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23 January 2019

Ms. El Kromhout, P.G.
Florida Department of Environmental Protection
Division of Waste Management
Permitting & Compliance Assistance Program
2600 Blair Stone Road, MS 4565
Tallahassee, Florida 32399-2400

Subject: **Intermediate Permit Modification Application**
Sideslope Modifications (Cells 4, 5, 7, 8, and 12)
Permit No. 0199726-031-SC-01
J.E.D. Solid Waste Management Facility
Omni Waste of Osceola County, LLC

Dear Ms. Kromhout:

Transmitted herewith is one copy of the subject intermediate permit modification application (application) for the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslopes at the J.E.D. Solid Waste Management Facility (JED Facility). An electronic copy has also been uploaded to the FDEP portal. This application was prepared by Geosyntec Consultants (Geosyntec) on behalf of Waste of Osceola County, LLC (WCOC), a wholly owned subsidiary of Waste Connections (WC).

This application requests approval to make intermediate modifications to the construction solid waste permit and complies with the requirements of Chapter 62-701 of the Florida Administrative Code. A check in the amount of $5,000 is enclosed with this intermediate permit modification application. If you or your staff have any questions or need additional information, please feel free to contact the undersigned.

Sincerely,

Craig R. Browne, P.E.
Senior Engineer
Florida P.E. No. 68613

Copies to: Kirk Wills, WC

Transmittal - Sideslope Int Mod (Jan 2019).doc

Prepared for

Waste Connections of Osceola County, LLC
1501 Omni Way
St. Cloud, Florida 34773

INTERMEDIATE PERMIT MODIFICATION APPLICATION: SIDESLOPE MODIFICATIONS (CELLS 4, 5, 7, 8, AND 12)

J.E.D. Solid Waste Management Facility
Osceola County, Florida

Prepared by

Geosyntec consultants
12802 Tampa Oaks Blvd., Suite 151
Tampa, Florida 33637
Authorization No.: 4321

Project No. FL3318

January 2019

CRAIG R. BROWNE LICENSE No. 68613 ★ STATE OF FLORIDA ★ PROFESSIONAL ENGINEER

Craig Browne, P.E.
Florida Registration No. 68613
(Expiration: 28 February 2021)
Date: ____________________

Digitally signed by Craig R. Browne, P.E.
Date: 2019.01.23 16:26:49 -05'00'

This document has been electronically signed and sealed by Craig R. Browne, PE on 1/23/2019 using a digital signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

TABLE OF CONTENTS

APPENDICES

INTERMEDIATE MODIFICATION PERMIT APPLICATION: SIDESLOPE MODIFICATIONS (CELLS 4, 5, 7, 8, 12) J.E.D. SOLID WASTE MANAGEMENT FACILITY OSCEOLA COUNTY, FLORIDA

1 INTRODUCTION

Geosyntec Consultants (Geosyntec) has prepared this intermediate modification permit application report (Report) to present the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslopes at the J.E.D. Solid Waste Management (JED) facility, located in Osceola County, Florida. The JED facility is owned and operated by Waste Connections of Osceola County, LLC (WCOC), a Waste Connections (WC) company.

This application is being submitted to the Florida Department of Environmental Protection (FDEP) on behalf of WCOC and has been prepared in accordance with Florida Administrative Code (F.A.C.) Chapter 62-701. The remainder of this Report provides: (i) a description of the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslopes; (ii) completed DEP Form 62-701.900(1) – *Application to Construct, Operate, Modify, or Close a Solid Waste Management Facility* in **Appendix A**; (iii) Intermediate Modification Permit Drawings (Permit Drawings) in **Appendix B**; (iv) a history of enforcement actions in **Appendix C**; (v) supporting design calculations in **Appendix D** through **Appendix G**; (vi) revised final cover geocomposite and interface friction conformance testing technical specifications in **Appendix H**; and (vii) financial assurance cost estimate in **Appendix I**. It is intended that this Report and appendices meet the requirements of an Engineering Report per paragraph 62-701.320(7)(d), F.A.C. A check in the amount of $5,000 for the permit application fee is also included in this submittal package.

This Report was prepared by Mr. Alex Rivera, P.E. and Craig R. Browne, P.E. and reviewed by Dr. Ramil G. Mijares, P.E. and Dr. Kwasi Badu-Tweneboah, P.E., all of Geosyntec. Professional engineer certification is provided on the cover sheet of this report, on the DEP Form 62-701.900(1), on each sheet of the Permit Drawings, on the cover sheet of each supporting design calculations, and on the cover sheet of the revised technical specifications.

2 PROPOSED MODIFICATIONS

As currently permitted, under FDEP Permit 0199726-031-SC-01, the final cover system design for Cells 4, 5, 7, 8, and 12 of the JED facility consists of 15-foot (ft.) wide sideslope benches spaced 40-ft. vertically (i.e., at Elev. 138, 178, 218, 258, and 298 ft. National Geodetic Vertical Datum of 1929 [NGVD29]) as depicted in the 2016 "*Phases 1-5 Renewal Permit Drawings*" (2016 Renewal Permit Drawings) included as Appendix B of the "*Renewal Permit Application to Construct Phase 5 of the J.E.D. Solid Waste Management Facility*" (2016 Renewal Permit Application) (Geosyntec, 2016).

In an effort to maximize waste storage capacity within the currently permitted disposal footprint, WCOC has proposed revisions to the Cells 4, 5, 7, 8, and 12 sideslopes. The proposed modification will incorporate tack-on berms as compared to the currently permitted sideslope benches while maintaining the 15-ft. wide drainage corridors and 40-ft. vertical spacing between berms as shown on the Permit Drawings (**Appendix B**). Also, the inclination of the waste sideslopes (i.e., 3 horizontal to 1 vertical [3H:1V]) and the maximum vertical elevation of the landfill are to be maintained. The remaining sections of this Report provide supporting permitting information and details for the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslopes.

3 GENERAL INFORMATION

3.1 Introduction

This section presents and addresses the general requirements in Chapter 62-701, F.A.C., not specifically addressed in other sections or appendices of this Report. Specifically, this section is organized to provide the information required by Parts A through R of DEP Form 62-701.900(1).

3.2 Location

The JED facility is a Class I landfill located in eastern Osceola County, Florida, west of highway U.S. 441, approximately 6.5 miles south of Holopaw. The JED facility is located in Sections 11, 13, and 14 of Township 28 South, Range 32 East, and Sections 17 and 18 of Township 28 South, Range 33 East, Osceola County, Florida. The site location is shown in the 2016 Renewal Permit Drawings. The main entrance of the facility is located at latitude 28° 02' 57" N, longitude 81° 03' 10" W, off highway U.S. 441, at 1501 Omni Way, St. Cloud, Florida, while the center of the landfill footprint is located at latitude 28º 03' 32" N and longitude 81º 05' 46" W.

3.3 Site Description

The property is generally bounded by the Bronson's, Inc. Property to the north and west, Clay Whaley Property to the south, and highway U.S. 441 to the east. The landfill facility is connected to highway U.S. 441 with an approximately 3-mile long access road. The JED property comprises a total of approximately 2,179 acres, of which approximately 360 acres are covered by the landfill footprint.

3.4 Prohibitions

This section provides information required by Part C of Form 62-701.900(1) that pertain to regulatory landfill prohibitions as described in Rule 62-701.300, F.A.C. The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans will not alter the horizontal or vertical extents of the disposal area. As such, the JED facility will continue to satisfy FDEP siting criteria requirements described by subsection 62-701.300(2), F.A.C. Accordingly, Parts C.1 through C.12 of Form 62-701.900(1) have been marked as "No Change".

3.5 Solid Waste Management Facility Permit Requirements

3.5.1 Overview

As previously stated, DEP Form 62-701.900(1) has been completed for this application. A dated, signed and sealed copy of DEP Form 62-701.900(1) is included in **Appendix A** of this application.

3.5.2 Operation Plan

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans are not intended to modify the currently approved landfill operations. As such, a revised operation plan is not included herein.

3.5.3 Closure Plan

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans will not alter the currently approved written landfill closure plan, included in the Operation Plan dated May 2017. As such, a revised closure plan is not included herein. The revised final cover system design and grading plan is described below.

3.5.4 Intermediate Modification Permit Drawings

Appendix B includes the Permit Drawings for the proposed modifications to the final cover system design. The Permit Drawings are numbered consistent with the 2016 Renewal Permit Drawings to facilitate review of the proposed modifications. Only the sheets that depict portions of Cells 4, 5, 7, 8, and 12 final cover system design that is proposed to be modified have been included in **Appendix B**.

3.5.5 Compliance History

As required by paragraph 62-701.320(7)(i), F.A.C., a history of solid waste management facility enforcement actions against WCOC or parent company (WC) in the State of Florida is presented in **Appendix C**.

3.5.6 Public Notification

This intermediate modification permit application does not propose to substantially modify the currently approved FDEP solid waste construction permit. As such, in accordance with the requirements of paragraph 62-701.320(8)(a), F.A.C., a Notice of Application is not required.

3.5.7 Airport Safety

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans will not alter the horizontal or vertical extents of the disposal area. As such, the JED facility will continue to satisfy the airport safety requirements provided in subsection 62-701.320(13), F.A.C.

3.6 Permit Application Requirements

3.6.1 Overview

The documentation required by paragraph 62-701.330(3)(a) through (h), F.A.C., [Part E of DEP Form 62-701.900(1)] is discussed below.

3.6.2 Permit Drawings

Appendix B includes the Permit Drawings for the proposed modifications to the final cover system design. The Permit Drawings are numbered consistent with the 2016 Renewal Permit Drawings to facilitate review of the proposed modifications. Only the sheets that depict portions of the Cells 4, 5, 7, 8, and 12 final cover system design that is proposed to be modified have been included in **Appendix B**.

3.6.3 Estimated Population for the Service Area

Information on the estimated population for the service area was most recently provided in the 2016 Renewal Permit Application. The proposed modifications will not alter the service area.

3.6.4 Type, Source of Solid Waste, and Annual Quantity

Information on the type, source, and annual quantity of accepted waste was most recently provided in the 2017 "*Renewal Permit Application for Operation of J.E.D. Solid Waste Management Facility*" (2017 Renewal Permit Application) (Geosyntec, 2017). The proposed modifications will not alter the previously estimated waste disposal rate of 6,000 tons/day, or 1,716,000 tons/year.

3.6.5 Anticipated Life

The waste disposal rate at the JED facility is variable and dependent on market conditions and may be as high as 9,200 tons/day. The facility's Title V permit limits the annual acceptance rate in Phases 1-3 to 2,631,200 tons/year. The existing operations plus the proposed development through Phase 5 of the JED facility yield approximately 18,961,656 yd^3 of airspace as of March 2018. This airspace value includes approximately 535,851 yd^3 of additional volume due to the proposed sideslope modifications in Cells 4, 5, 7, 8, and 12. At an estimated in-place unit weight of approximately 1,600 lb/yd^3 (including daily cover) and an approximate average disposal rate of 6,000 tons/day (6 days/week), the anticipated life including Phases 3, 4, and 5 under build-out conditions is estimated to be approximately 8.1 years (as of March 2018).

No change is proposed to the final design height of the JED facility; the maximum height of the facility during its operation is provided in the 2016 Renewal Permit Drawings (Geosyntec, 2016).

3.7 General Criteria for Landfills

3.7.1 Floodplain

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans will not alter the horizontal or vertical extents of the disposal area. As such, the JED facility will continue to satisfy the floodplain requirements provided in paragraph 62-701.340(3)(b), F.A.C.

3.7.2 Horizontal Separation

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans will not alter the horizontal or vertical extents of the disposal area. As such, the JED facility will continue to satisfy the horizontal separation requirements of paragraph 62-701.340(3)(c), F.A.C.

3.8 Landfill Construction Requirements

The applicable landfill construction requirements in Part G of DEP Form 62-701.900(1), and Rule 62-701.400, F.A.C., are described in subsequent sections of this Report and corresponding appendices. Select technical specifications have been updated and are included in **Appendix H**.

3.9 Hydrogeological and Geotechnical Investigation Requirements

No additional hydrogeological or geotechnical investigations have been performed in support of the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans. As such, Parts H and I on DEP Form 62-701.900(1) have been marked as "No Change". However, settlement and slope stability analyses are presented in Section 4 to support the proposed modifications as required by Rule 62-701.410, F.A.C.

3.10 Vertical Expansion of Landfills

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve an increase in maximum waste elevation. As such, Part J on DEP Form 62-701.900(1) has been marked as "Not Applicable".

3.11 Landfill Operation Requirements

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve modifications that would require changes to the landfill operations. As such, Part K on DEP Form 62-701.900(1) has been marked as "No Change".

3.12 Water Quality Monitoring Requirements

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve modifications that would require changes to the water quality monitoring plan. As such, Part L on DEP Form 62-701.900(1) has been marked as "No Change".

3.13 Special Waste Handling Requirements

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve modifications that would require changes to the management of special waste. As such, Part M on DEP Form 62-701.900(1) has been marked as "No Change".

3.14 Gas Management System Requirements

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve modifications that would require changes to gas management system at the JED facility. As such, Part N on DEP Form 62-701.900(1) has been marked as "No Change".

3.15 Landfill Final Closure and Long-Term Care Requirements

The proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans do not involve modifications that would require changes to the landfill closure and long-term care plans. However, the proposed modifications do comprise changes to the final cover system geometry (e.g., tack-on berms instead of sideslope benches). As such, evaluations of the proposed final cover system design and of the surface-water drainage system (to confirm the adequacy of the drainage swales and the downdrains to convey the storm water runoff) were performed. Section 5 provides a summary of landfill closure procedures, and the results of the final cover system and surface-water drainage system design calculations.

4 GEOTECHNICAL DESIGN

4.1 Overview

This section presents a summary of the geotechnical engineering design evaluations prepared in support of the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans at the JED facility. The proposed sideslope modifications will utilize tack-on berms while maintaining the 15-ft. wide drainage corridor and 40-ft. vertical spacing between berms (i.e., at Elev. 138, 178, 218, 258, and 298 ft. NGVD29) as shown on the Permit Drawings (**Appendix B**). Also, the inclination of the waste sideslopes (i.e., 3H:1V) and the maximum elevation of the landfill are to be maintained. Due to the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans, Geosyntec has evaluated the subgrade settlement (Section 4.2), waste settlement (Section 4.3), and slope stability (Section 4.4) based on the requirements of Rule 62-701.410, F.A.C.

4.2 Subgrade Settlement

Because the proposed modifications to the sideslope plans include changes to the final cover system design for Cells 4, 5, 7, 8, and 12, total subgrade settlement was evaluated for potentially critical cross sections as part of the foundation analyses in accordance with subparagraph 62-701.410(3)(e)2., F.A.C. One-dimensional settlement analyses were performed to estimate the total settlement at each end of the critical sections taking into consideration the thickness of the compacted subgrade fill, bottom liner system, waste, and the final cover system. The corresponding settlement calculations are included in **Appendix D**. The results of the settlement analyses were used to evaluate the impact of anticipated settlement on the performance of the leachate collection system (LCS) and the liner system.

Based on the results of the settlement analyses presented in **Appendix D**, the post-settlement slopes of the base grades for Cells 4, 5, 7, 8, and 12 are calculated to meet or exceed 1.0 percent while the post-settlement slopes of the leachate collection and leak detection pipes in Cells 4, 5, 7, 8, and 12 are calculated to meet or exceed 0.3 percent. In addition, the maximum calculated liner tensile strain in the liner system for all cases analyzed is 0.007 percent, which is less than the maximum allowable tensile strain of 5 percent (Berg and Bonaparte, 1993) for polyethylene geomembrane materials.

4.3 Waste Settlement

Calculations were performed to evaluate waste settlement and its impact on the integrity of the final cover system geosynthetic components for the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans at the JED facility. Specifically, total and differential settlements due to the placement of the final cover system were evaluated at select locations, and the corresponding tensile strains within the geomembrane were calculated and compared to the maximum allowable tensile strain of 5 percent (Berg and Bonaparte, 1993).

Based on the results of the waste settlement calculations presented in **Appendix E**, the calculated tensile strains are below the maximum allowable tensile strain (i.e., 5 percent). Therefore, the performance of the geomembrane component of the final cover system will not be significantly affected by the total final cover settlement.

4.4 Slope Stability

The proposed sideslope modifications include changes to the final cover system design plans for Cells 4, 5, 7, 8, and 12. Therefore, slope stability analyses were performed to evaluate the factor of safety (FS) for slope stability with respect to potential shear failure surfaces through the waste mass and foundation soils and shear failure surfaces passing through the waste mass and along the liner system. The slope stability analyses evaluated circular (rotational) and non-circular shear failure surfaces within the waste mass and the foundation soils. In addition, slope stability analysis of non-circular (block) shear failure surfaces through the waste mass and along the bottom liner system was performed. The stability analyses performed and the results of the analyses are presented in **Appendix F**.

As required by subsection 62-701.400(2), F.A.C., landfills must be designed to achieve a minimum FS of 1.5 using peak strength values to prevent failures of side slopes and deep-seated failures. Based on the results of the slope stability analyses presented in **Appendix F**, the minimum FS for the proposed landfill configuration met or exceeded 1.5. In addition, the minimum required peak interface friction angle required to achieve a minimum FS of 1.5 is calculated to be 12.3 degrees. It is noted that the required interface friction angle is less than the measured interface friction angles (e.g., 15.0 to 31.6 degrees) from construction quality assurance (CQA) testing performed during construction of the Cell 4, 5, 7, and 8 liner systems. The interface friction angle and GCL internal shear strength requirements have been revised accordingly (see **Appendix H** for updated technical specifications) for Cell 12 and future cell construction.

5 LANDFILL CLOSURE

5.1 Overview

This section presents and addresses the landfill closure requirements in Chapter 62-701, F.A.C., not addressed in other sections or appendices of this Report. Specifically, this section is organized to provide the information required by Parts O and P of DEP Form 62-701.900(1) for the JED facility. Although the proposed modifications to the Cells 4, 5, 7, 8, and 12 sideslope plans include changes to the final cover system design, the approach for closure of the JED facility described in the 2017 Renewal Permit Application will be maintained.

5.2 Closure Sequencing and Permitting

Although a final cover system design is included in the Permit Drawings, this application is not for closure and this section is provided as a summary of landfill closure procedures already on file with FDEP. A separate permit application for closure will be submitted to FDEP in accordance with applicable sections of Chapter 62-701, F.A.C., prior to initiating final closure construction activities. Details of the final cover system design for Cells 4, 5, 7, 8, and 12 (including storm water management features) are submitted with this application to present the proposed modifications to the final closure design for the JED facility.

Each portion of the proposed landfill will be closed as it reaches the maximum design height on a close-as-you-go basis. The ongoing, partial closure of the landfill (i.e., close as you go) is proposed to minimize leachate generation in the landfill. Partial closure will be accomplished concurrent with waste placement in the landfill. Areas that have reached final elevations will receive the final cover system within 180 days of reaching the final elevation, or a 12-inch thick intermediate cover will be placed over the area.

A closure report will be prepared at the time a closure permit from the FDEP is requested. A closure permit application, in the form of a Minor Permit Modification Application to the Operations Permit, will be submitted to FDEP a minimum of 180 days prior to the initiation of closure construction.

5.3 Final Cover System Design

The proposed sideslope modifications will utilize tack-on berms as an alternative to the currently permitted sideslope benches while maintaining the 15-ft. wide drainage corridor and 40-ft. vertical spacing between berms (i.e., at Elev. 138, 178, 218, 258, and 298 ft. NGVD29), as shown on the Permit Drawings (**Appendix B**). Also, the inclination of the waste sideslopes (i.e., 3H:1V) and the maximum elevation of the landfill are to be maintained.

Therefore, calculations were performed to evaluate the performance of the proposed final cover system design for Cells 4, 5, 7, 8, and 12 of the JED facility. The evaluation of final cover system performance included analysis of head on the geomembrane in the final cover system (including selecting geocomposite transmissivity), soil erosion resistance of the final cover system, and veneer stability (sliding on interface between final cover system components).

Calculations were performed to evaluate the required geocomposite transmissivity needed to limit the leachate head to less than the thickness of the geocomposite (i.e., 0.25 inches). Design calculations for the geocomposite component of the cover system are provided in **Appendix G**. The required transmissivity value is incorporated into Section 20740 of the revised Technical Specifications presented in **Appendix H**.

Also, subsection 62-701.400(2), F.A.C., requires that landfills must be designed to achieve a minimum FS of 1.5 using peak strength values to prevent failures of side slopes and deep-seated failures through waste. The final cover system performance evaluation estimated a minimum peak interface friction angle of 29.2 degrees is required to meet a FS of 1.5. The calculated minimum required peak interface friction angle (i.e., 29.2 degrees) is incorporated into Section 02790 of the revised Technical Specifications presented in **Appendix H**. The final cover system performance calculations for Cells 4, 5, 7, 8, and 12 of the JED facility are presented in **Appendix G**.

Lastly, the average annual soil loss due to erosion was calculated to be 2.95 tons/acre/year for the proposed final cover sideslopes, which is less than the maximum allowable soil loss of 5 tons/acre/year for landfill covers following general guidelines from the University of Wisconsin-Madison (1988). Calculations to estimate the soil erosion resistance of the final cover system are presented in **Appendix G**.

5.4 Surface-Water Drainage System

Diversion berms and drainage swales are incorporated in the final cover system on the top and on the sideslopes of the landfill as indicated in the Permit Drawings (**Appendix B**). The diversion berms and drainage swales convey water to the downdrains which convey the storm water runoff to the storm water detention basins at the toe of the landfill. The downdrains consist of corrugated HDPE pipes that tie into energy dissipater/junction boxes located at the toe of the waste slope. Because the proposed modifications to the sideslope plans include changes to the final cover system design for Cells 4, 5, 7, 8, and 12, the spacing and sizing of stormwater downchutes was evaluated to identify if modifications are needed to accommodate the revised sideslope grading. The evaluation confirms the adequacy of the currently permitted drainage swales and downchutes to convey the storm water runoff (i.e., no changes needed). While the grass-lined swales should provide suitable resistance to the anticipated flow velocity, turf reinforcement mat has been added to the bends in the swale as a measure to minimize potential erosion at these locations where flow direction changes.

6 LONG-TERM CARE AND FINANCIAL ASSURANCE

6.1 Overview

This section presents and addresses the long-term care and financial assurance requirements in Chapter 62-701, F.A.C., not addressed in other sections or appendices of this Report. Specifically, this section is organized to provide the information required by Parts Q and R of DEP Form 62-701.900(1) for the JED facility.

6.2 Long-Term Care and Closure Costs

The proposed Cells 4, 5, 7, 8, and 12 sideslope modifications revises the final cover system geometry from the currently permitted sideslope benches to the proposed tack-on berms as illustrated in the Permit Drawings (**Appendix B** of the Application). Therefore, the earthwork volume required to construct the tack-on berms is greater than the earthwork volume estimated in the 2017 "*Financial Assurance Cost Estimate*" (2017 Financial Assurance Cost Estimate) (Geosyntec, 2017) provided in Appendix E of the 2017 "*Renewal Permit Application for Operation of J.E.D. Solid Waste Management Facility*" (2017 Renewal Permit Application). Also, WCOC has submitted the 2018 "*Annual Financial Assurance Renewal – 2018*" (2018 Adjusted Financial Assurance Cost Estimate) (WCOC, 2018) to satisfy the annual financial assurance cost adjustment reporting requirement of paragraph 62-701.630(4)(a), F.A.C. During the pre-application meeting for the proposed sideslope modifications project on 5 April 2018, FDEP indicated that a revision of the earthwork quantity provided in the 2017 Financial Assurance Cost Estimate and applying the FDEP-approved inflation factor to the closure and long-term care costs as presented in the 2018 Adjusted Financial Assurance Cost Estimate would satisfy the financial assurance requirements of Rule 62-701.630, F.A.C.

Therefore, the closure cost estimate (for 109.7 acres) and long-term care cost estimate (for 153.5 acres) are included on the DEP Form 62-701.900(28), "*Closure Cost Estimating Form for Solid Waste Facilities*" presented in **Appendix I**. The estimate accounts for closure and long-term care costs associated with cells that have been constructed (Cells 1 through 11 and 13). In summary, the total estimated closing cost included for the 109.7-acre Class I area is calculated to be $13,337,525.34. Similarly, the estimated long-term care cost (for a 30-year period) for the 153.5-acre Class I area is calculated to be $6,329,942.82.

7 REFERENCES

Berg, R.R. and Bonaparte, R. (1993). "Long-Term Allowable Tensile Stresses for Polyethylene Geomembranes," Geotextiles and Geomembranes, Vol. 12, pp. 287-306.

Geosyntec Consultants (2016) "Renewal Permit Application to Construct Phase 5 of the J.E.D. Solid Waste Management Facility," received by FDEP on 15 June 2016.

Geosyntec Consultants (2017) "Renewal Permit Application for Operation of J.E.D. Solid Waste Management Facility," received by FDEP on 3 May 2017.

Waste Connections of Osceola County, LLC (2018) "Annual Financial Assurance Renewal – 2018," received by FDEP on 27 February 2018.

University of Wisconsin-Madison, "Sanitary Landfill Design", Short Course taught in the Department of Engineering Professional Development, Madison, Wisconsin, February 1988.

APPENDIX A
FDEP FORM 62-701.900(1)

Florida Department of Environmental Protection

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

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

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

Effective Date: February 15, 2015

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

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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

APPLICATION INSTRUCTIONS AND FORMS

Northwest District	Northeast District	Central District	Southwest District	South District	Southeast District
160 Governmental Street	7777 Baymeadows Way West	3319 Maguire Boulevard	13051 North Telecom Pkwy	2295 Victoria Ave, Suite 364	3301 Gun Club Road
Suite 308	Suite 100	Suite 232	Temple Terrace, FL 33637	P.O. Box 2549	MSC 7210-1
Pensacola, FL 32502-5794	Jacksonville, FL 32256-7590	Orlando, FL 32803-3767	813-470-5700	Fort Myers, FL 33901-3881	West Palm Beach, FL 33406
850-595-8300	904-256-1700	407-897-4100		239-344-5600	561-681-6600

INSTRUCTIONS TO APPLY FOR A SOLID WASTE MANAGEMENT FACILITY PERMIT

I. General

Solid Waste Management Facilities shall be permitted pursuant to Section 403.707, Florida Statutes (FS) and in accordance with Florida Administrative Code (FAC) Chapter 62-701. A permit application shall be submitted in accordance with the requirements of Rule 62-701.320(5)(a), F.A.C., to the appropriate Department office having jurisdiction over the facility. The appropriate fee in accordance with Rule 62-701.315, FAC, shall be submitted with the application by check made payable to the Department of Environmental Protection (DEP).

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

II. Application Parts Required for Construction and Operation Permits

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

NOTE: Portions of some Parts may not be applicable.

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

III. Application Parts Required for Closure Permits

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

NOTE: Portions of some Parts may not be applicable.

IV. Permit Renewals

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

V. Application Codes

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

VI. Listing of Application Parts

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

Please Type or Print

PART A. GENERAL INFORMATION

1. Type of disposal facility (check all that apply):
   - ☑ Class I Landfill
   - ☐ Class III Landfill
   - ☐ Industrial Solid Waste
   - ☐ Other (describe):
   - ☐ Ash Monofill
   - ☐ Asbestos Monofill

NOTE: Waste Processing Facilities should apply on Form 62-701.900(4), FAC;
Yard Trash Disposal Facilities should notify on Form 62-701.900(3), FAC;
Compost Facilities should apply on Form 62-709.901(1), FAC; and
C&D Disposal Facilities should apply on Form 62-701.900(6), FAC

2. Type of application:
   - ☑ Construction
   - ☐ Operation
   - ☐ Construction/Operation
   - ☐ Closure
   - ☐ Long-term Care Only

3. Classification of application:
   - ☐ New
   - ☐ Renewal
   - ☐ Substantial Modification
   - ☑ Intermediate Modification
   - ☐ Minor Modification

4. Facility name: J.E.D. Solid Waste Management Facility

5. DEP ID number: 89544 (WACS) County: Osceola

6. Facility location (main entrance):
   1501 Omni Way, St. Cloud, FL 34773

7. Location coordinates:
   Section: 11,13,14,17, & 18 Township: 28S Range: 32E & 33E
   Latitude: 28 ° 3 ' 32 " Longitude: 81 ° 5 ' 46 "
   Datum: WGS84 Coordinate method: DGPS
   Collected by: Johnston's Surveying Company/Affiliation: Johnston's Surveying

8. Applicant name (operating authority): Waste Connections of Osceola County LLC

Mailing address: 1501 Omni Way | St. Cloud | FL | 34773
(Street or P.O. Box | City | State | Zip)

Contact person: Kirk Wills Telephone: (813) 388-1026

Title: Southern Region Engineer

kirk.wills@wasteconnections.com
E-Mail address (if available)

9. Authorized agent/Consultant: Geosyntec Consultants

Mailing address: 12802 Tampa Oaks Blvd. Ste 151 | Tampa | FL | 33637
(Street or P.O. Box | City | State | Zip)

Contact person: Craig Browne, P.E. Telephone: (813) 558-0990

Title: Senior Engineer

cbrowne@geosyntec.com
E-Mail address (if available)

10. Landowner (if different than applicant): N/A

Mailing address: ____________________
(Street or P.O. Box | City | State | Zip)

Contact person: ____________________ Telephone: (_____) ____________

____
E-Mail address (if available)

11. Cities, towns, and areas to be served:
Primarily Osceola, Brevard, Indian River, Okeechobee, Orange, Polk, Volusia, Sumter, Lake, Seminole, Pasco, Hillsborough, Hardee, and Highlands Counties. Other Florida counties are served as waste streams are available.

12. Population to be served:
Current: 6,266,000 (approx.) Five-Year Projection: 6,500,000 (approx.)

13. Date site will be ready to be inspected for completion: N/A

14. Expected life of the facility: 22 years

15. Estimated costs:
Total Construction: $ ____________ Closing Costs: $ 13,337,525.34

16. Anticipated construction starting and completion dates:
From: 2018 To: 2027

17. Expected volume or weight of waste to be received:
____________ yds^3/day 6000 tons/day ____________ gallons/day

PART B. DISPOSAL FACILITY GENERAL INFORMATION

1. Provide brief description of disposal facility design and operations planned under this application:
   This application is being submitted to revise the sideslopes of Cells 4, 5, 7, 8, and 12 which includes a modification of the sideslope geometry of the final cover system.

2. Facility site supervisor: Benjamin Gray

   Title: District Manager Telephone: (407) 932-8672

   BenjaminG@WasteConnections.com
   E-Mail address (if available)

3. Disposal area: Total acres: 360 Used acres: 153.5 Available acres: 206.5

4. Weighing scales used: ☑ Yes ☐ No

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

6. Charge for waste received: ______ $/yds³ 35 $/ton

7. Surrounding land use, zoning:

   ☐ Residential ☐ Industrial
   ☑ Agricultural ☐ None
   ☐ Commercial ☐ Other (describe):

8. Types of waste received:

   ☑ Household ☑ C & D debris
   ☑ Commercial ☑ Shredded/cut tires
   ☑ Incinerator/WTE ash ☐ Yard trash
   ☑ Treated biomedical ☐ Septic tank
   ☑ Water treatment sludge ☑ Industrial
   ☐ Air treatment sludge ☑ Industrial sludge
   ☐ Agricultural ☑ Domestic sludge
   ☑ Asbestos ☑ Other (describe):

   Waste tires and liquid waste for solidification.

9. Salvaging permitted: ☐ Yes ☑ No unless volume of recyclable goods is sufficient

10. Attendant: ☑ Yes ☐ No   Trained operator: ☑ Yes ☐ No

11. Trained spotters: ☑ Yes ☐ No   Number of spotters used: Minimum of 1 per work face

12. Site located in: ☑ Floodplain   ☑ Wetlands   ☐ Other (describe):

13. Days of operation: Monday through Sunday

14. Hours of operation: Mon-Fri: 5am to 4pm, Sat: 6am to 12pm, Sun: 6am to 10am

15. Days working face covered: each working day

16. Elevation of water table: 79 ft. Datum Used: NGVD 1929

17. Number of monitoring wells: 63

18. Number of surface monitoring points: 2

19. Gas controls used: ☑ Yes ☐ No   Type controls: ☑ Active ☐ Passive

Gas flaring: ☑ Yes ☐ No   Gas recovery: ☑ Yes ☐ No

20. Landfill unit liner type:

- ☐ Natural soils
- ☐ Single clay liner
- ☐ Single geomembrane
- ☐ Single composite
- ☐ Slurry wall
- ☐ Double geomembrane
- ☑ Geomembrane & composite (Cells 5 through 23)
- ☑ Double composite (Cells 1 through 4)
- ☐ None
- ☑ Other (describe):

A GCL layer is provided below primary geomembrane liner in the sump area in Cells 5 through 23.

21. Leachate collection method:

- ☑ Collection pipes
- ☑ Geonets (geocomposite)
- ☐ Well points
- ☐ Perimeter ditch
- ☑ Other (describe):
- ☐ Double geomembrane
- ☐ Gravel layer
- ☐ Interceptor trench
- ☐ None

Sand layer above geocomposite.

22. Leachate storage method:

☐ Tanks ☑ Surface impoundments

☐ Other (describe):

23. Leachate treatment method:

☑ Oxidation ☐ Chemical treatment

☐ Secondary ☐ Settling

☐ Advanced ☐ None

☑ Other (describe):

Oxidation performed through aeration in the uncovered Cell of the leachate storage area.

24. Leachate disposal method:

☑ Recirculated ☐ Pumped to WWTP

☑ Transported to WWTP ☐ Discharged to surface water/wetland

☐ Injection well ☐ Percolation ponds

☑ Evaporation ☐ Spray irrigation

☐ Other (describe):

25. For leachate discharged to surface waters:

Name and Class of receiving water:

N/A

26. Storm Water:

Collected: ☑ Yes ☐ No

Type of treatment:

Dry and wet retention for landfill and dry retention for access road.

Name and Class of receiving water:

Bull Creek, Class III

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

Current ERP Numbers are ERP49-0199752-001-EI (Phase 1 Individual), ERP49-0199752-002-EI (Conceptual), ERP-49-0199752-003-EI (Phase 2 Individual), ERP49-0199752-004-EM (Phase 3 Individual), ERP-49-0199752-006-EM (Conceptual Permit Mod.), ERP-49-0199752-007-EM (Leachate Storage Facility), ERP-49-0199752-008 (Leachate Storage Facility Mod.), ERP49-0199752-010-EI (Phase 4 Individual).

PART C. PROHIBITIONS (62-701.300, FAC)

LOCATION

S ☐ _____________ N/A ☐ N/C ☑ 1. Provide documentation that each of the siting criteria will be satisfied for the facility; (62-701.300(2), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 2. If the facility qualifies for any of the exemptions contained in Rules 62-701.300(12), (13) and (16) through (18), FAC, then document this qualification(s);

S ☐ _____________ N/A ☐ N/C ☑ 3. Provide documentation that the facility will be in compliance with the burning restrictions; (62-701.300(3), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 4. Provide documentation that the facility will be in compliance with the hazardous waste restrictions; (62-701.300(4), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 5. Provide documentation that the facility will be in compliance with the PCB disposal restrictions; (62-701.300(5), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 6. Provide documentation that the facility will be in compliance with the biomedical waste restrictions; (62-701.300(6), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 7. Provide documentation that the facility will be in compliance with the Class I surface water restrictions; (62-701.300(7), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 8. Provide documentation that the facility will be in compliance with the special waste for landfills restrictions; (62-701.300(8), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 9. Provide documentation that the facility will be in compliance with the liquid restrictions; (62-701.300(10), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 10. Provide documentation that the facility will be in compliance with the used oil and oily waste restrictions; (62-701.300(11), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 11. Provide documentation that the facility will be in compliance with the CCA treated wood restrictions; (62-701.300(14), FAC)

S ☐ _____________ N/A ☐ N/C ☑ 12. Provide documentation that the facility will be in compliance with the dust control restrictions; (62-701.300(15), FAC)

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

S	LOCATION	N/A	N/C	
☑	Attached	☐	☐	1. A minimum of one completed electronic application form, all supporting data and reports; (62-701.320(5)(a), FAC)
☑	Report/Appendices	☐	☐	2. Engineering and/or professional certification (signature, date, and seal) provided on the applications and all engineering plans, reports, and supporting information for the application; (62-701.320(6), FAC)
☑	Attached letter	☐	☐	3. A letter of transmittal to the Department; (62-701.320(7)(a), FAC)
☑	Appendix A	☐	☐	4. A completed application form dated and signed by the applicant; (62-701.320(7)(b), FAC)
☑	Attached	☐	☐	5. Permit fee specified in Rule 62-701.315, FAC in check or money order, payable to the Department; (62-701.320(7)(c), FAC)
☑	Attached	☐	☐	6. An engineering report addressing the requirements of this rule and with the following format: a cover sheet, text printed on 8 ½ inch by 11 inch consecutively numbered pages, a table of contents or index, the body of the report and all appendices including an operation plan, contingency plan, illustrative charts and graphs, records or logs of tests and investigations, engineering calculations; (62-701.320(7)(d), FAC)
☐		☐	☑	7. Operation Plan and Closure Plan; (62-701.320(7)(e)1, FAC)
☐		☐	☑	8. Contingency Plan; (62-701.320(7)(e)2, FAC)
☑	Appendix B	☐	☐	9. Plans or drawings for the solid waste management facilities in appropriate format (including sheet size restrictions, cover sheet, legends, north arrow, horizontal and vertical scales, elevations referenced to NGVD 1929) showing: (62-701.320(7)(f), FAC)
☐		☐	☑	a. A regional map or plan with the project location in relation to major roadways and population centers;
☐		☐	☑	b. A vicinity map or aerial photograph no more than one year old showing the facility site and relevant surface features located within 1000 feet of the facility;
☐		☐	☑	c. A site plan showing all property boundaries certified by a Florida Licensed Professional Surveyor and Mapper;
☑	Appendix B	☐	☐	d. Other necessary details to support the engineering report, including referencing elevations to a consistent, nationally recognized datum, and identifying the method used for collecting latitude and longitude data;

LOCATION **PART D CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ 10. Documentation that the applicant either owns the property or has legal authority from the property owner to use the site; (62-701.320(7)(g), FAC)

S ☐ ____________ N/A ☑ N/C ☐ 11. For facilities owned or operated by a county, provide a description of how, if any, the facilities covered in this application will contribute to the county's achievement of the waste reduction and recycling goals contained in Section 403.706, FS; (62-701.320(7)(h), FAC)

S ☑ Appendix C N/A ☐ N/C ☐ 12. Provide a history and description of any enforcement actions taken by the Department against the applicant for violations of applicable statutes, rules, orders, or permit conditions relating to the operation of any solid waste management facility in the state; (62-701.320(7)(i), FAC)

S ☐ ____________ N/A ☑ N/C ☐ 13. Proof of publication in a newspaper of general circulation of notice of application for a permit to construct or substantially modify a solid waste management facility; (62-701.320(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 14. Provide a description of how the requirements for airport safety will be achieved, including proof of required notices if applicable. If exempt, explain how the exemption applies; (62-701.320(13), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 15. Explain how the operator and spotter training requirements and special criteria will be satisfied for the facility; (62-701.320(15), FAC)

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Regional map or aerial photograph no more than five years old showing all airports that are located within five miles of the proposed landfill; (62-701.330(3)(a), FAC)

S ☑ Appendix B N/A ☐ N/C ☐ 2. Plot plan with a scale not greater than 200 feet to the inch showing: (62-701.330(3)(b), FAC)

S ☑ Appendix B N/A ☐ N/C ☐ a. Dimensions;

S ☐ ____________ N/A ☐ N/C ☑ b. Locations of proposed and existing water quality monitoring wells;

S ☐ ____________ N/A ☐ N/C ☑ c. Locations of soil borings;

S ☐ ____________ N/A ☐ N/C ☑ d. Proposed plan of trenching or disposal areas;

S ☑ Appendix B N/A ☐ N/C ☐ e. Cross sections showing original elevations and proposed final contours which shall be included either on the plot plan or on separate sheets;

LOCATION				**PART E CONTINUED**
S ☐	____________	N/A ☐	N/C ☑	f. Any previously filled waste disposal areas;
S ☐	____________	N/A ☐	N/C ☑	g. Fencing or other measures to restrict access;
S ☑	Appendix B	N/A ☐	N/C ☐	3. Topographic maps with a scale not greater than 200 feet to the inch with five foot contour intervals showing: (62-701.330(3)(c), FAC)
S ☑	Appendix B	N/A ☐	N/C ☐	a. Proposed fill areas;
S ☐	____________	N/A ☐	N/C ☑	b. Borrow areas;
S ☐	____________	N/A ☐	N/C ☑	c. Access roads;
S ☐	____________	N/A ☐	N/C ☑	d. Grades required for proper drainage;
S ☐	____________	N/A ☐	N/C ☑	e. Cross sections of lifts;
S ☐	____________	N/A ☐	N/C ☑	f. Special drainage devices if necessary;
S ☐	____________	N/A ☐	N/C ☑	g. Fencing;
S ☐	____________	N/A ☐	N/C ☑	h. Equipment facilities;
S ☑	Section 3.6	N/A ☐	N/C ☐	4. A report on the landfill describing the following: (62-701.330(3)(d), FAC)
S ☑	Section 3.6.3	N/A ☐	N/C ☐	a. The current and projected population and area to be served by the proposed site;
S ☑	Section 3.6.4	N/A ☐	N/C ☐	b. The anticipated type, annual quantity, and source of solid waste expressed in tons;
S ☑	Section 3.6.5	N/A ☐	N/C ☐	c. Planned active life of the facility, the final design height of the facility, and the maximum height of the facility during its operation;
S ☐	____________	N/A ☐	N/C ☑	d. The source and type of cover material used for the landfill;
S ☐	____________	N/A ☐	N/C ☑	5. Provide evidence that an approved laboratory shall conduct water quality monitoring for the facility in accordance with Chapter 62-160, FAC; (62-701.330(3)(g), FAC
S ☐	____________	N/A ☐	N/C ☑	6. Provide a statement of how the applicant will demonstrate financial responsibility for the closing and long-term care of the landfill; (62-701.330(3)(h), FAC)

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Describe (and show on a Federal Insurance Administration flood map, if available) how the landfill or solid waste disposal unit shall not be located in the 100 year floodplain where it will restrict the flow of the 100 year flood, reduce the temporary water storage capacity of the floodplain unless compensating storage is provided, or result in a washout of solid waste; (62-701.340(3)(b), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Describe how the minimum horizontal separation between waste deposits in the landfill and the landfill property boundary shall be 100 feet, measured from the toe of the proposed final cover slope; (62-701.340(3)(c), FAC)

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

LOCATION

S ☑ Section 4 N/A ☐ N/C ☐ 1. Describe how the landfill shall be designed so the solid waste disposal units will be constructed and closed at planned intervals throughout the design period of the landfill, and shall be designed to achieve a minimum factor of safety of 1.5 using peak strength values to prevent failures of side slopes and deep-seated failures; (62-701.400(2), FAC)

S ☑ Report N/A ☐ N/C ☐ 2. Landfill liner requirements; (62-701.400(3), FAC)

S ☑ Report N/A ☐ N/C ☐ a. General construction requirements; (62-701.400(3)(a), FAC)

S ☐ ____________ N/A ☐ N/C ☑ (1) Provide test information and documentation to ensure the liner will be constructed of materials that have appropriate physical, chemical, and mechanical properties to prevent failure;

S ☑ Section 4 N/A ☐ N/C ☐ (2) Document foundation is adequate to prevent liner failure;

S ☐ ____________ N/A ☐ N/C ☑ (3) Constructed so bottom liner will not be adversely impacted by fluctuations of the ground water;

S ☐ ____________ N/A ☑ N/C ☐ (4) Designed to resist hydrostatic uplift if bottom liner located below seasonal high ground water table;

S ☐ ____________ N/A ☐ N/C ☑ (5) Installed to cover all surrounding earth which could come into contact with the waste or leachate;

LOCATION				PART G CONTINUED
S ☐	____________	N/A ☑	N/C ☐	b. Composite liners; (62-701.400(3)(b), FAC)
S ☐	____________	N/A ☑	N/C ☐	(1) Upper geomembrane thickness and properties;
S ☐	____________	N/A ☑	N/C ☐	(2) Design leachate head for primary leachate collection and removal system (LCRS) including leachate recirculation if appropriate;
S ☐	____________	N/A ☑	N/C ☐	(3) Design thickness in accordance with Table A and number of lifts planned for lower soil component;
S ☐	____________	N/A ☐	N/C ☑	c. Double liners; (62-701.400(3)(c), FAC)
S ☐	____________	N/A ☐	N/C ☑	(1) Upper and lower geomembrane thickness and properties;
S ☐	____________	N/A ☐	N/C ☑	(2) Design leachate head for primary LCRS to limit the head to one foot above the liner;
S ☐	____________	N/A ☐	N/C ☑	(3) Lower geomembrane sub-base design;
S ☐	____________	N/A ☐	N/C ☑	(4) Leak detection and secondary leachate collection system minimum design criteria (k ≥ 10 cm/sec, head on lower liner ≤ 1 inch, head not to exceed thickness of drainage layer);
S ☑	Appendix H	N/A ☐	N/C ☐	d. Standards for geosynthetic components; (62-701.400(3)(d), FAC)
S ☐	____________	N/A ☐	N/C ☑	(1) Factory and field seam test methods to ensure all geomembrane seams achieve the minimum specifications;
S ☐	____________	N/A ☐	N/C ☑	(2) Geomembranes to be used shall pass a continuous spark test by the manufacturer;
S ☐	____________	N/A ☐	N/C ☑	(3) Design of 24-inch-thick protective layer above upper geomembrane liner;
S ☐	____________	N/A ☐	N/C ☑	(4) Describe operational plans to protect the liner and leachate collection system when placing the first layer of waste above a 24-inch-thick protective layer;
S ☐	____________	N/A ☐	N/C ☑	(5) HDPE geomembranes, if used, meet the specifications in GRI GM13, and LLDPE geomembranes, if used, meet the specifications in GRI GM17;
S ☐	____________	N/A ☑	N/C ☐	(6) PVC geomembranes, if used, meet the specifications in PGI 1104;

LOCATION	PART G CONTINUED
S ☑ Section 4/App. H N/A ☐ N/C ☐	(7) Interface shear strength testing results of the actual components which will be used in the liner system;
S ☐ ____ N/A ☐ N/C ☑	(8) Transmissivity testing results of geonets if they are used in the liner system;
S ☐ ____ N/A ☐ N/C ☑	(9) Hydraulic conductivity testing results of geosynthetic clay liners if they are used in the liner system;
S ☑ Report/App. H N/A ☐ N/C ☐	e. Geosynthetic specification requirements; (62-701.400(3)(e), FAC)
S ☐ ____ N/A ☐ N/C ☑	(1) Definition and qualifications of the designer, manufacturer, installer, QA consultant and laboratory, and QA program;
S ☑ Report/App. H N/A ☐ N/C ☐	(2) Material specifications for geomembranes, geocomposites, geotextiles, geogrids, and geonets;
S ☐ ____ N/A ☐ N/C ☑	(3) Manufacturing and fabrication specifications including geomembrane raw material and roll QA, fabrication personnel qualifications, seaming equipment and procedures, overlaps, trial seams, destructive and non-destructive seam testing, seam testing location, frequency, procedure, sample size, and geomembrane repairs;
S ☐ ____ N/A ☐ N/C ☑	(4) Geomembrane installation specifications including earthwork, conformance testing, geomembrane placement, installation personnel qualifications, field seaming and testing, overlapping and repairs, materials in contact with geomembranes, and procedures for lining system acceptance;
S ☐ ____ N/A ☐ N/C ☑	(5) Geotextile and geogrids specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;
S ☑ Section 5/App. H N/A ☐ N/C ☐	(6) Geonet and geocomposites specifications including handling and placement, conformance testing, stacking and joining, repair, and placement of soil materials and any overlying materials;
S ☐ ____ N/A ☐ N/C ☑	(7) Geosynthetic clay liner specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;

LOCATION		PART G CONTINUED
S ☐ ____________ N/A ☑ N/C ☐		f. Standards for soil liner components; (62-701.400(3)(f), FAC)
S ☐ ____________ N/A ☑ N/C ☐	(1)	Description of construction procedures including over-excavation and backfilling to preclude structural inconsistencies and procedures for placing and compacting soil components in layers;
S ☐ ____________ N/A ☑ N/C ☐	(2)	Demonstration of compatibility of the soil component with actual or simulated leachate in accordance with EPA Test Method 9100, or an equivalent test method;
S ☐ ____________ N/A ☑ N/C ☐	(3)	Procedures for testing in situ soils to demonstrate they meet the specifications for soil liners;
S ☐ ____________ N/A ☑ N/C ☐	(4)	Specifications for soil component of liner including at a minimum:
S ☐ ____________ N/A ☑ N/C ☐	(a)	Allowable particle size distribution, and Atterberg limits including shrinkage limit;
S ☐ ____________ N/A ☑ N/C ☐	(b)	Placement moisture and dry density criteria;
S ☐ ____________ N/A ☑ N/C ☐	(c)	Maximum laboratory-determined saturated hydraulic conductivity using simulated leachate;
S ☐ ____________ N/A ☑ N/C ☐	(d)	Minimum thickness of soil liner;
S ☐ ____________ N/A ☑ N/C ☐	(e)	Lift thickness;
S ☐ ____________ N/A ☑ N/C ☐	(f)	Surface preparation (scarification);
S ☐ ____________ N/A ☑ N/C ☐	(g)	Type and percentage of clay mineral within the soil component;
S ☐ ____________ N/A ☑ N/C ☐	(5)	Procedures for constructing and using a field test section to document the desired saturated hydraulic conductivity and thickness can be achieved in the field;
S ☐ ____________ N/A ☑ N/C ☐		g. If a Class III landfill is to be constructed with a bottom liner system, provide a description of how the minimum requirements for the liner will be achieved;

LOCATION | **PART G CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ 3. Leachate collection and removal system (LCRS); (62-701.400(4), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. The primary and secondary LCRS requirements; (62-701.400(4)(a), FAC)

S ☐ ____________ N/A ☐ N/C ☑ (1) Constructed of materials chemically resistant to the waste and leachate;

S ☐ ____________ N/A ☐ N/C ☑ (2) Have sufficient mechanical properties to prevent collapse under pressure;

S ☐ ____________ N/A ☐ N/C ☑ (3) Have granular material or synthetic geotextile to prevent clogging;

S ☐ ____________ N/A ☐ N/C ☑ (4) Have a method for testing and cleaning clogged pipes or contingent designs for reducing leachate around failed areas;

S ☐ ____________ N/A ☐ N/C ☑ b. Other LCRS requirements; (62-701.400(4)(b), (c) and (d), FAC

S ☐ ____________ N/A ☐ N/C ☑ (1) Bottom 12 inches having hydraulic conductivity ≥ 1×10^{-3} cm/sec;

S ☐ ____________ N/A ☐ N/C ☑ (2) Total thickness of 24 inches of material chemically resistant to the waste and leachate;

S ☐ ____________ N/A ☐ N/C ☑ (3) Bottom slope design to accommodate for predicted settlement and still meet minimum slope requirements;

S ☐ ____________ N/A ☐ N/C ☑ (4) Demonstration that synthetic drainage material, if used, is equivalent or better than granular material in chemical compatibility, flow under load, and protection of geomembranes liner;

S ☐ ____________ N/A ☐ N/C ☑ (5) Schedule provided for routine maintenance of LCRS.

S ☐ ____________ N/A ☐ N/C ☑ 4. Leachate recirculation; (62-701.400(5), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Describe general procedures for recirculating leachate;

S ☐ ____________ N/A ☐ N/C ☑ b. Describe procedures for controlling leachate runoff and minimizing mixing of leachate runoff with storm water;

S ☐ ____________ N/A ☐ N/C ☑ c. Describe procedures for preventing perched water conditions and gas buildup;

LOCATION **PART G CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ d. Describe alternate methods for leachate management when it cannot be recirculated due to weather or runoff conditions, surface seeps, wind-blown spray, or elevated levels of leachate head on the liner;

S ☐ ____________ N/A ☐ N/C ☑ e. Describe methods of gas management in accordance with Rule 62-701.530, FAC;

S ☐ ____________ N/A ☐ N/C ☑ f. If leachate irrigation is proposed, describe treatment methods and standards for leachate treatment prior to irrigation over final cover, and provide documentation that irrigation does not contribute significantly to leachate generation;

S ☐ ____________ N/A ☐ N/C ☑ 5. Leachate storage tanks and leachate surface impoundments; (62-701.400(6), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Surface impoundment requirements; (62-701.400(6)(b), FAC)

S ☐ ____________ N/A ☐ N/C ☑ (1) Documentation that the design of the bottom liner will not be adversely impacted by fluctuations of the ground water;

S ☐ ____________ N/A ☐ N/C ☑ (2) Designed in segments to allow for inspection and repair, as needed, without interruption of service;

S ☐ ____________ N/A ☐ N/C ☑ (3) General design requirements;

S ☐ ____________ N/A ☐ N/C ☑ (a) Double liner system consisting of an upper and lower 60-mil minimum thickness geomembrane;

S ☐ ____________ N/A ☐ N/C ☑ (b) Leak detection and collection system with hydraulic conductivity ≥ 1 cm/sec;

S ☐ ____________ N/A ☐ N/C ☑ (c) Lower geomembrane place on subbase ≥ 6 inches thick with $k \leq 1 \times 10^{-5}$ cm/sec or on an approved geosynthetic clay liner with $k \leq 1 \times 10^{-7}$ cm/sec;

S ☐ ____________ N/A ☐ N/C ☑ (d) Design calculation to predict potential leakage through the upper liner;

S ☐ ____________ N/A ☐ N/C ☑ (e) Daily inspection requirements, and notification and corrective action requirements if leakage rates exceed that predicted by design calculations;

S ☐ ____________ N/A ☐ N/C ☑ (4) Description of procedures to prevent uplift, if applicable;

LOCATION	PART G CONTINUED
S ☐ ____________ N/A ☐ N/C ☑	(5) Design calculations to demonstrate minimum two feet of freeboard will be maintained;
S ☐ ____________ N/A ☐ N/C ☑	(6) Procedures for controlling vectors and off-site odors;
S ☐ ____________ N/A ☑ N/C ☐	b. Above-ground leachate storage tanks; (62-701.400(6)(c), FAC)
S ☐ ____________ N/A ☑ N/C ☐	(1) Describe tank materials of construction and ensure foundation is sufficient to support tank;
S ☐ ____________ N/A ☑ N/C ☐	(2) Describe procedures for cathodic protection for the tank, if needed;
S ☐ ____________ N/A ☑ N/C ☐	(3) Describe exterior painting and interior lining of the tank to protect it from the weather and the leachate stored;
S ☐ ____________ N/A ☑ N/C ☐	(4) Describe secondary containment design to ensure adequate capacity will be provided and compatibility of materials of construction;
S ☐ ____________ N/A ☑ N/C ☐	(5) Describe design to remove and dispose of stormwater from the secondary containment system;
S ☐ ____________ N/A ☑ N/C ☐	(6) Describe an overfill prevention system, such as level sensors, gauges, alarms, and shutoff controls to prevent overfilling;
S ☐ ____________ N/A ☑ N/C ☐	(7) Inspections, corrective action, and reporting requirements;
S ☐ ____________ N/A ☑ N/C ☐	(a) Weekly inspection of overfill prevention system;
S ☐ ____________ N/A ☑ N/C ☐	(b) Weekly inspection of exposed tank exteriors;
S ☐ ____________ N/A ☑ N/C ☐	(c) Inspection of tank interiors when tank is drained, or at least every three years;
S ☐ ____________ N/A ☑ N/C ☐	(d) Procedures for immediate corrective action if failures detected;
S ☐ ____________ N/A ☑ N/C ☐	(e) Inspection reports available for Department review;
S ☐ ____________ N/A ☑ N/C ☐	c. Underground leachate storage tanks; (62-701.400(6)(d), FAC)

LOCATION			PART G CONTINUED
S ☐ ____________	N/A ☑	N/C ☐	(1) Describe materials of construction;
S ☐ ____________	N/A ☑	N/C ☐	(2) A double-walled tank design system to be used with the following requirements:
S ☐ ____________	N/A ☑	N/C ☐	(a) Interstitial space monitoring at least weekly;
S ☐ ____________	N/A ☑	N/C ☐	(b) Corrosion protection provided for primary tank interior and external surface of outer shell;
S ☐ ____________	N/A ☑	N/C ☐	(c) Interior tank coatings compatible with stored leachate;
S ☐ ____________	N/A ☑	N/C ☐	(d) Cathodic protection inspected weekly and repaired as needed;
S ☐ ____________	N/A ☑	N/C ☐	(3) Describe an overfill prevention system, such as level sensors, gauges, alarms, and shutoff controls to prevent overfilling, and provide for weekly inspections;
S ☐ ____________	N/A ☑	N/C ☐	(4) Inspection reports available for Department review;
S ☐ ____________	N/A ☐	N/C ☑	6. Liner systems construction quality assurance (CQA); (62-701.400(7), FAC)
S ☐ ____________	N/A ☐	N/C ☑	a. Provide CQA Plan including:
S ☐ ____________	N/A ☐	N/C ☑	(1) Specifications and construction requirements for liner system;
S ☐ ____________	N/A ☐	N/C ☑	(2) Detailed description of quality control testing procedures and frequencies;
S ☐ ____________	N/A ☐	N/C ☑	(3) Identification of supervising professional engineer;
S ☐ ____________	N/A ☐	N/C ☑	(4) Identify responsibility and authority of all appropriate organizations and key personnel involved in the construction project;
S ☐ ____________	N/A ☐	N/C ☑	(5) State qualifications of CQA professional engineer and support personnel;

LOCATION **PART G CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ (6) Description of CQA reporting forms and documents;

S ☐ ____________ N/A ☐ N/C ☑ b. An independent laboratory experienced in the testing of geosynthetics to perform required testing;

S ☐ ____________ N/A ☐ N/C ☑ 7. Soil liner CQA; (62-701.400(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Documentation that an adequate borrow source has been located with test results, or description of the field exploration and laboratory testing program to define a suitable borrow source;

S ☐ ____________ N/A ☐ N/C ☑ b. Description of field test section construction and test methods to be implemented prior to liner installation;

S ☐ ____________ N/A ☐ N/C ☑ c. Description of field test methods, including rejection criteria and corrective measures to insure proper liner installation;

S ☐ ____________ N/A ☐ N/C ☑ 8. For surface water management systems at aboveground disposal units, provide documentation showing the design of any features intended to convey stormwater to a permitted or exempted treatment system; (62-701.400(9), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 9. Gas control systems; (62-701.400(10), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Provide documentation that if the landfill is receiving degradable wastes, it will have a gas control system complying with the requirements of Rule 62-701.530, FAC;

S ☐ ____________ N/A ☑ N/C ☐ 10. For landfills designed in ground water, provide documentation that the landfill will provide a degree of protection equivalent to landfills designed with bottom liners not in contact with ground water; (62-701.400(11), FAC)

PART H. HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS (62-701.410(2), FAC)

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Submit a hydrogeological investigation and site report including at least the following information:

S ☐ ____________ N/A ☐ N/C ☑ a. Regional and site specific geology and hydrology;

S ☐ ____________ N/A ☐ N/C ☑ b. Direction and rate of ground water and surface water flow including seasonal variations;

LOCATION **PART H CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ c. Background quality of ground water and surface water;

S ☐ ____________ N/A ☐ N/C ☑ d. Any on-site hydraulic connections between aquifers;

S ☐ ____________ N/A ☐ N/C ☑ e. Site stratigraphy and aquifer characteristics for confining layers, semi-confining layers, and all aquifers below the site that may be affected by the disposal facility;

S ☐ ____________ N/A ☐ N/C ☑ f. Description of topography, soil types, and surface water drainage systems;

S ☐ ____________ N/A ☐ N/C ☑ g. Inventory of all public and private water wells within a one mile radius of the site including, where available, well top of casing and bottom elevations, name of owner, age and usage of each well, stratigraphic unit screened, well construction technique, and static water level;

S ☐ ____________ N/A ☐ N/C ☑ h. Identify and locate any existing contaminated areas on the site;

S ☐ ____________ N/A ☐ N/C ☑ i. Include a map showing the locations of all potable wells within 500 feet of the waste storage and disposal areas;

S ☐ ____________ N/A ☐ N/C ☑ 2. Report signed, sealed, and dated by P.E. and/or P.G.

PART I. GEOTECHNICAL INVESTIGATION REQUIREMENTS (62-701.410(3) and (4), FAC)

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Submit a geotechnical site investigation report defining the engineering properties of the site including at least the following:

S ☐ ____________ N/A ☐ N/C ☑ a. Description of subsurface conditions including soil stratigraphy and ground water table conditions;

S ☐ ____________ N/A ☐ N/C ☑ b. Investigate for the presence of muck, previously filled areas, soft ground, and lineaments;

S ☐ ____________ N/A ☐ N/C ☑ c. Estimates of average and maximum high water table across the site;

S ☐ ____________ N/A ☐ N/C ☑ d. Evaluation of potential for fault areas and seismic impact zones;

S ☑ Section 4 N/A ☐ N/C ☐ e. Foundation analysis including:

LOCATION | **PART I CONTINUED**

S ☐ _____________ N/A ☐ N/C ☑ (1) Foundation bearing capacity analysis;

S ☑ Sec. 4.2/App. D N/A ☐ N/C ☐ (2) Total and differential subgrade settlement analysis;

S ☑ Sec. 4.4/App. F N/A ☐ N/C ☐ (3) Slope stability analysis;

S ☐ _____________ N/A ☐ N/C ☑ f. Evaluation of potential for sinkholes and sinkhole activity at the site that is based upon the investigations required in Rule 62-701.410(3)(f), F.A.C.;

S ☐ _____________ N/A ☐ N/C ☑ g. A geotechnical report providing a description of methods used in the investigation, and includes soil boring logs, laboratory results, analytical calculations, cross sections, interpretations, conclusions, and a description of any engineering measures proposed for the site;

S ☑ Report N/A ☐ N/C ☐ 2. Report signed, sealed, and dated by P.E. and/or P.G.

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

LOCATION

S ☐ _____________ N/A ☑ N/C ☐ 1. Describe how the vertical expansion shall not cause or contribute to any violations of water quality standards or criteria, shall not cause objectionable odors, or adversely affect the closure design of the existing landfill;

S ☐ _____________ N/A ☑ N/C ☐ 2. Describe how the vertical expansion over unlined landfills will meet the requirements of Rule 62-701.400, FAC with the exceptions of Rule 62-701.430(1)(c), FAC;

S ☐ _____________ N/A ☑ N/C ☐ 3. Provide foundation and settlement analysis for the vertical expansion;

S ☐ _____________ N/A ☑ N/C ☐ 4. Provide total settlement calculations demonstrating that the final elevations of the lining system, gravity drainage, and no other component of the design will be adversely affected;

S ☐ _____________ N/A ☑ N/C ☐ 5. Minimum stability factor of safety of 1.5 for the lining system component interface stability and for deep stability;

S ☐ _____________ N/A ☑ N/C ☐ 6. Provide documentation to show the surface water management system will not be adversely affected by the vertical expansion;

S ☐ _____________ N/A ☑ N/C ☐ 7. Provide gas control designs to prevent accumulation of gas under the new liner for the vertical expansion;

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Provide documentation that the landfill will have at least one trained operator during operation and at least one trained spotter at each working face; (62-701.500(1), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Provide a landfill operation plan including procedures for: (62-701.500(2), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Designating responsible operating and maintenance personnel;

S ☐ ____________ N/A ☐ N/C ☑ b. Emergency preparedness and response, as required in subsection 62-701.320(16), FAC;

S ☐ ____________ N/A ☐ N/C ☑ c. Controlling types of waste received at the landfill;

S ☐ ____________ N/A ☐ N/C ☑ d. Weighing incoming waste;

S ☐ ____________ N/A ☐ N/C ☑ e. Vehicle traffic control and unloading;

S ☐ ____________ N/A ☐ N/C ☑ f. Method and sequence of filling waste;

S ☐ ____________ N/A ☐ N/C ☑ g. Waste compaction and application of cover;

S ☐ ____________ N/A ☐ N/C ☑ h. Operations of gas, leachate, and stormwater controls;

S ☐ ____________ N/A ☐ N/C ☑ i. Water quality monitoring;

S ☐ ____________ N/A ☐ N/C ☑ j. Maintaining and cleaning the leachate collection system;

S ☐ ____________ N/A ☐ N/C ☑ 3. Provide a description of the landfill operation record to be used at the landfill, details as to location of where various operational records will be kept (i.e. DEP permit, engineering drawings, water quality records, etc.); (62-701.500(3), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 4. Describe the waste records that will be compiled monthly and provided to the Department annually; (62-701.500(4), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 5. Describe methods of access control; (62-701.500(5), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 6. Describe load checking program to be implemented at the landfill to discourage disposal of unauthorized waste at the landfill; (62-701.500(6), FAC)

LOCATION **PART K CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ 7. Describe procedures for spreading and compacting waste at the landfill that include: (62-701.500(7), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Waste layer thickness and compaction frequencies;

S ☐ ____________ N/A ☐ N/C ☑ b. Special considerations for first layer of waste placed above the liner and leachate collection system;

S ☐ ____________ N/A ☐ N/C ☑ c. Slopes of cell working face and side grades above land surface, and planned lift depths during operation;

S ☐ ____________ N/A ☐ N/C ☑ d. Maximum width of working face;

S ☐ ____________ N/A ☐ N/C ☑ e. Description of type of initial cover to be used at the facility that controls:

S ☐ ____________ N/A ☐ N/C ☑ (1) Vector breeding/animal attraction;

S ☐ ____________ N/A ☐ N/C ☑ (2) Fires;

S ☐ ____________ N/A ☐ N/C ☑ (3) Odors;

S ☐ ____________ N/A ☐ N/C ☑ (4) Blowing litter;

S ☐ ____________ N/A ☐ N/C ☑ (5) Moisture infiltration;

S ☐ ____________ N/A ☐ N/C ☑ f. Procedures for applying initial cover, including minimum cover frequencies;

S ☐ ____________ N/A ☐ N/C ☑ g. Procedures for applying intermediate cover;

S ☐ ____________ N/A ☐ N/C ☑ h. Time frames for applying final cover;

S ☐ ____________ N/A ☐ N/C ☑ i. Procedures for controlling scavenging and salvaging;

S ☐ ____________ N/A ☐ N/C ☑ j. Description of litter policing methods;

S ☐ ____________ N/A ☐ N/C ☑ k. Erosion control procedures;

LOCATION | **PART K CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ 8. Describe operational procedures for leachate management including: (62-701.500(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Leachate level monitoring;

S ☐ ____________ N/A ☐ N/C ☑ b. Operation and maintenance of leachate collection and removal system, and treatment as required;

S ☐ ____________ N/A ☐ N/C ☑ c. Procedures for managing leachate if it becomes regulated as a hazardous waste;

S ☐ ____________ N/A ☐ N/C ☑ d. Identification of treatment or disposal facilities that may be used for off-site discharge and treatment of leachate;

S ☐ ____________ N/A ☐ N/C ☑ e. Contingency plan for managing leachate during emergencies or equipment problems;

S ☐ ____________ N/A ☐ N/C ☑ f. Procedures for recording quantities of leachate generated in gal/day and including this in the operating record;

S ☐ ____________ N/A ☐ N/C ☑ g. Procedures for comparing precipitation experienced at the landfill with leachate generation rates and including this information in the operating record;

S ☐ ____________ N/A ☐ N/C ☑ h. Procedures for water pressure cleaning or video inspecting leachate collection systems;

S ☐ ____________ N/A ☐ N/C ☑ 9. Describe how the landfill receiving degradable wastes shall implement a gas management system meeting the requirements of Rule 62-701.530, FAC; (62-701.500(9), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 10. Describe procedures for operating and maintaining the landfill stormwater management system to comply with the requirements of Rule 62-701.400(9), FAC; (62-701.500(10), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 11. Equipment and operation feature requirements; (62-701.500(11), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Sufficient equipment for excavating, spreading, compacting, and covering waste;

S ☐ ____________ N/A ☐ N/C ☑ b. Reserve equipment or arrangements to obtain additional equipment within 24 hours of breakdown;

S ☐ ____________ N/A ☐ N/C ☑ c. Communications equipment;

LOCATION **PART K CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ d. Dust control methods;

S ☐ ____________ N/A ☐ N/C ☑ e. Fire protection capabilities and procedures for notifying local fire department authorities in emergencies;

S ☐ ____________ N/A ☐ N/C ☑ f. Litter control devices;

S ☐ ____________ N/A ☐ N/C ☑ g. Signs indicating operating authority, traffic flow, hours of operation, and disposal restrictions;

S ☐ ____________ N/A ☐ N/C ☑ 12. Provide a description of all-weather access road, inside perimeter road, and other on-site roads necessary for access at the landfill; (62-701.500(12), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 13. Additional record keeping and reporting requirements; (62-701.500(13), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Records used for developing permit applications and supplemental information maintained for the design period of the landfill;

S ☐ ____________ N/A ☐ N/C ☑ b. Monitoring information, calibration and maintenance records, and copies of reports required by permit maintained for at least 10 years;

S ☐ ____________ N/A ☐ N/C ☑ c. Maintain annual estimates of the remaining life of constructed landfills, and of other permitted areas not yet constructed, and submit this estimate annually to the Department;

S ☐ ____________ N/A ☐ N/C ☑ d. Procedures for archiving and retrieving records which are more than five years old;

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. A water quality monitoring plan shall be submitted describing the proposed ground water and surface water monitoring systems, and shall meet at least the following requirements:

S ☐ ____________ N/A ☐ N/C ☑ a. Based on the information obtained in the hydrogeological investigation and signed, dated, and sealed by the P.G. or P.E. who prepared it; (62-701.510(2)(a), FAC)

LOCATION		PART L CONTINUED
S ☐ ____________ N/A ☐ N/C ☑		b. All sampling and analysis performed in accordance with Chapter 62-160, FAC; (62-701.510(2)(b), FAC)
S ☐ ____________ N/A ☐ N/C ☑		c. Ground water monitoring requirements; (62-701.510(3), FAC)
S ☐ ____________ N/A ☐ N/C ☑	(1)	Detection wells located downgradient from and within 50 feet of disposal units;
S ☐ ____________ N/A ☐ N/C ☑	(2)	Downgradient compliance wells as required;
S ☐ ____________ N/A ☐ N/C ☑	(3)	Background wells screened in all aquifers below the landfill that may be affected by the landfill;
S ☐ ____________ N/A ☐ N/C ☑	(4)	Location information for each monitoring well;
S ☐ ____________ N/A ☐ N/C ☑	(5)	Well spacing no greater than 500 feet apart for downgradient wells and no greater than 1500 feet apart for upgradient wells, unless site specific conditions justify alternate well spacings;
S ☐ ____________ N/A ☐ N/C ☑	(6)	Properly selected well screen locations;
S ☐ ____________ N/A ☐ N/C ☑	(7)	Monitoring wells constructed to provide representative ground water samples;
S ☐ ____________ N/A ☐ N/C ☑	(8)	Procedures for properly abandoning monitoring wells;
S ☐ ____________ N/A ☐ N/C ☑	(9)	Detailed description of detection sensors, if proposed;
S ☐ ____________ N/A ☐ N/C ☑		d. Surface water monitoring requirements; (62-701.510(4), FAC)
S ☐ ____________ N/A ☐ N/C ☑	(1)	Location of and justification for all proposed surface water monitoring points;
S ☐ ____________ N/A ☐ N/C ☑	(2)	Each monitoring location to be marked and its position determined by a registered Florida land surveyor;
S ☐ ____________ N/A ☐ N/C ☑		e. Initial and routine sampling frequency and requirements; (62-701.510(5), FAC)
S ☐ ____________ N/A ☐ N/C ☑	(1)	Initial background ground water and surface water sampling and analysis requirements;

LOCATION **PART L CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ (2) Routine monitoring well sampling and analysis requirements;

S ☐ ____________ N/A ☐ N/C ☑ (3) Routine surface water sampling and analysis requirements;

S ☐ ____________ N/A ☐ N/C ☑ f. Describe procedures for implementing evaluation monitoring, prevention measures, and corrective action as required; (62-701.510(6), FAC)

S ☐ ____________ N/A ☐ N/C ☑ g. Water quality monitoring report requirements; (62-701.510(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ (1) Semi-annual report requirements; (see paragraphs 62-701.510(5)(c) and (d), FAC for sampling frequencies)

S ☐ ____________ N/A ☐ N/C ☑ (2) Documentation that the water quality data shall be provided to the Department in an electronic format consistent with requirements for importing into Department databases, unless an alternate form of submittal is specified in the permit;

S ☐ ____________ N/A ☐ N/C ☑ (3) Two and one-half year, or annual, report requirements, or every five years if in long-term care, signed dated, and sealed by P.G. or P.E.;

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Describe procedures for managing motor vehicles; (62-701.520(1), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Describe procedures for landfilling shredded waste; (62-701.520(2), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 3. Describe procedures for asbestos waste disposal; (62-701.520(3), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 4. Describe procedures for disposal or management of contaminated soil; (62-701.520(4), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 5. Describe procedures for disposal of biological wastes; (62-701.520(5), FAC)

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Provide documentation for a gas management system that will: (62-701.530(1), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Be designed to prevent concentrations of combustible gases from exceeding 25% the LEL in structures and 100% the LEL at the property boundary;

S ☐ ____________ N/A ☐ N/C ☑ b. Be designed for site specific conditions;

S ☐ ____________ N/A ☐ N/C ☑ c. Be designed to reduce gas pressure in the interior of the landfill;

S ☐ ____________ N/A ☐ N/C ☑ d. Be designed to not interfere with the liner, leachate control system, or final cover;

S ☐ ____________ N/A ☐ N/C ☑ 2. Provide documentation that will describe locations, construction details, and procedures for monitoring gas at ambient monitoring points and with soil monitoring probes; (62-701.530(2), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 3. Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented; (62-701.530(3), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 4. Landfill gas recovery facilities; (62-701.530(5), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Provide information required in Rules 62-701.320(7) and 62-701.330(3), FAC;

S ☐ ____________ N/A ☐ N/C ☑ b. Provide information required in Rule 62-701.600(4), FAC, where relevant and practical;

S ☐ ____________ N/A ☐ N/C ☑ c. Provide estimates of current and expected gas generation rates and description of condensate disposal methods;

S ☐ ____________ N/A ☐ N/C ☑ d. Provide description of procedures for condensate sampling, analyzing, and data reporting;

S ☐ ____________ N/A ☐ N/C ☑ e. Provide closure plan describing methods to control gas after recovery facility ceases operation, and any other requirements contained in Rule 62-701.400(10), FAC;

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

LOCATION

S ☐ _____________ N/A ☐ N/C ☑ 1. Closure permit requirements; (62-701.600(2), FAC)

S ☐ _____________ N/A ☐ N/C ☑ a. Application submitted to the Department at least 90 days prior to final receipt of wastes;

S ☐ _____________ N/A ☐ N/C ☑ b. Closure plan shall include the following:

S ☐ _____________ N/A ☐ N/C ☑ (1) Closure design plan;

S ☐ _____________ N/A ☐ N/C ☑ (2) Closure operation plan;

S ☐ _____________ N/A ☐ N/C ☑ (3) Plan for long-term care;

S ☐ _____________ N/A ☐ N/C ☑ (4) A demonstration that proof of financial assurance for long-term care will be provided;

S ☐ _____________ N/A ☐ N/C ☑ 2. Closure design plan including the following requirements: (62-701.600(3), FAC)

S ☐ _____________ N/A ☐ N/C ☑ a. Plan sheet showing phases of site closing;

S ☐ _____________ N/A ☐ N/C ☑ b. Drawings showing existing topography and proposed final grades;

S ☐ _____________ N/A ☐ N/C ☑ c. Provisions to close units when they reach approved design dimensions;

S ☐ _____________ N/A ☐ N/C ☑ d. Final elevations before settlement;

S ☐ _____________ N/A ☐ N/C ☑ e. Side slope design including benches, terraces, down slope drainage ways, energy dissipaters, and description of expected precipitation effects;

S ☐ _____________ N/A ☐ N/C ☑ f. Final cover installation plans including:

S ☐ _____________ N/A ☐ N/C ☑ (1) CQA plan for installing and testing final cover;

S ☐ _____________ N/A ☐ N/C ☑ (2) Schedule for installing final cover after final receipt of waste;

S ☐ _____________ N/A ☐ N/C ☑ (3) Description of drought resistant species to be used in the vegetative cover;

LOCATION		PART O CONTINUED
S ☐ ____________	N/A ☐ N/C ☑	(4) Top gradient design to maximize runoff and minimize erosion;
S ☐ ____________	N/A ☐ N/C ☑	(5) Provisions for cover material to be used for final cover maintenance;
S ☑ Section 5	N/A ☐ N/C ☐	g. Final cover design requirements;
S ☑ Appendix B	N/A ☐ N/C ☐	(1) Protective soil layer design;
S ☐ ____________	N/A ☑ N/C ☐	(2) Barrier soil layer design;
S ☐ ____________	N/A ☐ N/C ☑	(3) Erosion control vegetation;
S ☐ ____________	N/A ☐ N/C ☑	(4) Geomembrane barrier layer design;
S ☐ ____________	N/A ☑ N/C ☐	(5) Geosynthetic clay liner design, if used;
S ☑ App. F and G	N/A ☐ N/C ☐	(6) Stability analysis of the cover system and the disposed waste;
S ☑ Sec. 5	N/A ☐ N/C ☐	h. Proposed method of stormwater control;
S ☐ ____________	N/A ☐ N/C ☑	i. Proposed method of access control;
S ☐ ____________	N/A ☐ N/C ☑	j. Description of the proposed or existing gas management system which complies with Rule 62-701.530, FAC;
S ☐ ____________	N/A ☐ N/C ☑	3. Closure operation plan shall include: (62-701.600(4), FAC)
S ☐ ____________	N/A ☐ N/C ☑	a. Detailed description of actions which will be taken to close the landfill;
S ☐ ____________	N/A ☐ N/C ☑	b. Time schedule for completion of closing and long-term care;
S ☐ ____________	N/A ☐ N/C ☑	c. Describe proposed method for demonstrating financial assurance for long-term care;
S ☐ ____________	N/A ☐ N/C ☑	d. Operation of the water quality monitoring plan required in Rule 62-701.510, FAC;
S ☐ ____________	N/A ☐ N/C ☑	e. Development and implementation of gas management system required in Rule 62-701.530, FAC;

