6 NYCRR PART 360 PERMIT RENEWAL AND MSE BERM MODIFICATION APPLICATION
DUNN MINE AND C&D FACILITY

Prepared For:

S.A. DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION
RENSSELAER, NEW YORK 12144

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING, LANDSCAPE ARCHITECTURE, AND LAND SURVEYING, PLLC
31 BELLOWS ROAD
RAYNHAM, MASSACHUSETTS 02767

CEE Project 182-442

JANUARY 2022

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 General 1
1.2 Project Description 1
1.3 Permit Application 2

APPENDICES

Appendix A – Part 360 Permit Application Form
Appendix B – Record of Compliance
Appendix C – Engineering Report
Appendix C1 – Stability Analyses
Appendix C2 – Design Calculations
Appendix D – Facility Manual
Appendix E – Construction Quality Assurance/Construction Quality Control Plan
Appendix F – Technical Specifications
Appendix G – Financial Assurance
Appendix H – Engineering Permit Drawings (Included as a separate 24 inch by 36-inch rolled drawing set)
Appendix I – Mechanically Stabilized Earthen Berm Design and Drawings

CERTIFICATION PAGE
DUNN MINE AND C&D FACILITY

The material and data in this report were prepared under the supervision and direction of the undersigned.

Civil & Environmental Engineering, Landscape
Architecture and Land Surveying, PLLC

Amy J Knight 1/24/2022

Amy J. Knight, P.E.

STATE OF NEW YORK
AMY J. KNIGHT
076341
LICENSED PROFESSIONAL ENGINEER

1.0 INTRODUCTION

1.1 GENERAL

The purpose of this permit renewal and modification application, and accompanying appendices is to renew the existing permit which expires July 19, 2022, and to describe the proposed modification to the existing Dunn Mine and Construction & Demolitions (C&D) Facility. This permit renewal and modification application has been prepared consistent with the requirements set forth in 6CRR-NY 360.16(g) Permit Renewals and 16(f) Permit Modifications which require that "*An application to modify a permit must include a description of the proposed modification, a description of the impacts of the proposed modification on the facility, and a demonstration that, under the modified permit, the facility will comply with the applicable parts of this Title.*" The components of this permit application are described in Section 1.3 and have been prepared to demonstrate that the proposed renewal and modification will comply with applicable parts of Part 360 and Part 363.

The facility is an existing, permitted C&D disposal facility located in Rensselaer and North Greenbush, New York. It is owned and operated by S.A. Dunn & Company, LLC (S.A. Dunn). S.A. Dunn plans to modify the permitted landfill layout by incorporating a mechanically stabilized earthen (MSE) berm on the northern and eastern sides of the site. The proposed modification decreases the C&D disposal area footprint by 1.2 acres and is not expected to result in any adverse impacts. There are otherwise no changes to mining or C&D disposal operational conditions associated with the permit renewal. A permit application form is included in Appendix A.

1.2 PROJECT DESCRIPTION

The facility is currently permitted to operate under a permit initially issued by the New York State Department of Environmental Conservation (NYSDEC) on July 20, 2012 and renewed on September 9, 2016, with a stated expiration date of July 20, 2022 (Permit DEC #4-3899-00006/00006). The permit encompasses both the mining and disposal activities. Initial permitting for the landfill site was prepared by C.T. Male Associates, P.C. and included a Draft Environmental Impact Statement accepted by NYSDEC on January 9, 2012, a Final Environmental Impact Statement dated May 2012, and a solid waste permit application, including engineering drawings, dated October 2010, last revised December 2011. Subsequent to receiving approval for construction of the facility, the construction phasing plan as presented in the initial permit application was revised and a minor modification was prepared by Sanborn, Head and Associates

in May 2014. NYSDEC approved the permit revisions, and construction of the site began in late summer 2014. The first phase of construction was approved by NYSDEC in early 2015, and waste placement activities began in January 2015. Subsequently, Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLCC (CEE) prepared a permit modification to revise the landfill construction sequencing that was approved in September 2015. In 2016, a permit modification to adjust the waste footprint was prepared by CEE and approved by NYSDEC in 2016. Most recently, a permit modification to revise the baseliner construction and waste filling sequence was prepared by CEE and approved by NYSDEC in October 2021.

S.A. Dunn seeks a permit renewal for both its mining and C&D disposal operations. It submitted a Mined Land Permit Reclamation Permit renewal application for the Dunn Facility in August 2021, which will be processed with its Part 360 Solid Waste Management Facility permit renewal application. A Mining Permit Modification Application is included with this submittal to include changes to the Mined Land Use Plan associated with the MSE Berm. The permit renewal will not change or expand the mining or landfill operations.

The proposed permit modification includes construction of a MSE berm on the northerly and easterly sides of the site. The current footprint limit, along with the approximate limits of the proposed modification, is shown on Sheet C100 of the permit drawings, located in Appendix H. The reduced C&D disposal area is approximately 1.2 acres.

The proposed MSE Berm will consist of a perimeter berm on which a stormwater swale and access road consistent with the current landfill permit will be constructed. The engineering design and drawings developed for the MSE Berm are included in Appendix I.

1.3 PERMIT APPLICATION

The information required to modify and renew an existing permit application are listed in 6 NYCRR Part 360-16(f) and (g) and Part 363 as applicable. These requirements and the location within this permit application are detailed below:

- Engineering Drawings complying with 6 NYCRR Part 363-4.2 are included as a separate 24-inch by 36-inch set of rolled drawings in Appendix H.
- A Record of Compliance complying with the requirements of 6 NYCRR Part 360-16(f)(i) is included as Appendix B of this application.

- Compliance with the requirements of 6 NYCRR Part 360-16(f)(ii) are outlined in the cover letter of this submittal package.
- An Engineering Report complying with the requirements of 6 NYCRR Part 363-4.3 is included as Appendix C of this application.
- A Facility Manual prepared in accordance with 6 NYCRR Part 363-4.6 is included in Appendix D of this application. The Facility Manual also satisfies the requirements of Part 360.16(f)(iv), which requires an Operations and Maintenance Manual as part of the Permit Renewal.
- A Construction Quality Assurance/Construction Quality Control (CQA/CQC) Manual complying with 6 NYCRR Part 363-4.5 is included as Appendix E of this application.
- A description of the leachate management system as required by 6 NYCRR Part 363-4.3 is provided in Section 2.6 of the Engineering Report in Appendix C. Supporting technical back-up is provided in Appendix B to the Engineering Report and the leachate collection system plan and details are provided on the Engineering Permit Drawings presented in Appendix H.
- Financial assurance for the closure and post-closure costs for the facility through construction of Phase 6C is provided in Appendix G in accordance with 6 NYCRR Part 360.22.

APPENDIX A

PART 360 PERMIT APPLICATION FORM

(09/2020)

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

DEPARTMENT USE ONLY	
DEC APPLICATION NO.	
ACTIVITY NUMBER(S)	

DIVISION OF MATERIALS MANAGEMENT
APPLICATION FOR A SOLID WASTE MANAGEMENT FACILITY PERMIT

Please read all instructions before completing this application

Reset Form

Please **TYPE** or **PRINT** clearly

1. APPLICATION TYPE (CHECK ALL APPLICABLE BOXES):

☐ Initial (New) ☑ Modification ☑ Renewal (*Existing permit expiration date:* July 19, 2022)

2. APPLICANT IS:

☑ Facility Owner ☐ Facility Operator

3. IS APPLICATION FILED BY OR ON BEHALF OF A MUNICIPALITY?

☐ YES (*Name of municipality:* _____) ☑ NO

4. FACILITY NAME AND LOCATION (Attach USGS Topo Map showing exact location)

Name: Dunn Mine and C&D Facility

Address: 209 Partition Street Extension, Rensselaer, NY 12144

Town: _____ County: Rensselaer

Coordinates: NYTM-E 700,043 NYTM-N 1,390,807

Existing solid waste management facility permit number (if applicable): _____

☐ Check here if facility owner, operator and/or real property owner has changed since last application was submitted.

5. FACILITY OWNER'S INFORMATION

Name: S.A. Dunn & Company, LLC

Address: 209 Partition Street Extension

City/State/Zip: Rensselaer, NY 12144

Phone number: (518) 650-6106

Email: _____

6. FACILITY OPERATOR'S INFORMATION

Name: S.A. Dunn & Company, LLC

Address: 209 Partition Street Extension

City/State/Zip: Rensselaer, NY 12144

Phone number: (518) 650-6106

Email: _____

7. ENGINEER'S INFORMATION

Name: Amy J. Knight

NYS Professional Engineer License #: 076341

Firm Name: CEE, PLLC

Address: 31 Bellows Road

City/State/Zip: Raynham, MA 02767

Phone number: (774) 501-2176

Email: aknight@cecinc.com

8. REAL PROPERTY OWNER'S INFORMATION

Name: See attached

Address: _____

City/State/Zip: _____

Phone number: _____

Email: _____

☐ Check here if facility owner is not real property owner.
See instruction page for written permission requirement.

9. TYPE OF FACILITY (CHECK ALL APPLICABLE BOXES)

- ☐ Combustion & Thermal Treatment (362-1)
- ☐ C & D Debris Handling & Recovery (361-5)
- ☐ Composting & Other Organics Processing (361-3)
- ☐ Household Hazardous Waste Collection (362-4)
- ☐ Land Application & Associated Storage (361-2)
- ☑ Landfill (363)
- ☐ Regulated Medical Waste (365)
- ☐ Mulch Processing (361-4)
- ☐ Municipal Solid Waste Processing (362-2)
- ☐ Navigational Dredge Material Handling & Recovery (361-9)
- ☐ Nonspecific Facilities (360.17)
- ☐ Recyclables Handling & Recovery (361-1)
- ☐ Research, Development, and Demonstration (360.18)
- ☐ Transfer (362-3)
- ☐ Waste Oil (374-2)
- ☐ Waste Tire Handling & Recovery (361-6)
- ☐ Used Cooking Oil & Yellow Grease (361-8)

10. NAME(S) OF ALL MUNICIPALITIES IN SERVICE AREA:

Various

11. SOLID WASTE ACCEPTED: *Identify facility capacity and throughput of each waste type, as applicable*

Construction and Demolition Debris
No change in approved design capacity of 100 truck round trips per day is proposed. Truck count is inclusive of C&D deliveries, mining traffic and leachate collection trucks.

FOR MODIFICATION APPLICATION ONLY

12. DOES THE MODIFICATION APPLICATION INVOLVE (CHECK ALL APPLICABLE BOXES):

☐ New waste type ☐ New equipment ☐ Waste acceptance rate increase ☐ Facility expansion (including landfill)

SKIP QUESTION #13 AND #14 IF APPLYING FOR RENEWAL ONLY

13. APPLICATION DESCRIPTION

Include a brief description of new or modification request

The facility is an existing, permitted construction and demolition debris (C&D) disposal facility located in Rensselaer, New York that plans to modify the existing disposal footprint by incorporating a mechanically stabilized earthen (MSE) berm on the north side of the site. The proposed modification decreases the C&D disposal area footprint by approximately 1.2 acres and is not expected to result in any adverse impacts at the facility. The modification is submitted concurrently with the permit renewal application.

14. FACILITY SIZE

a. Facility size proposed (acres) 63.3

b. Total site area (acres) 90.4

For modification application ONLY

c. Associated facility size change (acres) -1.2

For Landfill ONLY

d. Facility size ultimately planned (acres) 62.1

e. Existing landfill area on this site and adjacent properties (acres) 62.1

f. Ultimate facility height above ground level (feet) 324

15. IS A VARIANCE REQUESTED FROM ANY PROVISION OF 6 NYCRR PART 360 SERIES?

☐ Yes ☑ No If yes, submit an application for variance and cite specific provision(s) here: _____

16. REAL PROPERTY OWNER CERTIFICATION

☑ Corporation ☐ Partnership ☐ Sole Proprietorship ☐ Municipality/other government entity ☐ Other: _____

I hereby attest that I am the owner of the real property on which the facility is located or the proposed or modified facility will be located and am signing in my individual capacity.

Or if signing in a representative capacity: I hereby attest that I am the (indicate title or capacity) Division Vice President, an authorized representative of the owner of the real property on which the facility is located or the proposed or modified facility will be located). I am duly authorized on behalf of said owner to sign make this certification on this application.

I grant permission for the applicant to apply for the permit, and construct and operate the facility described in the application in accordance with a final DEC permit or approval. I also grant permission for the department to access the above-described real property, including any adjacent areas, during all reasonable times (including but not limited to 7:00 am to 7:00 pm Monday through Friday, and additional facility hours of operation, and as appropriate during emergencies and similar exigent circumstances) without the property owner, applicant or other representative of the property owner or facility present. If the property is posted with "keep out" signs or fenced with an unlocked gate, department staff may still enter the property. Department staff may traverse the property, inspect the facility, take measurements, analyze site physical characteristics, take soil and vegetation samples, sketch and photograph the property, and conduct other activities necessary to evaluate the permit application or assess the facility's compliance with the permit and any other applicable statutory or regulatory requirements.

I am aware that any false statement made herein is punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

Signature: _____ Print Name: MARK CERESA Date: 1/13/2022

Title or Representation if signing in a representative capacity: Division Vice President

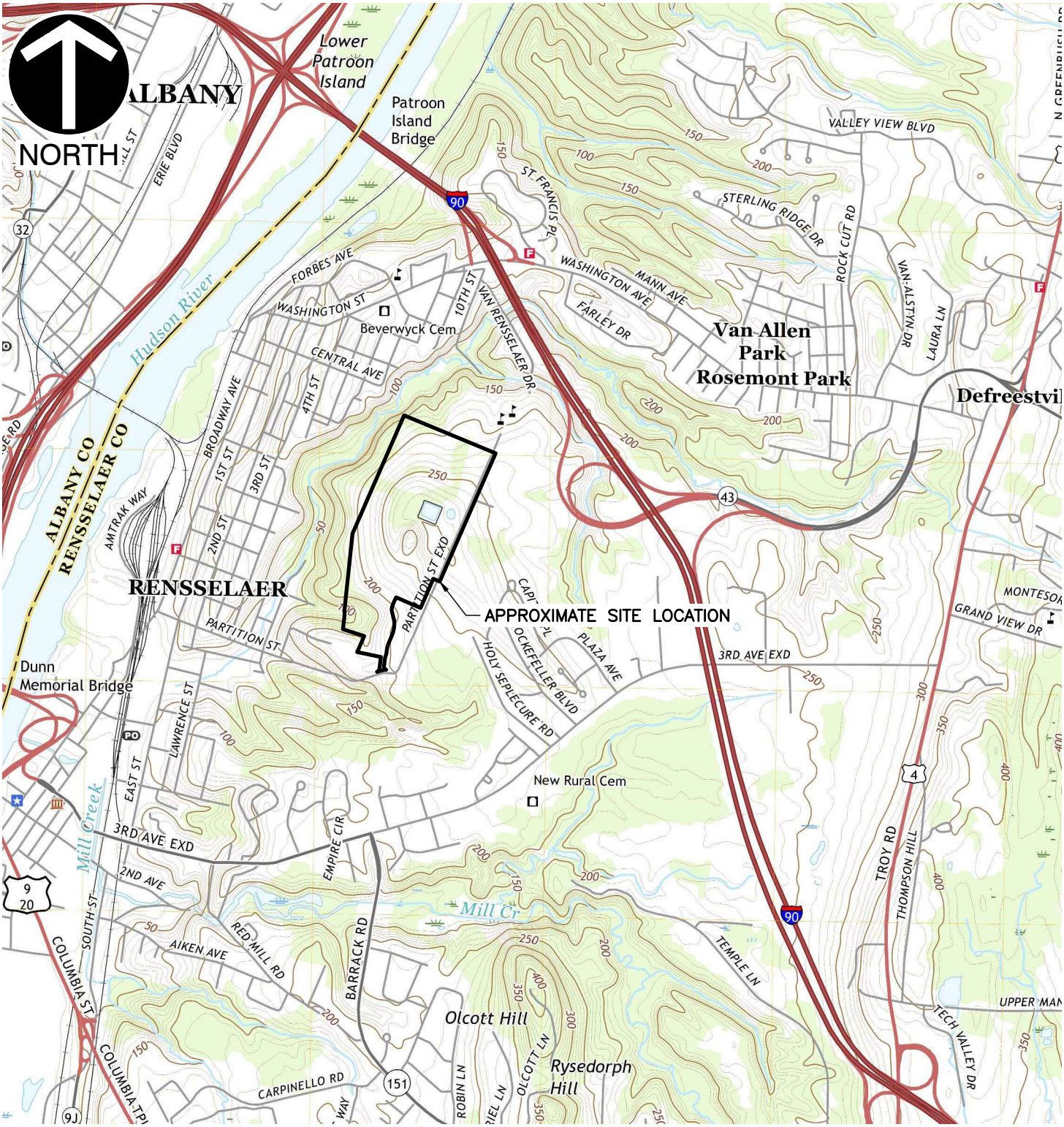
17. APPLICANT CERTIFICATION

☑ Corporation ☐ Partnership ☐ Sole Proprietorship ☐ Municipality/other government entity ☐ Other: _____

I hereby attest that I am the (check one) ☑ President/Vice President ☐ General Partner ☐ Sole Proprietor ☐ Duly Authorized Municipal Representative of (APPLICANT) S.A. Dunn & Company, LLC and the legally responsible party for this application as presented to NYSDEC. I affirm that the statements and information provided on this application and all attachments submitted herewith are true, accurate, and complete.

I am aware that any false statement made herein is punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law. I accept full responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agree to indemnify and hold harmless the State from any and all causes of action in law or equity, resulting from the said project.

Signature: _____ Print Name: MARK CERESA Date: 1/13/2022



REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, TROY SOUTH QUADRANGLE, NEW YORK DATED: 2019.

SCALE IN FEET

0 2000 4000

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

31 Bellows Road
Raynham, MA 02767

PERMIT RENEWAL AND MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

SITE LOCATION PLAN

DRAWN BY:	EMW	CHECKED BY:	KFH	APPROVED BY:	AJK	FIGURE NO.:	1
DATE:	JANUARY 2022	DWG SCALE:	1"=2,000'	PROJECT NO:	182-442		

P:\2018\182-442\-CADD\Dwg\SW16-Other Figures\182442-SW16-Fig 1-Site Locus.dwg{LAYOUT1} LS:(1/12/2022 - tgarani) - LP: 1/12/2022 10:23 AM

APPENDIX B

RECORD OF COMPLIANCE

47-19-2A (8/20)-10e

DEPARTMENT USE ONLY

DEC APPLICATION NUMBER:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

RECORD OF COMPLIANCE-Permit Application Supplement

Please read all instructions on reverse side before completing this application

1. FULL NAME OF APPLICANT
S. A. Dunn and Company, LLC

2. MAILING ADDRESS (Principal Place of Business)
Street
209 Partition Street

City/State/Zip Code
Rensselaer, NY 12144

3. NEW YORK STATE MAILING ADDRESS (If different)
Street

City/State/Zip Code

4. TYPE OF ORGANIZATION
☐ Individual ☐ Partnership
☑ Company ☐ Corporation ☐ Other

If other than individual, provide Federal Taxpayer ID Number
41-2240567

5. Does the applicant currently hold any permit issued under the Environmental Conservation Law?
☑ Yes ☐ No

6. a. Has the applicant been denied a permit or has the applicant had a permit revoked or suspended under the Environmental Conservation Law? or
b. Is the applicant currently the subject of an enforcement action under the Environmental Conservation Law?
a. ☐ Yes ☑ No b. ☑ Yes ☐ No

7. If any answer to questions 5, 6(a), or 6(b) is YES, provide details on a separate page and attach it to this form.

8. Has the applicant, and if the applicant Is a corporation, has any officer, director, or large stockholder (owner of 25 percent or more of not publicly-traded stock) of the corporation, within the last ten (10) years, been:

a. found in an administrative, civil or criminal proceeding to have violated any provision of the Environmental Conservation Law (ECL), any related order or determination of the Commissioner, any regulation promulgated pursuant to the ECL, the condition of any permit issued thereunder, or any similar statute, regulation, order or permit condition of any other state or federal government agency?
☑ Yes ☐ No

b. an officer, director or large stockholder (owner of 25% or more of not publicly-traded stock) of a corporation which-during the time such person was an officer, director or large stockholder-was determined in an administrative, civil or criminal proceeding to have violated any provision of the Environmental Conservation Law (ECL), any related order or determination of the Commissioner, any regulation promulgated pursuant to the ECL, the condition of any permit issued thereunder, or any similar statute, regulation, order or permit condition of any other state or federal government agency?
☐ Yes ☑ No

c. convicted of a criminal offense under the laws of any state or federal government agency, which involves environmental statutes or regulations, or fraud, bribery, perjury, theft or an offense against public administration as that term is used in Article 195 of the Penal Law, or an offense involving false written statements as those terms are defined in Article 175 of the Penal Law? Out-of-state history may be limited to misdemeanors, felonies and civil penalties assessed at $25,000 or more.
☐ Yes ☑ No

d. an officer, director or large stockholder (owner of 25% or more of not publicly-traded stock) of a corporation which-during the time such person was an officer, director or large stockholder-was convicted of a criminal offense under the laws of any state or federal government agency, which involves environmental statutes or regulations or fraud, **bribery,** perjury, theft, or an offense against public administration as that term is used in Article 195 of the Penal Law, or an offense involving false written statements as those terms are defined in Article 175 of the Penal Law? Out-of- state history may be limited to misdemeanors, felonies and civil penalties assessed at $25,000 or more.
☐ Yes ☑ No

9. If any answer to questions 8a through 8d is YES, provide details on a separate page and attach it to this form.

10. Does the applicant currently owe any regulatory fees pursuant to Article 72 of the Environmental Conservation Law to the Department of Environmental Conservation?
☐ **Yes**, amount $ ☑ **No** Under dispute for year(s) Amount $

11. CERTIFICATION (By Applicant who is an **Individual)**
I hereby affirm under penalty of perjury that information provided on this form and attached statements and exhibits is true to the best of my knowledge and belief. I am aware that any false statement made herein is punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

Date: **Signature:** **Print Name:**

ITEMS 12 THROUGH 15 TO BE COMPLETED BY AN APPLICANT OTHER THAN AN INDIVIDUAL

12. SPECIFY UNDER WHAT LAW APPLICANT WAS ORGANIZED
New York Limited Liability Company Law

13. STATE
NY

14. DATE OF ORGANIZATION
January 31, 2007

15. CERTIFICATION (By an Applicant **Other** Than an Individual)
I hereby affirm under penalty of perjury that I am Region Engineer (title) of S.A. Dunn & Company, LLC (entity); that I am authorized by that entity to make this application; that this application was prepared by me or under my supervision and direction; and that information provided on this form and attached statements and exhibits is true to the best of my knowledge and belief. I am aware that any false statement made herein is punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law.

Date: 1/13/2022 **Signature:** **Print Name:** Curt Taylor

Summary of Consent Orders

Consent Order	Subject(s)	Status
R4-2018-0228-27	1. Use of access points (gates) not identified in the Mined Land Use Plan. 2. Exceedance of truck trip limit due to moving sand to an adjacent parcel. 3. Silt-laden runoff leaving one of the gates identified above. 4. Visible dust leaving the site.	$100,000 penalty, $50,000 of which was suspended. $225,000 Environmental Benefit Project. Schedule of Compliance Items Complete.
R4-2019-0129-7	1. Liner system component deviation	$2,700 penalty, $1,700 of which was suspended Schedule of Compliance Item Complete.
R4-2019-0409-24	1. Deviation from Mined Land Use Plan (hydromulching) without approval. 2. Failure to apply palliatives to prevent visible dust from leaving the site.	$35,000 penalty, $15,000 of which was suspended Schedule of Compliance Items Complete, except to permit and construct berm per this application.
R4-2020-0312-41	1. Visible dust leaving the site. 2. Inadequate cover.	$17,500 penalty. Schedule of Compliance Items Complete.
R4-2021-0316-18	1. Deviation from Dust Control Plan (temporary removal of dune fence). 2. Visible dust leaving the site.	$24,000 penalty, $6,000 of which was suspended. Schedule of Compliance Items Complete.

APPENDIX C

ENGINEERING REPORT

ENGINEERING REPORT
DUNN MINE AND C&D FACILITY
MSE BERM PERMIT MODIFICATION

Prepared For:

S.A. DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION
RENSSELAER, NEW YORK 12144

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING,
LANDSCAPE ARCHITECTURE AND LAND SURVEYING, PLLC
31 BELLOWS ROAD
RAYNHAM, MASSACHUSETTS 02767

CEE Project 182-442

JANUARY 2022

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Location and Site Description 1

1.2 Project Description 2

1.3 Existing Facility Analysis Modifications 3

1.3.1 Continued Mining Operations 3

1.3.2 Capacity, Construction and Operation 3

1.3.3 Leachate Management 4

1.3.4 Phase Closure 5

1.3.5 Site Access and Vehicle Circulation 5

1.3.6 Stormwater Management 5

1.3.7 Electric Power, Water Supply and Sanitary Sewage Requirements 6

1.3.8 Service Area 6

1.3.9 Groundwater Management 6

1.3.10 Erosion and Sedimentation Control Plan 7

1.3.11 Landscape Plan 7

1.3.12 Materials Protection 7

2.0 BASELINER SYSTEM 8

2.1 General 8

2.2 Baseliner System Components 8

2.3 Subgrade Layer 9

2.4 Low Permeability Soil Liner 9

2.5 HDPE Geomembrane 10

2.6 Drainage Material Layer 10

2.7 Leachate Collection System 11

2.7.1 General 11

2.7.2 Leachate Generation 11

2.7.3 Leachate Collection System 13

2.7.3.1 Evaluation of Impacts of 500-year, 24-hour Design Storm 14

2.7.4 Leachate Pumping System 16

2.7.5 Leachate Riser Buildings 16

2.8 Leachate Storage System 16

2.8.1 General 16

2.8.2 Monitoring 17

3.0 LANDFILL GAS MANAGEMENT SYSTEM 18
3.1 Existing Gas Collection System 18
3.2 Proposed Gas Collection System 18
4.0 STORMWATER MANAGEMENT SYSTEM 20
4.1 General 20
4.2 Existing Permitted Conditions 21
4.3 Post-Development Conditions 21
4.4 Permit Modification – Pre-Development vs. Post-Development 21
4.5 Design Criteria for Stormwater Management Controls 22
4.6 Analysis of Stormwater Management Controls 22
4.6.1 Disposal Area Structures 22
4.6.2 Diversion Berms 23
4.6.3 Gabion Lined Downchutes 23
4.6.4 Perimeter Swales 24
4.6.5 Energy Dissipators 24
4.6.6 Basin Inlet Channels 25
4.6.7 Outlet Protection 25
4.6.8 Stormwater Management Pond 25
4.6.9 Evaluation of Impacts from 500-year Storm 26
5.0 GEOTECHNICAL ANALYSIS 28
5.1 General 28
6.0 CLOSURE AND POST-CLOSURE MAINTENANCE AND OPERATION 33
6.1 Closure Design 33
6.2 Post-Closure Water Quality Monitoring 33
6.3 Closure of Leachate Collection System and Storage 33
6.4 Landfill Gas Management System 34
6.5 Financial Assurance 34

FIGURES

Figure 1 – MSE Berm Modification Area
Figure 2 – Disturbed Area
Figure 3 – Site Vicinity Map

APPENDICES

Appendix C1 – Stability Analysis
Appendix C2 – Project Design Calculations

1.0 INTRODUCTION

The purpose of this Engineering Report is to describe the proposed mechanically stabilized earthen (MSE) berm modification relative to the design, construction, operation, and closure at the Dunn Mine and C&D Facility and to demonstrate compliance with 6 NYCCR Part 360 and 363 Regulations.

1.1 LOCATION AND SITE DESCRIPTION

Dunn Mine and C&D Facility is an existing sand and gravel mine and construction and demolition debris (C&D) disposal facility located in Rensselaer and North Greenbush, New York. The site is owned and operated by S.A. Dunn & Company, LLC. The facility activities include both C&D disposal and mining operations. The site is operating under a permit issued by the New York State Department of Environmental Conservation (NYSDEC) dated August 31, 2020. Figure 1 presents the site location in the region.

The topography in the vicinity of the project site, as shown on Figure 2, ranges from approximately 200 to 300 feet above mean sea level (MSL) and generally decreases to the west towards the Hudson River. Access to the project site is via Partition Street Extension through the City of Rensselaer. There is no other vehicular access to the project site.

The current C&D disposal footprint includes 9 phases of baseliner construction labelled as Phases 1 through 7A, which encompass approximately 37 acres. The total permitted waste footprint is 63.3 acres; with this modification the total permitted waste footprint will be reduced to 62.1 acres and is anticipated to include 7 additional phases of baseliner construction, including Phase 10C which is currently under construction and anticipated to be completed in spring 2022.

Prior to the disposal operations commencement in January 2015, the project site had historically had an existing sand and gravel mining operation, commonly known as the "Dunn Bank." The mining operations on the project site resulted in the excavation of two (2) large pits known as the south and north pits. Current mining operations are taking place in the north pit and within the proposed and permitted future disposal areas.

Surrounding land uses are primarily residential around the southern and eastern boundaries of the project site. Vacant land is located around the remaining perimeter of the property, and a pre-kindergarten to 12th grade school owned by the Rensselaer City School District is located to the north and northeast of the project site, and a cemetery is located to the east.

Municipal water, as well as electric power and telecommunications, currently provide service to the project site along Partition Street.

1.2 PROJECT DESCRIPTION

The facility is currently permitted to operate under a permit issued by the New York State Department of Environmental Conservation (NYSDEC) (Permit DEC #4-3899-00006/00006). The permit encompasses both the mining and disposal activities at the site. The initial permitting for the C&D disposal facility site was prepared by C.T. Male Associates, P.C. and included a Draft Environmental Impact Statement accepted by NYSDEC on January 9, 2012, a Final Environmental Impact Statement dated May 2012, and a solid waste permit application, including engineering drawings, dated October 2010, last revised December 2011. Subsequent to receiving approval for construction of the facility, the construction phasing plan as presented in the initial permit application was revised and a minor modification was prepared by Sanborn, Head and Associates in May 2014. NYSDEC approved the permit revisions, and construction of the site began in late summer 2014. The first phase of construction was approved by NYSDEC in early 2015, and waste placement activities began in January of 2015. Subsequently, CEE prepared a permit modification to revise the disposal facility construction sequencing that was approved in September 2015. In 2016, a permit modification to adjust the waste footprint was prepared by CEE and approved by NYSDEC in 2016. Most recently, a permit modification to revise the baseliner construction and waste filling sequence was prepared by CEE and approved by NYSDEC in May 2020.

This proposed modification includes modifying the northern and portion of eastern perimeter berm to include a mechanically stabilized earthen (MSE) berm. The current footprint limit, along with the approximate limits of the proposed berm modification, is shown on Sheet C100 of the permit drawings, located in Appendix H. The reduced C&D filling area is approximately 1.2 acres. The total land disturbance area has been reduced by 0.66 acres, based on difference between the limit of grading presented on the previously approved Footprint Modification permit drawings and the limit of grading on the MSE Berm Modification permit drawings.

1.3 EXISTING FACILITY ANALYSIS MODIFICATIONS

1.3.1 Continued Mining Operations

The proposed modification will not have any adverse effects on the current mining operations at the facility. The mining operations will continue within areas of future permitted cell construction; no changes are proposed to this permit condition.

To the extent possible, the mined soils will be utilized as part of the MSE berm construction. If sufficient quantity exists, clay from mining will be used for on-site baseliner construction. On-site sand and gravel will be utilized as part of the drainage layer (provided the material meets regulatory requirements) and for operating cover of the in-place C&D material.

1.3.2 Capacity, Construction and Operation

The design capacity relative to the proposed modification will be reduced as part of the proposed modification by approximately 220,000 cubic yards (CY). Based upon an average annual volume of incoming waste at 580,000 CY, the proposed modification will reduce site life by approximately four months. The maximum in-place density of the C&D is expected to be approximately 0.6 tons per cubic yard, based on historical tonnage rates and airspace consumption. Currently, the site is permitted to accept 100 trucks per day; no changes are proposed to this permit condition. Therefore, the total tonnage per day accepted will be within the constraints of the quantity of trucks allowed. The proposed waste disposal area associated with this modification will encompass an approximate final capped area of 62.1 acres. The total area inclusive of detention ponds, perimeter road and perimeter swales, as well as the capped area will remain relatively unchanged at approximately 70 acres.

As shown on permit modification drawings, the disposal facility footprint is anticipated to be constructed in ten phases. Phases 1 through 7A have been constructed and Phase 10A is currently under construction. The overall fill progression plans, as shown on Sheets C308 and C309 of the Engineering Permit Drawings, includes six remaining cells to be constructed within Phases 7, 8, 9 and 10.. The proposed reduction in the limit of waste results in changes to the individual phase and cell limits resulting in the following areas for each area:

- Phase 10B – 1.9 acres
- Phase 10C – 1.4 acres
- Phase 9 – 3.7 acres
- Phase 8A – 6.8 acres
- Phase 8B – 4.6 acres
- Phase 7B – 5.0 acres

Individual cells in a given phase of the landfill development may be separated by an operational berm to provide hydraulic separation between cells to minimize leachate generation through control of stormwater. Intermediate "phase division berms" will be used to the degree practical to segregate rainfall from solid waste inside a given cell.

Further, while the fill progression depicted in the Drawings illustrates specific cell dimensions; in practice, cells will be sized based on incoming waste rate, access requirements, and practical construction considerations. Filling may begin in a partially completed cell as liner construction continues on remaining portions of the cell. This practice generally allows for the placement of the initial lift of Select Waste, which requires additional time to fill. Fill progression will typically begin at the low point of a particular operating cell and proceed in an upslope direction. Areas of each cell will be covered with operating cover, consisting of a minimum of twelve inches of soil, as they are brought to final or interim grade. When a sufficiently large area has achieved final grade, the final cover system will be constructed. Upon reaching final waste fill elevations, an active gas collection system will be installed for each area.

Filling operations will be implemented in accordance with a NYSDEC approved Facility Manual, consistent with the requirement of 6 CRR-NY Part 363-7.1 and Part 360.19. The Facility Manual is included in Appendix D of the Part 360 Permit Application.

1.3.3 Leachate Management

Collected leachate is and will continue to be pumped from five leachate sump locations, all of which are currently permitted and operational. The leachate pump system within the cells includes submersible pumps installed in riser pipes placed along the side slopes of the cells that convey leachate to the existing 275,000-gallon storage tank via a dual-contained force main. The stored leachate is then pumped into tankers at the existing load out station and trucked to an approved wastewater treatment facility for treatment and disposal. The load out station has been constructed

with containment for potential spills while loading, and a roofed enclosure to prevent stormwater from entering the station floor and containment structure. The proposed modification will not adversely affect nor significantly change the existing management of leachate. The facility will continue to utilize the same haulers as currently in place to remove leachate from the site.

1.3.4 Phase Closure

The proposed modification will not adversely affect the phased closure. Closure construction will be phased and as the disposal area phases reach approved capacity, closure cap construction will be implemented, meeting 6 CRR-NY Part 363 requirements.

1.3.5 Site Access and Vehicle Circulation

Access to the project site is via Partition Street Extension using the existing entrance road. The existing gate is secured during periods of non-use to prevent unauthorized access into the facility. Vehicle circulation internal to the project site is and will be via gravel access roads (i.e., service roads) constructed for each future phase of disposal area construction. The remaining existing service roads associated with the current mining operation will be incorporated to the maximum extent possible.

1.3.6 Stormwater Management

Stormwater will be managed on site to maintain peak discharge of runoff off-site to less than the permitted conditions. Prior to the closing and capping of the facility, there will be no increase in stormwater leaving the site, as a portion of the runoff will continue to be directed into the mined areas, where it will infiltrate. Stormwater runoff that is not directed to the mining areas will be collected in a series of stormwater channels and conveyed to on-site stormwater ponds. Temporary and permanent detention ponds will be constructed, as necessary, to maintain zero increase in runoff discharge from the site.

There will be no increase in peak discharge of stormwater runoff as a result of the proposed modification above the previously permitted discharge levels. Stormwater will be directed towards on-site stormwater ponds and discharge will be controlled to avoid the potential for adversely altering downstream conditions. The proposed stormwater system is described in Section 4 and supporting calculations are provided in Appendix C2.

1.3.7 Electric Power, Water Supply and Sanitary Sewage Requirements

The proposed modification will not affect any existing electric power, water supply, or sanitary sewage requirements. The project site is currently serviced with electric power and municipal water. Three-phase electric power is currently supplied by National Grid to the project site via overhead transmission lines located along Partition Street Extension. City of Rensselaer water is available both along Partition Street Extension and along the existing entrance road where there is a 2-inch service connection. No municipal sewer service currently connects to the project site.

The existing office and maintenance garage building on the project site will continue to be used to service equipment and provide office space for all site operations. This existing building has three (3) toilets, several sinks, electric power, municipal water, and an on-site septic system.

The existing scale house is connected with electric power and municipal water. It has one rest room that is equipped with municipal water. A holding tank has been installed to collect wastewater. It is periodically pumped out with septic waste disposed of off-site.

Electric power is also connected to the leachate storage tank, leachate load-out facility, the flare, and to each of the existing leachate collection stations.

1.3.8 Service Area

The service area will not change as a result of this proposed modification and will remain operating as a private C&D facility that will accept only C&D waste material. Ongoing operations have accepted waste from the greater Capital District area including Albany, Saratoga, Schenectady and Rensselaer Counties, as well as areas outside of the Capital District.

1.3.9 Groundwater Management

The proposed modification will not affect the permitted conditions regarding groundwater management as this application includes a reduction in overall waste disposal footprint and no change to the maximum excavation grade.

1.3.10 Erosion and Sedimentation Control Plan

The proposed modification will not affect the permitted conditions regarding erosion and sedimentation controls. Standard methods of erosion and sedimentation control will be practiced during each construction sequence. Long-term controls will be provided by establishing vegetative cover in as many areas as practical within the project area, including the proposed footprint area.

1.3.11 Landscape Plan

The proposed modification will not significantly affect the permitted conditions regarding the landscape plan. After each phase of construction, disturbed areas will receive vegetative soil material and seed, consistent with the current existing conditions. At the end of C&D placement, the filled phase areas will have a final cover system installed in compliance with the closure plan.

1.3.12 Materials Protection

The proposed modification will not affect the permitted conditions regarding materials protection. Facility operations personnel will continue to perform daily inspections of installed construction materials to verify that the materials meet specifications and comply with the requirements of 6 CRR-NY Part 363-6.5 through Part 363-6.18, from completion of construction to operation of the new phases.

2.0 BASELINER SYSTEM

2.1 GENERAL

In general, the proposed phases will require mass excavation prior to the construction of the baseliner system. The baseliner system for each proposed phase will consist of a single composite liner system in accordance with the requirements of 6 CCR-NY Part 363-6 Regulations.

The proposed subgrade locations and elevations were unaltered from the currently permitted design with the exception of the northern limit of the footprint that includes Phases 7 and 8. In this area, the floor of the landfill has been reduced to account for the subgrade changes and structural fill required to construct the revised MSE berm and maintain the minimum slope in accordance with the regulations. As required by Part 363, the baseliner elevations will:

- Maintain 10 foot buffer between bedrock and the proposed single liner system subgrade;
- Maintain 5 foot buffer between maximum groundwater elevation and the proposed single liner system subgrade;
- Provide minimum 2% slope within the lined area;
- Provide maximum 3 horizontal to 1 vertical (3H:1V) sideslopes;
- Provide a minimum slope of 1% on all piping.

2.2 BASELINER SYSTEM COMPONENTS

The proposed baseliner system complies with Part 363-6, as described below:

1. A subgrade layer of compacted soil will provide support to the overlying baseliner, and attain design grades to assure adequate leachate drainage.
2. A compacted low permeability soil liner, minimum thickness of twenty-four (24) inches, with an in-place saturated hydraulic conductivity of 1×10^{-7} centimeters per second (cm/sec) or less.
3. A textured high-density polyethylene (HDPE) geomembrane liner, 60 mils thick.
4. A 16-ounce non-woven geotextile.
5. A leachate removal system, consisting of piping and leachate collection stone installed in a 24-inch drainage material layer.

Removal of leachate will be accomplished through the drainage layer and a network of perforated collection pipes enveloped in stone. The baseliner system has been designed so that leachate in the collection system will flow to and through the collection pipes to sumps located at the low points of the baseliner system along the west side of the facility, and then will be pumped from the sumps to the on-site leachate storage tank.

2.3 SUBGRADE LAYER

The top twelve (12) inches of the subgrade in the future baseliner phases will be compacted to 92% Modified Proctor density, as specified in the Technical Specifications. Embankment construction and intermediate grading that is necessary to reach subgrade elevations will be compacted to 92% Modified Proctor Density. A minimum of nine moisture/density field tests will be performed per acre in order to provide certification of the required compaction. The Construction Quality Assurance/Construction Quality Control (CQA/CQC) includes subgrade construction procedures.

The disposal area will be excavated and filled as necessary to achieve the design grades shown on the permit modification drawings, maintaining a 2.8% minimum slope. There are no changes to the approved subgrade elevations and slope on the floor of the landfill, with the exception of the northern portion of Phases 7 and 8, where a portion of the 2.8% sloped floor has been reduced to allow for backfill of the modified berm which will be constructed at a 3H:1V slope. The maximum loading on the subgrade will not be increased as a result of this analysis; therefore, the post-settlement slope provided in the original design will not be impacted. A NYS licensed land surveyor will be required to provide certification of subgrade as-built conditions, to a tolerance of 1 +/- inch.

2.4 LOW PERMEABILITY SOIL LINER

The low permeability soil liner component for the new phases will be installed over the prepared subgrade. The minimum compaction required will be 85% of the Modified Proctor Density, as well as sufficiently compacted to provide a maximum hydraulic conductivity of 1×10^{-7} cm/sec. The clay will be placed in lifts having a compacted thickness of 8 inches. QA/QC testing will be performed at the frequencies specified in the Technical Specifications. The QA/QC testing frequencies will meet the requirements of Part 363.

Excavated soils from the mining operations have historically been collected and tested to determine whether the material could be used as a low permeability material source. Test results have indicated that the clay is suitable for use as both the low permeability liner component and the final cover barrier layer when capping construction commences. Confirmatory testing will be conducted on material prior to construction of each phase in accordance with the Technical Specifications and CQA Manual. As required, low permeability soil consistent with regulatory requirements and the Technical Specifications, will be imported from an off-site source.

2.5 HDPE GEOMEMBRANE

The HDPE liner component will be a minimum of 60-mil thickness, and have a textured finish on both sides. The HDPE geomembrane will be installed using approved methods, consistent with applicable regulations and the approved Technical Specifications. A CQA/CQC program shall be conducted as required by Part 363.

2.6 DRAINAGE MATERIAL LAYER

The soil drainage layer component will be installed above the geomembrane. The drainage material layer will comply with the requirements of 6 CRR-NY 363-6.6(3)(ii). On slopes less than or equal to 10%, the material will have a minimum hydraulic conductivity of 1 cm/sec. On slopes greater than 10%, the material will have a minimum hydraulic conductivity of 0.1 cm/sec. The soil will be placed in one 24-inch lift using approved methods, consistent with applicable regulations and the Technical Specifications. A cushion layer of non-woven geotextile will be installed above the geomembrane to protect it from potential damage from the drainage layer materials.

Suitable material will be imported to the site for use in the baseliner system. Confirmatory testing will be conducted on the material prior to construction of each phase in accordance with the approved Technical Specifications and CQA/CQC Plan and as required by Part 363.

2.7 LEACHATE COLLECTION SYSTEM

2.7.1 General

In order to design the proposed system and confirm its feasibility, potential leachate generation quantities were estimated. Calculations are located in Appendix C2 and results are as follows:

- Leachate Generation:
  - The existing pumps and pipes have the capacity to handle the expected daily leachate generation rate.
- Maximum head on liner:
  - The maximum head on the liner will be less than 12 inches; the calculated daily leachate generation rate is similar to the previous design and the drainage stone permeability has increased, while the pipe spacing has remained the same. Therefore, the pipe layout will continue to maintain a head less than 12 inches on the liner and head calculations are not included.
- Pipe strength calculations:
  - Proposed pipes will consist of SDR-11 HDPE pipes and will withstand the dynamic and static loading stresses associated with construction, operation, closure, and post-closure. There is no increase in the maximum elevation of the landfill proposed with this permit application; therefore, the pipes as previously designed are adequate and pipe strength calculations are not included.

2.7.2 Leachate Generation

Leachate generation quantities were estimated using the Hydrologic Evaluation of Landfill Performance Model (HELP 3.07) developed by the U.S. Army Waterways Experiment Station for the USEPA. This program is used to model baseliner cross sections leachate generation rates, leachate collection and removal systems, and cover configurations by performing a water balance analysis of a landfill in any stage of completion.

The HELP program is used to model proposed groundwater protection systems, leachate collection and removal systems, and cover configurations by performing a water balance analysis of a landfill in any stage of completion. The HELP program models landfill performance using climatological data, soil characteristics, design details, and operational features, which together simulate

conditions expected at the site. Climatological data requirements included precipitation, temperature, and solar radiation. The soil characteristics include porosity, field capacity, wilting point, initial water content and hydraulic conductivity for each layer of the landfill profile. The required design data includes soil and waste layer thickness, liner and cover configurations, surface area, leachate collection or drainage layer slope, drainage length (flow path between collection pipes), and the condition of the landfill surface.

To perform the analyses for this proposed modification, climatological data for Albany, New York was used. The characteristics for the various layers of the facility were generally selected from a list of characteristics provided in the program that mostly reflect the types of materials that will be used at the Dunn facility. In various layers, in order to comply with project specifications, the hydraulic conductivity parameter within the model was modified.

The HELP model was utilized to predict leachate generation for the following waste depths: 10 feet, 50 feet, 100 feet, and 150 feet. A summary of the results is shown in the table below. As presented in the table below varying waste depths the average leachate generation was estimated between approximately 238 and 1,257 gallons per acre per day. The estimated generation rates shown below are similar to the rates which were presented in the previously approved permit modification. The HELP calculations are provided in Appendix C2.

HELP MODEL RESULTS – PER ACRE ANALYSIS

Waste Depth (ft)	Predicted Generation Rate (gal/acre/day)
10	1,257
50	755
100	381
150	238
Cap*	20

*20 gal/acre/day is assumed for final cap leachate generation based on historical final cover rates.

Using this information and the proposed phasing plan for the facility landfill, the maximum leachate generation rate was determined. The maximum leachate generation rate will occur when in the last phase of development when Phase 7B has just been constructed and initial filling has begun. In this scenario, there will be one lift or 10 feet of waste in place in Phase 7B, while the other phases will have final cover, intermediate cover, or daily cover.

For this case, approximately 5.0 acres will be filled with an average waste depth of 10 feet, 15.4 acres will be filled with an average waste depth of 50 feet, 8.1 acres will be filled with an average waste depth of 100 feet, 18.5 acres will be filled with an average waste depth of 150 feet, and 15.2 acres will be capped. A drawing depicting this stage of filling is included in with the leachate generation supporting technical data in Appendix C2. The following table presents the total leachate generation for this scenario. Based on this analysis, the anticipated average daily pumping rate is 18 gallons per minute (gpm). The current pumps in each phase have the capacity to handle this rate.

MAXIMUM LEACHATE GENERATION SCENARIO SUMMARY

Average Waste Depth (ft)	Area (acre)	Daily Collection Rate (gal/day)
10	5.0	6,285
50	15.4	11,627
100	8.1	3,086
150	18.5	4,403
Final Cover	15.2	304
TOTAL	62.2	**25,705**

2.7.3 Leachate Collection System

The leachate collection system will be installed above the HDPE geomembrane. For future development areas, the system will be comprised of 24 inches of granular drainage material with a minimum permeability of 1 cm/sec on slopes less than or equal to 10 percent and a minimum permeability of 0.1 cm/sec on slopes greater than 10 percent. The soil drainage layer will be installed in one 24-inch lift. The collection system will also include a network of perforated collection pipes installed within the drainage protection layer. The pipe slope, spacing, and alignment have not been changed with this modification. Together, these components will convey leachate to the existing sump areas and minimize the leachate head on the liner.

The piping network is proposed to be installed within the base area, generally conveying the leachate in an east-to-west direction, at a minimum two percent (2%) slope, towards the existing sump locations. The leachate collection piping will be 8-inch diameter perforated SDR-11 HDPE pipes. The existing sumps are equipped with 18-inch diameter riser pipes installed on the side slope to facilitate the leachate pump, as shown on the permit modification drawings. These pipes were selected based on pipe strength and hydraulic calculations contained in Appendix C2.

The leachate collection piping will be installed within a minimum three-foot wide stone trench. The proposed stone for this application is crushed, screened, non-carbonate, NYSDOT #2 stone. Pipes will be placed at the locations and slopes as shown on the permit drawings. The capacity of each 8-inch diameter pipe, calculated based on a 1% post-settlement slope, is approximately 640 gallons per minute when flowing full, which greatly exceeds the anticipated leachate generation rate.

In order to maintain the integrity of the leachate collection pipes, proposed leachate cleanouts will be installed at the ends of perforated pipe sections. These cleanouts will be 8-inch diameter solid walled SDR-11 HDPE pipe, installed on the proposed baseliner sideslope and terminating outside of the limits of the cell. All cleanouts will be fitted with a cap to allow for easy access and maintenance. The leachate collection system will be cleaned on an annual basis to prevent clogging and to access the overall operation and performance of the system. Access for cleaning will be provided by strategically located cleanouts built into the system, as shown on the permit modification drawings.

The proposed configurations satisfy the requirements of the NYSDEC regulatory design and performance standards and are shown on Sheet C301 of the permit drawings.

2.7.3.1 Evaluation of Impacts of 500-year, 24-hour Design Storm

The 6 CRR-NY Part 363-4.3(e)(ii) requires that the impacts of a 500-year storm on the landfill's leachate collection and removal system that do not have intermediate or final cover placed. Based on the Cornell Extreme Precipitation for New York and New England data, Rensselaer, NY will receive 9.91 inches of rain during a 24-hour, 500-year storm event.

During the initial stages of construction when the cell is open, the entire storm volume would be stored within the cell based on the cell geometry. The average cell area is approximately 8 acres and the operational berms will have a minimum height of 4 feet; therefore, providing about 1.4 million cubic feet of storage capacity with no freeboard and not including the storage capacity of the 24-inch thick sand layer. A storm with a total precipitation rate of 9.91 inches will generate approximately 288,000 cubic feet of rainwater. There will be contributory areas from adjacent landfill sideslopes draining into an open cell that will increase the storage requirements, though the exact areas will vary throughout the life of the landfill. During initial stages, there will be C&D waste in the cell as well that will somewhat reduce storage capacity; however, the C&D waste will have capacity to hold water as well. The average open cell is expected to have sufficient capacity to fully contain rainwater from the 500-year storm. The time to fully dewater the cell will be 15 days based on average pumping rates of the pump currently installed in Phase 7.

When the cells are partially filled with waste grades above the operational and perimeter berm elevation, rainwater that falls on the external slopes will flow to perimeter channels alongside the road. Rainwater that falls on the landfill plateau area will be absorbed by the waste mass or may become overland flow that will also be directed to the stormwater management system. The storm will cause a temporary increase in leachate generation and collection rates; however, the timing and actual impacts to the collection system will vary depending on the total depth of waste in place at the time of the storm as well as the size of the plateau area. The piping system at the facility includes 8-inch diameter pipes spaced approximately 188 feet apart. Based on the site geometry and pipe layout, each pipe will potentially have a contributing drainage area of approximately 6 acres. At the leachate generation rate expected for the landfill of 1,367 gallons per acre per day, this equates to a total flow rate of 5.7 gallons per minute. The maximum pipe flow capacity is 640 gallons per minute; therefore, the pipes have capacity over 100 times the expected leachate generation rate. The 500-year storm will increase the rate, though likely it will be less than that factor; therefore, the collection piping system is expected to have adequate capacity to convey the peak generation. There will also be an increase in the leachate head on the liner, though this again will vary based on the waste depth and timing of the storm and will be a temporary situation.

Depending on the site configuration at the time of the storm, there is also the potential for leachate seeps to occur. The facility would continue to monitor the landfill side slopes as in current operations and would address seeps by placing additional soil above the seep area for containment.

2.7.4 Leachate Pumping System

In accordance with 6 NYCRR 363-6.11(1), the leachate collection system must be designed to allow the peak flow from the 25-year, 24-hour design storm to be removed from the each disposal cell within seven days. All sumps have been constructed and the pumping systems were designed to meet this requirement.

There is no proposed modification to the leachate pumping system from the previously approved permit modification.

2.7.5 Leachate Riser Buildings

There are five existing leachate riser buildings at the facility. Once leachate has been collected from the piping network and directed into the leachate sumps, it is removed via submersible pumps that convey the liquid in a 2-inch force main contained in an 18-inch sideriser pipe, which terminates in a leachate collection building. There are five existing leachate riser buildings at the facility. The pump controls, flow meters, monitoring devices, and flow control valves are located within the building. From the leachate riser building, leachate is conveyed through a dual-contained 3-inch in 6-inch diameter force main that connects to the main dual-contained 4-inch in 8-inch diameter force main located, on the outside of the western perimeter access road. The entire conveyance force main from Phases 1 through 7 has been built. No additional force main construction is anticipated.

2.8 LEACHATE STORAGE SYSTEM

2.8.1 General

In accordance with 6 CRR-NY 363-6.20(a) and the transition requirements within 360.4(o)(2), no modifications are required to the existing on-site leachate storage tank. The existing tank, which was approved in a previous permit modification, is capable of storing at least 275,000 gallons of leachate, while maintaining a minimum of 2 feet of freeboard, has a secondary containment system in the event of a leachate spill, and provides adequate on-site storage for the expected leachate generation rate noted previously. The leachate within the tank is monitored as described below and leachate is removed as required.

2.8.2 Monitoring

The volume of leachate in the storage tank is monitored on a daily basis by recording the leachate as indicated by the level transmitter and converting this number to gallons using a conversion chart. The quantity of rainfall is also recorded on a daily basis from an on-site rain gauge. The leachate collection system is to be inspected on a regular basis as indicated by the inspection plan.

3.0 LANDFILL GAS MANAGEMENT SYSTEM

3.1 EXISTING GAS COLLECTION SYSTEM

The existing facility gas management system consists of a blower to provide vacuum, gas extraction wellheads, vertical gas extraction wells, a gas conveyance header, and a gas treatment system. Gas extraction wellheads are installed at eight leachate cleanout locations, while a ninth leachate cleanout is connected to the vacuum system with a valve that is used for condensate management. Additionally, there are currently seven vertical gas extraction wells located in the existing waste mass.

Header and lateral pipes have been installed to convey landfill gas from the extraction points to the flare and blower system. The existing pipe network consists of a main header pipe sloped at a minimum five percent towards a condensate collection point. The header pipe on the west side of the landfill is an 8-inch diameter HDPE pipe, while the header on the east side is a 6-inch diameter HDPE pipe. The 6-inch pipe is connected to the existing 4-inch perimeter pipe as shown on the drawings to connect the leachate cleanout extraction points in this area to the flare system. A series of lateral pipes connects the leachate collection points and the vertical gas well extraction points to the header pipe.

Condensate management is accomplished by sloping the pipes to low points for collection of condensate. The conveyance system piping has been designed with a minimum 5 percent slope towards one low point on the west side of the landfill as shown on the Drawings. At this location, a condensate dripleg and trap is constructed to discharge to the nearby leachate cleanout pipe. The knockout pot located on the utility flare/blower skid system discharges to an adjacent leachate cleanout.

3.2 PROPOSED GAS COLLECTION SYSTEM

The proposed landfill gas management system will consist of 13 additional vertical gas extraction wells located as shown on the Engineering Drawings connected via a series of lateral pipes to the main header, which will be extended along the east and west sides of the landfill. The existing condensation collection point will continue to be used as the system is expanded and no additional condensate management structures are needed.

Vertical wells will consist of 8-inch diameter SDR17 HDPE perforated pipe (or 8-inch SCH80 PVC perforated/slotted pipe) installed in a 36-inch borehole backfilled with round or crushed stone; the upper 10-feet of the well consists of solid walled HDPE (or PVC) pipe with a bentonite plug to limit air intrusion. The vertical wells are detailed on the Drawings. A landfill gas wellhead will be installed to control the vacuum to the well.

Shallow gas extraction wells will be constructed in the future as needed to control odors. These wells will be constructed using an excavator to dig the well to an approximate depth of 20 feet. Similar to drilled wells, these extraction points will consist of perforated pipe within crushed stone; however, the upper 5 feet will be solid walled pipe. Backfill at these locations will be low permeability soil with a minimum thickness of 2 feet.

Similarly, horizontal collection pipes will be installed in the future as needed to control odors. These extraction points will consist of perforated pipe installed in a horizontal trench backfilled with round or crushed stone (or similar permeable media) or waste backfill and connected to the header pipe. Horizontal collection pipes will be sloped towards a low point where a 5-foot deep sump will be constructed to discharge condensate, which will then drain back into the landfill.

4.0 STORMWATER MANAGEMENT SYSTEM

4.1 GENERAL

The stormwater management system for the proposed MSE Berm modification will consist of a number of components designed to minimize erosion, prevent run-on of stormwater onto active disposal areas, control stormwater run-off, and segregate contact and non-contact run-off. These components include flow diversions, channels, swales, stormwater management structures, and stormwater ponds. Each component of the system has been analyzed to assure it can manage the regulatory design requirements.

The following specific control measures will be employed to attenuate run-off discharge peaks, reduce sediment transport, and enhance the infiltration of managed run-off in areas outside the footprint. Stormwater runoff generated from the proposed MSE Berm Modification will flow into the proposed North Pond, similar to the previously approved permit modification.

- Grading will be used to shape surfaces and on and off the disposal areas disturbed by construction. Grading will be performed in a manner, which does not produce sharp changes in grade and to minimize the uncontrolled channeling of run-off.
- Sideslope diversion berms, lined with an erosion mat, will be installed on the final cover to divert slope runoff to downchutes. These berms are designed to reduce the distance that overland runoff has to travel, thereby reducing erosion of the completed final cover areas.
- Gabion lined downchutes will be constructed as part of the final cover system to direct runoff from the sideslope diversion berms to the perimeter swales at the toe of the disposal area.
- Perimeter swales will be constructed along the inside of the access road to convey runoff to the North Pond.
- The existing South Pond and proposed North Pond have been designed to manage the 100-year, 24-hour storm event.
- Vegetation will be developed on the final cover system. A mixture of native grasses shall be used for this purpose.

4.2 EXISTING PERMITTED CONDITIONS

The total area of land disturbance for the existing permitted conditions was approximately 70.5 acres. The closing and capping of the facility would have involved the installation of a low permeability cover system/cap designed to minimize the migration of water into the waste mass. Perimeter swales, two drainage ponds (North Pond and South Pond), and discharge pipes were permitted to control stormwater runoff. The drainage areas of the northern and southern ponds were about 45.1 and 27.7 acres, respectively. The drainage area of the south pond remains unchanged with the proposed modifications. There are no proposed changes to the south pond; therefore, the proposed modifications will not increase the discharge from this area. The drainage area to the North Pond has also decreased; however, the design grading has changed. A detailed analysis has been prepared to demonstrate that the peak discharge from the north pond will not increase post-development.

4.3 POST-DEVELOPMENT CONDITIONS

The total area of land disturbance associated with the proposed modification for the post-development conditions is approximately 45.1 acres, which eventually flows into North Pond. The closing and capping of the facility will involve a similar installation of a low permeability cover system designed to minimize the migration of water into the waste mass. Various stormwater controls, discussed above, have been designed to manage stormwater runoff.

4.4 PERMIT MODIFICATION – PRE-DEVELOPMENT VS. POST-DEVELOPMENT

The table below shows a comparison of permitted and post-development condition peak outflow rates for the proposed permit modification design. The existing South Pond will not be affected by the proposed modification and was not included in the analysis. The South Pond will be constructed as previously permitted. It should be noted that the outflow rates in the table below are based on infiltration capability through the basin, and are not discharges to the surface, i.e. in both permitted and proposed conditions, there is no proposed overland flow from the north pond. HydroCAD was used to compute flow rates for the 2-, 10-, 25-, and 100-year storm events.

PEAK OUTFLOW RATES COMPARISON						
Location	**Condition**	**Node Number**	**2-Year (cfs)**	**10-Year (cfs)**	**25-Year (cfs)**	**100-Year (cfs)**
North Pond	Permitted	10P	2.4	3.48	3.95	4.65
	Post-Development	26P	1.38	2.44	2.93	3.79

Supporting documentation for the stormwater management design calculations is provided in Appendix C2.

4.5 DESIGN CRITERIA FOR STORMWATER MANAGEMENT CONTROLS

The design criteria for stormwater management controls was developed to comply with all applicable regulatory design standards, and are as follows:

- Maintain existing drainage patterns as much as possible and continue the conveyance of upland watershed runoff.
- Control increase in stormwater runoff resulting from the closure and capping of the disposal facility without adversely altering downstream conditions.
- Mitigate potential stormwater quality impacts and prevent soil erosion and sedimentation resulting from stormwater runoff.
- Provide an outlet for the surface water runoff, minimize ponding and divert runoff to stormwater management ponds.
- Minimize the surface water runoff and other stormwater run-on from infiltrating the area around the perimeter of the footprint.

4.6 ANALYSIS OF STORMWATER MANAGEMENT CONTROLS

4.6.1 Disposal Area Structures

Stormwater runoff from the disposal area will be conveyed to the North Pond via diversion berms, downchutes, perimeter swales, and drop structures. Each of these structures have been designed for a rainfall of 4.9 inches over a 24-hour duration (the equivalent of a 25-year storm event) and have the ability to handle the peak runoff for the particular structure from the design storm. Therefore, each structure (diversion berms, downchutes, channels, drop structures and swales) is

capable of handling the flow that would be generated by the largest drainage area contributing runoff to any such structure on the disposal area.

The maximum flow rate and the design capacity of each conveyance structure is summarized in the table below. Supporting design calculations are provided in Appendix B2.

Stormwater Control Structure	Maximum Flow 25-Year Storm (cfs)	Maximum Capacity (cfs)
Diversion Berms	16	45
Gabion Lined Downchutes	44	106
Perimeter Swales	60	183
Energy Dissipator 1	27	400
Energy Dissipator 2	57	507
Basin Inlet Channels	85	130
36” Dia. HDPE Pipes	82	136

4.6.2 Diversion Berms

In general, sheet flow from the disposal area will be collected via the proposed sideslope diversion berms. The proposed locations of these sideslope diversion berms is shown on Sheet C303 and C304 of the permit modification drawings. The diversion berms are designed with a minimum slope of 4%. Diversion berms will be lined with an erosion control mat, which will minimize erosion caused by the maximum velocity developed in the channel.

The diversion berms are designed in accordance with the “Standards and Specifications for Lined Waterway or Outlet” in the *New York Standards and Specifications for Erosion and Sediment Control*. The HydroCAD report, and other relative calculations, for the proposed diversion berms can be found in Appendix C2.

4.6.3 Gabion Lined Downchutes

In general, flow from the proposed diversion berms will be conveyed into gabion lined downchutes. The purpose of these downchutes is to collect runoff from the diversion berms and convey the flow towards the perimeter swales, located along the inside of the perimeter access road, or to basin inlet channels, located along the sideslopes of the proposed stormwater

management pond. The locations of the proposed gabion lined downchutes is shown on Sheet C303 and C304 of the permit modification drawings. The downchutes will be constructed on a 3H:1V slope and shall have gabion baskets linings installed for purposes of erosion control.

The gabion lined downchutes are designed in accordance with the "Standards and Specifications for Lined Waterway or Outlet" in the *New York Standards and Specifications for Erosion and Sediment Control.* The HydroCAD report, and other relative calculations, for the gabion-lined downchutes can be found in Appendix C2.

4.6.4 Perimeter Swales

Drainage swales surround the perimeter of the disposal area with the purpose of collecting all runoff from the final cover area to convey the stormwater into the proposed North Pond and existing South Pond. Locations of the perimeter drainage swales can be found on Sheet C303 and C304 of the permit modification drawings. The proposed drainage swales will be lined with North American Green P550 Reinforcement Turf. This erosion mat was selected to handle the maximum velocity in a single swale section.

The swales are designed in accordance with the "Standards and Specifications for Lined Waterway or Outlet" in the *New York Standards and Specifications for Erosion and Sediment Control*. The HydroCAD report, and other relative calculations, for the perimeter drainage swales can be found in Appendix B2.

4.6.5 Energy Dissipators

Prior to reaching the perimeter diversion swales, stormwater runoff within the proposed downchutes will flow into concrete drop structures or rip-rap lined energy dissipators. The purpose of the concrete drop structure is to collect and combine incoming flow from the perimeter drainage swales and gabion lined downchutes in order to control the flow and result in non-erosive flow conditions. The purpose of the rip-rap energy dissipator is to reduce the velocity of flow within the downchute before it enters the perimeter drainage swale or exiting the drop structures and entering the basin inlet channel. Locations of these structures can be found on Sheet C303 and C304 of the permit modification drawings.

The downchute energy dissipators are designed in accordance with the *Design of Roadside Channels with Flexible Linings* published by the U.S. Department of Transportation Federal Highway Administration. The HydroCAD report, and other relative calculations, for these structures can be found in Appendix C2.

4.6.6 Basin Inlet Channels

Flow from perimeter swales will be conveyed into the North Pond via inlet channels. The purpose of the basin inlet channel is to convey flow into North Pond and resist the erosive flow velocities. Locations of the basin inlet channels can be found on Drawing Sheet C303 and C304 of the permit modification drawings.

The channels are designed in accordance with the "Standards and Specifications for Lined Waterway or Outlet" in the *New York Standards and Specifications for Erosion and Sediment Control*. The HydroCAD report, and other relative calculations, for the basin inlet channels can be found in Appendix B2.

4.6.7 Outlet Protection

Rock outlet protection has been designed for the flows discharging from the basin inlet channels. The purpose of rock outlet protection is to prevent soil erosion. Locations of outlet protection areas are shown on Sheet C303 and C304 of the permit modification drawings.

The outlet protection structures are designed in accordance with the "Standards and Specifications for Rock Outlet Protection" in the *New York Standards and Specifications for Erosion and Sediment Control*. Calculations for the rock outlet protection structure for the basin inlet channels can be found in Appendix B2.

4.6.8 Stormwater Management Pond

In the northwest corner of the facility, a stormwater infiltration pond, designated as the North Pond, will be constructed to control runoff from the disposal area. This pond has been designed and sized such that it will have no surface water discharge for a 100-year storm event. A rip-rap lined overflow weir will be constructed in the berm at an invert elevation of 167 feet MSL (mean sea level) to provide overflow capacity from the pond. The stormwater collected in this pond will

infiltrate the pond floor at a minimum rate of 0.5 inches per hour, based on the characteristics of the on-site sand.

An existing detention pond, located in the southwest corner of the facility, designated as the South Pond, was constructed during the baseliner construction of Phase 2 (summer 2015). The pond outlet structure consists of a 12-inch diameter pipe at an elevation of 157 feet. This discharge pipe leads to a four-foot square precast concrete chamber with a 12-inch diameter outlet pipe capped with a 7-inch diameter orifice cut into it. The chamber extends vertically to a height of 167 feet MSL where an 18-inch x 18-inch grate controls incoming flow. An emergency spillway has been built at elevation 168.9 feet MSL. The outlet structure will be modified as shown on the previously approved Footprint Modification drawings.

The proposed modification will not affect the permitted conditions of the South Pond.

4.6.9 Evaluation of Impacts from 500-year Storm

In accordance with 6 CRR-NY 363-4.3(f), an evaluation of the impacts of a 500-year storm was evaluated. HydroCAD was used to compute flow rates for the 500-year storm event to evaluate the potential impacts on the stormwater management system. Based on the Cornell Extreme Precipitation for New York and New England data, Rensselaer, NY will receive 9.91 inches of rain during a 24-hour, 500-year storm event.

Based upon the HydroCAD analysis, the north pond will have the capacity to store and safely pass the volume from the 500-year, 24-hour storm through the rip-rap lined overflow. This overflow will direct stormwater towards the unnamed creek to the north and west of the site. There may be overtopping of the landfill diversion berms and gabion downchutes during this event. Based on landfill grades, this flow will be directed towards the perimeter channels. In general, during the peak of the storm, overflow from the perimeter channel on the west will flow to the unnamed creek to the north and west of the site. On the east side, there is additional containment from the 40 foot berm and road; any overtopping in that location would be directed to the north and could flow to the MSE Berm channel adjacent to the property line and then into the North Pond. The second section of the perimeter channel on the northeast side will have the capacity to handle flow from the 500-year, 24-hour design storm. Based on the hydrograph for each structure, the peak elevation will be exceeded at hour 12 but will have receded below the top elevation at hour 12.5; therefore, the overtopping of any structures is limited to that time frame. Minor erosion and rock

displacement may occur. The eroded vegetation and displaced rock will be restored to existing conditions.

5.0 GEOTECHNICAL ANALYSIS

5.1 GENERAL

This section provides a description of the slope stability evaluation performed for the proposed modification. The evaluation includes an analysis of the base and final cover liner systems and the construction and demolition (C&D) waste that will be disposed, and addresses stability of the disposal area during construction, operation, and closure.

This evaluation provides the minimum interface shear angle required for a stable configuration and establishes conformance test interface shear strength criteria for the base liner system and final cover system components. These criteria can be used to evaluate the shear strength of various interfaces to verify the materials supplied for cell and cap construction will provide factors of safety equal to or greater than those described herein.

Slope stability calculations are attached and evaluate the following conditions:

- Interim and overall slope stability of the liner system and waste mass under several intermediate and final waste slope conditions under static and seismic conditions.

Various slope stability models were prepared to evaluate these conditions. Each model requires input related to disposal area geometry and physical properties of the various construction materials and C&D waste. The following sections describe the properties developed for use in the stability models.

<u>BASE LINER SYSTEM COMPONENTS AND DISPOSAL AREA GEOMETRY</u>

The base liner system will consist of the following components from top to bottom:

1. 5 foot thick select fill sand layer;
2. 24 inches of drainage material;
3. 16-ounce non-woven geotextile;
4. 60-mil textured high density polyethylene (HDPE) geomembrane;
5. 24 inches of low permeability soil; and
6. Subgrade.

The proposed base grades for the modification create a bowl-shaped footprint consisting of 3 horizontal to 1 vertical (3H:1V) sideslopes that extend downslope from the perimeter and tie into a floor area which is sloped at approximately 3 percent. Final grades consist of maximum 3H:1V sideslopes that extend upslope from the landfill perimeter and transition to an approximate 5 percent slope to form the landfill top plateau. The addition of the MSE berm will modify portions of both the base and final grades. Specifically, the toe of the sideslope in Phases 7 through 10B will extend further into the floor areas, and the final cover elevations are modified slightly at the perimeter in certain locations to reflect the revised height of the MSE berm.

DESIGN PARAMETERS FOR SOIL COMPONENTS

Shear strength and unit weight properties for the drainage layer material and low permeability soil were obtained from lab results for the materials used during previous construction of the C&D Facility.

Drainage Layer Material (pea gravel)
Moist unit weight = 132.8 pounds per cubic foot (pcf)
Internal friction angle = 33.8º
Cohesion = 107 psf

Low Permeability Soil
Moist unit weight = 118.5 pcf
Internal friction angle = 17.4º
Cohesion = 67 psf

DESIGN PARAMETERS FOR C&D WASTE

Several references were reviewed to develop shear strength and unit weight properties for C&D waste. These references include:

- Waste Materials in Construction, Goumans, van der Sloot and Aalbers, November 1991;
- Construction Demolition Waste, Sustainable Waste Management and Recycling, Limbachiya and Roberts, 2004; and
- Construction Materials and Structures, First International Conference on Construction Materials and Structures, Ekolu, Dundu and Gao, November 2014.

These references showed internal friction angles for C&D waste ranging from 35 to 42 degrees, and cohesion ranging from 0 to 3,500 pounds per square foot (psf). Based on a review of the reference material, a composite shear strength envelope was used to model the parameters of the C&D waste, as follows:

C&D Waste at Normal Stress < 2,000 psf
Unit weight = 60 pcf
Internal Friction Angle = 35º
Cohesion = 0

C&D Waste at Normal Stress ≥ 2,000 psf
Unit weight = 60 pcf
Internal Friction Angle = 33º
Cohesion = 0

GEOSYNTHETIC INTERFACE SHEAR STRENGTH PROPERTIES

The minimum acceptable interface shear strength properties for the base liner systems were determined as part of this evaluation. Specifically, the interface shear strength required to provide a factor of safety (FS) of at least 1.50 was determined for interim slope stability during waste filling operations and overall stability following closure per 6 CRR-NY 363-4.3(c)(3)(iii).

INTERIM AND OVERALL SLOPE STABILITY ANALYSIS

An analysis was performed to evaluate stability of the liner system and the waste mass under several different intermediate and final waste slope grading configurations, referred to as interim (i.e., at intermediate grading configurations) and overall (i.e., at final grading configurations) slope stability. The interim analysis evaluates slope stability during waste filling operations, when there could be long interior intermediate waste slopes coupled with relatively small temporary interior toe berms at the base of these slopes. The overall analysis evaluates slope stability of the longest and steepest portions of the 3H:1V final grades and/or base grades, such that the maximum forces that cause instability are captured in these cross-sections. The locations of these cross-sections are provided in Appendix C. The required interface shear strengths above and below the textured HDPE geomembrane which would provide a minimum interim slope stability FS of at least 1.5 were determined using the SLIDE slope stability computer program. The analysis uses a search

routine that generates hypothetical failure surfaces through a modeled cross-section of the disposal area and subsequently calculates the ratio of the mobilized shear strength to the driving shear stress to determine the FS along the failure surface.

Additionally, this slope stability analysis includes a piezometric surface located 1 foot above the base of the geosynthetic interface layer (i.e., within the sand drainage layer) in order to represent the maximum allowable hydraulic design pressure that is allowed to accumulate above the liner system.

Sliding block analyses were used to determine the minimum interface friction angle required of the liner system to provide a FS of at least 1.5. Cross-Sections A through C were evaluated based on the configuration of the base and final waste grades and Cross-sections D through F were evaluated based on the configuration of the base and intermediate waste grades. The locations of these cross-sections are shown in Appendix C.

- Results of the sliding block analysis show that an adequate factor of safety can be achieved during interim and overall waste conditions with the following minimum large displacement interface friction values:
- Drainage Layer Sand above Geotextile; $\phi = 12^{o}$
- Geotextile above Textured HDPE Geomembrane: $\phi = 12^{o}$
- Low Permeability Soil below Textured HDPE Geomembrane: $\phi = 12^{o}$

The condition being modeled contains a broad range of normal loads being applied to the liner system. As such, conformance tests that are performed to evaluate interface shear strength of the base liner system for interim slope stability should be conducted over a range of normal loads. Based on the minimum interface friction angles noted above, the required peak shear strengths that correspond to the above interface friction angles can be determined over a range of normal loads using Equation 1.

Thus, for interim slope stability confirmation, the interface shear strength conformance tests should be conducted over a range of normal loads, and results should be evaluated against the information in Table 5-1.

Table 5-1
Shear Strength Conformance Requirements for Liner System Components

Interface	Normal Stress σ (psf)	Peak Shear Stress[1] τ (psf)	Peak Friction Angle[1] (degrees)
Drainage Layer Sand above Textured HDPE Geomembrane and Geotextile above Geomembrane[2]	2,500 5,000 10,000	531 1,063 2,493	12º
Low Permeability Soil below Textured HDPE Geomembrane[2]	2,500 5,000 10,000	623 1,063 2,126	12º

Seismic Slope Stability Analysis

6 CRR-NY 366-4.3(d) requires a seismic analysis be performed if the landfill is located in a seismic impact zone. Per this section of the Regulations, a seismic impact zone is defined as an area with a 10 percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years. Using the "Unified Hazard Tool" United States Geological Society, retrieved June 6, 2019 from https://earthquake.usgs.gov/hazards/interactive/, the Maximum Horizontal Acceleration (MHA) at the facility is approximately 0.105g. Therefore, a pseudo-static seismic evaluation was prepared in accordance with the United States EPA Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, April 1995. The same cross-sections investigated in the static slope stability analysis were examined in the pseudo-static seismic slope stability analysis in accordance with the procedure outlined in the USEPA Guidance. The minimum large-displacement interface shear strength of 14 degrees (°) was used to model the liner system interface along the entire liner system as determined from the static analyses. The minimum acceptable pseudo-static FS is 1.0 using residual interface shear strength properties. The analyses demonstrated that the pseudo-static FS for each section analyzed is greater than or approximately 1.0. As such, it is not necessary to perform further seismic deformation analysis, and the interim and final grading configuration at Dunn is considered stable relative to the peak ground acceleration of 0.105g.

6.0 CLOSURE AND POST-CLOSURE MAINTENANCE AND OPERATION

6.1 CLOSURE DESIGN

The conceptual closure design, developed in accordance with 6 NYCRR Part 360-2.15, is shown in plan and detail on the permit drawings. An approvable final closure plan will be submitted to the department within 60 days before the last receipt of waste, within 60 days before the last day of operating permit, or in accordance with permit requirements, whichever is earliest. The plan will comply with the requirements of 6 CRR-NY Part 363-6.6(d).

Filling of the waste disposal area will progress with side slopes of 33% (3H:1V) to an elevation of approximately 300 feet. The remaining fill will be placed at a slope of 5% across the plateau, which will encompass approximately 33 acres at full closure of the facility. As fill progression develops, areas that have achieved final design elevations will be closed and capped, as required, following the final grading plan provided by Sheet C302 of the permit drawings.

The final cover section will consist of the following components, from bottom to top, which are described subsequently. For side slope areas with slopes over 25%, the cap will consist of, from bottom to top, an intermediate cover layer, a geocomposite gas venting layer, a 40 mil LLDPE geomembrane liner, a geocomposite drainage layer, a 12-inch barrier soil layer and 6 inches of vegetative soil material. In areas where the slope is less than 25%, the cap will consist of, from bottom to top, an intermediate cover layer, a geocomposite gas venting layer, a geosynthetic clay liner (GCL), a 40 mil LLDPE geomembrane liner, a geocomposite drainage layer, a 12-inch barrier soil layer, and 6 inches of vegetative cover soil.

6.2 POST-CLOSURE WATER QUALITY MONITORING

The proposed MSE Berm modification will not affect the currently permitted post-closure water quality monitoring.

6.3 CLOSURE OF LEACHATE COLLECTION SYSTEM AND STORAGE

Closure of the system will be completed within 180 days after leachate collection has ceased and in accordance with the requirements set forth in Part 363-9.6.

Closure of the leachate management system will consist of removal of solid waste from the tanks, connecting lines, and all associated secondary containment systems. Solid waste removed will be properly handled and disposed of according to Federal and State requirements, and all connecting lines will be disconnected and securely capped or plugged.

Access ways to the aboveground tanks will be securely fastened in place to prevent unauthorized access. Tanks will be stenciled with the date of permanent closure.

6.4 LANDFILL GAS MANAGEMENT SYSTEM

As shown in the Engineering Drawings (Sheet C305), an active gas collection system has been constructed in the existing landfill area; this system will be expanded as additional cells are constructed and reach final grade.

6.5 FINANCIAL ASSURANCE

Currently, the site maintains financial assurance for the closure and post-closure of the currently constructed and operational phases of the landfill, which encompasses the 37 acres associated with Phases 1 through 7A.

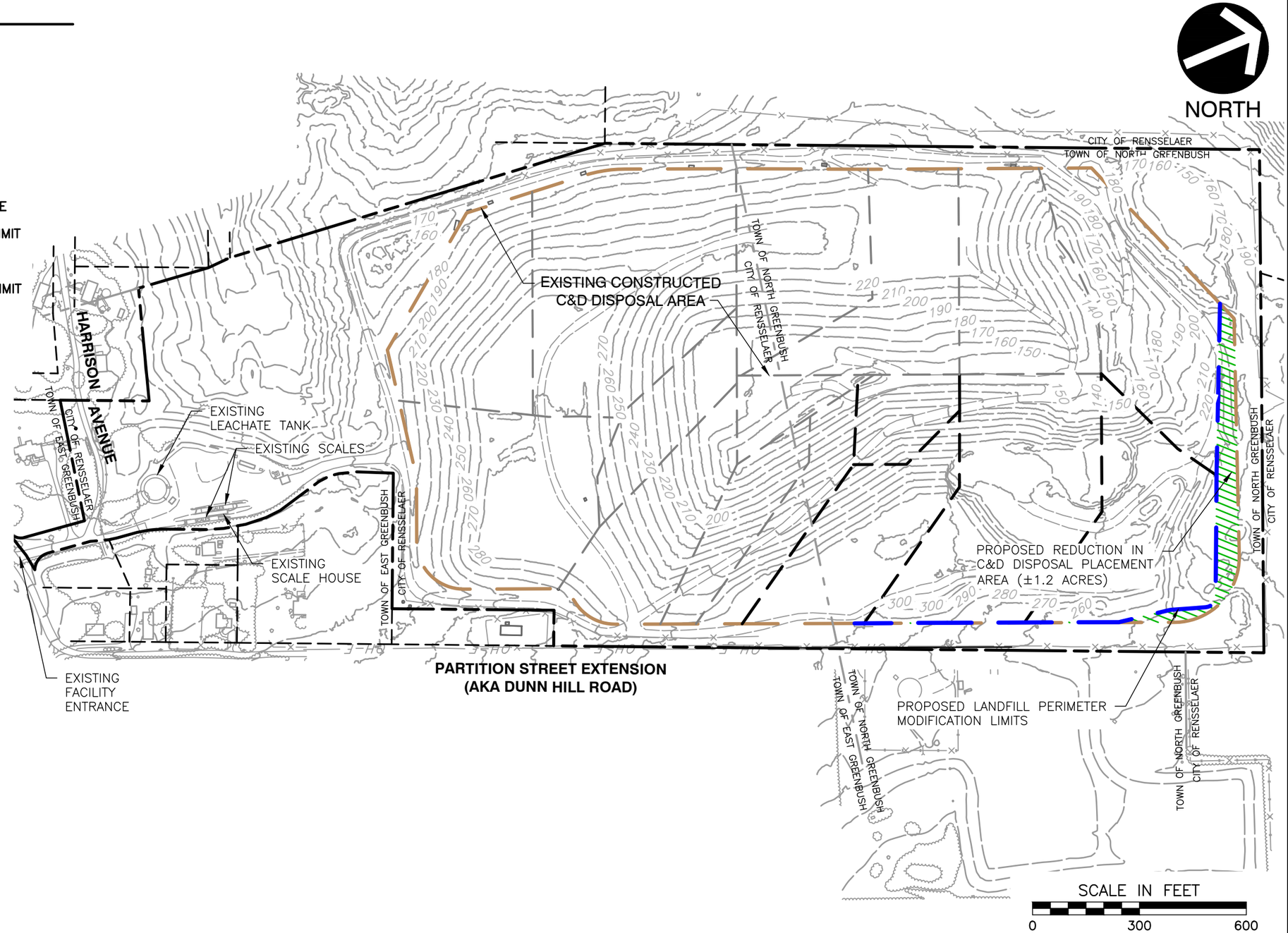
As subsequent phases of new cells are constructed and the environmental monitoring plan is expanded to include more wells, the financial assurance closure cost estimate will be revised to reflect actual conditions.

Financial assurance requirements will be maintained throughout the life of the project, until final closure.

FIGURES

LEGEND

- 200 — EXISTING MAJOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- PROPOSED REDUCTION IN C&D DISPOSAL FOOTPRINT AREA (± 1.2 ACRES)



REFERENCE NOTES:

1. EXISTING TOPOGRAPHY WAS COMPILED BY SOUTHERN RESOURCES MAPPING CORPORATION USING PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED MARCH 16, 2021, AND SUPPLEMENTED WITH TOPOGRAPHY FROM OCTOBER 10, 2020 AND NOVEMBER 4, 2020. SURVEY CONTROL DATA WAS PROVIDED BY WASTE CONNECTIONS, INC.
2. PROPERTY LINE INFORMATION WAS TAKEN FROM A PLAN TITLED "ATLA/ASCM LAND TITLE BOUNDARY SURVEY, LANDS OF KELLY AND DUNN TO BE CONVEYED TO S.A. DUNN & COMPANY, LLC," PREPARED AND SEALED BY WILLIAM N. CURRAN, AND UPDATED AS NECESSARY BASED ON AVAILABLE TITLE INFORMATION.

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A. DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

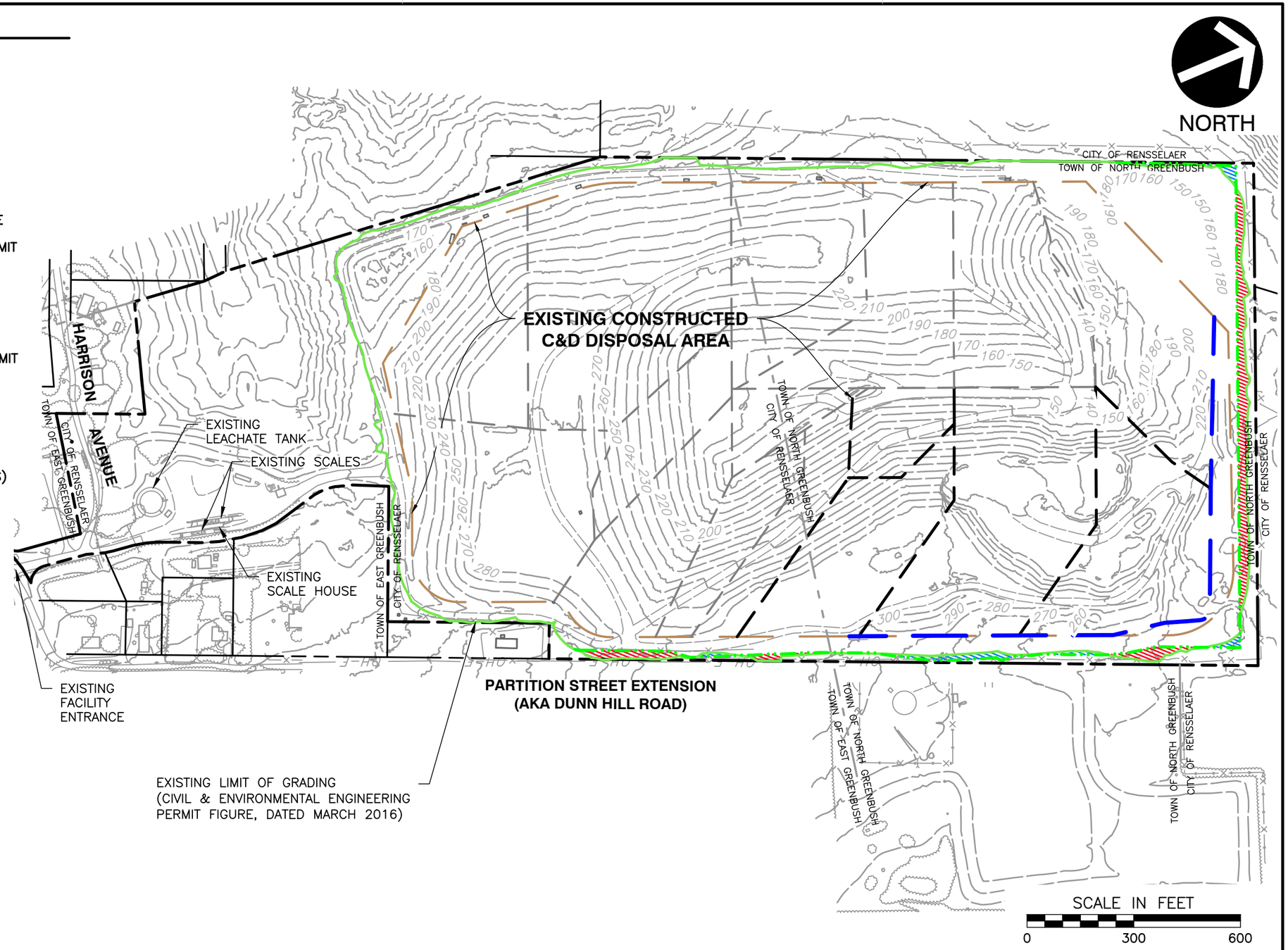
MSE BERM MODIFICATION AREA

DRAWN BY:	TLG	CHECKED BY:	EMW	APPROVED BY:	AJK	FIGURE NO.:	1
DATE:	JANUARY 2022	DWG SCALE:	1"=300'	PROJECT NO:	182-442		

P:\2018\182-442\-CADD\Dwg\SW16-Engineering Report Figures\182442-SW16-ER Report-Figure 1-Existing Figure.dwg{LAYOUT1} LS:(1/13/2022 - ewilson) - LP: 1/13/2022 2:42 PM

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LIMIT OF GRADING
- EXISTING LANDFILL PHASE LIMIT
- PROPOSED LIMIT OF GRADING
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- PROPOSED LIMIT OF ADDITIONAL DISTURBED AREA (0.27± ACRES)
- PROPOSED LIMIT OF REDUCTION IN DISTURBED AREA (0.93± ACRES)



NOTE:

1. NET DISTURBED AREA IS REDUCED BY APPROXIMATELY 0.66 ACRES.

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY WAS COMPILED BY SOUTHERN RESOURCES MAPPING CORPORATION USING PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED MARCH 16, 2021, AND SUPPLEMENTED WITH TOPOGRAPHY FROM OCTOBER 10, 2020 AND NOVEMBER 4, 2020. SURVEY CONTROL DATA WAS PROVIDED BY WASTE CONNECTIONS, INC.
2. PROPERTY LINE INFORMATION WAS TAKEN FROM A PLAN TITLED "ATLA/ASCM LAND TITLE BOUNDARY SURVEY, LANDS OF KELLY AND DUNN TO BE CONVEYED TO S.A. DUNN & COMPANY, LLC," PREPARED AND SEALED BY WILLIAM N. CURRAN, AND UPDATED AS NECESSARY BASED ON AVAILABLE TITLE INFORMATION.
3. THE EXISTING LIMIT OF GRADING WAS TAKEN FROM A FIGURE TITLED "ADDITIONAL DISTURBED AREA" PREPARED BY CIVIL & ENVIRONMENTAL ENGINEERING, LANDSCAPE ARCHITECTURE AND LAND SURVEYING PLLC, DATED MARCH, 2016.

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

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MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A. DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

DISTURBED AREA

DRAWN BY:	TLG	CHECKED BY:	EMW	APPROVED BY:	AJK	FIGURE NO.:	2
DATE:	JANUARY 2022	DWG SCALE:	1"=300'	PROJECT NO:	182-442		

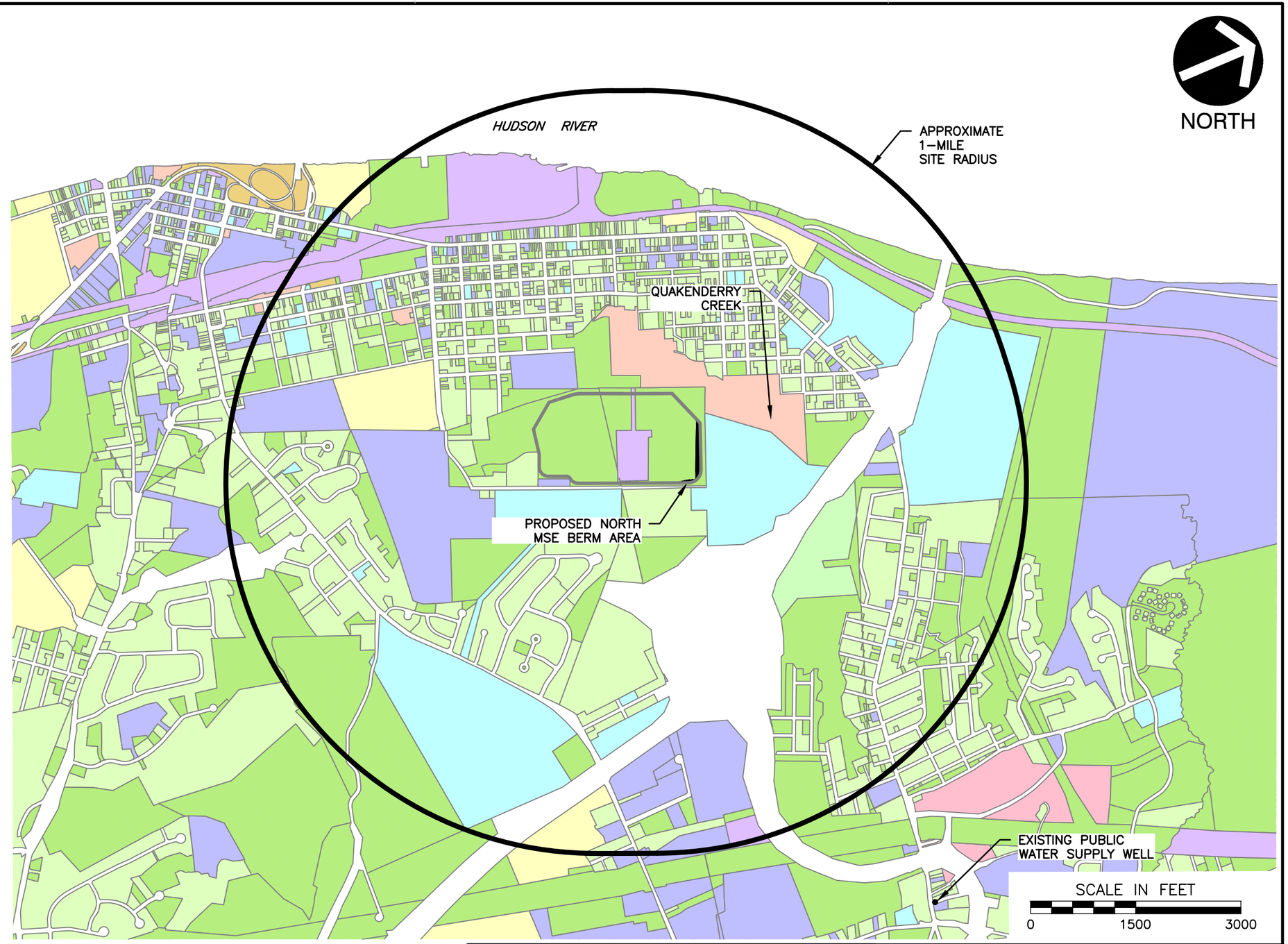
P:\2018\182-442\-CADD\Dwg\SW16-Engineering Report Figures\182442-SW16-ER Report-Figure 2-Altered Area Figure.dwg(FIGURE 2) LS:(1/12/2022 - tgaroni) - LP: 1/13/2022 3:05 PM

LEGEND:

- EXISTING 10-FOOT CONTOUR
- PROPERTY BOUNDARY
- 1-MILE SITE RADIUS
- EXISTING PAVED ROAD
- EXISTING WATER BODIES
- AGRICULTURAL ZONE
- COMMERCIAL ZONE
- COMMUNITY SERVICES ZONE
- INDUSTRIAL ZONE
- PUBLIC SERVICES ZONE
- RECREATION & ENTERTAINMENT ZONE
- RESIDENTIAL ZONE
- VACANT LAND ZONE
- WILD, FORESTED, CONSERVATION LAND ZONE
- PUBLIC/PRIVATE WATER SUPPLY WELL (SEE NOTE 3)

NOTES:

1. VECTOR DATA FROM OPEN STREETMAP INCLUDING ROADS, AND WATER FEATURES FOR WORLDWIDE LOCATIONS. ACCESS RASTER DATA FROM BINGMAP; GLOBAL, 90 METER SRTM TERRAIN DATA; AND US DEPARTMENT OF AGRICULTURE DATA AT 10 METER RESOLUTION.
2. ZONING/LANDUSE, AND WELL INFORMATION ARE BASED ON INFORMATION OBTAINED FROM NEW YORK GIS DATABASES.
3. THERE ARE NO PUBLIC/PRIVATE WELLS WITHIN 1-MILE OF THE PROPOSED AREA OF MODIFICATION.



Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC 31 Bellows Road Raynham, MA 02767	MSE BERM MODIFICATION DUNN MINE AND C&D FACILITY S.A. DUNN & COMPANY, LLC RENSSELAER, NEW YORK		
	SITE VICINITY PLAN		
DRAWN BY: TLG	CHECKED BY: EMW	APPROVED BY: AJK	FIGURE NO.:
DATE: AUGUST 2020	DWG SCALE: 1"=1500	PROJECT NO: 182-442	3

P:\2018\182-442\-CADD\Dwg\SW16-Engineering Report Figures\182442-SW16-ER Report-Figure 3-Site Vicinity Figure.dwg{11X17} LS:(1/11/2022 - ewillson) - LP: 1/12/2022 9:12 AM

APPENDIX C.1
STABILITY ANALYSIS

S. A. DUNN C&D FACILITY
PERMIT RENEWAL/MODIFICATION APPLICATION
SLOPE STABILITY EVALUATION

INTRODUCTION

This narrative provides a description of the slope stability evaluation performed to evaluate the stability of the landfill incorporating the mechanically stabilized earth (MSE) wall along the northern perimeter, as well as recent revisions to the operational sequencing and final grading configurations for the S. A. Dunn C&D Facility (Dunn). The landfill is located in Rensselaer County, New York. The evaluation includes an analysis of the stability of the liner system and the construction and demolition (C&D) waste fill slopes that will exist during operation of the site.

Slope stability models were evaluated using SLIDE, a slope stability modeling software to evaluate various conditions. Each model requires inputs related to landfill geometry and physical properties of the various construction materials and waste. The following sections describe the properties developed for use in the stability models.

BASE LINER SYSTEM AND LANDFILL GEOMETRY

The base liner system will consist of the following components from top to bottom:

1. 5 foot thick select fill sand layer;
2. 24 inches of pea gravel drainage layer material;
3. 16-ounce non-woven geotextile;
4. 60-mil textured high density polyethylene (HDPE) geomembrane;
5. 24 inches of low permeability soil; and
6. Subgrade.

DESIGN PARAMETERS FOR SOIL COMPONENTS

Shear strength and unit weight properties for the drainage layer, low permeability soil, and subgrade soil materials were obtained from lab results for sand materials from 2015 construction at the landfill.

Table 1
Soil Components Material Property Summary

Material	Moist unit weight (pcf)	Internal friction angle (deg)	Cohesion (psf)
Select Fill Sand	132.8	33.8	107
Pea Gravel Layer	132.8	33.8	107
Low Permeability Soil	118.5	17.4	67
Subgrade Soil	127	30.6	31

DESIGN PARAMETERS FOR C&D WASTE

Several references were reviewed to develop shear strength and unit weight properties for C&D waste. These references showed internal friction angles for C&D waste ranging from 35 to 42 degrees, and cohesion ranging from 0 to 3,500 pounds per square foot (psf). Based on a review of the reference material, a composite shear strength envelope was used to model the parameters of the C&D waste, as follows:

C&D Waste at Normal Stresses < 2,000 psf
Unit weight = 60 pcf
Internal Friction Angle = 35º
Cohesion = 0

C&D Waste at Normal Stresses ≥ 2,000 psf
Unit weight = 60 pcf
Internal Friction Angle = 33º
Cohesion = 0

GEOSYNTHETIC INTERFACE SHEAR STRENGTH PROPERTIES

The minimum acceptable interface shear strength properties for the base liner system to provide a FS of at least 1.50 was determined for interim slope stability during waste filling operations, per 6 CRR-NY 366-4.3(c)(3)(iii) of the New York Solid Waste Management Facilities Regulations. As such, this evaluation provides conformance test interface shear strength criteria for the base liner system components to be installed in the remaining phases of the landfill. These criteria can be used to evaluate the shear strength of various interfaces during pre-construction activities to verify the materials supplied for cell construction will provide a factor of safety equal to or greater than (FS ≥) 1.50.

Static Slope Stability Analysis

An analysis was performed to evaluate stability of the liner system and the C&D waste mass of the critical waste fill slope-grading configuration under interim and final conditions. Per inspection of the subgrade development and waste filling plans, CEC anticipates the critical interim waste fill slope will occur during Phase 9 waste filling. Three (3) cross sections were used to evaluate slope stability under final conditions. The location of this cross-sections is shown in the attached Static Slope Stability Calculation Brief.

The slope stability analyses include a piezometric surface located 1 foot above the base of the geosynthetic interface layer (i.e., within the sand drainage layer) in order to represent the maximum allowable hydraulic design pressure that is allowed to accumulate above the liner system.

Failures within the liner system were evaluated to determine the minimum interface friction angle required of the liner system to provide a FS ≥ 1.50. Results of the analysis show that an adequate factor of safety can be achieved during interim waste conditions with a minimum peak and large displacement interface friction value of 12 degrees (°) for all geosynthetic interfaces.

The conditions being modeled contains a broad range of normal loads being applied to the liner system. Thus, for interim and overall slope stability confirmation, the interface shear strength conformance tests should be conducted over a range of normal loads, and results should be evaluated against the information in Table 2 below.

Additionally, a veneer stability analysis performed as part of the 2018 footprint modification evaluated stability of the liner system during and immediately after construction. This evaluation included shear strength requirements under lower normal loads. As such, these previously provided shear strengths requirements for lower normal loads (i.e., 500 psf) have been included in the Table 2 below.

Table 2
Shear Strength Conformance Requirements for Liner System

Interface	Normal Stress σ (psf)	Peak/Large-Displacement Shear Strength[(1)] τ (psf)
Geosynthetic Interfaces above the Geomembrane	500 (from previous evaluation) 2,500 5,000 10,000	233 (from previous evaluation) 531 1,063 2,126
Geosynthetic Interfaces below the Geomembrane	500 (from previous evaluation) 2,500 5,000 10,000	212 (from previous evaluation) 531 1,063 2,126

Notes:

1. Peak/Large displacement shear strengths are provided in both friction angle and shear stress at the specified normal stress. Shear stress is calculated using the equation: $\tau = c + (\sigma \tan \phi)$ where c equals cohesion or adhesion. Exceeding either the required friction angle with cohesion/adhesion equal to zero or the large displacement shear stress at the required normal load is acceptable.

2. For lab testing, low permeability soils shall be compacted to 85 maximum dry density and ±2 percent of the optimum moisture content as determined by modified Proctor compaction test. Drainage layer sand shall be compacted to a dry density at a specified permeability. Geosynthetic materials shall be oriented in the machine direction. Shear rate shall be 0.04 inches per minute (in/min).

Additionally, the slope stability cross sections were analyzed to encompass failures in the waste mass. Using the waste and soil shear strength properties described above, a failure analysis of the interim and final grading configurations was performed to estimate the FS with respect to failures within the waste mass. Note, for this analysis, the geosynthetic liner system was excluded in order to limit the failure searches to the waste mass. A minimum FS of 1.50 is required by §363-4.3(c)(3)(iii) of the New York State solid waste regulations for the interim waste slopes. As shown

in the results in the attached calculation briefs, all of the calculated FS's were greater than 1.50, and therefore acceptable.

Seismic Slope Stability Analysis

6 CRR-NY 366-4.3(d)(i) requires a seismic analysis be performed if the landfill is located in a seismic impact zone. Per this section of the Regulations, a seismic impact zone is defined as an area with a 10 percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

As such, an evaluation was performed to determine if the S. A. Dunn Landfill is located in a seismic impact zone. This evaluation was performed using the American Society of Civil Engineers (ASCE) 7 Hazard Tool to evaluate the maximum horizontal acceleration for the probability and return interval described above. Using this tool, the maximum horizontal acceleration for the location of the S. A. Dunn C&D Landfill is 0.105g (hazard tool output is included with attached calculation brief). As such, a seismic slope stability analysis is warranted. Per the Regulations, a minimum long-term FS $\geq$ 1.0 is required using the seismic coefficient.

To be conservative, the seismic coefficient was based on an amplified maximum horizontal acceleration to account for acceleration amplification during a seismic event from the free field PGA through the waste mass. This resulted in an amplified PGA of 0.15g and a seismic coefficient of 0.075g.

As shown in the attached Seismic slope stability calculation brief, the calculated FS's are all greater than 1.0. As such, the interim and final grading configuration at Dunn is considered stable relative to the peak ground acceleration of 0.15g.

Summary

In summary, the calculated FS's indicate that the overall and interim grading conditions for Dunn will be stable under static and seismic conditions. Laboratory interface shear strength conformance testing should be performed on the specific products to be used in each construction increment to verify the materials used in construction of the landfill liner system are consistent with the shear strength properties listed in Table 2.

CALCULATION BRIEF
STATIC SLOPE STABILITY

CALCULATION BRIEF

S.A. DUNN C&D LANDFILL
PERMIT RENEWAL/MODIFICATION APPLICATION
STATIC SLOPE STABILITY

OBJECTIVE: Evaluate the final and interim (i.e., during waste placement) slope configurations with respect to static slope stability at the S.A. Dunn Landfill (Dunn). This evaluation will incorporate the recent operational sequencing modification, addition of the northern mechanically stabilized earth (MSE) wall, and minor revisions to the permitted final grading configuration. The analyses will encompass failure surfaces within the construction and demolition (C&D) waste mass and base liner system. Seismic conditions are evaluated in a separate calculation brief.

METHODOLOGY: Use the slope stability computer software SLIDE (Ref. No. 1) to evaluate slope stability by means of evaluating failure surfaces along the liner system and within the waste mass under static conditions.

REFERENCES:

1. Rocscience, Inc. (2021) "SLIDE," Version 9.020.

2. S.A. Dunn Sand & Gravel, Proposed Mined Land Use Plan Modification/C&D Landfill Project, prepared by C.T. Male Associates, P.C., amended by Sanborn, Head Engineering, P.C., last revised December 14, 2011.

3. ASTM D5321 Direct Shear (500, 5,000, 10,000 psf) results for Sand and Clay by RSA GEOLAB, LLC, July 2015

4. Waste Materials in Construction (pp. 225-231), edited by Th.G. Aalbers, J.J.J.M. Goumans, and H.A. van der Sloot, 1991.

5. Construction Demolition Waste (pp. 150-154), edited by Mukesh C. Limbachiya and J. J. Roberts, 2004.

6. Proceedings of the First International Conference on Construction Materials and Structures (p. 591), edited by Steven O. Ekolu, Morgan Dundu, and Xiaojian Gao, 2014.

7. Kavazanjian, E. Jr., et al, "Evaluation of MSW Properties for Seismic Analysis," Geoenvironment 2000, ASCE Geotechnical Special Publication No. 46, 1995.

8. "S.A. Dunn C&D Landfill; Operational Sequencing Modification; Static Slope Stability Evaluation", Civil Environmental Consultants, Inc., prepared July 2021.

STATIC ANALYSIS:

The static slope stability analysis to evaluate the addition of the northern MSE wall, as well as a modified operational sequencing and final grading for Dunn, was performed using three (3) cross sections that pass through the final grades and one (1) cross-section that passes through the critical interim waste slope configuration.

The overall stability cross sections that pass through the final grading configuration were selected to represent the longest and steepest sections of the final grades. Base and final grading configurations for the overall slope stability cross-section locations are shown on the attached Figures 1 and 3, respectively.

The critical interim waste slope was determined based on a review of the proposed filling and subgrade development plan drawings. The proposed phasing for Dunn includes relatively long 3 horizontal to 1 vertical (3H:1V) interim waste fill slopes that terminate along relatively flat portions (approximately 2% slope) of the permitted base grades. Due to the relatively flat and consistent configuration of the base grades, the critical interim waste slope occurs at the longest steepest 3H:1V interim waste fill slope. The longest steepest 3H:1V interim waste fill slope occurs during the filling of Phase 9 and Phase 10C. As such, the critical interim waste slope was evaluated to represent landfill conditions as of development of Phase 9. The interim grading configuration for the Phase 9 filling with the stability cross section is shown on the attached Figures 2.

The stability of the landfill largely depends on the shear strength properties of the soils, waste, and geosynthetic interfaces of the components used in its construction and operation. This analysis incorporates several design parameters for C&D waste and the Critical Liner System Interface used in Reference Number (Ref. No.) 2, and laboratory results for stockpiled sources of drainage sand, low permeability soil, and subgrade soils that were used during previous landfill cell construction events (Ref. No. 3). The laboratory results are included in an attachment to this calculation brief. Material properties used in this slope stability evaluation are further summarized below:

<u>Shear Strength and Unit Weight Properties of Select Fill Sand Layer, Pea Gravel Drainage Layer (Ref. No. 3)</u>:

Moist Unit Weight = 132.8 pcf

Angle of Internal Friction (ϕ) = 33.8 degrees

Cohesion (c) = 107 pounds per square foot (psf)

Shear Strength and Unit Weight Properties of Low Permeability Soil (Ref. No. 3):

Moist Unit Weight = 118.5 pcf

ϕ = 17.4 degrees

c = 67 psf

Shear Strength and Unit Weight Properties of Subgrade Soil (Ref. No. 3):

Moist Unit Weight = 127 pcf

ϕ = 30.6 degrees

c = 31 psf

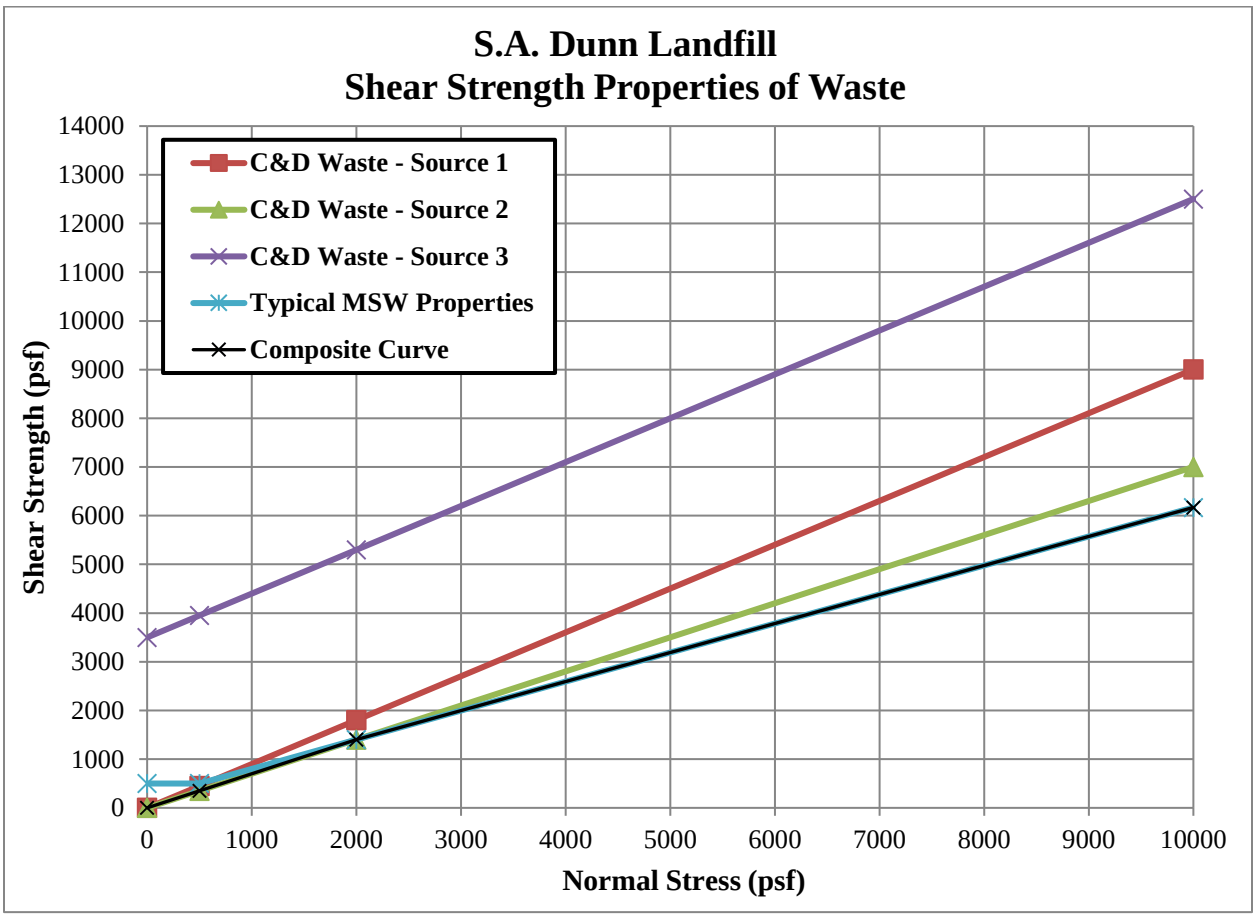
Shear Strength for and Unit Weight Properties of Waste:

C&D Unit Weight = 60 pounds per cubic foot (pcf) [Ref. No. 2]

Shear strength properties for the C&D waste material were determined using data from Ref. Nos. 4, 5, and 6, as well as typical municipal solid waste (MSW) properties (Ref. No. 7) for comparison. The table and graph below present the peak shear strength properties determined for the various waste materials.

Table 1 – Waste Shear Strength Properties

	C&D Waste - Source 1 (Ref. No. 4)	**C&D Waste - Source 2 (Ref. No. 5)**	**C&D Waste - Source 3 (Ref. No. 6)**	**Typical MSW**
Friction Angle (degrees)	42	35	42	0 for $0 < \sigma <$ 500 psf, 33 for $\sigma >$ 500 psf
Cohesion (psf)	0	0	3,500	500 psf for $0 < \sigma <$ 500 psf, 0 for $\sigma >$ 500 psf



As shown in the above graph, a composite curve was developed to represent the lowest anticipated peak shear strength properties of the C&D waste at different normal stresses. These normal and shear stress parameters were then input into the SLIDE program to model the C&D waste mass.

Additionally, this slope stability analysis includes a piezometric surface located 1 foot above the base of the geosynthetic interface layer (i.e., within the sand drainage layer) in order to represent the maximum allowable design pressure that is allowed to accumulate above the liner system.

Shear Strength for and Unit Weight Properties for the Critical Liner System Interface

The Dunn base liner system will consist of the following (listed from top to bottom):

- 5-foot thick select fill sand layer;
- 24-inch pea gravel drainage layer;
- 16 ounce non-woven geotextile;
- 60-mil textured high density polyethylene (HDPE) geomembrane; and
- 24-inch subbase comprised of low permeability soil.

The critical liner system interface was modeled with the following unit weight properties:

Critical Liner System Interface Unit Weight = 60 pcf [Typical]

The critical liner system interface was modeled using a cohesion value of 0 psf, and the friction angle was varied to determine the minimum allowable friction angle required to obtain a Factor of Safety (FS) of 1.5. The critical liner system interface value is defined as the value that produces a minimum FS of 1.5, required by §363-4.3(c)(3)(iii) of the New York State solid waste regulations. Results of the analyses are presented through the remainder of this calculation brief.

STATIC SLOPE STABILITY ANALYSIS RESULTS

"Failure along the Liner System" Analysis

The cross sections were analyzed to determine the minimum friction angle required for the critical liner system interface to obtain an adequate Factor of Safety. The Cross Section D was controlling, therefore the liner interface strengths for the other cross sections were also analyzed using a similar interface friction angle. The results of the analyses are as follows:

Table 2 – "Failure along the Liner System" Analysis Results

Cross Section	Failure Location	Interface Friction Angle	Factor of Safety (≥1.5 required)
A	Liner System	12°	2.23
B	Liner System	12°	2.11
C	Liner System	12°	3.45
D (Interim)	Liner System	12°	1.59 (Controlling)

Outputs from the SLIDE program for the static slope stability analyses are included at the end of this calculation brief.

Based on the values listed above, the required shear strengths that correspond to the above friction angles can be determined over a range of normal loads from the following equation:

$$\tau = \sigma \tan\phi$$

With: τ = shear strength [pounds per square feet (psf)]
σ = normal strength (psf)
ϕ = interface friction [degrees (deg)]

Thus, for interim stability confirmation, the interface shear strength conformance tests should be conducted over a range of normal loads, and results should be evaluated against the values in Table 3 below. Please note, interface shear strength conformance values are for both the peak large-displacement shear strength test results.

Table 3 – Shear Strength Conformance Requirements

Interface	Normal Stress σ (psf)	Peak/Large-Displacement Shear Strength(1) τ (psf)
All Geosynthetic Interfaces	2,500 5,000 10,000	531 1,063 2,126

Notes:

1. Peak/Large displacement shear strengths are provided in both friction angle and shear stress at the specified normal stress. Shear stress is calculated using the equation: $\tau = c + (\sigma \tan \phi)$ where c equals cohesion or adhesion. Exceeding either the required friction angle with cohesion/adhesion equal to zero or the large displacement shear stress at the required normal load is acceptable.

"Failure in the Waste" Analysis

The slope stability cross-sections were also analyzed to encompass critical locations and combinations of waste mass, base grades, and interim grades. Using the waste and soil shear strength properties described above, a failure analysis of the final and interim grading configurations was performed to estimate the FS with respect to failures within the waste mass. Note, for this analysis, the geosynthetic liner system was excluded in order to limit the failure searches to the waste mass. A minimum FS of 1.5 is required by §363-4.3(c)(3)(iii) of the New York State solid waste regulations for the interim waste slopes. Results of the analyses are presented in Table 4 below.

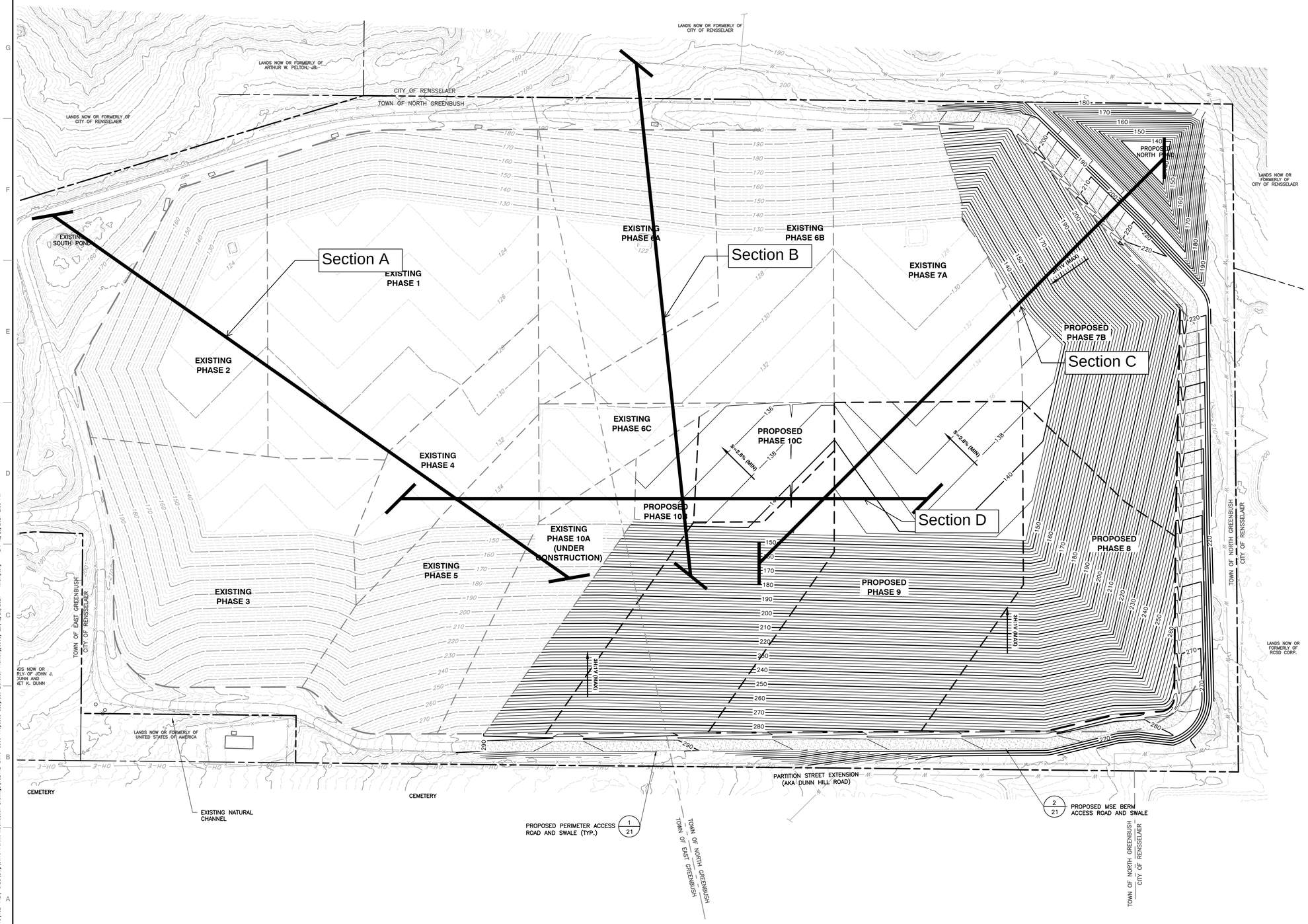
Table 4 – "Failure in the Waste" Analysis Results

Cross-Section	Failure Location	Factor of Safety (≥1.5 required)
A	C&D Waste Mass	2.11
B	C&D Waste Mass	2.11
C	C&D Waste Mass	2.47
D (Interim)	C&D Waste Mass	1.57

CONCLUSIONS: Laboratory interface shear strength conformance testing should be performed on the specific products to be used in each construction increment to verify the materials used in construction of the landfill liner system are consistent with the shear strength properties listed in Table 3 above. Additionally, the final and interim grading configurations are stable with respect to failure in the waste mass under static conditions.

FIGURES

Figure 1 - Permitted Base Grade Configuration



LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING LIMIT OF FRANCHISE AGREEMENT
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- PROPOSED LANDFILL PERIMETER LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD

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NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

PROPOSED SUBGRADE ELEVATION PLAN

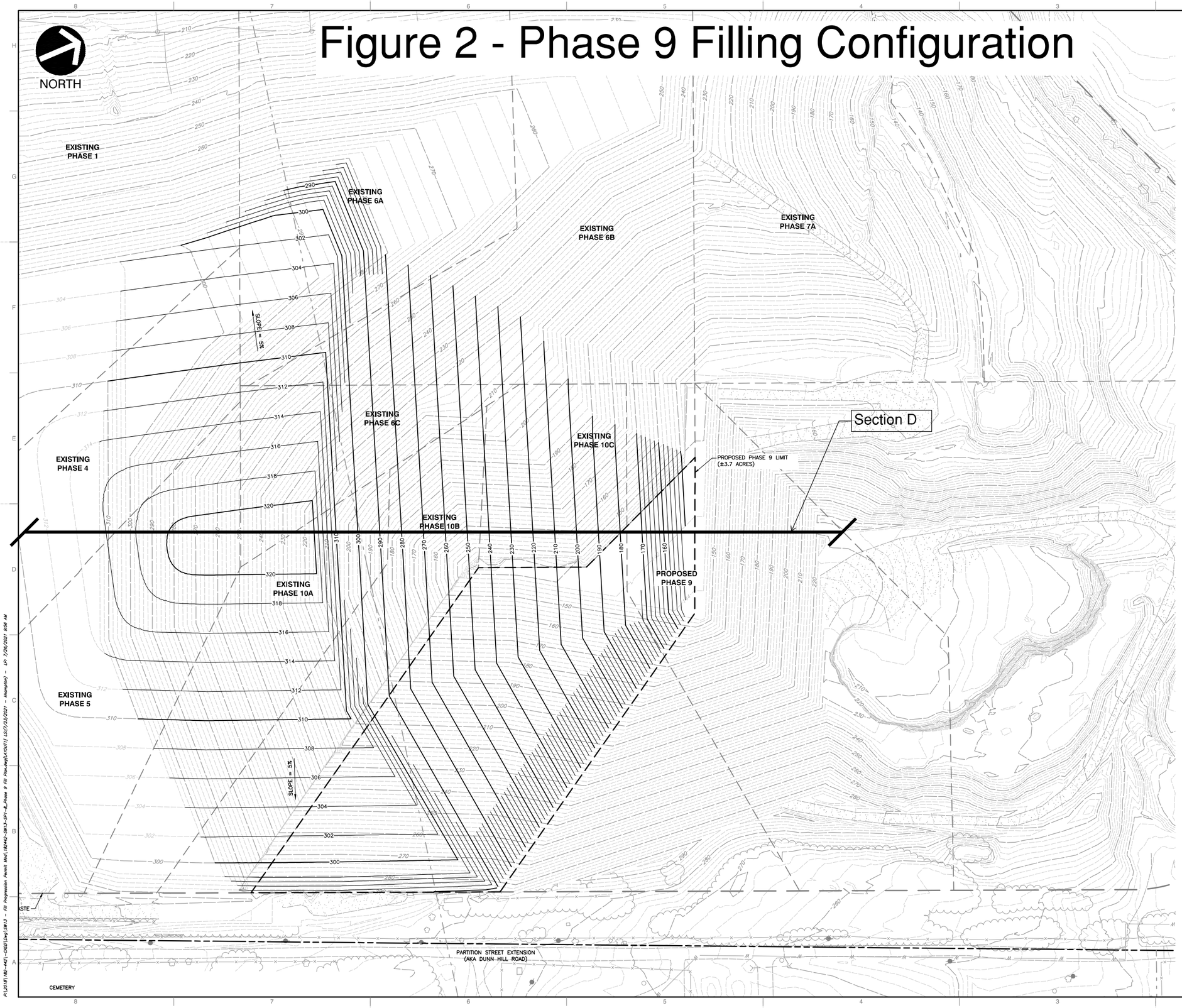
DATE:	MAY 2021
DRAWN BY:	KFH
DWG SCALE:	1"=100'
CHECKED BY:	AJK
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: **C300**

SHEET 3 OF 23

P:\2018\182-442\-CADD\Dwg\SW16-Permit Modification Drawings\182442-SW16-C300-Proposed Subgrade Elevation Plan.dwg(C300) LS:(12/29/2021 - kcampbell) - LP: 12/29/2021 2:38 PM

Figure 2 - Phase 9 Filling Configuration



LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING LIMIT OF FRANCHISE AGREEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

SCALE IN FEET
0 60 120

REVISION RECORD

NO.	DATE	DESCRIPTION

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Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

S.A. DUNN & COMPANY, LLC
DUNN MINE AND C&D FACILITY
RENSSELAER, NEW YORK

PHASE 9 FILLING PLAN

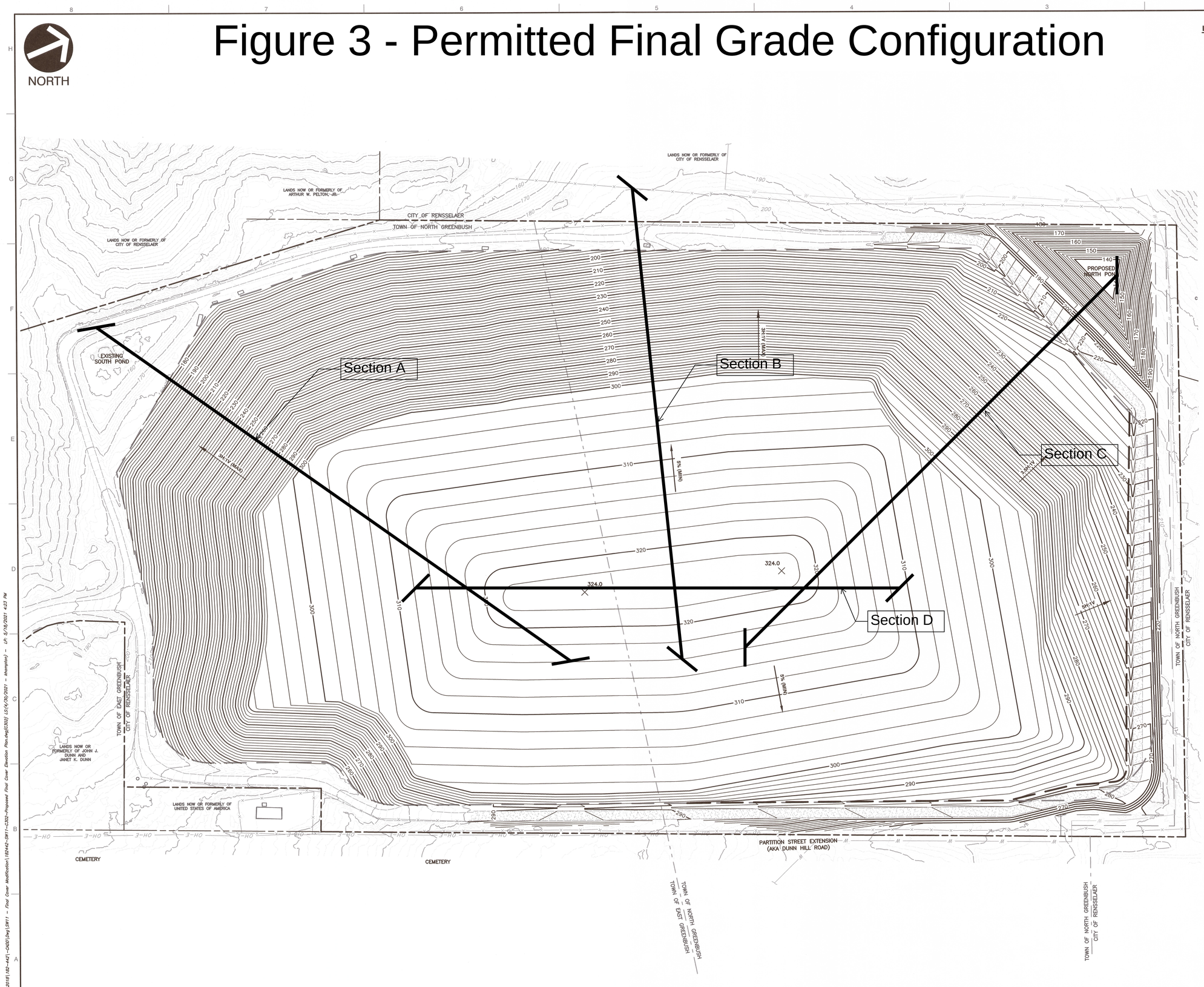
DATE:	JULY 2021
DRAWN BY:	KFH
DWG SCALE:	1" = 60'
CHECKED BY:	CSD
PROJECT NO:	182-442
APPROVED BY:	DRAFT

FIGURE NO.: **8**

SHEET 8 OF

P:\2018\182-442\-CADD\Dwg\SW13 - Fill Progression Permit Mod\182442-SW13-SP1-8_Phase 9 Fill Plan.dwg\LAYOUT1 | SCT/23/2021 - khampton) - LP: 7/26/2021 9:56 AM

Figure 3 - Permitted Final Grade Configuration



LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING LIMIT OF FRANCHISE AGREEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD

SCALE IN FEET
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STATE OF NEW YORK · AMY J. KNIGHT · 076347 · LICENSED PROFESSIONAL ENGINEER
5/19/2021

REVISION RECORD

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Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

PROPOSED FINAL COVER ELEVATION PLAN

DATE:	MAY 2021
DRAWN BY:	KFH
DWG SCALE:	1"=100'
CHECKED BY:	AJK
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: **C302**

SHEET 5 OF 23

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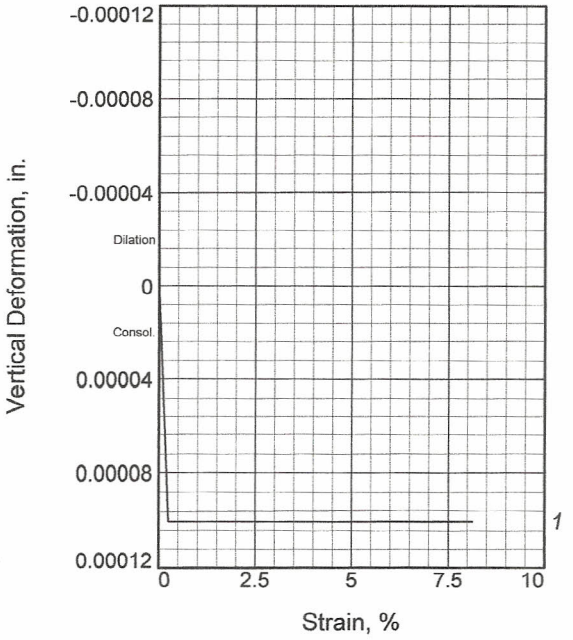
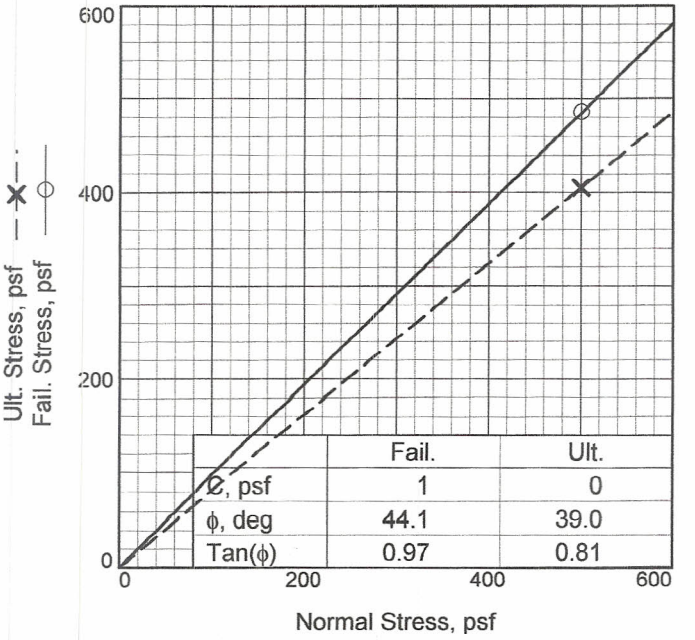
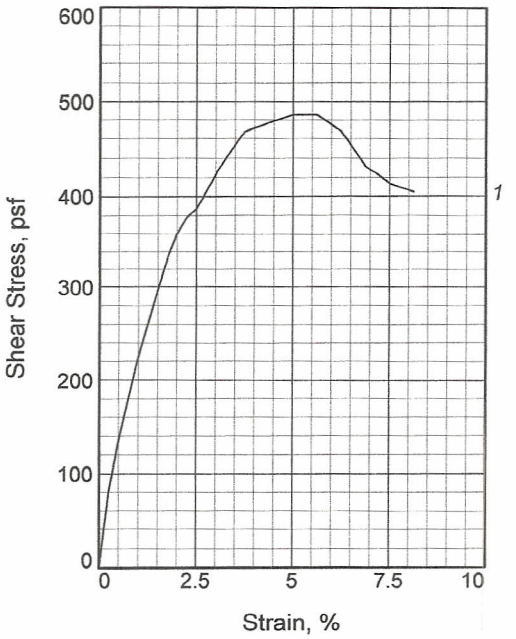
DIRECT SHEAR STRENGTH RESULTS
SITE SOILS
S.A. DUNN C&D LANDFILL





	Fail.	Ult.
c, psf	1	0
ϕ, deg	44.1	39.0
Tan(ϕ)	0.97	0.81



Sample No.		1
Initial	Water Content, %	4.8
	Dry Density, pcf	113.1
	Saturation, %	25.5
	Void Ratio	0.5127
	Side Length, in.	4.00
	Height, in.	1.00
At Test	Water Content, %	17.0
	Dry Density, pcf	113.2
	Saturation, %	91.2
	Void Ratio	0.5115
	Side Length, in.	4.00
	Height, in.	1.00
Normal Stress, psf		500
Fail. Stress, psf		486
Strain, %		5.0
Ult. Stress, psf		405
Strain, %		8.1
Strain rate, in./min.		0.008

Sample Type: ASTM D3080
Description: Dark Brown poorly graded sand

LL= NV **PI=** NP
Assumed Specific Gravity= 2.74
Remarks: Recompacted sample. -3/8" material tested. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

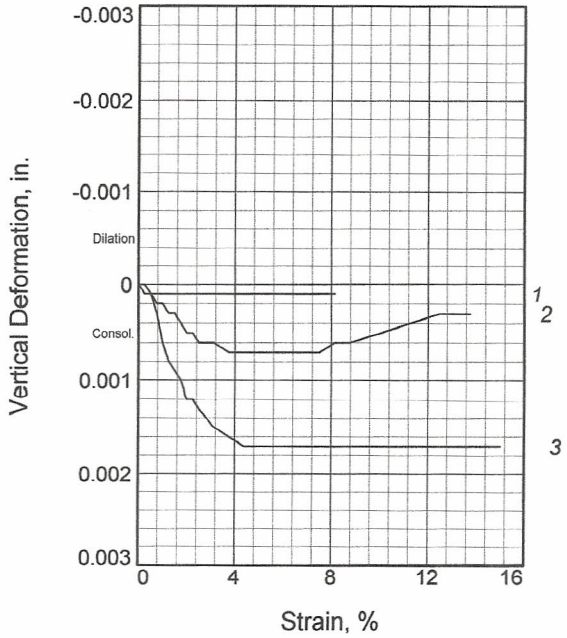
Project: Dunn Landfill 151-336 SA

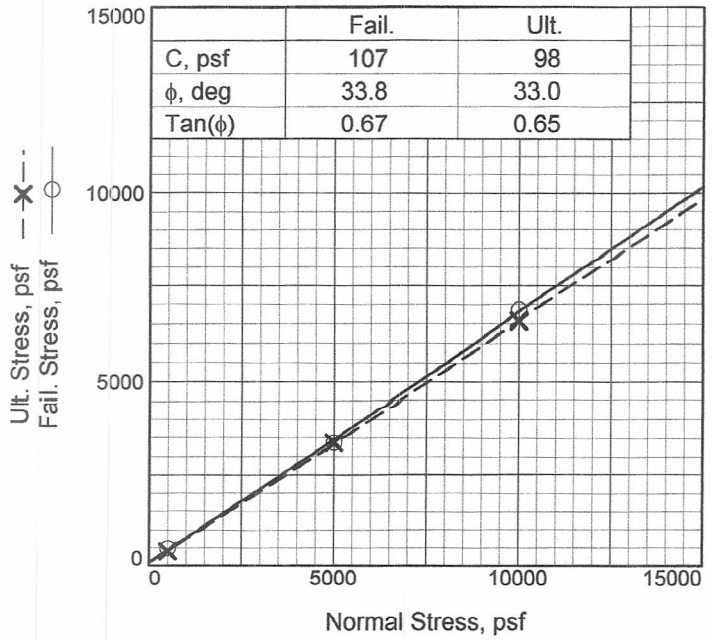
Sample Number: SIFT-3

Proj. No.: 848 **Date Sampled:** 8-4-15

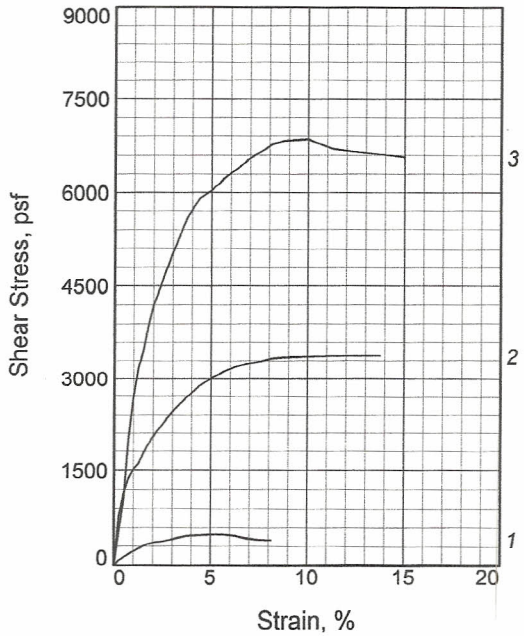
DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KK **Checked By:** KP





	Fail.	Ult.
C, psf	107	98
ϕ, deg	33.8	33.0
Tan(ϕ)	0.67	0.65



Sample No.		1	2	3
Initial	Water Content, %	4.8	5.0	4.5
	Dry Density, pcf	113.1	112.9	113.4
	Saturation, %	25.5	26.4	24.1
	Void Ratio	0.5127	0.5155	0.5084
	Side Length, in.	4.00	4.00	4.00
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	17.0	15.8	16.9
	Dry Density, pcf	113.2	113.9	114.6
	Saturation, %	91.2	86.5	94.1
	Void Ratio	0.5115	0.5015	0.4922
	Side Length, in.	4.00	4.00	4.00
	Height, in.	1.00	0.99	0.99
Normal Stress, psf		500	5000	10000
Fail. Stress, psf		486	3375	6849
Strain, %		5.0	12.5	10.0
Ult. Stress, psf		405	3375	6570
Strain, %		8.1	13.8	15.0
Strain rate, in./min.		0.008	0.008	0.008

Sample Type: ASTM D3080
Description: Dark Brown poorly graded sand

LL= NV **PI=** NP
Assumed Specific Gravity= 2.74
Remarks: Recompacted sample. -3/8" material tested. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

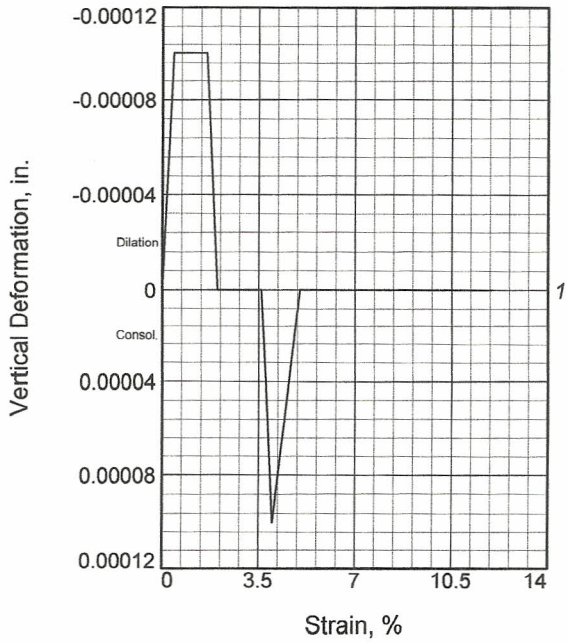
Project: Dunn Landfill 151-336 SA

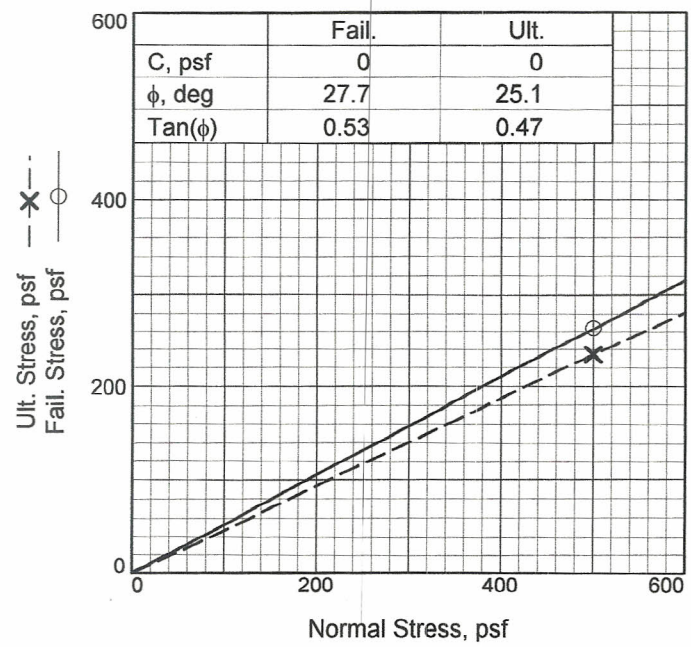
Sample Number: SIFT-3

Proj. No.: 848 **Date Sampled:** 8-4-15

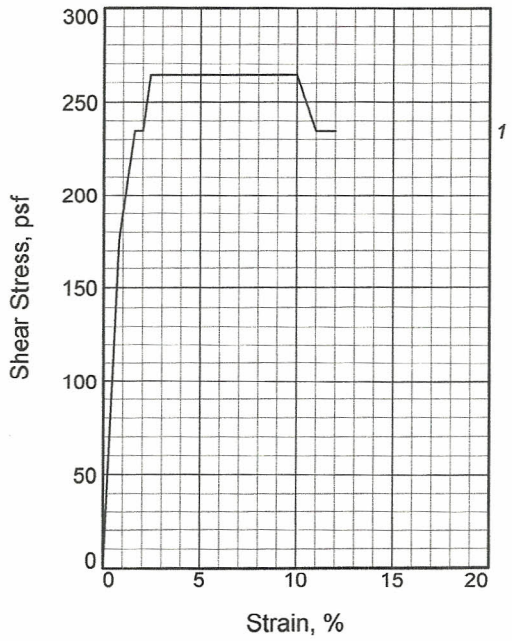
DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KK **Checked By:** KP





	Fail.	Ult.
C, psf	0	0
ϕ, deg	27.7	25.1
Tan(ϕ)	0.53	0.47



Sample No.		1
Initial	Water Content, %	22.7
	Dry Density, pcf	97.7
	Saturation, %	83.5
	Void Ratio	0.7383
	Diameter, in.	2.50
	Height, in.	1.00
At Test	Water Content, %	29.0
	Dry Density, pcf	97.7
	Saturation, %	106.9
	Void Ratio	0.7379
	Diameter, in.	2.50
	Height, in.	1.00
Normal Stress, psf		500
Fail. Stress, psf		264
Strain, %		2.4
Ult. Stress, psf		235
Strain, %		12.0
Strain rate, in./min.		0.003

Sample Type: ASTM D3080
Description: Gray lean clay

LL= 41 **PL=** 22 **PI=** 19
Assumed Specific Gravity= 2.72
Remarks: Recompacted sample. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

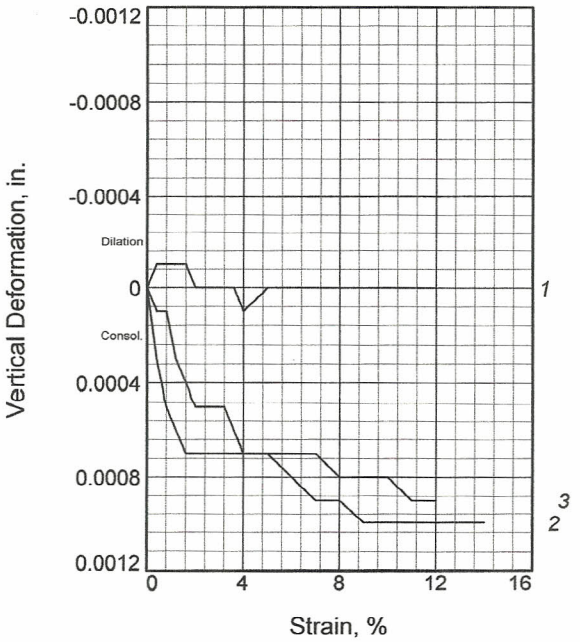
Project: Dunn Landfill 151-336 SA

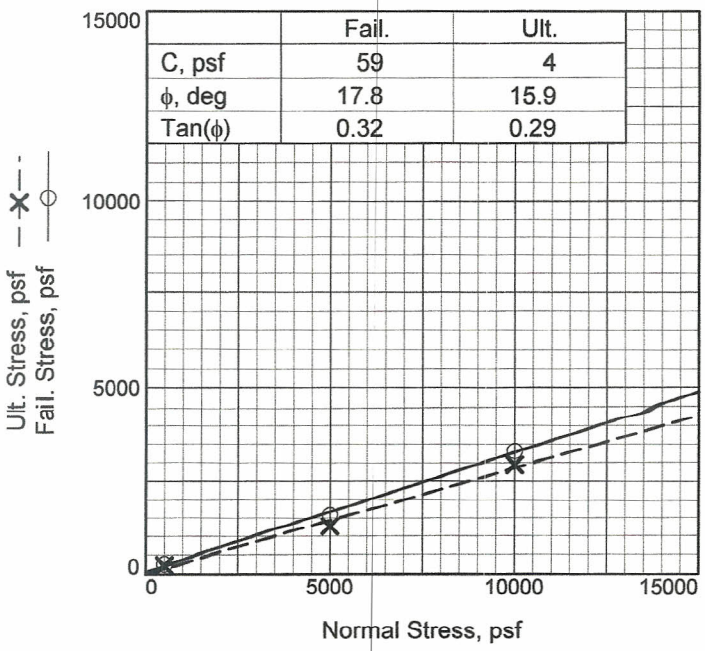
Location: Sample #2 Grey Clay Swent Slope Cell 1

Proj. No.: 848 **Date Sampled:** 5-7-15

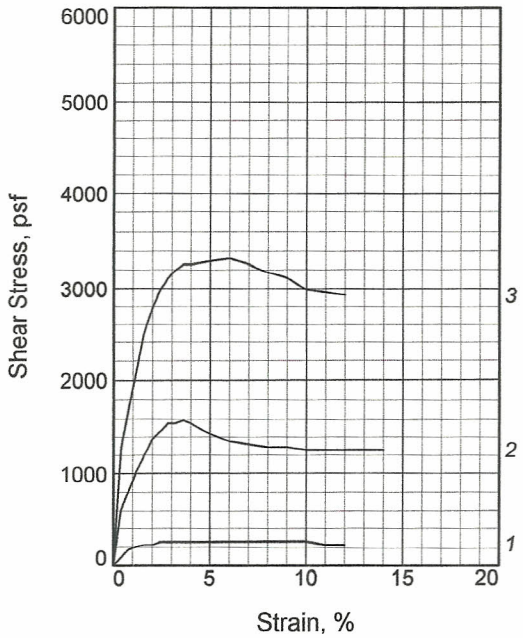
DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KH **Checked By:** JW





	Fail.	Ult.
C, psf	59	4
ϕ, deg	17.8	15.9
Tan(ϕ)	0.32	0.29



	Sample No.	1	2	3
Initial	Water Content, %	22.7	22.9	23.1
	Dry Density, pcf	97.7	97.5	97.3
	Saturation, %	83.5	84.0	84.4
	Void Ratio	0.7383	0.7417	0.7445
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	29.0	24.5	24.4
	Dry Density, pcf	97.7	98.5	98.2
	Saturation, %	106.9	91.9	91.0
	Void Ratio	0.7379	0.7243	0.7290
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.00	0.99	0.99
Normal Stress, psf		500	5000	10000
Fail. Stress, psf		264	1584	3315
Strain, %		2.4	3.6	6.0
Ult. Stress, psf		235	1261	2934
Strain, %		12.0	14.0	12.0
Strain rate, in./min.		0.003	0.003	0.003

Sample Type: ASTM D3080
Description: Gray lean clay

LL= 41 **PL=** 22 **PI=** 19
Assumed Specific Gravity= 2.72
Remarks: Recompacted sample. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

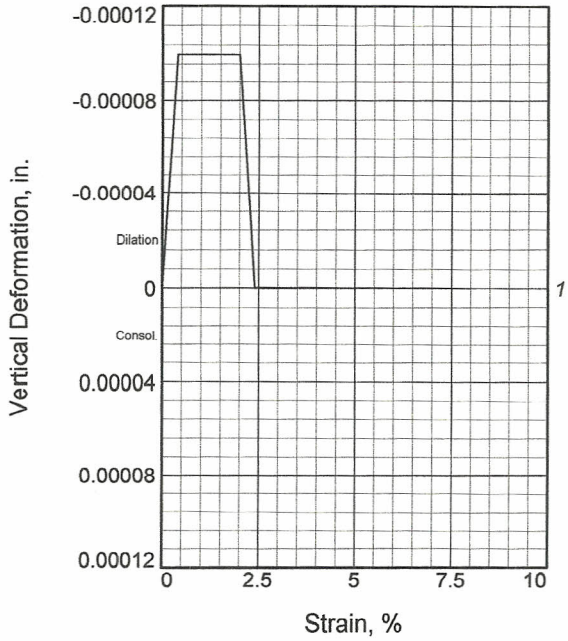
Project: Dunn Landfill 151-336 SA

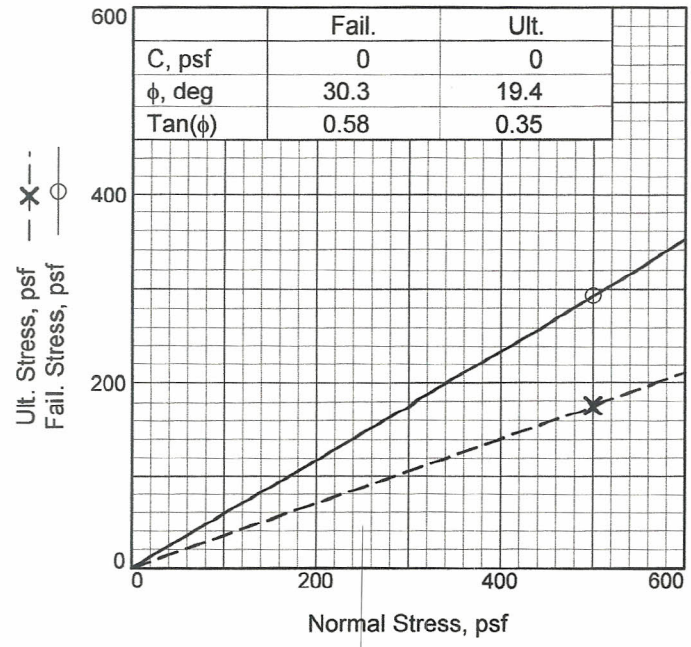
Location: Sample #2 Grey Clay Swent Slope Cell 1

Proj. No.: 848 **Date Sampled:** 5-7-15

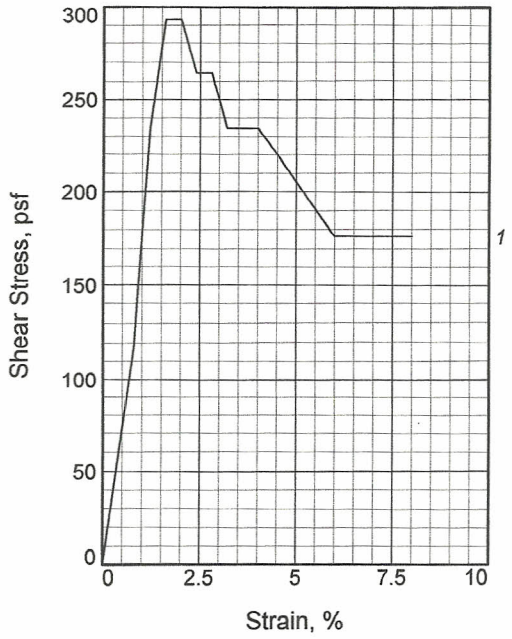
DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KH **Checked By:** JW





	Fail.	Ult.
C, psf	0	0
ϕ, deg	30.3	19.4
Tan(ϕ)	0.58	0.35



Sample No.		1
Initial	Water Content, %	23.8
	Dry Density, pcf	90.8
	Saturation, %	74.4
	Void Ratio	0.8707
	Diameter, in.	2.50
	Height, in.	1.00
At Test	Water Content, %	27.9
	Dry Density, pcf	91.0
	Saturation, %	87.4
	Void Ratio	0.8670
	Diameter, in.	2.50
	Height, in.	1.00
Normal Stress, psf		500
Fail. Stress, psf		293
Strain, %		1.6
Ult. Stress, psf		176
Strain, %		6.0
Strain rate, in./min.		0.003

Sample Type: ASTM D3080
Description: Light Olive Brown lean clay

LL= 47 **PL=** 25 **PI=** 22
Assumed Specific Gravity= 2.72
Remarks: Recompacted sample. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

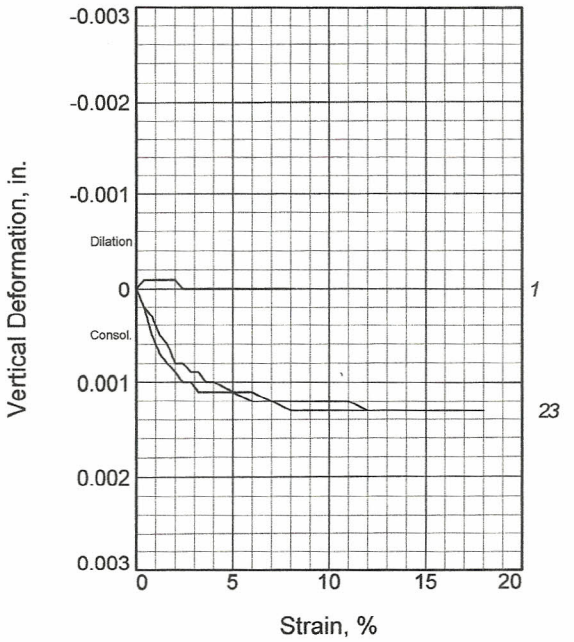
Project: Dunn Landfill 151-336 SA

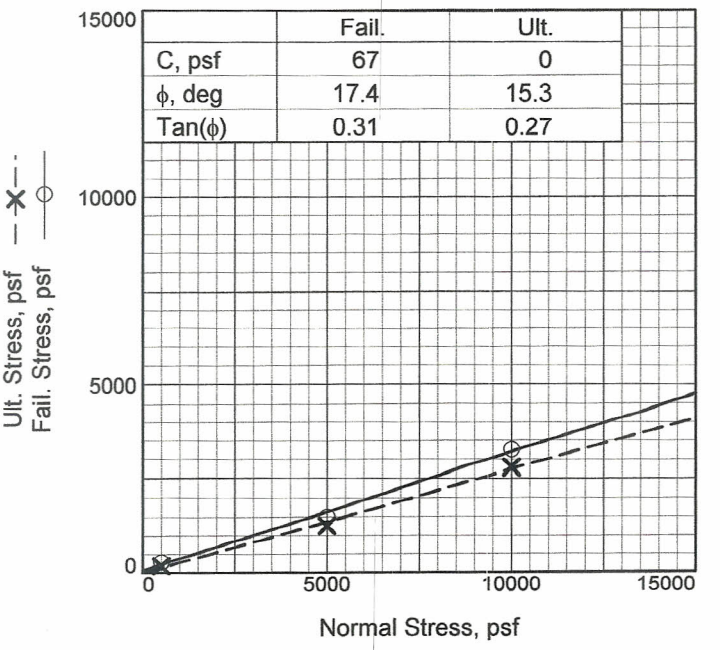
Location: Sample #1 Brown Clay SW Slope Cell 1

Proj. No.: 848 **Date Sampled:** 5-6-15

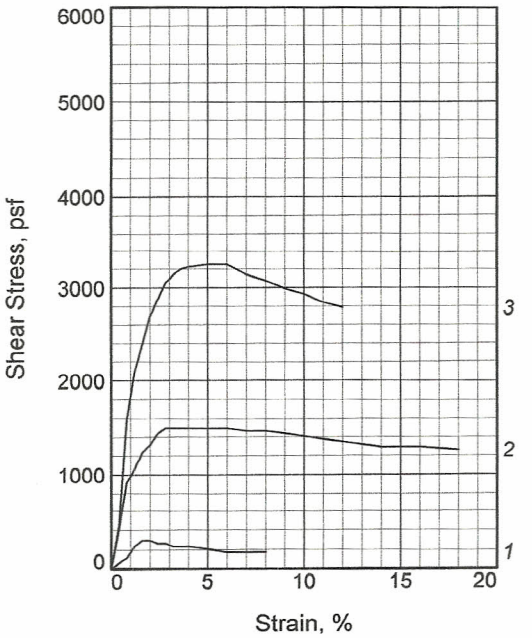
DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KH **Checked By:** JW





	Fail.	Ult.
C, psf	67	0
ϕ, deg	17.4	15.3
Tan(ϕ)	0.31	0.27



Sample No.		1	2	3
Initial	Water Content, %	23.8	24.3	24.5
	Dry Density, pcf	90.8	92.3	92.1
	Saturation, %	74.4	78.6	79.0
	Void Ratio	0.8707	0.8405	0.8437
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.00	0.98	0.98
At Test	Water Content, %	27.9	28.3	27.3
	Dry Density, pcf	91.0	93.4	93.6
	Saturation, %	87.4	94.1	91.5
	Void Ratio	0.8670	0.8187	0.8132
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.00	0.97	0.96
Normal Stress, psf		500	5000	10000
Fail. Stress, psf		293	1496	3256
Strain, %		1.6	2.8	5.0
Ult. Stress, psf		176	1261	2787
Strain, %		6.0	18.0	12.0
Strain rate, in./min.		0.003	0.003	0.003

Sample Type: ASTM D3080
Description: Light Olive Brown lean clay

LL= 47 **PL=** 25 **PI=** 22
Assumed Specific Gravity= 2.72
Remarks: Recompacted sample. Tested with water in box.

Figure _____

Client: Civil Environmental Consultants, Inc.

Project: Dunn Landfill 151-336 SA

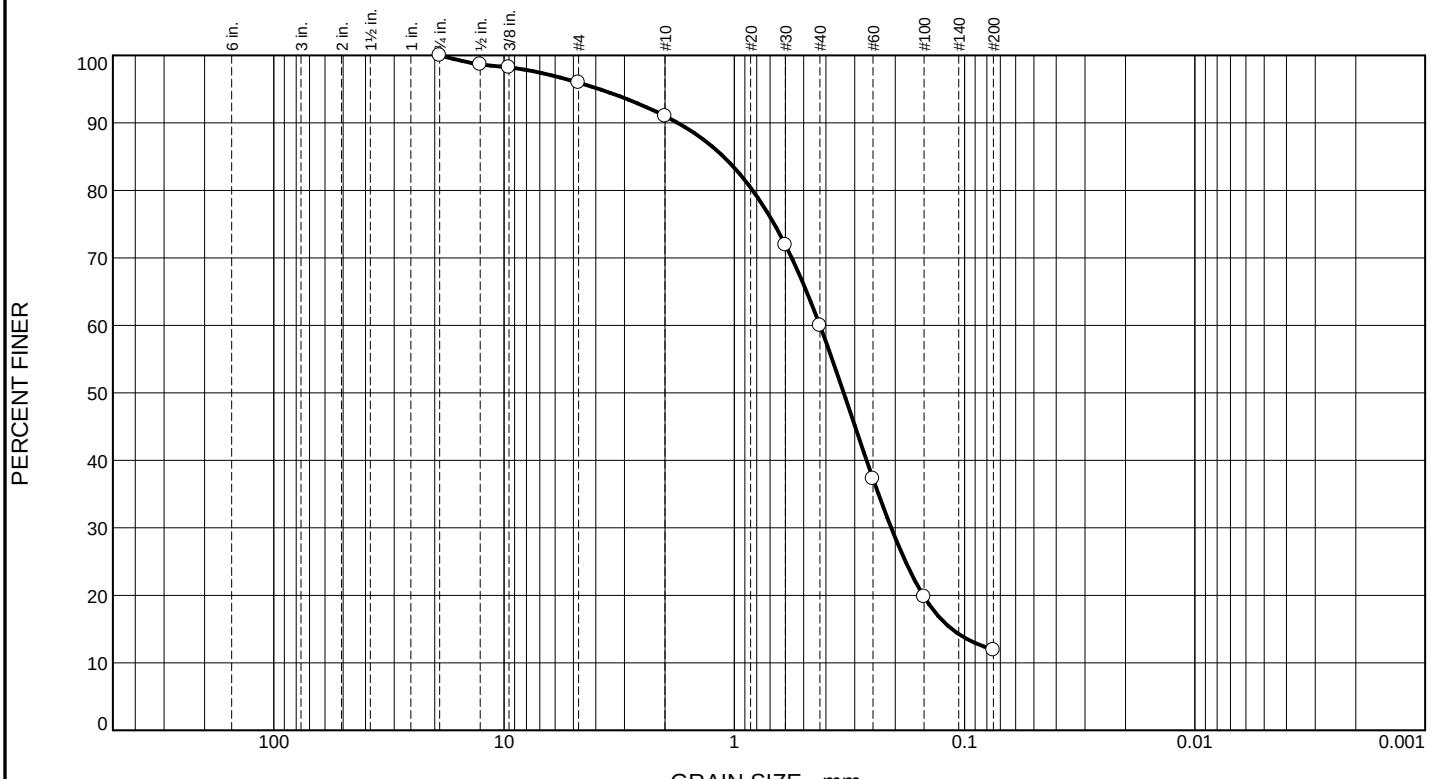
Location: Sample #1 Brown Clay SW Slope Cell 1

Proj. No.: 848 **Date Sampled:** 5-6-15

DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: KH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.0	5.0	31.0	48.1	11.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.7		
.375	98.2		
#4	96.0		
#10	91.0		
#30	71.9		
#40	60.0		
#60	37.3		
#100	19.8		
#200	11.9		

* (no specification provided)

Material Description

Grayish Brown poorly graded sand with silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.7604 D_{85}= 1.1143 D_{60}= 0.4251
D_{50}= 0.3351 D_{30}= 0.2083 D_{15}= 0.1136
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Remarks

Sample Number: Subgrade-1

Date: 9-1-20

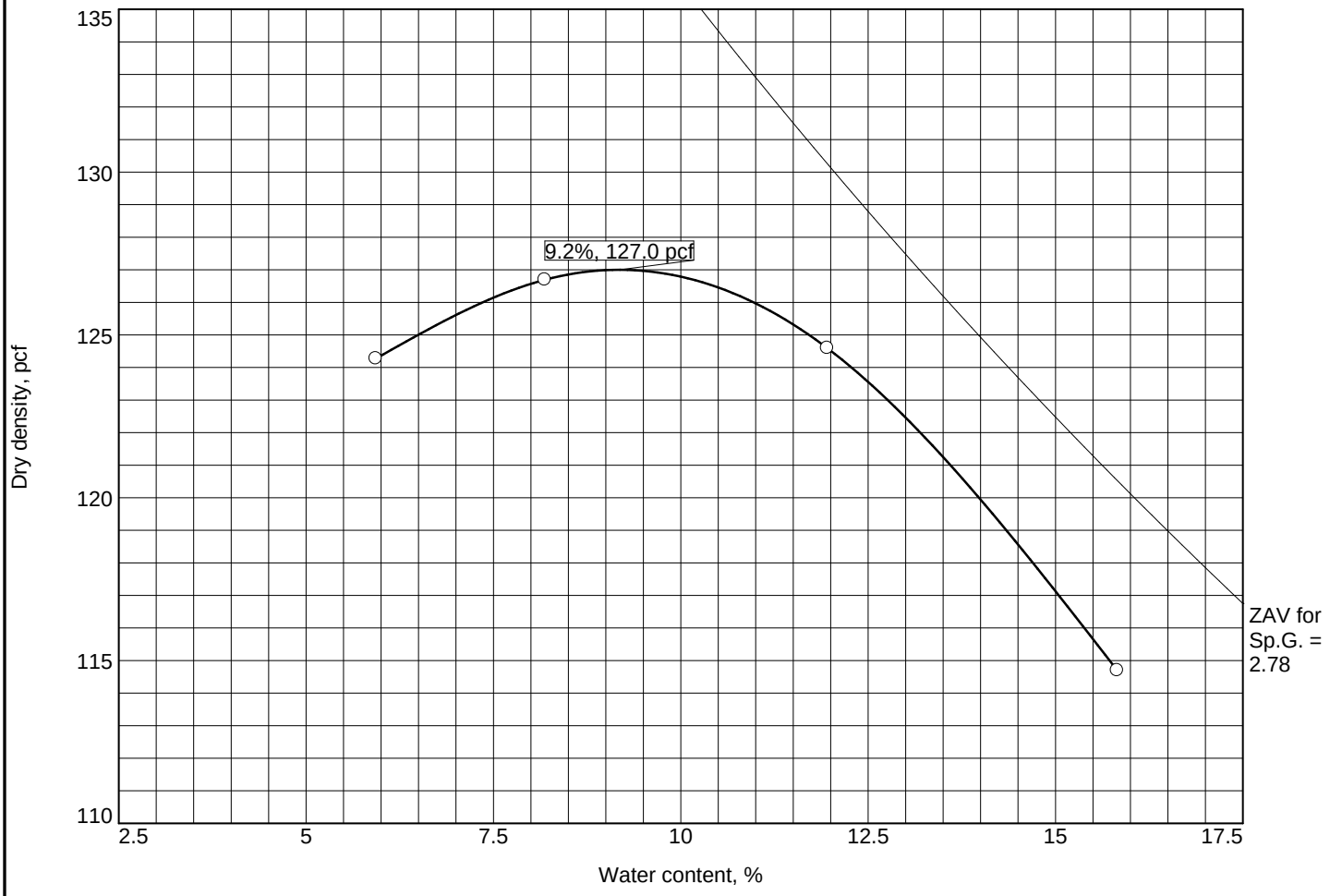
RSA Geolab

Union, New Jersey

Client: Civil Environmental Consultants, Inc.
Project: Dunn C & D Facility - Phase 6C
Project No: 848 **Figure**

Tested By: MF **Checked By:** KP

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
	SP-SM	A-2-4(0)		2.78	NV	NP	1.8	11.9

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 127.0 pcf	126.4 pcf	Grayish Brown poorly graded sand with silt
Optimum moisture = 9.2 %	9.2 %	

Project No. 848 **Client:** Civil Environmental Consultants, Inc.
Project: Dunn C & D Facility - Phase 6C

○ **Sample Number:** Subgrade-1

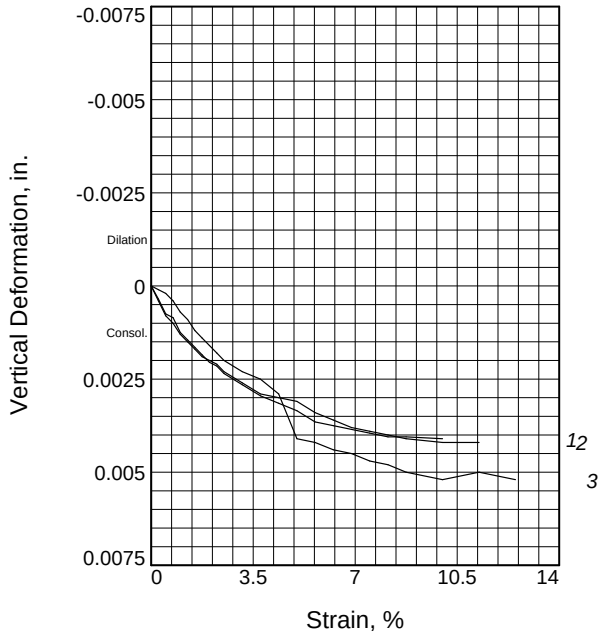
Remarks:
SG Assumed. Machine tested.
9-1-20

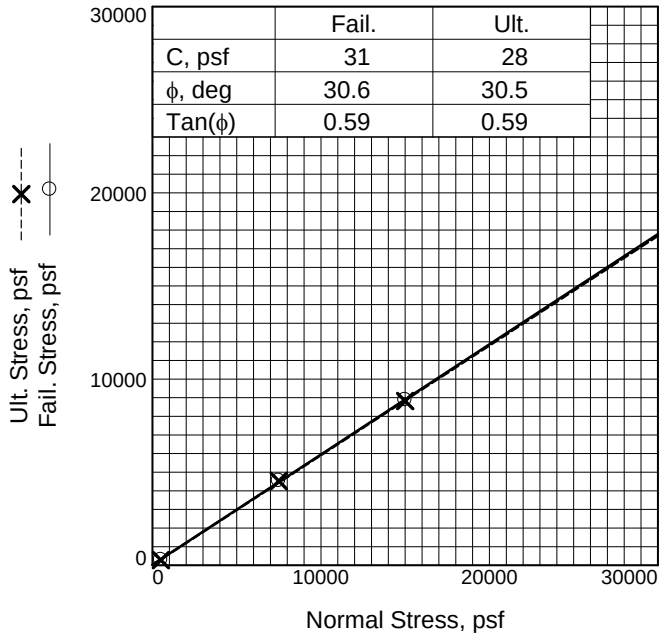
RSA Geolab

Union, New Jersey

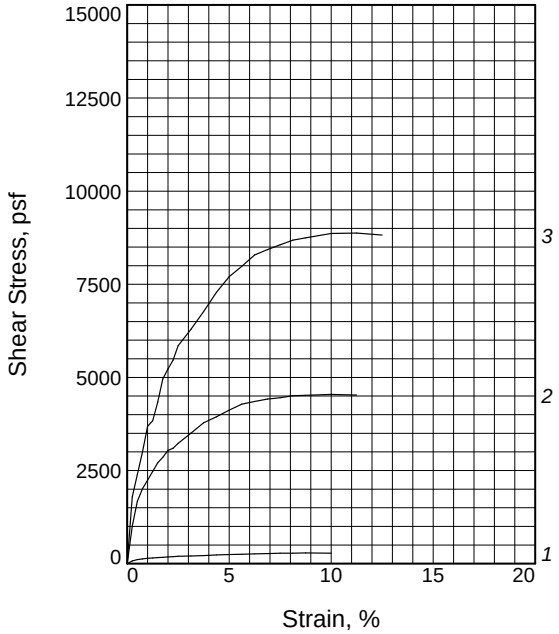
Figure

Tested By: ED **Checked By:** KP





	Fail.	Ult.
C, psf	31	28
ϕ, deg	30.6	30.5
Tan(ϕ)	0.59	0.59



Sample No.		1	2	3
Initial	Water Content, %	11.3	11.2	11.3
	Dry Density, pcf	116.7	116.9	116.8
	Saturation, %	64.7	64.1	64.5
	Void Ratio	0.4872	0.4851	0.4863
	Side Length, in.	4.00	4.00	4.00
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	17.1	15.1	15.7
	Dry Density, pcf	117.2	118.0	118.1
	Saturation, %	98.7	89.4	92.8
	Void Ratio	0.4810	0.4707	0.4700
	Side Length, in.	4.00	4.00	4.00
	Height, in.	1.00	0.99	0.99
Normal Stress, psf		500	7500	15000
Fail. Stress, psf		288	4545	8874
Strain, %		8.8	10.0	11.3
Ult. Stress, psf		279	4527	8820
Strain, %		10.0	11.3	12.5
Strain rate, in./min.		0.008	0.008	0.008

Sample Type: ASTM D3080
Description: Grayish Brown poorly graded sand with silt
LL= NV **PI=** NP
Assumed Specific Gravity= 2.78
Remarks: Recompacted sample (92% MDD, +2% OMC of ASTM D1557). Tested with water in box. Consolidate/Saturate 1 hr.

Figure _____

Client: Civil Environmental Consultants, Inc.

Project: Dunn C & D Facility - Phase 6C

Sample Number: Subgrade-1

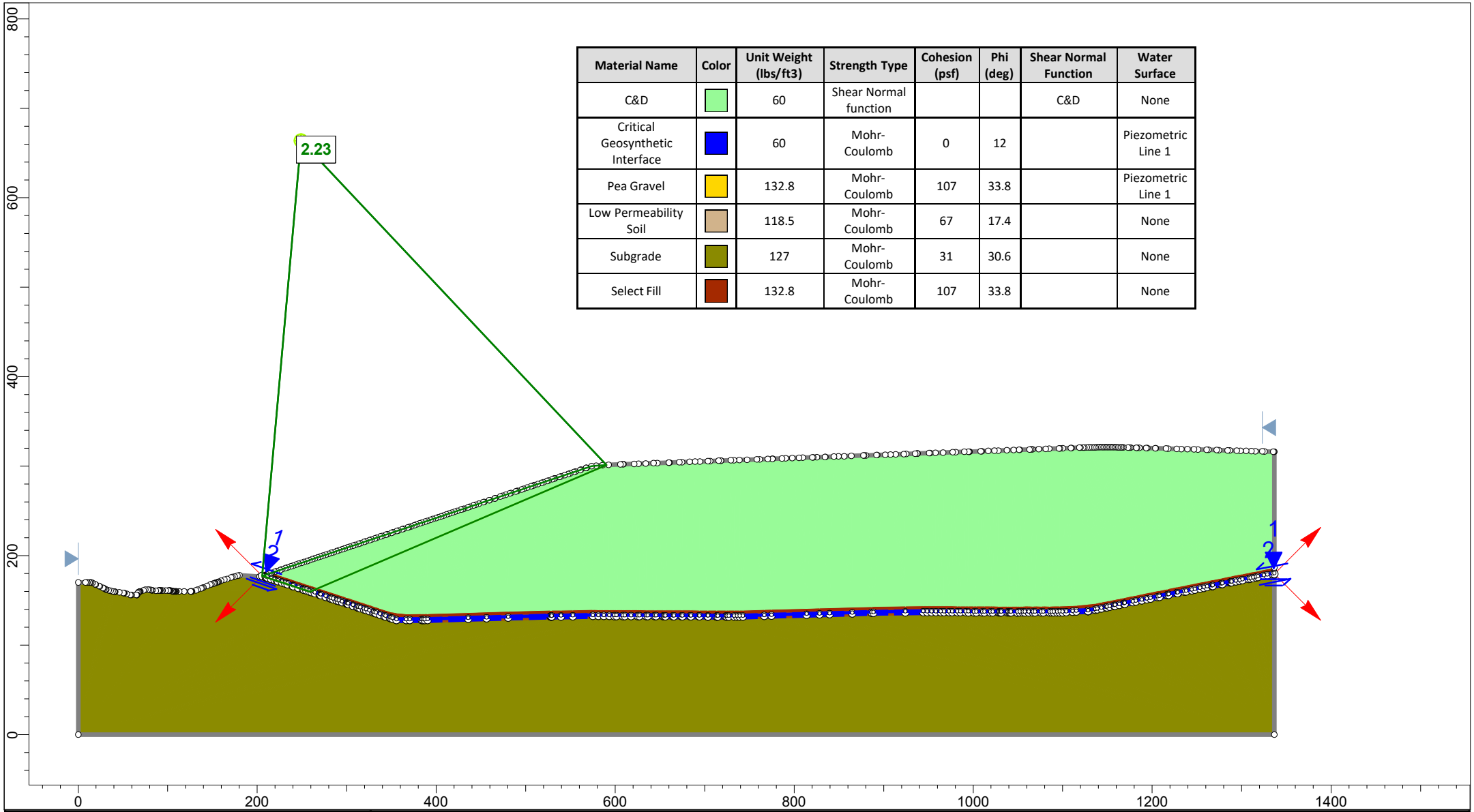
Proj. No.: 848 **Date Sampled:** 9-1-20

DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: MF/ED **Checked By:** KP

“FAILURE ALONG THE LINER SYSTEM” ANALYSIS RESULTS
SLIDE OUTPUT

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section A - Static - Liner System Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:00m:07.778s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.232740
Axis Location:	248.948, 663.787
Left Slip Surface Endpoint:	205.613, 177.382
Right Slip Surface Endpoint:	590.273, 301.245
Resisting Moment:	1.31324e+08 lb-ft
Driving Moment:	5.88172e+07 lb-ft
Resisting Horizontal Force:	258557 lb
Driving Horizontal Force:	115802 lb
Total Slice Area:	7504.33 ft2
Surface Horizontal Width:	384.66 ft
Surface Average Height:	19.509 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
205.613	177.382
209.644	175.98
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.014	168.298
233.924	168
239.731	166.085
239.989	166
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
259.228	159.677
590.273	301.245

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.23274

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.03156	707.296	-19.1755	Critical Geosynthetic Interface	0	12	11.2445	25.1061	180.502	62.3875	118.115	176.592	114.204
2	0.244676	89.5922	-18.2502	Critical Geosynthetic Interface	0	12	30.2225	67.4789	379.851	62.3875	317.463	369.885	307.497
3	1.135	484.546	-18.2501	Critical Geosynthetic Interface	0	12	36.33	81.1155	444.006	62.3875	381.619	432.026	369.639
4	4.6233	3146.26	-18.2501	Critical Geosynthetic Interface	0	12	62.0914	138.634	714.608	62.3875	652.221	694.133	631.746
5	3.80952	3745.51	-18.1362	Critical Geosynthetic Interface	0	12	93.4892	208.737	1044.42	62.3875	982.029	1013.79	951.407
6	2.29643	2540.04	-18.1362	Critical Geosynthetic Interface	0	12	106.927	238.741	1185.57	62.3875	1123.19	1150.55	1088.16
7	1.44433	1704.71	-18.2501	Critical Geosynthetic Interface	0	12	115.198	257.208	1272.45	62.3875	1210.07	1234.47	1172.08
8	4.62081	6010.87	-18.2501	Critical Geosynthetic Interface	0	12	128.761	287.489	1414.92	62.3875	1352.53	1372.46	1310.07
9	3.34887	4886.43	-18.1367	Critical Geosynthetic Interface	0	12	146.78	327.722	1604.2	62.3875	1541.81	1556.12	1493.73
10	1.84666	2884.76	-18.1367	Critical Geosynthetic Interface	0	12	158.729	354.401	1729.71	62.3875	1667.32	1677.72	1615.33
11	0.910228	1471.66	-18.1367	Critical Geosynthetic Interface	0	12	165.131	368.695	1796.96	62.3875	1734.58	1742.87	1680.49
12	5.80643	10163.3	-18.2501	Critical Geosynthetic Interface	0	12	181.078	404.3	1964.47	62.3875	1902.08	1904.76	1842.37
13	0.258707	484.041	-18.2501	Critical Geosynthetic Interface	0	12	195.568	436.652	2116.67	62.3875	2054.29	2052.18	1989.8
14	6.08554	12152.8	-18.193	Critical Geosynthetic Interface	0	12	210.921	470.931	2277.93	62.3875	2215.55	2208.62	2146.23
15	4.77149	10557.4	-18.1934	Critical Geosynthetic Interface	0	12	237.718	530.763	2559.44	62.3875	2497.05	2481.31	2418.93
16	1.31391	3065.94	-18.1934	Critical Geosynthetic Interface	0	12	253	564.884	2719.96	62.3875	2657.57	2636.81	2574.42
17	2.57085	6197.3	-18.1926	Critical Geosynthetic Interface	0	12	262.87	586.921	2823.64	62.3875	2761.25	2737.25	2674.86
18	3.51483	8897.64	-18.1926	Critical Geosynthetic Interface	0	12	278.487	621.788	2987.67	62.3875	2925.28	2896.15	2833.76
19	0.981947	2573.45	-18.1937	Critical Geosynthetic Interface	0	12	290.133	647.791	3110.01	62.3875	3047.62	3014.65	2952.26
20	2.64445	6769.73	23.1535	Pea Gravel	107	33.8	744.775	1662.89	2324.17	0	2324.17	2642.66	2642.66
21	6.61127	15067	23.1535	Select Fill	107	33.8	669.317	1494.41	2072.49	0	2072.49	2358.72	2358.72
22	80.4473	148877	23.1535	C&D	0	34.992	514.69	1149.17	1641.67	0	1641.67	1861.77	1861.77
23	80.4473	112249	23.1535	C&D	1.13687e-13	34.992	370.329	826.849	1181.22	0	1181.22	1339.58	1339.58
24	80.4473	75619	23.1535	C&D	0	34.992	246.437	550.23	786.044	0	786.044	891.43	891.43
25	80.4473	36902.1	23.1535	C&D	5.68434e-14	34.992	123.241	275.166	393.094	0	393.094	445.797	445.797

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.23274

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	205.613	177.382	0	0	0
2	209.644	175.98	298.408	4.64061	0.890948
3	209.889	175.899	336.452	5.54966	0.944988
4	211.024	175.525	543.874	11.3507	1.19559
5	215.647	174	1920.46	74.2655	2.21456
6	219.457	172.752	3579.92	190.801	3.05084
7	221.753	172	4717.31	292.902	3.55298
8	223.198	171.524	5489.77	371.166	3.86791
9	227.818	170	8240.83	702.136	4.86996
10	231.167	168.903	10492.2	1026.95	5.59016
11	233.014	168.298	11831.7	1240.38	5.98476
12	233.924	168	12517.8	1355.14	6.17861
13	239.731	166.085	17330.8	2251.83	7.4031
14	239.989	166	17562	2298.72	7.45715
15	246.075	164	23401.7	3587.01	8.71447
16	250.846	162.432	28549.9	4869.81	9.67989
17	252.16	162	30057	5268.65	9.94229
18	254.731	161.155	33118.6	6109.05	10.4513
19	258.246	160	37548.7	7392.07	11.1372
20	259.228	159.677	38837.4	7779.26	11.3266
21	261.872	160.808	38179	7998.35	11.8321
22	268.484	163.635	36745.6	8526.49	13.0638
23	348.931	198.038	21683.1	9433.09	23.5111
24	429.378	232.44	10845.3	4955.24	24.5558
25	509.826	266.843	3633.19	1048.24	16.0938
26	590.273	301.245	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
207.158	177.844
209.644	176.98
209.656	176.976
209.673	176.97
209.701	176.961
209.754	176.943
209.889	176.899
211.024	176.525
215.647	175
219.457	173.752
221.753	173
223.198	172.524
227.818	171
231.167	169.903
233.924	169
239.731	167.085

239.989	167
240.158	166.945
246.075	165
250.846	163.432
252.16	163
254.731	162.155
258.246	161
260.564	160.238
264.331	159
269.78	157.209
270.417	157
270.828	156.865
276.502	155
281.239	153.443
282.588	153
284.878	152.247
288.673	151
288.694	150.994
291.145	150.188
294.759	149
294.789	148.99
294.817	148.991
300.025	147.273
300.849	147
300.936	147
301.55	146.798
306.97	145
307.021	145
311.682	143.462
313.072	143
313.082	143
315.185	142.306
319.144	141
321.59	140.197
325.229	139
329.426	137.608
331.256	137
332.629	136.549
337.335	135
341.828	133.529
343.443	133
348.164	131.439
349.492	131
351.137	130.45
355.479	129
366.611	128.944
370.513	128.931
383.965	128.994
385.43	129
387.113	129.048
390.516	129.144
435.781	130.424
456.235	131

480.527	131.667
527.675	132.968
528.433	132.989
528.846	133
528.936	133
528.97	133
529.059	133.001
539.5	133.043
552.72	133.294
575.143	133.619
581.119	133.601
587.25	133.583
593.541	133.565
599.129	133.534
601.589	133.521
608.463	133.488
610.709	133.476
617.792	133.441
625.205	133.405
627.114	133.395
634.744	133.358
636.43	133.349
644.276	133.311
645.74	133.303
653.801	133.264
655.043	133.257
656.126	133.253
664.642	133.216
665.551	133.212
674.288	133.174
675.074	133.171
684.022	133.132
684.619	133.13
693.779	133.09
694.187	133.088
703.562	133.048
703.773	133.047
713.368	133.005
713.392	133.005
714.64	133
723.812	132.994
724.625	132.995
726.778	132.991
732.863	132.987
736.095	132.991
738.943	132.989
742.604	133
766.537	133.668
774.739	133.898
814.017	135
828.404	135.395
839.649	135.705
864.839	136.398

886.554	137
888.573	137.057
924.259	137.663
944.12	137.919
948.68	137.898
953.418	137.877
958.343	137.854
963.659	137.828
967.433	137.811
972.95	137.784
976.521	137.768
982.239	137.739
985.607	137.724
991.527	137.694
994.615	137.677
1000.75	137.646
1003.63	137.631
1009.99	137.599
1012.66	137.584
1019.23	137.551
1021.71	137.539
1028.5	137.505
1029.69	137.499
1030.85	137.495
1031.4	137.492
1038.35	137.463
1040.11	137.456
1041.2	137.452
1042.28	137.45
1049.3	137.42
1052.16	137.449
1055.45	137.483
1057.69	137.531
1062.15	137.526
1066.68	137.507
1069.19	137.568
1075.92	137.51
1078.47	137.582
1085.16	137.513
1087.7	137.49
1090.05	137.577
1093.69	137.552
1096.62	137.674
1099.96	137.645
1103.91	137.833
1111.1	138.173
1115.26	138.472
1128.34	138.992
1128.36	138.993
1128.54	139
1136.54	140.583
1138.64	141
1143.2	141.914

1148.64	143
1149.35	143.143
1152.53	143.786
1157.39	144.767
1158.54	145
1163.34	145.967
1168.47	147
1168.88	147.082
1169.38	147.184
1178.4	149
1181.82	149.688
1188.33	151
1194.13	152.167
1198.27	153
1206.33	154.622
1208.21	155
1216.89	156.747
1218.14	157
1218.36	157.045
1228.05	159
1228.06	159.001
1228.08	159.005
1228.4	159.083
1236.03	160.624
1237.89	161
1244.19	162.271
1247.8	163
1253.54	164.159
1257.71	165
1261.5	165.765
1266.92	166.86
1267.34	166.946
1267.61	167
1277.37	168.971
1277.52	169
1278.54	169.207
1287.42	171
1288.05	171.126
1288.73	171.264
1293.48	172.185
1297.69	173
1300.81	173.606
1308	175
1310.03	175.394
1312.81	175.933
1315.92	176.536
1318.32	177
1324.86	178.267
1328.64	179
1334.83	180.2
1336.61	180.546

Block Search Polyline

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961
209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148
294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138

329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439
349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395
634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088

703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995
726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551
1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507

1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552
1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158
1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168

1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606
1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

External Boundary

X	Y
0	170
0	0
1336.61	0
1336.61	177.546
1336.61	179.546
1336.61	180.546
1336.61	181.546
1336.61	186.546
1336.61	316.096
1336	316.115
1335.3	316.135
1325.6	316.421
1323.06	316.496
1315.25	316.726
1310.87	316.855
1304.93	317.03
1298.73	317.212
1294.66	317.332
1286.65	317.568
1284.42	317.634
1274.63	317.923
1272	318
1262.91	318.268
1260.99	318.324
1251.2	318.613
1246.79	318.743
1239.42	318.96
1232.47	319.165
1227.56	319.309
1218.04	319.59
1215.62	319.661
1204.11	320
1203.6	320.015

1194.6	320.266
1193.29	320.302
1185.64	320.515
1183.11	320.585
1182.42	320.604
1175.98	320.783
1174.59	320.814
1173.12	320.841
1167.94	320.981
1166.28	321.002
1165.04	321.034
1163.06	321.079
1161.3	321.092
1159.43	321.127
1157.67	321.154
1155.99	321.174
1154.16	321.179
1152.52	321.192
1150.91	321.199
1149.06	321.196
1147.46	321.198
1145.85	321.194
1144.21	321.184
1142.36	321.173
1140.67	321.157
1138.9	321.134
1137.03	321.105
1135.23	321.085
1133.24	321.046
1131.08	320.997
1129.38	320.97
1127.03	320.908
1124.38	320.829
1122.89	320.798
1119.95	320.7
1118.67	320.668
1109.8	320.35
1109.09	320.328
1100.04	320
1096.88	319.885
1096.03	319.854
1085.1	319.456
1081.1	319.31
1073.4	319.03
1066.29	318.771
1064.86	318.717
1062.97	318.643
1052.18	318.254
1051.41	318.223
1045.12	318
1037.57	317.725
1028.17	317.383
1023.72	317.221

1017.01	316.976
1009.52	316.704
1008.28	316.657
996.063	316.213
995.361	316.186
994.822	316.164
990.2	316
980.627	315.651
977.216	315.527
966.37	315.132
957.811	314.821
951.951	314.607
950.897	314.568
937.869	314.094
937.565	314.082
937.331	314.073
935.278	314
925.128	313.63
922.402	313.531
913.375	313.202
907.52	312.989
901.711	312.778
892.78	312.452
891.981	312.423
880.356	312
878.221	311.922
877.459	311.895
863.902	311.401
855.95	311.111
849.484	310.876
844.499	310.694
834.968	310.347
834.362	310.325
825.434	310
821.354	309.851
820.258	309.812
809.633	309.425
805.404	309.271
797.969	309
790.641	308.733
786.363	308.577
775.969	308.199
775.619	308.186
770.512	308
761.583	307.675
758.397	307.559
747.249	307.153
738.908	306.849
732.814	306.627
729.246	306.497
718.278	306.098
718.107	306.092
715.59	306

706.219	305.659
703.734	305.568
694.724	305.24
689.186	305.038
683.216	304.821
674.618	304.508
671.696	304.402
660.668	304
660.102	303.979
659.927	303.973
647.125	303.507
642.972	303.356
634.19	303.036
626.089	302.741
621.298	302.566
609.277	302.129
608.447	302.098
605.746	302
592.729	301.43
585.533	300.889
578.85	300.522
573.694	300
567.931	298.081
567.688	298
567.55	297.954
561.688	296
560.864	295.725
555.688	294
553.874	293.396
549.687	292
547.513	291.275
543.686	290
539.572	288.629
537.686	288
532.56	286.292
531.685	286
529.672	285.329
525.684	284
523.962	283.426
519.684	282
517.638	281.318
513.683	280
509.776	278.698
507.683	278
506.199	277.506
501.681	276
497.772	274.697
495.681	274
491.005	272.442
489.68	272
489.09	271.803
483.679	270
482.242	269.521

477.679	268
474.189	266.837
471.678	266
466.109	264.144
465.678	264
465.484	263.935
459.677	262
459.258	261.86
453.676	260
452.686	259.67
447.676	258
444.164	256.829
441.675	256
437.62	254.648
435.675	254
431.086	252.47
429.675	252
427.788	251.371
423.674	250
420.757	249.028
417.674	248
414.581	246.969
411.673	246
408.486	244.938
405.673	244
402.391	242.906
399.673	242
396.296	240.874
393.672	240
390.201	238.843
387.672	238
384.105	236.811
381.671	236
378.01	234.78
375.671	234
372.05	232.793
369.671	232
368.183	231.504
363.67	230
362.091	229.474
357.67	228
355.998	227.443
351.669	226
349.905	225.412
345.669	224
343.812	223.381
339.669	222
337.719	221.35
333.668	220
331.626	219.319
327.668	218
325.533	217.288
321.667	216

319.439	215.257
315.667	214
313.346	213.226
309.667	212
307.252	211.195
303.666	210
301.159	209.164
297.666	208
295.065	207.133
291.665	206
288.971	205.102
285.665	204
282.877	203.071
279.665	202
276.783	201.04
273.664	200
270.689	199.008
267.664	198
264.594	196.977
261.663	196
258.5	194.946
255.663	194
252.405	192.914
249.662	192
246.31	190.883
243.662	190
240.215	188.851
237.662	188
234.12	186.82
231.661	186
228.017	184.785
225.662	184
221.802	182.716
219.651	182
216.161	180.832
214.953	180.427
213.677	180
210.543	178.955
208.652	178.325
207.677	178
207.158	177.844
205.613	177.382
202.523	176.456
180.07	178
177.959	177.46
174.783	176.639
172.407	176
170.772	175.495
166.382	174
163.292	173.078
159.725	172
157.032	170.826
156.661	170.683

155.94	170.468
154.715	170
153.182	169.408
152.867	169.312
152.014	169.08
151.049	168.783
148.832	168
147.535	167.52
143.965	166
140.022	164.477
138.788	164
137.479	163.509
133.373	162
131.589	161.309
127.185	160
126.959	159.997
126.25	159.995
125.762	159.993
125.68	159.993
118.478	159.969
112.757	159.986
109.707	159.993
109.569	159.993
109.105	159.994
108.997	159.995
108.065	159.997
107.64	159.997
107.166	160
106.378	160.046
106.193	160.053
106.103	160.054
105.8	160.084
105.495	160.108
104.805	160.417
103.221	160.987
102.599	161.033
102.009	161.037
101.614	161.072
101.055	161.048
100.711	161.052
97.7835	161.058
94.3084	161.041
93.8975	161.022
91.9539	161.147
91.63	161.143
91.4102	161.082
90.2817	161.024
89.9486	161.022
89.707	160.951
86.7014	160.813
82.7048	161.264
82.458	161.296
81.3882	161.545

81.1637	161.594
79.2738	162
77.816	162
75.0666	162
72.9864	161.282
69.3934	160
68.7416	159.768
68.2736	159.597
68.1192	159.514
67.9386	159.38
67.3686	159.119
66.5713	158
65.7493	156.136
65.6836	156
65.5752	156
65.3068	156
65.0401	156
59.6261	156
59.182	156
58.1295	156
54.3138	157.2
51.6407	158
50.8258	158.181
50.3907	158.236
45.9965	158.999
41.4109	159.593
40.813	159.676
40.1879	159.755
38.4792	160
36.2697	160.68
34.0018	161.233
31.409	162
30.6648	162.367
29.2396	163.187
28.1824	163.779
27.7683	164
24.1653	165.56
23.3051	166
19.6494	167.648
18.9426	168
15.9722	169.385
14.4129	170
14.1982	170
12.8502	170
12.4376	170
10.2755	170
9.92074	170
8.21815	170

Material Boundary

X	Y
202.523	176.456

209.644	173.98
209.656	173.976
209.673	173.97
209.701	173.961
209.754	173.943
209.889	173.899
211.024	173.525
215.647	172
219.457	170.752
221.753	170
223.198	169.524
227.818	168
231.167	166.903
233.924	166
239.731	164.085
239.989	164
240.158	163.945
246.075	162
250.846	160.432
252.16	160
254.731	159.155
258.246	158
260.564	157.238
264.331	156
269.78	154.209
270.417	154
270.828	153.865
276.502	152
281.239	150.443
282.588	150
284.878	149.247
288.673	148
288.694	147.994
291.145	147.188
294.759	146
294.789	145.99
294.817	145.991
300.025	144.273
300.849	144
300.936	144
301.55	143.798
306.97	142
307.021	142
311.682	140.462
313.072	140
313.082	140
315.185	139.306
319.144	138
321.59	137.197
325.229	136
329.426	134.608
331.256	134
332.629	133.549

337.335	132
341.828	130.529
343.443	130
348.164	128.439
349.492	128
351.137	127.45
355.479	126
366.611	125.944
370.513	125.931
383.965	125.994
385.43	126
387.113	126.048
390.516	126.144
435.781	127.424
456.235	128
480.527	128.667
527.675	129.968
528.433	129.989
528.846	130
528.936	130
528.97	130
529.059	130.001
539.5	130.043
552.72	130.294
575.143	130.619
581.119	130.601
587.25	130.583
593.541	130.565
599.129	130.534
601.589	130.521
608.463	130.488
610.709	130.476
617.792	130.441
625.205	130.405
627.114	130.395
634.744	130.358
636.43	130.349
644.276	130.311
645.74	130.303
653.801	130.264
655.043	130.257
656.126	130.253
664.642	130.216
665.551	130.212
674.288	130.174
675.074	130.171
684.022	130.132
684.619	130.13
693.779	130.09
694.187	130.088
703.562	130.048
703.773	130.047
713.368	130.005

713.392	130.005
714.64	130
723.812	129.994
724.625	129.995
726.778	129.991
732.863	129.987
736.095	129.991
738.943	129.989
742.604	130
766.537	130.668
774.739	130.898
814.017	132
828.404	132.395
839.649	132.705
864.839	133.398
886.554	134
888.573	134.057
924.259	134.663
944.12	134.919
948.68	134.898
953.418	134.877
958.343	134.854
963.659	134.828
967.433	134.811
972.95	134.784
976.521	134.768
982.239	134.739
985.607	134.724
991.527	134.694
994.615	134.677
1000.75	134.646
1003.63	134.631
1009.99	134.599
1012.66	134.584
1019.23	134.551
1021.71	134.539
1028.5	134.505
1029.69	134.499
1030.85	134.495
1031.4	134.492
1038.35	134.463
1040.11	134.456
1041.2	134.452
1042.28	134.45
1049.3	134.42
1052.16	134.449
1055.45	134.483
1057.69	134.531
1062.15	134.526
1066.68	134.507
1069.19	134.568
1075.92	134.51
1078.47	134.582

1085.16	134.513
1087.7	134.49
1090.05	134.577
1093.69	134.552
1096.62	134.674
1099.96	134.645
1103.91	134.833
1111.1	135.173
1115.26	135.472
1128.34	135.992
1128.36	135.993
1128.54	136
1136.54	137.583
1138.64	138
1143.2	138.914
1148.64	140
1149.35	140.143
1152.53	140.786
1157.39	141.767
1158.54	142
1163.34	142.967
1168.47	144
1168.88	144.082
1169.38	144.184
1178.4	146
1181.82	146.688
1188.33	148
1194.13	149.167
1198.27	150
1206.33	151.622
1208.21	152
1216.89	153.747
1218.14	154
1218.36	154.045
1228.05	156
1228.06	156.001
1228.08	156.005
1228.4	156.083
1236.03	157.624
1237.89	158
1244.19	159.271
1247.8	160
1253.54	161.159
1257.71	162
1261.5	162.765
1266.92	163.86
1267.34	163.946
1267.61	164
1277.37	165.971
1277.52	166
1278.54	166.207
1287.42	168
1288.05	168.126

1288.73	168.264
1293.48	169.185
1297.69	170
1300.81	170.606
1308	172
1310.03	172.394
1312.81	172.933
1315.92	173.536
1318.32	174
1324.86	175.267
1328.64	176
1334.83	177.2
1336.61	177.546

Material Boundary

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961
209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148

294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138
329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439
349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395

634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088
703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995
726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551

1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507
1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552
1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158

1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168
1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606
1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

Material Boundary

X	Y
208.652	178.325
209.644	177.98
209.656	177.976
209.673	177.97
209.701	177.961
209.754	177.943
209.889	177.899
211.024	177.525
215.647	176
219.457	174.752
221.753	174
223.198	173.524
227.818	172
231.167	170.903
233.924	170
239.731	168.085
239.989	168
240.158	167.945

246.075	166
250.846	164.432
252.16	164
254.731	163.155
258.246	162
260.564	161.238
264.331	160
269.78	158.209
270.417	158
270.828	157.865
276.502	156
281.239	154.443
282.588	154
284.878	153.247
288.673	152
288.694	151.994
291.145	151.188
294.759	150
294.789	149.99
294.817	149.991
300.025	148.273
300.849	148
300.936	148
301.55	147.798
306.97	146
307.021	146
311.682	144.462
313.072	144
313.082	144
315.185	143.306
319.144	142
321.59	141.197
325.229	140
329.426	138.608
331.256	138
332.629	137.549
337.335	136
341.828	134.529
343.443	134
348.164	132.439
349.492	132
351.137	131.45
355.479	130
366.611	129.944
370.513	129.931
383.965	129.994
385.43	130
387.113	130.048
390.516	130.144
435.781	131.424
456.235	132
480.527	132.667
527.675	133.968

528.433	133.989
528.846	134
528.936	134
528.97	134
529.059	134.001
539.5	134.043
552.72	134.294
575.143	134.619
581.119	134.601
587.25	134.583
593.541	134.565
599.129	134.534
601.589	134.521
608.463	134.488
610.709	134.476
617.792	134.441
625.205	134.405
627.114	134.395
634.744	134.358
636.43	134.349
644.276	134.311
645.74	134.303
653.801	134.264
655.043	134.257
656.126	134.253
664.642	134.216
665.551	134.212
674.288	134.174
675.074	134.171
684.022	134.132
684.619	134.13
693.779	134.09
694.187	134.088
703.562	134.048
703.773	134.047
713.368	134.005
713.392	134.005
714.64	134
723.812	133.994
724.625	133.995
726.778	133.991
732.863	133.987
736.095	133.991
738.943	133.989
742.604	134
766.537	134.668
774.739	134.898
814.017	136
828.404	136.395
839.649	136.705
864.839	137.398
886.554	138
888.573	138.057

924.259	138.663
944.12	138.919
948.68	138.898
953.418	138.877
958.343	138.854
963.659	138.828
967.433	138.811
972.95	138.784
976.521	138.768
982.239	138.739
985.607	138.724
991.527	138.694
994.615	138.677
1000.75	138.646
1003.63	138.631
1009.99	138.599
1012.66	138.584
1019.23	138.551
1021.71	138.539
1028.5	138.505
1029.69	138.499
1030.85	138.495
1031.4	138.492
1038.35	138.463
1040.11	138.456
1041.2	138.452
1042.28	138.45
1049.3	138.42
1052.16	138.449
1055.45	138.483
1057.69	138.531
1062.15	138.526
1066.68	138.507
1069.19	138.568
1075.92	138.51
1078.47	138.582
1085.16	138.513
1087.7	138.49
1090.05	138.577
1093.69	138.552
1096.62	138.674
1099.96	138.645
1103.91	138.833
1111.1	139.173
1115.26	139.472
1128.34	139.992
1128.36	139.993
1128.54	140
1136.54	141.583
1138.64	142
1143.2	142.914
1148.64	144
1149.35	144.143

1152.53	144.786
1157.39	145.767
1158.54	146
1163.34	146.967
1168.47	148
1168.88	148.082
1169.38	148.184
1178.4	150
1181.82	150.688
1188.33	152
1194.13	153.167
1198.27	154
1206.33	155.622
1208.21	156
1216.89	157.747
1218.14	158
1218.36	158.045
1228.05	160
1228.06	160.001
1228.08	160.005
1228.4	160.083
1236.03	161.624
1237.89	162
1244.19	163.271
1247.8	164
1253.54	165.159
1257.71	166
1261.5	166.765
1266.92	167.86
1267.34	167.946
1267.61	168
1277.37	169.971
1277.52	170
1278.54	170.207
1287.42	172
1288.05	172.126
1288.73	172.264
1293.48	173.185
1297.69	174
1300.81	174.606
1308	176
1310.03	176.394
1312.81	176.933
1315.92	177.536
1318.32	178
1324.86	179.267
1328.64	180
1334.83	181.2
1336.61	181.546

Material Boundary

X	Y

216.161	180.832
219.457	179.752
221.753	179
223.198	178.524
227.818	177
231.167	175.903
233.924	175
239.731	173.085
239.989	173
240.158	172.945
246.075	171
250.846	169.432
252.16	169
254.731	168.155
258.246	167
260.564	166.238
264.331	165
269.78	163.209
270.417	163
270.828	162.865
276.502	161
281.239	159.443
282.588	159
284.878	158.247
288.673	157
288.694	156.994
291.145	156.188
294.759	155
294.789	154.99
294.817	154.991
300.025	153.273
300.849	153
300.936	153
301.55	152.798
306.97	151
307.021	151
311.682	149.462
313.072	149
313.082	149
315.185	148.306
319.144	147
321.59	146.197
325.229	145
329.426	143.608
331.256	143
332.629	142.549
337.335	141
341.828	139.529
343.443	139
348.164	137.439
349.492	137
351.137	136.45
355.479	135

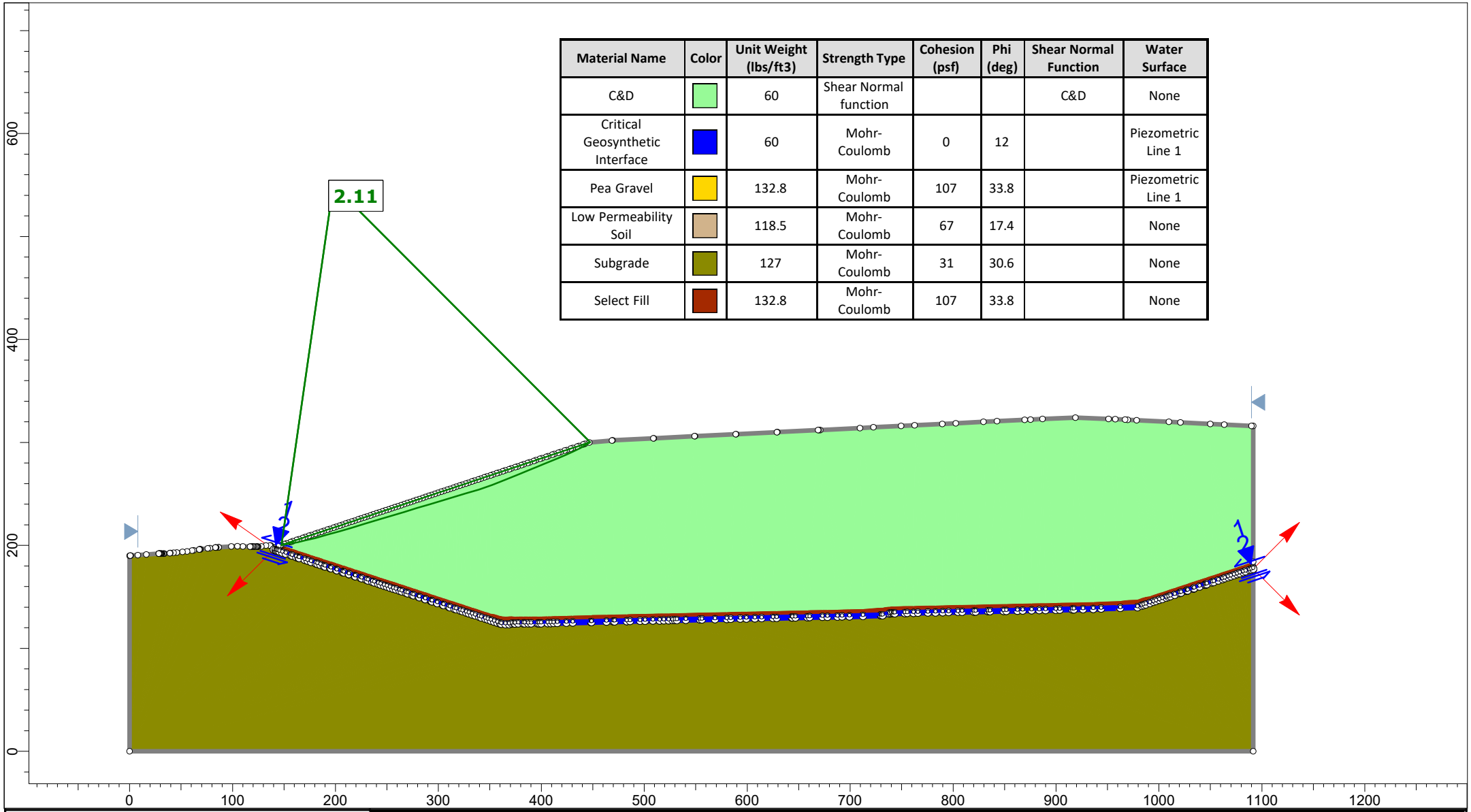
366.611	134.944
370.513	134.931
383.965	134.994
385.43	135
387.113	135.048
390.516	135.144
435.781	136.424
456.235	137
480.527	137.667
527.675	138.968
528.433	138.989
528.846	139
528.936	139
528.97	139
529.059	139.001
539.5	139.043
552.72	139.294
575.143	139.619
581.119	139.601
587.25	139.583
593.541	139.565
599.129	139.534
601.589	139.521
608.463	139.488
610.709	139.476
617.792	139.441
625.205	139.405
627.114	139.395
634.744	139.358
636.43	139.349
644.276	139.311
645.74	139.303
653.801	139.264
655.043	139.257
656.126	139.253
664.642	139.216
665.551	139.212
674.288	139.174
675.074	139.171
684.022	139.132
684.619	139.13
693.779	139.09
694.187	139.088
703.562	139.048
703.773	139.047
713.368	139.005
713.392	139.005
714.64	139
723.812	138.994
724.625	138.995
726.778	138.991
732.863	138.987
736.095	138.991

738.943	138.989
742.604	139
766.537	139.668
774.739	139.898
814.017	141
828.404	141.395
839.649	141.705
864.839	142.398
886.554	143
888.573	143.057
924.259	143.663
944.12	143.919
948.68	143.898
953.418	143.877
958.343	143.854
963.659	143.828
967.433	143.811
972.95	143.784
976.521	143.768
982.239	143.739
985.607	143.724
991.527	143.694
994.615	143.677
1000.75	143.646
1003.63	143.631
1009.99	143.599
1012.66	143.584
1019.23	143.551
1021.71	143.539
1028.5	143.505
1029.69	143.499
1030.85	143.495
1031.4	143.492
1038.35	143.463
1040.11	143.456
1041.2	143.452
1042.28	143.45
1049.3	143.42
1052.16	143.449
1055.45	143.483
1057.69	143.531
1062.15	143.526
1066.68	143.507
1069.19	143.568
1075.92	143.51
1078.47	143.582
1085.16	143.513
1087.7	143.49
1090.05	143.577
1093.69	143.552
1096.62	143.674
1099.96	143.645
1103.91	143.833

1111.1	144.173
1115.26	144.472
1128.34	144.992
1128.36	144.993
1128.54	145
1136.54	146.583
1138.64	147
1143.2	147.914
1148.64	149
1149.35	149.143
1152.53	149.786
1157.39	150.767
1158.54	151
1163.34	151.967
1168.47	153
1168.88	153.082
1169.38	153.184
1178.4	155
1181.82	155.688
1188.33	157
1194.13	158.167
1198.27	159
1206.33	160.622
1208.21	161
1216.89	162.747
1218.14	163
1218.36	163.045
1228.05	165
1228.06	165.001
1228.08	165.005
1228.4	165.083
1236.03	166.624
1237.89	167
1244.19	168.271
1247.8	169
1253.54	170.159
1257.71	171
1261.5	171.765
1266.92	172.86
1267.34	172.946
1267.61	173
1277.37	174.971
1277.52	175
1278.54	175.207
1287.42	177
1288.05	177.126
1288.73	177.264
1293.48	178.185
1297.69	179
1300.81	179.606
1308	181
1310.03	181.394
1312.81	181.933

1315.92	182.536
1318.32	183
1324.86	184.267
1328.64	185
1334.83	186.2
1336.61	186.546

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section B - Static - Liner System Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

182-442 S.A. Dunn Footprint Modification

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:01m:02.400s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	9/26/2018, 11:46:34 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	145
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.113600
Axis Location:	197.817, 550.186
Left Slip Surface Endpoint:	147.568, 200.339
Right Slip Surface Endpoint:	447.545, 300.078
Resisting Moment:	2.54486e+07 lb-ft
Driving Moment:	1.20404e+07 lb-ft
Resisting Horizontal Force:	73975.5 lb
Driving Horizontal Force:	34999.8 lb
Total Slice Area:	1954.51 ft2
Surface Horizontal Width:	299.977 ft
Surface Average Height:	6.51554 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
147.568	200.339
162.865	202.972
171.562	205.007
180.259	207.09
192.005	210.324
203.752	213.559
215.424	217.061
228.35	220.939
241.136	224.775
253.923	228.611
266.834	232.485
279.693	236.343
291.467	239.876
303.242	243.408
315.106	246.968
326.97	250.527
339.595	254.315
352.22	258.751
365.479	264.047
378.628	269.339
387.437	272.884
395.143	275.999
402.848	279.115
416.372	284.61
423.745	287.846
431.119	291.32
439.335	295.238
447.545	300.078

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.1136

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	5.09918	125.652	9.76651	C&D	3.55271e-15	34.992	7.74683	16.3737	23.391	0	23.391	24.7245	24.7245
2	5.09918	376.957	9.76651	C&D	0	34.992	23.3445	49.3409	70.4869	0	70.4869	74.5052	74.5052
3	5.09918	628.261	9.76651	C&D	0	34.992	39.0985	82.6385	118.055	0	118.055	124.785	124.785
4	8.69679	1510.85	13.1723	C&D	1.42109e-14	34.992	54.1276	114.404	163.434	0	163.434	176.102	176.102
5	4.3484	921.105	13.4676	C&D	2.84217e-14	34.992	66.0825	139.672	199.531	0	199.531	215.357	215.357
6	4.3484	1027.44	13.4676	C&D	0	34.992	73.8754	156.143	223.062	0	223.062	240.753	240.753
7	5.87324	1519.44	15.3944	C&D	0	34.992	79.7776	168.618	240.882	0	240.882	262.848	262.848
8	5.87324	1639.21	15.3944	C&D	2.84217e-14	34.992	86.2032	182.199	260.284	0	260.284	284.019	284.019
9	5.87352	1759.07	15.3944	C&D	0	34.992	92.64	195.804	279.721	0	279.721	305.229	305.229
10	5.87352	1878.86	15.3944	C&D	2.84217e-14	34.992	99.0859	209.428	299.183	0	299.183	326.465	326.465
11	5.8359	1960.24	16.7006	C&D	0	34.992	102.814	217.308	310.44	0	310.44	341.287	341.287
12	5.8359	2028.05	16.7006	C&D	2.84217e-14	34.992	106.417	224.924	321.32	0	321.32	353.248	353.248
13	6.46276	2325.03	16.7006	C&D	0	34.992	110.207	232.934	332.764	0	332.764	365.829	365.829
14	6.46276	2408.19	16.7006	C&D	0	34.992	114.181	241.333	344.761	0	344.761	379.018	379.018
15	6.39343	2464.19	16.7006	C&D	0	34.992	118.122	249.663	356.662	0	356.662	392.101	392.101
16	6.39343	2545.58	16.7006	C&D	0	34.992	122.029	257.921	368.46	0	368.46	405.071	405.071
17	6.39343	2626.97	16.7006	C&D	0	34.992	125.922	266.149	380.212	0	380.212	417.992	417.992
18	6.39343	2708.36	16.7006	C&D	0	34.992	129.798	274.342	391.917	0	391.917	430.86	430.86
19	6.4555	2817.23	16.7006	C&D	0	34.992	133.676	282.537	403.624	0	403.624	443.73	443.73
20	6.4555	2900.21	16.7006	C&D	0	34.992	137.552	290.73	415.328	0	415.328	456.597	456.597
21	6.4294	2970.96	16.7006	C&D	5.68434e-14	34.992	141.4	298.862	426.946	0	426.946	469.369	469.369
22	6.4294	3053.27	16.7006	C&D	5.68434e-14	34.992	145.217	306.931	438.473	0	438.473	482.042	482.042
23	5.88713	2867.94	16.7006	C&D	5.68434e-14	34.992	148.852	314.614	449.449	0	449.449	494.109	494.109
24	5.88713	2936.95	16.7006	C&D	5.68434e-14	34.992	152.306	321.915	459.878	0	459.878	505.574	505.574
25	5.88713	3005.96	16.7006	C&D	5.68434e-14	34.992	155.74	329.172	470.245	0	470.245	516.971	516.971
26	5.88713	3074.97	16.7006	C&D	5.68434e-14	34.992	159.152	336.384	480.549	0	480.549	528.299	528.299
27	5.9322	3168.31	16.7006	C&D	0	34.992	162.556	343.578	490.826	0	490.826	539.597	539.597
28	5.9322	3238.38	16.7006	C&D	0	34.992	165.951	350.753	501.075	0	501.075	550.865	550.865
29	5.9322	3308.46	16.7006	C&D	5.68434e-14	34.992	169.323	357.881	511.259	0	511.259	562.06	562.06
30	5.9322	3378.53	16.7006	C&D	5.68434e-14	34.992	172.673	364.962	521.374	0	521.374	573.181	573.181
31	6.3122	3671.89	16.7006	C&D	5.68434e-14	34.992	176.109	372.223	531.746	0	531.746	584.583	584.583
32	6.3122	3751.23	16.7006	C&D	0	34.992	179.627	379.659	542.369	0	542.369	596.262	596.262
33	6.31274	3769.49	19.3608	C&D	5.68434e-14	34.992	174.435	368.686	526.694	0	526.694	587.989	587.989
34	6.31274	3726.03	19.3608	C&D	0	34.992	172.298	364.168	520.24	0	520.24	580.783	580.783
35	4.41943	2554.53	21.7716	C&D	5.68434e-14	34.992	163.922	346.465	494.95	0	494.95	560.42	560.42
36	4.41943	2476.97	21.7716	C&D	5.68434e-14	34.992	158.993	336.047	480.068	0	480.068	543.569	543.569
37	4.41943	2399.41	21.7716	C&D	0	34.992	154.077	325.658	465.227	0	465.227	526.764	526.764
38	4.38309	2301.32	21.9215	C&D	5.68434e-14	34.992	148.831	314.569	449.384	0	449.384	509.279	509.279
39	4.38309	2221.53	21.9215	C&D	0	34.992	143.766	303.864	434.09	0	434.09	491.946	491.946

40	4.38309	2141.74	21.9215	C&D	0	34.992	138.708	293.174	418.821	0	418.821	474.642	474.642
41	4.40466	2071.89	21.9215	C&D	0	34.992	133.644	282.47	403.53	0	403.53	457.313	457.313
42	4.40466	1991.31	21.9215	C&D	5.68434e-14	34.992	128.571	271.748	388.211	0	388.211	439.953	439.953
43	7.70545	3286.41	22.0151	C&D	0	34.992	121.363	256.512	366.446	0	366.446	415.517	415.517
44	7.70545	3033.04	22.0151	C&D	2.84217e-14	34.992	112.253	237.257	338.938	0	338.938	384.326	384.326
45	6.76202	2450.2	22.1138	C&D	2.84217e-14	34.992	103.48	218.715	312.45	0	312.45	354.498	354.498
46	6.76202	2249.57	22.1138	C&D	0	34.992	95.2342	201.287	287.554	0	287.554	326.251	326.251
47	7.37329	2171.3	23.6928	C&D	2.84217e-14	34.992	83.4746	176.432	252.045	0	252.045	288.676	288.676
48	7.37365	1774.09	25.2295	C&D	2.84217e-14	34.992	67.7049	143.101	204.43	0	204.43	236.332	236.332
49	8.21559	1434.98	25.4956	C&D	1.42109e-14	34.992	49.3504	104.307	149.01	0	149.01	172.544	172.544
50	8.21001	619.252	30.5202	C&D	7.10543e-15	34.992	20.7395	43.835	62.6214	0	62.6214	74.8478	74.8478

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.1136

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	147.568	200.339	0	0	0
2	152.667	201.217	18.9719	0.421701	1.27334
3	157.766	202.094	76.1424	3.38011	2.5418
4	162.865	202.972	171.894	11.4189	3.80057
5	171.562	205.007	309.981	32.0969	5.91161
6	175.91	206.049	389.55	47.447	6.94439
7	180.259	207.09	478.503	66.8955	7.95846
8	186.132	208.707	557.516	91.2372	9.29404
9	192.005	210.324	642.892	120.143	10.5853
10	197.879	211.942	734.648	153.836	11.8269
11	203.752	213.559	832.788	192.485	13.0144
12	209.588	215.31	889.248	223.965	14.1364
13	215.424	217.061	947.687	257.434	15.1974
14	221.887	219	1014.71	296.669	16.2972
15	228.35	220.939	1084.14	337.987	17.3152
16	234.743	222.857	1155.21	380.673	18.2385
17	241.136	224.775	1228.62	424.887	19.0766
18	247.53	226.693	1304.38	470.32	19.8278
19	253.923	228.611	1382.46	516.628	20.4908
20	260.379	230.548	1463.67	563.891	21.0696
21	266.834	232.485	1547.22	611.242	21.5569
22	273.264	234.414	1632.77	658.042	21.9505
23	279.693	236.343	1720.62	704.011	22.2525
24	285.58	238.109	1803.08	744.953	22.4483
25	291.467	239.876	1887.45	784.388	22.5668
26	297.355	241.642	1973.73	821.911	22.6081
27	303.242	243.408	2061.89	857.105	22.5721
28	309.174	245.188	2152.63	889.786	22.4577
29	315.106	246.968	2245.27	919.241	22.2648
30	321.038	248.748	2339.78	945.033	21.9937
31	326.97	250.527	2436.17	966.731	21.6444
32	333.283	252.421	2540.77	984.846	21.1872
33	339.595	254.315	2647.46	997.343	20.6422
34	345.908	256.533	2580.31	939.668	20.01
35	352.22	258.751	2513.98	879.968	19.2916
36	356.64	260.517	2364.78	802.177	18.7379
37	361.059	262.282	2220.07	727.472	18.1429
38	365.479	264.047	2079.84	656.061	17.5073
39	369.862	265.811	1939.5	586.955	16.8375
40	374.245	267.575	1803.95	521.678	16.1292
41	378.628	269.339	1673.16	460.342	15.3834
42	383.033	271.111	1546.53	402.756	14.5971
43	387.437	272.884	1424.7	349.287	13.7752
44	395.143	275.999	1218.17	264.628	12.2562
45	402.848	279.115	1027.15	192.988	10.6411
46	409.61	281.862	868.373	139.913	9.15288
47	416.372	284.61	722.249	96.4534	7.60661
48	423.745	287.846	522.226	53.6434	5.86489
49	431.119	291.32	311.185	22.1818	4.07725
50	439.335	295.238	132.829	4.75007	2.04807
51	447.545	300.078	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
140.028	196.713

141.766	196.149
142.289	195.994
143.045	195.769
144.237	195.414
145.518	195
148.459	194.052
151.716	193
156.612	191.418
157.903	191
161.952	189.689
164.08	189
164.758	188.78
170.247	187
172.895	186.14
176.403	185
181.024	183.497
182.529	183
185.376	182.065
188.619	181
189.923	180.575
194.757	179
195.648	178.71
200.895	177
201.373	176.844
207.034	175
207.098	174.979
207.993	174.687
212.823	173.114
213.172	173
218.549	171.248
219.311	171
224.274	169.383
225.449	169
230	167.518
231.588	167
235.725	165.651
237.722	165
241.444	163.784
243.846	163
247.162	161.917
249.97	161
252.88	160.05
256.093	159
258.598	158.182
262.216	157
264.316	156.314
268.34	155
270.035	154.446
274.463	153
275.754	152.578
280.585	151
281.473	150.71
286.71	149

287.186	148.844
292.824	147
292.886	146.98
293.74	146.7
298.583	145.115
298.935	145
304.279	143.251
305.047	143
309.976	141.387
311.159	141
315.674	139.523
317.272	139
321.371	137.659
323.386	137
327.069	135.795
329.5	135
332.77	133.931
335.619	133
339.508	131.716
341.678	131
345.692	129.704
347.866	129
350.959	127.992
354.006	127
357.278	125.924
360.089	125
361.133	124.745
365.215	124.477
368.707	124.493
371.484	125
373.654	125.03
374.386	125.08
377.631	125.239
382.427	125.316
383.677	125.244
387.287	125.197
390.059	125.187
396.735	125.233
398.019	125.268
399.749	125.314
406.24	125.429
409.208	125.512
411.915	125.585
415.53	125.683
424.48	125.93
430.485	126.131
448.199	126.599
448.732	126.618
463.334	127
470.097	127.145
471.17	127.168
483.106	127.425
486.086	127.487

495.863	127.696
500.697	127.797
508.409	127.961
515.014	128.097
518.981	128.181
523.614	128.281
527.447	128.363
529.69	128.406
531.66	128.441
540.373	128.637
554.05	128.953
556.089	129
568.694	129.288
580.167	129.531
584.066	129.617
593.259	129.813
599.175	129.945
607.386	130.128
614.024	130.271
624.97	130.517
628.615	130.596
643.158	130.917
643.782	130.931
646.896	131
658.497	131.248
660.64	131.294
673.082	131.561
677.922	131.665
687.656	131.874
692.236	131.971
699.35	132.123
712.535	132.48
729.855	132.992
730.239	132.992
731.42	133
738.245	134.694
739.951	135
740.007	135.001
741.701	135.015
742.332	135.017
743.317	135.019
753.154	135.287
755.462	135.336
761.566	135.471
765.71	135.559
775.589	135.763
783.012	135.917
790.009	136.066
795.683	136.184
804.848	136.379
808.664	136.459
820.13	136.704
821.971	136.743

833.961	137
835.574	137.035
835.855	137.041
849.047	137.327
851.677	137.384
862.588	137.62
867.593	137.729
876.198	137.915
883.605	138.076
889.878	138.211
899.713	138.425
903.628	138.509
915.919	138.776
917.449	138.809
926.274	139
936.214	139.29
943.717	139.589
962.389	140.22
979.061	141
983.234	142.38
985.11	143
987.287	143.719
991.16	145
994.524	146.112
997.209	147
1000.33	148.033
1003.26	149
1007.19	150.301
1009.31	151
1011.14	151.607
1015.36	153
1020.26	154.621
1021.41	155
1027.04	156.861
1027.46	157
1027.82	157.12
1033.5	159
1034.29	159.258
1039.55	161
1044.85	162.749
1045.6	163
1046.49	163.294
1051.65	165
1053.18	165.503
1057.7	167
1061.67	168.313
1063.75	169
1067.3	170.173
1069.8	171
1072.91	172.028
1075.85	173
1078.52	173.882
1081.9	175

1084.13	175.737
1087.95	177
1089.74	177.591
1091.61	178.21

Block Search Polyline

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178
195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248
219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182

262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704
347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124
373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683

424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596
643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971
699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471

765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142
987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607
1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503

1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

External Boundary

X	Y
0	189.907
0	0
1091.61	0
1091.61	175.21
1091.61	177.21
1091.61	178.21
1091.61	179.21
1091.61	184.21
1091.61	315.915
1089.91	316
1063.4	317.322
1049.79	318
1020.8	319.445
1009.68	320
978.207	321.569
969.56	322
967.034	322.1
957.494	322.477
951.058	322.728
918.857	324
886.821	322.699
875.264	322.234
869.428	322
842.625	320.66
829.419	320
802.655	318.662
789.411	318
762.684	316.664
749.402	316
722.713	314.666
709.393	314
671.066	312.084
669.384	312
668.793	311.97
629.376	310
628.822	309.972

589.367	308
588.85	307.974
549.358	306
548.879	305.976
509.349	304
508.907	303.978
469.34	302
468.527	301.928
446.661	300
442.399	298.58
440.658	298
436.441	296.595
434.656	296
430.483	294.609
428.654	294
424.525	292.624
422.652	292
418.566	290.639
416.65	290
412.608	288.653
410.647	288
406.65	286.668
404.645	286
400.692	284.683
398.643	284
394.734	282.697
392.641	282
388.775	280.712
386.639	280
382.817	278.727
380.636	278
376.859	276.741
374.634	276
370.9	274.756
368.632	274
364.942	272.77
362.63	272
358.984	270.785
356.628	270
353.025	268.8
350.625	268
347.067	266.814
344.623	266
341.108	264.829
338.621	264
335.15	262.843
332.619	262
329.191	260.858
326.617	260
323.233	258.872
320.614	258
317.274	256.887
314.612	256

311.316	254.902
308.61	254
305.357	252.916
302.608	252
299.398	250.931
296.606	250
293.44	248.945
290.603	248
287.481	246.96
284.601	246
281.522	244.974
278.599	244
275.563	242.989
272.597	242
269.605	241.003
266.595	240
263.646	239.017
260.592	238
257.687	237.032
254.59	236
251.728	235.046
248.588	234
245.769	233.061
242.586	232
239.81	231.075
236.583	230
233.851	229.09
230.581	228
227.892	227.104
224.579	226
221.933	225.118
218.577	224
215.974	223.133
212.575	222
210.015	221.147
206.572	220
204.056	219.162
200.57	218
198.097	217.176
194.568	216
192.138	215.19
188.566	214
186.179	213.205
182.564	212
180.22	211.219
176.561	210
174.261	209.233
170.559	208
168.301	207.248
164.557	206
162.342	205.262
158.555	204
156.383	203.276

152.553	202
150.424	201.291
147.568	200.339
146.55	200
144.336	199.263
140.538	198
140.028	197.831
137.04	199.831
136.822	199.82
136.281	199.806
132.588	199.709
128.132	198.907
124.832	198.717
124.43	198.72
123.832	198.73
123.354	198.751
122.743	198.757
121.425	198.812
120.213	198.857
119.938	198.854
119.584	198.87
118.385	198.849
117.235	198.834
117.034	198.833
110.132	198.987
104.818	199.102
98.8143	198.859
86.6552	198.181
86.5428	198.179
84.1379	198
83.868	197.986
83.5647	197.967
83.3869	197.961
78.0277	197.266
75.9286	197.019
68.8572	196.138
68.697	196.118
67.841	196.002
67.8254	196.002
67.6997	196
62.2082	195.148
60.6701	194.935
55.9212	194
51.5095	193.601
45.8245	193.113
42.7715	192.86
39.5414	192.548
39.0396	192.503
33.5804	192
33.3498	191.999
33.0358	191.998
31.7133	191.995
31.057	191.995

30.8982	191.995
30.4475	191.994
29.8506	191.994
29.6366	191.993
29.391	191.993
29.3226	191.993
28.622	191.994
28.542	191.993
28.3605	191.993
28.2555	191.993
16.346	191.138
8.05554	190.53
0.998983	190.005
0.686216	190

Material Boundary

X	Y
140.028	197.831
140.028	197.713
140.028	196.713
140.028	195.713
140.028	193.713
141.766	193.149
142.289	192.994
143.045	192.769
144.237	192.414
145.518	192
148.459	191.052
151.716	190
156.612	188.418
157.903	188
161.952	186.689
164.08	186
164.758	185.78
170.247	184
172.895	183.14
176.403	182
181.024	180.497
182.529	180
185.376	179.065
188.619	178
189.923	177.575
194.757	176
195.648	175.71
200.895	174
201.373	173.844
207.034	172
207.098	171.979
207.993	171.687
212.823	170.114
213.172	170
218.549	168.248

219.311	168
224.274	166.383
225.449	166
230	164.518
231.588	164
235.725	162.651
237.722	162
241.444	160.784
243.846	160
247.162	158.917
249.97	158
252.88	157.05
256.093	156
258.598	155.182
262.216	154
264.316	153.314
268.34	152
270.035	151.446
274.463	150
275.754	149.578
280.585	148
281.473	147.71
286.71	146
287.186	145.844
292.824	144
292.886	143.98
293.74	143.7
298.583	142.115
298.935	142
304.279	140.251
305.047	140
309.976	138.387
311.159	138
315.674	136.523
317.272	136
321.371	134.659
323.386	134
327.069	132.795
329.5	132
332.77	130.931
335.619	130
339.508	128.716
341.678	128
345.692	126.704
347.866	126
350.959	124.992
354.006	124
357.278	122.924
360.089	122
361.133	121.745
365.215	121.477
368.707	121.493
371.484	122

373.654	122.03
374.386	122.08
377.631	122.239
382.427	122.316
383.677	122.244
387.287	122.197
390.059	122.187
396.735	122.233
398.019	122.268
399.749	122.314
406.24	122.429
409.208	122.512
411.915	122.585
415.53	122.683
424.48	122.93
430.485	123.131
448.199	123.599
448.732	123.618
463.334	124
470.097	124.145
471.17	124.168
483.106	124.425
486.086	124.487
495.863	124.696
500.697	124.797
508.409	124.961
515.014	125.097
518.981	125.181
523.614	125.281
527.447	125.363
529.69	125.406
531.66	125.441
540.373	125.637
554.05	125.953
556.089	126
568.694	126.288
580.167	126.531
584.066	126.617
593.259	126.813
599.175	126.945
607.386	127.128
614.024	127.271
624.97	127.517
628.615	127.596
643.158	127.917
643.782	127.931
646.896	128
658.497	128.248
660.64	128.294
673.082	128.561
677.922	128.665
687.656	128.874
692.236	128.971

699.35	129.123
712.535	129.48
729.855	129.992
730.239	129.992
731.42	130
738.245	131.694
739.951	132
740.007	132.001
741.701	132.015
742.332	132.017
743.317	132.019
753.154	132.287
755.462	132.336
761.566	132.471
765.71	132.559
775.589	132.763
783.012	132.917
790.009	133.066
795.683	133.184
804.848	133.379
808.664	133.459
820.13	133.704
821.971	133.743
833.961	134
835.574	134.035
835.855	134.041
849.047	134.327
851.677	134.384
862.588	134.62
867.593	134.729
876.198	134.915
883.605	135.076
889.878	135.211
899.713	135.425
903.628	135.509
915.919	135.776
917.449	135.809
926.274	136
936.214	136.29
943.717	136.589
962.389	137.22
979.061	138
983.234	139.38
985.11	140
987.287	140.719
991.16	142
994.524	143.112
997.209	144
1000.33	145.033
1003.26	146
1007.19	147.301
1009.31	148
1011.14	148.607

1015.36	150
1020.26	151.621
1021.41	152
1027.04	153.861
1027.46	154
1027.82	154.12
1033.5	156
1034.29	156.258
1039.55	158
1044.85	159.749
1045.6	160
1046.49	160.294
1051.65	162
1053.18	162.503
1057.7	164
1061.67	165.313
1063.75	166
1067.3	167.173
1069.8	168
1072.91	169.028
1075.85	170
1078.52	170.882
1081.9	172
1084.13	172.737
1087.95	174
1089.74	174.591
1091.61	175.21

Material Boundary

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178

195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248
219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182
262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704

347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124
373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683
424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596

643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971
699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471
765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142

987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607
1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503
1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

Material Boundary

X	Y
140.028	197.713
141.766	197.149
142.289	196.994
143.045	196.769
144.237	196.414
145.518	196
148.459	195.052
151.716	194
156.612	192.418
157.903	192
161.952	190.689
164.08	190
164.758	189.78

170.247	188
172.895	187.14
176.403	186
181.024	184.497
182.529	184
185.376	183.065
188.619	182
189.923	181.575
194.757	180
195.648	179.71
200.895	178
201.373	177.844
207.034	176
207.098	175.979
207.993	175.687
212.823	174.114
213.172	174
218.549	172.248
219.311	172
224.274	170.383
225.449	170
230	168.518
231.588	168
235.725	166.651
237.722	166
241.444	164.784
243.846	164
247.162	162.917
249.97	162
252.88	161.05
256.093	160
258.598	159.182
262.216	158
264.316	157.314
268.34	156
270.035	155.446
274.463	154
275.754	153.578
280.585	152
281.473	151.71
286.71	150
287.186	149.844
292.824	148
292.886	147.98
293.74	147.7
298.583	146.115
298.935	146
304.279	144.251
305.047	144
309.976	142.387
311.159	142
315.674	140.523
317.272	140

321.371	138.659
323.386	138
327.069	136.795
329.5	136
332.77	134.931
335.619	134
339.508	132.716
341.678	132
345.692	130.704
347.866	130
350.959	128.992
354.006	128
357.278	126.924
360.089	126
361.133	125.745
365.215	125.477
368.707	125.493
371.484	126
373.654	126.03
374.386	126.08
377.631	126.239
382.427	126.316
383.677	126.244
387.287	126.197
390.059	126.187
396.735	126.233
398.019	126.268
399.749	126.314
406.24	126.429
409.208	126.512
411.915	126.585
415.53	126.683
424.48	126.93
430.485	127.131
448.199	127.599
448.732	127.618
463.334	128
470.097	128.145
471.17	128.168
483.106	128.425
486.086	128.487
495.863	128.696
500.697	128.797
508.409	128.961
515.014	129.097
518.981	129.181
523.614	129.281
527.447	129.363
529.69	129.406
531.66	129.441
540.373	129.637
554.05	129.953
556.089	130

568.694	130.288
580.167	130.531
584.066	130.617
593.259	130.813
599.175	130.945
607.386	131.128
614.024	131.271
624.97	131.517
628.615	131.596
643.158	131.917
643.782	131.931
646.896	132
658.497	132.248
660.64	132.294
673.082	132.561
677.922	132.665
687.656	132.874
692.236	132.971
699.35	133.123
712.535	133.48
729.855	133.992
730.239	133.992
731.42	134
738.245	135.694
739.951	136
740.007	136.001
741.701	136.015
742.332	136.017
743.317	136.019
753.154	136.287
755.462	136.336
761.566	136.471
765.71	136.559
775.589	136.763
783.012	136.917
790.009	137.066
795.683	137.184
804.848	137.379
808.664	137.459
820.13	137.704
821.971	137.743
833.961	138
835.574	138.035
835.855	138.041
849.047	138.327
851.677	138.384
862.588	138.62
867.593	138.729
876.198	138.915
883.605	139.076
889.878	139.211
899.713	139.425
903.628	139.509

915.919	139.776
917.449	139.809
926.274	140
936.214	140.29
943.717	140.589
962.389	141.22
979.061	142
983.234	143.38
985.11	144
987.287	144.719
991.16	146
994.524	147.112
997.209	148
1000.33	149.033
1003.26	150
1007.19	151.301
1009.31	152
1011.14	152.607
1015.36	154
1020.26	155.621
1021.41	156
1027.04	157.861
1027.46	158
1027.82	158.12
1033.5	160
1034.29	160.258
1039.55	162
1044.85	163.749
1045.6	164
1046.49	164.294
1051.65	166
1053.18	166.503
1057.7	168
1061.67	169.313
1063.75	170
1067.3	171.173
1069.8	172
1072.91	173.028
1075.85	174
1078.52	174.882
1081.9	176
1084.13	176.737
1087.95	178
1089.74	178.591
1091.61	179.21

Material Boundary

X	Y
147.568	200.339
148.459	200.052
151.716	199
156.612	197.418

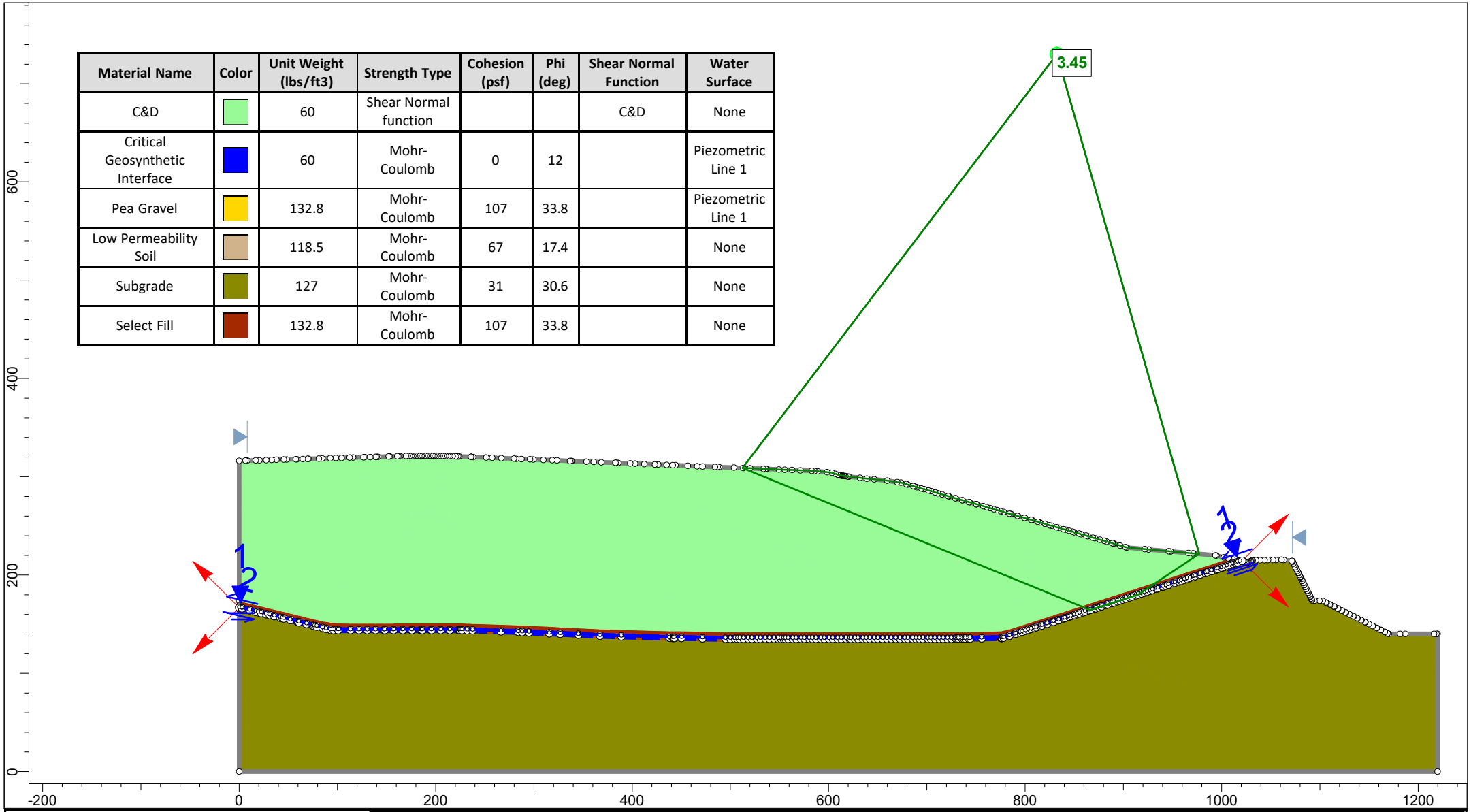
157.903	197
161.952	195.689
164.08	195
164.758	194.78
170.247	193
172.895	192.14
176.403	191
181.024	189.497
182.529	189
185.376	188.065
188.619	187
189.923	186.575
194.757	185
195.648	184.71
200.895	183
201.373	182.844
207.034	181
207.098	180.979
207.993	180.687
212.823	179.114
213.172	179
218.549	177.248
219.311	177
224.274	175.383
225.449	175
230	173.518
231.588	173
235.725	171.651
237.722	171
241.444	169.784
243.846	169
247.162	167.917
249.97	167
252.88	166.05
256.093	165
258.598	164.182
262.216	163
264.316	162.314
268.34	161
270.035	160.446
274.463	159
275.754	158.578
280.585	157
281.473	156.71
286.71	155
287.186	154.844
292.824	153
292.886	152.98
293.74	152.7
298.583	151.115
298.935	151
304.279	149.251
305.047	149

309.976	147.387
311.159	147
315.674	145.523
317.272	145
321.371	143.659
323.386	143
327.069	141.795
329.5	141
332.77	139.931
335.619	139
339.508	137.716
341.678	137
345.692	135.704
347.866	135
350.959	133.992
354.006	133
357.278	131.924
360.089	131
361.133	130.745
365.215	130.477
368.707	130.493
371.484	131
373.654	131.03
374.386	131.08
377.631	131.239
382.427	131.316
383.677	131.244
387.287	131.197
390.059	131.187
396.735	131.233
398.019	131.268
399.749	131.314
406.24	131.429
409.208	131.512
411.915	131.585
415.53	131.683
424.48	131.93
430.485	132.131
448.199	132.599
448.732	132.618
463.334	133
470.097	133.145
471.17	133.168
483.106	133.425
486.086	133.487
495.863	133.696
500.697	133.797
508.409	133.961
515.014	134.097
518.981	134.181
523.614	134.281
527.447	134.363
529.69	134.406

531.66	134.441
540.373	134.637
554.05	134.953
556.089	135
568.694	135.288
580.167	135.531
584.066	135.617
593.259	135.813
599.175	135.945
607.386	136.128
614.024	136.271
624.97	136.517
628.615	136.596
643.158	136.917
643.782	136.931
646.896	137
658.497	137.248
660.64	137.294
673.082	137.561
677.922	137.665
687.656	137.874
692.236	137.971
699.35	138.123
712.535	138.48
729.855	138.992
730.239	138.992
731.42	139
738.245	140.694
739.951	141
740.007	141.001
741.701	141.015
742.332	141.017
743.317	141.019
753.154	141.287
755.462	141.336
761.566	141.471
765.71	141.559
775.589	141.763
783.012	141.917
790.009	142.066
795.683	142.184
804.848	142.379
808.664	142.459
820.13	142.704
821.971	142.743
833.961	143
835.574	143.035
835.855	143.041
849.047	143.327
851.677	143.384
862.588	143.62
867.593	143.729
876.198	143.915

883.605	144.076
889.878	144.211
899.713	144.425
903.628	144.509
915.919	144.776
917.449	144.809
926.274	145
936.214	145.29
943.717	145.589
962.389	146.22
979.061	147
983.234	148.38
985.11	149
987.287	149.719
991.16	151
994.524	152.112
997.209	153
1000.33	154.033
1003.26	155
1007.19	156.301
1009.31	157
1011.14	157.607
1015.36	159
1020.26	160.621
1021.41	161
1027.04	162.861
1027.46	163
1027.82	163.12
1033.5	165
1034.29	165.258
1039.55	167
1044.85	168.749
1045.6	169
1046.49	169.294
1051.65	171
1053.18	171.503
1057.7	173
1061.67	174.313
1063.75	175
1067.3	176.173
1069.8	177
1072.91	178.028
1075.85	179
1078.52	179.882
1081.9	181
1084.13	181.737
1087.95	183
1089.74	183.591
1091.61	184.21

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section C - Static - Liner System Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:00m:27.573s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	3.454840
Axis Location:	832.254, 729.972
Left Slip Surface Endpoint:	512.397, 308.861
Right Slip Surface Endpoint:	977.228, 221.421
Resisting Moment:	4.05641e+08 lb-ft
Driving Moment:	1.17412e+08 lb-ft
Resisting Horizontal Force:	724937 lb
Driving Horizontal Force:	209832 lb
Total Slice Area:	20844.5 ft2
Surface Horizontal Width:	464.831 ft
Surface Average Height:	44.8433 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
512.397	308.861
866.244	164.328
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.814	169.649
883.717	169.94
888.684	171.536
889.992	171.956
893.812	173.184
896.291	173.981
899.174	174.907
902.626	176.015
906.046	177.114
908.81	178
912.925	179.322
915.037	180
977.228	221.421

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 3.45484

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	114.751	139592	-22.2183	C&D	0	34.992	220.184	760.702	1086.71	0	1086.71	1176.65	1176.65
2	114.751	349421	-22.2183	C&D	207.75	30.8002	520.892	1799.6	2670.33	0	2670.33	2883.1	2883.1
3	114.751	456382	-22.2183	C&D	207.75	30.8002	682.503	2357.94	3606.95	0	3606.95	3885.73	3885.73
4	6.85248	31545.5	-22.2183	Select Fill	107	33.8	866.318	2992.99	4311.04	0	4311.04	4664.9	4664.9
5	2.74099	13412.7	-22.2183	Pea Gravel	107	33.8	919.718	3177.48	4586.65	0	4586.65	4962.32	4962.32
6	5.20644	25413.9	17.8069	Critical Geosynthetic Interface	0	12	340.082	1174.93	5590.01	62.3886	5527.62	5480.77	5418.38
7	0.446836	2135.06	17.8069	Critical Geosynthetic Interface	0	12	332.389	1148.35	5464.94	62.3886	5402.56	5358.18	5295.79
8	3.19268	15043.3	17.8069	Critical Geosynthetic Interface	0	12	327.439	1131.25	5384.49	62.3886	5322.1	5279.32	5216.93
9	2.27087	10473.6	17.8069	Critical Geosynthetic Interface	0	12	320.009	1105.58	5263.76	62.3886	5201.37	5160.97	5098.58
10	0.316289	1443.85	17.8069	Critical Geosynthetic Interface	0	12	316.495	1093.44	5206.6	62.3886	5144.21	5104.94	5042.55
11	5.13751	22942.1	17.7921	Critical Geosynthetic Interface	0	12	309.074	1067.8	5086.04	62.4345	5023.61	4986.86	4924.42
12	0.90324	3934.01	17.8914	Critical Geosynthetic Interface	0	12	301.015	1039.96	4955.07	62.4345	4892.64	4857.9	4795.46
13	4.96635	21098.3	17.8108	Critical Geosynthetic Interface	0	12	292.954	1012.11	4823.99	62.377	4761.61	4729.87	4667.5
14	1.30852	5409.11	17.7922	Critical Geosynthetic Interface	0	12	284.447	982.72	4685.71	62.377	4623.33	4594.42	4532.05
15	3.82002	15429.4	17.8239	Critical Geosynthetic Interface	0	12	277.493	958.694	4572.65	62.3495	4510.3	4483.43	4421.08
16	2.47911	9724.16	17.8235	Critical Geosynthetic Interface	0	12	268.898	929	4432.9	62.2858	4370.61	4346.44	4284.16
17	2.883	11023.7	17.7972	Critical Geosynthetic Interface	0	12	261.608	903.813	4314.38	62.278	4252.1	4230.4	4168.12
18	3.45107	12796.2	17.8055	Critical Geosynthetic Interface	0	12	253.113	874.464	4176.33	62.2979	4114.03	4095.04	4032.74
19	3.42058	12289.7	17.8181	Critical Geosynthetic Interface	0	12	244.629	845.154	4038.41	62.278	3976.13	3959.78	3897.51
20	2.76401	9715.39	17.7667	Critical Geosynthetic Interface	0	12	238.641	824.465	3941.13	62.3219	3878.81	3864.67	3802.35
21	4.11483	14114	17.8069	Critical Geosynthetic Interface	0	12	232.195	802.198	3836.43	62.3886	3774.05	3761.85	3699.46
22	2.11186	7081.12	17.8069	Critical Geosynthetic Interface	0	12	226.339	781.965	3741.24	62.3886	3678.86	3668.55	3606.16
23	5.80016	18110.4	33.6643	Pea Gravel	107	33.8	843.347	2913.63	4192.49	0	4192.49	3630.81	3630.81
24	14.5004	34908.3	33.6643	Select Fill	107	33.8	644.635	2227.11	3166.98	0	3166.98	2737.64	2737.64
25	41.8909	39713.4	33.6643	C&D	1.13687e-13	34.992	239.103	826.061	1180.09	0	1180.09	1020.84	1020.84

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 3.45484

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	512.397	308.861	0	0	0
2	627.148	261.99	25669.9	4570.36	10.0954
3	741.899	215.118	91060.1	23152.8	14.2657
4	856.65	168.246	181806	33644.1	10.4843
5	863.503	165.447	187936	33223.5	10.0252
6	866.244	164.328	190550	33034.6	9.8353
7	871.45	166	179432	29913.3	9.4648
8	871.897	166.144	178499	29654.1	9.43242
9	875.09	167.169	171932	27842.2	9.19847
10	877.36	167.898	167366	26595.9	9.0293
11	877.677	168	166736	26425.1	9.0056
12	882.814	169.649	156763	23747.2	8.61394
13	883.717	169.94	155047	23293.4	8.5439
14	888.684	171.536	145895	20901.5	8.15295
15	889.992	171.956	143555	20298.7	8.04828
16	893.812	173.184	136879	18601.3	7.73886
17	896.291	173.981	132679	17550.2	7.53509
18	899.174	174.907	127931	16377.7	7.29531
19	902.626	176.015	122429	15041.6	7.00425
20	906.046	177.114	117152	13786.5	6.71172
21	908.81	178	113002	12819.9	6.47244
22	912.925	179.322	106976	11454.5	6.11168
23	915.037	180	103961	10788.2	5.92447
24	920.837	183.863	82873.3	7839.28	5.40373
25	935.337	193.521	42940.7	3050.61	4.0636
26	977.228	221.421	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	167.667
2.61045	167.033
2.74827	167
2.93545	166.955
10.984	165
16.9104	163.561
19.2198	163
22.3549	162.239
27.4555	161
31.2131	160.088
35.6913	159
41.768	157.524
43.927	157
45.5183	156.614
52.1628	155
59.8261	153.139
59.8924	153.123
60.4145	153
60.8582	152.895
60.9162	152.881

68.6396	151
75.206	149.4
76.8497	149
79.0691	148.459
85.0598	147
88.4071	146.185
93.2699	145
96.1305	144.964
100.713	144.947
101.016	144.941
113.425	144.821
121.918	144.822
130.421	144.823
138.934	144.824
147.456	144.825
148.142	144.848
156.777	144.849
157.383	144.866
166.104	144.867
166.646	144.881
175.435	144.882
175.924	144.893
184.77	144.893
185.454	144.904
186.03	144.91
186.471	144.91
195.39	144.911
195.828	144.911
204.75	144.912
205.185	144.912
214.11	144.912
214.542	144.912
223.469	144.913
223.899	144.913
224.328	144.913
224.757	144.913
226.606	144.875
232.206	144.736
237.619	144.555
266.437	143.593
284.194	143
288.023	142.82
294.955	142.494
315.577	141.526
326.764	141
345.352	140.109
367.261	139
389.122	138.384
438.282	137
441.106	136.989
441.813	136.988
442.992	136.982
450.152	136.954

471.589	136.475
495.112	136.041
499.816	136.042
504.522	136.042
507.015	136.043
509.52	136.047
513.255	136.047
518.191	136.045
521.934	136.044
526.857	136.043
530.609	136.042
535.521	136.04
539.492	136.044
544.41	136.042
548.376	136.045
551.45	136.051
554.115	136.053
556.005	136.053
558.664	136.055
563.412	136.057
566.946	136.064
571.737	136.066
575.242	136.073
580.075	136.075
583.551	136.082
586.977	136.088
591.874	136.09
595.541	136.09
600.448	136.093
604.107	136.093
609.025	136.095
612.675	136.095
617.604	136.097
621.244	136.097
622.641	136.096
626.431	136.093
629.889	136.087
634.698	136.083
638.19	136.076
641.731	136.07
646.478	136.066
650.054	136.06
654.753	136.056
659.419	136.052
663.75	136.06
668.432	136.056
672.746	136.063
677.444	136.06
680.743	136.07
685.469	136.067
688.752	136.077
692.299	136.081
695.852	136.075

701.119	136.075
703.992	136.063
708.239	136.071
712.549	136.079
716.654	136.084
721.014	136.092
725.057	136.098
729.467	136.106
730.766	136.109
732.057	136.112
735.706	136.117
737.361	136.116
738.906	136.115
742.564	136.12
743.989	136.118
755.732	136.35
775.632	136.895
775.782	136.895
775.919	136.894
776.153	136.893
778.05	137
783.506	138.753
784.276	139
789.286	140.609
790.503	141
794.831	142.39
796.73	143
800.37	144.169
802.957	145
805.905	145.947
809.183	147
811.435	147.723
815.41	149
816.957	149.497
821.637	151
822.473	151.269
827.863	153
827.984	153.039
828.909	153.336
833.494	154.808
834.09	155
838.998	156.577
840.317	157
844.497	158.343
846.543	159
849.989	160.107
852.77	161
855.476	161.869
858.997	163
860.956	163.629
865.223	165
866.43	165.387
871.45	167

871.897	167.144
875.09	168.169
877.36	168.898
877.677	169
882.821	170.652
883.903	171
888.276	172.404
890.13	173
893.723	174.154
896.357	175
899.164	175.902
902.583	177
906.152	178.146
908.81	179
912.925	180.322
915.037	181
918.41	182.083
921.263	183
923.888	183.843
927.49	185
929.36	185.601
933.717	187
934.825	187.356
939.944	189
940.292	189.112
943.235	190.057
945.863	190.901
946.17	191
951.208	192.618
952.397	193
956.633	194.361
958.624	195
962.07	196.107
964.85	197
967.5	197.851
971.077	199
972.917	199.591
977.304	201
978.32	201.326
983.53	203
983.726	203.063
985.426	203.609
989.318	204.859
989.757	205
994.64	206.568
995.984	207
999.949	208.274
1002.21	209
1005.61	210.122
1008.27	211
1011.51	212.172
1013.9	213
1014.76	213.314

1016.17	213.831
1018.57	214.636

Block Search Polyline

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4
76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185
93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893
185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911

195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912
223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041
499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047
513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073
580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09

595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095
617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
650.054	135.06
654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063
708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092
725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138
789.286	139.609
790.503	140
794.831	141.39
796.73	142

800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723
815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.821	169.652
883.903	170
888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356
939.944	188
940.292	188.112
943.235	189.057
945.863	189.901

946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194
962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

External Boundary

X	Y
0	316.109
0	173.667
0	168.667
0	167.667
0	166.667
0	164.667
0	0
1219.81	0
1219.81	140
1218.71	140
1216.08	140
1186.91	140
1181.65	140
1169.98	140
1168.96	140.51
1165.98	142
1165.94	142.022
1161.98	144
1161.87	144.052
1157.97	146
1157.81	146.083

1153.97	148
1153.74	148.113
1149.97	150
1146.3	151.832
1145.96	152
1142.35	153.804
1141.96	154
1138.41	155.775
1137.96	156
1134.46	157.746
1133.96	158
1130.52	159.716
1129.95	160
1126.58	161.687
1125.95	162
1122.63	163.658
1121.95	164
1118.69	165.628
1117.94	166
1114.74	167.599
1113.94	168
1110.8	169.569
1109.94	170
1106.86	171.539
1105.93	172
1102.91	173.513
1099.52	173.859
1094.52	173.86
1092.03	174
1091.53	174.999
1091.03	176
1090.13	177.801
1090.03	178
1089.94	178.171
1089.03	180
1088.12	181.822
1088.03	182
1087.11	183.832
1087.03	184
1086.11	185.84
1086.03	186
1085.11	187.848
1085.03	188
1084.1	189.856
1084.03	190
1083.1	191.864
1083.03	192
1082.1	193.874
1082.03	194
1081.09	195.885
1081.03	196
1080.32	197.424
1080.04	198

1079.89	198.297
1079.04	200
1078.08	201.905
1078.04	202
1077.98	202.109
1077.04	204
1076.2	205.676
1076.04	206
1075.05	207.97
1075.04	208
1075.02	208.038
1074.04	210
1073.25	211.588
1073.04	212
1072.31	213.453
1072.04	214
1071.94	214.206
1071.32	214.159
1063.42	215.257
1060.85	215.402
1055.24	215.305
1052.25	215.254
1047.24	215.167
1043.65	215.105
1039.23	215.029
1035.05	214.956
1031.23	214.89
1031.21	214.89
1031.2	214.89
1030.1	214.34
1029.41	214
1028.1	213.348
1027.2	212.901
1026.1	212.904
1025.2	212.906
1024.29	213.363
1024.06	213.481
1023.02	214
1021.42	214.349
1021.42	214.349
1020.86	214.406
1018.57	214.636
1018.35	214.657
1016.17	214.831
1016.17	214.831
1014.12	215.298
1011.03	216
1007.6	216.78
1006.66	216.994
1002.24	218
994.715	219.711
993.444	220
971.061	221.961

