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15 June 2016

Mr. Cory Dilmore, P.E.
Environmental Administrator
Florida Department of Environmental Protection (FDEP)
Permitting and Compliance Assistance Program
2600 Blair Stone Road, MS 4565
Tallahassee, Florida 32399

Subject: Renewal Permit Application to Construct Through Phase 5 at the J.E.D. Solid Waste Management Facility (WACS #89544) Osceola County, Florida

Dear Mr. Dilmore:

Transmitted herewith are two copies of the subject permit application (one electronic copy via FDEP FTP site and one hardcopy), which was prepared by Geosyntec Consultants (Geosyntec) on behalf of Omni Waste of Osceola County, LLC (Omni), a wholly owned subsidiary of Progressive Waste Solutions of FL, Inc. (PWSFL). The renewal permit application requests approval to continue operations at the J.E.D. Solid Waste Management Facility for a ten-year operation period, and complies with the requirements of Chapter 62-701 of the Florida Administrative Code.

A check in the amount of $10,000 is also enclosed with this permit 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, Progressive Waste Solutions of FL (PWSFL)

Transmittal_JED 2016 Constr Permit Renewal.doc

Prepared for:

Progressive Waste Solutions

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

RENEWAL PERMIT APPLICATION TO CONSTRUCT THROUGH PHASE 5 OF THE J.E.D. SOLID WASTE MANAGEMENT FACILITY

Prepared by:

Geosyntec consultants

13101 Telecom Drive, Suite 120
Temple Terrace, Florida 33637
Certificate of Authorization #4321

Project Number FL2786

June 2016

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

Craig R. Browne, P.E.
Florida Registration No. 68613
Date: 6/15/2016

Craig Browne

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TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

1.1 Terms of Reference

Geosyntec Consultants (Geosyntec) has prepared this 10-year renewal permit application (application) to renew the existing construction permit of the J.E.D. Solid Waste Management Facility (JED facility), a Class I municipal solid waste (MSW) landfill in Osceola County, Florida. The JED facility is owned and operated by Omni Waste of Osceola County, LLC (Omni), which is a wholly owned subsidiary of Progressive Waste Solutions of Florida, Inc. (PWSFL). This application is submitted to the Florida Department of Environmental Protection (FDEP) on behalf of Omni and has been prepared to comply with the requirements of Chapter 62-701 of the Florida Administrative Code (F.A.C.). FDEP Form 62-701.900(1) – *Application to Construct, Operate, Modify or Close a Solid Waste Management Facility* – included in **Appendix A** – has been used to verify the completeness of this application.

The JED facility is currently operating under FDEP solid waste construction Permit No. SC49-0199726-017, issued in August 2011, and FDEP solid waste operation Permit No. SO49-0199726-022, issued in July 2012, and associated permit modifications. The approved construction and operation permits authorize the construction of the Class I landfill lateral expansion area (Cells 11 through 23) and the continued operation of Phases 1 through 4 (Cells 1 through 13), respectively. The existing permits recognize the entirety of the JED Class I landfill build-out which includes 8 Phases (Cells 1 through 23) spanning approximately 360 acres of lined footprint. Currently, Cells 1 through 11 have been constructed to date and disposal operations are currently ongoing in these units. Construction of Cell 13 was recently completed and is pending FDEP authorization to commence disposal. The construction and operation permits expire on 16 August 2016 and 3 July 2017, respectively, and this application has been prepared to renew the construction permit only.

This application is being submitted to renew the existing construction permit at the JED facility for a 10-year period, which is anticipated to include construction through Phase 5, and proposes revisions to the base grades for Phase 5 (Cells 14 and 15) of the Class I landfill. Phase 1 consists of four cells (Cells 1 through 4) and has a footprint of approximately 52 acres. Phase 2 consists of three cells (Cells 5 through 7) with a footprint of approximately 36 acres. Phase 3 consists of three cells (Cells 8 through 10) and has a footprint of approximately 37 acres. Phase 4 also consists of three cells (Cells 11 through 13) and has a footprint of approximately 46 acres. Phase 5 consists of two cells (Cells 14 and 15) and has a footprint of approximately 37 acres. The combined footprint of Phases 1 through 5 is approximately 208 acres.

The drawing set titled *J.E.D. Solid Waste Management Facility, Phases 1–5 Renewal Permit Drawings* (Renewal Permit Drawings) is an integral part of this application and is provided in

Appendix B . The Renewal Permit Drawings show plans, sections, and details of the existing conditions and proposed construction at the JED facility. The Renewal Permit Drawings are intended to provide sufficient detail for renewal permit approval. Additional detail will be provided in construction drawings that will be prepared for the construction of individual cells.

This application was prepared by Alexander Rivera, P.E., Craig Browne, P.E., and Matthew Wissler, P.G., and reviewed by Kwasi Badu-Tweneboah, Ph.D., P.E., all with Geosyntec. Professional engineer certification of this application is provided on the cover sheet, on the FDEP Form 62-701.900(1), on the cover page of each calculation package, and on each sheet of the Renewal Permit Drawings.

1.2 Previous Permit Applications

The solid waste construction and operation permits for Phase 1 of the JED facility were issued by FDEP based on an application prepared and submitted by Geosyntec in May 2002 titled *Application for a Permit to Construct and Operate a Class I Landfill* (2002 Permit Application). A 50-sheet permit drawings set titled *Oak Hammock Disposal, A Solid Waste Facility, Permit Drawings* (2002 Permit Drawings) was issued along with the 2002 Permit Application.

A Conceptual Environmental Resources Permit (ERP) for the entire JED facility and an Individual ERP for Phase 1 development were issued by FDEP based on the application prepared and submitted by Geosyntec in May 2002 titled *Application for Environmental Resources Permit, Oak Hammock Disposal Facility* (2002 ERP Application).

The solid waste construction and operation permits for Phases 1 through 3 of the JED facility were issued by FDEP based on a renewal application prepared and submitted by Geosyntec in September 2006 titled *Renewal Permit Application to Construct and Operate Phases 2 and 3 of the Oak Hammock Disposal Facility* (2006 Renewal Permit Application). A 40-sheet permit drawing set titled *Oak Hammock Disposal Facility, Phases 2 and 3, Renewal Permit Drawings* (2006 Renewal Permit Drawings) was issued along with the 2006 Renewal Permit Application.

An Individual ERP for Phase 2 development was issued by FDEP based on an application prepared and submitted by Geosyntec in November 2006 titled *Application for an Environmental Resources Permit for Phase 2 Construction, Oak Hammock Disposal Facility* (2006 ERP Application).

A major modification application to vertically expand the JED facility was prepared by Geosyntec and submitted to FDEP in September 2007 in an application titled *Major Modification Application for Vertical Expansion of the J.E.D. Solid Waste Management Facility (Phases 1 through 3)* (2007 Major Modification Application). A 40-sheet permit drawing set titled *J.E.D. Solid Waste Management Facility, Vertical Expansion Permit*

Drawings, Phases 1 through 3 (2007 Permit Drawings) was submitted along with the 2007 Major Modification Application.

An Individual ERP for Phase 3 development and a modification to the Conceptual ERP was issued by FDEP based on an application prepared and submitted by Geosyntec in October 2007 titled *Major Modification of Environmental Resources Permit Applications for the Vertical Expansion of the J.E.D. Solid Waste Management Facility* (2007 ERP Application).

In February 2011 Geosyntec prepared and submitted a *Major Environmental Resources Permit Modification Application* (2011 ERP Application) along with the *Landfill Lateral Expansion – Application for a Major Permit Modification* (2011 Major Modification Application). A 40-sheet permit drawing set entitled *J.E.D. Solid Waste Management Facility, Lateral Expansion Major Solid Waste Permit Drawings* (2011 Permit Drawings) was submitted along with the 2011 Major Modification Application.

In November 2011 Geosyntec prepared and submitted a *Renewal Permit Application to Operate Phases 1 through 4 at the J.E.D. Solid Waste Management Facility* (2011 Renewal Permit Application). A 45-sheet permit drawing set entitled *J.E.D. Solid Waste Management Facility, Phases 1 through 4, Renewal Permit Drawings* (2011 Renewal Permit Drawings) was submitted along with the 2011 Renewal Permit Application.

In December 2014 Geosyntec prepared and submitted an *Intermediate Permit Modification Application: Base Grade Revisions to Phase 4 (Cells 11-13)* (2014 Intermediate Modification Application). A permit drawing set titled *J.E.D. Solid Waste Management Facility, Base Grade Revisions, Phase 4 (Cells 11-13) Disposal Area, Intermediate Modification Permit Drawings* (2014 Permit Modification Drawings) was submitted along with the 2014 Intermediate Modification Application.

The current solid waste construction and operation permits (Permit No. SC49-0199726-017 and SO49-0199726-022, respectively) were issued based on the 2011 Renewal Permit Application and subsequent responses to FDEP comments. As previously discussed, these permits expire on 16 August 2016 and 3 July 2017, respectively, and this application has been prepared to renew the construction permit only.

1.3 Purpose and Scope

The purpose of this application is to provide sufficient information to renew the solid waste construction permit of the existing Class I landfill for a 10-year period, which is anticipated to include construction through Cell 15. The overall site development plan of the JED facility (Cells 1 through 23) is shown in the Renewal Permit Drawings (**Appendix B**). In addition, this application includes information to support proposed revisions to the base grades in Phase 5 (Cells 14 and 15).

The intent of this application is to address all applicable parts of the FDEP Form 62-701.900(1). Parts of FDEP Form 62-701.900(1), marked as *no substantial change* (N/C) (i.e., those related to previous investigations, design, and/or analyses) have been previously submitted in previous application submittals as referenced above. When applicable, sections of FDEP Form 62-701.900(1), marked as N/C are incorporated herein by referencing the appropriate documents on file with the FDEP.

1.4 Organization of the Permit Application

This application is organized as follows:

- Section 1: Introduction – This section provides terms of reference, summarizes previous permit applications, and discusses the scope and organization of the application.
- Section 2: General Information – This section addresses Parts A through G of FDEP Form 62-701.900(1).
- Section 3: Hydrogeological and Geotechnical Investigation – This section addresses Parts H through J of FDEP Form 62-701.900(1).
- Section 4: Operation and Water Quality Plans – This section addresses Parts K through M of FDEP Form 62-701.900(1).
- Section 5: Geotechnical Design – This section summarizes the results of analyses for bearing capacity, subgrade settlement, and slope stability as a result of proposed base grade modifications to Cells 14 and 15.
- Section 6: Leachate Management System – This section summarizes the geocomposite and leachate removal and transmission design calculations as a result of proposed base grade modifications to Cells 14 and 15.
- Section 7: Landfill Gas Management System – This section addresses Part N of FDEP Form 62-701.900(1).
- Section 8: Landfill Closure – This section addresses Parts O and P of FDEP Form 62-701.900(1).
- Section 9: Long-Term Care and Financial Assurance – This section addresses Parts Q and R of FDEP Form 62-701.900(1).
- Section 10: References – This section includes a list of documents referenced herein.

2 GENERAL INFORMATION

2.1 Overview

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

2.2 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 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.

2.3 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 JED 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 will be covered by the landfill disposal footprint. The proposed footprint of Phase 5 of landfill development is approximately 38 acres.

2.4 Prohibitions

This section provides information required by Part C of Form 62-701.900(1) that pertain to regulatory landfill prohibitions as described in Section 62-701.300, F.A.C. The proposed base grade modifications 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 Section 62-701.300(2), F.A.C. Accordingly, Parts C.1 through C.10 of Form 62-701.900(1) have been marked as "No Change" and the information presented herein is for informational purposes only.

The JED facility satisfies FDEP siting criteria requirements described by Section 62-701.300(2). F.A.C. No solid waste will be placed:

- in an area where geological formations or other subsurface features will not provide adequate support (refer to Section 0 of this permit application);
- within 500 feet (ft.) of any existing or approved potable water well (Note: a well survey is provided in **Appendix C** of this application);
- in dewatered pits (see the Renewal Permit Drawings);
- in a natural or artificial body of water;
- within 200 ft. of a natural or artificial body of water except where the facility is designed with permanent leachate control methods, which will result in compliance with water quality standards and criteria; or
- on the right of way of any public highway, road, or alley (refer to Renewal Permit Drawings).

Note that, as shown in the Renewal Permit Drawings, the potable water well located in the existing administrative area will be relocated adjacent to the future location of the administrative area prior to placement of waste in Cell 19 such that a minimum 500-ft. offset is maintained from the waste.

The exemptions stated in Sections 62-701.300(12) through (18), F.A.C., are not applicable to the JED facility due to the following:

- yard trash storage areas will meet all siting criteria;
- tanks will meet all siting criteria;
- CCA treated wood will not be processed for use outside of the lined waste disposal facility;
- no indoor, vehicle, or container storage of waste will be allowed; and
- there are no existing facilities (i.e., facilities that were constructed prior to 27 May 2001) at the site.

Other Class I landfill prohibitions will be enforced at the JED facility, specifically:

- no open burning of solid waste will be allowed;
- no hazardous waste will be accepted for disposal;
- no liquids or non-liquids containing polychlorinated biphenyls (PCBs) will be accepted for disposal;
- no biomedical waste will be accepted for disposal unless the biomedical waste has been properly incinerated;
- no special waste (lead-acid batteries, used oil, yard trash, white goods, or whole tires) will be accepted for disposal in the landfill, however, yard trash, white goods, and whole tires will be accepted for processing, reuse, or recycling;
- no prohibited liquid waste will be accepted for disposal; and
- no prohibited commingled used oil will be accepted for disposal.

The JED facility is not located within 3,000 ft. of Class I surface waters. The nearest surface water to the landfill is the Bull Creek, an intermittent stream which is designated as a Class III surface water by FDEP. The nearest Class I surface water is located approximately 13 miles east of the JED facility.

2.5 Solid Waste Management Facility Permit Requirements

2.5.1 Overview

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

2.5.2 Operation Plan

This application is for renewal of the solid waste construction permit only. As such, a revised Operation Plan is not included herein.

2.5.3 Closure Plan

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 the final closure construction activities. Details of the final cover system design (including erosion control and storm water management features) are submitted with this application to outline the conceptual closure design for the JED facility. It is noted that Omni intends to construct final cover in sections of the landfill that have reached the final waste elevations (i.e., close as you go). As such, a revised closure plan is not included herein.

2.5.4 Renewal Permit Drawings

Appendix B contains the Renewal Permit Drawings for the JED facility including all information set forth in Section 62-701.320(7)f, F.A.C. The Renewal Permit Drawings specifically provide the layout and design for Phases 4 and 5 of landfill development at the JED facility. It is noted that the Renewal Permit Drawings also provide the proposed base grade modifications for Phase 5 (Cells 14 and 15) of the JED facility.

2.5.5 Compliance History

As required by Section 62-701.320(7)i, F.A.C., a history of the solid waste management facility enforcement actions against PWSFL in the State of Florida is presented in **Appendix D** of this application.

2.5.6 Public Notification

A public notification was published as part of the 2011 Major Modification Applications in accordance with the requirements of Rule 62-701.320(8)(a), F.A.C. As the proposed base grade modifications for Cells 14 and 15 of the JED facility will not alter the horizontal or vertical extents of the disposal area approved by the current FDEP solid waste construction permit, a Notice of Application is not included as part of this application.

2.5.7 Airport Safety

As part of the 2007 Major Modification Application process, the Federal Aviation Agency (FAA) was contacted to ensure that the proposed vertical expansion of the JED facility did not present a safety concern with respect to air traffic and nearby airports. FAA performed a study and concluded that the proposed maximum elevation of 330 ft. (NGVD) for the JED facility would not be a hazard to air navigation.

As the proposed base grade modifications for Cells 14 and 15 and construction permit renewal for the JED facility will not alter the horizontal or vertical extents of the disposal area, the JED facility satisfies the siting requirements for airport safety and notification approved by the current FDEP solid waste construction permit. As such, information required by Section 62-701.320(13), F.A.C., is not included as part of this application.

2.5.8 Screening of Landfill from Public View

Additional measures are not needed to screen the landfill from public view. The JED facility is located approximately 1.7 miles west of highway U.S. 441, which is the closest public area. The area between the facility and highway U.S. 441 consists of the natural vegetation of central Florida, including extensive stands of trees, which screen the site activities from public view.

2.6 <u>Landfill Permit Requirements</u>

2.6.1 Overview

The documentation required by Section 62-701.330(3)(a) through (h), F.A.C., [Part E of FDEP Form 62-701.900(1)] has been previously submitted to FDEP in the 2007 Permit Application and 2011 Major Permit Modification. Select items have been updated to reflect existing site conditions, projected development of the landfill over the next 10-year permit period, and proposed base grade modifications for Cells 14 and 15, as indicated on the FDEP Form and as described below.

2.6.2 Renewal Permit Drawings

The Permit Drawings, presented in **Appendix B** of this application, contain 48 sheets and have been prepared in an attempt to be "all-inclusive." Specific updates to the Permit Drawings include:

- Sheet 2: <u>Existing Site Conditions and Aerial Photograph</u> – updates to reflect existing site conditions and aerial photograph (aerial survey completed on 20 May 2015);
- Sheet 3: <u>Topographic Map of the Site</u> – incorporates topographic survey information from aerial survey completed on 20 May 2015;

- Sheet 8: Base Grading Plan – Phase 5 – reflects proposed base grade modifications to Phase 5 (Cells 14 and 15);
- Sheet 11: Landfill Cross Sections I – updates to reflect existing (May 2015) grades and revised base grades in Cell 14;
- Sheet 12: Landfill Cross Sections II – updates to reflect existing (May 2015) grades;
- Sheet 13: Landfill Cross Sections III – updates to reflect existing (May 2015) grades;
- Sheet 23: Groundwater Monitoring Network – updates to proposed groundwater monitoring network as a result of Phase 5 (Cells 14 and 15) construction;
- Sheet 25: Phase 5 Construction Sequencing – reflects construction sequencing through Phase 5 (Cells 14 and 15);
- Sheet 27: Waste Fill Sequencing Plan II – updates to waste sequencing plan through Phase 5 (Cells 14 and 15);
- Sheets 28-34: Gas Management System Plans and Details – reflects existing gas management system components and proposed gas management system plan and details (prepared by others); and
- Sheets 35-40: Dewatering Plans and Details – reflects existing and proposed dewatering system for gas extraction wells (prepared by others).

2.6.3 Estimated Population for the Service Area

The area serviced by the JED facility is primarily Osceola County. However, based on the agreement with Osceola County, the JED facility may also accept waste from surrounding counties. The primary counties from which the JED facility can accept waste include Osceola, Brevard, Indian River, Okeechobee, Orange, Polk, Volusia, Sumter, Lake, Seminole, Pasco, Hillsborough, Hardee, and Highlands.

According to population data available from the Office of Economic and Demographic Research (OEDR), the 1 April 2015 estimated population for Osceola County is 308,327 and the estimated population of all the counties (from which JED facility may accept waste) is 6,266,034 (OEDR, 2016).

2.6.4 Type, Source of Solid Waste, and Annual Quantity

Household trash, commercial waste, construction and demolition debris, shredded/cut tires, incinerator/WTE ash, treated biomedical, industrial, water treatment sludge, asbestos, industrial sludge, domestic sludge, waste tires, auto shredder waste, industrial liquid waste for solidification, and other waste classified as Class I waste are being and will be disposed in the JED landfill. The waste will be from residential communities and commercial sources.

The landfill is currently open from Monday through Sunday (half-day or less on Saturday and Sunday). As such, the landfill operates approximately 286 equivalent full days per year. The estimated waste disposal rate for the JED landfill is expected to average 6,000 tons/day, resulting in approximately 1,716,000 tons/year.

2.6.5 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 23,672,200 yd^3 of airspace as of May 2015. This airspace includes approximately 86,170 yd^3 of additional volume due to the proposed base grade modifications in Cells 14 and 15. 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, the expected life including Phases 3, 4, and 5 under build-out conditions is estimated to be approximately 10 years.

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 Renewal Permit Drawings.

2.7 <u>General Criteria for Landfills</u>

2.7.1 Floodplain

The documentation required by Section 62-701.340(3)(b), F.A.C., with respect to the 100-year flood plain has been previously submitted in the 2011 Major Modification Application and 2011 ERP Application. As the proposed base grade modifications for Cells 14 and 15 of the JED facility will not alter the horizontal or vertical extents of the disposal area approved by the current FDEP solid waste construction permit, the documentation previously submitted is still valid and is not re-submitted in this application.

2.7.2 Horizontal Separation

The Renewal Permit Drawings include dimensions between the landfill liner system perimeter anchor trench, which corresponds to the toe of the proposed final cover system slope, and the property boundary. As shown on the Renewal Permit Drawings, the proposed base grade modifications for Cells 14 and 15 of the JED facility will not alter the minimum horizontal separation between waste placed in the proposed landfill and the landfill property boundary, which exceeds the 100-foot setback requirement of Section 62-701.340(3)(c), F.A.C.

2.8 <u>Landfill Construction Requirements</u>

The applicable landfill construction requirements in Part G of FDEP Form 62-701.900(1), and Rule 62-701.400, F.A.C., are described in subsequent sections of this application and corresponding appendices. With the exception of geocomposite and geosynthetic clay liner (GCL), the technical specifications for construction are not proposed to be changed. The geocomposite design and specifications are discussed further in Section 6. The GCL specification was updated based on correspondence between Geosyntec, PWSFL, and FDEP during construction of Cell 11 relative to the residual internal shear strength requirements

(Geosyntec, 2015). In addition, the GCL specifications have been updated to make the manufacturer's quality control (MQC) testing frequencies consistent with current Geosynthetic Research Institute (GRI) recommendations, per GRI-GCL3 (GRI, 2016). The updated geocomposite and GCL specifications are provided in **Appendix G**.

3 HYDROGEOLOGICAL AND GEOTECHNICAL INVESTIGATIONS

3.1 Overview

This section presents and addresses the hydrogeological and geotechnical investigation requirements in Chapter 62-701, F.A.C., not addressed in other sections or appendices of this application. Specifically, this section is organized to provide the information required by Parts H through J of FDEP Form 62-701.900(1) for the JED facility.

3.2 Previous Investigations

In April 2002 Kubal-Furr & Associates prepared and submitted a *Hydrogeologic Investigation Report and Water-Quality Monitoring Plan, Oak Hammock Disposal, A Solid Waste Disposal Facility* (2002 Hydrogeologic Investigation Report) during the 2002 Permit Application.

In February 2011, Geosyntec prepared and submitted a *Hydrogeological Investigation Report Addendum and Conceptual Water Quality Monitoring Plan* (2011 Hydrogeologic Investigation Report) as Attachment C of the 2011 Major Modification Application. The 2002 Hydrogeologic Investigation Report was included as Attachment A in the 2011 Hydrogeologic Investigation Report.

Also in February 2011, Geosyntec prepared and submitted a *Geotechnical Investigation Report* (2011 Geotechnical Investigation Report) as Attachment D of the 2011 Major Modification Application.

As the proposed base grade modifications for Cells 14 and 15 of the JED facility will not alter the horizontal or vertical extents of the disposal area approved by the current FDEP solid waste construction permit, no further investigations have been completed and the previously submitted information is still valid and is not re-submitted in this application. As such, Parts H and I on FDEP Form 62-701.900(1) have been marked as “No Change”. However, geotechnical bearing capacity, settlement and slope stability analyses are presented in Section 5 to support the proposed modifications to the base grades as required by Rule 62-701.410, F.A.C.

3.3 Vertical Expansion

The proposed base grade modifications for Cells 14 and 15 will not involve an increase in maximum waste elevation. As such, Part J on FDEP Form 62-701.900(1) has been marked as “Not Applicable”.

4 OPERATION AND WATER QUALITY PLANS

Because this application is only for renewal of the solid waste construction permit, items related to operation and water quality plans are not applicable. Accordingly, Parts K through M of FDEP Form 62-701.900(1) have been marked as “Not Applicable”.

5 GEOTECHNICAL DESIGN

5.1 Overview

This section presents a summary of the geotechnical engineering design evaluations prepared in support of the proposed liner and leachate collection system (LCS) geometry, revisions for Cells 14 and 15 at the JED facility. The modified LCS includes revisions to the design base liner grades such that the slope of the leachate corridors in some areas are reduced from 1.0% to 0.5% and the cross-slope grades (floor of cells that drain to the leachate corridors) are reduced from 2.0% to 1.4% for the exterior portions of Cells 14 and 15 (i.e., the portion of the cell floor beneath the 3H:1V side slope of the final cover approximately between the sump and crest of final cover) and from 2.0% to 1.2% for the interior portions of Cells 14 and 15 (i.e., the portion of the cell floor beneath the crest of final cover to the toe of the intercell berm between Cells 14 and 15). Due to the proposed modifications to the LCS grades for Cells 14 and 15, Geosyntec has evaluated the resulting bearing capacity (Section 5.2), settlement (Section 5.3), and slope stability (Section 5.4) based on the requirements of Rules 62-701.400(2) and 62-701.410(3)(e), F.A.C.

5.2 Bearing Capacity

Bearing capacity calculations were most recently provided in Appendix F of the 2007 Major Modification Application. In this analysis, a worst-case loading scenario was assumed to evaluate the factor of safety (FS) against bearing capacity failure. The bearing capacity analysis was conservatively performed by assuming that the load due to the landfill at final build-out (i.e., at elevation 330 ft.) acts uniformly across the minimum width of the landfill. Because the maximum waste fill elevation is not proposed to change, the loading assumptions are representative of those anticipated for the revised configuration of Cells 14 and 15. In addition, the minimum landfill width was assumed to be 1,430 ft in the previous bearing capacity calculations (2007 Major Modification Application), whereas the minimum width for the Cells 14 and 15 area is approximately 3,000 ft. As such, the FS against bearing capacity failure will remain at least 14.5 as calculated for the 2007 Major Modification Application. A FS of 3 or higher is generally considered acceptable.

5.3 Subgrade Settlement

Due to the proposed base grade modifications and leachate pipe corridor inclination for Cells 14 and 15, total and differential subgrade settlements were evaluated for representative critical sections as part of the foundation analysis in accordance with Section 62-701.410(3)(e)2, F.A.C. Specifically, in accordance with Rule 62-701.400(4)(c), F.A.C., the minimum slope for the LCS, in areas which drain to lateral collection pipes and header pipes is 1.0 percent after estimated settlement and the minimum slopes for the collection pipes of the LCS (i.e., lateral and header pipes) is 0.3 percent after estimated settlement.

A one-dimensional settlement analysis was 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 E**. The results of the settlement analysis were used to evaluate the impact of anticipated settlements on the performance of the LCS and the proposed liner system.

Based on the results of the settlement analysis presented in **Appendix E**, the calculated post-settlement slopes of the base grades for Cells 14 and 15 meet or exceed 1.0 percent while the post-settlement slopes of the leachate collection and leak detection pipes in Cells 14 and 15 are calculated to be greater than 0.3 percent. Accordingly, the base grades and leachate collection and leak detection system pipe corridor inclination have been designed to meet the minimum requirements of Rule 62-701.400(4)(c), F.A.C. In addition, the strain induced on the geomembrane component of the liner system was calculated to be essentially negligible.

5.4 Slope Stability

As part of the 2014 Intermediate Permit Application, Geosyntec performed an evaluation of base grade modifications for Cells 11-13. The proposed design modifications included changes to the cell floor configurations while maintaining the waste side slope inclination and the maximum height of the landfill. Although the resulting FS against slope failure was not expected to be impacted by the proposed changes to Cells 11-13 of the JED facility, slope stability analyses were nevertheless performed to quantify the FS against slope failure for the proposed configuration. The stability analyses performed and the results of the analyses were presented in Attachment 5 of the 2014 Intermediate Permit Application.

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. Based on the results of the slope stability analyses presented in the 2014 Intermediate Modification Application, the minimum FS for the proposed landfill configuration met or exceeded 1.5 in accordance with Rule 62-701.400(2), F.A.C. In addition, the minimum required peak interface friction angle required to achieve a minimum FS of 1.5 was calculated to be 11.3 degrees. As such, the specified minimum interface friction angle of 11.6 degrees (as approved with the 2007 Major Modification Application) remains appropriate.

The proposed modification to the inclination of the leachate pipe corridor for Cells 14 and 15 does not deviate from the modifications to the leachate pipe corridor inclination of Cells 12 and 13 (2014 Intermediate Permit Application). As such, the slope stability analyses performed in the 2014 Intermediate Modification Application for Cells 11-13 remain valid and are applicable to the proposed base grade modifications for Cells 14 and 15 of the JED facility and Part I, Item e.(3) on FDEP Form 62-701.900(1) has been marked as “No Change”.

6 LEACHATE MANAGEMENT SYSTEM

6.1 Overview

The leachate management system consists of primary and secondary leachate collection and removal systems in each cell, a leachate transmission pipeline, and flexible leachate storage containers. In Cells 14 and 15, the liner system in each cell is sloped such that leachate drains towards a central leachate collection pipe and ultimately to a single low point (i.e., sump) located along the perimeter of the landfill. The elevation of the liner subgrade is above the seasonal high ground water level except in the sump areas. As currently approved, sump construction will place the bottom of the sumps 2 to 3 ft. below the elevation of the seasonal high water level. As such, Omni will attempt to schedule construction of the sump area during periods of low ground water level. Otherwise, the sump area will be dewatered during construction. After construction, the liner system will be held in place by the weight of the protective cover soil and LCS gravel.

The proposed base grade modifications will maintain the general configuration of the currently approved liner and LCS in Cells 14 and 15. However, as described in Section 5, the design slopes of the liner system and portions of LCS pipe corridors are proposed to be reduced.

6.2 Geocomposite Design

Because the design slope inclination and corresponding drainage lengths of the LCS are proposed to be modified, calculations were performed to evaluate the required primary geocomposite transmissivity needed to limit the leachate head to no more than 1 ft. above the primary geomembrane, in accordance with Rule 62-701.400(3)(c)1, F.A.C. Likewise, calculations were performed to evaluate the required secondary geocomposite transmissivity needed to limit the leachate head on the secondary geomembrane to the thickness of the secondary drainage geocomposite, in accordance with Rule 62-701.400(3)(c)2, F.A.C. Design calculations for the geocomposite component of the modified LCS are provided in **Appendix F**. Due to the revised geocomposite transmissivity requirements presented in **Appendix F**, the geocomposite Technical Specification has been revised and is provided in **Appendix G**.

6.3 Leachate Removal and Transmission Design

The components of the leachate removal system include the leachate sump pumps and the associated fittings and piping. The transmission system consists of piping used to convey the leachate from the sumps to the leachate storage facility.

Each cell will be equipped with three submersible leachate pumps. Two pumps are dedicated to the removal of leachate from the primary LCS and the third pump will be dedicated to removing leachate collected from the secondary LCS (or leak detection system). Sump pump sizing requirements were based on the peak daily leachate generated from the largest cell (Cell 19 at 23.5 acres). The design flow rate was previously calculated, as part of the 2011 Major Modification Application, to be 121.4 gallons per minute (gpm). Based on the calculations provided in **Appendix F** (see Tables 1a and 1b), the peak daily leachate generation rate is calculated to be 496 ft^3/acre/day for Cells 14 and 15. The calculated design flow rate for Cells 14 and 15 (18.6 and 18.7 acres, respectively) is approximately 100 gpm when assuming a FS of 2. Based on these calculated design flow rates, the currently approved sump pump and leachate transmission pipe sizing remain suitable for the proposed modifications in Cells 14 and 15.

7 LANDFILL GAS MANAGEMENT SYSTEM

7.1 Overview

This section presents and addresses the landfill gas system requirements in Chapter 62-701, F.A.C., not addressed in other sections or appendices of this permit application. Specifically, this section is organized to provide the information required by Part N of FDEP Form 62-701.900(1) for the JED facility.

7.2 Background

The JED facility has a gas management system (GMS) that complies with the requirements of Rule 62-701.530, F.A.C. As currently constructed, the GMS consists of active vertical and horizontal landfill gas (LFG) extraction wells, lateral and header conveyance piping within the waste, and a landfill gas to energy system and backup flares located to the southeast of the waste disposal footprint. The layout of future LFG extraction wells and associated piping is provided on Sheets 28 through 40 of the Renewal Permit Drawings.

8 LANDFILL CLOSURE

8.1 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 permit application. Specifically, this section is organized to provide the information required by Parts O and P of FDEP Form 62-701.900(1) for the JED facility.

The general approach for closure of the JED facility will remain identical to that presented in the 2007 and 2011 Major Modification Applications. Therefore, the following sections are provided as summaries of landfill closure procedures already on file with the FDEP.

8.2 Closure Sequencing and Permitting

Although a final cover system design is included in the Renewal Permit Drawings, this application is not for closure. 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 (including erosion control and storm water management features) are submitted with this permit application to outline the conceptual closure design for the 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.

8.3 Final Cover System Design

The general design of the final cover system is the same as that presented in the 2007 and 2011 Major Modification Applications. Namely, the final cover system will include 3H:1V side slopes (between benches) with 15-ft wide benches every 40 vertical feet (at elevations 138, 178, 218, 258, and 298 feet, NGVD) and top slopes graded at 5 percent.

The final cover system performance evaluation was provided in Appendix H of the 2007 Major Modification Application and no change is proposed for this permit application. The final cover system performance evaluation included analysis of head on the geomembrane in the final cover system, veneer stability, and soil erosion resistance.

8.4 Surface-Water Drainage System

Diversion berms and drainage swales are incorporated in the final cover system on the top and on the side slopes of the landfill as indicated in the Renewal Permit Drawings. 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. Design calculations confirming the adequacy of the drainage swales and the downdrains to convey the storm water runoff were presented in the 2011 ERP Application and no change is proposed for this permit application.

9 LONG-TERM CARE AND FINANCIAL ASSURANCE

9.1 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 permit application. Specifically, this section is organized to provide the information required by Parts Q and R of FDEP Form 62-701.900(1) for the JED facility.