LOCATION **PART O CONTINUED**

S ☐ ____________ N/A ☐ N/C ☑ 4. Certification of closure construction completion and final reports including: (62-701.600(6), FAC)

S ☐ ____________ N/A ☐ N/C ☑ a. Survey monuments; (62-701.600(6)(a), FAC)

S ☐ ____________ N/A ☐ N/C ☑ b. Final survey report; (62-701.600(6)(b), FAC)

S ☐ ____________ N/A ☐ N/C ☑ c. Closure construction quality assurance report; (62-701.400(7), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 5. Declaration to the public; (62-701.600(7), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 6. Official date of closing; (62-701.600(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 7. Justification for and detailed description of procedures to be followed for temporary closure of the landfill, if desired; (62-701.600(9), FAC)

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Describe how the requirements for use of closed solid waste disposal areas will be achieved; (62-701.610(1), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Describe how the requirements for relocation of wastes will be achieved; (62-701.610(2), FAC)

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

LOCATION

S ☐ ____________ N/A ☐ N/C ☑ 1. Maintaining the gas collection and monitoring system; (62-701.620(5), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Stabilization report requirements; (62-701.620(6), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 3. Right of access; (62-701.620(7), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 4. Requirements for replacement of monitoring devices; (62-701.620(8), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 5. Completion of long-term care signed and sealed by professional engineer; (62-701.620(9), FAC)

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

LOCATION

S ☑ Appendix I N/A ☐ N/C ☐ 1. Provide cost estimates for closing, long-term care, and corrective action costs estimated by a P.E. for a third party performing the work, on a per unit basis, with the source of estimates indicated; (62-701.630(3) & (7), FAC)

S ☐ ____________ N/A ☐ N/C ☑ 2. Describe procedures for providing annual cost adjustments to the Department based on inflation and changes in the closing, long-term care, and corrective action plans; (62-701.630(4) & (8), FAC)

S ☑ Appendix I N/A ☐ N/C ☐ 3. Describe funding mechanisms for providing proof of financial assurance and include appropriate financial assurance forms. (62-701.630(5), (6), & (9), FAC)

PART S. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

1. Applicant:

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

Kirk Wills	1501 Omni Way
Signature of Applicant or Agent	Mailing Address
Kirk Wills, Southern Region Engineer	St. Cloud, FL 34773
Name and Title (please type)	City, State, Zip Code
kirk.wills@wasteconnections.com	(813) 388-1026
E-Mail Address (if available)	Telephone Number
	Date: 1\23\2019

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

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

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

[signature]	12802 Tampa Oaks Blvd, Ste 151
Signature	Mailing Address
Craig R. Browne, Senior Engineer	Tampa, FL 33637
Name and Title (please type)	City, State, Zip Code
	cbrowne@geosyntec.com
	E-Mail Address (if available)
68613	(813) 558-0990
Florida Registration Number (please affix seal)	Telephone Number
	Date: 1/23/2019

CRAIG R. BROWNE LICENSE No. 68613 STATE OF FLORIDA PROFESSIONAL ENGINEER

APPENDIX B
INTERMEDIATE MODIFICATION PERMIT DRAWINGS

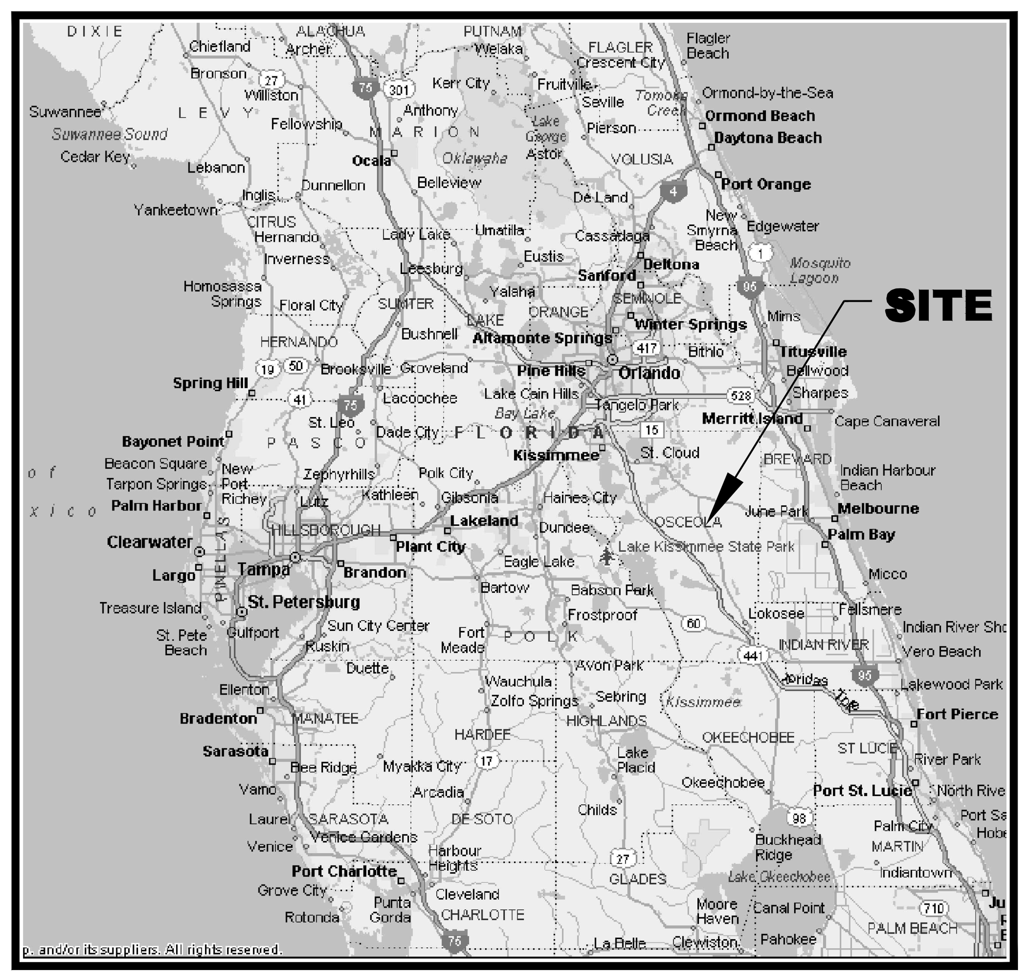
J.E.D. SOLID WASTE MANAGEMENT FACILITY

ST. CLOUD, FLORIDA

SOLID WASTE RENEWAL PERMIT

JUNE 2016

(REVISED, JANUARY 2019 FOR INTERMEDIATE MODIFICATION)



LOCATION MAP

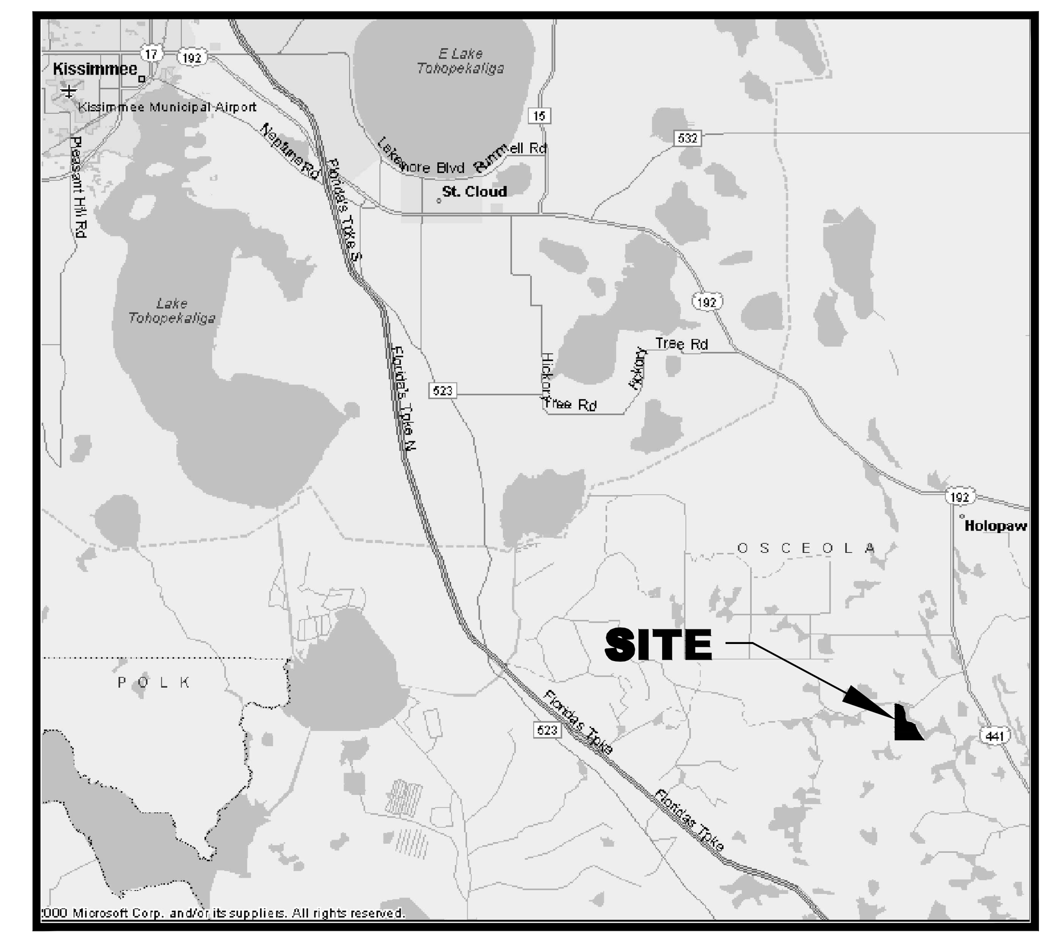
0 32

SCALE: 1" □ 32 MILES

LIST OF DRAWINGS

DRAWING NO.	DRAWING TITLE	REVISION
1	TITLE SHEET	3
2	EXISTING SITE CONDITIONS AND AERIAL PHOTOGRAPH	0
3	TOPOGRAPHIC MAP OF THE SITE	0
4	SITE CHARACTERIZATION PLAN I	1
5	SITE CHARACTERIZATION PLAN II	0
6	SITE DEVELOPMENT PLAN	0
7	BASE GRADING PLAN - PHASE 4	1
8	BASE GRADING PLAN - PHASE 5	1
9	LEACHATE COLLECTION SYSTEM LAYOUT PLAN I	1
10	LEACHATE COLLECTION SYSTEM LAYOUT PLAN II	0
11	LANDFILL CROSS SECTIONS I	1
12	LANDFILL CROSS SECTIONS II	2
13	LANDFILL CROSS SECTIONS III	0
14	PERIMETER BERM TYPICAL SECTIONS	0
15	LINER SYSTEM DETAILS I - CELLS 12 THROUGH 15	1
16	LINER SYSTEM DETAILS II - CELLS 12 THROUGH 15	1
17	LEACHATE SUMP PLAN - CELLS 12 THROUGH 15	1
18	SECONDARY SUMP CROSS SECTIONS - CELLS 12 THROUGH 15	0
19	PRIMARY SUMP CROSS SECTIONS - CELLS 12 THROUGH 15	0
20	LEACHATE SUMP CROSS SECTIONS - CELLS 12 THROUGH 15	1
21	LEACHATE COLLECTION SYSTEM DETAILS - CELLS 12 THROUGH 15	0
22	LEACHATE MANAGEMENT SYSTEM SCHEMATIC DIAGRAM	0
23	GROUNDWATER MONITORING NETWORK	2
24	PHASE 4 CONSTRUCTION SE□UENCING	2
25	PHASE 5 CONSTRUCTION SE□UENCING	0
26	WASTE FILL SE□UENCING PLAN I	0
27	WASTE FILL SE□UENCING PLAN II	0
28	GAS MANAGEMENT SYSTEM - EXISTING CONDITIONS (NOTE 1)	0
29	GAS MANAGEMENT SYSTEM - PHASE 5 PROPOSED CONSTRUCTION (NOTE 1)	0
30	GAS MANAGEMENT DETAILS I (NOTE 1)	0
31	GAS MANAGEMENT DETAILS II (NOTE 1)	0
32	GAS MANAGEMENT DETAILS III (NOTE 1)	0
33	GAS MANAGEMENT DETAILS IV (NOTE 1)	0
34	GAS MANAGEMENT DETAILS V (NOTE 1)	0
35	PROPOSED DEWATERING SYSTEM PLAN (1 OF 3) (NOTE 1)	0
36	PROPOSED DEWATERING SYSTEM PLAN (2 OF 3) (NOTE 1)	0
37	PROPOSED DEWATERING SYSTEM PLAN (3 OF 3) (NOTE 1)	0
38	DEWATERING DETAILS (1 OF 3) (NOTE 1)	0
39	DEWATERING DETAILS (2 OF 3) (NOTE 1)	0
40	DEWATERING DETAILS (3 OF 3) (NOTE 1)	0
41	SCALE AND ADMINISTRATIVE AREA LAYOUT	0
42	FINAL COVER SYSTEM GRADING PLAN I	1
43	FINAL COVER SYSTEM GRADING PLAN II	0
44	FINAL COVER SYSTEM DETAILS	0
45	STORM WATER MANAGEMENT PLAN	1
46	STORM WATER MANAGEMENT DETAILS I	0
46A	STORM WATER MANAGEMENT DETAILS IA	0
47	STORM WATER MANAGEMENT DETAILS II	0
47A	STORM WATER MANAGEMENT DETAILS III	0
48	STORM WATER DRAINAGE STRUCTURE DETAILS	0

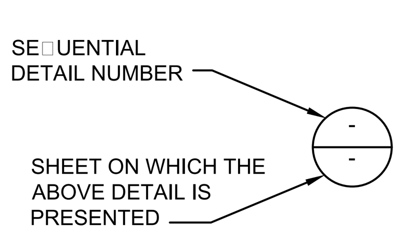
NOTE:
1. PREPARED BY OTHERS.



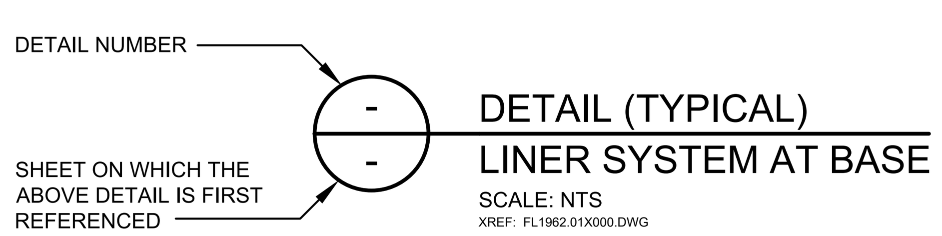
VICINITY MAP

0 4

SCALE: 1" □ 4 MILES

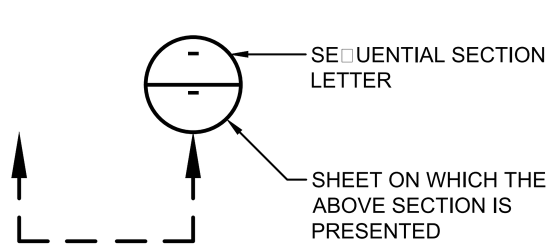


DETAIL REFERENCE KEY

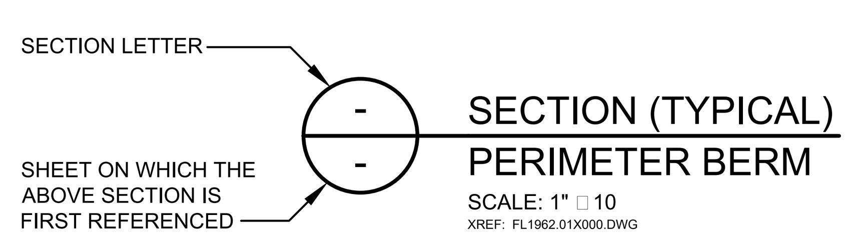


DETAIL BAR REFERENCE KEY

EXAMPLE: DETAIL 1 WHICH IS PRESENTED ON SHEET 7 WAS FIRST REFERENCED ON SHEET 5.



SECTION REFERENCE KEY



SECTION BAR REFERENCE KEY

EXAMPLE: SECTION C WHICH IS PRESENTED ON SHEET 5 WAS FIRST REFERENCED ON SHEET 3.

REV	DATE	DESCRIPTION	DRN	APP
3	JAN 2019	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB
2	MAY 2018	ISSUED FOR FDEP APPROVAL (MINOR MODIFICATION GAS PIPING, CELL 12, AND RAIN COVER)	CMV	CRB
1	MAY 2017	ISSUED FOR FDEP APPROVAL (OPERATIONS PERMIT RENEWAL)	CMV	AR
0	JUN 2016	ISSUED FOR FDEP APPROVAL	CMV	CRB

Geosyntec consultants
12802 TAMPA OAKS BLVD., SUITE 151
TEMPLE TERRACE, FLORIDA 33637 USA
PH: 813.558.0990 - FX:813.558.9726
AUTHORIZATION NUMBER: 4321

WASTE CONNECTIONS OF OSCEOLA COUNTY, LLC
1501 OMNI WAY
ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE: TITLE SHEET

PROJECT: SOLID WASTE RENEWAL PERMIT

SITE: J.E.D. SOLID WASTE MANAGEMENT FACILITY

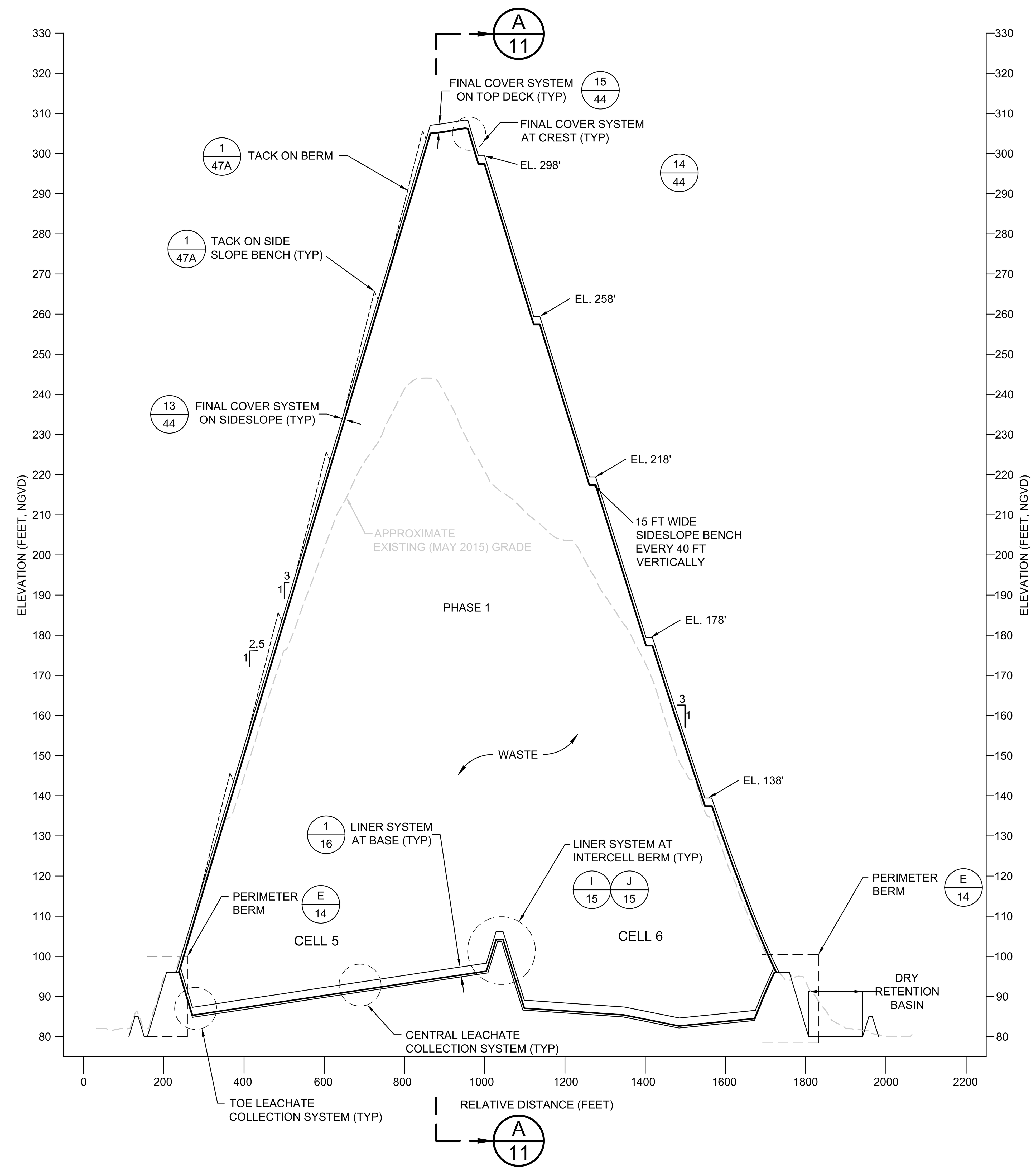
SIGNATURE

DATE

CRAIG BROWNE - LICENSE NO. 68613

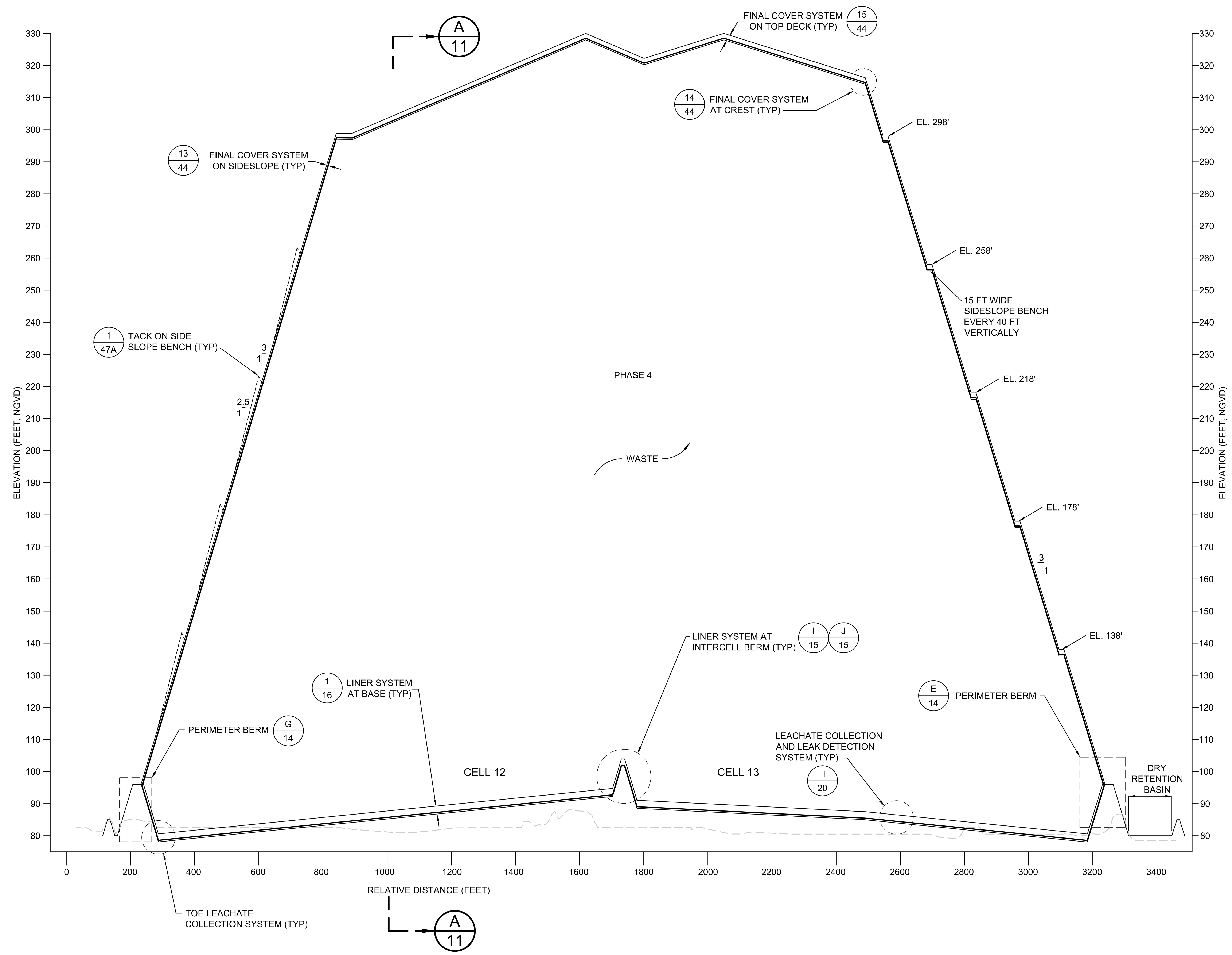
DESIGN BY:	CRB	DATE:	MAY 2018
DRAWN BY:	CMV	PROJECT NO.:	FL3318.01
CHECKED BY:	AR	FILE:	FL3318.01P01
REVIEWED BY:	KBT	DRAWING NO.:	1 OF 48
APPROVED BY:	CRB		

PERMIT DRAWING



B / 7 SECTION
LANDFILL CROSS SECTION

SCALE: 1" □ 200' (HOR) □ 1" □ 20' (VERT)



C / 7 SECTION
LANDFILL CROSS SECTION

SCALE: 1" □ 200' (HOR) □ 1" □ 20' (VERT)

GENERAL NOTES:

1. THE ELEVATIONS SHOWN REPRESENT NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29) (FEET).

REV	DATE	DESCRIPTION	DRN	APP
2	JAN 2019	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB
1	MAY 2017	ISSUED FOR FDEP APPROVAL (OPERATIONS PERMIT RENEWAL)	CMV	AR
0	JUN 2016	ISSUED FOR FDEP APPROVAL	CMV	CRB

Geosyntec consultants
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TEMPLE TERRACE, FLORIDA 33637 USA
PH: 813.558.0990 - FX:813.558.9726
AUTHORIZATION NUMBER: 4321

WASTE CONNECTIONS OF OSCEOLA COUNTY, LLC
1501 OMNI WAY
ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE: LANDFILL CROSS SECTIONS II

PROJECT: SOLID WASTE RENEWAL PERMIT

SITE: J.E.D. SOLID WASTE MANAGEMENT FACILITY

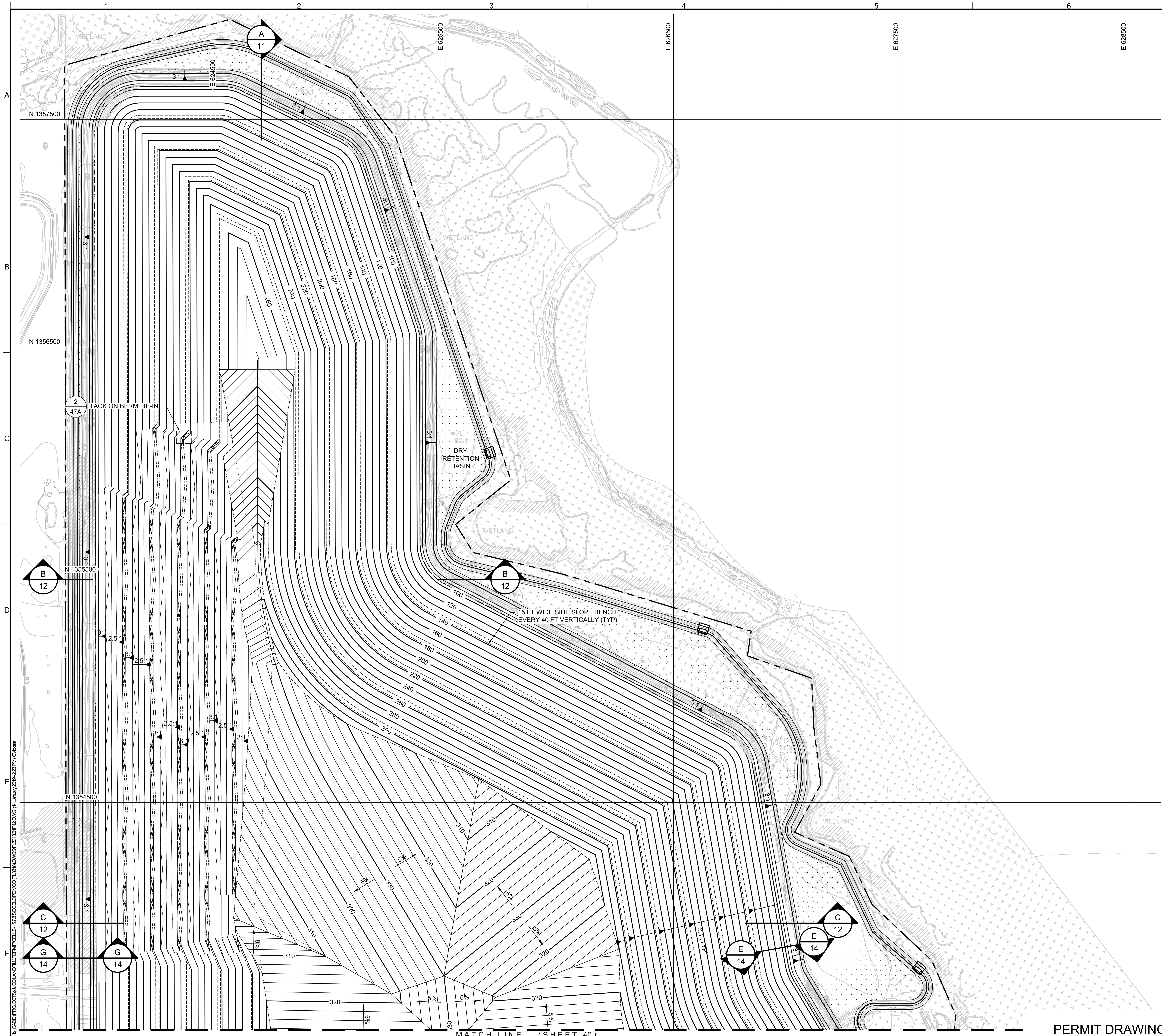
DESIGN BY:	CRB	DATE:	MAY 2018
DRAWN BY:	CMV	PROJECT NO.:	FL3318.01
CHECKED BY:	AR	FILE:	FL3318.01P11
REVIEWED BY:	KBT	DRAWING NO.:	
APPROVED BY:	CRB	12 OF 48	

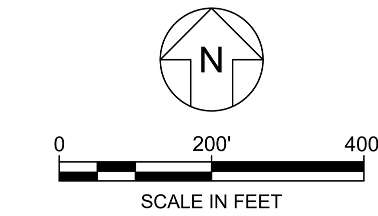
SIGNATURE

DATE

CRAIG BROWNE - LICENSE NO. 68613

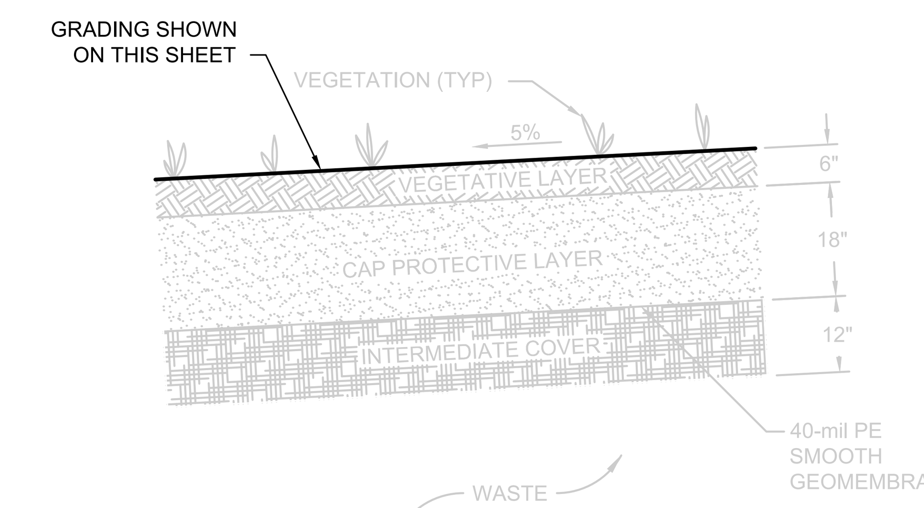
PERMIT DRAWING





LEGEND

- PROPERTY BOUNDARY
- EXISTING GROUND ELEVATION (FEET) (SEE NOTE 3)
- EXISTING FENCE
- STORMWATER MANAGEMENT POND
- WET RETENTION / BORROW AREA BOUNDARY
- PERMITTED FINAL COVER ELEVATION (FEET)
- SLOPE BREAKLNE



NOTES:

1. NORTHING AND EASTING COORDINATES SHOWN REPRESENT FLORIDA STATE PLANE EAST ZONE NORTH AMERICAN DATUM OF 1983 (NAD83).THE ELEVATIONS SHOWN REPRESENT NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29)(FEET).
2. THE PROPERTY BOUNDARY IS BASED ON A COMPOSITE BOUNDARY SURVEY PROVIDED BY JOHNSTON SURVEYING INC., KISSIMMEE FLORIDA, DATED AUGUST 12, 1999.
3. TOPOGRAPHIC INFORMATION SHOWN ON THIS DRAWING WAS PROVIDED BY BASE MAPPING CO. LTD BASED ON AN AERIAL PHOTOGRAPH TAKEN ON 20 MAY 2015.
4. THE WETLAND BOUNDARY INFORMATION SHOWN IS BASED ON: A FIELD SURVEY DATED 15 MAY 2002 BY JOHNSTON SURVEYING INC. OF WETLANDS BOUNDARIES FLAGGED BY BIOLOGICAL RESEARCH ASSOCIATES, INC. (BRA), THE EXISTING JURISDICTIONAL WETLAND DETERMINATIONS, A PHOTO INTERPRETATION OF WETLAND BOUNDARIES BY BRA IN AREAS OUTSIDE THE LIMITS OF CONSTRUCTION, AND A FIELD SURVEY DATED 24 NOVEMBER 2010 BY PEAVEY & ASSOCIATES OF WETLAND BOUNDARIES FLAGGED BY ENTRIX, INC.

REV	DATE	DESCRIPTION	DRN	APP
1	SEP 2018	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB
0	JUN 2016	ISSUED FOR FDEP APPROVAL	CMV	CRB

Geosyntec consultants
12802 TAMPA OAKS BLVD., SUITE 151
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PH: 813.558.0990 - FX:813.558.9726
AUTHORIZATION NUMBER: 4321

WASTE CONNECTIONS OF OSCEOLA COUNTY, LLC
1501 OMNI WAY
ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE:
FINAL COVER SYSTEM GRADING PLAN I

PROJECT:
SOLID WASTE RENEWAL PERMIT

SITE:
J.E.D. SOLID WASTE MANAGEMENT FACILITY

DESIGN BY:	CRB	DATE:	MAY 2018
DRAWN BY:	CMV	PROJECT NO.:	FL3318.01
CHECKED BY:	AR	FILE:	FL3318.01P42
REVIEWED BY:	KBT	DRAWING NO.:	
APPROVED BY:	CRB	42 OF 48	

SIGNATURE

DATE

CRAIG BROWNE - LICENSE NO. 68613

PERMIT DRAWING

P:\CADD\PROJECTS\JED\LANDFILL\PERMIT\CELLS 4,5,7,8 SIDESLOPE MOD\FL3318\DWGS\FL3318.01P42.DWG (14 January 2019 - 2:23 PM) Cvioers

N

0 300' 600'
SCALE IN FEET

LEGEND

- PROPERTY BOUNDARY
- 80 EXISTING GROUND ELEVATION (FEET)
- EXISTING FENCE
- STORMWATER DRY DETENTION BASIN
- WET RETENTION / BORROW AREA BOUNDARY
- 160 PERMITTED FINAL COVER ELEVATION (FEET)
- 200 LATERAL EXPANSION FINAL COVER ELEVATION (FEET)
- EXISTING 18" DOWNCHUTE
- EXISTING DRAINAGE STRUCTURE
- PROPOSED 24" DOWNCHUTE
- PROPOSED 18" DOWNCHUTE
- PROPOSED 30" DOWNCHUTE
- PROPOSED DRAINAGE STRUCTURE
- PROPOSED TOP AREA BERM

NOTES:

1. NORTHING AND EASTING COORDINATES SHOWN REPRESENT FLORIDA STATE PLANE EAST ZONE NORTH AMERICAN DATUM OF 1983 (NAD83). THE ELEVATIONS SHOWN REPRESENT NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29)(FEET).
2. MOSQUITO CONTROL PONDS SHOWN HEREON ARE IN ACCORDANCE WITH SHEET 36 AND DETAIL 29 ON SHEET 50 OF THE SOLID WASTE PERMIT DRAWINGS DATED 17 MAY 2002 (LAST REVISED 16 SEPTEMBER 2002).
3. THESE SECTIONS AND/OR DETAILS WERE INCLUDED IN THE VERTICAL EXPANSION PERMIT DRAWINGS DATED SEPTEMBER 2007. THERE ARE NO SUBSTANTIAL CHANGES TO THESE SECTIONS AND/OR DETAILS. THEREFORE, THESE SECTIONS AND/OR DETAILS ARE NOT INCLUDED IN THIS PERMIT DRAWING SET.
4. TOPOGRAPHIC INFORMATION SHOWN ON THIS DRAWING WAS PROVIDED BY BASE MAPPING CO. LTD BASED ON AN AERIAL PHOTOGRAPH TAKEN ON 20 MAY 2015.

REV	DATE	DESCRIPTION	DRN	APP
1	JAN 2019	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB
0	JUN 2016	ISSUED FOR FDEP APPROVAL	CMV	CRB

Geosyntec consultants
12802 TAMPA OAKS BLVD., SUITE 151
TEMPLE TERRACE, FLORIDA 33637 USA
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ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE: STORM WATER MANAGEMENT PLAN

PROJECT: SOLID WASTE RENEWAL PERMIT

SITE: J.E.D. SOLID WASTE MANAGEMENT FACILITY

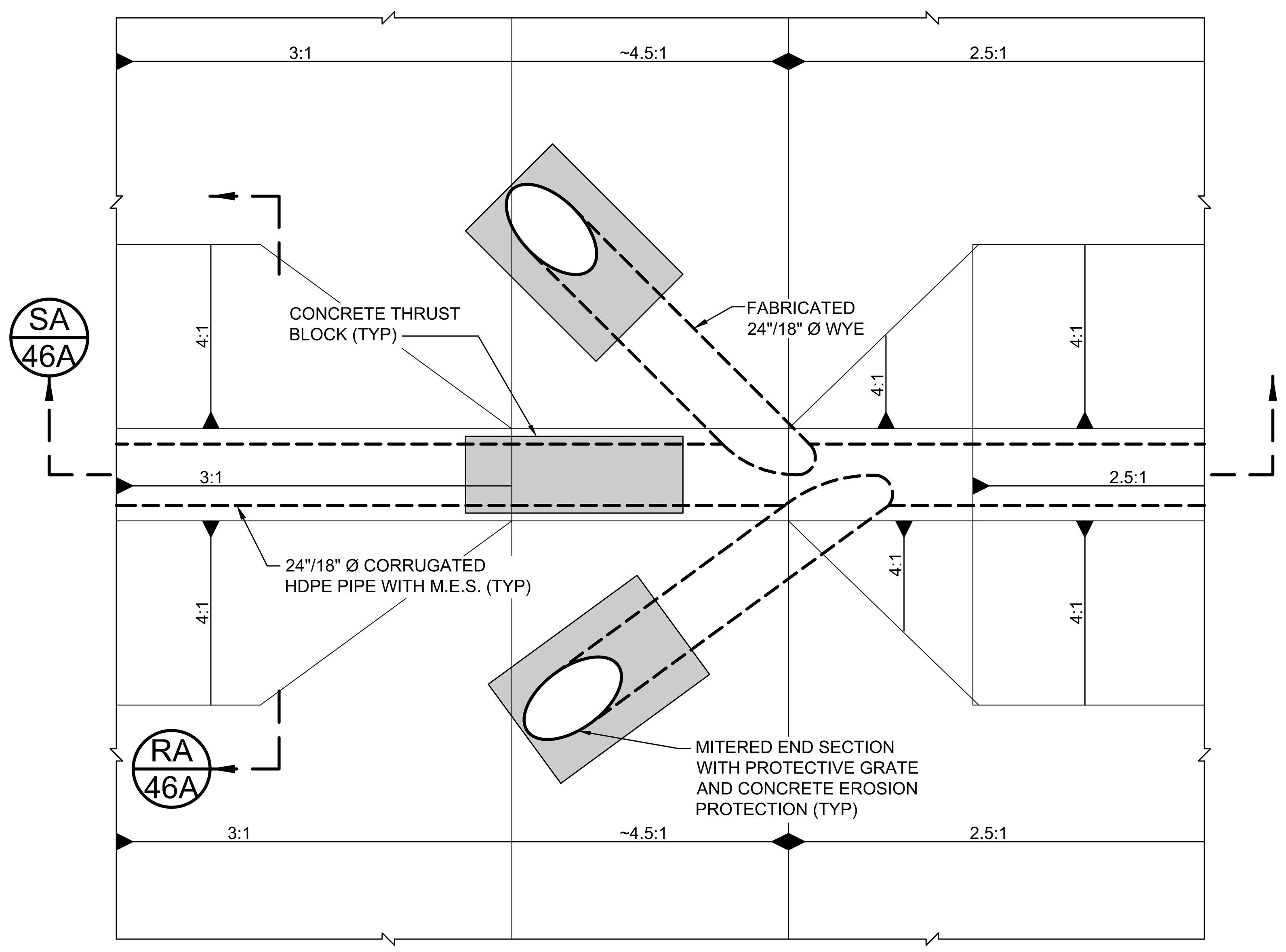
DESIGN BY: CRB		DATE:	MAY 2018
DRAWN BY: CMV		PROJECT NO.:	FL3318.01
CHECKED BY: AR		FILE:	FL3318.01P45
REVIEWED BY: KBT		DRAWING NO.:	
APPROVED BY: CRB		45 OF 48	

SIGNATURE

DATE

CRAIG BROWNE - LICENSE NO. 68613

PERMIT DRAWING



17A
45
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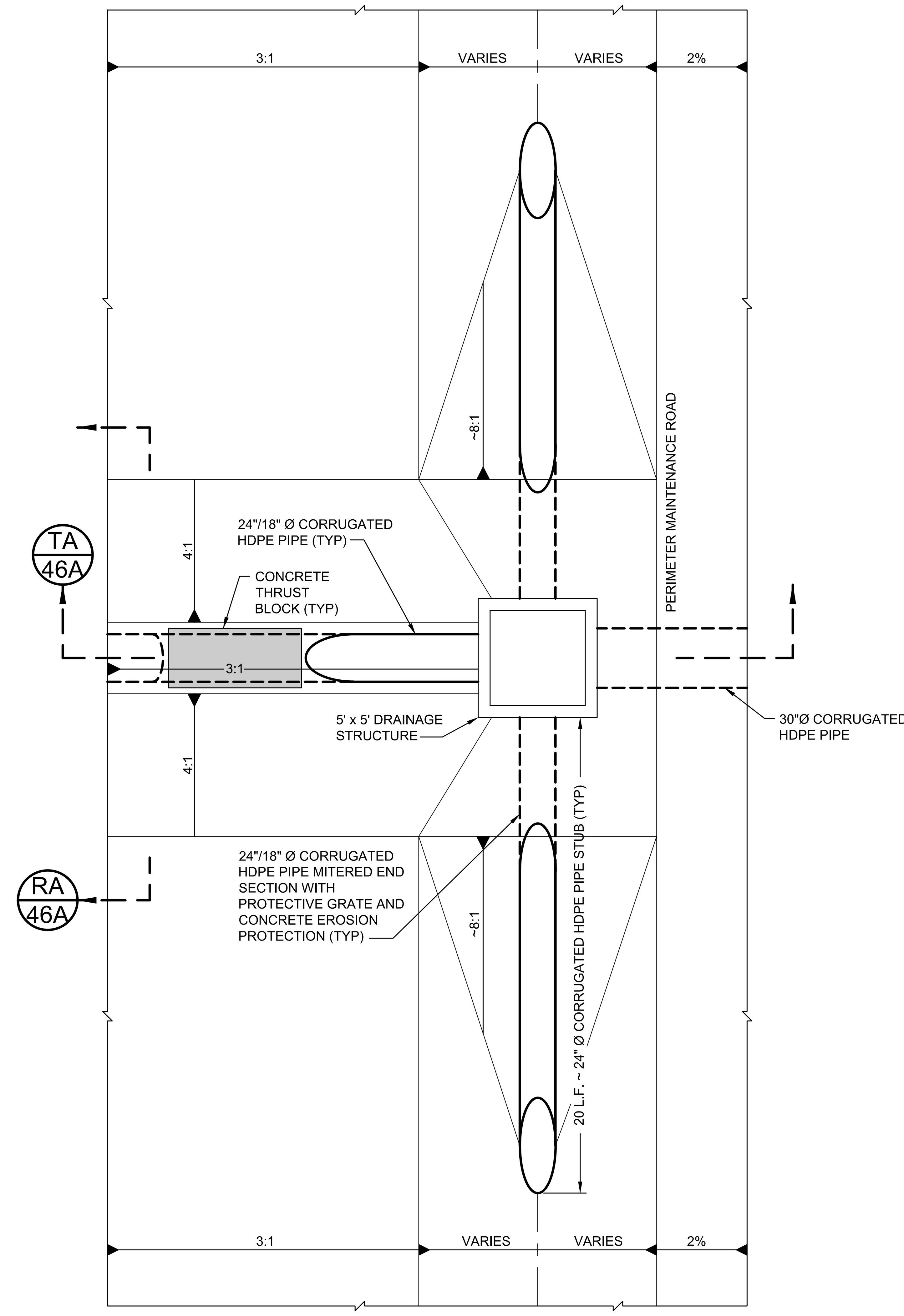
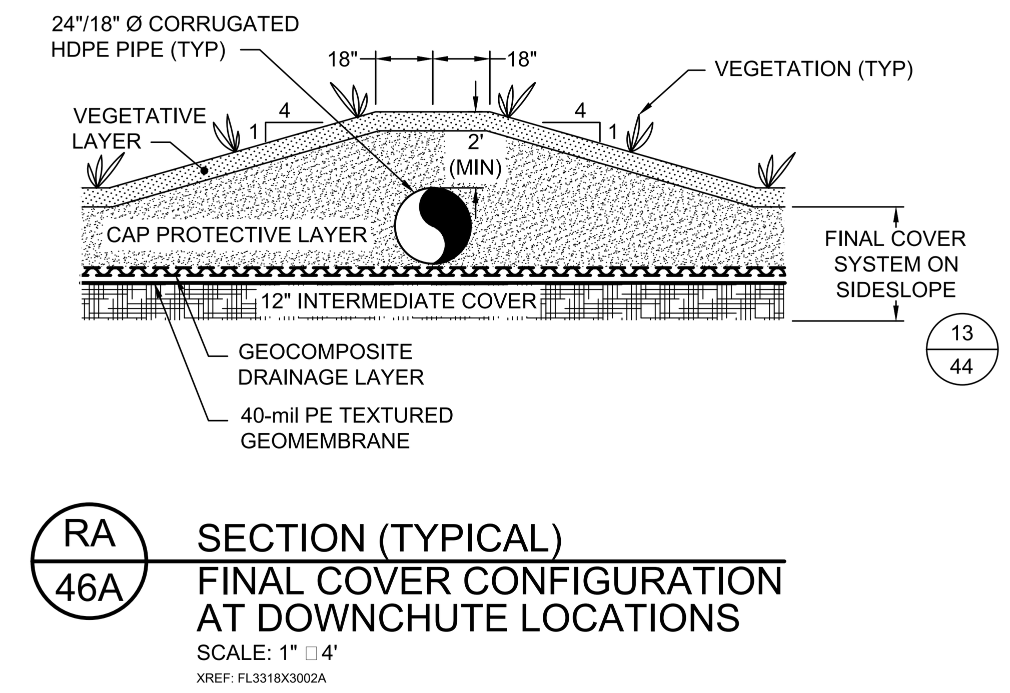
24" /18" Ø DOWNCHUTE PIPE AT TACK ON BERM

SCALE: 1" = 4'
XREF: FL3318.01P46A



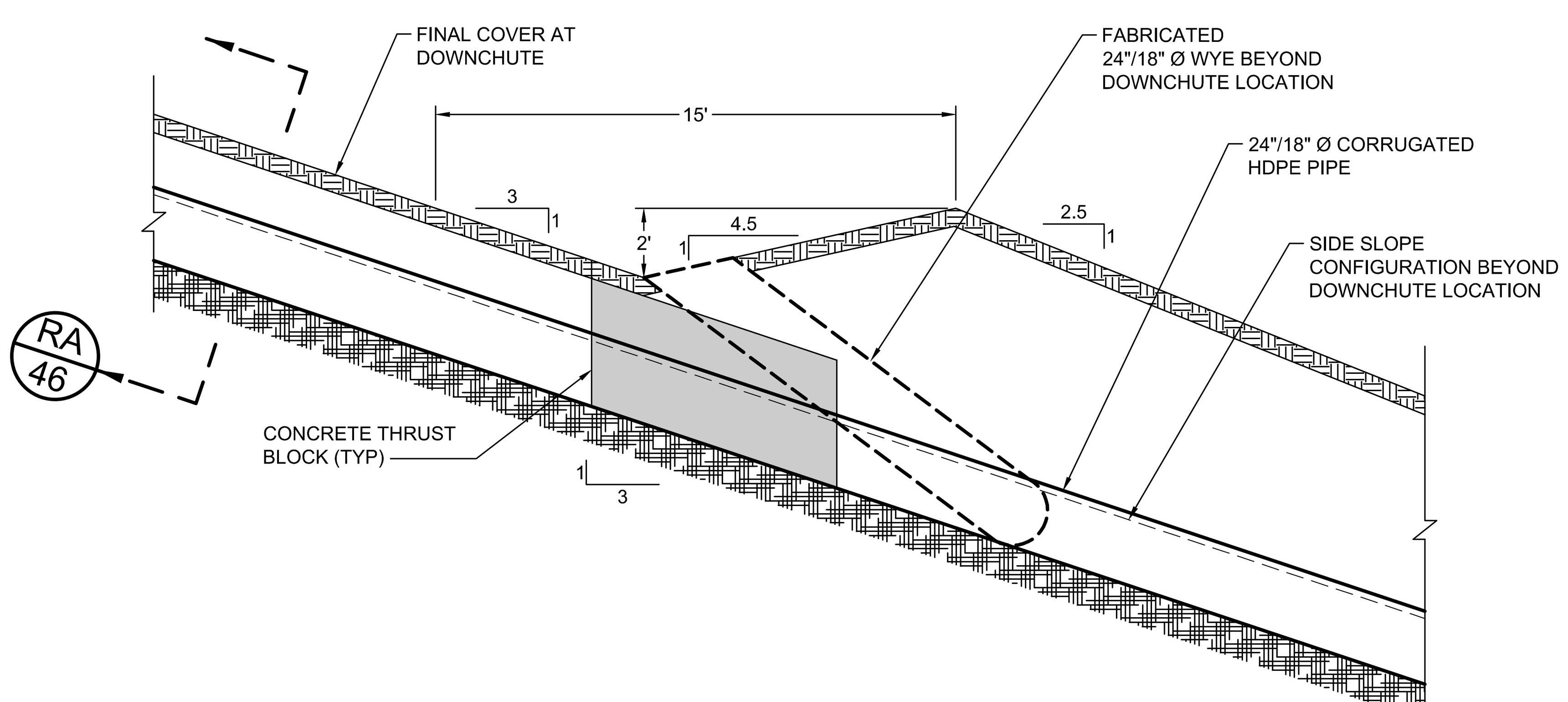
18A
45
PLAN (TYPICAL)
24"/18" Ø DOWNCHUTE PIPE AT DRAINAGE STRUCTURE / TOE

SCALE: 1" = 4'
XREF: FL3318.01P46A



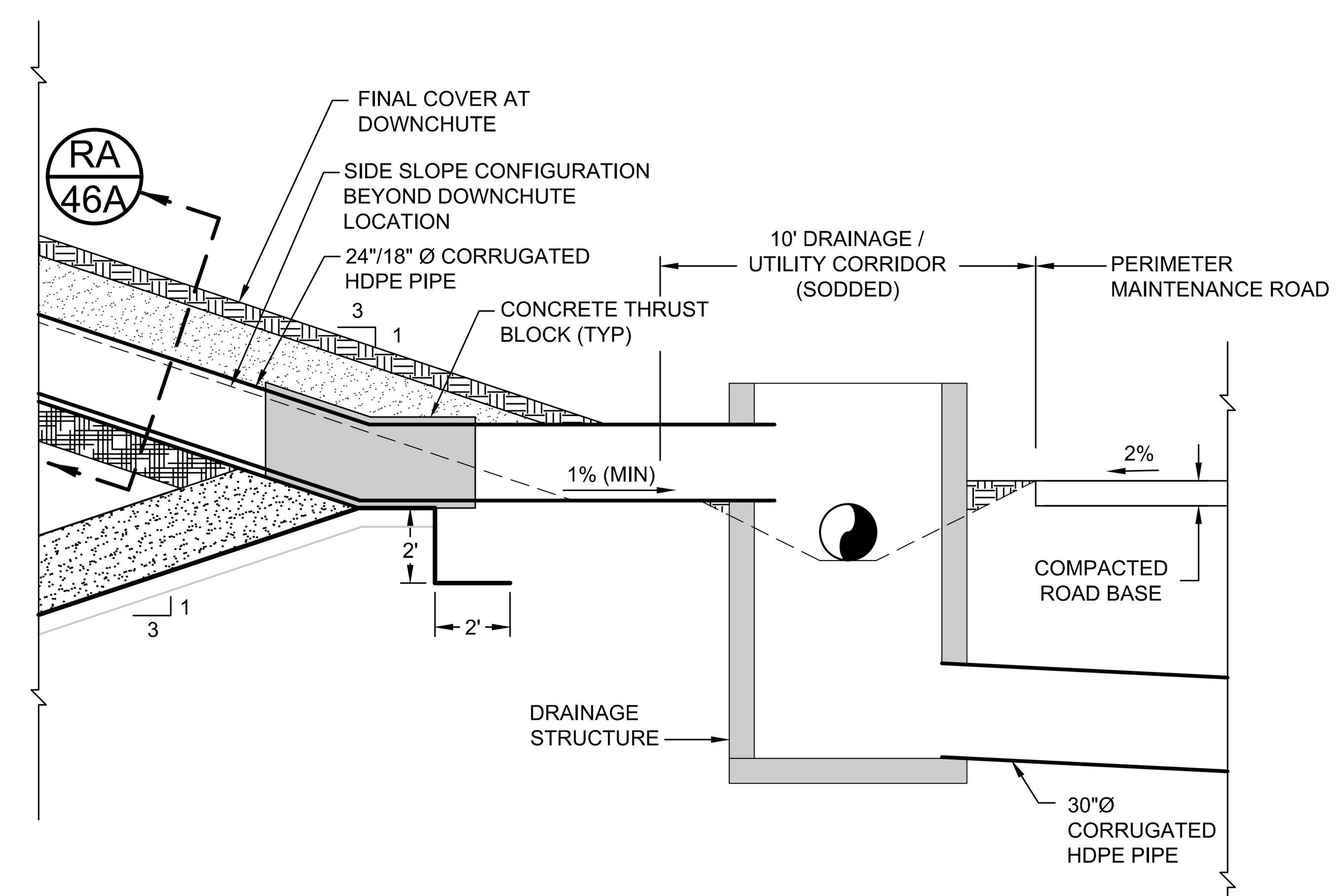
RA
46A
SECTION (TYPICAL)
FINAL COVER CONFIGURATION AT DOWNCHUTE LOCATIONS

SCALE: 1" □ 4'
XREF: FL3318X3002A



SA
46A
SECTION (TYPICAL)
24" /18" Ø DOWNCHUTE PIPE AT TACK ON BERM

SCALE: 1" = 4'
XREF: FL3318.01P46A



TA
46A
SECTION (TYPICAL)
24"/18" Ø DOWNCHUTE PIPE AT DRAINAGE STRUCTURE / TOE

SCALE: 1" = 4'
XREF: FL3318.01P46A

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP
0	JAN 2019	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB

Geosyntec consultants
12802 TAMPA OAKS BLVD., SUITE 151
TEMPLE TERRACE, FLORIDA 33637 USA
PH: 813.558.0990 - FX:813.558.9726
AUTHORIZATION NUMBER: 4321

WASTE CONNECTIONS OF OSCEOLA COUNTY, LLC
1501 OMNI WAY
ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE: STORM WATER MANAGEMENT DETAILS IA

PROJECT: SOLID WASTE RENEWAL PERMIT

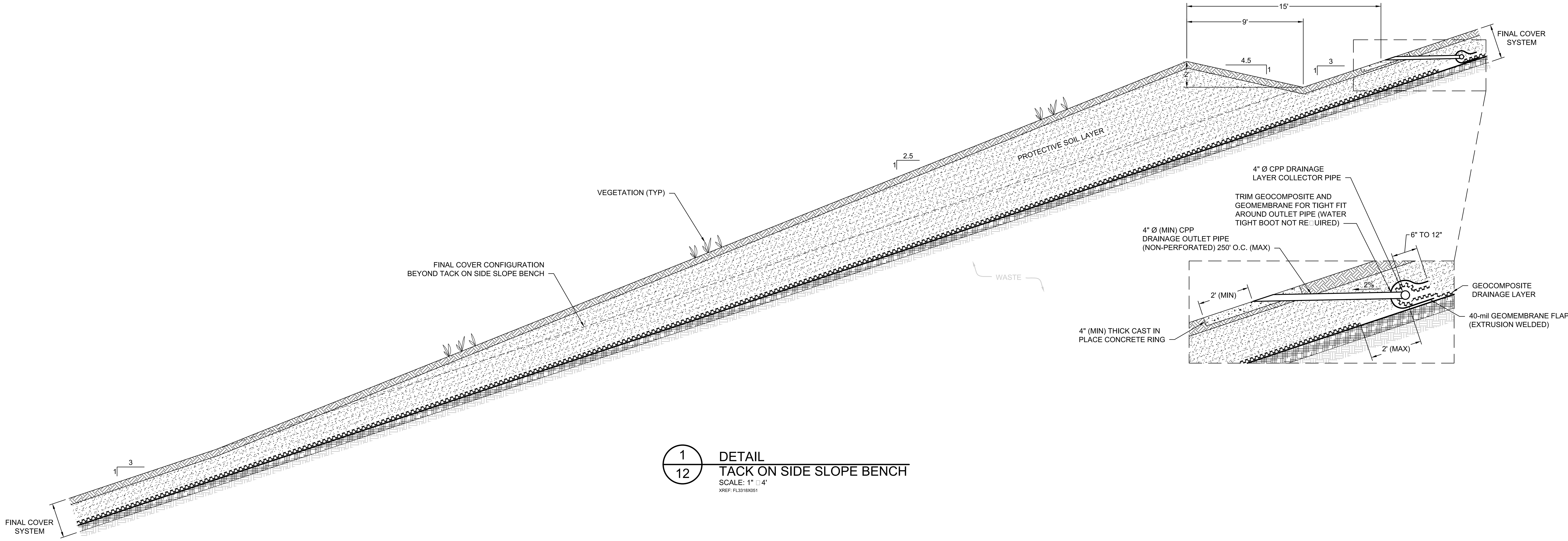
SITE: J.E.D. SOLID WASTE MANAGEMENT FACILITY

SIGNATURE

DATE

CRAIG BROWNE - LICENSE NO. 68613

DESIGN BY:	CRB	DATE:	SEPTEMBER 2018
DRAWN BY:	CMV	PROJECT NO.:	FL3318.01
CHECKED BY:	AR	FILE:	FL3318.01P46A
REVIEWED BY:	KBT	DRAWING NO.:	
APPROVED BY:	CRB	46A OF 48	



1/12 DETAIL
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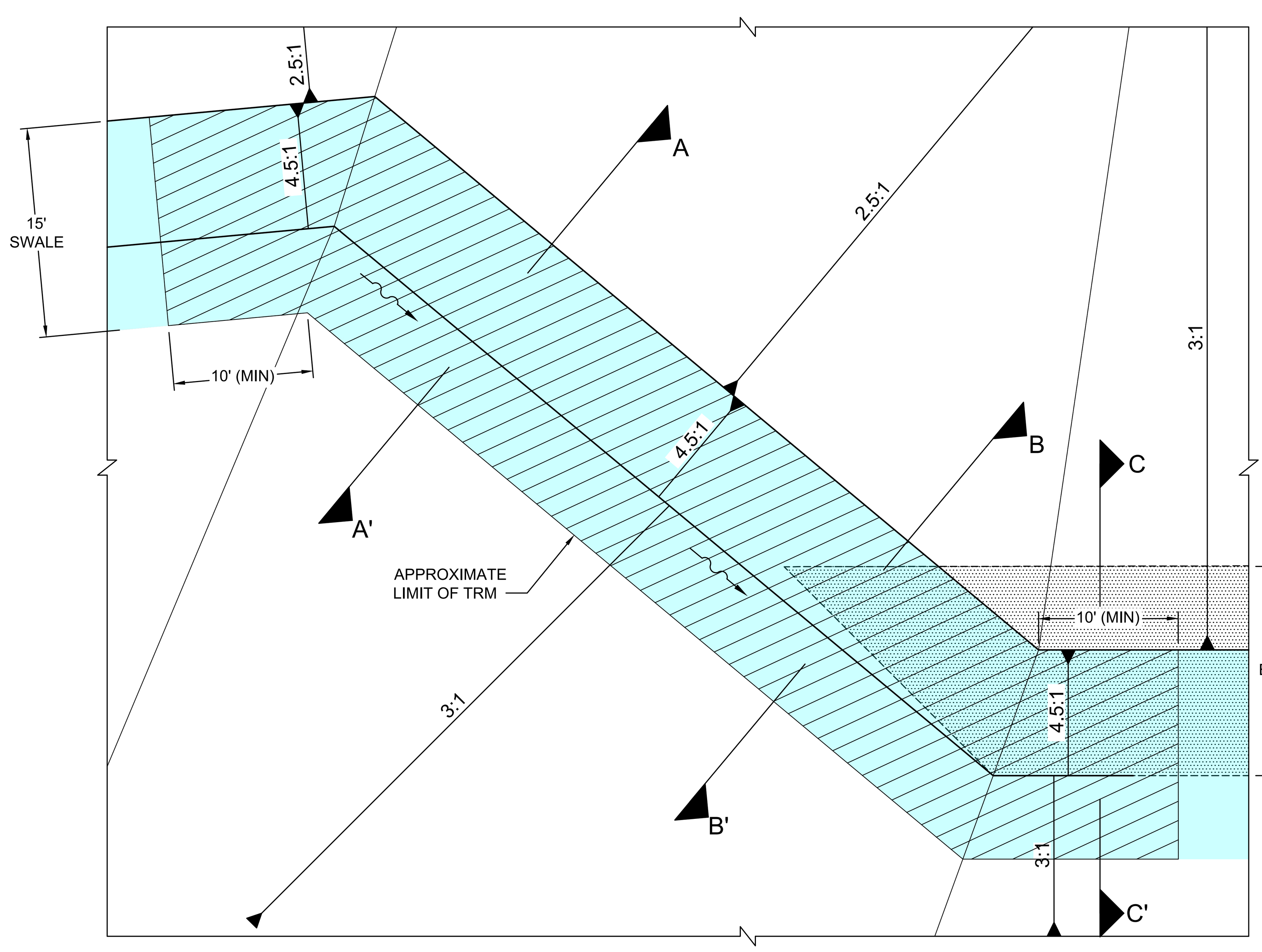
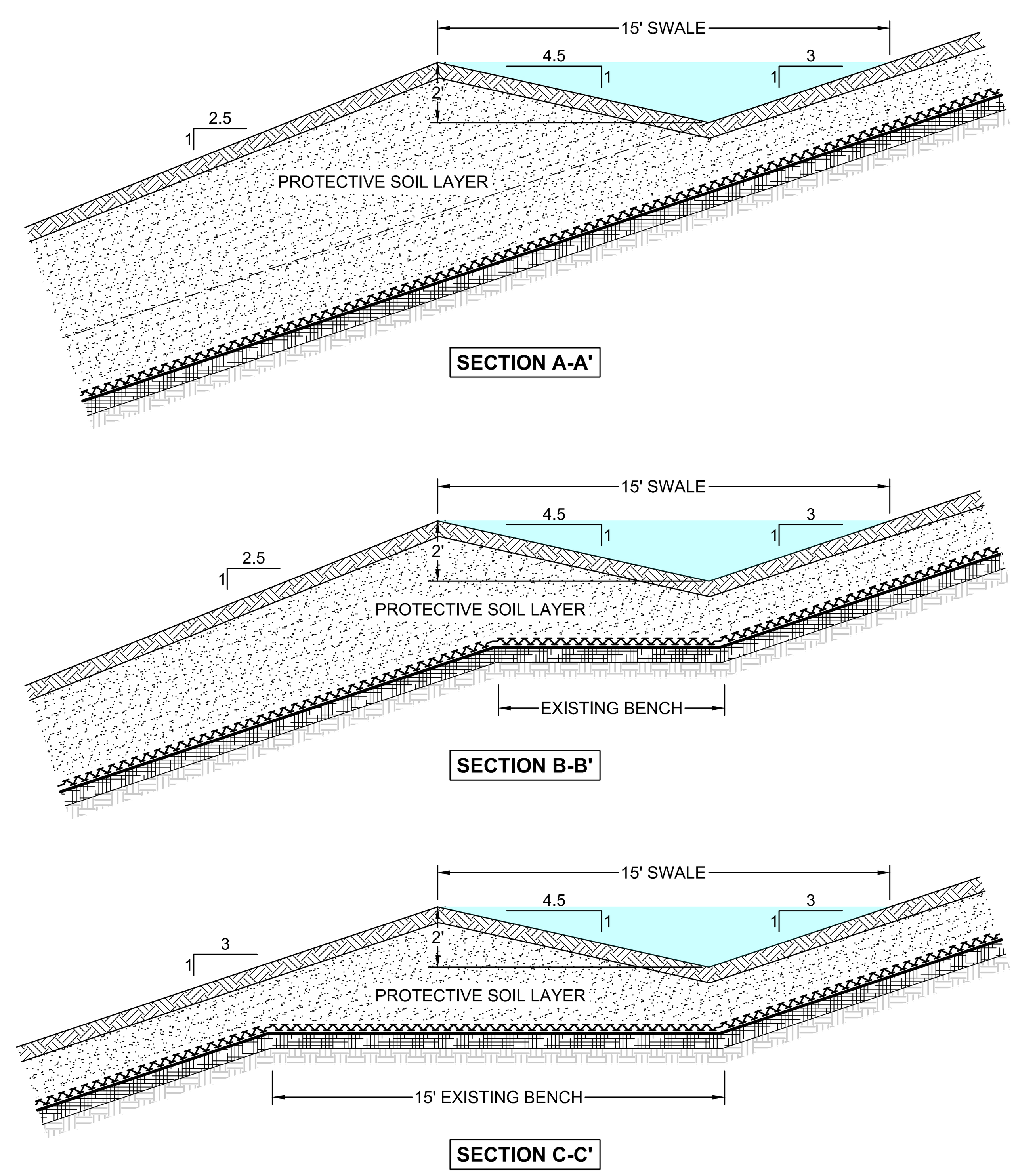
XREF: FL3318X051



PLAN VIEW



2/42 DETAIL
TACK ON BERM TIE-IN
SCALE: NTS
XREF: FL3318X053

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP
0	JAN 2019	REVISED CELLS 4, 5, 7, 8 AND 12 SIDESLOPE MODIFICATIONS	CMV	CRB

Geosyntec consultants
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AUTHORIZATION NUMBER: 4321

WASTE CONNECTIONS OF OSCEOLA COUNTY, LLC
1501 OMNI WAY
ST. CLOUD, FLORIDA 34773
TEL: 407-891-3720 FAX: 407-891-3730

TITLE: STORM WATER MANAGEMENT DETAILS III

PROJECT: SOLID WASTE RENEWAL PERMIT

SITE: J.E.D. SOLID WASTE MANAGEMENT FACILITY

SIGNATURE
DATE
CRAIG BROWNE - LICENSE NO. 68613

DESIGN BY:	CRB	DATE:	SEPTEMBER 2018
DRAWN BY:	CMV	PROJECT NO.:	FL3318.01
CHECKED BY:	AR	FILE:	FL3318.01P47A
REVIEWED BY:	KBT	DRAWING NO.:	
APPROVED BY:	CRB	47A OF 48	

APPENDIX C
HISTORY OF ENFORCEMENT ACTIONS

Waste Connections of Florida, Inc. Compliance History

Date	Facility	Location	Permit Number	Issuing Agency	Type of Action	Nature of Violation	Disposition	Fine or Penalty
12/22/14	Opa Locka Recycling and Transfer Station	Opa Locka, FL	0075972-013-SO/SW-1087	City of Opa Locka	NOV	Nuisance Dust Conditions	Closed. $500 fee paid	$500
03/06/15	Opa Locka Recycling and Transfer Station	Opa Locka, FL	0075972-014-SO/SW-1087	FDEP/DERM	NOV	Acceptance of unacceptable material	Closed. $1,010 fee paid	$1,010
07/26/16	SLD Landfill	Punta Gorda, FL	0246176-007-SO/22	FDEP	CO	Off Site Objectionable Odors	Implemented Odor Remediation Plan. $3,000 fee paid	$3,000

Note:
As of 10/24/2018 and subsequent to all Solid Waste facility permit transfers to Progressive Waste Solutions of FL, Inc., Waste Connections of Florida, Inc., and Waste Connections
List above includes only those violations which have been issued fines or consent orders for Solid Waste Management facilities in Florida within the last five (5) years.
The following NOVs were issued by DERM/EPC under County jurisdictions not related to solid waste management facilities, but have been provided since a fine was paid.

09/25/15	Miami Hauling	Miami, FL	NA	DERM	UCVN	Sanitary Nuisance (leachate leaking from haul truck)	Closed. $500 fee paid	$500
03/14/16	Miami Hauling	Miami, FL	NA	DERM	NOV	Failure to Comply with Warning Notice (truck wash in use)	Closed. $100 fee paid	$100
10/09/18	Tampa Hauling	Tampa, FL	NA	EPC	NOV/CO	Failure to Comply with Monitoring/Repairs (Diesel AST)	Closed. $2,879.15 fee paid	$2,879.15

APPENDIX D

SUBGRADE SETTLEMENT CALCULATIONS

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **WCI** Project: **JED Sideslope Modifications** Project No.: **FL3318**

Phase No.: **01**

Title of Computations **FOUNDATION SETTLEMENT ANALYSIS**

Computations by:	Signature		17 August 2018
	Printed Name	Ramil G. Mijares, Ph.D. P.E.	Date
	Title	Project Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature		22 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Checked by:	Signature		22 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Backchecked by: (originator)	Signature		24 August 2018
	Printed Name	Ramil G. Mijares, Ph.D., P.E.	Date
	Title	Project Engineer	
Approved by: (pm or designate)	Signature		24 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	

Approval notes: Senior review provided by Kwasi Badu-Tweneboah, Ph.D., P.E.

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

FOUNDATION SETTLEMENT ANALYSIS
J.E.D. SOLID WASTE MANAGEMENT FACILITY
ST. CLOUD, OSCEOLA COUNTY, FLORIDA

1 INTRODUCTION

The purpose of this analysis is to calculate the settlement of foundation soils below the liner system and to estimate the liner post-settlement grades and tensile strains for the proposed modifications to the Cells 4, 5, 7, 8, and 12 waste-fill plans at the J.E.D. Solid Waste Management (JED) facility. The proposed waste-fill modifications include changes to the final cover system design plans for Cells 4, 5, 7, 8, and 12. The performance of the liner and leachate collection system is evaluated to ensure that:

- A minimum 0.3 percent post-settlement slope is maintained along the leachate collection corridor pipes.
- A minimum 1.0 percent post-settlement slope is maintained along portions of the leachate collection system (i.e., cross slopes) that drain towards the leachate collection corridor pipes.
- Maximum tensile strains in the liner system resulting from settlement of the foundation soils do not exceed the maximum allowable tensile strains for the geomembrane liner.

2 METHODOLGY

Elastic settlement theory is used to calculate settlement for sandy soils while one-dimensional (1-D) consolidation theory is used to calculate settlement for clayey soils as described below.

For elastic and consolidation settlement calculations, a simplified one-dimensional stress distribution is used to calculate stress increase under a loaded area. One-dimensional stress distribution assumes that stress dissipation does not occur with depth. As such, the change in stress in the foundation soils is assumed to be equal to the weight of the materials placed or removed vertically above the location of interest. This stress distribution is appropriate for locations with foundation footprints significantly larger than the depth of potentially settlement prone soils. In this case the maximum depth of compressible soil extends approximately 300 ft below ground surface (bgs), compared to the average width of the proposed landfill of approximately 1,400 to 3,000 ft.

A one-dimensional stress distribution typically results in an overestimation of settlement beneath the crest of a large slope and an underestimation of settlement at the toe of a slope. Therefore, this simplification results in a conservative estimation of the settlements that could occur along the leachate collection system.

2.1 Elastic Settlement

Settlement of foundation soils exhibiting elastic settlement behavior (i.e., sandy, cohesionless soil units) are calculated using the following equation (Lambe and Whitman, 1969):

$$\Delta S = \frac{\Delta \sigma_v^{'}}{D} \Delta H \qquad (1)$$

where:

ΔS = total settlement for a ΔH thick layer (ft);

ΔH = layer thickness (ft);

$\Delta \sigma'_v$ = change in effective vertical stress at the mid-point of the layer (psf);

D = constrained elastic modulus = $\frac{E(1-\mu)}{(1+\mu)(1-2\mu)}$ (psf);

E = elastic modulus $=(194+8N)(1-\mu^2)\ tsf$ (U.S. Army Corp of Engineers, 1990);

N = is the average measured Standard Penetration Test (SPT) "N" value; and

μ = Poisson's ratio.

2.2 1-D Consolidation Settlement

Settlement of foundation soils exhibiting plastic settlement behavior (i.e., clay/clayey, cohesive soil units) are calculated using equations for conventional 1-D consolidation theory used in geotechnical engineering. The clayey foundation soils are conservatively assumed to be normally consolidated and the settlement is calculated using the following equation (Holtz and Kovacs, 1981):

$$\Delta S = C_{c\varepsilon} \cdot \Delta H \cdot \log\left(\frac{\sigma'_{vo} + \Delta\sigma'_{v}}{\sigma'_{vo}}\right) \tag{2}$$

where:

ΔS = total settlement for layer with a thickness of ΔH (ft);

ΔH = initial thickness of compressible layer (ft);

$C_{c\varepsilon}$ = modified compression index;

σ'_{vo} = initial effective overburden stress (psf); and

$\Delta\sigma'_{v}$ = increase in effective stress due to overburden pressure of the landfill (psf).

2.3 Settlement and Strain Calculation Steps

A summary of the steps used to perform the settlement and liner strain calculations is presented as follows:

- Potentially critical cross sections are identified that include the flattest liner system slopes, and therefore, the highest potential for adverse effects due to settlement (i.e., leachate collection corridors and cell cross slopes).
- Calculation points are selected along the identified cross sections at locations where change in grade occurs in the final cover system and the liner system.
- For each calculation point, the subsurface profile beneath the liner system is identified and broken into distinct layers, consistent with SPT boring intervals (i.e., 2-ft thick layers for top 10 ft and 5-ft thick layers thereafter), and material properties (i.e., strength parameters and layer classification – N-values and sands or clays). For points that do not coincide with boring locations, the subsurface profile parameters were calculated using the Inverse Distance Weighted Average (IDWA) method, detailed in Section 3.
- Using Equations 1 and 2, the settlement for each subsurface layer is calculated. The total settlement at a point is found by summing the contribution of the settlement from each compressible layer beneath a point.

- Calculated settlements are subtracted from the proposed subgrade elevation of the liner system to obtain the post-settlement subgrade elevation.
- Post-settlement grades are evaluated based on post-settlement elevations and the horizontal distance between each pair of adjacent calculation points.
- Pre- and post-settlement elevations between a pair of adjacent calculation points are used to assess the pre- and post-settlement length of the liner between the two calculation points. The difference in length relative to the initial length between the calculation points is used to assess the strain in the liner system according to the following equation:

$$\varepsilon = \frac{L_o - L_f}{L_o} \times 100 \quad (3)$$

where:

ε = strain in the liner system (+ indicates compression; – indicates tension);

L_f = final length between calculation points based on post-settlement elevations; and

L_o = initial length between calculation points based on pre-settlement elevations.

The estimated tensile strains were compared to the conservative allowable tensile strain of 5 percent (Berg and Bonaparte, 1993) for the liner system geomembrane.

3 INVERSE DISTANCE WEIGHTED AVERAGE

This section describes the methodology used to estimate subsurface parameters at a given point inside the landfill footprint (i.e., calculation points). The IDWA method was used to estimate N-values and material properties (i.e., sand or clay) for the calculation points used in the settlement analysis. The IDWA method provides a weighted average that is influenced most by nearby data, as such, as the distance to other data points increases, the average is less influenced. A common IDWA method is also known as Shepard's Method, described as follows:

$$F = \sum_{i=0}^{n-1} \left(w_i N_i \right) \quad (4)$$

where: n is the number of surrounding points; N is the set of data points being interpolated (i.e., N-values obtained from borings at a given depth); and w is the weighing function, defined as follows:

$$w = \frac{d_i^{-p}}{\sum_{j=0}^{n-1} d_j^{-p}} \tag{5}$$

where: p is the power parameter (typically equal to 2); and d is the distance between the desired point and surrounding data.

The IDWA method allows a parameter (i.e., N-value) to be estimated at any point within the footprint of the landfill, at any given depth. The advantage is that the IDWA method allows information from deeper borings to be added to shallow surrounding borings without modifying the measured data.

Data from 150 to 300 ft bgs were interpreted based on measured N-values and the subsurface model presented in the *Geotechnical Investigation Report* included as Appendix D of the 2011 Lateral Expansion Permit Application (Geosyntec, 2011). A summary of the measured N-values for the borings are presented in **Figure 1**. **Figure 2** presents a summary of the measured and calculated N-values versus depth.