970.626	222
966.337	222.38
948.029	224
946.173	224.161
925.668	226
921.667	226.352
903.558	228
902.15	228.407
896.627	230
890.917	231.686
889.857	232
888.805	232.302
882.886	234
880.441	234.701
875.91	236
870.915	237.432
868.933	238
863.881	239.448
861.956	240
856.849	241.464
854.979	242
849.816	243.48
848.002	244
844.816	244.913
841.024	246
838.911	246.606
834.049	248
831.937	248.605
827.072	250
824.844	250.639
820.092	252
815.118	253.427
813.119	254
807.03	255.746
806.142	256
799.957	257.773
799.166	258
792.927	259.789
792.189	260
785.902	261.802
785.213	262
784	262.348
778.236	264
774.987	264.932
771.259	266
767.956	266.946
764.278	268
760.966	268.949
757.298	270
750.551	271.933
750.317	272
750.187	272.037
743.335	274

743.061	274.079
736.354	276
736.025	276.094
729.373	278
728.994	278.109
722.393	280
721.65	280.213
715.413	282
711.155	283.22
708.431	284
704.082	285.246
701.451	286
697.045	287.263
694.47	288
689.688	289.37
687.491	290
686.287	290.345
680.51	292
679.092	292.406
673.53	294
669.841	294.53
659.621	296
646.437	297.28
639.023	298
631.875	298.773
620.523	300
619.315	300.188
617.055	300.54
615.53	300.777
614.431	300.948
613.602	301.077
612.954	301.178
612.434	301.259
612.007	301.326
611.651	301.381
611.349	301.428
610.968	301.547
610.518	301.688
609.978	301.857
609.52	302
607.088	302.81
603.517	304
598.461	304.667
588.88	305.484
585.658	305.81
582.821	306
571.381	306.465
562.784	306.814
555.284	307.119
549.352	307.36
536.852	307.868
535.963	307.904
533.597	308

520.061	308.55
513.256	308.826
503.601	309.219
488.514	309.832
487.129	309.888
484.372	310
471.823	310.51
466.201	310.738
456.663	311.126
444.195	311.632
441.407	311.746
435.148	312
426.585	312.348
423.112	312.489
412.237	312.931
403.018	313.305
398.046	313.507
385.924	314
383.861	314.084
382.932	314.122
368.722	314.699
360.927	315.016
353.446	315.32
338.63	315.922
338.031	315.946
336.699	316
323.645	316.53
318.615	316.735
309.688	317.097
299.451	317.513
296.058	317.651
287.475	318
282.072	318.219
279.631	318.319
266.885	318.837
257.515	319.217
251.553	319.46
238.25	320
236.354	320.077
236.173	320.083
235.965	320.089
224.14	320.551
222.969	320.58
220.62	320.668
217.402	320.78
214.627	320.868
213.003	320.9
210.498	320.971
208.258	321.027
206.459	321.054
204.401	321.099
202.505	321.134
200.731	321.162

198.84	321.182
197.16	321.202
195.55	321.217
193.625	321.229
192.069	321.238
190.542	321.241
189.025	321.24
187.104	321.244
185.592	321.237
184.055	321.226
182.47	321.208
180.586	321.204
178.955	321.18
177.231	321.148
175.401	321.135
173.584	321.095
171.608	321.044
169.885	321.023
163.988	320.857
162.472	320.831
161.042	320.799
153.258	320.573
152.168	320.544
141.311	320.227
139.934	320.187
138.971	320.159
133.511	320
127.85	319.835
126.697	319.801
116.045	319.491
112.503	319.388
104.328	319.15
98.4359	318.978
92.6962	318.811
84.4928	318.572
81.1502	318.474
70.6725	318.169
69.6887	318.14
64.8782	318
58.8789	317.825
57.7947	317.794
48.471	317.522
45.4995	317.435
38.0244	317.217
33.1503	317.075
27.539	316.912
20.747	316.714
17.0146	316.605
8.28898	316.351
6.451	316.297

Material Boundary

X	Y
0	164.667
2.61045	164.033
2.74827	164
2.93545	163.955
10.984	162
16.9104	160.561
19.2198	160
22.3549	159.239
27.4555	158
31.2131	157.088
35.6913	156
41.768	154.524
43.927	154
45.5183	153.614
52.1628	152
59.8261	150.139
59.8924	150.123
60.4145	150
60.8582	149.895
60.9162	149.881
68.6396	148
75.206	146.4
76.8497	146
79.0691	145.459
85.0598	144
88.4071	143.185
93.2699	142
96.1305	141.964
100.713	141.947
101.016	141.941
113.425	141.821
121.918	141.822
130.421	141.823
138.934	141.824
147.456	141.825
148.142	141.848
156.777	141.849
157.383	141.866
166.104	141.867
166.646	141.881
175.435	141.882
175.924	141.893
184.77	141.893
185.454	141.904
186.03	141.91
186.471	141.91
195.39	141.911
195.828	141.911
204.75	141.912
205.185	141.912
214.11	141.912
214.542	141.912

223.469	141.913
223.899	141.913
224.328	141.913
224.757	141.913
226.606	141.875
232.206	141.736
237.619	141.555
266.437	140.593
284.194	140
288.023	139.82
294.955	139.494
315.577	138.526
326.764	138
345.352	137.109
367.261	136
389.122	135.384
438.282	134
441.106	133.989
441.813	133.988
442.992	133.982
450.152	133.954
471.589	133.475
495.112	133.041
499.816	133.042
504.522	133.042
507.015	133.043
509.52	133.047
513.255	133.047
518.191	133.045
521.934	133.044
526.857	133.043
530.609	133.042
535.521	133.04
539.492	133.044
544.41	133.042
548.376	133.045
551.45	133.051
554.115	133.053
556.005	133.053
558.664	133.055
563.412	133.057
566.946	133.064
571.737	133.066
575.242	133.073
580.075	133.075
583.551	133.082
586.977	133.088
591.874	133.09
595.541	133.09
600.448	133.093
604.107	133.093
609.025	133.095
612.675	133.095

617.604	133.097
621.244	133.097
622.641	133.096
626.431	133.093
629.889	133.087
634.698	133.083
638.19	133.076
641.731	133.07
646.478	133.066
650.054	133.06
654.753	133.056
659.419	133.052
663.75	133.06
668.432	133.056
672.746	133.063
677.444	133.06
680.743	133.07
685.469	133.067
688.752	133.077
692.299	133.081
695.852	133.075
701.119	133.075
703.992	133.063
708.239	133.071
712.549	133.079
716.654	133.084
721.014	133.092
725.057	133.098
729.467	133.106
730.766	133.109
732.057	133.112
735.706	133.117
737.361	133.116
738.906	133.115
742.564	133.12
743.989	133.118
755.732	133.35
775.632	133.895
775.782	133.895
775.919	133.894
776.153	133.893
778.05	134
783.506	135.753
784.276	136
789.286	137.609
790.503	138
794.831	139.39
796.73	140
800.37	141.169
802.957	142
805.905	142.947
809.183	144
811.435	144.723

815.41	146
816.957	146.497
821.637	148
822.473	148.269
827.863	150
827.984	150.039
828.909	150.336
833.494	151.808
834.09	152
838.998	153.577
840.317	154
844.497	155.343
846.543	156
849.989	157.107
852.77	158
855.476	158.869
858.997	160
860.956	160.629
865.223	162
866.43	162.387
871.45	164
871.897	164.144
875.09	165.169
877.36	165.898
877.677	166
882.821	167.652
883.903	168
888.276	169.404
890.13	170
893.723	171.154
896.357	172
899.164	172.902
902.583	174
906.152	175.146
908.81	176
912.925	177.322
915.037	178
918.41	179.083
921.263	180
923.888	180.843
927.49	182
929.36	182.601
933.717	184
934.825	184.356
939.944	186
940.292	186.112
943.235	187.057
945.863	187.901
946.17	188
951.208	189.618
952.397	190
956.633	191.361
958.624	192

962.07	193.107
964.85	194
967.5	194.851
971.077	196
972.917	196.591
977.304	198
978.32	198.326
983.53	200
983.726	200.063
985.426	200.609
989.318	201.859
989.757	202
994.64	203.568
995.984	204
999.949	205.274
1002.21	206
1005.61	207.122
1008.27	208
1011.51	209.172
1013.9	210
1014.76	210.314
1016.17	210.831
1024.06	213.481

Material Boundary

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4
76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185

93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893
185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911
195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912
223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041
499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047

513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073
580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09
595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095
617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
650.054	135.06
654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063
708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092

725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138
789.286	139.609
790.503	140
794.831	141.39
796.73	142
800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723
815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.821	169.652
883.903	170

888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356
939.944	188
940.292	188.112
943.235	189.057
945.863	189.901
946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194
962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

Material Boundary

X	Y

0	168.667
2.61045	168.033
2.74827	168
2.93545	167.955
10.984	166
16.9104	164.561
19.2198	164
22.3549	163.239
27.4555	162
31.2131	161.088
35.6913	160
41.768	158.524
43.927	158
45.5183	157.614
52.1628	156
59.8261	154.139
59.8924	154.123
60.4145	154
60.8582	153.895
60.9162	153.881
68.6396	152
75.206	150.4
76.8497	150
79.0691	149.459
85.0598	148
88.4071	147.185
93.2699	146
96.1305	145.964
100.713	145.947
101.016	145.941
113.425	145.821
121.918	145.822
130.421	145.823
138.934	145.824
147.456	145.825
148.142	145.848
156.777	145.849
157.383	145.866
166.104	145.867
166.646	145.881
175.435	145.882
175.924	145.893
184.77	145.893
185.454	145.904
186.03	145.91
186.471	145.91
195.39	145.911
195.828	145.911
204.75	145.912
205.185	145.912
214.11	145.912
214.542	145.912
223.469	145.913

223.899	145.913
224.328	145.913
224.757	145.913
226.606	145.875
232.206	145.736
237.619	145.555
266.437	144.593
284.194	144
288.023	143.82
294.955	143.494
315.577	142.526
326.764	142
345.352	141.109
367.261	140
389.122	139.384
438.282	138
441.106	137.989
441.813	137.988
442.992	137.982
450.152	137.954
471.589	137.475
495.112	137.041
499.816	137.042
504.522	137.042
507.015	137.043
509.52	137.047
513.255	137.047
518.191	137.045
521.934	137.044
526.857	137.043
530.609	137.042
535.521	137.04
539.492	137.044
544.41	137.042
548.376	137.045
551.45	137.051
554.115	137.053
556.005	137.053
558.664	137.055
563.412	137.057
566.946	137.064
571.737	137.066
575.242	137.073
580.075	137.075
583.551	137.082
586.977	137.088
591.874	137.09
595.541	137.09
600.448	137.093
604.107	137.093
609.025	137.095
612.675	137.095
617.604	137.097

621.244	137.097
622.641	137.096
626.431	137.093
629.889	137.087
634.698	137.083
638.19	137.076
641.731	137.07
646.478	137.066
650.054	137.06
654.753	137.056
659.419	137.052
663.75	137.06
668.432	137.056
672.746	137.063
677.444	137.06
680.743	137.07
685.469	137.067
688.752	137.077
692.299	137.081
695.852	137.075
701.119	137.075
703.992	137.063
708.239	137.071
712.549	137.079
716.654	137.084
721.014	137.092
725.057	137.098
729.467	137.106
730.766	137.109
732.057	137.112
735.706	137.117
737.361	137.116
738.906	137.115
742.564	137.12
743.989	137.118
755.732	137.35
775.632	137.895
775.782	137.895
775.919	137.894
776.153	137.893
778.05	138
783.506	139.753
784.276	140
789.286	141.609
790.503	142
794.831	143.39
796.73	144
800.37	145.169
802.957	146
805.905	146.947
809.183	148
811.435	148.723
815.41	150

816.957	150.497
821.637	152
822.473	152.269
827.863	154
827.984	154.039
828.909	154.336
833.494	155.808
834.09	156
838.998	157.577
840.317	158
844.497	159.343
846.543	160
849.989	161.107
852.77	162
855.476	162.869
858.997	164
860.956	164.629
865.223	166
866.43	166.387
871.45	168
871.897	168.144
875.09	169.169
877.36	169.898
877.677	170
882.821	171.652
883.903	172
888.276	173.404
890.13	174
893.723	175.154
896.357	176
899.164	176.902
902.583	178
906.152	179.146
908.81	180
912.925	181.322
915.037	182
918.41	183.083
921.263	184
923.888	184.843
927.49	186
929.36	186.601
933.717	188
934.825	188.356
939.944	190
940.292	190.112
943.235	191.057
945.863	191.901
946.17	192
951.208	193.618
952.397	194
956.633	195.361
958.624	196
962.07	197.107

964.85	198
967.5	198.851
971.077	200
972.917	200.591
977.304	202
978.32	202.326
983.53	204
983.726	204.063
985.426	204.609
989.318	205.859
989.757	206
994.64	207.568
995.984	208
999.949	209.274
1002.21	210
1005.61	211.122
1008.27	212
1011.51	213.172
1013.9	214
1014.76	214.314
1016.17	214.831
1016.17	214.831

Material Boundary

X	Y
0	173.667
2.61045	173.033
2.74827	173
2.93545	172.955
10.984	171
16.9104	169.561
19.2198	169
22.3549	168.239
27.4555	167
31.2131	166.088
35.6913	165
41.768	163.524
43.927	163
45.5183	162.614
52.1628	161
59.8261	159.139
59.8924	159.123
60.4145	159
60.8582	158.895
60.9162	158.881
68.6396	157
75.206	155.4
76.8497	155
79.0691	154.459
85.0598	153
88.4071	152.185
93.2699	151

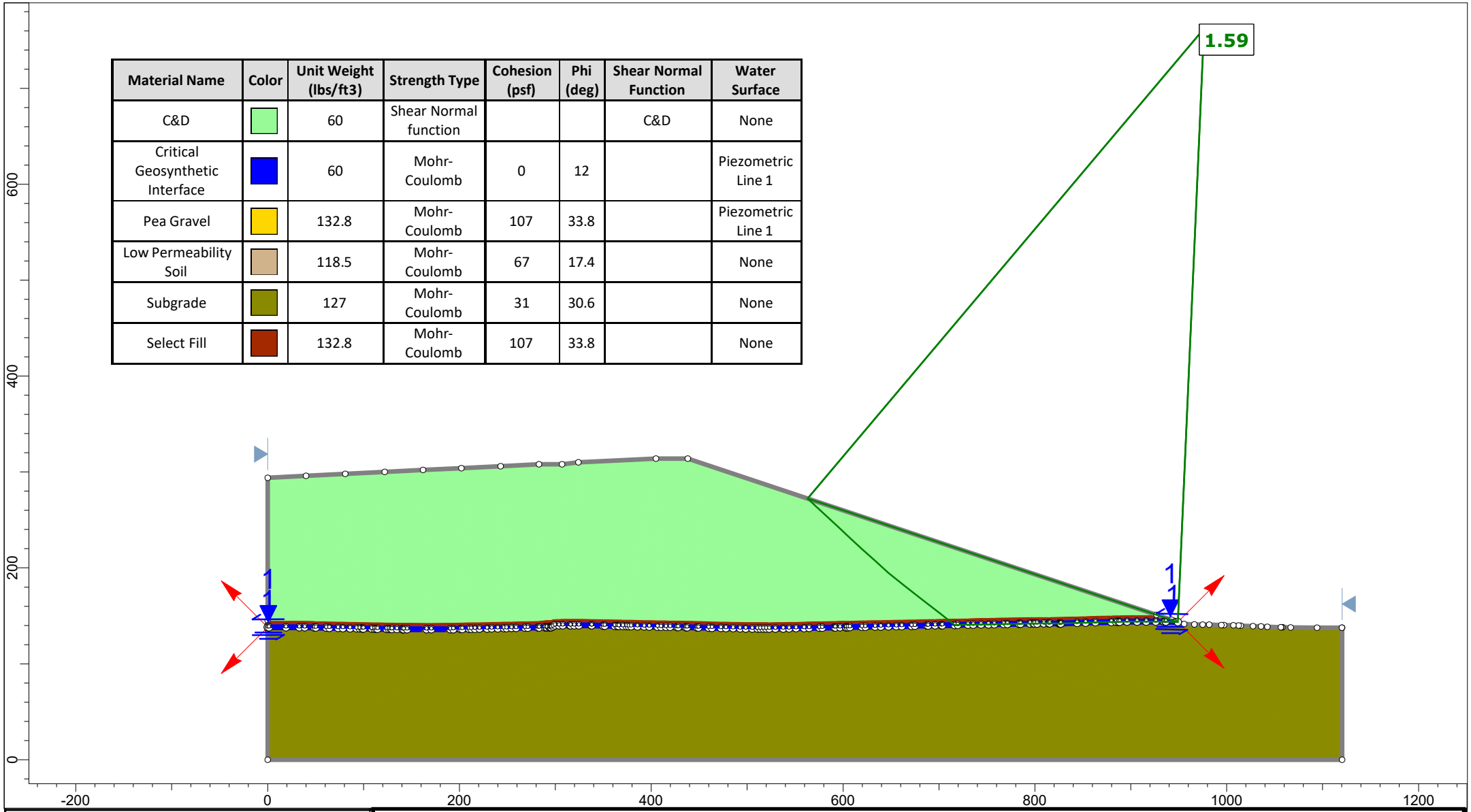
96.1305	150.964
100.713	150.947
101.016	150.941
113.425	150.821
121.918	150.822
130.421	150.823
138.934	150.824
147.456	150.825
148.142	150.848
156.777	150.849
157.383	150.866
166.104	150.867
166.646	150.881
175.435	150.882
175.924	150.893
184.77	150.893
185.454	150.904
186.03	150.91
186.471	150.91
195.39	150.911
195.828	150.911
204.75	150.912
205.185	150.912
214.11	150.912
214.542	150.912
223.469	150.913
223.899	150.913
224.328	150.913
224.757	150.913
226.606	150.875
232.206	150.736
237.619	150.555
266.437	149.593
284.194	149
288.023	148.82
294.955	148.494
315.577	147.526
326.764	147
345.352	146.109
367.261	145
389.122	144.384
438.282	143
441.106	142.989
441.813	142.988
442.992	142.982
450.152	142.954
471.589	142.475
495.112	142.041
499.816	142.042
504.522	142.042
507.015	142.043
509.52	142.047
513.255	142.047

518.191	142.045
521.934	142.044
526.857	142.043
530.609	142.042
535.521	142.04
539.492	142.044
544.41	142.042
548.376	142.045
551.45	142.051
554.115	142.053
556.005	142.053
558.664	142.055
563.412	142.057
566.946	142.064
571.737	142.066
575.242	142.073
580.075	142.075
583.551	142.082
586.977	142.088
591.874	142.09
595.541	142.09
600.448	142.093
604.107	142.093
609.025	142.095
612.675	142.095
617.604	142.097
621.244	142.097
622.641	142.096
626.431	142.093
629.889	142.087
634.698	142.083
638.19	142.076
641.731	142.07
646.478	142.066
650.054	142.06
654.753	142.056
659.419	142.052
663.75	142.06
668.432	142.056
672.746	142.063
677.444	142.06
680.743	142.07
685.469	142.067
688.752	142.077
692.299	142.081
695.852	142.075
701.119	142.075
703.992	142.063
708.239	142.071
712.549	142.079
716.654	142.084
721.014	142.092
725.057	142.098

729.467	142.106
730.766	142.109
732.057	142.112
735.706	142.117
737.361	142.116
738.906	142.115
742.564	142.12
743.989	142.118
755.732	142.35
775.632	142.895
775.782	142.895
775.919	142.894
776.153	142.893
778.05	143
783.506	144.753
784.276	145
789.286	146.609
790.503	147
794.831	148.39
796.73	149
800.37	150.169
802.957	151
805.905	151.947
809.183	153
811.435	153.723
815.41	155
816.957	155.497
821.637	157
822.473	157.269
827.863	159
827.984	159.039
828.909	159.336
833.494	160.808
834.09	161
838.998	162.577
840.317	163
844.497	164.343
846.543	165
849.989	166.107
852.77	167
855.476	167.869
858.997	169
860.956	169.629
865.223	171
866.43	171.387
871.45	173
871.897	173.144
875.09	174.169
877.36	174.898
877.677	175
882.821	176.652
883.903	177
888.276	178.404

890.13	179
893.723	180.154
896.357	181
899.164	181.902
902.583	183
906.152	184.146
908.81	185
912.925	186.322
915.037	187
918.41	188.083
921.263	189
923.888	189.843
927.49	191
929.36	191.601
933.717	193
934.825	193.356
939.944	195
940.292	195.112
943.235	196.057
945.863	196.901
946.17	197
951.208	198.618
952.397	199
956.633	200.361
958.624	201
962.07	202.107
964.85	203
967.5	203.851
971.077	205
972.917	205.591
977.304	207
978.32	207.326
983.53	209
983.726	209.063
985.426	209.609
989.318	210.859
989.757	211
994.64	212.568
995.984	213
999.949	214.274
1002.21	215
1005.61	216.122
1007.6	216.78

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section D - Static - Liner System Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:01m:15.701s
Date Created:	7/28/2021, 10:59:59 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.593580
Axis Location:	976.252, 762.037
Left Slip Surface Endpoint:	563.089, 272.295
Right Slip Surface Endpoint:	949.110, 143.595
Resisting Moment:	2.45034e+08 lb-ft
Driving Moment:	1.53763e+08 lb-ft
Resisting Horizontal Force:	331061 lb
Driving Horizontal Force:	207747 lb
Total Slice Area:	15902.6 ft2
Surface Horizontal Width:	386.021 ft
Surface Average Height:	41.1961 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
563.089	272.295
571.792	263.964
583.672	253.002
595.552	242.103
607.431	231.043
619.311	219.862
633.633	207.054
647.158	194.959
664.03	181.155
680.902	167.952
702.728	151.196
716.446	140.415
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.795	142
826.896	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.59358

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	8.70261	1417.37	-43.7481	C&D	0	34.992	49.8794	79.4868	113.553	0	113.553	161.299	161.299
2	11.8797	6364.92	-42.7	C&D	0	34.992	163.447	260.466	372.094	0	372.094	522.918	522.918
3	11.8798	11333.2	-42.5355	C&D	5.68434e-14	34.992	286.583	456.693	652.422	0	652.422	915.354	915.354
4	11.8799	16336.3	-42.9535	C&D	0	34.992	404.168	644.074	920.105	0	920.105	1296.38	1296.38
5	11.8799	21439.8	-43.2633	C&D	1.13687e-13	34.992	519.887	828.482	1183.55	0	1183.55	1672.84	1672.84
6	14.3219	32400.1	-41.8054	C&D	0	34.992	653.955	1042.13	1488.75	0	1488.75	2073.57	2073.57
7	13.5253	36935.3	-41.8044	C&D	0	34.992	778.417	1240.47	1772.1	0	1772.1	2468.19	2468.19
8	16.8717	54053.2	-39.2896	C&D	207.75	30.8002	927.691	1478.35	2131.43	0	2131.43	2890.45	2890.45
9	16.8718	62028.8	-38.0449	C&D	207.75	30.8002	1056.41	1683.48	2475.54	0	2475.54	3302.23	3302.23
10	21.8264	91413.2	-37.5139	C&D	207.75	30.8002	1190.31	1896.86	2833.48	0	2833.48	3747.3	3747.3
11	5.03409	22859.5	-38.1654	C&D	207.75	30.8002	1268.52	2021.49	3042.56	0	3042.56	4039.55	4039.55
12	6.20235	30239.4	-38.1654	Select Fill	107	33.8	1431.4	2281.05	3247.56	0	3247.56	4372.56	4372.56
13	1.24047	6444.15	-38.1654	Pea Gravel	107	33.8	1523.22	2427.38	3466.15	0	3466.15	4663.32	4663.32
14	1.24047	6576.24	-38.1654	Pea Gravel	107	33.8	1542.37	2457.89	3542.91	31.1895	3511.72	4755.12	4723.94
15	3.19866	17019.1	1.15722	Critical Geosynthetic Interface	0	12	730.738	1164.49	5540.88	62.3895	5478.49	5526.12	5463.73
16	10.5551	54620.5	1.15722	Critical Geosynthetic Interface	0	12	713.777	1137.46	5413.73	62.3895	5351.34	5399.31	5336.92
17	5.49021	27476.4	1.15722	Critical Geosynthetic Interface	0	12	693.545	1105.22	5262.04	62.3895	5199.65	5248.03	5185.64
18	8.28755	40264.7	1.15722	Critical Geosynthetic Interface	0	12	675.692	1076.77	5128.19	62.3895	5065.8	5114.54	5052.15
19	7.67752	36000.6	1.15722	Critical Geosynthetic Interface	0	12	654.526	1043.04	4969.5	62.3895	4907.11	4956.28	4893.89
20	6.041	27447.7	1.15722	Critical Geosynthetic Interface	0	12	635.927	1013.4	4830.09	62.3895	4767.7	4817.24	4754.85
21	9.84447	43070.1	1.15722	Critical Geosynthetic Interface	0	12	613.91	978.314	4665	62.3895	4602.61	4652.6	4590.21
22	3.81517	16138.7	1.15722	Critical Geosynthetic Interface	0	12	594.642	947.609	4520.55	62.3895	4458.16	4508.54	4446.15
23	11.9913	48714.3	1.15722	Critical Geosynthetic Interface	0	12	571.877	911.332	4349.87	62.3895	4287.48	4338.32	4275.93
24	1.60986	6307.74	1.15722	Critical Geosynthetic Interface	0	12	552.033	879.709	4201.09	62.3895	4138.7	4189.94	4127.55
25	9.97162	37845.6	1.15722	Critical Geosynthetic Interface	0	12	534.864	852.348	4072.37	62.3895	4009.98	4061.56	3999.17
26	3.40817	12457.2	0.204137	Critical Geosynthetic Interface	0	12	510.636	813.74	3890.75	62.3895	3828.36	3888.93	3826.54
27	1.24758	4501.38	0.125349	Critical Geosynthetic Interface	0	12	503.695	802.678	3838.7	62.3895	3776.31	3837.59	3775.2

28	2.68835	9592.84	0.238314	Critical Geosynthetic Interface	0	12	498.616	794.585	3800.63	62.3895	3738.24	3798.55	3736.16
29	7.04047	24429.8	0.203264	Critical Geosynthetic Interface	0	12	484.559	772.183	3695.23	62.3895	3632.84	3693.51	3631.12
30	4.87714	16336.8	0.113922	Critical Geosynthetic Interface	0	12	467.1	744.362	3564.34	62.3895	3501.95	3563.41	3501.02
31	1.15297	3792.35	-0.239823	Critical Geosynthetic Interface	0	12	457.073	728.382	3489.16	62.3895	3426.77	3491.07	3428.68
32	10.0876	32064.4	-0.317514	Critical Geosynthetic Interface	0	12	441.006	702.778	3368.7	62.3895	3306.31	3371.14	3308.75
33	0.675026	2074.11	-0.0457245	Critical Geosynthetic Interface	0	12	426.817	680.167	3262.32	62.3895	3199.93	3262.66	3200.27
34	0.68978	2110.03	0.0374701	Critical Geosynthetic Interface	0	12	425.143	677.5	3249.77	62.3872	3187.39	3249.5	3187.11
35	0.100717	307.294	0.0395942	Critical Geosynthetic Interface	0	12	424.008	675.69	3241.26	62.3895	3178.87	3240.96	3178.57
36	17.1855	49127.2	2.16691	Critical Geosynthetic Interface	0	12	402.83	641.942	3082.46	62.3664	3020.1	3067.22	3004.86
37	8.76831	22558.6	1.48686	Critical Geosynthetic Interface	0	12	358.032	570.553	2746.63	62.3895	2684.24	2737.33	2674.94
38	10.2174	24170.7	1.93867	Critical Geosynthetic Interface	0	12	328.219	523.044	2523.12	62.3895	2460.73	2512.01	2449.62
39	16.6274	34502.3	1.34699	Critical Geosynthetic Interface	0	12	283.664	452.041	2189.08	62.3895	2126.69	2182.41	2120.02
40	5.00303	9218.74	1.6504	Critical Geosynthetic Interface	0	12	249.779	398.043	1935.04	62.3895	1872.65	1927.84	1865.45
41	2.32748	4103.65	1.524	Critical Geosynthetic Interface	0	12	237.875	379.073	1845.79	62.3895	1783.4	1839.46	1777.07
42	1.22624	2115.26	1.13275	Critical Geosynthetic Interface	0	12	231.747	369.307	1799.84	62.3895	1737.45	1795.26	1732.87
43	7.83115	12757.1	1.13404	Critical Geosynthetic Interface	0	12	217.744	346.993	1694.86	62.3895	1632.47	1690.55	1628.16
44	10.341	14907.2	0.194502	Critical Geosynthetic Interface	0	12	189.653	302.228	1484.26	62.3895	1421.87	1483.62	1421.23
45	9.57219	11875.1	0.149724	Critical Geosynthetic Interface	0	12	160.967	256.514	1269.19	62.3895	1206.8	1268.77	1206.38
46	9.98167	10432.9	-0.180702	Critical Geosynthetic Interface	0	12	133.225	212.305	1061.21	62.3895	998.82	1061.63	999.24
47	8.44311	6590.33	-0.194337	Critical Geosynthetic Interface	0	12	96.7708	154.212	787.901	62.3895	725.512	788.23	725.84
48	1.67995	944.881	-1.58113	Critical Geosynthetic Interface	0	12	66.8645	106.554	563.686	62.3895	501.297	565.532	503.142
49	0.449087	233.174	-1.58092	Critical Geosynthetic Interface	0	12	61.0517	97.2908	520.106	62.3895	457.717	521.791	459.402
50	12.5608	3203.62	-1.58108	Critical Geosynthetic Interface	0	12	25.6986	40.9528	255.058	62.3895	192.668	255.767	193.378

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.59358

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	563.089	272.295	0	0	0
2	571.792	263.964	511.855	13.6512	1.52772
3	583.672	253.002	2649.14	166.458	3.59544
4	595.552	242.103	6355.54	625.467	5.62054
5	607.431	231.043	11730.6	1561.01	7.57991
6	619.311	219.862	18787.2	3127.85	9.45238
7	633.633	207.054	28488.8	5831.05	11.5675
8	647.158	194.959	39393.7	9383.7	13.3983
9	664.03	181.155	53164.7	14670.1	15.4261
10	680.902	167.952	68025.6	20984.3	17.1438
11	702.728	151.196	89524.2	30606.6	18.8746
12	707.762	147.239	95176.2	33129.9	19.1925
13	713.965	142.365	102129	36249.2	19.5416
14	715.205	141.39	103619	36908.7	19.6057
15	716.446	140.415	105160	37586.3	19.6679
16	719.644	140.479	102464	36929.3	19.8198
17	730.199	140.692	93776	34559.8	20.2306
18	735.69	140.803	89384.7	33223.4	20.3896
19	743.977	140.971	82926.4	31101.1	20.5583
20	751.655	141.126	77130.5	29049.7	20.6379
21	757.696	141.248	72699.4	27396.5	20.6487
22	767.54	141.447	65728.1	24664.1	20.5683
23	771.355	141.524	63111.1	23602	20.5046
24	783.347	141.766	55199.9	20294.2	20.1859
25	784.957	141.799	54174.5	19856.7	20.1295
26	794.928	142	48020.8	17201.8	19.7083
27	798.336	142.012	46233.2	16405	19.5363
28	799.584	142.015	45594.3	16118.6	19.4696
29	802.272	142.026	44211.4	15499.7	19.3197
30	809.313	142.051	40707.5	13925.4	18.885
31	814.19	142.061	38394.8	12883	18.5487
32	815.343	142.056	37884.7	12650.2	18.4648
33	825.43	142	33624.3	10708	17.6646
34	826.105	141.999	33338	10579.7	17.6067
35	826.795	142	33043.2	10448.3	17.547
36	826.896	142	33000.3	10429.2	17.5383
37	844.081	142.65	24073	6844.52	15.8717
38	852.85	142.878	20308.6	5401.29	14.8936
39	863.067	143.224	16082.4	3905.83	13.6508
40	879.695	143.615	10509.9	2120.53	11.4071
41	884.698	143.759	8981.32	1694.24	10.6828
42	887.025	143.821	8313.37	1516.58	10.3386
43	888.251	143.845	7985.55	1430.42	10.1555
44	896.082	144	6017.62	948.641	8.9586
45	906.423	144.035	4004.31	513.795	7.3117
46	915.996	144.06	2431.75	244.01	5.73007
47	925.977	144.029	1135.34	80.0807	4.03465
48	934.42	144	340.853	15.321	2.57366
49	936.1	143.954	254.663	10.143	2.28083
50	936.549	143.941	233.691	8.98758	2.20247
51	949.11	143.595	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y

0	139.001
1.53185	139.006
19.0865	139.06
32.9178	139.02
38.6457	139
48.7796	138.793
50.2602	138.763
61.0905	138.542
64.3705	138.476
73.4615	138.291
78.5505	138.189
85.9551	138.041
92.8528	137.903
95.9447	137.841
98.6483	137.789
99.8304	137.766
108.36	137.6
111.481	137.539
113.16	137.508
114.657	137.481
124.023	137.298
126.413	137.276
128.483	137.258
129.604	137.259
134.88	137.144
140.608	137.001
140.666	137
141.88	136.996
145.396	136.987
165.76	136.931
170.639	136.942
190.43	137
193.662	137.091
201.413	137.308
202.91	137.31
209.905	137.483
212.256	137.486
216.044	137.533
220.799	137.61
228.74	137.769
233.581	137.864
240.055	137.994
246.29	138.116
249.014	138.178
254.334	138.284
259.083	138.368
268.35	138.553
271.397	138.613
282.09	138.827
283.248	138.85
289.114	139
290.561	139
291.004	139

293.847	139
294.079	139
294.897	139
295.735	139
297.392	139.908
299.475	141
303.779	141.026
307.699	141.048
315.325	141.101
315.77	141.098
319.666	141.08
324.496	141.067
337.748	141
337.798	140.999
337.804	140.999
350.01	140.752
351.514	140.722
361.883	140.513
364.794	140.454
366.105	140.426
370.416	140.331
374.199	140.251
376.444	140.207
378.978	140.155
385.656	140.023
392.593	139.886
397.761	139.784
406.485	139.612
410.085	139.541
415.321	139.473
419.58	139.44
426.773	139.263
428.072	139.263
436.007	139.041
437.46	139
447.762	138.797
449.164	138.77
459.994	138.557
463.353	138.491
472.562	138.31
477.849	138.206
485.368	138.058
492.661	137.915
498.42	137.801
505.285	137.698
510.764	137.64
513.847	137.638
516.909	137.636
519.953	137.634
522.978	137.632
529.387	137.687
537.506	137.8
543.814	137.927

550.999	138.073
559.479	138.244
564.556	138.346
575.229	138.562
578.177	138.622
591.066	138.882
591.862	138.898
596.908	139
602.692	139.157
603.345	139.157
604.986	139.174
607.15	139.207
619.626	139.459
623.304	139.533
633.498	139.739
639.412	139.859
647.335	140.019
655.475	140.183
661.139	140.297
671.492	140.507
674.909	140.576
687.464	140.829
688.645	140.853
695.918	141
702.465	141.132
703.518	141.154
716.362	141.413
719.644	141.479
730.199	141.692
735.69	141.803
743.977	141.971
751.655	142.126
757.696	142.248
767.54	142.447
771.355	142.524
783.347	142.766
784.957	142.799
794.928	143
798.336	143.012
799.584	143.015
802.272	143.026
809.313	143.051
814.19	143.061
815.343	143.056
825.43	143
826.105	142.999
826.168	142.999
826.795	143
826.896	143
826.916	143
844.081	143.65
852.85	143.878
863.067	144.224

879.695	144.615
884.698	144.759
887.025	144.821
888.251	144.845
896.082	145
906.423	145.035
915.996	145.06
925.977	145.029
934.42	145
936.1	144.954
936.549	144.941
945.84	144.685

Block Search Polyline

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486

216.044	136.533
220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994
246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77

459.994	137.557
463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058
492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799

794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

External Boundary

X	Y
0	294
0	145.001
0	140.001
0	139.001
0	138.001
0	136.001
0	0
1120.27	0
1120.27	137.664
1120.15	137.662
1094.2	137.627
1066.59	137.768
1058.38	138
1056.96	138.055
1056.39	138.077
1042.28	138.625
1035.7	138.881
1027.44	139.202
1014.7	139.696
1012.45	139.784
1006.89	140
997.074	140.271
994.462	140.343
981.639	140.697
974.953	140.881
966.333	141.119
955.65	141.414
949.11	143.595
945.84	144.685
942.57	145.775
926.821	151.026
438	314
405	314
324	310
307	308
283	308
243	306
202	304
162	302
122	300
81	298
40	296

Material Boundary

X	Y
0	136.001
1.53185	136.006
19.0865	136.06
32.9178	136.02
38.6457	136
48.7796	135.793

50.2602	135.763
61.0905	135.542
64.3705	135.476
73.4615	135.291
78.5505	135.189
85.9551	135.041
92.8528	134.903
95.9447	134.841
98.6483	134.789
99.8304	134.766
108.36	134.6
111.481	134.539
113.16	134.508
114.657	134.481
124.023	134.298
126.413	134.276
128.483	134.258
129.604	134.259
134.88	134.144
140.608	134.001
140.666	134
141.88	133.996
145.396	133.987
165.76	133.931
170.639	133.942
190.43	134
193.662	134.091
201.413	134.308
202.91	134.31
209.905	134.483
212.256	134.486
216.044	134.533
220.799	134.61
228.74	134.769
233.581	134.864
240.055	134.994
246.29	135.116
249.014	135.178
254.334	135.284
259.083	135.368
268.35	135.553
271.397	135.613
282.09	135.827
283.248	135.85
289.114	136
290.561	136
291.004	136
293.847	136
294.079	136
294.897	136
295.735	136
297.392	136.908
299.475	138

303.779	138.026
307.699	138.048
315.325	138.101
315.77	138.098
319.666	138.08
324.496	138.067
337.748	138
337.798	137.999
337.804	137.999
350.01	137.752
351.514	137.722
361.883	137.513
364.794	137.454
366.105	137.426
370.416	137.331
374.199	137.251
376.444	137.207
378.978	137.155
385.656	137.023
392.593	136.886
397.761	136.784
406.485	136.612
410.085	136.541
415.321	136.473
419.58	136.44
426.773	136.263
428.072	136.263
436.007	136.041
437.46	136
447.762	135.797
449.164	135.77
459.994	135.557
463.353	135.491
472.562	135.31
477.849	135.206
485.368	135.058
492.661	134.915
498.42	134.801
505.285	134.698
510.764	134.64
513.847	134.638
516.909	134.636
519.953	134.634
522.978	134.632
529.387	134.687
537.506	134.8
543.814	134.927
550.999	135.073
559.479	135.244
564.556	135.346
575.229	135.562
578.177	135.622
591.066	135.882

591.862	135.898
596.908	136
602.692	136.157
603.345	136.157
604.986	136.174
607.15	136.207
619.626	136.459
623.304	136.533
633.498	136.739
639.412	136.859
647.335	137.019
655.475	137.183
661.139	137.297
671.492	137.507
674.909	137.576
687.464	137.829
688.645	137.853
695.918	138
702.465	138.132
703.518	138.154
716.362	138.413
719.644	138.479
730.199	138.692
735.69	138.803
743.977	138.971
751.655	139.126
757.696	139.248
767.54	139.447
771.355	139.524
783.347	139.766
784.957	139.799
794.928	140
798.336	140.012
799.584	140.015
802.272	140.026
809.313	140.051
814.19	140.061
815.343	140.056
825.43	140
826.105	139.999
826.168	139.999
826.795	140
826.896	140
826.916	140
844.081	140.65
852.85	140.878
863.067	141.224
879.695	141.615
884.698	141.759
887.025	141.821
888.251	141.845
896.082	142
906.423	142.035

915.996	142.06
925.977	142.029
934.42	142
936.1	141.954
936.549	141.941
951.154	141.538
955.65	141.414

Material Boundary

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486
216.044	136.533
220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994

246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77
459.994	137.557
463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058

492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051

814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Material Boundary

X	Y
0	140.001
1.53185	140.006
19.0865	140.06
32.9178	140.02
38.6457	140
48.7796	139.793
50.2602	139.763
61.0905	139.542
64.3705	139.476
73.4615	139.291
78.5505	139.189
85.9551	139.041
92.8528	138.903
95.9447	138.841
98.6483	138.789
99.8304	138.766
108.36	138.6
111.481	138.539
113.16	138.508
114.657	138.481
124.023	138.298
126.413	138.276
128.483	138.258
129.604	138.259
134.88	138.144
140.608	138.001

140.666	138
141.88	137.996
145.396	137.987
165.76	137.931
170.639	137.942
190.43	138
193.662	138.091
201.413	138.308
202.91	138.31
209.905	138.483
212.256	138.486
216.044	138.533
220.799	138.61
228.74	138.769
233.581	138.864
240.055	138.994
246.29	139.116
249.014	139.178
254.334	139.284
259.083	139.368
268.35	139.553
271.397	139.613
282.09	139.827
283.248	139.85
289.114	140
290.561	140
291.004	140
293.847	140
294.079	140
294.897	140
295.735	140
297.392	140.908
299.475	142
303.779	142.026
307.699	142.048
315.325	142.101
315.77	142.098
319.666	142.08
324.496	142.067
337.748	142
337.798	141.999
337.804	141.999
350.01	141.752
351.514	141.722
361.883	141.513
364.794	141.454
366.105	141.426
370.416	141.331
374.199	141.251
376.444	141.207
378.978	141.155
385.656	141.023
392.593	140.886

397.761	140.784
406.485	140.612
410.085	140.541
415.321	140.473
419.58	140.44
426.773	140.263
428.072	140.263
436.007	140.041
437.46	140
447.762	139.797
449.164	139.77
459.994	139.557
463.353	139.491
472.562	139.31
477.849	139.206
485.368	139.058
492.661	138.915
498.42	138.801
505.285	138.698
510.764	138.64
513.847	138.638
516.909	138.636
519.953	138.634
522.978	138.632
529.387	138.687
537.506	138.8
543.814	138.927
550.999	139.073
559.479	139.244
564.556	139.346
575.229	139.562
578.177	139.622
591.066	139.882
591.862	139.898
596.908	140
602.692	140.157
603.345	140.157
604.986	140.174
607.15	140.207
619.626	140.459
623.304	140.533
633.498	140.739
639.412	140.859
647.335	141.019
655.475	141.183
661.139	141.297
671.492	141.507
674.909	141.576
687.464	141.829
688.645	141.853
695.918	142
702.465	142.132
703.518	142.154

716.362	142.413
719.644	142.479
730.199	142.692
735.69	142.803
743.977	142.971
751.655	143.126
757.696	143.248
767.54	143.447
771.355	143.524
783.347	143.766
784.957	143.799
794.928	144
798.336	144.012
799.584	144.015
802.272	144.026
809.313	144.051
814.19	144.061
815.343	144.056
825.43	144
826.105	143.999
826.168	143.999
826.795	144
826.896	144
826.916	144
844.081	144.65
852.85	144.878
863.067	145.224
879.695	145.615
884.698	145.759
887.025	145.821
888.251	145.845
896.082	146
906.423	146.035
915.996	146.06
925.977	146.029
934.42	146
936.1	145.954
936.549	145.941
942.57	145.775

Material Boundary

X	Y
0	145.001
1.53185	145.006
19.0865	145.06
32.9178	145.02
38.6457	145
48.7796	144.793
50.2602	144.763
61.0905	144.542
64.3705	144.476
73.4615	144.291

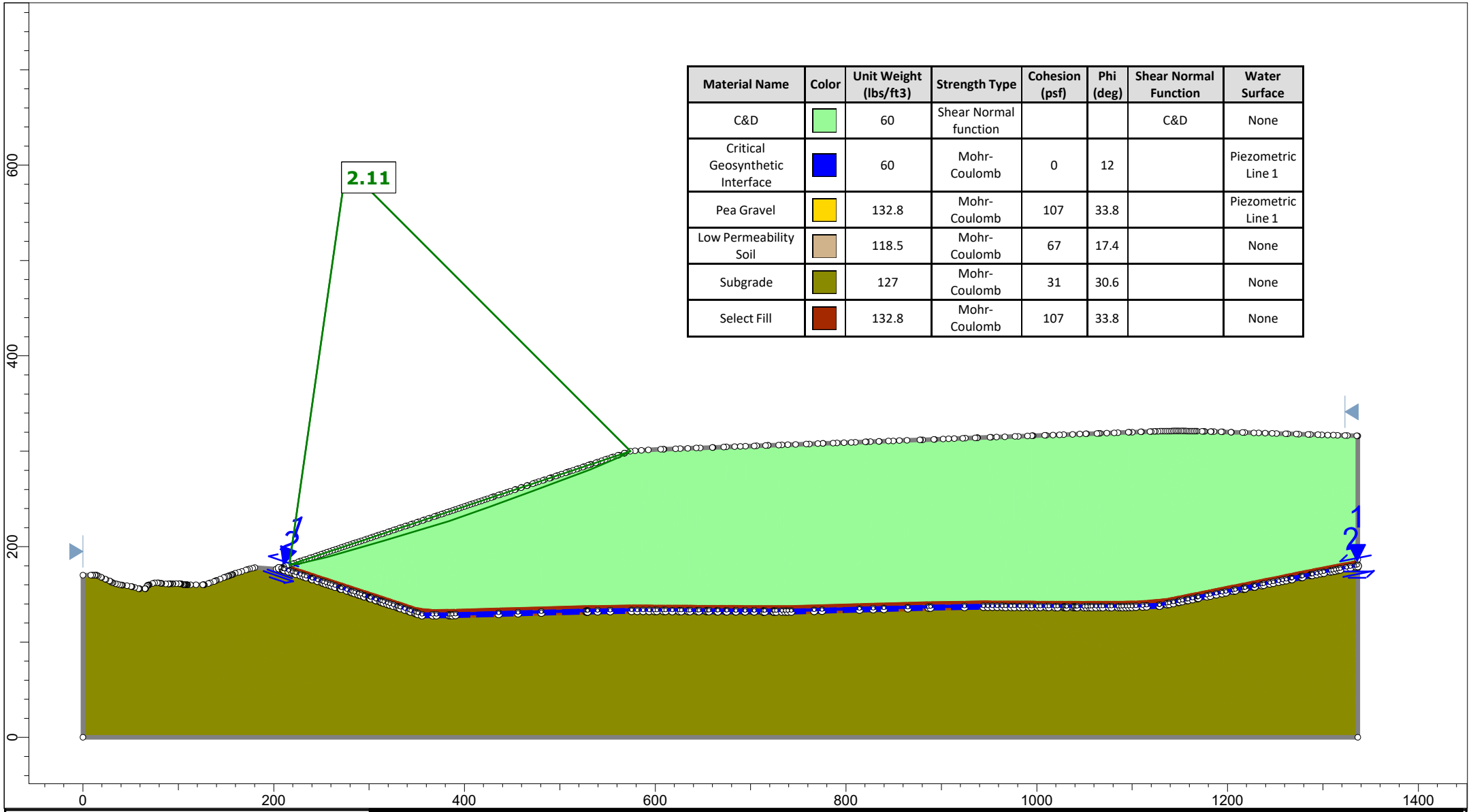
78.5505	144.189
85.9551	144.041
92.8528	143.903
95.9447	143.841
98.6483	143.789
99.8304	143.766
108.36	143.6
111.481	143.539
113.16	143.508
114.657	143.481
124.023	143.298
126.413	143.276
128.483	143.258
129.604	143.259
134.88	143.144
140.608	143.001
140.666	143
141.88	142.996
145.396	142.987
165.76	142.931
170.639	142.942
190.43	143
193.662	143.091
201.413	143.308
202.91	143.31
209.905	143.483
212.256	143.486
216.044	143.533
220.799	143.61
228.74	143.769
233.581	143.864
240.055	143.994
246.29	144.116
249.014	144.178
254.334	144.284
259.083	144.368
268.35	144.553
271.397	144.613
282.09	144.827
283.248	144.85
289.114	145
290.561	145
291.004	145
293.847	145
294.079	145
294.897	145
295.735	145
297.392	145.908
299.475	147
303.779	147.026
307.699	147.048
315.325	147.101
315.77	147.098

319.666	147.08
324.496	147.067
337.748	147
337.798	146.999
337.804	146.999
350.01	146.752
351.514	146.722
361.883	146.513
364.794	146.454
366.105	146.426
370.416	146.331
374.199	146.251
376.444	146.207
378.978	146.155
385.656	146.023
392.593	145.886
397.761	145.784
406.485	145.612
410.085	145.541
415.321	145.473
419.58	145.44
426.773	145.263
428.072	145.263
436.007	145.041
437.46	145
447.762	144.797
449.164	144.77
459.994	144.557
463.353	144.491
472.562	144.31
477.849	144.206
485.368	144.058
492.661	143.915
498.42	143.801
505.285	143.698
510.764	143.64
513.847	143.638
516.909	143.636
519.953	143.634
522.978	143.632
529.387	143.687
537.506	143.8
543.814	143.927
550.999	144.073
559.479	144.244
564.556	144.346
575.229	144.562
578.177	144.622
591.066	144.882
591.862	144.898
596.908	145
602.692	145.157
603.345	145.157

604.986	145.174
607.15	145.207
619.626	145.459
623.304	145.533
633.498	145.739
639.412	145.859
647.335	146.019
655.475	146.183
661.139	146.297
671.492	146.507
674.909	146.576
687.464	146.829
688.645	146.853
695.918	147
702.465	147.132
703.518	147.154
716.362	147.413
719.644	147.479
730.199	147.692
735.69	147.803
743.977	147.971
751.655	148.126
757.696	148.248
767.54	148.447
771.355	148.524
783.347	148.766
784.957	148.799
794.928	149
798.336	149.012
799.584	149.015
802.272	149.026
809.313	149.051
814.19	149.061
815.343	149.056
825.43	149
826.105	148.999
826.168	148.999
826.795	149
826.896	149
826.916	149
844.081	149.65
852.85	149.878
863.067	150.224
879.695	150.615
884.698	150.759
887.025	150.821
888.251	150.845
896.082	151
906.423	151.035
915.996	151.06
925.977	151.029
926.821	151.026

“FAILURE IN THE WASTE” ANALYSIS
SLIDE OUTPUT

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section A - Static - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:02m:41.832s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.107740
Axis Location:	275.908, 598.340
Left Slip Surface Endpoint:	216.161, 180.832
Right Slip Surface Endpoint:	574.067, 300.038
Resisting Moment:	3.72527e+07 lb-ft
Driving Moment:	1.76742e+07 lb-ft
Resisting Horizontal Force:	91263.9 lb
Driving Horizontal Force:	43299.4 lb
Total Slice Area:	2412.97 ft2
Surface Horizontal Width:	357.905 ft
Surface Average Height:	6.74193 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
216.161	180.832
226.395	182.086
255.839	189.12
314.574	205.802
383.622	226.65
426.331	241.851
470.777	257.9
531.909	280.939
563.542	294.293
574.067	300.038

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.10774

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	10.2335	663.979	6.98792	C&D	0	34.992	20.8246	43.8928	62.704	0	62.704	65.2565	65.2565
2	14.7218	2520.66	13.4356	C&D	0	34.992	53.1104	111.943	159.919	0	159.919	172.607	172.607
3	14.7218	3748.57	13.4356	C&D	0	34.992	79.3746	167.301	239.002	0	239.002	257.964	257.964
4	14.6838	4670.03	15.8558	C&D	2.84217e-14	34.992	97.662	205.846	294.066	0	294.066	321.804	321.804
5	14.6838	5307.66	15.8558	C&D	0	34.992	111.211	234.404	334.863	0	334.863	366.449	366.449
6	14.6838	5945.28	15.8558	C&D	5.68434e-14	34.992	124.769	262.981	375.687	0	375.687	411.125	411.125
7	14.6838	6582.91	15.8558	C&D	0	34.992	138.316	291.535	416.479	0	416.479	455.764	455.764
8	13.8096	6670.3	16.801	C&D	0	34.992	147.696	311.305	444.721	0	444.721	489.316	489.316
9	13.8096	7029.29	16.801	C&D	5.68434e-14	34.992	155.616	327.998	468.568	0	468.568	515.555	515.555
10	13.8096	7388.28	16.801	C&D	0	34.992	163.485	344.583	492.262	0	492.262	541.624	541.624
11	13.8096	7747.26	16.801	C&D	5.68434e-14	34.992	171.296	361.047	515.781	0	515.781	567.501	567.501
12	13.8096	8106.25	16.801	C&D	5.68434e-14	34.992	179.042	377.375	539.107	0	539.107	593.167	593.167
13	14.2364	8404.34	19.5918	C&D	0	34.992	174.182	367.131	524.473	0	524.473	586.468	586.468
14	14.2364	8129.38	19.5918	C&D	5.68434e-14	34.992	168.233	354.591	506.559	0	506.559	566.436	566.436
15	14.2364	7854.42	19.5918	C&D	0	34.992	162.339	342.168	488.812	0	488.812	546.592	546.592
16	14.8154	7847.89	19.8539	C&D	5.68434e-14	34.992	155.253	327.233	467.475	0	467.475	523.535	523.535
17	14.8154	7482.08	19.8539	C&D	5.68434e-14	34.992	147.924	311.786	445.409	0	445.409	498.822	498.822
18	14.8154	7116.18	19.8539	C&D	0	34.992	140.652	296.458	423.511	0	423.511	474.298	474.298
19	15.283	6846.77	20.6498	C&D	0	34.992	130.156	274.336	391.909	0	391.909	440.961	440.961
20	15.283	6236.19	20.6498	C&D	0	34.992	118.682	250.15	357.357	0	357.357	402.085	402.085
21	15.283	5625.45	20.6498	C&D	0	34.992	107.225	226.002	322.86	0	322.86	363.27	363.27
22	15.283	5014.82	20.6498	C&D	2.84217e-14	34.992	95.7713	201.861	288.373	0	288.373	324.466	324.466
23	15.8166	4206.9	22.8884	C&D	2.84217e-14	34.992	76.5232	161.291	230.416	0	230.416	262.722	262.722
24	15.8166	2872.85	22.8884	C&D	1.42109e-14	34.992	52.5425	110.746	158.208	0	158.208	180.391	180.391
25	10.5246	760.531	28.6251	C&D	0	34.992	20.2685	42.7208	61.0297	0	61.0297	72.092	72.092

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.10774

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	216.161	180.832	0	0	0
2	226.395	182.086	134.77	3.89338	1.65476
3	241.117	185.603	355.383	24.8701	4.0031
4	255.839	189.12	685.093	75.2959	6.27198
5	270.522	193.29	894.834	132.348	8.41318
6	285.206	197.461	1133.67	207.967	10.3951
7	299.89	201.631	1401.63	302.675	12.1856
8	314.574	205.802	1698.68	415.943	13.7589
9	328.383	209.972	1886.97	506.387	15.022
10	342.193	214.141	2085.36	600.413	16.0621
11	356.002	218.311	2293.78	695.593	16.87
12	369.812	222.48	2512.16	789.156	17.4393
13	383.622	226.65	2740.42	878.049	17.7658
14	397.858	231.717	2566.26	826.209	17.846
15	412.094	236.784	2398.05	763.715	17.6653
16	426.331	241.851	2235.73	693.143	17.225
17	441.146	247.201	2038.43	603.6	16.4946
18	455.961	252.55	1850.43	512.925	15.493
19	470.777	257.9	1671.68	423.924	14.2298
20	486.06	263.66	1406.52	316.135	12.6675
21	501.343	269.419	1164.74	223.51	10.8628
22	516.626	275.179	946.3	147.227	8.84328
23	531.909	280.939	751.191	87.4918	6.64335
24	547.726	287.616	424.726	31.3447	4.22077
25	563.542	294.293	200.569	5.95865	1.70168
26	574.067	300.038	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
207.158	177.844
209.644	176.98
209.656	176.976
209.673	176.97
209.701	176.961
209.754	176.943
209.889	176.899
211.024	176.525
215.647	175
219.457	173.752
221.753	173
223.198	172.524
227.818	171
231.167	169.903
233.924	169
239.731	167.085
239.989	167
240.158	166.945
246.075	165
250.846	163.432

252.16	163
254.731	162.155
258.246	161
260.564	160.238
264.331	159
269.78	157.209
270.417	157
270.828	156.865
276.502	155
281.239	153.443
282.588	153
284.878	152.247
288.673	151
288.694	150.994
291.145	150.188
294.759	149
294.789	148.99
294.817	148.991
300.025	147.273
300.849	147
300.936	147
301.55	146.798
306.97	145
307.021	145
311.682	143.462
313.072	143
313.082	143
315.185	142.306
319.144	141
321.59	140.197
325.229	139
329.426	137.608
331.256	137
332.629	136.549
337.335	135
341.828	133.529
343.443	133
348.164	131.439
349.492	131
351.137	130.45
355.479	129
366.611	128.944
370.513	128.931
383.965	128.994
385.43	129
387.113	129.048
390.516	129.144
435.781	130.424
456.235	131
480.527	131.667
527.675	132.968
528.433	132.989
528.846	133

528.936	133
528.97	133
529.059	133.001
539.5	133.043
552.72	133.294
575.143	133.619
581.119	133.601
587.25	133.583
593.541	133.565
599.129	133.534
601.589	133.521
608.463	133.488
610.709	133.476
617.792	133.441
625.205	133.405
627.114	133.395
634.744	133.358
636.43	133.349
644.276	133.311
645.74	133.303
653.801	133.264
655.043	133.257
656.126	133.253
664.642	133.216
665.551	133.212
674.288	133.174
675.074	133.171
684.022	133.132
684.619	133.13
693.779	133.09
694.187	133.088
703.562	133.048
703.773	133.047
713.368	133.005
713.392	133.005
714.64	133
723.812	132.994
724.625	132.995
726.778	132.991
732.863	132.987
736.095	132.991
738.943	132.989
742.604	133
766.537	133.668
774.739	133.898
814.017	135
828.404	135.395
839.649	135.705
864.839	136.398
886.554	137
888.573	137.057
924.259	137.663
944.12	137.919

948.68	137.898
953.418	137.877
958.343	137.854
963.659	137.828
967.433	137.811
972.95	137.784
976.521	137.768
982.239	137.739
985.607	137.724
991.527	137.694
994.615	137.677
1000.75	137.646
1003.63	137.631
1009.99	137.599
1012.66	137.584
1019.23	137.551
1021.71	137.539
1028.5	137.505
1029.69	137.499
1030.85	137.495
1031.4	137.492
1038.35	137.463
1040.11	137.456
1041.2	137.452
1042.28	137.45
1049.3	137.42
1052.16	137.449
1055.45	137.483
1057.69	137.531
1062.15	137.526
1066.68	137.507
1069.19	137.568
1075.92	137.51
1078.47	137.582
1085.16	137.513
1087.7	137.49
1090.05	137.577
1093.69	137.552
1096.62	137.674
1099.96	137.645
1103.91	137.833
1111.1	138.173
1115.26	138.472
1128.34	138.992
1128.36	138.993
1128.54	139
1136.54	140.583
1138.64	141
1143.2	141.914
1148.64	143
1149.35	143.143
1152.53	143.786
1157.39	144.767

1158.54	145
1163.34	145.967
1168.47	147
1168.88	147.082
1169.38	147.184
1178.4	149
1181.82	149.688
1188.33	151
1194.13	152.167
1198.27	153
1206.33	154.622
1208.21	155
1216.89	156.747
1218.14	157
1218.36	157.045
1228.05	159
1228.06	159.001
1228.08	159.005
1228.4	159.083
1236.03	160.624
1237.89	161
1244.19	162.271
1247.8	163
1253.54	164.159
1257.71	165
1261.5	165.765
1266.92	166.86
1267.34	166.946
1267.61	167
1277.37	168.971
1277.52	169
1278.54	169.207
1287.42	171
1288.05	171.126
1288.73	171.264
1293.48	172.185
1297.69	173
1300.81	173.606
1308	175
1310.03	175.394
1312.81	175.933
1315.92	176.536
1318.32	177
1324.86	178.267
1328.64	179
1334.83	180.2
1336.61	180.546

External Boundary

X	Y
0	170
0	0

1336.61	0
1336.61	177.546
1336.61	179.546
1336.61	180.546
1336.61	181.546
1336.61	186.546
1336.61	316.096
1336	316.115
1335.3	316.135
1325.6	316.421
1323.06	316.496
1315.25	316.726
1310.87	316.855
1304.93	317.03
1298.73	317.212
1294.66	317.332
1286.65	317.568
1284.42	317.634
1274.63	317.923
1272	318
1262.91	318.268
1260.99	318.324
1251.2	318.613
1246.79	318.743
1239.42	318.96
1232.47	319.165
1227.56	319.309
1218.04	319.59
1215.62	319.661
1204.11	320
1203.6	320.015
1194.6	320.266
1193.29	320.302
1185.64	320.515
1183.11	320.585
1182.42	320.604
1175.98	320.783
1174.59	320.814
1173.12	320.841
1167.94	320.981
1166.28	321.002
1165.04	321.034
1163.06	321.079
1161.3	321.092
1159.43	321.127
1157.67	321.154
1155.99	321.174
1154.16	321.179
1152.52	321.192
1150.91	321.199
1149.06	321.196
1147.46	321.198
1145.85	321.194

1144.21	321.184
1142.36	321.173
1140.67	321.157
1138.9	321.134
1137.03	321.105
1135.23	321.085
1133.24	321.046
1131.08	320.997
1129.38	320.97
1127.03	320.908
1124.38	320.829
1122.89	320.798
1119.95	320.7
1118.67	320.668
1109.8	320.35
1109.09	320.328
1100.04	320
1096.88	319.885
1096.03	319.854
1085.1	319.456
1081.1	319.31
1073.4	319.03
1066.29	318.771
1064.86	318.717
1062.97	318.643
1052.18	318.254
1051.41	318.223
1045.12	318
1037.57	317.725
1028.17	317.383
1023.72	317.221
1017.01	316.976
1009.52	316.704
1008.28	316.657
996.063	316.213
995.361	316.186
994.822	316.164
990.2	316
980.627	315.651
977.216	315.527
966.37	315.132
957.811	314.821
951.951	314.607
950.897	314.568
937.869	314.094
937.565	314.082
937.331	314.073
935.278	314
925.128	313.63
922.402	313.531
913.375	313.202
907.52	312.989
901.711	312.778

892.78	312.452
891.981	312.423
880.356	312
878.221	311.922
877.459	311.895
863.902	311.401
855.95	311.111
849.484	310.876
844.499	310.694
834.968	310.347
834.362	310.325
825.434	310
821.354	309.851
820.258	309.812
809.633	309.425
805.404	309.271
797.969	309
790.641	308.733
786.363	308.577
775.969	308.199
775.619	308.186
770.512	308
761.583	307.675
758.397	307.559
747.249	307.153
738.908	306.849
732.814	306.627
729.246	306.497
718.278	306.098
718.107	306.092
715.59	306
706.219	305.659
703.734	305.568
694.724	305.24
689.186	305.038
683.216	304.821
674.618	304.508
671.696	304.402
660.668	304
660.102	303.979
659.927	303.973
647.125	303.507
642.972	303.356
634.19	303.036
626.089	302.741
621.298	302.566
609.277	302.129
608.447	302.098
605.746	302
592.729	301.43
585.533	300.889
578.85	300.522
573.694	300

567.931	298.081
567.688	298
567.55	297.954
561.688	296
560.864	295.725
555.688	294
553.874	293.396
549.687	292
547.513	291.275
543.686	290
539.572	288.629
537.686	288
532.56	286.292
531.685	286
529.672	285.329
525.684	284
523.962	283.426
519.684	282
517.638	281.318
513.683	280
509.776	278.698
507.683	278
506.199	277.506
501.681	276
497.772	274.697
495.681	274
491.005	272.442
489.68	272
489.09	271.803
483.679	270
482.242	269.521
477.679	268
474.189	266.837
471.678	266
466.109	264.144
465.678	264
465.484	263.935
459.677	262
459.258	261.86
453.676	260
452.686	259.67
447.676	258
444.164	256.829
441.675	256
437.62	254.648
435.675	254
431.086	252.47
429.675	252
427.788	251.371
423.674	250
420.757	249.028
417.674	248
414.581	246.969

411.673	246
408.486	244.938
405.673	244
402.391	242.906
399.673	242
396.296	240.874
393.672	240
390.201	238.843
387.672	238
384.105	236.811
381.671	236
378.01	234.78
375.671	234
372.05	232.793
369.671	232
368.183	231.504
363.67	230
362.091	229.474
357.67	228
355.998	227.443
351.669	226
349.905	225.412
345.669	224
343.812	223.381
339.669	222
337.719	221.35
333.668	220
331.626	219.319
327.668	218
325.533	217.288
321.667	216
319.439	215.257
315.667	214
313.346	213.226
309.667	212
307.252	211.195
303.666	210
301.159	209.164
297.666	208
295.065	207.133
291.665	206
288.971	205.102
285.665	204
282.877	203.071
279.665	202
276.783	201.04
273.664	200
270.689	199.008
267.664	198
264.594	196.977
261.663	196
258.5	194.946
255.663	194

252.405	192.914
249.662	192
246.31	190.883
243.662	190
240.215	188.851
237.662	188
234.12	186.82
231.661	186
228.017	184.785
225.662	184
221.802	182.716
219.651	182
216.161	180.832
214.953	180.427
213.677	180
210.543	178.955
208.652	178.325
207.677	178
207.158	177.844
205.613	177.382
202.523	176.456
180.07	178
177.959	177.46
174.783	176.639
172.407	176
170.772	175.495
166.382	174
163.292	173.078
159.725	172
157.032	170.826
156.661	170.683
155.94	170.468
154.715	170
153.182	169.408
152.867	169.312
152.014	169.08
151.049	168.783
148.832	168
147.535	167.52
143.965	166
140.022	164.477
138.788	164
137.479	163.509
133.373	162
131.589	161.309
127.185	160
126.959	159.997
126.25	159.995
125.762	159.993
125.68	159.993
118.478	159.969
112.757	159.986
109.707	159.993

109.569	159.993
109.105	159.994
108.997	159.995
108.065	159.997
107.64	159.997
107.166	160
106.378	160.046
106.193	160.053
106.103	160.054
105.8	160.084
105.495	160.108
104.805	160.417
103.221	160.987
102.599	161.033
102.009	161.037
101.614	161.072
101.055	161.048
100.711	161.052
97.7835	161.058
94.3084	161.041
93.8975	161.022
91.9539	161.147
91.63	161.143
91.4102	161.082
90.2817	161.024
89.9486	161.022
89.707	160.951
86.7014	160.813
82.7048	161.264
82.458	161.296
81.3882	161.545
81.1637	161.594
79.2738	162
77.816	162
75.0666	162
72.9864	161.282
69.3934	160
68.7416	159.768
68.2736	159.597
68.1192	159.514
67.9386	159.38
67.3686	159.119
66.5713	158
65.7493	156.136
65.6836	156
65.5752	156
65.3068	156
65.0401	156
59.6261	156
59.182	156
58.1295	156
54.3138	157.2
51.6407	158

50.8258	158.181
50.3907	158.236
45.9965	158.999
41.4109	159.593
40.813	159.676
40.1879	159.755
38.4792	160
36.2697	160.68
34.0018	161.233
31.409	162
30.6648	162.367
29.2396	163.187
28.1824	163.779
27.7683	164
24.1653	165.56
23.3051	166
19.6494	167.648
18.9426	168
15.9722	169.385
14.4129	170
14.1982	170
12.8502	170
12.4376	170
10.2755	170
9.92074	170
8.21815	170

Material Boundary

X	Y
202.523	176.456
209.644	173.98
209.656	173.976
209.673	173.97
209.701	173.961
209.754	173.943
209.889	173.899
211.024	173.525
215.647	172
219.457	170.752
221.753	170
223.198	169.524
227.818	168
231.167	166.903
233.924	166
239.731	164.085
239.989	164
240.158	163.945
246.075	162
250.846	160.432
252.16	160
254.731	159.155
258.246	158

260.564	157.238
264.331	156
269.78	154.209
270.417	154
270.828	153.865
276.502	152
281.239	150.443
282.588	150
284.878	149.247
288.673	148
288.694	147.994
291.145	147.188
294.759	146
294.789	145.99
294.817	145.991
300.025	144.273
300.849	144
300.936	144
301.55	143.798
306.97	142
307.021	142
311.682	140.462
313.072	140
313.082	140
315.185	139.306
319.144	138
321.59	137.197
325.229	136
329.426	134.608
331.256	134
332.629	133.549
337.335	132
341.828	130.529
343.443	130
348.164	128.439
349.492	128
351.137	127.45
355.479	126
366.611	125.944
370.513	125.931
383.965	125.994
385.43	126
387.113	126.048
390.516	126.144
435.781	127.424
456.235	128
480.527	128.667
527.675	129.968
528.433	129.989
528.846	130
528.936	130
528.97	130
529.059	130.001

539.5	130.043
552.72	130.294
575.143	130.619
581.119	130.601
587.25	130.583
593.541	130.565
599.129	130.534
601.589	130.521
608.463	130.488
610.709	130.476
617.792	130.441
625.205	130.405
627.114	130.395
634.744	130.358
636.43	130.349
644.276	130.311
645.74	130.303
653.801	130.264
655.043	130.257
656.126	130.253
664.642	130.216
665.551	130.212
674.288	130.174
675.074	130.171
684.022	130.132
684.619	130.13
693.779	130.09
694.187	130.088
703.562	130.048
703.773	130.047
713.368	130.005
713.392	130.005
714.64	130
723.812	129.994
724.625	129.995
726.778	129.991
732.863	129.987
736.095	129.991
738.943	129.989
742.604	130
766.537	130.668
774.739	130.898
814.017	132
828.404	132.395
839.649	132.705
864.839	133.398
886.554	134
888.573	134.057
924.259	134.663
944.12	134.919
948.68	134.898
953.418	134.877
958.343	134.854

963.659	134.828
967.433	134.811
972.95	134.784
976.521	134.768
982.239	134.739
985.607	134.724
991.527	134.694
994.615	134.677
1000.75	134.646
1003.63	134.631
1009.99	134.599
1012.66	134.584
1019.23	134.551
1021.71	134.539
1028.5	134.505
1029.69	134.499
1030.85	134.495
1031.4	134.492
1038.35	134.463
1040.11	134.456
1041.2	134.452
1042.28	134.45
1049.3	134.42
1052.16	134.449
1055.45	134.483
1057.69	134.531
1062.15	134.526
1066.68	134.507
1069.19	134.568
1075.92	134.51
1078.47	134.582
1085.16	134.513
1087.7	134.49
1090.05	134.577
1093.69	134.552
1096.62	134.674
1099.96	134.645
1103.91	134.833
1111.1	135.173
1115.26	135.472
1128.34	135.992
1128.36	135.993
1128.54	136
1136.54	137.583
1138.64	138
1143.2	138.914
1148.64	140
1149.35	140.143
1152.53	140.786
1157.39	141.767
1158.54	142
1163.34	142.967
1168.47	144

1168.88	144.082
1169.38	144.184
1178.4	146
1181.82	146.688
1188.33	148
1194.13	149.167
1198.27	150
1206.33	151.622
1208.21	152
1216.89	153.747
1218.14	154
1218.36	154.045
1228.05	156
1228.06	156.001
1228.08	156.005
1228.4	156.083
1236.03	157.624
1237.89	158
1244.19	159.271
1247.8	160
1253.54	161.159
1257.71	162
1261.5	162.765
1266.92	163.86
1267.34	163.946
1267.61	164
1277.37	165.971
1277.52	166
1278.54	166.207
1287.42	168
1288.05	168.126
1288.73	168.264
1293.48	169.185
1297.69	170
1300.81	170.606
1308	172
1310.03	172.394
1312.81	172.933
1315.92	173.536
1318.32	174
1324.86	175.267
1328.64	176
1334.83	177.2
1336.61	177.546

Material Boundary

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961

209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148
294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138
329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439

349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395
634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088
703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995

726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551
1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507
1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552

1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158
1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168
1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606

1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

Material Boundary

X	Y
208.652	178.325
209.644	177.98
209.656	177.976
209.673	177.97
209.701	177.961
209.754	177.943
209.889	177.899
211.024	177.525
215.647	176
219.457	174.752
221.753	174
223.198	173.524
227.818	172
231.167	170.903
233.924	170
239.731	168.085
239.989	168
240.158	167.945
246.075	166
250.846	164.432
252.16	164
254.731	163.155
258.246	162
260.564	161.238
264.331	160
269.78	158.209
270.417	158
270.828	157.865
276.502	156
281.239	154.443
282.588	154
284.878	153.247
288.673	152
288.694	151.994
291.145	151.188
294.759	150
294.789	149.99
294.817	149.991
300.025	148.273
300.849	148

300.936	148
301.55	147.798
306.97	146
307.021	146
311.682	144.462
313.072	144
313.082	144
315.185	143.306
319.144	142
321.59	141.197
325.229	140
329.426	138.608
331.256	138
332.629	137.549
337.335	136
341.828	134.529
343.443	134
348.164	132.439
349.492	132
351.137	131.45
355.479	130
366.611	129.944
370.513	129.931
383.965	129.994
385.43	130
387.113	130.048
390.516	130.144
435.781	131.424
456.235	132
480.527	132.667
527.675	133.968
528.433	133.989
528.846	134
528.936	134
528.97	134
529.059	134.001
539.5	134.043
552.72	134.294
575.143	134.619
581.119	134.601
587.25	134.583
593.541	134.565
599.129	134.534
601.589	134.521
608.463	134.488
610.709	134.476
617.792	134.441
625.205	134.405
627.114	134.395
634.744	134.358
636.43	134.349
644.276	134.311
645.74	134.303

653.801	134.264
655.043	134.257
656.126	134.253
664.642	134.216
665.551	134.212
674.288	134.174
675.074	134.171
684.022	134.132
684.619	134.13
693.779	134.09
694.187	134.088
703.562	134.048
703.773	134.047
713.368	134.005
713.392	134.005
714.64	134
723.812	133.994
724.625	133.995
726.778	133.991
732.863	133.987
736.095	133.991
738.943	133.989
742.604	134
766.537	134.668
774.739	134.898
814.017	136
828.404	136.395
839.649	136.705
864.839	137.398
886.554	138
888.573	138.057
924.259	138.663
944.12	138.919
948.68	138.898
953.418	138.877
958.343	138.854
963.659	138.828
967.433	138.811
972.95	138.784
976.521	138.768
982.239	138.739
985.607	138.724
991.527	138.694
994.615	138.677
1000.75	138.646
1003.63	138.631
1009.99	138.599
1012.66	138.584
1019.23	138.551
1021.71	138.539
1028.5	138.505
1029.69	138.499
1030.85	138.495

1031.4	138.492
1038.35	138.463
1040.11	138.456
1041.2	138.452
1042.28	138.45
1049.3	138.42
1052.16	138.449
1055.45	138.483
1057.69	138.531
1062.15	138.526
1066.68	138.507
1069.19	138.568
1075.92	138.51
1078.47	138.582
1085.16	138.513
1087.7	138.49
1090.05	138.577
1093.69	138.552
1096.62	138.674
1099.96	138.645
1103.91	138.833
1111.1	139.173
1115.26	139.472
1128.34	139.992
1128.36	139.993
1128.54	140
1136.54	141.583
1138.64	142
1143.2	142.914
1148.64	144
1149.35	144.143
1152.53	144.786
1157.39	145.767
1158.54	146
1163.34	146.967
1168.47	148
1168.88	148.082
1169.38	148.184
1178.4	150
1181.82	150.688
1188.33	152
1194.13	153.167
1198.27	154
1206.33	155.622
1208.21	156
1216.89	157.747
1218.14	158
1218.36	158.045
1228.05	160
1228.06	160.001
1228.08	160.005
1228.4	160.083
1236.03	161.624

1237.89	162
1244.19	163.271
1247.8	164
1253.54	165.159
1257.71	166
1261.5	166.765
1266.92	167.86
1267.34	167.946
1267.61	168
1277.37	169.971
1277.52	170
1278.54	170.207
1287.42	172
1288.05	172.126
1288.73	172.264
1293.48	173.185
1297.69	174
1300.81	174.606
1308	176
1310.03	176.394
1312.81	176.933
1315.92	177.536
1318.32	178
1324.86	179.267
1328.64	180
1334.83	181.2
1336.61	181.546

Material Boundary

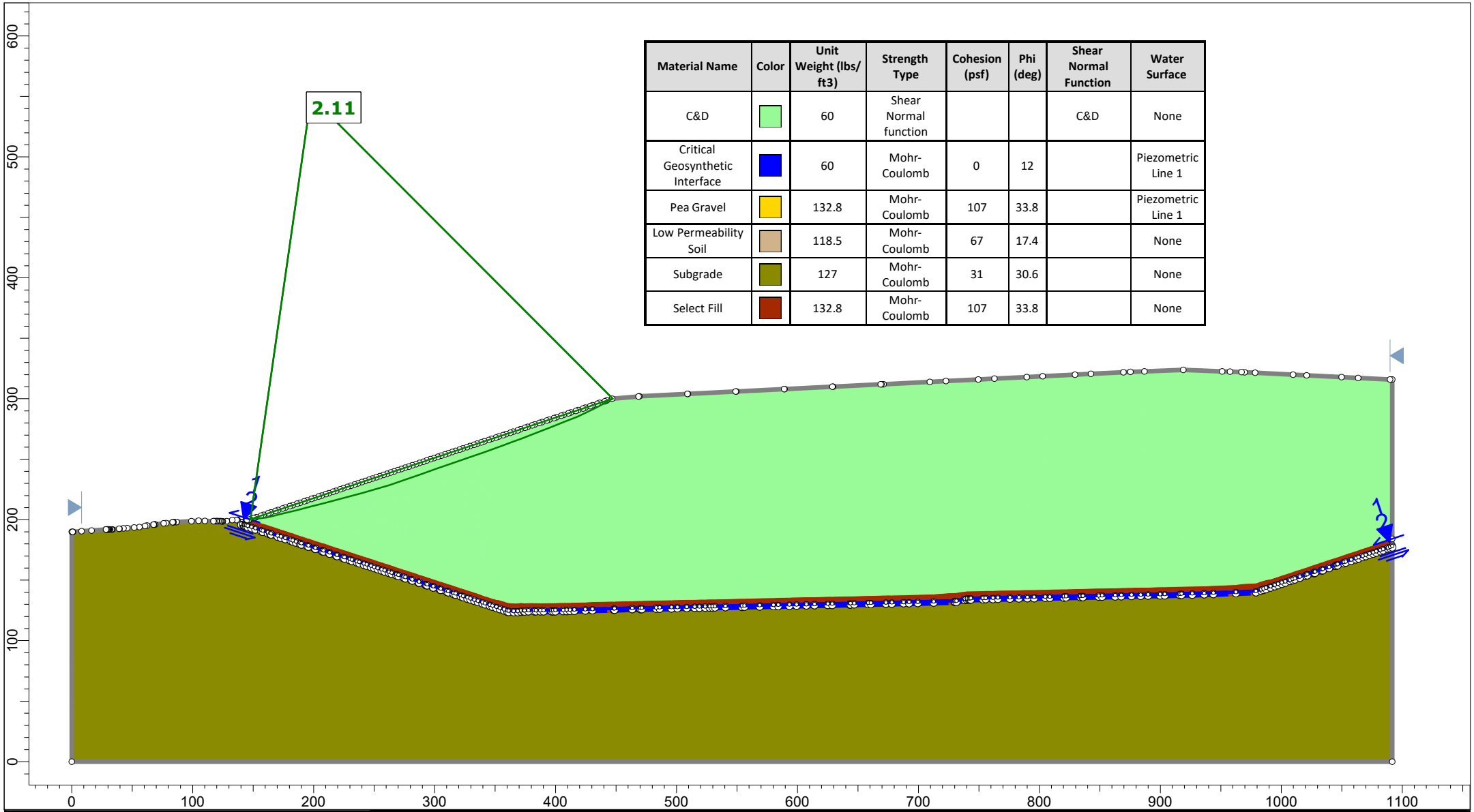
X	Y
216.161	180.832
219.457	179.752
221.753	179
223.198	178.524
227.818	177
231.167	175.903
233.924	175
239.731	173.085
239.989	173
240.158	172.945
246.075	171
250.846	169.432
252.16	169
254.731	168.155
258.246	167
260.564	166.238
264.331	165
269.78	163.209
270.417	163
270.828	162.865
276.502	161
281.239	159.443

282.588	159
284.878	158.247
288.673	157
288.694	156.994
291.145	156.188
294.759	155
294.789	154.99
294.817	154.991
300.025	153.273
300.849	153
300.936	153
301.55	152.798
306.97	151
307.021	151
311.682	149.462
313.072	149
313.082	149
315.185	148.306
319.144	147
321.59	146.197
325.229	145
329.426	143.608
331.256	143
332.629	142.549
337.335	141
341.828	139.529
343.443	139
348.164	137.439
349.492	137
351.137	136.45
355.479	135
366.611	134.944
370.513	134.931
383.965	134.994
385.43	135
387.113	135.048
390.516	135.144
435.781	136.424
456.235	137
480.527	137.667
527.675	138.968
528.433	138.989
528.846	139
528.936	139
528.97	139
529.059	139.001
539.5	139.043
552.72	139.294
575.143	139.619
581.119	139.601
587.25	139.583
593.541	139.565
599.129	139.534

601.589	139.521
608.463	139.488
610.709	139.476
617.792	139.441
625.205	139.405
627.114	139.395
634.744	139.358
636.43	139.349
644.276	139.311
645.74	139.303
653.801	139.264
655.043	139.257
656.126	139.253
664.642	139.216
665.551	139.212
674.288	139.174
675.074	139.171
684.022	139.132
684.619	139.13
693.779	139.09
694.187	139.088
703.562	139.048
703.773	139.047
713.368	139.005
713.392	139.005
714.64	139
723.812	138.994
724.625	138.995
726.778	138.991
732.863	138.987
736.095	138.991
738.943	138.989
742.604	139
766.537	139.668
774.739	139.898
814.017	141
828.404	141.395
839.649	141.705
864.839	142.398
886.554	143
888.573	143.057
924.259	143.663
944.12	143.919
948.68	143.898
953.418	143.877
958.343	143.854
963.659	143.828
967.433	143.811
972.95	143.784
976.521	143.768
982.239	143.739
985.607	143.724
991.527	143.694

994.615	143.677
1000.75	143.646
1003.63	143.631
1009.99	143.599
1012.66	143.584
1019.23	143.551
1021.71	143.539
1028.5	143.505
1029.69	143.499
1030.85	143.495
1031.4	143.492
1038.35	143.463
1040.11	143.456
1041.2	143.452
1042.28	143.45
1049.3	143.42
1052.16	143.449
1055.45	143.483
1057.69	143.531
1062.15	143.526
1066.68	143.507
1069.19	143.568
1075.92	143.51
1078.47	143.582
1085.16	143.513
1087.7	143.49
1090.05	143.577
1093.69	143.552
1096.62	143.674
1099.96	143.645
1103.91	143.833
1111.1	144.173
1115.26	144.472
1128.34	144.992
1128.36	144.993
1128.54	145
1136.54	146.583
1138.64	147
1143.2	147.914
1148.64	149
1149.35	149.143
1152.53	149.786
1157.39	150.767
1158.54	151
1163.34	151.967
1168.47	153
1168.88	153.082
1169.38	153.184
1178.4	155
1181.82	155.688
1188.33	157
1194.13	158.167
1198.27	159

1206.33	160.622
1208.21	161
1216.89	162.747
1218.14	163
1218.36	163.045
1228.05	165
1228.06	165.001
1228.08	165.005
1228.4	165.083
1236.03	166.624
1237.89	167
1244.19	168.271
1247.8	169
1253.54	170.159
1257.71	171
1261.5	171.765
1266.92	172.86
1267.34	172.946
1267.61	173
1277.37	174.971
1277.52	175
1278.54	175.207
1287.42	177
1288.05	177.126
1288.73	177.264
1293.48	178.185
1297.69	179
1300.81	179.606
1308	181
1310.03	181.394
1312.81	181.933
1315.92	182.536
1318.32	183
1324.86	184.267
1328.64	185
1334.83	186.2
1336.61	186.546



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None

rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section B - Static - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

182-442 S.A. Dunn Footprint Modification

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:02m:20.9s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	9/26/2018, 11:46:34 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.113860
Axis Location:	197.723, 549.947
Left Slip Surface Endpoint:	147.568, 200.339
Right Slip Surface Endpoint:	447.316, 300.058
Resisting Moment:	2.77194e+07 lb-ft
Driving Moment:	1.31135e+07 lb-ft
Resisting Horizontal Force:	80411.7 lb
Driving Horizontal Force:	38041.2 lb
Total Slice Area:	2124.53 ft2
Surface Horizontal Width:	299.748 ft
Surface Average Height:	7.08771 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
147.568	200.339
161.452	201.965
175.251	205.252
186.089	207.834
196.926	210.67
207.764	213.523
218.601	216.376
229.358	219.207
240.125	222.085
251.348	225.367
262.523	228.635
275.611	233.16
288.699	237.69
301.787	242.238
314.876	246.786
327.964	251.336
341.052	255.886
355.595	261.061
363.674	264.089
371.754	267.117
383.632	271.7
395.506	276.283
406.616	280.729
417.763	285.19
425.311	288.784
432.86	292.379
440.088	296.205
447.316	300.058

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.11386

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.94231	312.442	6.67998	C&D	3.55271e-15	34.992	14.4354	30.5145	43.5922	0	43.5922	45.2828	45.2828
2	6.94231	937.324	6.67998	C&D	1.42109e-14	34.992	43.6627	92.2968	131.853	0	131.853	136.966	136.966
3	4.59974	888.352	13.3987	C&D	0	34.992	60.0243	126.883	181.261	0	181.261	195.559	195.559
4	4.59974	1008.95	13.3987	C&D	0	34.992	68.3375	144.456	206.366	0	206.366	222.645	222.645
5	4.59974	1129.55	13.3987	C&D	0	34.992	76.6881	162.108	231.584	0	231.584	249.851	249.851
6	5.41871	1485.38	13.3987	C&D	2.84217e-14	34.992	85.8226	181.417	259.168	0	259.168	279.612	279.612
7	5.41871	1652.75	13.3987	C&D	0	34.992	95.7462	202.394	289.135	0	289.135	311.943	311.943
8	5.41872	1799.44	14.6646	C&D	2.84217e-14	34.992	103.35	218.467	312.095	0	312.095	339.14	339.14
9	5.41872	1925.45	14.6646	C&D	0	34.992	110.777	234.167	334.524	0	334.524	363.513	363.513
10	5.41874	2050.1	14.7481	C&D	2.84217e-14	34.992	118.043	249.527	356.467	0	356.467	387.541	387.541
11	5.41874	2173.37	14.7481	C&D	0	34.992	125.322	264.914	378.449	0	378.449	411.439	411.439
12	5.41874	2296.63	14.7482	C&D	0	34.992	132.605	280.309	400.441	0	400.441	435.348	435.348
13	5.41874	2419.9	14.7482	C&D	5.68434e-14	34.992	139.889	295.705	422.435	0	422.435	459.26	459.26
14	5.37848	2523.81	14.7482	C&D	5.68434e-14	34.992	147.141	311.036	444.337	0	444.337	483.072	483.072
15	5.37848	2645.25	14.7482	C&D	0	34.992	154.359	326.293	466.133	0	466.133	506.767	506.767
16	5.38337	2765.79	14.9622	C&D	0	34.992	160.971	340.27	486.1	0	486.1	529.118	529.118
17	5.38337	2880.5	14.9622	C&D	5.68434e-14	34.992	167.73	354.558	506.512	0	506.512	551.336	551.336
18	5.61155	3100.88	16.3015	C&D	5.68434e-14	34.992	170.545	360.509	515.014	0	515.014	564.89	564.89
19	5.61155	3177.9	16.3015	C&D	0	34.992	174.735	369.366	527.666	0	527.666	578.767	578.767
20	5.58728	3240.67	16.3015	C&D	0	34.992	178.893	378.154	540.22	0	540.22	592.537	592.537
21	5.58728	3317.02	16.3015	C&D	0	34.992	183.016	386.871	552.673	0	552.673	606.196	606.196
22	6.5441	3913.67	19.0723	C&D	5.68434e-14	34.992	177.928	376.115	537.307	0	537.307	598.824	598.824
23	6.5441	3881.48	19.0723	C&D	0	34.992	176.211	372.486	532.123	0	532.123	593.046	593.046
24	6.5441	3848.81	19.0913	C&D	0	34.992	174.439	368.74	526.772	0	526.772	587.147	587.147
25	6.5441	3815.66	19.0913	C&D	5.68434e-14	34.992	172.699	365.061	521.516	0	521.516	581.289	581.289
26	6.54412	3780.77	19.1612	C&D	5.68434e-14	34.992	170.736	360.913	515.59	0	515.59	574.917	574.917
27	6.54412	3744.11	19.1612	C&D	0	34.992	168.863	356.953	509.933	0	509.933	568.609	568.609
28	6.54412	3707.45	19.1613	C&D	0	34.992	167.004	353.023	504.318	0	504.318	562.348	562.348
29	6.54412	3670.79	19.1613	C&D	0	34.992	165.159	349.124	498.749	0	498.749	556.138	556.138
30	6.54412	3633.92	19.1696	C&D	0	34.992	163.304	345.202	493.145	0	493.145	549.917	549.917
31	6.54412	3596.84	19.1696	C&D	0	34.992	161.473	341.331	487.616	0	487.616	543.75	543.75
32	6.54412	3559.76	19.1696	C&D	0	34.992	159.658	337.494	482.134	0	482.134	537.638	537.638
33	6.54412	3522.68	19.1696	C&D	0	34.992	157.859	333.692	476.704	0	476.704	531.582	531.582
34	4.84752	2579.69	19.5897	C&D	0	34.992	155.168	328.003	468.575	0	468.575	523.796	523.796
35	4.84752	2547.73	19.5897	C&D	5.68434e-14	34.992	153.182	323.806	462.581	0	462.581	517.096	517.096
36	4.84752	2515.76	19.5897	C&D	5.68434e-14	34.992	151.208	319.633	456.618	0	456.618	510.43	510.43
37	8.07948	4085.09	20.5438	C&D	0	34.992	145.671	307.928	439.897	0	439.897	494.488	494.488
38	8.07948	3922.36	20.5438	C&D	5.68434e-14	34.992	139.905	295.739	422.484	0	422.484	474.915	474.915
39	5.93912	2767.81	21.0973	C&D	5.68434e-14	34.992	133.568	282.343	403.347	0	403.347	454.879	454.879
40	5.93912	2656.48	21.0973	C&D	0	34.992	128.294	271.196	387.422	0	387.422	436.92	436.92
41	5.93724	2544.16	21.1068	C&D	0	34.992	123.01	260.025	371.465	0	371.465	418.947	418.947

42	5.93724	2432.5	21.1068	C&D	2.84217e-14	34.992	117.735	248.875	355.536	0	355.536	400.983	400.983
43	5.55487	2161.62	21.81	C&D	2.84217e-14	34.992	111.224	235.113	335.876	0	335.876	380.385	380.385
44	5.55487	2037.64	21.81	C&D	2.84217e-14	34.992	105.013	221.983	317.118	0	317.118	359.142	359.142
45	5.57365	1919.93	21.81	C&D	2.84217e-14	34.992	98.7823	208.812	298.303	0	298.303	337.833	337.833
46	5.57365	1795.11	21.81	C&D	0	34.992	92.5293	195.594	279.42	0	279.42	316.448	316.448
47	7.54816	2102.12	25.4641	C&D	0	34.992	77.9342	164.742	235.345	0	235.345	272.458	272.458
48	7.54816	1613.29	25.4641	C&D	1.42109e-14	34.992	60.1525	127.154	181.649	0	181.649	210.294	210.294
49	7.22809	1003.38	27.8954	C&D	0	34.992	38.6325	81.6638	116.662	0	116.662	137.113	137.113
50	7.22809	379.619	28.058	C&D	3.55271e-15	34.992	14.7049	31.084	44.4057	0	44.4057	52.2435	52.2435

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.11386

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	147.568	200.339	0	0	0
2	154.51	201.152	64.7757	1.92681	1.70381
3	161.452	201.965	260.702	15.4686	3.39563
4	166.052	203.061	338.2	26.6418	4.50419
5	170.652	204.157	426.431	41.8044	5.599
6	175.251	205.252	525.444	61.5103	6.67685
7	180.67	206.543	655.979	91.2661	7.92069
8	186.089	207.834	801.609	128.856	9.13199
9	191.508	209.252	919.104	167.136	10.3064
10	196.926	210.67	1045.04	211.474	11.4399
11	202.345	212.096	1176.23	261.382	12.5287
12	207.764	213.523	1315.51	317.517	13.5696
13	213.183	214.949	1462.88	379.954	14.5597
14	218.601	216.376	1618.35	448.699	15.4964
15	223.98	217.791	1780.66	523.107	16.3713
16	229.358	219.207	1950.94	603.525	17.1895
17	234.742	220.646	2118.2	686.217	17.9504
18	240.125	222.085	2292.49	773.812	18.6517
19	245.737	223.726	2404.37	842.859	19.3183
20	251.348	225.367	2519	912.763	19.9181
21	256.935	227.001	2635.84	982.787	20.4482
22	262.523	228.635	2755.38	1052.78	20.9109
23	269.067	230.897	2704.12	1057.9	21.3663
24	275.611	233.16	2653.35	1057.4	21.728
25	282.155	235.425	2601.82	1050.97	21.9956
26	288.699	237.69	2550.8	1039.35	22.169
27	295.243	239.964	2495.74	1020.93	22.248
28	301.787	242.238	2441.3	997.889	22.2324
29	308.331	244.512	2387.44	970.533	22.1225
30	314.876	246.786	2334.18	939.196	21.9182
31	321.42	249.061	2280.99	904.014	21.6197
32	327.964	251.336	2228.4	865.556	21.2272
33	334.508	253.611	2176.4	824.178	20.7411
34	341.052	255.886	2124.99	780.244	20.162
35	345.9	257.611	2068.84	739.675	19.6736
36	350.747	259.336	2013.41	698.58	19.1349
37	355.595	261.061	1958.69	657.144	18.5467
38	363.674	264.089	1803.74	567.257	17.4578
39	371.754	267.117	1654.93	481.952	16.2367
40	377.693	269.408	1524.01	415.716	15.2578
41	383.632	271.7	1398.26	354.147	14.2128
42	389.569	273.991	1277.3	297.359	13.1052
43	395.506	276.283	1161.53	245.578	11.938
44	401.061	278.506	1032.77	196.933	10.7958
45	406.616	280.729	911.2	154.262	9.60881
46	412.19	282.959	796.457	117.285	8.37708
47	417.763	285.19	688.977	85.9287	7.10918
48	425.311	288.784	431.314	40.3414	5.34341
49	432.86	292.379	232.441	14.3552	3.53401
50	440.088	296.205	65.302	2.02228	1.77378
51	447.316	300.058	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
140.028	196.713

141.766	196.149
142.289	195.994
143.045	195.769
144.237	195.414
145.518	195
148.459	194.052
151.716	193
156.612	191.418
157.903	191
161.952	189.689
164.08	189
164.758	188.78
170.247	187
172.895	186.14
176.403	185
181.024	183.497
182.529	183
185.376	182.065
188.619	181
189.923	180.575
194.757	179
195.648	178.71
200.895	177
201.373	176.844
207.034	175
207.098	174.979
207.993	174.687
212.823	173.114
213.172	173
218.549	171.248
219.311	171
224.274	169.383
225.449	169
230	167.518
231.588	167
235.725	165.651
237.722	165
241.444	163.784
243.846	163
247.162	161.917
249.97	161
252.88	160.05
256.093	159
258.598	158.182
262.216	157
264.316	156.314
268.34	155
270.035	154.446
274.463	153
275.754	152.578
280.585	151
281.473	150.71
286.71	149

287.186	148.844
292.824	147
292.886	146.98
293.74	146.7
298.583	145.115
298.935	145
304.279	143.251
305.047	143
309.976	141.387
311.159	141
315.674	139.523
317.272	139
321.371	137.659
323.386	137
327.069	135.795
329.5	135
332.77	133.931
335.619	133
339.508	131.716
341.678	131
345.692	129.704
347.866	129
350.959	127.992
354.006	127
357.278	125.924
360.089	125
361.133	124.745
365.215	124.477
368.707	124.493
371.484	125
373.654	125.03
374.386	125.08
377.631	125.239
382.427	125.316
383.677	125.244
387.287	125.197
390.059	125.187
396.735	125.233
398.019	125.268
399.749	125.314
406.24	125.429
409.208	125.512
411.915	125.585
415.53	125.683
424.48	125.93
430.485	126.131
448.199	126.599
448.732	126.618
463.334	127
470.097	127.145
471.17	127.168
483.106	127.425
486.086	127.487

495.863	127.696
500.697	127.797
508.409	127.961
515.014	128.097
518.981	128.181
523.614	128.281
527.447	128.363
529.69	128.406
531.66	128.441
540.373	128.637
554.05	128.953
556.089	129
568.694	129.288
580.167	129.531
584.066	129.617
593.259	129.813
599.175	129.945
607.386	130.128
614.024	130.271
624.97	130.517
628.615	130.596
643.158	130.917
643.782	130.931
646.896	131
658.497	131.248
660.64	131.294
673.082	131.561
677.922	131.665
687.656	131.874
692.236	131.971
699.35	132.123
712.535	132.48
729.855	132.992
730.239	132.992
731.42	133
738.245	134.694
739.951	135
740.007	135.001
741.701	135.015
742.332	135.017
743.317	135.019
753.154	135.287
755.462	135.336
761.566	135.471
765.71	135.559
775.589	135.763
783.012	135.917
790.009	136.066
795.683	136.184
804.848	136.379
808.664	136.459
820.13	136.704
821.971	136.743

833.961	137
835.574	137.035
835.855	137.041
849.047	137.327
851.677	137.384
862.588	137.62
867.593	137.729
876.198	137.915
883.605	138.076
889.878	138.211
899.713	138.425
903.628	138.509
915.919	138.776
917.449	138.809
926.274	139
936.214	139.29
943.717	139.589
962.389	140.22
979.061	141
983.234	142.38
985.11	143
987.287	143.719
991.16	145
994.524	146.112
997.209	147
1000.33	148.033
1003.26	149
1007.19	150.301
1009.31	151
1011.14	151.607
1015.36	153
1020.26	154.621
1021.41	155
1027.04	156.861
1027.46	157
1027.82	157.12
1033.5	159
1034.29	159.258
1039.55	161
1044.85	162.749
1045.6	163
1046.49	163.294
1051.65	165
1053.18	165.503
1057.7	167
1061.67	168.313
1063.75	169
1067.3	170.173
1069.8	171
1072.91	172.028
1075.85	173
1078.52	173.882
1081.9	175

1084.13	175.737
1087.95	177
1089.74	177.591
1091.61	178.21

External Boundary

X	Y
0	189.907
0	0
1091.61	0
1091.61	175.21
1091.61	177.21
1091.61	178.21
1091.61	179.21
1091.61	184.21
1091.61	315.915
1089.91	316
1063.4	317.322
1049.79	318
1020.8	319.445
1009.68	320
978.207	321.569
969.56	322
967.034	322.1
957.494	322.477
951.058	322.728
918.857	324
886.821	322.699
875.264	322.234
869.428	322
842.625	320.66
829.419	320
802.655	318.662
789.411	318
762.684	316.664
749.402	316
722.713	314.666
709.393	314
671.066	312.084
669.384	312
668.793	311.97
629.376	310
628.822	309.972
589.367	308
588.85	307.974
549.358	306
548.879	305.976
509.349	304
508.907	303.978
469.34	302
468.527	301.928
446.661	300

442.399	298.58
440.658	298
436.441	296.595
434.656	296
430.483	294.609
428.654	294
424.525	292.624
422.652	292
418.566	290.639
416.65	290
412.608	288.653
410.647	288
406.65	286.668
404.645	286
400.692	284.683
398.643	284
394.734	282.697
392.641	282
388.775	280.712
386.639	280
382.817	278.727
380.636	278
376.859	276.741
374.634	276
370.9	274.756
368.632	274
364.942	272.77
362.63	272
358.984	270.785
356.628	270
353.025	268.8
350.625	268
347.067	266.814
344.623	266
341.108	264.829
338.621	264
335.15	262.843
332.619	262
329.191	260.858
326.617	260
323.233	258.872
320.614	258
317.274	256.887
314.612	256
311.316	254.902
308.61	254
305.357	252.916
302.608	252
299.398	250.931
296.606	250
293.44	248.945
290.603	248
287.481	246.96

284.601	246
281.522	244.974
278.599	244
275.563	242.989
272.597	242
269.605	241.003
266.595	240
263.646	239.017
260.592	238
257.687	237.032
254.59	236
251.728	235.046
248.588	234
245.769	233.061
242.586	232
239.81	231.075
236.583	230
233.851	229.09
230.581	228
227.892	227.104
224.579	226
221.933	225.118
218.577	224
215.974	223.133
212.575	222
210.015	221.147
206.572	220
204.056	219.162
200.57	218
198.097	217.176
194.568	216
192.138	215.19
188.566	214
186.179	213.205
182.564	212
180.22	211.219
176.561	210
174.261	209.233
170.559	208
168.301	207.248
164.557	206
162.342	205.262
158.555	204
156.383	203.276
152.553	202
150.424	201.291
147.568	200.339
146.55	200
144.336	199.263
140.538	198
140.028	197.831
137.04	199.831
136.822	199.82

136.281	199.806
132.588	199.709
128.132	198.907
124.832	198.717
124.43	198.72
123.832	198.73
123.354	198.751
122.743	198.757
121.425	198.812
120.213	198.857
119.938	198.854
119.584	198.87
118.385	198.849
117.235	198.834
117.034	198.833
110.132	198.987
104.818	199.102
98.8143	198.859
86.6552	198.181
86.5428	198.179
84.1379	198
83.868	197.986
83.5647	197.967
83.3869	197.961
78.0277	197.266
75.9286	197.019
68.8572	196.138
68.697	196.118
67.841	196.002
67.8254	196.002
67.6997	196
62.2082	195.148
60.6701	194.935
55.9212	194
51.5095	193.601
45.8245	193.113
42.7715	192.86
39.5414	192.548
39.0396	192.503
33.5804	192
33.3498	191.999
33.0358	191.998
31.7133	191.995
31.057	191.995
30.8982	191.995
30.4475	191.994
29.8506	191.994
29.6366	191.993
29.391	191.993
29.3226	191.993
28.622	191.994
28.542	191.993
28.3605	191.993

28.2555	191.993
16.346	191.138
8.05554	190.53
0.998983	190.005
0.686216	190

Material Boundary

X	Y
140.028	197.831
140.028	197.713
140.028	196.713
140.028	195.713
140.028	193.713
141.766	193.149
142.289	192.994
143.045	192.769
144.237	192.414
145.518	192
148.459	191.052
151.716	190
156.612	188.418
157.903	188
161.952	186.689
164.08	186
164.758	185.78
170.247	184
172.895	183.14
176.403	182
181.024	180.497
182.529	180
185.376	179.065
188.619	178
189.923	177.575
194.757	176
195.648	175.71
200.895	174
201.373	173.844
207.034	172
207.098	171.979
207.993	171.687
212.823	170.114
213.172	170
218.549	168.248
219.311	168
224.274	166.383
225.449	166
230	164.518
231.588	164
235.725	162.651
237.722	162
241.444	160.784
243.846	160

247.162	158.917
249.97	158
252.88	157.05
256.093	156
258.598	155.182
262.216	154
264.316	153.314
268.34	152
270.035	151.446
274.463	150
275.754	149.578
280.585	148
281.473	147.71
286.71	146
287.186	145.844
292.824	144
292.886	143.98
293.74	143.7
298.583	142.115
298.935	142
304.279	140.251
305.047	140
309.976	138.387
311.159	138
315.674	136.523
317.272	136
321.371	134.659
323.386	134
327.069	132.795
329.5	132
332.77	130.931
335.619	130
339.508	128.716
341.678	128
345.692	126.704
347.866	126
350.959	124.992
354.006	124
357.278	122.924
360.089	122
361.133	121.745
365.215	121.477
368.707	121.493
371.484	122
373.654	122.03
374.386	122.08
377.631	122.239
382.427	122.316
383.677	122.244
387.287	122.197
390.059	122.187
396.735	122.233
398.019	122.268

399.749	122.314
406.24	122.429
409.208	122.512
411.915	122.585
415.53	122.683
424.48	122.93
430.485	123.131
448.199	123.599
448.732	123.618
463.334	124
470.097	124.145
471.17	124.168
483.106	124.425
486.086	124.487
495.863	124.696
500.697	124.797
508.409	124.961
515.014	125.097
518.981	125.181
523.614	125.281
527.447	125.363
529.69	125.406
531.66	125.441
540.373	125.637
554.05	125.953
556.089	126
568.694	126.288
580.167	126.531
584.066	126.617
593.259	126.813
599.175	126.945
607.386	127.128
614.024	127.271
624.97	127.517
628.615	127.596
643.158	127.917
643.782	127.931
646.896	128
658.497	128.248
660.64	128.294
673.082	128.561
677.922	128.665
687.656	128.874
692.236	128.971
699.35	129.123
712.535	129.48
729.855	129.992
730.239	129.992
731.42	130
738.245	131.694
739.951	132
740.007	132.001
741.701	132.015

742.332	132.017
743.317	132.019
753.154	132.287
755.462	132.336
761.566	132.471
765.71	132.559
775.589	132.763
783.012	132.917
790.009	133.066
795.683	133.184
804.848	133.379
808.664	133.459
820.13	133.704
821.971	133.743
833.961	134
835.574	134.035
835.855	134.041
849.047	134.327
851.677	134.384
862.588	134.62
867.593	134.729
876.198	134.915
883.605	135.076
889.878	135.211
899.713	135.425
903.628	135.509
915.919	135.776
917.449	135.809
926.274	136
936.214	136.29
943.717	136.589
962.389	137.22
979.061	138
983.234	139.38
985.11	140
987.287	140.719
991.16	142
994.524	143.112
997.209	144
1000.33	145.033
1003.26	146
1007.19	147.301
1009.31	148
1011.14	148.607
1015.36	150
1020.26	151.621
1021.41	152
1027.04	153.861
1027.46	154
1027.82	154.12
1033.5	156
1034.29	156.258
1039.55	158

1044.85	159.749
1045.6	160
1046.49	160.294
1051.65	162
1053.18	162.503
1057.7	164
1061.67	165.313
1063.75	166
1067.3	167.173
1069.8	168
1072.91	169.028
1075.85	170
1078.52	170.882
1081.9	172
1084.13	172.737
1087.95	174
1089.74	174.591
1091.61	175.21

Material Boundary

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178
195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248

219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182
262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704
347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124

373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683
424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596
643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971

699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471
765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142
987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607

1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503
1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

Material Boundary

X	Y
140.028	197.713
141.766	197.149
142.289	196.994
143.045	196.769
144.237	196.414
145.518	196
148.459	195.052
151.716	194
156.612	192.418
157.903	192
161.952	190.689
164.08	190
164.758	189.78
170.247	188
172.895	187.14
176.403	186
181.024	184.497
182.529	184
185.376	183.065
188.619	182
189.923	181.575
194.757	180

195.648	179.71
200.895	178
201.373	177.844
207.034	176
207.098	175.979
207.993	175.687
212.823	174.114
213.172	174
218.549	172.248
219.311	172
224.274	170.383
225.449	170
230	168.518
231.588	168
235.725	166.651
237.722	166
241.444	164.784
243.846	164
247.162	162.917
249.97	162
252.88	161.05
256.093	160
258.598	159.182
262.216	158
264.316	157.314
268.34	156
270.035	155.446
274.463	154
275.754	153.578
280.585	152
281.473	151.71
286.71	150
287.186	149.844
292.824	148
292.886	147.98
293.74	147.7
298.583	146.115
298.935	146
304.279	144.251
305.047	144
309.976	142.387
311.159	142
315.674	140.523
317.272	140
321.371	138.659
323.386	138
327.069	136.795
329.5	136
332.77	134.931
335.619	134
339.508	132.716
341.678	132
345.692	130.704

347.866	130
350.959	128.992
354.006	128
357.278	126.924
360.089	126
361.133	125.745
365.215	125.477
368.707	125.493
371.484	126
373.654	126.03
374.386	126.08
377.631	126.239
382.427	126.316
383.677	126.244
387.287	126.197
390.059	126.187
396.735	126.233
398.019	126.268
399.749	126.314
406.24	126.429
409.208	126.512
411.915	126.585
415.53	126.683
424.48	126.93
430.485	127.131
448.199	127.599
448.732	127.618
463.334	128
470.097	128.145
471.17	128.168
483.106	128.425
486.086	128.487
495.863	128.696
500.697	128.797
508.409	128.961
515.014	129.097
518.981	129.181
523.614	129.281
527.447	129.363
529.69	129.406
531.66	129.441
540.373	129.637
554.05	129.953
556.089	130
568.694	130.288
580.167	130.531
584.066	130.617
593.259	130.813
599.175	130.945
607.386	131.128
614.024	131.271
624.97	131.517
628.615	131.596

643.158	131.917
643.782	131.931
646.896	132
658.497	132.248
660.64	132.294
673.082	132.561
677.922	132.665
687.656	132.874
692.236	132.971
699.35	133.123
712.535	133.48
729.855	133.992
730.239	133.992
731.42	134
738.245	135.694
739.951	136
740.007	136.001
741.701	136.015
742.332	136.017
743.317	136.019
753.154	136.287
755.462	136.336
761.566	136.471
765.71	136.559
775.589	136.763
783.012	136.917
790.009	137.066
795.683	137.184
804.848	137.379
808.664	137.459
820.13	137.704
821.971	137.743
833.961	138
835.574	138.035
835.855	138.041
849.047	138.327
851.677	138.384
862.588	138.62
867.593	138.729
876.198	138.915
883.605	139.076
889.878	139.211
899.713	139.425
903.628	139.509
915.919	139.776
917.449	139.809
926.274	140
936.214	140.29
943.717	140.589
962.389	141.22
979.061	142
983.234	143.38
985.11	144

987.287	144.719
991.16	146
994.524	147.112
997.209	148
1000.33	149.033
1003.26	150
1007.19	151.301
1009.31	152
1011.14	152.607
1015.36	154
1020.26	155.621
1021.41	156
1027.04	157.861
1027.46	158
1027.82	158.12
1033.5	160
1034.29	160.258
1039.55	162
1044.85	163.749
1045.6	164
1046.49	164.294
1051.65	166
1053.18	166.503
1057.7	168
1061.67	169.313
1063.75	170
1067.3	171.173
1069.8	172
1072.91	173.028
1075.85	174
1078.52	174.882
1081.9	176
1084.13	176.737
1087.95	178
1089.74	178.591
1091.61	179.21

Material Boundary

X	Y
147.568	200.339
148.459	200.052
151.716	199
156.612	197.418
157.903	197
161.952	195.689
164.08	195
164.758	194.78
170.247	193
172.895	192.14
176.403	191
181.024	189.497
182.529	189

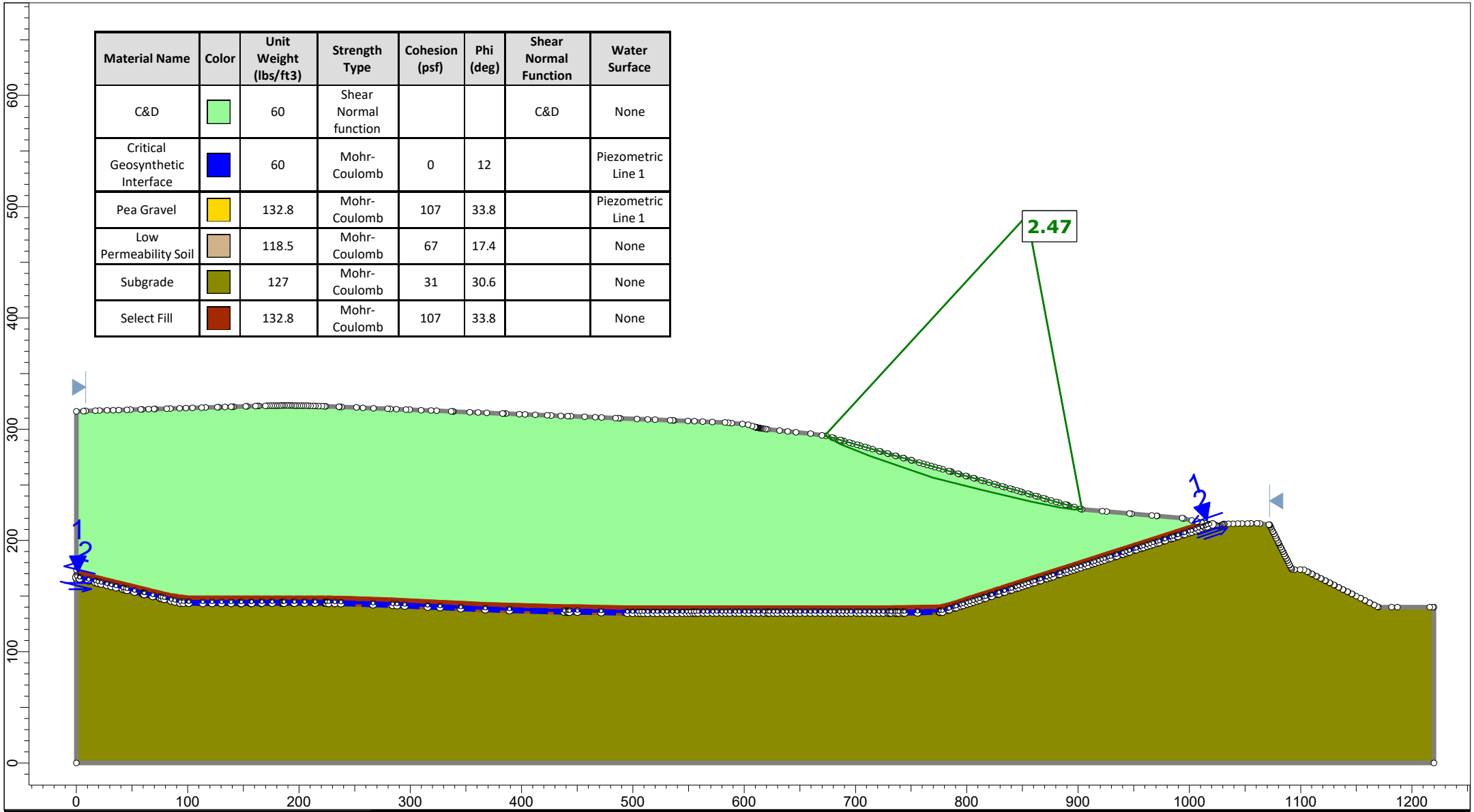
185.376	188.065
188.619	187
189.923	186.575
194.757	185
195.648	184.71
200.895	183
201.373	182.844
207.034	181
207.098	180.979
207.993	180.687
212.823	179.114
213.172	179
218.549	177.248
219.311	177
224.274	175.383
225.449	175
230	173.518
231.588	173
235.725	171.651
237.722	171
241.444	169.784
243.846	169
247.162	167.917
249.97	167
252.88	166.05
256.093	165
258.598	164.182
262.216	163
264.316	162.314
268.34	161
270.035	160.446
274.463	159
275.754	158.578
280.585	157
281.473	156.71
286.71	155
287.186	154.844
292.824	153
292.886	152.98
293.74	152.7
298.583	151.115
298.935	151
304.279	149.251
305.047	149
309.976	147.387
311.159	147
315.674	145.523
317.272	145
321.371	143.659
323.386	143
327.069	141.795
329.5	141
332.77	139.931

335.619	139
339.508	137.716
341.678	137
345.692	135.704
347.866	135
350.959	133.992
354.006	133
357.278	131.924
360.089	131
361.133	130.745
365.215	130.477
368.707	130.493
371.484	131
373.654	131.03
374.386	131.08
377.631	131.239
382.427	131.316
383.677	131.244
387.287	131.197
390.059	131.187
396.735	131.233
398.019	131.268
399.749	131.314
406.24	131.429
409.208	131.512
411.915	131.585
415.53	131.683
424.48	131.93
430.485	132.131
448.199	132.599
448.732	132.618
463.334	133
470.097	133.145
471.17	133.168
483.106	133.425
486.086	133.487
495.863	133.696
500.697	133.797
508.409	133.961
515.014	134.097
518.981	134.181
523.614	134.281
527.447	134.363
529.69	134.406
531.66	134.441
540.373	134.637
554.05	134.953
556.089	135
568.694	135.288
580.167	135.531
584.066	135.617
593.259	135.813
599.175	135.945

607.386	136.128
614.024	136.271
624.97	136.517
628.615	136.596
643.158	136.917
643.782	136.931
646.896	137
658.497	137.248
660.64	137.294
673.082	137.561
677.922	137.665
687.656	137.874
692.236	137.971
699.35	138.123
712.535	138.48
729.855	138.992
730.239	138.992
731.42	139
738.245	140.694
739.951	141
740.007	141.001
741.701	141.015
742.332	141.017
743.317	141.019
753.154	141.287
755.462	141.336
761.566	141.471
765.71	141.559
775.589	141.763
783.012	141.917
790.009	142.066
795.683	142.184
804.848	142.379
808.664	142.459
820.13	142.704
821.971	142.743
833.961	143
835.574	143.035
835.855	143.041
849.047	143.327
851.677	143.384
862.588	143.62
867.593	143.729
876.198	143.915
883.605	144.076
889.878	144.211
899.713	144.425
903.628	144.509
915.919	144.776
917.449	144.809
926.274	145
936.214	145.29
943.717	145.589

962.389	146.22
979.061	147
983.234	148.38
985.11	149
987.287	149.719
991.16	151
994.524	152.112
997.209	153
1000.33	154.033
1003.26	155
1007.19	156.301
1009.31	157
1011.14	157.607
1015.36	159
1020.26	160.621
1021.41	161
1027.04	162.861
1027.46	163
1027.82	163.12
1033.5	165
1034.29	165.258
1039.55	167
1044.85	168.749
1045.6	169
1046.49	169.294
1051.65	171
1053.18	171.503
1057.7	173
1061.67	174.313
1063.75	175
1067.3	176.173
1069.8	177
1072.91	178.028
1075.85	179
1078.52	179.882
1081.9	181
1084.13	181.737
1087.95	183
1089.74	183.591
1091.61	184.21

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section C - Static - Waste Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.465880
Axis Location:	854.137, 492.252
Left Slip Surface Endpoint:	672.388, 294.164
Right Slip Surface Endpoint:	903.558, 228.000
Resisting Moment:	1.58619e+07 lb-ft
Driving Moment:	6.43272e+06 lb-ft
Resisting Horizontal Force:	60717.8 lb
Driving Horizontal Force:	24623.7 lb
Total Slice Area:	1562.16 ft2
Surface Horizontal Width:	231.17 ft
Surface Average Height:	6.75764 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
672.388	294.164
686.128	286.674
713.291	275.828
769.624	256.468
813.452	245.421
857.301	234.967
883.064	229.664
896.804	227.713
903.558	228

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.46588

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.8699	427.783	-28.5957	C&D	0	34.992	15.1941	37.4668	53.524	0	53.524	61.8066	61.8066
2	6.8699	1165.65	-28.5957	C&D	0	34.992	40.9882	101.072	144.39	0	144.39	166.733	166.733
3	9.0543	2296.12	-21.7669	C&D	0	34.992	63.5246	156.644	223.776	0	223.776	249.141	249.141
4	9.0543	2850.91	-21.7669	C&D	0	34.992	78.3992	193.323	276.176	0	276.176	307.481	307.481
5	9.0543	3405.75	-21.7669	C&D	2.84217e-14	34.992	93.1505	229.698	328.14	0	328.14	365.335	365.335
6	9.38892	3970.48	-18.966	C&D	0	34.992	106.835	263.443	376.348	0	376.348	413.064	413.064
7	9.38892	4272.7	-18.966	C&D	0	34.992	114.786	283.048	404.354	0	404.354	443.802	443.802
8	9.38892	4574.99	-18.966	C&D	0	34.992	122.791	302.787	432.553	0	432.553	474.751	474.751
9	9.38892	4877.4	-18.966	C&D	5.68434e-14	34.992	130.872	322.714	461.02	0	461.02	505.996	505.996
10	9.38892	5179.85	-18.966	C&D	5.68434e-14	34.992	139.046	342.871	489.815	0	489.815	537.6	537.6
11	9.38892	5482.18	-18.966	C&D	0	34.992	147.328	363.292	518.989	0	518.989	569.62	569.62
12	8.76545	5179.69	-14.1482	C&D	0	34.992	157.533	388.457	554.939	0	554.939	594.65	594.65
13	8.76545	5020.25	-14.1482	C&D	5.68434e-14	34.992	153.106	377.541	539.345	0	539.345	577.939	577.939
14	8.76545	4860.8	-14.1482	C&D	-5.68434e-14	34.992	148.612	366.46	523.513	0	523.513	560.975	560.975
15	8.76545	4701.27	-14.1482	C&D	0	34.992	144.048	355.204	507.435	0	507.435	543.746	543.746
16	8.76545	4541.76	-14.1482	C&D	0	34.992	139.416	343.782	491.118	0	491.118	526.262	526.262
17	10.9624	5405.96	-13.4092	C&D	0	34.992	133.94	330.281	471.83	0	471.83	503.762	503.762
18	10.9624	5058.29	-13.4092	C&D	5.68434e-14	34.992	125.415	309.258	441.797	0	441.797	471.697	471.697
19	10.9624	4710.17	-13.4092	C&D	0	34.992	116.777	287.959	411.37	0	411.37	439.21	439.21
20	10.9624	4362.3	-13.4092	C&D	0	34.992	108.069	266.484	380.691	0	380.691	406.455	406.455
21	8.58756	3102.15	-11.6301	C&D	0	34.992	99.4063	245.124	350.178	0	350.178	370.638	370.638
22	8.58756	2744.43	-11.6301	C&D	-2.84217e-14	34.992	87.6555	216.148	308.782	0	308.782	326.824	326.824
23	8.58756	2386.7	-11.6301	C&D	0	34.992	75.9469	187.276	267.537	0	267.537	283.168	283.168
24	13.7398	2699.24	-8.08107	C&D	2.84217e-14	34.992	54.5282	134.46	192.085	0	192.085	199.827	199.827
25	6.75461	453.069	2.42996	C&D	7.10543e-15	34.992	19.4824	48.0413	68.6304	0	68.6304	67.8036	67.8036

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.46588

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	672.388	294.164	0	0	0
2	679.258	290.419	96.0586	3.17646	1.89396
3	686.128	286.674	355.191	23.3886	3.76737
4	695.182	283.059	589.05	63.6934	6.17136
5	704.237	279.443	877.669	130.575	8.4621
6	713.291	275.828	1220.59	228.46	10.6015
7	722.68	272.601	1431.83	320.717	12.6253
8	732.069	269.375	1658.79	426.588	14.4221
9	741.458	266.148	1901.58	544.164	15.9692
10	750.847	262.922	2160.35	670.804	17.2499
11	760.236	259.695	2435.28	803.161	18.2527
12	769.624	256.468	2726.58	937.224	18.9697
13	778.39	254.259	2571.88	904.536	19.3769
14	787.155	252.049	2421.52	858.877	19.5288
15	795.921	249.84	2275.58	802.46	19.4247
16	804.686	247.63	2134.12	737.544	19.065
17	813.452	245.421	1997.2	666.379	18.4516
18	824.414	242.807	1761.98	549.901	17.3328
19	835.376	240.194	1541.73	437.258	15.8341
20	846.339	237.58	1336.65	332.632	13.9745
21	857.301	234.967	1146.86	239.214	11.7819
22	865.889	233.199	912.115	158.486	9.85711
23	874.476	231.432	705.116	96.2957	7.77661
24	883.064	229.664	525.768	51.2729	5.56987
25	896.804	227.713	151.271	4.91853	1.8623
26	903.558	228	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	167.667
2.61045	167.033
2.74827	167
2.93545	166.955
10.984	165
16.9104	163.561
19.2198	163
22.3549	162.239
27.4555	161
31.2131	160.088
35.6913	159
41.768	157.524
43.927	157
45.5183	156.614
52.1628	155
59.8261	153.139
59.8924	153.123
60.4145	153
60.8582	152.895
60.9162	152.881

68.6396	151
75.206	149.4
76.8497	149
79.0691	148.459
85.0598	147
88.4071	146.185
93.2699	145
96.1305	144.964
100.713	144.947
101.016	144.941
113.425	144.821
121.918	144.822
130.421	144.823
138.934	144.824
147.456	144.825
148.142	144.848
156.777	144.849
157.383	144.866
166.104	144.867
166.646	144.881
175.435	144.882
175.924	144.893
184.77	144.893
185.454	144.904
186.03	144.91
186.471	144.91
195.39	144.911
195.828	144.911
204.75	144.912
205.185	144.912
214.11	144.912
214.542	144.912
223.469	144.913
223.899	144.913
224.328	144.913
224.757	144.913
226.606	144.875
232.206	144.736
237.619	144.555
266.437	143.593
284.194	143
288.023	142.82
294.955	142.494
315.577	141.526
326.764	141
345.352	140.109
367.261	139
389.122	138.384
438.282	137
441.106	136.989
441.813	136.988
442.992	136.982
450.152	136.954

471.589	136.475
495.112	136.041
499.816	136.042
504.522	136.042
507.015	136.043
509.52	136.047
513.255	136.047
518.191	136.045
521.934	136.044
526.857	136.043
530.609	136.042
535.521	136.04
539.492	136.044
544.41	136.042
548.376	136.045
551.45	136.051
554.115	136.053
556.005	136.053
558.664	136.055
563.412	136.057
566.946	136.064
571.737	136.066
575.242	136.073
580.075	136.075
583.551	136.082
586.977	136.088
591.874	136.09
595.541	136.09
600.448	136.093
604.107	136.093
609.025	136.095
612.675	136.095
617.604	136.097
621.244	136.097
622.641	136.096
626.431	136.093
629.889	136.087
634.698	136.083
638.19	136.076
641.731	136.07
646.478	136.066
650.054	136.06
654.753	136.056
659.419	136.052
663.75	136.06
668.432	136.056
672.746	136.063
677.444	136.06
680.743	136.07
685.469	136.067
688.752	136.077
692.299	136.081
695.852	136.075

701.119	136.075
703.992	136.063
708.239	136.071
712.549	136.079
716.654	136.084
721.014	136.092
725.057	136.098
729.467	136.106
730.766	136.109
732.057	136.112
735.706	136.117
737.361	136.116
738.906	136.115
742.564	136.12
743.989	136.118
755.732	136.35
775.632	136.895
775.782	136.895
775.919	136.894
776.153	136.893
778.05	137
783.506	138.753
784.276	139
789.286	140.609
790.503	141
794.831	142.39
796.73	143
800.37	144.169
802.957	145
805.905	145.947
809.183	147
811.435	147.723
815.41	149
816.957	149.497
821.637	151
822.473	151.269
827.863	153
827.984	153.039
828.909	153.336
833.494	154.808
834.09	155
838.998	156.577
840.317	157
844.497	158.343
846.543	159
849.989	160.107
852.77	161
855.476	161.869
858.997	163
860.956	163.629
865.223	165
866.43	165.387
871.45	167

871.897	167.144
875.09	168.169
877.36	168.898
877.677	169
882.821	170.652
883.903	171
888.276	172.404
890.13	173
893.723	174.154
896.357	175
899.164	175.902
902.583	177
906.152	178.146
908.81	179
912.925	180.322
915.037	181
918.41	182.083
921.263	183
923.888	183.843
927.49	185
929.36	185.601
933.717	187
934.825	187.356
939.944	189
940.292	189.112
943.235	190.057
945.863	190.901
946.17	191
951.208	192.618
952.397	193
956.633	194.361
958.624	195
962.07	196.107
964.85	197
967.5	197.851
971.077	199
972.917	199.591
977.304	201
978.32	201.326
983.53	203
983.726	203.063
985.426	203.609
989.318	204.859
989.757	205
994.64	206.568
995.984	207
999.949	208.274
1002.21	209
1005.61	210.122
1008.27	211
1011.51	212.172
1013.9	213
1014.76	213.314

1016.17	213.831
1018.57	214.636

External Boundary

X	Y
0	316.109
0	173.667
0	168.667
0	167.667
0	166.667
0	164.667
0	0
1219.81	0
1219.81	140
1218.71	140
1216.08	140
1186.91	140
1181.65	140
1169.98	140
1168.96	140.51
1165.98	142
1165.94	142.022
1161.98	144
1161.87	144.052
1157.97	146
1157.81	146.083
1153.97	148
1153.74	148.113
1149.97	150
1146.3	151.832
1145.96	152
1142.35	153.804
1141.96	154
1138.41	155.775
1137.96	156
1134.46	157.746
1133.96	158
1130.52	159.716
1129.95	160
1126.58	161.687
1125.95	162
1122.63	163.658
1121.95	164
1118.69	165.628
1117.94	166
1114.74	167.599
1113.94	168
1110.8	169.569
1109.94	170
1106.86	171.539
1105.93	172
1102.91	173.513

1099.52	173.859
1094.52	173.86
1092.03	174
1091.53	174.999
1091.03	176
1090.13	177.801
1090.03	178
1089.94	178.171
1089.03	180
1088.12	181.822
1088.03	182
1087.11	183.832
1087.03	184
1086.11	185.84
1086.03	186
1085.11	187.848
1085.03	188
1084.1	189.856
1084.03	190
1083.1	191.864
1083.03	192
1082.1	193.874
1082.03	194
1081.09	195.885
1081.03	196
1080.32	197.424
1080.04	198
1079.89	198.297
1079.04	200
1078.08	201.905
1078.04	202
1077.98	202.109
1077.04	204
1076.2	205.676
1076.04	206
1075.05	207.97
1075.04	208
1075.02	208.038
1074.04	210
1073.25	211.588
1073.04	212
1072.31	213.453
1072.04	214
1071.94	214.206
1071.32	214.159
1063.42	215.257
1060.85	215.402
1055.24	215.305
1052.25	215.254
1047.24	215.167
1043.65	215.105
1039.23	215.029
1035.05	214.956

1031.23	214.89
1031.21	214.89
1031.2	214.89
1030.1	214.34
1029.41	214
1028.1	213.348
1027.2	212.901
1026.1	212.904
1025.2	212.906
1024.29	213.363
1024.06	213.481
1023.02	214
1021.42	214.349
1021.42	214.349
1020.86	214.406
1018.57	214.636
1018.35	214.657
1016.17	214.831
1016.17	214.831
1014.12	215.298
1011.03	216
1007.6	216.78
1006.66	216.994
1002.24	218
994.715	219.711
993.444	220
971.061	221.961
970.626	222
966.337	222.38
948.029	224
946.173	224.161
925.668	226
921.667	226.352
903.558	228
902.15	228.407
896.627	230
890.917	231.686
889.857	232
888.805	232.302
882.886	234
880.441	234.701
875.91	236
870.915	237.432
868.933	238
863.881	239.448
861.956	240
856.849	241.464
854.979	242
849.816	243.48
848.002	244
844.816	244.913
841.024	246
838.911	246.606

834.049	248
831.937	248.605
827.072	250
824.844	250.639
820.092	252
815.118	253.427
813.119	254
807.03	255.746
806.142	256
799.957	257.773
799.166	258
792.927	259.789
792.189	260
785.902	261.802
785.213	262
784	262.348
778.236	264
774.987	264.932
771.259	266
767.956	266.946
764.278	268
760.966	268.949
757.298	270
750.551	271.933
750.317	272
750.187	272.037
743.335	274
743.061	274.079
736.354	276
736.025	276.094
729.373	278
728.994	278.109
722.393	280
721.65	280.213
715.413	282
711.155	283.22
708.431	284
704.082	285.246
701.451	286
697.045	287.263
694.47	288
689.688	289.37
687.491	290
686.287	290.345
680.51	292
679.092	292.406
673.53	294
669.841	294.53
659.621	296
646.437	297.28
639.023	298
631.875	298.773
620.523	300

619.315	300.188
617.055	300.54
615.53	300.777
614.431	300.948
613.602	301.077
612.954	301.178
612.434	301.259
612.007	301.326
611.651	301.381
611.349	301.428
610.968	301.547
610.518	301.688
609.978	301.857
609.52	302
607.088	302.81
603.517	304
598.461	304.667
588.88	305.484
585.658	305.81
582.821	306
571.381	306.465
562.784	306.814
555.284	307.119
549.352	307.36
536.852	307.868
535.963	307.904
533.597	308
520.061	308.55
513.256	308.826
503.601	309.219
488.514	309.832
487.129	309.888
484.372	310
471.823	310.51
466.201	310.738
456.663	311.126
444.195	311.632
441.407	311.746
435.148	312
426.585	312.348
423.112	312.489
412.237	312.931
403.018	313.305
398.046	313.507
385.924	314
383.861	314.084
382.932	314.122
368.722	314.699
360.927	315.016
353.446	315.32
338.63	315.922
338.031	315.946
336.699	316

323.645	316.53
318.615	316.735
309.688	317.097
299.451	317.513
296.058	317.651
287.475	318
282.072	318.219
279.631	318.319
266.885	318.837
257.515	319.217
251.553	319.46
238.25	320
236.354	320.077
236.173	320.083
235.965	320.089
224.14	320.551
222.969	320.58
220.62	320.668
217.402	320.78
214.627	320.868
213.003	320.9
210.498	320.971
208.258	321.027
206.459	321.054
204.401	321.099
202.505	321.134
200.731	321.162
198.84	321.182
197.16	321.202
195.55	321.217
193.625	321.229
192.069	321.238
190.542	321.241
189.025	321.24
187.104	321.244
185.592	321.237
184.055	321.226
182.47	321.208
180.586	321.204
178.955	321.18
177.231	321.148
175.401	321.135
173.584	321.095
171.608	321.044
169.885	321.023
163.988	320.857
162.472	320.831
161.042	320.799
153.258	320.573
152.168	320.544
141.311	320.227
139.934	320.187
138.971	320.159

133.511	320
127.85	319.835
126.697	319.801
116.045	319.491
112.503	319.388
104.328	319.15
98.4359	318.978
92.6962	318.811
84.4928	318.572
81.1502	318.474
70.6725	318.169
69.6887	318.14
64.8782	318
58.8789	317.825
57.7947	317.794
48.471	317.522
45.4995	317.435
38.0244	317.217
33.1503	317.075
27.539	316.912
20.747	316.714
17.0146	316.605
8.28898	316.351
6.451	316.297

Material Boundary

X	Y
0	164.667
2.61045	164.033
2.74827	164
2.93545	163.955
10.984	162
16.9104	160.561
19.2198	160
22.3549	159.239
27.4555	158
31.2131	157.088
35.6913	156
41.768	154.524
43.927	154
45.5183	153.614
52.1628	152
59.8261	150.139
59.8924	150.123
60.4145	150
60.8582	149.895
60.9162	149.881
68.6396	148
75.206	146.4
76.8497	146
79.0691	145.459
85.0598	144

88.4071	143.185
93.2699	142
96.1305	141.964
100.713	141.947
101.016	141.941
113.425	141.821
121.918	141.822
130.421	141.823
138.934	141.824
147.456	141.825
148.142	141.848
156.777	141.849
157.383	141.866
166.104	141.867
166.646	141.881
175.435	141.882
175.924	141.893
184.77	141.893
185.454	141.904
186.03	141.91
186.471	141.91
195.39	141.911
195.828	141.911
204.75	141.912
205.185	141.912
214.11	141.912
214.542	141.912
223.469	141.913
223.899	141.913
224.328	141.913
224.757	141.913
226.606	141.875
232.206	141.736
237.619	141.555
266.437	140.593
284.194	140
288.023	139.82
294.955	139.494
315.577	138.526
326.764	138
345.352	137.109
367.261	136
389.122	135.384
438.282	134
441.106	133.989
441.813	133.988
442.992	133.982
450.152	133.954
471.589	133.475
495.112	133.041
499.816	133.042
504.522	133.042
507.015	133.043

509.52	133.047
513.255	133.047
518.191	133.045
521.934	133.044
526.857	133.043
530.609	133.042
535.521	133.04
539.492	133.044
544.41	133.042
548.376	133.045
551.45	133.051
554.115	133.053
556.005	133.053
558.664	133.055
563.412	133.057
566.946	133.064
571.737	133.066
575.242	133.073
580.075	133.075
583.551	133.082
586.977	133.088
591.874	133.09
595.541	133.09
600.448	133.093
604.107	133.093
609.025	133.095
612.675	133.095
617.604	133.097
621.244	133.097
622.641	133.096
626.431	133.093
629.889	133.087
634.698	133.083
638.19	133.076
641.731	133.07
646.478	133.066
650.054	133.06
654.753	133.056
659.419	133.052
663.75	133.06
668.432	133.056
672.746	133.063
677.444	133.06
680.743	133.07
685.469	133.067
688.752	133.077
692.299	133.081
695.852	133.075
701.119	133.075
703.992	133.063
708.239	133.071
712.549	133.079
716.654	133.084

721.014	133.092
725.057	133.098
729.467	133.106
730.766	133.109
732.057	133.112
735.706	133.117
737.361	133.116
738.906	133.115
742.564	133.12
743.989	133.118
755.732	133.35
775.632	133.895
775.782	133.895
775.919	133.894
776.153	133.893
778.05	134
783.506	135.753
784.276	136
789.286	137.609
790.503	138
794.831	139.39
796.73	140
800.37	141.169
802.957	142
805.905	142.947
809.183	144
811.435	144.723
815.41	146
816.957	146.497
821.637	148
822.473	148.269
827.863	150
827.984	150.039
828.909	150.336
833.494	151.808
834.09	152
838.998	153.577
840.317	154
844.497	155.343
846.543	156
849.989	157.107
852.77	158
855.476	158.869
858.997	160
860.956	160.629
865.223	162
866.43	162.387
871.45	164
871.897	164.144
875.09	165.169
877.36	165.898
877.677	166
882.821	167.652

883.903	168
888.276	169.404
890.13	170
893.723	171.154
896.357	172
899.164	172.902
902.583	174
906.152	175.146
908.81	176
912.925	177.322
915.037	178
918.41	179.083
921.263	180
923.888	180.843
927.49	182
929.36	182.601
933.717	184
934.825	184.356
939.944	186
940.292	186.112
943.235	187.057
945.863	187.901
946.17	188
951.208	189.618
952.397	190
956.633	191.361
958.624	192
962.07	193.107
964.85	194
967.5	194.851
971.077	196
972.917	196.591
977.304	198
978.32	198.326
983.53	200
983.726	200.063
985.426	200.609
989.318	201.859
989.757	202
994.64	203.568
995.984	204
999.949	205.274
1002.21	206
1005.61	207.122
1008.27	208
1011.51	209.172
1013.9	210
1014.76	210.314
1016.17	210.831
1024.06	213.481

Material Boundary

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4
76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185
93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893
185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911
195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912

223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041
499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047
513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073
580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09
595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095

617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
650.054	135.06
654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063
708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092
725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138
789.286	139.609
790.503	140
794.831	141.39
796.73	142
800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723

815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.821	169.652
883.903	170
888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356
939.944	188
940.292	188.112
943.235	189.057
945.863	189.901
946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194

962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

Material Boundary

X	Y
0	168.667
2.61045	168.033
2.74827	168
2.93545	167.955
10.984	166
16.9104	164.561
19.2198	164
22.3549	163.239
27.4555	162
31.2131	161.088
35.6913	160
41.768	158.524
43.927	158
45.5183	157.614
52.1628	156
59.8261	154.139
59.8924	154.123
60.4145	154
60.8582	153.895
60.9162	153.881
68.6396	152
75.206	150.4
76.8497	150
79.0691	149.459
85.0598	148
88.4071	147.185

93.2699	146
96.1305	145.964
100.713	145.947
101.016	145.941
113.425	145.821
121.918	145.822
130.421	145.823
138.934	145.824
147.456	145.825
148.142	145.848
156.777	145.849
157.383	145.866
166.104	145.867
166.646	145.881
175.435	145.882
175.924	145.893
184.77	145.893
185.454	145.904
186.03	145.91
186.471	145.91
195.39	145.911
195.828	145.911
204.75	145.912
205.185	145.912
214.11	145.912
214.542	145.912
223.469	145.913
223.899	145.913
224.328	145.913
224.757	145.913
226.606	145.875
232.206	145.736
237.619	145.555
266.437	144.593
284.194	144
288.023	143.82
294.955	143.494
315.577	142.526
326.764	142
345.352	141.109
367.261	140
389.122	139.384
438.282	138
441.106	137.989
441.813	137.988
442.992	137.982
450.152	137.954
471.589	137.475
495.112	137.041
499.816	137.042
504.522	137.042
507.015	137.043
509.52	137.047

513.255	137.047
518.191	137.045
521.934	137.044
526.857	137.043
530.609	137.042
535.521	137.04
539.492	137.044
544.41	137.042
548.376	137.045
551.45	137.051
554.115	137.053
556.005	137.053
558.664	137.055
563.412	137.057
566.946	137.064
571.737	137.066
575.242	137.073
580.075	137.075
583.551	137.082
586.977	137.088
591.874	137.09
595.541	137.09
600.448	137.093
604.107	137.093
609.025	137.095
612.675	137.095
617.604	137.097
621.244	137.097
622.641	137.096
626.431	137.093
629.889	137.087
634.698	137.083
638.19	137.076
641.731	137.07
646.478	137.066
650.054	137.06
654.753	137.056
659.419	137.052
663.75	137.06
668.432	137.056
672.746	137.063
677.444	137.06
680.743	137.07
685.469	137.067
688.752	137.077
692.299	137.081
695.852	137.075
701.119	137.075
703.992	137.063
708.239	137.071
712.549	137.079
716.654	137.084
721.014	137.092

725.057	137.098
729.467	137.106
730.766	137.109
732.057	137.112
735.706	137.117
737.361	137.116
738.906	137.115
742.564	137.12
743.989	137.118
755.732	137.35
775.632	137.895
775.782	137.895
775.919	137.894
776.153	137.893
778.05	138
783.506	139.753
784.276	140
789.286	141.609
790.503	142
794.831	143.39
796.73	144
800.37	145.169
802.957	146
805.905	146.947
809.183	148
811.435	148.723
815.41	150
816.957	150.497
821.637	152
822.473	152.269
827.863	154
827.984	154.039
828.909	154.336
833.494	155.808
834.09	156
838.998	157.577
840.317	158
844.497	159.343
846.543	160
849.989	161.107
852.77	162
855.476	162.869
858.997	164
860.956	164.629
865.223	166
866.43	166.387
871.45	168
871.897	168.144
875.09	169.169
877.36	169.898
877.677	170
882.821	171.652
883.903	172

888.276	173.404
890.13	174
893.723	175.154
896.357	176
899.164	176.902
902.583	178
906.152	179.146
908.81	180
912.925	181.322
915.037	182
918.41	183.083
921.263	184
923.888	184.843
927.49	186
929.36	186.601
933.717	188
934.825	188.356
939.944	190
940.292	190.112
943.235	191.057
945.863	191.901
946.17	192
951.208	193.618
952.397	194
956.633	195.361
958.624	196
962.07	197.107
964.85	198
967.5	198.851
971.077	200
972.917	200.591
977.304	202
978.32	202.326
983.53	204
983.726	204.063
985.426	204.609
989.318	205.859
989.757	206
994.64	207.568
995.984	208
999.949	209.274
1002.21	210
1005.61	211.122
1008.27	212
1011.51	213.172
1013.9	214
1014.76	214.314
1016.17	214.831
1016.17	214.831

Material Boundary

X	Y

0	173.667
2.61045	173.033
2.74827	173
2.93545	172.955
10.984	171
16.9104	169.561
19.2198	169
22.3549	168.239
27.4555	167
31.2131	166.088
35.6913	165
41.768	163.524
43.927	163
45.5183	162.614
52.1628	161
59.8261	159.139
59.8924	159.123
60.4145	159
60.8582	158.895
60.9162	158.881
68.6396	157
75.206	155.4
76.8497	155
79.0691	154.459
85.0598	153
88.4071	152.185
93.2699	151
96.1305	150.964
100.713	150.947
101.016	150.941
113.425	150.821
121.918	150.822
130.421	150.823
138.934	150.824
147.456	150.825
148.142	150.848
156.777	150.849
157.383	150.866
166.104	150.867
166.646	150.881
175.435	150.882
175.924	150.893
184.77	150.893
185.454	150.904
186.03	150.91
186.471	150.91
195.39	150.911
195.828	150.911
204.75	150.912
205.185	150.912
214.11	150.912
214.542	150.912
223.469	150.913

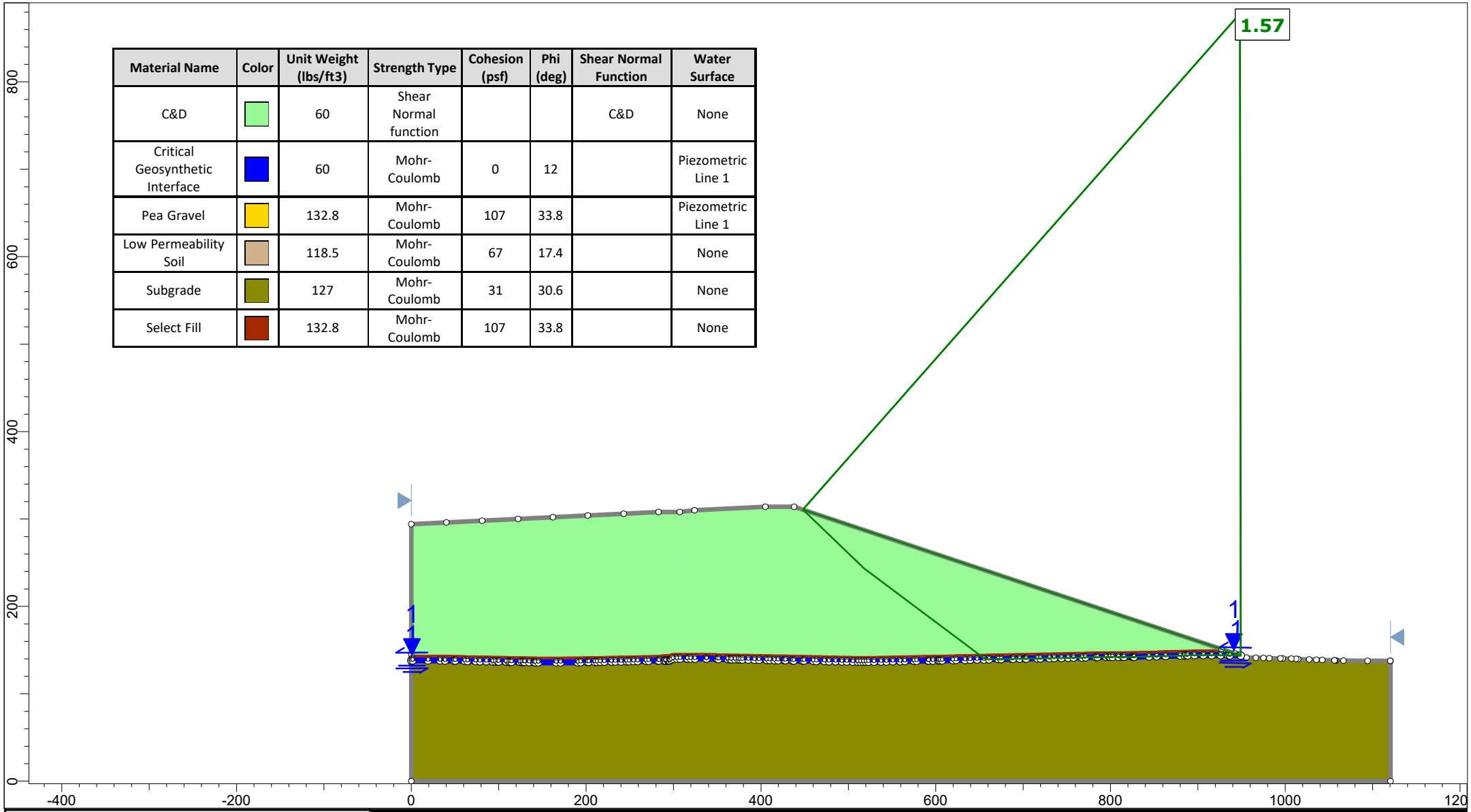
223.899	150.913
224.328	150.913
224.757	150.913
226.606	150.875
232.206	150.736
237.619	150.555
266.437	149.593
284.194	149
288.023	148.82
294.955	148.494
315.577	147.526
326.764	147
345.352	146.109
367.261	145
389.122	144.384
438.282	143
441.106	142.989
441.813	142.988
442.992	142.982
450.152	142.954
471.589	142.475
495.112	142.041
499.816	142.042
504.522	142.042
507.015	142.043
509.52	142.047
513.255	142.047
518.191	142.045
521.934	142.044
526.857	142.043
530.609	142.042
535.521	142.04
539.492	142.044
544.41	142.042
548.376	142.045
551.45	142.051
554.115	142.053
556.005	142.053
558.664	142.055
563.412	142.057
566.946	142.064
571.737	142.066
575.242	142.073
580.075	142.075
583.551	142.082
586.977	142.088
591.874	142.09
595.541	142.09
600.448	142.093
604.107	142.093
609.025	142.095
612.675	142.095
617.604	142.097

621.244	142.097
622.641	142.096
626.431	142.093
629.889	142.087
634.698	142.083
638.19	142.076
641.731	142.07
646.478	142.066
650.054	142.06
654.753	142.056
659.419	142.052
663.75	142.06
668.432	142.056
672.746	142.063
677.444	142.06
680.743	142.07
685.469	142.067
688.752	142.077
692.299	142.081
695.852	142.075
701.119	142.075
703.992	142.063
708.239	142.071
712.549	142.079
716.654	142.084
721.014	142.092
725.057	142.098
729.467	142.106
730.766	142.109
732.057	142.112
735.706	142.117
737.361	142.116
738.906	142.115
742.564	142.12
743.989	142.118
755.732	142.35
775.632	142.895
775.782	142.895
775.919	142.894
776.153	142.893
778.05	143
783.506	144.753
784.276	145
789.286	146.609
790.503	147
794.831	148.39
796.73	149
800.37	150.169
802.957	151
805.905	151.947
809.183	153
811.435	153.723
815.41	155

816.957	155.497
821.637	157
822.473	157.269
827.863	159
827.984	159.039
828.909	159.336
833.494	160.808
834.09	161
838.998	162.577
840.317	163
844.497	164.343
846.543	165
849.989	166.107
852.77	167
855.476	167.869
858.997	169
860.956	169.629
865.223	171
866.43	171.387
871.45	173
871.897	173.144
875.09	174.169
877.36	174.898
877.677	175
882.821	176.652
883.903	177
888.276	178.404
890.13	179
893.723	180.154
896.357	181
899.164	181.902
902.583	183
906.152	184.146
908.81	185
912.925	186.322
915.037	187
918.41	188.083
921.263	189
923.888	189.843
927.49	191
929.36	191.601
933.717	193
934.825	193.356
939.944	195
940.292	195.112
943.235	196.057
945.863	196.901
946.17	197
951.208	198.618
952.397	199
956.633	200.361
958.624	201
962.07	202.107

964.85	203
967.5	203.851
971.077	205
972.917	205.591
977.304	207
978.32	207.326
983.53	209
983.726	209.063
985.426	209.609
989.318	210.859
989.757	211
994.64	212.568
995.984	213
999.949	214.274
1002.21	215
1005.61	216.122
1007.6	216.78

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section D - Static - Waste Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:03m:48.910s
Date Created:	7/28/2021, 10:59:59 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.566460
Axis Location:	947.968, 878.110
Left Slip Surface Endpoint:	447.946, 310.684
Right Slip Surface Endpoint:	949.110, 143.595
Resisting Moment:	4.79817e+08 lb-ft
Driving Moment:	3.06307e+08 lb-ft
Resisting Horizontal Force:	550323 lb
Driving Horizontal Force:	351317 lb
Total Slice Area:	26373.1 ft2
Surface Horizontal Width:	501.164 ft
Surface Average Height:	52.6236 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
447.946	310.684
517.688	243.622
656.827	139.279
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.795	142
826.896	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.56646

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	69.7417	91660.3	-43.8776	C&D	1.13687e-13	34.992	387.212	606.552	866.503	0	866.503	1238.83	1238.83
2	130.139	553704	-36.8671	C&D	207.75	30.8002	1242.12	1945.73	2915.46	0	2915.46	3846.95	3846.95
3	6.49247	39889.8	-36.8671	Select Fill	107	33.8	1845.45	2890.82	4158.42	0	4158.42	5542.37	5542.37
4	1.29849	8387.97	-36.8671	Pea Gravel	107	33.8	1939.53	3038.19	4378.56	0	4378.56	5833.05	5833.05
5	1.20975	7937.66	-36.8671	Pea Gravel	107	33.8	1958.79	3068.36	4452.69	29.0571	4423.64	5921.63	5892.57
6	4.3116	28324	0.249143	Critical Geosynthetic Interface	0	12	920.011	1441.16	6840.37	60.2571	6780.11	6836.36	6776.11
7	10.3537	66452	1.15722	Critical Geosynthetic Interface	0	12	909.758	1425.1	6766.93	62.3895	6704.54	6748.56	6686.17
8	3.41639	21428.1	1.15722	Critical Geosynthetic Interface	0	12	891.871	1397.08	6635.13	62.3895	6572.74	6617.11	6554.72
9	12.5555	76622.9	1.15722	Critical Geosynthetic Interface	0	12	870.632	1363.81	6478.62	62.3895	6416.23	6461.03	6398.64
10	1.18099	7035.16	1.15722	Critical Geosynthetic Interface	0	12	852.093	1334.77	6342	62.3895	6279.61	6324.78	6262.39
11	7.27292	42672.5	1.15722	Critical Geosynthetic Interface	0	12	840.487	1316.59	6256.44	62.3895	6194.05	6239.46	6177.07
12	6.54642	37450.2	1.15722	Critical Geosynthetic Interface	0	12	821.279	1286.5	6114.91	62.3895	6052.52	6098.32	6035.93
13	1.0537	5942.98	1.15722	Critical Geosynthetic Interface	0	12	810.598	1269.77	6036.17	62.3895	5973.78	6019.8	5957.41
14	12.8437	70546.4	1.15722	Critical Geosynthetic Interface	0	12	790.77	1238.71	5890.04	62.3895	5827.65	5874.06	5811.67
15	3.28235	17467.4	1.15722	Critical Geosynthetic Interface	0	12	767.482	1202.23	5718.43	62.3895	5656.04	5702.92	5640.53
16	10.5551	54620.5	1.15722	Critical Geosynthetic Interface	0	12	747.15	1170.38	5568.59	62.3895	5506.2	5553.5	5491.11
17	5.49021	27476.4	1.15722	Critical Geosynthetic Interface	0	12	723.293	1133.01	5392.81	62.3895	5330.42	5378.19	5315.81
18	8.28755	40264.7	1.15722	Critical Geosynthetic Interface	0	12	702.533	1100.49	5239.8	62.3895	5177.41	5225.61	5163.22
19	7.67752	36000.6	1.15722	Critical Geosynthetic Interface	0	12	678.211	1062.39	5060.56	62.3895	4998.18	5046.87	4984.48
20	6.041	27447.7	1.15722	Critical Geosynthetic Interface	0	12	657.099	1029.32	4904.98	62.3895	4842.59	4891.7	4829.31
21	9.84447	43070.1	1.15722	Critical Geosynthetic Interface	0	12	632.416	990.654	4723.05	62.3895	4660.66	4710.27	4647.88
22	3.81517	16138.7	1.15722	Critical Geosynthetic Interface	0	12	611.036	957.163	4565.49	62.3895	4503.11	4553.15	4490.76

23	11.9913	48714.3	1.15722	Critical Geosynthetic Interface	0	12	586.094	918.093	4381.68	62.3895	4319.29	4369.84	4307.45
24	1.60986	6307.74	1.15722	Critical Geosynthetic Interface	0	12	564.53	884.314	4222.76	62.3895	4160.37	4211.35	4148.96
25	9.97162	37845.6	1.15722	Critical Geosynthetic Interface	0	12	546.069	855.395	4086.71	62.3895	4024.32	4075.68	4013.29
26	3.40817	12457.2	0.204137	Critical Geosynthetic Interface	0	12	520.696	815.65	3899.73	62.3895	3837.34	3897.87	3835.48
27	1.24758	4501.38	0.125349	Critical Geosynthetic Interface	0	12	513.359	804.157	3845.65	62.3895	3783.26	3844.52	3782.13
28	2.68835	9592.84	0.238314	Critical Geosynthetic Interface	0	12	507.919	795.635	3805.57	62.3895	3743.18	3803.46	3741.07
29	7.04047	24429.8	0.203264	Critical Geosynthetic Interface	0	12	493.092	772.409	3696.29	62.3895	3633.9	3694.54	3632.15
30	4.87714	16336.8	0.113922	Critical Geosynthetic Interface	0	12	474.788	743.736	3561.38	62.3895	3499	3560.44	3498.05
31	1.15297	3792.35	-0.239823	Critical Geosynthetic Interface	0	12	464.45	727.543	3485.21	62.3895	3422.82	3487.16	3424.77
32	10.0876	32064.4	-0.317514	Critical Geosynthetic Interface	0	12	447.737	701.362	3362.04	62.3895	3299.65	3364.52	3302.13
33	0.675026	2074.11	-0.0457245	Critical Geosynthetic Interface	0	12	432.884	678.095	3252.57	62.3895	3190.18	3252.92	3190.53
34	0.68978	2110.03	0.0374701	Critical Geosynthetic Interface	0	12	431.119	675.33	3239.57	62.3872	3177.18	3239.29	3176.9
35	0.100717	307.294	0.0395942	Critical Geosynthetic Interface	0	12	429.941	673.486	3230.89	62.3895	3168.5	3230.59	3168.2
36	17.1855	49127.2	2.16691	Critical Geosynthetic Interface	0	12	407.38	638.144	3064.6	62.3664	3002.23	3049.18	2986.82
37	8.76831	22558.6	1.48686	Critical Geosynthetic Interface	0	12	361.851	566.825	2729.09	62.3895	2666.7	2719.7	2657.31
38	10.2174	24170.7	1.93867	Critical Geosynthetic Interface	0	12	331.477	519.245	2505.25	62.3895	2442.86	2494.03	2431.64
39	16.6274	34502.3	1.34699	Critical Geosynthetic Interface	0	12	286.595	448.939	2174.48	62.3895	2112.09	2167.74	2105.35
40	5.00303	9218.74	1.6504	Critical Geosynthetic Interface	0	12	252.398	395.372	1922.47	62.3895	1860.08	1915.2	1852.81
41	2.32748	4103.65	1.524	Critical Geosynthetic Interface	0	12	240.438	376.637	1834.33	62.3895	1771.94	1827.93	1765.54
42	1.22624	2115.26	1.13275	Critical Geosynthetic Interface	0	12	234.322	367.056	1789.25	62.3895	1726.86	1784.62	1722.23
43	7.83115	12757.1	1.13404	Critical Geosynthetic Interface	0	12	220.231	344.983	1685.41	62.3895	1623.02	1681.05	1618.66
44	10.341	14907.2	0.194502	Critical Geosynthetic Interface	0	12	192.039	300.821	1477.64	62.3895	1415.25	1476.99	1414.6
45	9.57219	11875.1	0.149724	Critical Geosynthetic Interface	0	12	163.136	255.546	1264.64	62.3895	1202.25	1264.21	1201.82
46	9.98167	10432.9	-0.180702	Critical Geosynthetic Interface	0	12	135.168	211.735	1058.52	62.3895	996.135	1058.95	996.561
47	8.44311	6590.33	-0.194337	Critical Geosynthetic Interface	0	12	98.2796	153.951	786.672	62.3895	724.283	787.005	724.616

48	1.67995	944.881	-1.58113	Critical Geosynthetic Interface	0	12	67.9583	106.454	563.218	62.3895	500.828	565.094	502.704
49	0.449087	233.174	-1.58092	Critical Geosynthetic Interface	0	12	62.0571	97.2099	519.726	62.3895	457.336	521.438	459.049
50	12.5608	3203.62	-1.58108	Critical Geosynthetic Interface	0	12	26.1362	40.9413	255.004	62.3895	192.614	255.725	193.335

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.56646

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	447.946	310.684	0	0	0
2	517.688	243.622	31096.6	5246	9.57564
3	647.826	146.029	153935	58263.8	20.7315
4	654.319	141.16	162197	62161.8	20.9693
5	655.617	140.186	163941	62973.8	21.013
6	656.827	139.279	165610	63746.2	21.0526
7	661.139	139.297	161514	62596.3	21.1843
8	671.492	139.507	150677	59177.6	21.4422
9	674.909	139.576	147171	57999.3	21.5091
10	687.464	139.829	134594	53500.5	21.6776
11	688.645	139.853	133436	53066	21.6872
12	695.918	140	126402	50358.7	21.7224
13	702.465	140.132	120216	47885.8	21.7189
14	703.518	140.154	119233	47485.5	21.7153
15	716.362	140.413	107546	42584.4	21.6018
16	719.644	140.479	104647	41332	21.5523
17	730.199	140.692	95571	37332.5	21.3369
18	735.69	140.803	91000.7	35280.1	21.1908
19	743.977	140.971	84299.6	32235.4	20.9264
20	751.655	141.126	78306.3	29487.1	20.6344
21	757.696	141.248	73737.1	27383	20.373
22	767.54	141.447	66570.4	24081.5	19.8873
23	771.355	141.524	63886.7	22848.9	19.6794
24	783.347	141.766	55795.3	19162.7	18.9549
25	784.957	141.799	54749	18690.8	18.8494
26	794.928	142	48479.1	15895.7	18.1537
27	798.336	142.012	46656.6	15069	17.8993
28	799.584	142.015	46005.5	14774.3	17.804
29	802.272	142.026	44597.1	14142.7	17.5949
30	809.313	142.051	41032.2	12562.8	17.023
31	814.19	142.061	38681.4	11536	16.6062
32	815.343	142.056	38162.6	11308.1	16.5053
33	825.43	142	33832.7	9435.55	15.5832
34	826.105	141.999	33542.1	9314.05	15.519
35	826.795	142	33243.2	9189.88	15.4531
36	826.896	142	33199.7	9171.83	15.4435
37	844.081	142.65	24203.9	5900.63	13.7008
38	852.85	142.878	20409	4614.61	12.7407
39	863.067	143.224	16154.8	3305.98	11.5655
40	879.695	143.615	10538	1769.99	9.53455
41	884.698	143.759	8997.78	1408.6	8.89742
42	887.025	143.821	8324.42	1258.55	8.59731
43	888.251	143.845	7993.62	1185.85	8.43826
44	896.082	144	6007.2	781.08	7.40826
45	906.423	144.035	3968.91	418.135	6.01407
46	915.996	144.06	2375.27	195.055	4.69454
47	925.977	144.029	1059.01	60.9757	3.29534
48	934.42	144	251.524	9.21572	2.09835
49	936.1	143.954	163.442	5.30522	1.85913
50	936.549	143.941	142.007	4.45068	1.79513
51	949.11	143.595	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	139.001
1.53185	139.006
19.0865	139.06
32.9178	139.02
38.6457	139
48.7796	138.793
50.2602	138.763
61.0905	138.542
64.3705	138.476
73.4615	138.291
78.5505	138.189
85.9551	138.041
92.8528	137.903
95.9447	137.841
98.6483	137.789
99.8304	137.766
108.36	137.6
111.481	137.539
113.16	137.508
114.657	137.481
124.023	137.298
126.413	137.276
128.483	137.258
129.604	137.259
134.88	137.144
140.608	137.001
140.666	137
141.88	136.996
145.396	136.987
165.76	136.931
170.639	136.942
190.43	137
193.662	137.091
201.413	137.308
202.91	137.31
209.905	137.483
212.256	137.486
216.044	137.533
220.799	137.61
228.74	137.769
233.581	137.864

240.055	137.994
246.29	138.116
249.014	138.178
254.334	138.284
259.083	138.368
268.35	138.553
271.397	138.613
282.09	138.827
283.248	138.85
289.114	139
290.561	139
291.004	139
293.847	139
294.079	139
294.897	139
295.735	139
297.392	139.908
299.475	141
303.779	141.026
307.699	141.048
315.325	141.101
315.77	141.098
319.666	141.08
324.496	141.067
337.748	141
337.798	140.999
337.804	140.999
350.01	140.752
351.514	140.722
361.883	140.513
364.794	140.454
366.105	140.426
370.416	140.331
374.199	140.251
376.444	140.207
378.978	140.155
385.656	140.023
392.593	139.886
397.761	139.784
406.485	139.612
410.085	139.541
415.321	139.473
419.58	139.44
426.773	139.263
428.072	139.263
436.007	139.041
437.46	139
447.762	138.797
449.164	138.77
459.994	138.557
463.353	138.491
472.562	138.31
477.849	138.206

485.368	138.058
492.661	137.915
498.42	137.801
505.285	137.698
510.764	137.64
513.847	137.638
516.909	137.636
519.953	137.634
522.978	137.632
529.387	137.687
537.506	137.8
543.814	137.927
550.999	138.073
559.479	138.244
564.556	138.346
575.229	138.562
578.177	138.622
591.066	138.882
591.862	138.898
596.908	139
602.692	139.157
603.345	139.157
604.986	139.174
607.15	139.207
619.626	139.459
623.304	139.533
633.498	139.739
639.412	139.859
647.335	140.019
655.475	140.183
661.139	140.297
671.492	140.507
674.909	140.576
687.464	140.829
688.645	140.853
695.918	141
702.465	141.132
703.518	141.154
716.362	141.413
719.644	141.479
730.199	141.692
735.69	141.803
743.977	141.971
751.655	142.126
757.696	142.248
767.54	142.447
771.355	142.524
783.347	142.766
784.957	142.799
794.928	143
798.336	143.012
799.584	143.015
802.272	143.026

809.313	143.051
814.19	143.061
815.343	143.056
825.43	143
826.105	142.999
826.168	142.999
826.795	143
826.896	143
826.916	143
844.081	143.65
852.85	143.878
863.067	144.224
879.695	144.615
884.698	144.759
887.025	144.821
888.251	144.845
896.082	145
906.423	145.035
915.996	145.06
925.977	145.029
934.42	145
936.1	144.954
936.549	144.941
945.84	144.685

External Boundary

X	Y
0	294
0	145.001
0	140.001
0	139.001
0	138.001
0	136.001
0	0
1120.27	0
1120.27	137.664
1120.15	137.662
1094.2	137.627
1066.59	137.768
1058.38	138
1056.96	138.055
1056.39	138.077
1042.28	138.625
1035.7	138.881
1027.44	139.202
1014.7	139.696
1012.45	139.784
1006.89	140
997.074	140.271
994.462	140.343
981.639	140.697
974.953	140.881
966.333	141.119
955.65	141.414
949.11	143.595
945.84	144.685
942.57	145.775
926.821	151.026
438	314
405	314
324	310
307	308
283	308
243	306
202	304
162	302
122	300
81	298
40	296

Material Boundary

X	Y
0	136.001
1.53185	136.006
19.0865	136.06
32.9178	136.02
38.6457	136
48.7796	135.793

50.2602	135.763
61.0905	135.542
64.3705	135.476
73.4615	135.291
78.5505	135.189
85.9551	135.041
92.8528	134.903
95.9447	134.841
98.6483	134.789
99.8304	134.766
108.36	134.6
111.481	134.539
113.16	134.508
114.657	134.481
124.023	134.298
126.413	134.276
128.483	134.258
129.604	134.259
134.88	134.144
140.608	134.001
140.666	134
141.88	133.996
145.396	133.987
165.76	133.931
170.639	133.942
190.43	134
193.662	134.091
201.413	134.308
202.91	134.31
209.905	134.483
212.256	134.486
216.044	134.533
220.799	134.61
228.74	134.769
233.581	134.864
240.055	134.994
246.29	135.116
249.014	135.178
254.334	135.284
259.083	135.368
268.35	135.553
271.397	135.613
282.09	135.827
283.248	135.85
289.114	136
290.561	136
291.004	136
293.847	136
294.079	136
294.897	136
295.735	136
297.392	136.908
299.475	138

303.779	138.026
307.699	138.048
315.325	138.101
315.77	138.098
319.666	138.08
324.496	138.067
337.748	138
337.798	137.999
337.804	137.999
350.01	137.752
351.514	137.722
361.883	137.513
364.794	137.454
366.105	137.426
370.416	137.331
374.199	137.251
376.444	137.207
378.978	137.155
385.656	137.023
392.593	136.886
397.761	136.784
406.485	136.612
410.085	136.541
415.321	136.473
419.58	136.44
426.773	136.263
428.072	136.263
436.007	136.041
437.46	136
447.762	135.797
449.164	135.77
459.994	135.557
463.353	135.491
472.562	135.31
477.849	135.206
485.368	135.058
492.661	134.915
498.42	134.801
505.285	134.698
510.764	134.64
513.847	134.638
516.909	134.636
519.953	134.634
522.978	134.632
529.387	134.687
537.506	134.8
543.814	134.927
550.999	135.073
559.479	135.244
564.556	135.346
575.229	135.562
578.177	135.622
591.066	135.882

591.862	135.898
596.908	136
602.692	136.157
603.345	136.157
604.986	136.174
607.15	136.207
619.626	136.459
623.304	136.533
633.498	136.739
639.412	136.859
647.335	137.019
655.475	137.183
661.139	137.297
671.492	137.507
674.909	137.576
687.464	137.829
688.645	137.853
695.918	138
702.465	138.132
703.518	138.154
716.362	138.413
719.644	138.479
730.199	138.692
735.69	138.803
743.977	138.971
751.655	139.126
757.696	139.248
767.54	139.447
771.355	139.524
783.347	139.766
784.957	139.799
794.928	140
798.336	140.012
799.584	140.015
802.272	140.026
809.313	140.051
814.19	140.061
815.343	140.056
825.43	140
826.105	139.999
826.168	139.999
826.795	140
826.896	140
826.916	140
844.081	140.65
852.85	140.878
863.067	141.224
879.695	141.615
884.698	141.759
887.025	141.821
888.251	141.845
896.082	142
906.423	142.035

915.996	142.06
925.977	142.029
934.42	142
936.1	141.954
936.549	141.941
951.154	141.538
955.65	141.414

Material Boundary

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486
216.044	136.533
220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994

246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77
459.994	137.557
463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058

492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051

814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Material Boundary

X	Y
0	140.001
1.53185	140.006
19.0865	140.06
32.9178	140.02
38.6457	140
48.7796	139.793
50.2602	139.763
61.0905	139.542
64.3705	139.476
73.4615	139.291
78.5505	139.189
85.9551	139.041
92.8528	138.903
95.9447	138.841
98.6483	138.789
99.8304	138.766
108.36	138.6
111.481	138.539
113.16	138.508
114.657	138.481
124.023	138.298
126.413	138.276
128.483	138.258
129.604	138.259
134.88	138.144
140.608	138.001

140.666	138
141.88	137.996
145.396	137.987
165.76	137.931
170.639	137.942
190.43	138
193.662	138.091
201.413	138.308
202.91	138.31
209.905	138.483
212.256	138.486
216.044	138.533
220.799	138.61
228.74	138.769
233.581	138.864
240.055	138.994
246.29	139.116
249.014	139.178
254.334	139.284
259.083	139.368
268.35	139.553
271.397	139.613
282.09	139.827
283.248	139.85
289.114	140
290.561	140
291.004	140
293.847	140
294.079	140
294.897	140
295.735	140
297.392	140.908
299.475	142
303.779	142.026
307.699	142.048
315.325	142.101
315.77	142.098
319.666	142.08
324.496	142.067
337.748	142
337.798	141.999
337.804	141.999
350.01	141.752
351.514	141.722
361.883	141.513
364.794	141.454
366.105	141.426
370.416	141.331
374.199	141.251
376.444	141.207
378.978	141.155
385.656	141.023
392.593	140.886

397.761	140.784
406.485	140.612
410.085	140.541
415.321	140.473
419.58	140.44
426.773	140.263
428.072	140.263
436.007	140.041
437.46	140
447.762	139.797
449.164	139.77
459.994	139.557
463.353	139.491
472.562	139.31
477.849	139.206
485.368	139.058
492.661	138.915
498.42	138.801
505.285	138.698
510.764	138.64
513.847	138.638
516.909	138.636
519.953	138.634
522.978	138.632
529.387	138.687
537.506	138.8
543.814	138.927
550.999	139.073
559.479	139.244
564.556	139.346
575.229	139.562
578.177	139.622
591.066	139.882
591.862	139.898
596.908	140
602.692	140.157
603.345	140.157
604.986	140.174
607.15	140.207
619.626	140.459
623.304	140.533
633.498	140.739
639.412	140.859
647.335	141.019
655.475	141.183
661.139	141.297
671.492	141.507
674.909	141.576
687.464	141.829
688.645	141.853
695.918	142
702.465	142.132
703.518	142.154

716.362	142.413
719.644	142.479
730.199	142.692
735.69	142.803
743.977	142.971
751.655	143.126
757.696	143.248
767.54	143.447
771.355	143.524
783.347	143.766
784.957	143.799
794.928	144
798.336	144.012
799.584	144.015
802.272	144.026
809.313	144.051
814.19	144.061
815.343	144.056
825.43	144
826.105	143.999
826.168	143.999
826.795	144
826.896	144
826.916	144
844.081	144.65
852.85	144.878
863.067	145.224
879.695	145.615
884.698	145.759
887.025	145.821
888.251	145.845
896.082	146
906.423	146.035
915.996	146.06
925.977	146.029
934.42	146
936.1	145.954
936.549	145.941
942.57	145.775

Material Boundary

X	Y
0	145.001
1.53185	145.006
19.0865	145.06
32.9178	145.02
38.6457	145
48.7796	144.793
50.2602	144.763
61.0905	144.542
64.3705	144.476
73.4615	144.291

78.5505	144.189
85.9551	144.041
92.8528	143.903
95.9447	143.841
98.6483	143.789
99.8304	143.766
108.36	143.6
111.481	143.539
113.16	143.508
114.657	143.481
124.023	143.298
126.413	143.276
128.483	143.258
129.604	143.259
134.88	143.144
140.608	143.001
140.666	143
141.88	142.996
145.396	142.987
165.76	142.931
170.639	142.942
190.43	143
193.662	143.091
201.413	143.308
202.91	143.31
209.905	143.483
212.256	143.486
216.044	143.533
220.799	143.61
228.74	143.769
233.581	143.864
240.055	143.994
246.29	144.116
249.014	144.178
254.334	144.284
259.083	144.368
268.35	144.553
271.397	144.613
282.09	144.827
283.248	144.85
289.114	145
290.561	145
291.004	145
293.847	145
294.079	145
294.897	145
295.735	145
297.392	145.908
299.475	147
303.779	147.026
307.699	147.048
315.325	147.101
315.77	147.098

319.666	147.08
324.496	147.067
337.748	147
337.798	146.999
337.804	146.999
350.01	146.752
351.514	146.722
361.883	146.513
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374.199	146.251
376.444	146.207
378.978	146.155
385.656	146.023
392.593	145.886
397.761	145.784
406.485	145.612
410.085	145.541
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419.58	145.44
426.773	145.263
428.072	145.263
436.007	145.041
437.46	145
447.762	144.797
449.164	144.77
459.994	144.557
463.353	144.491
472.562	144.31
477.849	144.206
485.368	144.058
492.661	143.915
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516.909	143.636
519.953	143.634
522.978	143.632
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537.506	143.8
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550.999	144.073
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564.556	144.346
575.229	144.562
578.177	144.622
591.066	144.882
591.862	144.898
596.908	145
602.692	145.157
603.345	145.157

604.986	145.174
607.15	145.207
619.626	145.459
623.304	145.533
633.498	145.739
639.412	145.859
647.335	146.019
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671.492	146.507
674.909	146.576
687.464	146.829
688.645	146.853
695.918	147
702.465	147.132
703.518	147.154
716.362	147.413
719.644	147.479
730.199	147.692
735.69	147.803
743.977	147.971
751.655	148.126
757.696	148.248
767.54	148.447
771.355	148.524
783.347	148.766
784.957	148.799
794.928	149
798.336	149.012
799.584	149.015
802.272	149.026
809.313	149.051
814.19	149.061
815.343	149.056
825.43	149
826.105	148.999
826.168	148.999
826.795	149
826.896	149
826.916	149
844.081	149.65
852.85	149.878
863.067	150.224
879.695	150.615
884.698	150.759
887.025	150.821
888.251	150.845
896.082	151
906.423	151.035
915.996	151.06
925.977	151.029
926.821	151.026

CALCULATION BRIEF
SEISMIC SLOPE STABILITY

CALCULATION BRIEF

S.A. DUNN C&D LANDFILL
PERMIT RENEWAL/MODIFICATION APPLICATION
SEISMIC SLOPE STABILITY

OBJECTIVE: Evaluate the final and interim (i.e., during waste placement) slope configurations with respect to seismic slope stability at the S.A. Dunn Landfill (Dunn). This evaluation will incorporate the recent operational sequencing modification, addition of the northern mechanically stabilized earth (MSE) wall, and minor revisions to the permitted final grading configuration. The analyses will encompass failure surfaces within the construction and demolition (C&D) waste mass and base liner system. Static Slope Stability Calculations are included under a separate calculation brief.

METHODOLOGY: Utilize the same stability cross-sections and shear strengths as determined in reference number (Ref. No.) 1 to estimate the slope stability under seismic conditions. Use SLIDE slope stability software (Ref. No. 2) to evaluate slope stability by means of a pseudo-static seismic slope stability analysis. Use the methodology described in (Ref No. 3) to determine the pseudo-static factor of safety (FS) for each slope stability cross-section. Perform a seismic deformation analysis if necessary.

REFERENCES:

1. "S.A. Dunn C&D Landfill; Permit Renewal/Modification Application; Static Slope Stability Evaluation" (This Permit Application), Civil Environmental Consultants, Inc., prepared January 2022.

2. Rocscience, Inc. (2021) "SLIDE," Version 9.020.

3. United States Environmental Protection Agency, RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, April 1995.

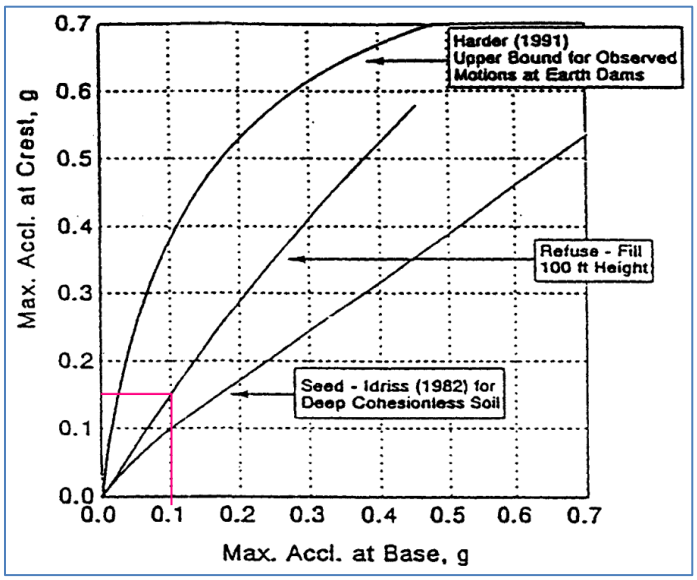
4. ASCE 7 Hazard Tool, Seismic Hazard Report, generated July 28, 2021.

5. "Seismic Response of Municipal Solid Waste Landfills", S. Singh.

PSEUDO-STATIC SEISMIC EVALUATION

The same critical cross-sections investigated in the static slope stability analysis were examined in the pseudo-static seismic slope stability analysis in accordance with the procedure outlined in Ref. No. 3. The same shear strength properties for the waste and soil components were used for the pseudo-static analysis. Per the results of the static evaluation, the minimum large-displacement interface shear strength of 12 degrees (°) was used to model the liner system interface along the entire liner system. Per Ref. No. 4, the Maximum Horizontal Acceleration (MHA) with a 10 percent chance of occurring in 250 years is approximately 0.105g. The output Ref. No. 4 has been attached to this calculation brief.

To account for acceleration amplification during a seismic event from the free field PGA through the waste mass, the Refuse-Fill 100 ft Height curve presented on the following figure was used from Ref. No. 5. This resulted in an amplified PGA/design PGA of 0.15g.



A maximum value for the seismic coefficient (k_s) was determined in accordance with Ref. No. 3 as follows. Per Ref. No. 3 the maximum value of the seismic coefficient for use in evaluating the pseudo-static slope stability of the base liner system is equal to one half of a_{max}.

$$k_s = \frac{a_{max}}{2} = \frac{0.15}{2} = 0.075g$$

In accordance with Ref. No. 3, a pseudo-static slope stability analysis was modeled in SLIDE using a seismic coefficient of 0.075g. Similar analyses that were analyzed in Ref. No. 1 were also analyzed under

Seismic conditions. The slope stability analyses are attached to this calculation brief, and are summarized as follows:

Table 1 – "Failure along the Liner System" Pseudo-Static Analysis Results

Cross-Section	Failure Location	FS
A	Liner System	1.72
B	Liner System	1.75
C	Liner System	2.55
D (Interim)	Liner System	1.18

Table 2 – "Failure in the Waste" Pseudo-Static Analysis Results

A	C&D Waste Mass	1.68
B	C&D Waste Mass	1.68
C	C&D Waste Mass	1.91
D (Interim)	C&D Waste Mass	1.16

Per §363-4.3(d)(1)(i) of the New York State solid waste regulations, the minimum acceptable pseudo-static FS is 1.0 using large-displacement interface shear strength properties. As shown, the pseudo-static FS are all greater than 1.0. As such, it is not necessary to perform further seismic deformation analysis, and the interim and final grading configuration at Dunn is considered stable relative to the peak ground acceleration of 0.15g.

CONCLUSIONS: The calculated FSs indicate that the interim and overall grading configuration at Dunn Landfill will be stable under seismic conditions (FS $\geq$ 1.0), for the assumptions and conditions modeled, as described above.

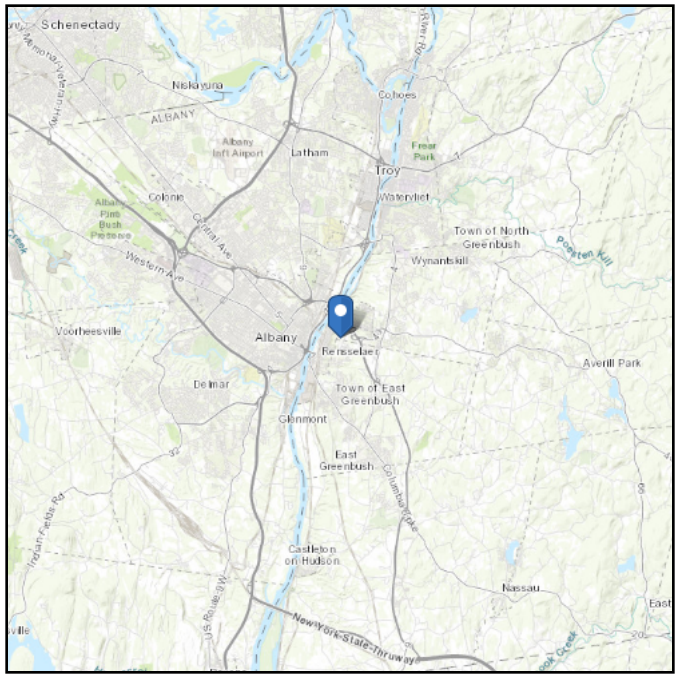
ASCE 7 SEISMIC HAZARD TOOL
PEAK GROUND ACCELERATION

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: IV
Soil Class: D - Default (see Section 11.4.3)

Elevation: 292.65 ft (NAVD 88)
Latitude: 42.650107
Longitude: -73.726494



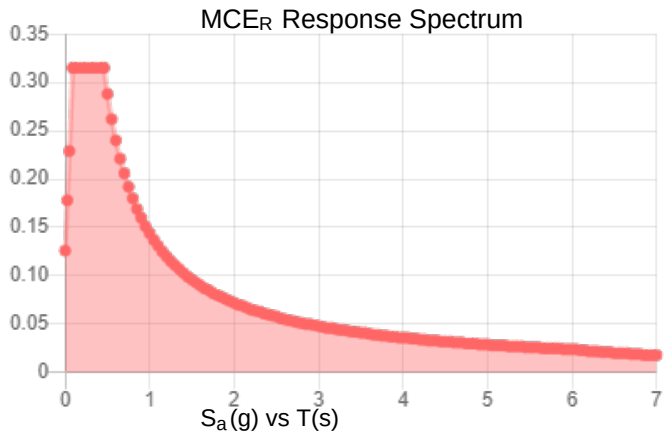
Seismic

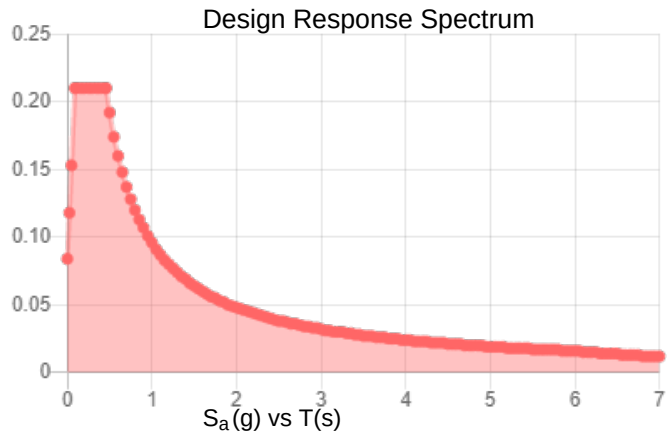
Site Soil Class: D - Default (see Section 11.4.3)

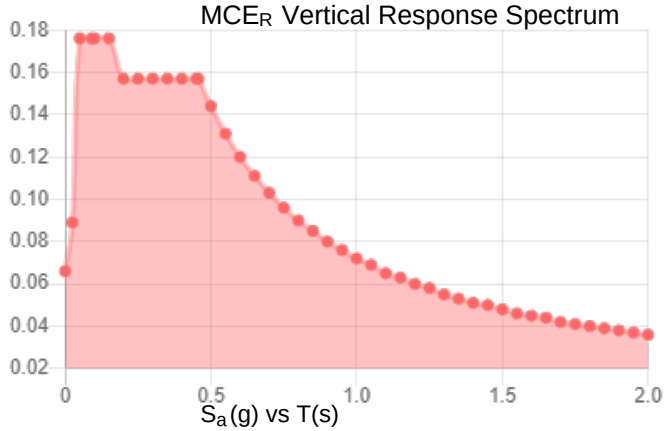
Results:

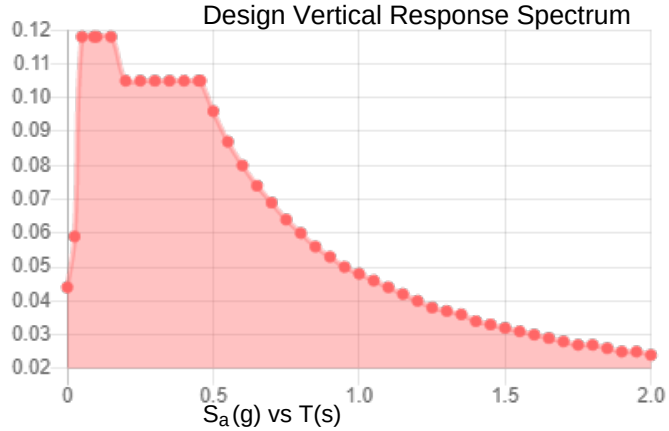
S_S :	0.197	S_{D1} :	0.096
S_1 :	0.06	T_L :	6
F_a :	1.6	PGA :	0.105
F_v :	2.4	PGA_M :	0.167
S_{MS} :	0.315	F_{PGA} :	1.59
S_{M1} :	0.144	I_e :	1.5
S_{DS} :	0.21	C_v :	0.7

Seismic Design Category C









Data Accessed: Thu Jul 29 2021

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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UNITED STATES GEOLOGIC SURVEY
TECHNICAL Q&A

U.S. Geological Survey - Earthquake Hazards Program

Earthquake Hazards 201 - Technical Q&A

- What is %g?
- What is acceleration? peak acceleration? peak ground acceleration (PGA)?
- What is spectral acceleration (SA)?
- What is probability of exceedence (PE)?
- What is the relationship between peak ground acceleration (PGA) and "effective peak acceleration" (Aa), or between peak ground velocity (PGV) and "effective peak velocity" (Av) as these parameters appear on building code maps?
- What is percent damping?
- Why do you decluster the earthquake catalog to develop the Seismic Hazard maps?
- How do I use the seismic hazard maps?
- What if we need to know about total rates of earthquakes with M>5 including aftershocks?
- The seismic hazard map values show ground motions that have a probability of being exceeded in 50 years of 10, 5 and 2 percent. What is the probability of their being exceeded in one year (the annual probability of exceedance)?
- The seismic hazard map is for ground motions having a 2% probability of exceedance in 50 years. Are those values the same as those for 10% in 250?
- I am trying to calculate the ground motion effect for a certain location in California. I obtained the design spectrum acceleration from your site, but I would like to identify the soil type of this location - how can I get that?
- What is a distance metric? Why is the choice of distance metric important in probability assessments? What distance should I use?

What is %g?

See %g in the Earthquake Glossary.

What is acceleration? peak acceleration? peak ground acceleration (PGA)?

See acceleration in the Earthquake Glossary.

What is spectral acceleration (SA)?

PGA (peak acceleration) is what is experienced by a particle on the ground, and SA is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building.

The mass on the rod behaves about like a simple harmonic oscillator (SHO). If one "drives" the mass-rod system at its base, using the seismic record, and assuming a certain damping to the mass-rod system, one will get a record of the particle motion which basically "feels" only the components of ground motion with periods near the natural period of this SHO. If we look at this particle seismic record we can identify the maximum displacement. If we take the derivative (rate of change) of the displacement record with respect to time we can get the velocity record. The maximum velocity can likewise be determined. Similarly for response acceleration (rate of change of velocity) also called response spectral acceleration, or simply spectral acceleration, SA (or Sa).

PGA is a good index to hazard for short buildings, up to about 7 stories. To be a good index, means that if you plot some measure of demand placed on a building, like inter story displacement or base shear, against PGA, for a number of different buildings for a number of different earthquakes, you will get a strong correlation.

PGA is a natural simple design parameter since it can be related to a force and for simple design one can design a building to resist a certain horizontal force.PGV, peak ground velocity, is a good index to hazard to taller buildings. However, it is not clear how to relate velocity to force in order to design a taller building.

SA would also be a good index to hazard to buildings, but ought to be more closely related to the building behavior than peak ground motion parameters. Design might also be easier, but the relation to design force is likely to be more complicated than with PGA, because the value of the period comes into the picture.

PGA, PGV, or SA are only approximately related to building demand/design because the building is not a simple oscillator, but has overtones of vibration, each of which imparts maximum demand to different parts of the structure, each part of which may have its own weaknesses. Duration also plays a role in damage, and some argue that duration-related damage is not well-represented by response parameters.

On the other hand, some authors have shown that non-linear response of a certain structure is only weakly dependent on the magnitude and distance of the causative earthquake, so that non-linear response is related to linear response (SA) by a simple scalar (multiplying factor). This is not so for peak ground parameters, and this fact argues that SA ought to be significantly better as an index to demand/design than peak ground motion parameters.

There is no particular significance to the relative size of PGA, SA (0.2), and SA (1.0). On the average, these roughly correlate, with a factor that depends on period.While PGA may reflect what a person might feel standing on the ground in an earthquake, I don't believe it is correct to state that SA reflects what one might "feel" if one is in a building. In taller buildings, short period ground motions are felt only weakly, and long-period motions tend not to be felt as forces, but rather disorientation and dizziness.

What is probability of exceedence (PE)?

For any given site on the map, the computer calculates the ground motion effect (peak acceleration) at the site for all the earthquake locations and magnitudes believed possible in the vicinity of the site. Each of these magnitude-location pairs is believed to happen at some average probability per year. Small ground motions are relatively likely, large ground motions are very unlikely.Beginning with the largest ground motions and proceeding to smaller, we add up probabilities until we arrive at a total probability corresponding to a given probability, P, in a particular period of time, T.

The probability P comes from ground motions larger than the ground motion at which we stopped adding. The corresponding ground motion (peak acceleration) is said to have a P probability of exceedance (PE) in T years.The map contours the ground motions corresponding to this probability at all the sites in a grid covering the U.S. Thus the maps are not actually probability maps, but rather ground motion hazard maps at a given level of probability.In the future we are likely to post maps which are probability maps. They will show the probability of exceedance for some constant ground motion. For instance, one such map may show the probability of a ground motion exceeding 0.20 g in 50 years.

What is the relationship between peak ground acceleration (PGA) and "effective peak acceleration" (Aa), or between peak ground velocity (PGV) and "effective peak velocity" (Av) as these parameters appear on building code maps?

Aa and Av have no clear physical definition, as such. Rather, they are building code constructs, adopted by the staff that produced the Applied Technology Council (1978) (ATC-3) seismic provisions. Maps for Aa and Av were derived by ATC project staff from a draft of the Algermissen and Perkins (1976) probabilistic peak acceleration map (and other maps) in order to provide for design ground motions for use in model building codes. Many aspects of that ATC-3 report have been adopted by the current (in use in 1997) national model building codes, except for the new NEHRP provisions.

This process is explained in the ATC-3 document referenced below, (p 297-302). Here are some excerpts from that document:

- p. 297. "At the present time, the best workable tool for describing the design ground shaking is a smoothed elastic response spectrum for single degree-of-freedom systems…
- p. 298. "In developing the design provisions, two parameters were used to characterize the intensity of design ground shaking. These parameters are called the Effective Peak Acceleration (EPA), Aa, and the Effective Peak Velocity (EPV), Av. These parameters do not at present have precise definitions in physical terms but their significance may be understood from the following paragraphs.
- "To best understand the meaning of EPA and EPV, they should be considered as normalizing factors for construction of smoothed elastic response spectra for ground motions of normal duration. The EPA is proportional to spectral ordinates for periods in the range of 0.1 to 0.5 seconds, while the EPV is proportional to spectral ordinates at a period of about 1 second . . . The constant of proportionality (for a 5 percent damping spectrum) is set at a standard value of 2.5 in both cases.
- "…The EPA and EPV thus obtained are related to peak ground acceleration and peak ground velocity but are not necessarily the same as or even proportional to peak acceleration and velocity. When very high frequencies are present in the ground motion, the EPA may be significantly less than the peak acceleration. This is consistent with the observation that chopping off the spectrum computed from that motion, except at periods much shorter than those of interest in ordinary building practice has very little effect upon the response spectrum computed from that motion, except at periods much shorter than those of interest in ordinary building practice. . . On the other hand, the EPV

will generally be greater than the peak velocity at large distances from a major earthquake..."

- p. 299. "Thus the EPA and EPV for a motion may be either greater or smaller than the peak acceleration and velocity, although generally the EPA will be smaller than peak acceleration while the EPV will be larger than the peak velocity.
- ". . .For purposes of computing the lateral force coefficient in Sec. 4.2, EPA and EPV are replaced by dimensionless coefficients Aa and Av respectively. Aa is numerically equal to EPA when EPA is expressed as a decimal fraction of the acceleration of gravity..."

Now, examination of the tripartite diagram of the response spectrum for the 1940 El Centro earthquake (p. 274, Newmark and Rosenblueth, Fundamentals of Earthquake Engineering) verifies that taking response acceleration at .05 percent damping, at periods between 0.1 and 0.5 sec, and dividing by a number between 2 and 3 would approximate peak acceleration for that earthquake. Thus, in this case, effective peak acceleration in this period range is nearly numerically equal to actual peak acceleration.

However, since the response acceleration spectrum is asymptotic to peak acceleration for very short periods, some people have assumed that effective peak acceleration is 2.5 times less than true peak acceleration. This would only be true if one continued to divide response accelerations by 2.5 for periods much shorter than 0.1 sec. But EPA is only defined for periods longer than 0.1 sec.

Effective peak acceleration could be some factor lower than peak acceleration for those earthquakes for which the peak accelerations occur as short-period spikes. This is precisely what effective peak acceleration is designed to do.

On the other hand, the ATC-3 report map limits EPA to 0.4 g even where probabilistic peak accelerations may go to 1.0 g, or larger. THUS EPA IN THE ATC-3 REPORT MAP may be a factor of 2.5 less than than probabilistic peak acceleration for locations where the probabilistic peak acceleration is around 1.0 g.

The following paragraphs describe how the Aa, and Av maps in the ATC code were constructed.

The USGS 1976 probabilistic ground motion map was considered. Thirteen seismologists were invited to smooth the probabilistic peak acceleration map, taking into account other regional maps and their own regional knowledge. A final map was drawn based upon those smoothing's. Ground motions were truncated at 40 % g in areas where probabilistic values

could run from 40 to greater than 80 % g. This resulted in an Aa map, representing a design basis for buildings having short natural periods. Aa was called "Effective Peak Acceleration."

An attenuation function for peak velocity was "draped" over the Aa map in order to produce a spatial broadening of the lower values of Aa. The broadened areas were denominated Av for "Effective Peak Velocity-Related Acceleration" for design for longer-period buildings, and a separate map drawn for this parameter.

Note that, in practice, the Aa and Av maps were obtained from a PGA map and NOT by applying the 2.5 factors to response spectra.

Note also, that if one examines the ratio of the SA(0.2) value to the PGA value at individual locations in the new USGS national probabilistic hazard maps, the value of the ratio is generally less than 2.5.

Sources of Information:

Algermissen, S.T., and Perkins, David M., 1976, A probabilistic estimate of maximum acceleration in rock in the contiguous United States, U.S. Geological Survey Open-File Report OF 76-416, 45 p.

Applied Technology Council, 1978, Tentative provisions for the development of seismic regulations for buildings, ATC-3-06 (NBS SP-510) U.S Government Printing Office, Washington, 505 p.

What is percent damping?

In our question about response acceleration, we used a simple physical modela particle mass on a mass-less vertical rod to explain natural period. For this ideal model, if the mass is very briefly set into motion, the system will remain in oscillation indefinitely. In a real system, the rod has stiffness which not only contributes to the natural period (the stiffer the rod, the shorter the period of oscillation), but also dissipates energy as it bends. As a result, the oscillation steadily decreases in size, until the mass-rod system is at rest again. This decrease in size of oscillation we call damping. We say the oscillation has damped out.

When the damping is small, the oscillation takes a long time to damp out. When the damping is large enough, there is no oscillation and the mass-rod system takes a long time to return to vertical. Critical damping is the least value of damping for which the damping prevents oscillation. Any particular damping value we can express as a percentage of the critical damping value.Because spectral accelerations are used to represent the effect of earthquake ground motions on buildings, the damping used in the calculation of spectral acceleration

should correspond to the damping typically experienced in buildings for which earthquake design is used. The building codes assume that 5 percent of critical damping is a reasonable value to approximate the damping of buildings for which earthquake-resistant design is intended. Hence, the spectral accelerations given in the seismic hazard maps are also 5 percent of critical damping.

Why do you decluster the earthquake catalog to develop the Seismic Hazard maps?

The primary reason for declustering is to get the best possible estimate for the rate of mainshocks. Also, the methodology requires a catalog of independent events (Poisson model), and declustering helps to achieve independence.

Damage from the earthquake has to be repaired, regardless of how the earthquake is labeled. Some argue that these aftershocks should be counted. This observation suggests that a better way to handle earthquake sequences than declustering would be to explicitly model the clustered events in the probability model. This step could represent a future refinement. The other side of the coin is that these secondary events arent going to occur without the mainshock. Any potential inclusion of foreshocks and aftershocks into the earthquake probability forecast ought to make clear that they occur in a brief time window near the mainshock, and do not affect the earthquake-free periods except trivially. That is, the probability of no earthquakes with M>5 in a few-year period is or should be virtually unaffected by the declustering process. Also, in the USA experience, aftershock damage has tended to be a small proportion of mainshock damage.

How do I use the seismic hazard maps?

The maps come in three different probability levels and four different ground motion parameters, peak acceleration and spectral acceleration at 0.2, 0.3, and 1.0 sec. (These values are mapped for a given geologic site condition. Other site conditions may increase or decrease the hazard. Also, other things being equal, older buildings are more vulnerable than new ones.)

The maps can be used to determine (a) the relative probability of a given critical level of earthquake ground motion from one part of the country to another; (b) the relative demand on structures from one part of the country to another, at a given probability level. In addition, © building codes use one or more of these maps to determine the resistance required by buildings to resist damaging levels of ground motion.

The different levels of probability are those of interest in the protection of buildings against earthquake ground motion. The ground motion parameters are proportional to the hazard faced by a particular kind of building.

Peak acceleration is a measure of the maximum force experienced by a small mass located at the surface of the ground during an earthquake. It is an index to hazard for short stiff structures.

Spectral acceleration is a measure of the maximum force experienced by a mass on top of a rod having a particular natural vibration period. Short buildings, say, less than 7 stories, have short natural periods, say, 0.2-0.6 sec. Tall buildings have long natural periods, say 0.7 sec or longer. A earthquake strong motion record is made up of varying amounts of energy at different periods. A building natural period indicates what spectral part of an earthquake ground-motion time history has the capacity to put energy into the building. Periods much shorter than the natural period of the building or much longer than the natural period do not have much capability of damaging the building. Thus, a map of a probabilistic spectral value at a particular period thus becomes an index to the relative damage hazard to buildings of that period as a function of geographic location.

Choose a ground motion parameter according to the above principles. For many purposes, peak acceleration is a suitable and understandable parameter.Choose a probability value according to the chance you want to take. One can now select a map and look at the relative hazard from one part of the country to another.

If one wants to estimate the probability of exceedance for a particular level of ground motion, one can plot the ground motion values for the three given probabilities, using log-log graph paper and interpolate, or, to a limited extent, extrapolate for the desired probability level.Conversely, one can make the same plot to estimate the level of ground motion corresponding to a given level of probability different from those mapped.

If one wants to estimate the probabilistic value of spectral acceleration for a period between the periods listed, one could use the method reported in the Open File Report 95-596, USGS Spectral Response Maps and Their Use in Seismic Design Forces in Building Codes. (This report can be downloaded from the web-site.) The report explains how to construct a design spectrum in a manner similar to that done in building codes, using a long-period and a short-period probabilistic spectral ordinate of the sort found in the maps. Given the spectrum, a design value at a given spectral period other than the map periods can be obtained.

What if we need to know about total rates of earthquakes with M>5 including aftershocks

Aftershocks and other dependent-event issues are not really addressable at this web site given our modeling assumptions, with one exception. The current National Seismic Hazard model (and this web site) explicitly deals with clustered events in the New Madrid Seismic Zone and gives this clustered-model branch 50% weight in the logic-tree. Even in the NMSZ case, however, only mainshocks are clustered, whereas NMSZ aftershocks are omitted. We are performing research on aftershock-related damage, but how aftershocks should influence the hazard model is currently unresolved.

The seismic hazard map values show ground motions that have a probability of being exceeded in 50 years of 10, 5 and 2 percent. What is the probability of their being exceeded in one year (the annual probability of exceedance)?

Let r = 0.10, 0.05, or 0.02, respectively. The approximate annual probability of exceedance is the ratio, r*/50, where r* = r(1+0.5r). (To get the annual probability in percent, multiply by 100.) The inverse of the annual probability of exceedance is known as the "return period," which is the average number of years it takes to get an exceedance.

Example: What is the annual probability of exceedance of the ground motion that has a 10 percent probability of exceedance in 50 years?

Answer: Let r = 0.10. The approximate annual probability of exceedance is about 0.10(1.05)/50 = 0.0021. The calculated return period is 476 years, with the true answer less than half a percent smaller.

The same approximation can be used for r = 0.20, with the true answer about one percent smaller. When r is 0.50, the true answer is about 10 percent smaller.

Example: Suppose a particular ground motion has a 10 percent probability of being exceeded in 50 years. What is the probability it will be exceeded in 500 years? Is it (500/50)10 = 100 percent?

Answer: No. We are going to solve this by equating two approximations:

r1*/T1 = r2*/T2. Solving for r2*, and letting T1=50 and T2=500,
r2* = r1*(500/50) = .0021(500) = 1.05.

Take half this value = 0.525. r2 = 1.05/(1.525) = 0.69.
Stop now. Don't try to refine this result.

The true answer is about ten percent smaller, 0.63.For r2* less than 1.0 the approximation gets much better quickly.

For r2* = 0.50, the error is less than 1 percent.
For r2* = 0.70, the error is about 4 percent.
For r2* = 1.00, the error is about 10 percent.

Caution is urged for values of r2* larger than 1.0, but it is interesting to note that for r2* = 2.44, the estimate is only about 17 percent too large. This suggests that, keeping the error in mind, useful numbers can be calculated.

Here is an unusual, but useful example. Evidently, r2* is the number of times the reference ground motion is expected to be exceeded in T2 years. Suppose someone tells you that a particular event has a 95 percent probability of occurring in time T. For r2 = 0.95, one would expect the calculated r2 to be about 20% too high. Therefore, let calculated r2 = 1.15.

The previous calculations suggest the equation,
r2calc = r2*/(1 + 0.5r2*)
Find r2*.r2* = 1.15/(1 - 0.5x1.15) = 1.15/0.425 = 2.7

This implies that for the probability statement to be true, the event ought to happen on the average 2.5 to 3.0 times over a time duration = T. If history does not support this conclusion, the probability statement may not be credible.

The seismic hazard map is for ground motions having a 2% probability of exceedance in 50 years. Are those values the same as those for 10% in 250?

Yes, basically. This conclusion will be illustrated by using an approximate rule-of-thumb for calculating Return Period (RP).

A typical seismic hazard map may have the title, "Ground motions having 90 percent probability of not being exceeded in 50 years." The 90 percent is a "non-exceedance probability"; the 50 years is an "exposure time." An equivalent alternative title for the same map would be, "Ground motions having 10 percent probability of being exceeded in 50 years." A typical shorthand to describe these ground motions is to say that they are 475-year return-

period ground motions. This means the same as saying that these ground motions have an annual probability of occurrence of 1/475 per year. "Return period" is thus just the inverse of the annual probability of occurrence (of getting an exceedance of that ground motion).

To get an approximate value of the return period, RP, given the exposure time, T, and exceedance probability, r = 1 - non-exceedance probability, NEP, (expressed as a decimal, rather than a percent), calculate:

RP = T / r* Where r* = r(1 + 0.5r).r* is an approximation to the value -loge (NEP).
In the above case, where r = 0.10, r* = 0.105 which is approximately = -loge (0.90) = 0.10536
Thus, approximately, when r = 0.10, RP = T / 0.105

Consider the following table:

				Rule of Thumb		**Exact**
NEP	T	r	r*	Calculation	RP	RP
0.90	50	0.10	0.105	50/0.105	476.2	474.6
0.90	100	0.10	0.105	100/0.105	952.4	949.1
0.90	250	0.10	0.105	250/0.105	2381.0	2372.8

In this table, the exceedance probability is constant for different exposure times. Compare the results of the above table with those shown below, all for the same exposure time, with differing exceedance probabilities.

				Rule of Thumb		**Exact**
NEP	T	r	r*	Calculation	RP	RP
0.90	50	0.10	0.105	50/0.105	476.2	474.6
0.95	50	0.05	0.05125	50/0.05125	975.6	974.8
0.98	50	0.02	0.0202	50/0.0202	2475.2	2475.9

Comparison of the last entry in each table allows us to see that ground motion values having a 2% probability of exceedance in 50 years should be approximately the same as those having 10% probability of being exceeded in 250 years: The annual exceedance probabilities differ by about 4%. Corresponding ground motions should differ by 2% or less in the EUS and 1 percent or less in the WUS, based upon typical relations between ground motion and return period.

I am trying to calculate the ground motion effect for a certain location in California. I obtained the design spectrum acceleration from your site, but I would like to identify the soil type of this location - how can I get that?

You can't find that information at our site.

We don't know any site that has a map of site conditions by National Earthquake Hazard Reduction Program (NEHRP) Building Code category. There is a map of some kind of generalized site condition created by the California Division of Mines and Geology (CDMG). The map is statewide, largely based on surface geology, and can be seen at the web site of the CDMG. It does not have latitude and longitude lines, but if you click on it, it will blow up to give you more detail, in case you can make correlations with geographic features. There is no advice on how to convert the theme into particular NEHRP site categories.

For sites in the Los Angeles area, there are at least three papers in the following publication that will give you either generalized geologic site condition or estimated shear wave velocity for sites in the San Fernando Valley, and other areas in Los Angeles. Look for papers with author/coauthor J.C. Tinsley. This is older work and may not necessarily be more accurate than the CDMG state map for estimating geologic site response.

References

Ziony, J.I., ed, 1985, Evaluating earthquake hazards in the Los Angeles region--an earth-science perspective, U.S. Geological Survey Professional Paper 1360, US Gov't Printing Office, Washington, 505 p.

C. J. Wills, et al:, A Site-Conditions Map for California Based on Geology and Shear-Wave Velocity, BSSA, Bulletin Seismological Society of America,December 2000, Vol. 90 Number 6, Part B Supplement, pp. S187-S208.In general, someone using the code is expected either to get the geologic site condition from the local county officials or to have a geotechnical engineer visit the site.

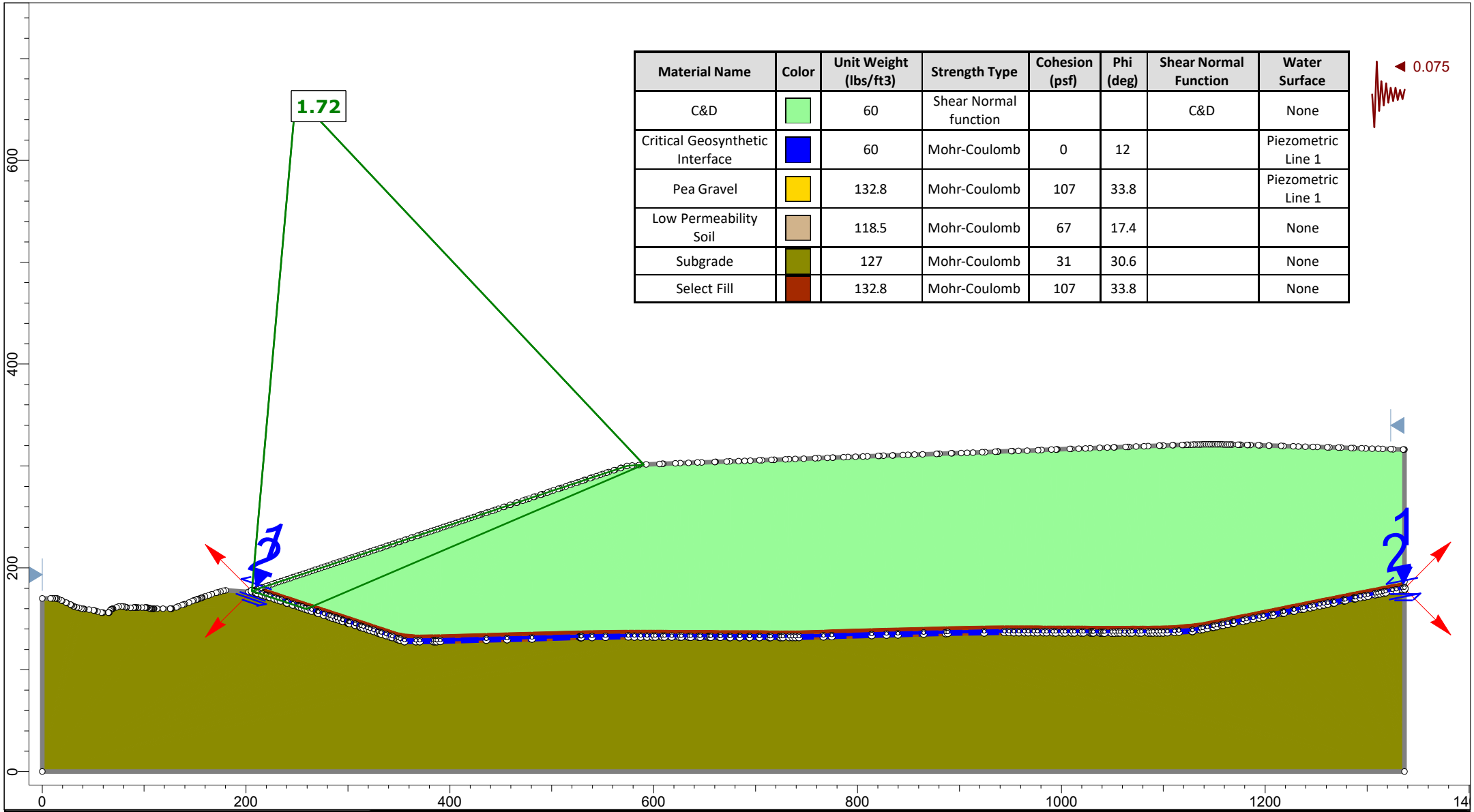
What is a distance metric? Why is the choice of distance metric important in probability assessments? What distance should I use?

For earthquakes, there are several ways to measure how far away it is. The one we use here is the epicentral distance or the distance of the nearest point of the projection of the fault to the Earth surface, technically called Rjb. Even if the earthquake source is very deep, more than 50 km deep, it could still have a small epicentral distance, like 5 km. Frequencies of such sources are included in the map if they are within 50 km epicentral distance.

Several cities in the western U.S. have experienced significant damage from earthquakes with hypocentral depth greater than 50 km. These earthquakes represent a major part of the seismic hazard in the Puget Sound region of Washington. If the probability assessment used a cutoff distance of 50 km, for example, and used hypocentral distance rather than epicentral, these deep Puget Sound earthquakes would be omitted, thereby yielding a much lower value for the probability forecast. Another example where distance metric can be important is at sites over dipping faults. The distance reported at this web site is Rjb =0, whereas another analysis might use another distance metric which produces a value of R=10 km, for example, for the same site and fault. Thus, if you want to know the probability that a nearby dipping fault may rupture in the next few years, you could input a very small value of Maximum distance, like 1 or 2 km, to get a report of this probability.

This distance (in km not miles) is something you can control. If you are interested only in very close earthquakes, you could make this a small number like 10 or 20 km. If you are interested in big events that might be far away, you could make this number large, like 200 or 500 km. The report will tell you rates of small events as well as large, so you should expect a high rate of M5 earthquakes within 200 km or 500 km of your favorite site, for example. Most of these small events would not be felt. If an M8 event is possible within 200 km of your site, it would probably be felt even at this large of a distance.

“FAILURE ALONG THE LINER SYSTEM” PSUEDO-STATIC ANALYSIS RESULTS SLIDE OUTPUT



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None

rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section A - Seismic - Liner System Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:00m:07.824s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.718690
Axis Location:	248.948, 663.787
Left Slip Surface Endpoint:	205.613, 177.382
Right Slip Surface Endpoint:	590.273, 301.245
Resisting Moment:	1.27074e+08 lb-ft
Driving Moment:	7.39367e+07 lb-ft
Resisting Horizontal Force:	250093 lb
Driving Horizontal Force:	145514 lb
Total Slice Area:	7504.33 ft2
Surface Horizontal Width:	384.66 ft
Surface Average Height:	19.509 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
205.613	177.382
209.644	175.98
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.014	168.298
233.924	168
239.731	166.085
239.989	166
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
259.228	159.677
590.273	301.245

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.71869

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.03156	707.296	-19.1755	Critical Geosynthetic Interface	0	12	14.7724	25.3891	181.834	62.3875	119.447	176.697	114.309
2	0.244676	89.5922	-18.2502	Critical Geosynthetic Interface	0	12	39.6949	68.2233	383.353	62.3875	320.965	370.263	307.876
3	1.135	484.546	-18.2501	Critical Geosynthetic Interface	0	12	47.7275	82.0287	448.302	62.3875	385.915	432.564	370.176
4	4.6233	3146.26	-18.2501	Critical Geosynthetic Interface	0	12	81.6517	140.334	722.609	62.3875	660.222	695.684	633.297
5	3.80952	3745.51	-18.1362	Critical Geosynthetic Interface	0	12	123.1	211.57	1057.75	62.3875	995.36	1017.43	955.039
6	2.29643	2540.04	-18.1362	Critical Geosynthetic Interface	0	12	140.954	242.256	1202.11	62.3875	1139.73	1155.95	1093.56
7	1.44433	1704.71	-18.2501	Critical Geosynthetic Interface	0	12	151.98	261.207	1291.27	62.3875	1228.88	1241.16	1178.77
8	4.62081	6010.87	-18.2501	Critical Geosynthetic Interface	0	12	170.071	292.3	1437.55	62.3875	1375.16	1381.47	1319.08
9	3.34887	4886.43	-18.1367	Critical Geosynthetic Interface	0	12	194.134	333.657	1632.12	62.3875	1569.73	1568.53	1506.14
10	1.84666	2884.76	-18.1367	Critical Geosynthetic Interface	0	12	210.138	361.162	1761.52	62.3875	1699.13	1692.69	1630.3
11	0.910228	1471.66	-18.1367	Critical Geosynthetic Interface	0	12	218.723	375.917	1830.94	62.3875	1768.55	1759.29	1696.9
12	5.80643	10163.3	-18.2501	Critical Geosynthetic Interface	0	12	240.182	412.798	2004.46	62.3875	1942.07	1925.26	1862.87
13	0.258707	484.041	-18.2501	Critical Geosynthetic Interface	0	12	259.682	446.312	2162.12	62.3875	2099.74	2076.49	2014.11
14	6.08554	12152.8	-18.193	Critical Geosynthetic Interface	0	12	280.369	481.868	2329.4	62.3875	2267.02	2237.26	2174.87
15	4.77149	10557.4	-18.1934	Critical Geosynthetic Interface	0	12	316.587	544.115	2622.24	62.3875	2559.85	2518.19	2455.8
16	1.31391	3065.94	-18.1934	Critical Geosynthetic Interface	0	12	337.284	579.687	2789.6	62.3875	2727.21	2678.75	2616.36
17	2.57085	6197.3	-18.1926	Critical Geosynthetic Interface	0	12	350.67	602.693	2897.84	62.3875	2835.45	2782.59	2720.2
18	3.51483	8897.64	-18.1926	Critical Geosynthetic Interface	0	12	371.873	639.134	3069.27	62.3875	3006.88	2947.06	2884.67
19	0.981947	2573.45	-18.1937	Critical Geosynthetic Interface	0	12	387.702	666.34	3197.27	62.3875	3134.88	3069.85	3007.46
20	2.64445	6769.73	23.1535	Pea Gravel	107	33.8	940.455	1616.35	2254.63	0	2254.63	2656.81	2656.81
21	6.61127	15067	23.1535	Select Fill	107	33.8	845.801	1453.67	2011.63	0	2011.63	2373.33	2373.33
22	80.4473	148877	23.1535	C&D	0	34.992	646.76	1111.58	1587.97	0	1587.97	1864.55	1864.55
23	80.4473	112249	23.1535	C&D	1.13687e-13	34.992	461.433	793.061	1132.94	0	1132.94	1330.27	1330.27
24	80.4473	75619	23.1535	C&D	0	34.992	306.368	526.552	752.217	0	752.217	883.232	883.232
25	80.4473	36902.1	23.1535	C&D	0	34.992	154.014	264.703	378.148	0	378.148	444.011	444.011

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.71869

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	205.613	177.382	0	0	0
2	209.644	175.98	261.61	5.00839	1.09676
3	209.889	175.899	295.561	6.00163	1.16328
4	211.024	175.525	481.332	12.3665	1.47173
5	215.647	174	1725.6	82.1484	2.72555
6	219.457	172.752	3234.84	212.246	3.75394
7	221.753	172	4273.18	326.631	4.37104
8	223.198	171.524	4980.46	414.536	4.7579
9	227.818	170	7508.19	787.524	5.98778
10	231.167	168.903	9584.06	1154.8	6.87055
11	233.014	168.298	10822.4	1396.72	7.35384
12	233.924	168	11457.6	1526.95	7.59106
13	239.731	166.085	15931.8	2548.36	9.08772
14	239.989	166	16147.3	2601.9	9.15369
15	246.075	164	21605.8	4076.92	10.6858
16	250.846	162.432	26441	5552.18	11.8589
17	252.16	162	27860.1	6011.95	12.1772
18	254.731	161.155	30747.7	6982.22	12.7938
19	258.246	160	34936.6	8467.01	13.6232
20	259.228	159.677	36157.2	8915.84	13.852
21	261.872	160.808	35593.9	9179.72	14.4615
22	268.484	163.635	34384.3	9822.07	15.9423
23	348.931	198.038	20767.3	11122.2	28.1719
24	429.378	232.44	10599.8	5962.11	29.3566
25	509.826	266.843	3767.24	1338.06	19.5542
26	590.273	301.245	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
207.158	177.844
209.644	176.98
209.656	176.976
209.673	176.97
209.701	176.961
209.754	176.943
209.889	176.899
211.024	176.525
215.647	175
219.457	173.752
221.753	173
223.198	172.524
227.818	171
231.167	169.903
233.924	169
239.731	167.085

239.989	167
240.158	166.945
246.075	165
250.846	163.432
252.16	163
254.731	162.155
258.246	161
260.564	160.238
264.331	159
269.78	157.209
270.417	157
270.828	156.865
276.502	155
281.239	153.443
282.588	153
284.878	152.247
288.673	151
288.694	150.994
291.145	150.188
294.759	149
294.789	148.99
294.817	148.991
300.025	147.273
300.849	147
300.936	147
301.55	146.798
306.97	145
307.021	145
311.682	143.462
313.072	143
313.082	143
315.185	142.306
319.144	141
321.59	140.197
325.229	139
329.426	137.608
331.256	137
332.629	136.549
337.335	135
341.828	133.529
343.443	133
348.164	131.439
349.492	131
351.137	130.45
355.479	129
366.611	128.944
370.513	128.931
383.965	128.994
385.43	129
387.113	129.048
390.516	129.144
435.781	130.424
456.235	131

480.527	131.667
527.675	132.968
528.433	132.989
528.846	133
528.936	133
528.97	133
529.059	133.001
539.5	133.043
552.72	133.294
575.143	133.619
581.119	133.601
587.25	133.583
593.541	133.565
599.129	133.534
601.589	133.521
608.463	133.488
610.709	133.476
617.792	133.441
625.205	133.405
627.114	133.395
634.744	133.358
636.43	133.349
644.276	133.311
645.74	133.303
653.801	133.264
655.043	133.257
656.126	133.253
664.642	133.216
665.551	133.212
674.288	133.174
675.074	133.171
684.022	133.132
684.619	133.13
693.779	133.09
694.187	133.088
703.562	133.048
703.773	133.047
713.368	133.005
713.392	133.005
714.64	133
723.812	132.994
724.625	132.995
726.778	132.991
732.863	132.987
736.095	132.991
738.943	132.989
742.604	133
766.537	133.668
774.739	133.898
814.017	135
828.404	135.395
839.649	135.705
864.839	136.398

886.554	137
888.573	137.057
924.259	137.663
944.12	137.919
948.68	137.898
953.418	137.877
958.343	137.854
963.659	137.828
967.433	137.811
972.95	137.784
976.521	137.768
982.239	137.739
985.607	137.724
991.527	137.694
994.615	137.677
1000.75	137.646
1003.63	137.631
1009.99	137.599
1012.66	137.584
1019.23	137.551
1021.71	137.539
1028.5	137.505
1029.69	137.499
1030.85	137.495
1031.4	137.492
1038.35	137.463
1040.11	137.456
1041.2	137.452
1042.28	137.45
1049.3	137.42
1052.16	137.449
1055.45	137.483
1057.69	137.531
1062.15	137.526
1066.68	137.507
1069.19	137.568
1075.92	137.51
1078.47	137.582
1085.16	137.513
1087.7	137.49
1090.05	137.577
1093.69	137.552
1096.62	137.674
1099.96	137.645
1103.91	137.833
1111.1	138.173
1115.26	138.472
1128.34	138.992
1128.36	138.993
1128.54	139
1136.54	140.583
1138.64	141
1143.2	141.914

1148.64	143
1149.35	143.143
1152.53	143.786
1157.39	144.767
1158.54	145
1163.34	145.967
1168.47	147
1168.88	147.082
1169.38	147.184
1178.4	149
1181.82	149.688
1188.33	151
1194.13	152.167
1198.27	153
1206.33	154.622
1208.21	155
1216.89	156.747
1218.14	157
1218.36	157.045
1228.05	159
1228.06	159.001
1228.08	159.005
1228.4	159.083
1236.03	160.624
1237.89	161
1244.19	162.271
1247.8	163
1253.54	164.159
1257.71	165
1261.5	165.765
1266.92	166.86
1267.34	166.946
1267.61	167
1277.37	168.971
1277.52	169
1278.54	169.207
1287.42	171
1288.05	171.126
1288.73	171.264
1293.48	172.185
1297.69	173
1300.81	173.606
1308	175
1310.03	175.394
1312.81	175.933
1315.92	176.536
1318.32	177
1324.86	178.267
1328.64	179
1334.83	180.2
1336.61	180.546

Block Search Polyline

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961
209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148
294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138

329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439
349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395
634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088

703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995
726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551
1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507

1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552
1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158
1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168

1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606
1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

External Boundary

X	Y
0	170
0	0
1336.61	0
1336.61	177.546
1336.61	179.546
1336.61	180.546
1336.61	181.546
1336.61	186.546
1336.61	316.096
1336	316.115
1335.3	316.135
1325.6	316.421
1323.06	316.496
1315.25	316.726
1310.87	316.855
1304.93	317.03
1298.73	317.212
1294.66	317.332
1286.65	317.568
1284.42	317.634
1274.63	317.923
1272	318
1262.91	318.268
1260.99	318.324
1251.2	318.613
1246.79	318.743
1239.42	318.96
1232.47	319.165
1227.56	319.309
1218.04	319.59
1215.62	319.661
1204.11	320
1203.6	320.015

1194.6	320.266
1193.29	320.302
1185.64	320.515
1183.11	320.585
1182.42	320.604
1175.98	320.783
1174.59	320.814
1173.12	320.841
1167.94	320.981
1166.28	321.002
1165.04	321.034
1163.06	321.079
1161.3	321.092
1159.43	321.127
1157.67	321.154
1155.99	321.174
1154.16	321.179
1152.52	321.192
1150.91	321.199
1149.06	321.196
1147.46	321.198
1145.85	321.194
1144.21	321.184
1142.36	321.173
1140.67	321.157
1138.9	321.134
1137.03	321.105
1135.23	321.085
1133.24	321.046
1131.08	320.997
1129.38	320.97
1127.03	320.908
1124.38	320.829
1122.89	320.798
1119.95	320.7
1118.67	320.668
1109.8	320.35
1109.09	320.328
1100.04	320
1096.88	319.885
1096.03	319.854
1085.1	319.456
1081.1	319.31
1073.4	319.03
1066.29	318.771
1064.86	318.717
1062.97	318.643
1052.18	318.254
1051.41	318.223
1045.12	318
1037.57	317.725
1028.17	317.383
1023.72	317.221

1017.01	316.976
1009.52	316.704
1008.28	316.657
996.063	316.213
995.361	316.186
994.822	316.164
990.2	316
980.627	315.651
977.216	315.527
966.37	315.132
957.811	314.821
951.951	314.607
950.897	314.568
937.869	314.094
937.565	314.082
937.331	314.073
935.278	314
925.128	313.63
922.402	313.531
913.375	313.202
907.52	312.989
901.711	312.778
892.78	312.452
891.981	312.423
880.356	312
878.221	311.922
877.459	311.895
863.902	311.401
855.95	311.111
849.484	310.876
844.499	310.694
834.968	310.347
834.362	310.325
825.434	310
821.354	309.851
820.258	309.812
809.633	309.425
805.404	309.271
797.969	309
790.641	308.733
786.363	308.577
775.969	308.199
775.619	308.186
770.512	308
761.583	307.675
758.397	307.559
747.249	307.153
738.908	306.849
732.814	306.627
729.246	306.497
718.278	306.098
718.107	306.092
715.59	306

706.219	305.659
703.734	305.568
694.724	305.24
689.186	305.038
683.216	304.821
674.618	304.508
671.696	304.402
660.668	304
660.102	303.979
659.927	303.973
647.125	303.507
642.972	303.356
634.19	303.036
626.089	302.741
621.298	302.566
609.277	302.129
608.447	302.098
605.746	302
592.729	301.43
585.533	300.889
578.85	300.522
573.694	300
567.931	298.081
567.688	298
567.55	297.954
561.688	296
560.864	295.725
555.688	294
553.874	293.396
549.687	292
547.513	291.275
543.686	290
539.572	288.629
537.686	288
532.56	286.292
531.685	286
529.672	285.329
525.684	284
523.962	283.426
519.684	282
517.638	281.318
513.683	280
509.776	278.698
507.683	278
506.199	277.506
501.681	276
497.772	274.697
495.681	274
491.005	272.442
489.68	272
489.09	271.803
483.679	270
482.242	269.521

477.679	268
474.189	266.837
471.678	266
466.109	264.144
465.678	264
465.484	263.935
459.677	262
459.258	261.86
453.676	260
452.686	259.67
447.676	258
444.164	256.829
441.675	256
437.62	254.648
435.675	254
431.086	252.47
429.675	252
427.788	251.371
423.674	250
420.757	249.028
417.674	248
414.581	246.969
411.673	246
408.486	244.938
405.673	244
402.391	242.906
399.673	242
396.296	240.874
393.672	240
390.201	238.843
387.672	238
384.105	236.811
381.671	236
378.01	234.78
375.671	234
372.05	232.793
369.671	232
368.183	231.504
363.67	230
362.091	229.474
357.67	228
355.998	227.443
351.669	226
349.905	225.412
345.669	224
343.812	223.381
339.669	222
337.719	221.35
333.668	220
331.626	219.319
327.668	218
325.533	217.288
321.667	216

319.439	215.257
315.667	214
313.346	213.226
309.667	212
307.252	211.195
303.666	210
301.159	209.164
297.666	208
295.065	207.133
291.665	206
288.971	205.102
285.665	204
282.877	203.071
279.665	202
276.783	201.04
273.664	200
270.689	199.008
267.664	198
264.594	196.977
261.663	196
258.5	194.946
255.663	194
252.405	192.914
249.662	192
246.31	190.883
243.662	190
240.215	188.851
237.662	188
234.12	186.82
231.661	186
228.017	184.785
225.662	184
221.802	182.716
219.651	182
216.161	180.832
214.953	180.427
213.677	180
210.543	178.955
208.652	178.325
207.677	178
207.158	177.844
205.613	177.382
202.523	176.456
180.07	178
177.959	177.46
174.783	176.639
172.407	176
170.772	175.495
166.382	174
163.292	173.078
159.725	172
157.032	170.826
156.661	170.683

155.94	170.468
154.715	170
153.182	169.408
152.867	169.312
152.014	169.08
151.049	168.783
148.832	168
147.535	167.52
143.965	166
140.022	164.477
138.788	164
137.479	163.509
133.373	162
131.589	161.309
127.185	160
126.959	159.997
126.25	159.995
125.762	159.993
125.68	159.993
118.478	159.969
112.757	159.986
109.707	159.993
109.569	159.993
109.105	159.994
108.997	159.995
108.065	159.997
107.64	159.997
107.166	160
106.378	160.046
106.193	160.053
106.103	160.054
105.8	160.084
105.495	160.108
104.805	160.417
103.221	160.987
102.599	161.033
102.009	161.037
101.614	161.072
101.055	161.048
100.711	161.052
97.7835	161.058
94.3084	161.041
93.8975	161.022
91.9539	161.147
91.63	161.143
91.4102	161.082
90.2817	161.024
89.9486	161.022
89.707	160.951
86.7014	160.813
82.7048	161.264
82.458	161.296
81.3882	161.545

81.1637	161.594
79.2738	162
77.816	162
75.0666	162
72.9864	161.282
69.3934	160
68.7416	159.768
68.2736	159.597
68.1192	159.514
67.9386	159.38
67.3686	159.119
66.5713	158
65.7493	156.136
65.6836	156
65.5752	156
65.3068	156
65.0401	156
59.6261	156
59.182	156
58.1295	156
54.3138	157.2
51.6407	158
50.8258	158.181
50.3907	158.236
45.9965	158.999
41.4109	159.593
40.813	159.676
40.1879	159.755
38.4792	160
36.2697	160.68
34.0018	161.233
31.409	162
30.6648	162.367
29.2396	163.187
28.1824	163.779
27.7683	164
24.1653	165.56
23.3051	166
19.6494	167.648
18.9426	168
15.9722	169.385
14.4129	170
14.1982	170
12.8502	170
12.4376	170
10.2755	170
9.92074	170
8.21815	170

Material Boundary

X	Y
202.523	176.456

209.644	173.98
209.656	173.976
209.673	173.97
209.701	173.961
209.754	173.943
209.889	173.899
211.024	173.525
215.647	172
219.457	170.752
221.753	170
223.198	169.524
227.818	168
231.167	166.903
233.924	166
239.731	164.085
239.989	164
240.158	163.945
246.075	162
250.846	160.432
252.16	160
254.731	159.155
258.246	158
260.564	157.238
264.331	156
269.78	154.209
270.417	154
270.828	153.865
276.502	152
281.239	150.443
282.588	150
284.878	149.247
288.673	148
288.694	147.994
291.145	147.188
294.759	146
294.789	145.99
294.817	145.991
300.025	144.273
300.849	144
300.936	144
301.55	143.798
306.97	142
307.021	142
311.682	140.462
313.072	140
313.082	140
315.185	139.306
319.144	138
321.59	137.197
325.229	136
329.426	134.608
331.256	134
332.629	133.549

337.335	132
341.828	130.529
343.443	130
348.164	128.439
349.492	128
351.137	127.45
355.479	126
366.611	125.944
370.513	125.931
383.965	125.994
385.43	126
387.113	126.048
390.516	126.144
435.781	127.424
456.235	128
480.527	128.667
527.675	129.968
528.433	129.989
528.846	130
528.936	130
528.97	130
529.059	130.001
539.5	130.043
552.72	130.294
575.143	130.619
581.119	130.601
587.25	130.583
593.541	130.565
599.129	130.534
601.589	130.521
608.463	130.488
610.709	130.476
617.792	130.441
625.205	130.405
627.114	130.395
634.744	130.358
636.43	130.349
644.276	130.311
645.74	130.303
653.801	130.264
655.043	130.257
656.126	130.253
664.642	130.216
665.551	130.212
674.288	130.174
675.074	130.171
684.022	130.132
684.619	130.13
693.779	130.09
694.187	130.088
703.562	130.048
703.773	130.047
713.368	130.005

713.392	130.005
714.64	130
723.812	129.994
724.625	129.995
726.778	129.991
732.863	129.987
736.095	129.991
738.943	129.989
742.604	130
766.537	130.668
774.739	130.898
814.017	132
828.404	132.395
839.649	132.705
864.839	133.398
886.554	134
888.573	134.057
924.259	134.663
944.12	134.919
948.68	134.898
953.418	134.877
958.343	134.854
963.659	134.828
967.433	134.811
972.95	134.784
976.521	134.768
982.239	134.739
985.607	134.724
991.527	134.694
994.615	134.677
1000.75	134.646
1003.63	134.631
1009.99	134.599
1012.66	134.584
1019.23	134.551
1021.71	134.539
1028.5	134.505
1029.69	134.499
1030.85	134.495
1031.4	134.492
1038.35	134.463
1040.11	134.456
1041.2	134.452
1042.28	134.45
1049.3	134.42
1052.16	134.449
1055.45	134.483
1057.69	134.531
1062.15	134.526
1066.68	134.507
1069.19	134.568
1075.92	134.51
1078.47	134.582

1085.16	134.513
1087.7	134.49
1090.05	134.577
1093.69	134.552
1096.62	134.674
1099.96	134.645
1103.91	134.833
1111.1	135.173
1115.26	135.472
1128.34	135.992
1128.36	135.993
1128.54	136
1136.54	137.583
1138.64	138
1143.2	138.914
1148.64	140
1149.35	140.143
1152.53	140.786
1157.39	141.767
1158.54	142
1163.34	142.967
1168.47	144
1168.88	144.082
1169.38	144.184
1178.4	146
1181.82	146.688
1188.33	148
1194.13	149.167
1198.27	150
1206.33	151.622
1208.21	152
1216.89	153.747
1218.14	154
1218.36	154.045
1228.05	156
1228.06	156.001
1228.08	156.005
1228.4	156.083
1236.03	157.624
1237.89	158
1244.19	159.271
1247.8	160
1253.54	161.159
1257.71	162
1261.5	162.765
1266.92	163.86
1267.34	163.946
1267.61	164
1277.37	165.971
1277.52	166
1278.54	166.207
1287.42	168
1288.05	168.126

1288.73	168.264
1293.48	169.185
1297.69	170
1300.81	170.606
1308	172
1310.03	172.394
1312.81	172.933
1315.92	173.536
1318.32	174
1324.86	175.267
1328.64	176
1334.83	177.2
1336.61	177.546

Material Boundary

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961
209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148

294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138
329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439
349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395

634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088
703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995
726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551

1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507
1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552
1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158

1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168
1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606
1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

Material Boundary

X	Y
208.652	178.325
209.644	177.98
209.656	177.976
209.673	177.97
209.701	177.961
209.754	177.943
209.889	177.899
211.024	177.525
215.647	176
219.457	174.752
221.753	174
223.198	173.524
227.818	172
231.167	170.903
233.924	170
239.731	168.085
239.989	168
240.158	167.945

246.075	166
250.846	164.432
252.16	164
254.731	163.155
258.246	162
260.564	161.238
264.331	160
269.78	158.209
270.417	158
270.828	157.865
276.502	156
281.239	154.443
282.588	154
284.878	153.247
288.673	152
288.694	151.994
291.145	151.188
294.759	150
294.789	149.99
294.817	149.991
300.025	148.273
300.849	148
300.936	148
301.55	147.798
306.97	146
307.021	146
311.682	144.462
313.072	144
313.082	144
315.185	143.306
319.144	142
321.59	141.197
325.229	140
329.426	138.608
331.256	138
332.629	137.549
337.335	136
341.828	134.529
343.443	134
348.164	132.439
349.492	132
351.137	131.45
355.479	130
366.611	129.944
370.513	129.931
383.965	129.994
385.43	130
387.113	130.048
390.516	130.144
435.781	131.424
456.235	132
480.527	132.667
527.675	133.968

528.433	133.989
528.846	134
528.936	134
528.97	134
529.059	134.001
539.5	134.043
552.72	134.294
575.143	134.619
581.119	134.601
587.25	134.583
593.541	134.565
599.129	134.534
601.589	134.521
608.463	134.488
610.709	134.476
617.792	134.441
625.205	134.405
627.114	134.395
634.744	134.358
636.43	134.349
644.276	134.311
645.74	134.303
653.801	134.264
655.043	134.257
656.126	134.253
664.642	134.216
665.551	134.212
674.288	134.174
675.074	134.171
684.022	134.132
684.619	134.13
693.779	134.09
694.187	134.088
703.562	134.048
703.773	134.047
713.368	134.005
713.392	134.005
714.64	134
723.812	133.994
724.625	133.995
726.778	133.991
732.863	133.987
736.095	133.991
738.943	133.989
742.604	134
766.537	134.668
774.739	134.898
814.017	136
828.404	136.395
839.649	136.705
864.839	137.398
886.554	138
888.573	138.057

924.259	138.663
944.12	138.919
948.68	138.898
953.418	138.877
958.343	138.854
963.659	138.828
967.433	138.811
972.95	138.784
976.521	138.768
982.239	138.739
985.607	138.724
991.527	138.694
994.615	138.677
1000.75	138.646
1003.63	138.631
1009.99	138.599
1012.66	138.584
1019.23	138.551
1021.71	138.539
1028.5	138.505
1029.69	138.499
1030.85	138.495
1031.4	138.492
1038.35	138.463
1040.11	138.456
1041.2	138.452
1042.28	138.45
1049.3	138.42
1052.16	138.449
1055.45	138.483
1057.69	138.531
1062.15	138.526
1066.68	138.507
1069.19	138.568
1075.92	138.51
1078.47	138.582
1085.16	138.513
1087.7	138.49
1090.05	138.577
1093.69	138.552
1096.62	138.674
1099.96	138.645
1103.91	138.833
1111.1	139.173
1115.26	139.472
1128.34	139.992
1128.36	139.993
1128.54	140
1136.54	141.583
1138.64	142
1143.2	142.914
1148.64	144
1149.35	144.143

1152.53	144.786
1157.39	145.767
1158.54	146
1163.34	146.967
1168.47	148
1168.88	148.082
1169.38	148.184
1178.4	150
1181.82	150.688
1188.33	152
1194.13	153.167
1198.27	154
1206.33	155.622
1208.21	156
1216.89	157.747
1218.14	158
1218.36	158.045
1228.05	160
1228.06	160.001
1228.08	160.005
1228.4	160.083
1236.03	161.624
1237.89	162
1244.19	163.271
1247.8	164
1253.54	165.159
1257.71	166
1261.5	166.765
1266.92	167.86
1267.34	167.946
1267.61	168
1277.37	169.971
1277.52	170
1278.54	170.207
1287.42	172
1288.05	172.126
1288.73	172.264
1293.48	173.185
1297.69	174
1300.81	174.606
1308	176
1310.03	176.394
1312.81	176.933
1315.92	177.536
1318.32	178
1324.86	179.267
1328.64	180
1334.83	181.2
1336.61	181.546

Material Boundary

X	Y

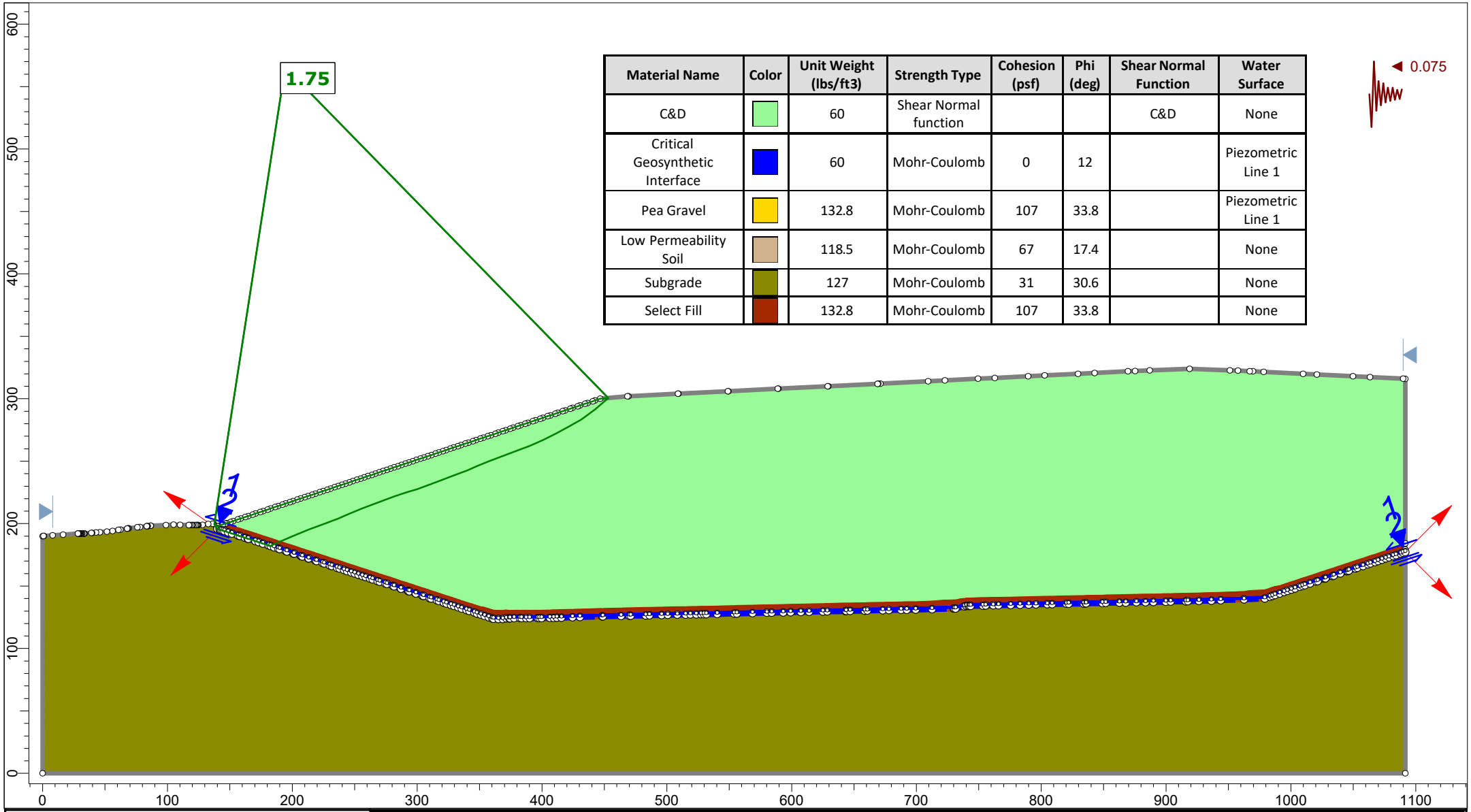
216.161	180.832
219.457	179.752
221.753	179
223.198	178.524
227.818	177
231.167	175.903
233.924	175
239.731	173.085
239.989	173
240.158	172.945
246.075	171
250.846	169.432
252.16	169
254.731	168.155
258.246	167
260.564	166.238
264.331	165
269.78	163.209
270.417	163
270.828	162.865
276.502	161
281.239	159.443
282.588	159
284.878	158.247
288.673	157
288.694	156.994
291.145	156.188
294.759	155
294.789	154.99
294.817	154.991
300.025	153.273
300.849	153
300.936	153
301.55	152.798
306.97	151
307.021	151
311.682	149.462
313.072	149
313.082	149
315.185	148.306
319.144	147
321.59	146.197
325.229	145
329.426	143.608
331.256	143
332.629	142.549
337.335	141
341.828	139.529
343.443	139
348.164	137.439
349.492	137
351.137	136.45
355.479	135

366.611	134.944
370.513	134.931
383.965	134.994
385.43	135
387.113	135.048
390.516	135.144
435.781	136.424
456.235	137
480.527	137.667
527.675	138.968
528.433	138.989
528.846	139
528.936	139
528.97	139
529.059	139.001
539.5	139.043
552.72	139.294
575.143	139.619
581.119	139.601
587.25	139.583
593.541	139.565
599.129	139.534
601.589	139.521
608.463	139.488
610.709	139.476
617.792	139.441
625.205	139.405
627.114	139.395
634.744	139.358
636.43	139.349
644.276	139.311
645.74	139.303
653.801	139.264
655.043	139.257
656.126	139.253
664.642	139.216
665.551	139.212
674.288	139.174
675.074	139.171
684.022	139.132
684.619	139.13
693.779	139.09
694.187	139.088
703.562	139.048
703.773	139.047
713.368	139.005
713.392	139.005
714.64	139
723.812	138.994
724.625	138.995
726.778	138.991
732.863	138.987
736.095	138.991

738.943	138.989
742.604	139
766.537	139.668
774.739	139.898
814.017	141
828.404	141.395
839.649	141.705
864.839	142.398
886.554	143
888.573	143.057
924.259	143.663
944.12	143.919
948.68	143.898
953.418	143.877
958.343	143.854
963.659	143.828
967.433	143.811
972.95	143.784
976.521	143.768
982.239	143.739
985.607	143.724
991.527	143.694
994.615	143.677
1000.75	143.646
1003.63	143.631
1009.99	143.599
1012.66	143.584
1019.23	143.551
1021.71	143.539
1028.5	143.505
1029.69	143.499
1030.85	143.495
1031.4	143.492
1038.35	143.463
1040.11	143.456
1041.2	143.452
1042.28	143.45
1049.3	143.42
1052.16	143.449
1055.45	143.483
1057.69	143.531
1062.15	143.526
1066.68	143.507
1069.19	143.568
1075.92	143.51
1078.47	143.582
1085.16	143.513
1087.7	143.49
1090.05	143.577
1093.69	143.552
1096.62	143.674
1099.96	143.645
1103.91	143.833

1111.1	144.173
1115.26	144.472
1128.34	144.992
1128.36	144.993
1128.54	145
1136.54	146.583
1138.64	147
1143.2	147.914
1148.64	149
1149.35	149.143
1152.53	149.786
1157.39	150.767
1158.54	151
1163.34	151.967
1168.47	153
1168.88	153.082
1169.38	153.184
1178.4	155
1181.82	155.688
1188.33	157
1194.13	158.167
1198.27	159
1206.33	160.622
1208.21	161
1216.89	162.747
1218.14	163
1218.36	163.045
1228.05	165
1228.06	165.001
1228.08	165.005
1228.4	165.083
1236.03	166.624
1237.89	167
1244.19	168.271
1247.8	169
1253.54	170.159
1257.71	171
1261.5	171.765
1266.92	172.86
1267.34	172.946
1267.61	173
1277.37	174.971
1277.52	175
1278.54	175.207
1287.42	177
1288.05	177.126
1288.73	177.264
1293.48	178.185
1297.69	179
1300.81	179.606
1308	181
1310.03	181.394
1312.81	181.933

1315.92	182.536
1318.32	183
1324.86	184.267
1328.64	185
1334.83	186.2
1336.61	186.546



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None

rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section B - Seismic - Liner System Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

182-442 S.A. Dunn Footprint Modification

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:00m:38.652s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	9/26/2018, 11:46:34 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	145
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.747240
Axis Location:	194.226, 565.588
Left Slip Surface Endpoint:	137.483, 199.535
Right Slip Surface Endpoint:	453.022, 300.561
Resisting Moment:	8.42381e+07 lb-ft
Driving Moment:	4.82121e+07 lb-ft
Resisting Horizontal Force:	220102 lb
Driving Horizontal Force:	125971 lb
Total Slice Area:	6420.12 ft2
Surface Horizontal Width:	315.54 ft
Surface Average Height:	20.3465 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
137.483	199.535
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.268	182.086
186.43	184.031
199.749	189.79
213.001	195.058
227.651	200.543
236.876	204.076
246.101	208.033
255.329	211.849
264.557	215.343
273.486	218.654
282.417	221.951
291.349	224.951
300.282	227.654
315.77	233.378
331.259	239.327
339.742	242.429
348.933	246.381
358.047	250.047
367.16	253.629
379.275	258.089
390.468	262.306
401.108	267.049
410.912	271.965
421.204	277.543
431.496	283.32
442.8	291.714
453.022	300.561

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.74724

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.54541	342.449	-56.3368	Subgrade	31	30.6	134.741	235.425	345.664	0	345.664	143.347	143.347
2	1.73757	620.427	-17.9725	Critical Geosynthetic Interface	0	12	38.8325	67.8497	381.598	62.3898	319.208	369.001	306.611
3	0.522929	237.787	-16.551	Critical Geosynthetic Interface	0	12	51.315	89.6597	484.206	62.3898	421.816	468.956	406.567
4	0.756555	384.503	-16.551	Critical Geosynthetic Interface	0	12	58.2833	101.835	541.486	62.3898	479.096	524.165	461.775
5	1.19178	702.8	-16.551	Critical Geosynthetic Interface	0	12	68.9459	120.465	629.132	62.3898	566.742	608.643	546.253
6	1.28149	891.117	-17.9236	Critical Geosynthetic Interface	0	12	83.2439	145.447	746.665	62.3898	684.275	719.74	657.35
7	2.9402	2565.99	-17.8782	Critical Geosynthetic Interface	0	12	107.012	186.976	942.04	62.3898	879.65	907.521	845.131
8	3.25728	3350.96	-17.8921	Critical Geosynthetic Interface	0	12	128.875	225.176	1121.76	62.3898	1059.37	1080.15	1017.76
9	4.89629	5823.09	-17.9103	Critical Geosynthetic Interface	0	12	152.424	266.322	1315.34	62.3898	1252.95	1266.07	1203.68
10	1.29095	1692.61	-17.9242	Critical Geosynthetic Interface	0	12	170.659	298.183	1465.23	62.3898	1402.84	1410.03	1347.64
11	4.04873	5734.51	-17.9425	Critical Geosynthetic Interface	0	12	186.754	326.304	1597.53	62.3898	1535.14	1537.06	1474.67
12	2.12828	3273.55	-17.9381	Critical Geosynthetic Interface	0	12	205.636	359.296	1752.75	62.3898	1690.36	1686.18	1623.79
13	0.677532	1079.6	-17.9564	Critical Geosynthetic Interface	0	12	214.358	374.534	1824.43	62.3898	1762.04	1754.96	1692.57
14	5.48926	9414.47	-17.9703	Critical Geosynthetic Interface	0	12	233.83	408.558	1984.5	62.3898	1922.11	1908.65	1846.26
15	2.64813	4966.9	-17.9887	Critical Geosynthetic Interface	0	12	259.982	454.251	2199.47	62.3898	2137.08	2115.06	2052.67
16	3.50846	7006.98	-18.0026	Critical Geosynthetic Interface	0	12	280.226	489.622	2365.88	62.3898	2303.49	2274.81	2212.42
17	4.62083	9970.51	-18.0211	Critical Geosynthetic Interface	0	12	307.504	537.284	2590.11	62.3898	2527.72	2490.07	2427.68
18	1.24348	2827.38	-18.2716	Critical Geosynthetic Interface	0	12	328.176	573.403	2760.04	62.3898	2697.65	2651.68	2589.29
19	1.25629	2835.51	25.0479	Pea Gravel	107	33.8	796.897	1392.37	1951.24	31.1743	1920.07	2323.65	2292.48
20	1.25692	2732.72	25.0479	Pea Gravel	107	33.8	780.643	1363.97	1877.64	0	1877.64	2242.46	2242.46
21	1.64861	3426.32	25.0479	Select Fill	107	33.8	749.17	1308.98	1795.5	0	1795.5	2145.61	2145.61
22	4.85632	9106.1	23.3839	Select Fill	107	33.8	695.463	1215.14	1655.32	0	1655.32	1956.04	1956.04
23	8.46271	14397.9	23.3839	C&D	0	34.992	602.07	1051.96	1502.8	0	1502.8	1763.14	1763.14
24	6.62619	11021.9	21.677	C&D	0	34.992	596.764	1042.69	1489.56	0	1489.56	1726.76	1726.76
25	6.62619	10852.5	21.677	C&D	0	34.992	584.041	1020.46	1457.8	0	1457.8	1689.95	1689.95
26	7.32498	11837.2	20.5251	C&D	0	34.992	581.712	1016.39	1451.99	0	1451.99	1669.77	1669.77
27	7.32498	11704.6	20.5251	C&D	0	34.992	571.73	998.95	1427.07	0	1427.07	1641.11	1641.11
28	9.22499	14530	20.9582	C&D	1.13687e-13	34.992	556.123	971.681	1388.12	0	1388.12	1601.13	1601.13

29	9.22512	14158.5	23.2182	C&D	1.13687e-13	34.992	519.454	907.61	1296.59	0	1296.59	1519.42	1519.42
30	9.22759	13712.6	22.4669	C&D	1.13687e-13	34.992	504.259	881.061	1258.66	0	1258.66	1467.19	1467.19
31	9.22796	13391.9	20.7374	C&D	0	34.992	502.009	877.13	1253.05	0	1253.05	1443.11	1443.11
32	8.9298	12757.1	20.3443	C&D	0	34.992	493.83	862.839	1232.63	0	1232.63	1415.73	1415.73
33	8.93074	12582.5	20.2614	C&D	0	34.992	484.507	846.55	1209.35	0	1209.35	1388.21	1388.21
34	8.93174	12491.6	18.5657	C&D	1.13687e-13	34.992	491.574	858.898	1227	0	1227	1392.11	1392.11
35	8.93269	12559.8	16.8356	C&D	0	34.992	505.761	883.686	1262.41	0	1262.41	1415.45	1415.45
36	15.4881	21642.7	20.2819	C&D	1.13687e-13	34.992	471.189	823.281	1176.12	0	1176.12	1350.25	1350.25
37	7.74464	10599.8	21.0121	C&D	0	34.992	453.287	792.002	1131.43	0	1131.43	1305.54	1305.54
38	7.74464	10416.6	21.0121	C&D	0	34.992	443.993	775.763	1108.23	0	1108.23	1278.77	1278.77
39	8.48253	11238.6	20.0878	C&D	1.13687e-13	34.992	442.466	773.095	1104.42	0	1104.42	1266.23	1266.23
40	9.19141	11856.7	23.2654	C&D	0	34.992	409.247	715.053	1021.5	0	1021.5	1197.46	1197.46
41	9.11376	11341.4	21.9112	C&D	1.13687e-13	34.992	402.669	703.56	1005.09	0	1005.09	1167.05	1167.05
42	9.1138	11020.4	21.4565	C&D	1.13687e-13	34.992	393.748	687.973	982.819	0	982.819	1137.57	1137.57
43	12.115	14297.7	20.2093	C&D	0	34.992	391.027	683.218	976.026	0	976.026	1119.97	1119.97
44	11.1927	12903.5	20.645	C&D	0	34.992	379.959	663.879	948.399	0	948.399	1091.56	1091.56
45	10.6402	11728.7	24.0252	C&D	0	34.992	349.584	610.808	872.58	0	872.58	1028.41	1028.41
46	9.80354	9969.11	26.6315	C&D	1.13687e-13	34.992	315.302	550.908	787.011	0	787.011	945.12	945.12
47	10.2924	9293.37	28.458	C&D	5.68434e-14	34.992	277.629	485.084	692.976	0	692.976	843.453	843.453
48	10.2916	7904.36	29.3061	C&D	5.68434e-14	34.992	237.667	415.262	593.231	0	593.231	726.637	726.637
49	11.3039	6316.37	36.5982	C&D	0	34.992	164.493	287.408	410.583	0	410.583	532.738	532.738
50	10.2225	2326.99	40.8727	C&D	0	34.992	66.1861	115.643	165.205	0	165.205	222.482	222.482

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.74724

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	137.483	199.535	0	0	0
2	140.028	195.713	1638.42	22.4291	0.7843
3	141.766	195.149	1874.45	43.1682	1.31928
4	142.289	194.994	1958.7	50.6119	1.48017
5	143.045	194.769	2095.7	62.6685	1.71283
6	144.237	194.414	2347.98	85.2352	2.07901
7	145.518	194	2697.31	116.458	2.47224
8	148.459	193.052	3712.95	218.762	3.37189
9	151.716	192	5061.02	386.155	4.3632
10	156.612	190.418	7452.04	762.123	5.83936
11	157.903	190	8157.24	889.79	6.2252
12	161.952	188.689	10577.7	1378.41	7.42454
13	164.08	188	11977.4	1693.52	8.04787
14	164.758	187.78	12442.3	1802.97	8.24514
15	170.247	186	16553	2865.64	9.82165
16	172.895	185.14	18760.2	3499.71	10.567
17	176.403	184	21915.3	4473.84	11.538
18	181.024	182.497	26482.1	6009.56	12.7855
19	182.268	182.086	27811.2	6479.51	13.1149
20	183.524	182.673	27454.1	6563.18	13.4448
21	184.781	183.261	27127.5	6649.04	13.7719
22	186.43	184.031	26722.3	6760	14.1964
23	191.286	186.131	25940.7	7153.09	15.4161
24	199.749	189.79	24456.8	7676.13	17.4252
25	206.375	192.424	23661.2	8096.15	18.8894
26	213.001	195.058	22877.7	8441.53	20.2533
27	220.326	197.8	22269.1	8835.39	21.641
28	227.651	200.543	21665.6	9151.93	22.9
29	236.876	204.076	20801.3	9392.3	24.3003
30	246.101	208.033	19400.4	9250.6	25.493
31	255.329	211.849	18222.1	9076.64	26.4784
32	264.557	215.343	17472.3	9001.67	27.2574
33	273.486	218.654	16844	8886.8	27.8159
34	282.417	221.951	16240.4	8702	28.1835
35	291.349	224.951	16013.2	8644.31	28.3612
36	300.282	227.654	16176.8	8728.23	28.3492
37	315.77	233.378	15119.7	7998.31	27.8788
38	323.514	236.352	14469.5	7509.47	27.4287
39	331.259	239.327	13830.1	6996.48	26.8343
40	339.742	242.429	13314.4	6498.7	26.0168
41	348.933	246.381	12149.9	5648.39	24.9333
42	358.047	250.047	11284.7	4943.2	23.6556
43	367.16	253.629	10526.2	4290.41	22.1755
44	379.275	258.089	9838.41	3561.19	19.8986
45	390.468	262.306	9123.92	2875.18	17.491
46	401.108	267.049	7825.32	2089.05	14.9471
47	410.912	271.965	6299.77	1385.45	12.4031
48	421.204	277.543	4594.43	773.199	9.55282
49	431.496	283.32	3020.6	347.065	6.55451
50	442.8	291.714	959.662	52.6747	3.14174
51	453.022	300.561	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
140.028	196.713