9.2 Long-Term Care and Closure Costs

A financial assurance cost estimate has been prepared for the JED facility, in compliance with Rule 62-701.630, F.A.C. The financial assurance cost estimate covers the closure costs and long-term care costs for cells that have been constructed and cells that are projected to be constructed over the next 10 years (i.e., Cells 1-15). The combined total two-dimensional area of these cells is approximately 211 acres, as summarized on Table 1 of the *Financial Assurance Cost Estimate* included as **Appendix H** of this Permit Application. Of this total area, 43.8 ac. of side slopes and top deck area of Phase I have been closed as of May 2016, which leaves 164.6 acres remaining to be closed.

The closure cost estimate (for 164.6 acres) and long-term care cost estimate (for 208 acres) are included on the FDEP Form 62-701.900(28), *Closure Cost Estimating Form for Solid Waste Facilities*, in Attachment 1 of **Appendix H**. In summary, the total estimated closing cost included for the areas noted above is calculated to be $26,925,829.58. Similarly, the estimated long-term care cost (for a 30-year period) for the areas noted above is calculated to be $9,197,465.31.

10 REFERENCES

Geosyntec Consultants (2002a) "Application for a Permit to Construct and Operate a Class I Landfill," received by FDEP on 24 May 2002.

Geosyntec Consultants (2002b) "Application for Environmental Resources Permit, Oak Hammock Disposal Facility," received by FDEP on 24 May 2002.

Geosyntec Consultants (2006a) "Renewal Permit Application to Construct and Operate Phases 2 and 3 of the Oak Hammock Disposal Facility," received by FDEP on 12 September 2006.

Geosyntec Consultants (2006b) "Application for an Environmental Resources Permit for Phase 2 Construction, Oak Hammock Disposal Facility," received by FDEP on 12 September 2006.

Geosyntec Consultants (2007a) "Major Modification Application for Vertical Expansion of the J.E.D. Solid Waste Management Facility (Phases 1 through 3)," received by FDEP on 21 September 2007.

Geosyntec Consultants (2007b) "Major Modification of Environmental Resources Permit Applications for the Vertical Expansion of the J.E.D. Solid Waste Management Facility," received by FDEP in October 2007.

Geosyntec Consultants (2011a) "Major Environmental Resources Permit Modification Application," received by FDEP on 18 February 2011.

Geosyntec Consultants (2011b) "Landfill Lateral Expansion – Application for a Major Permit Modification," received by FDEP on 18 February 2011.

Geosyntec Consultants (2011c) "Renewal Permit Application to Operate Phases 1 through 4 at the J.E.D Solid Waste Management Facility," received by FDEP on 10 November 2011.

Geosyntec Consultants (2014) "Intermediate Permit Modification Application: Base Grade Revisions to Phase 4 (Cells 11-13)," received by FDEP on 9 December 2014.

Geosyntec Consultants (2015) "Technical Memorandum – Evaluation of GCL Residual Shear Strength Test Results for JED Cell 11 Construction," 17 March 2015.

Geosynthetic Research Institute (GRI)(2016) "Standard Specification for Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)", Rev. #4, March 28, 2016.

APPENDICES

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

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

PART A: GENERAL INFORMATION

PART B: DISPOSAL FACILITY GENERAL INFORMATION

PART C: PROHIBITIONS

PART D: SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL

PART E: LANDFILL PERMIT REQUIREMENTS

PART F: GENERAL CRITERIA FOR LANDFILLS

PART G: LANDFILL CONSTRUCTION REQUIREMENTS

PART H: HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS

PART I: GEOTECHNICAL INVESTIGATION REQUIREMENTS

PART J: VERTICAL EXPANSION OF LANDFILLS

PART K: LANDFILL OPERATION REQUIREMENTS

PART L: WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS

PART M: SPECIAL WASTE HANDLING REQUIREMENTS

PART N: GAS MANAGEMENT SYSTEM REQUIREMENTS

PART O: LANDFILL CLOSURE REQUIREMENTS

PART P: OTHER CLOSURE PROCEDURES

PART Q: LONG-TERM CARE

PART R: FINANCIAL ASSURANCE

PART S: CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

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

Please Type or Print

PART A. GENERAL INFORMATION

1. Type of disposal facility (check all that apply):
   - ☑ 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): Omini Waste 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: Senior Region Engineer

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

9. Authorized agent/Consultant: Geosyntec Consultants

Mailing address: 13101 Telecom Drive, Suite 120 | Temple Terrace | 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 Five-Year Projection: 6,500,000

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: $ ______________

16. Anticipated construction starting and completion dates:

From: 2016 To: 2026

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 in support of the renewal of the construction permit for the JED facility, including construction through Phase 5 (Cells 14 and 15) and propose revisions to the base grades for Phase 5.

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: 136* Available acres: 224

   *136 acres currently receiving waste. Cell 13 (17.6 acres) currently pending approval.

4. Weighing scales used: ☑ Yes ☐ No

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

6. Charge for waste received: ________ $/yds^3 35 $/ton

7. Surrounding land use, zoning:

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

8. Types of waste received:

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

LOCATION

S ☑ Attached N/A ☐ N/C ☐ 1. A minimum of one completed electronic application form, all supporting data and reports; (62-701.320(5)(a), FAC)

S ☑ Report/Appendices N/A ☐ N/C ☐ 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)

S ☑ Attached letter N/A ☐ N/C ☐ 3. A letter of transmittal to the Department; (62-701.320(7)(a), FAC)

S ☑ Appendix A N/A ☐ N/C ☐ 4. A completed application form dated and signed by the applicant; (62-701.320(7)(b), FAC)

S ☑ Attached N/A ☐ N/C ☐ 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)

S ☑ Attached N/A ☐ N/C ☐ 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)

S ☐ ______ N/A ☑ N/C ☐ 7. Operation Plan and Closure Plan; (62-701.320(7)(e)1, FAC)

S ☐ ______ N/A ☑ N/C ☐ 8. Contingency Plan; (62-701.320(7)(e)2, FAC)

S ☑ Appendix B N/A ☐ N/C ☐ 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)

S ☑ App. B/Sheet 1 N/A ☐ N/C ☐ a. A regional map or plan with the project location in relation to major roadways and population centers;

S ☑ App. B/Sheet 2 N/A ☐ N/C ☐ 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;

S ☑ App. B/Sheet 3 N/A ☐ N/C ☐ c. A site plan showing all property boundaries certified by a Florida Licensed Professional Surveyor and Mapper;

S ☑ Appendix B N/A ☐ N/C ☐ 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 D 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 ☐ App. B/Sheet 3 N/A ☐ N/C ☑ a. Dimensions;

S ☑ App. B/Sheet 23 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 ☑ App. B/Sheet 6 N/A ☐ N/C ☐ d. Proposed plan of trenching or disposal areas;

S ☑ App. B/Sheet 11-13 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 ☑	App. B/Sheet 3	N/A ☐	N/C ☐	f. Any previously filled waste disposal areas;
S ☐	App. B/Sheet 3	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 ☑	App. B/Sheet 6	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 2.6	N/A ☐	N/C ☐	4. A report on the landfill describing the following: (62-701.330(3)(d), FAC)
S ☑	Section 2.6.3	N/A ☐	N/C ☐	a. The current and projected population and area to be served by the proposed site;
S ☑	Section 2.6.4	N/A ☐	N/C ☐	b. The anticipated type, annual quantity, and source of solid waste expressed in tons;
S ☑	Section 2.6.5	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 ☐ Section 2.7.1 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 ☐ Section 2.7.2 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 5 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 & App N/A ☐ N/C ☐ 2. Landfill liner requirements; (62-701.400(3), FAC)

S ☐ ____________ 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 5.4 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 ☑ Report 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 ☑ Sec. 6/App. F 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 ☑ Sec. 6/App. F 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 ☑ Report 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 ☐	____________	N/A ☐	N/C ☑	(7) Interface shear strength testing results of the actual components which will be used in the liner system;
S ☑	Sec. 6/App. G	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. G	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. G	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 ☑	Report/App. G	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 ☑	Report/App. G	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 ☑	Section 6	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 $\geq 1 \times 10^{-3}$ cm/sec;
S ☐		N/A ☐	N/C ☑	(2) Total thickness of 24 inches of material chemically resistant to the waste and leachate;
S ☑	Sec. 5/App. E	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 ☐ _____________ N/A ☐ N/C ☑ e. Foundation analysis including:

LOCATION **PART I CONTINUED**

S ☐ Section 5.2 N/A ☐ N/C ☑ (1) Foundation bearing capacity analysis;

S ☑ Sec. 5.3/App. E N/A ☐ N/C ☐ (2) Total and differential subgrade settlement analysis;

S ☐ Section 5.4 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 ☑ ____________ 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 ☐	____________	N/A ☑	N/C ☐	g. Final cover design requirements;
S ☐	____________	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 ☐	____________	N/A ☑	N/C ☐	(6) Stability analysis of the cover system and the disposed waste;
S ☐	____________	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 Omni Waste of Osceola County, LLC ______ is aware that statements made in this form and attached information are an application for a Construction 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 (signature)	1501 Omni Way
Signature of Applicant or Agent	Mailing Address
Kirk Wills, Senior Region Engineer	St. Cloud, FL 34773
Name and Title (please type)	City, State, Zip Code
kirk.wills@progressivewaste.com	(813) 388-1026
E-Mail Address (if available)	Telephone Number
	Date: June 14, 2016

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)	13101 Telecom Drive, Suite 120
Signature	Mailing Address
Craig R. Browne, Senior Engineer	Temple Terrace, 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: 6/15/2016

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

DEP Form 62-701.900(1)
Effective February 15, 2015

WRITTEN CONSENT OF
THE SOLE MEMBER AND SOLE MANAGER OF
OMNI WASTE OF OSCEOLA COUNTY LLC

The undersigned, being the sole member and the sole manager of the Board of Managers of OMNI WASTE OF OSCEOLA COUNTY LLC, a Florida limited liability company (the "Company"), consent to the following actions and adopt the following resolutions:

WHEREAS, the sole member and the sole manager of the Company have determined that it is in the best interests of the Company to submit a construction renewal application to the Florida Department of Environmental Protection (the "Application"); therefore, be it

RESOLVED, that Kirk Wills, Senior Region Engineer of the Company, is hereby authorized and directed to execute the Application and to take such other action in furtherance thereof as he deems necessary, convenient or advisable to facilitate the renewal of the construction application.

IN WITNESS WHEREOF, the undersigned sole member of the Company and sole manager of the Board of Managers of the Company, have duly executed this Written Consent in The Woodlands, Texas on the date set forth below.

Dated: June 3, 2016

SOLE MEMBER:

WASTE SERVICES, INC.,
a Delaware corporation

By: ______________________
Name: Ronald J. Mittelstaedt
Its: Chief Executive Officer

SOLE MANAGER OF THE BOARD OF MANAGERS:

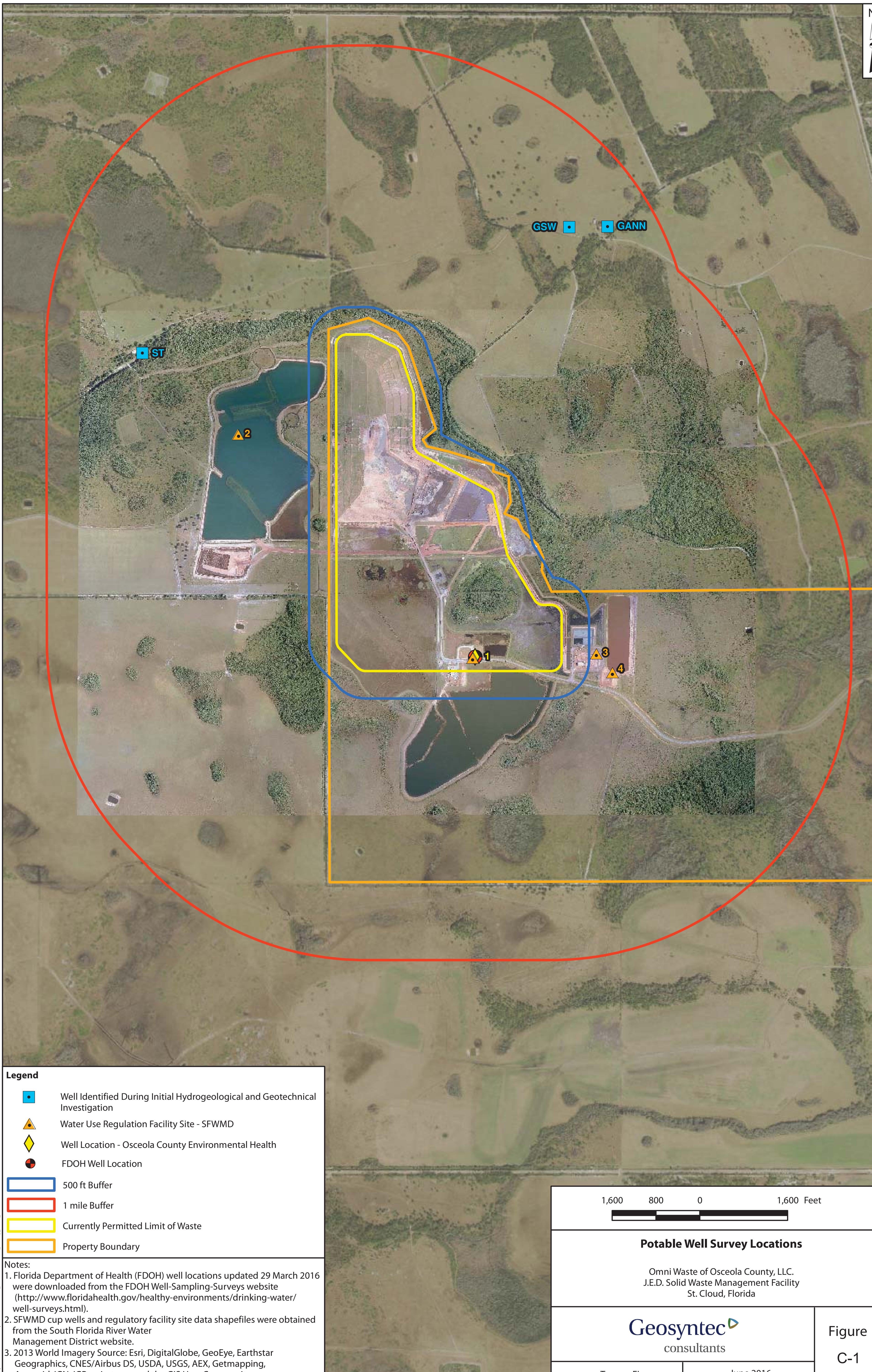
____
Ronald J. Mittelstaedt, Manager

Appendix B

Renewal Permit Drawings

(PROVIDED UNDER SEPARATE COVER)

Appendix C
Well Survey



Legend

- Well Identified During Initial Hydrogeological and Geotechnical Investigation
- Water Use Regulation Facility Site - SFWMD
- Well Location - Osceola County Environmental Health
- FDOH Well Location
- 500 ft Buffer
- 1 mile Buffer
- Currently Permitted Limit of Waste
- Property Boundary

Notes:
1. Florida Department of Health (FDOH) well locations updated 29 March 2016 were downloaded from the FDOH Well-Sampling-Surveys website (http://www.floridahealth.gov/healthy-environments/drinking-water/well-surveys.html).
2. SFWMD cup wells and regulatory facility site data shapefiles were obtained from the South Florida River Water Management District website.
3. 2013 World Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

1,600 800 0 1,600 Feet

Potable Well Survey Locations

Omni Waste of Osceola County, LLC.
J.E.D. Solid Waste Management Facility
St. Cloud, Florida

Geosyntec consultants

Figure C-1

Tampa, FL | June 2016

Path: (Titusville-01\DATA) T:\0GIS\FL1868_JED\MXDs\Well_survey_1mile_revAPR2016.mxd 14 June 2016 JRB

Table C-1
Summary of Water Well Inventory
Omni Waste of Osceola County, LLC
J.E.D. Solid Waste Management Facility, Osceola County, FL

	Object ID	Well Coordinates (NAD83)		Well Coordinates (FL State Plane)		Data Source	Owner Name	Predominant Use of Well	FLUWid Identification	Permit Number	Permitted Usage		Well Construction Details			
		Latitude	Longitude	Northing	Easting						Daily Peak (GPD)	Daily Average (GPD)	Surface Casing Depth (ft. BLS)	Well Total Depth (ft. BLS)	Surface Casing Diameter (inches)	Primary Stratigraphic Production Zone
Water Wells Identified from Various Databases (September 2010)	1	28° 03' 08.47''	81° 05' 31.10''			OCEHD, SFWMD, SUPERACT	JED Disposal Facility	Potable	AAJ6820	49-01310-W	NA	NA	255	380	4	Upper Floridan Aquifer System
	2	NA[A]	NA[A]	NA[A]	NA[A]	SFWMD	JED Disposal Facility	Dewatering[A]	AAJ5471	49-01337-W	NA	NA	NA	NA	NA	Surficial Aquifer System
	3			1351799	628507	SFWMD	Progressive Waste Solutions	Potable	NA	49-02440-W	NA	NA	275	400	4	Upper Floridan Aquifer System
	4			1351469	628999	SFWMD	Omni Waste of Osceola County, LLC	Industrial	NA	49-02333-W	NA	NA	NA	150	2	Intermediate Aquifer System
Water Wells Indentified During Initial Hydrogeologic Investigation (Kubal-Furr, 2002)	GANN	28° 04' 26.55" **	81° 05' 04.62" **			Kubal-Furr (2002)	Ganarelli Ranch	Presumed Potable**	NA	NA	NA	NA	NA	NA	4	NA
	GSW	28° 04' 26.27" **	81° 05' 12.39" **			Kubal-Furr (2002)	Ganarelli Ranch	Presumed Potable**	NA	NA	NA	NA	NA	NA	4	NA
	ST	28° 04' 03.17" **	81° 06' 39.61" **			Kubal-Furr (2002)	Bronson Ranch	Presumed Potable**	NA	NA	NA	NA	NA	NA	2	NA

Notes:

NA = not applicable/available

GPD = gallons per day

ft. BLS = feet below land surface

[A] = No well is installed at this location. The permit specifies a surface water withdrawal with a centrifugal pump for dewatering purposes.

** = Well Coordinates are based on graphical location depicted on Figure 5 (Potable Well Survey) and are approximate only.

Appendix D
Compliance History

Progressive Waste Solutions of FL, Inc. Compliance History

Date	Facility	Location	Permit Number	Issuing Agency	Type of Action	Nature of Violation	Disposition	Fine or Penalty
09/06/13	Opa Locka Recycling and Transfer Station	Opa Locka, FL	0075972-013-SO/SW-1087	FDEP/ DERM	NOV	Acceptance of unacceptable material	Closed. $500 fee paid.	$500
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
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
03/25/16	SLD Landfill	Punta Gorda, FL	0246176-007-SO/22	FDEP	CO	Off Site Odors	Implemented Odor Remediation Plan. $3,000 fee paid	$3,000
03/31/16	Sun Country Landfill	Riverview, FL	35438-020-SO/22	HCPUD	NOV	Arsenic concentration in leachate exceeded Hillsborough County discharge limit	Published in local newspaper	None

Note:
As of 4/12/2016 and subsequent to all facility permit transfers to Progressive Waste Solutions of FL, Inc.
List includes only those violations which have been issued fines or consent orders for facilities in Florida within the last five (5) years.

Appendix E

Settlement Calculations

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **PWSFL** Project: **JED Construction Permit Renewal** Project No.: **FL2786**

Phase No.: **02**

Title of Computations **SUBGRADE SETTLEMENT ANALYSIS**

Computations by:	Signature	[signature]	6 April 2016
	Printed Name	Ramil G. Mijares, Ph.D. P.E.	Date
	Title	Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature	[signature]	7 April 2016
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	
Computations Checked by:	Signature	[signature]	7 April 2016
	Printed Name	Alex Rivera, P.E.	Date
	Title	Engineer	
Computations Backchecked by: (originator)	Signature	[signature]	8 April 2016
	Printed Name	Ramil G. Mijares, Ph.D., P.E.	Date
	Title	Engineer	
Approved by: (pm or designate)	Signature	[signature]	31 May 2016
	Printed Name	Craig R. Browne, P.E.	Date
	Title	Senior Engineer	

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

SUBGRADE 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 base grade revisions for Cells 14 and 15 at the J.E.D. Solid Waste Management (JED) facility. The performance of the liner and leachate collection system is evaluated to ensure that:

- A minimum 0.3% post-settlement slope is maintained along the leachate collection corridor pipes.
- A minimum 1.0% 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

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)

$\Delta\sigma'_{v}$ = 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 layers for top 10 ft and 5-ft 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

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% (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 below land surface (bls) 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.
- 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., EL 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 analyses 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 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 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 the cells proposed as part of the lateral expansion and previously permitted cells that will experience increased overburden loading due to the proposed final cover grading plan. The locations of the settlement points on the proposed liner and final cover grading plans are illustrated on **Figures 3** and **4**, respectively.

7 RESULTS

Settlement calculations performed using MathCAD® are presented in **Attachment 1**. 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 leachate collection corridor pipes meet or exceed 0.3%, and the calculated post-settlement subgrade slopes along the cell floor cross-slopes draining towards leachate collection pipes meet or exceed 1.0%. The maximum calculated liner tensile strain in the liner system for all cases analyzed is 0.005%, which is less than the allowable tensile strain of 5% (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% will be maintained along leachate collection corridor pipes and a minimum grade of 1.0% 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 allowable tensile strain 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]	Init. Elev. (ft)	Final Elev. (ft)	Settlement
14.1	80.000	79.291	0.709 ft
14.2	87.182	82.404	4.778 ft
14.3	91.112	86.267	4.844 ft
14.4	89.077	84.501	4.576 ft
14.5	84.503	81.238	3.264 ft
14.6	92.000	87.332	4.668 ft
14.7	89.089	84.292	4.798 ft
15.1	80.000	79.316	0.684 ft
15.2	88.266	83.554	4.712 ft
15.3	91.662	86.833	4.829 ft
15.4	90.806	86.260	4.546 ft
15.5	86.215	82.551	3.664 ft
15.6	91.996	87.410	4.586 ft
15.7	89.011	84.297	4.714 ft

Notes: 1. Refer to Figures 3 and 4 for point location.
2. Definition of Point ID: X.Y where X is the Cell number and Y is the point identified within the Cell.

Table 4

Summary of Slope and Tensile Strain Calculation Results

Cell	Point 1	Point 2	Initial Slope (%)	Final Slope (%)	Allowable (%)	Strain (%)
14	14.2	14.1	1.0	0.43	0.30	4.1E-03
	14.3	14.2	0.5	0.49	0.30	4.2E-05
	14.4	14.5	1.4	1.00	1.00	4.8E-03
	14.6	14.7	1.2	1.25	1.00	-6.6E-04
15	15.2	15.1	1.0	0.51	0.30	3.7E-03
	15.3	15.2	0.5	0.48	0.30	8.5E-05
	15.4	15.5	1.4	1.13	1.00	3.4E-03
	15.6	15.7	1.2	1.25	1.00	-6.3E-04

FIGURES

Figure 1

Summary of Measured N-Values
JED Facility, St. Cloud, FL

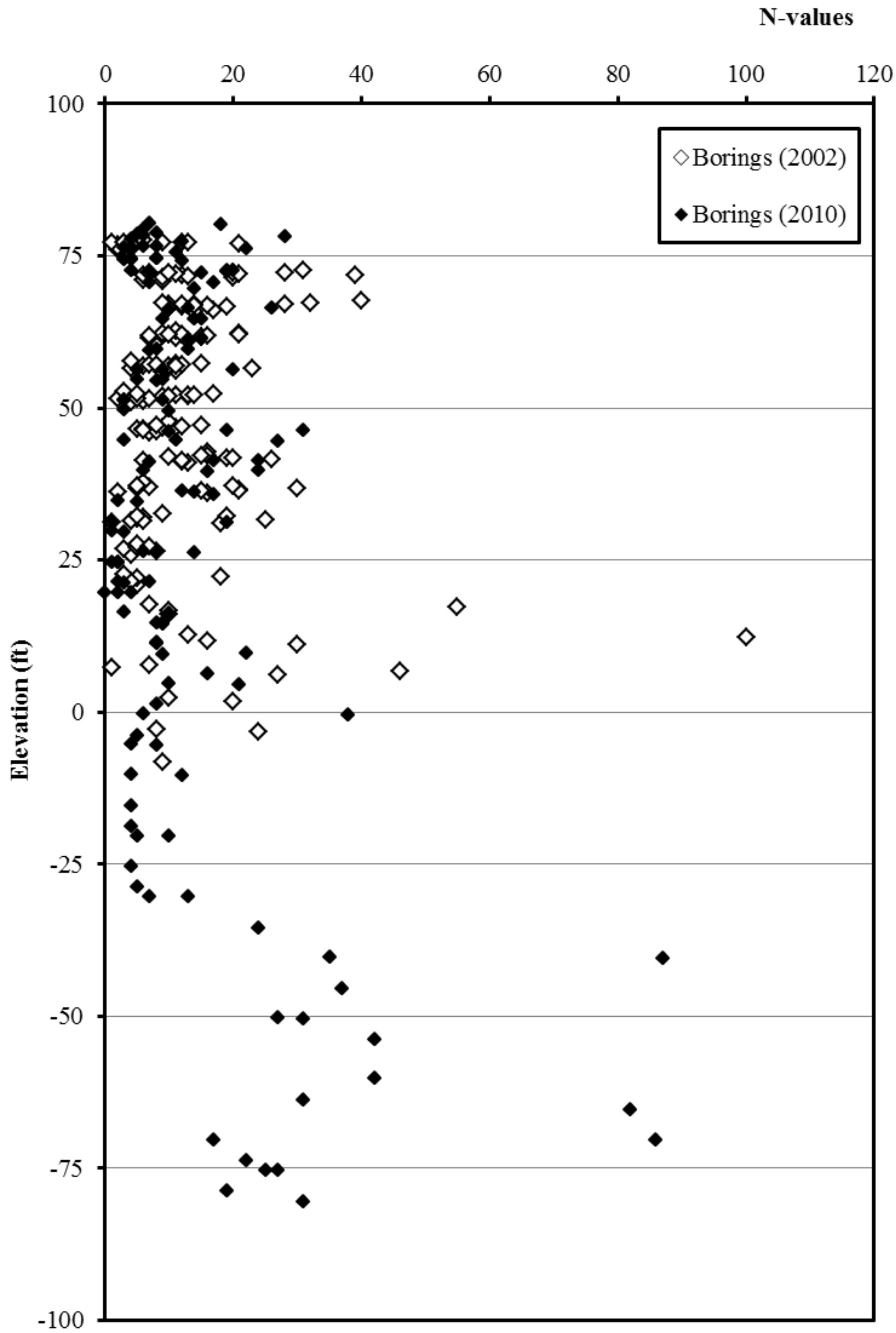
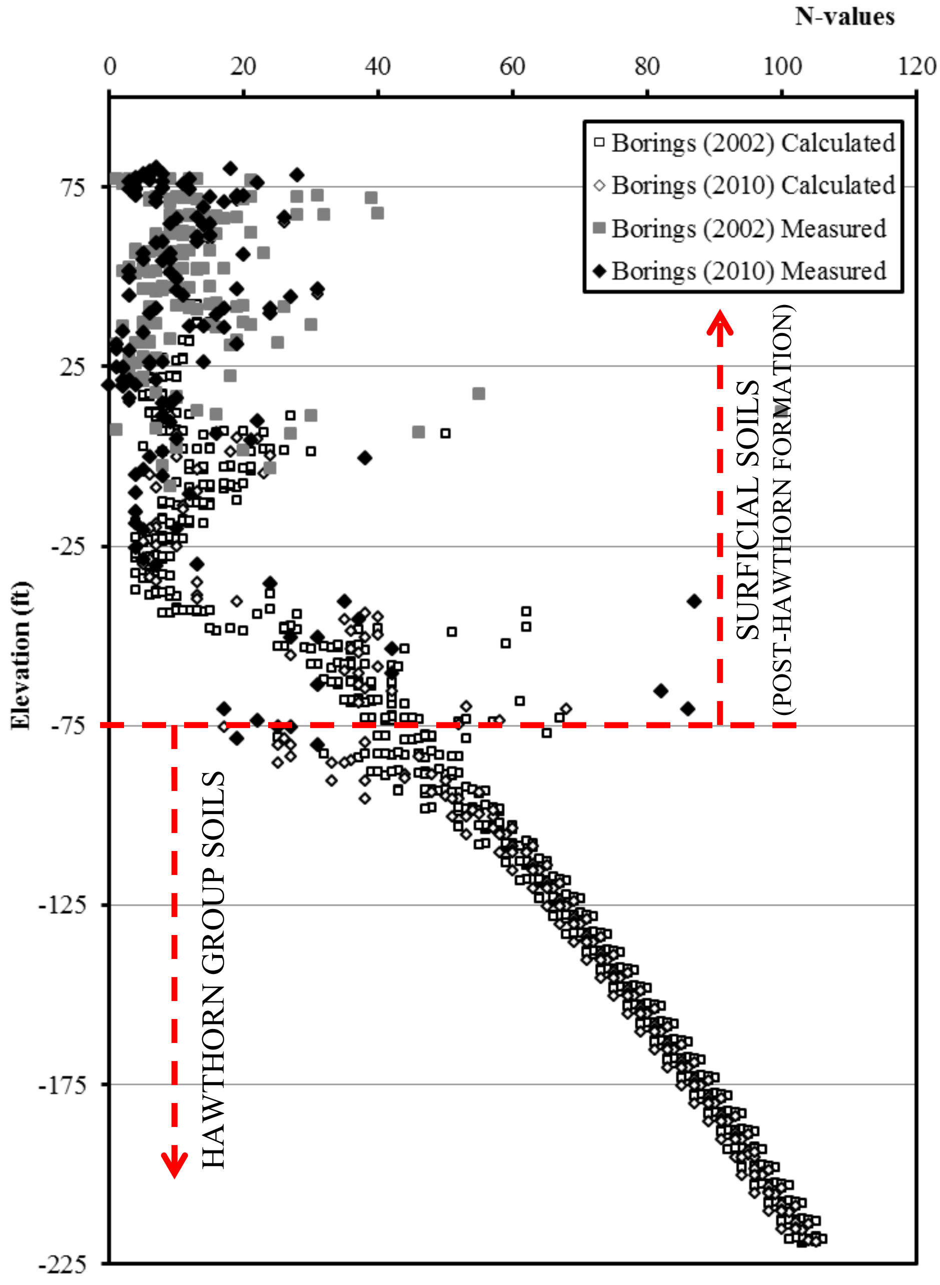


Figure 2

Summary of Measured and Calculated[1] N-Values
JED Facility, St. Cloud, FL



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

Figure 3
Locations of Analyzed Settlement Points on Liner Grading Plan
JED Facility, St. Cloud, FL