4 SUBSURFACE STRATIGRAPHY

Information regarding subsurface stratigraphy and geotechnical properties used for the settlement calculations is summarized below. A detailed discussion of the soil layers and empirical correlations used to estimate soil properties is presented in the *Geotechnical Investigation Report* (Geosyntec, 2011). The subsurface stratigraphy encountered at the site generally consists of the following:

- undifferentiated sands (i.e., sands and silty sandy soils) comprising the Post Hawthorn formation to a depth of 155 ft bgs; and
- interbedded clay, silts, and sands with varying thickness are encountered from approximately 155 to 300 ft bgs. These layers comprise the Hawthorn group which includes soils from the Peace River Formation and Arcadia Formation characterized by interbedded cohesive and sandy soils.

The groundwater table was assumed to be at the original ground surface (i.e., Elev. 80 ft, National Geodetic Vertical Datum 1929 (NAVD29)) and all soils within the undifferentiated sand layer and Hawthorn Group were considered to be fully saturated.

5 MATERIAL PROPERTIES

Material properties used in the settlement analysis are discussed in the following subsections and summarized in **Table 1**.

5.1 Structural Fill, Liner, and Final Cover Systems

The soil material to be used as structural fill and the protective layer components of the liner and final cover systems was assumed to have a unit weight of 120 pcf. The protective layer soils for the liner and final cover systems were considered as vertical loading for the foundation soils in this calculation package. The structural fill was also assumed as vertical loading; however, the settlement of the structural fill layer itself was neglected because it is installed in controlled compacted lifts.

5.2 Waste

Waste was considered as vertical loading for the foundation soils in this calculation package. The unit weight of the compacted waste, including initial cover soils, is assumed to be on the average equal to 70 pcf. Settlement of the waste itself is not calculated because it is above the liner system and therefore does not affect the subgrade settlement calculations.

5.3 Subsurface Soils

The unit weight of the sandy subsurface soils is assumed to be 115 pcf. The elastic and constrained moduli of the sandy soils are calculated for each SPT interval (i.e., 5-ft thick layers) and SPT N-value. **Figure 1** shows a compilation of the SPT data obtained at the site for a total of 21 soil borings with SPTs (i.e., 15 borings from 2002 and 6 borings from 2010). Typical values of Poisson's ratio for sand range between 0.3 and 0.4 (see **Table 2**). For the purpose of this calculation package, the Poisson's ratio is conservatively assumed to be 0.3 for the subsurface sandy soils.

As discussed in the *Geotechnical Investigation Report* (Geosyntec, 2011), the unit weight of the subsurface clayey soils is assumed to be 115 pcf and the modified compression index ($C_{c\varepsilon}$) is assumed to be 0.10.

6 CROSS SECTIONS ANALYZED

Slopes along leachate collection corridors and the base liner were analyzed within Cells 4, 5, 7, 8, and 12. The locations of the settlement points on the liner and modified final cover grading plans are illustrated on **Figures 3** and **4**, respectively.

7 RESULTS

Settlement calculations performed using MathCAD® are presented in **Attachment A**. The calculation results are summarized in **Tables 3** and **4** for the analyzed points.

Inspection of **Tables 3** and **4** reveals that the calculated post-settlement subgrade slopes along the leachate collection corridor pipes meet or exceed 0.3 percent and the calculated post-settlement subgrade slopes along the cell floor cross slopes draining towards leachate collection pipes meet or exceed 1.0 percent. The maximum calculated liner tensile strain in the liner system for all cases analyzed is 0.007 percent, which is less than the maximum allowable tensile strain of 5 percent (Berg and Bonaparte, 1993) for polyethylene geomembrane materials.

8 CONCLUSIONS

Based on the results of the settlement calculations, the following conclusions can be made:

- a minimum slope of 0.3 percent will be maintained along leachate collection corridor pipes and a minimum grade of 1.0 percent will be maintained along the cell floor cross slopes draining towards leachate collection pipes for the post-settlement conditions; and
- maximum tensile strains in the liner system are less than the maximum allowable tensile strains for the liner system geosynthetic components.

9 REFERENCES

Berg, R.R. and Bonaparte, R. (1993). "Long-Term Allowable Tensile Stresses for Polyethylene Geomembranes," Geotextiles and Geomembranes, Vol. 12, pp. 287-306.

Coduto, D.P. (2001). "*Foundation Design, Principles and Practices*," Prentice-Hall, Inc. Upper Saddle River, NJ.

Geosyntec Consultants (2011). "*Landfill Lateral Expansion – Application for a Major Permit Modification, J.E.D. Solid Waste Management Facility*," February 2011.

Holtz, R.D., and Kovacs, W.D. (1981). "*An Introduction to Geotechnical Engineering*," Prentice-Hall, Inc., Englewood Cliffs, NJ.

Lambe, T.W., and Whitman, R.V. (1969). "*Soil Mechanics*," John Wiley and Sons, Inc., New York.

U.S. Army Corps of Engineers (1990). "Engineering and Design: Settlement Analysis," Engineer Manual 1110-1-1904.

TABLES

Table 1

Summary of Material Properties

Material	Unit Weight (lb/ft^3)	Layer Thickness (ft)	Elastic Modulus	$C_{c\varepsilon}$
Liner and Final Cover Systems Protective Layers	120	2 and 3, respectively	---	---
Waste	70	Varies	---	---
Structural Fill	120	Varies	---	---
Surficial Soils (Post Hawthorn Formation):				
Sands	115	Varies[1]	Varies with SPT	---
Clays	115	Varies[1]		0.10
Hawthorn Group Soils:				
Sands	115	Varies[1]	Varies with SPT	---
Clays	115	Varies[1]		0.10

Notes: 1. Thickness and/or presence of sand or clay layer varies according to actual boring information and IDWA extrapolation for point locations that do not coincide with a boring location.

Table 2

Typical Ranges of Poisson's Ratio
(Coduto, 2001)

TABLE 14.1 TYPICAL VALUES OF POISSON'S RATIO FOR SOILS AND ROCKS (Adapted from Kulhawy, et al., 1983)

Soil or Rock Type	Poisson's Ratio, ν
Saturated clay, undrained conditions	0.50
Partially saturated clay	0.30–0.40
Dense sand, drained conditions	0.30–0.40
Loose sand, drained conditions	0.10–0.30
Sandstone	0.25–0.30
Granite	0.23–0.27

Table 3

Summary of Settlement Calculation Results

Point ID[1,2]	Initial Elevation (ft)	Final Elevation (ft)	Settlement
401	88.26	87.61	0.66 ft
402	80.34	79.62	0.72 ft
403	89.79	86.14	3.65 ft
404	94.05	89.99	4.06 ft
405	84.56	82.35	2.21 ft
406	98.21	93.79	4.42 ft
407	80.99	79.48	1.51 ft
408	96.59	92.29	4.30 ft
409	82.16	81.50	0.66 ft
410	90.86	89.14	1.72 ft
411	86.35	85.71	0.64 ft
501	94.82	90.40	4.42 ft
502	94.00	89.43	4.57 ft
503	92.00	87.48	4.52 ft
504	84.05	83.40	0.65 ft
505	87.57	87.13	0.44 ft
506	80.53	79.83	0.70 ft
507	89.90	85.59	4.32 ft
508	88.68	84.46	4.22 ft
509	91.61	87.19	4.42 ft
510	86.40	83.20	3.20 ft
511	88.00	85.20	2.80 ft
512	99.69	95.18	4.51 ft
513	92.00	87.92	4.08 ft
514	98.35	93.45	4.90 ft
515	90.00	86.73	3.27 ft
516	96.92	92.10	4.82 ft
517	88.00	85.38	2.62 ft

Table 3 (continued)

Summary of Settlement Calculation Results

Point ID[1,2]	Initial Elevation (ft)	Final Elevation (ft)	Settlement
701	88.34	83.49	4.85 ft
702	86.25	81.49	4.76 ft
703	80.00	79.28	0.72 ft
704	90.36	85.57	4.80 ft
705	84.71	80.96	3.75 ft
706	91.30	86.42	4.88 ft
707	85.69	81.28	4.40 ft
708	91.96	87.42	4.54 ft
709	86.37	81.56	4.81 ft
710	93.87	89.02	4.85 ft
711	87.72	82.82	4.90 ft
712	90.69	86.04	4.64 ft
713	84.55	80.91	3.64 ft
801	89.80	84.99	4.80 ft
802	85.89	81.40	4.49 ft
803	80.00	79.28	0.72 ft
804	89.68	85.04	4.65 ft
805	84.86	81.05	3.81 ft
806	92.96	88.06	4.90 ft
807	88.12	83.47	4.65 ft
808	94.10	89.32	4.77 ft
809	89.29	84.53	4.76 ft
810	89.33	84.92	4.41 ft
811	84.51	80.93	3.57 ft

Table 3 (continued)

Summary of Settlement Calculation Results

Point ID[1,2]	Initial Elevation (ft)	Final Elevation (ft)	Settlement
1201	94.27	89.50	4.77 ft
1202	85.56	81.26	4.29 ft
1203	80.00	79.28	0.72 ft
1204	89.75	85.36	4.38 ft
1205	84.31	80.86	3.45 ft
1206	97.75	93.13	4.62 ft
1207	92.12	87.40	4.72 ft
1208	99.23	94.31	4.92 ft
1209	93.89	89.09	4.80 ft
1210	90.82	86.24	4.59 ft
1211	85.43	81.22	4.21 ft

Notes:
1. Refer to Figures 3 and 4 for point location.
2. Definition of Point ID: CXX/CCXX where C/CC is the cell number and XX is the point identified within the cell.

Table 4

Summary of Slope and Tensile Strain Calculation Results

Cell	Point 1	Point 2	Pre-settlement Slope (%)	Post-settlement Slope (%)	Minimum Allowable Slope (%)	Strain (%)
4	401	402	1.3	1.3	0.3	-1.2E-04
	403	402	1.5	1.1	0.3	6.2E-03
	404	405	2.0	1.6	1.0	7.0E-03
	406	407	2.0	1.7	1.0	6.3E-03
	408	409	2.0	1.5	1.0	8.9E-03
	410	411	2.0	1.5	1.0	8.5E-03
5	501	502	1.9	2.2	0.3	-6.6E-03
	502	503	2.3	2.2	0.3	1.1E-03
	503	504	1.4	0.7	0.3	6.8E-03
	505	504	1.3	1.3	0.3	-9.9E-04
	504	506	1.3	1.3	0.3	-2.2E-04
	507	508	1.5	1.4	0.3	1.7E-03
	508	506	1.5	0.9	0.3	7.6E-03
	509	508	2.0	1.9	1.0	2.6E-03
	501	510	2.0	1.7	1.0	5.4E-03
	511	506	1.8	1.3	1.0	7.6E-03
	512	513	1.8	1.7	1.0	1.8E-03
	514	515	2.0	1.6	1.0	7.0E-03
	516	517	2.1	1.6	1.0	9.8E-03
7	701	702	1.0	1.0	0.3	3.9E-04
	702	703	1.0	0.4	0.3	4.4E-03
	704	705	2.0	1.6	1.0	6.7E-03
	706	707	2.0	1.8	1.0	3.3E-03
	708	709	2.0	2.1	1.0	-1.9E-03
	710	711	2.0	2.0	1.0	-3.3E-04
	712	713	2.0	1.7	1.0	6.0E-03

Table 4 (continued)

Summary of Slope and Tensile Strain Calculation Results

Cell	Point 1	Point 2	Pre-settlement Slope (%)	Post-settlement Slope (%)	Minimum Allowable Slope (%)	Strain (%)
8	801	802	1.0	0.9	0.3	7.7E-04
	802	803	1.0	0.4	0.3	4.3E-03
	804	805	2.0	1.7	1.0	6.3E-03
	806	807	2.0	1.9	1.0	2.0E-03
	808	809	2.0	2.0	1.0	9.3E-05
	810	811	2.0	1.7	1.0	6.3E-03
12	1201	1202	1.0	1.0	0.3	5.3E-04
	1202	1203	1.0	0.4	0.3	4.4E-03
	1204	1205	2.0	1.7	1.0	6.3E-03
	1206	1207	2.0	2.0	1.0	-6.8E-04
	1208	1209	2.0	2.0	1.0	9.0E-04
	1210	1211	2.0	1.9	1.0	2.7E-03

FIGURES

Figure 1

Summary of Measured N-Values
J.E.D. Solid Waste Management Facility, St. Cloud, Florida

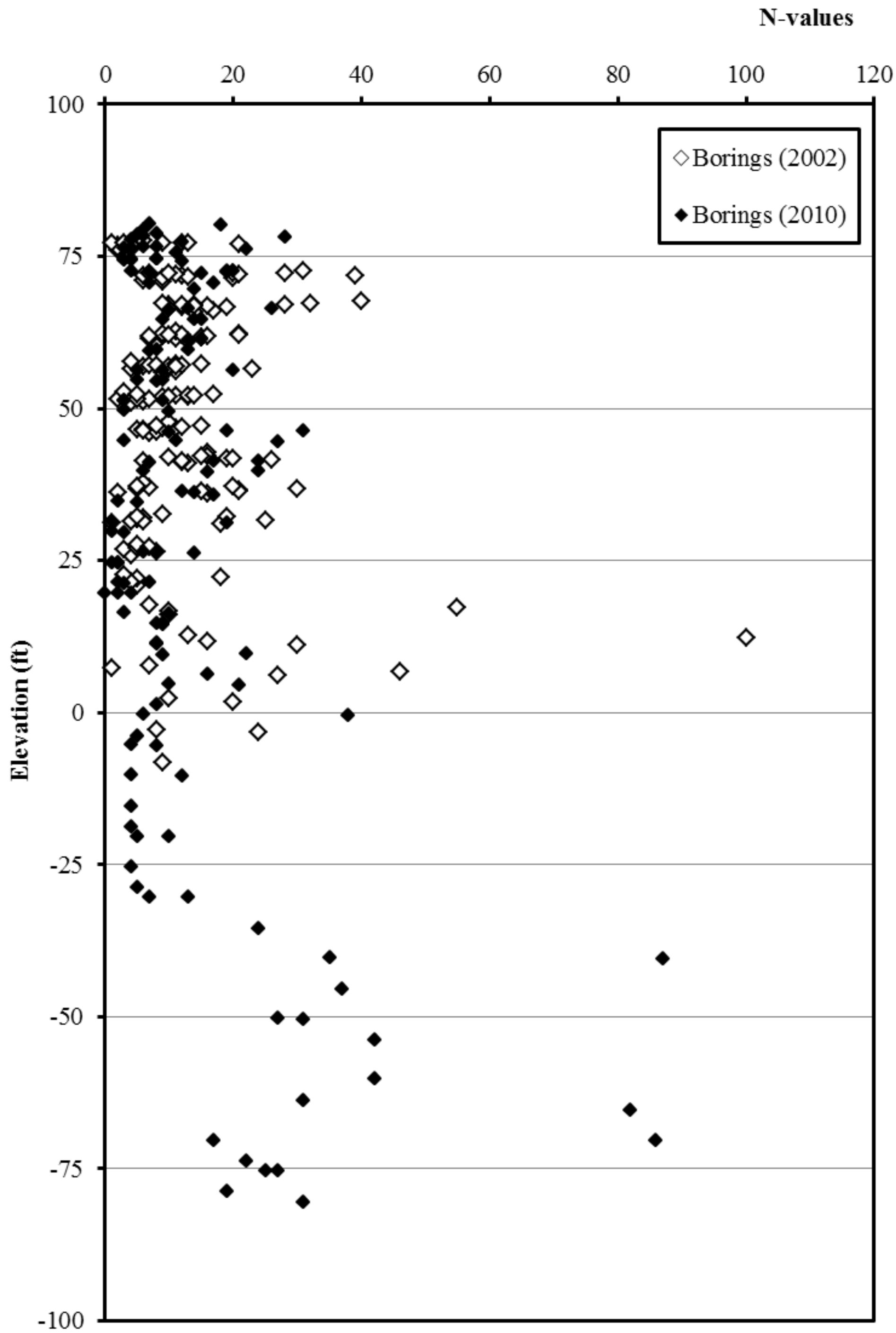
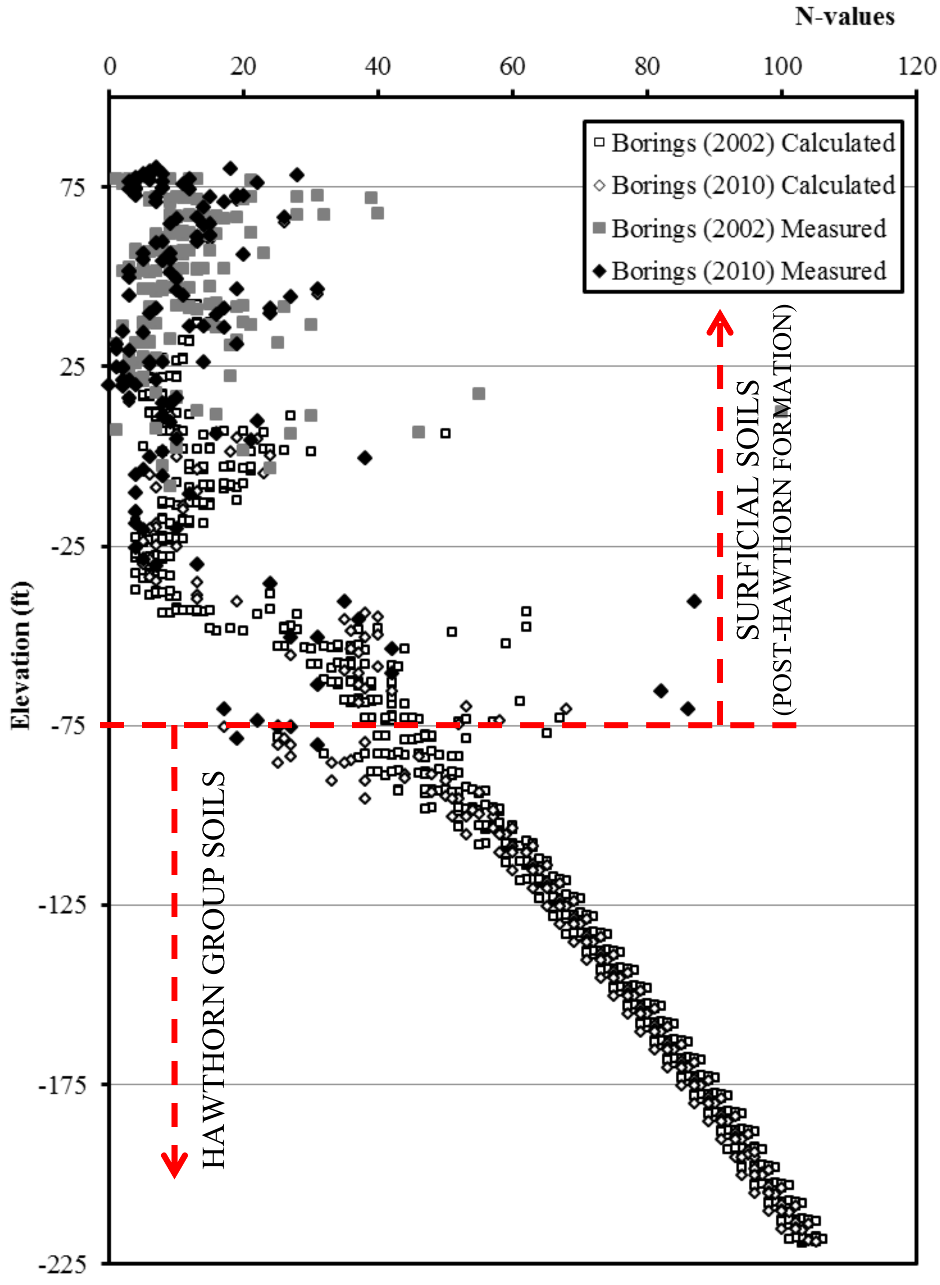


Figure 2

Summary of Measured and Calculated[1] N-Values
J.E.D. Solid Waste Management Facility, St. Cloud, Florida



Note: 1. N-values calculated using the IDWA method.

Figure 3

Locations of Analyzed Settlement Points on Liner Grading Plan J.E.D. Solid Waste Management Facility, St. Cloud, Florida

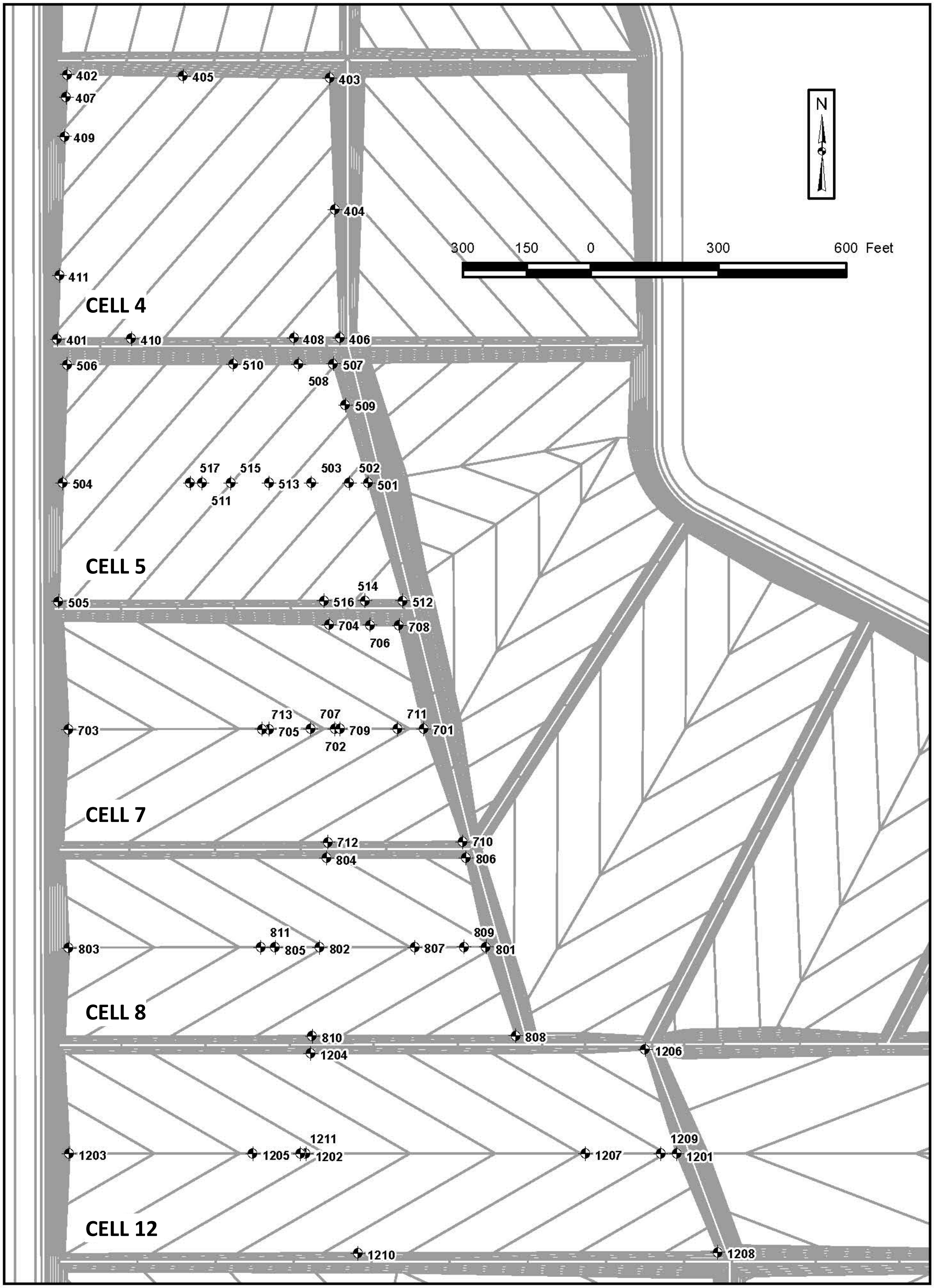
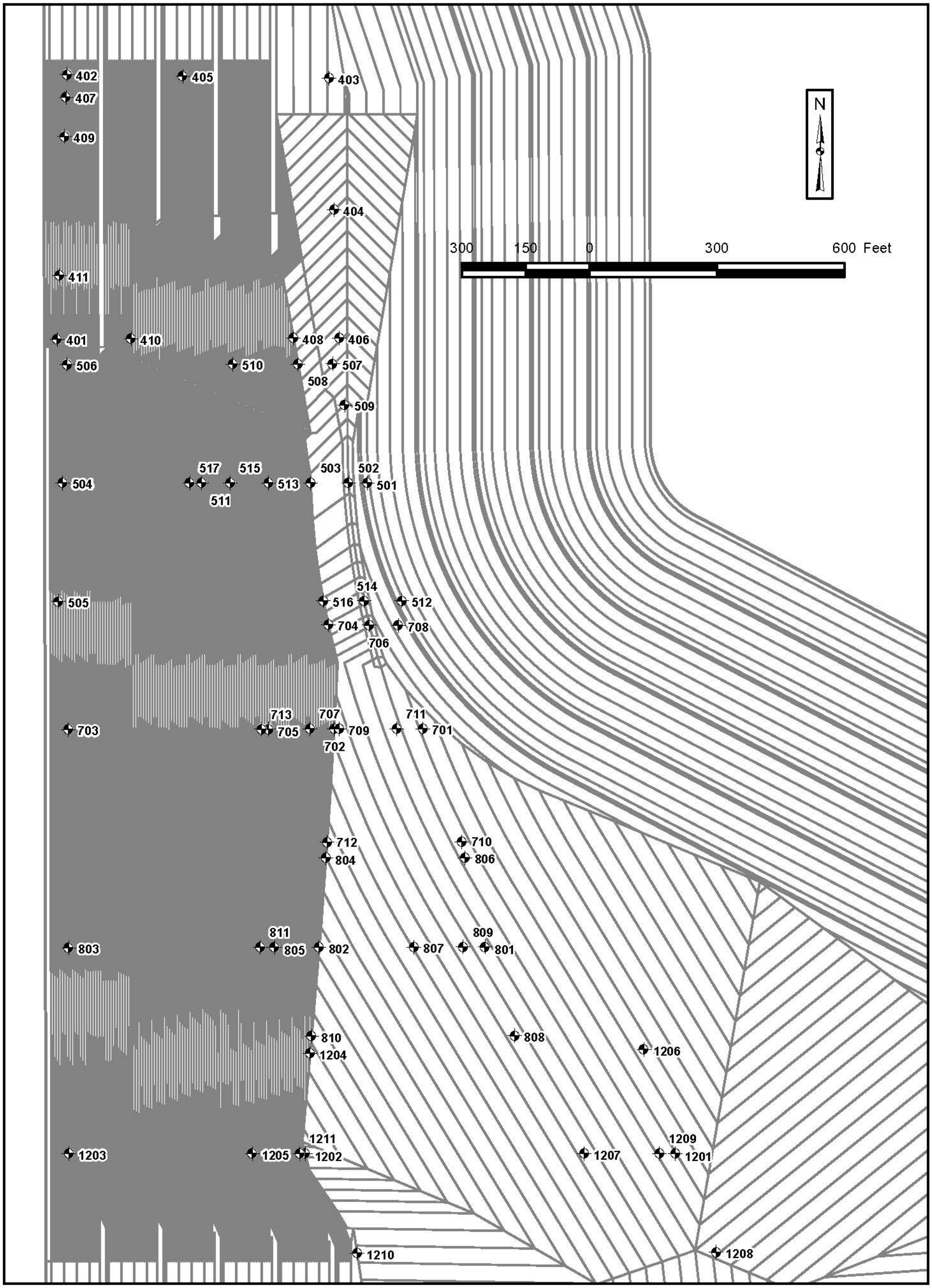


Figure 4

Locations of Analyzed Settlement Points on Final Cover Grading Plan
J.E.D. Solid Waste Management Facility, St. Cloud, Florida



ATTACHMENT A

Settlement Calculations

General Site Data and Overburden Properties:

Misc Constants -- Material Properties and Thicknesses

Unit weight of overburden materials: $\gamma_{waste} := 70pcf$ $\gamma_{cover} := 120pcf$

$\gamma_{fill} := 120pcf$ $\gamma_{bliner} := 120pcf$

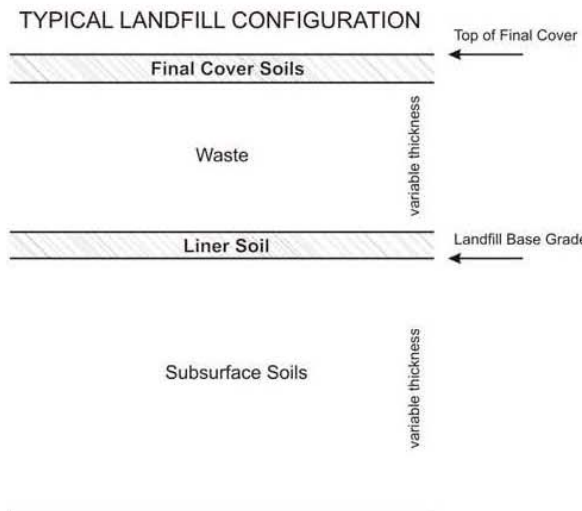
Thickness of final cover and bottom liner: $t_{cover} := 3ft$ $t_{bliner} := 2ft$

The waste thickness is calculated based on 3D CADD surfaces and the general equations are as follows:

$$H_{waste} := H_{final} - t_{cover} - \left(H_{base} + t_{bliner}\right)$$

where H_{final} = elevation of top of final cover

H_{base} = elevation of top of base grade



Vertical Stress Increment: $\Delta\sigma := H_{waste}\cdot\gamma_{waste} + t_{cover}\cdot\gamma_{cover} + H_{fill}\cdot\gamma_{fill} + t_{bliner}\cdot\gamma_{bliner}$

General Clay Properties

Average unit weight of soil: $\gamma_{soil} := 115pcf$

Average moisture content: $w := mean(29, 29.4, 24.9, 20.4, 38.7, 26.5, 37.9, 29.7, 54.4)$ $w = 32.3$

Average plasticity index: $I_p := mean(65, 70, 58)$ $I_p = 64.3$

Average liquid limit: $LL := mean(100, 96, 87)$ $LL = 94.3$

Average plastic limit: $PL := mean(35, 26, 29)$ $PL = 30$

Specific Gravity: $G_s := 2.65$

Estimated in-situ void ratio: $e_0 := \frac{w}{100}\cdot G_s$ $e_0 = 0.857$

Modified Compression Index: $C_{c\varepsilon} := 0.1$ (Geotechnical Investigation Report, 2010)

Poisson's Ratio: Sand $\mu_1 := 0.3$

Saturated Clay = 0.5
Partially Saturated Clay = 0.3 - 0.4
Dense sand = 0.3 - 0.4
Loose sand = 0.1 - 0.3
(Coduto, 2001)

Depth to groundwater table: $GWT := 0ft$

SPT Data format and definition

Modulus of Elasticity: $E = (194 + 8N)\cdot\left(1 - \mu^2\right)tsf$ (US Army Corp of Engineers, 1990)

Constrained Modulus: $D = E\cdot\frac{(1-\mu)}{(1+\mu)\cdot(1-2\mu)}$ (US Army Corp of Engineers, 1990)

SPT Interpolation Equations:

The Inverse Distance Weighted Average (IDWA) was calculated as a function of depth for all the borings based on existing soil boring data. IDWA was selected because this method provides a weighted average that is influenced most by nearby data. As the distance to other soil boring locations increases, the weighted average is affected less. A common IDWA method is also known as Shepard's Method, described as follows.

$$F = \sum_{i=0}^{n-1} \left(w_i \cdot N_i\right)$$

where n is the number of surrounding points, N is the set of data points being interpolated, and w is the weighing function, defined as follows:

$$w_i = \frac{\left(d_i\right)^{-p}}{\sum_{j=0}^{n-1} \left(d_j\right)^{-p}}$$

where p is the power parameter (typically equal to 2) and d is the distance between the interpolated point and surrounding data, calculated as:

$$d_i = \sqrt{\left(x - x_i\right)^2 + \left(y - y_i\right)^2 + \left(z - z_i\right)^2}$$

This method allows a N-value to be determined at any point within the footprint of the landfill at any given depth. Note that existing N-values are not replaced.

Settlement is calculated at any given location based on the N-values obtained through this interpolation as follows.

SPT Based Settlement Formulation:

Elastic Theory:
Settlement Sandy Soils: $\Delta S_{sand} = \Delta H\cdot\frac{\Delta\sigma}{D}$ (Lambe and Whitman, 1969 - Constrained Modulus Definition)

1D Consolidation Theory: (Normally consolidated clays, 1D Theory - Terzaghi)
Clayey Soils:

$$\Delta S_{clay} = C_c \cdot \frac{\Delta H}{1 + e_0} \cdot \log\left(\frac{\sigma_{eff} + \Delta\sigma}{\sigma_{eff}}\right)$$

Notes:
1. The settlement calculation uses the Elastic theory as presented in Lambe and Whitman (1969) for the non-cohesive soil (i.e., sandy) layers and applies Terzaghi's One Dimensional theory of consolidation to calculate the settlement in the cohesive soil layers.

SPT Based Settlement Calculations

Total settlement:

$\Delta S =$

	0	1	2
54	"Under Point-701"	4.845	"ft"
55	"Under Point-702"	4.762	"ft"
56	"Under Point-703"	0.716	"ft"
57	"Under Point-704"	4.796	"ft"
58	"Under Point-705"	3.753	"ft"
59	"Under Point-706"	4.88	"ft"
60	"Under Point-707"	4.401	...

slopes =

	0	1	2	3	4
20	701	702	1	0.96	0.000391757
21	702	703	1	0.35	0.0043766892
22	704	705	2	1.63	0.0066988038
23	706	707	2	1.83	0.0032666885
24	708	709	2	2.09	-0.0019327395
25	710	711	2	2.02	-0.0003313742
26	712	713	2	1.67	...

$\text{minimum\_slope} = 0.35 \cdot \%$

$\text{maximum\_tensilestrain} = -6.59 \times 10^{-3} \cdot \%$

APPENDIX E
WASTE SETTLEMENT CALCULATIONS

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **WCI** Project: **JED Sideslope Modifications** Project No.: **FL3318**

Phase No.: **01**

Title of Computations **FINAL COVER SYSTEM WASTE SETTLEMENT ANALYSIS**

Computations by:	Signature	[signature]	17 August 2018
	Printed Name	Ramil G. Mijares, Ph.D. P.E.	Date
	Title	Project Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature	[signature]	22 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Checked by:	Signature	[signature]	22 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Backchecked by: (originator)	Signature	[signature]	24 August 2018
	Printed Name	Ramil G. Mijares, Ph.D., P.E.	Date
	Title	Project Engineer	
Approved by: (pm or designate)	Signature	[signature]	24 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	

Approval notes: Senior review provided by Kwasi Badu-Tweneboah, Ph.D., P.E.

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

FINAL COVER SYSTEM WASTE SETTLEMENT ANALYSIS
J.E.D. SOLID WASTE MANAGEMENT FACILITY
ST. CLOUD, OSCEOLA COUNTY, FLORIDA

1 INTRODUCTION

The purpose of this calculation package is to evaluate waste settlement and its impact on the integrity of the final cover system geosynthetic components for the proposed modifications to the Cells 4, 5, 7, 8, and 12 waste-fill plans at the J.E.D. Solid Waste Management (JED) facility. The proposed waste-fill modifications include changes to the final cover system design plans for Cells 4, 5, 7, 8, and 12. Total and differential settlements due to the placement of the final cover system were evaluated at select locations, and the corresponding tensile strains within the geomembrane were calculated and compared to allowable tensile strain limits.

The subsequent sections present several aspects of the settlement analysis and include the following items:

- Methodology utilized to evaluate settlement and strains;
- Input parameters and assumptions used for the settlement analysis; and
- Results of the total and differential settlement analysis and corresponding tensile strains.

2 METHODOLGY

Four representative cross sections (see **Figures 1** through **3**) were developed to evaluate total and differential settlement. The cross sections include portions of the landfill cell footprints (i.e., Cells 4, 5, 7, 8, and 12) subjected to maximum waste thickness which are expected to yield maximum waste settlements. Subgrade settlement was neglected since most of the settlement of the foundation soils are anticipated to have occurred at the time of closure. The methodologies used to calculate total and differential waste settlements are described below.

2.1 Total Waste Settlement

Total settlement was calculated along the cross sections presented in **Figures 1** and **2**. Waste settlement was based on the conventional one-dimensional consolidation-compression model, where the total settlement due to an applied stress is taken as the sum of the primary consolidation and secondary compression settlements. The following one-dimensional consolidation equation was utilized to calculate primary waste settlement (ΔS_p) associated with mechanical compression of the waste (Sowers, 1973):

$$\Delta S_p = C_{c\varepsilon} H_o \log\left(\frac{\sigma'_{vo} + \Delta\sigma}{\sigma'_{vo}}\right) \quad (1)$$

where:

$C_{c\varepsilon}$ = modified compression index;

H_o = initial height of waste (ft);

σ'_{vo} = initial effective vertical stress (psf); and

$\Delta\sigma$ = additional vertical stress (psf).

Modified compression indices for waste have been reported to range from 0.05 to 0.40 (Sowers, 1973; NAVFAC, 1983; Burlingame, 1985; Landva and Clark, 1990; Fassett et al., 1994).

Secondary waste settlement (ΔS_s), associated with long-term creep and waste biodegradation, was evaluated using the following equation:

$$\Delta S_s = C_{\alpha\varepsilon} H_1 \log\left(\frac{t_2}{t_1}\right) \quad (2)$$

where:

$C_{\alpha\varepsilon}$ = modified secondary compression index;

H_1 = thickness of waste (ft) at time t_1 (corresponds to the time of closure and is equal to $H_0 - \Delta S_p$);

t_1 = elapsed time (years) from initial waste placement in the landfill to placement of the final cover system; and

t_2 = total elapsed time (years) from initial waste placement in the landfill to the time of concern, typically the end of the post-closure period (i.e., $t_2 = t_1 + 30$ years).

Modified secondary compression indices for waste have been reported to range from 0.01 to 0.1 (Sowers, 1973; NAVFAC, 1983; Burlingame, 1985, Landva and Clark, 1990; Fassett et al., 1994).

2.2 Differential Settlement and Tensile Strain

The differential settlement and corresponding tensile strains were calculated along the final cover liner system. Tensile strains (ε) were calculated using the following equation:

$$\varepsilon = \left(\frac{L_f - L_o}{L_o}\right) \times 100\% \qquad (3)$$

where:

L_f = distance between adjacent settlement points after settlement (ft); and

L_o = initial distance between adjacent settlement points (ft).

The calculated tensile strains were compared to allowable tensile strains of the critical geosynthetic component of the cover system (i.e., the hydraulic barrier, specifically the geomembrane). Berg and Bonaparte (1993) noted a maximum allowable tensile strain of 5 percent for polyethylene geomembranes. The performance of the geomembrane will not be significantly affected for strains that are less than the allowable strains.

3 INPUT PARAMETERS AND ASSUMPTIONS

The proposed final cover system for the JED facility will consist of the following components from top to bottom:

- 6-inch thick topsoil layer and vegetation;
- 18-inch thick protective soil layer;
- geocomposite drainage layer consisting of a geonet with non-woven geotextile heat-bonded on both sides (side slopes only);

- 40-mil thick textured polyethylene (PE) geomembrane liner; and
- 12-inch thick bedding/intermediate cover soil layer.

A summary of the geometric parameters, material properties and assumptions established with respect to landfill waste settlement are presented in **Table 1**.

The final cover system settlement analysis presented in this calculation package assumes that waste settlement will occur instantaneously. This assumption is conservative because by the time the final cover system (or portion thereof) is constructed, some settlement of the waste will have occurred. As such, actual final cover settlements will likely be less than those presented herein.

4 WASTE SETTLEMENT RESULTS

Attachment A provides the waste settlement calculations for the cross sections shown in **Figure 3**. The calculated settlement and strain values are presented in **Attachment B** and summarized in **Figure 4**. Results indicate that the maximum settlements along the four cross sections is equal to approximately 52.8 inches (Cross Section 3). The calculated tensile strains experienced by the critical geosynthetic component of the cover system (i.e., geomembrane) varied from a minimum of approximately -2.75 to 0.07 percent (Cross Section 3). The negative sign indicates a shortening of the distance between the points evaluated and therefore no tensile strain. These calculated tensile strain values are less than the maximum allowable strains of 5 percent for geomembranes.

5 CONCLUSIONS

The maximum total final cover settlement is equal to approximately 52.8 inches and the strains ranged from approximately -2.75 to 0.07 percent. The calculated tensile strains are below the maximum allowable tensile strain (i.e., 5 percent). Hence, the performance of the geomembrane component of the final cover system will not be significantly affected by the total final cover settlement.

6 REFERENCES

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Landva, A.O. and Clark, J.I. (1990). “Geothechnics of Waste Fill, ASTM STP 1070, Geotechnics of Waste Fills-Theory and Practice,” A.O. Landva and G.D. Knowles, Eds., *American Society for Testing and Materials*, Philadelphia, PA, pp. 86-103.

NAVFAC DM-7.3 (1983). “Soil Dynamics, Deep Stabilization, and Special Geotechnical Construction,” Design Manual 7.3, pp. 77-78.

Sowers, G.F. (1973). “Settlement of Waste Disposal Fills,” *Proceedings of the Eighth International Conference on Soil Mechanics and Foundation Engineering*, Moscow, pp. 207-210.

TABLE

Table 1

Geometric Parameters, Material Properties, and Assumptions
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

Analysis	Parameter	Value	Description
One-Dimensional Consolidation-Compression (Primary Consolidation and Secondary Compression)	γ_{waste}	70 pcf	Assumed unit weight of waste
	γ_{cover}	120 pcf	Assumed unit weight of cover system soil
	H_{waste}	Variable	Difference between final and base grades (see **Figures 1** and **2**)
	Cover System Thickness	3 ft	Assumed cover system thickness
	σ'_{vo}	Variable	Equal to $\gamma_{\mathrm{waste}} \times H_{\mathrm{waste}}$
	$\Delta\sigma$	360 psf	Additional vertical stress due to cover system placement (i.e., 120 pcf × 3 ft)
	$C_{c\varepsilon}$	0.25	Assumed modified compression index for waste
	$C_{\alpha\varepsilon}$	0.024	Assumed modified secondary compression index for waste
	t_1	30 yrs	Assumed time from initial waste placement to placement of the cover system
	t_2	60 yrs	Assumed total time from initial waste placement to the end of the post-closure monitoring period (i.e., $t_2 = t_1 + 30$ yrs = 60 yrs)

FIGURES

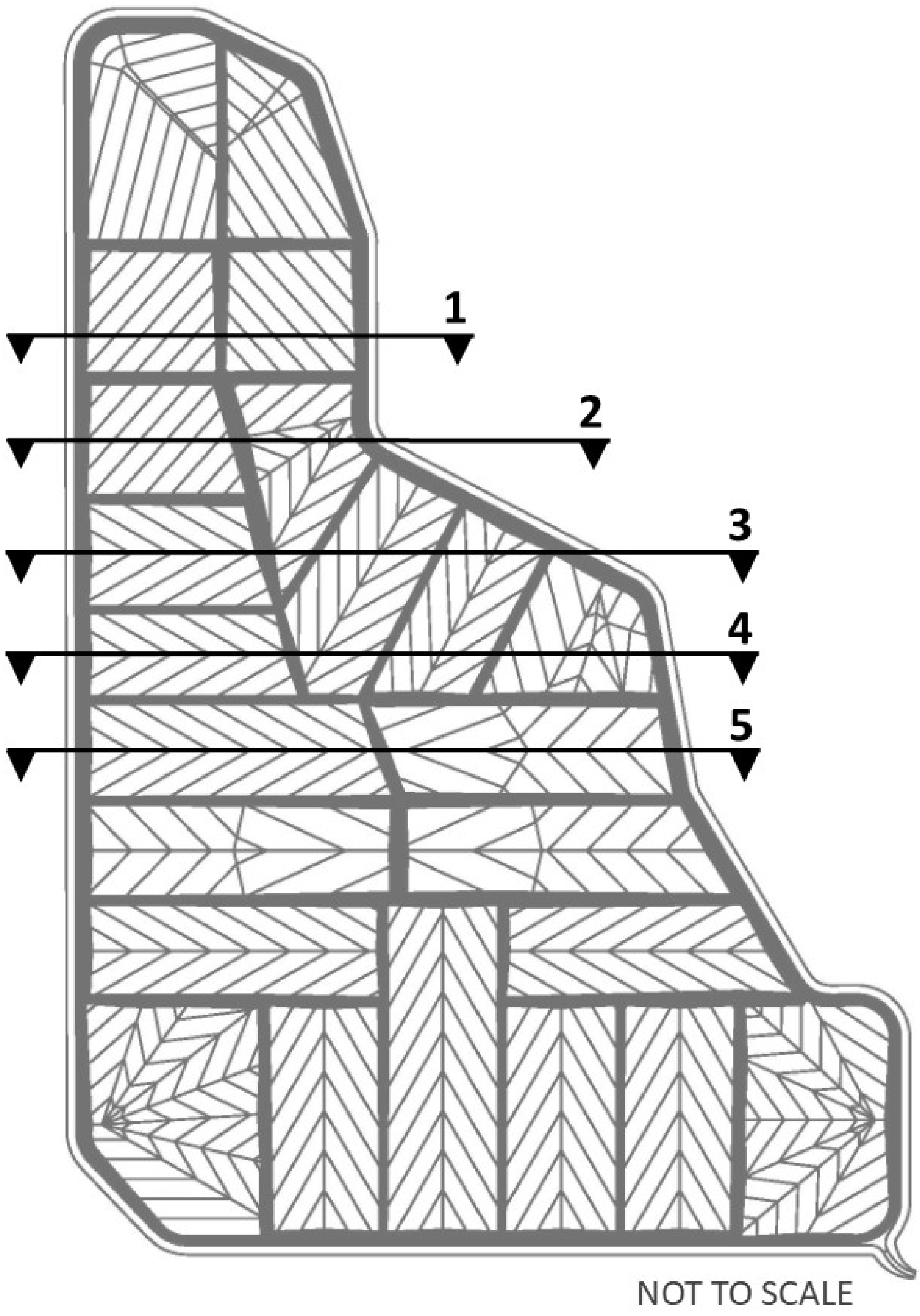


Figure 1. Representative Cross Section Locations Shown on Base Grades

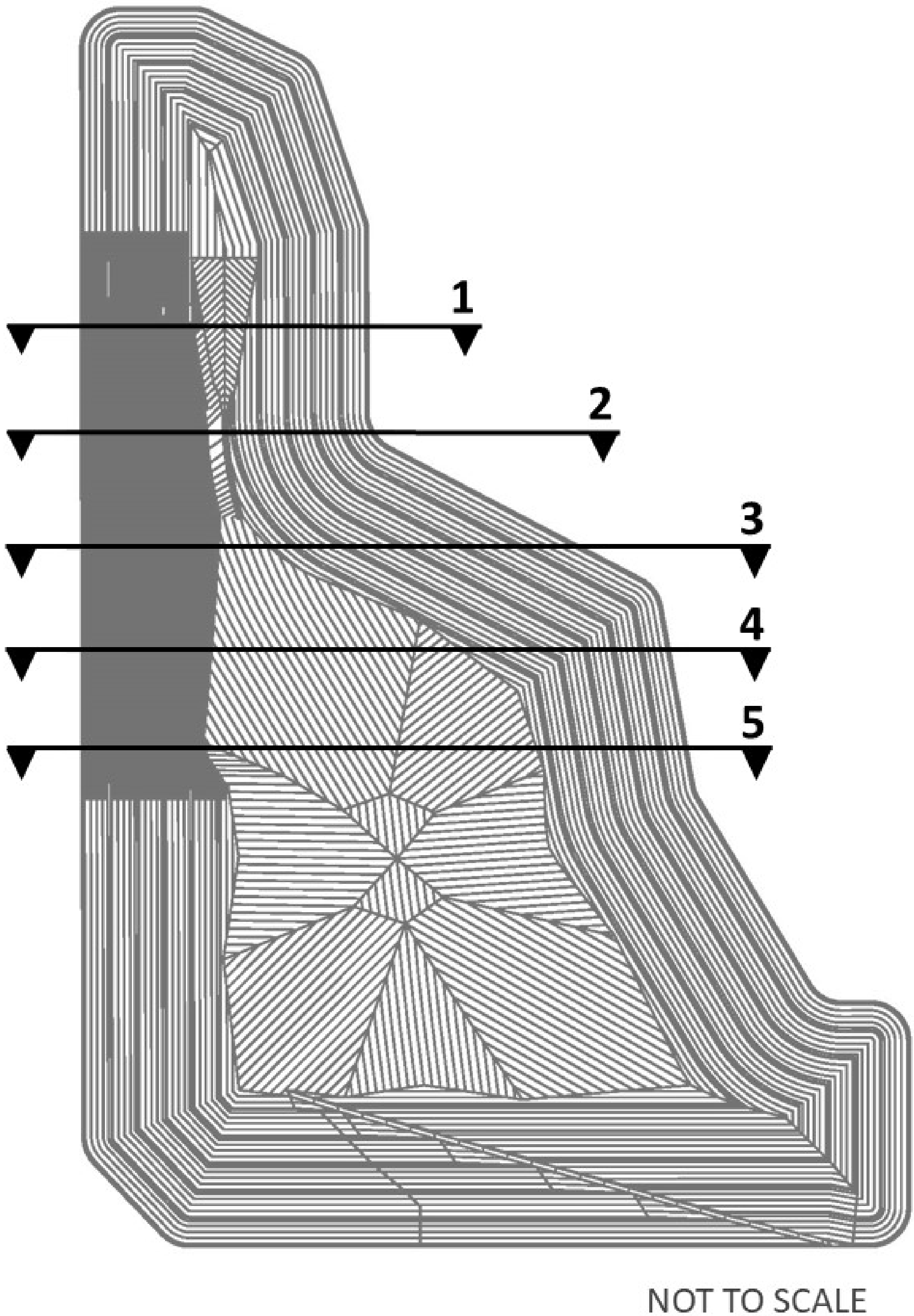


Figure 2. Representative Cross Section Locations Shown on Final Grades

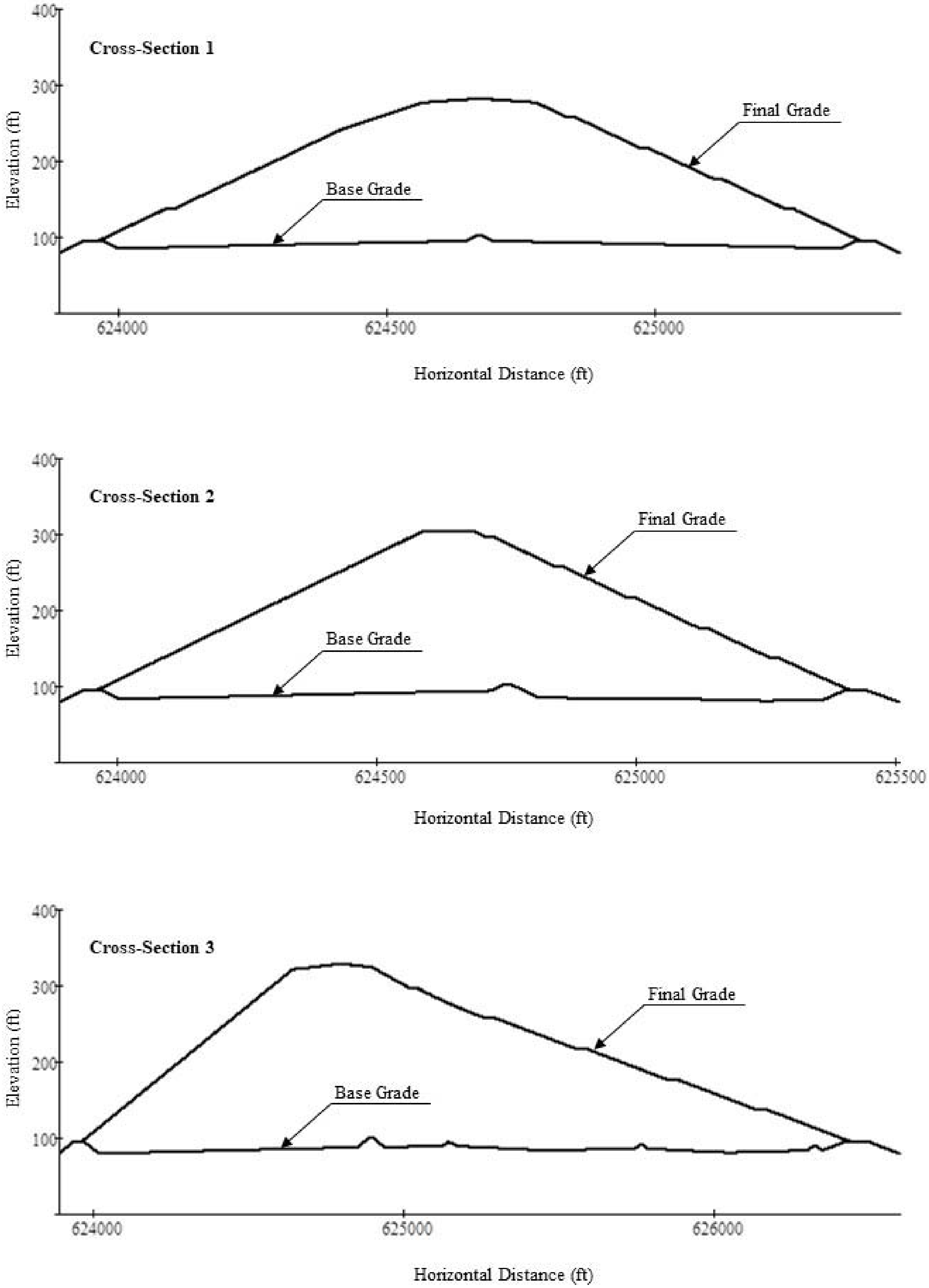
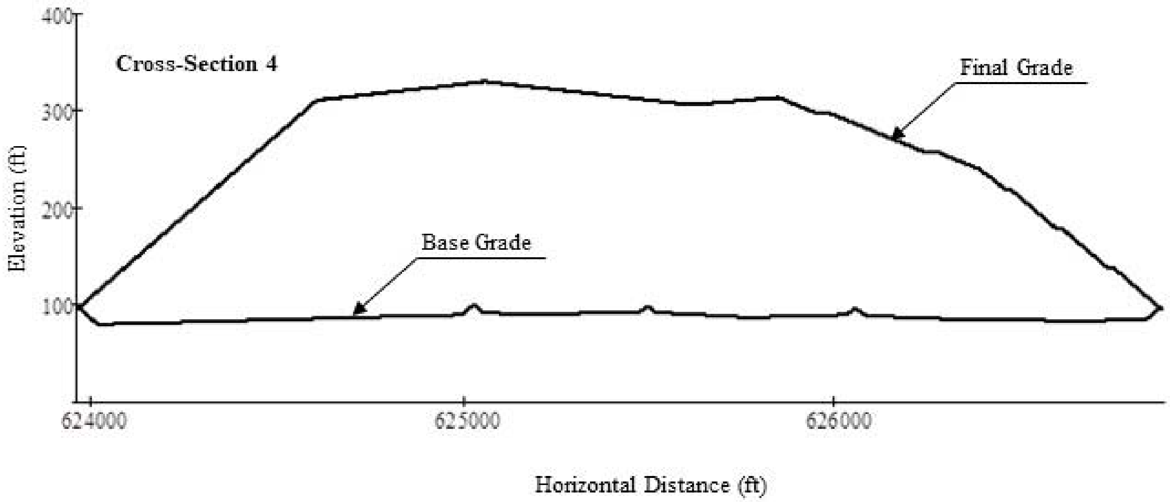


Figure 3. Representative Cross Sections



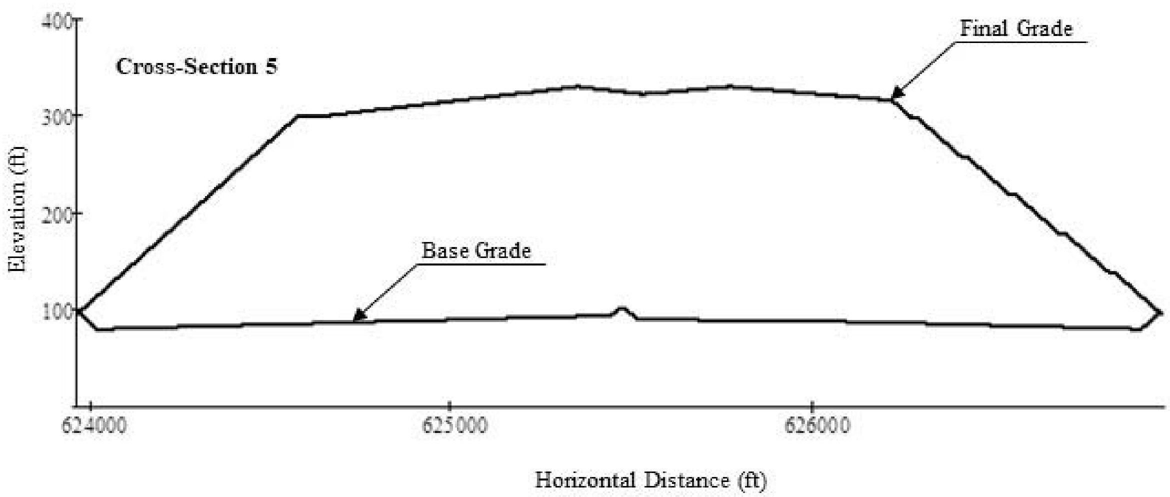


Figure 3. Representative Cross Sections (continued)

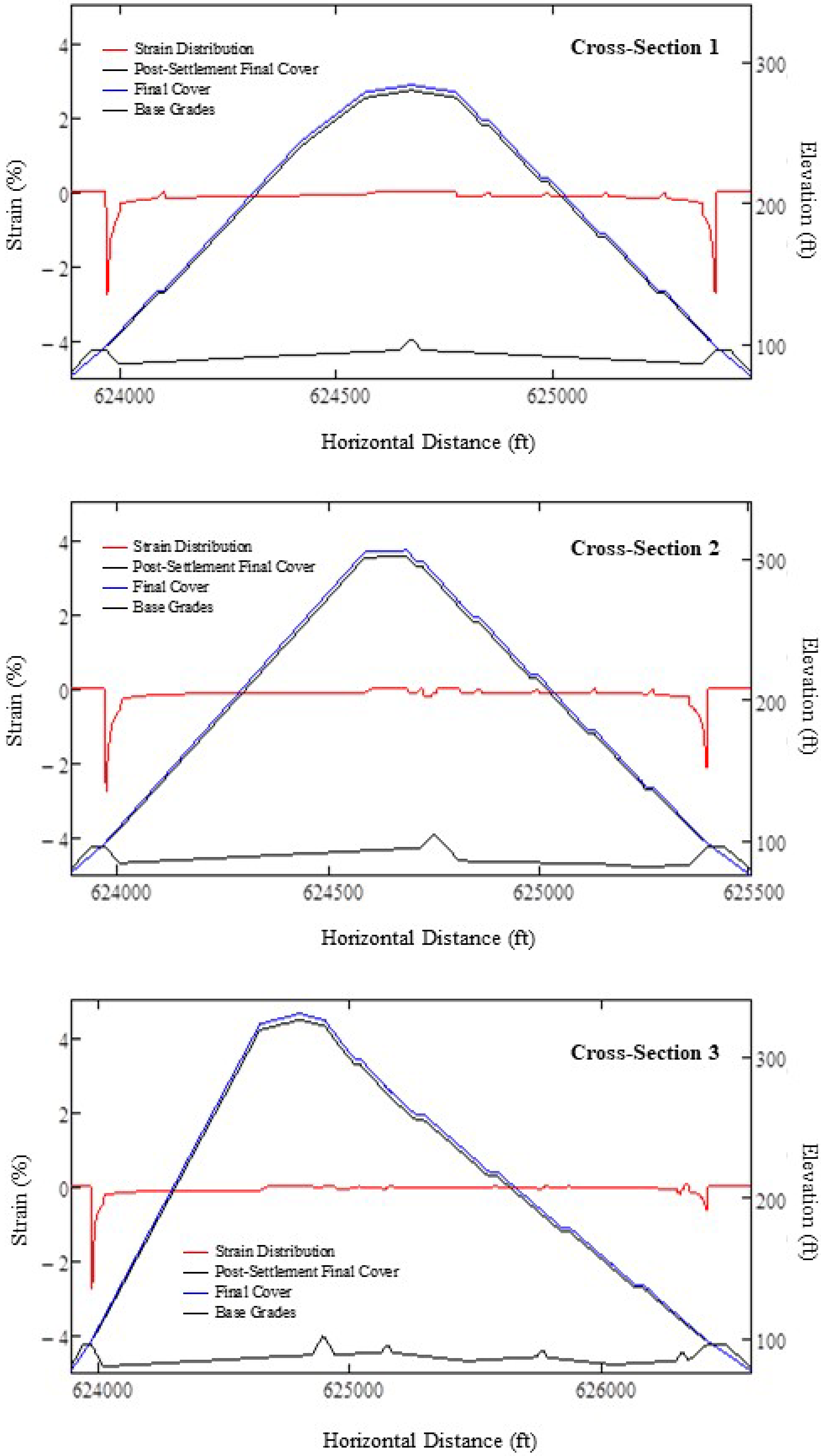
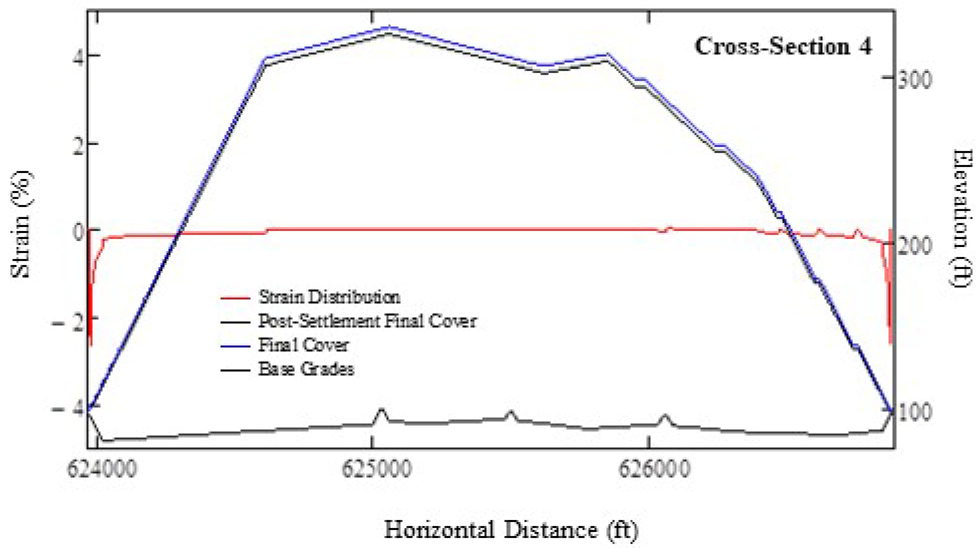


Figure 4. Summary of Calculation Results



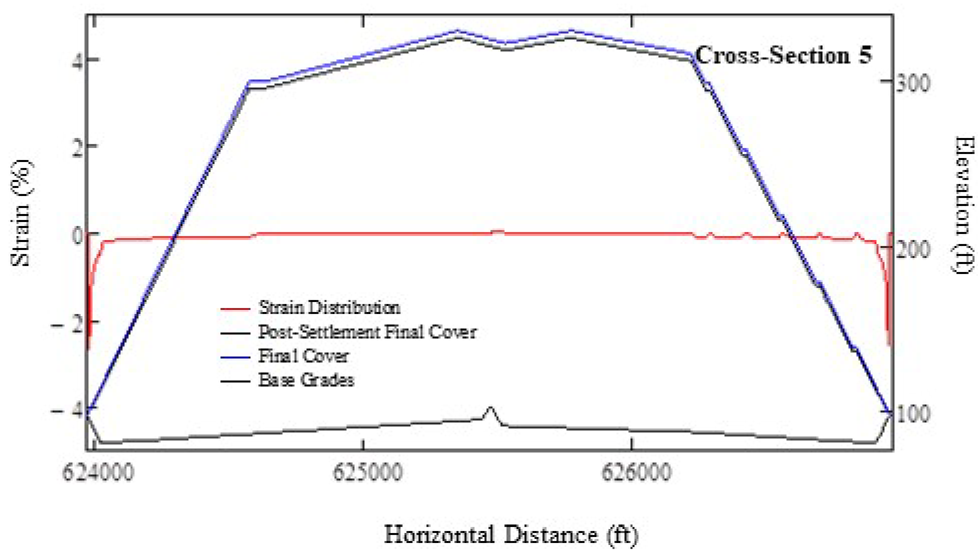


Figure 4. Summary of Calculation Results (continued)

ATTACHMENT A

Settlement Calculations

One dimensional waste compression model

Waste Properties:

Unit weight Models

Primary Compression Index: $C_{c\varepsilon} := 0.25$

Secondary Compression Index: $C_{\alpha\varepsilon} := 0.024$

Final Cover Properties:

Cover System Thickness: $H_{cover} := 3ft$

Unit Weight of Cover: $\gamma_{cover} := 120pcf$ (typical cover unit weight)

Settlement Equations:

Primary Settlement: $\Delta S_p = C_{c\varepsilon} \cdot H_0 \cdot \log\left(1 + \frac{\Delta\sigma}{\sigma_{v0}}\right)$

Secondary Compression: $\Delta S_s = C_{\alpha\varepsilon} \cdot H_f \cdot \log\left(\frac{t_2}{t_1}\right)$

Sample Settlement Calculation for a Given Point

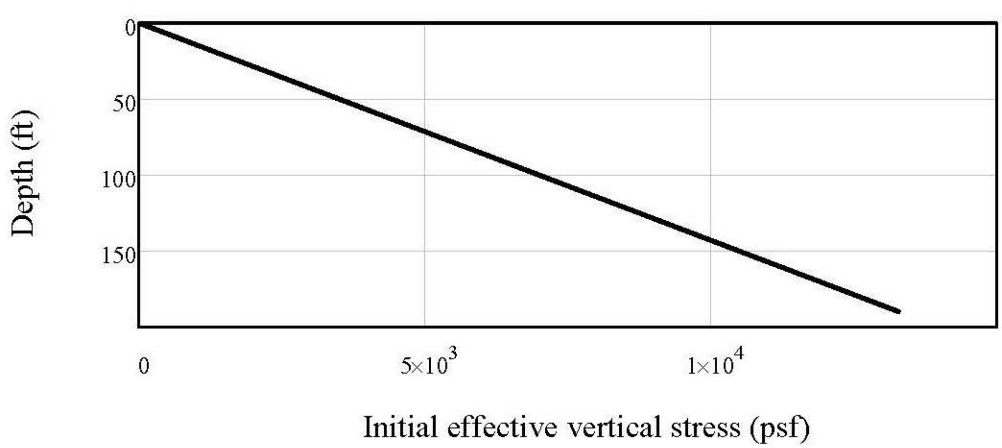
Number of layer subdivisions: $div := 500$ Simple Program Counter: $k := 0 .. div - 1$

Total Thickness of Waste: $H_T := 190ft$

Waste Layer Thickness: $H_0 := \frac{H_T}{div}$ $H_0 = 0.38 \cdot ft$

Depth of layer @ mid-depth: $Z_k := \frac{H_0}{2} + k \cdot H_0$

Applied initial effective stress at mid-depth: $\sigma_{v0}(Z) := \overrightarrow{\left(\gamma_{waste}(Z) \cdot Z\right)}$



Primary Compression:

Applied stress from cover soil and overburden waste:

$\Delta\sigma := \gamma_{cover} \cdot H_{cover} + \gamma_{ob} \cdot H_{ob}$ $\Delta\sigma = 360 \cdot psf$

$\Delta Sp(Z) := C_{c\varepsilon} \cdot H_0 \cdot \log\left(1 + \frac{\Delta\sigma}{\sigma_{v0}(Z)}\right)$ $\Delta S_p := \sum \Delta Sp(Z)$ $\Delta S_p = 30.805 \cdot in$

Secondary Settlement:

Assumed time from initial waste placement to placement of cover system: $t_1 := 30yr$

Post-closure period: $t_2 := t_1 + 30yr = 60 \cdot yr$

Height of waste at end of primary settlement: $H_f := H_T - \Delta S_p$

$\Delta S_s := C_{\alpha\varepsilon} \cdot H_f \cdot \log\left(\frac{t_2}{t_1}\right)$ $\Delta S_s = 16.25 \cdot in$

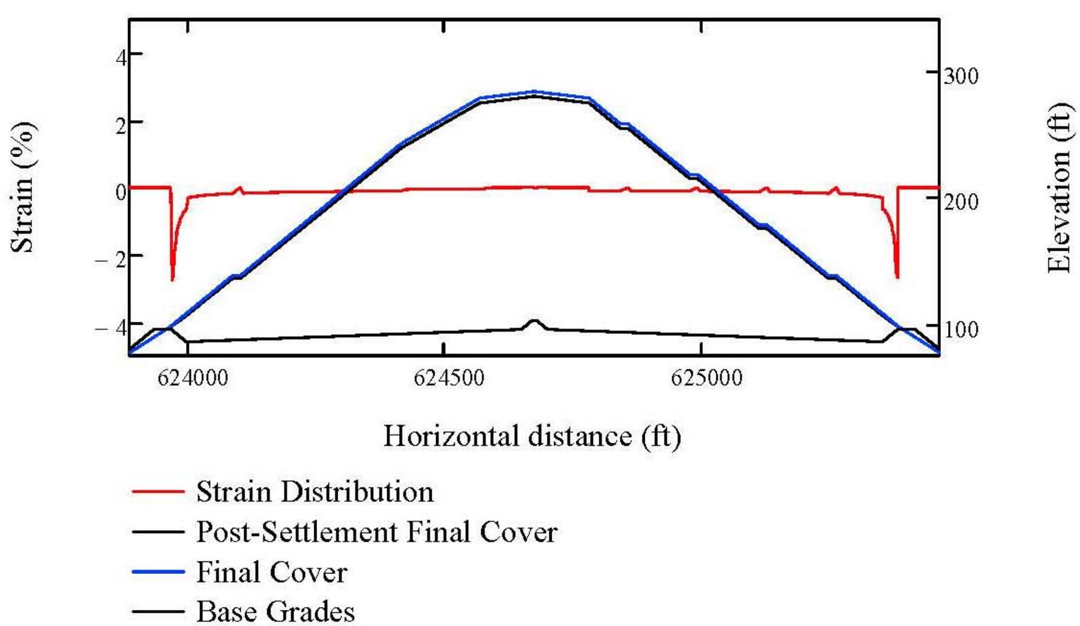
Total Waste Settlement:

$\Delta S_T := \Delta S_p + \Delta S_s$ $\Delta S_T = 47.055 \cdot in$

Strain Calculations:

$$\varepsilon = \left(\frac{L_f - L_0}{L_0}\right) \cdot 100$$

Total Settlement Calculations as a function of waste thickness



ATTACHMENT B

Calculated Settlement and Tensile Strains

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
623,887.3	77.2	0.0	0.0	77.2	0.00
623,935.3	89.7	0.0	0.0	89.7	0.00
623,949.3	93.4	0.0	0.0	93.4	0.00
623,959.3	96.0	0.0	0.0	96.0	0.00
623,961.0	96.4	0.0	0.0	96.4	0.00
623,963.2	97.0	0.0	0.0	97.0	0.00
623,965.3	97.6	0.0	0.0	97.6	0.00
623,967.0	98.0	0.0	0.0	98.0	0.00
623,967.3	98.1	0.0	0.0	98.1	0.00
623,970.3	99.1	1.1	3.9	98.8	-2.75
623,973.0	100.0	2.9	7.0	99.4	-2.56
623,973.3	100.1	3.1	7.3	99.5	-2.05
623,976.3	101.1	5.1	9.6	100.3	-1.74
623,979.0	102.0	6.9	11.2	101.1	-1.38
623,979.3	102.1	7.1	11.4	101.2	-1.25
623,982.3	103.1	9.1	12.8	102.0	-1.14
623,985.0	104.0	10.9	13.9	102.8	-0.99
623,985.3	104.1	11.1	14.1	102.9	-0.93
623,988.3	105.1	13.1	15.2	103.8	-0.87
623,991.0	106.0	14.9	16.0	104.7	-0.79
623,991.3	106.1	15.1	16.1	104.8	-0.75
623,994.3	107.1	17.1	17.0	105.7	-0.72
623,997.0	108.0	18.9	17.8	106.5	-0.66
623,997.3	108.1	19.1	17.8	106.6	-0.64
623,997.7	108.2	19.4	18.0	106.7	-0.63
624,001.2	109.4	20.5	18.4	107.9	-0.30
624,003.0	110.0	21.0	18.6	108.5	-0.29
624,004.6	110.5	21.5	18.8	109.0	-0.28
624,009.0	112.0	22.9	19.3	110.4	-0.28
624,015.0	114.0	24.8	19.9	112.3	-0.27
624,021.0	116.0	26.8	20.5	114.3	-0.25
624,027.0	118.0	28.7	21.1	116.2	-0.24
624,033.0	120.0	30.6	21.7	118.2	-0.23
624,039.0	122.0	32.5	22.2	120.1	-0.22
624,045.0	124.0	34.4	22.7	122.1	-0.21
624,051.0	126.0	36.3	23.2	124.1	-0.21
624,057.0	128.0	38.2	23.7	126.0	-0.20
624,063.0	130.0	40.1	24.2	128.0	-0.19
624,069.0	132.0	42.0	24.6	129.9	-0.19
624,072.0	133.0	43.0	24.8	130.9	-0.18
624,075.0	134.0	43.9	25.1	131.9	-0.18
624,081.0	136.0	45.9	25.5	133.9	-0.18
624,087.0	138.0	47.8	25.9	135.8	-0.17
624,102.0	138.0	47.5	25.9	135.8	0.00
624,108.0	140.0	49.4	26.3	137.8	-0.17

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,114.0	142.0	51.4	26.7	139.8	-0.17
624,120.0	144.0	53.3	27.1	141.7	-0.16
624,126.0	146.0	55.2	27.5	143.7	-0.16
624,132.0	148.0	57.1	27.9	145.7	-0.16
624,137.7	149.9	58.9	28.2	147.6	-0.15
624,138.0	150.0	59.0	28.2	147.6	-0.15
624,144.0	152.0	60.9	28.6	149.6	-0.15
624,150.0	154.0	62.8	29.0	151.6	-0.15
624,156.0	156.0	64.7	29.3	153.6	-0.15
624,162.0	158.0	66.6	29.7	155.5	-0.14
624,168.0	160.0	68.5	30.0	157.5	-0.14
624,174.0	162.0	70.5	30.3	159.5	-0.14
624,180.0	164.0	72.4	30.7	161.4	-0.14
624,186.0	166.0	74.3	31.0	163.4	-0.14
624,192.0	168.0	76.2	31.3	165.4	-0.14
624,198.0	170.0	78.1	31.7	167.4	-0.13
624,204.0	172.0	80.0	32.0	169.3	-0.13
624,207.0	173.0	81.0	32.1	170.3	-0.13
624,210.0	174.0	81.9	32.3	171.3	-0.13
624,216.0	176.0	83.8	32.6	173.3	-0.13
624,222.0	178.0	85.7	32.9	175.3	-0.13
624,228.0	180.0	87.6	33.2	177.2	-0.13
624,234.0	182.0	89.6	33.5	179.2	-0.13
624,240.0	184.0	91.5	33.8	181.2	-0.12
624,246.0	186.0	93.4	34.1	183.2	-0.12
624,252.0	188.0	95.3	34.4	185.1	-0.12
624,258.0	190.0	97.2	34.7	187.1	-0.12
624,264.0	192.0	99.1	35.0	189.1	-0.12
624,270.0	194.0	101.0	35.3	191.1	-0.12
624,270.9	194.3	101.3	35.3	191.3	-0.12
624,276.0	196.0	102.9	35.6	193.0	-0.12
624,282.0	198.0	104.8	35.9	195.0	-0.12
624,288.0	200.0	106.7	36.1	197.0	-0.12
624,294.0	202.0	108.7	36.4	199.0	-0.12
624,300.0	204.0	110.6	36.7	200.9	-0.11
624,306.0	206.0	112.5	37.0	202.9	-0.11
624,312.0	208.0	114.4	37.2	204.9	-0.11
624,318.0	210.0	116.3	37.5	206.9	-0.11
624,324.0	212.0	118.2	37.8	208.9	-0.11
624,330.0	214.0	120.1	38.1	210.8	-0.11
624,336.0	216.0	122.0	38.3	212.8	-0.11
624,339.0	217.0	123.0	38.5	213.8	-0.11
624,342.0	218.0	123.9	38.6	214.8	-0.11
624,348.0	220.0	125.8	38.9	216.8	-0.11
624,354.0	222.0	127.8	39.1	218.7	-0.11

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,360.0	224.0	129.7	39.4	220.7	-0.11
624,366.0	226.0	131.6	39.6	222.7	-0.11
624,372.0	228.0	133.5	39.9	224.7	-0.11
624,378.0	230.0	135.4	40.2	226.7	-0.11
624,384.0	232.0	137.3	40.4	228.6	-0.11
624,390.0	234.0	139.2	40.7	230.6	-0.11
624,396.0	236.0	141.1	40.9	232.6	-0.10
624,402.0	238.0	143.0	41.2	234.6	-0.10
624,404.0	238.7	143.7	41.2	235.2	-0.10
624,408.0	240.0	144.9	41.4	236.5	-0.10
624,414.0	242.0	146.8	41.7	238.5	-0.10
624,421.9	244.0	148.7	41.9	240.5	-0.06
624,430.4	246.0	150.6	42.2	242.5	-0.05
624,438.9	248.0	152.5	42.4	244.5	-0.05
624,447.4	250.0	154.3	42.6	246.4	-0.05
624,455.8	252.0	156.2	42.9	248.4	-0.05
624,464.3	254.0	158.1	43.1	250.4	-0.05
624,470.6	255.5	159.5	43.3	251.9	-0.05
624,472.8	256.0	160.0	43.3	252.4	-0.05
624,481.3	258.0	161.8	43.6	254.4	-0.05
624,489.8	260.0	163.7	43.8	256.3	-0.05
624,498.3	262.0	165.6	44.1	258.3	-0.05
624,506.7	264.0	167.5	44.3	260.3	-0.05
624,515.2	266.0	169.3	44.5	262.3	-0.05
624,523.7	268.0	171.2	44.8	264.3	-0.05
624,532.2	270.0	173.1	45.0	266.3	-0.05
624,537.1	271.1	174.1	45.1	267.4	-0.05
624,540.9	272.0	174.9	45.2	268.2	-0.05
624,549.6	274.0	176.8	45.5	270.2	-0.05
624,558.3	276.0	178.7	45.7	272.2	-0.05
624,567.0	278.0	180.6	45.9	274.2	-0.05
624,592.3	279.3	181.4	46.0	275.4	0.00
624,606.9	280.0	182.0	46.1	276.2	0.00
624,646.8	282.0	183.4	46.3	278.1	0.00
624,647.5	282.0	183.4	46.3	278.2	0.00
624,648.5	282.1	183.1	46.2	278.2	0.01
624,654.5	282.4	181.4	46.0	278.5	0.01
624,660.0	282.7	179.8	45.8	278.8	0.01
624,660.5	282.7	179.7	45.8	278.9	0.01
624,666.5	283.0	178.0	45.6	279.2	0.01
624,668.1	283.1	177.5	45.5	279.3	0.01
624,673.1	283.3	177.8	45.6	279.5	0.00
624,678.1	283.1	177.5	45.5	279.3	0.00
624,679.6	283.0	178.0	45.6	279.2	0.01
624,685.6	282.7	179.7	45.8	278.9	0.01