141.766	196.149
142.289	195.994
143.045	195.769
144.237	195.414
145.518	195
148.459	194.052
151.716	193
156.612	191.418
157.903	191
161.952	189.689
164.08	189
164.758	188.78
170.247	187
172.895	186.14
176.403	185
181.024	183.497
182.529	183
185.376	182.065
188.619	181
189.923	180.575
194.757	179
195.648	178.71
200.895	177
201.373	176.844
207.034	175
207.098	174.979
207.993	174.687
212.823	173.114
213.172	173
218.549	171.248
219.311	171
224.274	169.383
225.449	169
230	167.518
231.588	167
235.725	165.651
237.722	165
241.444	163.784
243.846	163
247.162	161.917
249.97	161
252.88	160.05
256.093	159
258.598	158.182
262.216	157
264.316	156.314
268.34	155
270.035	154.446
274.463	153
275.754	152.578
280.585	151
281.473	150.71
286.71	149

287.186	148.844
292.824	147
292.886	146.98
293.74	146.7
298.583	145.115
298.935	145
304.279	143.251
305.047	143
309.976	141.387
311.159	141
315.674	139.523
317.272	139
321.371	137.659
323.386	137
327.069	135.795
329.5	135
332.77	133.931
335.619	133
339.508	131.716
341.678	131
345.692	129.704
347.866	129
350.959	127.992
354.006	127
357.278	125.924
360.089	125
361.133	124.745
365.215	124.477
368.707	124.493
371.484	125
373.654	125.03
374.386	125.08
377.631	125.239
382.427	125.316
383.677	125.244
387.287	125.197
390.059	125.187
396.735	125.233
398.019	125.268
399.749	125.314
406.24	125.429
409.208	125.512
411.915	125.585
415.53	125.683
424.48	125.93
430.485	126.131
448.199	126.599
448.732	126.618
463.334	127
470.097	127.145
471.17	127.168
483.106	127.425
486.086	127.487

495.863	127.696
500.697	127.797
508.409	127.961
515.014	128.097
518.981	128.181
523.614	128.281
527.447	128.363
529.69	128.406
531.66	128.441
540.373	128.637
554.05	128.953
556.089	129
568.694	129.288
580.167	129.531
584.066	129.617
593.259	129.813
599.175	129.945
607.386	130.128
614.024	130.271
624.97	130.517
628.615	130.596
643.158	130.917
643.782	130.931
646.896	131
658.497	131.248
660.64	131.294
673.082	131.561
677.922	131.665
687.656	131.874
692.236	131.971
699.35	132.123
712.535	132.48
729.855	132.992
730.239	132.992
731.42	133
738.245	134.694
739.951	135
740.007	135.001
741.701	135.015
742.332	135.017
743.317	135.019
753.154	135.287
755.462	135.336
761.566	135.471
765.71	135.559
775.589	135.763
783.012	135.917
790.009	136.066
795.683	136.184
804.848	136.379
808.664	136.459
820.13	136.704
821.971	136.743

833.961	137
835.574	137.035
835.855	137.041
849.047	137.327
851.677	137.384
862.588	137.62
867.593	137.729
876.198	137.915
883.605	138.076
889.878	138.211
899.713	138.425
903.628	138.509
915.919	138.776
917.449	138.809
926.274	139
936.214	139.29
943.717	139.589
962.389	140.22
979.061	141
983.234	142.38
985.11	143
987.287	143.719
991.16	145
994.524	146.112
997.209	147
1000.33	148.033
1003.26	149
1007.19	150.301
1009.31	151
1011.14	151.607
1015.36	153
1020.26	154.621
1021.41	155
1027.04	156.861
1027.46	157
1027.82	157.12
1033.5	159
1034.29	159.258
1039.55	161
1044.85	162.749
1045.6	163
1046.49	163.294
1051.65	165
1053.18	165.503
1057.7	167
1061.67	168.313
1063.75	169
1067.3	170.173
1069.8	171
1072.91	172.028
1075.85	173
1078.52	173.882
1081.9	175

1084.13	175.737
1087.95	177
1089.74	177.591
1091.61	178.21

Block Search Polyline

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178
195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248
219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182

262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704
347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124
373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683

424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596
643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971
699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471

765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142
987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607
1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503

1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

External Boundary

X	Y
0	189.907
0	0
1091.61	0
1091.61	175.21
1091.61	177.21
1091.61	178.21
1091.61	179.21
1091.61	184.21
1091.61	315.915
1089.91	316
1063.4	317.322
1049.79	318
1020.8	319.445
1009.68	320
978.207	321.569
969.56	322
967.034	322.1
957.494	322.477
951.058	322.728
918.857	324
886.821	322.699
875.264	322.234
869.428	322
842.625	320.66
829.419	320
802.655	318.662
789.411	318
762.684	316.664
749.402	316
722.713	314.666
709.393	314
671.066	312.084
669.384	312
668.793	311.97
629.376	310
628.822	309.972

589.367	308
588.85	307.974
549.358	306
548.879	305.976
509.349	304
508.907	303.978
469.34	302
468.527	301.928
446.661	300
442.399	298.58
440.658	298
436.441	296.595
434.656	296
430.483	294.609
428.654	294
424.525	292.624
422.652	292
418.566	290.639
416.65	290
412.608	288.653
410.647	288
406.65	286.668
404.645	286
400.692	284.683
398.643	284
394.734	282.697
392.641	282
388.775	280.712
386.639	280
382.817	278.727
380.636	278
376.859	276.741
374.634	276
370.9	274.756
368.632	274
364.942	272.77
362.63	272
358.984	270.785
356.628	270
353.025	268.8
350.625	268
347.067	266.814
344.623	266
341.108	264.829
338.621	264
335.15	262.843
332.619	262
329.191	260.858
326.617	260
323.233	258.872
320.614	258
317.274	256.887
314.612	256

311.316	254.902
308.61	254
305.357	252.916
302.608	252
299.398	250.931
296.606	250
293.44	248.945
290.603	248
287.481	246.96
284.601	246
281.522	244.974
278.599	244
275.563	242.989
272.597	242
269.605	241.003
266.595	240
263.646	239.017
260.592	238
257.687	237.032
254.59	236
251.728	235.046
248.588	234
245.769	233.061
242.586	232
239.81	231.075
236.583	230
233.851	229.09
230.581	228
227.892	227.104
224.579	226
221.933	225.118
218.577	224
215.974	223.133
212.575	222
210.015	221.147
206.572	220
204.056	219.162
200.57	218
198.097	217.176
194.568	216
192.138	215.19
188.566	214
186.179	213.205
182.564	212
180.22	211.219
176.561	210
174.261	209.233
170.559	208
168.301	207.248
164.557	206
162.342	205.262
158.555	204
156.383	203.276

152.553	202
150.424	201.291
147.568	200.339
146.55	200
144.336	199.263
140.538	198
140.028	197.831
137.04	199.831
136.822	199.82
136.281	199.806
132.588	199.709
128.132	198.907
124.832	198.717
124.43	198.72
123.832	198.73
123.354	198.751
122.743	198.757
121.425	198.812
120.213	198.857
119.938	198.854
119.584	198.87
118.385	198.849
117.235	198.834
117.034	198.833
110.132	198.987
104.818	199.102
98.8143	198.859
86.6552	198.181
86.5428	198.179
84.1379	198
83.868	197.986
83.5647	197.967
83.3869	197.961
78.0277	197.266
75.9286	197.019
68.8572	196.138
68.697	196.118
67.841	196.002
67.8254	196.002
67.6997	196
62.2082	195.148
60.6701	194.935
55.9212	194
51.5095	193.601
45.8245	193.113
42.7715	192.86
39.5414	192.548
39.0396	192.503
33.5804	192
33.3498	191.999
33.0358	191.998
31.7133	191.995
31.057	191.995

30.8982	191.995
30.4475	191.994
29.8506	191.994
29.6366	191.993
29.391	191.993
29.3226	191.993
28.622	191.994
28.542	191.993
28.3605	191.993
28.2555	191.993
16.346	191.138
8.05554	190.53
0.998983	190.005
0.686216	190

Material Boundary

X	Y
140.028	197.831
140.028	197.713
140.028	196.713
140.028	195.713
140.028	193.713
141.766	193.149
142.289	192.994
143.045	192.769
144.237	192.414
145.518	192
148.459	191.052
151.716	190
156.612	188.418
157.903	188
161.952	186.689
164.08	186
164.758	185.78
170.247	184
172.895	183.14
176.403	182
181.024	180.497
182.529	180
185.376	179.065
188.619	178
189.923	177.575
194.757	176
195.648	175.71
200.895	174
201.373	173.844
207.034	172
207.098	171.979
207.993	171.687
212.823	170.114
213.172	170
218.549	168.248

219.311	168
224.274	166.383
225.449	166
230	164.518
231.588	164
235.725	162.651
237.722	162
241.444	160.784
243.846	160
247.162	158.917
249.97	158
252.88	157.05
256.093	156
258.598	155.182
262.216	154
264.316	153.314
268.34	152
270.035	151.446
274.463	150
275.754	149.578
280.585	148
281.473	147.71
286.71	146
287.186	145.844
292.824	144
292.886	143.98
293.74	143.7
298.583	142.115
298.935	142
304.279	140.251
305.047	140
309.976	138.387
311.159	138
315.674	136.523
317.272	136
321.371	134.659
323.386	134
327.069	132.795
329.5	132
332.77	130.931
335.619	130
339.508	128.716
341.678	128
345.692	126.704
347.866	126
350.959	124.992
354.006	124
357.278	122.924
360.089	122
361.133	121.745
365.215	121.477
368.707	121.493
371.484	122

373.654	122.03
374.386	122.08
377.631	122.239
382.427	122.316
383.677	122.244
387.287	122.197
390.059	122.187
396.735	122.233
398.019	122.268
399.749	122.314
406.24	122.429
409.208	122.512
411.915	122.585
415.53	122.683
424.48	122.93
430.485	123.131
448.199	123.599
448.732	123.618
463.334	124
470.097	124.145
471.17	124.168
483.106	124.425
486.086	124.487
495.863	124.696
500.697	124.797
508.409	124.961
515.014	125.097
518.981	125.181
523.614	125.281
527.447	125.363
529.69	125.406
531.66	125.441
540.373	125.637
554.05	125.953
556.089	126
568.694	126.288
580.167	126.531
584.066	126.617
593.259	126.813
599.175	126.945
607.386	127.128
614.024	127.271
624.97	127.517
628.615	127.596
643.158	127.917
643.782	127.931
646.896	128
658.497	128.248
660.64	128.294
673.082	128.561
677.922	128.665
687.656	128.874
692.236	128.971

699.35	129.123
712.535	129.48
729.855	129.992
730.239	129.992
731.42	130
738.245	131.694
739.951	132
740.007	132.001
741.701	132.015
742.332	132.017
743.317	132.019
753.154	132.287
755.462	132.336
761.566	132.471
765.71	132.559
775.589	132.763
783.012	132.917
790.009	133.066
795.683	133.184
804.848	133.379
808.664	133.459
820.13	133.704
821.971	133.743
833.961	134
835.574	134.035
835.855	134.041
849.047	134.327
851.677	134.384
862.588	134.62
867.593	134.729
876.198	134.915
883.605	135.076
889.878	135.211
899.713	135.425
903.628	135.509
915.919	135.776
917.449	135.809
926.274	136
936.214	136.29
943.717	136.589
962.389	137.22
979.061	138
983.234	139.38
985.11	140
987.287	140.719
991.16	142
994.524	143.112
997.209	144
1000.33	145.033
1003.26	146
1007.19	147.301
1009.31	148
1011.14	148.607

1015.36	150
1020.26	151.621
1021.41	152
1027.04	153.861
1027.46	154
1027.82	154.12
1033.5	156
1034.29	156.258
1039.55	158
1044.85	159.749
1045.6	160
1046.49	160.294
1051.65	162
1053.18	162.503
1057.7	164
1061.67	165.313
1063.75	166
1067.3	167.173
1069.8	168
1072.91	169.028
1075.85	170
1078.52	170.882
1081.9	172
1084.13	172.737
1087.95	174
1089.74	174.591
1091.61	175.21

Material Boundary

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178

195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248
219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182
262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704

347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124
373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683
424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596

643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971
699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471
765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142

987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607
1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503
1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

Material Boundary

X	Y
140.028	197.713
141.766	197.149
142.289	196.994
143.045	196.769
144.237	196.414
145.518	196
148.459	195.052
151.716	194
156.612	192.418
157.903	192
161.952	190.689
164.08	190
164.758	189.78

170.247	188
172.895	187.14
176.403	186
181.024	184.497
182.529	184
185.376	183.065
188.619	182
189.923	181.575
194.757	180
195.648	179.71
200.895	178
201.373	177.844
207.034	176
207.098	175.979
207.993	175.687
212.823	174.114
213.172	174
218.549	172.248
219.311	172
224.274	170.383
225.449	170
230	168.518
231.588	168
235.725	166.651
237.722	166
241.444	164.784
243.846	164
247.162	162.917
249.97	162
252.88	161.05
256.093	160
258.598	159.182
262.216	158
264.316	157.314
268.34	156
270.035	155.446
274.463	154
275.754	153.578
280.585	152
281.473	151.71
286.71	150
287.186	149.844
292.824	148
292.886	147.98
293.74	147.7
298.583	146.115
298.935	146
304.279	144.251
305.047	144
309.976	142.387
311.159	142
315.674	140.523
317.272	140

321.371	138.659
323.386	138
327.069	136.795
329.5	136
332.77	134.931
335.619	134
339.508	132.716
341.678	132
345.692	130.704
347.866	130
350.959	128.992
354.006	128
357.278	126.924
360.089	126
361.133	125.745
365.215	125.477
368.707	125.493
371.484	126
373.654	126.03
374.386	126.08
377.631	126.239
382.427	126.316
383.677	126.244
387.287	126.197
390.059	126.187
396.735	126.233
398.019	126.268
399.749	126.314
406.24	126.429
409.208	126.512
411.915	126.585
415.53	126.683
424.48	126.93
430.485	127.131
448.199	127.599
448.732	127.618
463.334	128
470.097	128.145
471.17	128.168
483.106	128.425
486.086	128.487
495.863	128.696
500.697	128.797
508.409	128.961
515.014	129.097
518.981	129.181
523.614	129.281
527.447	129.363
529.69	129.406
531.66	129.441
540.373	129.637
554.05	129.953
556.089	130

568.694	130.288
580.167	130.531
584.066	130.617
593.259	130.813
599.175	130.945
607.386	131.128
614.024	131.271
624.97	131.517
628.615	131.596
643.158	131.917
643.782	131.931
646.896	132
658.497	132.248
660.64	132.294
673.082	132.561
677.922	132.665
687.656	132.874
692.236	132.971
699.35	133.123
712.535	133.48
729.855	133.992
730.239	133.992
731.42	134
738.245	135.694
739.951	136
740.007	136.001
741.701	136.015
742.332	136.017
743.317	136.019
753.154	136.287
755.462	136.336
761.566	136.471
765.71	136.559
775.589	136.763
783.012	136.917
790.009	137.066
795.683	137.184
804.848	137.379
808.664	137.459
820.13	137.704
821.971	137.743
833.961	138
835.574	138.035
835.855	138.041
849.047	138.327
851.677	138.384
862.588	138.62
867.593	138.729
876.198	138.915
883.605	139.076
889.878	139.211
899.713	139.425
903.628	139.509

915.919	139.776
917.449	139.809
926.274	140
936.214	140.29
943.717	140.589
962.389	141.22
979.061	142
983.234	143.38
985.11	144
987.287	144.719
991.16	146
994.524	147.112
997.209	148
1000.33	149.033
1003.26	150
1007.19	151.301
1009.31	152
1011.14	152.607
1015.36	154
1020.26	155.621
1021.41	156
1027.04	157.861
1027.46	158
1027.82	158.12
1033.5	160
1034.29	160.258
1039.55	162
1044.85	163.749
1045.6	164
1046.49	164.294
1051.65	166
1053.18	166.503
1057.7	168
1061.67	169.313
1063.75	170
1067.3	171.173
1069.8	172
1072.91	173.028
1075.85	174
1078.52	174.882
1081.9	176
1084.13	176.737
1087.95	178
1089.74	178.591
1091.61	179.21

Material Boundary

X	Y
147.568	200.339
148.459	200.052
151.716	199
156.612	197.418

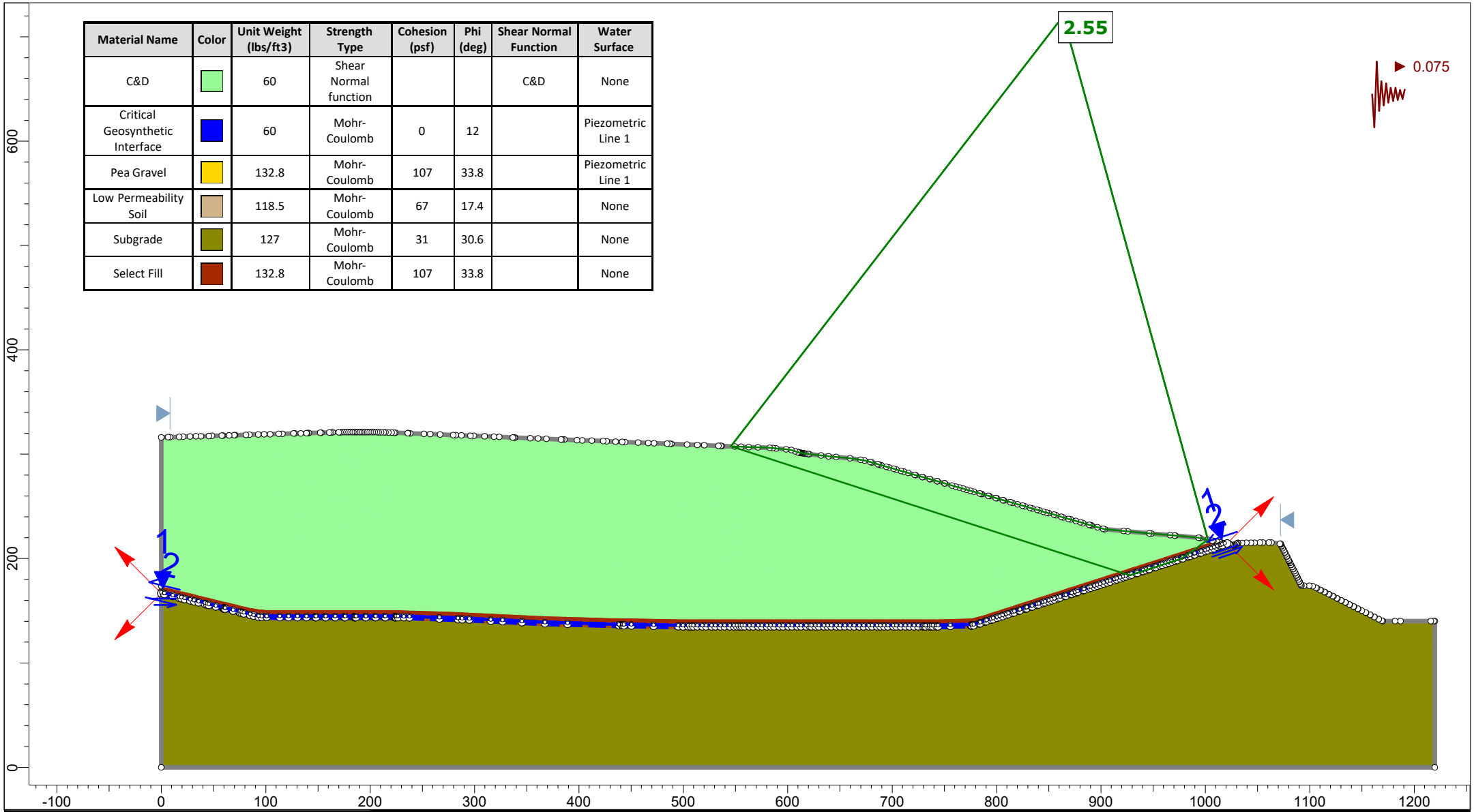
157.903	197
161.952	195.689
164.08	195
164.758	194.78
170.247	193
172.895	192.14
176.403	191
181.024	189.497
182.529	189
185.376	188.065
188.619	187
189.923	186.575
194.757	185
195.648	184.71
200.895	183
201.373	182.844
207.034	181
207.098	180.979
207.993	180.687
212.823	179.114
213.172	179
218.549	177.248
219.311	177
224.274	175.383
225.449	175
230	173.518
231.588	173
235.725	171.651
237.722	171
241.444	169.784
243.846	169
247.162	167.917
249.97	167
252.88	166.05
256.093	165
258.598	164.182
262.216	163
264.316	162.314
268.34	161
270.035	160.446
274.463	159
275.754	158.578
280.585	157
281.473	156.71
286.71	155
287.186	154.844
292.824	153
292.886	152.98
293.74	152.7
298.583	151.115
298.935	151
304.279	149.251
305.047	149

309.976	147.387
311.159	147
315.674	145.523
317.272	145
321.371	143.659
323.386	143
327.069	141.795
329.5	141
332.77	139.931
335.619	139
339.508	137.716
341.678	137
345.692	135.704
347.866	135
350.959	133.992
354.006	133
357.278	131.924
360.089	131
361.133	130.745
365.215	130.477
368.707	130.493
371.484	131
373.654	131.03
374.386	131.08
377.631	131.239
382.427	131.316
383.677	131.244
387.287	131.197
390.059	131.187
396.735	131.233
398.019	131.268
399.749	131.314
406.24	131.429
409.208	131.512
411.915	131.585
415.53	131.683
424.48	131.93
430.485	132.131
448.199	132.599
448.732	132.618
463.334	133
470.097	133.145
471.17	133.168
483.106	133.425
486.086	133.487
495.863	133.696
500.697	133.797
508.409	133.961
515.014	134.097
518.981	134.181
523.614	134.281
527.447	134.363
529.69	134.406

531.66	134.441
540.373	134.637
554.05	134.953
556.089	135
568.694	135.288
580.167	135.531
584.066	135.617
593.259	135.813
599.175	135.945
607.386	136.128
614.024	136.271
624.97	136.517
628.615	136.596
643.158	136.917
643.782	136.931
646.896	137
658.497	137.248
660.64	137.294
673.082	137.561
677.922	137.665
687.656	137.874
692.236	137.971
699.35	138.123
712.535	138.48
729.855	138.992
730.239	138.992
731.42	139
738.245	140.694
739.951	141
740.007	141.001
741.701	141.015
742.332	141.017
743.317	141.019
753.154	141.287
755.462	141.336
761.566	141.471
765.71	141.559
775.589	141.763
783.012	141.917
790.009	142.066
795.683	142.184
804.848	142.379
808.664	142.459
820.13	142.704
821.971	142.743
833.961	143
835.574	143.035
835.855	143.041
849.047	143.327
851.677	143.384
862.588	143.62
867.593	143.729
876.198	143.915

883.605	144.076
889.878	144.211
899.713	144.425
903.628	144.509
915.919	144.776
917.449	144.809
926.274	145
936.214	145.29
943.717	145.589
962.389	146.22
979.061	147
983.234	148.38
985.11	149
987.287	149.719
991.16	151
994.524	152.112
997.209	153
1000.33	154.033
1003.26	155
1007.19	156.301
1009.31	157
1011.14	157.607
1015.36	159
1020.26	160.621
1021.41	161
1027.04	162.861
1027.46	163
1027.82	163.12
1033.5	165
1034.29	165.258
1039.55	167
1044.85	168.749
1045.6	169
1046.49	169.294
1051.65	171
1053.18	171.503
1057.7	173
1061.67	174.313
1063.75	175
1067.3	176.173
1069.8	177
1072.91	178.028
1075.85	179
1078.52	179.882
1081.9	181
1084.13	181.737
1087.95	183
1089.74	183.591
1091.61	184.21

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section C - Seismic - Liner System Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:00m:31.533s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	2.547550
Axis Location:	863.552, 719.524
Left Slip Surface Endpoint:	545.611, 307.512
Right Slip Surface Endpoint:	1002.397, 217.964
Resisting Moment:	2.28694e+08 lb-ft
Driving Moment:	8.97701e+07 lb-ft
Resisting Horizontal Force:	438281 lb
Driving Horizontal Force:	172040 lb
Total Slice Area:	12114.2 ft2
Surface Horizontal Width:	456.786 ft
Surface Average Height:	26.5205 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
545.611	307.512
927.308	183.941
929.36	184.601
929.897	184.774
934.779	186.344
940.013	188.023
940.251	188.099
943.148	189.033
945.739	189.861
946.212	190.017
951.217	191.621
952.42	192.01
956.69	193.379
958.44	193.944
962.048	195.1
964.881	196.013
967.433	196.83
971.161	198.029
972.894	198.585
977.304	200
1002.4	217.964

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.54755

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	185.422	215307	-17.9388	C&D	1.13687e-13	34.992	280.352	714.21	1020.3	0	1020.3	1111.06	1111.06
2	185.422	373402	-17.9388	C&D	2.27374e-13	34.992	500.504	1275.06	1821.52	0	1821.52	1983.55	1983.55
3	7.75268	20145.2	-17.9388	Select Fill	107	33.8	691.233	1760.95	2470.64	0	2470.64	2694.42	2694.42
4	3.10107	9085.17	-17.9388	Pea Gravel	107	33.8	772.13	1967.04	2778.49	0	2778.49	3028.46	3028.46
5	2.05237	6155.05	17.8069	Critical Geosynthetic Interface	0	12	284.762	725.445	3475.34	62.3886	3412.95	3383.87	3321.48
6	0.536672	1592.32	17.9047	Critical Geosynthetic Interface	0	12	281.422	716.937	3435.28	62.3571	3372.92	3344.36	3282
7	4.8826	14159.8	17.8231	Critical Geosynthetic Interface	0	12	273.989	698	3346.12	62.278	3283.84	3258.03	3195.75
8	5.23426	14527	17.7918	Critical Geosynthetic Interface	0	12	260.405	663.396	3183.31	62.2781	3121.03	3099.74	3037.47
9	0.237284	642.585	17.5862	Critical Geosynthetic Interface	0	12	252.865	644.186	3093.01	62.3572	3030.66	3012.87	2950.51
10	2.89697	7732.84	17.8704	Critical Geosynthetic Interface	0	12	249.075	634.53	3047.51	62.278	2985.23	2967.2	2904.92
11	2.59123	6741.46	17.7359	Critical Geosynthetic Interface	0	12	241.663	615.649	2958.68	62.278	2896.4	2881.39	2819.11
12	0.473451	1213.87	18.1735	Critical Geosynthetic Interface	0	12	238.143	606.682	2916.49	62.2841	2854.2	2838.31	2776.03
13	5.0048	12495.3	17.7742	Critical Geosynthetic Interface	0	12	230.539	587.309	2825.35	62.278	2763.07	2751.44	2689.17
14	1.20265	2910.91	17.9328	Critical Geosynthetic Interface	0	12	222.635	567.173	2730.63	62.2853	2668.34	2658.58	2596.29
15	4.2705	10049.1	17.7743	Critical Geosynthetic Interface	0	12	215.409	548.766	2644.03	62.278	2581.75	2574.97	2512.7
16	1.7501	3988.73	17.8862	Critical Geosynthetic Interface	0	12	207.775	529.317	2552.52	62.2783	2490.24	2485.46	2423.19
17	3.60731	7984.08	17.7686	Critical Geosynthetic Interface	0	12	200.838	511.645	2469.38	62.278	2407.1	2405.02	2342.74
18	2.83306	6046.18	17.8557	Critical Geosynthetic Interface	0	12	192.737	491.006	2372.28	62.278	2310	2310.19	2247.91
19	2.55243	5278.41	17.7438	Critical Geosynthetic Interface	0	12	185.872	473.518	2290.02	62.2917	2227.73	2230.54	2168.25
20	3.72748	7420.68	17.8428	Critical Geosynthetic Interface	0	12	178.079	453.664	2196.63	62.3083	2134.32	2139.31	2077
21	1.73354	3334.66	17.7589	Critical Geosynthetic Interface	0	12	171.234	436.227	2114.57	62.278	2052.29	2059.72	1997.45
22	4.40941	8150.58	17.7955	Critical Geosynthetic Interface	0	12	163.7	417.033	2024.34	62.3583	1961.99	1971.8	1909.44
23	5.06727	8105.06	35.5984	Pea Gravel	107	33.8	628.439	1600.98	2231.69	0	2231.69	1781.8	1781.8
24	12.6682	11608.4	35.5984	Select Fill	107	33.8	370.167	943.02	1248.83	0	1248.83	983.832	983.832
25	7.3576	1531.98	35.5984	C&D	2.84217e-14	34.992	72.8567	185.606	265.152	0	265.152	212.994	212.994

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 2.54755

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	545.611	307.512	0	0	0
2	731.032	247.484	25411.7	9292.28	20.0859
3	916.454	187.455	69955.1	14900.9	12.0247
4	924.206	184.945	72308.1	14157.1	11.0777
5	927.308	183.941	73384.5	13850.8	10.6884
6	929.36	184.601	70970.7	13061	10.4277
7	929.897	184.774	70343.4	12858.4	10.359
8	934.779	186.344	64814.9	11110.7	9.72721
9	940.013	188.023	59194.3	9412.72	9.03518
10	940.251	188.099	58949.9	9340.4	9.00346
11	943.148	189.033	55961.8	8477.36	8.61395
12	945.739	189.861	53389.2	7752.47	8.26199
13	946.212	190.017	52914.2	7622.53	8.19732
14	951.217	191.621	48164.6	6347.35	7.50744
15	952.42	192.01	47052.4	6060.93	7.33999
16	956.69	193.379	43266.5	5113.6	6.74043
17	958.44	193.944	41760.4	4752.52	6.49258
18	962.048	195.1	38780.1	4060.94	5.97806
19	964.881	196.013	36522.5	3562.22	5.57072
20	967.433	196.83	34573.6	3147.31	5.20142
21	971.161	198.029	31830.8	2593.77	4.65852
22	972.894	198.585	30610	2357.83	4.40469
23	977.304	200	27634.4	1813.93	3.75552
24	982.371	203.628	16962.1	890.165	3.00411
25	995.039	212.697	1817.77	35.1449	1.10762
26	1002.4	217.964	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	167.667
2.61045	167.033
2.74827	167
2.93545	166.955
10.984	165
16.9104	163.561
19.2198	163
22.3549	162.239
27.4555	161
31.2131	160.088
35.6913	159
41.768	157.524
43.927	157
45.5183	156.614
52.1628	155
59.8261	153.139

59.8924	153.123
60.4145	153
60.8582	152.895
60.9162	152.881
68.6396	151
75.206	149.4
76.8497	149
79.0691	148.459
85.0598	147
88.4071	146.185
93.2699	145
96.1305	144.964
100.713	144.947
101.016	144.941
113.425	144.821
121.918	144.822
130.421	144.823
138.934	144.824
147.456	144.825
148.142	144.848
156.777	144.849
157.383	144.866
166.104	144.867
166.646	144.881
175.435	144.882
175.924	144.893
184.77	144.893
185.454	144.904
186.03	144.91
186.471	144.91
195.39	144.911
195.828	144.911
204.75	144.912
205.185	144.912
214.11	144.912
214.542	144.912
223.469	144.913
223.899	144.913
224.328	144.913
224.757	144.913
226.606	144.875
232.206	144.736
237.619	144.555
266.437	143.593
284.194	143
288.023	142.82
294.955	142.494
315.577	141.526
326.764	141
345.352	140.109
367.261	139
389.122	138.384
438.282	137

441.106	136.989
441.813	136.988
442.992	136.982
450.152	136.954
471.589	136.475
495.112	136.041
499.816	136.042
504.522	136.042
507.015	136.043
509.52	136.047
513.255	136.047
518.191	136.045
521.934	136.044
526.857	136.043
530.609	136.042
535.521	136.04
539.492	136.044
544.41	136.042
548.376	136.045
551.45	136.051
554.115	136.053
556.005	136.053
558.664	136.055
563.412	136.057
566.946	136.064
571.737	136.066
575.242	136.073
580.075	136.075
583.551	136.082
586.977	136.088
591.874	136.09
595.541	136.09
600.448	136.093
604.107	136.093
609.025	136.095
612.675	136.095
617.604	136.097
621.244	136.097
622.641	136.096
626.431	136.093
629.889	136.087
634.698	136.083
638.19	136.076
641.731	136.07
646.478	136.066
650.054	136.06
654.753	136.056
659.419	136.052
663.75	136.06
668.432	136.056
672.746	136.063
677.444	136.06
680.743	136.07

685.469	136.067
688.752	136.077
692.299	136.081
695.852	136.075
701.119	136.075
703.992	136.063
708.239	136.071
712.549	136.079
716.654	136.084
721.014	136.092
725.057	136.098
729.467	136.106
730.766	136.109
732.057	136.112
735.706	136.117
737.361	136.116
738.906	136.115
742.564	136.12
743.989	136.118
755.732	136.35
775.632	136.895
775.782	136.895
775.919	136.894
776.153	136.893
778.05	137
783.506	138.753
784.276	139
789.286	140.609
790.503	141
794.831	142.39
796.73	143
800.37	144.169
802.957	145
805.905	145.947
809.183	147
811.435	147.723
815.41	149
816.957	149.497
821.637	151
822.473	151.269
827.863	153
827.984	153.039
828.909	153.336
833.494	154.808
834.09	155
838.998	156.577
840.317	157
844.497	158.343
846.543	159
849.989	160.107
852.77	161
855.476	161.869
858.997	163

860.956	163.629
865.223	165
866.43	165.387
871.45	167
871.897	167.144
875.09	168.169
877.36	168.898
877.677	169
882.821	170.652
883.903	171
888.276	172.404
890.13	173
893.723	174.154
896.357	175
899.164	175.902
902.583	177
906.152	178.146
908.81	179
912.925	180.322
915.037	181
918.41	182.083
921.263	183
923.888	183.843
927.49	185
929.36	185.601
933.717	187
934.825	187.356
939.944	189
940.292	189.112
943.235	190.057
945.863	190.901
946.17	191
951.208	192.618
952.397	193
956.633	194.361
958.624	195
962.07	196.107
964.85	197
967.5	197.851
971.077	199
972.917	199.591
977.304	201
978.32	201.326
983.53	203
983.726	203.063
985.426	203.609
989.318	204.859
989.757	205
994.64	206.568
995.984	207
999.949	208.274
1002.21	209
1005.61	210.122

1008.27	211
1011.51	212.172
1013.9	213
1014.76	213.314
1016.17	213.831
1018.57	214.636

Block Search Polyline

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4
76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185
93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893

185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911
195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912
223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041
499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047
513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073

580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09
595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095
617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
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654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063
708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092
725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138

789.286	139.609
790.503	140
794.831	141.39
796.73	142
800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723
815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.821	169.652
883.903	170
888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356

939.944	188
940.292	188.112
943.235	189.057
945.863	189.901
946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194
962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

External Boundary

X	Y
0	316.109
0	173.667
0	168.667
0	167.667
0	166.667
0	164.667
0	0
1219.81	0
1219.81	140
1218.71	140
1216.08	140
1186.91	140
1181.65	140
1169.98	140
1168.96	140.51
1165.98	142
1165.94	142.022

1161.98	144
1161.87	144.052
1157.97	146
1157.81	146.083
1153.97	148
1153.74	148.113
1149.97	150
1146.3	151.832
1145.96	152
1142.35	153.804
1141.96	154
1138.41	155.775
1137.96	156
1134.46	157.746
1133.96	158
1130.52	159.716
1129.95	160
1126.58	161.687
1125.95	162
1122.63	163.658
1121.95	164
1118.69	165.628
1117.94	166
1114.74	167.599
1113.94	168
1110.8	169.569
1109.94	170
1106.86	171.539
1105.93	172
1102.91	173.513
1099.52	173.859
1094.52	173.86
1092.03	174
1091.53	174.999
1091.03	176
1090.13	177.801
1090.03	178
1089.94	178.171
1089.03	180
1088.12	181.822
1088.03	182
1087.11	183.832
1087.03	184
1086.11	185.84
1086.03	186
1085.11	187.848
1085.03	188
1084.1	189.856
1084.03	190
1083.1	191.864
1083.03	192
1082.1	193.874
1082.03	194

1081.09	195.885
1081.03	196
1080.32	197.424
1080.04	198
1079.89	198.297
1079.04	200
1078.08	201.905
1078.04	202
1077.98	202.109
1077.04	204
1076.2	205.676
1076.04	206
1075.05	207.97
1075.04	208
1075.02	208.038
1074.04	210
1073.25	211.588
1073.04	212
1072.31	213.453
1072.04	214
1071.94	214.206
1071.32	214.159
1063.42	215.257
1060.85	215.402
1055.24	215.305
1052.25	215.254
1047.24	215.167
1043.65	215.105
1039.23	215.029
1035.05	214.956
1031.23	214.89
1031.21	214.89
1031.2	214.89
1030.1	214.34
1029.41	214
1028.1	213.348
1027.2	212.901
1026.1	212.904
1025.2	212.906
1024.29	213.363
1024.06	213.481
1023.02	214
1021.42	214.349
1021.42	214.349
1020.86	214.406
1018.57	214.636
1018.35	214.657
1016.17	214.831
1016.17	214.831
1014.12	215.298
1011.03	216
1007.6	216.78
1006.66	216.994

1002.24	218
994.715	219.711
993.444	220
971.061	221.961
970.626	222
966.337	222.38
948.029	224
946.173	224.161
925.668	226
921.667	226.352
903.558	228
902.15	228.407
896.627	230
890.917	231.686
889.857	232
888.805	232.302
882.886	234
880.441	234.701
875.91	236
870.915	237.432
868.933	238
863.881	239.448
861.956	240
856.849	241.464
854.979	242
849.816	243.48
848.002	244
844.816	244.913
841.024	246
838.911	246.606
834.049	248
831.937	248.605
827.072	250
824.844	250.639
820.092	252
815.118	253.427
813.119	254
807.03	255.746
806.142	256
799.957	257.773
799.166	258
792.927	259.789
792.189	260
785.902	261.802
785.213	262
784	262.348
778.236	264
774.987	264.932
771.259	266
767.956	266.946
764.278	268
760.966	268.949
757.298	270

750.551	271.933
750.317	272
750.187	272.037
743.335	274
743.061	274.079
736.354	276
736.025	276.094
729.373	278
728.994	278.109
722.393	280
721.65	280.213
715.413	282
711.155	283.22
708.431	284
704.082	285.246
701.451	286
697.045	287.263
694.47	288
689.688	289.37
687.491	290
686.287	290.345
680.51	292
679.092	292.406
673.53	294
669.841	294.53
659.621	296
646.437	297.28
639.023	298
631.875	298.773
620.523	300
619.315	300.188
617.055	300.54
615.53	300.777
614.431	300.948
613.602	301.077
612.954	301.178
612.434	301.259
612.007	301.326
611.651	301.381
611.349	301.428
610.968	301.547
610.518	301.688
609.978	301.857
609.52	302
607.088	302.81
603.517	304
598.461	304.667
588.88	305.484
585.658	305.81
582.821	306
571.381	306.465
562.784	306.814
555.284	307.119

549.352	307.36
536.852	307.868
535.963	307.904
533.597	308
520.061	308.55
513.256	308.826
503.601	309.219
488.514	309.832
487.129	309.888
484.372	310
471.823	310.51
466.201	310.738
456.663	311.126
444.195	311.632
441.407	311.746
435.148	312
426.585	312.348
423.112	312.489
412.237	312.931
403.018	313.305
398.046	313.507
385.924	314
383.861	314.084
382.932	314.122
368.722	314.699
360.927	315.016
353.446	315.32
338.63	315.922
338.031	315.946
336.699	316
323.645	316.53
318.615	316.735
309.688	317.097
299.451	317.513
296.058	317.651
287.475	318
282.072	318.219
279.631	318.319
266.885	318.837
257.515	319.217
251.553	319.46
238.25	320
236.354	320.077
236.173	320.083
235.965	320.089
224.14	320.551
222.969	320.58
220.62	320.668
217.402	320.78
214.627	320.868
213.003	320.9
210.498	320.971
208.258	321.027

206.459	321.054
204.401	321.099
202.505	321.134
200.731	321.162
198.84	321.182
197.16	321.202
195.55	321.217
193.625	321.229
192.069	321.238
190.542	321.241
189.025	321.24
187.104	321.244
185.592	321.237
184.055	321.226
182.47	321.208
180.586	321.204
178.955	321.18
177.231	321.148
175.401	321.135
173.584	321.095
171.608	321.044
169.885	321.023
163.988	320.857
162.472	320.831
161.042	320.799
153.258	320.573
152.168	320.544
141.311	320.227
139.934	320.187
138.971	320.159
133.511	320
127.85	319.835
126.697	319.801
116.045	319.491
112.503	319.388
104.328	319.15
98.4359	318.978
92.6962	318.811
84.4928	318.572
81.1502	318.474
70.6725	318.169
69.6887	318.14
64.8782	318
58.8789	317.825
57.7947	317.794
48.471	317.522
45.4995	317.435
38.0244	317.217
33.1503	317.075
27.539	316.912
20.747	316.714
17.0146	316.605
8.28898	316.351

6.451	316.297

Material Boundary

X	Y
0	164.667
2.61045	164.033
2.74827	164
2.93545	163.955
10.984	162
16.9104	160.561
19.2198	160
22.3549	159.239
27.4555	158
31.2131	157.088
35.6913	156
41.768	154.524
43.927	154
45.5183	153.614
52.1628	152
59.8261	150.139
59.8924	150.123
60.4145	150
60.8582	149.895
60.9162	149.881
68.6396	148
75.206	146.4
76.8497	146
79.0691	145.459
85.0598	144
88.4071	143.185
93.2699	142
96.1305	141.964
100.713	141.947
101.016	141.941
113.425	141.821
121.918	141.822
130.421	141.823
138.934	141.824
147.456	141.825
148.142	141.848
156.777	141.849
157.383	141.866
166.104	141.867
166.646	141.881
175.435	141.882
175.924	141.893
184.77	141.893
185.454	141.904
186.03	141.91
186.471	141.91
195.39	141.911
195.828	141.911

204.75	141.912
205.185	141.912
214.11	141.912
214.542	141.912
223.469	141.913
223.899	141.913
224.328	141.913
224.757	141.913
226.606	141.875
232.206	141.736
237.619	141.555
266.437	140.593
284.194	140
288.023	139.82
294.955	139.494
315.577	138.526
326.764	138
345.352	137.109
367.261	136
389.122	135.384
438.282	134
441.106	133.989
441.813	133.988
442.992	133.982
450.152	133.954
471.589	133.475
495.112	133.041
499.816	133.042
504.522	133.042
507.015	133.043
509.52	133.047
513.255	133.047
518.191	133.045
521.934	133.044
526.857	133.043
530.609	133.042
535.521	133.04
539.492	133.044
544.41	133.042
548.376	133.045
551.45	133.051
554.115	133.053
556.005	133.053
558.664	133.055
563.412	133.057
566.946	133.064
571.737	133.066
575.242	133.073
580.075	133.075
583.551	133.082
586.977	133.088
591.874	133.09
595.541	133.09

600.448	133.093
604.107	133.093
609.025	133.095
612.675	133.095
617.604	133.097
621.244	133.097
622.641	133.096
626.431	133.093
629.889	133.087
634.698	133.083
638.19	133.076
641.731	133.07
646.478	133.066
650.054	133.06
654.753	133.056
659.419	133.052
663.75	133.06
668.432	133.056
672.746	133.063
677.444	133.06
680.743	133.07
685.469	133.067
688.752	133.077
692.299	133.081
695.852	133.075
701.119	133.075
703.992	133.063
708.239	133.071
712.549	133.079
716.654	133.084
721.014	133.092
725.057	133.098
729.467	133.106
730.766	133.109
732.057	133.112
735.706	133.117
737.361	133.116
738.906	133.115
742.564	133.12
743.989	133.118
755.732	133.35
775.632	133.895
775.782	133.895
775.919	133.894
776.153	133.893
778.05	134
783.506	135.753
784.276	136
789.286	137.609
790.503	138
794.831	139.39
796.73	140
800.37	141.169

802.957	142
805.905	142.947
809.183	144
811.435	144.723
815.41	146
816.957	146.497
821.637	148
822.473	148.269
827.863	150
827.984	150.039
828.909	150.336
833.494	151.808
834.09	152
838.998	153.577
840.317	154
844.497	155.343
846.543	156
849.989	157.107
852.77	158
855.476	158.869
858.997	160
860.956	160.629
865.223	162
866.43	162.387
871.45	164
871.897	164.144
875.09	165.169
877.36	165.898
877.677	166
882.821	167.652
883.903	168
888.276	169.404
890.13	170
893.723	171.154
896.357	172
899.164	172.902
902.583	174
906.152	175.146
908.81	176
912.925	177.322
915.037	178
918.41	179.083
921.263	180
923.888	180.843
927.49	182
929.36	182.601
933.717	184
934.825	184.356
939.944	186
940.292	186.112
943.235	187.057
945.863	187.901
946.17	188

951.208	189.618
952.397	190
956.633	191.361
958.624	192
962.07	193.107
964.85	194
967.5	194.851
971.077	196
972.917	196.591
977.304	198
978.32	198.326
983.53	200
983.726	200.063
985.426	200.609
989.318	201.859
989.757	202
994.64	203.568
995.984	204
999.949	205.274
1002.21	206
1005.61	207.122
1008.27	208
1011.51	209.172
1013.9	210
1014.76	210.314
1016.17	210.831
1024.06	213.481

Material Boundary

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4

76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185
93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893
185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911
195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912
223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041

499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047
513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073
580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09
595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095
617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
650.054	135.06
654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063

708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092
725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138
789.286	139.609
790.503	140
794.831	141.39
796.73	142
800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723
815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169

877.36	167.898
877.677	168
882.821	169.652
883.903	170
888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356
939.944	188
940.292	188.112
943.235	189.057
945.863	189.901
946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194
962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

Material Boundary

X	Y
0	168.667
2.61045	168.033
2.74827	168
2.93545	167.955
10.984	166
16.9104	164.561
19.2198	164
22.3549	163.239
27.4555	162
31.2131	161.088
35.6913	160
41.768	158.524
43.927	158
45.5183	157.614
52.1628	156
59.8261	154.139
59.8924	154.123
60.4145	154
60.8582	153.895
60.9162	153.881
68.6396	152
75.206	150.4
76.8497	150
79.0691	149.459
85.0598	148
88.4071	147.185
93.2699	146
96.1305	145.964
100.713	145.947
101.016	145.941
113.425	145.821
121.918	145.822
130.421	145.823
138.934	145.824
147.456	145.825
148.142	145.848
156.777	145.849
157.383	145.866
166.104	145.867
166.646	145.881
175.435	145.882
175.924	145.893
184.77	145.893
185.454	145.904
186.03	145.91
186.471	145.91
195.39	145.911
195.828	145.911
204.75	145.912

205.185	145.912
214.11	145.912
214.542	145.912
223.469	145.913
223.899	145.913
224.328	145.913
224.757	145.913
226.606	145.875
232.206	145.736
237.619	145.555
266.437	144.593
284.194	144
288.023	143.82
294.955	143.494
315.577	142.526
326.764	142
345.352	141.109
367.261	140
389.122	139.384
438.282	138
441.106	137.989
441.813	137.988
442.992	137.982
450.152	137.954
471.589	137.475
495.112	137.041
499.816	137.042
504.522	137.042
507.015	137.043
509.52	137.047
513.255	137.047
518.191	137.045
521.934	137.044
526.857	137.043
530.609	137.042
535.521	137.04
539.492	137.044
544.41	137.042
548.376	137.045
551.45	137.051
554.115	137.053
556.005	137.053
558.664	137.055
563.412	137.057
566.946	137.064
571.737	137.066
575.242	137.073
580.075	137.075
583.551	137.082
586.977	137.088
591.874	137.09
595.541	137.09
600.448	137.093

604.107	137.093
609.025	137.095
612.675	137.095
617.604	137.097
621.244	137.097
622.641	137.096
626.431	137.093
629.889	137.087
634.698	137.083
638.19	137.076
641.731	137.07
646.478	137.066
650.054	137.06
654.753	137.056
659.419	137.052
663.75	137.06
668.432	137.056
672.746	137.063
677.444	137.06
680.743	137.07
685.469	137.067
688.752	137.077
692.299	137.081
695.852	137.075
701.119	137.075
703.992	137.063
708.239	137.071
712.549	137.079
716.654	137.084
721.014	137.092
725.057	137.098
729.467	137.106
730.766	137.109
732.057	137.112
735.706	137.117
737.361	137.116
738.906	137.115
742.564	137.12
743.989	137.118
755.732	137.35
775.632	137.895
775.782	137.895
775.919	137.894
776.153	137.893
778.05	138
783.506	139.753
784.276	140
789.286	141.609
790.503	142
794.831	143.39
796.73	144
800.37	145.169
802.957	146

805.905	146.947
809.183	148
811.435	148.723
815.41	150
816.957	150.497
821.637	152
822.473	152.269
827.863	154
827.984	154.039
828.909	154.336
833.494	155.808
834.09	156
838.998	157.577
840.317	158
844.497	159.343
846.543	160
849.989	161.107
852.77	162
855.476	162.869
858.997	164
860.956	164.629
865.223	166
866.43	166.387
871.45	168
871.897	168.144
875.09	169.169
877.36	169.898
877.677	170
882.821	171.652
883.903	172
888.276	173.404
890.13	174
893.723	175.154
896.357	176
899.164	176.902
902.583	178
906.152	179.146
908.81	180
912.925	181.322
915.037	182
918.41	183.083
921.263	184
923.888	184.843
927.49	186
929.36	186.601
933.717	188
934.825	188.356
939.944	190
940.292	190.112
943.235	191.057
945.863	191.901
946.17	192
951.208	193.618

952.397	194
956.633	195.361
958.624	196
962.07	197.107
964.85	198
967.5	198.851
971.077	200
972.917	200.591
977.304	202
978.32	202.326
983.53	204
983.726	204.063
985.426	204.609
989.318	205.859
989.757	206
994.64	207.568
995.984	208
999.949	209.274
1002.21	210
1005.61	211.122
1008.27	212
1011.51	213.172
1013.9	214
1014.76	214.314
1016.17	214.831
1016.17	214.831

Material Boundary

X	Y
0	173.667
2.61045	173.033
2.74827	173
2.93545	172.955
10.984	171
16.9104	169.561
19.2198	169
22.3549	168.239
27.4555	167
31.2131	166.088
35.6913	165
41.768	163.524
43.927	163
45.5183	162.614
52.1628	161
59.8261	159.139
59.8924	159.123
60.4145	159
60.8582	158.895
60.9162	158.881
68.6396	157
75.206	155.4
76.8497	155

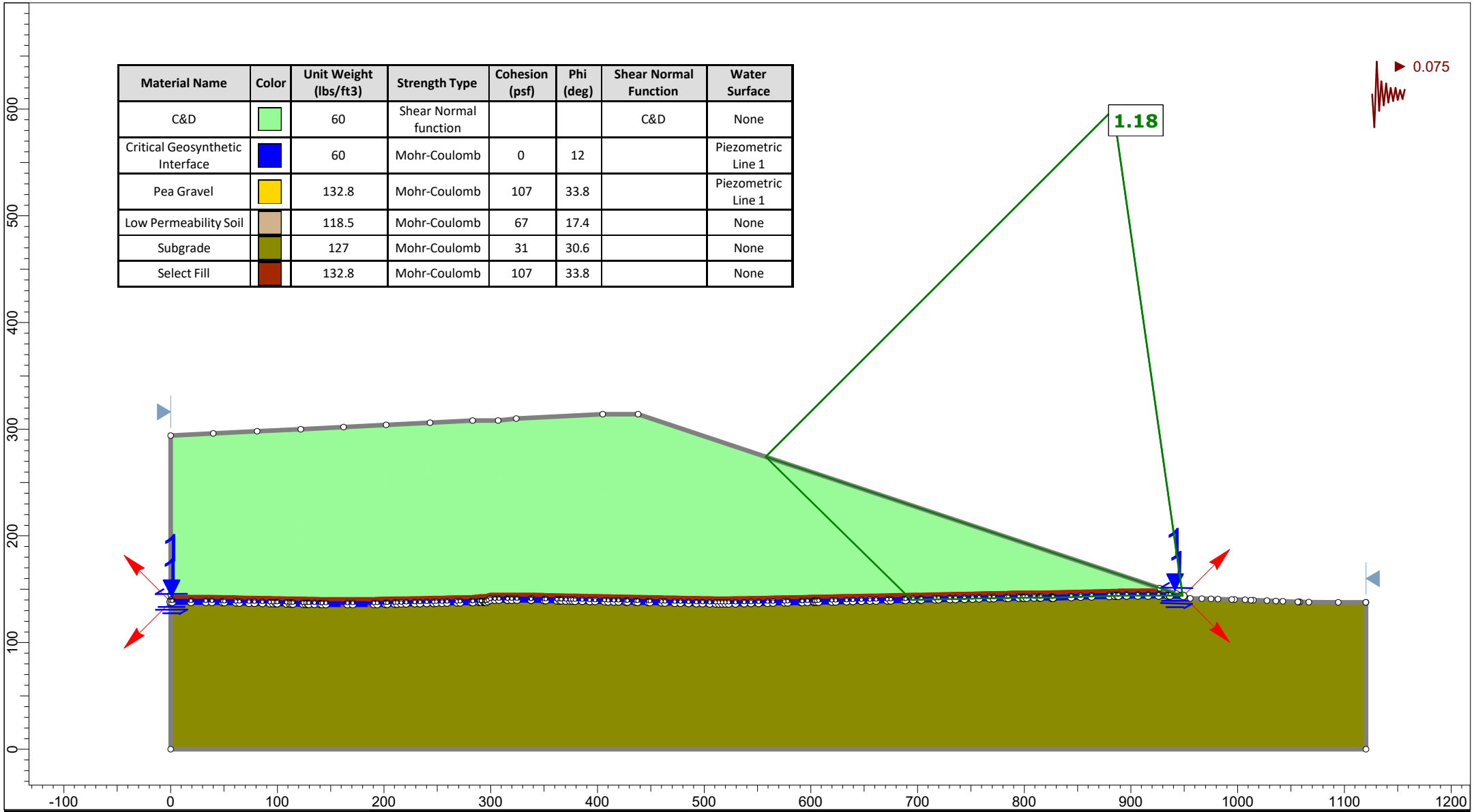
79.0691	154.459
85.0598	153
88.4071	152.185
93.2699	151
96.1305	150.964
100.713	150.947
101.016	150.941
113.425	150.821
121.918	150.822
130.421	150.823
138.934	150.824
147.456	150.825
148.142	150.848
156.777	150.849
157.383	150.866
166.104	150.867
166.646	150.881
175.435	150.882
175.924	150.893
184.77	150.893
185.454	150.904
186.03	150.91
186.471	150.91
195.39	150.911
195.828	150.911
204.75	150.912
205.185	150.912
214.11	150.912
214.542	150.912
223.469	150.913
223.899	150.913
224.328	150.913
224.757	150.913
226.606	150.875
232.206	150.736
237.619	150.555
266.437	149.593
284.194	149
288.023	148.82
294.955	148.494
315.577	147.526
326.764	147
345.352	146.109
367.261	145
389.122	144.384
438.282	143
441.106	142.989
441.813	142.988
442.992	142.982
450.152	142.954
471.589	142.475
495.112	142.041
499.816	142.042

504.522	142.042
507.015	142.043
509.52	142.047
513.255	142.047
518.191	142.045
521.934	142.044
526.857	142.043
530.609	142.042
535.521	142.04
539.492	142.044
544.41	142.042
548.376	142.045
551.45	142.051
554.115	142.053
556.005	142.053
558.664	142.055
563.412	142.057
566.946	142.064
571.737	142.066
575.242	142.073
580.075	142.075
583.551	142.082
586.977	142.088
591.874	142.09
595.541	142.09
600.448	142.093
604.107	142.093
609.025	142.095
612.675	142.095
617.604	142.097
621.244	142.097
622.641	142.096
626.431	142.093
629.889	142.087
634.698	142.083
638.19	142.076
641.731	142.07
646.478	142.066
650.054	142.06
654.753	142.056
659.419	142.052
663.75	142.06
668.432	142.056
672.746	142.063
677.444	142.06
680.743	142.07
685.469	142.067
688.752	142.077
692.299	142.081
695.852	142.075
701.119	142.075
703.992	142.063
708.239	142.071

712.549	142.079
716.654	142.084
721.014	142.092
725.057	142.098
729.467	142.106
730.766	142.109
732.057	142.112
735.706	142.117
737.361	142.116
738.906	142.115
742.564	142.12
743.989	142.118
755.732	142.35
775.632	142.895
775.782	142.895
775.919	142.894
776.153	142.893
778.05	143
783.506	144.753
784.276	145
789.286	146.609
790.503	147
794.831	148.39
796.73	149
800.37	150.169
802.957	151
805.905	151.947
809.183	153
811.435	153.723
815.41	155
816.957	155.497
821.637	157
822.473	157.269
827.863	159
827.984	159.039
828.909	159.336
833.494	160.808
834.09	161
838.998	162.577
840.317	163
844.497	164.343
846.543	165
849.989	166.107
852.77	167
855.476	167.869
858.997	169
860.956	169.629
865.223	171
866.43	171.387
871.45	173
871.897	173.144
875.09	174.169
877.36	174.898

877.677	175
882.821	176.652
883.903	177
888.276	178.404
890.13	179
893.723	180.154
896.357	181
899.164	181.902
902.583	183
906.152	184.146
908.81	185
912.925	186.322
915.037	187
918.41	188.083
921.263	189
923.888	189.843
927.49	191
929.36	191.601
933.717	193
934.825	193.356
939.944	195
940.292	195.112
943.235	196.057
945.863	196.901
946.17	197
951.208	198.618
952.397	199
956.633	200.361
958.624	201
962.07	202.107
964.85	203
967.5	203.851
971.077	205
972.917	205.591
977.304	207
978.32	207.326
983.53	209
983.726	209.063
985.426	209.609
989.318	210.859
989.757	211
994.64	212.568
995.984	213
999.949	214.274
1002.21	215
1005.61	216.122
1007.6	216.78

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section D - Seismic - Liner System Failure

Created By: ZLM	Checked By: TDM	Civil & Environmental Consultants, Inc.
Created Date: 1/6/2022	Checked Date: 1/9/2022	

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:01m:10.685s
Date Created:	7/28/2021, 10:59:59 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	225
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	-45
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.184480
Axis Location:	883.242, 599.738
Left Slip Surface Endpoint:	557.591, 274.128
Right Slip Surface Endpoint:	948.340, 143.851
Resisting Moment:	1.70564e+08 lb-ft
Driving Moment:	1.43999e+08 lb-ft
Resisting Horizontal Force:	317543 lb
Driving Horizontal Force:	268085 lb
Total Slice Area:	17204.4 ft2
Surface Horizontal Width:	390.749 ft
Surface Average Height:	44.0292 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
557.591	274.128
694.295	139.967
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.795	142
826.896	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
937.72	143.909
948.34	143.851

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.18448

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	21.6191	9085.92	-44.4622	C&D	2.84217e-14	34.992	152.782	180.967	258.524	0	258.524	408.464	408.464
2	21.6191	27257.8	-44.4622	C&D	0	34.992	441.609	523.077	747.252	0	747.252	1180.65	1180.65
3	21.6191	45429.6	-44.4622	C&D	0	34.992	709.041	839.845	1199.78	0	1199.78	1895.63	1895.63
4	21.6191	63601.5	-44.4622	C&D	0	34.992	961.266	1138.6	1626.57	0	1626.57	2569.96	2569.96
5	21.6191	81773.3	-44.4622	C&D	207.75	30.8002	1203.14	1425.09	2042.09	0	2042.09	3222.85	3222.85
6	21.6191	99945.2	-44.4622	C&D	207.75	30.8002	1417.12	1678.55	2467.27	0	2467.27	3858.04	3858.04
7	4.992	26569.1	-44.4622	Select Fill	107	33.8	1675.65	1984.77	2804.98	0	2804.98	4449.46	4449.46
8	0.998401	5648.14	-44.4622	Pea Gravel	107	33.8	1777.46	2105.37	2985.13	0	2985.13	4729.54	4729.54
9	0.998401	5759.58	-44.4622	Pea Gravel	107	33.8	1796.75	2128.22	3050.45	31.1895	3019.26	4813.79	4782.6
10	1.62366	9429.23	1.15722	Critical Geosynthetic Interface	0	12	1061.82	1257.7	5979.42	62.3895	5917.03	5957.98	5895.59
11	6.54642	37450.2	1.15722	Critical Geosynthetic Interface	0	12	1049.93	1243.62	5913.16	62.3895	5850.77	5891.95	5829.56
12	1.0537	5942.98	1.15722	Critical Geosynthetic Interface	0	12	1038.71	1230.33	5850.66	62.3895	5788.27	5829.67	5767.29
13	12.8437	70546.4	1.15722	Critical Geosynthetic Interface	0	12	1017.57	1205.29	5732.83	62.3895	5670.44	5712.28	5649.89
14	3.28235	17467.4	1.15722	Critical Geosynthetic Interface	0	12	992.402	1175.48	5592.6	62.3895	5530.21	5572.55	5510.16
15	10.5551	54620.5	1.15722	Critical Geosynthetic Interface	0	12	969.962	1148.9	5467.55	62.3895	5405.16	5447.96	5385.57
16	5.49021	27476.4	1.15722	Critical Geosynthetic Interface	0	12	943.232	1117.24	5318.56	62.3895	5256.17	5299.51	5237.12
17	8.28755	40264.7	1.15722	Critical Geosynthetic Interface	0	12	919.509	1089.14	5186.38	62.3895	5123.99	5167.81	5105.42
18	7.67752	36000.6	1.15722	Critical Geosynthetic Interface	0	12	891.26	1055.68	5028.96	62.3895	4966.57	5010.96	4948.57
19	6.041	27447.7	1.15722	Critical Geosynthetic Interface	0	12	866.33	1026.15	4890.03	62.3895	4827.64	4872.53	4810.14
20	9.84447	43070.1	1.15722	Critical Geosynthetic Interface	0	12	836.681	991.032	4724.83	62.3895	4662.44	4707.92	4645.54
21	3.81517	16138.7	1.15722	Critical Geosynthetic Interface	0	12	810.658	960.208	4579.8	62.3895	4517.41	4563.43	4501.04
22	11.9913	48714.3	1.15722	Critical Geosynthetic Interface	0	12	779.797	923.654	4407.84	62.3895	4345.45	4392.09	4329.7
23	1.60986	6307.74	1.15722	Critical Geosynthetic Interface	0	12	752.835	891.718	4257.6	62.3895	4195.21	4242.39	4180
24	9.97162	37845.6	1.15722	Critical Geosynthetic Interface	0	12	729.447	864.015	4127.26	62.3895	4064.87	4112.53	4050.14
25	3.40817	12457.2	0.204137	Critical Geosynthetic Interface	0	12	693.897	821.907	3929.16	62.3895	3866.77	3926.68	3864.29
26	1.24758	4501.38	0.125349	Critical Geosynthetic Interface	0	12	684.282	810.518	3875.58	62.3895	3813.19	3874.08	3811.69
27	2.68835	9592.84	0.238314	Critical Geosynthetic Interface	0	12	677.681	802.7	3838.79	62.3895	3776.4	3835.97	3773.58

28	7.04047	24429.8	0.203264	Critical Geosynthetic Interface	0	12	658.51	779.992	3731.96	62.3895	3669.57	3729.62	3667.23
29	4.87714	16336.8	0.113922	Critical Geosynthetic Interface	0	12	634.592	751.662	3598.68	62.3895	3536.29	3597.42	3535.03
30	1.15297	3792.35	-0.239823	Critical Geosynthetic Interface	0	12	620.199	734.613	3518.47	62.3895	3456.08	3521.06	3458.67
31	10.0876	32064.4	-0.317514	Critical Geosynthetic Interface	0	12	598.268	708.637	3396.27	62.3895	3333.88	3399.58	3337.19
32	0.675026	2074.11	-0.0457245	Critical Geosynthetic Interface	0	12	579.578	686.498	3292.11	62.3895	3229.72	3292.57	3230.18
33	0.68978	2110.03	0.0374701	Critical Geosynthetic Interface	0	12	577.466	683.997	3280.35	62.3872	3217.96	3279.97	3217.58
34	0.100717	307.294	0.0395942	Critical Geosynthetic Interface	0	12	575.926	682.173	3271.77	62.3895	3209.38	3271.37	3208.98
35	17.1855	49127.2	2.16691	Critical Geosynthetic Interface	0	12	550.765	652.37	3131.52	62.3664	3069.16	3110.68	3048.32
36	8.76831	22558.6	1.48686	Critical Geosynthetic Interface	0	12	487.956	577.974	2781.54	62.3895	2719.15	2768.87	2706.48
37	10.2174	24170.7	1.93867	Critical Geosynthetic Interface	0	12	447.563	530.129	2556.45	62.3895	2494.07	2541.3	2478.92
38	16.6274	34502.3	1.34699	Critical Geosynthetic Interface	0	12	385.755	456.919	2212.02	62.3895	2149.64	2202.95	2140.56
39	5.00303	9218.74	1.6504	Critical Geosynthetic Interface	0	12	339.636	402.292	1955.03	62.3895	1892.64	1945.24	1882.85
40	2.32748	4103.65	1.524	Critical Geosynthetic Interface	0	12	323.262	382.897	1863.78	62.3895	1801.39	1855.18	1792.79
41	1.22624	2115.26	1.13275	Critical Geosynthetic Interface	0	12	314.623	372.665	1815.64	62.3895	1753.25	1809.42	1747.03
42	7.83115	12757.1	1.13404	Critical Geosynthetic Interface	0	12	295.545	350.067	1709.32	62.3895	1646.93	1703.47	1641.08
43	10.341	14907.2	0.194502	Critical Geosynthetic Interface	0	12	256.896	304.288	1493.95	62.3895	1431.56	1493.08	1430.69
44	9.57219	11875.1	0.149724	Critical Geosynthetic Interface	0	12	218.079	258.31	1277.65	62.3895	1215.26	1277.08	1214.69
45	9.98167	10432.9	-0.180702	Critical Geosynthetic Interface	0	12	180.538	213.844	1068.44	62.3895	1006.05	1069.01	1006.62
46	8.44311	6590.33	-0.194337	Critical Geosynthetic Interface	0	12	131.448	155.697	794.888	62.3895	732.499	795.334	732.945
47	1.67995	944.881	-1.58113	Critical Geosynthetic Interface	0	12	91.0729	107.874	569.897	62.3895	507.507	572.411	510.021
48	0.449087	233.174	-1.58092	Critical Geosynthetic Interface	0	12	83.2724	98.6345	526.428	62.3895	464.038	528.726	466.337
49	1.1703	569.16	-1.58108	Critical Geosynthetic Interface	0	12	77.3452	91.6138	493.398	62.3895	431.009	495.533	433.144
50	10.6204	2456.35	-0.311005	Pea Gravel	107	33.8	193.799	229.551	238.106	55.042	183.064	239.158	184.116

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.18448

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	557.591	274.128	0	0	0
2	579.21	252.911	2867.92	259.037	5.16108
3	600.83	231.694	11232.2	1998.45	10.0886
4	622.449	210.477	24786.6	6448.49	14.5828
5	644.068	189.26	43313.5	14490.9	18.4981
6	665.687	168.043	66797.3	26643.7	21.7458
7	687.306	146.826	96045	43332.6	24.2835
8	692.298	141.927	103426	47716.8	24.7668
9	693.296	140.947	105002	48648.8	24.8589
10	694.295	139.967	106632	49608.5	24.9493
11	695.918	140	105421	49367.6	25.0932
12	702.465	140.132	100584	48260.7	25.6319
13	703.518	140.154	99811.7	48063.1	25.7126
14	716.362	140.413	90563.3	45264.9	26.5566
15	719.644	140.479	88249.4	44445.8	26.7316
16	730.199	140.692	80955.8	41574.3	27.1825
17	735.69	140.803	77255	39959.3	27.3498
18	743.977	140.971	71796.2	37399	27.5152
19	751.655	141.126	66882.8	34928.8	27.5753
20	757.696	141.248	63118.1	32940.7	27.5596
21	767.54	141.447	57183	29660.1	27.4152
22	771.355	141.524	54951.7	28386.4	27.3195
23	783.347	141.766	48199.2	24425.7	26.8743
24	784.957	141.799	47323.5	23902.5	26.7978
25	794.928	142	42066.4	20731.5	26.2354
26	798.336	142.012	40591.2	19804.7	26.008
27	799.584	142.015	40065.7	19472.4	25.9203
28	802.272	142.026	38922.8	18751.7	25.7232
29	809.313	142.051	36031.7	16920	25.1541
30	814.19	142.061	34131.2	15709.3	24.7148
31	815.343	142.056	33718.5	15441.6	24.6057
32	825.43	142	30286.1	13208	23.5624
33	826.105	141.999	30052.7	13059.2	23.487
34	826.795	142	29811.7	12906.4	23.4093
35	826.896	142	29776.6	12884.1	23.3978
36	844.081	142.65	21972.2	8531.51	21.2205
37	852.85	142.878	18758.1	6803.94	19.9367
38	863.067	143.224	15119.9	4999.59	18.2971
39	879.695	143.615	10437.1	2858.02	15.3141
40	884.698	143.759	9149.77	2339.83	14.3446
41	887.025	143.821	8590.74	2123.29	13.883
42	888.251	143.845	8320.07	2018.55	13.6372
43	896.082	144	6700.49	1427.41	12.026
44	906.423	144.035	5113.05	883	9.79807
45	915.996	144.06	3887	521.982	7.64845
46	925.977	144.029	2903.41	271.168	5.33574
47	934.42	144	2312.09	134.857	3.3381
48	936.1	143.954	2256.59	115.79	2.93738
49	936.549	143.941	2243.25	110.895	2.83011
50	937.72	143.909	2211.48	98.5013	2.55032
51	948.34	143.851	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	139.001

1.53185	139.006
19.0865	139.06
32.9178	139.02
38.6457	139
48.7796	138.793
50.2602	138.763
61.0905	138.542
64.3705	138.476
73.4615	138.291
78.5505	138.189
85.9551	138.041
92.8528	137.903
95.9447	137.841
98.6483	137.789
99.8304	137.766
108.36	137.6
111.481	137.539
113.16	137.508
114.657	137.481
124.023	137.298
126.413	137.276
128.483	137.258
129.604	137.259
134.88	137.144
140.608	137.001
140.666	137
141.88	136.996
145.396	136.987
165.76	136.931
170.639	136.942
190.43	137
193.662	137.091
201.413	137.308
202.91	137.31
209.905	137.483
212.256	137.486
216.044	137.533
220.799	137.61
228.74	137.769
233.581	137.864
240.055	137.994
246.29	138.116
249.014	138.178
254.334	138.284
259.083	138.368
268.35	138.553
271.397	138.613
282.09	138.827
283.248	138.85
289.114	139
290.561	139
291.004	139
293.847	139

294.079	139
294.897	139
295.735	139
297.392	139.908
299.475	141
303.779	141.026
307.699	141.048
315.325	141.101
315.77	141.098
319.666	141.08
324.496	141.067
337.748	141
337.798	140.999
337.804	140.999
350.01	140.752
351.514	140.722
361.883	140.513
364.794	140.454
366.105	140.426
370.416	140.331
374.199	140.251
376.444	140.207
378.978	140.155
385.656	140.023
392.593	139.886
397.761	139.784
406.485	139.612
410.085	139.541
415.321	139.473
419.58	139.44
426.773	139.263
428.072	139.263
436.007	139.041
437.46	139
447.762	138.797
449.164	138.77
459.994	138.557
463.353	138.491
472.562	138.31
477.849	138.206
485.368	138.058
492.661	137.915
498.42	137.801
505.285	137.698
510.764	137.64
513.847	137.638
516.909	137.636
519.953	137.634
522.978	137.632
529.387	137.687
537.506	137.8
543.814	137.927
550.999	138.073

559.479	138.244
564.556	138.346
575.229	138.562
578.177	138.622
591.066	138.882
591.862	138.898
596.908	139
602.692	139.157
603.345	139.157
604.986	139.174
607.15	139.207
619.626	139.459
623.304	139.533
633.498	139.739
639.412	139.859
647.335	140.019
655.475	140.183
661.139	140.297
671.492	140.507
674.909	140.576
687.464	140.829
688.645	140.853
695.918	141
702.465	141.132
703.518	141.154
716.362	141.413
719.644	141.479
730.199	141.692
735.69	141.803
743.977	141.971
751.655	142.126
757.696	142.248
767.54	142.447
771.355	142.524
783.347	142.766
784.957	142.799
794.928	143
798.336	143.012
799.584	143.015
802.272	143.026
809.313	143.051
814.19	143.061
815.343	143.056
825.43	143
826.105	142.999
826.168	142.999
826.795	143
826.896	143
826.916	143
844.081	143.65
852.85	143.878
863.067	144.224
879.695	144.615

884.698	144.759
887.025	144.821
888.251	144.845
896.082	145
906.423	145.035
915.996	145.06
925.977	145.029
934.42	145
936.1	144.954
936.549	144.941
945.84	144.685

Block Search Polyline

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486
216.044	136.533

220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994
246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77
459.994	137.557

463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058
492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142

798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

External Boundary

X	Y
0	294
0	145.001
0	140.001
0	139.001
0	138.001
0	136.001
0	0
1120.27	0
1120.27	137.664
1120.15	137.662
1094.2	137.627
1066.59	137.768
1058.38	138
1056.96	138.055
1056.39	138.077
1042.28	138.625
1035.7	138.881
1027.44	139.202
1014.7	139.696
1012.45	139.784
1006.89	140
997.074	140.271
994.462	140.343
981.639	140.697
974.953	140.881
966.333	141.119
955.65	141.414
949.11	143.595
945.84	144.685
942.57	145.775
926.821	151.026
438	314
405	314
324	310
307	308
283	308
243	306
202	304
162	302
122	300
81	298
40	296

Material Boundary

X	Y
0	136.001
1.53185	136.006
19.0865	136.06
32.9178	136.02
38.6457	136
48.7796	135.793

50.2602	135.763
61.0905	135.542
64.3705	135.476
73.4615	135.291
78.5505	135.189
85.9551	135.041
92.8528	134.903
95.9447	134.841
98.6483	134.789
99.8304	134.766
108.36	134.6
111.481	134.539
113.16	134.508
114.657	134.481
124.023	134.298
126.413	134.276
128.483	134.258
129.604	134.259
134.88	134.144
140.608	134.001
140.666	134
141.88	133.996
145.396	133.987
165.76	133.931
170.639	133.942
190.43	134
193.662	134.091
201.413	134.308
202.91	134.31
209.905	134.483
212.256	134.486
216.044	134.533
220.799	134.61
228.74	134.769
233.581	134.864
240.055	134.994
246.29	135.116
249.014	135.178
254.334	135.284
259.083	135.368
268.35	135.553
271.397	135.613
282.09	135.827
283.248	135.85
289.114	136
290.561	136
291.004	136
293.847	136
294.079	136
294.897	136
295.735	136
297.392	136.908
299.475	138

303.779	138.026
307.699	138.048
315.325	138.101
315.77	138.098
319.666	138.08
324.496	138.067
337.748	138
337.798	137.999
337.804	137.999
350.01	137.752
351.514	137.722
361.883	137.513
364.794	137.454
366.105	137.426
370.416	137.331
374.199	137.251
376.444	137.207
378.978	137.155
385.656	137.023
392.593	136.886
397.761	136.784
406.485	136.612
410.085	136.541
415.321	136.473
419.58	136.44
426.773	136.263
428.072	136.263
436.007	136.041
437.46	136
447.762	135.797
449.164	135.77
459.994	135.557
463.353	135.491
472.562	135.31
477.849	135.206
485.368	135.058
492.661	134.915
498.42	134.801
505.285	134.698
510.764	134.64
513.847	134.638
516.909	134.636
519.953	134.634
522.978	134.632
529.387	134.687
537.506	134.8
543.814	134.927
550.999	135.073
559.479	135.244
564.556	135.346
575.229	135.562
578.177	135.622
591.066	135.882

591.862	135.898
596.908	136
602.692	136.157
603.345	136.157
604.986	136.174
607.15	136.207
619.626	136.459
623.304	136.533
633.498	136.739
639.412	136.859
647.335	137.019
655.475	137.183
661.139	137.297
671.492	137.507
674.909	137.576
687.464	137.829
688.645	137.853
695.918	138
702.465	138.132
703.518	138.154
716.362	138.413
719.644	138.479
730.199	138.692
735.69	138.803
743.977	138.971
751.655	139.126
757.696	139.248
767.54	139.447
771.355	139.524
783.347	139.766
784.957	139.799
794.928	140
798.336	140.012
799.584	140.015
802.272	140.026
809.313	140.051
814.19	140.061
815.343	140.056
825.43	140
826.105	139.999
826.168	139.999
826.795	140
826.896	140
826.916	140
844.081	140.65
852.85	140.878
863.067	141.224
879.695	141.615
884.698	141.759
887.025	141.821
888.251	141.845
896.082	142
906.423	142.035

915.996	142.06
925.977	142.029
934.42	142
936.1	141.954
936.549	141.941
951.154	141.538
955.65	141.414

Material Boundary

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486
216.044	136.533
220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994

246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77
459.994	137.557
463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058

492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051

814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Material Boundary

X	Y
0	140.001
1.53185	140.006
19.0865	140.06
32.9178	140.02
38.6457	140
48.7796	139.793
50.2602	139.763
61.0905	139.542
64.3705	139.476
73.4615	139.291
78.5505	139.189
85.9551	139.041
92.8528	138.903
95.9447	138.841
98.6483	138.789
99.8304	138.766
108.36	138.6
111.481	138.539
113.16	138.508
114.657	138.481
124.023	138.298
126.413	138.276
128.483	138.258
129.604	138.259
134.88	138.144
140.608	138.001

140.666	138
141.88	137.996
145.396	137.987
165.76	137.931
170.639	137.942
190.43	138
193.662	138.091
201.413	138.308
202.91	138.31
209.905	138.483
212.256	138.486
216.044	138.533
220.799	138.61
228.74	138.769
233.581	138.864
240.055	138.994
246.29	139.116
249.014	139.178
254.334	139.284
259.083	139.368
268.35	139.553
271.397	139.613
282.09	139.827
283.248	139.85
289.114	140
290.561	140
291.004	140
293.847	140
294.079	140
294.897	140
295.735	140
297.392	140.908
299.475	142
303.779	142.026
307.699	142.048
315.325	142.101
315.77	142.098
319.666	142.08
324.496	142.067
337.748	142
337.798	141.999
337.804	141.999
350.01	141.752
351.514	141.722
361.883	141.513
364.794	141.454
366.105	141.426
370.416	141.331
374.199	141.251
376.444	141.207
378.978	141.155
385.656	141.023
392.593	140.886

397.761	140.784
406.485	140.612
410.085	140.541
415.321	140.473
419.58	140.44
426.773	140.263
428.072	140.263
436.007	140.041
437.46	140
447.762	139.797
449.164	139.77
459.994	139.557
463.353	139.491
472.562	139.31
477.849	139.206
485.368	139.058
492.661	138.915
498.42	138.801
505.285	138.698
510.764	138.64
513.847	138.638
516.909	138.636
519.953	138.634
522.978	138.632
529.387	138.687
537.506	138.8
543.814	138.927
550.999	139.073
559.479	139.244
564.556	139.346
575.229	139.562
578.177	139.622
591.066	139.882
591.862	139.898
596.908	140
602.692	140.157
603.345	140.157
604.986	140.174
607.15	140.207
619.626	140.459
623.304	140.533
633.498	140.739
639.412	140.859
647.335	141.019
655.475	141.183
661.139	141.297
671.492	141.507
674.909	141.576
687.464	141.829
688.645	141.853
695.918	142
702.465	142.132
703.518	142.154

716.362	142.413
719.644	142.479
730.199	142.692
735.69	142.803
743.977	142.971
751.655	143.126
757.696	143.248
767.54	143.447
771.355	143.524
783.347	143.766
784.957	143.799
794.928	144
798.336	144.012
799.584	144.015
802.272	144.026
809.313	144.051
814.19	144.061
815.343	144.056
825.43	144
826.105	143.999
826.168	143.999
826.795	144
826.896	144
826.916	144
844.081	144.65
852.85	144.878
863.067	145.224
879.695	145.615
884.698	145.759
887.025	145.821
888.251	145.845
896.082	146
906.423	146.035
915.996	146.06
925.977	146.029
934.42	146
936.1	145.954
936.549	145.941
942.57	145.775

Material Boundary

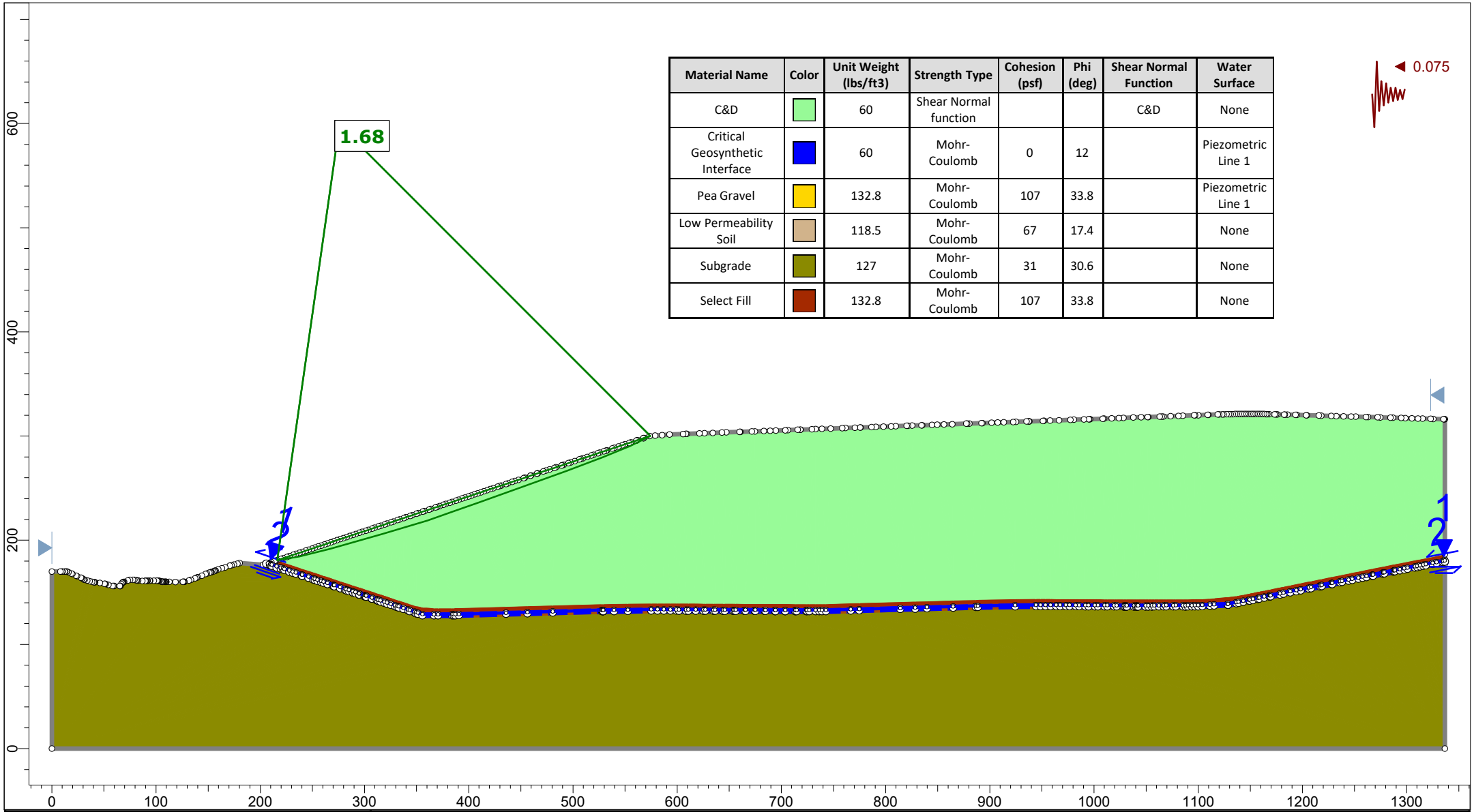
X	Y
0	145.001
1.53185	145.006
19.0865	145.06
32.9178	145.02
38.6457	145
48.7796	144.793
50.2602	144.763
61.0905	144.542
64.3705	144.476
73.4615	144.291

78.5505	144.189
85.9551	144.041
92.8528	143.903
95.9447	143.841
98.6483	143.789
99.8304	143.766
108.36	143.6
111.481	143.539
113.16	143.508
114.657	143.481
124.023	143.298
126.413	143.276
128.483	143.258
129.604	143.259
134.88	143.144
140.608	143.001
140.666	143
141.88	142.996
145.396	142.987
165.76	142.931
170.639	142.942
190.43	143
193.662	143.091
201.413	143.308
202.91	143.31
209.905	143.483
212.256	143.486
216.044	143.533
220.799	143.61
228.74	143.769
233.581	143.864
240.055	143.994
246.29	144.116
249.014	144.178
254.334	144.284
259.083	144.368
268.35	144.553
271.397	144.613
282.09	144.827
283.248	144.85
289.114	145
290.561	145
291.004	145
293.847	145
294.079	145
294.897	145
295.735	145
297.392	145.908
299.475	147
303.779	147.026
307.699	147.048
315.325	147.101
315.77	147.098

319.666	147.08
324.496	147.067
337.748	147
337.798	146.999
337.804	146.999
350.01	146.752
351.514	146.722
361.883	146.513
364.794	146.454
366.105	146.426
370.416	146.331
374.199	146.251
376.444	146.207
378.978	146.155
385.656	146.023
392.593	145.886
397.761	145.784
406.485	145.612
410.085	145.541
415.321	145.473
419.58	145.44
426.773	145.263
428.072	145.263
436.007	145.041
437.46	145
447.762	144.797
449.164	144.77
459.994	144.557
463.353	144.491
472.562	144.31
477.849	144.206
485.368	144.058
492.661	143.915
498.42	143.801
505.285	143.698
510.764	143.64
513.847	143.638
516.909	143.636
519.953	143.634
522.978	143.632
529.387	143.687
537.506	143.8
543.814	143.927
550.999	144.073
559.479	144.244
564.556	144.346
575.229	144.562
578.177	144.622
591.066	144.882
591.862	144.898
596.908	145
602.692	145.157
603.345	145.157

604.986	145.174
607.15	145.207
619.626	145.459
623.304	145.533
633.498	145.739
639.412	145.859
647.335	146.019
655.475	146.183
661.139	146.297
671.492	146.507
674.909	146.576
687.464	146.829
688.645	146.853
695.918	147
702.465	147.132
703.518	147.154
716.362	147.413
719.644	147.479
730.199	147.692
735.69	147.803
743.977	147.971
751.655	148.126
757.696	148.248
767.54	148.447
771.355	148.524
783.347	148.766
784.957	148.799
794.928	149
798.336	149.012
799.584	149.015
802.272	149.026
809.313	149.051
814.19	149.061
815.343	149.056
825.43	149
826.105	148.999
826.168	148.999
826.795	149
826.896	149
826.916	149
844.081	149.65
852.85	149.878
863.067	150.224
879.695	150.615
884.698	150.759
887.025	150.821
888.251	150.845
896.082	151
906.423	151.035
915.996	151.06
925.977	151.029
926.821	151.026

“FAILURE IN THE WASTE” PSUEDO-STATIC ANALYSIS RESULTS
SLIDE OUTPUT



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None

rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section A - Seismic - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:02m:33.439s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.678120
Axis Location:	275.981, 598.533
Left Slip Surface Endpoint:	216.161, 180.832
Right Slip Surface Endpoint:	574.250, 300.056
Resisting Moment:	3.66852e+07 lb-ft
Driving Moment:	2.18609e+07 lb-ft
Resisting Horizontal Force:	89781.3 lb
Driving Horizontal Force:	53501 lb
Total Slice Area:	2433.94 ft2
Surface Horizontal Width:	358.089 ft
Surface Average Height:	6.79702 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
216.161	180.832
237.317	184.392
266.872	191.797
317.064	206.024
360.523	218.951
383.022	226.864
408.644	235.902
450.284	250.72
494.396	266.774
528.124	279.577
554.655	290.439
574.25	300.056

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.67812

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	10.578	555.935	9.5518	C&D	7.10543e-15	34.992	20.6093	34.5848	49.4069	0	49.4069	52.8748	52.8748
2	10.578	1663.3	9.5518	C&D	0	34.992	62.1618	104.315	149.021	0	149.021	159.481	159.481
3	14.7774	3639.7	14.0669	C&D	2.84217e-14	34.992	94.4074	158.427	226.324	0	226.324	249.98	249.98
4	14.7774	4723.83	14.0669	C&D	0	34.992	123.194	206.735	295.336	0	295.336	326.205	326.205
5	16.7305	6380.61	15.8253	C&D	2.84217e-14	34.992	144.932	243.214	347.449	0	347.449	388.53	388.53
6	16.7305	7218.04	15.8253	C&D	5.68434e-14	34.992	164.352	275.803	394.004	0	394.004	440.589	440.589
7	16.7305	8055.47	15.8253	C&D	5.68434e-14	34.992	183.739	308.336	440.48	0	440.48	492.56	492.56
8	14.4864	7563.21	16.5655	C&D	0	34.992	197.495	331.42	473.457	0	473.457	532.203	532.203
9	14.4864	8014.65	16.5655	C&D	5.68434e-14	34.992	209.223	351.102	501.574	0	501.574	563.809	563.809
10	14.4864	8466.09	16.5655	C&D	0	34.992	220.838	370.593	529.418	0	529.418	595.108	595.108
11	11.2494	6679.76	19.378	C&D	0	34.992	215.323	361.337	516.196	0	516.196	591.93	591.93
12	11.2494	6539.95	19.378	C&D	0	34.992	210.431	353.129	504.47	0	504.47	578.484	578.484
13	12.8109	7272.48	19.4295	C&D	5.68434e-14	34.992	204.953	343.936	491.337	0	491.337	563.631	563.631
14	12.8109	7081.21	19.4295	C&D	0	34.992	199.211	334.3	477.571	0	477.571	547.84	547.84
15	13.8803	7438.37	19.5884	C&D	0	34.992	192.384	322.844	461.206	0	461.206	529.667	529.667
16	13.8803	7177.76	19.5884	C&D	5.68434e-14	34.992	185.393	311.111	444.444	0	444.444	510.417	510.417
17	13.8803	6917.13	19.5884	C&D	0	34.992	178.477	299.505	427.865	0	427.865	491.376	491.376
18	14.7038	6990.72	19.9989	C&D	5.68434e-14	34.992	169.216	283.964	405.663	0	405.663	467.249	467.249
19	14.7038	6593.14	19.9989	C&D	0	34.992	159.592	267.815	382.592	0	382.592	440.675	440.675
20	14.7038	6195.55	19.9989	C&D	2.84217e-14	34.992	150.036	251.779	359.683	0	359.683	414.289	414.289
21	16.8644	6482.93	20.7859	C&D	0	34.992	135.793	227.877	325.539	0	325.539	377.084	377.084
22	16.8644	5692.98	20.7859	C&D	0	34.992	119.565	200.645	286.635	0	286.635	332.02	332.02
23	13.2655	3765.73	22.2641	C&D	2.84217e-14	34.992	99.4118	166.825	238.322	0	238.322	279.021	279.021
24	13.2655	2962.23	22.2641	C&D	2.84217e-14	34.992	78.5677	131.846	188.351	0	188.351	220.517	220.517
25	19.5949	1965.52	26.142	C&D	0	34.992	34.3979	57.7238	82.4623	0	82.4623	99.345	99.345

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.67812

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	216.161	180.832	0	0	0
2	226.739	182.612	88.7226	3.46936	2.23932
3	237.317	184.392	357.341	27.8263	4.45266
4	252.095	188.094	643.719	84.2193	7.45381
5	266.872	191.797	1019.35	185.112	10.2926
6	283.603	196.539	1321.88	311.107	13.2437
7	300.333	201.282	1666.25	473.291	15.857
8	317.064	206.024	2052.31	670.342	18.0885
9	331.55	210.333	2310.56	826.844	19.69
10	346.036	214.642	2583.97	990.461	20.9723
11	360.523	218.951	2872.08	1156.24	21.9287
12	371.772	222.908	2754.88	1137.98	22.4444
13	383.022	226.864	2639.45	1107.4	22.7608
14	395.833	231.383	2503.66	1056.44	22.8777
15	408.644	235.902	2370.74	993.423	22.7354
16	422.524	240.841	2209.5	905.683	22.2889
17	436.404	245.781	2053.4	810.478	21.5392
18	450.284	250.72	1902.58	710.904	20.4883
19	464.988	256.072	1699.58	586.91	19.0511
20	479.692	261.423	1508.13	469.422	17.2893
21	494.396	266.774	1328.35	361.343	15.2176
22	511.26	273.176	1052.02	233.023	12.4894
23	528.124	279.577	809.858	134.546	9.4327
24	541.39	285.008	554.04	66.4686	6.84112
25	554.655	290.439	352.903	25.4737	4.12864
26	574.25	300.056	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
207.158	177.844
209.644	176.98
209.656	176.976
209.673	176.97
209.701	176.961
209.754	176.943
209.889	176.899
211.024	176.525
215.647	175
219.457	173.752
221.753	173
223.198	172.524
227.818	171
231.167	169.903
233.924	169
239.731	167.085
239.989	167
240.158	166.945
246.075	165
250.846	163.432

252.16	163
254.731	162.155
258.246	161
260.564	160.238
264.331	159
269.78	157.209
270.417	157
270.828	156.865
276.502	155
281.239	153.443
282.588	153
284.878	152.247
288.673	151
288.694	150.994
291.145	150.188
294.759	149
294.789	148.99
294.817	148.991
300.025	147.273
300.849	147
300.936	147
301.55	146.798
306.97	145
307.021	145
311.682	143.462
313.072	143
313.082	143
315.185	142.306
319.144	141
321.59	140.197
325.229	139
329.426	137.608
331.256	137
332.629	136.549
337.335	135
341.828	133.529
343.443	133
348.164	131.439
349.492	131
351.137	130.45
355.479	129
366.611	128.944
370.513	128.931
383.965	128.994
385.43	129
387.113	129.048
390.516	129.144
435.781	130.424
456.235	131
480.527	131.667
527.675	132.968
528.433	132.989
528.846	133

528.936	133
528.97	133
529.059	133.001
539.5	133.043
552.72	133.294
575.143	133.619
581.119	133.601
587.25	133.583
593.541	133.565
599.129	133.534
601.589	133.521
608.463	133.488
610.709	133.476
617.792	133.441
625.205	133.405
627.114	133.395
634.744	133.358
636.43	133.349
644.276	133.311
645.74	133.303
653.801	133.264
655.043	133.257
656.126	133.253
664.642	133.216
665.551	133.212
674.288	133.174
675.074	133.171
684.022	133.132
684.619	133.13
693.779	133.09
694.187	133.088
703.562	133.048
703.773	133.047
713.368	133.005
713.392	133.005
714.64	133
723.812	132.994
724.625	132.995
726.778	132.991
732.863	132.987
736.095	132.991
738.943	132.989
742.604	133
766.537	133.668
774.739	133.898
814.017	135
828.404	135.395
839.649	135.705
864.839	136.398
886.554	137
888.573	137.057
924.259	137.663
944.12	137.919

948.68	137.898
953.418	137.877
958.343	137.854
963.659	137.828
967.433	137.811
972.95	137.784
976.521	137.768
982.239	137.739
985.607	137.724
991.527	137.694
994.615	137.677
1000.75	137.646
1003.63	137.631
1009.99	137.599
1012.66	137.584
1019.23	137.551
1021.71	137.539
1028.5	137.505
1029.69	137.499
1030.85	137.495
1031.4	137.492
1038.35	137.463
1040.11	137.456
1041.2	137.452
1042.28	137.45
1049.3	137.42
1052.16	137.449
1055.45	137.483
1057.69	137.531
1062.15	137.526
1066.68	137.507
1069.19	137.568
1075.92	137.51
1078.47	137.582
1085.16	137.513
1087.7	137.49
1090.05	137.577
1093.69	137.552
1096.62	137.674
1099.96	137.645
1103.91	137.833
1111.1	138.173
1115.26	138.472
1128.34	138.992
1128.36	138.993
1128.54	139
1136.54	140.583
1138.64	141
1143.2	141.914
1148.64	143
1149.35	143.143
1152.53	143.786
1157.39	144.767

1158.54	145
1163.34	145.967
1168.47	147
1168.88	147.082
1169.38	147.184
1178.4	149
1181.82	149.688
1188.33	151
1194.13	152.167
1198.27	153
1206.33	154.622
1208.21	155
1216.89	156.747
1218.14	157
1218.36	157.045
1228.05	159
1228.06	159.001
1228.08	159.005
1228.4	159.083
1236.03	160.624
1237.89	161
1244.19	162.271
1247.8	163
1253.54	164.159
1257.71	165
1261.5	165.765
1266.92	166.86
1267.34	166.946
1267.61	167
1277.37	168.971
1277.52	169
1278.54	169.207
1287.42	171
1288.05	171.126
1288.73	171.264
1293.48	172.185
1297.69	173
1300.81	173.606
1308	175
1310.03	175.394
1312.81	175.933
1315.92	176.536
1318.32	177
1324.86	178.267
1328.64	179
1334.83	180.2
1336.61	180.546

External Boundary

X	Y
0	170
0	0

1336.61	0
1336.61	177.546
1336.61	179.546
1336.61	180.546
1336.61	181.546
1336.61	186.546
1336.61	316.096
1336	316.115
1335.3	316.135
1325.6	316.421
1323.06	316.496
1315.25	316.726
1310.87	316.855
1304.93	317.03
1298.73	317.212
1294.66	317.332
1286.65	317.568
1284.42	317.634
1274.63	317.923
1272	318
1262.91	318.268
1260.99	318.324
1251.2	318.613
1246.79	318.743
1239.42	318.96
1232.47	319.165
1227.56	319.309
1218.04	319.59
1215.62	319.661
1204.11	320
1203.6	320.015
1194.6	320.266
1193.29	320.302
1185.64	320.515
1183.11	320.585
1182.42	320.604
1175.98	320.783
1174.59	320.814
1173.12	320.841
1167.94	320.981
1166.28	321.002
1165.04	321.034
1163.06	321.079
1161.3	321.092
1159.43	321.127
1157.67	321.154
1155.99	321.174
1154.16	321.179
1152.52	321.192
1150.91	321.199
1149.06	321.196
1147.46	321.198
1145.85	321.194

1144.21	321.184
1142.36	321.173
1140.67	321.157
1138.9	321.134
1137.03	321.105
1135.23	321.085
1133.24	321.046
1131.08	320.997
1129.38	320.97
1127.03	320.908
1124.38	320.829
1122.89	320.798
1119.95	320.7
1118.67	320.668
1109.8	320.35
1109.09	320.328
1100.04	320
1096.88	319.885
1096.03	319.854
1085.1	319.456
1081.1	319.31
1073.4	319.03
1066.29	318.771
1064.86	318.717
1062.97	318.643
1052.18	318.254
1051.41	318.223
1045.12	318
1037.57	317.725
1028.17	317.383
1023.72	317.221
1017.01	316.976
1009.52	316.704
1008.28	316.657
996.063	316.213
995.361	316.186
994.822	316.164
990.2	316
980.627	315.651
977.216	315.527
966.37	315.132
957.811	314.821
951.951	314.607
950.897	314.568
937.869	314.094
937.565	314.082
937.331	314.073
935.278	314
925.128	313.63
922.402	313.531
913.375	313.202
907.52	312.989
901.711	312.778

892.78	312.452
891.981	312.423
880.356	312
878.221	311.922
877.459	311.895
863.902	311.401
855.95	311.111
849.484	310.876
844.499	310.694
834.968	310.347
834.362	310.325
825.434	310
821.354	309.851
820.258	309.812
809.633	309.425
805.404	309.271
797.969	309
790.641	308.733
786.363	308.577
775.969	308.199
775.619	308.186
770.512	308
761.583	307.675
758.397	307.559
747.249	307.153
738.908	306.849
732.814	306.627
729.246	306.497
718.278	306.098
718.107	306.092
715.59	306
706.219	305.659
703.734	305.568
694.724	305.24
689.186	305.038
683.216	304.821
674.618	304.508
671.696	304.402
660.668	304
660.102	303.979
659.927	303.973
647.125	303.507
642.972	303.356
634.19	303.036
626.089	302.741
621.298	302.566
609.277	302.129
608.447	302.098
605.746	302
592.729	301.43
585.533	300.889
578.85	300.522
573.694	300

567.931	298.081
567.688	298
567.55	297.954
561.688	296
560.864	295.725
555.688	294
553.874	293.396
549.687	292
547.513	291.275
543.686	290
539.572	288.629
537.686	288
532.56	286.292
531.685	286
529.672	285.329
525.684	284
523.962	283.426
519.684	282
517.638	281.318
513.683	280
509.776	278.698
507.683	278
506.199	277.506
501.681	276
497.772	274.697
495.681	274
491.005	272.442
489.68	272
489.09	271.803
483.679	270
482.242	269.521
477.679	268
474.189	266.837
471.678	266
466.109	264.144
465.678	264
465.484	263.935
459.677	262
459.258	261.86
453.676	260
452.686	259.67
447.676	258
444.164	256.829
441.675	256
437.62	254.648
435.675	254
431.086	252.47
429.675	252
427.788	251.371
423.674	250
420.757	249.028
417.674	248
414.581	246.969

411.673	246
408.486	244.938
405.673	244
402.391	242.906
399.673	242
396.296	240.874
393.672	240
390.201	238.843
387.672	238
384.105	236.811
381.671	236
378.01	234.78
375.671	234
372.05	232.793
369.671	232
368.183	231.504
363.67	230
362.091	229.474
357.67	228
355.998	227.443
351.669	226
349.905	225.412
345.669	224
343.812	223.381
339.669	222
337.719	221.35
333.668	220
331.626	219.319
327.668	218
325.533	217.288
321.667	216
319.439	215.257
315.667	214
313.346	213.226
309.667	212
307.252	211.195
303.666	210
301.159	209.164
297.666	208
295.065	207.133
291.665	206
288.971	205.102
285.665	204
282.877	203.071
279.665	202
276.783	201.04
273.664	200
270.689	199.008
267.664	198
264.594	196.977
261.663	196
258.5	194.946
255.663	194

252.405	192.914
249.662	192
246.31	190.883
243.662	190
240.215	188.851
237.662	188
234.12	186.82
231.661	186
228.017	184.785
225.662	184
221.802	182.716
219.651	182
216.161	180.832
214.953	180.427
213.677	180
210.543	178.955
208.652	178.325
207.677	178
207.158	177.844
205.613	177.382
202.523	176.456
180.07	178
177.959	177.46
174.783	176.639
172.407	176
170.772	175.495
166.382	174
163.292	173.078
159.725	172
157.032	170.826
156.661	170.683
155.94	170.468
154.715	170
153.182	169.408
152.867	169.312
152.014	169.08
151.049	168.783
148.832	168
147.535	167.52
143.965	166
140.022	164.477
138.788	164
137.479	163.509
133.373	162
131.589	161.309
127.185	160
126.959	159.997
126.25	159.995
125.762	159.993
125.68	159.993
118.478	159.969
112.757	159.986
109.707	159.993

109.569	159.993
109.105	159.994
108.997	159.995
108.065	159.997
107.64	159.997
107.166	160
106.378	160.046
106.193	160.053
106.103	160.054
105.8	160.084
105.495	160.108
104.805	160.417
103.221	160.987
102.599	161.033
102.009	161.037
101.614	161.072
101.055	161.048
100.711	161.052
97.7835	161.058
94.3084	161.041
93.8975	161.022
91.9539	161.147
91.63	161.143
91.4102	161.082
90.2817	161.024
89.9486	161.022
89.707	160.951
86.7014	160.813
82.7048	161.264
82.458	161.296
81.3882	161.545
81.1637	161.594
79.2738	162
77.816	162
75.0666	162
72.9864	161.282
69.3934	160
68.7416	159.768
68.2736	159.597
68.1192	159.514
67.9386	159.38
67.3686	159.119
66.5713	158
65.7493	156.136
65.6836	156
65.5752	156
65.3068	156
65.0401	156
59.6261	156
59.182	156
58.1295	156
54.3138	157.2
51.6407	158

50.8258	158.181
50.3907	158.236
45.9965	158.999
41.4109	159.593
40.813	159.676
40.1879	159.755
38.4792	160
36.2697	160.68
34.0018	161.233
31.409	162
30.6648	162.367
29.2396	163.187
28.1824	163.779
27.7683	164
24.1653	165.56
23.3051	166
19.6494	167.648
18.9426	168
15.9722	169.385
14.4129	170
14.1982	170
12.8502	170
12.4376	170
10.2755	170
9.92074	170
8.21815	170

Material Boundary

X	Y
202.523	176.456
209.644	173.98
209.656	173.976
209.673	173.97
209.701	173.961
209.754	173.943
209.889	173.899
211.024	173.525
215.647	172
219.457	170.752
221.753	170
223.198	169.524
227.818	168
231.167	166.903
233.924	166
239.731	164.085
239.989	164
240.158	163.945
246.075	162
250.846	160.432
252.16	160
254.731	159.155
258.246	158

260.564	157.238
264.331	156
269.78	154.209
270.417	154
270.828	153.865
276.502	152
281.239	150.443
282.588	150
284.878	149.247
288.673	148
288.694	147.994
291.145	147.188
294.759	146
294.789	145.99
294.817	145.991
300.025	144.273
300.849	144
300.936	144
301.55	143.798
306.97	142
307.021	142
311.682	140.462
313.072	140
313.082	140
315.185	139.306
319.144	138
321.59	137.197
325.229	136
329.426	134.608
331.256	134
332.629	133.549
337.335	132
341.828	130.529
343.443	130
348.164	128.439
349.492	128
351.137	127.45
355.479	126
366.611	125.944
370.513	125.931
383.965	125.994
385.43	126
387.113	126.048
390.516	126.144
435.781	127.424
456.235	128
480.527	128.667
527.675	129.968
528.433	129.989
528.846	130
528.936	130
528.97	130
529.059	130.001

539.5	130.043
552.72	130.294
575.143	130.619
581.119	130.601
587.25	130.583
593.541	130.565
599.129	130.534
601.589	130.521
608.463	130.488
610.709	130.476
617.792	130.441
625.205	130.405
627.114	130.395
634.744	130.358
636.43	130.349
644.276	130.311
645.74	130.303
653.801	130.264
655.043	130.257
656.126	130.253
664.642	130.216
665.551	130.212
674.288	130.174
675.074	130.171
684.022	130.132
684.619	130.13
693.779	130.09
694.187	130.088
703.562	130.048
703.773	130.047
713.368	130.005
713.392	130.005
714.64	130
723.812	129.994
724.625	129.995
726.778	129.991
732.863	129.987
736.095	129.991
738.943	129.989
742.604	130
766.537	130.668
774.739	130.898
814.017	132
828.404	132.395
839.649	132.705
864.839	133.398
886.554	134
888.573	134.057
924.259	134.663
944.12	134.919
948.68	134.898
953.418	134.877
958.343	134.854

963.659	134.828
967.433	134.811
972.95	134.784
976.521	134.768
982.239	134.739
985.607	134.724
991.527	134.694
994.615	134.677
1000.75	134.646
1003.63	134.631
1009.99	134.599
1012.66	134.584
1019.23	134.551
1021.71	134.539
1028.5	134.505
1029.69	134.499
1030.85	134.495
1031.4	134.492
1038.35	134.463
1040.11	134.456
1041.2	134.452
1042.28	134.45
1049.3	134.42
1052.16	134.449
1055.45	134.483
1057.69	134.531
1062.15	134.526
1066.68	134.507
1069.19	134.568
1075.92	134.51
1078.47	134.582
1085.16	134.513
1087.7	134.49
1090.05	134.577
1093.69	134.552
1096.62	134.674
1099.96	134.645
1103.91	134.833
1111.1	135.173
1115.26	135.472
1128.34	135.992
1128.36	135.993
1128.54	136
1136.54	137.583
1138.64	138
1143.2	138.914
1148.64	140
1149.35	140.143
1152.53	140.786
1157.39	141.767
1158.54	142
1163.34	142.967
1168.47	144

1168.88	144.082
1169.38	144.184
1178.4	146
1181.82	146.688
1188.33	148
1194.13	149.167
1198.27	150
1206.33	151.622
1208.21	152
1216.89	153.747
1218.14	154
1218.36	154.045
1228.05	156
1228.06	156.001
1228.08	156.005
1228.4	156.083
1236.03	157.624
1237.89	158
1244.19	159.271
1247.8	160
1253.54	161.159
1257.71	162
1261.5	162.765
1266.92	163.86
1267.34	163.946
1267.61	164
1277.37	165.971
1277.52	166
1278.54	166.207
1287.42	168
1288.05	168.126
1288.73	168.264
1293.48	169.185
1297.69	170
1300.81	170.606
1308	172
1310.03	172.394
1312.81	172.933
1315.92	173.536
1318.32	174
1324.86	175.267
1328.64	176
1334.83	177.2
1336.61	177.546

Material Boundary

X	Y
205.613	177.382
209.644	175.98
209.656	175.976
209.673	175.97
209.701	175.961

209.754	175.943
209.889	175.899
211.024	175.525
215.647	174
219.457	172.752
221.753	172
223.198	171.524
227.818	170
231.167	168.903
233.924	168
239.731	166.085
239.989	166
240.158	165.945
246.075	164
250.846	162.432
252.16	162
254.731	161.155
258.246	160
260.564	159.238
264.331	158
269.78	156.209
270.417	156
270.828	155.865
276.502	154
281.239	152.443
282.588	152
284.878	151.247
288.673	150
288.694	149.994
291.145	149.188
294.759	148
294.789	147.99
294.817	147.991
300.025	146.273
300.849	146
300.936	146
301.55	145.798
306.97	144
307.021	144
311.682	142.462
313.072	142
313.082	142
315.185	141.306
319.144	140
321.59	139.197
325.229	138
329.426	136.608
331.256	136
332.629	135.549
337.335	134
341.828	132.529
343.443	132
348.164	130.439

349.492	130
351.137	129.45
355.479	128
366.611	127.944
370.513	127.931
383.965	127.994
385.43	128
387.113	128.048
390.516	128.144
435.781	129.424
456.235	130
480.527	130.667
527.675	131.968
528.433	131.989
528.846	132
528.936	132
528.97	132
529.059	132.001
539.5	132.043
552.72	132.294
575.143	132.619
581.119	132.601
587.25	132.583
593.541	132.565
599.129	132.534
601.589	132.521
608.463	132.488
610.709	132.476
617.792	132.441
625.205	132.405
627.114	132.395
634.744	132.358
636.43	132.349
644.276	132.311
645.74	132.303
653.801	132.264
655.043	132.257
656.126	132.253
664.642	132.216
665.551	132.212
674.288	132.174
675.074	132.171
684.022	132.132
684.619	132.13
693.779	132.09
694.187	132.088
703.562	132.048
703.773	132.047
713.368	132.005
713.392	132.005
714.64	132
723.812	131.994
724.625	131.995

726.778	131.991
732.863	131.987
736.095	131.991
738.943	131.989
742.604	132
766.537	132.668
774.739	132.898
814.017	134
828.404	134.395
839.649	134.705
864.839	135.398
886.554	136
888.573	136.057
924.259	136.663
944.12	136.919
948.68	136.898
953.418	136.877
958.343	136.854
963.659	136.828
967.433	136.811
972.95	136.784
976.521	136.768
982.239	136.739
985.607	136.724
991.527	136.694
994.615	136.677
1000.75	136.646
1003.63	136.631
1009.99	136.599
1012.66	136.584
1019.23	136.551
1021.71	136.539
1028.5	136.505
1029.69	136.499
1030.85	136.495
1031.4	136.492
1038.35	136.463
1040.11	136.456
1041.2	136.452
1042.28	136.45
1049.3	136.42
1052.16	136.449
1055.45	136.483
1057.69	136.531
1062.15	136.526
1066.68	136.507
1069.19	136.568
1075.92	136.51
1078.47	136.582
1085.16	136.513
1087.7	136.49
1090.05	136.577
1093.69	136.552

1096.62	136.674
1099.96	136.645
1103.91	136.833
1111.1	137.173
1115.26	137.472
1128.34	137.992
1128.36	137.993
1128.54	138
1136.54	139.583
1138.64	140
1143.2	140.914
1148.64	142
1149.35	142.143
1152.53	142.786
1157.39	143.767
1158.54	144
1163.34	144.967
1168.47	146
1168.88	146.082
1169.38	146.184
1178.4	148
1181.82	148.688
1188.33	150
1194.13	151.167
1198.27	152
1206.33	153.622
1208.21	154
1216.89	155.747
1218.14	156
1218.36	156.045
1228.05	158
1228.06	158.001
1228.08	158.005
1228.4	158.083
1236.03	159.624
1237.89	160
1244.19	161.271
1247.8	162
1253.54	163.159
1257.71	164
1261.5	164.765
1266.92	165.86
1267.34	165.946
1267.61	166
1277.37	167.971
1277.52	168
1278.54	168.207
1287.42	170
1288.05	170.126
1288.73	170.264
1293.48	171.185
1297.69	172
1300.81	172.606

1308	174
1310.03	174.394
1312.81	174.933
1315.92	175.536
1318.32	176
1324.86	177.267
1328.64	178
1334.83	179.2
1336.61	179.546

Material Boundary

X	Y
208.652	178.325
209.644	177.98
209.656	177.976
209.673	177.97
209.701	177.961
209.754	177.943
209.889	177.899
211.024	177.525
215.647	176
219.457	174.752
221.753	174
223.198	173.524
227.818	172
231.167	170.903
233.924	170
239.731	168.085
239.989	168
240.158	167.945
246.075	166
250.846	164.432
252.16	164
254.731	163.155
258.246	162
260.564	161.238
264.331	160
269.78	158.209
270.417	158
270.828	157.865
276.502	156
281.239	154.443
282.588	154
284.878	153.247
288.673	152
288.694	151.994
291.145	151.188
294.759	150
294.789	149.99
294.817	149.991
300.025	148.273
300.849	148

300.936	148
301.55	147.798
306.97	146
307.021	146
311.682	144.462
313.072	144
313.082	144
315.185	143.306
319.144	142
321.59	141.197
325.229	140
329.426	138.608
331.256	138
332.629	137.549
337.335	136
341.828	134.529
343.443	134
348.164	132.439
349.492	132
351.137	131.45
355.479	130
366.611	129.944
370.513	129.931
383.965	129.994
385.43	130
387.113	130.048
390.516	130.144
435.781	131.424
456.235	132
480.527	132.667
527.675	133.968
528.433	133.989
528.846	134
528.936	134
528.97	134
529.059	134.001
539.5	134.043
552.72	134.294
575.143	134.619
581.119	134.601
587.25	134.583
593.541	134.565
599.129	134.534
601.589	134.521
608.463	134.488
610.709	134.476
617.792	134.441
625.205	134.405
627.114	134.395
634.744	134.358
636.43	134.349
644.276	134.311
645.74	134.303

653.801	134.264
655.043	134.257
656.126	134.253
664.642	134.216
665.551	134.212
674.288	134.174
675.074	134.171
684.022	134.132
684.619	134.13
693.779	134.09
694.187	134.088
703.562	134.048
703.773	134.047
713.368	134.005
713.392	134.005
714.64	134
723.812	133.994
724.625	133.995
726.778	133.991
732.863	133.987
736.095	133.991
738.943	133.989
742.604	134
766.537	134.668
774.739	134.898
814.017	136
828.404	136.395
839.649	136.705
864.839	137.398
886.554	138
888.573	138.057
924.259	138.663
944.12	138.919
948.68	138.898
953.418	138.877
958.343	138.854
963.659	138.828
967.433	138.811
972.95	138.784
976.521	138.768
982.239	138.739
985.607	138.724
991.527	138.694
994.615	138.677
1000.75	138.646
1003.63	138.631
1009.99	138.599
1012.66	138.584
1019.23	138.551
1021.71	138.539
1028.5	138.505
1029.69	138.499
1030.85	138.495

1031.4	138.492
1038.35	138.463
1040.11	138.456
1041.2	138.452
1042.28	138.45
1049.3	138.42
1052.16	138.449
1055.45	138.483
1057.69	138.531
1062.15	138.526
1066.68	138.507
1069.19	138.568
1075.92	138.51
1078.47	138.582
1085.16	138.513
1087.7	138.49
1090.05	138.577
1093.69	138.552
1096.62	138.674
1099.96	138.645
1103.91	138.833
1111.1	139.173
1115.26	139.472
1128.34	139.992
1128.36	139.993
1128.54	140
1136.54	141.583
1138.64	142
1143.2	142.914
1148.64	144
1149.35	144.143
1152.53	144.786
1157.39	145.767
1158.54	146
1163.34	146.967
1168.47	148
1168.88	148.082
1169.38	148.184
1178.4	150
1181.82	150.688
1188.33	152
1194.13	153.167
1198.27	154
1206.33	155.622
1208.21	156
1216.89	157.747
1218.14	158
1218.36	158.045
1228.05	160
1228.06	160.001
1228.08	160.005
1228.4	160.083
1236.03	161.624

1237.89	162
1244.19	163.271
1247.8	164
1253.54	165.159
1257.71	166
1261.5	166.765
1266.92	167.86
1267.34	167.946
1267.61	168
1277.37	169.971
1277.52	170
1278.54	170.207
1287.42	172
1288.05	172.126
1288.73	172.264
1293.48	173.185
1297.69	174
1300.81	174.606
1308	176
1310.03	176.394
1312.81	176.933
1315.92	177.536
1318.32	178
1324.86	179.267
1328.64	180
1334.83	181.2
1336.61	181.546

Material Boundary

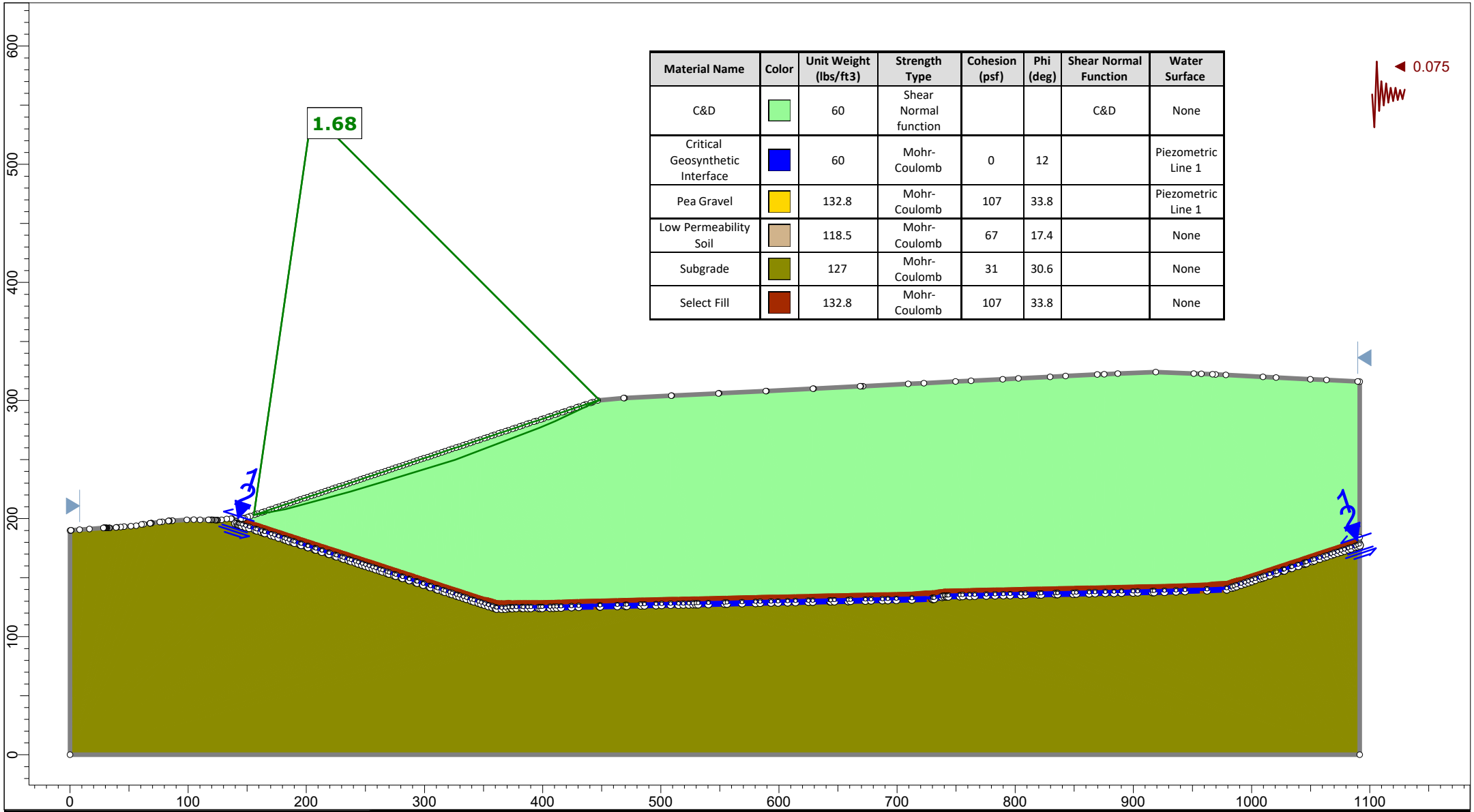
X	Y
216.161	180.832
219.457	179.752
221.753	179
223.198	178.524
227.818	177
231.167	175.903
233.924	175
239.731	173.085
239.989	173
240.158	172.945
246.075	171
250.846	169.432
252.16	169
254.731	168.155
258.246	167
260.564	166.238
264.331	165
269.78	163.209
270.417	163
270.828	162.865
276.502	161
281.239	159.443

282.588	159
284.878	158.247
288.673	157
288.694	156.994
291.145	156.188
294.759	155
294.789	154.99
294.817	154.991
300.025	153.273
300.849	153
300.936	153
301.55	152.798
306.97	151
307.021	151
311.682	149.462
313.072	149
313.082	149
315.185	148.306
319.144	147
321.59	146.197
325.229	145
329.426	143.608
331.256	143
332.629	142.549
337.335	141
341.828	139.529
343.443	139
348.164	137.439
349.492	137
351.137	136.45
355.479	135
366.611	134.944
370.513	134.931
383.965	134.994
385.43	135
387.113	135.048
390.516	135.144
435.781	136.424
456.235	137
480.527	137.667
527.675	138.968
528.433	138.989
528.846	139
528.936	139
528.97	139
529.059	139.001
539.5	139.043
552.72	139.294
575.143	139.619
581.119	139.601
587.25	139.583
593.541	139.565
599.129	139.534

601.589	139.521
608.463	139.488
610.709	139.476
617.792	139.441
625.205	139.405
627.114	139.395
634.744	139.358
636.43	139.349
644.276	139.311
645.74	139.303
653.801	139.264
655.043	139.257
656.126	139.253
664.642	139.216
665.551	139.212
674.288	139.174
675.074	139.171
684.022	139.132
684.619	139.13
693.779	139.09
694.187	139.088
703.562	139.048
703.773	139.047
713.368	139.005
713.392	139.005
714.64	139
723.812	138.994
724.625	138.995
726.778	138.991
732.863	138.987
736.095	138.991
738.943	138.989
742.604	139
766.537	139.668
774.739	139.898
814.017	141
828.404	141.395
839.649	141.705
864.839	142.398
886.554	143
888.573	143.057
924.259	143.663
944.12	143.919
948.68	143.898
953.418	143.877
958.343	143.854
963.659	143.828
967.433	143.811
972.95	143.784
976.521	143.768
982.239	143.739
985.607	143.724
991.527	143.694

994.615	143.677
1000.75	143.646
1003.63	143.631
1009.99	143.599
1012.66	143.584
1019.23	143.551
1021.71	143.539
1028.5	143.505
1029.69	143.499
1030.85	143.495
1031.4	143.492
1038.35	143.463
1040.11	143.456
1041.2	143.452
1042.28	143.45
1049.3	143.42
1052.16	143.449
1055.45	143.483
1057.69	143.531
1062.15	143.526
1066.68	143.507
1069.19	143.568
1075.92	143.51
1078.47	143.582
1085.16	143.513
1087.7	143.49
1090.05	143.577
1093.69	143.552
1096.62	143.674
1099.96	143.645
1103.91	143.833
1111.1	144.173
1115.26	144.472
1128.34	144.992
1128.36	144.993
1128.54	145
1136.54	146.583
1138.64	147
1143.2	147.914
1148.64	149
1149.35	149.143
1152.53	149.786
1157.39	150.767
1158.54	151
1163.34	151.967
1168.47	153
1168.88	153.082
1169.38	153.184
1178.4	155
1181.82	155.688
1188.33	157
1194.13	158.167
1198.27	159

1206.33	160.622
1208.21	161
1216.89	162.747
1218.14	163
1218.36	163.045
1228.05	165
1228.06	165.001
1228.08	165.005
1228.4	165.083
1236.03	166.624
1237.89	167
1244.19	168.271
1247.8	169
1253.54	170.159
1257.71	171
1261.5	171.765
1266.92	172.86
1267.34	172.946
1267.61	173
1277.37	174.971
1277.52	175
1278.54	175.207
1287.42	177
1288.05	177.126
1288.73	177.264
1293.48	178.185
1297.69	179
1300.81	179.606
1308	181
1310.03	181.394
1312.81	181.933
1315.92	182.536
1318.32	183
1324.86	184.267
1328.64	185
1334.83	186.2
1336.61	186.546



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None

rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section B - Seismic - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

182-442 S.A. Dunn Footprint Modification

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:01m:53.374s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	9/26/2018, 11:46:34 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.682130
Axis Location:	204.692, 543.991
Left Slip Surface Endpoint:	155.587, 203.011
Right Slip Surface Endpoint:	448.013, 300.119
Resisting Moment:	2.40024e+07 lb-ft
Driving Moment:	1.4269e+07 lb-ft
Resisting Horizontal Force:	71585.6 lb
Driving Horizontal Force:	42556.4 lb
Total Slice Area:	1939.64 ft2
Surface Horizontal Width:	292.426 ft
Surface Average Height:	6.63291 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
155.587	203.011
182.574	207.875
237.041	222.665
266.641	231.689
325.864	249.747
397.468	276.876
410.571	282.373
448.013	300.119

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.68213

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	5.39737	133.714	10.2157	C&D	0	34.992	9.62256	16.1864	23.1234	0	23.1234	24.8575	24.8575
2	5.39737	401.143	10.2157	C&D	0	34.992	29.0033	48.7874	69.6963	0	69.6963	74.923	74.923
3	5.39737	668.572	10.2157	C&D	0	34.992	48.5856	81.7273	116.753	0	116.753	125.509	125.509
4	5.39737	936.001	10.2157	C&D	0	34.992	68.3645	114.998	164.283	0	164.283	176.603	176.603
5	5.39737	1203.43	10.2157	C&D	2.84217e-14	34.992	88.3338	148.589	212.271	0	212.271	228.19	228.19
6	6.05189	1567.04	15.1927	C&D	0	34.992	98.3568	165.449	236.355	0	236.355	263.065	263.065
7	6.05189	1702.52	15.1927	C&D	0	34.992	107.06	180.089	257.27	0	257.27	286.343	286.343
8	6.05189	1838.01	15.1927	C&D	0	34.992	115.783	194.762	278.232	0	278.232	309.673	309.673
9	6.05189	1973.49	15.1927	C&D	2.84217e-14	34.992	124.521	209.46	299.228	0	299.228	333.043	333.043

10	6.05189	2108.98	15.1927	C&D	2.84217e-14	34.992	133.269	224.175	320.25	0	320.25	356.44	356.44
11	6.05189	2244.46	15.1927	C&D	0	34.992	142.022	238.899	341.285	0	341.285	379.852	379.852
12	6.05189	2379.95	15.1927	C&D	0	34.992	150.774	253.622	362.318	0	362.318	403.262	403.262
13	6.05189	2515.43	15.1927	C&D	0	34.992	159.521	268.335	383.337	0	383.337	426.656	426.656
14	6.05189	2650.92	15.1927	C&D	0	34.992	168.256	283.028	404.327	0	404.327	450.018	450.018
15	5.92002	2689.24	16.9536	C&D	0	34.992	170.699	287.138	410.197	0	410.197	462.234	462.234
16	5.92002	2748.88	16.9536	C&D	5.68434e-14	34.992	174.444	293.437	419.195	0	419.195	472.373	472.373
17	5.92002	2808.53	16.9536	C&D	0	34.992	178.168	299.702	428.146	0	428.146	482.46	482.46
18	5.92002	2868.18	16.9536	C&D	0	34.992	181.872	305.932	437.046	0	437.046	492.489	492.489
19	5.92002	2927.82	16.9536	C&D	0	34.992	185.553	312.125	445.892	0	445.892	502.458	502.458
20	5.92226	2988.53	16.9574	C&D	0	34.992	189.198	318.255	454.651	0	454.651	512.34	512.34
21	5.92226	3048.07	16.9574	C&D	0	34.992	192.823	324.354	463.363	0	463.363	522.158	522.158
22	5.92226	3107.61	16.9574	C&D	5.68434e-14	34.992	196.425	330.412	472.016	0	472.016	531.91	531.91
23	5.92226	3167.15	16.9574	C&D	5.68434e-14	34.992	200.001	336.427	480.611	0	480.611	541.594	541.594
24	5.92226	3226.69	16.9574	C&D	0	34.992	203.551	342.4	489.142	0	489.142	551.208	551.208
25	5.92226	3286.22	16.9574	C&D	5.68434e-14	34.992	207.076	348.328	497.611	0	497.611	560.753	560.753
26	5.92226	3345.76	16.9574	C&D	5.68434e-14	34.992	210.575	354.214	506.02	0	506.02	570.228	570.228
27	5.92226	3405.3	16.9574	C&D	5.68434e-14	34.992	214.048	360.056	514.365	0	514.365	579.632	579.632
28	5.92226	3464.84	16.9574	C&D	0	34.992	217.494	365.854	522.649	0	522.649	588.967	588.967
29	5.92226	3524.38	16.9574	C&D	5.68434e-14	34.992	220.917	371.611	530.873	0	530.873	598.235	598.235
30	5.508	3263.97	20.7505	C&D	0	34.992	208.119	350.083	500.119	0	500.119	578.97	578.97
31	5.508	3180.85	20.7505	C&D	0	34.992	202.691	340.953	487.075	0	487.075	563.87	563.87
32	5.508	3097.72	20.7505	C&D	0	34.992	197.299	331.882	474.118	0	474.118	548.869	548.869
33	5.508	3014.6	20.7505	C&D	5.68434e-14	34.992	191.939	322.867	461.238	0	461.238	533.96	533.96
34	5.508	2931.48	20.7505	C&D	5.68434e-14	34.992	186.61	313.903	448.434	0	448.434	519.136	519.136
35	5.508	2848.36	20.7505	C&D	5.68434e-14	34.992	181.31	304.987	435.696	0	435.696	504.389	504.389
36	5.508	2765.23	20.7505	C&D	5.68434e-14	34.992	176.035	296.114	423.02	0	423.02	489.715	489.715
37	5.508	2682.11	20.7505	C&D	5.68434e-14	34.992	170.783	287.28	410.4	0	410.4	475.106	475.106
38	5.508	2598.99	20.7505	C&D	0	34.992	165.551	278.479	397.828	0	397.828	460.552	460.552
39	5.508	2515.86	20.7505	C&D	0	34.992	160.338	269.709	385.297	0	385.297	446.045	446.045
40	5.508	2432.74	20.7505	C&D	5.68434e-14	34.992	155.138	260.962	372.803	0	372.803	431.581	431.581
41	5.508	2349.62	20.7505	C&D	0	34.992	149.95	252.236	360.337	0	360.337	417.149	417.149
42	5.508	2266.5	20.7505	C&D	2.84217e-14	34.992	144.772	243.525	347.894	0	347.894	402.744	402.744
43	6.5513	2535.25	22.7588	C&D	2.84217e-14	34.992	133.376	224.355	320.507	0	320.507	376.46	376.46
44	6.5513	2313	22.7588	C&D	0	34.992	122.02	205.254	293.221	0	293.221	344.41	344.41
45	6.24044	1932.95	25.3593	C&D	2.84217e-14	34.992	104.61	175.967	251.381	0	251.381	300.962	300.962
46	6.24044	1604.07	25.3593	C&D	0	34.992	87.2323	146.736	209.622	0	209.622	250.967	250.967
47	6.24044	1275.18	25.3593	C&D	2.84217e-14	34.992	69.695	117.236	167.48	0	167.48	200.513	200.513
48	6.24044	946.297	25.3593	C&D	0	34.992	51.9874	87.4495	124.928	0	124.928	149.568	149.568
49	6.24044	617.412	25.3593	C&D	7.10543e-15	34.992	34.0996	57.3599	81.9426	0	81.9426	98.1046	98.1046
50	6.24044	275.081	25.3593	C&D	0	34.992	15.2772	25.6982	36.7117	0	36.7117	43.9525	43.9525

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.68213

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	155.587	203.011	0	0	0
2	160.985	203.984	19.5489	0.477391	1.39891
3	166.382	204.957	78.6127	3.83305	2.79145
4	171.779	205.929	177.81	12.9682	4.17136
5	177.177	206.902	317.747	30.7777	5.53254
6	182.574	207.875	499.008	60.1134	6.86908
7	188.626	209.518	589.805	86.3749	8.33154
8	194.678	211.161	688.875	118.354	9.74868
9	200.73	212.805	796.259	156.42	11.1139
10	206.782	214.448	911.989	200.865	12.421
11	212.834	216.092	1036.09	251.898	13.6648
12	218.886	217.735	1168.56	309.637	14.8408
13	224.937	219.379	1309.41	374.1	15.9447
14	230.989	221.022	1458.63	445.205	16.9733
15	237.041	222.665	1616.19	522.759	17.9239
16	242.961	224.47	1687.33	573.631	18.7762
17	248.881	226.275	1759.98	624.971	19.55
18	254.801	228.08	1834.12	676.425	20.244
19	260.721	229.884	1909.69	727.616	20.8575
20	266.641	231.689	1986.69	778.146	21.3893
21	272.564	233.495	2064.87	827.535	21.8394
22	278.486	235.301	2144.38	875.411	22.207
23	284.408	237.106	2225.17	921.335	22.4921
24	290.33	238.912	2307.22	964.857	22.6942
25	296.253	240.718	2390.48	1005.52	22.8133
26	302.175	242.524	2474.9	1042.88	22.8497
27	308.097	244.33	2560.45	1076.47	22.803
28	314.019	246.135	2647.08	1105.84	22.6731
29	319.942	247.941	2734.75	1130.57	22.4606
30	325.864	249.747	2823.43	1150.21	22.165
31	331.372	251.834	2684.2	1074.48	21.8161
32	336.88	253.921	2548.45	998.515	21.3959
33	342.388	256.008	2416.2	922.881	20.9046
34	347.896	258.094	2287.46	848.105	20.3429
35	353.404	260.181	2162.26	774.674	19.7111
36	358.912	262.268	2040.6	703.038	19.0101
37	364.42	264.355	1922.5	633.605	18.2408
38	369.928	266.442	1807.97	566.741	17.4045
39	375.436	268.529	1697.02	502.769	16.5028
40	380.944	270.615	1589.66	441.967	15.5373
41	386.452	272.702	1485.9	384.57	14.5105
42	391.96	274.789	1385.74	330.767	13.4249
43	397.468	276.876	1289.19	280.707	12.2838
44	404.019	279.624	1094.18	209.896	10.8591
45	410.571	282.373	916.257	151.154	9.36766
46	416.811	285.331	682.234	94.5732	7.89221
47	423.051	288.288	487.671	54.4499	6.37086
48	429.292	291.246	332.703	28.0075	4.81191
49	435.532	294.204	217.475	12.2508	3.22418
50	441.773	297.162	142.141	4.01257	1.617
51	448.013	300.119	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
140.028	196.713

141.766	196.149
142.289	195.994
143.045	195.769
144.237	195.414
145.518	195
148.459	194.052
151.716	193
156.612	191.418
157.903	191
161.952	189.689
164.08	189
164.758	188.78
170.247	187
172.895	186.14
176.403	185
181.024	183.497
182.529	183
185.376	182.065
188.619	181
189.923	180.575
194.757	179
195.648	178.71
200.895	177
201.373	176.844
207.034	175
207.098	174.979
207.993	174.687
212.823	173.114
213.172	173
218.549	171.248
219.311	171
224.274	169.383
225.449	169
230	167.518
231.588	167
235.725	165.651
237.722	165
241.444	163.784
243.846	163
247.162	161.917
249.97	161
252.88	160.05
256.093	159
258.598	158.182
262.216	157
264.316	156.314
268.34	155
270.035	154.446
274.463	153
275.754	152.578
280.585	151
281.473	150.71
286.71	149

287.186	148.844
292.824	147
292.886	146.98
293.74	146.7
298.583	145.115
298.935	145
304.279	143.251
305.047	143
309.976	141.387
311.159	141
315.674	139.523
317.272	139
321.371	137.659
323.386	137
327.069	135.795
329.5	135
332.77	133.931
335.619	133
339.508	131.716
341.678	131
345.692	129.704
347.866	129
350.959	127.992
354.006	127
357.278	125.924
360.089	125
361.133	124.745
365.215	124.477
368.707	124.493
371.484	125
373.654	125.03
374.386	125.08
377.631	125.239
382.427	125.316
383.677	125.244
387.287	125.197
390.059	125.187
396.735	125.233
398.019	125.268
399.749	125.314
406.24	125.429
409.208	125.512
411.915	125.585
415.53	125.683
424.48	125.93
430.485	126.131
448.199	126.599
448.732	126.618
463.334	127
470.097	127.145
471.17	127.168
483.106	127.425
486.086	127.487

495.863	127.696
500.697	127.797
508.409	127.961
515.014	128.097
518.981	128.181
523.614	128.281
527.447	128.363
529.69	128.406
531.66	128.441
540.373	128.637
554.05	128.953
556.089	129
568.694	129.288
580.167	129.531
584.066	129.617
593.259	129.813
599.175	129.945
607.386	130.128
614.024	130.271
624.97	130.517
628.615	130.596
643.158	130.917
643.782	130.931
646.896	131
658.497	131.248
660.64	131.294
673.082	131.561
677.922	131.665
687.656	131.874
692.236	131.971
699.35	132.123
712.535	132.48
729.855	132.992
730.239	132.992
731.42	133
738.245	134.694
739.951	135
740.007	135.001
741.701	135.015
742.332	135.017
743.317	135.019
753.154	135.287
755.462	135.336
761.566	135.471
765.71	135.559
775.589	135.763
783.012	135.917
790.009	136.066
795.683	136.184
804.848	136.379
808.664	136.459
820.13	136.704
821.971	136.743

833.961	137
835.574	137.035
835.855	137.041
849.047	137.327
851.677	137.384
862.588	137.62
867.593	137.729
876.198	137.915
883.605	138.076
889.878	138.211
899.713	138.425
903.628	138.509
915.919	138.776
917.449	138.809
926.274	139
936.214	139.29
943.717	139.589
962.389	140.22
979.061	141
983.234	142.38
985.11	143
987.287	143.719
991.16	145
994.524	146.112
997.209	147
1000.33	148.033
1003.26	149
1007.19	150.301
1009.31	151
1011.14	151.607
1015.36	153
1020.26	154.621
1021.41	155
1027.04	156.861
1027.46	157
1027.82	157.12
1033.5	159
1034.29	159.258
1039.55	161
1044.85	162.749
1045.6	163
1046.49	163.294
1051.65	165
1053.18	165.503
1057.7	167
1061.67	168.313
1063.75	169
1067.3	170.173
1069.8	171
1072.91	172.028
1075.85	173
1078.52	173.882
1081.9	175

1084.13	175.737
1087.95	177
1089.74	177.591
1091.61	178.21

External Boundary

X	Y
0	189.907
0	0
1091.61	0
1091.61	175.21
1091.61	177.21
1091.61	178.21
1091.61	179.21
1091.61	184.21
1091.61	315.915
1089.91	316
1063.4	317.322
1049.79	318
1020.8	319.445
1009.68	320
978.207	321.569
969.56	322
967.034	322.1
957.494	322.477
951.058	322.728
918.857	324
886.821	322.699
875.264	322.234
869.428	322
842.625	320.66
829.419	320
802.655	318.662
789.411	318
762.684	316.664
749.402	316
722.713	314.666
709.393	314
671.066	312.084
669.384	312
668.793	311.97
629.376	310
628.822	309.972
589.367	308
588.85	307.974
549.358	306
548.879	305.976
509.349	304
508.907	303.978
469.34	302
468.527	301.928
446.661	300

442.399	298.58
440.658	298
436.441	296.595
434.656	296
430.483	294.609
428.654	294
424.525	292.624
422.652	292
418.566	290.639
416.65	290
412.608	288.653
410.647	288
406.65	286.668
404.645	286
400.692	284.683
398.643	284
394.734	282.697
392.641	282
388.775	280.712
386.639	280
382.817	278.727
380.636	278
376.859	276.741
374.634	276
370.9	274.756
368.632	274
364.942	272.77
362.63	272
358.984	270.785
356.628	270
353.025	268.8
350.625	268
347.067	266.814
344.623	266
341.108	264.829
338.621	264
335.15	262.843
332.619	262
329.191	260.858
326.617	260
323.233	258.872
320.614	258
317.274	256.887
314.612	256
311.316	254.902
308.61	254
305.357	252.916
302.608	252
299.398	250.931
296.606	250
293.44	248.945
290.603	248
287.481	246.96

284.601	246
281.522	244.974
278.599	244
275.563	242.989
272.597	242
269.605	241.003
266.595	240
263.646	239.017
260.592	238
257.687	237.032
254.59	236
251.728	235.046
248.588	234
245.769	233.061
242.586	232
239.81	231.075
236.583	230
233.851	229.09
230.581	228
227.892	227.104
224.579	226
221.933	225.118
218.577	224
215.974	223.133
212.575	222
210.015	221.147
206.572	220
204.056	219.162
200.57	218
198.097	217.176
194.568	216
192.138	215.19
188.566	214
186.179	213.205
182.564	212
180.22	211.219
176.561	210
174.261	209.233
170.559	208
168.301	207.248
164.557	206
162.342	205.262
158.555	204
156.383	203.276
152.553	202
150.424	201.291
147.568	200.339
146.55	200
144.336	199.263
140.538	198
140.028	197.831
137.04	199.831
136.822	199.82

136.281	199.806
132.588	199.709
128.132	198.907
124.832	198.717
124.43	198.72
123.832	198.73
123.354	198.751
122.743	198.757
121.425	198.812
120.213	198.857
119.938	198.854
119.584	198.87
118.385	198.849
117.235	198.834
117.034	198.833
110.132	198.987
104.818	199.102
98.8143	198.859
86.6552	198.181
86.5428	198.179
84.1379	198
83.868	197.986
83.5647	197.967
83.3869	197.961
78.0277	197.266
75.9286	197.019
68.8572	196.138
68.697	196.118
67.841	196.002
67.8254	196.002
67.6997	196
62.2082	195.148
60.6701	194.935
55.9212	194
51.5095	193.601
45.8245	193.113
42.7715	192.86
39.5414	192.548
39.0396	192.503
33.5804	192
33.3498	191.999
33.0358	191.998
31.7133	191.995
31.057	191.995
30.8982	191.995
30.4475	191.994
29.8506	191.994
29.6366	191.993
29.391	191.993
29.3226	191.993
28.622	191.994
28.542	191.993
28.3605	191.993

28.2555	191.993
16.346	191.138
8.05554	190.53
0.998983	190.005
0.686216	190

Material Boundary

X	Y
140.028	197.831
140.028	197.713
140.028	196.713
140.028	195.713
140.028	193.713
141.766	193.149
142.289	192.994
143.045	192.769
144.237	192.414
145.518	192
148.459	191.052
151.716	190
156.612	188.418
157.903	188
161.952	186.689
164.08	186
164.758	185.78
170.247	184
172.895	183.14
176.403	182
181.024	180.497
182.529	180
185.376	179.065
188.619	178
189.923	177.575
194.757	176
195.648	175.71
200.895	174
201.373	173.844
207.034	172
207.098	171.979
207.993	171.687
212.823	170.114
213.172	170
218.549	168.248
219.311	168
224.274	166.383
225.449	166
230	164.518
231.588	164
235.725	162.651
237.722	162
241.444	160.784
243.846	160

247.162	158.917
249.97	158
252.88	157.05
256.093	156
258.598	155.182
262.216	154
264.316	153.314
268.34	152
270.035	151.446
274.463	150
275.754	149.578
280.585	148
281.473	147.71
286.71	146
287.186	145.844
292.824	144
292.886	143.98
293.74	143.7
298.583	142.115
298.935	142
304.279	140.251
305.047	140
309.976	138.387
311.159	138
315.674	136.523
317.272	136
321.371	134.659
323.386	134
327.069	132.795
329.5	132
332.77	130.931
335.619	130
339.508	128.716
341.678	128
345.692	126.704
347.866	126
350.959	124.992
354.006	124
357.278	122.924
360.089	122
361.133	121.745
365.215	121.477
368.707	121.493
371.484	122
373.654	122.03
374.386	122.08
377.631	122.239
382.427	122.316
383.677	122.244
387.287	122.197
390.059	122.187
396.735	122.233
398.019	122.268

399.749	122.314
406.24	122.429
409.208	122.512
411.915	122.585
415.53	122.683
424.48	122.93
430.485	123.131
448.199	123.599
448.732	123.618
463.334	124
470.097	124.145
471.17	124.168
483.106	124.425
486.086	124.487
495.863	124.696
500.697	124.797
508.409	124.961
515.014	125.097
518.981	125.181
523.614	125.281
527.447	125.363
529.69	125.406
531.66	125.441
540.373	125.637
554.05	125.953
556.089	126
568.694	126.288
580.167	126.531
584.066	126.617
593.259	126.813
599.175	126.945
607.386	127.128
614.024	127.271
624.97	127.517
628.615	127.596
643.158	127.917
643.782	127.931
646.896	128
658.497	128.248
660.64	128.294
673.082	128.561
677.922	128.665
687.656	128.874
692.236	128.971
699.35	129.123
712.535	129.48
729.855	129.992
730.239	129.992
731.42	130
738.245	131.694
739.951	132
740.007	132.001
741.701	132.015

742.332	132.017
743.317	132.019
753.154	132.287
755.462	132.336
761.566	132.471
765.71	132.559
775.589	132.763
783.012	132.917
790.009	133.066
795.683	133.184
804.848	133.379
808.664	133.459
820.13	133.704
821.971	133.743
833.961	134
835.574	134.035
835.855	134.041
849.047	134.327
851.677	134.384
862.588	134.62
867.593	134.729
876.198	134.915
883.605	135.076
889.878	135.211
899.713	135.425
903.628	135.509
915.919	135.776
917.449	135.809
926.274	136
936.214	136.29
943.717	136.589
962.389	137.22
979.061	138
983.234	139.38
985.11	140
987.287	140.719
991.16	142
994.524	143.112
997.209	144
1000.33	145.033
1003.26	146
1007.19	147.301
1009.31	148
1011.14	148.607
1015.36	150
1020.26	151.621
1021.41	152
1027.04	153.861
1027.46	154
1027.82	154.12
1033.5	156
1034.29	156.258
1039.55	158

1044.85	159.749
1045.6	160
1046.49	160.294
1051.65	162
1053.18	162.503
1057.7	164
1061.67	165.313
1063.75	166
1067.3	167.173
1069.8	168
1072.91	169.028
1075.85	170
1078.52	170.882
1081.9	172
1084.13	172.737
1087.95	174
1089.74	174.591
1091.61	175.21

Material Boundary

X	Y
140.028	195.713
141.766	195.149
142.289	194.994
143.045	194.769
144.237	194.414
145.518	194
148.459	193.052
151.716	192
156.612	190.418
157.903	190
161.952	188.689
164.08	188
164.758	187.78
170.247	186
172.895	185.14
176.403	184
181.024	182.497
182.529	182
185.376	181.065
188.619	180
189.923	179.575
194.757	178
195.648	177.71
200.895	176
201.373	175.844
207.034	174
207.098	173.979
207.993	173.687
212.823	172.114
213.172	172
218.549	170.248

219.311	170
224.274	168.383
225.449	168
230	166.518
231.588	166
235.725	164.651
237.722	164
241.444	162.784
243.846	162
247.162	160.917
249.97	160
252.88	159.05
256.093	158
258.598	157.182
262.216	156
264.316	155.314
268.34	154
270.035	153.446
274.463	152
275.754	151.578
280.585	150
281.473	149.71
286.71	148
287.186	147.844
292.824	146
292.886	145.98
293.74	145.7
298.583	144.115
298.935	144
304.279	142.251
305.047	142
309.976	140.387
311.159	140
315.674	138.523
317.272	138
321.371	136.659
323.386	136
327.069	134.795
329.5	134
332.77	132.931
335.619	132
339.508	130.716
341.678	130
345.692	128.704
347.866	128
350.959	126.992
354.006	126
357.278	124.924
360.089	124
361.133	123.745
365.215	123.477
368.707	123.493
371.484	124

373.654	124.03
374.386	124.08
377.631	124.239
382.427	124.316
383.677	124.244
387.287	124.197
390.059	124.187
396.735	124.233
398.019	124.268
399.749	124.314
406.24	124.429
409.208	124.512
411.915	124.585
415.53	124.683
424.48	124.93
430.485	125.131
448.199	125.599
448.732	125.618
463.334	126
470.097	126.145
471.17	126.168
483.106	126.425
486.086	126.487
495.863	126.696
500.697	126.797
508.409	126.961
515.014	127.097
518.981	127.181
523.614	127.281
527.447	127.363
529.69	127.406
531.66	127.441
540.373	127.637
554.05	127.953
556.089	128
568.694	128.288
580.167	128.531
584.066	128.617
593.259	128.813
599.175	128.945
607.386	129.128
614.024	129.271
624.97	129.517
628.615	129.596
643.158	129.917
643.782	129.931
646.896	130
658.497	130.248
660.64	130.294
673.082	130.561
677.922	130.665
687.656	130.874
692.236	130.971

699.35	131.123
712.535	131.48
729.855	131.992
730.239	131.992
731.42	132
738.245	133.694
739.951	134
740.007	134.001
741.701	134.015
742.332	134.017
743.317	134.019
753.154	134.287
755.462	134.336
761.566	134.471
765.71	134.559
775.589	134.763
783.012	134.917
790.009	135.066
795.683	135.184
804.848	135.379
808.664	135.459
820.13	135.704
821.971	135.743
833.961	136
835.574	136.035
835.855	136.041
849.047	136.327
851.677	136.384
862.588	136.62
867.593	136.729
876.198	136.915
883.605	137.076
889.878	137.211
899.713	137.425
903.628	137.509
915.919	137.776
917.449	137.809
926.274	138
936.214	138.29
943.717	138.589
962.389	139.22
979.061	140
983.234	141.38
985.11	142
987.287	142.719
991.16	144
994.524	145.112
997.209	146
1000.33	147.033
1003.26	148
1007.19	149.301
1009.31	150
1011.14	150.607

1015.36	152
1020.26	153.621
1021.41	154
1027.04	155.861
1027.46	156
1027.82	156.12
1033.5	158
1034.29	158.258
1039.55	160
1044.85	161.749
1045.6	162
1046.49	162.294
1051.65	164
1053.18	164.503
1057.7	166
1061.67	167.313
1063.75	168
1067.3	169.173
1069.8	170
1072.91	171.028
1075.85	172
1078.52	172.882
1081.9	174
1084.13	174.737
1087.95	176
1089.74	176.591
1091.61	177.21

Material Boundary

X	Y
140.028	197.713
141.766	197.149
142.289	196.994
143.045	196.769
144.237	196.414
145.518	196
148.459	195.052
151.716	194
156.612	192.418
157.903	192
161.952	190.689
164.08	190
164.758	189.78
170.247	188
172.895	187.14
176.403	186
181.024	184.497
182.529	184
185.376	183.065
188.619	182
189.923	181.575
194.757	180

195.648	179.71
200.895	178
201.373	177.844
207.034	176
207.098	175.979
207.993	175.687
212.823	174.114
213.172	174
218.549	172.248
219.311	172
224.274	170.383
225.449	170
230	168.518
231.588	168
235.725	166.651
237.722	166
241.444	164.784
243.846	164
247.162	162.917
249.97	162
252.88	161.05
256.093	160
258.598	159.182
262.216	158
264.316	157.314
268.34	156
270.035	155.446
274.463	154
275.754	153.578
280.585	152
281.473	151.71
286.71	150
287.186	149.844
292.824	148
292.886	147.98
293.74	147.7
298.583	146.115
298.935	146
304.279	144.251
305.047	144
309.976	142.387
311.159	142
315.674	140.523
317.272	140
321.371	138.659
323.386	138
327.069	136.795
329.5	136
332.77	134.931
335.619	134
339.508	132.716
341.678	132
345.692	130.704

347.866	130
350.959	128.992
354.006	128
357.278	126.924
360.089	126
361.133	125.745
365.215	125.477
368.707	125.493
371.484	126
373.654	126.03
374.386	126.08
377.631	126.239
382.427	126.316
383.677	126.244
387.287	126.197
390.059	126.187
396.735	126.233
398.019	126.268
399.749	126.314
406.24	126.429
409.208	126.512
411.915	126.585
415.53	126.683
424.48	126.93
430.485	127.131
448.199	127.599
448.732	127.618
463.334	128
470.097	128.145
471.17	128.168
483.106	128.425
486.086	128.487
495.863	128.696
500.697	128.797
508.409	128.961
515.014	129.097
518.981	129.181
523.614	129.281
527.447	129.363
529.69	129.406
531.66	129.441
540.373	129.637
554.05	129.953
556.089	130
568.694	130.288
580.167	130.531
584.066	130.617
593.259	130.813
599.175	130.945
607.386	131.128
614.024	131.271
624.97	131.517
628.615	131.596

643.158	131.917
643.782	131.931
646.896	132
658.497	132.248
660.64	132.294
673.082	132.561
677.922	132.665
687.656	132.874
692.236	132.971
699.35	133.123
712.535	133.48
729.855	133.992
730.239	133.992
731.42	134
738.245	135.694
739.951	136
740.007	136.001
741.701	136.015
742.332	136.017
743.317	136.019
753.154	136.287
755.462	136.336
761.566	136.471
765.71	136.559
775.589	136.763
783.012	136.917
790.009	137.066
795.683	137.184
804.848	137.379
808.664	137.459
820.13	137.704
821.971	137.743
833.961	138
835.574	138.035
835.855	138.041
849.047	138.327
851.677	138.384
862.588	138.62
867.593	138.729
876.198	138.915
883.605	139.076
889.878	139.211
899.713	139.425
903.628	139.509
915.919	139.776
917.449	139.809
926.274	140
936.214	140.29
943.717	140.589
962.389	141.22
979.061	142
983.234	143.38
985.11	144

987.287	144.719
991.16	146
994.524	147.112
997.209	148
1000.33	149.033
1003.26	150
1007.19	151.301
1009.31	152
1011.14	152.607
1015.36	154
1020.26	155.621
1021.41	156
1027.04	157.861
1027.46	158
1027.82	158.12
1033.5	160
1034.29	160.258
1039.55	162
1044.85	163.749
1045.6	164
1046.49	164.294
1051.65	166
1053.18	166.503
1057.7	168
1061.67	169.313
1063.75	170
1067.3	171.173
1069.8	172
1072.91	173.028
1075.85	174
1078.52	174.882
1081.9	176
1084.13	176.737
1087.95	178
1089.74	178.591
1091.61	179.21

Material Boundary

X	Y
147.568	200.339
148.459	200.052
151.716	199
156.612	197.418
157.903	197
161.952	195.689
164.08	195
164.758	194.78
170.247	193
172.895	192.14
176.403	191
181.024	189.497
182.529	189

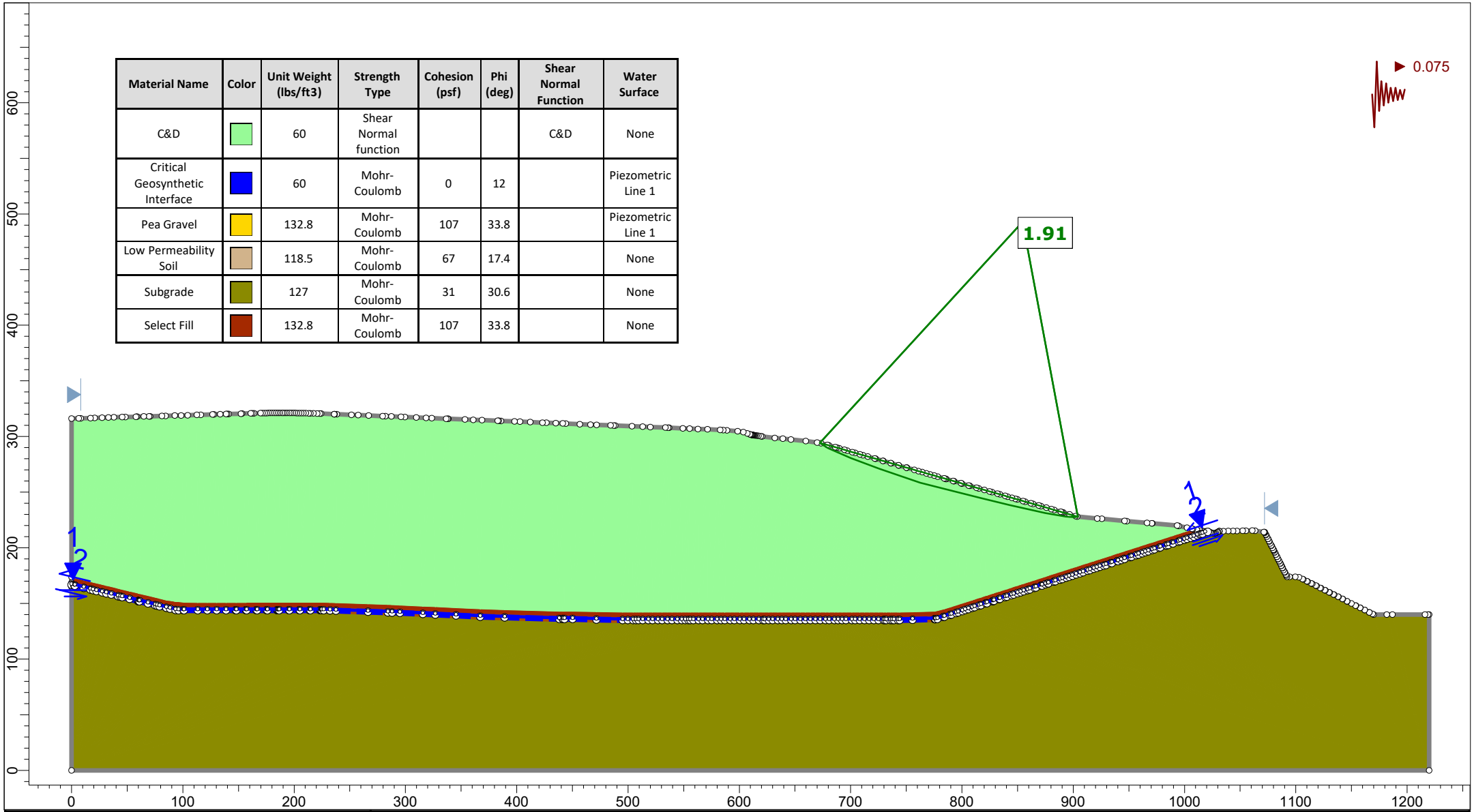
185.376	188.065
188.619	187
189.923	186.575
194.757	185
195.648	184.71
200.895	183
201.373	182.844
207.034	181
207.098	180.979
207.993	180.687
212.823	179.114
213.172	179
218.549	177.248
219.311	177
224.274	175.383
225.449	175
230	173.518
231.588	173
235.725	171.651
237.722	171
241.444	169.784
243.846	169
247.162	167.917
249.97	167
252.88	166.05
256.093	165
258.598	164.182
262.216	163
264.316	162.314
268.34	161
270.035	160.446
274.463	159
275.754	158.578
280.585	157
281.473	156.71
286.71	155
287.186	154.844
292.824	153
292.886	152.98
293.74	152.7
298.583	151.115
298.935	151
304.279	149.251
305.047	149
309.976	147.387
311.159	147
315.674	145.523
317.272	145
321.371	143.659
323.386	143
327.069	141.795
329.5	141
332.77	139.931

335.619	139
339.508	137.716
341.678	137
345.692	135.704
347.866	135
350.959	133.992
354.006	133
357.278	131.924
360.089	131
361.133	130.745
365.215	130.477
368.707	130.493
371.484	131
373.654	131.03
374.386	131.08
377.631	131.239
382.427	131.316
383.677	131.244
387.287	131.197
390.059	131.187
396.735	131.233
398.019	131.268
399.749	131.314
406.24	131.429
409.208	131.512
411.915	131.585
415.53	131.683
424.48	131.93
430.485	132.131
448.199	132.599
448.732	132.618
463.334	133
470.097	133.145
471.17	133.168
483.106	133.425
486.086	133.487
495.863	133.696
500.697	133.797
508.409	133.961
515.014	134.097
518.981	134.181
523.614	134.281
527.447	134.363
529.69	134.406
531.66	134.441
540.373	134.637
554.05	134.953
556.089	135
568.694	135.288
580.167	135.531
584.066	135.617
593.259	135.813
599.175	135.945

607.386	136.128
614.024	136.271
624.97	136.517
628.615	136.596
643.158	136.917
643.782	136.931
646.896	137
658.497	137.248
660.64	137.294
673.082	137.561
677.922	137.665
687.656	137.874
692.236	137.971
699.35	138.123
712.535	138.48
729.855	138.992
730.239	138.992
731.42	139
738.245	140.694
739.951	141
740.007	141.001
741.701	141.015
742.332	141.017
743.317	141.019
753.154	141.287
755.462	141.336
761.566	141.471
765.71	141.559
775.589	141.763
783.012	141.917
790.009	142.066
795.683	142.184
804.848	142.379
808.664	142.459
820.13	142.704
821.971	142.743
833.961	143
835.574	143.035
835.855	143.041
849.047	143.327
851.677	143.384
862.588	143.62
867.593	143.729
876.198	143.915
883.605	144.076
889.878	144.211
899.713	144.425
903.628	144.509
915.919	144.776
917.449	144.809
926.274	145
936.214	145.29
943.717	145.589

962.389	146.22
979.061	147
983.234	148.38
985.11	149
987.287	149.719
991.16	151
994.524	152.112
997.209	153
1000.33	154.033
1003.26	155
1007.19	156.301
1009.31	157
1011.14	157.607
1015.36	159
1020.26	160.621
1021.41	161
1027.04	162.861
1027.46	163
1027.82	163.12
1033.5	165
1034.29	165.258
1039.55	167
1044.85	168.749
1045.6	169
1046.49	169.294
1051.65	171
1053.18	171.503
1057.7	173
1061.67	174.313
1063.75	175
1067.3	176.173
1069.8	177
1072.91	178.028
1075.85	179
1078.52	179.882
1081.9	181
1084.13	181.737
1087.95	183
1089.74	183.591
1091.61	184.21

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section C - Seismic - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

151-877 S.A. Dunn C&D Landfill

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:02m:27.155s
Author:	DVS
Company:	Civil & Environmental Consultants, Inc.
Date Created:	12/10/2015, 12:09:38 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	25
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.912030
Axis Location:	854.443, 492.913
Left Slip Surface Endpoint:	672.287, 294.179
Right Slip Surface Endpoint:	904.137, 227.947
Resisting Moment:	1.57582e+07 lb-ft
Driving Moment:	8.24159e+06 lb-ft
Resisting Horizontal Force:	60259.1 lb
Driving Horizontal Force:	31515.8 lb
Total Slice Area:	1583.57 ft2
Surface Horizontal Width:	231.85 ft
Surface Average Height:	6.83014 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
672.287	294.179
679.917	289.387
700.071	280.591
725.788	271.046
762.541	258.498
791.182	251.192
816.898	244.729
842.56	238.49
874.888	231.28
893.118	228.063
901.107	227.498
904.137	227.947

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.91203

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	7.62961	671.122	-32.1319	C&D	0	34.992	25.8742	49.4722	70.6745	0	70.6745	86.9254	86.9254
2	10.0774	2139.56	-23.5757	C&D	0	34.992	65.841	125.89	179.842	0	179.842	208.574	208.574
3	10.0774	3052.62	-23.5757	C&D	2.84217e-14	34.992	92.9583	177.739	253.912	0	253.912	294.478	294.478
4	12.8581	4897.61	-20.3648	C&D	0	34.992	119.34	228.181	325.973	0	325.973	370.272	370.272
5	12.8581	5737.83	-20.3648	C&D	0	34.992	139.01	265.792	379.703	0	379.703	431.303	431.303
6	9.18824	4539.31	-18.8504	C&D	5.68434e-14	34.992	156.027	298.328	426.183	0	426.183	479.452	479.452
7	9.18824	4817.43	-18.8504	C&D	0	34.992	165.461	316.367	451.952	0	451.952	508.442	508.442
8	9.18824	5095.68	-18.8504	C&D	0	34.992	175.021	334.646	478.066	0	478.066	537.82	537.82
9	9.18824	5373.9	-18.8504	C&D	0	34.992	184.73	353.209	504.585	0	504.585	567.653	567.653
10	9.5473	5642.46	-14.3103	C&D	0	34.992	198.553	379.639	542.341	0	542.341	592.989	592.989
11	9.5473	5470.18	-14.3103	C&D	0	34.992	193.197	369.399	527.713	0	527.713	576.995	576.995
12	9.5473	5297.49	-14.3103	C&D	0	34.992	187.73	358.945	512.778	0	512.778	560.666	560.666
13	8.57188	4600.73	-14.1063	C&D	0	34.992	182.614	349.163	498.804	0	498.804	544.695	544.695
14	8.57188	4444.76	-14.1063	C&D	5.68434e-14	34.992	176.83	338.105	483.007	0	483.007	527.445	527.445
15	8.57188	4288.73	-14.1063	C&D	0	34.992	170.947	326.856	466.938	0	466.938	509.897	509.897
16	8.55392	4106.09	-13.6652	C&D	0	34.992	165.176	315.822	451.174	0	451.174	491.333	491.333
17	8.55392	3915.26	-13.6652	C&D	5.68434e-14	34.992	157.613	301.36	430.515	0	430.515	468.835	468.835
18	8.55392	3724.05	-13.6652	C&D	0	34.992	149.946	286.702	409.574	0	409.574	446.03	446.03
19	10.776	4349.38	-12.5723	C&D	5.68434e-14	34.992	140.648	268.923	384.176	0	384.176	415.543	415.543
20	10.776	3906.01	-12.5723	C&D	2.84217e-14	34.992	125.989	240.894	344.134	0	344.134	372.232	372.232
21	10.776	3462.61	-12.5723	C&D	2.84217e-14	34.992	111.31	212.828	304.04	0	304.04	328.865	328.865
22	9.11521	2466.71	-10.0079	C&D	0	34.992	95.4279	182.461	260.659	0	260.659	277.499	277.499
23	9.11521	1913.84	-10.0079	C&D	2.84217e-14	34.992	73.5098	140.553	200.79	0	200.79	213.762	213.762
24	7.98904	999.213	-4.04946	C&D	1.42109e-14	34.992	45.2982	86.6116	123.731	0	123.731	126.938	126.938
25	3.02976	101.544	8.44047	C&D	0	34.992	13.0716	24.9933	35.7046	0	35.7046	33.7649	33.7649

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.91203

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	672.287	294.179	0	0	0
2	679.917	289.387	191.583	7.90838	2.36378
3	689.994	284.989	479.384	45.5676	5.42991
4	700.071	280.591	888.108	130.605	8.36594
5	712.93	275.819	1276.7	267.234	11.8223
6	725.788	271.046	1731.81	459.337	14.8548
7	734.976	267.909	1975.47	593.361	16.7184
8	744.164	264.772	2234.15	739.151	18.3064
9	753.352	261.635	2507.76	893.263	19.6059
10	762.541	258.498	2796.21	1051.5	20.6085
11	772.088	256.062	2644.47	1032.64	21.3302
12	781.635	253.627	2495.3	994.161	21.723
13	791.182	251.192	2349.02	938.849	21.7854
14	799.754	249.038	2203.12	870.493	21.5599
15	808.326	246.883	2061.07	793.998	21.0685
16	816.898	244.729	1923.14	711.872	20.3126
17	825.452	242.65	1756.42	615.005	19.2975
18	834.006	240.57	1597.13	519.758	18.0266
19	842.56	238.49	1445.53	428.385	16.5073
20	853.336	236.087	1179.29	299.669	14.2576
21	864.112	233.684	941.552	194.392	11.6653
22	874.888	231.28	732.386	113.091	8.77797
23	884.003	229.672	466.775	50.3084	6.15152
24	893.118	228.063	263.198	15.6605	3.40513
25	901.107	227.498	46.2083	0.758594	0.940531
26	904.137	227.947	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	167.667
2.61045	167.033
2.74827	167
2.93545	166.955
10.984	165
16.9104	163.561
19.2198	163
22.3549	162.239
27.4555	161
31.2131	160.088
35.6913	159
41.768	157.524
43.927	157
45.5183	156.614
52.1628	155
59.8261	153.139
59.8924	153.123
60.4145	153
60.8582	152.895
60.9162	152.881

68.6396	151
75.206	149.4
76.8497	149
79.0691	148.459
85.0598	147
88.4071	146.185
93.2699	145
96.1305	144.964
100.713	144.947
101.016	144.941
113.425	144.821
121.918	144.822
130.421	144.823
138.934	144.824
147.456	144.825
148.142	144.848
156.777	144.849
157.383	144.866
166.104	144.867
166.646	144.881
175.435	144.882
175.924	144.893
184.77	144.893
185.454	144.904
186.03	144.91
186.471	144.91
195.39	144.911
195.828	144.911
204.75	144.912
205.185	144.912
214.11	144.912
214.542	144.912
223.469	144.913
223.899	144.913
224.328	144.913
224.757	144.913
226.606	144.875
232.206	144.736
237.619	144.555
266.437	143.593
284.194	143
288.023	142.82
294.955	142.494
315.577	141.526
326.764	141
345.352	140.109
367.261	139
389.122	138.384
438.282	137
441.106	136.989
441.813	136.988
442.992	136.982
450.152	136.954

471.589	136.475
495.112	136.041
499.816	136.042
504.522	136.042
507.015	136.043
509.52	136.047
513.255	136.047
518.191	136.045
521.934	136.044
526.857	136.043
530.609	136.042
535.521	136.04
539.492	136.044
544.41	136.042
548.376	136.045
551.45	136.051
554.115	136.053
556.005	136.053
558.664	136.055
563.412	136.057
566.946	136.064
571.737	136.066
575.242	136.073
580.075	136.075
583.551	136.082
586.977	136.088
591.874	136.09
595.541	136.09
600.448	136.093
604.107	136.093
609.025	136.095
612.675	136.095
617.604	136.097
621.244	136.097
622.641	136.096
626.431	136.093
629.889	136.087
634.698	136.083
638.19	136.076
641.731	136.07
646.478	136.066
650.054	136.06
654.753	136.056
659.419	136.052
663.75	136.06
668.432	136.056
672.746	136.063
677.444	136.06
680.743	136.07
685.469	136.067
688.752	136.077
692.299	136.081
695.852	136.075

701.119	136.075
703.992	136.063
708.239	136.071
712.549	136.079
716.654	136.084
721.014	136.092
725.057	136.098
729.467	136.106
730.766	136.109
732.057	136.112
735.706	136.117
737.361	136.116
738.906	136.115
742.564	136.12
743.989	136.118
755.732	136.35
775.632	136.895
775.782	136.895
775.919	136.894
776.153	136.893
778.05	137
783.506	138.753
784.276	139
789.286	140.609
790.503	141
794.831	142.39
796.73	143
800.37	144.169
802.957	145
805.905	145.947
809.183	147
811.435	147.723
815.41	149
816.957	149.497
821.637	151
822.473	151.269
827.863	153
827.984	153.039
828.909	153.336
833.494	154.808
834.09	155
838.998	156.577
840.317	157
844.497	158.343
846.543	159
849.989	160.107
852.77	161
855.476	161.869
858.997	163
860.956	163.629
865.223	165
866.43	165.387
871.45	167

871.897	167.144
875.09	168.169
877.36	168.898
877.677	169
882.821	170.652
883.903	171
888.276	172.404
890.13	173
893.723	174.154
896.357	175
899.164	175.902
902.583	177
906.152	178.146
908.81	179
912.925	180.322
915.037	181
918.41	182.083
921.263	183
923.888	183.843
927.49	185
929.36	185.601
933.717	187
934.825	187.356
939.944	189
940.292	189.112
943.235	190.057
945.863	190.901
946.17	191
951.208	192.618
952.397	193
956.633	194.361
958.624	195
962.07	196.107
964.85	197
967.5	197.851
971.077	199
972.917	199.591
977.304	201
978.32	201.326
983.53	203
983.726	203.063
985.426	203.609
989.318	204.859
989.757	205
994.64	206.568
995.984	207
999.949	208.274
1002.21	209
1005.61	210.122
1008.27	211
1011.51	212.172
1013.9	213
1014.76	213.314

1016.17	213.831
1018.57	214.636

External Boundary

X	Y
0	316.109
0	173.667
0	168.667
0	167.667
0	166.667
0	164.667
0	0
1219.81	0
1219.81	140
1218.71	140
1216.08	140
1186.91	140
1181.65	140
1169.98	140
1168.96	140.51
1165.98	142
1165.94	142.022
1161.98	144
1161.87	144.052
1157.97	146
1157.81	146.083
1153.97	148
1153.74	148.113
1149.97	150
1146.3	151.832
1145.96	152
1142.35	153.804
1141.96	154
1138.41	155.775
1137.96	156
1134.46	157.746
1133.96	158
1130.52	159.716
1129.95	160
1126.58	161.687
1125.95	162
1122.63	163.658
1121.95	164
1118.69	165.628
1117.94	166
1114.74	167.599
1113.94	168
1110.8	169.569
1109.94	170
1106.86	171.539
1105.93	172
1102.91	173.513

1099.52	173.859
1094.52	173.86
1092.03	174
1091.53	174.999
1091.03	176
1090.13	177.801
1090.03	178
1089.94	178.171
1089.03	180
1088.12	181.822
1088.03	182
1087.11	183.832
1087.03	184
1086.11	185.84
1086.03	186
1085.11	187.848
1085.03	188
1084.1	189.856
1084.03	190
1083.1	191.864
1083.03	192
1082.1	193.874
1082.03	194
1081.09	195.885
1081.03	196
1080.32	197.424
1080.04	198
1079.89	198.297
1079.04	200
1078.08	201.905
1078.04	202
1077.98	202.109
1077.04	204
1076.2	205.676
1076.04	206
1075.05	207.97
1075.04	208
1075.02	208.038
1074.04	210
1073.25	211.588
1073.04	212
1072.31	213.453
1072.04	214
1071.94	214.206
1071.32	214.159
1063.42	215.257
1060.85	215.402
1055.24	215.305
1052.25	215.254
1047.24	215.167
1043.65	215.105
1039.23	215.029
1035.05	214.956

1031.23	214.89
1031.21	214.89
1031.2	214.89
1030.1	214.34
1029.41	214
1028.1	213.348
1027.2	212.901
1026.1	212.904
1025.2	212.906
1024.29	213.363
1024.06	213.481
1023.02	214
1021.42	214.349
1021.42	214.349
1020.86	214.406
1018.57	214.636
1018.35	214.657
1016.17	214.831
1016.17	214.831
1014.12	215.298
1011.03	216
1007.6	216.78
1006.66	216.994
1002.24	218
994.715	219.711
993.444	220
971.061	221.961
970.626	222
966.337	222.38
948.029	224
946.173	224.161
925.668	226
921.667	226.352
903.558	228
902.15	228.407
896.627	230
890.917	231.686
889.857	232
888.805	232.302
882.886	234
880.441	234.701
875.91	236
870.915	237.432
868.933	238
863.881	239.448
861.956	240
856.849	241.464
854.979	242
849.816	243.48
848.002	244
844.816	244.913
841.024	246
838.911	246.606

834.049	248
831.937	248.605
827.072	250
824.844	250.639
820.092	252
815.118	253.427
813.119	254
807.03	255.746
806.142	256
799.957	257.773
799.166	258
792.927	259.789
792.189	260
785.902	261.802
785.213	262
784	262.348
778.236	264
774.987	264.932
771.259	266
767.956	266.946
764.278	268
760.966	268.949
757.298	270
750.551	271.933
750.317	272
750.187	272.037
743.335	274
743.061	274.079
736.354	276
736.025	276.094
729.373	278
728.994	278.109
722.393	280
721.65	280.213
715.413	282
711.155	283.22
708.431	284
704.082	285.246
701.451	286
697.045	287.263
694.47	288
689.688	289.37
687.491	290
686.287	290.345
680.51	292
679.092	292.406
673.53	294
669.841	294.53
659.621	296
646.437	297.28
639.023	298
631.875	298.773
620.523	300

619.315	300.188
617.055	300.54
615.53	300.777
614.431	300.948
613.602	301.077
612.954	301.178
612.434	301.259
612.007	301.326
611.651	301.381
611.349	301.428
610.968	301.547
610.518	301.688
609.978	301.857
609.52	302
607.088	302.81
603.517	304
598.461	304.667
588.88	305.484
585.658	305.81
582.821	306
571.381	306.465
562.784	306.814
555.284	307.119
549.352	307.36
536.852	307.868
535.963	307.904
533.597	308
520.061	308.55
513.256	308.826
503.601	309.219
488.514	309.832
487.129	309.888
484.372	310
471.823	310.51
466.201	310.738
456.663	311.126
444.195	311.632
441.407	311.746
435.148	312
426.585	312.348
423.112	312.489
412.237	312.931
403.018	313.305
398.046	313.507
385.924	314
383.861	314.084
382.932	314.122
368.722	314.699
360.927	315.016
353.446	315.32
338.63	315.922
338.031	315.946
336.699	316

323.645	316.53
318.615	316.735
309.688	317.097
299.451	317.513
296.058	317.651
287.475	318
282.072	318.219
279.631	318.319
266.885	318.837
257.515	319.217
251.553	319.46
238.25	320
236.354	320.077
236.173	320.083
235.965	320.089
224.14	320.551
222.969	320.58
220.62	320.668
217.402	320.78
214.627	320.868
213.003	320.9
210.498	320.971
208.258	321.027
206.459	321.054
204.401	321.099
202.505	321.134
200.731	321.162
198.84	321.182
197.16	321.202
195.55	321.217
193.625	321.229
192.069	321.238
190.542	321.241
189.025	321.24
187.104	321.244
185.592	321.237
184.055	321.226
182.47	321.208
180.586	321.204
178.955	321.18
177.231	321.148
175.401	321.135
173.584	321.095
171.608	321.044
169.885	321.023
163.988	320.857
162.472	320.831
161.042	320.799
153.258	320.573
152.168	320.544
141.311	320.227
139.934	320.187
138.971	320.159

133.511	320
127.85	319.835
126.697	319.801
116.045	319.491
112.503	319.388
104.328	319.15
98.4359	318.978
92.6962	318.811
84.4928	318.572
81.1502	318.474
70.6725	318.169
69.6887	318.14
64.8782	318
58.8789	317.825
57.7947	317.794
48.471	317.522
45.4995	317.435
38.0244	317.217
33.1503	317.075
27.539	316.912
20.747	316.714
17.0146	316.605
8.28898	316.351
6.451	316.297

Material Boundary

X	Y
0	164.667
2.61045	164.033
2.74827	164
2.93545	163.955
10.984	162
16.9104	160.561
19.2198	160
22.3549	159.239
27.4555	158
31.2131	157.088
35.6913	156
41.768	154.524
43.927	154
45.5183	153.614
52.1628	152
59.8261	150.139
59.8924	150.123
60.4145	150
60.8582	149.895
60.9162	149.881
68.6396	148
75.206	146.4
76.8497	146
79.0691	145.459
85.0598	144

88.4071	143.185
93.2699	142
96.1305	141.964
100.713	141.947
101.016	141.941
113.425	141.821
121.918	141.822
130.421	141.823
138.934	141.824
147.456	141.825
148.142	141.848
156.777	141.849
157.383	141.866
166.104	141.867
166.646	141.881
175.435	141.882
175.924	141.893
184.77	141.893
185.454	141.904
186.03	141.91
186.471	141.91
195.39	141.911
195.828	141.911
204.75	141.912
205.185	141.912
214.11	141.912
214.542	141.912
223.469	141.913
223.899	141.913
224.328	141.913
224.757	141.913
226.606	141.875
232.206	141.736
237.619	141.555
266.437	140.593
284.194	140
288.023	139.82
294.955	139.494
315.577	138.526
326.764	138
345.352	137.109
367.261	136
389.122	135.384
438.282	134
441.106	133.989
441.813	133.988
442.992	133.982
450.152	133.954
471.589	133.475
495.112	133.041
499.816	133.042
504.522	133.042
507.015	133.043

509.52	133.047
513.255	133.047
518.191	133.045
521.934	133.044
526.857	133.043
530.609	133.042
535.521	133.04
539.492	133.044
544.41	133.042
548.376	133.045
551.45	133.051
554.115	133.053
556.005	133.053
558.664	133.055
563.412	133.057
566.946	133.064
571.737	133.066
575.242	133.073
580.075	133.075
583.551	133.082
586.977	133.088
591.874	133.09
595.541	133.09
600.448	133.093
604.107	133.093
609.025	133.095
612.675	133.095
617.604	133.097
621.244	133.097
622.641	133.096
626.431	133.093
629.889	133.087
634.698	133.083
638.19	133.076
641.731	133.07
646.478	133.066
650.054	133.06
654.753	133.056
659.419	133.052
663.75	133.06
668.432	133.056
672.746	133.063
677.444	133.06
680.743	133.07
685.469	133.067
688.752	133.077
692.299	133.081
695.852	133.075
701.119	133.075
703.992	133.063
708.239	133.071
712.549	133.079
716.654	133.084

721.014	133.092
725.057	133.098
729.467	133.106
730.766	133.109
732.057	133.112
735.706	133.117
737.361	133.116
738.906	133.115
742.564	133.12
743.989	133.118
755.732	133.35
775.632	133.895
775.782	133.895
775.919	133.894
776.153	133.893
778.05	134
783.506	135.753
784.276	136
789.286	137.609
790.503	138
794.831	139.39
796.73	140
800.37	141.169
802.957	142
805.905	142.947
809.183	144
811.435	144.723
815.41	146
816.957	146.497
821.637	148
822.473	148.269
827.863	150
827.984	150.039
828.909	150.336
833.494	151.808
834.09	152
838.998	153.577
840.317	154
844.497	155.343
846.543	156
849.989	157.107
852.77	158
855.476	158.869
858.997	160
860.956	160.629
865.223	162
866.43	162.387
871.45	164
871.897	164.144
875.09	165.169
877.36	165.898
877.677	166
882.821	167.652

883.903	168
888.276	169.404
890.13	170
893.723	171.154
896.357	172
899.164	172.902
902.583	174
906.152	175.146
908.81	176
912.925	177.322
915.037	178
918.41	179.083
921.263	180
923.888	180.843
927.49	182
929.36	182.601
933.717	184
934.825	184.356
939.944	186
940.292	186.112
943.235	187.057
945.863	187.901
946.17	188
951.208	189.618
952.397	190
956.633	191.361
958.624	192
962.07	193.107
964.85	194
967.5	194.851
971.077	196
972.917	196.591
977.304	198
978.32	198.326
983.53	200
983.726	200.063
985.426	200.609
989.318	201.859
989.757	202
994.64	203.568
995.984	204
999.949	205.274
1002.21	206
1005.61	207.122
1008.27	208
1011.51	209.172
1013.9	210
1014.76	210.314
1016.17	210.831
1024.06	213.481

Material Boundary

X	Y
0	166.667
2.61045	166.033
2.74827	166
2.93545	165.955
10.984	164
16.9104	162.561
19.2198	162
22.3549	161.239
27.4555	160
31.2131	159.088
35.6913	158
41.768	156.524
43.927	156
45.5183	155.614
52.1628	154
59.8261	152.139
59.8924	152.123
60.4145	152
60.8582	151.895
60.9162	151.881
68.6396	150
75.206	148.4
76.8497	148
79.0691	147.459
85.0598	146
88.4071	145.185
93.2699	144
96.1305	143.964
100.713	143.947
101.016	143.941
113.425	143.821
121.918	143.822
130.421	143.823
138.934	143.824
147.456	143.825
148.142	143.848
156.777	143.849
157.383	143.866
166.104	143.867
166.646	143.881
175.435	143.882
175.924	143.893
184.77	143.893
185.454	143.904
186.03	143.91
186.471	143.91
195.39	143.911
195.828	143.911
204.75	143.912
205.185	143.912
214.11	143.912
214.542	143.912

223.469	143.913
223.899	143.913
224.328	143.913
224.757	143.913
226.606	143.875
232.206	143.736
237.619	143.555
266.437	142.593
284.194	142
288.023	141.82
294.955	141.494
315.577	140.526
326.764	140
345.352	139.109
367.261	138
389.122	137.384
438.282	136
441.106	135.989
441.813	135.988
442.992	135.982
450.152	135.954
471.589	135.475
495.112	135.041
499.816	135.042
504.522	135.042
507.015	135.043
509.52	135.047
513.255	135.047
518.191	135.045
521.934	135.044
526.857	135.043
530.609	135.042
535.521	135.04
539.492	135.044
544.41	135.042
548.376	135.045
551.45	135.051
554.115	135.053
556.005	135.053
558.664	135.055
563.412	135.057
566.946	135.064
571.737	135.066
575.242	135.073
580.075	135.075
583.551	135.082
586.977	135.088
591.874	135.09
595.541	135.09
600.448	135.093
604.107	135.093
609.025	135.095
612.675	135.095

617.604	135.097
621.244	135.097
622.641	135.096
626.431	135.093
629.889	135.087
634.698	135.083
638.19	135.076
641.731	135.07
646.478	135.066
650.054	135.06
654.753	135.056
659.419	135.052
663.75	135.06
668.432	135.056
672.746	135.063
677.444	135.06
680.743	135.07
685.469	135.067
688.752	135.077
692.299	135.081
695.852	135.075
701.119	135.075
703.992	135.063
708.239	135.071
712.549	135.079
716.654	135.084
721.014	135.092
725.057	135.098
729.467	135.106
730.766	135.109
732.057	135.112
735.706	135.117
737.361	135.116
738.906	135.115
742.564	135.12
743.989	135.118
755.732	135.35
775.632	135.895
775.782	135.895
775.919	135.894
776.153	135.893
778.05	136
783.506	137.753
784.276	138
789.286	139.609
790.503	140
794.831	141.39
796.73	142
800.37	143.169
802.957	144
805.905	144.947
809.183	146
811.435	146.723

815.41	148
816.957	148.497
821.637	150
822.473	150.269
827.863	152
827.984	152.039
828.909	152.336
833.494	153.808
834.09	154
838.998	155.577
840.317	156
844.497	157.343
846.543	158
849.989	159.107
852.77	160
855.476	160.869
858.997	162
860.956	162.629
865.223	164
866.43	164.387
871.45	166
871.897	166.144
875.09	167.169
877.36	167.898
877.677	168
882.821	169.652
883.903	170
888.276	171.404
890.13	172
893.723	173.154
896.357	174
899.164	174.902
902.583	176
906.152	177.146
908.81	178
912.925	179.322
915.037	180
918.41	181.083
921.263	182
923.888	182.843
927.49	184
929.36	184.601
933.717	186
934.825	186.356
939.944	188
940.292	188.112
943.235	189.057
945.863	189.901
946.17	190
951.208	191.618
952.397	192
956.633	193.361
958.624	194

962.07	195.107
964.85	196
967.5	196.851
971.077	198
972.917	198.591
977.304	200
978.32	200.326
983.53	202
983.726	202.063
985.426	202.609
989.318	203.859
989.757	204
994.64	205.568
995.984	206
999.949	207.274
1002.21	208
1005.61	209.122
1008.27	210
1011.51	211.172
1013.9	212
1014.76	212.314
1016.17	212.831
1020.86	214.406

Material Boundary

X	Y
0	168.667
2.61045	168.033
2.74827	168
2.93545	167.955
10.984	166
16.9104	164.561
19.2198	164
22.3549	163.239
27.4555	162
31.2131	161.088
35.6913	160
41.768	158.524
43.927	158
45.5183	157.614
52.1628	156
59.8261	154.139
59.8924	154.123
60.4145	154
60.8582	153.895
60.9162	153.881
68.6396	152
75.206	150.4
76.8497	150
79.0691	149.459
85.0598	148
88.4071	147.185

93.2699	146
96.1305	145.964
100.713	145.947
101.016	145.941
113.425	145.821
121.918	145.822
130.421	145.823
138.934	145.824
147.456	145.825
148.142	145.848
156.777	145.849
157.383	145.866
166.104	145.867
166.646	145.881
175.435	145.882
175.924	145.893
184.77	145.893
185.454	145.904
186.03	145.91
186.471	145.91
195.39	145.911
195.828	145.911
204.75	145.912
205.185	145.912
214.11	145.912
214.542	145.912
223.469	145.913
223.899	145.913
224.328	145.913
224.757	145.913
226.606	145.875
232.206	145.736
237.619	145.555
266.437	144.593
284.194	144
288.023	143.82
294.955	143.494
315.577	142.526
326.764	142
345.352	141.109
367.261	140
389.122	139.384
438.282	138
441.106	137.989
441.813	137.988
442.992	137.982
450.152	137.954
471.589	137.475
495.112	137.041
499.816	137.042
504.522	137.042
507.015	137.043
509.52	137.047

513.255	137.047
518.191	137.045
521.934	137.044
526.857	137.043
530.609	137.042
535.521	137.04
539.492	137.044
544.41	137.042
548.376	137.045
551.45	137.051
554.115	137.053
556.005	137.053
558.664	137.055
563.412	137.057
566.946	137.064
571.737	137.066
575.242	137.073
580.075	137.075
583.551	137.082
586.977	137.088
591.874	137.09
595.541	137.09
600.448	137.093
604.107	137.093
609.025	137.095
612.675	137.095
617.604	137.097
621.244	137.097
622.641	137.096
626.431	137.093
629.889	137.087
634.698	137.083
638.19	137.076
641.731	137.07
646.478	137.066
650.054	137.06
654.753	137.056
659.419	137.052
663.75	137.06
668.432	137.056
672.746	137.063
677.444	137.06
680.743	137.07
685.469	137.067
688.752	137.077
692.299	137.081
695.852	137.075
701.119	137.075
703.992	137.063
708.239	137.071
712.549	137.079
716.654	137.084
721.014	137.092

725.057	137.098
729.467	137.106
730.766	137.109
732.057	137.112
735.706	137.117
737.361	137.116
738.906	137.115
742.564	137.12
743.989	137.118
755.732	137.35
775.632	137.895
775.782	137.895
775.919	137.894
776.153	137.893
778.05	138
783.506	139.753
784.276	140
789.286	141.609
790.503	142
794.831	143.39
796.73	144
800.37	145.169
802.957	146
805.905	146.947
809.183	148
811.435	148.723
815.41	150
816.957	150.497
821.637	152
822.473	152.269
827.863	154
827.984	154.039
828.909	154.336
833.494	155.808
834.09	156
838.998	157.577
840.317	158
844.497	159.343
846.543	160
849.989	161.107
852.77	162
855.476	162.869
858.997	164
860.956	164.629
865.223	166
866.43	166.387
871.45	168
871.897	168.144
875.09	169.169
877.36	169.898
877.677	170
882.821	171.652
883.903	172

888.276	173.404
890.13	174
893.723	175.154
896.357	176
899.164	176.902
902.583	178
906.152	179.146
908.81	180
912.925	181.322
915.037	182
918.41	183.083
921.263	184
923.888	184.843
927.49	186
929.36	186.601
933.717	188
934.825	188.356
939.944	190
940.292	190.112
943.235	191.057
945.863	191.901
946.17	192
951.208	193.618
952.397	194
956.633	195.361
958.624	196
962.07	197.107
964.85	198
967.5	198.851
971.077	200
972.917	200.591
977.304	202
978.32	202.326
983.53	204
983.726	204.063
985.426	204.609
989.318	205.859
989.757	206
994.64	207.568
995.984	208
999.949	209.274
1002.21	210
1005.61	211.122
1008.27	212
1011.51	213.172
1013.9	214
1014.76	214.314
1016.17	214.831
1016.17	214.831

Material Boundary

X	Y

0	173.667
2.61045	173.033
2.74827	173
2.93545	172.955
10.984	171
16.9104	169.561
19.2198	169
22.3549	168.239
27.4555	167
31.2131	166.088
35.6913	165
41.768	163.524
43.927	163
45.5183	162.614
52.1628	161
59.8261	159.139
59.8924	159.123
60.4145	159
60.8582	158.895
60.9162	158.881
68.6396	157
75.206	155.4
76.8497	155
79.0691	154.459
85.0598	153
88.4071	152.185
93.2699	151
96.1305	150.964
100.713	150.947
101.016	150.941
113.425	150.821
121.918	150.822
130.421	150.823
138.934	150.824
147.456	150.825
148.142	150.848
156.777	150.849
157.383	150.866
166.104	150.867
166.646	150.881
175.435	150.882
175.924	150.893
184.77	150.893
185.454	150.904
186.03	150.91
186.471	150.91
195.39	150.911
195.828	150.911
204.75	150.912
205.185	150.912
214.11	150.912
214.542	150.912
223.469	150.913

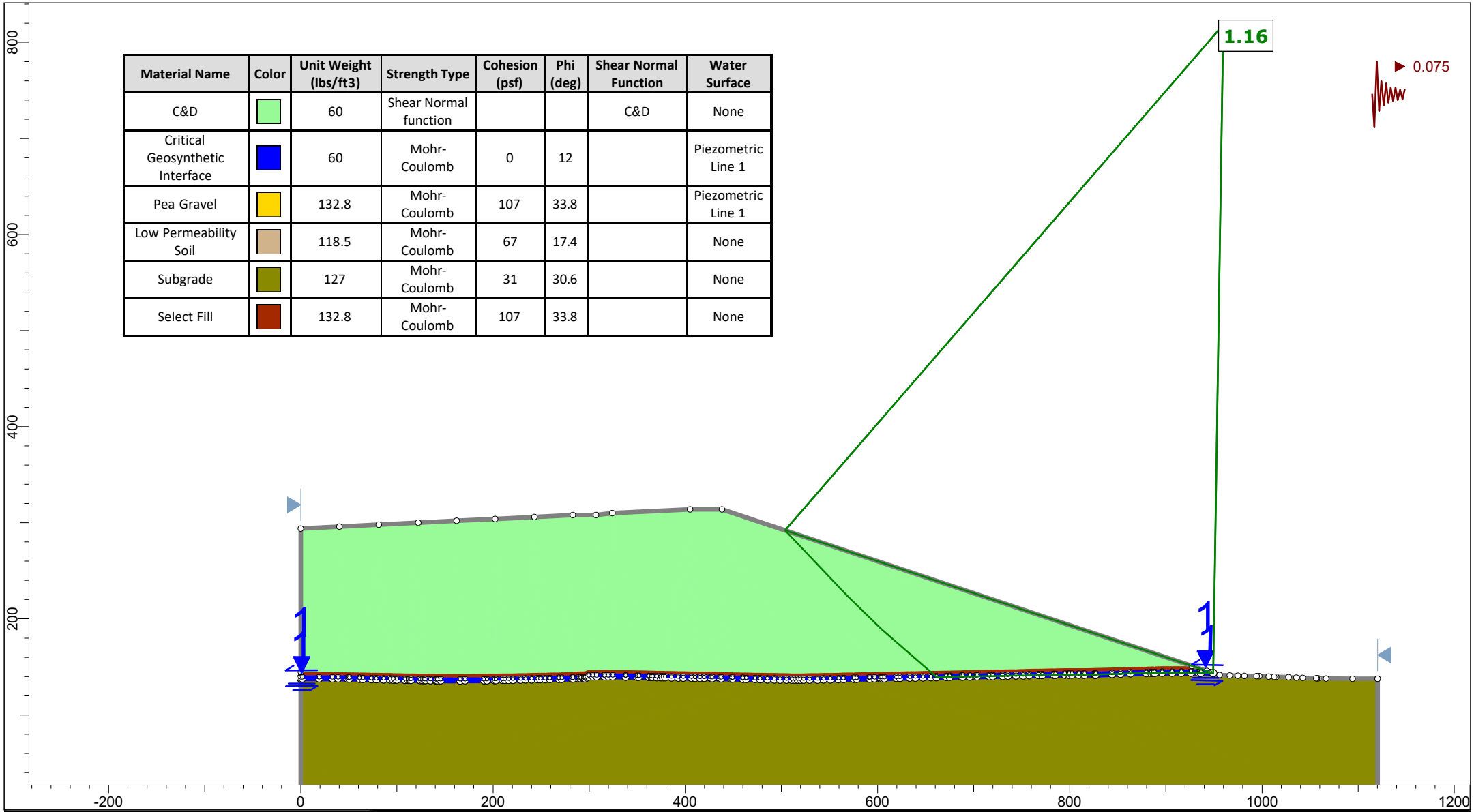
223.899	150.913
224.328	150.913
224.757	150.913
226.606	150.875
232.206	150.736
237.619	150.555
266.437	149.593
284.194	149
288.023	148.82
294.955	148.494
315.577	147.526
326.764	147
345.352	146.109
367.261	145
389.122	144.384
438.282	143
441.106	142.989
441.813	142.988
442.992	142.982
450.152	142.954
471.589	142.475
495.112	142.041
499.816	142.042
504.522	142.042
507.015	142.043
509.52	142.047
513.255	142.047
518.191	142.045
521.934	142.044
526.857	142.043
530.609	142.042
535.521	142.04
539.492	142.044
544.41	142.042
548.376	142.045
551.45	142.051
554.115	142.053
556.005	142.053
558.664	142.055
563.412	142.057
566.946	142.064
571.737	142.066
575.242	142.073
580.075	142.075
583.551	142.082
586.977	142.088
591.874	142.09
595.541	142.09
600.448	142.093
604.107	142.093
609.025	142.095
612.675	142.095
617.604	142.097

621.244	142.097
622.641	142.096
626.431	142.093
629.889	142.087
634.698	142.083
638.19	142.076
641.731	142.07
646.478	142.066
650.054	142.06
654.753	142.056
659.419	142.052
663.75	142.06
668.432	142.056
672.746	142.063
677.444	142.06
680.743	142.07
685.469	142.067
688.752	142.077
692.299	142.081
695.852	142.075
701.119	142.075
703.992	142.063
708.239	142.071
712.549	142.079
716.654	142.084
721.014	142.092
725.057	142.098
729.467	142.106
730.766	142.109
732.057	142.112
735.706	142.117
737.361	142.116
738.906	142.115
742.564	142.12
743.989	142.118
755.732	142.35
775.632	142.895
775.782	142.895
775.919	142.894
776.153	142.893
778.05	143
783.506	144.753
784.276	145
789.286	146.609
790.503	147
794.831	148.39
796.73	149
800.37	150.169
802.957	151
805.905	151.947
809.183	153
811.435	153.723
815.41	155

816.957	155.497
821.637	157
822.473	157.269
827.863	159
827.984	159.039
828.909	159.336
833.494	160.808
834.09	161
838.998	162.577
840.317	163
844.497	164.343
846.543	165
849.989	166.107
852.77	167
855.476	167.869
858.997	169
860.956	169.629
865.223	171
866.43	171.387
871.45	173
871.897	173.144
875.09	174.169
877.36	174.898
877.677	175
882.821	176.652
883.903	177
888.276	178.404
890.13	179
893.723	180.154
896.357	181
899.164	181.902
902.583	183
906.152	184.146
908.81	185
912.925	186.322
915.037	187
918.41	188.083
921.263	189
923.888	189.843
927.49	191
929.36	191.601
933.717	193
934.825	193.356
939.944	195
940.292	195.112
943.235	196.057
945.863	196.901
946.17	197
951.208	198.618
952.397	199
956.633	200.361
958.624	201
962.07	202.107

964.85	203
967.5	203.851
971.077	205
972.917	205.591
977.304	207
978.32	207.326
983.53	209
983.726	209.063
985.426	209.609
989.318	210.859
989.757	211
994.64	212.568
995.984	213
999.949	214.274
1002.21	215
1005.61	216.122
1007.6	216.78

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
C&D		60	Shear Normal function			C&D	None
Critical Geosynthetic Interface		60	Mohr-Coulomb	0	12		Piezometric Line 1
Pea Gravel		132.8	Mohr-Coulomb	107	33.8		Piezometric Line 1
Low Permeability Soil		118.5	Mohr-Coulomb	67	17.4		None
Subgrade		127	Mohr-Coulomb	31	30.6		None
Select Fill		132.8	Mohr-Coulomb	107	33.8		None



rocscience

SLIDEINTERPRET 9.020

Project: 182-442 S.A. Dunn Permit Renewal/Modification Application

Analysis Description: Section D - Seismic - Waste Failure

Created By: ZLM | Checked By: TDM

Created Date: 1/6/2022 | Checked Date: 1/9/2022

Civil & Environmental Consultants, Inc.

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

Slide Modeler Version:	9.02
Compute Time:	00h:03m:01.566s
Date Created:	7/28/2021, 10:59:59 AM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Cuckoo Search
Initial # of Surface Vertices:	8
Maximum Iterations:	500
Number of Nests:	50
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Convex Surfaces Only:	Enabled

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Materials

C&D	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Pea Gravel	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	Piezometric Line 1
Hu Value	1
Low Permeability Soil	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	None
Ru Value	0
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	127
Cohesion [psf]	31
Friction Angle [deg]	30.6
Water Surface	None
Ru Value	0
Select Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.8
Cohesion [psf]	107
Friction Angle [deg]	33.8
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Effective Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Global Minimums

Method: gle/morgenstern-price

FS	1.164880
Axis Location:	959.724, 818.096
Left Slip Surface Endpoint:	503.645, 292.114
Right Slip Surface Endpoint:	949.110, 143.595
Resisting Moment:	3.37195e+08 lb-ft
Driving Moment:	2.89469e+08 lb-ft
Resisting Horizontal Force:	418898 lb
Driving Horizontal Force:	359607 lb
Total Slice Area:	22674.3 ft2
Surface Horizontal Width:	445.465 ft
Surface Average Height:	50.9004 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
503.645	292.114
568.085	224.46
604.182	189.274
661.559	139.306
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051
814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.795	142
826.896	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Global Minimum Support Data

No Supports Present

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.16488

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	64.4393	89254.7	-46.3942	C&D	0	34.992	471.692	549.464	784.949	0	784.949	1280.17	1280.17
2	36.097	125065	-44.2671	C&D	0	34.992	1152.69	1342.74	1918.2	0	1918.2	3041.77	3041.77
3	49.5216	245514	-41.0518	C&D	207.75	30.8002	1629.94	1898.69	2836.56	0	2836.56	4256.04	4256.04
4	5.6112	33828.1	-41.0518	Select Fill	107	33.8	2043.28	2380.18	3395.63	0	3395.63	5175.08	5175.08
5	1.12224	7132.56	-41.0518	Pea Gravel	107	33.8	2151.9	2506.71	3584.65	0	3584.65	5458.69	5458.69
6	1.12224	7254.88	-41.0518	Pea Gravel	107	33.8	2172.75	2530.99	3652.1	31.1895	3620.91	5544.29	5513.1
7	9.93357	63711.5	1.15722	Critical Geosynthetic Interface	0	12	1201.81	1399.96	6648.69	62.3895	6586.3	6624.41	6562.03
8	3.41639	21428.1	1.15722	Critical Geosynthetic Interface	0	12	1181.55	1376.36	6537.65	62.3895	6475.26	6513.78	6451.39
9	12.5555	76622.9	1.15722	Critical Geosynthetic Interface	0	12	1156.46	1347.14	6400.17	62.3895	6337.78	6376.81	6314.42
10	1.18099	7035.16	1.15722	Critical Geosynthetic Interface	0	12	1134.39	1321.43	6279.23	62.3895	6216.84	6256.32	6193.93
11	7.27292	42672.5	1.15722	Critical Geosynthetic Interface	0	12	1120.44	1305.18	6202.76	62.3895	6140.37	6180.13	6117.74
12	6.54642	37450.2	1.15722	Critical Geosynthetic Interface	0	12	1097.19	1278.1	6075.37	62.3895	6012.98	6053.2	5990.81
13	1.0537	5942.98	1.15722	Critical Geosynthetic Interface	0	12	1084.17	1262.93	6004.02	62.3895	5941.63	5982.12	5919.73
14	12.8437	70546.4	1.15722	Critical Geosynthetic Interface	0	12	1059.78	1234.52	5870.33	62.3895	5807.94	5848.92	5786.53
15	3.28235	17467.4	1.15722	Critical Geosynthetic Interface	0	12	1030.91	1200.89	5712.12	62.3895	5649.73	5691.3	5628.91
16	10.5551	54620.5	1.15722	Critical Geosynthetic Interface	0	12	1005.4	1171.17	5572.33	62.3895	5509.94	5552.02	5489.63
17	5.49021	27476.4	1.15722	Critical Geosynthetic Interface	0	12	975.234	1136.03	5407.01	62.3895	5344.62	5387.31	5324.92
18	8.28755	40264.7	1.15722	Critical Geosynthetic Interface	0	12	948.716	1105.14	5261.66	62.3895	5199.27	5242.5	5180.11
19	7.67752	36000.6	1.15722	Critical Geosynthetic Interface	0	12	917.391	1068.65	5089.98	62.3895	5027.59	5071.45	5009.06
20	6.041	27447.7	1.15722	Critical Geosynthetic Interface	0	12	889.971	1036.71	4939.75	62.3895	4877.36	4921.77	4859.38
21	9.84447	43070.1	1.15722	Critical Geosynthetic Interface	0	12	857.663	999.075	4762.67	62.3895	4700.28	4745.34	4682.95
22	3.81517	16138.7	1.15722	Critical Geosynthetic Interface	0	12	829.502	966.27	4608.34	62.3895	4545.95	4591.59	4529.2
23	11.9913	48714.3	1.15722	Critical Geosynthetic Interface	0	12	796.404	927.715	4426.94	62.3895	4364.56	4410.86	4348.47

24	1.60986	6307.74	1.15722	Critical Geosynthetic Interface	0	12	767.655	894.226	4269.39	62.3895	4207	4253.88	4191.49
25	9.97162	37845.6	1.15722	Critical Geosynthetic Interface	0	12	742.901	865.391	4133.74	62.3895	4071.35	4118.73	4056.34
26	3.40817	12457.2	0.204137	Critical Geosynthetic Interface	0	12	706.152	822.582	3932.32	62.3895	3869.93	3929.81	3867.42
27	1.24758	4501.38	0.125349	Critical Geosynthetic Interface	0	12	696.111	810.886	3877.31	62.3895	3814.92	3875.78	3813.39
28	2.68835	9592.84	0.238314	Critical Geosynthetic Interface	0	12	689.116	802.738	3838.98	62.3895	3776.59	3836.11	3773.72
29	7.04047	24429.8	0.203264	Critical Geosynthetic Interface	0	12	669.101	779.422	3729.29	62.3895	3666.9	3726.91	3664.52
30	4.87714	16336.8	0.113922	Critical Geosynthetic Interface	0	12	644.241	750.464	3593.04	62.3895	3530.65	3591.76	3529.37
31	1.15297	3792.35	-0.239823	Critical Geosynthetic Interface	0	12	629.499	733.291	3512.25	62.3895	3449.86	3514.88	3452.49
32	10.0876	32064.4	-0.317514	Critical Geosynthetic Interface	0	12	606.82	706.873	3387.97	62.3895	3325.58	3391.33	3328.94
33	0.675026	2074.11	-0.0457245	Critical Geosynthetic Interface	0	12	587.349	684.191	3281.25	62.3895	3218.86	3281.72	3219.33
34	0.68978	2110.03	0.0374701	Critical Geosynthetic Interface	0	12	585.129	681.605	3269.08	62.3872	3206.7	3268.7	3206.31
35	0.100717	307.294	0.0395942	Critical Geosynthetic Interface	0	12	583.54	679.754	3260.38	62.3895	3197.99	3259.98	3197.59
36	17.1855	49127.2	2.16691	Critical Geosynthetic Interface	0	12	556.723	648.515	3113.39	62.3664	3051.03	3092.33	3029.96
37	8.76831	22558.6	1.48686	Critical Geosynthetic Interface	0	12	492.92	574.193	2763.75	62.3895	2701.36	2750.96	2688.57
38	10.2174	24170.7	1.93867	Critical Geosynthetic Interface	0	12	451.739	526.222	2538.07	62.3895	2475.68	2522.77	2460.38
39	16.6274	34502.3	1.34699	Critical Geosynthetic Interface	0	12	389.309	453.498	2195.93	62.3895	2133.54	2186.78	2124.39
40	5.00303	9218.74	1.6504	Critical Geosynthetic Interface	0	12	342.624	399.116	1940.08	62.3895	1877.69	1930.21	1867.82
41	2.32748	4103.65	1.524	Critical Geosynthetic Interface	0	12	326.109	379.878	1849.58	62.3895	1787.19	1840.9	1778.51
42	1.22624	2115.26	1.13275	Critical Geosynthetic Interface	0	12	317.444	369.784	1802.09	62.3895	1739.7	1795.81	1733.43
43	7.83115	12757.1	1.13404	Critical Geosynthetic Interface	0	12	298.172	347.335	1696.47	62.3895	1634.08	1690.57	1628.18
44	10.341	14907.2	0.194502	Critical Geosynthetic Interface	0	12	259.213	301.952	1482.97	62.3895	1420.58	1482.09	1419.7
45	9.57219	11875.1	0.149724	Critical Geosynthetic Interface	0	12	219.954	256.22	1267.81	62.3895	1205.43	1267.24	1204.85
46	9.98167	10432.9	-0.180702	Critical Geosynthetic Interface	0	12	181.976	211.98	1059.68	62.3895	997.287	1060.25	997.861
47	8.44311	6590.33	-0.194337	Critical Geosynthetic Interface	0	12	132.198	153.995	786.881	62.3895	724.491	787.329	724.939
48	1.67995	944.881	-1.58113	Critical Geosynthetic Interface	0	12	91.2145	106.254	562.276	62.3895	499.886	564.794	502.404

49	0.449087	233.174	-1.58092	Critical Geosynthetic Interface	0	12	83.2891	97.0218	518.842	62.3895	456.453	521.141	458.751
50	12.5608	3203.62	-1.58108	Critical Geosynthetic Interface	0	12	35.0664	40.8482	254.565	62.3895	192.176	255.533	193.143

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.16488

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	503.645	292.114	0	0	0
2	568.085	224.46	29399.1	6740.04	12.9125
3	604.182	189.274	64656.6	21986.1	18.7803
4	653.703	146.147	124673	56746.3	24.4732
5	659.314	141.261	132337	61528.1	24.9354
6	660.437	140.283	133960	62532.9	25.0233
7	661.559	139.306	135634	63564.2	25.1099
8	671.492	139.507	127139	61488	25.8097
9	674.909	139.576	124257	60667.2	26.0235
10	687.464	139.829	113859	57239.5	26.6897
11	688.645	139.853	112897	56887	26.7428
12	695.918	140	107036	54616.5	27.0335
13	702.465	140.132	101857	52442.1	27.2421
14	703.518	140.154	101033	52081.9	27.2708
15	716.362	140.413	91187	47505.4	27.518
16	719.644	140.479	88734.1	46290.8	27.5501
17	730.199	140.692	81028.8	42303.4	27.5681
18	735.69	140.803	77134.9	40198.3	27.5259
19	743.977	140.971	71410.2	37008.4	27.3955
20	751.655	141.126	66276.5	34065.6	27.2028
21	757.696	141.248	62355.2	31775	27.0025
22	767.54	141.447	56193.8	28120.3	26.5841
23	771.355	141.524	53883.9	26737.9	26.3912
24	783.347	141.766	46913.9	22550.6	25.6727
25	784.957	141.799	46012.1	22009	25.5632
26	794.928	142	40608.8	18778.2	24.8166
27	798.336	142.012	39088.3	17841.8	24.5343
28	799.584	142.015	38546.8	17507.8	24.4274
29	802.272	142.026	37370.5	16787.8	24.1909
30	809.313	142.051	34398.1	14978.7	23.5308
31	814.19	142.061	32446	13798.6	23.039
32	815.343	142.056	32021.4	13538.7	22.9187
33	825.43	142	28493.4	11395.6	21.7984
34	826.105	141.999	28254.2	11254.6	21.7191
35	826.795	142	28007.3	11110.1	21.6375
36	826.896	142	27971.3	11089.1	21.6256
37	844.081	142.65	20062.4	7070.6	19.414
38	852.85	142.878	16802.5	5510.19	18.1563
39	863.067	143.224	13121.3	3907.81	16.5847
40	879.695	143.615	8376.25	2057.07	13.7978
41	884.698	143.759	7073.57	1621.06	12.9077
42	887.025	143.821	6507.69	1441.05	12.486
43	888.251	143.845	6233.32	1354.74	12.2619
44	896.082	144	4591.74	876.073	10.8018
45	906.423	144.035	2976.81	460.993	8.80298
46	915.996	144.06	1729.97	209.09	6.89153
47	925.977	144.029	729.101	61.8473	4.84861
48	934.42	144	129.578	6.99842	3.0915
49	936.1	143.954	73.2586	3.50553	2.7396
50	936.549	143.941	59.7678	2.76151	2.64541
51	949.11	143.595	0	0	0

Discharge Sections

Entity Information

Piezoline

X	Y
0	139.001
1.53185	139.006
19.0865	139.06
32.9178	139.02
38.6457	139
48.7796	138.793
50.2602	138.763
61.0905	138.542
64.3705	138.476
73.4615	138.291
78.5505	138.189
85.9551	138.041
92.8528	137.903
95.9447	137.841
98.6483	137.789
99.8304	137.766
108.36	137.6
111.481	137.539
113.16	137.508
114.657	137.481
124.023	137.298
126.413	137.276
128.483	137.258
129.604	137.259
134.88	137.144
140.608	137.001
140.666	137
141.88	136.996
145.396	136.987
165.76	136.931
170.639	136.942
190.43	137
193.662	137.091
201.413	137.308
202.91	137.31
209.905	137.483
212.256	137.486
216.044	137.533
220.799	137.61
228.74	137.769
233.581	137.864
240.055	137.994
246.29	138.116

249.014	138.178
254.334	138.284
259.083	138.368
268.35	138.553
271.397	138.613
282.09	138.827
283.248	138.85
289.114	139
290.561	139
291.004	139
293.847	139
294.079	139
294.897	139
295.735	139
297.392	139.908
299.475	141
303.779	141.026
307.699	141.048
315.325	141.101
315.77	141.098
319.666	141.08
324.496	141.067
337.748	141
337.798	140.999
337.804	140.999
350.01	140.752
351.514	140.722
361.883	140.513
364.794	140.454
366.105	140.426
370.416	140.331
374.199	140.251
376.444	140.207
378.978	140.155
385.656	140.023
392.593	139.886
397.761	139.784
406.485	139.612
410.085	139.541
415.321	139.473
419.58	139.44
426.773	139.263
428.072	139.263
436.007	139.041
437.46	139
447.762	138.797
449.164	138.77
459.994	138.557
463.353	138.491
472.562	138.31
477.849	138.206
485.368	138.058
492.661	137.915

498.42	137.801
505.285	137.698
510.764	137.64
513.847	137.638
516.909	137.636
519.953	137.634
522.978	137.632
529.387	137.687
537.506	137.8
543.814	137.927
550.999	138.073
559.479	138.244
564.556	138.346
575.229	138.562
578.177	138.622
591.066	138.882
591.862	138.898
596.908	139
602.692	139.157
603.345	139.157
604.986	139.174
607.15	139.207
619.626	139.459
623.304	139.533
633.498	139.739
639.412	139.859
647.335	140.019
655.475	140.183
661.139	140.297
671.492	140.507
674.909	140.576
687.464	140.829
688.645	140.853
695.918	141
702.465	141.132
703.518	141.154
716.362	141.413
719.644	141.479
730.199	141.692
735.69	141.803
743.977	141.971
751.655	142.126
757.696	142.248
767.54	142.447
771.355	142.524
783.347	142.766
784.957	142.799
794.928	143
798.336	143.012
799.584	143.015
802.272	143.026
809.313	143.051
814.19	143.061

815.343	143.056
825.43	143
826.105	142.999
826.168	142.999
826.795	143
826.896	143
826.916	143
844.081	143.65
852.85	143.878
863.067	144.224
879.695	144.615
884.698	144.759
887.025	144.821
888.251	144.845
896.082	145
906.423	145.035
915.996	145.06
925.977	145.029
934.42	145
936.1	144.954
936.549	144.941
945.84	144.685

External Boundary

X	Y
0	294
0	145.001
0	140.001
0	139.001
0	138.001
0	136.001
0	0
1120.27	0
1120.27	137.664
1120.15	137.662
1094.2	137.627
1066.59	137.768
1058.38	138
1056.96	138.055
1056.39	138.077
1042.28	138.625
1035.7	138.881
1027.44	139.202
1014.7	139.696
1012.45	139.784
1006.89	140
997.074	140.271
994.462	140.343
981.639	140.697
974.953	140.881
966.333	141.119
955.65	141.414
949.11	143.595
945.84	144.685
942.57	145.775
926.821	151.026
438	314
405	314
324	310
307	308
283	308
243	306
202	304
162	302
122	300
81	298
40	296

Material Boundary

X	Y
0	136.001
1.53185	136.006
19.0865	136.06
32.9178	136.02
38.6457	136
48.7796	135.793

50.2602	135.763
61.0905	135.542
64.3705	135.476
73.4615	135.291
78.5505	135.189
85.9551	135.041
92.8528	134.903
95.9447	134.841
98.6483	134.789
99.8304	134.766
108.36	134.6
111.481	134.539
113.16	134.508
114.657	134.481
124.023	134.298
126.413	134.276
128.483	134.258
129.604	134.259
134.88	134.144
140.608	134.001
140.666	134
141.88	133.996
145.396	133.987
165.76	133.931
170.639	133.942
190.43	134
193.662	134.091
201.413	134.308
202.91	134.31
209.905	134.483
212.256	134.486
216.044	134.533
220.799	134.61
228.74	134.769
233.581	134.864
240.055	134.994
246.29	135.116
249.014	135.178
254.334	135.284
259.083	135.368
268.35	135.553
271.397	135.613
282.09	135.827
283.248	135.85
289.114	136
290.561	136
291.004	136
293.847	136
294.079	136
294.897	136
295.735	136
297.392	136.908
299.475	138

303.779	138.026
307.699	138.048
315.325	138.101
315.77	138.098
319.666	138.08
324.496	138.067
337.748	138
337.798	137.999
337.804	137.999
350.01	137.752
351.514	137.722
361.883	137.513
364.794	137.454
366.105	137.426
370.416	137.331
374.199	137.251
376.444	137.207
378.978	137.155
385.656	137.023
392.593	136.886
397.761	136.784
406.485	136.612
410.085	136.541
415.321	136.473
419.58	136.44
426.773	136.263
428.072	136.263
436.007	136.041
437.46	136
447.762	135.797
449.164	135.77
459.994	135.557
463.353	135.491
472.562	135.31
477.849	135.206
485.368	135.058
492.661	134.915
498.42	134.801
505.285	134.698
510.764	134.64
513.847	134.638
516.909	134.636
519.953	134.634
522.978	134.632
529.387	134.687
537.506	134.8
543.814	134.927
550.999	135.073
559.479	135.244
564.556	135.346
575.229	135.562
578.177	135.622
591.066	135.882

591.862	135.898
596.908	136
602.692	136.157
603.345	136.157
604.986	136.174
607.15	136.207
619.626	136.459
623.304	136.533
633.498	136.739
639.412	136.859
647.335	137.019
655.475	137.183
661.139	137.297
671.492	137.507
674.909	137.576
687.464	137.829
688.645	137.853
695.918	138
702.465	138.132
703.518	138.154
716.362	138.413
719.644	138.479
730.199	138.692
735.69	138.803
743.977	138.971
751.655	139.126
757.696	139.248
767.54	139.447
771.355	139.524
783.347	139.766
784.957	139.799
794.928	140
798.336	140.012
799.584	140.015
802.272	140.026
809.313	140.051
814.19	140.061
815.343	140.056
825.43	140
826.105	139.999
826.168	139.999
826.795	140
826.896	140
826.916	140
844.081	140.65
852.85	140.878
863.067	141.224
879.695	141.615
884.698	141.759
887.025	141.821
888.251	141.845
896.082	142
906.423	142.035

915.996	142.06
925.977	142.029
934.42	142
936.1	141.954
936.549	141.941
951.154	141.538
955.65	141.414

Material Boundary

X	Y
0	138.001
1.53185	138.006
19.0865	138.06
32.9178	138.02
38.6457	138
48.7796	137.793
50.2602	137.763
61.0905	137.542
64.3705	137.476
73.4615	137.291
78.5505	137.189
85.9551	137.041
92.8528	136.903
95.9447	136.841
98.6483	136.789
99.8304	136.766
108.36	136.6
111.481	136.539
113.16	136.508
114.657	136.481
124.023	136.298
126.413	136.276
128.483	136.258
129.604	136.259
134.88	136.144
140.608	136.001
140.666	136
141.88	135.996
145.396	135.987
165.76	135.931
170.639	135.942
190.43	136
193.662	136.091
201.413	136.308
202.91	136.31
209.905	136.483
212.256	136.486
216.044	136.533
220.799	136.61
228.74	136.769
233.581	136.864
240.055	136.994

246.29	137.116
249.014	137.178
254.334	137.284
259.083	137.368
268.35	137.553
271.397	137.613
282.09	137.827
283.248	137.85
289.114	138
290.561	138
291.004	138
293.847	138
294.079	138
294.897	138
295.735	138
297.392	138.908
299.475	140
303.779	140.026
307.699	140.048
315.325	140.101
315.77	140.098
319.666	140.08
324.496	140.067
337.748	140
337.798	139.999
337.804	139.999
350.01	139.752
351.514	139.722
361.883	139.513
364.794	139.454
366.105	139.426
370.416	139.331
374.199	139.251
376.444	139.207
378.978	139.155
385.656	139.023
392.593	138.886
397.761	138.784
406.485	138.612
410.085	138.541
415.321	138.473
419.58	138.44
426.773	138.263
428.072	138.263
436.007	138.041
437.46	138
447.762	137.797
449.164	137.77
459.994	137.557
463.353	137.491
472.562	137.31
477.849	137.206
485.368	137.058

492.661	136.915
498.42	136.801
505.285	136.698
510.764	136.64
513.847	136.638
516.909	136.636
519.953	136.634
522.978	136.632
529.387	136.687
537.506	136.8
543.814	136.927
550.999	137.073
559.479	137.244
564.556	137.346
575.229	137.562
578.177	137.622
591.066	137.882
591.862	137.898
596.908	138
602.692	138.157
603.345	138.157
604.986	138.174
607.15	138.207
619.626	138.459
623.304	138.533
633.498	138.739
639.412	138.859
647.335	139.019
655.475	139.183
661.139	139.297
671.492	139.507
674.909	139.576
687.464	139.829
688.645	139.853
695.918	140
702.465	140.132
703.518	140.154
716.362	140.413
719.644	140.479
730.199	140.692
735.69	140.803
743.977	140.971
751.655	141.126
757.696	141.248
767.54	141.447
771.355	141.524
783.347	141.766
784.957	141.799
794.928	142
798.336	142.012
799.584	142.015
802.272	142.026
809.313	142.051

814.19	142.061
815.343	142.056
825.43	142
826.105	141.999
826.168	141.999
826.795	142
826.896	142
826.916	142
844.081	142.65
852.85	142.878
863.067	143.224
879.695	143.615
884.698	143.759
887.025	143.821
888.251	143.845
896.082	144
906.423	144.035
915.996	144.06
925.977	144.029
934.42	144
936.1	143.954
936.549	143.941
949.11	143.595

Material Boundary

X	Y
0	140.001
1.53185	140.006
19.0865	140.06
32.9178	140.02
38.6457	140
48.7796	139.793
50.2602	139.763
61.0905	139.542
64.3705	139.476
73.4615	139.291
78.5505	139.189
85.9551	139.041
92.8528	138.903
95.9447	138.841
98.6483	138.789
99.8304	138.766
108.36	138.6
111.481	138.539
113.16	138.508
114.657	138.481
124.023	138.298
126.413	138.276
128.483	138.258
129.604	138.259
134.88	138.144
140.608	138.001

140.666	138
141.88	137.996
145.396	137.987
165.76	137.931
170.639	137.942
190.43	138
193.662	138.091
201.413	138.308
202.91	138.31
209.905	138.483
212.256	138.486
216.044	138.533
220.799	138.61
228.74	138.769
233.581	138.864
240.055	138.994
246.29	139.116
249.014	139.178
254.334	139.284
259.083	139.368
268.35	139.553
271.397	139.613
282.09	139.827
283.248	139.85
289.114	140
290.561	140
291.004	140
293.847	140
294.079	140
294.897	140
295.735	140
297.392	140.908
299.475	142
303.779	142.026
307.699	142.048
315.325	142.101
315.77	142.098
319.666	142.08
324.496	142.067
337.748	142
337.798	141.999
337.804	141.999
350.01	141.752
351.514	141.722
361.883	141.513
364.794	141.454
366.105	141.426
370.416	141.331
374.199	141.251
376.444	141.207
378.978	141.155
385.656	141.023
392.593	140.886

397.761	140.784
406.485	140.612
410.085	140.541
415.321	140.473
419.58	140.44
426.773	140.263
428.072	140.263
436.007	140.041
437.46	140
447.762	139.797
449.164	139.77
459.994	139.557
463.353	139.491
472.562	139.31
477.849	139.206
485.368	139.058
492.661	138.915
498.42	138.801
505.285	138.698
510.764	138.64
513.847	138.638
516.909	138.636
519.953	138.634
522.978	138.632
529.387	138.687
537.506	138.8
543.814	138.927
550.999	139.073
559.479	139.244
564.556	139.346
575.229	139.562
578.177	139.622
591.066	139.882
591.862	139.898
596.908	140
602.692	140.157
603.345	140.157
604.986	140.174
607.15	140.207
619.626	140.459
623.304	140.533
633.498	140.739
639.412	140.859
647.335	141.019
655.475	141.183
661.139	141.297
671.492	141.507
674.909	141.576
687.464	141.829
688.645	141.853
695.918	142
702.465	142.132
703.518	142.154

716.362	142.413
719.644	142.479
730.199	142.692
735.69	142.803
743.977	142.971
751.655	143.126
757.696	143.248
767.54	143.447
771.355	143.524
783.347	143.766
784.957	143.799
794.928	144
798.336	144.012
799.584	144.015
802.272	144.026
809.313	144.051
814.19	144.061
815.343	144.056
825.43	144
826.105	143.999
826.168	143.999
826.795	144
826.896	144
826.916	144
844.081	144.65
852.85	144.878
863.067	145.224
879.695	145.615
884.698	145.759
887.025	145.821
888.251	145.845
896.082	146
906.423	146.035
915.996	146.06
925.977	146.029
934.42	146
936.1	145.954
936.549	145.941
942.57	145.775

Material Boundary

X	Y
0	145.001
1.53185	145.006
19.0865	145.06
32.9178	145.02
38.6457	145
48.7796	144.793
50.2602	144.763
61.0905	144.542
64.3705	144.476
73.4615	144.291

78.5505	144.189
85.9551	144.041
92.8528	143.903
95.9447	143.841
98.6483	143.789
99.8304	143.766
108.36	143.6
111.481	143.539
113.16	143.508
114.657	143.481
124.023	143.298
126.413	143.276
128.483	143.258
129.604	143.259
134.88	143.144
140.608	143.001
140.666	143
141.88	142.996
145.396	142.987
165.76	142.931
170.639	142.942
190.43	143
193.662	143.091
201.413	143.308
202.91	143.31
209.905	143.483
212.256	143.486
216.044	143.533
220.799	143.61
228.74	143.769
233.581	143.864
240.055	143.994
246.29	144.116
249.014	144.178
254.334	144.284
259.083	144.368
268.35	144.553
271.397	144.613
282.09	144.827
283.248	144.85
289.114	145
290.561	145
291.004	145
293.847	145
294.079	145
294.897	145
295.735	145
297.392	145.908
299.475	147
303.779	147.026
307.699	147.048
315.325	147.101
315.77	147.098

319.666	147.08
324.496	147.067
337.748	147
337.798	146.999
337.804	146.999
350.01	146.752
351.514	146.722
361.883	146.513
364.794	146.454
366.105	146.426
370.416	146.331
374.199	146.251
376.444	146.207
378.978	146.155
385.656	146.023
392.593	145.886
397.761	145.784
406.485	145.612
410.085	145.541
415.321	145.473
419.58	145.44
426.773	145.263
428.072	145.263
436.007	145.041
437.46	145
447.762	144.797
449.164	144.77
459.994	144.557
463.353	144.491
472.562	144.31
477.849	144.206
485.368	144.058
492.661	143.915
498.42	143.801
505.285	143.698
510.764	143.64
513.847	143.638
516.909	143.636
519.953	143.634
522.978	143.632
529.387	143.687
537.506	143.8
543.814	143.927
550.999	144.073
559.479	144.244
564.556	144.346
575.229	144.562
578.177	144.622
591.066	144.882
591.862	144.898
596.908	145
602.692	145.157
603.345	145.157

604.986	145.174
607.15	145.207
619.626	145.459
623.304	145.533
633.498	145.739
639.412	145.859
647.335	146.019
655.475	146.183
661.139	146.297
671.492	146.507
674.909	146.576
687.464	146.829
688.645	146.853
695.918	147
702.465	147.132
703.518	147.154
716.362	147.413
719.644	147.479
730.199	147.692
735.69	147.803
743.977	147.971
751.655	148.126
757.696	148.248
767.54	148.447
771.355	148.524
783.347	148.766
784.957	148.799
794.928	149
798.336	149.012
799.584	149.015
802.272	149.026
809.313	149.051
814.19	149.061
815.343	149.056
825.43	149
826.105	148.999
826.168	148.999
826.795	149
826.896	149
826.916	149
844.081	149.65
852.85	149.878
863.067	150.224
879.695	150.615
884.698	150.759
887.025	150.821
888.251	150.845
896.082	151
906.423	151.035
915.996	151.06
925.977	151.029
926.821	151.026

APPENDIX C2

PROJECT DESIGN CALCULATIONS

APPENDIX C2.1 – LEACHATE

. Leachate Generation Estimate
. Help Model Output

LEACHATE GENERATION ESTIMATE

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project Name:	North Berm Permit Modification	**Date:**	1/7/2022
Project Location:	Dunn C&D Facility	**Calculated By:**	CSD
Project Number:	182-442	**Checked By:**	AJK

Maximum Expected Leachate Generation

Average Waste Depth	Area (acre)	Annual Totals (ft^3/acre/year)	Annual Totals (gal/acre/year)	Daily Values (gal/acre/day)	Avg. Daily Value (gal/day)
Open (10ft)	5.0	61,374	459,078	1,257	6,285
50 ft	15.4	36,878	275,847	755	11,627
100 ft	8.1	18,625	139,315	381	3,086
150 ft	18.5	12,586	94,143	238	4,403
Cap*	15.2	n/a	n/a	20	304
				TOTAL:	**25,705**
				Rate (GPM):	**18**

Notes:

*Final cap assumed to produce 20 gal/acre/day of leachate based on previous data.

Daily rates from HELP model (refer to collection estimates table)

Areas associated with each waste depth are delineated on attached figure.

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project Name:	North Berm Permit Modification	**Date:**	1/4/2022
Project Location:	Dunn C&D Facility	**Calculated By:**	EMW
Project Number:	182-442	**Checked By:**	AJK

HELP Model Leachate Collection Estimates

Month	10 feet waste (gal/ac/day)	50 feet waste (gal/ac/day)	100 feet waste (gal/ac/day)	150 feet waste (gal/ac/day)
January	1,014	311	51	36
February	1,251	689	208	111
March	1,044	824	421	268
April	1,121	512	358	46
May	3,121	241	159	106
June	2,287	870	122	58
July	1,603	1,245	507	247
August	1,151	1,248	706	473
September	810	1,085	688	501
October	715	974	626	482
November	474	620	430	331
December	494	445	290	195
Average:	1,257	755	381	238

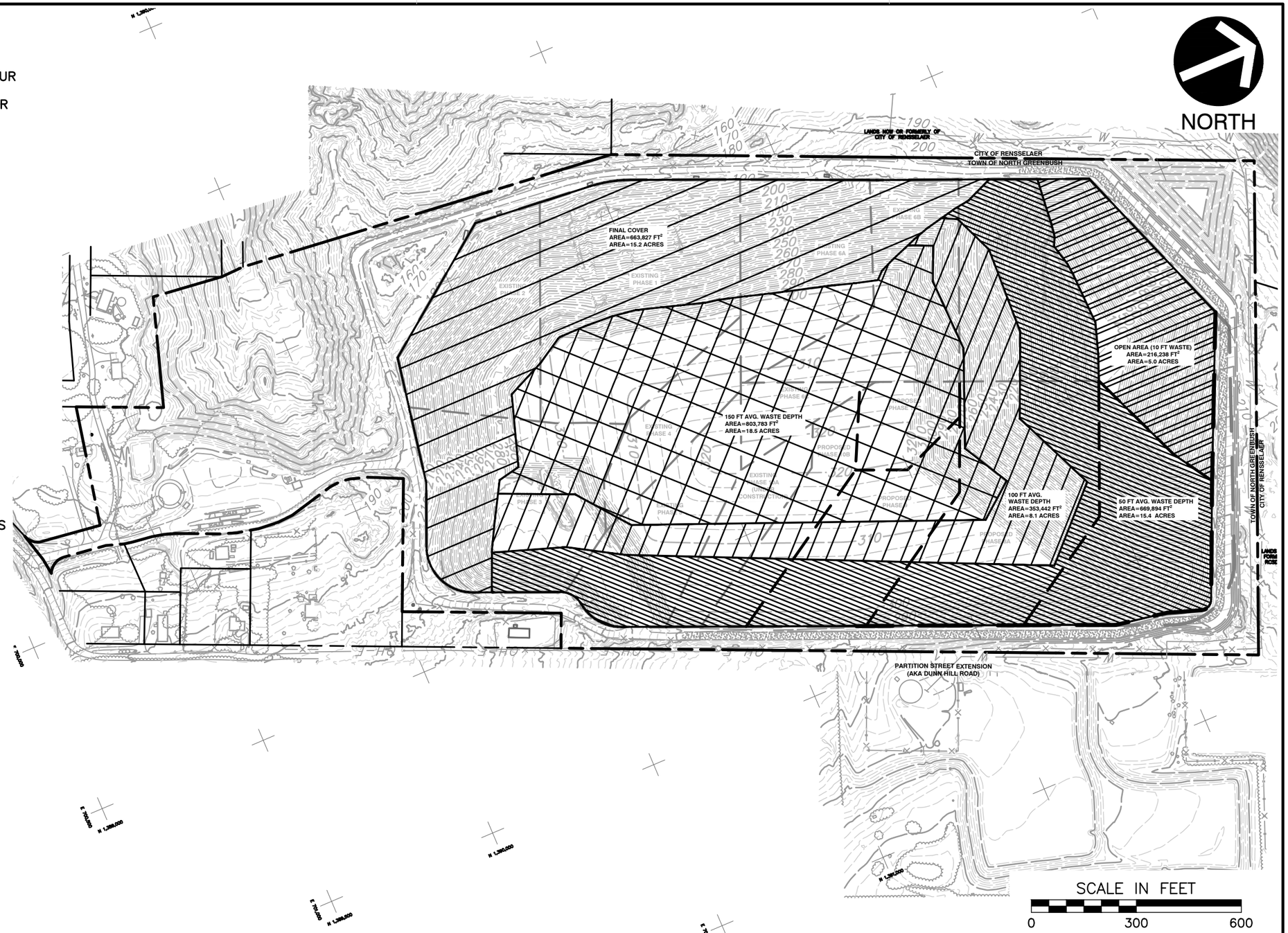
LEGEND:

- EXISTING 10–FOOT CONTOUR
- EXISTING 2–FOOT CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING WATER LINE
- EXISTING PROPERTY LINE
- EXISTING TOWN LINE

REFERENCE NOTES:

1. UNLESS NOTED OTHERWISE, EXISTING TOPOGRAPHY WAS COMPILED BY SOUTHERN RESOURCES MAPPING CORPORATION USING PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED MARCH 16, 2021, AND SUPPLEMENTED WITH TOPOGRAPHY FROM OCTOBER 7, 2020 AND NOVEMBER 4, 2020. SURVEY CONTROL DATA WAS PROVIDED BY WASTE CONNECTIONS, INC.

2. PROPERTY LINE INFORMATION WAS TAKEN FROM A PLAN TITLED "ATLA/ASCM LAND TITLE BOUNDARY SURVEY, LANDS OF KELLY AND DUNN TO BE CONVEYED TO S.A. DUNN & COMPANY, LLC," PREPARED AND SEALED BY WILLIAM N. CURRAN, AND UPDATED AS NECESSARY BASED ON AVAILABLE TITLE INFORMATION.