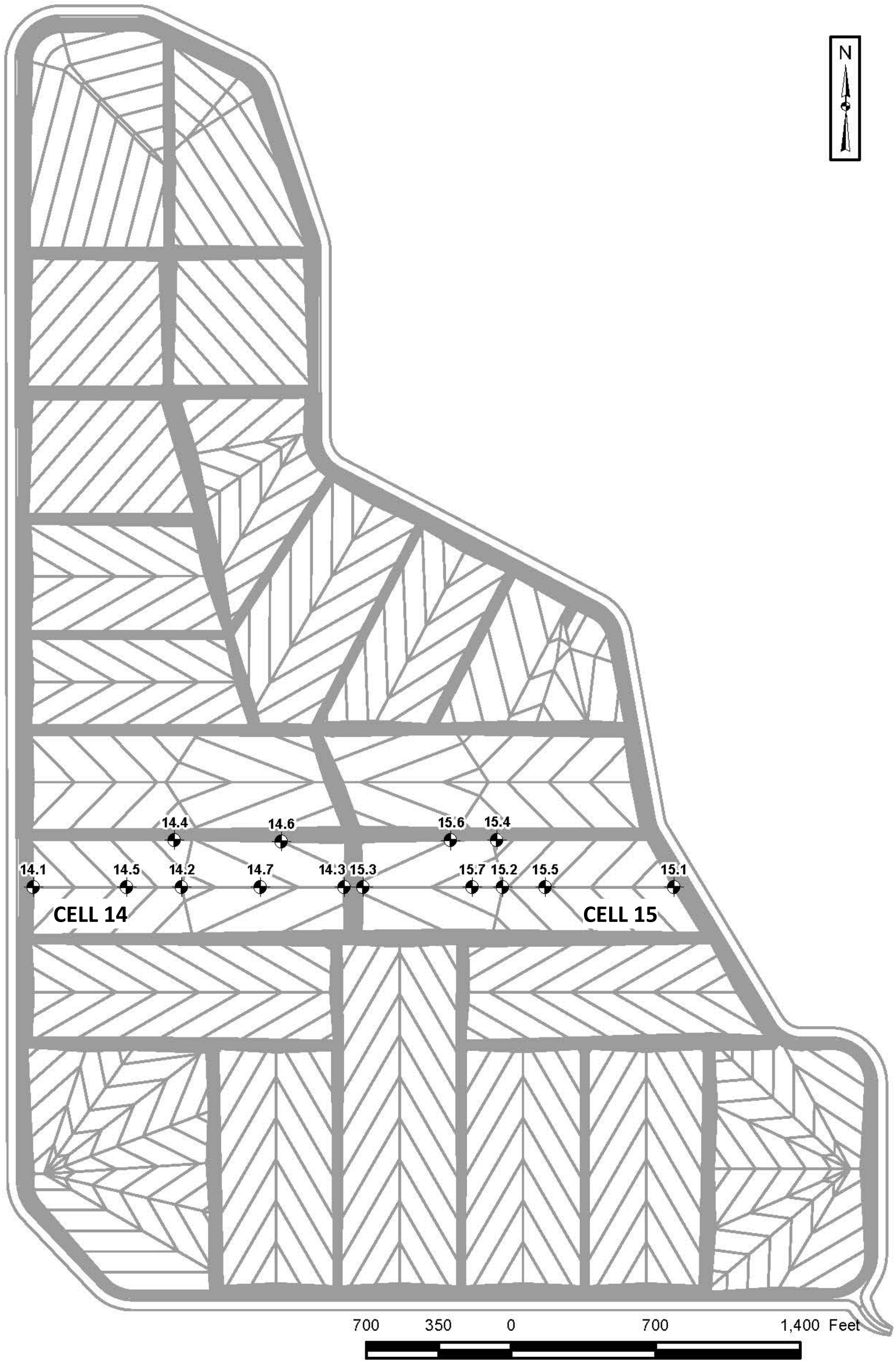
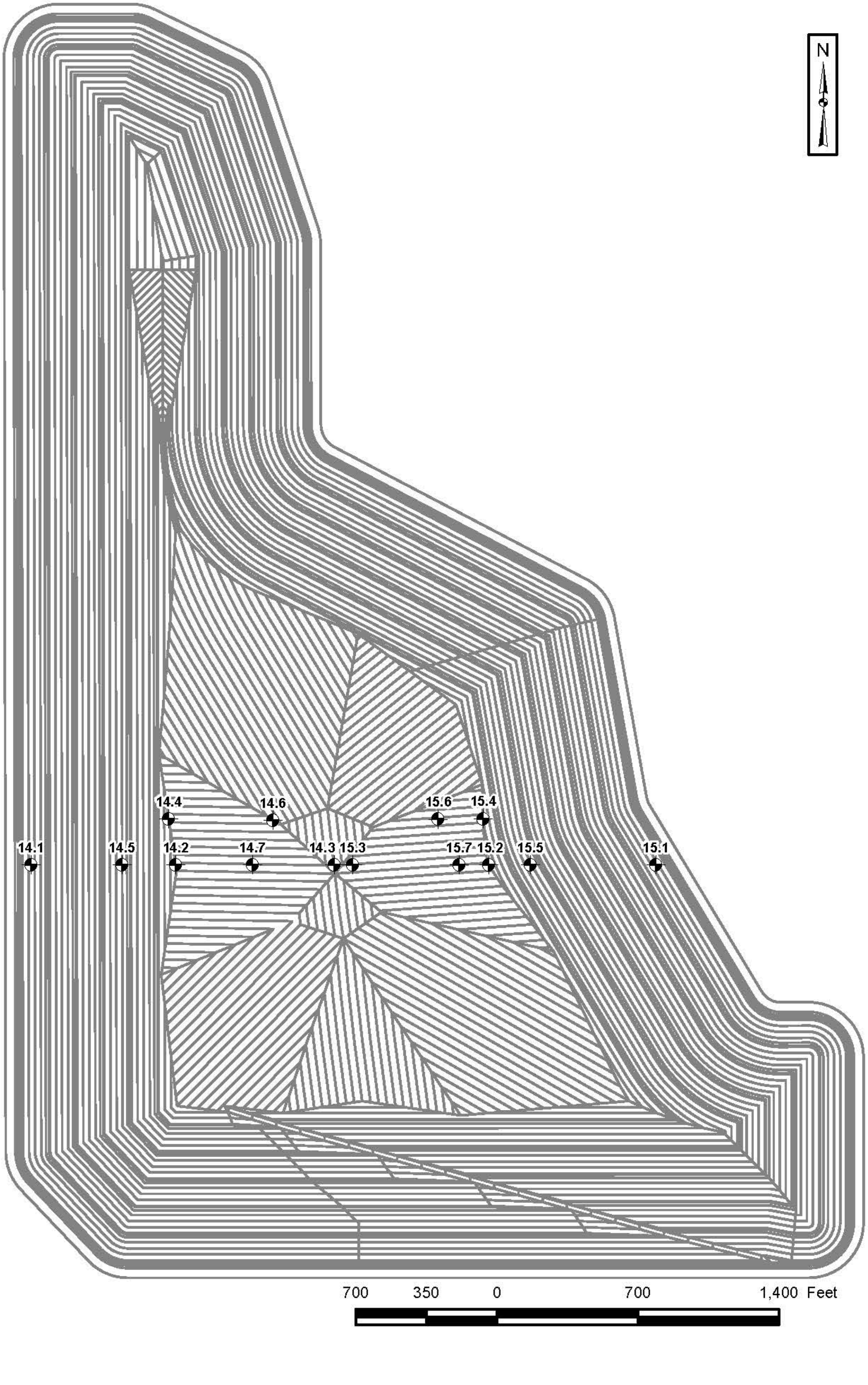


Figure 4
Locations of Analyzed Settlement Points on Final Cover Grading Plan
JED Facility, St. Cloud, FL



ATTACHMENT 1

Settlement Calculations

General Site Data and Overburden Properties:

Misc Constants -- Material Properties and Thicknesses

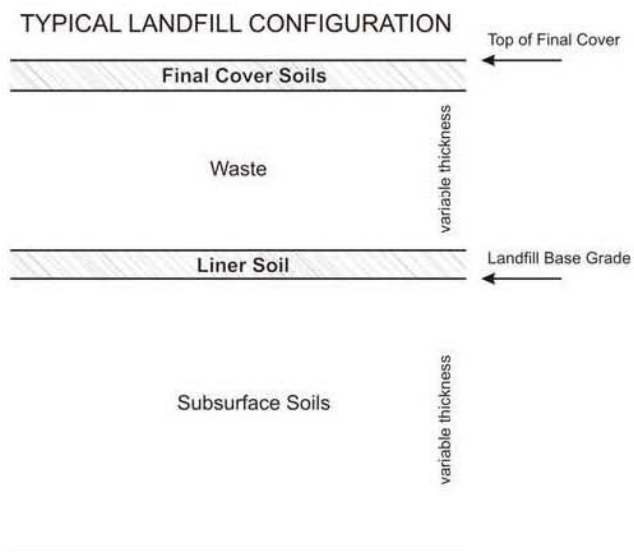
Unit weight of overburden materials:	$\gamma_{waste} := 70pcf$	$\gamma_{cover} := 120pcf$
	$\gamma_{fill} := 120pcf$	$\gamma_{bliner} := 120pcf$
Thickness of final cover and bottom liner:	$t_{cover} := 3ft$	$t_{bliner} := 2ft$

The waste thickness is calculated based on 3D CADD surfaces and the general equaltions 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
49	"Under Point-14.1"	0.709	"ft"
50	"Under Point-14.2"	4.778	"ft"
51	"Under Point-14.3"	4.844	"ft"
52	"Under Point-14.4"	4.576	"ft"
53	"Under Point-14.5"	3.264	"ft"
54	"Under Point-14.6"	4.668	"ft"
55	"Under Point-14.7"	4.798	...

slopes =

	0	1	2	3	4
15	14.2	14.1	1	0.43	0.0040602581
16	14.3	14.2	0.5	0.49	0.0000415864
17	14.4	14.5	1.4	1	0.0048136756
18	14.6	14.7	1.2	1.25	-0.0006564514
19	15.2	15.1	1	0.51	0.0036849729
20	15.3	15.2	0.5	0.48	0.0000849349
21	15.4	15.5	1.4	1.13	...

$\text{minimumslope} = 0.43 \cdot \%$

$\text{maximumstrain} = 4.81 \times 10^{-3} \cdot \%$

Appendix F

Geocomposite Design Calculations

Geosyntec consultants

COMPUTATION COVER SHEET

Client:	**PWSFL**	Project:	**JED Cells 14&15 Base Grade Revs.**	Project No.:	**FL2786**
				Phase No.:	**02**

Title of Computations: **GEOCOMPOSITE DESIGN EVALUATION**

Computations by:	Signature		20 April 2016 (Date)
	Printed Name	Ramil G. Mijares, Ph.D., P.E.	
	Title	Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature		21 April 2016 (Date)
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	Title	Senior Engineer	
Computations Checked by:	Signature		25 April 2016 (Date)
	Printed Name	Alex Rivera, P.E.	
	Title	Engineer	
Computations Backchecked by: (originator)	Signature		26 April 2016 (Date)
	Printed Name	Ramil G. Mijares, Ph.D., P.E.	
	Title	Engineer	
Approved by: (pm or designate)	Signature		27 May 20[illegible] (Date)
	Printed Name	Craig R. Browne, P.E.	
	Title	Senior Engineer	

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Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

Written by:	**R. Mijares**	Date:	**20-Apr-2016**	Reviewed by:	**C. Browne**	Date:	**21-Apr-2016**
Client:	**PWSFL**	Project:	**JED Constr. Permit Renewal**	Project No.:	**FL2786**	Phase No.:	**02**

GEOCOMPOSITE DESIGN 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 engineering design and performance of the geocomposite component of the modified leachate collection system (LCS) that is proposed for Cells 14 and 15 at the J.E.D. Solid Waste Management (JED) facility. The modified LCS includes revisions to the design base liner grades such that the slope of the leachate corridors in some areas are reduced from 1.0% to 0.5% and the cross-slope grades (floor of cells that drain to the leachate corridors) are reduced from 2.0% to 1.4% for the exterior portions of Cells 14 and 15 (i.e., the portion of the cell floor beneath the 3H:1V side slope of the final cover approximately between the sump and crest of final cover) and from 2.0% to 1.2% for the interior portions of Cells 14 and 15 (i.e., the portion of the cell floor beneath the crest of final cover to the toe of the intercell berm between Cells 14 and 15). The LCS is comprised of primary and secondary leachate collection and removal systems in the cells. The primary LCS is a component of the proposed primary liner system that consists of a geocomposite drainage layer on top of the primary geomembrane liner. This primary geocomposite drainage layer is designed to collect the leachate that percolates vertically through the waste and convey it to a sump for removal from the cell. The primary LCS is designed to limit the leachate head to no more than 1 ft above the primary geomembrane, in accordance with Rule 62-701.400(3)(c)1, Florida Administrative Code (F.A.C.).

The secondary LCS is a component of the proposed liner system that consists of a lateral drainage layer between the primary and secondary liners. This secondary lateral drainage layer is designed to collect leachate that may leak through the primary liner system and convey it to a sump for removal. The secondary LCS components include a secondary geocomposite drainage layer, secondary leak detection pipe, and a leachate collection sump. The secondary drainage system is designed to limit the leachate head on the secondary geomembrane to the thickness of the secondary drainage geocomposite, in accordance with Rule 62-701.400(3)(c)2, F.A.C.

2 DESCRIPTION OF RELEVANT SYSTEMS AND OPERATIONS

2.1 General Layout

Currently, Cells 1 through 11 have been constructed at the JED facility as part of Phase 1 through Phase 4 development. Construction of Cell 13 was recently completed while Cell 12 has not been built yet. Cells 14 and 15 are proposed to be constructed as part of Phase 5 development.

The currently permitted design for Cells 14 and 15 is a conventional "herringbone" pattern with a leachate collection and leak detection system in the valley of the herringbone-shaped cell as depicted in the 2011 Renewal Permit Drawings included as Appendix B of the "Renewal Permit Application to Operate Phases 1 through 4 of the J.E.D. Solid Waste Management Facility" (Geosyntec, 2011). As described above, the base grades in Cells 14 and 15 are proposed to be modified as part of the revised landfill design proposed in this permit renewal application. The proposed revisions to the geometry of Cells 14 and 15 will also follow the herringbone design except that the base slopes and pipe corridor slopes will be lowered to the grades shown on the Permit Renewal Application drawings.

2.2 Liner System

The double liner system in Cells 14 and 15 at the JED facility will consist of the following components from top to bottom:

- 24-inch thick protective soil layer;
- primary geocomposite drainage layer (consisting of a geonet with non-woven geotextile heat-bonded on both side);
- primary 60-mil textured high density polyethylene (HDPE) geomembrane liner;
- secondary geocomposite drainage layer (consisting of a geonet with non-woven geotextile heat-bonded on both side);
- secondary 60-mil textured HDPE geomembrane liner;
- geosynthetic clay liner (GCL); and
- compacted prepared subbase.

2.3 Initial and Intermediate Covers

An initial soil cover of 6 inches will be placed on top of all exposed waste at the end of each day's operation to control vectors, fires, blowing litter, odors, and scavenging. A 1-ft thick intermediate cover of clean soil will be placed on top of the waste following the completion of any intermediate lift of waste, which will not have additional waste placed within 30 to 60 days. The initial cover and intermediate cover will be graded to facilitate runoff and limit infiltration. The thickness and grade of the intermediate cover will be maintained until additional waste or the final cover is placed.

3 HELP MODEL OVERVIEW

3.1 Purpose

The Hydrologic Evaluation of Landfill Performance (HELP) model, Version 3.07 (Schroeder et. al., 1994a, 1994b) was used to estimate leachate generation rates, leakage through geomembranes, and maximum head on geomembranes for the proposed LCS for Cells 14 and 15. The HELP model is a quasi-two dimensional water balance computer program used to evaluate the movement of water through the waste and components of the liner system. The computer program, along with site-specific weather data and design information, was utilized to estimate runoff, evapotranspiration, drainage, leachate collection, and liner leakage for the initial startup, intermediate development, and the final build-out configurations.

The estimated leachate generation rates and other information obtained from the HELP model were used to evaluate the performance of the proposed primary and secondary LCS.

3.2 Landfill Development Conditions Analyzed

To estimate leachate generation rates for different landfill development conditions, four waste configurations were analyzed assuming an area of 1 acre. The leachate generation rates, leakage through the geomembranes, and the maximum heads on the primary and secondary geomembranes were estimated for the cases described below.

Case 1: This scenario considered the initial conditions of operation in a cell after the placement of a start-up lift of waste for a total of 10 ft of waste. For this case, no runoff from the daily cover surfaces, and no surface vegetation was assumed.

Case 2: This scenario considered an intermediate condition with 80 ft of waste. For this case, 50 percent runoff from the intermediate cover surfaces was allowed and poor surface vegetation was assumed.

Case 3: This scenario considered an intermediate condition with 150 ft of waste. For this case, 70 percent runoff from the intermediate cover surfaces was allowed and poor surface vegetation was assumed.

Case 4: This scenario considered the maximum waste height of 220 ft, prior to construction of the final cover. For this case, 100 percent runoff from the intermediate cover surfaces was allowed and fair surface vegetation was assumed.

3.3 Geocomposite Properties

The geocomposite properties used in the calculation of heads, leachate generation rate, and leakage for the landfill are based on properties of commercially available geocomposites. It is not the objective of this calculation to identify specific geocomposites for use in the construction of the future cells. However, the performance of commercially available geocomposites was checked to evaluate if they meet the minimum requirements of the proposed LCS design.

3.4 Reduction Factors

The reduction factors used to predict the long-term performance of the drainage geocomposite layer in the liner system are discussed in this section. The following discussion describes the application of reduction factors to transmissivity of drainage geocomposites (in bottom liner system) as suggested by Richardson et al. (2000).

The required transmissivity ($\theta_{req'd}$) is the minimum transmissivity required for a candidate geocomposite to maintain the head on the geomembrane liner below the regulatory requirement of 12 inches. 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 (1998) provides the following relationship between θ_{LTIS} and $\theta_{req'd}$:

$$\theta_{LTIS} = \frac{\theta_{req'd}}{\Pi(RF)} = \frac{\theta_{req'd}}{RF_{in} * RF_{cr} * RF_{cc} * RF_{bc}} \qquad \text{[Equation 3.1]}$$

where:

$$FS = \frac{\theta_{LTIS}}{\theta_{model}} \qquad \text{[Equation 3.2]}$$

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.

There are also other reduction factors (i.e., 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 as the geocomposite transmissivity used in the analyses was 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 was 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 expected.

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 expected to adequately prevent clogging.

Richardson et. al. (2000) provide the following guidance for reduction factors for geonets and geocomposites for which the transmissivity is measured using seating times of 100 or more hours under the same boundary conditions as in the field.

Applications	Normal Stress	Liquid	RF_{in}	RF_{cc}	RF_{bc}
Facility cover drainage layer; Low retaining wall drainage	Low	Water	1.0-1.2	1.0-1.2	1.2-1.5
Facility leachate collection layer; Facility and Leachate Pond leakage collection and detection layer	High	Leachate	1.0-1.2	1.5-2.0	1.5-2.0

The GSE Drainage Design Manual (GSE, 2007) and the SKAPS compressive creep data report (TRI, 2011 and 2014) provide the following reduction factors for creep deformation

(RF_{cr}) for GSE and Skaps products, respectively, as a function of applied stress. These reduction factors for creep deformation (RF_{cr}) were integrated into the analyses.

Applied Stress (psf)	GSE Average Creep Reduction Factor (RF_{cr})	SKAPS Creep Reduction Factor (RF_{cr})	Average Creep Reduction Factor (RF_{cr})
1,000	1.01	1.030 (Est'd)	1.02
5,000	1.08	1.045	1.06
10,000	1.12	1.065	1.09
15,000	1.14	1.113	1.13

The creep reduction factors used in the analysis were conservatively assigned based on the applied stress calculated for each case and the average creep reduction factor shown above. The reduction factors used in the HELP model analysis for the primary geocomposite drainage layer are summarized in the table below.

Case	Applied Stress[1] (psf)	RF_{in}	RF_{cr}	RF_{cc}	RF_{bc}	$\Pi(RF)$
1	686	1.0	1.02	1.50	1.50	2.30
2	4,568	1.1	1.06	1.75	1.75	3.57
3	9,642	1.1	1.09	1.75	1.75	3.67
4	15,000	1.1	1.13	1.75	1.75	3.81

[1] Applied Stress values were calculated using weighted averages of unit weights by depths as presented in the *MSW Unit Weight Versus Depth Relationship* [Kavazanjian, 1995]. This relationship is shown on Figure 1.

A review of the GSE (2007) and SKAPS (TRI, 2011 and 2014) creep reduction factors for 200-mil to 270-mil geocomposite products compared to 300-mil or thicker products reveals that the thinner products typically have a creep reduction factor that is approximately 20% greater than the thicker product. Accordingly, the reduction factors used in the HELP analysis for the secondary geocomposite drainage layer are summarized in the table below.

Case	Applied Stress[1] (psf)	RF_{in}	RF_{cr}	RF_{cc}	RF_{bc}	$\Pi(RF)$
1	686	1.0	1.22	1.50	1.50	2.75

2	4,568	1.1	1.27	1.75	1.75	4.29
3	9,642	1.1	1.31	1.75	1.75	4.41
4	15,000	1.1	1.36	1.75	1.75	4.57

[2] Applied Stress values were calculated using weighted averages of unit weights by depths as presented in the *MSW Unit Weight Versus Depth Relationship* (Kavazanjian, 1995). This relationship is shown on Figure 1.

3.5 Transmissivity Values Used in HELP Model Analyses

The transmissivity values calculated by the HELP model (θ_{model}) for the candidate geocomposite were evaluated such that the head on the primary geomembrane liner is no greater than 12 inches and the head on the secondary geomembrane liner is less than or equal to the thickness of the secondary geocomposite. The required transmissivity values ($\theta_{req'd}$) were then computed by applying the cumulative reduction factors ($\Pi(RF)$) and the assumed FS of 2.

The required transmissivity values represent transmissivity values obtained from typical manufacturer laboratory testing at a gradient corresponding to the initial minimum liner slopes of 1.4% (exterior portions of Cells 14 and 15) and 1.2% (interior portions of Cells 14 and 15), under normal loads of approximately 700 psf (with 24-hour seating time) to 15,000 psf (with 100-hour seating time) (i.e., stress range applicable to the JED facility), and with the same boundary conditions as in the field (i.e., primary geocomposite drainage layer sandwiched between liner protective cover soils and a textured geomembrane for the primary system and geocomposite drainage layer sandwiched between two textured geomembranes for the secondary system).

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 was 30 years.

3.6.1 Weather Data Description

The weather data required in the HELP model includes evapotranspiration, precipitation, temperature, and solar radiation. The description for the inputs required for these processes include:

3.6.1.1 Evapotranspiration

Evapotranspiration inputs include: evaporative zone depth, maximum leaf area index, starting and ending dates of the growing season, normal average wind speed, and normal average quarterly relative humidity. A description of the values used for the JED facility analysis is provided below.

- Evaporative zone depth – the maximum depth at which water can be removed by evapotranspiration. The default values of evaporative zone depth provided by the HELP model are 10 inches for bare areas, 22 inches for fair vegetation, and 40 inches for excellent vegetation. The evaporative zone depth values used in the HELP model for each scenario analyzed were conservatively assumed as follows:

Case	Evaporative zone depth (in)
1	10
2	12
3	12
4	12

- Maximum leaf area index (LAI) – the ratio of the area of actively transpiring vegetation to the surface area of the land. The amount of water removed due to evapotranspiration increases as the LAI increases. The LAI typically ranges from zero (bare ground) to 5.0 (excellent stand of grass). The LAI values used for each case are as follows:

Case	LAI
1	0.0

2	1.0
3	1.0
4	2.0

- Start and end dates of the growing season – provided by the HELP model for Orlando, Florida. The default values for the growing season start date is the 0th day of the year and the growing season end date is the 367th day.

- Normal average annual wind speed – based on the default values provided by the HELP model for Orlando, Florida. The average wind speed utilized in the HELP analysis was 8.6 miles per hour (mph).

- Normal average quarterly relative humidity – default normal average quarterly relative humidity values for Orlando, Florida were used as provided by the HELP model. Values utilized in the analyses include:

Quarter	**Humidity%**
First	72
Second	72
Third	80
Fourth	76

3.6.1.2 Precipitation

The HELP model provides default and synthetically generated precipitation data for specific cities in the United States. However, precipitation data for Orlando is not available in the HELP Model Version 3.07. Daily precipitation data files for a 30-year period from 1975 to 2004 were obtained from the National Climatic Data Center (NCDC) website. Fort Drum's precipitation data was used to simulate the rainfall at the JED Landfill. A summary of the annual rainfall for the 30-year period used in the analysis (1974 thru 2004) is presented in Table 3. As shown in the table, the average annual rainfall over the 30-year period is 53.1 inches and the maximum annual rainfall is 72.7 inches in 2004.

3.6.1.3 Temperature

The default normal mean monthly temperature data provided by the HELP model for Orlando, Florida was used to provide the temperature input data for all the cases analyzed.

3.6.1.4 Solar Radiation Data

Solar radiation data for the JED Landfill was synthetically generated for the site using the HELP model. The default station latitude for Orlando was 27.8 degrees.

3.6.2 Soil and Design Data

The soil and design data required in the HELP model include model plan area, runoff, initial moisture content, and layer data. The following is the description for the data used in the analyses.

3.6.2.1 Model Plan Area

Areas were assumed equal to 1 acre (43,560 ft^2) in the HELP analyses.

3.6.2.2 Runoff

This input parameter specifies the percentage of area that will allow drainage from the surface. The percentage of runoff assumed for each case was as follows:

Case	Runoff %
1	0
2	50
3	70
4	100

3.6.2.3 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.

3.6.2.4 Layer Data

Layer data was selected based on Geosyntec's experience, knowledge with local soils and site conditions, and HELP model recommendations. The HELP model provides default parameter values based on the Unified Soil Classification System (USCS) soil classification system 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) geomembrane liners as barrier layers.

3.6.2.5 Geomembrane Liner

Pinhole density refers to the number of assumed defects 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 refers to the assumed number of defects in a given area with a hole diameter larger than the geomembrane thickness. For this analysis, a 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.

3.6.2.6 Liner System Drainage Path Lengths

The longest drainage paths utilized in the HELP model analysis for the proposed primary LCS were 330 ft for the exterior portions of Cells 14 and 15 and 255 ft for the interior portions of Cells 14 and 15.

3.6.2.7 Liner System Slope

To conservatively account for subgrade settlement, the performance evaluation for the proposed LCS design for Cells 14 and 15 assumed the following slope values for each case. It is noted that the design slope was assumed for Case 1 (initial loading conditions) and the minimum allowable slope of 1.0% was assumed for Case 4 (maximum loading conditions).

Case	Exterior Portions of Cell 14&15 – Slope (%)	Interior Portions of Cell 14&15 – Slope (%)
1	1.4	1.2
2	1.2	1.1
3	1.1	1.1
4	1.0	1.0

3.6.2.8 Surface Soil Texture

The surface soil texture for waste was used in all cases.

3.6.2.9 Surface Vegetation

The surface vegetation of each case used the following values.

Case	Surface Vegetation Number	Description
1	1	Bare ground
2	2	Poor surface vegetation

3	2	Poor surface vegetation
4	3	Fair surface vegetation

3.6.2.10 Leachate Recirculation

Leachate collected from the bottom liner system at the JED facility will be re-circulated. A separate HELP analysis was performed for each case using the leachate recirculation option in the HELP model, to ensure the primary leachate collection and the secondary leak detection systems meet the regulatory requirements for maximum head on the geomembranes. However, the recirculation option requires the input of the recirculation rate as a percentage of leachate collected and not a constant rate. To control the leachate recirculation rate being modeled, the daily precipitation data used in the HELP model analyses was increased by a constant rate to simulate the effect of leachate recirculation. Each HELP model recirculation analyses was performed assuming a leachate recirculation rate of approximately 2 inches per acre per month (in./ac/month), which corresponds to approximately 54,000 gallons per acre per month (gal/ac/month). Therefore, the daily precipitation input for the 30-year period was increased by 0.0667 in./ac/day (or 1,800 gal/ac/day).

4 HELP MODEL ANALYSES

HELP model analyses were performed for Cases 1 through 4 to calculate the minimum transmissivity value (θ_{model}) required to maintain a head on the primary geomembrane liner less than or equal to 12 inches and on the secondary geomembrane liner less than the thickness of the secondary geocomposite. 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.

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 primary geomembrane liner computed by the HELP model was not used.

The head on the bottom liner system was computed using the method presented by Giroud et al. (2004). Giroud et al. (2004) developed an alternative method 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 leachate generation rate, the hydraulic conductivities of the two layers, the length of the drainage path, and the slope. The leachate generation rate, q_h, was obtained from the HELP model analysis output for the peak monthly average lateral drainage in the primary geocomposite drainage layer.

A summary of the input data used in the HELP model analysis is presented in Attachment A. Output files from the HELP model for each case are included in Attachment B. The parameters used to compute the heads using Giroud et al. (2004) are presented in the spreadsheets included in Attachment C of this calculation package.

5 HELP MODEL RESULTS

Tables 1a, 1b, 2a, and 2b present a summary of the results for lateral drainage and head on liner for each case analyzed for the proposed primary and secondary LCS for the landfill facility, respectively. The properties of the primary and secondary geocomposite drainage layers used in the analyses (i.e., required transmissivity based on laboratory testing) are also presented in Tables 1a, 1b, 2a and 2b.

6 REFERENCES

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TABLES

Table 1a

HEADS ON PRIMARY GEOMEMBRANE FOR CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE)
COMPUTED USING GIROUD'S METHOD
J.E.D. SOLID WASTE MANAGEMENT FACILITY
OSCEOLA COUNTY, FLORIDA

						Primary Geocomposite Drainage Layer					HELP Model Results		Heads computed using Giroud's Method		
Case Analyzed	Waste Height (ft)	Leachate Recirculation	Vertical Stress (psf)	Drainage Length (ft)	Liner System Slope (%)	$\theta_{req'd}$ [1] (m^2/sec)	RF*FS [3]	θ_{model} [2] (m^2/sec)	Geonet Thickness (in)	Permeability k (cm/s)	Lateral Drainage (Peak Daily) (ft^3/ac/day)	Lateral Drainage (Peak Monthly Avg.) (in/ac/mon)	Impingement Rate [4] (Peak Monthly Avg.) (in/ac/mon)	(ft^3/ac/day)	Head on Primary Geomembrane [5] (in)
Case 1	10	2 in/mon of Recirculation [6]	686	330	1.4	6.48E-04	4.59	1.41E-04	0.300	1.85	496	2.18	2.18	260	12.0
		Without Recirculation	686	330	1.4	1.87E-04	4.59	4.07E-05	0.300	0.53	150	0.69	0.69	83	12.0
Case 2	80	2 in/mon of Recirculation [6]	4,568	330	1.2	9.27E-04	7.14	1.30E-04	0.300	1.70	383	1.74	1.74	207	12.0
		Without Recirculation	4,568	330	1.2	2.86E-05	7.14	4.01E-06	0.300	0.05	16	0.11	0.11	13	12.0
Case 3	150	2 in/mon of Recirculation [6]	9,642	330	1.1	9.09E-04	7.34	1.24E-04	0.300	1.62	334	1.53	1.53	182	12.0
		Without Recirculation	9,642	330	1.1	3.21E-05	7.34	4.37E-06	0.300	0.06	16	0.11	0.11	13	12.0
Case 4	220	2 in/mon of Recirculation [6]	15,000	330	1.0	9.95E-04	7.61	1.31E-04	0.300	1.71	321	1.47	1.47	175	12.0
		Without Recirculation	15,000	330	1.0	3.31E-05	7.61	4.34E-06	0.300	0.06	14	0.10	0.10	12	12.0

Note:

[1] Measured transmissivity during laboratory testing.

[2] Transmissivity used in HELP model analysis.

[3] Assumed FS (Factor of Safety) is 2.0.

[4] Rate of liquid supply (qh) obtained from HELP model analysis.

[5] Analysis performed iteratively by changing the geocomposite transmissivity to obtain a maximum head of almost (but less than) 12 inches on the geomembrane using the Giroud et al (2004) equation.

[6] 2 in/month of recirculation corresponds to approximately 54,000 gallons per acre per month.

Table 1b

HEADS ON PRIMARY GEOMEMBRANE FOR CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK)
COMPUTED USING GIROUD'S METHOD
J.E.D. SOLID WASTE MANAGEMENT FACILITY
OSCEOLA COUNTY, FLORIDA

						Primary Geocomposite Drainage Layer					HELP Model Results		Heads computed using Giroud's Method		
Case Analyzed	Waste Height (ft)	Leachate Recirculation	Vertical Stress (psf)	Drainage Length (ft)	Liner System Slope (%)	$\theta_{req'd}$ [1] (m^2/sec)	RF*FS [3]	θ_{model} [2] (m^2/sec)	Geonet Thickness (in)	Permeability k (cm/s)	Lateral Drainage (Peak Daily) (ft^3/ac/day)	Lateral Drainage (Peak Monthly Avg.) (in/ac/mon)	Impingement Rate [4] (Peak Monthly Avg.) (in/ac/mon)	(ft^3/ac/day)	Head on Primary Geomembrane [5] (in)
Case 1	10	2 in/mon of Recirculation [6]	686	255	1.2	5.55E-04	4.59	1.21E-04	0.300	1.59	490	2.12	2.12	253	12.0
		Without Recirculation	686	255	1.2	1.48E-05	4.59	3.22E-06	0.300	0.04	34	0.14	0.14	16	12.0
Case 2	80	2 in/mon of Recirculation [6]	4,568	255	1.1	7.46E-04	7.14	1.04E-04	0.300	1.37	365	1.71	1.71	203	12.0
		Without Recirculation	4,568	255	1.1	3.89E-05	7.14	5.45E-06	0.300	0.07	24	0.17	0.17	20	12.0
Case 3	150	2 in/mon of Recirculation [6]	9,642	255	1.1	6.71E-04	7.34	9.14E-05	0.300	1.20	319	1.51	1.51	180	12.0
		Without Recirculation	9,642	255	1.1	4.11E-05	7.34	5.60E-06	0.300	0.07	24	0.17	0.17	20	12.0
Case 4	220	2 in/mon of Recirculation [6]	15,000	255	1.0	7.33E-04	7.61	9.63E-05	0.300	1.26	305	1.45	1.45	172	12.0
		Without Recirculation	15,000	255	1.0	4.26E-05	7.61	5.59E-06	0.300	0.07	22	0.16	0.16	19	12.0

Note:

[1] Measured transmissivity during laboratory testing.

[2] Transmissivity used in HELP model analysis.

[3] Assumed FS (Factor of Safety) is 2.0.

[4] Rate of liquid supply (qh) obtained from HELP model analysis.

[5] Analysis performed iteratively by changing the geocomposite transmissivity to obtain a maximum head of almost (but less than) 12 inches on the geomembrane using the Giroud et al (2004) equation.

[6] 2 in/month of recirculation corresponds to approximately 54,000 gallons per acre per month.

Table 2a

HEADS ON SECONDARY GEOMEMBRANE FOR CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE)
COMPUTED USING GIROUD'S METHOD
J.E.D. SOLID WASTE MANAGEMENT FACILITY
OSCEOLA COUNTY, FLORIDA

						Secondary Geocomposite Drainage Layer					HELP Model Results		
Case Analyzed	**Waste Height (ft)**	**Leachate Recirculation**	**Vertical Stress (psf)**	**Drainage Length (ft)**	**Liner System Slope (%)**	**$\theta_{req'd}$ [1] (m^2/sec)**	**RF*FS [3]**	**θ_{model} [2] (m^2/sec)**	**Geonet Thickness (in)**	**Permeability k (cm/s)**	**Lateral Drainage (Peak Daily) (ft^3/ac/day)**	**Lateral Drainage (Peak Monthly Avg.) (in/ac/mon)**	**Head on Secondary Geomembrane (in)**
Case 1	10	2 in/mon of Recirculation [4]	686	330	1.4	1.40E-04	5.51	2.54E-05	0.200	0.50	87	0.74	0.20
		Without Recirculation	686	330	1.4	1.68E-04	5.51	3.05E-05	0.200	0.60	105	0.88	0.20
Case 2	80	2 in/mon of Recirculation [4]	4,568	330	1.2	2.13E-04	8.57	2.49E-05	0.200	0.49	73	0.62	0.20
		Without Recirculation	4,568	330	1.2	2.74E-04	8.57	3.20E-05	0.200	0.63	94	0.79	0.20
Case 3	150	2 in/mon of Recirculation [4]	9,642	330	1.1	2.51E-04	8.81	2.84E-05	0.200	0.56	77	0.65	0.20
		Without Recirculation	9,642	330	1.1	3.04E-04	8.81	3.45E-05	0.200	0.68	93	0.78	0.20
Case 4	220	2 in/mon of Recirculation [4]	15,000	330	1.0	2.97E-04	9.14	3.25E-05	0.200	0.64	80	0.68	0.20
		Without Recirculation	15,000	330	1.0	3.53E-04	9.14	3.86E-05	0.200	0.76	95	0.80	0.20

Note:

[1] Measured transmissivity during laboratory testing.

[2] Transmissivity used in HELP model analysis.

[3] Assumed FS (Factor of Safety) is 2.0.

[4] 2 in/month of recirculation corresponds to approximately 54,000 gallons per acre per month.