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,688.6	282.5	180.5	45.9	278.7	0.01
624,691.6	282.4	181.4	46.0	278.6	0.01
624,697.6	282.1	183.1	46.2	278.2	0.01
624,698.7	282.0	183.4	46.3	278.2	0.01
624,699.4	282.0	183.4	46.3	278.1	0.00
624,739.4	280.0	182.0	46.1	276.2	0.00
624,759.3	279.0	181.3	46.0	275.2	0.00
624,779.1	278.0	180.6	45.9	274.2	0.00
624,779.1	278.0	180.5	45.9	274.2	-0.10
624,785.1	276.0	178.6	45.7	272.2	-0.10
624,791.1	274.0	176.7	45.4	270.2	-0.10
624,797.1	272.0	174.8	45.2	268.2	-0.10
624,803.1	270.0	172.9	45.0	266.3	-0.10
624,809.1	268.0	171.0	44.7	264.3	-0.10
624,809.4	267.9	170.9	44.7	264.2	-0.10
624,815.1	266.0	169.1	44.5	262.3	-0.10
624,821.1	264.0	167.2	44.3	260.3	-0.10
624,827.1	262.0	165.3	44.0	258.3	-0.10
624,833.1	260.0	163.4	43.8	256.4	-0.10
624,839.1	258.0	161.4	43.5	254.4	-0.10
624,854.1	258.0	161.7	43.6	254.4	0.00
624,860.1	256.0	159.8	43.3	252.4	-0.10
624,866.1	254.0	157.8	43.1	250.4	-0.10
624,872.1	252.0	155.9	42.8	248.4	-0.10
624,876.2	250.7	154.7	42.7	247.1	-0.10
624,878.1	250.0	154.0	42.6	246.5	-0.10
624,884.1	248.0	152.1	42.3	244.5	-0.10
624,890.1	246.0	150.2	42.1	242.5	-0.10
624,896.1	244.0	148.3	41.9	240.5	-0.10
624,902.1	242.0	146.4	41.6	238.5	-0.10
624,908.1	240.0	144.5	41.4	236.6	-0.10
624,914.1	238.0	142.6	41.1	234.6	-0.10
624,920.1	236.0	140.7	40.9	232.6	-0.10
624,926.1	234.0	138.7	40.6	230.6	-0.11
624,932.1	232.0	136.8	40.3	228.6	-0.11
624,938.1	230.0	134.9	40.1	226.7	-0.11
624,942.9	228.4	133.4	39.9	225.1	-0.11
624,944.1	228.0	133.0	39.8	224.7	-0.11
624,950.1	226.0	131.1	39.6	222.7	-0.11
624,956.1	224.0	129.2	39.3	220.7	-0.11
624,962.1	222.0	127.3	39.1	218.7	-0.11
624,968.1	220.0	125.4	38.8	216.8	-0.11
624,974.1	218.0	123.5	38.5	214.8	-0.11
624,989.1	218.0	123.7	38.6	214.8	0.00
624,995.1	216.0	121.8	38.3	212.8	-0.11

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,001.1	214.0	119.9	38.0	210.8	-0.11
625,007.1	212.0	118.0	37.8	208.9	-0.11
625,010.1	211.0	117.0	37.6	207.9	-0.11
625,013.1	210.0	116.1	37.5	206.9	-0.11
625,019.1	208.0	114.1	37.2	204.9	-0.11
625,025.1	206.0	112.2	36.9	202.9	-0.11
625,031.1	204.0	110.3	36.7	200.9	-0.11
625,037.1	202.0	108.4	36.4	199.0	-0.11
625,043.1	200.0	106.5	36.1	197.0	-0.12
625,049.1	198.0	104.6	35.8	195.0	-0.12
625,055.1	196.0	102.7	35.5	193.0	-0.12
625,061.1	194.0	100.8	35.3	191.1	-0.12
625,067.1	192.0	98.9	35.0	189.1	-0.12
625,073.1	190.0	97.0	34.7	187.1	-0.12
625,076.5	188.9	95.9	34.5	186.0	-0.12
625,079.1	188.0	95.0	34.4	185.1	-0.12
625,085.1	186.0	93.1	34.1	183.2	-0.12
625,091.1	184.0	91.2	33.8	181.2	-0.12
625,097.1	182.0	89.3	33.5	179.2	-0.12
625,103.1	180.0	87.4	33.2	177.2	-0.13
625,109.1	178.0	85.5	32.9	175.3	-0.13
625,124.1	178.0	85.7	32.9	175.3	0.00
625,130.1	176.0	83.8	32.6	173.3	-0.13
625,136.1	174.0	81.9	32.3	171.3	-0.13
625,142.1	172.0	80.0	32.0	169.3	-0.13
625,145.1	171.0	79.0	31.8	168.3	-0.13
625,148.1	170.0	78.1	31.7	167.4	-0.13
625,154.1	168.0	76.2	31.3	165.4	-0.13
625,160.1	166.0	74.3	31.0	163.4	-0.14
625,166.1	164.0	72.3	30.7	161.4	-0.14
625,172.1	162.0	70.4	30.3	159.5	-0.14
625,178.1	160.0	68.5	30.0	157.5	-0.14
625,184.1	158.0	66.6	29.7	155.5	-0.14
625,190.1	156.0	64.7	29.3	153.6	-0.14
625,196.1	154.0	62.8	29.0	151.6	-0.15
625,202.1	152.0	60.9	28.6	149.6	-0.15
625,208.1	150.0	59.0	28.2	147.6	-0.15
625,210.0	149.4	58.4	28.1	147.0	-0.15
625,214.1	148.0	57.1	27.8	145.7	-0.16
625,220.1	146.0	55.2	27.5	143.7	-0.16
625,226.1	144.0	53.2	27.1	141.7	-0.16
625,232.1	142.0	51.3	26.7	139.8	-0.16
625,238.1	140.0	49.4	26.3	137.8	-0.17
625,244.1	138.0	47.5	25.9	135.8	-0.17
625,259.1	138.0	47.7	25.9	135.8	0.00

Cross Section 1

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,265.1	136.0	45.8	25.5	133.9	-0.17
625,271.1	134.0	43.9	25.1	131.9	-0.18
625,276.8	132.1	42.1	24.6	130.1	-0.18
625,277.1	132.0	42.0	24.6	129.9	-0.19
625,283.1	130.0	40.1	24.2	128.0	-0.19
625,289.1	128.0	38.2	23.7	126.0	-0.19
625,295.1	126.0	36.3	23.2	124.1	-0.20
625,301.1	124.0	34.4	22.7	122.1	-0.21
625,307.1	122.0	32.5	22.2	120.2	-0.21
625,313.1	120.0	30.5	21.7	118.2	-0.22
625,319.1	118.0	28.6	21.1	116.2	-0.23
625,325.1	116.0	26.7	20.5	114.3	-0.24
625,331.1	114.0	24.8	19.9	112.3	-0.25
625,337.1	112.0	22.9	19.3	110.4	-0.27
625,343.1	110.0	21.0	18.6	108.5	-0.28
625,343.5	109.9	20.9	18.5	108.3	-0.29
625,346.1	109.0	20.0	18.2	107.5	-0.30
625,348.6	108.2	19.3	17.9	106.7	-0.30
625,348.8	108.1	19.1	17.8	106.6	-0.64
625,349.1	108.0	18.9	17.8	106.5	-0.64
625,352.1	107.0	16.9	16.9	105.6	-0.67
625,354.8	106.1	15.1	16.1	104.8	-0.72
625,355.1	106.0	14.9	16.0	104.7	-0.75
625,358.1	105.0	12.9	15.0	103.7	-0.79
625,360.8	104.1	11.1	14.1	102.9	-0.88
625,361.1	104.0	10.9	13.9	102.8	-0.93
625,364.1	103.0	8.9	12.7	101.9	-1.00
625,366.8	102.1	7.1	11.4	101.2	-1.15
625,367.1	102.0	6.9	11.2	101.1	-1.25
625,370.1	101.0	4.9	9.4	100.2	-1.40
625,372.8	100.1	3.1	7.3	99.5	-1.77
625,373.1	100.0	2.9	7.0	99.4	-2.05
625,376.1	99.0	0.9	3.3	98.7	-2.64
625,378.8	98.1	0.0	0.0	98.1	-2.68
625,379.1	98.0	0.0	0.0	98.0	0.00
625,380.8	97.6	0.0	0.0	97.6	0.00
625,383.0	97.0	0.0	0.0	97.0	0.00
625,385.1	96.5	0.0	0.0	96.5	0.00
625,386.8	96.0	0.0	0.0	96.0	0.00
625,391.8	94.7	0.0	0.0	94.7	0.00
625,396.8	93.5	0.0	0.0	93.5	0.00
625,410.8	89.9	0.0	0.0	89.9	0.00
625,458.8	77.5	0.0	0.0	77.5	0.00

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
623,888.2	77.2	0.0	0.0	77.2	0.00
623,936.2	89.7	0.0	0.0	89.7	0.00
623,950.2	93.4	0.0	0.0	93.4	0.00
623,960.2	96.0	0.0	0.0	96.0	0.00
623,961.9	96.4	0.0	0.0	96.4	0.00
623,964.0	97.0	0.0	0.0	97.0	0.00
623,966.2	97.6	0.0	0.0	97.6	0.00
623,967.9	98.0	0.0	0.0	98.0	0.00
623,968.2	98.1	0.0	0.0	98.1	0.00
623,971.2	99.1	1.1	3.9	98.8	-2.75
623,973.9	100.0	2.9	7.0	99.4	-2.56
623,974.2	100.1	3.1	7.3	99.5	-2.05
623,977.2	101.1	5.1	9.6	100.3	-1.74
623,979.9	102.0	6.9	11.2	101.1	-1.38
623,980.2	102.1	7.1	11.4	101.2	-1.25
623,983.2	103.1	9.1	12.8	102.0	-1.14
623,985.9	104.0	10.9	13.9	102.8	-0.99
623,986.2	104.1	11.1	14.1	102.9	-0.93
623,989.2	105.1	13.1	15.2	103.8	-0.87
623,991.9	106.0	14.9	16.0	104.7	-0.79
623,992.2	106.1	15.1	16.1	104.8	-0.75
623,995.2	107.1	17.1	17.0	105.7	-0.72
623,997.9	108.0	18.9	17.8	106.5	-0.66
623,998.2	108.1	19.1	17.8	106.6	-0.64
624,001.1	109.1	21.1	18.6	107.5	-0.62
624,003.9	110.0	22.9	19.2	108.4	-0.58
624,004.1	110.1	23.0	19.3	108.5	-0.56
624,009.9	112.0	24.9	19.9	110.3	-0.27
624,015.9	114.0	26.8	20.5	112.3	-0.25
624,021.9	116.0	28.7	21.1	114.2	-0.24
624,027.9	118.0	30.6	21.7	116.2	-0.23
624,033.9	120.0	32.5	22.2	118.1	-0.22
624,039.9	122.0	34.4	22.7	120.1	-0.21
624,045.9	124.0	36.3	23.2	122.1	-0.21
624,051.9	126.0	38.2	23.7	124.0	-0.20
624,057.9	128.0	40.1	24.2	126.0	-0.19
624,063.9	130.0	42.1	24.6	127.9	-0.19
624,069.0	131.7	43.7	25.0	129.6	-0.18
624,069.9	132.0	44.0	25.1	129.9	-0.18
624,075.9	134.0	45.9	25.5	131.9	-0.18
624,081.9	136.0	47.8	25.9	133.8	-0.17
624,087.9	138.0	49.7	26.3	135.8	-0.17
624,093.9	140.0	51.6	26.7	137.8	-0.17
624,099.9	142.0	53.5	27.1	139.7	-0.16
624,105.9	144.0	55.4	27.5	141.7	-0.16

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,111.9	146.0	57.3	27.9	143.7	-0.16
624,117.9	148.0	59.2	28.3	145.6	-0.15
624,123.9	150.0	61.2	28.6	147.6	-0.15
624,129.9	152.0	63.1	29.0	149.6	-0.15
624,133.9	153.4	64.4	29.2	150.9	-0.15
624,135.9	154.0	65.0	29.4	151.6	-0.15
624,141.9	156.0	66.9	29.7	153.5	-0.14
624,147.9	158.0	68.8	30.0	155.5	-0.14
624,153.9	160.0	70.7	30.4	157.5	-0.14
624,159.9	162.0	72.6	30.7	159.4	-0.14
624,165.9	164.0	74.5	31.1	161.4	-0.14
624,171.9	166.0	76.4	31.4	163.4	-0.14
624,177.9	168.0	78.3	31.7	165.4	-0.13
624,183.9	170.0	80.2	32.0	167.3	-0.13
624,189.9	172.0	82.2	32.3	169.3	-0.13
624,195.9	174.0	84.1	32.7	171.3	-0.13
624,200.5	175.5	85.5	32.9	172.8	-0.13
624,201.9	176.0	86.0	33.0	173.3	-0.13
624,207.9	178.0	87.9	33.3	175.2	-0.13
624,213.9	180.0	89.8	33.6	177.2	-0.13
624,219.9	182.0	91.7	33.9	179.2	-0.12
624,225.9	184.0	93.6	34.2	181.2	-0.12
624,231.9	186.0	95.5	34.5	183.1	-0.12
624,237.9	188.0	97.4	34.8	185.1	-0.12
624,243.9	190.0	99.3	35.0	187.1	-0.12
624,249.9	192.0	101.3	35.3	189.1	-0.12
624,255.9	194.0	103.2	35.6	191.0	-0.12
624,261.9	196.0	105.1	35.9	193.0	-0.12
624,267.1	197.7	106.7	36.1	194.7	-0.12
624,267.9	198.0	107.0	36.2	195.0	-0.12
624,273.9	200.0	108.9	36.5	197.0	-0.12
624,279.9	202.0	110.8	36.7	198.9	-0.11
624,285.9	204.0	112.7	37.0	200.9	-0.11
624,291.9	206.0	114.6	37.3	202.9	-0.11
624,297.9	208.0	116.5	37.6	204.9	-0.11
624,303.9	210.0	118.4	37.8	206.8	-0.11
624,309.9	212.0	120.4	38.1	208.8	-0.11
624,315.9	214.0	122.3	38.4	210.8	-0.11
624,321.9	216.0	124.2	38.6	212.8	-0.11
624,327.9	218.0	126.1	38.9	214.8	-0.11
624,333.6	219.9	127.9	39.1	216.7	-0.11
624,333.9	220.0	128.0	39.1	216.7	-0.11
624,339.9	222.0	129.9	39.4	218.7	-0.11
624,345.9	224.0	131.8	39.7	220.7	-0.11
624,351.9	226.0	133.7	39.9	222.7	-0.11

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,357.9	228.0	135.6	40.2	224.7	-0.11
624,363.9	230.0	137.5	40.4	226.6	-0.11
624,369.9	232.0	139.5	40.7	228.6	-0.11
624,375.9	234.0	141.4	40.9	230.6	-0.10
624,381.9	236.0	143.3	41.2	232.6	-0.10
624,387.9	238.0	145.2	41.4	234.5	-0.10
624,393.9	240.0	147.1	41.7	236.5	-0.10
624,399.9	242.0	149.0	41.9	238.5	-0.10
624,400.2	242.1	149.1	42.0	238.6	-0.10
624,405.9	244.0	150.9	42.2	240.5	-0.10
624,411.9	246.0	152.8	42.4	242.5	-0.10
624,417.9	248.0	154.7	42.7	244.4	-0.10
624,423.9	250.0	156.6	42.9	246.4	-0.10
624,429.9	252.0	158.6	43.2	248.4	-0.10
624,435.9	254.0	160.5	43.4	250.4	-0.10
624,441.9	256.0	162.4	43.7	252.4	-0.10
624,447.9	258.0	164.3	43.9	254.3	-0.10
624,453.9	260.0	166.2	44.1	256.3	-0.10
624,459.9	262.0	168.1	44.4	258.3	-0.10
624,465.9	264.0	170.0	44.6	260.3	-0.10
624,468.9	265.0	171.0	44.7	261.3	-0.10
624,471.9	266.0	171.9	44.8	262.3	-0.10
624,477.9	268.0	173.8	45.1	264.2	-0.10
624,483.9	270.0	175.7	45.3	266.2	-0.10
624,489.9	272.0	177.7	45.6	268.2	-0.10
624,495.9	274.0	179.6	45.8	270.2	-0.10
624,501.9	276.0	181.5	46.0	272.2	-0.10
624,507.9	278.0	183.4	46.3	274.1	-0.10
624,513.9	280.0	185.3	46.5	276.1	-0.10
624,519.9	282.0	187.2	46.7	278.1	-0.10
624,525.9	284.0	189.1	46.9	280.1	-0.10
624,531.9	286.0	191.0	47.2	282.1	-0.10
624,533.3	286.5	191.5	47.2	282.6	-0.10
624,537.9	288.0	192.9	47.4	284.0	-0.10
624,543.9	290.0	194.8	47.6	286.0	-0.09
624,549.9	292.0	196.8	47.9	288.0	-0.09
624,555.9	294.0	198.7	48.1	290.0	-0.09
624,561.9	296.0	200.6	48.3	292.0	-0.09
624,567.9	298.0	202.5	48.5	294.0	-0.09
624,573.9	300.0	204.4	48.8	295.9	-0.09
624,579.9	302.0	206.3	49.0	297.9	-0.09
624,585.9	304.0	208.2	49.2	299.9	-0.09
624,587.7	304.6	208.8	49.3	300.5	-0.09
624,606.3	304.8	208.7	49.3	300.7	0.00
624,624.8	305.0	208.6	49.3	300.9	0.00

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,666.5	305.4	208.4	49.2	301.3	0.00
624,676.7	305.5	208.4	49.2	301.4	0.00
624,688.7	305.5	208.2	49.2	301.4	0.00
624,693.2	304.0	206.6	49.0	299.9	-0.11
624,696.0	303.0	205.6	48.9	298.9	-0.11
624,698.9	302.0	204.5	48.8	297.9	-0.11
624,704.6	300.0	202.4	48.5	296.0	-0.11
624,710.5	298.0	200.3	48.3	294.0	-0.10
624,721.0	298.0	200.2	48.3	294.0	0.00
624,724.7	298.0	199.0	48.1	294.0	0.00
624,725.6	298.0	198.7	48.1	294.0	0.00
624,725.7	298.0	198.7	48.1	294.0	0.00
624,728.7	297.0	196.7	47.9	293.0	-0.19
624,730.8	296.3	195.3	47.7	292.3	-0.19
624,731.7	296.0	194.7	47.6	292.0	-0.19
624,734.7	295.0	192.7	47.4	291.1	-0.19
624,737.0	294.3	191.3	47.2	290.3	-0.19
624,737.8	294.0	190.8	47.1	290.1	-0.19
624,740.8	293.0	188.8	46.9	289.1	-0.19
624,743.2	292.2	187.2	46.7	288.3	-0.19
624,743.8	292.0	186.8	46.7	288.1	-0.19
624,746.9	291.0	184.8	46.4	287.1	-0.19
624,747.8	290.7	184.2	46.4	286.8	-0.19
624,749.9	290.0	183.5	46.3	286.1	-0.10
624,753.0	289.0	182.5	46.1	285.1	-0.10
624,755.9	288.0	181.5	46.0	284.2	-0.10
624,758.1	287.3	180.8	45.9	283.5	-0.10
624,760.4	286.5	180.8	45.9	282.7	0.00
624,762.0	286.0	180.7	45.9	282.2	0.00
624,762.8	285.7	180.7	45.9	281.9	0.00
624,765.9	284.7	180.7	45.9	280.9	0.00
624,768.0	284.0	180.7	45.9	280.2	0.00
624,769.0	283.7	180.7	45.9	279.8	0.00
624,772.1	282.7	180.7	45.9	278.8	0.00
624,774.0	282.0	180.6	45.9	278.2	0.00
624,775.2	281.6	180.6	45.9	277.8	0.00
624,778.2	280.6	180.6	45.9	276.8	0.00
624,780.1	280.0	180.6	45.9	276.2	0.00
624,781.3	279.6	180.6	45.9	275.8	0.00
624,784.4	278.6	180.6	45.9	274.7	0.00
624,786.1	278.0	180.5	45.9	274.2	0.00
624,787.5	277.5	180.5	45.9	273.7	0.00
624,790.6	276.5	180.5	45.9	272.7	0.00
624,792.2	276.0	180.5	45.9	272.2	0.00
624,793.7	275.5	180.5	45.9	271.7	0.00

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,796.8	274.5	180.5	45.9	270.6	0.00
624,798.2	274.0	180.4	45.9	270.2	0.00
624,799.9	273.4	180.4	45.9	269.6	0.00
624,803.0	272.4	180.4	45.9	268.6	0.00
624,804.2	272.0	180.4	45.9	268.2	0.00
624,806.1	271.4	180.4	45.9	267.6	0.00
624,809.2	270.4	180.4	45.9	266.5	0.00
624,810.3	270.0	180.4	45.9	266.2	0.00
624,812.3	269.3	180.3	45.9	265.5	0.00
624,813.3	269.0	180.3	45.9	265.2	0.00
624,813.7	268.9	180.3	45.9	265.1	0.00
624,816.3	268.0	179.5	45.8	264.2	-0.10
624,822.4	266.0	177.5	45.5	262.2	-0.10
624,828.5	264.0	175.5	45.3	260.2	-0.10
624,834.5	262.0	173.6	45.1	258.2	-0.10
624,840.6	260.0	171.6	44.8	256.3	-0.10
624,846.6	258.0	169.7	44.6	254.3	-0.10
624,861.7	258.0	169.8	44.6	254.3	0.00
624,861.8	258.0	169.8	44.6	254.3	0.00
624,867.8	256.0	167.8	44.3	252.3	-0.10
624,873.9	254.0	165.8	44.1	250.3	-0.10
624,879.9	252.0	163.9	43.8	248.3	-0.10
624,886.0	250.0	161.9	43.6	246.4	-0.10
624,892.1	248.0	160.0	43.4	244.4	-0.10
624,898.1	246.0	158.0	43.1	242.4	-0.10
624,904.2	244.0	156.1	42.9	240.4	-0.10
624,910.3	242.0	154.1	42.6	238.4	-0.10
624,916.3	240.0	152.1	42.3	236.5	-0.10
624,922.4	238.0	150.2	42.1	234.5	-0.10
624,928.5	236.0	148.2	41.8	232.5	-0.10
624,931.5	235.0	147.2	41.7	231.5	-0.10
624,934.5	234.0	146.3	41.6	230.5	-0.10
624,940.6	232.0	144.3	41.3	228.6	-0.10
624,946.7	230.0	142.3	41.1	226.6	-0.10
624,952.8	228.0	140.4	40.8	224.6	-0.11
624,958.8	226.0	138.4	40.6	222.6	-0.11
624,964.9	224.0	136.5	40.3	220.6	-0.11
624,971.0	222.0	134.5	40.0	218.7	-0.11
624,977.1	220.0	132.5	39.8	216.7	-0.11
624,983.1	218.0	130.6	39.5	214.7	-0.11
624,998.3	218.0	130.7	39.5	214.7	0.00
624,998.4	218.0	130.7	39.5	214.7	0.00
625,004.5	216.0	128.7	39.2	212.7	-0.11
625,010.5	214.0	126.8	39.0	210.8	-0.11
625,016.6	212.0	124.8	38.7	208.8	-0.11

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,022.7	210.0	122.9	38.4	206.8	-0.11
625,028.8	208.0	120.9	38.2	204.8	-0.11
625,034.9	206.0	118.9	37.9	202.8	-0.11
625,041.0	204.0	117.0	37.6	200.9	-0.11
625,044.5	202.9	115.9	37.5	199.7	-0.11
625,047.1	202.0	115.0	37.3	198.9	-0.11
625,053.2	200.0	113.1	37.1	196.9	-0.11
625,059.3	198.0	111.1	36.8	194.9	-0.11
625,065.4	196.0	109.1	36.5	193.0	-0.11
625,071.5	194.0	107.2	36.2	191.0	-0.11
625,077.6	192.0	105.2	35.9	189.0	-0.12
625,083.7	190.0	103.3	35.6	187.0	-0.12
625,089.8	188.0	101.3	35.3	185.1	-0.12
625,095.9	186.0	99.4	35.0	183.1	-0.12
625,102.1	184.0	97.4	34.7	181.1	-0.12
625,105.1	183.0	96.4	34.6	180.1	-0.12
625,108.2	182.0	95.4	34.4	179.1	-0.12
625,114.3	180.0	93.5	34.1	177.2	-0.12
625,120.4	178.0	91.5	33.8	175.2	-0.12
625,135.8	178.0	91.6	33.9	175.2	0.00
625,135.9	178.0	91.6	33.9	175.2	0.00
625,142.0	176.0	89.7	33.5	173.2	-0.12
625,148.2	174.0	87.7	33.2	171.2	-0.12
625,154.3	172.0	85.7	32.9	169.3	-0.12
625,160.0	170.2	84.0	32.6	167.4	-0.12
625,160.5	170.0	83.8	32.6	167.3	-0.12
625,166.7	168.0	81.9	32.3	165.3	-0.12
625,172.8	166.0	80.0	32.0	163.3	-0.12
625,179.0	164.0	78.2	31.7	161.4	-0.12
625,185.2	162.0	76.3	31.4	159.4	-0.12
625,190.4	160.3	74.7	31.1	157.7	-0.13
625,191.4	160.0	74.4	31.0	157.4	-0.13
625,197.6	158.0	72.5	30.7	155.4	-0.13
625,203.7	156.0	70.7	30.4	153.5	-0.13
625,209.9	154.0	68.8	30.0	151.5	-0.13
625,216.1	152.0	66.9	29.7	149.5	-0.13
625,220.8	150.5	65.5	29.5	148.0	-0.13
625,222.3	150.0	65.0	29.4	147.6	-0.13
625,228.6	148.0	63.2	29.0	145.6	-0.13
625,234.8	146.0	61.3	28.7	143.6	-0.14
625,237.9	145.0	60.3	28.5	142.6	-0.14
625,241.0	144.0	59.4	28.3	141.6	-0.14
625,247.3	142.0	57.5	27.9	139.7	-0.14
625,249.1	141.4	57.0	27.8	139.1	-0.14
625,253.6	140.0	55.5	27.5	137.7	-0.16

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,259.8	138.0	53.5	27.1	135.7	-0.16
625,275.5	138.0	53.3	27.1	135.7	0.00
625,275.6	138.0	53.3	27.1	135.7	0.00
625,278.7	137.0	52.3	26.9	134.8	-0.16
625,281.9	136.0	51.2	26.7	133.8	-0.16
625,288.2	134.0	49.2	26.2	131.8	-0.17
625,294.5	132.0	47.1	25.8	129.9	-0.17
625,300.9	130.0	45.0	25.3	127.9	-0.17
625,305.4	128.6	43.6	25.0	126.5	-0.17
625,307.2	128.0	43.0	24.8	125.9	-0.18
625,313.6	126.0	40.9	24.4	124.0	-0.18
625,320.0	124.0	38.9	23.9	122.0	-0.18
625,326.4	122.0	36.8	23.3	120.1	-0.19
625,332.8	120.0	34.7	22.8	118.1	-0.20
625,332.8	120.0	34.7	22.8	118.1	-0.20
625,339.3	118.0	32.7	22.2	116.1	-0.20
625,345.7	116.0	30.6	21.7	114.2	-0.21
625,352.3	114.0	28.5	21.1	112.2	-0.21
625,358.8	112.0	26.5	20.4	110.3	-0.22
625,360.2	111.6	26.0	20.3	109.9	-0.23
625,362.6	110.9	24.6	19.8	109.2	-0.45
625,365.0	110.1	23.1	19.3	108.5	-0.46
625,365.4	110.0	22.9	19.2	108.4	-0.47
625,368.7	109.0	20.9	18.5	107.5	-0.49
625,371.5	108.1	19.1	17.9	106.6	-0.52
625,372.0	108.0	18.9	17.7	106.5	-0.54
625,375.3	107.0	16.9	16.9	105.6	-0.56
625,378.2	106.1	15.1	16.1	104.8	-0.60
625,378.6	106.0	14.9	16.0	104.7	-0.63
625,381.9	105.0	12.9	15.0	103.7	-0.65
625,384.8	104.1	11.1	14.1	103.0	-0.72
625,385.3	104.0	10.9	13.9	102.8	-0.76
625,388.6	103.0	8.9	12.7	101.9	-0.82
625,391.6	102.1	7.1	11.4	101.2	-0.94
625,391.9	102.0	6.9	11.2	101.1	-1.02
625,395.3	101.0	4.9	9.4	100.2	-1.11
625,398.3	100.1	3.1	7.4	99.5	-1.40
625,398.7	100.0	2.9	7.0	99.4	-1.63
625,402.2	99.0	0.9	3.3	98.7	-2.10
625,405.1	98.1	0.0	0.0	98.1	-2.13
625,405.6	98.0	0.0	0.0	98.0	0.00
625,407.4	97.6	0.0	0.0	97.6	0.00
625,410.0	97.0	0.0	0.0	97.0	0.00
625,412.4	96.5	0.0	0.0	96.5	0.00
625,414.3	96.0	0.0	0.0	96.0	0.00

Cross Section 2

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,420.1	94.7	0.0	0.0	94.7	0.00
625,426.0	93.4	0.0	0.0	93.4	0.00
625,442.7	89.6	0.0	0.0	89.6	0.00
625,507.6	75.0	0.0	0.0	75.0	0.00

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
623,889.2	77.2	0.0	0.0	77.2	0.00
623,937.2	89.7	0.0	0.0	89.7	0.00
623,951.2	93.4	0.0	0.0	93.4	0.00
623,961.2	96.0	0.0	0.0	96.0	0.00
623,962.9	96.4	0.0	0.0	96.4	0.00
623,965.0	97.0	0.0	0.0	97.0	0.00
623,967.2	97.6	0.0	0.0	97.6	0.00
623,968.9	98.0	0.0	0.0	98.0	0.00
623,969.2	98.1	0.0	0.0	98.1	0.00
623,972.2	99.1	1.1	3.9	98.8	-2.75
623,974.9	100.0	2.9	7.0	99.4	-2.56
623,975.2	100.1	3.1	7.3	99.5	-2.05
623,978.2	101.1	5.1	9.6	100.3	-1.74
623,980.9	102.0	6.9	11.2	101.1	-1.38
623,981.2	102.1	7.1	11.4	101.2	-1.25
623,984.2	103.1	9.1	12.8	102.0	-1.14
623,986.9	104.0	10.9	13.9	102.8	-0.99
623,987.2	104.1	11.1	14.1	102.9	-0.93
623,990.2	105.1	13.1	15.2	103.8	-0.87
623,992.9	106.0	14.9	16.0	104.7	-0.79
623,993.2	106.1	15.1	16.1	104.8	-0.75
623,996.2	107.1	17.1	17.0	105.7	-0.72
623,998.9	108.0	18.9	17.8	106.5	-0.66
623,999.2	108.1	19.1	17.8	106.6	-0.64
624,002.2	109.1	21.1	18.6	107.6	-0.62
624,004.9	110.0	22.9	19.2	108.4	-0.58
624,005.2	110.1	23.1	19.3	108.5	-0.56
624,008.2	111.1	25.1	20.0	109.4	-0.55
624,010.9	112.0	26.9	20.6	110.3	-0.52
624,011.2	112.1	27.1	20.6	110.4	-0.51
624,014.2	113.1	29.1	21.2	111.3	-0.49
624,016.9	114.0	30.9	21.8	112.2	-0.47
624,017.2	114.1	31.1	21.8	112.3	-0.46
624,022.9	116.0	32.9	22.3	114.1	-0.22
624,028.9	118.0	34.9	22.8	116.1	-0.21
624,034.9	120.0	36.8	23.4	118.1	-0.21
624,040.9	122.0	38.8	23.8	120.0	-0.20
624,046.9	124.0	40.7	24.3	122.0	-0.19
624,052.9	126.0	42.6	24.8	123.9	-0.19
624,058.9	128.0	44.6	25.2	125.9	-0.18
624,064.9	130.0	46.5	25.6	127.9	-0.18
624,070.9	132.0	48.5	26.1	129.8	-0.18
624,076.9	134.0	50.4	26.5	131.8	-0.17
624,082.9	136.0	52.3	26.9	133.8	-0.17
624,088.9	138.0	54.3	27.3	135.7	-0.16

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,094.9	140.0	56.2	27.7	137.7	-0.16
624,100.9	142.0	58.2	28.1	139.7	-0.16
624,106.9	144.0	60.1	28.4	141.6	-0.16
624,112.9	146.0	62.0	28.8	143.6	-0.15
624,117.2	147.4	63.4	29.1	145.0	-0.15
624,118.9	148.0	64.0	29.2	145.6	-0.15
624,124.9	150.0	65.9	29.5	147.5	-0.15
624,130.9	152.0	67.9	29.9	149.5	-0.15
624,136.9	154.0	69.8	30.2	151.5	-0.14
624,142.9	156.0	71.7	30.6	153.5	-0.14
624,148.9	158.0	73.7	30.9	155.4	-0.14
624,154.9	160.0	75.6	31.2	157.4	-0.14
624,160.9	162.0	77.6	31.6	159.4	-0.14
624,166.9	164.0	79.5	31.9	161.3	-0.13
624,172.9	166.0	81.4	32.2	163.3	-0.13
624,178.9	168.0	83.4	32.5	165.3	-0.13
624,184.9	170.0	85.3	32.9	167.3	-0.13
624,190.9	172.0	87.3	33.2	169.2	-0.13
624,196.9	174.0	89.2	33.5	171.2	-0.13
624,202.9	176.0	91.1	33.8	173.2	-0.13
624,208.9	178.0	93.1	34.1	175.2	-0.13
624,214.9	180.0	95.0	34.4	177.1	-0.12
624,217.2	180.8	95.8	34.5	177.9	-0.12
624,220.9	182.0	97.0	34.7	179.1	-0.12
624,226.9	184.0	98.9	35.0	181.1	-0.12
624,232.9	186.0	100.8	35.3	183.1	-0.12
624,238.9	188.0	102.8	35.6	185.0	-0.12
624,244.9	190.0	104.7	35.8	187.0	-0.12
624,250.9	192.0	106.7	36.1	189.0	-0.12
624,256.9	194.0	108.6	36.4	191.0	-0.12
624,262.9	196.0	110.5	36.7	192.9	-0.12
624,268.9	198.0	112.5	37.0	194.9	-0.12
624,274.9	200.0	114.4	37.3	196.9	-0.12
624,280.9	202.0	116.4	37.5	198.9	-0.11
624,286.9	204.0	118.3	37.8	200.8	-0.11
624,292.9	206.0	120.2	38.1	202.8	-0.11
624,298.9	208.0	122.2	38.3	204.8	-0.11
624,304.9	210.0	124.1	38.6	206.8	-0.11
624,310.9	212.0	126.1	38.9	208.8	-0.11
624,316.9	214.0	128.0	39.2	210.7	-0.11
624,319.9	215.0	129.0	39.3	211.7	-0.11
624,322.9	216.0	129.9	39.4	212.7	-0.11
624,328.9	218.0	131.9	39.7	214.7	-0.11
624,334.9	220.0	133.8	39.9	216.7	-0.11
624,340.9	222.0	135.8	40.2	218.6	-0.11

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,346.9	224.0	137.7	40.5	220.6	-0.11
624,352.9	226.0	139.6	40.7	222.6	-0.11
624,358.9	228.0	141.6	41.0	224.6	-0.11
624,364.9	230.0	143.5	41.2	226.6	-0.11
624,370.9	232.0	145.5	41.5	228.5	-0.11
624,376.9	234.0	147.4	41.7	230.5	-0.10
624,382.9	236.0	149.3	42.0	232.5	-0.10
624,388.9	238.0	151.3	42.2	234.5	-0.10
624,394.9	240.0	153.2	42.5	236.5	-0.10
624,400.9	242.0	155.2	42.7	238.4	-0.10
624,406.9	244.0	157.1	43.0	240.4	-0.10
624,412.9	246.0	159.0	43.2	242.4	-0.10
624,417.2	247.4	160.4	43.4	243.8	-0.10
624,418.9	248.0	161.0	43.5	244.4	-0.10
624,424.9	250.0	162.9	43.7	246.4	-0.10
624,430.9	252.0	164.9	44.0	248.3	-0.10
624,436.9	254.0	166.8	44.2	250.3	-0.10
624,442.9	256.0	168.7	44.5	252.3	-0.10
624,448.9	258.0	170.7	44.7	254.3	-0.10
624,454.9	260.0	172.6	44.9	256.3	-0.10
624,460.9	262.0	174.6	45.2	258.2	-0.10
624,466.9	264.0	176.5	45.4	260.2	-0.10
624,472.9	266.0	178.4	45.7	262.2	-0.10
624,478.9	268.0	180.4	45.9	264.2	-0.10
624,484.9	270.0	182.3	46.1	266.2	-0.10
624,490.9	272.0	184.3	46.4	268.1	-0.10
624,496.9	274.0	186.2	46.6	270.1	-0.10
624,502.9	276.0	188.1	46.8	272.1	-0.10
624,508.9	278.0	190.1	47.1	274.1	-0.10
624,514.9	280.0	192.0	47.3	276.1	-0.10
624,517.9	281.0	193.0	47.4	277.0	-0.10
624,520.9	282.0	194.0	47.5	278.0	-0.10
624,526.9	284.0	195.9	47.8	280.0	-0.10
624,532.9	286.0	197.8	48.0	282.0	-0.10
624,538.9	288.0	199.8	48.2	284.0	-0.10
624,544.9	290.0	201.7	48.5	286.0	-0.10
624,550.9	292.0	203.7	48.7	287.9	-0.10
624,556.9	294.0	205.6	48.9	289.9	-0.09
624,562.9	296.0	207.5	49.1	291.9	-0.09
624,568.9	298.0	209.5	49.4	293.9	-0.09
624,574.9	300.0	211.4	49.6	295.9	-0.09
624,580.9	302.0	213.4	49.8	297.8	-0.09
624,586.9	304.0	215.3	50.0	299.8	-0.09
624,592.9	306.0	217.2	50.3	301.8	-0.09
624,598.9	308.0	219.2	50.5	303.8	-0.09

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,604.9	310.0	221.1	50.7	305.8	-0.09
624,610.9	312.0	223.1	50.9	307.8	-0.09
624,616.9	314.0	225.0	51.2	309.7	-0.09
624,617.2	314.1	225.1	51.2	309.8	-0.09
624,622.9	316.0	226.9	51.4	311.7	-0.09
624,628.9	318.0	228.9	51.6	313.7	-0.09
624,634.9	320.0	230.8	51.8	315.7	-0.09
624,640.9	322.0	232.8	52.1	317.7	-0.09
624,642.5	322.5	233.3	52.1	318.2	-0.09
624,673.0	324.0	234.4	52.3	319.6	0.00
624,715.4	326.0	236.0	52.4	321.6	0.00
624,736.6	327.0	236.8	52.5	322.6	0.00
624,757.8	328.0	237.6	52.6	323.6	0.00
624,800.4	330.0	239.2	52.8	325.6	0.00
624,817.2	329.2	238.2	52.7	324.8	0.00
624,834.1	328.4	237.3	52.6	324.0	0.00
624,843.1	328.0	236.7	52.5	323.6	0.00
624,851.0	327.6	236.3	52.5	323.3	0.00
624,856.2	327.4	234.4	52.2	323.0	-0.02
624,862.4	327.1	232.1	52.0	322.8	-0.02
624,865.5	326.9	230.9	51.9	322.6	-0.02
624,868.7	326.8	229.8	51.7	322.5	-0.02
624,874.9	326.5	227.5	51.5	322.2	-0.02
624,881.1	326.2	225.2	51.2	322.0	-0.02
624,885.8	326.0	223.5	51.0	321.8	-0.02
624,887.3	325.9	222.9	50.9	321.7	-0.02
624,890.7	325.8	221.7	50.8	321.5	-0.02
624,895.9	325.5	221.5	50.8	321.3	0.00
624,901.0	325.3	221.3	50.7	321.1	0.00
624,901.4	325.3	221.4	50.8	321.1	0.01
624,903.9	324.6	221.6	50.8	320.4	0.02
624,904.1	324.6	221.6	50.8	320.4	0.02
624,906.5	324.0	221.8	50.8	319.8	0.02
624,910.2	323.1	222.1	50.8	318.8	0.02
624,913.3	322.3	222.3	50.9	318.1	0.02
624,914.6	322.0	222.4	50.9	317.8	0.02
624,916.3	321.6	222.6	50.9	317.3	0.02
624,919.4	320.8	222.8	50.9	316.6	0.02
624,922.5	320.0	223.0	50.9	315.8	0.02
624,922.7	320.0	223.1	50.9	315.8	0.02
624,926.9	319.0	223.5	51.0	314.8	0.02
624,928.6	318.6	223.6	51.0	314.4	0.02
624,931.2	318.0	223.9	51.0	313.7	0.02
624,934.7	317.2	224.2	51.1	312.9	0.02
624,937.3	316.6	224.4	51.1	312.3	0.02

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,939.8	316.0	224.7	51.1	311.7	0.02
624,940.0	316.0	224.7	51.1	311.7	0.02
624,948.5	314.0	222.6	50.9	309.8	-0.05
624,957.2	312.0	220.5	50.7	307.8	-0.05
624,966.1	310.0	218.4	50.4	305.8	-0.05
624,975.0	308.0	216.4	50.2	303.8	-0.05
624,984.0	306.0	214.3	49.9	301.8	-0.05
624,992.9	304.0	212.2	49.7	299.9	-0.05
625,002.1	302.0	210.1	49.4	297.9	-0.05
625,011.3	300.0	208.0	49.2	295.9	-0.05
625,020.5	298.0	205.9	48.9	293.9	-0.05
625,032.3	298.0	205.8	48.9	293.9	0.00
625,044.1	298.0	205.7	48.9	293.9	0.00
625,044.2	298.0	205.7	48.9	293.9	0.00
625,053.7	296.0	203.6	48.7	291.9	-0.04
625,063.5	294.0	201.5	48.4	290.0	-0.04
625,073.4	292.0	199.4	48.2	288.0	-0.04
625,083.3	290.0	197.3	47.9	286.0	-0.04
625,093.3	288.0	195.2	47.7	284.0	-0.04
625,103.6	286.0	193.1	47.4	282.0	-0.04
625,109.8	284.8	191.8	47.3	280.8	-0.04
625,113.9	284.0	191.0	47.2	280.1	-0.04
625,119.2	283.0	189.9	47.0	279.1	-0.04
625,124.4	282.0	188.9	46.9	278.1	-0.04
625,126.9	281.5	188.4	46.9	277.6	-0.04
625,130.3	280.9	186.8	46.7	277.0	-0.08
625,133.6	280.3	185.3	46.5	276.4	-0.08
625,135.2	280.0	184.6	46.4	276.1	-0.08
625,140.5	279.0	182.1	46.1	275.2	-0.08
625,140.9	278.9	181.9	46.1	275.1	-0.08
625,143.3	278.5	180.8	45.9	274.6	-0.08
625,145.9	278.0	180.3	45.9	274.2	-0.03
625,151.5	277.0	179.4	45.8	273.2	-0.03
625,155.3	276.3	178.7	45.7	272.5	-0.03
625,157.0	276.0	178.9	45.7	272.2	0.02
625,157.5	275.9	178.9	45.7	272.1	0.02
625,162.7	275.0	179.5	45.8	271.2	0.02
625,164.5	274.7	179.7	45.8	270.9	0.02
625,168.3	274.0	180.1	45.9	270.2	0.02
625,171.5	273.4	180.4	45.9	269.6	0.02
625,171.9	273.4	180.5	45.9	269.5	0.02
625,179.6	272.0	179.3	45.8	268.2	-0.03
625,191.5	270.0	177.5	45.5	266.2	-0.02
625,203.3	268.0	175.7	45.3	264.2	-0.02
625,215.7	266.0	174.0	45.1	262.2	-0.02

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,222.0	265.0	173.1	45.0	261.3	-0.02
625,228.2	264.0	172.2	44.9	260.3	-0.02
625,241.0	262.0	170.5	44.7	258.3	-0.02
625,253.9	260.0	168.8	44.5	256.3	-0.02
625,265.9	258.1	167.1	44.3	254.4	-0.02
625,266.8	258.0	167.0	44.2	254.3	-0.02
625,299.1	258.0	167.7	44.3	254.3	0.00
625,312.0	256.0	165.9	44.1	252.3	-0.02
625,318.4	255.0	165.1	44.0	251.3	-0.02
625,324.9	254.0	164.2	43.9	250.3	-0.02
625,337.8	252.0	162.4	43.7	248.4	-0.02
625,350.7	250.0	160.7	43.4	246.4	-0.02
625,363.6	248.0	159.0	43.2	244.4	-0.02
625,365.9	247.6	158.6	43.2	244.0	-0.02
625,376.5	246.0	157.2	43.0	242.4	-0.02
625,389.4	244.0	155.5	42.8	240.4	-0.02
625,402.4	242.0	153.7	42.6	238.5	-0.02
625,415.3	240.0	152.0	42.3	236.5	-0.02
625,421.7	239.0	151.1	42.2	235.5	-0.02
625,428.2	238.0	150.2	42.1	234.5	-0.02
625,441.1	236.0	148.5	41.9	232.5	-0.02
625,454.0	234.0	146.8	41.7	230.5	-0.02
625,465.9	232.2	145.2	41.4	228.7	-0.02
625,466.2	232.1	145.1	41.4	228.7	-0.02
625,466.8	232.0	145.0	41.4	228.6	-0.03
625,466.9	232.0	145.0	41.4	228.5	-0.03
625,479.8	230.0	142.9	41.1	226.6	-0.03
625,492.7	228.0	140.7	40.9	224.6	-0.03
625,505.6	226.0	138.6	40.6	222.6	-0.03
625,518.6	224.0	136.5	40.3	220.6	-0.03
625,531.5	222.0	134.4	40.0	218.7	-0.03
625,544.4	220.0	132.2	39.7	216.7	-0.03
625,557.3	218.0	130.1	39.4	214.7	-0.03
625,573.4	218.0	129.9	39.4	214.7	0.00
625,589.6	218.0	129.8	39.4	214.7	0.00
625,602.5	216.0	127.7	39.1	212.7	-0.03
625,615.4	214.0	125.5	38.8	210.8	-0.03
625,628.3	212.0	123.4	38.5	208.8	-0.03
625,641.2	210.0	121.3	38.2	206.8	-0.03
625,654.1	208.0	119.1	37.9	204.8	-0.03
625,667.0	206.0	117.0	37.6	202.9	-0.03
625,669.1	205.7	116.7	37.6	202.5	-0.03
625,679.9	204.0	114.9	37.3	200.9	-0.03
625,692.9	202.0	112.8	37.0	198.9	-0.03
625,705.8	200.0	110.6	36.7	196.9	-0.03

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,712.2	199.0	109.6	36.6	196.0	-0.03
625,718.7	198.0	108.5	36.4	195.0	-0.03
625,731.6	196.0	106.4	36.1	193.0	-0.03
625,744.5	194.0	104.3	35.8	191.0	-0.03
625,746.9	193.6	103.9	35.7	190.7	-0.03
625,751.0	193.0	102.0	35.4	190.0	-0.08
625,751.1	193.0	102.0	35.4	190.0	-0.08
625,757.4	192.0	99.2	35.0	189.1	-0.08
625,758.0	191.9	98.9	35.0	189.0	-0.08
625,761.8	191.3	97.2	34.7	188.4	-0.08
625,767.5	190.4	96.4	34.6	187.6	-0.03
625,770.3	190.0	95.9	34.5	187.1	-0.03
625,773.1	189.6	95.5	34.5	186.7	-0.03
625,776.6	189.0	96.0	34.5	186.1	0.03
625,780.0	188.5	96.5	34.6	185.6	0.03
625,783.2	188.0	97.0	34.7	185.1	0.03
625,783.3	188.0	97.0	34.7	185.1	0.03
625,788.4	187.2	97.7	34.8	184.3	0.03
625,796.1	186.0	96.7	34.6	183.1	-0.03
625,802.6	185.0	95.8	34.5	182.1	-0.03
625,809.1	184.0	94.9	34.4	181.1	-0.03
625,811.8	183.6	94.6	34.3	180.7	-0.03
625,822.0	182.0	93.2	34.1	179.2	-0.03
625,834.9	180.0	91.5	33.8	177.2	-0.03
625,847.8	178.0	89.7	33.6	175.2	-0.03
625,863.9	178.0	90.0	33.6	175.2	0.00
625,880.1	178.0	90.4	33.7	175.2	0.00
625,893.0	176.0	88.6	33.4	173.2	-0.03
625,905.9	174.0	86.9	33.1	171.2	-0.03
625,911.9	173.1	86.1	33.0	170.3	-0.03
625,918.8	172.0	85.1	32.8	169.3	-0.03
625,931.7	170.0	83.4	32.5	167.3	-0.03
625,944.6	168.0	81.7	32.3	165.3	-0.03
625,957.5	166.0	79.9	32.0	163.3	-0.03
625,964.0	165.0	79.0	31.8	162.3	-0.03
625,970.5	164.0	78.2	31.7	161.4	-0.03
625,983.4	162.0	76.4	31.4	159.4	-0.03
625,996.3	160.0	74.7	31.1	157.4	-0.03
626,009.2	158.0	72.9	30.8	155.4	-0.03
626,012.0	157.6	72.6	30.7	155.0	-0.03
626,022.1	156.0	71.2	30.5	153.5	-0.03
626,029.8	154.8	70.2	30.3	152.3	-0.03
626,035.0	154.0	69.5	30.2	151.5	-0.03
626,047.6	152.0	67.8	29.9	149.6	-0.03
626,047.9	152.0	67.7	29.9	149.5	-0.04

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
626,060.8	150.0	65.6	29.5	147.5	-0.04
626,073.7	148.0	63.4	29.1	145.6	-0.04
626,080.9	146.9	62.2	28.8	144.5	-0.04
626,086.7	146.0	61.3	28.7	143.6	-0.04
626,099.6	144.0	59.2	28.3	141.6	-0.04
626,112.5	142.0	57.0	27.8	139.7	-0.04
626,114.2	141.7	56.7	27.8	139.4	-0.04
626,125.4	140.0	54.9	27.4	137.7	-0.04
626,138.3	138.0	52.7	27.0	135.8	-0.04
626,170.6	138.0	52.4	26.9	135.8	0.00
626,183.5	136.0	50.3	26.5	133.8	-0.04
626,196.4	134.0	48.1	26.0	131.8	-0.04
626,207.7	132.2	46.2	25.6	130.1	-0.05
626,209.3	132.0	46.0	25.5	129.9	-0.05
626,222.2	130.0	43.8	25.0	127.9	-0.05
626,235.1	128.0	41.7	24.5	126.0	-0.05
626,248.0	126.0	39.6	24.0	124.0	-0.05
626,261.0	124.0	37.4	23.5	122.0	-0.05
626,273.9	122.0	35.3	23.0	120.1	-0.05
626,286.8	120.0	33.2	22.4	118.1	-0.06
626,299.7	118.0	31.0	21.8	116.2	-0.06
626,301.3	117.8	30.8	21.7	115.9	-0.06
626,303.3	117.4	30.4	21.6	115.6	-0.06
626,306.7	116.9	28.9	21.2	115.2	-0.16
626,310.1	116.4	27.4	20.7	114.7	-0.16
626,312.6	116.0	26.3	20.4	114.3	-0.17
626,317.0	115.3	24.3	19.7	113.7	-0.18
626,319.5	114.9	23.2	19.3	113.3	-0.18
626,322.1	114.5	22.1	19.0	113.0	-0.19
626,325.5	114.0	21.5	18.8	112.4	-0.07
626,332.0	113.0	20.6	18.4	111.5	-0.07
626,333.4	112.8	20.4	18.3	111.3	-0.07
626,338.1	112.0	21.0	18.6	110.5	0.07
626,338.4	112.0	21.1	18.6	110.4	0.07
626,344.8	111.0	22.0	18.9	109.4	0.07
626,348.0	110.5	22.5	19.1	108.9	0.07
626,351.2	110.0	22.9	19.3	108.4	0.07
626,351.3	110.0	22.9	19.2	108.4	-0.13
626,357.8	109.0	20.9	18.5	107.5	-0.14
626,363.5	108.1	19.1	17.8	106.6	-0.14
626,364.2	108.0	18.9	17.8	106.5	-0.15
626,370.7	107.0	16.9	16.9	105.6	-0.16
626,376.4	106.1	15.1	16.1	104.8	-0.17
626,377.2	106.0	14.9	16.0	104.7	-0.18
626,383.6	105.0	12.9	15.0	103.7	-0.19

Cross Section 3

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
626,389.4	104.1	11.1	14.1	102.9	-0.20
626,390.1	104.0	10.9	13.9	102.8	-0.22
626,396.5	103.0	8.9	12.7	101.9	-0.23
626,402.3	102.1	7.1	11.4	101.2	-0.27
626,403.0	102.0	6.9	11.2	101.1	-0.29
626,409.4	101.0	4.9	9.4	100.2	-0.33
626,415.2	100.1	3.1	7.3	99.5	-0.41
626,415.9	100.0	2.9	7.0	99.4	-0.48
626,422.3	99.0	0.9	3.3	98.7	-0.61
626,428.1	98.1	0.0	0.0	98.1	-0.62
626,428.8	98.0	0.0	0.0	98.0	0.00
626,432.4	97.6	0.0	0.0	97.6	0.00
626,437.1	97.0	0.0	0.0	97.0	0.00
626,441.7	96.4	0.0	0.0	96.4	0.00
626,445.3	96.0	0.0	0.0	96.0	0.00
626,445.3	96.0	0.0	0.0	96.0	0.00
626,466.9	93.4	0.0	0.0	93.4	0.00
626,497.1	89.7	0.0	0.0	89.7	0.00
626,600.3	77.2	0.0	0.0	77.2	0.00

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
623,962.1	96.0	0.0	0.0	96.0	0.00
623,962.9	96.0	0.0	0.0	96.0	0.00
623,963.7	96.0	0.0	0.0	96.0	0.00
623,968.1	97.4	0.0	0.0	97.4	0.00
623,969.7	98.0	0.0	0.0	98.0	0.00
623,970.1	98.1	0.0	0.0	98.1	0.00
623,975.7	100.0	2.9	7.0	99.4	-2.66
623,976.1	100.1	3.1	7.3	99.5	-2.05
623,979.1	101.1	5.1	9.6	100.3	-1.74
623,981.7	102.0	6.9	11.2	101.1	-1.38
623,982.1	102.1	7.1	11.4	101.2	-1.25
623,985.1	103.1	9.1	12.8	102.0	-1.14
623,987.7	104.0	10.9	13.9	102.8	-0.99
623,988.1	104.1	11.1	14.1	102.9	-0.93
623,991.1	105.1	13.1	15.2	103.8	-0.87
623,993.7	106.0	14.9	16.0	104.7	-0.79
623,994.1	106.1	15.1	16.1	104.8	-0.75
623,997.1	107.1	17.1	17.0	105.7	-0.72
623,999.7	108.0	18.9	17.8	106.5	-0.66
624,000.1	108.1	19.1	17.8	106.6	-0.64
624,003.1	109.1	21.1	18.6	107.6	-0.62
624,005.7	110.0	22.9	19.2	108.4	-0.58
624,006.1	110.1	23.1	19.3	108.5	-0.56
624,009.1	111.1	25.1	20.0	109.4	-0.55
624,011.7	112.0	26.9	20.6	110.3	-0.52
624,012.1	112.1	27.1	20.6	110.4	-0.51
624,015.1	113.1	29.1	21.2	111.3	-0.49
624,017.7	114.0	30.9	21.8	112.2	-0.47
624,018.1	114.1	31.1	21.8	112.3	-0.46
624,023.7	116.0	32.9	22.3	114.1	-0.22
624,029.7	118.0	34.9	22.8	116.1	-0.21
624,035.7	120.0	36.8	23.4	118.1	-0.21
624,041.7	122.0	38.8	23.8	120.0	-0.20
624,047.7	124.0	40.7	24.3	122.0	-0.19
624,053.7	126.0	42.6	24.8	123.9	-0.19
624,059.7	128.0	44.6	25.2	125.9	-0.18
624,065.7	130.0	46.5	25.6	127.9	-0.18
624,071.7	132.0	48.5	26.1	129.8	-0.18
624,077.7	134.0	50.4	26.5	131.8	-0.17
624,083.7	136.0	52.3	26.9	133.8	-0.17
624,089.7	138.0	54.3	27.3	135.7	-0.16
624,095.7	140.0	56.2	27.7	137.7	-0.16
624,101.7	142.0	58.2	28.1	139.7	-0.16

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,107.7	144.0	60.1	28.4	141.6	-0.16
624,113.7	146.0	62.0	28.8	143.6	-0.15
624,118.1	147.4	63.4	29.1	145.0	-0.15
624,119.7	148.0	64.0	29.2	145.6	-0.15
624,125.7	150.0	65.9	29.5	147.5	-0.15
624,131.7	152.0	67.9	29.9	149.5	-0.15
624,137.7	154.0	69.8	30.2	151.5	-0.14
624,143.7	156.0	71.7	30.6	153.5	-0.14
624,149.7	158.0	73.7	30.9	155.4	-0.14
624,155.7	160.0	75.6	31.2	157.4	-0.14
624,161.7	162.0	77.6	31.6	159.4	-0.14
624,167.7	164.0	79.5	31.9	161.3	-0.13
624,173.7	166.0	81.4	32.2	163.3	-0.13
624,179.7	168.0	83.4	32.5	165.3	-0.13
624,185.7	170.0	85.3	32.9	167.3	-0.13
624,191.7	172.0	87.3	33.2	169.2	-0.13
624,197.7	174.0	89.2	33.5	171.2	-0.13
624,203.7	176.0	91.1	33.8	173.2	-0.13
624,209.7	178.0	93.1	34.1	175.2	-0.13
624,215.7	180.0	95.0	34.4	177.1	-0.12
624,218.1	180.8	95.8	34.5	177.9	-0.12
624,221.7	182.0	97.0	34.7	179.1	-0.12
624,227.7	184.0	98.9	35.0	181.1	-0.12
624,233.7	186.0	100.8	35.3	183.1	-0.12
624,239.7	188.0	102.8	35.6	185.0	-0.12
624,245.7	190.0	104.7	35.8	187.0	-0.12
624,251.7	192.0	106.7	36.1	189.0	-0.12
624,257.7	194.0	108.6	36.4	191.0	-0.12
624,263.7	196.0	110.5	36.7	192.9	-0.12
624,269.7	198.0	112.5	37.0	194.9	-0.12
624,275.7	200.0	114.4	37.3	196.9	-0.12
624,281.7	202.0	116.4	37.5	198.9	-0.11
624,287.7	204.0	118.3	37.8	200.8	-0.11
624,293.7	206.0	120.2	38.1	202.8	-0.11
624,299.7	208.0	122.2	38.3	204.8	-0.11
624,305.7	210.0	124.1	38.6	206.8	-0.11
624,311.7	212.0	126.1	38.9	208.8	-0.11
624,317.7	214.0	128.0	39.2	210.7	-0.11
624,320.7	215.0	129.0	39.3	211.7	-0.11
624,323.7	216.0	129.9	39.4	212.7	-0.11
624,329.7	218.0	131.9	39.7	214.7	-0.11
624,335.7	220.0	133.8	39.9	216.7	-0.11
624,341.7	222.0	135.8	40.2	218.6	-0.11

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,347.7	224.0	137.7	40.5	220.6	-0.11
624,353.7	226.0	139.6	40.7	222.6	-0.11
624,359.7	228.0	141.6	41.0	224.6	-0.11
624,365.7	230.0	143.5	41.2	226.6	-0.11
624,371.7	232.0	145.5	41.5	228.5	-0.11
624,377.7	234.0	147.4	41.7	230.5	-0.10
624,383.7	236.0	149.3	42.0	232.5	-0.10
624,389.7	238.0	151.3	42.2	234.5	-0.10
624,395.7	240.0	153.2	42.5	236.5	-0.10
624,401.7	242.0	155.2	42.7	238.4	-0.10
624,407.7	244.0	157.1	43.0	240.4	-0.10
624,413.7	246.0	159.0	43.2	242.4	-0.10
624,418.1	247.4	160.4	43.4	243.8	-0.10
624,419.7	248.0	161.0	43.5	244.4	-0.10
624,425.7	250.0	162.9	43.7	246.4	-0.10
624,431.7	252.0	164.9	44.0	248.3	-0.10
624,437.7	254.0	166.8	44.2	250.3	-0.10
624,443.7	256.0	168.7	44.5	252.3	-0.10
624,449.7	258.0	170.7	44.7	254.3	-0.10
624,455.7	260.0	172.6	44.9	256.3	-0.10
624,461.7	262.0	174.6	45.2	258.2	-0.10
624,467.7	264.0	176.5	45.4	260.2	-0.10
624,473.7	266.0	178.4	45.7	262.2	-0.10
624,479.7	268.0	180.4	45.9	264.2	-0.10
624,485.7	270.0	182.3	46.1	266.2	-0.10
624,491.7	272.0	184.3	46.4	268.1	-0.10
624,497.7	274.0	186.2	46.6	270.1	-0.10
624,503.7	276.0	188.1	46.8	272.1	-0.10
624,509.7	278.0	190.1	47.1	274.1	-0.10
624,515.7	280.0	192.0	47.3	276.1	-0.10
624,518.7	281.0	193.0	47.4	277.0	-0.10
624,521.7	282.0	194.0	47.5	278.0	-0.10
624,527.7	284.0	195.9	47.8	280.0	-0.10
624,533.7	286.0	197.8	48.0	282.0	-0.10
624,539.7	288.0	199.8	48.2	284.0	-0.10
624,545.7	290.0	201.7	48.5	286.0	-0.10
624,551.7	292.0	203.7	48.7	287.9	-0.10
624,557.7	294.0	205.6	48.9	289.9	-0.09
624,563.7	296.0	207.5	49.1	291.9	-0.09
624,569.7	298.0	209.5	49.4	293.9	-0.09
624,575.7	300.0	211.4	49.6	295.9	-0.09
624,581.7	302.0	213.4	49.8	297.8	-0.09
624,587.7	304.0	215.3	50.0	299.8	-0.09

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,593.7	306.0	217.2	50.3	301.8	-0.09
624,599.7	308.0	219.2	50.5	303.8	-0.09
624,605.7	310.0	221.1	50.7	305.8	-0.09
624,607.7	310.7	221.8	50.8	306.4	-0.09
624,618.1	311.1	222.1	50.8	306.9	0.00
624,639.0	312.0	222.8	50.9	307.8	0.00
624,686.9	314.0	224.3	51.1	309.7	0.00
624,693.6	314.3	224.5	51.1	310.0	0.00
624,718.1	315.3	225.3	51.2	311.1	0.00
624,732.9	316.0	225.9	51.3	311.7	0.00
624,779.2	318.0	227.4	51.4	313.7	0.00
624,818.1	319.7	228.7	51.6	315.4	0.00
624,825.8	320.0	228.9	51.6	315.7	0.00
624,872.7	322.0	230.5	51.8	317.7	0.00
624,907.8	323.5	231.6	51.9	319.2	0.00
624,919.5	324.0	232.0	52.0	319.7	0.00
624,966.2	326.0	233.5	52.1	321.7	0.00
624,997.6	327.3	234.5	52.3	323.0	0.00
625,004.5	327.6	232.6	52.0	323.3	0.01
625,010.7	327.9	230.9	51.8	323.6	0.01
625,012.9	328.0	230.3	51.8	323.7	0.01
625,016.9	328.2	229.2	51.6	323.9	0.01
625,023.1	328.4	227.4	51.4	324.1	0.01
625,025.6	328.5	226.7	51.4	324.3	0.01
625,036.0	329.0	227.1	51.4	324.7	0.00
625,037.5	329.1	227.6	51.5	324.8	-0.01
625,039.1	329.1	228.1	51.5	324.8	-0.01
625,044.9	329.4	230.4	51.8	325.1	-0.01
625,051.2	329.6	232.6	52.0	325.3	-0.01
625,057.0	329.9	234.8	52.3	325.5	-0.01
625,059.7	330.0	234.9	52.3	325.6	0.00
625,063.4	329.8	234.8	52.3	325.5	0.00
625,106.4	328.0	233.9	52.2	323.7	0.00
625,129.8	327.0	233.3	52.1	322.7	0.00
625,153.2	326.0	232.8	52.1	321.7	0.00
625,163.4	325.6	232.6	52.0	321.2	0.00
625,167.0	325.4	232.5	52.0	321.1	0.00
625,174.2	325.1	232.1	52.0	320.8	0.00
625,199.9	324.0	230.7	51.8	319.7	0.00
625,246.7	322.0	228.3	51.5	317.7	0.00
625,275.4	320.8	226.8	51.4	316.5	0.00
625,293.4	320.0	225.8	51.3	315.7	0.00
625,340.1	318.0	223.4	51.0	313.8	0.00

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,376.6	316.4	221.4	50.8	312.2	0.00
625,386.9	316.0	220.9	50.7	311.8	0.00
625,427.9	314.2	218.7	50.4	310.0	0.00
625,433.6	314.0	218.4	50.4	309.8	0.00
625,479.2	312.0	216.0	50.1	307.9	0.00
625,480.4	312.0	215.7	50.1	307.8	-0.01
625,482.6	311.9	214.9	50.0	307.7	-0.01
625,489.5	311.6	212.6	49.7	307.5	-0.01
625,494.0	311.4	211.1	49.6	307.3	-0.01
625,503.7	311.0	210.7	49.5	306.9	0.00
625,505.3	310.9	210.7	49.5	306.8	0.00
625,509.5	310.8	211.8	49.6	306.6	0.01
625,516.2	310.5	213.5	49.8	306.3	0.01
625,522.1	310.2	215.0	50.0	306.0	0.01
625,527.1	310.0	214.9	50.0	305.8	0.00
625,533.1	309.7	214.7	50.0	305.6	0.00
625,573.8	308.0	213.8	49.9	303.8	0.00
625,595.7	307.1	213.3	49.8	302.9	0.00
625,617.5	306.1	212.8	49.8	302.0	0.00
625,633.2	306.6	213.6	49.9	302.5	0.00
625,677.3	308.0	215.9	50.1	303.8	0.00
625,709.3	309.0	217.5	50.3	304.8	0.00
625,733.2	309.7	218.7	50.4	305.5	0.00
625,741.3	310.0	219.2	50.5	305.8	0.00
625,773.3	311.0	220.8	50.7	306.8	0.00
625,779.8	311.2	221.1	50.7	307.0	0.00
625,805.3	312.0	221.7	50.8	307.8	0.00
625,829.0	312.7	222.1	50.8	308.5	0.00
625,852.7	313.5	222.6	50.9	309.2	0.00
625,866.8	311.3	220.3	50.6	307.1	-0.02
625,875.2	310.0	218.9	50.5	305.8	-0.02
625,939.7	300.0	208.2	49.2	295.9	-0.02
625,951.0	298.3	206.4	49.0	294.2	-0.02
625,952.6	298.0	206.1	49.0	293.9	-0.02
625,984.9	298.0	205.7	48.9	293.9	0.00
626,025.7	291.7	199.0	48.1	287.7	-0.02
626,035.2	290.2	197.4	47.9	286.2	-0.02
626,035.9	290.1	197.1	47.9	286.1	-0.07
626,036.5	290.0	196.8	47.9	286.0	-0.07
626,042.9	289.0	194.0	47.5	285.1	-0.07
626,049.9	287.9	190.9	47.2	284.0	-0.07
626,054.3	287.3	189.0	46.9	283.3	-0.07
626,065.6	285.5	187.3	46.7	281.6	-0.02

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
626,068.8	285.0	187.7	46.8	281.1	0.02
626,069.9	284.8	187.8	46.8	280.9	0.02
626,076.9	283.8	188.8	46.9	279.8	0.02
626,083.4	282.7	189.7	47.0	278.8	0.02
626,086.6	282.2	190.3	47.1	278.3	0.03
626,101.1	280.0	188.3	46.9	276.1	-0.02
626,133.4	275.0	183.8	46.3	271.1	-0.02
626,148.9	272.6	181.6	46.0	268.8	-0.02
626,165.7	270.0	179.2	45.7	266.2	-0.02
626,217.7	261.9	171.9	44.9	258.2	-0.02
626,230.2	260.0	170.2	44.6	256.3	-0.02
626,243.1	258.0	168.4	44.4	254.3	-0.02
626,275.4	258.0	168.8	44.5	254.3	0.00
626,286.4	256.3	167.3	44.3	252.6	-0.02
626,327.1	250.0	161.6	43.6	246.4	-0.02
626,359.3	245.0	157.1	43.0	241.4	-0.02
626,391.6	240.0	152.5	42.4	236.5	-0.02
626,416.2	233.5	146.3	41.6	230.0	-0.07
626,429.1	230.0	142.8	41.1	226.6	-0.07
626,459.6	220.0	132.7	39.8	216.7	-0.11
626,465.7	218.0	130.6	39.5	214.7	-0.11
626,473.3	218.0	130.6	39.5	214.7	0.00
626,481.0	218.0	130.5	39.5	214.7	0.00
626,505.3	210.0	122.4	38.4	206.8	-0.11
626,522.7	204.3	116.6	37.6	201.2	-0.11
626,535.8	200.0	112.5	37.0	196.9	-0.11
626,551.0	195.0	107.7	36.3	192.0	-0.11
626,566.3	190.0	102.9	35.6	187.0	-0.11
626,575.8	186.9	99.9	35.1	183.9	-0.12
626,596.7	180.0	93.3	34.1	177.2	-0.12
626,602.8	178.0	91.3	33.8	175.2	-0.12
626,616.4	178.0	91.5	33.8	175.2	0.00
626,618.1	178.0	91.5	33.8	175.2	0.00
626,642.5	170.0	83.8	32.6	167.3	-0.12
626,657.0	165.2	79.3	31.9	162.6	-0.13
626,672.9	160.0	73.8	30.9	157.4	-0.14
626,691.6	153.9	67.4	29.8	151.4	-0.15
626,703.4	150.0	63.3	29.1	147.6	-0.15
626,726.1	142.5	55.5	27.5	140.2	-0.16
626,733.9	140.0	52.9	27.0	137.7	-0.17
626,740.0	138.0	50.8	26.6	135.8	-0.17
626,755.2	138.0	50.6	26.5	135.8	0.00
626,779.6	130.0	42.2	24.7	127.9	-0.19

Cross Section 4

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
626,794.8	125.0	37.0	23.4	123.1	-0.20
626,810.0	120.0	31.7	22.0	118.2	-0.22
626,840.5	110.0	21.3	18.7	108.4	-0.27
626,845.6	108.3	19.6	18.0	106.8	-0.31
626,846.3	108.1	19.1	17.8	106.6	-0.62
626,852.4	106.1	15.1	16.1	104.8	-0.67
626,855.7	105.0	12.9	15.1	103.7	-0.77
626,858.5	104.1	11.1	14.1	102.9	-0.85
626,864.6	102.1	7.1	11.4	101.2	-1.03
626,870.6	100.1	3.1	7.3	99.5	-1.52
626,871.0	100.0	2.9	7.0	99.4	-2.00
626,876.7	98.1	0.0	0.0	98.1	-2.57
626,877.8	97.8	0.0	0.0	97.8	0.00
626,878.8	97.4	0.0	0.0	97.4	0.00
626,883.2	96.0	0.0	0.0	96.0	0.00
626,884.0	96.0	0.0	0.0	96.0	0.00
626,884.9	96.0	0.0	0.0	96.0	0.00

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
623,962.9	96.0	0.0	0.0	96.0	0.00
623,963.7	96.0	0.0	0.0	96.0	0.00
623,964.6	96.0	0.0	0.0	96.0	0.00
623,968.9	97.4	0.0	0.0	97.4	0.00
623,970.6	98.0	0.0	0.0	98.0	0.00
623,970.9	98.1	0.0	0.0	98.1	0.00
623,976.6	100.0	2.9	7.0	99.4	-2.66
623,976.9	100.1	3.1	7.3	99.5	-2.05
623,979.9	101.1	5.1	9.6	100.3	-1.74
623,982.6	102.0	6.9	11.2	101.1	-1.38
623,982.9	102.1	7.1	11.4	101.2	-1.25
623,985.9	103.1	9.1	12.8	102.0	-1.14
623,988.6	104.0	10.9	13.9	102.8	-0.99
623,988.9	104.1	11.1	14.1	102.9	-0.93
623,991.9	105.1	13.1	15.2	103.8	-0.87
623,994.6	106.0	14.9	16.0	104.7	-0.79
623,994.9	106.1	15.1	16.1	104.8	-0.75
623,997.9	107.1	17.1	17.0	105.7	-0.72
624,000.6	108.0	18.9	17.8	106.5	-0.66
624,000.9	108.1	19.1	17.8	106.6	-0.64
624,003.9	109.1	21.1	18.6	107.6	-0.62
624,006.6	110.0	22.9	19.2	108.4	-0.58
624,006.9	110.1	23.1	19.3	108.5	-0.56
624,009.9	111.1	25.1	20.0	109.4	-0.55
624,012.6	112.0	26.9	20.6	110.3	-0.52
624,012.9	112.1	27.1	20.6	110.4	-0.51
624,015.9	113.1	29.1	21.2	111.3	-0.49
624,018.6	114.0	30.9	21.8	112.2	-0.47
624,018.9	114.1	31.1	21.8	112.3	-0.46
624,024.6	116.0	32.9	22.3	114.1	-0.22
624,030.6	118.0	34.9	22.8	116.1	-0.21
624,036.6	120.0	36.8	23.4	118.1	-0.21
624,042.6	122.0	38.8	23.8	120.0	-0.20
624,048.6	124.0	40.7	24.3	122.0	-0.19
624,054.6	126.0	42.6	24.8	123.9	-0.19
624,060.6	128.0	44.6	25.2	125.9	-0.18
624,066.6	130.0	46.5	25.6	127.9	-0.18
624,072.6	132.0	48.5	26.1	129.8	-0.18
624,078.6	134.0	50.4	26.5	131.8	-0.17
624,084.6	136.0	52.3	26.9	133.8	-0.17
624,090.6	138.0	54.3	27.3	135.7	-0.16
624,096.6	140.0	56.2	27.7	137.7	-0.16
624,102.6	142.0	58.2	28.1	139.7	-0.16

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,108.6	144.0	60.1	28.4	141.6	-0.16
624,114.6	146.0	62.0	28.8	143.6	-0.15
624,118.9	147.4	63.4	29.1	145.0	-0.15
624,120.6	148.0	64.0	29.2	145.6	-0.15
624,126.6	150.0	65.9	29.5	147.5	-0.15
624,132.6	152.0	67.9	29.9	149.5	-0.15
624,138.6	154.0	69.8	30.2	151.5	-0.14
624,144.6	156.0	71.7	30.6	153.5	-0.14
624,150.6	158.0	73.7	30.9	155.4	-0.14
624,156.6	160.0	75.6	31.2	157.4	-0.14
624,162.6	162.0	77.6	31.6	159.4	-0.14
624,168.6	164.0	79.5	31.9	161.3	-0.13
624,174.6	166.0	81.4	32.2	163.3	-0.13
624,180.6	168.0	83.4	32.5	165.3	-0.13
624,186.6	170.0	85.3	32.9	167.3	-0.13
624,192.6	172.0	87.3	33.2	169.2	-0.13
624,198.6	174.0	89.2	33.5	171.2	-0.13
624,204.6	176.0	91.1	33.8	173.2	-0.13
624,210.6	178.0	93.1	34.1	175.2	-0.13
624,216.6	180.0	95.0	34.4	177.1	-0.12
624,218.9	180.8	95.8	34.5	177.9	-0.12
624,222.6	182.0	97.0	34.7	179.1	-0.12
624,228.6	184.0	98.9	35.0	181.1	-0.12
624,234.6	186.0	100.8	35.3	183.1	-0.12
624,240.6	188.0	102.8	35.6	185.0	-0.12
624,246.6	190.0	104.7	35.8	187.0	-0.12
624,252.6	192.0	106.7	36.1	189.0	-0.12
624,258.6	194.0	108.6	36.4	191.0	-0.12
624,264.6	196.0	110.5	36.7	192.9	-0.12
624,270.6	198.0	112.5	37.0	194.9	-0.12
624,276.6	200.0	114.4	37.3	196.9	-0.12
624,282.6	202.0	116.4	37.5	198.9	-0.11
624,288.6	204.0	118.3	37.8	200.8	-0.11
624,294.6	206.0	120.2	38.1	202.8	-0.11
624,300.6	208.0	122.2	38.3	204.8	-0.11
624,306.6	210.0	124.1	38.6	206.8	-0.11
624,312.6	212.0	126.1	38.9	208.8	-0.11
624,318.6	214.0	128.0	39.2	210.7	-0.11
624,321.6	215.0	129.0	39.3	211.7	-0.11
624,324.6	216.0	129.9	39.4	212.7	-0.11
624,330.6	218.0	131.9	39.7	214.7	-0.11
624,336.6	220.0	133.8	39.9	216.7	-0.11
624,342.6	222.0	135.8	40.2	218.6	-0.11

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,348.6	224.0	137.7	40.5	220.6	-0.11
624,354.6	226.0	139.6	40.7	222.6	-0.11
624,360.6	228.0	141.6	41.0	224.6	-0.11
624,366.6	230.0	143.5	41.2	226.6	-0.11
624,372.6	232.0	145.5	41.5	228.5	-0.11
624,378.6	234.0	147.4	41.7	230.5	-0.10
624,384.6	236.0	149.3	42.0	232.5	-0.10
624,390.6	238.0	151.3	42.2	234.5	-0.10
624,396.6	240.0	153.2	42.5	236.5	-0.10
624,402.6	242.0	155.2	42.7	238.4	-0.10
624,408.6	244.0	157.1	43.0	240.4	-0.10
624,414.6	246.0	159.0	43.2	242.4	-0.10
624,418.9	247.4	160.4	43.4	243.8	-0.10
624,420.6	248.0	161.0	43.5	244.4	-0.10
624,426.6	250.0	162.9	43.7	246.4	-0.10
624,432.6	252.0	164.9	44.0	248.3	-0.10
624,438.6	254.0	166.8	44.2	250.3	-0.10
624,444.6	256.0	168.7	44.5	252.3	-0.10
624,450.6	258.0	170.7	44.7	254.3	-0.10
624,456.6	260.0	172.6	44.9	256.3	-0.10
624,462.6	262.0	174.6	45.2	258.2	-0.10
624,468.6	264.0	176.5	45.4	260.2	-0.10
624,474.6	266.0	178.4	45.7	262.2	-0.10
624,480.6	268.0	180.4	45.9	264.2	-0.10
624,486.6	270.0	182.3	46.1	266.2	-0.10
624,492.6	272.0	184.3	46.4	268.1	-0.10
624,498.6	274.0	186.2	46.6	270.1	-0.10
624,504.6	276.0	188.1	46.8	272.1	-0.10
624,510.6	278.0	190.1	47.1	274.1	-0.10
624,516.6	280.0	192.0	47.3	276.1	-0.10
624,519.6	281.0	193.0	47.4	277.0	-0.10
624,522.6	282.0	194.0	47.5	278.0	-0.10
624,528.6	284.0	195.9	47.8	280.0	-0.10
624,534.6	286.0	197.8	48.0	282.0	-0.10
624,540.6	288.0	199.8	48.2	284.0	-0.10
624,546.6	290.0	201.7	48.5	286.0	-0.10
624,552.6	292.0	203.7	48.7	287.9	-0.10
624,558.6	294.0	205.6	48.9	289.9	-0.09
624,564.6	296.0	207.5	49.1	291.9	-0.09
624,570.6	298.0	209.5	49.4	293.9	-0.09
624,574.4	299.3	210.7	49.5	295.1	-0.09
624,618.9	299.2	210.2	49.5	295.1	0.00
624,633.1	299.2	210.1	49.4	295.1	0.00

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
624,652.0	300.0	210.7	49.5	295.9	0.00
624,698.8	302.0	212.2	49.7	297.9	0.00
624,718.9	302.9	212.9	49.8	298.7	0.00
624,726.1	303.2	213.1	49.8	299.0	0.00
624,745.6	304.0	213.7	49.9	299.8	0.00
624,792.3	306.0	215.3	50.0	301.8	0.00
624,818.9	307.1	216.1	50.1	303.0	0.00
624,839.1	308.0	216.8	50.2	303.8	0.00
624,885.9	310.0	218.3	50.4	305.8	0.00
624,918.9	311.4	219.4	50.5	307.2	0.00
624,932.7	312.0	219.9	50.6	307.8	0.00
624,979.5	314.0	221.4	50.8	309.8	0.00
625,018.9	315.7	222.7	50.9	311.4	0.00
625,026.3	316.0	222.9	50.9	311.8	0.00
625,073.1	318.0	224.5	51.1	313.7	0.00
625,118.9	320.0	226.0	51.3	315.7	0.00
625,119.9	320.0	226.0	51.3	315.7	0.00
625,166.7	322.0	227.5	51.5	317.7	0.00
625,213.5	324.0	229.1	51.6	319.7	0.00
625,218.9	324.2	229.2	51.7	319.9	0.00
625,260.2	326.0	230.6	51.8	321.7	0.00
625,307.0	328.0	232.1	52.0	323.7	0.00
625,330.4	329.0	232.9	52.1	324.7	0.00
625,353.8	330.0	233.7	52.2	325.7	0.00
625,400.6	328.0	231.2	51.9	323.7	0.00
625,418.9	327.2	230.2	51.8	322.9	0.00
625,432.2	326.7	229.5	51.7	322.3	0.00
625,445.5	326.1	228.8	51.6	321.8	0.00
625,447.4	326.0	228.1	51.5	321.7	-0.01
625,451.0	325.8	226.8	51.4	321.6	-0.01
625,457.3	325.6	224.6	51.1	321.3	-0.01
625,463.7	325.3	222.3	50.9	321.1	-0.01
625,470.0	325.0	220.0	50.6	320.8	-0.01
625,470.1	325.0	220.0	50.6	320.8	-0.01
625,475.4	324.8	219.8	50.6	320.6	0.00
625,480.7	324.6	219.6	50.5	320.4	0.00
625,480.8	324.6	219.6	50.5	320.4	0.01
625,487.2	324.3	221.3	50.7	320.1	0.01
625,493.7	324.0	223.0	50.9	319.8	0.01
625,494.2	324.0	223.2	51.0	319.8	0.01
625,500.1	323.7	224.7	51.1	319.5	0.01
625,506.6	323.5	226.5	51.3	319.2	0.01
625,513.1	323.2	228.2	51.5	318.9	0.01

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
625,515.6	323.1	228.9	51.6	318.8	0.01
625,518.1	323.0	229.5	51.7	318.7	0.01
625,531.9	322.4	229.0	51.6	318.1	0.00
625,562.5	323.3	230.1	51.8	319.0	0.00
625,583.5	324.0	230.9	51.8	319.7	0.00
625,607.0	324.7	231.7	51.9	320.4	0.00
625,647.3	326.0	233.2	52.1	321.7	0.00
625,711.2	328.0	235.5	52.4	323.6	0.00
625,775.1	330.0	237.8	52.6	325.6	0.00
625,807.1	329.0	237.0	52.5	324.6	0.00
625,839.0	328.0	236.2	52.4	323.6	0.00
625,902.9	326.0	234.5	52.3	321.6	0.00
625,966.8	324.0	232.8	52.1	319.7	0.00
626,007.0	322.7	231.7	51.9	318.4	0.00
626,030.6	322.0	231.1	51.9	317.7	0.00
626,094.5	320.0	229.4	51.7	315.7	0.00
626,126.5	319.0	228.6	51.6	314.7	0.00
626,158.4	318.0	227.8	51.5	313.7	0.00
626,224.2	315.9	226.0	51.3	311.7	0.00
626,242.3	310.0	220.3	50.6	305.8	-0.09
626,269.9	300.9	211.5	49.6	296.8	-0.09
626,272.8	300.0	210.6	49.5	295.9	-0.09
626,278.9	298.0	208.6	49.3	293.9	-0.09
626,294.2	298.0	208.8	49.3	293.9	0.00
626,315.6	291.0	202.0	48.5	286.9	-0.09
626,318.5	290.0	201.0	48.4	286.0	-0.09
626,349.0	280.0	191.3	47.2	276.1	-0.09
626,379.5	270.0	181.6	46.0	266.2	-0.09
626,410.0	260.0	171.9	44.9	256.3	-0.10
626,415.6	258.1	170.1	44.6	254.4	-0.10
626,416.1	258.0	170.0	44.6	254.3	-0.10
626,431.3	258.0	170.2	44.6	254.3	0.00
626,455.7	250.0	162.4	43.7	246.4	-0.10
626,486.2	240.0	152.7	42.4	236.5	-0.10
626,515.6	230.3	143.3	41.2	226.9	-0.10
626,516.7	230.0	143.0	41.2	226.6	-0.10
626,547.1	220.0	133.3	39.9	216.7	-0.10
626,553.2	218.0	131.4	39.6	214.7	-0.11
626,568.5	218.0	131.5	39.6	214.7	0.00
626,592.9	210.0	123.8	38.6	206.8	-0.11
626,615.6	202.5	116.5	37.6	199.4	-0.11
626,623.3	200.0	114.1	37.2	196.9	-0.11
626,653.8	190.0	104.4	35.8	187.0	-0.11

Cross Section 5

x (ft)	Final Grade Elev. (ft)	Initial Waste Thickness (ft)	Settlement (in)	Post-Set. Elev. (ft)	Strain (%)
626,684.3	180.0	94.7	34.3	177.1	-0.12
626,690.4	178.0	92.7	34.0	175.2	-0.12
626,705.6	178.0	92.9	34.1	175.2	0.00
626,715.6	174.7	89.7	33.6	171.9	-0.12
626,730.0	170.0	85.1	32.8	167.3	-0.12
626,760.5	160.0	75.4	31.2	157.4	-0.13
626,791.0	150.0	65.8	29.5	147.5	-0.14
626,815.6	141.9	57.9	28.0	139.6	-0.15
626,821.5	140.0	56.1	27.6	137.7	-0.15
626,827.6	138.0	54.1	27.3	135.7	-0.16
626,842.8	138.0	54.3	27.3	135.7	0.00
626,867.2	130.0	46.5	25.6	127.9	-0.16
626,897.7	120.0	36.8	23.4	118.1	-0.18
626,915.6	114.1	31.1	21.8	112.3	-0.21
626,921.7	112.1	27.1	20.6	110.4	-0.47
626,927.8	110.1	23.1	19.3	108.5	-0.52
626,928.2	110.0	22.9	19.2	108.4	-0.55
626,933.9	108.1	19.1	17.8	106.6	-0.58
626,940.0	106.1	15.1	16.1	104.8	-0.67
626,943.4	105.0	12.9	15.1	103.7	-0.77
626,946.1	104.1	11.1	14.1	102.9	-0.85
626,952.2	102.1	7.1	11.4	101.2	-1.03
626,958.3	100.1	3.1	7.3	99.5	-1.52
626,958.6	100.0	2.9	7.0	99.4	-2.00
626,964.4	98.1	0.0	0.0	98.1	-2.57
626,965.4	97.8	0.0	0.0	97.8	0.00
626,966.4	97.4	0.0	0.0	97.4	0.00
626,970.8	96.0	0.0	0.0	96.0	0.00
626,971.7	96.0	0.0	0.0	96.0	0.00
626,972.5	96.0	0.0	0.0	96.0	0.00

APPENDIX F
SLOPE STABILITY CALCULATIONS

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **WCI** Project: **JED Sideslope Modifications** Project No.: **FL3318**

Phase No.: **01**

Title of Computations: **SLOPE STABILITY ANALYSES**

Computations by:	Signature	[signature]	18 August 2018
	Printed Name	Alex Rivera, P.E.	Date
	Title	Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature	[signature]	23 August 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Checked by:	Signature	[signature]	23 August 2018
	Printed Name	Ramil Mijares, Ph.D., P.E.	Date
	Title	Project Engineer	
Computations Backchecked by: (originator)	Signature	[signature]	24 August 2018
	Printed Name	Alex Rivera, P.E.	Date
	Title	Engineer	
Approved by: (pm or designate)	Signature	[signature]	7 September 2018
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	

Approval notes: Senior Review by Kwasi Badu-Tweneboah, Ph.D., P.E.