Civil & Environmental Engineering, Landscape Architecture and Land Surveying PLLC 31 BELLOWS ROAD - RAYNHAM, MA 02767 774-501-2176 · 866-312-2024				MSE BERM MODIFICATION DUNN MINE AND C&D FACILITY S.A. DUNN & COMPANY, LLC RENSSELAER, NEW YORK	
				HELP MODEL PHASING AREAS	
DRAWN BY:	CSD	CHECKED BY:	EMW	APPROVED BY: AJK	FIGURE NO.:
DATE:	JANUARY 2022	DWG SCALE:	1"=300'	PROJECT NO: 182-442	1

P:\2018\182-442\-CADD\Dwg\SW16-Other Figures\182442-SW16-HELP Phasing Areas_7B.dwg{LAYOUT1} LS:(1/10/2022 - ewilson) - LP: 1/12/2022 10:37 AM

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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:\DUNNPREC.D4
TEMPERATURE DATA FILE:      C:\DUNNTEMP.D7
SOLAR RADIATION DATA FILE:  C:\DUNNSOL.D13
EVAPOTRANSPIRATION DATA:    C:\DUNNEVAP.D11
SOIL AND DESIGN DATA FILE:  C:\DUNN10FT.D10
OUTPUT DATA FILE:           C:\DUNN10FT.OUT


TIME:   8:40     DATE:   1/ 8/2019


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

     TITLE:  DUNN OPEN (10FT WASTE)

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


     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   0
          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 =      0.3632 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-04 CM/SEC


                                   LAYER  2
                                   --------
```

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            TYPE 2 - LATERAL DRAINAGE 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  =      0.0496 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   1.00000000000     CM/SEC
SLOPE                       =      2.80   PERCENT
DRAINAGE LENGTH             =    200.0    FEET


                        LAYER  3
                        --------

            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         =      3.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      3.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER  4
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


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

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER             =     74.00
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      8.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      4.008  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.368  INCHES
```

LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	55.023	INCHES
TOTAL INITIAL WATER	=	55.023	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ALBANY NEW YORK

STATION LATITUDE	=	42.45	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50	
START OF GROWING SEASON (JULIAN DATE)	=	123	
END OF GROWING SEASON (JULIAN DATE)	=	282	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.90	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA FOR ALBANY NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY NEW YORK
AND STATION LATITUDE = 42.45 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	2.04	2.12	3.10	2.80	3.47	3.31
	4.84	3.53	5.37	1.49	3.83	2.57
RUNOFF	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	0.388	0.504	0.413	2.927	4.072	3.491
	2.994	4.226	3.090	1.392	1.227	0.309
LATERAL DRAINAGE COLLECTED	0.1284	0.8823	0.9305	0.5344	2.8447	2.2750
FROM LAYER 2	1.6606	1.1959	0.9115	0.6936	0.2492	0.4800
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.040	0.038	0.022	0.116	0.096
TOP OF LAYER 3	0.068	0.049	0.038	0.028	0.010	0.020
STD. DEVIATION OF DAILY	0.006	0.012	0.013	0.016	0.033	0.008
HEAD ON TOP OF LAYER 3	0.007	0.006	0.009	0.009	0.007	0.008

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.47	139646.125	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	25.032	90865.602	65.07
DRAINAGE COLLECTED FROM LAYER 2	12.7860	46413.094	33.24
PERC./LEAKAGE THROUGH LAYER 4	0.000062	0.225	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0441		
CHANGE IN WATER STORAGE	0.652	2367.149	1.70
SOIL WATER AT START OF YEAR	55.023	199733.750	
SOIL WATER AT END OF YEAR	55.675	202100.891	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.045	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.75	3.58	2.72	2.18	2.96	3.80
	6.96	5.98	4.57	5.88	2.89	2.78
RUNOFF	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	0.638	0.508	0.291	2.309	2.258	4.397
	5.642	4.764	3.066	1.310	0.921	0.491
LATERAL DRAINAGE COLLECTED	0.3332	1.2062	1.2453	1.6300	3.7880	2.3523
FROM LAYER 2	1.6607	1.1134	0.3974	0.8482	0.7508	1.4761
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.014	0.054	0.051	0.069	0.154	0.099
TOP OF LAYER 3	0.068	0.045	0.017	0.035	0.032	0.060
STD. DEVIATION OF DAILY	0.016	0.005	0.012	0.078	0.026	0.010
HEAD ON TOP OF LAYER 3	0.007	0.017	0.006	0.016	0.034	0.017

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.05	170791.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.595	96541.062	56.53

DRAINAGE COLLECTED FROM LAYER 2	16.8017	60990.016	35.71
PERC./LEAKAGE THROUGH LAYER 4	0.000079	0.286	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0580		
CHANGE IN WATER STORAGE	3.653	13260.115	7.76
SOIL WATER AT START OF YEAR	55.675	202100.891	
SOIL WATER AT END OF YEAR	57.422	208441.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.906	6919.856	4.05
ANNUAL WATER BUDGET BALANCE	0.0000	0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.78	2.60	3.57	3.63	4.89	5.37
	2.60	5.04	2.61	5.65	1.41	1.39
RUNOFF	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	0.541	0.615	0.688	3.006	5.514	3.509
	4.409	4.601	2.766	1.565	0.844	0.467
LATERAL DRAINAGE COLLECTED	2.2361	1.7768	1.4317	0.8824	4.5263	2.4207
FROM LAYER 2	1.8520	1.4960	1.1049	0.9782	0.5535	0.1390
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.091	0.077	0.058	0.037	0.184	0.102
TOP OF LAYER 3	0.075	0.061	0.046	0.040	0.023	0.006
STD. DEVIATION OF DAILY	0.005	0.006	0.008	0.025	0.027	0.017
HEAD ON TOP OF LAYER 3	0.010	0.004	0.003	0.008	0.008	0.006

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.54	154420.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.524	103541.469	67.05
DRAINAGE COLLECTED FROM LAYER 2	19.3977	70413.539	45.60
PERC./LEAKAGE THROUGH LAYER 4	0.000090	0.327	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0667		
CHANGE IN WATER STORAGE	-5.382	-19535.172	-12.65
SOIL WATER AT START OF YEAR	57.422	208441.156	
SOIL WATER AT END OF YEAR	53.023	192473.828	
SNOW WATER AT START OF YEAR	1.906	6919.856	4.48
SNOW WATER AT END OF YEAR	0.923	3352.010	2.17
ANNUAL WATER BUDGET BALANCE	0.0000	0.068	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.51	2.63	5.90	3.41	2.29	2.87
	2.31	3.66	6.66	4.00	4.85	4.21
RUNOFF	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	0.497	0.599	0.622	1.964	3.652	2.861
	2.319	3.547	2.849	1.627	1.207	0.434
LATERAL DRAINAGE COLLECTED	0.9429	0.9993	0.9439	0.6256	2.3813	2.8381

FROM LAYER 2	2.0494	1.4163	1.0637	0.7276	0.3366	0.3473
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.038	0.045	0.038	0.026	0.097	0.119
TOP OF LAYER 3	0.083	0.058	0.045	0.030	0.014	0.014
STD. DEVIATION OF DAILY	0.013	0.003	0.008	0.015	0.068	0.015
HEAD ON TOP OF LAYER 3	0.010	0.005	0.006	0.012	0.008	0.012

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.30	160809.016	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.178	80507.086	50.06
DRAINAGE COLLECTED FROM LAYER 2	14.6719	53259.059	33.12
PERC./LEAKAGE THROUGH LAYER 4	0.000070	0.255	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0506		
CHANGE IN WATER STORAGE	7.450	27042.574	16.82
SOIL WATER AT START OF YEAR	53.023	192473.828	
SOIL WATER AT END OF YEAR	58.832	213560.437	
SNOW WATER AT START OF YEAR	0.923	3352.010	2.08
SNOW WATER AT END OF YEAR	2.564	9307.977	5.79
ANNUAL WATER BUDGET BALANCE	0.0000	0.036	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.44	0.88	1.99	1.68	1.96	4.60
	4.04	3.06	1.87	2.95	0.91	3.08
RUNOFF	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	0.423	0.589	0.390	2.431	2.346	4.842
	2.619	4.111	1.814	1.345	1.019	0.620
LATERAL DRAINAGE COLLECTED	2.1498	1.5844	1.4084	2.5019	4.2789	2.7459
FROM LAYER 2	1.9277	1.3499	0.9993	0.8313	0.7259	0.3773
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.087	0.071	0.057	0.105	0.174	0.115
TOP OF LAYER 3	0.078	0.055	0.042	0.034	0.031	0.015
STD. DEVIATION OF DAILY	0.016	0.019	0.042	0.060	0.015	0.013
HEAD ON TOP OF LAYER 3	0.009	0.005	0.003	0.002	0.003	0.007

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.46	121459.836	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.550	81857.352	67.39
DRAINAGE COLLECTED FROM LAYER 2	20.8806	75796.461	62.40
PERC./LEAKAGE THROUGH LAYER 4	0.000096	0.350	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0721		
CHANGE IN WATER STORAGE	-9.971	-36194.371	-29.80
SOIL WATER AT START OF YEAR	58.832	213560.437	
SOIL WATER AT END OF YEAR	49.816	180831.312	

SNOW WATER AT START OF YEAR	2.564	9307.977	7.66
SNOW WATER AT END OF YEAR	1.610	5842.733	4.81
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.30	2.36	3.46	2.74	3.11	3.99
	4.15	4.25	4.22	3.99	2.78	2.81
STD. DEVIATIONS	1.95	0.98	1.48	0.82	1.15	1.00
	1.88	1.21	1.97	1.85	1.64	1.01
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	0.497	0.563	0.481	2.527	3.569	3.820
	3.596	4.250	2.717	1.448	1.044	0.464
STD. DEVIATIONS	0.099	0.053	0.167	0.437	1.347	0.791
	1.396	0.475	0.523	0.140	0.170	0.112
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.1581	1.2898	1.1920	1.2349	3.5638	2.5264
	1.8301	1.3143	0.8954	0.8158	0.5232	0.5639
STD. DEVIATIONS	0.9915	0.3812	0.2434	0.8288	0.9224	0.2500
	0.1699	0.1574	0.2878	0.1122	0.2257	0.5248
PERCOLATION/LEAKAGE THROUGH LAYER 4						
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 3

AVERAGES	0.0471	0.0575	0.0485	0.0519	0.1450	0.1062
	0.0744	0.0535	0.0376	0.0332	0.0220	0.0229
STD. DEVIATIONS	0.0403	0.0163	0.0099	0.0348	0.0375	0.0105
	0.0069	0.0064	0.0121	0.0046	0.0095	0.0213

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	41.16	(5.315)	149425.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	24.976	(2.6891)	90662.52	60.674
LATERAL DRAINAGE COLLECTED FROM LAYER 2	16.90756	(3.31595)	61374.437	41.07365
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00008	(0.00001)	0.289	0.00019
AVERAGE HEAD ON TOP OF LAYER 3	0.058	(0.011)		
CHANGE IN WATER STORAGE	-0.720	(6.9832)	-2611.94	-1.748

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	2.45	8893.500
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	0.22271	808.45447
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000001	0.00332
AVERAGE HEAD ON TOP OF LAYER 3	0.281	
MAXIMUM HEAD ON TOP OF LAYER 3	0.544	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	6.2 FEET	
SNOW WATER	6.73	24443.5762

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 1978

LAYER	(INCHES)	(VOL/VOL)
1	38.2342	0.3186
2	1.3336	0.0556
3	0.0000	0.0000
4	10.2480	0.4270
SNOW WATER	1.610	

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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:\DUNNPREC.D4
TEMPERATURE DATA FILE:      C:\DUNNTEMP.D7
SOLAR RADIATION DATA FILE:  C:\DUNNSOL.D13
EVAPOTRANSPIRATION DATA:    C:\DUNNEVAP.D11
SOIL AND DESIGN DATA FILE:  C:\DUNN50FT.D10
OUTPUT DATA FILE:           C:\DUNN50FT.OUT


TIME:   8:46     DATE:   1/ 8/2019


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

     TITLE:  DUNN 50FT WASTE

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


     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   0
          THICKNESS                  =    600.00   INCHES
          POROSITY                   =      0.6710 VOL/VOL
          FIELD CAPACITY             =      0.2920 VOL/VOL
          WILTING POINT              =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.3118 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-04 CM/SEC


                                   LAYER  2
                                   --------
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            TYPE 2 - LATERAL DRAINAGE 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  =      0.0464 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   1.00000000000     CM/SEC
SLOPE                       =      2.80   PERCENT
DRAINAGE LENGTH             =    200.0    FEET


                        LAYER  3
                        --------

            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         =      3.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      3.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER  4
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


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

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER             =     74.00
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      8.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      4.008  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.368  INCHES
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LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.616  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =    198.415  INCHES
TOTAL INITIAL WATER                 =    198.415  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ALBANY                NEW YORK

     STATION LATITUDE                        =  42.45 DEGREES
     MAXIMUM LEAF AREA INDEX                 =   4.50
     START OF GROWING SEASON (JULIAN DATE)   =    123
     END OF GROWING SEASON (JULIAN DATE)     =    282
     EVAPORATIVE ZONE DEPTH                  =   8.0  INCHES
     AVERAGE ANNUAL WIND SPEED               =   8.90 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  68.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  66.00 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  74.00 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  74.00 %

NOTE:  PRECIPITATION DATA FOR     ALBANY              NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
           AND STATION LATITUDE  =  42.45 DEGREES
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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	2.04	2.12	3.10	2.80	3.47	3.31
	4.84	3.53	5.37	1.49	3.83	2.57
RUNOFF	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	0.388	0.504	0.413	2.927	4.072	3.491
	2.994	4.226	3.090	1.392	1.227	0.309
LATERAL DRAINAGE COLLECTED	0.0452	0.0609	0.0589	0.0893	0.0369	0.0315
FROM LAYER 2	0.4351	0.6492	0.6386	0.5401	0.2332	0.2528
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.003	0.002	0.004	0.001	0.001
TOP OF LAYER 3	0.018	0.026	0.027	0.022	0.010	0.010
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.002	0.001	0.001
HEAD ON TOP OF LAYER 3	0.009	0.003	0.008	0.007	0.006	0.005

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.47	139646.125	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	25.032	90865.602	65.07
DRAINAGE COLLECTED FROM LAYER 2	3.0716	11150.082	7.98
PERC./LEAKAGE THROUGH LAYER 4	0.000018	0.067	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0105		
CHANGE IN WATER STORAGE	10.366	37630.289	26.95
SOIL WATER AT START OF YEAR	198.415	720246.875	
SOIL WATER AT END OF YEAR	208.782	757877.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.078	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.75	3.58	2.72	2.18	2.96	3.80
	6.96	5.98	4.57	5.88	2.89	2.78
RUNOFF	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	0.638	0.508	0.291	2.309	2.258	4.397
	5.642	4.764	3.066	1.310	0.921	0.491
LATERAL DRAINAGE COLLECTED	0.0762	0.0229	0.6767	0.4481	0.1151	0.4677
FROM LAYER 2	1.0548	0.9590	0.2879	0.6186	0.3625	0.2805
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.028	0.019	0.005	0.020
TOP OF LAYER 3	0.043	0.039	0.012	0.025	0.015	0.011
STD. DEVIATION OF DAILY	0.002	0.001	0.011	0.004	0.004	0.017
HEAD ON TOP OF LAYER 3	0.001	0.014	0.005	0.014	0.007	0.005

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.05	170791.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.595	96541.062	56.53

DRAINAGE COLLECTED FROM LAYER 2	5.3700	19493.129	11.41
PERC./LEAKAGE THROUGH LAYER 4	0.000029	0.106	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0184		
CHANGE IN WATER STORAGE	15.085	54757.191	32.06
SOIL WATER AT START OF YEAR	208.782	757877.125	
SOIL WATER AT END OF YEAR	221.960	805714.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.906	6919.856	4.05
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.78	2.60	3.57	3.63	4.89	5.37
	2.60	5.04	2.61	5.65	1.41	1.39
RUNOFF	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	0.541	0.615	0.688	3.006	5.514	3.509
	4.409	4.601	2.766	1.565	0.844	0.467
LATERAL DRAINAGE COLLECTED	0.0505	0.9843	1.3399	0.9097	0.2199	1.1670
FROM LAYER 2	1.4026	1.5846	1.4938	1.5146	0.7553	0.1874
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.043	0.054	0.038	0.009	0.049
TOP OF LAYER 3	0.057	0.064	0.063	0.062	0.032	0.008
STD. DEVIATION OF DAILY	0.002	0.014	0.009	0.014	0.010	0.009
HEAD ON TOP OF LAYER 3	0.006	0.004	0.001	0.010	0.015	0.007

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.54	154420.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.524	103541.469	67.05
DRAINAGE COLLECTED FROM LAYER 2	11.6097	42143.066	27.29
PERC./LEAKAGE THROUGH LAYER 4	0.000057	0.207	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0401		
CHANGE IN WATER STORAGE	2.406	8735.470	5.66
SOIL WATER AT START OF YEAR	221.960	805714.500	
SOIL WATER AT END OF YEAR	225.349	818017.812	
SNOW WATER AT START OF YEAR	1.906	6919.856	4.48
SNOW WATER AT END OF YEAR	0.923	3352.010	2.17
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.51	2.63	5.90	3.41	2.29	2.87
	2.31	3.66	6.66	4.00	4.85	4.21
RUNOFF	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	0.497	0.599	0.622	1.964	3.652	2.861
	2.319	3.547	2.849	1.627	1.207	0.434
LATERAL DRAINAGE COLLECTED	1.1691	1.3269	1.4602	0.7153	0.3435	0.9506

FROM LAYER 2	1.8333	1.7365	1.6063	0.9945	0.4139	0.3384
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.048	0.060	0.059	0.030	0.014	0.040
TOP OF LAYER 3	0.075	0.071	0.068	0.040	0.017	0.014
STD. DEVIATION OF DAILY	0.012	0.001	0.012	0.014	0.009	0.026
HEAD ON TOP OF LAYER 3	0.001	0.001	0.008	0.020	0.008	0.005

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.30	160809.016	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.178	80507.086	50.06
DRAINAGE COLLECTED FROM LAYER 2	12.8886	46785.512	29.09
PERC./LEAKAGE THROUGH LAYER 4	0.000063	0.228	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0446		
CHANGE IN WATER STORAGE	9.233	33516.129	20.84
SOIL WATER AT START OF YEAR	225.349	818017.812	
SOIL WATER AT END OF YEAR	232.942	845578.000	
SNOW WATER AT START OF YEAR	0.923	3352.010	2.08
SNOW WATER AT END OF YEAR	2.564	9307.977	5.79
ANNUAL WATER BUDGET BALANCE	0.0000	0.056	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.44	0.88	1.99	1.68	1.96	4.60
	4.04	3.06	1.87	2.95	0.91	3.08
RUNOFF	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	0.423	0.589	0.390	2.431	2.346	4.842
	2.619	4.111	1.814	1.345	1.019	0.620
LATERAL DRAINAGE COLLECTED	0.4331	1.1560	1.1701	0.6655	0.6631	2.1918
FROM LAYER 2	2.3832	2.1934	1.9658	1.8902	1.6601	1.4842
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.018	0.052	0.048	0.028	0.027	0.092
TOP OF LAYER 3	0.097	0.089	0.083	0.077	0.070	0.060
STD. DEVIATION OF DAILY	0.015	0.016	0.019	0.012	0.028	0.007
HEAD ON TOP OF LAYER 3	0.002	0.002	0.002	0.002	0.007	0.009

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.46	121459.836	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.550	81857.352	67.39
DRAINAGE COLLECTED FROM LAYER 2	17.8565	64819.250	53.37
PERC./LEAKAGE THROUGH LAYER 4	0.000084	0.306	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0617		
CHANGE IN WATER STORAGE	-6.947	-25217.105	-20.76
SOIL WATER AT START OF YEAR	232.942	845578.000	
SOIL WATER AT END OF YEAR	226.949	823826.125	

SNOW WATER AT START OF YEAR	2.564	9307.977	7.66
SNOW WATER AT END OF YEAR	1.610	5842.733	4.81
ANNUAL WATER BUDGET BALANCE	0.0000	0.040	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.30	2.36	3.46	2.74	3.11	3.99
	4.15	4.25	4.22	3.99	2.78	2.81
STD. DEVIATIONS	1.95	0.98	1.48	0.82	1.15	1.00
	1.88	1.21	1.97	1.85	1.64	1.01
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	0.497	0.563	0.481	2.527	3.569	3.820
	3.596	4.250	2.717	1.448	1.044	0.464
STD. DEVIATIONS	0.099	0.053	0.167	0.437	1.347	0.791
	1.396	0.475	0.523	0.140	0.170	0.112
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.3548	0.7102	0.9411	0.5656	0.2757	0.9617
	1.4218	1.4245	1.1985	1.1116	0.6850	0.5086
STD. DEVIATIONS	0.4836	0.6221	0.5764	0.3128	0.2453	0.8162
	0.7420	0.6189	0.7044	0.5814	0.5782	0.5480
PERCOLATION/LEAKAGE THROUGH LAYER 4						
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 3

AVERAGES	0.0144	0.0317	0.0383	0.0238	0.0112	0.0404
	0.0578	0.0579	0.0504	0.0452	0.0288	0.0207
STD. DEVIATIONS	0.0197	0.0279	0.0234	0.0131	0.0100	0.0343
	0.0302	0.0252	0.0296	0.0236	0.0243	0.0223

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	41.16	(5.315)	149425.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	24.976	(2.6891)	90662.52	60.674
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.15929	(5.95760)	36878.211	24.68003
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00005	(0.00003)	0.183	0.00012
AVERAGE HEAD ON TOP OF LAYER 3	0.035	(0.021)		
CHANGE IN WATER STORAGE	6.029	(8.5525)	21884.39	14.646

****

PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	2.45	8893.500
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	0.08012	290.82498
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00132
AVERAGE HEAD ON TOP OF LAYER 3	0.101	
MAXIMUM HEAD ON TOP OF LAYER 3	0.199	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	2.8 FEET	
SNOW WATER	6.73	24443.5762

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 1978

LAYER	(INCHES)	(VOL/VOL)
1	215.2881	0.3588
2	1.4132	0.0589
3	0.0000	0.0000
4	10.2480	0.4270
SNOW WATER	1.610	

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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:\DUNNPREC.D4
TEMPERATURE DATA FILE:      C:\DUNNTEMP.D7
SOLAR RADIATION DATA FILE:  C:\DUNNSOL.D13
EVAPOTRANSPIRATION DATA:    C:\DUNNEVAP.D11
SOIL AND DESIGN DATA FILE:  C:\DUNN100F.D10
OUTPUT DATA FILE:           C:\DUNN100F.OUT


TIME:   8:52     DATE:   1/ 8/2019


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

     TITLE:  DUNN 100FT WASTE

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


     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   0
          THICKNESS                   =   1200.00   INCHES
          POROSITY                    =      0.6710 VOL/VOL
          FIELD CAPACITY              =      0.2920 VOL/VOL
          WILTING POINT               =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.3021 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                                   LAYER  2
                                   --------
```

```
            TYPE 2 - LATERAL DRAINAGE 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  =      0.0460 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   1.00000000000     CM/SEC
SLOPE                       =      2.80   PERCENT
DRAINAGE LENGTH             =    200.0    FEET
```

LAYER 3

```
            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         =      3.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      3.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 4

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              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER             =     74.00
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      8.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      4.008  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.368  INCHES
```

```
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.616  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =    373.847  INCHES
TOTAL INITIAL WATER                 =    373.847  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ALBANY                NEW YORK

    STATION LATITUDE                        =  42.45 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   4.50
    START OF GROWING SEASON (JULIAN DATE)   =    123
    END OF GROWING SEASON (JULIAN DATE)     =    282
    EVAPORATIVE ZONE DEPTH                  =   8.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =   8.90 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  68.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  66.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  74.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  74.00 %

NOTE:  PRECIPITATION DATA FOR     ALBANY              NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
           AND STATION LATITUDE  =  42.45 DEGREES
```

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	2.04	2.12	3.10	2.80	3.47	3.31
	4.84	3.53	5.37	1.49	3.83	2.57
RUNOFF	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	0.388	0.504	0.413	2.927	4.072	3.491
	2.994	4.226	3.090	1.392	1.227	0.309
LATERAL DRAINAGE COLLECTED	0.0341	0.0469	0.0375	0.0550	0.0039	0.0352
FROM LAYER 2	0.1511	0.4178	0.4491	0.4129	0.1419	0.1652
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.002	0.002	0.000	0.001
TOP OF LAYER 3	0.006	0.017	0.019	0.017	0.006	0.007
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.002
HEAD ON TOP OF LAYER 3	0.006	0.003	0.007	0.004	0.005	0.004

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.47	139646.125	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	25.032	90865.602	65.07
DRAINAGE COLLECTED FROM LAYER 2	1.9506	7080.858	5.07
PERC./LEAKAGE THROUGH LAYER 4	0.000013	0.046	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0067		
CHANGE IN WATER STORAGE	11.487	41699.469	29.86
SOIL WATER AT START OF YEAR	373.847	1357063.870	
SOIL WATER AT END OF YEAR	385.334	1398763.370	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.140	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.75	3.58	2.72	2.18	2.96	3.80
	6.96	5.98	4.57	5.88	2.89	2.78
RUNOFF	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	0.638	0.508	0.291	2.309	2.258	4.397
	5.642	4.764	3.066	1.310	0.921	0.491
LATERAL DRAINAGE COLLECTED	0.0365	0.0435	0.2836	0.3349	0.0694	0.0449
FROM LAYER 2	0.4063	0.6212	0.3002	0.2126	0.1384	0.0844
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.012	0.014	0.003	0.002
TOP OF LAYER 3	0.017	0.025	0.013	0.009	0.006	0.003
STD. DEVIATION OF DAILY	0.001	0.002	0.011	0.005	0.002	0.002
HEAD ON TOP OF LAYER 3	0.007	0.009	0.004	0.006	0.004	0.001

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.05	170791.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.595	96541.062	56.53

DRAINAGE COLLECTED FROM LAYER 2	2.5760	9350.970	5.48
PERC./LEAKAGE THROUGH LAYER 4	0.000016	0.058	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0088		
CHANGE IN WATER STORAGE	17.879	64899.488	38.00
SOIL WATER AT START OF YEAR	385.334	1398763.370	
SOIL WATER AT END OF YEAR	401.307	1456743.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.906	6919.856	4.05
ANNUAL WATER BUDGET BALANCE	0.0000	-0.074	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.78	2.60	3.57	3.63	4.89	5.37
	2.60	5.04	2.61	5.65	1.41	1.39
RUNOFF	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	0.541	0.615	0.688	3.006	5.514	3.509
	4.409	4.601	2.766	1.565	0.844	0.467
LATERAL DRAINAGE COLLECTED	0.0369	0.0619	0.6711	0.6301	0.2842	0.1737
FROM LAYER 2	0.2491	0.6332	0.7916	0.9061	0.5715	0.2261
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.003	0.027	0.026	0.012	0.007
TOP OF LAYER 3	0.010	0.026	0.033	0.037	0.024	0.009
STD. DEVIATION OF DAILY	0.001	0.005	0.007	0.008	0.005	0.004
HEAD ON TOP OF LAYER 3	0.008	0.008	0.001	0.008	0.008	0.005

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.54	154420.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.524	103541.469	67.05
DRAINAGE COLLECTED FROM LAYER 2	5.2356	19005.242	12.31
PERC./LEAKAGE THROUGH LAYER 4	0.000029	0.105	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0180		
CHANGE IN WATER STORAGE	8.781	31873.285	20.64
SOIL WATER AT START OF YEAR	401.307	1456743.000	
SOIL WATER AT END OF YEAR	411.070	1492184.120	
SNOW WATER AT START OF YEAR	1.906	6919.856	4.48
SNOW WATER AT END OF YEAR	0.923	3352.010	2.17
ANNUAL WATER BUDGET BALANCE	0.0000	0.129	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.51	2.63	5.90	3.41	2.29	2.87
	2.31	3.66	6.66	4.00	4.85	4.21
RUNOFF	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	0.497	0.599	0.622	1.964	3.652	2.861
	2.319	3.547	2.849	1.627	1.207	0.434
LATERAL DRAINAGE COLLECTED	0.0801	0.7105	0.9242	0.5783	0.3301	0.0459

FROM LAYER 2	0.7441	1.0190	0.9986	0.7689	0.3270	0.1836
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.032	0.038	0.024	0.013	0.002
TOP OF LAYER 3	0.030	0.041	0.042	0.031	0.014	0.007
STD. DEVIATION OF DAILY	0.006	0.003	0.008	0.010	0.005	0.002
HEAD ON TOP OF LAYER 3	0.014	0.001	0.007	0.013	0.006	0.005

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.30	160809.016	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.178	80507.086	50.06
DRAINAGE COLLECTED FROM LAYER 2	6.7104	24358.580	15.15
PERC./LEAKAGE THROUGH LAYER 4	0.000036	0.129	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0232		
CHANGE IN WATER STORAGE	15.411	55943.242	34.79
SOIL WATER AT START OF YEAR	411.070	1492184.120	
SOIL WATER AT END OF YEAR	424.841	1542171.370	
SNOW WATER AT START OF YEAR	0.923	3352.010	2.08
SNOW WATER AT END OF YEAR	2.564	9307.977	5.79
ANNUAL WATER BUDGET BALANCE	0.0000	-0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.44	0.88	1.99	1.68	1.96	4.60
	4.04	3.06	1.87	2.95	0.91	3.08
RUNOFF	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	0.423	0.589	0.390	2.431	2.346	4.842
	2.619	4.111	1.814	1.345	1.019	0.620
LATERAL DRAINAGE COLLECTED	0.1008	0.2076	0.4885	0.3816	0.2214	0.3738
FROM LAYER 2	1.3408	1.3384	1.2633	1.2736	1.1950	0.9974
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.009	0.020	0.016	0.009	0.016
TOP OF LAYER 3	0.055	0.054	0.053	0.052	0.050	0.041
STD. DEVIATION OF DAILY	0.003	0.007	0.008	0.005	0.005	0.019
HEAD ON TOP OF LAYER 3	0.001	0.000	0.000	0.000	0.005	0.010

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.46	121459.836	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.550	81857.352	67.39
DRAINAGE COLLECTED FROM LAYER 2	9.1821	33331.102	27.44
PERC./LEAKAGE THROUGH LAYER 4	0.000046	0.169	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0316		
CHANGE IN WATER STORAGE	1.728	6271.106	5.16
SOIL WATER AT START OF YEAR	424.841	1542171.370	
SOIL WATER AT END OF YEAR	427.523	1551907.750	

SNOW WATER AT START OF YEAR	2.564	9307.977	7.66
SNOW WATER AT END OF YEAR	1.610	5842.733	4.81
ANNUAL WATER BUDGET BALANCE	0.0000	0.114	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.30	2.36	3.46	2.74	3.11	3.99
	4.15	4.25	4.22	3.99	2.78	2.81
STD. DEVIATIONS	1.95	0.98	1.48	0.82	1.15	1.00
	1.88	1.21	1.97	1.85	1.64	1.01
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	0.497	0.563	0.481	2.527	3.569	3.820
	3.596	4.250	2.717	1.448	1.044	0.464
STD. DEVIATIONS	0.099	0.053	0.167	0.437	1.347	0.791
	1.396	0.475	0.523	0.140	0.170	0.112
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0577	0.2141	0.4810	0.3960	0.1818	0.1347
	0.5783	0.8059	0.7606	0.7148	0.4747	0.3313
STD. DEVIATIONS	0.0308	0.2858	0.3421	0.2282	0.1399	0.1454
	0.4820	0.3686	0.3935	0.4169	0.4399	0.3759
PERCOLATION/LEAKAGE THROUGH LAYER 4						
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 3

AVERAGES	0.0023	0.0096	0.0196	0.0166	0.0074	0.0057
	0.0235	0.0328	0.0320	0.0291	0.0200	0.0135
STD. DEVIATIONS	0.0013	0.0129	0.0139	0.0096	0.0057	0.0061
	0.0196	0.0150	0.0165	0.0170	0.0185	0.0153

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	41.16	(5.315)	149425.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	24.976	(2.6891)	90662.52	60.674
LATERAL DRAINAGE COLLECTED FROM LAYER 2	5.13095	(2.98159)	18625.348	12.46465
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00003	(0.00001)	0.101	0.00007
AVERAGE HEAD ON TOP OF LAYER 3	0.018	(0.010)		
CHANGE IN WATER STORAGE	11.057	(6.2829)	40137.32	26.861

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	2.45	8893.500
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	0.05588	202.83315
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00095
AVERAGE HEAD ON TOP OF LAYER 3	0.070	
MAXIMUM HEAD ON TOP OF LAYER 3	0.139	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	2.3 FEET	
SNOW WATER	6.73	24443.5762

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 1978

LAYER	(INCHES)	(VOL/VOL)
1	415.8846	0.3466
2	1.3902	0.0579
3	0.0000	0.0000
4	10.2480	0.4270
SNOW WATER	1.610	

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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:\DUNNPREC.D4
TEMPERATURE DATA FILE:      C:\DUNNTEMP.D7
SOLAR RADIATION DATA FILE:  C:\DUNNSOL.D13
EVAPOTRANSPIRATION DATA:    C:\DUNNEVAP.D11
SOIL AND DESIGN DATA FILE:  C:\DUNN150F.D10
OUTPUT DATA FILE:           C:\DUNN150F.OUT


TIME:   8:55     DATE:   1/ 8/2019


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

     TITLE:  DUNN 150FT WASTE

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


     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   0
          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 =      0.2988 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.999999975000E-04 CM/SEC


                                   LAYER  2
                                   --------
```

```
            TYPE 2 - LATERAL DRAINAGE 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  =      0.0459 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   1.00000000000     CM/SEC
SLOPE                       =      2.80   PERCENT
DRAINAGE LENGTH             =    200.0    FEET
```

LAYER 3

```
            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         =      3.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      3.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 4

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER             =     74.00
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      8.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      4.008  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.368  INCHES
```

```
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.616  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =    549.114  INCHES
TOTAL INITIAL WATER                 =    549.114  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ALBANY                NEW YORK

    STATION LATITUDE                        =  42.45 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   4.50
    START OF GROWING SEASON (JULIAN DATE)   =    123
    END OF GROWING SEASON (JULIAN DATE)     =    282
    EVAPORATIVE ZONE DEPTH                  =   8.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =   8.90 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  68.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  66.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  74.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  74.00 %

NOTE:  PRECIPITATION DATA FOR     ALBANY              NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