Table 2b

HEADS ON SECONDARY GEOMEMBRANE FOR CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK)
COMPUTED USING GIROUD'S METHOD
J.E.D. SOLID WASTE MANAGEMENT FACILITY
OSCEOLA COUNTY, FLORIDA

						Secondary Geocomposite Drainage Layer					HELP Model Results		
Case Analyzed	Waste Height (ft)	Leachate Recirculation	Vertical Stress (psf)	Drainage Length (ft)	Liner System Slope (%)	$\theta_{req'd}$ [1] (m^2/sec)	RF*FS [3]	θ_{model} [2] (m^2/sec)	Geonet Thickness (in)	Permeability k (cm/s)	Lateral Drainage (Peak Daily) (ft^3/ac/day)	Lateral Drainage (Peak Monthly Avg.) (in/ac/mon)	Head on Secondary Geomembrane (in)
Case 1	10	2 in/mon of Recirculation [4]	686	255	1.2	1.32E-04	5.51	2.39E-05	0.200	0.47	91	0.77	0.20
		Without Recirculation	686	255	1.2	1.96E-04	5.51	3.56E-05	0.200	0.70	136	1.15	0.20
Case 2	80	2 in/mon of Recirculation [4]	4,568	255	1.1	1.83E-04	8.57	2.13E-05	0.200	0.42	75	0.63	0.20
		Without Recirculation	4,568	255	1.1	2.22E-04	8.57	2.59E-05	0.200	0.51	91	0.75	0.20
Case 3	150	2 in/mon of Recirculation [4]	9,642	255	1.1	1.97E-04	8.81	2.24E-05	0.200	0.44	78	0.67	0.20
		Without Recirculation	9,642	255	1.1	2.24E-04	8.81	2.54E-05	0.200	0.50	89	0.74	0.20
Case 4	220	2 in/mon of Recirculation [4]	15,000	255	1.0	2.37E-04	9.14	2.59E-05	0.200	0.51	82	0.70	0.20
		Without Recirculation	15,000	255	1.0	2.60E-04	9.14	2.84E-05	0.200	0.56	90	0.75	0.20

Note:

[1] Measured transmissivity during laboratory testing.

[2] Transmissivity used in HELP model analysis.

[3] Assumed FS (Factor of Safety) is 2.0.

[4] 2 in/month of recirculation corresponds to approximately 54,000 gallons per acre per month.

Table 3

AVERAGE ANNUAL RAINFALL, FORTDRUM, FLORIDA
J.E.D. SOILD WASTE MANAGEMENT FACILITY

Year	Annual Rainfall (in)
1975	55.1
1976	54.3
1977	45.1
1978	57.2
1979	61.2
1980	37.5
1981	32.7
1982	61.3
1983	64.3
1984	48.6
1985	38.2
1986	48.5
1987	50.5
1988	37.1
1989	50.9
1990	48.1
1991	62.0
1992	58.3
1993	45.8
1994	53.4
1995	65.7
1996	56.1
1997	51.0
1998	69.7
1999	58.6
2000	27.9
2001	52.5
2002	65.9
2003	62.2
2004	72.7
Avg. Annual Rainfall	**53.1**

FIGURE

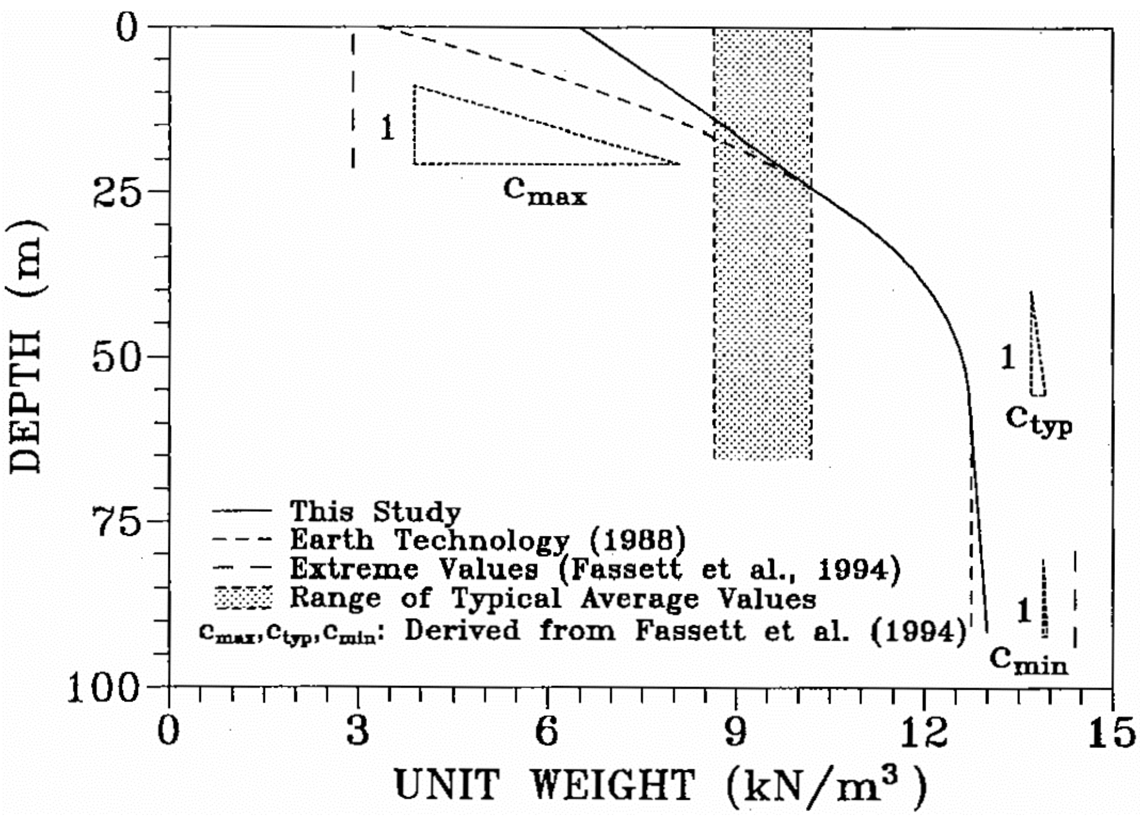

Figure 1. Unit Weight Relationships for MSW (Kavazanjian, 1995)

ATTACHMENT A
Summary of HELP Model Data

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 1 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
10 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	10	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	0	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	0	%
Surface Length	1100	ft
Surface Slope	5	%
Surface Slope Vegetation	1	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	120	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.85	330	1.4
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.50	330	1.4
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 2 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
80 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	50	%
Surface Length	800	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	960	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.70	330	1.2
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.49	330	1.2
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 3 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
150 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	70	%
Surface Length	600	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	1,800	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.62	330	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.56	330	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 4 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
220 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	2	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	100	%
Surface Length	300	ft
Surface Slope	5	%
Surface Slope Vegetation	3	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	2,640	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.71	330	1.0
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.64	330	1.0
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 1 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
10 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	10	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	0	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	0	%
Surface Length	1100	ft
Surface Slope	5	%
Surface Slope Vegetation	1	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	120	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.53	330	1.4
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.60	330	1.4
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 2 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
80 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	50	%
Surface Length	800	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	960	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.05	330	1.2
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.63	330	1.2
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 3 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
150 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	70	%
Surface Length	600	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	1,800	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.06	330	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.68	330	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (EXTERIOR PORTION UNDER 3H:1V SIDE SLOPE) - CASE 4 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
220 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	2	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	100	%
Surface Length	300	ft
Surface Slope	5	%
Surface Slope Vegetation	3	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	2,640	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.06	330	1.0
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.76	330	1.0
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 1 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
10 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	10	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	0	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	0	%
Surface Length	1100	ft
Surface Slope	5	%
Surface Slope Vegetation	1	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	120	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.59	255	1.2
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.47	255	1.2
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 2 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
80 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	50	%
Surface Length	800	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	960	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.37	255	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.42	255	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 3 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
150 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	70	%
Surface Length	600	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	1,800	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.20	255	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.44	255	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 4 WITH LEACHATE RECIRCULATION
INPUT DATA SUMMARY
220 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	2	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	100	%
Surface Length	300	ft
Surface Slope	5	%
Surface Slope Vegetation	3	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	2,640	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	1.26	255	1.0
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.51	255	1.0
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 1 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
10 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	10	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	0	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	0	%
Surface Length	1100	ft
Surface Slope	5	%
Surface Slope Vegetation	1	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	120	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.04	255	1.2
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.70	255	1.2
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 2 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
80 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	50	%
Surface Length	800	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	960	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.07	255	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.51	255	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 3 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
150 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	1	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	70	%
Surface Length	600	ft
Surface Slope	5	%
Surface Slope Vegetation	2	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	1,800	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.07	255	1.1
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.50	255	1.1
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

CELLS 14 & 15 (INTERIOR PORTION UNDER TOP DECK) - CASE 4 WITHOUT LEACHATE RECIRCULATION
INPUT DATA SUMMARY
220 FT OF WASTE AND BOTTOM LINER SYSTEM

WEATHER DATA AND SOIL LAYERS PROPERTIES

A. Evapotranspiration data

Data	Value	Units
Nearby city	Orlando	
State	Florida	
Latitude	27.8	
Evaporative zone depth	12	in
bare	10	
fair	22	
excellent	40	
Maximum leaf area index	2	
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	%

B. Precipitation

Data	Value
Nearby city	Fort Drum
State	Florida
Years for data generation	1975 thru 2004

C. 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	October	74.9
May	77.3	November	67.5
June	80.9	December	62

D. Solar Radiation

Data	Value
Nearby city	Orlando
State	Florida
Years for data generation	30

E. Other Conditions

Area assumed in analysis	1	ac
Area of runoff at the Surface	100	%
Surface Length	300	ft
Surface Slope	5	%
Surface Slope Vegetation	3	
bare ground	1	
grass (poor)	2	
grass (fair)	3	
grass (good)	4	
grass (excellent)	5	

F. Geomembrane

Placement of geomembrane	Good
Pinhole (# of defects/area)	2
Defect density per acre	2

G. Material Properties

Layer	Type	Description	Thickness in	Texture number	Porosity vol/vol	Field cap. vol/vol	Wilting point vol/vol	k cm/sec	Length Drain ft	Liner slope %
1	1	Vertical percolation	2,640	18	0.671	0.292	0.077	0.001		
2	1	Vertical percolation	24	1	0.417	0.045	0.018	0.001		
3	2	Lateral drainage	0.300		0.85	0.01	0.005	0.07	255	1.0
4	4	Geomembrane liner	0.060	35				2E-13		
6	2	Lateral drainage	0.200		0.85	0.01	0.005	0.56	255	1.0
7	4	Geomembrane liner	0.060	35				2E-13		
8	3	GCL	0.250	17	0.750	0.747	0.400	3.00E-09		
9	1	Vertical percolation	120	5	0.457	0.131	0.058	0.001		

ATTACHMENT B
HELP Model Output

Cells 14 & 15 (Exterior Portion under 3H:1V Side Slope) – With Leachate Recirculation

```
******************************************************************************
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**                                                                          **
**                                                                          **
**              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              **
**                                                                          **
**                                                                          **
******************************************************************************
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PRECIPITATION DATA FILE:    C:\HELP\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE1.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE1.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE1.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE1.D10
OUTPUT DATA FILE:           C:\HELP\12CASE1.OUT


TIME:  12:55     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                  =    120.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2828 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1281 VOL/VOL
```



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           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0445 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.85350001000     CM/SEC
           SLOPE                      =      1.40   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  4
                                   --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.500000000000     CM/SEC
           SLOPE                      =      1.40   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  6
                                   --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 1100. FEET.

SCS RUNOFF CURVE NUMBER	=	78.90	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.813	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.710	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	53.097	INCHES
TOTAL INITIAL WATER	=	53.097	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	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	10.0 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

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1975 THROUGH 2004

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	3.313	3.337	4.180	3.901	4.590	6.196
	6.154	5.783	4.964	4.037	3.147	2.821
STD. DEVIATIONS	0.300	0.481	0.781	1.038	1.349	1.114
	1.110	1.019	0.527	0.569	0.481	0.310

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.8124	0.7513	0.6477	1.0028	0.7365	1.0686
	2.0137	2.0918	2.1838	2.0946	1.4556	0.8129
STD. DEVIATIONS	0.9738	0.8145	0.7208	1.1591	0.6714	1.1536
	1.0814	1.2185	1.0306	1.0785	1.0954	0.7856

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.4870	0.4122	0.4121	0.7022	0.4393	0.8789
	1.3674	1.4678	1.5040	1.4157	0.8289	0.4774
STD. DEVIATIONS	0.4481	0.2999	0.3317	1.0561	0.2753	1.1475
	1.5308	1.3500	1.3681	1.4083	0.8012	0.2925

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7129	0.6442	0.7088	0.6989	0.7101	0.7011
	0.7282	0.7342	0.7190	0.7412	0.7038	0.7323
STD. DEVIATIONS	0.1249	0.1375	0.1420	0.1214	0.1374	0.1048
	0.0943	0.0616	0.0133	0.0231	0.0963	0.0720

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1328	0.0754	0.0772	0.3633	0.0816	0.5426
	0.8351	0.9039	0.9822	0.8439	0.3382	0.0929
STD. DEVIATIONS	0.2701	0.1329	0.1766	1.0622	0.1666	1.0530
	1.7262	1.3755	1.5841	1.4656	0.7398	0.1420

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1913	0.1894	0.1902	0.1938	0.1905	0.1944
	0.1954	0.1970	0.1993	0.1989	0.1951	0.1965
STD. DEVIATIONS	0.0335	0.0402	0.0381	0.0337	0.0369	0.0291
	0.0253	0.0165	0.0037	0.0062	0.0267	0.0193

***

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	78.67	(10.922)	285560.9	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	52.423	(3.3460)	190294.75	66.639
LATERAL DRAINAGE COLLECTED FROM LAYER 3	15.67177	(5.04350)	56888.531	19.92168
PERCOLATION/LEAKAGE THROUGH LAYER 4	10.39305	(4.46560)	37726.762	13.21146
AVERAGE HEAD ON TOP OF LAYER 4	0.439	(0.367)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.53463	(0.82998)	30980.721	10.84908
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.194	(0.019)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	2.038	(5.2204)	7396.97	2.590

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.13671	496.25348
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.319700	1160.51038
AVERAGE HEAD ON TOP OF LAYER 4	12.140	
MAXIMUM HEAD ON TOP OF LAYER 4	16.112	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	111.2 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02405	87.28857
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.389	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	9.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1180

*** 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	37.2946	0.3108
2	4.8808	0.2034
3	0.2256	0.7519
4	0.0000	0.0000
5	55.9208	279.6038
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**              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\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE2.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE2.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE2.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE2.D10
OUTPUT DATA FILE:           C:\HELP\12CASE2.OUT


TIME:  13: 9     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                 =    960.00   INCHES
           POROSITY                  =      0.6710 VOL/VOL
           FIELD CAPACITY            =      0.2920 VOL/VOL
           WILTING POINT             =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2949 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =     24.00   INCHES
           POROSITY                  =      0.4170 VOL/VOL
           FIELD CAPACITY            =      0.0450 VOL/VOL
```



```
           WILTING POINT             =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.1884 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.30   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.6220 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   1.70410001000     CM/SEC
           SLOPE                     =      1.20   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.20   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.490000010000     CM/SEC
           SLOPE                     =      1.20   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                  LAYER  6
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC
```

```
                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =    120.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
         POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  800. FEET.

SCS RUNOFF CURVE NUMBER            =     71.50
FRACTION OF AREA ALLOWING RUNOFF   =     50.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.176  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    303.881  INCHES
TOTAL INITIAL WATER                =    303.881  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                   =   1.00
START OF GROWING SEASON (JULIAN DATE)     =      0
END OF GROWING SEASON (JULIAN DATE)       =    367
EVAPORATIVE ZONE DEPTH                    =  12.0  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	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.016	0.001	0.099	0.003	0.038	0.058
	0.047	0.167	0.073	0.025	0.058	0.017
STD. DEVIATIONS	0.042	0.003	0.315	0.010	0.092	0.092
	0.124	0.410	0.228	0.070	0.191	0.062
EVAPOTRANSPIRATION						
TOTALS	3.233	3.461	4.468	4.426	4.942	6.639
	6.613	6.158	5.304	4.302	3.162	2.773

STD. DEVIATIONS	0.235	0.406	0.729	1.018	1.432	1.117
	1.048	0.970	0.351	0.594	0.545	0.364

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3780	1.1629	1.0490	1.0188	1.0132	0.6519
	0.9701	1.1899	1.1538	1.2977	1.7382	1.6973
STD. DEVIATIONS	0.7213	0.7495	0.8603	0.8176	0.9343	0.6734
	0.8057	0.7083	0.6184	0.6494	0.8145	0.9128

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7317	0.6347	0.6060	0.5674	0.5743	0.4268
	0.5602	0.6759	0.6747	0.7330	0.8686	0.8400
STD. DEVIATIONS	0.2829	0.2960	0.3273	0.3353	0.3671	0.2896
	0.3291	0.2844	0.2612	0.2912	0.3187	0.3413

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6075	0.5414	0.5967	0.5932	0.6081	0.5820
	0.6105	0.6097	0.5802	0.6225	0.6055	0.6222
STD. DEVIATIONS	0.0807	0.1146	0.1129	0.0397	0.0863	0.0915
	0.0858	0.0675	0.0803	0.0161	0.0025	0.0219

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1345	0.1242	0.1001	0.0967	0.0943	0.0632
	0.0930	0.1286	0.1406	0.1534	0.2070	0.1689
STD. DEVIATIONS	0.0742	0.0988	0.0835	0.0776	0.0870	0.0660
	0.0811	0.0944	0.1164	0.1445	0.1359	0.1021

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1940	0.1895	0.1906	0.1958	0.1942	0.1921
	0.1950	0.1947	0.1915	0.1988	0.1998	0.1987
STD. DEVIATIONS	0.0258	0.0399	0.0361	0.0131	0.0276	0.0302
	0.0274	0.0216	0.0265	0.0051	0.0008	0.0070

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	78.67	(10.922)	285560.9	100.00
RUNOFF	0.603	(0.6869)	2187.36	0.766
EVAPOTRANSPIRATION	55.480	(3.3712)	201392.77	70.525
LATERAL DRAINAGE COLLECTED FROM LAYER 3	14.32090	(4.86741)	51984.875	18.20448
PERCOLATION/LEAKAGE THROUGH LAYER 4	7.89351	(2.02043)	28653.459	10.03410
AVERAGE HEAD ON TOP OF LAYER 4	0.125	(0.055)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.17937	(0.58051)	26061.119	9.12629
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.195	(0.016)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.084	(6.2756)	3935.20	1.378

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.498	5437.7178
DRAINAGE COLLECTED FROM LAYER 3	0.10547	382.86972
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.117824	427.70126
AVERAGE HEAD ON TOP OF LAYER 4	2.810	
MAXIMUM HEAD ON TOP OF LAYER 4	4.585	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	59.6 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02020	73.32622
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.387	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0834

*** 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	294.5388	0.3068
2	4.3566	0.1815
3	0.0052	0.0175
4	0.0000	0.0000
5	21.5950	107.9748
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              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\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE3.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE3.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE3.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE3.D10
OUTPUT DATA FILE:           C:\HELP\12CASE3.OUT


TIME:  13:32     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                  =   1800.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2943 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
```



```
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1874 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.6541 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.62390006000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  4
                                   --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                          MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.560000002000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  6
                                   --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                          MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH A POOR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 600. FEET.

SCS RUNOFF CURVE NUMBER	=	71.90	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.176	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.052	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.924	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	550.590	INCHES
TOTAL INITIAL WATER	=	550.590	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	=	1.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 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	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.024	0.002	0.138	0.005	0.056	0.087
	0.071	0.243	0.107	0.037	0.085	0.026
STD. DEVIATIONS	0.062	0.005	0.428	0.015	0.134	0.136
	0.179	0.589	0.328	0.104	0.275	0.090
EVAPOTRANSPIRATION						
TOTALS	3.232	3.460	4.469	4.428	4.942	6.637
	6.615	6.159	5.303	4.300	3.158	2.777

STD. DEVIATIONS	0.236	0.408	0.730	1.018	1.432	1.116
	1.048	0.968	0.352	0.597	0.548	0.357

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3304	1.1761	1.0580	0.9903	1.0854	0.7204
	0.9122	1.0518	1.0235	1.1026	1.5054	1.5279
STD. DEVIATIONS	0.6624	0.6635	0.7473	0.7814	0.8685	0.7081
	0.7255	0.6164	0.4930	0.5625	0.6963	0.7812

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7774	0.6933	0.6713	0.6078	0.6585	0.4938
	0.5933	0.6761	0.6767	0.7066	0.8521	0.8550
STD. DEVIATIONS	0.2922	0.2860	0.3194	0.3497	0.3880	0.3355
	0.3354	0.2717	0.2261	0.2583	0.2964	0.3344

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6411	0.5810	0.6267	0.6246	0.6485	0.6101
	0.6395	0.6440	0.6188	0.6530	0.6338	0.6526
STD. DEVIATIONS	0.0817	0.0881	0.1130	0.0391	0.0294	0.0946
	0.0902	0.0659	0.0671	0.0116	0.0059	0.0191

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1475	0.1380	0.1188	0.1089	0.1191	0.0834
	0.1046	0.1246	0.1332	0.1339	0.1915	0.1722
STD. DEVIATIONS	0.0767	0.0775	0.0887	0.0869	0.0958	0.0851
	0.0891	0.0821	0.0782	0.1044	0.1061	0.0955

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1955	0.1942	0.1911	0.1968	0.1977	0.1922
	0.1949	0.1963	0.1949	0.1991	0.1997	0.1989
STD. DEVIATIONS	0.0249	0.0292	0.0344	0.0123	0.0090	0.0298
	0.0275	0.0201	0.0211	0.0035	0.0019	0.0058

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	78.67	(10.922)	285560.9	100.00
RUNOFF	0.880	(0.9721)	3192.72	1.118
EVAPOTRANSPIRATION	55.479	(3.3580)	201389.08	70.524
LATERAL DRAINAGE COLLECTED FROM LAYER 3	13.48379	(4.33007)	48946.152	17.14035
PERCOLATION/LEAKAGE THROUGH LAYER 4	8.26187	(2.00956)	29990.596	10.50235
AVERAGE HEAD ON TOP OF LAYER 4	0.131	(0.050)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.57364	(0.50523)	27492.316	9.62748
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.196	(0.013)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.251	(6.9136)	4540.79	1.590

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.997	7248.7427
DRAINAGE COLLECTED FROM LAYER 3	0.09198	333.87573
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.116756	423.82455
AVERAGE HEAD ON TOP OF LAYER 4	2.759	
MAXIMUM HEAD ON TOP OF LAYER 4	4.457	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	61.8 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02116	76.81971
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.386	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	11.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6586

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0834

*** 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	547.1699	0.3040
2	4.2127	0.1755
3	0.0113	0.0376
4	0.0000	0.0000
5	20.8158	104.0789
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
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\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE4.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE4.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE4.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE4.D10
OUTPUT DATA FILE:           C:\HELP\12CASE4.OUT


TIME:  14:18     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                 =   2640.00   INCHES
           POROSITY                  =      0.6710 VOL/VOL
           FIELD CAPACITY            =      0.2920 VOL/VOL
           WILTING POINT             =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =    0.2936 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =     24.00   INCHES
           POROSITY                  =      0.4170 VOL/VOL
           FIELD CAPACITY            =      0.0450 VOL/VOL
```



```
           WILTING POINT             =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =    0.1864 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.30   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =    0.6584 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   1.71440005000     CM/SEC
           SLOPE                     =      1.00   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                  LAYER  4
                                  --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.20   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =    0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.639999986000     CM/SEC
           SLOPE                     =      1.00   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                  LAYER  6
                                  --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC
```

```
                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =    120.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
        SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
        FAIR STAND OF GRASS, A SURFACE SLOPE OF  5.%
        AND A SLOPE LENGTH OF  300. FEET.

SCS RUNOFF CURVE NUMBER            =     57.30
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.083  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    795.966  INCHES
TOTAL INITIAL WATER                =    795.966  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                 =   2.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.043	0.000	0.004	0.002
	0.009	0.070	0.026	0.002	0.024	0.001
STD. DEVIATIONS	0.002	0.000	0.191	0.000	0.021	0.009
	0.048	0.234	0.132	0.009	0.091	0.006
EVAPOTRANSPIRATION						
TOTALS	3.185	3.519	4.576	4.410	4.905	6.644
	6.598	6.174	5.355	4.382	3.165	2.784

STD. DEVIATIONS	0.227	0.359	0.735	1.086	1.490	1.094
	1.076	0.957	0.361	0.568	0.539	0.366

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3287	1.1880	1.1255	1.0189	1.1126	0.7909
	0.9562	1.0218	0.9930	1.0732	1.4280	1.4673
STD. DEVIATIONS	0.6370	0.6247	0.6932	0.7529	0.8580	0.7170
	0.7012	0.5910	0.4630	0.5447	0.6723	0.7460

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7978	0.7175	0.7234	0.6434	0.6919	0.5395
	0.6301	0.6877	0.6768	0.7095	0.8439	0.8514
STD. DEVIATIONS	0.2951	0.2846	0.3083	0.3454	0.3991	0.3558
	0.3370	0.2650	0.2133	0.2461	0.2957	0.3378

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6583	0.5883	0.6487	0.6486	0.6732	0.6322
	0.6643	0.6685	0.6418	0.6780	0.6582	0.6756
STD. DEVIATIONS	0.0954	0.1284	0.1256	0.0419	0.0335	0.1044
	0.0940	0.0716	0.0719	0.0134	0.0077	0.0329

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1556	0.1451	0.1333	0.1192	0.1306	0.0984
	0.1123	0.1269	0.1278	0.1302	0.1866	0.1697
STD. DEVIATIONS	0.0763	0.0758	0.0860	0.0893	0.1021	0.0911
	0.0886	0.0801	0.0656	0.0870	0.1005	0.0912

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1932	0.1892	0.1903	0.1967	0.1975	0.1917
	0.1949	0.1962	0.1946	0.1989	0.1996	0.1982
STD. DEVIATIONS	0.0280	0.0411	0.0369	0.0127	0.0098	0.0317
	0.0276	0.0210	0.0218	0.0039	0.0023	0.0097

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES	CU. FEET	PERCENT
PRECIPITATION	78.67 (10.922)	285560.9	100.00
RUNOFF	0.180 (0.3798)	654.98	0.229
EVAPOTRANSPIRATION	55.696 (3.4229)	202176.50	70.800
LATERAL DRAINAGE COLLECTED FROM LAYER 3	13.50414 (4.06455)	49020.023	17.16622
PERCOLATION/LEAKAGE THROUGH LAYER 4	8.51294 (1.95197)	30901.959	10.82149
AVERAGE HEAD ON TOP OF LAYER 4	0.136 (0.046)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.83584 (0.64750)	28444.111	9.96078
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002 (0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.195 (0.016)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002 (0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.451 (7.5592)	5265.43	1.844

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.035	3758.4060
DRAINAGE COLLECTED FROM LAYER 3	0.08837	320.78922
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.116665	423.49271
AVERAGE HEAD ON TOP OF LAYER 4	2.769	
MAXIMUM HEAD ON TOP OF LAYER 4	4.422	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	65.2 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02199	79.81436
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.385	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	12.1 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6083

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0817

*** 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	798.9160	0.3026
2	4.1650	0.1735
3	0.0121	0.0402
4	0.0000	0.0000
5	20.4813	102.4063
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

****
****

Cells 14 & 15 (Exterior Portion under 3H:1V Side Slope) – With No Leachate Recirculation

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**                                                                          **
**                                                                          **
**              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\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE1.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE1.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE1.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE1N.D10
OUTPUT DATA FILE:           C:\HELP\12CASE1N.OUT


TIME:  17:54     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                  =    120.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2802 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC



                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1185 VOL/VOL
```



```
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0333 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.534600019000     CM/SEC
           SLOPE                      =      1.40   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.600000024000     CM/SEC
           SLOPE                      =      1.40   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                  LAYER  6
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =    120.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE
         GROUND CONDITIONS, A SURFACE SLOPE OF  5.% AND
         A SLOPE LENGTH OF 1100. FEET.

SCS RUNOFF CURVE NUMBER              =     78.90
FRACTION OF AREA ALLOWING RUNOFF     =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000  ACRES
EVAPORATIVE ZONE DEPTH               =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE    =      1.507  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE   =      6.710  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      0.770  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =     52.558  INCHES
TOTAL INITIAL WATER                  =     52.558  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                  =   0.00
START OF GROWING SEASON (JULIAN DATE)    =      0
END OF GROWING SEASON (JULIAN DATE)      =    367
EVAPORATIVE ZONE DEPTH                   =  10.0  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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.790	1.735	2.531	2.185	2.927	4.929
	4.993	4.632	4.042	2.704	1.837	1.411
STD. DEVIATIONS	0.866	0.998	1.209	1.214	1.869	1.612
	1.370	1.482	0.914	1.044	0.884	0.897

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1707	0.1707	0.1324	0.2698	0.2210	0.2973
	0.6674	0.6949	0.6810	0.6503	0.4383	0.2350
STD. DEVIATIONS	0.2777	0.2705	0.2203	0.3709	0.2627	0.3377
	0.3778	0.4256	0.3622	0.3823	0.3540	0.2792

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.4702	0.3830	0.2980	0.8409	0.4812	0.9820
	1.8176	1.9720	1.9719	1.7834	1.0916	0.5337
STD. DEVIATIONS	0.6154	0.4921	0.3315	1.4382	0.4872	1.3173
	1.5986	1.7605	1.6249	1.7589	1.2321	0.5424

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.8500	0.7686	0.8423	0.8390	0.8446	0.8124
	0.8675	0.8801	0.8599	0.8835	0.8413	0.8707
STD. DEVIATIONS	0.1706	0.1817	0.1990	0.1462	0.1715	0.1835
	0.1080	0.0790	0.0318	0.0603	0.1335	0.1308

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1841	0.1229	0.0558	0.5841	0.1500	0.6747
	1.2689	1.3980	1.4824	1.2264	0.6224	0.1643
STD. DEVIATIONS	0.4303	0.3376	0.1534	1.4980	0.2955	1.2329
	1.7047	1.7893	1.8210	1.8529	1.2042	0.3679

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1900	0.1883	0.1883	0.1938	0.1888	0.1877
	0.1940	0.1968	0.1987	0.1975	0.1944	0.1947
STD. DEVIATIONS	0.0381	0.0443	0.0445	0.0338	0.0383	0.0424
	0.0242	0.0177	0.0073	0.0135	0.0308	0.0292

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	35.717	(5.2175)	129653.45	67.266
LATERAL DRAINAGE COLLECTED FROM LAYER 3	4.62880	(1.75767)	16802.559	8.71742
PERCOLATION/LEAKAGE THROUGH LAYER 4	12.62561	(6.10061)	45830.973	23.77779
AVERAGE HEAD ON TOP OF LAYER 4	0.661	(0.490)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	10.15973	(1.17470)	36879.809	19.13380
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.074	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.193	(0.022)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.593	(6.1829)	9411.41	4.883

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.04119	149.51431
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.304440	1105.11609
AVERAGE HEAD ON TOP OF LAYER 4	11.205	
MAXIMUM HEAD ON TOP OF LAYER 4	15.101	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	107.6 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02886	104.74629
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.389	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	9.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** 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	35.2807	0.2940
2	4.7466	0.1978
3	0.2550	0.8500
4	0.0000	0.0000
5	74.1489	370.7445
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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******************************************************************************
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**                                                                          **
**                                                                          **
**              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\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE2.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE2.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE2.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE2N.D10
OUTPUT DATA FILE:           C:\HELP\12CASE2N.OUT


TIME:  18:15     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                 =    960.00   INCHES
           POROSITY                  =      0.6710 VOL/VOL
           FIELD CAPACITY            =      0.2920 VOL/VOL
           WILTING POINT             =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2900 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =     24.00   INCHES
           POROSITY                  =      0.4170 VOL/VOL
           FIELD CAPACITY            =      0.0450 VOL/VOL
```



```
           WILTING POINT             =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.1242 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                   TYPE 2 - LATERAL DRAINAGE LAYER
                     MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.30   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.8315 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.526000001000E-01 CM/SEC
           SLOPE                     =      1.20   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                   LAYER  4
                                   --------

                   TYPE 4 - FLEXIBLE MEMBRANE LINER
                     MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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 2 - LATERAL DRAINAGE LAYER
                     MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.20   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.629999995000     CM/SEC
           SLOPE                     =      1.20   PERCENT
           DRAINAGE LENGTH           =    330.0    FEET


                                   LAYER  6
                                   --------

                   TYPE 4 - FLEXIBLE MEMBRANE LINER
                     MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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 7

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =    120.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
         POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  800. FEET.