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

SLOPE STABILITY ANALYSES
J.E.D. SOLID WASTE MANAGEMENT FACILITY
ST. CLOUD, OSCEOLA COUNTY, FLORIDA

1 INTRODUCTION

This calculation package is prepared in support of the proposed sideslope modifications for Cells 4, 5, 7, 8, and 12 at the J.E.D. Solid Waste Management (JED) facility. The proposed sideslope modifications involve replacing the currently permitted sideslope configuration with a tack-on berm sideslope configuration. The footprint, base grades, and maximum landfill height above ground surface will not change as a result of the sideslope modifications. Analyses are performed to evaluate the factor of safety (FS) for slope stability with respect to potential shear failure surfaces through the waste mass and foundation soils and shear failure surfaces passing through the waste mass and along the liner system.

2 METHOD OF ANALYSES

2.1 Overview

Appendix D of the *Major Modification Application for Vertical Expansion of the J.E.D. Solid Waste Management Facility (Phases 1 through 3)*, prepared by Geosyntec, dated September 2007 (2007 Vertical Expansion Application) (Geosyntec, 2007), presented slope stability analyses for the: (i) critical cross section (final waste configuration); (ii) perimeter berm; and (iii) interim configuration geometry. The stability of the critical cross section and the perimeter berm were subsequently evaluated in Appendix E of the *Landfill Lateral Expansion – Application for a Major Permit Modification, J.E.D. Solid Waste Management Facility*, prepared by Geosyntec, dated February 2011 (2011 Lateral Expansion Permit Application) (Geosyntec, 2011). Subsequently, the *Intermediate Permit Modification Application: Base Grade Revisions to Phase 4 (Cells 11 – 13), J.E.D. Solid Waste Management Facility*, prepared by Geosyntec, dated December 2014 (2014 Intermediate Permit Modification Application) (Geosyntec, 2014), proposed the reduction of the design slope of the leachate corridors in some areas from 1.0% to 0.5% and the cross-slope grades (floor of cells that drain to the leachate corridors) from 2.0% to 1.5% for Cell 11 and from 2.0% to 1.4% for Cells 12 and 13. Attachment 5 of the 2014 Intermediate Permit Modification Application evaluated the critical cross section to account for the revised base grades. Finally, the *Minor Permit Modification Application for Base Grade Gas Collection Improvements, Rain Cover, and Cell 12 Grading Revision*, prepared by Geosyntec, dated June 2018 (2018 Minor Permit Modification) (Geosyntec 2018), proposed a modification of the Cell 12 base grades to revert to the originally designed base grading plan in the 2011 Lateral Expansion Permit Application.

Therefore, for the slope stability analyses, only the sideslope geometry has been modified for the critical cross section as it relates to Cells 4, 5, 7, and 8 (e.g., no modifications were made to the design base grade, maximum cover height, etc.).

2.2 Waste Slope Stability and Foundation Stability

Slope stability analyses of circular and non-circular slip surfaces were performed using Spencer's method (Spencer, 1973), as implemented in the computer program *Slide* version 6.0 (Rocscience, 2010). Spencer's method is utilized because it satisfies vertical and horizontal force equilibrium and moment equilibrium. *Slide* was used to generate potential slip surfaces, calculate the FS for each of these surfaces, and identify the slip surface with the lowest FS. The slip surface with the lowest FS is considered the critical potential slip surface. Information required for the analyses includes:

- the geometry of the landfill (e.g., liner system and final fill grades) at the cross-section location;
- the subsurface soil stratigraphy at the cross-section location;
- the material properties for waste, structural fill, liner system, and subsurface materials; and
- the groundwater table elevation for the cross-section location.

3 TARGET FACTOR OF SAFETY

Based on the requirements of Chapter 62-701 of the Florida Administrative Code (FAC), a target FS of 1.5, using peak strength parameters, was used for the slope stability analyses performed herein.

4 INPUT PARAMETERS

4.1 Geometry

The proposed sideslope modifications at the JED facility will not alter the currently permitted maximum landfill height of 330 feet (ft), National Geodetic Vertical Datum of 1929 (NGVD 29) (approximately 250 ft above existing ground surface). The proposed modifications as presented in **Figure 1** will change the currently permitted landfill sideslope geometry (e.g., modify the existing bench geometry to include tack-on berms). The 3 horizontal to 1 vertical (3H:1V) sideslope, 40 vertical feet spacing between tack-on berms (e.g., Elev. 138, 178, 218, 258, and 298), and width of 15 ft is not proposed to change with this intermediate modification.

The ground water table was modeled at existing ground level or approximately Elev. 80 ft, NGVD 29.

4.1.1 Subsurface Stratigraphy

A simplified subsurface stratigraphy was used for the stability analyses. A detailed discussion of the stratigraphy underlying the proposed JED facility was presented in the *Geotechnical Investigation Report* submitted in Appendix D of the 2011 Lateral Expansion Permit Application (Geosyntec, 2011). The simplified subsurface is composed of (from top to bottom):

- loose to medium dense silty sands to approximately 155 ft in depth; and
- an underlying formation, referred to as the Hawthorn Group, consisting of 11.5-ft thick clay layer underlain by undifferentiated sands, silty sands, and clayey sands with dolomite cementation.

4.1.2 Liner System Geometry

The liner system for Cells 4, 5, 7, and 8 consists of a double liner system over a compacted liner subbase and subgrade. The liner system consists of (from bottom to top): (i) a geosynthetic clay liner (GCL); (ii) secondary 60-mil thick HDPE textured geomembrane; (iii) secondary geocomposite drainage layer; (iv) primary 60-mil thick HDPE textured geomembrane; (v) primary geocomposite drainage layer; and (vi) a liner protective layer. As the maximum head on the primary geomembrane is designed to be less than 12 inches, a phreatic surface within the landfill was not considered.

4.1.3 Critical Cross Section

Typical cross sections for the proposed final configuration of the JED facility are shown on the Permit Drawings (see Appendix B of the intermediate modification permit application report). The cross sections consist of (from bottom to top): (i) foundation soils; (ii) a compacted subgrade; (iii) the double liner system; (iv) municipal solid waste (MSW); and (v) the final cover system. The critical cross section is the one in which the landfill top slope reaches the maximum elevation of 330 ft (NGVD 29). The top area of the landfill has been conservatively modeled as a flat surface at elevation 330 ft (NGVD 29). The landfill sideslopes are inclined at 3H:1V between tack-on berms. Tack-on berms are provided every 40 vertical feet and each have a width of 15 ft.

4.2 <u>Material Properties</u>

4.2.1 Soil Properties

Soil properties used for the stability analyses were selected based on the results of the site characterization program described in the Geotechnical Investigation Report submitted with the 2011 Lateral Expansion Permit Application (Geosyntec, 2011). For the Hawthorn Formation, a unit weight of 115 pcf and a peak effective friction angle of 30 degrees were selected for the non-cohesive soils. The Hawthorn confining layer, composed of cohesive soils, was assigned a unit weight equal to 120 pcf and undrained shear strength of 5,000 psf. For the loose to medium dense silty sand layer above the Hawthorn Formation, a unit weight of 115 pcf and a peak effective friction angle of 30 degrees were also selected. For the perimeter berm fill and compacted subgrade, a unit weight of 120 pcf and a peak effective friction angle of 35 degrees were used in the analyses. This is consistent with typical values for compacted silty sand. For the liner protective layer, a unit weight of 120 pcf and a peak effective friction angle of 30 degrees were used in the analyses. These strength parameters are also consistent with those previously presented by Geosyntec (2007 and 2011).

The soil properties, from bottom to top, are summarized in the following table.

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)
Hawthorn Formation	115	0	30
Hawthorn Confining layer	120	5,000	0
Silty Sand	115	0	30

Berm Fill/Compacted Subgrade	120	0	35
Liner Protective Layer	120	0	30
Final Cover System	120	0	35

4.2.2 Waste Material Properties

The waste material disposed in the landfill primarily consists of MSW. **Attachment A** presents the unit weight versus depth relationship used in the analyses (Kavazanjian et al., 1995). The unit weight of MSW is a function of the overburden and therefore varies with depth (i.e., the unit weight of MSW increases with depth). As shown, the unit weight varies linearly with depth from 0 to 115 ft (35 m) with a unit weight variation of 41.4 pcf (6.5 kN/m^3) to 66.9 pcf (10.5 kN/m^3), respectively. It varies asymptotically between 115 ft (35 m) and 328 ft (100 m) to a unit weight of approximately 83.4 pcf (13.1 kN/m^3).

For the slope stability analyses of the proposed final configuration of the JED facility, the MSW was divided into three sublayers. Each sublayer was assigned a unit weight corresponding to its midpoint depth.

The shear strength of the MSW was modeled using a truncated linear Mohr-Coulomb envelope presented by Kavazanjian et al. (1995) and included in **Attachment A**. As shown, the shear strength envelope has a constant value for shear stress of 500 psf (24 kPa) in the normal stress range of 0 to 625 psf (30 kPa) and transitions to a linear relationship corresponding to an effective friction angle of 33 degrees.

4.3 Cases Analyzed

The following slope failure mechanisms were evaluated:

- Case 1 – Final Configuration Circular Failure Mechanism: Circular slip surfaces that pass through the MSW and/or the foundation soils of the final configuration of the proposed sideslope modifications.
- Case 2 – Final Configuration Localized Circular Failure Mechanism: Circular slip surfaces that pass through the general fill soils of the final configuration of the proposed tack-on berm.
- Case 3 – Final Configuration Non-circular (block) Failure Mechanism: Non-circular slip surfaces that pass through the MSW and along the double liner system of the final configuration of the proposed sideslope modifications.

5 RESULTS

The results for Cases 1 through 3 for the proposed final configuration of the JED facility are presented in **Attachments B, C,** and **D**, respectively. The critical slip surface is shown for each analysis with the computed FS value. The output files from the slope stability software (*Slide*) are also presented in the respective attachments.

5.1 Case 1 - Final Configuration Circular Failure Mechanism

The results of the circular shear surface slope stability analyses for the critical cross section for the proposed final configuration of the JED facility are included in **Attachment B**. For the proposed sideslope modifications and the input parameters discussed above, the minimum FS was evaluated to be 2.15 for the critical slip surface. The minimum calculated FS for failure surfaces that pass through the waste mass and foundation soils meet or exceed the established minimum requirement of 1.5.

5.2 Case 2 - Final Configuration Localized Circular Failure Mechanism

The results of the localized circular shear surface slope stability analyses for the critical cross section for the proposed final configuration of the JED facility are included in **Attachment C**. For the proposed sideslope modifications (e.g., tack-on berm geometry) and the input parameters discussed above, the minimum FS was evaluated to be 1.76 for the critical slip surface. The minimum calculated FS for failure surfaces that pass through the general fill soils of the tack-on berm meet or exceed the established minimum requirement of 1.5.

5.3 Case 3 - Final Configuration Non-Circular (Block) Failure Mechanism

The results of the non-circular shear surface slope stability analyses for the critical cross section for the proposed final configuration of the JED facility are included in **Attachment D**. Based on the sensitivity analyses performed for shearing along the liner system, a minimum peak interface friction angle of 12.3 degrees is required to meet a FS of 1.5. It is noted that the required interface friction angle is less than the range of soil-geosynthetic and geosynthetic-geosynthetic interface friction angles (e.g., 15 to 31.6 degrees) from construction quality assurance (CQA) test results performed during construction of the Cell 4, 5, 7, and 8 liner system.

6 SUMMARY AND CONCLUSIONS

The results of the waste mass and foundation slope stability analyses for the proposed sideslope configuration of the JED facility (i.e., Cases 1, 2, and 3) showed that the FS exceeded the minimum requirement of 1.5.

7 REFERENCES

Geosyntec Consultants (2007), "*Major Modification Application for Vertical Expansion of the J.E.D. Solid Waste Management Facility (Phases 1 through 3),*" September 2007.

Geosyntec Consultants (2011), "*Landfill Lateral Expansion – Application for a Major Permit Modification, J.E.D. Solid Waste Management Facility,*" February 2011.

Geosyntec Consultants (2014), "*Intermediate Permit Modification Application: Base Grade Revisions to Phase 4 (Cells 11 – 13), J.E.D. Solid Waste Management Facility,*" December 2014.

Geosyntec Consultants (2018), "*Minor Permit Modification Application for Base Grade Gas Collection Improvements, Rain Cover, and Cell 12 Grading Revision,*" June 2018.

Kavazanjian Jr, E., Matasovic, N., Bonaparte, R., and Schmertmann, G. (1995), "*Evaluation of MSW Properties for Seismic Analysis,*" Proceedings, Geoenvironmental 2000, Vol II, New Orleans, LA, February, pp. 1126-1141.

Rocscience (2010), *Slide Version 6.0 - 2D Limit Equilibrium Slope Stability Analysis. www.rocscience.com,* Rocscience Inc., Toronto, Ontario, Canada.

Spencer, E. (1973), "The Thrust Line Criterion in Embankment Stability Analysis," *Géotechnique*, Vol. 23, No. 1, pp. 85-100.

FIGURE

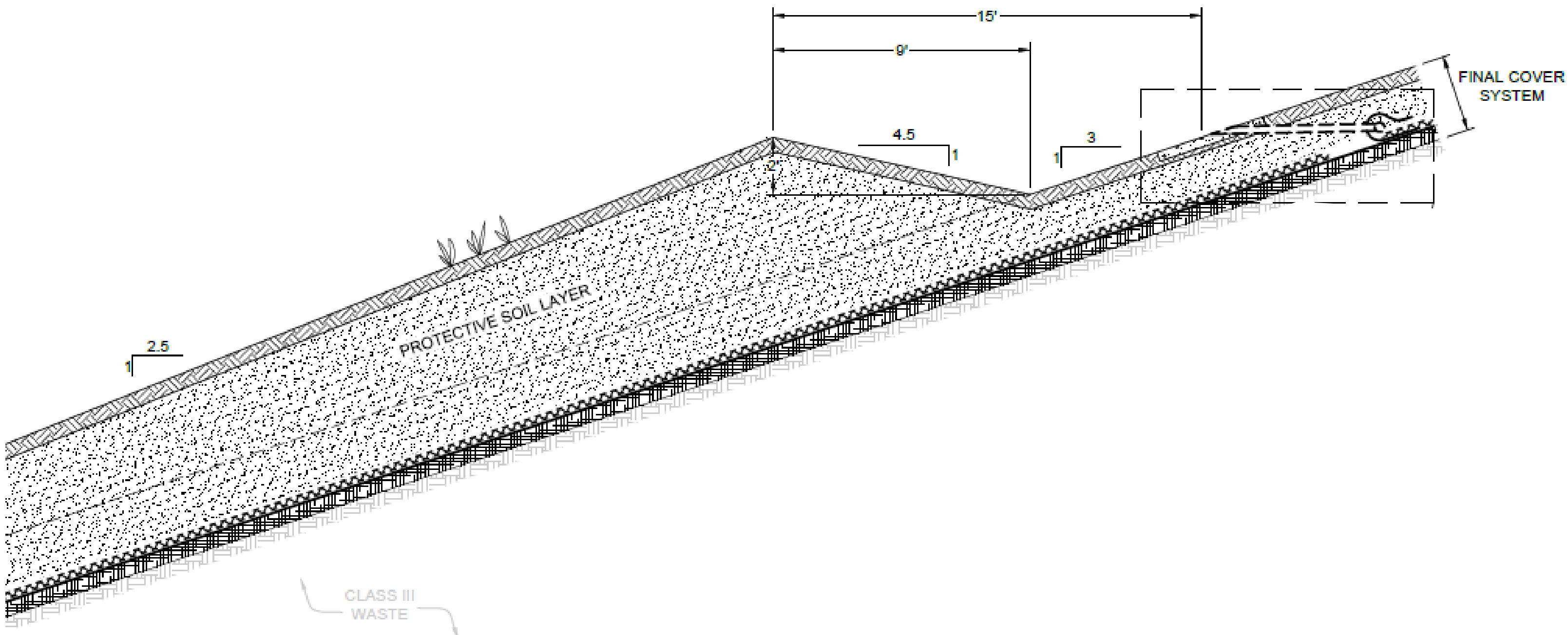
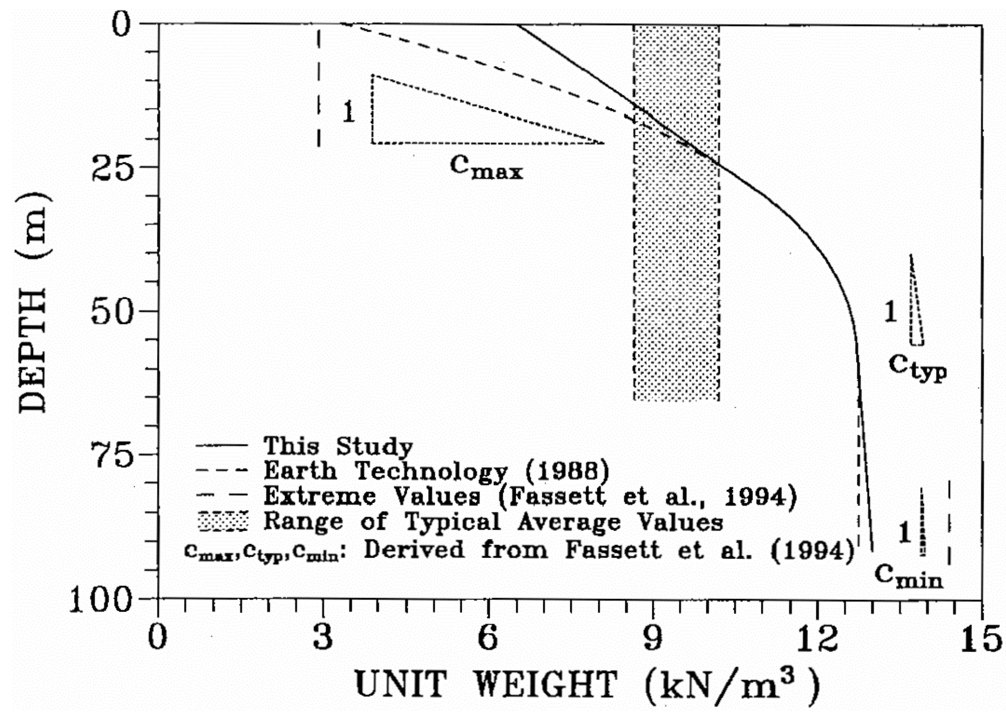
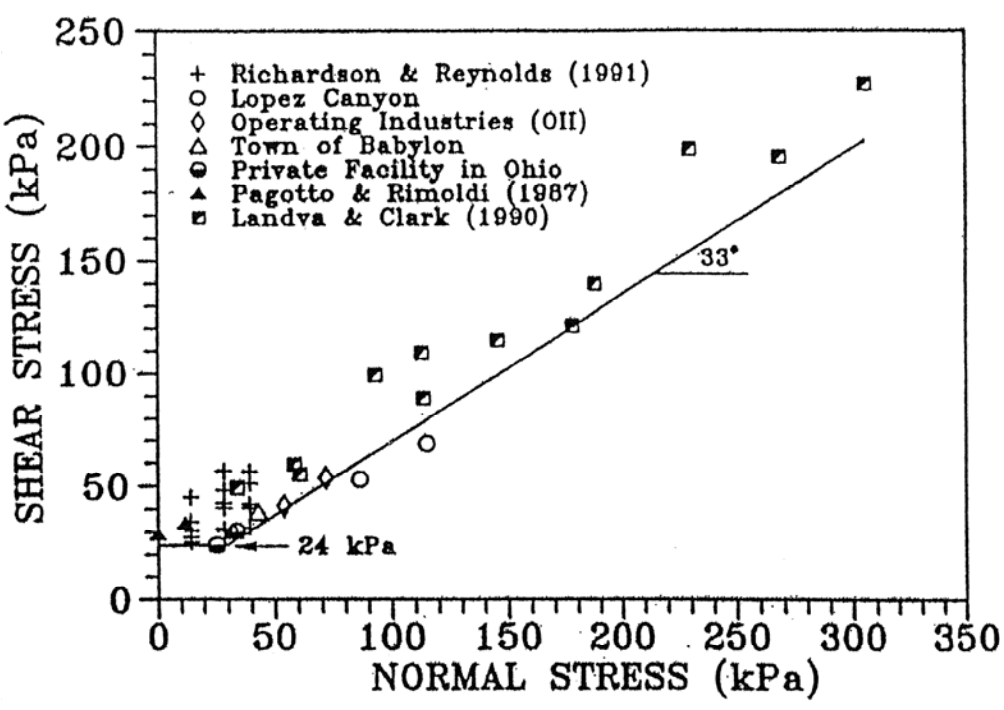


Figure 1

Typical Cross Section of Proposed Sideslope
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

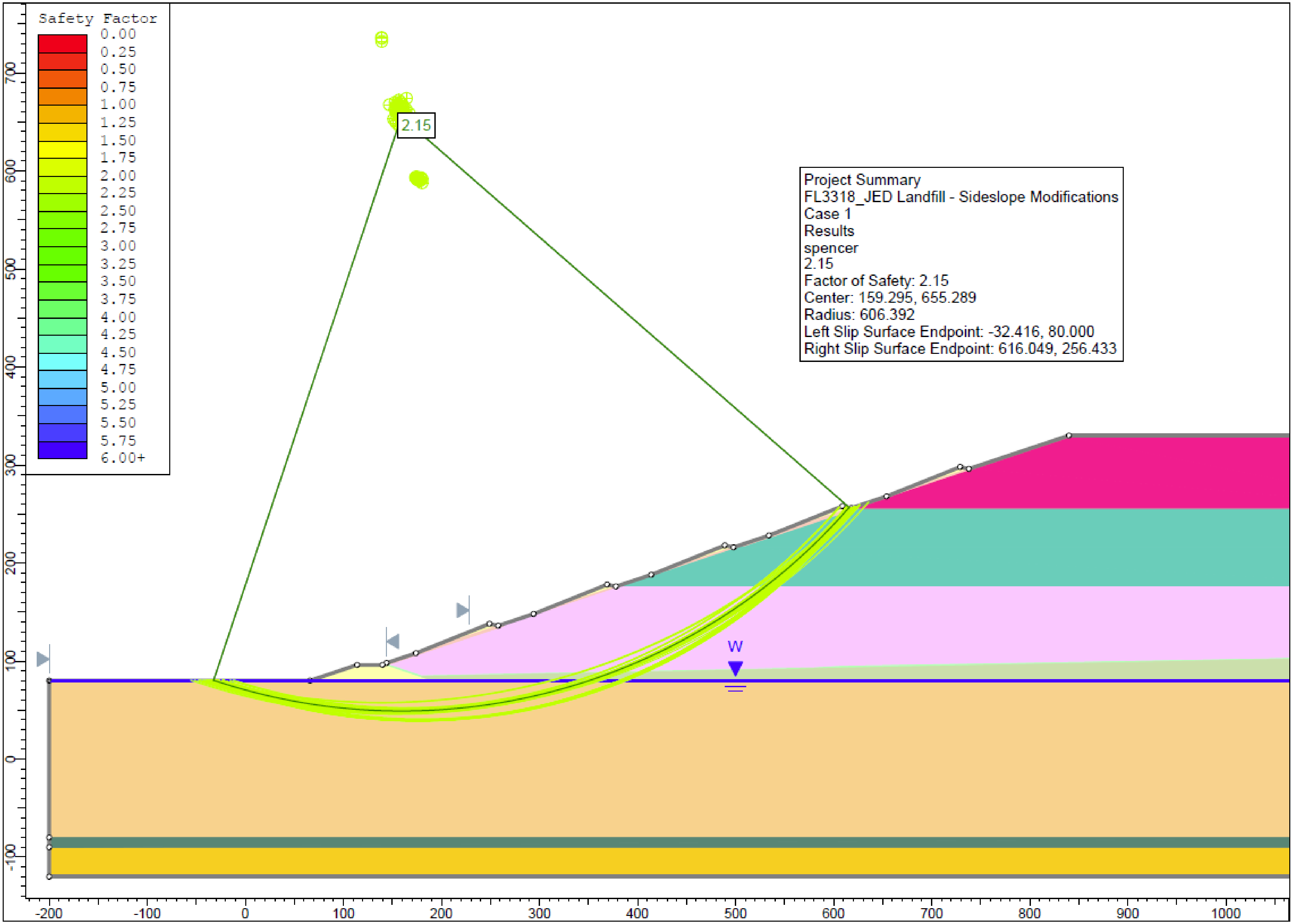
ATTACHMENT A





Unit Weight and Shear Strength Relationships for MSW (Kavazanjian et al., 1995)

ATTACHMENT B



Safety Factor
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00+
2.15
Project Summary
FL3318_JED Landfill - Sideslope Modifications
Case 1
Results
spencer
2.15
Factor of Safety: 2.15
Center: 159.295, 655.289
Radius: 606.392
Left Slip Surface Endpoint: -32.416, 80.000
Right Slip Surface Endpoint: 616.049, 256.433
W
-200
-100
0
100
200
300
400
500
600
700
800
900
1000

Slide Analysis Information

FL3318_JED Landfill - Sideslope Modifications

Project Summary

File Name: Case 1
Slide Modeler Version: 6.039
Project Title: FL3318_JED Landfill - Sideslope Modifications
Analysis: Case 1
Author: A. Rivera
Company: Geosyntec Consultants
Date Created: 04.18.2018

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 10
Circles per division: 20
Number of iterations: 50
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth: 2

Material Properties

Property	Berm Fill	Compacted Subgrade	Silty Sand	Hawthorne Formation	Final Cover System	Liner System	Upper MSW	Middle MSW
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function
Unit Weight [lbs/ft3]	120	120	115	115	120	120	54	72
Cohesion [psf]	0	0	0	0	0	0		
Friction Angle [deg]	35	35	30	30	35	30		
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Property	Lower MSW	Hawthorn Confining
Color		
Strength Type	Shear Normal function	Mohr-Coulomb
Unit Weight [lbs/ft3]	82	120
Cohesion [psf]		5000
Friction Angle [deg]		0
Water Surface	Water Table	Water Table
Hu Value	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: On
Probabilistic Analysis: Off

Variables

Material	Property	Distribution	Mean	Min	Max
Final Cover System	Phi	Normal	35	25	45

Global Minimums

Method: spencer

FS: 2.149420
Center: 159.295, 655.289
Radius: 606.392
Left Slip Surface Endpoint: -32.416, 80.000
Right Slip Surface Endpoint: 616.049, 256.433
Resisting Moment=1.06275e+009 lb-ft
Driving Moment=4.94437e+008 lb-ft
Resisting Horizontal Force=1.6248e+006 lb
Driving Horizontal Force=755928 lb
Total Slice Area=36382.6 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 15043
Number of Invalid Surfaces: 0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.14942

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]

1	29.4939	15266.8	Silty Sand	0	30	91.1246	195.865	620.115	280.867	339.248
2	29.4939	43078.4	Silty Sand	0	30	244.104	524.682	1701.3	792.526	908.776
3	29.4939	65547.4	Silty Sand	0	30	353.502	759.825	2521.95	1205.89	1316.06
4	29.4939	90503.1	Silty Sand	0	30	508.277	1092.5	3416.5	1524.24	1892.26
5	29.4939	135573	Silty Sand	0	30	888.477	1909.71	5057.67	1749.98	3307.69
6	29.4939	159694	Silty Sand	0	30	1059.9	2278.18	5830.69	1884.77	3945.92
7	29.4939	177373	Silty Sand	0	30	1183.52	2543.88	6335.71	1929.59	4406.12
8	29.4939	194979	Silty Sand	0	30	1324.79	2847.53	6816.84	1884.77	4932.07
9	29.4939	218812	Silty Sand	0	30	1541.58	3313.5	7489.12	1749.98	5739.14
10	29.4939	231793	Silty Sand	0	30	1674.14	3598.44	7756.92	1524.24	6232.68
11	29.4939	227665	Silty Sand	0	30	1674.87	3600	7441.28	1205.89	6235.39
12	29.4939	232662	Silty Sand	0	30	1780.23	3826.46	7420.16	792.526	6627.64
13	29.4939	236232	Silty Sand	0	30	1895.35	4073.9	7337.05	280.867	7056.19
14	22.1547	175532	Compacted Subgrade	0	35	2297.1	4937.43	7051.39	0	7051.39
15	5.51758	40495.3	Liner System	0	30	1738.68	3737.15	6472.94	0	6472.94
16	30.4181	213123	Lower MSW	94.1176	33.0002	1868.63	4016.48	6039.88	0	6039.88
17	30.4181	203617	Lower MSW	94.1176	33.0002	1730.84	3720.3	5583.8	0	5583.8
18	30.4181	193513	Lower MSW	94.1176	33.0002	1592.71	3423.4	5126.61	0	5126.61
19	30.4181	173135	Lower MSW	94.1176	33.0002	1379.42	2964.96	4420.68	0	4420.68
20	30.4181	130906	Lower MSW	94.1176	33.0002	1013.46	2178.36	3209.42	0	3209.42
21	27.1435	91437.5	Middle MSW	94.1176	33.0002	771.184	1657.6	2407.53	0	2407.53
22	27.1435	68553.4	Middle MSW	94.1176	33.0002	564.574	1213.51	1723.7	0	1723.7
23	27.1435	39235.2	Middle MSW	94.1176	33.0002	324.557	697.61	929.29	0	929.29
24	2.50953	1061.81	Final Cover System	0	35	87.0909	187.195	267.342	0	267.342
25	1.34126	147.176	Berm Fill	0	35	24.6045	52.8855	75.5284	0	75.5284

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.14942

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	-32.4159	80	0	0	0
2	-2.92194	70.9979	8271.88	2250.94	15.2227
3	26.572	63.6007	28061.4	7636.04	15.2227
4	56.066	57.7489	53252.9	14491.1	15.2226
5	85.5599	53.3973	83121.5	22619	15.2227
6	115.054	50.5137	123929	33723.5	15.2227
7	144.548	49.0771	163589	44515.6	15.2227
8	174.042	49.0771	198520	54021	15.2227
9	203.536	50.5137	227827	61996.1	15.2227
10	233.03	53.3973	251730	68500.7	15.2227
11	262.524	57.7489	267388	72761.3	15.2227
12	292.018	63.6007	273276	74363.6	15.2227
13	321.512	70.9979	270931	73725.4	15.2227
14	351.005	80	260822	70974.6	15.2227
15	373.16	87.8632	256303	69744.9	15.2227

16	378.678	89.9736	252242	68640	15.2227
17	409.096	102.74	232012	63135	15.2227
18	439.514	117.527	202132	55003.9	15.2227
19	469.932	134.506	163570	44510.4	15.2226
20	500.35	153.899	119827	32607.3	15.2227
21	530.768	176	79745.6	21700.3	15.2227
22	557.912	198.326	46942.1	12773.8	15.2226
23	585.055	223.504	18878.9	5137.32	15.2227
24	612.199	252.066	1151.81	313.43	15.2227
25	614.708	254.903	612.203	166.592	15.2227
26	616.049	256.433	0	0	0

List Of Coordinates

Water Table

X	Y
-200	80
1200	80

External Boundary

X	Y
618	256
609	258
534	228
498	216
489	218
414	188
378	176
369	178
294	148
258	136
249	138
174	108
144	98
140	96
114	96
66	80
-200	80
-200	-80
-200	-90
-200	-120
1200	-120
1200	-90
1200	-80
1200	80

1200	104.4
1200	106.4
1200	136
1200	176
1200	216
1200	256
1200	328
1200	319.516
1200	330
1085	330
840	330
738	296
729	298
654	268

Material Boundary

X	Y
66	80
192	80
1200	80

Material Boundary

X	Y
140	96
144	96
180	84
192	80

Material Boundary

X	Y
180	86
329.258	88.9852
579.842	93.9968
1200	106.4

Material Boundary

X	Y
150	96
180	86

Material Boundary

X	Y
-200	-80

1200	-80

Material Boundary

X	Y
624	256
1200	256

Material Boundary

X	Y
504	216
1200	216

Material Boundary

X	Y
180	84
1200	104.4

Material Boundary

X	Y
264	136
384	176
504	216
624	256
744	296

Material Boundary

X	Y
744	296
840	328
1085	328
1200	328

Material Boundary

X	Y
147	97
148.5	96.5
150	96

Material Boundary

X	Y
144	96

147	97

Material Boundary

X	Y
147	97
264	136

Material Boundary

X	Y
1200	328
1200	330

Material Boundary

X	Y
384	176
1200	176

Material Boundary

X	Y
264	136
1200	136

Material Boundary

X	Y
174	108
258	136

Material Boundary

X	Y
294	148
378	176

Material Boundary

X	Y
414	188
498	216

Material Boundary

X	Y
534	228

618	256

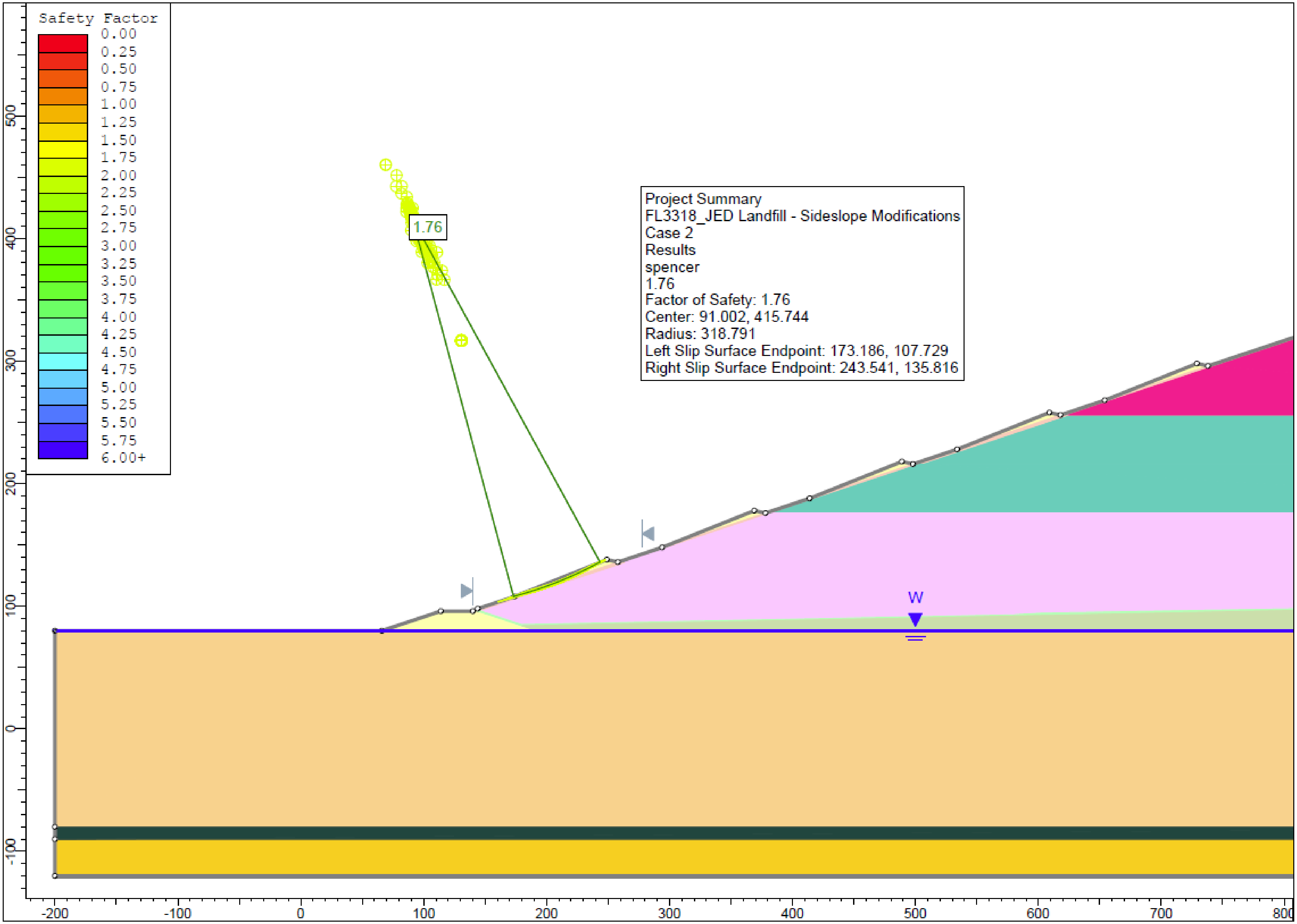
Material Boundary

X	Y
654	268
738	296

Material Boundary

X	Y
-200	-90
1200	-90

ATTACHMENT C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0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
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3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00+
1.76
Project Summary
FL3318_JED Landfill - Sideslope Modifications
Case 2
Results
spencer
1.76
Factor of Safety: 1.76
Center: 91.002, 415.744
Radius: 318.791
Left Slip Surface Endpoint: 173.186, 107.729
Right Slip Surface Endpoint: 243.541, 135.816
W
500
400
300
200
100
0
-100
-200
-100
0
100
200
300
400
500
600
700
800

Slide Analysis Information

FL3318_JED Landfill - Sideslope Modifications

Project Summary

File Name: Case 2
Slide Modeler Version: 6.039
Project Title: FL3318_JED Landfill - Sideslope Modifications
Analysis: Case 2
Author: A. Rivera
Company: Geosyntec Consultants
Date Created: 04.18.2018

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 10
Circles per division: 20
Number of iterations: 50
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth: 2

Material Properties

Property	Berm Fill	Compacted Subgrade	Silty Sand	Hawthorne Formation	Final Cover System	Liner System	Upper MSW	Middle MSW
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function
Unit Weight [lbs/ft3]	120	120	115	115	120	120	54	72
Cohesion [psf]	0	0	0	0	0	0		
Friction Angle [deg]	35	35	30	30	35	30		
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Property	Lower MSW	Hawthorn Confining
Color		
Strength Type	Shear Normal function	Mohr-Coulomb
Unit Weight [lbs/ft3]	82	120
Cohesion [psf]		5000
Friction Angle [deg]		0
Water Surface	Water Table	Water Table
Hu Value	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: On
Probabilistic Analysis: Off

Variables

Material	Property	Distribution	Mean	Min	Max
Final Cover System	Phi	Normal	35	25	45

Global Minimums

Method: spencer

FS: 1.761520
Center: 91.002, 415.744
Radius: 318.791
Left Slip Surface Endpoint: 173.186, 107.729
Right Slip Surface Endpoint: 243.541, 135.816
Resisting Moment=2.79244e+006 lb-ft
Driving Moment=1.58524e+006 lb-ft
Resisting Horizontal Force=8130.51 lb
Driving Horizontal Force=4615.61 lb
Total Slice Area=112.054 ft2

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 19597
Number of Invalid Surfaces: 0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.76152

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]

1	2.83665	46.0945	Final Cover System	0	35	6.08026	10.7105	15.2962	0	15.2962
2	2.83665	162.47	Final Cover System	0	35	21.2799	37.4849	53.5341	0	53.5341
3	2.83665	271.857	Final Cover System	0	35	35.3556	62.2796	88.9444	0	88.9444
4	2.83665	371.533	Final Cover System	0	35	47.9766	84.5118	120.695	0	120.695
5	2.83665	461.415	Final Cover System	0	35	59.1608	104.213	148.832	0	148.832
6	2.83665	541.42	Final Cover System	0	35	68.9257	121.414	173.398	0	173.398
7	2.83665	611.459	Final Cover System	0	35	77.2884	136.145	194.435	0	194.435
8	2.83665	671.44	Final Cover System	0	35	84.2647	148.434	211.985	0	211.985
9	2.83665	721.268	Final Cover System	0	35	89.8701	158.308	226.088	0	226.088
10	2.83665	760.841	Final Cover System	0	35	94.121	165.796	236.781	0	236.781
11	2.83665	790.055	Final Cover System	0	35	97.0315	170.923	244.103	0	244.103
12	2.83665	808.8	Final Cover System	0	35	98.6165	173.715	248.09	0	248.09
13	2.83665	816.961	Final Cover System	0	35	98.889	174.195	248.777	0	248.777
14	2.78981	801.078	Berm Fill	0	35	97.8831	172.423	246.245	0	246.245
15	2.78981	788.321	Berm Fill	0	35	95.6316	168.457	240.581	0	240.581
16	2.78981	765.143	Berm Fill	0	35	92.1494	162.323	231.821	0	231.821
17	2.78981	731.418	Berm Fill	0	35	87.4478	154.041	219.994	0	219.994
18	2.78981	687.011	Berm Fill	0	35	81.5392	143.633	205.129	0	205.129
19	2.78981	631.785	Berm Fill	0	35	74.4346	131.118	187.255	0	187.255
20	2.78981	565.596	Berm Fill	0	35	66.1446	116.515	166.4	0	166.4
21	2.78981	488.293	Berm Fill	0	35	56.6799	99.8427	142.59	0	142.59
22	2.78981	399.717	Berm Fill	0	35	46.0514	81.1204	115.852	0	115.852
23	2.78981	299.705	Berm Fill	0	35	34.2691	60.3657	86.2112	0	86.2112
24	2.78981	188.084	Berm Fill	0	35	21.343	37.5962	53.693	0	53.693
25	2.78981	64.6748	Berm Fill	0	35	7.26844	12.8035	18.2853	0	18.2853

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.76152

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	173.186	107.729	0	0	0
2	176.023	108.5	5.45708	1.98632	20.001
3	178.86	109.299	23.0465	8.38869	20.001
4	181.696	110.126	49.7429	18.1059	20.001
5	184.533	110.982	82.5115	30.0334	20.001
6	187.37	111.868	118.619	43.1763	20.0011
7	190.206	112.782	155.634	56.6491	20.001
8	193.043	113.725	191.42	69.6751	20.001
9	195.88	114.699	224.145	81.5864	20.001
10	198.716	115.702	252.269	91.8235	20.001
11	201.553	116.735	274.555	99.9354	20.001
12	204.389	117.8	290.063	105.58	20.001
13	207.226	118.895	298.153	108.525	20.001
14	210.063	120.021	298.488	108.647	20.0011
15	212.853	121.159	291.22	106.001	20.001

16	215.642	122.329	276.675	100.707	20.001
17	218.432	123.53	255.4	92.9633	20.0011
18	221.222	124.762	228.237	83.0761	20.001
19	224.012	126.027	196.323	71.4597	20.001
20	226.802	127.324	161.099	58.6385	20.001
21	229.591	128.654	124.312	45.2483	20.001
22	232.381	130.018	88.0218	32.0391	20.001
23	235.171	131.415	54.6081	19.8768	20.001
24	237.961	132.847	26.7766	9.74641	20.001
25	240.751	134.314	7.56695	2.7543	20.001
26	243.541	135.816	0	0	0

List Of Coordinates

Water Table

X	Y
-200	80
1200	80

External Boundary

X	Y
618	256
609	258
534	228
498	216
489	218
414	188
378	176
369	178
294	148
258	136
249	138
174	108
144	98
140	96
114	96
66	80
-200	80
-200	-80
-200	-90
-200	-120
1200	-120
1200	-90
1200	-80
1200	80

1200	104.4
1200	106.4
1200	136
1200	176
1200	216
1200	256
1200	328
1200	319.516
1200	330
1085	330
840	330
738	296
729	298
654	268

Material Boundary

X	Y
66	80
192	80
1200	80

Material Boundary

X	Y
140	96
144	96
180	84
192	80

Material Boundary

X	Y
180	86
329.258	88.9852
579.842	93.9968
1200	106.4

Material Boundary

X	Y
150	96
180	86

Material Boundary

X	Y
-200	-80

1200	-80

Material Boundary

X	Y
624	256
1200	256

Material Boundary

X	Y
504	216
1200	216

Material Boundary

X	Y
180	84
1200	104.4

Material Boundary

X	Y
264	136
384	176
504	216
624	256
744	296

Material Boundary

X	Y
744	296
840	328
1085	328
1200	328

Material Boundary

X	Y
147	97
148.5	96.5
150	96

Material Boundary

X	Y
144	96

147	97

Material Boundary

X	Y
147	97
264	136

Material Boundary

X	Y
1200	328
1200	330

Material Boundary

X	Y
384	176
1200	176

Material Boundary

X	Y
264	136
1200	136

Material Boundary

X	Y
174	108
258	136

Material Boundary

X	Y
294	148
378	176

Material Boundary

X	Y
414	188
498	216

Material Boundary

X	Y
534	228

618	256

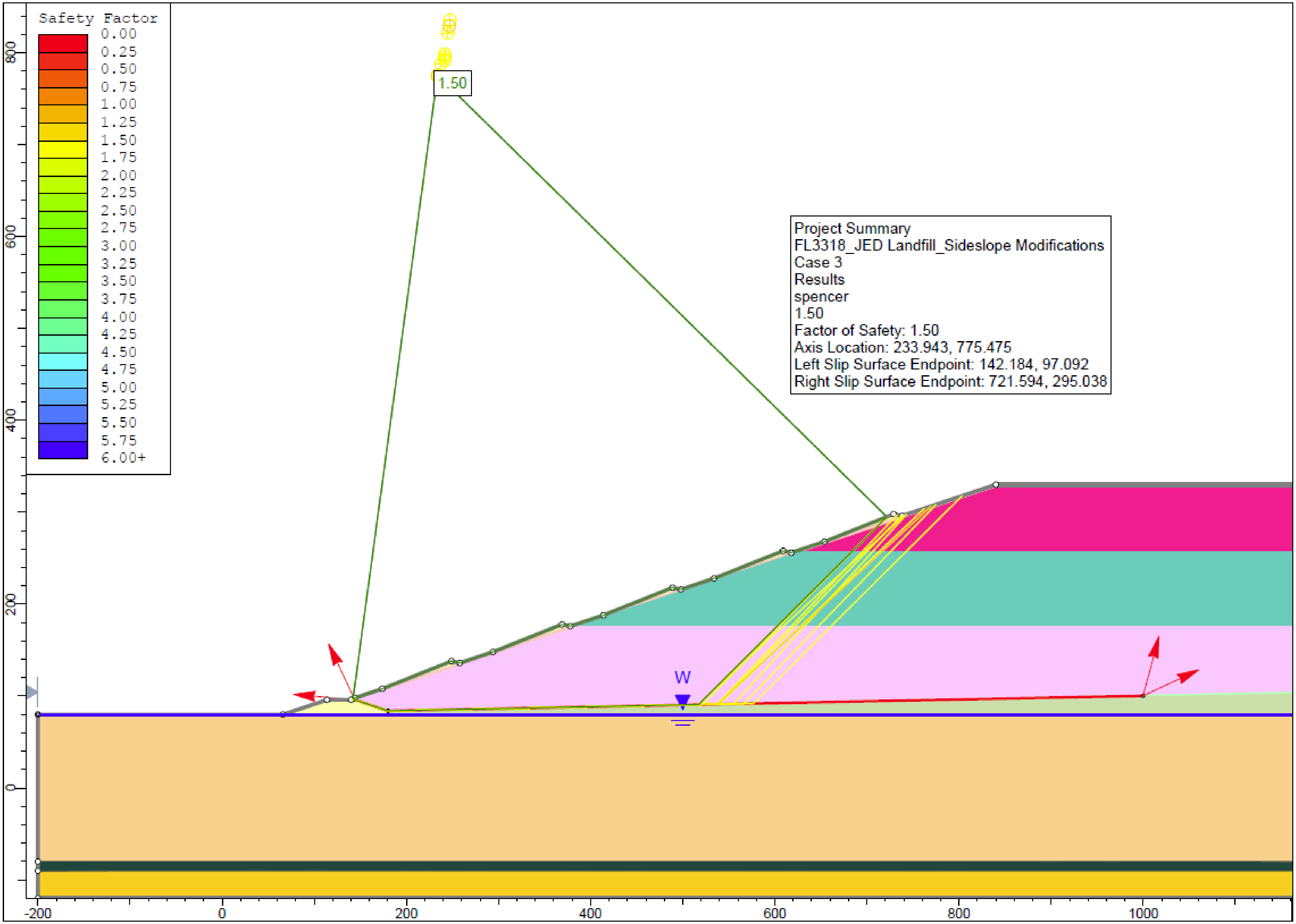
Material Boundary

X	Y
654	268
738	296

Material Boundary

X	Y
-200	-90
1200	-90

ATTACHMENT D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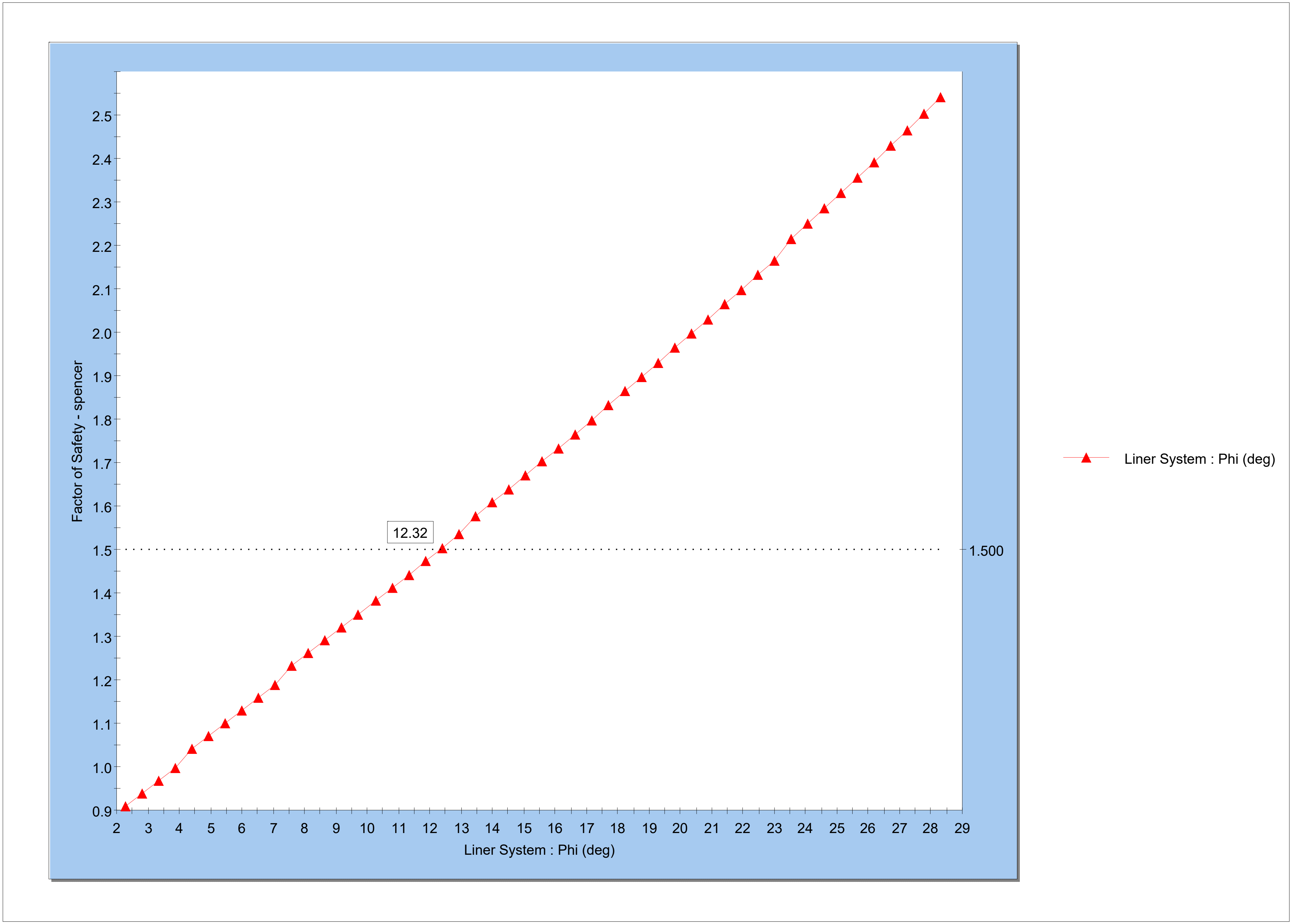
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00+
1.50
Project Summary
FL3318_JED Landfill_Sideslope Modifications
Case 3
Results
spencer
1.50
Factor of Safety: 1.50
Axis Location: 233.943, 775.475
Left Slip Surface Endpoint: 142.184, 97.092
Right Slip Surface Endpoint: 721.594, 295.038
W
800
600
400
200
0
-200
0
200
400
600
800
1000



Factor of Safety - spencer
Liner System : Phi (deg)
12.32
1.500
Liner System : Phi (deg)

Slide Analysis Information

FL3318_JED Landfill_Sideslope Modifications

Project Summary

File Name: Case 3
Slide Modeler Version: 6.039
Project Title: FL3318_JED Landfill_Sideslope Modifications
Analysis: Case 3

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Enabled
Left Projection Angle (Start Angle): 115
Left Projection Angle (End Angle): 175
Right Projection Angle (Start Angle): 25
Right Projection Angle (End Angle): 75
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Berm Fill	Compacted Subgrade	Silty Sand	Hawthorne Formation	Final Cover System	Liner System	Upper MSW	Middle MSW
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function
Unit Weight [lbs/ft3]	120	120	115	115	120	120	54	72
Cohesion [psf]	0	0	0	0	0	0		
Friction Angle [deg]	35	35	30	30	35	12.3		
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Property	Lower MSW	Hawthorn Confining
Color		
Strength Type	Shear Normal function	Mohr-Coulomb
Unit Weight [lbs/ft3]	82	120
Cohesion [psf]		5000
Friction Angle [deg]		0
Water Surface	Water Table	Water Table
Hu Value	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: On
Probabilistic Analysis: Off

Variables

Material	Property	Distribution	Mean	Min	Max
Liner System	Phi	Normal	12.3	2.3	28.3

Global Minimums

Method: spencer

FS: 1.496400
Axis Location: 233.943, 775.475
Left Slip Surface Endpoint: 142.184, 97.092
Right Slip Surface Endpoint: 721.594, 295.038
Resisting Moment=8.02043e+008 lb-ft
Driving Moment=5.35983e+008 lb-ft
Resisting Horizontal Force=991253 lb
Driving Horizontal Force=662427 lb
Total Slice Area=41065.3 ft2

Global Minimum Coordinates

Method: spencer

X	Y
142.184	97.0919
144	96
180	84
517.12	90.7424
721.594	295.038

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 3968
Number of Invalid Surfaces: 1032

Error Codes:

Error Code -106 reported for 1 surface
Error Code -108 reported for 92 surfaces
Error Code -111 reported for 28 surfaces
Error Code -112 reported for 911 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.4964

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.81616	217.939	Final Cover System	0	35	122.321	183.041	261.41	0	261.41
2	36	46830	Berm Fill	0	35	953.034	1426.12	2036.71	0	2036.71
3	25.9323	71803.4	Liner System	0	12.3	416.21	622.816	2856.49	0	2856.49
4	25.9323	94461.7	Liner System	0	12.3	547.549	819.353	3757.89	0	3757.89
5	25.9323	114231	Liner System	0	12.3	662.142	990.829	4544.34	0	4544.34
6	25.9323	119705	Liner System	0	12.3	693.872	1038.31	4762.13	0	4762.13
7	25.9323	137964	Liner System	0	12.3	799.706	1196.68	5488.49	0	5488.49
8	25.9323	160200	Liner System	0	12.3	928.602	1389.56	6373.08	0	6373.08
9	25.9323	182858	Liner System	0	12.3	1059.94	1586.1	7274.48	0	7274.48
10	25.9323	195758	Liner System	0	12.3	1134.72	1697.99	7787.71	0	7787.71
11	25.9323	204679	Liner System	0	12.3	1186.43	1775.37	8142.6	0	8142.6
12	25.9323	222286	Liner System	0	12.3	1288.49	1928.09	8843.02	0	8843.02
13	25.9323	242706	Liner System	0	12.3	1406.85	2105.21	9655.39	0	9655.39
14	25.9323	262949	Liner System	0	12.3	1524.19	2280.8	10460.7	0	10460.7
15	25.9323	266393	Liner System	0	12.3	1544.15	2310.67	10597.7	0	10597.7
16	2.04263	21255.3	Liner System	0	12.3	1111.64	1663.46	7629.33	0	7629.33
17	27.7631	264547	Lower MSW	94.1176	33.0002	2660.14	3980.63	5984.66	0	5984.66
18	27.7631	225187	Lower MSW	94.1176	33.0002	2271.82	3399.56	5089.89	0	5089.89
19	27.7631	186709	Lower MSW	94.1176	33.0002	1892.19	2831.48	4215.14	0	4215.14
20	27.3572	138560	Middle MSW	94.1176	33.0002	1437.45	2151.01	3167.3	0	3167.3
21	27.3572	94069.1	Middle MSW	94.1176	33.0002	991.993	1484.42	2140.86	0	2140.86
22	27.3572	57339.8	Middle MSW	94.1176	33.0002	624.247	934.124	1293.49	0	1293.49

23	27.2635	29614.8	Upper MSW	94.1176	33.0002	347.675	520.261	656.198	0	656.198
24	3.03818	1810.21	Final Cover System	0	35	173.208	259.189	370.16	0	370.16
25	6.76825	1646.74	Berm Fill	0	35	73.2698	109.641	156.583	0	156.583

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.4964

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	142.184	97.0919	0	0	0
2	144	96	507.927	135.293	14.9152
3	180	84	59309.2	15797.8	14.9152
4	205.932	84.5186	68637.2	18282.5	14.9152
5	231.865	85.0373	80908.7	21551.1	14.9152
6	257.797	85.5559	95748.4	25503.9	14.9152
7	283.729	86.0746	111299	29646.1	14.9153
8	309.662	86.5932	129222	34420.1	14.9152
9	335.594	87.1119	150034	39963.5	14.9152
10	361.526	87.6305	173789	46291	14.9152
11	387.459	88.1492	199220	53064.9	14.9152
12	413.391	88.6678	225810	60147.5	14.9152
13	439.323	89.1865	254687	67839.4	14.9152
14	465.256	89.7051	286217	76237.8	14.9152
15	491.188	90.2238	320377	85336.7	14.9152
16	517.12	90.7424	354984	94554.8	14.9152
17	519.163	92.7833	341687	91013.1	14.9152
18	546.926	120.522	249644	66496.1	14.9152
19	574.689	148.261	171623	45714.2	14.9152
20	602.453	176	107312	28584	14.9152
21	629.81	203.333	60122.6	16014.5	14.9152
22	657.167	230.667	28784.6	7667.18	14.9152
23	684.524	258	10532.6	2805.5	14.9152
24	711.788	285.24	2150.98	572.942	14.9152
25	714.826	288.275	1554.37	414.028	14.9152
26	721.594	295.038	0	0	0

List Of Coordinates

Water Table

X	Y
-200	80
1200	80

Block Search Polyline

X	Y
144	96
180	84
999.802	100.396

External Boundary

X	Y
609	258
534	228
498	216
489	218
414	188
378	176
369	178
294	148
258	136
249	138
174	108
144	98
140	96
114	96
66	80
-200	80
-200	-80
-200	-90
-200	-120
1200	-120
1200	-90
1200	-80
1200	80
1200	90
1200	104.4
1200	106.4
1200	136
1200	176
1200	216
1200	258
1200	328
1200	330
840	330
738	296
729	298
654	268
618	256

Material Boundary

X	Y
66	80
192	80
1200	80

Material Boundary

X	Y
140	96
144	96
180	84
192	80

Material Boundary

X	Y
180	86
329.258	88.9852
579.842	93.9968
1200	106.4

Material Boundary

X	Y
150	96
180	86

Material Boundary

X	Y
-200	-80
1200	-80

Material Boundary

X	Y
630.112	258
1200	258

Material Boundary

X	Y
180	84
999.802	100.396
1200	104.4

Material Boundary

X	Y
264	136
384	176
630.112	258
840	328

Material Boundary

X	Y
147	97
148.5	96.5
150	96

Material Boundary

X	Y
144	96
147	97

Material Boundary

X	Y
147	97
264	136

Material Boundary

X	Y
384	176
1200	176

Material Boundary

X	Y
840	328
1200	328

Material Boundary

X	Y
174	108
258	136

Material Boundary

X	Y
294	148
378	176

Material Boundary

X	Y
414	188
498	216

Material Boundary

X	Y
534	228
618	256

Material Boundary

X	Y
654	268
738	296

Material Boundary

X	Y
-200	-90
1200	-90

APPENDIX G

FINAL COVER SYSTEM PERFORMANCE EVALUATION

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **WCI** Project: **JED Sideslope Modifications** Project No.: **FL3318**

Phase No.: **01**

Title of Computations **FINAL COVER SYSTEM PERFORMANCE EVALUATION**

Computations by:	Signature		24 August 2018
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Computations Backchecked by: (originator)	Signature		4 Sept 2018
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Approved by: (pm or designate)	Signature		7 Sept 2018
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	Title	Senior Engineer	

Approval notes: Senior review provided by Kwasi Badu-Tweneboah, Ph.D., P.E.

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

Written by:	**A. Rivera**	Date:	**08/24/2018**	Reviewed by:	**C. Browne**	Date:	**9/07/2018**
Client:	**WCOC**	Project:	**JED Sideslope Modifications**	Project No.:	**FL3318**	Phase No.:	**01**

FINAL COVER SYSTEM PERFORMANCE EVALUATION
J.E.D. SOLID WASTE MANAGEMENT FACILITY
ST. CLOUD, OSCEOLA COUNTY, FLORIDA

1 INTRODUCTION

The purpose of this calculation package is to evaluate the performance of the final cover system modifications proposed for Cells 4, 5, 7, 8, and 12 at the J.E.D. Solid Waste Management (JED) facility. The proposed modifications involve replacing the currently permitted sideslope configuration with a tack-on berm sideslope configuration. The evaluation of final cover system performance includes: (i) analyzing head on the geomembrane in the final cover system (including selecting geocomposite transmissivity); (ii) analyzing the soil erosion resistance of the final cover system; and (iii) performing veneer (sliding on interface between components) stability analyses. The remainder of this calculation package presents the following:

- description of the final cover system;
- Hydrologic Evaluation of Landfill Performance (HELP) model analyses;
- required transmissivity of the final cover geocomposite;
- soil erosion resistance of the final cover system; and
- veneer stability analysis.

2 DESCRIPTION OF FINAL COVER SYSTEM

The general cross-section of the final cover system on the sideslopes for the JED facility is presented in **Figure 1** and consists of the following components, from top to bottom:

- 6-inch thick topsoil layer and vegetation;
- 18-inch thick protective soil layer;
- geocomposite drainage layer consisting of a geonet with non-woven geotextile heat-bonded on both sides;

- 40-mil thick textured polyethylene (PE) geomembrane liner; and
- 12-inch thick bedding/intermediate cover soil layer

The components of the final cover system at the proposed tack-on berms are the same as above, except the geocomposite drainage layer below the tack-on berm is overlain by a thicker protective soil layer due to the configuration of the proposed sideslope geometry as presented in **Figure 1**. Beneath the crest of the tack-on berm, the geocomposite drainage layer is overlain by a maximum overburden thickness of 84 inches.

As the proposed sideslope modifications do not change the geometry of the final cover system on the top slope area of the landfill, only the sideslope modifications are analyzed in the calculation.

3 HELP MODEL ANALYSES

3.1 Purpose

The Hydrogeologic Evaluation of Landfill Performance (HELP) model, Version 3.07 (Schroeder, 1994a, 1994b) was used to estimate the peak daily lateral drainage for the proposed final cover system for the JED landfill. The HELP model is a quasi-two-dimensional water balance computer program used to evaluate the vertical movement of water through final cover soils and geosynthetics, in addition to the waste and components of the liner system. The lateral drainage obtained from the HELP model was then used to compute the maximum head on the geomembrane in the final cover system. The head on geomembrane is required to evaluate the stability of the final cover system proposed for the sideslopes of the landfill.

3.2 Cases Analyzed

It is anticipated that sandy soils, such as those commonly found in Florida borrow areas, will be used in the final cover system. The typical range of soil permeability for borrow soils in Florida is between 1×10^{-2} and 1×10^{-5} centimeters per second (cm/s). Two cases (Case A and Case B) were considered to estimate peak daily lateral drainage, which represent soil layer permeabilities of 1×10^{-2} and 1×10^{-5} cm/s, respectively.

3.3 Geocomposite Properties

The geocomposite properties used in the calculation of heads and lateral drainage rate for the JED landfill are based on properties of commercially available geocomposites. Note that it is not the objective of this section to identify specific geocomposites for use in the construction of the final cover system. However, the performance of commercially available materials is checked against the minimum requirements identified in this evaluation.

3.4 Reduction Factors

The reduction factors used to predict the long-term performance of the drainage geocomposite in the cover system are discussed in this section. The following discussion details the use of the reduction factors on the geocomposite transmissivity, as suggested by Koerner and Narejo (2005) and GRI (2013).

The required transmissivity ($\theta_{req'd}$) is the minimum transmissivity required for a candidate geocomposite to maintain the head on the geomembrane within the thickness of the geocomposite. The required transmissivity ($\theta_{req'd}$) is obtained by applying a factor of safety (*FS*) to the long-term-in-soil transmissivity (θ_{LTIS}) of the candidate geocomposite. Koerner (2005) provides relationships for *FS*, reduction factors, and flow rates for a geocomposite layer which can be expressed as functions of θ_{LTIS} and $\theta_{req'd}$ for a given layer thickness:

$$FS = \frac{\theta_{LTIS}}{\theta_{model}} \qquad \text{Equation 1}$$

$$\theta_{LTIS} = \frac{\theta_{req'd}}{\Pi(RF)} = \frac{\theta_{req'd}}{RF_{in} \cdot RF_{cr} \cdot RF_{cc} \cdot RF_{bc}} \qquad \text{Equation 2}$$

where:

- *FS* = the overall factor of safety;
- θ_{LTIS} = the long-term-in-soil hydraulic transmissivity of the drainage geocomposite;

$\theta_{req'd}$ = the minimum transmissivity required to maintain the head on the geomembrane liner below the regulatory requirement. This is the transmissivity measured in a geosynthetics testing laboratory;

θ_{model} = the minimum transmissivity required to maintain the head on the geomembrane liner as calculated in the HELP model;

RF_{in} = reduction factor for elastic deformation or intrusion of the adjacent geotextiles into the drainage channel;

RF_{cr} = reduction factor for creep deformation of the drainage core and/or adjacent geotextile into the drainage channel;

RF_{cc} = reduction factor for chemical clogging and/or precipitation of chemicals in the drainage core space;

RF_{bc} = reduction factor for biological clogging in the drainage core space; and

$\Pi(RF)$ = cumulative reduction factors.

For landfill final cover systems, Koerner and Narejo (2005) recommends reduction factors for creep (RF_{cr}) ranging from 1.2 to 1.4 and reduction factors for intrusion (RF_{in}) ranging from 1.3 to 1.5. Following these recommendations, RF_{cr} and RF_{in} were assumed as 1.3 and 1.4, respectively.

GRI (2013) provides guidance for clogging reduction factors for landfill final cover systems. Chemical and biological clogging can increase over time as infiltrating water passes through the geocomposite. GRI (2013) recommends a chemical clogging reduction factor (RF_{cc}) between 1.0 and 1.2 and a biological clogging reduction factor (RF_{bc}) between 1.2 and 3.5 at final conditions. Based on recommendations by GRI, RF_{cc} was assumed as 1.2. The final cover geocomposite is potentially susceptible to biological clogging due to root penetrations from the vegetative cover, therefore RF_{bc} was assumed as 2.4, which is the average of the recommended range.