```
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ALBANY              NEW YORK
           AND STATION LATITUDE  =  42.45 DEGREES
```

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	2.04	2.12	3.10	2.80	3.47	3.31
	4.84	3.53	5.37	1.49	3.83	2.57
RUNOFF	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	0.388	0.504	0.413	2.927	4.072	3.491
	2.994	4.226	3.090	1.392	1.227	0.309
LATERAL DRAINAGE COLLECTED	0.0307	0.0450	0.0344	0.0485	0.0017	0.0197
FROM LAYER 2	0.1198	0.3589	0.3897	0.3914	0.0970	0.1419
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.001	0.002	0.000	0.001
TOP OF LAYER 3	0.005	0.015	0.016	0.016	0.004	0.006
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.001
HEAD ON TOP OF LAYER 3	0.005	0.003	0.006	0.004	0.003	0.003

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.47	139646.125	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	25.032	90865.602	65.07
DRAINAGE COLLECTED FROM LAYER 2	1.6787	6093.555	4.36
PERC./LEAKAGE THROUGH LAYER 4	0.000011	0.041	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0058		
CHANGE IN WATER STORAGE	11.759	42686.840	30.57
SOIL WATER AT START OF YEAR	549.114	1993284.750	
SOIL WATER AT END OF YEAR	560.874	2035971.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.076	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.75	3.58	2.72	2.18	2.96	3.80
	6.96	5.98	4.57	5.88	2.89	2.78
RUNOFF	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	0.638	0.508	0.291	2.309	2.258	4.397
	5.642	4.764	3.066	1.310	0.921	0.491
LATERAL DRAINAGE COLLECTED	0.0326	0.0251	0.2227	0.2883	0.0420	0.0497
FROM LAYER 2	0.2392	0.5095	0.2517	0.1451	0.0860	0.0541
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.009	0.012	0.002	0.002
TOP OF LAYER 3	0.010	0.021	0.011	0.006	0.004	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.009	0.005	0.002	0.002
HEAD ON TOP OF LAYER 3	0.006	0.007	0.006	0.005	0.002	0.001

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.05	170791.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.595	96541.062	56.53

DRAINAGE COLLECTED FROM LAYER 2	1.9461	7064.447	4.14
PERC./LEAKAGE THROUGH LAYER 4	0.000013	0.046	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0067		
CHANGE IN WATER STORAGE	18.509	67185.961	39.34
SOIL WATER AT START OF YEAR	560.874	2035971.620	
SOIL WATER AT END OF YEAR	577.476	2096237.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.906	6919.856	4.05
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.78	2.60	3.57	3.63	4.89	5.37
	2.60	5.04	2.61	5.65	1.41	1.39
RUNOFF	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	0.541	0.615	0.688	3.006	5.514	3.509
	4.409	4.601	2.766	1.565	0.844	0.467
LATERAL DRAINAGE COLLECTED	0.0199	0.0280	0.4025	0.5209	0.2291	0.1495
FROM LAYER 2	0.1129	0.2220	0.5320	0.6788	0.4873	0.1610
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.016	0.022	0.009	0.006
TOP OF LAYER 3	0.005	0.009	0.022	0.028	0.020	0.007
STD. DEVIATION OF DAILY	0.001	0.002	0.008	0.006	0.006	0.004
HEAD ON TOP OF LAYER 3	0.003	0.008	0.002	0.007	0.006	0.005

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.54	154420.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.524	103541.469	67.05
DRAINAGE COLLECTED FROM LAYER 2	3.5439	12864.395	8.33
PERC./LEAKAGE THROUGH LAYER 4	0.000021	0.075	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0122		
CHANGE IN WATER STORAGE	10.472	38014.309	24.62
SOIL WATER AT START OF YEAR	577.476	2096237.750	
SOIL WATER AT END OF YEAR	588.931	2137819.750	
SNOW WATER AT START OF YEAR	1.906	6919.856	4.48
SNOW WATER AT END OF YEAR	0.923	3352.010	2.17
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.51	2.63	5.90	3.41	2.29	2.87
	2.31	3.66	6.66	4.00	4.85	4.21
RUNOFF	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	0.497	0.599	0.622	1.964	3.652	2.861
	2.319	3.547	2.849	1.627	1.207	0.434
LATERAL DRAINAGE COLLECTED	0.0548	0.3408	0.6767	0.4985	0.2476	0.0808

FROM LAYER 2	0.2377	0.7010	0.7196	0.6419	0.2731	0.1233
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.015	0.028	0.021	0.010	0.003
TOP OF LAYER 3	0.010	0.029	0.030	0.026	0.011	0.005
STD. DEVIATION OF DAILY	0.002	0.008	0.007	0.008	0.006	0.001
HEAD ON TOP OF LAYER 3	0.011	0.001	0.006	0.009	0.006	0.003

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.30	160809.016	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.178	80507.086	50.06
DRAINAGE COLLECTED FROM LAYER 2	4.5959	16683.193	10.37
PERC./LEAKAGE THROUGH LAYER 4	0.000026	0.094	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0159		
CHANGE IN WATER STORAGE	17.526	63618.551	39.56
SOIL WATER AT START OF YEAR	588.931	2137819.750	
SOIL WATER AT END OF YEAR	604.816	2195482.500	
SNOW WATER AT START OF YEAR	0.923	3352.010	2.08
SNOW WATER AT END OF YEAR	2.564	9307.977	5.79
ANNUAL WATER BUDGET BALANCE	0.0000	0.085	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.44	0.88	1.99	1.68	1.96	4.60
	4.04	3.06	1.87	2.95	0.91	3.08
RUNOFF	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	0.423	0.589	0.390	2.431	2.346	4.842
	2.619	4.111	1.814	1.345	1.019	0.620
LATERAL DRAINAGE COLLECTED	0.0677	0.1355	0.1936	0.1695	0.0867	0.0229
FROM LAYER 2	0.7019	0.9089	0.8740	0.8925	0.8837	0.6340
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.006	0.008	0.007	0.004	0.001
TOP OF LAYER 3	0.029	0.037	0.037	0.036	0.037	0.026
STD. DEVIATION OF DAILY	0.003	0.005	0.005	0.005	0.002	0.001
HEAD ON TOP OF LAYER 3	0.011	0.000	0.000	0.000	0.004	0.010

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.46	121459.836	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.550	81857.352	67.39
DRAINAGE COLLECTED FROM LAYER 2	5.5709	20222.211	16.65
PERC./LEAKAGE THROUGH LAYER 4	0.000030	0.109	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0192		
CHANGE IN WATER STORAGE	5.339	19380.004	15.96
SOIL WATER AT START OF YEAR	604.816	2195482.500	
SOIL WATER AT END OF YEAR	611.110	2218327.750	

SNOW WATER AT START OF YEAR	2.564	9307.977	7.66
SNOW WATER AT END OF YEAR	1.610	5842.733	4.81
ANNUAL WATER BUDGET BALANCE	0.0000	0.163	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.30	2.36	3.46	2.74	3.11	3.99
	4.15	4.25	4.22	3.99	2.78	2.81
STD. DEVIATIONS	1.95	0.98	1.48	0.82	1.15	1.00
	1.88	1.21	1.97	1.85	1.64	1.01
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	0.497	0.563	0.481	2.527	3.569	3.820
	3.596	4.250	2.717	1.448	1.044	0.464
STD. DEVIATIONS	0.099	0.053	0.167	0.437	1.347	0.791
	1.396	0.475	0.523	0.140	0.170	0.112
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0411	0.1149	0.3060	0.3051	0.1214	0.0645
	0.2823	0.5400	0.5534	0.5499	0.3654	0.2229
STD. DEVIATIONS	0.0195	0.1341	0.2450	0.2052	0.1111	0.0535
	0.2424	0.2724	0.2493	0.2879	0.3325	0.2334
PERCOLATION/LEAKAGE THROUGH LAYER 4						
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 3

AVERAGES	0.0017	0.0052	0.0124	0.0128	0.0049	0.0027
	0.0115	0.0220	0.0233	0.0224	0.0154	0.0091
STD. DEVIATIONS	0.0008	0.0060	0.0100	0.0086	0.0045	0.0022
	0.0099	0.0111	0.0105	0.0117	0.0140	0.0095

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	41.16	(5.315)	149425.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	24.976	(2.6891)	90662.52	60.674
LATERAL DRAINAGE COLLECTED FROM LAYER 2	3.46710	(1.67465)	12585.562	8.42264
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002	(0.00001)	0.073	0.00005
AVERAGE HEAD ON TOP OF LAYER 3	0.012	(0.006)		
CHANGE IN WATER STORAGE	12.721	(5.4097)	46177.13	30.903

****

PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	2.45	8893.500
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	0.04128	149.83722
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00073
AVERAGE HEAD ON TOP OF LAYER 3	0.052	
MAXIMUM HEAD ON TOP OF LAYER 3	0.103	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	1.7 FEET	
SNOW WATER	6.73	24443.5762

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 1978

LAYER	(INCHES)	(VOL/VOL)
1	599.4922	0.3331
2	1.3694	0.0571
3	0.0000	0.0000
4	10.2480	0.4270
SNOW WATER	1.610	

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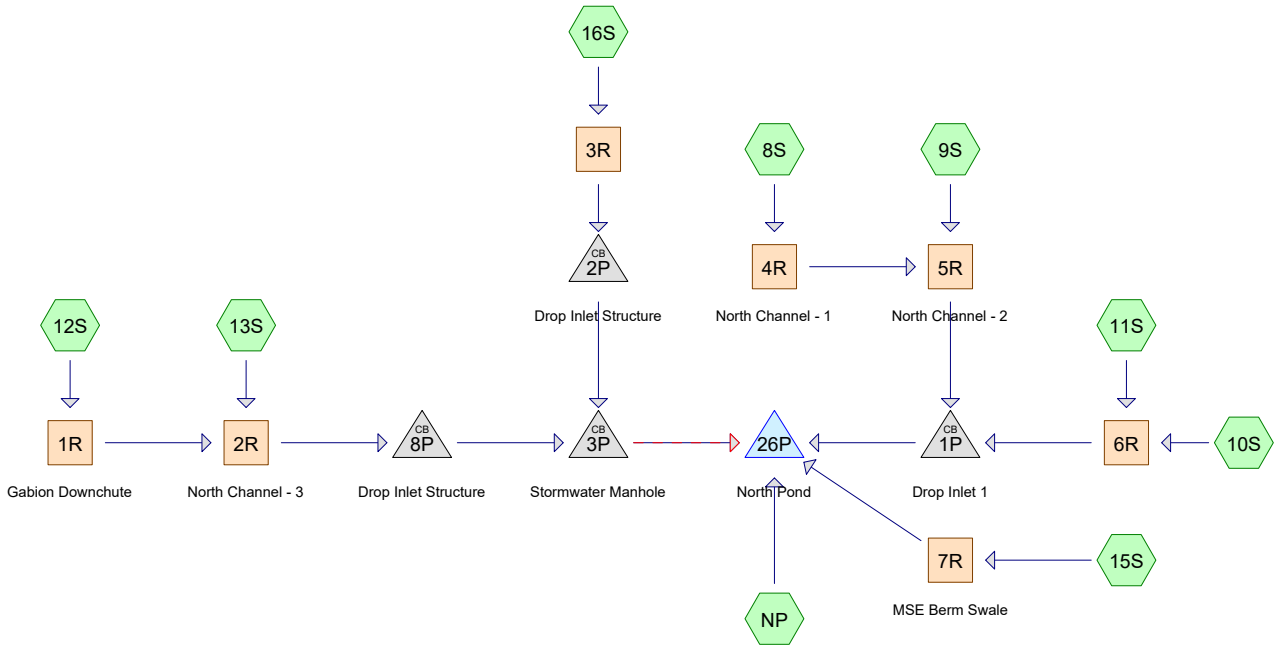
APPENDIX C2.2 – STORMWATER

. North Pond Hydrocad Analyses
. Downchute and Downchute Energy Dissipator Design
. Final Cover Diversion Berm and Perimeter Swale Design
. Drainage Area Maps

NORTH POND HYDROCAD ANALYSIS



Subcat Reach Pond Link

Routing Diagram for Post-Development_North Pond
Prepared by CEC, Inc., Printed 5/11/2021
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	2.80	2
2	10-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	4.25	2
3	25-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	4.90	2
4	100-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	5.90	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.736	80	(12S)
1.730	98	Basin (NP)
0.576	80	CAP (11S)
27.987	80	Cap (8S, 9S, 10S, 13S, 16S)
0.947	85	Gravel Road (13S, 16S, NP)
1.279	85	Gravel roads, HSG B (8S, 9S, 11S)
0.660	67	Vegetation (Hyd. Group B) (15S)
44.915	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
1.279	HSG B	8S, 9S, 11S
0.000	HSG C	
0.000	HSG D	
43.636	Other	8S, 9S, 10S, 11S, 12S, 13S, 15S, 16S, NP
44.915		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	11.736	11.736		12S
0.000	0.000	0.000	0.000	1.730	1.730	Basin	NP
0.000	0.000	0.000	0.000	0.576	0.576	CAP	11S
0.000	0.000	0.000	0.000	27.987	27.987	Cap	8S, 9S, 10S, 13S, 16S
0.000	0.000	0.000	0.000	0.947	0.947	Gravel Road	13S, 16S, NP
0.000	1.279	0.000	0.000	0.000	1.279	Gravel roads	8S, 9S, 11S
0.000	0.000	0.000	0.000	0.660	0.660	Vegetation (Hyd. Group B)	15S
0.000	**1.279**	**0.000**	**0.000**	**43.636**	**44.915**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1P	200.60	200.00	65.0	0.0092	0.013	0.0	36.0	0.0
2	2P	187.00	185.20	36.0	0.0500	0.011	0.0	36.0	0.0
3	3P	179.30	177.00	46.0	0.0500	0.011	0.0	36.0	0.0
4	8P	187.00	183.00	80.0	0.0500	0.011	0.0	36.0	0.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment8S: Runoff Area=11.897 ac 0.00% Impervious Runoff Depth>1.10"
Flow Length=633' Tc=11.4 min CN=80 Runoff=18.83 cfs 1.089 af

Subcatchment9S: Runoff Area=5.653 ac 0.00% Impervious Runoff Depth>1.10"
Flow Length=717' Tc=10.7 min CN=80 Runoff=9.15 cfs 0.518 af

Subcatchment10S: Runoff Area=9.230 ac 0.00% Impervious Runoff Depth>1.10"
Flow Length=1,350' Tc=15.0 min CN=80 Runoff=12.85 cfs 0.844 af

Subcatchment11S: Runoff Area=0.758 ac 0.00% Impervious Runoff Depth>1.16"
Flow Length=291' Slope=0.0800 '/' Tc=9.3 min CN=81 Runoff=1.37 cfs 0.073 af

Subcatchment12S: Runoff Area=11.736 ac 0.00% Impervious Runoff Depth>1.10"
Flow Length=944' Slope=0.0500 '/' Tc=13.5 min CN=80 Runoff=17.26 cfs 1.074 af

Subcatchment13S: Runoff Area=1.365 ac 0.00% Impervious Runoff Depth>1.16"
Flow Length=510' Tc=6.0 min CN=81 Runoff=2.76 cfs 0.132 af

Subcatchment15S: Runoff Area=0.660 ac 0.00% Impervious Runoff Depth>0.49"
Flow Length=854' Tc=7.7 min CN=67 Runoff=0.45 cfs 0.027 af

Subcatchment16S: Runoff Area=1.546 ac 0.00% Impervious Runoff Depth>1.16"
Flow Length=122' Slope=0.0800 '/' Tc=6.2 min CN=81 Runoff=3.11 cfs 0.149 af

SubcatchmentNP: Runoff Area=2.070 ac 83.57% Impervious Runoff Depth>2.35"
Tc=6.0 min CN=96 Runoff=7.63 cfs 0.406 af

Reach 1R: Gabion Downchute Avg. Flow Depth=0.42' Max Vel=13.56 fps Inflow=17.26 cfs 1.074 af
n=0.030 L=260.0' S=0.3308 '/' Capacity=105.82 cfs Outflow=17.06 cfs 1.073 af

Reach 2R: North Channel - 3 Avg. Flow Depth=0.90' Max Vel=5.35 fps Inflow=18.56 cfs 1.205 af
n=0.028 L=457.0' S=0.0219 '/' Capacity=100.17 cfs Outflow=17.96 cfs 1.202 af

Reach 3R: Avg. Flow Depth=0.25' Max Vel=4.95 fps Inflow=3.11 cfs 0.149 af
n=0.028 L=348.0' S=0.0747 '/' Capacity=185.10 cfs Outflow=2.93 cfs 0.149 af

Reach 4R: North Channel - 1 Avg. Flow Depth=1.03' Max Vel=3.91 fps Inflow=18.83 cfs 1.089 af
n=0.028 L=1,200.0' S=0.0100 '/' Capacity=67.72 cfs Outflow=15.97 cfs 1.081 af

Reach 5R: North Channel - 2 Avg. Flow Depth=0.70' Max Vel=8.56 fps Inflow=20.36 cfs 1.598 af
n=0.028 L=850.0' S=0.0729 '/' Capacity=182.89 cfs Outflow=20.00 cfs 1.594 af

Reach 6R: Avg. Flow Depth=0.93' Max Vel=3.85 fps Inflow=13.98 cfs 0.917 af
n=0.028 L=185.0' S=0.0108 '/' Capacity=70.41 cfs Outflow=13.68 cfs 0.916 af

Reach 7R: MSE Berm Swale Avg. Flow Depth=0.14' Max Vel=1.67 fps Inflow=0.45 cfs 0.027 af
n=0.028 L=850.0' S=0.0188 '/' Capacity=14.63 cfs Outflow=0.29 cfs 0.026 af

Pond 1P: Drop Inlet 1 Peak Elev=203.22' Inflow=32.08 cfs 2.510 af
36.0" Round Culvert n=0.013 L=65.0' S=0.0092 '/' Outflow=32.08 cfs 2.510 af

Pond 2P: Drop Inlet Structure Peak Elev=187.63' Inflow=2.93 cfs 0.149 af
36.0" Round Culvert n=0.011 L=36.0' S=0.0500 '/' Outflow=2.93 cfs 0.149 af

Pond 3P: Stormwater Manhole Peak Elev=181.08' Inflow=19.84 cfs 1.352 af
Primary=19.84 cfs 1.352 af Secondary=0.00 cfs 0.000 af Outflow=19.84 cfs 1.352 af

Pond 8P: Drop Inlet Structure Peak Elev=188.68' Inflow=17.96 cfs 1.202 af
36.0" Round Culvert n=0.011 L=80.0' S=0.0500 '/' Outflow=17.96 cfs 1.202 af

Pond 26P: North Pond Peak Elev=151.81' Storage=133,473 cf Inflow=53.37 cfs 4.294 af
Discarded=1.38 cfs 1.312 af Primary=0.00 cfs 0.000 af Outflow=1.38 cfs 1.312 af

Total Runoff Area = 44.915 ac Runoff Volume = 4.312 af Average Runoff Depth = 1.15"
96.15% Pervious = 43.185 ac 3.85% Impervious = 1.730 ac

Summary for Subcatchment 8S:

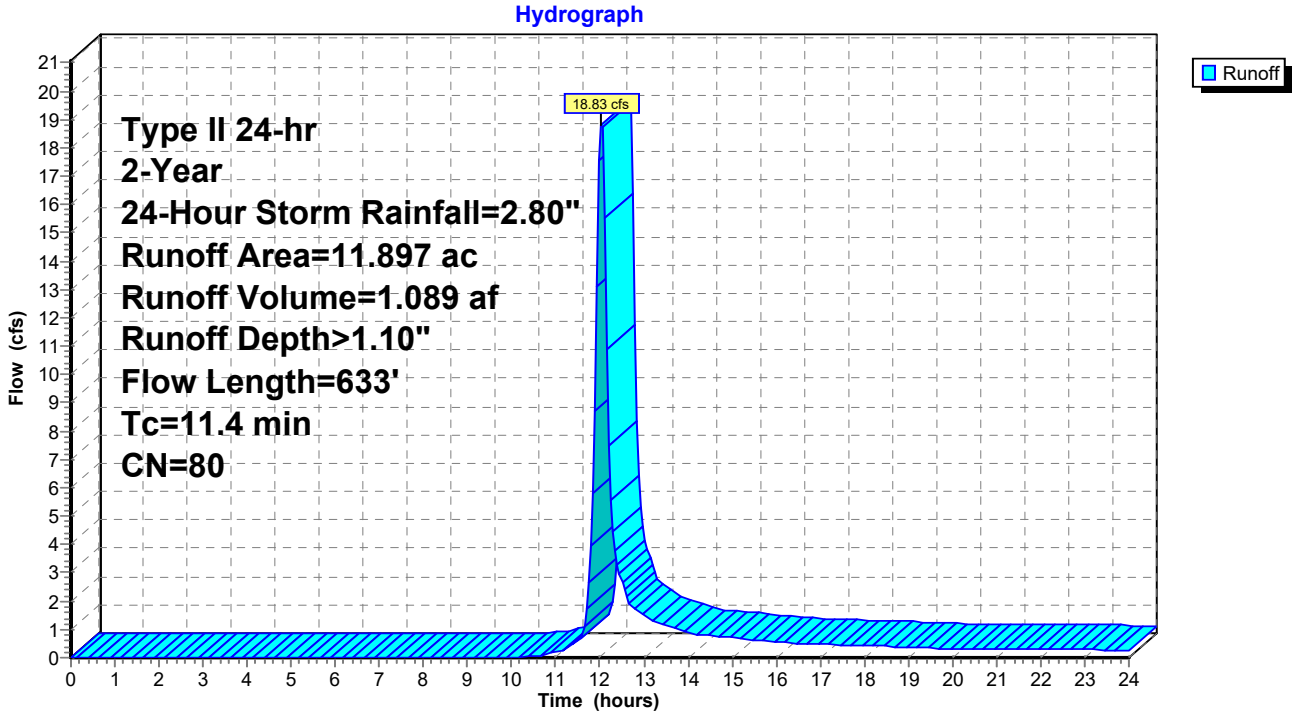
Runoff = 18.83 cfs @ 12.04 hrs, Volume= 1.089 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	11.340	80	Cap
	0.557	85	Gravel roads, HSG B
	11.897	80	Weighted Average
	11.897		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
0.4	182	0.0250	7.37	41.47	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=7.50' n= 0.025
11.4	633	Total			

Subcatchment 8S:



Summary for Subcatchment 9S:

[47] Hint: Peak is 292% of capacity of segment #3

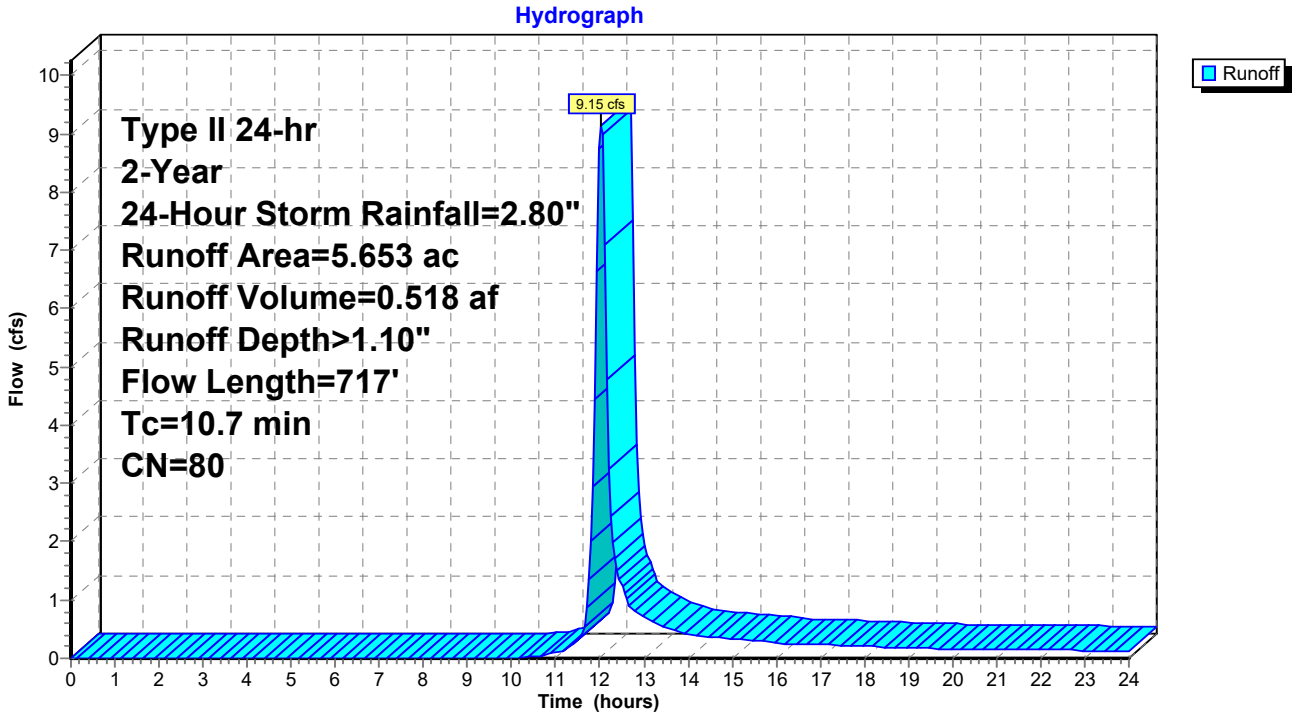
Runoff = 9.15 cfs @ 12.03 hrs, Volume= 0.518 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	5.113	80	Cap
	0.540	85	Gravel roads, HSG B
	5.653	80	Weighted Average
	5.653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
2.0	191	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
1.4	406	0.0500	5.01	3.13	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.025
0.0	20	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Let-Down Channel 1** Bot.W=3.00' D=1.50' n= 0.040
10.7	717	Total			

Subcatchment 9S:



Summary for Subcatchment 10S:

[47] Hint: Peak is 716% of capacity of segment #4

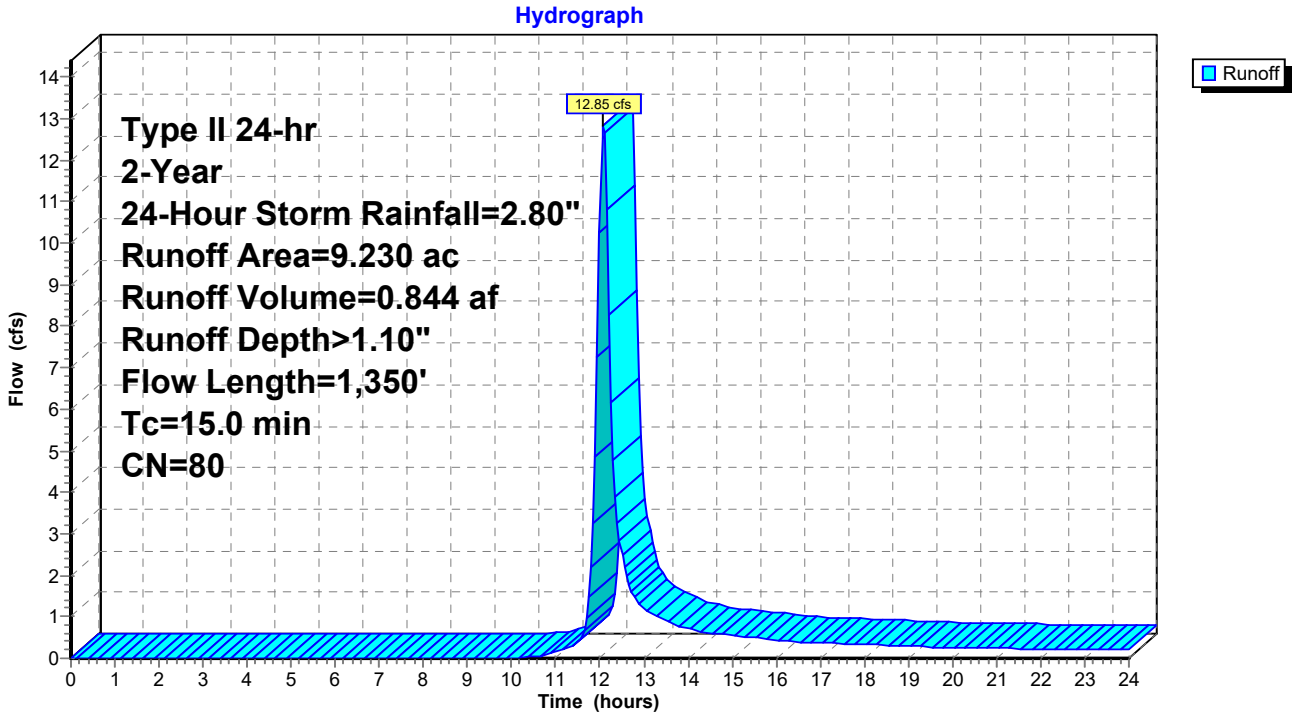
Runoff = 12.85 cfs @ 12.08 hrs, Volume= 0.844 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	9.230	80	Cap
	9.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
5.2	488	0.0500	1.57		**Shallow Concentrated Flow, Section 1** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	280	0.0400	2.87	1.80	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.039
0.2	222	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Gabion Downchute** Bot.W=3.00' D=1.50' n= 0.040
0.4	190	0.0210	7.63	91.59	**Trap/Vee/Rect Channel Flow, North Channel** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.030
15.0	1,350	Total			

Subcatchment 10S:



Summary for Subcatchment 11S:

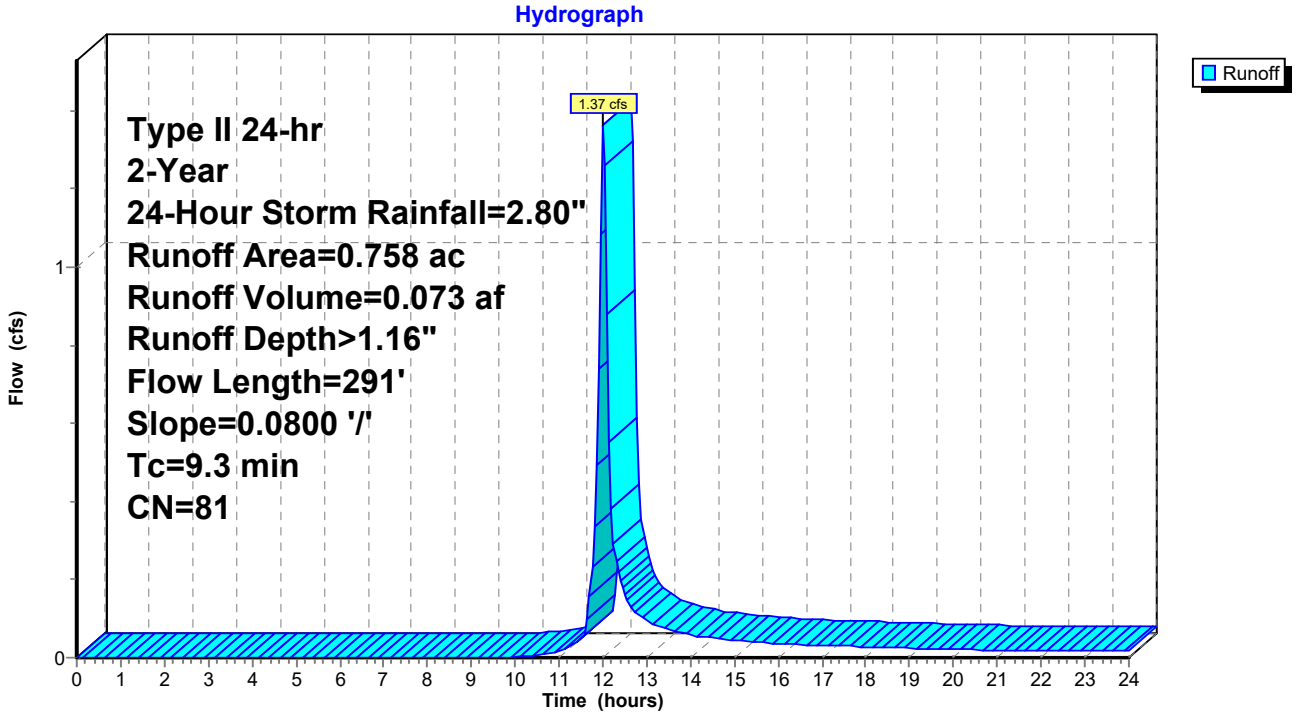
Runoff = 1.37 cfs @ 12.01 hrs, Volume= 0.073 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	0.576	80	CAP
	0.182	85	Gravel roads, HSG B
	0.758	81	Weighted Average
	0.758		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0800	0.19		**Sheet Flow, MSE Exterior Slope** Grass: Dense n= 0.240 P2= 2.80"
0.2	20	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	171	0.0800	9.56	14.34	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
9.3	291	Total			

Subcatchment 11S:



Summary for Subcatchment 12S:

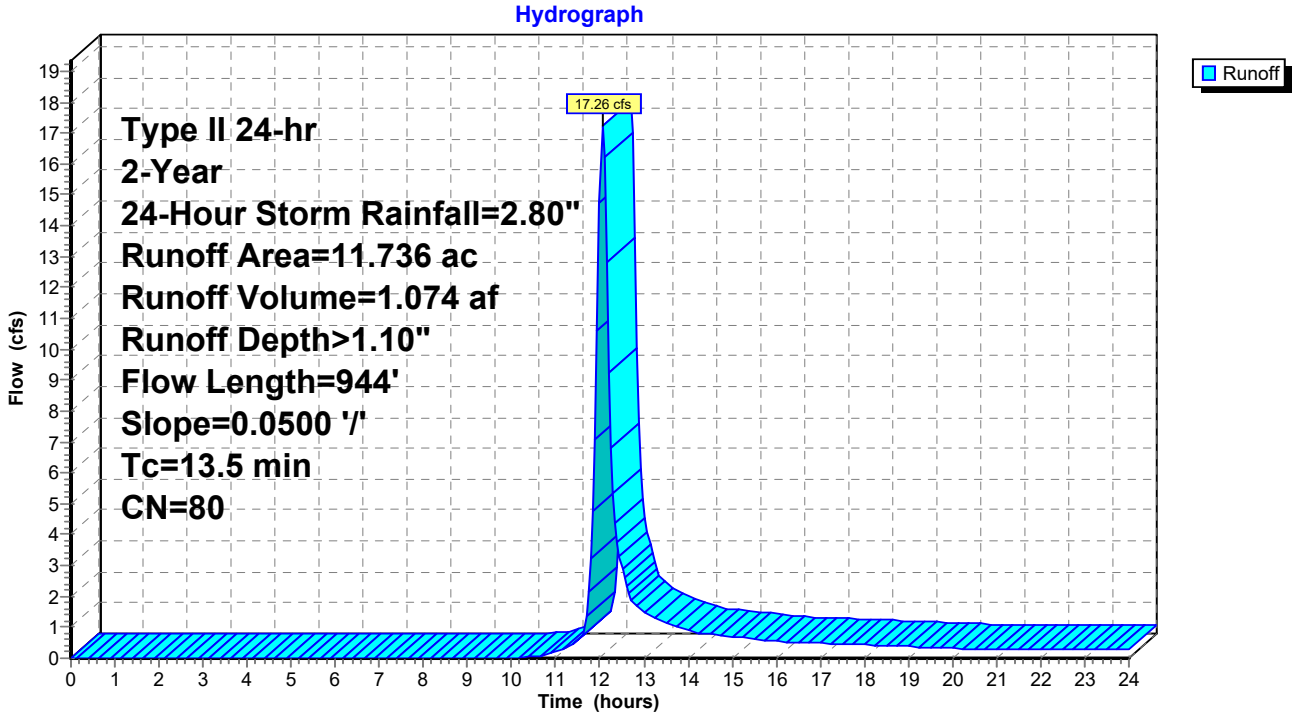
Runoff = 17.26 cfs @ 12.06 hrs, Volume= 1.074 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	11.736	80	
	11.736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Plateau** Grass: Short n= 0.150 P2= 2.80"
3.8	359	0.0500	1.57		**Shallow Concentrated Flow, Plateau** Short Grass Pasture Kv= 7.0 fps
2.4	485	0.0500	3.35		**Shallow Concentrated Flow, Sideslope Berm** Grassed Waterway Kv= 15.0 fps
13.5	944	Total			

Subcatchment 12S:



Summary for Subcatchment 13S:

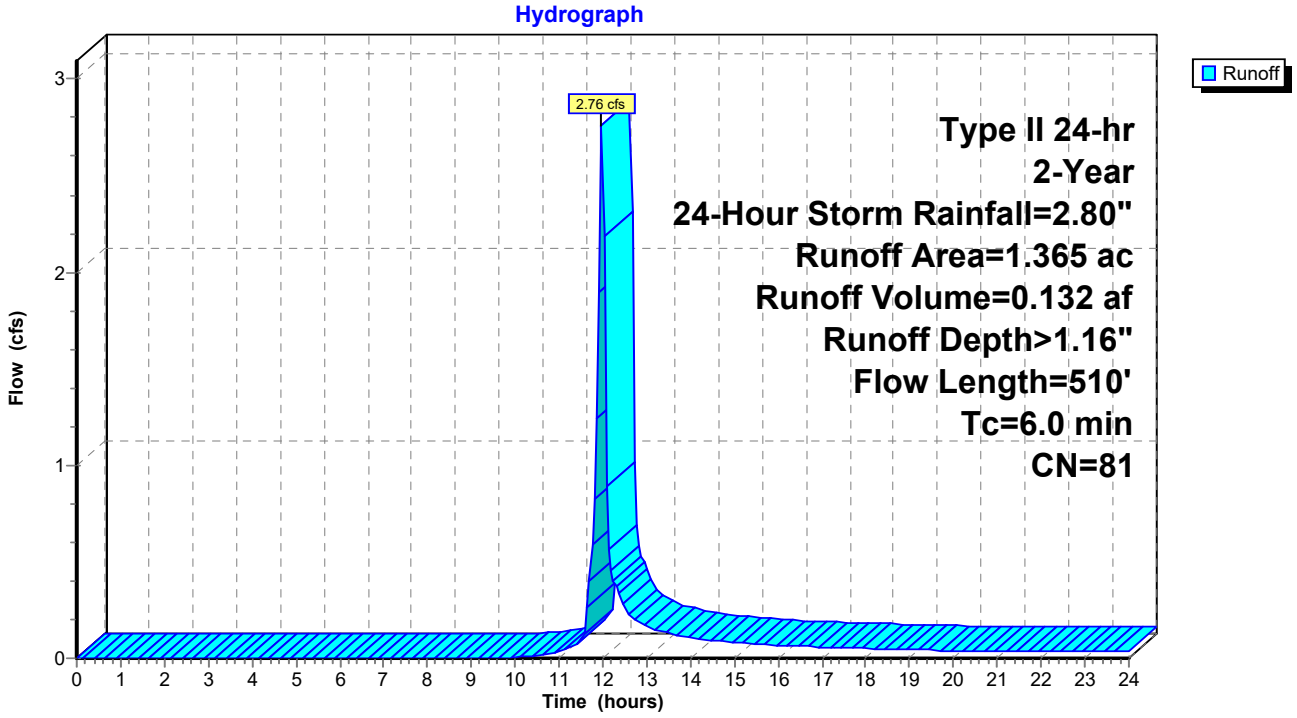
Runoff = 2.76 cfs @ 11.98 hrs, Volume= 0.132 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	1.080	80	Cap
*	0.285	85	Gravel Road
	1.365	81	Weighted Average
	1.365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	50	0.3300	0.43		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.0	460	0.0300	2.60		**Shallow Concentrated Flow, Perimeter Swale** Grassed Waterway Kv= 15.0 fps
5.0	510	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 13S:



Summary for Subcatchment 15S:

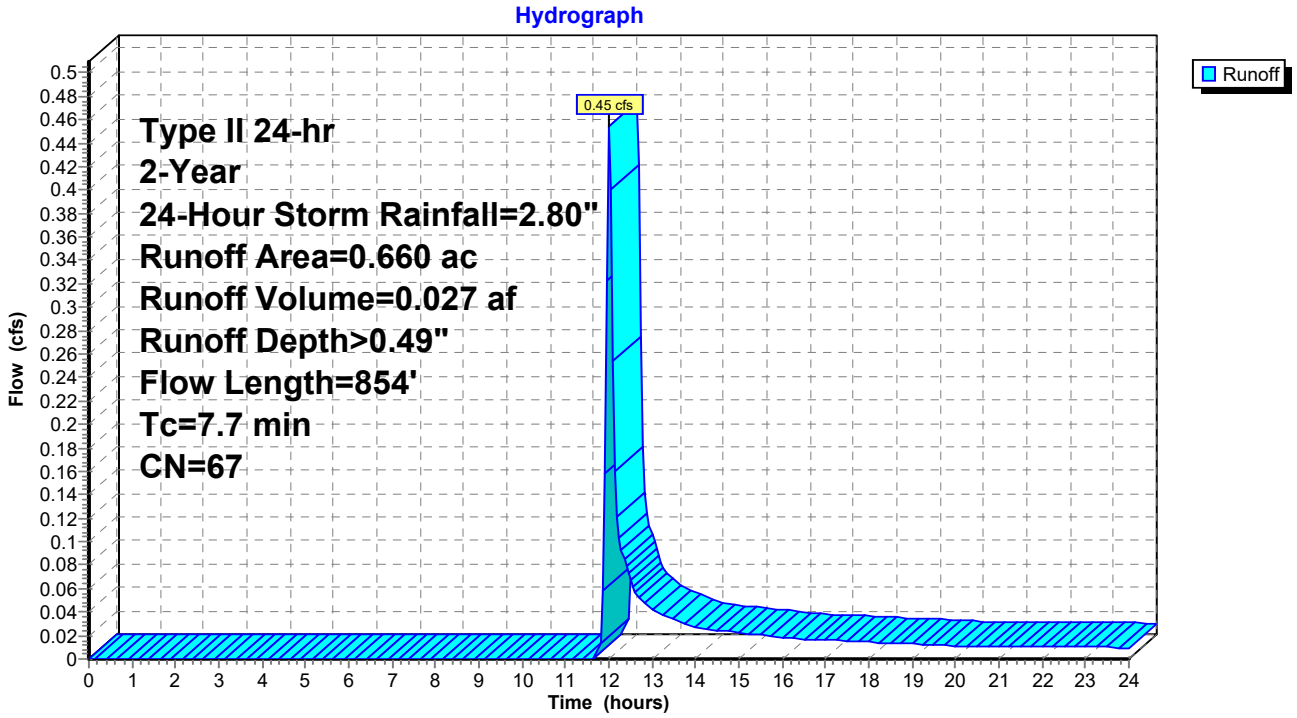
Runoff = 0.45 cfs @ 12.01 hrs, Volume= 0.027 af, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	0.660	67	Vegetation (Hyd. Group B)
	0.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	29	0.0330	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
4.5	825	0.0100	3.09	3.09	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.022 Earth, clean & straight
7.7	854	Total			

Subcatchment 15S:



Summary for Subcatchment 16S:

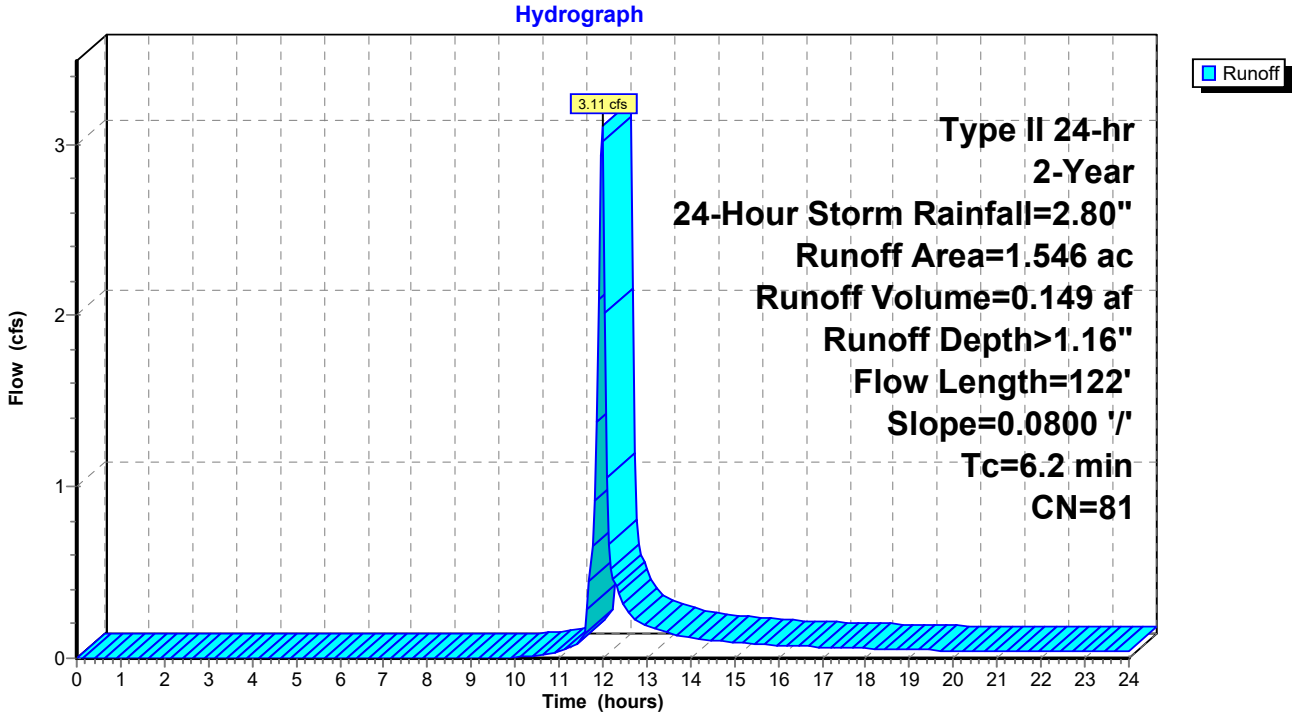
Runoff = 3.11 cfs @ 11.98 hrs, Volume= 0.149 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	1.224	80	Cap
*	0.322	85	Gravel Road
	1.546	81	Weighted Average
	1.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0800	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
0.2	22	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.2	122	Total			

Subcatchment 16S:



Summary for Subcatchment NP:

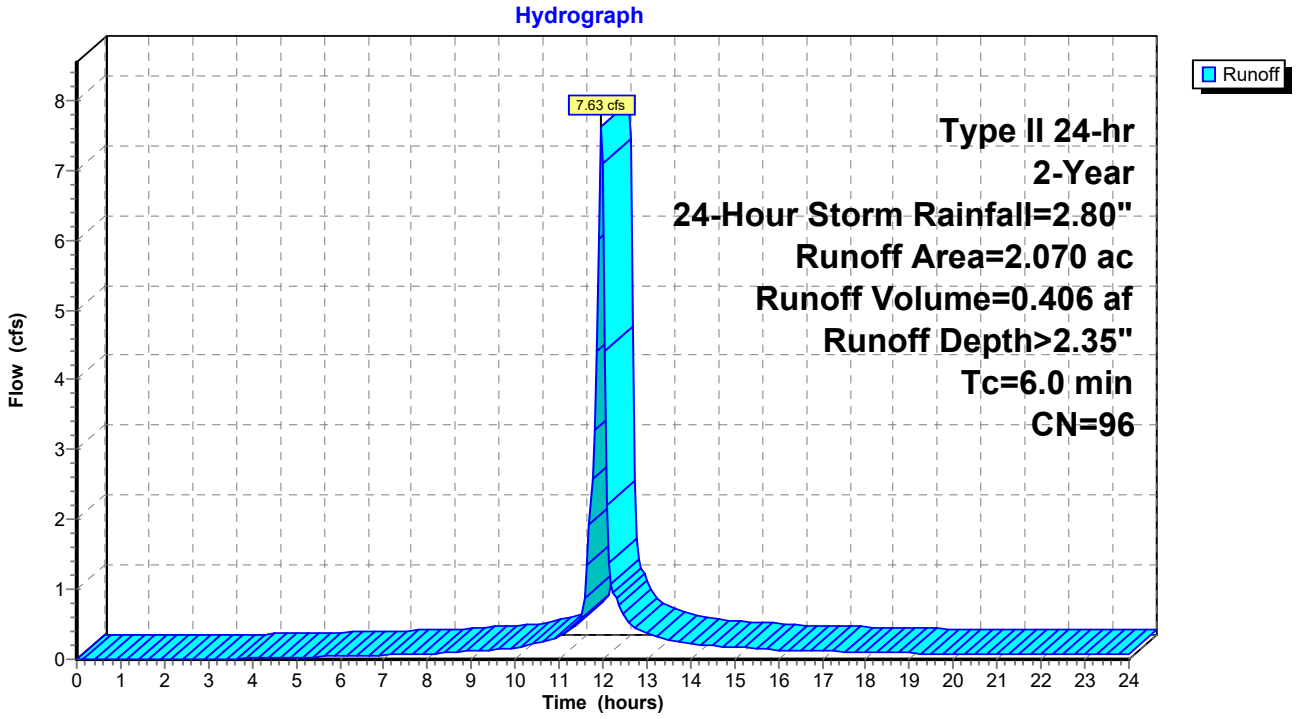
Runoff = 7.63 cfs @ 11.96 hrs, Volume= 0.406 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year, 24-Hour Storm Rainfall=2.80"

	Area (ac)	CN	Description
*	1.730	98	Basin
*	0.340	85	Gravel Road
	2.070	96	Weighted Average
	0.340		16.43% Pervious Area
	1.730		83.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					**Direct Entry,**
1.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment NP:



Summary for Reach 1R: Gabion Downchute

Mannings from Figure 5B.11 Determing "n" for Riprap Lined Channel Using Depth of Flow

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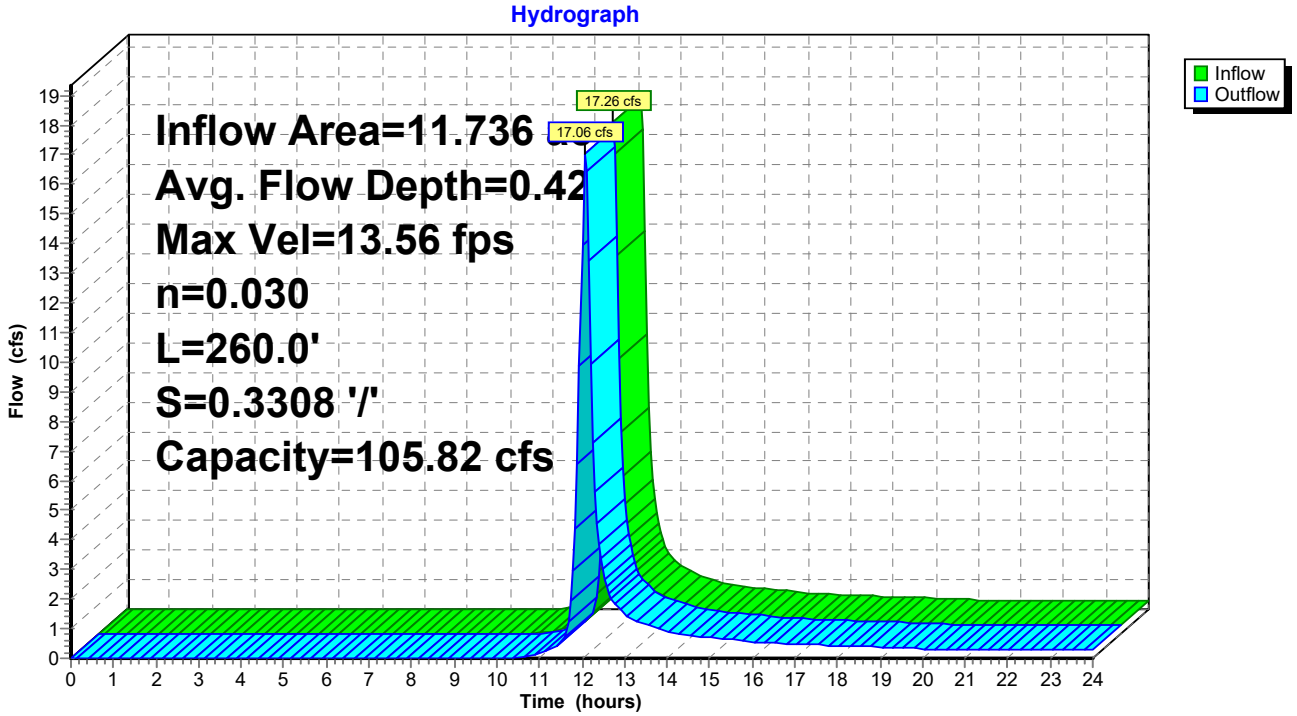
Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year, 24-Hour Storm event
Inflow = 17.26 cfs @ 12.06 hrs, Volume= 1.074 af
Outflow = 17.06 cfs @ 12.07 hrs, Volume= 1.073 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.56 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.83 fps, Avg. Travel Time= 1.1 min

Peak Storage= 330 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 3.00'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 105.82 cfs

3.00' x 1.50' deep channel, n= 0.030
Length= 260.0' Slope= 0.3308 '/'
Inlet Invert= 290.00', Outlet Invert= 204.00'

Reach 1R: Gabion Downchute



Summary for Reach 2R: North Channel - 3

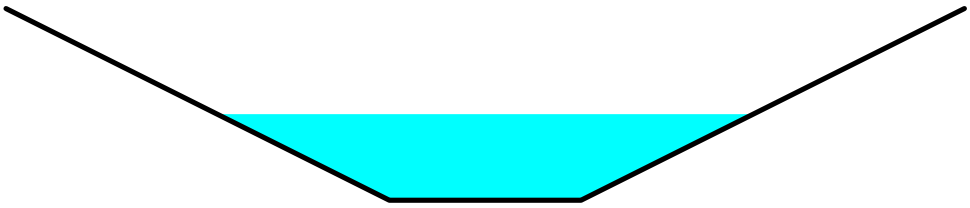
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.48' @ 12.10 hrs

Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year, 24-Hour Storm event
Inflow = 18.56 cfs @ 12.06 hrs, Volume= 1.205 af
Outflow = 17.96 cfs @ 12.10 hrs, Volume= 1.202 af, Atten= 3%, Lag= 2.6 min

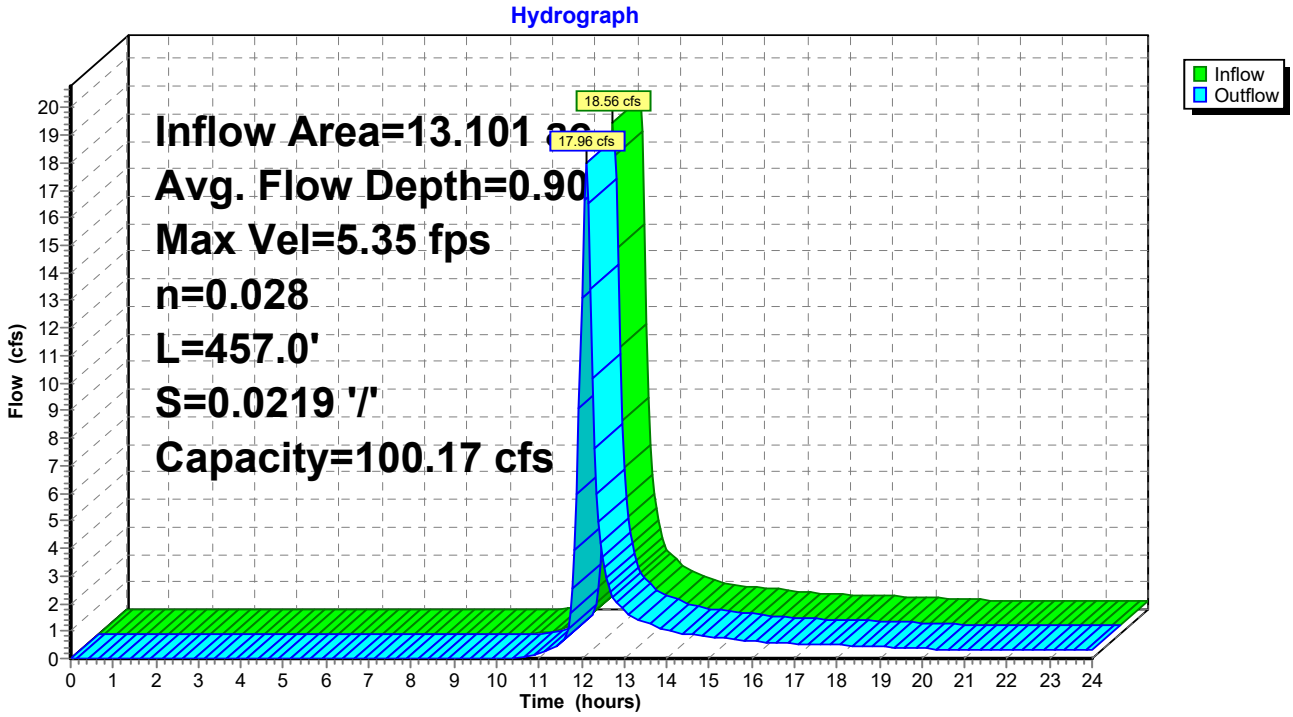
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.35 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 4.0 min

Peak Storage= 1,559 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.90' , Surface Width= 5.60'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 100.17 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 457.0' Slope= 0.0219 '/'
Inlet Invert= 204.00', Outlet Invert= 194.00'



Reach 2R: North Channel - 3



Summary for Reach 3R:

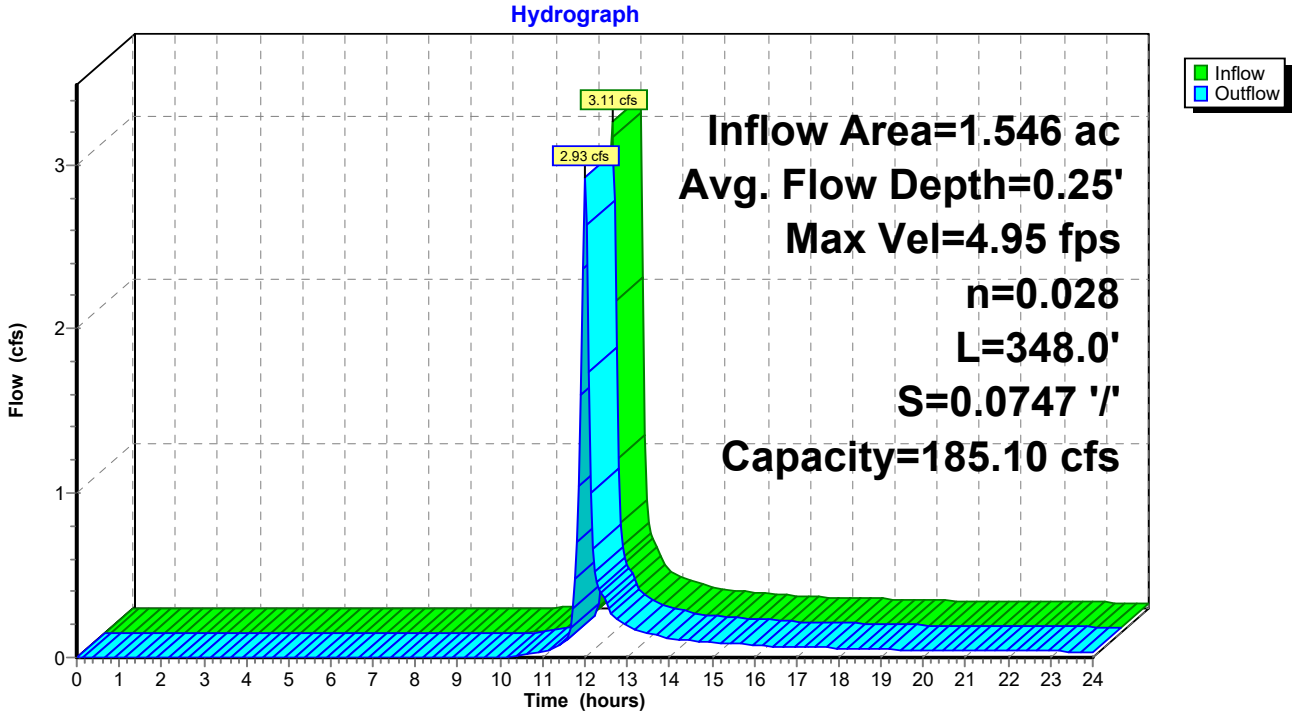
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 1.16" for 2-Year, 24-Hour Storm event
Inflow = 3.11 cfs @ 11.98 hrs, Volume= 0.149 af
Outflow = 2.93 cfs @ 12.01 hrs, Volume= 0.149 af, Atten= 6%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.95 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 4.2 min

Peak Storage= 216 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.25' , Surface Width= 2.99'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 185.10 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 348.0' Slope= 0.0747 '/'
Inlet Invert= 220.00', Outlet Invert= 194.00'

Reach 3R:



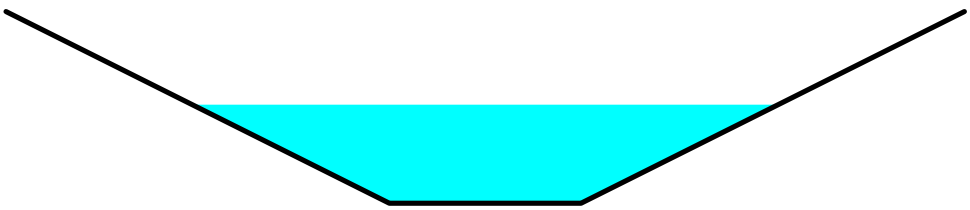
Summary for Reach 4R: North Channel - 1

Inflow Area = 11.897 ac, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year, 24-Hour Storm event
Inflow = 18.83 cfs @ 12.04 hrs, Volume= 1.089 af
Outflow = 15.97 cfs @ 12.18 hrs, Volume= 1.081 af, Atten= 15%, Lag= 8.5 min

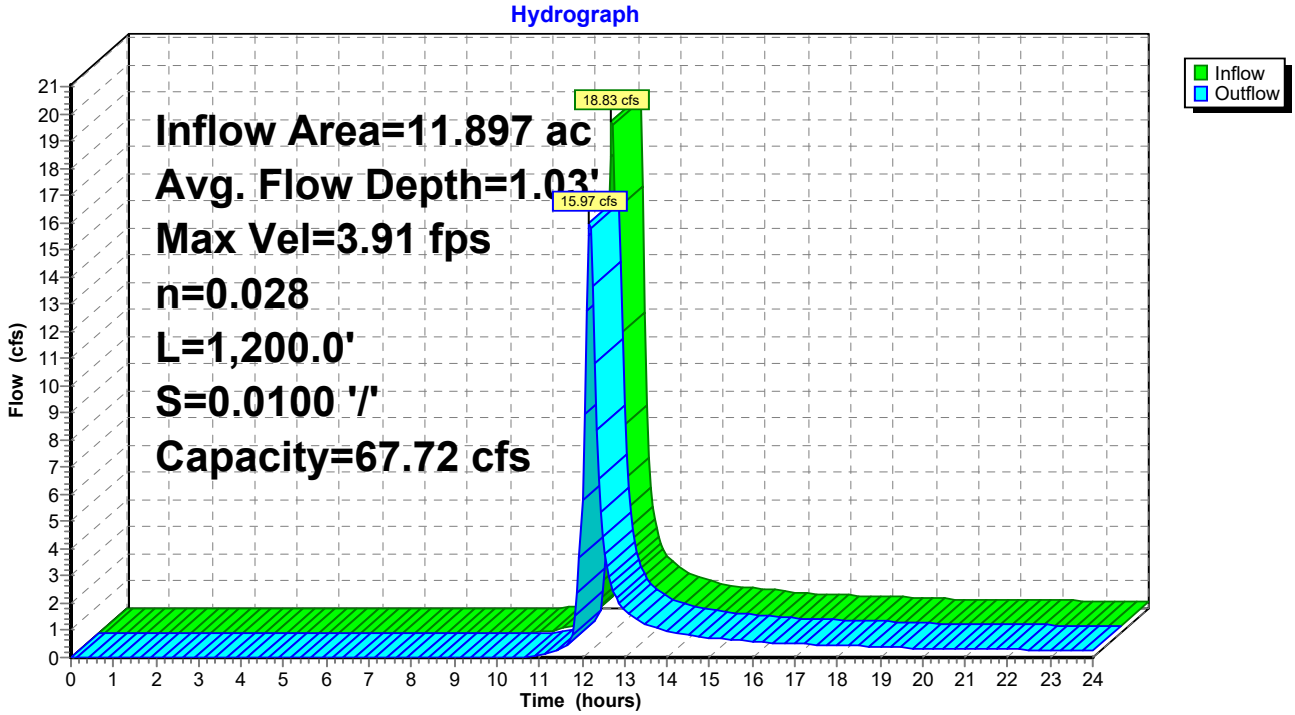
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.91 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 1.42 fps, Avg. Travel Time= 14.1 min

Peak Storage= 5,009 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.03' , Surface Width= 6.12'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.72 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,200.0' Slope= 0.0100 '/'
Inlet Invert= 290.00', Outlet Invert= 278.00'



Reach 4R: North Channel - 1



Summary for Reach 5R: North Channel - 2

[61] Hint: Exceeded Reach 4R outlet invert by 0.70' @ 12.15 hrs

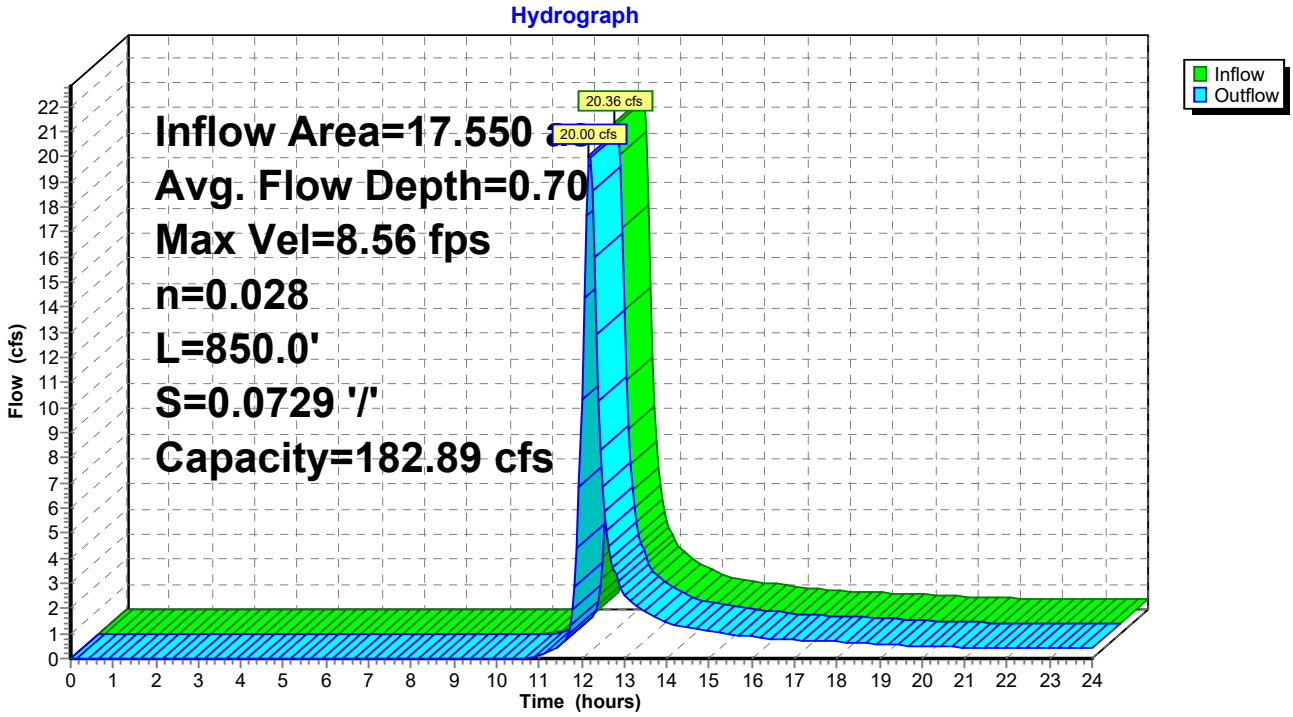
Inflow Area = 17.550 ac, 0.00% Impervious, Inflow Depth > 1.09" for 2-Year, 24-Hour Storm event
Inflow = 20.36 cfs @ 12.14 hrs, Volume= 1.598 af
Outflow = 20.00 cfs @ 12.19 hrs, Volume= 1.594 af, Atten= 2%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.56 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 3.14 fps, Avg. Travel Time= 4.5 min

Peak Storage= 2,005 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.70' , Surface Width= 4.78'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 182.89 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 850.0' Slope= 0.0729 '/'
Inlet Invert= 278.00', Outlet Invert= 216.00'

Reach 5R: North Channel - 2



Summary for Reach 6R:

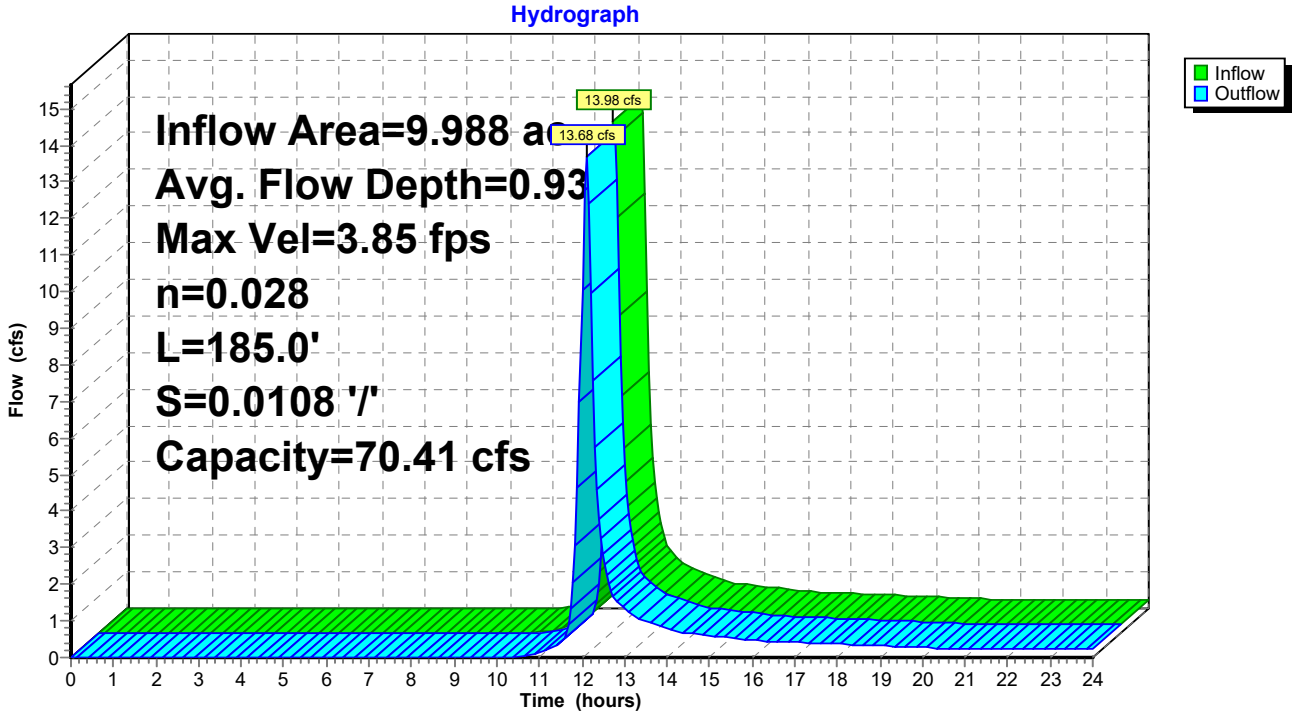
Inflow Area = 9.988 ac, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year, 24-Hour Storm event
Inflow = 13.98 cfs @ 12.07 hrs, Volume= 0.917 af
Outflow = 13.68 cfs @ 12.10 hrs, Volume= 0.916 af, Atten= 2%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.85 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 2.3 min

Peak Storage= 667 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.93' , Surface Width= 5.73'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 70.41 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 185.0' Slope= 0.0108 '/'
Inlet Invert= 218.00', Outlet Invert= 216.00'

Reach 6R:



Summary for Reach 7R: MSE Berm Swale

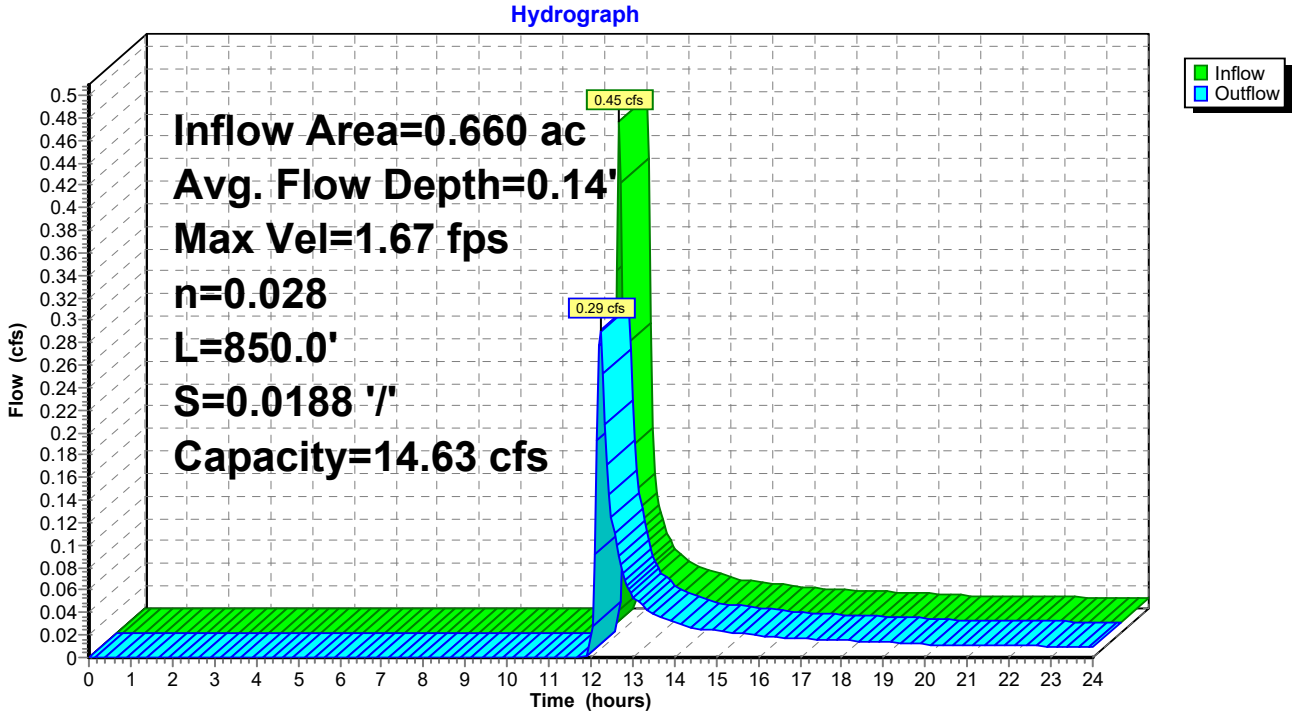
Inflow Area = 0.660 ac, 0.00% Impervious, Inflow Depth > 0.49" for 2-Year, 24-Hour Storm event
Inflow = 0.45 cfs @ 12.01 hrs, Volume= 0.027 af
Outflow = 0.29 cfs @ 12.24 hrs, Volume= 0.026 af, Atten= 36%, Lag= 13.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.67 fps, Min. Travel Time= 8.5 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 21.7 min

Peak Storage= 151 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.14' , Surface Width= 1.55'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 14.63 cfs

1.00' x 1.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 216.00', Outlet Invert= 200.00'

Reach 7R: MSE Berm Swale



Summary for Pond 1P: Drop Inlet 1

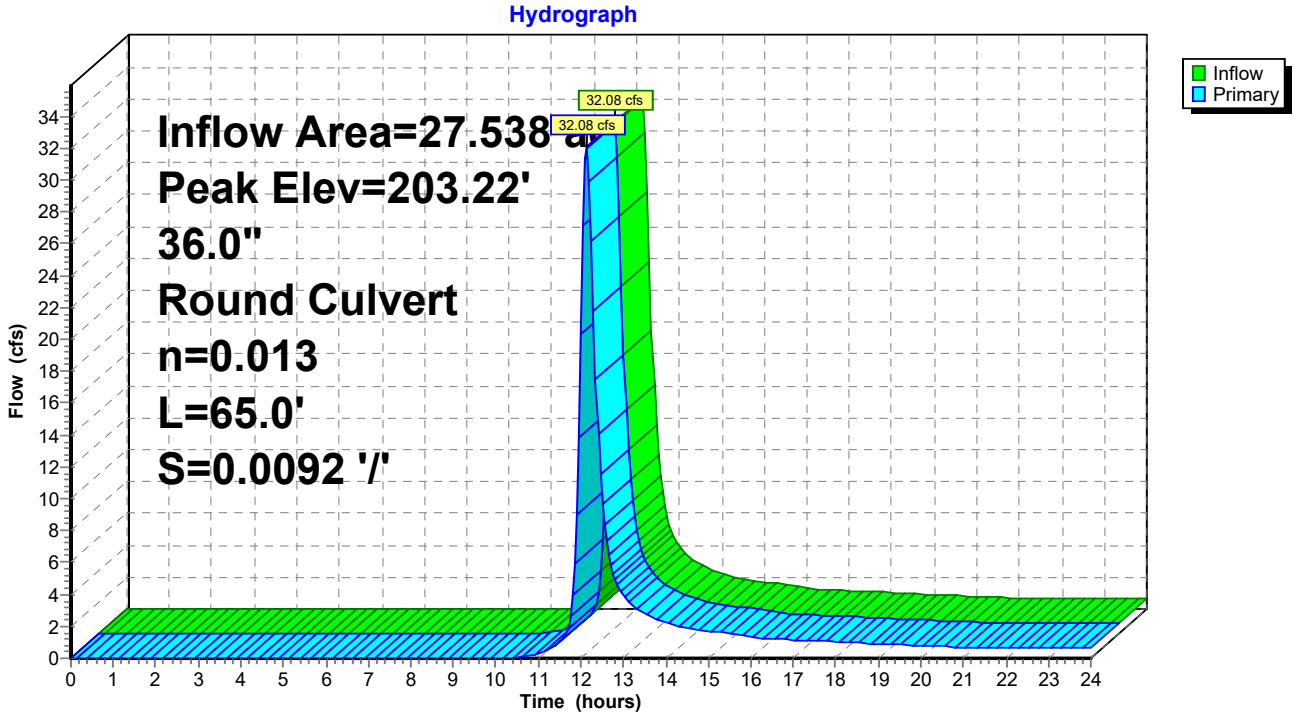
Inflow Area = 27.538 ac, 0.00% Impervious, Inflow Depth > 1.09" for 2-Year, 24-Hour Storm event
Inflow = 32.08 cfs @ 12.14 hrs, Volume= 2.510 af
Outflow = 32.08 cfs @ 12.14 hrs, Volume= 2.510 af, Atten= 0%, Lag= 0.0 min
Primary = 32.08 cfs @ 12.14 hrs, Volume= 2.510 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 203.22' @ 12.14 hrs
Flood Elev= 220.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	200.60'	**36.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 200.60' / 200.00' S= 0.0092 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=31.81 cfs @ 12.14 hrs HW=203.20' (Free Discharge)
└**1=Culvert** (Barrel Controls 31.81 cfs @ 6.53 fps)

Pond 1P: Drop Inlet 1



Summary for Pond 2P: Drop Inlet Structure

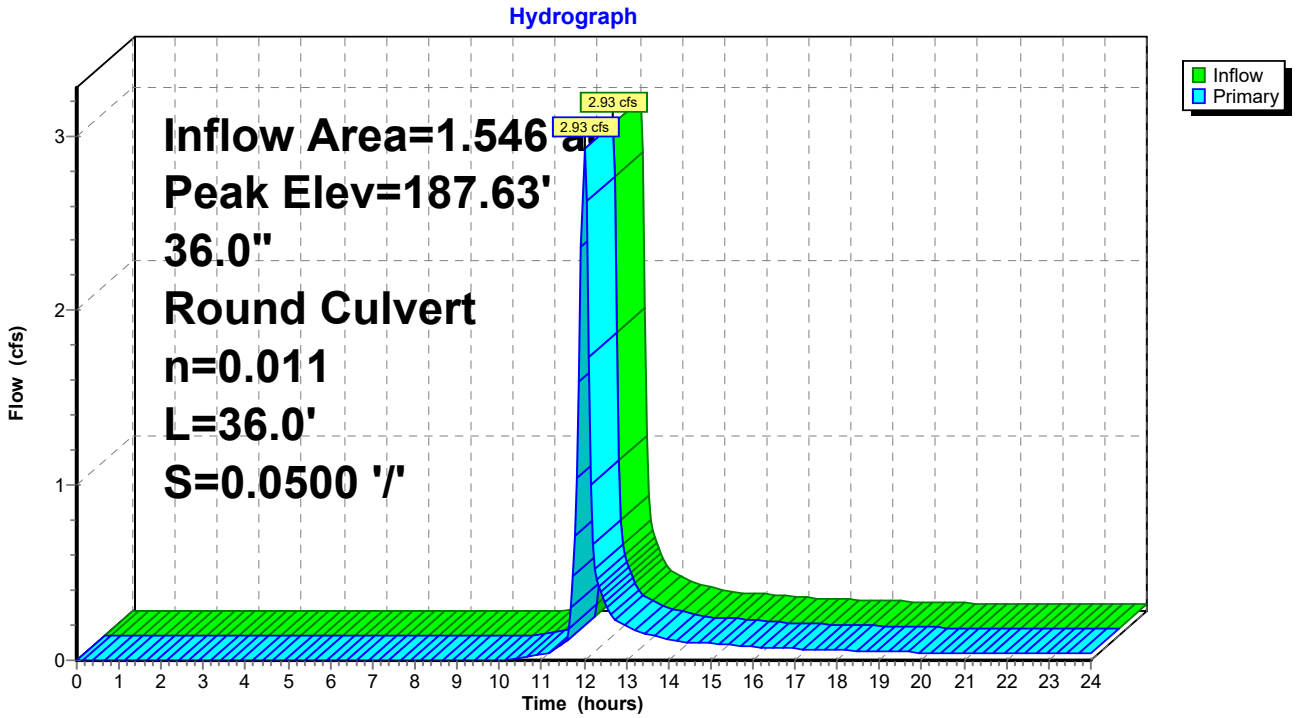
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 1.16" for 2-Year, 24-Hour Storm event
Inflow = 2.93 cfs @ 12.01 hrs, Volume= 0.149 af
Outflow = 2.93 cfs @ 12.01 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
Primary = 2.93 cfs @ 12.01 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 187.63' @ 12.01 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round 36" HDPE Pipe** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 185.20' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=2.87 cfs @ 12.01 hrs HW=187.62' (Free Discharge)
└─**1=36" HDPE Pipe** (Inlet Controls 2.87 cfs @ 2.69 fps)

Pond 2P: Drop Inlet Structure



Summary for Pond 3P: Stormwater Manhole

Inflow Area = 14.647 ac, 0.00% Impervious, Inflow Depth > 1.11" for 2-Year, 24-Hour Storm event
Inflow = 19.84 cfs @ 12.08 hrs, Volume= 1.352 af
Outflow = 19.84 cfs @ 12.08 hrs, Volume= 1.352 af, Atten= 0%, Lag= 0.0 min
Primary = 19.84 cfs @ 12.08 hrs, Volume= 1.352 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

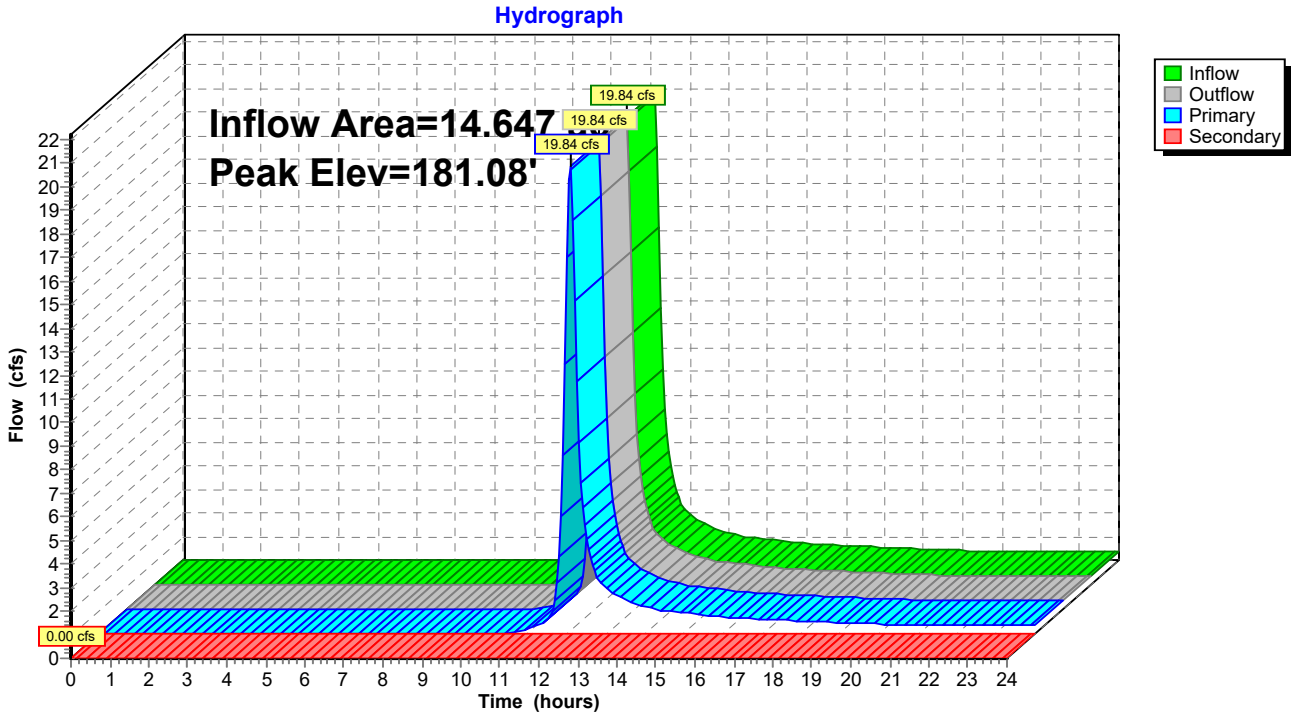
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 181.08' @ 12.08 hrs
Flood Elev= 188.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.30'	**36.0" Round 36" HDPE Pipe** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.30' / 177.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Secondary	196.00'	**6.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=19.54 cfs @ 12.08 hrs HW=181.06' (Free Discharge)
└─**1=36" HDPE Pipe** (Inlet Controls 19.54 cfs @ 4.52 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=179.30' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Stormwater Manhole



Summary for Pond 8P: Drop Inlet Structure

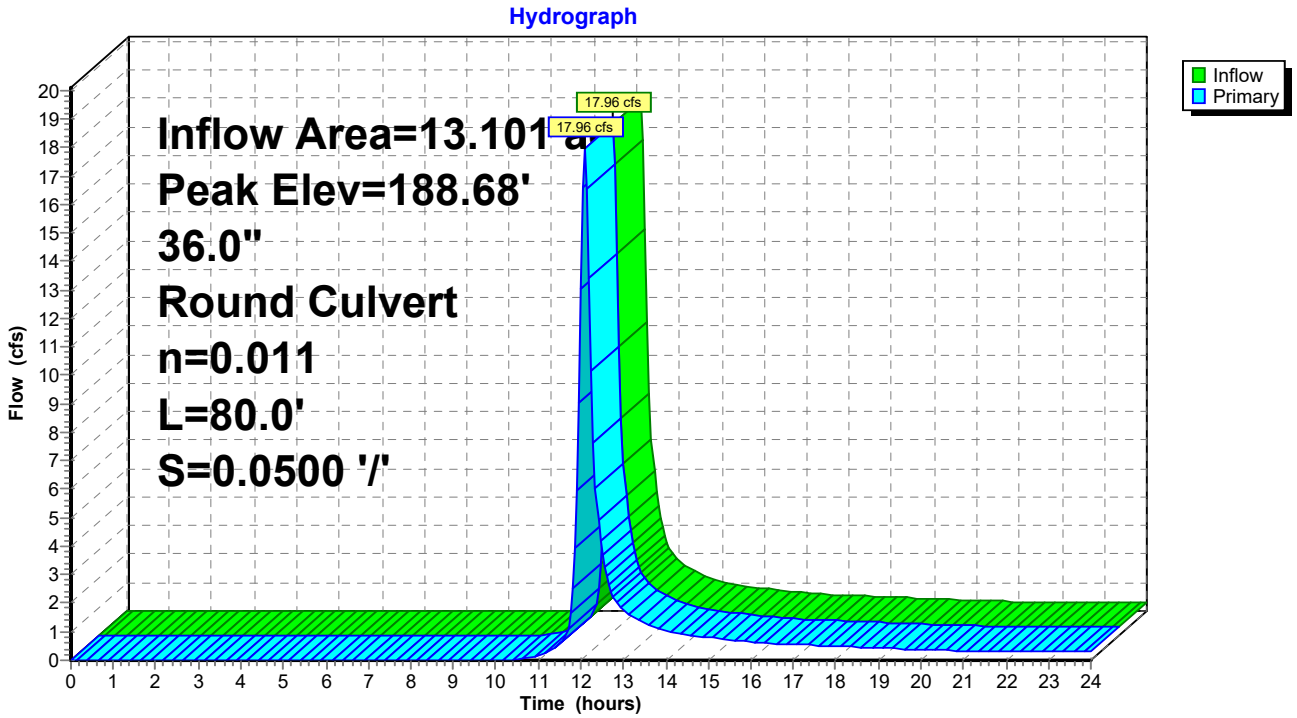
Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year, 24-Hour Storm event
Inflow = 17.96 cfs @ 12.10 hrs, Volume= 1.202 af
Outflow = 17.96 cfs @ 12.10 hrs, Volume= 1.202 af, Atten= 0%, Lag= 0.0 min
Primary = 17.96 cfs @ 12.10 hrs, Volume= 1.202 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 188.68' @ 12.10 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round Culvert** L= 80.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 183.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=17.94 cfs @ 12.10 hrs HW=188.68' (Free Discharge)
└**1=Culvert** (Inlet Controls 17.94 cfs @ 4.41 fps)

Pond 8P: Drop Inlet Structure



Summary for Pond 26P: North Pond

Inflow Area = 44.915 ac, 3.85% Impervious, Inflow Depth > 1.15" for 2-Year, 24-Hour Storm event
Inflow = 53.37 cfs @ 12.10 hrs, Volume= 4.294 af
Outflow = 1.38 cfs @ 19.45 hrs, Volume= 1.312 af, Atten= 97%, Lag= 441.2 min
Discarded = 1.38 cfs @ 19.45 hrs, Volume= 1.312 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 151.81' @ 19.45 hrs Surf.Area= 17,623 sf Storage= 133,473 cf

Plug-Flow detention time= 379.8 min calculated for 1.309 af (30% of inflow)
Center-of-Mass det. time= 241.1 min (1,089.6 - 848.5)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	731,085 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

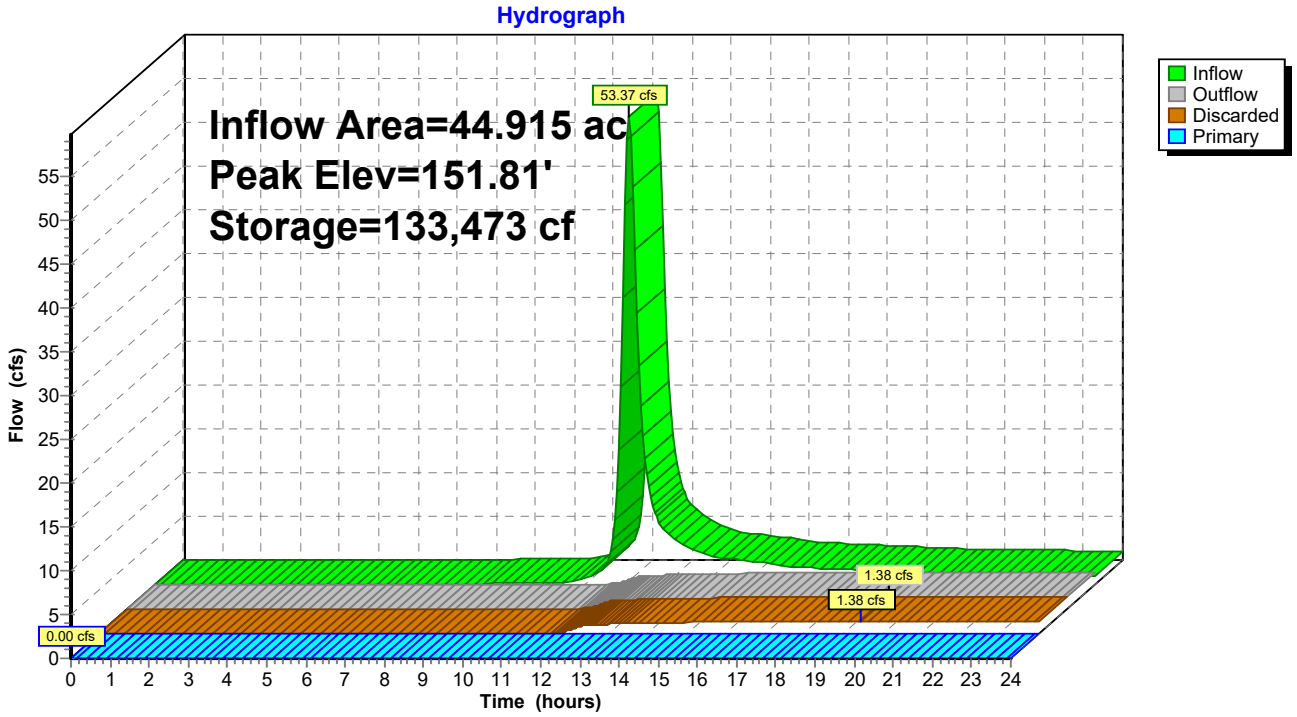
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	5,675	0	0
150.00	15,091	103,830	103,830
160.00	29,062	220,765	324,595
170.00	52,236	406,490	731,085

Device	Routing	Invert	Outlet Devices
#1	Discarded	140.00'	**5.000 in/hr Exfiltration over Horizontal area above 140.00'** Excluded Horizontal area = 5,675 sf
#2	Primary	167.00'	**17.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=1.38 cfs @ 19.45 hrs HW=151.81' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.38 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: North Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment8S: Runoff Area=11.897 ac 0.00% Impervious Runoff Depth>2.24"
Flow Length=633' Tc=11.4 min CN=80 Runoff=38.71 cfs 2.225 af

Subcatchment9S: Runoff Area=5.653 ac 0.00% Impervious Runoff Depth>2.24"
Flow Length=717' Tc=10.7 min CN=80 Runoff=18.75 cfs 1.057 af

Subcatchment10S: Runoff Area=9.230 ac 0.00% Impervious Runoff Depth>2.24"
Flow Length=1,350' Tc=15.0 min CN=80 Runoff=26.67 cfs 1.724 af

Subcatchment11S: Runoff Area=0.758 ac 0.00% Impervious Runoff Depth>2.33"
Flow Length=291' Slope=0.0800 '/' Tc=9.3 min CN=81 Runoff=2.75 cfs 0.147 af

Subcatchment12S: Runoff Area=11.736 ac 0.00% Impervious Runoff Depth>2.24"
Flow Length=944' Slope=0.0500 '/' Tc=13.5 min CN=80 Runoff=35.68 cfs 2.193 af

Subcatchment13S: Runoff Area=1.365 ac 0.00% Impervious Runoff Depth>2.33"
Flow Length=510' Tc=6.0 min CN=81 Runoff=5.46 cfs 0.265 af

Subcatchment15S: Runoff Area=0.660 ac 0.00% Impervious Runoff Depth>1.30"
Flow Length=854' Tc=7.7 min CN=67 Runoff=1.39 cfs 0.071 af

Subcatchment16S: Runoff Area=1.546 ac 0.00% Impervious Runoff Depth>2.33"
Flow Length=122' Slope=0.0800 '/' Tc=6.2 min CN=81 Runoff=6.13 cfs 0.300 af

SubcatchmentNP: Runoff Area=2.070 ac 83.57% Impervious Runoff Depth>3.78"
Tc=6.0 min CN=96 Runoff=11.92 cfs 0.653 af

Reach 1R: Gabion Downchute Avg. Flow Depth=0.69' Max Vel=17.25 fps Inflow=35.68 cfs 2.193 af
n=0.030 L=260.0' S=0.3308 '/' Capacity=105.82 cfs Outflow=35.37 cfs 2.192 af

Reach 2R: North Channel - 3 Avg. Flow Depth=1.28' Max Vel=6.51 fps Inflow=38.51 cfs 2.458 af
n=0.028 L=457.0' S=0.0219 '/' Capacity=100.17 cfs Outflow=37.39 cfs 2.454 af

Reach 3R: Avg. Flow Depth=0.37' Max Vel=6.11 fps Inflow=6.13 cfs 0.300 af
n=0.028 L=348.0' S=0.0747 '/' Capacity=185.10 cfs Outflow=5.92 cfs 0.300 af

Reach 4R: North Channel - 1 Avg. Flow Depth=1.48' Max Vel=4.75 fps Inflow=38.71 cfs 2.225 af
n=0.028 L=1,200.0' S=0.0100 '/' Capacity=67.72 cfs Outflow=34.23 cfs 2.212 af

Reach 5R: North Channel - 2 Avg. Flow Depth=1.04' Max Vel=10.61 fps Inflow=45.57 cfs 3.270 af
n=0.028 L=850.0' S=0.0729 '/' Capacity=182.89 cfs Outflow=44.72 cfs 3.264 af

Reach 6R: Avg. Flow Depth=1.33' Max Vel=4.65 fps Inflow=28.94 cfs 1.871 af
n=0.028 L=185.0' S=0.0108 '/' Capacity=70.41 cfs Outflow=28.39 cfs 1.870 af

Reach 7R: MSE Berm Swale Avg. Flow Depth=0.29' Max Vel=2.47 fps Inflow=1.39 cfs 0.071 af
n=0.028 L=850.0' S=0.0188 '/' Capacity=14.63 cfs Outflow=1.11 cfs 0.071 af

Pond 1P: Drop Inlet 1 Peak Elev=206.51' Inflow=71.53 cfs 5.134 af
36.0" Round Culvert n=0.013 L=65.0' S=0.0092 '/' Outflow=71.53 cfs 5.134 af

Pond 2P: Drop Inlet Structure Peak Elev=187.91' Inflow=5.92 cfs 0.300 af
36.0" Round Culvert n=0.011 L=36.0' S=0.0500 '/' Outflow=5.92 cfs 0.300 af

Pond 3P: Stormwater Manhole Peak Elev=182.28' Inflow=41.52 cfs 2.753 af
Primary=41.52 cfs 2.753 af Secondary=0.00 cfs 0.000 af Outflow=41.52 cfs 2.753 af

Pond 8P: Drop Inlet Structure Peak Elev=189.69' Inflow=37.39 cfs 2.454 af
36.0" Round Culvert n=0.011 L=80.0' S=0.0500 '/' Outflow=37.39 cfs 2.454 af

Pond 26P: North Pond Peak Elev=158.34' Storage=278,297 cf Inflow=116.01 cfs 8.611 af
Discarded=2.44 cfs 2.378 af Primary=0.00 cfs 0.000 af Outflow=2.44 cfs 2.378 af

Total Runoff Area = 44.915 ac Runoff Volume = 8.637 af Average Runoff Depth = 2.31"
96.15% Pervious = 43.185 ac 3.85% Impervious = 1.730 ac

Summary for Subcatchment 8S:

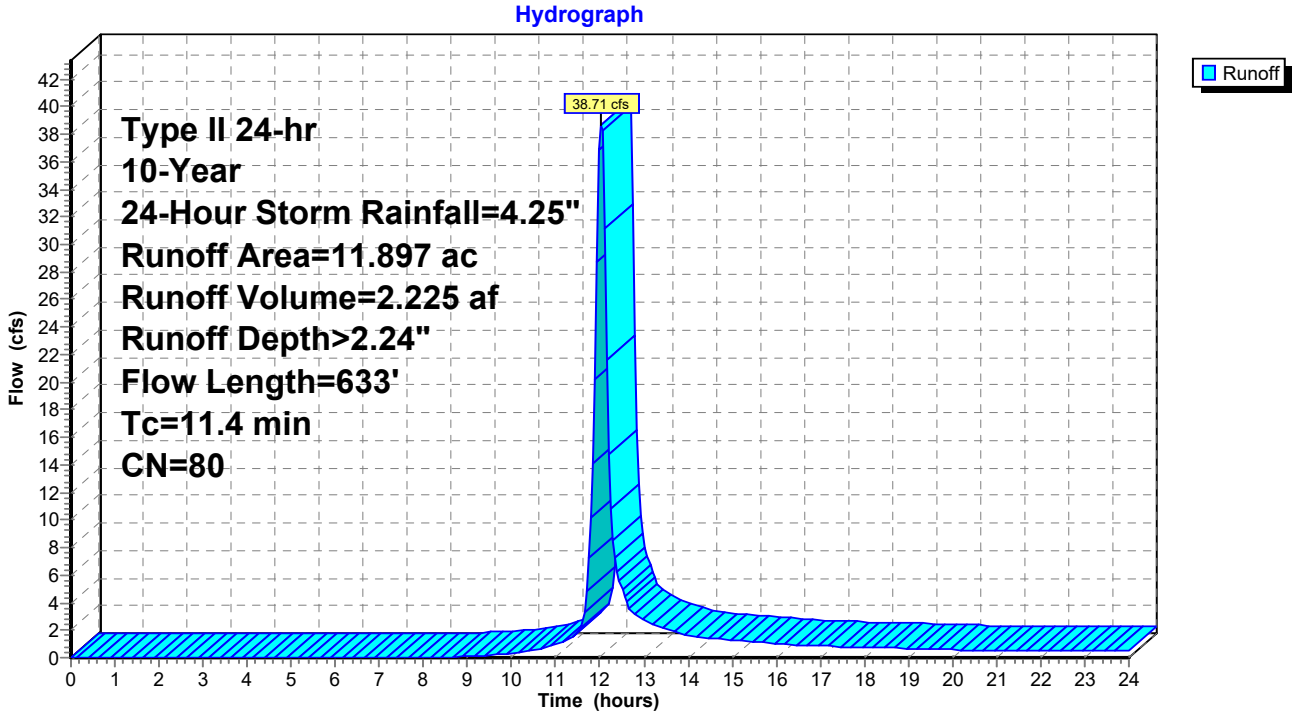
Runoff = 38.71 cfs @ 12.03 hrs, Volume= 2.225 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	11.340	80	Cap
	0.557	85	Gravel roads, HSG B
	11.897	80	Weighted Average
	11.897		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
0.4	182	0.0250	7.37	41.47	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=7.50' n= 0.025
11.4	633	Total			

Subcatchment 8S:



Summary for Subcatchment 9S:

[47] Hint: Peak is 599% of capacity of segment #3

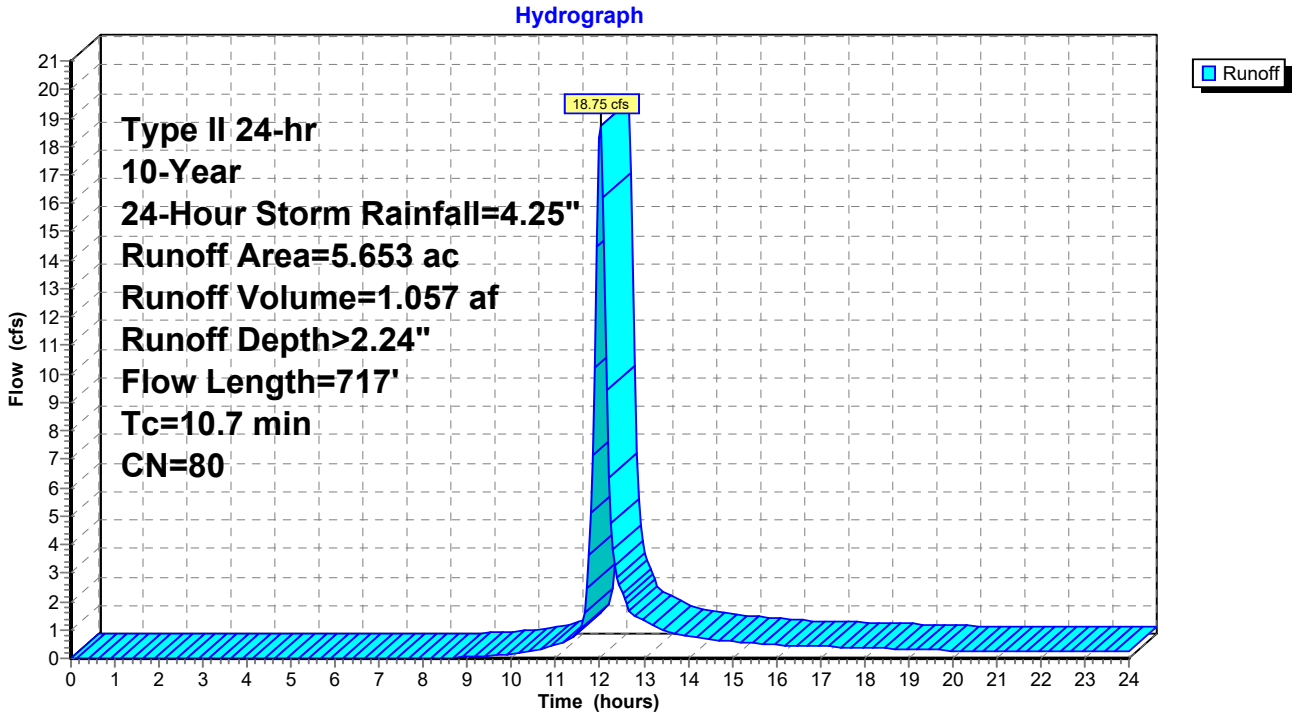
Runoff = 18.75 cfs @ 12.02 hrs, Volume= 1.057 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	5.113	80	Cap
	0.540	85	Gravel roads, HSG B
	5.653	80	Weighted Average
	5.653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
2.0	191	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
1.4	406	0.0500	5.01	3.13	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.025
0.0	20	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Let-Down Channel 1** Bot.W=3.00' D=1.50' n= 0.040
10.7	717	Total			

Subcatchment 9S:



Summary for Subcatchment 10S:

[47] Hint: Peak is 1485% of capacity of segment #4

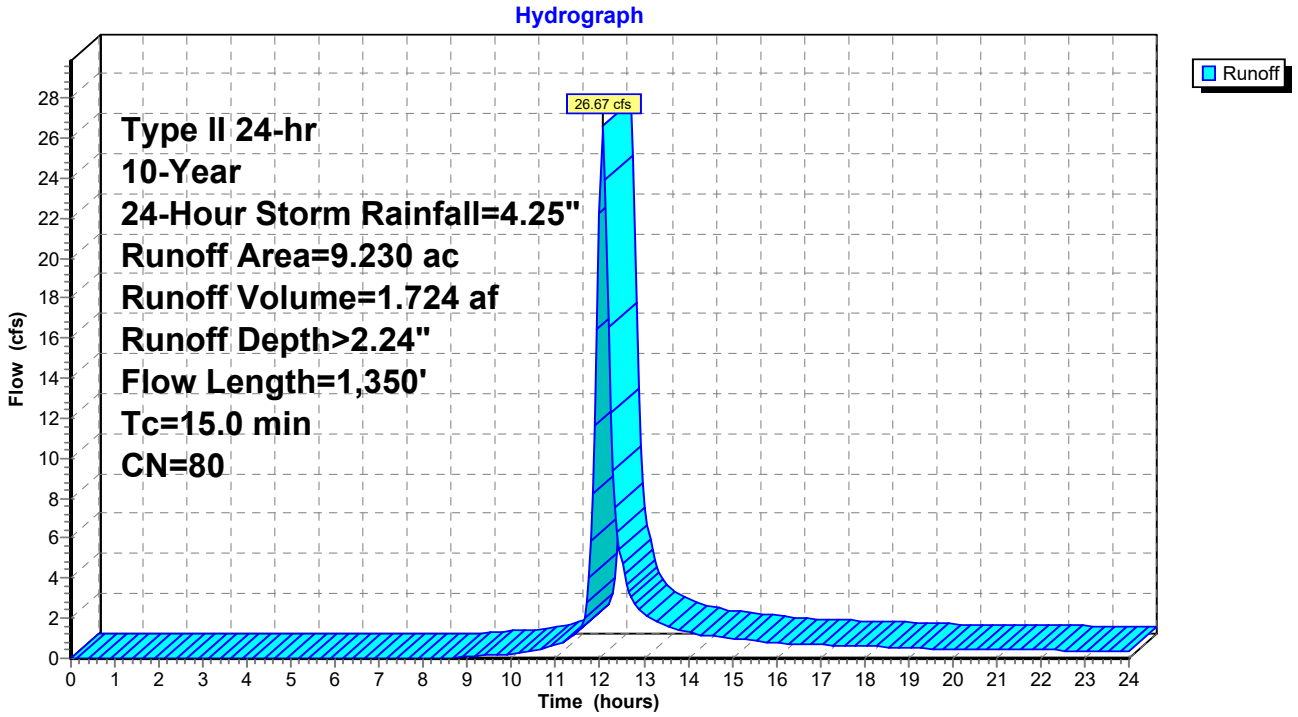
Runoff = 26.67 cfs @ 12.07 hrs, Volume= 1.724 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	9.230	80	Cap
	9.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
5.2	488	0.0500	1.57		**Shallow Concentrated Flow, Section 1** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	280	0.0400	2.87	1.80	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.039
0.2	222	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Gabion Downchute** Bot.W=3.00' D=1.50' n= 0.040
0.4	190	0.0210	7.63	91.59	**Trap/Vee/Rect Channel Flow, North Channel** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.030
15.0	1,350	Total			

Subcatchment 10S:



Summary for Subcatchment 11S:

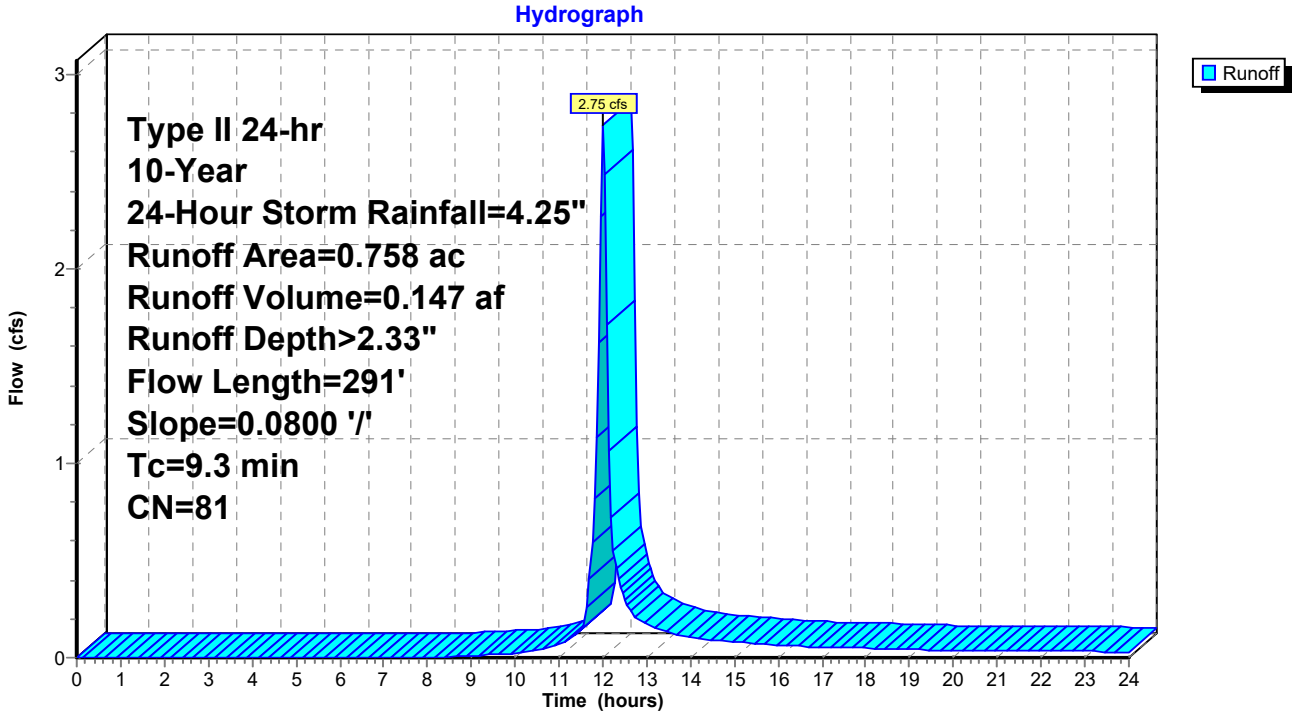
Runoff = 2.75 cfs @ 12.01 hrs, Volume= 0.147 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	0.576	80	CAP
	0.182	85	Gravel roads, HSG B
	0.758	81	Weighted Average
	0.758		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0800	0.19		**Sheet Flow, MSE Exterior Slope** Grass: Dense n= 0.240 P2= 2.80"
0.2	20	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	171	0.0800	9.56	14.34	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
9.3	291	Total			

Subcatchment 11S:



Summary for Subcatchment 12S:

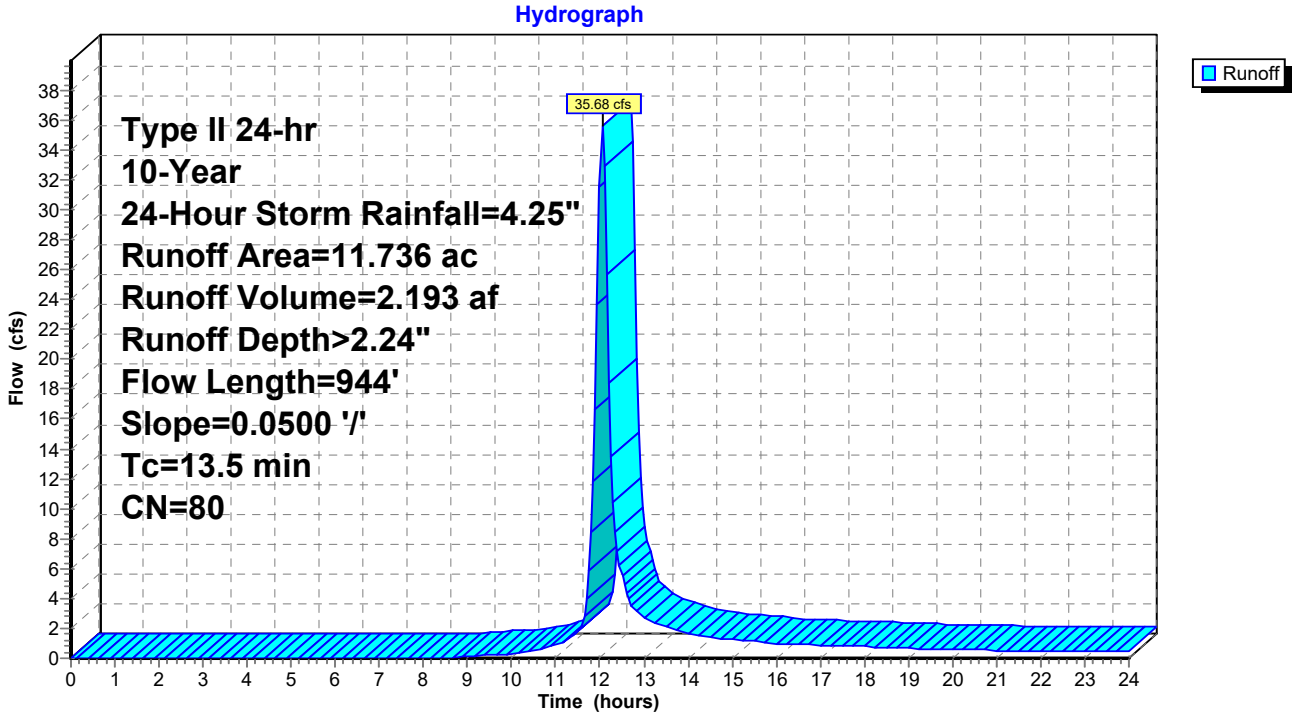
Runoff = 35.68 cfs @ 12.06 hrs, Volume= 2.193 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	11.736	80	
	11.736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Plateau** Grass: Short n= 0.150 P2= 2.80"
3.8	359	0.0500	1.57		**Shallow Concentrated Flow, Plateau** Short Grass Pasture Kv= 7.0 fps
2.4	485	0.0500	3.35		**Shallow Concentrated Flow, Sideslope Berm** Grassed Waterway Kv= 15.0 fps
13.5	944	Total			

Subcatchment 12S:



Summary for Subcatchment 13S:

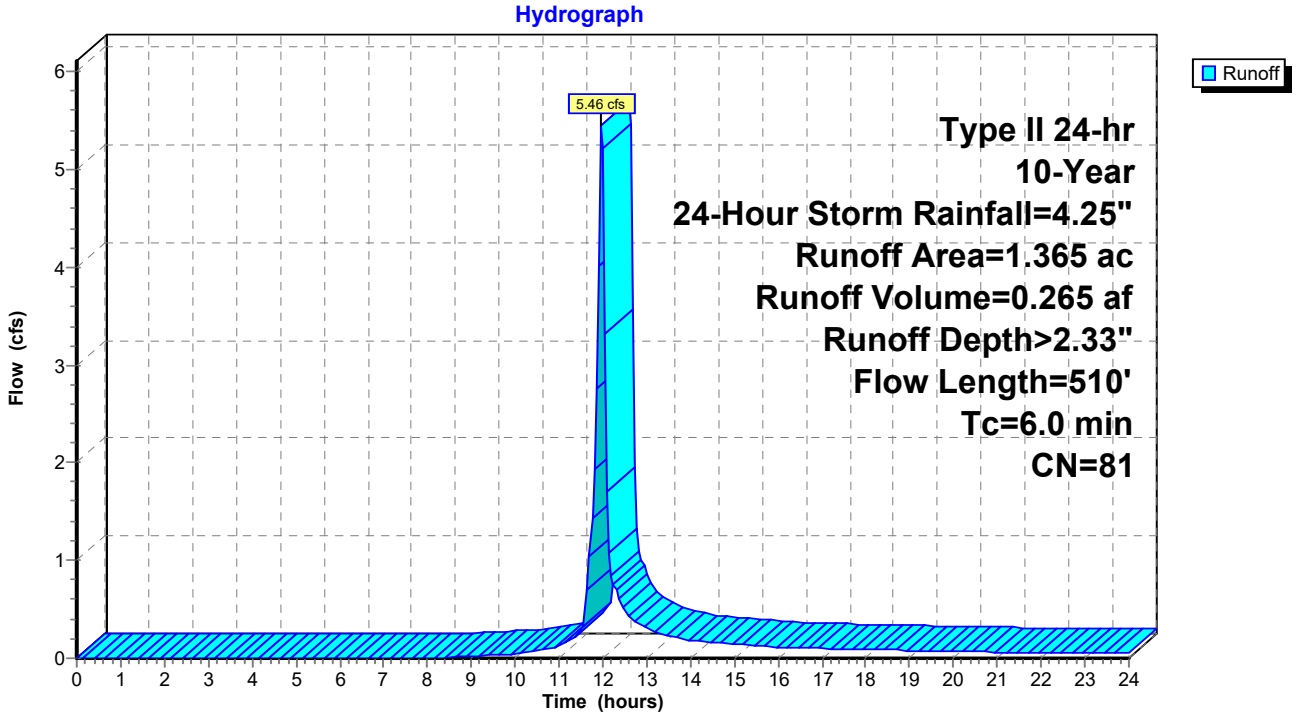
Runoff = 5.46 cfs @ 11.97 hrs, Volume= 0.265 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	1.080	80	Cap
*	0.285	85	Gravel Road
	1.365	81	Weighted Average
	1.365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	50	0.3300	0.43		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.0	460	0.0300	2.60		**Shallow Concentrated Flow, Perimeter Swale** Grassed Waterway Kv= 15.0 fps
5.0	510	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 13S:



Summary for Subcatchment 15S:

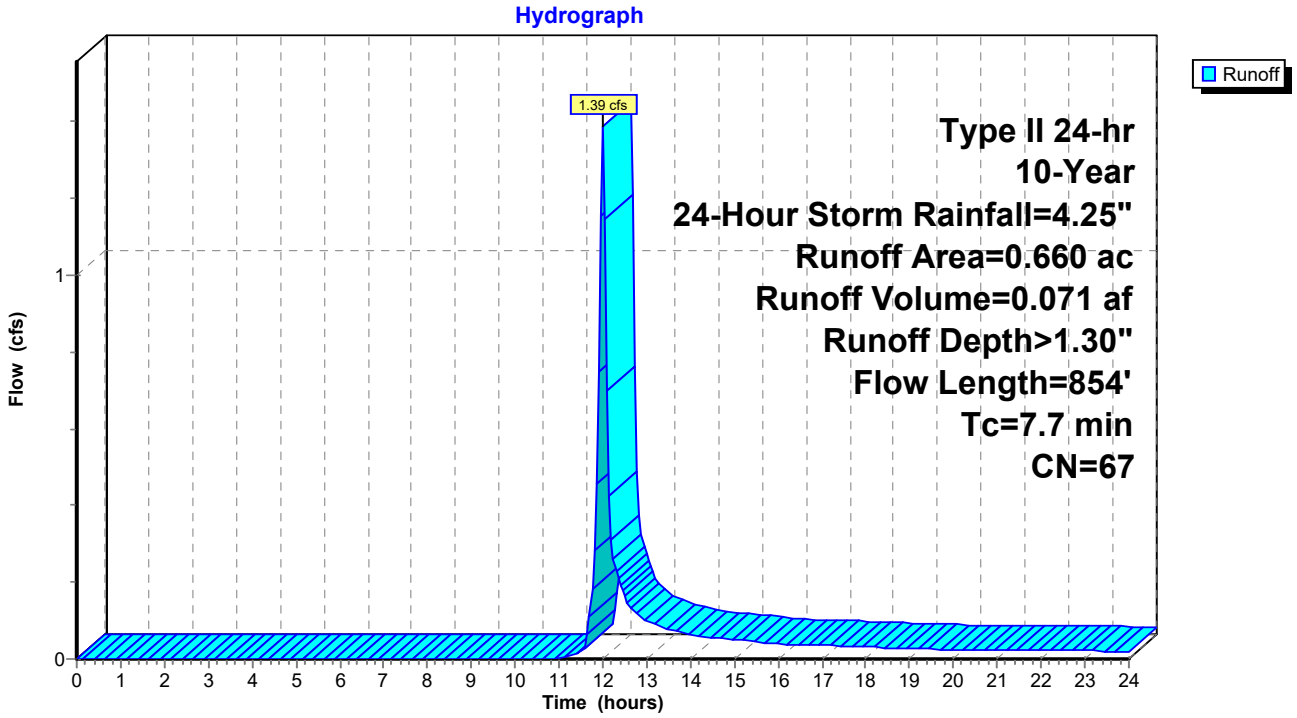
Runoff = 1.39 cfs @ 12.00 hrs, Volume= 0.071 af, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	0.660	67	Vegetation (Hyd. Group B)
	0.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	29	0.0330	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
4.5	825	0.0100	3.09	3.09	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.022 Earth, clean & straight
7.7	854	Total			

Subcatchment 15S:



Summary for Subcatchment 16S:

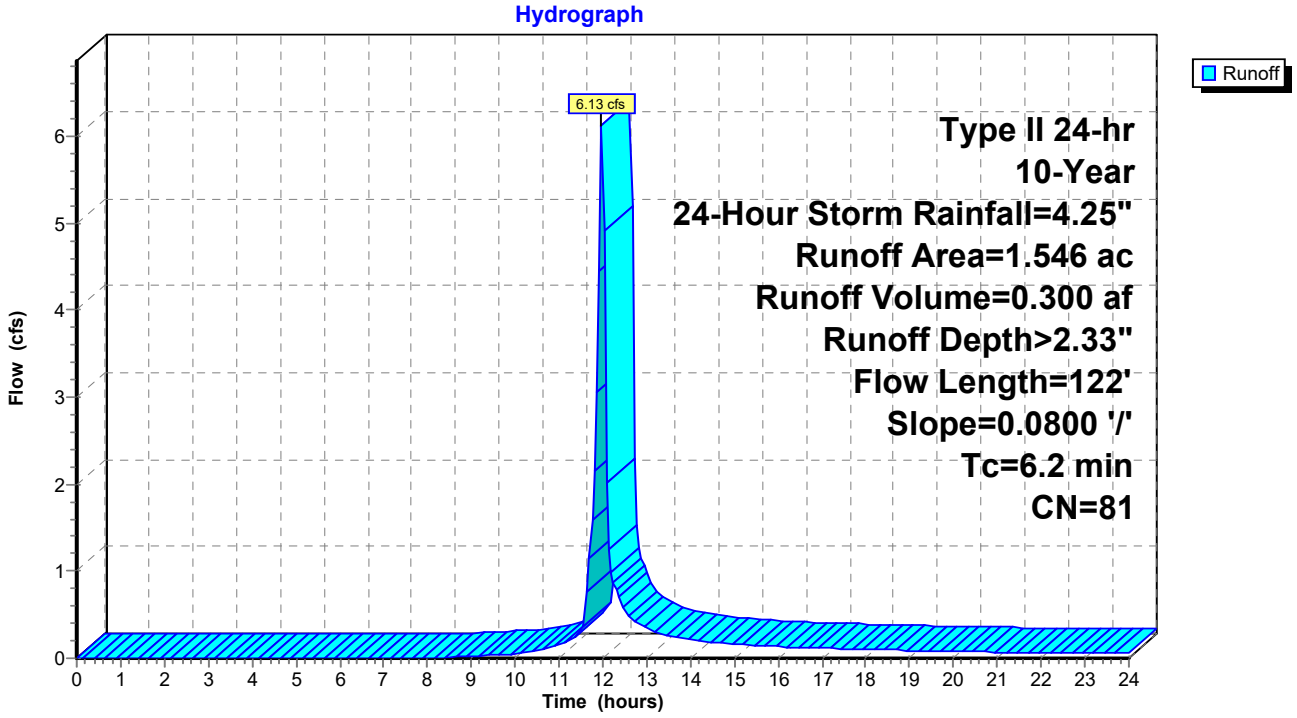
Runoff = 6.13 cfs @ 11.97 hrs, Volume= 0.300 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	1.224	80	Cap
*	0.322	85	Gravel Road
	1.546	81	Weighted Average
	1.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0800	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
0.2	22	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.2	122	Total			

Subcatchment 16S:



Summary for Subcatchment NP:

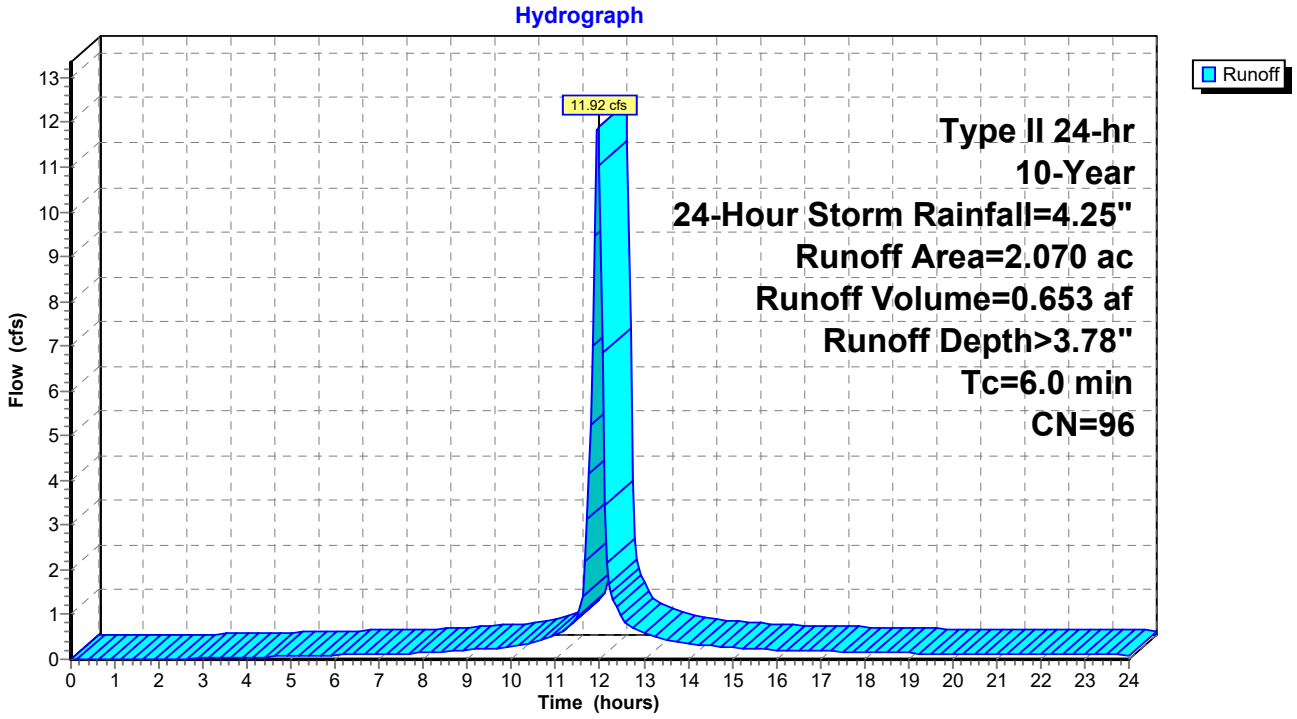
Runoff = 11.92 cfs @ 11.96 hrs, Volume= 0.653 af, Depth> 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year, 24-Hour Storm Rainfall=4.25"

	Area (ac)	CN	Description
*	1.730	98	Basin
*	0.340	85	Gravel Road
	2.070	96	Weighted Average
	0.340		16.43% Pervious Area
	1.730		83.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					**Direct Entry,**
1.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment NP:



Summary for Reach 1R: Gabion Downchute

Mannings from Figure 5B.11 Determing "n" for Riprap Lined Channel Using Depth of Flow

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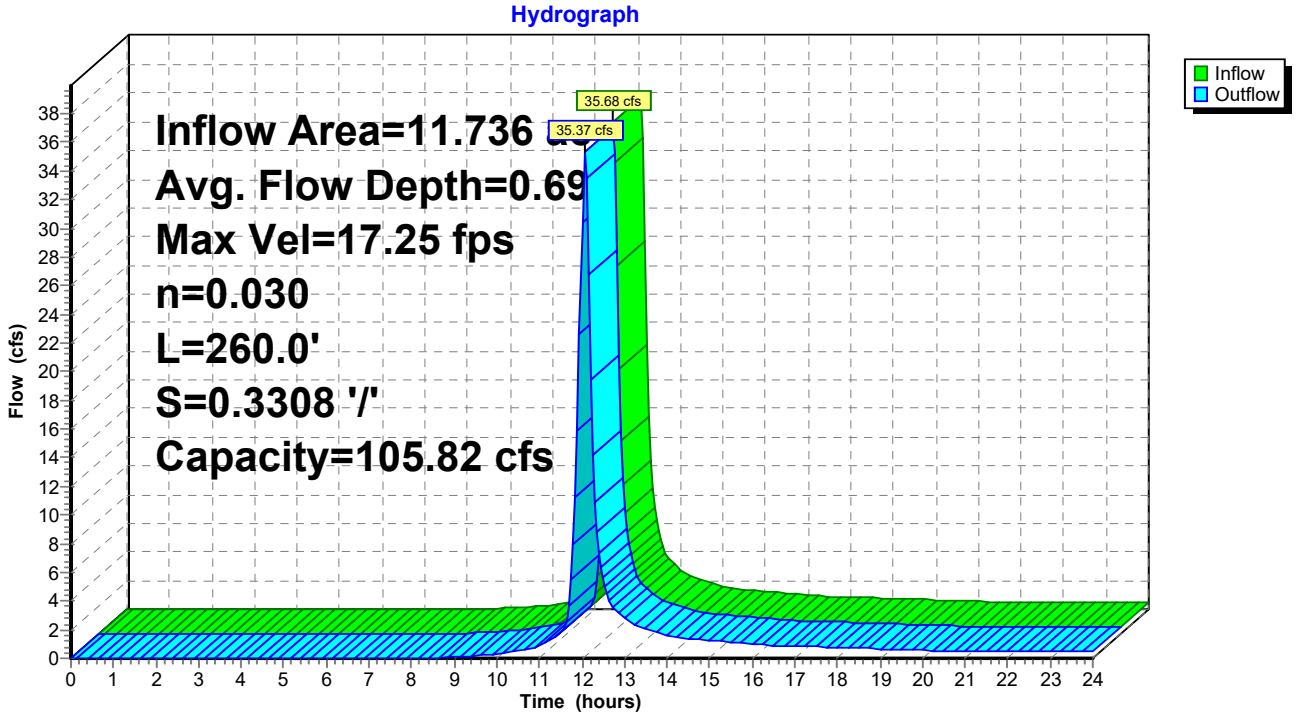
Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 2.24" for 10-Year, 24-Hour Storm event
Inflow = 35.68 cfs @ 12.06 hrs, Volume= 2.193 af
Outflow = 35.37 cfs @ 12.06 hrs, Volume= 2.192 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 4.63 fps, Avg. Travel Time= 0.9 min

Peak Storage= 537 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.69' , Surface Width= 3.00'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 105.82 cfs

3.00' x 1.50' deep channel, n= 0.030
Length= 260.0' Slope= 0.3308 '/'
Inlet Invert= 290.00', Outlet Invert= 204.00'

Reach 1R: Gabion Downchute



Summary for Reach 2R: North Channel - 3

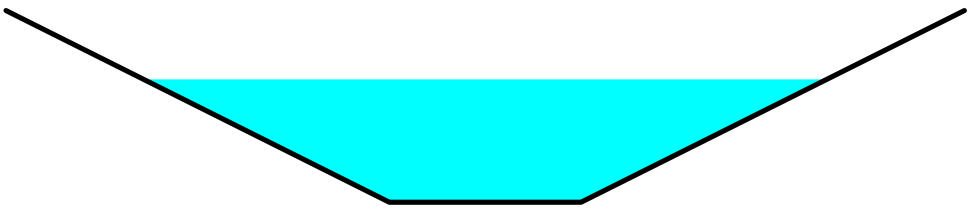
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.60' @ 12.10 hrs

Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year, 24-Hour Storm event
Inflow = 38.51 cfs @ 12.05 hrs, Volume= 2.458 af
Outflow = 37.39 cfs @ 12.08 hrs, Volume= 2.454 af, Atten= 3%, Lag= 2.1 min

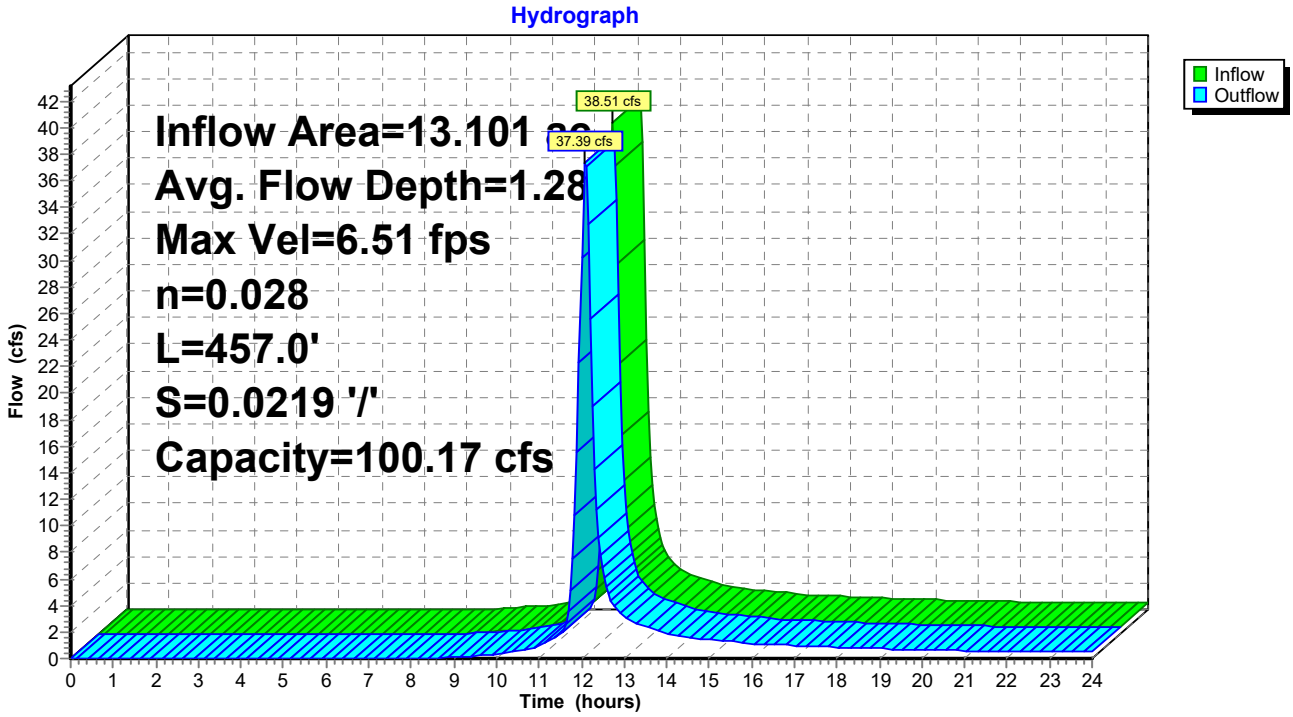
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.51 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.21 fps, Avg. Travel Time= 3.4 min

Peak Storage= 2,679 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.28' , Surface Width= 7.13'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 100.17 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 457.0' Slope= 0.0219 '/'
Inlet Invert= 204.00', Outlet Invert= 194.00'



Reach 2R: North Channel - 3



Summary for Reach 3R:

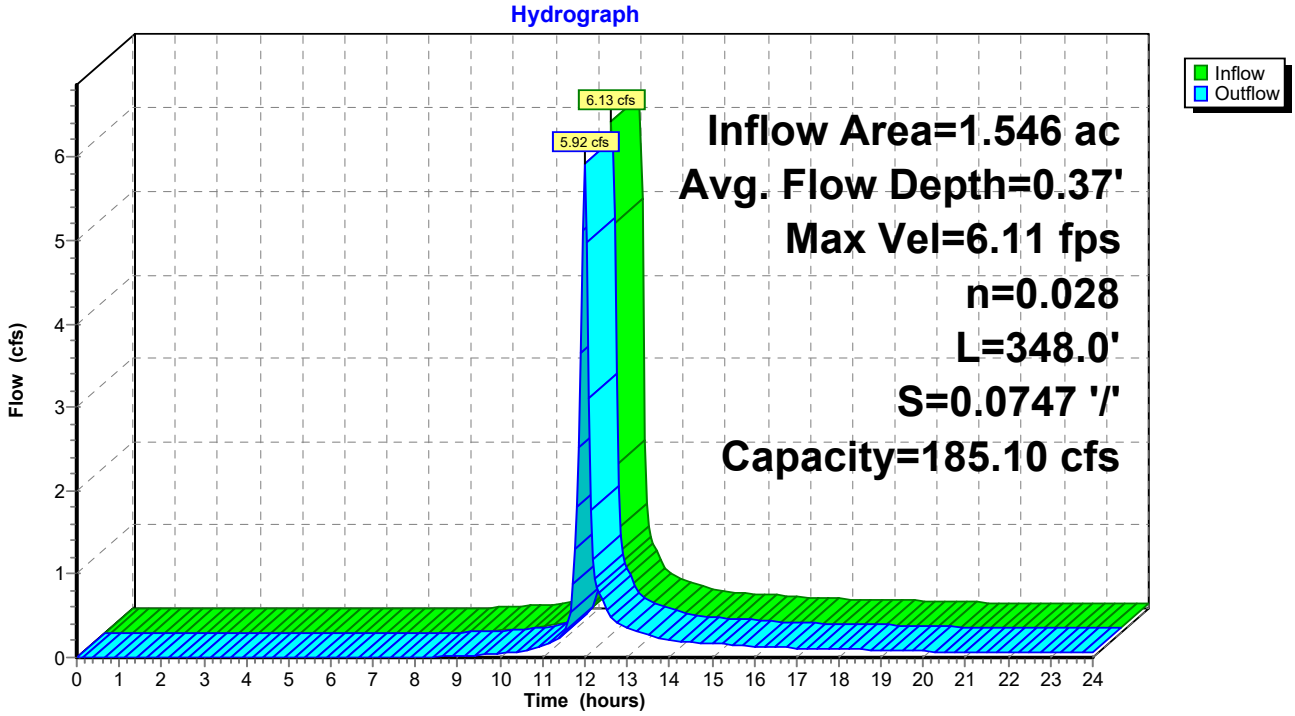
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 2.33" for 10-Year, 24-Hour Storm event
Inflow = 6.13 cfs @ 11.97 hrs, Volume= 0.300 af
Outflow = 5.92 cfs @ 12.00 hrs, Volume= 0.300 af, Atten= 3%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.11 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 3.5 min

Peak Storage= 349 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.37' , Surface Width= 3.47'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 185.10 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 348.0' Slope= 0.0747 '/'
Inlet Invert= 220.00', Outlet Invert= 194.00'

Reach 3R:



Summary for Reach 4R: North Channel - 1

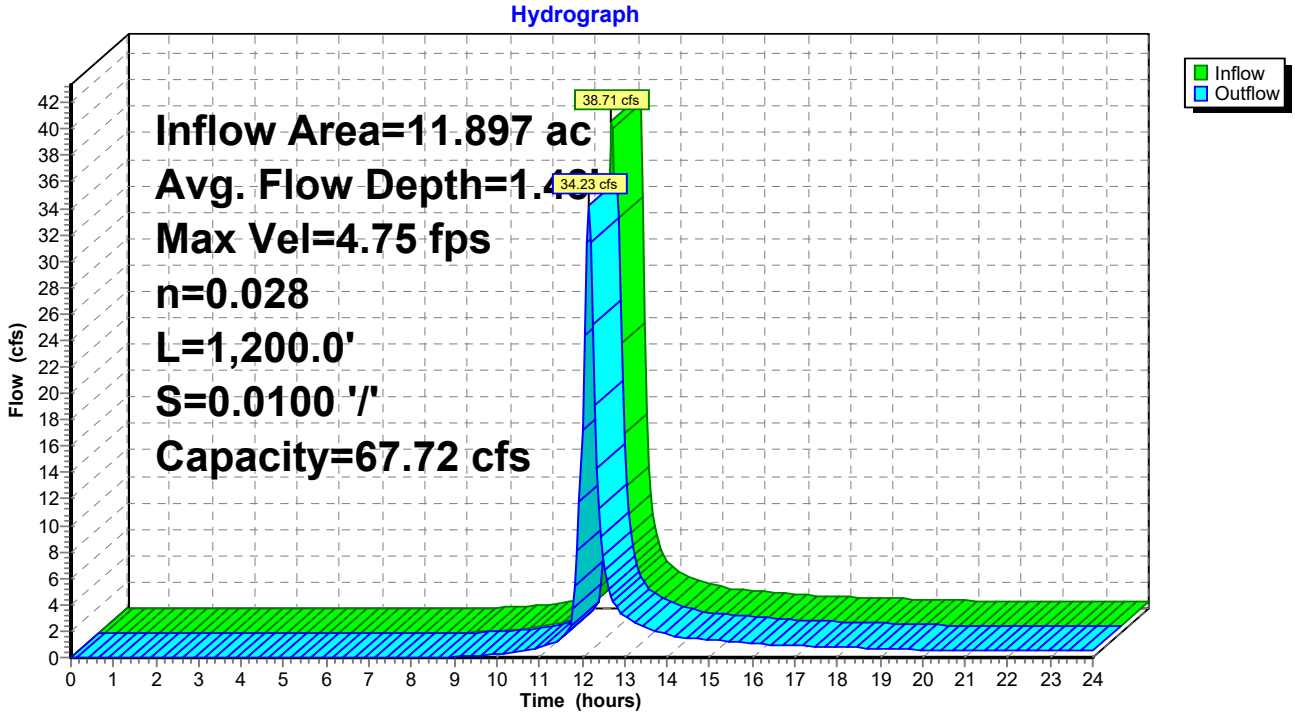
Inflow Area = 11.897 ac, 0.00% Impervious, Inflow Depth > 2.24" for 10-Year, 24-Hour Storm event
Inflow = 38.71 cfs @ 12.03 hrs, Volume= 2.225 af
Outflow = 34.23 cfs @ 12.15 hrs, Volume= 2.212 af, Atten= 12%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.75 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 12.1 min

Peak Storage= 8,793 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.48' , Surface Width= 7.91'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.72 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,200.0' Slope= 0.0100 '/'
Inlet Invert= 290.00', Outlet Invert= 278.00'

Reach 4R: North Channel - 1



Summary for Reach 5R: North Channel - 2

[61] Hint: Exceeded Reach 4R outlet invert by 1.04' @ 12.10 hrs

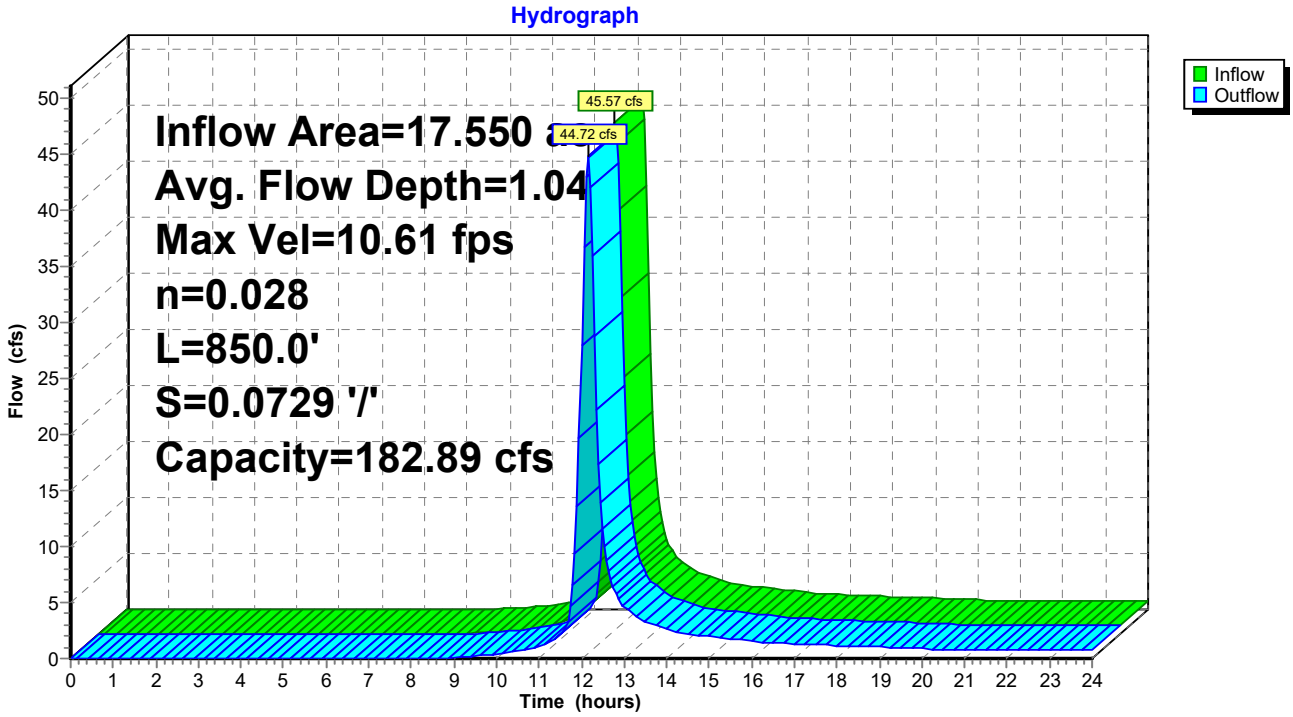
Inflow Area = 17.550 ac, 0.00% Impervious, Inflow Depth > 2.24" for 10-Year, 24-Hour Storm event
Inflow = 45.57 cfs @ 12.11 hrs, Volume= 3.270 af
Outflow = 44.72 cfs @ 12.15 hrs, Volume= 3.264 af, Atten= 2%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.61 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 3.68 fps, Avg. Travel Time= 3.8 min

Peak Storage= 3,623 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.04' , Surface Width= 6.17'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 182.89 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 850.0' Slope= 0.0729 '/'
Inlet Invert= 278.00', Outlet Invert= 216.00'

Reach 5R: North Channel - 2



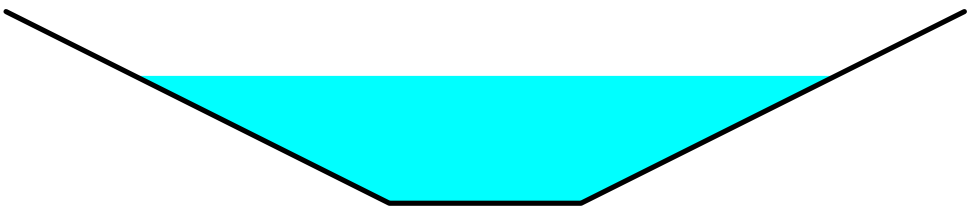
Summary for Reach 6R:

Inflow Area = 9.988 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year, 24-Hour Storm event
Inflow = 28.94 cfs @ 12.06 hrs, Volume= 1.871 af
Outflow = 28.39 cfs @ 12.09 hrs, Volume= 1.870 af, Atten= 2%, Lag= 1.3 min

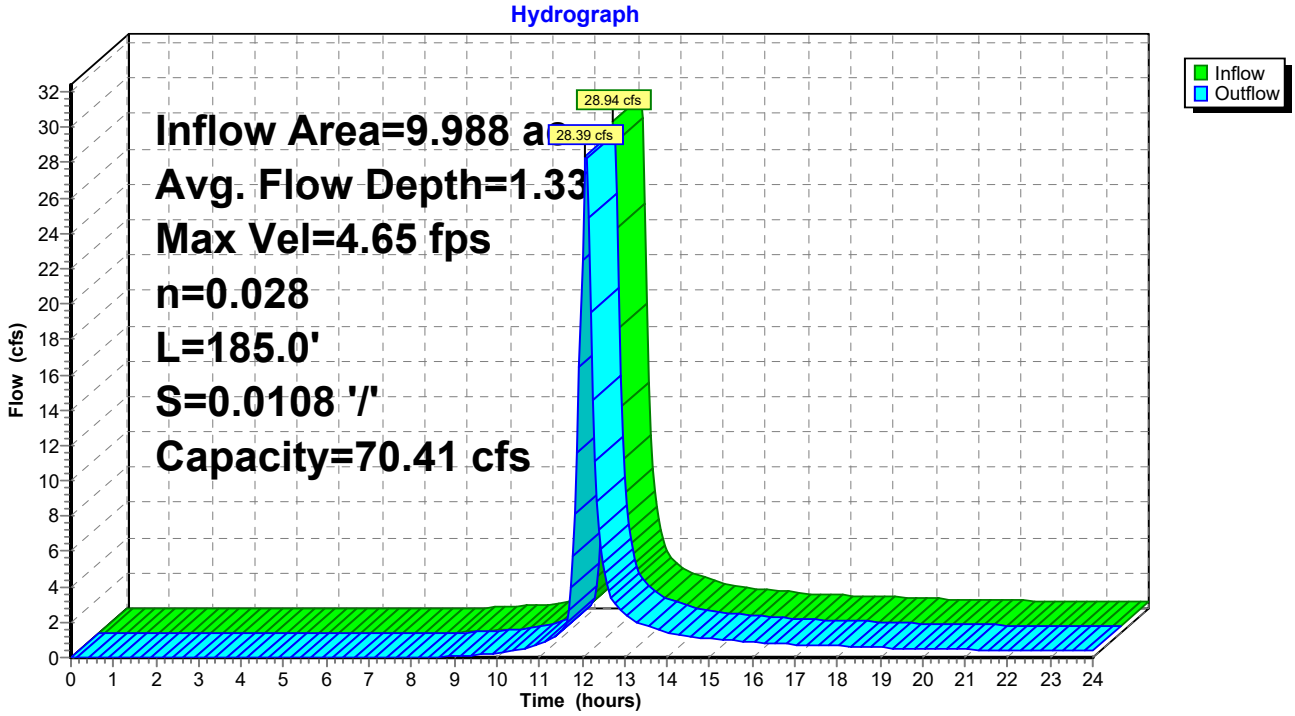
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.65 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 1.9 min

Peak Storage= 1,143 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.33' , Surface Width= 7.31'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 70.41 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 185.0' Slope= 0.0108 '/'
Inlet Invert= 218.00', Outlet Invert= 216.00'



Reach 6R:



Summary for Reach 7R: MSE Berm Swale

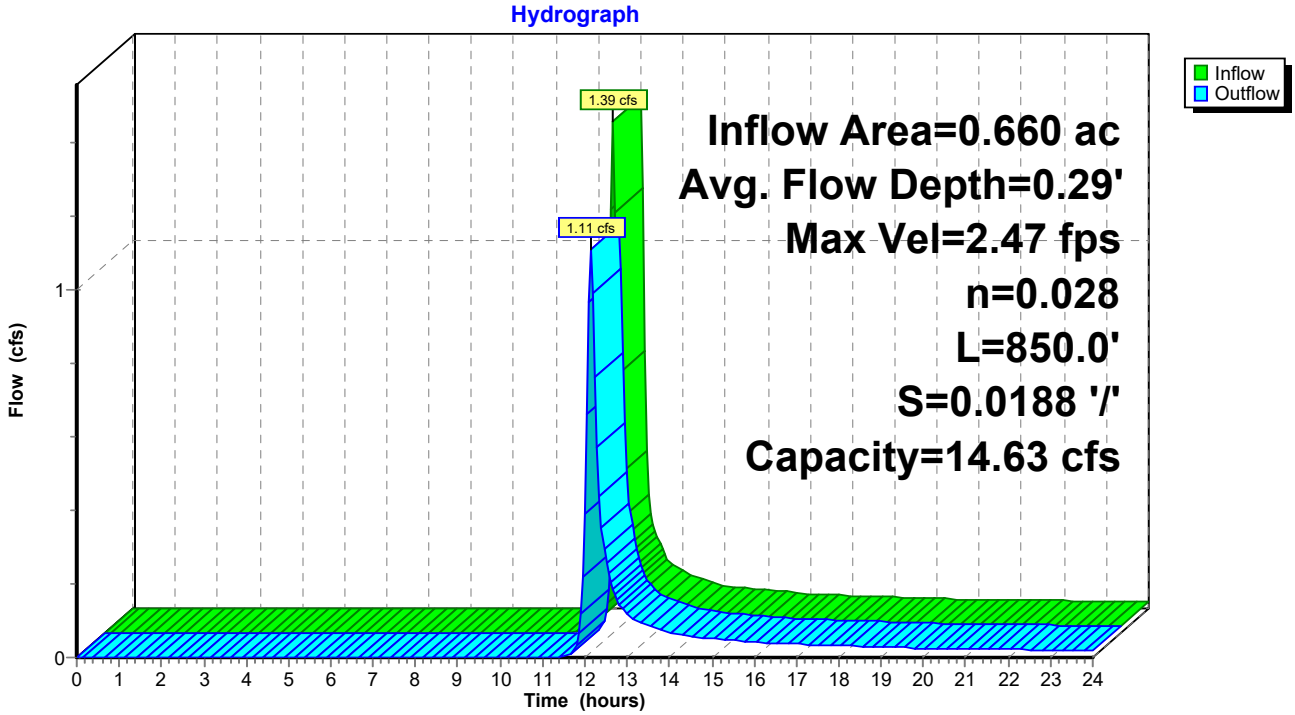
Inflow Area = 0.660 ac, 0.00% Impervious, Inflow Depth > 1.30" for 10-Year, 24-Hour Storm event
Inflow = 1.39 cfs @ 12.00 hrs, Volume= 0.071 af
Outflow = 1.11 cfs @ 12.15 hrs, Volume= 0.071 af, Atten= 20%, Lag= 9.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 16.4 min

Peak Storage= 385 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 2.15'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 14.63 cfs

1.00' x 1.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 216.00', Outlet Invert= 200.00'

Reach 7R: MSE Berm Swale



Summary for Pond 1P: Drop Inlet 1

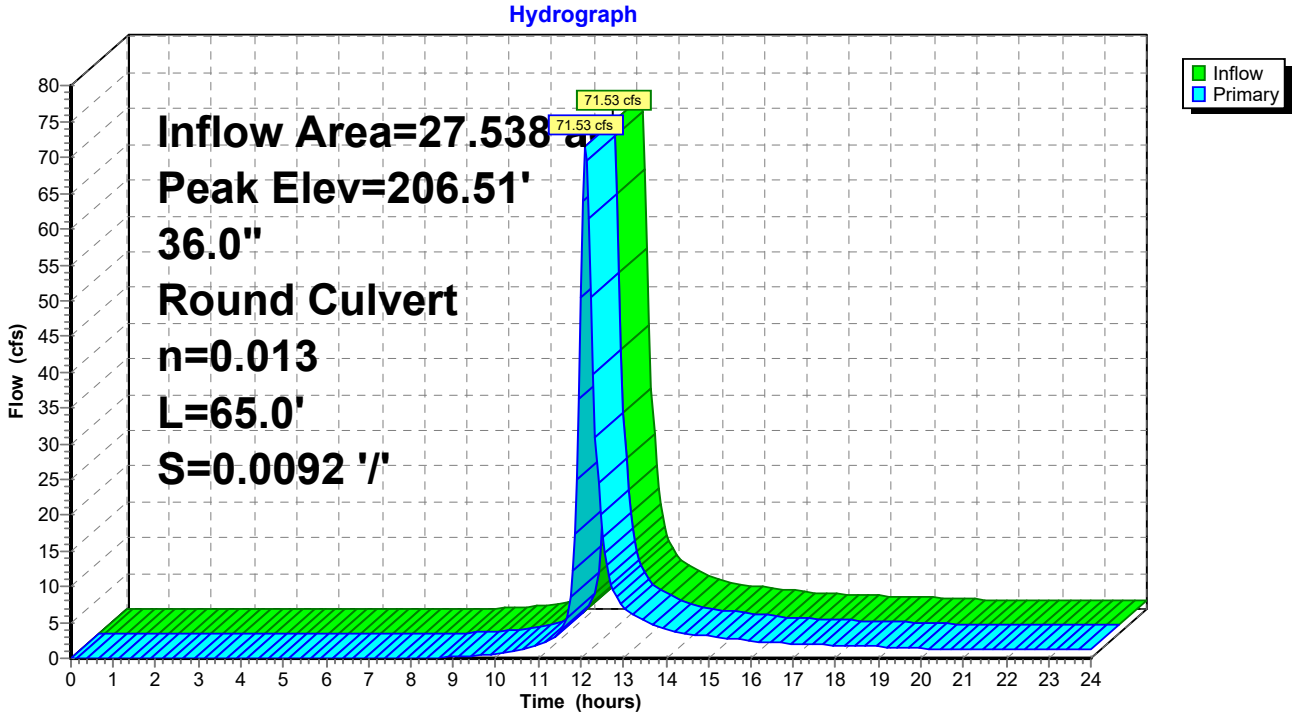
Inflow Area = 27.538 ac, 0.00% Impervious, Inflow Depth > 2.24" for 10-Year, 24-Hour Storm event
Inflow = 71.53 cfs @ 12.12 hrs, Volume= 5.134 af
Outflow = 71.53 cfs @ 12.12 hrs, Volume= 5.134 af, Atten= 0%, Lag= 0.0 min
Primary = 71.53 cfs @ 12.12 hrs, Volume= 5.134 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 206.51' @ 12.12 hrs
Flood Elev= 220.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	200.60'	**36.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 200.60' / 200.00' S= 0.0092 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=70.60 cfs @ 12.12 hrs HW=206.40' (Free Discharge)
└**1=Culvert** (Inlet Controls 70.60 cfs @ 9.99 fps)

Pond 1P: Drop Inlet 1



Summary for Pond 2P: Drop Inlet Structure

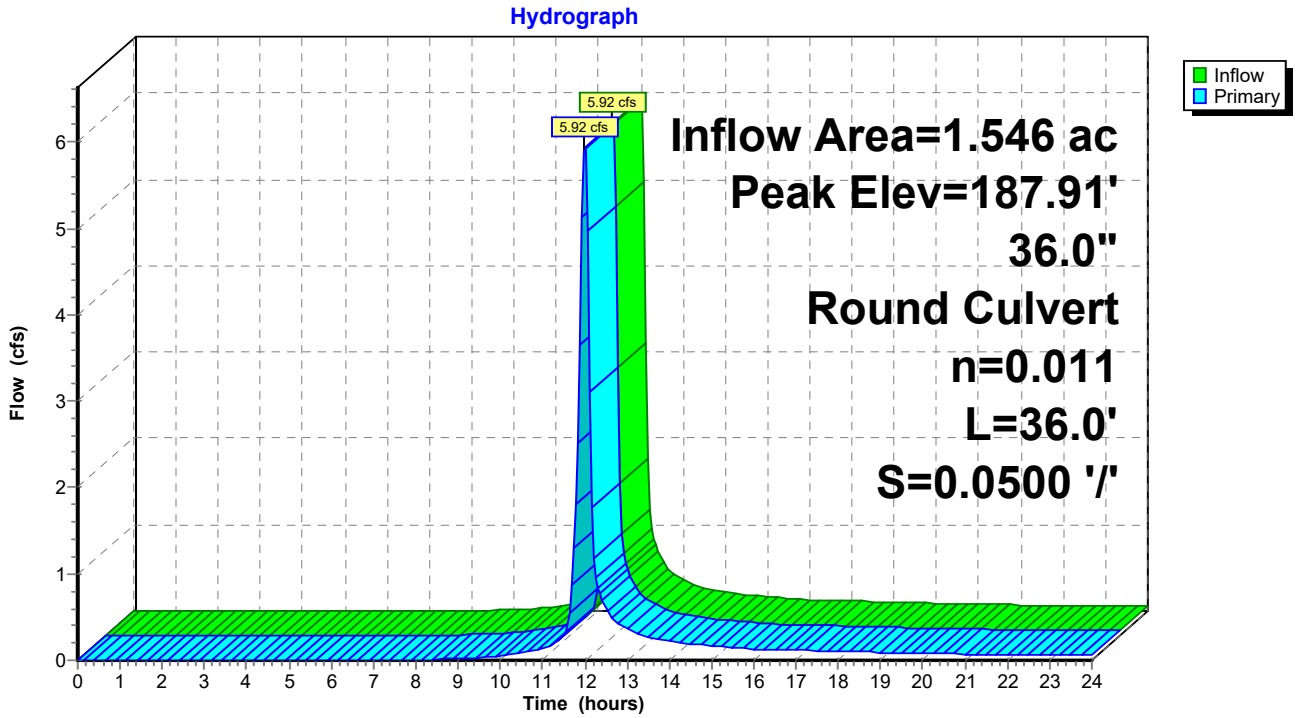
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 2.33" for 10-Year, 24-Hour Storm event
Inflow = 5.92 cfs @ 12.00 hrs, Volume= 0.300 af
Outflow = 5.92 cfs @ 12.00 hrs, Volume= 0.300 af, Atten= 0%, Lag= 0.0 min
Primary = 5.92 cfs @ 12.00 hrs, Volume= 0.300 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 187.91' @ 12.00 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round 36" HDPE Pipe** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 185.20' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=5.88 cfs @ 12.00 hrs HW=187.91' (Free Discharge)
└**1=36" HDPE Pipe** (Inlet Controls 5.88 cfs @ 3.25 fps)

Pond 2P: Drop Inlet Structure



Summary for Pond 3P: Stormwater Manhole

Inflow Area = 14.647 ac, 0.00% Impervious, Inflow Depth > 2.26" for 10-Year, 24-Hour Storm event
Inflow = 41.52 cfs @ 12.07 hrs, Volume= 2.753 af
Outflow = 41.52 cfs @ 12.07 hrs, Volume= 2.753 af, Atten= 0%, Lag= 0.0 min
Primary = 41.52 cfs @ 12.07 hrs, Volume= 2.753 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

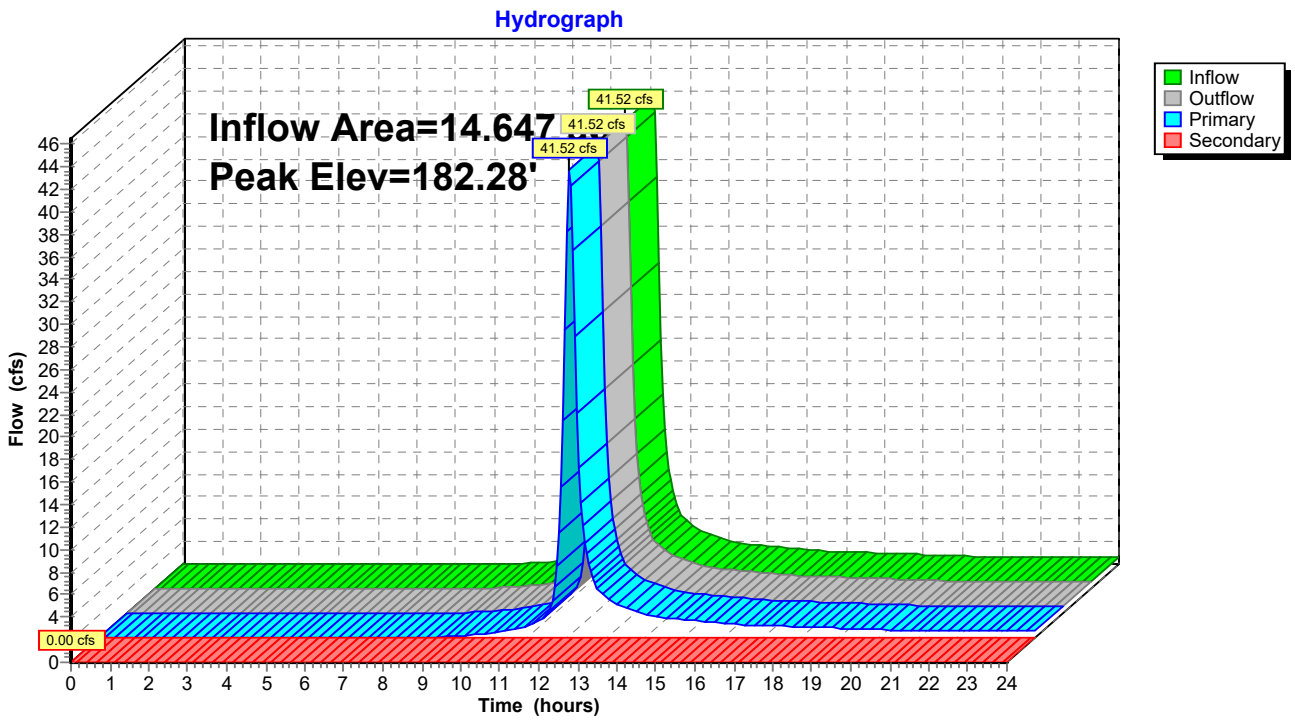
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 182.28' @ 12.07 hrs
Flood Elev= 188.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.30'	**36.0" Round 36" HDPE Pipe** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.30' / 177.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Secondary	196.00'	**6.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=40.95 cfs @ 12.07 hrs HW=182.23' (Free Discharge)
└─**1=36" HDPE Pipe** (Inlet Controls 40.95 cfs @ 5.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=179.30' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Stormwater Manhole



Summary for Pond 8P: Drop Inlet Structure

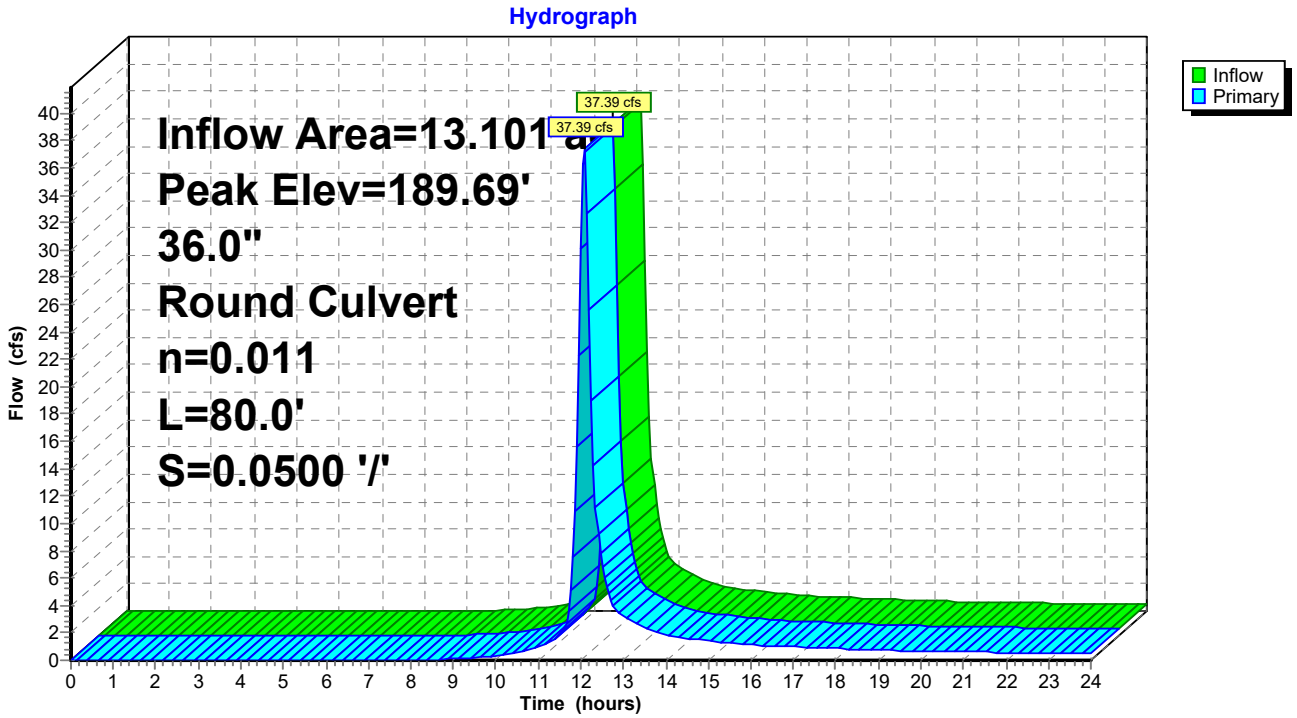
Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 2.25" for 10-Year, 24-Hour Storm event
Inflow = 37.39 cfs @ 12.08 hrs, Volume= 2.454 af
Outflow = 37.39 cfs @ 12.08 hrs, Volume= 2.454 af, Atten= 0%, Lag= 0.0 min
Primary = 37.39 cfs @ 12.08 hrs, Volume= 2.454 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 189.69' @ 12.08 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round Culvert** L= 80.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 183.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=36.81 cfs @ 12.08 hrs HW=189.66' (Free Discharge)
└**1=Culvert** (Inlet Controls 36.81 cfs @ 5.55 fps)

Pond 8P: Drop Inlet Structure



Summary for Pond 26P: North Pond

Inflow Area = 44.915 ac, 3.85% Impervious, Inflow Depth > 2.30" for 10-Year, 24-Hour Storm event
Inflow = 116.01 cfs @ 12.09 hrs, Volume= 8.611 af
Outflow = 2.44 cfs @ 19.41 hrs, Volume= 2.378 af, Atten= 98%, Lag= 439.1 min
Discarded = 2.44 cfs @ 19.41 hrs, Volume= 2.378 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 158.34' @ 19.41 hrs Surf.Area= 26,744 sf Storage= 278,297 cf

Plug-Flow detention time= 386.5 min calculated for 2.378 af (28% of inflow)
Center-of-Mass det. time= 251.6 min (1,081.1 - 829.5)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	731,085 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

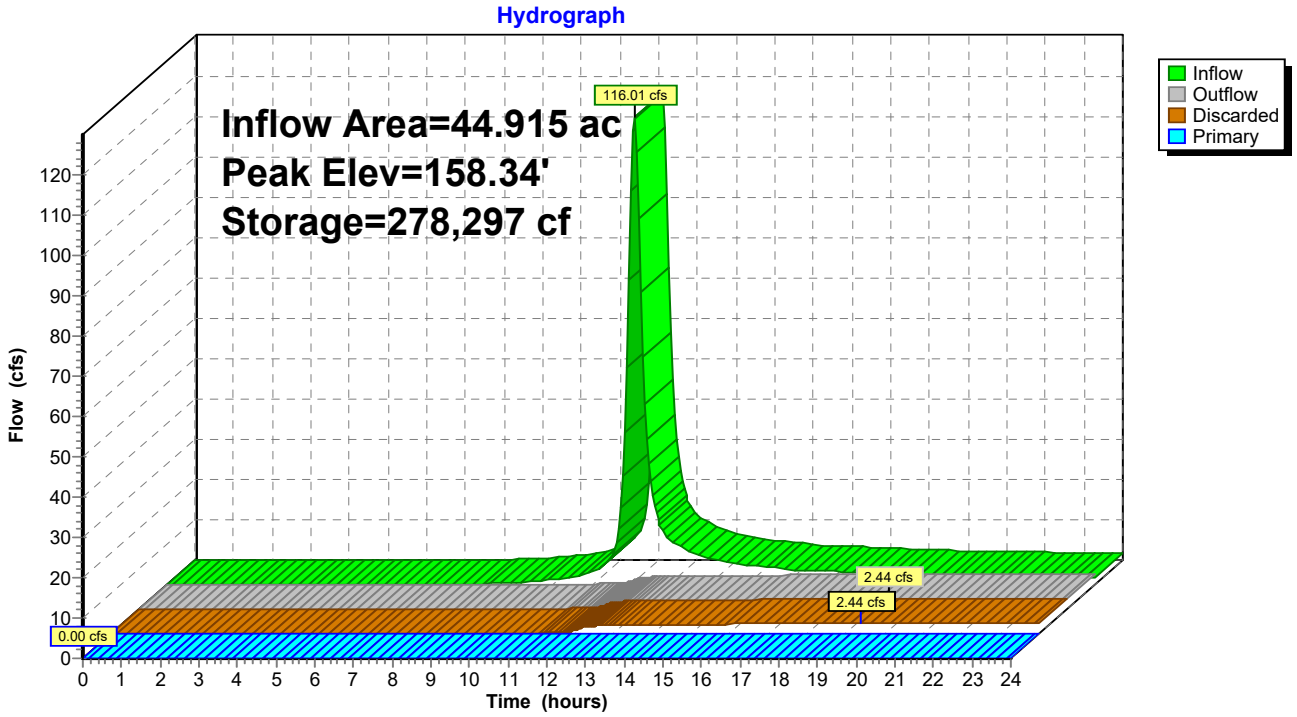
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	5,675	0	0
150.00	15,091	103,830	103,830
160.00	29,062	220,765	324,595
170.00	52,236	406,490	731,085

Device	Routing	Invert	Outlet Devices
#1	Discarded	140.00'	**5.000 in/hr Exfiltration over Horizontal area above 140.00'** Excluded Horizontal area = 5,675 sf
#2	Primary	167.00'	**17.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=2.44 cfs @ 19.41 hrs HW=158.34' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.44 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: North Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment8S: Runoff Area=11.897 ac 0.00% Impervious Runoff Depth>2.80"
Flow Length=633' Tc=11.4 min CN=80 Runoff=48.10 cfs 2.775 af

Subcatchment9S: Runoff Area=5.653 ac 0.00% Impervious Runoff Depth>2.80"
Flow Length=717' Tc=10.7 min CN=80 Runoff=23.31 cfs 1.319 af

Subcatchment10S: Runoff Area=9.230 ac 0.00% Impervious Runoff Depth>2.80"
Flow Length=1,350' Tc=15.0 min CN=80 Runoff=33.21 cfs 2.151 af

Subcatchment11S: Runoff Area=0.758 ac 0.00% Impervious Runoff Depth>2.89"
Flow Length=291' Slope=0.0800 '/' Tc=9.3 min CN=81 Runoff=3.39 cfs 0.183 af

Subcatchment12S: Runoff Area=11.736 ac 0.00% Impervious Runoff Depth>2.80"
Flow Length=944' Slope=0.0500 '/' Tc=13.5 min CN=80 Runoff=44.40 cfs 2.736 af

Subcatchment13S: Runoff Area=1.365 ac 0.00% Impervious Runoff Depth>2.89"
Flow Length=510' Tc=6.0 min CN=81 Runoff=6.73 cfs 0.329 af

Subcatchment15S: Runoff Area=0.660 ac 0.00% Impervious Runoff Depth>1.73"
Flow Length=854' Tc=7.7 min CN=67 Runoff=1.88 cfs 0.095 af

Subcatchment16S: Runoff Area=1.546 ac 0.00% Impervious Runoff Depth>2.89"
Flow Length=122' Slope=0.0800 '/' Tc=6.2 min CN=81 Runoff=7.56 cfs 0.373 af

SubcatchmentNP: Runoff Area=2.070 ac 83.57% Impervious Runoff Depth>4.43"
Tc=6.0 min CN=96 Runoff=13.82 cfs 0.764 af

Reach 1R: Gabion Downchute Avg. Flow Depth=0.80' Max Vel=18.46 fps Inflow=44.40 cfs 2.736 af
n=0.030 L=260.0' S=0.3308 '/' Capacity=105.82 cfs Outflow=44.05 cfs 2.735 af

Reach 2R: North Channel - 3 Avg. Flow Depth=1.42' Max Vel=6.90 fps Inflow=47.96 cfs 3.064 af
n=0.028 L=457.0' S=0.0219 '/' Capacity=100.17 cfs Outflow=46.62 cfs 3.059 af

Reach 3R: Avg. Flow Depth=0.41' Max Vel=6.50 fps Inflow=7.56 cfs 0.373 af
n=0.028 L=348.0' S=0.0747 '/' Capacity=185.10 cfs Outflow=7.33 cfs 0.372 af

Reach 4R: North Channel - 1 Avg. Flow Depth=1.64' Max Vel=5.03 fps Inflow=48.10 cfs 2.775 af
n=0.028 L=1,200.0' S=0.0100 '/' Capacity=67.72 cfs Outflow=43.01 cfs 2.761 af

Reach 5R: North Channel - 2 Avg. Flow Depth=1.17' Max Vel=11.32 fps Inflow=57.95 cfs 4.079 af
n=0.028 L=850.0' S=0.0729 '/' Capacity=182.89 cfs Outflow=56.79 cfs 4.073 af

Reach 6R: Avg. Flow Depth=1.47' Max Vel=4.92 fps Inflow=36.02 cfs 2.333 af
n=0.028 L=185.0' S=0.0108 '/' Capacity=70.41 cfs Outflow=35.36 cfs 2.331 af

Reach 7R: MSE Berm Swale Avg. Flow Depth=0.34' Max Vel=2.71 fps Inflow=1.88 cfs 0.095 af
n=0.028 L=850.0' S=0.0188 '/' Capacity=14.63 cfs Outflow=1.52 cfs 0.094 af

Pond 1P: Drop Inlet 1 Peak Elev=209.18' Inflow=90.56 cfs 6.404 af
36.0" Round Culvert n=0.013 L=65.0' S=0.0092 '/' Outflow=90.56 cfs 6.404 af

Pond 2P: Drop Inlet Structure Peak Elev=188.02' Inflow=7.33 cfs 0.372 af
36.0" Round Culvert n=0.011 L=36.0' S=0.0500 '/' Outflow=7.33 cfs 0.372 af

Pond 3P: Stormwater Manhole Peak Elev=183.12' Inflow=51.81 cfs 3.432 af
Primary=51.81 cfs 3.432 af Secondary=0.00 cfs 0.000 af Outflow=51.81 cfs 3.432 af

Pond 8P: Drop Inlet Structure Peak Elev=190.37' Inflow=46.62 cfs 3.059 af
36.0" Round Culvert n=0.011 L=80.0' S=0.0500 '/' Outflow=46.62 cfs 3.059 af

Pond 26P: North Pond Peak Elev=160.84' Storage=349,888 cf Inflow=146.18 cfs 10.694 af
Discarded=2.93 cfs 2.854 af Primary=0.00 cfs 0.000 af Outflow=2.93 cfs 2.854 af

Total Runoff Area = 44.915 ac Runoff Volume = 10.723 af Average Runoff Depth = 2.87"
96.15% Pervious = 43.185 ac 3.85% Impervious = 1.730 ac

Summary for Subcatchment 8S:

[47] Hint: Peak is 116% of capacity of segment #3

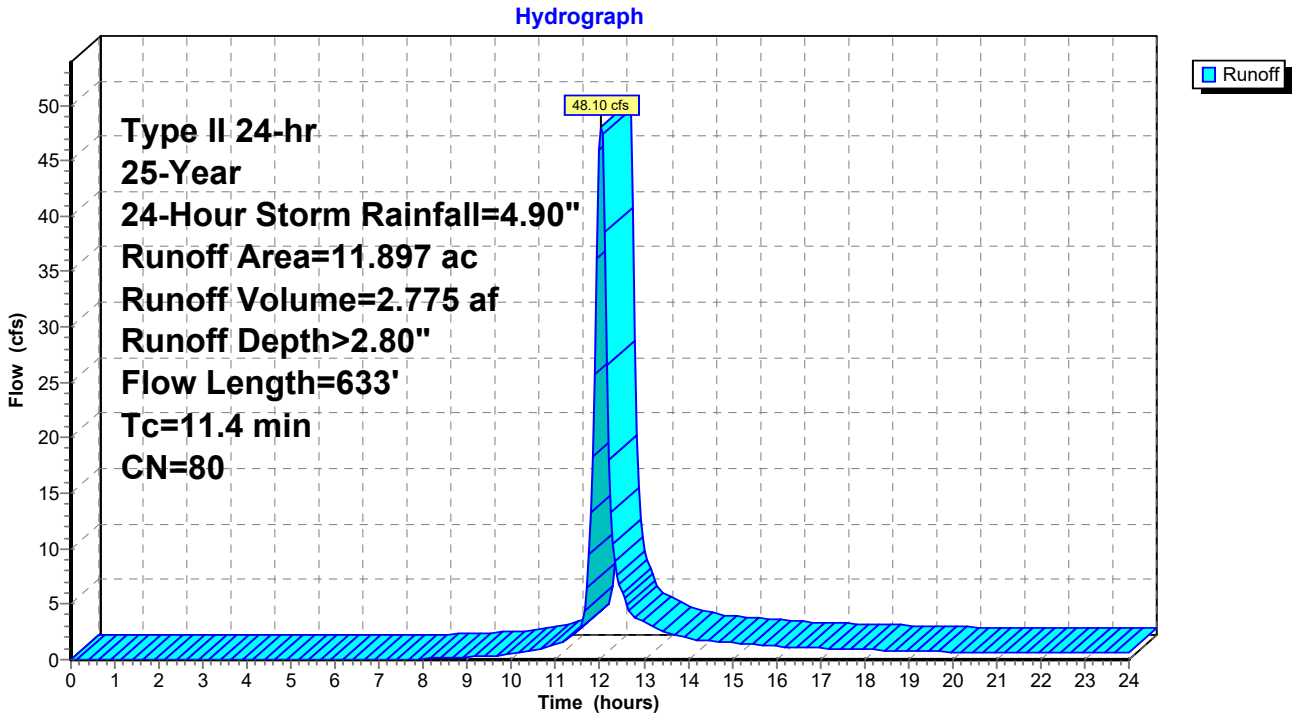
Runoff = 48.10 cfs @ 12.03 hrs, Volume= 2.775 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	11.340	80	Cap
	0.557	85	Gravel roads, HSG B
	11.897	80	Weighted Average
	11.897		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
0.4	182	0.0250	7.37	41.47	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=7.50' n= 0.025
11.4	633	Total			

Subcatchment 8S:



Summary for Subcatchment 9S:

[47] Hint: Peak is 744% of capacity of segment #3

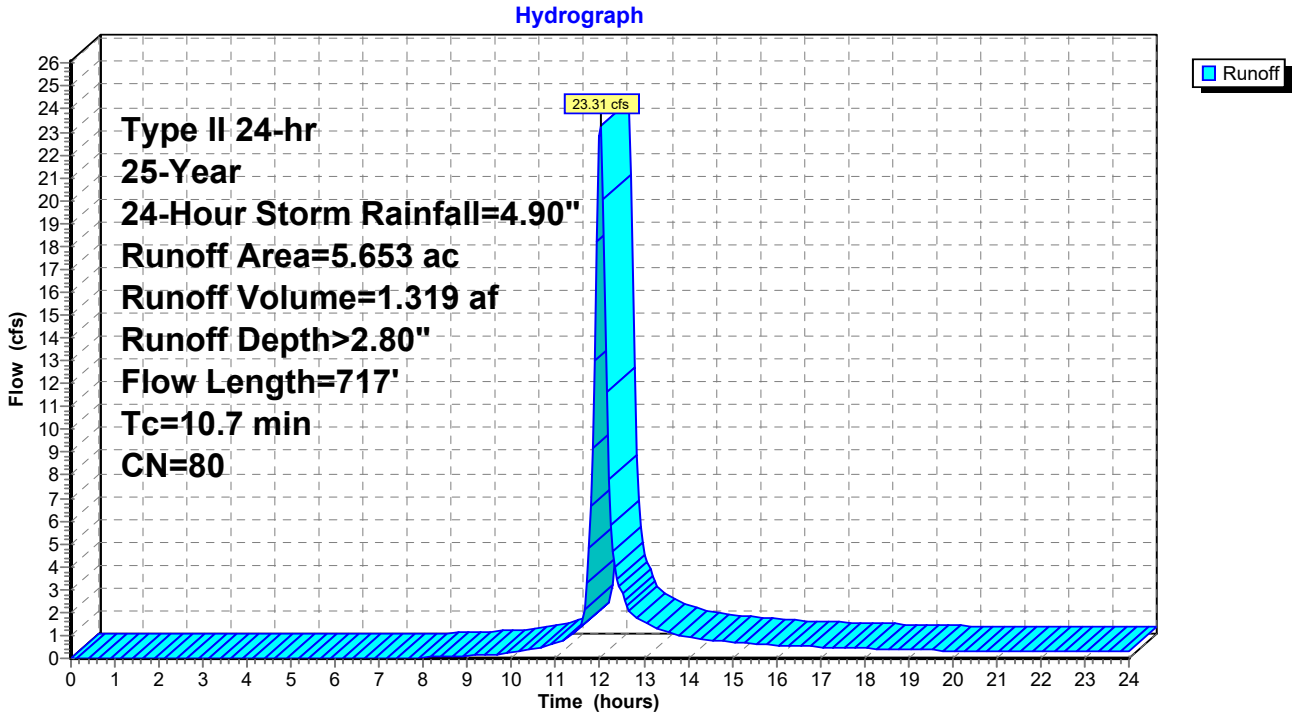
Runoff = 23.31 cfs @ 12.02 hrs, Volume= 1.319 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	5.113	80	Cap
	0.540	85	Gravel roads, HSG B
	5.653	80	Weighted Average
	5.653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
2.0	191	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
1.4	406	0.0500	5.01	3.13	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.025
0.0	20	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Let-Down Channel 1** Bot.W=3.00' D=1.50' n= 0.040
10.7	717	Total			

Subcatchment 9S:



Summary for Subcatchment 10S:

[47] Hint: Peak is 1849% of capacity of segment #4

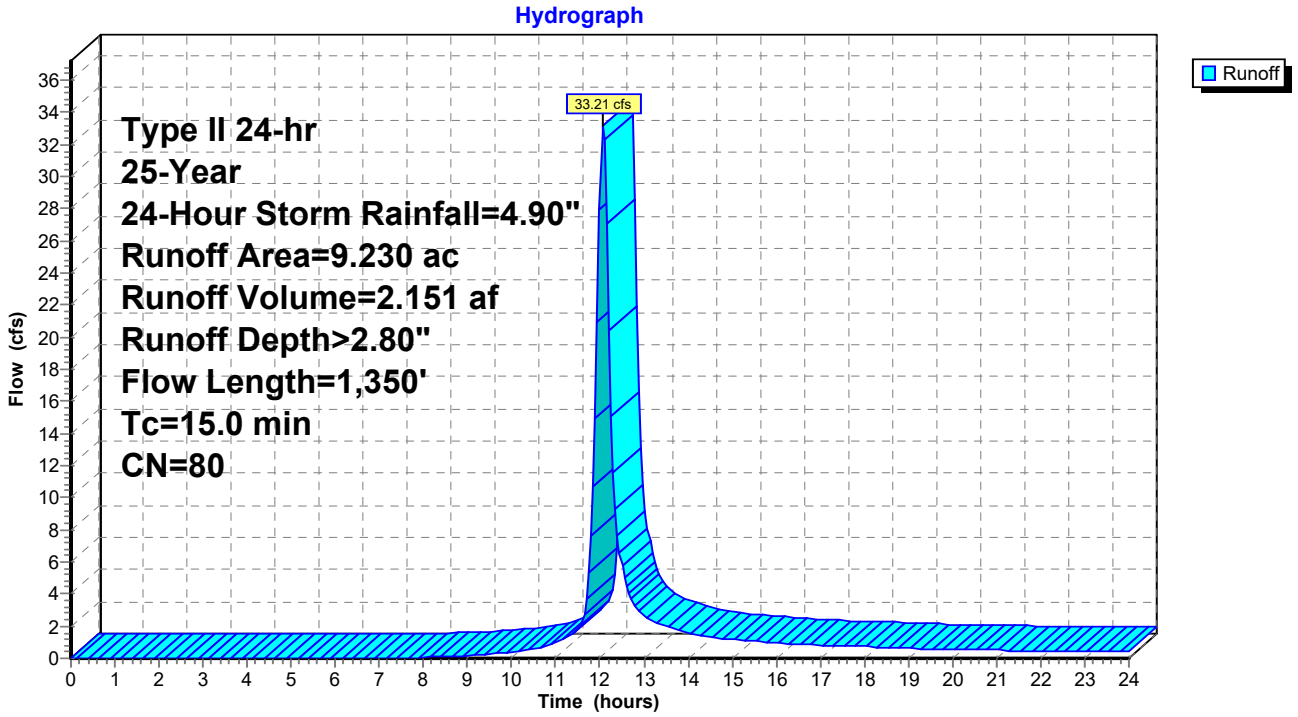
Runoff = 33.21 cfs @ 12.07 hrs, Volume= 2.151 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	9.230	80	Cap
	9.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
5.2	488	0.0500	1.57		**Shallow Concentrated Flow, Section 1** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	280	0.0400	2.87	1.80	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.039
0.2	222	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Gabion Downchute** Bot.W=3.00' D=1.50' n= 0.040
0.4	190	0.0210	7.63	91.59	**Trap/Vee/Rect Channel Flow, North Channel** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.030
15.0	1,350	Total			

Subcatchment 10S:



Summary for Subcatchment 11S:

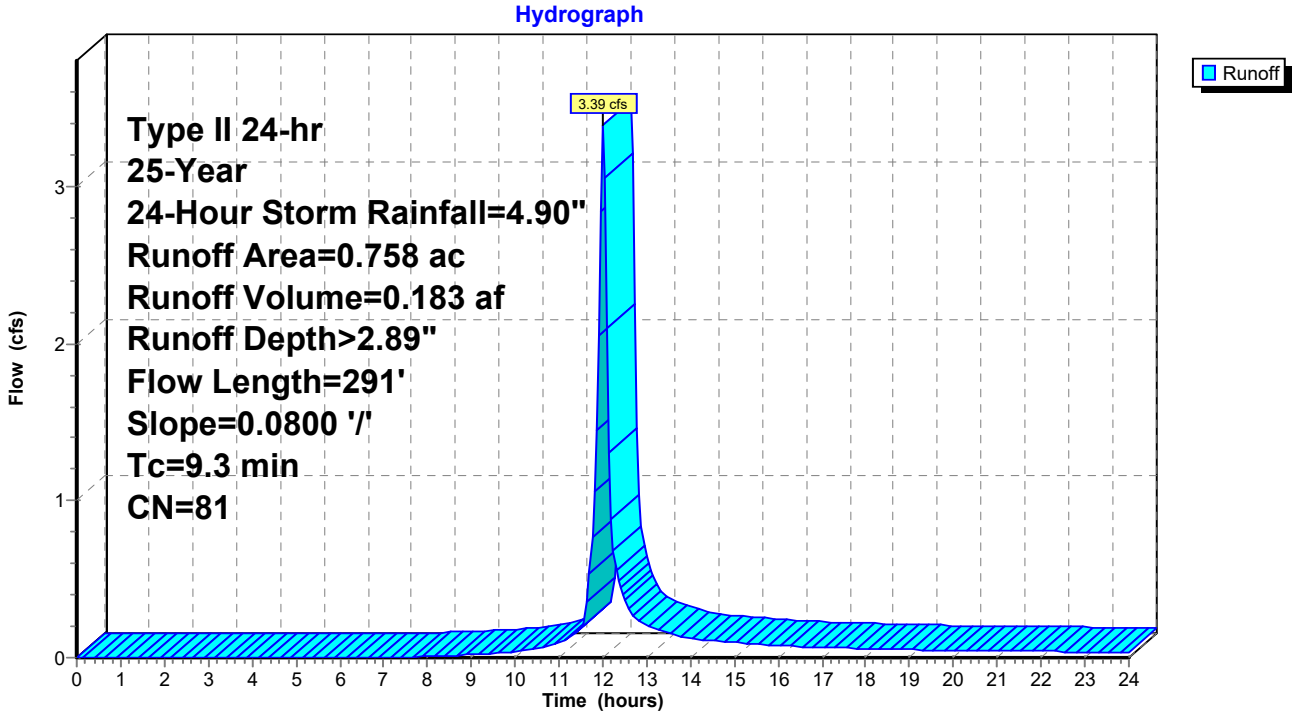
Runoff = 3.39 cfs @ 12.01 hrs, Volume= 0.183 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	0.576	80	CAP
	0.182	85	Gravel roads, HSG B
	0.758	81	Weighted Average
	0.758		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0800	0.19		**Sheet Flow, MSE Exterior Slope** Grass: Dense n= 0.240 P2= 2.80"
0.2	20	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	171	0.0800	9.56	14.34	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
9.3	291	Total			

Subcatchment 11S:



Summary for Subcatchment 12S:

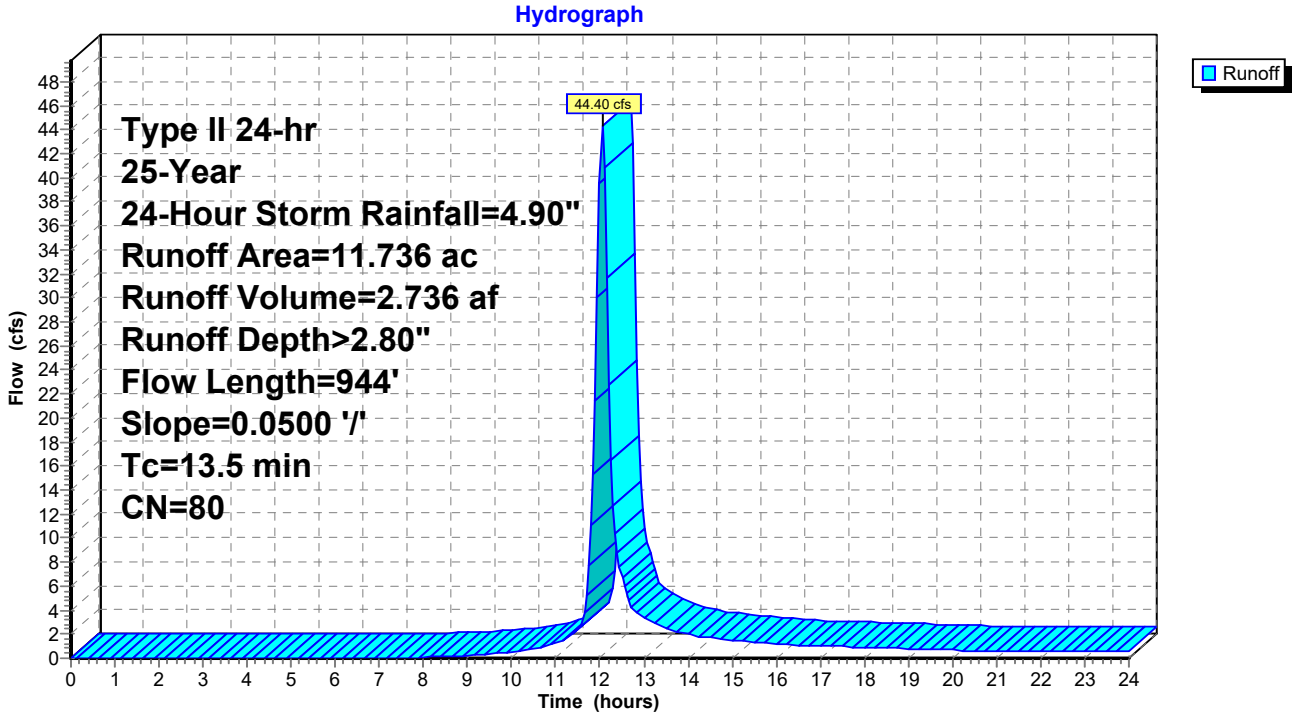
Runoff = 44.40 cfs @ 12.05 hrs, Volume= 2.736 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	11.736	80	
	11.736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Plateau** Grass: Short n= 0.150 P2= 2.80"
3.8	359	0.0500	1.57		**Shallow Concentrated Flow, Plateau** Short Grass Pasture Kv= 7.0 fps
2.4	485	0.0500	3.35		**Shallow Concentrated Flow, Sideslope Berm** Grassed Waterway Kv= 15.0 fps
13.5	944	Total			

Subcatchment 12S:



Summary for Subcatchment 13S:

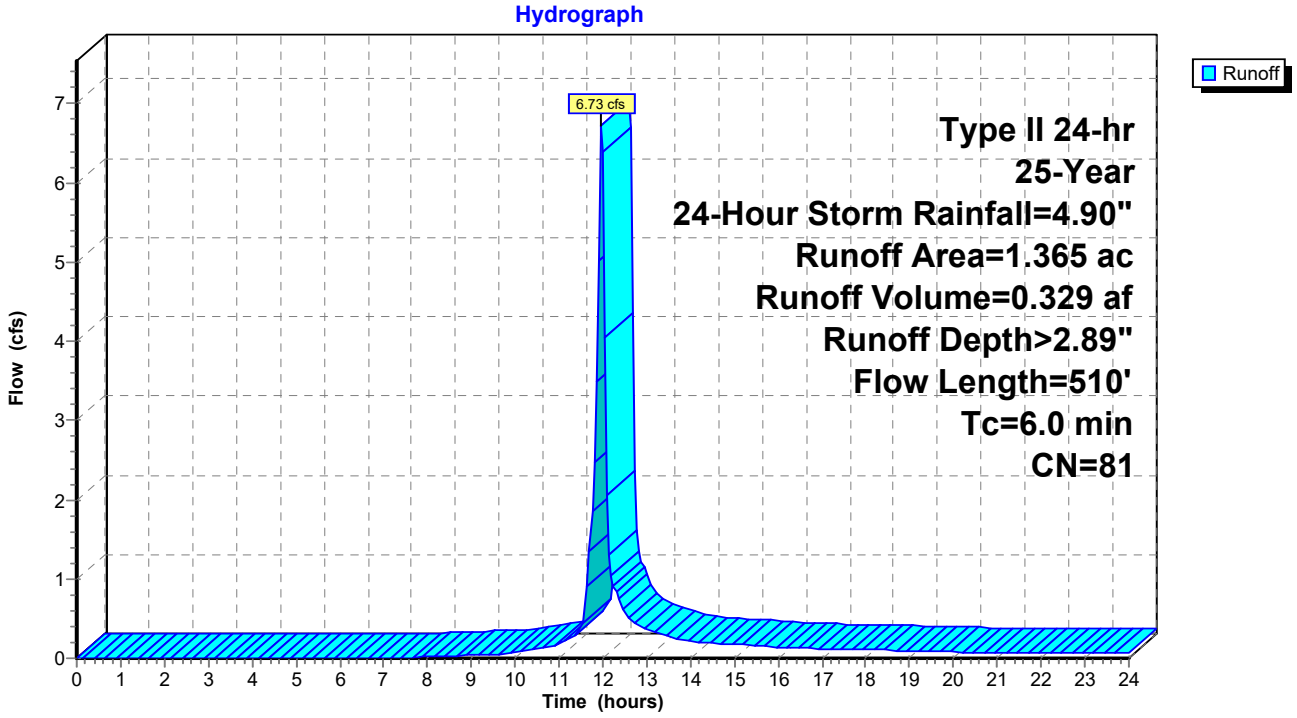
Runoff = 6.73 cfs @ 11.97 hrs, Volume= 0.329 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	1.080	80	Cap
*	0.285	85	Gravel Road
	1.365	81	Weighted Average
	1.365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	50	0.3300	0.43		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.0	460	0.0300	2.60		**Shallow Concentrated Flow, Perimeter Swale** Grassed Waterway Kv= 15.0 fps
5.0	510	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 13S:



Summary for Subcatchment 15S:

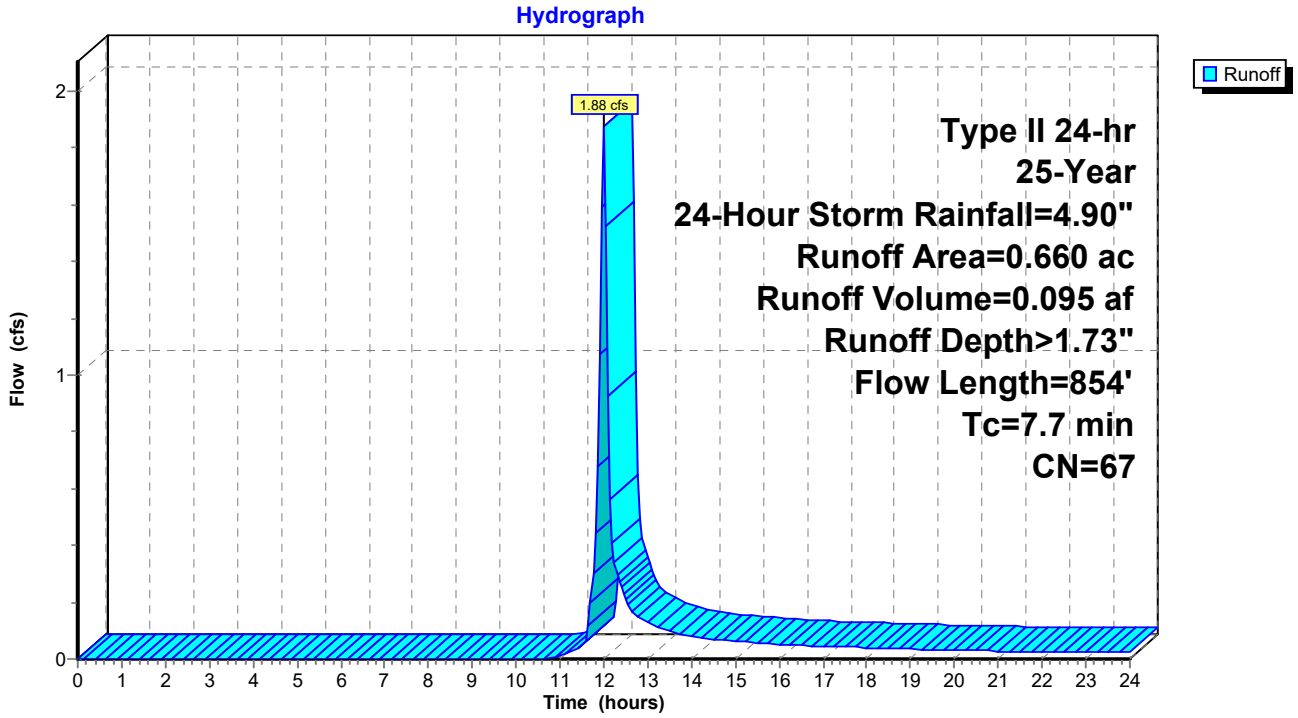
Runoff = 1.88 cfs @ 12.00 hrs, Volume= 0.095 af, Depth> 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	0.660	67	Vegetation (Hyd. Group B)
	0.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	29	0.0330	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
4.5	825	0.0100	3.09	3.09	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.022 Earth, clean & straight
7.7	854	Total			

Subcatchment 15S:



Summary for Subcatchment 16S:

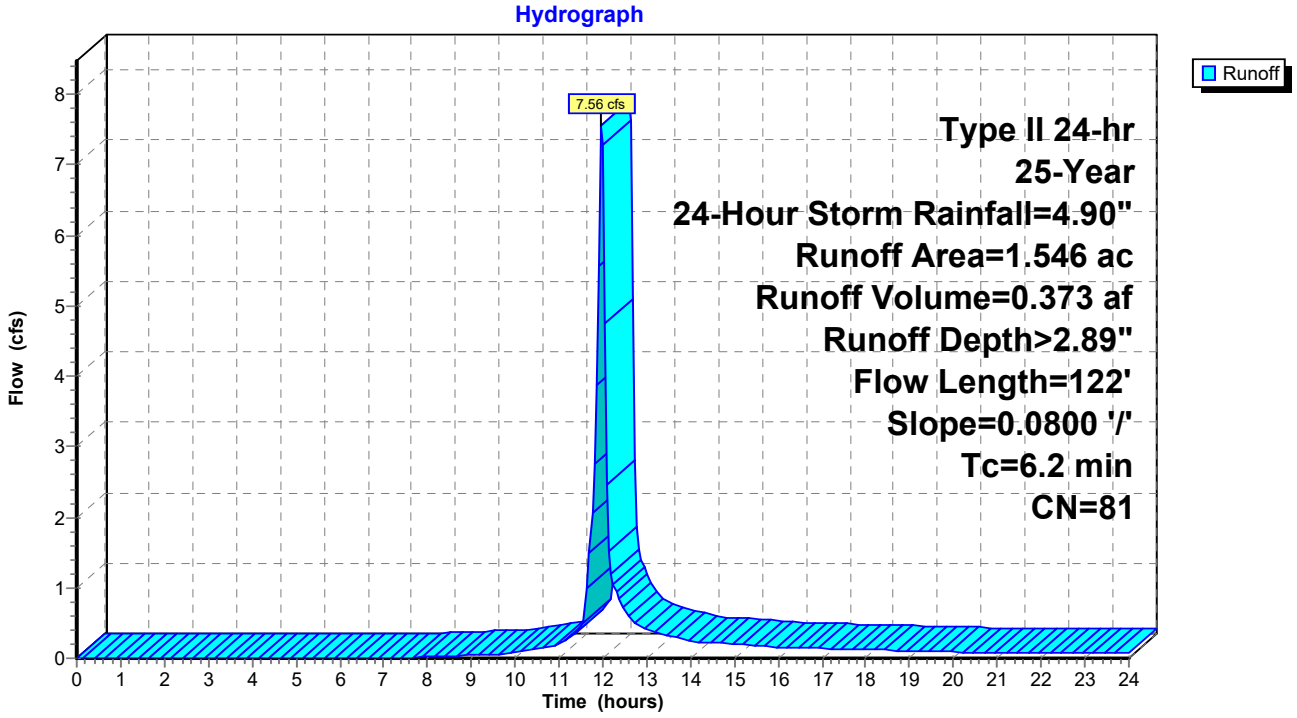
Runoff = 7.56 cfs @ 11.97 hrs, Volume= 0.373 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	1.224	80	Cap
*	0.322	85	Gravel Road
	1.546	81	Weighted Average
	1.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0800	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
0.2	22	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.2	122	Total			

Subcatchment 16S:



Summary for Subcatchment NP:

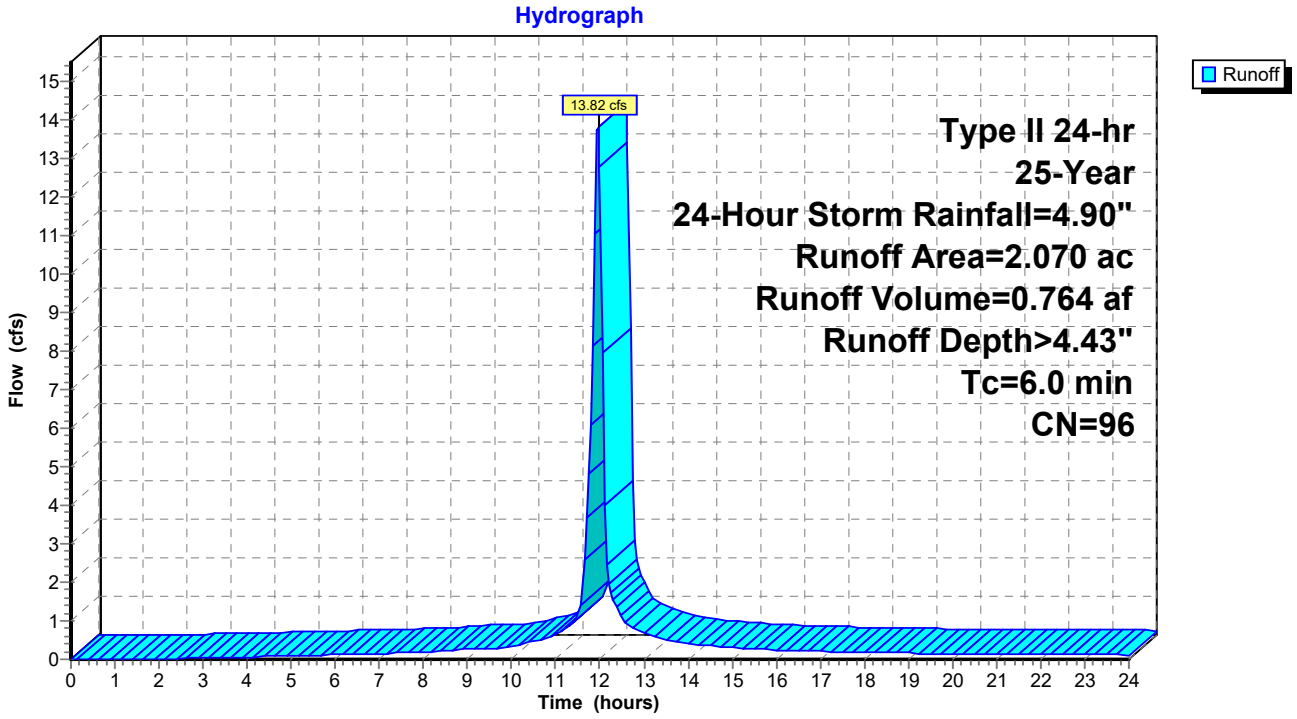
Runoff = 13.82 cfs @ 11.96 hrs, Volume= 0.764 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	1.730	98	Basin
*	0.340	85	Gravel Road
	2.070	96	Weighted Average
	0.340		16.43% Pervious Area
	1.730		83.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					**Direct Entry,**
1.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment NP:



Summary for Reach 1R: Gabion Downchute

Mannings from Figure 5B.11 Determing "n" for Riprap Lined Channel Using Depth of Flow

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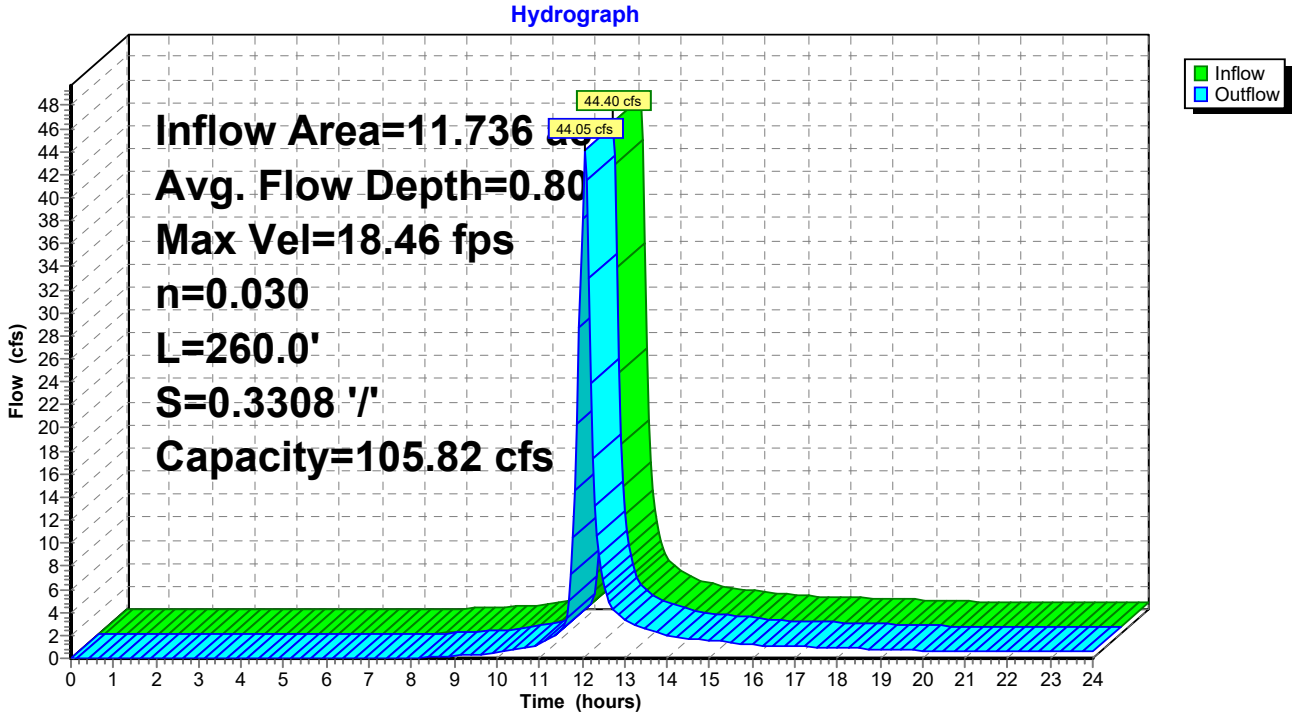
Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 44.40 cfs @ 12.05 hrs, Volume= 2.736 af
Outflow = 44.05 cfs @ 12.06 hrs, Volume= 2.735 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.46 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.91 fps, Avg. Travel Time= 0.9 min

Peak Storage= 625 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.80' , Surface Width= 3.00'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 105.82 cfs

3.00' x 1.50' deep channel, n= 0.030
Length= 260.0' Slope= 0.3308 '/'
Inlet Invert= 290.00', Outlet Invert= 204.00'

Reach 1R: Gabion Downchute



Summary for Reach 2R: North Channel - 3

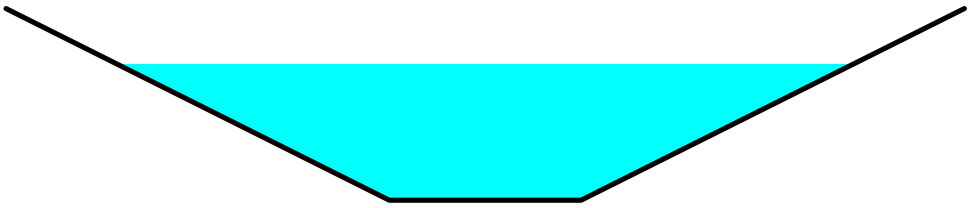
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.63' @ 12.10 hrs

Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 2.81" for 25-Year, 24-Hour Storm event
Inflow = 47.96 cfs @ 12.05 hrs, Volume= 3.064 af
Outflow = 46.62 cfs @ 12.08 hrs, Volume= 3.059 af, Atten= 3%, Lag= 2.0 min

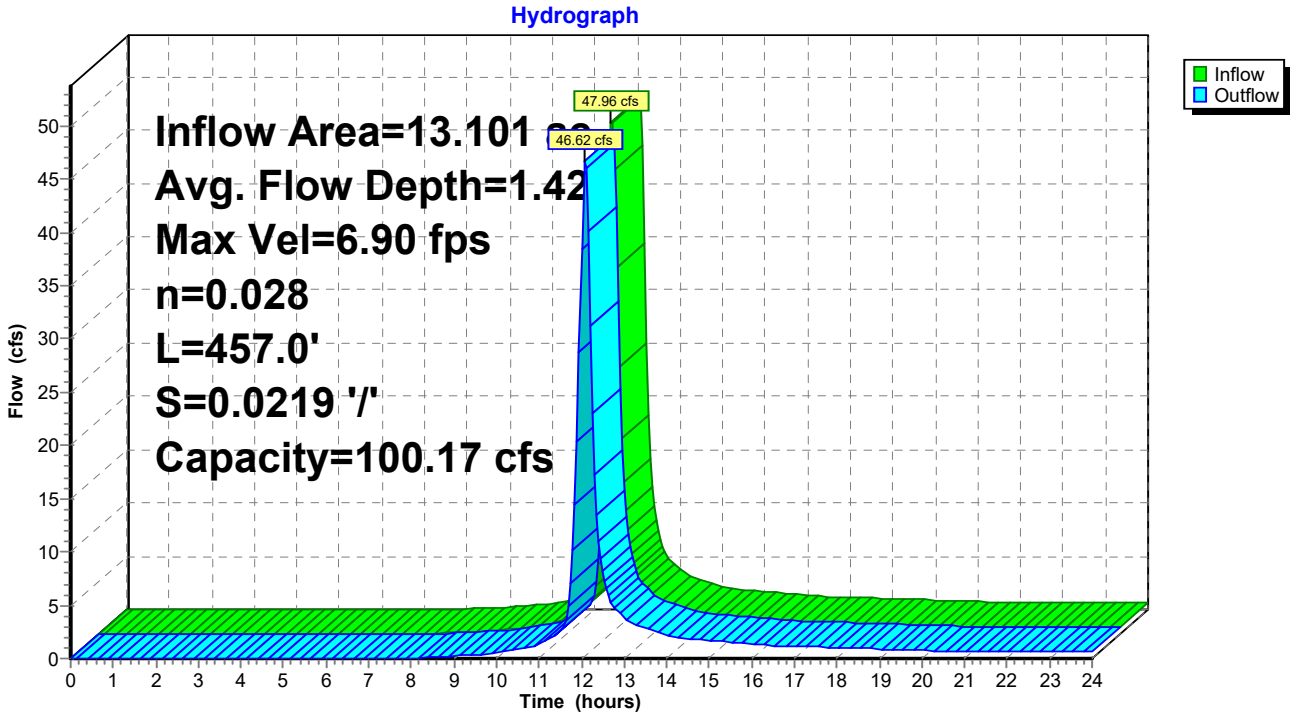
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.90 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.32 fps, Avg. Travel Time= 3.3 min

Peak Storage= 3,154 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.42' , Surface Width= 7.70'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 100.17 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 457.0' Slope= 0.0219 '/'
Inlet Invert= 204.00', Outlet Invert= 194.00'



Reach 2R: North Channel - 3



Summary for Reach 3R:

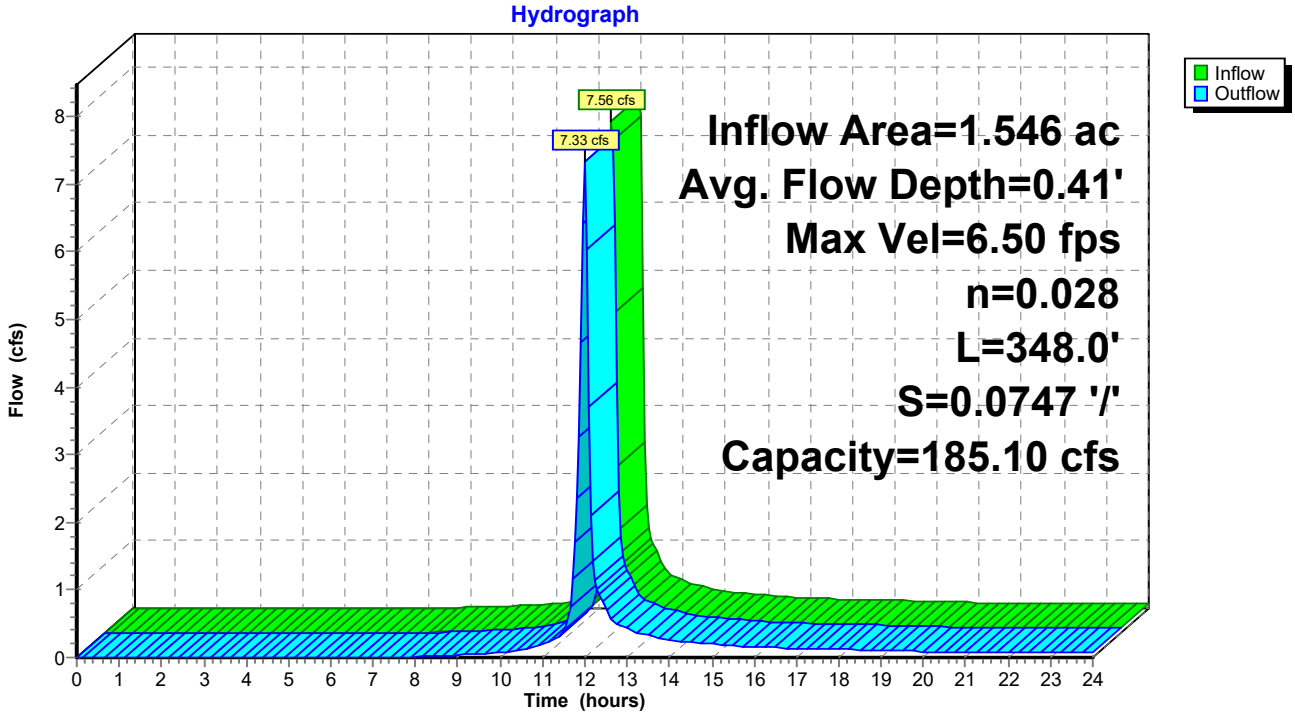
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 2.89" for 25-Year, 24-Hour Storm event
Inflow = 7.56 cfs @ 11.97 hrs, Volume= 0.373 af
Outflow = 7.33 cfs @ 12.00 hrs, Volume= 0.372 af, Atten= 3%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.50 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.73 fps, Avg. Travel Time= 3.3 min

Peak Storage= 404 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.41' , Surface Width= 3.65'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 185.10 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 348.0' Slope= 0.0747 '/'
Inlet Invert= 220.00', Outlet Invert= 194.00'

Reach 3R:



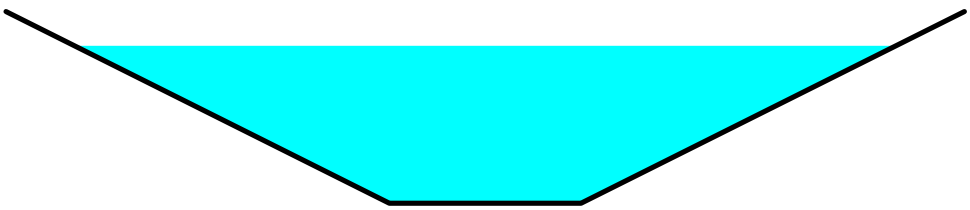
Summary for Reach 4R: North Channel - 1

Inflow Area = 11.897 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 48.10 cfs @ 12.03 hrs, Volume= 2.775 af
Outflow = 43.01 cfs @ 12.14 hrs, Volume= 2.761 af, Atten= 11%, Lag= 6.6 min

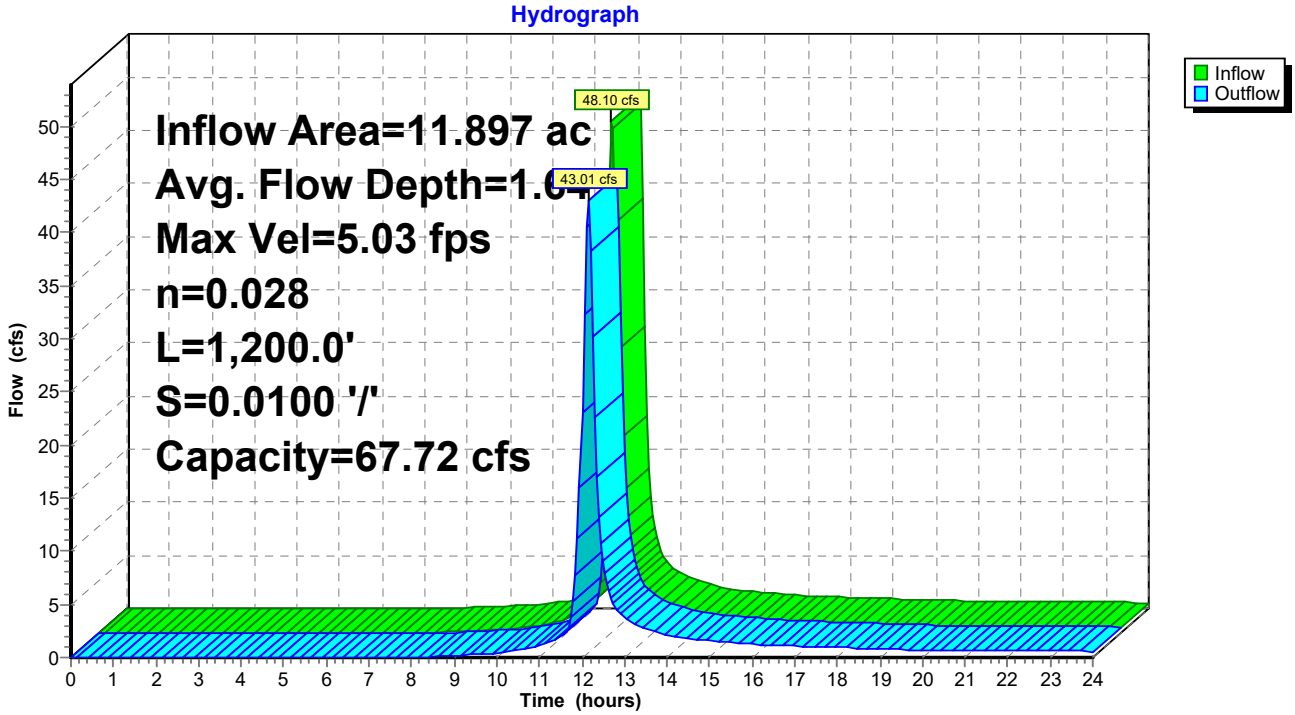
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.03 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.74 fps, Avg. Travel Time= 11.5 min

Peak Storage= 10,408 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.64' , Surface Width= 8.57'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.72 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,200.0' Slope= 0.0100 '/'
Inlet Invert= 290.00', Outlet Invert= 278.00'



Reach 4R: North Channel - 1



Summary for Reach 5R: North Channel - 2

[61] Hint: Exceeded Reach 4R outlet invert by 1.17' @ 12.10 hrs

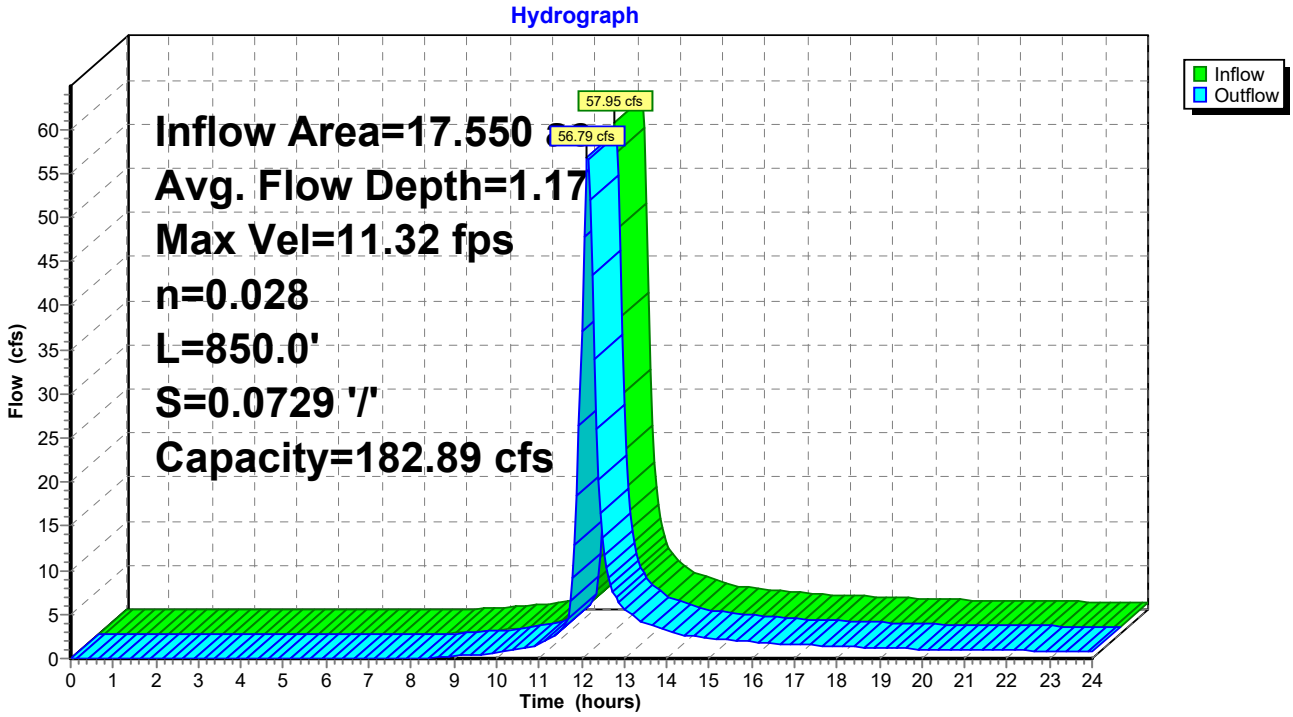
Inflow Area = 17.550 ac, 0.00% Impervious, Inflow Depth > 2.79" for 25-Year, 24-Hour Storm event
Inflow = 57.95 cfs @ 12.10 hrs, Volume= 4.079 af
Outflow = 56.79 cfs @ 12.14 hrs, Volume= 4.073 af, Atten= 2%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.32 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 3.87 fps, Avg. Travel Time= 3.7 min

Peak Storage= 4,326 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.17' , Surface Width= 6.69'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 182.89 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 850.0' Slope= 0.0729 '/'
Inlet Invert= 278.00', Outlet Invert= 216.00'

Reach 5R: North Channel - 2



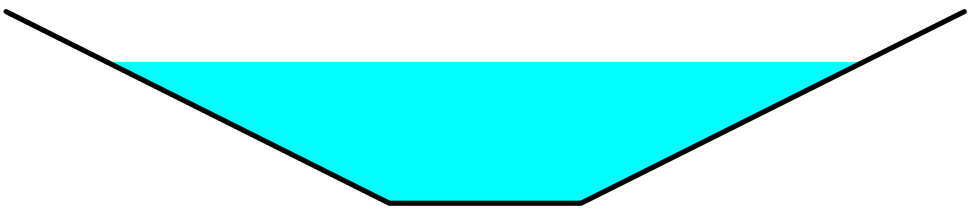
Summary for Reach 6R:

Inflow Area = 9.988 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 36.02 cfs @ 12.06 hrs, Volume= 2.333 af
Outflow = 35.36 cfs @ 12.08 hrs, Volume= 2.331 af, Atten= 2%, Lag= 1.2 min

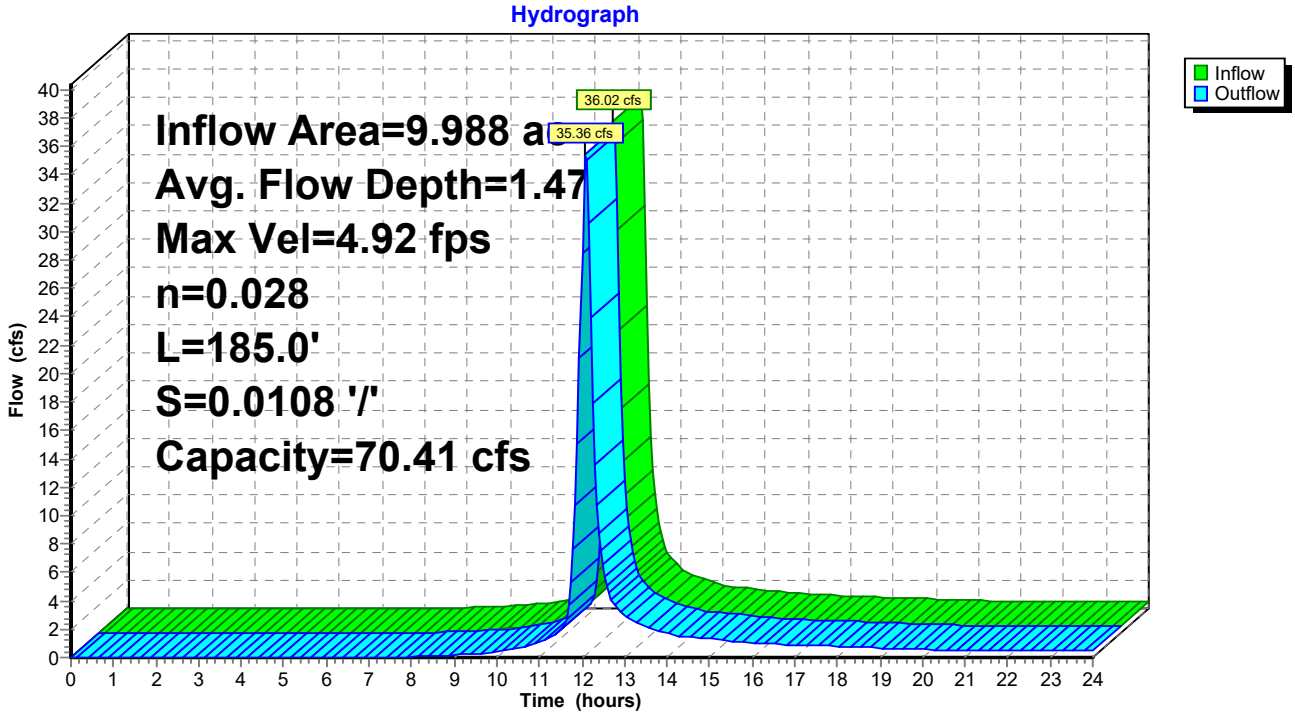
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.92 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 1.8 min

Peak Storage= 1,345 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.47' , Surface Width= 7.88'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 70.41 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 185.0' Slope= 0.0108 '/'
Inlet Invert= 218.00', Outlet Invert= 216.00'



Reach 6R:



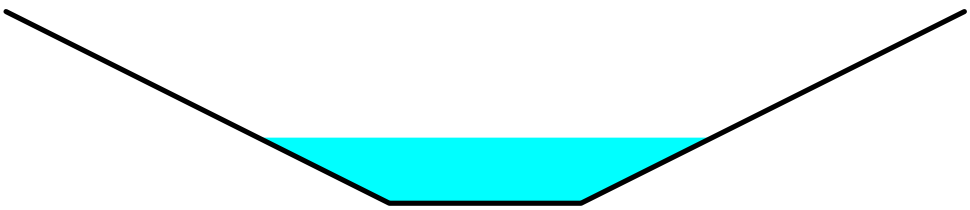
Summary for Reach 7R: MSE Berm Swale

Inflow Area = 0.660 ac, 0.00% Impervious, Inflow Depth > 1.73" for 25-Year, 24-Hour Storm event
Inflow = 1.88 cfs @ 12.00 hrs, Volume= 0.095 af
Outflow = 1.52 cfs @ 12.14 hrs, Volume= 0.094 af, Atten= 19%, Lag= 8.5 min

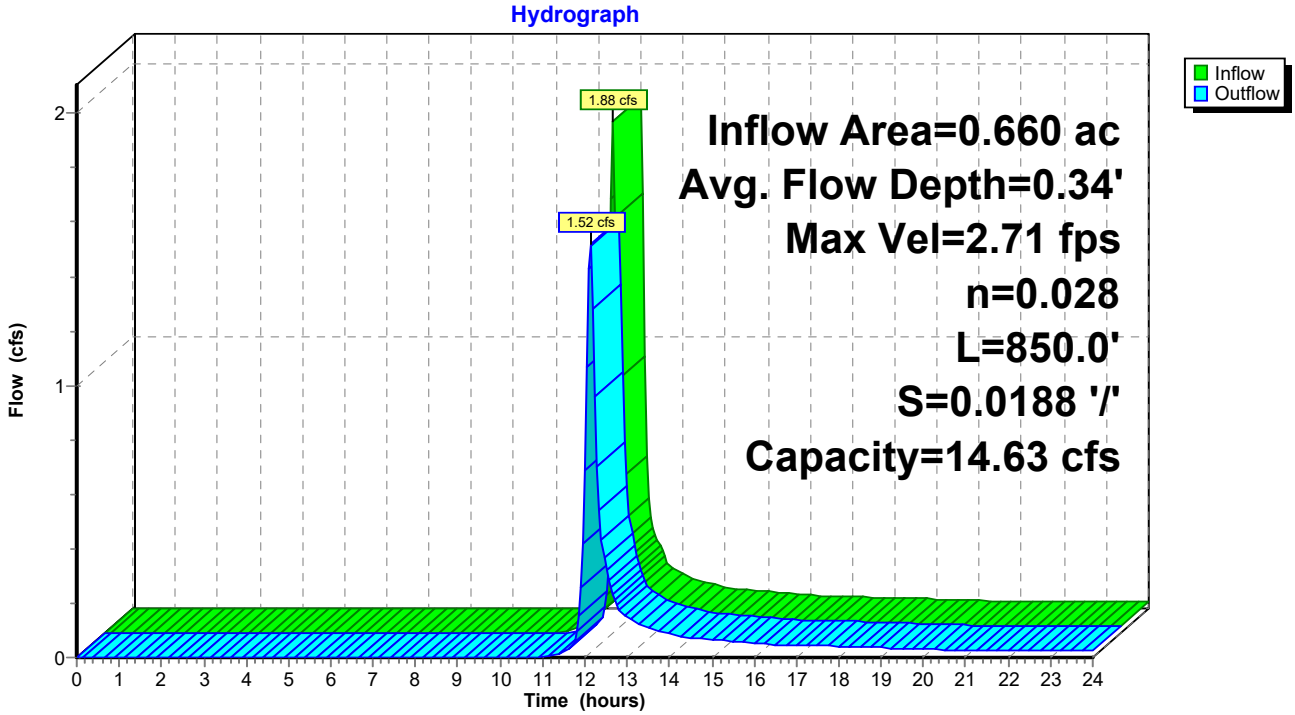
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.71 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 15.3 min

Peak Storage= 489 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.34' , Surface Width= 2.37'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 14.63 cfs

1.00' x 1.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 216.00', Outlet Invert= 200.00'



Reach 7R: MSE Berm Swale



Summary for Pond 1P: Drop Inlet 1

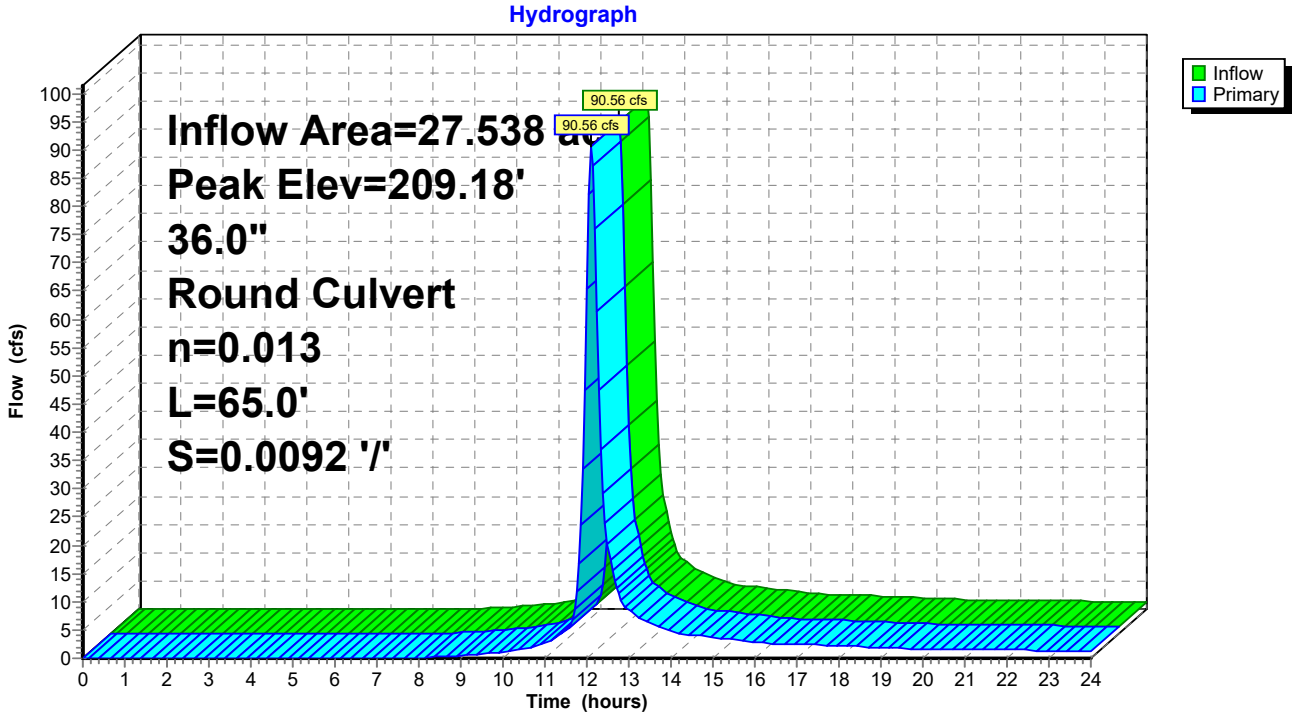
Inflow Area = 27.538 ac, 0.00% Impervious, Inflow Depth > 2.79" for 25-Year, 24-Hour Storm event
Inflow = 90.56 cfs @ 12.11 hrs, Volume= 6.404 af
Outflow = 90.56 cfs @ 12.11 hrs, Volume= 6.404 af, Atten= 0%, Lag= 0.0 min
Primary = 90.56 cfs @ 12.11 hrs, Volume= 6.404 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 209.18' @ 12.11 hrs
Flood Elev= 220.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	200.60'	**36.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 200.60' / 200.00' S= 0.0092 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=89.60 cfs @ 12.11 hrs HW=209.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 89.60 cfs @ 12.68 fps)

Pond 1P: Drop Inlet 1



Summary for Pond 2P: Drop Inlet Structure

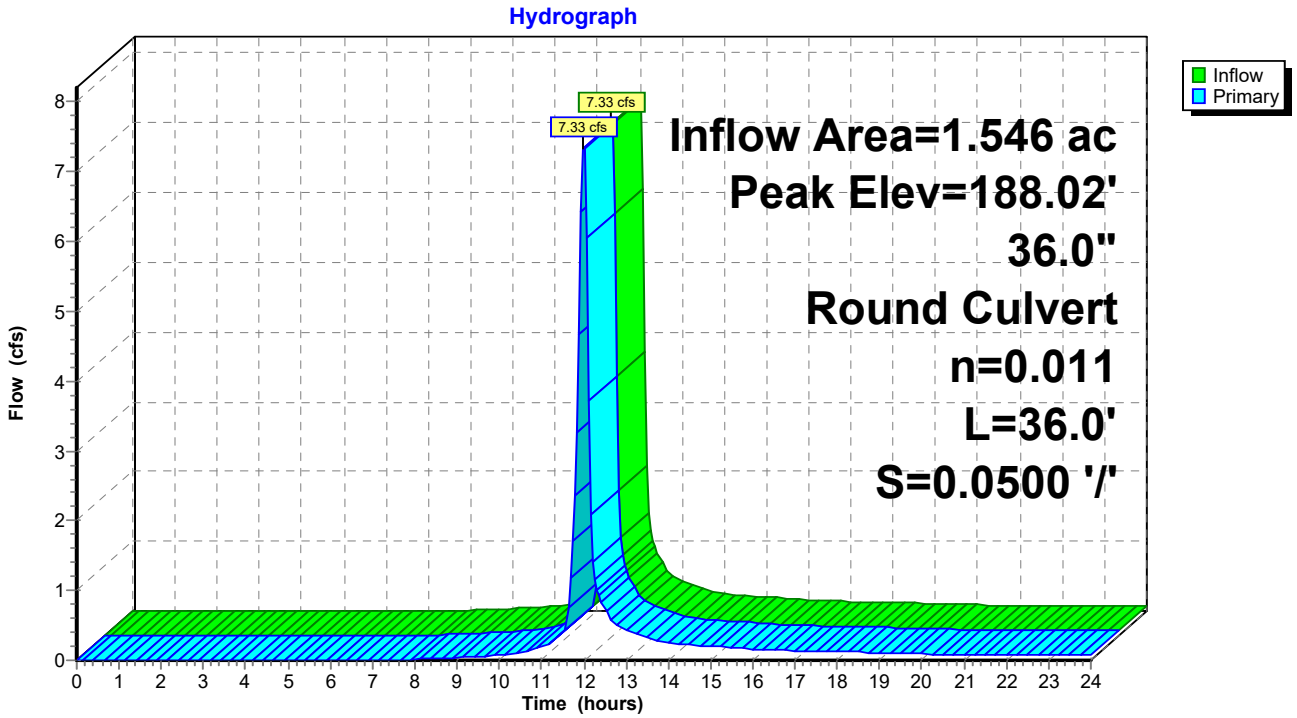
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 2.89" for 25-Year, 24-Hour Storm event
Inflow = 7.33 cfs @ 12.00 hrs, Volume= 0.372 af
Outflow = 7.33 cfs @ 12.00 hrs, Volume= 0.372 af, Atten= 0%, Lag= 0.0 min
Primary = 7.33 cfs @ 12.00 hrs, Volume= 0.372 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 188.02' @ 12.00 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round 36" HDPE Pipe** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 185.20' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=7.23 cfs @ 12.00 hrs HW=188.02' (Free Discharge)
└**1=36" HDPE Pipe** (Inlet Controls 7.23 cfs @ 3.43 fps)

Pond 2P: Drop Inlet Structure



Summary for Pond 3P: Stormwater Manhole

[79] Warning: Submerged Pond 8P Primary device # 1 OUTLET by 0.09'

Inflow Area =	14.647 ac,	0.00% Impervious,	Inflow Depth >	2.81"	for 25-Year, 24-Hour Storm event
Inflow =	51.81 cfs @	12.06 hrs,	Volume=	3.432 af	
Outflow =	51.81 cfs @	12.06 hrs,	Volume=	3.432 af,	Atten= 0%, Lag= 0.0 min
Primary =	51.81 cfs @	12.06 hrs,	Volume=	3.432 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

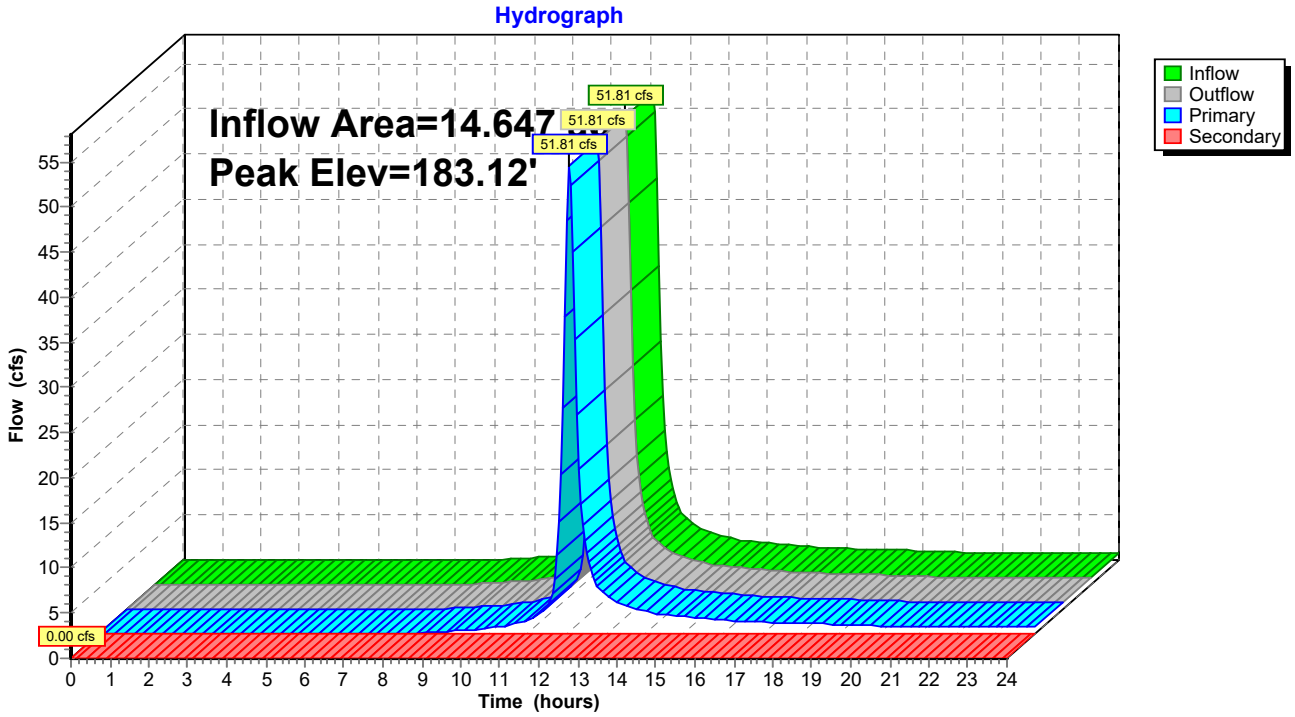
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.12' @ 12.06 hrs
Flood Elev= 188.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.30'	**36.0" Round 36" HDPE Pipe** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.30' / 177.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Secondary	196.00'	**6.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=51.09 cfs @ 12.06 hrs HW=183.05' (Free Discharge)
└─**1=36" HDPE Pipe** (Inlet Controls 51.09 cfs @ 7.23 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=179.30' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Stormwater Manhole



Summary for Pond 8P: Drop Inlet Structure

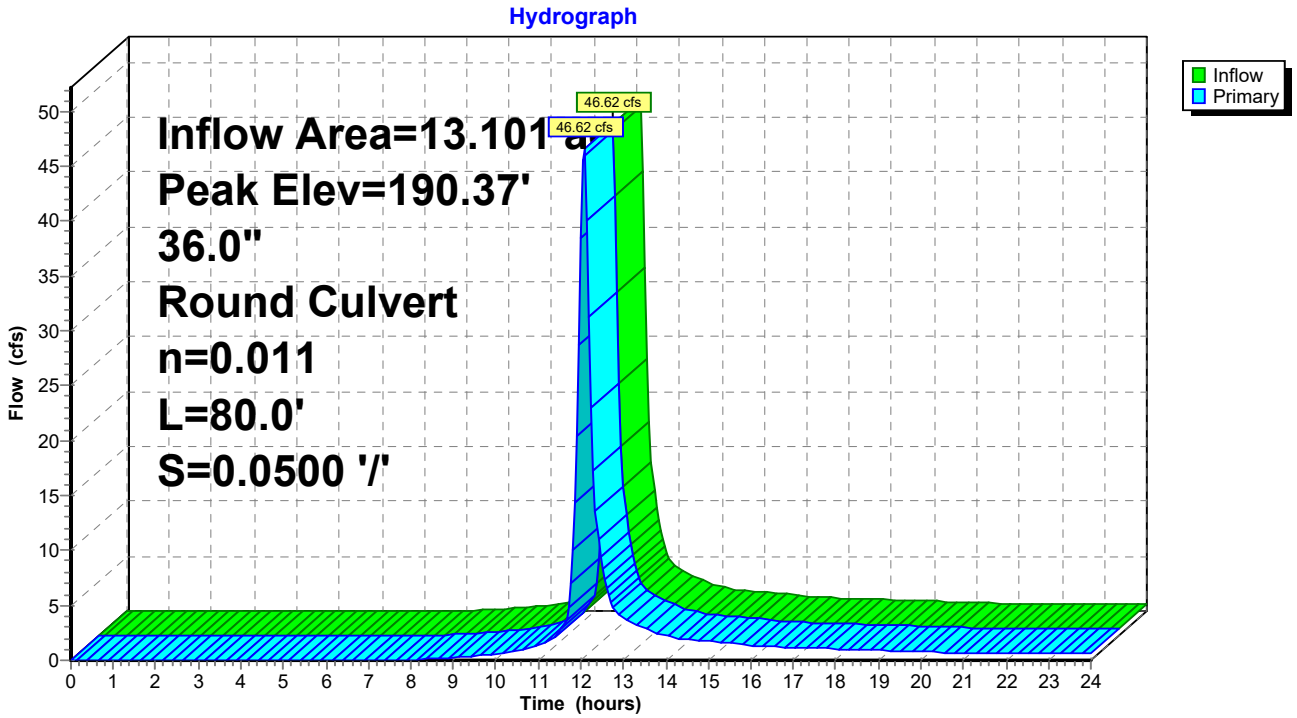
Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 46.62 cfs @ 12.08 hrs, Volume= 3.059 af
Outflow = 46.62 cfs @ 12.08 hrs, Volume= 3.059 af, Atten= 0%, Lag= 0.0 min
Primary = 46.62 cfs @ 12.08 hrs, Volume= 3.059 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 190.37' @ 12.08 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round Culvert** L= 80.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 183.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=45.83 cfs @ 12.08 hrs HW=190.31' (Free Discharge)
└**1=Culvert** (Inlet Controls 45.83 cfs @ 6.48 fps)

Pond 8P: Drop Inlet Structure



Summary for Pond 26P: North Pond

Inflow Area = 44.915 ac, 3.85% Impervious, Inflow Depth > 2.86" for 25-Year, 24-Hour Storm event
Inflow = 146.18 cfs @ 12.08 hrs, Volume= 10.694 af
Outflow = 2.93 cfs @ 19.35 hrs, Volume= 2.854 af, Atten= 98%, Lag= 436.2 min
Discarded = 2.93 cfs @ 19.35 hrs, Volume= 2.854 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 160.84' @ 19.35 hrs Surf.Area= 31,013 sf Storage= 349,888 cf

Plug-Flow detention time= 392.1 min calculated for 2.854 af (27% of inflow)
Center-of-Mass det. time= 256.1 min (1,079.7 - 823.5)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	731,085 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

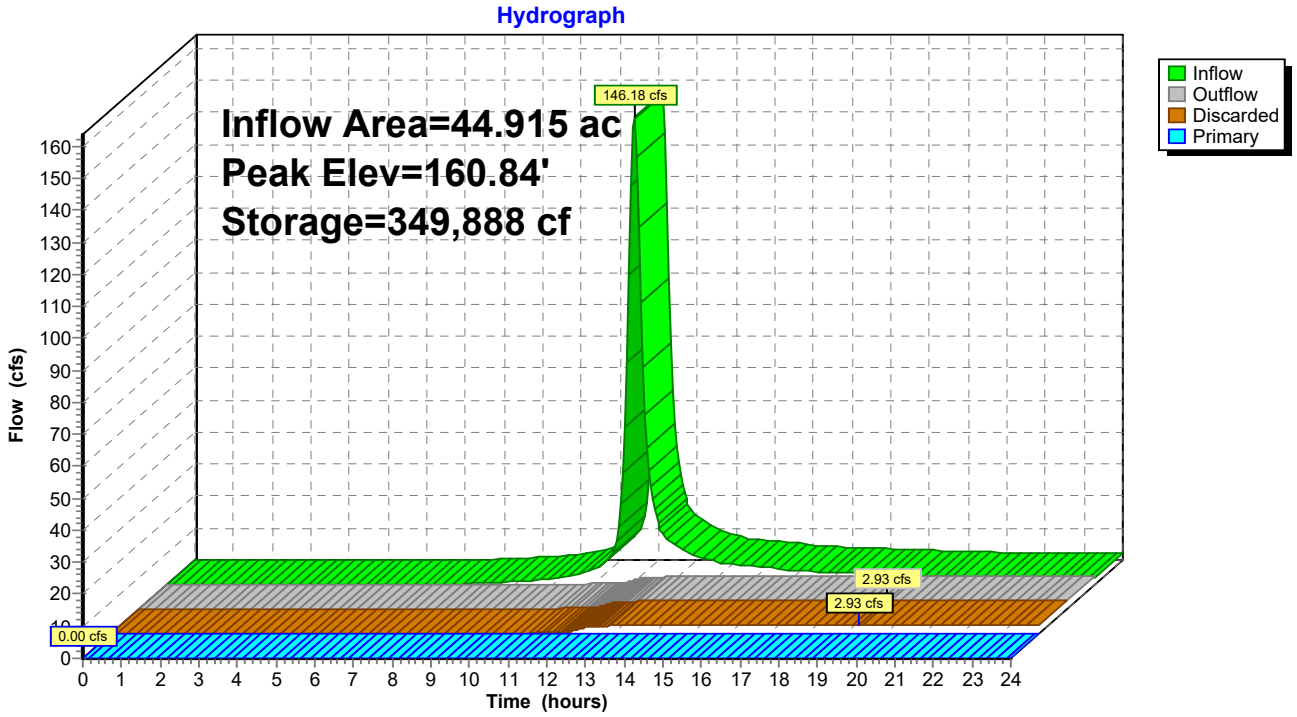
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	5,675	0	0
150.00	15,091	103,830	103,830
160.00	29,062	220,765	324,595
170.00	52,236	406,490	731,085

Device	Routing	Invert	Outlet Devices
#1	Discarded	140.00'	**5.000 in/hr Exfiltration over Horizontal area above 140.00'** Excluded Horizontal area = 5,675 sf
#2	Primary	167.00'	**17.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=2.93 cfs @ 19.35 hrs HW=160.84' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.93 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: North Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment8S: Runoff Area=11.897 ac 0.00% Impervious Runoff Depth>3.68"
Flow Length=633' Tc=11.4 min CN=80 Runoff=62.82 cfs 3.651 af

Subcatchment9S: Runoff Area=5.653 ac 0.00% Impervious Runoff Depth>3.68"
Flow Length=717' Tc=10.7 min CN=80 Runoff=30.45 cfs 1.735 af

Subcatchment10S: Runoff Area=9.230 ac 0.00% Impervious Runoff Depth>3.68"
Flow Length=1,350' Tc=15.0 min CN=80 Runoff=43.48 cfs 2.830 af

Subcatchment11S: Runoff Area=0.758 ac 0.00% Impervious Runoff Depth>3.79"
Flow Length=291' Slope=0.0800 '/' Tc=9.3 min CN=81 Runoff=4.40 cfs 0.239 af

Subcatchment12S: Runoff Area=11.736 ac 0.00% Impervious Runoff Depth>3.68"
Flow Length=944' Slope=0.0500 '/' Tc=13.5 min CN=80 Runoff=58.07 cfs 3.599 af

Subcatchment13S: Runoff Area=1.365 ac 0.00% Impervious Runoff Depth>3.79"
Flow Length=510' Tc=6.0 min CN=81 Runoff=8.72 cfs 0.431 af

Subcatchment15S: Runoff Area=0.660 ac 0.00% Impervious Runoff Depth>2.45"
Flow Length=854' Tc=7.7 min CN=67 Runoff=2.68 cfs 0.135 af

Subcatchment16S: Runoff Area=1.546 ac 0.00% Impervious Runoff Depth>3.79"
Flow Length=122' Slope=0.0800 '/' Tc=6.2 min CN=81 Runoff=9.80 cfs 0.488 af

SubcatchmentNP: Runoff Area=2.070 ac 83.57% Impervious Runoff Depth>5.42"
Tc=6.0 min CN=96 Runoff=16.74 cfs 0.936 af

Reach 1R: Gabion Downchute Avg. Flow Depth=0.97' Max Vel=19.99 fps Inflow=58.07 cfs 3.599 af
n=0.030 L=260.0' S=0.3308 '/' Capacity=105.82 cfs Outflow=57.66 cfs 3.598 af

Reach 2R: North Channel - 3 Avg. Flow Depth=1.61' Max Vel=7.40 fps Inflow=62.79 cfs 4.029 af
n=0.028 L=457.0' S=0.0219 '/' Capacity=100.17 cfs Outflow=61.17 cfs 4.024 af

Reach 3R: Avg. Flow Depth=0.47' Max Vel=7.01 fps Inflow=9.80 cfs 0.488 af
n=0.028 L=348.0' S=0.0747 '/' Capacity=185.10 cfs Outflow=9.53 cfs 0.487 af

Reach 4R: North Channel - 1 Avg. Flow Depth=1.87' Max Vel=5.40 fps Inflow=62.82 cfs 3.651 af
n=0.028 L=1,200.0' S=0.0100 '/' Capacity=67.72 cfs Outflow=56.93 cfs 3.635 af

Reach 5R: North Channel - 2 Avg. Flow Depth=1.35' Max Vel=12.23 fps Inflow=77.68 cfs 5.369 af
n=0.028 L=850.0' S=0.0729 '/' Capacity=182.89 cfs Outflow=76.04 cfs 5.362 af

Reach 6R: Avg. Flow Depth=1.67' Max Vel=5.28 fps Inflow=47.14 cfs 3.069 af
n=0.028 L=185.0' S=0.0108 '/' Capacity=70.41 cfs Outflow=46.31 cfs 3.067 af

Reach 7R: MSE Berm Swale Avg. Flow Depth=0.42' Max Vel=3.01 fps Inflow=2.68 cfs 0.135 af
n=0.028 L=850.0' S=0.0188 '/' Capacity=14.63 cfs Outflow=2.21 cfs 0.134 af

Pond 1P: Drop Inlet 1 Peak Elev=214.69' Inflow=120.76 cfs 8.429 af
36.0" Round Culvert n=0.013 L=65.0' S=0.0092 '/' Outflow=120.76 cfs 8.429 af

Pond 2P: Drop Inlet Structure Peak Elev=188.18' Inflow=9.53 cfs 0.487 af
36.0" Round Culvert n=0.011 L=36.0' S=0.0500 '/' Outflow=9.53 cfs 0.487 af

Pond 3P: Stormwater Manhole Peak Elev=184.79' Inflow=67.98 cfs 4.512 af
Primary=67.98 cfs 4.512 af Secondary=0.00 cfs 0.000 af Outflow=67.98 cfs 4.512 af

Pond 8P: Drop Inlet Structure Peak Elev=191.72' Inflow=61.17 cfs 4.024 af
36.0" Round Culvert n=0.011 L=80.0' S=0.0500 '/' Outflow=61.17 cfs 4.024 af

Pond 26P: North Pond Peak Elev=164.04' Storage=460,796 cf Inflow=193.95 cfs 14.009 af
Discarded=3.79 cfs 3.723 af Primary=0.00 cfs 0.000 af Outflow=3.79 cfs 3.723 af

Total Runoff Area = 44.915 ac Runoff Volume = 14.043 af Average Runoff Depth = 3.75"
96.15% Pervious = 43.185 ac 3.85% Impervious = 1.730 ac

Summary for Subcatchment 8S:

[47] Hint: Peak is 152% of capacity of segment #3

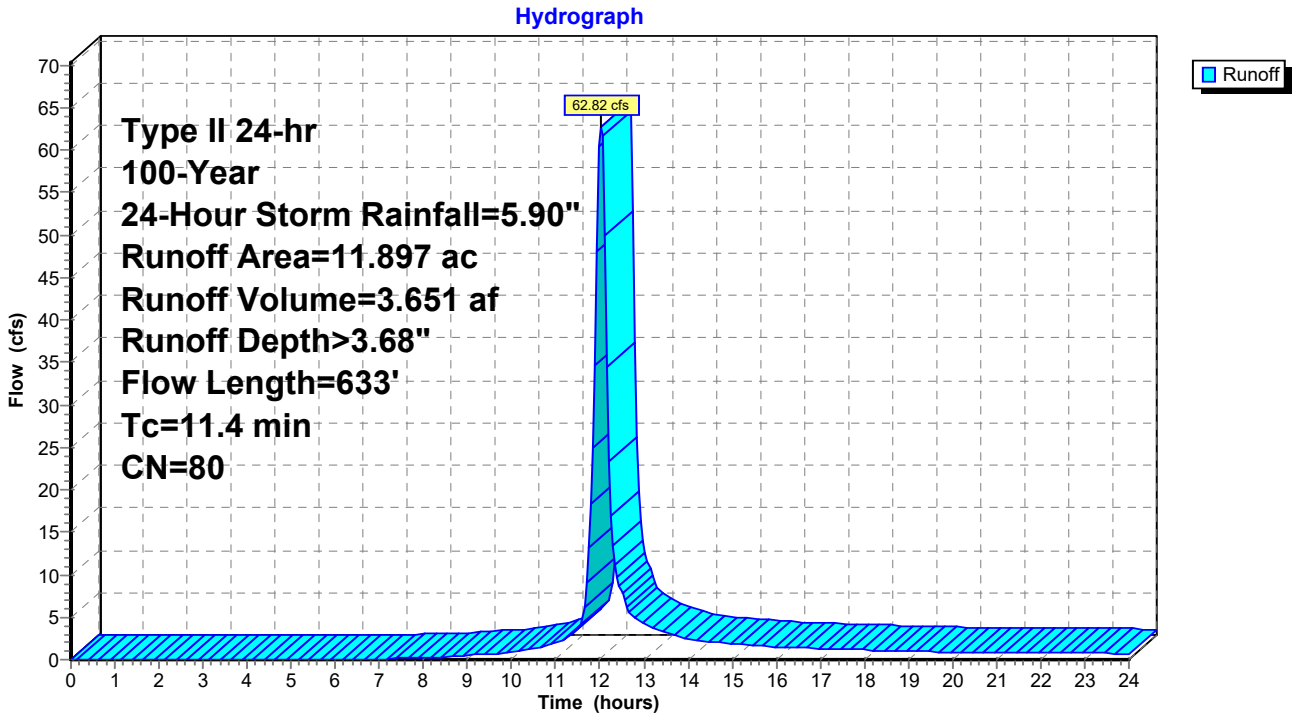
Runoff = 62.82 cfs @ 12.03 hrs, Volume= 3.651 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	11.340	80	Cap
	0.557	85	Gravel roads, HSG B
	11.897	80	Weighted Average
	11.897		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
0.4	182	0.0250	7.37	41.47	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=7.50' n= 0.025
11.4	633	Total			

Subcatchment 8S:



Summary for Subcatchment 9S:

[47] Hint: Peak is 972% of capacity of segment #3

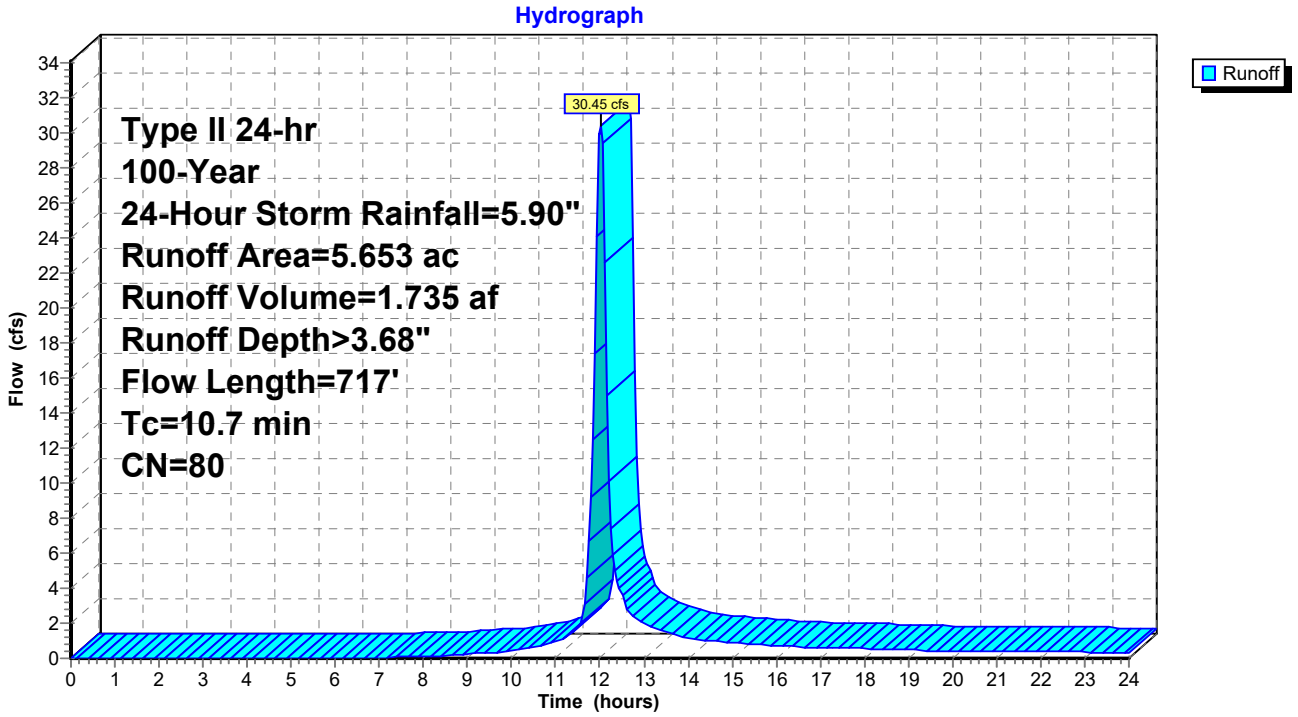
Runoff = 30.45 cfs @ 12.02 hrs, Volume= 1.735 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	5.113	80	Cap
	0.540	85	Gravel roads, HSG B
	5.653	80	Weighted Average
	5.653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
2.0	191	0.0500	1.57		**Shallow Concentrated Flow, Section 2** Short Grass Pasture Kv= 7.0 fps
1.4	406	0.0500	5.01	3.13	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.025
0.0	20	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Let-Down Channel 1** Bot.W=3.00' D=1.50' n= 0.040
10.7	717	Total			

Subcatchment 9S:



Summary for Subcatchment 10S:

[47] Hint: Peak is 2421% of capacity of segment #4

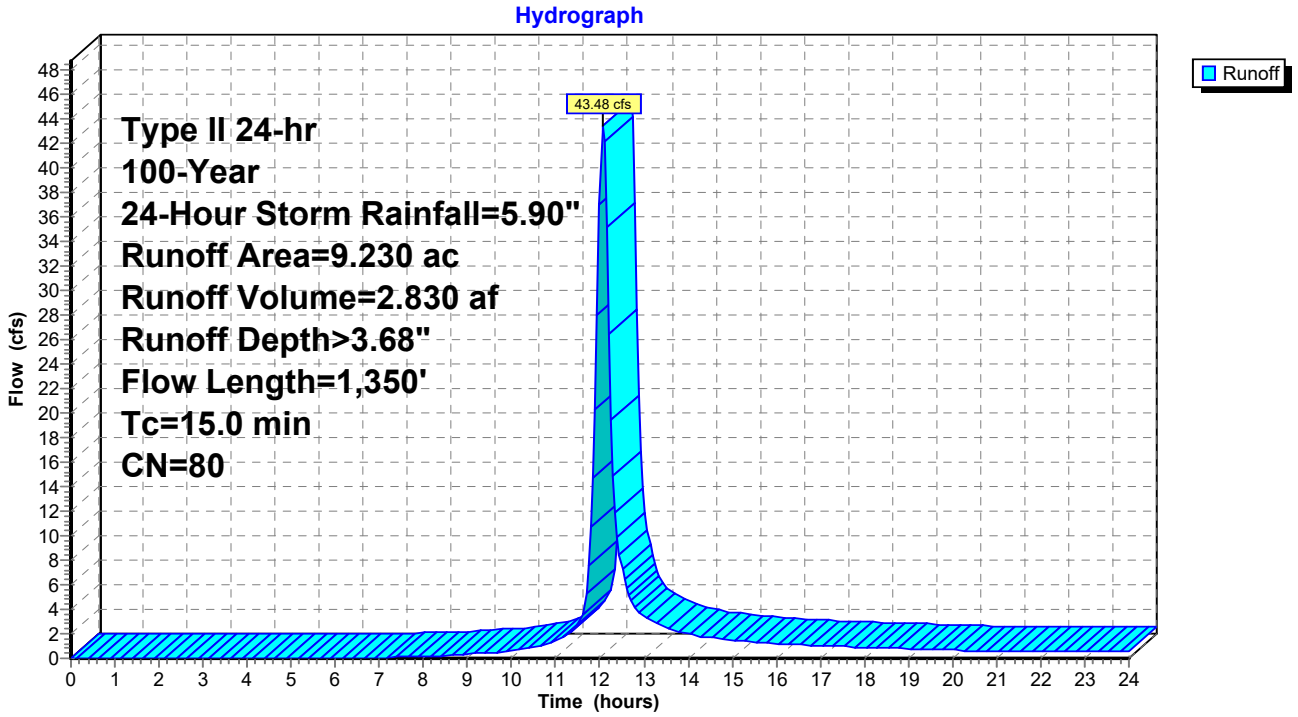
Runoff = 43.48 cfs @ 12.07 hrs, Volume= 2.830 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	9.230	80	Cap
	9.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
5.2	488	0.0500	1.57		**Shallow Concentrated Flow, Section 1** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	280	0.0400	2.87	1.80	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.039
0.2	222	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Gabion Downchute** Bot.W=3.00' D=1.50' n= 0.040
0.4	190	0.0210	7.63	91.59	**Trap/Vee/Rect Channel Flow, North Channel** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.030
15.0	1,350	Total			

Subcatchment 10S:



Summary for Subcatchment 11S:

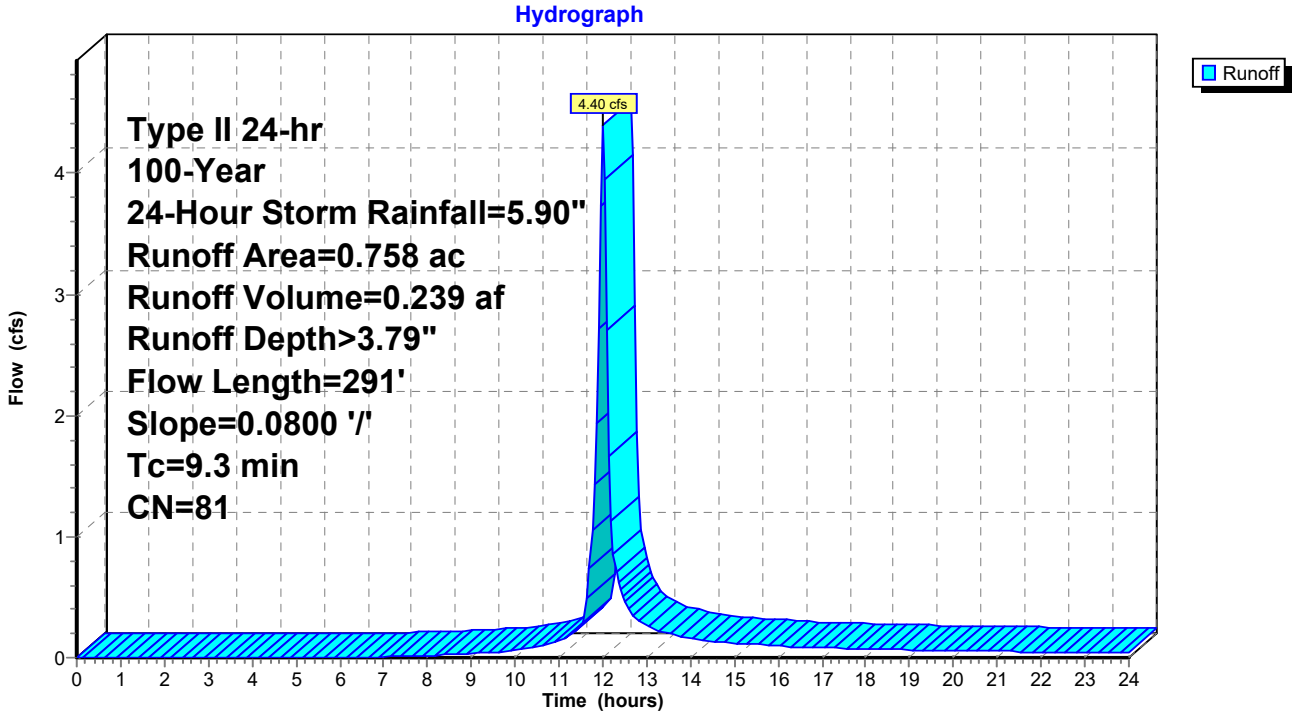
Runoff = 4.40 cfs @ 12.00 hrs, Volume= 0.239 af, Depth> 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	0.576	80	CAP
	0.182	85	Gravel roads, HSG B
	0.758	81	Weighted Average
	0.758		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0800	0.19		**Sheet Flow, MSE Exterior Slope** Grass: Dense n= 0.240 P2= 2.80"
0.2	20	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	171	0.0800	9.56	14.34	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
9.3	291	Total			

Subcatchment 11S:



Summary for Subcatchment 12S:

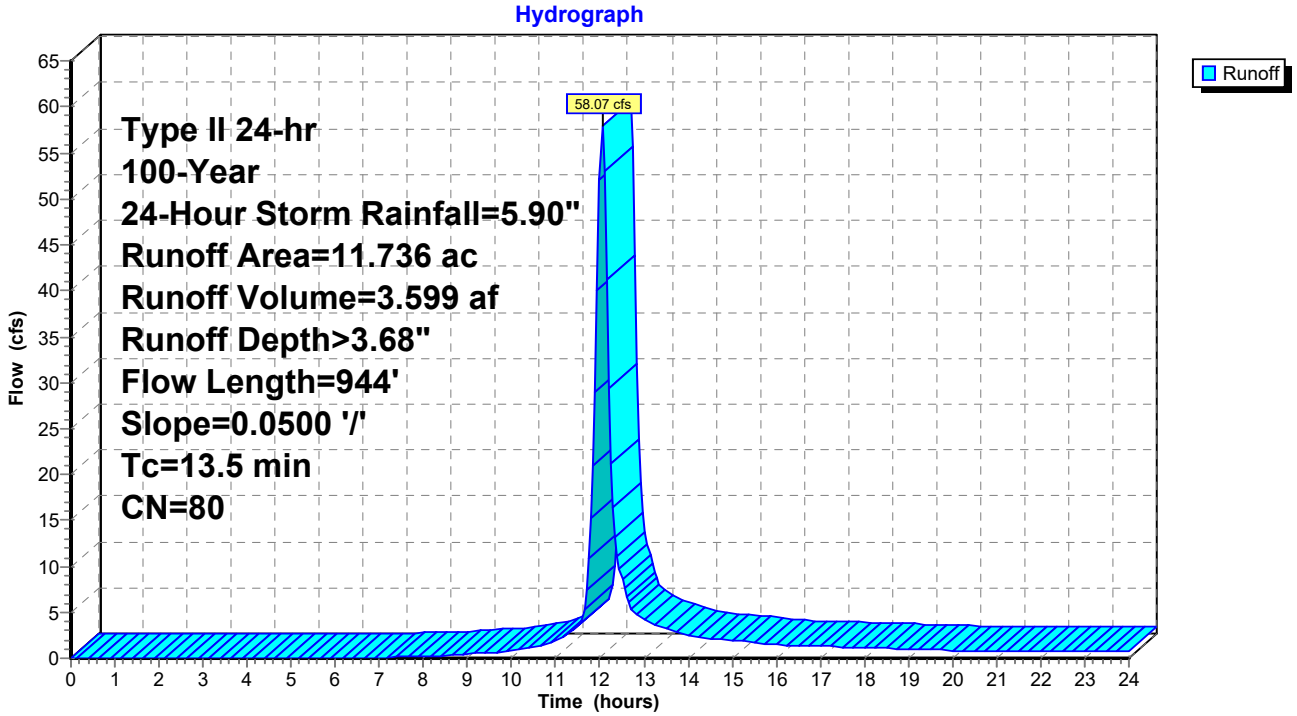
Runoff = 58.07 cfs @ 12.05 hrs, Volume= 3.599 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	11.736	80	
	11.736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Plateau** Grass: Short n= 0.150 P2= 2.80"
3.8	359	0.0500	1.57		**Shallow Concentrated Flow, Plateau** Short Grass Pasture Kv= 7.0 fps
2.4	485	0.0500	3.35		**Shallow Concentrated Flow, Sideslope Berm** Grassed Waterway Kv= 15.0 fps
13.5	944	Total			

Subcatchment 12S:



Summary for Subcatchment 13S:

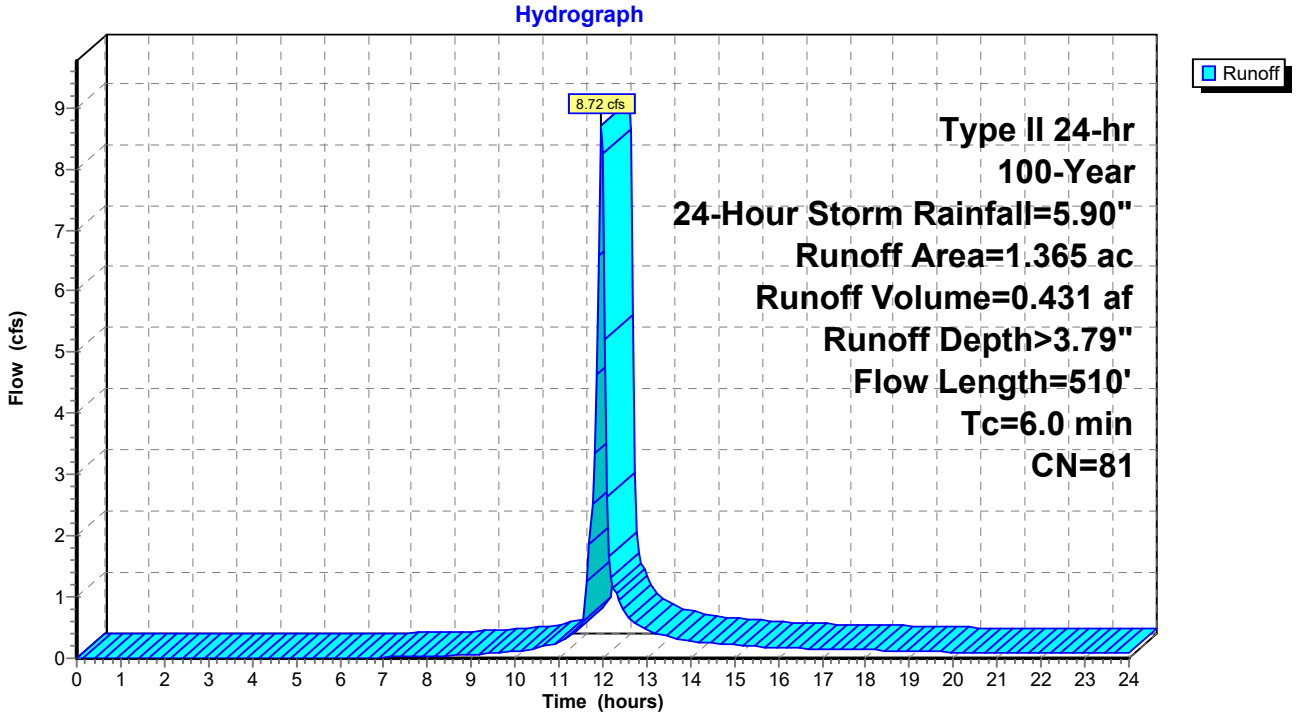
Runoff = 8.72 cfs @ 11.97 hrs, Volume= 0.431 af, Depth> 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	1.080	80	Cap
*	0.285	85	Gravel Road
	1.365	81	Weighted Average
	1.365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	50	0.3300	0.43		**Sheet Flow, Section 1** Grass: Short n= 0.150 P2= 2.80"
3.0	460	0.0300	2.60		**Shallow Concentrated Flow, Perimeter Swale** Grassed Waterway Kv= 15.0 fps
5.0	510	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 13S:



Summary for Subcatchment 15S:

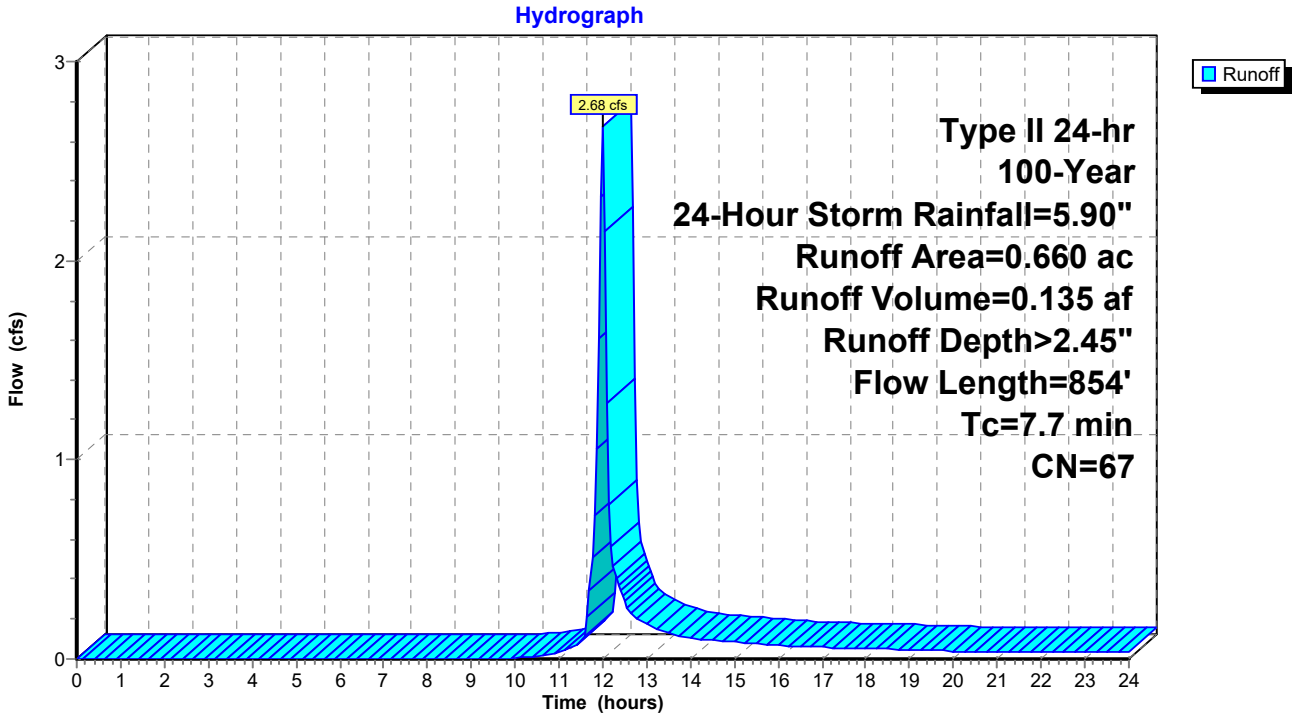
Runoff = 2.68 cfs @ 11.99 hrs, Volume= 0.135 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	0.660	67	Vegetation (Hyd. Group B)
	0.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	29	0.0330	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
4.5	825	0.0100	3.09	3.09	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.022 Earth, clean & straight
7.7	854	Total			

Subcatchment 15S:



Summary for Subcatchment 16S:

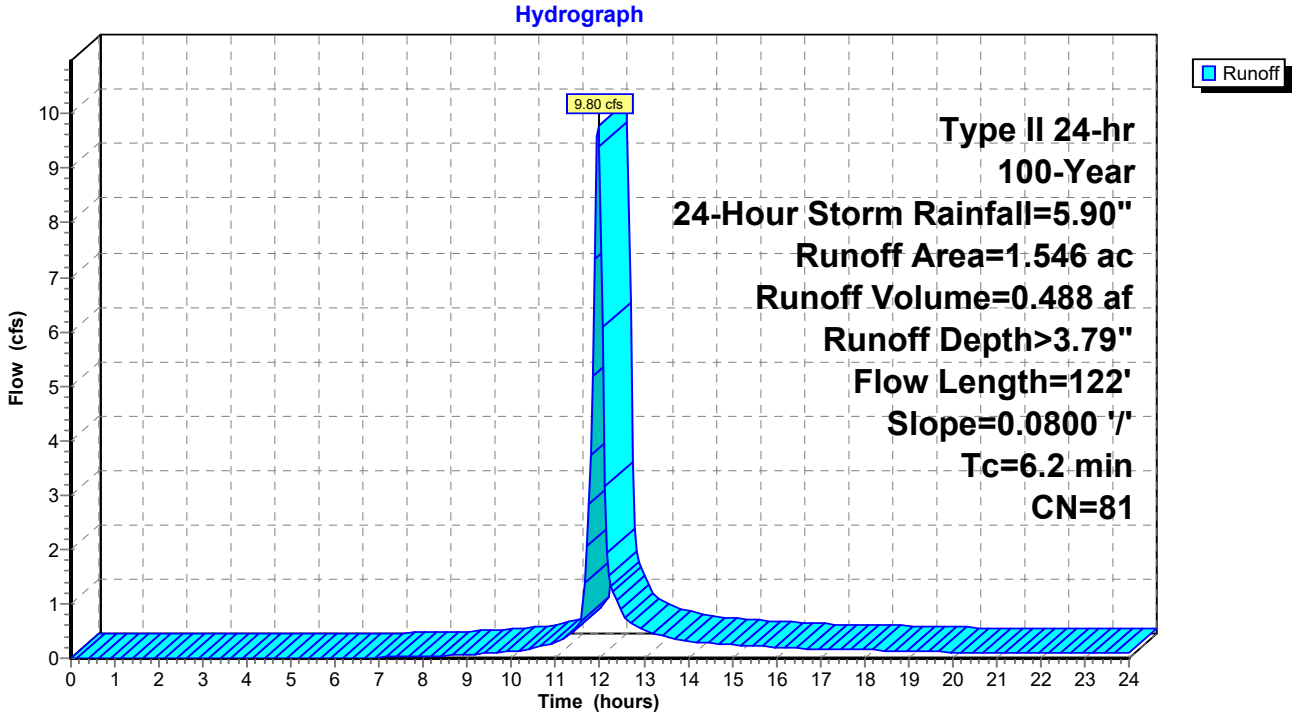
Runoff = 9.80 cfs @ 11.97 hrs, Volume= 0.488 af, Depth> 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	1.224	80	Cap
*	0.322	85	Gravel Road
	1.546	81	Weighted Average
	1.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0800	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
0.2	22	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.2	122	Total			

Subcatchment 16S:



Summary for Subcatchment NP:

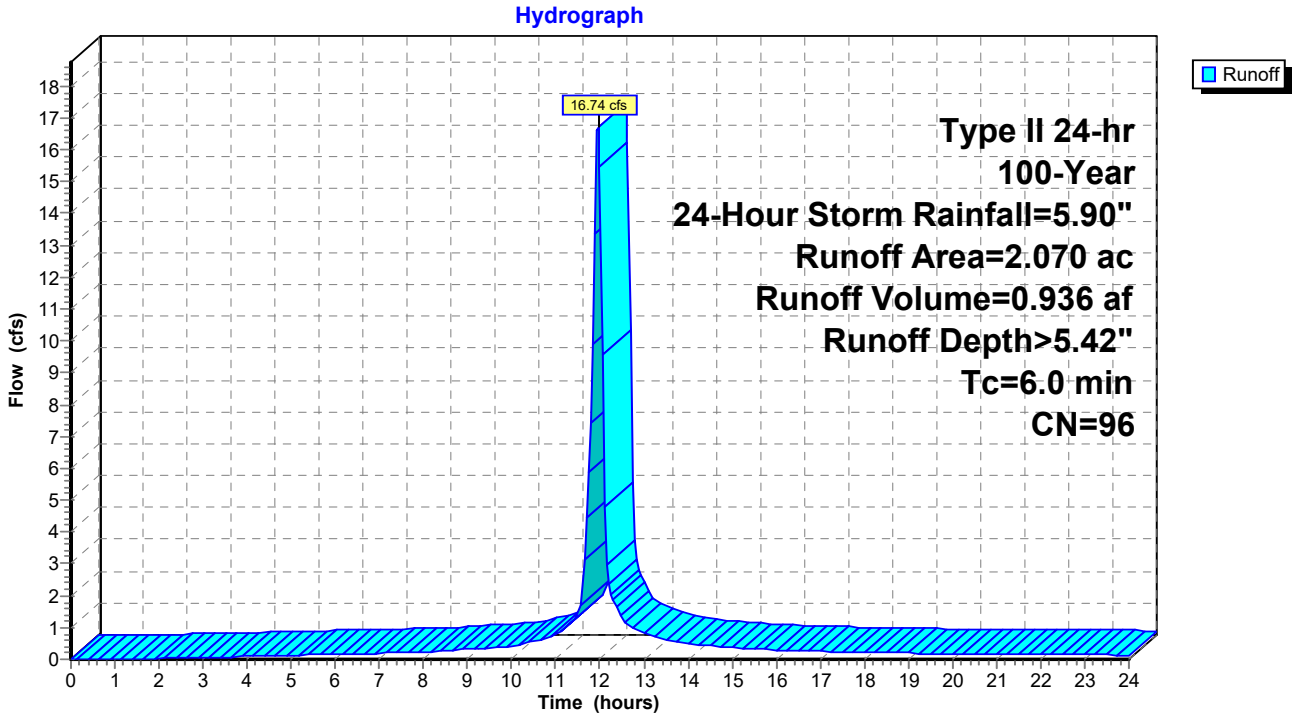
Runoff = 16.74 cfs @ 11.96 hrs, Volume= 0.936 af, Depth> 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year, 24-Hour Storm Rainfall=5.90"

	Area (ac)	CN	Description
*	1.730	98	Basin
*	0.340	85	Gravel Road
	2.070	96	Weighted Average
	0.340		16.43% Pervious Area
	1.730		83.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					**Direct Entry,**
1.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment NP:



Summary for Reach 1R: Gabion Downchute

Mannings from Figure 5B.11 Determing "n" for Riprap Lined Channel Using Depth of Flow

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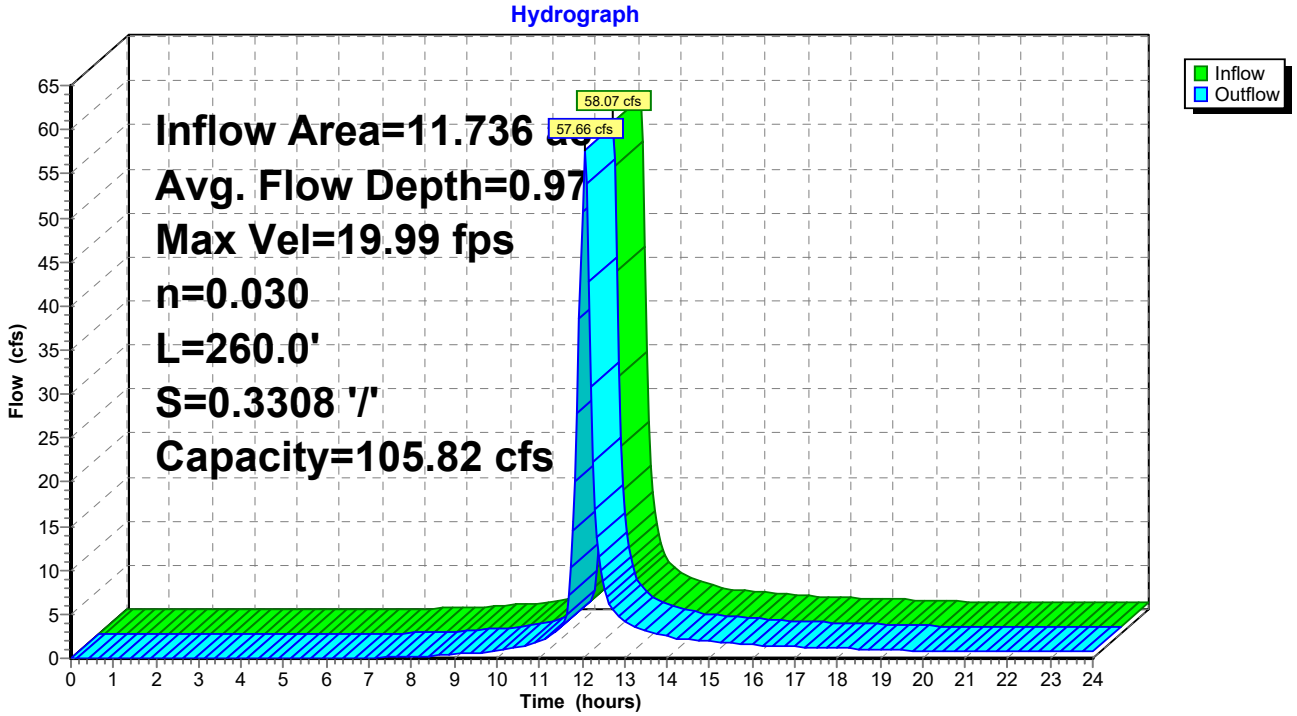
Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 3.68" for 100-Year, 24-Hour Storm event
Inflow = 58.07 cfs @ 12.05 hrs, Volume= 3.599 af
Outflow = 57.66 cfs @ 12.06 hrs, Volume= 3.598 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 19.99 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.29 fps, Avg. Travel Time= 0.8 min

Peak Storage= 755 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.97' , Surface Width= 3.00'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 105.82 cfs

3.00' x 1.50' deep channel, n= 0.030
Length= 260.0' Slope= 0.3308 '/'
Inlet Invert= 290.00', Outlet Invert= 204.00'

Reach 1R: Gabion Downchute



Summary for Reach 2R: North Channel - 3

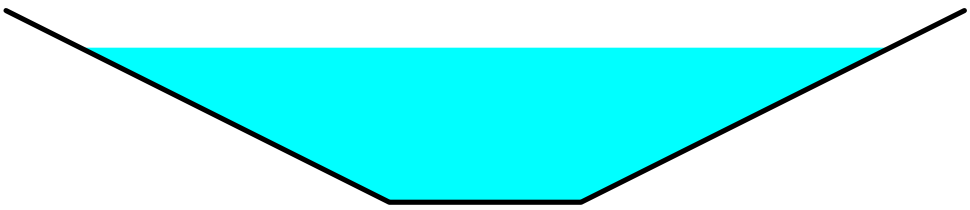
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.66' @ 12.15 hrs

Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 3.69" for 100-Year, 24-Hour Storm event
Inflow = 62.79 cfs @ 12.04 hrs, Volume= 4.029 af
Outflow = 61.17 cfs @ 12.07 hrs, Volume= 4.024 af, Atten= 3%, Lag= 1.8 min

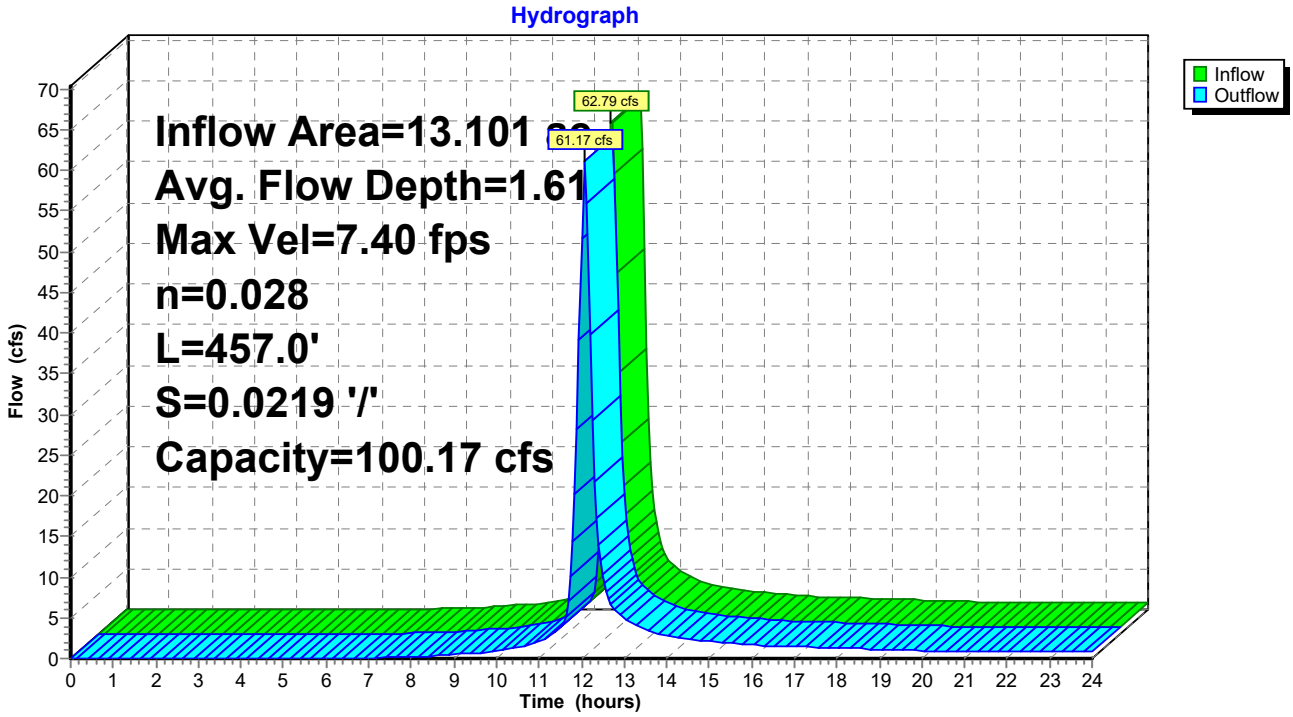
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.40 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 2.48 fps, Avg. Travel Time= 3.1 min

Peak Storage= 3,857 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.61' , Surface Width= 8.46'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 100.17 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 457.0' Slope= 0.0219 '/'
Inlet Invert= 204.00', Outlet Invert= 194.00'



Reach 2R: North Channel - 3



Summary for Reach 3R:

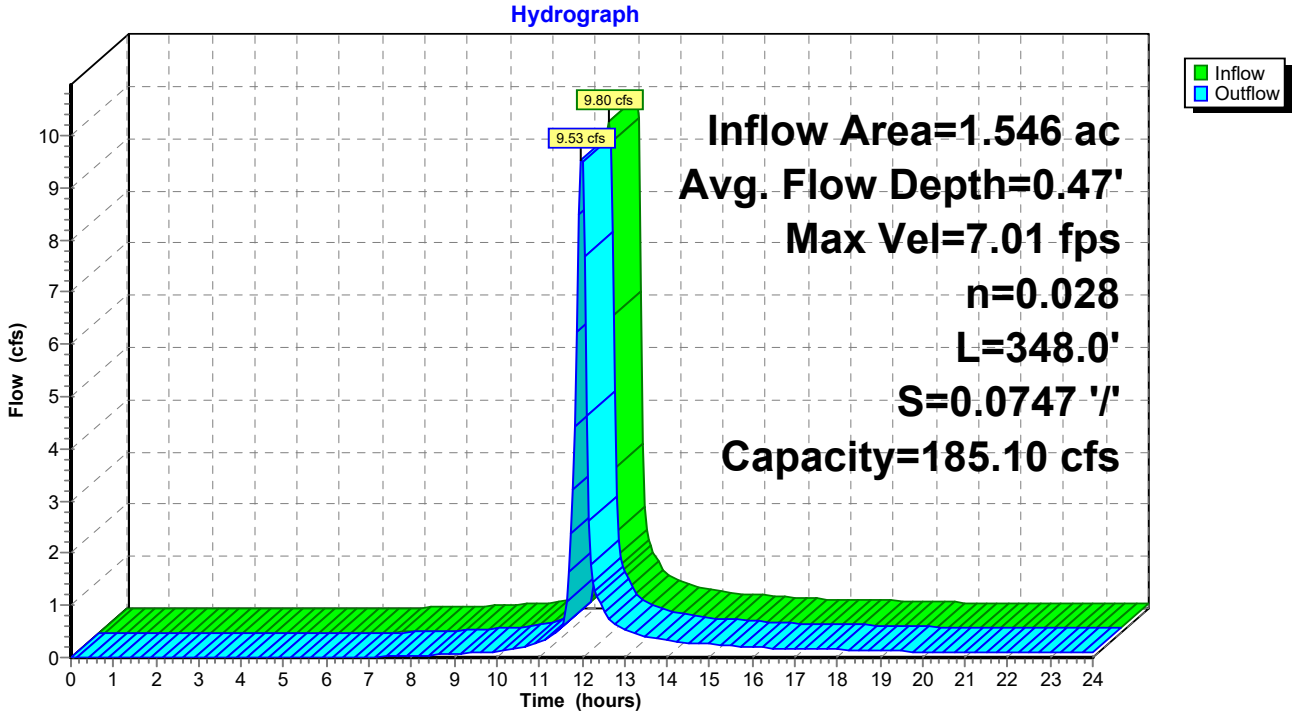
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 3.79" for 100-Year, 24-Hour Storm event
Inflow = 9.80 cfs @ 11.97 hrs, Volume= 0.488 af
Outflow = 9.53 cfs @ 11.99 hrs, Volume= 0.487 af, Atten= 3%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.01 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 3.1 min

Peak Storage= 485 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 3.89'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 185.10 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 348.0' Slope= 0.0747 '/'
Inlet Invert= 220.00', Outlet Invert= 194.00'

Reach 3R:



Summary for Reach 4R: North Channel - 1

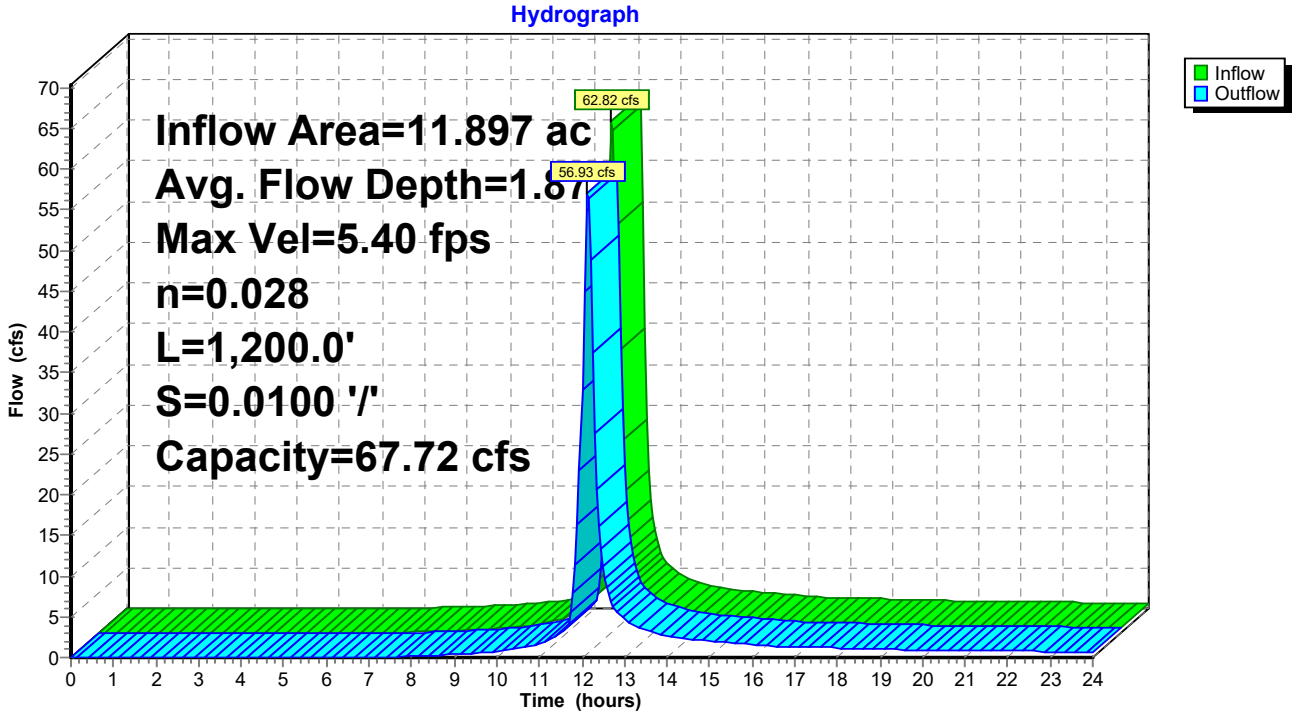
Inflow Area = 11.897 ac, 0.00% Impervious, Inflow Depth > 3.68" for 100-Year, 24-Hour Storm event
Inflow = 62.82 cfs @ 12.03 hrs, Volume= 3.651 af
Outflow = 56.93 cfs @ 12.13 hrs, Volume= 3.635 af, Atten= 9%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.40 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 10.8 min

Peak Storage= 12,821 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.87' , Surface Width= 9.46'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 67.72 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,200.0' Slope= 0.0100 '/'
Inlet Invert= 290.00', Outlet Invert= 278.00'

Reach 4R: North Channel - 1



Summary for Reach 5R: North Channel - 2

[61] Hint: Exceeded Reach 4R outlet invert by 1.35' @ 12.10 hrs

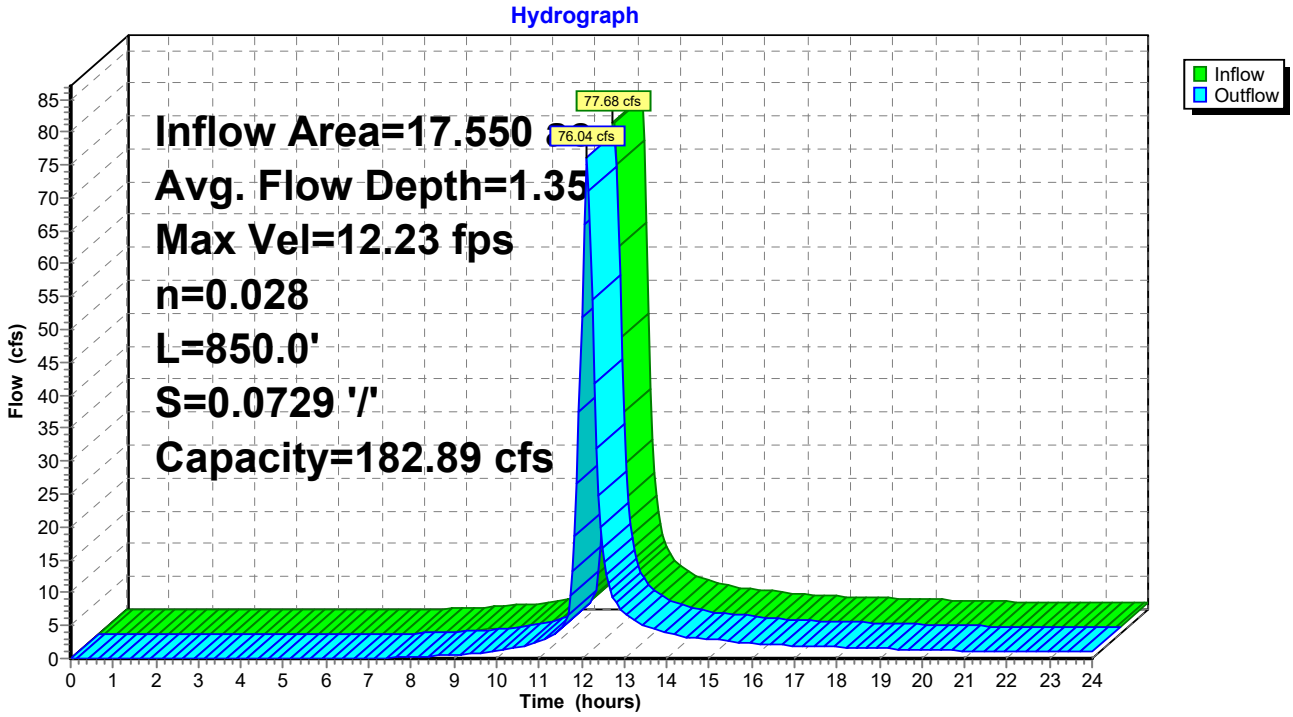
Inflow Area = 17.550 ac, 0.00% Impervious, Inflow Depth > 3.67" for 100-Year, 24-Hour Storm event
Inflow = 77.68 cfs @ 12.09 hrs, Volume= 5.369 af
Outflow = 76.04 cfs @ 12.13 hrs, Volume= 5.362 af, Atten= 2%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.23 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 4.13 fps, Avg. Travel Time= 3.4 min

Peak Storage= 5,375 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.35' , Surface Width= 7.39'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 182.89 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 850.0' Slope= 0.0729 '/'
Inlet Invert= 278.00', Outlet Invert= 216.00'

Reach 5R: North Channel - 2



Summary for Reach 6R:

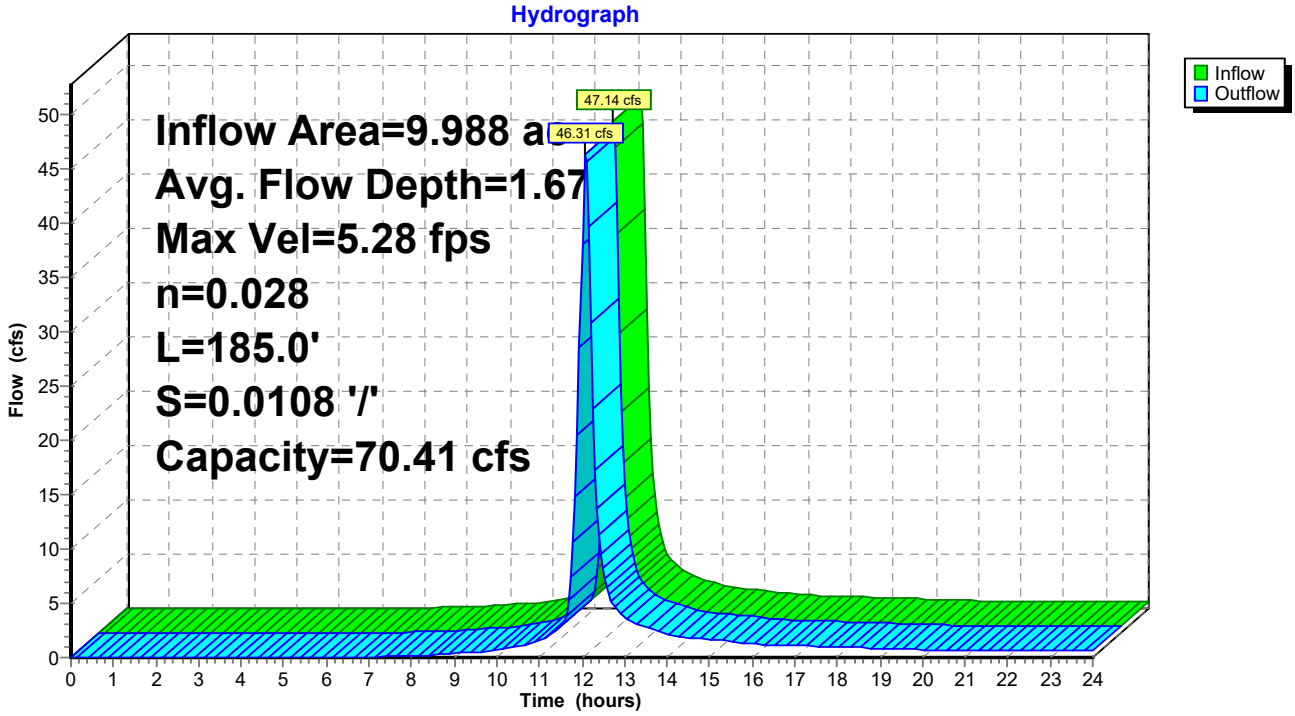
Inflow Area = 9.988 ac, 0.00% Impervious, Inflow Depth > 3.69" for 100-Year, 24-Hour Storm event
Inflow = 47.14 cfs @ 12.06 hrs, Volume= 3.069 af
Outflow = 46.31 cfs @ 12.08 hrs, Volume= 3.067 af, Atten= 2%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.28 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 1.7 min

Peak Storage= 1,643 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.67' , Surface Width= 8.66'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 70.41 cfs

2.00' x 2.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 185.0' Slope= 0.0108 '/'
Inlet Invert= 218.00', Outlet Invert= 216.00'

Reach 6R:



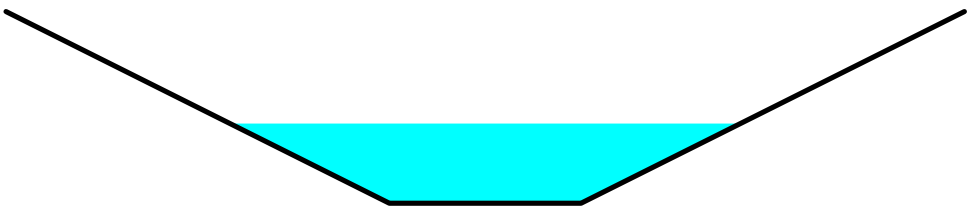
Summary for Reach 7R: MSE Berm Swale

Inflow Area = 0.660 ac, 0.00% Impervious, Inflow Depth > 2.45" for 100-Year, 24-Hour Storm event
Inflow = 2.68 cfs @ 11.99 hrs, Volume= 0.135 af
Outflow = 2.21 cfs @ 12.12 hrs, Volume= 0.134 af, Atten= 17%, Lag= 7.6 min

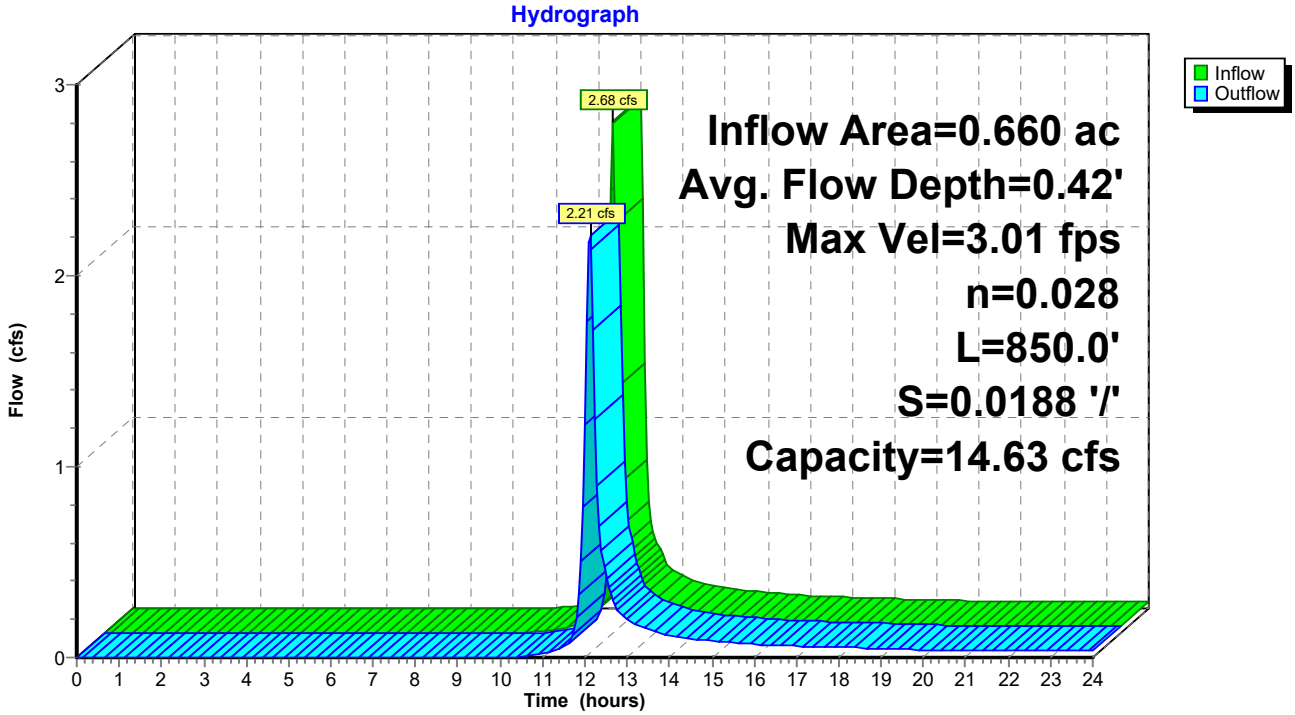
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.01 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 14.1 min

Peak Storage= 646 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 2.66'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 14.63 cfs

1.00' x 1.00' deep channel, n= 0.028
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 850.0' Slope= 0.0188 '/'
Inlet Invert= 216.00', Outlet Invert= 200.00'



Reach 7R: MSE Berm Swale



Summary for Pond 1P: Drop Inlet 1

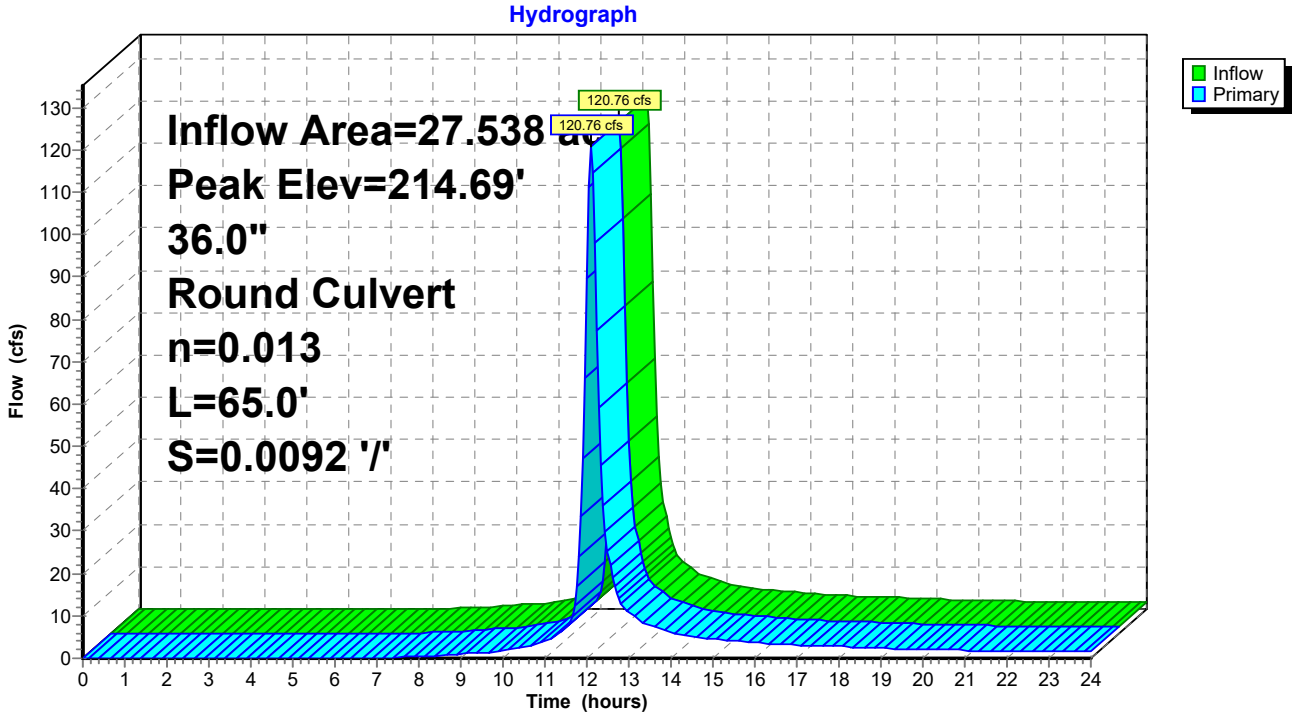
Inflow Area = 27.538 ac, 0.00% Impervious, Inflow Depth > 3.67" for 100-Year, 24-Hour Storm event
Inflow = 120.76 cfs @ 12.11 hrs, Volume= 8.429 af
Outflow = 120.76 cfs @ 12.11 hrs, Volume= 8.429 af, Atten= 0%, Lag= 0.0 min
Primary = 120.76 cfs @ 12.11 hrs, Volume= 8.429 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.69' @ 12.11 hrs
Flood Elev= 220.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	200.60'	**36.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 200.60' / 200.00' S= 0.0092 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=120.01 cfs @ 12.11 hrs HW=214.53' (Free Discharge)
└**1=Culvert** (Inlet Controls 120.01 cfs @ 16.98 fps)

Pond 1P: Drop Inlet 1



Summary for Pond 2P: Drop Inlet Structure

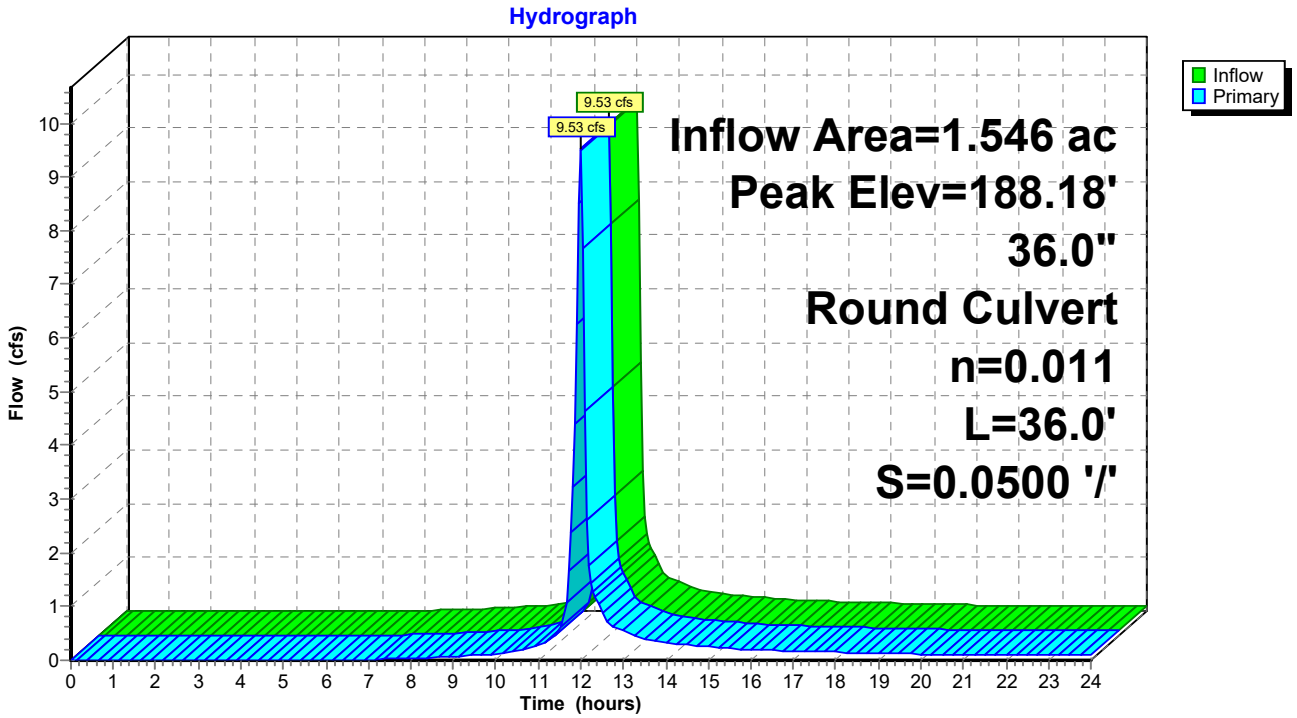
Inflow Area = 1.546 ac, 0.00% Impervious, Inflow Depth > 3.78" for 100-Year, 24-Hour Storm event
Inflow = 9.53 cfs @ 11.99 hrs, Volume= 0.487 af
Outflow = 9.53 cfs @ 11.99 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min
Primary = 9.53 cfs @ 11.99 hrs, Volume= 0.487 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 188.18' @ 11.99 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round 36" HDPE Pipe** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 185.20' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=9.35 cfs @ 11.99 hrs HW=188.17' (Free Discharge)
└**1=36" HDPE Pipe** (Inlet Controls 9.35 cfs @ 3.68 fps)

Pond 2P: Drop Inlet Structure



Summary for Pond 3P: Stormwater Manhole

[79] Warning: Submerged Pond 8P Primary device # 1 OUTLET by 1.77'

Inflow Area =	14.647 ac,	0.00% Impervious,	Inflow Depth >	3.70"	for 100-Year, 24-Hour Storm event
Inflow =	67.98 cfs @	12.06 hrs,	Volume=	4.512 af	
Outflow =	67.98 cfs @	12.06 hrs,	Volume=	4.512 af,	Atten= 0%, Lag= 0.0 min
Primary =	67.98 cfs @	12.06 hrs,	Volume=	4.512 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

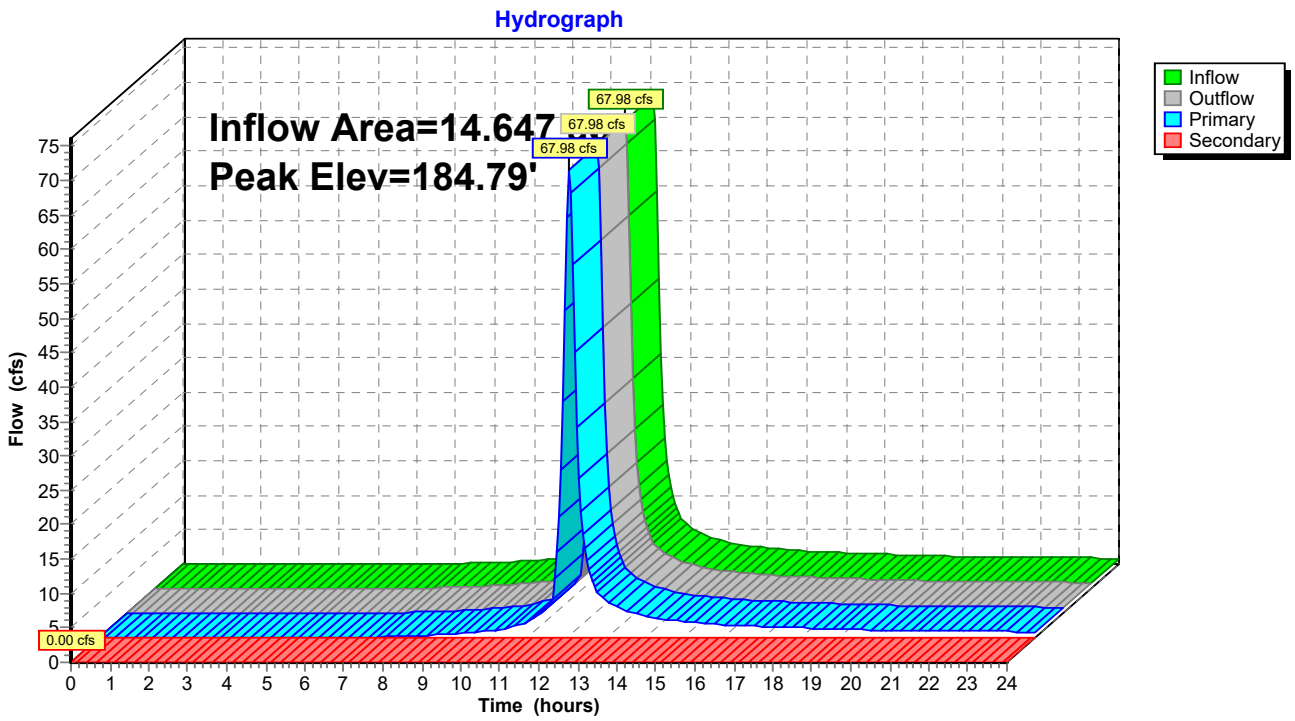
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 184.79' @ 12.06 hrs
Flood Elev= 188.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.30'	**36.0" Round 36" HDPE Pipe** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.30' / 177.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf
#2	Secondary	196.00'	**6.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=67.27 cfs @ 12.06 hrs HW=184.71' (Free Discharge)
└─**1=36" HDPE Pipe** (Inlet Controls 67.27 cfs @ 9.52 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=179.30' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Stormwater Manhole



Summary for Pond 8P: Drop Inlet Structure

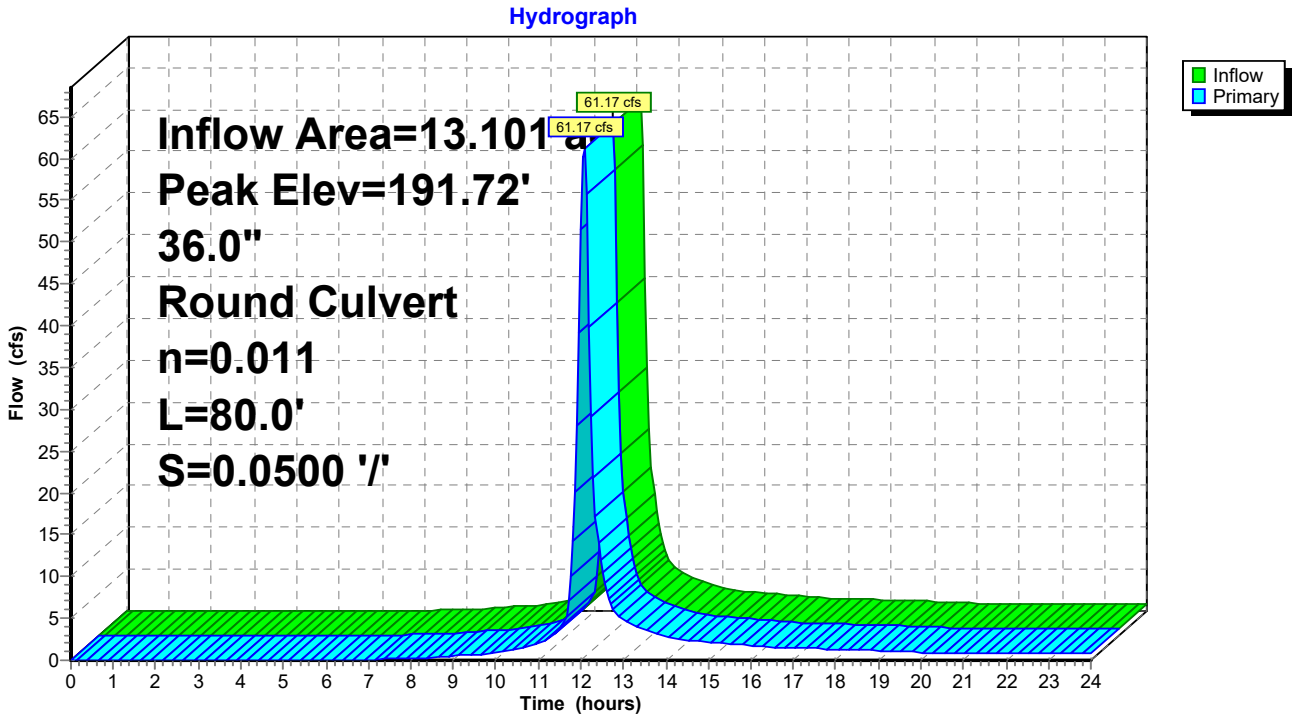
Inflow Area = 13.101 ac, 0.00% Impervious, Inflow Depth > 3.69" for 100-Year, 24-Hour Storm event
Inflow = 61.17 cfs @ 12.07 hrs, Volume= 4.024 af
Outflow = 61.17 cfs @ 12.07 hrs, Volume= 4.024 af, Atten= 0%, Lag= 0.0 min
Primary = 61.17 cfs @ 12.07 hrs, Volume= 4.024 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 191.72' @ 12.07 hrs
Flood Elev= 196.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	**36.0" Round Culvert** L= 80.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 187.00' / 183.00' S= 0.0500 '/' Cc= 0.900 n= 0.011, Flow Area= 7.07 sf

Primary OutFlow Max=60.08 cfs @ 12.07 hrs HW=191.62' (Free Discharge)
└**1=Culvert** (Inlet Controls 60.08 cfs @ 8.50 fps)

Pond 8P: Drop Inlet Structure



Summary for Pond 26P: North Pond

Inflow Area = 44.915 ac, 3.85% Impervious, Inflow Depth > 3.74" for 100-Year, 24-Hour Storm event
Inflow = 193.95 cfs @ 12.08 hrs, Volume= 14.009 af
Outflow = 3.79 cfs @ 19.13 hrs, Volume= 3.723 af, Atten= 98%, Lag= 423.2 min
Discarded = 3.79 cfs @ 19.13 hrs, Volume= 3.723 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 164.04' @ 19.13 hrs Surf.Area= 38,417 sf Storage= 460,796 cf

Plug-Flow detention time= 397.9 min calculated for 3.723 af (27% of inflow)
Center-of-Mass det. time= 260.3 min (1,076.4 - 816.1)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	731,085 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

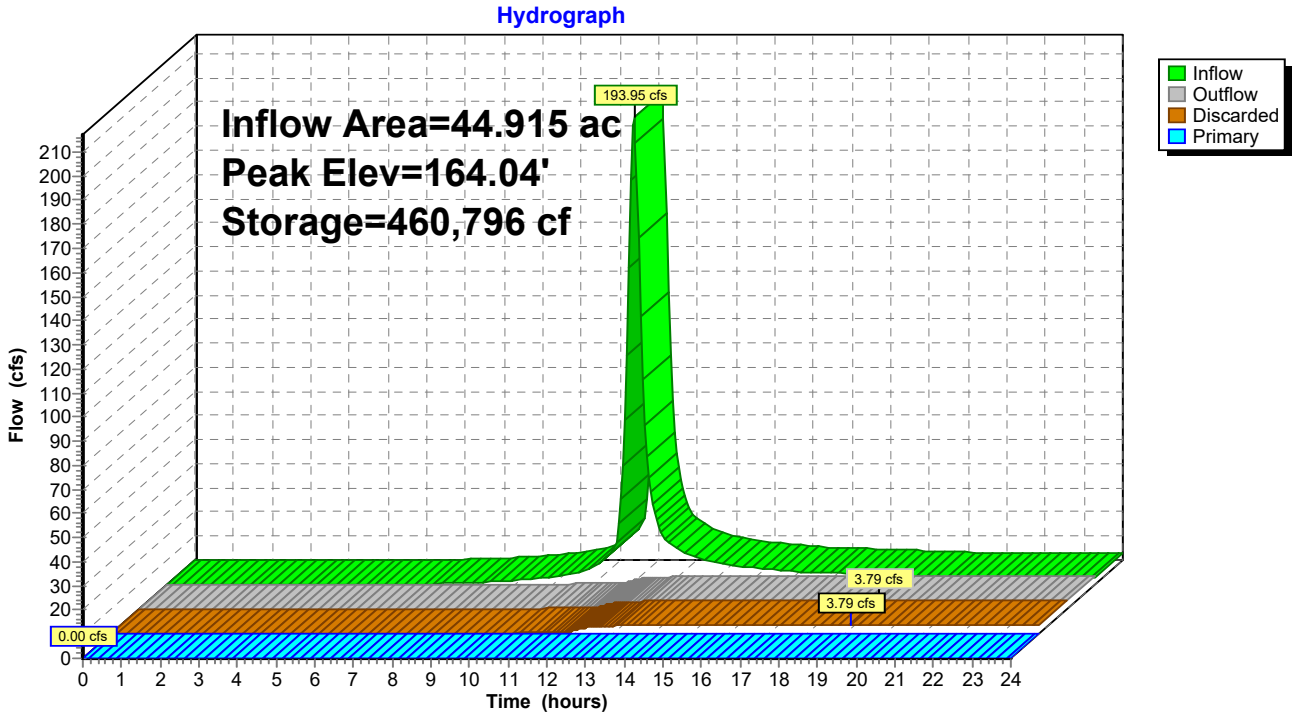
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	5,675	0	0
150.00	15,091	103,830	103,830
160.00	29,062	220,765	324,595
170.00	52,236	406,490	731,085

Device	Routing	Invert	Outlet Devices
#1	Discarded	140.00'	**5.000 in/hr Exfiltration over Horizontal area above 140.00'** Excluded Horizontal area = 5,675 sf
#2	Primary	167.00'	**17.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=3.79 cfs @ 19.13 hrs HW=164.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 3.79 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: North Pond



DOWNCHUTE

AND

DOWNCHUTE ENERGY DISSIPATOR DESIGN

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project:	North Berm Modification	**Date:**	5/11/2021
Prepared by:	KFH	**Job #:**	182-442
Checked by:		**Sheet**	1 of 1

Downchute Design - Gabion Baskets

Reference Material: Standards and Specifications for Lined Waterway or Outlet, *New York Standards and Specifications For Erosion and Sediment Control*, November 2016.

Objective: Determine appropriate cross-section and gabion basket size for downchutes along landfill using methodology presented in reference manual.

HydroCAD Analysis:

The downchutes will be designed with the same cross-section and gabion basket sizes. Therefore, the design input will utilize the largest drainage area to represent the maximum flow rate to any downchute. *The representative drainage area is subcatchment "12S" (refer to node "1R" in HydroCAD report titled "Energy Dissipator Model"). The curve number for stablized final cover is 80. The downchute was designed for a 25-Year, 24-Hour storm event.*

25-Year, 24-Hour Storm:	4.9 in

Channel Parameters

Depth	1.5 ft
Bottom Width	3 ft
Side Slopes	0 H:0V
Channel Slope	0.33 ft/ft
Manning's, n	0.03

Table 2. Stone Sizes and Allowable Velocities for Gabions (courtesy of and adapted from Maccaferri Gabions)

Type	Thickness (ft)	Filling Stone Range	D50	Critical* Velocity	Limit** Velocity
Mattress	0.5	3 - 4"	3.4"	11.5	13.8
	0.5	3 - 6"	4.3"	13.8	14.8
	0.75	3 - 4"	3.4"	14.8	16
	0.75	3 - 6"	4.7"	14.8	20
	1	3 - 5"	4"	13.6	18
	1	4 - 6"	5"	16.4	21
Basket	1.5	4 - 8"	6"	19	24.9
	1.5	5 - 10"	7.5"	21	26.2

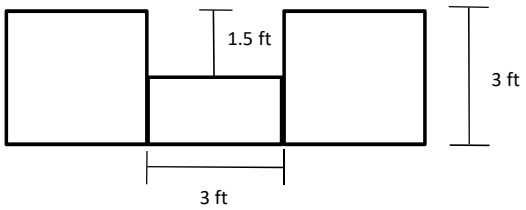
Reference: Freeman, Gary E., Fischenich, J.Craig, *Gabions for Streambank Erosion Control*, May 2000.

Maximum Velocity =	18.47 fps

Choose Gabion Basket

Gabion Basket Parameters*

	Outside Baskets	Inside Basket
Thickness	3 ft	1.5 ft
Length	6 ft	6 ft
Width	3 ft	3 ft
D_{50}	7.5 in	
Critical Velocity	21 fps	



*Reference: Gabion - Galvanized, *Product Standard Specifications*, Maccaferri, May 2005.

Maximum Velocity	<	**Critical Velocity**	
18.47	<	21	GOOD

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project:	North Berm Modification	**Date:**	5/11/2021
Prepared by:	KFH	**Job #:**	182-442
Checked by:		**Sheet**	1 of 2

Downchute Energy Dissipator

Reference Material: Design of Roadside Channels with Flexible Linings, September 2005 (U.S. Department of Transportation Federal Highway Administration).

Objective:

Determine the minimum bottom width of gabion-lined downchutes so that rip-rap will be able to withstand shear stresses of incoming flow using methodology presented in reference manual.

HydroCAD Analysis:

The energy dissipators will have specific cross-section and rip-rap size based on inflow. Therefore, the design input will utilize the individual drainage areas to represent the maximum flow rate to that downchute. The representative drainage area is shown *as subcatchment "**12S**"* (*refer to node "3R" in HydroCAD report titled "Energy Dissipator Model"*). The curve number for stablized final cover is 80. The energy dissipator was designed for a 25-Year, 24-Hour storm event.

25-Year, 24-Hour Storm:	4.9 in

Inflow, Q =	44.40	cfs
Bottom Width, B =	7	ft
Side slope, Z =	2	H:1V
Channel Slope, S =	0.3333	ft/ft
Channel Depth =	1.5	ft
D_{50} =	1	ft
Manning's n (assumed) =	0.04	

$$\tau_d = \gamma d S$$

τ_d = maximum shear stress
γ = specific weight of water
d = depth of flow

γ =	62.4	pcf
d =	0.47	ft
S =	0.33	ft/ft
τ_d =	9.78	psf

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project:	North Berm Modification	**Date:**	5/11/2021
Prepared by:	KFH	**Job #:**	182-442
Checked by:		**Sheet**	2 of 2

$$\tau_p \geq SF\tau_d$$

$$\tau_p = F(\gamma_s - \gamma)D_{50}$$

$$Re = \frac{V * D_{50}}{\vartheta}$$

$$V = \sqrt{gdS}$$

Table 6.1. Selection of Shields' Parameter and Safety Factor

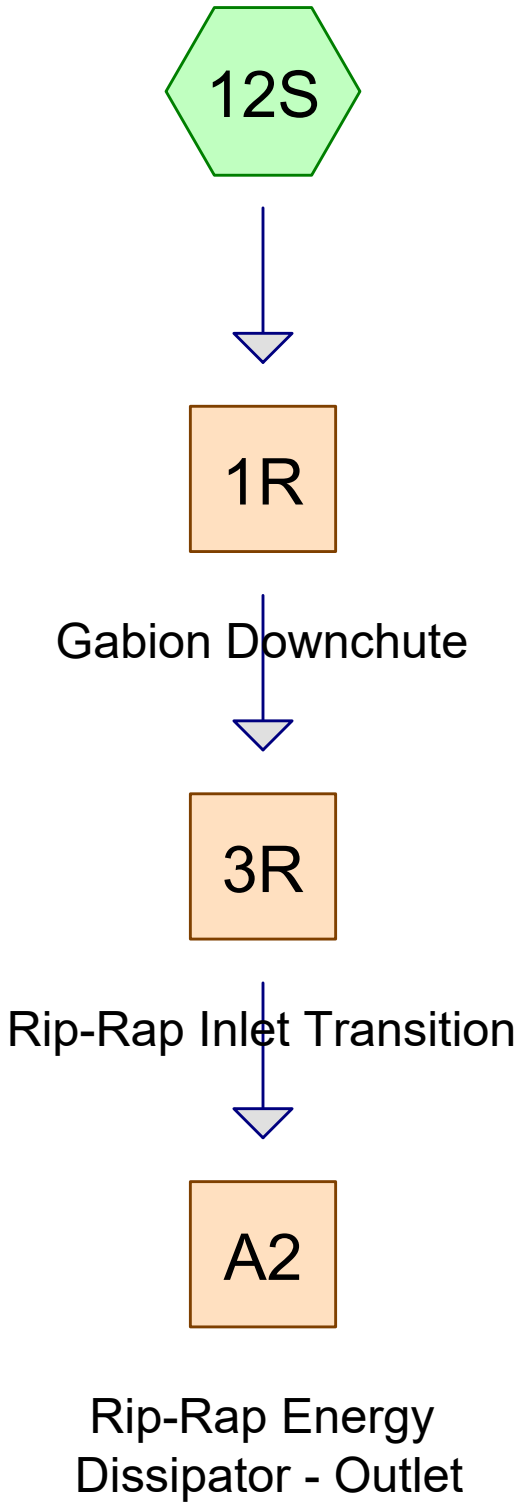
Reynolds number	F*	SF
$\leq 4x10^4$	0.047	1.0
$4x10^4 < R_e < 2x10^5$	Linear interpolation	Linear interpolation
$\geq 2x10^5$	0.15	1.5

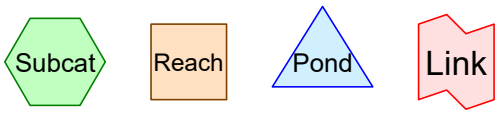
τ_p = permissible shear stress
SF = Safety Factor
F = Shield's Parameter
γ_s = specific weight of stone, 165 pcf
Re = Reynold's Number
V = Shear Velocity
υ = kinematic viscosity, $1.217*10^{-5}$ ft^2/s

V =	2.25	
Re =	184545.71	
F =	0.140	(Linear Interpolation)
SF =	1.40	(Linear Interpolation)

τ_p =	14.37	≥	13.7	GOOD

CONCLUSION: Transitioning from the gabion-lined downchute to a rip-rap lined channel with bottom width of 7 ft maintains a sufficient flow depth and velocity to utilize rip-rap of D_{50}= 1 ft in the energy dissipator.





Routing Diagram for Energy Dissipator Model
Prepared by CEC, Inc., Printed 5/11/2021
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	4.90	2

Summary for Subcatchment 12S:

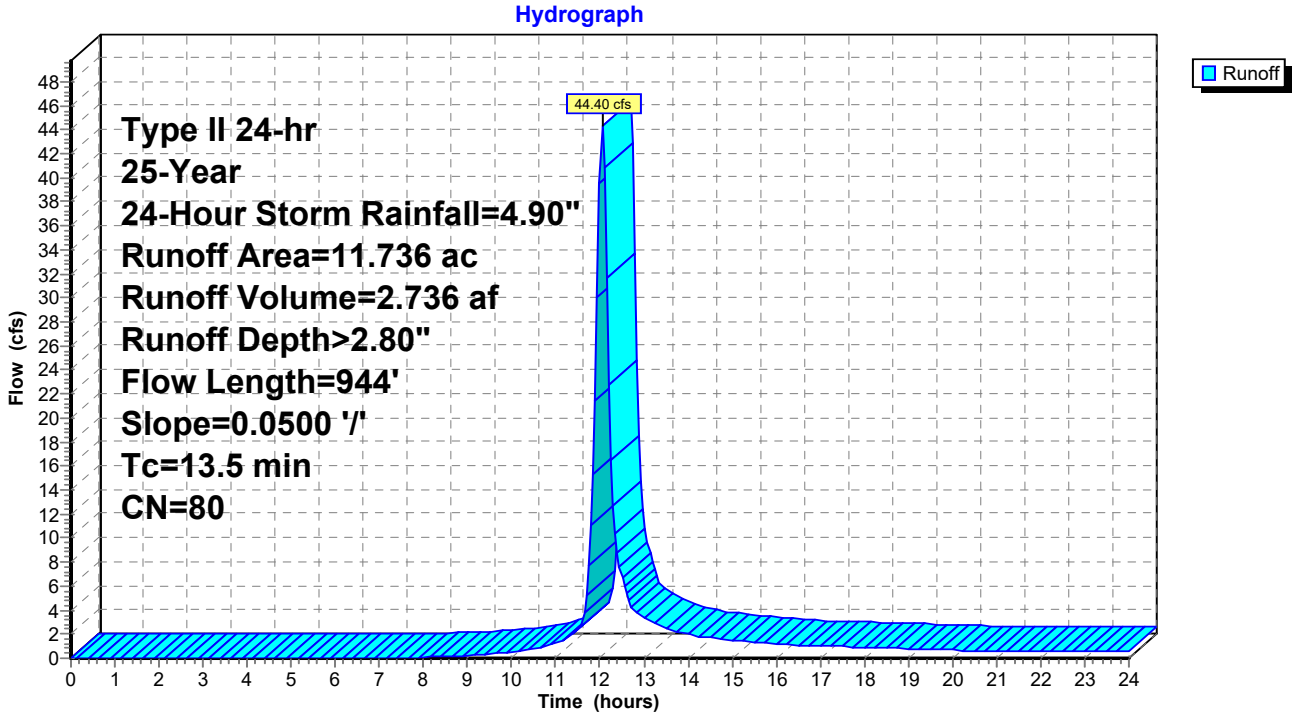
Runoff = 44.40 cfs @ 12.05 hrs, Volume= 2.736 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	11.736	80	
	11.736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow, Plateau** Grass: Short n= 0.150 P2= 2.80"
3.8	359	0.0500	1.57		**Shallow Concentrated Flow, Plateau** Short Grass Pasture Kv= 7.0 fps
2.4	485	0.0500	3.35		**Shallow Concentrated Flow, Sideslope Berm** Grassed Waterway Kv= 15.0 fps
13.5	944	Total			

Subcatchment 12S:



Summary for Reach 1R: Gabion Downchute

Mannings from Figure 5B.11 Determing "n" for Riprap Lined Channel Using Depth of Flow

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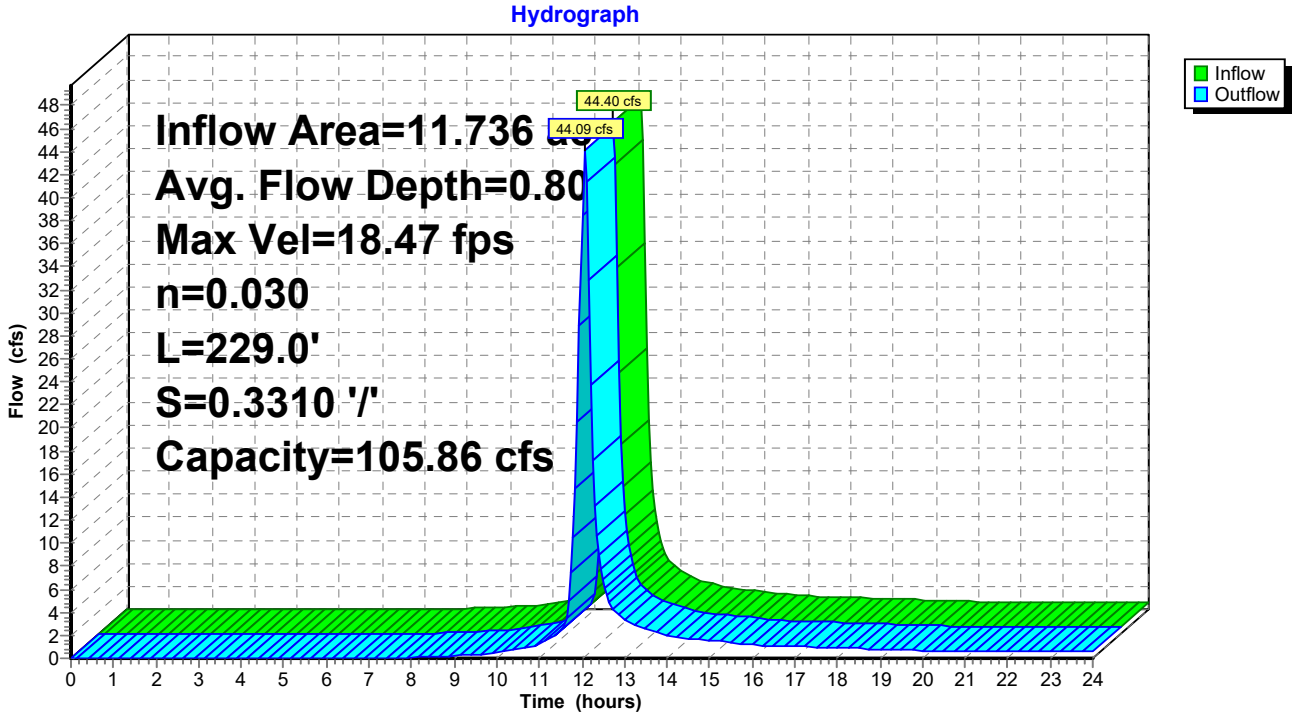
Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 44.40 cfs @ 12.05 hrs, Volume= 2.736 af
Outflow = 44.09 cfs @ 12.06 hrs, Volume= 2.735 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.47 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.91 fps, Avg. Travel Time= 0.8 min

Peak Storage= 550 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.80' , Surface Width= 3.00'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 105.86 cfs

3.00' x 1.50' deep channel, n= 0.030
Length= 229.0' Slope= 0.3310 '/'
Inlet Invert= 290.00', Outlet Invert= 214.20'

Reach 1R: Gabion Downchute



Summary for Reach 3R: Rip-Rap Inlet Transition

[61] Hint: Exceeded Reach 1R outlet invert by 0.47' @ 12.05 hrs

Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 44.09 cfs @ 12.06 hrs, Volume= 2.735 af
Outflow = 44.07 cfs @ 12.06 hrs, Volume= 2.735 af, Atten= 0%, Lag= 0.0 min

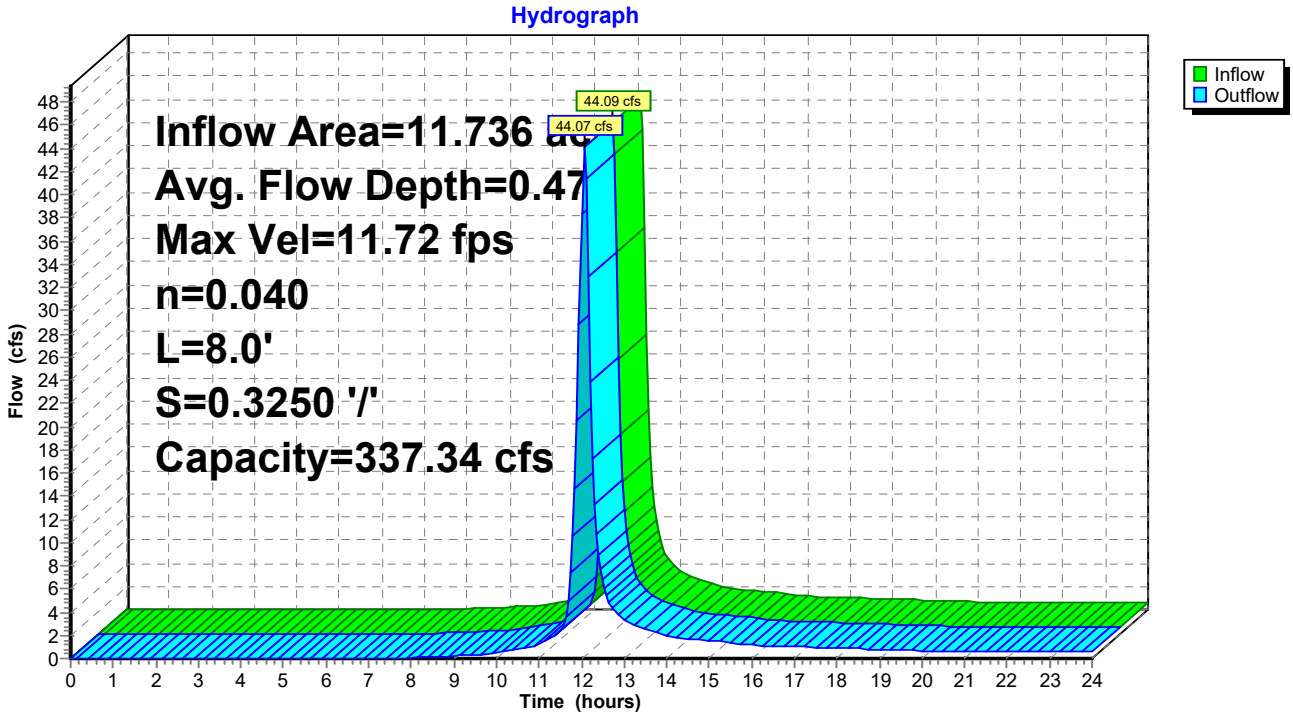
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.72 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.98 fps, Avg. Travel Time= 0.0 min

Peak Storage= 30 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 8.89'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 337.34 cfs

7.00' x 1.50' deep channel, n= 0.040 Riprap, 12-inch
Side Slope Z-value= 2.0 '/' Top Width= 13.00'
Length= 8.0' Slope= 0.3250 '/'
Inlet Invert= 214.20', Outlet Invert= 211.60'

‡

Reach 3R: Rip-Rap Inlet Transition



Summary for Reach A2: Rip-Rap Energy Dissipator - Outlet

[61] Hint: Exceeded Reach 3R outlet invert by 0.25' @ 12.05 hrs

Inflow Area = 11.736 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 44.07 cfs @ 12.06 hrs, Volume= 2.735 af
Outflow = 43.97 cfs @ 12.06 hrs, Volume= 2.734 af, Atten= 0%, Lag= 0.1 min

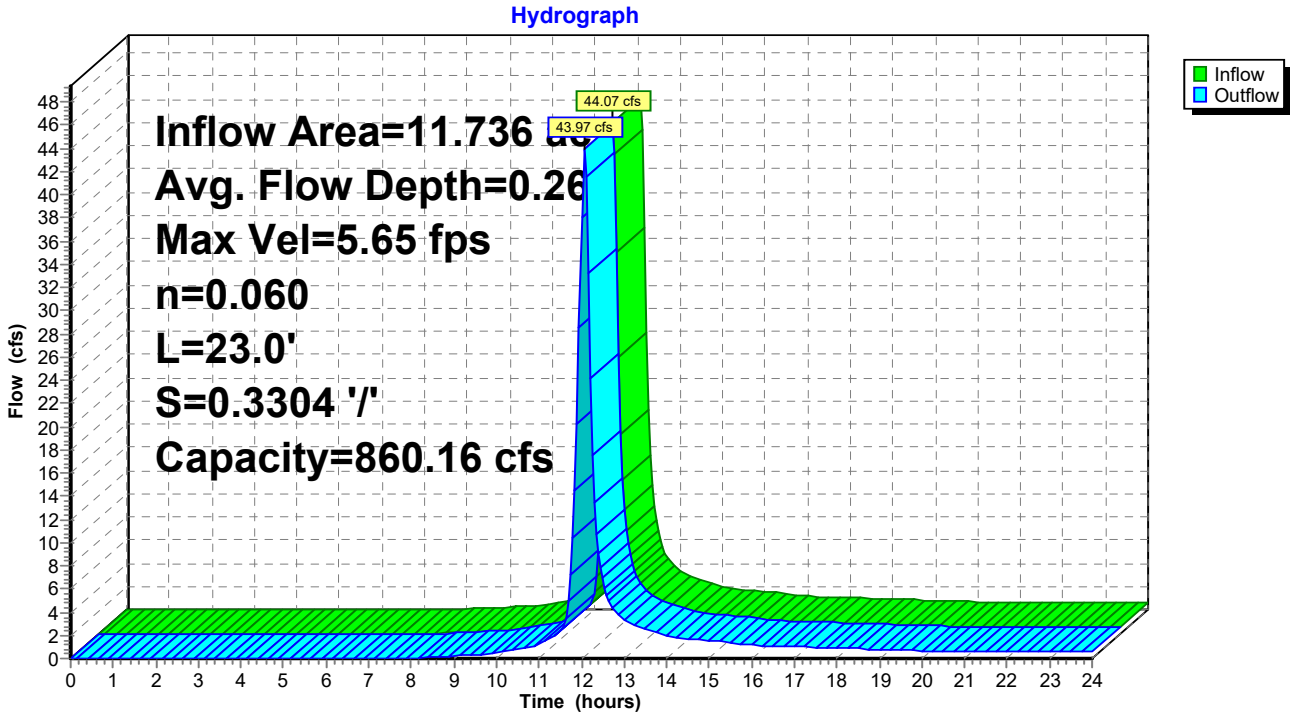
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.65 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 0.3 min

Peak Storage= 179 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 31.02'
Bank-Full Depth= 1.50' Flow Area= 49.5 sf, Capacity= 860.16 cfs

30.00' x 1.50' deep channel, n= 0.060
Side Slope Z-value= 2.0 '/' Top Width= 36.00'
Length= 23.0' Slope= 0.3304 '/'
Inlet Invert= 211.60', Outlet Invert= 204.00'

‡

Reach A2: Rip-Rap Energy Dissipator - Outlet



FINAL COVER DIVERSION BERM

AND

PERIMETER SWALE DESIGN

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project:	North Berm Modification	**Date:**	5/11/2021
Prepared by:	KFH	**Job #:**	182-442
Checked by:		**Sheet**	1 of 1

Perimeter Swale Design - Erosion Mat

Reference Material: Standards and Specifications for Lined Waterway or Outlet, *New York Standards and Specifications For Erosion and Sediment Control* , November 2016.

Objective: Determine appropriate erosion mat for perimeter swales using methodology presented in reference manual.

HydroCAD Analysis:

The same erosion mat will be utilized for the entire length of the perimeter swale. Therefore, the swale with the largest peak flow will be utilized to select the appropriate erosion mat (refer to node "5R" in the HydroCAD report titled "Post Development_North Pond" provided in this appendix). The erosion mat was selected to provide adequate resistance to erosion during the peak flow from a 25-Year, 24-Hour storm event.

25-Year, 24-Hour Storm:	4.9 in

Channel Parameters

Depth	2 ft
Bottom Width	2 ft
Side Slopes	2 H:1V
Channel Slope	0.073 ft/ft

Selected Erosion Mat: North American Green P550

Manning's Roughness Coefficient*

*Since Manning's n varies with depth in a grass lined channel, an iterative process is used to determine the hydraulic characteristics of the proposed channel. The value of Manning's n is linearly interpolated from the values indicated on P550 Turf Reinforcement Mat, Material and Performance Specification Sheet, North American Green, March 2009.

Assume Depth of Flow =	1 ft
Manning's n =	0.031
HydroCAD Depth of Flow =	1.25 ft

CONTINUE

Depth of Flow =	1.25 ft
Manning's n =	0.027
HydroCAD Depth of Flow =	1.17 ft

CONTINUE

Depth of Flow =	1.17 ft
Manning's n =	0.028
HydroCAD Depth of Flow =	1.19 ft

STOP

Maximum Velocity =	11.41 fps

Maximum Permissible Shear Stress		
	Short Duration	Long Duration
Phase 1 Unvegetated	4.0 lbs/ft² (191 Pa)	3.25 lbs/ft² (156 Pa)
Phase 2 Partially Veg.	12.0 lbs/ft² (576 Pa)	12.0 lbs/ft² (576 Pa)
Phase 3 Fully Veg.	14.0 lbs/ft² (672 Pa)	12.0 lbs/ft² (576 Pa)
Velocity Unveg	12.5 ft/s (3.8 m/s)	
Velocity Veg.	25 ft/s (7.6 m/s)	

*Reference: P550 Turf Reinforcement Mat, *Material and Performance Specification Sheet* , North American Green, March 2009.

Maximum Velocity	<	**Critical Velocity**	
11.41	<	12.5	GOOD

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

Project:	North Berm Modification	**Date:**	5/11/2021
Prepared by:	KFH	**Job #:**	182-442
Checked by:		**Sheet**	1 of 1

Diversion Berm Design - Erosion Mat

Reference Material: Standards and Specifications for Lined Waterway or Outlet, *New York Standards and Specifications For Erosion and Sediment Control*, November 2016.

Objective: Determine appropriate erosion mat for perimeter swales using methodology presented in reference manual.

HydroCAD Analysis:

The final cover diversion berms will be designed with the same cross-section and erosion matting. Therefore, the design input will utilize the largest drainage area to represent the maximum flow rate to any diversion berm. The representative drainage area is shown as subcatchment "28S" (refer to HydroCAD report titled "Diversion Berm Model"). The curve number for stablized final cover is 80. The swale was designed or a 25-Year, 24-Hour storm event.

25-Year, 24-Hour Storm:	4.9 in

Channel Parameters

Depth	1.5 ft
Bottom Width	0 ft
Side Slopes	2 H:1V
	3 H:1V
Channel Slope	0.04 ft/ft

Selected Erosion Mat: North American Green P300

Manning's Roughness Coefficient*

*Manning's n varies with depth of flow in a grass lined channel. For the purposes of this calculation, the value of Manning's n has been estimated using an assumed flow depth and linear interpolation of the values indicated on P300 Turf Reinforcement Mat, Material and Performance Specification Sheet, North American Green, March 2009.

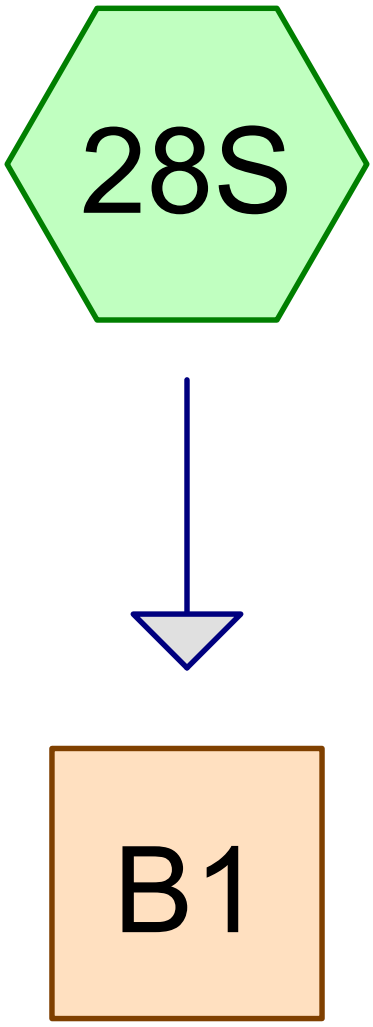
Assumed Depth of Flow =	1 ft
Manning's n =	0.029

Depth of Flow from HydroCAD =	1.01 ft
Maximum Velocity =	5.83 fps

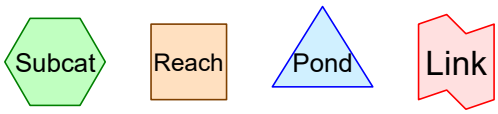
Maximum Permissible Shear Stress		
	Short Duration	Long Duration
Phase 1 Unvegetated	3.0 lbs/ft^2 (144 Pa)	2.0 lbs/ft^2 (196 Pa)
Phase 2 Partially Veg.	8.0 lbs/ft^2 (383 Pa)	8.0 lbs/ft^2 (383 Pa)
Phase 3 Fully Veg.	8.0 lbs/ft^2 (383Pa)	8.0 lbs/ft^2 (383 Pa)
Velocity Unveg	9.0 ft/s (2.7 m/s)	
Velocity Veg.	16 ft/s (4.9 m/s)	

*Reference: P300 Turf Reinforcement Mat, *Material and Performance Specification Sheet*, North American Green, March 2009.

Maximum Velocity	<	**Critical Velocity**	
5.83	<	9	GOOD



Sideslope Swale



Routing Diagram for Diversion Berm Model
Prepared by CEC, Inc., Printed 5/11/2021
HydroCAD® 10.10-5a s/n 07492 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-Year, 24-Hour Storm	Type II 24-hr		Default	24.00	1	4.90	2

Summary for Subcatchment 28S:

[47] Hint: Peak is 868% of capacity of segment #4

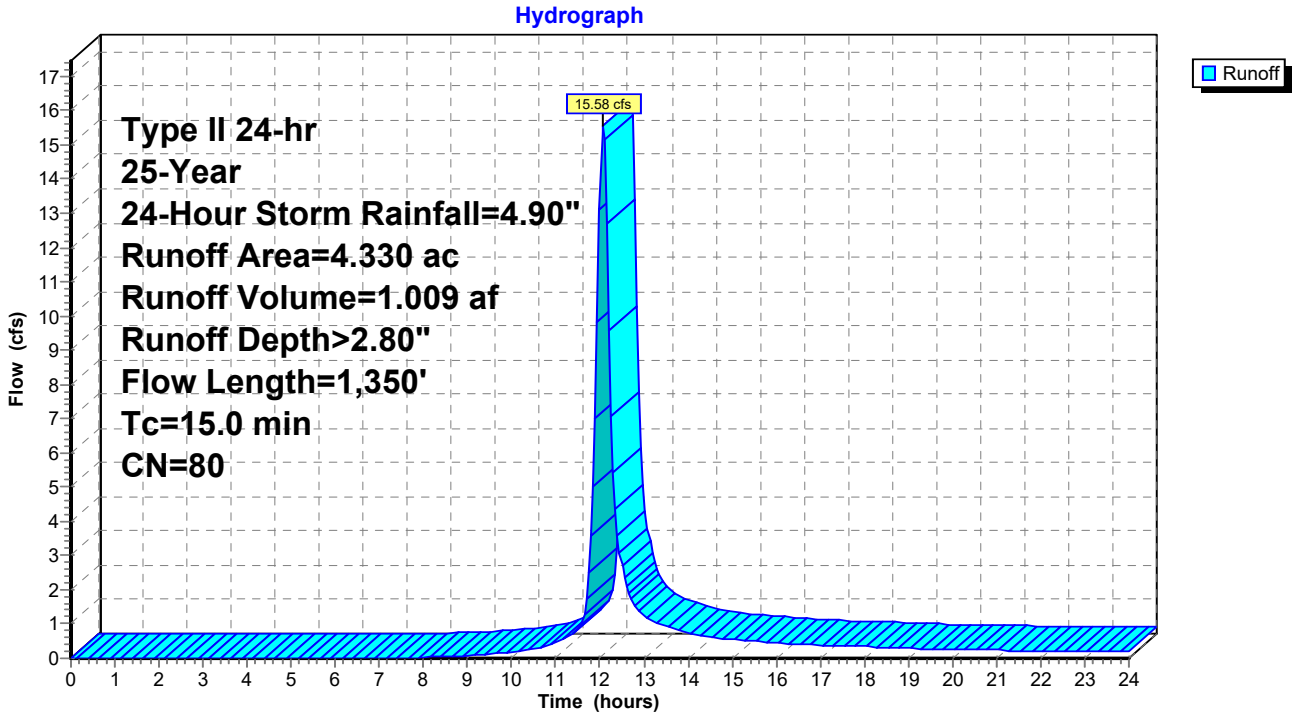
Runoff = 15.58 cfs @ 12.07 hrs, Volume= 1.009 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year, 24-Hour Storm Rainfall=4.90"

	Area (ac)	CN	Description
*	4.330	80	Cap
	4.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0500	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.80"
5.2	488	0.0500	1.57		**Shallow Concentrated Flow, Section 1** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	280	0.0400	2.87	1.80	**Trap/Vee/Rect Channel Flow, Diversion Berm 1** Bot.W=0.00' D=0.50' Z= 3.0 & 2.0 '/' Top.W=2.50' n= 0.039
0.2	222	0.3333	17.70	79.67	**Trap/Vee/Rect Channel Flow, Gabion Downchute** Bot.W=3.00' D=1.50' n= 0.040
0.4	190	0.0210	7.63	91.59	**Trap/Vee/Rect Channel Flow, North Channel** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.030
15.0	1,350	Total			

Subcatchment 28S:



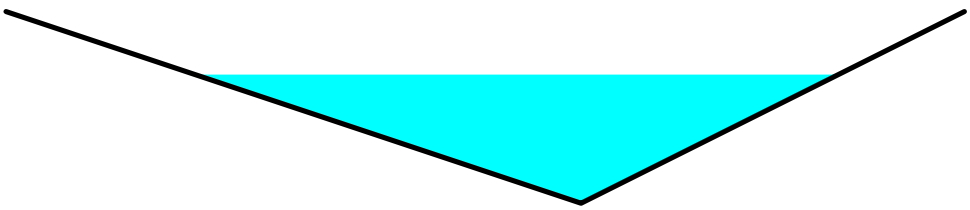
Summary for Reach B1: Sideslope Swale

Inflow Area = 4.330 ac, 0.00% Impervious, Inflow Depth > 2.80" for 25-Year, 24-Hour Storm event
Inflow = 15.58 cfs @ 12.07 hrs, Volume= 1.009 af
Outflow = 15.45 cfs @ 12.08 hrs, Volume= 1.009 af, Atten= 1%, Lag= 0.5 min

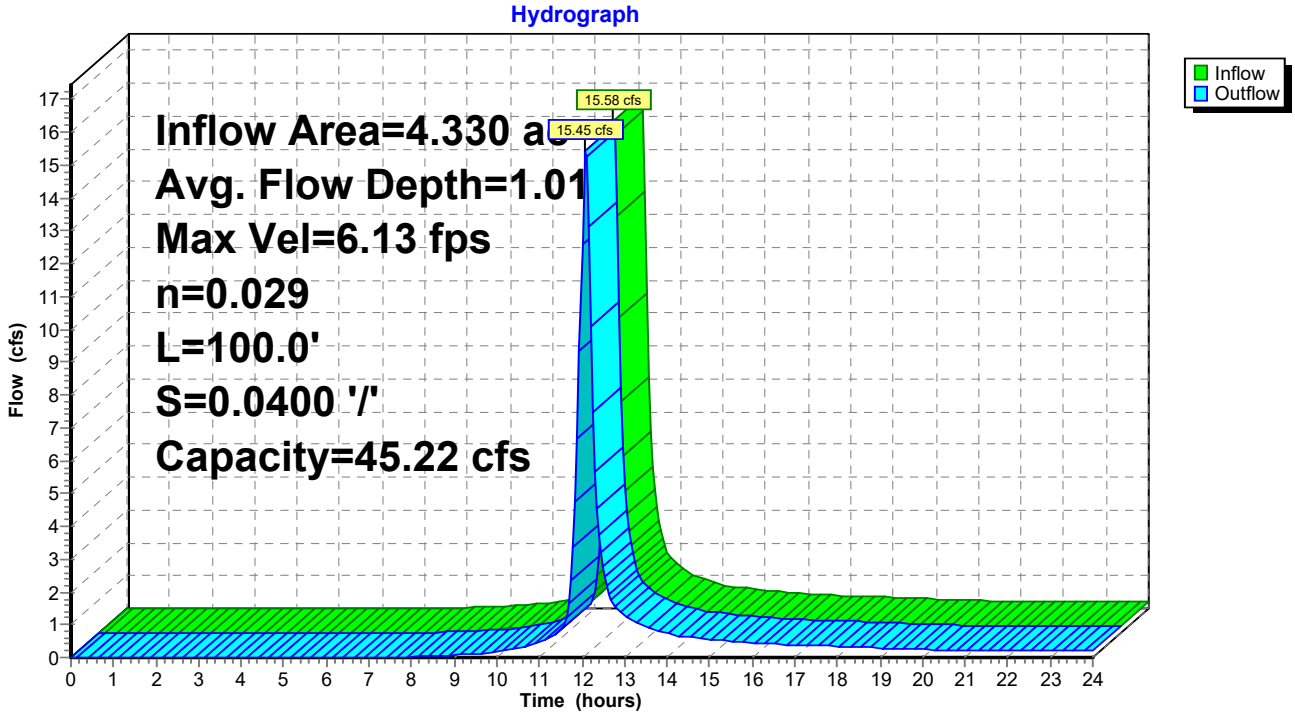
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.13 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.41 fps, Avg. Travel Time= 0.7 min

Peak Storage= 253 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.01' , Surface Width= 5.03'
Bank-Full Depth= 1.50' Flow Area= 5.6 sf, Capacity= 45.22 cfs

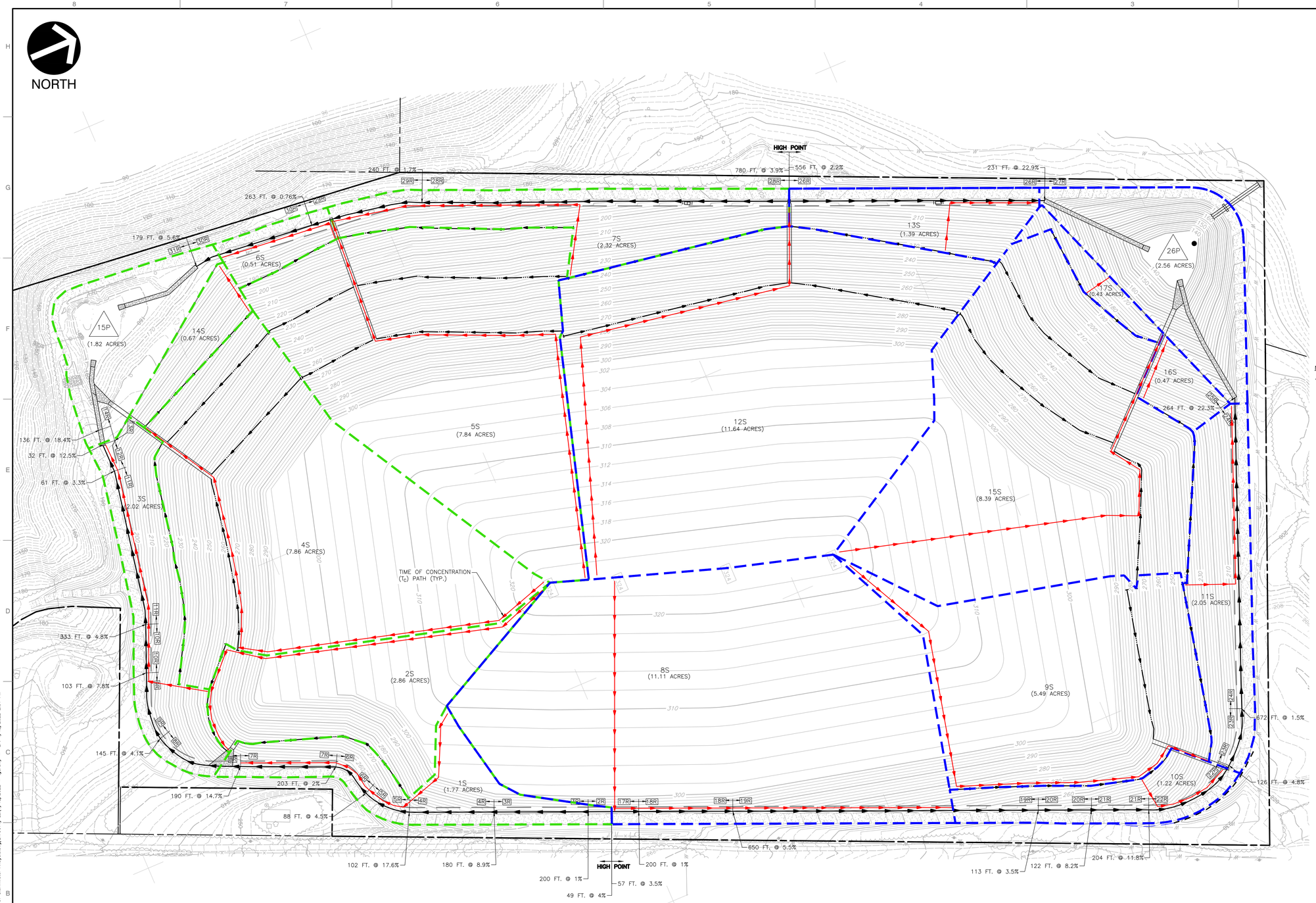
0.00' x 1.50' deep channel, n= 0.029
Side Slope Z-value= 3.0 2.0 '/' Top Width= 7.50'
Length= 100.0' Slope= 0.0400 '/'
Inlet Invert= 290.00', Outlet Invert= 286.00'



Reach B1: Sideslope Swale



DRAINAGE AREA MAPS



LEGEND:

- EXISTING 10-FOOT CONTOUR
- EXISTING 2-FOOT CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING SEWER LINE
- EXISTING WATER LINE
- EXISTING PROPERTY LINE
- PERMITTED TIME OF CONCENTRATION (T_C) PATH
- PERMITTED SOUTH POND DRAINAGE AREA LIMIT
- PERMITTED NORTH POND DRAINAGE AREA LIMIT
- PERMITTED LANDFILL PERIMETER PHASE LIMIT
- PERMITTED ACCESS ROAD
- PERMITTED DOWNCHUTE
- PERMITTED SIDESLOPE DIVERSION BERM
- PERMITTED PERIMETER DRAINAGE SWALE
- PERMITTED CLEAN WATER DIVERSION SWALE
- PERMITTED BASIN INLET CHANNEL
- 10P — HYDROCAD MODEL POND DESIGNATION
- 7R — HYDROCAD MODEL REACH DESIGNATION

NOTE:

1. PRE-DEVELOPMENT CONDITIONS REPRESENT CONDITIONS AT THE TIME OF FOOTPRINT MODIFICATION APPROVED BY NYSDEC IN SEPTEMBER 2016.

SCALE IN FEET
0 100 200

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

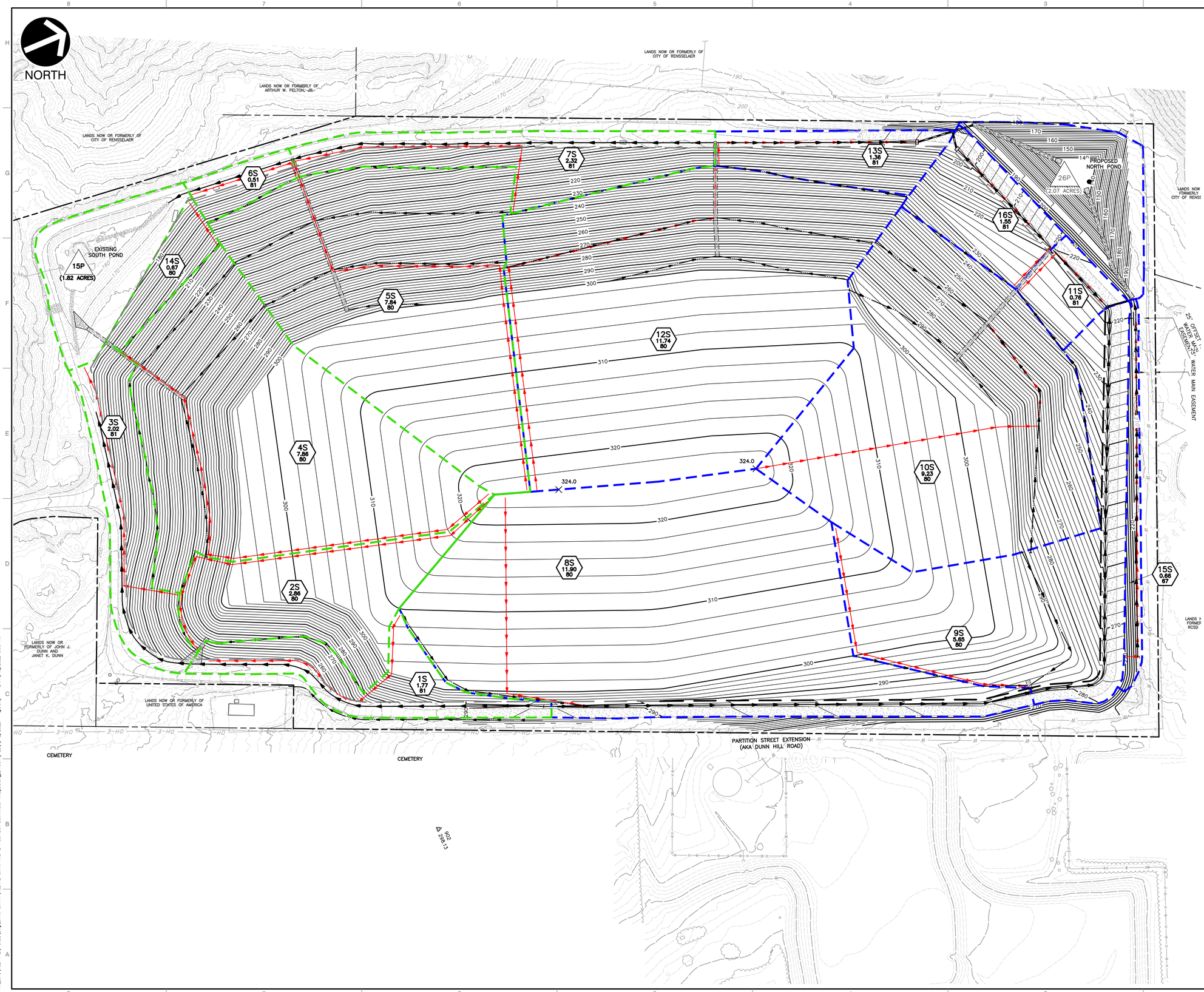
PRE-DEVELOPMENT STORMWATER ANALYSIS PLAN

DATE:	MAY 2021	DRAWN BY:	KFH
DWG SCALE:	1"=100'	CHECKED BY:	AJK
PROJECT NO:			182-442
APPROVED BY:			AJK

FIGURE NO.: 1

SHEET 1 OF 2

P:\2018\182-442\-CADD\Dwg\SWPP\182442-SWPP-HYD-1-Pre-Dev Stormwater Analysis.dwg\LAYOUT1 LS(1/12/2022 - bgarand) - LP: 1/12/2022 2:31 PM



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING WATER MAIN
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- PERMITTED TIME OF CONCENTRATION (T_C) PATH
- PERMITTED SOUTH POND DRAINAGE AREA LIMIT
- PERMITTED NORTH POND DRAINAGE AREA LIMIT
- PROPOSED LANDFILL PERIMETER LIMIT
- PERMITTED SIDESLOPE DIVERSION BERM
- PERMITTED PERIMETER DRAINAGE SWALE
- PERMITTED BASIN INLET CHANNEL
- HYDROCAD MODEL POND DESIGNATION
- SUBCATCHMENT IDENTIFICATION
- SUBCATCHMENT AREA (ACRES)
- WEIGHTED CURVE NUMBER

NOTES:

1. LANDFILL ACCESS ROAD WILL BE LOCATED ON LANDFILL BASED ON OPERATIONAL NEEDS.
2. DARK CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES. CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF FINAL COVER ELEVATIONS.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

POST DEVELOPMENT STORMWATER ANALYSIS PLAN

DATE:	MAY 2021
DRAWN BY:	CJJ
DWG SCALE:	1"=100'
CHECKED BY:	KFH
PROJECT NO:	182-442
APPROVED BY:	AJK

FIGURE NO.: 2

SHEET 2 OF 2

P:\2018\182-442\-CADD\dwg\SWPR\182442-SWPR-HYD-2-Post-Dev. Stormwater Analysis.dwg\LAYOUT1 LS(1/12/2022 - lgarand) - LP: 1/12/2022 3:06 PM

APPENDIX D

FACILITY MANUAL

FACILITY MANUAL

DUNN MINE AND C&D FACILITY

Prepared For:

S.A. DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION
RENSSELAER, NEW YORK 12144

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING,
LANDSCAPE ARCHITECTURE AND LAND SURVEYING, PLLC
31 BELLOWS ROAD
RAYNHAM, MASSACHUSETTS 02767

CEE PROJECT 182-442

JANUARY 2022

TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 Location and Site Description 1
- 1.2 Hours of Operation 1
- 1.3 Site Access 2
- 1.4 Facilities 2
- 1.5 Equipment 2
- 1.6 Protection of Water 3
- 1.7 Sustainability Plan 4

2.0 WASTE CONTROL PLAN 5
- 2.1 Incoming Waste Inspection 5
- 2.2 Confinement of C&D Solid Waste 6
- 2.3 Education and Training 6

3.0 FILL PROGRESSION AND WASTE PLACEMENT PLAN 7
- 3.1 Unloading Waste 7
- 3.2 Selective Material Placement 7
- 3.3 C&D Waste Density Monitoring 7
- 3.4 C&D Waste Placement 7
- 3.5 Landfill Fill Progression and Final Grades 8
- 3.6 Cover Materials Management Plan 8
  - 3.6.1 Operating Cover 8
  - 3.6.2 Intermediate Cover 9
  - 3.6.3 Final Cover 10

4.0 OPERATIONS AND MAINTENANCE 11
- 4.1 Leachate Management Plan 11
  - 4.1.1 Leachate Collection 11
  - 4.1.2 Leachate Conveyance and Storage 11
  - 4.1.3 Leachate Collection System Maintenance 12
  - 4.1.4 Leachate Monitoring 12
- 4.2 Gas Monitoring and Emission Control Plan 12
  - 4.2.1 Landfill Gas Generation 12
  - 4.2.2 Landfill Gas Collection and Control System 13
  - 4.2.3 Landfill Gas Monitoring 13
- 4.3 Post-Construction Care Plan 15
- 4.4 Maintenance of On-Site Roads 15
- 4.5 Salvaging 16
- 4.6 Open Burning 16

4.7 Winter and Inclement Weather Operation Plan 16
4.8 Dust and Vector Control 17
4.9 Odor Control Plan 18
4.10 Noise Control 19
5.0 INSPECTIONS, RECORDKEEPING, AND REPORTING 21
5.1 Routine Inspection 21
5.2 Recordkeeping and Reporting 21
5.2.1 Application Documents 21
5.2.2 Operating Records 21
5.2.3 Annual Report 22
6.0 PERSONNEL PLAN 23
6.1 Operational Positions and Responsibilities 23
6.1.1 District Manager 23
6.1.2 Assistant District Manager 23
6.1.3 Scale Attendant 23
6.1.4 Equipment Operators 24
6.1.5 Skilled Mechanic 24
6.2 Employee Training 24
7.0 EMERGENCY RESPONSE PLAN 27
7.1 Arrangements with Local Emergency Responders 27
7.2 Emergency Coordinators 27
7.3 Emergency Equipment 28
7.4 Fires and Delivery of Hot Loads 28
7.5 Equipment Breakdown 29
7.6 Unscheduled Facility Shutdown 29
7.7 Groundwater and Surface Water Contamination 29
7.8 Uncontrolled Landfill Gas 29
7.9 Evacuation Plan 30
7.10 Natural Disasters and Other Extreme Emergencies 30
8.0 CONCEPTUAL CLOSURE, POST-CLOSURE, CUSTODIAL CARE, AND END USE PLAN 31
8.1 Closure Plan 31
8.2 Landfill Closure and Post-Closure Description 31
8.3 Closure and Post-Closure Monitoring and Maintenance 32
8.4 Closure and Post-Closure Custodial Care Monitoring and Maintenance Cost 32

APPENDICES

Appendix A – Facility Inspection Forms
Appendix B – Environmental Monitoring Plan
Appendix C – Dust Control Plan

1.0 INTRODUCTION

1.1 LOCATION AND SITE DESCRIPTION

The Dunn Mine and C&D Facility is an existing sand and gravel mine and construction and demolition debris (C&D) disposal facility owned and operated by S.A. Dunn & Company, LLC. The facility operates under an existing New York State Department of Environmental Conservation (NYSDEC) permit (Permit ID 4-3899-00006/00006). Under the current permit, the site performs mining operations with the final stage of reclamation achieved when landfill liner is constructed.

Mining operations are currently taking place in the north pit and within the future landfill development and disposal areas. Landfill development progresses sequentially in designated phases of waste disposal. Each phase of the Dunn Mine and C&D Facility will be operated and maintained in accordance with the applicable parts of Title 6 of the New York State Codes, Rules, and Regulations (6 CRR-NY). This plan has been prepared to demonstrate the facility's compliance with the facility plan and operating requirements outlined in 6 CRR-NY Parts 363-4.6 and 360-19, respectively. Appendix B includes the Environmental Monitoring Plan and Site Analytical Plan as required by Part 363-4 (f) and (g).

In addition to this plan, other documents exist for the facility in order to demonstrate compliance with the applicable requirements outlined in 6 CRR-NY. Such documents include: the most recent version of the facility's Stormwater Pollution Prevention Plan (SWPPP), the Operational Sequencing Permit Modification Plans dated August 2021, the MSE Bern Permit Modification Plans dated January 2022 and any subsequent updates to these plans, the Engineering Report prepared for the Operational Sequencing Permit Modification dated August 2021, along with the Engineering Report prepared for the MSE Berm Permit Modification, dated January 2022, and any subsequent updates to these reports, and the Mined Land Use Plans, dated January 2022.

1.2 HOURS OF OPERATION

Project operations, which include mining, reclamation, and waste disposal, are performed only within the following times:

Monday – Friday 6:30 a.m. to 5:30 p.m.

Supporting facility operations, such as landfill maintenance, as well as construction activities may be conducted outside these hours.

Project operations are not conducted on Sundays or Federal Holidays. When a federal holiday falls on a Sunday, and is observed on the following Monday, no project operations will take place on that Monday. The hours of operation listed above are the same as the existing site operations. No change is proposed.

1.3 SITE ACCESS

Signs are posted at the facility entrance gate that indicate the hours of operation and the types of waste that are accepted and not accepted. Signs are also posted which designate the facility as private property in order to deter unauthorized use of the site. Unauthorized access and use of the facility during non-operating hours is prevented using a locking gate at the facility entrance.

The site is currently permitted to generate up to 100 round trips per day (200 total truck trips per day). Vehicles expected to access the site for waste disposal vary in type and size, however transfer trailers are most common. The facility has been designed to allow for the smooth flow of traffic into and through the facility, including during inclement weather and winter conditions, and the facility roadways and travel paths are able to accommodate the size and quantity of vehicles expected to access the facility.

1.4 FACILITIES

The facility contains several buildings that are used by facility personnel as office space and as the maintenance garage. The buildings are adequately heated and lit and contain a potable drinking water supply, sanitary toilet facilities, and radio and/or telephone communication. Municipal water and sewer services exist on-site.

1.5 EQUIPMENT

Various pieces of heavy machinery are utilized at the site to perform the routine facility operations of mining and waste management. The equipment utilized at the site are suitable in size and function for the facility operations described in this plan.

Equipment (listed make/model or similar) to be maintained on site, in good working order, includes:

1-Caterpillar D-8T Bulldozer
1-Caterpillar 836K Landfill Compactor
1-Case CX250 Excavator
1-Caterpillar 730C Articulated All-Wheel Drive Dump Truck
1-Water Truck

1.6 PROTECTION OF WATER

C&D waste is not deposited into and is managed such that it will not enter surface water or groundwater. The facility is operated in a manner that minimizes leachate generation, and the migration of leachate into surface water is prevented as a result of the proper collection and disposal of leachate at the facility, which is conducted in accordance with regulatory requirements and as described in Section 4.1 of this plan.

Stormwater runoff generated at the facility is directed to retention ponds via stormwater conveyance structures such as channels, diversion berms, and culverts. Throughout landfill construction phases, stormwater may be managed in temporary stormwater retention ponds that will not have any off-site surficial discharge of stormwater. Runoff that comes into contact with waste or leachate is managed as leachate, as described in Section 4.1. During the later stages of cell closure, the landfill cap will effectively shed stormwater from the constructed landfill to the surrounding areas above the current mine floor into two permanent stormwater management basins. The south pond is currently constructed and operational. Construction of the north pond will coincide with the development of Phases 7B or 8. Pond grading and outlet structures are shown on the Footprint Modification Drawings. The stormwater management basins undergo regular inspections and maintenance in order to verify and maintain functionality. The stormwater inspection form is provided in Appendix A.

The maintenance and operation practices related to stormwater management that are implemented at the facility are described in greater detail in the most recent version of the facility's SWPPP.

1.7 SUSTAINABILITY PLAN

To the maximum extent possible, future landfill construction will utilize soils obtained from the site mining operations as opposed to outside sources. If sufficient quantity exists and the material meets the regulatory and specification requirements, clay from mining will be used for on-site baseliner construction. On-site sand and gravel will be utilized as part of the subgrade layer, drainage layer, and for cover materials used during the placement of C&D material, as described in Section 3.4.

C&D material is visually inspected when it is disposed of on the working face to confirm that no prohibited materials are present. Recyclable materials observed during this process will be removed from the waste stream and stored for future handling, as appropriate.

Greenhouse gas emissions are reduced at the facility through the use of the active landfill gas collection and control system, as described in Section 4.2.

2.0 WASTE CONTROL PLAN

The site utilizes an inbound and outbound scale to quantify the weight of waste received at the site on a daily basis and confirm that the permitted amount of daily truck trips, as described in Section 1.3, is not exceeded. Facility daily start-up consists of opening the security gate and allowing vehicle access to the facility scales and performing start-up procedures for the facility equipment.

2.1 INCOMING WASTE INSPECTION

Incoming New York state waste will be accepted from municipalities that are included in a department approved comprehensive recycling analysis (CRA) or local solid waste management plan (LSWMP). The facility only accepts C&D waste. Wastes not accepted at the facility include: municipal solid waste, solid waste resulting from industrial or commercial operations, sludge from the treatment of wastewater or sewage, drilling and production wastes, friable asbestos containing wastes, or other prohibited wastes as defined in 6 CRR-NY Part 363-7.1(o).

All incoming loads are visually inspected to confirm the characterization of incoming waste materials are acceptable for disposal at the facility, and random load inspections are performed on a weekly basis. Additional inspections are conducted for suspicious loads to confirm the suitability of incoming waste. Incoming and outgoing vehicles are continuously monitored to confirm they are adequately covered when they enter and exit the site.

The quantity of incoming waste is restricted by the permitted amount of truck trips that can be made to and from the facility, as described in Section 1.3. The site typically receives around 1,000 to 2,500 tons (1,700 to 4,200 cubic yards) of waste on a daily basis; however, this quantity is subject to variability due to waste availability and various other factors, including permitting, agency review and construction timeframes. Trucks containing accepted materials for disposal are directed to the working face of the landfill, where the waste is unloaded and placed as described in Section 3.0.

Records of load inspections are kept at the facility. The waste load inspection form is provided in Appendix A.

If unauthorized waste is discovered in a load, the load will be rejected immediately. The unauthorized waste will be re-directed to an appropriate facility for disposal or management. If immediate relocation is not feasible, the unauthorized waste will be adequately segregated, secured, and contained at the facility until it can be removed. The containment of such material at

the facility will last no more than seven days without prior approval by the NYSDEC, and the relocation will be performed by a person authorized to transport the waste. The NYSDEC will be notified of such discoveries.

In the event that unauthorized solid waste is disposed of at the facility, documentation of the incident will be prepared which will include the following information: the date and time of receipt, the identity of the waste, contact and vehicle information for the waste transporter that delivered the unauthorized waste, contact information for the generator of the unauthorized waste, a description of the incident and the response measures taken, and the disposition of the waste. This information will be summarized within the annual report in accordance with 6 CRR-NY 360.19(c)(4).

2.2 CONFINEMENT OF C&D SOLID WASTE

C&D solid waste disposed of at the facility is confined to a managed area and prevented from migrating outside of the managed area. C&D will only be accepted from adequately covered vehicles to control dust and blowing litter. Litter that does migrate outside of the managed area is picked up by facility personnel.

2.3 EDUCATION AND TRAINING

The facility will educate users on proper methods of electronic waste management by providing written information annually, and upon request, to all potential users of the facility. Signs are posted designating that electronic waste cannot be accepted at the facility.

A similar program may be implemented to educate users that the facility is prohibited from accepting for disposal source-separated materials (such as source-separated recyclables, source-separated electronic waste, source-separated rechargeable batteries, etc.). This program would be deemed necessary if the results of incoming load inspections, as described in Section 2.1, found that these materials were commonly being transported to the site for disposal. Source-separated materials are not anticipated to be delivered to the site for disposal due to the acceptance of solely C&D debris materials for disposal at the facility.

The facility will provide training to the facility staff to ensure the waste acceptance and control plan is implemented in accordance with the requirements described above.

3.0 FILL PROGRESSION AND WASTE PLACEMENT PLAN

3.1 UNLOADING WASTE

Following the inspection and documentation of waste materials, as described in Section 2.1, accepted waste materials are unloaded within the working face of the landfill. Logs are kept to document the waste received for each day of operation at the facility. The daily waste logs include the date, the quantity and type of waste received, and the location where waste was placed. The daily waste logs are kept at the facility.

The working face is maintained within the lined area, as shown on the Permit Drawings, in order to maintain acceptable waste management. The working face will be adequate in size to facilitate efficient unloading of waste and unobstructed movement of vehicles and equipment.

3.2 SELECTIVE MATERIAL PLACEMENT

The first layer of waste to be placed in a newly opened landfill phase, on top of the leachate collection layer, will be at least five feet thick and will be comprised of selective material that will not impact the operation or integrity of the composite liner system. The material will be placed using the equipment described in Section 1.5 and placement will occur in a manner to prevent damage to the liner system as a result of the material placement or equipment operation. The equipment operators will take care to maintain the 5-foot depth of material between the equipment and the top of the leachate collection layer and will minimize, to the extent practical, excessive turning of the equipment or other movements that may be unfavorable in these scenarios.

3.3 C&D WASTE DENSITY MONITORING

The facility tracks waste acceptance rates, cover soil usage, and airspace consumption. On an annual basis, the in-place density of the waste will be calculated by dividing the total tonnage of waste and estimated (truck counts) over soils placed by the total airspace consumed.

3.4 C&D WASTE PLACEMENT

Following the establishment of the first layer of selective material, C&D debris placement will proceed in layers of approximately ten feet in un-compacted thickness. Waste placement will occur solely within the designated landfill areas, as described in Section 2.2, and will progress sequentially in designated phases (refer to Permit Drawings for waste fill progression, landfill

development, landfill gas collection line locations, and final cover elevation plans. [Note: horizontal gas collection lines are not required at the facility and are thus not shown on the aforementioned plans. Refer to Section 4.2.2 for additional description of the landfill gas collection and control system.]). The C&D waste will be placed using the equipment described in Section 1.5 and will be placed in a manner that promotes rapid compaction of the waste. The working areas will be adequately drained to minimize standing water.

Low permeability and/or low shear-strength wastes are not anticipated to be received by the facility; however, in the event that these wastes are disposed of at the facility they will be visually identified and then mixed with other materials during waste placement in order to minimize waste mass instability and prevent interference to leachate movement through the waste mass.

3.5 LANDFILL FILL PROGRESSION AND FINAL GRADES

The facility currently has Phases 1 through 7A constructed and operational. Phase 10A, which is currently under construction and expected to be operational in spring 2022, will be the next phase of construction, followed by Phases 10B, 10C, 9, 8A, 8B, and, 7B. The overall fill progression plans, as shown on Sheets C309 and C310 of the MSE Berm Permit Modification Plans, depict the seven remaining phases of continued cell construction, beginning with Phase 10A.

Filling of the waste disposal area will progress with side slopes of 33% (3H:1V) to an elevation of approximately 300 feet. In general, waste will be placed in lifts of approximately 10 feet in height. The working face area size encompasses an area of approximately 1 acre. Final external slopes will not exceed 3H:1V. The remaining fill will be placed at a slope of 5% across the plateau, which will encompass approximately 35 acres at full closure of the facility. Final grading of the facility is shown on Sheet C302 of the above referenced plans.

No subsequent development of the facility is proposed for at this time.

3.6 COVER MATERIALS MANAGEMENT PLAN

3.6.1 Operating Cover

The operating cover material will consist of soil, clean masonry material, or approved equal that is effective in preventing and controlling vectors, fires, odors, dust, and blowing litter. The operating cover material is most commonly obtained from the mining activities at the site, which typically consists of a silty sand material with a permeability typically within the range of 10^{-4} to

10^{-3} centimeters per second. The specific material characteristics may change based on the mining operations at the site; however, the material used for operating cover will continue to meet the requirements outlined in this Section.

On a daily basis, or more frequently if nuisance conditions arise that warrant increased placement, the working face of the landfill will be covered with a minimum of 6-inches of operating cover. Cover soils are placed using the facility equipment identified in Section 1.5. The thickness of the cover material will be increased if necessary to control nuisances. On landfill surfaces where no additional waste has been placed within 30 calendar days, a minimum of 12-inches of operating cover will be placed.

Operating cover will be hauled to the active area at the end of each operating day or stockpiled throughout the day within the active area. The landfill plateau area provides additional space for operational support and materials storage. A sufficient supply of operating cover material will be generated and maintained on site; however, the exact quantity required will vary based on site operations. The supply of material will be suitable to at least cover the working face of the landfill with the depth of material described above.

Currently, the only approved alternative operating cover is tarps. Tarps are used (typically in conjunction with soil cover placement to ensure the tarps provide complete coverage of the wastes) to reduce the quantity of cover soils used. The tarps are moved into place using facility equipment and the edges of tarps are ballasted with soils, concrete blocks or large equipment tires to hold them in place. The tarps are then removed the following day to resume waste placement.

3.6.2 Intermediate Cover

Intermediate cover material will consist of soil proven effective at inhibiting precipitation from entering the waste mass, containing leachate outbreaks, and inhibiting the migration of gases. The material generated on-site and used as operating cover, as described in Section 3.4.1, is also used for the intermediate cover applications described in this Section. Intermediate cover will be placed and maintained on all external slopes for every 20 feet of vertical rise, and will be placed using the facility equipment identified in Section 1.5. The quantity of intermediate cover required will vary based on the progression of waste filling.

3.6.3 Final Cover

A final cover system has been designed in accordance with 6 CRR-NY 363-6, as shown on the Permit Drawings. Refer to the Engineering Report for material specifications related to the final cover system. Final cover installation will occur periodically as sufficient areas of finish grades are achieved. Materials required for the final cover installation will be delivered and stored on-site accordingly. The final cover system will be installed and maintained in accordance with the requirements outlined in 6 CRR-NY 363-9.

4.0 OPERATIONS AND MAINTENANCE

4.1 LEACHATE MANAGEMENT PLAN

4.1.1 Leachate Collection

The design and operational objective is to keep C&D wastes accepted at the facility in a well-drained configuration above a leachate collection system. This will effectively reduce both the ponding of water within the waste mass and the creation of a potential reducing environment. The leachate collection system has been designed to reduce ponding of water within the waste mass and maintain less than 12-inches of head above the liner system, except during the seven day period following a storm event and within designated sump areas.

C&D waste will be placed on top of a sloping drainage layer with a thickness of 2 feet (the 2-foot drainage layer is underlain by a composite membrane and clay liner system). In addition, each cell will be configured with sloping surfaces pitched towards central collection systems to facilitate fluid flow within leachate collection piping. The leachate collection piping will be installed within a stone trench lined with geotextile to further facilitate the flow of fluids into the leachate collection system. These engineering design features will reduce the possibility for the C&D waste mass to become saturated.

In the event of an unexpected condition during the construction or operation of the leachate collection system, the system will be evaluated and appropriate action, such as repairs or cleaning, will be taken to provide continued system operation.

4.1.2 Leachate Conveyance and Storage

Leachate collected from the leachate collection system is pumped from the landfill at designated sump locations and conveyed through dual-contained force mains to the existing above ground storage tank (AST) located near the entrance of the facility. The leachate sump locations have alarms to alert the operator in the event the leachate pumps shut off unexpectedly. The AST is capable of storing 275,000 gallons of leachate while maintaining a minimum of 2 feet of freeboard, and is equipped with a high-level alarm to prevent overfilling. The volume of leachate in the storage tank is monitored on a daily basis by recording the leachate as indicated by the level transmitter and converting this number to gallons using a conversion chart. The quantity of rainfall is also recorded on a daily basis from an on-site rain gauge. The leachate within the tank is removed once the tank reaches 75% capacity or once every two operating days. The leachate is pumped

into tanker trucks destined for authorized disposal or treatment locations. The tank components are inspected on a monthly basis and remedial measures are taken immediately in the event that any deficiencies are identified.

As described in the facility's SWPPP, stormwater within the secondary containment storage area of the existing AST is removed by opening a drain valve, provided the stormwater is observed to be free from leachate contamination. The valve is normally kept closed, and is temporarily opened after storm events in order to maintain the capacity of the storage area.

4.1.3 Leachate Collection System Maintenance

The leachate collection system will be cleaned annually and properly maintained in good operating condition. The leachate collection pipes will be inspected by video at least biennially and cleaned annually unless a waiver is granted by NYSDEC.

A log will be maintained to record monthly leachate generation amounts and a maintenance log documenting completion of cleaning and video inspection as described above.

4.1.4 Leachate Monitoring

Samples and measurements taken for the purpose of monitoring will be done in accordance with 6 CRR-NY Part 363-4(6)(f)(8) and the NYSDEC approved Environmental Monitoring Plan (EMP) for the site, which also includes acceptable laboratory use and data reporting format.

4.2 GAS MONITORING AND EMISSION CONTROL PLAN

4.2.1 Landfill Gas Generation

The C&D materials accepted for disposal at this facility have the potential to generate landfill gas (LFG) within the waste mass. Several operational controls are implemented at the facility to reduce the generation of landfill gas. Waste placement for potentially gas producing C&D debris will be spread in lifts over a broad area, and not concentrated in any one area of the landfill. The use of on-site sand and gravel materials as a source of cover, as described in Section 3.4, will serve to facilitate the draining of fluids from the C&D waste and limit the creation of pockets of saturation within the waste mass. During periods of wet weather, operating cover or a tarp will be placed over exposed sheetrock or other potentially gas producing C&D debris to reduce the potential for landfill gas generation from this waste.

4.2.2 Landfill Gas Collection and Control System

The facility has an active landfill gas collection and control system (GCCS) in operation. The system consists of a blower to exert vacuum on the system and a flare to combust the collected landfill gas. Several collection points are in place within the waste mass, including vertical landfill gas extraction wells and the connection of the LFG collection system to the leachate collection system cleanout pipes. Landfill gas collection components, as shown on C304 of the Permit Drawings, are installed as the waste placement progresses. Additional collection points, including vertical extraction wells and horizontal collection pipes, can be installed and connected to the LFG collection system as needed based on waste placement and gas generation at the facility, or if increased odor levels resulting from landfill gas generation are observed.

The flare is equipped with a connection for supplemental propane if it is necessary to augment the collected landfill gas to maintain combustion. A cellular modem/communications package is included with the flare system to allow for text notifications for system faults. Upon receiving notification of system faults, S.A. Dunn will initiate a response immediately regardless of time of day or day of the week. Some system faults can be reset remotely. If the fault requires a site response and occurs outside of operating hours, an S.A. Dunn representative will respond as soon as possible upon determining that a remote reset is not practical or effective to diagnose and remedy the fault.

In the event of unexpected conditions during the expansion or operation of the LFG collection system, the system operations will be evaluated and the system will be shut down if needed until repairs or adjustments can be made. The system operations would resume as soon as possible provided it is safe to do so.

4.2.3 Landfill Gas Monitoring

During landfill operations and the post-closure care period, quarterly gas monitoring will be conducted to further verify that landfill gas is within acceptable levels. Gas monitoring will be performed for hydrogen sulfide at each of the groundwater monitoring well locations. The gas monitoring will also include field measurements of hydrogen sulfide gas at four (4) locations on and/or around the landfill mass.

The LFG collection and control system will be routinely monitored and the system operations will be adjusted as needed to control LFG generated at the facility. During normal operations of the system, excessive concentrations of explosive gas (>25% of the lower explosive limit) will be prevented from persisting on-site or beyond the property boundary.

The GCCS inspection form is provided in Appendix A. Routine operation, maintenance, and monitoring will be performed as follows:

Blower/Flare Operation and Maintenance

The blower and flare will be operated in accordance with manufacturers requirements as outlined in the equipment specific Operations and Maintenance (O&M) Manual prepared by Parnell (provided upon initial start-up of the equipment). Equipment maintenance will be conducted based on service life also in accordance with the manufacturer's recommendations. A log of the performed maintenance will be prepared and kept on-site with the flare and blower O&M Manual.

Daily Operations, Maintenance, and Monitoring

On a daily basis, the flare and blower system will be visually observed to verify that the system components are operating correctly. Specific activities include:

- Observe panel for system malfunctions;
- Observe and document the flare temperature (verify it is within appropriate range), inlet pressure, flow, pressure, and methane percentage;
- Observe the flame;
- Observe the liquid level in the knock-out pot and verify that it is draining properly; and
- Observe landfill surface for indications that gas venting or air intrusion is occurring.

If repairs or corrective actions are necessary, these will be noted and a schedule of repairs will be developed.

Monthly Operations and Maintenance

On a monthly basis, the flare and blower system, landfill gas wellheads, and above grade piping will be visually observed to verify that the system components are operating correctly.

In addition to the above monitoring activities, each landfill gas well will be monitored monthly for the following:

- Carbon dioxide concentration;
- Oxygen concentration;
- Methane concentration;
- Balance gas concentration;
- Wellhead gas temperature (before and after adjustment);
- Wellhead vacuum (before and after adjustment); and
- Wellhead adjustment valve position (before and after adjustment).

The collected data will be used to adjust or tune the wellfield to maintain proper operation of the flare and to control odors. Adjustment at one well may impact the performance of other wells; therefore, initial readings will be made at each well before adjustments at wells are made.

Annual Operations, Maintenance, and Monitoring

On an annual basis, the following activities will be performed:

- Clean electrical equipment controls and instrumentation;
- Observe condensate equipment corrosion and other maintenance needs; and
- Compete a visual check of overall system operations.

4.3 POST-CONSTRUCTION CARE PLAN

Upon completion of construction of a new landfill phase and prior to placement of select material, the facility will regularly inspect the drainage soils for signs of erosion or intrusion of fines related to water-borne or wind-borne sediments. Prior to placement of select fill, any eroded areas of drainage material will be re-graded using the same drainage material used for construction. If significant migration of fines from adjacent areas migrates into the new phase drainage layer, the affected drainage material will be removed and replaced using the same drainage material used for construction.

4.4 MAINTENANCE OF ON-SITE ROADS

On-site roads will be maintained as safe and passable at all times.

4.5 SALVAGING

Salvaging will not be permitted at the facility.

4.6 OPEN BURNING

Open burning at the facility is prohibited, unless a restricted burning permit is obtained from NYSDEC. Immediate measures will be taken to extinguish any non-permitted open burning, for which NYSDEC will be notified of its occurrence.

4.7 WINTER AND INCLEMENT WEATHER OPERATION PLAN

Snow removal will occur as needed during the winter months to maintain access to the site.

During the winter months, the first layer of selective waste material will be placed as quickly as possible following construction certification approval to prevent frost from penetrating the leachate collection layer and potentially impacting the liner system. The material placement will occur as described in Section 3.2.

Dunn will implement an extreme weather action plan on days when the National Weather Service forecasts the following weather notifications:

- High Wind Watch (issued when sustained winds of 40 miles per hour (mph) or higher for one hour or more or wind gust of 58 mph or higher for any duration are possible).
- High Wind Warning (issued when sustained winds of 40 mph or higher for one hour or more or wind gust of 58 mph or higher for any duration are expected).
- Wind Advisory (issued when sustained winds of 31 to 39 mph for an hour or more and/or wind gusts of 46 to 57 mph for any duration are expected).
- Severe Thunderstorm Watch (issued when thunderstorms are possible in the watch area and winds of 58 mph or higher are expected).
- Tornado Watch (issued when a tornado is possible in the watch area and winds of 58 mph or higher are expected).
- Severe Thunderstorm Warning (thunderstorms are imminent in the warning area).
- Tornado Warning (tornado is imminent in the warning area).

When a high wind watch, severe thunderstorm watch, or tornado watch is issued, Dunn will implement the following procedures:

- Evaluate condition of exposed slopes; if necessary and sufficient time exists, apply tackifier-bonded mulch to disturbed excavation or stockpile slopes. As often as necessary, apply water or calcium chloride if temperatures are below freezing.
- Evaluate condition of roadways; as often as necessary, apply water. If temperatures are below freezing, as often as necessary, apply calcium chloride.
- Monitor weather forecast updates for upgrades from watches to warnings.

If a high wind warning, wind advisory, severe thunderstorm warning, tornado watch or warning are issued, Dunn will conduct the activities mentioned above and cease both mining and waste operations one hour prior to the warning period (provided that the weather notification is issued at least one hour prior to the beginning of the effective period). In addition, cover placement activities will begin one hour prior to the effective time (or immediately if the notification is issued less than one hour in advance of the effective time) of such notifications.

If the National Weather Service issues any of the above mentioned weather watches, warnings or advisories or elevated (or greater) risk for tornados, thunderstorm wind gust, or non-thunderstorm winds (i.e., Wind Advisories, High Wind Watches or High Wind Warnings that occur without a Severe Thunderstorm Warning) for an effective period during a weekend, holiday, or on a Monday morning, Dunn will undertake the procedures mentioned above ahead of time during permitted hours of operation. This includes placement of chlorides (e.g. calcium or magnesium) or other long-lasting approved dust palliatives as approved in the facility's Dust Control Plan to roadways and other exposed sand surfaces that are not stabilized by tackifier bonded mulch and/or erosion control matting. If such watches, warnings or advisories are issued outside of permitted hours of operation, the Department will be notified and Dunn will mobilize resources as soon as possible to mitigate dust potential.

4.8 DUST AND VECTOR CONTROL

The facility will be operated and maintained such that dust and vectors are not a nuisance or health threat to the nearby residents. Neighboring residents are encouraged to contact the facility manager if they are being impacted by noise, dust or other issues related to facility operations. All complaints will be recorded and responded to, in a timely manner, by facility staff.

Facility operations will continue in accordance with the established dust control plan, dated November 2020, and any subsequent revisions. The Dust Control Plan is included in Appendix C. The access roads will be watered if dust problems appear imminent. Water will not be sprayed onto potentially gas producing C&D debris that is excessively dry, rather either operating cover or an approved dust palliative will be applied in instances where dust generation becomes a nuisance, particularly for pulverized C&D debris waste. The facility dust control measures inspection form is provided in Appendix A.

As described in Section 4.1, leachate is collected and controlled in a manner to reduce any open exposure of leachate, minimizing the potential for odors. All leachate piping and the leachate storage tank will be water tight and not vented to the surrounding environment. Similarly, leachate trucks will be water tight and not vented upon being filled.

Since no putrescible waste will be accepted, the opportunity for vector problems arising from the accepted waste is minimized. Furthermore, the waste characterization at the site, which consists solely of C&D debris materials, is not expected to change.

In the event that nuisances arise due to a change in conditions such as an increase in waste volume acceptance, or change in waste characterization, the nuisances would be controlled by increasing the amount and/or frequency of cover material. Further controls would be developed and implemented if needed.

4.9 ODOR CONTROL PLAN

The facility will be operated and maintained such that odors are not a nuisance or health threat to the nearby residents. Neighboring residents are encouraged to contact the facility manager if they believe they are being impacted by odors related to facility operations. All complaints will be recorded and responded to, in a timely manner, by facility staff. The individual responsible for implementing the odor control plan is the Assistant District Manager as identified in Section 6.0.

Potential sources of odor at the facility include uncontrolled leachate, odorous wastes, and the generation of odorous gases within the waste mass. Potential generation of odors associated with C&D debris waste and leachate management mainly includes the potential generation of hydrogen sulfide gas associated with sulfate-reducing bacteria's (SRB) reaction with sheetrock in a reducing environment.

The C&D landfill will be operated in a manner to not cause the production of any significant amounts of hydrogen sulfide or become the source of odors at or near the facility. Cover material will be placed as described in Section 3.4 and as necessary to minimize and control any nuisance conditions such as odors, fire hazards, vectors, blowing material and scavenging. Furthermore, the landfill gas collection and control system, as described in Section 4.2, is operated to collect gas generated within the landfill and prevent landfill gas from creating nuisance odor conditions.

In the event that nuisances arise due to a change in conditions such as a change in waste characterization, or increased landfill gas generation, the nuisances would be controlled by increasing the amount and/or frequency of cover material placement or expanding the landfill gas collection and control system. Further controls would be developed and implemented if needed.

4.10 NOISE CONTROL

The facility will be operated in ways to avoid any increase in noise associated with activities at the facility, and truck traffic to and from the project site. As discussed in Section 1.3, truck traffic traveling to and from the project site is currently limited to 100 round trips per day (200 total trips per day). This threshold is a baseline condition that will not be exceeded.

Noise levels from equipment and operations at the facility will be controlled to prevent transmission of sound levels beyond the property lines that exceed equivalent sound levels currently experienced in the area. All internal combustion powered equipment will have mufflers to reduce potential sound levels.

Noise best management practices (BMP's) implemented during facility operations that will serve to mitigate the potential for adverse noise impacts to off-site receptors include the following:

- Blasting is prohibited.
- Mining equipment on-site will be equipped with back-up alarms, which will activate only when infrared sensors detect personnel in the vicinity of such equipment. Facility operations will be planned such that waste disposal trucks entering into the facility will not need to back up, except under unusual circumstances.
- Mufflers will be used for all mining and waste disposal equipment on-site, and will be required for all waste delivery trucks entering into the facility. Mufflers will be maintained in good working order.

- Vehicles speeds on haul roads and City streets will be kept to practicable minimums and engines will be kept at idling speeds to the greatest extent possible.
- Portable screening operations for the mining operations will be located in the lowest portions of the active mining area surrounded by bank slopes.
- The average amount of equipment in operation at a given time will be kept to a practicable minimum. Only the equipment that is needed at a given time will be in operation at that time.
- The existing access road off of Partition Street Extension will continue to be used as the primary entry and exit point to and from the project site.

5.0 INSPECTIONS, RECORDKEEPING, AND REPORTING

5.1 ROUTINE INSPECTION

The facility will be monitored continuously for situations that could create a potentially harmful release to the environment or threat to human health. Daily inspections will be made by facility staff to avoid minor deficiencies that may include, but are not limited to, inappropriate slope of waste placement and insufficient depth of cover material. Proper function of leachate pumping stations will be maintained, and leachate storage tank levels will be tracked routinely.

The facility operator will record self-inspections, noting date and time of the inspection, name of inspector, the specific nature of the inspection, and a description of what was observed. Dates and details of any remedial action will also be recorded. The daily site inspection form is provided in Appendix A.

5.2 RECORDKEEPING AND REPORTING

The following documents and records will be kept at the facility office building.

5.2.1 Application Documents

The operator of the facility will, during all times of operations including post-closure and custodial care periods, have a copy of all permits issued for the facility by NYSDEC, including construction certifications and closure construction certification documents.

5.2.2 Operating Records

Operating records shall include daily waste logs (as described in Section 2.1), routine inspection logs (as described in Section 5.1), applicable training programs and certifications, and applicable monitoring reports in accordance with the EMP and 6 CRR-NY Parts 360 and 363.

Records will be retained of all monitoring information for a period of at least seven years from the date of the sampling event, measurement, report or application.

5.2.3 Annual Report

An annual report will be submitted March 1 of each year to the central and Region 4 offices of NYSDEC. The report will include: the volume and weight of waste received, along with an estimation of the remaining approved design volume; the results of the approved environmental monitoring plan; any deviations made from the approved plans, specifications, operating requirements and permit conditions; an accounting of how much leachate was collected, and how it was disposed of; and adjustments to closure and post-closure care cost estimates and financial assurance documents.

6.0 PERSONNEL PLAN

The facility staff will be appropriately trained to manage the quantity and type of waste that will be handled at the facility. It is anticipated that the facility will be staffed, at a minimum, by one attendant and one operator during hours of operation.

6.1 OPERATIONAL POSITIONS AND RESPONSIBILITIES

6.1.1 District Manager

The District Manager is responsible for the overall operation of the Facility and the supervision of Facility employees. The District Manager coordinates the efforts of the Operations Supervisor, Scale Attendant, Laborers and Equipment Operators. The District Manager is responsible for making sure that workers follow the various federal, city and state laws relative to the inspection and handling of solid waste.

6.1.2 Assistant District Manager

The Assistant District Manager is jointly responsible for the overall operation of the Facility and the supervision of Facility employees. The Assistant District Manager coordinates the efforts of the Scale Attendant, Laborers and Equipment Operators. The Assistant District Manager acts as the Emergency Coordinator when present at the Facility. The Assistant District Manager is responsible for making sure that workers follow the various federal, city and state laws relative to the inspection and handling of solid waste. The operator will complete a course, approved by NYSDEC, for instruction in solid waste management procedures pertinent to operating a C&D landfill. The course will be completed within 12 months of the date of employment and renewed every five years. Proof of training will be kept on file at the facility.

6.1.3 Scale Attendant

The scale attendant at the facility is responsible for directing and recording waste and traffic flows at the facility. The scale attendant's responsibilities include operating the facility scales and communicating with the drivers of inbound and outbound vehicles.

6.1.4 Equipment Operators

The facility equipment operators are responsible for operating the facility equipment described in Section 1.5. The equipment operators shall be adequately trained in the operation of the equipment to be used and in the facility's waste control plan.

6.1.5 Skilled Mechanic

The Skilled Mechanic is responsible for maintaining the facility equipment in good working order to reduce the frequency of equipment breakdowns and limit equipment downtime. The skilled mechanic performs necessary routine inspections and maintenance of the equipment, as well as more extensive maintenance measures provided the site maintenance facility is suitable for the work.

6.2 EMPLOYEE TRAINING

The Dunn Mine and C&D Facility is committed to protecting the health and safety of its employees. This commitment is the foundation of the company's core values and culture. These values will not be compromised under any circumstances. Dunn Mine and C&D Facility continuously builds on their resolute commitment to workplace health and safety, in order for the company to accomplish its goal of becoming the safest workplace possible their employees, customers, contractors and the general public's interest.

Dunn Mine and C&D Facility has a comprehensive and proactive safety program, which includes written safety protocols that have been established to encourage worker safety at the Facility. These protocols are integrated into the weekly and monthly safety training sessions. A copy of these safety protocols are maintained at the Facility and are available to Facility employees at all times.

The Site Manager conducts a comprehensive training session on a monthly basis to enforce Dunn Mine and C&D Facility safety policies. Topics covered typically include regulations (OSHA, New York State Department of Labor/ Public Employee Safety and Health Bureau, NYSDEC) and safe operating practices (equipment operation, safety devices, MSDS, PPE, etc.). The monthly training sessions include quizzes and each employee in attendance must sign-off indicating they understood the training that was presented. Each employee in attendance must also sign a Training Session Roster, which attests the employee understood the topics covered in the session.

Training presented is from Dunn Mine and C&D Facility training courses. Safety training courses include information such as the Facility's standard operating procedures. Initial employee training focuses on the employee's duties they will be initially performing which will ensure the Facility continues to comply with safety standards and with the NYSDEC's 6 NYCRR Part 360 and Part 363 regulations.

The Dunn Mine and C&D Facility's training focuses on the hazards associated with infectious and hazardous materials and the means to identify and correctly handle unauthorized wastes. The training also includes site-specific training in waste handling and transfer station operations. In addition to detailing the routine procedures of Facility operations, this site-specific training includes emergency topics such as emergency spill response, fire extinguisher use, and fire safety. Facility employees complete weekly and monthly safety training, which serves to re-emphasize previous training and to maintain employee safety at the Facility.

Dunn Mine and C&D Facility training courses include the following topics:

- Site Procedures and Processes; Start-up and Shutdown of Facility Operations;
- Site Safety Plan;
- Site Contingency Plan;
- Safe work practices;
- Nature of anticipated hazards;
- Handling and responding to emergencies;
- Use and care of Facility emergency equipment, communication and alarm systems;
- Handling, storage, and transportation of materials;
- Employee rights and responsibilities;
- Bloodborne Pathogens and Bio Hazards;
- Cold and Heat Stress;
- Confined Space Compliance Training;
- Ergonomics and Safe Lifting;
- Hazard Communications;
- Hazard Identification;
- Lockout/Tag out;
- Use and care of Personnel Protective Equipment (PPE);
- Three Point Contact Rule;
- Unauthorized Waste Recognition and Handling Procedures;
- Asbestos Recognition and Handling Procedures;

- Incident Reporting;
- OSHA 300 Log;
- Slip/Trip/Fall Hazards;
- Fire Protection;
- Facility Permits – NYSDEC;
- Truck Direction and Backing.

In addition, newly hired employees initially engage in actual field activities under the direct supervision of the Facility Manager or designee.

Although each employee may have a specified job title, most employees are required to assume other positions as deemed necessary by current site activities.

7.0 EMERGENCY RESPONSE PLAN

The facility will respond to emergencies such as fires, explosions, natural disasters, and spills in accordance with Part 360-19(m) and as described below.

The following Plan will ensure that a coordinated course of action will be taken in the event of unanticipated emergencies that may occur during construction and operation of the facility.

Actions taken by the facility in response to spills are described in the most recent version of the facility's SWPPP, which includes the Spill Prevention Control and Countermeasures Plan (SPCC).

7.1 ARRANGEMENTS WITH LOCAL EMERGENCY RESPONDERS

During the first three (3) months of operation, local emergency response agencies were provided with a tour of the facility to become familiar with the facility operations, site layout and environment, as well as the opportunity to inspect and comment, as appropriate. The agencies included the City of Rensselaer Fire Department, Police Department, and Volunteer Ambulance Service, Inc.; NYSDEC Region 4; the Rensselaer County Sheriff's Department; and the New York State Police.

7.2 EMERGENCY COORDINATORS

The emergency coordinator for the facility is the following individual:

Corey Judd
Regional Manager
209 Partition Street Extension
Rensselaer, New York 12144
Mobile Phone: (518)431-9439

The coordinator will contact all applicable emergency response agencies in the event of an emergency. All facility employees will be instructed to contact the above coordinator should an emergency arise.

The following emergency response agencies may be contacted depending upon the specific emergency situation:

EMERGENCY RESPONSE AGENCIES	TELEPHONE NUMBER
1.0 City of Rensselaer Fire Department	(518) 462-7453
2.0 Rensselaer Volunteer Ambulance Services, Inc.	(518) 427-8515
3.0 City of Rensselaer Police Department	(518) 462-7451
4.0 Rensselaer County Sheriff's Department	(518) 270-5448
5.0 New York State Police	(518) 474-5331
6.0 Albany Memorial Hospital	(518) 471-3221
7.0 NYSDEC Region 4	(518) 357-2045
8.0 New York State Office of Fire Prevention and Control	(518) 474-6746

In addition, outside emergency response contractors may be contacted to handle situations that involve unacceptable waste requiring a prompt response, as described in Section 2.1.

7.3 EMERGENCY EQUIPMENT

Basic emergency equipment is available on-site. Fire extinguishers of appropriate size are located in all buildings and on all pieces of heavy equipment. Spill control and abatement equipment for isolating and preventing the migration of spilled materials is also available on-site.

Mobile phones and/or radios are accessible in all buildings, vehicles, and heavy equipment for use in communications during an emergency.

7.4 FIRES AND DELIVERY OF HOT LOADS

All incoming loads are visually inspected for smoldering waste and, if found to contain smoldering waste, will remain in the trailers/roll offs outside of the working face and extinguished.

The working face will be visually inspected for smoke, emissions and/or holes and depressions on a daily basis with the findings being logged. In the event of a fire, the emergency coordinator will contact the Rensselaer Fire Department. The necessity of further assistance will be identified by the on-scene commander from the Fire Department. HazMat teams will be contacted if necessary and are available through the New York State Office of Fire Prevention and Control.

Very limited fires will be contained with fire extinguishers or smothered with cover soil, if appropriate.

7.5 EQUIPMENT BREAKDOWN

Essential equipment will be maintained in good working order; however, if a necessary piece of equipment will not be available for an extended length of time (longer than normal maintenance operations), the facility will lease the appropriate replacement equipment until the original is put back into service. Failing equipment will be replaced, as necessary.

7.6 UNSCHEDULED FACILITY SHUTDOWN

In the event of significant interruptions to the facility's operations, the emergency coordinator, identified in Section 7.2, will be notified. Depending on the nature of the incident, appropriate remedial actions will be determined and implemented.

If an unscheduled facility shutdown exceeds 24 hours, the facility will notify the NYSDEC immediately to describe the incident and propose temporary waste management procedures.

7.7 GROUNDWATER AND SURFACE WATER CONTAMINATION

The controls listed in Section 1.6 are implemented to prevent groundwater and surface water contamination. In the event that the routine monitoring and sampling at the facility does identify potential groundwater and/or surface water contamination, the appropriate procedures as described in the EMP will be implemented.

7.8 UNCONTROLLED LANDFILL GAS

In the event the landfill gas monitoring, as described in Section 4.2.3, detects explosive gas concentrations exceeding 25 percent of the lower explosive limit, immediate actions will be taken to assess and remedy the situation.

Assessment of the situation will involve inspecting the landfill gas collection and control system to verify the system is operating correctly, provided it is safe to perform such an inspection. Depending on the nature of the monitoring results, the system operations will be adjusted to increase the level of collection in order to control the excessive LFG concentrations. If the problem cannot be resolved with adjustments to the operation of the LFG collection system, alternative

short-term solutions will be pursued and the LFG collection system will be evaluated and expanded as needed.

The NYSDEC will be notified within 24 hours of the detection of the excessive explosive gas levels. Within seven days of the detection, the detected levels will be submitted to the NYSDEC along with a plan describing steps to be taken to prevent property damage and protect the health and safety of facility personnel and the public. If the excessive concentrations persist for an extended period of time, a plan will be developed that describes the nature and extent of the problem and outlines steps to take to remediate the gas release(s). The plan will be submitted to the NYSDEC within 30 days of the initial explosive gas detection.

7.9 EVACUATION PLAN

In the event of an emergency at the facility that requires evacuation, an alarm will sound and personnel will report to the main entrance, as instructed during training for employment at the facility. At the entrance, the emergency coordinator will take attendance to ensure that all personnel have left the site. The emergency coordinator will notify employees when it is appropriate and safe to return to the facility.

7.10 NATURAL DISASTERS AND OTHER EXTREME EMERGENCIES

In the event of a natural disaster that impacts the site, the emergency coordinator will work will other facility personnel to assess the condition of the site's facilities. The assessment will include the facility access roads and stormwater controls, the landfill gas collection and control system, the leachate collection and conveyance system, the leachate storage tank, exposed areas of baseliner or cover components, and other visible components that may be impacted by such an event. Following the assessment, it will be determined if the facility operations have been or have the potential to be disrupted, and appropriate measures will be implemented to prevent or limit such disruptions. Equipment used at the facility for day to day operations, as described in Section 1.5, could be used to assist in clean-up and material management efforts.

If a natural disaster generates a large quantity of debris in surrounding areas, the facility would have the ability to expand on its routine services (i.e. longer operating hours) or provide non-standard services for the purposes of disaster relief, provided the NYSDEC grants approval for those services. The facility would be able to coordinate with debris transporters to provide them with important information about the facility and its disaster response efforts.

8.0 CONCEPTUAL CLOSURE, POST-CLOSURE, CUSTODIAL CARE, AND END USE PLAN

8.1 CLOSURE PLAN

Site plans depicting the proposed final contours, property lines, water courses, roads, structures, stormwater management system, and a landfill gas collection system was presented in the drawings titled Footprint Modification Drawings prepared by CEE, dated March 2016, and approved by NYSDEC in June 2016. Subsequent plans, titled MSE Berm Permit Modification Drawings, were submitted to NYSDEC in January 2022 presenting revised final contours, roads, structures, stormwater management system, and landfill gas collection system. The stormwater management system is presented on Sheet C303 and the landfill gas collection system is presented on Sheet C304. Details of the final cover components are shown on the Footprint Modification Drawings.

A closure plan will be developed and submitted to the NYSDEC at least 180 days before the commencement of construction of final facility closure, in accordance with 6 CRR-NY 363-9.3(c).

An updated deed description will be submitted along with the closure plan in accordance with Part 363-7.1(r). The updated deed description will include/address the following items:

- Period of time during which the property has been used as a landfill;
- Description of the wastes contained within the landfill; and,
- Survey and map indicating the limits of the disposal areas within the property boundary.

8.2 LANDFILL CLOSURE AND POST-CLOSURE DESCRIPTION

Complete landfill closure will consist of installing the final cover system and final cover stormwater controls, as shown in the Permit Drawings. As described in Section 3.4.3, final cover installation will occur periodically as sufficient areas of finished grades are achieved. Due to the nature of the fill progression sequencing, it is possible that all of the landfill cells may receive waste before any one individual cell is completely closed. The landfill fill progression sequencing is shown in the Permit Drawings, and the final cover sequencing will be described in greater detail in the future Closure Plan, as described in Section 8.1.

The final cover system will be installed and maintained in accordance with the requirements in Subpart 363-9. Upon final facility closure, the quantity of waste and operating cover within the

landfill will have reached the design capacity of approximately 11 million cubic yards, as described in the Engineering Report.

No conceptual end use of the facility is proposed for the site at this time.

8.3 CLOSURE AND POST-CLOSURE MONITORING AND MAINTENANCE

Upon termination of use, the facility will be closed in accordance with the approved closure plan and will continue to be monitored in accordance with the approved Environmental Monitoring Plan (EMP) and in accordance with Subpart 363-9.6(a)(1)(iv). The landfill gas collection and control system will continue to be monitored as described in Section 4.2.3, and in accordance with Subpart 363-7.1(e).

8.4 CLOSURE AND POST-CLOSURE CUSTODIAL CARE MONITORING AND MAINTENANCE COST

The facility maintains a financial assurance mechanism (FAM) in an amount sufficient to cover the cost of closure, post-closure care, custodial care, and corrective actions. The FAM is updated as needed as the facility develops, and includes the following items:

- Quantities and costs for each component of the final cover system;
- Construction costs for the final cover system; and,
- Post-closure operational, monitoring, maintenance, and custodial costs for the 30-year post-closure care period.

APPENDIX A

FACILITY INSPECTION FORMS

- Waste Load Inspection Form
- Daily Site Inspection Form
- GCCS Inspection Form
- Dust Control Measures Inspection Form
- Stormwater Inspection Form

WASTE CONNECTIONS, INC.

DUNN LANDFILL

Waste Load Inspection Form

Inspector: _____ **Date:** _____ **Time:** _____

Owner: _____ Driver: _____

ID Code: _____ Vehicle Type: _____ Vehicle Capacity: _____

Waste Source: _____

1)	Explosives or ammunitions		10)	Rolls of carpet or fencing over twelve inches in diameter, and/or 4' in length	
2)	Combustible liquid or gas containers, bottles, cylinders or cans.		11)	Animal wastes or parts of animals *Excluding normal household garbage*	
3)	HAZARDOUS MATERIALS **Caustic acids, corrosives, chemicals or other hazardous wastes containing radioactivity or other contaminates or pollutants prohibited by mandatory and binding laws or regulations of the US and/or NYS government(s)**		12)	Automotive or larger sized tires	
4)	Liquid or slurry wastes (<20% Solids)		13)	INFECTIOUS WASTE **Contaminated hypodermic needles, syringes, broken glass and scalpel blades, isolation wastes, cultures and stocks from hospitals and laboratories, human blood and blood products**	
5)	Unopened containers the contents of which cannot be readily visually identified, including barrels of any kind		14)	Electronics (TV's, computer equip.), fluorescent bulbs,lead-acid&rechargeable batteries, newspapers or any other bulk recyclable materials	
6)	Tree trunks, stumps, branches, limbs or lumber over 4 inches in diameter or over 5 feet in length. Lawn or leaf debris; grass, branches, leaves, etc		15)	Telephone poles or railroad ties in bulk quantities	
7)	Slag, rock, sand, brick		16)	ASBESTOS WASTE	
8)	Bulk Metals: Thick-walled or solid metallic objects such as castings, gas cylinders or motors, or bulk metals of any kind such as white goods(washers, dryers, refrigerators)			**If "Y" (yes) was answered for any of the above items, a decision must be made by the supervisor to accept or reject the load. If the load is rejected, the waste must be segregated and enforcement actions initiated. The waste is to be removed from the site by the vehicle owner at no cost to the Dunn Landfill.**	

Additional Comments on Waste Load: _____

DISPOSITION OF WASTE LOAD **ACCEPTED** ☐ **REJECTED** ☐

Reason for Rejection: _____

INSPECTOR SIGNATURE: _____ **DRIVER SIGNATURE:** _____

S.A. Dunn & Company, LLC
209 Partition Street Extension
Rensselaer, New York 12144
(518) 650-6107

DUNN C&D LANDFILL

Daily Site Inspection Form

Name of Personnel Observing: _____ Time: _____ Date: _____

General Weather Conditions: _____ Temp: _____ °F General Wind Direction: N S E W

Wind Speed: _____

Rain/Snow: _____

- **LEACHATE**

___ 1) Leachate was observed seeping from Landfill _____

___ 2) Leachate was observed entering surface water _____

___ 3) Leachate Levels Observed in Storage Tank _____(Ft)

___ 4) Liquid Level in Leachate Secondary Containment _____(in)

- **WASTE / COVER**

___ 5) Evidence of Unacceptable Wastes
___ 6) Waste Slopes Steeper than 3:1
___ 7) Waste in the active landfill is not covered
___ 8) Waste is protruding through cover
___ 9) Erosion of cover observed

If YES, location and description: _____

_____

- **NUISANCE**

___ 10) Noise is a nuisance off site
___ 11) Odors are detectable off site
___ 12) Windblown debris observed to be blowing out of landfill
___ 13) Blowing dust or dirt is a nuisance
___ 14) Blowing debris fence needs repairs
___ 15) Tracked Material on Paved Roadways
___ 16) Required Repairs to On Site Roads
___ 17) All maint. gates shut & locked

If YES, location and description: _____

_____

- **NOTES**

Signature of personnel conducting site observation: _____ Date: _____

Signature of site Operations Supervisor: _____ Date: _____

Dunn Landfill GCCS Inspection Form

Date: _____

Daily Inspection:

Control Panel: _____
Flare Temp: _____
Inlet Pressure: _____
Flow: _____
Flame: _____
KOP: _____
Landfill Surface: _____

Monthly Inspection:

Well Head Condition: _____
Piping Condition: _____

Annual:

Electrical / Controls: _____
Corrosion Inspection: _____
Overall Inspection: _____

Dunn Mine and C&D Facility Dust Control Measures Inspection

Date: _____

Name of Personnel Performing Inspection: _____

☐ Weekly Inspection

☐ Monthly Inspection

ITEM	LOCATION	REPAIRS NEEDED (Y/N)	COMMENTS
Erosion Control Matting			
Mulch surfaces			
Fences			

Notes:

1. Weekly inspections required between March 15 to May 15. Monthly inspections are required for remainder of year.
2. Areas of damaged mulch or matting that are greater than 400 contiguous square feet must be repaired within 10 days.
3. Fences must be repaired within 10 days of observation.

DATE: _____

S.A. Dunn Landfill SWPPP ESC Inspection Form	Completed by: _____ Title: _____ Weather Condition: _____ Soil Condition (e.g. dry, wet, saturated): _____

Item	Comment
Condition of runoff at discharge points	Outfall No. 1: Outfall No. 2:
Discharges of sediment or other pollutants from the Site	
Description of natural surface water bodies located within or immediately adjacent to the property	
BMPs and Erosion and Sediment Control practices that need repair or maintenance	
BMPs and erosion and sediment control practices not installed properly or not functioning properly	
Description or sketch of area disturbed at time of inspection and areas that have been stabilized since last inspection (1)	
Corrective actions needed (1)	

SIGNATURE: DATE:

(1) Note: Attach photos, with date stamp, that clearly show the condition of all practices that have been identified as needing corrective actions and documenting completion of corrective actions.

APPENDIX B

ENVIRONMENTAL MONITORING PLAN

ENVIRONMENTAL MONITORING PLAN

DUNN MINE AND C&D FACILITY

Prepared For:

SA DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION
RENSSELAER, NEW YORK 12144

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING, LANDSCAPE ARCHITECTURE, AND LAND SURVEYING, PLLC
31 BELLOWS ROAD
RAYNHAM, MASSACHUSETTS 02767

CEE PROJECT 182-442

JANUARY 2022

TABLE OF CONTENTS

1.0 ENVIRONMENTAL MONITORING PLAN 1
1.1 Introduction 1
2.0 FACILITY DESCRIPTION 2
2.1 Location and Description 2
3.0 HYDROGEOLOGY 3
3.1 Regional Geology 3
3.2 Site Geology 3
3.3 Groundwater Elevation Measurements 4
3.4 Hydraulic Conductivity 4
4.0 MONITORING AND REPORTING 5
4.1 Groundwater Monitoring 5
4.2 Surface Water Monitoring 6
4.3 Leachate Monitoring 6
4.4 Water Supply Well Monitoring 6
4.5 Gas Monitoring 7
4.6 Quarterly and Annual REports 7
4.6.1 Content of Report 9
5.0 SITE ANALYSIS PLAN 10
6.0 DATA QUALITY ASSESSMENT 12
6.1 Data Validation 12
6.1.1 Data Usability Analysis 12
7.0 POST-CLOSURE ENVIRONMENTAL MONITORING 13

FIGURES

Figure 1 – Site Location Plan
Figure 2 – Monitoring Well Location Plan

1.0 ENVIRONMENTAL MONITORING PLAN

1.1 INTRODUCTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC (CEE) prepared this Environmental Monitoring Plan (EMP) on behalf of S.A. Dunn & Company, LLC (S.A. Dunn). This EMP addresses the environmental monitoring plan and associated Site Analytical Plan at the Dunn Mine and C&D Facility located at Partition Street in Rensselaer, New York (the facility) and prepared in accordance with 6 CRR-NY-363-4.6 (f) and (g).

The facility began operation in January 2015 and groundwater, surface water, leachate, and gas monitoring has been conducted since that time in accordance with the EMP and Sampling and Analysis Plan (SAP), that was included as part of the Hydrologic Report for Dunn Sand & Gravel Mined Land Use Plan Modification/C&D Landfill dated October 5, 2010, revised on June 14, 2011 and prepared by C.T. Male Associates P.C.

2.0 FACILITY DESCRIPTION

2.1 LOCATION AND DESCRIPTION

Dunn Mine and C&D Facility is an existing sand and gravel mine and construction and demolition debris (C&D) disposal facility located in Rensselaer and North Greenbush, New York. The site is owned and operated by S.A. Dunn & Company, LLC. The facility activities include both C&D disposal and mining operations. The site is operating under a permit issued by the New York State Department of Environmental Conservation (NYSDEC) dated October 4, 2019. Figure 1 presents the site location in the region.

The topography in the vicinity of the project site, as shown on Figure 1, ranges from approximately 200 to 300 feet above mean sea level (MSL) and generally decreases to the west towards the Hudson River. Access to the project site is via Partition Street Extension through the City of Rensselaer. There is no other vehicular access to the project site.

The current C&D disposal footprint includes 8 phases of baseline construction labelled as Phases 1 through 7A, which encompass approximately 37 acres. The total permitted waste footprint is 63.3 acres.

Prior to the disposal operations commencement in January 2015, the project site had historically had an existing sand and gravel mining operation, commonly known as the "Dunn Bank." The mining operations on the project site resulted in the excavation of two (2) large pits known as the south and north pits. Current mining operations are taking place in the north pit and within the proposed and permitted future disposal areas.

Surrounding land uses are primarily residential around the southern and eastern boundaries of the project site. Vacant land is located around the remaining perimeter of the property, and a pre-kindergarten to 12th grade school owned by the Rensselaer City School District is located to the north and northeast of the project site, and a cemetery is located to the east.

Municipal water, as well as electric power and telecommunications, currently provide service to the project site along Partition Street. Based on the most recent Hydrogeologic Report Addendum prepared in 2016 by CEE, private water supply wells have not been identified within a 1-mile radius of the site.

3.0 HYDROGEOLOGY

3.1 REGIONAL GEOLOGY

The site is located within the Hudson-Mohawk Lowlands physiographic province of New York, which is characterized by a general low-lying topography surrounding the Mohawk and Hudson Rivers that resulted from erosion of weak underlying bedrock formations and subsequent deposition of glacial sediments. The Taconic Mountains are located to the east of the site and the Helderberg Escarpment associated with the Catskill Mountains is located to the west of the site. Bedrock underlying the site is mapped as the Upper to Middle Ordovician Canajoharie/Normanskill Shale Formation. Glacial sediments deposited during the waning stages of deglaciation in the area are dominated by glaciolacustrine sand/silt sediments and kame deposits. The kame deposits consist of a thick sequence of ice-contact sand and gravel that have historically been mined at the site, resulting in the excavated north and south pits where the current C&D landfill has been constructed. Glaciolacustrine sand and clay deposits are mapped around the kame deposits (C.T. Male 2011).

3.2 SITE GEOLOGY

The stratigraphy beneath the landfill consists of glaciolacustrine silts and sand, interbedded with deposits of finer and coarser materials underlain by shale bedrock. The glaciolacustrine clay unit identified at borings MW-4, MW-6S/6D and MW-8S extends to the boundary of the south pit. The thickness of the unconsolidated sediments ranges from approximately 130 feet (below the floor of the mine) to 170 feet (above the mine floor). Several distinct unconsolidated deposits exist within the site, several of which are discontinuous across the site. A major deposit of sand, sand and gravel, gravel and silt lie beneath the floor of the mine and are underlain by a deposit of sand, gravel and silt which represents a glacial till deposit that lacks the typical coarse sediment load embedment within a silt and clay matrix. The standard penetration values within the till were generally 80 to 90 blows per 12-inch sampling increment. The soils above the glacial till deposits represent a sequence characteristic of ice contact and lacustrine depositional environments. Shale bedrock was encountered at one boring location (MW-6D) at a depth of approximately 198 feet bgs (about 9 feet below msl). Detailed maps and cross sections of the site geology were provided in the C.T. Male report.

3.3 GROUNDWATER ELEVATION MEASUREMENTS

The groundwater elevation from the current monitoring wells was first measured on March 31, 2011 as part of a site-wide groundwater monitoring. The minimum separation distance between the water table and the ground surface was approximately 72 feet at monitoring well MW-1, which is similar to the data collected in January 2010. Data from the previous reports indicates the groundwater flows to the west or west-southwest across the site (C.T. Male 2011). Quarterly water level monitoring, conducted from 2015 to present has confirmed the groundwater flow direction.

3.4 HYDRAULIC CONDUCTIVITY

Rising and falling head slug tests were completed at monitoring wells MW-1 and MW-3 on December 7, 2009 by C.T. Male. The data indicates that the hydraulic conductivity of monitoring well MW-1 ranges from 1.1×10^{-3} centimeters per second (cm/sec) to 1.6×10^{-3} cm/sec. Monitoring well MW-1 is screened across fine sand and till deposits. The hydraulic conductivity at monitoring well MW-3 ranges from 7.7×10^{-5} cm/sec to 1.7×10^{-4} cm/sec. This well is screened in brown silt.

4.0 MONITORING AND REPORTING

The monitoring program will consists of sampling five downgradient wells MW-6S, MW- 7S, MW-8S, MW-10S, and MW-12S, sampling two upgradient wells MW-9SR and WM-11S, sampling the downstream and upstream surface water in the Quackenbush Creek (SW-1 and SW-2, respectively), sampling the leachate, and sampling landfill gases. The following is the EMP and Site Analytical Plan based on 6 CRR-NY-363-4.6 (f) and (g).

4.1 GROUNDWATER MONITORING

Groundwater monitoring within the first water bearing formation (i.e., outwash sand and gravel) is to be conducted quarterly using monitoring wells (MW-6S, MW- 7S, MW-8S, MW-9SR, MW-10S, WM-11S and MW-12S) that were installed around the perimeter of the landfill and within 50 feet of the edge of the waste mass between 2010 and 2019. The upgradient and downgradient wells are set in the same hydrologic unit and the monitoring well screens do not exceed 20 feet in length. The current array of monitoring wells as shown on Figure 2 satisfy the 500-foot downgradient and 1,500-foot cross-gradient and upgradient spacing requirements.

The groundwater wells will be sampled on a quarterly basis and analyzed three (3) times per year for Routine Parameters, and once per year for Baseline Parameters. The Baseline Parameter sampling event must be conducted at the same time period each year. The samples will be analyzed per the Routine and Baseline Parameters specified in the Water Quality Analysis Tables presented in 6 CRR-NY-363-4.6 (h). Refer to 6 CRR-NY-363-4.6 (f) (9) (ii) (c) and (d) for the requirements to reduce the sampling events to semi-annually and to omit sampling during the winter. A one-time sampling event for expanded parameters included in Tables 3A and 3B of 6 CRR-NY-363-4.6 (h), but not previously sampled for under the superseded Part 360-2.11(d)(6) will be performed at upgradient wells. This will include the following:

- Radium-226 (EPA 903.1)
- Radium-228 (EPA 904.0)
- Total Uranium (EPA 908.0)
- Per-and polyfluoroalkyl substances
- 1,4 Dioxane

4.2 SURFACE WATER MONITORING

Surface water samples will be collected from the Quackenbush Creek at the same locations as conducted since 2011 and during the same schedule as the quarterly groundwater-monitoring program; three (3) times per year for Routine Parameters, and once per year for Baseline Parameters. One downstream sample (SW-1) and one upstream sample (SW-2) will be collected from the creek. Refer to Figure 1 for the surface water sample locations.

4.3 LEACHATE MONITORING

Leachate generated from the leachate collection system has been collected and analyzed for Expanded Parameters on a semi-annual basis since 2015. The leachate samples are collected within the leachate collection structure. One composite sample will be prepared for analysis for Pump Stations 1 through 3 (southern locations) and individual grab samples will be taken from Pump Stations 4 and 5 (northern locations).

Having developed a significant database of leachate quality data and observing generally consistent results, leachate sampling will continue on an annual basis, provided there are no significant changes in the analytical concentrations going forward. If significant changes in leachate quality are indicated in the future, S.A. Dunn and NYSDEC may re-institute semi-annual leachate quality sampling.

4.4 WATER SUPPLY WELL MONITORING

Based on the Hydrogeologic Report Addendum dated Mach 2016, a Freedom of Information Law (FOIL) request was made to Rensselaer County on January 18, 2016 and the County replied that they did not have information regarding well locations. The New York State Department of Health (NYSDOH) was also contacted on January 18, 2016 and no response was received. The Geographic Information System (GIS) data from the New York State GIS Clearing House Water Wells File did not identify any data regarding private water supply wells within a 1-mile radius of the site. Based on this information, there is a low probability that private wells are located in the general surrounding area of the facility. Therefore, water supply well sampling is not required.

4.5 GAS MONITORING

Gas monitoring will be done on a quarterly basis at the same time as the groundwater monitoring. The gas monitoring will be done for hydrogen sulfide at each of the groundwater monitoring well locations and at four (4) locations on and/or directly adjacent to the C&D waste mass. Refer to Figure 2 for the monitoring well locations.

4.6 QUARTERLY AND ANNUAL REPORTS

The results of the groundwater and leachate monitoring will be summarized in Quarterly and Annual Reports and provided to the New York State Department of Environmental Conservation (NYSDEC). Reports will be provided to NYSDEC within 90 days of completing sampling and will assess whether or not there has been a significant increase in parameter concentrations above existing groundwater quality. A significant increase in concentration will be deemed to have occurred if: 1) the concentration of a parameter exceeds the existing water quality value for that parameter by three (3) standard deviations; or 2) the groundwater concentration exceeds the existing concentration for that parameter and exceeds the water quality standards for that parameter (refer to 6 CRR-NY-363-4.6 (f) (9) (i) (b) (4) (*ii*)). This update to the EMP will include an update to the existing water quality values currently used as a basis for comparison to future water quality data. The update will include the calculation of the mean and standard deviation for each analyzed parameter at each well location using the available analytical data collected to date. This update will result in a more statistically representative data set for comparison to future water quality results as the greater number of data points represent seasonal and year over year changes in water levels and associated natural water quality variability. The updated existing water quality values will be calculated following approval of this EMP and will then be used moving forward to identify a significant increase as stated above. Updated existing water quality values will be provided as an appendix to the first quarterly report following the update.

If elevated concentrations are identified in any of the monitoring wells during monitoring for Routine Parameters, NYSDEC will be notified within 14 days of the identification of such elevated concentrations. During the following quarterly event, the Baseline Parameters must be analyzed until at least the semi-annually elevated concentrations decrease or are determined not to be landfill-derived or NYSDEC determines that such monitoring is not needed. Alternatively, the facility can attempt to demonstrate there is an off-site source of the elevated concentrations or demonstrate that an error in sampling or the analyses was the results of the significantly increased result.

If significantly elevated concentrations persist over two consecutive events (other than field parameters), then the facility must notify the NYSDEC within 14 days of such identification. Contingency water quality monitoring will be implemented if it cannot be demonstrated that elevated concentrations are attributable to a source other than the landfill, or data collection or laboratory error. Such contingency monitoring will include:

- Within 90 days of identifying elevated concentrations of Baseline Parameters, sampling and analysis for Expanded Parameters per Water Quality Analysis Tables presented in 6 CRR-NY-363-4.6 (h) will be initiated;
- Within 14 days of receipt of the Expanded Parameters results, NYSDEC will be notified and provided with a list of Expanded Parameters that have been detected at elevated concentrations;
- Within 90 days of establishing which Expanded Parameters have elevated concentrations, quarterly sampling will be performed for all Baseline and Expanded Parameters with elevated concentrations, and annual monitoring will be conducted for Expanded Parameters. Groundwater Protection Standards for all parameters exceeding Trigger Values calculated per 6 CRR-NY-363-4.6 (f) (9) (i) (b) (4) (i)) must be established;
- If the Expanded Parameter concentrations are at or below the Trigger Values for two consecutive events, the facility must notify the NYSDEC to remove the parameter; and
- If any concentrations are above the Groundwater Protection Standards, the facility must notify the NYSDEC within 24 hours of identifying the exceedance, and the appropriate local government officials within seven (7) days of the detection. Additional assessment and response actions are required to address the exceedances.

Contingency water quality monitoring will continue until NYSDEC provides written approval that this expanded sampling is no longer needed to ensure public health or protection of the environment, or until information is provided that shows the elevated parameter concentrations are not landfill derived.

4.6.1 Content of Report

Per 6 CRR-NY-363-4.6 (f) (10), the data shall be submitted to the NYSDEC within 90 days of sampling collection and consists of the following:

- Summary table of results, detection limits, well locations (i.e. upgradient, downgradient, etc.), potentiometer data, water quality standards, groundwater protection standards, and chemical abstract service (CAS) numbers;
- Comparison data to existing water quality and upgradient water quality;
- Summary of results, exceedances, proposed sampling or analysis modifications, etc.; and
- QA/QC documentation.

The Annual report must also contain the following:

- Summary of changes in water quality throughout the year;
- Data quality assessment report;
- Graph of time verse concentration for exceedances; and
- Updated groundwater contour map.

5.0 SITE ANALYSIS PLAN

Sampling will be done in accordance with 6 CRR-NY-363-4.6 (g). The water samples will be collected in accordance with regulatory requirements by trained personnel that are knowledgeable with sampling techniques and analytical method preservation procedures. The laboratory testing methods must, at a minimum, include detection limits that are lower than the established groundwater quality standards. The data quality objective is to collect samples and data in a manner that will provide consistent and accurate field and laboratory results. The following are the sampling protocols:

- Field instruments will be calibrated prior to use in the field according to manufacturer's specifications.
- If explosive gases or organic vapors are suspected within the well, then the ambient air must be appropriately monitored/screened for potential hazards prior to entering the well.
- Static water levels will be measured to the nearest one-hundredth of a foot.
- A minimum of three (3) well volumes using the appropriate water evacuation method (i.e. submersible pump, peristaltic pumps, bailing, etc.) will be conducted.
- The water level should not decrease below the monitoring well's sand pack during purging or sampling.
- For contaminated wells, the first volume of stagnant purge water will be visually evaluated for non-aqueous phase liquids (NAPL), floaters or sinkers, etc. and tested for field parameters (temperature, pH, Eh, and specific conductance) and/or analytical methods, if necessary.
- Purge water must be properly managed.
- Sampling techniques will be performed as needed to reduce turbidity.
- Samples are not to be filtered. However, the NYSDEC may approve the filtering of samples if site/well specific conditions do not allow the turbidity to be reduced below 50 NTUs (Nephelometric turbidity units).
- VOC samples will be collected first, and field parameters will be tested again, after the VOC samples are taken.
- All sampling and purging equipment will consists of stainless steel Non-dedicated sampling equipment will be decontaminated between sampling events.

- Field QA/QC procedures will include the use of equipment blanks and trip blanks. At a minimum, one equipment blank will be taken during each quarterly sampling event to ascertain the likelihood of the introduction of contaminants during sampling. The equipment blank will be analyzed and reported according to the same analytical methods as the other samples collected during the event. One trip blank will be taken during baseline events where VOCs are analyzed.
- Surface water sampling techniques should avoid introducing sediment from the bottom of the water body. Water bodies greater than 3 feet deep should be evaluated for stratification and sampled accordingly.
- Sample bottles will be prepared by and obtained from a laboratory certified under the NYS Department of Health Environmental Laboratory Approval Program (ELAP) program.
- Sample bottles will be prepared and preserved, as necessary, to ensure sample integrity.
- Samples will be shipped with ice packs in coolers, the same day collected, and using chain of custody documentation that specifies the required sampling parameters.
- Laboratory results will describe the test methods employed, list personnel involved and provide precision and accuracy data.

Laboratory testing will be conducted by a NYS Department of Health ELAP certified laboratory under the NYSDEC—Analytical Services Protocol (ASP) category. At a minimum, the laboratory's standard operation procedures should consists of documenting the receipt, storage and handling of the samples, the hold times per the analytical method, reagent/standard preparation, general laboratory techniques, description of analytical methods, standard operation procedures for equipment calibration and maintenance, and narrative for any analytical discrepancies or corrective actions.

Analysis results will be compared with standards contained in 6 NYCRR Parts 700-705 and to existing water quality values as appropriate, and downgradient results will be compared with upgradient results to assess landfill-derived contamination, if any.

6.0 DATA QUALITY ASSESSMENT

A data quality assessment is required at the conclusion of each sampling event that validates and analyses the usability of the data.

6.1 DATA VALIDATION

For sampling events involving only Routine Parameters, data validation will be performed by the laboratory performing the analysis. For sampling events involving Baseline or Expanded Parameters, data validation will be performed by a person or entity other than the laboratory that performed the analyses. Data validation will be performed on at least 5 percent of the data generated for each sampling event and will include the following:

- Field records and sample analytical data will be reviewed to confirm data accuracy. Analytical QA/QC information and results will be reviewed, with due consideration to any corrective actions taken during that sampling event.
- Data summaries must clearly indicate any data that is not representative of environmental conditions or that was not generated in accordance with the Site Analytical Plan.
- Analytical QA/QC measures and laboratory procedures will be performed in accordance with Exhibit E of the NYSDEC ASP.

6.1.1 Data Usability Analysis

All the data generated must be analyzed for the following requirements:

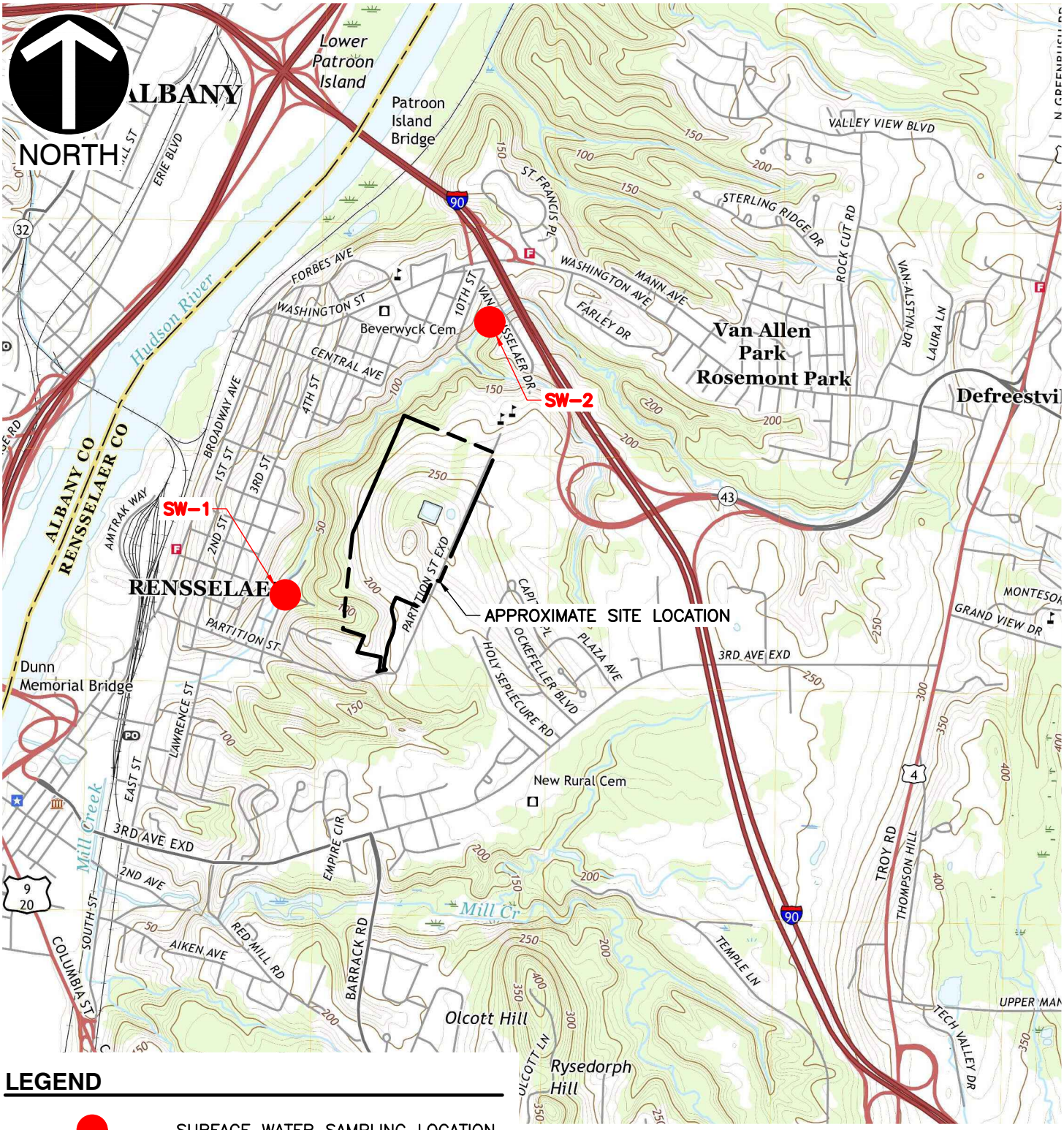
- Determine if the Data Quality Objectives were met;
- Compare data to previous sampling events for consistencies;
- Evaluate field duplicates to determine if the samples are representative;
- Compare sampling data to field blanks, trip blanks, equipment rinsate blanks, and method blanks, as required, to determine if contaminates were introduced during sampling, shipping, or analysis;
- Evaluate the laboratories matrix effects to determine if the data has a low or high bias;
- Evaluate the field and laboratory data to determine if geological, hydrogeological, and meteorological data is contributing to the extent of the contamination; and
- Review the precision, accuracy, representativeness, comparability, completeness and defensibility of the data generated.

7.0 POST-CLOSURE ENVIRONMENTAL MONITORING

Upon closure of the landfill, quarterly groundwater quality monitoring will continue for Routine (3 times per year) and Baseline (one time per year) Parameters. Sampling results and annual reports will be provided to NYSDEC as required by 6 CRR-NY-363-9.6 (a) (1) (iv) (b). This quarterly sampling will continue for a minimum period of five (5) years, at which time the post-closure results will be evaluated and NYSDEC may be petitioned to reduce the monitoring requirements.

In accordance with 6 CRR-NY-363-9.6 (b) (1) (iv) (a), the post-closure monitoring must be maintained and sampled per 6 CRR-NY-363-4.6. Refer to Section 4.0 of this report.

FIGURES



LEGEND

SURFACE WATER SAMPLING LOCATION

REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, TROY SOUTH QUADRANGLE, NEW YORK DATED: 2019.

SCALE IN FEET

0 2000 4000

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

31 Bellows Road
Raynham, MA 02767

ENVIRONMENTAL MONITORING PLAN
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

SITE LOCATION PLAN

DRAWN BY:	EMW	CHECKED BY:	AJK	APPROVED BY:	AJK	FIGURE NO.:	1
DATE:	JANUARY 2022	DWG SCALE:	1"=2,000'	PROJECT NO:	182-442		

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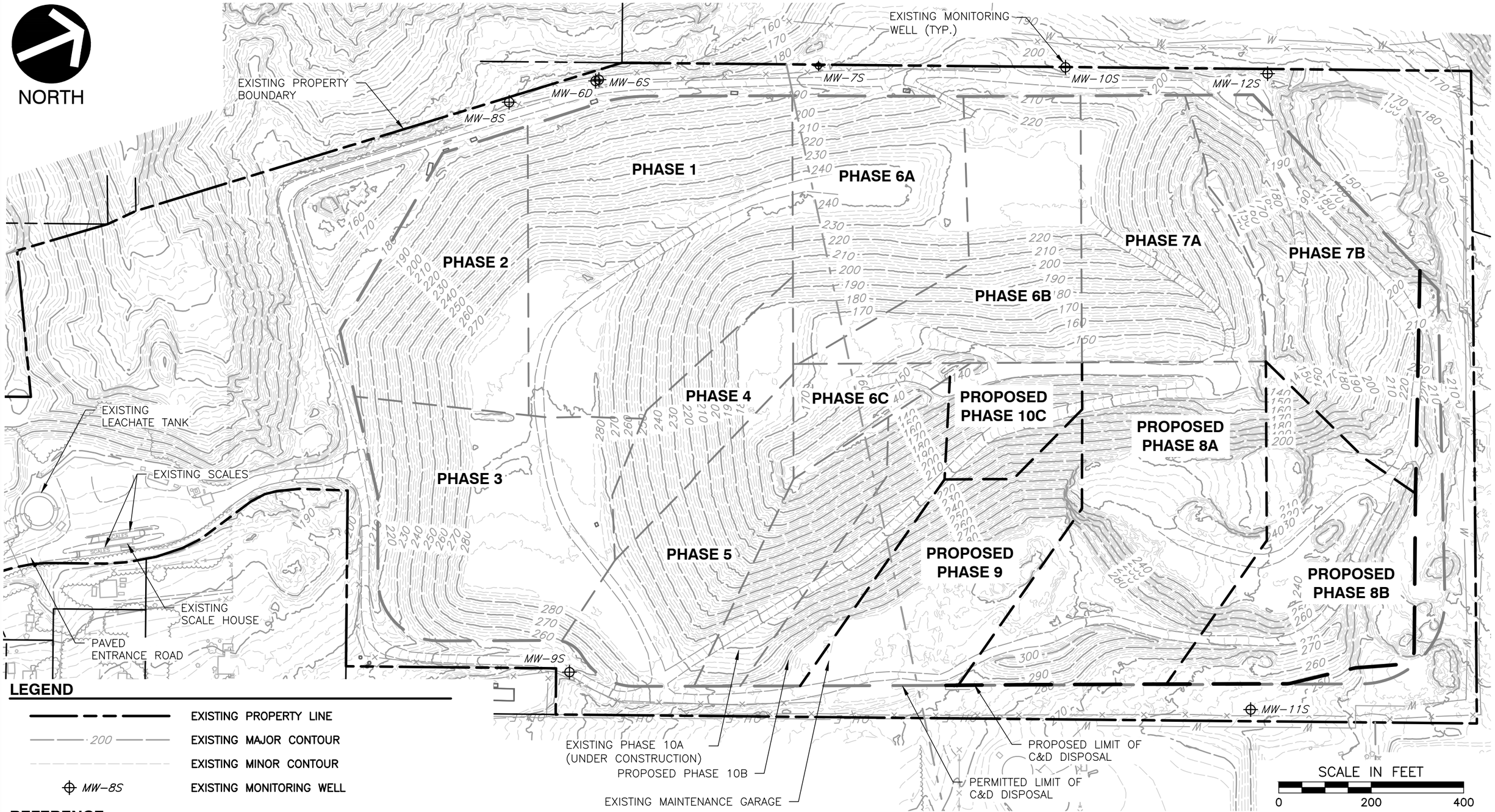

LEGEND

- EXISTING PROPERTY LINE
- 200 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- MW-8S — EXISTING MONITORING WELL

REFERENCE

1. UNLESS NOTED OTHERWISE, EXISTING TOPOGRAPHY WAS COMPILED BY SOUTHERN RESOURCES MAPPING CORPORATION USING PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED MARCH 16, 2021, AND SUPPLEMENTED WITH TOPOGRAPHY FROM OCTOBER 7, 2020 AND NOVEMBER 4, 2020. SURVEY CONTROL DATA WAS PROVIDED BY WASTE CONNECTIONS, INC.
2. PROPERTY LINE INFORMATION WAS TAKEN FROM A PLAN TITLED "ALTA/ASCM LAND TITLE BOUNDARY SURVEY, LANDS OF KELLY AND DUNN TO BE CONVEYED TO S.A. DUNN & COMPANY, LLC," PREPARED AND SEALED BY WILLIAM N. CURRAN, AND UPDATED AS NECESSARY BASED ON AVAILABLE TITLE INFORMATION.
3. THE LOCATION OF EXISTING MONITORING WELLS WERE PROVIDED ELECTRONICALLY TO CEC BY TETRA TECH. CEE HAS NOT VERIFIED THE ACCURACY OF THE INFORMATION.

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC

31 Bellows Road
Raynham, MA 02767

ENVIRONMENTAL MONITORING PLAN
DUNN MINE AND C&D FACILITY
S.A. DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

MONITORING PLAN LOCATION PLAN

DRAWN BY:	EMW	CHECKED BY:	AJK	APPROVED BY:	AJK	FIGURE NO.:
DATE:	JANUARY 2022	DWG SCALE:	1"=200'	PROJECT NO:	182-442	2

P:\2018\182-442\-CADD\Dwg\SW16-EMP Figures\182442-SW16-EMP-MW Figure.dwg{FIGURE 2} LS:(1/11/2022 - ewilson) - LP: 1/11/2022 2:30 PM

APPENDIX C

DUST CONTROL PLAN

REVISED DUST CONTROL PLAN

DUNN MINE AND C&D FACILITY

Prepared For:

S.A. DUNN & COMPANY, LLC

Prepared By:

**CIVIL & ENVIRONMENTAL ENGINEERING,
LANDSCAPE ARCHITECTURE AND LAND SURVEYING, PLLC**

CEE PROJECT 182-442

SEPTEMBER 2018

**REVISED JULY 2019
REVISED OCTOBER 2019
REVISED AUGUST 2020
REVISED NOVEMBER 2020
REVISED SEPTEMBER 2021
REVISED NOVEMBER 2021
REVISED JANUARY 2022**

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Purpose 1

2.0 DUST SOURCES 2

2.1 Facility Dust Sources 2

2.1.1 Construction and Demolition Debris Landfill 2

2.1.1.1 Waste Operations 2

2.1.1.2 Site Development 3

2.1.2 Mining Operations 3

3.0 MITIGATION MEASURES 4

3.1 Dust Mitigation Measures 4

3.1.1 Seasonal Mining Operational Limitations 4

3.1.2 Water Truck 4

3.1.3 Chloride Application 5

3.1.4 Truck Tipper Sprayer/Misting Cannon 5

3.1.5 Litter Fence 5

3.1.6 Snow/Sand Fence 5

3.1.7 Stabilization of Exposed Slopes 6

3.1.8 Internal Haul Roads 6

3.1.9 Tire Wash 7

3.1.10 Street Sweeping 7

3.1.11 Vegetative Buffer 7

3.1.12 Internal Truck Routes 8

3.1.13 High Winds 8

3.1.14 Speed Limit 8

3.1.15 Meteorological Monitoring Station 8

3.1.16 Inspection of Matting, Mulch Surfaces and Fences 9

4.0 EVALUATION OF OTHER MITIGATION MEASURES 10

4.1 Palliatives Evaluation 10

4.1.1 Water-Attracting Chemicals 10

4.1.2 Organic Non-Bituminous Chemicals 11

4.1.3 Petroleum Based Binders and Waste Oils 11

4.1.4 Electro-Chemical Stabilizers 12

4.1.5 Polymers 12

4.1.6 Microbiological Binders 13

4.1.7 Recommendations for Alternative Palliatives 13

4.2 Berms and/or Vegetative Buffers 14
4.3 Erosion Control Mat and Seeding 14
4.4 Tackifier Bonded Mulch 14
4.5 Proposed Mine Site Mitigation Measures 14
4.6 Extreme Weather Action Plan 15

TABLE

Table 1 – Dust Palliatives Approved for NYDOT Projects

APPENDICES

Appendix A – Snow Fence Location
Appendix B – SACI, LLC Technical Memoranda/NYSDEC Conditional Approval
- NYSDEC Conditional Approval dated August 26, 2021
- SACI, LLC Technical Memorandum dated July 26, 2021

DUST CONTROL PLAN
DUNN MINE AND C&D FACILITY
RENSSELAER, NEW YORK

The material and data in this report were prepared under the supervision and direction of the undersigned.

Civil and Environmental Engineering,

Landscape Architecture and Land Surveying, PLLC

Amy J Knight 1/12/2022

Amy J. Knight, P.E.
Certifying Engineer
N.Y.P.E. License No. 076341

1.0 INTRODUCTION

1.1 PURPOSE

Dunn Mine and C&D Facility is an existing sand and gravel mine and construction and demolition debris (C&D) disposal facility owned and operated by S.A. Dunn & Company, LLC (Dunn), and located in Rensselaer and North Greenbush, New York. The facility activities include both C&D disposal and mining operations. The purpose of this report is to describe the mitigation and control measures to be implemented by the facility to prevent dust from migrating off-site. The report has been revised to incorporate recommendations for additional dust control measures provided by SACI, LLC in a technical memorandum dated July 26, 2021, as approved by the New York State Department of Environmental Conservation (the Department) in correspondence dated August 26, 2021. Recommendations were prepared based on a site inspection by SACI on April 22, 2021 and a review of the existing Dust Control Plan.

2.0 DUST SOURCES

2.1 FACILITY DUST SOURCES

Dust at the facility has the potential to be generated by both the C&D landfill and the active mining operations. The various sources associated with each activity are detailed in the following sections.

2.1.1 Construction and Demolition Debris Landfill

Potential dust sources from the landfill activities include:

- Waste Operations
  - Commercial waste truck traffic on paved and unpaved roads
  - Tipping, pushing, and compacting C&D waste
- Site Development

2.1.1.1 Waste Operations

During operation of the landfill, transfer trailer trucks travel along a paved entrance roadway to the unpaved landfill perimeter road. Travel distance along internal paved roadways is approximately 1,120 linear feet (LF), while travel distance along internal unpaved roads will vary based on which phase of the landfill is operational. In general, this distance will range from 1,500 LF to 3,000 LF.

Potential dust from paved roads includes soil material tracked from unpaved surfaces onto paved roads by vehicles, while potential dust from unpaved roads includes soil material disturbed by truck traffic or tracked by the truck to other areas of the site. Factors leading to dust generation include dry road conditions, high winds, and vehicle traffic.