SCS RUNOFF CURVE NUMBER            =     71.50
FRACTION OF AREA ALLOWING RUNOFF   =     50.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.617  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    297.742  INCHES
TOTAL INITIAL WATER                =    297.742  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                 =   1.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.011	0.000	0.090	0.002	0.031	0.048
	0.041	0.150	0.065	0.021	0.051	0.013
STD. DEVIATIONS	0.030	0.002	0.297	0.007	0.077	0.081
	0.116	0.369	0.208	0.063	0.176	0.049
EVAPOTRANSPIRATION						
TOTALS	1.798	2.212	2.840	2.502	3.167	5.575
	5.550	5.181	4.404	3.076	1.892	1.369

STD. DEVIATIONS	0.814	0.941	1.358	1.522	1.999	1.637
	1.680	1.555	0.958	1.146	0.978	0.798

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1008	0.0872	0.0860	0.0795	0.0827	0.0769
	0.0914	0.1060	0.1067	0.1122	0.1095	0.1074
STD. DEVIATIONS	0.0230	0.0240	0.0274	0.0287	0.0336	0.0298
	0.0335	0.0292	0.0225	0.0222	0.0191	0.0219

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8972	0.7112	0.4377	0.4335	0.5764	0.3547
	0.9844	1.4327	1.4318	1.5505	1.5581	1.2151
STD. DEVIATIONS	1.1356	0.8186	0.6863	0.6176	0.9356	0.4992
	0.9764	1.0029	0.9979	1.1315	1.2244	1.3078

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7630	0.6901	0.7554	0.7400	0.7615	0.7385
	0.7810	0.7806	0.7646	0.7863	0.7562	0.7808
STD. DEVIATIONS	0.1631	0.1701	0.1891	0.1527	0.1682	0.1468
	0.1321	0.1345	0.0793	0.1029	0.1254	0.1332

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.6842	1.5067	0.8881	0.8989	1.1160	0.7520
	1.8454	2.6525	2.7280	2.8380	2.9121	2.2250
STD. DEVIATIONS	1.9610	1.6014	1.2166	1.1620	1.6497	0.9291
	1.7299	1.7520	1.7758	1.9326	2.1150	2.2111

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1895	0.1879	0.1877	0.1900	0.1892	0.1896
	0.1940	0.1939	0.1963	0.1953	0.1941	0.1940
STD. DEVIATIONS	0.0405	0.0461	0.0470	0.0392	0.0418	0.0377
	0.0328	0.0334	0.0203	0.0256	0.0322	0.0331

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES	CU. FEET	PERCENT
PRECIPITATION	53.10 (10.929)	192747.0	100.00
RUNOFF	0.521 (0.6279)	1893.04	0.982
EVAPOTRANSPIRATION	39.567 (5.7499)	143626.55	74.516
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.14635 (0.21344)	4161.268	2.15893
PERCOLATION/LEAKAGE THROUGH LAYER 4	11.58340 (5.80568)	42047.727	21.81499
AVERAGE HEAD ON TOP OF LAYER 4	1.837 (0.859)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.09802 (1.27819)	33025.812	17.13428
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002 (0.00000)	0.074	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.192 (0.027)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002 (0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.766 (6.9923)	10040.37	5.209

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	1.446	5250.4331
DRAINAGE COLLECTED FROM LAYER 3	0.00451	16.38572
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.126948	460.82120
AVERAGE HEAD ON TOP OF LAYER 4	6.419	
MAXIMUM HEAD ON TOP OF LAYER 4	9.323	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	90.3 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02597	94.27657
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.387	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0770

*** 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	285.3067	0.2972
2	4.5185	0.1883
3	0.2550	0.8500
4	0.0000	0.0000
5	74.7321	373.6606
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              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              **
**                                                                          **
**                                                                          **
******************************************************************************
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PRECIPITATION DATA FILE:    C:\HELP\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE3.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE3.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE3.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE3N.D10
OUTPUT DATA FILE:           C:\HELP\12CASE3N.OUT


TIME:  18:32     DATE:  11/ 3/2014


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                  =   1800.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2910 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
```



```
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1267 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8360 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.573999994000E-01 CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  4
                                   --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                          MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.680000007000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    330.0    FEET


                                   LAYER  6
                                   --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                          MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH A POOR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 600. FEET.

SCS RUNOFF CURVE NUMBER	=	71.90	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.617	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.052	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.924	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	543.081	INCHES
TOTAL INITIAL WATER	=	543.081	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	=	1.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 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

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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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.016	0.001	0.125	0.003	0.045	0.072
	0.061	0.219	0.094	0.032	0.074	0.019
STD. DEVIATIONS	0.044	0.003	0.405	0.010	0.113	0.120
	0.169	0.531	0.300	0.093	0.253	0.072
EVAPOTRANSPIRATION						
TOTALS	1.798	2.210	2.846	2.504	3.168	5.568
	5.551	5.179	4.407	3.071	1.892	1.373

STD. DEVIATIONS	0.813	0.942	1.363	1.520	2.001	1.631
	1.682	1.556	0.957	1.144	0.979	0.796

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.0996	0.0870	0.0854	0.0792	0.0820	0.0760
	0.0891	0.1030	0.1040	0.1092	0.1071	0.1055
STD. DEVIATIONS	0.0221	0.0240	0.0273	0.0292	0.0329	0.0297
	0.0327	0.0282	0.0215	0.0202	0.0171	0.0204

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8993	0.7818	0.4540	0.4762	0.5750	0.3422
	0.9310	1.3648	1.3759	1.4476	1.4992	1.1814
STD. DEVIATIONS	1.1124	0.8750	0.6791	0.7219	0.8997	0.4664
	0.9291	0.9424	0.9463	1.0392	1.1317	1.2315

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7558	0.6831	0.7477	0.7292	0.7519	0.7208
	0.7727	0.7723	0.7556	0.7766	0.7484	0.7726
STD. DEVIATIONS	0.1589	0.1671	0.1861	0.1602	0.1698	0.1581
	0.1307	0.1332	0.0783	0.1098	0.1234	0.1313

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.6333	1.5730	0.8839	0.9336	1.0758	0.6996
	1.6849	2.4389	2.5370	2.5759	2.7304	2.1087
STD. DEVIATIONS	1.8660	1.6379	1.1614	1.2849	1.5379	0.8356
	1.5916	1.5983	1.6434	1.7372	1.9298	2.0437

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1897	0.1880	0.1877	0.1892	0.1888	0.1870
	0.1940	0.1939	0.1960	0.1950	0.1942	0.1940
STD. DEVIATIONS	0.0399	0.0458	0.0467	0.0416	0.0426	0.0410
	0.0328	0.0334	0.0203	0.0276	0.0320	0.0330

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.761	(0.8899)	2763.19	1.434
EVAPOTRANSPIRATION	39.568	(5.7468)	143632.02	74.518
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.12708	(0.20931)	4091.306	2.12263
PERCOLATION/LEAKAGE THROUGH LAYER 4	11.32841	(5.57867)	41122.145	21.33478
AVERAGE HEAD ON TOP OF LAYER 4	1.740	(0.807)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.98670	(1.28166)	32621.721	16.92464
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.074	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.191	(0.027)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.655	(6.8311)	9639.00	5.001

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	1.934	7020.4219
DRAINAGE COLLECTED FROM LAYER 3	0.00428	15.53624
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.113364	411.51276
AVERAGE HEAD ON TOP OF LAYER 4	5.731	
MAXIMUM HEAD ON TOP OF LAYER 4	8.361	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	89.3 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02570	93.28107
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.386	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	11.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6535
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** 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	531.6869	0.2954
2	4.4691	0.1862
3	0.2550	0.8501
4	0.0000	0.0000
5	70.4236	352.1182
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**              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\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE4.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE4.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE4.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\12CASE4N.D10
OUTPUT DATA FILE:           C:\HELP\12CASE4N.OUT



TIME:  19: 0     DATE:  11/ 3/2014



******************************************************************************

     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                 =   2640.00   INCHES
           POROSITY                  =      0.6710 VOL/VOL
           FIELD CAPACITY            =      0.2920 VOL/VOL
           WILTING POINT             =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2913 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =     24.00   INCHES
           POROSITY                  =      0.4170 VOL/VOL
           FIELD CAPACITY            =      0.0450 VOL/VOL
```



```
           WILTING POINT                =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.1265 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC



                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =      0.30   INCHES
           POROSITY                     =      0.8500 VOL/VOL
           FIELD CAPACITY               =      0.0100 VOL/VOL
           WILTING POINT                =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.8391 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.570000000000E-01 CM/SEC
           SLOPE                        =      1.00   PERCENT
           DRAINAGE LENGTH              =    330.0    FEET



                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                    =      0.06   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 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =      0.20   INCHES
           POROSITY                     =      0.8500 VOL/VOL
           FIELD CAPACITY               =      0.0100 VOL/VOL
           WILTING POINT                =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.759999990000     CM/SEC
           SLOPE                        =      1.00   PERCENT
           DRAINAGE LENGTH              =    330.0    FEET



                                  LAYER  6
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                    =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	57.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.537	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.052	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.924	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	788.278	INCHES
TOTAL INITIAL WATER	=	788.278	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	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.038	0.000	0.003	0.002
	0.008	0.059	0.024	0.001	0.020	0.001
STD. DEVIATIONS	0.000	0.000	0.177	0.000	0.014	0.008
	0.044	0.193	0.124	0.007	0.077	0.002
EVAPOTRANSPIRATION						
TOTALS	1.782	2.385	2.791	2.504	3.213	5.606
	5.551	5.240	4.393	3.090	1.907	1.310

STD. DEVIATIONS	0.750	0.979	1.409	1.531	1.997	1.609
	1.713	1.536	1.019	1.181	1.038	0.822

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.0910	0.0809	0.0806	0.0734	0.0758	0.0698
	0.0820	0.0937	0.0943	0.1006	0.0984	0.0963
STD. DEVIATIONS	0.0196	0.0212	0.0237	0.0235	0.0275	0.0254
	0.0283	0.0243	0.0185	0.0140	0.0139	0.0173

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.9260	0.8672	0.5528	0.4764	0.5973	0.3558
	0.9619	1.3819	1.3720	1.5014	1.5467	1.1910
STD. DEVIATIONS	1.1182	0.9629	0.7947	0.7111	0.9185	0.4660
	0.9315	0.9437	0.9396	1.0175	1.0867	1.1908

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7681	0.6941	0.7598	0.7409	0.7647	0.7449
	0.7853	0.7848	0.7680	0.7996	0.7606	0.7851
STD. DEVIATIONS	0.1606	0.1696	0.1888	0.1627	0.1716	0.1487
	0.1321	0.1348	0.0836	0.0538	0.1244	0.1333

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.6848	1.7338	1.0586	0.9417	1.1199	0.7316
	1.7454	2.4799	2.5445	2.6823	2.8345	2.1431
STD. DEVIATIONS	1.8859	1.7961	1.3621	1.2671	1.5766	0.8431
	1.6047	1.6100	1.6396	1.7093	1.8673	1.9878

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1898	0.1880	0.1877	0.1892	0.1889	0.1902
	0.1940	0.1939	0.1961	0.1976	0.1942	0.1940
STD. DEVIATIONS	0.0397	0.0458	0.0466	0.0415	0.0424	0.0380
	0.0326	0.0333	0.0214	0.0133	0.0318	0.0329

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.155	(0.3383)	563.67	0.292
EVAPOTRANSPIRATION	39.774	(5.8256)	144379.92	74.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.03670	(0.17016)	3763.206	1.95241
PERCOLATION/LEAKAGE THROUGH LAYER 4	11.73060	(5.78125)	42582.074	22.09222
AVERAGE HEAD ON TOP OF LAYER 4	1.808	(0.840)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.15591	(1.29051)	33235.945	17.24331
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.074	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.192	(0.027)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.976	(7.1722)	10804.11	5.605

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	0.967	3509.6682
DRAINAGE COLLECTED FROM LAYER 3	0.00385	13.97573
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.109610	397.88455
AVERAGE HEAD ON TOP OF LAYER 4	5.613	
MAXIMUM HEAD ON TOP OF LAYER 4	8.084	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	92.3 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02611	94.77955
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.385	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	12.1 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6229
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** 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	779.6431	0.2953
2	4.3564	0.1815
3	0.2509	0.8363
4	0.0000	0.0000
5	77.4100	387.0499
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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Cells 14 & 15 (Interior Portion under Top Deck) – With Leachate Recirculation

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**                                                                          **
**              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\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE1.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE1.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE1.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE1.D10
OUTPUT DATA FILE:           C:\HELP\14CASE1.OUT


TIME:  15: 3     DATE:   4/ 8/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                  =    120.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2828 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                LAYER  2
                                --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1281 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
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                                LAYER  3
                                --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0456 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.58580005000     CM/SEC
           SLOPE                      =      1.20   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                LAYER  4
                                --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.469999999000     CM/SEC
           SLOPE                      =      1.20   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                LAYER  6
                                --------

                      TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 1100. FEET.

SCS RUNOFF CURVE NUMBER	=	78.90
FRACTION OF AREA ALLOWING RUNOFF	=	0.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000 ACRES
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.813 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.710 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770 INCHES
INITIAL SNOW WATER	=	0.000 INCHES
INITIAL WATER IN LAYER MATERIALS	=	53.098 INCHES
TOTAL INITIAL WATER	=	53.098 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	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	10.0 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

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1975 THROUGH 2004

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	3.313	3.337	4.180	3.901	4.590	6.196
	6.154	5.783	4.964	4.037	3.147	2.821
STD. DEVIATIONS	0.300	0.481	0.781	1.038	1.349	1.114
	1.110	1.019	0.527	0.569	0.481	0.310
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.7965	0.7411	0.6385	0.9767	0.7277	1.0328
	1.9612	2.0337	2.1247	2.0426	1.4313	0.8018
STD. DEVIATIONS	0.9498	0.8002	0.7100	1.1187	0.6655	1.1053
	1.0409	1.1709	0.9868	1.0296	1.0651	0.7741

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.5010	0.4228	0.4210	0.7282	0.4492	0.9121
	1.4141	1.5288	1.5599	1.4683	0.8592	0.4904
STD. DEVIATIONS	0.4709	0.3141	0.3424	1.0969	0.2840	1.1954
	1.5516	1.3946	1.3998	1.4570	0.8475	0.3041

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7428	0.6714	0.7388	0.7285	0.7397	0.7246
	0.7496	0.7637	0.7493	0.7651	0.7333	0.7633
STD. DEVIATIONS	0.1322	0.1445	0.1492	0.1269	0.1455	0.1146
	0.1106	0.0662	0.0145	0.0669	0.1036	0.0765

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1418	0.0808	0.0805	0.3874	0.0854	0.5751
	0.8784	0.9628	1.0376	0.8942	0.3631	0.0995
STD. DEVIATIONS	0.2943	0.1497	0.1857	1.1095	0.1755	1.1065
	1.7542	1.4252	1.6252	1.5285	0.7959	0.1511

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1911	0.1894	0.1901	0.1937	0.1903	0.1926
	0.1929	0.1965	0.1992	0.1969	0.1950	0.1964
STD. DEVIATIONS	0.0340	0.0405	0.0384	0.0338	0.0374	0.0305
	0.0285	0.0170	0.0038	0.0172	0.0276	0.0197

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES	CU. FEET	PERCENT
PRECIPITATION	78.67 (10.922)	285560.9	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000

EVAPOTRANSPIRATION	52.423 (3.3460)	190294.75	66.639
LATERAL DRAINAGE COLLECTED FROM LAYER 3	15.30852 (4.88925)	55569.914	19.45992
PERCOLATION/LEAKAGE THROUGH LAYER 4	10.75497 (4.62751)	39040.539	13.67153
AVERAGE HEAD ON TOP OF LAYER 4	0.466 (0.382)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.87010 (0.91279)	32198.445	11.27551
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002 (0.00000)	0.074	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.194 (0.020)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002 (0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	2.066 (5.3265)	7498.23	2.626

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.13492	489.77371
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.320843	1164.66174
AVERAGE HEAD ON TOP OF LAYER 4	12.211	
MAXIMUM HEAD ON TOP OF LAYER 4	15.188	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	102.1 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02507	91.01958
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.385	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	9.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1180

*** 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	37.2946	0.3108
2	4.8918	0.2038
3	0.2550	0.8500
4	0.0000	0.0000
5	56.7175	283.5876
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                        **
**              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            **
**                                                                        **
**                                                                        **
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PRECIPITATION DATA FILE:    C:\HELP\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE2.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE2.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE2.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE2.D10
OUTPUT DATA FILE:           C:\HELP\14CASE2.OUT


TIME:  16: 5     DATE:   4/ 8/2016


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     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                  =    960.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2949 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
           FIELD CAPACITY             =      0.0450 VOL/VOL
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           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1884 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.6458 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.37059999000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.419999987000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                  LAYER  6
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                   =    120.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
       SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
       POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
       AND A SLOPE LENGTH OF  800. FEET.

SCS RUNOFF CURVE NUMBER            =     71.50
FRACTION OF AREA ALLOWING RUNOFF   =     50.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.176  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    303.888  INCHES
TOTAL INITIAL WATER                =    303.888  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                 =   1.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.016	0.001	0.099	0.003	0.038	0.058
	0.047	0.167	0.073	0.025	0.058	0.017
STD. DEVIATIONS	0.042	0.003	0.315	0.010	0.092	0.092
	0.124	0.410	0.228	0.070	0.191	0.062
EVAPOTRANSPIRATION						
TOTALS	3.233	3.461	4.468	4.426	4.942	6.639
	6.613	6.158	5.304	4.302	3.162	2.773
STD. DEVIATIONS	0.235	0.406	0.729	1.018	1.432	1.117
	1.048	0.970	0.351	0.594	0.545	0.364

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3622	1.1445	1.0374	1.0077	1.0026	0.6433
	0.9573	1.1686	1.1364	1.2710	1.7072	1.6716
STD. DEVIATIONS	0.7139	0.7325	0.8511	0.8100	0.9253	0.6659
	0.7964	0.6923	0.6084	0.6262	0.7957	0.8916

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7491	0.6526	0.6186	0.5780	0.5862	0.4354
	0.5724	0.6967	0.6911	0.7613	0.8981	0.8654
STD. DEVIATIONS	0.2917	0.3133	0.3365	0.3424	0.3770	0.2972
	0.3384	0.2999	0.2717	0.3218	0.3399	0.3612

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6223	0.5539	0.6068	0.6033	0.6184	0.5918
	0.6207	0.6219	0.5928	0.6331	0.6157	0.6328
STD. DEVIATIONS	0.0793	0.1046	0.1146	0.0400	0.0880	0.0932
	0.0874	0.0656	0.0751	0.0157	0.0025	0.0219

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1429	0.1363	0.1049	0.1002	0.0991	0.0666
	0.0986	0.1421	0.1497	0.1748	0.2294	0.1856
STD. DEVIATIONS	0.0824	0.1251	0.0894	0.0806	0.0929	0.0709
	0.0879	0.1126	0.1277	0.1815	0.1677	0.1281

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1955	0.1907	0.1906	0.1958	0.1942	0.1921
	0.1950	0.1953	0.1924	0.1989	0.1999	0.1987
STD. DEVIATIONS	0.0249	0.0357	0.0360	0.0130	0.0276	0.0302
	0.0275	0.0206	0.0244	0.0049	0.0008	0.0069

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	78.67	(10.922)	285560.9	100.00
RUNOFF	0.603	(0.6869)	2187.36	0.766
EVAPOTRANSPIRATION	55.480	(3.3712)	201392.77	70.525
LATERAL DRAINAGE COLLECTED FROM LAYER 3	14.10974	(4.77149)	51218.355	17.93605
PERCOLATION/LEAKAGE THROUGH LAYER 4	8.10489	(2.12437)	29420.764	10.30280
AVERAGE HEAD ON TOP OF LAYER 4	0.136	(0.065)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.31337	(0.55245)	26547.549	9.29663
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.195	(0.015)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.161	(6.3250)	4215.16	1.476

****

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.498	5437.7178
DRAINAGE COLLECTED FROM LAYER 3	0.10055	364.98108
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.117711	427.29138
AVERAGE HEAD ON TOP OF LAYER 4	2.817	
MAXIMUM HEAD ON TOP OF LAYER 4	4.385	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	55.3 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02054	74.56030
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.383	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0834

*** 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	294.5388	0.3068
2	4.3566	0.1815
3	0.0059	0.0196
4	0.0000	0.0000
5	23.9152	119.5761
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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****

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE3.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE3.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE3.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE3.D10
OUTPUT DATA FILE:           C:\HELP\14CASE3.OUT


TIME:  16:20     DATE:   4/ 8/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                  =   1800.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2943 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
```



```
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1874 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.6777 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.19920003000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  4
                                   --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.439999998000     CM/SEC
           SLOPE                      =      1.10   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  6
                                   --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                     =      0.25   INCHES
POROSITY                      =      0.7500 VOL/VOL
FIELD CAPACITY                =      0.7470 VOL/VOL
WILTING POINT                 =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.300000003000E-08 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                     =    120.00   INCHES
POROSITY                      =      0.4570 VOL/VOL
FIELD CAPACITY                =      0.1310 VOL/VOL
WILTING POINT                 =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
         POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  600. FEET.

SCS RUNOFF CURVE NUMBER            =     71.90
FRACTION OF AREA ALLOWING RUNOFF   =     70.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.176  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    550.597  INCHES
TOTAL INITIAL WATER                =    550.597  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                 =   1.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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                 4.43     4.19     6.09     4.71     6.81     9.98
                          9.31     9.85     8.68     5.50     4.71     4.41

   STD. DEVIATIONS        1.68     1.68     3.65     1.76     3.99     3.97
                          3.81     3.77     3.81     3.24     1.90     1.87

 RUNOFF
 ------
   TOTALS                0.024    0.002    0.138    0.005    0.056    0.087
                         0.071    0.243    0.107    0.037    0.085    0.026

   STD. DEVIATIONS       0.062    0.005    0.428    0.015    0.134    0.136
                         0.179    0.589    0.328    0.104    0.275    0.090

 EVAPOTRANSPIRATION
 ------------------
   TOTALS                3.232    3.460    4.469    4.428    4.942    6.637
                         6.615    6.159    5.303    4.300    3.158    2.777

   STD. DEVIATIONS       0.236    0.408    0.730    1.018    1.432    1.116
                         1.048    0.968    0.352    0.597    0.548    0.357
```

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3124	1.1600	1.0445	0.9770	1.0728	0.7100
	0.9007	1.0352	1.0087	1.0824	1.4820	1.5088
STD. DEVIATIONS	0.6551	0.6529	0.7390	0.7727	0.8593	0.6991
	0.7170	0.6074	0.4863	0.5448	0.6824	0.7731

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7965	0.7087	0.6864	0.6203	0.6723	0.5042
	0.6045	0.6930	0.6903	0.7270	0.8753	0.8732
STD. DEVIATIONS	0.3008	0.2953	0.3282	0.3583	0.3983	0.3443
	0.3439	0.2802	0.2324	0.2795	0.3109	0.3429

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6526	0.5922	0.6420	0.6352	0.6595	0.6203
	0.6502	0.6548	0.6322	0.6659	0.6445	0.6659
STD. DEVIATIONS	0.0793	0.0896	0.1022	0.0393	0.0296	0.0964
	0.0919	0.0671	0.0648	0.0065	0.0060	0.0066

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1582	0.1465	0.1262	0.1149	0.1255	0.0884
	0.1092	0.1341	0.1396	0.1472	0.2070	0.1813
STD. DEVIATIONS	0.0838	0.0871	0.0946	0.0921	0.1025	0.0904
	0.0952	0.0893	0.0841	0.1309	0.1264	0.1019

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1957	0.1947	0.1925	0.1968	0.1977	0.1922
	0.1949	0.1963	0.1959	0.1996	0.1997	0.1996
STD. DEVIATIONS	0.0238	0.0292	0.0306	0.0122	0.0089	0.0299
	0.0276	0.0201	0.0201	0.0019	0.0018	0.0020

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES	CU. FEET	PERCENT
PRECIPITATION	78.67 (10.922)	285560.9	100.00
RUNOFF	0.880 (0.9721)	3192.72	1.118
EVAPOTRANSPIRATION	55.479 (3.3580)	201389.08	70.524
LATERAL DRAINAGE COLLECTED FROM LAYER 3	13.29437 (4.25502)	48258.570	16.89957
PERCOLATION/LEAKAGE THROUGH LAYER 4	8.45149 (2.08727)	30678.900	10.74338
AVERAGE HEAD ON TOP OF LAYER 4	0.140 (0.057)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.71515 (0.48563)	28005.986	9.80736
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002 (0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.196 (0.012)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002 (0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.299 (6.9269)	4714.91	1.651

****

PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.997	7248.7427
DRAINAGE COLLECTED FROM LAYER 3	0.08799	319.39679
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.116895	424.32974
AVERAGE HEAD ON TOP OF LAYER 4	2.772	
MAXIMUM HEAD ON TOP OF LAYER 4	4.323	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	54.8 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02152	78.11079
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.383	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6586

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0834

*** 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	547.1699	0.3040
2	4.2127	0.1755
3	0.0123	0.0412
4	0.0000	0.0000
5	22.2608	111.3040
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              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              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:    C:\HELP\RECIR2.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE4.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE4.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE4.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE4.D10
OUTPUT DATA FILE:           C:\HELP\14CASE4.OUT


TIME:   9:51     DATE:   4/18/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                  =   2640.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2936 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
```



```
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1864 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.6827 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   1.26380002000     CM/SEC
           SLOPE                      =      1.00   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  4
                                   --------

                  TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.509999990000     CM/SEC
           SLOPE                      =      1.00   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  6
                                   --------

                  TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC
```

```
                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                    =    120.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
         FAIR STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  300. FEET.

SCS RUNOFF CURVE NUMBER            =     57.30
FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      2.083  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    795.973  INCHES
TOTAL INITIAL WATER                =    795.973  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                 =   2.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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
```

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1975 THROUGH 2004

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.43	4.19	6.09	4.71	6.81	9.98
	9.31	9.85	8.68	5.50	4.71	4.41
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.043	0.000	0.004	0.002
	0.009	0.070	0.026	0.002	0.024	0.001
STD. DEVIATIONS	0.002	0.000	0.191	0.000	0.021	0.009
	0.048	0.234	0.132	0.009	0.091	0.006
EVAPOTRANSPIRATION						
TOTALS	3.185	3.519	4.576	4.410	4.905	6.644
	6.598	6.174	5.355	4.382	3.165	2.784
STD. DEVIATIONS	0.227	0.359	0.735	1.086	1.490	1.094
	1.076	0.957	0.361	0.568	0.539	0.366

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.3107	1.1704	1.1063	1.0021	1.0973	0.7782
	0.9398	1.0065	0.9766	1.0527	1.4034	1.4471
STD. DEVIATIONS	0.6289	0.6165	0.6845	0.7428	0.8480	0.7074
	0.6895	0.5830	0.4555	0.5253	0.6590	0.7365

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8168	0.7347	0.7436	0.6599	0.7072	0.5532
	0.6461	0.7032	0.6928	0.7304	0.8658	0.8722
STD. DEVIATIONS	0.3045	0.2927	0.3177	0.3558	0.4093	0.3663
	0.3489	0.2723	0.2210	0.2688	0.3094	0.3476

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6690	0.6062	0.6688	0.6687	0.6940	0.6518
	0.6850	0.6872	0.6514	0.6973	0.6787	0.6920
STD. DEVIATIONS	0.1289	0.1343	0.1303	0.0440	0.0365	0.1082
	0.0976	0.0752	0.0901	0.0216	0.0083	0.0418

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1656	0.1552	0.1457	0.1292	0.1384	0.1065
	0.1216	0.1345	0.1365	0.1436	0.2008	0.1813
STD. DEVIATIONS	0.0835	0.0827	0.0932	0.0971	0.1087	0.0975
	0.0987	0.0857	0.0721	0.1170	0.1184	0.1004

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1904	0.1891	0.1903	0.1966	0.1975	0.1916
	0.1949	0.1955	0.1915	0.1984	0.1996	0.1969
STD. DEVIATIONS	0.0367	0.0417	0.0371	0.0129	0.0104	0.0318
	0.0278	0.0214	0.0265	0.0062	0.0024	0.0119

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	78.67	(10.922)	285560.9	100.00
RUNOFF	0.180	(0.3798)	654.98	0.229
EVAPOTRANSPIRATION	55.696	(3.4229)	202176.50	70.800
LATERAL DRAINAGE COLLECTED FROM LAYER 3	13.29128	(4.00187)	48247.328	16.89563
PERCOLATION/LEAKAGE THROUGH LAYER 4	8.72600	(2.01746)	31675.393	11.09234
AVERAGE HEAD ON TOP OF LAYER 4	0.147	(0.051)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.05020	(0.72158)	29222.242	10.23328
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.075	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.194	(0.018)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00003
CHANGE IN WATER STORAGE	1.449	(7.5767)	5260.16	1.842

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.07	32924.098
RUNOFF	1.035	3758.4060
DRAINAGE COLLECTED FROM LAYER 3	0.08405	305.10464
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.116770	423.87573
AVERAGE HEAD ON TOP OF LAYER 4	2.772	
MAXIMUM HEAD ON TOP OF LAYER 4	4.255	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	57.4 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02267	82.30856
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.382	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	11.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6083

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0817

*** 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	798.9160	0.3026
2	4.1650	0.1735
3	0.0132	0.0441
4	0.0000	0.0000
5	20.4439	102.2193
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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Cells 14 & 15 (Interior Portion under Top Deck) – With No Leachate Recirculation

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**                                                                          **
**              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              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:    C:\HELP\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE1.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE1.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE1.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE1N.D10
OUTPUT DATA FILE:           C:\HELP\14CASE1N.OUT


TIME:  13:56     DATE:   4/18/2016


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     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                   =   120.00   INCHES
           POROSITY                    =     0.6710 VOL/VOL
           FIELD CAPACITY              =     0.2920 VOL/VOL
           WILTING POINT               =     0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =     0.2802 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                                  LAYER  2
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =    24.00   INCHES
           POROSITY                    =     0.4170 VOL/VOL
           FIELD CAPACITY              =     0.0450 VOL/VOL
           WILTING POINT               =     0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =     0.1188 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```



```
                                  LAYER  3
                                  --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     0.30   INCHES
           POROSITY                    =     0.8500 VOL/VOL
           FIELD CAPACITY              =     0.0100 VOL/VOL
           WILTING POINT               =     0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =     0.8405 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.421999991000E-01 CM/SEC
           SLOPE                       =     1.20   PERCENT
           DRAINAGE LENGTH             =   255.0    FEET


                                  LAYER  4
                                  --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                         MATERIAL TEXTURE NUMBER  35
           THICKNESS                   =     0.06   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 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     0.20   INCHES
           POROSITY                    =     0.8500 VOL/VOL
           FIELD CAPACITY              =     0.0100 VOL/VOL
           WILTING POINT               =     0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =     0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.699999988000     CM/SEC
           SLOPE                       =     1.20   PERCENT
           DRAINAGE LENGTH             =   255.0    FEET


                                  LAYER  6
                                  --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                         MATERIAL TEXTURE NUMBER  35
           THICKNESS                   =     0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 1100. FEET.

SCS RUNOFF CURVE NUMBER	=	78.90
FRACTION OF AREA ALLOWING RUNOFF	=	0.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000 ACRES
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.507 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.710 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770 INCHES
INITIAL SNOW WATER	=	0.000 INCHES
INITIAL WATER IN LAYER MATERIALS	=	52.808 INCHES
TOTAL INITIAL WATER	=	52.808 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	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	10.0 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

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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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.790	1.735	2.531	2.185	2.927	4.929
	4.993	4.632	4.042	2.704	1.837	1.411
STD. DEVIATIONS	0.866	0.998	1.209	1.214	1.869	1.612
	1.370	1.482	0.914	1.044	0.884	0.897
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.1055	0.0924	0.0922	0.0953	0.0973	0.1023
	0.1306	0.1372	0.1354	0.1366	0.1213	0.1122
STD. DEVIATIONS	0.0177	0.0205	0.0246	0.0339	0.0319	0.0317
	0.0333	0.0289	0.0237	0.0245	0.0220	0.0163

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.5320	0.4900	0.3687	0.9108	0.6841	0.9953
	2.3106	2.4984	2.5089	2.3382	1.5112	0.7498
STD. DEVIATIONS	0.7967	0.7345	0.5278	1.4909	0.9129	1.2873
	1.8011	1.9708	1.8588	1.8894	1.5769	0.8966

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	1.0718	0.9577	1.0513	1.0577	1.1020	1.0585
	1.1249	1.1351	1.1138	1.1525	1.0869	1.1218
STD. DEVIATIONS	0.2693	0.3025	0.3249	0.2408	0.2244	0.2016
	0.1290	0.1239	0.0360	0.0284	0.1834	0.1963

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.1640	1.1910	0.8530	1.7719	1.4408	1.9731
	4.1836	4.4900	4.6180	4.2429	2.9822	1.6045
STD. DEVIATIONS	1.4969	1.5636	1.0676	2.4354	1.6944	2.1977
	2.7352	2.9652	2.7463	2.7691	2.5289	1.6305

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1852	0.1813	0.1816	0.1888	0.1904	0.1890
	0.1943	0.1961	0.1988	0.1991	0.1940	0.1938
STD. DEVIATIONS	0.0465	0.0571	0.0561	0.0430	0.0388	0.0360
	0.0223	0.0214	0.0064	0.0049	0.0327	0.0339

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	35.717	(5.2175)	129653.45	67.266
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.35835	(0.17989)	4930.794	2.55817
PERCOLATION/LEAKAGE THROUGH LAYER 4	15.89804	(7.52855)	57709.891	29.94075
AVERAGE HEAD ON TOP OF LAYER 4	2.543	(1.032)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	13.03411	(1.64379)	47313.805	24.54711
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.073	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.191	(0.024)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.989	(7.5144)	10848.50	5.628

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00928	33.69613
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.547011	1985.65027
AVERAGE HEAD ON TOP OF LAYER 4	18.395	
MAXIMUM HEAD ON TOP OF LAYER 4	21.991	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	120.3 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.03734	135.56108
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.385	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	9.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0770

*** 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	35.2807	0.2940
2	4.9366	0.2057
3	0.2550	0.8500
4	0.0000	0.0000
5	86.0848	430.4240
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              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\FTDRUM.D4
TEMPERATURE DATA FILE:       C:\HELP\CASE2.D7
SOLAR RADIATION DATA FILE:   C:\HELP\CASE2.D13
EVAPOTRANSPIRATION DATA:     C:\HELP\CASE2.D11
SOIL AND DESIGN DATA FILE:   C:\HELP\14CASE2N.D10
OUTPUT DATA FILE:            C:\HELP\14CASE2N.OUT


TIME:  11:14     DATE:   4/18/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
          THICKNESS                  =    960.00   INCHES
          POROSITY                   =      0.6710 VOL/VOL
          FIELD CAPACITY             =      0.2920 VOL/VOL
          WILTING POINT              =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2900 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     24.00   INCHES
          POROSITY                   =      0.4170 VOL/VOL
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          FIELD CAPACITY             =      0.0450 VOL/VOL
          WILTING POINT              =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.1241 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      0.30   INCHES
          POROSITY                   =      0.8500 VOL/VOL
          FIELD CAPACITY             =      0.0100 VOL/VOL
          WILTING POINT              =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.8203 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.715000033000E-01 CM/SEC
          SLOPE                      =      1.10   PERCENT
          DRAINAGE LENGTH            =    255.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
          THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      0.20   INCHES
          POROSITY                   =      0.8500 VOL/VOL
          FIELD CAPACITY             =      0.0100 VOL/VOL
          WILTING POINT              =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.509999990000     CM/SEC
          SLOPE                      =      1.10   PERCENT
          DRAINAGE LENGTH            =    255.0    FEET


                                LAYER  6
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
          THICKNESS                  =      0.06   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  7
                          --------

                 TYPE 3 - BARRIER SOIL LINER
                 MATERIAL TEXTURE NUMBER  17
     THICKNESS                    =      0.25   INCHES
     POROSITY                     =      0.7500 VOL/VOL
     FIELD CAPACITY               =      0.7470 VOL/VOL
     WILTING POINT                =      0.4000 VOL/VOL
     INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
     EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC
```

```
                          LAYER  8
                          --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   5
     THICKNESS                    =    120.00   INCHES
     POROSITY                     =      0.4570 VOL/VOL
     FIELD CAPACITY               =      0.1310 VOL/VOL
     WILTING POINT                =      0.0580 VOL/VOL
     INITIAL SOIL WATER CONTENT   =      0.1310 VOL/VOL
     EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
           SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
           POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
           AND A SLOPE LENGTH OF  800. FEET.

   SCS RUNOFF CURVE NUMBER            =     71.50
   FRACTION OF AREA ALLOWING RUNOFF   =     50.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
   EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE  =      1.617  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
   INITIAL SNOW WATER                 =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS   =    297.735  INCHES
   TOTAL INITIAL WATER                =    297.735  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                  =   1.00
       START OF GROWING SEASON (JULIAN DATE)    =      0
       END OF GROWING SEASON (JULIAN DATE)      =    367
       EVAPORATIVE ZONE DEPTH                   =  12.0  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
```