The reduction factors for infiltration, creep, chemical clogging, and biological clogging used in the analyses for the final cover system are summarized in the following table:

RF_{in}	RF_{cr}	RF_{cc}	RF_{bc}	$(RF)_{total}$
1.3	1.4	1.2	2.4	5.24

There are also other reduction factors including RF_{IMCO}, RF_{IMIN}, RF_{CD}, RF_{PC} that were not used in the analyses. A description of these reduction factors and the reasons for not using them in the analyses are as follows:

RF_{IMCO} = reduction factor for immediate compression. This reduction factor was not used in the analyses since the geocomposite transmissivity will be measured under a normal stress equal to or greater than the anticipated normal stress in the field;

RF_{IMIN} = reduction factor for immediate intrusion. This reduction factor may not be used if the geocomposite transmissivity test simulates the boundary conditions in the field. This reduction factor was not used in the analyses since geocomposite transmissivity will be measured under field conditions.

RF_{CD} = reduction factor for chemical degradation. This reduction factor can be assumed to be 1.0 if the geocomposite is not expected to degrade during the design life of the facility or be exposed to harmful chemicals. This reduction factor was not used in the analyses because degradation due to harmful chemicals is not anticipated.

RF_{PC} = reduction factor for particulate clogging. This reduction factor can be assumed to be 1.0 if an adequate filter fabric is selected. This reduction factor was not used in the analyses because the geotextile filter fabric is anticipated to adequately prevent clogging.

3.5 Transmissivity Values Used in HELP Model Analyses

The HELP model uses McEnroe's equation to calculate the head on the geomembrane liner. However, it has been demonstrated that the maximum head on the geomembrane liner, as calculated by McEnroe's equation, is valid only when the head lies within the thickness of the geocomposite (Ellithy and Zhao, 2001). Furthermore, McEnroe's equations are mathematically sensitive under certain ranges of drainage layer slope and hydraulic conductivity and may produce incorrect results. As such, the head on the geomembrane liner computed by the HELP model was not used.

The head on the cover system was computed using an alternative method presented by Giroud et al. (2004), based on simplified assumptions and numerical methods for calculating the maximum liquid thickness and the maximum head in drainage systems composed of two layers, with the lower layer being a geocomposite. The solution for maximum liquid thickness and maximum head takes into consideration the liquid impingement rate, the hydraulic conductivities of the two layers, the length of the drainage path, and the slope. The liquid impingement rate, q_h, was obtained from the HELP model analysis output for the peak monthly average lateral drainage in the geocomposite drainage layer.

The geocomposite transmissivity was adjusted iteratively for Cases A and B to calculate the minimum transmissivity value (θ_{model}) required to maintain a head on the geomembrane liner less than or equal to the thickness of the geocomposite (i.e., 0.25 inches), in compliance with the established design criteria. The minimum transmissivity calculated using the HELP model was then used to compute the required transmissivity values ($\theta_{req'd}$) using the cumulative reduction factors and the assumed *FS* of 2. A final check was made to ensure that the computed required transmissivity values were within the range of the transmissivity values for commercially available geocomposites when tested under the conditions discussed above.

3.6 Input Data for HELP Model

The HELP model requires weather, soil, and basic design data as input and uses solution techniques that account for above-surface and subsurface hydraulic processes including precipitation, runoff, and evapotranspiration. The simulation period used in the HELP model analysis for the JED landfill was 30 years.

3.6.1 Weather Data

The HELP model allows default and synthetically generated weather, precipitation, temperature, solar radiation, and evapotranspiration data for specific cities in the United States. Since no default precipitation data were available for Orlando, Florida, precipitation data from the National Oceanic and Atmospheric Administration (NOAA) 1975-2004 Monthly Normals was used and then the peak daily precipitation value was adjusted to reflect the 25-year, 24-hour design storm event of 8.45 inches (representative of a peak storm event that may statistically occur within the 30-year simulation period) as presented in **Table 1**. Temperature and solar radiation data were synthetically generated using Orlando, Florida as the nearby city. Evapotranspiration was also synthetically generated using Orlando, Florida as well as an assumed 22 inches of evaporative zone depth (representing fair conditions) and a maximum leaf area index of 3.5 (representing a good stand of grass on the final cover system).

3.6.2 Soil and Design Data

Subsections 3.6.3 and 3.6.4 describe the parameters considered for the input data required for the soil and design data in the cases analyzed for the JED landfill.

3.6.3 Initial Moisture Content

Default values for initial moisture content were calculated by the HELP model for approximately steady-state conditions and used for all soil layers.

3.6.4 Layer Data

Layer data were selected based on Geosyntec's experience, knowledge with local soils and site conditions, and the HELP model recommendation. The HELP model provides default parameters based on the soil classification per the Unified Soil Classification System (USCS) or the United States Department of Agriculture (USDA) textural classification system.

The HELP model recognizes four general types of layers: (i) vertical percolation layer; (ii) lateral drainage layer designed to convey drainage laterally to a collection and removal system; (iii) soil barrier layer designed to restrict vertical leakage or percolation through which a saturated vertical flow is allowed; and (iv) flexible membrane liners.

Attachment A shows the input properties of each layer for the two cases analyzed using the HELP model. Other information used in the HELP model analyses is presented in the following section.

3.6.5 *Miscellaneous Input*

3.6.5.1 Geomembrane Liner

- Pinhole density corresponds to the number of assumed defects in a given area with a hole diameter equal to or smaller than the geomembrane thickness. A conservative hole diameter of 1 mm was used in the HELP model analyses. Two pinholes per acre were assumed in the analyses, which is a typical assumption for a manufacturer with a good quality control program.
- Installation defects correspond to the assumed number of defects in a given area with a hole diameter larger than the geomembrane thickness. A circular hole size of 1 cm^2 was used in the HELP model analyses. Installation defects are the result of seaming faults and punctures during installation. Two defects per acre were assumed in the analyses, which is a typical assumption for a project with a good construction quality assurance (CQA) program.
- Geomembrane placement quality corresponds to the potential for flow through installation and pinhole defects. A placement quality of "good" was selected, which assumes an installation with a well-prepared, smooth soil surface, and geomembrane wrinkle control to ensure good contact between the geomembrane and the adjacent soil.

3.6.5.2 Final Cover Drainage Path Lengths

Generally, the tack-on berms are vertically spaced at 40 ft, however, the vertical height between the lowest sideslope swale (Elev. 138 ft) and the toe of the sideslope varies, with a maximum vertical height of 48 ft. Therefore, the longest drainage path for the proposed cover system was conservatively assumed to be equal to approximately 150 ft, which corresponds to the lateral slope distance when using the maximum vertical height of the sideslope configuration of 48 ft.

3.6.5.3 Surface Soil Texture

The surface soil texture assumed in each case corresponds to the default vegetated topsoil layer properties used for the cover system.

3.6.5.4 Surface Vegetation

The surface vegetation assumed in each case corresponds to a good stand of grass (vegetation type number 4 in the HELP model).

3.7 Results and Summary of the HELP Analyses

The results of the HELP model analyses are summarized in **Table 2**. A summary of the input data used in the HELP model analysis is presented in **Attachment A** of this calculation package. Output files from the HELP model for each case are included in **Attachment B**. The parameters used to compute the heads using Giroud's method are presented in the spreadsheets included in **Attachment C** of this calculation package.

Table 2 also presents a summary of the peak daily lateral drainage and heads for the final cover system. As noted in **Table 2**, the head on the final cover geomembrane is less than the thickness of the geocomposite (i.e., 0.25 inches) for all cases analyzed. It is noted that the minimum required transmissivity values to maintain a head-on-liner value within the thickness of the geocomposite can be achieved with commercially available products.

4 SOIL EROSION RESISTANCE OF THE FINAL COVER SYSTEM

The purpose of this calculation is to estimate the average annual soil loss from the proposed final cover system and evaluate the erosion resistance by comparing the calculated loss to the published acceptable range. Erosion of the final cover will be controlled by the cover swales, cover vegetation, and cover system maintenance program. The average annual soil loss on the cover can be estimated using the Revised Universal Soil Loss Equation (RUSLE) (USDA, 1997):

$$A = R \cdot K \cdot LS \cdot C \cdot P \qquad \text{Equation 3}$$

where:

A = average annual soil loss (ton/acre/year);

R = rainfall and runoff erosivity index;

K = soil erodibility factor (ton/acre/year);

LS = topographic factor accounting for slope length and slope steepness;

C = cover management factor; and

P = practice factor.

The parameter values used with Equation 3 are as follows:

- runoff erosivity index (R) of 475, based on USDA (1997), as presented in **Figure 2**;
- soil erodibility factor (K) of 0.05. Soils specific to the site area are predominantly fine sands, based on the survey generated for the site area (USDA, 2018), as presented in **Attachment D**. K for a majority (greater than 98 percent) of the soils specific to the site typically range from 0.2 to 0.5 (see **Attachment D**). The value of 0.5 was conservatively selected;
- topographic factor (LS) interpolated to be 9.56 for a 150 ft horizontal sideslope length between drainage benches (the maximum for the final cover system), based on USDA (1997). A 37 percent slope was selected (weighted average of 2.5 horizontal to 1 vertical (2.5H:1V) slope of the tack-on berm geometry and the 3H:1V of the sideslope between tack-on berms) and a high ratio of rill to interrill erosion was conservatively assumed (see **Table 3**);
- cover management factor (C) equal to 0.013, based on USDA (1977). The final cover system is categorized as having no appreciable canopy with a vegetated cover of grass at least 2 inches deep. An 80 percent vegetated cover was conservatively assumed (see **Table 4**); and
- practice factor (P) equal to 1, for sites not subjected to agricultural practices, based on USEPA (1982) (see **Table 5**).

Using Equation 3 and the above parameter values the following is calculated:

$$A = 475 \times 0.05 \times 9.56 \times 0.013 \times 1$$

$$A = 2.95 \text{ tons/acre/year}$$

The average annual soil loss due to erosion was calculated to be 2.95 tons/acre/year for the final cover sideslopes of 37 percent. This value is lower than the maximum allowable soil loss of 5 tons/acre/year for landfill covers following general guidelines from the University of Wisconsin-Madison (1988). For a total soil unit weight (γ) of 120 pounds per cubic foot (pcf), the calculated soil loss with respect to thickness (A/γ) equates to approximately 0.015 inches per year. Over a 30-year post closure period, the soil loss is calculated to be about 0.45 inches, or approximately 1.87 percent of the total final cover thickness.

5 FINAL COVER SYSTEM VENEER SLOPE STABILITY

The purpose of this calculation is to evaluate the veneer stability of the final cover system to evaluate the final cover system stability along the proposed landfill sideslopes. The subsequent sections present several aspects of the veneer stability analysis.

5.1 Input Parameters and Assumptions

The following geometric parameters, material properties and assumptions were established with respect to the veneer stability analyses performed for the sideslope and tack-on berm (i.e., drainage swale) configuration:

- final cover system side slope is 40 percent (conservatively assumed that 2.5H:1V slope of the tack-on berm geometry is the critical slope) and corresponding slope angle of 21.8 degrees;
- assume total unit weight of 120 pcf and saturated unit weight of 135 pcf for the final cover system soils, typical for medium-compacted sand;
- the soils local to the site are predominantly sands and loamy sands. Assume an internal friction angle (ϕ) of 35 degrees and a cohesion (c) of zero for the cover system soil;
- final cover system thickness is 3.75 ft (the cover system thickness is variable due to the tack-on berm geometry and ranges from 6 ft thick below the swale crest to 2 ft thick between sideslopes. Therefore, an average cover thickness of 3.75 ft was used based on the weighted average of the overburden);

- maximum vertical height of the sideslope configuration varies, and is assumed to be 50 ft.
- assume 0.25 inches of water flow thickness along the length of the sideslopes for the cover system, based on the results from the HELP model analyses and the method proposed by Giroud et al. (2004); and
- assume zero interface adhesion (*a*) along a defined slip surface.

5.2 Method of Analysis

5.2.1 *Giroud et al. (1995) Method*

The veneer slope stability of the final cover system with the proposed sideslope modification geometry was evaluated using the method proposed by Giroud et al. (1995) for geosynthetic-soil layered systems. The factor of safety (*FOS*) for a layered system of uniform thickness is given by the following equation:

$$FS = \left[\frac{\gamma_t(t - t_w) + \gamma_b t_w}{\gamma_t(t - t_w) + \gamma_{sat} t_w}\right]\frac{\tan\delta}{\tan\beta} + \frac{a/\sin\beta}{\gamma_t(t - t_w) + \gamma_{sat} t_w}$$

$$+\left[\frac{\gamma_t(t - t^*_w) + \gamma_b t^*_w}{\gamma_t(t - t_w) + \gamma_{sat} t_w}\right]\left[\frac{\tan\phi/(2\sin\beta\cos^2\beta)}{1 - \tan\beta\tan\phi}\right]\frac{t}{h}$$

$$+\left[\frac{1}{\gamma_t(t - t_w) + \gamma_{sat} t_w}\right]\left[\frac{1/(\sin\beta\cos\beta)}{1 - \tan\beta\tan\phi}\right]\frac{ct}{h} \qquad \text{(Equation 4)}$$

where:

FS = factor of safety;

δ = interface friction angle along the slip surface (degrees);

a = apparent interface adhesion (psf);

ϕ = internal friction angle of the soil component of the layered system (degrees);

c = apparent cohesion of the soil component of the layered system (psf);

γ_t = moist soil unit weight (pcf);

γ_b = buoyant soil unit weight (pcf);

γ_{sat} = saturated soil unit weight (pcf);

t = soil layer thickness above the geocomposite (ft);

t_w = water depth above critical interface (ft);

t^*_w = water depth at slope toe (ft);

β = slope inclination (degrees); and

h = vertical height of slope (ft).

A parametric analysis was performed to establish the minimum interface friction angle (δ) such that the calculated veneer stability *FOS* is equal to or greater than 1.5, as recommended by Duncan (1992) and USEPA (2004) as the minimum requirement for long-term slope stability of final cover systems. The parametric analysis was performed by calculating the *FOS* from Equation 4 for various values of interface friction angle.

Figure 3 presents the results of the parametric analysis for the proposed final cover system geometry. A summary of the input and output used in the computations is provided as **Table 6**. Based on the input parameters presented above, a minimum interface friction angle of 29.1 degrees is required to meet a *FOS* of 1.5 which is the minimum requirement for long-term slope stability.

5.2.2 Slide® Analysis

Due to the non-ideal geometry of the proposed sideslope modifications (i.e., tack-on berm), a slope stability analysis of non-circular slip surfaces was performed using Spencer's method (Spencer, 1973), as implemented in the computer program Slide® version 6.0 (Rocscience, 2010). Spencer's method is utilized because it satisfies vertical and horizontal force equilibrium and moment equilibrium. Slide® was used to generate potential slip surfaces, calculate the *FOS* for each of these surfaces, and identify the slip surface with the lowest *FOS*. The slip surface with the lowest *FOS* is considered the critical potential slip surface. Information required for the analyses includes:

- the geometry of the landfill (e.g., liner system and final fill grades) at the cross-section location;

- the subsurface soil stratigraphy at the cross-section location;
- the material properties for waste, structural fill, final cover system, and subsurface materials; and
- the water table elevation for the cross-section location.

The input parameters utilized in the slope stability analysis may be referenced in the "Slope Stability Analyses" calculation package included as part of this intermediate permit modification submittal.

The slope stability analysis presented herein evaluated non-circular (block) failure mechanisms that pass through the berm fill material utilized in constructing the tack-on berm and along the geosynthetic cap system of the final configuration of the proposed sideslope modifications. The results of the non-circular shear surface slope stability analysis for the critical cross section for the proposed final configuration of the JED facility and output files are included in **Attachment E**. Based on the sensitivity analyses performed for shearing along the cap system, a minimum peak interface friction angle of 29.2 degrees is required to meet a *FOS* of 1.5, as illustrated in **Figure 4**.

5.3 Veneer Stability Results

The results of the parametric analysis for the veneer slope stability using the method proposed by Giroud et al. (1995) for the proposed sideslope geometry of the final cover system are presented on **Figure 3**. Based on the input parameters presented above and utilizing a 40 percent slope, a minimum interface friction angle of 29.1 degrees is required to meet a *FOS* of 1.5. Based on the sensitivity analysis performed for shearing along the cap system using Slide® (see **Figure 4**), a minimum peak interface friction angle of 29.2 degrees is required to meet a *FOS* of 1.5. Therefore, the resulting interface friction angle of 29.2 degrees governs the design.

It is noted that the required interface friction angle is less than the range of soil-geosynthetic and geosynthetic-geosynthetic interface friction angles (e.g., 31.0 to 36.1 degrees) from CQA test results performed during partial closure construction of Cells 1 to 4.

Prior to construction of the final cover system and tack-on berms, the interface friction angles between the actual soil and geosynthetic materials shall be verified by performing site-specific interface shear strength testing.

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TABLES

Table 1

Point Precipitation Frequency Estimates, from NOAA (2018)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.476 (0.385-0.598)	0.542 (0.439-0.682)	0.648 (0.523-0.818)	0.733 (0.588-0.931)	0.846 (0.654-1.11)	0.931 (0.704-1.24)	1.01 (0.741-1.40)	1.09 (0.767-1.56)	1.19 (0.807-1.76)	1.27 (0.838-1.92)
10-min	0.696 (0.564-0.876)	0.794 (0.643-0.999)	0.949 (0.765-1.20)	1.07 (0.861-1.36)	1.24 (0.958-1.62)	1.36 (1.03-1.82)	1.48 (1.09-2.04)	1.60 (1.12-2.28)	1.75 (1.18-2.58)	1.86 (1.23-2.81)
15-min	0.849 (0.688-1.07)	0.968 (0.784-1.22)	1.16 (0.934-1.46)	1.31 (1.05-1.66)	1.51 (1.17-1.98)	1.66 (1.26-2.22)	1.81 (1.32-2.49)	1.95 (1.37-2.78)	2.13 (1.44-3.15)	2.26 (1.50-3.43)
30-min	1.36 (1.10-1.71)	1.55 (1.25-1.95)	1.85 (1.49-2.34)	2.09 (1.68-2.66)	2.42 (1.87-3.17)	2.66 (2.01-3.55)	2.89 (2.12-3.99)	3.12 (2.19-4.45)	3.41 (2.31-5.04)	3.62 (2.39-5.48)
60-min	1.83 (1.48-2.30)	2.08 (1.68-2.62)	2.48 (2.00-3.13)	2.81 (2.25-3.56)	3.24 (2.51-4.25)	3.57 (2.70-4.77)	3.88 (2.84-5.36)	4.20 (2.95-5.99)	4.60 (3.11-6.80)	4.89 (3.23-7.41)
2-hr	2.29 (1.87-2.86)	2.61 (2.12-3.26)	3.11 (2.52-3.90)	3.52 (2.84-4.44)	4.06 (3.16-5.30)	4.47 (3.41-5.95)	4.88 (3.59-6.68)	5.28 (3.73-7.48)	5.79 (3.94-8.50)	6.17 (4.10-9.27)
3-hr	2.53 (2.06-3.15)	2.87 (2.35-3.58)	3.44 (2.80-4.30)	3.91 (3.16-4.91)	4.55 (3.56-5.93)	5.04 (3.86-6.69)	5.53 (4.10-7.57)	6.03 (4.29-8.54)	6.69 (4.58-9.80)	7.18 (4.80-10.8)
6-hr	2.93 (2.40-3.62)	3.35 (2.74-4.14)	4.06 (3.32-5.05)	4.69 (3.81-5.86)	5.60 (4.43-7.32)	6.34 (4.90-8.42)	7.11 (5.31-9.74)	7.93 (5.69-11.2)	9.05 (6.25-13.3)	9.95 (6.68-14.8)
12-hr	3.35 (2.77-4.12)	3.87 (3.19-4.76)	4.80 (3.95-5.93)	5.67 (4.64-7.04)	7.00 (5.61-9.20)	8.13 (6.34-10.8)	9.36 (7.06-12.8)	10.7 (7.75-15.2)	12.6 (8.79-18.4)	14.2 (9.58-20.9)
24-hr	3.83 (3.18-4.68)	4.44 (3.68-5.43)	5.60 (4.62-6.86)	6.70 (5.51-8.26)	8.45 (6.84-11.1)	9.97 (7.84-13.3)	11.6 (8.85-15.9)	13.5 (9.86-19.1)	16.2 (11.4-23.6)	18.4 (12.5-27.0)
2-day	4.44 (3.70-5.39)	5.10 (4.25-6.19)	6.36 (5.28-7.75)	7.60 (6.28-9.31)	9.57 (7.81-12.5)	11.3 (8.96-15.0)	13.2 (10.1-18.0)	15.4 (11.3-21.6)	18.5 (13.1-26.9)	21.1 (14.5-30.8)
3-day	4.95 (4.14-5.98)	5.58 (4.66-6.75)	6.83 (5.68-8.28)	8.06 (6.68-9.83)	10.1 (8.23-13.1)	11.8 (9.40-15.6)	13.8 (10.6-18.7)	16.0 (11.8-22.4)	19.3 (13.7-27.8)	22.0 (15.1-31.9)
4-day	5.37 (4.50-6.47)	6.00 (5.02-7.23)	7.23 (6.04-8.75)	8.46 (7.02-10.3)	10.4 (8.57-13.6)	12.2 (9.74-16.1)	14.2 (10.9-19.2)	16.4 (12.2-22.9)	19.7 (14.0-28.3)	22.4 (15.4-32.4)
7-day	6.35 (5.35-7.61)	7.07 (5.94-8.47)	8.41 (7.05-10.1)	9.70 (8.08-11.7)	11.7 (9.61-15.0)	13.5 (10.8-17.5)	15.4 (11.9-20.6)	17.5 (13.0-24.2)	20.6 (14.8-29.4)	23.2 (16.1-33.4)
10-day	7.24 (6.11-8.65)	8.05 (6.79-9.63)	9.53 (8.01-11.4)	10.9 (9.10-13.1)	13.0 (10.6-16.4)	14.7 (11.7-19.0)	16.6 (12.8-22.0)	18.7 (13.9-25.6)	21.6 (15.5-30.6)	24.0 (16.7-34.4)
20-day	9.99 (8.47-11.8)	11.0 (9.37-13.1)	12.9 (10.9-15.3)	14.4 (12.1-17.3)	16.7 (13.6-20.8)	18.5 (14.8-23.5)	20.4 (15.8-26.7)	22.3 (16.7-30.2)	25.0 (18.0-35.1)	27.2 (19.0-38.8)
30-day	12.4 (10.5-14.6)	13.7 (11.6-16.2)	15.8 (13.4-18.8)	17.6 (14.8-21.0)	20.1 (16.4-24.8)	22.0 (17.6-27.7)	24.0 (18.6-31.1)	25.9 (19.4-34.9)	28.6 (20.6-39.8)	30.6 (21.5-43.5)
45-day	15.4 (13.1-18.1)	17.1 (14.6-20.1)	19.7 (16.8-23.3)	21.9 (18.5-26.0)	24.8 (20.3-30.3)	26.9 (21.6-33.6)	29.0 (22.6-37.4)	31.1 (23.3-41.5)	33.7 (24.4-46.6)	35.7 (25.2-50.5)
60-day	18.0 (15.4-21.1)	20.0 (17.1-23.5)	23.2 (19.8-27.3)	25.7 (21.8-30.5)	29.0 (23.7-35.3)	31.4 (25.2-39.0)	33.7 (26.2-43.2)	35.8 (26.9-47.6)	38.5 (27.9-53.0)	40.4 (28.6-57.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Table 2

Heads on Final Cover Geomembrane
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

Case	Drainage Length (ft)	Liner System Slope (%)	**Geocomposite Drainage Layer** Θ_{model} (m^2/s)	$\prod(RF)\cdot FS$	Geonet Thickness (in)	Permeability (cm/s)	$\Theta_{req'd}$ (m^2/s)	**HELP Model Results** Impingement Rate (Peak Daily) ($ft^3/ac/day$)	Maximum Head on Liner (in)
A	150	33.3	1.53E-04	10.483	0.25	2.4030	1.60E-03	12,235	0.235
B	150	33.3	1.42E-05	10.483	0.25	0.2240	1.49E-04	1,212	0.250

Table 3

Values for Topographic Factor (*LS*) for High Ratio of Rill to Interrill Erosion[1], from USDA (1997)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

Table 4-3.
Values for topographic factor, LS, for high ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

[1]Such as for freshly prepared construction and other highly disturbed soil conditions with little or no cover (not applicable to thawing soil)

Table 4

Cover Management Factor (C) Values for Permanent Pasture, Rangeland, Idle Land, and Grazed Woodland[1], from USDA (1977)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

Vegetal Canopy		Cover That Contacts the Surface						
Type and Height of Raised Canopy[2/]	Canopy Cover[3/] %	Type[4/]	Percent Ground Cover					
			0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

1/ All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists. Idle land refers to land with undisturbed profiles for at least a period of three consecutive years. Also to be used for burned forest land and forest land that has been harvested less than three years ago.

2/ Average fall height of waterdrops from canopy to soil surface: m = meters.

3/ Portion of total-area surface that would be hidden from view by canopy in a vertical projection, (a bird's-eye view).

4/ G: Cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 inches deep.

W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface), and/or undecayed residue.

Table 5

Values of Practice Factor, P. (USEPA, 1982)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

Practice	Land slope (percent)				
	1.1-2	2.1-7	7.1-12	12.1-18	18.1-24
Contouring (P_c)	0.6	0.5	0.6	0.8	0.9
Contour strip cropping (P_{sc})					
R-R-M-M (See Note 1)	0.3	0.25	0.3	0.4	0.45
R-R-M-M	0.3	0.25	0.3	0.4	0.45
R-R-W-M	0.45	0.38	0.45	0.6	0.68
R-W	0.52	0.44	0.52	0.7	0.9
R-O	0.6	0.5	0.6	0.8	0.9
Contour listing or ridge planting (P_{cl})	0.3	0.25	0.3	0.4	0.45
Contour terracing (P_1) (See Note 2)	$0.6/\sqrt{n}$ (See Note 3)	$0.5/\sqrt{n}$	$0.6/\sqrt{n}$	$0.8/\sqrt{n}$	$0.9/\sqrt{n}$
No support practice	1	1	1	1	1

Notes:
1) R = rowcrop, W = fall-seeded grain, O = spring-seeded grain, M = meadow. The crops are grown in rotation and so arranged on the field that rowcrop strips are always separated by a meadow or winter grain strip.
2) These P1 values estimate the amount of soil eroded to the terrace channels and are used for conservation planning. For prediction of off-field sediment, the P1 values are multiplied by 0.2.
3) n = number of approximately equal-length intervals into which the field slope is divided by the terraces. Tillage operations must be parallel to the terraces.

Table 6

Finite Slope Equation (Giroud et. al., 1995)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

FS Above GEOMEMBRANE		
Input Parameters:		
γ_t (Unit weight of soil):	120	pcf
γ_{sat} (Saturated unit weight of soil):	135	pcf
γ_w (Unit weight of water):	62.4	pcf
γ_b (Buoyant unit weight of soil):	72.6	pcf
t_w (water thickness):	0.021	ft
t* (water thickness at slope toe):	0.021	ft
δ (weakest interface friction angle):	***29.1***	deg
ϕ (friction angle of soil):	35	deg
a (interface adhesion)	0	psf
c (cohesion of soil above geocomposite)	0	psf
h (height of slope):	50	ft
t (thickness of soil layer)	3.75	ft
β (slope angle)	21.80	deg
FS	1.50	

FS Below GEOMEMBRANE		
Input Parameters:		
γ_t (Unit weight of soil):	120	pcf
γ_{sat} (Saturated unit weight of soil):	135	pcf
γ_w (Unit weight of water):	62.4	pcf
γ_b (Buoyant unit weight of soil):	72.6	pcf
t_w (water thickness):	0.021	ft
t* (water thickness at slope toe):	0.021	ft
δ (weakest interface friction angle):	***29.1***	deg
ϕ (friction angle of soil):	35	deg
a (interface adhesion)	0	psf
c (cohesion of soil above geocomposite)	0	psf
h (height of slope):	50	ft
t (thickness of soil layer)	3.75	ft
β (slope angle)	21.80	deg
FS	1.51	

FIGURES

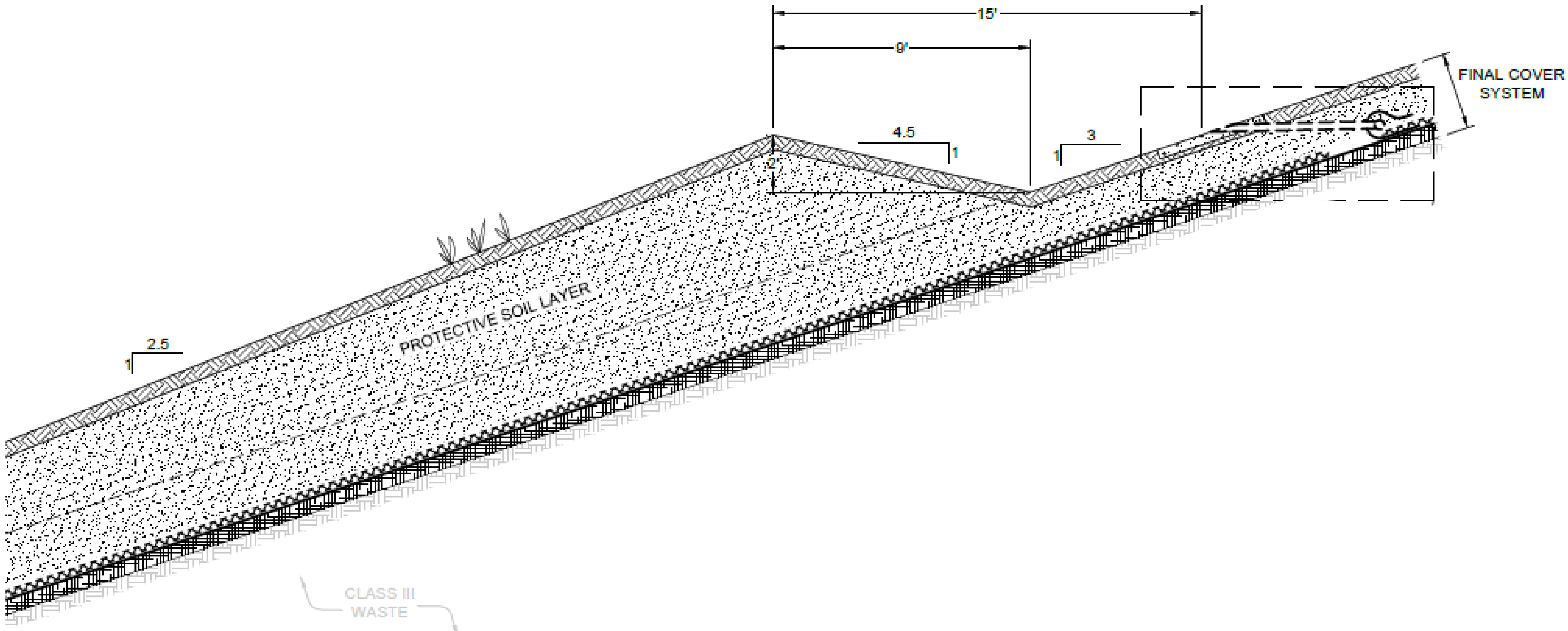

Figure 1

Typical Cross Section of Proposed Sideslope
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

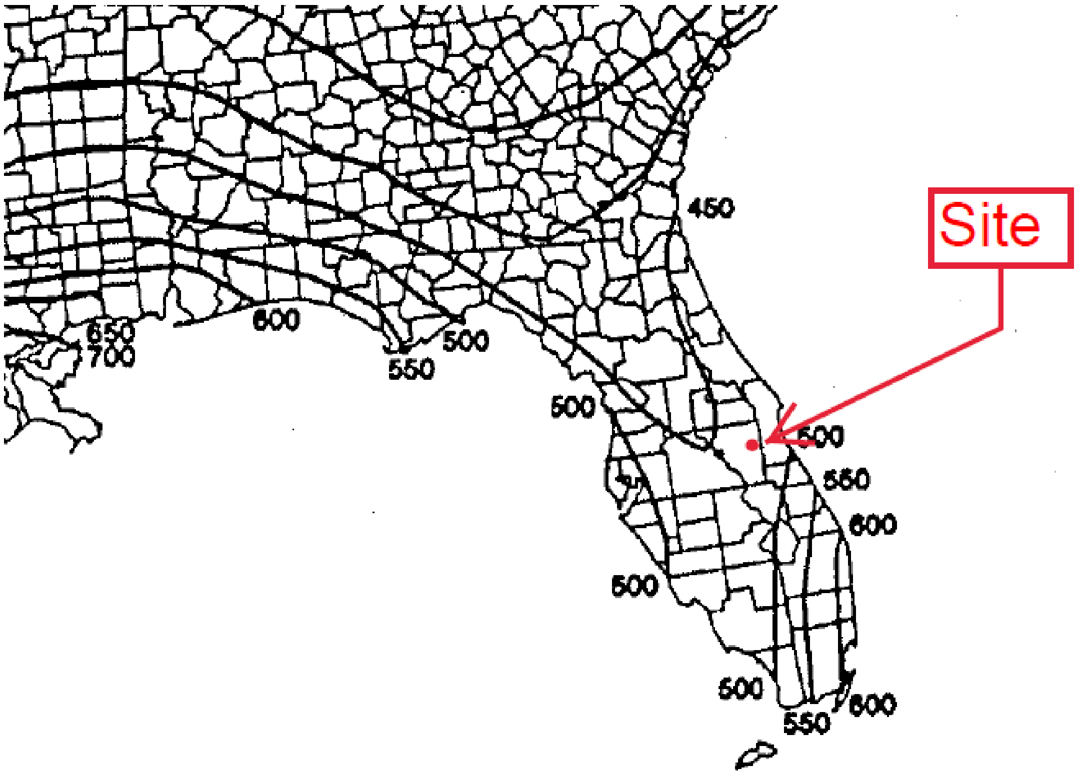

Figure 2

Average Annual Rainfall Runoff Erosivity Index (R), from USDA (1997)
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

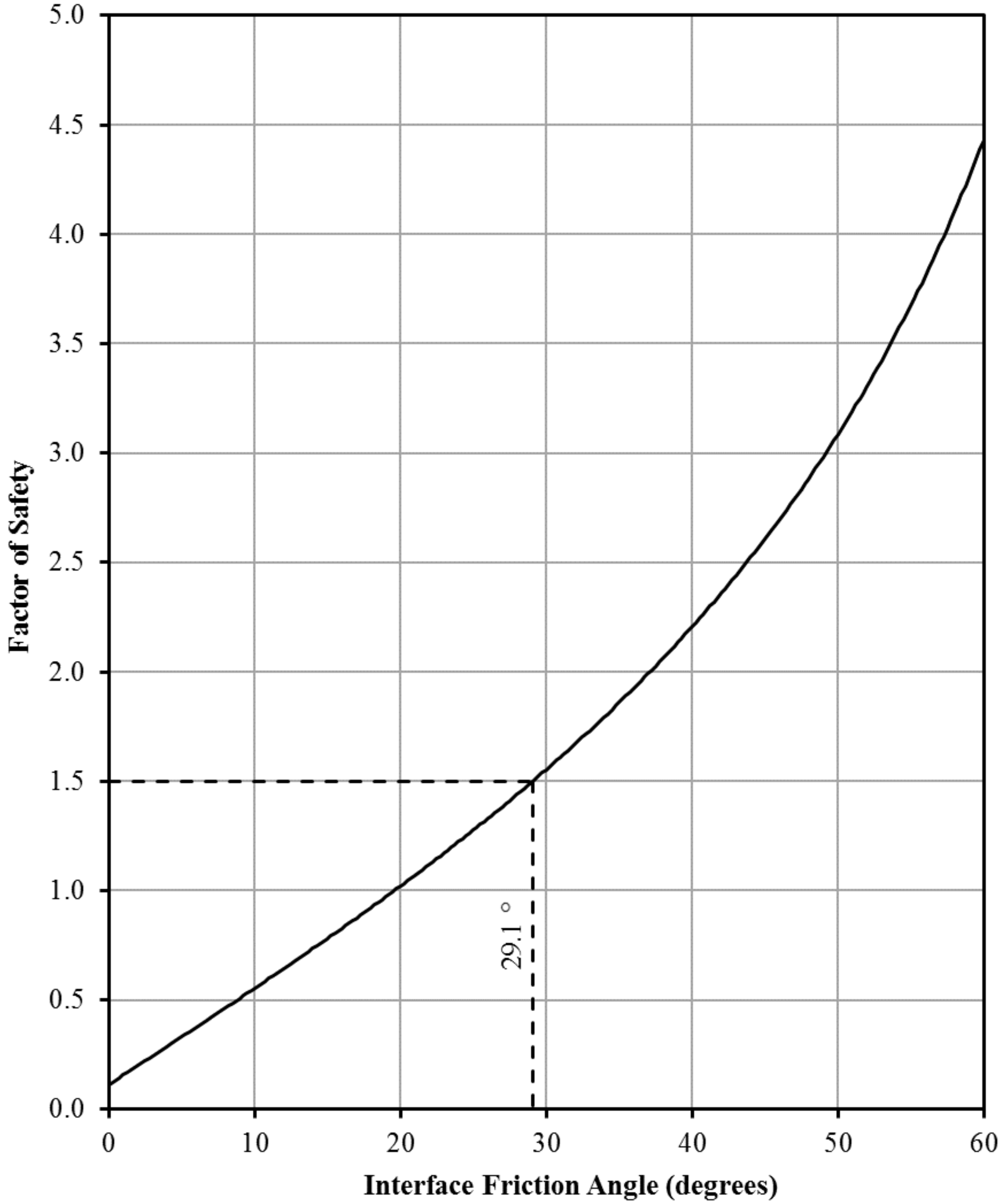

Figure 3

Proposed Side Slope Final Cover Veneer Stability
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

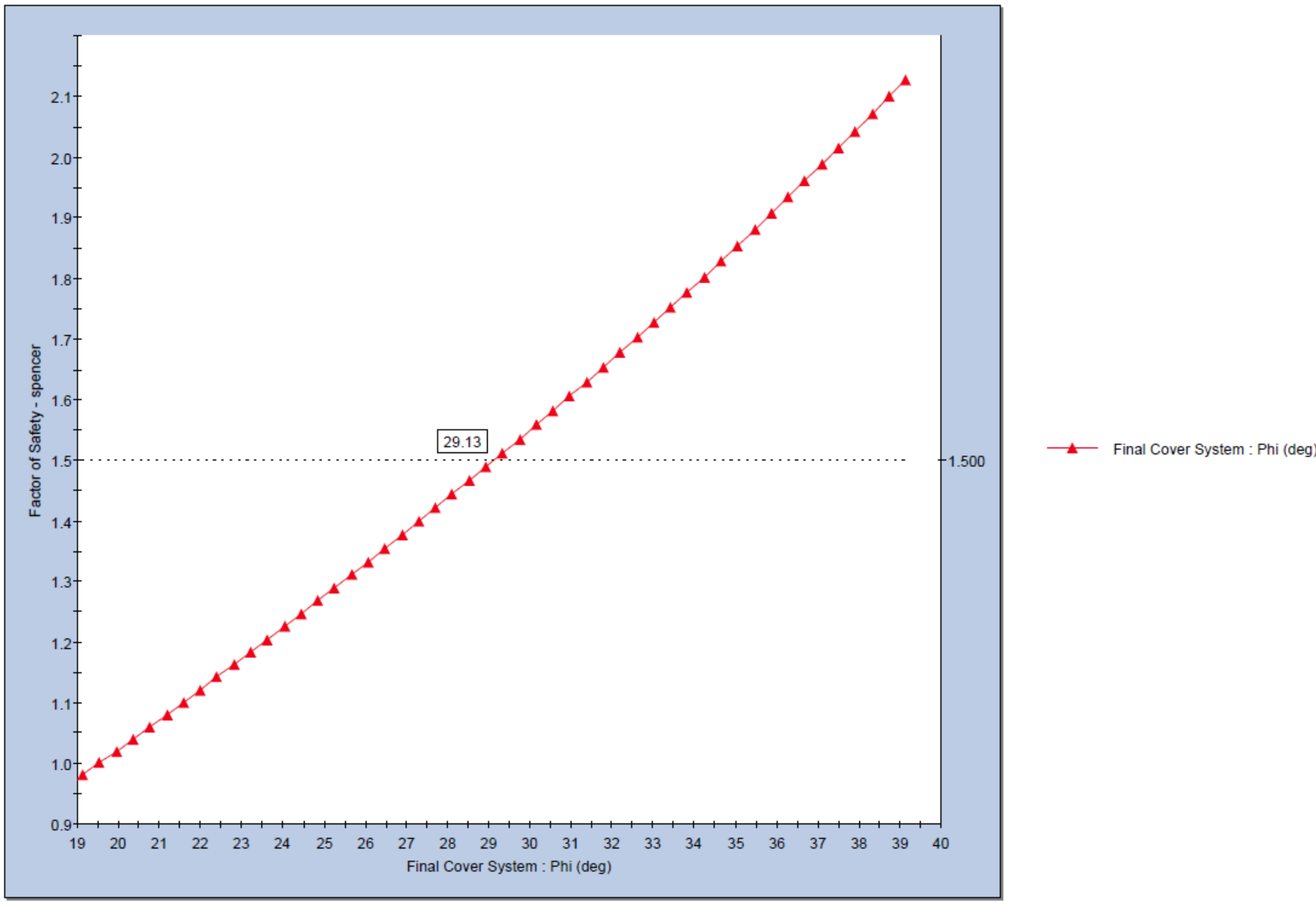

Figure 4

SLIDE® Sensitivity Plot
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

ATTACHMENT A
HELP MODEL INPUT DATA SUMMARY

INPUT DATA, CASE A
JED Sideslope Modifications
St. Cloud, FLORIDA

WEATHER DATA AND SOIL LAYERS PROPERTIES

Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	30

Temperature

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

Normal mean monthly temperature (ºF)

January	60.5	July	82.4
February	61.5	August	82.5
March	66.8	September	81.1
April	72.0	October	74.9
May	77.3	November	67.5
June	80.9	December	62.0

Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth		
bare	10	
fair	**22**	
excellent	40	
Maximum leaf area index		
bare ground	0	
poor stand of grass	1	
fair stand of grass	2	
good stand of grass	**3.5**	
excellent stand of grass	5	
Growing season start day	0	
Growing season end day	367	
Average wind speed	8.6	mph
First quarter relative humidity	72	%
Second quarter relative humidity	72	%
Third quarter relative humidity	80	%
Fourth quarter relative humidity	76	%

Runoff Curve Number

Data	Value
Slope	37.0%
Slope Length (ft)	150
Soil Texture	1
Vegetation	4
Curve Number	46.5

Geomembrane and Area

Data	Value
Placement of geomembrane	good (3)
Pinhole (# of defects/area)	2
Defect density per acre	2
Area assumed in program (acre)	1

Final Transmissivity and Conductivity

Data	Value	
$\Theta_{req'd}$	1.60E-03	m^2/s
∏(RF)	5.242	
$t_{geocomposite}$	0.250	in
Θ_{LTIS}	3.05E-04	m^2/s
Θ_{model}	1.53E-04	m^2/s
k_{sat}	2.403	cm/s

Properties of soil layers

Layer	Type	Description	Thickness (in)	Texture number	Porosity (vol/vol)	Field cap. (vol/vol)	Wilting point (vol/vol)	k (cm/s)	Drain Length (ft)	Liner slope
1	1	Vertical percolation	6	1	0.417	0.045	0.018	0.01		
2	1	Vertical percolation	39	1	0.417	0.045	0.018	0.01		
3	2	Lateral Drainage	0.250	0	0.85	0.01	0.005	2.403	150	33.3%
4	4	Geomembrane Liner	0.040	35	2E-13	0	0	2E-13		
5	1	Vertical percolation	12.000	1	0.417	0.045	0.018	0.01		

INPUT DATA, CASE B
JED Sideslope Modifications
St. Cloud, FLORIDA

WEATHER DATA AND SOIL LAYERS PROPERTIES

Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	30

Temperature

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

Normal mean monthly temperature (ºF)

January	60.5	July	82.4
February	61.5	August	82.5
March	66.8	September	81.1
April	72.0	October	74.9
May	77.3	November	67.5
June	80.9	December	62.0

Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth		
bare	10	
fair	**22**	
excellent	40	
Maximum leaf area index		
bare ground	0	
poor stand of grass	1	
fair stand of grass	2	
good stand of grass	**3.5**	
excellent stand of grass	5	
Growing season start day	0	
Growing season end day	367	
Average wind speed	8.6	mph
First quarter relative humidity	72	%
Second quarter relative humidity	72	%
Third quarter relative humidity	80	%
Fourth quarter relative humidity	76	%

Runoff Curve Number

Data	Value
Slope	37.0%
Slope Length (ft)	150
Soil Texture	1
Vegetation	4
Curve Number	46.5

Geomembrane and Area

Data	Value
Placement of geomembrane	good (3)
Pinhole (# of defects/area)	2
Defect density per acre	2
Area assumed in program (acre)	1

Final Transmissivity and Conductivity

Data	Value	
$\Theta_{req'd}$	1.49E-04	m^2/s
Π(RF)	5.242	
$t_{geocomposite}$	0.250	in
Θ_{LTIS}	2.84E-05	m^2/s
Θ_{model}	1.42E-05	m^2/s
k_{sat}	0.224	cm/s

Properties of soil layers

Layer	Type	Description	Thickness (in)	Texture number	Porosity (vol/vol)	Field cap. (vol/vol)	Wilting point (vol/vol)	k (cm/s)	Drain Length (ft)	Liner slope
1	1	Vertical percolation	6	1	0.417	0.045	0.018	0.01		
2	1	Vertical percolation	39	0	0.417	0.045	0.018	0.00001		
3	2	Lateral Drainage	0.250	0	0.85	0.01	0.005	0.224	150	33.3%
4	4	Geomembrane Liner	0.040	35	2E-13	0	0	2E-13		
5	1	Vertical percolation	12.000	1	0.417	0.045	0.018	0.01		

ATTACHMENT B
HELP MODEL OUTPUT FILES

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:    C:\help\JED\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\help\JED\TEMP.D7
SOLAR RADIATION DATA FILE:  C:\help\JED\SOLAR.D13
EVAPOTRANSPIRATION DATA:    C:\help\JED\EVAPO.D11
SOIL AND DESIGN DATA FILE:  C:\help\JED\CASEA.D10
OUTPUT DATA FILE:           C:\help\JED\CASEA.OUT


TIME:  10:52     DATE:   5/ 9/2018


******************************************************************************

     TITLE:  JED SIDESLOPE MODIFICATIONS - CASE A

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                   LAYER  1
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   1
           THICKNESS                   =      6.00   INCHES
           POROSITY                    =      0.4170 VOL/VOL
           FIELD CAPACITY              =      0.0450 VOL/VOL
           WILTING POINT               =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.0282 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.999999978000E-02 CM/SEC
```

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.63
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	39.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0721	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0127	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	2.40300012000	CM/SEC
SLOPE	=	33.30	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0455	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 1 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 37.% AND A SLOPE LENGTH OF 150. FEET.

SCS RUNOFF CURVE NUMBER	=	46.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.459	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.174	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.396	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	3.531	INCHES
TOTAL INITIAL WATER	=	3.531	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM ORLANDO FLORIDA

STATION LATITUDE	=	27.80	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	0	
END OF GROWING SEASON (JULIAN DATE)	=	367	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%

AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 80.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 76.00 %

NOTE: PRECIPITATION DATA FOR FORTDRUM FLORIDA
WAS ENTERED FROM AN ASCII DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ORLANDO FLORIDA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
60.50	61.50	66.80	72.00	77.30	80.90
82.40	82.50	81.10	74.90	67.50	62.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ORLANDO FLORIDA
AND STATION LATITUDE = 27.80 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1975 THROUGH 2004

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.26	2.21	3.90	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.59	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.005	0.000	0.000	0.000
	0.000	0.005	0.003	0.000	0.001	0.000
STD. DEVIATIONS	0.000	0.000	0.026	0.000	0.000	0.000
	0.000	0.021	0.019	0.000	0.005	0.000

```
  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 1.228    1.554    1.953    1.819    2.596    4.719
                           4.557    4.321    3.601    2.293    1.416    0.981

    STD. DEVIATIONS        0.690    0.985    1.260    1.214    1.842    1.676
                           1.763    1.569    1.214    1.173    0.785    0.814

  LATERAL DRAINAGE COLLECTED FROM LAYER  3
  ----------------------------------------
    TOTALS                 1.0299   0.8197   1.5592   1.1881   1.4035   2.9524
                           2.7510   3.2436   2.7628   2.0756   1.2117   0.9825

    STD. DEVIATIONS        0.9448   0.5750   1.7239   1.0377   1.5840   2.3062
                           1.8374   2.6394   2.5332   1.9789   1.3210   1.0673

  PERCOLATION/LEAKAGE THROUGH LAYER  4
  ------------------------------------
    TOTALS                 0.0005   0.0004   0.0007   0.0005   0.0006   0.0010
                           0.0010   0.0012   0.0010   0.0008   0.0006   0.0004

    STD. DEVIATIONS        0.0003   0.0002   0.0009   0.0003   0.0004   0.0006
                           0.0005   0.0011   0.0009   0.0005   0.0005   0.0003

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  ------------------------------------
    TOTALS                 0.0007   0.0006   0.0006   0.0006   0.0007   0.0004
                           0.0004   0.0004   0.0004   0.0005   0.0006   0.0007

    STD. DEVIATIONS        0.0003   0.0002   0.0003   0.0003   0.0003   0.0003
                           0.0002   0.0002   0.0003   0.0003   0.0003   0.0003


-------------------------------------------------------------------------------
              AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  4
  -------------------------------------
    AVERAGES               0.0012   0.0011   0.0037   0.0015   0.0017   0.0036
                           0.0033   0.0061   0.0046   0.0025   0.0023   0.0012

    STD. DEVIATIONS        0.0011   0.0008   0.0115   0.0013   0.0019   0.0028
                           0.0022   0.0130   0.0089   0.0023   0.0058   0.0013

*******************************************************************************


*******************************************************************************

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004
```

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.08	(10.924)	192680.4	100.00
RUNOFF	0.014	(0.0427)	51.68	0.027
EVAPOTRANSPIRATION	31.038	(5.4905)	112669.27	58.475
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.98001	(6.93446)	79787.430	41.40921
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00873	(0.00239)	31.702	0.01645
AVERAGE HEAD ON TOP OF LAYER 4	0.003	(0.002)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00658	(0.00236)	23.871	0.01239
CHANGE IN WATER STORAGE	0.041	(1.2083)	148.15	0.077

****

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	8.45	30673.500
RUNOFF	0.140	509.8184
DRAINAGE COLLECTED FROM LAYER 3	3.37051	12234.96480
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.002905	10.54543
AVERAGE HEAD ON TOP OF LAYER 4	1.367	
MAXIMUM HEAD ON TOP OF LAYER 4	1.316	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000049	0.17637
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.2123

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0180

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 2004

LAYER	(INCHES)	(VOL/VOL)
1	0.2409	0.0402
2	3.8996	0.1000
3	0.0041	0.0163
4	0.0000	0.0000
5	0.6110	0.0509
SNOW WATER	0.000	

****
****

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:    C:\help\JED\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\help\JED\TEMP.D7
SOLAR RADIATION DATA FILE:  C:\help\JED\SOLAR.D13
EVAPOTRANSPIRATION DATA:    C:\help\JED\EVAPO.D11
SOIL AND DESIGN DATA FILE:  C:\help\JED\CASEB.D10
OUTPUT DATA FILE:           C:\help\JED\CASEB.OUT


TIME:  11: 5     DATE:   5/ 9/2018


******************************************************************************

     TITLE:  JED SIDESLOPE MODIFICATIONS - CASE B

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                   LAYER  1
                                   --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   1
           THICKNESS                  =     6.00   INCHES
           POROSITY                   =     0.4170 VOL/VOL
           FIELD CAPACITY             =     0.0450 VOL/VOL
           WILTING POINT              =     0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =     0.0491 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.999999978000E-02 CM/SEC
```

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.63
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	39.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1763	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0404	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.224000007000	CM/SEC
SLOPE	=	33.30	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0460	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 1 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 37.% AND A SLOPE LENGTH OF 150. FEET.

SCS RUNOFF CURVE NUMBER	=	46.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.111	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.174	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.396	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	7.732	INCHES
TOTAL INITIAL WATER	=	7.732	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM ORLANDO FLORIDA

STATION LATITUDE	=	27.80	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	0	
END OF GROWING SEASON (JULIAN DATE)	=	367	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%

AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 80.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 76.00 %

NOTE: PRECIPITATION DATA FOR FORTDRUM FLORIDA
WAS ENTERED FROM AN ASCII DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ORLANDO FLORIDA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
60.50	61.50	66.80	72.00	77.30	80.90
82.40	82.50	81.10	74.90	67.50	62.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ORLANDO FLORIDA
AND STATION LATITUDE = 27.80 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1975 THROUGH 2004

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.26	2.21	3.90	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.59	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.029	0.000	0.438	0.012	0.124	0.458
	0.297	0.768	0.356	0.186	0.234	0.066
STD. DEVIATIONS	0.158	0.000	1.302	0.064	0.399	1.040
	0.842	1.738	1.139	0.619	0.812	0.253

EVAPOTRANSPIRATION

TOTALS	1.278	2.201	2.451	2.482	2.854	5.494
	5.455	5.078	4.340	3.189	1.711	1.112
STD. DEVIATIONS	0.475	1.007	1.453	1.607	1.887	1.729
	1.925	1.658	1.091	1.310	0.797	0.649

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.6172	0.6383	0.7835	0.8057	0.6715	0.8221
	1.3114	1.5851	1.5795	1.6457	1.1848	0.6782
STD. DEVIATIONS	0.3332	0.5857	0.4772	0.5605	0.3569	0.9620
	0.9422	0.8535	1.2422	1.1864	0.7053	0.3053

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0021	0.0020	0.0025	0.0025	0.0022	0.0024
	0.0035	0.0042	0.0041	0.0043	0.0034	0.0023
STD. DEVIATIONS	0.0008	0.0013	0.0011	0.0012	0.0009	0.0019
	0.0018	0.0017	0.0024	0.0023	0.0015	0.0008

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0031	0.0028	0.0026	0.0025	0.0027	0.0028
	0.0022	0.0018	0.0018	0.0020	0.0022	0.0032
STD. DEVIATIONS	0.0015	0.0015	0.0014	0.0013	0.0012	0.0013
	0.0012	0.0013	0.0012	0.0012	0.0013	0.0015

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0078	0.0089	0.0100	0.0106	0.0085	0.0108
	0.0167	0.0201	0.0207	0.0209	0.0156	0.0086
STD. DEVIATIONS	0.0042	0.0082	0.0061	0.0074	0.0045	0.0126
	0.0120	0.0108	0.0163	0.0151	0.0093	0.0039

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.08	(10.924)	192680.4	100.00
RUNOFF	2.968	(3.2681)	10773.15	5.591
EVAPOTRANSPIRATION	37.645	(6.5970)	136652.08	70.922
LATERAL DRAINAGE COLLECTED FROM LAYER 3	12.32293	(3.86404)	44732.250	23.21578
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.03539	(0.00800)	128.474	0.06668
AVERAGE HEAD ON TOP OF LAYER 4	0.013	(0.004)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.02966	(0.01246)	107.679	0.05589
CHANGE IN WATER STORAGE	0.114	(2.1150)	415.22	0.215

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	8.45	30673.500
RUNOFF	4.956	17989.1621
DRAINAGE COLLECTED FROM LAYER 3	0.33394	1212.19263
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000610	2.21272
AVERAGE HEAD ON TOP OF LAYER 4	0.132	
MAXIMUM HEAD ON TOP OF LAYER 4	0.263	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000246	0.89187
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4091
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0180

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2004

LAYER	(INCHES)	(VOL/VOL)
1	0.2896	0.0483
2	10.1480	0.2602
3	0.0025	0.0100
4	0.0000	0.0000
5	0.7238	0.0603
SNOW WATER	0.000	

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ATTACHMENT C
SPREADSHEETS FOR VERIFICATION OF HEADS USING GIROUD et al. (2004)

<u>CASE A – Final Cover System with 10^{-2} cm/s Top-Soil Permeability</u>

LEACHATE HEAD COMPUTATIONS FOR LANDFILLS WITH BOTTOM LINER SYSTEM

Reference:

Giroud, J.P., Zhao, A., Tomlinson, H.M., and Zornberg, J.G., 2004, "Liquid Flow Equations for Drainage Systems Composed of Two Layers Including a Geocomposite", Geosynthetics International, Vo. 11, No. 1.

Assumptions:

1. *Drainage systems consists of two layers, with the bottom layer being a geocomposite;*
2. *Hydraulic conductivity of the bottom drainage layer is greater than that of the top drainage layer;*
3. *The drainage system is underlain by a geomembrane with no defects;*
4. *Length of drainage layer is measured horizontally;*
5. *Liquid impingement rate is uniform and constant (steady-state flow conditions); and*
6. *Liquid impingement rate is smaller than the hydraulic conductivity of top drainage layer.*

Notes:

1. *The indicated equation numbers correspond to the equation numbers in Giroud et al. (2004)*
2. *For "Top Drainage Layer" using subscript "t" (same as "2" in the paper)*
3. *For "Bottom Drainage Layer" using subscript "b" (same as "1" in the paper)*
4. *Manually input numbers in* ***RED***

Input Parameters

Geocomposite Permeability (k_{HELP}) =	***2.403***	cm/s	$k_1 = k_b$ =	0.079 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.250***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-02***	cm/s	3.3E-04 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***150***	ft			
Slope (%) =	***33.3***	%			
Liquid Impingement Rate = qh =	***12,235***	ft^3/acre/day	3.25E-06 ft/s		Check qh < k2 or kt < k1 or kb

Miscelaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =		1.53E-04 m²/s	1.64E-03 ft²/s	
Slope angle (β)=	18.418 deg	0.321 rad		
Length of Upstream Section (L_u) =	159.6 ft	(Equation 19)		
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.000			
Characteristic Parameter = $\lambda_2 = \lambda_t$	0.089	(Equation 17 - derived from Equation 7)		

Maximum Liquid Thickness: Top Layer = t_{maxt}; Bottom Layer = t_{maxb}; Combined = t_{max}

Maximum Head: Top Layer = h_{maxt}; Bottom Layer = h_{maxb}; Combined = h_{max}

Results

For $L_u \geq L$, flow is in the bottom drainage layer (geocomposite) only.

Is the flow only in the bottom layer?	Yes	Therefore,	$t_{max} = t_{maxb}$ =	**0.235** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**0.223** inches	(Equation 21)

For $L_u < L$ and $\lambda_t < 0.01$, flow is in both the drainage layers (limit case).

Does the limit case apply?	No	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**N/A** inches	(Equation 36)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** inches	(Equation 40)

For $L_u < L$ and $\lambda_t > 0.01$, flow is in both the drainage layers (general case).

Does the general case apply?	No	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**N/A** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** inches	(Equation 38)

CASE B – Final Cover System with 10^{-5} cm/s Top-Soil Permeability

LEACHATE HEAD COMPUTATIONS FOR LANDFILLS WITH BOTTOM LINER SYSTEM

Reference:

Giroud, J.P., Zhao, A., Tomlinson, H.M., and Zornberg, J.G., 2004, "Liquid Flow Equations for Drainage Systems Composed of Two Layers Including a Geocomposite", Geosynthetics International, Vo. 11, No. 1.

Assumptions:

1. *Drainage systems consists of two layers, with the bottom layer being a geocomposite;*
2. *Hydraulic conductivity of the bottom drainage layer is greater than that of the top drainage layer;*
3. *The drainage system is underlain by a geomembrane with no defects;*
4. *Length of drainage layer is measured horizontally;*
5. *Liquid impingement rate is uniform and constant (steady-state flow conditions); and*
6. *Liquid impingement rate is smaller than the hydraulic conductivity of top drainage layer.*

Notes:

1. *The indicated equation numbers correspond to the equation numbers in Giroud et al. (2004)*
2. *For "Top Drainage Layer" using subscript "t" (same as "2" in the paper)*
3. *For "Bottom Drainage Layer" using subscript "b" (same as "1" in the paper)*
4. *Manually input numbers in **RED***

Input Parameters

Geocomposite Permeability (k_{HELP}) =	***0.224*** cm/s	$k_1 = k_b$ =	0.007 ft/s		
Geocomposite Thickness (t_1) = (t_b) =	***0.250*** in				
Sand Permeability (k_2) = (k_t) =	***1.00E-05*** cm/s		3.3E-07 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***150*** ft				
Slope (%) =	***33.3*** %				
Liquid Impingement Rate = qh =	***1,212*** ft^3/acre/day		3.22E-07 ft/s		Check qh < k2 or kt < k1 or kb

Miscelaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.42E-05 m²/s	1.53E-04 ft²/s	
Slope angle (β)=	18.418 deg	0.321 rad	
Length of Upstream Section (L_u) =	150.2 ft	(Equation 19)	
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.000		
Characteristic Parameter = $\lambda_2 = \lambda_t$	8.852	(Equation 17 - derived from Equation 7)	

Maximum Liquid Thickness: Top Layer = t_{maxt}; Bottom Layer = t_{maxb}; Combined = t_{max}

Maximum Head: Top Layer = h_{maxt}; Bottom Layer = h_{maxb}; Combined = h_{max}

Results

For $L_u \geq L$, flow is in the bottom drainage layer (geocomposite) only.

Is the flow only in the bottom layer?	Yes	Therefore,	$t_{max} = t_{maxb}$ =	**0.250** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**0.237** inches	(Equation 21)

For $L_u < L$ and $\lambda_t < 0.01$, flow is in both the drainage layers (limit case).

Does the limit case apply?	No	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**N/A** inches	(Equation 36)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** inches	(Equation 40)

For $L_u < L$ and $\lambda_t > 0.01$, flow is in both the drainage layers (general case).

Does the general case apply?	No	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**N/A** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** inches	(Equation 38)

ATTACHMENT D
NRCS SOIL SURVEY

Soil Map—Osceola County, Florida
(JED Landfill)

81° 7' 54" W

81° 3' 57" W

81° 7' 54" W

81° 3' 57" W

Map Scale: 1:29,700 if printed on A landscape (11" x 8.5") sheet.

N

0 400 800 1600 2400 Meters

0 1000 2000 4000 6000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Osceola County, Florida
Survey Area Data: Version 14, Oct 6, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 22, 2015—Mar 17, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Basinger fine sand, 0 to 2 percent slopes	315.1	7.8%
6	Basinger fine sand, depressional, 0 to 1 percent slopes	733.6	18.2%
9	Cassia fine sand, 0 to 2 percent slopes	73.2	1.8%
10	Delray loamy fine sand, depressional	14.2	0.4%
11	EauGallie fine sand	50.0	1.2%
13	Gentry fine sand	15.7	0.4%
14	Holopaw fine sand, 0 to 2 percent slopes	34.2	0.8%
16	Immokalee fine sand, 0 to 2 percent slopes	140.3	3.5%
19	Malabar fine sand, 0 to 2 percent slopes	90.6	2.3%
20	Malabar fine sand, depressional	34.8	0.9%
22	Myakka fine sand, 0 to 2 percent slopes	545.5	13.6%
27	Ona fine sand, 0 to 2 percent slopes	55.1	1.4%
32	Placid fine sand, frequently ponded, 0 to 1 percent slopes	77.3	1.9%
34	Pomello fine sand, 0 to 5 percent slopes	23.7	0.6%
36	Pompano fine sand, 0 to 2 percent slopes	9.5	0.2%
40	Samsula muck, frequently ponded, 0 to 1 percent slopes	2.0	0.0%
42	Smyrna fine sand, 0 to 2 percent slopes	1,805.7	44.9%
Totals for Area of Interest		**4,020.5**	**100.0%**

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the mineral surface horizon. Missing surface data may indicate the presence of an organic surface layer. .

Report—RUSLE2 Related Attributes

Soil properties and interpretations for erosion runoff calculations. The surface mineral horizon properties are displayed. Organic surface horizons are not displayed.

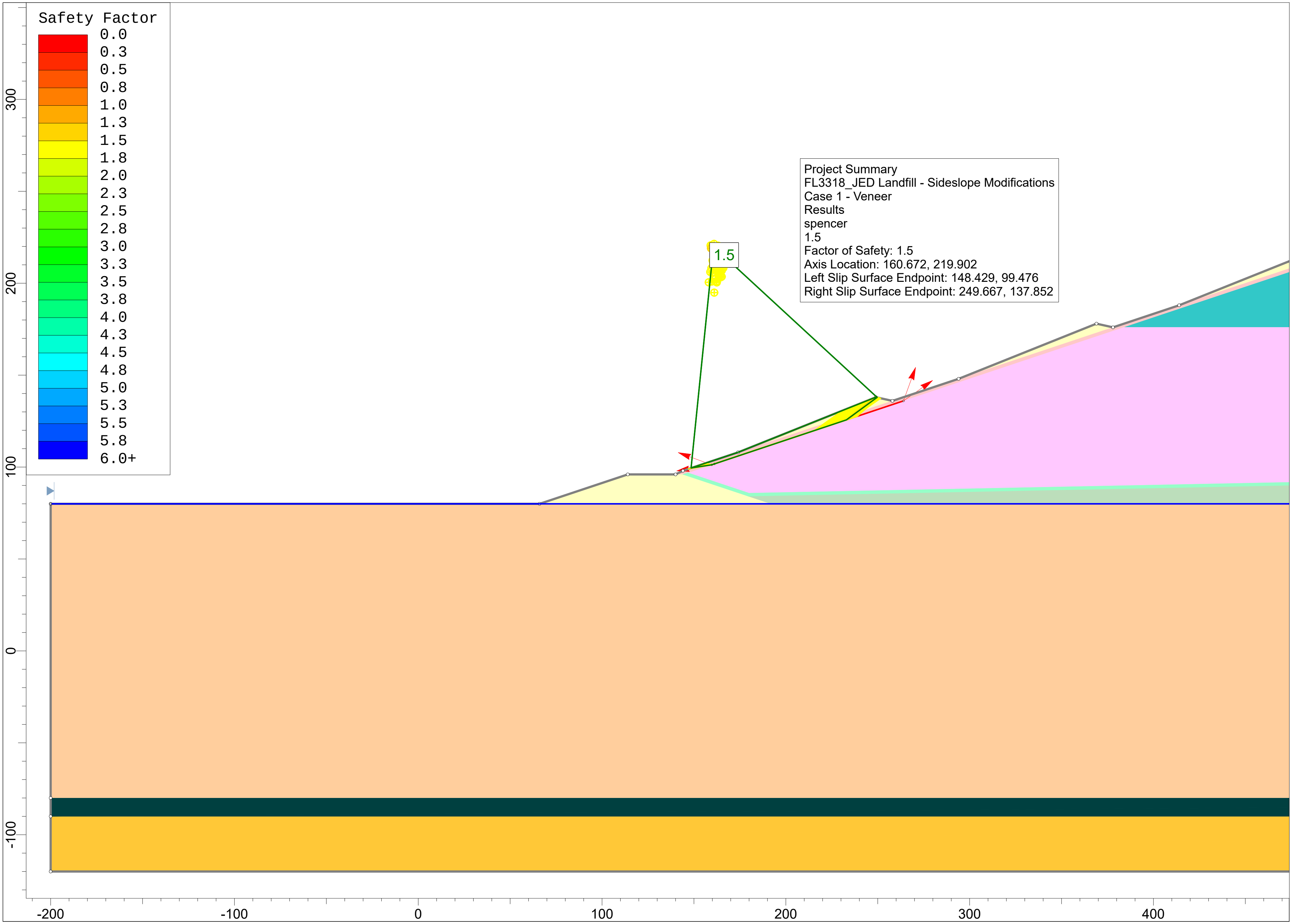
RUSLE2 Related Attributes–Osceola County, Florida								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
5—Basinger fine sand, 0 to 2 percent slopes								
Basinger	85	200	A/D	.05	5	98.0	1.0	1.0
6—Basinger fine sand, depressional, 0 to 1 percent slopes								
Basinger, depressional	92	151	A/D	.05	5	92.0	5.0	3.0
9—Cassia fine sand, 0 to 2 percent slopes								
Cassia	80	200	A/D	.05	5	98.0	1.0	1.0
10—Delray loamy fine sand, depressional								
Delray, depressional	90	151	A/D	.05	5	84.9	7.1	8.0
11—EauGallie fine sand								
EauGallie	90	151	A/D	.02	5	96.0	2.0	2.0
13—Gentry fine sand								
Gentry	90	151	C/D	.05	5	91.3	6.0	2.7
14—Holopaw fine sand, 0 to 2 percent slopes								
Holopaw	85	200	A/D	.02	5	97.0	1.0	2.0
16—Immokalee fine sand, 0 to 2 percent slopes								
Immokalee	90	200	B/D	.05	5	98.0	1.0	1.0
19—Malabar fine sand, 0 to 2 percent slopes								
Malabar	85	200	A/D	.02	5	98.0	1.0	1.0

RUSLE2 Related Attributes–Osceola County, Florida								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
20—Malabar fine sand, depressional								
Malabar, depressional	85	151	A/D	.02	5	96.0	2.0	2.0
22—Myakka fine sand, 0 to 2 percent slopes								
Myakka	85	200	A/D	.05	5	96.3	0.7	3.0
27—Ona fine sand, 0 to 2 percent slopes								
Ona	90	151	B/D	.10	5	96.3	0.7	3.0
32—Placid fine sand, frequently ponded, 0 to 1 percent slopes								
Placid	80	98	A/D	.02	5	95.0	1.0	4.0
34—Pomello fine sand, 0 to 5 percent slopes								
Pomello	95	151	A	.02	5	96.2	2.8	1.0
36—Pompano fine sand, 0 to 2 percent slopes								
Pompano	80	200	A/D	.05	5	98.0	1.0	1.0
40—Samsula muck, frequently ponded, 0 to 1 percent slopes								
Samsula	85	98	A/D	.02	1	95.0	2.0	3.0
42—Smyrna fine sand, 0 to 2 percent slopes								
Smyrna, non-hydric	95	151	A/D	.02	5	93.9	5.0	1.1

Data Source Information

Soil Survey Area: Osceola County, Florida
Survey Area Data: Version 14, Oct 6, 2017

ATTACHMENT E
SLIDE OUTPUT FILES



Safety Factor
0.0
0.3
0.5
0.8
1.0
1.3
1.5
1.8
2.0
2.3
2.5
2.8
3.0
3.3
3.5
3.8
4.0
4.3
4.5
4.8
5.0
5.3
5.5
5.8
6.0+
Project Summary
FL3318_JED Landfill - Sideslope Modifications
Case 1 - Veneer
Results
spencer
1.5
Factor of Safety: 1.5
Axis Location: 160.672, 219.902
Left Slip Surface Endpoint: 148.429, 99.476
Right Slip Surface Endpoint: 249.667, 137.852
1.5
300
200
100
0
-100
-200
-100
0
100
200
300
400

Slide Analysis Information

FL3318_JED Landfill - Sideslope Modifications

Project Summary

File Name: Tack on berm - Veneer
Slide Modeler Version: 6.039
Project Title: FL3318_JED Landfill - Sideslope Modifications
Analysis: Case 1 - Veneer
Author: A. Rivera
Company: Geosyntec Consultants
Date Created: 04.18.2018

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Right to Left
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Enabled
Left Projection Angle (Start Angle): 160
Left Projection Angle (End Angle): 190
Right Projection Angle (Start Angle): 35
Right Projection Angle (End Angle): 70
Minimum Elevation: Not Defined
Minimum Depth: 2

Material Properties

Property	Berm Fill	Compacted Subgrade	Silty Sand	Hawthorne Formation	Final Cover System	Liner System	Upper MSW	Middle MSW
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function
Unit Weight [lbs/ft3]	120	120	115	115	120	120	54	72
Cohesion [psf]	0	0	0	0	0	0		
Friction Angle [deg]	35	35	30	30	29.14	30		
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Property	Lower MSW	Hawthorn Confining
Color		
Strength Type	Shear Normal function	Mohr-Coulomb
Unit Weight [lbs/ft3]	82	120
Cohesion [psf]		5000
Friction Angle [deg]		0
Water Surface	Water Table	Water Table
Hu Value	1	1

Shear Normal Functions

Name: MSW-Kavazanjian et al. 1995

Normal (psf)	Shear (psf)
0	500
625	500
24000	15680

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: On
Probabilistic Analysis: Off

Variables

Material	Property	Distribution	Mean	Min	Max
Final Cover System	Phi	Normal	29.14	19.14	39.14

Global Minimums

Method: spencer

FS: 1.498400
Axis Location: 160.672, 219.902
Left Slip Surface Endpoint: 148.429, 99.476
Right Slip Surface Endpoint: 249.667, 137.852
Resisting Moment=2.37208e+006 lb-ft
Driving Moment=1.58308e+006 lb-ft
Resisting Horizontal Force=19396.2 lb
Driving Horizontal Force=12944.6 lb
Total Slice Area=326.479 ft2

Global Minimum Coordinates

Method: spencer

X	Y
148.429	99.4762
159.67	101.223
161.17	101.723
232.933	125.644
249.667	137.852

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 5000
Number of Invalid Surfaces: 0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.4984

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	3.74707	149.883	Final Cover System	0	29.14	15.0972	22.6217	40.5764	0	40.5764
2	3.74707	449.648	Final Cover System	0	29.14	45.2917	67.8651	121.73	0	121.73
3	3.74707	749.414	Final Cover System	0	29.14	75.4859	113.108	202.882	0	202.882
4	1.5	360	Final Cover System	0	29.14	80.3677	120.423	216.003	0	216.003
5	4.22137	1013.13	Final Cover System	0	29.14	80.3677	120.423	216.003	0	216.003
6	4.22137	1013.13	Final Cover System	0	29.14	80.3677	120.423	216.003	0	216.003
7	4.22137	1013.13	Final Cover System	0	29.14	80.3677	120.423	216.003	0	216.003
8	4.22137	1078.91	Final Cover System	0	29.14	85.586	128.242	230.028	0	230.028
9	4.22137	1221.36	Final Cover System	0	29.14	96.886	145.174	260.398	0	260.398
10	4.22137	1363.92	Final Cover System	0	29.14	108.195	162.119	290.794	0	290.794
11	4.22137	1506.48	Final Cover System	0	29.14	119.503	179.064	321.187	0	321.187
12	4.22137	1649.04	Final Cover System	0	29.14	130.812	196.009	351.582	0	351.582
13	4.22137	1791.6	Final Cover System	0	29.14	142.121	212.954	381.975	0	381.975
14	4.22137	1934.16	Final Cover System	0	29.14	153.43	229.899	412.37	0	412.37
15	4.22137	2076.72	Final Cover System	0	29.14	164.738	246.844	442.763	0	442.763
16	4.22137	2219.28	Final Cover System	0	29.14	176.047	263.789	473.158	0	473.158
17	4.22137	2361.84	Final Cover System	0	29.14	187.356	280.734	503.553	0	503.553
18	4.22137	2504.4	Final Cover System	0	29.14	198.665	297.679	533.946	0	533.946
19	4.22137	2646.96	Final Cover System	0	29.14	209.973	314.624	564.341	0	564.341
20	4.22137	2789.52	Final Cover System	0	29.14	221.282	331.569	594.734	0	594.734
21	4.22137	2932.08	Final Cover System	0	29.14	232.591	348.514	625.129	0	625.129
22	5.04834	3087.86	Final Cover System	0	29.14	163.759	245.376	440.13	0	440.13
23	3.89516	1693.79	Berm Fill	0	35	142.29	213.207	304.492	0	304.492
24	3.89516	1093.87	Berm Fill	0	35	91.8927	137.692	196.645	0	196.645
25	3.89516	477.342	Berm Fill	0	35	40.1644	60.1824	85.9493	0	85.9493

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.4984

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	148.429	99.4762	0	0	0
2	152.176	100.059	32.9038	10.9843	18.4606
3	155.923	100.641	131.615	43.9372	18.4606

4	159.67	101.223	296.135	98.8588	18.4606
5	161.17	101.723	308.607	103.022	18.4605
6	165.391	103.13	343.708	114.74	18.4605
7	169.613	104.538	378.808	126.458	18.4606
8	173.834	105.945	413.909	138.175	18.4605
9	178.055	107.352	451.288	150.654	18.4606
10	182.277	108.759	493.603	164.78	18.4606
11	186.498	110.166	540.857	180.555	18.4606
12	190.719	111.573	593.05	197.978	18.4606
13	194.941	112.98	650.182	217.051	18.4606
14	199.162	114.387	712.254	237.772	18.4606
15	203.384	115.795	779.264	260.142	18.4606
16	207.605	117.202	851.214	284.161	18.4606
17	211.826	118.609	928.102	309.829	18.4606
18	216.048	120.016	1009.93	337.146	18.4606
19	220.269	121.423	1096.7	366.111	18.4605
20	224.49	122.83	1188.4	396.725	18.4606
21	228.712	124.237	1285.05	428.988	18.4605
22	232.933	125.644	1386.63	462.9	18.4606
23	237.982	129.327	591.904	197.596	18.4606
24	241.877	132.169	280.565	93.6613	18.4606
25	245.772	135.01	79.4985	26.539	18.4606
26	249.667	137.852	0	0	0

List Of Coordinates

Water Table

X	Y
-200	80
1200	80

Block Search Polyline

X	Y
264	136
161.17	101.723
159.67	101.223

External Boundary

X	Y
618	256
609	258
534	228
498	216
489	218

414	188
378	176
369	178
294	148
258	136
249	138
174	108
144	98
140	96
114	96
66	80
-200	80
-200	-80
-200	-90
-200	-120
1200	-120
1200	-90
1200	-80
1200	80
1200	104.4
1200	106.4
1200	136
1200	176
1200	216
1200	256
1200	328
1200	319.516
1200	330
1085	330
840	330
738	296
729	298
654	268

Material Boundary

X	Y
66	80
192	80
1200	80

Material Boundary

X	Y
140	96
144	96
180	84
192	80

Material Boundary

X	Y
180	86
329.258	88.9852
579.842	93.9968
1200	106.4

Material Boundary

X	Y
150	96
180	86

Material Boundary

X	Y
-200	-80
1200	-80

Material Boundary

X	Y
624	256
1200	256

Material Boundary

X	Y
504	216
1200	216

Material Boundary

X	Y
180	84
1200	104.4

Material Boundary

X	Y
264	136
384	176
504	216
624	256
744	296

Material Boundary

X	Y
744	296
840	328
1085	328
1200	328

Material Boundary

X	Y
147	97
148.5	96.5
150	96

Material Boundary

X	Y
144	96
147	97

Material Boundary

X	Y
147	97
264	136

Material Boundary

X	Y
1200	328
1200	330

Material Boundary

X	Y
384	176
1200	176

Material Boundary

X	Y
264	136
1200	136

Material Boundary

X	Y

174	108
258	136

Material Boundary

X	Y
294	148
378	176

Material Boundary

X	Y
414	188
498	216

Material Boundary

X	Y
534	228
618	256

Material Boundary

X	Y
654	268
738	296

Material Boundary

X	Y
-200	-90
1200	-90

APPENDIX H
REVISED TECHNICAL SPECIFICATIONS

SECTION 02740

GEOCOMPOSITE

PART 1 GENERAL

1.01 SCOPE

A. This section includes requirements for final cover system geocomposite drainage layer products and installation.

1.02 RELATED SECTIONS AND PLANS

A. Section 02240 – Cap Protective Soil Layer

B. Section 02770 – Geomembrane

C. Section 02790 – Interface Friction Conformance Testing

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) standards.