After traveling internal roads to the working face, the waste material is unloaded from the truck. The facility is equipped with a tipper, which elevates the trailer at an angle, allowing waste to slide from the trailer onto the landfill active area. In addition, dump trailers are also used to similarly tipping loads at the landfill area. Potential dust generation from tipping includes impact of the material as it hits the existing ground.

After waste is placed in the active area (tipped as described above or discharged from walking floor trailers), a bulldozer is utilized to push and grade the waste and a compactor is used to break up the waste and compact it. Each of these activities could potentially result in dust generation as the material is moved and compacted.

2.1.1.2 Site Development

Over the course of the landfill life, construction activities at the facility will generally include baseliner and final cover construction. These construction activities may include:

- Mass excavation of soil/excavation of soil from stockpiles
- Soil transport in off-road trucks
- Soil placement

The physical movement of soil from mass excavation or from stockpiles, along with placement in the construction area and transport over unpaved surfaces will contribute to the potential for dust. Factors leading to dust generation include dry road conditions, high winds, and vehicle traffic.

2.1.2 Mining Operations

Potential dust sources from mining operations include:

- Sand excavation
- Sand loading
- Off-road truck traffic/sand hauling
- Sand stockpiles/windborne erosion

Mining operations include the use of heavy equipment to excavate material from the existing ground or stockpiles, which is then either stockpiled on site or placed in trucks for offsite uses. The physical movement of this material, vehicles traveling over unpaved surfaces and heavy equipment operation all contribute to the potential for dust. Dust can also result from stockpile areas or excavated side slopes because of wind erosion, as well as from unloading of materials from trucks into the stockpile or loading of materials into haul trucks.

3.0 MITIGATION MEASURES

Site personnel will coordinate C&D placement and mining operations and assess the need for dust control on a continual basis. The following sections detail mitigation measures that will be implemented, as needed, to control dust.

3.1 DUST MITIGATION MEASURES

The primary mitigation methods for dust control at the site include proper housekeeping and maintenance, and application of water, as described below.

3.1.1 Seasonal Mining Operational Limitations

Between March 1 and May 15 of each year, site operations will be conducted such that:

- Exposed mining areas which are not stabilized with hydro mulch or erosion control matting and that are subject to potential wind erosion will be limited to 1 acre or less. Travel routes are excluded from the 1-acre limitation if these routes are stabilized with crushed stone as described in Section 4.1.8.
- The height of the mine face will be no higher than 15 feet.
- All stockpiles above elevation 200 feet mean sea level on the northern and eastern side of the site will be stabilized or removed. Concrete barriers or other large size (greater than ¼-inch particle size) aggregate material may be utilized to provide traffic direction.
- Unstabilized sand stockpiles located on the west side of the site will be constructed in oval shapes with the long axis oriented east-west and the stockpile will not exceed 15 feet in height.

3.1.2 Water Truck

A water truck is used to apply water to internal paved and unpaved roads as well as along a portion of Partition Street. A hydrant has been installed on the west side of the facility to facilitate and expedite filling of the water trucks. The water truck will apply water to the roadways as needed to minimize dust generation based on activities being performed and actual site and weather conditions. Water application will not occur when the ambient air temperature is below freezing or ice is present.

3.1.3 Chloride Application

When temperatures are below freezing or if water cannot be applied for another reason, chlorides (e.g. calcium or magnesium) will be utilized, if needed based on weather conditions, for dust control. These chlorides are available in liquid or solid forms; for freezing conditions, they will be initially applied as a liquid followed by application of either pellet or liquid solution form for maintenance. Chloride usage is required when temperatures prevent the use of water; however, chlorides may be applied year-round, regardless of temperature.

3.1.4 Truck Tipper Sprayer/Misting Cannon

During C&D disposal, the use of the tipper creates the potential for dust generation. A spray system has been installed on the tipper to control dust resulting from the off-loading of material. This equipment is mounted on the tipper and is automated to spray water when the tipper is activated. A dust suppression misting cannon has been purchased and found to be more effective than the tipper sprayer at controlling dust. At this time, the misting cannon has replaced the use of the tipper sprayer but the facility is working with different vendors to improve the tipper sprayer system. This equipment (tipper sprayer and/or misting cannon) will be utilized when waste disposal activities occur at elevations higher than the perimeter berm or as needed based on weather conditions and operational activities. As the sprayers utilize an aqueous solution, its use will be suspended during freezing temperatures.

3.1.5 Litter Fence

Dunn has installed litter control fences around the perimeter of the facility. In addition to containing litter, the fence provides a windbreak that can provide additional control of dust.

3.1.6 Snow/Sand Fence

Snow fence or sand dune fence will be maintained at the crest of the west-facing mine slope west of the eastern perimeter access road where it parallels Partition Street Extension north of landfill Phase 5 (subsequently north of Phase 10 when it is completed). Refer to Appendix A for approximate location of the fence; actual location may vary based on site operations and actual conditions at the site.

As recommended by SACI, LLC in the July 26, 2021 technical memorandum (included in Appendix B), a hybrid fencing system will be installed where woven/welded wire fencing is installed. Woven/welded wire fence will be installed with two layers of plastic fence material staggered on the windward side of the wire fence to achieve a porosity of approximately 50 percent. Dunn may also use wooden snow fence and/or heavier T-posts to reduce maintenance intervals on the fence.

3.1.7 Stabilization of Exposed Slopes

Excavation areas on wind sided (i.e., western facing) slopes that will be exposed for more than 30 days will receive erosion control mat to reduce the potential for wind borne erosion within 14 days after excavation in these areas is completed. Hydro mulch also may be used on exposed sand surfaces that will be exposed less than 30 days. Exposed sand slopes along the northern boundary adjacent to the school will receive erosion control mat or mulch, as appropriate. The slopes will be monitored by site personnel for erosion and additional matting or hydro mulch will be re-applied as necessary.

3.1.8 Internal Haul Roads

A 6-inch thick stone layer will be applied to the existing landfill perimeter road, where it currently exists at the final location and grades as shown on the *Proposed Stormwater Management Plan* (Sheet C302) of the permit drawings titled "*Footprint Modification Permit Drawings*", dated March 2016. Stone will also be applied to the primary internal haul road that is used to transport sand and gravel from the active excavation either to stockpile areas or for off-site transport. The road surface will be wide enough to allow two-way traffic to remain on crushed stone surface.

Dunn will maintain a stockpile of stone on-site to apply additional stone to roadway areas that have been filled with sand and/or silt where the crushed stone's ability to mitigate airborne dust has been diminished.

In addition to the application of stone on the primary internal haul road, Dunn may spread coarse, loose rock over the trafficked portions of the mining area (i.e., secondary maneuvering areas) in order to comply with the seasonal 1-acre limitation specified in Section 3.1.1, or to provide additional dust control based on site-specific weather conditions.

3.1.9 Tire Wash

Dunn has installed a tire washing device for outbound vehicles to utilize prior to exiting the site. In general, the tire wash will allow the truck tires to be washed to remove soil and will reduce the potential for off-site tracking of material during inclement weather. Mining export and waste trucks will be required to utilize the tire wash before leaving the site during inclement weather unless the unit is closed for maintenance or repair (such period not to exceed two consecutive operating days without prior Department notice and approval).

3.1.10 Street Sweeping

Dunn has retained a contractor to run a street sweeper on Partition Street. In general, the road will be swept in the morning between 10:30 AM and 12 PM and again in the afternoon between 3 PM and 4 PM; however, the contractor will be brought in more often for additional sweeping as needed to remove any tracked material from the site on Partition Street. When ambient temperatures support the use of water, the sweeper will be operated with sufficient water to adequately suppress dust. The street sweeper will also be utilized on the internal paved roadways of the site.

3.1.11 Vegetative Buffer

Vegetation can be utilized to provide a windbreak that can aid in reducing the potential for dust generation. Dunn has installed additional evergreen trees along the southern perimeter of the landfill to provide additional dust control. Evergreens were planted along the property line to the south of the landfill footprint. Typically, the additional plantings consisted of two rows of trees that are approximately 6 feet high and 10 feet wide.

Additionally, Dunn has submitted a permit modification application incorporating a proposed mechanically stabilized earthen (MSE) berm (and corresponding changes to the subgrade) to the Department for approval. The proposed MSE berm, if approved, will be as much as 30 to 50 feet higher in elevation than the existing features, which will provide additional visual and dust control. The construction of the berm will incorporate vegetative cover as defined in the application documents, following Department approval.

3.1.12 Internal Truck Routes

Operations at the site require internal truck traffic for both waste placement and mining activities. Site personnel will review operations continually to select the most efficient routes for trucks to travel accomplish operations and to minimize dust generation and will coordinate with drivers and operators using the site to ensure that the proper traffic flow pattern is followed. Highly trafficked roads will be maintained with 6 inches of stone.

3.1.13 High Winds

High winds have the potential to generate dust. Facility personnel will monitor wind speed visually as well as through the on-site weather station and will halt or reduce operations during high wind conditions. In general, high wind conditions are considered to be sustained winds in excess of 25 miles per hour. Refer to Section 5.6 for contingencies for high wind conditions.

3.1.14 Speed Limit

The road speed limit at the landfill will be 10 miles per hour. A speed limit sign is posted at the entrance and will be strictly enforced by facility personnel. Additional speed limit signs will be posted prominently throughout the site. Vehicular traffic may be advised to lower their speed on unpaved roads based on road conditions due to weather, to speeds that minimize dust. Drivers and operators identified by site personnel that have exceeded the speed limit will receive a warning for the first incident; if a second incident occurs, the contractor will be denied access to the site.

3.1.15 Meteorological Monitoring Station

Dunn maintains a meteorological monitoring station at a relative high point on the Dunn facility property generally away from interfering obstructions. The first 12 months of collected data will be analyzed by SACI, LLC or other qualified firm to determine the following:

- Wind speeds and directions of interest
- Threshold velocity of different on-site surfaces
- Additional recommendations for further dust control based upon an analysis of the meteorological data.

The data analysis and additional recommendations, if any, will be completed and submitted to the Department of Environmental Conservation (Department) for approval. Any recommendations resulting from the meteorological data analysis that are approved by the Department will be incorporated into a subsequent revision to the dust control plan and be enforceable under the permit.

Compiled raw data will be made available to the Department upon request.

3.1.16 Inspection of Matting, Mulch Surfaces and Fences

Matting, mulch surfaces, and fences shall be inspected on a monthly basis; provided that inspections shall be increased to weekly from March 1 to May 15 during each calendar year. Any areas where the matting or mulch are damaged or covered by deposits of sand over a contiguous 400 square foot area will be "patched" or repaired within 10 calendar days of observation. Fences shall be repaired within 10 calendar days of observation. Logs of the inspections will be recorded and stored in the office. The logs will be made available to the Department upon request.

4.0 EVALUATION OF OTHER MITIGATION MEASURES

Typically, the mitigation measures described in Section 3 are adequate to sufficiently control dust. However, there are other control measures that could be implemented in the unlikely event that they are necessary. Additional control measures may include applying palliatives or dust suppression agents, installation of perimeter berms and/or vegetation, and installation of erosion control mat, hydroseed, or tackifier. A discussion of each of these is provided in the sections below.

4.1 PALLIATIVES EVALUATION

In addition to good construction and maintenance practices, chemical dust suppressants (palliatives) can be considered as an add-on when high dust generation persists. Palliatives are commercially available for use on most types of dust sources and are generally classified into the categories described in the following sections[1].

4.1.1 Water-Attracting Chemicals

e.g., Chlorides, Salts, and Brine Solutions

Water attracting chemicals are easy to apply and suppress dust by attracting moisture from the atmosphere, thereby keeping the trafficked surface moist and the soil particles agglomerated. Due to this mechanism, these products are most effective where relative humidity is higher. The most commonly used salts are calcium chloride (CaCl) and Magnesium chloride (MgCl).

Limitations: Water attracting chemicals are highly soluble, release heat when mixed with water, and will leach away from the trafficked surface with precipitation. Solubility limits their durability/effectiveness and may require reapplication at controlled rates. Repeated applications and long-term use may harm existing vegetation in the vicinity. This product category is also highly corrosive to metals and therefore construction equipment exposure should be monitored with frequent washing and maintenance.

Note: State of New York prohibits the use of salts within 100 ft. of regulated wetlands and limits yearly application rates for non-wetland areas, and is controlled by *Section 652 – Furnishing and*

[1] Environmental Considerations for Selecting Cost-Effective Dust Control Technologies, Army Corps of Engineers, Public Works Technical Bulletin 200-1-133, October 2013.

Applying Salts of the New York State Department of Transportation, Standard Specifications, May 2006.

4.1.2 Organic Non-Bituminous Chemicals

e.g., Lignosulfonates, Sulphite Liquors, Tall Oil Pitch, Pine Tar, Vegetable Oils, Molasses, and Synthetic Oils

These chemicals perform best under arid and semi-arid conditions by increasing the dry strength of soil particles through binding soil particles together, thereby preventing them from becoming entrained by wind or vehicle traffic. These chemicals after curing have low solubility; thereby minimize leaching and providing plasticity to road surfaces. These chemicals exhibit high bonding strength and are non-corrosive. Commonly used organic non-bituminous chemicals are:

- Lignosulfonates are waste products derived from the wood pulping industry.
- Oils, pine tar and molasses are also derivatives of food and wood processing technologies and are often readily available locally, depending on location.
- Synthetic oils are composed of isoalkanes and other proprietary compounds.

Limitations: These chemicals require proper weather conditions and time to cure. Heavy precipitation before curing will result in leaching, making the chemical corrosive to aluminum alloys due to acidity. Some of the products in this category may be visually unappealing, odorous, or very sticky upon application. Products can also become slippery when wet and brittle when dry; therefore require careful consideration for site-specific conditions. Lignin products have a high biological oxygen demand (BOD) in aquatic systems. Spills or runoff into surface or groundwater may create low dissolved oxygen conditions and affect aquatic life.

4.1.3 Petroleum Based Binders and Waste Oils

e.g., Bitumin Emulsions, Asphalt Emulsions, and Waste Oils

These chemicals are effective in a variety of climatic conditions. They control dust by binding particles together, are effective on many soil types, and are generally more resistant to leaching even in relatively wet conditions.

Limitations: Waste oils can cause significant adverse environmental effects due to toxic materials and are not environmentally acceptable unless they have been processed to remove these materials. Asphalt emulsions, although relatively expensive compared to other product types, are considered effective under a broad range of soil types and climates. Similar to the organic non-bituminous product category, some of these commercial products may also be visually unappealing, odorous, or very sticky upon application.

4.1.4 Electro-Chemical Stabilizers

e.g., Sulphonated Petroleum, Ionic Stabilizers, and Bentonite

These products also work in a wide range of climatic conditions, are resistant to leaching and are particularly effective on clayey or sandy surface materials. The dust control efficiency is dependent on the clay mineralogy.

Limitations: These products may only be effective on very specific sites and have no standard laboratory tests for predicting performance under field conditions and need to be evaluated in small-scale trials prior to large-scale applications.

4.1.5 Polymers

e.g., Polyvinyl Acrylics and Acetates

These products bind soil particles together by forming a polymerizing matrix, similar to adhesive, thus forming a crust that is resistant to disintegration. Most of the polymer products are supplied in concentrated form and require dilution with water before application. With variations in dilution and final application rates, polymers are generally suitable for use under a wide range of soil and climatic conditions. Most polymer-based products are considered non-toxic and environmentally friendly when used according to manufacturer's recommendations. Some products allow seeded vegetation to grow through the polymer matrix.

Limitations: Polymer products do need proper weather conditions and time to cure and they may be subject to UV degradation. Application equipment requires timely cleaning.

4.1.6 Microbiological Binders

e.g., Cryptogams, Blue-Green Algae Inoculants, Enzyme Slurries, and Microbial By-Products

This product is mostly important in arid climates, as cryptogams bind soil particles together, resulting in a reduction in the movement of dust particles. Many enzymes are adsorbed by clay particles, resulting in a compression of the pore space, which aids in compaction and consequently reduces dust generation.

Limitations: Similar to electro-chemical stabilizer products, these products have shown great performance in highly specific surface conditions. Since standard testing procedures to predict their performance under field conditions are not available, small-scale trials are required to evaluate their efficiency.

4.1.7 Recommendations for Alternative Palliatives

As described previously, water-attracting chemicals result in potentially adverse environmental conditions and are not recommended for use at the site. Organic non-bituminous chemicals and microbiological binders work best in arid or semi-arid climates and as such are not suitable for the climate at this site. The effectiveness of electro-chemical stabilizers is not currently well defined, and they are also not recommended. Therefore, if additional control measures are needed, polymer or petroleum based binders that have been accepted as non-toxic, are suitable for use at the site.

NYSDEC has currently approved the dust palliatives shown in Table 1 for use in the New York State Department of Transportation (NYDOT) projects. If needed for additional mitigation, and if approved by the Department for use at this facility, a product in Table 1, or the most recently approved list, will be utilized on-site. While not specifically included in the table, calcium chloride is also accepted by the Department as a dust palliative[2] and therefore may be utilized as well. For clarity, calcium or magnesium chloride have been approved for use as an alternative dust control palliative in any temperatures as noted in Section 3.1.3.

[2] NYSDOT website. (https://www.dot.ny.gov/divisions/engineering/technical-services/technical-services-repository/alme/pages/580-1.html)

4.2 BERMS AND/OR VEGETATIVE BUFFERS

As noted in Section 3, Dunn intends to modify the existing perimeter berm layout on the northern side of the site to be approximately 30 to 50 feet higher to provide additional visual screening from the neighbors as well as to provide additional dust control. The construction of the berm will incorporate vegetative cover as defined in the application documents, following Department approval.

4.3 EROSION CONTROL MAT AND SEEDING

Erosion control mats are preformed protective blankets that can be constructed of plastic, straw, or other natural material, designed to protect disturbed slopes from the impact of water and wind erosion. The use of mats can stabilize soil and allow germination of seed mixes and planting. When used in conjunction with application of hydroseed, erosion control mats can be an effective measure to reduce wind erosion and thus provide effective long-term dust control. Erosion control matting will be applied to all exposed sand surfaces exposed for longer than one month.

4.4 TACKIFIER BONDED MULCH

Mulch used as ground cover over disturbed slopes will help to conserve soil moisture thereby reducing wind and waterborne erosion. Tackifiers can be added to mulch as a "glue" to bind and immobilize mulch and further stabilize the soils and reducing airborne particulates from wind erosion. Spray mulch may only be used on exposed sand surfaces that will be exposed for less than 30 days.

4.5 PROPOSED MINE SITE MITIGATION MEASURES

Based on the evaluation of mitigation measures described, the facility will implement the following procedures at the site in addition to the measures specified in Section 4:

- Temporary exposed interior slopes in mine: Temporary excavation or fill slopes that will be exposed more than 14 days will have tackifier-bonded mulch applied in accordance with manufacturers' recommendations. These slopes will receive treatment no more than 7 days after construction activity has ceased on that surface. To the extent possible, such applications will occur late in the week to avoid dust issues occurring over weekend periods.

- Permanent exposed exterior slopes in mine: Erosion control mat and hydroseed will be applied to western-facing mine slopes above the elevation of the western site perimeter road that will be exposed for longer than 30 days. These slopes will receive treatment no more than 14 days after excavation activity has ceased.
- Temperatures below freezing – During winter when temperatures are below freezing and water cannot be applied to roadways, chlorides (e.g. calcium or magnesium) will be applied once (on December 1st of each year) to provide dust control on the perimeter access roads, and applied further as needed in accordance with Section 3.1.3. Chloride usage is required when temperatures are below freezing; however, it's usage is not limited to winter and it may be utilized year-round, regardless of temperature.

4.6 EXTREME WEATHER ACTION PLAN

Dunn will implement an extreme weather action plan on days when the National Weather Service forecasts the following weather notifications:

- High Wind Watch (issued when sustained winds of 40 miles per hour (mph) or higher for one hour or more or wind gust of 58 mph or higher for any duration are possible).
- High Wind Warning (issued when sustained winds of 40 mph or higher for one hour or more or wind gust of 58 mph or higher for any duration are expected).
- Wind Advisory (issued when sustained winds of 31 to 39 mph for an hour or more and/or wind gusts of 46 to 57 mph for any duration are expected).
- Severe Thunderstorm Watch (issued when thunderstorms are possible in the watch area and winds of 58 mph or higher are expected).
- Tornado Watch (issued when a tornado is possible in the watch area and winds of 58 mph or higher are expected).
- Severe Thunderstorm Warning (thunderstorms are imminent in the warning area).
- Tornado Warning (tornado is imminent in the warning area).

When a high wind watch, severe thunderstorm watch, or tornado watch is issued, Dunn will implement the following procedures:

- Evaluate condition of exposed slopes; if necessary and sufficient time exists, apply tackifier-bonded mulch to disturbed excavation or stockpile slopes. As often as necessary, apply water or calcium chloride if temperatures are below freezing.

- Evaluate condition of roadways; as often as necessary, apply water. If temperatures are below freezing, as often as necessary, apply calcium chloride. As noted previously, chlorides must be used to control dust when temperatures are below freezing; however, their usage is not limited to winter, and they can be applied year-round, regardless of temperature.
- Monitor weather forecast updates for upgrades from watches to warnings.

If a high wind warning, wind advisory, severe thunderstorm warning, tornado watch or warning are issued, Dunn will conduct the activities mentioned above and cease both mining and waste operations one hour prior to the warning period (provided that the weather notification is issued at least one hour prior to the beginning of the effective period). In addition, cover placement activities will begin one hour prior to the effective time (or immediately if the notification is issued less than one hour in advance of the effective time) of such notifications.

If the National Weather Service issues any of the above mentioned weather watches, warnings or advisories or elevated (or greater) risk for tornados, thunderstorm wind gust, or non-thunderstorm winds (i.e., Wind Advisories, High Wind Watches or High Wind Warnings that occur without a Severe Thunderstorm Warning) for an effective period during a weekend, holiday, or on a Monday morning, Dunn will undertake the procedures mentioned above ahead of time during permitted hours of operation. This includes placement of chlorides (e.g. calcium or magnesium) or other long-lasting approved dust palliatives listed in Table 1 to roadways and other exposed sand surfaces that are not stabilized by tackifier bonded mulch and/or erosion control matting. If such watches, warnings or advisories are issued outside of permitted hours of operation, the Department will be notified and Dunn will mobilize resources as soon as possible to mitigate dust potential.

TABLE 1
DUST PALLIATIVES APPROVED FOR NYDOT PROJECTS

Table 1: Dust Palliatives Approved for NYDOT Projects[3]

Product	Company & Address	Date Approved	Category
DirtGlue™	DirtGlue Enterprises PO Box 1647 Wakefield, NY 01880	April 27, 2004	Polymers
Earthbind 100	EnviRoad LLC 2606 N. Newark Street Portland, OR, 97217	May 27, 2004	Polymers
Silt Stop® 700 Series	Applied Polymer Systems, Inc. 519 Industrial Supply, Inc. Woodstock, GA 30189	May 13, 2004	Polymers
Soil Sement	Midwest Industrial Supply, Inc. PO Box 8431 Canton, OH 44711	June 1, 1990	Polymers
EcoRoads-DS	TerraFusion, Inc. 1145 2nd Street #A331 Brentwood, CA 94513	March 13, 2009	Organic Non-Bituminous Chemicals
PennzSuppress D	PennzSuppress Corp. PO Box 4339 Lago Vista, TX 78645	June 4, 1999	Petroleum Based Binders

[3] https://www.dot.ny.gov/divisions/engineering/technical-services/geotechnical-engineering-bureau/dust-palliatives

APPENDIX A
SNOW FENCE LOCATION

Appendix A
Snow Fence Location

APPENDIX B
SACI, LLC TECHNICAL MEMORANDA/NYSDEC CONDITIONAL APPROVAL

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Mineral Resources, Region 4
1130 North Westcott Road, Schenectady, NY 12306-2014
P: (518) 357-2172 | F: (518) 357-2460
www.dec.ny.gov

August 26, 2021

Curt Taylor
SA Dunn & Company, LLC
1319 New Loudon Rd
Cohoes, NY 12047

Re: Order On Consent
R4-2021-0316-18
Dunn Facility
SACI LLC Technical Memorandum

Dear Mr. Taylor:

Department staff have conferred with the Office of General Counsel (OGC) concerning your proposal to not revise the Technical Memorandum of SACI, which contains recommendations for changes in the dust control plan or operational practices to minimize the potential for dust dispersion. You have proposed to proceed with Item 5 of the Order, submit to the Department for review and approval, a revised dust control plan, incorporating the requirements of Paragraph 2 [of the Schedule of Compliance] and all the ***approved*** [emphasis added] recommendations of the consultant (i.e. any unapproved recommendations will not be included).

The Department finds this proposal acceptable, and Dunn may proceed with revising the dust control plans, with the following stipulations:

- Recommendation 2 – Clarifying Observation Methods. This recommendation is not approved by the Department. It is not appropriate for Dunn to dictate to the Department the methods of observation utilized during inspections. This recommendation may not be included in the dust control plan.
- Recommendation 4 – Use of chlorides for dust control.
  More specificity is required. Rather than a recommendation that Dunn "*consider* [emphasis added] use of calcium or magnesium chloride to control dust on roads and open areas when temperatures are below freezing", the document should make a clear provision for the use chlorides (i.e. to not just *consider*), both when temperatures are below freezing and year-round.
- Recommendation 5 – Additional Control/Stabilization Measures (1st paragraph). Department review and written approval is required prior to application of any alternative palliatives (i.e. asphalt emulsions, petroleum resins, and polymers).
- Recommendation 5 – Additional Control/Stabilization Measures (2nd paragraph) Section 3.1.6 already requires a 6" thick layer of stone to be applied to the existing landfill perimeter road and primary internal haul roads used to transport sand and gravel from the active excavation to either the stockpile area or for off-site

transport. The road is to be wide enough to allow two-way traffic to remain on the crushed stone surface. Dunn is to maintain a stockpile of stone to apply additional stone to the areas that have been filled with sand or silt where the crushed stone's ability to mitigate airborne dust has been diminished. Please provide more specificity concerning application of loose rock over the trafficked portion of the mining area (i.e. not to just *consider*).

Pursuant to Item 5 of the Schedule of Compliance attached to the above referenced Order, within fifteen (15) calendar days of this letter, Dunn is required to submit to the Department for review and approval, a Revised Dust Control Plan. The plan shall incorporate the requirements contained in the SACI Technical Memorandum, with the above detailed stipulations (see the above referenced order for details).

If you have any questions or comments, please contact me a 518-357-2254.

Sincerely,

Psalm Wyckoff
Mined Land Reclamation Specialist II

c: MLF file 40346
Brian Maglienti, Materials Management
Karen Lavery, Assistant Regional Attorney
Kate Kornak, Regional Permit Administrator

Reference No. 2001-02

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TECHNICAL MEMORANDUM

July 26, 2021

To: Curt Taylor, S.A. Dunn & Company, LLC
From: Greg Muleski, SACI LLC
Subject: Site Assessment, April 22, 2021

This memorandum presents results from an April 22, 2021 visit to the Dunn Facility located on Partition Street Extension in Rensselaer, NY. The purpose of the visit was to assess current conditions at the site and factors that might contribute to visible fugitive dust leaving the property.

Background

On March 19, 2021, the New York Department of Environmental Conservation (DEC) notified the Dunn Facility of alleged violations of a permit condition prohibiting visible dust leaving the property. DEC indicated that the incident occurred at approximately 2:48 pm on March 4 and between 3:10 and 4:15 pm on March 5.

The DEC provided an 8-page pdf file containing photos and still shots from videos taken on those two dates. For ease in this discussion, a separate Appendix labels each photo/still using the page number (1 through 8) followed by a letter (A or B) indicating the order in which it appears on the page. Figures 1 and 2[1] show the northern portion of the Dunn Facility and indicate areas to which the DEC photos/stills refer.

Figures 8.A and 8.B in the Appendix are stills from a security video taken on March 4, 2021 from the neighboring school. These figures appear to form the basis for the alleged 2:48 pm violation on that date cited by the DEC. At that time, Dunn's on-site meteorological station recorded a wind of 26.84 mph from 310.7^{o} from north. While it is impossible to locate where visible dust crossed the property line, for purposes of this report, it is reasonable to assume that there may have been a contribution from the sand mining area shown in Figure 1.

[1]Figures mentioned are included at the end of this memorandum.

On the morning of March 5, 2021 DEC personnel visited the sand mining area and obtained Appendix Figures 1.A and 1.B which show a level of wind erosion of the sand mining travel area.[2] However, no visible dust was observed by either Dunn or DEC personnel at the compliance point along Partition Street Extension. DEC personnel returned to Partition Street Extension later on March 5 to obtain Appendix Figures 3.A through 7.B. These stills appear to form the basis for DEC's alleged violation between 3:10 and 4:15 pm on that date.[3]

According to DEC, mobilization of dust from the mine floor, bank face, and the east side (leeward side) of sand stockpiles was caused by high wind. In addition to the visible dust violation, DEC also cited the Dunn Facility's failure to have a sand fence in place in the location above the mine face on March 5, 2021.[4] It was subsequently confirmed that this was limited to an area where the Dunn Facility had been undertaking grading activities requiring the fence's removal.

SACI also reviewed video clips of the March 5 incident that were provided by DEC.

The Dunn Facility and DEC ultimately executed an Order on Consent, dated June 21, 2021, (Order) concerning the above incidents. The Order attached a "Schedule of Compliance" (shown on page A-9 in the Appendix) for the Dunn Facility to follow. Main points of the Schedule of Compliance are summarized below:

1. Install a sand fence above crest of the active mine face.
2. Incorporate the following restrictions in the dust control plan for the months of March through mid-May:
    a. Reduce the area affected by mining exposed to potential wind erosion (i.e. not stabilized by hydromulch or erosion control matting) to no more than one acre (1.0 acre). Travel routes for vehicles can be excluded from the 1.0-acre limitation provided that they are stabilized with crushed stone as required by the dust control plan.
    b. Reduce the exposed mine face to a height no higher than 15 ft.
    c. Remove all unstabilized sand piles on the northern and eastern side of the mine above elevation 200 ft. amsl. Those unstabilized sand piles used for the purpose of traffic direction shall be replaced by jersey or concrete barriers, or other large size aggregate (i.e., particles larger than ¼"). Unstabilized sand stockpiles located

[2]The Dunn Facility had closed at approximately 9 am because freezing temperatures prevented watering for dust control. Meteorological conditions between 10:00 and 10:30 am on March 5, 2021 (roughly the time Figures 1.A and 1.B were taken) were 19 F and a northwesterly wind at 22 mph.

[3] SACI found it difficult to discern visible dust in several of the stills (in particular, Appendix Figures 3.A, 6.A and 6.B).

[4]See Appendix Figures 2.A and 2.B

on the west side of the mine must be constructed in oval shapes with the long axis oriented east-west and the pile may not exceed 15 feet in height.

The Order also indicates that permit conditions overrode the dust control plan's limitation on the use of alternative dust control palliatives during high wind conditions in the event water could not be used to suppress dust, for example during freezing temperature conditions.

Finally, the Order required the Dunn Facility to hire a consultant to undertake an assessment and develop recommendations relating to the following:

a. An assessment of prevailing conditions on March 4, 2021 and March 5, 2021;
b. An assessment of current site conditions and factors that potentially contribute to dust creation;
c. Recommendations for changes to the dust control plan or operational practices to minimize the potential for dust dispersion, including without limitation, other potential mitigation measures to further minimize the potential for dust creation.

This report is intended to address these items.

Observations from Site Visit and Discussion

SACI visited the Dunn Facility on April 22, 2021 and found it reasonable to assume there could have been a contribution to the visible dust incidents observed on March 4 and 5 from the sand mining area. Appendix Figures 1.A and 1.B indicate wind erosion of the mine floor. This area is dried and pulverized by loader and truck traffic, thus regularly regenerating the erosion potential.[5]

SACI does not believe significant dust can be generally attributed[6] to the mine face because it is compacted and retains moisture much better than the trafficked area. No sand stockpiles were seen during the April 22 visit, but SACI did observe a series of small heaps used to designate the traffic patterns (Figure 3). SACI does not believe that appreciable dust could arise from these "safety piles."

Sand fences were present throughout the mining area during SACI's April 22 visit. Dunn Facility personnel stated that the portion of the fence had been removed to bulldoze down a slope. Figure 4 (based on Appendix Figure 1.B). Recommendations for fences are presented in the following section.

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[5]See the general discussion about wind erosion in SACI's June 25, 2020 technical memorandum.

[6] Appendix Figures 1.A and 1.B show the recently bulldozed material. Although this material would be more erodible than a typical mine face, it is not nearly as erodible as the mine floor. Note that none of the DEC photos shows that surface eroding in this area while there is dusting in the mine floor.

Summary and Recommendations

The following summarizes the site visit and assessment; in addition, recommendations are presented for Dunn's consideration.

1. STATUS OF MARCH 4-5, 2021 EVENTS. It is important to recognize how effective Dunn's response to the prior 2020[7] dust event has been. While there was clear visible evidence of the 2020 event, it is difficult to discern visible dust in several of the Appendix figures from the 2021 observation period. In fact, taken as a whole, visible dust was not present during the vast majority of the 2021 observation period when reviewing the entire video footage. Figure 5 provides a side-by-side comparison of the March 4 events of 2020 and 2021. It is clear that Dunn's actions over the past year have proved highly effective in controlling fugitive dust.

   After comparing the 2020 and 2021 events, and considering the mitigation measures in place, SACI believes that the sand mining area is the only open area[8] left at the facility that has the potential to produce off-site visible dust during high winds. Effective dust control during freezing temperatures still poses a problem and SACI offers recommendations below.

2. CLARIFYING OBSERVATION METHODS. As noted above, SACI found it difficult to discern visible dust in some of the videos and believes that optical effects could be mistaken for visible dust. In particular, sunshine filtering through trees and/or shadows cast on chain link fence might be mistaken for dust. For example, review of the two screengrabs (Figure 6) from the file named "2021.3.5 3:14 Dunn offsite dust.MOV" which might be construed as showing visible dust at the fenceline. However, dust is clearly not being transported by the wind because the two views (34 seconds apart) are essentially identical. In other words, no dust cloud moves from right to left to obscure different portions of the view. It is easier to see this phenomenon in the "3:14" video than in the other three videos because this video provides more of a "head-on" view of the fence line. The view down the fenceline in the other videos would be more vulnerable to mistaking chain link shadows as dust.

   SACI recommends that Dunn propose guidelines (such as restricting attention to above the chain link fence top, requiring a more heads-on view in video angles, limits on sun angles, etc.) to the DEC that would safeguard against misconstruing the phenomenon as dust.

3. USE OF MEASURES SPECIFIED IN DEC ORDER. As described above, the Order

[7]The date of the 2020 dust event was also March 4.

[8]Dusting of roadways during high winds is possible but emissions would be more dispersed and less likely to lead to an off-site violation.

specifies a number of measures that are to be implemented during the months of March to mid-May, and the Dunn Facility has agreed to these measures. For completeness, these measures should be incorporated into the dust control plan.

4. USE OF CHLORIDES FOR DUST CONTROL. The Dunn Facility should consider use of calcium or magnesium chloride to control dust on roads and open areas when temperatures are below freezing. Both materials are available in liquid or solid (flakes or pellets) forms. For freezing conditions, SACI recommends liquid application followed by pellets. Year-round use of salt materials might prove cost-effective because of their hygroscopic nature. In other words, by drawing moisture from the air, the salts could reduce the frequency of using water for dust control. The current dust control plan permits the use of alternative palliatives but only under limited conditions. SACI recommends that that the plan be updated to provide more flexibility to the facility when use of water is not feasible. Based on the Order, DEC appears to be amenable to allowing more flexibility in alternative palliatives use.

5. ADDITIONAL CONTROL/STABILIZATION MEASURES. Although chlorides are believed to be Dunn's most cost-effective control option for freezing conditions, Dunn may wish to consider other chemical dust controls if the expanded use of chlorides is not adequately effective. There is a wide variety, including asphalt emulsions, petroleum resins, and polymers. Because the mine floor is subject to spillage from loading trucks and high shear stresses as vehicles maneuver into place, the surface may require frequent retreatment.

   Dunn might also consider the feasibility of spreading coarse, loose rock over the trafficked portion of the mining area. Inclusion of these “non-erodible elements” on the surface increases the threshold velocity at which wind erosion of the surface begins.[9] However, the rock will be subject to frequent covering by sand spillage from active loading operations making its effectiveness short-term between applications.

6. IMPROVED “SAFETY PILE” MATERIAL. Although the small sand heaps that delineate traffic routes do not represent a significant dust source, SACI recommends that Dunn replace them with concrete bunker blocks, water-filled plastic barricades, used equipment tires, or other suitable materials.

7. SAND FENCE IMPROVEMENTS. Although SACI found that the required fences were present as required by the dust control plan, it appears that Dunn has not yet found a completely satisfactory fence system. Figure 7 shows some of the fences in the mining area. High wind events have torn the plastic fence material (Figure 7a) from its anchors. The welded wire material (Figure 8b) has proven more durable but the material is too

[9]See Figures A-1 through A-3 of Reference 1.

porous[10] to be very effective. Combining the two materials (Figure 7a) improved retention of the plastic but SACI recommends (1) placing the plastic material on the other side of the wire fence and (2) staggering two layers of the plastic material to achieve a porosity of 50%. Dunn may also wish to experiment with wooden snow fence and/or heavier T-posts to reduce maintenance intervals.

References

1. U.S. Environmental Protection Agency, "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites," EPA/600/8-85/002 (February 1985).

2. U.S. Environmental Protection Agency, "*Control of Open Fugitive Dust Sources,*" EPA-450/3-88-008 (September 1988).

[10]A porosity of 50% is generally recommended for dune fences. The green plastic material is approximately 75% porous.

Figures

Figure 1. Northern portion of the Dunn Facility.

Figure 2. “Mine floor” in the sand mining area.

Figure 3. “Safety piles” used to direct traffic.

Figure 4. DEC Figure 1.B showing recently bulldozed material

Figure 5. Comparison of the 2020 and 2021 events.

Figure 6. Comparison of “3:14” video screenshots 34 seconds apart.

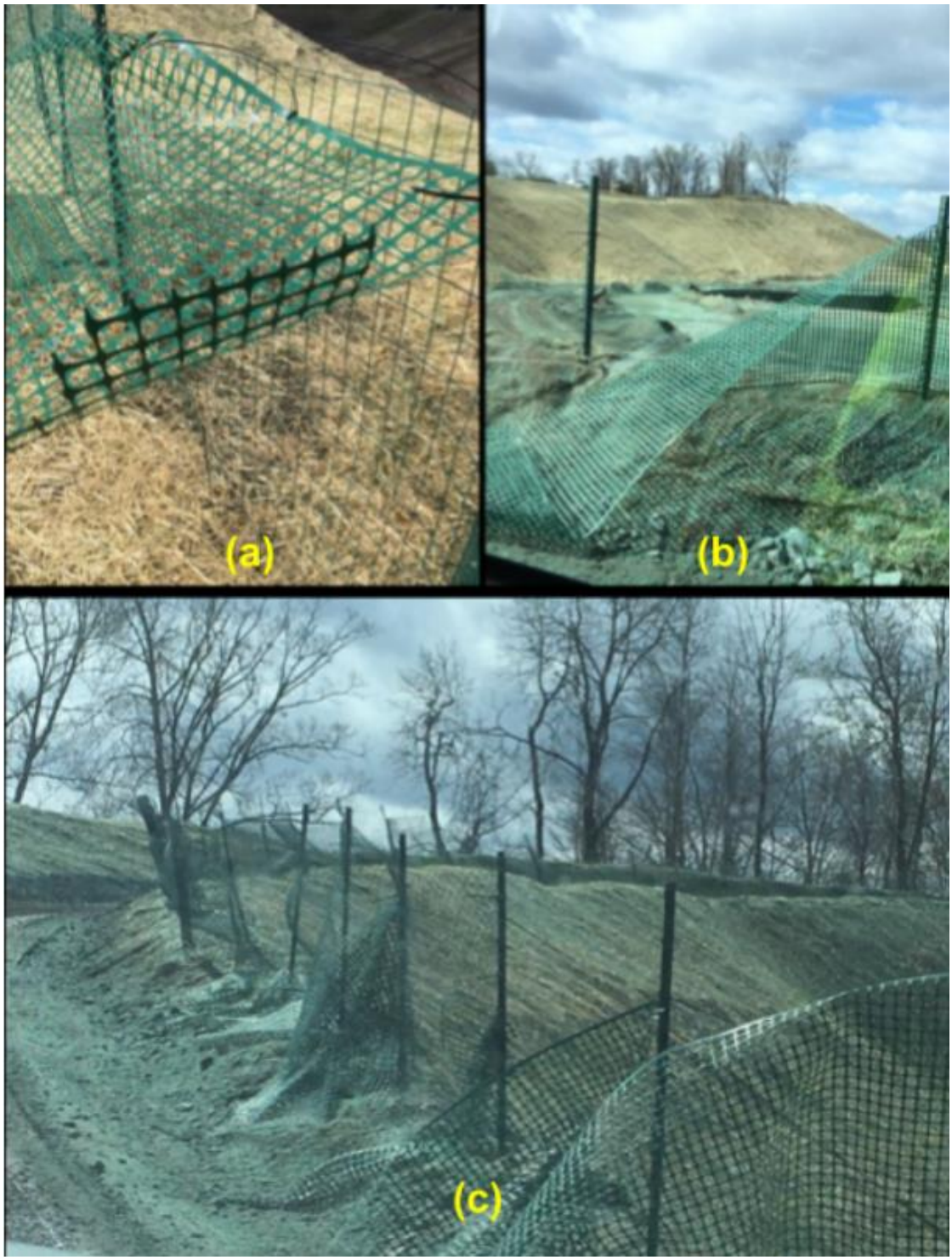

Figure 7. Fences in the sand mining area.

Figure 8. Plastic and welded wire fence materials

SACI LLC

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T E C H N I C A L M E M O R A N D U M

June 25, 2020

To: Curt Taylor, S.A. Dunn & Company, LLC
From: Greg Muleski, SACI LLC
Subject: Site Assessment, June 2-4, 2020

This memorandum presents the results of a site inspection that SACI, LLC ("SACI") conducted on June 2-4, 2020 at the Dunn Facility located on Partition Street Extension in Rensselaer, NY. The purpose of the visit was to assess current conditions at the site and factors that might contribute to fugitive dust leaving the property. I also reviewed the Dunn Facility's dust control plan, as last revised in October 2019. This memorandum provides a summary of the visit and assessment and provides recommendations for future dust control measures.

Background – Purpose for Assessment

The New York Department of Environmental Conservation (DEC) notified the Dunn Facility of a March 4, 2020 incident which it stated constituted a violation of a permit condition banning "visible dust ... leaving the property." The Dunn Facility and DEC subsequently entered into a consent order (R4-2020-0312-41) that called for an expert report to assess:

> i) "the current site conditions and contributing factors that result in fugitive dust leaving the facility, including an assessment of the location, condition, orientation, and geometry of the sand piles on the eastern and northeastern sides of the facility and an assessment of the potential benefits, if any, of sand pile relocation (e.g., to the west side of the mine) and/or reconfiguration (e.g., limiting height and/or pile axis orientation)"

and

> ii) the "mitigation measures intended to reduce erosion of sand from both the mine face and any sand stockpiles"

This memorandum represents the required expert report.

It is generally recognized that the March 4 event resulted from high winds and wind erosion of exposed surfaces. Before addressing site-specific conditions, the following material describes the wind erosion process in general terms. Clearly, two basic requirements for wind erosion are that the surface be dry and exposed to the action of the wind.

Background – Basics of Airborne Dust Creation

There has been ongoing research into wind erosion and/or "aeolian processes" since at least the 1940s. Different sized particles are transported by different means (known as **suspension**, **saltation,** and **creep**) as illustrated in Figure 1.[1] It is important to note that movement of relatively large (~ 100 µm and larger) particles is necessary to initiate and to sustain wind erosion.

"Creep" occurs when loose particles roll along the bed surface but never become airborne. Slightly smaller particles undergo "saltation" (a word whose Latin root means leaping or dancing). Saltation occurs when particles become airborne (up to a height of roughly 1 meter) and are carried a short distance before falling back to the surface. When the particles fall back, they dislodge smaller particles which can remain suspended in the air. Particles that are sufficiently small are transported by suspension and can travel a considerable distance away from their source.

The threshold velocity is the lowest wind speed at which erosion is initiated. Wind erosion threshold is best defined in terms of the threshold <u>friction</u> velocity u_t*. Friction velocity (u*) is a measure of the shear stress at the surface and arises from a logarithmic wind profile

$$u(z) = (u^*/k)\ln(z/z_0) \qquad (1)$$

where: $u(z)$ = wind speed at height z
z_0 = roughness height
u^* = friction velocity
k = von Karman's constant (approximately 0.4)

A value of 75 cm/s represents a rough demarcation between "limited" and "unlimited" erosion surfaces, as described in Reference [1]. Unlimited surfaces will continue to emit dust at an approximately steady rate as long as the threshold speed is exceeded. At higher threshold velocities, surfaces tend to have a "limited reservoir" in which erodible particles are mixed with larger, non-erodible elements. Crusted areas with small amounts of fine material lying on the surface also represent limited reservoirs. Limited reservoirs emit dust at a decreasing rate as

[1] Figures are presented at the end of the memorandum.

erodible particles are depleted. In that way, even if the wind stays constant, the erosion rate goes to zero.

Observations from June 2020 Site Visit and Analysis

As noted earlier, SACI inspected the Dunn Facility on June 2-4, 2020. Based on observations during the site visit, SACI believes that some freshly exposed sand surfaces[2] would have represented unlimited reservoirs when the March 4 incident occurred; however, almost the entire facility has now been treated with long-term (emulsified mulch) or semi-permanent (matting to promote vegetation) treatments which limit the reservoir of erodible material.

Between the March 4 event and the latter part of April 2020, Dunn effectively doubled the area covered with erosion matting. Figures 2a and 2b show aerial views from March 9 and April 24, respectively, with the red dashes outlining the newly matted areas. Since April, additional areas have been matted to effectively cover essentially all inactive areas at the facility. In addition, the unpaved road shown with yellow dots has been upgraded with 6 inches of (non-erodible) rock armoring. These improvements lie "upwind" of where the March 4 incident was observed. Quotes are used because only anecdotal wind information is available. Dunn Facility personnel stated that high winds were from the west to west-southwest on March 4.

SACI compared March 4, 2020 wind data from four stations in the area (Figure 3).[3] Although some differences are to be expected,[4] the four stations show substantial differences in speeds and directions. For example, the highest gusts recorded for that day span the range of 12.6 to 42.6 mph (Figure 3). The three contemporaneous wind direction records in Figure 4 for the period between 1:30 and 2:30 pm[5] generally agree on the westerly component but vary on whether there is a northerly or a southerly component to the wind.

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[2] This would be the case for fine sand. Fresh faces where sand and gravel are highly mixed would be naturally "limited" in terms of erosion because non-erodible elements would be present.

[3] Three stations were available from https://mesowest.utah.edu/ and the fourth was taken from https://www.wunderground.com/wundermap .

[4] These differences could be due to monitoring equipment used; scan rate and averaging periods; calibration and maintenance practices; and siting (such as sensor height, elevation, surrounding obstructions, etc.).

[5] This time period was chosen because all four stations recorded high gust values at the time and it is understood to roughly correspond with when visible dust was observed. Note the different number of values reported for a 1-hr period.

Taken as a whole, it is safe to say that there is no definitive (quantitative) information about exactly what the wind speed(s) and wind direction(s) were at those time(s) at the time visible dust was reported.

Assuming (i) facility conditions as shown in the March 9 aerial photo (Figure 2a) and (ii) a strong westerly wind component of wind on March 4, SACI believes that visible dust at the property line originated from the yellow cross-hatched area in Figure 5 and, to a lesser extent,[6] the road shown in blue. At that time, open areas in sectors C3 and D3 had been treated with emulsified mulch and would have had a limited erosion reservoir. Furthermore, any saltation particles coming from the cross-hatched area would be slowed when they reached the recirculation zone at the crest.

Finally, the northeast corner lies below the rest of sector D3 and is partially shielded by trees, and therefore would not be expected to be a source of visible dust during higher wind conditions. In addition, the clay pile in that area is not considered erodible and the topsoil pile is vegetated.

Since March 4, Dunn has treated the two sources believed responsible for that day's visible dust event. Other areas have been matted as well (see Figure 2b).

Conclusions and Recommendations

The following summarizes the site visit and assessment and presents recommendations for Dunn's consideration. The facility's dust control plan should be updated to incorporate the measures already implemented by the Dunn Facility since the March 4 incident and the recommendations provided below once they have been reviewed by Dunn and DEC.

1. STATUS OF MARCH 4, 2020 VISIBLE OFF-SITE DUST EVENT.
   SACI believes that Dunn has already addressed the immediate source areas of the visible dust on March 4, 2020. Recent matting upgrades will also control erosion due to winds with strong northerly or southerly components.

2. ON-SITE QUALITY METEOROLOGICAL DATA.
   As mentioned earlier, winds (especially high winds) are not well characterized for the Dunn Facility. It is strongly recommended that Dunn establish on-site meteorological monitoring capable of providing high quality meteorological data. Four stations between 2 and 7 miles away show substantial differences in terms of speed and direction.

[6] Besides having greater spatial extent than the road, the cross-hatched area was more likely to have exhibited "unlimited" erosion.

Collection and analysis[7] of high-quality on-site meteorological data would be far more useful than either anecdotal observations or distant monitoring.

3. STOCKPILE RELOCATION.
The consent order asks for an assessment of "potential benefits, if any, of sand pile relocation (e.g., to the west side of the mine) and/or reconfiguration (e.g., limiting height and/or pile axis orientation)." Contemplation of any change based on modeling (e.g., computational fluid dynamics) is at best premature without better definition of (i) what wind speeds and directions might be of interest and (ii) the threshold velocity of different surfaces. At any rate, elimination of the erosion potential (because of the matting upgrades) should render the idea of reconfiguration moot. Furthermore, the facts that (i) massive material transport and handling activities would result in far higher dust creation and (ii) the process would create temporary erodible surfaces (i.e., before they can be matted) do not support further consideration of stockpile relocation.

4. ASSESSMENT OF EXISTING MITIGATION MEASURES.
The consent order also asked that "mitigation measures intended to reduce erosion" be assessed. As noted above, SACI had reviewed Dunn's October 2019 dust control plan before the site visit and noted that two additional controls[8] ("erosion control mat and seeding" and "tackifier bonded mulch") had already been implemented. SACI found that the mitigation measures undertaken by Dunn to be highly effective, as discussed below.

<u>4.a Control Matting and Spray-Applied Mulch</u> – SACI took photos of different surfaces at the facility (Figure 6). Figures 6 a through 6c show a crust removed (and ultimately crushed) from a recently matted surface. The crust's presence ensures that erosion would be of the "limited" variety. Figures 6d and 6e are photos of matted and mulched surfaces, respectively; both surfaces show "limited reservoirs" for erosion.[9] Furthermore, as vegetation becomes more widespread, the surface shown in Figure 6d would become essentially non-erodible. Although both methods were observed to be highly effective, the spray-applied mulch appears to have a much shorter effective lifespan because of weathering. Surfaces that will remain exposed longer (a month or more) should be treated with the erosion control matting instead of the spray-applied mulch.

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[7] SACI recommends that Dunn utilize the meteorological station data to calculate running 30- or 60-second averages of on-site wind measurements. "Vector averaging" (i.e., tail-to-head addition) should be used.

[8] These are sections 4.3 and 4.4 of the dust control plan.

[9] The presence of non-erodible elements in Figure 6e would approximately double the threshold velocity (see Figure A-2 in Reference [1]). Also, the erosion matting provides immediate control (i.e., even before a crust can form or vegetation take root) because the netting/straw matrix lowers the wind speed at the (erodible) surface.

4.b Roadways and Landfill Operations – In addition to the erosion controls, SACI assessed other dust control measures at the site. In-place speed limits, gravel application, and watering (calcium chloride application for freezing conditions where water cannot be effectively used) combine to effectively control unpaved road dust emissions by 90%. The estimates are based on what SACI observed during the visit and its 39 years of experience field testing controlled and uncontrolled roads. The spray cannon (fogger) was observed to operate in the active cells and was effective in controlling the small amount of dust emitted as the "walking floor" trailers were unloaded and the wastes spread and compacted. The existing practice of ceasing landfill operations prior to high-wind events will prevent that activity from contributing to any visible off-site dust. The supplemental measures described above (e.g., gravel application/maintenance, watering, etc.) should be encouraged and authorized under the dust control plan and the facility's permit on an as-needed basis in advance of forecasted high wind conditions, regardless of whether the facility is in operation at the time or not.

5. MINOR MODIFICATIONS TO EXISTING MEASURES.
   SACI suggests that the Dunn Facility consider minor additional controls, such as mulch or matting far corners in sector D3 (to accomplish nearly complete coverage of the facility) or snow fence along the crest of slopes (to further slow any saltating particles). Small (less than 100 square feet each), isolated areas along the eastern portions of the site appear to have some sand deposited on top of the matting. SACI recommends that these be "patch" matted to prevent further sand movement and that Dunn conduct monthly inspections of matted areas to determine if patching is warranted.

Reference

1. U.S. Environmental Protection Agency. "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Site." Office of Health and Environmental Assessment, Washington, DC 20460. EPA/600/8-85/002.

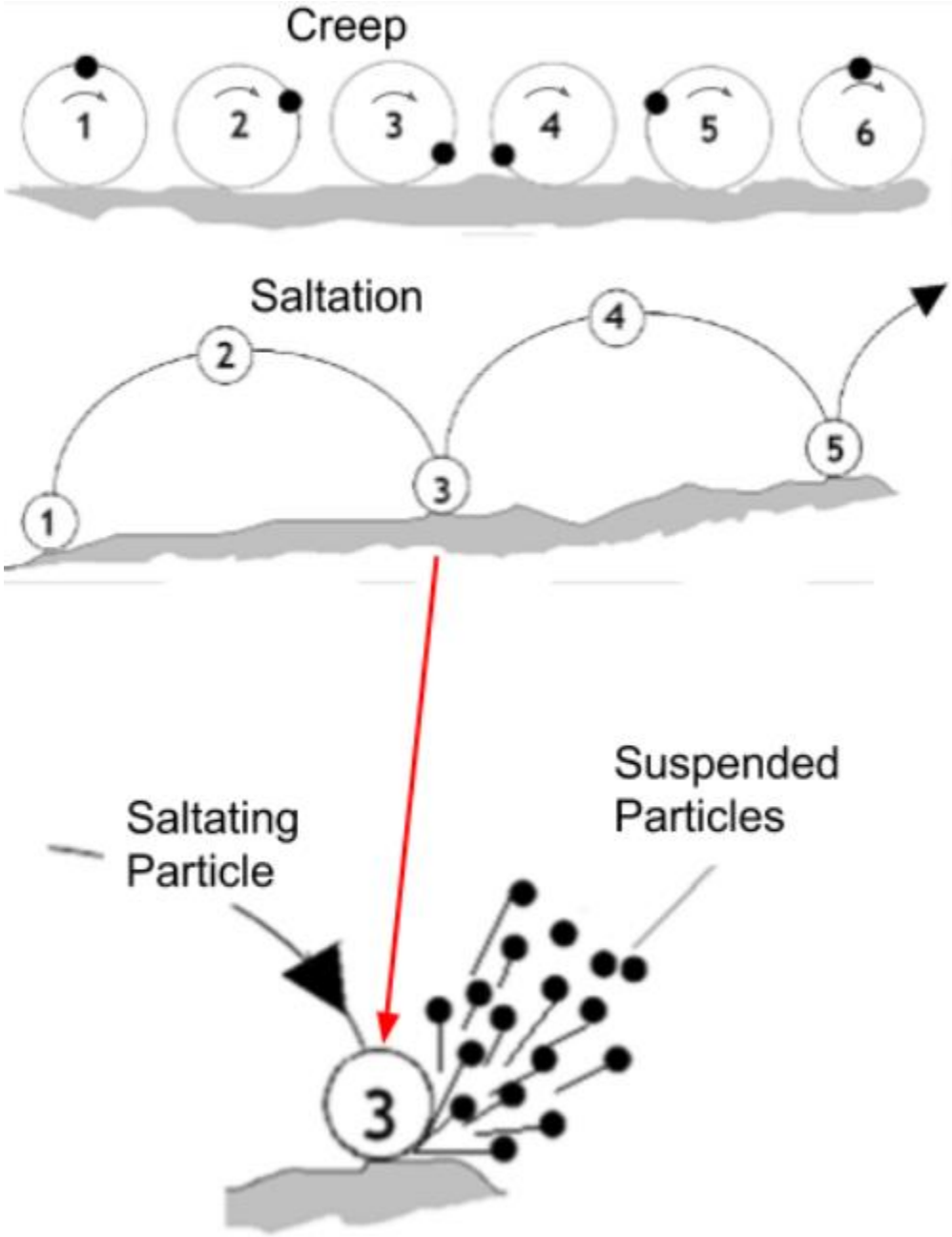

Figure 1. Illustration of the wind erosion process

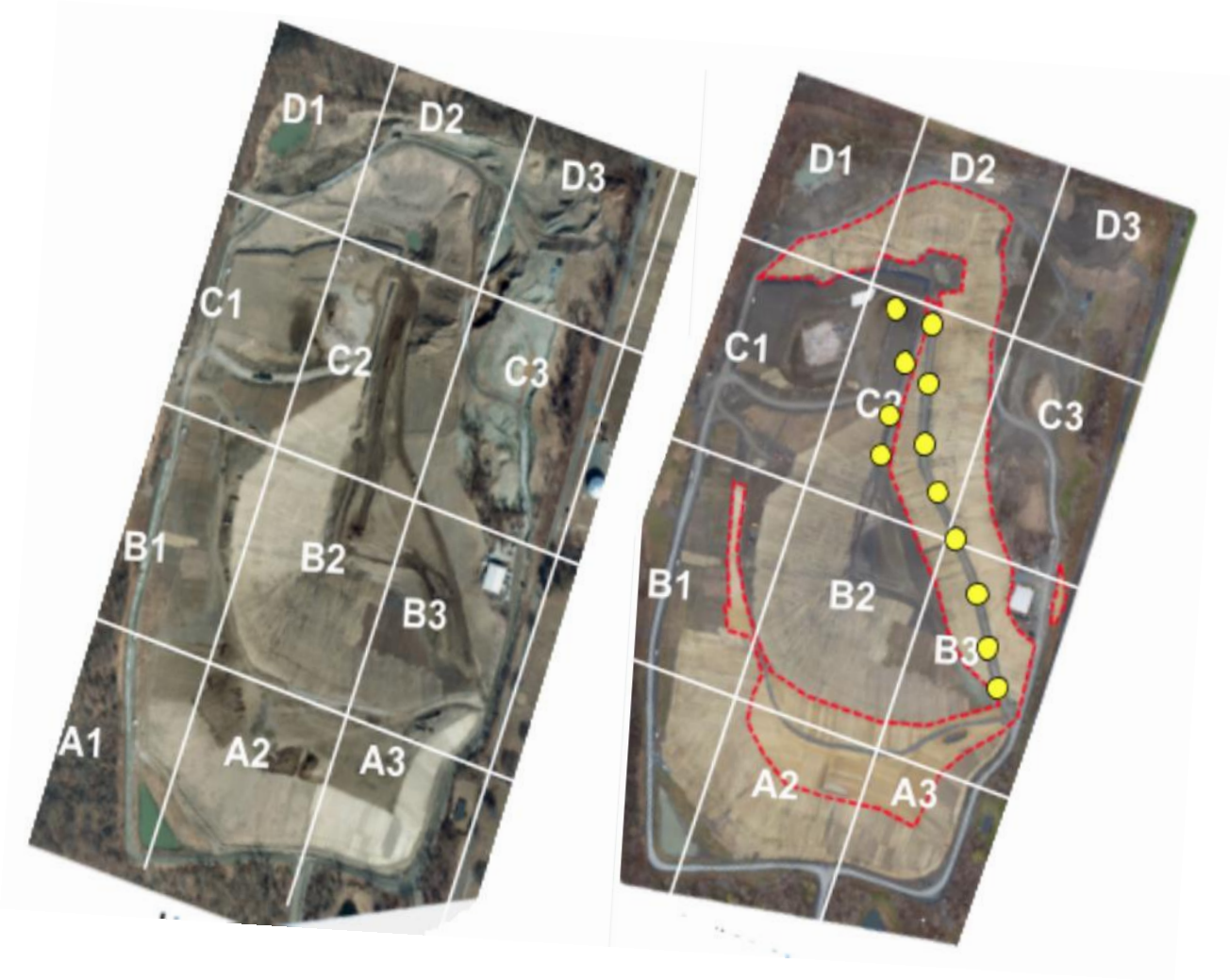

Figure 2. Aerial photos of the Dunn facility from (a) March 9 and (b) April 24, 2020

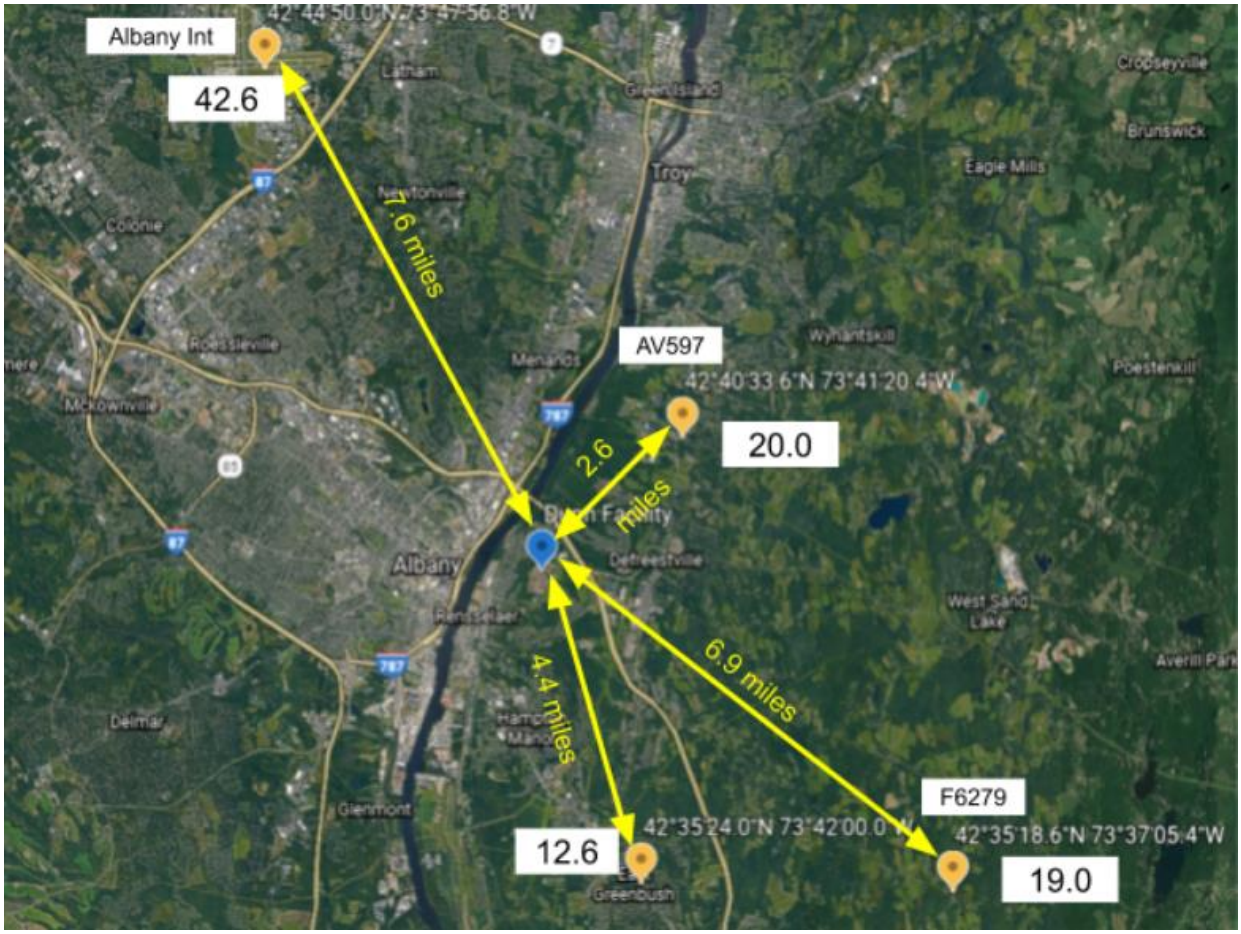

Figure 3. Locations where the four meteorological records were obtained. Number next to each location is the maximum wind gust (in mph) recorded for March 4, 2020.

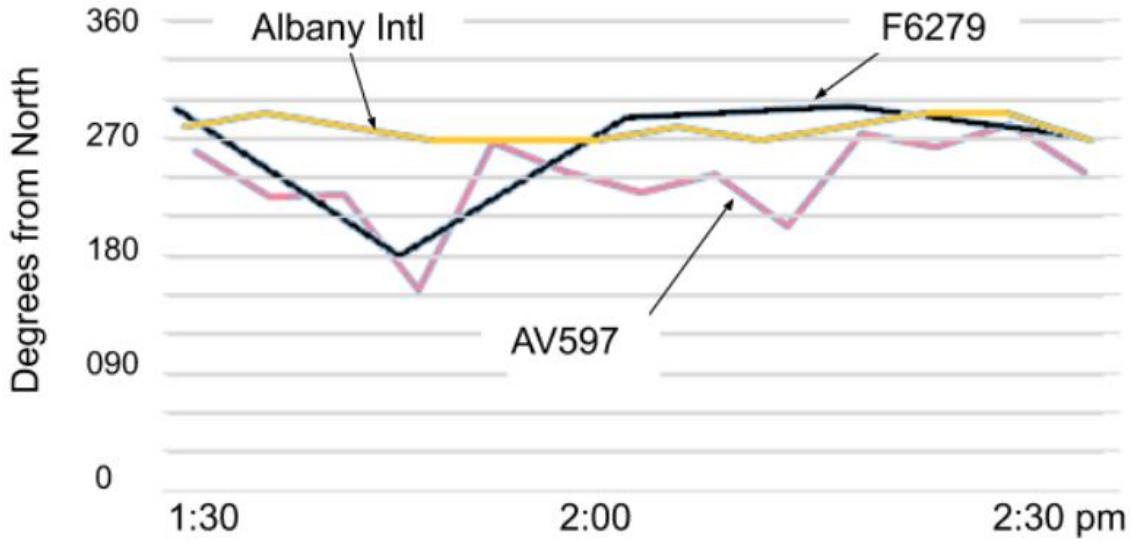

Figure 4. Comparison of wind directions at three wind stations recorded between 1:30 and 2:30 pm on March 4, 2020. The fourth station reported WNW (292.5^{o}) throughout the 1-hr period.

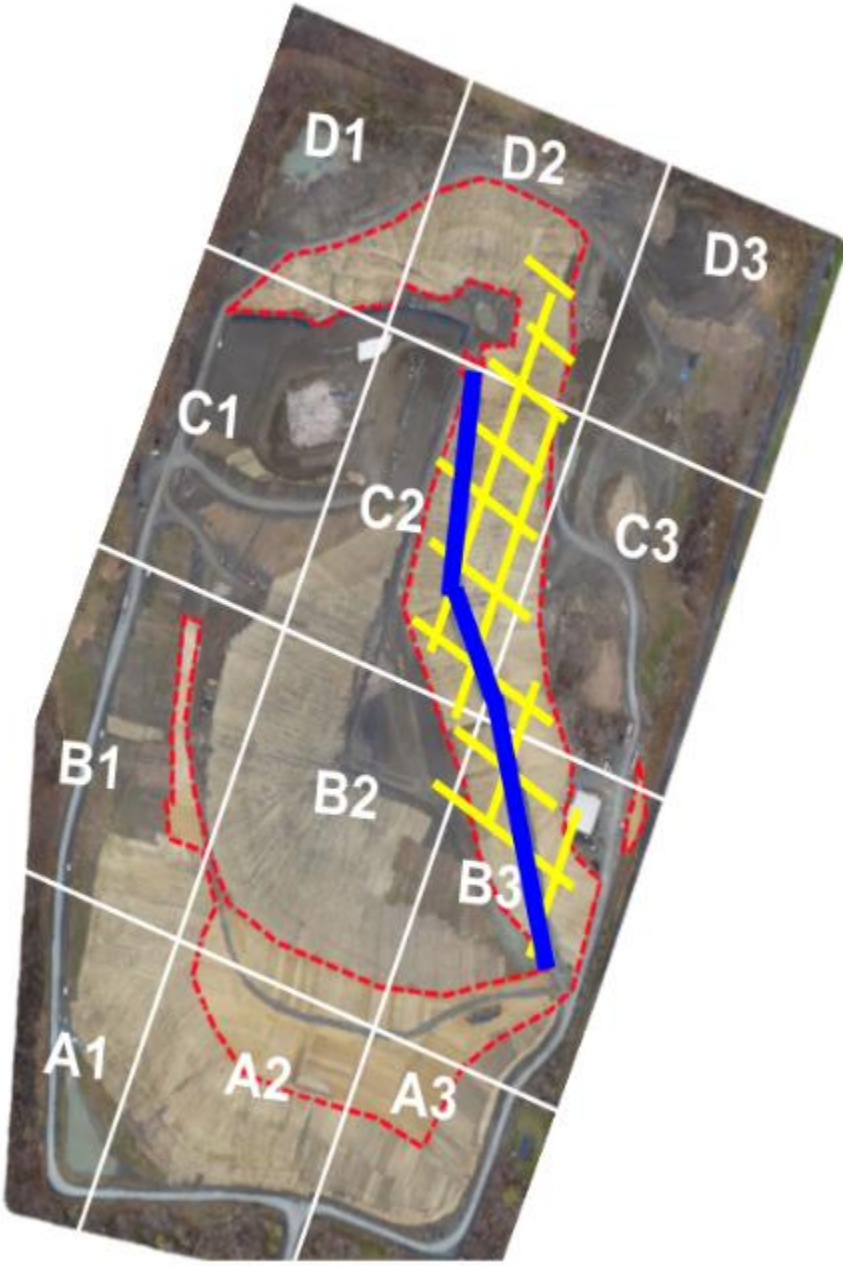

Figure 5. Areas most responsible for March 4 wind erosion

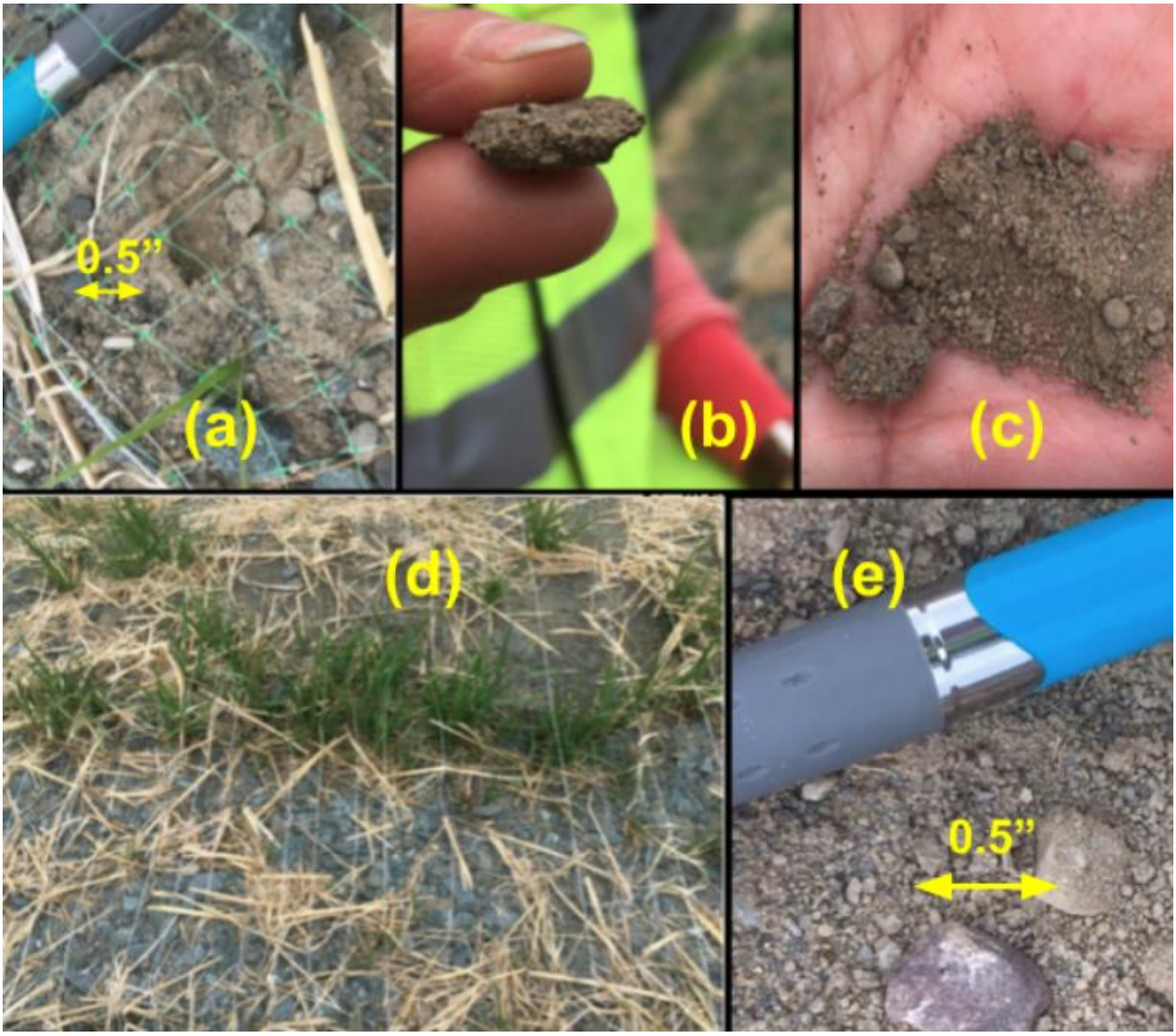

Figure 6. Photos taken of surfaces at the Dunn Facility

APPENDIX E

CONSTRUCTION QUALITY ASSURANCE/CONSTRUCTION QUALITY CONTROL PLAN

CONSTRUCTION QUALITY ASSURANCE/CONSTRUCTION QUALITY CONTROL PLAN

DUNN MINE AND C&D FACILITY

Prepared For:

S.A. DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION
RENSSELAER, NEW YORK 12144

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING,
LANDSCAPE ARCHITECTURE AND LAND SURVEYING, PLLC

CEE Project 182-442

March 2016
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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Objective 1
1.2 Related Documents 1
2.0 RESPONSIBILITIES AND AUTHORITIES 2
2.1 CQA/CQC Organization 2
2.1.1 Owner 2
2.1.2 Certifying Engineer 2
2.1.3 Engineer 2
2.1.4 CQA Officer 3
2.1.5 CQA Observation Staff 3
2.2 Contractors Quality Control 3
2.2.1 Geosynthetic Contractor's CQC Manager 4
2.3 Contractor's Personnel Qualifications 4
2.3.1 Geosynthetics Contractor 4
2.3.2 Earthworks Contractor 5
3.0 CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL 6
3.1 General CQC/CQA Duties 6
3.2 Sampling 6
3.2.1 Testing Requirements 7
3.2.1.1 Transportation of Samples For Testing 7
3.2.2 Non-Compliance 7
3.3 Subgrade Preparation 7
3.4 Subgrade Layer 8
3.4.1 Observation Requirements 8
3.4.2 Pre-Construction Testing Requirements 8
3.4.3 Construction Testing Requirements 9
3.5 Low-Permeability Soil Layer 9
3.5.1 Observation Requirements 9
3.5.2 Pre-Construction Testing Requirements 10
3.5.3 Construction Testing Requirements 11
3.5.3.1 Conformance Testing Requirements 11
3.5.3.2 In-Place Soil Testing 12
3.6 Geomembrane Liners 13
3.6.1 Observation Requirements 13
3.6.2 Materials Transport and Storage 14
3.6.3 Final Viewing of the Low Permeability Soil Layer 15
3.6.4 Geomembrane Placement and Positioning 15

3.6.5 Geomembrane Seaming 15
3.6.5.1 General Seaming Requirements 16
3.6.5.2 Hot-Wedge Weld 17
3.6.5.3 Extrusion Weld 17
3.6.5.4 Cold Weather Seaming 17
3.6.5.5 Hot Weather Seaming 18
3.6.6 Quality Control Testing Requirements 18
3.6.6.1 Geomembrane Resin 18
3.6.6.2 Geomembrane Rolls 18
3.6.7 Quality Assurance Testing Requirements 20
3.6.7.1 Geomembrane Delivered to Project 20
3.6.8 Interface Shear Testing Requirements 21
3.6.9 Construction Testing Requirements 22
3.6.9.1 Trial Seams 22
3.6.9.2 Non-Destructive Testing 23
3.6.9.3 Destructive Testing 25
3.6.10 Detail and Repair Work 28
3.7 Soil Drainage Layer 29
3.7.1 Leachate Collection Pipes and Stone 29
3.7.1.1 Observation Requirements 29
3.7.1.2 Pre-Construction Testing 29
3.7.2 Drainage Layer Materials 30
3.7.2.1 Observation Requirements 30
3.7.2.2 Pre-Construction Testing Requirements 30
3.7.2.3 Construction Testing Requirements 31
3.8 Storm Water Controls 31
3.8.1 Observation Requirements 31
4.0 DOCUMENTATION AND RECORD-KEEPING 32
4.1 Daily Record-Keeping 32
4.2 Observation and Testing Reports 32
4.3 Changes to Specifications/Drawings 32
4.4 Deficiencies/Corrective Measures Reports 32
4.5 Record Drawings 33
4.6 Final Report 33
5.0 MEETINGS 34
5.1 Pre-Construction Meeting 34
5.2 Progress Meetings 34
5.3 Final Viewing of Work 34

TABLES

Table 1. Subgrade Pre-Construction Tests
Table 2. Subgrade Construction Tests
Table 3. Low-Permeability Soil Pre-Construction Tests
Table 4. Low-Permeability Soil Conformance Tests
Table 5. Low-Permeability Soil In-Place Tests
Table 6. Geomembrane Resin Conformance Tests
Table 7. Geomembrane Quality Control Tests
Table 8. Geomembrane Quality Assurance Tests
Table 9. Field Seam Strength Requirements
Table 10. Air Pressure Testing
Table 11. Vacuum Box Testing
Table 12. Destructive Testing
Table 13. Leachate Collection Stone Pre-Construction Testing
Table 14. Drainage Material Pre-Construction Tests
Table 15. Drainage Material Construction Tests

1.0 INTRODUCTION

1.1 OBJECTIVE

This Construction Quality Assurance/Construction Quality Control (CQA/CQC) Plan has been prepared in accordance with the requirements of 6 NYCRR Part 363-4.5. The objective of the Plan is to address the observations and tests that will be used before, during, and upon completion of construction of the Dunn Construction and Demolition Debris (C&D) Facility to ensure that the construction materials will meet the design criteria and specifications, and construction and certification requirements set forth in Part 363-6 and also to provide procedures for post-construction care requirements prior to initial operation. The plan should serve as the guideline for assessment of the adequacy of soil and geosynthetic materials, installation procedures, and maintenance of detailed records of the constructed project.

Amendments and clarifications to this Plan may be made by the Certifying Engineer prior to or during construction to account for field conditions and other necessary construction adjustments. These amendments and clarifications shall comply with New York State Department of Environmental Conservation (Department) regulations.

1.2 RELATED DOCUMENTS

This CQA Manual is part of a construction documents submittal to the Department for landfill construction. The Construction documents for the landfill also include the following:

- Bid form;
- General Specifications;
- Technical Specifications, and;
- Construction Drawings.

2.0 RESPONSIBILITIES AND AUTHORITIES

2.1 CQA/CQC ORGANIZATION

The following defines the authorities and responsibilities, as well as the qualifications, of the personnel involved with the implementation of the procedures outlined in this document and their respective duties during the construction project.

2.1.1 Owner

The Owner is the individual or designated representative of the firm, agency or municipality that owns and/or operates the Landfill. The Owner of this project is S.A. Dunn & Company, LLC. The Owner will retain a Contractor who will be responsible for the installation of the landfill baseliner system. There may be separate contractors for installation of certain specific components of the baseliner (e.g., earthwork and geosynthetics).

2.1.2 Certifying Engineer

The Certifying Engineer is a licensed Professional Engineer in the state of New York, with a minimum of seven years of experience in the design, construction, and testing of landfill systems. The Certifying Engineer is responsible for the oversight of the engineering team and will review and sign the permit and construction documents and drawings, as well as the construction certification report. During construction, the Certifying Engineer will provide interpretation of the approved design. This includes providing technical oversight of the CQA Officer, interpreting field and laboratory testing data, verifying construction activities are in accordance with approved design drawings, and making final determinations of the acceptability of installed work. The Certifying Engineer will act independently, and without influence from the Contractors or the Owner.

2.1.3 Engineer

The term Engineer, as used throughout this document, shall mean the Certifying Engineer or his/her designated representative.

2.1.4 CQA Officer

The Certifying Engineer will maintain full time observation staff at the site, which will be led by the CQA Officer. The number of staff present will vary as required to provide adequate coverage to document and observe the daily construction activities. The CQA Officer must have experience in landfill baseliner and final cover system construction projects, which may be educational experience or field experience, or have other construction experience acceptable to the Engineer. The CQA Officer will be on-site full time during construction and will serve as the daily contact person with the Owner and Contractors. The CQA Officer is responsible for observing daily activities of the Contractors, maintaining field records, making judgments in conjunction with the Certifying Engineer on the acceptability of installed materials, maintaining construction summary reports as detailed in Section 4.0, maintaining routine communications with the Certifying Engineer and assisting in the preparation of the final certification report. The CQA Officer will oversee the CQA observation staff.

2.1.5 CQA Observation Staff

This staff will observe and provide oversight to the Contractor's QC personnel and will report directly to the CQA Officer.

2.2 CONTRACTORS QUALITY CONTROL

Prior to the initiation of construction, the geosynthetic contractor will furnish the Contractor Quality Control (CQC) Plan, for approval by the Certifying Engineer. The plan will identify personnel, procedures, instructions, records and forms to be used. No construction will begin prior to Certifying Engineer's approval of the CQC Plan. The Contractors CQC Plan will include the following:

- Description of the quality control organization, including a chart showing lines of authority and acknowledgement that the CQC staff will be in addition to, and separate from, the contractor's project supervisory staff and will report to the Contractor's management at a level of Vice President or above in the Contractor's organization.
- The name, qualifications, duties, responsibilities, and authorities of each firm or person assigned a QC function.
- Procedures for scheduling and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents.

- Control testing procedures for each specific test included in a Quality Assurance Plan or equivalent from the proposed laboratory. Laboratory testing facilities will be approved by the Certifying Engineer.
- Reporting procedures including proposed reporting formats.

2.2.1 Geosynthetic Contractor's CQC Manager

The Contractor(s) shall provide a CQC manager who will be responsible for overall management of the CQC and have the authority to act in all CQC matters for the Contractor. This person will demonstrate the ability to perform correctly the duties required to the satisfaction of the Certifying Engineer. The CQC manager, or a designated representative, shall be present at the project site whenever work is in progress. The CQC manager shall have documented qualification of having been responsible for geosynthetic CQC on a minimum of five separate landfill (or other comparable geosynthetic projects) totaling 50 acres.

2.3 CONTRACTOR'S PERSONNEL QUALIFICATIONS

2.3.1 Geosynthetics Contractor

The geosynthetic installer must document a minimum of five projects involving 50 acres of successfully installed HDPE geomembrane within the last three years. The installer will be approved by the geosynthetic manufacturer.

Installation will be performed under the direction of a project superintendent who will have the following responsibilities and qualifications:

- The Project Superintendent will be on-site and in responsible charge throughout the liner installation, including subgrade acceptance, liner layout, seaming, testing and repairs, and all other activities contracted with the installer.
- The Project Superintendent will have the documented qualification of having supervised the installation of at least 50 acres of previous landfill, or comparable geosynthetic systems on a minimum of five different projects.
- The Project Superintendent or designated seamer will have a minimum of 25 acres of HDPE geomembrane seaming experience using the same type of seaming apparatus as that specified for this project.

- Each welding machine must be operated by a welding technician who has been certified to operate the welder by a certification program acceptable to the New York State Department of Environmental Conservation.

2.3.2 Earthworks Contractor

Work performed on other parts of the liner system will be performed by experienced, qualified installers. The contractor must have a minimum of five years of experience in the installation of landfill liner systems and have completed at least three successfully completed landfill construction projects.

3.0 CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL

3.1 GENERAL CQC/CQA DUTIES

Once installation begins, it is the CQA Officer's responsibility to observe and document construction of the landfill baseliner system.

The CQA Officer is responsible for observing the installation of the following components:

- Subgrade Installation and Preparation;
- Low-Permeability Soil Layer;
- Geomembrane Liner;
- Geotextile Layer, and;
- Drainage Layer.

The CQA Officer is not responsible for the supervision, direction, or control of the Contractors, nor do they have authority over or responsibility for the contractor's means, methods, techniques, sequences or procedures of construction, for the safety precautions and programs related to the contractor's work, or for the failure of the contractor to comply with laws and regulations applicable to the work.

3.2 SAMPLING

Sampling and laboratory confirmatory testing requirements for each component of the landfill construction are specified in subsequent sections and in the Technical Specifications. The CQA Officer or Designated Third Party Representative will perform the pre-construction tests specified or required in order to verify that control measures are adequate, and to provide a product that conforms to contract requirements. The CQA Officer or Designated Third Party Representative will perform the construction tests specified to ensure that the materials utilized during the construction conform to the technical specifications. The CQA Officer will procure the services of an industry- recognized testing laboratory, or an approved testing laboratory may be established at the project site. This laboratory will be approved by the Certifying Engineer. A list and schedule of tests (other than chemical sampling and analysis), which the Earthwork and Geosynthetic Contractors understand are to be performed, will be furnished as a part of the CQC plan to the Engineer. The list will give the test name, specification paragraph containing the test requirements, and the personnel and laboratory responsible for each type of test. The Earthwork and Geosynthetic Contractor will perform the following activities, and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Verify that recording forms, including all of the test documentation requirements, have been prepared.

3.2.1 Testing Requirements

Quality control tests or certification will be performed on, but not necessarily limited to, the following:

1. Laboratory and field testing of soils for subgrade, low permeability soil, drainage layer, and backfill.
2. Laboratory and field testing of geosynthetics materials and installation.

3.2.1.1 Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the CQA Officer or Designated Representative.

3.2.2 Non-Compliance

The Engineer will notify the Earthwork and Geosynthetic Contractor of any noncompliance with the requirements of this Plan and the Technical Specifications. The Earthwork and Geosynthetic Contractor will, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Earthwork and Geosynthetic Contractor or his representative at the site of the work, will be sufficient for the purpose of notification. If the Earthwork and Geosynthetic Contractor fails, or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop work orders will be made the subject of a claim for extension to time, or for excess costs or damages by the Earthwork and Geosynthetic Contractor.

3.3 SUBGRADE PREPARATION

Observation requirements for the CQA Officer during the Subgrade Preparation phase include the following:

- Placement of subgrade soils to reach design elevations
- Compaction of subgrade

The CQA Officer does not need to be present during excavation required to achieve design grades.

3.4 SUBGRADE LAYER

3.4.1 Observation Requirements

The CQA Officer is responsible for viewing the subgrade to confirm that the subgrade layer is ready for the placement of the low-permeability soil layer. At a minimum, the CQA Officer will:

- Confirm the suitability of the subgrade soil.
- Confirm that, where applicable, the soil is installed in compacted lifts which are a maximum of eight inches in thickness.
- View the subgrade area to check for the presence of sharp rocks, construction utensils, debris, survey stakes, organic matter, vegetation, clumps of soil and any other unsuitable objects.
- View the subgrade layer is property compacted, smooth, and uniform.
- Confirm the subgrade is substantially free of surface depressions, fissures, irregularities and abrupt breaks in slopes.
- Review a record drawing of the subgrade layer prepared by the Earthwork Contractor's registered land surveyor.

Each of these activities must be observed and carefully documented by the CQA Officer. Soils shall conform to Technical Specification Section 02210.

3.4.2 Pre-Construction Testing Requirements

A sample of the subgrade soil shall be collected by the CQA Officer from each borrow source used by the Earthworks Contractor and delivered to a qualified independent geotechnical testing laboratory for analysis. The sample shall be sent to a qualified independent geotechnical testing laboratory for analysis of those tests specified in Table 1 provided below. The CQA Officer will review all test results with the Certifying Engineer.

Table 1. Subgrade Pre-Construction Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
Subgrade	Grain Size	ASTM D422	1 Test/Source
	Modified Proctor	ASTM D1557	1 Test/Source
	Direct Shear	ASTM D3080	1 Test/ Source
Note: Direct shear testing and interface shear testing (subgrade/low permeability soil) shall be completed before construction commences. Refer to Section 3.6.8 Conformance/Acceptance Testing for testing conditions.			

3.4.3 Construction Testing Requirements

As part of the required construction testing, the CQA Officer or a licensed subcontractor will conduct field density tests using a nuclear density gauge. Testing frequencies shall be as shown in the Table 2 below. The nuclear density gauge will be checked daily by performing a standard count to ensure it is functioning properly.

Table 2. Subgrade Construction Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
Subgrade	Field Density/Moisture Content Tests	ASTM D2922/D3017	9 tests/acre; 1 test/100 LF berm

3.5 LOW-PERMEABILITY SOIL LAYER

3.5.1 Observation Requirements

The placement of low-permeability soil layer must be carefully monitored to verify conformance with the specified degree of compaction, layer thickness, and maximum saturated hydraulic conductivity. These characteristics are used to assess the layer's ability to impede the flow of liquids through the layer.

The CQA Officer is responsible for viewing the installed low-permeability soil layer to confirm that the low-permeability soil layer is ready for the placement of the geomembrane liner. At a minimum, the CQA Officer should:

- View incoming material loads to visually assess moisture and other characteristics.
- Observe the material as it is being installed to confirm that:
  - the material remains uniform and relatively consistent in gradation;
  - the soil is installed in approximate 8-inch thick compacted lifts (minimum thickness at each location shall be 24 inches);
  - the low-permeability soil layer is at least 24 inches thick;
  - clod sizes are minimized to the extent possible;
  - the material is installed at the appropriate moisture conditions;
  - the soil is protected prior to and after compaction to limit desiccation;
  - enough passes are made by the compaction equipment to achieve suitable compaction, and;
  - bonding between lifts is maximized by "tracking" each lift prior to the installation of successive lifts.
- Observe and verify in-situ density and moisture content tests.
- Review a record drawing of the low-permeability soil layer prepared by the Earthwork Contractor's registered land surveyor; final slopes must be no less than 2 percent nor more than 33 percent.

Each of these activities must be observed and carefully documented by the CQA Officer. Soils shall conform to the Technical Specifications Section as provided in Section 5 of this Plan.

The CQA Officer may also excavate test pits where more than one lift of material is provided to evaluate the bonding between successive lifts. Those areas exhibiting distinct layering or inadequate bonding between lifts must be reworked.

Perforations in the low-permeability soil layer that results from nuclear density test probe locations, sample tubes locations or test pit locations shall be backfilled and compacted by hand with bentonite or low permeability soil obtained from an on-site stockpile.

3.5.2 Pre-Construction Testing Requirements

A sample of the low-permeability soil shall be collected from each borrow source used by the CQA Officer or Designated Representative and delivered to a qualified independent geotechnical testing laboratory for analysis. The sample shall be sent to a qualified independent geotechnical testing laboratory for analysis of those tests specified in Table 3 provided below. The CQA Officer will review all test results with the Certifying Engineer.

Table 3. Low Permeability Soil Layer Pre-Construction Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
Low Permeability Soil	Grain Size/Hydrometer	ASTM D422	1 Test/Source
	Moisture Content	ASTM D2216	1 Test/Source
	Atterberg Limits	ASTM D4318	1 Test/ Source
	Modified Proctor	ASTM D1557	1 Test/Source
	Permeability	ASTM D5084	1 Test/Source
	Direct Shear	ASTM D3080	1 Test/Source
	Interface Shear	ASTM D5321	1 Test/Source

3.5.3 Construction Testing Requirements

3.5.3.1 Conformance Testing Requirements

Samples of the low-permeability soil shall be collected, during placement, at minimum testing frequencies as shown in Table 4 below. The CQA Officer shall send the samples to a qualified independent geotechnical testing laboratory for analysis. The laboratory test results must be made available in a timely manner so as to allow the Certifying Engineer and/or CQA Officer time to notify the Earthworks Contractor of any deficiencies. The CQA Officer will review all test results with the Certifying Engineer.

Table 4. Low Permeability Soil Layer Construction Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
Low Permeability Soil	Grain Size/Hydrometer	ASTM D422	1 Test/2,500 CY
	Moisture Content	ASTM D2216	1 Test/1,000 CY
	Atterberg Limits	ASTM D4318	1 Test/ 1,000 CY
	Permeability	ASTM D5084	1 Test/5,000 CY
	Moisture-Density-Permeability	ASTM D1557 and ASTM D5084 (see note below)	1 Test/5,000 CY

Note: The testing lab will perform the following testing in order to provide sufficient information for the Engineer to develop a moisture-density-permeability relationship as described in the Technical Specifications.

3.5.3.2 In-Place Soil Testing

Samples of the in-place soil shall be collected via Shelby tubes at minimum testing frequencies as shown in the table below. The samples shall be sent to a qualified independent geotechnical testing laboratory for analysis by the CQA Officer. The laboratory test results must be made available in a timely manner so as to allow the Certifying Engineer and/or CQA Officer time to notify the Earthwork Contractor of any deficiencies. The CQA Officer will review all test results with the Certifying Engineer.

Use of the nuclear density method is the preferred method for field density and moisture content testing due to the ease of testing and relatively large number of tests which can be performed in a short period of time. The CQA Officer or a licensed subcontractor will be responsible for conducting field density tests. Testing frequency shall be, at a minimum, nine compaction tests per lift per acre. The nuclear density gauge will be checked daily by performing a standard count to ensure it is functioning properly.

At locations where the field-testing indicates densities below the requirements of the specification, these areas shall be reworked by the Earthwork Contractor and re-tested. Table 5 below details the types of tests and minimum testing frequencies required for the low-permeability soil during the construction process.

Table 5. Low Permeability Soil In-Place Testing

Material	Test	Standard	Min. Test Frequency
Low Permeability Soil	Permeability	ASTM D5084	1 Test/Acre/Lift
	Field Density/Moisture Content	ASTM D2922/C3017	9 Tests/Acre/Lift

3.6 GEOMEMBRANE LINERS

3.6.1 Observation Requirements

The geomembrane shall be a 60-mil textured high density polyethylene (HDPE) liner. The installation of the geomembrane liners will include the following related activities:

- Delivery of geomembrane materials to the project site,
- Final observations of the low permeability soil layer before placement of the geomembrane,
- Delivery of geomembrane materials to the work area from the on-site storage area,
- Deployment and positioning of geomembrane panels,
- Geomembrane seaming and testing of seams, and
- Anchoring of geomembrane panels in an anchor trench.

Each of these activities must be observed and carefully documented by the CQA Officer. Documentation will include a summary table of geomembrane installation indicating the total number of seaming crew, number of machines used (fusion and extrusion) and the number of trial welds performed. Geomembrane liner shall conform to the Technical Specifications Section 02500.

In addition to observation and documentation of geomembrane deployment, testing must be performed on samples of geomembrane to verify its conformance with project specifications. Testing must also be performed on seams constructed in the field. All independent laboratory geosynthetics testing must be performed by a Geosynthetics Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) certified laboratory. The CQA Officer is responsible for observing and verifying that samples are collected by the Geosynthetics Contractor for these conformance/acceptance tests as well as observing collection of seam samples for laboratory testing, observing testing of trial seams, and observing non-destructive testing of seams.

The CQA Officer will observe the texturing of the geomembrane liner to ensure consistency across the panel. The texturing of each deployed panel will be compared to an archived sample previously obtained for interface shear testing. Any panel with texturing inconsistent with the archived sample will be rejected by the CQA Officer. Additional interface shear testing may be performed on the rejected panels as directed by the CQA Officer in order to allow rejected panels to be used in the project.

3.6.2 Materials Transport and Storage

The geomembrane manufacturer and/or Geosynthetics Contractor are responsible for the safe and proper transport of all lining materials to the project site. The Geosynthetics Contractor will ensure the scheduled arrival date of the geomembrane is acceptable to the Facility Manager and the CQA Officer will verify that the storage area has been properly prepared. The geomembrane should be delivered before the final clay lift placement to avoid desiccation and the need to rework desiccated areas.

Once the geomembrane has arrived, the CQA Officer is responsible for viewing all materials for visual evidence of damage and the conditions under which the geomembrane was transported to the project site. Observations shall be documented and, if possible, should be performed in the presence of a representative of the manufacturer or Geosynthetics Contractor. The observations should include the following:

- Observe the unloading of the geomembrane at the designated on-site storage area. The storage area must be sufficiently distant from heavy equipment traffic and accessible only to authorized personnel.
- Confirm material quantities.
- Record geomembrane identification markings and viewing of each roll.
- Conduct a completeness review of geomembrane Quality Control Certificates. Each roll must be accompanied by a certificate which indicates the manufacturer's name, type of material, nominal thickness, specific gravity, melt flow index, percent carbon black, carbon black dispersion, roll width and length, resin batch code and date of manufacture.
- Conduct a completeness review of raw material Quality Control Certificates. Since different geomembrane rolls for a specific project may be manufactured from different resin batches, a certificate must be furnished for each resin batch.

All information compiled must be cross-checked with the project specifications.

In addition to viewing manufactured materials delivered to the project site, the CQA Officer is responsible for viewing the material's storage area. The CQA Officer should be thoroughly familiar with the manufacturer's storage specifications. Consideration should be given to ambient temperature, control of access, location with respect to vehicular traffic movements, and means proposed to protect the geomembrane from the elements. If the geomembrane is to be stored in contact with the ground, protective mats or sand may need to be spread on the surface to prevent damage from sharp rocks or debris.

3.6.3 Final Viewing of the Low Permeability Soil Layer

Before the geomembrane liner is deployed, a thorough viewing and verification of the underlying low permeability soil layer surface must be completed by the Certifying Engineer. In order to minimize transport and exposure of the geomembrane to the elements, the low permeability soil layer should be approved prior to allowing the Geosynthetics Contractor to begin geomembrane deployment.

3.6.4 Geomembrane Placement and Positioning

Panel placement should typically commence at the upgradient limit of work and progress in a downhill fashion. The panels can be placed by manually unrolling the geomembrane into position or by using heavy equipment. As much as practicable, the panels should be oriented parallel to the line of maximum slope, (i.e., oriented up and down, not across, the side slope). In corners and odd shaped geometric locations, the number of field seams should be minimized. Horizontal seams should not be within five feet of the toe of the slope in either direction and staggered so as not to be continuous throughout the construction.

After the geomembrane is completely unrolled it must be positioned. If the panel is being installed abutting a previously placed panel, care must be taken to align the sheets for seaming. When positioned, wrinkles should be worked out of the geomembrane prior to seaming. The Geosynthetics Contractor shall provide ballast as needed, usually sandbags, to prevent the movement of deployed geomembrane.

3.6.5 Geomembrane Seaming

Once adjoining panels are placed and aligned, seaming may commence. Typically, two welding methods will be employed to seam the HDPE: (1) the double-track hot-wedge weld, and (2) the extrusion weld. Prior to completing either type of weld, the geomembrane surface to be welded must be free of dust, silt and debris. Furthermore, the welding surface must be dry and at the proper temperature. The Geosynthetics Contractor should be equipped with an ample supply of rags to dry and clean the welding surface.

3.6.5.1 General Seaming Requirements

Regardless of the seaming procedure employed by the Geosynthetics Contractor, the following general requirements must be satisfied during the seaming of the geomembrane.

- Seaming shall only be performed under proper weather conditions. The highest and lowest allowable temperatures for welding is based on conditions such as ambient temperature, wind, subgrade conditions, exposure to sunlight, material type, and material thickness. Welding in extreme temperatures can be performed by increasing or decreasing the welding speeds and/or wedge temperature. Seaming shall not be performed when either air or sheet temperature is below 32° Fahrenheit (F) or above 120°F, when the sheet temperature exceeds 158° F, during periods of precipitation or when sustained winds are in excess of 20 miles/hour.
- Seaming shall be performed only when the geomembrane is dry and protected, and shall not be performed during periods of precipitation unless the material is protected. The CQA Officer shall determine whether or not the weather conditions are appropriate.
- Seams must extend the full length of the panels being joined. When seaming adjacent panels at an anchor trench, the seam shall extend completely through the anchor trench.
- Wrinkles on a seam must be removed by cutting the geomembrane and installing an overlapping patch.
- Every seam, once completed, must be tested by non-destructive testing procedures to establish its continuity. Seams which do not pass such testing must be repaired and re-tested.
- Seam samples for destructive testing must be taken at a minimum of every 1,000 linear feet of seam, per machine, per day. Additional testing may be warranted when seaming conditions are not optimal due to ambient temperature or if there is reason to suspect that the seam quality is inadequate.
- The Geosynthetics Contractor is responsible for the collection of seam samples and providing samples for field testing and archive. Duplicate samples shall be provided to the CQA Officer to send to independent laboratory for testing.

3.6.5.2 Hot-Wedge Weld

The hot-wedge weld is accomplished using a special device to heat adjoining geomembrane panels. The welding device is equipped with a heating element, referred to as the hot-wedge, which is allowed to contact the bottom of the overlapping panel and the top of the previously placed panel. Once the adjoining panels are overlapped a minimum of approximately three inches and heated via the hot-wedge, the two surfaces are squeezed together with rollers, resulting in a bond between the adjoining panels. Since the hot-wedge welding machine is equipped with two wedges and two sets of rollers, the final bond actually consists of parallel welds with an air gap between the welds. The quality of the hot-wedge weld is dependent on the temperature of the hot-wedge and the speed at which the welding is performed. Both of these variables are controlled by the machine operator.

3.6.5.3 Extrusion Weld

Extrusion welding joins abutting geomembrane panels by creating a bond between the panels with an extruded bead of high-density polyethylene. This welding process requires additional preparation above and beyond usual cleaning of the weld surface. Specifically, the weld surface must be abraded to remove the sheen on the surface of the geomembrane to provide a surface that is more conducive to accepting a weld. Abrasion of the weld surface is normally accomplished using a disc grinder with an abrasive disc. Great care must be taken to assure that the abrasion process does not sacrifice the strength of the weld by substantially diminishing the thickness of the geomembrane.

3.6.5.4 Cold Weather Seaming

When the geomembrane sheet temperature is between temperatures 32 °F and 40°F, the following may apply to seaming operations at the discretion of the CQA Officer:

- Trial welds may be performed more frequently as the length of time a seaming crew may work will likely be reduced.
- Trial welds may be given additional scrutiny. It is particularly important, in cold weather, to make sure trial seams are made under the same conditions as will be experienced in the work-area. Since the substrate will be cold, the trial weld must simulate this condition.
- The CQA Officer may require an increase in the frequency of destructive testing, if seam strength or seam integrity is suspect.

When the geomembrane sheet temperature is 32°F or less, approval to seam is required from the New York State Department of Environmental Conservation (NYSDEC). The Geosynthetic Contractor must prepare appropriate protocol, at a minimum following the procedures described in GRI-GM9 – "Standard Practices Cold Weather Seaming of Geomembranes" for submission and approval.

3.6.5.5 Hot Weather Seaming

Seaming in hot weather will likely be controlled by the ability of the seaming crew to work under such conditions. Also, during high temperature conditions seam "burn-outs" can occur. If an excessive number of "burn-outs" occur, seaming operations should cease. The effects of high temperatures on seaming may be counteracted by increasing the speed of seaming or decreasing the welding temperature. However, this may affect seam strength so seam quality should be checked via trial welds and/or additional destructive tests.

3.6.6 Quality Control Testing Requirements

3.6.6.1 Geomembrane Resin

The manufacturer of the geomembrane shall supply the CQA Officer with quality control certificates on each batch of resin used to produce geomembrane and welding rod for the project. The certificates shall be prepared by the resin producer and provide results of tests indicated in Table 6 below.

Table 6. Geomembrane Resin Properties and Quality Control Testing Requirements

Test	Standard	HDPE Value
Density	ASTM D1505	0.932 g/cc (min.)
Melt Flow Index	ASTM D1238	1.0 g/10 minutes (max.)

3.6.6.2 Geomembrane Rolls

The manufacturer of the geomembrane shall supply the CQA Officer with quality control certificates on each roll of geomembrane material used for the project. The certificates shall be prepared by the geomembrane manufacturer and provide results of tests indicated in Table 7 below.

Table 7. 60-Mil HDPE Geomembrane Testing Frequency and Test Methods[1]		
Test	**Frequency**	**Value**
Thickness (ASTM D5994)	Each roll	57 mil (min. avg.) 8 out of 10 values[2] = 54 mil (min.) 10 out of 10 values[3] = 51 mil (min.)
Asperity Height (ASTM D7466)	Every second roll	16 mil (min. avg.)
Density (ASTM D1505/792)	200,000 lbs.	0.940 g/cc (min. avg.)
Tensile Properties (ASTM D6693 – Type IV)	20,000 lbs.	Yield strength: 126 ppi Break Strength: 90 ppi Yield elongation: 12% Break elongation: 100%
Tear Resistance (ASTM D1004)	45,000 lbs.	42 lbs. (min. avg.)
Puncture Resistance (ASTM D4833)	45,000 lbs.	90 lbs. (min. avg.)
Stress Crack Resistance (ASTM D5397)[4]	per GRI GM10	500 hr
Carbon Black Content (ASTM D4218)	20,000 lbs.	2%-3%
Carbon Black Dispersion (ASTM D5596)	45,000 lbs.	9 values: Category 1 or 2 1 value: Category 3
Oxidative Induction Time (OIT) (e) Standard OIT (ASTM D3895) — or — (f) High Pressure OIT (ASTM D5885)	200,000 lbs.	100 (min. avg.) 400 (min. avg.)
Oven Aging at 85°C (ASTM D5721) (a) Standard OIT - % ret. after 90 days (ASTM D3895) — or — (b) High Pressure OIT - % ret. after 90 days (ASTM D5885)	per formulation	55% (min. avg.) 80% (min. avg.)

Table 7. 60-Mil HDPE Geomembrane Testing Frequency and Test Methods[1]		
Test	**Frequency**	**Value**
UV Resistance (GM11) (a) Standard OIT (ASTM D3895) — or — (b) High Pressure OIT -% ret. after 1600 hrs. (ASTM D5885)	per formulation	N.R.[5] 50% (min. avg.)

Notes: 1. Properties presented in this table are based on GRI GM13, Test Methods, Test Properties and Testing.
Frequency for HDPE Smooth and Textured Geomembranes, Revision 12, dated 11/14/2014.
2. Lowest individual for 8 out of 10 values.
3. Lowest individual for any of the 10 values.
4. See note #4 in table 2(a) of GRI GM13.
5. See note #10 in table 2(a) of GRI GM13.

The geomembrane manufacturer shall provide certification proving that the geomembrane to be utilized is approved by GRI Test Method GM13 (high-density polyethylene geomembrane) as developed by Geosynthetic Research Institute.

3.6.7 Quality Assurance Testing Requirements

3.6.7.1 Geomembrane Delivered to Project

The Geosynthetics Contractor is responsible for taking, and the CQA Officer is responsible for observing and verifying, one sample per 100,000 square feet of material delivered to the site. The samples should be a minimum of three (3) feet long by the entire roll width and should not include the first five (5) feet of roll length. Each sample should be marked with the following information: the manufacturer's roll identification number, the date the sample was obtained, and the machine direction. The samples shall be sent to an independent testing laboratory for analysis of those tests specified in the table provided below.

Table 8. Geomembrane Quality Assurance Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
60-mil Textured HDPE Geomembrane	Thickness	ASTM D5994	1 Test/100,000 SF
	Density	ASTM D1505	1 Test/100,000 SF
	Asperity Height	GRI-GM 12	1 Test/100,000 SF
	Tensile Properties	ASTM D638	1 Test/100,000 SF
	Tear Resistance	ASTM D1004	1 Test/100,000 SF
	Puncture Resistance	ASTM D4833	1 Test/100,000 SF
	Carbon Black Content	ASTM D1603	1 Test/100,000 SF
	Carbon Black Dispersion	ASTM D5596	1 Test/100,000 SF

3.6.8 Interface Shear Testing Requirements

Interface shear testing will be performed on each interface of the geosynthetic base liner system in accordance with ASTM D5321. Direct shear testing will be performed on each base liner soil material in accordance with ASTM D3080. Normal stresses applied to each test will be 500 psf, 5,000 psf and 10,000 psf. The materials should be hydrated to equilibrium conditions, as appropriate, and sheared under drained conditions. The following are the interfaces with testing conditions:

- Low-permeability soil/ geomembrane – to be tested at a compaction of approximately 85% of the maximum dry density for low-permeability soil and under saturated conditions.
- Geomembrane/Geotextile

The samples of geomembrane should be a minimum of three (3) feet long by the entire roll width and should not include the first five (5) feet of roll length. A one (1) foot by the entire roll width portion of each interface sample shall be retained on site for comparison with deployed panels (see Section 3.6.1).

When testing the interface shear of any material against textured geomembrane material, the test shall be performed on the smoothest portion of the geomembrane sample as determined by an asperity height gauge.

3.6.9 Construction Testing Requirements

Testing of the geomembrane seams shall be performed in accordance with ASTM D-6392, in conjunction with GRI-GM19. All seams shall meet the requirements in Table 9 below:

Table 9. Field Seam Strength Requirements				
Material	**Peel Strength**		**Peel Separation**	**Shear Strength**
	Extrusion Weld	**Hot Wedge Weld**		
60 mil textured HDPE	78 ppi	91 ppi	25%	120 ppi

3.6.9.1 Trial Seams

Trial welds shall be performed with each welding apparatus to be used as follows:

- At the beginning of each seaming period,
- At least once every four (4) hours,
- When a different operator takes over running the welding equipment, and
- When the welding equipment has been shut off or has been unused for a period for one hour or longer.

Trial welds shall be performed on fragment pieces of geomembrane, varying in length between three-feet (extrusion welds) to ten-feet (double-track welds) long and one (1) foot wide. Once completed, the weld shall be visually inspected for deficiencies before taking a minimum of seven, one-inch wide random specimens from the trial weld. Each specimen shall be tested in the field by the Geosynthetics Contractor for peel and sheer strength (five in peel, two in shear) using a field tensiometer with the results being properly recorded by the Geosynthetics Contractor and CQA Officer. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. All trial weld specimens shall exhibit a film tear bond (FTB) and meet or exceed the minimum seam strength requirements. Only those pieces of equipment which provide passing test results shall be used for seaming or repair work.

Additional trial welds must be performed for failed samples. The welding conditions shall be altered, including adjusting the temperature of the hot-wedge (or extrusion welding gun) and/or the speed at which the weld is performed. Once adjustments have been made, additional trial welds shall be made on fragments of geomembrane, which shall be re-tested. If the specimen fails, the seaming apparatus and procedures will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive successful trial welds are achieved.

Trial welds shall be performed by the welder responsible for using that piece of equipment. The objective of the trial weld is to simulate field-seaming conditions. No attempt should be made to create an ideal environment for completing a trial weld.

The CQA Officer will:

- observe and document the trial welds,
- confirm trial weld samples are properly labeled (e.g., machine number, welder, temperature control setting, and test results), and
- archive trial welds for the Facility Manager.

3.6.9.2 Non-Destructive Testing

The purpose of non-destructive seam testing is to verify the continuity of a field seam, not to provide an indication of the seam's strength. All seams constructed in the field shall be subjected to non-destructive testing along their entire lengths. The CQA Officer will observe the tests, record test results, the name of the individual performing the test, and the location of the test. Areas found to be defective shall be marked as requiring repair. In general, seam testing should be done immediately following seaming operations. The Geosynthetic Contractor should not be permitted to complete all field seams prior to the commencement of testing.

Non-destructive seam tests should be completed using the Air Pressure Test or the Vacuum Box Test as outlined in this section, unless otherwise approved by the Certifying Engineer and/or CQA Officer.

Air Pressure Test

The air pressure test will be performed on all double-track hot-wedge welds. This test method involves the application of air pressure to the channel between the parallel welds for a specified period of time and observing the stability of the pressure for the duration of the test.

The usual procedure for completing an air pressure test is as follows:

- Seal both ends of the seam length to be tested.
- Insert air feed device (usually a hollow needle) into the air channel between the two parallel welds.
- Pressurize the air channel to a pressure between 27 and 30 psi and then cease airflow to the seam by closing the valve in the air feed line.
- Once pressurized, the seam should be allowed a "relaxing period" of at least 2 minutes. This period will allow the air temperature and pressure in the seam channel to stabilize.
- Record seam pressure at the end of the "relaxing period" and use the recorded pressure as the initial pressure for the seam test. If the initial pressure is below 27 psi, additional air shall be introduced into the seam channel so that a minimum pressure is used to start the test.
- Allow seam channel to stand for 5 minutes. If a pressure loss exceeding 3 psi is observed, the seam shall be considered discontinuous and repairs will have to be made.
- At the conclusion of a passing seam channel test, the end of the seam channel opposite the pressure test gauge must be cut to relieve the test pressure. If the pressure gauge does not detect the loss of pressure it must be assumed that the seam channel is blocked. In this case the location of the blockage must be identified and the seam retested in segments for continuity.

Following the seam test, the CQA Officer will verify that seam channel perforations and cuts made during the test have been properly sealed. Any defective areas shall be marked, repaired, and re-tested by the Geosynthetics Contractor using the vacuum box test method, as detailed in the next section.

Table 10. Air Pressure Testing

Material	Test	Standard	Min. Test Frequency
HDPE Geomembrane	Seam Continuity	GRI-GM6	100% Double Fusion Welds

Vacuum Box Test

The vacuum box test is typically used on seams which cannot be tested by air pressurization. This test is predominantly used on extrusion welds used for patches and repairs.

The procedure for completing a vacuum box test is as follows:

- Apply a generous amount of soapy solution to the seam length to be tested.
- Place vacuum box test apparatus over wetted portion of the seam and apply a vacuum of at least 2 psi to the seam or until the tested area has risen off the ground due to the applied vacuum.
- During the test, the response of the soapy solution on the weld should be observed and noted. Bubbling of the solution indicates the presence of a hole or discontinuity, the location of which shall be marked and repaired.
- Move the vacuum box over to adjoining areas and repeat the process.

Since the test apparatus must be moved along the length of the seam in order to perform a complete seam continuity test, the CQA Officer must confirm segments of the seam are not passed over and that each test is conducted properly.

Table 11. Vacuum Box Testing

Material	Test	Standard	Min. Test Frequency
HDPE Geomembrane	Seam Continuity	Vacuum Box Test	100% Extrusion Welds

3.6.9.3 Destructive Testing

The non-destructive seam testing procedures presented in Section 3.5.9.2 only establish seam continuity and not seam strength; they do not provide for a quantitative comparison with specified seam qualities. As a result, samples of completed seams must be collected and subjected to laboratory examination. At a minimum, one seam sample must be taken, at random, every 1,000 feet of seam welded, per seaming machine, per day. If field conditions warrant, or the CQA Officer suspects a seam may not have been constructed properly, samples may be collected at a greater frequency.

Sample Collection

One seam sample shall be collected, at random, a minimum of every 1,000 feet of seam, per seaming machine, per day. Each sample shall be cut from the seam by the Geosynthetics Contractor. The CQA Officer will:

- Specify locations for the test samples.
- Observe the collection of samples.
- Identify the sample with a number and verify it is marked accordingly.
- Note the sample location, the date, the reason for sampling (e.g., random sample, previous failure), and other pertinent information in the project log.
- Confirm that the sample location is repaired as soon as practicable following sample collection.

Sample Size

Destructive samples shall be approximately twelve (12) inches wide and fifty (50) inches long, centered over the seam. Seven 1-inch wide by 12-inch long specimens shall be cut from each sample by the Geosynthetics Contractor. Each specimen shall be tested in the field by the Geosynthetics Contractor for peel and sheer strength (five in peel, two in shear) using a field tensiometer with the results being properly recorded by the Geosynthetics Contractor and CQA Officer. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. All specimens shall exhibit a film tear bond (FTB). The peel strength of four out of five specimens in peel shall meet or exceed the minimum seam strength requirements. The fifth specimen must meet or exceed 80% of the minimum seam strength requirements. If the sample passes the field peel and shear tests, the remaining sections shall be cut and distributed as follows:

- one 12 inch by 12 inch section for the CQA Officer to preserve for the Facility Manager's archives,
- one 12 inch by 12 inch section for the Geosynthetics Contractor, and
- one 12 inch by 18 inch section for shear and peel testing by the Geosynthetics Contractor’s independent laboratory.

Laboratory Testing

An independent testing laboratory will perform all material conformance testing and confirmation of the field destructive seam testing. Samples should be collected, packaged, and sent to the independent laboratory on the same day that the samples are obtained by the CQA Officer.

All independent laboratory testing shall be in accordance with the requirements of this specification. Conformance testing shall conform to the standards listed and destructive seam samples will be tested for peel and shear strength. For each destructive sample submitted, five (5) specimens shall be tested under each test method. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. The peel strength of four out of five specimens in peel shall meet or exceed the minimum seam strength requirements. The fifth specimen must meet or exceed 80% of the minimum seam strength requirements.

Laboratory results shall become available in a timely manner so as to allow the Certifying Engineer or CQA Officer time to notify the Geosynthetics Contractor of any failures. No areas of the geomembrane may be covered prior to receiving test results from the independent laboratory.

Sample Failure Response

If the sample fails the peel and shear tests by the Geosynthetics Contractor's independent laboratory, then the Geosynthetics Contractor has the following options to reconstruct the seam between the failed location and any passed test section:

- cap stripping of the seam, or
- replacing the failed seam with a new two foot wide panel which is double-track welded to the adjacent panels, or
- retrace the failed seam in both directions, by taking additional samples for destructive testing and conducting field peel and shear tests, until the length of the poor quality seam is established. Additional destructive samples shall be collected at minimum intervals of ten (10) feet from the location of the failed sample. Upon attaining passing results from the destructive samples, the seam shall be reconstructed between the passing location and the original failed location.

All passing seams shall be bounded by two locations from which passing laboratory destructive tests have been taken. Reconstructed seams of over 50 feet or more in length must have a sample taken from the reconstructed seam in order to pass the destructive testing.

Table 12. Destructive Testing			
Material	**Test**	**Standard**	**Min. Test Frequency**
HDPE Geomembrane	Seam Peel[1]	ASTM D6392	1 Test/1,000 LF/seaming machine
	Seam Shear	ASTM D6392	1 Test/1,000 LF/seaming machine
1. Both welds shall be tested on samples of double-track welds.			

3.6.10 Detail and Repair Work

Once the geomembrane has been deployed, the panels must be examined for flaws, holes, defects and tears. Each location requiring a repair shall be repaired using the following procedures:

- Patching - A patch shall be used to repair defects in the geomembrane which are 1/8-inch or larger.
- Abrading and Re-welding - This procedure may be used to repair seam sections which are less than 10 feet in length.
- Spot Welding - Spot welding may be used to repair small tears, pinholes and/or other small defects.
- Capping – Capping shall be used to repair failed seams that are greater than 10 feet in length.

Patches or caps shall extend at least six inches beyond the edge of the defect. The edges of the new section of liner shall be extrusion welded to the old liner after the liners are abraded by a disc grinder with an abrasive disc in order to remove the sheen of the surface of the geomembrane and to provide a surface which is more conducive to accepting the weld. Welding of the repair patch is completed by extrusion welding the geomembrane. The repairs shall be non-destructive tested using the vacuum-box method.

3.7 SOIL DRAINAGE LAYER

The drainage layer is comprised of a permeable drainage layer and an interconnected network of perforated leachate collection pipes enveloped in stone.

3.7.1 Leachate Collection Pipes and Stone

3.7.1.1 Observation Requirements

The leachate collection pipes are used to convey leachate from the surface of the geomembrane liner into the leachate management system. The position of the leachate pipes are to be in accordance with locations specified on the design drawings and adjusted to field conditions, so as to provide the most effective drainage capability. During installation of leachate collection pipes, the CQA Officer will:

- view incoming loads of the leachate collection pipe and stone; and
- observe the placement of the leachate collection pipes on the surface of the underlying layer.

3.7.1.2 Pre-construction Testing

The CQA Officer or Designated Representative is responsible for taking one sample of the leachate collection stone from each source used. These samples must be sent to a qualified independent geotechnical testing laboratory for analysis of those tests specified in Table 13 provided below. The test results will be reviewed by the Certifying Engineer and the CQA Officer.

Table 13. Leachate Collection Stone Pre-Construction Testing

Material	Test	Standard	Min. Test Frequency
Leachate Collection Stone	Grain Size	ASTM D422	1 Test/Each Source
	Carbonate Content	ASTM D3042	1 Test/Each Source
Note: Carbonate content should be performed using a solution with a pH representative of landfill leachate.			

3.7.2 Drainage Layer Materials

3.7.2.1 Observation Requirements

The drainage layer materials are used to protect the geomembrane liner and convey leachate from the geomembrane surface to the leachate collection pipes. During installation of the drainage layer, the CQA Officer will:

- View incoming loads of the drainage layer material,
- Observe and record the placement of the drainage layer on the surface of the geomembrane liner, and
- Collect samples of the drainage layer for specified compliance testing.

Each of these activities must be observed and carefully documented by the CQA Officer. Soils shall conform to the Technical Specifications Section 02550.

3.7.2.2 Pre-Construction Testing Requirements

The CQA Officer or Designated Representative is responsible for taking one sample of the drainage material from each source used. These samples must be sent to a qualified independent geotechnical testing laboratory for analysis of those tests specified in Table 14 provided below. The test results will be reviewed by the Certifying Engineer and the CQA Officer.

Table 14. Drainage Layer Pre-Construction Testing

Material	Test	Standard	Min. Test Frequency
Drainage Layer	Grain Size	ASTM D422	1 Test/Each Source
	Permeability	ASTM D2434	1 Test/Each Source
	Carbonate Content	ASTM D4373	1 Test/Each Source
	Direct Shear	ASTM D3080	1 Test/Each Source

Note:

- *Carbonate content should be performed using a solution with a pH representative of landfill leachate.*
- *Direct shear testing and interface shear testing (geotextile/drainage layer material) shall be completed before construction commences.*

3.7.2.3 Construction Testing Requirements

The Certifying Engineer and the CQA Officer must confirm that the necessary grain size and hydraulic conductivity tests have been performed. One sample of the drainage layer material shall be collected at the frequencies shown below (see Table 15 below) and sent to a qualified independent geotechnical laboratory by the CQA Officer. The laboratory results must become available in a timely manner so as to allow the Certifying Engineer or CQA Officer time to notify the Earthworks Contractor of any deficiencies.

Table 15. Drainage Layer Construction Testing

Material	Test	Standard	Min. Test Frequency
Drainage Layer	Grain Size	ASTM D422	1 Test/1,000 CY
	Permeability	ASTM D2434	1 Test/2,500 CY delivered 1 Test/2,500 CY in-place

3.8 STORM WATER CONTROLS

3.8.1 Observation Requirements

Storm water controls such as drainage swales, storm water basins, culverts, and associated stormwater infrastructure shall be installed to the line and grade as shown on the Contract Drawings. The CQA Officer is responsible for confirming that materials installed conform to the Technical Specifications Section and the Contract Drawings.

4.0 DOCUMENTATION AND RECORD-KEEPING

The effectiveness of a CQA plan is largely dependent on the ability to properly monitor and document all activities. It is the responsibility of the CQA Officer to observe and document the activities of the Contractors in sufficient detail and with sufficient continuity to provide a high level of confidence and to produce sufficient documentation that the work product complies with the Contract Drawings and specifications. Documentation to be provided by the CQA Officer shall include work summaries of construction activities, laboratory test results, and design and specification revisions.

4.1 DAILY RECORD-KEEPING

The CQA Officer will compile logs which detail such items as the construction activities, observation and testing data sheets, and meetings. The daily construction log should include the quantities and types of material and or equipment installed, the equipment used and the CQA/CQC Officer(s) present at the site. The observation and testing data sheets should include where soil samples are collected and tested, and the sample numbers sent to the lab for testing. All meetings and/or discussions of any construction problems, along with the actions taken to alleviate the problem, shall also be documented.

4.2 OBSERVATION AND TESTING REPORTS

The CQA Officer will compile and maintain a complete record of material test results.

4.3 CHANGES TO SPECIFICATIONS/DRAWINGS

In the event that any design and/or specification changes are required, the CQA Officer shall notify the Certifying Engineer. Design and/or specification changes shall be made only with the agreement of the Certifying Engineer and shall take the form of an addendum to the specifications or Design Drawings.

4.4 DEFICIENCIES/CORRECTIVE MEASURES REPORTS

In the event that problems or work deficiencies arise, the CQA Officer should determine the nature and extent of the deficiency, notify the Contractors and the Certifying Engineer, and properly document the situation. The procedure for handling such a situation is to define and discuss the problem/deficiency, review any alternative solutions, and record the Contractor's implementation of a plan to resolve the problem/deficiency. In the event the issue is not resolved, the CQA Officer or the Certifying Engineer shall notify the Owner.

4.5 RECORD DRAWINGS

After the project has been completed, record drawings should be prepared to document the as-built conditions of the site. The record drawings shall be prepared by the Contractor's registered professional land surveyor and should present the limits and elevations of the components of the base liner system and the overall constructed work product. The Contractor shall also prepare a record drawing showing the geomembrane liner installed, including the approximate locations of panels, field seams, and destructive tests.

4.6 FINAL REPORT

After completion of the construction work, the Certifying Engineer and CQA Officer will prepare a final certification report in accordance with Part 360 2.13. The purpose of this report is to certify that the work has been performed in general compliance with Part 360 requirements, and the Contract Drawings and Specifications, and shall include supporting documentation.

5.0 MEETINGS

5.1 PRE-CONSTRUCTION MEETING

Upon award of the construction contract, a pre-construction meeting will be scheduled with mandatory attendance of the Owner, Engineer, CQA/CQC personnel and the Contractor. The meeting shall address the following topics, at a minimum:

- Distribution of relevant CQA/CQC documents and supporting information, including this document and the Contractors CQC Plan
- Addressing the site-specific CQA/CQC plan and its role relative to the design criteria, plans, and specifications
- Reviewing the responsibilities, authorities and lines of communication for each of the parties involved
- Reviewing the established procedures for observation and testing
- Reviewing the established acceptance and rejection procedures in the CQA/CQC Plan and approved specifications, along with methods and means for decision making and/or resolution of problems regarding data
- Reviewing methods for documenting and reporting all inspection
- Discussing procedures for the storage and protection of landfill construction materials on-site
- Conducting a site walk to review the project site layout and construction material and equipment storage locations.

The meeting minutes from this meeting will become part of the Contract file.

5.2 PROGRESS MEETINGS

Progress meetings should be held on a routine basis. These meetings may be necessary in order to solve problems, improve lines of communication and discuss the status of the project to date. DEC representatives should be invited to each meeting to facilitate communication and improve oversight.

5.3 FINAL VIEWING OF WORK

At the completion of the project, a final viewing of the work should be performed. The Owner, the Certifying Engineer, CQA Officer and Contractors should walk the site to view the construction.

APPENDIX F

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

DUNN C&D FACILITY

Prepared For:

S.A. DUNN LANDFILL AND COMPANY, LLC

Prepared By:

CIVIL & ENVIRONMENTAL ENGINEERING,
LANDSCAPE ARCHITECTURE AND LAND SURVEYING, PLLC

CEE Project 182-442

JANUARY 2022

TECHNICAL SPECIFICATIONS
DUNN C&D FACILITY
RENSSELAER, NY

Section No.	Section Title	Page No.
DIVISION 1 - GENERAL REQUIREMENTS		
01000	GENERAL REQUIREMENTS	01000-1
01120	ENVIRONMENTAL PROTECTION PLAN	01120-1
01200	PROJECT MEETINGS AND ADMINISTRATION	01200-1
01330	SUBMITTALS	01330-1
01450	CONTROL OF WORK	01450-1
01500	CONSTRUCTION FACILITIES AND TEMPORARY UTILITIES	01500-1
01525	HEALTH AND SAFETY PLAN/RESPONSIBILITIES	01525-1
01560	DUST, ODOR AND NOISE CONTROL	01560-1
01600	MATERIALS AND EQUIPMENT	01600-1
01669	TESTING PIPE SYSTEMS	01669-1
01740	PROJECT FINAL CLEAN-UP	01740-1
01770	CONTRACT CLOSE-OUT	01770-1
DIVISION 2 - SITEWORK		
02100	EROSION CONTROL	02100-1
02150	EXCAVATION & TRENCHING	02150-1
02175	CLEARING & GRUBBING	02175-1
02200	GENERAL FILL	02200-1
02210	SUBGRADE	02210-1
02300	LOW PERMEABILITY SOIL LINER	02300-1

02500	HDPE GEOMEMBRANE	02500-1
02550	DRAINAGE LAYER	02550-1
02595	GEOTEXTILES	02595-1
02800	ACCESS ROADS	02800-1
02810	STONE	02810-1
02820	HDPE PIPES & FITTINGS	02820-1
02850	STORMWATER CONTROLS	02850-1
02880	LOAM/SEEDING/EROSION MAT	02880-1

DIVISION 1 - GENERAL

SECTION 01000
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. REFERENCE POINTS - Construction reference monuments and benchmarks have been established for use in controlling the construction work. All work shall be constructed based on and in relation to these reference points. The CONTRACTOR shall be responsible for re-establishing any reference points disturbed during construction. Disturbed or destroyed points shall be re-established at the CONTRACTOR's expense, as directed by the OWNER.

B. SURVEYING - The CONTRACTOR shall be responsible for all surveying required to layout and control their work. The CONTRACTOR shall furnish the OWNER with "Record Drawings" (also referred to as "as-built" drawings) in accordance with Section 01780. All surveys shall use the coordinate system as required by the OWNER.

C. CONSTRUCTION TOLERANCES - Unless otherwise stated herein, construction tolerances shall be +0.2 feet horizontally, and +0.1 feet vertically. All surfaces shall be reasonably free from irregularities. Slopes or grades shall not be less than specified minimums or greater than specified maximums as shown on the Drawings. Thicknesses of soil components shall be no less than specified and/or shown on the Drawings.

D. PERMITS - The CONTRACTOR shall be required to obtain all local, state and federal permits related to specific construction equipment or techniques he intends to employ to accomplish the work.

E. SEDIMENTATION, EROSION CONTROL, AND DEWATERING – The CONTRACTOR shall comply with all requirements for controlling erosion, water pollution, and dust emissions resulting from construction activities; the CONTRACTOR shall be responsible for any fines imposed due to noncompliance. The CONTRACTOR shall review, sign and agree to maintain the site in accordance with the Contract Documents, and the site specific Storm Water Pollution Prevention Plan (SWPPP) prepared for the Work, at a minimum. The OWNER has submitted to New York Department of Environmental Conservation a Notice of Intent (NOI) for the SWPPP for Storm Water Discharges associated with the construction activity, copies of which will be provided to the CONTRACTOR. Notwithstanding the provisions of other Sections of the Technical Specifications, the CONTRACTOR is responsible for developing an Erosion Control Plan implementing the requirements of the SWPPP. Each week,

CONTRACTOR shall provide to the OWNER a summary of all activities performed the previous week in order to comply with the SWPPP, including copies of inspection reports and other documentation.

F. WORK LIMITS - All clearing, stripping, excavation, backfill, and surfacing shall be done to the lines, grades, and dimensions called for on the Drawings and Specifications unless directed otherwise by the OWNER and/or CERTIFYING ENGINEER. All work done beyond designated limits without prior approval shall be corrected to the OWNER's satisfaction, at no additional cost to the OWNER.

G. PROTECTION OF EXISTING SERVICES AND WELLS - The CONTRACTOR shall exercise care to avoid disturbing or damaging the existing monitoring or observation wells, manholes, electrical poles and lines, permanent drainage structures, leachate forcemains, temporary utilities and structures, or items which exist at the site. If the CONTRACTOR encounters any unexpected underground utilities during the course of the work, the CONTRACTOR shall immediately inform the OWNER who will determine whether or not the utility is active. If the work requires the CONTRACTOR to be near or cross known utilities, the CONTRACTOR shall carefully uncover, support and protect these utilities and shall not cut, damage, or otherwise disturb them without prior authorization from the OWNER. All utilities or wells damaged by the CONTRACTOR shall be immediately repaired by the CONTRACTOR to the satisfaction of the OWNER, and no additional cost to the OWNER.

H. EXCAVATED SOILS - Clean soils excavated during construction activities may be utilized for backfill only with the approval of the OWNER and/or the CERTIFYING ENGINEER.

I. EXPLOSIVES - The use of explosives for demolition or excavation will not be permitted without prior written approval of the OWNER. If explosives are required to complete the job, the responsibility of any required permits and/or any required notifications to local, state or federal authorities is the responsibility of the CONTRACTOR.

J. BURNING - The burning of any materials at the site will not be permitted without prior written approval of the OWNER. The responsibility of any required permits and/or any required notifications to local, state or federal authorities is the responsibility of the CONTRACTOR.

K. TEMPORARY ROADS - The CONTRACTOR shall be responsible for constructing and maintaining all temporary roads that may be required in the execution of their work. Material laydown areas shall be designated, prepared and maintained by the by the CONTRACTOR. Material laydown areas shall be approved by the OWNER.

L. ACCESS ROADS – The CONTRACTOR shall be responsible for cleaning any and all soil materials deposited on on-site access roads and public roadways by project-generated traffic. The CONTRACTOR shall maintain on site or maintain access to a broom or vacuum-type street sweeper for this purpose. CONTRACTOR shall routinely inspect all access points to public roadways by project-generated traffic to ensure there is no off-site tracking of materials. CONTRACTOR shall clean any soil deposited on off-site roadways to the satisfaction of the OWNER as soon as possible upon becoming aware of such an occurrence, but no later than one (1) hour after becoming aware of such an occurrence.

M. CONSTRUCTION WATER - The quality of construction water used to accomplish construction work is crucial due to the nature of the facilities being constructed and environmental monitoring requirements imposed on the site. The CONTRACTOR may obtain water for general construction and dust control purposes from the reservoir between the north and south pits or other location on-site approved by the OWNER. The CONTRACTOR shall not add substances (such as soap) to construction water. The CONTRACTOR shall utilize measuring devices that allow the volume of water used to be tracked.

N. COOPERATION - The CONTRACTOR shall cooperate with all other parties engaged in project-related activities to the greatest extent possible. Disputes or problems should be referred to the OWNER for resolution.

O. FAMILIARIZATION - The CONTRACTOR is responsible for becoming familiar with all aspects of work and the site prior to performing the work.

P. SAFEGUARDS - The CONTRACTOR shall provide and use all personnel safety equipment, barricades, guardrails, signs, lights, flares, and flagmen as required by OSHA, state, or local codes and ordinances. The CONTRACTOR shall be responsible for any fines imposed due to violation of any laws and regulations relating to the safety of the CONTRACTOR's personnel. The CONTRACTOR shall ensure all subcontractors comply with this requirement.

Q. CLEAN-UP - The CONTRACTOR shall be responsible for general housekeeping during construction. Upon completion of work, the CONTRACTOR shall remove all of their equipment, facilities, construction materials and trash. All disturbed areas shall be re-vegetated or otherwise put into a condition satisfactory to the OWNER.

R. SECURITY - The CONTRACTOR is responsible for the safety and condition of all of its tools and equipment. The OWNER and OWNER's agents will not be responsible for lost or stolen materials or equipment.

S. HEALTH AND SAFETY TRAINING - The CONTRACTOR shall provide necessary health and safety training for all of the CONTRACTOR's and subcontractors on-site personnel in accordance with applicable local, state, and federal regulations. The CONTRACTOR and its subcontractors shall attend the OWNER'S health and safety training program. The OWNER may require evidence of health and safety training at any time for any of the CONTRACTOR's personnel and subcontractors working on site.

T. EXCLUSION AREAS - The CONTRACTOR's personnel shall not enter any areas on-site identified with signs as exclusion areas without approval of the OWNER.

U. WORK HOURS & DAYS – Work shall not begin before 6:30 a.m. and all work must end by 5:30 p.m., Monday through Friday. Work shall not begin before 8 AM and must end by 4 P.M. on Saturdays. No work will be permitted on Sundays or federal holidays. Work that does not generate noise above ambient levels at the property line may be performed at times outside these restrictions with the prior approval of the OWNER.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01120
ENVIRONMENTAL PROTECTION PLAN

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Environmental requirements.
2. Protection of soil and water resources.
3. Spillages.
4. Debris disposal.
5. Dust, odor, and noise control.

1.02 SUBMITTALS

A. Environmental Protection Plan

1. Submit prior to start of work. Work shall not commence until submittal is approved.
2. Plan shall address protection of soil and water resources, debris disposal, dust control, odor control, noise control and spill control.
3. Approval of the plans for environmental protection shall not relieve the CONTRACTOR of any responsibility for adequate and continuing control of potential environmental impacts.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Perform all Work while minimizing all potential environmental impacts on, but not limited to the air, water, and land.

B. Minimize all environmental impacts in accordance with all applicable federal, state and local laws and regulations.

1.04 PROTECTION OF SOIL OUTSIDE WORK LIMITS

A. Soil outside the limits of work performed under this Contract shall not be disturbed. Confine construction activities to areas defined by the Drawings or Specifications. Assure that any potential contaminated material does not migrate outside the limits of work.

B. Disruption of soil beyond that specifically called for in the Contract Documents will not be permitted without the prior approval of the OWNER. CONTRACTOR shall not perform any unauthorized disruption of soil and shall be responsible for restoring such disruptions, including handling of any wastes generated there from at no additional cost.

1.05 PROTECTION OF WATER RESOURCES

Do not discharge waste materials to surface or groundwater. Comply with all applicable federal, state and local laws concerning pollution of surface and ground waters.

1.06 STORMWATER CONTROL

A. Notwithstanding the provisions of other Sections of the Technical Specifications, the CONTRACTOR is responsible for developing an Environmental Protection Plan implementing the requirements of the site specific Storm Water Pollution Prevention Plan (SWPPP), a copy of which will be available to the CONTRACTOR.

B. Each Monday, CONTRACTOR shall provide to the OWNER, a summary of all activities performed the previous week to comply with the SWPPP, including copies of inspection reports and other documentation.

1.07 SPILLAGES

A. Take all necessary measures to ensure that no accidental contamination of the soil, groundwater, or other uncontaminated areas will occur from any of the activities required to perform the Work or from equipment or materials used to perform the Work. Report all spills to OWNER immediately. Take corrective action immediately, using approved emergency response and spill containment techniques in accordance with CONTRACTOR's Environmental Protection Plan and Health and Safety Plan (Section 01525).

1.08 DEBRIS DISPOSAL

A. Dispose of all waste materials in accordance with the Contract Documents, except as otherwise directed by the OWNER. If any waste material is placed in unauthorized areas, immediately remove the material and restore the area to the original undisturbed condition.

1.09 DUST CONTROL

A. As necessary, implement dust control measures to adequately protect the public, employees of CONTRACTOR, CERTIFYING ENGINEER, and OWNER. See Section 01560 for details.

1.10 ODOR CONTROL

A. As necessary, implement odor control measures to adequately protect the public and employees of CONTRACTOR, CERTIFYING ENGINEER, and OWNER. See Section 01560 for details.

1.11 NOISE CONTROL

A. As necessary, implement noise control measures to adequately protect the public and employees of CONTRACTOR, CERTIFYING ENGINEER, and OWNER. See Section 01560 for details.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 SOIL AND WATER

A. Install barriers (e.g., silt fence, straw bale, diversion berms, temporary pipes, or other) as necessary to prevent migration of contaminated materials into or outside the work area limits (see Section 02100 for details).

END OF SECTION

SECTION 01200
PROJECT MEETINGS AND ADMINISTRATION

PART 1 - GENERAL

1.01 PRE-CONSTRUCTION CONFERENCE

A. The OWNER will schedule and conduct one pre-construction conference prior to the commencement of any work at the site, to which all interested agencies will be invited to discuss their interests and requirements relating to the project. CONTRACTOR and all subcontractor representatives shall attend.

1.02 CONSTRUCTION PERIOD MEETINGS

A. Construction period meetings will be conducted at the site at weekly intervals or at a frequency designated by the OWNER. These meetings shall be attended by the OWNER, CONTRACTOR, ENGINEER and any others that are invited by these people.

B. The agenda of these project meetings will include reports on CONTRACTOR construction progress, the status of submittal reviews, the status of CONTRACTOR information requests, and any general business. The meetings will be conducted by the OWNER. OWNER shall keep and distribute minutes of the proceedings.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. This section contains requirements for administrative and work related submittals such as construction progress schedules, Shop Drawings, test results, operation and maintenance data, construction photographs, and other submittals required by Contract Documents.

1.02 COMPUTER BASED SUBMITTAL SYSTEM

A. OWNER may elect to utilize a computer-based system (such as Sharefile) for managing the submittal process. OWNER will provide CONTRACTOR with instructions and software access prior to the implementation of such a system. This specification section may be revised by the OWNER prior to initiating the computer-based system.

B. Submittal for Review:

Prepare and submit five (5) copies of each submittal for the OWNER's, or their designated representatives', review in accordance with requirements of the Contract Documents. Within two weeks of receipt by OWNER, Submittals for Review will be determined to be:

1. ACCEPTED
2. ACCEPTED AS NOTED (WITH CONDITIONS)
3. NOT ACCEPTED
4. REVISE AND RESUBMIT

and will be stamped as such. Submittals stamped REVISE AND RESUBMIT shall be re-submitted in accordance with changes or corrections noted on the original submittal.

C. Submittal for Record:

Submit required materials for inclusion into the OWNER's records. Submittal materials may or may not be reviewed by OWNER and/or CERTIFYING ENGINEER.

1.03 CONTRACTOR PLANS

A. The CONTRACTOR(S) shall prepare and submit five (5) copies of the required plan to the OWNER for review prior to the commencement of construction.

The Plans to be submitted include:

1. Construction Schedule (see Section 01310)

2. Environmental Protection Plan (see Section 01120)

3. Health and Safety Plan (see Section 01525)

1.04 SHOP DRAWINGS AND SAMPLES

A. Shop Drawings, product data, and samples shall be submitted as required in individual specification sections.

B. The CONTRACTOR shall maintain an updated submittal register identifying all required project submittals and current status for each submittal. The submittal register shall be updated and presented to the OWNER on a weekly basis.

C. Shop Drawings, product data, and samples shall be submitted as required in individual specification sections.

D. The CONTRACTOR's responsibilities:

1. Review shop drawings, product data, and samples prior to submittal.

2. Determine and verify:

   a. Field measurements.

   b. Field construction criteria.

   c. Catalog numbers and similar data.

   d. Conformance with specifications.

3. Coordinate each submittal with requirements of the Work and Contract Documents.

4. Notify the OWNER in writing, at the time of the submittal, of deviations from requirements of Contract Documents.

5. Begin no fabrication or work requiring the submittals until return of the submittals with the OWNER's approval/comments.

6. Designate in the construction progress schedule, dates for submittal and receipt of reviewed Shop Drawings and samples.

7. Submittals shall contain

   a. Date of submittal and dates of previous submittals.

   b. Project title and number.

   c. Contract identification.

   d. Names of:

      i. The CONTRACTOR(S)

      ii. Supplier

      iii. Manufacturer

      iv. Summary of items contained in the submittal.

      v. Identification of the product with identification numbers and the Drawing and Specification section number

   e. Clearly identified field dimensions.

   f. Details required on the Drawings and in the Specifications.

   g. Manufacturer, model number, dimensions, and clearances where applicable.

   h. Relation to adjacent or critical features of the Work or materials.

   i. Applicable standards, such as ASTM or Federal Specification numbers.

   j. Identification of revisions on re-submittals.

   k. The CONTRACTOR's stamp, signed, certifying to review of the submittal, verification of the products, field measurements, field construction criteria, and coordination of information within the submittal with requirements of work and Contract Documents.

8. Re-submittal Requirements:

   a. Corrections or changes in submittals required by the OWNER or CERTIFYING ENGINEER. Re-submittals are required until all comments by the OWNER or CERTIFYING ENGINEER are addressed.

9. Shop Drawings and Product Data:

   a. Revise initial drawings or data and resubmit as specified for initial submittal.

   b. Indicate changes made other than those requested by OWNER or CERTIFYING ENGINEER.

   c. Distribute reproductions of Shop Drawings and copies of product data which have been accepted by the OWNER to:

      i. Job site file.

      ii. Record documents file.

1.05 TEST RESULTS AND CERTIFICATION

A. Results of tests conducted by the CONTRACTOR(S) on materials or products shall be submitted for review so they may be included in the project record.

B. Certification of products shall be submitted for review so they may be included in the project record.

1.06 SUBMITTAL REQUIREMENTS

A. Provide complete copies of required submittals as follows:

1. Construction progress schedule.

   a. Five (5) copies of initial schedule.

   b. Five (5) copies of each revision.

2. Schedule of values.

   a. Five (5) copies of initial schedule.

   b. Five (5) copies of each revision.

3. Shop drawings: five (5) copies.

4. Certification test results: five (5) copies.

5. Other required submittals:

   a. Five (5) copies if required for review.

   b. Five (5) copies if required for record.

6. Deliver the required copies of the submittals to the OWNER.

END OF SECTION

SECTION 01450
CONTROL OF WORK

PART 1 - GENERAL

1.01 RESPONSIBILITIES OF PARTIES

A. OWNER - In the context of the project organization, OWNER is responsible for facility administration, regulatory oversight, accounting, purchasing, etc. On-site construction activities are monitored for the OWNER by OWNER's representatives, CERTIFYING ENGINEER, and CQA OFFICER.

B. CONTRACTOR - CONTRACTOR is responsible for implementing and ensuring the completion of the work. CONTRACTOR is responsible for subcontracting all work required (as needed) to complete the project and producing Record Drawings delineating the construction area and elevations. The CONTRACTOR reports to the OWNER, but may communicate daily with the CERTIFYING ENGINEER and CQA OFFICER.

C. CERTIFYING ENGINEER - The CERTIFYING ENGINEER is responsible for the design of the project and shall review any significant design changes or modifications. The CERTIFYING ENGINEER will decide all questions that arise regarding the interpretation of the Drawings and Specifications. The CERTIFYING ENGINEER reports to the OWNER. The CERTIFYING ENGINEER may communicate directly with the CONTRACTOR and CQA OFFICER to receive information. The CERTIFYING ENGINEER is responsible for preparing a final report documenting construction in accordance with the requirements of the New York State Department of Environmental Conservation.

D. CQA OFFICER - The CQA OFFICER is responsible for observing construction activities on-site. The CQA OFFICER will collect all material certifications from the CONTRACTOR. The CQA OFFICER will also manage the activities of on-site construction observation and will be responsible for reviewing all Drawings and Specifications. The CQA OFFICER is responsible to coordinate with the CERTIFYING ENGINEER for preparing a final report documenting construction in accordance with the requirements of the New York State Department of Environmental Conservation.

The CQA OFFICER reports to the OWNER. The CQA OFFICER may communicate directly with the CONTRACTOR and CERTIFYING ENGINEER to coordinate activities and receive information.

1.02 INTERPRETATION OF PLANS AND SPECIFICATIONS

A. Should it appear that the work to be done or any matters relative thereto are not sufficiently detailed or explained in the Drawings and Specifications, the CERTIFYING ENGINEER will further explain or clarify, as may be necessary. In the event of any questions arising respecting the true meaning of the Drawings and Specifications, the matter shall be referred to the CERTIFYING ENGINEER, whose decision thereon shall be final.

B. The CONTRACTOR shall provide the OWNER with a minimum of three (3) days advance notice that interpretation pertaining to the plans or specifications is requested.

1.03 TEMPORARY SUSPENSION OF THE WORK

A. The OWNER or their designated representative shall have the authority to suspend the work wholly, or in part, for such period as the OWNER may deem necessary, due to unsuitable weather, nuisance conditions caused by the work, unsafe work practices, or to such other conditions unfavorable for the suitable execution of the work.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish, install and maintain temporary utilities required for construction. Remove all temporary utilities on completion of Work.

B. Furnish, install and maintain suitable barriers as required to prevent public entry, and to protect the Work, existing facilities, trees and plants from construction operations; remove when no longer needed, or at the completion of Work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with all federal, state and local electric codes.

B. Comply with federal, state and local codes and regulations and with utility company requirements.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Materials must be new and must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 CONSTRUCTION LIGHT AND POWER

A. The CONTRACTOR shall make the necessary arrangements to provide and maintain temporary electric service during the construction period. All current consumed will be paid for by the CONTACTOR. CONTRACTOR shall be responsible for all local permits and inspections associated with temporary electric services.

B. The electrical service shall be of sufficient capacity and characteristic to supply the proper current for the various types of pumps and tools with motors, lights, temporary office trailers, and other required work. All necessary temporary supports, connections for utility wiring, panel boards, outlets, switches, lamps, lamp holders, circuit protection devices, controls, and accessories shall be provided by the CONTRACTOR.

C. All wiring materials, devices, etc., installed as part of the construction light and power work, shall be completely removed by the CONTRACTOR as permanent work is completed and the temporary services are no longer required.

2.03 WATER SUPPLY

A. The CONTRACTOR may obtain water for construction and dust control from a location to be determined at the site. The CONTRACTOR shall not add substance (such as soap) to construction water. The CONTRACTOR shall utilize measuring devices that allow him to track the volume of water used.

2.04 TEMPORARY TELEPHONE SERVICE

A. CONTRACTOR shall pay all costs for installation, maintenance and removal, and service charges for local telephone service at the construction site for the use of the CONTRACTOR, OWNER's representative(s), CERTIFYING ENGINEER, and CQA OFFICER.

2.05 TEMPORARY INTERNET SERVICE

A. CONTRACTOR shall pay all costs for installation, maintenance and removal, and service charges for a dedicated high-speed internet service at the site for use by the CONTRACTOR, OWNER's representative(s), CERTIFYING ENGINEER, and CQA OFFICER. Using routers, direct connections, or OWNER-approved secure wireless devices, internet service shall be accessible from each office of the temporary offices.

B. Internet download speed shall be at least six (6) megabytes and upload speed shall be at least 768 kilobytes.

C. Internet access may be arranged through the temporary telephone service or the local cable company.

2.06 TEMPORARY SANITARY FACILITIES

A. The CONTRACTOR shall provide sanitary facilities for use by CONTRACTOR's employees, Subcontractors and the OWNER's representatives, in compliance with laws and regulations, at the site.

B. Service, clean and maintain facilities and enclosures.

C. Location of temporary toilets shall be remote from public roadways and shall be locked when construction operations are not underway.

2.07 FIELD OFFICES AND SHEDS

A. Prior to commencement of construction at the site, the OWNER shall designate the proposed locations of temporary offices, sheds, trailers, storage areas, assembly areas for the CONTRACTOR and temporary access roads.

B. The CONTRACTOR shall provide and maintain a temporary office at the site of sufficient size for his own general use. CONTRACTOR'S temporary office shall have sufficient room to host construction progress meetings with the OWNER, OWNER'S representative(s), CERTIFYING ENGINEER, CQA OFFICER, and any subcontractors.

C. The CONTRACTOR shall provide a separate temporary office at the site for use by the OWNER'S representative, CERTIFYING ENGINEER, and CQA OFFICER.

2.08 SPECIAL CONTROLS

A. Safety

1. The CONTRACTOR, for contract work on this project, shall be responsible for full compliance with the regulations established under the Federal Occupational Safety and Health Act of 1970 (OSHA), including agreements with the U.S. Department of Labor and New York State, and any applicable amendments or revisions thereof, whether associated with the furnishing of equipment and or systems, the furnishing and installation of equipment and/or systems, the construction of facilities, the performance of services or any other similar contractual relation.

2. The CONTRACTOR shall be responsible for any violations of the regulations including payment of costs involved with correction of violations, hearing or appeal procedures, and claims and/or fines associated with said violations.

3. The CONTRACTOR shall comply with applicable requirements of labor laws and regulations of New York State applicable to safety and the authorities having jurisdiction over same.

4. In addition to the Federal and Statutory Safety Laws, the CONTRACTOR shall abide with the American National Standards Association Code A10.2 and the National Safety Council's Accident Prevention Manual, during the construction period.

5. The CONTRACTOR shall maintain adequate protection against damage to life and property involved in the work and shall provide all necessary, protective devices until completion and final acceptance of project by the OWNER.

6. In any emergency threatening life or property, not considered by a CONTRACTOR as coming under the preceding provisions, he may act at his own discretion without authorization by the OWNER.

7. Should a storm watch, advisory, or warning for the site area be issued by a governmental agency, the CONTRACTOR shall take reasonable and customary precautions to minimize danger to persons and to the work.

B. Cleaning and Removal

1. The CONTRACTOR shall be responsible for removal of rubbish and debris of their own making. The CONTRACTOR shall at all times assure that the area within the limits of Contracts and the adjoining areas, including roadways, access areas and storage areas used by him are free of waste and rubbish, snow, ice and water, and he shall clean up the site and remove all rubbish as work progresses. The CONTRACTOR shall remove snow and ice from areas of his own work sufficiently to permit the work to be continued. Where products are delivered in crates, cartons or boxes, the CONTRACTOR installing such products shall remove the resulting rubbish.

2. CONTRACTOR shall maintain a separate dumpster at the site for project-generated wastes. Rubbish shall be removed from the premises regularly and shall not be permitted to accumulate on the premises.

3. The CONTRACTOR shall completely remove all items of temporary facilities, protection and construction provided by them upon completion of the work or when directed by the OWNER.

C. Anti-Pollution

1. The CONTRACTOR shall comply with all applicable anti-pollution laws and regulations, inclusive of applicable motor vehicle anti-idling restrictions.

2. Odors and/or noise shall be controlled so as not to create nuisance conditions.

3. If odors persist, OWNER reserves the right to stop all work until odors have been eliminated or controlled to the satisfaction of the OWNER.

4. Dust, dirt and other airborne waste materials shall be held to a minimum insofar as is practical by temporary enclosures and wetting.

D. Protection

1. During construction and until final acceptance of the work, the CONTRACTOR shall protect and be responsible for all work performed by the CONTRACTOR. CONTRACTOR shall protect their work immediately after installation.

2. Existing trees and other natural growth on the site indicated as remaining shall be protected, as required, from damage or any type that might result from contract operations.

3. The CONTRACTOR shall provide adequate interior barricades to prevent unauthorized access into construction areas.

E. Temporary Access Roads

1. The CONTRACTOR shall provide and maintain for the duration of the work, a means of access to and around the site as required for vehicular traffic and authorized personnel. The means of access shall be constructed to sustain the dimensions and weight of trucks and equipment customarily engaged for use in construction projects of this type and magnitude.

2. The CONTRACTOR shall furnish labor and materials to properly maintain this means of access in an acceptable condition, as determined by the OWNER, at all times regardless of the weather or the condition of the earth.

3. Access roads with ponded water and excessive tire ruts will not be considered acceptable and will be required to be repaired by the CONTRACTOR at no additional cost to the OWNER.

F. Traffic Over Trenches

1. The CONTRACTOR shall construct and maintain suitable and safe crossings over trenches as necessary to care for public and private traffic. The material excavated from trenches shall be compactly deposited along the sides of the trenches or elsewhere in such manner as shall give as little inconvenience as possible.

2.09 SIGNS

A. Individual advertising signs will only be allowed with the prior approval of the OWNER.

B. Signs needed to direct deliveries will be allowed with the prior approval of the OWNER.

C. The CONTRACTOR shall furnish, erect and maintain approved danger, warning and "Keep Out" at places and locations where the placing of such signs is warranted, or directed by the OWNER. All such signs shall be sufficiently illuminated to make them visible at all times.

D. The CONTRACTOR shall furnish traffic directional signage as necessary to maintain a safe flow pattern for construction vehicles and landfill operational vehicles.

PART 3 - EXECUTION

3.01 PREPARATION

A. Consult with the OWNER and CERTIFYING ENGINEER, review site conditions and factors that affect construction procedures and construction aids, including adjacent properties and public facilities that may be affected by execution of the work.

3.02 GENERAL

A. Comply with applicable requirements specified in Sections of Division 2.

B. Maintain and operate systems to assure continuous service.

C. Modify and extend systems, as work progress requires.

D. Relocate construction aids as required by progress of construction, by storage or work requirements of OWNER and other CONTRACTOR(s) employed at the site.

E. Install facilities in a neat and reasonable uniform appearance structurally adequate for the required purposes.

F. Maintain barriers during entire construction period.

G. Relocate barriers as required by progress of construction.

END OF SECTION

SECTION 01525
HEALTH AND SAFETY PLAN/RESPONSIBILITIES

PART 1 - GENERAL

A. Health and safety aspects of this project shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall familiarize himself with the nature and the materials contained in the work area in which he shall be working, and all applicable regulations governing such work.

1.01 SCOPE OF WORK

A. The CONTRACTOR shall determine the level of personal protection required and provide all appropriate and legally required safety equipment during the performance of all potentially hazardous tasks. This safety equipment shall be provided to the appropriate personnel of the CONTRACTOR and other persons representing or serving the CONTRACTOR whom have a legitimate business at the active construction area. The CONTRACTOR shall control access to the construction area, provide appropriate decontamination facilities and equipment, and shall conduct weekly health and safety meetings for the CONTRACTOR's personnel. The CONTRACTOR shall prepare a detailed health and safety plan for this project.

1.02 PAYMENT

A. All costs for health and safety equipment shall be included in the contract price. Payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

1.03 GENERAL REQUIREMENTS RELATED TO WORK ON LANDFILL SITES

A. The CONTRACTOR shall be responsible for informing their employees and subcontractors and their employees of the potential danger in working in or near landfills.

B. The CONTRACTOR is advised that the construction of this project is being performed adjacent to buried wastes and refuse. As these buried materials decompose, they will generate landfill gas (biogas), which normally consists of carbon dioxide (CO_2), methane (CH_4), hydrogen sulfide (H_2S) and other gases, depending on the composition of the buried materials. These gases usually vent to the atmosphere through the cover soil, but may migrate laterally over 1,000 feet to adjacent areas depending on site and weather conditions.

C. During the work, CONTRACTOR may encounter and may be exposed to waste materials and may encounter leachate (liquids that have percolated through waste).

1.04 POTENTIAL FOR HAZARDS

A. Landfill gases have the potential to create hazardous conditions if not controlled or recognized. Some of these hazards include:

1. Fires, which may start spontaneously from exposed and/or decomposing refuse.

2. Fires and explosions, which may occur from the presence of methane and/or hydrogen sulfide gases.

3. Landfill gases, which may cause an oxygen deficiency in underground trenches, vaults, conduits, and structures.

4. Hydrogen sulfide, a highly toxic and flammable gas, which may be present.

B. Possible caving of trenches and excavations when working over or in refuse fills.

1.05 GENERAL SAFETY GUIDELINES

A. Safeguard measures to protect the worker from the effects of the dangers from hazardous gases include, but are not necessarily limited to:

1. Test the atmosphere

2. Ventilate confined spaces

3. Use appropriate safety equipment

4. Provide backup safety personnel

B. Before entering a workspace such as a trench, boring, excavation, underground vault, pit or crawlspace, the atmosphere should be tested to detect any adverse environmental conditions. The workspace should be tested for oxygen deficiency, toxic gases, and combustible gases with a gas-detecting instrument. Test instruments should be properly maintained and calibrated. The test should be conducted from top to bottom of the workspace.

C. When testing the workspace, the presence of explosive gas conditions should be determined first. If this test indicates non-explosive conditions, the presence of asphyxiating (toxic) gases and oxygen deficiency conditions should be determined. Because carbon monoxide, carbon dioxide, hydrogen sulfide or other vapors may

accumulate in the lower levels of the workspace and their presence may not be detected by only testing the upper portions of the workspace, these tests should be performed throughout the workspace.

D. To safeguard against toxic and combustible gases or oxygen deficiency, a workspace should be thoroughly ventilated before entry and during the entire time workers are in the confined space. Forced ventilation is one measure, and can be started by blowing air into the workspace until the air is suitable for entry.

E. Ventilation equipment should be placed upwind from the excavation so that emerging gases will not be ignited by the equipment or recycled into the workplace. Ventilation equipment should also be located away from the exhaust of nearby motor vehicles so that the exhaust fumes are not introduced into the workspace. The air discharge hose from the ventilation equipment should be inspected periodically to check that it is not bent or kinked so that air flow to the workspace will not be reduced or restricted.

F. All personnel should be instructed in the use of appropriate safety equipment that will be utilized during the course of the work. It shall be the responsibility of the CONTRACTOR, to verify that all safety equipment is being used when appropriate.

G. Prior to any personnel entering a workspace, an additional individual should be positioned outside of the space, but always within eyesight of the personnel within the space, to assist should the workers be overcome by the loss of oxygen.

1.06 SAFETY OFFICER

A. The CONTRACTOR shall provide a person who will be designated as the Safety Officer. The CONTRACTOR'S Safety Officer shall be thoroughly trained in rescue procedures, and the use of safety equipment and gas detectors. This person should be present at the site all times during working hours and shall have experience with health and safety related to the type of work to be performed for this project.

B. The CONTRACTOR'S Safety Officer shall have appropriate instruments (detectors) to test for oxygen deficiency and for the presence of landfill gases. A portable gas detector should be available for this purpose. The instrument should have the accessories necessary to monitor the atmosphere at the bottom of excavations. The Safety Monitor should periodically calibrate their instruments, regularly test the excavation areas for safe working conditions, and make appropriate safety equipment available at the site. A record of the use and calibration of the instruments should be maintained at the job site.

C. The CONTRACTOR'S Safety Officer should have the delegated authority to order any person or worker to follow the safety rules related to landfill gas. Failure to observe these rules should be sufficient cause for removal of the person or worker from the project site.

1.07 SAFETY PROGRAM

A. Supplemental to the CONTRACTOR's regular safety program, they shall develop and institute procedures to inform all workers, and the public visiting the site, of the potential for the presence of methane and other landfill gases emanating from the natural decomposition of refuse buried at or near the job site, and the importance of safety precautions to provide for the safety of workers and the public. The CONTRACTOR shall also instruct all workers, and maintain strict control on construction activity, so as to protect and maintain the integrity of the gas collection system design features as they are installed.

1.08 GENERAL PRECAUTIONS

A. In addition to conforming to the safety rules and regulations of the federal, state and local agencies having jurisdiction, the CONTRACTOR should consider the following precautionary measures:

1. Regularly during construction, the work area should be monitored for landfill gases. Workers shall not be permitted to enter workspace where there is an oxygen deficiency or a combustible mixture of gas without appropriate protection.

2. Smoking shall be prohibited in or near open excavations or exposed waste, and in the vicinity of underground pipe laying activities. Smoking will be permitted only in those areas designated by the CONTRACTOR'S Safety Officer.

3. Soil should be stockpiled adjacent to facility in areas of exposed waste for fire fighting purposes. Soil may be an effective means of extinguishing landfill fires by precluding oxygen availability.

4. The use of explosives shall not be permitted with the exception of approved blasting requirements.

5. No welding should be permitted in trenches, enclosed areas, or over waste unless performed in areas of the site tested and approved by the CONTRACTOR's Safety Officer.

6. Construction equipment used in excavating activities and/or refuse removal should be equipped with vertical exhaust and spark arresters.

B. If not already included in his standard safety practices, the CONTRACTOR should consider adding the following measures to his safety program:

1. Workers should be cautioned on the possibility of caving during construction facility near and in open excavations, particularly in waste-filled areas. Anyone working near the edge of deep excavations should be secured with a safety belt, harness, or rope to preclude the possibility of falling into the opening. (Waste filling and compaction are quite variable and therefore, may not provide the same slope stability as excavations in native soils).

2. Any personnel working near the edge of well excavations, or similar construction, should wear a parachute-type harness securely attached to a rope. The rope should be made as short as possible and securely fastened to a safe object such as a parked vehicle or drill rig.

3. Work performed within trenches shall be performed in accordance with OSHA compliance.

4. Work parties of three may be best suited for work in excavations or confined spaces. No worker should be allowed to work alone in an excavation. An additional individual should be positioned outside the excavation to assist them should an emergency develop. Confined space permits shall be required and submitted to the OWNER.

5. Inhalation of landfill gases should be avoided. Such gases (or oxygen deficient air) may cause nausea and dizziness, which could lead to accidents. Work should be done upwind from the excavation whenever possible, unless the excavation is constantly monitored and declared safe.

6. Workers should avoid contact with exposed refuse wherever possible. Irritants or hazardous materials may be present.

7. No excavation or drilled hole should be left unattended or left open overnight unless it is securely so as to prevent unauthorized access.

8. Fire extinguishers with a rating of at least A, B, and C should be available.

9. Start-up and shutdown of equipment should be avoided in areas of exposed waste.

10. Personnel, when working in an open excavation or in the presence of landfill gas, should be fully clothed with non-sparking cloth, wear shoes with non-metallic soles, and wear a hard hat and safety goggles or glasses. The excavations should be monitored continuously in a manner satisfactory to the CONTRACTOR's

Safety Monitor for methane, hydrogen sulfide and oxygen deficiency for the duration that personnel are in an excavation. Workers should immediately vacate an excavation if methane, hydrogen sulfide, or an oxygen deficiency is detected therein, and should not be permitted to reenter the excavation until satisfactory measures are implemented.

11. Assembly of construction work should be performed outside of the trenches or excavations. Prefabricated items should be lowered into the excavation. Only final connections should be made within trenches with careful attention to the necessary precautions started within these special safety provisions.

END OF SECTION

SECTION 01560
DUST, ODOR, AND NOISE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Dust Control.
2. Odor Control.
3. Noise Control.
4. Dust Monitoring.
5. Organic Vapor Monitoring.
6. Noise Monitoring.

1.02 REFERENCES

A. Occupational Safety and Health Administration (OSHA) Regulations – Part 1910.95.

B. OSHA Regulations – Part 1910.1000 Table Z-1.

C. Health and Safety Plan.

PART 2 – PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 DUST CONTROL

A. No visible dust shall be permitted to leave the work area and the site.

B. Prepare and submit a plan describing techniques and methods proposed to control dust during the project as part of the Environmental Protection Plan, as specified within Section 01120.

C. Implement all necessary dust control procedures to prevent dust from leaving the work area or at the OWNER's request.

D. Conduct all operations and maintain the work area (including sweeping and sprinkling) so as to prevent creation and dispersion of dust. Calcium chloride or other chemical methods shall not be used for dust control unless otherwise approved in writing by OWNER. Dust control may require the use of mulch, gravel, plastic sheeting or other temporary restoration or soil surface treatment methods subject to the approval of the OWNER.

E. In the event that it becomes necessary in the opinion of OWNER to provide additional measures to control the release of dust, such measures shall be immediately implemented, at no additional cost.

F. OWNER shall reserve the right to suspend work at any time if necessary due to dust generation, which causes a safety or air quality problem, or which may cause contamination of adjacent areas and CONTRACTOR shall not be entitled to any additional compensation for suspension of Work under such conditions.

G. The OWNER may independently monitor and assess dust emissions from the Site, and may require CONTRACTOR to implement corrective measures based on the results. Such monitoring by OWNER does not relieve the CONTRACTOR from any such monitoring responsibilities.

3.02 ODOR CONTROL

A. Conduct all operations and maintain the work area so as to minimize odors associated with the work activities.

B. CONTRACTOR shall implement odor control procedures to suppress objectionable odors in the work area or at the OWNER's request.

C. In the event that it becomes necessary in the opinion of OWNER to provide additional measures to suppress odors, such measures shall be immediately implemented, at no additional cost.

D. OWNER reserves the right to suspend Work at any time if necessary due to objectionable odors, which cause a safety or air quality problem, and CONTRACTOR shall not be entitled to any additional compensation for suspension of Work under such conditions.

E. The OWNER may independently monitor and assess odor emissions from the Site, and may require CONTRACTOR to implement corrective measures based on the results. Such monitoring by OWNER does not relieve the CONTRACTOR from any such monitoring responsibilities.

3.03 NOISE CONTROL

A. CONTRACTOR shall take all necessary precautions to minimize noise from its activities and prevent disturbance of neighboring residential and commercial areas. Special attention shall be directed to noise generated before 9:00 a.m. and on weekends.

B. CONTRACTOR shall not operate equipment outside of the approved work hours unless otherwise approved in advance by OWNER.

C. OWNER reserves the right to suspend Work at any time if necessary due to noise generation causing a nuisance, or safety or excessive vibration hazard.

D. The OWNER may independently monitor and assess noise at the Site, and may require CONTRACTOR to implement corrective measures based on the results. Such monitoring by OWNER does not relieve the CONTRACTOR from any such monitoring responsibilities.

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 TRANSPORTATION AND HANDLING

A. The CONTRACTOR or party who would normally transport and handle a particular material or piece of equipment shall be responsible for delivery to and/or return from the job site of all materials and equipment necessary to perform his work and shall pay all freight and handling charges for same. All unloading, storing and reloading necessary shall be the responsibility of the CONTRACTOR or party who would normally handle the material or piece of equipment, and shall be at their expense.

B. The CONTRACTOR shall be responsible for unloading, stockpiling, storage, and protection of all materials purchased by the OWNER for the work.

1.02 STORAGE AND PROTECTION

A. All materials delivered to and used on the project shall be suitably housed and protected. The areas to be used for storage are defined elsewhere in the contract documents or shall be as specified by the OWNER. The CONTRACTOR shall provide their own storage sheds.

B. No materials or equipment shall be stored so as to interfere with the use by the public of adjacent sidewalks and roads, unless otherwise approved by OWNER and special permission is obtained from the local government having jurisdiction.

C. The OWNER assumes no responsibility for damage, deterioration or theft of stored materials, equipment, tools and supplies.

D. Deliver all construction materials in original, undamaged, sealed containers that are to be unbroken and with labels plainly indicating manufacturer’s name, brand, type and grade.

E. Containers that are broken, opened, watermarked, or otherwise damaged and/or which contain unsuitable or damaged materials are unacceptable and shall be immediately removed from the premises.

F. Store all bentonite, cement, lime, sealants, aggregates, and similar items above ground and protect from dampness, weather and other damage.

G. Sheds for flammable liquids shall be so placed or located to avoid damage and danger to OWNER’s property and the public.

H. The CONTRACTOR shall retain all loose and small detachable parts of apparatus and equipment furnished under his contract until the completion of their work. CONTRACTOR shall then turn same over to the OWNER and obtain an itemized receipt in triplicate. CONTRACTOR shall retain one copy of this receipt and shall attach the other two to the request for final payment for the work.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01669
TESTING PIPE SYSTEMS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Pressure Test Reports.

PART 2 - PRODUCTS

2.01 PROVISIONS

A. The Contractor shall perform an air pressure test of the containment pipe and fittings, and a hydrostatic pressure test of the carrier pipe and fittings, in accordance with these Specifications.

B. The total test time, including initial pressurization, initial expansion, and time at test pressure shall not exceed eight hours. If the test is not completed in eight hours, the pressure in the test section shall be released and the section allowed to "relax" for at least eight hours before initiating another test.

C. Pipe lines shall be pressure tested in presence of QA/QC Engineer. Provide minimum 24 hours notice to the QA/QC Engineer before performing test.

D. Provide necessary connections between section of pipe being tested and nearest available source of water or air supply, together with test pressure equipment, meters, pressure gauge, other equipment, materials and facilities necessary to make specified tests.

E. OWNER will provide a source of water for testing of the carrier pipe.

F. Provide bulkheads, flanges, valves, bracing, blocking, and monitoring apparatus as necessary to complete the pressure tests.

G. Pipe to be tested shall be exposed for CQA OFFICER to observe, except that bends, reduced pressure rated fittings and components should be buried or restrained. Flange connections shall be visible to check for leaks.

H. Contractor shall notify on-site personnel of the testing schedule, and only allow personnel required to perform the test in the test area for the duration of the test.

I. Contractor shall provide a system without leaks.

PART 3 - EXECUTION

3.01 PREPARATION

A. Commence test procedures when the following conditions have been met.

1. Remove or isolate valves, flow meters, and instruments that may not withstand the required test pressure from within the test sections. Reconnect pipes with temporary fittings. Vent isolated equipment.

2. Flush pipe, with clean water until pipe section to be tested is clean and free of dirt, sand, pipe shavings, or other foreign material.

3. Plug pipe outlets with test plugs, blind flanges or other devices suitable for the test pressure. Brace securely to prevent blowouts. Verify test pressure does not exceed any component of the pipe system.

4. Restrain or remove expansion joints.

5. Pressurizing equipment shall include regulator, set to avoid over- pressurizing and damaging otherwise acceptable pipe.

B. Provide necessary pipe connections between the section of line being tested and the compressed air supply, together with test pressure equipment, meters, pressure gauge, and other equipment, materials, and facilities necessary to perform the specified tests.

C. Furnish and install bulkheads, flanges, valves, bracing, blocking or other temporary sectionalizing devices that may be required.

D. Remove temporary sectionalizing devices after tests have been completed.

3.02 TESTING

A. OWNER and ENGINEER shall be given 24-hr notification prior to test.

B. Appropriate Safety precautions must be in-place.

C. OWNER and ENGINEER shall be given 24-hr notification prior to test.

D. Appropriate Safety precautions must be in-place.

3.2.1 Hydrostatic Pressure Testing

A. Contractor shall use a hydrostatic test pump specifically designed for performing hydrostatic pressure tests on pipe.

B. Pipe shall be tested at 1.5 times the rated working pressure of the pipe or the lowest rated pressure of any component of the system being tested.

C. Apply test pressure slowly, and once the test pressure has been reached, allow the pressure to stabilize, without adding additional pressure. This may take 2 to 3 hours.

D. Once pressure has stabilized, add additional water to achieve the test pressure and begin the test.

E. After 1 hour, additional water shall be added to return to the test pressure. If the volume of water required to achieve the test pressure after 1hour is less than shown in the table, then the pipe has passed the pressure test.

F. The total test time, including the initial pressurization, initial expansion and time at test pressure, shall not exceed eight hours. If the test is not completed within that time, the test pressure shall be removed for at least eight hours, prior to performing the test again.

G. Clean potable water shall be used as the testing medium to fill the pipes.

Allowable Water Loss Under Pressure	
Nominal Pipe Size (in.)	**US Gals per 100 feet of Pipe**
	1-Hour Test
1	0.06
2	0.07
3	0.10
4	0.13
6	0.30
8	0.50
10	0.80
12	1.1

3.2.2 Air Pressure Test

A. Contractor shall provide ASME standard 840.1 Grade 3A pressure gauges (accuracy of ± 0.25% of full span) to measure the test pressure in the pipe. Gauge pressure range shall be not more than 2 times the test pressure.

B. Pipe test pressure shall be a minimum of 10 psig or the lowest rated pressure of any component of the system being tested.

C. Apply the test pressure slowly, and once the test pressure has been reached maintain the pressure for 15 minutes or until it has stabilized.

D. After the pressure has stabilized at 10 psig, begin the test.

E. The pressure shall drop less than 0.5 psig, over 10 minutes, for an acceptable pressure test.

3.2.3 Test Pressures

A. Dual Containment HDPE force main pipe.

1. Carrier pipe: 150% of rated pressure.

2. Containment pipe: 10 psig.

B. In no case exceed maximum allowable pressure for any pipeline component, including valves, fittings, and instruments.

C. If pressure test is not accepted, correct leaks or defects in the pipe and retest.

D. Remove temporary sectionalizing devices after tests are complete.

3.2.4 Test Failure:

A. If retest is necessary, allow pressure to relax to 0 psi for at least 8 hours prior to retest.

B. Perform the following when pipe segment fails test.

1. Check entire length of pipe and fusion welds for cracks, pinholes, perforations or other possible leakage points.

2. Check blocked risers and capped ends for leakage and check gaskets at blind flanges.

3. Verify leaks by applying a soapy water solution and observe for bubble formation.

C. Repair pipe and fused joint leaks by cutting out leak areas and refusing suitable segments.

D. After the leaks are repaired, retest the pipe after the 8 hour relaxation period.

3.03 TEST REPORTING

A. Each test shall be reported in writing, on Attachment 1 included with this section.

B. Include following information if failure occurs:

1. Location of failure segment.
2. Nature of leaks.
3. Details of repairs performed.
4. Retest results.

ATTACHMENT 1 TO SECTION 01669
HDPE PIPE PRESSURE TEST REPORT FORM

Project Name/ No.: _____ Date: _____

Contractor: _____ Time: _____

Person Performing Tests: _____

Description/Location of Test Segment: (Pipe Diameter, Length, and SDR's)

_____

_____

Location of Pipe Test Segment

Station From: Station To:

T_i = Initial Temperature = _____ °F

P_i = Initial test pressure = _____ psi

P_c = Initial Pressure in psi corrected for temperature (T_t) at time "t"

t = Time in minutes from initiation of test

T_t = Temperature in °F at time 't'

P_t = Test pressure in psi at time 't'

$$P_c = \left[\frac{(P_i + 1013)(T_t + 273)}{T_i + 273}\right] - 1013$$

$$\text{Percent Pressure Drop} = \frac{P_c - P_t}{P_c} \times 100$$

Time (min)	T_t Temp Reading (°F)	P_t Gauge Pressure (psi)	P_c Corrected Pressure (psi)	Pressure Drop (%)
0				
20				
30				
40				
50				
60				

Pass/Fail: _____ Retest (yes/no) _____

Description/Nature of leaks repair of retest segment:

_____

_____

_____

ATTACHMENT 2 TO SECTION 01669
HYDROSTATIC PIPE PRESSURE TEST REPORT FORM

Project No.:			
Project Name:			
Project Location:			
Weather:			
Contractor:		Test No.:	
CQA Personnel:		Person/Company Performing Test:	
Date of Test:	Time of test: Start:	Finish:	
Pipe Length: ft.	Pipe Diameter: in.	Pipe Material	Pipe SDR/Sch:
Rated Working Pressure:		Test Pressure:	
Location/designation of pipe tested:			

t **Time** **(hours)**	Pt Pressure Gauge Reading (psig)	Pc Pressure Drop (%)	Amount of Make-Up Water Added (gal.)
0			
1			
2			
3			
4			
5			
6			
Pass	Fail	Retest? Yes	No

Description/location of defects for failed test:

Test Procedure:

1. **Pressurize to 150 percent of rated pressure;**
2. **Add make-up water each hour for three hours to maintain pressure;**
3. **Test phase begins after the initial three hour phase;**
4. **After one, two or three hours, add a measured amount of make-up water to return to the test pressure; and**
5. **The amount of make-up water added to return to the test phase must not exceed the amount in the make-up water test values table on the next sheet.**

Comments:

Signature:

MAXIMUM ALLOWABLE MAKE-UP WATER VOLUME

Nominal Pipe Size (inches)	***Make-Up Water Allowance (U.S. Gallons per 100 ft of Pipe)***		
	1 Hour Test	**2 Hour Test**	**3 Hour Test**
1 – 1/4	0.06	0.10	0.16
1 – 1/2	0.07	0.10	0.17
2	0.07	0.11	0.19
3	0.10	0.15	0.25
4	0.13	0.25	0.40
5	0.19	0.38	0.58
5 – 3/8	0.21	0.41	0.62
6	0.30	0.60	0.90
7 – 1/8	0.40	0.70	1.0
8	0.50	1.0	1.5
10	0.80	1.3	2.1
12	1.1	2.3	3.4
13-3/8	1.2	2.5	3.7
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.0	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
26	5.0	10.0	15.0
28	5.5	11.1	16.8
30	6.3	12.7	19.2
32	7.0	14.3	21.5
34	8.0	16.2	24.3
36	9.0	18.0	27.0
42	12.0	23.1	35.3
48	15.0	27.0	43.0
54	18.5	31.4	51.7

END OF SECTION

SECTION 01740
PROJECT FINAL CLEAN-UP

PART 1 - GENERAL

1.01 DESCRIPTION

A. The provisions of this section shall apply to each CONTRACTOR unless otherwise specified.

B. Each CONTRACTOR shall do all removal of debris and cleaning work required resulting from operations in performance of his contract work. Cleaning work shall be performed throughout the duration of the project. Final clean-up shall be performed at the completion of the work.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. At completion, each CONTRACTOR shall clean all work of his contract and remove from site, all their debris and waste material. General CONTRACTOR shall then perform a general and final cleanup of the site.

B. Employ skilled workers for final cleaning.

C. Remove debris and packing material associated with construction activities from the project area.

D. Prior to final completion the OWNER and CERTIFYING ENGINEER shall view all work areas, to verify that the entire work is clean.

END OF SECTION

SECTION 01770
CONTRACT CLOSE-OUT

PART 1 - GENERAL

1.01 SUBSTANTIAL COMPLETION

A. When the CONTRACTOR considers the work is substantially complete, they shall submit to the OWNER and CERTIFYING ENGINEER:

1. A written notice that the work or designed portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the OWNER and CERTIFYING ENGINEER will view the work to determine the status of completion.

C. Should the OWNER and CERTIFYING ENGINEER determine that the work is not substantially complete:

1. The OWNER or CERTIFYING ENGINEER will promptly notify the CONTRACTOR in writing, giving the reasons therefore.

2. The CONTRACTOR shall remedy the deficiencies in the work and send a second written notice of substantial completion to the OWNER and CERTIFYING ENGINEER.

3. The OWNER and CERTIFYING ENGINEER will view the work.

D. When the OWNER and CERTIFYING ENGINEER concurs that the work is substantially complete, he will:

1. Prepare a Certificate of Substantial Completion, accompanied by the CONTRACTOR's list of items to be completed or corrected, as verified and amended by the CERTIFYING ENGINEER.

2. Submit the Certificate to the OWNER and CONTRACTOR for their written acceptance of the responsibilities assigned to them in the certificate.

1.02 FINAL VIEWING OF WORK

A. When the CONTRACTOR considers the work is complete, CONTRACTOR shall submit written certification that:

1. Contract documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the CERTIFYING ENGINEER, and are operational.

5. Work is completed and ready for final viewing by the OWNER and CERTIFYING ENGINEER.

B. The OWNER and CERTIFYING ENGINEER will view the work to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should the OWNER or CERTIFYING ENGINEER consider that the work is incomplete or defective:

1. The OWNER or CERTIFYING ENGINEER will promptly notify the CONTRACTOR in writing, listing the incomplete or defective work.

2. The CONTRACTOR shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the OWNER and CERTIFYING ENGINEER that the work is complete.

3. The OWNER and CERTIFYING ENGINEER will view the work.

D. When the CERTIFYING ENGINEER finds that the work is acceptable under the Contract Documents, he shall request the CONTRACTOR to make closeout submittals.

1.03 RE-INSPECTION FEES

A. Should the CERTIFYING ENGINEER have to view the work more than once after the CONTRACTOR notifies the CERTIFYING ENGINEER that the work is substantially complete due to failure of the work to comply with the claims of status of completion made by the CONTRACTOR:

1. The OWNER will compensate the CERTIFYING ENGINEER for such additional services.

2. The OWNER will deduct the amount of such compensation from the final payment to the CONTRACTOR.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO CERTIFYING ENGINEER

1. Evidence of compliance with requirements of governing authorities.

2. Project record Documents: To requirements of Section 01780.

3. Loose and Small Detachable parts of Apparatus and Equipment.

4. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

5. Certificate of Insurance for Products and Completed Operations.

6. Guarantees and Warranties.

7. Operations and Maintenance Instructions.

1.05 GUARANTEES

A. The CONTRACTOR and his subcontractors, as the case may be, shall guarantee that all work under this contract, shall be free from defects of faulty labor and/or materials for a period of one year from date of final acceptance. This guarantee is to be provided within the limitations of other guarantees or warranties in the Contract Documents. This requirement shall not expand or supersede any guarantees or warranties stated, implied, or offered or specified in these Contract Documents.

B. Final payments are contingent upon the OWNER's and CERTIFYING ENGINEER's receipt of such guarantees from the CONTRACTOR and subcontractors, as the case may be.

C. The CONTRACTOR shall make or cause his Subcontractor who is responsible to make any repair or replacement necessary by reason of any defects in materials or workmanship, or failure to meet the requirement of the specifications, which may develop within one year from date of final payment.

D. If any CONTRACTOR chooses to use any system, equipment, facilities, or services that have been provided by any other CONTRACTOR, the former shall assume full responsibility for any damage and shall make arrangement with the installing CONTRACTOR so that the guarantee period shall not be jeopardized. If during the guarantee period, repair or changes are required as the result of such use, the

CONTRACTOR shall promptly, upon receipt of notice from the OWNER, and without expense to the OWNER, correct the condition to restore the guarantee.

1.06 OPERATION AND MAINTENANCE DATA

A. At the completion of work, each CONTRACTOR and subcontractor shall provide the OWNER with two sets of each of the following items for equipment and devices provided furnished and/or installed for the project by the CONTRACTOR/ subcontractors.

1. Catalog Date or Literature.
2. Manufacturer's Operating Instructions.
3. Manufacturer's Maintenance Instructions.
4. Installation Instructions.

B. In each of these, the model number and the data for the model number shall be checked off in ink where the literature covers more than one model. For items assembled by the CONTRACTOR for special functions, CONTRACTOR shall write and provide duplicate operating and maintenance instructions.

1.07 TESTS AND CERTIFICATIONS

A. Completed installations of all equipment and systems shall be fully tested in the presence of the CERTIFYING ENGINEER and approved prior to acceptance of the OWNER.

B. The CONTRACTOR shall make all necessary adjustments and/or replacements that are necessary to fulfill the requirements, to comply with the directions and/or recommendations of the manufacturer and to comply with all applicable codes and regulations.

C. The CONTRACTOR shall certify to the OWNER that the work has been performed in compliance with the Contract Documents.

1.08 FINAL ADJUSTMENTS OF ACCOUNTS

A. Submit a final statement of accounting to the OWNER and CERTIFYING ENGINEER.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

   a. Previous change orders.

   b. Unit prices.

   c. Deductions for incorrect work.

   d. Deductions for re-inspection payments.

   e. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. The CERTIFYING ENGINEER will prepare a final Change Order, reflecting approved adjustments to the Contract Sum, which were not previously made by Change Orders.

1.09 FINAL APPLICATION FOR PAYMENT

A. CONTRACTOR shall submit the final application of Payment in accordance with procedures and requirements stated in Conditions of the Contract.

B. A certificate of completion of contract work will be issued at the completion of project after receipt of required and maintenance instructions, record drawings, Guarantees and Release of Liens. The date of said certificates shall be the beginning date of all guarantees.

C. The CONTRACTOR shall not reuse any of the Contract Document in any manner.

D. All Contract Documents, except for one complete set for record purposes, shall be returned to the CERTIFYING ENGINEER upon completion of the project.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

DIVISION 2 - SITEWORK

TECHNICAL SPECIFICATIONS

DUNN MINE AND C&D FACILITY

DIVISION 2 – SITEWORK

Section	No. Section	Page No.
02100	EROSION CONTROL	02100-1
02150	EXCAVATION & TRENCHING	02150-1
02175	CLEARING & GRUBBING	02175-1
02200	GENERAL FILL	02200-1
02210	SUBGRADE	02210-1
02300	LOW-PERMEABILITY SOIL LINER	02300-1
02500	HDPE GEOMEMBRANE	02500-1
02550	DRAINAGE LAYER	02550-1
02595	GEOTEXTILES	02595-1
02800	ACCESS ROADS	02800-1
02810	STONE	02810-1
02820	HDPE PIPES & FITTINGS	02820-1
02850	STORMWATER CONTROLS	02850-1
02880	LOAM/SEEDING/EROSION MAT	02880-1

SECTION 02100
EROSION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to installation and maintenance of erosion control measures, as specified herein and on the Drawings.

1.03 RELATED WORK

A. Section 02880 – Loam/Seeding/Erosion Mat

B. Section 02850 – Storm Water Controls

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

1.05 INTENT

A. The intent of the work under this Section is to provide erosion control measures to prevent siltation from entering adjoining properties, wetlands, or water bodies. In addition, the intent is to comply with requirements of the federal National Pollution Discharge Elimination System Construction General Permit by complying with the site-specific Storm Water Pollution Prevention Plan.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Silt Fence

1. Silt fence shall be 36 inches in height and fabricated of polypropylene.

B. Jute Netting

1. The jute netting shall be woven netting as manufactured by Fabriscape, Inc., or an approved equal. The jute netting shall meet the following specifications:

Typical Specifications	
Structure	Woven
Yarn	Jute, undyed, unbleached
Weight	0.92 lbs/sy
Yarn Count Wrap	78 (width, min)
Weft	42 (linear yard, min)
Absorption	450%
Open Area	60 – 65%
Life (Years)	2 Years

C. Erosion Control Mat

1. The erosion control mat used within the proposed drainage swales shall be VMax® P550® Turf Reinforcement Mat, as manufactured by North American Green, or approved equal. The selection of an erosion mat is subject to the approval of the CERTIFYING ENGINEER.

2. The erosion control mat used for slope stabilization shall be ECP-3™ Polypropylene Turf Reinforcement Mat, as manufactured by East Coast Erosion Blankets, LLC, or approved equal. The selection of an erosion mat is subject to the approval of the CERTIFYING ENGINEER.

PART 3 - EXECUTION

3.01 SEDIMENT CONTAINMENT

A. Place silt fence as close as feasible to work so as to prevent siltation from entering adjacent properties and areas outside the limits of work.

B. Silt fence shall be installed at the locations indicated on the Drawings and adjacent to other work areas as directed by CQA OFFICER.