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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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.011	0.000	0.090	0.002	0.031	0.048
	0.041	0.150	0.065	0.021	0.051	0.013
STD. DEVIATIONS	0.030	0.002	0.297	0.007	0.077	0.081
	0.116	0.369	0.208	0.063	0.176	0.049
EVAPOTRANSPIRATION						
TOTALS	1.798	2.212	2.840	2.502	3.167	5.575
	5.550	5.181	4.404	3.076	1.892	1.369
STD. DEVIATIONS	0.814	0.941	1.358	1.522	1.999	1.637
	1.680	1.555	0.958	1.146	0.978	0.798

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1448	0.1231	0.1210	0.1090	0.1140	0.1077
	0.1300	0.1559	0.1574	0.1663	0.1610	0.1581
STD. DEVIATIONS	0.0410	0.0442	0.0512	0.0517	0.0585	0.0519
	0.0558	0.0472	0.0354	0.0343	0.0330	0.0382

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8409	0.6607	0.4012	0.4096	0.5384	0.3225
	0.9534	1.3950	1.3870	1.5046	1.5184	1.1503
STD. DEVIATIONS	1.0800	0.7954	0.6513	0.6108	0.9096	0.4850
	0.9663	1.0208	1.0094	1.1317	1.2382	1.2871

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7318	0.6625	0.7251	0.7091	0.7295	0.6998
	0.7495	0.7334	0.7225	0.7517	0.7262	0.7496
STD. DEVIATIONS	0.1598	0.1640	0.1832	0.1519	0.1674	0.1530
	0.1279	0.1547	0.0985	0.1179	0.1207	0.1294

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.3658	1.1969	0.6970	0.7188	0.8917	0.5806
	1.5234	2.2025	2.2627	2.3623	2.4512	1.8302
STD. DEVIATIONS	1.6310	1.3420	1.0029	0.9797	1.3888	0.7695
	1.4739	1.5287	1.5552	1.6725	1.8784	1.9156

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1893	0.1878	0.1876	0.1895	0.1887	0.1871
	0.1939	0.1897	0.1931	0.1944	0.1941	0.1939
STD. DEVIATIONS	0.0413	0.0463	0.0474	0.0406	0.0433	0.0409
	0.0331	0.0400	0.0263	0.0305	0.0323	0.0335

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.521	(0.6279)	1893.04	0.982
EVAPOTRANSPIRATION	39.567	(5.7499)	143626.55	74.516
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.64839	(0.35644)	5983.638	3.10440
PERCOLATION/LEAKAGE THROUGH LAYER 4	11.08198	(5.73236)	40227.574	20.87066
AVERAGE HEAD ON TOP OF LAYER 4	1.507	(0.736)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.69068	(1.29995)	31547.160	16.36714
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.073	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.191	(0.029)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.671	(6.8916)	9696.67	5.031

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	1.446	5250.4331
DRAINAGE COLLECTED FROM LAYER 3	0.00658	23.89427
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.129717	470.87198
AVERAGE HEAD ON TOP OF LAYER 4	5.769	
MAXIMUM HEAD ON TOP OF LAYER 4	8.028	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	77.6 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02494	90.53751
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.383	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0770

*** 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	285.3067	0.2972
2	4.4932	0.1872
3	0.2550	0.8500
4	0.0000	0.0000
5	71.9099	359.5493
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
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\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE3.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE3.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE3.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE3N.D10
OUTPUT DATA FILE:           C:\HELP\14CASE3N.OUT


TIME:  11:49     DATE:   4/18/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

******************************************************************************


     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  18
           THICKNESS                 =   1800.00   INCHES
           POROSITY                  =      0.6710 VOL/VOL
           FIELD CAPACITY            =      0.2920 VOL/VOL
           WILTING POINT             =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2910 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  1.80
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =     24.00   INCHES
           POROSITY                  =      0.4170 VOL/VOL
```



```
           FIELD CAPACITY            =      0.0450 VOL/VOL
           WILTING POINT             =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.1265 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.30   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.8091 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.734999999000E-01 CM/SEC
           SLOPE                     =      1.10   PERCENT
           DRAINAGE LENGTH           =    255.0    FEET


                                  LAYER  4
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                 =      0.20   INCHES
           POROSITY                  =      0.8500 VOL/VOL
           FIELD CAPACITY            =      0.0100 VOL/VOL
           WILTING POINT             =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.500000000000     CM/SEC
           SLOPE                     =      1.10   PERCENT
           DRAINAGE LENGTH           =    255.0    FEET


                                  LAYER  6
                                  --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  35
           THICKNESS                 =      0.06   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  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                  =      0.25   INCHES
POROSITY                   =      0.7500 VOL/VOL
FIELD CAPACITY             =      0.7470 VOL/VOL
WILTING POINT              =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.300000003000E-08 CM/SEC
```

```
                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   5
THICKNESS                  =    120.00   INCHES
POROSITY                   =      0.4570 VOL/VOL
FIELD CAPACITY             =      0.1310 VOL/VOL
WILTING POINT              =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT =      0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
```

```
          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #18 WITH A
         POOR STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  600. FEET.

SCS RUNOFF CURVE NUMBER            =     71.90
FRACTION OF AREA ALLOWING RUNOFF   =     70.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =      1.000  ACRES
EVAPORATIVE ZONE DEPTH             =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =      1.617  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =      8.052  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =      0.924  INCHES
INITIAL SNOW WATER                 =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS   =    543.070  INCHES
TOTAL INITIAL WATER                =    543.070  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                 =   1.00
START OF GROWING SEASON (JULIAN DATE)   =      0
END OF GROWING SEASON (JULIAN DATE)     =    367
EVAPORATIVE ZONE DEPTH                  =  12.0  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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.016	0.001	0.125	0.003	0.045	0.072
	0.061	0.219	0.094	0.032	0.074	0.019
STD. DEVIATIONS	0.044	0.003	0.405	0.010	0.113	0.120
	0.169	0.531	0.300	0.093	0.253	0.072
EVAPOTRANSPIRATION						
TOTALS	1.798	2.210	2.846	2.504	3.168	5.568
	5.551	5.179	4.407	3.071	1.892	1.373
STD. DEVIATIONS	0.813	0.942	1.363	1.520	2.001	1.631
	1.682	1.556	0.957	1.144	0.979	0.796

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1481	0.1270	0.1247	0.1128	0.1168	0.1099
	0.1315	0.1581	0.1599	0.1689	0.1640	0.1615
STD. DEVIATIONS	0.0423	0.0461	0.0534	0.0543	0.0597	0.0536
	0.0567	0.0484	0.0359	0.0341	0.0329	0.0388

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8508	0.7329	0.4155	0.4424	0.5378	0.3081
	0.8862	1.3152	1.3172	1.4000	1.4470	1.1189
STD. DEVIATIONS	1.0793	0.8486	0.6562	0.6990	0.8795	0.4605
	0.9111	0.9472	0.9415	1.0385	1.1260	1.2081

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7181	0.6498	0.7110	0.6920	0.7125	0.6837
	0.7350	0.7220	0.7083	0.7370	0.7120	0.7349
STD. DEVIATIONS	0.1547	0.1600	0.1790	0.1588	0.1669	0.1554
	0.1259	0.1435	0.0969	0.1149	0.1181	0.1267

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.3616	1.2940	0.7110	0.7572	0.8799	0.5508
	1.4040	2.0604	2.1321	2.1907	2.3286	1.7660
STD. DEVIATIONS	1.6055	1.4051	0.9969	1.0961	1.3255	0.7225
	1.3727	1.4121	1.4417	1.5352	1.7144	1.7855

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1895	0.1879	0.1876	0.1887	0.1880	0.1864
	0.1939	0.1905	0.1931	0.1945	0.1941	0.1939
STD. DEVIATIONS	0.0408	0.0461	0.0472	0.0433	0.0440	0.0424
	0.0332	0.0379	0.0264	0.0303	0.0322	0.0334

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.761	(0.8899)	2763.19	1.434
EVAPOTRANSPIRATION	39.568	(5.7468)	143632.02	74.518
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.68310	(0.36770)	6109.657	3.16978
PERCOLATION/LEAKAGE THROUGH LAYER 4	10.77196	(5.46534)	39102.227	20.28682
AVERAGE HEAD ON TOP OF LAYER 4	1.453	(0.700)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.51651	(1.28432)	30914.924	16.03913
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.073	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.191	(0.029)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.569	(6.7333)	9327.07	4.839

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	1.934	7020.4219
DRAINAGE COLLECTED FROM LAYER 3	0.00664	24.09583
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.119803	434.88516
AVERAGE HEAD ON TOP OF LAYER 4	5.396	
MAXIMUM HEAD ON TOP OF LAYER 4	7.603	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	75.4 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02445	88.76227
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.383	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	10.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6535

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0770

*** 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	531.6869	0.2954
2	4.4709	0.1863
3	0.2550	0.8501
4	0.0000	0.0000
5	67.8329	339.1643
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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**              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\FTDRUM.D4
TEMPERATURE DATA FILE:      C:\HELP\CASE4.D7
SOLAR RADIATION DATA FILE:  C:\HELP\CASE4.D13
EVAPOTRANSPIRATION DATA:    C:\HELP\CASE4.D11
SOIL AND DESIGN DATA FILE:  C:\HELP\14CASE4N.D10
OUTPUT DATA FILE:           C:\HELP\14CASE4N.OUT


TIME:  12: 3     DATE:   4/18/2016


******************************************************************************

     TITLE:  JED Solid Waste Management Facility

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     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  18
           THICKNESS                  =   2640.00   INCHES
           POROSITY                   =      0.6710 VOL/VOL
           FIELD CAPACITY             =      0.2920 VOL/VOL
           WILTING POINT              =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2913 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
                                   --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.4170 VOL/VOL
```



```
           FIELD CAPACITY             =      0.0450 VOL/VOL
           WILTING POINT              =      0.0180 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1262 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.100000005000E-02 CM/SEC


                                   LAYER  3
                                   --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.30   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8068 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.733999982000E-01 CM/SEC
           SLOPE                      =      1.00   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  4
                                   --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 2 - LATERAL DRAINAGE LAYER
                      MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      0.20   INCHES
           POROSITY                   =      0.8500 VOL/VOL
           FIELD CAPACITY             =      0.0100 VOL/VOL
           WILTING POINT              =      0.0050 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.8500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.560000002000     CM/SEC
           SLOPE                      =      1.00   PERCENT
           DRAINAGE LENGTH            =    255.0    FEET


                                   LAYER  6
                                   --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                      MATERIAL TEXTURE NUMBER  35
           THICKNESS                  =      0.06   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 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	120.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	57.30	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.537	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.052	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.924	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	788.262	INCHES
TOTAL INITIAL WATER	=	788.262	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	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	0
END OF GROWING SEASON (JULIAN DATE)	=	367
EVAPORATIVE ZONE DEPTH	=	12.0 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

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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	3.92	2.61	4.64	7.88
	7.14	7.68	6.58	3.33	2.61	2.23
STD. DEVIATIONS	1.68	1.68	3.65	1.76	3.99	3.97
	3.81	3.77	3.81	3.24	1.90	1.87
RUNOFF						
TOTALS	0.000	0.000	0.038	0.000	0.003	0.002
	0.008	0.059	0.024	0.001	0.020	0.001
STD. DEVIATIONS	0.000	0.000	0.177	0.000	0.014	0.008
	0.044	0.193	0.124	0.007	0.077	0.002
EVAPOTRANSPIRATION						
TOTALS	1.782	2.385	2.791	2.504	3.213	5.606
	5.551	5.240	4.393	3.090	1.907	1.310
STD. DEVIATIONS	0.750	0.979	1.409	1.531	1.997	1.609
	1.713	1.536	1.019	1.181	1.038	0.822

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1380	0.1196	0.1181	0.1056	0.1090	0.1018
	0.1213	0.1445	0.1463	0.1562	0.1519	0.1490
STD. DEVIATIONS	0.0369	0.0404	0.0466	0.0461	0.0525	0.0479
	0.0502	0.0428	0.0314	0.0243	0.0265	0.0325

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.8815	0.8259	0.5126	0.4442	0.5644	0.3172
	0.9222	1.3288	1.3268	1.4555	1.4954	1.1309
STD. DEVIATIONS	1.0888	0.9372	0.7702	0.6901	0.9087	0.4497
	0.9169	0.9464	0.9419	1.0142	1.0863	1.1778

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7312	0.6617	0.7241	0.7047	0.7277	0.7098
	0.7486	0.7480	0.7258	0.7505	0.7250	0.7483
STD. DEVIATIONS	0.1575	0.1625	0.1818	0.1615	0.1688	0.1433
	0.1273	0.1303	0.0875	0.1165	0.1201	0.1288

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.4084	1.4452	0.8591	0.7642	0.9218	0.5702
	1.4592	2.0830	2.1515	2.2777	2.4083	1.7912
STD. DEVIATIONS	1.6206	1.5407	1.1648	1.0803	1.3700	0.7105
	1.3846	1.4132	1.4424	1.5007	1.6546	1.7413

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.1895	0.1879	0.1876	0.1887	0.1886	0.1900
	0.1940	0.1938	0.1944	0.1945	0.1941	0.1939
STD. DEVIATIONS	0.0408	0.0460	0.0471	0.0432	0.0438	0.0384
	0.0330	0.0338	0.0234	0.0302	0.0322	0.0334

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1975 THROUGH 2004

	INCHES		CU. FEET	PERCENT
PRECIPITATION	53.10	(10.929)	192747.0	100.00
RUNOFF	0.155	(0.3383)	563.67	0.292
EVAPOTRANSPIRATION	39.774	(5.8256)	144379.92	74.906
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.56139	(0.30831)	5667.850	2.94057
PERCOLATION/LEAKAGE THROUGH LAYER 4	11.20547	(5.67510)	40675.852	21.10324
AVERAGE HEAD ON TOP OF LAYER 4	1.512	(0.727)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.70537	(1.27950)	31600.506	16.39482
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00002	(0.00000)	0.074	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.191	(0.028)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00002	(0.00002)	0.073	0.00004
CHANGE IN WATER STORAGE	2.902	(7.0847)	10534.76	5.466

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PEAK DAILY VALUES FOR YEARS 1975 THROUGH 2004

	(INCHES)	(CU. FT.)
PRECIPITATION	9.00	32670.000
RUNOFF	0.967	3509.6682
DRAINAGE COLLECTED FROM LAYER 3	0.00603	21.88727
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.119934	435.35864
AVERAGE HEAD ON TOP OF LAYER 4	5.404	
MAXIMUM HEAD ON TOP OF LAYER 4	7.476	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	78.6 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.02490	90.37802
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00021
AVERAGE HEAD ON TOP OF LAYER 6	0.200	
MAXIMUM HEAD ON TOP OF LAYER 6	0.382	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	11.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000038	0.13716
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6229
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** 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	779.6431	0.2953
2	4.3492	0.1812
3	0.2550	0.8501
4	0.0000	0.0000
5	75.1708	375.8542
6	0.0000	0.0000
7	0.1875	0.7500
8	15.7200	0.1310
SNOW WATER	0.000	

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ATTACHMENT C
Spreadsheets for Computation of Heads Using Giroud's Method

CELLS 14 & 15 (Exterior Portion) - Case 1 with Leachate Recirculation

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}) =	***1.8535***	cm/s	$k_1 = k_b$ =	0.061 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.40***	%			
Liquid Impingement Rate = qh =	***2.1838***	in/month	7.02E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.41E-04 m²/s	1.52E-03 ft²/s	
Slope angle (β)=	0.802 deg	0.014 rad	
Length of Upstream Section (L_u) =	303.1 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.006		
Characteristic Parameter = $\lambda_2 = \lambda_t$	10.918		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99** inches	(Equation 38)

CELLS 14 & 15 (Exterior Portion) - Case 2 with Leachate Recirculation

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}) =	***1.7041***	cm/s	$k_1 = k_b$ =	0.056 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.20***	%			
Liquid Impingement Rate = qh =	***1.7382***	in/month	5.59E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.30E-04 m²/s	1.40E-03 ft²/s	
Slope angle (β)=	0.688 deg	0.012 rad	
Length of Upstream Section (L_u) =	300.1 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.007		
Characteristic Parameter = $\lambda_2 = \lambda_t$	11.829		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99** inches	(Equation 38)

<u>CELLS 14 & 15 (Exterior Portion) - Case 3 with Leachate Recirculation</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}) =	***1.6239***	cm/s	$k_1 = k_b$ =	0.053 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.10***	%			
Liquid Impingement Rate = qh =	***1.5279***	in/month	4.91E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.24E-04 m²/s	1.33E-03 ft²/s		
Slope angle (β)=	0.630 deg	0.011 rad		
Length of Upstream Section (L_u) =	298.2 ft	(Equation 19)		
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.008			
Characteristic Parameter = $\lambda_2 = \lambda_t$	12.374	(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**N/A** inches	(Equation 21)

For L_u < L and λ_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 λ_t > 0.01, flow is in both the drainage layers (general case).

Does the general case apply?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**12.00** inches	(Equation 38)

CELLS 14 & 15 (Exterior Portion) - Case 4 with Leachate Recirculation

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}) = ***1.7144*** cm/s $k_1 = k_b$ = 0.056 ft/s

Geocomposite Thickness (t_1) = (t_b) = ***0.300*** in

Sand Permeability (k_2) = (k_t) = ***1.00E-03*** cm/s 3.3E-05 ft/s Check k1 or kb > k2 or kt

Drainage Length (L)= ***330*** ft

Slope (%) = ***1.00*** %

Liquid Impingement Rate = qh = ***1.4673*** in/month 4.72E-08 ft/s Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) = 1.31E-04 m²/s 1.41E-03 ft²/s

Slope angle (β)= 0.573 deg 0.010 rad

Length of Upstream Section (L_u) = 298.1 ft (Equation 19)

Characteristic Parameter = $\lambda_1 = \lambda_b$ 0.008

Characteristic Parameter = $\lambda_2 = \lambda_t$ 14.379 (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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A**	inches	(Equation 20)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**N/A**	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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00**	inches	(Equation 33)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**12.00**	inches	(Equation 38)

CELLS 14 & 15 (Exterior Portion) - Case 1 without Leachate Recirculation

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}) =	***0.5346***	cm/s	$k_1 = k_b$ =	0.018 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s		3.3E-05 ft/s	Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.40***	%			
Liquid Impingement Rate = qh =	***0.6949***	in/month		2.23E-08 ft/s	Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	4.07E-05 m²/s	4.38E-04 ft²/s	
Slope angle (β)=	0.802 deg	0.014 rad	
Length of Upstream Section (L_u) =	274.7 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.006		
Characteristic Parameter = $\lambda_2 = \lambda_t$	3.474		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**11.99** inches	(Equation 38)

CELLS 14 & 15 (Exterior Portion) - Case 2 without Leachate Recirculation

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}) =	***0.0526***	cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.20***	%			
Liquid Impingement Rate = qh =	***0.1122***	in/month	3.61E-09 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	4.01E-06 m²/s	4.31E-05 ft²/s	
Slope angle (β)=	0.688 deg	0.012 rad	
Length of Upstream Section (L_u) =	143.5 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.015		
Characteristic Parameter = $\lambda_2 = \lambda_t$	0.764		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.98** inches	(Equation 33)
		and	$h_{max} = (t_{max})\cdot\cos\beta$ =	**11.98** inches	(Equation 38)

<u>CELLS 14 & 15 (Exterior Portion) - Case 3 without Leachate Recirculation</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}) =	***0.0574*** cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300*** in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03*** cm/s		3.3E-05 ft/s	Check k1 or kb > k2 or kt
Drainage Length (L)=	***330*** ft			
Slope (%) =	***1.10*** %			
Liquid Impingement Rate = qh =	***0.1092*** in/month		3.51E-09 ft/s	Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	4.37E-06 m²/s	4.71E-05 ft²/s	
Slope angle (β)=	0.630 deg	0.011 rad	
Length of Upstream Section (L_u) =	147.5 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.015		
Characteristic Parameter = $\lambda_2 = \lambda_t$	0.884		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99** inches	(Equation 38)

<u>CELLS 14 & 15 (Exterior Portion) - Case 4 without Leachate Recirculation</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}) =	***0.057***	cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***330***	ft			
Slope (%) =	***1.00***	%			
Liquid Impingement Rate = qh =	***0.1006***	in/month	3.23E-09 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	4.34E-06 m²/s	4.68E-05 ft²/s	
Slope angle (β)=	0.573 deg	0.010 rad	
Length of Upstream Section (L_u) =	144.5 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.017		
Characteristic Parameter = $\lambda_2 = \lambda_t$	0.986		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 1 with Leachate Recirculation

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}) =	***1.5858***	cm/s	$k_1 = k_b$ =	0.052 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s		3.3E-05 ft/s	Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.20***	%			
Liquid Impingement Rate = qh =	***2.1247***	in/month		6.83E-08 ft/s	Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.21E-04 m²/s	1.30E-03 ft²/s	
Slope angle (β)=	0.688 deg	0.012 rad	
Length of Upstream Section (L_u) =	228.5 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.009		
Characteristic Parameter = $\lambda_2 = \lambda_t$	14.459		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 2 with Leachate Recirculation

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}) =	***1.3706***	cm/s	$k_1 = k_b$ =	0.045 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.10***	%			
Liquid Impingement Rate = qh =	***1.7072***	in/month	5.49E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	1.04E-04 m²/s	1.12E-03 ft²/s	
Slope angle (β)=	0.630 deg	0.011 rad	
Length of Upstream Section (L_u) =	225.3 ft	(Equation 19)	
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.010		
Characteristic Parameter = $\lambda_2 = \lambda_t$	13.826	(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 3 with Leachate Recirculation

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}) =	***1.1992***	cm/s	$k_1 = k_b$ =	0.039 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.10***	%			
Liquid Impingement Rate = qh =	***1.5088***	in/month	4.85E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	9.14E-05 m²/s	9.84E-04 ft²/s	
Slope angle (β)=	0.630 deg	0.011 rad	
Length of Upstream Section (L_u) =	223.0 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.010		
Characteristic Parameter = $\lambda_2 = \lambda_t$	12.219		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 4 with Leachate Recirculation

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}) =	***1.2638*** cm/s	$k_1 = k_b$ =	0.041 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300*** in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03*** cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255*** ft			
Slope (%) =	***1.00*** %			
Liquid Impingement Rate = qh =	***1.4471*** in/month	4.65E-08 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	9.63E-05 m²/s	1.04E-03 ft²/s	
Slope angle (β)=	0.573 deg	0.010 rad	
Length of Upstream Section (L_u) =	222.8 ft	(Equation 19)	
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.011		
Characteristic Parameter = $\lambda_2 = \lambda_t$	14.181	(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 1 without Leachate Recirculation

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}) =	***0.0422***	cm/s	$k_1 = k_b$ =	0.001 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.20***	%			
Liquid Impingement Rate = qh =	***0.1372***	in/month	4.41E-09 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	3.22E-06 m²/s	3.46E-05 ft²/s	
Slope angle (β)=	0.688 deg	0.012 rad	
Length of Upstream Section (L_u) =	94.2 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.022		
Characteristic Parameter = $\lambda_2 = \lambda_t$	0.934		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A**	inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A**	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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00**	inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00**	inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 2 without Leachate Recirculation

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}) =	***0.0715***	cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s		3.3E-05 ft/s	Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.10***	%			
Liquid Impingement Rate = qh =	***0.1663***	in/month		5.35E-09 ft/s	Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) = 5.45E-06 m²/s 5.86E-05 ft²/s

Slope angle (β)= 0.630 deg 0.011 rad

Length of Upstream Section (L_u) = 120.6 ft (Equation 19)

Characteristic Parameter = $\lambda_1 = \lambda_b$ 0.019

Characteristic Parameter = $\lambda_2 = \lambda_t$ 1.347 (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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A**	inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A**	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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99**	inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99**	inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 3 without Leachate Recirculation

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}) =	***0.0735***	cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.10***	%			
Liquid Impingement Rate = qh =	***0.1689***	in/month	5.43E-09 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	5.60E-06 m²/s	6.03E-05 ft²/s	
Slope angle (β)=	0.630 deg	0.011 rad	
Length of Upstream Section (L_u) =	122.1 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.019		
Characteristic Parameter = $\lambda_2 = \lambda_t$	1.368		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**11.99** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**11.99** inches	(Equation 38)

CELLS 14 & 15 (Interior Portion) - Case 4 without Leachate Recirculation

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}) =	***0.0734***	cm/s	$k_1 = k_b$ =	0.002 ft/s	
Geocomposite Thickness (t_1) = (t_b) =	***0.300***	in			
Sand Permeability (k_2) = (k_t) =	***1.00E-03***	cm/s	3.3E-05 ft/s		Check k1 or kb > k2 or kt
Drainage Length (L)=	***255***	ft			
Slope (%) =	***1.00***	%			
Liquid Impingement Rate = qh =	***0.1562***	in/month	5.02E-09 ft/s		Check qh < k2 or kt < k1 or kb

Miscellaneous Calculations and Conversions

Geocomposite Transmissivity (θ_1) = (θ_b) =	5.59E-06 m²/s	6.02E-05 ft²/s	
Slope angle (β)=	0.573 deg	0.010 rad	
Length of Upstream Section (L_u) =	119.9 ft		(Equation 19)
Characteristic Parameter = $\lambda_1 = \lambda_b$	0.021		
Characteristic Parameter = $\lambda_2 = \lambda_t$	1.531		(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?	No	Therefore,	$t_{max} = t_{maxb}$ =	**N/A** inches	(Equation 20)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**N/A** 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?	Yes	Therefore,	$t_{max} = t_b + t_{maxt}$ =	**12.00** inches	(Equation 33)
		and	$h_{max} = (t_{max}) \cdot \cos\beta$ =	**12.00** inches	(Equation 38)

Appendix G

Revised Technical Specifications

CRAIG R. BROWNE
LICENSE
No. 68613
STATE OF
FLORIDA
PROFESSIONAL ENGINEER
6/15/2016

SECTION 02740

GEOCOMPOSITES

PART 1 GENERAL

1.01 SCOPE

A. This section includes requirements for primary and secondary geocomposite drainage layer products and installation.

1.02 RELATED SECTIONS AND PLANS

A. Section 02240 – Protective Soil Layer

B. Section 02770 – Geomembrane

C. Section 02780 – Geosynthetic Clay Liner

D. Section 02790 – Interface Friction Conformance Testing

E. 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 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 Tables 02740-1 through 02740-4; and
3. projected geocomposite delivery dates.

B. 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.

C. 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 drainage layers will be monitored by the CQA Consultant as required by the CQA Plan.

B. The CQA Consultant will perform material conformance testing of the geocomposites 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 primary and secondary leachate collection drainage layer having properties meeting the required property values shown in Tables 02740-1 and 02740-2. 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 Tables 02740-1 and 02740-2, 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 Tables 02740-1 and 02740-2 as tested by an approved testing laboratory. The transmissivity of the geocomposites for liner 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 primary and secondary geocomposites used in the bottom liner system shall be tested using the actual boundary materials intended for each geocomposite at the normal loads of 700 and 15,000 pounds per square foot (psf). At the normal load of 700 psf, testing shall be conducted for a minimum period of 24 hours. At the normal load of 15,000 psf, testing shall be conducted for a minimum period of 100 hours unless project-specific data equivalent to the 100-hour period is provided in which case the test shall be conducted for a minimum period of 1 hour.

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 Tables 02740-1 and 02740-2. Perform as a minimum, the following manufacturing quality control tests at a minimum frequency of once per 100,000 square feet with a 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
Static (CBR) 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 Tables 02740-1 and 02740-2.

D. Perform manufacturing quality control tests to demonstrate that the geonet drainage core properties conform to the values specified in Tables 02740-1 and 02740-2. 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 Tables 02740-1 and 02740-2.

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 with the high transmissivity direction (usually the roll direction) in the downgradient direction and perpendicular to elevation contours.

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
PRIMARY GEOCOMPOSITE PROPERTY VALUES (CELLS 14 & 15 ONLY)

PROPERTIES [4]	QUALIFIER	UNITS	SPECIFIED VALUES [1]	TEST METHOD
Geonet Component:				
Polymer composition	Minimum	%	95 polyethylene by wt	--
Polymer density	Minimum	g/cm^3	0.93	ASTM D 792 (Method B) or ASTM D 1505
Carbon black content	Range	%	2 - 3	ASTM D 1603 or 4218
Nominal thickness	Minimum	mil	200	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 tensile strength	Minimum	lb	200	ASTM D 4632 [2]
Trapezoidal tear strength	Minimum	lb	75	ASTM D 4533 [2]
CBR puncture strength	Minimum	psi	500	ASTM D 6241
Geocomposite:				
Transmissivity	Minimum	m^2/s	See note 3	ASTM D 4716
Ply Adhesion	Minimum	lb/in	1.0	ASTM D 7005

Notes:

1. All values represent minimum average roll values (with the exception of apparent opening size, which is a maximum average roll value).
2. Minimum value measured in machine and cross-machine direction.
3. The design transmissivity of the primary geocomposite drainage layer for Cells 14 and 15 is measured using water at a gradient of 0.014 under compressive stresses of 700 psf and of 15,000 psf for a period of 24 hours and 100 hours, respectively. For the test, the primary geocomposite shall be sandwiched between 60-mil textured HDPE geomembrane and soil actually used for the liner protective layer. The minimum required transmissivities are 6.5×10^{-4} m^2/s and 1.0×10^{-3} m^2/s under the compressive stresses of 700 psf and 15,000 psf, respectively.
4. See Paragraph 2.02 for required MQC test frequencies.

TABLE 02740-2
SECONDARY GEOCOMPOSITE PROPERTY VALUES (CELLS 14 & 15 ONLY)

PROPERTIES (4)	QUALIFIER	UNITS	SPECIFIED VALUES (1)	TEST METHOD
Geonet Component:				
Polymer composition	Minimum	%	95 polyethylene by wt	--
Polymer density	Minimum	g/cm^3	0.93	ASTM D 792 (Method B) or ASTM D 1505
Carbon black content	Range	%	2 - 3	ASTM D 1603 or 4218
Nominal thickness	Minimum	mil	200	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	6	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 tensile strength	Minimum	lb	160	ASTM D 4632 (2)
Trapezoidal tear strength	Minimum	lb	65	ASTM D 4533 (2)
CBR puncture strength	Minimum	psi	435	ASTM D 6241
Geocomposite:				
Transmissivity	Minimum	m^2/s	See note 3	ASTM D 4716
Ply Adhesion	Minimum	lb/in	1.0	ASTM D 7005

Notes:

1. All values represent minimum average roll values (with the exception of apparent opening size, which is a maximum average roll value).
2. Minimum value measured in machine and cross-machine direction.
3. The design transmissivity of the secondary geocomposite drainage layer for Cells 14 and 15 is measured using water at a gradient of 0.014 under compressive stresses of 700 psf and of 15,000 psf for a period of 24 hours and 100 hours, respectively. For the test, the secondary geocomposite shall be sandwiched between two 60-mil textured HDPE geomembranes. The minimum required transmissivities are 2.0×10^{-4} m^2/s and 3.6×10^{-4} m^2/s under the compressive stresses of 700 psf and 15,000 psf, respectively.
4. 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 11.3° assuming no cohesion. ~~The large-displacement internal shear strength envelope for the GCL shall exceed an envelope characterized by an effective friction angle of 6.5° 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	~~100,000~~270,000 sq. ft
Tensile/Grab strength	~~45,000~~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]

Appendix H

Financial Assurance

Geosyntec consultants

COMPUTATION COVER SHEET

Client: **Omni Waste of Osceola County, LLC** Project: **Class I Landfill Permit Renewal** Project No.: **FL2786**

Phase No.: **01**

Title of Computations **FINANCIAL ASSURANCE COST ESTIMATE**

Computations by: Signature

Printed Name Alex Rivera, P.E.

Title Engineer

Date 3-June-2016

Assumptions and Procedures Checked by: (peer reviewer) Signature

Printed Name Craig Browne, P.E.

Title Senior Engineer

Date 8-June-2016

Computations Checked by: Signature

Printed Name Craig Browne, P.E.

Title Senior Engineer

Date 8-June-2016

Computations Backchecked by: (originator) Signature

Printed Name Alex Rivera, P.E.