1. ASTM D 792 - Standard Test Methods for Density and Specific Gravity of Plastics by Displacement.
2. ASTM D 1505 - Standard Test Method for the Density of Plastic by the Density Gradient Method.
3. ASTM D 1603 - Standard Test Method for Determination of Carbon Black Content in Olefin Plastics
4. ASTM D 4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by Muffle-Furnace Techniques.
5. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
7. ASTM D 4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).
8. ASTM D 4716 - Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

9. ASTM D 4751 - Standard Test Method for determining apparent opening size of a geotextile
10. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
11. ASTM D 5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
12. ASTM D 5261 – Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
13. ASTM D 6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
14. ASTM D 7005 - Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

1.04 SUBMITTALS

A. Submit the following to the Engineer for review at least 21 calendar days prior to use:
1. geocomposite Manufacturer and product names;
2. certification of minimum average roll values and the corresponding test procedures for all geocomposite properties listed in Table 02740-1; and
3. projected geocomposite delivery dates.

D. Submit to the Engineer for review at least 14 calendar days prior to geocomposite placement, manufacturing quality control certificates for each roll of geocomposite as specified in this section.

E. For each proposed geocomposite material, the Contractor shall submit to the Engineer for review at least 14 calendar days prior to transporting the geocomposite to site the results of manufacturing quality control testing and certification that the geocomposite is manufactured to meet the minimum interface shear strength criteria when tested in compliance with requirements of Section 02790.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of the geocomposite will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing of the geocomposite as required by the CQA Plan.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the installation schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 PRODUCT

2.01 GEOCOMPOSITE

A. Furnish geocomposite drainage layer materials consisting of a polyethylene geonet core with a needle-punched nonwoven geotextile heat laminated to both sides of the geonet core.

B. Furnish geocomposite for the final cover having properties meeting the required property values shown in Table 02740-1. Required geocomposites properties shall be considered minimum average roll values (95 percent lower confidence limit).

C. Furnish geocomposites that are stock products.

D. In addition to the property values listed in Table 02740-1, the geocomposites shall:
1. retain their structure during handling, placement, and long-term service (provide manufacturer's data for long-term compression creep testing); and
2. be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.

E. Furnish geocomposite that meets the interface shear strength requirements of Section 02790 as tested by an approved testing laboratory.

F. Furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Furnish polyester or polypropylene threads that have a minimum size of 2,000 denier.

G. Furnish geocomposite meeting the transmissivity requirements in Table 02740-1 as tested by an approved testing laboratory. The transmissivity of the geocomposites for final cover system construction shall be tested in accordance with ASTM D 4716 to demonstrate that the design transmissivity will be maintained for the design period of the facility. The geocomposite used in the final cover system shall be tested using the actual boundary materials intended for the geocomposite at a normal load of ~~500~~ 800 psf for a minimum period of 24 hours.

2.02 MANUFACTURING QUALITY CONTROL

A. Sample and test the geotextile and geonet components of the geocomposite to demonstrate that these materials conform to the requirements of this section.

B. Perform manufacturing quality control tests to demonstrate that the geotextile properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet with minimum of 1 test per lot:

Test	Procedure
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833
Static Puncture strength	ASTM D 6241

C. Perform additional manufacturing quality control tests on the geotextile, at a minimum frequency of once per 250,000 square feet with minimum of 1 test per lot, to demonstrate that the apparent opening size (per ASTM D 4751) and permittivity (per ASTM D 4491) of the geotextile conform to the values specified in Table 02740-1.

D. Perform manufacturing quality control tests to demonstrate that the geonet drainage core properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet with minimum of 1 test per lot:

Test	Procedure
Polymer density	ASTM D 792 or 1505
Carbon black	ASTM D 1603 or 4218
Thickness	ASTM D 5199

E. Perform additional manufacturing quality control tests, at a minimum frequency of once per 100,000 square feet with minimum of 1 test per geonet lot, to demonstrate that the geocomposite drainage layers conform to the hydraulic transmissivity (per ASTM D 4716) and ply adhesion (per ASTM D 7005) requirements of Table 02740-1.

F. Submit quality control test certificates signed by the geotextile, geonet, and geocomposite manufacturer quality control manager. The quality control certificates shall include:
1. lot, batch, and roll number and identification; and
2. results of manufacturing quality control tests including description of test methods used.

G. Do not supply any geocomposite roll that does not comply with the manufacturing quality control requirements.

H. If a geotextile, geonet, or geocomposite sample fails to meet the quality control requirements of this section, sample and test rolls manufactured at the same time or in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKING AND LABELING

A. The geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

B. Geocomposite rolls shall be labeled with the following information.
1. Fabricator's name;
2. product identification;
3. lot or batch number;
4. roll number; and
5. roll dimensions.

C. Geocomposite rolls not labeled in accordance with this section or on which labels are illegible upon delivery to the site shall be rejected and replaced with properly labeled rolls at no additional cost to the Owner.

D. If any special handling is required, it shall be so marked on the geotextile component e.g., "This Side Up" or "This Side Against Soil To Be Retained".

2.04 TRANSPORTATION

A. Geocomposites shall be delivered to the site at least 21 days prior to the planned deployment date to allow the CQA Consultant adequate time to perform conformance testing on the geocomposite samples as required by the CQA Plan.

2.05 HANDLING AND STORAGE

A. The Contractor shall be responsible for storage of the geocomposite at the site.

B. Handling and care of the geocomposite prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the materials incurred prior to final acceptance by the Owner.

C. The geocomposite shall be stored off the ground and out of direct sunlight, and shall be protected from excessive heat or cold, mud, dirt, and dust. Any additional storage procedures required by the manufacturer shall be the Contractor's responsibility.

PART 3 EXECUTION

3.01 PLACEMENT

A. The Contractor shall not commence geocomposite installation until the CQA Consultant completes conformance evaluation of the geocomposite and quality assurance evaluation of previous work, including evaluation of Contractor's survey results for previous work.

B. For geocomposite with directional hydraulic transmissivity, the Contractor shall install the geocomposite in accordance with manufacturer's recommendations (usually the roll direction).

C. The Contractor shall handle the geocomposite in such a manner as to ensure the geocomposite is not damaged in any way.

D. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

E. The geocomposite shall only be cut using manufacturer's recommended procedures.

F. In the presence of wind, all geocomposite panels shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

G. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. Care shall be exercised when handling sandbags, to prevent rupture or damage of the sandbags.

H. If necessary, the geocomposite shall be positioned by hand after being unrolled over a smooth rub sheet.

I. Tools shall not be left on, in, or under the geocomposite.

J. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 30 days.

K. If white colored geotextile is used in the geocomposite, precautions shall be taken against "snowblindness" of personnel.

3.02 SEAMS AND OVERLAPS

A. The components of the geocomposite (i.e., geotextile, geonet, and geotextile) are not bonded together at the ends and edges of the rolls. Each component will be secured or seamed to the like component of adjoining panels.

B. Geotextile Components:
1. The bottom layers of geotextile shall be overlapped. The top layers of geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 6 inches prior to seaming.
2. No horizontal seams shall be allowed higher than one-third the slope height on slopes steeper than 10 horizontal to 1 vertical.
3. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn using Stitch Type 401 per Federal Standard No. 751a. The seam type shall be Federal Standard Type SSN-1.

3.03 REPAIR

A. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 2 ft beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the top geotextile and geonet on the slope. The patch shall be secured every 6 inches with approved tying devices. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or tear width across the panel is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with this section.

B. All repairs shall be performed at no additional cost to the Owner.

3.04 PLACEMENT OF SOIL MATERIALS

A. The Contractor shall place all soil materials in such a manner as to ensure that:
1. the geocomposite and underlying geosynthetic materials are not damaged;
2. minimal slippage occurs between the geocomposite and underlying layers; and
3. excess tensile stresses are not produced in the geocomposite.

B. Spread soil on top of the geocomposite from the bottom of slopes upward to cause the soil to cascade over the geocomposite rather than be shoved across the geocomposite.

C. For geocomposites overlying the geomembrane, do not place overlying soil material at ambient temperatures below 40 degrees Fahrenheit (F) or above 104°F, unless authorized in writing by the Engineer. For cold (<40°F) and hot (>104°F) weather placement operations, use the additional procedures authorized in writing by the Engineer.

D. Do not drive equipment directly on the geocomposite. Only use equipment above a geocomposite overlying a geomembrane that meets the following ground pressure requirements above the geomembrane:

Maximum Allowable Equipment Ground Pressure (pounds per square inch)	Minimum Thickness of Overlying Soil (inches)
<5	12
<10	18
<20	24
>20	36

TABLE 02740-1
GEOCOMPOSITE PROPERTY VALUES

PROPERTIES (6)	QUALIFIER	UNITS	SPECIFIED VALUES (1)	TEST METHOD
Geonet Component:				
Polymer composition	Minimum	%	95 polyethylene by wt	--
Polymer density	Minimum	g/cm^3	0.~~93~~94	ASTM D 792 (Method B) or D 1505
Carbon black content	Range	%	2 - 3	ASTM D 1603 or 4218
Nominal thickness	Minimum	mil	~~200~~250	ASTM D 5199
Geotextile Component:				
Type	None	none	Needlepunched nonwoven	--
Polymer composition	Minimum	%	95 polyester or polypropylene	
Mass per unit area	Minimum	oz/yd^2	8	ASTM D 5261
Apparent opening size	Maximum	mm	$O_{95} \leq 0.21$ mm	ASTM D 4751
Permittivity	Minimum	sec^{-1}	0.5	ASTM D 4491
Grab strength	Minimum	lb	200	ASTM D 4632 (2)
Tear strength	Minimum	lb	75	ASTM D 4533 (2)
Puncture strength	Minimum	lb	90	ASTM D 4833 (3)
Static puncture strength	Minimum	psi	500	ASTM D 6241
Geocomposite:				
Transmissivity	Minimum	m^2/s	~~$6.1x10^{-4}$~~$1.6x10^{-3}$ (See notes 4 and 5)	ASTM D 4716
Ply Adhesion	Minimum	lb/in	1.0	ASTM D 7005

Notes:

1. All values represent minimum average roll values.
2. Minimum value measured in machine and cross-machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.

(notes continued on following page)

TABLE 02740-1 (Continued)

4. The design transmissivity of the geocomposite drainage layer in the final cover system shall be measured using water at a gradient of 0.33 under compressive stresses of 500 800 psf for a period of 24 hours. For the test, the geocomposite shall be sandwiched between 40-mil textured PE geomembrane and soil actually used for the cap protective layer. The minimum required transmissivity is 6.11.60 x 10^{-3-4} m^2/s under the compressive stresses of 500 800 psf.

5. See Paragraph 2.02 for required MQC test frequencies.

[END OF SECTION]

SECTION 02780

GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.01 SCOPE

A. This section includes the requirements for geosynthetic clay liner (GCL) products and placement.

1.02 RELATED SECTIONS AND PLANS

A. Section 02200 - Earthwork

B. Section 02740 - Geocomposites

C. Section 02770 - Geomembrane

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) standards and other standards noted in this specification.

1.04 SUBMITTALS

A. Submit to the Engineer for review not less than 21 calendar days prior to use the following information regarding the GCL proposed for the project.
1. manufacturer and product name;
2. evidence that the manufacturer has more than two years of experience in the manufacturing of GCL;
3. manufacturer's quality control procedures;
4. manufacturer's requirements for the geotextile component of the GCL that include (as a minimum) mass per unit area, grab strength, and grab elongation;
5. certification that manufacturer's requirements for geotextile component of GCL are met;
6. certification of minimum average roll values (95 percent lower confidence limit) and the corresponding test procedures for all GCL properties listed in Table 02780-1; and
7. manufacturer's recommended procedures for overlapping adjacent GCL panels.

B. Submit to the Engineer for review at least 14 days prior to GCL placement the manufacturing quality control certificates for each roll of GCL as specified in this section. Submit certificates signed by the manufacturer quality control manager. The quality control certificates shall include:
   1. lot, batch, or roll numbers and identification;
   2. sampling procedures; and
   3. results of Manufacturer quality control tests.

C. For each proposed GCL material, the Contractor shall submit for review by the Engineer at least 14 calendar days prior to transporting the GCL to the site the results of manufacturing quality control testing and certification that the GCL is manufactured to meet the minimum internal shear strength requirements of this section and the minimum interface shear strength requirements of Section 02790.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of the GCLs will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing of the GCLs.

C. The Contractor shall be aware of the activities required of the CQA Consultant per the CQA Plan and shall account for these activities in the installation schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant and shall do so at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 GCL

A. Furnish GCL with internally-reinforced bentonite core and woven and/or nonwoven geotextile backings. The GCL must be free of broken needles or fragments of needles.

B. Furnish GCL having properties that comply with the required values shown in Table 02780-1.

C. GCL consisting of an internally-reinforced bentonite core with woven and/or nonwoven geotextile backings shall meet the following requirements:
   1. Hydraulic conductivity is equal to or less than 5×10^{-9} centimeters per second, when measured in a flexible wall permeameter in accordance with ASTM D 5887 under an effective confining stress of 5 pounds per square inch.
   2. Minimum roll width is 15 feet.
   3. Minimum roll length is 100 feet.
   4. Bentonite component is at least 90 percent sodium montmorillonite.

5. Bentonite component is applied at a minimum rate of 0.75 pounds per square foot, when measured on an oven-dried sample.
6. Geotextile backings are woven and/or nonwoven materials, respectively, manufactured with polypropylene or polyester material, and conforming to the minimum property values shown in Table 02780-1.
7. Needlepunching is used to bind geotextile backings and bentonite core.
8. Bentonite is contained by the geotextiles in a manner that prevents more than nominal dislodgment of bentonite during GCL transportation, handling, and installation.

D. Furnish GCL that meets the internal shear strength requirements of this section and interface shear strength requirements of Section 02790 as tested by an approved testing laboratory. Tests will be performed in accordance with ASTM D 6243 and as specified below on representative samples of GCL destined for use on this project. The source of the representative samples will be provided with the test results. The GCL will be tested for:
1. internal shear strength in accordance with this section; and
2. interface shear strength in accordance with Section 02790.

E. The testing laboratory will follow the specific procedures and conditions listed below:
1. Place the materials to be tested with their machine directions aligned in the direction of shear in the shear box. For the internal shear strength test, use a test specimen configuration of (from bottom to top): rigid substrate with textured gripping surface, GCL, and rigid substrate with textured gripping surface.
2. Perform the direct shear tests at normal stresses of 5,000, 10,000 and 15,000 pounds per square foot (psf), and report the peak and large-displacement (3-inch displacement) shearing resistance for each test.
3. Use fresh specimens for each normal stress.
4. Repeat any tests for which the shear displacements do not occur within the desired material (internal strength).
5. The testing laboratory shall report peak and large-displacement internal shear strength of GCL. The peak internal shear strength envelope for the GCL shall equal or exceed an envelope characterized by an effective friction angle of 11.312.3° assuming no cohesion.

2.02 MANUFACTURING QUALITY CONTROL

A. Sample and test the GCL to demonstrate that the material complies with the requirements of this section.

B. Perform manufacturing quality control tests to demonstrate that GCL properties conform to the requirements in Table 02780-1. Perform the following tests at the minimum frequency indicated below with a minimum of one test per lot.

Test	Frequency
Bentonite content	45,000 sq. ft
Bentonite moisture content	45,000 sq. ft
Bentonite free swell	50 ton
Hydraulic conductivity	270,000 sq. ft
Tensile/Grab strength	225,000 sq. ft
Peel	45,000 sq. ft

C. Comply with the certification and submittal requirements of this section.

D. If a GCL sample fails to meet the quality control requirements of this section, sample and test rolls fabricated at the same time and in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply the failing rolls.

2.03 PACKING AND SHIPPING

A. Supply GCL in rolls wrapped in impermeable and opaque protective covers.

B. Mark or tag GCL rolls with the following information:
1. manufacturer's name;
2. product identification;
3. lot number;
4. roll number;
5. roll weight; and
6. roll dimensions.

C. GCL rolls not labeled in accordance with this section or on which labels are illegible upon delivery to the project site will be rejected and replaced at no additional expense to the Owner.

D. Deliver the GCL to the site at least 14 calendar days prior to the scheduled installation date to allow the CQA Consultant to obtain conformance samples and complete conformance testing as described in the CQA Plan.

2.04 HANDLING AND STORAGE

A. Handle, store, and care for the GCL in a manner that does not cause hydration or damage.

B. Protect the GCL from moisture, excessive heat or cold, puncture, or other damaging or deleterious conditions. Store the GCL rolls on pallets or other elevated structures. Do not store GCL rolls directly on the ground surface. Cover the GCL entirely with a tarp. Store GCL rolls out of direct sunlight. Follow any additional storage procedures required by the Manufacturer.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Provide certification in writing that the surface on which the GCL will be installed is acceptable as described below. Give this certification of acceptance to the CQA Consultant prior to commencement of GCL installation in the area under consideration.

B. Maintain the prepared soil surface until the GCL is placed. The subgrade should be rolled with a smooth-drum compactor to remove any wheel ruts, footprints, or other abrupt grade changes before placement of the GCL.

C. Do not place the GCL onto an area that has been softened by precipitation or that has cracked due to desiccation. Repair such areas in accordance with Section 02200.

3.02 PLACEMENT

A. Do not commence GCL placement until the CQA Consultant completes conformance evaluation of this material and performance evaluation of previous work, including Contractor's survey results for previous work.

B. Weight GCL with sandbags or other means to prevent uplift or movement in wind. Immediately remove and replace any damaged or leaking sandbags.

C. Cut the GCL using a utility blade. Do not damage underlying material during cutting and fully repair any such damage.

D. Do not entrap stones or other foreign objects under the GCL. Do not drag equipment across the exposed GCL.

E. Replace any GCL that is damaged by any means including foreign objects, or installation activities.

F. Install GCLs in accordance with Manufacturer's recommendation (i.e., typically geotextile on the outside of the roll facing down).

G. Do not install the GCL on a wet subgrade or in standing water. Prevent hydration of the bentonite core prior to completion of construction of the liner system.

H. Do not install the GCL during precipitation or other conditions that may cause hydration of the GCL.

I. Install the overlying geomembrane as soon as possible following GCL installation. Cover all GCL that is placed during a workday with overlying geomembrane. Cover and protect the edges of GCL from hydration due to storm water run-on.

J. Remove and replace GCL that becomes hydrated. Hydration is defined by a moisture content of 40 percent or greater when measured in accordance with ASTM D 2216 or ASTM D 4643. However, the CQA Consultant shall be responsible for evaluating cases of GCL hydration and determining if the GCL needs to be removed and replaced.

K. Place earthen and other geosynthetics material components of the liner system over the GCL as soon after installation of the GCL as possible, but in no case longer than 7 days after the first GCL is placed.

3.03 OVERLAPS

A. On slopes steeper than 5 horizontal to 1 vertical, install GCLs continuously down the slope; that is, allow no horizontal seams on the slope.

B. Allow no horizontal seams on the base of the landfill within 5 feet of the toe of a slope.

C. Overlap GCL in strict accordance with the Manufacturer's recommended procedures. As a minimum, overlap adjacent panels at least 6 inches along the sides and 12 inches along the ends.

3.04 MATERIALS IN CONTACT WITH THE GCL

A. Perform installation of other components in a manner that prevents damage to the GCL.

B. Do not drive equipment directly on the GCL.

C. Install the GCL in appurtenant areas, and connect the GCL to appurtenances as indicated on the Construction Drawings. Do not damage the GCL while working around the appurtenances.

3.05 REPAIR

A. Repair any holes or tears in the GCL by placing a GCL patch over or under the hole. On slopes greater than 5 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 feet in all directions. On slopes 5 percent or flatter, the patch shall overlap the edges of the hole or tear by a minimum of 1 foot in all directions. Secure the patch with a water-based adhesive approved by the Manufacturer.

B. Remove any soil or other material that may have penetrated the torn GCL.

C. Do not nail or staple the patch.

TABLE 02780-1

REQUIRED GCL PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS (4)	SPECIFIED VALUES (1)	TEST METHOD
GCL Properties (7)				
Bentonite Content (2)	Minimum	lb/ft^2	0.75	ASTM D 5993
Bentonite Moisture Content	Maximum	%	35	ASTM D 5993 or 2216
Bentonite Free Swell	Minimum	ml/2g	24	ASTM D 5890
Hydraulic Conductivity (5,6)	Maximum	cm/s	5×10^{-9}	ASTM D 5887
Tensile / Grab Strength (3)	Minimum	ppi / lb	23 / 90	ASTM D 6768 / 4632
Peel Strength (3)	Minimum	ppi / lb	2.1 / 15	ASTM D 6496 / 4632
Geotextile Properties				
Polymer Composition	Minimum	%	95 polyester or polypropylene	

Notes:
1. All values represent minimum average roll values.
2. Measured on an oven dried sample.
3. For geotextile backed GCLs.
4. lb/ft^2 = pounds per square foot
   cm/s = centimeter per second
   % = percent
   lb = pound
   ppi = pounds per inch
   ml/2g = milliliters per two grams
5. The GCL test specimen shall be hydrated with the fluid which is expected to cause hydration in the field, or similar fluid, for a minimum of 48 hours using sufficient backpressure to achieve a minimum B coefficient of 0.9 and using a confined effective consolidation stress not exceeding five pounds per square inch. Then, the hydraulic conductivity test on the GCL specimen shall be conducted, using the appropriate permeant fluid, at a confined effective consolidation stress not exceeding five pounds per square inch. The hydraulic conductivity test shall continue until steady state conditions are reached or a minimum of two pore volumes of permeant fluid have passed through the test specimen. The permeant fluid shall be either leachate from the landfill (or similar landfill) if the GCL is used in a liner system.
6. Hydraulic conductivity may be performed using water once the relationship between hydraulic conductivities measured using the appropriate permeant fluid and water is established for the GCL product being supplied for the project.
7. See Paragraph 2.02 for required MQC test frequencies.

[END OF SECTION]

SECTION 02740

GEOCOMPOSITE

PART 1 GENERAL

1.01 SCOPE

A. This section includes requirements for final cover system geocomposite drainage layer products and installation.

1.02 RELATED SECTIONS AND PLANS

A. Section 02240 – Cap Protective Soil Layer

B. Section 02770 – Geomembrane

C. Section 02790 – Interface Friction Conformance Testing

D. Construction Quality Assurance (CQA) Plan

1.03 REFERENCES

A. Latest version of American Society of Testing and Materials (ASTM) standards.

1. ASTM D 792 - Standard Test Methods for Density and Specific Gravity of Plastics by Displacement.
2. ASTM D 1505 - Standard Test Method for the Density of Plastic by the Density Gradient Method.
3. ASTM D 1603 - Standard Test Method for Determination of Carbon Black Content in Olefin Plastics
4. ASTM D 4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by Muffle-Furnace Techniques.
5. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
7. ASTM D 4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).
8. ASTM D 4716 - Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

9. ASTM D 4751 - Standard Test Method for determining apparent opening size of a geotextile
10. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
11. ASTM D 5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
12. ASTM D 5261 – Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
13. ASTM D 6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
14. ASTM D 7005 - Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

1.04 SUBMITTALS

A. Submit the following to the Engineer for review at least 21 calendar days prior to use:
   1. geocomposite Manufacturer and product names;
   2. certification of minimum average roll values and the corresponding test procedures for all geocomposite properties listed in Table 02740-1; and
   3. projected geocomposite delivery dates.

D. Submit to the Engineer for review at least 14 calendar days prior to geocomposite placement, manufacturing quality control certificates for each roll of geocomposite as specified in this section.

E. For each proposed geocomposite material, the Contractor shall submit to the Engineer for review at least 14 calendar days prior to transporting the geocomposite to site the results of manufacturing quality control testing and certification that the geocomposite is manufactured to meet the minimum interface shear strength criteria when tested in compliance with requirements of Section 02790.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. The installation of the geocomposite will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing of the geocomposite as required by the CQA Plan.

C. The Contractor shall be aware of the activities required of the CQA Consultant by the CQA Plan and shall account for these activities in the installation schedule.

D. The Contractor shall correct all deficiencies and nonconformances identified by the CQA Consultant at no additional cost to the Owner.

PART 2 PRODUCT

2.01 GEOCOMPOSITE

A. Furnish geocomposite drainage layer materials consisting of a polyethylene geonet core with a needle-punched nonwoven geotextile heat laminated to both sides of the geonet core.

B. Furnish geocomposite for the final cover having properties meeting the required property values shown in Table 02740-1. Required geocomposites properties shall be considered minimum average roll values (95 percent lower confidence limit).

C. Furnish geocomposites that are stock products.

D. In addition to the property values listed in Table 02740-1, the geocomposites shall:
   1. retain their structure during handling, placement, and long-term service (provide manufacturer's data for long-term compression creep testing); and
   2. be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.

E. Furnish geocomposite that meets the interface shear strength requirements of Section 02790 as tested by an approved testing laboratory.

F. Furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Furnish polyester or polypropylene threads that have a minimum size of 2,000 denier.

G. Furnish geocomposite meeting the transmissivity requirements in Table 02740-1 as tested by an approved testing laboratory. The transmissivity of the geocomposites for final cover system construction shall be tested in accordance with ASTM D 4716 to demonstrate that the design transmissivity will be maintained for the design period of the facility. The geocomposite used in the final cover system shall be tested using the actual boundary materials intended for the geocomposite at a normal load of 500 800 psf for a minimum period of 24 hours.

2.02 MANUFACTURING QUALITY CONTROL

A. Sample and test the geotextile and geonet components of the geocomposite to demonstrate that these materials conform to the requirements of this section.

B. Perform manufacturing quality control tests to demonstrate that the geotextile properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet with minimum of 1 test per lot:

Test	Procedure
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833
Static Puncture strength	ASTM D 6241

C. Perform additional manufacturing quality control tests on the geotextile, at a minimum frequency of once per 250,000 square feet with minimum of 1 test per lot, to demonstrate that the apparent opening size (per ASTM D 4751) and permittivity (per ASTM D 4491) of the geotextile conform to the values specified in Table 02740-1.

D. Perform manufacturing quality control tests to demonstrate that the geonet drainage core properties conform to the values specified in Table 02740-1. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet with minimum of 1 test per lot:

Test	Procedure
Polymer density	ASTM D 792 or 1505
Carbon black	ASTM D 1603 or 4218
Thickness	ASTM D 5199

E. Perform additional manufacturing quality control tests, at a minimum frequency of once per 100,000 square feet with minimum of 1 test per geonet lot, to demonstrate that the geocomposite drainage layers conform to the hydraulic transmissivity (per ASTM D 4716) and ply adhesion (per ASTM D 7005) requirements of Table 02740-1.

F. Submit quality control test certificates signed by the geotextile, geonet, and geocomposite manufacturer quality control manager. The quality control certificates shall include:
1. lot, batch, and roll number and identification; and
2. results of manufacturing quality control tests including description of test methods used.

G. Do not supply any geocomposite roll that does not comply with the manufacturing quality control requirements.

H. If a geotextile, geonet, or geocomposite sample fails to meet the quality control requirements of this section, sample and test rolls manufactured at the same time or in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKING AND LABELING

A. The geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

B. Geocomposite rolls shall be labeled with the following information.
1. Fabricator's name;
2. product identification;
3. lot or batch number;
4. roll number; and
5. roll dimensions.

C. Geocomposite rolls not labeled in accordance with this section or on which labels are illegible upon delivery to the site shall be rejected and replaced with properly labeled rolls at no additional cost to the Owner.

D. If any special handling is required, it shall be so marked on the geotextile component e.g., "This Side Up" or "This Side Against Soil To Be Retained".

2.04 TRANSPORTATION

A. Geocomposites shall be delivered to the site at least 21 days prior to the planned deployment date to allow the CQA Consultant adequate time to perform conformance testing on the geocomposite samples as required by the CQA Plan.

2.05 HANDLING AND STORAGE

A. The Contractor shall be responsible for storage of the geocomposite at the site.

B. Handling and care of the geocomposite prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damage to the materials incurred prior to final acceptance by the Owner.

C. The geocomposite shall be stored off the ground and out of direct sunlight, and shall be protected from excessive heat or cold, mud, dirt, and dust. Any additional storage procedures required by the manufacturer shall be the Contractor's responsibility.

PART 3 EXECUTION

3.01 PLACEMENT

A. The Contractor shall not commence geocomposite installation until the CQA Consultant completes conformance evaluation of the geocomposite and quality assurance evaluation of previous work, including evaluation of Contractor's survey results for previous work.

B. For geocomposite with directional hydraulic transmissivity, the Contractor shall install the geocomposite in accordance with manufacturer's recommendations (usually the roll direction).

C. The Contractor shall handle the geocomposite in such a manner as to ensure the geocomposite is not damaged in any way.

D. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

E. The geocomposite shall only be cut using manufacturer's recommended procedures.

F. In the presence of wind, all geocomposite panels shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

G. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. Care shall be exercised when handling sandbags, to prevent rupture or damage of the sandbags.

H. If necessary, the geocomposite shall be positioned by hand after being unrolled over a smooth rub sheet.

I. Tools shall not be left on, in, or under the geocomposite.

J. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 30 days.

K. If white colored geotextile is used in the geocomposite, precautions shall be taken against "snowblindness" of personnel.

3.02 SEAMS AND OVERLAPS

A. The components of the geocomposite (i.e., geotextile, geonet, and geotextile) are not bonded together at the ends and edges of the rolls. Each component will be secured or seamed to the like component of adjoining panels.

B. Geotextile Components:
   1. The bottom layers of geotextile shall be overlapped. The top layers of geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 6 inches prior to seaming.
   2. No horizontal seams shall be allowed higher than one-third the slope height on slopes steeper than 10 horizontal to 1 vertical.
   3. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn using Stitch Type 401 per Federal Standard No. 751a. The seam type shall be Federal Standard Type SSN-1.

3.03 REPAIR

A. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 2 ft beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the top geotextile and geonet on the slope. The patch shall be secured every 6 inches with approved tying devices. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or tear width across the panel is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with this section.

B. All repairs shall be performed at no additional cost to the Owner.

3.04 PLACEMENT OF SOIL MATERIALS

A. The Contractor shall place all soil materials in such a manner as to ensure that:
   1. the geocomposite and underlying geosynthetic materials are not damaged;
   2. minimal slippage occurs between the geocomposite and underlying layers; and
   3. excess tensile stresses are not produced in the geocomposite.

B. Spread soil on top of the geocomposite from the bottom of slopes upward to cause the soil to cascade over the geocomposite rather than be shoved across the geocomposite.

C. For geocomposites overlying the geomembrane, do not place overlying soil material at ambient temperatures below 40 degrees Fahrenheit (F) or above 104°F, unless authorized in writing by the Engineer. For cold (<40°F) and hot (>104°F) weather placement operations, use the additional procedures authorized in writing by the Engineer.

D. Do not drive equipment directly on the geocomposite. Only use equipment above a geocomposite overlying a geomembrane that meets the following ground pressure requirements above the geomembrane:

Maximum Allowable Equipment Ground Pressure (pounds per square inch)	Minimum Thickness of Overlying Soil (inches)
<5	12
<10	18
<20	24
>20	36

TABLE 02740-1
GEOCOMPOSITE PROPERTY VALUES

PROPERTIES (6)	QUALIFIER	UNITS	SPECIFIED VALUES (1)	TEST METHOD
Geonet Component:				
Polymer composition	Minimum	%	95 polyethylene by wt	--
Polymer density	Minimum	g/cm^3	0.9394	ASTM D 792 (Method B) or D 1505
Carbon black content	Range	%	2 - 3	ASTM D 1603 or 4218
Nominal thickness	Minimum	mil	200250	ASTM D 5199
Geotextile Component:				
Type	None	none	Needlepunched nonwoven	--
Polymer composition	Minimum	%	95 polyester or polypropylene	
Mass per unit area	Minimum	oz/yd^2	8	ASTM D 5261
Apparent opening size	Maximum	mm	$O_{95} \leq 0.21$ mm	ASTM D 4751
Permittivity	Minimum	sec^{-1}	0.5	ASTM D 4491
Grab strength	Minimum	lb	200	ASTM D 4632 (2)
Tear strength	Minimum	lb	75	ASTM D 4533 (2)
Puncture strength	Minimum	lb	90	ASTM D 4833 (3)
Static puncture strength	Minimum	psi	500	ASTM D 6241
Geocomposite:				
Transmissivity	Minimum	m^2/s	6.1x10^{-4} (See notes 4 and 5)	ASTM D 4716
Ply Adhesion	Minimum	lb/in	1.0	ASTM D 7005

Notes:

1. All values represent minimum average roll values.
2. Minimum value measured in machine and cross-machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.

(notes continued on following page)

TABLE 02740-1 (Continued)

4. The design transmissivity of the geocomposite drainage layer in the final cover system shall be measured using water at a gradient of 0.33 under compressive stresses of ~~500~~ 800 psf for a period of 24 hours. For the test, the geocomposite shall be sandwiched between 40-mil textured PE geomembrane and soil actually used for the cap protective layer. The minimum required transmissivity is ~~6.1~~1.60 x 10^{-3} ~~$^{-4}$~~ m^2/s under the compressive stresses of ~~500~~ 800 psf.

5. See Paragraph 2.02 for required MQC test frequencies.

[END OF SECTION]

APPENDIX I
FINANCIAL ASSURANCE COST ESTIMATE

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **WCOC** Project: **JED Sideslope Modifications** Project No.: **FL3318**

Phase No.: **02**

Title of Computations **FINANCIAL ASSURANCE COST ESTIMATE**

Computations by:	Signature		28 August 2018
	Printed Name	Alex Rivera, P.E.	Date
	Title	Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature		6 September 2018
	Printed Name	Ramil Mijares, Ph.D., P.E.	Date
	Title	Project Engineer	
Computations Checked by:	Signature		6 September 2018
	Printed Name	Ramil Mijares, Ph.D., P.E.	Date
	Title	Project Engineer	
Computations Backchecked by: (originator)	Signature		7 September 2018
	Printed Name	Alex Rivera, P.E.	Date
	Title	Engineer	
Approved by: (pm or designate)	Signature		7 September 2018
	Printed Name	Craig Browne, P.E.	Date
	Title	Senior Engineer	

Approval notes: Senior review provided by Kwasi Badu-Tweneboah, Ph.D., P.E.

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

FINANCIAL ASSURANCE COST ESTIMATE
J.E.D. SOLID WASTE MANAGEMENT FACILITY
ST. CLOUD, OSCEOLA COUNTY, FLORIDA

On behalf of Waste Connections of Osceola County, LLC. (WCOC), Geosyntec Consultants (Geosyntec) has prepared the financial assurance cost estimate (Estimate) in support of the intermediate modification permit application (Application) for the Class I Landfill at the J.E.D. Solid Waste Management Facility (JED facility) in St. Cloud, Osceola County, Florida. This narrative discusses the methods and assumptions used to estimate the cost for the items listed on the Florida Department Environmental Protection (FDEP) Form 62-701.900(28), Florida Administrative Code (F.A.C.), included in **Attachment A**, and hereafter referred to as FDEP form.

The proposed Cells 4, 5, 7, 8, and 12 sideslope modifications revises the final cover system geometry from the currently permitted sideslope benches to the proposed tack-on berms as illustrated in the Permit Drawings (Appendix B of the Application) and presented in **Figures 1** and **2**. Therefore, the earthwork volume required to construct the tack-on berms is greater than the earthwork volume estimated in the 2017 "*Financial Assurance Cost Estimate*" (2017 Financial Assurance Cost Estimate) (Geosyntec, 2017) provided in Appendix E of the 2017 "*Renewal Permit Application for Operation of J.E.D. Solid Waste Management Facility*" (2017 Renewal Permit Application). Also, WCOC has submitted the 2018 "*Annual Financial Assurance Renewal – 2018*" (2018 Adjusted Financial Assurance Cost Estimate) (WCOC, 2018) to satisfy the annual financial assurance cost adjustment reporting requirement of paragraph 62-701.630(4)(a), F.A.C. During the pre-application meeting for the proposed sideslope modifications project on 5 April 2018, FDEP indicated that a revision of the Stormwater Control System earthwork quantity provided in the 2017 Financial Assurance Cost Estimate and applying the FDEP-approved inflation factor to the closure and long-term care costs as presented in the 2018 Adjusted Financial Assurance Cost Estimate would satisfy the financial assurance requirements of Rule 62-701.630, F.A.C.

The items listed below, unit pricing, and supporting documentation are on file with FDEP and are included in this Estimate for reference. The earthwork quantity for the stormwater control system (i.e., Part IV, Item 6 of the FDEP form) has been updated to reflect the additional fill volume needed to construct the tack-on berms.

I. General Information

This Estimate covers the closure costs and long-term care costs for cells that have been constructed (including Phase 1 (Cells 1 through 4), Phase 2 (Cells 5 through 7), Phase 3 (Cells 8 through 10), and Phase 4 (Cells 11 and 13), and therefore, does not include costs for Cell 12.

The total two-dimensional (2D) area of these cells is approximately 153.5 acres. Of this total area, 43.8 acres has been closed as of August 2018, which leaves 109.7 acres remaining to be closed. The closure cost estimate (for 109.7 acres) and long-term care cost estimate (for 153.5 acres) are included on the FDEP form in **Attachment A**.

For the purposes of closure construction cost estimating, three-dimensional (3D) areas were calculated to account for the additional area attributed to the 5 percent grade of the top deck and the 3 horizontal to 1 vertical (3H:1V) side slopes. As such, the top deck and side slope 2D areas are multiplied by 1.001 and 1.054, respectively, to calculate corresponding 3D areas.

II. Type of Financial Assurance Document

WCOC maintains an insurance certificate to meet the financial assurance obligations of the JED facility.

III. Estimate Adjustment

This Estimate represents a recalculated cost estimate as required for intermediate modification permit application.

IV. Estimated Closing Cost (Recalculated Cost Estimate)

1. Proposed Monitoring Wells

A groundwater monitoring well system for the JED facility is already in place and additional monitoring wells will be installed as part of construction certification of proposed cells. Therefore, no additional cost for monitoring well installation is included as part of this Estimate.

2. Slope and Fill (bedding layer between waste and barrier layer)

During closure, an intermediate layer of cover soil, approximately 12-inch (in.) thick, will be used for grading the surface of the waste. For the approximately 109.7-acre disposal area that needs to be closed, approximately 3.0 acres cover the top deck area and approximately 106.7 acres cover the side slope area as presented in the Permit Drawings (Appendix B of the Application). Utilizing the slope correction factors, the estimated cubic yardage for the intermediate layer of cover soil is 186,284 cubic yards (CY) (i.e., 3.0 acres × 1.001 × 1 foot (ft) + 106.7 acres × 1.054 × 1 ft). This material will be obtained from an on-site borrow source at a unit cost of approximately $3.75/CY, which includes handling, placement/spreading, and compaction. The cost estimate was obtained from Comanco Environmental Corporation (Comanco) of Plant City, Florida (see **Attachment B**).

The total cost for material handling, placement, spreading, and compaction is:

186,284 CY @ $3.75/CY = **$698,565.00**

3. Cover Material (Barrier Layer)

The barrier layer of the final cover system consists of a 40-mil thick textured polyethylene (PE) geomembrane on the top deck and side slopes and a geocomposite drainage layer (i.e., geonet with geotextile on both sides) on the 3H:1V side slopes only. For the 109.7-acre closure area, approximately 558,850 square yards (SY) (i.e., 3.0 acres × 1.001 + 106.7 acres × 1.054) of 40-mil thick textured PE geomembrane will be needed. Also, approximately 106.7 acres of the closure area consists of side slopes that will require 544,316 SY (i.e., 106.7 acres × 1.054) of geocomposite drainage layer in the final cover system. The material and delivery costs for the geomembrane and geocomposite are $0.22 per square foot (SF) or $1.98/SY and $0.32/SF or $2.88/SY, respectively, as obtained from Agru America, Inc. (Agru) of Georgetown, South Carolina (see **Attachment B**). Installation costs are approximately $0.10/SF or $0.90/SY for both geomembrane and geocomposite as provided in the 2016 Comanco proposal for the Cell 13 construction (see **Attachment B**).

Therefore, the estimated cost for construction of the barrier layer is:

558,850 SY of 40-mil thick textured PE geomembrane @ $2.88/SY = $1,609,488.00

544,316 SY of geocomposite drainage layer @ $3.78/SY = $2,057,514.48

Total cost = **$3,667,002.48**

4. Top Soil Cover (includes vegetative soil layer)

The cover protective layer consists of 24-in. thick vegetative soil layer over the entire final cover, resulting in an estimated volume of 372,567 CY (i.e., 3.0 acres × 1.001 × 2 ft + 106.7 acres × 1.054 × 2 ft) for the 109.7-acre closure area. The material will be obtained from an on-site borrow source, with a unit cost of $4.50/CY which includes handling, placement/spreading, and compaction as provided by Comanco in **Attachment B**. The total cost for the top soil cover is:

372,567 CY of on-site soil material @ $4.50/CY = **$1,676,551.50**

5. Vegetative Layer

Approximately 558,850 SY of sod (i.e., 3.0 acres × 1.001 plus 106.7 acres × 1.054) will be required for the final cover system of the closure area. The material will be obtained at a unit cost of approximately $2.70/SY. This cost estimate was provided by Comanco (see **Attachment B**).

The total cost for sodding the final cover system is:

558,850 SY @ $2.70/SY **= $1,508,895.00**

6. Stormwater Control System

The perimeter and site stormwater controls are either already in place or will be constructed as part of cell construction activities and are therefore not included as part of this Estimate. Stormwater control components for the closure will include top deck berms, seepage header piping, corrugated HDPE pipe downdrains, and concrete structures.

The proposed waste-fill modifications will utilize tack-on berms while maintaining a 15-ft. wide drainage corridor and a 40-ft. vertical spacing between berms (i.e., at Elev. 138, 178, 218, 258, and 298 ft. NGVD29) as shown on the Permit Drawings (Appendix B of the Application). Also, the inclination of the waste sideslopes (i.e., 3 horizontal to 1 vertical [3H:1V]) and the maximum vertical elevation of the landfill are to be maintained. Therefore, the earthwork required to construct the tack-on berms (estimated by comparison of the currently permitted sideslope bench surface to the proposed sideslope tack-on berm surface using AutoCAD software) and final cover system at downchutes will require approximately 73,461 CY of earthwork (66,255 CY + 7,206 CY = 73,461 CY). Based on the proposed sideslope geometry presented in **Figure 2**, it is assumed that top deck berms would not be required. The price includes earthwork and placement of the material at a unit cost of $3.00/CY and is based on cost information provided by Comanco (**Attachment B**).

Also, turf reinforcement mats (TRM) will be installed at spans of the drainage swale with changes in alignment to reduce erosion potential. The estimated area of the drainage swales that requires TRM is approximately 1,720 SY. The price for the material and installation labor is $5.05 /SY and is based on item average unit costs reported by the Florida Department of Transportation (FDOT) (**Attachment B**).

Based on the proposed closure design there is approximately 11,800 LF of 24-in. diameter of corrugated HDPE piping/downdrains to drain the closure area slopes. Lengths of the 24-in. diameter pipe represent plan dimensions with 10 percent slope and bench correction applied (i.e., 10,725 LF × 1.10). The price to install the 24-in. diameter pipe is $35.00 per ft, respectively, as provided by Comanco (**Attachment B**). Also, approximately 8,540 LF of 4-in. diameter HDPE corrugated drainage pipe will be installed as part of the final cover system. The material and installation cost of the piping, including a 3-ft wide strip of geomembrane used to wrap the 4-in. diameter drainage pipe, is $20.00 per LF as provided by Comanco (**Attachment B**).

Two concrete pads and grates will be installed with each "wye" connection – which joins the bench swale pipes to the main side slope downchute – to hold the piping in place and reduce erosion. A total of 84 pairs of concrete pads (168 total) will be installed as part of closure activities. Each concrete pad will be 6-in. thick with dimensions of approximately 7.5-ft x 7.5-

ft and fitted with a galvanized grate. The cost to install all fittings, concrete, and grates is $1,250.00 per "wye" connection, as provided by Comanco (**Attachment B**).

All concrete drainage inlets and outfall piping at the perimeter road are installed during cell construction and therefore are not included as part of this Estimate.

Concrete thrust blocks will be installed within each downdrain pipe at side slope benches and at the landfill toe. The unit price of $1,750.00 each was provided by Comanco (**Attachment B**).

The cost for construction of the storm water control components of the final cover system is:

Earthwork: 73,461 CY @ $3.00/CY = $220,383.00

TRM: 1,720 SY @ $5.05/SY = $8,686.00

Piping/Downdrains: 24-in. diameter HDPE – 11,800 LF @ $35.00/LF = $413,000.00

4-in. diameter HDPE – 8,540 LF @ $20.00/LF = $170,800.00

"Wye" Connections: 168 @ $1,250.00 each = $210,000.00

Concrete thrust blocks: 179 @ $1,750.00 each = $313,250.00

Total cost = **$1,336,119.00**

7. Passive Gas Control

Passive gas control systems are not a part of the design of the Class I landfill. Therefore, there is no cost for this item.

8. Active Gas Extraction Control

The existing gas collection and control system (GCCS), consisting of a perimeter header, vertical well network, blowers, and flare will be expanded as part of the closure. The blower, flare, and the main header system have already been installed as part of landfill operations. As provided by Comanco and QED Environmental Systems, Inc. (QED) of Dexter, Michigan in **Attachment B**, the cost of installation of the remaining components can be estimated as follows:

- $81.65 per linear foot of well (includes drilling, well casing, gravel backfill and seal);
- $478.36 per wellhead;
- $19.90 per linear foot of lateral pipe (8 in. diameter);
- $27.84 per linear foot of header pipe (12 in. diameter); and
- $39.59 per linear foot of perimeter header pipe (18 in. diameter).

The final components of the GCCS will include:

- 120 wells – 68 shallow wells (average depth of 60 ft), 46 intermediate wells (average depth of 120 ft), and 6 deep wells (average depth of 180 ft). Total well depth = 10,680 ft or an average of 89 ft per well;
- approximately 21,680 ft of 8-in. diameter SDR-17 HDPE lateral pipe (increased by 10 percent to allow for a 3H:1V slope correction factor and additional length required for vertical risers to connect to the adjacent extraction well or 19,710 ft × 1.10 = 21,680 ft);
- approximately 8,690 ft of 12-in. diameter SDR-17 HDPE header pipe (increased by 10 percent to allow for a 3H:1V slope correction factor and additional length required for vertical risers to connect to the adjacent extraction well or 7,900 ft × 1.10 = 8,690 ft); and
- approximately 8,320 ft of 18-in. diameter SDR-17 HDPE perimeter header pipe.

The cost of the active gas extraction control system at closure is therefore:

120 wells @ 89 ft/well x $81.65/ft = $7,266.85 per well = $872,022.00

120 wellheads @ $478.36/wellhead = $57,403.20

21,680 ft of lateral pipe @ $19.90/ft = $431,432.00

8,690 ft of header pipe @ $27.84/ft = $241,929.60

8,320 ft of perimeter header pipe @ $39.59/ft = $329,388.80

Total active gas extraction control system cost= **$1,932,175.60**

9. <u>Security System</u>

The security systems, consisting of perimeter fencing, gates and signs, for the JED facility are already in place and are thus not included as part of the closing costs. Additional fencing and signs are included in the long-term maintenance section of this cost estimate for upkeep purposes.

10. <u>Engineering</u>

Because a final cover plan, including stormwater management system has already been designed, the costs of engineering services related to closure of the site is estimated to be 2 percent of the construction cost (sum of items 1 through 9 above).

The total cost for closure-related engineering services is:

$10,819,308.58 × 0.02 = **$216,386.17**

11. Professional Services

These costs are based on Geosyntec estimates and labor rates. It is estimated that approximately 3 percent of construction cost will be needed for contract/construction management, which equates to 0.03 × $10,819,308.58 = $324,579.26.

It is estimated that approximately 5 percent of construction cost will be needed for construction quality assurance (CQA), which equates to 0.05 × $10,819,308.58 = $540,965.43.

It is assumed that CQA testing cost is included in the 5 percent estimate above.

12. Contingency

A contingency factor for closure costs (Items 1-11 above) of 10 percent is estimated.

13. Site Specific Costs

a. Mobilization

Contractor mobilization costs as provided by Comanco in **Attachment B**, excluding the costs for professional services, are $75,000.00.

b. Inflation Adjustment

As discussed above, an FDEP-approved adjustment (i.e., 1.013) was applied to the total closure cost (includes mobilization cost above) for the JED facility. Therefore, an inflation factor of 0.013 was multiplied to $13,166,362.63 for a total adjustment of $171,162.71.

V. Annual Cost for Long-Term Care

1. <u>Ground Water Monitoring</u>

Sampling of the projected 56 monitoring wells will be conducted on a semi-annual basis. The estimate for laboratory analytical testing and labor for the sampling of the projected 56 monitoring wells is $271 per well with approximately $107 of labor per sample point as provided in the estimate by Environmental Conservation Laboratories, Inc. (ENCO) of Orlando, Florida (**Attachment B**).

It is assumed that the total cost for monitoring the 56 wells projected to be in use for monitoring Cells 1 through 11 and Cell 13 (does not include Cell 12) at the JED facility is:

56 wells @ $378 analytical/well/event = $21,168/event X 2 events = **$42,336/year**

2. <u>Surface Water Monitoring</u>

Surface water monitoring will be conducted at existing monitoring locations SW-3 and SW-4 (if flow at Bull Creek is observed) on a semi-annual basis; no new monitoring points will be added. Sampling of the 2 monitoring points associated with the Class I sampling event is estimated to cost $455 per event with approximately $107 of labor per sample point as provided in the estimate by ENCO (**Attachment B**).

Therefore, the assumed total cost for surface water monitoring at the JED facility is:

2 samples @ $455 analytical/location/event = $910/event X 2 events = **$1,820/year**

3. <u>Landfill Gas Monitoring</u>

The landfill gas monitoring probes will be monitored quarterly for concentrations of combustible gases. The long-term care cost associated with the landfill gas monitoring shown below are based on Geosyntec labor rates for a senior engineering technician ($75.00/hour) and assumed 10 hours to perform the monitoring at the estimated 23 gas probe locations.

The cost to perform the monitoring includes field and travel time.

- 10-hrs × $75.00/hr = $750.00
- Monitoring equipment rental and travel costs = $250.00/event
- Time to prepare report - 1 hr @ $75.00/hr = $75.00

Total cost per monitoring event equals $750.00 + $250.00 + $75.00 = **$1,075.00/quarter**

4. <u>Leachate Monitoring</u>

Because leachate monitoring is no longer required by Rule 62.701, F.A.C., the cost for leachate monitoring is not included.

5. Leachate Collection/Treatment System Maintenance

For the long-term care, assume the following maintenance activities:

Pump Maintenance and Replacement: Assumed that pumps require annual maintenance and Cells 1 through 11 and 13 will require one primary and one secondary replacement pump once during the 30-year monitoring period:

- Annual maintenance = $250/year; and
- Leachate pump replacement cost = $11,766.00 (total for primary and secondary pumps, provided by Diamond Scientific of Cocoa, Florida and presented in **Attachment B**) ÷ 30 years = $392.20/year.

Therefore, the total estimated annual cost for pumps is **$642.20**/year.

Leachate Collection Pipe Cleaning: It is assumed that approximately 29,170 LF of pipe will require cleaning every 10 years within the 30-year monitoring period (total of 3 cleanings). The associated cost is estimated to be 29,170 ft × $0.58/ft = ($16,918.60/event x 3 events) ÷ 30 years **= $1,691.86/year**. The leachate pipe cleaning unit rate is based on a proposal for jet cleaning services by Florida Jetclean of Odessa, Florida (**Attachment B**).

Leachate Storage Containers: Long term care for the leachate storage ponds assumes that each of the four bladder liners will require replacement once over the 30-year monitoring period. Replacement cost has been assumed to be $14,500.00 per flexible bladder as estimated below.

Approximately 22,500 SF or 2,500 SY of geomembrane required for each bladder (150 ft by 150 ft unit). Installation and purchase cost for 40-mil thick textured PE geomembrane equals $5.40/SY (based on Comanco's estimate for material and installation costs for 40-mil thick textured PE geomembrane). Assume $1,000/bladder to clean and remove existing bladder. The unit cost for each bladder replacement equals 2,500 SY × $5.40/SY + $1,000.00 = $14,500.00/bladder.

Total long-term care cost for the four bladder replacements based on a square yard and cost per year for the FDEP form is as follows:

4 bladders × $14,500.00/bladder = $58,000.00 ÷ 30 years = **$1,933.33/year**.

Leachate Aeration: Assume **$250.00/year** to maintain the leachate aeration system piping, pumps and electrical controls.

Leachate Disposal: The long-term average leachate production rate was calculated as part of the 2011 permit renewal for the JED facility (refer to response to RAI 2 documents, dated January 2012) to be approximately 8,394.53 gallons per acre per year. The total leachate production is therefore:

8,394.53 gallons/acre/year × 153.5 acres = 1,288,561 gallons per year

1,288.6 thousand gallons/year × $40.00/thousand gallons = **$51,544/year** or $4,296/mo.

6. Maintenance of Groundwater Monitoring Wells

It is assumed that up to 5 groundwater monitoring wells will be replaced over the 30-year monitoring period.

The estimated average cost associated with replacement of a groundwater monitoring wells is approximately $3,400.00/well. Therefore,

5 wells @ $3,400.00/well/30 years = **$567.00/year**

7. Gas System Maintenance

Approximately 177 gas wells would be installed within the footprint of Cells 1 through 11 and 13. Based on previous experience, it is estimated that an additional $55.00 per well/year will be needed for maintenance ($55.00 × 177 wells = **$9,735**). It is assumed 50 ft of lateral or header piping will require replacement or repair at an average cost of $55.00/ft ($55/ft x 50 ft = **$2,750**). It is assumed that **$2,500/year** will be required for general maintenance of both skid mounted flare station (includes blowers, meters, valves and flame arrestors).

8. Landscape Maintenance

It is estimated that the 153.5 acres of the Class I landfill will require mowing at an annual cost of $122.72 per acre. The estimate is based on the recent invoice received from RCS Excavation, Inc. (RCS) of Lake Placid, Florida (see **Attachment B**). It is assumed that mowing activities would be performed twice a year. Therefore, total yearly cost associated with landscape maintenance is:

Mowing (annually): $122.72/acre × 153.5 acres/event × 2 events/year = $**37,675.04/year**

9. Erosion Control and Cover Maintenance

The long-term care cost for erosion control and cover maintenance assumes that a 0.25-acre (1,210 SY) area will require maintenance (i.e., sodding) per year. As such, 1,210 SY @ $2.70/SY = $3,267.00/year. The lump sum cost for material and equipment mobilization costs to perform maintenance and general grading of the protective liner for re-sodding is estimated @ $2,500/year. The total cost associated with the erosion control and cover maintenance, per year, is equal to **$5,767.00/year**. This estimate is based on Geosyntec's experience with similar facilities.

10. Storm Water Management System Maintenance

Maintenance is estimated to occur on an annual basis. For the long-term care cost, a lump-sum cost of **$2,500** has been assumed based on Geosyntec's experience on similar sites and includes mobilization of a rubber tire mounted excavator and operator to clean and clear storm water ditches.

11. Security System Maintenance

An estimate of 100 LF of fencing per year, one (1) gate, and six (6) signs have been assumed to require replacement over the course of the 30-year monitoring period. The cost to replace fencing is $4.00/LF; replace a gate is $800.00; and replace a total of six (6) signs is $200/sign as provided in the estimate by RCS (**Attachment B**).

12. Utilities

The annual utility cost is based on recent invoices from Duke Energy to WCOC. The estimated yearly lump sum amount is indicated on the FDEP form.

13. Leachate Collection/Treatment Systems Operation

Leachate collection/treatment system operation cost estimates are based on weekly monitoring by a technician for total of 3 hours/week × 52 weeks/year @ $65/hour = **$10,140/year**. Additional material maintenance costs for the pumps and aeration system at the storage holding ponds is assumed as **$500.00/year**.

14. Administrative

The administrative long-term cost estimates that 10 hours per month will be expended towards administrative/overhead activities @ $40.00/hour (i.e., $4,800/year). In addition, one 3rd party engineer (@$120.00/hr) and one technician (@$65.00/hr) are expected to perform a yearly site inspection under the oversight of a P.E. Supervisor (@150.00/hr). The yearly site inspection is estimated to require 8 hours from each on-site personnel and supervisor. Therefore, the total yearly administrative cost for the facility is equal to **$7,480.00**.

15. Contingency

A contingency of 10 percent of the total long-term care costs has been included in this Estimate.

16. Site-Specific Costs

a. Inflation Adjustment

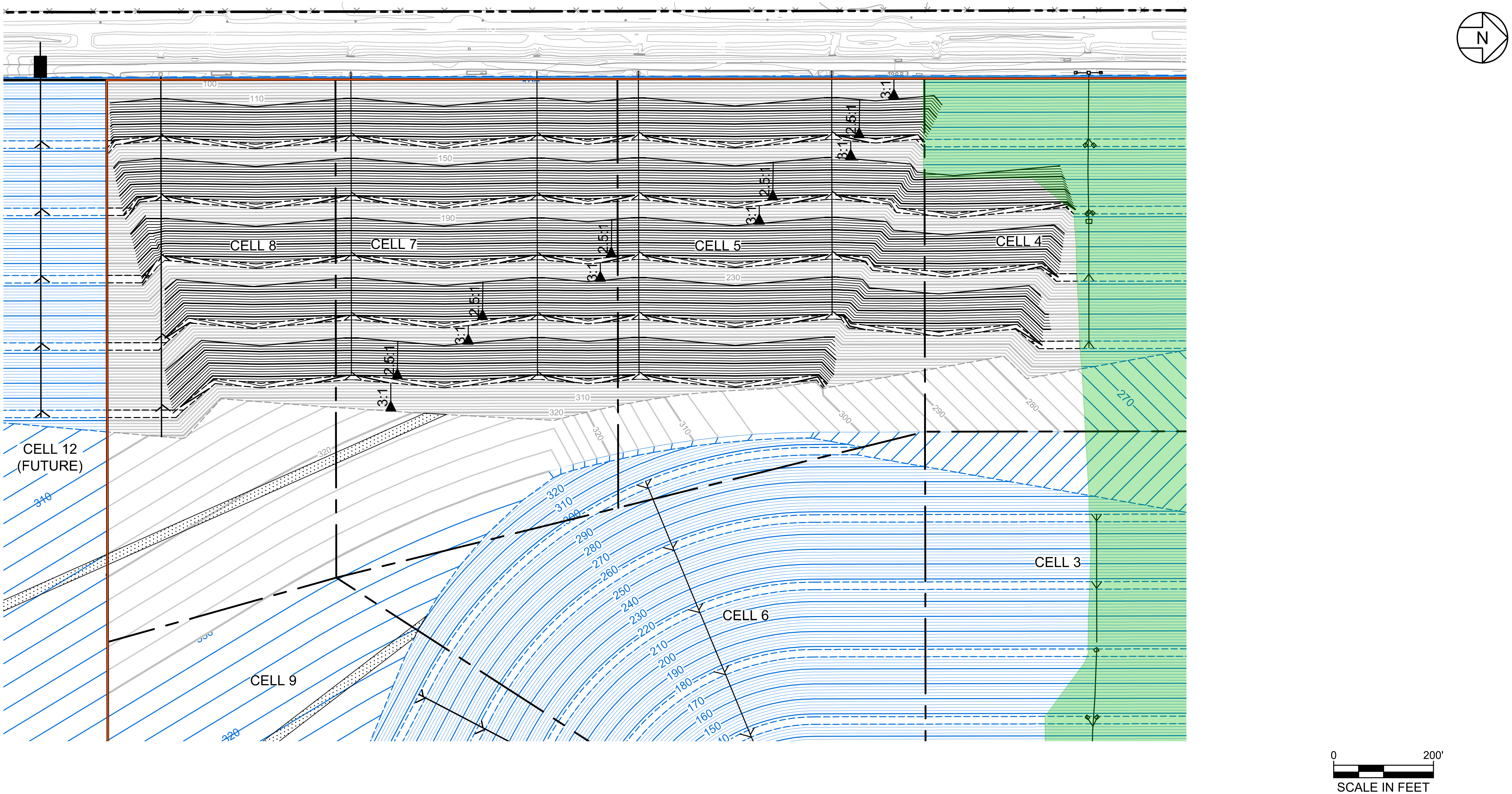
As discussed above, an FDEP-approved adjustment (i.e., 1.013) was applied to the annual long-term care cost for the JED facility. Therefore, an inflation factor of 0.013 was multiplied to the annual long-term care cost of $208,290.32 for a total annual adjustment of $2,707.77. Therefore, over the 30-year long-term care period, the total long-term care cost is increased from $6,248,709.72 to $6,329,942.82.

VI. References

Geosyntec Consultants (2017) "Renewal Permit Application for Operation of J.E.D. Solid Waste Management Facility," received by FDEP on 3 May 2017.

Waste Connections of Osceola County, LLC (2018) "Annual Financial Assurance Renewal – 2018," received by FDEP on 27 February 2018.

FIGURE



LEGEND

- GROUND ELEVATION CONTOUR 10 MAY 2017 (FT, MSL)
- PROPERTY BOUNDARY
- PERMITTED LIMITS OF WASTE
- INTERCELL BOUNDARY
- CURRENTLY CONSTRUCTED LANDFILL FOOTPRINT
- CLOSED AREA

JED SOLID WASTE MANAGEMENT FACILITY

Geosyntec consultants

TAMPA, FL

APRIL 2018

FIGURE 1

I:_CADD (PROJECTS)\J\JED LANDFILL\FIGURE\FL3318.01\FL3318.01F01

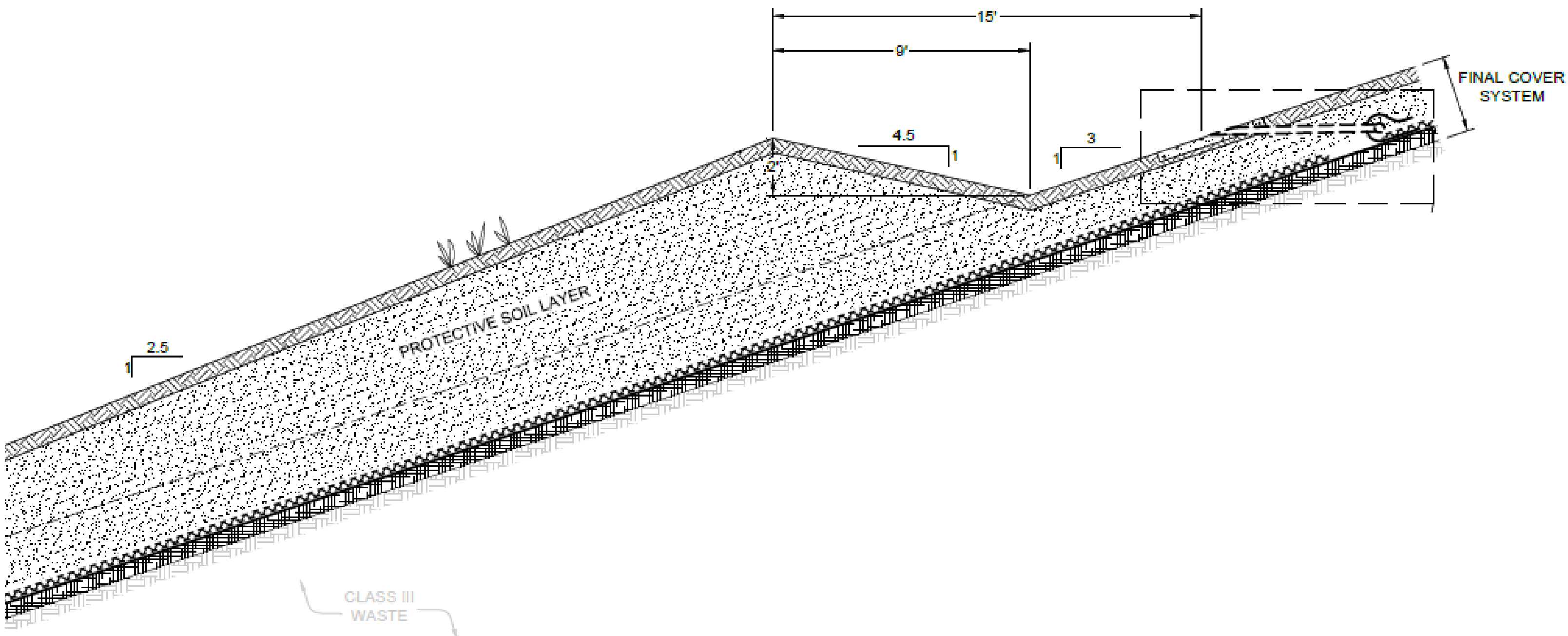


Figure 2

Typical Cross Section of Proposed Sideslope
J.E.D. Solid Waste Management Facility
St. Cloud, Osceola County, Florida

ATTACHMENT A

FDEP CLOSURE COST ESTIMATING FORM

Print Form Reset Form

Florida Department of Environmental Protection

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

DEP Form # 62-701.900(28), F.A.C.
Form Title: Closure Cost Estimating Form For Solid Waste Facilities
Effective Date: January 6, 2010
Incorporated in Rule 62-701.630(3), F.A.C.

CLOSURE COST ESTIMATING FORM FOR SOLID WASTE FACILITIES

Date of DEP Approval: ______________

I. GENERAL INFORMATION:

Facility Name: J.E.D. Solid Waste Management Facility WACS ID: 89544

Permit Application or Consent Order No.: 0199726-033-SO-01 Expiration Date: 06/13/2027

Facility Address: 1501 Omni Way, St. Cloud, Florida 34773

Permittee or Owner/Operator: Waste Connections of Osceola County, LLC

Mailing Address: 1501 Omni Way, St. Cloud, Florida 34773

Latitude: 28 ° 3 ' 32 " Longitude: 81 ° 5 ' 46 "

Coordinate Method: DGPS Datum: WGS84

Collected by: Johnston's Surveying Company/Affiliation Johnston's Surveying

Solid Waste Disposal Units Included in Estimate:

Phase / Cell	Acres	Date Unit Began Accepting Waste	Active Life of Unit From Date of Initial Receipt of Waste	If active: Remaining life of unit	If closed: Date last waste received	If closed: Official date of closing
Cell 13	17.6	Oct 2016				
Cells 5-11	84.1	Mar 2009				
Cells 3-4 (active)	8.0	Jan 2004				
Cells 1-4 (part. clos. event 2)	19.4	Jan 2004				10/2012
Cells 1-4 (part. clos.)	24.4	Jan 2004				02/2009

Total disposal unit acreage included in this estimate: Closure: 109.7 Long-Term Care: 153.5

Facility type: (Check all that apply)
☒ Class I ☐ Class III ☐ C&D Debris Disposal
☐ Other: ______________

II. TYPE OF FINANCIAL ASSURANCE DOCUMENT (Check type)

☐ Letter of Credit* ☒ Insurance Certificate ☐ Escrow Account
☐ Performance Bond* ☐ Financial Test ☐ Form 29 (FA Deferral)
☐ Guarantee Bond* ☐ Trust Fund Agreement

* - Indicates mechanisms that require the use of a Standby Trust Fund Agreement

III. ESTIMATE ADJUSTMENT

40 CFR Part 264 Subpart H as adopted by reference in Rule 62-701.630, Florida Administrative Code, (F.A.C.) sets forth the method of annual cost estimate adjustment. Cost estimates may be adjusted by using an inflation factor or by recalculating the maximum costs of closure in current dollars. Select one of the methods of cost estimate ajustment below.

☐ **(a) Inflation Factor Adjustment** ☒ **(b) Recalculated or New Cost Estimates**

Inflation adjustment using an inflation factor may only be made when a Department approved closure cost estimate exists and no changes have occurred in the facility operation which would necessitate modification to the closure plan. The inflation factor is derived from the most recent Implicit Price Deflator for Gross National Product published by the U.S. Department of Commerce in its survey of Current Business. The inflation factor is the result of dividing the latest published annual Deflatory by the Deflator for the previous year. The inflation factor may also be obtained from the Solid Waste website www.dep.state.fl.us/waste/categories/swfr or call the Financial Coordinator at (850) 245-8706.

This adjustment is based on the Department approved closing cost estimate dated: ______________

Latest Department Approved **Closing Cost** Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Closing Cost Estimate:
______________	×	______	=	______________

This adjustment is based on the Department approved long-term care cost estimate dated: ______________

Latest Department Approved Annual **Long-Term Care** Cost Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Annual Long-Term Care Cost Estimate:
______________	×	______	=	______________
Number of Years of Long Term Care Remaining:			×	______________
Inflation Adjusted Long-Term Care Cost Estimate:			=	______________

Signature by: ☐ **Owner/Operator** ☒ **Engineer** (check what applies)

______________________ Signature	______________________ Address
______________________ Name & Title	______________________ City, State, Zip Code
______________________ Date	______________________ E-Mail Address
______________________ Telephone Number	

IV. ESTIMATED CLOSING COST (check what applies)

☒ **Recalculated Cost Estimate** ☐ **New Facility Cost Estimate**

Notes: 1. Cost estimates for the time period when the extent and manner of landfill operation makes closing most ex

2. Cost estimate must be certified by a professional engineer.

3. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.

4. In some cases, a price quote in support of individual item estimates may be required.

Description	Unit	Number of Units	Cost / Unit	Total Cost
1. Proposed Monitoring Wells (Do not include wells already in existence.)				
	EA	0		
			Subtotal Proposed Monitoring Wells:	
2. Slope and Fill (bedding layer between waste and barrier layer):				
Excavation	CY			
Placement and Spreading	CY			
Compaction	CY			
On-Site Material	CY	186,284	$3.75	$698,565.00
Delivery	CY			
			Subtotal Slope and Fill:	$698,565.00
3. Cover Material (Barrier Layer):				
Off-Site Clay	CY			
Synthetics - 40 mil	SY	558,850	$2.88	$1,609,488.00
Synthetics - GCL	SY			
Synthetics - Geonet	SY	544,316	$3.78	$2,057,514.48
Synthetics - Other (explain)				
			Subtotal Cover Material:	$3,667,002.48
4. Top Soil Cover:				
On-Site Material	CY	372,567	$4.50	$1,676,551.50
Delivery	CY			
Spread	CY			
			Subtotal Top Soil Cover:	$1,676,551.50
5. Vegetative Layer				
Sodding	SY	558,850	$2.70	$1,508,895.00
Hydroseeding	AC			
Fertilizer	AC			
Mulch	AC			
Other (explain)				
			Subtotal Vegetative Layer:	$1,508,895.00
6. Stormwater Control System:				
Earthwork	CY	73,461	$3.00	$220,383.00
Piping (4 in. diameter)	LF	8,540	$20.00	$170,800.00
Piping (24 in. diameter)	LF	11,800	$35.00	$413,000.00
TRM	SY	1,720	$5.05	$8,686.00
Concrete thrust blocks	EA	179	$1,750.00	$313,250.00
Control Structures	EA	0	$0.00	
Other (explain) "wye" connection;	EA	168	$1,250.00	$210,000.00
			Subtotal Stormwater Control System:	$1,336,119.00

Description	Unit	Number of Units	Cost / Unit	Total Cost
7. Passive Gas Control:				
Wells	EA			
Pipe and Fittings	LF			
Monitoring Probes	EA			
NSPS/Title V requirements	LS	1		
			Subtotal Passive Gas Control:	
8. Active Gas Extraction Control:				
Traps	EA			
Sumps	EA			
Flare Assembly	EA			
Flame Arrestor	EA			
Mist Eliminator	EA			
Flow Meter	EA			
Blowers	EA			
Collection System	LF			
Other (explain)		1	$1,932,175.60	$1,932,175.60
itemized in narrative			Subtotal Active Gas Extraction Control:	$1,932,175.60
9. Security System:				
Fencing	LF			
Gate(s)	EA			
Sign(s)	EA			
			Subtotal Security System:	
10. Engineering:				
Closure Plan Report	LS	1		
Certified Engineering Drawings	LS	1		
NSPS/Title V Air Permit	LS	1		
Final Survey	LS	1		
Certification of Closure	LS	1		
Other (explain)		1	$216,386.17	$216,386.17
2% of Construction Cost			Subtotal Engineering:	$216,386.17

Description	Hours	Cost / Hour	Hours	Cost / Hour	Total Cost
11. Professional Services					
	Contract Management		Quality Assurance		
P.E. Supervisor					
On-Site Engineer					
Office Engineer					
On-Site Technician					
Other (explain)	1	$324,57	1	$540,9	$865,544.00
3% and 5% of cons. Co					

Description	Unit	Number of Units	Cost / Unit	Total Cost
Quality Assurance Testing	LS	1		
			Subtotal Professional Services:	$865,544.00

Subtotal of 1-11 Above:	$11,901,238.75
12. Contingency 10 % of Subtotal of 1-11 Above	$1,190,123.88
Subtotal Contingency:	$1,190,123.88
Estimated Closing Cost Subtotal:	$13,091,362.63

Description	**Total Cost**
13. Site Specific Costs	
Mobilization	$75,000.00
Waste Tire Facility	
Materials Recovery Facility	
Special Wastes	
Leachate Management System Modification	
Other (explain) Inflation adjustment of 0.013 to closing cost	$171,162.71
Subtotal Site Specific Costs:	$246,162.71

TOTAL ESTIMATED CLOSING COSTS ($): $13,337,525.34

V. ANNUAL COST FOR LONG-TERM CARE

See 62-701.600(1)a.1., 62-701.620(1), 62-701.630(3)a. and 62-701.730(11)b. F.A.C. for required term length. For landfills certified closed and Department accepted, enter the remaining long-term care length as "Other" and provide years remaining.

(Check Term Length) ☐ 5 Years ☐ 20 Years ☒ 30 Years ☐ Other, ___ Years

Notes: 1. Cost estimates must be certified by a professional engineer.

2. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.

3. In some cases, a price quote in support of individual item estimates may be required.

All items must be addressed. Attach a detailed explanation for all entries left blank.

Description	Sampling Frequency (Events / Year)	Number of Wells	(Cost / Well) / Event	Annual Cost
1. Groundwater Monitoring [62-701.510(6), and (8)(a)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	56	$378.00	$42,336.00
Annually	1			
			Subtotal Groundwater Monitoring:	$42,336.00
2. Surface Water Monitoring [62-701.510(4), and (8)(b)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	2	$455.00	$1,820.00
Annually	1			
			Subtotal Surface Water Monitoring:	$1,820.00
3. Gas Monitoring [62-701.400(10)]				
Monthly	12			
Quarterly	4	1	$1,075.00	$4,300.00
Semi-Annually	2			
Annually	1	1		
			Subtotal Gas Monitoring:	$4,300.00
4. Leachate Monitoring [62-701.510(5), (6)(b) and 62-701.510(8)c]				
Monthly	12			
Quarterly	4			
Semi-Annually	2			
Annually	1	0		
Other (explain) ______				
			Subtotal Leachate Monitoring:	

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. Leachate Collection/Treatment Systems Maintenance				
Maintenance				
Collection Pipes	LF	2,917	$0.58	$1,691.86
Sumps, Traps	EA	1	$642.20	$642.20
Lift Stations	EA			
Cleaning	LS	1		
Tanks	EA			

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. (continued)				
Impoundments				
Liner Repair	SY	10,000	$0.19	$1,933.33
Sludge Removal	CY			
Aeration Systems				
Floating Aerators	EA	1	$250.00	$250.00
Spray Aerators	EA			
Disposal				
Off-site (Includes transportation and disposal)	1000 gallon	1,288.6	$40.00	$51,544.00
			Subtotal Leachate Collection / Treatment Systems Maintenance:	$56,061.39
6. Groundwater Monitoring Well Maintenance				
Monitoring Wells	EA	5	$113.40	$567.00
Replacement	EA			
Abandonment	EA			
			Subtotal Groundwater Monitoring Well Maintenance:	$567.00
7. Gas System Maintenance				
Well Maintenance	EA	177	$55.00	$9,735.00
Lateral/Header Pipe	LF	50	$55.00	$2,750.00
Flaring Units	EA	1	$2,500.00	$2,500.00
Meters, Valves	EA			
Compressors	EA			
Flame Arrestors	EA			
Operation	LS	1		
			Subtotal Gas System Maintenance:	$14,985.00
8. Landscape Maintenance				
Mowing (2 events)	AC	307	$122.72	$37,675.04
Fertilizer	AC			
			Subtotal Landscape Maintenance:	$37,675.04
9. Erosion Control and Cover Maintenance				
Sodding	SY	1,210	$2.70	$3,267.00
Regrading	AC	1	$2,500.00	$2,500.00
Liner Repair	SY			
Clay	CY			
			Subtotal Erosion Control and Cover Maintenance:	$5,767.00
10. Storm Water Management System Maintenance				
Conveyance Maintenance	LS	1	$2,500.00	$2,500.00
			Subtotal Storm Water Management System Maintenance:	$2,500.00
11. Security System Maintenance				
Fences	LF	1	$400.00	$400.00
Gate(s)	EA	1	$26.67	$26.67
Sign(s)	EA	1	$40.00	$40.00
			Subtotal Security System Maintenance:	$466.67

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
12. Utilities	LS	1	$4,756.74	$4,756.74
			Subtotal Utilities:	$4,756.74
13. Leachate Collection/Treatment Systems Operation				
Operation				
P.E. Supervisor	HR			
On-Site Engineer	HR			
Office Engineer	HR			
OnSite Technician	HR	156	$65.00	$10,140.00
Materials	LS	1	$500.00	$500.00
	Subtotal Leachate Collection/Treatment Systems Operation:			$10,640.00
14. Administrative				
P.E. Supervisor	HR	8	$150.00	$1,200.00
On-Site Engineer	HR	8	$120.00	$960.00
Office Engineer	HR			
OnSite Technician	HR	8	$65.00	$520.00
Other clerical	HR	120	$40.00	$4,800.00
			Subtotal Administrative:	$7,480.00
			Subtotal of 1-14 Above:	$189,354.84
15. Contingency	10	% of Subtotal of 1-14 Above		$18,935.48
			Subtotal Contingency:	$18,935.48

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
16. Site Specific Costs				
Inflation adjustment of 0.013 to long-term care cost	1	1	$2,707.77	$2,707.77
			Subtotal Site Specific Costs:	$2,707.77

ANNUAL LONG-TERM CARE COST ($ / YEAR): $210,998.09

Number of Years of Long-Term Care: 30

TOTAL LONG-TERM CARE COST ($): $6,329,942.82

VI. CERTIFICATION BY ENGINEER

This is to certify that the Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and/or long-term care of the facility and comply with the requirements of Rule 62-701.630 F.A.C. and all other Department of Environmental Protection rules, and statutes of the State of Florida. It is understood that the Cost Estimates shall be submitted to the Department annually, revised or adjusted as required by Rule 62-701.630(4), F.A.C.