C. Silt fence shall be constructed or installed as shown on the Drawings and shall be maintained in such a manner so as to prevent siltation of wetlands for the duration of the project.

D. Silt fence shall be replaced or repaired as required by OWNER and/or CERTIFYING ENGINEER.

3.02 EROSION CONTROL

A. All areas disturbed by CONTRACTOR that exhibit erosion potential prior to the completion of work shall, at the direction of OWNER and/or CERTIFYING ENGINEER, be provided with an acceptable temporary vegetative cover or mulch.

B. Protect work areas against erosion. Repair and re-grade as needed to restore work areas. Place and compact soils in areas disturbed by CONTRACTOR.

C. Erosion control mat shall be placed within all locations as shown on the Drawings.

D. Prior to the installation of vegetative support soils and seeding, the external slopes of all soil fill areas shall be protected against erosion.

3.03 MONITORING

A. CONTRACTOR shall monitor surface waters in accordance with the OWNER's Stormwater Pollution Prevention Plan and CONTRACTOR's Environmental Protection Plan.

3.04 PROTECTION OF INSTALLED MATERIALS

A. CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, and at no additional cost to OWNER.

END OF SECTION

SECTION 02150
EXCAVATION & TRENCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: excavation and trenching, including preparation, excavation, bedding, backfilling, disposal of excess and unsuitable materials, and other related and incidental work within the designated area and as required for construction of other work, as shown, specified or required.

B. Strip and remove any existing vegetative soil from the proposed Phase 4 area to the grades as indicated on the Drawings.

C. Locate all existing utilities in work areas prior to commencing any excavation activities. CONTRACTOR shall be responsible for preserving and protecting all utilities.

1.03 RELATED WORK

A. Section 01120 – Environmental Protection Plan

B. Section 02175 – Clearing and Grubbing

C. Section 02100 – Erosion Control

D. Section 02200 – General Fill

E. Section 02210 – Subgrade

F. Section 02820 – High-Density Polyethylene (HDPE) Pipe

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

B. All materials and labor furnished under this section shall comply with OSHA, ASTM, AA, NEC, ANSI and all other applicable Federal, State and Municipal codes and regulations including revisions to date of Contract.

C. Use adequate number of skilled workers who are thoroughly trained and experienced in the specified requirements and the methods needed for proper performance of the work in this Section.

1.05 CLASSIFICATION OF EARTHWORK

A. Excavation: consists of removal of soil, waste, rock, debris and all other materials to the proposed grading indicated in the Contract Documents. No classification of type of excavated materials will be made. Excavation includes all soil, and waste materials if encountered, regardless of type, character, composition, moisture, or condition thereof.

B. Unauthorized Excavation: consists of removal of materials beyond indicated areas without specific approval of the CQA OFFICER. Unauthorized excavation shall be at CONTRACTOR'S expense.

C. Unauthorized excavations shall be backfilled as specified for authorized excavations at no additional cost to the OWNER, unless otherwise directed by the CQA OFFICER.

D. Additional Excavation: When excavation has reached required subgrade elevations, notify the CQA OFFICER, who will make an inspection of conditions. If the CQA OFFICER determines that materials at required subgrade elevations are unsatisfactory, continue excavation until satisfactory materials are encountered. Backfill, stockpile or replace excavated material as approved by the CQA OFFICER.

1.06 PROTECTION OF PEOPLE AND PROPERTY

A. The CONTRACTOR shall plan and conduct operations so as to prevent damage to existing structures and utilities, safeguard people and property, protect the structures to be installed, and provide safe working conditions.

B. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the CQA OFFICER to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under the Contract. The CONTRACTOR shall be responsible for the condition of all excavations made by him. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

C. Work is restricted to the land provided for the CONTRACTOR'S use.

D. Side slopes will be maintained in stable condition under all normal anticipated weather conditions for the period that the excavation will be open. The CONTRACTOR shall regrade side slopes to a more stable configuration if so directed by the CQA OFFICER.

E. In cases where excavation without sheeting or bracing is not feasible solely because of protection of workers, trench boxes may be used.

F. Stockpiles of clean excavated soil that are approved by the CQA OFFICER shall be carefully placed at a location approved by the OWNER, and the surrounding area shall be protected by placement of silt fence, or an equivalent erosion control structure.

G. Excavated clean soil, which will be replaced by other fill materials such as sand, crushed stone, pea gravel or low permeability backfill, shall be placed on-site at a location approved by the OWNER.

H. It shall be the CONTRACTOR'S complete responsibility to adequately control water that may be present in the excavation. CONTRACTOR shall provide for the disposal of water removed from excavations, in such a manner not to cause damage to public property, private property or to any portion of the Work, whether completed or in progress. CONTRACTOR shall not cause any impediment to the use of any area by the public; nor shall he discharge any flushing, ground water or any material of any nature into existing sanitary sewers or streams.

I. The CONTRACTOR shall be responsible for the condition of all excavations made by him. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

J. In the event that any act by the OWNER and CQA OFFICER results in the keeping of any excavation open longer than would otherwise have been necessary, the CONTRACTOR shall not be relieved from his responsibility of properly and adequately protecting the excavation from caving or slipping nor from any of his obligations under the contract relating to protection of persons and property. Neither shall any failure of or refusal by the CQA OFFICER to direct bracing, sheeting and shoring to be left in place relieve the CONTRACTOR of his responsibilities as set forth in these Specifications.

1.07 SUBMITTALS

A. A completed bill of materials list showing all items to be furnished and installed under this Section.

B. Sheeting, shoring, bracing and trench boxes shall be designed and signed by a registered professional engineer and submitted.

1.08 SAFETY

A. All excavation shall comply with the applicable requirements as stated in the:

1. OSHA excavation safety standards 29 CFR, 1926-650, Subpart P.

2. State and OWNER construction safety regulations.

3. Trench safety guidelines as specified by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).

B. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by New York State Department of Transportation.

2. Protect existing slopes, embankments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 – PRODUCTS

2.01 GENERAL

A. Excavation shall mean the removal from place of all materials and shall include soil, structures above and below ground, rock, pavements, topsoil, demolition waste material, rubbish, tree stumps, boulders, logs, ashes, cinders or organic material such as peat, humus or organic silt.

B. Muck excavation shall mean the excavation and removal of soft, wet unsuitable subgrade material to the depth as directed by CERTIFYING ENGINEER.

C. No frozen earth shall be used for backfill or subgrade fill materials. All fill materials shall be free from all perishable and objectionable materials.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Drawings, these Specifications and any pertaining local ordinances.

3.02 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify and protect utilities from damage prior to work.

C. The CONTRACTOR shall notify the OWNER at least 5 days prior to removal or relocation of utilities and shall coordinate such work with the OWNER.

D. Protect plant life, lawns and other features remaining as a portion of final landscaping.

E. Protect benchmarks, survey control points, monitoring wells, existing structures and fences from excavating equipment and vehicular traffic.

F. Remove and replace soft areas of subgrade not capable of in-situ compaction. Backfill with fill material as directed by the CQA OFFICER and compact to density equal to or greater than requirements for subsequent backfill material.

G. Dewatering:

1. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory foundation condition until the fill, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils, which become soft, loose, "quick", or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the CQA OFFICER at the CONTRACTOR's expense. The bottom of excavations shall be firm and without standing water before placing structures or pipes. Provide and maintain pumps, well points, sumps, suction and

discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Establish and maintain temporary drainage ditches and/or other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

4. Disposal of Water Removed by Dewatering System:

   a. Water conveyed away from excavations that has not contacted waste materials shall be routed to existing sedimentation basins or discharge to areas approved by the OWNER or CQA OFFICER.

   b. Water in contact with waste shall be pumped and disposed of in the existing leachate collection system at the site. The CONTRACTOR shall coordinate leachate disposal with OWNER.

3.03 EXCAVATION

A. General:

1. Excavation shall not commence until the CONTRACTOR has staked out the proposed work, including the alignment of trenches and this alignment is approved by the CQA OFFICER.

2. Excavations, except as specified hereinafter, shall be adequately sheeted and braced. Where the installation of sheeting is impractical or might cause damage, as a result of, but not limited to, vibration settlement or lateral movement, the CONTRACTOR shall utilize other acceptable methods.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

4. Notify CQA OFFICER of unexpected subsurface conditions and discontinue affected work in area until notified by the CQA OFFICER to resume work.

5. Excavation shall be carried to the dimensions indicated, specified or as required, to provide sufficient clearance for the construction and inspection of the structure to be installed.

6. Underpin adjacent structures that may be damaged by excavating work.

7. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Contract Drawings.

8. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against hazards and in accordance with the Health and Safety Plan. Excavations shall provide adequate working space and clearances for the work to be performed therein. If walls of the excavation cannot be kept stable, the excavation shall be properly shored and braced.

9. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Well/boring/test pit logs performed on-site are available for information purposes only to the CONTRACTOR. Excavated waste shall not be relocated except as approved by the OWNER. If excavated waste is allowed to be relocated and disposed of in landfill areas, the CONTRACTOR shall provide an approved daily soil cover or alternative daily cover over the waste at the end of each day. Temporary measures to minimize stormwater run-on to the waste disposal areas shall be implemented by the CONTRACTOR at no additional expense to the OWNER.

10. Excavation shall conform to the limits indicated on the Contract Drawings and as specified herein. This work shall include shaping, sloping, grading and other work necessary in bringing the site to the required grade, alignment, and cross-section.

11. Unsatisfactory materials shall be removed to the required depth and replaced to the satisfaction of the CQA OFFICER with General Fill or Subgrade material. Unsatisfactory materials shall be removed and disposed of in the designated areas on-site as directed by the CQA OFFICER or OWNER.

12. Clean excavated materials shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.

13. Rock may be encountered during construction outside the landfill area. If encountered, rock excavation limits shall be approved by the CQA OFFICER in accordance with the following criteria before the work commences:

    a. Pipe Trenches:

        i. The width of trenches shall be established as the outside diameter of the pipe plus 18 inches, unless otherwise specified, exclusive of

bells, branches, hubs, spurs, or cradles. The sides of the trench shall be considered as vertical.

ii. The depth of the trench shall be established at a depth of 6 inches below the outside of the pipe, unless otherwise specified.

iii. The length shall be equal to the laid length of pipe, measured horizontally (plan view).

iv. Additional width in pipe trenches at field joints or beyond the lines described above will be considered outside the limits described.

b. Structures:

i. The bottom of the footing, drainage course material, or compacted backfill or as shown on the drawings.

ii. The surface of the rock.

iii. Vertical planes located 12 inches outside the footing.

3.04 STRIPPING AND STOCKPILING OF VEGETATIVE SUPPORT SOILS

A. CONTRACTOR shall strip any vegetative support soils from all cleared areas. Avoid mixing vegetative support soils with subsoil and stockpile in areas on the site approved by the OWNER. Vegetative support soils shall be stockpiled free from brush, trash, large stones, and other extraneous material and protected until it is placed for surface restoration efforts as specified under the applicable section of these Specifications. Any vegetative support soils remaining after all Work is completed shall remain at the site in stockpiles as directed by the OWNER.

3.05 TRENCHING

A. Trench excavation for pipes and drainage structures (outside waste area limits):

1. Trench width shall be minimized to greatest extent practical but shall conform to the following:

a. Sufficient to provide room for installing, jointing, and inspecting piping, but in no case wider than shown on the Construction Drawings unless otherwise approved by the CQA OFFICER.

b. Enlargements at pipe joints may be made if required and approved by the CQA OFFICER.

c. Sufficient for sheeting, bracing, sloping, and dewatering.

d. Sufficient to allow thorough compacting of backfill adjacent to bottom half of pipe.

2. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil or bedding material.

3. No more than 200 feet of trench within landfill areas may be opened in advance of pipe laying operations at one time unless approved by the CQA OFFICER.

4. All trenches shall be constructed in a uniform grade, and free of standing water. The CONTRACTOR shall be responsible for maintaining these conditions. Subgrade soils that become soft, loose, or unsatisfactory as a result of inadequate dewatering and cannot be stabilized or re-compacted shall be removed and replaced with fill material as directed by the CQA OFFICER at the CONTRACTOR's expense.

5. Excavation for appurtenances shall maintain a minimum clearance of 12 inches between their outer surfaces and the face of the excavation, or sheeting, if used.

3.06 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations during period excavations will be open. Extend shoring and bracing as excavation progresses.

3.07 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for potential reuse, in accordance to respective specifications, where approved by the OWNER and/or CQA OFFICER. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain excavated soil and backfill materials away from edge of excavations. No excavated materials or other construction materials shall be placed within thirty (30) feet of the edge of pavement of any public road unless otherwise approved by the CQA OFFICER.

2. Comply with all erosion and sediment control requirements by state and local authorities.

3.08 DISPOSAL

A. CONTRACTOR shall coordinate the disposal of any and all suitable excess excavated materials with OWNER.

3.09 FINISHING WORK

A. Unless otherwise stated herein, construction tolerances shall be +0.2 feet horizontally, and +0.1 feet vertically. All surfaces shall be reasonably free from irregularities. Slopes or grades shall not be less than specified minimums nor greater than specified maximums as shown on the Drawings. Thicknesses of soil components shall be no less than specified and/or shown on the Drawings.

B. Grass areas disturbed by the operations under this section shall be restored to the grades indicated on the Contract Drawings, seeded, and mulched as specified in Section 02880, Loam/Seeding/Erosion Mat.

C. Existing bituminous pavements damaged by the CONTRACTOR's operations shall be restored by the CONTRACTOR to equal or better condition at no additional cost to the OWNER.

D. During trench excavation, no trench may be left open overnight. All open excavations must be covered by 2-inch thick plywood or steel sheeting and adequately barricaded.

3.10 FIELD QUALITY CONTROL

A. The depth and limit of excavation will be in accordance with these Contract Documents and the CQA OFFICER'S direction, and will be verified during the course of excavation by the CQA OFFICER.

END OF SECTION

SECTION 02175
CLEARING & GRUBBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials, the protection of certain existing trees and vegetation, removal of trees, stumps, roots and other vegetation, and the disposal of waste materials, as specified herein and on the Drawings.

1.03 RELATED WORK

Not applicable.

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Drawings, these Specifications and any pertaining local ordinances.

B. All work shall be performed within the Contract Limits shown on the Drawings.

C. Clearing may not be performed until adequate erosion and sedimentation controls have been established to the satisfaction of the OWNER and/or CERTIFYING ENGINEER.

3.02 PROTECTION OF EXISTING TREES AND VEGETATION

A. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

B. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during courses of construction operations.

C. Provide protection of roots over 1 ½-inch diameter from being cut during construction operations. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations. Repair or replacement shall be done in a manner acceptable to OWNER. Employ qualified tree surgeon to repair damages to trees and shrubs.

3.03 CLEARING

A. Clear site of trees, shrubs and other vegetation with the exceptions of those that are to remain.

B. In areas where more than ten (10) feet of filling is to occur, trees may be cut to within 12-inches above the existing ground surface and the stumps may be left in-place.

C. CONTRACTOR shall chip the small trees, shrubs and other vegetation and remove from site. Large trees shall be logged and removed from site.

3.04 DISPOSAL OF WASTE MATERIALS

A. Roots, stumps, brush, foliage, and other vegetation that are not suitable for reuse shall become the property of the CONTRACTOR, and shall be removed and disposed of off-site in a manner complying with all applicable local, State, and Federal regulations.

B. Burning of waste materials shall not be permitted without the consent of OWNER and local Fire Department. If burning is permitted, it shall be conducted in accordance with all pertaining State and local ordinances.

C. All waste materials and debris, including chips, roots, and logs shall be removed from site at no additional cost to OWNER.

D. All off-site disposal locations shall be approved by OWNER prior to any deposition of material at the designated site. Should the disposal site be located on private property, the CONTRACTOR shall provide the OWNER with a copy of the individual property owner's written permission to utilize that site.

3.05 PROTECTION OF INSTALLED MATERIALS

A. CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, and at no additional cost to OWNER.

END OF SECTION

SECTION 02200
GENERAL FILL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limiting to: hauling, grading, drying, removal of stormwater, removal of unsuitable materials, protection of installed materials, and all work incidental to installation or excavation of general fill material, as specified herein and on the Drawings.

1.03 RELATED WORK

A. Section 02210 – Subgrade

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

1.05 CLASSIFICATION OF EARTHWORK

A. All earthwork shall be unclassified; consequently, the bid price shall be taken to include all materials required to excavate, handle or compact whether wet or dry and regardless of the character of the materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General Fill material shall be a non-plastic material, free of contamination, sharp rocks, debris of any kind, organic matter, vegetation or any unsuitable objects.

B. General Fill soil shall be substantially free of particles over 6-inches in diameter. Particles over 6-inches in diameter may be placed in the bottom portion of the containment berms, fill areas, and/or perimeter roads. These particles shall be placed at intervals no less than

approximately two particle diameters apart and not within approximately two feet of the subgrade surface.

C. The surface of installed General Fill layer shall be substantially free of particles over 3 inches in diameter.

D. Suitable excavated materials shall be considered as General Fill.

PART 3 - EXECUTION

3.01 GENERAL FILL INSTALLATION

A. The existing site soils shall be used to the maximum possible extent.

B. Fill shall be constructed in horizontal layers as nearly even as practicable to prevent the thickness of lift from exceeding that specified.

C. The general fill shall be installed to the line and grade, as shown on the Drawings.

D. The bonding surface between adjoining lifts shall be moistened and scarified or tracked prior to installing overlying lifts.

E. Grading of the general fill soil shall be accomplished via grade stakes set to establish the thickness of the layer. Grade stakes must be removed once the layer has been completed and before subsequent materials are installed. Grade all surfaces to achieve a uniform grade and consistent surface free of ruts, voids, rills and soft spots.

3.02 MAINTENANCE OF GRADING

A. Repair any settlement or washouts that occur prior to acceptance of work. Re-establish all grades to required elevations and slopes.

B. Scarify, reshape and compact all areas disturbed by subsequent operations or adverse weather.

3.03 PROTECTION OF INSTALLED MATERIALS

A. CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, and at no additional cost to OWNER.

END OF SECTION

SECTION 02210
SUBGRADE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limiting to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to the proper placement and preparation of subgrade soil, as specified herein and as indicated on the Drawings.

1.03 RELATED WORK

A. Section 02200 – General Fill

1.04 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. Pre-construction testing is required on all proposed subgrade materials and excavated on-site soil proposed for use as subgrade material. All sampling and testing will be conducted by the CQA OFFICER. CONTRACTOR will provide labor and equipment as necessary to allow the CQA OFFICER or third party representative to collect a sample at source.

B. CQA OFFICER or designated representative shall conduct a minimum of one grain size test (ASTM D422), one modified proctor test (ASTM D1557) and one direct shear test (ASTM D3080) on a representative sample of each source of subgrade soil (including in-place soil to remain). This testing shall be conducted prior to the installation of imported Subgrade Soil. The results of this testing shall be submitted for approval a minimum of 5 days before the installation of Subgrade Soil.

C. OWNER and CERTIFYING ENGINEER reserve the right to require additional tests, and more frequent testing when there is a change (i.e. source or physical properties) in the material being delivered to the project site, or when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting the samples and testing.

1.05 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subgrade Soil shall be a non-plastic material, free of contamination, sharp rocks, and debris of any kind, organic matter, vegetation or any unsuitable objects.

B. Subgrade soil shall be substantially free of particles over 6-inches in diameter. Particles over 6-inches in diameter may be placed in the bottom portion of the containment berms, fill areas, and/or perimeter roads. These particles shall be placed at intervals no less than approximately two particle diameters apart and not within approximately two feet of the subgrade surface.

C. The surface of installed subgrade layer (top 6-inches) shall be substantially free of particles over 3 inches in diameter.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Drawings, these Specifications and any pertaining local ordinances.

B. CONTRACTOR will install a construction control grid. The control grid shall have defined positions every 50 feet across the area of the proposed baseliner. All aspects of construction shall be defined by the control grid including, but not limited to: the floor, tops and toes of slope, anchor trench, berms, and roadways. The construction control grid shall be established in rectangular coordinates and lie in the same orientation as the existing site's coordinate system.

C. Subgrade work shall result in a surface suitable for subsequent installation of base liner system, storm water structures, and access roads.

3.02 SUBGRADE SOIL INSTALLATION

A. CONTRACTOR shall construct the subgrade to elevations as shown on the Drawings. Subgrade soils shall be spread and compacted in loose lifts, not exceeding approximately 12 inches in thickness.

B. The subgrade shall be excavated or installed to the line and grade, and with a minimum thickness, as shown on the Drawings.

C. The density of the in-place Subgrade Soils shall not be less than 92 percent of the maximum dry density, as determined by the modified proctor test ASTM D1557, or as approved by CERTIFYING ENGINEER and/or CQA OFFICER.

D. No materials shall be placed over a lift that has not been tested and accepted by CERTIFYING ENGINEER and/or CQA OFFICER. Areas of installed subgrade that fail testing or are otherwise unacceptable to CERTIFYING ENGINEER and/or CQA OFFICER shall be reworked and retested.

E. The bonding surface between adjoining lifts shall be moistened and scarified or tracked prior to installing overlying lifts.

F. Grading of the subgrade layer shall be accomplished via grade stakes set to establish the thickness of the subgrade layer. Grade stakes must be removed once the layer has been completed and before subsequent materials are installed. Grade all surfaces to achieve a uniform grade and consistent surface free of ruts, voids, rills and soft spots.

3.03 CONSTRUCTION TESTING REQUIREMENTS

A. CQA OFFICER shall conduct construction testing on in-place subgrade as follows:

1. Field density/Moisture content test (ASTM D2922/D3017) shall be performed on all installed subgrade at a minimum frequency of nine tests every acre every 12-inch lift on the base and side slope areas. On containment berms, field density/moisture content testing shall be performed at a minimum frequency of one test every 100 linear feet every 12-inch lift.

B. Subgrade Soils must pass the specifications as provided in Part 2.01 of this Section.

C. OWNER and CERTIFYING ENGINEER reserve the right to require additional tests, and more frequent testing, when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting the samples and testing.

3.04 PROTECTION OF INSTALLED MATERIALS

A. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING INSTALLED MATERIALS AND PREVENTING THEIR DAMAGE.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the satisfaction of OWNER, and at no additional cost to OWNER.

3.05 RECORD DRAWINGS

A. CONTRACTOR shall submit preliminary "as-built" information after the completion of the Subgrade Layer so CERTIFYING ENGINEER can review and compare "as-built" grades to design grades. The plan shall depict the topographic information, construction grid (refer to 3.01B), and locations where material samples were collected. No work shall begin on low permeability soil layer until OWNER and ENGINEER have approved the Record Drawings.

B. CONTRACTOR shall submit "as-built" Record Drawings in accordance with Section 01780 - Record Drawings.

END OF SECTION

SECTION 02300
LOW-PERMEABILITY SOIL LINER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to the proper installation of the Low Permeability Soil layer, as specified herein and as indicated on the Drawings. Low Permeability Soil may be available from on-site sources.

B. Prepare and submit to OWNER a written plan describing Low Permeability Soil screening, wetting, installation, and protection of installed materials. The plan shall include equipment and manpower estimates and a description of construction controls. The plan shall be submitted to OWNER and CERTIFYING ENGINEER at least 2 weeks prior to CONTRACTOR beginning installation of the Low Permeability Soil layer.

1.03 RELATED WORK

A. Section 02210 – Subgrade

B. Section 02500 – Geomembrane

1.04 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. Pre-construction testing is required on all proposed low permeability materials. CQA OFFICER is responsible for collecting all samples and testing. CONTRACTOR will provide labor and equipment as needed for the CQA OFFICER or third party representative to collect samples at source.

B. CQA OFFICER, or designated representative shall collect sample and conduct a minimum of one grain size/hydrometer (ASTM D422), one moisture content test (ASTM D2216), one Atterberg limit test (ASTM D4318), one modified proctor test (ASTM D1557), one permeability test (ASTM D5084) and one direct shear test (ASTM D3080) on a representative sample of each source of Low Permeability Soil. This testing shall be conducted prior to the delivery of the Low Permeability Soil to the project site. The results of this testing shall be submitted for approval a minimum of 5 days before the delivery of the Low Permeability Soil to the project site.

C. CQA OFFICER shall conduct testing consisting of interface shear tests (ASTM D5321) on the following interfaces:

a. Low permeability soil and Geomembrane.

D. Direct shear testing (ASTM D3080) and interface shear testing (ASTM D5321) shall determine strength at normal stresses of 500 psf, 5,000 psf, and 10,000 psf. Each shear test shall be performed using the same installation procedures in order to represent actual field conditions. Tests shall be run on fully saturated materials under drained conditions and sheared at a displacement rate of 0.04 in/min to a minimum horizontal displacement of 3 inches. Additional samples shall be collected and tested if the material does not meet specifications as of Part 2.01 of this Section, at no additional cost to OWNER.

E. CQA OFFICER, before delivering Low Permeability Soil to the project site, shall prepare a Hydraulic Conductivity Curve that documents and defines the soil densities and moisture contents needed to achieve the specified hydraulic conductivity. Several hydraulic conductivity tests shall be performed on samples of each Low Permeability Soil source; the tests shall cover a range of soil densities (85% to 90% of the modified proctor) and moisture contents (optimum to 8% wet of optimum). The results of the hydraulic conductivity tests shall be plotted on the moisture-density curve for the soil. The acceptable range of soil densities and moisture contents shall be those that achieve the hydraulic conductivity specification. As additional test data is developed during the installation of the Low Permeability Soil, CQA OFFICER shall add the data to the Hydraulic Conductivity Curve, as determined by such testing.

F. CERTIFYING ENGINEER and/or CQA OFFICER reserves the right to require additional tests, and more frequent testing, when there is a change (i.e. source or physical properties) in the material being delivered to the project site, or when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting samples and testing.

1.05 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Low Permeability Soil shall be clean, substantially free of contamination, sharp rocks, gypsum, ferrous, limestone based materials or other unsuitable objects as identified by the CERTIFYING ENGINEER and classified as a GM, GC, CL or CH soil by the Unified Soil Classification System.

B. The low permeability soil material must be free from stones greater than one inch in diameter and stones having an angular surface.

C. The following gradation requirements serve as a general guideline for selection of material suitable for placement as low permeability soil. Deviation from these guidelines may be allowed at the discretion of the CERTIFYING ENGINEER, provided the material meets the permeability requirements identified below.

1. A minimum of 90 percent of the soil by weight shall pass a #4 sieve as determined by ASTM D422.

2. A minimum of 40 percent of the soil by weight shall pass a #200 sieve as determined by ASTM D422.

3. A minimum of 10 percent of the soil by weight shall be less than 0.002 mm "clay" size particles as determined by ASTM D422.

4. The maximum clod size of soils delivered to the site shall be less than approximately 3 inches. Any clod size over approximately 3 inches in diameter that is developed through the mixing process shall be pulverized or removed prior to compaction.

D. Low Permeability Soil shall have an in-place hydraulic conductivity equal to or less than 1×10^{-7} centimeters per second as determined by ASTM D5084.

E. As part of the pre-construction testing (see Part 1.04 of this Section), CQA OFFICER or third party representative will collect sample and perform direct shear testing in accordance with ASTM D3080. The Low Permeability Soil shall have the following minimum internal shear strengths:

Low Permeability Soil (85 percent of the maximum dry density at 5 to 8 percent above optimum moisture content) under saturated conditions:

Shear Strength (at 500 psf) $\geq 25°$

Large Displacement Shear Strength (at 5,000psf and 10,000 psf) $\geq 14°$

F. As part of the pre-construction testing (see Part 1.04 of this Section), CQA OFFICER shall perform interface shear testing in accordance with ASTM D5321. The Low Permeability Soil shall have the following minimum shear strength:

Low Permeability soil (85 percent of the maximum dry density at 5 to 8 percent above optimum moisture content) and Geomembrane under saturated conditions:

Interface shear strength (at 500 psf) $\geq 23°$

Large Displacement Interface shear strength (at 5,000 psf and 10,000 psf) $\geq 14°$

G. If peak shear strength at 500 psf does not meet minimum friction angle requirement, ENGINEER may conduct veneer stability analyses that account for anchor trench soil weight and submit calculations in Certification Report confirming adequate factor of safety is obtained during short-term conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Drawings, these Specifications and any pertaining local ordinances.

B. CONTRACTOR will install a construction control grid. The control grid shall have defined positions every 50 feet across the area of the proposed baseliner. All aspects of construction shall be defined by the control grid including, but not limited to: the floor, tops and toes of slope, anchor trench, berms, and roadways. The construction control grid shall be established in rectangular coordinates and lie in the same orientation as the existing site's coordinate system.

3.02 PREPARATION

A. CONTRACTOR and CQA OFFICER shall inspect the surface of the subgrade prior to installing the Low Permeability Soil. CONTRACTOR shall remove stones larger than approximately 3 inches in size and any other materials considered unsuitable. CONTRACTOR shall remove ponded water, remove subgrade soils softened by water, and

replace the soils with new subgrade soils. New subgrade soils placed by CONTRACTOR shall be compacted and placed to the lines and grades shown on the Drawings.

B. CONTRACTOR shall repair erosion rills and irregularities of grade in the subgrade prior to placing the Low Permeability Soil. Repairs shall be such that the lines and grade of the subgrade are as shown on the Drawings.

C. CONTRACTOR shall proof-roll the subgrade prior to placing the Low Permeability Soil.

D. Prior to the placement of the Low Permeability Soil, CQA OFFICER shall verify that the subgrade surface is acceptable and that CERTIFYING ENGINEER has verified all lines and grades of the subgrade layer.

E. The subgrade surface shall be wetted so as to prevent "wicking" of moisture from installed Low Permeability Soil and to ensure a proper bonding between layers.

F. CONTRACTOR and CQA OFFICER shall visually inspect each truckload of material delivered to the site. The Low Permeability Soil shall be accepted for use once all parties agreed that the quality of the Low Permeability Soil visually satisfied the specifications.

3.03 TEST PAD

A. CONTRACTOR shall construct a test pad using the same materials that will be used for the Low Permeability Soil layer. The test pad shall be approximately 75 feet wide and approximately 75 feet long, and shall be comprised of a maximum acceptable compacted lift thickness of 8 inches for all areas. The test pad will represent the first (i.e. bottom) lift of the low permeability soil liner. The minimum thickness of the completed Low Permeability Soil layer shall be at least 24 inches after compaction. It shall be constructed in the same manner (i.e. same equipment and effort) that will be used to construct the Low Permeability Soil layer. CONTRACTOR may construct the test pad in the work area. A successful test pad may be incorporated into the Low Permeability Soil layer.

B. CQA OFFICER shall conduct in-place construction tests described in Part 3.06 to document construction of the test pad. The objective of the test pad is for CONTRACTOR to get familiar with the Low Permeability Soil to be used and to refine their procedures for installing the materials.

C. CONTRACTOR and CQA OFFICER shall observe the test pad construction and record the work.

D. If the test results indicate that the test pad construction does not conform to the specifications, CONTRACTOR shall reconstruct and/or rework the test pad until the test

pad conforms to specifications before beginning work on the remaining Low Permeability Soil layer.

3.04 LOW PERMEABILITY SOIL LAYER INSTALLATION

A. CONTRACTOR shall place Low Permeability Soils in maximum 8-inch thick lifts (after compaction). The completed Low Permeability Soil layer shall be at least 24 inches thick. Shim lifts will not be allowed. While placing the Low Permeability Soil, laborers shall remove materials that do not conform to the specifications.

B. No low permeability soil shall be placed over subgrade or low permeability layers that have not been tested and approved by the CERTIFYING ENGINEER and/or CQA OFFICER. Areas that fail testing or are otherwise unacceptable to the CERTIFYING ENGINEER and/or CQA OFFICER shall be reworked and retested as necessary.

C. Using a bulldozer and a pad-foot vibratory roller (or similar equipment), the Low Permeability Soil shall be mixed and moisture added to achieve uniform particle size and uniform moisture content throughout the material. During the mixing process, laborers shall remove materials that do not conform to the specifications.

D. The control of moisture is critical to achieving the desired in-place saturated hydraulic conductivity of the Low Permeability Soil layer. Thus, maintaining the moisture content shall be given a high priority by CONTRACTOR. CONTRACTOR shall provide a means for protecting all installed Low Permeability Soil against drying and freezing. If in the opinion of the CQA OFFICER, the soil is too dry to achieve proper compaction or a sufficiently low permeability, a sufficient quantity of clean water shall be added to the soil to attain an acceptable moisture content.

E. Once the uniform particle size and moisture content are achieved, the Low Permeability Soil shall be compacted using a smooth drum vibratory roller or similar equipment to produce a smooth surface.

F. Compaction shall be performed until the in-place density and moisture content are within the acceptable range to achieve the hydraulic conductivity specification as established by the Hydraulic Conductivity Curve (see Part 1.04). At no time shall the density be less than 85 percent of the maximum dry density, as determined by the modified Proctor test ASTM D1557.

G. A new lift of Low Permeability Soil shall not be placed above a previously placed lift of Low Permeability Soil that has not been tested for in-place moisture content and density.

H. Once the first lift is approved and prior to the second lift placement, the first lift shall be tracked with a bulldozer or pad-foot vibratory roller and wetted to enhance adhesion

between the upper and lower lifts. This procedure shall be followed for the placement of lifts until reaching the required minimum thickness of 24 inches.

I. The following lifts shall be placed and compacted in the same manner as the first lift. While placing and compacting the subsequent lift of Low Permeability Soil, laborers shall remove any unsuitable materials.

J. CONTRACTOR may need to utilize the bucket of an excavator, wooden planks attached to the laborers' work boots and/or hand-held tampers to smooth out footprints and minor ridges in the Low Permeability Soil surface.

K. The CQA Officer or Certifying Engineer will observe the final surface of the low permeability soil layer for contaminants, such as vegetation and other foreign matter, and for rutting, ridges, or other defects that would inhibit direct contact between the low permeability soil and the overlying geomembrane. The CONTRACTOR will remedy areas identified by the CQA Officer or Certifying Engineer prior to geomembrane installation.

3.05 LOW PERMEABILITY SOIL THICKNESS CONTROL

A. CONTRACTOR shall place Low Permeability Soils in maximum lifts of 8 inches in thickness (after compaction). The completed Low Permeability Soil layer shall be at least 24 inches thick (after compaction). Thus, a number of measures must be implemented to assess the compliance with this requirement.

B. CONTRACTOR shall provide grade stakes set at specific control points (see Part 3.01) for line and grade controls to guide the installation of the Low Permeability Soil. Once grades are achieved and prior to the geomembrane placement, CONTRACTOR is responsible for removing all grade stakes from the Low Permeability Soil. All penetrations in the Low Permeability Soil layer shall be filled with Low Permeability Soil or bentonite.

3.06 CONSTRUCTION TESTING REQUIREMENTS

A. CQA OFFICER shall retain the services of a qualified geotechnical laboratory to conduct construction tests on samples of Low Permeability Soil. CQA OFFICER is responsible for collecting samples and testing.

B. CQA OFFICER shall conduct construction testing on Low Permeability Soil as follows:

1. Atterberg limits tests (ASTM D4318) shall be performed on each source sample as the material is transported on-site at a minimum frequency of one test every 1,000 cubic yards placed.

2. Moisture content tests (ASTM D2216) shall be performed on each source sample as the material is transported on-site at a minimum frequency of one test every 1,000 cubic yards placed.

3. Grain size/hydrometer test (ASTM D422) shall be performed on each source sample as the material is transported on-site at a minimum frequency of one test every 2,500 cubic yards placed.

   a. Comparisons of the moisture-density-permeability relation shall be performed on each source sample as the material is transported on-site at a minimum frequency of one test every 5,000 cubic yards placed.

   b. Permeability tests (ASTM D5084) shall be performed on each source sample as the material is transported on-site at a minimum frequency of one test every 5,000 cubic yards.

C. CQA OFFICER shall conduct construction testing on in-place Low-Permeability Soil as follows:

1. Permeability tests (ASTM D5084) shall be performed on undisturbed samples of in-place compacted soils at a minimum frequency of one test every acre every 8-inch thick lift.

D. CQA OFFICER shall conduct construction testing on in-place Low-Permeability Soil as follows:

1. Field density/Moisture content test (ASTM D2922/D3017) shall be performed on all installed Low Permeability Soil at a minimum frequency of nine tests every acre every lift. On containment berms, field density/moisture content testing shall be performed at a minimum frequency of one test every 100 linear feet every lift.

2. Low Permeability Soil must pass the specifications as provided in Part 2.01 of this Section.

E. CONTRACTOR shall provide labor and equipment as needed for the CQA OFFICER or third party representative to collect the required samples.

F. OWNER, CERTIFYING ENGINEER, and/or CQA OFFICER reserves the right to require additional tests, and more frequent testing, when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting samples and testing.

3.07 PROTECTION OF INSTALLED MATERIALS

A. CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, and at no additional cost to OWNER.

C. CONTRACTOR shall re-wet, rework, re-compact and retest any installed Low Permeability Soil that has a moisture content below the acceptable range defined on the Hydraulic Conductivity Curve (see Part 1.04 of this Section).

D. Any installed Low Permeability Soil that exhibits desiccation or cracking, or has frozen, shall be reworked to attain the desired saturated hydraulic conductivity and retested prior to placing overlying liner materials at the approved of OWNER, CERTIFYING ENGINEER, and/or CQA OFFICER.

E. To prevent the Low Permeability Soil layer from desiccating, CONTRACTOR may cover the soil layer with a plastic film on a daily basis. The plastic film shall be weighted down with sand bags or other materials to prevent transfer of air between the plastic film and soil. It is CONTRACTOR'S responsibility to maintain the moisture content within the acceptable range as shown on the Hydraulic Conductivity Curve.

F. The final surface of the Low Permeability Soil layer shall be maintained using water and brooms to keep the surface hydrated and to manage surficial cracks. Any areas not conforming to the specifications shall be reworked and retested prior to deployment of the geomembrane. Granular bentonite may be used to fill in minor, but acceptable, cracks that developed on the surface.

G. The daily work area shall be no larger than necessary to maintain moist soil conditions and continuous operations. Approved areas shall be covered with the geomembrane as soon as possible to prevent the surface of the low permeability soil from desiccation.

H. To prevent the Low Permeability Soil layer from freezing, CONTRACTOR may cover the soil layer with frost blankets on a daily basis, as needed.

3.08 RECORD DRAWINGS

A. CONTRACTOR shall submit "as-built" information within 24 hours after the completion of the Low Permeability Soil layer so CERTIFYING ENGINEER can review and compare "as-built" grades to design grades. The plan shall depict the topographic information, construction grid (refer to 3.01B), and locations where material samples were collected. No work may begin on the geomembrane until the "as-built" information is accepted by OWNER and CERTIFYING ENGINEER.

B. CONTRACTOR shall submit "as-built" Record Drawings of the Low-Permeability Soil in accordance with Section 01780 – Record Drawings.

END OF SECTION

SECTION 02500
HDPE GEOMEMBRANE

PART 1 - GENERAL

1.05 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.06 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all geomembrane liner materials, tools, supervision, equipment, and labor consisting of but not limited to: supplying quality control certificates from the manufacturer, providing pre-construction testing (Part 1.04) and construction testing (Part 3.04), transportation, unloading and proper storage and handling, layout and placement, patching, seam testing, removal of unsuitable materials, protection of installed materials and all work incidental to the proper installation of the geomembrane liner, as specified herein and as indicated on the Contract Drawings.

B. Coordinate geomembrane liner installation with the placement of the low permeability soil layer and the placement of the drainage layer materials.

C. CONTRACTOR shall be responsible for geomembrane material staging areas, unloading, stockpiling, storage, and protection.

1.07 RELATED WORK

A. Section 02300 – Low Permeability Soil Layer

B. Section 02550 – Drainage Layer

C. Section 02595 - Geotextile

1.08 MANUFACTURER'S TESTING REQUIREMENTS

A. The GEOMEMBRANE MANUFACTURER shall supply the CERTIFYING ENGINEER with quality control certificates on each roll of geomembrane delivered to the site. The certificates shall conform to testing frequencies and parameters as indicated in Part 2.01 of this Section. The certificates shall, at a minimum, indicate manufacturer's name, type of material, nominal thickness, roll width and length, and date of manufacture.

B. Extrudate rod shall be manufactured of the same resin type as the geomembrane and shall have the physical properties as indicated in Part 2.01 of this Section.

1.09 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. OWNER will retain the services of a Geosynthetics Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) certified laboratory for performing pre-construction testing required in this Section. The results of all testing shall be completed before any geomembrane is incorporated into the work.

B. The GEOMEMBRANE MANUFACTURER shall send samples of the geomembrane taken from rolls that will be delivered to the site to the geotechnical laboratory, as determined by the OWNER, to conduct pre-construction testing. Each sample must be identified with the corresponding roll number.

C. At the OWNER'S direction, the laboratory shall conduct testing consisting of interface shear tests (ASTM D5321) on the following interfaces:

1. 60-mil textured HDPE Geomembrane and Low Permeability Soil Layer,

2. 60-mil textured HDPE Geomembrane and Geotextile

D. Each test shall determine interface strength at normal stresses as specified in the table below. Each interface shear test shall be performed using the same materials and installation procedures in order to represent actual field conditions. Tests shall be run on fully saturated materials under drained conditions and sheared at a displacement rate of 0.04 in/min to a minimum horizontal displacement of 3 inches. Additional samples shall be collected and tested if the material does not meet specifications as of Part 2.01 of this Section, at no additional cost to the OWNER.

Material	Normal Stresses for Interface Testing (psf)
60-Mil Textured HDPE Geomembrane	500 psf, 5,000 psf, 10,000 psf

1.010 LINE AND GRADE CONTROL

A. The EARTHWORK and GEOMEMBRANE CONTRACTORS are responsible for line and grade control for all aspects of the work in this Section in accordance with the Contract Drawings and these Specifications.

1.011 SUBMITTALS

A. The GEOMEMBRANE MANUFACTURER shall submit to the CERTIFYING ENGINEER quality control certificates on each roll of the geomembrane. Such test results must document compliance with the specifications in Part 2.01 of this Section.

B. The GEOMEMBRANE MANUFACTURER shall submit representative samples of the geomembrane (that will be delivered to the site) to a geotechnical laboratory for pre-construction testing and samples to a Geosynthetics Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) certified laboratory for construction testing. Such test results must document compliance with the specifications in Part 2.01 of this Section.

C. The GEOMEMBRANE CONTRACTOR shall submit geomembrane panel layout drawings to the OWNER at least 10 days prior to beginning the installation of the geomembrane. The panel layout drawings shall be prepared at scale not less than 1” = 50’. Each drawing shall show the location of geomembrane panels, seam locations, destructive sample locations, pipe penetrations and anchor trench.

D. GEOMEMBRANE CONTRACTOR shall submit acceptable verification of installer’s qualifications and experience.

1.012 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle and store geomembrane rolls and associated materials in such a manner as to ensure a sound, undamaged condition. Procedures shall be in conformance with manufacturer's recommendations.

B. Rolls will be stored at the job site away from high-traffic areas but sufficiently close to the active work area to minimize handling. The designated storage area should be flat, dry and stable.

C. Only undamaged geomembrane shall be included within this Work.

D. The OWNER shall replace geomembrane material found to be damaged, as necessary. If such damage occurs after the commencement of Work, as determined by the OWNER and/or CQA OFFICER, the CONTRACTOR will be responsible for reimbursing the OWNER’s cost of providing replacement geomembrane material, including laboratory testing, freight, and taxes. The CONTRACTOR will not be granted extensions to the completion dates as a result of the manufacturing lead-time or delivery times required for the OWNER to replace damaged geomembrane material, unless otherwise approved in writing by the OWNER.

1.013 QUALIFICATIONS

A. The GEOMEMBRANE MANUFACTURER must have at least five years' experience in the manufacture of the specified geomembrane material. In addition, the geomembrane manufacturer shall have produced at least 10 million square feet of similar material within the last three years.

B. The GEOMEMBRANE CONTRACTOR must have at least five years' experience in the installation of the specified geomembrane material. In addition, the geomembrane installer must have installed at least five projects involving a total of 50 acres of similar material within the last three years.

C. The GEOMEMBRANE CONTRACTOR's supervisor must be on-site and be in responsible charge for the full duration of the geomembrane installation. The supervisor must have supervised the installation of at least 50 acres of geomembrane on a minimum of five separate projects.

D. The GEOMEMBRANE CONTRACTOR must establish a Quality Control (QC) representative who must be responsible in the field for the quality and integrity of the geomembrane installation, including all testing, inspections, documentation and interaction with the CQA OFFICER. The QC representative must have performed these duties on at least 50 acres of geomembrane on a minimum of five separate projects.

E. The GEOMEMBRANE CONTRACTOR is responsible for all means, methods, techniques, sequences, and procedures related to the installation of the geomembrane materials.

F. The GEOMEMBRANE CONTRACTOR's welding personnel must be certified to operate the welder by a certification program acceptable to the New York State Department of Environmental Conservation.

PART 2 - PRODUCTS

2.01 GEOMEMBRANE

A. The geomembrane shall be 60-mil textured high-density polyethylene (HDPE), as shown on the Contract Drawings. The texturing shall be evenly distributed on both sides of the membrane.

B. Geomembrane materials shall be delivered to the site in rolls and shall be manufactured by GSE Lining Technologies, Inc. or approved equal.

C. The geomembrane material shall be tested to the frequencies and physical properties as follows:

60-Mil HDPE Geomembrane Testing Frequency and Test Methods[1]		
Test	**Frequency**	**Value**
Thickness (ASTM D5994)	Each roll	57 mil (min. avg.) 8 out of 10 values[2] = 54 mil (min.) 10 out of 10 values[3] = 51 mil (min.)
Asperity Height (ASTM D7466)	Every second roll	16 mil (min. avg.)
Density (ASTM D1505/792)	200,000 lbs.	0.940 g/cc (min. avg.)
Tensile Properties (ASTM D6693 – Type IV)	20,000 lbs.	Yield strength: 126 ppi Break Strength: 90 ppi Yield elongation: 12% Break elongation: 100%
Tear Resistance (ASTM D1004)	45,000 lbs.	42 lbs. (min. avg.)
Puncture Resistance (ASTM D4833)	45,000 lbs.	90 lbs. (min. avg.)
Stress Crack Resistance (ASTM D5397)[4]	per GRI GM10	500 hr
Carbon Black Content (ASTM D4218)	20,000 lbs.	2%-3%

Carbon Black Dispersion (ASTM D5596)	45,000 lbs.	9 values: Category 1 or 2 1 value: Category 3
Oxidative Induction Time (OIT) (e) Standard OIT (ASTM D3895) — or — (f) High Pressure OIT (ASTM D5885)	200,000 lbs.	100 (min. avg.) 400 (min. avg.)
Oven Aging at 85°C (ASTM D5721) (a) Standard OIT - % ret. after 90 days (ASTM D3895) — or — (b) High Pressure OIT - % ret. after 90 days (ASTM D5885)	per formulation	55% (min. avg.) 80% (min. avg.)
UV Resistance (GM11) (a) Standard OIT (ASTM D3895) — or — (b) High Pressure OIT -% ret. after 1600 hrs. (ASTM D5885)	per formulation	N.R.[5] 50% (min. avg.)

Notes: 1. Properties presented in this table are based on GRI GM13, Test Methods, Test Properties and Testing

Frequency for HDPE Smooth and Textured Geomembranes, Revision 12, dated 11/14/2014.

2. Lowest individual for 8 out of 10 values.

3. Lowest individual for any of the 10 values.

4. See note #4 in table 2(a) of GRI GM13.

5. See note #10 in table 2(a) of GRI GM13.

Geomembrane and extrudate rod shall be manufactured with the same resin type. Each batch of resin used to produce the geomembrane and extrudate rod shall have the physical properties as follows:

GEOMEMBRANE RESIN PROPERTIES AND QUALITY CONTROL TESTING REQUIREMENTS		
Test	**Standard**	**HDPE Value**
Density	ASTM D1505	0.932 g/cc (min.)
Melt Flow Index	ASTM D1238	1.0 g / 10 minutes (max)

D. As part of the pre-construction testing (see Part 1.05 of this Section), CQA OFFICER shall conduct interface shear testing to be performed on each interface of the baseliner system in accordance with ASTM D5321. The geomembrane interfaces shall have the following minimum secant friction angles:

60-mil Textured HDPE Geomembrane and Low Permeability Soil Layer under saturated conditions:

Interface shear strength (at 500 psf) $\geq 23°$

Large Displacement Interface shear strength (at 5,000 psf and 10,000 psf) $\geq 14°$

60-mil Textured HDPE Geomembrane and Geotextile under saturated conditions:

Interface shear strength (at 500 psf) $\geq 25°$

Large Displacement Interface shear strength (at 5,000 psf and 10,000 psf) $\geq 14°$

E. If peak shear strength at 500 psf does not meet minimum friction angle requirement, ENGINEER may conduct veneer stability analyses that account for anchor trench soil weight and submit calculations in Certification Report confirming adequate factor of safety is obtained during short-term conditions.

PART 3 – EXECUTION

3.01 GENERAL

All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

3.02 PREPARATION

A. The GEOMEMBRANE CONTRACTOR shall conduct all work necessary to ensure that the surfaces on which the geomembrane is to be placed are free of irregularities, erosion rills, protrusions, loose soil, changes in grade, stones, rocks, sticks, roots, sharp objects, or debris of any kind that may damage the geomembrane. No areas with standing water, or which are excessively softened by high water content, shall be allowed.

B. The low permeability soil layer must be reviewed and approved by the CQA OFFICER before placing the geomembrane.

3.03 GEOMEMBRANE BARRIER INSTALLATION

C. Panel placement should commence at the upgradient limit of work and progress in a downhill fashion. The panels may be placed by manually unrolling the geomembrane into position or by using heavy equipment provided the chosen method does not create ruts or other damage in the underlying materials or damage the geomembrane. A smooth geomembrane rub sheet may be used.

D. Vehicles used for geomembrane deployment shall conform to the following requirements:

1. Vehicles to be used shall be approved by the CERTIFYING ENGINEER prior to use on the geosynthetics.

2. Tire pressure shall not exceed five (5) psi unless otherwise approved by the CERTIFYING ENGINEER, and shall adhere to minimum ground pressure requirements.

3. No sharp turns, sudden stops or quick starts shall be allowed.

4. Vehicles shall be used in a controlled manner at all times and for the use of geosynthetic deployment only. Abuse or misuse of the vehicles will result in termination of such vehicles for use in geosynthetic deployment.

5. No equipment other than LGP vehicles shall be used over any the low permeability soil layer.

6. Rub sheets acceptable to the CQA OFFICER must be placed underneath all tools, generators, welding equipment, etc. while on the geomembrane.

C. The geomembrane panels must be oriented parallel to the line of maximum slope, (i.e., oriented up and down, not across, the side slope). No horizontal seams shall be within five feet of the toe of the slope or any anchor trench. No horizontal seams shall be allowed on slopes unless otherwise approved by CQA OFFICER.

D. Adjacent panels for end of panels shall be overlapped a minimum of 12 inches. All over laps shall be such that the upslope panel is placed over the down slope panel. Horizontal end of roll seams shall be staggered every other panel upslope and downslope by a minimum of 15 feet.

E. After the geomembrane is completely unrolled, it must be positioned. If the panel is being installed overlapping a previously placed panel, as recommended by the geomembrane manufacturer, care must be taken to align the sheets for seaming. When positioned, wrinkles shall be worked out of the geomembrane, prior to seaming.

F. All deployed panels must be provided with ballast to prevent their movement. Ballast shall be provided, as needed, to prevent the movement of deployed geomembrane. At a minimum, sand in burlap bags should be placed every 1 to 2 feet along a seam.

3.04 GEOMEMBRANE SEAMING

A. All geomembrane seam welding shall be by the hot-wedge (fusion) weld method. The welding equipment shall form a double-track fusion weld seam with an air channel in between. Extrusion welding is allowed but shall be limited to detail work and patching, and shall not be used as a general method of seaming unless otherwise approved by CQA OFFICER. The welding process shall be in accordance with the geomembrane manufacturer's recommendations.

B. Prior to field seaming, the geomembrane surface shall be free of dust, silt and debris. Furthermore, the welding surface must be dry and at the proper temperature as recommended by the geomembrane manufacturer. The installer should be equipped with an ample supply of clean rags to dry and remove dust from the welding surface. A means for preheating the seam prior to welding may be necessary in cold weather.

C. Seaming shall only be performed under proper weather conditions. The highest and lowest allowable ambient temperatures for welding are based on conditions such as ambient temperature, wind, subgrade conditions, exposure to sunlight, material type, and material thickness. Welding in such temperatures may be performed by increasing or decreasing the welding speeds and/or wedge temperature. Seaming shall not be

performed during periods of precipitation, or when winds are in excess of 20 miles/hour. Unless otherwise approved, field seaming is prohibited when the ambient temperature is below 32°F and above 120°F as measured six inches above the geomembrane surface, or when the sheet temperature exceeds 158 °F. CQA OFFICER at its discretion may request cessation of seaming due to unacceptable weather conditions or may require an increase in the number of trial welds and/or supplemental destructive seam testing.

D. All seams shall extend the full length of the panels being joined. Repairs shall be placed at all panel intersections. When seaming adjacent panels along an anchor trench, the seam shall extend completely through the anchor trench. Plywood or other flat surfaces shall be used to bridge the trench while welding the seam.

E. All "fish-mouths" and wrinkles on a seam shall be removed by cutting the geomembrane and installing an overlapping patch.

F. The CONTRACTOR shall not conduct any seaming operations without prior notification of CQA OFFICER.

3.05 PATCHING

E. Once the geomembrane has been deployed, the panels must be examined for flaws, holes, defects and tears. Each location requiring a repair shall be repaired using the following procedures:

1. Patching - A patch shall be used to repair defects in the geomembrane that are 1/8-inch or larger.

2. Abrading and Re-welding - This procedure may be used to repair seam sections that are less than 10 feet in length

3. Spot Welding - Spot welding may be used to repair small tears, pinholes and/or other small defects.

4. Capping – Capping shall be used to repair failed seams that are greater than 10 feet in length.

F. Patches or caps shall extend at least six inches beyond the edge of the defect. The edges of the patch or cap shall be extrusion welded to the in place geomembrane after both the liners are abraded to remove the surface sheen of the geomembrane and to provide a surface that is more conducive to accepting the weld. Welding of the repair patch or cap shall be completed by extrusion welding the geomembrane. The repairs shall be non-destructive tested using the vacuum-box method as described in this Section.

G. The CONTRACTOR shall not conduct repairs without prior notification of CQA OFFICER.

3.06 GEOMEMBRANE TESTING

H. TRIAL WELD TESTS

1. The CONTRACTOR shall perform trial welds for each piece of welding equipment to be used as follows: at the beginning of each seaming period, at least once every four (4) hours, when the person running the welding equipment has changed, when the welding equipment has been shut-off or has been unused for a period for one hour or longer, and if there has been a 20°F rise or drop in ambient temperature since the last passing trial weld. CQA OFFICER may require more frequent trial welds when the ambient air temperature is less than 40°F or CQA OFFICER's observations of seam conditions warrant additional trails welds.

2. Trial welds shall be performed on fragment pieces of geomembrane, varying in length between three-feet (extrusion welds) to ten-feet (double-track welds) long and one (1) foot wide. Once completed, the weld shall be visually inspected for deficiencies before taking a minimum of seven, one-inch wide random specimens from the trial weld. The seven specimens shall be tested by the CONTRACTOR for peel and shear strength (five in peel, two in shear) using a field tensiometer with the results being properly recorded by the CONTRACTOR and CQA OFFICER. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. All trial weld specimens shall exhibit a film tear bond (FTB) and shall meet or exceed the minimum seam strength requirements in Section C part f of this specification section. Only those pieces of equipment that provide passing test results shall be used for seaming or repair work

3. Additional trial welds shall be performed for failed samples. This retesting procedure includes adjusting the temperature of the double-track hot-wedge (or extrusion welding gun) and/or the speed at which the double-track hot-wedge weld is performing. Once adjustments have been made, additional trial welds shall be made and tested. If the specimen fails the retest, the seaming apparatus and procedures will not be accepted and shall not be used for seaming until the deficiencies are corrected and a minimum of two consecutive successful trial welds are achieved.

4. The CONTRACTOR shall not conduct trial welds without prior notification of CQA OFFICER.

I. NON-DESTRUCTIVE TESTS

1. The CONTRACTOR shall perform non-destructive tests on all welds during the seaming process to establish seam continuity. All seams constructed in the field shall be subjected to non-destructive testing along their entire lengths (including seams that pass through the anchor trench).

2. The CONTRACTOR shall verify the continuity of the entire length of hot wedge welded field seams by performing an air pressure test.

3. The air pressure test shall be performed on all double-track hot-wedge welds. This test method involves the application of air pressure (27 to 30 psi for 60-mil HDPE) to the channel between the parallel welds and observing the stability of the pressure for the duration of the test. After a two-minute (minimum) relaxation period to stabilize the air pressure in the channel, the pressure shall be at least 27 psi for 60-mil HDPE before beginning the test. The test shall be at least 5 minutes in length. If a pressure loss exceeding 3 psi is observed, the seam shall be considered discontinuous (unacceptable) and repairs shall be made.

4. At the conclusion of a passing seam channel test, the end of the seam channel opposite the pressure test gauge must be cut to relieve the pressure. If the pressure gauge does not detect a drop in pressure, it must be assumed that the seam channel is blocked. In this case, the location of the blockage must be identified and the seam retested in segments for continuity.

5. The CONTRACTOR shall verify all field seams constructed by the extrusion welding method by performing the vacuum box test.

   a) The vacuum box test shall be used on seams that cannot be tested by air pressurization. After a generous amount of soapy solution has been applied to the seam length to be tested, the vacuum box test apparatus shall be placed over the seam and a vacuum of at least 2 psi shall be applied to the seam or until the tested area has risen off the ground due to the applied vacuum. During the test, the response of the soapy solution shall be observed and noted. Bubbling of the solution indicates the presence of a hole or discontinuity. The location of holes and discontinuities shall be marked and repaired.

   b) The CONTRACTOR shall not conduct any non-destructive seam tests without prior notification to CQA OFFICER.

J. DESTRUCTIVE TESTS

1. The CONTRACTOR shall verify that all seam welds are fully integrated with each other and evaluate seam strength by collecting seam samples for destructive testing. At a minimum, one seam sample shall be taken, at random, every 1,000 feet of seam length, per seaming machine operating, per day. The locations of seam samples shall be determined by CQA OFFICER. If field conditions warrant, or the CQA OFFICER suspects a seam may not have been constructed properly, samples may be collected at a greater frequency.

2. Each destructive sample, measuring twelve (12) inches wide and fifty (50) inches long, shall be cut from the seam by the CONTRACTOR. Seven 1-inch wide by 12-inch long specimens shall be cut from each sample by the CONTRACTOR. Each specimen shall be tested in the field by the CONTRACTOR for peel and sheer strength (five in peel, two in shear) using a field tensiometer with the results being properly recorded by the CONTRACTOR and CQA OFFICER. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. All specimens shall exhibit a film tear bond (FTB). The peel strength of four out of five specimens in peel shall meet or exceed the minimum seam strength requirements. The fifth specimen must meet or exceed 80% of the minimum seam strength requirements. If the sample passes the field peel and shear tests, the remaining sections shall be cut and distributed as follows

   a. one 12 inch by 12 inch section for OWNER's archives,

   b. one 12 inch by 12 inch section for the CONTRACTOR, and

   c. one 12 inch by 18 inch section for shear and peel testing by CQA OFFICER’S independent laboratory.

3. Each of the 12-inch by 18-inch samples for laboratory testing shall provide 10 specimens: five for shear and five for peel. When peel testing is performed, both welds of double fusion welds shall be tested to provide an indication of the quality of the weld. All specimens shall exhibit a film tear bond (FTB). The peel (shear) strength of four out of five specimens in peel (shear) shall meet or exceed the minimum seam strength requirements. The fifth specimen must meet or exceed 80% of the minimum seam strength requirements.

4. If the sample fails the peel and shear tests by CQA OFFICER’S laboratory, then the CONTRACTOR has the following options to reconstruct the seam between the failed location and any passed test section, which include:

a. cap stripping of the seam, or

b. replacing the failed seam with a new two foot wide panel that is double-track welded to the adjacent panels, or

c. retrace the failed seam in both directions, by taking additional samples for destructive testing and conducting field peel and shear tests, until the length of the poor quality seam is established. Additional destructive samples shall be collected at minimum intervals of ten (10) feet from the location of the failed sample. Upon attaining passing results from the destructive samples, the seam shall be reconstructed between the passing location and the original failed location.

5. All passing seams shall be bound by two locations from which passing laboratory destructive tests have been taken. Reconstructed seams of over 50 feet or more in length must have a sample taken from the reconstructed seam in order to pass the destructive testing.

6. Testing of the geomembrane seams shall be performed in accordance with ASTM D6392, in conjunction with GRI-GM19. All seams shall meet the requirements in the following table:

Material	**Peel Strength**		**Peel Separation**	**Shear Strength**
	Extrusion Weld	**Hot Wedge Weld**		
60 mil textured HDPE	78 ppi	91 ppi	25%	120 ppi

K. PIPE PENETRATIONS

1. The Contractor shall furnish all liner penetration boots and other appropriate material required to complete the installation of the geomembrane. All geomembrane boots shall be of the same sheet density and at least as thick as the liner to which they are being welded.

2. Geomembrane penetrations are to be minimized. The CONTRACTOR is cautioned that no deviation in the quantity or configuration of geomembrane penetrations will be accepted without the advance written approval of CQA OFFICER.

3. In attaching the geomembrane liner penetration boot in the field, no field seams or welds will be allowed in locations or configurations that do not allow for quality control testing. Visual observation is not considered a sole acceptable method for in-field quality control.

4. Where field non-destructive testing cannot be performed, attachments shall be field spark tested by standard leak detectors. Spark testing shall be done in areas where both air pressure testing and vacuum testing is not possible.

5. Where clamps, fasteners, gaskets, seals or sealants are used, the Contractor shall use only materials that are compatible with the geomembrane material and the proposed material to be contained.

6. The CONTRACTOR shall provide suitable documentation to indicate that the clamps or fasteners will maintain their seal through adverse temperature cycles.

L. **CONSTRUCTION TESTING**

1. Owner will retain the services of a GAI-LAP certified laboratory for performing construction testing on samples of the geomembrane liner.

2. The GEOMEMBRANE MANUFACTURER shall send a sample of the geomembrane every 100,000 square feet to an independent laboratory, as determined by OWNER, to conduct construction testing. The samples shall be a minimum of three feet long by the entire roll width and shall not include the first five feet of roll length. These samples shall be analyzed for the parameters listed below.

   a. Thickness (ASTM D5994)

      1. Asperity Height (ASTM D7466)

      2. Density (ASTM D1505)

      3. Tensile Properties (ASTM D638)

      4. Tear Resistance (ASTM D1004)

      5. Puncture Resistance (ASTM D4833)

      6. Carbon Black Content (ASTM D1603)

      7. Carbon Black Dispersion (ASTM D5596)

3. Geomembrane must pass the specifications as provided in Part 2.01 of this Section.

4. OWNER, CERTIFYING ENGINEER, and/or CQA OFFICER reserves the right to require additional tests, and more frequent testing, when the materials do not comply with the specifications.

3.07 ELECTRICAL RESISTIVITY LEAK LOCATION

A. After placement of the soil drainage layer, an electrical resistivity leak location evaluation and/or other geomembrane liner integrity evaluation must be conducted on the geomembrane in areas with slopes of 10 percent or less. The testing must be conducted by a person independent of the liner installer.

B. Electrical resistivity leak location evaluation must be performed in accordance with standards of ASTM D8265 - Standard Practices for Electrical Methods for Mapping Leaks in Installed Geomembranes.

C. Prior to the commencement of the electrical leak location survey, the electrical leak location consultant shall submit a Work Plan to CQA Officer. The Work Plan shall include qualifications of the proposed electrical leak location consultant including square footage and number of projects of successful application of leak location methods performed, description of the proposed survey method, procedures, site preparations, estimated duration of survey, and quality control and field calibration procedures.

D. Geomembrane leak location survey using electrical methods requires the conductive media above and below the geomembrane to be electrically isolated from each other. A continuous electrically conducting pathway through the material above the geomembrane, through the leaks, and through the low permeability soil under the geomembrane is required. CONTRACTOR shall install necessary electrodes, wires, etc. as required in the electrical leak location Work Plan.

3.08 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. The geomembrane shall be properly secured and/or ballasted so as to prevent uplift by wind or landfill gases.

C. Damaged geomembrane and scrap material are the property of the CONTRACTOR and shall be removed from the site and disposed of at a disposal location approved by the OWNER at the CONTRACTOR'S expense. The CONTRACTOR shall retain all ownership and responsibility for the geomembrane until final acceptance of the entire project by OWNER.

D. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, and at no additional cost to OWNER.

3.09 RECORD DRAWINGS

A. CONTRACTOR shall submit "as-built" Record Drawings in accordance with Section 01780 - Record Drawings.

3.10 WARRANTY

A. The manufacturer shall warrant that the geomembrane liners be free from manufacturing defects and that the geomembrane, when properly installed and maintained, shall not suffer significant deterioration due to normal weather aging.

B. The CONTRACTOR shall guarantee the geomembrane installation against defects in the installation and workmanship for one year commencing with the date of final acceptance.

END OF SECTION

SECTION 02550
DRAINAGE LAYER

PART 1 - GENERAL

1.014 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.015 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to the proper installation of the drainage layer, as specified herein and as indicated on the Contract Drawings. Drainage Layer materials will be available from an on-site stockpile.

1.016 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. Pre-construction testing is required on all proposed materials for use in the drainage layer. CQA OFFICER is responsible for collecting all samples and testing. CONTRACTOR will provide labor and equipment as needed for the CQA OFFICER or third party representative to collect samples at material source for testing.

B. CQA OFFICER shall conduct a minimum of one grain size test (ASTM D422), one soil classification (ASTM D2487), one permeability test (ASTM D2434), one carbonate content (ASTM D4373) using a solution with a pH representative of landfill leachate, and one direct shear test (ASTM D3080) on a representative sample of each source of drainage layer materials. This testing shall be conducted prior to the delivery of drainage layer materials to the project site. The results of this testing shall be submitted to the CERTIFYING ENGINEER a minimum of 5 days before the delivery of drainage layer materials to the project site.

C. CQA OFFICER shall conduct testing consisting of interface shear tests (ASTM D5321) on the following interfaces:

   a. Geotextile vs. Drainage Layer Material

D. Direct shear testing (ASTM D3080) and interface shear testing (ASTM D5321) shall determine strength at normal stresses of 500 psf, 5,000 psf, and 10,000 psf. Each shear

test shall be performed using the same installation procedures in order to represent actual field conditions. Tests shall be run on fully saturated materials under drained conditions and sheared at a displacement rate of 0.04 in/min to a minimum horizontal displacement of 3 inches. Additional samples shall be collected and tested if the material does not meet specifications as of Part 2.01 of this Section, at no additional cost to OWNER.

E. OWNER, CERTIFYING ENGINEER and/or CQA OFFICER reserve the right to require additional tests, and more frequent testing, when there is a change (i.e. source or physical properties) in the material being delivered to the project site, or when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting samples and testing.

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Contract Drawings and these Specifications.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Drainage layer materials shall be clean, free of contamination, sharp rocks, debris of any kind, organic matter, vegetation, gypsum, ferrous, limestone based materials or any other unsuitable objects.

B. Drainage layer materials must have less than 5 percent by weight pass the No. 200 sieve.

C. Drainage layer materials must have no more than 15 percent calcium carbonate equivalent and be tested using a solution with a pH representative of landfill leachate.

D. Drainage layer materials must meet filter criteria below:

$$\frac{D_{15}\text{ (Drainage Material)}}{D_{85}\text{ (Crushed Stone)}} = <5$$

$$\frac{D_{15}\text{ (Crushed Stone)}}{D_{15}\text{ (Drainage Material)}} = >4 \text{ and } <20$$

$$\frac{D_{50}\text{ (Drainage Material)}}{D_{50}\text{ (Crushed Stone)}} = <25$$

E. Drainage layer material placed on slopes less than or equal to 10 percent shall have a minimum hydraulic conductivity of 1.0 centimeters per second, as determined by ASTM D2434.

F. Drainage layer material placed on slopes greater than 10 percent shall have a minimum hydraulic conductivity of 0.1 centimeters per second, as determined by ASTM D2434.

G. As part of the pre-construction testing (see Part 1.03 of this Section), the CQA OFFICER shall perform direct shear testing in accordance with ASTM D3080. The drainage layer materials shall have the following minimum secant friction angles:

Drainage layer material (at dry density required to meet minimum permeability):

Shear Strength (at 500 psf) $\geq 25°$

Large Displacement Shear Strength (at 5,000 psf and 10,000 psf) $\geq 14°$

H. As part of the pre-construction testing (see Part 1.04 of this Section), CQA OFFICER shall perform interface shear testing in accordance with ASTM D5321. Drainage layer materials shall have the following minimum strengths:

Drainage layer materials (at maximum dry density required to achieve minimum permeability) vs. Geotextile:

Interface shear strength (at 500 psf) $\geq 25°$

Large Displacement Interface shear strength (at 5,000 psf and 10,000 psf) $\geq 14°$

I. If peak shear strength at 500 psf does not meet minimum friction angle requirement, ENGINEER may conduct veneer stability analyses that account for anchor trench soil weight and submit calculations in Certification Report confirming adequate factor of safety is obtained during short-term conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

B. CONTRACTOR will install a construction control grid. The control grid shall have defined positions every 50 feet across the area of the proposed baseliner. All aspects of construction shall be defined by the control grid including, but not limited to, the floor, tops and toes of slope, anchor trench, berms, and roadways. The construction control grid shall be established in rectangular coordinates and lie in the same orientation as the existing site's coordinate system.

3.02 PREPARATION

A. The CONTRACTOR shall ensure that the surface of the geomembrane shall be free of scraps of the liner, wastes, loose soil, stones, rocks, sticks, roots, sharp objects, or debris of any kind that may damage the geomembrane during placement of the drainage layer material.

B. All geomembrane testing shall be completed and passed before placing the drainage layer material.

3.03 DRAINAGE LAYER MATERIALS INSTALLATION

A. Drainage layer materials shall be spread directly on top of the geotextile surface. The drainage layer materials shall have a minimum thickness, after compaction, of approximately 24 inches as shown on the Contract Drawings.

B. Placement of the material should be performed using a low ground pressure bulldozer. The tracked equipment shall operate only over previously placed drainage layer materials. The CONTRACTOR shall not operate equipment directly on the geotextile surface.

C. The equipment used to spread the drainage layer material shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	Thickness of Drainage Layer Above Geomembrane (in.)
< 5	12
< 10	18
< 20	24
> 20	36

D. No equipment, including LGP equipment, will be allowed to travel over geomembrane layers with less than 12 inches of drainage layer materials.

E. When traveling on drainage layer materials spread over the geomembrane and geotextile layers, vehicle speeds and turning shall be minimized to the satisfaction of the CERTIFYING ENGINEER and/or CQA OFFICER to avoid rutting, bouncing, and other stresses on the underlying geosynthetics.

F. Spreading of drainage layer materials shall be done so as to avoid stretching, wrinkling or creasing of the geosynthetics.

G. Drainage layer materials shall be spread from the bottom of the slopes to the top, unless otherwise approved by the OWNER and the CQA OFFICER.

H. CONTRACTOR shall post one spotter at each piece of equipment spreading drainage layer materials over the geosynthetics at all times of active material spreading. At a minimum, the spotter shall walk out wrinkles, inspect for unacceptable objects within the drainage layer materials, and ensure lifts of adequate depth. The presence of the OWNER, CERTIFYING ENGINEER, or CQA OFFICER shall not relieve the CONTRACTOR from the responsibility to post a spotter.

3.04 CONSTRUCTION TESTING REQUIREMENTS

A. The CQA OFFICER shall retain the services of a qualified geotechnical laboratory to conduct construction tests on samples of drainage layer materials. All collection of samples and testing is the responsibility of the CQA OFFICER.

B. The CQA OFFICER shall conduct construction testing on the drainage layer materials as the soils are delivered to the site as follows:

1. Grain size test (ASTM D422) shall be performed at a minimum frequency of one test every 1,000 cubic yards.

2. Permeability test (ASTM D2434) shall be performed at a minimum frequency of one test every 2,500 cubic yards.

C. The CQA OFFICER shall conduct construction testing on the drainage layer materials in-place as follows:

1. Permeability test (ASTM D2434) shall be performed at a minimum frequency of one test in-place every 2,500 cubic yards.

D. CONTRACTOR shall provide labor and equipment as needed for the CQA OFFICER or third party representative to collect the required samples.

E. Drainage layer materials must pass the specifications as provided in Part 2.01 of this Section.

F. OWNER, CERTIFYING ENGINEER, and CQA OFFICER reserves the right to require additional tests, and more frequent testing, when the materials do not comply with the specifications, at no additional cost to the OWNER. CQA OFFICER or third party representative is responsible for collecting samples and testing.

3.05 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER, and at no additional cost to the OWNER.

3.06 RECORD DRAWINGS

A. The CONTRACTOR shall submit “as-built” information to the OWNER within five (5) days after the completion of the drainage layer so the CERTIFYING ENGINEER can review and compare “as-built” grades to design grades. The plan shall depict the topographic information, construction grid (refer to 3.01B), and locations where material samples were collected.

B. CONTRACTOR shall submit “as-built” Record Drawings in accordance with Section 01780 – Record Drawings.

END OF SECTION

SECTION 02595
GEOTEXTILES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limiting to: hauling, unloading, storing, and placing the woven and non-woven geotextile, protection of installed materials, and all work incidental to the proper installation of the geotextiles, as specified herein and as indicated on the Contract Drawings.

1.03 RELATED WORK

A. Not Used.

1.04 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. OWNER will retain the services of a Geosynthetics Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) certified laboratory for performing pre-construction testing required in this Section. The results of all testing shall be completed before any geomembrane is incorporated into the work.

B. The GEOTEXTILE MANUFACTURER shall send samples of the geotextile taken from rolls that will be delivered to the site to the certified laboratory, as determined by the OWNER, to conduct pre-construction testing. Each sample must be identified with the corresponding roll number.

C. At the OWNER'S direction, the laboratory shall conduct testing consisting of interface shear tests (ASTM D5321) on the following interfaces:

   a. Geotextile and 60-mil textured HDPE Geomembrane

   b. Geotextile and the Drainage Layer

D. Each test shall determine interface strength at normal stresses of 500 psf, 5,000 psf, and 10,000 psf. Each interface shear test shall be performed using the same materials and

installation procedures in order to represent actual field conditions. Tests shall be run on fully saturated materials under drained conditions and sheared at a displacement rate of 0.04 in/min to a minimum horizontal displacement of 3 inches. Additional samples shall be collected and tested if the material does not meet specifications as of Part 2.01 of this Section, at no additional cost to the OWNER.

E. OWNER, CERTIFYING ENGINEER and/or CQA OFFICER reserve the right to require additional tests, and more frequent testing, when there is a change (i.e. source or physical properties) in the material being delivered to the project site, or when the materials do not comply with the specifications, at no additional cost to OWNER. CQA OFFICER or third party representative is responsible for collecting samples and testing.

1.05 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Contract Drawings and these Specifications.

1.06 SUBMITTALS

A. The GEOTEXTILE MANUFACTURER shall submit to the CERTIFYING ENGINEER quality control certificates on each roll of the geotextile. Such test results must document compliance with the specifications in Part 2.01 of this Section.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle and store geotextile rolls and associated materials in such a manner as to ensure a sound, undamaged condition. Procedures shall be in conformance with manufacturer's recommendations.

B. Rolls will be stored at the job site away from high-traffic areas but sufficiently close to the active work area to minimize handling. The designated storage area should be flat, dry and stable.

C. Geotextile will be rejected if it is found to have defects, rips, holes, flaws, deterioration or other damage.

PART 2 – PRODUCTS

2.01 16 OZ. NON-WOVEN GEOTEXTILE

D. The 16-ounce non-woven needle-punched polypropylene geotextile shall be manufactured by LINQ Industrial Fabrics, Inc. or approved equal.

E. The non-woven geotextile shall meet the following requirements.

Property	Test Method	Minimum Requirements
Mass per Unit Area	ASTM D5261	16 oz./SY
Grab Tensile Strength	ASTM D4632	370 lbs.
Grab Elongation	ASTM D4632	50%
Puncture Strength	ASTM D4833	170 lbs.
Trapezoidal Tear Strength	ASTM D4533	145 lbs.

F. As part of the pre-construction testing (see Part 1.04 of this Section), CQA OFFICER shall conduct interface shear testing to be performed on each interface of the baseliner system in accordance with ASTM D5321. The geotextile interfaces shall have the following minimum secant friction angles:

Geotextile and 60-mil Textured HDPE Geomembrane and Geotextile and Drainage Layer under saturated conditions:

Interface shear strength (at 500 psf) $\geq 25°$

Large Displacement Interface shear strength (at 5,000 psf and 10,000 psf) $\geq 14°$

G. If peak shear strength at 500 psf does not meet minimum friction angle requirement, ENGINEER may conduct veneer stability analyses that account for anchor trench soil weight and submit calculations in Certification Report confirming adequate factor of safety is obtained during short-term conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

3.02 PREPARATION

A. The base surface shall be cleared of sharp objects, boulders, stumps, or any materials that may contribute to fabric punctures, shearing, rupturing or tearing. The subgrade shall be inspected for unstable areas or soft spots, before the fabric is placed and additional fill shall be placed and compacted to eliminate those unstable areas.

3.03 INSTALLATION

A. When placing the geotextile, sections placed on slopes shall be placed so that the upper strip of geotextile overlaps the next lower strip by six inches. Fabric shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

B. Bulldozer blades or buckets shall not be in direct contact with the geotextile. If geotextile should be damaged, a piece of geotextile material shall be cut and placed over the damaged area and overlap the undamaged material a minimum of 3 feet in each direction.

3.04 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER, and at no additional cost to the OWNER.

END OF SECTION

SECTION 02800
ACCESS ROADS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division -1 General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to proper installation of the access roads, as specified herein and on the Contract Drawings.

1.03 RELATED WORK

A. Section 02810 – Stones

B. Section 02595 – Geotextile

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. NYSDOT #2 Crushed Stone (703-0201) shall be used as the top course for the proposed gravel access roads, as shown on the Contract Drawings.

1. NYSDOT #2 Crushed Stone (703-0201) shall conform to the specifications of Section 02810, Stone.

B. NYSDOT #5 Screened Gravel (703-0203) shall be used as the base course for the proposed gravel access roads, as shown on the Contract Drawings.

1. NYSDOT #5 Screened Gravel (703-0203) shall conform to the specifications of Section 02810, Stone.

C. Woven geotextile shall be used beneath the base course of the proposed gravel access roads, as shown on the Contract Drawings.

1. Geotextile shall conform to the specifications of Section 02950, Geotextile.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

3.02 PREPARATION

A. Before placing material on the access road, CONTRACTOR shall ensure that the subgrade layer is at the line and grade required by the Drawings.

3.03 ACCESS ROAD CONSTRUCTION

A. Width of each access road shall be constructed as shown on the Contract Drawings.

B. Contractor shall construct the access road by placing a woven geotextile above the existing subgrade soils and fill the respective base course and top course stones to the specified minimum thicknesses as shown on the Contract Drawings. The material shall be compacted via several passes of a roller.

C. Loam and seed shall be placed on exterior berm slopes at the locations shown on the Contract Drawings.

3.04 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and prevent their damage.

B. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER, and at no additional cost to the OWNER.

3.05 RECORD DRAWINGS

A. The CONTRACTOR shall submit "as-built" information to the OWNER within five (5) days after the completion of the access roads so the CERTIFYING ENGINEER can review and compare "as-built" grades to design grades.

B. CONTRACTOR shall submit "as-built" Record Drawings in accordance with Section 01780 – Record Drawings.

END OF SECTION

SECTION 02810
STONE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 SCOPE OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to the proper installation of each respective stone, as specified herein and on the Contract Drawings.

B. The CONTRACTOR is responsible for conducting pre-construction testing (see Part 1.03 of this Section) and construction testing (see Part 3.03 of this Section) on a representative sample of each size and source of each stone material.

1.03 RELATED WORK

A. Section 02800 – Access Roads

B. Section 02850 – Stormwater Controls

1.04 PRE-CONSTRUCTION TESTING REQUIREMENTS

A. CONTRACTOR shall retain the services of a qualified geotechnical laboratory to conduct pre-construction tests on samples of each stone material.

B. CONTRACTOR shall conduct a minimum of one grain size test (ASTM D422) on a representative sample of size and source of each stone material. This testing shall be conducted prior to the delivery of stone to the project site. The results of this testing shall be submitted to the CERTIFYING ENGINEER a minimum of 5 days before the delivery of stone to the project site.

C. CONTRACTOR shall conduct a minimum of one standard test for insoluble residue in carbonate aggregates (ASTM D-3042) on a representative sample of each stone material to be used as leachate collection stone. Stone shall exhibit a maximum acid solubility of 15 percent. This testing shall be conducted prior to the delivery of stone to the project

site. The results of this testing shall be submitted to the CERTIFYING ENGINGEER a minimum of 5 days before the delivery of stone to the site.

D. OWNER, CERTIFYING ENGINEER, and/or CQA OFFICER reserves the right to require additional tests, and more frequent testing, by CONTRACTOR when there is a change (i.e. source or physical properties) in the material being delivered to the project site, or when the materials do not comply with the specifications, at no additional cost to the OWNER.

1.05 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Contract Drawings and these Specifications.

1.06 SUBMITTALS

A. The CONTRACTOR shall submit to the OWNER representative samples of each source of stone prior to delivery of the materials to the project site. OWNER may elect to conduct tests on said sample.

B. The CONTRACTOR shall submit to the CERTIFYING ENGINEER testing results of pre-construction tests conducted on representative samples of each stone material. The results of this testing shall be submitted to the CERTIFYING ENGINEER a minimum of 5 days after the tests are completed. Such test results must document compliance with the specifications in Part 2.01.

PART 2 - PRODUCTS

2.01 NYSDOT #2 CRUSHED STONE (703-0201)

A. The NYSDOT #2 crushed stone (703-0201) shall be used as the top course for the proposed gravel access roads and as leachate collection pipe stone, as shown on the Contract Drawings.

B. The crushed stone shall consist of clean, durable, sharp-angled fragments of rock of uniform quality.

C. The crushed stone used as aggregate for all items shall be obtained from sources conforming to the requirements of the Department as to sampling, testing methods, Quarry Reports, and any other required procedures.

2.02 NYSDOT #4 CRUSHED STONE (703-0204)

A. The NYSDOT #4 crushed stone (703-020) shall be used as leachate collection pipe stone, as shown on the Contract Drawings.

B. The crushed stone shall consist of clean, durable, sharp-angled fragments of rock of uniform quality.

C. The crushed stone used as aggregate for all items shall be obtained from sources conforming to the requirements of the Department as to sampling, testing methods, Quarry Reports, and any other required procedures.

2.03 NYSDOT #5 SCREENED GRAVEL (703-0203)

A. The NYSDOT #5 screened gravel (703-0203) shall be used as the base course for the proposed gravel access roads, as shown on the Contract Drawings.

B. The screened gravel shall consist of clean, durable gravel free from coatings. Screened gravel may consist of all uncrushed particles and shall be obtained from sources conforming to the requirements for crushed gravel.

2.04 NYSDOT "FINE" STONE FILLING

A. The NYSDOT "fine" stone filling shall be used as backfill around the proposed stormwater diffuser, as shown on the Contract Drawings.

B. The NYSDOT "fine" stone filling shall be clean, free of contamination, debris of any kind, organic matter, vegetation, limestone based materials or any other unsuitable objects.

C. NYSDOT "fine" stone filling shall be within the following limits:

Stone Filling Item	Stone Size	Percent of Total By Weight
Fine	Smaller than 200 mm	90-100
	Larger than 75 mm	50-100
	Smaller than 2.0 mm	0-10

NOTES:

1. Stone sizes, other than weights, refer to the average of the maximum and minimum dimensions of a stone particle as estimated by the engineer.
2. Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.

3. Air-cooled blast furnace slag, cobbles, or gravel having at least one fractured face per particle are acceptable substitutes for stone under these items, provided that the soundness and gradation requirements are met.
4. Materials shall contain a sufficient amount of stones smaller than the average stone size to fill in the spaces between the larger stones.

2.05 STONE RIP-RAP

A. The stone rip-rap stone shall be clean, free of contamination, debris of any kind, organic matter, vegetation, limestone based materials or any other unsuitable objects.

B. Stone rip-rap shall consist of a well-graded rip-rap, consisting of a D_{50} of 6 inches and within the following limits:

Sieve Size	Percent Finer
12”	100
4” – 6”	30 – 60
2” – 4”	30 – 40
1” – 2”	10 – 20
Less than 1”	0 – 10

C. The breadth or thickness of a single stone shall not be less than 1/3 its length.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

3.02 STONE INSTALLATION

A. The NYSDOT #2 crushed stone (703-0201) shall be installed as the top course for the proposed gravel access roads, to the depths and widths as shown on the Contract Drawings.

B. The NYSDOT #5 screened gravel (703-0203) shall be installed as the base course for the proposed gravel access roads, to the depths and widths as shown on the Contract Drawings.

C. The NYSDOT “fine” stone filling shall be placed as backfill around the proposed stormwater diffuser, to the depths and widths as shown on the Contract Drawings.

D. Stone rip-rap shall be placed at the proposed apron outlet locations, to the depths and widths as shown on the Contract Drawings.

3.03 CONSTRUCTION TESTING REQUIREMENTS

A. The CQA OFFICER shall retain the services of a qualified geotechnical laboratory to conduct construction tests on each sample of Stone.

B. The CQA OFFICER shall conduct construction testing on each type of Stone as the stone is delivered to the site as follows:

1. Grain size test (ASTM D422) shall be performed at a minimum frequency of one test every 500 cubic yards.

C. The stone must pass the specifications as provided in Part 2 of this Section.

D. CONTRACTOR shall facilitate the CQA OFFICER in obtaining the required samples.

E. OWNER, CERTIFYING ENGINEER, and CQA OFFICER reserves the right to require additional tests, and more frequent testing, when the materials do not comply with the specifications, at no additional cost to the OWNER.

3.04 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and preventing their damage.

B. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER CERTIFYING ENGINEER, and/or CQA OFFICER and at no additional cost to the OWNER.

END OF SECTION

SECTION 02820
HDPE PIPES & FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limiting to all work incidental to the proper installation and testing of the high-density polyethylene (HDPE) piping, as specified herein and as indicated on the Drawings.

B. Solid and perforated HDPE pipe shall be used in the leachate collection and removal system.

1.03 RELATED WORK

A. Section 01669 – Testing Pipe Systems

B. Section 02150 – Excavation & Trenching

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

1.05 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D-638-95 - Test Method for Tensile Properties of Plastics.

2. ASTM D-790-86 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

3. ASTM D-1238-88 - Test Method for Flow Rates of Thermoplastic by Extrusion Plastometer.

4. ASTM D-1248-84 - Specification for Polyethylene Plastics Molding and Extrusion Materials.

5. ASTM D-1505-85 - Test Method for Density of Plastics by Density-Gradient Technique.

6. ASTM D-1693-70 - Test Method for Environmental Stress - Cracking of Ethylene Plastics.

7. ASTM D-2122-88 - Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings.

8. ASTM D-2513-95(c) - Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

9. ASTM D-2837-88 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

10. ASTM D-3261-88 - Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

11. ASTM D-3350-84 - Polyethylene Plastic Pipe and Fittings Material.

12. ASTM F-1055-95 - Electrofusion Type Polyethylene Fittings.

1.06 SUBMITTALS

A. CONTRACTOR shall submit shop drawings detailing the dimensioning and technical specifications for all pipe, culvert, and fittings.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pipe Storage:

1. Store or stack pipe to prevent damage from marring, crushing or puncture. Limit maximum stacking height to 6 feet or manufacturer's maximum recommended height, whichever is less.

2. Store in accordance with manufacturer's recommendations.

B. Pipe handling:

1. Protect pipe from excessive heat or harmful chemicals.

PART 2 - PRODUCTS

2.01 PHYSICAL PROPERTIES OF HDPE PIPE RESIN

A. Density: ASTM D-1505, not less than 0.941 – 0.955 gm/cu cm.

B. Melt Flow: ASTM D-1238 - Condition E, not greater than 0.15.

C. Flexural Modulus: ASTM D-790, 110,000 to less than 160,000 psi.

D. Tensile Strength at Yield: ASTM D-638, 3,000 to less than 3,500 psi.

E. Environmental Stress Crack Resistance (ESCR): ASTM D-1693 - Condition C, shall be in excess of 5,000 hrs with zero failure.

F. Hydrostatic Design Basis: ASTM D-2837, 1600 psi at 23ºC.

2.02 HDPE PIPE

A. High performance, high molecular weight, high density polyethylene pipe (type PE 4710 resin).

B. ASTM D-1248 (Type III, Class C, Category 5, P34).

C. ASTM D-3350, minimum cell classification value 345434C.

D. Standard dimension ratio: See Drawings.

E. Marking: Intervals of 5 ft or less.

1. Manufacturer's name or trademark.
2. Nominal pipe size.
3. Type of plastic resin (i.e., PE 3408).
4. Standard dimension ratio (i.e., SDR-17)
5. ASTM D-2413.
6. Extrusion date, period of manufacture or lot, or batch number.

F. Dimensions:

1. Conform to standard dimensions and tolerances of ASTM D-2513.

2.03 HDPE FITTINGS

A. Fittings from polyethylene compound having cell classification equal to or exceeding compound used in pipe to insure compatibility of polyethylene resins.

B. Polyethylene fittings shall be molded for sizes 6-inch and smaller and shall be fabricated from polyethylene pipe for sizes 8-inch and larger by means of thermal butt-fusion. Extrusion welds on fittings will not be allowed. The ends of the fabricated fittings shall not be trimmed to match the pipe section to which they are going to be joined. All polyethylene fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications**.**

C. Joints.

1. Joints shall be thermal butt-fusion, except where connecting to unions, valves, and equipment with connections that may require future disassembly.

2. No mechanical couplings shall be used unless shown on the Drawings.

3. Extrusion welds will not be allowed.

D. Flange Connections:

1. 150-lb carbon steel or convoluted epoxy coated ductile iron backup rings for flanged connections as recommended by manufacturer.

2. Type 316 stainless steel, zinc plated hex head nuts and bolts, and accompanying flat washers.

3. Viton full-face flange gaskets.

4. Flanges and bolt patterns consistent with ANSI B16.5/AWWA C207/ASTM A536, as recommended by manufacturer.

E. Dimensions of fittings conform to standard dimensions and tolerances according to ASTM D-3261.

F. Markings:

1. Manufacturer’s name or trademark.

2. Nominal size.

3. Type of plastic resin (i.e. PE 4710).

4. Standard dimension ratio (i.e., SDR-17).

5. ASTM D-2513.

6. Extrusion date, lot number, or batch number.

G. Pressure rating of fittings shall be equal to or greater than pressure rating of pipe.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to Specifications, or for:

1. Fractures or cracks passing through pipe wall, except a single crack not exceeding two (2) inches in length at either end of pipe that could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of shipment or delivery.

2. Cracks sufficient to impair strength, durability, or serviceability of pipe.

3. Defects indicating improper proportioning, mixing, and molding.

4. Damaged ends, where such damage would prevent making satisfactory joints.

B. Acceptance of fittings, stubs, or other specifically fabricated pipe sections shall be based on visual observation by the OWNER or ENGINEER at the Project site and documentation that they conform to these Specifications.

3.02 INSTALLATION

A. General:

1. Perform trenching, backfilling, and compaction in accordance with Sections 02150.

2. Pipes and fittings shall be carefully lowered into trench to limit stress to pipes, fittings, and joints.

3. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings that do not fit together to form a tight fitting joint are not permitted.

4. Pipes shall be installed at the locations and to the required lines and grades shown in the Construction Drawings and provided in these Specifications,

using an approved method of control. The CQA OFFICER has the authority to order the removal or relaying of pipe laid contrary to the specifications, her/his instructions, or during her/his absence.

5. Excavations shall be maintained free of water during the progress of the work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the CQA OFFICER.

6. Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work. Cap pipe sections longer than single joint (usually 40 feet) on both ends during placement, except during fusing operations.

7. All adjustments to the line and grade of pipe laid on earth foundation shall be done by scraping away or placing compacted fill under the barrel of the pipe, and not by blocking or wedging the pipe. Wherever the excavation has been over excavated to a depth in excess of six (6) inches, the CQA OFFICER may order crushed stone or gravel fill be placed in the excavation to provide the proper grade. In all cases, the trench under the joint shall be excavated to permit an even bearing surface for the barrel of the pipe.

8. When unsuitable materials and/or conditions are encountered, the CQA OFFICER may direct the excavation to continue below grade and the trench filled with gravel or crushed stone foundation, or the CQA OFFICER may order other corrective measures.

9. Fittings shall be installed as required and in accordance with the Construction Drawings and Specifications. The installation of fittings after the pipeline has been laid will not be permitted without written approval from the CQA OFFICER. In such cases, complete details pertaining to the proposed type of fittings and the installation procedure shall be submitted by the CONTRACTOR to the CQA OFFICER for review before approval will be considered.

10. Approval by the CQA OFFICER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without a written consent from the CQA OFFICER.

11. All installed pipe shall form completely connected systems, including connections to valves and appurtenances specified in other sections, to result in a satisfactorily operating installation.

B. Heat Fusion of HDPE Piping:

1. HDPE pipe shall be joined by butt-fusion methods, having a uniform and monolithic pipe interior according to the fusion joining procedures as instructed by the manufacturer, except within the structures, as shown in the Construction Drawings.

2. Each individual performing fusion joining shall have at least one (1) year of experience in the use of the fusion procedure.

3. Join pipe sections at ground level to a maximum length of 400 feet, or a length recommended by the manufacturer such that maximum allowable stress, when pulling the pipe into position alongside the trench, is not exceeded. Use appropriate materials and equipment, as recommended by the HDPE pipe manufacturer, when pulling butt-fused pipe sections alongside the trench to prevent pipe damage.

4. For summertime installations, it may be necessary to provide a slightly longer length of HDPE pipe when connections are to be made between two fixed points or structures to compensate for contraction of the pipe in a cooler trench bottom. The additional pipe length requirements shall be in accordance with the HDPE pipe manufacturer's instructions.

5. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer’s recommendations.

6. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.

7. Do not subject pipe to strains that will overstress or buckle pipe or impose excessive stress on joints.

8. Branch saddle fusions shall be joined in accordance with manufacturer’s recommendations and procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the trench.

9. Before butt fusing pipe, each length shall be observed for presence of dirt, sand, mud, shavings, and other debris or animals. Remove all materials from the inside of the pipe.

10. At end of each working day, cover open ends of fused pipe. Cap to prevent entry by animals or debris.

11. Use compatible fusion techniques when polyethylene pipes of different melt indexes are fused together. Refer to manufacturer's specifications for compatible fusion.

12. Interior pipe joints shall be de-beaded to provide a smooth interior surface. De-beading shall be performed using manufacturer recommended tools and equipment.

C. Flange Joining:

1. Use on flanged pipe connection sections.

2. Connect slip-on backup flanges with nuts and bolts.

3. Butt fuse flange adapters to pipe.

4. Observe the following precautions when connecting flanged joints.

   a. Align flanges or flange/valve connections to provide a tight seal. Viton full-face gaskets are required for flange/valve connections.
   b. Place U.S. Standard round washers as may be required on some flanges per manufacturer's recommendations. Bolts shall be lubricated in accordance with manufacturer's recommendations.
   c. Tighten flange bolts in sequence and in accordance with manufacturer's recommendations. CAUTION: Do not over-torque the bolts. CONTRACTOR shall be required to use a torque wrench to secure flanged connections.
   d. Pull bolt down by degrees to uniform torque in accordance with manufacturer's recommendations.

D. Pipe Placement

1. Grade control equipment shall accurately maintain design grades and slopes during installation of pipe.

2. Maximum lengths of fused pipe to be handled as one section shall be placed according to manufacturer's recommendations as to pipe size, pipe SDR, and topography so as to not cause excessive gouging or surface abrasion; but not to exceed 400 feet.

3. Notify CQA OFFICER prior to installing pipe into trench and allow time for CQA OFFICER'S observation.

4. Correct irregularities found during inspection.

5. Complete connections within trench whenever possible to prevent overstressed connections.

6. Complete flanged branch saddle connections within trench.

7. Allow pipe sufficient time to adjust to trench temperature prior to any testing, segment connections, or backfilling activity.

8. Install reducers adjacent to laterals or tees.

9. To reduce branch saddle stress, saddles shall be installed at slope equal to and continuous with lateral piping.

10. Place in trench by allowing at least 12 inches/100 feet for thermal contraction and expansion.

11. Coordinate construction of header lines near access roads with OWNER to limit interruptions to normal landfill operations.

3.03 PIPE TESTING

A. Test pipe sections in accordance with Section 01669, Testing Pipe Systems.

B. Pig all pipe sections to clean pipe shavings prior to placing the leachate collection and removal system in operation.

3.04 PROTECTION OF INSTALLED MATERIALS

A. All installed materials shall be maintained so as to assure compliance with materials and installation specifications.

B. In the event of damage to prior work or work completed as specified in this Section, CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of OWNER, CERTIFYING ENGINEER, and CQA OFFICER and at no additional cost to OWNER.

3.05 RECORD DRAWINGS

A. CONTRACTOR shall submit “as-built” Record Drawings of all pipe locations and elevations in accordance with Section 01780 - Record Drawings.

END OF SECTION

SECTION 02850
STORMWATER CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all materials, tools, supervision, equipment, and labor consisting of but not limited to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to installation and maintenance of storm water controls, as specified herein and on the Contract Drawings.

1.03 RELATED WORK

A. Section 02880 – Loam/Seeding/Erosion Mat

B. Section 02150 – Excavation & Trenching

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Contract Drawings and these Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drainage Swales

1. The drainage swale shall consist of the following:

- Loam and seed shall be in accordance to specification Section 02880.
- Erosion control mat shall be in accordance to specification Section 02880.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Contract Drawings, these Specifications and any pertaining local ordinances.

3.02 STORM WATER CONTROL INSTALLATION

A. Drainage Swale

1. The drainage swale shall be installed at the dimensions and locations as indicated on the Contract Drawings.

3.03 PROTECTION OF INSTALLED MATERIALS

A. The CONTRACTOR shall be responsible for maintaining installed materials and prevent their damage.

B. In the event of damage to prior work or work completed as specified in this Section, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the OWNER, and at no additional cost to the OWNER.

3.04 RECORD DRAWINGS

A. CONTRACTOR shall submit "as-built" Record Drawings of all pipe and structure locations and all associated stormwater control elevations in accordance with Section 01780 - Record Drawings.

END OF SECTION

SECTION 02880
LOAM/SEEDING/EROSION MAT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 – General Specification sections, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work in this Section includes the furnishing of all tools, supervision, equipment, and labor consisting of but not limiting to: hauling, grading, drying, removal of storm water, removal of unsuitable materials, protection of installed materials and all work incidental to the proper installation of the loam/seeding/erosion mat, as specified herein and as indicated on the Drawings.

1.03 RELATED WORK

Not Applicable.

1.04 LINE AND GRADE CONTROL

A. CONTRACTOR is responsible for line and grade control for all aspects of the work in this Section in accordance with the Drawings and these Specifications.

1.05 SUBMITTALS

A. Contractor shall submit shop drawings detailing the dimensioning and technical specifications for the erosion mat.

B. Contractor shall submit the seed vendor's certified statement for each grass seed mixture and other data substantiating that materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. **LOAM**

1. Native topsoil, which has been stripped and stockpiled on site by the CONTRACTOR, may be utilized, where approved by the OWNER and/or CERTIFYING ENGINEER.

2. The material shall be original loam of rich, uniform grade, without admixture of subsoil and shall be free from hard clods, stiff clay, hard pan, sods, large stones, lime, cement, bricks, coal ashes, cinders, slags, concrete, tar or its residue, boards, sticks, or other deleterious matter.

3. The loam material shall be graded within the following limits:

Sieve Size	Percent Finer
1-inch	100%
¼-inch	100 – 97%
#200 sieve	20 – 65%

4. The loam shall contain not less than 5% or more than 20% organic matter in that portion of any sample that passes a ¼-inch sieve, when determined by the wet combustion method of a sample dried at 105° C.

B. **SEEDING**

1. Loam shall be a mixture of vegetative species comprised of one of the following recommended seed mixtures, or an approved equal.

Common Name	Seeding Rate (lbs/acre)	Seeding Rate (lbs/1,000 ft^2)
Empire Birdsfoot Trefoil OR Common White Clover	8 lbs/acre	0.2 lbs/ ft^2
Tall Fescue	20 lbs/acre	0.45 lbs/ ft^2
Redtop OR Perennial Ryegrass	2 lbs/acre (Redtop) 5 lbs/acre (Ryegrass)	0.05 lbs/ ft^2 0.10 lbs/ ft^2

2. Fertilizer: Available nutrients, percent by total weight.

   a. 10% nitrogen.

   b. 10% phosphorus.

   c. 10% potassium.

3. Hard, caked material will not be acceptable.

4. Limestone: Ground limestone with a minimum total neutralizing value of 88% calcium carbonate equivalence; minimum 90% passing the 20 mesh sieve and minimum 60% passing the 100 mesh sieve; and hard, caked material will not be accepted.

5. Starter fertilizer shall be applied to the loam layer areas at a rate as determined by the manufacturer of the material.

C. **EROSION CONTROL MAT**

1. The erosion control mat used within the proposed drainage swales shall be VMax® P550® Turf Reinforcement Mat, as manufactured by North American Green, or approved equal. The selection of an erosion mat is subject to the approval of the CERTIFYING ENGINEER.

2. The erosion control mat used for slope stabilization shall be ECP-3™ Polypropylene Turf Reinforcement Mat, as manufactured by East Coast Erosion Blankets, LLC, or approved equal. The selection of an erosion mat is subject to the approval of the CERTIFYING ENGINEER.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with the Drawings, these Specifications and any pertaining local ordinances.

3.02 PREPARATION

A. Contractor shall ensure that the surfaces where loam is to be placed shall be graded to a uniform slope.

B. Surfaces with loam that are ready for the placement of seed shall be prepared by tracking the seedbed perpendicular to the slope or raking the slope.

C. Any erosion rills in the seedbed must be repaired before seeding.

3.03 INSTALLATION

A. Loam shall be spread in the drainage swales, exterior slope of the berms, and all vegetated areas disturbed by construction. The loam shall have a minimum thickness, after compaction, of 4 inches, as shown on the Drawings.

B. Grading of the loam material may be accomplished via depth markers, or other approved method, to establish the thickness of the loam material layer. Depth markers shall be removed once the material has been installed.

C. Seed may be spread by a broadcast spreader or using hydro-seeding methods. CONTRACTOR shall be responsible for re-seeding in areas of poor germination.

D. A minimum of 150 lbs. of seed mixture must be applied per acre.

E. Contractor shall submit the testing data from an approved soils laboratory, which provides recommendations for the application rates for fertilizer and lime appropriate for the soil to be used. Contractor will provide such test information for each new source of soil.

F. Hay, straw mulch, or erosion control matting shall be applied, as necessary, to areas that have been seeded.

G. The proposed erosion control mat shall be installed within the perimeter drainage swales, as shown on the Contract Drawings.

3.04 PROTECTION OF INSTALLED MATERIALS

A. Contractor shall be responsible for maintaining installed materials in conformance with the requirements of this Section. CONTRACTOR will be responsible for vegetation growth 1 year from final date of seeding. A satisfactory stand of growth will be defined as a section of grass of 10,000 square feet or larger that has:

1. No bare spots larger than three (3) square feet.

2. No more than ten percent (10%) of total area with bare spots larger than one (1) square foot.

3. No more than fifteen percent (15%) of total area with bare spots larger than 6-inches square.

4. The observations by the ENGINEER or OWNER will determine whether maintenance shall continue in any area found deficient.

B. In the event of damage to prior work or work completed as specified in this Section, Contractor shall immediately make all repairs and replacements necessary, to the approval of Owner and CQA OFFICER and at no additional cost to Owner.

END OF SECTION

APPENDIX G

FINANCIAL ASSURANCE

S.A. Dunn & Company, LLC
209 Partition St. Ext.
Rensselaer, NY 12144
Phone: (518) 650-6106

March 6, 2020

Victoria Schmitt, PE
New York State Department of Environmental Conservation
1130 North Westcott Road
Schenectady, NY 12306

RE: Amendment to Standby Trust Agreement and Bond Rider

Enclosed, please find the above-referenced documents comprising the updated financial assurance for the solid waste operations of S.A. Dunn & Company, LLC that increase the amount of the bond to $5,088,034.56. There are three (3) original copies of the Amendment to the Standby Trust Agreement and one (1) original copy of the Bond Rider.

Please execute and return two (2) of the Amendment to the Standby Trust Agreement copies for our records.

Sincerely,

S.A. Dunn & Company, LLC

Curt Taylor
Region Engineer

cc: Jon Whitcomb (email only)
Brian Maglienti (email only)
Joel Falbo (email only)

Amendment to Schedule A and B of Standby Trust Agreement
entered into on June 20, 2014 by and between
S.A. Dunn & Company, LLC, Settlor
U.S. Bank National Association, Trustee

Schedule A (amended February 20, 2020)
Identification of Facility(s) and Cost Estimates

Name and Address of Facility: S.A. Dunn & Company, LLC
209 Partition Street Ext.
Rensselaer, New York 12144

NYS DEC Identification Number(s): 4-3899-00006/00001

Cost estimate(s):

Closure	$4,219,809.61
Post-Closure Care	$ 868,224.95
Corrective Measures	$0.00
Total	$5,088,034.56

Schedule B (amended February 20, 2020)
Identification of Property

The fund is established initially as consisting of the following:

Amount: $5,088,034.56

Type of property: Surety Bond Number SUR0041322.

This agreement will be funded by the following:

Surety Bond #SUR0041322

Issue by Argonaut Insurance Company on June 1, 2017 in accordance with the terms of the Surety Bond

Original Surety Bond Number 865589 issued by Evergreen National Indemnity Company in the total amount of $3,756,000.00 is hereby substituted, effective June 1, 2017, with Surety Bond Number SUR0041322 issued by Argonaut Insurance Company in the initial total amount of $3,756,000. The total amount of Surety Bond Number SUR0041322 was amended to $5,088,034.56 as of February 7, 2020. Except as amended hereby, all provisions of the Standby Trust Agreement entered into on June 20, 2014 by and between S.A. Dunn & Company, LLC, "Settlor" and U.S. Bank National Association, "Trustee" shall remain in full force and effect.

Executed by (Settlor):

S.A. Dunn & Company, LLC

By: (Signature)
Name: WORTHING JACKMAN
Title: PRESIDENT & CEO
Date: FEB 25, 2020

Witness: (signature)
Name: HANSAL KUMAR PATEL
Title: DIRECTOR OF CORPORATE FINANCE

Executed by (Trustee):

U.S. Bank National Association

By: (Signature)
Name: Ismael Diaz
Title: Vice President
Date: February 20, 2020

Witness: (signature)
Name: Ilse Vlach
Title: Vice President

Approved and Accepted by:

New York State Department of Environmental Conservation

By: (Signature)
Name:
Title:
Date:

RIDER

To be attached to and form a part of Bond No. SUR0041322

Effective: June 1, 2017

Bond Amount: $3,756,000.00

Executed by: S.A. Dunn & Company, LLC, as Principal

and by: Argonaut Insurance Company, as Surety

in favor of: New York State Department of Environmental Conservation, as Obligee

In consideration of the mutual agreements herein contained, the Principal and the Surety hereby consent to Revise the Bond Amount as Follows:

Increase Closure Amount From: $3,591,000.00 To: $4,219,809.61

Increase Post Closure Amount From: $165,000.00 To: $868,224.95

For a total new bond amount of: $5,088,034.56

Nothing herein contained shall vary, alter or extend any provision or condition of this bond except as herein expressly stated.

This rider is effective: February 7, 2020

Signed and Sealed: February 7, 2020

Principal: S.A. Dunn & Company, LLC

By: Scott I. Schreiber, Vice President Principal

Surety: Argonaut Insurance Company

By: Dawn L. Morgan
Dawn L. Morgan, Attorney-In-Fact

Argonaut Insurance Company
Deliveries Only: 225 W. Washington, 24th Floor
Chicago, IL 60606
United States Postal Service: P.O. Box 469011, San Antonio, TX 78246

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the Argonaut Insurance Company, a Corporation duly organized and existing under the laws of the State of Illinois and having its principal office in the County of Cook, Illinois does hereby nominate, constitute and appoint:

Stephen T. Kazmer, Elaine Marcus, James I. Moore, Dawn L. Morgan, Diane M. Rubright, Jennifer J. McComb, Amy Wickett

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on its behalf as surety, and as its act and deed any and all bonds, contracts, agreements of indemnity and other undertakings in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

$85,000,000.00

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolution adopted by the Board of Directors of Argonaut Insurance Company:

"RESOLVED, That the President, Senior Vice President, Vice President, Assistant Vice President, Secretary, Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the Company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the Argonaut Insurance Company, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Argonaut Insurance Company has caused its official seal to be hereunto affixed and these presents to be signed by its duly authorized officer on the 8th day of May, 2017.

Argonaut Insurance Company

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

by: _____

Joshua C. Betz, Senior Vice President

STATE OF TEXAS
COUNTY OF HARRIS SS:

On this 8th day of May, 2017 A.D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICER OF THE COMPANY, to me personally known to be the individual and officer described in, and who executed the preceding instrument, and he acknowledged the execution of same, and being by me duly sworn, deposed and said that he is the officer of the said Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and the said Corporate Seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority and direction of the said corporation, and that Resolution adopted by the Board of Directors of said Company, referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

KATHLEEN M. MEEKS
Notary Public, State of Texas
Comm. Expires 07-15-2021
Notary ID 557902-8

Kathleen M. Meeks
(Notary Public)

I, the undersigned Officer of the Argonaut Insurance Company, Illinois Corporation, do hereby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, I have hereunto set my hand, and affixed the Seal of said Company, on the 7th day of February, 2020.

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

James Bluzard, Vice President-Surety

THIS DOCUMENT IS NOT VALID UNLESS THE WORDS ARGO POWER OF ATTORNEY ARE IN BLUE. IF YOU HAVE QUESTIONS ON AUTHENTICITY OF THIS DOCUMENT CALL (210) 321 - 8400.

ARGO POWER OF ATTORNEY

State of Illinois}
} ss.
County of Dupage }

On February 7, 2020, before me, Tariese M. Pisciotto, a Notary Public in and for said Dawn L. Morgan known to me to be Attorney-in-Fact of Argonaut Insurance Company the corporation described in and that executed the within and foregoing instrument, and known to me to be the person who executed the said instrument in behalf of the said corporation, and he duly acknowledged to me that such corporation executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year stated in this certificate above.

My Commission Expires June 26, 2022

OFFICIAL SEAL
TARIESE M PISCIOTTO
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:06/26/22

Tariese M. Pisciotto, Notary Public

Commission No. 560807

APPENDIX H

ENGINEERING PERMIT DRAWINGS
(INCLUDED AS A SEPARATE 24-INCH BY 36-INCH ROLLED DRAWING SET)

APPENDIX I

MECHANICALLY STABILIZED EARTHEN BERM DESIGN AND DRAWINGS

Slide uses 2D limit equilibrium methods to determine the minimum FS. The auto-refine, non-circular search method with optimization was used utilizing Morgenstern-Price Method to calculate all FS. The General Limit Equilibrium (GLE) / Morgenstern-Price (MP) method of analysis was selected as the method since it satisfies all conditions of equilibrium, is applicable to any shape of slip surface, side force inclinations can be the same or can vary from slice to slice, side force inclinations are calculated in the process of solution so that all conditions of equilibrium are satisfied, and is considered an accurate method.

ReSlope was utilized to evaluate sliding and pullout failures considering both static and seismic scenarios for the critical cross section at approximately Station 19+47. ReSlope is an interactive, design-oriented, program for the design of geosynthetic-reinforced slopes, which also uses 2D limit equilibrium methods to determine the minimum FS. For a given problem including geosynthetic strength, reduction factors, and design safety factors, ReSlope produces the optimal layout (embedment length and spacing) of reinforcement layers.

GEOLOGY

According Reference 1, the proposed north perimeter berm for the Dunn C&D Landfill overlays glaciolacustrine silts and sands. Subsurface information determined that significant glaciofluvial deposits are present between existing ground surface and from depths ranging from 130 to 170 feet. The glaciofluvial deposits are underlain by glacial till and the glacial till is underlain by shale. Based on the web soil survey some alluvial soil is present near the northeast corner.

GEOMETRY

The proposed north perimeter berm will be mostly constructed in areas of fill in order to construct the proposed bottom liner of the northern cells. The berm will have a slope of 0.5H:1V (horizontal:vertical). The proposed northern pond in the northwest corner, located downslope of the proposed berm, will be constructed with 2H:1V slopes. The proposed waste slopes will be constructed no steeper than 3H:1V. There is a proposed perimeter access road at the top of the proposed berm.

MATERIAL PARAMETERS

The following table summarizes the parameters used in this analysis. All parameters excluding the new fill were based on the slope stability analysis performed by CEC for the proposed modification of the facility (Reference 3). The new fill (which includes reinforced fill) parameters are based on the remolded direct shear test results of on-site materials (Reference 4).

Material	Unit Weight (pcf)	Angle of Friction (degrees)	Cohesion (psf)	Reference
Subgrade	120	30	0	4
Bottom Liner/	118.5	17.4	67	3

Material	Unit Weight (pcf)	Angle of Friction (degrees)	Cohesion (psf)	Reference
Low Permeability Soil				
C&D Waste	60	Shear / Normal Function	Shear / Normal Function	3
Final Cover System	119.9	27	0	3
New Fill	120	30	100	3

SURCHARGE LOADING

Exact equipment and traffic loading was not provided by at the time of the calculation. Therefore CEC has assumed a surcharge of 250 psf for equipment and traffic surcharge based on our experience. This surcharge was applied to the top of the proposed berm for all scenarios.

GROUNDWATER

Based on Reference 1, the depth to static groundwater is in excess of 50 feet below existing ground surface and is not considered in this analysis.

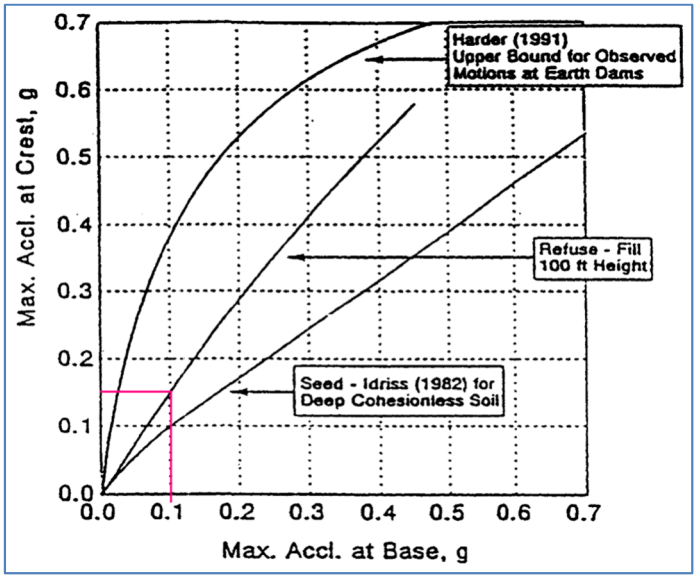
FACTOR OF SAFETY

Per 6 CCR-NY-363-4.3(c) and (d), the minimum acceptable FS for static slope stability is 1.5 and for seismic slope stability is 1.0. The minimum target FS for sliding of 1.5 for static and 1.0 for seismic were based on Reference 8.

SEISMIC ANALYSIS

Per 6 CRR-NY-363-4.3(d) any facility located in a seismic impact zone, must include a seismic stability analysis. A seismic impact zone, as defined in the RCRA Subtitle D regulations, is an area that has a 10% or greater probability that the peak ground acceleration (PGA) in lithified earth material (bedrock) expressed as a percentage of the earth's gravitational pull will exceed 0.10g (10 percent of gravity) in 250 years.

Values of PGA having a certain probability of exceedance (P_e) were determined from the United Stated Geologic Survey (USGS) Unified Hazard Tool. The USGS Unified Hazard Tool presents the PGA value for a seismic risk level of 2% probability that the PGA will be exceeded in 50 years (e.g. P_e = 2% in 50 years); however, a seismic risk level of P_e = 2% is equivalent to P_e = 10% in 250 years. Using the unified hazard tool with the Conterminous U.S. 2014 Edition, the PGA at Dunn C&D Landfill site corresponding to P_e = 2% in 50 years is 0.105g. The USGS hazard maps report PGA at the ground surface assuming 30 meters of soil with an average shear wave velocity of 760 m/s, which is conservative based on our review of the test borings previously drilled at the site. Therefore, 0.105g was considered the free field PGA for the site. To account for acceleration amplification during a seismic event from the free field PGA (at the base of the MSE berm) to the top of the MSE berm, the Refuse-Fill 100 ft Height curve presented on the following figure was used from Reference 6. This resulted in an amplified PGA/design PGA of 0.15g.



According to 6 CRR-NY-363-4.3(d)(1)(i) a pseudo-dynamic analysis shall demonstrate all long-term containment structures are designed to retain a minimum factory of safety of 1.0 using a seismic coefficient (expressed as a fraction of the acceleration of gravity) equal to one-half the free field peak ground acceleration at the site for the design earthquake. Therefore, the seismic coefficient used in the analysis was 0.075g (1/2 the design PGA).

GEOSYNTHETIC MATERIAL STREGNTH PROPERTIES

Geosynthetic material strength properties used in the analysis are listed in the table below. The long-term design strengths were input into slide and the reinforcements were modeled as an active support. The strengths used were based on the ultimate strength and reduction factors listed in Reference 7. The long term design strengths calculated in Attachment C were input into ReSlope with reduction factors of 1.0 to model a generic type of geogrid. It is assumed that the backfill material will be on-site material which generally consists of silty sand. Calculations are shown in spreadsheets in Attachment B. The interface friction between the geogrid and the reinforced fill/foundation soil was determined in accordance with Reference 8.

Geogrid Material	Interface Friction (°)	Ultimate Tensile Strength (lb/ft)
Type 1	21	1900
Type 2		3900
Type 3		8400

RESULTS AND CONCLUSIONS

The following tables summarize the calculated minimum global stability FS for each cross section and each scenario using Slide.

GLOBAL STATIC STABILITY RESULTS

Approximate Cross Section Station	Minimum Calculated FS	Minimum Target FS
00+27	1.59	1.50
00+60	1.53	
01+50	1.50	
03+30	1.81	
10+27	1.52	
15+01	1.71	
19+47	1.56	

GLOBAL SEISMIC STABILITY RESULTS

Cross Section	Minimum Calculated FS	Minimum Target FS
00+27	1.36	1.00
00+60	1.31	
01+50	1.31	
03+30	1.54	
10+27	1.30	
15+01	1.47	
19+47	1.32	

Direct sliding analysis was performed in ReSlope to check the minimum required length of the bottom geogrid at the critical cross section at Station 19+47. The minimum length required by ReSlope was 45 feet which is less than the length of 100 feet used in Slide.

Based on these results, CEC concludes that the proposed MSE berm will meet the requirements in 6 CCR-NY-363-4.3(c) and (d) if constructed in accordance with this design and the construction drawings.

OBJECTIVE

The objective of this analysis was to design the proposed mechanical stabilized earth (MSE) berm to meet the requirements in 6 CCR-NY-363-4.3(c) and (d).

REFERENCES

1. "Hydrogeological Report, Dunn Sand & Gravel Mined Land Use, Plan Modification/C&D Landfill" Prepared by C.T. Male Associates, P.C., Dated October 5, 2010, Revised June 14, 2011.
2. "Custom Soil Resource Report for Rensselaer County, New York", by United States Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey.
3. S.A. Dunn C&D Landfill Footprint Modification Application Interim and Overall Slope Stability, Performed by Civil & Environmental Consultants, Inc. Dated August 2020.
4. Direct Shear Results, (500, 7,500, and 15,000 psf) for Sample SG-1 (Subgrade), Lab Log: 18-115, tested by RSA Geolab, LLC, Dated 5-16-18.
5. "Unified Hazard Tool", United States Geologic Survey, Access June 6, 2019.
6. "Seismic Response of Municipal Solid Waste Landfills", S. Singh,
7. Tencate – Determination of the Long-term Properties of Miragrid XT Geogrids.
8. FHWA. Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes (Volumes I and II). November 2009.

METHODOLOGY

Slope stability software Slide 9.0 and ReSlope Version 4.0 were used to calculate the minimum factor of safety (FS) in general accordance with Federal Highway Administration (FHWA) design methodology for reinforced soil slopes (RSSs) at the cross sections listed in the following table. According to Reference 8, inclinations of less than 70 degrees are considered slopes and inclinations of 70 degrees or greater are considered walls. These cross sections were chosen for analysis based on proposed berm height, proposed slope at toe of MSE berm, subsurface conditions, proposed waste height, and/or to optimize the design.

Analyzed Cross Sections Summary Table

Approximate MSE Berm Station	Approximate Proposed MSE Berm Height (ft)
0+27	18
0+60	20
1+50	24
3+30	30
10+27	54
15+01	28
19+47	48

ATTACHMENT A

DRAWINGS

LEGEND

- EXISTING MAJOR CONTOUR (200)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR (180)
- PROPOSED MINOR CONTOUR
- EXISTING FENCE
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING WATER MAIN
- EXISTING PROPERTY LINE
- CROSS SECTION LOCATION
- B-101 PROPOSED TEST BORING LOCATION (SEE NOTE 1)
- 0+00 1+00 MSE BERM ALIGNMENT AND STATIONING
- RSS DRAIN
- RSS DRAIN OUTLET

REFERENCE

1. EXISTING TOPOGRAPHY AND PROPERTY OWNER INFORMATION WAS COMPILED BY SOUTHERN RESOURCES MAPPING CORPORATION USING PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED APRIL 11, 2018.
2. PROPERTY LINE INFORMATION WAS TAKEN FROM A PLAN TITLED "ALTA/ASCM LAND TITLE BOUNDARY SURVEY, LANDS OF KELLY AND DUNN TO BE CONVEYED TO S.A. DUNN & COMPANY, LLC." PREPARED AND SEALED BY WILLIAM N. CURRAN, AND UPDATED AS NECESSARY BASED ON AVAILABLE TITLE INFORMATION.
3. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES. CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF FINAL COVER ELEVATIONS.

NOTES

1. A SUBSURFACE INVESTIGATION SHALL BE PERFORMED BY AN ENGINEER LICENSED IN THE STATE OF NEW YORK PRIOR TO CONSTRUCTION TO CONFIRM THE FOUNDATION SOIL DESIGN PARAMETERS THAT WERE ASSUMED AS PART OF THE MSE BERM DESIGN. THE SUBSURFACE INVESTIGATION SHALL INCLUDE THE FOLLOWING AT A MINIMUM.
   - TEST BORINGS AT THE APPROXIMATE LOCATIONS SHOWN ON DRAWING GT01.
   - STANDARD PENETRATION TESTING AT ALL LOCATIONS FROM THE GROUND SURFACE TO A MINIMUM DEPTH OF TWICE THE HEIGHT OF THE PROPOSED MSE BERM OR 35' WHICHEVER IS GREATER.
   - LABORATORY TESTING INCLUDING BUT NOT LIMITED TO GRAIN SIZE ANALYSIS, ATTERBURG LIMITS, MOISTURE CONTENT, AND SHEAR STRENGTH TESTING.

SCALE IN FEET
0 60 120

STATE OF NEW YORK
KENNETH RICHARD MILLER
090870
LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION
1	11/25/2020	REVISED MSE BERM AND NORTH POND GRADING
2	08/18/2021	REVISED FINAL WASTE GRADES

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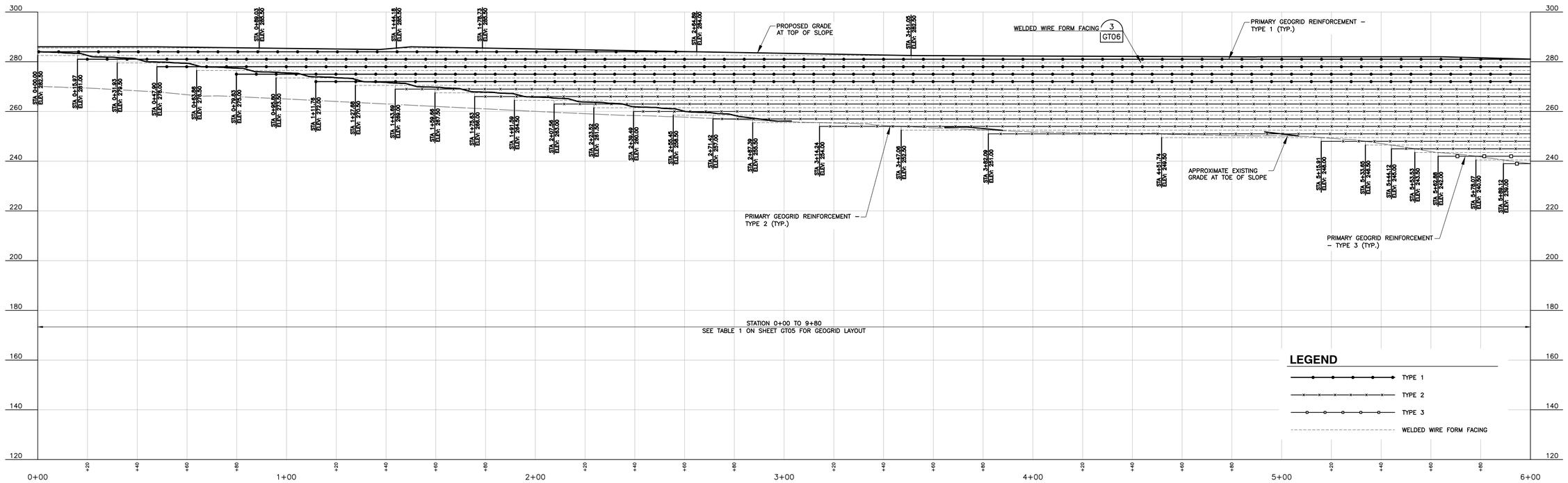
NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

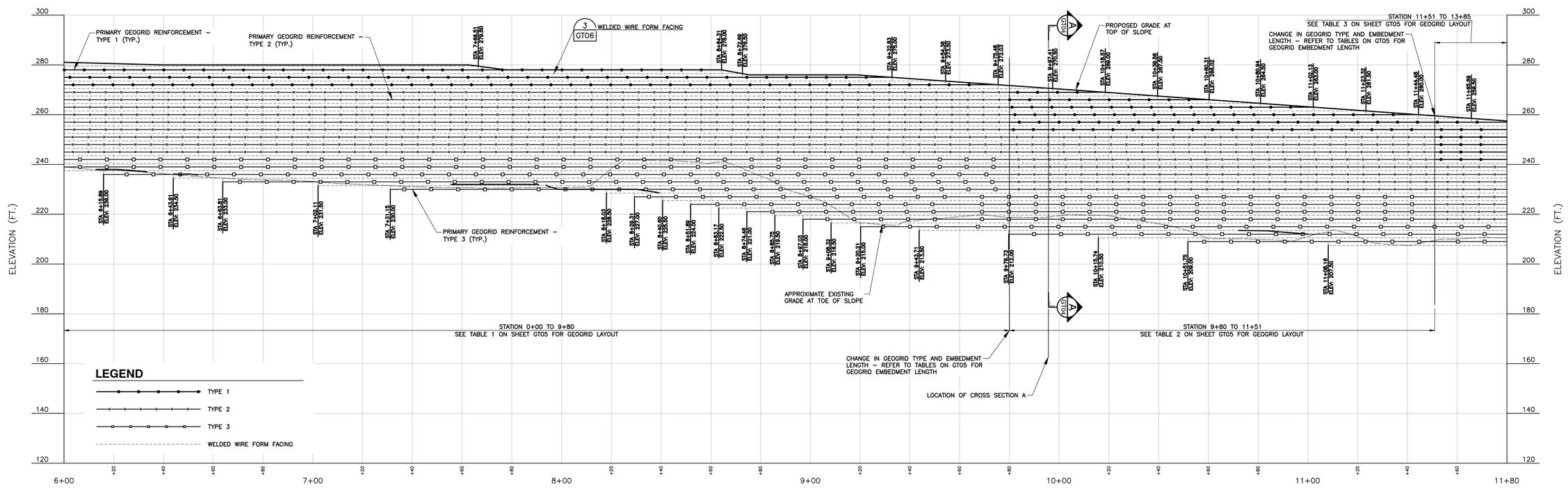
MSE BERM PLAN

DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

DRAWING NO.: **GT01**
SHEET 1 OF 7

\\svr-boston\projects\2018\182-442\-CADD\Dwg\GT01 - MSE Berm\182442-GT01-MSE Plan and Profile_R1.dwg\GT01\ LS:(5/14/2021 - jhanckelson) - LP: 5/19/2021 11:29 AM





MSE BERM PROFILE

SCALE H:1"=20'; V:1"=20'

SCALE IN FEET

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STATE OF NEW YORK
KENNETH RICHARD WILLEY
090870
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REVISION RECORD

NO	DATE	DESCRIPTION

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S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

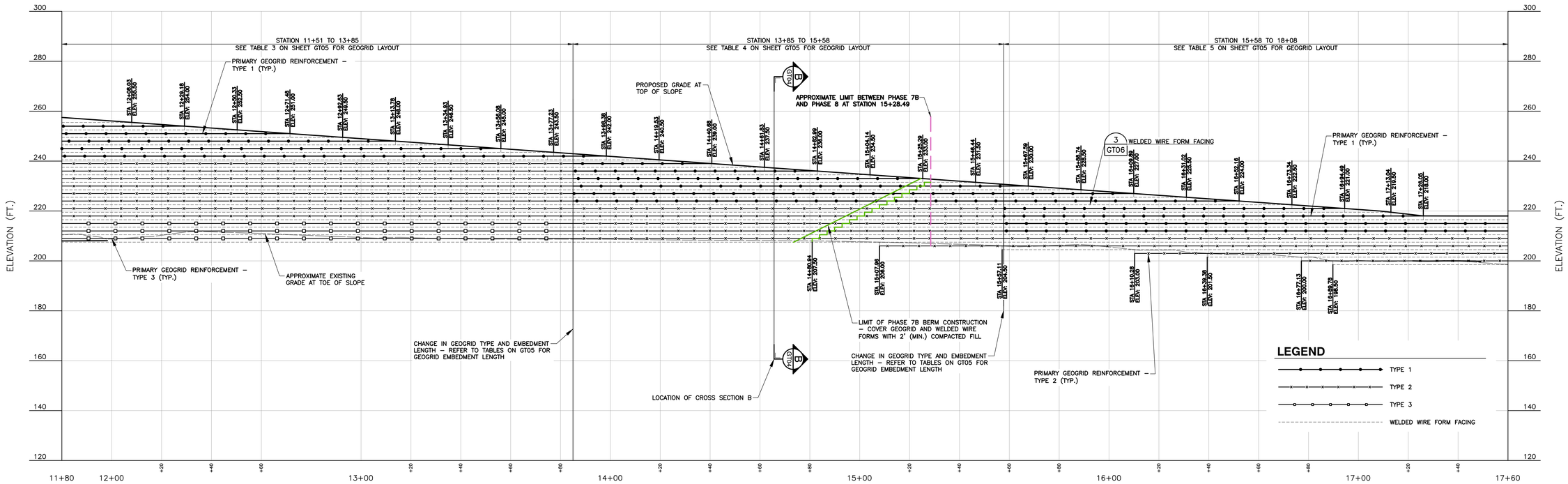
MSE BERM PROFILE

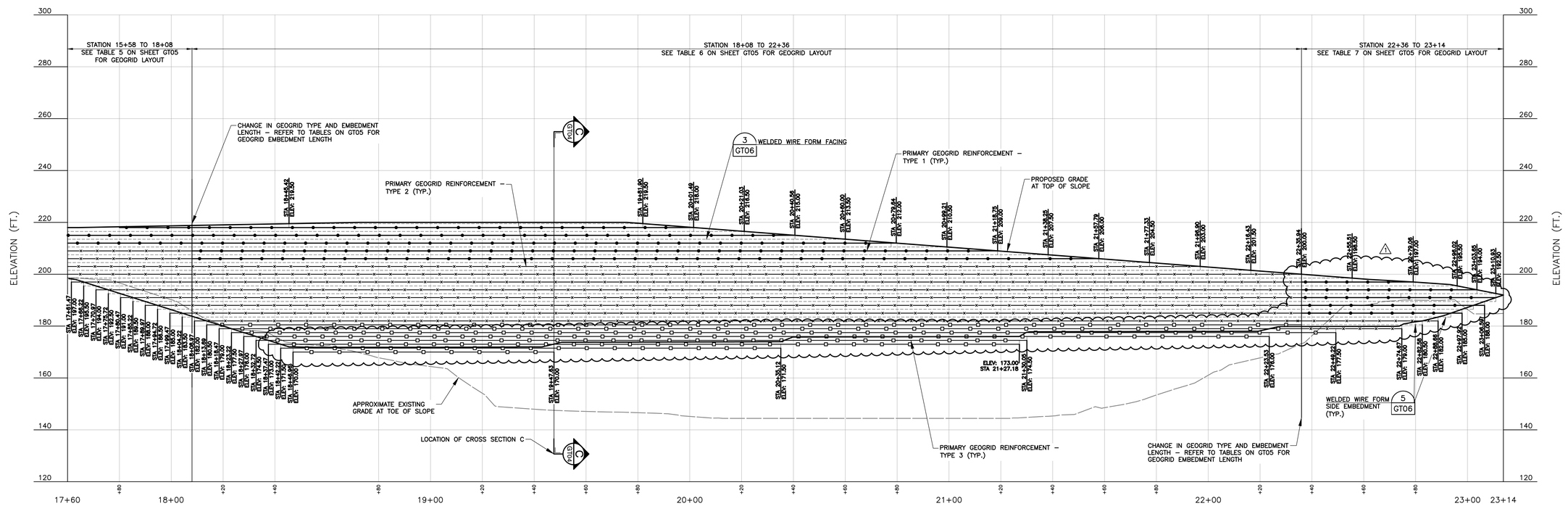
DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

DRAWING NO.: **GT02**

SHEET 2 OF 7

\\sar-boston\projects\2018\182-442\-CADD\dwg\GT01 - MSE Wall\182442-GT01-MSE Plan and Profile_R1.dwg\GT02\ LS:(5/14/2021 - jhendrickson) - LP: 5/19/2021 11:29 AM





LEGEND

- TYPE 1
- TYPE 2
- TYPE 3
- WELDED WIRE FORM FACING

MSE BERM PROFILE

SCALE H:1"=20'; V:1"=20'

SCALE IN FEET

0 20 40

STATE OF NEW YORK · KENNETH RICHARD MILLER · 090870 · LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION
1	11/20/2020	REVISED BOTTOM AND END OF RISE BETWEEN 18+45 AND 23+14

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NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

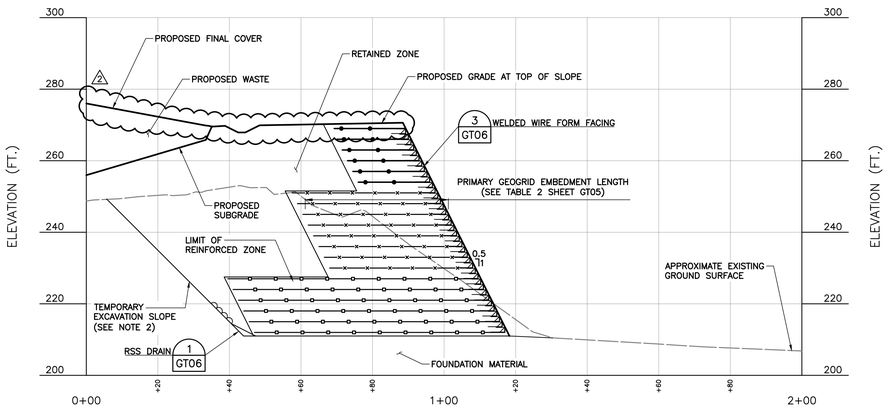
MSE BERM PROFILE

DATE:	08/14/2020	DRAWN BY: JAH
DWG SCALE:	AS SHOWN	CHECKED BY: JMN
PROJECT NO:		182-442
APPROVED BY:		KRM

DRAWING NO.: **GT03**

SHEET 3 OF 7

\\srv-boston\projects\2018\182-442\-CADD\dwg\GT01 - MSE Wall\182442-GT01-MSE Plan and Profile_R1.dwg\GT03\ LS:S/14/2021 - jhendricksen\ - LP: 3/19/2021 11:29 AM



CROSS SECTION A-A - STA. 9+95

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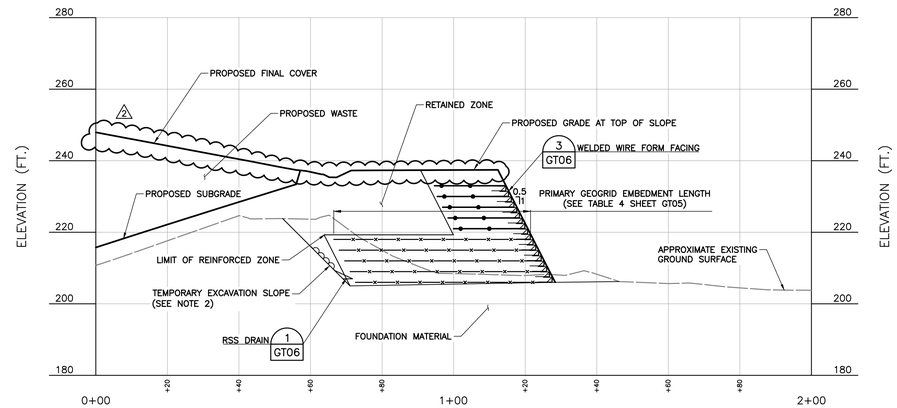

CROSS SECTION B-B - STA. 14+69

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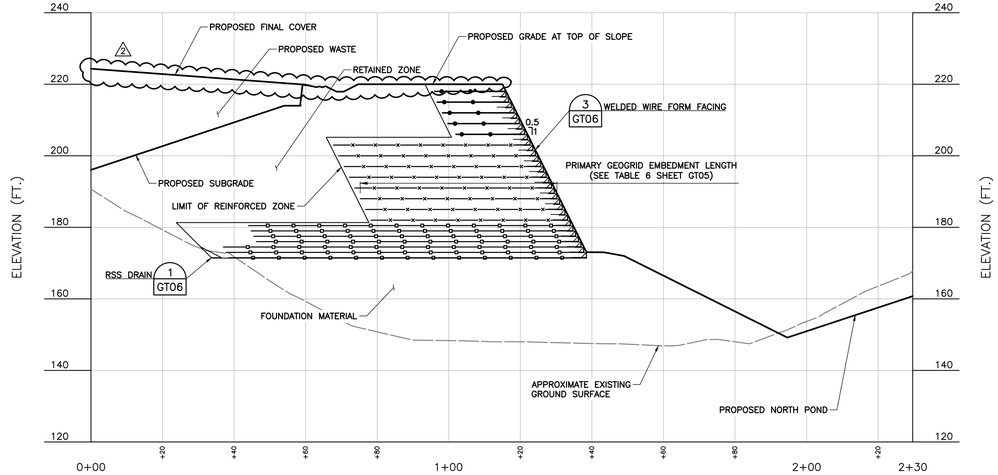

CROSS SECTION C-C - STA. 19+47

SCALE H:1"=20''; V:1"=20''

LEGEND

- TYPE 1
- TYPE 2
- TYPE 3

NOTES

1. SEE GT05 FOR SUMMARY OF GEOGRID ELEVATION, TYPE, AND EMBEDMENT LENGTH.
2. ALL EXCAVATIONS SHALL BE PERFORMED IN ACCORDANCE WITH OSHA REGULATIONS. CONTRACTOR IS RESPONSIBLE FOR STABILITY OF TEMPORARY EXCAVATIONS.

SCALE IN FEET
0 20 40

STATE OF NEW YORK · KENNETH RICHARD MILLER · 090870 · LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION
1	11/25/2020	REVISED PROPOSED GRADING AND SECTIONS LAYOUT AT CROSS SECTION C-C
2	06/18/2021	REVISED FINAL WASTE GRADES

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NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

CROSS SECTIONS A-A, B-B AND C-C

DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

DRAWING NO.: **GT04**

SHEET 4 OF 7

\\svr-boston\projects\2018\182-442\-CADD\Dwg\GT01 - MSE Wall\182442-GT01-MSE Plan and Profile_RT.dwg\GT04 LS:(15/19/2021 - jhendrickson) - LP: 5/19/2021 11:31 AM

TABLE 1
GEOGRID LAYOUT
STATIONS 0+00 TO 9+80

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
284	0+00	2+64.89	Type 1	21
281	0+15.97	6+00	Type 1	21
278	0+49.90	7+66.51	Type 1	21
275	0+79.83	9+32.83	Type 1	21
272	1+11.76	9+75.48	Type 1	21
269	1+43.69	9+80	Type 2	40
266	1+75.63	9+80	Type 2	40
263	2+07.56	9+80	Type 2	40
260	2+39.49	9+80	Type 2	40
257	2+71.42	9+80	Type 2	40
254	3+14.24	9+80	Type 2	40
251	3+82.09	9+80	Type 2	40
248	5+15.91	9+80	Type 2	40
245	5+44.12	9+80	Type 2	40
242	5+62.88	9+80	Type 3	70
239	5+89.12	9+80	Type 3	70
236	6+15.89	9+80	Type 3	70
233	6+63.81	9+80	Type 3	70
230	7+31.15	9+80	Type 3	70
227	8+29.31	9+80	Type 3	70
224	8+51.89	9+80	Type 3	70
221	8+74.46	9+80	Type 3	70
218	8+97.03	9+80	Type 3	70
215	9+20.21	9+80	Type 3	70

2

TABLE 2
GEOGRID LAYOUT
STATIONS 9+80 TO 11+51

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
269	9+80	10+18.57	Type 1	20
266	9+80	10+60.31	Type 1	20
263	9+80	11+02.13	Type 1	20
260	9+80	11+44.48	Type 1	20
257	9+80	11+51	Type 1	20
254	9+80	11+51	Type 1	20
251	9+80	11+51	Type 2	40
248	9+80	11+51	Type 2	40
245	9+80	11+51	Type 2	40
242	9+80	11+51	Type 2	40
239	9+80	11+51	Type 2	40
236	9+80	11+51	Type 2	40
233	9+80	11+51	Type 2	40
230	9+80	11+51	Type 2	40
227	9+80	11+51	Type 3	70
224	9+80	11+51	Type 3	70
221	9+80	11+51	Type 3	70
218	9+80	11+51	Type 3	70
215	9+80	11+51	Type 3	70
212	9+80	11+51	Type 3	70
209	10+51.75	11+51	Type 3	70

TABLE 3
GEOGRID LAYOUT
STATIONS 11+51 TO 13+85

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
257	11+51	11+80	Type 1	20
254	11+51	12+29.18	Type 1	20
251	11+51	12+71.48	Type 1	20
248	11+51	13+13.78	Type 1	20
245	11+51	13+56.08	Type 1	20
242	11+51	13+85	Type 1	20
239	11+51	13+85	Type 2	40
236	11+51	13+85	Type 2	40
233	11+51	13+85	Type 2	40
230	11+51	13+85	Type 2	40
227	11+51	13+85	Type 2	40
224	11+51	13+85	Type 2	40
221	11+51	13+85	Type 2	40
218	11+51	13+85	Type 2	40
215	11+51	13+85	Type 3	70
212	11+51	13+85	Type 3	70
209	11+51	13+85	Type 3	70

TABLE 4
GEOGRID LAYOUT
STATIONS 13+85 TO 15+58

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
242	13+85	13+98.38	Type 1	20
239	13+85	14+40.68	Type 1	20
236	13+85	14+82.99	Type 1	20
233	13+85	15+25.29	Type 1	20
230	13+85	15+58	Type 1	20
227	13+85	15+58	Type 1	20
224	13+85	15+58	Type 1	20
221	13+85	15+58	Type 2	40
218	13+85	15+58	Type 2	40
215	13+85	15+58	Type 2	40
212	13+85	15+58	Type 2	40
209	13+85	15+58	Type 2	40
206	15.07.96	15+58	Type 2	40

TABLE 5
GEOGRID LAYOUT
STATIONS 15+58 TO 18+08

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
230	15+58	15+67.59	Type 1	20
227	15+58	16+09.89	Type 1	20
224	15+58	16+52.16	Type 1	20
221	15+58	16+94.49	Type 1	20
218	15+58	17+26.05	Type 1	20
215	15+58	18+08	Type 1	20
212	15+58	18+08	Type 1	20
209	15+58	18+08	Type 2	40
206	15+58	18+08	Type 2	40
203	16+10.28	18+08	Type 2	40
200	16+77.13	18+08	Type 2	40
197	17+61.47	18+08	Type 2	40
194	17+70.97	18+08	Type 2	40
191	17+80.47	18+08	Type 2	40
188	17+89.97	18+08	Type 2	40
185	17+99.47	18+08	Type 2	40

TABLE 6
GEOGRID LAYOUT
STATIONS 18+08 TO 22+36

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
218	18+08	20+01.49	Type 1	20
215	18+08	20+40.56	Type 1	20
212	18+08	20+79.64	Type 1	20
209	18+08	21+18.75	Type 1	20
206	18+08	21+57.79	Type 1	20
203	18+08	21+96.90	Type 2	55
200	18+08	22+35.94	Type 2	55
197	18+08	22+36	Type 2	55
194	18+08	22+36	Type 2	55
191	18+08	22+36	Type 2	55
188	18+08	22+36	Type 2	55
185	18+08	22+36	Type 2	55
182	18+08.97	22+36	Type 2	55
180.5	18+13.69	22+36	Type 3	90
179	18+18.47	22+36	Type 3	90
177.5	18+23.22	22+36	Type 3	90
176	18+27.97	22+23.53	Type 3	90
174.5	18+32.72	21+30.05	Type 3	100
173	18+37.47	21+27.18	Type 3	100
171.5	18+42.22	20+35.12	Type 3	100
170	18+46.96	19+47.63	Type 3	100

TABLE 7
GEOGRID LAYOUT
STATIONS 22+36 TO 23+14

ELEV.	STARTING STATION	ENDING STATION	GEOGRID TYPE	EMBEDMENT LENGTH (FT)
197	22+36	22+79.06	Type 1	20
194	22+36	23+03.65	Type 1	20
191	22+36	23+10.93	Type 1	20
188	22+36	23+06.59	Type 1	20
185	22+36	22+97.92	Type 1	20
182	22+36	22+88.66	Type 2	40
179	22+36	22+74.76	Type 2	40
177.5	22+36	22+49.22	Type 3	40

STATE OF NEW YORK
KENNETH RICHARD MILLER
090870
LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION
1	11/19/2020	REVISED TABLES 4 AND 7.
2	02/16/2021	REVISED FINAL WASTE GRADES.
3		

Civil & Environmental Engineering, Landscape Architecture and Land Surveying PLLC
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NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

GEOGRID LAYOUT TABLES

DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

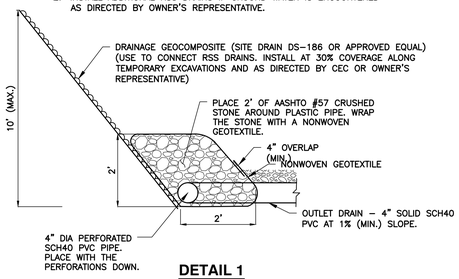
DRAWING NO.: GT05

SHEET 5 OF 7

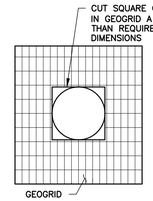
\\ svr-boston\projects\2018\182-442\-CADD\Dwg\GT01 - ASE Mill\182442-GT01-ASE DALCS_PT.dwg(GT05) LS:15/16/2021 - jhendricksen) - LP: 5/19/2021 11:29 AM

NOTES:

1. INSTALL RSS DRAINS AT BASE/REAR OF TEMPORARY EXCAVATION AS SHOWN ON CROSS SECTIONS.
2. INSTALL ADDITIONAL RSS DRAINS IF GROUND WATER IS ENCOUNTERED AS DIRECTED BY OWNER'S REPRESENTATIVE.



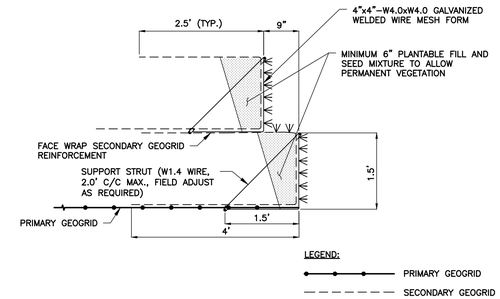
DETAIL 1
RSS DRAIN
N.T.S



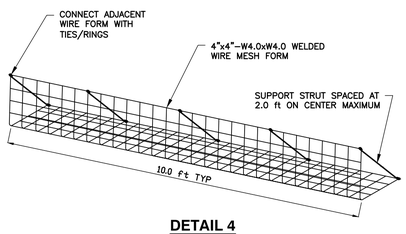
NOTES:

1. THIS DETAIL SHALL BE USED FOR GEOGRID PENETRATIONS FOR FENCE POSTS, GUIDERAIL, AND ANY OTHER REQUIRED PENETRATION THROUGH THE GEOGRID IN THE REINFORCED BACKFILL.
2. AS AN ALTERNATIVE, POSTS MAY BE DRIVEN THROUGH THE GRID. DO NOT DRILL USING AUGERS ONCE THE GEOGRID IS INSTALLED.
3. CONTRACTOR SHALL COORDINATE INSTALLATION OF THE GUIDERAIL AND ANY OTHER ITEMS WITH CONSTRUCTION OF THE REINFORCED BACKFILL AND INSTALLATION OF GEOGRIDS REQUIRING THE PENETRATIONS.

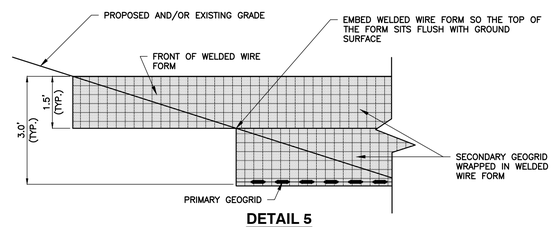
DETAIL 2
GEOGRID PENETRATION
N.T.S



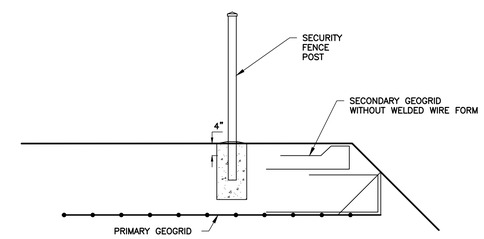
DETAIL 3
WELDED WIRE FORM FACING
N.T.S



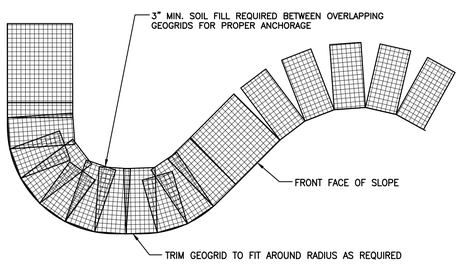
DETAIL 4
WELDED WIRE FORM
N.T.S



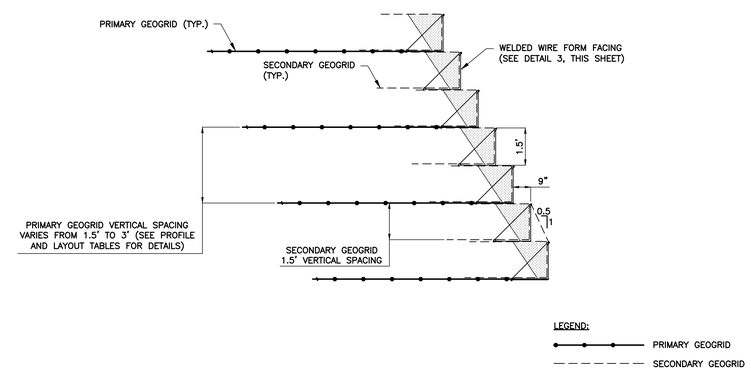
DETAIL 5
WELDED WIRE FORM SIDE EMBEDMENT
N.T.S



DETAIL 6
GEOGRID AT TOP OF SLOPE
N.T.S



DETAIL 7
GEOGRID PLACEMENT ON CURVES
N.T.S



DETAIL 8
TYPICAL MSE BERM CROSS SECTION
N.T.S

STATE OF NEW YORK
KENNETH RICHARD MILLER
090870
LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying PLLC
31 BELLOWS ROAD - RAYNHAM, MA 02767
774-501-2176 · 888-312-2024

NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

MSE BERM DETAILS

DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

DRAWING NO.: GT06

SHEET 6 OF 7

I:\svr-boston\projects\2018\182-442\-CADD\Dwg\GT01 - MSE Wall\182442-GT01-MSE Details.dwg\GT06\ LS:(1/19/2021 - kkempton) - LP: 5/19/2021 11:29 AM

PART 1– GENERAL

1.1 SUMMARY

A. DESCRIPTION OF WORK: THE WORK SHALL CONSIST OF THE CONSTRUCTION OF A REINFORCED SOIL SLOPE (RSS) AS PART OF EARTHWORK CONSTRUCTION FOR THE PROJECT. WORK CONSISTS OF:

1. FURNISHING PRIMARY GEOGRID REINFORCEMENT, SECONDARY GEOGRID REINFORCEMENT, WELDED WIRE MESH FORMS, DRAINAGE GEOCOMPOSITE, EROSION CONTROL, AND OTHER DRAINAGE MATERIALS AS SHOWN ON THE DRAWINGS AND PRESENTED HEREIN.
2. STORING, CUTTING, AND PLACING PRIMARY GEOGRID REINFORCEMENT, SECONDARY GEOGRID REINFORCEMENT, WELDED WIRE MESH FORMS, AND INSTALLING DRAINAGE MATERIALS AS SPECIFIED HEREIN AND AS SHOWN ON THE DRAWINGS.
3. PLACEMENT AND COMPACTION OF BACKFILL MATERIAL AND EXCAVATION AS SPECIFIED HEREIN AND AS SHOWN ON THE DRAWINGS.
4. PLACEMENT OF PERMANENT SEEDING AND EROSION CONTROL TO ESTABLISH LONG–TERM VEGETATION ON THE RSS FACE.

1.2 REFERENCES

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. D4759–92 – PRACTICE FOR DETERMINING THE SPECIFICATION CONFORMANCE OF GEOSYNTHETICS
2. D5262–97 – STANDARD TEST METHOD FOR EVALUATING UNCONFINED TENSILE CREEP BEHAVIOR OF GEOSYNTHETICS
3. D5818–95 – PRACTICE FOR OBTAINING SAMPLES OF GEOSYNTHETICS FROM A TEST SECTION FOR ASSESSMENT OF INSTALLATION DAMAGE
4. F904–91 – STANDARD TEST METHOD FOR COMPARISON OF BOND STRENGTH OR PLY ADHESION OF SIMILAR LAMINATES MADE FROM FLEXIBLE MATERIAL
5. D698 – LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING STANDARD EFFORT
6. D5321 – TEST METHOD FOR INTERFACE FRICTION BY DIRECT SHEAR (GEOSYNTHETICS TO SOILS)
7. D3080 – DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS
8. D4318 – LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS
9. D422 – MECHANICAL SIEVE
10. D2487 – CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES (UNIFIED SOIL CLASSIFICATION SYSTEM)
11. D6637–01 – STANDARD TEST METHOD FOR DETERMINING TENSILE PROPERTIES OF GEOGRIDS BY THE SINGLE OR MULTI–RIB TENSILE METHOD
12. D4355 – STANDARD TEST METHOD FOR DETERIORATION OF GEOTEXTILES BY EXPOSURE TO LIGHT, MOISTURE AND HEAT IN A XENON ARC=TYPE APPARATUS.

B. GEOSYNTHETIC RESEARCH INSTITUTE (GRI)

1. GG1–87 – STANDARD TEST METHOD FOR GEOGRID RIB TENSILE STRENGTH
2. GG2–87 – STANDARD TEST METHOD FOR GEOGRID JUNCTION STRENGTH
3. GG4–91 – DETERMINATION OF THE LONG–TERM DESIGN STRENGTH OF GEOGRIDS
4. GG5–91 – STANDARD TEST METHOD FOR GEOGRID PULLOUT
5. GG7 – STANDARD TEST METHOD FOR CARBOXYL END GROUP CONTENT OF POLY ETHYLENE TEREPHTHALATE (PET) YARNS
6. GG8 – DETERMINATION OF THE NUMBER AVERAGE MOLECULAR WEIGHT OF POLY ETHYLENE TEREPHTHALATE (PET) YARNS BASED ON A RELATIVE VISCOSITY VALUE

C. U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

1. FHWA–NHI–10–024 – MECHANICALLY STABILIZED EARTH WALLS AND REINFORCED SOIL SLOPE DESIGN AND CONSTRUCTION GUIDELINES (NOVEMBER 2009)
2. SA–96–072 – CORROSION/DEGRADATION OF SOIL REINFORCEMENTS FOR MECHANICALLY STABILIZED EARTH WALLS AND REINFORCED SOIL SLOPES.

1.3 DEFINITIONS

A. PRIMARY GEOGRID – A STRUCTURAL GEOGRID IS FORMED BY A REGULAR NETWORK OF INTEGRALLY CONNECTED TENSILE ELEMENTS WITH APERTURES OF SUFFICIENT SIZE TO ALLOW INTERLOCKING WITH SURROUNDING SOIL, ROCK, OR EARTH; STRUCTURAL GEOGRIDS FUNCTION PRIMARILY AS REINFORCEMENT.

B. SECONDARY GEOGRID – AN OPEN MESH BIAXIAL GEOGRID DESIGNED SPECIFICALLY TO BE A FACE WRAP MATERIAL FOR STEEPENED SLOPE APPLICATIONS. IT PROVIDES SECONDARY REINFORCEMENT.

C. WELDED WIRE FORMS – STEEL MESH FOR FORMING AND SUPPORTING SLOPE FACING AS SHOWN ON THE PLANS.

D. DRAINAGE GEOCOMPOSITE – A GEOCOMPOSITE CONSISTING OF A HIGH COMPRESSIVE STRENGTH GEONET CORE WITH A NON–WOVEN FILTER GEOTEXTILE BONDED TO BOTH SIDES. THE GEOCOMPOSITE IS PLACED AGAINST THE BACK SLOPE OF THE EXCAVATION MADE TO ALLOW FOR INSTALLATION OF THE RSS. THE GEOCOMPOSITE PROVIDES A DRAINAGE PATH FOR ANY WATER SEEPING FROM THE EXCAVATED SURFACE AFTER CONSTRUCTION OF THE RSS.

E. REINFORCED SOIL – COMPACTED SOIL THAT IS WITHIN THE REINFORCED ZONE AS SHOWN ON THE DRAWINGS.

F. RETAINED MATERIAL – SOIL OR BEDROCK THAT IS RETAINED BEHIND THE REINFORCED SOIL.

G. FOUNDATION MATERIAL – RESIDUAL SOIL, NEW FILL, OR BEDROCK COMPRISING THE SUBGRADE BELOW THE REINFORCED SOIL.

H. PLANTABLE FILL – SOILS PLACED IN THE FRONT OF THE WELDED WIRE FORMS TO PROMOTE VEGETATION GROWTH.

I. TESTING AGENCY – THE GEOTECHNICAL ENGINEERING FIRM RETAINED BY THE OWNER TO PROVIDE QUALITY ASSURANCE OVERSIGHT AND TESTING DURING RSS CONSTRUCTION. THE FIRM SHALL HAVE DEMONSTRATED EXPERIENCE PROVIDING OVERSIGHT OF RSS CONSTRUCTION AND PERFORMING GEOTECHNICAL TESTING. PERFORM ALL TESTING UNDER THE DIRECTION OF THE GEOTECHNICAL ENGINEER OF RECORD.

J. DESIGN ENGINEER – DESIGNER OF THE RSS DETAILED IN THESE PLANS AND SPECIFICATIONS (CEC).

1.4 SUBMITTALS

A. TESTING AGENCY: THE TESTING AGENCY, SHALL BE AN EXPERIENCED GEOTECHNICAL ENGINEER LICENSED IN THE STATE OF NEW YORK AND MAINTAIN A MINIMUM OF $1.0 MILLION PROFESSIONAL LIABILITY COVERAGE.

B. CERTIFICATE OF COMPLETION: WITHIN TWO WEEKS AFTER COMPLETION OF RSS CONSTRUCTION, FURNISH TO THE OWNER A CERTIFICATE OF COMPLETION PREPARED BY THE TESTING AGENCY CERTIFYING THE RSS WAS CONSTRUCTED IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS. THE CERTIFICATE SHALL BE ACCOMPANIED BY THE FOLLOWING INFORMATION IN A REPORT FORMAT:

1. PERFORM PRE–CONSTRUCTION TESTING IN ACCORDANCE WITH SECTION 1.6.B ON THIS SHEET.
2. ALL ADDITIONAL LABORATORY TEST RESULTS PERFORMED DURING CONSTRUCTION.
3. FIELD REPORTS. THE FIELD REPORTS SHALL BE SIGNED AND DATED AND INCLUDE THE FOLLOWING:
   - DOCUMENTATION APPROVING RSS FOUNDATION SOILS AND SUBGRADE.
   - NUCLEAR DENSITY TEST RESULTS FOR REINFORCED SOIL (TEST RESULTS SHALL INDICATE APPROXIMATE LOCATION AND APPROXIMATE ELEVATION OF ALL TESTS).
   - DOCUMENTATION STATING CORRECT GEOGRID WAS INSTALLED PROPERLY AND IN ACCORDANCE WITH DESIGN DRAWINGS.
   - DOCUMENTATION STATING THE SUBSURFACE DRAINAGE WAS PROPERLY INSTALLED AND IN ACCORDANCE WITH THE DESIGN DRAWINGS.

C. CONTRACTOR SHALL SUBMIT EXAMPLES OF PREVIOUS RSS CONSTRUCTION EXPERIENCE FOR THE OWNER AND CEC TO REVIEW PRIOR TO BEGINNING WORK.

1.5 SPECIAL PROVISIONS

A. THE DESIGN OF THE RSS IS BASED ON ANTICIPATED SOIL PARAMETERS AND FOUNDATION CONDITIONS. AN ASSUMED VALUE OF 250 POUNDS PER SQUARE FOOT (PSF) WAS USED IN THE DESIGN TO ACCOUNT FOR TRAFFIC LOADING.

B. THE DESIGN ENGINEER ASSUMES NO LIABILITY FOR VARIATIONS IN, OR UNKNOWN SUBSURFACE SOIL, ROCK, OR GROUNDWATER CONDITIONS.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS FOR EXECUTION OF THE WORK, INCLUDING LOCAL BUILDING AND CURRENT OSHA EXCAVATION REGULATIONS.

D. A SUBSURFACE INVESTIGATION SHALL BE PERFORMED BY AN ENGINEER LICENSED IN THE STATE OF NEW YORK PRIOR TO CONSTRUCTION TO CONFIRM THE FOUNDATION SOIL DESIGN PARAMETERS THAT WERE ASSUMED AS PART OF THE RSS DESIGN. THE SUBSURFACE INVESTIGATION SHALL INCLUDE THE FOLLOWING AT A MINIMUM.

1. TEST BORINGS AT THE APPROXIMATE LOCATIONS SHOWN ON DRAWING GT01.
2. STANDARD PENETRATION TESTING AT ALL LOCATIONS FROM THE GROUND SURFACE TO A MINIMUM DEPTH OF TWICE THE HEIGHT OF THE PROPOSED RSS OR 35' WHICHEVER IS GREATER.
3. PROPER LABORATORY TESTING INCLUDING BUT NOT LIMITED TO GRAIN SIZE ANALYSIS, ATTERBURG LIMITS, MOISTURE CONTENT, AND SHEAR STRENGTH TESTING.

1.6 QUALITY ASSURANCE

A. PRE–CONSTRUCTION MEETING – PRIOR TO THE CONSTRUCTION OF THE RSS, THE CONTRACTOR SHALL ARRANGE A MEETING AT THE SITE WITH THE TESTING AGENCY, CEC, THE GEOGRID INSTALLER, AND THE OWNER.

B. LABORATORY TEST RESULTS – PERFORM A MINIMUM OF ONE GRAIN SIZE DISTRIBUTION AND LABORATORY STANDARD PROCTOR COMPACTION TEST (ASTM D698), ON EACH SOIL BACKFILL TYPE PRIOR TO STARTING CONSTRUCTION. SUBMIT THE TEST RESULTS TO CEC FOR REVIEW A MINIMUM OF FIVE DAYS PRIOR TO CONSTRUCTION. PERFORM A MINIMUM OF ONE ADDITIONAL GRAIN SIZE DISTRIBUTION AND STANDARD PROCTOR COMPACTION TEST DURING CONSTRUCTION FOR ANY CHANGES NOTED IN THE MATERIAL USED AS FILL. ADDITIONAL LABORATORY TESTING SHALL BE PERFORMED AS DIRECTED BY CEC. SAMPLES OF THE RETAINED AND REINFORCED FILL MATERIAL SHALL BE COLLECTED BY THE CONTRACTOR AS NEEDED IN THE FIELD AS DIRECTED BY CEC.

C. FIELD QUALITY ASSURANCE:

1. THE TESTING AGENCY SHALL BE ON SITE FULL–TIME DURING RSS CONSTRUCTION TO OBSERVE PLACEMENT AND PERFORM FIELD DENSITY TESTING OF REINFORCED SOIL CONDUCT DENSITY TESTING AT A FREQUENCY OF ONE TEST PER EVERY 10,000 SQUARE FEET OF FILL PLACED WITH A MINIMUM OF ONE TEST PER LIFT.

1.7 DELIVERY, STORAGE, AND HANDLING

A. STORAGE AND PROTECTION

1. PREVENT MUD, WET CONCRETE, EPOXY, OR OTHER DELETERIOUS MATERIALS FROM COMING IN CONTACT WITH AND AFFIXING TO THE GEOSYNTHETIC MATERIALS.
2. PREVENT EXPOSURE OF THE GEOSYNTHETICS TO SUNLIGHT IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS
3. STORE AT TEMPERATURES ABOVE –20 DEGREES F (–29 DEGREES C) AND BELOW 140 DEGREES F.
4. ROLLED MATERIALS MAY BE LAID FLAT OR STOOD ON END.

PART 2–MATERIALS

2.1 GEOSYNTHETIC PRODUCTS

A. PRIMARY GEOGRID–THE PRIMARY GEOGRID SHALL CONSIST OF AN INTEGRALLY FORMED GRID STRUCTURE MANUFACTURED OF POLYESTER WHICH IMPART: (A) HIGH RESISTANCE TO LOSS OF LOAD CAPACITY OR STRUCTURAL INTEGRITY WHEN THE GEOGRID IS SUBJECTED TO MECHANICAL STRESS IN INSTALLATION; (B) HIGH RESISTANCE TO DEFORMATION WHEN THE GEOGRID IS SUBJECTED TO APPLIED FORCE IN USE; AND (C) HIGH RESISTANCE TO LOSS OF LOAD CAPACITY OR STRUCTURAL INTEGRITY WHEN THE GEOGRID IS SUBJECTED TO LONG–TERM ENVIRONMENTAL STRESS. THE PRIMARY GEOGRIDS, SHALL MEET THE FOLLOWING MINIMUM AVERAGE PHYSICAL PROPERTY REQUIREMENTS AS DETERMINED BY GEOSYNTHETIC RESEARCH INSTITUTE TEST METHOD GG4–91.

TABLE 1

GEOGRID PROPERTIES

MATERIAL	LONG–TERM DESIGN TENSILE STRENGTH (LBS/FT)
TYPE 1	1,900
TYPE 2	3,900
TYPE 3	8,400

B. SECONDARY GEOGRID–USE OPEN MESH BIAXIAL GEOGRID CONSISTING WOVEN MONOFILAMENT POLYPROPYLENE YARNS THAT HAVE AN ULTIMATE TENSILE STRENGTH OF 1,400 LBS/FT OR GREATER, A MINIMUM APERTURE SIZE OF 2MM, AND A 500 HOUR UV RESISTANCE OF 99% IN ACCORDANCE WITH ASTM D4355.

C. DRAINAGE GEOCOMPOSITE – USE SITE DRAIN DS–186 DRAINAGE GEOCOMPOSITE OR APPROVED EQUAL CONSISTING OF A GEONET CORE WITH A NON–WOVEN FILTER GEOTEXTILE BONDED TO BOTH SIDES.

2.2 WELDED WIRE FORMS

A. USE 4" X 4" – W4.0 x W4.0 WELDED WIRE FABRIC, OR EQUIVALENT. BLACK STEEL WELDED WIRE MESH MEETING THE REQUIREMENTS OF AASHTO M 55, AS INDICATED IN THESE SPECIFICATIONS, AND AS FOLLOWS:

- FORMED TO A 90 DEGREE "L" SHAPE WITH 18" X 18" SIDES
- MINIMUM LENGTH OF 10 FEET
- MAXIMUM 4–INCH BY 4–INCH MESH OPENING
- MINIMUM WIRE SIZE NUMBER W4.0;

B. SUPPORT STRUTS – STEEL WIRE FORMED TO INTERLOCK WITH MESH LONGITUDINAL WIRES, MEETING THE REQUIREMENTS OF AASHTO M 32, AS INDICATED IN THESE SPECIFICATIONS, AND AS FOLLOWS:

- MINIMUM WIRE SIZE NUMBER W4.0

2.3 EARTHEN MATERIALS

A. DRAINAGE FILL – DRAINAGE FILL SHALL BE HARD AND DURABLE AND SHALL MEET THE REQUIREMENTS OF AASHTO #57 COARSE AGGREGATE AND SHALL BE PLACED IN THE RSS DRAINS AS SHOWN ON THE CONSTRUCTION DRAWINGS.

B. REINFORCED SOIL – SOIL WITH A pH RANGE OF 3 TO 9, A USCS CLASSIFICATION OF GM, GP, SM, SP, OR SW, AND A MAXIMUM PARTICLE SIZE OF 4 INCHES. REINFORCED SOIL SHALL BE FREE OF EXCESS MOISTURE, ROOTS, OR FROZEN MATERIAL. THE REINFORCED SOIL SHALL BE COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR TEST (ASTM D 698) AND BE WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT. REINFORCED SOIL PLACED AND COMPACTED IN ACCORDANCE WITH THESE RECOMMENDATIONS SHALL HAVE AN EFFECTIVE ANGLE OF FRICTION OF AT LEAST 30 DEGREES AND AN EFFECTIVE COHESION OF AT LEAST 100 PSF (OR EQUIVALENT SHEAR STRENGTH).

C. RETAINED MATERIAL – IN–STILL SOIL OR BEDROCK, OR COMPACTED SOIL OR ROCK FILL PER THE PROJECT SPECIFICATIONS.

D. FOUNDATION MATERIAL – SHALL CONSIST OF RESIDUAL SOIL, NEW FILL, OR UNDISTURBED BEDROCK.

E. PLANTABLE FILL – TOPSOIL WITH A MINIMUM OF 4% ORGANIC MATERIAL.

2.4 SEED – SEED SHALL CONTAIN THE FOLLOWING VARIETIES:

- 50% TALL AND CREEPING RED FESCUE
- 25% ANNUAL RYE
- 20% PERENNIAL RYE
- 5% WHITE CLOVER OR BIRDSFOOT TREFOIL

PART 3–EXECUTION

3.1 EXAMINATION

A. THE CONTRACTOR SHALL CHECK ALL MATERIALS UPON DELIVERY TO VERIFY THAT THE PROPER MATERIALS HAVE BEEN RECEIVED. THE MATERIALS SHALL BE INSPECTED BY THE CONTRACTOR TO BE FREE OF FLAWS OR DAMAGE OCCURRING DURING MANUFACTURING, SHIPPING, OR HANDLING.

3.2 PREPARATION

A. EXCAVATE THE FOUNDATION SUBGRADE TO THE LINES AND GRADES AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE TESTING AGENCY.

B. THE FOUNDATION MATERIAL SHALL CONSIST OF UNDISTURBED SOIL OR NEW FILL. REMOVE UNSUITABLE SUBGRADE MATERIAL. BACKFILL ANY OVER–EXCAVATIONS WITH PROPERLY COMPACTED FILL. THE BACKFILL MATERIAL SHALL BE PLACED IN MAXIMUM LOOSE LIFTS OF 10 INCHES AND SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF ITS MAXIMUM DRY DENSITY AT PLUS OR MINUS 3% OF THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D698.

C. INSTALL THE RSS DRAINS AS SHOWN ON THE DRAWINGS. CONNECT THE DRAINS USING PROPER FITTINGS AND OUTLET USING THE DETAILS ON DRAWING GT06.

3.3 GEOGRID INSTALLATION

A. GEOGRID OF THE SPECIFIED TYPE SHALL BE LAID AT THE PROPER ELEVATION, EMBEDMENT, AND ORIENTATION (ROLL DIRECTION) AS SHOWN ON THE DRAWINGS. ORIENT UNIAXIAL PRIMARY GEOGRIDS WITH THE ROLL DIRECTION PERPENDICULAR TO THE SLOPE FACE. CORRECT ORIENTATION OF THE GEOGRID SHALL BE VERIFIED BY THE TESTING AGENCY. GEOGRIDS SHALL BE CUT AND PLACED SO THAT A TRANSVERSE BAR IS EXTENDED TO THE SLOPE FACE. SLACK IN THE GEOGRID SHALL BE REMOVED BY PULLING THE GRID TAUT AWAY FROM THE SLOPE FACE. THE GEOGRID SHALL BE TEMPORARILY SECURED IN PLACE WITH STAPLES, PINS, SAND BAGS, OR BACKFILL AS REQUIRED BASED ON FILL PROPERTIES, FILL PLACEMENT PROCEDURES, OR WEATHER CONDITIONS; OR AS DIRECTED BY THE TESTING AGENCY.

B. EACH GEOGRID SHALL BE INSTALLED WITHIN ±3 INCHES OF THE ELEVATIONS SPECIFIED ON THE DRAWINGS. PROPER SURVEY CONTROL MEASURES SHALL BE ESTABLISHED TO VERIFY THAT EACH LAYER OF GEOGRID IS INSTALLED AT THE CORRECT ELEVATION.

C. PIECES OF GEOGRID REINFORCEMENT SHALL NOT BE CONNECTED OR SPLICED.

3.4 REPAIR

A. ANY GEOGRID DAMAGED DURING INSTALLATION SHALL BE REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

B. COATED GEOGRIDS SHALL NOT BE USED IF THE COATING IS TORN, SHREDDING, CRACKED, PUNCTURED, FLAWED OR CUT, UNLESS A REPAIR PROCEDURE IS CARRIED OUT AS APPROVED BY THE TESTING AGENCY. THE REPAIR PROCEDURE SHALL INCLUDE PLACING A SUITABLE PATCH OVER THE DEFECTIVE AREA OR APPLYING A COATING SOLUTION IDENTICAL TO THE ORIGINAL COATING.

3.5 PROTECTION

A. FOLLOW THE MANUFACTURER'S RECOMMENDATIONS REGARDING PROTECTION FROM EXPOSURE TO SUNLIGHT.

3.6 FILL PLACEMENT OVER GEOGRID

A. REINFORCED SOIL SHALL BE PLACED IN LIFTS AND COMPACTED AS SPECIFIED HEREIN. THE REINFORCED SOIL SHALL BE PLACED, SPREAD, AND COMPACTED IN SUCH A MANNER THAT MINIMIZES THE DEVELOPMENT OF WRINKLES IN AND/OR MOVEMENT OF THE GEOGRID. SOIL MATERIALS SHALL BE PLACED FROM THE MIDDLE OF THE REINFORCED ZONE TOWARD THE END OF THE GEOGRID, AWAY FROM THE SLOPE FACE, TO ENSURE FURTHER TENSIONING.

B. CONSTRUCTION EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON THE GEOGRID. A MINIMUM FILL THICKNESS OF 6 INCHES IS REQUIRED PRIOR TO OPERATION OF VEHICLES OR EQUIPMENT OVER THE GEOGRID. TURNING OF VEHICLES OR EQUIPMENT SHALL BE KEPT TO A MINIMUM TO PREVENT TRACKS OR TIRES FROM DISPLACING THE FILL AND DAMAGING THE GEOGRID. SUDDEN BRAKING AND SHARP TURNING SHALL BE AVOIDED.

C. COMPACT REINFORCED SOIL USING HEAVY COMPACTION EQUIPMENT EXCEPT WITHIN AT LEAST 3 FEET OF THE BERM FACE. COMPACT THE REINFORCED SOIL WITHIN AT LEAST 3 FEET OF THE BERM FACE USING LIGHTWEIGHT, HAND OPERATED COMPACTION EQUIPMENT.

D. THE REINFORCED SOIL SHALL BE PLACED IN MAXIMUM 10–INCH THICK LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY AT PLUS OR MINUS 3% OF THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D698. LIFT THICKNESS MAY NEED TO BE REDUCED TO ACHIEVE PROPER COMPACTION WHEN USING HAND OPERATED COMPACTION EQUIPMENT.

E. AT THE END OF EACH WORK DAY, THE REINFORCED SOIL AND RETAINED SOIL SURFACE SHALL BE COMPACTED WITH A SMOOTH–DRUM ROLLER TO MINIMIZE THE EFFECTS OF PRECIPITATION.

F. PROVIDE AT LEAST 4 INCHES OF COMPACTED FILL BETWEEN OVERLAPPING GEOGRIDS.

3.7 STRUCTURE PENETRATIONS

A. INSTALL FENCE POSTS AND OTHER PENETRATIONS IN ACCORDANCE WITH THE DRAWING DETAILS.

B. NO UTILITY OR OTHER TRENCHES SHALL BE EXCAVATED WITHIN THE REINFORCED SOIL. TRENCHES EXCAVATED BEYOND THE LIMITS OF THE REINFORCED SOIL MUST BE BACKFILLED WITH THE MATERIALS AND METHODS PRESENTED HEREIN.

C. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE AND DETERMINE THE LOCATIONS OF ALL PENETRATIONS PRIOR TO CONSTRUCTION. GEOGRIDS DAMAGED AFTER PLACEMENT SHALL BE REPAIRED OR REPLACED IN A MANNER SATISFACTORY TO THE TESTING AGENCY OR THE OWNER AT NO ADDITIONAL COST TO THE OWNER.

3.8 WELDED WIRE FORM INSTALLATION

A. INSTALL WELDED WIRE FORMS TO CREATE A SLOPE AS SHOWN ON THE PLANS. CARE SHALL BE TAKEN NOT TO DAMAGE OR BULGE FORMS DURING PLACEMENT.

B. PLACE SECONDARY GEOGRID ALONG THE FILL SURFACE AND WITHIN THE FORM, AS SHOWN ON THE PLANS. POSITION THE GEOGRID TO ALLOW FOR A SUFFICIENT WRAPPED LENGTH AT THE TOP AND BOTTOM OF THE FORM AS SHOWN ON THE DRAWINGS.

C. WELDED WIRE FORMS SHALL BE ERECTED AND MAINTAINED DURING CONSTRUCTION TO THE BATTER AS SHOWN ON THE DRAWINGS. INDIVIDUAL WIRE FORM DEFORMATIONS SHALL BE LIMITED TO 2.5 INCHES AT THE TOP AND A BULGE OF 2 INCHES, MEASURED FROM THE BASE OF THE WIRE FORM. THE CONTRACTOR SHALL PROVIDE ALIGNMENT CONTROL FOR EACH COURSE OF WELDED WIRE FORMS AND MAKE ALIGNMENT CORRECTIONS AS NECESSARY.

D. IF EXCESSIVE DEFORMATION OCCURS, COMPACTION PROCEDURES SHOULD BE MODIFIED TO ALLOW/PROVIDE MAXIMUM ALLOWABLE COMPACTION AT THE SLOPE FACE. ALSO, ADDITIONAL STRUTS MAY BE REQUIRED TO STIFFEN THE WIRE FACE.

E. WELDED WIRE FORMS SHALL BE INSTALLED USING THE CORRECT ANGLE SHOWN ON THE DRAWINGS. THE WELDED WIRE FORM JOINTS SHALL BE STAGGERED VERTICALLY WITH A MINIMUM OVERLAP OF 2 INCHES AT EACH ABUTTING FORM. ANY PROTRUDING WIRES SHALL BE BENT OR CUT OFF.

3.9 PLANTABLE FILL AND VEGETATION

A. MIX SEED WITH PLANTABLE FILL AT A RATE RECOMMENDED BY SEED SUPPLIER (MIN 1.5 LBS/1000 SF OF FACE). PROVIDE LIME AND/OR FERTILIZER AS NEEDED.

B. PLACE AND HAND TAMP PLANTABLE FILL AND SEED MIXTURE IN FACE WRAP.

C. MONITOR AND IRRIGATE FACE AS NECESSARY TO ESTABLISH VEGETATION.

D. SEEDING AND VEGETATION WILL BE CONSIDERED ACCEPTABLE WHEN THE BERM FACE EXHIBITS A MINIMUM OF 90% SURFACE AREA COVERAGE NO MORE THAN 90 DAYS AFTER INSTALLATION.

STATE OF NEW YORK
KENNETH RICHARD WALKER
090870
LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying PLLC
31 BELLOWS ROAD - RAYNHAM, MA 02767
774-501-2176 888-312-2024

NORTH BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

MSE BERM SPECIFICATIONS

DATE:	08/14/2020
DRAWN BY:	JAH
DWG SCALE:	AS SHOWN
CHECKED BY:	JMN
PROJECT NO:	182-442
APPROVED BY:	KRM

DRAWING NO.: GT07

SHEET 7 OF 7

\\sen-boston\projects\2018\182-442\-CADD\Dwg\GT01 - MSE Wall\182442-GT01-MSE Specifications.dwg(GT07) LS(1/19/2021 - khampton) - LP: 5/19/2021 11:30 AM

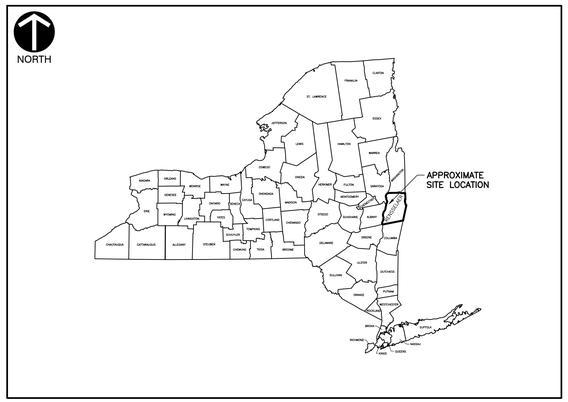
ATTACHMENT B

SLOPE STABILITY OUTPUT

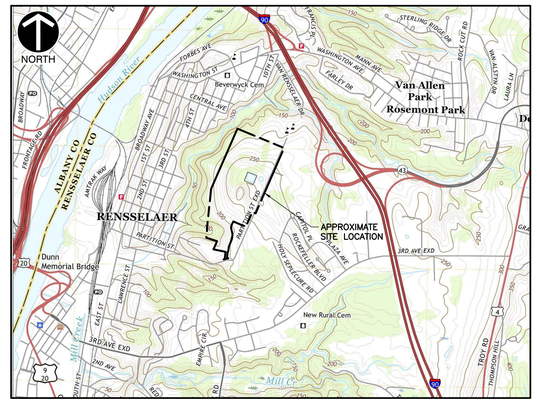
PERMIT PLANS
MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY

PREPARED FOR:

S.A. DUNN & COMPANY, LLC
209 PARTITION STREET EXTENSION, RENSSELAER, NY 12144



LOCATION OF SITE IN NEW YORK
SCALE: 1"= 400,000'



SITE LOCATION MAP
SCALE: 1"= 2,000'

REFERENCE: USGS TOPOGRAPHIC MAP, TROY SOUTH QUADRANGLE, NEW YORK, 7.5-MINUTE SERIES, 2019

DRAWING INDEX:

C000	TITLE SHEET
C100	EXISTING CONDITIONS PLAN
C300	PROPOSED SUBGRADE ELEVATION PLAN
C301	PROPOSED DRAINAGE LAYER ELEVATION AND LEACHATE MANAGEMENT SYSTEM PLAN
C302	PROPOSED FINAL COVER ELEVATION PLAN
C303	PROPOSED STORMWATER MANAGEMENT SYSTEM PLAN
C304	PROPOSED LANDFILL GAS MANAGEMENT SYSTEM PLAN
C305	CROSS SECTION SITE PLAN
C306	CROSS SECTIONS A-A' & B-B'
C307	CROSS SECTIONS C-C' & D-D'
C308	CROSS SECTIONS E-E' & F-F'
C309	FILL PROGRESSION PLAN (SHEET 1 OF 2)
C310	FILL PROGRESSION PLAN (SHEET 2 OF 2)
C800	BASELINER DETAILS (SHEET 1 OF 2)
C801	BASELINER DETAILS (SHEET 2 OF 2)
C802	LEACHATE MANAGEMENT SYSTEM DETAILS
C803	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 1 OF 3)
C804	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 2 OF 3)
C805	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 3 OF 3)
C806	EROSION AND SEDIMENT CONTROL DETAILS
C807	FINAL COVER/GENERAL DETAILS
C808	LANDFILL GAS COLLECTION SYSTEM DETAILS (SHEET 1 OF 2)
C809	LANDFILL GAS COLLECTION SYSTEM DETAILS (SHEET 2 OF 2)

JANUARY 2022

UNAUTHORIZED ALTERATION OR ADDITION TO THIS PLAN BEARING A LICENSED PROFESSIONAL'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

ONLY COPIES FROM THE ORIGINAL OF THIS PLAN MARKED WITH AN ORIGINAL PROFESSIONAL'S SEAL SHALL BE CONSIDERED TO BE VALID TRUE COPIES.

STATE OF NEW YORK · AMY J. KNIGHT · 076341 · LICENSED PROFESSIONAL ENGINEER

1/14/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

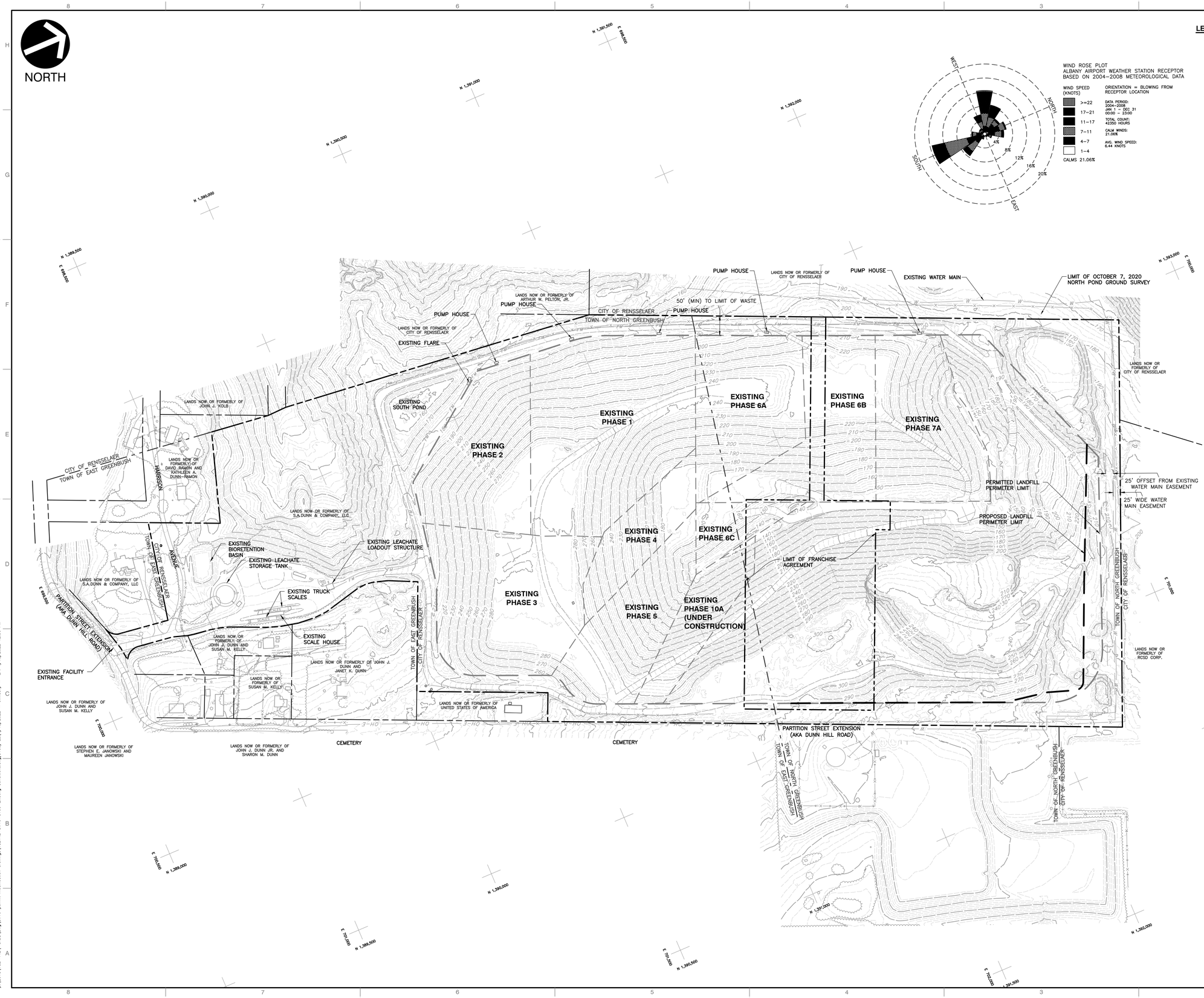
TITLE SHEET

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C000

SHEET 1 OF 23

p:\2018\182-442\-CADD\dwg\w19-permit modification drawings\182442-SW19-C000-Title Sheet.dwg(C000) LST(1/13/2022 - wellbore) - LP: 1/13/2022 12:36 PM


NORTH
WIND ROSE PLOT
ALBANY AIRPORT WEATHER STATION RECEPTOR
BASED ON 2004–2008 METEOROLOGICAL DATA
WIND SPEED (KNOTS)
>=22
17–21
11–17
7–11
4–7
1–4
CALMS 21.06%
ORIENTATION = BLOWING FROM RECEPTOR LOCATION
DATA PERIOD: 2004–2008 JAN 1 – DEC 31 00:00 – 23:00
TOTAL COUNT: 42350 HOURS
CALM WINDS: 21.06%
AVG. WIND SPEED: 6.44 KNOTS
WEST
NORTH
SOUTH
EAST
4%
8%
12%
16%
20%
PUMP HOUSE
LANDS NOW OR FORMERLY OF CITY OF RENSSELAER
EXISTING WATER MAIN
LIMIT OF OCTOBER 7, 2020 NORTH POND GROUND SURVEY
LANDS NOW OR FORMERLY OF ARTHUR W. PELTON, JR.
50' (MIN) TO LIMIT OF WASTE
CITY OF RENSSELAER
TOWN OF NORTH GREENBUSH
EXISTING FLARE
LANDS NOW OR FORMERLY OF JOHN J. KOLB
EXISTING SOUTH POND
EXISTING PHASE 1
EXISTING PHASE 2
EXISTING PHASE 3
EXISTING PHASE 4
EXISTING PHASE 5
EXISTING PHASE 6A
EXISTING PHASE 6B
EXISTING PHASE 6C
EXISTING PHASE 7A
EXISTING PHASE 10A (UNDER CONSTRUCTION)
CITY OF RENSSELAER
TOWN OF EAST GREENBUSH
LANDS NOW OR FORMERLY OF DAVID RAMON AND KATHLEEN A. DUNN-RAMON
HARRISON AVENUE
LANDS NOW OR FORMERLY OF S.A.DUNN & COMPANY, LLC
EXISTING BIORETENTION BASIN
EXISTING LEACHATE STORAGE TANK
EXISTING LEACHATE LOADOUT STRUCTURE
EXISTING TRUCK SCALES
EXISTING SCALE HOUSE
LANDS NOW OR FORMERLY OF JOHN J. DUNN AND SUSAN M. KELLY
LANDS NOW OR FORMERLY OF JOHN J. DUNN AND JANET K. DUNN
LANDS NOW OR FORMERLY OF UNITED STATES OF AMERICA
PARTITION STREET EXTENSION (AKA DUNN HILL ROAD)
EXISTING FACILITY ENTRANCE
LANDS NOW OR FORMERLY OF STEPHEN E. JANOWSKI AND MAUREEN JANOWSKI
LANDS NOW OR FORMERLY OF JOHN J. DUNN JR. AND SHARON M. DUNN
CEMETERY
LIMIT OF FRANCHISE AGREEMENT
PERMITTED LANDFILL PERIMETER LIMIT
PROPOSED LANDFILL PERIMETER LIMIT
25' OFFSET FROM EXISTING WATER MAIN EASEMENT
25' WIDE WATER MAIN EASEMENT
LANDS NOW OR FORMERLY OF RCSD CORP.
TOWN OF NORTH GREENBUSH
CITY OF RENSSELAER
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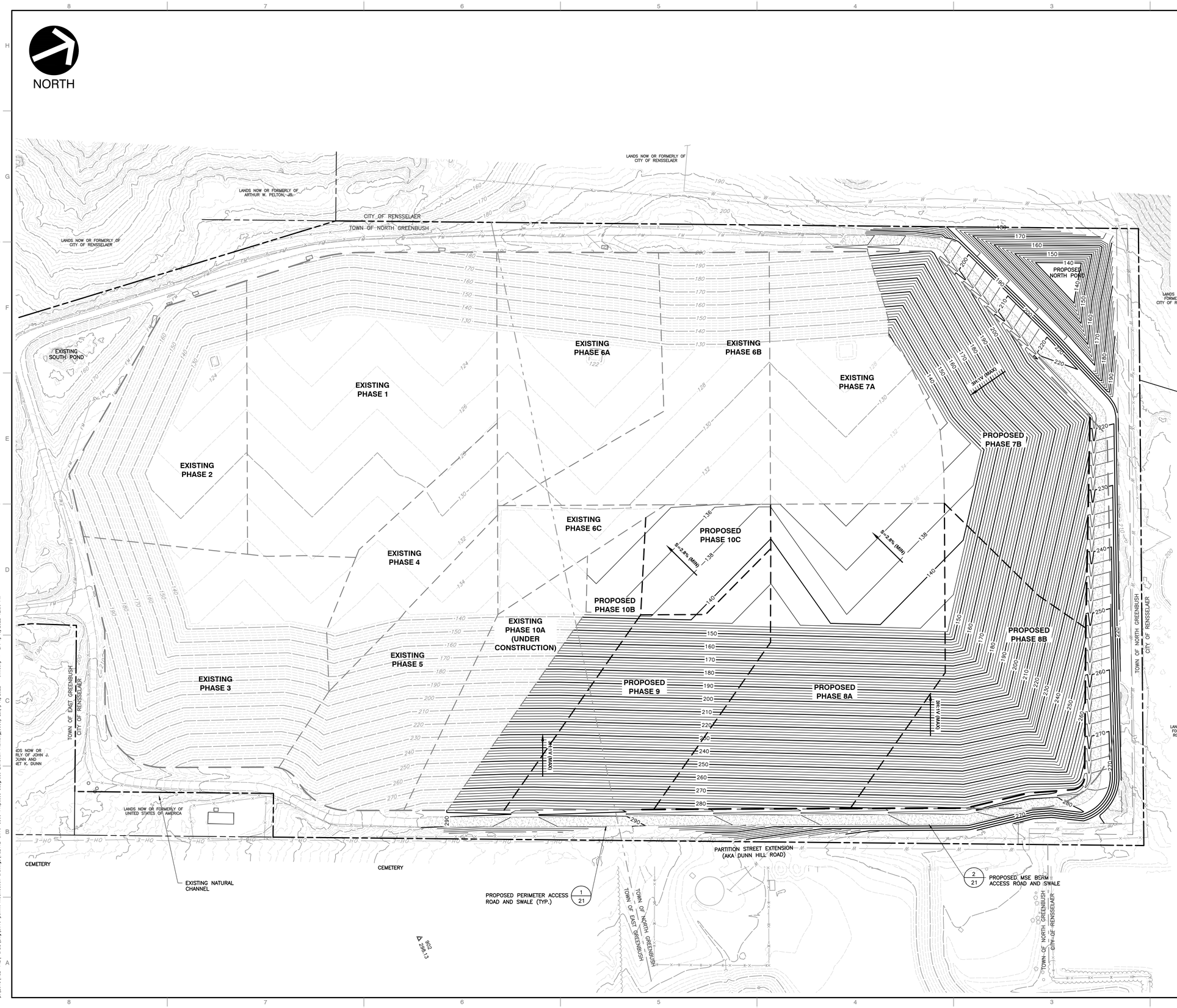
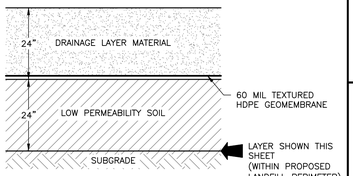


LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. CONTOURS SHOWN WITHIN EXISTING PHASE 1 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED SEPTEMBER 22, 2014 AND SEALED BY WILLIAM N. CURRAN.
3. CONTOURS SHOWN WITHIN EXISTING PHASE 2 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED AUGUST 1, 2015 AND SEALED BY WILLIAM M. CURRAN.
4. CONTOURS SHOWN WITHIN EXISTING PHASE 3 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED AUGUST 1, 2015 AND SEALED BY WILLIAM M. CURRAN.
5. CONTOURS SHOWN WITHIN EXISTING PHASE 4 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED AUGUST 1, 2015 AND SEALED BY WILLIAM M. CURRAN.
6. CONTOURS SHOWN WITHIN EXISTING PHASE 5 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED AUGUST 1, 2015 AND SEALED BY WILLIAM M. CURRAN.
7. CONTOURS SHOWN WITHIN EXISTING PHASE 6 REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM PLANS TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED MAY 31, 2018 FOR PHASE 6A, AUGUST 19, 2018 FOR PHASE 6B, AND SEPTEMBER 11, 2020 FOR PHASE 6C.
8. CONTOURS SHOWN WITHIN EXISTING PHASE 7A REPRESENT AS-BUILT TOP OF SUBGRADE ELEVATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM PLANS TITLED "FINAL SUBGRADE TOPOGRAPHY" DATED AUGUST 28, 2019 FOR PHASE 7A1 AND OCTOBER 24, 2019 FOR PHASE 7A2.
9. CONTOURS SHOWN WITHIN EXISTING PHASE 10A REPRESENT PERMITTED TOP OF SUBGRADE ELEVATIONS.
10. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES.
11. INTERCELL BERM SHALL BE CONSTRUCTED WITHIN FUTURE CELLS AT LOCATIONS AS DIRECTED BY OWNER TO FACILITATE OPERATIONS.



LINER SYSTEM SECTION

NOT TO SCALE

SCALE IN FEET

0 100 200

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STATE OF NEW YORK · AMY J. KNIGHT · 079941 · LICENSED PROFESSIONAL ENGINEER

1/12/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

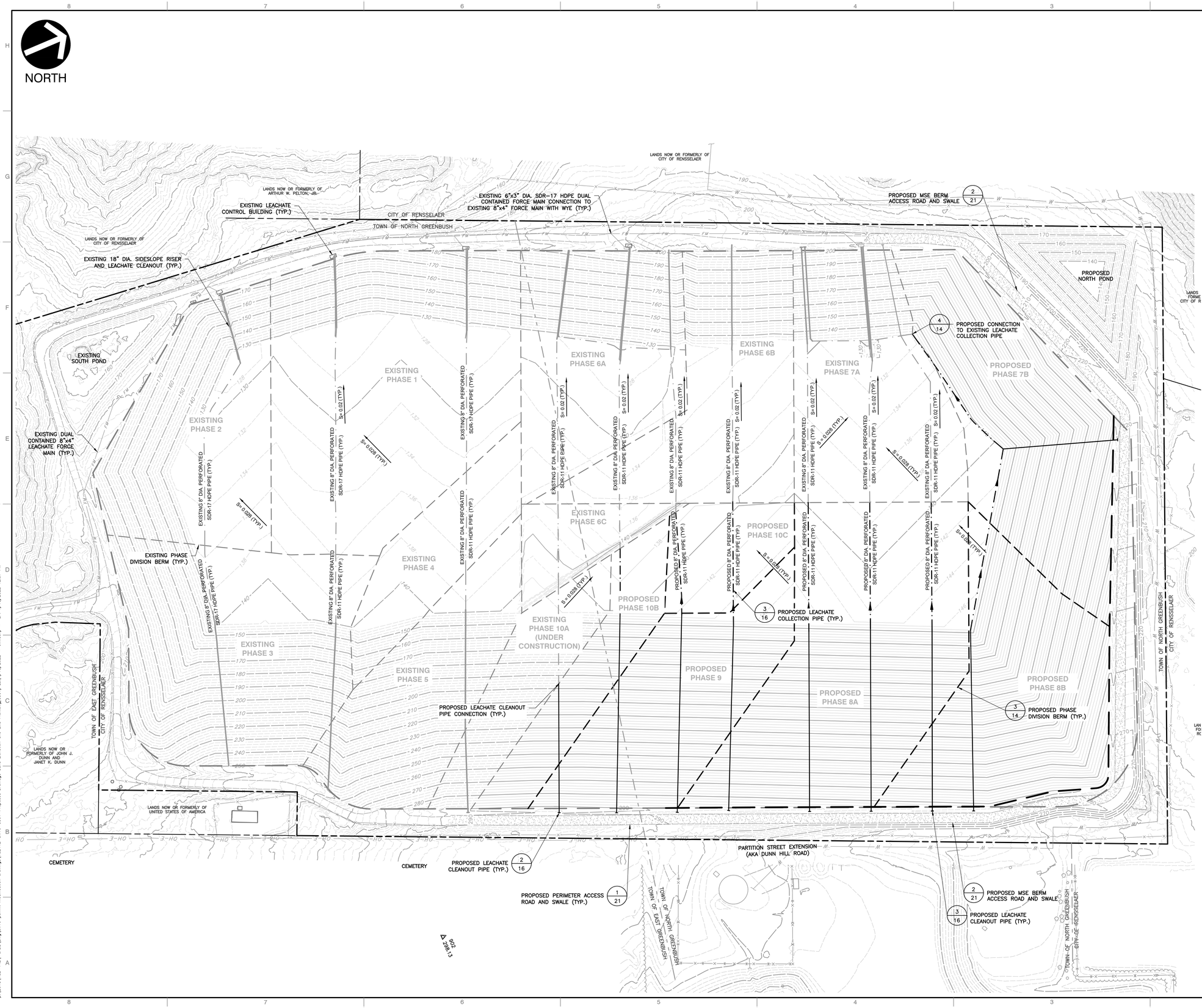
PROPOSED SUBGRADE ELEVATION PLAN

DATE: JANUARY 2022	DRAWN BY: TLG
DWG SCALE: 1"=100'	CHECKED BY: EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C300

SHEET 3 OF 23

p:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C300-Proposed Subgrade Elevation Plan.dwg(C300) LS(1/13/2022 - wellman) - LP: 1/13/2022 12:36 PM

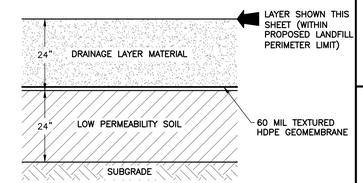


LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- EXISTING LEACHATE COLLECTION PIPE
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD
- PROPOSED LEACHATE COLLECTION PIPE
- PROPOSED LEACHATE CLEANOUT

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 1 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL LEACHATE COLLECTION SYSTEM," DATED NOVEMBER 7, 2014 AND SEALED BY WILLIAM N. CURRAN.
3. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 2 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL LEACHATE COLLECTION SYSTEM" DATED SEPTEMBER 8, 2015 AND SEALED BY WILLIAM M. CURRAN.
4. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 3 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL LEACHATE COLLECTION SYSTEM" DATED MAY 27, 2016 AND SEPTEMBER 12, 2016 AND SEALED BY WILLIAM M. CURRAN.
5. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 4 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL LEACHATE COLLECTION SYSTEM" DATED DECEMBER 1, 2016 AND SEALED BY WILLIAM M. CURRAN.
6. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 5 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM A PLAN TITLED "FINAL LEACHATE COLLECTION SYSTEM" DATED SEPTEMBER 29, 2017 AND SEALED BY WILLIAM M. CURRAN.
7. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 6 REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM PLANS TITLED "FINAL LEACHATE COLLECTION SYSTEM" SEALED BY WILLIAM M. CURRAN, AND DATED AUGUST 15, 2018 FOR PHASE 6A, FEBRUARY 20, 2019 FOR PHASE 6B, AND OCTOBER 23, 2020 FOR PHASE 6C.
8. CONTOURS AND PIPING SHOWN WITHIN EXISTING PHASE 7A REPRESENT AS-BUILT TOP OF DRAINAGE SAND ELEVATIONS AND LEACHATE PIPE LOCATIONS COMPLETED WITH GROUND SURVEY BY KUBRICKY CONSTRUCTION CORPORATION, FROM PLANS TITLED "FINAL LEACHATE COLLECTION SYSTEM." DATED JANUARY 7, 2020 SEALED BY WILLIAM M. CURRAN.
9. CONTOURS SHOWN WITHIN EXISTING PHASE 10A REPRESENT PERMITTED TOP OF DRAINAGE MATERIAL ELEVATIONS.
10. FADED SOLID CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF DRAINAGE SAND LAYER ELEVATIONS WHICH WILL BE REVISED FROM THE PREVIOUSLY APPROVED PERMITTED GRADES. FADED CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PREVIOUSLY PERMITTED OR RECORD DRAINAGE SAND LAYER ELEVATIONS.
11. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES.



LINER SYSTEM SECTION
NOT TO SCALE

SCALE IN FEET
0 100 200

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STATE OF NEW YORK · AMY J. KNIGHT · 079341 · LICENSED PROFESSIONAL ENGINEER

1/14/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

PROPOSED DRAINAGE LAYER ELEVATION AND LEACHATE MANAGEMENT SYSTEM PLAN

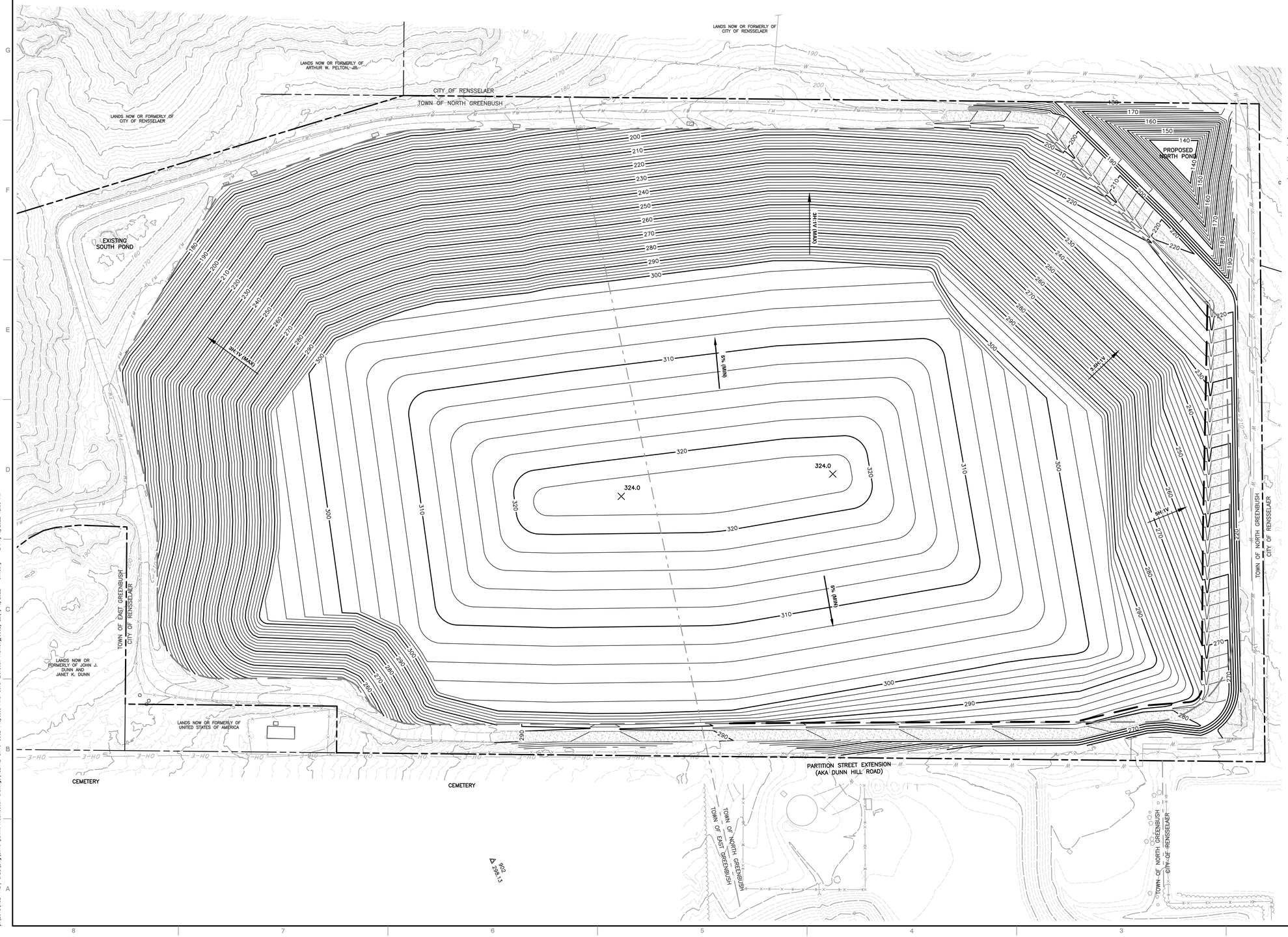
DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	1"=100'
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C301

SHEET 4 OF 23

p:\2018\182-442\-CADD\Dwg\w16-permit modification drawings\182442-SW16-C301-Proposed Drainage Sand Elevation and LMS Plan.dwg(C301) LS(1/13/2022 - ewilson) - LP: 1/13/2022 12:37 PM

NORTH

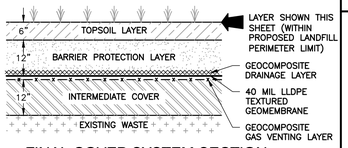


LEGEND

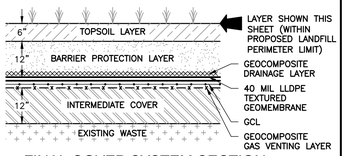
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. LANDFILL ACCESS ROAD WILL BE LOCATED ON LANDFILL BASED ON OPERATIONAL NEEDS.
3. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES. CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF FINAL COVER ELEVATIONS.



FINAL COVER SYSTEM SECTION
≥25% SLOPE
NOT TO SCALE



FINAL COVER SYSTEM SECTION
<25% SLOPE
NOT TO SCALE

SCALE IN FEET
0 100 200

UNAUTHORIZED ALTERATION OR ADDITION TO THIS PLAN BEARING A LICENSED PROFESSIONAL'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

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STATE OF NEW YORK · AMY J. KNIGHT · 078347 · LICENSED PROFESSIONAL ENGINEER

1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

PROPOSED FINAL COVER ELEVATION PLAN

DATE:	JANUARY 2022	DRAWN BY:	TLG
DWG SCALE:	1"=100'	CHECKED BY:	EMW
PROJECT NO:			182-442
APPROVED BY:			AJK

DRAWING NO.: C302

SHEET 5 OF 23

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NORTH

PROPOSED 6' DIA. CONCRETE STORMWATER MANHOLE (2/19)
RIM = 193.0
INV (IN ; E) = 185.2
INV (IN ; S) = 183.0
INV (OUT) = 179.3

PROPOSED 36" DIA. HDPE PIPE (5/17)
INV (IN) = 187.0
INV (OUT) = 183.0
SLOPE = 5%

PROPOSED 6' x 10' CONCRETE DROP INLET STRUCTURE (1/19)
RIM = ± 197
INV (OUT) = 187.0

PROPOSED MSE BERM ACCESS ROAD AND SWALE (2/21)

PROPOSED 36" DIA. HDPE PIPE (5/17)
INV (IN) = 179.3
INV (OUT) = 177.0
SLOPE = 5%

PROPOSED 36" DIA. HDPE PIPE (5/17)
INV (IN) = 187.0
INV (OUT) = 185.2
SLOPE = 5%

PROPOSED 6' x 10' CONCRETE DROP INLET STRUCTURE (1/19)
RIM = ± 197
INV (OUT) = 187.0

LANDS NOW OR FORMERLY OF CITY OF RENSSELAER

LANDS NOW OR FORMERLY OF ARTHUR W. PELTON, JR.

PROPOSED PERIMETER DRAINAGE SWALE (TYP.) (1/21)

PROPOSED SIDESLOPE DIVERSION BERM (TYP.) SLOPE= 4% (2/18)

CITY OF RENSSELAER

TOWN OF NORTH GREENBUSH

HIGH POINT

LANDS NOW OR FORMERLY OF CITY OF RENSSELAER

PROPOSED DOWNCHUTE/SIDESLOPE DIVERSION BERM INLET (TYP.) (3/18)

EXISTING POND INLET CHANNEL (TYP.)

EXISTING 12" DIA. CULVERT INV.(OUT)= 156.62

EXISTING INV. (IN)= 166.94

EXISTING SOUTH POND

EXISTING POND OUTLET STRUCTURE

EXISTING EMERGENCY SPILLWAY

EXISTING POND INLET CHANNEL (TYP.)

PROPOSED DOWNCHUTE ENERGY DISSIPATOR 1 (4/18)

PROPOSED SIDESLOPE DIVERSION BERM (TYP.) SLOPE= 4% (2/18)

PROPOSED GABION-LINED DOWNCHUTE (TYP.) (1/18)

PROPOSED NORTH POND

HIGH POINT

PROPOSED RIP-RAP EMERGENCY SPILLWAY (10' X 17') ELEV. = 167.0 (2/17)

PROPOSED DRY WELL (3/17)

PROPOSED POND INLET CHANNEL OUTLET PROTECTION (6/17)

PROPOSED POND INLET CHANNEL (TYP.) (4/17)

PROPOSED 36" DIA. HDPE PIPE (5/17)
INV (IN) = 200.6
INV (OUT) = 200.0
S = 1%

PROPOSED 6' x 10' CONCRETE DROP INLET STRUCTURE (1/19)
RIM = ± 219
INV (OUT) = 200.6

NORTH PERIMETER SWALE (7/17)

PROPOSED MSE BERM ACCESS ROAD AND SWALE (2/21)

PROPOSED GABION-LINED DOWNCHUTE (TYP.) (1/18)

PROPOSED SIDESLOPE DIVERSION BERM (TYP.) SLOPE= 4% (2/18)

324.0

324.0

PROPOSED SIDESLOPE DIVERSION BERM (TYP.) SLOPE= 4% (2/18)

PROPOSED DOWNCHUTE ENERGY DISSIPATOR 2 (5/18)

PROPOSED SIDESLOPE DIVERSION BERM (TYP.) SLOPE= 4% (2/18)

TOWN OF EAST GREENBUSH
CITY OF RENSSELAER

TOWN OF NORTH GREENBUSH
CITY OF RENSSELAER

LANDS NOW OR FORMERLY OF JOHN J. DUNN AND JANET K. DUNN

LANDS NOW OR FORMERLY OF UNITED STATES OF AMERICA

CEMETERY

CEMETERY

HIGH POINT

EXISTING NATURAL CHANNEL

PARTITION STREET EXTENSION (AKA DUNN HILL ROAD)

PROPOSED PERIMETER DRAINAGE SWALE (TYP.) (1/21)

TOWN OF NORTH GREENBUSH
TOWN OF EAST GREENBUSH

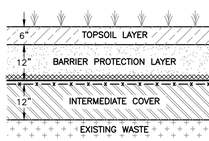
TOWN OF NORTH GREENBUSH
CITY OF RENSSELAER

LEGEND

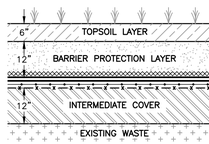
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED RIP-RAP
- PROPOSED SIDESLOPE DIVERSION BERM
- PROPOSED PERIMETER DRAINAGE SWALE

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. LANDFILL ACCESS ROAD WILL BE LOCATED ON LANDFILL BASED ON OPERATIONAL NEEDS.
3. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES. CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF FINAL COVER ELEVATIONS.



FINAL COVER SYSTEM SECTION
≥25% SLOPE
NOT TO SCALE



FINAL COVER SYSTEM SECTION
<25% SLOPE
NOT TO SCALE

SCALE IN FEET
0 100 200

UNAUTHORIZED ALTERATION OR ADDITION TO THIS PLAN BEARING A LICENSED PROFESSIONAL'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

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STATE OF NEW YORK · AMY J. KNIGHT · 078341 · LICENSED PROFESSIONAL ENGINEER

1/21/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

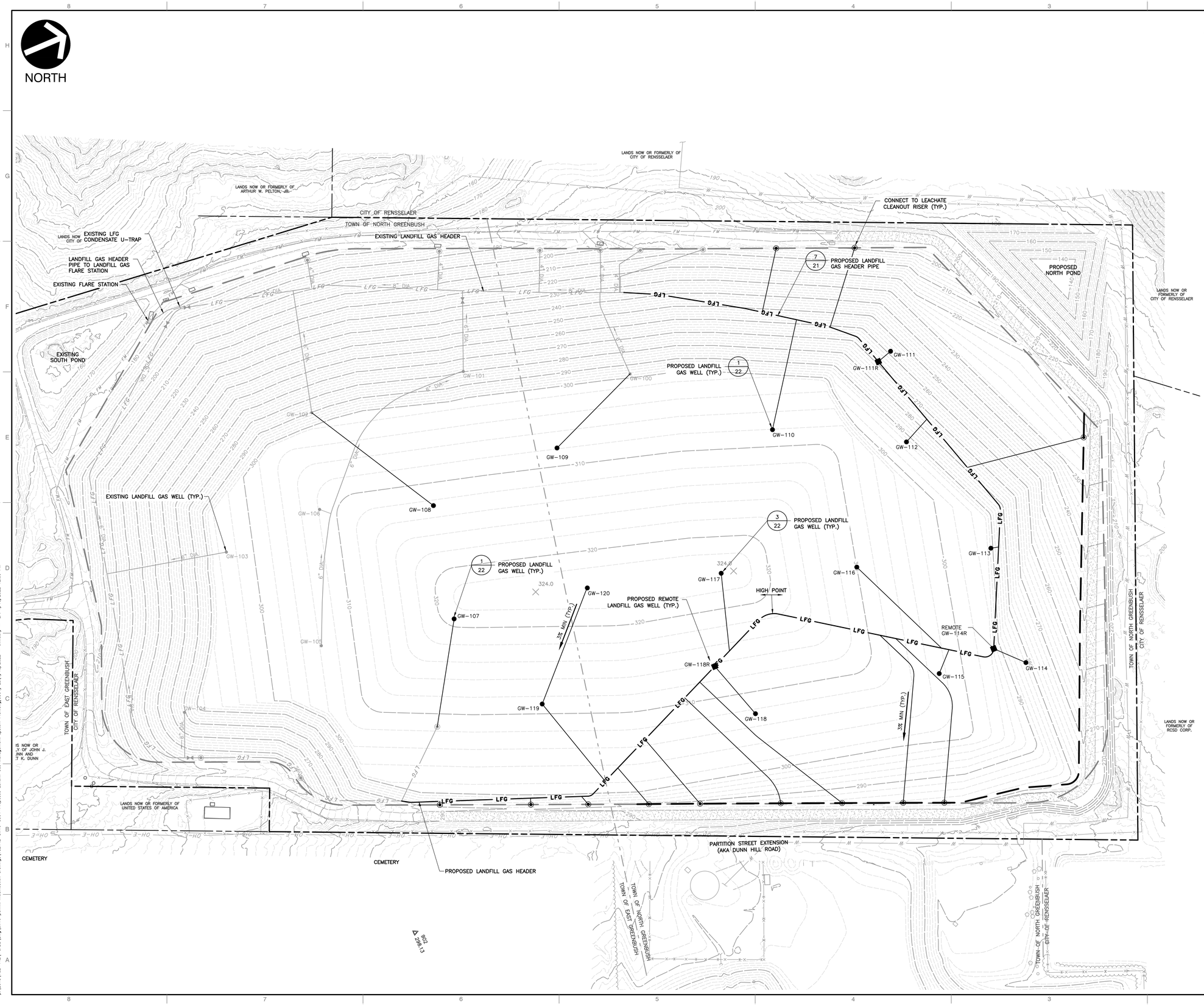
PROPOSED STORMWATER MANAGEMENT SYSTEM PLAN

DATE: JANUARY 2022	DRAWN BY: TLG
DWG SCALE: 1"=100'	CHECKED BY: EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C303

SHEET 6 OF 23

F:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C303-Proposed Stormwater Management System Plan.dwg(C303) LS:(1/13/2022 - ewilson) - LP: 1/13/2022 12:38 PM

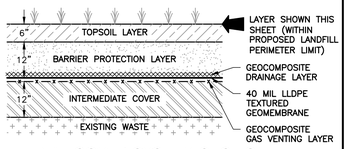


LEGEND

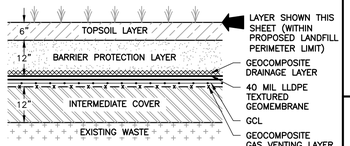
- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- EXISTING LANDFILL GAS WELL
- EXISTING LANDFILL GAS WELL AT LEACHATE CLEANOUT RISER
- EXISTING LANDFILL GAS HEADER
- EXISTING LANDFILL GAS LATERAL PIPE
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL GAS WELL
- PROPOSED LANDFILL GAS WELL AT LEACHATE CLEANOUT RISER
- PROPOSED LANDFILL GAS REMOTE WELL
- PROPOSED LANDFILL GAS HEADER
- PROPOSED LANDFILL GAS LATERAL PIPE

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. LANDFILL ACCESS ROAD WILL BE LOCATED ON LANDFILL BASED ON OPERATIONAL NEEDS.
3. MINIMUM SLOPE OF LANDFILL GAS PIPES WITHIN WASTE IS 3% TOWARDS CONDENSATE MANAGEMENT STRUCTURE. MINIMUM SLOPE OUTSIDE LIMIT OF WASTE IS 1% TOWARDS CONDENSATE MANAGEMENT STRUCTURE.
4. CONTOURS SHOWN OUTSIDE THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED FINAL GRADES. CONTOURS SHOWN WITHIN THE PROPOSED LANDFILL PERIMETER LIMIT REPRESENT PROPOSED TOP OF FINAL COVER ELEVATIONS.



FINAL COVER SYSTEM SECTION
≥25% SLOPE
NOT TO SCALE



FINAL COVER SYSTEM SECTION
<25% SLOPE
NOT TO SCALE

SCALE IN FEET
0 100 200

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STATE OF NEW YORK · AMY S. KNIGHT · 076341 · LICENSED PROFESSIONAL ENGINEER

1/12/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

PROPOSED LANDFILL GAS MANAGEMENT SYSTEM PLAN

DATE:	JANUARY 2022	DRAWN BY:	TLG
DWG SCALE:	1"=100'	CHECKED BY:	EMW
PROJECT NO:			182-442
APPROVED BY:			AJK

DRAWING NO.: C304

SHEET 7 OF 23

p:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C304-Proposed Landfill Gas Management System Plan.dwg(C304) LS(1/13/2022 - evelisa) - LP: 1/13/2022 12:39 PM

LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- EXISTING LANDFILL PHASE LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- EXISTING WATER MAIN
- EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD

REFERENCE

1. REFER TO DRAWING C100 FOR GENERAL NOTES.
2. BOLD CONTOURS SHOWN WITHIN THE LIMIT OF WASTE REPRESENT PROPOSED FINAL COVER ELEVATIONS.
3. CROSS-SECTION DESIGNATION AND ALIGNMENTS TAKEN FROM PREVIOUSLY APPROVED PERMIT DRAWINGS TITLED "FOOTPRINT MODIFICATION PERMIT DRAWINGS", PREPARED BY CEE, DATED MARCH 2016 AND APPROVED BY THE NYSDEC IN SEPTEMBER 2016.
4. CROSS-SECTIONS C-C', D-D', E-E' AND F-F' HAVE BEEN PROJECTED ALONG THE ORIGINAL 2016 ALIGNMENTS TO FULLY PRESENT PROPOSED 2021 GRADING.

SCALE IN FEET
0 100 200

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STATE OF NEW YORK · AMY J. KNIGHT · 078341 · LICENSED PROFESSIONAL ENGINEER

1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

CROSS SECTION SITE PLAN

DATE:	JANUARY 2022	DRAWN BY:	CJJ
DWG SCALE:	1"=100'	CHECKED BY:	EMW
PROJECT NO:		182-442	
APPROVED BY:			AJK

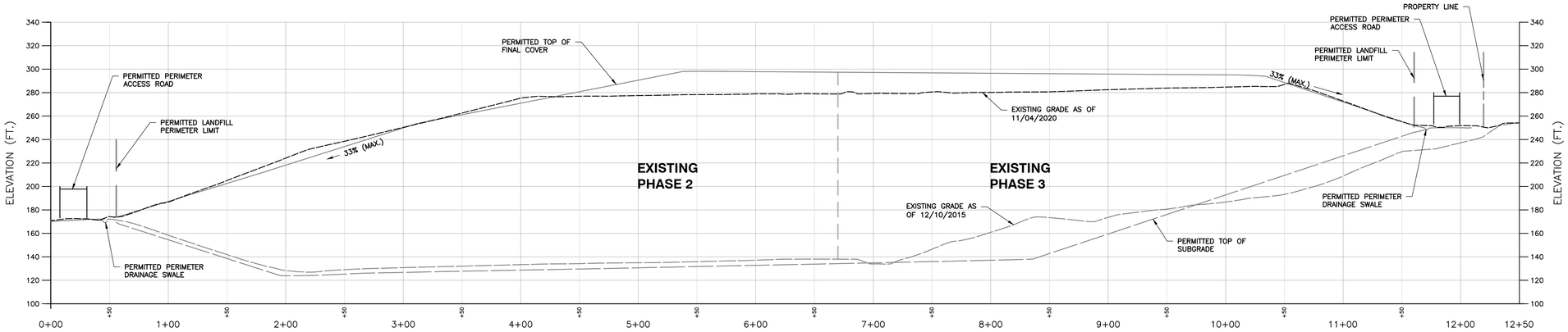
DRAWING NO.: C305

SHEET 8 OF 23

P:\2018\182-442\-CADD\Dwg\w16-permit modification drawings\182442-SW16-C305-C308-Cross-Sections.dwg(C305) LS:(1/13/2022 - ewilson) - LP: 1/13/2022 2:38 PM

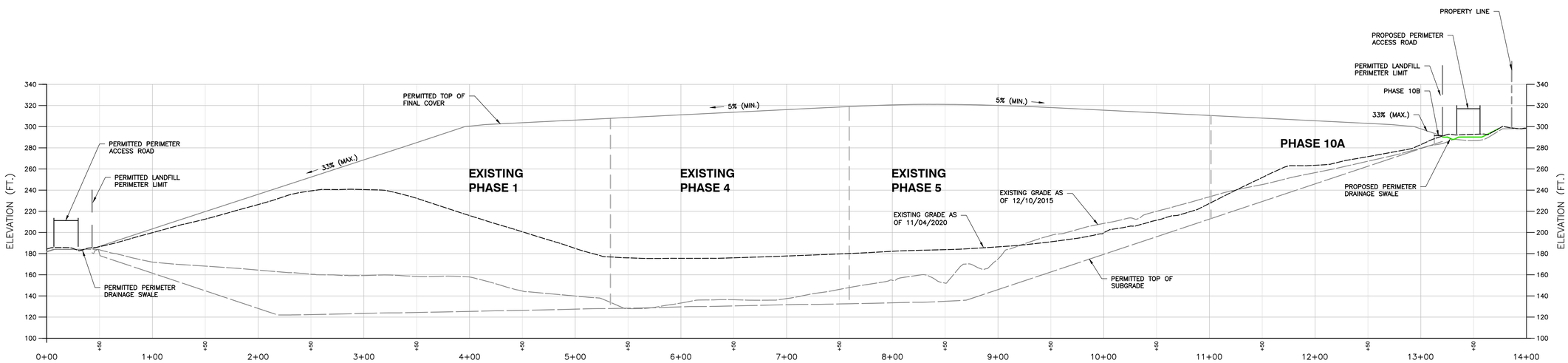
NOTES:

1. REFER TO DRAWING C100 AND C305 FOR GENERAL NOTES.
2. REFER TO DRAWING C305 FOR CROSS-SECTION LOCATIONS.
3. EXISTING AND PROPOSED SLOPES SHOWN ON THIS PLAN MAY BE SKEWED IF THE CROSS-SECTION ALIGNMENT IS NOT PERPENDICULAR TO THE SLOPE.



CROSS SECTION A-A'

SCALE H:1"=100'; V:1"=100'



CROSS SECTION B-B'

SCALE H:1"=100'; V:1"=100'

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STATE OF NEW YORK · AMY J. KNIGHT · 078347 · LICENSED PROFESSIONAL ENGINEER

1/14/2022

REVISION RECORD

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Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

CROSS SECTIONS A-A' & B-B'

DATE:	JANUARY 2022
DRAWN BY:	CJJ
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

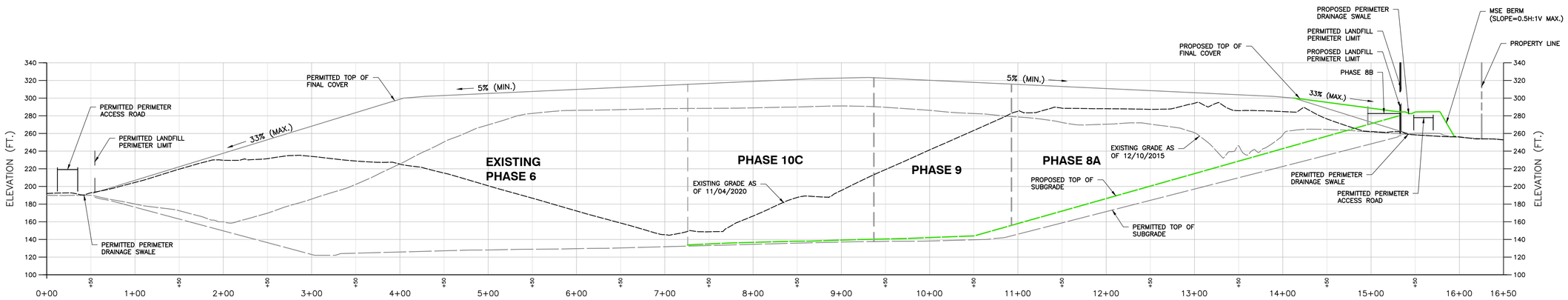
DRAWING NO.: C306

SHEET 9 OF 23

P:\2018\182-442\-CADD\Dwg\sw18-permit modification drawings\182442-SW18-C305-Cross-Sections.dwg[C306] LS:(1/13/2022 - ewilson) - LP: 1/13/2022 12:39 PM

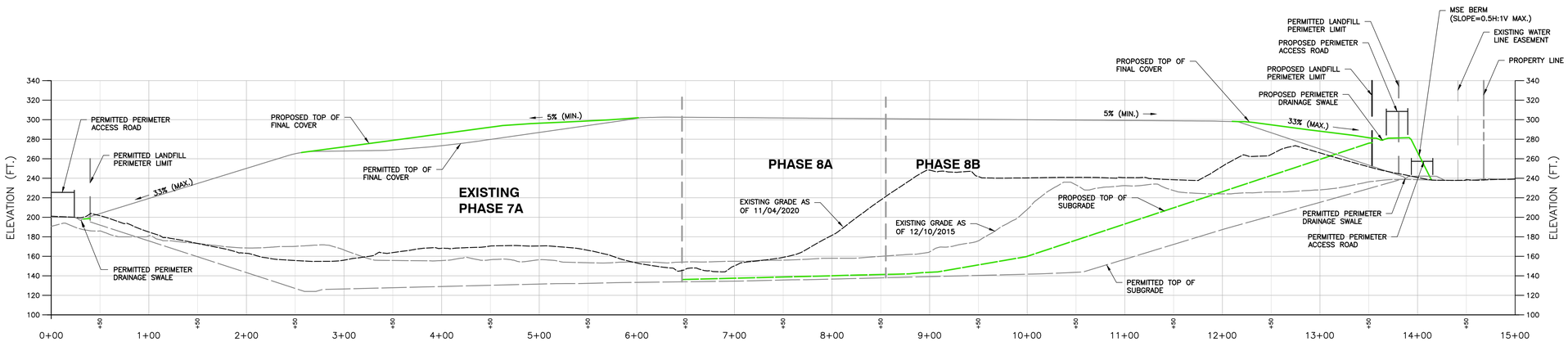
NOTES:

1. REFER TO DRAWING C100 AND C305 FOR GENERAL NOTES.
2. REFER TO DRAWING C305 FOR CROSS-SECTION LOCATIONS.
3. EXISTING AND PROPOSED SLOPES SHOWN ON THIS PLAN MAY BE SKEWED IF THE CROSS-SECTION ALIGNMENT IS NOT PERPENDICULAR TO THE SLOPE.



CROSS SECTION C-C'

SCALE H:1"=100'; V:1"=100'



CROSS SECTION D-D'

SCALE H:1"=100'; V:1"=100'

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STATE OF NEW YORK · AMY J. KNIGHT · 078341 · LICENSED PROFESSIONAL ENGINEER

1/18/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

CROSS SECTIONS C-C' & D-D'

DATE:	JANUARY 2022
DRAWN BY:	CJJ
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

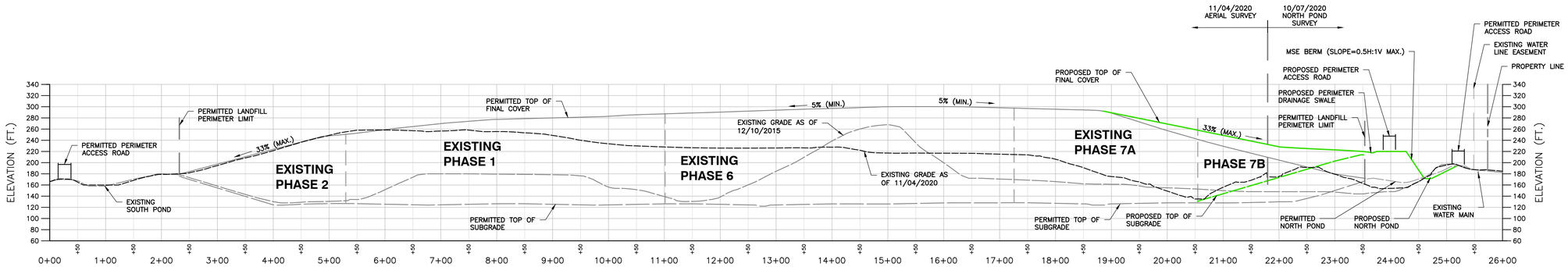
DRAWING NO.: C307

SHEET 10 OF 23

P:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C305-C308-Cross-Sections.dwg[C307] LS:(1/13/2022 - ewilson) - LM: 1/13/2022 2:54 PM

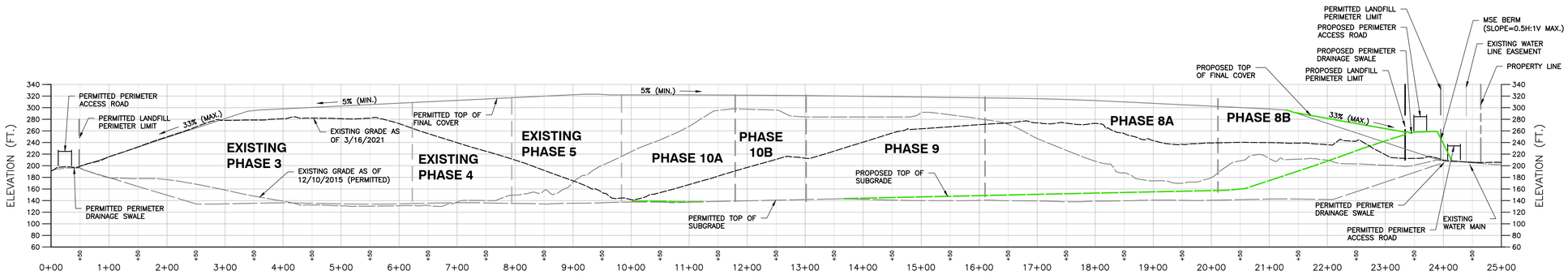
NOTES:

1. REFER TO DRAWING C100 AND C305 FOR GENERAL NOTES.
2. REFER TO DRAWING C305 FOR CROSS-SECTION LOCATIONS.
3. EXISTING AND PROPOSED SLOPES SHOWN ON THIS PLAN MAY BE SKEWED IF THE CROSS-SECTION ALIGNMENT IS NOT PERPENDICULAR TO THE SLOPE.



CROSS SECTION E-E'

SCALE H:1"=100'; V:1"=100'



CROSS SECTION F-F'

SCALE H:1"=100'; V:1"=100'

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STATE OF NEW YORK · AMY J. KNIGHT · 078341 · LICENSED PROFESSIONAL ENGINEER

1/26/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

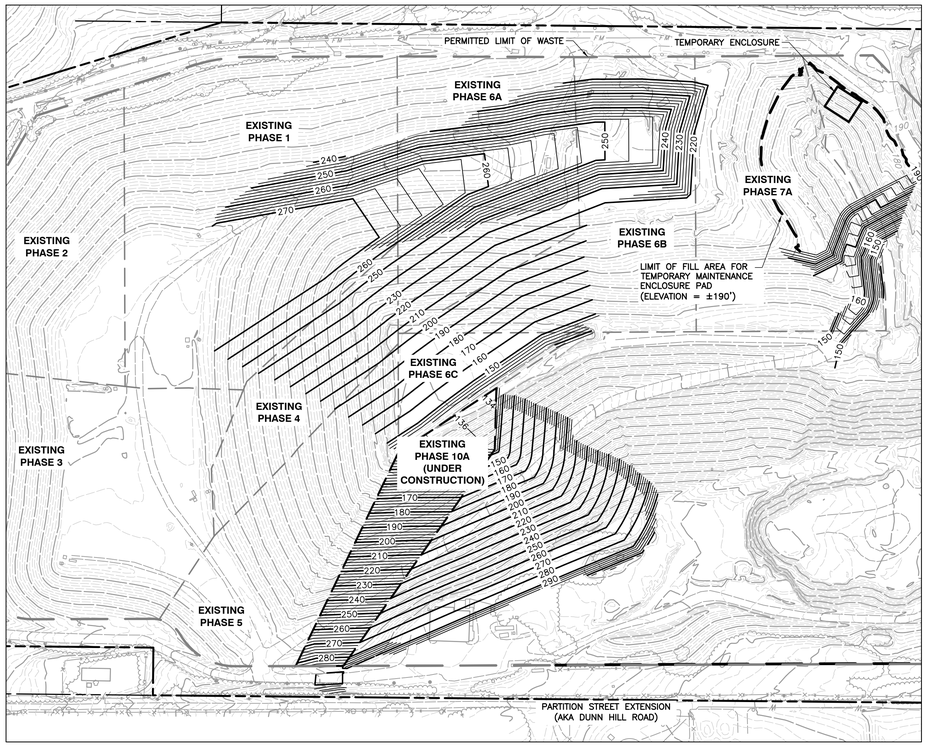
CROSS SECTIONS
E-E' & F-F'

DATE:	JANUARY 2022
DRAWN BY:	CJJ
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C308

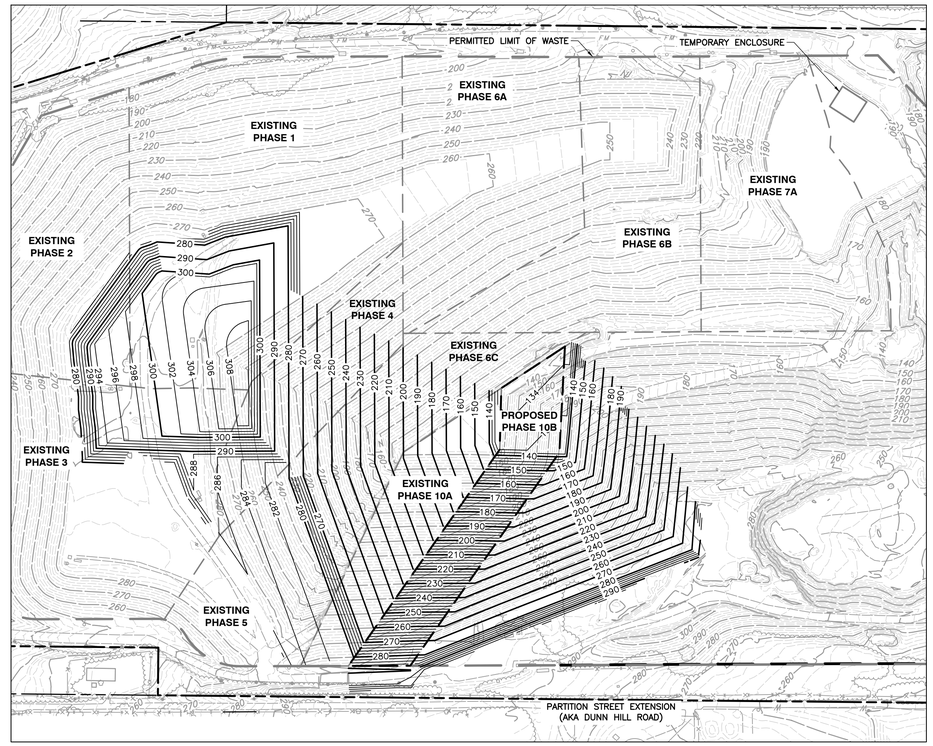
SHEET 11 OF 23

P:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C305-C308-Cross-Sections.dwg[C308] LS:(1/13/2022 - ewilson) - LP: 1/13/2022 2:54 PM



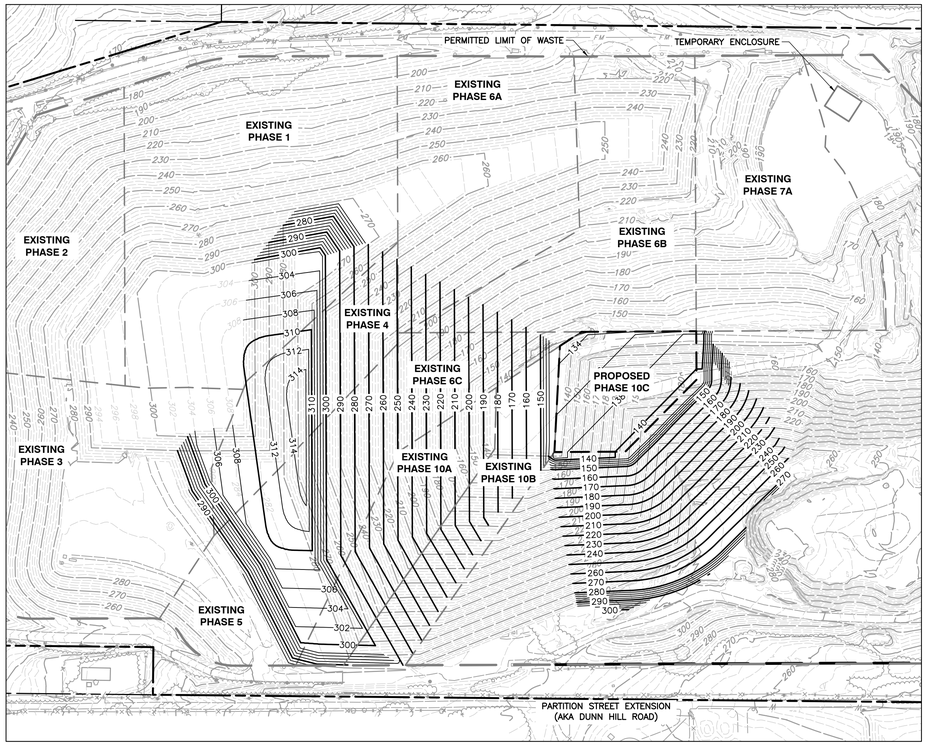
FILL PROGRESSION 1: PHASE 6C WASTE FILL GRADES AND PHASE 10A SUBGRADE GRADES

SCALE: 1" = 150'



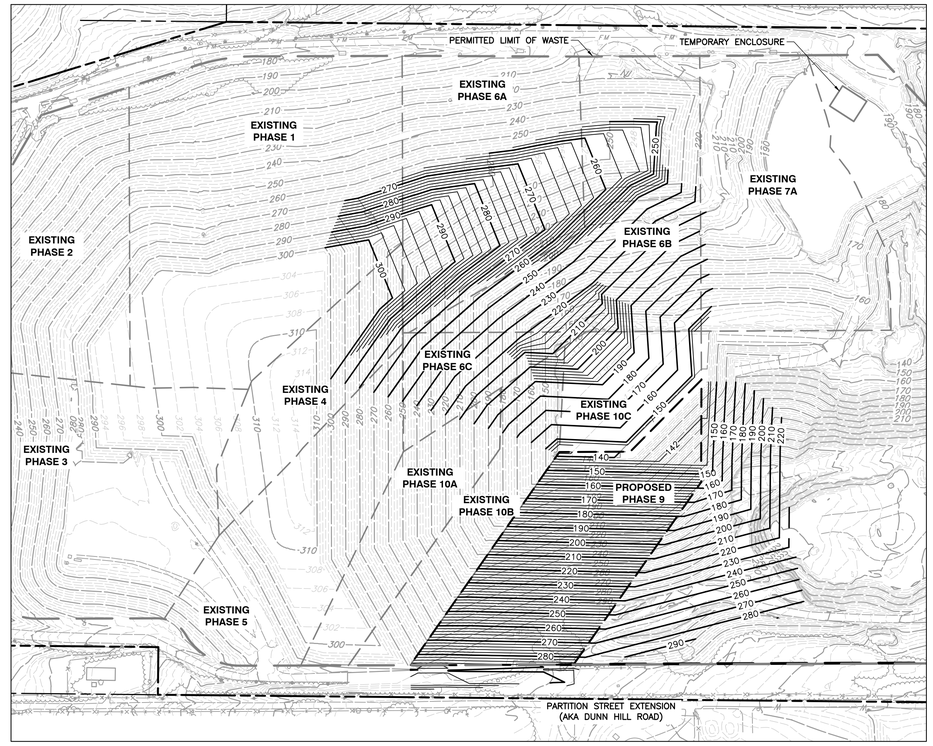
FILL PROGRESSION 2: PHASE 10A WASTE FILL GRADES AND PHASE 10B SUBGRADE GRADES

SCALE: 1" = 150'



FILL PROGRESSION 3: PHASE 10B WASTE FILL GRADES AND PHASE 10C SUBGRADE GRADES

SCALE: 1" = 150'



FILL PROGRESSION 4: PHASE 10C WASTE FILL GRADES AND PHASE 9 SUBGRADE GRADES

SCALE: 1" = 150'

LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- 200 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- W EXISTING WATER MAIN
- FM EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- 200 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

NOTE:

1. PROPOSED GRADING SHOWN WITHIN EACH FILL PROGRESSION SEQUENCE REPRESENTS PROPOSED TOP OF SUBGRADE ELEVATIONS (WITHIN PROPOSED PHASES) AND PROPOSED TOP OF INTERMEDIATE COVER ELEVATIONS (WITHIN EXISTING PHASES).
2. WASTE FILL GRADING REPRESENTS TOP OF INTERMEDIATE COVER ELEVATIONS. REFER TO SHEET C303 FOR PROPOSED FINAL COVER GRADES.

SCALE IN FEET

0 150 300

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STATE OF NEW YORK · AMY J. KNIGHT · 070341 · LICENSED PROFESSIONAL ENGINEER

1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

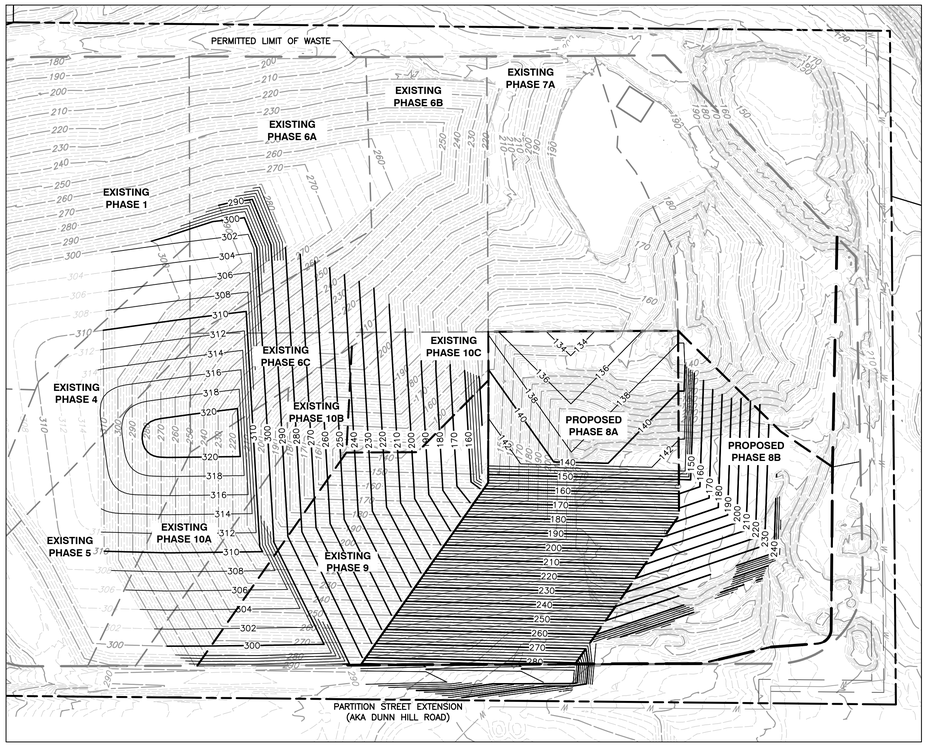
FILL PROGRESSION PLAN
(SHEET 1 OF 2)

DATE:	JANUARY 2022
DRAWN BY:	CJJ
DWG SCALE:	1"=150'
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C309

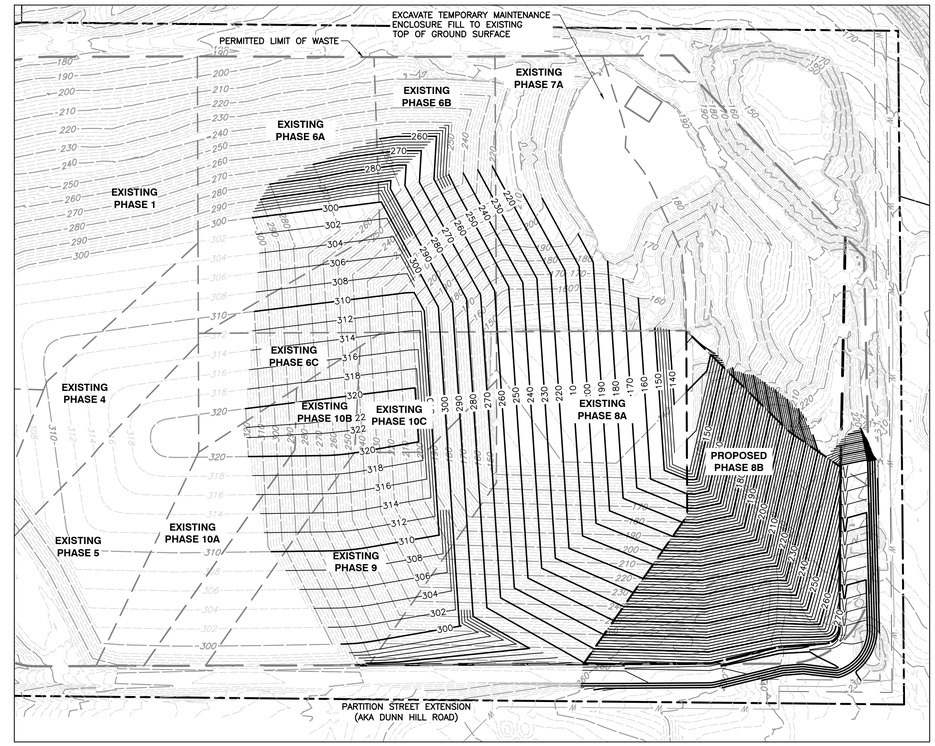
SHEET 12 OF 23

A:\2018\182-442\-CADD\Dwg\land-fill-permit modification drawings\182442-3R16-C309-FIll Progression Plans.dwg[C309] LS:(1/13/2022 - ewilson) - LP: 1/13/2022 12:41 PM



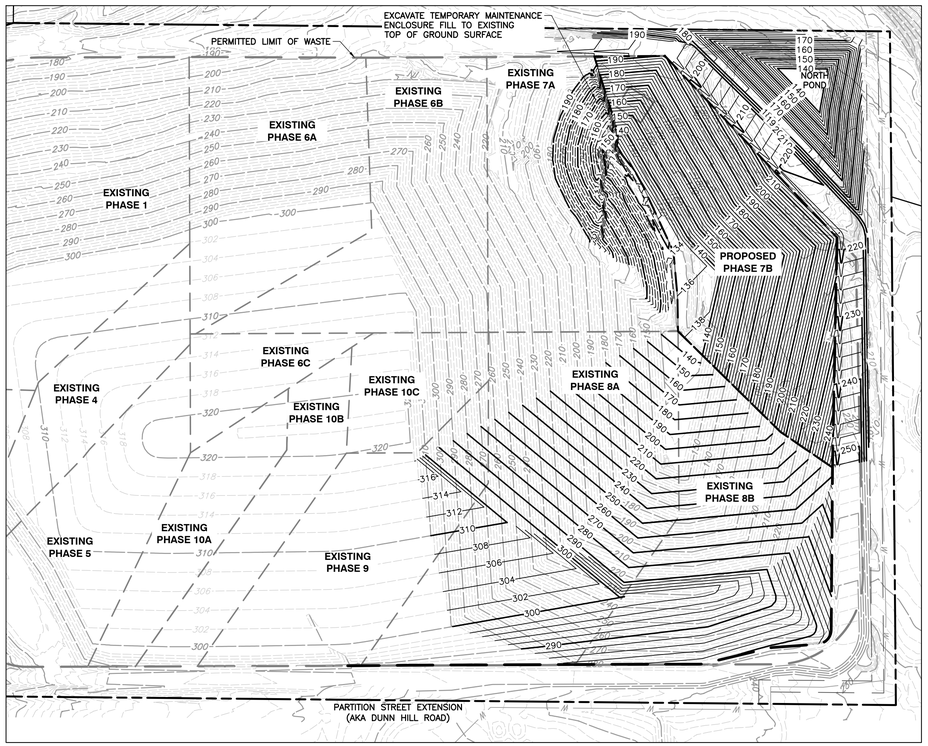
FILL PROGRESSION 5: PHASE 9 WASTE FILL GRADES AND PHASE 8A SUBGRADE GRADES

SCALE: 1" = 150'



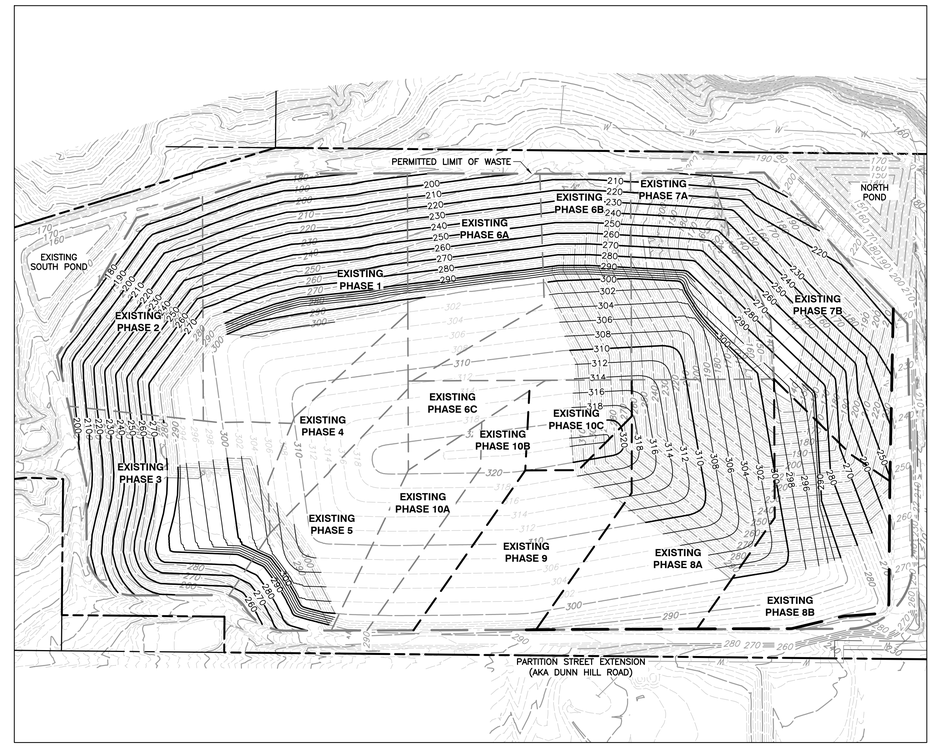
FILL PROGRESSION 5: PHASE 8A WASTE FILL GRADES AND PHASE 8B SUBGRADE GRADES

SCALE: 1" = 150'



FILL PROGRESSION 6: PHASE 8B WASTE FILL GRADES AND PHASE 7B SUBGRADE GRADES

SCALE: 1" = 150'



FILL PROGRESSION 7: PHASE 7B TOP OF INTERMEDIATE COVER GRADES

SCALE: 1" = 200'

LEGEND

- EXISTING PROPERTY LINE
- EXISTING ADJACENT PROPERTY LINE
- EXISTING TOWN LINE
- EXISTING WATER MAIN EASEMENT
- PERMITTED LANDFILL PERIMETER LIMIT
- 200 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCE
- EXISTING UNPAVED ROAD
- EXISTING TREE LINE
- EXISTING STRUCTURE
- W EXISTING WATER MAIN
- FM EXISTING FORCE MAIN
- PROPOSED LANDFILL PERIMETER LIMIT
- PROPOSED LANDFILL PHASE LIMIT
- 200 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

NOTE:

1. PROPOSED GRADING SHOWN WITHIN EACH FILL PROGRESSION SEQUENCE REPRESENTS PROPOSED TOP OF SUBGRADE ELEVATIONS (WITHIN PROPOSED PHASES) AND PROPOSED TOP OF INTERMEDIATE COVER ELEVATIONS (WITHIN EXISTING PHASES).
2. WASTE FILL GRADING REPRESENTS TOP OF INTERMEDIATE COVER ELEVATIONS. REFER TO SHEET C303 FOR PROPOSED FINAL COVER GRADES.

SCALE IN FEET

0 150 300

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STATE OF NEW YORK · AMY J. KNIGHT · 079341 · LICENSED PROFESSIONAL ENGINEER

1/21/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

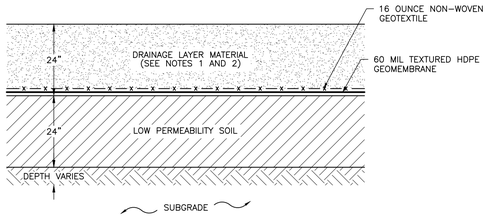
FILL PROGRESSION PLAN
(SHEET 2 OF 2)

DATE:	JANUARY 2022	DRAWN BY:	CJJ
DWG SCALE:	AS-SHOWN	CHECKED BY:	EMW
PROJECT NO:			182-442
APPROVED BY:			AJK

DRAWING NO.: C310

SHEET 13 OF 23

A:\2018\182-442\-CADD\Dwg\sw-fill-permit modification drawings\182442-SW16-C310-FIll Progression Plans.dwg[C310] LS:(1/13/2022 - ewilson) - LP: 1/13/2022 12:41 PM

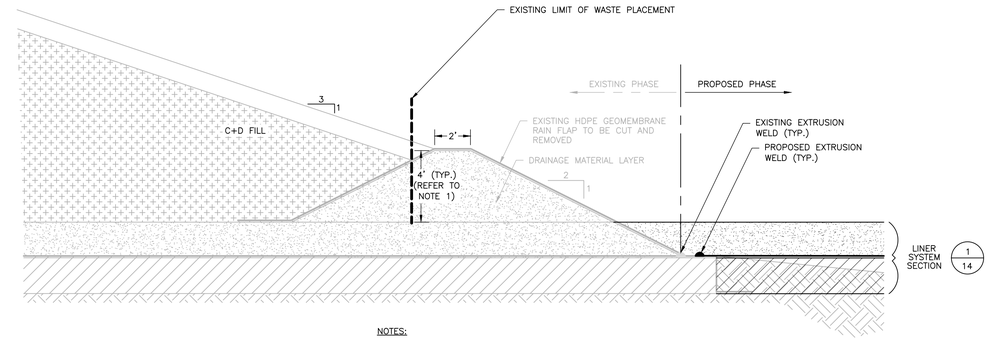


NOTES:

1. ON SLOPES LESS THAN OR EQUAL TO 10 PERCENT THE DRAINAGE MATERIAL LAYER SHALL HAVE A MINIMUM HYDRAULIC CONDUCTIVITY OF 1.0 CM/SEC. ALTERNATIVELY, THE UPPER 12 INCHES MAY HAVE A MINIMUM HYDRAULIC CONDUCTIVITY OF 0.1 CM/SEC. IF THE LOWER 12 INCHES HAS A MINIMUM HYDRAULIC CONDUCTIVITY OF 1.0 CM/SEC.
2. ON SLOPES GREATER THAN 10 PERCENT THE DRAINAGE MATERIAL LAYER SHALL HAVE A MINIMUM HYDRAULIC CONDUCTIVITY OF 0.1 CM/SEC.

1/14 LINER SYSTEM SECTION

SCALE: 1"=2'

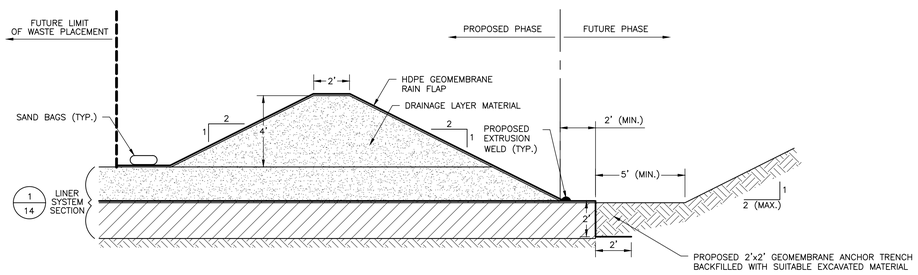


NOTES:

1. BERM GEOMETRY MAY VARY BASED ON LOCATION IN PHASE AND FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.
2. CUT AND REMOVE EXISTING EXPOSED GEOMEMBRANE RAIN FLAP.
3. BACKFILL AREA WITH SUBGRADE MATERIAL TO THE TOP OF SUBGRADE ELEVATIONS SHOWN ON PLAN.
4. EXCAVATE EXISTING ANCHOR TRENCH TO EXPOSE BASELINER GEOMEMBRANE AND LOW PERMEABILITY SOIL LAYER.
5. INSTALL AND CONNECT PROPOSED PHASE LOW PERMEABILITY SOIL LAYER TO EXISTING LOW PERMEABILITY SOIL LAYER.
6. INSTALL AND CONNECT THE PROPOSED PHASE GEOMEMBRANE TO THE EXISTING BASELINER GEOMEMBRANE.
7. GEOSYNTHETIC LAYERS NOT SHOWN FOR CLARITY.
8. CONNECTION DETAIL IS REPRESENTATIVE OF CONNECTION BETWEEN PHASES 6C AND 10B, 6C AND 10C, 7 AND 8, 8 AND 9, 9 AND 10B, 9 AND 10C, 10A AND 10B, AND 10B AND 10C

2/14 EXISTING PHASE / PROPOSED PHASE BASELINER SYSTEM CONNECTION DETAIL

SCALE: 1"=4'

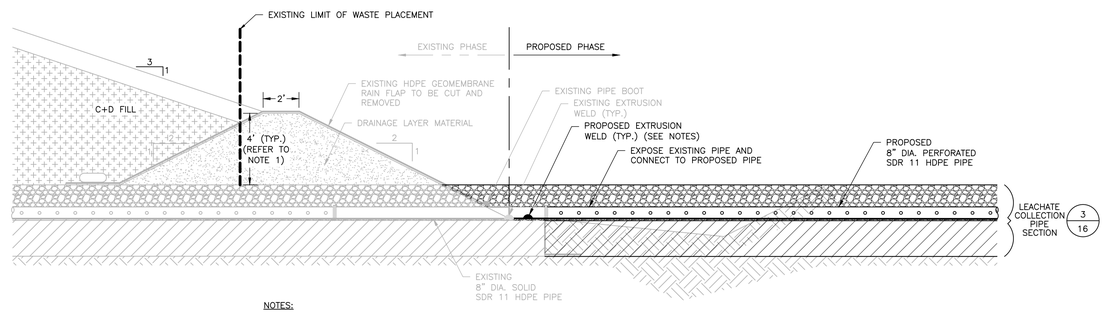


NOTE:

1. SHINGLE ADJACENT SHEETS OF RAIN FLAP GEOMEMBRANE IN DIRECTION OF FLOW AND EXTRUSION WELD ALL SEAMS.

3/14 PHASE DIVISION BERM

SCALE: 1"=4'

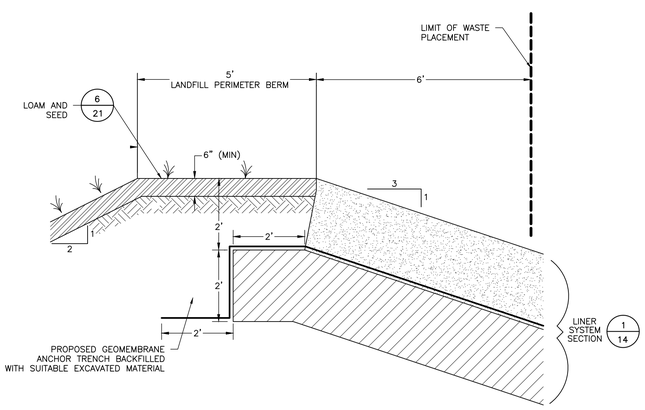


NOTES:

1. BERM GEOMETRY MAY VARY BASED ON LOCATION IN PHASE AND FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.
2. CUT AND REMOVE EXISTING GEOMEMBRANE RAIN FLAP.
3. BACKFILL AREA WITH SUBGRADE MATERIAL TO THE TOP OF SUBGRADE ELEVATIONS SHOWN ON PLAN.
4. EXCAVATE EXISTING ANCHOR TRENCH TO EXPOSE BASELINER GEOMEMBRANE AND LOW PERMEABILITY SOIL LAYER.
5. INSTALL AND CONNECT PROPOSED PHASE LOW PERMEABILITY SOIL LAYER TO EXISTING LOW PERMEABILITY SOIL LAYER.
6. INSTALL AND CONNECT THE PROPOSED PHASE GEOMEMBRANE TO THE EXISTING BASELINER GEOMEMBRANE.