Title Engineer

Date 9-June-2016

Approved by: (pm or designate) Signature

Printed Name Craig Browne, P.E.

Title Senior Engineer

Date 14-June-2016

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 Omni Waste of Osceola County, LLC. (Omni), Geosyntec Consultants (Geosyntec) has prepared the financial assurance cost estimate (Estimate) in support of the construction permit renewal 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 DEP Form 62-701.900(28), hereafter referred to as FDEP form. The items listed below were derived from item/unit pricing from contractors and Geosyntec's experience with similar projects. For engineering and professional time, current Geosyntec labor rates and/or State and federal guidelines were used. The unit costs/labor rates were then used to prepare the costs presented in the FDEP form. All estimated costs are for all construction and laboratory analytical testing to be performed by a third party. The item numbers noted below correspond to the item numbers on the FDEP form.

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 cells that are projected to be constructed over the 10-year renewal permit period, which includes construction through Cells 14 and 15 of Phase 5. The total two-dimensional (2D) area of these cells is approximately 208.4 acres. Of this total area, 43.8 acres has been closed as of May 2016, which leaves 164.6 acres remaining to be closed. The closure cost estimate (for 164.6 acres) and long-term care cost estimate (for 208.4 acres) are included on the FDEP form in **Attachment 1**.

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

Omni maintains an insurance certificate to meet the financial assurance obligations of the JED facility.

III. Estimate Adjustment

This financial assurance cost estimate represents a recalculated cost estimate as required for solid waste permit renewals.

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 is included as part of the closure cost estimate.

2. Slope and Fill (bedding layer between waste and barrier layer)

During closure of the Class I area, an intermediate layer of cover soil, approximately 12 inch (in.) thick, will be used for grading the surface of the waste. For the approximately 164.6-acre disposal area that needs to be closed, approximately 31.3 acres cover the top deck area and approximately 133.3 acres cover the side slope area as presented in **Figure 1**. Utilizing the slope correction factors, the estimated cubic yardage for the intermediate layer of cover soil is 277,219 cubic yards (CY) (i.e., 31.3 acres × 1.001 × 1 foot (ft) plus 133.3 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 2**).

The total cost for material handling, placement, spreading, and compaction is:

277,219 CY @ $3.75/CY = **$1,039,571.25**

3. Cover Material (Barrier Layer)

The barrier layer of the final cover system consists of a 40-mil 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 164.6-acre closure area, approximately 831,655 square yards (SY) (i.e., 31.3 acres × 1.001 plus 133.3 acres × 1.054) of 40-mil thick textured PE geomembrane will be needed. Also, approximately 133.3 acres of the closure area consists of side slopes that will require 680,012 SY (i.e., 133.3 acres × 1.054) of geocomposite drainage layer in the final cover system. The material and installation costs for the geomembrane and geocomposite are $0.20 per square foot (SF) or $5.40/SY and $0.25/SF or $6.75/SY, respectively, as obtained from Comanco (see **Attachment 2**).

The total cost for construction of the barrier layer is:

831,655 SY of 40-mil textured PE geomembrane @ $5.40/SY = $4,490,937.00

680,012 SY of geocomposite drainage layer @ $6.75/SY = $4,590,081.00

Total cost = **$9,081,018.00**

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 554,437 CY (i.e., 31.3 acres × 1.001 × 2 ft plus 133.3 acres × 1.054 × 2 ft) for the 164.6-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 2**. The total cost for the top soil cover is:

554,437 CY of on-site soil material @ $4.50/CY = **$2,494,966.50**

5. Vegetative Layer

Approximately 831,655 SY of sod (i.e., 31.3 acres × 1.001 plus 133.3 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 2**).

The total cost for sodding the final cover system is:

831,655 SY @ $2.70/SY **= $2,245,468.50**

6. Stormwater Control System

The perimeter and site storm water 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. Storm water control components for the closure will include top deck berms, seepage header piping, corrugated HDPE pipe downdrains, and concrete structures.

The earthwork required to construct the top area berms, sideslope drainage swales (calculated based on the typical cross-section detail for the drainage swale from the 2011 ERP Application drawings and using the average depth of the swale = 20.6 SF per linear foot of swale), and final cover system at downchutes will require approximately 45,243 CY of earthwork (2,953 CY + 30,412 CY + 11,878 CY = 45,243 CY). The earthwork price includes excavation, backfilling and placing the material at a unit cost of $3.00/CY, and is based on cost information provided by Comanco (**Attachment 2**).

Based on the proposed design, there is approximately 15,950 and 2,300 linear feet of 24-in. and 30-in. diameter, respectively, of corrugated HDPE piping/downdrains to drain the closure area slopes. Lengths of 24-in. and 30-in. diameter pipe represent plan dimensions with 10 percent slope and bench correction applied (i.e., 14,500 linear feet × 1.10 plus 2091 linear feet

× 1.10). The price to install the 24-in. and 30-in. diameter pipe is $35.00 and $46.00 per ft, respectively, as provided by Comanco (**Attachment 2**). Also, approximately 49,656 ft of 4-in. diameter HDPE corrugated drainage pipe will be installed as part of the final cover system. The material and installation cost, including a 3-ft wide strip of geomembrane used to wrap the 4-in. diameter drainage pipe, is $8.31 per linear foot as estimated in the *Financial Assurance Cost Estimates Update Construction of Cell 13 Disposal Area* (Cell 13 Estimate) (Kimley-Horn and Associates, Inc., March 2016).

A concrete pad and grate 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 106 concrete pads 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 $2,398.53 per "wye" connection (see the Cell 13 Estimate).

All concrete drainage inlets and outfall piping at the perimeter road are installed during cell construction, though it is assumed that concrete structures will be installed along the south slope (Cells 14 and 15) as part of closure activities. A total of 8 concrete structures are estimated at a unit price of $12,000.00 each as provided by Comanco (**Attachment 2**). Concrete thrust blocks will be installed within each downdrain pipe at side slope benches and at the landfill toe. The unit price of $2,800.00 each was provided by Comanco (**Attachment 2**).

At the 30-in. diameter pipe entrances (located at the crest) a total of 51 CY of riprap may be required for erosion protection. The unit price for material and installation of riprap is $153.00 per CY as provided by Comanco in **Attachment 2**.

The cost for construction of the storm water control components of the final cover system is:

Earthwork: 45,243 CY @ $3.00/CY = $135,729.00

Piping/Downdrains: 24-in. diameter HDPE – 15,950 LF @ $35.00/LF = $558,250.00

30-in. diameter HDPE – 2,300 LF @ $46.00/LF = $105,800.00

4-in. diameter HDPE – 49,656 LF @ $8.31/LF = $412,641.36

"Wye" Connections: 108 @ $2,398.53 each = $259,041.24

Concrete Structures: 8 @ $12,000 each = $96,000.00

Concrete thrust blocks: 132 @ $2,800 each = $369,600.00

Riprap: 51 CY @ $153.00/CY = $7,803.00

Total cost = **$1,944,864.60**

7. Gas Controls: Passive

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. Gas Control: Active Extraction

The 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 will already be installed prior to closure as part of operating costs of the landfill. As provided by Comanco in **Attachment 2**, the cost of installation of the remaining components can be estimated as follows:

- $130 per linear foot of well (includes solid well casing and perforated zone casing);
- $900 per wellhead;
- $28.00 per linear foot of lateral pipe (8 in. diameter);
- $39.00 per linear foot of header pipe (12 in. diameter); and
- $68.00 per linear foot of perimeter header pipe (18 in. diameter).

The final components of the GCCS will include:

- 132 wells – 41 shallow wells (average depth of 60 ft), 40 intermediate wells (average depth of 120 ft), and 51 deep wells (average depth of 180 ft);
- approximately 23,227 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 21,115 ft × 1.10 = 23,327 ft);
- approximately 7,134 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 6,485 ft × 1.10 = 7,134 ft); and
- 4,550 ft of 18-in. diameter SDR-17 HDPE perimeter header pipe.

The cost of the active gas collection system at closure is therefore:

132 wells @ $16,190.91 per well = $2,137,200.12

132 wellheads @ $900/wellhead = $118,800.00

23,227 ft of lateral pipe @ $28.00/ft = $650,356.00

7,134 ft of header pipe @ $39.00/ft = $278,226.00

4,550 ft of perimeter header pipe @ \$68.00/ft = \$309,400.00

Total gas control system cost= **\$3,493,982.12**

9. Security System

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. Engineering

The costs of engineering services related to closure of the site is estimated to be 10 percent of the construction cost (sum of items 1 through 9 above). This estimate is based on Geosyntec experience.

The total cost for closure-related engineering services is:

\$20,299,870.97 × 0.10 = **\$2,029,987.10**

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 × \$20,299,870.97 = \$608,996.13.

It is estimated that approximately 7 percent of construction cost will be needed for construction quality assurance (CQA), which equates to 0.07 × \$20,299,870.97 = \$1,420,990.97. It is noted that the entries in the FDEP form do not allow more than 6 digits, which necessitated adding costs on two lines (\$999,999 and \$420,992) for the CQA cost estimate.

Quality assurance testing is estimated to be \$50,000, based on the requirements of the CQA Plan, estimated quantities, and Geosyntec's experience.

12. Contingency

A contingency factor for closure costs of 10 percent is estimated.

13. Site Specific Costs

a. Mobilization

Contractor mobilization costs as provided by Comanco in **Attachment 2**, excluding the costs for professional services, are \$75,000.00.

V. Annual Cost for Long-Term Care

1. <u>Ground Water Monitoring</u>

Sampling of the projected 56 wells associated with the Class I sampling event is estimated to cost $15,660 per event. This cost is based on Geosyntec estimates and labor rates. The estimate for laboratory analytical testing is $427 per well based on the fee schedule provided by Environmental Conservation Laboratories, Inc. (ENCO) of Orlando, Florida (**Attachment 2**).

The total cost for monitoring the 56 wells projected to be in use for monitoring Phase 1 through Phase 5 at the JED facility is:

56 wells @ $427 analytical/well/event + $15,660/event =

$39,572.00/event or $706.64/well/event

2. <u>Surface Water Monitoring</u>

Surface water monitoring will be conducted at 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 $240 per event. This cost is based on Geosyntec estimates and labor rates and assumes that sampling would occur during the semi-annual ground water sample event and therefore mobilization and equipment fees are not included as part of this task. The estimate for laboratory analytical testing is $643 per monitoring point based on the fee schedule provided by ENCO (**Attachment 2**).

2 samples @ $643 analytical/location/event + $240/event =

$1,526.00/event or $763.00/well/event

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 technician ($74.00/hour) and assumed 29 hours to perform the monitoring at the estimated 29 gas probe locations.

The cost to perform the monitoring includes field and travel time.

- 29-hrs × $74.00/hr = $2,146.00
- Monitoring equipment rental and travel costs = $250.00/event
- Time to prepare report - 4 hrs @ $74.00/hr = $296.00

Total cost per monitoring event equals $2,146.00 + $250.00 + $296.00 = **$2,692.00/quarter**

Other gas and air monitoring costs required by the facility permits are listed below and shown as an annual cost in Section 3 of the FDEP form. Costs shown below are developed based on Geosyntec experience preparing similar reports.

- Title V Permit Reporting (AOR) – $7,000.00 (Annual)
- Visible Emissions and Sulfur Testing at Flare – $4,000.00 (Annual)
- Greenhouse Gas Reporting – $7,000.00 (Annual)

4. Leachate Monitoring

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 15 will require one primary and one secondary replacement pump once during the 30-year monitoring period:

- Annual maintenance = $533.32/year (Cell 13 Estimate) and
- Leachate pump replacement cost = $11,486.76 (Cell 13 Estimate) ÷ 30 years = $382.89/year

Therefore, the total estimated annual cost for pumps is **$916.21**/year.

Leachate Collection Pipe Cleaning: It is assumed that approximately 38,136 linear feet 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 38,136 ft × $0.58/ft = ($22,118.88/event x 3 events) ÷ 30 years **= $2,211.89/year**. The leachate pipe cleaning unit rate is based on a previous proposal for jet cleaning services by Florida Jetclean of Odessa, Florida (**Attachment 2**).

Leachate Storage Containers: Long term care for the leachate storage ponds assumes that each of the four bladder liners will require replacement over the 30-year monitoring period. Replacement cost has been assumed to be $9,850.00 (refer to response to RAI 2 documents, dated January 2012) 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 textured PE geomembrane equals $3.54/SY. Assume $1,000/bladder to clean and remove existing bladder. The unit cost for each bladder replacement equals 2,500 SY × $3.54/SY + $1,000.00 = $9,850.00/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 × $9,850.00/bladder = $39,400.00 ÷ 30 years = $1,313.34/year ÷ $3.54/SY **=**

$371.00 SY/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 × 208.4 acres = 1,749,420 gallons per year

1,749.4 thousand gallons/year × $40.00/thousand gallons = **$69,976.00/year** or $5,831.33/mo.

6. Maintenance of Groundwater Monitoring Wells

Maintenance of groundwater monitoring wells is estimated at $70.00/well/year, based on experience with similar facilities.

Total yearly cost associated with maintenance of groundwater monitoring wells is:

56 wells @ $70.00/well = **$3,920.00/year**

7. Gas System Maintenance

Approximately 248 gas wells will eventually be installed within the footprint of Cells 1 through 15. It is estimated in the Cell 13 Estimate that an additional $53.39 per well/year will be needed for maintenance ($53.39 × 248 wells = **$13,240.72**). 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). It is assumed 50 ft of lateral or header piping will require replacement or repair at an average cost of $53.39/ft.

8. Landscape Maintenance

It is estimated that the 208.4 acres of the Class I landfill will require mowing at an annual cost of $63.04 per acre. The estimate is based on Geosyntec's experience with similar facilities. It is assumed that mowing activities would be performed twice a year. Therefore, total yearly cost associated with landscape maintenance is:

Mowing (annually): $63.04/acre × 208.4 acres × 2 times/year = **$26,275.07/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

Maintenance of the security system will be performed on a monthly basis. An estimate of 100 LF of fencing, a gate and two (2) signs have been proposed for the maintenance of the Class I Landfill. The cost to install this fencing is \$21.00/LF, \$200.00 for gate repair and replacement of 2 signs at a unit cost of \$200 per sign, based on Geosyntec's experience and previous construction at similar sites.

12. Utilities

The annual utility cost is based on historical invoices from Progressive Energy to Omni. The estimated yearly lump sum amount is indicated on the FDEP cost estimate 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 @ \$70/hour = **\$10,920/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 20 hours per month will be expended towards administrative/overhead activities @ \$40.00/hour (i.e., 9,600/year). More so, one 3rd party engineer (@\$120.00/hr) and one technician (@\$65.00/hr) are expected to perform a yearly site inspection under 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 **\$12,280.00**.

15. Contingency

A contingency of 10 percent of the total long term care costs has been included in the cost estimate.

16. Site Specific Costs

No additional site specific costs are estimated.

ATTACHMENT 1

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.: SC49-0199726-017   Expiration Date: 08/16/2016

Facility Address: 1501 Omni Way, St. Cloud, Florida 34773

Permittee or Owner/Operator: Omni Waste 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 12/Cells 14&15	54.9	Proposed				
Cell 13	17.6	Est. 7/2016				
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: 164.6   Long-Term Care: 208.4

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	277,219	$3.75	$1,039,571.25
Delivery	CY			
			Subtotal Slope and Fill:	$1,039,571.25
3. Cover Material (Barrier Layer):				
Off-Site Clay	CY			
Synthetics - 40 mil	SY	831,655	$5.40	$4,490,937.00
Synthetics - GCL	SY			
Synthetics - Geonet	SY	680,012	$6.75	$4,590,081.00
Synthetics - Other (explain)				
			Subtotal Cover Material:	$9,081,018.00
4. Top Soil Cover:				
On-Site Material	CY	554,437	$4.50	$2,494,966.50
Delivery	CY			
Spread	CY			
			Subtotal Top Soil Cover:	$2,494,966.50
5. Vegetative Layer				
Sodding	SY	831,655	$2.70	$2,245,468.50
Hydroseeding	AC			
Fertilizer	AC			
Mulch	AC			
Other (explain)				
			Subtotal Vegetative Layer:	$2,245,468.50
6. Stormwater Control System:				
Earthwork	CY	45,243	$3.00	$135,729.00
Piping (4 in. diameter)	LF	49,656	$8.31	$412,641.36
Piping (24 in. diameter)	LF	15,950	$35.00	$558,250.00
Piping (30 in. diameter)	LF	2,300	$46.00	$105,800.00
Concrete thrust blocks	EA	132	$2,800.00	$369,600.00
Control Structures	EA	8	$12,000.00	$96,000.00
Other (explain) "wye" connection; Riprap	LS	1	$266,844.24	$266,844.24
			Subtotal Stormwater Control System:	$1,944,864.60

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	$3,493,982.12	$3,493,982.12
itemized in narrative			Subtotal Active Gas Extraction Control:	$3,493,982.12
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	$2,029,987.10	$2,029,987.10
10% of Construction Cost			Subtotal Engineering:	$2,029,987.10

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			1	$999,9!	$999,999.00
Other (explain)	1	$608,9!	1	$420,9!	$1,029,988.00
3% and 7% of cons. Co					

Description	Unit	Number of Units	Cost / Unit	Total Cost
Quality Assurance Testing	LS	1	$50,000.00	$50,000.00
			Subtotal Professional Services:	$2,079,987.00

Subtotal of 1-11 Above:	$24,409,845.07

12. Contingency	10	% of Subtotal of 1-11 Above	$2,440,984.51
		Subtotal Contingency:	$2,440,984.51
		Estimated Closing Cost Subtotal:	$26,850,829.58

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)	
Subtotal Site Specific Costs:	$75,000.00

TOTAL ESTIMATED CLOSING COSTS ($):	$26,925,829.58

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	$706.64	$79,143.68
Annually	1			
			Subtotal Groundwater Monitoring:	$79,143.68
2. Surface Water Monitoring [62-701.510(4), and (8)(b)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	2	$763.00	$3,052.00
Annually	1			
			Subtotal Surface Water Monitoring:	$3,052.00
3. Gas Monitoring [62-701.400(10)]				
Monthly	12			
Quarterly	4	1	$2,692.00	$10,768.00
Semi-Annually	2			
Annually	1	1	$18,000.00	$18,000.00
			Subtotal Gas Monitoring:	$28,768.00
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	3,813.6	$0.58	$2,211.89
Sumps, Traps	EA	1	$916.21	$916.21
Lift Stations	EA			
Cleaning	LS	1		
Tanks	EA			

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. (continued)				
Impoundments				
Liner Repair	SY	1	$371.00	$371.00
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	1,749.4	$40.00	$69,976.00
		Subtotal Leachate Collection / Treatment Systems Maintenance:		$73,725.10
6. Groundwater Monitoring Well Maintenance				
Monitoring Wells	EA	56	$70.00	$3,920.00
Replacement	EA			
Abandonment	EA			
		Subtotal Groundwater Monitoring Well Maintenance:		$3,920.00
7. Gas System Maintenance				
Well Maintenance	EA	248	$53.39	$13,240.72
Lateral/Header Pipe	LF	50	$53.39	$2,669.50
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:		$18,410.22
8. Landscape Maintenance				
Mowing (2 events)	AC	416.8	$63.04	$26,275.07
Fertilizer	AC			
		Subtotal Landscape Maintenance:		$26,275.07
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	$2,100.00	$2,100.00
Gate(s)	EA	1	$200.00	$200.00
Sign(s)	EA	2	$200.00	$400.00
		Subtotal Security System Maintenance:		$2,700.00

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
12. Utilities	LS	1	$10,750.00	$10,750.00
			Subtotal Utilities:	$10,750.00
13. Leachate Collection/Treatment Systems Operation				
Operation				
P.E. Supervisor	HR			
On-Site Engineer	HR			
Office Engineer	HR			
OnSite Technician	HR	156	$70.00	$10,920.00
Materials	LS	1	$500.00	$500.00
	Subtotal Leachate Collection/Treatment Systems Operation:			$11,420.00
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	240	$40.00	$9,600.00
			Subtotal Administrative:	$12,280.00
			Subtotal of 1-14 Above:	$278,711.07
15. Contingency	10	% of Subtotal of 1-14 Above		$27,871.11
			Subtotal Contingency:	$27,871.11

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
16. Site Specific Costs				
			Subtotal Site Specific Costs:	

ANNUAL LONG-TERM CARE COST ($ / YEAR): $306,582.18

Number of Years of Long-Term Care: 30

TOTAL LONG-TERM CARE COST ($): $9,197,465.31

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	13101 Telecom Dr., Suite 120 Mailing Address
Craig R. Browne, P.E., Senior Engineer Name and Title (please type)	Temple Terrace, FL, 33637 City, State, Zip Code
6/15/2016 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, Senior Region Engineer Name and Title (please type)	St. Cloud, FL 34773 City, State, Zip Code
kirk.wills@progressivewaste.com E-Mail address (if available)	813-388-1026 Telephone Number

**WRITTEN CONSENT OF
THE SOLE MEMBER AND SOLE MANAGER OF
OMNI WASTE OF OSCEOLA COUNTY LLC**

The undersigned, being the sole member and the sole manager of the Board of Managers of OMNI WASTE OF OSCEOLA COUNTY LLC, a Florida limited liability company (the "Company"), consent to the following actions and adopt the following resolutions:

WHEREAS, the sole member and the sole manager of the Company have determined that it is in the best interests of the Company to submit a construction renewal application to the Florida Department of Environmental Protection (the "Application"); therefore, be it

RESOLVED, that Kirk Wills, Senior Region Engineer of the Company, is hereby authorized and directed to execute the Application and to take such other action in furtherance thereof as he deems necessary, convenient or advisable to facilitate the renewal of the construction application.

IN WITNESS WHEREOF, the undersigned sole member of the Company and sole manager of the Board of Managers of the Company, have duly executed this Written Consent in The Woodlands, Texas on the date set forth below.

Dated: June 3, 2016

SOLE MEMBER:

WASTE SERVICES, INC.,
a Delaware corporation

By: ________________
Name: Ronald J. Mittelstaedt
Its: Chief Executive Officer

SOLE MANAGER OF THE BOARD OF MANAGERS:

____
Ronald J. Mittelstaedt, Manager

ATTACHMENT 2

COST ESTIMATES FROM CONTRACTORS/VENDORS

From:	John Jacobs
To:	Alex Rivera
Cc:	Nick Bridges
Subject:	RE: Request for Estimate
Date:	Friday, May 27, 2016 1:25:30 PM
Attachments:	image003.png image004.png image005.png Copy of Copy of FECC - JED FA Estimate scotty 5-27-16.xlsx

---

Alexander,

Here is our best initial assessment of the budget pricing numbers for your project.

Thanks,

John

COMANCO
SAFETY ★ QUALITY ★ SERVICE

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: 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

13101 Telecom Drive Ste 120
Temple Terrace, FL 33637
Phone: 813.558.0990
Fax: 813.558.9726
Mobile: 813-777-2914
www.geosyntec.com

Geosyntec consultants

engineers | scientists | innovators

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	269,266	$3.75	$1,009,748
3	Cover Material (barrier layer)				
	a. 40-mil textured PE geomembrane	SY	807,796	$5.40	$4,362,098
	b. geocomposite drainage layer	SY	645,172	$6.75	$4,354,911
4	Topsoil Cover (includes vegetative soil layer) Onsite Matl	CY	538,531	$4.50	$2,423,390
5	Vegetative Layer @ 6" Thickness Onsiet Matl	SY	807,796	$1.00	$807,796
6	Stormwater Control System				
	a. earthwork Cut/Fill	CY	14,451	$3.00	$43,353
	b. piping - 30" diameter corrugated HDPE pipe	LF	3,813	$46.00	$175,398
	c. piping - 24" diameter corrugated HDPE pipe	LF	15,855	$35.00	$554,925
	d. 5'Lx5'Wx11'H (inside) concrete stormwater drainage structure	Each	21	$12,000.00	$252,000
	e. 5'Lx2'Wx4'H concrete thrust block	Each	144	$2,800.00	$403,200
	f. Riprap	CY	3,832	$153.00	$586,296
7	Passive Gas Control	N/A	-	-	-
8	Active Gas Extraction Control				
	a. well - 8" diameter Sched. 80 PVC	LF	34,560	$130.00	$4,492,800
	b. wellhead	Each	150	$900.00	$135,000
	c. lateral pipe - 8" diameter SDR 17	LF	5,000	$28.00	$140,000
	d. header pipe - 12" diameter SDR 17	LF	5,000	$39.00	$195,000
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
	b. waste tire storage and processing facility	LS	1		
	c. auto shredder residual recycling operations	LS	1		

Notes: 1. FDEP form 62-701.900(28)

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

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: 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

From: John Jacobs [mailto:JJacobs@comanco.com]
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

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: 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

13101 Telecom Drive Ste 120
Temple Terrace, FL 33637
Phone: 813.558.0990
Fax: 813.558.9726
Mobile: 813-777-2914
www.geosyntec.com

Geosyntec consultants
engineers | scientists | innovators

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From:	John Jacobs
To:	Alex Rivera
Cc:	Nick Bridges
Subject:	RE: Request for Estimate
Date:	Friday, June 3, 2016 3:28:14 PM
Attachments:	image002.png image003.png image004.png

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

From: John Jacobs [mailto:JJacobs@comanco.com]
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

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Here is our best initial assessment of the budget pricing numbers for your project.

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Sent: Wednesday, May 25, 2016 9:18 AM
To: John Jacobs
Cc: Nick Bridges
Subject: Request for Estimate

Good morning John,

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Thank you,

Alex Rivera, P.E.
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Geosyntec consultants
engineers | scientists | innovators

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Standard Analytical Rates For:

GEOSYNTEC

Effective January 2014

Environmental Conservation Laboratories, Inc.
10775 Central Port Drive
Orlando, Florida 32824

(407) 826-5314

Chromatography and Gas Chromatography/Mass Spectroscopy

Aqueous Matrix

Parameter	Description	Price ($)
504 or 8011	EDB and DBCP	45
601/8021 HALOS by 8260	Volatile Halocarbons	60
602/8021 AROMS by 8260	Volatile Aromatics	50
601/602 A/H by 8260	Volatile Halocarbons/Aromatics	75
608 or 8081	Organochlorine Pesticides	85
608 or 8082	PCBs	65
608	Organochlorine Pesticides/PCBs	100
8081/8082	Organochlorine Pesticides/PCBs	120
614 or 8141	Organophosphorus Pesticides	120
615 or 8151	Chlorophenoxy Acid Herbicides	120
624 or 8260	Volatiles by GC/MS	75
625 or 8270 BNA	Semivolatiles by GC/MS	190
625 or 8270 Acids Only	Acid Extractables by GC/MS	100
625 or 8270 B/N Only	Base/Neutrals by GC/MS	120
8270 SIM	Polynuclear Aromatics by GC/MS	95
8310 Compounds by 8270 SIM	Polynuclear Aromatics by HPLC	85
8015	Alcohols by GC/FID DAI	90
RSK 175	Methane, Ethane and Ethene	100
EPH	Extractable Petroleum Hydrocarbons	195
VPH	Volatile Petroleum Hydrocarbons	100
DRO	Diesel Range Organics	65
GRO	Gasoline Range Organics	55
FL PRO	Florida Petroleum Residual Organics	65
VFA	Volatile Fatty Acids	100
Glycols by 8015	(ethylene,propylene,diethylene,triethylene)	100
Alcohols by 8015	(methanol,ethanol,2-butanone,2-propanol, etc)	100

Metals

Aqueous Matrix

Parameter	Description	Price ($)
Antimony by ICP or ICP/MS	Sb by 6010, 200.7, 6020 or 200.8	10
Arsenic by ICP or ICP/MS	As by 6010, 200.7, 6020 or 200.8	10
Aluminum by ICP or ICP/MS	Al by 6010, 200.7, 6020 or 200.8	10
Barium by ICP or ICP/MS	Ba by 6010, 200.7, 6020 or 200.8	10
Beryllium by ICP or ICP/MS	Be by 6010, 200.7, 6020 or 200.8	10
Boron by ICP or ICP/MS	B by 6010, 200.7, 6020 or 200.8	10
Calcium by ICP or ICP/MS	Ca by 6010, 200.7, 6020 or 200.8	10
Cadmium by ICP or ICP/MS	Cd by 6010, 200.7, 6020 or 200.8	10
Chromium by ICP or ICP/MS	Cr by 6010, 200.7, 6020 or 200.8	10
Cobalt by ICP or ICP/MS	Co by 6010, 200.7, 6020 or 200.8	10
Copper by ICP or ICP/MS	Cu by 6010, 200.7, 6020 or 200.8	10
Iron by ICP or ICP/MS	Fe by 6010, 200.7, 6020 or 200.8	10
Lead by ICP or ICP/MS	Pb by 6010, 200.7, 6020 or 200.8	10
Lithium by ICP or ICP/MS	Li by 6010, 200.7, 6020 or 200.8	10
Mercury by CVAA	Hg by 7470 or 245.1	20
Magnesium by ICP or ICP/MS	Mg by 6010, 200.7, 6020 or 200.8	10
Manganese by ICP or ICP/MS	Mn by 6010, 200.7, 6020 or 200.8	10
Molybdenum by ICP or ICP/MS	Mo by 6010, 200.7, 6020 or 200.8	10
Nickel by ICP or ICP/MS	Ni by 6010, 200.7, 6020 or 200.8	10
Potassium by ICP or ICP/MS	K by 6010, 200.7, 6020 or 200.8	10
Selenium by ICP or ICP/MS	Se by 6010, 200.7, 6020 or 200.8	10
Silver by ICP or ICP/MS	Ag by 6010, 200.7, 6020 or 200.8	10

Metals

Aqueous Matrix

Parameter	Description	Price ($)
Sodium by ICP or ICP/MS	Na by 6010, 200.7, 6020 or 200.8	10
Strontium by ICP or ICP/MS	Sr by 6010, 200.7, 6020 or 200.8	10
Thallium by ICP or ICP/MS	Tl by 6010, 200.7, 6020 or 200.8	10
Tin by ICP or ICP/MS	Sn by 6010, 200.7, 6020 or 200.8	10
Titanium by ICP or ICP/MS	Ti by 6010, 200.7, 6020 or 200.8	10
Vanadium by ICP or ICP/MS	V by 6010, 200.7, 6020 or 200.8	10
Zinc by ICP or ICP/MS	Zn by 6010, 200.7, 6020 or 200.8	10
RCRA (8) Metals	As, Ba, Cd, Cr, Pb, Se, Ag and Hg	90
RCRA (4) Metals	As, Cd, Cr and Pb	35
Metals Preparation	Digestion Fee Per Sample (Not Per Metal)	10
Laboratory Filtration	Laboratory Filtration for Dissolved Metals	20

Wet Chemistry

Aqueous Matrix

Parameter	Description	Price ($)
Acidity	Acidity by 305.1	12
Alkalinity	Alkalinity by 310.1	12
Ammonia	Ammonia by 350.1	15
Ammonia, Unionized	Unionized Ammonia by FDEP SOP	15
Ammonium	Ammonium by 350.1	15
Bicarbonate	Bicarbonate by 310.1, 310.2 or SM 4500-CO2/B	12
BOD	Biochemical Oxygen Demand by 405.1	35
Bromide	Bromide by 9056 or 300	15
BTU	British Thermal Units by ASTM D240-85	65
Carbonate	Carbonate by 310.1, 310.2 or SM 4500-CO2/B	12
CBOD	Carbonaceous BOD by SM5210 B	30
Chloride	Chloride by 9056 or 300	15
Chlorine, Residual	Field Parameter Only	Field
Chlorophyll A	Chlorophyll A by SM 10200 H	60
Carbon Dioxide	Carbon Dioxide by SM 4500-CO2/D	20
Coliform, Fecal	Fecal Coliform by SM 9222 D	30

Coliform, Total	Total Coliform by SM 9222 B	30
COD	Chemical Oxygen Demand by 410.4	25
Color	Color by 110.2	15
Conductivity	Conductivity by 120.1	10
Corrosivity	Corrosivity as pH by 9040	10
Chromium, Hexavalent	Hexavalent Chromium by SM 3500-CR-D	35
Cyanide	Ammenable Cyanide by 9010 or 335.1	60

Wet Chemistry

Aqueous Matrix

Parameter	Description	Price ($)
Cyanide	Total Cyanide by 9010 or 335.1	30
DO	Dissolved Oxygen by 360.1	10
Ferrous Iron	Ferrous Iron by SM 3500-FE-D	30
Fluoride	Fluoride by 9056 or 300	15
Hydrogen Sulfide	Hydrogen Sulfide by SM 4500-S2-F or 376.1	20
Hardness	Hardness by 130.2	12
Ignitability	Ignitability by 1010	30
Nitrate	Nitrate Nitrogen by 300 or 353.1	15
Nitrite	Nitrite Nitrogen by 300 or 354.1	15
Nitrate/Nitrite	Nitrate/Nitrite Ntrogen by 9056, 300 or 353.1	15
Nitrogen,Organic	TKN less Ammonia by 351.2/350.1	40
Nitrogen, TKN	Total Kjeldahl Nitrogen by 351.2	25
Nitrogen, Total	TKN + NOx by Calculation	40
Nitrogen, Total	TKN, NO3, NO2, NOx and NH3 reported	48
Oil & Grease	Oil & Grease by 413.2 or 9071 (Freon)	75
Oil & Grease	Oil & Grease by 1664 (Hexane)	60
Odor	Odor Threshold by 140.1	40
Paint Filter Test	Free Liquids by 9095	20
Percent Liquids	Percent Liquids by SM 2540 G	20
Percent Solids	Percent Solids by ENCO WETS 72	12
pH	pH by 9040 or 150.1	10
Phenols, Total	Phenols by 9065 or 420.1	35