[signature] Signature	12802 Tampa Oaks Blvd, Suite 151 Mailing Address
Craig Browne, P.E., Engineer Name and Title (please type)	Tampa, FL, 33637 City, State, Zip Code
1/23/2019 Date	cbrowne@geosyntec.com E-Mail address (if available)
68613 Florida Registration Number (please affix seal)	813-558-0990 Telephone Number

CRAIG R. BROWNE
LICENSE
No. 68613
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

VII. SIGNATURE BY OWNER/OPERATOR

[signature] Signature of Applicant	1501 Omni Way Mailing Address
Kirk Wills, Southern Region Engineer Name and Title (please type)	St. Cloud, FL 34773 City, State, Zip Code
kirk.wills@wasteconnections.com E-Mail address (if available)	813-388-1026 Telephone Number

ATTACHMENT B

COST ESTIMATES FROM CONTRACTORS/VENDORS

FINANCIAL ASSURANCE SUMMARY TABLE
J.E.D. Solid Waste Management Facility
1501 Omni Way, St. Cloud, FL 34773

FA Form Item No.[1]	Work Description	Units	Estimated Quantity	Unit Price	Amount
1	Proposed Monitoring Wells	N/A	-	-	-
2	Slope and Fill (bedding layer between waste and barrier layer) Onsite Matl	CY	186,284	$3.75	$698,565
3	Cover Material (barrier layer)				
	a. 40-mil textured PE geomembrane	SY	558,850	$5.40	$3,017,790
	b. geocomposite drainage layer	SY	544,316	$6.75	$3,674,133
4	Topsoil Cover (includes vegetative soil layer) Onsite Matl	CY	372,567	$4.50	$1,676,552
5	Vegetative Layer @ 6" Thickness Onsiet Matl	SY	558,850	$2.70	$1,508,895
6	Stormwater Control System				
	a. earthwork Cut/Fill	CY	31,090	$3.00	$93,270
	b. piping - 24" diameter corrugated HDPE pipe	LF	11,800	$35.00	$413,000
	c. piping - 4" diameter corrugated HDPE pipe	LF	8,540	$20.00	$170,800
	d. Wye Connections	Each	168	$1,250.00	$210,000
	e. 5'Lx2'Wx4'H concrete thrust block	Each	179	$1,750.00	$313,250
	f.	CY		$0.00	$0
7	Passive Gas Control	N/A	-	-	-
8	Active Gas Extraction Control				
	a. well - 8" diameter Sched. 80 PVC	LF	10,680	$130.00	$1,388,400
	b. wellhead	Each	120	$900.00	$108,000
	c. lateral pipe - 8" diameter SDR 17	LF	21,680	$28.00	$607,040
	d. header pipe - 12" diameter SDR 17	LF	8,690	$39.00	$338,910
	f. perimeter header pipe - 18" SDR 17	LF	8,320	$68.00	$565,760
9	Security System	N/A	-	-	-
10	Engineering	N/A	-	-	-
11	Professional Services	N/A	-	-	-
12	Contingency	%	-	-	-
13	Site Specific Costs				
	a. contractor mobilization costs	LS	1	$75,000.00	$75,000

Notes: 1. FDEP form 62-701.900(28)

From:	John Jacobs
To:	Alex Rivera
Cc:	Nick Bridges
Subject:	RE: Request for Estimate
Date:	Friday, March 31, 2017 1:31:48 PM
Attachments:	image002.png image003.png image004.png image008.png image010.png image012.png

---

Alex,

Those still look like good budget numbers for the work.

Best Regards,

John Jacobs

John Jacobs | Senior Estimator
COMANCO Environmental Corporation
4301 Sterling Commerce Dr. | Plant City, FL 33566
Office: 813-988-8829 | Fax: 813-386-7385 | Cell: 813-714-2253
email: jjacobs@comanco.com | web: www.comanco.com

From: Alex Rivera [mailto:ARivera@Geosyntec.com]
Sent: Tuesday, March 28, 2017 3:59 PM
To: John Jacobs
Cc: Nick Bridges
Subject: RE: Request for Estimate

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The quantities for this 2017 permit are slightly reduced as the footprint we are evaluating is generally smaller.

Please take a look and let me know if this is something you would be able to help with.

Thank you,

Alex Rivera

From: Alex Rivera
Sent: Friday, June 3, 2016 3:34 PM
To: John Jacobs <JJacobs@comanco.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

Great,

Thank you John

From: John Jacobs [mailto:JJacobs@comanco.com]
Sent: Friday, June 3, 2016 3:28 PM
To: Alex Rivera <ARivera@Geosyntec.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

Alex,

If it is sod that you're looking for, that should be in the area of $0.30 per SF ($2.70 per SY).

John

From: Alexander Rivera [mailto:ARivera@Geosyntec.com]
Sent: Friday, June 03, 2016 3:05 PM
To: John Jacobs
Cc: Nick Bridges
Subject: RE: Request for Estimate

Hi John,

Just wanted to confirm your cost for line item #5 (vegetative layer) on your initial assessment. This line item is for sod, and you have a note stating on-site material. This line item is for sod (not to be confused with topsoil which includes the vegetative soil layer).

Thanks,

Alex

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Sent: Friday, May 27, 2016 1:24 PM
To: Alex Rivera <ARivera@Geosyntec.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

Alexander,

Here is our best initial assessment of the budget pricing numbers for your project.

Thanks,

John

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Office: 813-988-8829 | Fax: 813-386-7385 | Cell: 813-714-2253
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From: Alexander Rivera [mailto:ARivera@Geosyntec.com]
Sent: Wednesday, May 25, 2016 9:18 AM
To: John Jacobs
Cc: Nick Bridges
Subject: Request for Estimate

Good morning John,

We are currently assisting Mike Kaiser of Progressive Waste with a renewal permit through Phase 5 (Cell 15) of the JED Class I Landfill in St. Cloud, FL. The attached proposal was forwarded to my office by Mike as a reference. We are asking for your assistance with providing an estimate for cell closure based on estimated quantities in the attached Excel table.

Please take a look and let me know if this is something you would be able to help with. We have a short turnaround on this and your response would be greatly appreciated.

Thank you,

Alex Rivera, P.E.
Engineer

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Fax: 813.558.9726
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From: John Jacobs
To: Alex Rivera
Cc: Nick Bridges
Subject: RE: Request for Estimate
Date: Friday, June 3, 2016 3:10:05 PM
Attachments: image002.png
image003.png
image004.png

Alex,

For budgetary purposes, let's call it 68.00/LF supplied and installed.

Best Regards,

John

COMANCO
SAFETY ★ QUALITY ★ SERVICE

John Jacobs | Senior Estimator
COMANCO Environmental Corporation
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Office: 813-988-8829 | Fax: 813-386-7385 | Cell: 813-714-2253
email: jjacobs@comanco.com | web: www.comanco.com

From: Alexander Rivera [mailto:ARivera@Geosyntec.com]
Sent: Friday, June 03, 2016 1:02 PM
To: John Jacobs
Cc: Nick Bridges
Subject: RE: Request for Estimate

Good afternoon John,

Just following up with regards to the unit cost of the pipe below.

Thanks,

Alex

From: Alex Rivera
Sent: Friday, May 27, 2016 5:42 PM
To: 'John Jacobs' <JJacobs@comanco.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

I inadvertently left out approximately 4,550 LF of 18-in diameter SDR 17 perimeter header pipe.

Could you provide an estimate for this line item.

Thank you,

Alex

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Cc: Nick Bridges <nbridges@comanco.com>
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engineers | scientists | innovators

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For more information please visit http://www.mimecast.com

From:	John Jacobs
To:	Alex Rivera
Cc:	Nick Bridges
Subject:	RE: Request for Estimate
Date:	Thursday, April 13, 2017 1:32:09 PM
Attachments:	image002.png image003.png image004.png image007.png image008.png image009.png image012.png image013.png image014.png

---

Alex,

That is a valid point. Not sure why we priced the thrust blocks up so high for this budget, especially given the quantity. Go ahead and consider them to be $1,750 each, for the sake of this budget. As always, much will depend upon the final design, access to the site, etc.

Best Regards,

John

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email: jjacobs@comanco.com | web: www.comanco.com

From: Alex Rivera [mailto:ARivera@Geosyntec.com]
Sent: Wednesday, April 12, 2017 3:06 PM
To: John Jacobs
Cc: Nick Bridges
Subject: RE: Request for Estimate

Good afternoon John,

I just wanted to confirm the estimate for the concrete thrust blocks on the attached file. The thrust blocks have app. 1.4 CY of concrete compared to the 1.0 CY of concrete used in the concrete pad of the "wye" connection. The cost comparison is $2,800 for the concrete block vs. the $1,250 for the wye connection.

I went back and looked at Comanco's bid on the Sun Country partial closure in 2014 and saw that the estimate for concrete blocks on that project were $1,250/ea.

Thanks,

Alex

From: John Jacobs [mailto:JJacobs@comanco.com]
Sent: Tuesday, April 4, 2017 10:49 AM
To: Alex Rivera <ARivera@Geosyntec.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

Alex,

- I'm thinking that the 4" corrugated HDPE pipe with geomembrane (including weld to cover geomembrane) should be in the neighborhood of $20 per LF. This does not include the geocomposite, which is assumed to be a separate item.

- The 24" wye connections with concrete pad and grate would be around $1,250 each.

As always, these are budgetary prices and represent industry standard pricing for such work. Any final pricing would depend on final design, total scope, and construction timeline.

Best Regards,

John

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email: jjacobs@comanco.com | web: www.comanco.com

From: Alex Rivera [mailto:ARivera@Geosyntec.com]
Sent: Monday, April 03, 2017 11:06 AM
To: John Jacobs
Cc: Nick Bridges
Subject: RE: Request for Estimate

John,

Could you provide a unit cost for two items that were inadvertently overlooked the last time:

- 8,540 LF of 4-in. diameter HDPE corrugated drainage pipe (including a 3-ft wide strip of geomembrane used to wrap the 4-in. diameter drainage pipe); and
- 79 “wye” connections with concrete pad and grates (which joins the bench swale pipes to the main side slope downchute)

I’ve attached the permit drawings showing these details.

Much appreciated,

Alex

From: Alex Rivera
Sent: Friday, March 31, 2017 1:34 PM
To: 'John Jacobs' <JJacobs@comanco.com>
Cc: Nick Bridges <nbridges@comanco.com>
Subject: RE: Request for Estimate

Thank you John,

Alex

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Engineer

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Temple Terrace, FL 33637
Phone: 813.558.0990
Fax: 813.558.9726
Mobile: 813-777-2914
www.geosyntec.com

QUOTATION

Progressive Waste Services
Kirk Wills
1786 Salcman Road
Waterloo, NY 13165

kirk.wills@progressivewaste.com
Terms: Net 60

Quote Date **4/26/2017**

Project Number: **170426281**
Project Name: Sun Country C&D Disposal
Location: Riverview FL
Application: MISC

PRODUCT	QUANTITY (SF)	ROLL SIZE	F.O.B.	UNIT PRICE ($/SF)	TOTAL PRICE	WARRANTY
40 mil HDPE DS MicroSpike-GRI	86,250 5 Rolls	23 x 750 12 rolls/truck	Georgetown, SC Flatbed	$0.2136	$ 18,423.00	1 Year
Composite 250 mil, DS 6 oz.	81,200 28 Rolls	14.5 x 200 27 rolls/truck	Georgetown, SC Flatbed	$0.2979	$ 24,189.48	1 Year
Composite, 200 mil, DS 6 oz.	16,675 5 Rolls	14.5 x 230 27 rolls/truck	Georgetown, SC Flatbed	$0.2858	$ 4,765.72	1 Year
Agrutex 8.0 oz. Marv	9,000 1 Rolls	15 x 600 45 rolls/truck	Georgetown, SC Flatbed	$0.0750	$ 675.00	1 Year

# of flatbeds from Georgetown	2	
Est Cost/Truck from Georgetown	$ 1,733.10	$ 3,466.20

Freight price is an estimate.

Total Freight Cost	(Estimated)	$ 3,466.20
Material Cost		$ 48,053.20
Project Cost		$ 51,519.40

Exceptions/Clarifications and Special Requirements: Agru Standard

Comments:

- Unless otherwise specified, Agru America standard material specification values and testing will apply for this quotation and the Customer agrees that Agru America standard values will be acceptable according to this quote.
- Material prices are valid for 30 days.
- Agru America Standard Warranty shall apply.
- Agru America General Terms and Conditions will apply.
- If the material quantity changes from the above square footage, a revised quotation must be issued.
- Agru America reserves the right to pass along any verifiable resin increases from the resin supplier up to time of material shipment.
- Shipping dates are estimates only and Agru America will not be held liable for any delays due to shipping.
- Any costs associated with third party testing will be the responsibility of the customer.
- Interest will accrue on unpaid balances at 1 ½% per month and Purchaser is responsible for collection costs and attorney fees.

Customer Acknowledgment

P. O. No.:______________________________ Signature:_________________________________

Date:_________________________________ Title:______________________________________

Date Required: _________________________________ **Please return to:**

Phone:
Email:

Quality from the ground up.

40-mil HDPE Textured Geomembrane
Liner rolls = 17,250 SF = 1,917 SY
Total liner required = 558,850 SY
# of liner rolls = 558,850/1,917 = 292 rolls
Each truck can haul 12 liner rolls, therefore # of trucks = 292/12 = 24.3 = 25 truckloads
Total Cost for trucking = 25 x $1,733.10 = $43,327.50
Trucking Cost per SF = $43,327.50/(558,850 SY*9 SF/SY) = $0.0086/SF + $0.2136 (mtl Cost) = $0.22 SF Delivered

250-mil DS Geocomposite
Geocomposite rolls = 2,900 SF = 322.2 SY
Total geocomposite required = 544,316 SY
# of geocomposite rolls = 544,316/322.2 = 1,689.4 = 1,690 rolls
Each truck can haul 27 geocomposite rolls, therefore # of trucks = 1,690/27 = 62.6 = 63 truckloads
Total Cost for trucking = 63 x $1,733.10 = $109,185.30
Trucking Cost per SF = $109,185.30/(544,316 SY*9 SF/SY) = $0.0222/SF + $0.2979 (mtl Cost) = $0.32 SF Delivered

2.1 BID WORKSHEET:

J.E.D Solid Waste Management Facility (JED Landfill) - Cell 13 Construction

M/P Item	Description	Unit	Bid Estimate Install Quantity	Install Unit Price	Install Sub-Total	Bid Estimate Material Supply Quantity	Material Unit Price	Material Sub-Total	Total
1	Mobilization and Demobilization	LS	1	$5,000	$5,000.00				$5,000.00
2	Extrusion Tie-In Welds for Connection to Existing	LF	3,084	$4.00	$12,336.00				$12,336.00
3	GCL	SF	777,726	$0.080	$62,218.08	843,750			$62,218.08
4	60-Mil HDPE Geomembrane	SF	1,563,821	$0.095	$148,563.00	1,719,020			$148,563.00
5	Weld Primary Liner to Secondary in Anchor Trench	LF	2,526	$4.000	$10,104.00				$10,104.00
6	6" & 8" Pipe Boots	EA	5	$275.000	$1,375.00				$1,375.00
7	24" Pipe Boots	EA	4	$450.000	$1,800.00				$1,800.00
8	Geocomposite (Primary & Secondary)	SF	1,531,510	$0.085	$130,178.35	1,715,700			$130,178.35
9	40-Mil HDPE Geomembrane Flap (Extrusion Weld)	LF	2,506	$4.00	$10,024.00	2,680			$10,024.00
					$381,598.43				**$381,598.43**

WSI Notes:

1. Install and Material Supply quantities are provided for bid estimate purposes. Install pay quantities will be based on actual square footage verified by 3rd party survey (including anchor trench). Material Supply quantities shall be based on Installers take-off estimate, approved by Owner. Supply quantities shall include waste, slope, anchor trench, overlap, and any other adjustment factors necessary to supply all material to complete the work.
2. Unit rate for tie-in welds and connections must include all geosynthetic types (geocomposite, GCL and geomembrane). Payment will be made based on group installation at the unit rate provided.
3. Earthwork Contractor will offload and stage geosynthetics materials delivered to the site. Material Supplier will furnish spreader bars or other specialized off loading equipment with the first load of material for use by the Earthworks Contractor.
4. Geosynthetics installation is scheduled for approximately 60 working days.

Bidder Notes:

Item # 4 supply is based on the 40 mil material being provided already cut to width of 7.5'. 2,680 LF x 7.5' =20,100 SF

Bid Worksheet

JED Solid Waste Management Facility

GCCS 2016 Phase 3 - Cells 3 through 9 New/Replacement Vertical LFG Wells and Piping

Rev #3 November 7, 2016

Item/Description	Unit	Quantity	Unit Cost	Subtotal Cost
General				
Mobilization/Demobilization (Drilling Contractor)	LS	1	$19,100.00	$19,100.00
HDPE Header Piping and Tie-ins				
Connections to Existing Header, cut and electrofusion coupling Cells 3 & 9	EA	2	$2,500.00	$5,000.00
Install 18" HDPE New Header Pipe Cells 3, 6, & 9.	LF	1,200	$18.00	$21,600.00
Install 4" HDPE Condensate Forcemain in Common Trench	LF	1,200	$3.00	$3,600.00
Install 2" HDPE Airline in Common Trench	LF	1,200	$1.00	$1,200.00
Connections to Existing Laterals	EA	2	$2,500.00	$5,000.00
Abandonment with HDPE Butt Cap (12" and 16")	EA	2	$400.00	$800.00
HDPE Crossover Header Piping and Tie-ins				
Connections to Existing Header, cut and electrofusion coupling Cells 5 & 6	EA	2	$2,500.00	$5,000.00
Install 12" HDPE New Header Pipe Cells 5 & 6.	LF	650	$17.00	$11,050.00
Abandonment with HDPE Butt Cap	EA	2	$400.00	$800.00
HDPE Lateral Piping and Tie-ins				
Connections to header/crossover header/laterals in Cells 3, 4, 5, 6, 7, & 9	EA	17	$150.00	$2,550.00
Install 8" HDPE New Lateral Pipe Cells 3, 4, 5, 6, 7, & 9.	LF	3,530	$15.00	$52,950.00
Connections to Existing Laterals via Existing Blind Flanges/RiserS	EA	2	$400.00	$800.00
Connection to Downslope Wells	EA	4	$1,100.00	$4,400.00
Abandonment with HDPE Butt Cap	EA	13	$70.00	$910.00
Valves and Other Components				
18" Butterfly Valve with Valve Extension (Install Only)	EA	2	$850.00	$1,700.00
12" Butterfly Valve with Valve Extension (Install Only)	EA	1	$220.00	$220.00
Install 2" HDPE Forcemain/2" HDPE Airline in common trench	LF	3,130	$2.00	$6,260.00
HDPE Fittings, Gaskets, Bolt Kits and Other Miscellaneous Material Allowance	LS	1	$25,000.00	$25,000.00
New LFG Extraction Wells - Cells 3, 4, 5, & 6				
8" Sch 80 PVC Perforated Gas Extraction Well Section	LF	1,009	$42.00	$42,378.00
8" Sch 80 PVC Solid Gas Extraction Well Section	LF	135	$44.00	$5,940.00
Vertical Well Boring Drilling (36-inch diameter)	LF	1,153	$28.00	$32,284.00
2" QED Precision Quick Change Well Heads w/Pump Capability (Install Only)	EA	9	$100.00	$900.00
Construct and Remove Drill Rig Access/Pad on Sideslope Areas	EA	9	$400.00	$3,600.00
Replacement LFG Extraction Wells - Cells 3 & 6				
8" Sch 80 PVC Perforated Gas Extraction Well Section	LF	415	$42.00	$17,430.00
8" Sch 80 PVC Solid Gas Extraction Well Section	LF	60	$44.00	$2,640.00
Vertical Well Boring Drilling (36-inch diameter)	LF	479	$28.00	$13,412.00
Remove Wellhead from Existing Well and Install on Replacement Well	EA	4	$175.00	$700.00
Abandon Existing Well (cut and cap)	EA	4	$350.00	$1,400.00
Construct and Remove Drill Rig Access/Pad on Sideslope Areas	EA	4	$400.00	$1,600.00
Option 1 (as excercised at Omni's discretion)				
8" Sch 80 PVC Perforated Gas Extraction Well Section	LF	80	$42.00	$3,360.00
8" Sch 80 PVC Solid Gas Extraction Well Section	LF	45	$44.00	$1,980.00
Vertical Well Boring Drilling (36-inch diameter)	LF	128	$28.00	$3,584.00
Install 8" HDPE New Lateral Pipe Cell 8	LF	200	$15.00	$3,000.00
2" QED Precision Quick Change Well Heads w/Pump Capability (Install Only)	EA	3	$100.00	$300.00
Connection to Downslope Wells	EA	2	$1,100.00	$2,200.00
Construct and Remove Drill Rig Access/Pad on Sideslope Areas	EA	3	$400.00	$1,200.00
Option 2 (as excercised at Omni's discretion)				
Removal of Abandoned Header Pipe	LS	1	$12,147.00	$12,147.00
Performance Bond				
Performance Bond (Required)	LS	1	$3,575.00	$3,575.00
TOTAL CONSTRUCTION COSTS				**$321,570.00**

Notes:

1. Quantities shall be used and bid as provided. Refer to the GCCS Phase 3 Disposal Area Drawings, Golder Associates, September 2012 and GCCS Phase 4 Disposal Area Drawings, Cornerstone, June 2016

2. Assume 9 new wells in Cells 3, 4, 5, & 6; 1 mid tier wells GW-82 (80' average borehole depth), and 8-upper tier wells GW-84, GW-91, GW-96, GW-111, GW-114, GW-115, GW-116, and GW-117 (135' average borehole depth). Solid PVC section for upper and mid tier wells shall be 15' below existing grades. Stick-up shall be 3' above existing grade with new QED wellhead and QED well cap.

3. Assume 3 replacement wells in Cells 3 & 6; 1 mid tier wells GW-83R1 (90' average borehole depth), and 8-upper tier wells GW-84, GW-91, GW-96, GW-111, GW-114, GW-115, GW-116, and GW-117 (130' average borehole depth). Solid PVC section for upper and mid tier wells shall be 15' below existing grades. Stick-up shall be 3' above existing grade with new QED wellhead and QED well cap.

4. Wells may be located on a sodded closure cap. Access to the well location by the drill rig must be from the perimeter access up to the new well location. Contractor shall furnish a track type loader to transport materials to the well location and remove waste. No articulating trucks or excavators shall be on the closed slope at any time due to stability concerns. Contractor must repair and regrade to existing conditions all damaged areas of the closure cap and benches caused by their work.

5. Refuse shall be transported by the Contractor to the active disposal area.

6. Owner will provide a contractor to abandon old wells and connect replacement wells to the existing laterals in the closure cap area.

7. Omni will supply Schedule 80 PVC perforated and solid pipe, couplings, and caps for the well casings, HDPE header, lateral, forcemain and air pipe, butterfly valves and QED wellheads. Contractor to furnish all HDPE fittings, bolt kits, back-up rings, gaskets, and fernco fittings to complete the work. Pipe markers and tape, joint wrapping, tools, banding, and other consumables etc. are not reimbursable under the bid allowance and shall be included in the approriate bid item. Costs will be reimbursed to the Contractor at cost plus 10% under the allowance bid item. In advance of material purchase, the Contractor shall review existing inventory of HDPE fittings available onsite and use available fittings before purchase of new fittings. Drilling contractor to furnish bentonite, isolation ring and well rock.

8. Unit rate for solid gas extraction well section shall include bentonite plugs, isolation rings, and soil backfill.

9. Unit rate for perforated gas extraction well section shall include rock backfill media.

10. Contractor shall regrade any disturbed areas and prep for sodding by Omni.

11. Omni will provide for abandonment of the existing well and repair of the geosynthetic lined cap.

QED Environmental Systems

Quote No: R-15937, Dec 02, 2016

Site Reference: ORP215

Prepared For:
Brad Robbins
321.354.4597
Brad.robbins@wasteconnections.com

WASTE CONNECTIONS
JED SOLID WASTE MANAGEMENT FACILITY
1501 OMNI WAY
ST CLOUD, FL 34773
USA

Represented By:
Ken Still, Regional Sales Mgr
770-856-7845
kstill@qedenv.com

Prepared By:
Robyn Wooley
734-995-2547 ext 81-355
rwooley@qedenv.com

QTY	PART NO.	DESCRIPTION	UM	UNIT PRICE	EXTENSION
13	ORP215	Quick change orifice plate LFG wellhead assembly, 2" Vertical. Quick orifice plate change function for optimizing flow measurement. PVC construction. Includes Model CV2000 Fine Tune Control Valve, and 4 Easy Port fittings (threaded nylon barb, cap with tether): 3 pressure/sampling, 1 temperature. Requires orifice plates.	EA	392.00	5,096.00
13	40770	Orifice plate set for ORP215 wellhead. 6 molded nylon plates with individual color for each size for easy identification. Plate sizes include: 0.40, 0.50, 0.75, 1.0, 1.25 and 1.40"	EA	26.00	338.00
13	40647	2" Sch 80 PVC pipe, 12-1/4" long.	EA	8.86	115.18
13	40979	Banding Kit for 2.38" Solarguard (TM) Flex Hose. Includes two (2) all stainless steel Solarguard band clamps, and two (2) banding coils.	EA	18.50	240.50
1	40947	Solarguard (TM) Flex Hose, 2.38" ID x 5 ft long. PVC construction with yellow pigment and UV inhibitors for extended service life. Commonly used in landfill gas collection systems. Requires QED banding coil for use with band clamp.	EA	33.00	33.00
				SUBTOTAL	**5,822.68**
				DISCOUNT	**-582.32**
				TOTAL	**5,240.36**

TERMS & CONDITIONS: Payment Terms: NET 30

Estimated shipping time 5-10 working days after receipt of Purchase Order, transit time not included. Pricing valid for 30 days. Final delivery date will be determined at time of order. All prices are in U. S. dollars, FOB SHIPPING POINT, USA. A copy of your purchase order, or signed quote, is required at time of order.

Payment terms (shown above) are calculated from invoice date, subject to credit approval. A service charge of 1% per month will be applied to all past due invoices.

Unless shown as separate line item(s), total price shown DOES NOT include applicable sales tax or shipping & handling charges. Applicable sales taxes, shipping and handling charges will be added to the invoice. Estimates available upon request.

After acceptance of an order, no order can be returned without QED approval. Standard equipment, not custom in nature, can generally be returned for credit within 30 days of purchase. The equipment must be unused and in its original packaging and is subject to a 15% restocking fee. Custom equipment or tubing cut to a requested length cannot be returned for credit. All products will be returned freight prepaid to sellers facility.

Invoice To: ________________________________ Ship To: ________________________________

________________________________ ________________________________

________________________________ ________________________________

________________________________ Attn: ________________________________

REQUESTED DELIVERY DATE: ____ / ____ / 2016 Amount Approved: $ ______________________

Accepted by: ______________________________ PO Number: ____________________________

Print Name: ______________________________ Company: ____________________________

Title: ______________________________ Date: ____________________________

[__] Check box if this order is necessary to your (or another contractors) contract with the federal government.

To place your order, complete the above section and email to: info@qedenv.com (or fax to: 734-995-1170).
(Please note that a hard copy of your PO may be required before shipment.)

When placing orders, please make paperwork out to: QED Environmental Systems, Inc.

Mailing Address:	Remit To Address:
PO Box 3726	PO Box 935668
Ann Arbor, MI, 48106	Atlanta, GA 31193-5668

TOTAL BEING APPROVED $5,240.36

Environmental Conservation Laboratories, Inc.

10775 Central Port Drive
Orlando, Florida 32824
(407) 826-5314 phone
(407) 850-6945 fax
NELAP #E83182

4810 Executive Park Ct, Suite 111
Jacksonville, FL 32216-6069
(904) 296-3007 phone
(904) 296-6210 fax
NELAP #E82277

102-A Woodwinds Industrial Court
Cary, NC 27511
(919) 467-3090 phone
(919) 467-3515 fax
NELAP #E87610

www.encolabs.com

March 29, 2017

Geosyntec Consultants
13101 Telecom Dr.
Suite 120
Temple Terrace, FL 33637

Re: **St. Cloud Area Landfill – 28 Wells & 2 SW's for App. I Paramaters w/ Extras**

Attention: Alex Rivera

Environmental Conservation Laboratories, Inc. is pleased to submit the following quotation for analytical services.

Sampling Supplies/Shipping Requirements

Shipping containers and bottles will be supplied by Environmental Conservation Laboratories, Inc. Samples must be iced from time of collection until received at the laboratory. Some analyses require special sample handling – please contact your Project Manager at the laboratory if you have any questions upon receipt of containers.

Quality Assurance

All of our facilities are accredited by NELAP and also maintain additional state certifications and approvals throughout the Southeast and Mid-Atlantic regions. Unit pricing includes adherence to and documentation of compliance with applicable Quality Assurance/ Quality Control protocols for each procedure performed. Our Quality Assurance/ Quality Control program ensures acceptable accuracy and precision for each analytical method. All published data is defensible, with quality control results provided with every report.

Analytical Requirements and Unit Pricing

Environmental Conservation Laboratories, Inc. anticipates receiving samples from Geosyntec Consultants from the proposed **St. Cloud Area Landfill – 28 Wells & 2 SW's for App. I Paramaters w/ Extras** project in the near future. These samples will be analyzed for the parameters listed in the Analytical Requirements and Unit Pricing section below.

Quantity	Matrix	Analytical Parameter or Test Group	Rate	Extended
		Surface Water Laboratory Paramaters;		
2	SW	Unionized ammonia - N (calc w/ NH3 + field measurements)	15.00	30.00
2	SW	Total Hardness	10.00	20.00
2	SW	Biochemical Oxygen demand, BOD 5	20.00	40.00
2	SW	Iron as Fe	9.00	18.00
2	SW	Mercury as Hg (standard GW processing limits 7470 or 245.1)	20.00	40.00
2	SW	Nitrate	10.00	20.00
2	SW	Chemical Oxygen Demand, COD	20.00	40.00
2	SW	Total Organic Carbon, TOC	18.00	36.00
2	SW	Total Dissolved Solids, TDS	10.00	20.00
2	SW	Fecal Coliform, MF (8 hour holding time)	35.00	70.00
2	SW	Total Phosphates as TP	18.00	36.00
2	SW	Chlorophyll A	45.00	90.00
2	SW	Total Nitrogen, TN (as TKN + NO2 + NO3)	35.00	70.00
2	SW	Total Suspended Solids, TSS	10.00	20.00
2	SW	Those parameters listed in 40 CFR Part 258 Appendix I as;	180.00	360.00
		Volatile Organic Compounds, SW846 8260		
		EDB and DBCP, 8011		
		15 Metals: Sb,As,Ba,Be,Cd,Cr,Co,Cu,Pb,Ni,Se,Ag,Tl,V,Zn		
		Cost per Surface Water Sample	**455.00**	
		Cost for two Surface Water Samples		**910.00**

Quantity	Matrix	Analytical Parameter or Test Group	Rate	Extended
		Appendix I "plus" Groundwater Laboratory Paramaters;		
28	GW	Total ammonia - N	15.00	420.00
28	GW	Bicarbonate	10.00	280.00
28	GW	Chlorides	10.00	280.00
28	GW	Iron as Fe	9.00	252.00
28	GW	Mercury as Hg	18.00	504.00
28	GW	Nitrate	10.00	280.00
28	GW	Sodium as Na	9.00	252.00
28	GW	Total Dissolved Solids, TDS	10.00	280.00
28	GW	Those parameters listed in 40 CFR Part 258 Appendix I as;	180.00	5040.00
		Volatile Organic Compounds, SW846 8260		
		EDB and DBCP, 8011		
		15 Metals: Sb,As,Ba,Be,Cd,Cr,Co,Cu,Pb,Ni,Se,Ag,Tl,V,Zn		
		Cost per Groundwater Water Sample	**271.00**	
		Cost for 28 Groundwater Samples		**7588.00**

Quantity	Matrix	Analytical Parameter or Test Group	Rate	Extended
1	Per Event	**Field Collection Services** Sample Collection of 28 MW's and 2 SW's Water levels prior to purging Field Parameters: Specific Conductivity pH Dissolved Oxygen Turbidity Colors and sheens (by observation) Incidentals (gloves, towels, tubing, reagents, ice, etc.) Mobilization - Demobilization Travel	**3190.00**	**3190.00**

Comments/Special Considerations:

Reporting - ADaPT included
SW's - If you require Mercury to Class III Surfacewater Criteria a different method needs to be utilized at a unit cost of $ 115 ea.

Quote Expiration Date: March 29, 2017

This quote shall expire 120 days from the above date.

Terms and Conditions:

The information contained in this proposal is confidential and shall not be used or disclosed to any third party without prior written permission from Environmental Conservation Laboratories, Inc. In the absence of a written agreement, acceptance of samples is in accordance with Environmental Conservation Laboratories, Inc.'s attached Standard Terms and Conditions of Sale. All payment is due net thirty (30) days from invoicing date unless special arrangements have been requested and approved by ENCO.

This quotation does not include sales tax. Applicable sales tax will be added to invoices where required by law.

Reporting Format

A final report summarizing all data and Quality Assurance/Quality Control results will be forwarded no later than one (1) day following completion of analyses. Additionally, ***numerous electronic reporting options are available*** – contact your Project Manager for details.

ENCO's standard Hardcopy Report includes the following minimum information:

Date of Sample Collection/Receipt/Extraction/Analysis
Analytical Data
Matrix Spike/Matrix Spike Duplicate Recoveries
Laboratory Check Sample Recoveries
MS/MSD Relative Percent Differences
Laboratory Blank Data
Surrogate Recoveries
Original Chain-of-Custody

Sample Disposal/Invoicing

Samples will be disposed of thirty (30) days after the report date, unless prior arrangements have been made with the laboratory. Samples will be held longer, upon request, on a fee per month basis.

To ensure successful completion of your project, I urge you to communicate any changes in the scope of work (i.e., methods, project start up dates, numbers of samples, matrices, etc.) to either myself or the laboratory as soon as possible. Should you require further information, please do not hesitate to contact me at (407) 826-5314.

Sincerely,
ENVIRONMENTAL CONSERVATION LABORATORIES, INC.

Russell W. Erickson

QUOTE

Attention: Alex Rivera, P.E. Engineer
GeoSyntec
13101 Telecom Drive Ste 120
Temple Terrace, FL 33637

Date
30 March 2017

Quote Number
Q001169

Job Number
J001257

Diamond Systems LLC
PO Box 348
Mims, Florida 32754
www.DiamondSci.com
info@DiamondSci.com
Phone: 001-321-223-7500
Fax: 001-321-747-0316

JED

Costs	Quantity	Rate	Amount
EPG Model WSDPT 20-3 SurePump WPZ02003050E3064QX (PRIMARY SUMP PUMP) patented, stainless steel Wheeled Sump Drainer, size 6, with 5 HP, 460 V, 3Ø motor, 100' of jacketed 12-4 CP motor lead, 0-5 PSI level sensor with 100' poly lead, and 100' of 3/16" stainless steel suspension cable and clamps.	1.00	7,299.00	7,299.00
EPG Model WSDPT 7-5 SurePump WPZ00705015E3044OX (SECONDARY SUMP PUMP) patented, stainless steel Wheeled Sump Drainer, size 4, with 1.5 HP, 460 V, 3Ø motor, 100' of jacketed 14-4 CP motor lead, 0-5 PSI level sensor with 100' poly lead, and 100' of 1/8" stainless steel suspension cable and clamps. Includes 2" stainless steel discharge adapter.	1.00	4,467.00	4,467.00

Subtotal	11,766.00
Florida Sales Tax	0.00
Total	**11,766.00**

Valid To: 27 April 2017

RCS EXCAVATION, INC.
PO Box 1787
Lake Placid, FL 33862

Invoice

Date	Invoice #
8/19/2016	83035

Bill To
Waste Connections Attn: Mr. Benjamin Gray

P.O.
6465-16-00551

Terms	Due Date	Project
Net 30	9/18/2016	2016 Closure Mowing JED Landfill

Description	Est Amt	Prior %	Qty	Rate	Curr %	Total %	Amount
2016 Closure Mowing of JED Landfill PO#6465-16-00551							
Monthly tractor mowing and weed eating around Gas Wells within the Closure	5,400.00			5,400.00	100.00%	100.00%	5,400.00

Thank you for your business.

Total	$5,400.00
Balance Due	$5,400.00

RCS EXCAVATION, INC.

PO Box 1787 ● Lake Placid, FL 33862
(P) 863-699-1727 ● (F) 863-582-9292

3/14/2017

To: Waste Connections, Inc.
Attn: Mr. Kirk Wills
5135 Madison Ave
Tampa, FL 33619

Proposal: Barb Wire Fencing

Project Location: JED Landfill, St. Cloud, FL

Item 1: Replace 100’ of 4-strand barb wire fencing @ per LF cost= $4/LF
Item 2: Replace 2-20’ 6-ft chain-link swing gates= $800

**Please note: Price is only guaranteed for 30 days.*

DUKE ENERGY®

STATEMENT OF ELECTRIC SERVICE

MARCH 2017
Duke Energy

25

ACCOUNT NUMBER
73736 31476

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

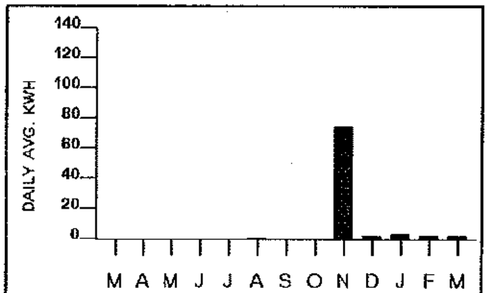
SERVICE ADDRESS
1501 OMNI WAY, CELL 13 PUMP
ST CLOUD FL 34773

DUE DATE MAR 23 2017	**TOTAL AMOUNT DUE** 83.00
NEXT READ DATE ON OR ABOUT MAR 31 2017	**DEPOSIT AMOUNT ON ACCOUNT** Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		008922540
PRESENT	(ACTUAL)	002827
PREVIOUS	(ACTUAL)	002733
DIFFERENCE		000094
PRESENT ONPEAK		000889
PREVIOUS ONPEAK		000863
DIFFERENCE ONPEAK		000026
TOTAL KWH		94
ON PEAK KWH		26
PRESENT KW	(ACTUAL)	0003.44
PRESENT PEAK KW		0003.44
BASE KW		3
ON-PEAK KW		3
LOAD FACTOR		4.5%



ENERGY USE

DAILY AVG. USE -	3 KWH/DAY
USE ONE YEAR AGO -	0 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.75

PAYMENTS RECEIVED AS OF FEB 01 2017 33.95 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	94 KWH @ 6.97000¢	6.55	
FUEL CHARGE	94 KWH @ 3.66700¢	3.45	
ASSET SECURITIZATION CHARGE	94 KWH @ 0.18900¢	0.18	
*TOTAL ELECTRIC COST			21.77
GROSS RECEIPTS TAX			.56
COUNTY UTILITY TAX			1.56
STATE AND OTHER TAXES ON ELECTRIC			1.89
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			30.78
AMOUNT PAST DUE			52.22
TOTAL DUE THIS STATEMENT			**$83.00**

25,78

Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $52.22 and electric service may be disconnected. Please pay immediately.

BF_BL_DEF_20170301_220626_3.CSV-1431-000000116

DETACH AND RETURN THIS SECTION MM 0005049 BILL # 12 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
52.22	PAST DUE	30.78	MAR 23 2017

ACCOUNT NUMBER - 73736 31476

001431 000000116

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
83.00

PLEASE ENTER AMOUNT PAID

737363147610000000830060000000522250000000307830100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

ACCOUNT NUMBER
99882 87420

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY PUMP 1
ST CLOUD FL 34773

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	87.58
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.	008921999
PRESENT (ACTUAL)	000313
PREVIOUS (ACTUAL)	000138
DIFFERENCE	000175
PRESENT ONPEAK	000049
PREVIOUS ONPEAK	000023
DIFFERENCE ONPEAK	000026
TOTAL KWH	175
ON PEAK KWH	26
PRESENT KW (ACTUAL)	0005.33
PRESENT PEAK KW	0004.81
BASE KW	5
ON-PEAK KW	5
LOAD FACTOR	5.0%

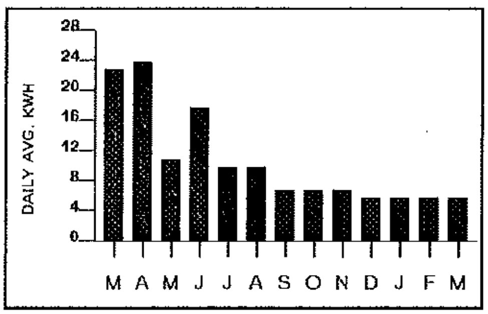
PAYMENTS RECEIVED AS OF FEB 01 2017 37.80 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	175 KWH @ 6.97000¢	12.20	
FUEL CHARGE	175 KWH @ 3.66700¢	6.42	
ASSET SECURITIZATION CHARGE	175 KWH @ 0.18900¢	0.33	
*TOTAL ELECTRIC COST			30.54
GROSS RECEIPTS TAX			.78
COUNTY UTILITY TAX			2.09
STATE AND OTHER TAXES ON ELECTRIC			2.65
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			41.06
BALANCE FORWARD			46.52
TOTAL DUE THIS STATEMENT			$87.58

completed

36.04



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater.
If your previous unpaid balance has been paid, please disregard.

ENERGY USE

DAILY AVG. USE -	6 KWH/DAY
USE ONE YEAR AGO -	23 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.05

BF_BL_DEF_20170301_220626_3.CSV-1447-000000112

DETACH AND RETURN THIS SECTION MM 0005054 BILL # 17 OF 17 GRP 1142

Make checks payable to: Duke Energy

ACCOUNT NUMBER - 99882 87420

001447 000000112

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

DUE DATE
MAR 23 2017

TOTAL DUE
87.58

PLEASE ENTER AMOUNT PAID

99882874202000000008758500000004652400000000410610100000000009

DUKE ENERGY®

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

ACCOUNT NUMBER
11757 94261

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:	OMNI WASTE OF OSC CTY LLC	DUE DATE	TOTAL AMOUNT DUE
1-877-372-8477	1501 OMNI WAY SAINT CLOUD FL 34773	MAR 23 2017	82.19
WEB SITE: www.duke-energy.com	SERVICE ADDRESS	NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
TO REPORT A POWER OUTAGE: 1-800-228-8485	1501 OMNI WAY, CELL 4/PUMP AREA	MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		006638806
PRESENT	(ACTUAL)	001790
PREVIOUS	(ACTUAL)	001681
DIFFERENCE		000109
TOTAL KWH		109

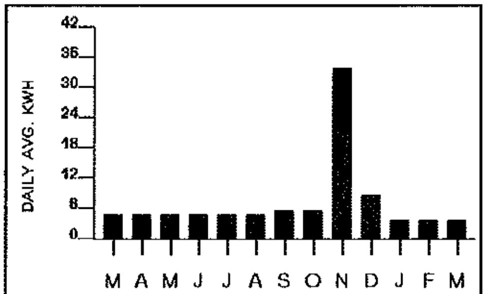
PAYMENTS RECEIVED AS OF FEB 01 2017 28.91 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	109 KWH @ 6.97000¢	7.60	
FUEL CHARGE	109 KWH @ 3.66700¢	4.00	
ASSET SECURITIZATION CHARGE	109 KWH @ 0.18900¢	0.21	
*TOTAL ELECTRIC COST			23.40
GROSS RECEIPTS TAX			.60
COUNTY UTILITY TAX			1.66
STATE AND OTHER TAXES ON ELECTRIC			2.03
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			32.69
BALANCE FORWARD			49.50
TOTAL DUE THIS STATEMENT			**$82.19**

completed

27.69



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. If your previous unpaid balance has been paid, please disregard.

ENERGY USE

DAILY AVG. USE -	4 KWH/DAY
USE ONE YEAR AGO -	5 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.81

BF_BL_DEF_20170301_220626_3.CSV-1432-000000115

DETACH AND RETURN THIS SECTION MM 0005039 BILL # 2 OF 17 GRP 1142

Make checks payable to: Duke Energy

ACCOUNT NUMBER - 11757 94261

001432 000000115

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

DUE DATE
MAR 23 2017

TOTAL DUE
82.19

PLEASE ENTER AMOUNT PAID

117579426190000000821980000000495020000000326980100000000009

DUKE ENERGY®

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

Duke Energy

25

ACCOUNT NUMBER

75594 97574

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL: 1-877-372-8477 **WEB SITE:** www.duke-energy.com **TO REPORT A POWER OUTAGE:** 1-800-228-8485	**OMNI WASTE OF OSC CTY LLC** 1501 OMNI WAY SAINT CLOUD FL 34773 **SERVICE ADDRESS** 1501 OMNI WAY, CELL 3/PUMP AREA	**DUE DATE** MAR 23 2017 — **TOTAL AMOUNT DUE** 132.62 **NEXT READ DATE ON OR ABOUT** MAR 31 2017 — **DEPOSIT AMOUNT ON ACCOUNT** Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		002663582
PRESENT	(ACTUAL)	028236
PREVIOUS	(ACTUAL)	028138
DIFFERENCE		000098
TOTAL KWH		98
PRESENT KW	(ACTUAL)	0002.62
BASE KW		3
LOAD FACTOR		4.7%

PAYMENTS RECEIVED AS OF FEB 01 2017 27.65 THANK YOU

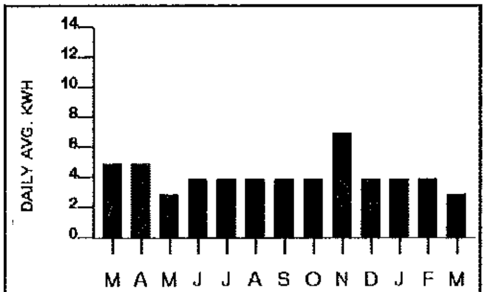
GS-1 060 GENERAL SERVICE - NON DEMAND SEC

BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	98 KWH @ 6.97000¢	6.83	
FUEL CHARGE	98 KWH @ 3.66700¢	3.59	
ASSET SECURITIZATION CHARGE	98 KWH @ 0.18900¢	0.19	
*TOTAL ELECTRIC COST			22.20
GROSS RECEIPTS TAX			.57
COUNTY UTILITY TAX			1.59
STATE AND OTHER TAXES ON ELECTRIC			1.93
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			31.29
AMOUNT PAST DUE			101.33
TOTAL DUE THIS STATEMENT			$132.62

completed

26.29



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $101.33 and electric service may be disconnected. Please pay immediately.

ENERGY USE

DAILY AVG. USE -	3 KWH/DAY
USE ONE YEAR AGO -	5 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.77

BF_BL_DEF_20170301_220626_3.CSV-1444-000000112

DETACH AND RETURN THIS SECTION MM 0005050 BILL # 13 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
101.33	PAST DUE	31.29	MAR 23 2017

ACCOUNT NUMBER - 75594 97574

001444 000000112

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE

132.62

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

PLEASE ENTER AMOUNT PAID

755949757440000001326210000001013370000000312940100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017
Duke Energy

25

ACCOUNT NUMBER
72938 86199

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY,
CELL 5/PUMP AREA

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	106.75
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		002667927
PRESENT	(ACTUAL)	020975
PREVIOUS	(ACTUAL)	020783
DIFFERENCE		000192
TOTAL KWH		192
PRESENT KW	(ACTUAL)	0005.55
BASE KW		6
LOAD FACTOR		4.6%

PAYMENTS RECEIVED AS OF FEB 01 2017 41.31 THANK YOU

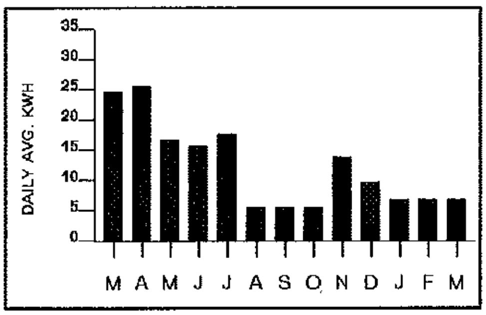
GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	192 KWH @ 6.97000¢	13.38	
FUEL CHARGE	192 KWH @ 3.66700¢	7.04	
ASSET SECURITIZATION CHARGE	192 KWH @ 0.18900¢	0.36	
*TOTAL ELECTRIC COST			32.37
GROSS RECEIPTS TAX			.83
COUNTY UTILITY TAX			2.20
STATE AND OTHER TAXES ON ELECTRIC			2.81
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			43.21
AMOUNT PAST DUE			63.54
TOTAL DUE THIS STATEMENT			**$106.75**

38.21

completed

Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $63.54 and electric service may be disconnected. Please pay immediately.



ENERGY USE

DAILY AVG. USE -	7 KWH/DAY
USE ONE YEAR AGO -	25 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.12

BF_BL_DEF_20170301_220626_3.CSV-1430-000000116

DETACH AND RETURN THIS SECTION MM 0005048 BILL # 11 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
63.54	PAST DUE	43.21	MAR 23 2017

ACCOUNT NUMBER - 72938 86199

001430 000000116

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
106.75

PLEASE ENTER AMOUNT PAID

729388619940000001067570000000635450000000432160100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

ACCOUNT NUMBER
13961 72312

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL: 1-877-372-8477 WEB SITE: www.duke-energy.com TO REPORT A POWER OUTAGE: 1-800-228-8485	OMNI WASTE OF OSC CTY LLC 1501 OMNI WAY SAINT CLOUD FL 34773 SERVICE ADDRESS 1501 OMNI WAY, CELL 6/PUMP AREA	DUE DATE: MAR 23 2017 TOTAL AMOUNT DUE: 66.27 NEXT READ DATE ON OR ABOUT: MAR 31 2017 DEPOSIT AMOUNT ON ACCOUNT: Blanket Cash

PIN: 625482228

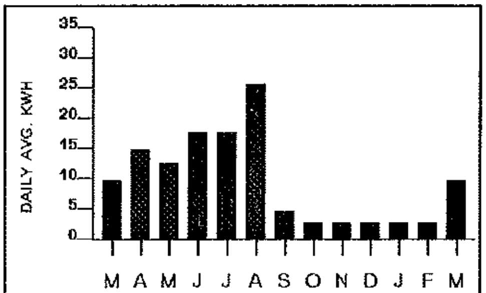
METER READINGS

METER NO.	008922983
PRESENT (ACTUAL)	003368
PREVIOUS (ACTUAL)	003071
DIFFERENCE	000297
PRESENT ONPEAK	000987
PREVIOUS ONPEAK	000906
DIFFERENCE ONPEAK	000081
TOTAL KWH	297
ON PEAK KWH	81
PRESENT KW (ACTUAL)	0008.84
PRESENT PEAK KW	0005.59
BASE KW	9
ON-PEAK KW	6
LOAD FACTOR	4.7%

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	297 KWH @ 6.97000¢	20.70	
FUEL CHARGE	297 KWH @ 3.66700¢	10.89	
ASSET SECURITIZATION CHARGE	297 KWH @ 0.18900¢	0.56	
*TOTAL ELECTRIC COST			43.74
GROSS RECEIPTS TAX			1.12
COUNTY UTILITY TAX			2.88
STATE AND OTHER TAXES ON ELECTRIC			3.79
TOTAL CURRENT BILL			51.53
BALANCE FORWARD			14.74
TOTAL DUE THIS STATEMENT			**$66.27**

completed



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater.
If your previous unpaid balance has been paid, please disregard.

ENERGY USE

DAILY AVG. USE -	10 KWH/DAY
USE ONE YEAR AGO -	10 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.51

BF_BL_DEF_20170301_220626_3.CSV-1433-000000115

DETACH AND RETURN THIS SECTION MM 0005040 BILL # 3 OF 17 GRP 1142

Make checks payable to: Duke Energy

ACCOUNT NUMBER - 13961 72312

001433 000000115

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

DUE DATE
MAR 23 2017

TOTAL DUE
66.27

PLEASE ENTER AMOUNT PAID

13961723120000000066274000000014746000000051532010000000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017
Duke Energy

25

ACCOUNT NUMBER
49354 75320

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY PUMP 7
ST CLOUD FL 34773

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	150.98
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		006652561
PRESENT	(ACTUAL)	001580
PREVIOUS	(ACTUAL)	001258
DIFFERENCE		000322
TOTAL KWH		322

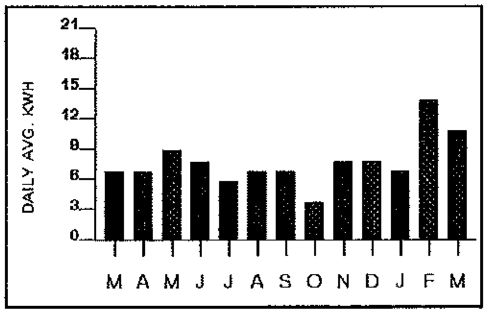
PAYMENTS RECEIVED AS OF FEB 01 2017 41.34 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	322 KWH @ 6.97000¢	22.44	
FUEL CHARGE	322 KWH @ 3.66700¢	11.81	
ASSET SECURITIZATION CHARGE	322 KWH @ 0.18900¢	0.61	
*TOTAL ELECTRIC COST			46.45
GROSS RECEIPTS TAX			1.19
COUNTY UTILITY TAX			3.05
STATE AND OTHER TAXES ON ELECTRIC			4.03
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			59.72
AMOUNT PAST DUE			91.26
TOTAL DUE THIS STATEMENT			**$150.98**

completed

54.72



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $91.26 and electric service may be disconnected. Please pay immediately.

ENERGY USE

DAILY AVG. USE -	11 KWH/DAY
USE ONE YEAR AGO -	7 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.60

BF_BL_DEF_20170301_220626_3.CSV-1429-000000116

DETACH AND RETURN THIS SECTION MM 0005047 BILL # 10 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
91.26	PAST DUE	59.72	MAR 23 2017

ACCOUNT NUMBER - 49354 75320

001429 000000116

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
150.98

PLEASE ENTER AMOUNT PAID

4935475320900000015098700000009126400000005972501000000000009

DUKE ENERGY.

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

Duke Energy

25

ACCOUNT NUMBER

35953 09071

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY, CELL 8
ST CLOUD FL 34773

DUE DATE MAR 23 2017	**TOTAL AMOUNT DUE** 138.77
NEXT READ DATE ON OR ABOUT MAR 31 2017	**DEPOSIT AMOUNT ON ACCOUNT** Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		006654970
PRESENT	(ACTUAL)	006780
PREVIOUS	(ACTUAL)	006469
DIFFERENCE		000311
TOTAL KWH		311

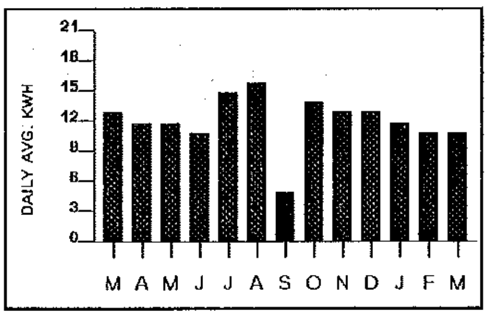
PAYMENTS RECEIVED AS OF FEB 01 2017 58.51 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	311 KWH @ 6.97000¢	21.68	
FUEL CHARGE	311 KWH @ 3.66700¢	11.40	
ASSET SECURITIZATION CHARGE	311 KWH @ 0.18900¢	0.59	
*TOTAL ELECTRIC COST			45.26
GROSS RECEIPTS TAX			1.16
COUNTY UTILITY TAX			2.98
STATE AND OTHER TAXES ON ELECTRIC			3.93
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			58.33
AMOUNT PAST DUE			80.44
TOTAL DUE THIS STATEMENT			**$138.77**

53.33

completed



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $80.44 and electric service may be disconnected. Please pay immediately.

ENERGY USE

DAILY AVG. USE -	11 KWH/DAY
USE ONE YEAR AGO -	13 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.56

BF_BL_DEF_20170301_220626_3.CSV-1427-000000116

DETACH AND RETURN THIS SECTION MM 0005045 BILL # 8 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
80.44	PAST DUE	58.33	MAR 23 2017

ACCOUNT NUMBER - 35953 09071

001427 000000116

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
138.77

PLEASE ENTER AMOUNT PAID

3595309071400000013877600000000804400000000583390100000000009

DUKE ENERGY.

STATEMENT OF ELECTRIC SERVICE

MARCH 2017
Duke Energy

25

ACCOUNT NUMBER
80684 27063

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY, CELL 9
ST CLOUD FL 34773

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	85.69
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		002654529
PRESENT	(ACTUAL)	007203
PREVIOUS	(ACTUAL)	007075
DIFFERENCE		000128
TOTAL KWH		128
PRESENT KW	(ACTUAL)	0003.43
BASE KW		3
LOAD FACTOR		6.1%

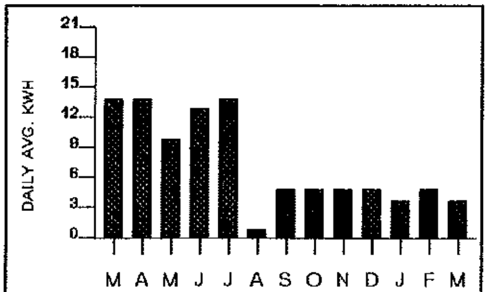
PAYMENTS RECEIVED AS OF FEB 01 2017 29.91 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	128 KWH @ 6.97000¢	8.92	
FUEL CHARGE	128 KWH @ 3.66700¢	4.69	
ASSET SECURITIZATION CHARGE	128 KWH @ 0.18900¢	0.24	
*TOTAL ELECTRIC COST			25.44
GROSS RECEIPTS TAX			.65
COUNTY UTILITY TAX			1.78
STATE AND OTHER TAXES ON ELECTRIC			2.20
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			35.07
AMOUNT PAST DUE			50.62
TOTAL DUE THIS STATEMENT			$85.69

30.07

completed



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $50.62 and electric service may be disconnected. Please pay immediately.

ENERGY USE

DAILY AVG. USE -	4 KWH/DAY
USE ONE YEAR AGO -	14 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.88

BF_BL_DEF_20170301_220626_3.CSV-1445-000000112

DETACH AND RETURN THIS SECTION MM 0005051 BILL # 14 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
50.62	PAST DUE	35.07	MAR 23 2017

ACCOUNT NUMBER - 80684 27063

001445 000000112

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
85.69

PLEASE ENTER AMOUNT PAID

80684270631000000085696000000050625000000035071010000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

25

ACCOUNT NUMBER

24257 63348

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:	OMNI WASTE OF OSC CTY LLC	DUE DATE	TOTAL AMOUNT DUE
1-877-372-8477	1501 OMNI WAY	MAR 23 2017	78.77
WEB SITE: www.duke-energy.com	SAINT CLOUD FL 34773	NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
TO REPORT A POWER OUTAGE: 1-800-228-8485	SERVICE ADDRESS 1501 OMNI WAY, CELL 10 ST CLOUD FL 34773	MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		006650637
PRESENT	(ACTUAL)	000856
PREVIOUS	(ACTUAL)	000757
DIFFERENCE		000099
TOTAL KWH		99

PAYMENTS RECEIVED AS OF FEB 01 2017 28.42 THANK YOU

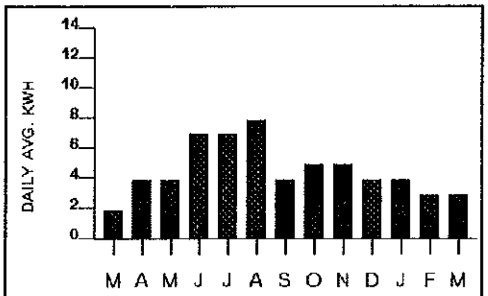
GS-1 060 GENERAL SERVICE - NON DEMAND SEC

BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	99 KWH @ 6.97000¢	6.90	
FUEL CHARGE	99 KWH @ 3.66700¢	3.63	
ASSET SECURITIZATION CHARGE	99 KWH @ 0.18900¢	0.19	
*TOTAL ELECTRIC COST			22.31
GROSS RECEIPTS TAX			.57
COUNTY UTILITY TAX			1.60
STATE AND OTHER TAXES ON ELECTRIC			1.94
LATE PAYMENT CHARGE FOR PREVIOUS BILL			5.00
TOTAL CURRENT BILL			31.42
BALANCE FORWARD			47.35
TOTAL DUE THIS STATEMENT			**$78.77**

26.42

completed



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater.
If your previous unpaid balance has been paid, please disregard.

ENERGY USE

DAILY AVG. USE -	3 KWH/DAY
USE ONE YEAR AGO -	2 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.77

BF_BL_DEF_20170301_220626_3.CSV-1435-000000115

DETACH AND RETURN THIS SECTION MM 0005043 BILL # 6 OF 17 GRP 1142

Make checks payable to: Duke Energy

ACCOUNT NUMBER - 24257 63348

001435 000000115

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

DUE DATE

MAR 23 2017

TOTAL DUE

78.77

PLEASE ENTER AMOUNT PAID

242576334870000000787740000000473570000000314270100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017
Duke Energy

ACCOUNT NUMBER
07424 95209

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

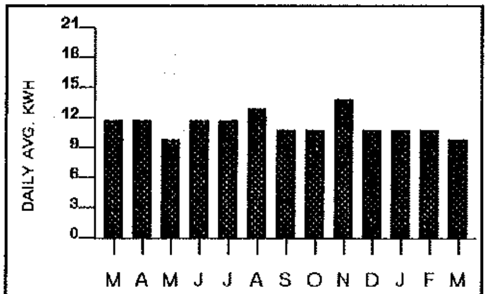
SERVICE ADDRESS
1501 OMNI WAY,
CELL 11/PUMP AREA

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	134.82
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.		008922634
PRESENT	(ACTUAL)	005775
PREVIOUS	(ACTUAL)	005478
DIFFERENCE		000297
PRESENT ONPEAK		001437
PREVIOUS ONPEAK		001365
DIFFERENCE ONPEAK		000072
TOTAL KWH		297
ON PEAK KWH		72
PRESENT KW	(ACTUAL)	0001.95
PRESENT PEAK KW		0001.95
BASE KW		2
ON-PEAK KW		2
LOAD FACTOR		21.3%



ENERGY USE

DAILY AVG. USE -	10 KWH/DAY
USE ONE YEAR AGO -	12 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.51

PAYMENTS RECEIVED AS OF FEB 01 2017 55.52 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE			11.59	
ENERGY CHARGE	297 KWH @	6.97000¢	20.70	
FUEL CHARGE	297 KWH @	3.66700¢	10.89	
ASSET SECURITIZATION CHARGE	297 KWH @	0.18900¢	0.56	
*TOTAL ELECTRIC COST				43.74
GROSS RECEIPTS TAX				1.12
COUNTY UTILITY TAX				2.88
STATE AND OTHER TAXES ON ELECTRIC				3.79
LATE PAYMENT CHARGE FOR PREVIOUS BILL				5.00
TOTAL CURRENT BILL				56.53
AMOUNT PAST DUE				78.29
TOTAL DUE THIS STATEMENT				**$134.82**

51.53

completed

Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $78.29 and electric service may be disconnected. Please pay immediately.

BF_BL_DEF_20170301_220626_3.CSV-1437-000000114

DETACH AND RETURN THIS SECTION MM 0005038 BILL # 1 OF 17 GRP I142

DELINQUENT AMOUNT	DELINQUENT DUE DATE	CURRENT CHARGES AMOUNT	CURRENT CHARGES DUE DATE
78.29	PAST DUE	56.53	MAR 23 2017

ACCOUNT NUMBER - 07424 95209

001437 000000114

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
134.82

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

PLEASE ENTER AMOUNT PAID

074249520940000001348250000000782950000000565310100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

Duke Energy

ACCOUNT NUMBER **49100 99422**

25

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC

1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1401 OMNI WAY,
METHANE GAS STATION

DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	10,177.56
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.	002827472
PRESENT (ACTUAL)	008499
PREVIOUS (ACTUAL)	008027
DIFFERENCE	000472
PRESENT ONPEAK	002115
PREVIOUS ONPEAK	001999
DIFFERENCE ONPEAK	000116
CONSTANT APPLIED	100
TOTAL KWH	47200
ON PEAK KWH	11600
PRESENT KW (ACTUAL)	0001.00
PRESENT PEAK KW	0000.93
BASE KW	100
ON-PEAK KW	93
LOAD FACTOR	67.8%

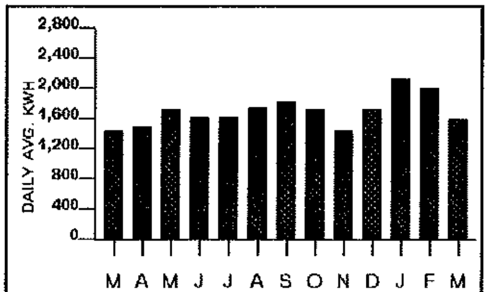
PAYMENTS RECEIVED AS OF FEB 08 2017 5,647.02 THANK YOU

GSDT-1 053 GENERAL SERVICE DEM TOU SEC
BILLING PERIOD..01-31-17 TO 03-01-17 29 DAYS

CUSTOMER CHARGE			19.01	
ENERGY CHARGE (ON-PEAK)	11600 KWH @ 5.19400¢		602.50	
ENERGY CHARGE(OFF-PEAK)	35600 KWH @ 0.99100¢		352.80	
FUEL CHARGE (ON-PEAK)	11600 KWH @ 4.57300¢		530.47	
FUEL CHARGE (OFF-PEAK)	35600 KWH @ 3.24500¢		1,155.22	
DEMAND CHARGE (BASE)	100 KW @ $5.93000		593.00	
DEMAND CHARGE (ON-PEAK)	93 KW @ $3.87000		359.91	
ASSET SECURITIZATION CHARGE	47200 KWH @ 0.17200¢		81.18	
*TOTAL ELECTRIC COST				3,694.09
GROSS RECEIPTS TAX				94.72
COUNTY UTILITY TAX				194.64
STATE AND OTHER TAXES ON ELECTRIC				320.16
LATE PAYMENT CHARGE FOR PREVIOUS BILL				86.81
TOTAL CURRENT BILL				4,390.42
AMOUNT PAST DUE				5,787.14
TOTAL DUE THIS STATEMENT				**$10,177.56**

4303.61

completed



Payment of your bill prior to the above due date will avoid a late payment charge of $5.00 or 1.5%, whichever is greater. Your account has a past due amount of $5,787.14 and electric service may be disconnected. Please pay immediately.

ENERGY USE
DAILY AVG. USE - 1628 KWH/DAY
USE ONE YEAR AGO - 1453 KWH/DAY
*DAILY AVG. ELECTRIC COST -$127.38

BF_BL_DEF_20170301_220626_3.CSV-1428-000000116

DETACH AND RETURN THIS SECTION MM 0005046 BILL # 9 OF 17 GRP 1142

DELINQUENT		CURRENT CHARGES	
AMOUNT	DUE DATE	AMOUNT	DUE DATE
5,787.14	PAST DUE	4,390.42	MAR 23 2017

ACCOUNT NUMBER - 49100 99422

001428 000000116

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

TOTAL DUE
10,177.56

PLEASE ENTER AMOUNT PAID

491009942230000101775660000057871480000043904230100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

ACCOUNT NUMBER
16261 25416

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.duke-energy.com

TO REPORT A POWER OUTAGE:
1-800-228-8485

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773

SERVICE ADDRESS
1501 OMNI WAY,
CELL 2/PUMP AREA

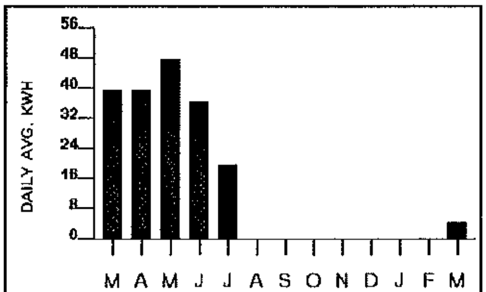
DUE DATE	TOTAL AMOUNT DUE
MAR 23 2017	.00
NEXT READ DATE ON OR ABOUT	**DEPOSIT AMOUNT ON ACCOUNT**
MAR 31 2017	Blanket Cash

PIN: 625482228

METER READINGS

METER NO.	008921464
PRESENT (ESTIMATE)	012348
PREVIOUS (ESTIMATE)	012348
DIFFERENCE	000000
PRESENT ONPEAK	002985
PREVIOUS ONPEAK	002985
DIFFERENCE ONPEAK	000000
TOTAL KWH	0
ON PEAK KWH	0

METER NO.	008921464
PRESENT (ACTUAL)	000139
PREVIOUS (ACTUAL)	000000
DIFFERENCE	000139
PRESENT ONPEAK	000037



ENERGY USE

DAILY AVG. USE -	5 KWH/DAY
USE ONE YEAR AGO -	40 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.95

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..02-01-17 TO 03-01-17 28 DAYS

CUSTOMER CHARGE			11.59	
ENERGY CHARGE	139 KWH @	6.97000¢	9.69	
FUEL CHARGE	139 KWH @	3.66700¢	5.10	
ASSET SECURITIZATION CHARGE	139 KWH @	0.18900¢	0.26	
*TOTAL ELECTRIC COST				26.64
GROSS RECEIPTS TAX				.68
COUNTY UTILITY TAX				1.86
STATE AND OTHER TAXES ON ELECTRIC				2.32
TOTAL CURRENT BILL				31.50
CREDIT BALANCE				247.83CR

TOTAL DUE THIS STATEMENT NONE
CREDIT BALANCE TO BE APPLIED TO FUTURE BILLINGS $216.33

completed

no po # Ø$ owed

BF_BL_DEF_20170301_220626_3.CSV-1438-000000114

DETACH AND RETURN THIS SECTION MM 0005041 BILL # 4 OF 17 GRP 1142 PAGE 1 OF 2

Make checks payable to: Duke Energy

ACCOUNT NUMBER - 16261 25416

001438 000000114

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773-9177

P.O. BOX 1004
CHARLOTTE,
NC 28201-1004

DUE DATE
MAR 23 2017

TOTAL DUE
0.00

PLEASE ENTER AMOUNT PAID

162612541650000000000000000000000000000000000100000000009

DUKE ENERGY

STATEMENT OF ELECTRIC SERVICE

MARCH 2017

25

ACCOUNT NUMBER
16261 25416

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL: **1-877-372-8477** **WEB SITE: www.duke-energy.com** **TO REPORT A POWER OUTAGE:** **1-800-228-8485**	**OMNI WASTE OF OSC CTY LLC** 1501 OMNI WAY SAINT CLOUD FL 34773 **SERVICE ADDRESS** 1501 OMNI WAY, CELL 2/PUMP AREA	**DUE DATE** MAR 23 2017 — **TOTAL AMOUNT DUE** .00 **NEXT READ DATE ON OR ABOUT** MAR 31 2017 — **DEPOSIT AMOUNT ON ACCOUNT** Blanket Cash

METER READINGS

PREVIOUS ONPEAK	000000
DIFFERENCE ONPEAK	000037
TOTAL KWH	139
ON PEAK KWH	37
PRESENT KW (ACTUAL)	0003.74
PRESENT PEAK KW	0003.74
BASE KW	4
ON-PEAK KW	4
LOAD FACTOR	5.2%

BF_BL_DEF_20170301_220626_3.CSV-1439-000000114

Florida Department of Transportation
Item Average Unit Cost
From 2017/01/01 to 2017/12/31

Contract Type: CC STATEWIDE
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0550 10325	1	$89.03	$47,185.90	530.000	LF	N	FENCING, TYPE R, 5.1-6.0', VERTICAL
0550 10344	2	$116.10	$72,564.00	625.000	LF	N	FENCING, TYPE R, 7.1-8.0, W/PART ENCLOS
0550 10353	2	$243.85	$89,980.00	369.000	LF	N	FENCING, TYPE R, 8.1-10', W/FULL ENCLOS
0550 10363	1	$525.00	$281,400.00	536.000	LF	N	FENCING, TYPE R, GR TH10', W/FULL ENCLOS
0550 10410	1	$12.00	$32,688.00	2,724.000	LF	N	FENCING, WOOD FENCE, 0.0-5.0'
0550 10620	1	$45.00	$3,870.00	86.000	LF	N	FENCING, VINYL, 5.1-6.0'
0550 60124	1	$650.00	$3,250.00	5.000	EA	N	FENCE GATE,TYP A, DBL, 18.1-20.' OPENING
0550 60125	1	$2,000.00	$2,000.00	1.000	EA	N	FENCE GATE,TYP A, DBL, 20.1-24.' OPENING
0550 60132	1	$4,000.00	$4,000.00	1.000	EA	N	FENCE GATE,TYP A, SLIIDE/CAN, 6.1-12.'
0550 60211	6	$1,209.27	$54,417.31	45.000	EA	N	FENCE GATE,TYP B,SGL, 0- 6.0' OPENING
0550 60212	4	$1,692.20	$40,612.71	24.000	EA	N	FENCE GATE,TYP B,SGL,6.1-12.0' OPENING
0550 60213	1	$2,700.00	$2,700.00	1.000	EA	N	FENCE GATE,TYP B, SGL,12.1-18.0' OPENING
0550 60214	1	$1,400.00	$2,800.00	2.000	EA	N	FENCE GATE,TYP B,SGL,18.1-20.0' OPENING
0550 60222	1	$1,840.00	$1,840.00	1.000	EA	N	FENCE GATE,TYP B, DBL, 6.1-12.0' OPENING
0550 60223	2	$1,814.74	$7,258.94	4.000	EA	N	FENCE GATE,TYP B, DBL,12.1-18.0' OPENING
0550 60224	1	$2,900.00	$75,400.00	26.000	EA	N	FENCE GATE,TYP B, DBL,18.1-20.0' OPENING
0550 60225	3	$2,506.28	$10,025.12	4.000	EA	N	FENCE GATE,TYP B, DBL, 20.1-24' OPENING
0550 60226	1	$4,000.00	$4,000.00	1.000	EA	N	FENCE GATE,TYP B, DBL, 24-30' OPENING
0550 60233	1	$3,970.00	$3,970.00	1.000	EA	N	FENCE GATE,TYP B,SLIDE/CANT,12.1-18'OPEN
0550 60234	4	$2,202.21	$15,415.46	7.000	EA	N	FENCE GATE,TYP B,SLIDE/CANT,18.1-20'OPEN
0550 60235	4	$2,773.00	$11,092.00	4.000	EA	N	FENCE GATE,TYP B,SLIDE/CANT,20.1-24'OPEN
0550 60236	1	$5,710.00	$5,710.00	1.000	EA	N	FENCE GATE,TYP B,SLIDE/CANT,24.1-30'OPEN
0550 60623	1	$1,500.00	$1,500.00	1.000	EA	N	FENCE GATE, VIN, DOUBLE, 12.1-18.9' OPEN
0561 1	10	$1,034.66	$11,762,672.73	11,368.600	TN	N	COATING EXISTING STRUCTURAL STEEL
0561 2	3	$38.14	$1,203,214.50	31,545.000	SF	N	COATING EXISTING STRUCTURAL STEEL
0563 4	3	$1.26	$74,607.10	59,030.000	SF	N	ANTI-GRAFFITI COATING, NON-SACRIFICIAL
0570 1 1	32	$1.48	$3,963,635.35	2,683,080.000	SY	N	PERFORMANCE TURF
0570 1 2	190	$2.36	$18,352,113.85	7,782,355.000	SY	N	PERFORMANCE TURF, SOD
0571 1 11	6	$5.05	$309,888.78	61,372.000	SY	N	PLASTIC EROSION MAT, TRM, TYPE 1
0571 1 12	2	$11.45	$155,992.52	13,629.000	SY	N	PLASTIC EROSION MAT, TRM, TYPE 2
0571 1 13	2	$9.05	$4,305.64	476.000	SY	N	PLASTIC EROSION MAT, TRM, TYPE 3
0580 1 1	5	$64,523.80	$322,619.02	5.000	LS	N	LANDSCAPE COMPLETE- SMALL PLANTS
0580 1 2	11	$32,622.38	$424,090.96	13.000	LS	N	LANDSCAPE COMPLETE- LARGE PLANTS
0580 2 2	1	$4,000.00	$36,000.00	9.000	EA	N	LANDSCAPE- RELOCATE TREE, PALMS >14'
0590 70	3	$62,828.26	$251,313.04	4.000	LS	N	IRRIGATION SYSTEM
0590 70 1	5	$11,473.01	$57,365.04	5.000	LS	N	IRRIGATION SYSTEM REPAIRS
0630 2 11	114	$6.76	$7,616,379.81	1,126,035.000	LF	N	CONDUIT, F& I, OPEN TRENCH
0630 2 12	122	$19.90	$9,538,340.06	479,310.000	LF	N	CONDUIT, F& I, DIRECTIONAL BORE
0630 2 14	35	$20.82	$227,057.69	10,906.000	LF	N	CONDUIT, F& I, ABOVEGROUND
0630 2 15	15	$23.71	$1,597,359.80	67,373.000	LF	N	CONDUIT, F& I, BRIDGE MOUNT