Wet Chemistry

Aqueous Matrix

Parameter	Description	Price ($)
Phosphate, ortho	Ortho-phosphate by 365.1	15
Phosphorus, Total	Total Phosphorus by 365.4	24
Redox Potential	Oxidation/Reduction Potential by SM 2580 B	15
Salinity	Salinity by SM 210 C	30
Specific Gravity	Specific Gravity by ASTM D1298	30
Sulfate	Sulfate by 9056, 300 or 375.4	15
Sulfide	Hydrogen Sulfide calculation by 376.1	20
TDS	Total Dissolved Solids by 160.1	12
TDVS	Total Dissolved Volatile Solids by SM 2540 C	15
TS	Total Solids by 160.3	12
TFS	Total Fixed Solids by SM 2540 E	15
TSS	Total Suspended Solids by 160.2	12
TVS	Total Volatile Solids by 160.4	15
TOC	Total Organic Carbon by 9060 or 415.1	25
TOX	Total Organic Halogens by 9020	120
Turbidity	Turbidity by 180.1	10

Chromatography and Gas Chromatography/Mass Spectroscopy

Soil/Solid Matrix

Parameter	Description	Price ($)
8021 HALOS by 8260	Volatile Halocarbons	60
8021 AROMS by 8260	Volatile Aromatics	50
8021 AROM/HALO by 8260	Volatile Halocarbons/Aromatics	75
8081	Organochlorine Pesticides	85
8082	PCBs	65
8081/8082	Organochlorine Pesticides/PCBs	120
8141	Organophosphorus Pesticides	120
8151	Chlorophenoxy Acid Herbicides	120
8260	Volatiles by GC/MS	75
8270 BNA	Semivolatiles by GC/MS	190
8270 Acids Only	Acid Extractables by GC/MS	100
8270 B/N Only	Base/Neutrals by GC/MS	120

8270 SIM	Polynuclear Aromatics by GC/MS	85
8310 Compounds by 8270 SIM	Polynuclear Aromatics by HPLC	85
8015	Alcohols by GC/FID DAI	N/A
EPH	Extractable Petroleum Hydrocarbons	195
VPH	Volatile Petroleum Hydrocarbons	100
DRO	Diesel Range Organics	65
GRO	Gasoline Range Organics	55
FL PRO	Florida Petroleum Residual Organics	65

Metals

Soil/Solid Matrix

Parameter	**Description**	**Price ($)**
Antimony by ICP or ICP/MS	Sb by 6010 or 6020	10
Arsenic by ICP or ICP/MS	As by 6010 or 6020	10
Aluminum by ICP or ICP/MS	Al by 6010 or 6020	10
Barium by ICP or ICP/MS	Ba by 6010 or 6020	10
Beryllium by ICP or ICP/MS	Be by 6010 or 6020	10
Boron by ICP or ICP/MS	B by 6010 or 6020	10
Calcium by ICP or ICP/MS	Ca by 6010 or 6010	10
Cadmium by ICP or ICP/MS	Cd by 6010 or 6020	10
Chromium by ICP or ICP/MS	Cr by 6010 or 6020	10
Cobalt by ICP or ICP/MS	Co by 6010 or 6020	10
Copper by ICP or ICP/MS	Cu by 6010 or 6020	10
Iron by ICP or ICP/MS	Fe by 6010 or 6020	10
Lead by ICP or ICP/MS	Pb by 6010 or 6020	10
Lithium by ICP or ICP/MS	Li by 6010 or 6020	10
Mercury by CVAA	Hg by 7471	20
Magnesium by ICP or ICP/MS	Mg by 6010 or 6020	10
Manganese by ICP or ICP/MS	Mn by 6010 or 6020	10
Molybdenum by ICP or ICP/MS	Mo by 6010 or 6020	10
Nickel by ICP or ICP/MS	Ni by 6010 or 6020	10
Potassium by ICP or ICP/MS	K by 6010 or 6020	10
Selenium by ICP or ICP/MS	Se by 6010 or 6020	10
Silver by ICP or ICP/MS	Ag by 6010 or 6020	10

Sodium by ICP or ICP/MS	Na by 6010 or 6020	10

Metals

Soil/Solid Matrix

Parameter	Description	Price ($)
Strontium by ICP or ICP/MS	Sr by 6010 or 6020	10
Thallium by ICP or ICP/MS	Tl by 6010 or 6020	10
Tin by ICP or ICP/MS	Sn by 6010 or 6020	10
Titanium by ICP or ICP/MS	Ti by 6010 or 6020	10
Vanadium by ICP or ICP/MS	V by 6010 or 6020	10
Zinc by ICP or ICP/MS	Zn by 6010 or 6020	10
RCRA (8) Metals	As, Ba, Cd, Cr, Pb, Se, Ag and Hg	90
RCRA (4) Metals	As, Cd, Cr and Pb	35
Metals Preparation	Digestion Fee Per Sample (Not Per Metal)	10

Wet Chemistry

Soil/Solid Matrix

Parameter	Description	Price ($)
Alkalinity	Alkalinity by CE-81-1/310.1	12
Ammonia	Ammonia by CE-81-1/350.1	15
Ammonia, Unionized	Unionized Ammonia by FDEP SOP	15
Ammonium	Ammonium by 350.1/Calculation	15
Bromide	Bromide by CE-81-1/9056	15
BTU	British Thermal Units by ASTM D240-85	65
Bulk Density	Bulk Density by ASTM Method 30	75
Carbonate	Carbonate by SM 4500-CO2/B	12
Chloride	Chloride by CE-81-1/9056	15
Corrosivity	Corrosivity as pH by 9045	10
Chromium, Hexavalent	Hexavalent Chromium by 3060 A	35
Cyanide	Ammenable Cyanide by 9010/9014	60
Cyanide	Total Cyanide by 9010/9014	30
Fluoride	Fluoride by CE-81-1/9056	15
Hardness	Hardness by CE-81-1/130.2	12
Ignitability	Ignitability by 1030	30

Nitrate	Nitrate Nitrogen by CE-81-1/9056	15
Nitrite	Nitrite Nitrogen by CE-81-1/9056	15
Nitrate/Nitrite	Nitrate and Nitrite Ntrogen by CE-81-1/9056	15
Nitrogen,Organic	TKN less Ammonia by CE-81-1/351.2/350.1	40
Nitrogen, TKN	Total Kjeldahl Nitrogen by 351.2	25
Nitrogen, Total	TKN + NOx by Calculation	40

Wet Chemistry

Soil/Solid Matrix

Parameter	Description	Price ($)
Nitrogen, Total	TKN, NO3, NO2, NOx and NH3 reported	40
Oil & Grease	Oil & Grease by 9071 (Freon)	Not Available
Oil & Grease	Oil & Grease by 9071B (Hexane)	60
Percent Solids	Percent Solids by ENCO WETS 72	15
pH	pH by 9045	10
Phenols, Total	Phenols by CE-81-1/420.1	35
Phosphate, ortho	Ortho-phosphate by 9056	15
Phosphorus, Total	Total Phosphorus by 365.4	24
Resistivity	Resistivity by MC Miller	30
Salinity	Salinity by SM 210 C	30
Sulfate	Sulfate by 9056	15
Sulfide	Hydrogen Sulfide by 9030	50
TS	Total Solids by 160.3	12
TVS	Total Volatile Solids by 160.4	15
TOC	Total Organic Carbon by Walkley Black	60
TX	Total Halogens by 5050/9056	55

Parameter	Description	Price ($)
Air Matrix		
Method 18 HALO	Volatile Halocarbons by Method 18	100
Method 18 AROM	BTEX+MTBE by Method 18	100
TLPH	Total Light Petroleum Hydrocarbons by Method 18	125
TO-14	Volatile Compounds by TO-14	150
TO-15	Volatile Compounds by TO-15	175
Flow Controller	Flow Controller for Summa Cannisters	35
Wipe Samples		
8081	Organochlorine Pesticides	85
8082	PCBs	75
8081/8082	Organochlorine Pesticides/PCBs	120
8141	Organophosphorus Pesticides	120
TCLP Analyses		
Volatiles	8260 (Requires ZHE)	90
Semivolatiles	8270 (Requires NVE)	220
Metals (8)	Multiple (Requires NVE)	90
Pesticides	8081 (Requires NVE)	85
Herbicides	8151 (Requires NVE)	120
Zero Headspace Extn.	1311	30
Nonvolatile Extn.	1311	30
Full TCLP	**Includes all Required Extractions**	**705**
Reactivity (Total CN & S)	SW 846	60
Ignitability	SW 846	30
Corrosivity (as pH)	SW 846	10

Quality Turf of Okeechobee, Inc.
Estimate

Quality Turf of Okeechobee, Inc.
8731 N.E. 48th St.
Okeechobee, FL 34972

(863)634-7140
qualityturf@ymail.com

Date	Estimate #
07/05/2011	2734
	Exp. Date

Address

Florida WSI
1501 Omni Way
St. Cloud, Fl. 34773

Date	Activity	Quantity	Rate	Amount
07/05/2011	Mow (Bush Hog) from entrance road to landfill	1	540.00	540.00
07/05/2011	Mow (Bush Hog) closed side slopes of landfill and perimeter berms	1	1,800.00	1,800.00
07/05/2011	Weed-eating and additional mowing by the hour	40	25.00	1,000.00
07/05/2011	Transport of equipment each way	1	250.00	250.00
07/05/2011	****any extra mowing will be charged by the hour @ $70.00 per hour****			0.00

See e-mail Attached - Matt Orr
Average cost/acre = $60.00

Thank you for the opportunity. We look forward to doing business with you soon!

Total	$3,590.00

Accepted By: __________ Accepted Date: __________

Quality Turf of Okee __________ Accepted By __________

Progress Energy

Cell 1

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
99882 87420

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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

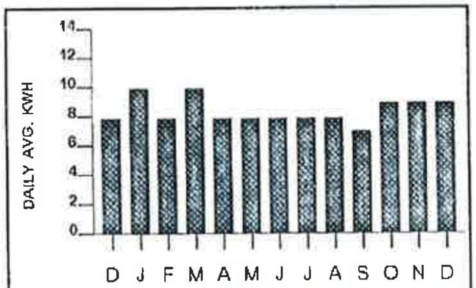
DUE DATE	TOTAL AMOUNT DUE
DEC 30 2011	48.72
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	100.00

PIN: 625482228

METER READINGS

METER NO.		002652009
PRESENT	(ACTUAL)	002561
PREVIOUS	(ACTUAL)	002286
DIFFERENCE		000275
TOTAL KWH		275
PRESENT KW	(ACTUAL)	0010.15
BASE KW		10
LOAD FACTOR		3.7%

RECEIVED
DEC 12 2011
BY: [signature]



ENERGY USE

DAILY AVG. USE -	9 KWH/DAY
USE ONE YEAR AGO -	8 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.35

PAYMENTS RECEIVED AS OF NOV 30 2011 49.74 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE			11.59	
ENERGY CHARGE	275 KWH @	6.17300¢	16.98	
FUEL CHARGE	275 KWH @	4.77600¢	13.13	
*TOTAL ELECTRIC COST				41.70
GROSS RECEIPTS TAX				1.07
COUNTY UTILITY TAX				2.52
SALES TAX ON ELECTRIC				3.43
TOTAL CURRENT BILL				48.72
TOTAL DUE THIS STATEMENT				$48.72

PO NO
VEND ID
GL A/C# 302.66.610.330.400
APPROVED
TOTAL AMOUNT 48.72

Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-831-1539. to update, please call TOLL FREE 1-866-231-6450.
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.
Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

Average Monthly Cells 1-7 = $383.07/7
= $54.72/Cell

DETACH AND RETURN THIS SECTION MM 0005439 BILL # 12 OF 12 GRP 1386

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 99882 87420

DUE DATE
DEC 30 2011

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

TOTAL DUE
48.72

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

PLEASE ENTER AMOUNT PAID

998828742020000000048728000000000000000000000487280100000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
16261 25416

Cell 2

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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
DEC 30 2011	34.36
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	100.00

PIN: 625482228

METER READINGS

METER NO.		002654570
PRESENT	(ACTUAL)	001795
PREVIOUS	(ACTUAL)	001633
DIFFERENCE		000162
TOTAL KWH		162
PRESENT KW	(ACTUAL)	0005.56
BASE KW		6
LOAD FACTOR		3.6%

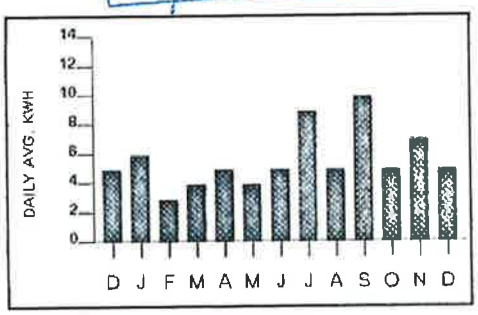
PAYMENTS RECEIVED AS OF NOV 30 2011 41.86 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	162 KWH @ 6.173000¢	10.00	
FUEL CHARGE	162 KWH @ 4.776000¢	7.74	
*TOTAL ELECTRIC COST			29.33
GROSS RECEIPTS TAX			.75
COUNTY UTILITY TAX			1.88
SALES TAX ON ELECTRIC			2.40
TOTAL CURRENT BILL			34.36
TOTAL DUE THIS STATEMENT			$34.36

RECEIVED
DEC 1 9 2011
BY: Jeuli

PO NO
VEND ID
ACCT



ENERGY USE

DAILY AVG. USE -	5 KWH/DAY
USE ONE YEAR AGO -	5 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.95

Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-908-2110. to update, please call TOLL FREE 1-866-231-6450.
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.
Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

DETACH AND RETURN THIS SECTION MM 0005431 BILL # 4 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 16261 25416

DUE DATE
DEC 30 2011

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

TOTAL DUE
34.36

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

PLEASE ENTER AMOUNT PAID

1626125416500000003436300000000000000000003436301000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
75594 97574

Cell 3

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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 DEC 30 2011	TOTAL AMOUNT DUE 31.96
NEXT READ DATE ON OR ABOUT JAN 11 2012	DEPOSIT AMOUNT ON ACCOUNT 200.00

PIN: 625482228

METER READINGS

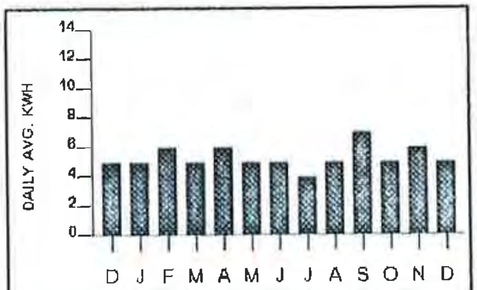
METER NO.		002663582
PRESENT	(ACTUAL)	017020
PREVIOUS	(ACTUAL)	016877
DIFFERENCE		000143
TOTAL KWH		143
PRESENT KW	(ACTUAL)	0003.65
BASE KW		4
LOAD FACTOR		4.8%

RECEIVED
DEC 1 2 2011
BY:

PAYMENTS RECEIVED AS OF NOV 30 2011 38.18 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	143 KWH @ 6.17300¢	8.83	
FUEL CHARGE	143 KWH @ 4.77600¢	6.83	
*TOTAL ELECTRIC COST			27.25
GROSS RECEIPTS TAX			.70
COUNTY UTILITY TAX			1.77
SALES TAX ON ELECTRIC			2.24
TOTAL CURRENT BILL			31.96
TOTAL DUE THIS STATEMENT			$31.96



Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-908-2110. to update, please call TOLL FREE 1-866-231-6450.
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To report an outage, please call our outage line at 1-800-228-8485.

ENERGY USE

DAILY AVG. USE -	5 KWH/DAY
USE ONE YEAR AGO -	5 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.88

DETACH AND RETURN THIS SECTION MM 0005435 BILL # 8 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 75594 97574

DUE DATE
DEC 30 2011

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

TOTAL DUE
31.96

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

PLEASE ENTER AMOUNT PAID

75594975744000000003196300000000000000000000003196301000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
11757 94261

Cell 4

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL: 1-877-372-8477 WEB SITE: www.progress-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 4/PUMP AREA	DUE DATE DEC 30 2011 — TOTAL AMOUNT DUE 149.31 NEXT READ DATE ON OR ABOUT JAN 11 2012 — DEPOSIT AMOUNT ON ACCOUNT 480.00

PIN: 625482228

METER READINGS

METER NO.		006649102
PRESENT	(ACTUAL)	011759
PREVIOUS	(ACTUAL)	010692
DIFFERENCE		001067
TOTAL KWH		1067

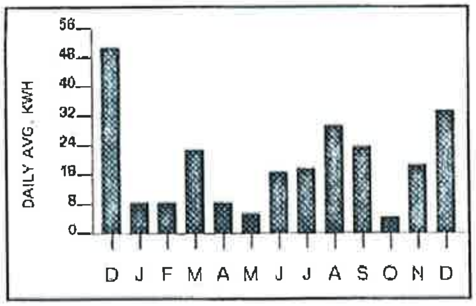
RECEIVED
DEC 12 2011
BY:

PAYMENTS RECEIVED AS OF NOV 30 2011 87.96 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	1067 KWH @ 6.173000¢	65.87	
FUEL CHARGE	1067 KWH @ 4.776000¢	50.96	
*TOTAL ELECTRIC COST			128.42
GROSS RECEIPTS TAX			3.29
COUNTY UTILITY TAX			7.06
SALES TAX ON ELECTRIC			10.54
TOTAL CURRENT BILL			149.31
TOTAL DUE THIS STATEMENT			$149.31

VOL
PO NO
VEND ID



Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-908-2110. to update, please call TOLL FREE 1-866-231-6450.
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.
Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

ENERGY USE

DAILY AVG. USE -	34 KWH/DAY
USE ONE YEAR AGO -	51 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$4.14

DETACH AND RETURN THIS SECTION MM 0005429 BILL # 2 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 11757 94261

DUE DATE
DEC 30 2011

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

TOTAL DUE
149.31

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

PLEASE ENTER AMOUNT PAID

11757942619000000149310000000000000000000014931001000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
72938 86199

Cell 5

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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
DEC 30 2011	45.54
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	200.00

PIN: 625482228

METER READINGS

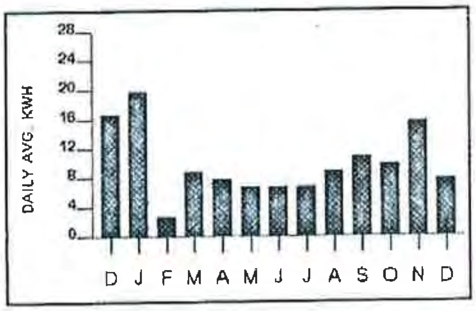
METER NO.		002667927
PRESENT	(ACTUAL)	002750
PREVIOUS	(ACTUAL)	002500
DIFFERENCE		000250
TOTAL KWH		250
PRESENT KW	(ACTUAL)	0015.24
BASE KW		15
LOAD FACTOR		2.2%

RECEIVED
DEC 12 2011
BY:

PAYMENTS RECEIVED AS OF NOV 30 2011 71.71 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	250 KWH @ 6.17300¢	15.43	
FUEL CHARGE	250 KWH @ 4.77600¢	11.94	
*TOTAL ELECTRIC COST			38.96
GROSS RECEIPTS TAX			1.00
COUNTY UTILITY TAX			2.38
SALES TAX ON ELECTRIC			3.20
TOTAL CURRENT BILL			45.54
TOTAL DUE THIS STATEMENT			$45.54



ENERGY USE

DAILY AVG. USE -	8 KWH/DAY
USE ONE YEAR AGO -	17 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.26

Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-908-2110 to update, please call TOLL FREE 1-866-231-6450.
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.
Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

DETACH AND RETURN THIS SECTION MM 0005434 BILL # 7 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 72938 86199

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

DUE DATE
DEC 30 2011

TOTAL DUE
45.54

PLEASE ENTER AMOUNT PAID

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

729388619940000000045542000000000000000000004554201000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
13961 72312

Cell 6

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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	TOTAL AMOUNT DUE
DEC 30 2011	37.42
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	200.00

PIN: 625482228

METER READINGS

METER NO.		002663581
PRESENT	(ACTUAL)	011494
PREVIOUS	(ACTUAL)	011308
DIFFERENCE		000186
TOTAL KWH		186
PRESENT KW	(ACTUAL)	0000.81
BASE KW		1
LOAD FACTOR		25.0%

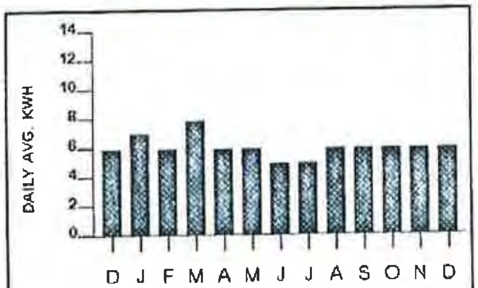
PAYMENTS RECEIVED AS OF NOV 30 2011 39.06 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	186 KWH @ 6.17300¢	11.48	
FUEL CHARGE	186 KWH @ 4.77600¢	8.88	
*TOTAL ELECTRIC COST			31.95
GROSS RECEIPTS TAX			.82
COUNTY UTILITY TAX			2.02
SALES TAX ON ELECTRIC			2.63
TOTAL CURRENT BILL			37.42
TOTAL DUE THIS STATEMENT			$37.42

RECEIVED
DEC 1 2 2011
BY: [signature]

VENDOR
PO. NO
VEND. ID
G/L A/C#
SALES TAX PAID
PO VERIFIED



ENERGY USE

DAILY AVG. USE -	6 KWH/DAY
USE ONE YEAR AGO -	6 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$1.03

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Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

DETACH AND RETURN THIS SECTION MM 0005430 BILL # 3 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 13961 72312

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

DUE DATE
DEC 30 2011

TOTAL DUE
37.42

PLEASE ENTER AMOUNT PAID

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

13961723120000000003742400000000000000000000374240100000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
49354 75320

Cell 7

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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
DEC 30 2011	35.76
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	200.00

PIN: 625482228

METER READINGS

METER NO.		006644791
PRESENT	(ACTUAL)	009218
PREVIOUS	(ACTUAL)	009045
DIFFERENCE		000173
TOTAL KWH		173

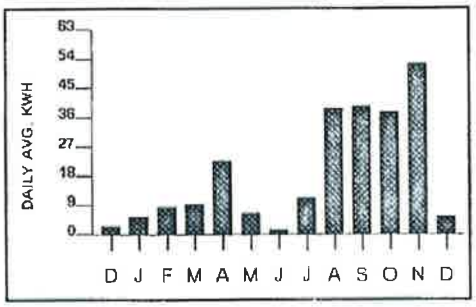
RECEIVED
DEC 12 2011
BY: [signature]

PAYMENTS RECEIVED AS OF NOV 30 2011 221.06 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	173 KWH @ 6.17300¢	10.68	
FUEL CHARGE	173 KWH @ 4.77600¢	8.26	
*TOTAL ELECTRIC COST			30.53
GROSS RECEIPTS TAX			.78
COUNTY UTILITY TAX			1.94
SALES TAX ON ELECTRIC			2.51
TOTAL CURRENT BILL			35.76
TOTAL DUE THIS STATEMENT			$35.76

VOI
PO NO
VEND ID
GL A/C#
35.76



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To report an outage, please call our outage line at 1-800-228-8485.

ENERGY USE

DAILY AVG. USE -	6 KWH/DAY
USE ONE YEAR AGO -	3 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$.98

DETACH AND RETURN THIS SECTION MM 0005433 BILL # 6 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 49354 75320

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

DUE DATE
DEC 30 2011

TOTAL DUE
35.76

PLEASE ENTER AMOUNT PAID

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

493547532090000000357660000000000000000035766010000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
07346 56092

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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,
GAS FLARE STATION

DUE DATE	TOTAL AMOUNT DUE
DEC 30 2011	1,982.49
NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
JAN 11 2012	4,155.00

PIN: 625482228

METER READINGS

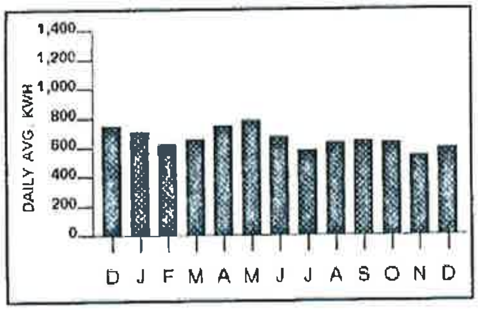
METER NO.		002665644
PRESENT	(ACTUAL)	029848
PREVIOUS	(ACTUAL)	011209
DIFFERENCE		018639
TOTAL KWH		18639
PRESENT KW	(ACTUAL)	0036.72
BASE KW		37
LOAD FACTOR		67.7%

RECEIVED
DEC 12 2011
BY:

GSD-1 070 GENERAL SERVICE - DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	18639 KWH @ 3.26900¢	609.31	
FUEL CHARGE	18639 KWH @ 4.77600¢	890.20	
DEMAND CHARGE	37 KW @ $4.95000	183.15	
*TOTAL ELECTRIC COST			1,694.25
GROSS RECEIPTS TAX			43.44
COUNTY UTILITY TAX			78.22
SALES TAX ON ELECTRIC			139.02
LATE PAYMENT CHARGE FOR PREVIOUS BILL			27.56
TOTAL CURRENT BILL			1,982.49

TOTAL DUE THIS STATEMENT $1,982.49



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To report an outage, please call our outage line at 1-800-228-8485.

ENERGY USE

DAILY AVG. USE -	601 KWH/DAY
USE ONE YEAR AGO -	753 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$54.65

DETACH AND RETURN THIS SECTION MM 0005428 BILL # 1 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 07346 56092

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

DUE DATE
DEC 30 2011
TOTAL DUE
1,982.49
PLEASE ENTER AMOUNT PAID

0734656092100000198249500000000000000000198249501000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
81326 27580

FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:
1-877-372-8477

WEB SITE: www.progress-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,
LECHATE HOLDING AREA

DUE DATE DEC 30 2011	TOTAL AMOUNT DUE 1,349.75
NEXT READ DATE ON OR ABOUT JAN 11 2012	DEPOSIT AMOUNT ON ACCOUNT 2,370.00

PIN: 625482228

METER READINGS

METER NO.		002652390
PRESENT	(ACTUAL)	064670
PREVIOUS	(ACTUAL)	054151
DIFFERENCE		010519
TOTAL KWH		10519
PRESENT KW	(ACTUAL)	0023.12
BASE KW		23
LOAD FACTOR		61.5%

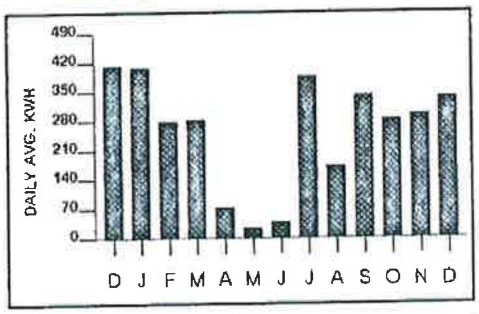
RECEIVED
DEC 1 2 2011
BY:

PAYMENTS RECEIVED AS OF NOV 30 2011 1,194.42 THANK YOU

GS-1 060 GENERAL SERVICE - NON DEMAND SEC
BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE		11.59	
ENERGY CHARGE	10519 KWH @ 6.17300¢	649.34	
FUEL CHARGE	10519 KWH @ 4.77600¢	502.39	
*TOTAL ELECTRIC COST			1,163.32
GROSS RECEIPTS TAX			29.83
COUNTY UTILITY TAX			61.14
SALES TAX ON ELECTRIC			95.46
TOTAL CURRENT BILL			1,349.75
TOTAL DUE THIS STATEMENT			$1,349.75

VO
P.O. NO
GL A/C#
DATE ENTERED



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To report an outage, please call our outage line at 1-800-228-8485.

ENERGY USE

DAILY AVG. USE -	339 KWH/DAY
USE ONE YEAR AGO -	415 KWH/DAY
*DAILY AVG. ELECTRIC COST -	$37.53

DETACH AND RETURN THIS SECTION MM 0005436 BILL # 9 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 81326 27580

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

DUE DATE
DEC 30 2011

TOTAL DUE
1,349.75

PLEASE ENTER AMOUNT PAID

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

8132627580200000134975200000000000000000134975201000000000009

Progress Energy

STATEMENT OF ELECTRIC SERVICE

DECEMBER 2011

ACCOUNT NUMBER
90698 00530

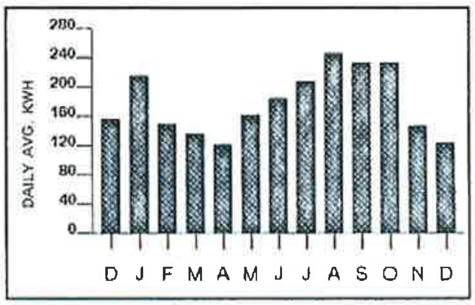
FOR CUSTOMER SERVICE OR PAYMENT LOCATIONS CALL:	OMNI WASTE OF OSC CTY LLC	DUE DATE	TOTAL AMOUNT DUE
1-877-372-8477	1501 OMNI WAY	DEC 30 2011	631.34
WEB SITE: www.progress-energy.com	SAINT CLOUD FL 34773	NEXT READ DATE ON OR ABOUT	DEPOSIT AMOUNT ON ACCOUNT
TO REPORT A POWER OUTAGE: 1-800-228-8485	SERVICE ADDRESS 1501 OMNI WAY, ADMIN/MAINT OFC	JAN 11 2012	900.00

PIN: 625482228

METER READINGS

METER NO.		002637255
PRESENT	(ACTUAL)	008048
PREVIOUS	(ACTUAL)	004121
DIFFERENCE		003927
TOTAL KWH		3927
PRESENT KW	(ACTUAL)	0028.32
BASE KW		28
LOAD FACTOR		18.9%

RECEIVED
DEC 12 2011
BY:



ENERGY USE

DAILY AVG. USE - 147 KWH/DAY
USE ONE YEAR AGO - 180 KWH/DAY
*DAILY AVG. ELECTRIC COST - $17.63

PAYMENTS RECEIVED AS OF NOV 30 2011 633.12 THANK YOU

GSD-1 070 GENERAL SERVICE - DEMAND SEC

BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE			11.59
ENERGY CHARGE	3927 KWH @	3.26900¢	128.37
FUEL CHARGE	3927 KWH @	4.77600¢	187.55
DEMAND CHARGE	28 KW	@ $4.95000	138.60

LS-1 017 LIGHTING SER COMPANY OWNED/MAINTAINED

BILLING PERIOD..11-07-11 TO 12-08-11 31 DAYS

CUSTOMER CHARGE			1.19
ENERGY CHARGE	624 KWH @	2.56100¢	15.98
FUEL CHARGE	624 KWH @	4.48600¢	27.99

*TOTAL ELECTRIC COST	511.27
EQUIPMENT RENTAL FOR: 6 SV RW 27500	
FIXTURE TOTAL	24.96
MAINTENANCE TOTAL	10.32
GROSS RECEIPTS TAX	13.11
COUNTY UTILITY TAX	27.26
SALES TAX ON ELECTRIC	41.95
SALES TAX ON EQUIPMENT RENTAL	2.47
TOTAL CURRENT BILL	631.34
TOTAL DUE THIS STATEMENT	**$631.34**

Having your phone number helps us identify your service location during power outages. Our records show your phone number is 407-891-3720. to update, please call TOLL FREE 1-866-231-6450.
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.
Progress Energy will be closed on December 23 and 26, 2011 and January 2, 2012. You may visit progress-energy.com for self-service options.
To report an outage, please call our outage line at 1-800-228-8485.

DETACH AND RETURN THIS SECTION MM 0005437 BILL # 10 OF 12 GRP 1366

Make checks payable to: Progress Energy Florida, Inc.

ACCOUNT NUMBER - 90698 00530

P.O. BOX 33199
ST. PETERSBURG,
FL 33733-8199

DUE DATE
DEC 30 2011

TOTAL DUE
631.34

PLEASE ENTER AMOUNT PAID

OMNI WASTE OF OSC CTY LLC
1501 OMNI WAY
SAINT CLOUD FL 34773 - 9177

906980053010000006313410000000000000000000631341010000000000009

FLORIDA JETCLEAN

HIGH PRESSURE WATER JETTING - PIPELINE TV INSPECTION
PIPE LOCATING – NO DIG POINT REPAIRS - VACUUM TRUCK SVCS

7538 Dunbridge Drive
Odessa, FL 33556
www.floridajetclean.com

TEL : 800-226-8013
FAX : 813-926-4616

PROPOSAL

DATE : 6/9/2016
TO : Alex Rivera – Geosyntec
FROM : Ralph Calistri (floridajetclean@yahoo.com)
SUBJECT : JED Landfill - 2016 LCS/LDS Pipe Maintenance

Thank you for your inquiry. We confirm our capability and interest in providing these leachate collection system maintenance services for Geosyntec at the JED Landfill.

FLORIDA JETCLEAN specializes in leachate collection system maintenance and inspection, and has developed a considerable amount of specific expertise in this field over the last 28+ years. Our company has worked at an extensive number of landfills in Florida, Georgia, the Carolinas, Delaware, and westward to Arkansas. We have worked with most engineering companies active in this field, and have also fostered excellent working relationships with the regulatory authorities. We use modified jetting equipment designed to achieve extended pipe distances found in landfill environments and **our explosion proof camera equipment complies with all OSHA and regulatory mandates for methane environments**. Substantial references are available on request.

Based on extensive prior work at the JED Landfill, we quote as follows:

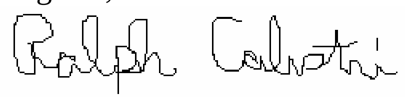
High-pressure water-jetting of an estimated 38,136 LF of existing 4" /8"leachate collection piping $ 22,118.88

Subject to:

- An adequate no charge on site water supply for jetcleaning.
- 2 wheel drive vehicle access within 10’-15’ of each cleanout and manhole.
- Continuity of access allowing work to be carried out on a single mobilization
- Exposed and opened cleanouts at ground level
- All jetting work will begin at the available access locations and continue through the piping as far as possible. Additional access may be required for complete coverage.
- Throughput from jetcleaning will be directed downstream toward sump areas and/or pump stations. Vacuum removal from these areas, if necessary, at additional cost.
- Standby time chargeable at $200.00 per hour should delays not of our making delay progress e.g. bad weather, access problems, high leachate flow levels etc.

- Payment : net 30 days

Regards,



Ralph Calistri - Florida Jetclean - 800-226-8013