7. GEOSYNTHETIC LAYERS NOT SHOT FOR CLARITY.
8. CONNECTION DETAIL IS REPRESENTATIVE OF CONNECTION BETWEEN PHASES 6C AND 10B, 6C AND 10C, 7 AND 8, 8 AND 9, 9 AND 10B, 9 AND 10C, 10A AND 10B, AND 10B AND 10C

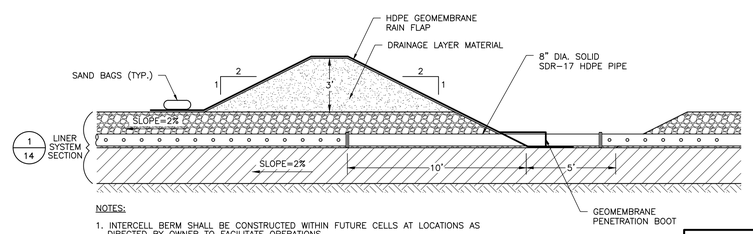
4/14 PROPOSED LEACHATE COLLECTION PIPE CONNECTION DETAIL

SCALE: 1"=4'



5/14 PROPOSED PERIMETER BERM ANCHOR TRENCH

SCALE: 1"=2'



NOTES:

1. INTERCELL BERM SHALL BE CONSTRUCTED WITHIN FUTURE CELLS AT LOCATIONS AS DIRECTED BY OWNER TO FACILITATE OPERATIONS.

6/14 INTERCELL BERM

SCALE: 1"=4'

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STATE OF NEW YORK · AMY J. KNIGHT · 070341 · LICENSED PROFESSIONAL ENGINEER

1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION
1	07/24/2019	REVISED SHEET BASED ON NYSDEC NOVA LETTER DATED 8/17/2019

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

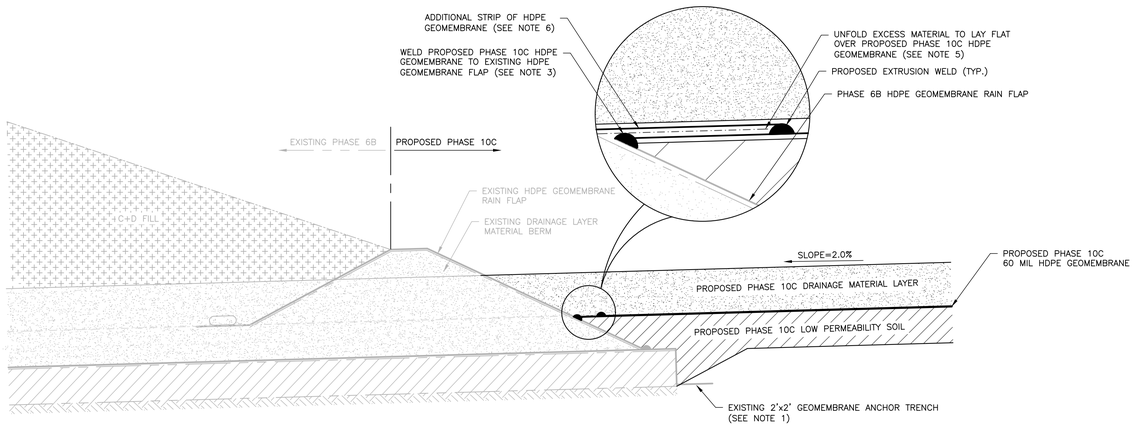
BASELINER DETAILS (SHEET 1 OF 2)

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C800

SHEET 14 OF 23

p:\2018\182-442\-0400\dwg\sw18-permit modification drawings\182442-SW18-C800-Baseliner Details (dwg(C800) LS(1/13/2022 - wellman) - LP: 1/13/2022 12:42 PM

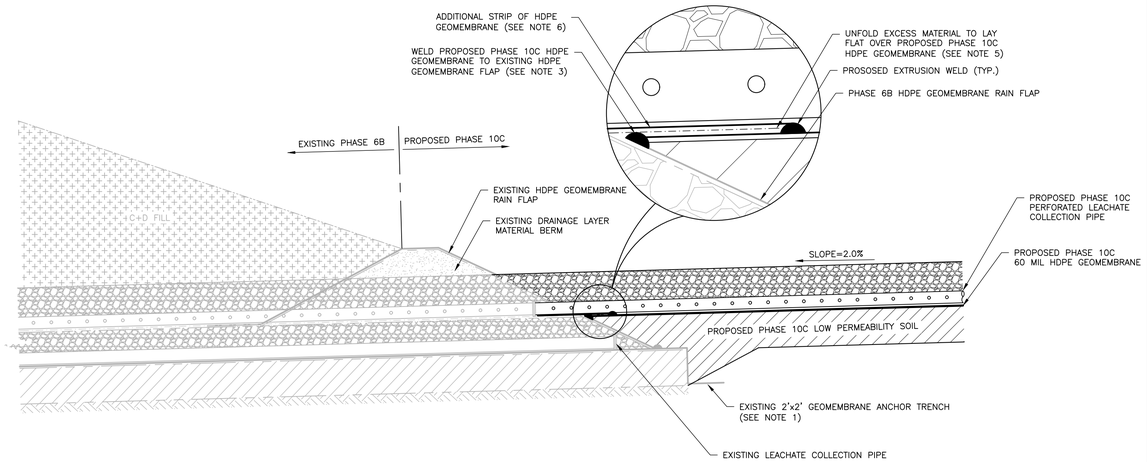


CONSTRUCTION SEQUENCE NOTES:

1. EXCAVATE AND EXPOSE PHASE 6B ANCHOR TRENCH. CUT AND REMOVE GEOMEMBRANE WITHIN ANCHOR TRENCH.
2. CONNECT PHASE 10C LOW PERMEABILITY SOIL TO PHASE 6B LOW PERMEABILITY SOIL.
3. INSTALL PHASE 10C HDPE GEOMEMBRANE AND WELD TO EXISTING PHASE 6B HDPE GEOMEMBRANE RAIN FLAP. EXISTING GEOMEMBRANE SHALL BE INSPECTED AND DAMAGED AREAS SHALL BE REPAIRED AS NECESSARY PRIOR TO PERFORMING EXTRUSION WELDING.
4. CUT AND REMOVE EXCESS GEOMEMBRANE RAIN FLAP MATERIAL AS NECESSARY TO ALLOW FOR THE INSTALLATION OF THE PHASE 10C LEACHATE COLLECTION PIPE AND DRAINAGE LAYER MATERIALS.
5. UNFOLD THE EXCESS GCL MATERIAL AND LAY FLAT OVER THE FUTURE PHASE HDPE GEOMEMBRANE.
6. INSTALL ADDITIONAL HDPE GEOMEMBRANE STRIP OVER THE GCL MATERIAL. STRIP SHALL BE EXTENDED 2' INTO THE OPERATIONAL BERM AND WELDED TO THE PHASE 10C HDPE GEOMEMBRANE.

1/15 EXISTING PHASE 6B/PROPOSED PHASE 10C BASELINER CONNECTION DETAIL

SCALE: 1"=4'



NOTES:

1. EXCAVATE AND EXPOSE PHASE 6B ANCHOR TRENCH. CUT AND REMOVE GEOMEMBRANE WITHIN ANCHOR TRENCH.
2. CONNECT PHASE 10C LOW PERMEABILITY SOIL TO PHASE 6B LOW PERMEABILITY SOIL.
3. INSTALL PHASE 10C HDPE GEOMEMBRANE AND WELD TO EXISTING PHASE 6B HDPE GEOMEMBRANE RAIN FLAP. EXISTING GEOMEMBRANE SHALL BE INSPECTED AND DAMAGED AREAS SHALL BE REPAIRED AS NECESSARY PRIOR TO PERFORMING EXTRUSION WELDING.
4. CUT AND REMOVE EXCESS GEOMEMBRANE RAIN FLAP MATERIAL AS NECESSARY TO ALLOW FOR THE INSTALLATION OF THE PHASE 10C LEACHATE COLLECTION PIPE, STONE, AND DRAINAGE LAYER MATERIAL.
5. UNFOLD THE EXCESS GCL MATERIAL AND LAY FLAT OVER THE PHASE 10C HDPE GEOMEMBRANE.
6. INSTALL ADDITIONAL HDPE GEOMEMBRANE STRIP OVER THE GCL MATERIAL. STRIP SHALL BE EXTENDED 2' INTO THE OPERATIONAL BERM AND WELDED TO THE PHASE 10C HDPE GEOMEMBRANE.

2/15 EXISTING PHASE 6B / PROPOSED PHASE 10C LEACHATE COLLECTION PIPE CONNECTION DETAIL

SCALE= 1" = 4'

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1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION
1	07/26/2019	REVISED SHEET BASED ON NYSDEC NOIA LETTER DATED 8/17/2019

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

BASELINER DETAILS (SHEET 2 OF 2)

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C801

SHEET 15 OF 23

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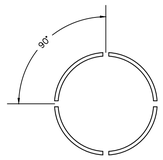
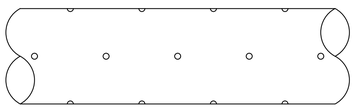


SECTION X–X



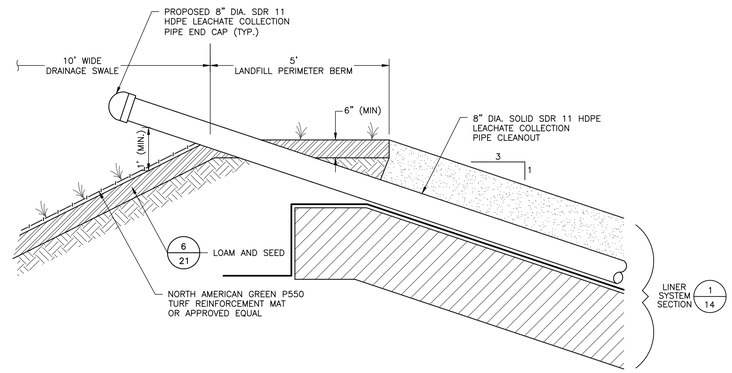
ELEVATION VIEW

NOTES:

1. PROVIDE 8" DIA. HDPE PIPE PERFORATED WITH ½" DIA. HOLES SPACED 90° APART CIRCUMFERENTIALLY, AND 6 INCHES ON CENTER AXIALLY WHEN USED WITH NYSDOT #2 STONE AS SHOWN IN DETAIL 4, THIS SHEET.
2. PROVIDE 8" DIA. HDPE PIPE PERFORATED WITH ⅜" DIA. HOLES SPACED 90° APART CIRCUMFERENTIALLY, AND 6 INCHES ON CENTER AXIALLY WHEN USED WITH NYSDOT #3 STONE AS SHOWN IN DETAIL 4, THIS SHEET.

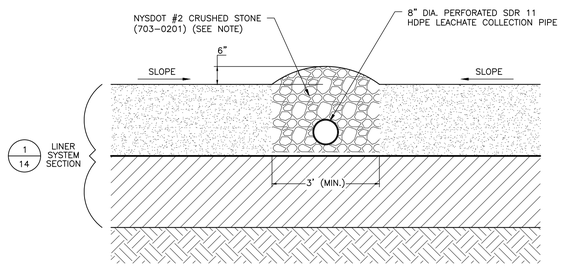
1/16 LEACHATE COLLECTION PIPE PERFORATION DETAIL

NOT TO SCALE



2/16 LEACHATE COLLECTION PIPE CLEANOUT SECTION

SCALE: 1"=2'



NOTE:

1. NYSDOT #3 STONE CAN BE USED AROUND PIPE IF PIPE PERFORATIONS ARE ⅜" DIAMETER. REFER TO DETAIL 1, THIS SHEET.
2. GRADATION OF DRAINAGE MATERIAL AND CRUSHED STONE SHALL SATISFY FILTER CRITERIA BELOW:

$$\frac{D_{15}\ \text{(DRAINAGE MATERIAL)}}{D_{85}\ \text{(CRUSHED STONE)}} = <5$$

$$\frac{D_{15}\ \text{(CRUSHED STONE)}}{D_{15}\ \text{(DRAINAGE MATERIAL)}} = >4 \text{ AND } <20$$

$$\frac{D_{50}\ \text{(DRAINAGE MATERIAL)}}{D_{50}\ \text{(CRUSHED STONE)}} = <25$$

3/16 LEACHATE COLLECTION PIPE SECTION

SCALE: 1"=2'

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STATE OF NEW YORK · AMY J. KNIGHT · 070347 · LICENSED PROFESSIONAL ENGINEER

1/26/2022

REVISION RECORD

NO	DATE	DESCRIPTION
1	07/26/2019	REVISED SHEET BASED ON NYSDEC NOIA LETTER DATED 8/1/2019

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

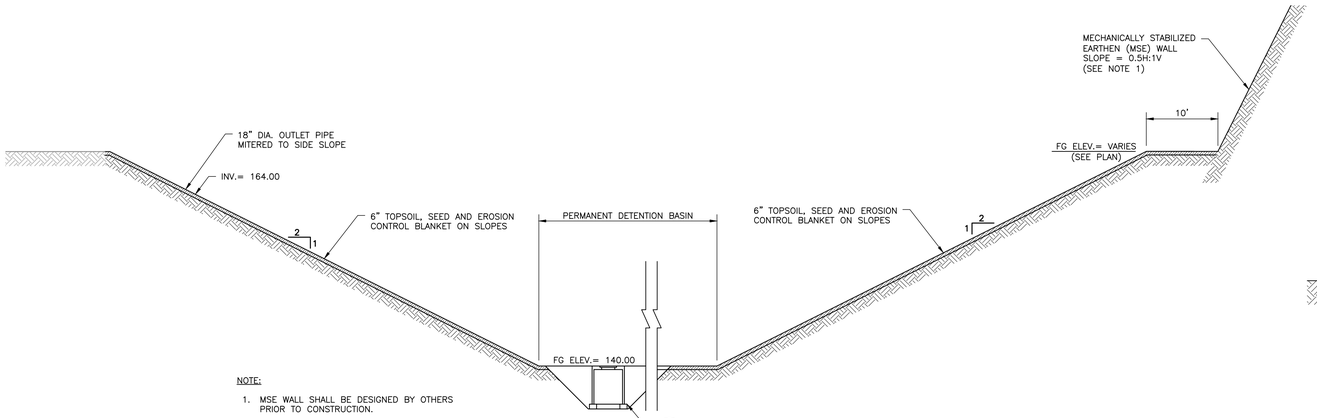
LEACHATE MANAGEMENT SYSTEM DETAILS

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C802

SHEET 16 OF 23

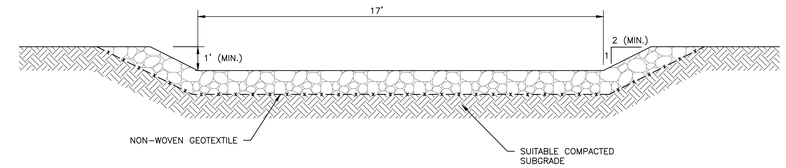
P:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C802-Leachate Management System Details.dwg[C802] LS:(1/13/2022 - wellbury) - LP: 1/13/2022 12:44 PM



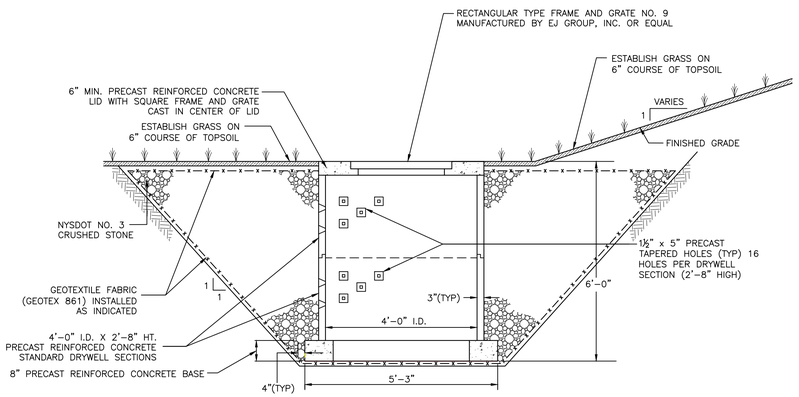
NOTE:

1. MSE WALL SHALL BE DESIGNED BY OTHERS PRIOR TO CONSTRUCTION.

1/17 NORTH POND DRYWELL OUTLET DETAIL
SCALE: 1"=10'



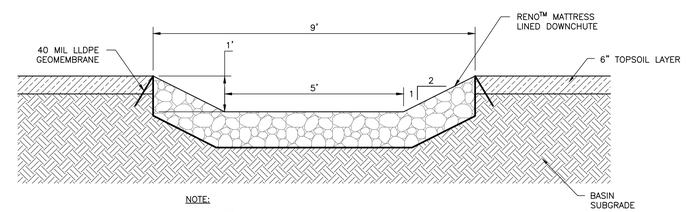
2/17 SPILLWAY OUTLET DETAIL
SCALE: 1"=3'



NOTES:

1. DRY WELL SECTIONS, LIDS, AND BASES SHALL BE PRECAST CONCRETE UNITS AS MANUFACTURED BY FORT MILLER COMPANY, INC. OF GREENWICH, NEW YORK, OR EQUIVALENT.
2. GEOTEXTILE FABRIC SHALL BE "GEOTEX 861" AS MANUFACTURED BY PROPEX, OR EQUIVALENT.

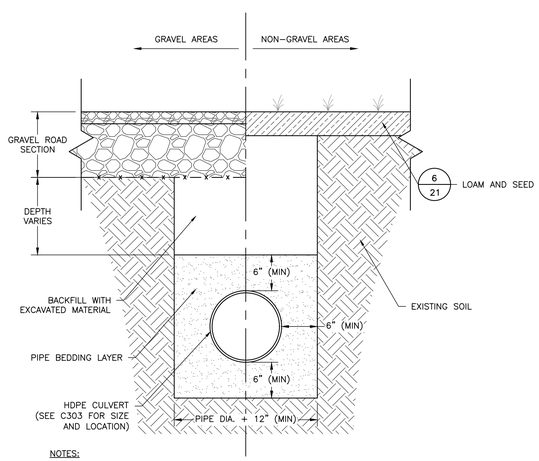
3/17 DRYWELL DETAIL
N.T.S.



NOTE:

1. RENO™ MATTRESSES SHALL BE 6x9x1 FEET. MATTRESSES SHALL BE FILLED WITH STONE RANGING FROM 4"-6" IN DIAMETER.

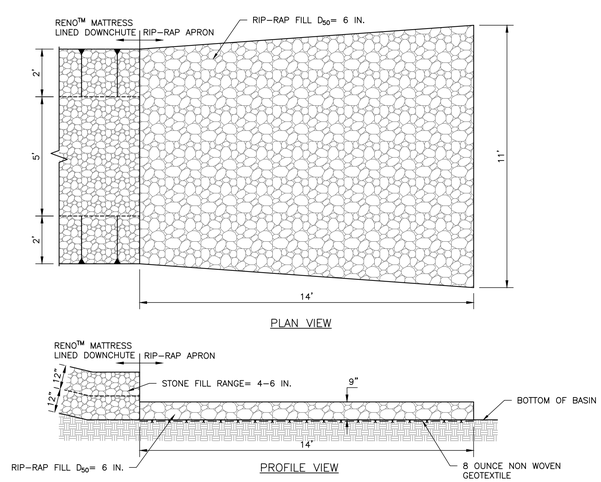
4/17 POND INLET CHANNEL
SCALE: 1"=2'



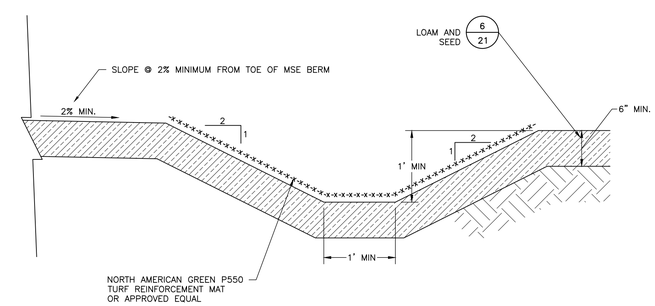
NOTES:

1. CULVERTS SHALL BE N-12 PIPE AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS OR EQUIVALENT PRODUCT APPROVED BY ENGINEER.

5/17 TYPICAL CULVERT TRENCH SECTION
SCALE: 1"=1'



6/17 POND INLET CHANNEL OUTLET PROTECTION DETAIL
SCALE: 1"=3'



7/17 NORTH PERIMETER SWALE
SCALE: 1"=1'

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STATE OF NEW YORK · AMY J. KNIGHT · 078347 · LICENSED PROFESSIONAL ENGINEER

1/13/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

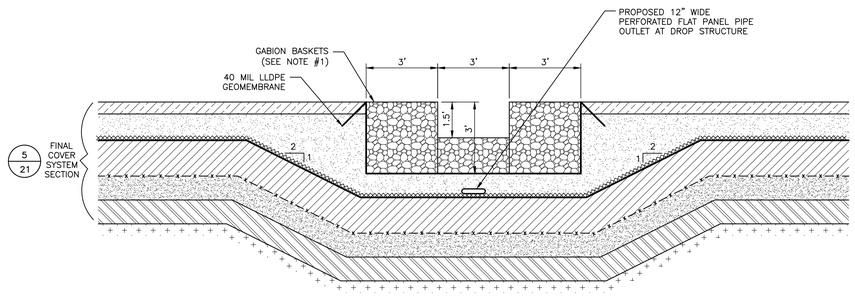
MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 1 OF 3)

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C803
SHEET 17 OF 23

F:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C803-Stormwater Management System Details.dwg[C803] LS:(1/13/2022 - emilson) - LP: 1/13/2022 12:42 PM

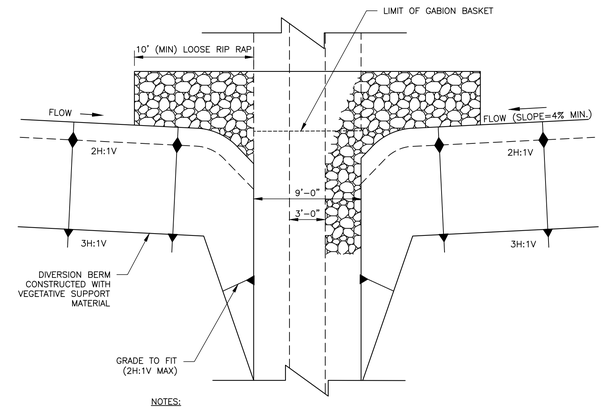


NOTE:

1. PERIMETER GABION BASKETS SHALL BE 6'x3'x3' FEET. INSIDE GABION BASKETS SHALL BE 6'x3'x1.5' FEET. ALL GABION BASKETS SHALL BE FILLED WITH STONE RANGING FROM 4"–8" IN DIAMETER.

1/18 GABION LINED DOWNCHUTE DETAIL

SCALE: 1"=2'

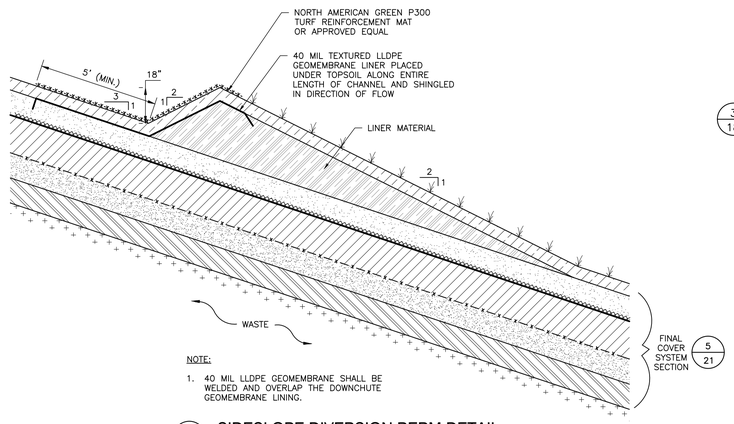


NOTES:

1. CHANNEL SHALL BE CONSTRUCTED WITH A MINIMUM 4% SLOPE TOWARDS DOWNCHUTE.
2. 40 MIL LLDPE GEOMEMBRANE BENEATH SWALE SHALL OVERLAP THE DOWNCHUTE GEOMEMBRANE LINING.
3. SIZE OF RIP–RAP IN DOWNCHUTE SHALL BE D_{50}=12".

3/18 DOWNCHUTE / SIDESLOPE DIVERSION BERM INLET DETAIL

SCALE: 1"=6'

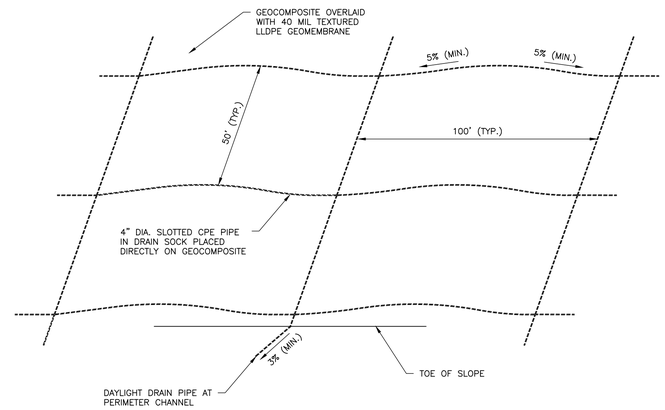


NOTE:

1. 40 MIL LLDPE GEOMEMBRANE SHALL BE WELDED AND OVERLAP THE DOWNCHUTE GEOMEMBRANE LINING.

2/18 SIDESLOPE DIVERSION BERM DETAIL

SCALE: 1"=2'

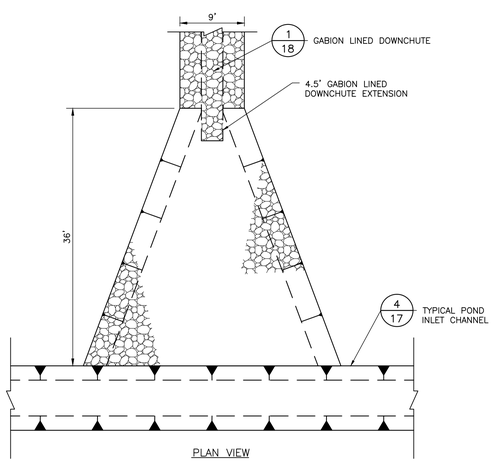


NOTES:

1. CONTRACTOR SHALL COORDINATE CAP DRAIN INSTALLATION LOCATIONS SUCH THAT DRAIN PIPE DOES NOT INTERFERE WITH PROPOSED LANDFILL GAS COLLECTION PIPE AND DOWNDRAIN PIPE LOCATIONS.
2. PIPE SHALL BE INSTALLED SUCH THAT 4" LATERAL PIPE IS LOCATED AT TOE OF SLOPEAND SPACED UP SLOPE ACCORDINGLY.
3. CONTRACTOR SHALL USE TAPE AT JOINTS TO SEAL THE DRAIN SOCK AROUND PIPE AND PREVENT JOINT BECOMING UNCOUPLED.

6/18 FINAL COVER DRAINAGE PIPE

SCALE: 1"=30'

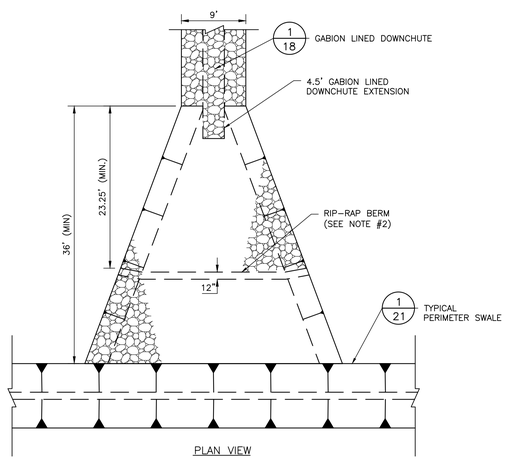


NOTES:

1. SIZE OF RIP–RAP IN ENERGY DISSIPATOR SHALL BE D_{50}= 12".

4/18 DOWNCHUTE ENERGY DISSIPATOR 1

SCALE: 1"=10'



NOTES:

1. SIZE OF RIP–RAP IN ENERGY DISSIPATOR SHALL BE D_{50}= 9".
2. RIP–RAP BERM SHALL BE 12" HIGH, 12" IN LENGTH, AND BUILT ACROSS WIDTH OF DISSIPATOR.

5/18 DOWNCHUTE ENERGY DISSIPATOR 2

SCALE: 1"=10'

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STATE OF NEW YORK · AMY J. KNIGHT · 070347 · LICENSED PROFESSIONAL ENGINEER

1/14/2022

REVISION RECORD		
NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 2 OF 3)

DATE:	JANUARY 2022	DRAWN BY:	TLG
DWG SCALE:	AS SHOWN	CHECKED BY:	EMW
PROJECT NO:			182-442
APPROVED BY:			AJK

DRAWING NO.: C804

SHEET 18 OF 23

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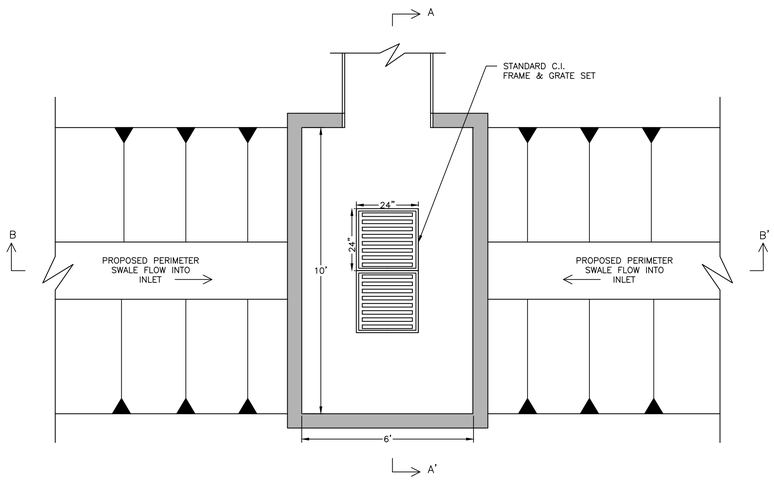
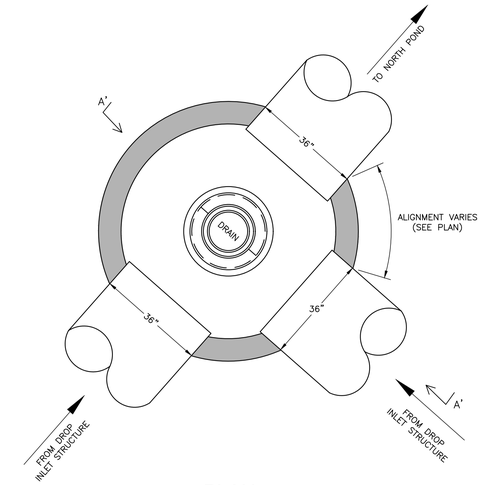
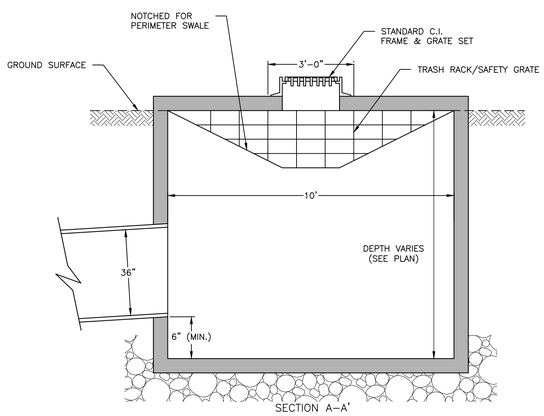
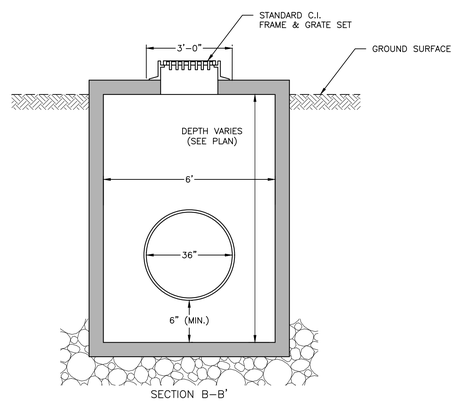




PLAN



SECTION A–A'

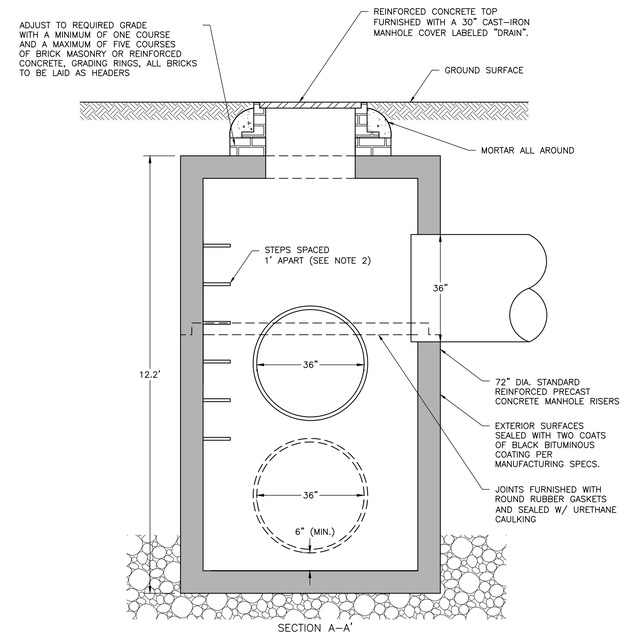


SECTION B–B'

NOTES:

1. CONTRACTOR SHALL PROVIDE PLANS FOR REINFORCED CONCRETE DROP STRUCTURE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NEW YORK.
2. CONTRACTOR SHALL PROVIDE SCOURING PROTECTION WITHIN CONCRETE CATCH BASIN.
3. SWALE ALINGMENT AND LOCATION INTO DROP INLET VARIES. REFER TO PLAN FOR ACTUAL NUMBER OF SWALES AND ALIGNMENT.

1/19 CONCRETE DROP INLET STRUCTURE
NOT TO SCALE



SECTION A–A'

NOTES:

1. CONCRETE: 4,000 PSI MINIMUM AFTER 28 DAYS.
2. STEEL REINFORCED COPOLYMER POLYPROPYLENE PLASTIC STEP SHALL CONFORM TO LATEST ASTM C478 SPECIFICATIONS.

2/19 STORMWATER MANHOLE
SCALE: 1"=2'

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STATE OF NEW YORK · AMY J. KNIGHT · 078341 · LICENSED PROFESSIONAL ENGINEER

1/14/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

STORMWATER MANAGEMENT
SYSTEM DETAILS
(SHEET 3 OF 3)

DATE:	JANUARY 2022	DRAWN BY: TLG
DWG SCALE:	AS SHOWN	CHECKED BY: EMW
PROJECT NO:		182-442
APPROVED BY:		AJK

DRAWING NO.: C805

SHEET 19 OF 23

P:\2018\182-442\-CADD\Dwg\site-permit modification drawings\182442-SWF6-C805-Stormwater Management System Details III.dwg[C805] LS:(1/13/2022 - ewilson) - LP: 1/13/2022 12:42 PM

GENERAL NOTES:

1. BEFORE UNDERTAKING ANY CONSTRUCTION ACTIVITY, ALL CONTRACTORS AND SUBCONTRACTORS INVOLVED WITH SITE WORK THAT INVOLVES PHYSICAL GROUND DISTURBANCE ON THE PROJECT SITE SHALL SIGN AND DATE A COPY OF THE CERTIFICATION STATEMENT, WHICH IS LOCATED IN THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP), PREPARED FOR THIS PROJECT.
2. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL CONFORM TO THE "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" (A.K.A. "NYS BLUE BOOK"), MOST RECENT EDITION AND ANY ADDENDA THERETO.
3. THE SEDIMENT CONTROL MEASURES DETAILED IN THESE PLANS SHALL BE IN PLACE PRIOR TO THE START OF EACH CONSTRUCTION PHASE. AT A MINIMUM THESE MEASURES CONSIST OF SILT FENCE AND STABILIZED CONSTRUCTION ENTRANCE(S), ONCE CONSTRUCTED, ALL MEASURES SHALL BE PROPERLY MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD, AND THEN REMOVED FROM THE SITE ONCE THE SITE IS STABILIZED.
4. AFTER THE START OF CONSTRUCTION, SITE SWPPP INSPECTIONS SHALL BE CONDUCTED AT LEAST EVERY 7 CALENDAR DAYS.
5. BASED ON THE WEEKLY SITE SWPPP INSPECTIONS, THE EROSION AND SEDIMENT CONTROL MEASURES IDENTIFIED IN THE SWPPP MAY BE REVISED AS SITE CONDITIONS WARRANT. THE CONTRACTOR SHALL IMPLEMENT THESE CHANGES AS SOON AS PRACTICABLE.
6. THE EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED BY THE CONTRACTOR UNTIL THE FINAL SURFACE TREATMENT HAS BEEN INSTALLED AND VEGETATED AREAS HAVE ESTABLISHED 80% COVERAGE. AFTER THE VEGETATED AREAS HAVE BEEN STABILIZED WITH AT LEAST 80% VEGETATIVE COVER, THE PROPERTY OWNER SHALL ASSUME RESPONSIBILITY FOR MAINTAINING THE EROSION AND SEDIMENT CONTROL SYSTEM(S) THEREAFTER.
7. CONSTRUCTION ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE CONSTRUCTION PHASING SCHEDULE SUPPLIED BY THE CONTRACTOR OR AS SHOWN ON THE PLANS.
8. OUTSIDE THE GROWING SEASON, OTHER METHODS OF SOIL STABILIZATION (SUCH AS THE USE OF JUTE MESH AND EXCELSIOR MATTING) SHALL BE USED UNTIL SUCH TIME AS VEGETATIVE COVER CAN BE ESTABLISHED.
9. EXISTING VEGETATION SHALL BE PRESERVED TO THE MAXIMUM EXTENT PRACTICABLE. SITE WORK ACTIVITIES SHALL BE PLANNED TO MINIMIZE THE AREA AND DURATION OF SOIL DISTURBANCE. REMOVAL OF WOODY VEGETATION SHALL BE KEPT TO THE MINIMUM EXTENT PRACTICABLE.
10. TRENCH DEWATERING SHALL BE CONDUCTED USING A PORTABLE PUMP AND HOSE, AS NECESSARY. WATER SHALL BE PUMPED TO A DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG LOCATED IN A WELL VEGETATED UPLAND AREA. WHEN COMPLETED, ALL DEPOSITED SEDIMENTS SHALL BE PROPERLY MANAGED IN UPLAND AREAS OR DISPOSED OF OFF-SITE.
11. INLET PROTECTION MEASURES SHALL BE INSTALLED AROUND STORM DRAIN INLETS TO PREVENT SEDIMENT LADEN WATER FROM ENTERING STORM SEWER SYSTEMS.

STABILIZED CONSTRUCTION ENTRANCE NOTES:

1. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED WHERE NECESSARY TO PREVENT SEDIMENT FROM BEING TRACKED ONTO ROADWAYS.
2. PERMANENT TRAFFIC CORRIDORS SHALL BE ESTABLISHED AND "ROUTES OF CONVENIENCE" SHALL BE AVOIDED. CONSTRUCTION TRAFFIC SHALL NOT CROSS STREAMS OR DITCHES EXCEPT AT SUITABLE CROSSING FACILITIES, AND SHALL NOT OPERATE UNNECESSARILY WITHIN WATERWAYS OR DRAINAGE DITCHES.
3. IF INTERNAL CONSTRUCTION ROADS ARE DETERMINED TO BE A SOURCE OF SEDIMENT-LADEN RUNOFF TO SENSITIVE AREAS, THEY SHALL BE STABILIZED AS SOON AS PRACTICABLE.

STOCKPILE NOTES:

1. TOPSOIL AND FILL THAT IS ANTICIPATED TO REMAIN STOCKPILED ON-SITE FOR PERIODS GREATER THAN 30 DAYS SHALL BE STABILIZED BY SEEDING. PRIOR TO THE SEEDING OPERATION, THE STOCKPILED MATERIAL SHALL BE GRADED TO PERMIT THE USE OF CONVENTIONAL EQUIPMENT FOR SEEDBED PREPARATION, SEEDING, MULCH APPLICATION, AND MULCH ANCHORING. IN NO CASE SHALL ERODIBLE MATERIALS BE STOCKPILED WITHIN 25 FT OF ANY DITCH, STREAM, OR OTHER SURFACE WATERBODY.
2. SILT FENCE SHALL BE CONSTRUCTED AROUND ALL STOCKPILES OF FILL, TOPSOIL AND EXCAVATED OVERBURDEN THAT ARE TO REMAIN EXPOSED FOR PERIODS LESS THAN 30 DAYS. SILT FENCE AND/OR HAY BALES SHALL BE ANCHORED AND MAINTAINED IN GOOD CONDITION UNTIL SUCH TIME AS SAID STOCKPILES ARE REMOVED AND STOCKPILING AREAS ARE BROUGHT TO FINAL GRADE AND PERMANENTLY STABILIZED.

SILT FENCE NOTES:

1. SILT FENCE SHALL BE PLACED ON THE DOWNSLOPE SIDE OF DISTURBED AREAS AND AROUND THE PERIMETER OF SOIL STOCKPILES.
2. WITHIN RESIDENTIAL AREAS, SILT FENCE SHALL BE INSTALLED ALONG THE PERIMETER OF THE ENTIRE WORK AREA WHEN WORK IS CONDUCTED IN LAWNS.
3. SILT FENCE SHALL BE REPAIRED OR REPLACED WHEN THE ENDS ARE FRAYED OR WORN, AND WHEN THE FENCE IS NOT ANCHORED 6" INTO THE GROUND. WHEN THE ACCUMULATED SEDIMENT REACHES 50% OF THE SILT FENCE HEIGHT OR WHEN "BULGES" DEVELOP IN THE FENCING, THE SEDIMENT SHALL BE REMOVED AND DISPOSED OF IN AN APPROPRIATE UPLAND AREA.

TRENCHES & SLOPES NOTES:

1. IN AREAS OF CONCENTRATED FLOWS, SUCH AS DRAINAGE DITCHES AND ROADSIDE DITCHES, STONE CHECK DAMS SHALL BE INSTALLED TO SLOW THE VELOCITY OF THE FLOWS. FOLLOWING THE WORK, THE DITCHES AND/OR SWALES SHALL BE RECONSTRUCTED TO PRE-CONSTRUCTION CONTOURS AND STABILIZED IN ACCORDANCE WITH THE PLAN DETAILS.
2. TRENCH BREAKERS SHALL BE INSTALLED IN TRENCHES ADJACENT TO WETLANDS AND ROAD CROSSINGS, AS REQUIRED, TO PREVENT SUBSURFACE EROSION AND DEWATERING OF WETLANDS AND WATERBODIES.
3. IF NECESSARY, PERMANENT SLOPE BREAKERS SHALL BE CONSTRUCTED WITH A 2-8% OUTSLOPE TO DIVERT SURFACE FLOW TO WELL VEGETATED STABLE AREAS.

MULCHING & SEEDING NOTES:

1. TEMPORARY STABILIZATION MEASURES SHALL START AS SOON AS PRACTICAL ON PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT NOT MORE THAN 14 DAYS AFTER WORK HAS CEASED. ACCEPTABLE TEMPORARY STABILIZATION MEASURES INCLUDE, BUT MAY NOT BE LIMITED TO MULCH, STRAW, HAY, EROSION CONTROL FABRIC OR SOME FUNCTIONAL EQUIVALENT MEASURE. MULCH, STRAW OR HAY SHALL BE APPLIED AT A RATE SUCH THAT 90% COVERAGE OF THE PREVIOUSLY DISTURBED AREA IS ATTAINED.
2. TEMPORARY EROSION CONTROL PROTECTION BY MULCHING SHALL BE CARRIED OUT WITHIN 14 DAYS OF THE FILL GRADE BEING FINALIZED TO AVOID POSSIBLE CONTAMINATION OF PONDS, STREAMS, OR OTHER WATERCOURSES. PLACEMENT OF JUTE MESH OVER THE MULCH IS RECOMMENDED TO PROVIDE POSITIVE "TACKING" OF THE MULCH AND INCREASED PROTECTION AGAINST EROSION.
3. PERMANENT SEEDING AND MULCH SHALL BE APPLIED AS SOON AS THE DISTURBED AREAS HAVE ACHIEVED FINAL GRADE. IF SEEDING DATES ARE SPECIFIED IN THE LANDSCAPE NOTES AND THE FILL IS TRIMMED "OUT OF SEEDING SEASON", MULCH SHALL BE APPLIED TO THE SLOPE AS SPECIFIED IN THE SEEDING ITEM AND SEED SHALL BE APPLIED TO THE TOP OF THE MULCH IN THE NEXT SEEDING SEASON. WHEN THE FINAL GRADE CANNOT BE OBTAINED IN 14-DAYS, MULCH SHALL BE APPLIED FOR PURPOSES OF TEMPORARY EROSION CONTROL.
4. EROSION CONTROL MATTING SHALL SERVE AS A TEMPORARY EROSION CONTROL MEASURE ON ALL SLOPES GREATER THAN 3H:1V AND AS INDICATED ON THE PLAN. THE MATTING MATERIAL SHALL BE THE PRODUCT DEFINED IN THE PROJECT SPECIFICATIONS OR AN APPROVED EQUIVALENT.
5. UPLAND AREAS SHALL BE REVEGETATED IN ACCORDANCE WITH RECOMMENDATIONS FROM THE "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" (MOST RECENT EDITION), AND ANY ADDENDA THERETO.

RECOMMENDED SEED MIXTURE FOR REVEGETATION OF DISTURBED AREAS		
COMMON NAME	SEEDING RATE (LBS. / ACRE)**	SEEDING RATE (LBS. / 1,000 SQ. FOOT)
EMPIRE BIRDSFOOT TREFOIL* OR COMMON WHITE CLOVER*	8 LBS./ACRE	0.2 LBS./SQ. FOOT
TALL FESCUE	20LBS./ACRE	0.45 LBS./SQ. FOOT
REDTOP OR PERENNIAL RYEGRASS	2 LBS./ACRE (REDTOP) 5 LBS./ACRE (RYEGRASS)	0.05 LBS./SQ. FOOT 0.10 LBS./SQ. FOOT
RECOMMENDED MULCH MIXTURE FOR SEEDED AREAS		
COMMON NAME	MULCHING RATE (TON/ACRE & LBS./ACRE)**	MULCHING RATE (LBS. / 1,000 SQ. FOOT)
STRAW (CEREAL GRAIN)***	2 TON/ACRE	0.09 LBS./SQ. FOOT
WOOD FIBER (HYDROMULCH)****	500-750 LBS./ACRE	0.01-0.02 LBS./SQ. FOOT

* ADD INOCULANT IMMEDIATELY PRIOR TO SEEDING.

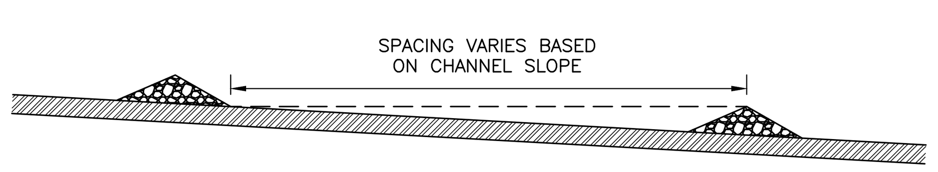
** SEEDING AND MULCHING RATES WERE OBTAINED FROM THE "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" (MOST RECENT EDITION).

*** ANCHOR STRAW WITH WOOD FIBER MULCH (HYDROMULCH).

**** WOOD FIBER MULCH MUST BE APPLIED THROUGH A HYDROSEEDER IMMEDIATELY AFTER MULCHING.

TEMPORARY STABILIZATION APPLICATION RATES*				
MULCH MATERIAL	QUALITY STANDARDS	MULCHING RATE (PER 1,000 SQ. FEET)	MULCHING RATE (PER ACRE)	DEPTH OF APPLICATION
WOOD CHIPS OR SHAVINGS	AIR-DRIED. FREE OF OBJECTIONABLE, COURSE MATERIAL	500-900 LBS.	10-20 TONS	2-7 INCHES
WOOD FIBER CELLULOSE	MADE FROM NATURAL WOOD	50 LBS.	2000 LBS.	2 INCHES
GRAVEL, CRUSHED STONE OR SLAG	WASHED, #2 STONE	9 CY	405 CY	3 INCHES
HAY OR STRAW	AIR-DRIED. FREE OF UNDESIRABLE SEEDS	90-100 LBS., 2-3 BALES	2 TONS, 100-120 BALES	COVER 90% OF SURFACE
COMPOST	UP TO 3 INCH PIECES, MODERATE TO HIGHLY STABLE	3-9 CY	135-405 CY	1-3 INCHES

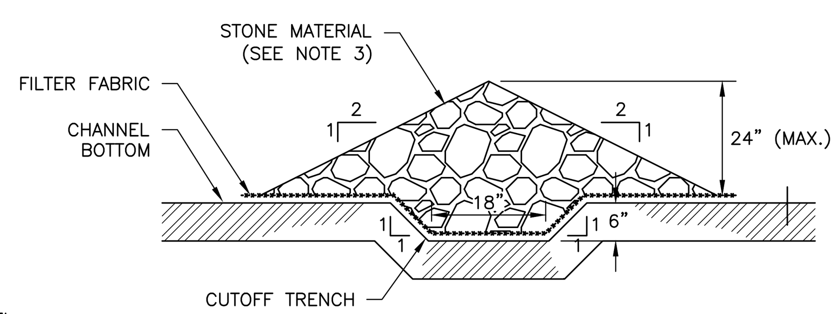
* APPLICATION RATES WERE OBTAINED FROM THE "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" (MOST RECENT EDITION).



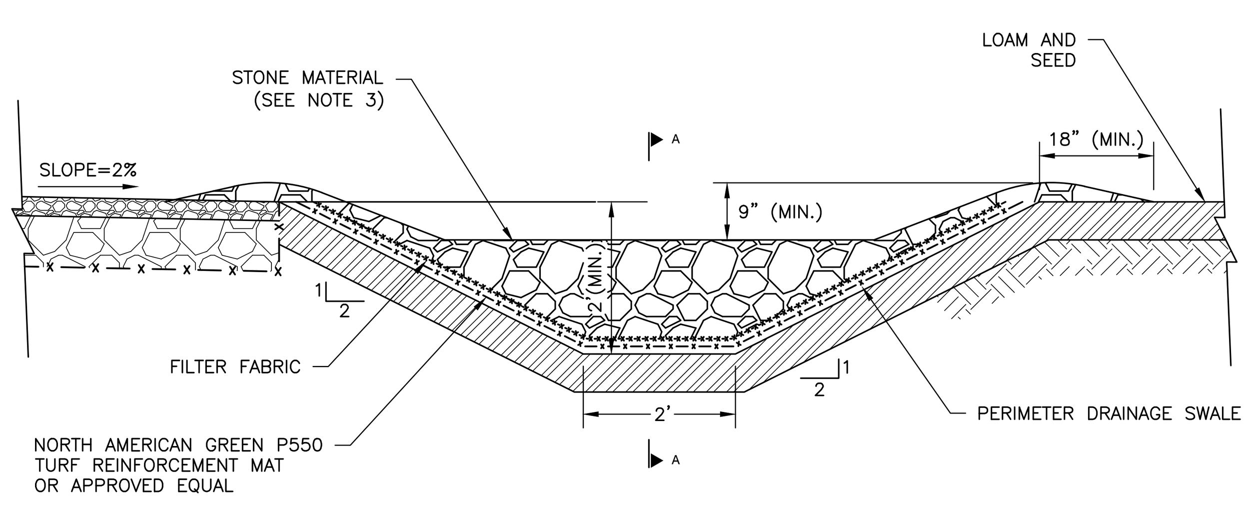
SWALE PROFILE – CHECK DAM SPACING

SLOPE	SPACING*
1%	150 FT.
2%	75 FT.
5%	30 FT.

*BASED ON 18" CHECK DAM HEIGHT WITHIN 2' DEEP CHANNEL



SECTION A-A

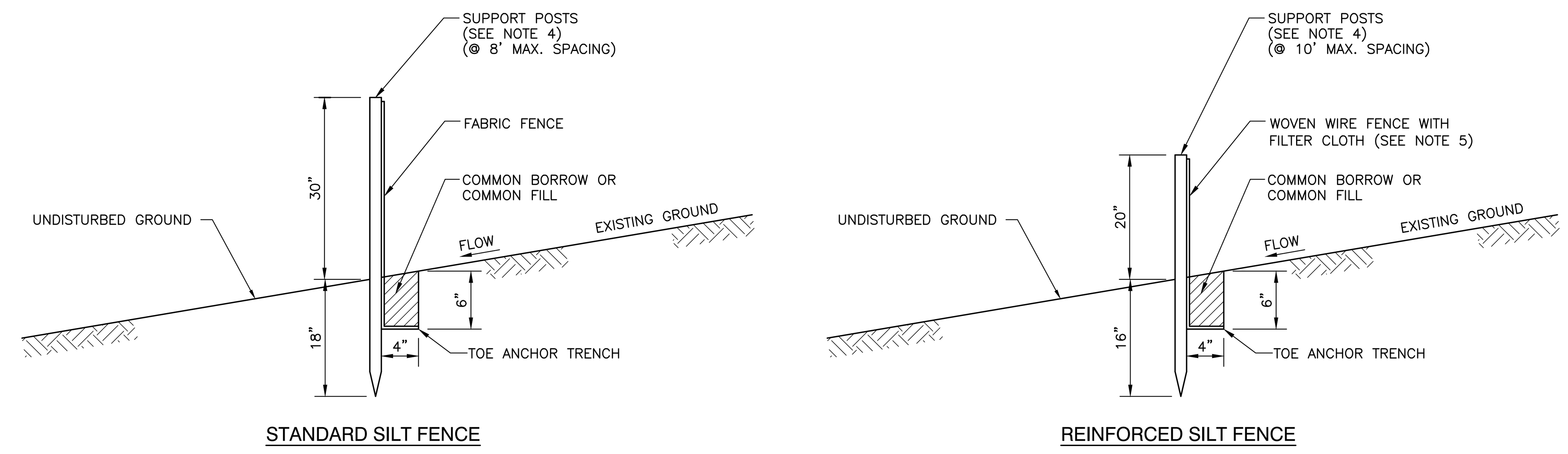


NOTES:

1. STONE CHECK DAMS ARE TO BE INSTALLED WITHIN PERIMETER DRAINAGE CHANNELS FOR TEMPORARY EROSION CONTROL, AS SHOWN ON THE PLANS.
2. THE MAXIMUM DRAINAGE AREA ABOVE THE CHECK DAM SHALL NOT EXCEED TWO (2) ACRES.
3. STONE CHECK DAMS ARE TO BE CONSTRUCTED USING A WELL GRADED STONE MATRIX 2 TO 9 INCHES IN SIZE. STONE MATERIAL SHALL BE NYS - DOT LIGHT STONE FILL OR EQUIVALENT.

1/20 CHECK DAM DETAIL

NOT TO SCALE

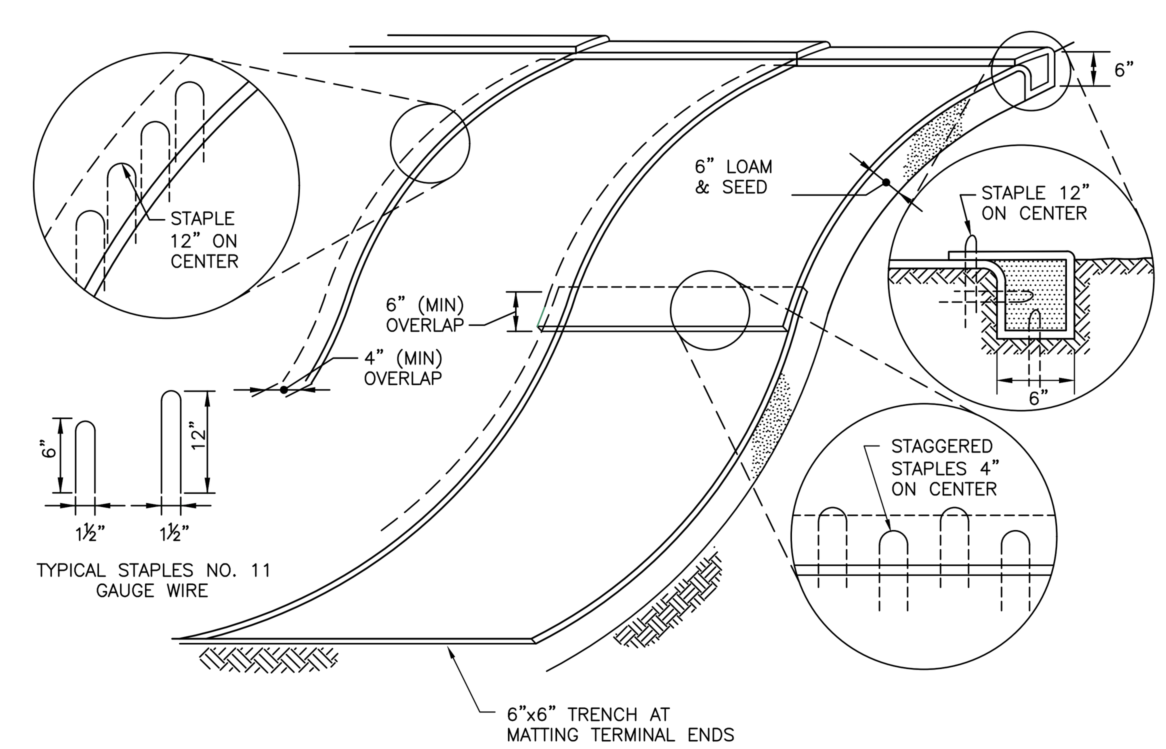


NOTES:

1. REINFORCED SILT FENCE SHALL BE INSTALLED WHEN THE SLOPE OF THE DISTURBED GROUND SURFACE UP-GRADIENT OF THE INSTALLATION LOCATION IS GREATER THAN 3H:1V.
2. FILTER FABRIC FENCE MUST BE INSTALLED AT EXISTING LEVEL GRADE. BOTH ENDS OF EACH FENCE SECTION MUST BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.
3. SEDIMENT MUST BE REMOVED WHERE ACCUMULATIONS REACH 50-PERCENT OF THE ABOVE GROUND HEIGHT OF THE FENCE OR WHEN "BULGES" DEVELOP IN THE SILT FENCE.
4. SUPPORT POSTS SHALL BE 2"x2" WOOD STAKES OR EQUIVALENT STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
5. WIRE FENCING FOR REINFORCED SILT FENCE SHALL BE MINIMUM 14 GAGE WITH A MAXIMUM 6 INCH MESH OPENING, OR EQUIVALENT.
6. SILT FENCE SHALL BE REMOVED UPON STABILIZATION OF THE UP-GRADIENT AREA.

2/20 SILT FENCE DETAIL

NOT TO SCALE



INSTALLATION NOTES:

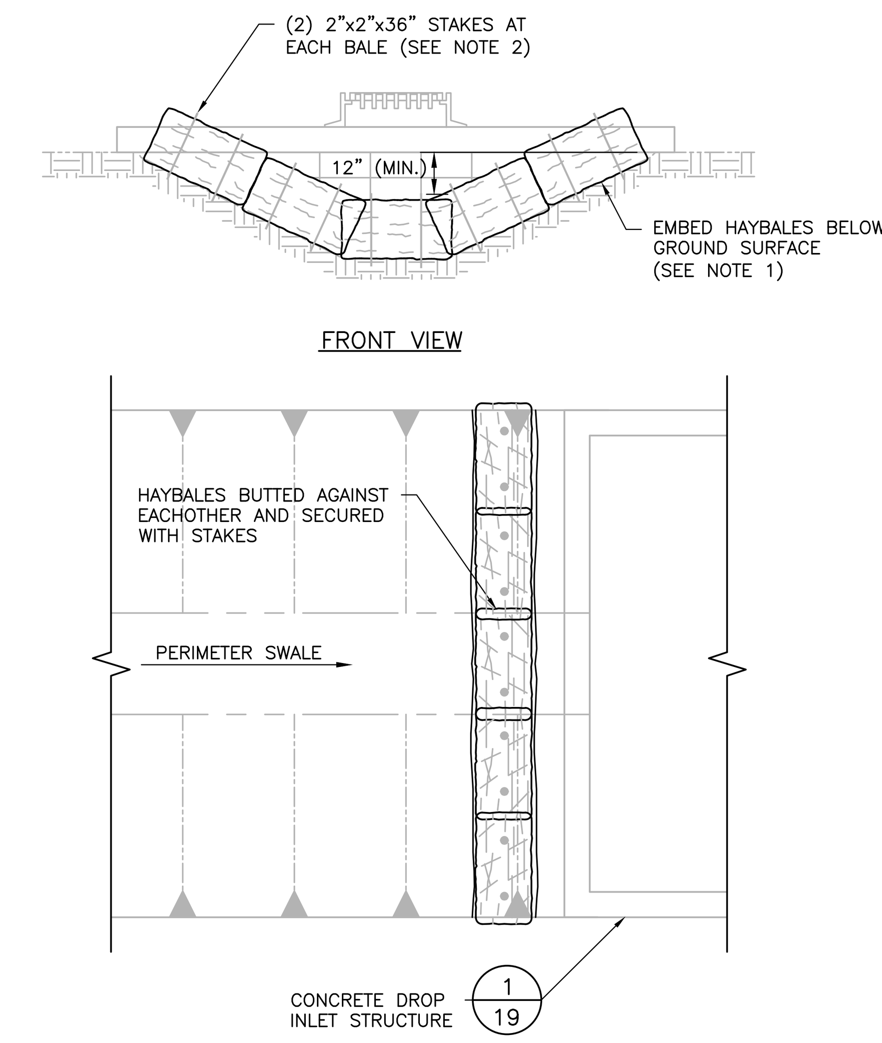
1. SOIL SUBBASE SHALL BE PREPARED PRIOR TO INSTALLATION BY SMOOTHING THE SURFACE, REMOVING DEBRIS AND LARGE STONE, AND APPLYING FERTILIZER AND SEED.
2. BEGIN AT THE TOP OF MATTING INSTALLATION AREA BY ANCHORING MATTING IN A SIX (6) INCH DEEP TRENCH. BACKFILL AND COMPACT TRENCH AFTER STAPLING.
3. ROLL THE MATTING DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
4. THE EDGES OF MATTING MUST BE STAPLED WITH APPROXIMATELY FOUR (4) INCH OVERLAP WHERE TWO (2) OR MORE STRIP WIDTHS ARE REQUIRED.
5. WHEN MATTING MUST BE SPLICED DOWN THE SWALE, PLACE UPPER MATTING END OVER LOWER END WITH SIX (6) INCH MINIMUM OVERLAP AND STAPLE BOTH TOGETHER.
6. MORE FASTENERS MAY BE REQUIRED DUE TO MATTING COMPOSITION, SOIL TYPE, SURFACE UNIFORMITY AND SLOPE STEEPNESS. METHOD OF INSTALLATION SHALL BE PER MANUFACTURER'S RECOMMENDATIONS.

GENERAL NOTES:

1. EROSION CONTROL MATTING IS TO BE PLACED ON SLOPES 3H:1V OR GREATER AND AS SHOWN ON PLANS.
2. THE MATERIAL USED FOR THE EROSION CONTROL MATTING SHALL BE THE PRODUCT DEFINED IN THE PROJECT SPECIFICATIONS OR AN APPROVED EQUIVALENT.

3/20 EROSION CONTROL MATTING

NOT TO SCALE



PLAN VIEW

NOTES:

1. EACH BALE SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 4 INCHES AND PLACED SO THE BINDINGS ARE HORIZONTAL.
2. BALES SHALL BE SECURELY ANCHORED IN PLACE BY EITHER TWO STAKES OR RE-BARS DRIVEN THROUGH THE BALE. THE FIRST STAKE IN EACH BALE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE, AT AN ANGLE, TO FORCE THE BALES TOGETHER. STAKES SHALL BE DRIVEN FLUSH WITH THE BALE.
3. BALES SHALL BE REMOVED WHEN UP-GRADIENT AREAS REACH STABILIZATION SO AS NOT TO BLOCK OR IMPEDE STORMWATER FLOW OR DRAINAGE.
4. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATION REACHES ½ THE HEIGHT OF THE ABOVE-GROUND BALE. BALES SHALL BE REPLACED AS NEEDED.

4/20 DROP STRUCTURE INLET PROTECTION

NOT TO SCALE

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STATE OF NEW YORK · AMY J. KNIGHT · 076341 · LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION

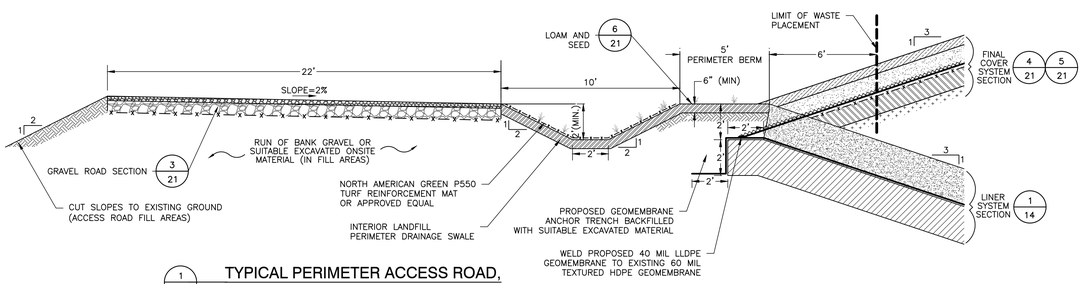
Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

EROSION AND SEDIMENT CONTROL DETAILS

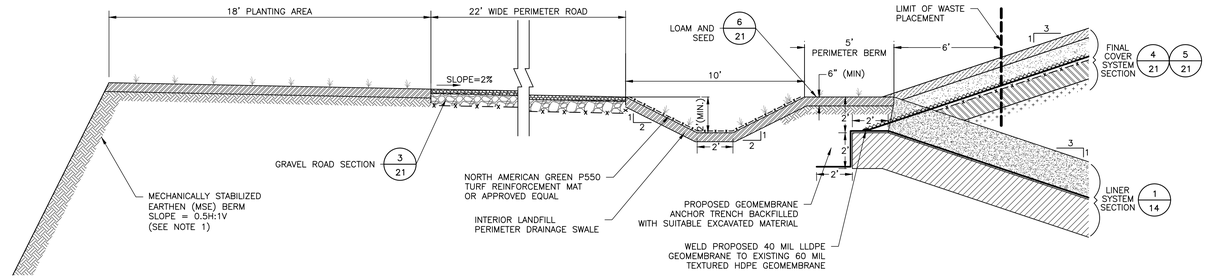
DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: **C806**



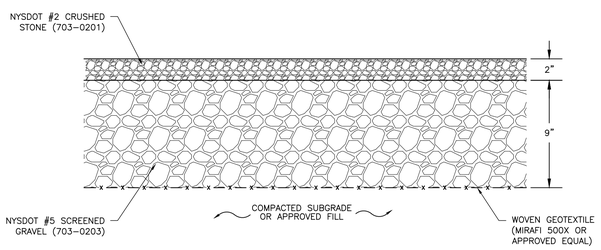
1/21 TYPICAL PERIMETER ACCESS ROAD, DRAINAGE SWALE, AND ANCHOR TRENCH

SCALE: 1"=4'



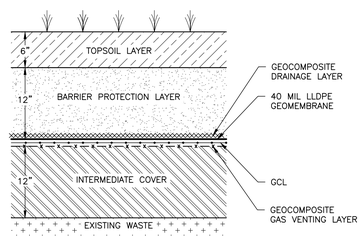
2/21 TYPICAL MSE BERM, DRAINAGE SWALE, AND ANCHOR TRENCH

SCALE: 1"=4'



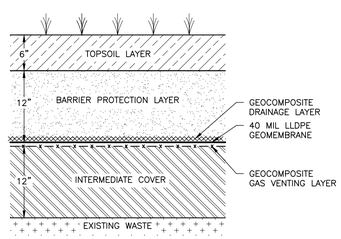
3/21 GRAVEL ROAD SECTION

NOT TO SCALE



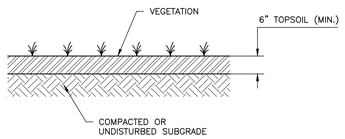
4/21 FINAL COVER SYSTEM SECTION <25% SLOPES

SCALE: 1"=1'



5/21 FINAL COVER SYSTEM SECTION >25% SLOPES

SCALE: 1"=1'



6/21 LOAM AND SEED

NOT TO SCALE

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STATE OF NEW YORK · AMY J. KNIGHT · 078347 · LICENSED PROFESSIONAL ENGINEER

1/26/2022

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

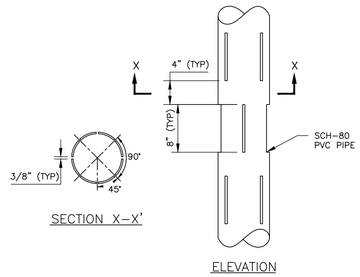
FINAL COVER/GENERAL DETAILS

DATE:	JANUARY 2022	DRAWN BY:	TLG
DWG SCALE:	AS SHOWN	CHECKED BY:	EMW
PROJECT NO:			182-442
APPROVED BY:			AJK

DRAWING NO.: C807

SHEET 21 OF 23

A:\2018\182-442\-CADD\Dwg\sw16-permit modification drawings\182442-SW16-C807-Final Cover_General Details.dwg[C807] LS(1/13/2022 - ewilliams) - LP: 1/13/2022 12:43 PM

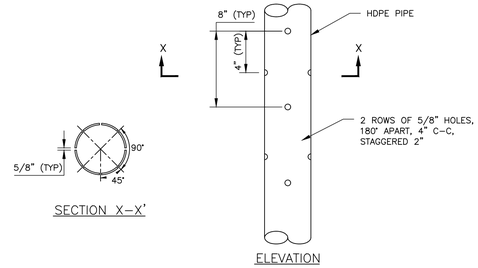


NOTES:

1. STAGGER SLOTS BY 45° FOR ADJACENT ROWS
2. PROVIDE FACTORY FABRICATED SLOTTED PIPE

PVC PIPE SLOT DETAIL

NOT TO SCALE

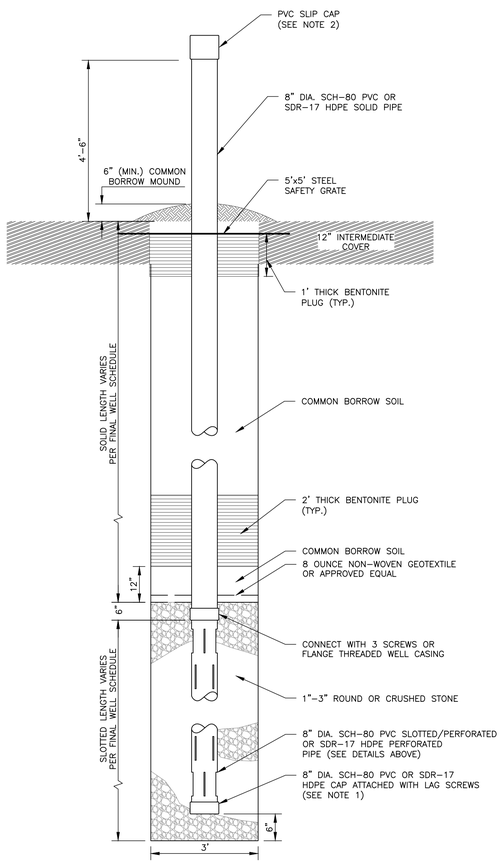


NOTES:

1. STAGGER SLOTS BY 45° FOR ADJACENT ROWS
2. PROVIDE FACTORY FABRICATED PERFORATED PIPE

PVC OR HDPE PIPE PERFORATIONS DETAIL

NOT TO SCALE

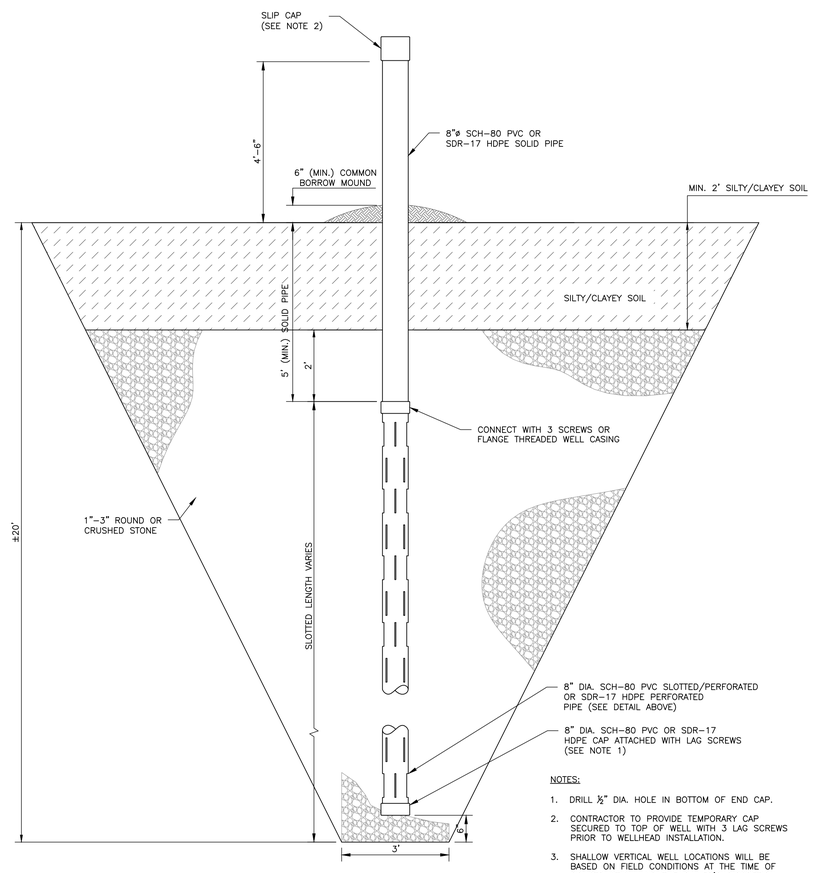


NOTES:

1. DRILL ½" DIA. HOLE IN BOTTOM OF END CAP.
2. CONTRACTOR TO PROVIDE TEMPORARY CAP TO BE SECURED TO TOP OF WELL WITH 3 LAG SCREWS PRIOR TO WELLHEAD INSTALLATION.
3. PIPING MAY CONSIST OF SLOTTED SCH-80 PVC OR PERFORATED HDPE PIPE IN ACCORDANCE WITH SLOT AND PERFORATED DETAILS ABOVE.

1/22 VERTICAL GAS EXTRACTION WELL

NOT TO SCALE

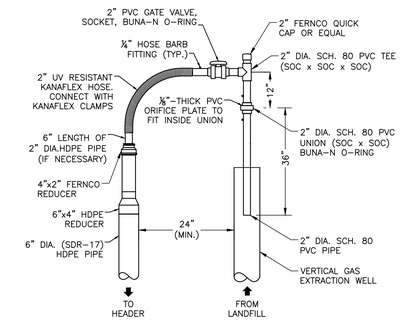


NOTES:

1. DRILL ½" DIA. HOLE IN BOTTOM OF END CAP.
2. CONTRACTOR TO PROVIDE TEMPORARY CAP SECURED TO TOP OF WELL WITH 3 LAG SCREWS PRIOR TO WELLHEAD INSTALLATION.
3. SHALLOW VERTICAL WELL LOCATIONS WILL BE BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION AND THE OWNER'S DISCRETION.
4. PIPING MAY CONSIST OF SLOTTED SCH-80PVC OR PERFORATED HDPE PIPE IN ACCORDANCE WITH SLOT AND PERFORATED DETAILS ABOVE.

2/22 SHALLOW VERTICAL GAS EXTRACTION WELL

NOT TO SCALE



INSTALLATION NOTES:

1. REFER TO WELLHEAD INSTALLATION INSTRUCTION MANUAL. READ DIRECTIONS THOROUGHLY BEFORE ATTEMPTING ASSEMBLY AND INSTALLATION OF WELLHEAD ON WELL CASING.
2. WELLHEAD SHALL BE SUPPLIED WITH LABORATORY CERTIFIED FLOW CALIBRATION PERFORMANCE CURVES.
3. INSTALL WELLBORE SEAL BEFORE WELLHEAD ASSEMBLY.
4. USE ONLY "IPS WELD-ON 795" PLASTIC PIPE CEMENT OR EQUAL FOR FLEXIBLE HOSE TO PIPE CONNECTIONS. USE OF OTHER UNAPPROVED CEMENTS MAY RESULT IN PREMATURE JOINT FAILURE.
5. WARNING: DO NOT CUT THE FLOW MEASURING TUBE ASSEMBLY. FAILURE TO HEED THIS WARNING WILL RESULT IN A DAMAGED OR INOPERATIVE WELLHEAD AND VOID THE WARRANTY.
6. WELLHEAD TO BE INSTALLED AT WELLS AND HORIZONTAL COLLECTORS WHERE WELLS AND HORIZONTAL COLLECTORS ARE UPSLOPE OF HEADER PIPELINE. WELLHEAD TO BE INSTALLED AT HEADER PIPELINE WHERE HEADER IS ABOVE WELL OR HORIZONTAL COLLECTOR.

3/22 LANDFILL GAS WELLHEAD

NOT TO SCALE

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STATE OF NEW YORK · AMY J. KNIGHT · 070341 · LICENSED PROFESSIONAL ENGINEER

11/21/22

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering,
Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

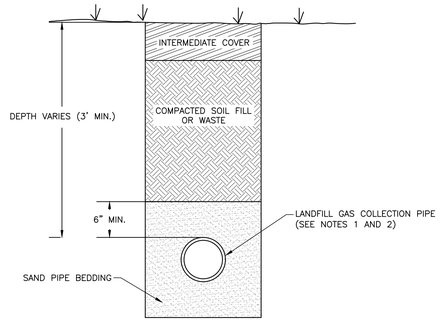
LANDFILL GAS COLLECTION
SYSTEM DETAILS
(SHEET 1 OF 2)

DATE:	JANUARY 2022
DRAWN BY:	TLG
DWG SCALE:	AS SHOWN
CHECKED BY:	EMW
PROJECT NO:	182-442
APPROVED BY:	AJK

DRAWING NO.: C808

SHEET 22 OF 23

p:\2018\182-442\-0400\dwg\sw18-permit modification drawings\182442-SW18-C808-Landfill Gas Collection Details.dwg(C808) LS:(1/13/2022 - wellbore) - LP: 1/13/2022 12:43 PM

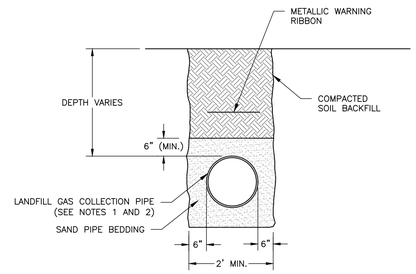


NOTES:

1. SLOPE OF PIPE IN ALL AREAS WITHIN THE LIMIT OF WASTE SHALL BE 5% MINIMUM.
2. PIPE SIZE VARIES. REFER TO SHEET C300 FOR SIZE AND ALIGNMENT OF PIPES.
3. PROVIDE MINIMUM 6" BEDDING SAND BELOW PIPES.
4. ALL DISTURBED AREAS OUTSIDE THE LIMIT OF WASTE SHALL BE LOAMED AND SEEDED.

1/23 LANDFILL GAS PIPE TRENCH (ON LANDFILL AREA)

NOT TO SCALE

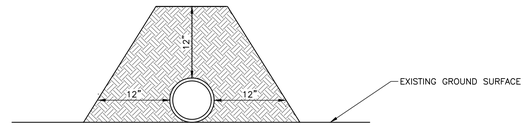


NOTE:

1. SLOPE OF PIPE IN ALL OFF LANDFILL AREAS SHALL BE 2% MINIMUM.
2. PIPE SIZE VARIES. REFER TO SHEET C300 FOR SIZE AND ALIGNMENT OF PIPES.
3. PROVIDE MINIMUM 6" BEDDING SAND BELOW PIPES.
4. ALL DISTURBED AREAS OUTSIDE THE LIMIT OF WASTE SHALL BE LOAMED AND SEEDED.

2/23 LANDFILL GAS PIPE TRENCH (OFF LANDFILL AREA)

NOT TO SCALE

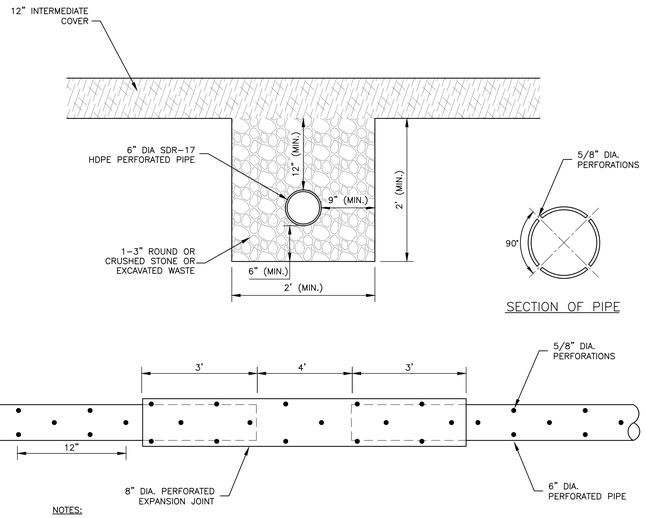


NOTES:

1. PIPE SIZE VARIES. REFER TO SHEET C300 FOR SIZE AND ALIGNMENT OF PIPES.
2. CONTRACTOR SHALL PLACE SOIL MOUND AT 50 FT INTERVALS ALONG THE PROPOSED GAS HEADER PIPE. SOIL DIMENSIONS APPROXIMATELY 12 INCHES ABOVE AND 12 INCHES ON EITHER SIDE OF THE PIPE.

3/23 ABOVE GROUND LANDFILL GAS PIPE

NOT TO SCALE

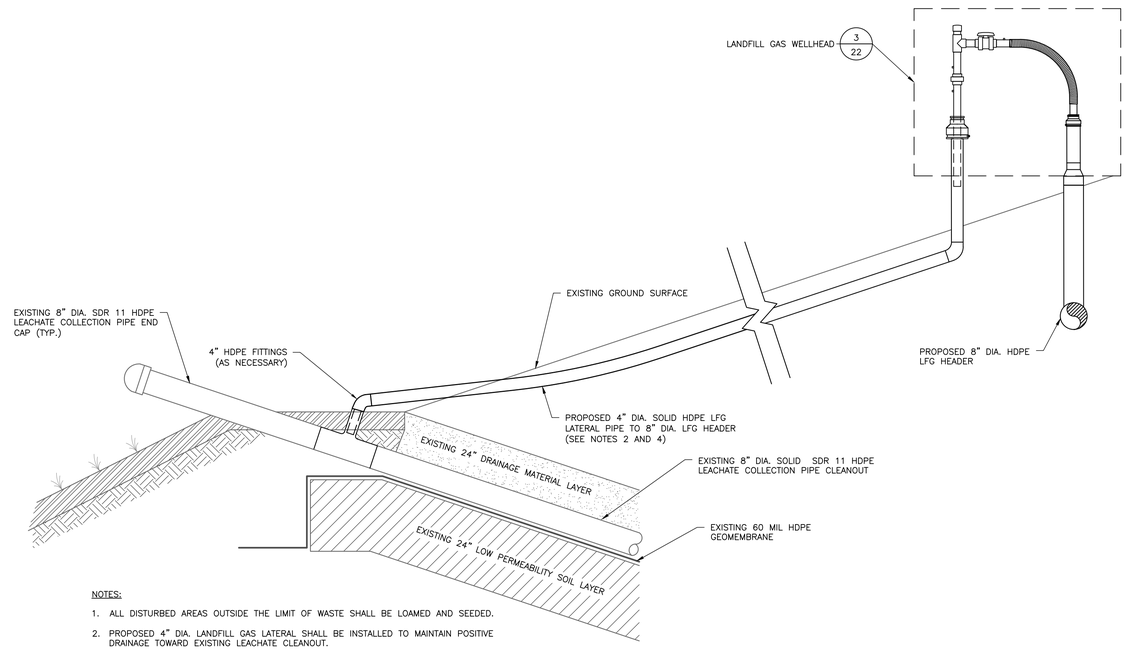


NOTES:

1. 1. PERFORATIONS TO BE STAGGERED AS SHOWN TO MAXIMIZE PIPE STRENGTH (12 HOLES PER FOOT OF PIPE).
2. 2. EXPANSION JOINT TO BE PLACED APPROXIMATELY EVERY 200 FEET OF PIPE.
3. HORIZONTAL COLLECTOR LOCATIONS WILL BE BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION AND THE OWNER'S DISCRETION.
4. ALTERNATIVELY 6" SLOTTED ADS PIPE MAY BE USED FOR HORIZONTAL COLLECTOR.

4/23 HORIZONTAL COLLECTOR TRENCH SECTION VIEW

NOT TO SCALE



NOTES:

1. ALL DISTURBED AREAS OUTSIDE THE LIMIT OF WASTE SHALL BE LOAMED AND SEEDED.
2. PROPOSED 4" DIA. LANDFILL GAS LATERAL SHALL BE INSTALLED TO MAINTAIN POSITIVE DRAINAGE TOWARD EXISTING LEACHATE CLEANOUT.
3. PROVIDE MINIMUM 6" BEDDING SAND BELOW PIPES.
4. PIPING MAY BE INSTALLED ABOVE OR BELOW EXISTING GROUND SURFACE. REFER TO DETAILS 1,2 AND 4 ON SHEET C808.

5/23 LEACHATE COLLECTION PIPE CLEANOUT WELLHEAD MODIFICATION

SCALE: 1"=2'

UNAUTHORIZED ALTERATION OR ADDITION TO THIS PLAN BEARING A LICENSED PROFESSIONAL'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

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STATE OF NEW YORK · AMY J. KNIGHT · 076341 · LICENSED PROFESSIONAL ENGINEER

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Engineering, Landscape Architecture and Land Surveying, PLLC
31 Bellows Road
Raynham, MA 02767

MSE BERM MODIFICATION
DUNN MINE AND C&D FACILITY
S.A.DUNN & COMPANY, LLC
RENSSELAER, NEW YORK

LANDFILL GAS COLLECTION SYSTEM DETAILS (SHEET 2 OF 2)

DATE: JANUARY 2022	DRAWN BY: TLG
DWG SCALE: AS SHOWN	CHECKED BY: EMW
PROJECT NO: 182-442	
APPROVED BY: AJK	

DRAWING NO.: C809

SHEET 23 OF 23

p:\2018\182-442\-CADD\dwg\w-fd-permit modification drawings\182442-SW16-C809-Landfill Gas Collection Details II.dwg(C809) LS(1/13/2022 - wellbum) - LP: 1/13/2022 12:43 PM

Attachment B.1

Static Slope Stability Output

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:06.78s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.592420
Axis Location:	83.082, 333.716
Left Slip Surface Endpoint:	75.213, 266.004
Right Slip Surface Endpoint:	132.530, 286.794
Resisting Moment:	2.6389e+06 lb-ft
Driving Moment:	1.65716e+06 lb-ft
Resisting Horizontal Force:	34358.5 lb
Driving Horizontal Force:	21576.2 lb
Active Support Moment:	-3066.38 lb-ft
Active Horizontal Support Force:	-48.7186 lb
Maximum Single Support Force:	49.8791 lb
Total Support Force:	49.9846 lb
Total Slice Area:	487.839 ft2
Surface Horizontal Width:	57.3166 ft
Surface Average Height:	8.5113 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
75.2134	266.004
76.9957	264.992
79.6233	263.933
82.251	263.499
85.0226	263.385
87.7942	263.86
90.4126	264.258
93.0311	264.692
96.1451	265.373
99.2591	266.067
102.002	266.835
104.746	267.614
106.574	268.379
108.403	269.093
110.232	269.916
112.061	271.165
113.89	272.545
115.719	273.875
117.547	275.141
119.376	276.343
121.589	277.721
123.173	278.651
124.728	279.511
126.263	280.305
127.769	281.033
129.169	282.643
130.285	283.915
131.401	285.24
132.53	286.794

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 2

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
107.77, 281	20	19.9321	0.0679296	19.9321	0.0679296	49.8791
110.357, 284	20	19.9998	0.000232673	19.9998	0.000232673	0.105508

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	4291
Number of Invalid Surfaces:	14717

Error Codes

Error Code -105 reported for 2020 surfaces
Error Code -108 reported for 7 surfaces
Error Code -110 reported for 202 surfaces
Error Code -111 reported for 138 surfaces
Error Code -113 reported for 12350 surfaces

Error Code Descriptions

The following errors were encountered during the computation:
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.59242

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.891152	31.9389	-29.5911	Subgrade	0	30	16.7976	26.7489	46.3304	0	46.3304	36.7915	36.7915
2	0.891152	95.8167	-29.5911	Subgrade	0	30	52.2208	83.1575	144.033	0	144.033	114.378	114.378
3	1.31383	240.698	-21.9499	Subgrade	0	30	85.2708	135.787	235.19	0	235.19	200.825	200.825
4	1.31383	373.421	-21.9499	Subgrade	0	30	138.145	219.985	381.026	0	381.026	325.352	325.352
5	1.31383	533.88	-9.38316	Subgrade	0	30	177.788	283.113	490.365	0	490.365	460.986	460.986
6	1.31383	670.907	-9.38316	Subgrade	0	30	228.823	364.383	631.13	0	631.13	593.318	593.318
7	1.38579	841.821	-2.34613	Subgrade	0	30	257.752	410.45	710.92	0	710.92	700.359	700.359
8	1.38579	965.629	-2.34613	Subgrade	0	30	300.576	478.643	829.036	0	829.036	816.721	816.721
9	1.38579	1065	9.71269	Subgrade	0	30	293.251	466.979	808.833	0	808.833	859.026	859.026
10	1.38579	1139.92	9.71269	Subgrade	0	30	314.816	501.32	868.309	0	868.309	922.193	922.193
11	1.30923	1147.72	8.65575	Subgrade	0	30	340.605	542.387	939.44	0	939.44	991.291	991.291
12	1.30923	1218.48	8.65575	Subgrade	0	30	362.51	577.268	999.857	0	999.857	1055.04	1055.04
13	1.30923	1287.87	9.40708	Subgrade	0	30	380.104	605.286	1048.38	0	1048.38	1111.36	1111.36
14	1.30923	1355.87	9.40708	Subgrade	0	30	400.352	637.529	1104.23	0	1104.23	1170.56	1170.56
15	1.038	1119.88	12.3387	Subgrade	0	30	400.78	638.21	1105.41	0	1105.41	1193.08	1193.08
16	1.038	1155.76	12.3387	Subgrade	0	30	412.764	657.294	1138.47	0	1138.47	1228.75	1228.75
17	1.038	1191.65	12.3387	Subgrade	0	30	424.531	676.031	1170.92	0	1170.92	1263.78	1263.78
18	1.038	1227.27	12.5565	Subgrade	0	30	434.639	692.128	1198.8	0	1198.8	1295.61	1295.61
19	1.038	1262.64	12.5565	Subgrade	0	30	445.675	709.702	1229.24	0	1229.24	1328.51	1328.51
20	1.038	1298.01	12.5565	Subgrade	0	30	456.453	726.865	1258.97	0	1258.97	1360.63	1360.63
21	1.37162	1762.96	15.6516	Subgrade	0	30	446.591	711.16	1231.77	0	1231.77	1356.89	1356.89
22	1.37162	1811.75	15.6516	Subgrade	0	30	455.915	726.008	1257.48	0	1257.48	1385.22	1385.22
23	1.17104	1585.11	15.845	Subgrade	0	30	462.922	737.167	1276.81	0	1276.81	1408.2	1408.2
24	1.17104	1620.07	15.845	Subgrade	0	30	470.229	748.802	1296.96	0	1296.96	1430.42	1430.42
25	0.401168	563.034	15.845	New Fill	100	30	541.407	862.147	1320.08	0	1320.08	1473.74	1473.74
26	0.914418	1291.96	22.6998	New Fill	100	30	495.622	789.238	1193.79	0	1193.79	1401.11	1401.11
27	0.914418	1303.84	22.6998	New Fill	100	30	497.505	792.237	1198.99	0	1198.99	1407.09	1407.09
28	0.914417	1328.04	21.3305	New Fill	100	30	512.668	816.382	1240.81	0	1240.81	1441.01	1441.01
29	0.914417	1346.42	21.3305	New Fill	100	30	516.763	822.904	1252.11	0	1252.11	1453.9	1453.9
30	0.914418	1361.79	24.2173	New Fill	100	30	500.768	797.433	1207.99	0	1207.99	1433.23	1433.23
31	0.914418	1439.13	24.2173	New Fill	100	30	524.486	835.202	1273.41	0	1273.41	1509.31	1509.31
32	0.914421	1585.03	34.3451	New Fill	100	30	500.2	796.529	1206.43	0	1206.43	1548.22	1548.22
33	0.914421	1717.29	34.3451	New Fill	100	30	547.702	872.172	1337.44	0	1337.44	1711.69	1711.69
34	1.82884	3358.76	37.025	New Fill	100	30	573.174	912.733	1407.69	0	1407.69	1840	1840
35	0.914421	1564.4	36.0269	New Fill	100	30	550.914	877.287	1346.3	0	1346.3	1746.95	1746.95
36	0.914421	1489.55	36.0269	New Fill	100	30	531.517	846.399	1292.8	0	1292.8	1679.35	1679.35
37	0.91442	1416.46	34.6964	New Fill	100	30	521.483	830.42	1265.13	0	1265.13	1626.17	1626.17
38	0.91442	1345.11	34.6964	New Fill	100	30	502.699	800.508	1213.32	0	1213.32	1561.36	1561.36
39	0.91442	1275.52	33.3217	New Fill	100	30	492.575	784.387	1185.39	0	1185.39	1509.22	1509.22
40	0.91442	1207.68	33.3217	New Fill	100	30	474.284	755.259	1134.94	0	1134.94	1446.75	1446.75
41	1.10634	1373.02	31.9022	New Fill	100	30	462.064	735.8	1101.24	0	1101.24	1388.87	1388.87
42	1.10634	1278.84	31.9022	New Fill	100	30	440.409	701.316	1041.51	0	1041.51	1315.66	1315.66
43	1.58372	1672.02	30.4375	New Fill	100	30	421.217	670.755	988.576	0	988.576	1236.07	1236.07
44	1.55503	1469.25	28.9275	New Fill	100	30	397.641	633.211	923.547	0	923.547	1143.31	1143.31
45	1.53528	1292.88	27.3722	New Fill	100	30	374.556	596.451	859.876	0	859.876	1053.8	1053.8
46	1.50629	1125.77	25.7719	New Fill	100	30	350.916	558.805	794.675	0	794.675	964.102	964.102
47	1.39988	845.356	48.9957	New Fill	100	30	248.811	396.212	513.054	0	513.054	799.236	799.236
48	1.11605	477.765	48.7512	New Fill	100	30	210.882	335.812	408.437	0	408.437	648.912	648.912
49	1.11605	301.023	49.8934	New Fill	100	30	172.239	274.277	301.857	0	301.857	506.349	506.349
50	1.12871	106.645	54.0019	New Fill	100	30	124.477	198.22	170.122	0	170.122	341.462	341.462

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.59242

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	75.2134	266.004	0	0	0
2	76.1045	265.498	38.4153	0.847897	1.26442
3	76.9957	264.992	157.842	6.9594	2.52459
4	78.3095	264.462	394.403	30.1116	4.36591
5	79.6233	263.933	777.652	84.1478	6.17581
6	80.9372	263.716	1117.7	155.926	7.94186
7	82.251	263.499	1555.35	264.54	9.65272
8	83.6368	263.442	1952.91	393.268	11.3857
9	85.0226	263.385	2416.51	559.439	13.0347
10	86.4084	263.622	2631.05	684.87	14.5905
11	87.7942	263.86	2861.36	822.921	16.0451
12	89.1034	264.059	3120.05	973.033	17.3208
13	90.4126	264.258	3395.38	1135.84	18.4964
14	91.7218	264.475	3665.62	1303	19.5685
15	93.0311	264.692	3950.26	1479.66	20.5346
16	94.0691	264.919	4115.28	1598.2	21.2241
17	95.1071	265.146	4285.23	1717.89	21.8452
18	96.1451	265.373	4460.03	1838.05	22.3973
19	97.1831	265.604	4634.03	1955.63	22.8805
20	98.2211	265.835	4812.45	2071.98	23.2941
21	99.2591	266.067	4995.18	2186.31	23.6382
22	100.631	266.451	5134.38	2284.49	23.9862
23	102.002	266.835	5276.48	2372.74	24.2126
24	103.173	267.168	5394.21	2436.69	24.3098
25	104.344	267.5	5513.81	2491.7	24.3183
26	104.746	267.614	5580.7	2519.88	24.3008
27	105.66	267.996	5577.27	2509.12	24.2222
28	106.574	268.379	5573.58	2491.96	24.0895
29	107.489	268.736	5599.31	2481.6	23.9028
30	108.403	269.093	5624.75	2464.66	23.6621
31	109.318	269.504	5585.83	2413.43	23.3674
32	110.232	269.916	5541.69	2354.44	23.0187
33	111.146	270.54	5245.27	2185.13	22.6161
34	112.061	271.165	4910.43	1999.89	22.1598
35	113.89	272.545	4016.92	1548.92	21.0866
36	114.804	273.21	3625.37	1353.33	20.4703
37	115.719	273.875	3251.66	1170.77	19.8016
38	116.633	274.508	2927.58	1012.67	19.0809
39	117.547	275.141	2619.12	866.642	18.3089
40	118.462	275.742	2356.93	742.538	17.4868
41	119.376	276.343	2108.35	629.146	16.6155
42	120.483	277.032	1861.14	516.055	15.4976
43	121.589	277.721	1631.1	416.147	14.3127
44	123.173	278.651	1378.26	305.725	12.5068
45	124.728	279.511	1202.91	225.524	10.6187
46	126.263	280.305	1094.47	166.628	8.65654
47	127.769	281.033	1093.74	127.557	6.65205
48	129.169	282.643	615.956	51.0028	4.73345
49	130.285	283.915	331.507	18.3918	3.17548
50	131.401	285.24	123.857	3.46168	1.60094
51	132.53	286.794	0	0	0

Entity Information

Water Table

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Distributed Load

X	Y
111.928	287.179
134.411	286.759

External Boundary

X	Y
143.248	286.168
140.418	284.756
138.415	284.757
135.724	286.103
134.411	286.759
111.928	287.179
109.368	282
106.63	280.43
106.051	280
83.8859	269
80.8634	267.5
80.7629	267.45
78.5343	266.344
72.2699	265.703
69.1878	266.011
55.3832	266.113
39.6389	266.039
20.6674	267.5
0	267.5
0	200
387.211	200
387.211	203.083
387.211	207.083
387.211	305.134
387.211	309.134
312.913	305.426
260.546	302.181
225.955	300.037
204.31	296.629
180.448	292.499
157.775	288
149.576	286.66
149.047	286.66
144.422	286.754

Material Boundary

X	Y
244.663	295.699
244.694	295.711

Material Boundary

X	Y
148.682	282.579
173.428	274.332
387.211	203.083

Material Boundary

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Material Boundary

X	Y
145.765	281.982
145.982	281.982
148.682	282.579
155.895	284.175
164.141	286
204.211	292.612
231.729	297.374
250.636	298.317
387.211	305.134

Material Boundary

X	Y
145.765	281.982
145.765	285.982

Material Boundary

X	Y
80.5109	265.57
89.0341	266.75
94.3815	266.427
101.894	266.956
104.526	267.047
107.788	267.13
113.663	267.281
116.659	267.5
117.909	267.591
123.92	268.031
127.297	268.278
135.426	269.186
144.588	269.691
150.755	270.65
156.308	271.514
163.814	272.652
168.855	273.338
173.428	274.332
180.694	275.91
181.831	276.157
186.389	277.148
193.556	279.072
202.952	281.64
216.413	285.317
231.672	290.925
250.636	298.317
260.546	302.181

Material Boundary

X	Y
0	267.5
72.8134	264.477
80.5109	265.57
80.7629	267.45

Material Boundary

X	Y
80.8634	267.5
116.659	267.5

Material Boundary

X	Y
145.765	285.982
146.969	286.2

Material Boundary

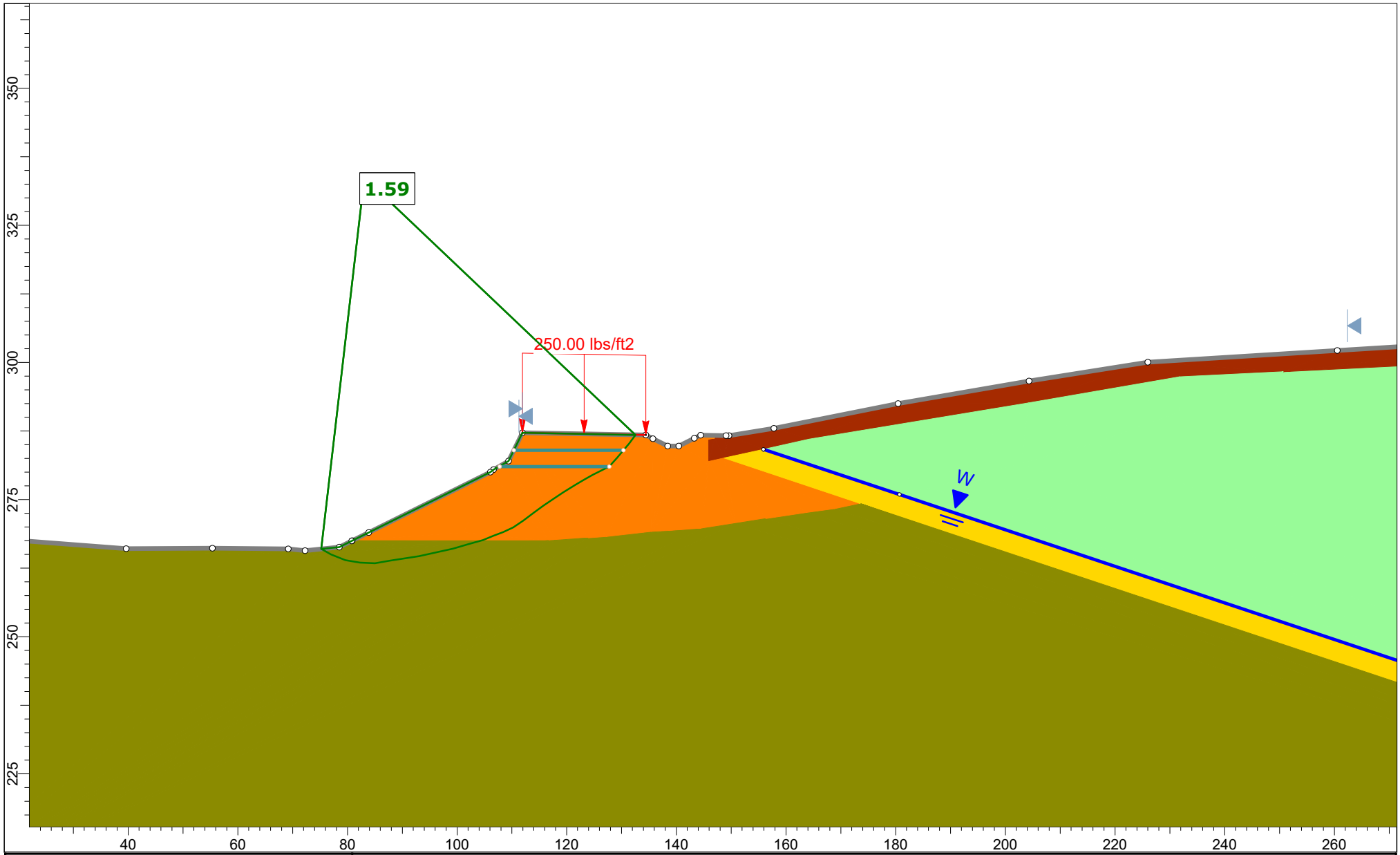
X	Y
83.8859	269
101.238	269

Material Boundary

X	Y
106.63	280.43
109.37	281.8
112.37	285.9
135.724	286.103

Material Boundary

X	Y
143.248	286.168
146.969	286.2
149.047	286.66



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 00+27 Static

Scale: 1:290

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 00+27 Static.slim

Slide Analysis Information

Project Summary

File Name:	Station 00+27 Seismic.slim
Last saved with Slide version:	9.009

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Entity Information

Water Table

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Distributed Load

X	Y
111.928	287.179
134.411	286.759

Bolt

X	Y
107.77	281
127.77	281

Bolt

X	Y
110.357	284
130.357	284

External Boundary

X	Y
143.248	286.168
140.418	284.756
138.415	284.757
135.724	286.103
134.411	286.759
111.928	287.179
109.368	282
106.63	280.43
106.051	280
83.8859	269
80.8634	267.5
80.7629	267.45
78.5343	266.344
72.2699	265.703
69.1878	266.011
55.3832	266.113
39.6389	266.039
20.6674	267.5
0	267.5
0	200
387.211	200
387.211	203.083
387.211	207.083
387.211	305.134
387.211	309.134
262.404	302.905
231.729	301.374
204.31	296.629
180.448	292.499
157.775	288
149.576	286.66
149.047	286.66
144.422	286.754

Material Boundary

X	Y
244.663	295.699
244.694	295.711

Material Boundary

X	Y
148.682	282.579
173.428	274.332
387.211	203.083

Material Boundary

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Material Boundary

X	Y
145.765	281.982
145.982	281.982
148.682	282.579
155.895	284.175
164.141	286
204.211	292.612
231.729	297.374
250.636	298.317
387.211	305.134

Material Boundary

X	Y
145.765	281.982
145.765	285.982

Material Boundary

X	Y
80.5109	265.57
89.0341	266.75
94.3815	266.427
101.894	266.956
104.526	267.047
107.788	267.13
113.663	267.281
116.659	267.5
117.909	267.591
123.92	268.031
127.297	268.278
135.426	269.186
144.588	269.691
150.755	270.65
156.308	271.514
163.814	272.652
168.855	273.338
173.428	274.332
180.694	275.91
181.831	276.157
186.389	277.148
193.556	279.072
202.952	281.64
216.413	285.317
231.672	290.925
250.636	298.317
262.404	302.905

Material Boundary

X	Y
0	267.5
72.8134	264.477
80.5109	265.57
80.7629	267.45

Material Boundary

X	Y
80.8634	267.5
116.659	267.5

Material Boundary

X	Y
145.765	285.982
146.969	286.2

Material Boundary

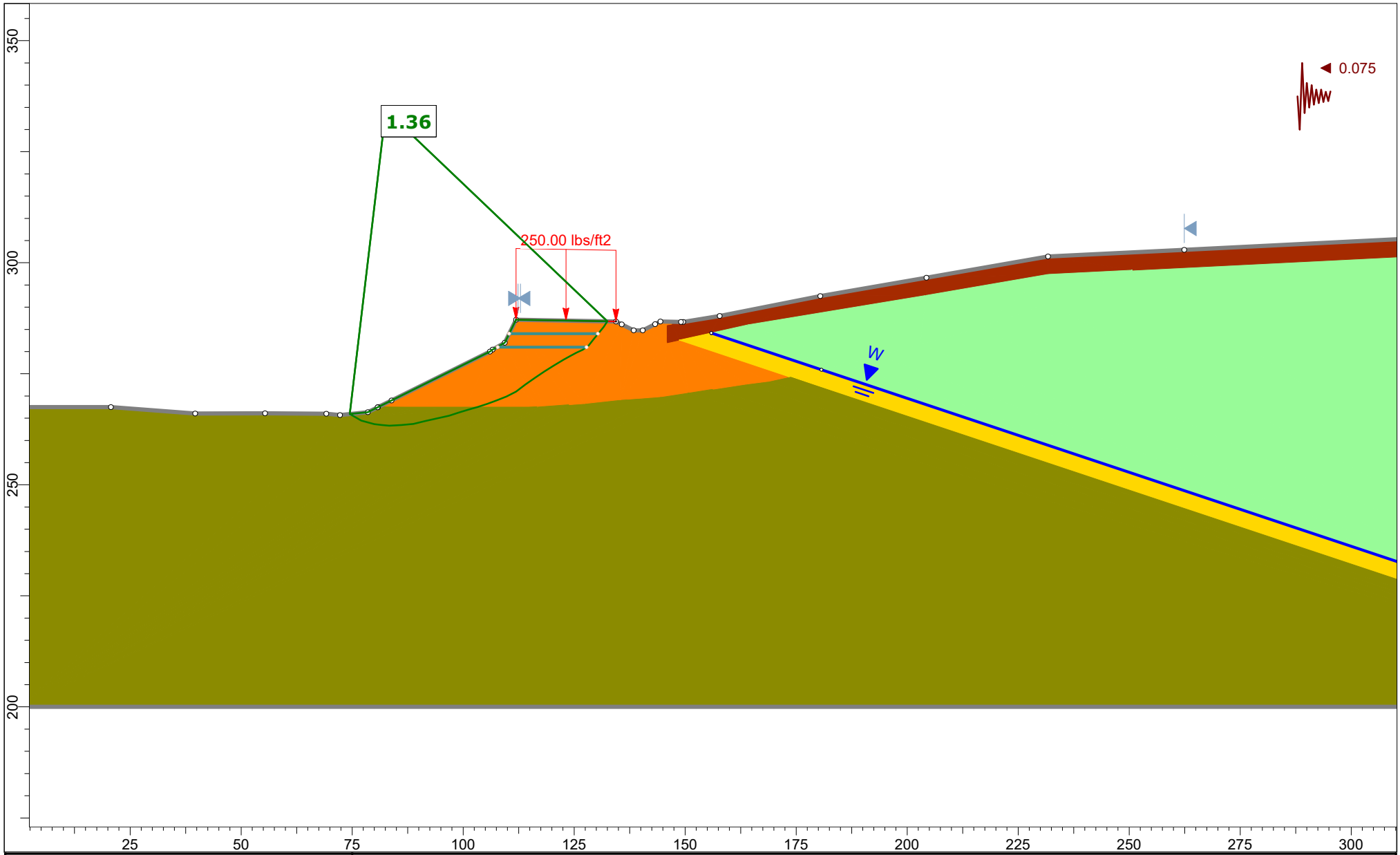
X	Y
83.8859	269
101.238	269

Material Boundary

X	Y
106.63	280.43
109.37	281.8
112.37	285.9
135.724	286.103

Material Boundary

X	Y
143.248	286.168
146.969	286.2
149.047	286.66



Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 00+27 Seismic

Scale: 1:359

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 00+27 Seismic.slim

SLIDEINTERPRET 9.009

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:08.253s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.528490
Axis Location:	84.446, 331.140
Left Slip Surface Endpoint:	78.221, 264.976
Right Slip Surface Endpoint:	133.642, 286.462
Resisting Moment:	2.77936e+06 lb-ft
Driving Moment:	1.81836e+06 lb-ft
Resisting Horizontal Force:	35897.1 lb
Driving Horizontal Force:	23485.3 lb
Active Support Moment:	-14.3591 lb-ft
Active Horizontal Support Force:	-0.201415 lb
Maximum Single Support Force:	0.218623 lb
Total Support Force:	0.218623 lb
Total Slice Area:	521.119 ft2
Surface Horizontal Width:	55.4204 ft
Surface Average Height:	9.40301 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
78.2212	264.976
80.3715	263.883
83.0974	262.952
85.8232	262.529
88.3153	262.545
90.8073	262.65
93.194	262.933
95.5807	263.231
98.4042	263.698
101.228	264.221
104.053	264.852
106.879	265.477
109.705	266.547
111.118	267.233
112.531	268.062
114.415	269.43
116.299	270.734
118.183	271.972
120.067	273.146
121.951	274.288
123.805	275.451
125.201	276.279
126.565	277.092
127.914	278.478
129.161	280.047
130.281	281.654
131.401	283.265
132.521	284.864
133.642	286.462

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 3

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
107.449, 278	20	19.9998	0.000222265	19.9998	0.000222265	0.218623
109.723, 281	20	Not Effective	Not Effective	Not Effective	Not Effective	0
111.223, 284	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	4098
Number of Invalid Surfaces:	14910

Error Codes

Error Code -105 reported for 1804 surfaces
Error Code -108 reported for 10 surfaces
Error Code -110 reported for 210 surfaces
Error Code -111 reported for 202 surfaces
Error Code -113 reported for 12657 surfaces
Error Code -123 reported for 8 surfaces
Error Code -1000 reported for 19 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

-1000 = No valid slip surface is generated

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.52849

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.07515	44.9839	-26.9522	Subgrade	0	30	20.2006	30.8764	53.4795	0	53.4795	43.208	43.208
2	1.07515	134.952	-26.9522	Subgrade	0	30	63.3228	96.7882	167.642	0	167.642	135.444	135.444
3	1.36294	281.767	-18.8496	Subgrade	0	30	99.7978	152.54	264.207	0	264.207	230.137	230.137
4	1.36294	400.077	-18.8496	Subgrade	0	30	148.462	226.923	393.043	0	393.043	342.358	342.358
5	0.908621	355.281	-8.82335	Subgrade	0	30	181.365	277.215	480.15	0	480.15	451.997	451.997
6	0.908621	419.827	-8.82335	Subgrade	0	30	218.066	333.311	577.311	0	577.311	543.462	543.462
7	0.908621	484.372	-8.82335	Subgrade	0	30	256.153	391.527	678.145	0	678.145	638.383	638.383
8	1.24603	754.132	0.364204	Subgrade	0	30	265.834	406.324	703.774	0	703.774	705.463	705.463
9	1.24603	845.41	0.364204	Subgrade	0	30	301.954	461.534	799.4	0	799.4	801.319	801.319
10	1.24603	933.347	2.41696	Subgrade	0	30	328.97	502.828	870.924	0	870.924	884.81	884.81
11	1.24603	1017.94	2.41696	Subgrade	0	30	362.277	553.737	959.102	0	959.102	974.394	974.394
12	1.19333	1047.71	6.74129	Subgrade	0	30	370.67	566.566	981.324	0	981.324	1025.14	1025.14
13	1.19333	1112.32	6.74129	Subgrade	0	30	394.985	603.73	1045.69	0	1045.69	1092.38	1092.38
14	1.19333	1176.35	7.1234	Subgrade	0	30	416.666	636.87	1103.09	0	1103.09	1155.17	1155.17
15	1.19333	1239.8	7.1234	Subgrade	0	30	439.834	672.282	1164.43	0	1164.43	1219.39	1219.39
16	0.941196	1020.45	9.3891	Subgrade	0	30	444.376	679.225	1176.45	0	1176.45	1249.93	1249.93
17	0.941196	1055.63	9.3891	Subgrade	0	30	459.124	701.766	1215.49	0	1215.49	1291.41	1291.41
18	0.941196	1090.81	9.3891	Subgrade	0	30	473.565	723.839	1253.72	0	1253.72	1332.03	1332.03
19	1.41179	1699.78	10.5034	Subgrade	0	30	482.228	737.08	1276.66	0	1276.66	1366.07	1366.07
20	1.41179	1774.13	10.5034	Subgrade	0	30	500.606	765.172	1325.32	0	1325.32	1418.13	1418.13
21	0.941821	1222.87	12.592	Subgrade	0	30	498.257	761.581	1319.09	0	1319.09	1430.4	1430.4
22	0.941821	1251.91	12.592	Subgrade	0	30	507.393	775.545	1343.28	0	1343.28	1456.62	1456.62
23	0.941821	1280.96	12.592	Subgrade	0	30	516.207	789.018	1366.62	0	1366.62	1481.93	1481.93
24	1.41273	1976.2	12.4579	Subgrade	0	30	527.918	806.917	1397.62	0	1397.62	1514.25	1514.25
25	1.41273	2042.15	12.4579	Subgrade	0	30	540.083	825.512	1429.83	0	1429.83	1549.14	1549.14
26	0.941977	1395.15	20.7452	New Fill	100	30	551.563	843.059	1287.01	0	1287.01	1495.93	1495.93
27	0.941977	1462.65	20.7452	New Fill	100	30	571.737	873.894	1340.43	0	1340.43	1556.98	1556.98
28	0.941977	1554.58	20.7452	New Fill	100	30	600.419	917.734	1416.35	0	1416.35	1643.77	1643.77
29	1.41296	2625.74	25.8987	New Fill	100	30	619.302	946.597	1466.35	0	1466.35	1767.05	1767.05
30	1.41296	2979.7	30.3959	New Fill	100	30	650.883	994.868	1549.95	0	1549.95	1931.76	1931.76
31	0.942083	2087.51	35.9931	New Fill	100	30	687.036	1050.13	1645.67	0	1645.67	2144.71	2144.71
32	0.942083	2009.62	35.9931	New Fill	100	30	673.859	1029.99	1610.79	0	1610.79	2100.25	2100.25
33	0.942083	1931.93	34.676	New Fill	100	30	665.07	1016.55	1587.52	0	1587.52	2047.62	2047.62
34	0.942083	1856.08	34.676	New Fill	100	30	644.324	984.843	1532.6	0	1532.6	1978.35	1978.35
35	0.942084	1782.06	33.3156	New Fill	100	30	635.801	971.816	1510.03	0	1510.03	1927.92	1927.92
36	0.942084	1709.88	33.3156	New Fill	100	30	615.869	941.35	1457.26	0	1457.26	1862.05	1862.05
37	0.942063	1639.51	31.9115	New Fill	100	30	607.382	928.378	1434.79	0	1434.79	1813.02	1813.02
38	0.942063	1571.02	31.9115	New Fill	100	30	588.095	898.897	1383.73	0	1383.73	1749.95	1749.95
39	0.942063	1503.4	31.2237	New Fill	100	30	573.902	877.204	1346.15	0	1346.15	1694.05	1694.05
40	0.942063	1436.67	31.2237	New Fill	100	30	554.945	848.228	1295.97	0	1295.97	1632.37	1632.37
41	0.926784	1347.15	32.115	New Fill	100	30	530.397	810.706	1230.98	0	1230.98	1563.89	1563.89
42	0.926784	1280.35	32.115	New Fill	100	30	511.571	781.931	1181.14	0	1181.14	1502.23	1502.23
43	1.39639	1807.02	30.6673	New Fill	100	30	496.341	758.652	1140.82	0	1140.82	1435.14	1435.14
44	1.36332	1625.38	30.807	New Fill	100	30	467.995	715.325	1065.77	0	1065.77	1344.83	1344.83
45	1.34924	1426.1	45.7692	New Fill	100	30	367.042	561.02	798.508	0	798.508	1175.54	1175.54
46	1.24666	1092.66	51.5342	New Fill	100	30	305.201	466.496	634.79	0	634.79	1018.95	1018.95
47	1.12026	765.179	55.1092	New Fill	100	30	252.77	386.357	495.985	0	495.985	858.446	858.446
48	1.12026	545.812	55.1934	New Fill	100	30	212.752	325.189	390.039	0	390.039	696.073	696.073
49	1.12026	326.965	54.9786	New Fill	100	30	171.367	261.932	280.475	0	280.475	525.017	525.017
50	1.12026	108.987	54.9779	New Fill	100	30	126.981	194.089	162.967	0	162.967	344.166	344.166

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.52849

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	78.2212	264.976	0	0	0
2	79.2963	264.43	50.955	1.47095	1.65353
3	80.3715	263.883	210.684	12.1413	3.29819
4	81.7344	263.418	469.637	44.0359	5.35672
5	83.0974	262.952	854.864	110.572	7.36998
6	84.006	262.811	1087.38	165.985	8.67902
7	84.9146	262.67	1366.94	239.96	9.95656
8	85.8232	262.529	1695.33	335.638	11.1985
9	87.0692	262.537	2021	460.534	12.837
10	88.3153	262.545	2390.91	613.591	14.3935
11	89.5613	262.598	2755.01	782.742	15.8607
12	90.8073	262.65	3155.97	978.919	17.2328
13	92.0007	262.791	3459.88	1154.54	18.4535
14	93.194	262.933	3783.73	1345.8	19.5795
15	94.3873	263.082	4116.45	1547.95	20.6083
16	95.5807	263.231	4467.66	1763.3	21.5382
17	96.5219	263.386	4702.82	1919.28	22.201
18	97.463	263.542	4945.78	2079.12	22.801
19	98.4042	263.698	5196.38	2242.01	23.3381
20	99.816	263.959	5543.02	2470.84	24.0253
21	101.228	264.221	5902.88	2698.81	24.57
22	102.17	264.432	6094.63	2823.13	24.8543
23	103.111	264.642	6289.9	2943.09	25.0752
24	104.053	264.852	6488.56	3057.84	25.2329
25	105.466	265.164	6798.16	3220.87	25.3509
26	106.879	265.477	7114.9	3367.24	25.3266
27	107.821	265.833	7175.26	3381.23	25.2314
28	108.763	266.19	7235.57	3385.22	25.0729
29	109.705	266.547	7295.8	3379.05	24.8512
30	111.118	267.233	7164.85	3250.09	24.3998
31	112.531	268.062	6799.85	2999.91	23.8058
32	113.473	268.746	6320.98	2726.23	23.3305
33	114.415	269.43	5853.57	2459.64	22.7919
34	115.357	270.082	5445.47	2221.17	22.1902
35	116.299	270.734	5053.62	1993.3	21.5258
36	117.241	271.353	4717.58	1791.93	20.7988
37	118.183	271.972	4395.45	1600.68	20.01
38	119.125	272.559	4125.93	1433.59	19.1602
39	120.067	273.146	3868.19	1275.57	18.2504
40	121.009	273.717	3640.1	1132.5	17.2818
41	121.951	274.288	3422.81	998.053	16.2561
42	122.878	274.869	3198.3	868.55	15.1932
43	123.805	275.451	2985.34	748.705	14.079
44	125.201	276.279	2733.78	596.534	12.3095
45	126.565	277.092	2505.41	463.688	10.4854
46	127.914	278.478	1894.14	286.383	8.59767
47	129.161	280.047	1278.51	152.271	6.79195
48	130.281	281.654	764.927	68.6503	5.12841
49	131.401	283.265	374.736	22.4967	3.43554
50	132.521	284.864	118.338	3.55929	1.72278
51	133.642	286.462	0	0	0

Entity Information

Water Table

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Distributed Load

X	Y
112.646	286.891
135.298	286.428

External Boundary

X	Y
144.4	285.97
141.305	284.426
139.194	284.485
136.355	285.9
135.298	286.428
112.646	286.891
112.055	285.69
111.223	284
109.723	281
109.221	280
107.449	278
83.1301	265.931
82.3807	265.559
81.788	265.476
73.867	264.366
72.8134	264.477
69.8711	264.611
67.7057	264.587
64.5131	264.545
60.7151	264.494
55.8371	264.505
53.4833	264.141
40.0729	264.756
33.4287	264.519
30.4559	264.094
28.6735	263.839
27.3257	263.666
24.7768	263.352
23.3886	263.183
0	263.329
0	200
387.211	200
387.211	203.083
387.211	207.083
387.211	305.134
387.211	309.134
313.138	305.437
261.054	302.378
254.612	302
232.044	300
209.207	296.471
202.096	295.324
182.073	292
150.345	286.321
147.755	286.374
145.309	286.424

Material Boundary

X	Y
244.663	295.699
244.694	295.711

Material Boundary

X	Y
148.682	282.579
173.428	274.332
387.211	203.083

Material Boundary

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Material Boundary

X	Y
145.765	281.982
145.982	281.982
148.682	282.579
155.895	284.175
204.211	292.177
232.944	297.434
250.636	298.317
387.211	305.134

Material Boundary

X	Y
145.765	281.982
145.765	285.982

Material Boundary

X	Y
83.1301	265.931
89.0341	266.75
94.3815	266.427
101.894	266.956
104.526	267.047
107.788	267.13
113.663	267.281
117.909	267.591
122.267	267.91
127.297	268.278
135.426	269.186
144.588	269.691
150.755	270.65
156.308	271.514
163.814	272.652
168.855	273.338
173.428	274.332
180.694	275.91
181.831	276.157
186.389	277.148
193.556	279.072
202.952	281.64
216.413	285.317
231.672	290.925
250.636	298.317
261.054	302.378

Material Boundary

X	Y
81.788	265.476
106.965	265.476
120.801	265.476

Material Boundary

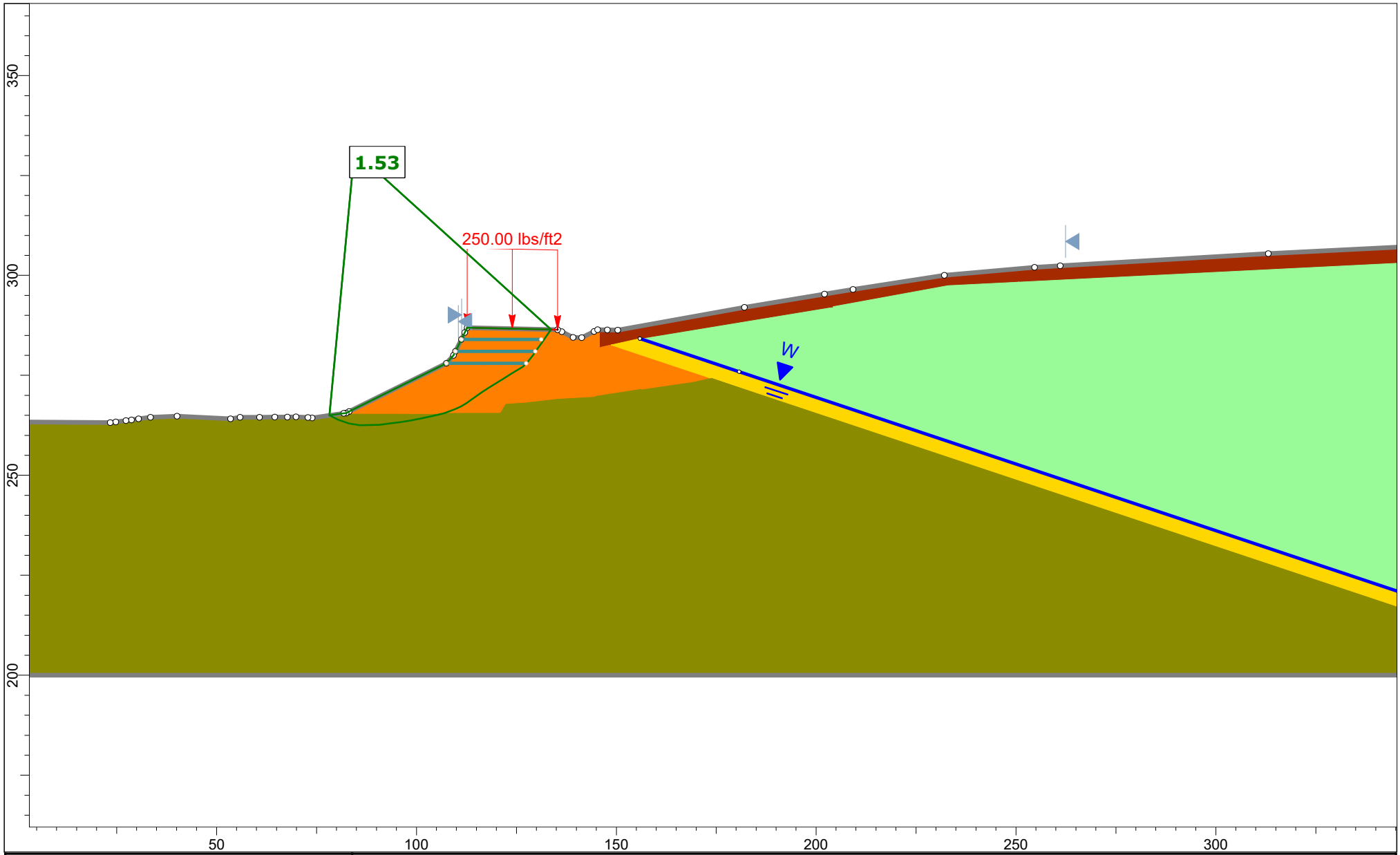
X	Y
120.801	265.476
122.267	267.91

Material Boundary

X	Y
112.055	285.69
136.355	285.9

Material Boundary

X	Y
144.4	285.97
145.765	285.982
145.982	285.982
147.755	286.374



CEC	Dunn Mine and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York	
	Station 00+60 Static	
	Scale: 1:398	PREPARED BY: Civil & Environmental Consultants, Inc.
SLIDEINTERPRET 9.009	Date: 5/17/2021	File Name: Station 00+60 Static.slim

Slide Analysis Information

Project Summary

File Name:	Station 00+60 Seismic.slim
Last saved with Slide version:	9.009

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Entity Information

Water Table

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Distributed Load

X	Y
112.646	286.891
135.298	286.428

Bolt

X	Y
107.449	278
127.449	278

Bolt

X	Y
109.723	281
129.723	281

Bolt

X	Y
111.223	284
131.223	284

External Boundary

X	Y
144.4	285.97
141.305	284.426
139.194	284.485
136.355	285.9
135.298	286.428
112.646	286.891
112.055	285.69
111.223	284
109.723	281
109.221	280
107.449	278
83.1301	265.931
82.3807	265.559
81.788	265.476
73.867	264.366
72.8134	264.477
69.8711	264.611
67.7057	264.587
64.5131	264.545
60.7151	264.494
55.8371	264.505
53.4833	264.141
40.0729	264.756
33.4287	264.519
30.4559	264.094
28.6735	263.839
27.3257	263.666
24.7768	263.352
23.3886	263.183
0	263.329
0	200
387.211	200
387.211	203.083
387.211	207.083
387.211	305.134
387.211	309.134
262.404	302.905
232.944	301.434
150.345	286.321
147.755	286.374
145.309	286.424

Material Boundary

X	Y
244.663	295.699
244.694	295.711

Material Boundary

X	Y
148.682	282.579
173.428	274.332
387.211	203.083

Material Boundary

X	Y
155.895	284.175
180.694	275.91
387.211	207.083

Material Boundary

X	Y
145.765	281.982
145.982	281.982
148.682	282.579
155.895	284.175
204.211	292.177
232.944	297.434
250.636	298.317
387.211	305.134

Material Boundary

X	Y
145.765	281.982
145.765	285.982

Material Boundary

X	Y
83.1301	265.931
89.0341	266.75
94.3815	266.427
101.894	266.956
104.526	267.047
107.788	267.13
113.663	267.281
117.909	267.591
122.267	267.91
127.297	268.278
135.426	269.186
144.588	269.691
150.755	270.65
156.308	271.514
163.814	272.652
168.855	273.338
173.428	274.332
180.694	275.91
181.831	276.157
186.389	277.148
193.556	279.072
202.952	281.64
216.413	285.317
231.672	290.925
250.636	298.317
262.404	302.905

Material Boundary

X	Y
81.788	265.476
106.965	265.476
120.801	265.476

Material Boundary

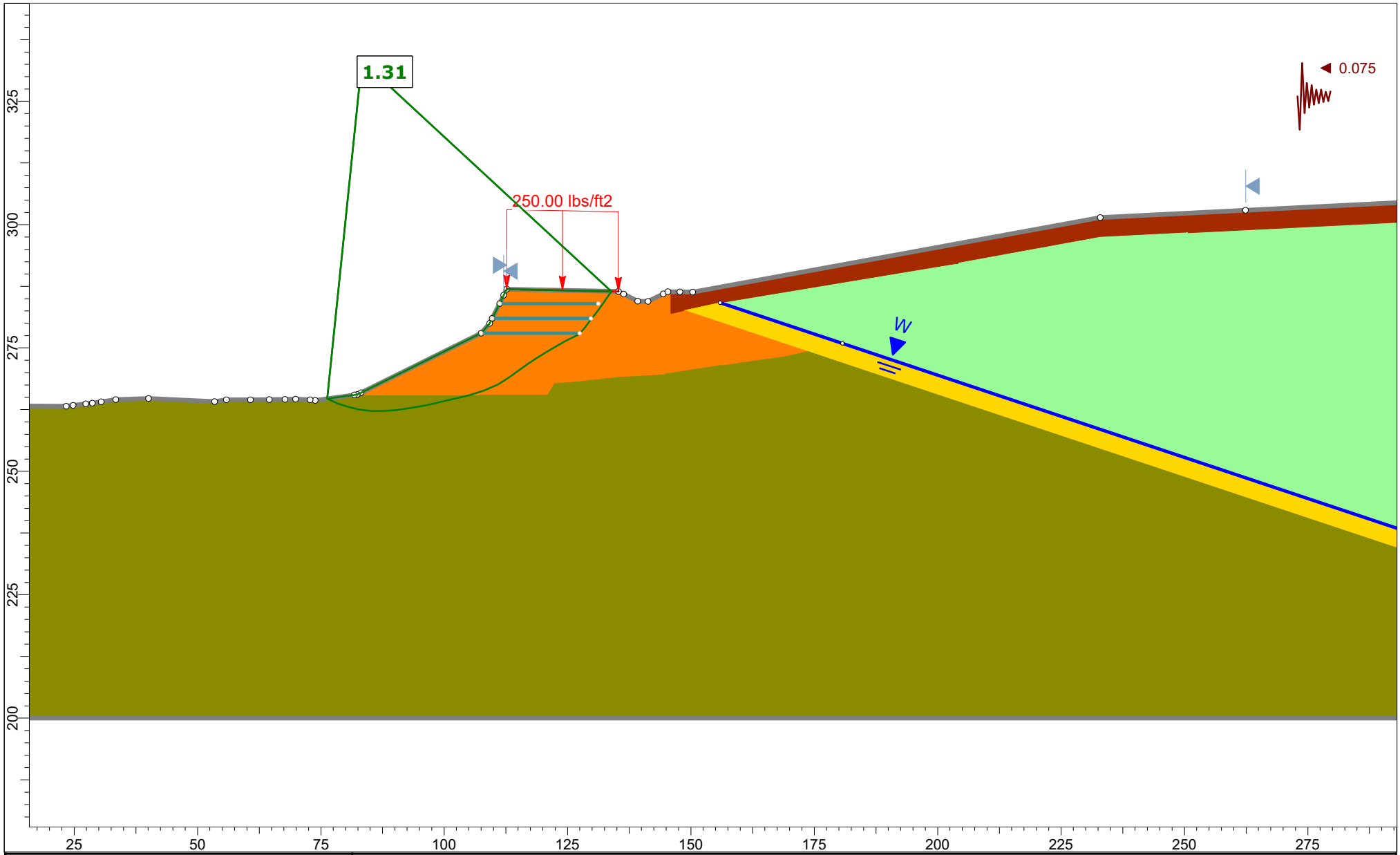
X	Y
120.801	265.476
122.267	267.91

Material Boundary

X	Y
112.055	285.69
136.355	285.9

Material Boundary

X	Y
144.4	285.97
145.765	285.982
145.982	285.982
147.755	286.374



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 00+60 Seismic

Scale: 1:323

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 00+60 Seismic.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:07.922s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	1
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.4
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.502760
Axis Location:	109.676, 326.072
Left Slip Surface Endpoint:	107.467, 261.402
Right Slip Surface Endpoint:	160.086, 285.503
Resisting Moment:	3.05342e+06 lb-ft
Driving Moment:	2.03187e+06 lb-ft
Resisting Horizontal Force:	38552.1 lb
Driving Horizontal Force:	25654.1 lb
Active Support Moment:	-252161 lb-ft
Active Horizontal Support Force:	-3761.48 lb
Maximum Single Support Force:	3900 lb
Total Support Force:	3900.22 lb
Total Slice Area:	586.948 ft2
Surface Horizontal Width:	52.6195 ft
Surface Average Height:	11.1546 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
107.467	261.402
109.234	260.479
111.002	259.781
112.769	259.203
114.537	258.906
116.318	258.694
118.12	258.537
120.831	258.647
123.542	258.872
126.292	259.205
129.33	259.7
131.973	260.385
134.616	261.526
137.259	263.25
138.581	264.172
139.903	265.093
142.546	266.845
145.19	268.504
147.833	270.071
150.248	271.417
151.455	272.541
152.771	274.317
154.085	276.046
155.391	277.726
156.566	279.487
157.741	281.206
158.916	283.303
160.086	285.503

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 6

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
126.435, 268.996	40	19.5857	20.4143	19.5857	20.4143	3900

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
129.874, 272	21	20.9999	0.000148273	20.9999	0.000148273	0.215617
131.376, 275	21	Not Effective	Not Effective	Not Effective	Not Effective	0
132.876, 278	21	Not Effective	Not Effective	Not Effective	Not Effective	0
134.379, 281	21	Not Effective	Not Effective	Not Effective	Not Effective	0
135.883, 284.004	21	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	4387
Number of Invalid Surfaces:	14622

Error Codes

Error Code -105 reported for 1530 surfaces
Error Code -108 reported for 8 surfaces
Error Code -110 reported for 161 surfaces
Error Code -111 reported for 203 surfaces
Error Code -113 reported for 12660 surfaces
Error Code -123 reported for 60 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.50276

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.304344	3.63615	-27.5843	New Fill	100	30	89.5856	134.626	59.9737	0	59.9737	13.1707	13.1707
2	1.46305	118.989	-27.5843	Subgrade	0	30	42.5066	63.8772	110.638	0	110.638	88.4312	88.4312
3	0.883728	147.3	-21.5365	Subgrade	0	30	85.0741	127.846	221.435	0	221.435	187.861	187.861
4	0.883728	196.64	-21.5365	Subgrade	0	30	118.414	177.948	308.215	0	308.215	261.483	261.483
5	0.883814	242.848	-18.1212	Subgrade	0	30	145.746	219.022	379.356	0	379.356	331.659	331.659
6	0.883814	288.096	-18.1212	Subgrade	0	30	179.582	269.869	467.427	0	467.427	408.657	408.657
7	0.883814	350.818	-9.5362	Subgrade	0	30	200.725	301.641	522.458	0	522.458	488.738	488.738
8	0.883814	413.062	-9.5362	Subgrade	0	30	241.247	362.536	627.931	0	627.931	587.404	587.404
9	0.890487	476.816	-6.80301	Subgrade	0	30	271.955	408.683	707.859	0	707.859	675.416	675.416
10	0.890487	535.37	-6.80301	Subgrade	0	30	311.148	467.581	809.873	0	809.873	772.754	772.754
11	0.901314	599.911	-4.94775	Subgrade	0	30	341.489	513.176	888.846	0	888.846	859.283	859.283
12	0.901314	656.708	-4.94775	Subgrade	0	30	379.995	571.041	989.073	0	989.073	956.177	956.177
13	0.903558	709.132	2.31483	Subgrade	0	30	372.508	559.79	969.584	0	969.584	984.642	984.642
14	0.903558	753.77	2.31483	Subgrade	0	30	398.932	599.499	1038.36	0	1038.36	1054.49	1054.49
15	0.903558	798.409	2.31483	Subgrade	0	30	425.445	639.342	1107.37	0	1107.37	1124.57	1124.57
16	0.903558	840.962	4.74369	Subgrade	0	30	433.912	652.065	1129.4	0	1129.4	1165.41	1165.41
17	0.903558	881.431	4.74369	Subgrade	0	30	456.245	685.626	1187.54	0	1187.54	1225.4	1225.4
18	0.903558	921.9	4.74369	Subgrade	0	30	478.313	718.79	1244.98	0	1244.98	1284.67	1284.67
19	1.37525	1476.51	6.91025	Subgrade	0	30	486.128	730.534	1265.32	0	1265.32	1324.24	1324.24
20	1.37525	1561.58	6.91025	Subgrade	0	30	513.105	771.074	1335.54	0	1335.54	1397.72	1397.72
21	1.01252	1201.52	9.25656	Subgrade	0	30	513.306	771.375	1336.06	0	1336.06	1419.72	1419.72
22	1.01252	1242.49	9.25656	Subgrade	0	30	528.028	793.499	1374.38	0	1374.38	1460.44	1460.44
23	1.01252	1325.23	9.25656	Subgrade	0	30	558.843	839.807	1454.59	0	1454.59	1545.67	1545.67
24	1.32145	1970.6	14.523	Subgrade	0	30	574.894	863.927	1496.36	0	1496.36	1645.29	1645.29
25	1.32145	2324.54	14.523	Subgrade	0	30	669.016	1005.37	1741.36	0	1741.36	1914.67	1914.67
26	0.881058	1744.24	23.3493	Subgrade	0	30	644.445	968.446	1677.4	0	1677.4	1955.6	1955.6
27	0.881058	1890.12	23.3493	Subgrade	0	30	693.551	1042.24	1805.23	0	1805.23	2104.62	2104.62
28	0.881058	2035.99	23.3493	Subgrade	0	30	742.78	1116.22	1933.35	0	1933.35	2253.99	2253.99
29	0.0788384	189.212	33.1051	Subgrade	0	30	655.441	984.971	1706.02	0	1706.02	2133.38	2133.38
30	1.28233	3218.51	33.1051	New Fill	100	30	748.203	1124.37	1774.26	0	1774.26	2262.1	2262.1
31	1.28233	3466.35	33.1051	New Fill	100	30	818.507	1230.02	1957.25	0	1957.25	2490.93	2490.93
32	1.32175	3530.29	34.8944	New Fill	100	30	832.269	1250.7	1993.06	0	1993.06	2573.54	2573.54
33	1.32175	3379.67	34.8944	New Fill	100	30	801.771	1204.87	1913.7	0	1913.7	2472.9	2472.9
34	1.32172	3232.65	33.5262	New Fill	100	30	789.581	1186.55	1881.96	0	1881.96	2405.09	2405.09
35	1.32172	3089.36	33.5262	New Fill	100	30	761.718	1144.68	1809.43	0	1809.43	2314.11	2314.11
36	0.881148	1981.59	32.1133	New Fill	100	30	755.091	1134.72	1792.19	0	1792.19	2266.1	2266.1
37	0.881148	1921.16	32.1133	New Fill	100	30	737.629	1108.48	1746.74	0	1746.74	2209.69	2209.69
38	0.881148	1860.73	32.1133	New Fill	100	30	720.443	1082.65	1702.01	0	1702.01	2154.17	2154.17
39	1.3217	2681.4	30.6553	New Fill	100	30	821.841	1235.03	1965.93	0	1965.93	2453.04	2453.04
40	1.3217	2552.75	30.6553	New Fill	100	30	663.445	996.999	1553.65	0	1553.65	1946.87	1946.87
41	1.2072	2222.26	29.1519	New Fill	100	30	650.747	977.916	1520.59	0	1520.59	1883.57	1883.57
42	1.2072	2121.04	29.1519	New Fill	100	30	626.797	941.926	1458.26	0	1458.26	1807.88	1807.88
43	1.20742	1987.57	42.9418	New Fill	100	30	502.437	755.042	1134.57	0	1134.57	1602.14	1602.14
44	1.31624	1933.54	53.4531	New Fill	100	30	400.283	601.53	868.676	0	868.676	1408.7	1408.7
45	1.31416	1649.78	52.7621	New Fill	100	30	369.056	554.603	787.394	0	787.394	1272.94	1272.94
46	1.30585	1367.89	52.1546	New Fill	100	30	335.707	504.487	700.594	0	700.594	1132.68	1132.68
47	1.17474	984.336	56.2851	New Fill	100	30	278.424	418.405	551.496	0	551.496	968.74	968.74
48	1.17474	735.58	55.6586	New Fill	100	30	241.262	362.559	454.766	0	454.766	807.894	807.894
49	1.17486	463.207	60.7302	New Fill	100	30	178.929	268.888	292.522	0	292.522	611.765	611.765
50	1.17057	156.281	61.9899	New Fill	100	30	122.878	184.656	146.628	0	146.628	377.629	377.629

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.50276

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	107.467	261.402	0	0	0
2	107.771	261.243	36.8007	0.372255	0.579552
3	109.234	260.479	183.557	10.7632	3.3558
4	110.118	260.13	335.967	29.4819	5.01499
5	111.002	259.781	548.106	63.9221	6.65199
6	111.885	259.492	786.643	114.199	8.26007
7	112.769	259.203	1080.56	187.28	9.83269
8	113.653	259.054	1335.53	268.416	11.364
9	114.537	258.906	1641.98	374.509	12.8484
10	115.427	258.8	1959.35	499.143	14.2921
11	116.318	258.694	2322.46	651.902	15.6791
12	117.219	258.616	2699.6	826.477	17.0219
13	118.12	258.537	3119.26	1031.59	18.2999
14	119.024	258.574	3420.43	1212.14	19.5134
15	119.928	258.611	3742.96	1411.16	20.6573
16	120.831	258.647	4086.93	1628.87	21.73
17	121.735	258.722	4394.31	1840.93	22.7305
18	122.638	258.797	4717.51	2066.73	23.6581
19	123.542	258.872	5056.35	2305.6	24.5121
20	124.917	259.039	5514	2650.26	25.6709
21	126.292	259.205	5997.05	3010.9	26.6596
22	127.305	259.37	6296.31	3246.89	27.2793
23	128.317	259.535	6604.15	3483.12	27.8078
24	129.33	259.7	6929.95	3722.91	28.2456
25	130.651	260.043	7177.42	3926.49	28.6814
26	131.973	260.385	7465.4	4132.09	28.9645
27	132.854	260.765	7395.2	4110.84	29.0688
28	133.735	261.146	7319.66	4075.02	29.1057
29	134.616	261.526	7238.76	4024.93	29.0751
30	134.695	261.577	7202.74	4003.91	29.0691
31	135.977	262.414	6678.72	3686.15	28.8954
32	137.259	263.25	6091.85	3318.41	28.5784
33	138.581	264.172	5354.54	2859.19	28.1011
34	139.903	265.093	4650.1	2417.57	27.4698
35	141.225	265.969	4045.68	2033.28	26.6832
36	142.546	266.845	3467.94	1672.02	25.7404
37	143.427	267.398	3142.15	1466.86	25.0247
38	144.309	267.951	2826.12	1272.42	24.239
39	145.19	268.504	2519.68	1089.49	23.3833
40	146.511	269.287	5827.12	2350.69	21.9694
41	147.833	270.071	5486.91	2040.61	20.4004
42	149.04	270.744	5248.59	1790.33	18.8349
43	150.248	271.417	5023.34	1549.89	17.147
44	151.455	272.541	4355.34	1194.92	15.342
45	152.771	274.317	3339.65	786.428	13.2507
46	154.085	276.046	2463.27	480.873	11.0462
47	155.391	277.726	1724.14	265.547	8.75573
48	156.566	279.487	1080.33	125.476	6.62499
49	157.741	281.206	581.809	45.209	4.44319
50	158.916	283.303	178.852	6.95312	2.22633
51	160.086	285.503	0	0	0

Entity Information

Water Table

X	Y
187.474	283.266
227.772	269.835
327.434	236.619

Distributed Load

X	Y
136.877	285.99
160.086	285.503

External Boundary

X	Y
272.187	300
245.655	296.295
234.935	294.797
188.252	287.541
175.079	285.419
170.051	285.522
167.164	284.082
166.046	283.524
164.044	283.525
162.418	284.337
160.086	285.503
136.877	285.99
136.42	285.077
136.296	284.829
133.656	279.555
129.874	272
128.459	270
112.451	262.059
111.026	261.872
104.405	260.999
100.389	260.505
97.6543	260.428
66.92	261.104
29.0118	265.324
-1.16415e-10	266.694
0	200
327.434	200
327.434	232.619
327.434	236.619
327.434	292.184
327.434	300.376
327.434	303.571
310.859	302.5

Material Boundary

X	Y
110.463	261.577
119.167	262.702
124.03	262.659
127.434	262.659
141.217	263.437
149.221	263.835
154.279	264.378
162.441	265.253
170.48	266.684
187.204	267.066
195.833	266.671
207.068	267.599
218.016	269.087
219.104	269.235
227.772	269.835
232.742	270.179
244.597	272.857
248.558	274.049
254.401	276.602
259.524	279.071
268.069	283.189
278.873	289.039
285.459	292.512
293.959	296.85
298.846	298.895
302.446	296.562
306.008	292.872
308.463	292.195
315.155	292.146
319.507	292.276
322.276	292.423
325.501	292.274
327.434	292.184

Material Boundary

X	Y
179.982	285.763
179.982	281.763
218.016	269.087
327.434	232.619

Material Boundary

X	Y
187.474	283.266
189.835	283.794
199.685	286
234.935	294.797

Material Boundary

X	Y
187.474	283.266
227.772	269.835
327.434	236.619

Material Boundary

X	Y
179.982	281.763
187.474	283.266

Material Boundary

X	Y
110.463	261.577
136.795	261.577
141.217	263.437

Material Boundary

X	Y
136.795	261.577
144.097	261.577
149.221	263.835

Material Boundary

X	Y
144.097	261.577
151.502	261.577
154.279	264.378

Material Boundary

X	Y
104.405	260.999
105.8	260.999
107.434	261.201
110.463	261.577
111.026	261.872

Material Boundary

X	Y
136.42	285.077
148.677	285.077
162.418	284.337

Material Boundary

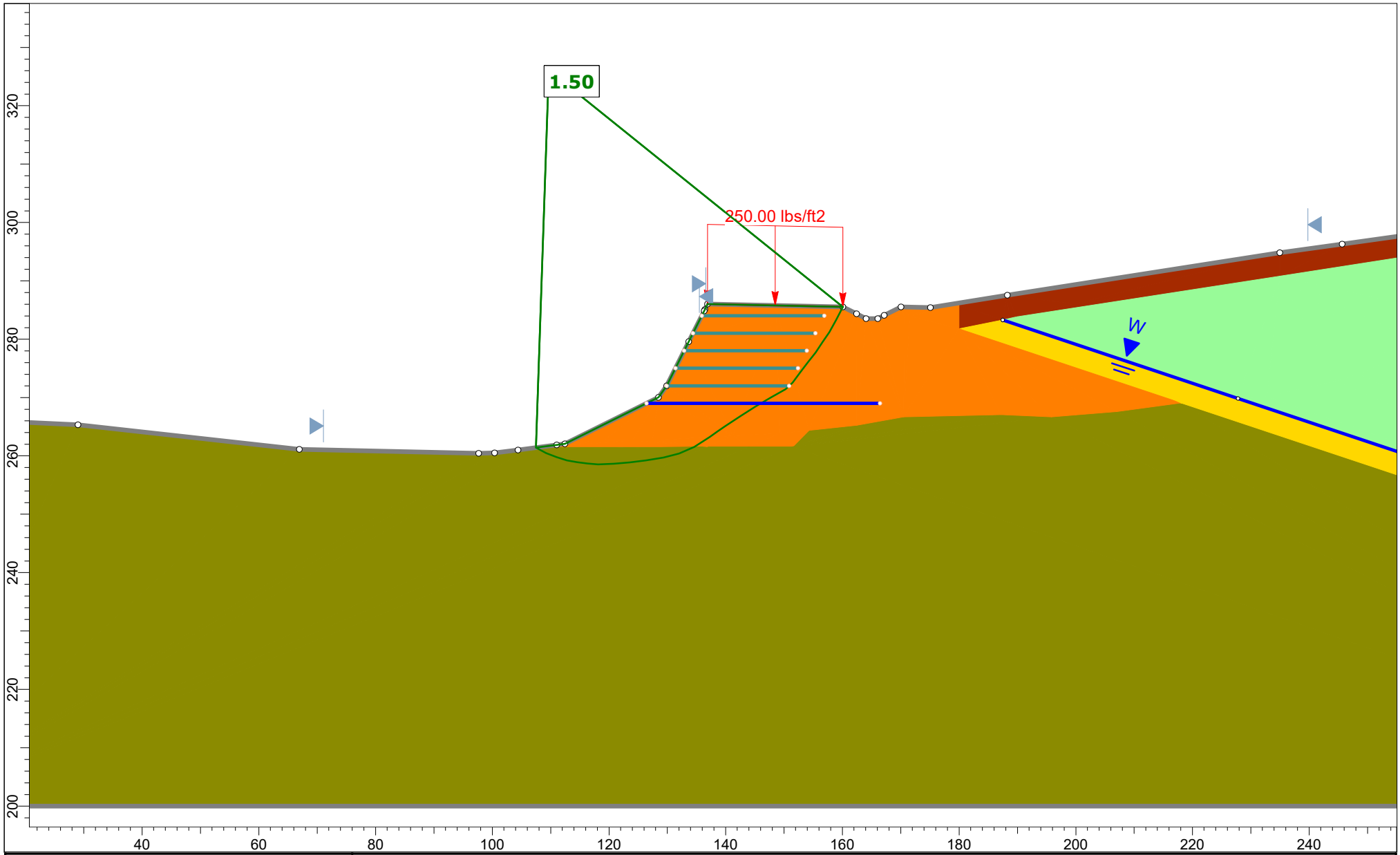
X	Y
167.164	284.082
170.606	283.897
171.571	283.954
179.982	285.763
188.252	287.541

Material Boundary

X	Y
245.655	296.295
282.016	298.11
327.434	300.376

Material Boundary

X	Y
188.519	283.59
189.835	283.794
234.935	290.797
280.237	297.839
282.016	298.11
310.859	302.5



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 01+50 Static

Scale: 1:273

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 01+50 Static.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:10.323s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	1
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.4
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.311130
Axis Location:	106.725, 330.463
Left Slip Surface Endpoint:	102.774, 260.798
Right Slip Surface Endpoint:	160.086, 285.503
Resisting Moment:	3.37674e+06 lb-ft
Driving Moment:	2.57545e+06 lb-ft
Resisting Horizontal Force:	39792.1 lb
Driving Horizontal Force:	30349.5 lb
Active Support Moment:	-275010 lb-ft
Active Horizontal Support Force:	-3725.55 lb
Maximum Single Support Force:	3900 lb
Total Support Force:	3900 lb
Total Slice Area:	619.686 ft2
Surface Horizontal Width:	57.312 ft
Surface Average Height:	10.8125 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
102.774	260.798
104.859	259.9
106.943	259.194
109.028	258.74
111.813	258.258
114.585	257.959
117.01	257.956
119.429	258.093
121.841	258.286
124.669	258.673
127.458	259.086
130.246	259.654
133.035	260.517
135.823	261.79
138.612	263.535
141.4	265.433
142.691	266.311
143.981	267.189
146.759	269.091
149.568	271.032
150.978	272.075
152.787	274.217
154.657	276.587
155.846	278.103
156.911	279.779
157.975	281.609
159.04	283.44
160.086	285.503

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 6

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
126.435, 268.996	40	20.1853	19.8147	20.1853	19.8147	3900

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
129.874, 272	21	Not Effective	Not Effective	Not Effective	Not Effective	0
131.376, 275	21	Not Effective	Not Effective	Not Effective	Not Effective	0
132.876, 278	21	Not Effective	Not Effective	Not Effective	Not Effective	0
134.379, 281	21	Not Effective	Not Effective	Not Effective	Not Effective	0
135.883, 284.004	21	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	4431
Number of Invalid Surfaces:	14578

Error Codes

Error Code -105 reported for 1730 surfaces
Error Code -108 reported for 4 surfaces
Error Code -110 reported for 177 surfaces
Error Code -111 reported for 133 surfaces
Error Code -113 reported for 12428 surfaces
Error Code -123 reported for 106 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.31113

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.04227	36.1076	-23.3225	Subgrade	0	30	19.6245	25.7303	44.5663	0	44.5663	36.1055	36.1055
2	1.04227	108.434	-23.3225	Subgrade	0	30	62.4056	81.8219	141.72	0	141.72	114.815	114.815
3	1.04226	175.586	-18.6929	Subgrade	0	30	100.619	131.924	228.498	0	228.498	194.455	194.455
4	1.04226	236.877	-18.6929	Subgrade	0	30	143.731	188.45	326.404	0	326.404	277.774	277.774
5	1.04225	290.312	-12.291	Subgrade	0	30	168.628	221.093	382.945	0	382.945	346.206	346.206
6	1.04225	335.898	-12.291	Subgrade	0	30	204.164	267.686	463.646	0	463.646	419.164	419.164
7	1.39276	514.815	-9.82304	Subgrade	0	30	236.635	310.259	537.385	0	537.385	496.413	496.413
8	1.39276	585.807	-9.82304	Subgrade	0	30	284.229	372.661	645.468	0	645.468	596.255	596.255
9	1.38587	658.067	-6.14627	Subgrade	0	30	313.581	411.146	712.125	0	712.125	678.357	678.357
10	1.38587	788.331	-6.14627	Subgrade	0	30	386.423	506.651	877.546	0	877.546	835.934	835.934
11	1.21234	794.343	-0.0742318	Subgrade	0	30	402.573	527.826	914.221	0	914.221	913.699	913.699
12	1.21234	882.063	-0.0742318	Subgrade	0	30	452.706	593.557	1028.07	0	1028.07	1027.49	1027.49
13	1.2099	962.669	3.23133	Subgrade	0	30	467.234	612.605	1061.07	0	1061.07	1087.44	1087.44
14	1.2099	1039.89	3.23133	Subgrade	0	30	507.513	665.415	1152.53	0	1152.53	1181.18	1181.18
15	1.20581	1111.13	4.58761	Subgrade	0	30	530.345	695.351	1204.38	0	1204.38	1246.94	1246.94
16	1.20581	1183.68	4.58761	Subgrade	0	30	565.444	741.371	1284.09	0	1284.09	1329.46	1329.46
17	0.942773	972.999	7.78192	Subgrade	0	30	553.05	725.121	1255.95	0	1255.95	1331.53	1331.53
18	0.942773	1011.33	7.78192	Subgrade	0	30	572.364	750.444	1299.8	0	1299.8	1378.02	1378.02
19	0.942773	1049.66	7.78192	Subgrade	0	30	590.964	774.83	1342.04	0	1342.04	1422.8	1422.8
20	0.929485	1071.79	8.43486	Subgrade	0	30	599.293	785.751	1360.97	0	1360.97	1449.83	1449.83
21	0.929485	1107.85	8.43486	Subgrade	0	30	614.897	806.21	1396.39	0	1396.39	1487.58	1487.58
22	0.929485	1143.9	8.43486	Subgrade	0	30	629.659	825.565	1429.92	0	1429.92	1523.29	1523.29
23	0.929503	1177.12	11.4979	Subgrade	0	30	598.514	784.73	1359.19	0	1359.19	1480.93	1480.93
24	0.929503	1247.99	11.4979	Subgrade	0	30	626.995	822.072	1423.88	0	1423.88	1551.42	1551.42
25	0.929503	1377.98	11.4979	Subgrade	0	30	683.634	896.333	1552.49	0	1552.49	1691.56	1691.56
26	1.39424	2387.01	17.2081	Subgrade	0	30	687.412	901.286	1561.08	0	1561.08	1773.97	1773.97
27	1.39424	2780.76	17.2081	Subgrade	0	30	789.693	1035.39	1793.35	0	1793.35	2037.92	2037.92
28	1.16127	2604.8	24.5364	Subgrade	0	30	757.777	993.544	1720.87	0	1720.87	2066.79	2066.79
29	1.16127	2854.2	24.5364	Subgrade	0	30	825.395	1082.2	1874.43	0	1874.43	2251.22	2251.22
30	0.465904	1215.21	24.5364	New Fill	100	30	955.901	1253.31	1997.59	0	1997.59	2433.95	2433.95
31	1.3942	3842.51	32.0426	New Fill	100	30	892.985	1170.82	1854.72	0	1854.72	2413.65	2413.65
32	1.3942	3826.14	32.0426	New Fill	100	30	947.625	1242.46	1978.8	0	1978.8	2571.92	2571.92
33	1.39419	3668.86	34.2333	New Fill	100	30	879.447	1153.07	1823.98	0	1823.98	2422.4	2422.4
34	1.39419	3505.25	34.2333	New Fill	100	30	848.939	1113.07	1754.69	0	1754.69	2332.35	2332.35
35	1.29068	3099.15	34.2333	New Fill	100	30	820.82	1076.2	1690.83	0	1690.83	2249.36	2249.36
36	1.29068	2958.93	34.2333	New Fill	100	30	794.781	1042.06	1631.7	0	1631.7	2172.51	2172.51
37	1.38879	3026.74	34.4032	New Fill	100	30	766.376	1004.82	1567.19	0	1567.19	2092	2092
38	1.38879	2863.39	34.4032	New Fill	100	30	874.841	1147.03	1813.51	0	1813.51	2412.6	2412.6
39	1.40444	2728.81	34.6418	New Fill	100	30	677.382	888.136	1365.09	0	1365.09	1833.12	1833.12
40	1.40444	2560.31	34.6418	New Fill	100	30	648.745	850.589	1300.06	0	1300.06	1748.3	1748.3
41	1.41021	2395.46	36.4874	New Fill	100	30	603.348	791.068	1196.96	0	1196.96	1643.21	1643.21
42	0.904406	1418.92	49.8192	New Fill	100	30	469.537	615.624	893.089	0	893.089	1449.09	1449.09
43	0.904406	1300.64	49.8192	New Fill	100	30	447.402	586.602	842.823	0	842.823	1372.61	1372.61
44	0.935182	1216.14	51.7231	New Fill	100	30	410.192	537.815	758.32	0	758.32	1278.14	1278.14
45	0.935182	1080.94	51.7231	New Fill	100	30	384.735	504.437	700.506	0	700.506	1188.07	1188.07
46	1.18884	1178.3	51.8912	New Fill	100	30	353.228	463.128	628.956	0	628.956	1079.3	1079.3
47	1.06448	848.183	57.5772	New Fill	100	30	286.455	375.58	477.318	0	477.318	928.302	928.302
48	1.06448	621.38	59.8201	New Fill	100	30	235.182	308.354	360.879	0	360.879	765.289	765.289
49	1.06448	384.711	59.8201	New Fill	100	30	189.751	248.788	257.708	0	257.708	583.996	583.996
50	1.0466	130.952	63.1046	New Fill	100	30	128.176	168.055	117.876	0	117.876	370.575	370.575

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.31113

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	102.774	260.798	0	0	0
2	103.816	260.349	37.7722	1.52381	2.31018
3	104.859	259.9	158.366	12.7568	4.60538
4	105.901	259.547	330.646	39.8429	6.87102
5	106.943	259.194	577.79	92.4778	9.09331
6	107.985	258.967	818.728	162.997	11.2596
7	109.028	258.74	1111.61	263.971	13.3584
8	110.42	258.499	1532.17	440.538	16.0413
9	111.813	258.258	2039.75	685.171	18.5677
10	113.199	258.109	2531.26	967.224	20.9124
11	114.585	257.959	3138.64	1337.41	23.0794
12	115.797	257.958	3568.56	1650.79	24.8249
13	117.01	257.956	4052.86	2014.4	26.4288
14	118.22	258.025	4473.49	2367.44	27.8885
15	119.429	258.093	4930.81	2756.67	29.2083
16	120.635	258.19	5370.45	3149.12	30.3865
17	121.841	258.286	5839.26	3568.53	31.4302
18	122.784	258.415	6125.87	3850.87	32.1545
19	123.727	258.544	6422.16	4138.71	32.7994
20	124.669	258.673	6727.68	4430.43	33.3664
21	125.599	258.811	7016.75	4706.23	33.8503
22	126.528	258.949	7312.73	4981.07	34.2608
23	127.458	259.086	7615.11	5253.04	34.5986
24	128.387	259.275	7826.16	5452.46	34.8648
25	129.317	259.465	8046.14	5646.51	35.0599
26	130.246	259.654	8284.7	5840.83	35.1844
27	131.641	260.085	8390.02	5927.16	35.2394
28	133.035	260.517	8508.11	5987.75	35.1367
29	134.196	261.047	8280.49	5783.06	34.9303
30	135.357	261.577	8031.28	5543.13	34.6132
31	135.823	261.79	7960.65	5461.91	34.4545
32	137.217	262.663	7298.98	4899.42	33.8714
33	138.612	263.535	6606.43	4310.44	33.1229
34	140.006	264.484	5827.03	3670.25	32.2054
35	141.4	265.433	5083.1	3068.13	31.1149
36	142.691	266.311	4425.12	2549.44	29.9475
37	143.981	267.189	3795.99	2071.78	28.6249
38	145.37	268.14	3142.87	1603.12	27.0253
39	146.759	269.091	6143.93	2896.41	25.2404
40	148.163	270.062	5565.98	2390.92	23.2464
41	149.568	271.032	5023.55	1934.8	21.064
42	150.978	272.075	4446.28	1503.99	18.6885
43	151.883	273.146	3808.06	1169.48	17.0721
44	152.787	274.217	3212.54	884.083	15.3868
45	153.722	275.402	2606.23	629.39	13.5767
46	154.657	276.587	2054.77	425.659	11.7037
47	155.846	278.103	1433.02	233.197	9.24279
48	156.911	279.779	874.41	106.993	6.97605
49	157.975	281.609	417.587	34.0643	4.66353
50	159.04	283.44	119.003	4.8208	2.31978
51	160.086	285.503	0	0	0

Entity Information

Water Table

X	Y
187.474	283.266
227.772	269.835
327.434	236.619

Distributed Load

X	Y
136.877	285.99
160.086	285.503

External Boundary

X	Y
272.187	300
245.655	296.295
234.935	294.797
188.252	287.541
175.079	285.419
170.051	285.522
167.164	284.082
166.046	283.524
164.044	283.525
162.418	284.337
160.086	285.503
136.877	285.99
136.42	285.077
136.296	284.829
133.656	279.555
129.874	272
128.459	270
112.451	262.059
111.026	261.872
104.405	260.999
100.389	260.505
97.6543	260.428
66.92	261.104
29.0118	265.324
-1.16415e-10	266.694
0	200
327.434	200
327.434	232.619
327.434	236.619
327.434	292.184
327.434	300.376
327.434	303.571
310.859	302.5

Material Boundary

X	Y
110.463	261.577
119.167	262.702
124.03	262.659
127.434	262.659
141.217	263.437
149.221	263.835
154.279	264.378
162.441	265.253
170.48	266.684
187.204	267.066
195.833	266.671
207.068	267.599
218.016	269.087
219.104	269.235
227.772	269.835
232.742	270.179
244.597	272.857
248.558	274.049
254.401	276.602
259.524	279.071
268.069	283.189
278.873	289.039
285.459	292.512
293.959	296.85
298.846	298.895
302.446	296.562
306.008	292.872
308.463	292.195
315.155	292.146
319.507	292.276
322.276	292.423
325.501	292.274
327.434	292.184

Material Boundary

X	Y
179.982	285.763
179.982	281.763
218.016	269.087
327.434	232.619

Material Boundary

X	Y
187.474	283.266
189.835	283.794
199.685	286
234.935	294.797

Material Boundary

X	Y
187.474	283.266
227.772	269.835
327.434	236.619

Material Boundary

X	Y
179.982	281.763
187.474	283.266

Material Boundary

X	Y
110.463	261.577
136.795	261.577
141.217	263.437

Material Boundary

X	Y
136.795	261.577
144.097	261.577
149.221	263.835

Material Boundary

X	Y
144.097	261.577
151.502	261.577
154.279	264.378

Material Boundary

X	Y
104.405	260.999
105.8	260.999
107.434	261.201
110.463	261.577
111.026	261.872

Material Boundary

X	Y
136.42	285.077
148.677	285.077
162.418	284.337

Material Boundary

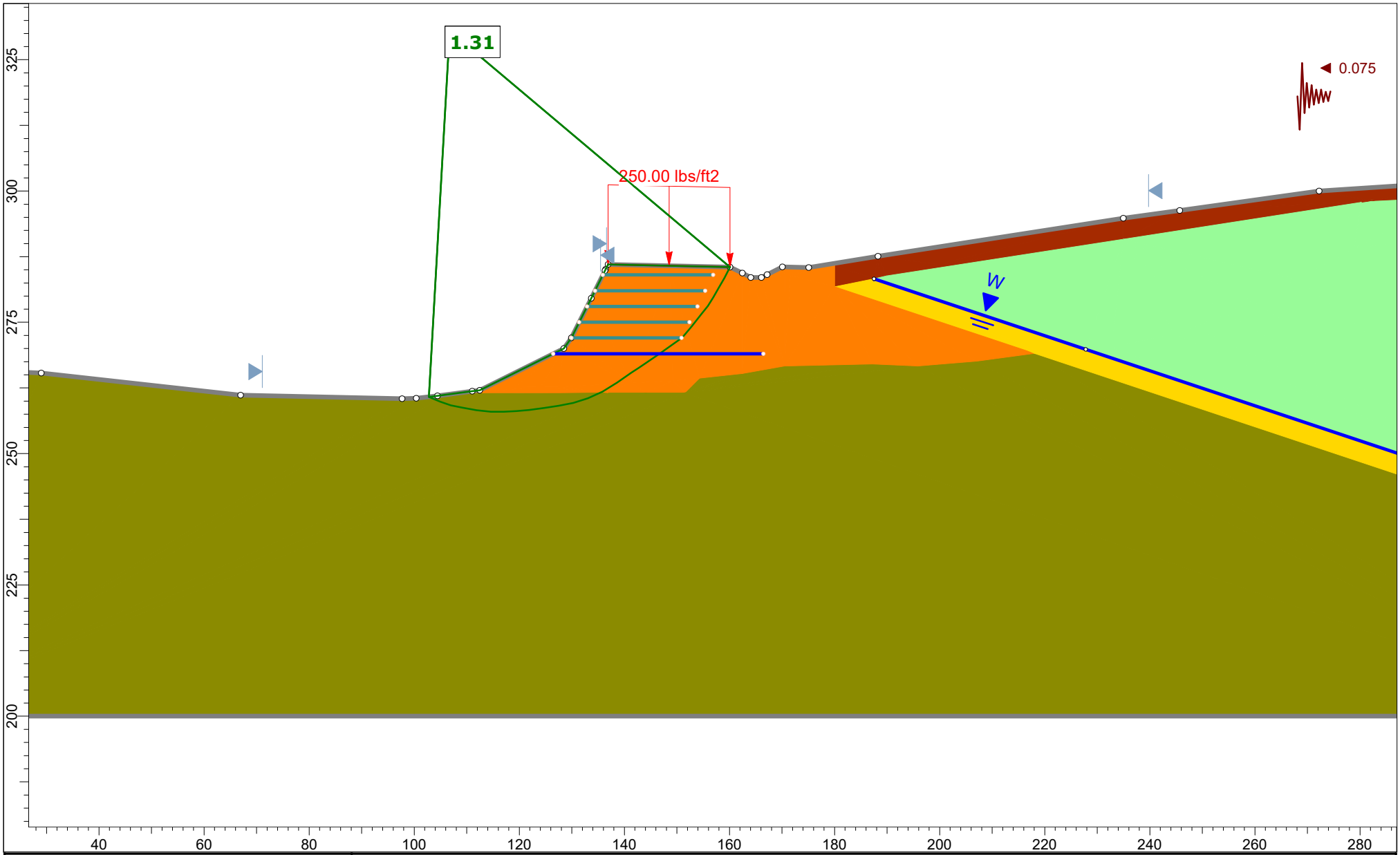
X	Y
167.164	284.082
170.606	283.897
171.571	283.954
179.982	285.763
188.252	287.541

Material Boundary

X	Y
245.655	296.295
282.016	298.11
327.434	300.376

Material Boundary

X	Y
188.519	283.59
189.835	283.794
234.935	290.797
280.237	297.839
282.016	298.11
310.859	302.5



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 01+50 Seismic

Scale: 1:303

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 01+50 Seismic.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:11.600s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.810170
Axis Location:	281.924, 370.359
Left Slip Surface Endpoint:	265.932, 252.700
Right Slip Surface Endpoint:	366.455, 286.970
Resisting Moment:	1.79393e+07 lb-ft
Driving Moment:	9.9103e+06 lb-ft
Resisting Horizontal Force:	130721 lb
Driving Horizontal Force:	72215 lb
Total Slice Area:	1996.8 ft2
Surface Horizontal Width:	100.524 ft
Surface Average Height:	19.864 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
265.932	252.7
269.171	249.301
273.016	247.125
276.861	245.2
280.684	244.142
284.506	243.084
288.585	241.999
292.688	241.594
297.112	242.131
301.497	243.473
305.896	245.352
310.295	247.231
314.694	248.959
319.093	250.688
323.491	252.329
327.89	253.921
332.296	257.68
336.702	261.388
340.124	264.149
343.546	266.891
346.992	269.542
350.463	272.199
354.162	275.744
357.86	279.251
360.009	281.256
362.158	283.186
364.307	285.078
366.455	286.97

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 10

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
297.027, 272	20	Not Effective	Not Effective	Not Effective	Not Effective	0
298.535, 275	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
295.519, 269	40	Not Effective	Not Effective	Not Effective	Not Effective	0
294.012, 266	40	Not Effective	Not Effective	Not Effective	Not Effective	0
292.504, 263	40	Not Effective	Not Effective	Not Effective	Not Effective	0
290.997, 260	40	Not Effective	Not Effective	Not Effective	Not Effective	0
289.489, 257	40	Not Effective	Not Effective	Not Effective	Not Effective	0
287.981, 254	40	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
300.042, 278	20	Not Effective	Not Effective	Not Effective	Not Effective	0
301.55, 281	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	3706
Number of Invalid Surfaces:	15311

Error Codes

Error Code -105 reported for 2544 surfaces
Error Code -108 reported for 8 surfaces
Error Code -110 reported for 190 surfaces
Error Code -111 reported for 144 surfaces
Error Code -113 reported for 12411 surfaces
Error Code -123 reported for 14 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.81017

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.61949	154.504	-46.3832	Subgrade	0	30	47.6917	86.3301	149.528	0	149.528	99.4763	99.4763
2	1.61949	487.696	-46.3832	Subgrade	0	30	159.356	288.462	499.631	0	499.631	332.389	332.389
3	1.92264	975.876	-29.5103	Subgrade	0	30	219.346	397.054	687.716	0	687.716	563.564	563.564
4	1.92264	1311.41	-29.5103	Subgrade	0	30	306.312	554.476	960.378	0	960.378	787.003	787.003
5	1.92264	1632.41	-26.588	Subgrade	0	30	382.143	691.744	1198.13	0	1198.13	1006.87	1006.87
6	1.92264	1938.88	-26.588	Subgrade	0	30	470.424	851.548	1474.92	0	1474.92	1239.48	1239.48
7	1.9112	2182.04	-15.4705	Subgrade	0	30	481.655	871.877	1510.13	0	1510.13	1376.83	1376.83
8	1.9112	2386.81	-15.4705	Subgrade	0	30	538.189	974.214	1687.39	0	1687.39	1538.43	1538.43
9	1.9112	2591.58	-15.4705	Subgrade	0	30	596.546	1079.85	1870.35	0	1870.35	1705.25	1705.25
10	1.9112	2767.07	-15.4705	Subgrade	0	30	650.315	1177.18	2038.93	0	2038.93	1858.94	1858.94
11	2.03947	3054.35	-14.8992	Subgrade	0	30	683.168	1236.65	2141.93	0	2141.93	1960.16	1960.16
12	2.03947	3153.48	-14.8992	Subgrade	0	30	720.595	1304.4	2259.29	0	2259.29	2067.56	2067.56
13	2.05145	3777.39	-5.63859	Subgrade	0	30	761.713	1378.83	2388.21	0	2388.21	2313.01	2313.01
14	2.05145	4832.17	-5.63859	Subgrade	0	30	964.07	1745.13	3022.65	0	3022.65	2927.46	2927.46
15	2.21201	6327.58	6.92594	Subgrade	0	30	1001.55	1812.98	3140.17	0	3140.17	3261.83	3261.83
16	2.21201	7424.64	6.92594	Subgrade	0	30	1164.61	2108.14	3651.41	0	3651.41	3792.87	3792.87
17	2.19237	8387.98	17.0125	Subgrade	0	30	1172.48	2122.39	3676.09	0	3676.09	4034.83	4034.83
18	2.19237	9359.23	17.0125	Subgrade	0	30	1295.87	2345.75	4062.95	0	4062.95	4459.45	4459.45
19	2.19967	10282.4	23.1254	Subgrade	0	30	1328.71	2405.2	4165.92	0	4165.92	4733.37	4733.37
20	2.19967	10320.5	23.1254	Subgrade	0	30	1372.93	2485.23	4304.56	0	4304.56	4890.88	4890.88
21	2.19967	10066.1	23.1254	Subgrade	0	30	1333.45	2413.77	4180.77	0	4180.77	4750.23	4750.23
22	2.19967	9811.66	23.1254	Subgrade	0	30	1294.59	2343.42	4058.92	0	4058.92	4611.78	4611.78
23	2.1994	9565.98	21.4542	Subgrade	0	30	1283.91	2324.09	4025.44	0	4025.44	4530	4530
24	2.1994	9331.41	21.4542	Subgrade	0	30	1248.14	2259.34	3913.28	0	3913.28	4403.79	4403.79
25	2.1994	9096.84	21.4542	Subgrade	0	30	1212.79	2195.35	3802.47	0	3802.47	4279.08	4279.08
26	2.1994	8862.28	21.4542	Subgrade	0	30	1177.87	2132.15	3693	0	3693	4155.89	4155.89
27	2.19924	8632.84	20.4659	Subgrade	0	30	1158.16	2096.46	3631.17	0	3631.17	4063.4	4063.4
28	2.19924	8409.79	20.4659	Subgrade	0	30	1124.95	2036.35	3527.06	0	3527.06	3946.9	3946.9
29	2.35743	8770.77	19.8972	Subgrade	0	30	1098.9	1989.2	3445.4	0	3445.4	3843.14	3843.14
30	2.04102	7327.1	19.8972	New Fill	100	30	1061.45	1921.4	3154.77	0	3154.77	3538.95	3538.95
31	4.40597	13911.5	40.4634	New Fill	100	30	716.043	1296.16	2071.81	0	2071.81	2682.58	2682.58
32	2.20297	6235.11	40.0884	New Fill	100	30	651.408	1179.16	1869.16	0	1869.16	2417.47	2417.47
33	2.20297	6027.41	40.0884	New Fill	100	30	634.051	1147.74	1814.73	0	1814.73	2348.43	2348.43
34	1.7111	4428.89	38.897	New Fill	100	30	613.859	1111.19	1751.44	0	1751.44	2246.71	2246.71
35	1.7111	4143.03	38.897	New Fill	100	30	579.299	1048.63	1643.07	0	1643.07	2110.46	2110.46
36	1.71109	3861.19	38.6953	New Fill	100	30	546.553	989.354	1540.4	0	1540.4	1978.2	1978.2
37	1.71109	3613.85	38.6953	New Fill	100	30	516.959	935.784	1447.62	0	1447.62	1861.72	1861.72
38	1.72298	3407.49	37.5753	New Fill	100	30	495.757	897.405	1381.15	0	1381.15	1762.59	1762.59
39	1.72298	3180.78	37.5753	New Fill	100	30	468.38	847.848	1295.31	0	1295.31	1655.69	1655.69
40	1.73556	2975.4	37.437	New Fill	100	30	441.45	799.099	1210.87	0	1210.87	1548.84	1548.84
41	1.73556	2746.66	37.437	New Fill	100	30	413.573	748.638	1123.47	0	1123.47	1440.1	1440.1
42	1.84928	2635.34	43.7866	New Fill	100	30	355.338	643.222	940.887	0	940.887	1281.48	1281.48
43	1.84928	2296.47	43.7866	New Fill	100	30	318.451	576.451	825.237	0	825.237	1130.48	1130.48
44	1.84927	1959.75	43.4712	New Fill	100	30	281.869	510.231	710.54	0	710.54	977.755	977.755
45	1.84927	1625.19	43.4712	New Fill	100	30	243.511	440.797	590.278	0	590.278	821.129	821.129
46	0.658605	498.398	43.0143	New Fill	100	30	218.026	394.665	510.376	0	510.376	713.791	713.791
47	1.49021	974.111	43.0143	Final Cover System	0	27	136.58	247.233	485.223	0	485.223	612.65	612.65
48	2.14879	1039.28	41.9323	Final Cover System	0	27	103.594	187.523	368.036	0	368.036	461.091	461.091
49	2.14879	620.615	41.3639	Final Cover System	0	27	63.2797	114.547	224.811	0	224.811	280.528	280.528
50	2.14879	206.872	41.3639	Final Cover System	0	27	21.4455	38.82	76.1885	0	76.1885	95.0713	95.0713

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.81017

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	265.932	252.7	0	0	0
2	267.551	251.001	331.379	6.59611	1.14032
3	269.171	249.301	1438.64	57.1991	2.27683
4	271.093	248.213	2608.77	164.857	3.61591
5	273.016	247.125	4242.82	366.578	4.93807
6	274.938	246.162	6130.49	670.025	6.23732
7	276.861	245.2	8454.24	1114.22	7.50798
8	278.772	244.671	10173.6	1563.56	8.73731
9	280.684	244.142	12094.7	2117	9.92821
10	282.595	243.613	14224.2	2784.49	11.076
11	284.506	243.084	16545.6	3570.24	12.1767
12	286.545	242.542	19101.2	4513.59	13.2951
13	288.585	241.999	21796.8	5576.85	14.3516
14	290.636	241.797	23843.1	6544.49	15.3486
15	292.688	241.594	26433.1	7717.87	16.2766
16	294.9	241.863	27804.8	8605.5	17.1971
17	297.112	242.131	29399.8	9570.76	18.0321
18	299.304	242.802	29504.4	10028.6	18.773
19	301.497	243.473	29620	10446.2	19.4264
20	303.696	244.412	28629.3	10415.9	19.9924
21	305.896	245.352	27605.6	10303.8	20.4681
22	308.096	246.291	26611.4	10136.8	20.8528
23	310.295	247.231	25646.2	9919.55	21.1457
24	312.495	248.095	24990.7	9766.97	21.3468
25	314.694	248.959	24353.4	9571.35	21.4558
26	316.893	249.824	23734.2	9336.02	21.4726
27	319.093	250.688	23132.9	9064.31	21.397
28	321.292	251.509	22699.6	8818.03	21.2295
29	323.491	252.329	22278.7	8538.58	20.9699
30	325.849	253.183	21929.5	8238.36	20.5899
31	327.89	253.921	21765.5	7997.86	20.1762
32	332.296	257.68	17134.1	5905.68	19.0177
33	334.499	259.534	15103.1	4996.19	18.3045
34	336.702	261.388	13134.8	4142.3	17.5036
35	338.413	262.769	11767.3	3557.75	16.8223
36	340.124	264.149	10490.2	3025.93	16.0904
37	341.835	265.52	9314.13	2549.63	15.309
38	343.546	266.891	8214.57	2121.34	14.4798
39	345.269	268.216	7237.78	1750.75	13.5981
40	346.992	269.542	6327.61	1422.69	12.6716
41	348.728	270.871	5484.87	1135.39	11.6953
42	350.463	272.199	4709.88	888.093	10.6783
43	352.312	273.972	3699.22	622.572	9.55325
44	354.162	275.744	2825.34	416.667	8.38922
45	356.011	277.498	2100.93	265.051	7.19039
46	357.86	279.251	1516.42	158.347	5.96131
47	358.519	279.865	1346.4	130.052	5.51722
48	360.009	281.256	875.311	68.914	4.50166
49	362.158	283.186	387.538	20.4176	3.01586
50	364.307	285.078	98.1689	2.59187	1.51238
51	366.455	286.97	0	0	0

Entity Information

Water Table

X	Y
365.835	281.44
409.442	267.038
684.38	176.23

Distributed Load

X	Y
303.057	284
326.395	283.741

External Boundary

X	Y
338.805	283.627
338.452	283.693
336.164	283.577
332.706	281.825
330.396	281.742
326.395	283.741
303.057	284
298.535	275
288.545	255.121
287.934	255.121
283.141	255.464
271.516	253.25
267.921	252.566
263.085	252.893
257.823	252.384
245.177	254.596
231.415	256.663
214.366	258.632
205.363	259.636
190.193	260.85
171.476	262.294
149.371	263.956
131.973	264.299
115.73	264.375
93.3949	264.373
63.3936	264.373
39.1526	264.403
21.634	264.404
0	264.404
0	160
684.38	160
684.38	172.23
684.38	176.23
684.38	290
684.38	308.847
684.38	312.847
509.3	304.105
455.845	298.606
439.873	296.639
433.123	295.808
418.604	293.886
383.449	289.233
345.484	284.177
341.396	283.633

Material Boundary

X	Y
350.751	282.423
358.504	279.862
405.071	264.481
684.38	172.23

Material Boundary

X	Y
365.835	281.44
409.442	267.038
684.38	176.23

Material Boundary

X	Y
358.504	279.862
365.835	281.44
383.449	285.233
387.014	286
418.604	293.886

Material Boundary

X	Y
287.514	253.183
303.412	255.284
317.441	255.742
327.532	256.071
331.114	256.204
394.947	258.56
405.071	264.481
409.442	267.038
423.315	275.152
447.48	288.459
456.447	286.407
466.701	291.266
495.498	289.061
500.784	286.547
537.312	286.363
552.089	294.063
584.318	294.638
588.434	293.38
593.115	290.081
597.227	287.154
605.644	285.815
621.904	294.92
636.67	295.489
647.141	300.993
684.38	290

Material Boundary

X	Y
287.514	253.183
314.068	253.183
317.441	255.742

Material Boundary

X	Y
314.068	253.183
325.655	253.183
327.532	256.071

Material Boundary

X	Y
325.655	253.183
328.748	253.183
331.114	256.204

Material Boundary

X	Y
271.516	253.25
273.485	253.232
277.371	253.148
280.907	253.072
281.897	252.998
284.425	252.81
285.256	252.88
286.65	253.033
287.514	253.183
287.981	254
288.545	255.121

Material Boundary

X	Y
338.805	283.627
347.395	282
349.898	282
350.751	282.423
351.623	282.855
352.272	282.724
352.962	282.934
353.586	282.812
356.795	283.494
383.449	289.233

Material Boundary

X	Y
439.873	296.639
509.3	300.105
684.38	308.847

Material Boundary

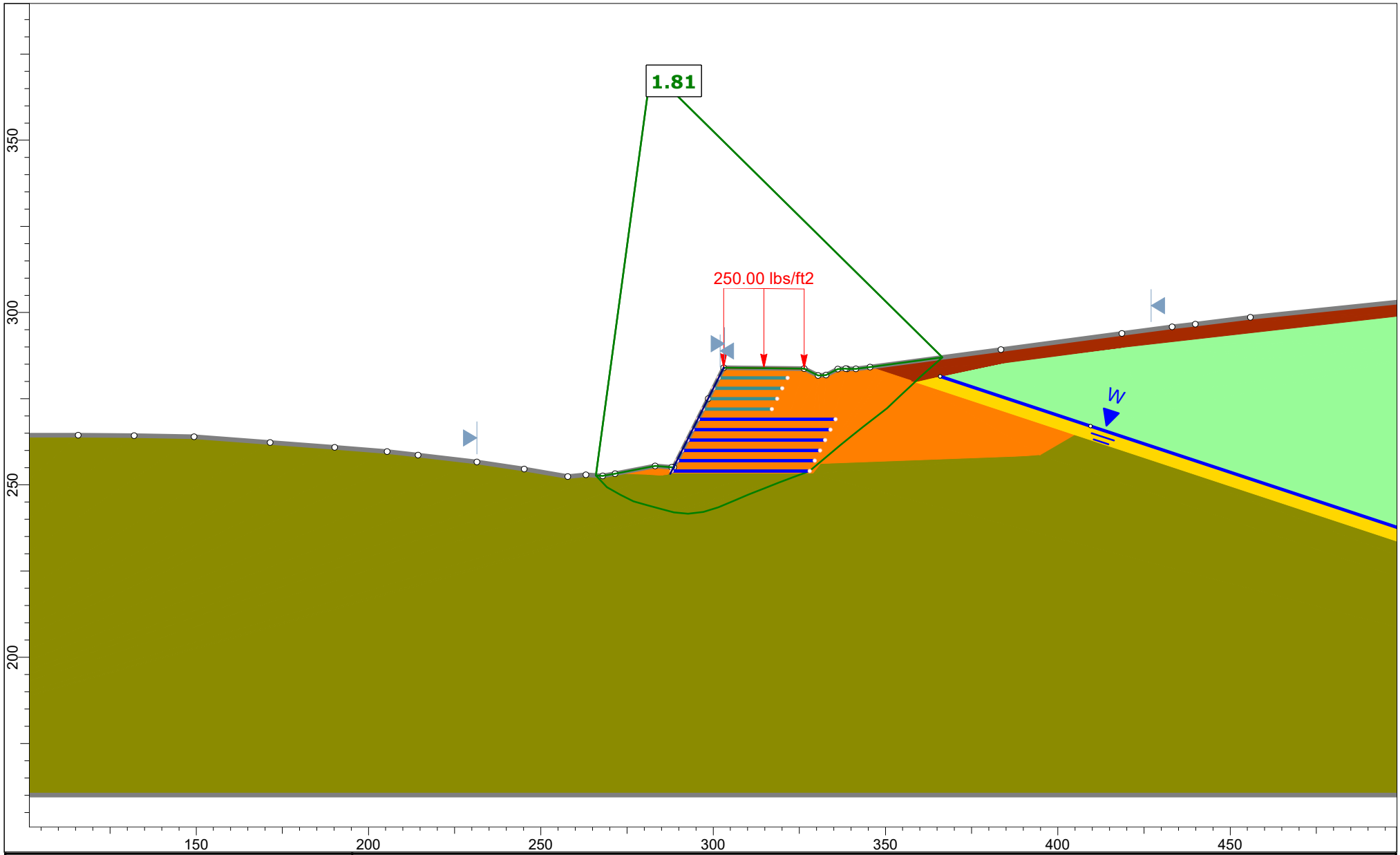
X	Y
357.552	280.177
383.449	285.233
418.604	289.886
509.3	300.105

Material Boundary

X	Y
365.391	281.44
365.835	281.44

Material Boundary

X	Y
345.484	284.177
350.751	282.423



Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 03+30 Static

Scale: 1:462

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 03+30 Static.slim

SLIDEINTERPRET 9.009

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:09.323s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.540800
Axis Location:	285.278, 382.680
Left Slip Surface Endpoint:	264.809, 252.776
Right Slip Surface Endpoint:	376.920, 288.363
Resisting Moment:	2.02102e+07 lb-ft
Driving Moment:	1.31166e+07 lb-ft
Resisting Horizontal Force:	138095 lb
Driving Horizontal Force:	89625.1 lb
Total Slice Area:	2129.74 ft2
Surface Horizontal Width:	112.111 ft
Surface Average Height:	18.9968 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
264.809	252.776
269.717	248.822
273.559	246.896
277.083	245.741
280.607	244.761
285.15	243.717
289.491	242.762
294.18	242.577
298.869	243.685
303.706	245.531
308.583	247.523
313.46	249.345
318.307	251
323.153	252.485
327.976	253.996
332.797	256.736
337.618	259.845
341.134	262.41
344.604	264.958
348.075	267.385
351.096	269.392
354.458	271.668
358.95	274.553
363.442	277.331
367.935	281.07
372.427	284.718
376.92	288.363

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 10

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
297.027, 272	20	Not Effective	Not Effective	Not Effective	Not Effective	0
298.535, 275	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
295.519, 269	40	Not Effective	Not Effective	Not Effective	Not Effective	0
294.012, 266	40	Not Effective	Not Effective	Not Effective	Not Effective	0
292.504, 263	40	Not Effective	Not Effective	Not Effective	Not Effective	0
290.997, 260	40	Not Effective	Not Effective	Not Effective	Not Effective	0
289.489, 257	40	Not Effective	Not Effective	Not Effective	Not Effective	0
287.981, 254	40	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
300.042, 278	20	Not Effective	Not Effective	Not Effective	Not Effective	0
301.55, 281	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	3086
Number of Invalid Surfaces:	15925

Error Codes

Error Code -105 reported for 2128 surfaces
Error Code -108 reported for 3 surfaces
Error Code -109 reported for 2 surfaces
Error Code -110 reported for 754 surfaces
Error Code -111 reported for 101 surfaces
Error Code -113 reported for 12931 surfaces
Error Code -123 reported for 6 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.5408

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.45419	266.726	-38.8594	Subgrade	0	30	62.3049	95.9994	166.276	0	166.276	116.075	116.075
2	2.45419	850.15	-38.8594	Subgrade	0	30	217.654	335.362	580.864	0	580.864	405.494	405.494
3	1.9206	1094.87	-26.6256	Subgrade	0	30	312.74	481.87	834.623	0	834.623	677.84	677.84
4	1.9206	1401.06	-26.6256	Subgrade	0	30	420.607	648.071	1122.49	0	1122.49	911.635	911.635
5	1.76204	1522.37	-18.1486	Subgrade	0	30	459.838	708.518	1227.19	0	1227.19	1076.46	1076.46
6	1.76204	1715.44	-18.1486	Subgrade	0	30	535.385	824.921	1428.81	0	1428.81	1253.31	1253.31
7	3.52409	3973.09	-15.5449	Subgrade	0	30	625.589	963.907	1669.54	0	1669.54	1495.52	1495.52
8	2.27179	2916.4	-12.937	Subgrade	0	30	715.421	1102.32	1909.27	0	1909.27	1744.94	1744.94
9	2.27179	3113.14	-12.937	Subgrade	0	30	790.057	1217.32	2108.46	0	2108.46	1926.98	1926.98
10	2.17031	3063.88	-12.4061	Subgrade	0	30	835.475	1287.3	2229.67	0	2229.67	2045.88	2045.88
11	2.17031	3265.13	-12.4061	Subgrade	0	30	914.337	1408.81	2440.14	0	2440.14	2239	2239
12	2.34461	4676.4	-2.25668	Subgrade	0	30	1004.23	1547.32	2680.03	0	2680.03	2640.46	2640.46
13	2.34461	6015.06	-2.25668	Subgrade	0	30	1275.51	1965.31	3404.01	0	3404.01	3353.75	3353.75
14	2.34435	7261.89	13.2957	Subgrade	0	30	1197.81	1845.58	3196.65	0	3196.65	3479.7	3479.7
15	2.34435	8418.41	13.2957	Subgrade	0	30	1367.29	2106.72	3648.94	0	3648.94	3972.04	3972.04
16	2.41862	9846.18	20.8881	Subgrade	0	30	1364.19	2101.94	3640.66	0	3640.66	4161.27	4161.27
17	2.41862	10924.6	20.8881	Subgrade	0	30	1513.52	2332.03	4039.19	0	4039.19	4616.79	4616.79
18	2.43855	11105.2	22.2175	Subgrade	0	30	1539.81	2372.54	4109.38	0	4109.38	4738.31	4738.31
19	2.43855	10805.8	22.2175	Subgrade	0	30	1489.06	2294.35	3973.92	0	3973.92	4582.13	4582.13
20	2.43853	10518.8	20.4872	Subgrade	0	30	1481.7	2283	3954.28	0	3954.28	4507.88	4507.88
21	2.43853	10244.2	20.4872	Subgrade	0	30	1435.76	2212.22	3831.67	0	3831.67	4368.12	4368.12
22	2.42329	9919.58	18.848	Subgrade	0	30	1430.29	2203.79	3817.08	0	3817.08	4305.32	4305.32
23	2.42329	9671.2	18.848	Subgrade	0	30	1388.27	2139.04	3704.92	0	3704.92	4178.82	4178.82
24	2.42327	9435.05	17.0373	Subgrade	0	30	1389.73	2141.3	3708.85	0	3708.85	4134.72	4134.72
25	2.42327	9211.29	17.0373	Subgrade	0	30	1350.59	2080.99	3604.38	0	3604.38	4018.26	4018.26
26	2.22623	8263.04	17.3996	Subgrade	0	30	1304.93	2010.63	3482.52	0	3482.52	3891.45	3891.45
27	2.59609	9318.84	17.3996	New Fill	100	30	1274.35	1963.52	3227.71	0	3227.71	3627.06	3627.06
28	2.53982	8411.82	29.6119	New Fill	100	30	943.03	1453.02	2343.5	0	2343.5	2879.48	2879.48
29	1.39589	4344.2	29.6119	Subgrade	0	30	822.066	1266.64	2193.88	0	2193.88	2661.11	2661.11
30	0.885618	2691.85	29.6119	New Fill	100	30	865.992	1334.32	2137.91	0	2137.91	2630.1	2630.1
31	2.41071	7222.86	32.8086	New Fill	100	30	812.902	1252.52	1996.23	0	1996.23	2520.28	2520.28
32	2.41071	7068.86	32.8086	New Fill	100	30	797.326	1228.52	1954.66	0	1954.66	2468.67	2468.67
33	1.75768	4886.88	36.1182	New Fill	100	30	722.553	1113.31	1755.1	0	1755.1	2282.35	2282.35
34	1.75768	4611.08	36.1182	New Fill	100	30	686.373	1057.56	1658.55	0	1658.55	2159.39	2159.39
35	3.47068	8390.68	36.2855	New Fill	100	30	638.346	983.564	1530.38	0	1530.38	1999.04	1999.04
36	1.73533	3875.54	34.9637	New Fill	100	30	609.102	938.504	1452.33	0	1452.33	1878.25	1878.25
37	1.73533	3670.84	34.9637	New Fill	100	30	582.534	897.568	1381.43	0	1381.43	1788.77	1788.77
38	3.02089	5921.04	33.5978	New Fill	100	30	557.77	859.412	1315.34	0	1315.34	1685.89	1685.89
39	3.36194	5896.41	34.1031	New Fill	100	30	506.656	780.655	1178.93	0	1178.93	1522	1522
40	2.24608	3538.5	32.7089	New Fill	100	30	473.235	729.161	1089.74	0	1089.74	1393.65	1393.65
41	2.24608	3230.02	32.7089	New Fill	100	30	440.095	678.098	1001.3	0	1001.3	1283.93	1283.93
42	2.24612	2926.28	31.7275	New Fill	100	30	411.394	633.876	924.702	0	924.702	1179.06	1179.06
43	2.24612	2628.5	31.7275	New Fill	100	30	377.729	582.005	834.856	0	834.856	1068.4	1068.4
44	0.774189	829.279	39.7731	New Fill	100	30	323.029	497.723	688.877	0	688.877	957.757	957.757
45	3.44039	3028.38	39.7731	Bottom Liner	67	17.4	151.483	233.405	643.518	112.519	530.999	769.608	657.089
46	0.277827	191.215	39.7731	C&D Waste	0	34.992	209.278	322.456	460.652	0	460.652	634.85	634.85
47	1.37824	896.244	39.0776	C&D Waste	0	34.992	200.744	309.307	441.867	0	441.867	604.878	604.878
48	3.11415	1532.41	39.0776	Final Cover System	0	27	120.108	185.063	363.207	0	363.207	460.739	460.739
49	2.24619	615.465	39.0565	Final Cover System	0	27	68.8019	106.01	208.056	0	208.056	263.883	263.883
50	2.24619	205.155	39.0565	Final Cover System	0	27	23.4303	36.1014	70.8531	0	70.8531	89.8648	89.8648

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.5408

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	264.809	252.776	0	0	0
2	267.263	250.799	461.7	18.1444	2.25052
3	269.717	248.822	2080.71	163.154	4.48354
4	271.638	247.859	3402.85	370.137	6.20781
5	273.559	246.896	5186.37	719.959	7.90315
6	275.321	246.318	6591.24	1094.35	9.42688
7	277.083	245.741	8231.2	1587.3	10.9149
8	280.607	244.761	11774.5	2884.53	13.7653
9	282.879	244.239	14177.4	3932.25	15.5019
10	285.15	243.717	16839.1	5196.81	17.151
11	287.321	243.239	19487	6573.14	18.6397
12	289.491	242.762	22391.5	8167.41	20.0397
13	291.836	242.67	24642.9	9681.87	21.4492
14	294.18	242.577	27496.8	11530.1	22.7495
15	296.524	243.131	27989.4	12425.8	23.9387
16	298.869	243.685	28541.9	13319.3	25.0165
17	301.287	244.608	27742.5	13537.6	26.0111
18	303.706	245.531	26855.6	13617.2	26.8874
19	306.145	246.527	25684.6	13456.9	27.6513
20	308.583	247.523	24547.2	13215.2	28.2962
21	311.022	248.434	23768.7	13079.4	28.823
22	313.46	249.345	23010.5	12877.3	29.2326
23	315.884	250.173	22574.9	12784.9	29.5243
24	318.307	251	22149	12634.3	29.7014
25	320.73	251.742	22054.9	12612.9	29.7647
26	323.153	252.485	21960.3	12533.1	29.7141
27	325.38	253.183	21816.1	12376.7	29.5671
28	327.976	253.996	21799.6	12220.3	29.2739
29	330.516	255.44	20181	11121.8	28.8593
30	331.911	256.233	19262.1	10492.2	28.5774
31	332.797	256.736	18751.1	10129.6	28.3785
32	335.208	258.291	17066.7	8982.45	27.7585
33	337.618	259.845	15420.9	7864.85	27.0221
34	339.376	261.127	14073.3	6989.59	26.4116
35	341.134	262.41	12806.7	6174.02	25.7384
36	344.604	264.958	10493.3	4721.38	24.225
37	346.34	266.171	9497.32	4105.22	23.3764
38	348.075	267.385	8556.59	3538.47	22.4669
39	351.096	269.392	7157.72	2710.31	20.7394
40	354.458	271.668	5735.04	1930.76	18.6063
41	356.704	273.111	4960.68	1522.51	17.0621
42	358.95	274.553	4262.6	1176.29	15.4272
43	361.196	275.942	3683.01	898.298	13.707
44	363.442	277.331	3174.92	669.538	11.9082
45	364.217	277.975	2918.89	581.741	11.2715
46	367.657	280.839	1370.08	201.099	8.35019
47	367.935	281.07	1307.36	186.26	8.10838
48	369.313	282.189	1022.29	123.675	6.89803
49	372.427	284.718	362.92	26.059	4.107
50	374.673	286.54	92.0997	3.31311	2.06022
51	376.92	288.363	0	0	0

Entity Information

Water Table

X	Y
365.835	281.44
409.442	267.038
684.38	176.23

Distributed Load

X	Y
303.057	284
326.395	283.741

External Boundary

X	Y
338.805	283.627
338.452	283.693
336.164	283.577
332.706	281.825
330.396	281.742
326.395	283.741
303.057	284
298.535	275
288.545	255.121
287.934	255.121
283.141	255.464
271.516	253.25
267.921	252.566
263.085	252.893
257.823	252.384
245.177	254.596
231.415	256.663
214.366	258.632
205.363	259.636
190.193	260.85
171.476	262.294
149.371	263.956
131.973	264.299
115.73	264.375
93.3949	264.373
63.3936	264.373
39.1526	264.403
21.634	264.404
0	264.404
0	160
684.38	160
684.38	172.23
684.38	176.23
684.38	290
684.38	308.847
684.38	312.847
509.3	304.105
455.845	298.606
439.873	296.639
433.123	295.808
418.604	293.886
383.449	289.233
345.484	284.177
341.396	283.633

Material Boundary

X	Y
350.751	282.423
358.504	279.862
405.071	264.481
684.38	172.23

Material Boundary

X	Y
365.835	281.44
409.442	267.038
684.38	176.23

Material Boundary

X	Y
358.504	279.862
365.835	281.44
383.449	285.233
387.014	286
418.604	293.886

Material Boundary

X	Y
287.514	253.183
303.412	255.284
317.441	255.742
327.532	256.071
331.114	256.204
394.947	258.56
405.071	264.481
409.442	267.038
423.315	275.152
447.48	288.459
456.447	286.407
466.701	291.266
495.498	289.061
500.784	286.547
537.312	286.363
552.089	294.063
584.318	294.638
588.434	293.38
593.115	290.081
597.227	287.154
605.644	285.815
621.904	294.92
636.67	295.489
647.141	300.993
684.38	290

Material Boundary

X	Y
287.514	253.183
314.068	253.183
317.441	255.742

Material Boundary

X	Y
314.068	253.183
325.655	253.183
327.532	256.071

Material Boundary

X	Y
325.655	253.183
328.748	253.183
331.114	256.204

Material Boundary

X	Y
271.516	253.25
273.485	253.232
277.371	253.148
280.907	253.072
281.897	252.998
284.425	252.81
285.256	252.88
286.65	253.033
287.514	253.183
287.981	254
288.545	255.121

Material Boundary

X	Y
338.805	283.627
347.395	282
349.898	282
350.751	282.423
351.623	282.855
352.272	282.724
352.962	282.934
353.586	282.812
356.795	283.494
383.449	289.233

Material Boundary

X	Y
439.873	296.639
509.3	300.105
684.38	308.847

Material Boundary

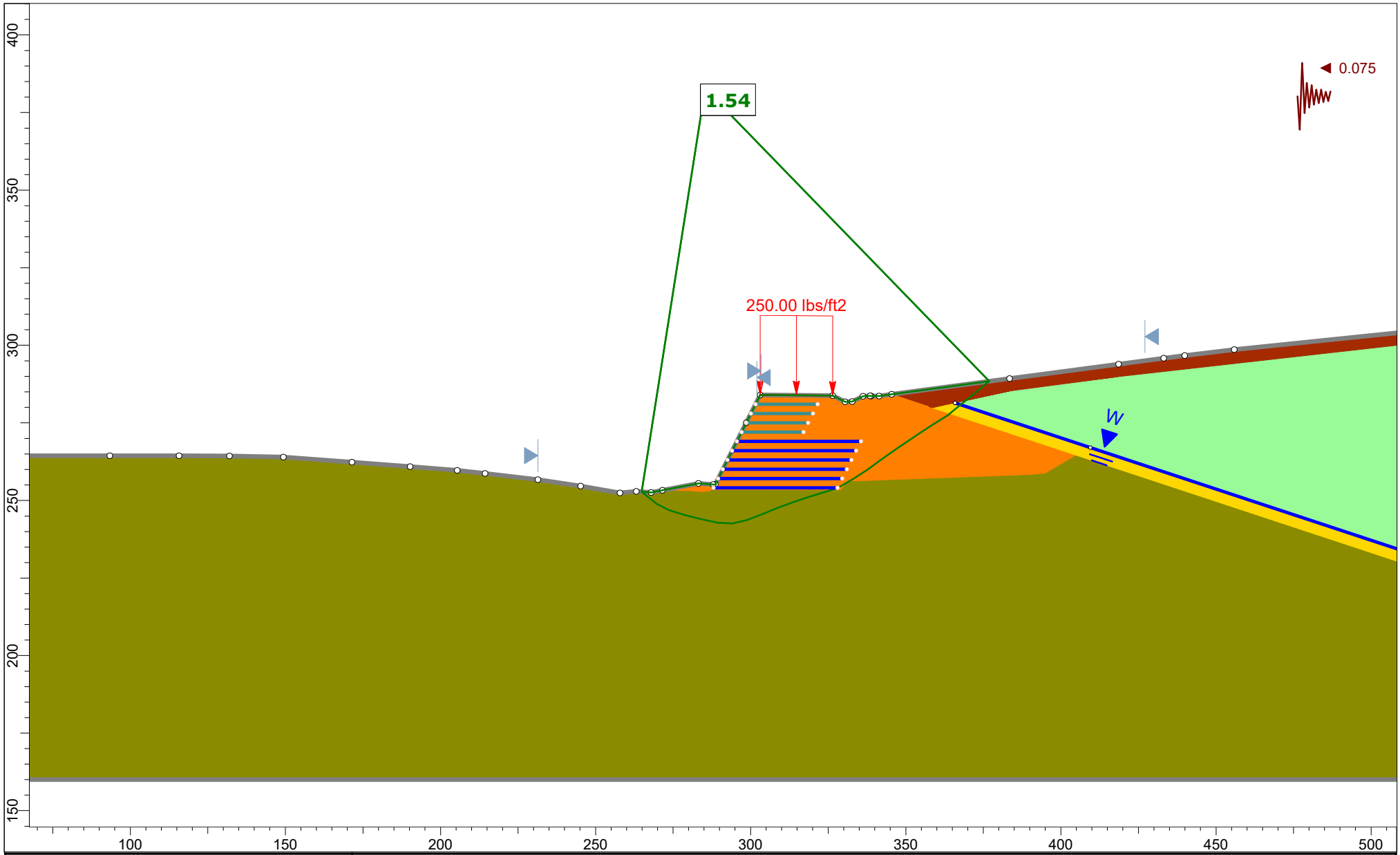
X	Y
357.552	280.177
383.449	285.233
418.604	289.886
509.3	300.105

Material Boundary

X	Y
365.391	281.44
365.835	281.44

Material Boundary

X	Y
345.484	284.177
350.751	282.423



Dunn Mine and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York		
Station 03+30 Seismic		
	Scale: 1:513	PREPARED BY: Civil & Environmental Consultants, Inc.
Date: 5/17/2021		File Name: Station 03+30 Seismic.slim

SLIDEINTERPRET 9.009

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:30.445s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.4
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 3	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	8400
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.522870
Axis Location:	98.021, 295.066
Left Slip Surface Endpoint:	116.762, 226.615
Right Slip Surface Endpoint:	164.026, 268.988
Resisting Moment:	3.79577e+06 lb-ft
Driving Moment:	2.49251e+06 lb-ft
Resisting Horizontal Force:	40606.6 lb
Driving Horizontal Force:	26664.5 lb
Active Support Moment:	-2.09187e+06 lb-ft
Active Horizontal Support Force:	-28791.7 lb
Maximum Single Support Force:	3900 lb
Total Support Force:	31384.9 lb
Total Slice Area:	776.53 ft2
Surface Horizontal Width:	47.2641 ft
Surface Average Height:	16.4296 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
116.762	226.615
118.158	226.956
119.553	227.253
120.949	227.501
122.301	227.724
125.252	228.815
127.419	229.93
128.73	230.824
129.916	231.591
131.107	232.32
132.297	233.007
134.005	234.481
135.71	236.003
137.415	238.048
139.208	240.137
141.001	242.163
142.673	243.994
144.345	246.01
146.017	248.021
147.381	249.656
148.745	251.288
149.838	252.557
150.934	253.792
152.031	254.989
153.244	256.272
155.279	258.35
156.406	259.462
157.665	260.979
158.729	262.335
159.788	263.648
160.848	264.925
161.907	266.164
162.966	267.449
164.026	268.988

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 20

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
119.957, 233.01	40	12.3437	27.6563	12.3437	27.6563	3900
121.456, 236.01	40	14.2596	25.7404	14.2596	25.7404	3900
122.955, 239.01	40	15.285	24.715	15.285	24.715	3900
124.454, 242.01	40	16.411	23.589	16.411	23.589	3900
125.953, 245.01	40	17.5624	22.4376	17.5624	22.4376	3900
127.452, 248.01	40	18.5562	21.4438	18.5562	21.4438	3900
128.951, 251.01	40	19.5615	20.4385	19.5615	20.4385	3900
118.458, 230.01	40	9.07784	30.9222	9.07784	30.9222	3900

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
130.45, 254.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
131.949, 257.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
133.448, 260.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
134.947, 263.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
136.446, 266.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
137.945, 269.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 3

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
110.958, 215	70	Not Effective	Not Effective	Not Effective	Not Effective	0
109.459, 212	70	Not Effective	Not Effective	Not Effective	Not Effective	0
112.457, 218	70	Not Effective	Not Effective	Not Effective	Not Effective	0
113.956, 221	70	Not Effective	Not Effective	Not Effective	Not Effective	0
115.455, 224	70	Not Effective	Not Effective	Not Effective	Not Effective	0
116.954, 227	70	1.41096	68.589	1.41096	68.589	184.933

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	8617
Number of Invalid Surfaces:	10403

Error Codes

Error Code -105 reported for 1475 surfaces
Error Code -108 reported for 7 surfaces
Error Code -110 reported for 76 surfaces
Error Code -111 reported for 98 surfaces
Error Code -113 reported for 8747 surfaces

Error Code Descriptions

The following errors were encountered during the computation:
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.52287

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.697927	51.358	13.7144	New Fill	100	30	87.0603	132.582	56.4329	0	56.4329	77.6791	77.6791
2	0.697927	154.074	13.7144	New Fill	100	30	141.72	215.821	200.607	0	200.607	235.192	235.192
3	0.697929	257.707	12.0073	New Fill	100	30	206.739	314.836	372.108	0	372.108	416.079	416.079
4	0.697929	362.256	12.0073	New Fill	100	30	265.597	404.469	527.355	0	527.355	583.845	583.845
5	0.697929	467.826	10.0801	New Fill	100	30	333.852	508.413	707.392	0	707.392	766.741	766.741
6	0.697929	574.417	10.0801	New Fill	100	30	400.069	609.253	882.051	0	882.051	953.171	953.171
7	0.675633	657.945	9.38671	New Fill	100	30	471.525	718.071	1070.53	0	1070.53	1148.48	1148.48
8	0.675633	758.516	9.38671	New Fill	100	30	541.055	823.957	1253.93	0	1253.93	1343.37	1343.37
9	1.47549	1979.44	20.2928	New Fill	100	30	547.671	834.031	1271.38	0	1271.38	1473.89	1473.89
10	1.47549	2405.68	20.2928	New Fill	100	30	648.105	986.979	1536.3	0	1536.3	1775.94	1775.94
11	1.08355	2027.9	27.2155	New Fill	100	30	647.305	985.762	1534.18	0	1534.18	1867.07	1867.07
12	1.08355	2237.41	27.2155	New Fill	100	30	696.588	1060.81	1664.18	0	1664.18	2022.41	2022.41
13	0.655603	1451.16	34.2867	New Fill	100	30	1376.68	2096.5	3458.03	0	3458.03	4396.67	4396.67
14	0.655603	1519.22	34.2867	New Fill	100	30	707.391	1077.26	1692.68	0	1692.68	2174.99	2174.99
15	1.18631	2924.96	32.8986	New Fill	100	30	750.182	1142.43	1805.54	0	1805.54	2290.83	2290.83
16	1.19065	3168.6	31.4655	New Fill	100	30	806.293	1227.88	1953.54	0	1953.54	2446.97	2446.97
17	1.19064	3407.89	29.9872	New Fill	100	30	870.6	1325.81	2123.16	0	2123.16	2625.54	2625.54
18	0.853764	2580.32	40.8019	New Fill	100	30	1322.42	2013.88	3314.93	0	3314.93	4456.49	4456.49
19	0.853764	2679.87	40.8019	New Fill	100	30	744.075	1133.13	1789.44	0	1789.44	2431.75	2431.75
20	0.852389	2773.58	41.7536	New Fill	100	30	738.441	1124.55	1774.57	0	1774.57	2433.74	2433.74
21	0.852389	2870.24	41.7536	New Fill	100	30	749.683	1141.67	1804.23	0	1804.23	2473.44	2473.44
22	0.85239	2953.51	50.1899	New Fill	100	30	1075.03	1637.13	2662.39	0	2662.39	3952.22	3952.22
23	0.85239	3023.39	50.1899	New Fill	100	30	632.381	963.034	1494.82	0	1494.82	2253.56	2253.56
24	0.896544	3257.09	49.3555	New Fill	100	30	1115.3	1698.45	2768.59	0	2768.59	4067.79	4067.79
25	0.896544	3249.81	49.3555	New Fill	100	30	687.782	1047.4	1640.95	0	1640.95	2442.14	2442.14
26	0.896544	3142.9	48.4917	New Fill	100	30	679.161	1034.27	1618.21	0	1618.21	2385.64	2385.64
27	0.896544	3032.25	48.4917	New Fill	100	30	1142.65	1740.1	2840.73	0	2840.73	4131.88	4131.88
28	0.836108	2729.58	47.5975	New Fill	100	30	648.403	987.434	1537.08	0	1537.08	2247.11	2247.11
29	0.836108	2636.26	47.5975	New Fill	100	30	629.108	958.049	1486.18	0	1486.18	2175.08	2175.08
30	0.836106	2538.31	50.3214	New Fill	100	30	570.231	868.388	1330.89	0	1330.89	2018.26	2018.26
31	0.836106	2435.73	50.3214	New Fill	100	30	1015	1545.72	2504.05	0	2504.05	3727.56	3727.56
32	0.836108	2333.28	50.252	New Fill	100	30	530.587	808.015	1226.32	0	1226.32	1864.33	1864.33
33	0.836108	2230.94	50.252	New Fill	100	30	955.347	1454.87	2346.71	0	2346.71	3495.47	3495.47
34	0.681972	1743.99	50.1759	New Fill	100	30	489.845	745.97	1118.85	0	1118.85	1706.28	1706.28
35	0.681972	1676.09	50.1759	New Fill	100	30	477.555	727.254	1086.43	0	1086.43	1659.12	1659.12
36	1.36395	3148.81	50.1086	New Fill	100	30	699.607	1065.41	1672.14	0	1672.14	2509.12	2509.12
37	1.09258	2329.39	49.2713	New Fill	100	30	428.853	653.087	957.975	0	957.975	1456.06	1456.06
38	1.09655	2170.58	48.4046	New Fill	100	30	418.126	636.752	929.679	0	929.679	1400.7	1400.7
39	1.09655	2008.05	47.5073	New Fill	100	30	408.058	621.419	903.126	0	903.126	1348.56	1348.56
40	1.21341	2038.62	46.5783	New Fill	100	30	397.598	605.49	875.537	0	875.537	1295.67	1295.67
41	1.01716	1564.88	45.6163	New Fill	100	30	387.988	590.856	850.185	0	850.185	1246.61	1246.61
42	1.01716	1435.87	45.6163	New Fill	100	30	372.71	567.589	809.888	0	809.888	1190.7	1190.7
43	1.12692	1442.82	44.6201	New Fill	100	30	363.254	553.188	784.947	0	784.947	1143.41	1143.41
44	1.25923	1410.35	50.2967	New Fill	100	30	310.392	472.686	645.513	0	645.513	1019.34	1019.34
45	1.06421	1001.18	51.8823	New Fill	100	30	281.114	428.1	568.286	0	568.286	926.577	926.577
46	1.05936	817.656	51.1068	New Fill	100	30	218.639	332.959	403.497	0	403.497	674.525	674.525
47	1.05936	643.808	50.3044	New Fill	100	30	184.142	280.425	312.506	0	312.506	534.341	534.341
48	1.05936	473.748	49.474	New Fill	100	30	155.17	236.303	236.083	0	236.083	417.597	417.597
49	1.05936	299.198	50.4935	New Fill	100	30	117.516	178.962	136.766	0	136.766	279.291	279.291
50	1.05935	105.124	55.4638	New Fill	100	30	67.8351	103.304	5.72277	0	5.72277	104.29	104.29

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.52287

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	116.762	226.615	0	0	0
2	117.46	226.786	51.1501	2.85636	3.19623
3	118.158	226.956	115.893	12.9296	6.36588
4	118.855	227.104	388.863	64.9587	9.48357
5	119.553	227.253	495.949	110.185	12.526
6	120.251	227.377	641.188	177.491	15.4729
7	120.949	227.501	810.972	268.323	18.3076
8	121.625	227.613	1009.98	386.33	20.9325
9	122.301	227.724	1235.49	535.443	23.4312
10	123.776	228.27	1349.92	730.731	28.4273
11	125.252	228.815	1468.02	945.457	32.783
12	126.335	229.373	1314.5	940.635	35.5869
13	127.419	229.93	1141.94	894.625	38.0761
14	128.074	230.377	4225.48	3475.54	39.438
15	128.73	230.824	3932.62	3382.26	40.6973
16	129.916	231.591	3436.97	3174.98	42.7309
17	131.107	232.32	2973.55	2919.88	44.4782
18	132.297	233.007	2551.38	2638.08	45.9571
19	133.151	233.744	4892.7	5222.09	46.8652
20	134.005	234.481	4209.16	4618.41	47.6544
21	134.857	235.242	3488.35	3919.39	48.3302
22	135.71	236.003	2754.57	3157.54	48.8993
23	136.562	237.026	4479.94	5220.66	49.3665
24	137.415	238.048	3490.22	4120.74	49.7358
25	138.311	239.093	5142.51	6133.29	50.0216
26	139.208	240.137	4045.37	4856.24	50.2049
27	140.104	241.15	3014.92	3629.85	50.2873
28	141.001	242.163	4717.5	5676.12	50.2696
29	141.837	243.079	3852.32	4617.58	50.1627
30	142.673	243.994	3017.61	3592.14	49.9678
31	143.509	245.002	2153.03	2537.26	49.6832
32	144.345	246.01	4007.91	4660.76	49.3069
33	145.181	247.015	3218.62	3681.23	48.8357
34	146.017	248.021	5189.03	5817.08	48.266
35	146.699	248.839	4608.06	5068.67	47.7252
36	147.381	249.656	4045.22	4355.17	47.1131
37	148.745	251.288	5803.96	5939.57	45.6616
38	149.838	252.557	5056.89	4928.54	44.2636
39	150.934	253.792	4366.98	4019.93	42.6305
40	152.031	254.989	3733.41	3216.52	40.7465
41	153.244	256.272	3093.28	2446.69	38.3429
42	154.261	257.311	2604.34	1895.49	36.0479
43	155.279	258.35	2141.74	1416.43	33.4785
44	156.406	259.462	1678.19	980.369	30.2927
45	157.665	260.979	1090.08	538.614	26.2942
46	158.729	262.335	618.433	256.808	22.551
47	159.788	263.648	320.179	107.164	18.5054
48	160.848	264.925	116.43	29.3973	14.1704
49	161.907	266.164	-11.7471	-1.98554	9.59368
50	162.966	267.449	-62.973	-5.33516	4.84261
51	164.026	268.988	0	0	0

Entity Information

Water Table

X	Y
188.955	268.129
189.345	268
195.14	266.085
209.113	261.467
237.757	252
243.808	250
249.86	248
252.025	247.284
253.803	246.696
255.906	246
268.009	242
269.613	241.472
274.09	240
279.281	238.284
279.679	238.281
284.074	238.253
319.355	238
340.951	237.846
348.732	237.634
354.978	237.421
362.922	236.992
414.823	233.843
415.732	233.787
430.633	232.883
436.252	232.542
465.537	230.765
484.568	229.61
493.294	229.08
558.588	230.158
561.535	230.207
585.166	230.597
600	230.842

Distributed Load

X	Y
138.333	269.786
139.254	269.864
157.461	269.547
158.915	269.447

External Boundary

X	Y
599.009	304.329
551.257	304.247
306.301	302.471
297.878	302.14
291.298	302.111
282.616	302
276.502	300
248.013	290
187.037	270
183.831	269.067
180.644	268.615
177.82	268
175.551	267.909
173.156	268
169	268.728
165.258	268.855
161.285	269.284
158.915	269.447
157.461	269.547
139.254	269.864
138.333	269.786
109.209	211.5
106.917	211.479
0	210.5
0	60
600	60
600	226.842
600	230.842
600	287.321
600	300.331
600	304.331

Material Boundary

X	Y
183.831	269.067
184.819	266.855
185.531	265.261
186.278	265.014
186.323	264.999
189.345	264
195.14	262.085
234.104	249.207
243.808	246
249.86	244
252.025	243.284
255.906	242
268.009	238
269.613	237.472
274.09	236
279.281	234.284
279.679	234.281
284.074	234.253
340.951	233.846
348.732	233.634
354.978	233.421
362.922	232.992
414.823	229.843
415.732	229.787
430.633	228.883
436.252	228.542
465.537	226.765
484.568	225.61
493.294	225.08
558.588	226.158
561.535	226.207
585.166	226.597
600	226.842

Material Boundary

X	Y
188.955	268.129
189.345	268
195.14	266.085
209.113	261.467
237.757	252
243.808	250
249.86	248
252.025	247.284
253.803	246.696
255.906	246
268.009	242
269.613	241.472
274.09	240
279.281	238.284
279.679	238.281
284.074	238.253
319.355	238
340.951	237.846
348.732	237.634
354.978	237.421
362.922	236.992
414.823	233.843
415.732	233.787
430.633	232.883
436.252	232.542
465.537	230.765
484.568	229.61
493.294	229.08
558.588	230.158
561.535	230.207
585.166	230.597
600	230.842

Material Boundary

X	Y
282.616	298
285.662	298.039
288.091	298.058
291.298	298.111
293.364	298.102
296.474	298.137
297.878	298.14
306.301	298.471
435.34	299.406
454.564	299.546
483.219	299.753
511.453	299.958
551.257	300.247
600	300.331

Material Boundary

X	Y
184.819	266.855
187.037	267.5
188.955	268.129
210.575	275.223
210.615	275.236
214.538	276.523
217.516	277.5
238.207	284.285
248.013	287.5
262.752	292.693
276.502	297.5
278.611	298.19
282.616	299.5

Material Boundary

X	Y
282.616	298
282.616	299.5

Material Boundary

X	Y
109.209	211.5
179.7	211.5
184.7	221.5
185.7	223.5
186.7	225.5
187.644	227.467
158.044	227.467
162.061	235.5
166.756	244.89
167.061	245.5
170.038	251.454
149.839	251.454
156.941	265.5
158.915	269.447

Material Boundary

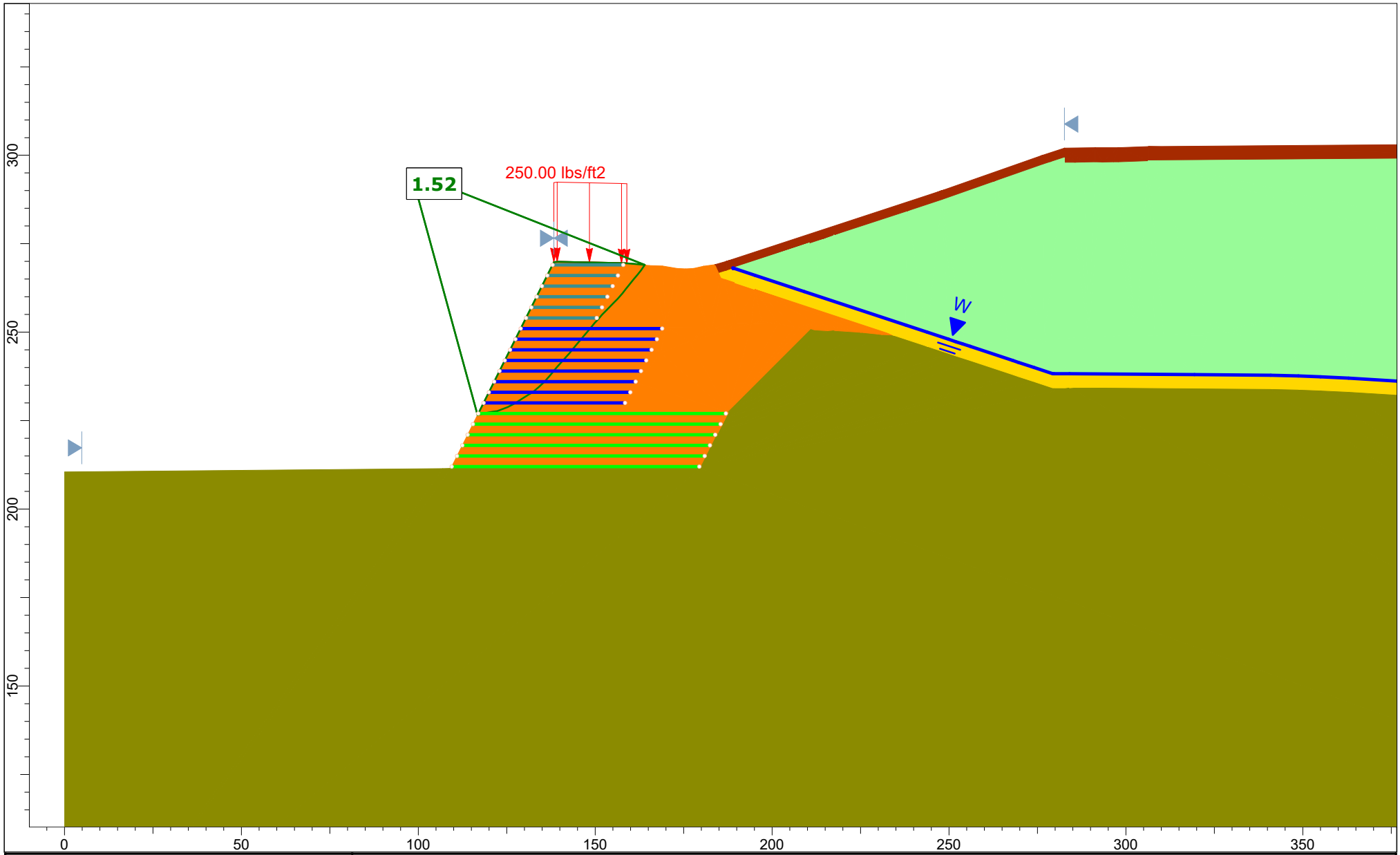
X	Y
109.209	211.5
113.346	212
116.035	212.75
135.237	226.567
149.539	236.387
161.902	245.909
163.014	246.327
166.756	244.89
168.535	244.206
176.707	247.452
181.679	251.408
182.921	251.089
187.481	250.571

189.706	252.514
194.169	252.453
197.058	253.055
201.693	252.344
206.514	251.604
207.801	251.15
209.376	251.298
210.956	250.779
211.871	250.479
215.827	250.229
217.746	250.488
225.195	249.965
231.101	249.35
234.104	249.207
238.077	249.018
242.567	248.314
251.498	246.602
252.795	246.633
253.803	246.696
254.544	246.742
266.618	247.183
276.942	248.011
289.568	248.577
302.908	249.224
308.197	249.096
310.691	249.197
322.981	249.052
324.829	249.851
326.794	250.102
329.818	249.858
333.021	248.984
341.672	254.103
345.536	255.454
351.933	259.414
359.864	262.304
368.33	267.503
380.893	276.434
385.018	278.926
387.297	280.67
399.095	279.63
400.557	279.221
403.836	279.374
426.32	281.672
434.374	282.672
458.823	285.199
469.446	286.25
497.853	288.827
506.714	289.507
524.117	290.667
525.982	290.956
532.284	291.807
533.489	291.386
537.367	290.755

538.857	289.665
542.424	287.723
549.701	285.77
567.168	285.834
572.29	286.14
576.13	286.145
591.361	286.377
591.689	286.452
600	287.321

Material Boundary

X	Y
187.644	227.467
210.956	250.779
212.644	252.467



SLIDEINTERPRET 9.009	Dunn MIne and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York	
	Station 10+27 Static	
	Scale: 1:450	PREPARED BY: Civil & Environmental Consultants, Inc.
	Date: 5/17/2021	File Name: Station 10+27 Static.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:01m:11.303s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	132.4
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 3	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	8400
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.303140
Axis Location:	94.076, 296.230
Left Slip Surface Endpoint:	114.885, 222.859
Right Slip Surface Endpoint:	165.258, 268.855
Resisting Moment:	3.83772e+06 lb-ft
Driving Moment:	2.94498e+06 lb-ft
Resisting Horizontal Force:	39311.8 lb
Driving Horizontal Force:	30166.9 lb
Active Support Moment:	-2.31302e+06 lb-ft
Active Horizontal Support Force:	-31070.3 lb
Maximum Single Support Force:	3900 lb
Total Support Force:	33501.9 lb
Total Slice Area:	784.735 ft2
Surface Horizontal Width:	50.3727 ft
Surface Average Height:	15.5786 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
114.885	222.859
116.953	224.177
119.021	225.448
121.089	226.647
123.157	227.791
124.978	228.79
127.026	230.201
129.088	231.613
131.146	233.01
132.44	234.176
133.733	235.342
135.029	236.583
136.325	237.824
138.044	239.618
139.762	241.352
141.481	243.183
143.2	244.956
144.919	246.849
146.638	248.764
147.873	250.099
148.856	251.182
150.823	253.284
152.106	254.642
153.388	256.001
154.672	257.319
155.956	258.637
157.159	259.954
158.361	261.271
160.526	263.681
161.7	264.948
162.874	266.174
164.048	267.359
165.258	268.855

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 20

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
119.957, 233.01	40	11.1897	28.8103	11.1897	28.8103	3900
121.456, 236.01	40	12.9747	27.0253	12.9747	27.0253	3900
122.955, 239.01	40	14.5064	25.4936	14.5064	25.4936	3900
124.454, 242.01	40	15.9261	24.0739	15.9261	24.0739	3900
125.953, 245.01	40	17.296	22.704	17.296	22.704	3900
127.452, 248.01	40	18.5089	21.4911	18.5089	21.4911	3900
128.951, 251.01	40	19.7484	20.2516	19.7484	20.2516	3900
118.458, 230.01	40	8.28965	31.7104	8.28965	31.7104	3900

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
130.45, 254.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
131.949, 257.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
133.448, 260.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
134.947, 263.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
136.446, 266.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0
137.945, 269.01	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 3

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
110.958, 215	70	Not Effective	Not Effective	Not Effective	Not Effective	0
109.459, 212	70	Not Effective	Not Effective	Not Effective	Not Effective	0
112.457, 218	70	Not Effective	Not Effective	Not Effective	Not Effective	0
113.956, 221	70	Not Effective	Not Effective	Not Effective	Not Effective	0
115.455, 224	70	1.22054	68.7795	1.22054	68.7795	157.526
116.954, 227	70	4.77361	65.2264	4.77361	65.2264	2144.41

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	4097
Number of Invalid Surfaces:	14925

Error Codes

Error Code -105 reported for 1190 surfaces
Error Code -108 reported for 9 surfaces
Error Code -110 reported for 84 surfaces
Error Code -111 reported for 4598 surfaces
Error Code -113 reported for 9044 surfaces

Error Code Descriptions

The following errors were encountered during the computation:
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.30314

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.03407	87.5252	32.5004	New Fill	100	30	91.915	119.778	34.2567	0	34.2567	92.8139	92.8139
2	1.03407	262.576	32.5004	New Fill	100	30	150.827	196.548	167.227	0	167.227	263.315	263.315
3	1.03407	439.066	31.5767	New Fill	100	30	217.269	283.132	317.195	0	317.195	450.737	450.737
4	1.03407	616.996	31.5767	New Fill	100	30	270.316	352.259	436.925	0	436.925	603.072	603.072
5	0.68938	511.178	30.1018	New Fill	100	30	319.226	415.996	547.32	0	547.32	732.383	732.383
6	0.68938	592.25	30.1018	New Fill	100	30	352.96	459.956	623.462	0	623.462	828.08	828.08
7	0.68938	673.322	30.1018	New Fill	100	30	385.244	502.027	696.331	0	696.331	919.666	919.666
8	1.03407	1163.7	28.9496	New Fill	100	30	838.413	1092.57	1719.19	0	1719.19	2182.96	2182.96
9	1.03407	1349.52	28.9496	New Fill	100	30	552.064	719.417	1072.86	0	1072.86	1378.24	1378.24
10	0.910358	1342.1	28.7501	New Fill	100	30	593.688	773.659	1166.81	0	1166.81	1492.52	1492.52
11	0.910358	1486.57	28.7501	New Fill	100	30	628.948	819.607	1246.4	0	1246.4	1591.45	1591.45
12	1.02367	1835.31	34.586	New Fill	100	30	572.053	745.465	1117.98	0	1117.98	1512.4	1512.4
13	1.02367	2000.27	34.586	New Fill	100	30	1627.35	2120.66	3499.89	0	3499.89	4621.93	4621.93
14	1.03142	2182.59	34.3783	New Fill	100	30	688.479	897.184	1380.76	0	1380.76	1851.79	1851.79
15	1.03142	2350.74	34.3783	New Fill	100	30	702.156	915.007	1411.63	0	1411.63	1892.02	1892.02
16	1.02901	2513.15	34.1657	New Fill	100	30	720.794	939.296	1453.7	0	1453.7	1942.92	1942.92
17	1.02901	2681.2	34.1657	New Fill	100	30	736.302	959.505	1488.7	0	1488.7	1988.45	1988.45
18	1.29341	3586.11	42.039	New Fill	100	30	1378.31	1796.13	2937.78	0	2937.78	4180.51	4180.51
19	1.29341	3806.87	42.039	New Fill	100	30	631.913	823.471	1253.09	0	1253.09	1822.84	1822.84
20	1.29583	4029.74	43.7584	New Fill	100	30	1375.03	1791.86	2930.39	0	2930.39	4247.09	4247.09
21	1.29583	4240.06	43.7584	New Fill	100	30	629.248	819.998	1247.07	0	1247.07	1849.62	1849.62
22	0.859395	2924.18	46.2235	New Fill	100	30	590.843	769.951	1160.39	0	1160.39	1777.02	1777.02
23	0.859395	3009.05	46.2235	New Fill	100	30	1674.36	2181.92	3606	0	3606	5353.43	5353.43
24	0.859397	3058.1	45.2563	New Fill	100	30	649.425	846.292	1292.61	0	1292.61	1947.87	1947.87
25	0.859397	2984.2	45.2563	New Fill	100	30	645.161	840.735	1282.99	0	1282.99	1933.95	1933.95
26	0.859394	2891.47	46.815	New Fill	100	30	1650.43	2150.74	3551.97	0	3551.97	5310.42	5310.42
27	0.859394	2795.5	46.815	New Fill	100	30	580.984	757.103	1138.14	0	1138.14	1757.15	1757.15
28	0.859396	2701.04	45.8879	New Fill	100	30	577.949	753.148	1131.28	0	1131.28	1727.43	1727.43
29	0.859396	2608.09	45.8879	New Fill	100	30	563.362	734.139	1098.36	0	1098.36	1679.46	1679.46
30	0.859392	2512.03	47.7581	New Fill	100	30	1502.85	1958.43	3218.9	0	3218.9	4873.88	4873.88
31	0.859392	2412.89	47.7581	New Fill	100	30	503.704	656.397	963.706	0	963.706	1518.4	1518.4
32	0.859392	2313.17	48.0932	New Fill	100	30	485.72	632.961	923.114	0	923.114	1464.33	1464.33
33	0.859392	2212.88	48.0932	New Fill	100	30	1400.37	1824.88	2987.57	0	2987.57	4547.94	4547.94
34	1.23576	3009.3	47.2172	New Fill	100	30	453.009	590.334	849.284	0	849.284	1338.78	1338.78
35	0.982575	2247.89	47.7895	New Fill	100	30	1206.99	1572.88	2551.1	0	2551.1	3881.74	3881.74
36	0.98342	2121.9	46.8912	New Fill	100	30	405.425	528.325	741.883	0	741.883	1175	1175
37	0.98342	1995.91	46.8912	New Fill	100	30	393.703	513.05	715.421	0	715.421	1136.01	1136.01
38	1.28269	2414.86	46.6433	New Fill	100	30	383.894	500.267	693.285	0	693.285	1099.86	1099.86
39	1.28269	2202.33	46.6433	New Fill	100	30	371.073	483.56	664.345	0	664.345	1057.34	1057.34
40	1.28382	1994.64	45.7591	New Fill	100	30	366.963	478.204	655.067	0	655.067	1031.88	1031.88
41	1.28382	1788.11	45.7591	New Fill	100	30	355.357	463.08	628.873	0	628.873	993.773	993.773
42	1.20281	1481.99	47.5898	New Fill	100	30	329.879	429.878	571.368	0	571.368	932.502	932.502
43	1.20281	1286.41	47.5898	New Fill	100	30	317.589	413.863	543.626	0	543.626	891.307	891.307
44	0.721414	674.218	48.0847	New Fill	100	30	289.849	377.714	481.015	0	481.015	803.884	803.884
45	0.721414	600.356	48.0847	New Fill	100	30	235.422	306.788	358.168	0	358.168	620.409	620.409
46	0.721414	526.495	48.0847	New Fill	100	30	221.175	288.222	326.01	0	326.01	572.382	572.382
47	1.17416	701.455	47.1761	New Fill	100	30	203.168	264.756	285.366	0	285.366	504.583	504.583
48	1.17416	509.304	46.2353	New Fill	100	30	174.082	226.853	219.716	0	219.716	401.471	401.471
49	1.17416	321.564	45.2612	New Fill	100	30	137.786	179.555	137.792	0	137.792	276.84	276.84
50	1.20949	118.016	51.0337	New Fill	100	30	80.2164	104.533	7.85164	0	7.85164	107.03	107.03

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.30314

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	114.885	222.859	0	0	0
2	115.919	223.518	65.9136	8.44999	7.30536
3	116.953	224.177	243.251	62.239	14.352
4	117.987	224.812	233.388	89.2627	20.9301
5	119.021	225.448	188.935	95.8799	26.9067
6	119.711	225.848	151.927	89.5879	30.5269
7	120.4	226.247	101.665	68.1956	33.8532
8	121.089	226.647	38.4563	28.8675	36.894
9	122.123	227.219	1911.11	1658.49	40.9519
10	123.157	227.791	1767.08	1734.16	44.4613
11	124.068	228.29	1624.13	1750.77	47.149
12	124.978	228.79	1462.7	1712.98	49.5063
13	126.002	229.496	1121.56	1425.85	51.8117
14	127.026	230.201	3890.85	5316.16	53.7999
15	128.057	230.907	3462.92	5043.5	55.5261
16	129.088	231.613	3014.7	4644.19	57.011
17	130.117	232.311	2552.63	4130.29	58.2828
18	131.146	233.01	2069.46	3495.17	59.3706
19	132.44	234.176	3797.71	6714.8	60.5087
20	133.733	235.342	2868.18	5265.44	61.4221
21	135.029	236.583	4330.65	8192.11	62.1374
22	136.325	237.824	3280.61	6348.48	62.6721
23	137.184	238.721	2528.3	4948.01	62.9342
24	138.044	239.618	4094.31	8079.39	63.1259
25	138.903	240.485	3302.21	6551.35	63.2496
26	139.762	241.352	2520.34	5012.54	63.3064
27	140.622	242.267	4048.54	8048.64	63.2972
28	141.481	243.183	3296.05	6531.18	63.2216
29	142.341	244.07	2587.32	5095.25	63.079
30	143.2	244.956	1902.22	3712.09	62.8676
31	144.059	245.902	3525.21	6796.56	62.5853
32	144.919	246.849	2865.08	5440.75	62.2289
33	145.778	247.806	2225.06	4148.69	61.7941
34	146.638	248.764	3963.25	7231.83	61.276
35	147.873	250.099	3163.31	5562.12	60.3721
36	148.856	251.182	4982.98	8461.37	59.5058
37	149.839	252.233	4443.13	7248.31	58.4922
38	150.823	253.284	3929	6123.41	57.3143
39	152.106	254.642	3298.5	4798.5	55.4953
40	153.388	256.001	2706.8	3631.67	53.3017
41	154.672	257.319	2164.74	2640.82	50.6578
42	155.956	258.637	1657.81	1807.58	47.4747
43	157.159	259.954	1191.08	1146.51	43.9077
44	158.361	261.271	760.76	630.985	39.6728
45	159.083	262.074	532.751	398.1	36.769
46	159.804	262.878	369.738	245.351	33.5675
47	160.526	263.681	227.828	131.814	30.0523
48	161.7	264.948	52.2352	22.8671	23.6424
49	162.874	266.174	-50.9169	-15.0016	16.4165
50	164.048	267.359	-76.5239	-11.4715	8.52558
51	165.258	268.855	0	0	0

Entity Information

Water Table

X	Y
188.955	268.129
189.345	268
195.14	266.085
209.113	261.467
237.757	252
243.808	250
249.86	248
252.025	247.284
253.803	246.696
255.906	246
268.009	242
269.613	241.472
274.09	240
279.281	238.284
279.679	238.281
284.074	238.253
319.355	238
340.951	237.846
348.732	237.634
354.978	237.421
362.922	236.992
414.823	233.843
415.732	233.787
430.633	232.883
436.252	232.542
465.537	230.765
484.568	229.61
493.294	229.08
558.588	230.158
561.535	230.207
585.166	230.597
600	230.842

Distributed Load

X	Y
138.333	269.786
139.254	269.864
157.461	269.547
158.915	269.447

External Boundary

X	Y
599.009	304.329
551.257	304.247
306.301	302.471
297.878	302.14
291.298	302.111
282.616	302
276.502	300
248.013	290
187.037	270
183.831	269.067
180.644	268.615
177.82	268
175.551	267.909
173.156	268
169	268.728
165.258	268.855
161.285	269.284
158.915	269.447
157.461	269.547
139.254	269.864
138.333	269.786
109.209	211.5
106.917	211.479
0	210.5
0	60
600	60
600	226.842
600	230.842
600	287.321
600	300.331
600	304.331

Material Boundary

X	Y
183.831	269.067
184.819	266.855
185.531	265.261
186.278	265.014
186.323	264.999
189.345	264
195.14	262.085
234.104	249.207
243.808	246
249.86	244
252.025	243.284
255.906	242
268.009	238
269.613	237.472
274.09	236
279.281	234.284
279.679	234.281
284.074	234.253
340.951	233.846
348.732	233.634
354.978	233.421
362.922	232.992
414.823	229.843
415.732	229.787
430.633	228.883
436.252	228.542
465.537	226.765
484.568	225.61
493.294	225.08
558.588	226.158
561.535	226.207
585.166	226.597
600	226.842

Material Boundary

X	Y
188.955	268.129
189.345	268
195.14	266.085
209.113	261.467
237.757	252
243.808	250
249.86	248
252.025	247.284
253.803	246.696
255.906	246
268.009	242
269.613	241.472
274.09	240
279.281	238.284
279.679	238.281
284.074	238.253
319.355	238
340.951	237.846
348.732	237.634
354.978	237.421
362.922	236.992
414.823	233.843
415.732	233.787
430.633	232.883
436.252	232.542
465.537	230.765
484.568	229.61
493.294	229.08
558.588	230.158
561.535	230.207
585.166	230.597
600	230.842

Material Boundary

X	Y
282.616	298
285.662	298.039
288.091	298.058
291.298	298.111
293.364	298.102
296.474	298.137
297.878	298.14
306.301	298.471
435.34	299.406
454.564	299.546
483.219	299.753
511.453	299.958
551.257	300.247
600	300.331

Material Boundary

X	Y
184.819	266.855
187.037	267.5
188.955	268.129
210.575	275.223
210.615	275.236
214.538	276.523
217.516	277.5
238.207	284.285
248.013	287.5
262.752	292.693
276.502	297.5
278.611	298.19
282.616	299.5

Material Boundary

X	Y
282.616	298
282.616	299.5

Material Boundary

X	Y
109.209	211.5
179.7	211.5
184.7	221.5
185.7	223.5
186.7	225.5
187.644	227.467
158.044	227.467
162.061	235.5
166.756	244.89
167.061	245.5
170.038	251.454
149.839	251.454
156.941	265.5
158.915	269.447

Material Boundary

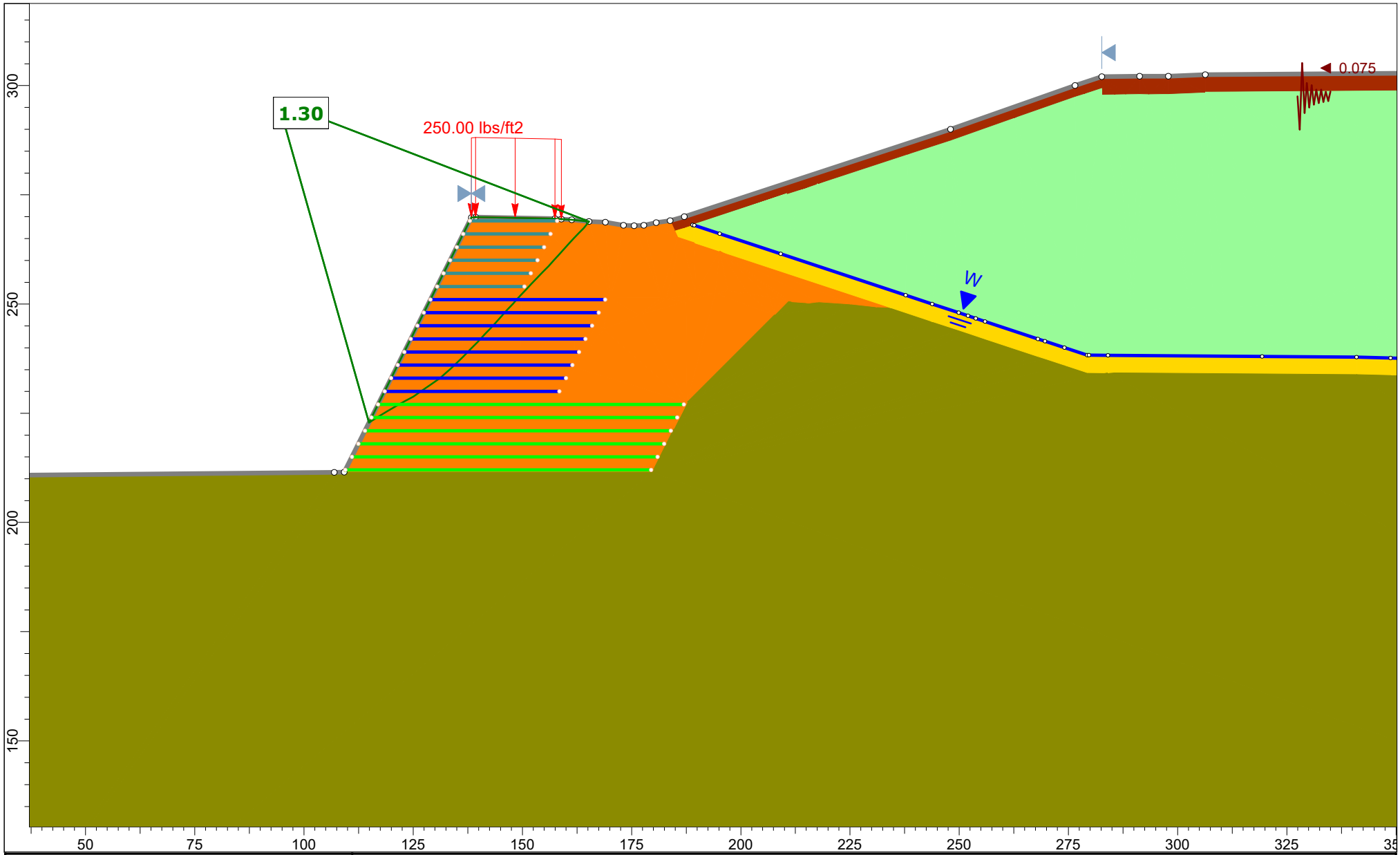
X	Y
109.209	211.5
113.346	212
116.035	212.75
135.237	226.567
149.539	236.387
161.902	245.909
163.014	246.327
166.756	244.89
168.535	244.206
176.707	247.452
181.679	251.408
182.921	251.089
187.481	250.571

189.706	252.514
194.169	252.453
197.058	253.055
201.693	252.344
206.514	251.604
207.801	251.15
209.376	251.298
210.956	250.779
211.871	250.479
215.827	250.229
217.746	250.488
225.195	249.965
231.101	249.35
234.104	249.207
238.077	249.018
242.567	248.314
251.498	246.602
252.795	246.633
253.803	246.696
254.544	246.742
266.618	247.183
276.942	248.011
289.568	248.577
302.908	249.224
308.197	249.096
310.691	249.197
322.981	249.052
324.829	249.851
326.794	250.102
329.818	249.858
333.021	248.984
341.672	254.103
345.536	255.454
351.933	259.414
359.864	262.304
368.33	267.503
380.893	276.434
385.018	278.926
387.297	280.67
399.095	279.63
400.557	279.221
403.836	279.374
426.32	281.672
434.374	282.672
458.823	285.199
469.446	286.25
497.853	288.827
506.714	289.507
524.117	290.667
525.982	290.956
532.284	291.807
533.489	291.386
537.367	290.755

538.857	289.665
542.424	287.723
549.701	285.77
567.168	285.834
572.29	286.14
576.13	286.145
591.361	286.377
591.689	286.452
600	287.321

Material Boundary

X	Y
187.644	227.467
207.644	247.467
210.956	250.779



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 10+27 Seismic

Scale: 1:364

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 10+27 Seismic.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:00m:09.228s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.713230
Axis Location:	163.935, 299.723
Left Slip Surface Endpoint:	153.928, 204.589
Right Slip Surface Endpoint:	234.038, 234.637
Resisting Moment:	1.29195e+07 lb-ft
Driving Moment:	7.541e+06 lb-ft
Resisting Horizontal Force:	111851 lb
Driving Horizontal Force:	65286.4 lb
Total Slice Area:	1713.5 ft2
Surface Horizontal Width:	80.1107 ft
Surface Average Height:	21.3892 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
153.928	204.589
156.106	202.272
158.284	200.453
160.462	199.222
162.64	197.918
165.143	196.676
168.029	195.351
170.701	194.439
173.341	194.072
177.778	194.439
181.835	195.372
185.928	196.812
190.272	198.484
194.617	200.057
198.962	201.841
203.195	203.435
207.428	204.979
210.25	206.089
212.278	208.237
214.307	210.386
216.346	212.773
218.384	215.16
220.692	218.064
223.017	221.013
224.815	223.23
226.647	225.425
228.494	227.574
230.342	229.66
232.19	231.813
234.038	234.637

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 10

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
179.341, 224	20	Not Effective	Not Effective	Not Effective	Not Effective	0
180.864, 227	20	Not Effective	Not Effective	Not Effective	Not Effective	0
182.387, 230	20	Not Effective	Not Effective	Not Effective	Not Effective	0
183.91, 233	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
171.726, 209	40	Not Effective	Not Effective	Not Effective	Not Effective	0
173.249, 212	40	Not Effective	Not Effective	Not Effective	Not Effective	0
174.772, 215	40	Not Effective	Not Effective	Not Effective	Not Effective	0
176.295, 218	40	Not Effective	Not Effective	Not Effective	Not Effective	0
177.818, 221	40	Not Effective	Not Effective	Not Effective	Not Effective	0
170.248, 206.089	40	Not Effective	Not Effective	Not Effective	Not Effective	0

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	3907
Number of Invalid Surfaces:	15104

Error Codes

Error Code -105 reported for 2135 surfaces
Error Code -108 reported for 3 surfaces
Error Code -110 reported for 247 surfaces
Error Code -111 reported for 128 surfaces
Error Code -113 reported for 12543 surfaces
Error Code -123 reported for 48 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-123 = Surface radius equal or less than the internal cutoff of 0.01.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.71323

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.17801	302.684	-46.7613	Subgrade	0	30	79.2783	135.822	235.251	0	235.251	150.942	150.942
2	2.1781	843.167	-39.8728	Subgrade	0	30	212.204	363.555	629.697	0	629.697	452.438	452.438
3	2.17824	1241.91	-29.4744	Subgrade	0	30	287.748	492.978	853.865	0	853.865	691.235	691.235
4	2.17823	1573.15	-30.897	Subgrade	0	30	398.443	682.624	1182.34	0	1182.34	943.907	943.907
5	1.25118	1048.13	-26.4097	Subgrade	0	30	453.086	776.241	1344.49	0	1344.49	1119.48	1119.48
6	1.25118	1141.42	-26.4097	Subgrade	0	30	510.158	874.018	1513.85	0	1513.85	1260.5	1260.5
7	1.44348	1428.04	-24.6535	Subgrade	0	30	556.472	953.364	1651.28	0	1651.28	1395.87	1395.87
8	1.44348	1542.8	-24.6535	Subgrade	0	30	622.176	1065.93	1846.25	0	1846.25	1560.69	1560.69
9	1.33592	1517.48	-18.8424	Subgrade	0	30	618.854	1060.24	1836.39	0	1836.39	1625.2	1625.2
10	1.33592	1763.27	-18.8424	Subgrade	0	30	724.538	1241.3	2149.98	0	2149.98	1902.73	1902.73
11	1.32009	2207.41	-7.9178	Subgrade	0	30	776.79	1330.82	2305.06	0	2305.06	2197.02	2197.02
12	1.32009	2648.43	-7.9178	Subgrade	0	30	926.116	1586.65	2748.16	0	2748.16	2619.36	2619.36
13	1.4787	3461.2	4.72635	Subgrade	0	30	915.738	1568.87	2717.37	0	2717.37	2793.08	2793.08
14	1.4787	3956.36	4.72635	Subgrade	0	30	1038.16	1778.61	3080.65	0	3080.65	3166.48	3166.48
15	1.4787	4451.52	4.72635	Subgrade	0	30	1161.01	1989.08	3445.18	0	3445.18	3541.17	3541.17
16	2.02876	6876.8	12.9545	Subgrade	0	30	1171.55	2007.14	3476.47	0	3476.47	3745.96	3745.96
17	2.02876	7736.1	12.9545	Subgrade	0	30	1304.55	2235	3871.13	0	3871.13	4171.22	4171.22
18	1.36415	5671.35	19.3844	Subgrade	0	30	1301.06	2229.02	3860.77	0	3860.77	4318.55	4318.55
19	1.36415	6032.66	19.3844	Subgrade	0	30	1373.97	2353.92	4077.11	0	4077.11	4560.54	4560.54
20	1.36415	6342.98	19.3844	Subgrade	0	30	1435.57	2459.46	4259.91	0	4259.91	4765.02	4765.02
21	1.44828	6702.74	21.0497	Subgrade	0	30	1391.65	2384.21	4129.58	0	4129.58	4665.17	4665.17
22	1.44828	6600.28	21.0497	Subgrade	0	30	1363.55	2336.07	4046.19	0	4046.19	4570.97	4570.97
23	1.44828	6497.81	21.0497	Subgrade	0	30	1335.61	2288.2	3963.27	0	3963.27	4477.3	4477.3
24	2.17241	9561.33	19.8981	Subgrade	0	30	1321.91	2264.73	3922.63	0	3922.63	4401.11	4401.11
25	2.17241	9394.58	19.8981	Subgrade	0	30	1288.82	2208.05	3824.44	0	3824.44	4290.94	4290.94
26	2.17243	9225.69	22.3246	Subgrade	0	30	1274.17	2182.95	3780.99	0	3780.99	4304.2	4304.2
27	2.17243	8992.18	22.3246	Subgrade	0	30	1248.2	2138.46	3703.93	0	3703.93	4216.48	4216.48
28	1.41092	5718.35	20.6329	Subgrade	0	30	1243.87	2131.03	3691.05	0	3691.05	4159.41	4159.41
29	1.41092	5627.4	20.6329	Subgrade	0	30	1219.46	2089.22	3618.63	0	3618.63	4077.8	4077.8
30	1.41092	5536.45	20.6329	Subgrade	0	30	1195.29	2047.81	3546.92	0	3546.92	3996.98	3996.98
31	1.5818	6100.59	20.0432	Subgrade	0	30	1179.02	2019.93	3498.63	0	3498.63	3928.76	3928.76
32	1.5818	5989.79	20.0432	Subgrade	0	30	1152.7	1974.84	3420.53	0	3420.53	3841.06	3841.06
33	1.06915	3985.77	20.0432	New Fill	100	30	1189.28	2037.51	3355.87	0	3355.87	3789.75	3789.75
34	1.41095	5179.11	21.4769	New Fill	100	30	1148.37	1967.43	3234.49	0	3234.49	3686.31	3686.31
35	1.41095	5084.12	21.4769	New Fill	100	30	1124.78	1927.01	3164.47	0	3164.47	3607.01	3607.01
36	2.02883	6977.41	46.6387	New Fill	100	30	784.647	1344.28	2155.15	0	2155.15	2986.02	2986.02
37	2.02883	6441.32	46.6387	New Fill	100	30	738.377	1265.01	2017.85	0	2017.85	2799.72	2799.72
38	2.03847	5903.2	49.5034	New Fill	100	30	661.534	1133.36	1789.83	0	1789.83	2564.48	2564.48
39	2.03847	5305.26	49.5034	New Fill	100	30	613.283	1050.69	1646.65	0	1646.65	2364.8	2364.8
40	1.1537	2730.61	51.5354	New Fill	100	30	557.207	954.623	1480.25	0	1480.25	2181.64	2181.64
41	1.1537	2525.06	51.5354	New Fill	100	30	528.269	905.047	1394.38	0	1394.38	2059.35	2059.35
42	1.16256	2335.76	51.7405	New Fill	100	30	497.19	851.8	1302.15	0	1302.15	1932.62	1932.62
43	1.16256	2125.54	51.7405	New Fill	100	30	466.949	799.991	1212.42	0	1212.42	1804.54	1804.54
44	1.79795	2862.92	50.9602	New Fill	100	30	394.629	676.09	997.817	0	997.817	1484.45	1484.45
45	1.83192	2353.85	50.1527	New Fill	100	30	321.528	550.852	780.897	0	780.897	1166.16	1166.16
46	1.84792	1868.13	49.317	New Fill	100	30	269.95	462.486	627.844	0	627.844	941.878	941.878
47	1.84792	1265.97	48.452	New Fill	100	30	202.13	346.296	426.597	0	426.597	654.678	654.678
48	1.84795	722.323	49.3645	New Fill	100	30	134.374	230.214	225.538	0	225.538	382.118	382.118
49	0.955677	171.068	56.7979	New Fill	100	30	78.1176	133.834	58.6014	0	58.6014	177.968	177.968
50	0.892302	49.015	56.7979	Final Cover System	0	27	11.0929	19.0047	37.2987	0	37.2987	54.2491	54.2491

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.71323

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	153.928	204.589	0	0	0
2	156.106	202.272	717.561	26.0688	2.08063
3	158.284	200.453	2325.45	168.353	4.14075
4	160.462	199.222	4003.43	432.117	6.16047
5	162.64	197.918	6412.5	914.999	8.12071
6	163.891	197.297	7814.8	1267.54	9.21299
7	165.143	196.676	9393.74	1703.23	10.277
8	166.586	196.013	11291	2290.11	11.4655
9	168.029	195.351	13412.3	3000.15	12.6087
10	169.365	194.895	15076.2	3653.81	13.6233
11	170.701	194.439	17024.3	4432.45	14.5935
12	172.021	194.255	18472.9	5125.31	15.5067
13	173.341	194.072	20200	5934.7	16.3726
14	174.82	194.194	21221.9	6603.62	17.2846
15	176.299	194.316	22380.4	7329.52	18.1335
16	177.778	194.439	23676	8114.32	18.9178
17	179.806	194.905	24430.4	8837.2	19.8866
18	181.835	195.372	25270.5	9563.54	20.729
19	183.199	195.852	25192.2	9783.36	21.2236
20	184.563	196.332	25109.6	9971.98	21.6599
21	185.928	196.812	25023.3	10129.2	22.0376
22	187.376	197.369	24737.1	10183	22.3745
23	188.824	197.927	24456.6	10202.7	22.6447
24	190.272	198.484	24181.8	10189.3	22.8487
25	192.445	199.27	23969.1	10189	23.0298
26	194.617	200.057	23761.7	10116.1	23.061
27	196.79	200.949	23156.9	9802	22.9423
28	198.962	201.841	22564.4	9426.74	22.6737
29	200.373	202.372	22358.5	9224.26	22.4192
30	201.784	202.903	22156.7	8997.6	22.1015
31	203.195	203.435	21958.8	8747.86	21.7212
32	204.777	204.012	21804.8	8466.34	21.2201
33	206.358	204.589	21654.2	8156.88	20.6408
34	207.428	204.979	21616.8	7955.62	20.2051
35	208.839	205.534	21441.5	7624.97	19.5763
36	210.25	206.089	21271.8	7277.42	18.8866
37	212.278	208.237	18233.8	5850.79	17.7902
38	214.307	210.386	15396.8	4582.21	16.5734
39	216.346	212.773	12473	3396.8	15.234
40	218.384	215.16	9792.51	2402.28	13.7835
41	219.538	216.612	8285.68	1900.1	12.9159
42	220.692	218.064	6870.17	1462.38	12.0166
43	221.854	219.538	5528.55	1082.64	11.0799
44	223.017	221.013	4284.07	764.23	10.1145
45	224.815	223.23	2781.31	419.152	8.57016
46	226.647	225.425	1656.22	201.602	6.94014
47	228.494	227.574	805.39	73.9811	5.24832
48	230.342	229.66	289.386	17.7995	3.5197
49	232.19	231.813	52.0449	1.60481	1.76616
50	233.146	233.273	41.1243	0.612704	0.853577
51	234.038	234.637	0	0	0

Entity Information

Water Table

X	Y
239.379	233.369
241.729	231.905
267.762	223.824
305.856	212
325.184	206
536.167	142
539.199	141.882
550.798	141.429
563.541	141.037
570.958	140.885
586.49	140.52
604.544	140.153
777.197	137.439
780.819	137.382
800	137.08

Distributed Load

X	Y
195.034	235.9
211.017	235.833
223.621	235.478

External Boundary

X	Y
169.506	204.589
141.85	204.589
131.978	203.905
122.258	203.825
93.9061	202.931
81.4642	202.76
70.8931	202.018
65.2022	200.967
60.3118	200.341
46.9303	197.781
38.5618	196.748
27.2664	196.163
0	196.201
0	0
800	0
800	133.08
800	137.08
800	244.379
800	318
800	322
499.734	322
373.088	280
343.734	270
241.729	235.905
240.595	235.711
238.871	235.734
238.038	235.498
235.871	235.555
232.768	234
231.963	233.989
230.095	234
228.116	234.931
225.827	234.974
223.621	235.478
211.017	235.833
195.034	235.9
192.264	235.533
185.274	235.688
183.91	233
177.819	221.002
176.295	218
170.248	206.089
170.242	206.076

Material Boundary

X	Y
235.871	235.555
239.379	233.369
241.729	231.905
267.762	223.824
305.856	212
312.3	210
325.184	206
463.642	164
496.608	154
536.167	142
539.199	141.882
550.798	141.429
563.541	141.037
570.958	140.885
586.49	140.52
604.544	140.153
777.197	137.439
780.819	137.382
800	137.08

Material Boundary

X	Y
170.248	206.089
173.722	206.227
181.132	208.641
183.568	209.25
187.68	208.231
188.785	207.948
188.96	207.953
194.097	208.265
198.511	207.987
200.965	207.891
207.125	208.092
214.877	208.345
224.162	208.519
224.748	208.719
227.761	209.66
236.954	213.307
246.468	218.629
253.908	224.125
254.798	224.782
257.288	224.172
258.624	223.62
267.762	223.824
268.559	223.842
276.801	223.733
277.35	223.976
279.904	224.663
294.867	219.426
310.669	213.858
318.14	211.333

339.89	204.51
348.744	201.745
367.473	195.761
373.011	194.062
391.919	187.721
396.291	185.896
399.922	186.085
403.587	185.694
414.635	186.642
425.909	188.05
434.864	189.152
451.032	191.196
456.908	191.736
458.199	191.872
473.223	187.443
473.306	187.356
474.037	187.216
474.785	186.894
485.213	181.934
486.479	182.695
496.339	176.403
510.112	174.888
511.921	174.511
514.356	174.73
519.993	173.831
533.581	172.533
536.872	172.738
545.906	173.493
549.494	173.039
557.418	171.993
562.439	171.657
574.666	173.419
591.182	178.015
599.36	180.603
604.858	180.265
609.812	179.164
616.71	178.254
620.105	178.44
623.466	179.291
631.375	180.78
636.949	180.91
641.901	182.165
646.344	182.052
652.94	184.267
657.255	185.358
664.689	185.819
669.057	188.878
673.746	191.858
691.992	196.743
692.936	196.933
707.079	203.199
708.949	203.904
724.311	207.678

730.025	209.155
730.553	209.447
743.892	218.45
762.748	228.283
769.069	231.713
777.207	235.77
793.455	241.864
799.817	244.305
800	244.379

Material Boundary

X	Y
231.963	233.989
233.114	233.273
241.729	227.905
253.908	224.125
305.856	208
312.3	206
325.184	202
463.642	160
496.608	150
536.167	138
539.199	137.882
550.798	137.429
563.541	137.037
570.958	136.885
586.49	136.52
604.544	136.153
777.197	133.439
780.819	133.382
800	133.08

Material Boundary

X	Y
499.734	322
499.734	319.5
499.734	318
504.934	318
800	318

Material Boundary

X	Y
233.114	233.273
239.379	233.369
241.73	233.405
253.734	237.5
343.734	267.5
373.088	277.5
403.632	287.5
499.734	319.5

Material Boundary

X	Y
170.242	206.076
196.136	206.076
200.965	207.891

Material Boundary

X	Y
196.136	206.076
204.37	206.076
207.125	208.092

Material Boundary

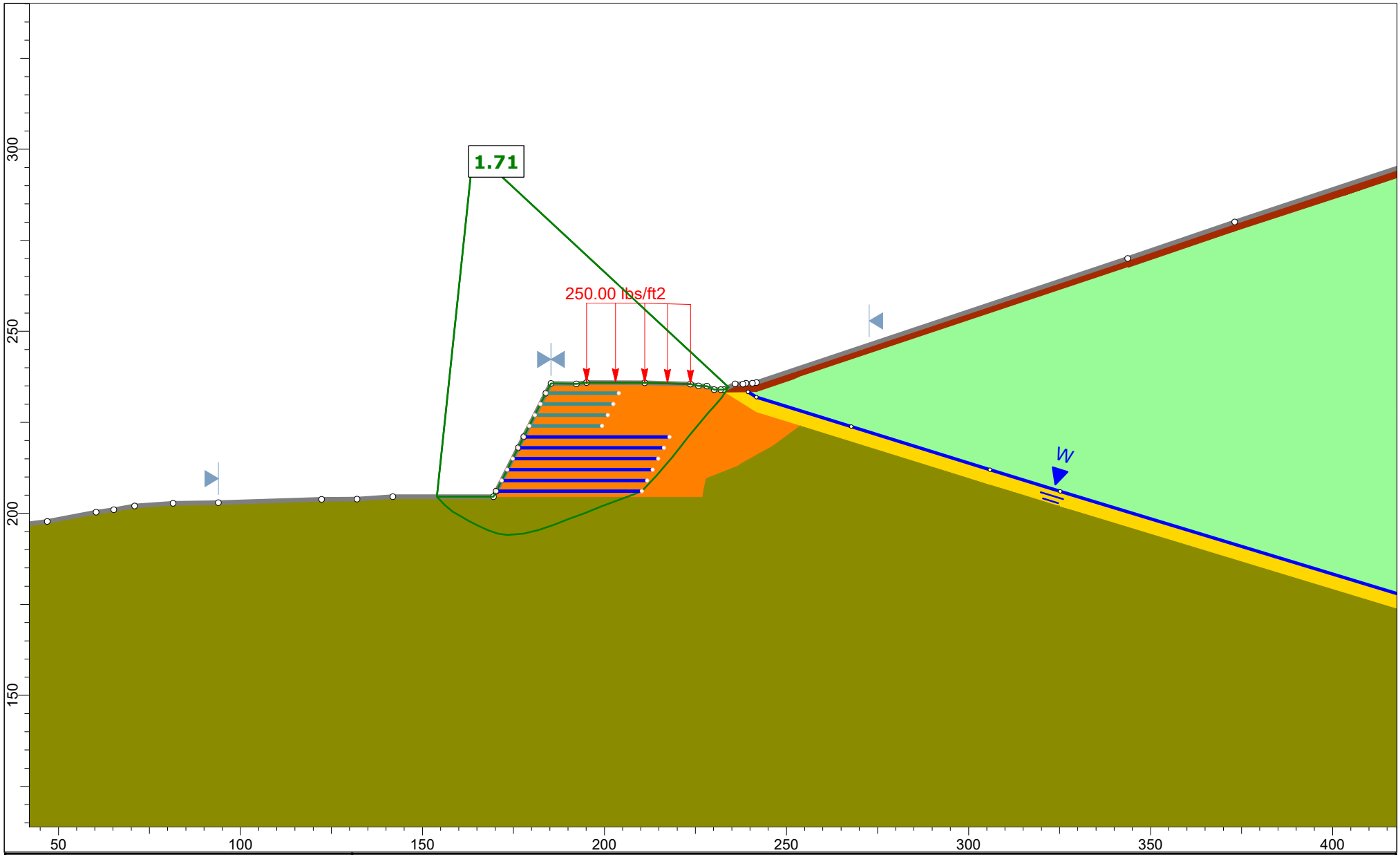
X	Y
204.37	206.076
227.035	206.076
227.761	209.66

Material Boundary

X	Y
176.295	218
214.643	218

Material Boundary

X	Y
169.506	204.589
226.741	204.589
227.035	206.076



SLIDEINTERPRET 9.009	Dunn Mine and C&D Facility S.A.Dunn & Company, LLC Rensselaer, New York	
	Station 15+01 Static	
	Scale: 1:437	PREPARED BY: Civil & Environmental Consultants, Inc.
	Date: 5/17/2021	File Name: Station 15+01 Static.slim

Slide Analysis Information

Project Summary

Slide Modeler Version:	9.009
Compute Time:	00h:01m:14.678s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Vertical

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Water Table
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.468380
Axis Location:	205.828, 577.706
Left Slip Surface Endpoint:	155.391, 204.589
Right Slip Surface Endpoint:	474.060, 313.486
Resisting Moment:	6.70595e+07 lb-ft
Driving Moment:	4.56692e+07 lb-ft
Resisting Horizontal Force:	179832 lb
Driving Horizontal Force:	122470 lb
Active Support Moment:	-1.4184e+06 lb-ft
Active Horizontal Support Force:	-3818.02 lb
Maximum Single Support Force:	3900 lb
Total Support Force:	3906.23 lb
Total Slice Area:	3092.94 ft2
Surface Horizontal Width:	318.669 ft
Surface Average Height:	9.7058 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
155.391	204.589
163.741	198.373
171.498	194.534
181.489	195.856
191.592	200.268
200.601	203.955
211.913	209.086
220.285	213.162
233.822	219.28
243.925	223.493
256.183	228.177
267.77	233.487
277.18	237.584
284.523	240.525
291.865	243.209
299.526	246.516
309.241	250.53
316.032	253.339
322.822	256.115
332.936	260.44
343.173	265.657
349.411	268.618
356.061	271.542
362.712	274.234
369.363	276.694
381.721	280.834
394.079	284.542
407.335	288.998
423.098	294.198
438.863	300.226
450.595	304.643
462.327	308.65
474.06	313.486

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 10

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
179.341, 224	20	Not Effective	Not Effective	Not Effective	Not Effective	0
180.864, 227	20	Not Effective	Not Effective	Not Effective	Not Effective	0
182.387, 230	20	Not Effective	Not Effective	Not Effective	Not Effective	0
183.91, 233	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
171.726, 209	40	39.9977	0.0023409	39.9977	0.0023409	6.2344
173.249, 212	40	Not Effective	Not Effective	Not Effective	Not Effective	0
174.772, 215	40	Not Effective	Not Effective	Not Effective	Not Effective	0
176.295, 218	40	Not Effective	Not Effective	Not Effective	Not Effective	0
177.818, 221	40	Not Effective	Not Effective	Not Effective	Not Effective	0
170.248, 206.089	40	35.0577	4.94231	35.0577	4.94231	3900

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	5263
Number of Invalid Surfaces:	13795

Error Codes

Error Code -105 reported for 2164 surfaces
Error Code -108 reported for 1 surface
Error Code -110 reported for 315 surfaces
Error Code -111 reported for 71 surfaces
Error Code -113 reported for 11244 surfaces

Error Code Descriptions

The following errors were encountered during the computation:
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.46838

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	8.35077	3114.53	-36.6628	Subgrade	0	30	234.778	344.743	597.113	0	597.113	422.351	422.351
2	7.75627	8048.39	-26.3316	Subgrade	0	30	625.574	918.581	1591.03	0	1591.03	1281.42	1281.42
3	9.99146	27811.6	7.53783	Subgrade	0	30	1140.89	1675.26	2901.64	0	2901.64	3052.6	3052.6
4	5.05136	21780.7	23.5902	Subgrade	0	30	1463.85	2149.49	3723.03	0	3723.03	4362.27	4362.27
5	5.05136	22088.1	23.5902	Subgrade	0	30	1468.6	2156.47	3735.13	0	3735.13	4376.45	4376.45
6	9.00956	36432.9	22.2558	Subgrade	0	30	1419.61	2084.52	3610.5	0	3610.5	4191.44	4191.44
7	1.39755	5299.87	24.4001	Subgrade	0	30	1318.04	1935.39	3352.2	0	3352.2	3950.09	3950.09
8	4.95677	17932.1	24.4001	New Fill	100	30	1380.71	2027.4	3338.36	0	3338.36	3964.67	3964.67
9	4.95677	16581.2	24.4001	New Fill	100	30	1235.72	1814.5	2969.6	0	2969.6	3530.15	3530.15
10	8.3723	24681.1	25.9598	New Fill	100	30	1072.09	1574.24	2553.46	0	2553.46	3075.42	3075.42
11	6.76867	16760.2	24.3202	New Fill	100	30	899.032	1320.12	2113.31	0	2113.31	2519.62	2519.62
12	6.76867	13460.5	24.3202	New Fill	100	30	700.819	1029.07	1609.19	0	1609.19	1925.92	1925.92
13	5.05165	9083.2	22.6372	New Fill	100	30	656.046	963.325	1495.32	0	1495.32	1768.91	1768.91
14	5.05165	7779.26	22.6372	New Fill	100	30	571.881	839.738	1281.26	0	1281.26	1519.75	1519.75
15	5.38617	6865.63	20.9119	New Fill	100	30	501.53	736.437	1102.34	0	1102.34	1293.98	1293.98
16	5.77615	5935.16	20.9119	Bottom Liner	67	17.4	198.38	291.297	829.559	113.826	715.733	905.36	791.534
17	1.09524	985.779	20.9119	C&D Waste	1.13687e-13	34.992	373.476	548.404	783.434	0	783.434	926.14	926.14
18	5.79358	5081.66	24.6215	C&D Waste	5.68434e-14	34.992	334.4	491.027	701.468	0	701.468	854.72	854.72
19	5.79358	4833.68	24.6215	C&D Waste	5.68434e-14	34.992	316.703	465.04	664.343	0	664.343	809.484	809.484
20	9.40984	7383.12	23.5285	C&D Waste	0	34.992	303.941	446.301	637.573	0	637.573	769.91	769.91
21	7.34288	5447.89	21.8253	C&D Waste	0	34.992	298.104	437.73	625.328	0	625.328	744.714	744.714
22	7.3424	5292.7	20.0805	C&D Waste	5.68434e-14	34.992	301.665	442.959	632.799	0	632.799	743.076	743.076
23	7.66038	5300.63	23.3507	C&D Waste	5.68434e-14	34.992	266.161	390.826	558.323	0	558.323	673.23	673.23
24	4.8577	3198.29	22.4488	C&D Waste	0	34.992	258.186	379.115	541.593	0	541.593	648.267	648.267
25	4.8577	3087.84	22.4488	C&D Waste	0	34.992	248.708	365.198	521.711	0	521.711	624.469	624.469
26	6.79064	4130.83	22.4696	C&D Waste	5.68434e-14	34.992	237.239	348.357	497.653	0	497.653	595.774	595.774
27	6.7906	3920.41	22.2356	C&D Waste	5.68434e-14	34.992	225.756	331.495	473.564	0	473.564	565.857	565.857
28	10.1136	5403.19	23.1552	C&D Waste	5.68434e-14	34.992	203.356	298.604	426.576	0	426.576	513.547	513.547
29	5.11875	2453.93	27.0022	C&D Waste	2.84217e-14	34.992	165.684	243.287	347.553	0	347.553	431.981	431.981
30	5.11875	2179.73	27.0022	C&D Waste	0	34.992	146.918	215.731	308.187	0	308.187	383.052	383.052
31	6.23733	2331.52	25.3915	C&D Waste	2.84217e-14	34.992	133.68	196.293	280.418	0	280.418	343.87	343.87
32	6.65074	2187.82	23.7366	C&D Waste	-2.84217e-14	34.992	121.929	179.038	255.768	0	255.768	309.384	309.384
33	2.45451	747.331	22.0386	C&D Waste	2.84217e-14	34.992	117.108	171.959	245.656	0	245.656	293.062	293.062
34	4.19629	1190.13	22.0386	Final Cover System	0	27	75.5411	110.923	217.699	0	217.699	248.278	248.278
35	6.65075	1701.48	20.2989	Final Cover System	0	27	70.4933	103.511	203.151	0	203.151	229.225	229.225
36	6.179	1518.61	18.5193	Final Cover System	0	27	70.1814	103.053	202.251	0	202.251	225.76	225.76

37	6.179	1510.85	18.5193	Final Cover System	0	27	69.9124	102.658	201.476	0	201.476	224.895	224.895
38	6.179	1575.5	16.7018	Final Cover System	0	27	75.6487	111.081	218.009	0	218.009	240.707	240.707
39	6.179	1720.08	16.7018	Final Cover System	0	27	82.8743	121.691	238.832	0	238.832	263.698	263.698
40	6.62806	1910.81	18.5785	Final Cover System	0	27	83.3388	122.373	240.172	0	240.172	268.184	268.184
41	6.62806	1887.17	18.5785	Final Cover System	0	27	82.6653	121.384	238.23	0	238.23	266.015	266.015
42	15.7634	4485.83	18.2579	Final Cover System	0	27	83.7733	123.011	241.423	0	241.423	269.06	269.06
43	7.88205	2066.92	20.9252	Final Cover System	0	27	75.2489	110.494	216.856	0	216.856	245.629	245.629
44	7.88205	1688.99	20.9252	Final Cover System	0	27	62.0776	91.1535	178.898	0	178.898	202.635	202.635
45	5.8662	1023.91	20.6292	Final Cover System	0	27	51.1748	75.144	147.479	0	147.479	166.744	166.744
46	5.8662	838.963	20.6292	Final Cover System	0	27	42.2356	62.0179	121.717	0	121.717	137.617	137.617
47	5.86621	726.055	18.8569	Final Cover System	0	27	37.4532	54.9956	107.935	0	107.935	120.727	120.727
48	5.86621	685.189	18.8569	Final Cover System	0	27	35.5877	52.2563	102.559	0	102.559	114.713	114.713
49	5.86623	498.569	22.4008	Final Cover System	0	27	25.381	37.269	73.1445	0	73.1445	83.6062	83.6062
50	5.86623	166.19	22.4008	Final Cover System	0	27	8.54016	12.5402	24.6114	0	24.6114	28.1316	28.1316

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.46838

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	155.391	204.589	0	0	0
2	163.741	198.373	5438.67	412.422	4.33652
3	171.498	194.534	15794.7	2303.1	8.2961
4	181.489	195.856	21271.7	4991.48	13.2057
5	186.54	198.062	18820.2	5246.2	15.576
6	191.592	200.268	16342.9	5265.1	17.8571
7	200.601	203.955	13088.7	5203.28	21.6798
8	201.999	204.589	12408.1	5074.48	22.2428
9	206.956	206.837	14212.7	6379.35	24.1729
10	211.913	209.086	12423.2	6058.34	25.9968
11	220.285	213.162	9139.77	5031.69	28.834
12	227.053	216.221	7503.31	4491.71	30.906
13	233.822	219.28	6314.79	4067.16	32.7843
14	238.874	221.387	5797.56	3919.87	34.0636
15	243.925	223.493	5403.89	3817.86	35.2413
16	249.312	225.551	5321.62	3921.83	36.3888
17	255.088	227.758	4191.47	3216.17	37.4995
18	256.183	228.177	4198.72	3244.73	37.6965
19	261.977	230.832	3892.49	3114.97	38.6686
20	267.77	233.487	3600.89	2971.11	39.5262
21	277.18	237.584	3295.02	2832.74	40.6858
22	284.523	240.525	3236.47	2853.21	41.3988
23	291.865	243.209	3355.98	3016.47	41.9503
24	299.526	246.516	3150.89	2873.05	42.3592
25	304.383	248.523	3078.22	2823.85	42.5322
26	309.241	250.53	3007.69	2769.5	42.6391
27	316.032	253.339	2911.2	2684.35	42.6784
28	322.822	256.115	2835.52	2606.46	42.5898
29	332.936	260.44	2641.87	2397.05	42.2184
30	338.055	263.049	2399.37	2154.33	41.9198
31	343.173	265.657	2184.06	1935.35	41.545
32	349.411	268.618	2012.81	1748.66	40.983
33	356.061	271.542	1911.64	1618.47	40.2526
34	358.516	272.536	1898.94	1590.46	39.9479
35	362.712	274.234	1756.87	1442.17	39.3817
36	369.363	276.694	1598.33	1265.21	38.3645
37	375.542	278.764	1499.47	1141.57	37.2826
38	381.721	280.834	1401.13	1020.34	36.0631
39	387.9	282.688	1346.22	932.167	34.7
40	394.079	284.542	1286.5	841.466	33.1876
41	400.707	286.77	1160.51	708.18	31.3929
42	407.335	288.998	1036.15	584.167	29.4137
43	423.098	294.198	764.772	339.594	23.9434
44	430.981	297.212	549.299	208.716	20.8052
45	438.863	300.226	372.753	116.894	17.4112
46	444.729	302.434	270.475	71.1211	14.7324
47	450.595	304.643	186.52	39.4344	11.9378
48	456.461	306.646	135.525	21.574	9.04493
49	462.327	308.65	87.4227	9.30373	6.07469
50	468.194	311.068	22.0591	1.17576	3.051
51	474.06	313.486	0	0	0

Entity Information

Water Table

X	Y
239.379	233.369
241.729	231.905
267.762	223.824
305.856	212
325.184	206
536.167	142
539.199	141.882
550.798	141.429
563.541	141.037
570.958	140.885
586.49	140.52
604.544	140.153
777.197	137.439
780.819	137.382
800	137.08

Distributed Load

X	Y
195.034	235.9
211.017	235.833
223.621	235.478

External Boundary

X	Y
169.506	204.589
141.85	204.589
131.978	203.905
122.258	203.825
93.9061	202.931
81.4642	202.76
70.8931	202.018
65.2022	200.967
60.3118	200.341
46.9303	197.781
38.5618	196.748
27.2664	196.163
0	196.201
0	0
800	0
800	133.08
800	137.08
800	244.379
800	318
800	322
499.734	322
373.088	280
343.734	270
241.729	235.905
240.595	235.711
238.871	235.734
238.038	235.498
235.871	235.555
232.768	234
231.963	233.989
230.095	234
228.116	234.931
225.827	234.974
223.621	235.478
211.017	235.833
195.034	235.9
192.264	235.533
185.274	235.688
183.91	233
177.819	221.002
176.295	218
170.248	206.089
170.242	206.076

Material Boundary

X	Y
235.871	235.555
239.379	233.369
241.729	231.905
267.762	223.824
305.856	212
312.3	210
325.184	206
463.642	164
496.608	154
536.167	142
539.199	141.882
550.798	141.429
563.541	141.037
570.958	140.885
586.49	140.52
604.544	140.153
777.197	137.439
780.819	137.382
800	137.08

Material Boundary

X	Y
170.248	206.089
173.722	206.227
181.132	208.641
183.568	209.25
187.68	208.231
188.785	207.948
188.96	207.953
194.097	208.265
198.511	207.987
200.965	207.891
207.125	208.092
214.877	208.345
224.162	208.519
224.748	208.719
227.761	209.66
236.954	213.307
246.468	218.629
253.908	224.125
254.798	224.782
257.288	224.172
258.624	223.62
267.762	223.824
268.559	223.842
276.801	223.733
277.35	223.976
279.904	224.663
294.867	219.426
310.669	213.858
318.14	211.333

339.89	204.51
348.744	201.745
367.473	195.761
373.011	194.062
391.919	187.721
396.291	185.896
399.922	186.085
403.587	185.694
414.635	186.642
425.909	188.05
434.864	189.152
451.032	191.196
456.908	191.736
458.199	191.872
473.223	187.443
473.306	187.356
474.037	187.216
474.785	186.894
485.213	181.934
486.479	182.695
496.339	176.403
510.112	174.888
511.921	174.511
514.356	174.73
519.993	173.831
533.581	172.533
536.872	172.738
545.906	173.493
549.494	173.039
557.418	171.993
562.439	171.657
574.666	173.419
591.182	178.015
599.36	180.603
604.858	180.265
609.812	179.164
616.71	178.254
620.105	178.44
623.466	179.291
631.375	180.78
636.949	180.91
641.901	182.165
646.344	182.052
652.94	184.267
657.255	185.358
664.689	185.819
669.057	188.878
673.746	191.858
691.992	196.743
692.936	196.933
707.079	203.199
708.949	203.904
724.311	207.678

730.025	209.155
730.553	209.447
743.892	218.45
762.748	228.283
769.069	231.713
777.207	235.77
793.455	241.864
799.817	244.305
800	244.379

Material Boundary

X	Y
231.963	233.989
233.114	233.273
241.729	227.905
253.908	224.125
305.856	208
312.3	206
325.184	202
463.642	160
496.608	150
536.167	138
539.199	137.882
550.798	137.429
563.541	137.037
570.958	136.885
586.49	136.52
604.544	136.153
777.197	133.439
780.819	133.382
800	133.08

Material Boundary

X	Y
499.734	322
499.734	319.5
499.734	318
504.934	318
800	318

Material Boundary

X	Y
233.114	233.273
239.379	233.369
241.73	233.405
253.734	237.5
343.734	267.5
373.088	277.5
403.632	287.5
499.734	319.5

Material Boundary

X	Y
170.242	206.076
196.136	206.076
200.965	207.891

Material Boundary

X	Y
196.136	206.076
204.37	206.076
207.125	208.092

Material Boundary

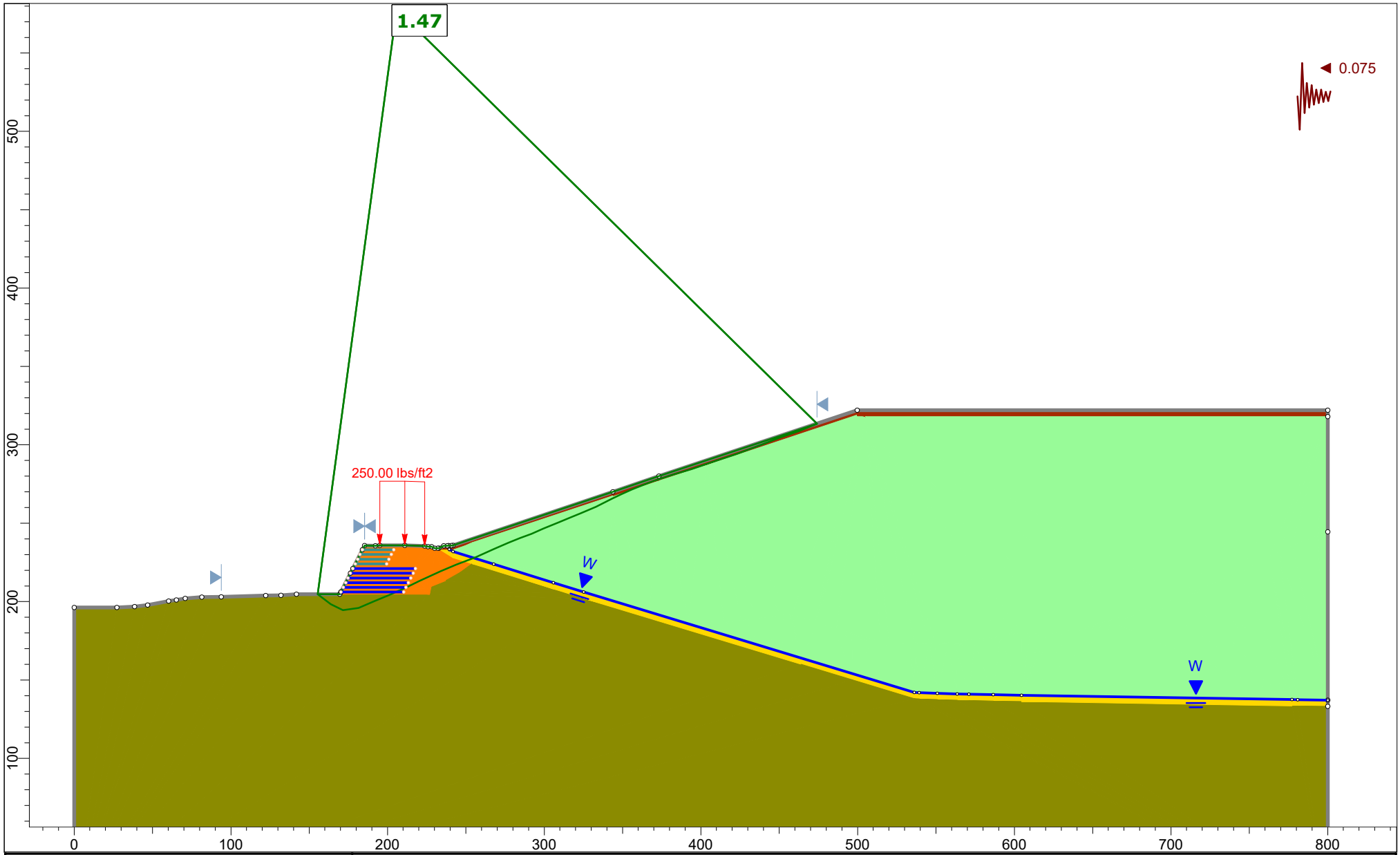
X	Y
204.37	206.076
227.035	206.076
227.761	209.66

Material Boundary

X	Y
176.295	218
214.643	218

Material Boundary

X	Y
169.506	204.589
226.741	204.589
227.035	206.076



Dunn Mine and C&D Facility S.A.Dunn & Company, LLC Rensselaer, New York		
Station 15+01 Seismic		
	Scale: 1:1016	PREPARED BY: Civil & Environmental Consultants, Inc.
Date: 5/17/2021		File Name: Station 15+01 Seismic.slim

SLIDEINTERPRET 9.009

Slide Analysis Information

Station 19+47 Static.Rev1

Project Summary

File Name:	Station 19+47 Static.Rev1.slmd
Slide Modeler Version:	9.009
Compute Time:	00h:00m:07.47s
Analysis:	Station 19+47 Static
Company:	Civil & Environmental Consultants, Inc.
Comments	
	Dunn Mine and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Discard data for surfaces with FS above:	2
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Normal to boundary

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Piezometric Line 1
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 3	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	8400
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.555360
Axis Location:	319.538, 358.188
Left Slip Surface Endpoint:	312.081, 140.000
Right Slip Surface Endpoint:	489.614, 221.309
Resisting Moment:	8.4536e+07 lb-ft
Driving Moment:	5.43514e+07 lb-ft
Resisting Horizontal Force:	326357 lb
Driving Horizontal Force:	209828 lb
Active Support Moment:	-1.25099e+07 lb-ft
Active Horizontal Support Force:	-55568.9 lb
Maximum Single Support Force:	8400 lb
Total Support Force:	58810.7 lb
Total Slice Area:	5547.42 ft2
Surface Horizontal Width:	177.533 ft
Surface Average Height:	31.2472 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
312.081	140
316.065	137.093
322.805	134.627
329.544	133.502
336.59	132.793
343.635	132.391
351.115	132.629
358.523	133.5
366.199	134.787
374.152	136.548
382.105	138.511
390.058	140.196
398.01	142.318
405.962	146.294
413.913	151.608
417.888	155.078
421.862	158.549
429.812	165.211
437.763	171.597
443.283	175.838
450.538	181.594
457.344	187.611
463.759	194.347
470.553	201.49
477.346	208.635
483.48	214.972
489.614	221.309

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 20

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
402, 194	55	Not Effective	Not Effective	Not Effective	Not Effective	0
403.5, 197	55	Not Effective	Not Effective	Not Effective	Not Effective	0
405, 200	55	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
414, 218	20	Not Effective	Not Effective	Not Effective	Not Effective	0
412.5, 215	20	Not Effective	Not Effective	Not Effective	Not Effective	0
411, 212	20	Not Effective	Not Effective	Not Effective	Not Effective	0
409.5, 209	20	Not Effective	Not Effective	Not Effective	Not Effective	0
408, 206	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
400.5, 191	55	Not Effective	Not Effective	Not Effective	Not Effective	0
399, 188	55	Not Effective	Not Effective	Not Effective	Not Effective	0
397.5, 185	55	Not Effective	Not Effective	Not Effective	Not Effective	0
396, 182	55	54.9971	0.00289802	54.9971	0.00289802	10.7017
406.5, 203	55	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 3

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
393, 176	90	50.4873	39.5127	50.4873	39.5127	8400
393.75, 177.5	90	51.6279	38.3721	51.6279	38.3721	8400
394.5, 179	90	52.7685	37.2315	52.7685	37.2315	8400
395.25, 180.5	90	53.909	36.091	53.909	36.091	8400
391.5, 173	100	48.089	51.911	48.089	51.911	8400
392.25, 174.5	100	49.2915	50.7085	49.2915	50.7085	8400
390.75, 171.5	100	46.892	53.108	46.892	53.108	8400

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	1276
Number of Invalid Surfaces:	17733

Error Codes

Error Code -97 reported for 1249 surfaces
Error Code -105 reported for 3633 surfaces
Error Code -108 reported for 10 surfaces
Error Code -110 reported for 419 surfaces
Error Code -111 reported for 161 surfaces
Error Code -113 reported for 12261 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-97 = Factor of safety is out of valid range set by user.

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.55536

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.9842	694.922	-36.1156	Subgrade	0	30	93.7661	145.84	252.602	0	252.602	184.188	184.188
2	3.36999	1561.63	-20.0942	Subgrade	0	30	215.09	334.542	579.444	0	579.444	500.757	500.757
3	3.36999	2695.85	-20.0942	Subgrade	0	30	383.94	597.165	1034.32	0	1034.32	893.862	893.862
4	3.36961	3739.86	-9.47973	Subgrade	0	30	491.346	764.22	1323.67	0	1323.67	1241.62	1241.62
5	3.36961	4648.63	-9.47973	Subgrade	0	30	625.604	973.04	1685.35	0	1685.35	1580.89	1580.89
6	3.52273	5782.16	-5.74979	Subgrade	0	30	731.766	1138.16	1971.35	0	1971.35	1897.67	1897.67
7	3.52273	6676.69	-5.74979	Subgrade	0	30	862.848	1342.04	2324.49	0	2324.49	2237.6	2237.6
8	3.52269	7538.61	-3.26535	Subgrade	0	30	964.716	1500.48	2598.9	0	2598.9	2543.86	2543.86
9	3.52269	8368.13	-3.26535	Subgrade	0	30	1089.32	1694.29	2934.6	0	2934.6	2872.46	2872.46
10	3.73976	9716.9	1.8282	Subgrade	0	30	1134.08	1763.9	3055.16	0	3055.16	3091.36	3091.36
11	3.73976	10502.5	1.8282	Subgrade	0	30	1238.9	1926.93	3337.52	0	3337.52	3377.07	3377.07
12	3.70418	11106.5	6.70229	Subgrade	0	30	1250.89	1945.59	3369.87	0	3369.87	3516.87	3516.87
13	3.70418	11736.3	6.70229	Subgrade	0	30	1327.33	2064.48	3575.78	0	3575.78	3731.76	3731.76
14	3.83813	12780.7	9.51608	Subgrade	0	30	1345.86	2093.29	3625.68	0	3625.68	3851.29	3851.29
15	3.83813	13368.2	9.51608	Subgrade	0	30	1408.13	2190.15	3793.45	0	3793.45	4029.5	4029.5
16	3.97636	14418.3	12.4875	Subgrade	0	30	1403.52	2182.98	3781.02	0	3781.02	4091.85	4091.85
17	3.97636	14946.8	12.4875	Subgrade	0	30	1450.12	2255.46	3906.57	0	3906.57	4227.72	4227.72
18	3.97636	15451.2	13.8657	Subgrade	0	30	1462.68	2274.99	3940.41	0	3940.41	4301.46	4301.46
19	3.97636	15931.5	13.8657	Subgrade	0	30	1500.04	2333.1	4041.05	0	4041.05	4411.32	4411.32
20	3.97644	16213.3	11.9651	Subgrade	0	30	1563.15	2431.26	4211.06	0	4211.06	4542.32	4542.32
21	3.97644	15854	11.9651	Subgrade	0	30	1521.31	2366.19	4098.36	0	4098.36	4420.75	4420.75
22	3.97626	16169.7	14.9349	Subgrade	0	30	1470.6	2287.31	3961.73	0	3961.73	4353.98	4353.98
23	3.97626	19208.6	14.9349	Subgrade	0	30	1729.27	2689.64	4658.59	0	4658.59	5119.85	5119.85
24	3.97577	22272.8	26.5692	Subgrade	0	30	1666.26	2591.63	4488.84	0	4488.84	5322.12	5322.12
25	3.97577	25117.9	26.5692	Subgrade	0	30	1867.72	2904.98	5031.56	0	5031.56	5965.59	5965.59
26	2.50494	17223.2	33.7582	Subgrade	0	30	1814.04	2821.49	4886.97	0	4886.97	6099.45	6099.45
27	5.44585	40903.5	33.7582	New Fill	100	30	2039.85	3172.7	5322.07	0	5322.07	6685.48	6685.48
28	3.97493	31652.8	41.1214	New Fill	100	30	1966.73	3058.97	5125.09	0	5125.09	6842.07	6842.07
29	3.97493	30139.4	41.1214	New Fill	100	30	1899.43	2954.29	4943.78	0	4943.78	6602	6602
30	3.97501	28517.9	39.9661	New Fill	100	30	1846.07	2871.31	4800.04	0	4800.04	6347.22	6347.22
31	3.97501	26928.8	39.9661	New Fill	100	30	1761.44	2739.68	4572.06	0	4572.06	6048.31	6048.31
32	3.97509	25373.2	38.7705	New Fill	100	30	1711.66	2662.25	4437.94	0	4437.94	5812.7	5812.7
33	3.97509	23850.3	38.7705	New Fill	100	30	1654.67	2573.6	4284.41	0	4284.41	5613.39	5613.39
34	2.76014	15680.8	37.5333	New Fill	100	30	1615.24	2512.28	4178.17	0	4178.17	5419.08	5419.08
35	2.76014	14978.4	37.5333	New Fill	100	30	1538.05	2392.22	3970.22	0	3970.22	5151.83	5151.83
36	3.62729	18596.4	38.4288	New Fill	100	30	1418.12	2205.68	3647.15	0	3647.15	4772.29	4772.29
37	3.62729	17343.7	38.4288	New Fill	100	30	1291.16	2008.22	3305.14	0	3305.14	4329.56	4329.56
38	3.40305	15048.6	41.4792	New Fill	100	30	1151.62	1791.18	2929.19	0	2929.19	3947.31	3947.31
39	3.40305	13456.9	41.4792	New Fill	100	30	1003.57	1560.91	2530.36	0	2530.36	3417.6	3417.6
40	3.20777	11113.9	46.3966	New Fill	100	30	835.324	1299.23	2077.13	0	2077.13	2954.21	2954.21
41	3.20777	9906.14	46.3966	New Fill	100	30	759.342	1181.05	1872.43	0	1872.43	2669.72	2669.72
42	3.3968	9427.42	46.4373	New Fill	100	30	697.143	1084.31	1704.87	0	1704.87	2437.9	2437.9
43	3.3968	8094.17	46.4373	New Fill	100	30	614.519	955.798	1482.29	0	1482.29	2128.44	2128.44
44	3.3968	6816.75	46.4422	New Fill	100	30	533.34	829.535	1263.59	0	1263.59	1824.48	1824.48
45	3.3968	5462.85	46.4422	New Fill	100	30	443.647	690.031	1021.96	0	1021.96	1488.53	1488.53
46	3.59915	4318.12	45.9336	New Fill	100	30	350.137	544.589	770.049	0	770.049	1131.79	1131.79
47	2.53484	2107.99	45.9336	Bottom Liner	67	17.4	145.094	225.674	633.862	127.533	506.329	783.764	656.231
48	0.394889	249.624	45.9341	Bottom Liner	67	17.4	134.109	208.588	466.944	15.1371	451.807	605.499	590.362
49	0.962054	555.228	45.9341	C&D Waste	5.68434e-14	34.992	172.012	267.54	382.201	0	382.201	559.914	559.914
50	4.77704	1311.95	45.9341	Final Cover System	0	27	65.7591	102.279	200.734	0	200.734	268.673	268.673

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.55536

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	312.081	140	0	0	0
2	316.065	137.093	1107.9	38.9213	2.01201
3	319.435	135.86	2547.13	164.841	3.70281
4	322.805	134.627	5116.17	481.288	5.37411
5	326.175	134.065	7516.59	925.214	7.01722
6	329.544	133.502	10572.9	1603.59	8.62431
7	333.067	133.147	13850	2506.45	10.2579
8	336.59	132.793	17714.1	3712.33	11.8361
9	340.113	132.592	21634.8	5135.08	13.3522
10	343.635	132.391	26062	6885.94	14.8001
11	347.375	132.51	29938.5	8730.21	16.2569
12	351.115	132.629	34173.2	10857.5	17.6261
13	354.819	133.065	37339.9	12778.3	18.8918
14	358.523	133.5	40700.1	14865.3	20.0642
15	362.361	134.143	43532.9	16866.5	21.1785
16	366.199	134.787	46496.9	18964.2	22.1886
17	370.176	135.667	48748.1	20816.7	23.1237
18	374.152	136.548	51074.1	22680.9	23.945
19	378.128	137.529	53022.6	24333.8	24.6519
20	382.105	138.511	55020.9	25943.3	25.2447
21	386.081	139.354	57688.1	27792.2	25.7232
22	390.058	140.196	60283.9	29516.9	26.0878
23	394.034	141.257	61929.6	30659.8	26.3389
24	398.01	142.318	63864.7	31808.9	26.4764
25	401.986	144.306	61564.5	30695.7	26.5006
26	405.962	146.294	58986.2	29295.7	26.4115
27	408.467	147.968	55348.2	27351.4	26.2972
28	413.913	151.608	47085	22856.3	25.8932
29	417.888	155.078	37117.7	17675.3	25.4636
30	421.862	158.549	27512	12782.3	24.92
31	425.837	161.88	18859.2	8500.28	24.2622
32	429.812	165.211	10629.5	4619.67	23.4902
33	433.788	168.404	3264.53	1359.18	22.6043
34	437.763	171.597	4087.04	1618.56	21.6047
35	440.523	173.717	7638.99	2908.57	20.8445
36	443.283	175.838	11418.8	4163.02	20.0306
37	446.91	178.716	21930.7	7500.26	18.8806
38	450.538	181.594	32966.4	10483.7	17.6413
39	453.941	184.602	28082.7	8265.22	16.4001
40	457.344	187.611	23885.1	6438.35	15.0858
41	460.551	190.979	19568.7	4800.53	13.7834
42	463.759	194.347	15698	3458.09	12.4232
43	467.156	197.919	11976.8	2311.7	10.9246
44	470.553	201.49	8770.03	1447.43	9.37177
45	473.95	205.063	6067.8	828.102	7.77142
46	477.346	208.635	3924.06	421.499	6.13086
47	480.946	212.353	2320.91	176.856	4.35758
48	483.48	214.972	1028.73	55.5771	3.0924
49	483.875	215.38	891.185	45.0577	2.89437
50	484.837	216.374	676.783	28.4968	2.41109
51	489.614	221.309	0	0	0

Entity Information

Group 1

Shared Entities

Type	Coordinates (x,y)
External Boundary	380.3, 171.5 317.3, 140 300.623, 140 186.076, 175.814 180.749, 175.21 177.103, 174.502 173.919, 174.049 168.077, 173.629 162.334, 173.167 158.792, 172.962 149.383, 171.734 142.209, 171.055 139.841, 170.852 131.095, 169.848 122.464, 168.846 113.506, 168.081 108.58, 167.62 106.167, 166.548 102.779, 165.424 100.704, 164.746 97.1202, 163.317 90.4984, 155.011 82.4686, 139.273 77.1292, 137.905 57.573, 121.275 52.7049, 117.102 49.4852, 113.688 47.3428, 112.076 29.7971, 100.128 20.7316, 96.425 0, 96.425 0, -60 1500, -60 1500, 177.713 1500, 181.713 1500, 292.83 1500, 309.839 1500, 313.839 1373.34, 317.661 1238.22, 322 1113.67, 322 882.738, 314.583 829.159, 313.1 816.405, 308.747 579.825, 228 480.195, 220.611 471.961, 220 469.01, 219.63 466.666, 219.122

	465.856, 219.318 465.361, 219.168 464.478, 219.484 462.482, 218.492 461.493, 218 460.364, 217.999 459.302, 218 455.627, 219.028 452.962, 220 415, 220 408, 206 406.5, 203 398.85, 187.7 397.821, 185.641 396, 182 395.25, 180.5 394.5, 179 391.5, 173 383.3, 173
Material Boundary	679.556, 146.222 679.659, 146.188
Material Boundary	462.482, 218.492 467.538, 216.811 471.961, 215.34 480.624, 212.46 490.154, 209.291 498.125, 206.641 504.977, 204.363 530.19, 196 543.024, 191.723 580.953, 179.083 596.205, 174 611.982, 168.742 644.215, 158 674.04, 148.061 679.556, 146.222
	341.65, 149.043 345.946, 147.446 354.918, 148.674 358.59, 148.539 359.264, 148.32 365.545, 147.003 368.082, 146.83 370.259, 146.867 381.654, 147.418 388.679, 147.474 399.065, 147.741 412.618, 148.069 415.536, 147.958 426.261, 148.275 439.874, 148.457 444.572, 149.513 456.024, 152.177 457.378, 152.578 471.97, 160.321 474.665, 161.616 476.041, 162.472 478.887, 164.244 485.361, 168.626

491.216, 172.59
494.285, 173.024
496.898, 173.394
497.818, 173.493
502.123, 175.191
517.079, 182.966
519.812, 184.269
520.992, 184.921
530.944, 191.258
534.194, 193.463
534.918, 193.095
538.276, 191.619
543.024, 191.723
543.714, 191.738
550.585, 192.032
552.604, 192.53
553.154, 192.666
554.551, 193.036
568.396, 187.268
571.04, 186.166
571.641, 185.926
573.356, 185.335
594.033, 178.422
600.282, 176.36
627.672, 166.757
632.565, 164.896
640.148, 163.138
641.774, 162.814
647.025, 161.764
660.11, 161.695
666.193, 161.705
673.288, 159.415
674.211, 159.193
675.404, 158.902
676.983, 158.511
679.14, 157.974
682.084, 157.233
686.308, 157.233
689.377, 157.233
691.596, 157.233
691.732, 157.233
693.401, 157.233
707.907, 157.233
710.128, 157.233
728.345, 157.233
728.415, 157.233
728.796, 157.233
728.865, 157.233
728.931, 157.233
728.995, 157.233
729.615, 157.233
729.673, 157.233
729.726, 157.233
730.384, 157.233
732.31, 157.233
733.014, 157.233
746.705, 157.233
746.877, 157.233
746.955, 157.233

Material Boundary	747.046, 157.233 747.717, 157.233 747.815, 157.233 747.923, 157.233 748.656, 157.233 748.769, 157.233 748.889, 157.233 749.654, 157.233 749.777, 157.233 750.551, 157.233 750.675, 157.233 751.434, 157.233 751.559, 157.233 752.282, 157.233 752.407, 157.233 753.076, 157.233 753.678, 157.233 753.8, 157.233 754.057, 157.233 754.739, 157.233 766.42, 157.233 766.549, 157.233 766.904, 157.233 767.08, 157.233 767.216, 157.233 767.384, 157.233 767.533, 157.233 767.691, 157.233 767.85, 157.233 768.069, 157.233 768.232, 157.233 768.403, 157.233 768.639, 157.233 768.807, 157.233 769.061, 157.233 769.379, 157.233 769.527, 157.233 770.042, 157.233 770.21, 157.233 770.408, 157.233 770.663, 157.233 770.922, 157.233 771.126, 157.233 771.373, 157.233 771.614, 157.233 772.039, 157.233 774.386, 157.233 774.452, 157.233 774.512, 157.233 774.559, 157.233 774.931, 157.233 774.961, 157.233 775.367, 157.233 775.401, 157.233 776.247, 157.286 777.028, 157.337 777.671, 157.38 778.186, 157.417 778.581, 157.449

778.862, 157.475
783.551, 157.969
790.108, 158.186
798.6, 158.519
809.535, 158.849
843.835, 160.001
846.293, 160.089
847.159, 160.152
849.637, 160.268
866.743, 161.218
873.476, 161.278
877.576, 161.355
888.228, 161.812
889.815, 161.89
895.696, 164.994
896.357, 165.231
898.087, 164.714
902.669, 167.126
906.077, 167.939
907.788, 167.521
909.116, 168.298
912.794, 170.282
921.58, 171.527
926.416, 172.161
927.334, 172.197
934.394, 172.502
939.995, 172.711
940.314, 172.75
941.031, 172.768
948.74, 175.986
953.918, 177.83
958.843, 179.444
968.83, 181.685
971.257, 181.784
972.949, 182.025
984.3, 185.078
990.206, 186.968
991.891, 188.102
1000.51, 194.523
1000.89, 194.307
1003.12, 193.411
1015.58, 188.515
1024.56, 186.575
1028.32, 183.743
1034.83, 183.741
1035.33, 183.59
1041.38, 179.685
1043.37, 178.556
1043.55, 178.456
1048.32, 181.858
1053.87, 184.714
1063.46, 185.442
1072.52, 186.42
1076.18, 191.404
1091.57, 213.32
1107.86, 213.235
1108.83, 213.181
1110.31, 213.165
1125.68, 212.596

	1134.55, 212.296 1135.26, 212.258 1149.65, 211.949 1174.52, 211.423 1176.11, 211.377 1176.72, 211.332 1190.89, 210.189 1197.61, 212.782 1215.78, 218.32 1240.39, 226.167 1244.64, 227.429 1251.66, 229.668 1275.26, 237.111 1285.49, 240.306 1317.11, 250.108 1348.93, 260.257 1368.04, 266.247 1396.06, 275.448 1406.31, 279.816 1427.31, 285.78 1434.09, 288.541 1439.03, 290.725 1457.49, 295.321 1459.12, 294.83 1468.45, 293.335 1476.04, 293.238 1489.53, 293.023 1493.41, 292.968 1494.79, 292.97 1500, 292.83

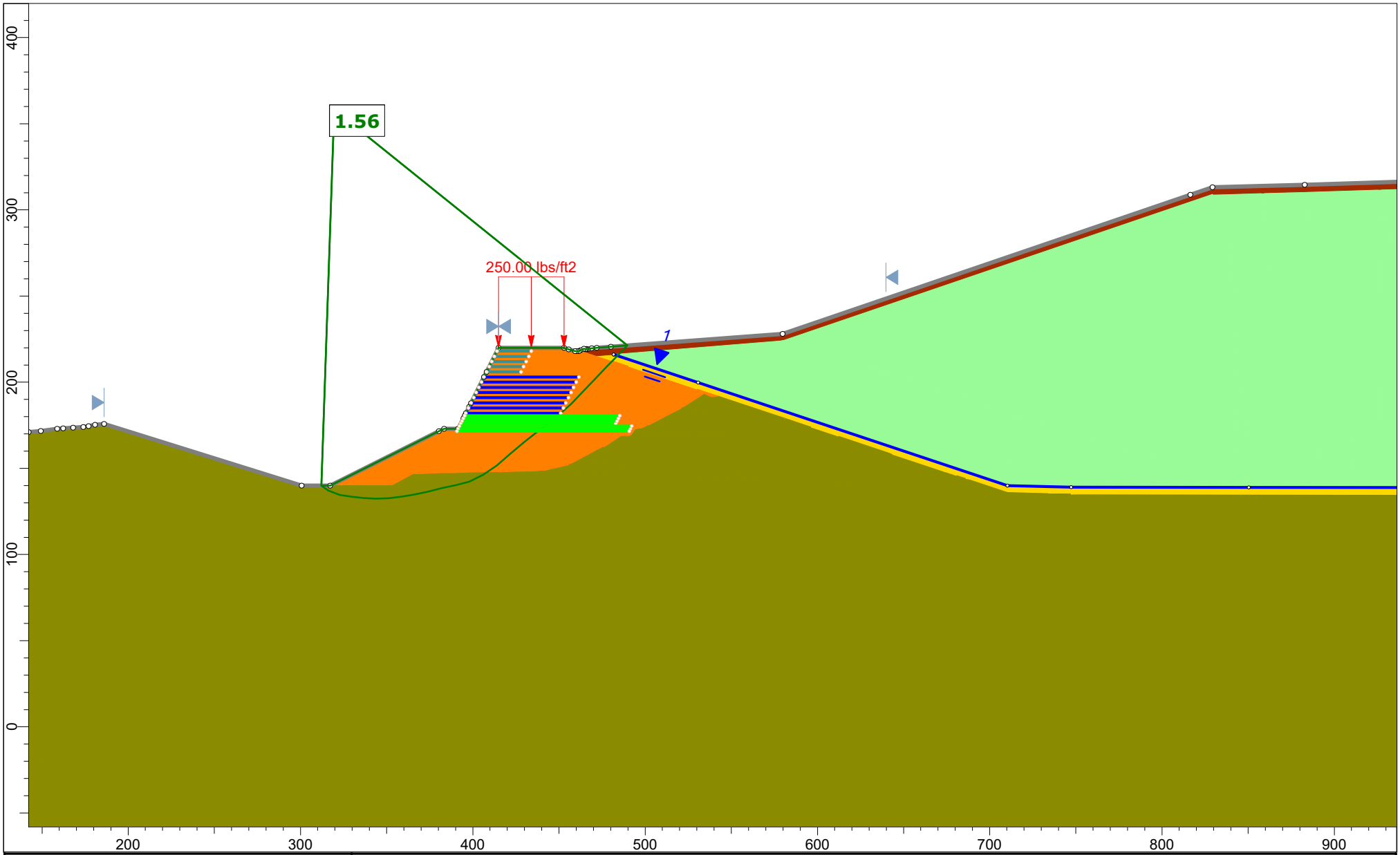
Material Boundary	474.174, 218.604 481.652, 216.118 504.977, 208.363 530.19, 200 552.604, 192.53 568.396, 187.268 638.214, 164 641.774, 162.814 679.556, 150.222 680.589, 149.878 686.101, 148.041 710.23, 140 717.128, 139.963 733.673, 139.409 747.226, 139.068 850.321, 138.949 884.358, 138.909 889.686, 138.903 894.14, 138.898 909.357, 138.88 993.915, 138.782 1007.61, 138.766 1013.66, 138.759 1027.23, 138.743 1057.38, 138.708 1070.71, 138.919 1098.28, 139.464 1117.33, 140 1155.78, 141.555 1167.24, 142 1209.53, 144 1230.37, 144.7 1269.07, 146 1269.84, 146.004 1270.03, 146.004 1311.13, 147.025 1325.73, 147.317 1335.19, 147.531 1337.55, 147.527 1345.58, 147.733 1346.8, 147.731 1355.95, 148 1443.5, 168.509 1467.16, 174.051 1467.96, 174.234 1475.53, 176 1500, 181.713
Material Boundary	467.538, 216.811 470.86, 217.5 474.174, 218.604 480.195, 220.611

Material Boundary	816.405, 308.747 829.159, 309.1 838.386, 309.356 858.579, 309.915 882.738, 310.583 926.849, 312 956.644, 312.957 981.404, 313.752 1031.11, 315.349 1093.6, 317.355 1113.67, 318 1238.22, 318 1285.71, 316.475 1310.67, 315.673 1328.89, 315.088 1335.69, 314.87 1360.27, 314.08 1373.34, 313.661 1449.02, 311.377 1474.32, 310.614 1494.67, 310 1500, 309.839
Material Boundary	390, 170 456.486, 164.183 467.135, 163.252 476.041, 162.472
Material Boundary	476.041, 162.472 485.055, 180.5 498.125, 206.641
Material Boundary	456.486, 164.183 464.644, 180.5 480.624, 212.46
Material Boundary	467.135, 163.252 475.759, 180.5 490.154, 209.291

Material Boundary	679.659, 146.188 680.589, 145.878 686.101, 144.041 710.23, 136 717.128, 135.963 733.673, 135.409 747.226, 135.068 1007.61, 134.766 1013.66, 134.759 1027.23, 134.743 1057.38, 134.708 1070.71, 134.919 1098.28, 135.464 1117.33, 136 1155.78, 137.555 1167.24, 138 1209.53, 140 1230.37, 140.7 1269.07, 142 1269.84, 142.004 1270.03, 142.004 1311.13, 143.025 1325.73, 143.317 1335.19, 143.531 1337.55, 143.527 1345.58, 143.733 1346.8, 143.731 1355.95, 144 1467.16, 170.051 1467.96, 170.234 1475.53, 172 1500, 177.713
Material Boundary	323.563, 140 352.549, 140 365.545, 147.003
Material Boundary	396, 182 402.783, 182
Material Boundary	485.361, 168.626 491.288, 168.626 494.285, 173.024
Material Boundary	317.3, 140 323.563, 140 341.65, 149.043 379.564, 168 390, 170 390.75, 171.5
Material Boundary	390.75, 171.5 391.5, 173
Material Boundary	471.961, 215.34 481.652, 216.118 579.825, 224 829.159, 309.1

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Piezoline	481.652, 216.118 530.705, 199.829 710.23, 140 747.226, 139.068 850.321, 138.949 1013.66, 138.759 1027.23, 138.743 1057.38, 138.708 1070.71, 138.919 1098.28, 139.464 1117.33, 140 1155.78, 141.555 1167.24, 142 1209.53, 144 1230.37, 144.7 1270.03, 146.004 1355.95, 148 1500, 181.713	Assigned to: Bottom Liner
Distributed Load	452.962, 220 415, 220	Constant DistributionOrientation: Normal to boundaryMagnitude: 250 lbs/ft2Creates Excess Pore Pressure: No



SLIDEINTERPRET 9.009	Dunn Mine and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York	
	Station 19+47 Static	
	Scale: 1:924	PREPARED BY: Civil & Environmental Consultants, Inc.
	Date: 5/17/2021	File Name: Station 19+47 Static.Rev1.slmd

Slide Analysis Information

Station 19+47 Seismic

Project Summary

File Name:	Station 19+47 Seismic.slmd
Slide Modeler Version:	9.009
Compute Time:	00h:00m:09.795s
Analysis:	Station 19+47 Seismic
Company:	Civil & Environmental Consultants, Inc.
Comments	
	Dunn Mine and C&D Facility S.A. Dunn & Company, LLC Rensselaer, New York

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Discard data for surfaces with FS above:	2
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

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

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.075

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	250
Orientation:	Normal to boundary

Materials

C&D Waste	
Color	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	60
Water Surface	None
Ru Value	0
Bottom Liner	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	118.5
Cohesion [psf]	67
Friction Angle [deg]	17.4
Water Surface	Piezometric Line 1
Hu Value	Automatically Calculated
Subgrade	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	None
Ru Value	0
Final Cover System	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	119.9
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	None
Ru Value	0
New Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	30
Water Surface	None
Ru Value	0

Shear Normal Functions

Name: C&D

Normal (psf)	Shear (psf)
0	0
2000	1400
10000	6169

Support

Type 1	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	1900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 2	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	3900
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Type 3	
Color	
Support Type	Geosynthetic
Force Application	Active
Force Orientation	Bisector of Parallel and Tangent
Anchorage	None
Shear Strength Model	Linear
Use External Loads for Strength	yes
Strip Coverage [percent]	100
Tensile Strength [lb/ft]	8400
Pullout Strength Adhesion [psf]	0
Pullout Strength Friction Angle [degrees]	21
Material Dependent	No

Global Minimums

Method: gle/morgenstern-price

FS	1.320650
Axis Location:	320.967, 361.111
Left Slip Surface Endpoint:	312.331, 140.000
Right Slip Surface Endpoint:	492.674, 221.536
Resisting Moment:	7.82195e+07 lb-ft
Driving Moment:	5.92283e+07 lb-ft
Resisting Horizontal Force:	305714 lb
Driving Horizontal Force:	231488 lb
Active Support Moment:	-1.27197e+07 lb-ft
Active Horizontal Support Force:	-55143.7 lb
Maximum Single Support Force:	8400 lb
Total Support Force:	58800 lb
Total Slice Area:	5300.86 ft2
Surface Horizontal Width:	180.343 ft
Surface Average Height:	29.3932 ft

Global Minimum Coordinates

Method: gle/morgenstern-price

X	Y
312.331	140
317.768	136.654
324.726	134.782
331.684	134.243
338.4	134.108
345.117	134.626
352.258	135.354
360.064	136.775
367.641	138.297
375.218	140.175
383.036	142.293
390.277	144.553
397.518	146.813
404.76	150.149
409.897	152.986
415.034	156.151
420.171	159.316
425.308	162.482
433.154	167.316
437.077	170.054
441	173.399
446.297	177.948
451.595	182.511
456.892	187.477
461.184	191.5
466.412	196.401
471.637	201.3
476.863	206.199
482.133	211.139
487.404	216.08
492.674	221.536

Global Minimum Support Data

Method: gle/morgenstern-price

Number of Supports: 20

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
402, 194	55	Not Effective	Not Effective	Not Effective	Not Effective	0
403.5, 197	55	Not Effective	Not Effective	Not Effective	Not Effective	0
405, 200	55	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 1

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
414, 218	20	Not Effective	Not Effective	Not Effective	Not Effective	0
412.5, 215	20	Not Effective	Not Effective	Not Effective	Not Effective	0
411, 212	20	Not Effective	Not Effective	Not Effective	Not Effective	0
409.5, 209	20	Not Effective	Not Effective	Not Effective	Not Effective	0
408, 206	20	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 2

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
400.5, 191	55	Not Effective	Not Effective	Not Effective	Not Effective	0
399, 188	55	Not Effective	Not Effective	Not Effective	Not Effective	0
397.5, 185	55	Not Effective	Not Effective	Not Effective	Not Effective	0
396, 182	55	Not Effective	Not Effective	Not Effective	Not Effective	0
406.5, 203	55	Not Effective	Not Effective	Not Effective	Not Effective	0

Type 3

Support Type: Geosynthetic

Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
393, 176	90	51.0289	38.9711	51.0289	38.9711	8400
393.75, 177.5	90	52.0253	37.9747	52.0253	37.9747	8400
394.5, 179	90	53.0183	36.9817	53.0183	36.9817	8400
395.25, 180.5	90	54.0098	35.9902	54.0098	35.9902	8400
391.5, 173	100	49.0326	50.9674	49.0326	50.9674	8400
392.25, 174.5	100	50.0325	49.9675	50.0325	49.9675	8400
390.75, 171.5	100	48.0234	51.9766	48.0234	51.9766	8400

Valid and Invalid Surfaces

Method: gle/morgenstern-price

Number of Valid Surfaces:	2698
Number of Invalid Surfaces:	16310

Error Codes

Error Code -97 reported for 1032 surfaces
Error Code -105 reported for 3284 surfaces
Error Code -108 reported for 6 surfaces
Error Code -110 reported for 320 surfaces
Error Code -111 reported for 121 surfaces
Error Code -113 reported for 11547 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

-97 = Factor of safety is out of valid range set by user.

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.32065

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.71828	272.894	-31.6138	Subgrade	0	30	63.3805	83.7035	144.979	0	144.979	105.966	105.966
2	2.71828	825.248	-31.6138	Subgrade	0	30	206.715	272.998	472.846	0	472.846	345.606	345.606
3	3.47881	2053.07	-15.0597	Subgrade	0	30	335.016	442.439	766.327	0	766.327	676.186	676.186
4	3.47881	3169.95	-15.0597	Subgrade	0	30	544.9	719.622	1246.42	0	1246.42	1099.81	1099.81
5	3.47932	4148.34	-4.42682	Subgrade	0	30	645.382	852.324	1476.27	0	1476.27	1426.31	1426.31
6	3.47932	4987.14	-4.42682	Subgrade	0	30	802.514	1059.84	1835.7	0	1835.7	1773.57	1773.57
7	3.35799	5569.84	-1.14708	Subgrade	0	30	912.891	1205.61	2088.18	0	2088.18	2069.9	2069.9
8	3.35799	6273.5	-1.14708	Subgrade	0	30	1056.47	1395.23	2416.61	0	2416.61	2395.46	2395.46
9	3.35815	6911.84	4.40508	Subgrade	0	30	1088.07	1436.96	2488.89	0	2488.89	2572.71	2572.71
10	3.35815	7484.22	4.40508	Subgrade	0	30	1196.94	1580.74	2737.93	0	2737.93	2830.13	2830.13
11	3.57056	8566.34	5.8238	Subgrade	0	30	1275.36	1684.3	2917.29	0	2917.29	3047.37	3047.37
12	3.57056	9175.23	5.8238	Subgrade	0	30	1383.58	1827.22	3164.85	0	3164.85	3305.97	3305.97
13	3.90308	10653.1	10.3171	Subgrade	0	30	1361.8	1798.46	3115.02	0	3115.02	3362.93	3362.93
14	3.90308	11234.4	10.3171	Subgrade	0	30	1441.36	1903.53	3297.02	0	3297.02	3559.4	3559.4
15	3.78862	11444.7	11.3561	Subgrade	0	30	1484.11	1959.99	3394.79	0	3394.79	3692.86	3692.86
16	3.78862	11960	11.3561	Subgrade	0	30	1550.68	2047.91	3547.08	0	3547.08	3858.52	3858.52
17	3.78871	12435.1	13.9204	Subgrade	0	30	1522.76	2011.03	3483.21	0	3483.21	3860.63	3860.63
18	3.78871	12869.4	13.9204	Subgrade	0	30	1567.6	2070.25	3585.77	0	3585.77	3974.3	3974.3
19	3.90865	13710.8	15.1626	Subgrade	0	30	1564.59	2066.28	3578.89	0	3578.89	4002.89	4002.89
20	3.90865	14130.6	15.1626	Subgrade	0	30	1599.13	2111.89	3657.91	0	3657.91	4091.27	4091.27
21	3.62058	13093.5	17.33	Subgrade	0	30	1511.63	1996.33	3457.75	0	3457.75	3929.44	3929.44
22	3.62058	12604.8	17.33	Subgrade	0	30	1444.01	1907.03	3303.06	0	3303.06	3753.65	3753.65
23	3.62058	12803.6	17.33	Subgrade	0	30	1450.69	1915.86	3318.38	0	3318.38	3771.06	3771.06
24	3.62058	15279.3	17.33	Subgrade	0	30	1706.02	2253.06	3902.42	0	3902.42	4434.76	4434.76
25	2.04025	9742.71	24.7376	Subgrade	0	30	1622.51	2142.77	3711.39	0	3711.39	4458.95	4458.95
26	5.20119	28315.5	24.7376	New Fill	100	30	1917.93	2532.92	4213.94	0	4213.94	5097.62	5097.62
27	5.13712	32726.9	28.9085	New Fill	100	30	2027.06	2677.04	4463.57	0	4463.57	5582.96	5582.96
28	5.13705	37209.9	31.6393	New Fill	100	30	2162.18	2855.48	4772.63	0	4772.63	6104.86	6104.86
29	5.13712	38384.4	31.6393	New Fill	100	30	2307.03	3046.78	5103.97	0	5103.97	6525.45	6525.45
30	5.13712	36433.1	31.6393	New Fill	100	30	2205.41	2912.58	4871.54	0	4871.54	6230.41	6230.41
31	3.92298	26508.3	31.6393	New Fill	100	30	2120.89	2800.95	4678.18	0	4678.18	5984.97	5984.97
32	3.92298	25370.4	31.6393	New Fill	100	30	2051.16	2708.86	4518.69	0	4518.69	5782.51	5782.51
33	3.92335	24159.4	34.9084	New Fill	100	30	1860.34	2456.86	4082.2	0	4082.2	5380.4	5380.4
34	3.92316	22726.3	40.4528	New Fill	100	30	1894.04	2501.36	4159.27	0	4159.27	5774.23	5774.23
35	2.64854	14449.5	40.6596	New Fill	100	30	1699.86	2244.92	3715.12	0	3715.12	5175.14	5175.14
36	2.64854	13726.5	40.6596	New Fill	100	30	1786.81	2359.75	3914.01	0	3914.01	5448.71	5448.71
37	5.29708	25280	40.7388	New Fill	100	30	1454.12	1920.38	3152.99	0	3152.99	4405.45	4405.45
38	2.64851	11484.4	43.1505	New Fill	100	30	1112.76	1469.56	2372.15	0	2372.15	3415.29	3415.29
39	2.64851	10437.4	43.1505	New Fill	100	30	996.827	1316.46	2106.97	0	2106.97	3041.43	3041.43
40	4.2924	14783.4	43.1505	New Fill	100	30	891.728	1177.66	1866.56	0	1866.56	2702.5	2702.5
41	5.22788	15650.2	43.1505	New Fill	100	30	803.519	1061.17	1664.8	0	1664.8	2418.04	2418.04
42	5.22534	12993.9	43.1505	New Fill	100	30	698.61	922.619	1424.82	0	1424.82	2079.72	2079.72
43	5.22592	10287.4	43.1505	New Fill	100	30	583.543	770.656	1161.61	0	1161.61	1708.64	1708.64
44	2.63519	4108.23	43.1505	New Fill	100	30	485.761	641.52	937.939	0	937.939	1393.31	1393.31
45	2.63519	3381.77	43.1505	New Fill	100	30	416.186	549.636	778.793	0	778.793	1168.94	1168.94
46	0.644866	705.522	43.1505	New Fill	100	30	366.288	483.738	664.655	0	664.655	1008.03	1008.03
47	3.15114	2689.3	43.1505	Bottom Liner	67	17.4	169.682	224.091	613.684	112.404	501.28	772.75	660.346
48	1.4745	908.064	43.1505	C&D Waste	0	34.992	207.206	273.646	390.922	0	390.922	585.164	585.164
49	0.52352	294.321	45.9922	C&D Waste	2.84217e-14	34.992	183.609	242.483	346.406	0	346.406	536.486	536.486
50	4.74694	1298.31	45.9922	Final Cover System	0	27	72.7634	96.095	188.596	0	188.596	263.924	263.924

Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.32065

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	312.331	140	0	0	0
2	315.05	138.327	394.399	15.1503	2.19986
3	317.768	136.654	1685.58	129.353	4.38833
4	321.247	135.718	3414.37	428.603	7.15487
5	324.726	134.782	6238.92	1084.68	9.86269
6	328.205	134.512	8570.94	1898.91	12.4922
7	331.684	134.243	11483.6	3082.59	15.0259
8	335.042	134.176	14271.8	4463.48	17.367
9	338.4	134.108	17511.4	6233.94	19.5954
10	341.758	134.367	20003	7961.67	21.7037
11	345.117	134.626	22753	9981.5	23.6866
12	348.687	134.99	25601.8	12296	25.654
13	352.258	135.354	28701.3	14925	27.4749
14	356.161	136.065	31004.2	17397.7	29.2985
15	360.064	136.775	33444.9	20056	30.95
16	363.852	137.536	35626.1	22602.2	32.3922
17	367.641	138.297	37905.1	25260.7	33.6803
18	371.43	139.236	39470.9	27452.4	34.819
19	375.218	140.175	41077.7	29640.6	35.8132
20	379.127	141.234	42374	31575.7	36.6923
21	383.036	142.293	43690.2	33436.4	37.4271
22	386.656	143.423	44274.7	34569.7	37.9827
23	390.277	144.553	44825.8	35555.4	38.4211
24	393.897	145.683	45369	36405.1	38.7443
25	397.518	146.813	45991	37182.2	38.9544
26	399.558	147.753	45081.8	36536.9	39.0233
27	404.76	150.149	42835.4	34735.1	39.0385
28	409.897	152.986	38131.8	30688.6	38.8272
29	415.034	156.151	31342	24831.2	38.3886
30	420.171	159.316	24159.4	18684.7	37.7181
31	425.308	162.482	17336.9	12973.6	36.8084
32	429.231	164.899	12361.1	8963.52	35.9473
33	433.154	167.316	7582.68	5297.01	34.9369
34	437.077	170.054	1893.19	1266.03	33.7718
35	441	173.399	9470.12	6020.86	32.4472
36	443.649	175.674	12314	7534.14	31.4598
37	446.297	177.948	22866.6	13413.5	30.3958
38	451.595	182.511	30037.3	15992.7	28.0321
39	454.243	184.994	26233.6	13211.6	26.7305
40	456.892	187.477	22859.7	10829.3	25.3483
41	461.184	191.5	18067.8	7645.97	22.9372
42	466.412	196.401	12935.9	4636.93	19.7204
43	471.637	201.3	8632.49	2510.23	16.2138
44	476.863	206.199	5219.8	1152.05	12.4461
45	479.498	208.669	3874.74	715.424	10.4612
46	482.133	211.139	2793.97	414.01	8.42875
47	482.778	211.744	2575.46	358.524	7.92509
48	485.929	214.698	1095.64	104.232	5.43439
49	487.404	216.08	792.711	58.9802	4.25515
50	487.928	216.622	679.018	45.5148	3.83482
51	492.674	221.536	0	0	0

Entity Information

Group 1

Shared Entities

Type	Coordinates (x,y)
External Boundary	380.3, 171.5 317.3, 140 300.623, 140 186.076, 175.814 180.749, 175.21 177.103, 174.502 173.919, 174.049 168.077, 173.629 162.334, 173.167 158.792, 172.962 149.383, 171.734 142.209, 171.055 139.841, 170.852 131.095, 169.848 122.464, 168.846 113.506, 168.081 108.58, 167.62 106.167, 166.548 102.779, 165.424 100.704, 164.746 97.1202, 163.317 90.4984, 155.011 82.4686, 139.273 77.1292, 137.905 57.573, 121.275 52.7049, 117.102 49.4852, 113.688 47.3428, 112.076 29.7971, 100.128 20.7316, 96.425 0, 96.425 0, -60 1500, -60 1500, 177.713 1500, 181.713 1500, 292.83 1500, 309.839 1500, 313.839 1373.34, 317.661 1238.22, 322 1113.67, 322 882.738, 314.583 829.159, 313.1 816.405, 308.747 579.825, 228 480.195, 220.611 471.961, 220 469.01, 219.63 466.666, 219.122

	465.856, 219.318 465.361, 219.168 464.478, 219.484 462.482, 218.492 461.493, 218 460.364, 217.999 459.302, 218 455.627, 219.028 452.962, 220 415, 220 408, 206 406.5, 203 398.85, 187.7 397.821, 185.641 396, 182 395.25, 180.5 394.5, 179 391.5, 173 383.3, 173
Material Boundary	679.556, 146.222 679.659, 146.188
Material Boundary	462.482, 218.492 467.538, 216.811 471.961, 215.34 480.624, 212.46 490.154, 209.291 498.125, 206.641 504.977, 204.363 530.19, 196 543.024, 191.723 580.953, 179.083 596.205, 174 611.982, 168.742 644.215, 158 674.04, 148.061 679.556, 146.222
	341.65, 149.043 345.946, 147.446 354.918, 148.674 358.59, 148.539 359.264, 148.32 365.545, 147.003 368.082, 146.83 370.259, 146.867 381.654, 147.418 388.679, 147.474 399.065, 147.741 412.618, 148.069 415.536, 147.958 426.261, 148.275 439.874, 148.457 444.572, 149.513 456.024, 152.177 457.378, 152.578 471.97, 160.321 474.665, 161.616 476.041, 162.472 478.887, 164.244 485.361, 168.626

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732.31, 157.233
733.014, 157.233
746.705, 157.233
746.877, 157.233
746.955, 157.233

Material Boundary	747.046, 157.233 747.717, 157.233 747.815, 157.233 747.923, 157.233 748.656, 157.233 748.769, 157.233 748.889, 157.233 749.654, 157.233 749.777, 157.233 750.551, 157.233 750.675, 157.233 751.434, 157.233 751.559, 157.233 752.282, 157.233 752.407, 157.233 753.076, 157.233 753.678, 157.233 753.8, 157.233 754.057, 157.233 754.739, 157.233 766.42, 157.233 766.549, 157.233 766.904, 157.233 767.08, 157.233 767.216, 157.233 767.384, 157.233 767.533, 157.233 767.691, 157.233 767.85, 157.233 768.069, 157.233 768.232, 157.233 768.403, 157.233 768.639, 157.233 768.807, 157.233 769.061, 157.233 769.379, 157.233 769.527, 157.233 770.042, 157.233 770.21, 157.233 770.408, 157.233 770.663, 157.233 770.922, 157.233 771.126, 157.233 771.373, 157.233 771.614, 157.233 772.039, 157.233 774.386, 157.233 774.452, 157.233 774.512, 157.233 774.559, 157.233 774.931, 157.233 774.961, 157.233 775.367, 157.233 775.401, 157.233 776.247, 157.286 777.028, 157.337 777.671, 157.38 778.186, 157.417 778.581, 157.449

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1000.89, 194.307
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1035.33, 183.59
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1043.55, 178.456
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1108.83, 213.181
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1125.68, 212.596

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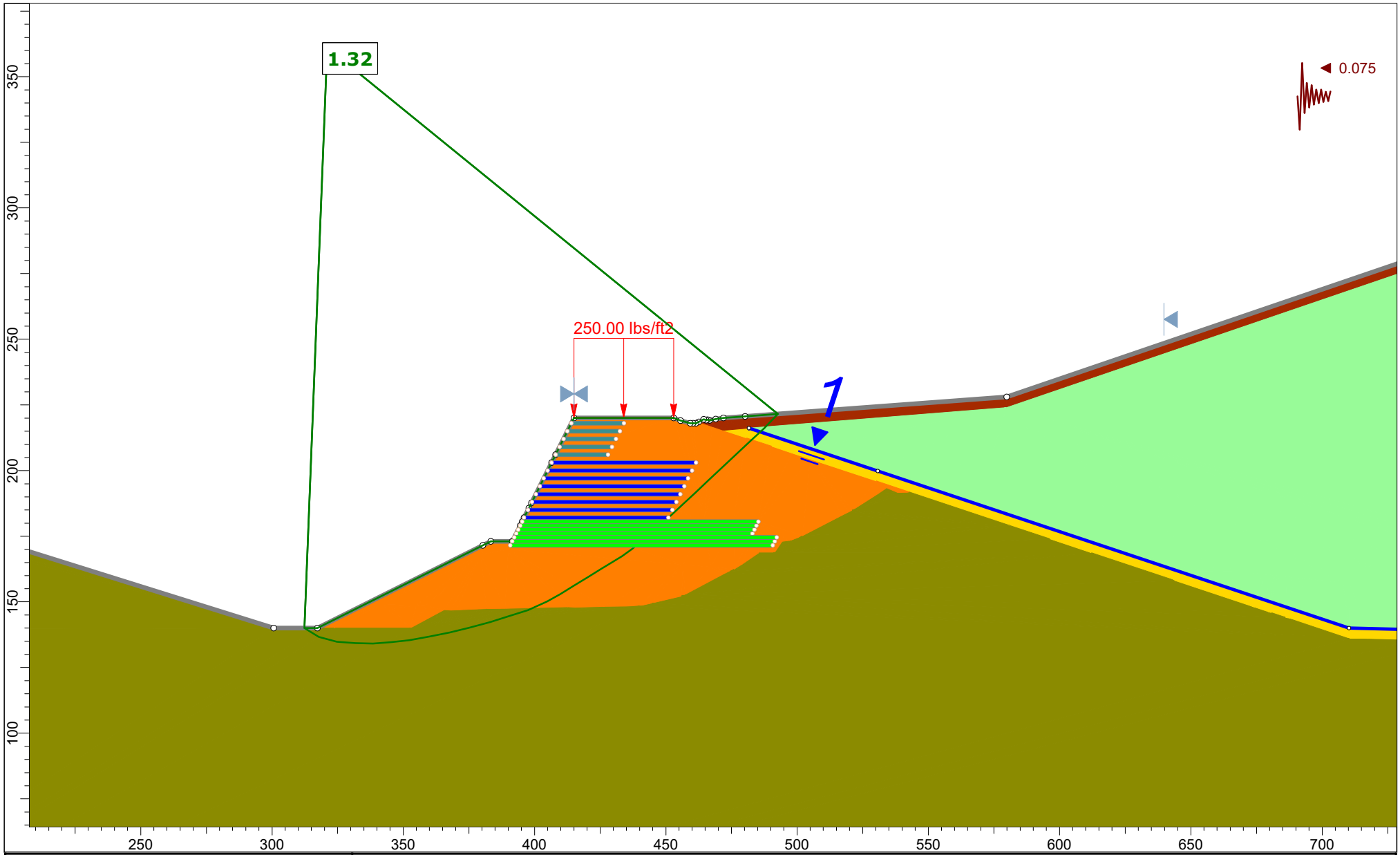
Material Boundary	474.174, 218.604 481.652, 216.118 504.977, 208.363 530.19, 200 552.604, 192.53 568.396, 187.268 638.214, 164 641.774, 162.814 679.556, 150.222 680.589, 149.878 686.101, 148.041 710.23, 140 717.128, 139.963 733.673, 139.409 747.226, 139.068 850.321, 138.949 884.358, 138.909 889.686, 138.903 894.14, 138.898 909.357, 138.88 993.915, 138.782 1007.61, 138.766 1013.66, 138.759 1027.23, 138.743 1057.38, 138.708 1070.71, 138.919 1098.28, 139.464 1117.33, 140 1155.78, 141.555 1167.24, 142 1209.53, 144 1230.37, 144.7 1269.07, 146 1269.84, 146.004 1270.03, 146.004 1311.13, 147.025 1325.73, 147.317 1335.19, 147.531 1337.55, 147.527 1345.58, 147.733 1346.8, 147.731 1355.95, 148 1443.5, 168.509 1467.16, 174.051 1467.96, 174.234 1475.53, 176 1500, 181.713
Material Boundary	467.538, 216.811 470.86, 217.5 474.174, 218.604 480.195, 220.611

Material Boundary	816.405, 308.747 829.159, 309.1 838.386, 309.356 858.579, 309.915 882.738, 310.583 926.849, 312 956.644, 312.957 981.404, 313.752 1031.11, 315.349 1093.6, 317.355 1113.67, 318 1238.22, 318 1285.71, 316.475 1310.67, 315.673 1328.89, 315.088 1335.69, 314.87 1360.27, 314.08 1373.34, 313.661 1449.02, 311.377 1474.32, 310.614 1494.67, 310 1500, 309.839
Material Boundary	390, 170 456.486, 164.183 467.135, 163.252 476.041, 162.472
Material Boundary	476.041, 162.472 485.055, 180.5 498.125, 206.641
Material Boundary	456.486, 164.183 464.644, 180.5 480.624, 212.46
Material Boundary	467.135, 163.252 475.759, 180.5 490.154, 209.291

Material Boundary	679.659, 146.188 680.589, 145.878 686.101, 144.041 710.23, 136 717.128, 135.963 733.673, 135.409 747.226, 135.068 1007.61, 134.766 1013.66, 134.759 1027.23, 134.743 1057.38, 134.708 1070.71, 134.919 1098.28, 135.464 1117.33, 136 1155.78, 137.555 1167.24, 138 1209.53, 140 1230.37, 140.7 1269.07, 142 1269.84, 142.004 1270.03, 142.004 1311.13, 143.025 1325.73, 143.317 1335.19, 143.531 1337.55, 143.527 1345.58, 143.733 1346.8, 143.731 1355.95, 144 1467.16, 170.051 1467.96, 170.234 1475.53, 172 1500, 177.713
Material Boundary	323.563, 140 352.549, 140 365.545, 147.003
Material Boundary	396, 182 402.783, 182
Material Boundary	485.361, 168.626 491.288, 168.626 494.285, 173.024
Material Boundary	317.3, 140 323.563, 140 341.65, 149.043 379.564, 168 390, 170 390.75, 171.5
Material Boundary	390.75, 171.5 391.5, 173
Material Boundary	471.961, 215.34 481.652, 216.118 579.825, 224 829.159, 309.1

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Piezoline	481.652, 216.118 530.705, 199.829 710.23, 140 747.226, 139.068 850.321, 138.949 1013.66, 138.759 1027.23, 138.743 1057.38, 138.708 1070.71, 138.919 1098.28, 139.464 1117.33, 140 1155.78, 141.555 1167.24, 142 1209.53, 144 1230.37, 144.7 1270.03, 146.004 1355.95, 148 1500, 181.713	Assigned to: Bottom Liner
Distributed Load	452.962, 220 415, 220	Constant DistributionOrientation: Normal to boundaryMagnitude: 250 lbs/ft2Creates Excess Pore Pressure: No



SLIDEINTERPRET 9.009

Dunn Mine and C&D Facility
S.A. Dunn & Company, LLC
Rensselaer, New York

Station 19+47 Seismic

Scale: 1:606

PREPARED BY: Civil & Environmental Consultants, Inc.

Date: 5/17/2021

File Name: Station 19+47 Seismic.slmd

Attachment B.2

ReSlope Output

Dunn MSE Berm Station 19+47

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PROJECT IDENTIFICATION

Title: Dunn MSE Berm Station 19+47
Project Number: 182-442.0002
Designer: JMN

Description:

File path and name: \\svr-boston\projects\2018\182-442\-Calculations\MSE Be.....
.....(Seismic) - Rev1.NAT
Date and time of creating the input data file: Mon Jun 10 17:40:24 2019

Design Philosophy and Program Developed by:

Dov Leshchinsky, Ph.D.
33 The Horseshoe
Newark, Delaware 19711, USA

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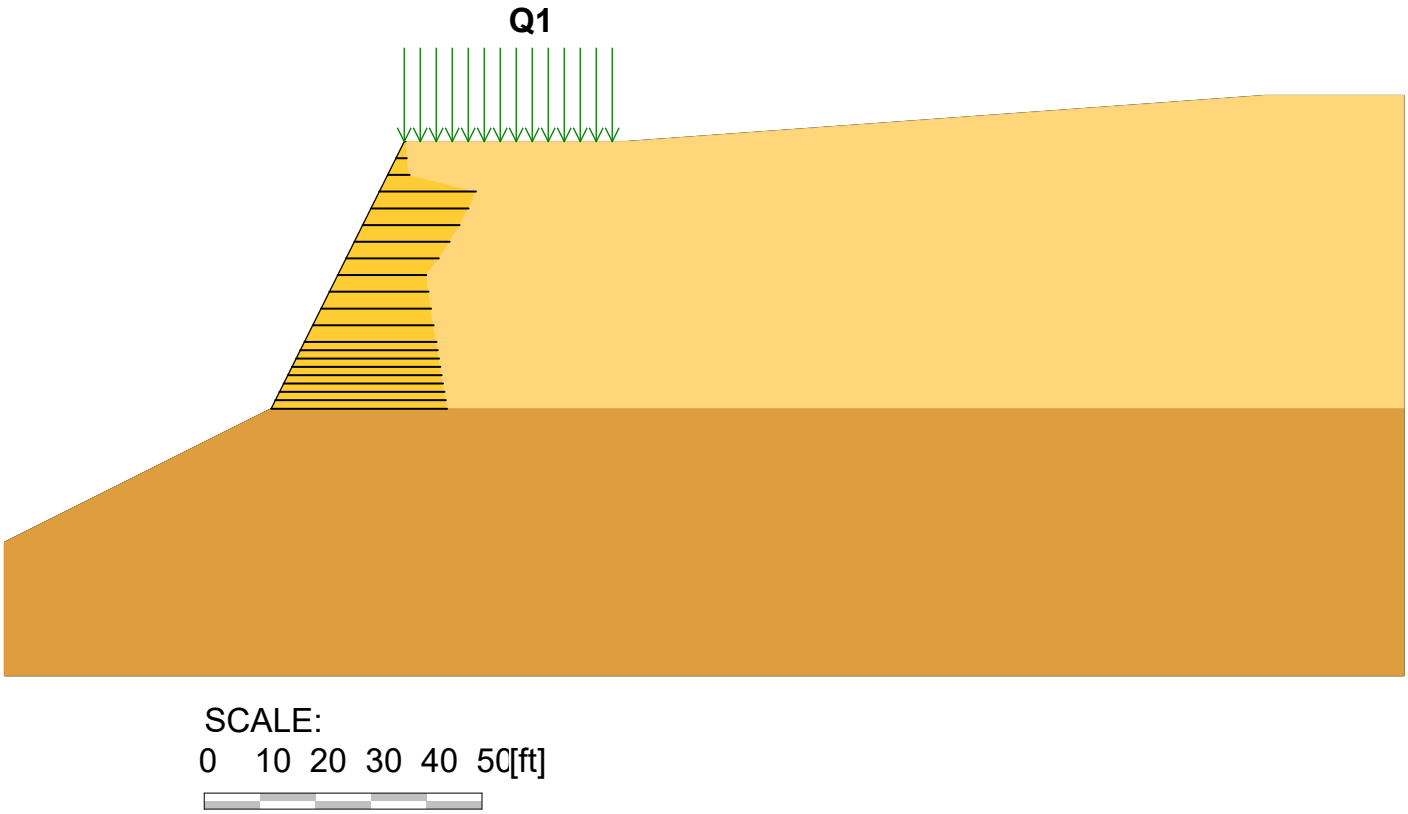
GEOMETRY AND LOADING DATA

Height of slope, H [ft]	48.00
Slope angle, i °	63.43
Horizontal length, A [ft]	40.00
Horizontal length, B [ft]	115.00
Backslope angle, β °	4.10
Slope at bottom of wall, α °	26.57
Surcharge load over A, Q1 [lb/ft ²]	250.00
Surcharge load over backslope B, Q2 [lb/ft ²]	0.00
Surcharge load away from backslope, Q3 [lb/ft ²]	0.00

Water is not present.



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SOIL DATA

REINFORCED SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	100.00
	Moist unit weight, γ [lb/ft ³]	120.00
BACKFILL SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	100.00
	Moist unit weight, γ [lb/ft ³]	120.00
FOUNDATION SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	0.00
	Moist unit weight, γ [lb/ft ³]	120.00

GENERAL DATA

Assumed angle of interwedge force (direct sliding analysis), $\delta°$	20.00
Pullout interaction coefficient (reinforced soil), Ci	0.80
Pullout interaction coefficient (foundation soil), Ci	0.80
Direct sliding coefficient (along reinforced soil), Cds	0.80
Direct sliding coefficient (along foundation soil), Cds	0.80

Minimum required length at each elevation was specified.

SEISMIC PARAMETERS

Horizontal seismic coefficient, Kh (100% used)	0.00
Vertical seismic coefficient, Kv	0.00

Kh and Kv ARE being applied to the reinforced mass and surcharge in direct sliding analysis.

FOUNDATION EFFECTS

Slip surfaces in tieback and compound analyses are allowed to penetrate the foundation soil.
Bishop's deepseated analysis was invoked and circles may penetrate the
foundation to a maximum depth of [ft] 28.00

GEOSYNTHETIC DESIGN PARAMETERS

(-------- Manual input data --------)

Reduction factor for installation damage, RFid	1.00
Reduction factor for durability, RFd	1.00
Reduction factor for creep, RFc	1.00
Coverage ratio, Rc	1.00

SPECIFIED FORCE ORIENTATION

Relative orientation of reinforcement is prescribed, ROR	0.00

GENERAL SAFETY FACTORS

Factor of safety on soil shear strength	1.00
Factor of safety on geosynthetic strength	1.00
Factor of safety on pullout resistance	1.50
Factor of safety on direct sliding resistance	1.50

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SUMMARY OF TIEBACK AND COMPOUND RESULTS

#	Elevation [ft]	Length [ft]	Mode of Failure	Strength: Required, Tr [lb/ft]	Ultimate, T-ult [lb/ft]	Long-term (design) T-ltds [lb/ft]	Actual Overall Fs	Status
1	0.00	31.73	Compound	8400.00	8400.00	8400.00	> 1.00	OK
2	1.50	30.74	Compound	8400.00	8400.00	8400.00	> 1.00	OK
3	3.00	29.74	Compound	8400.00	8400.00	8400.00	> 1.00	OK
4	4.50	28.75	Tieback	1102.30	8400.00	8400.00	7.62	OK
5	6.00	27.76	Tieback	1058.88	8400.00	8400.00	7.93	OK
6	7.50	26.77	Tieback	1015.46	8400.00	8400.00	8.27	OK
7	9.00	25.78	Tieback	972.05	8400.00	8400.00	8.64	OK
8	10.50	24.79	Tieback	928.65	8400.00	8400.00	9.05	OK
9	12.00	23.80	Tieback	1708.23	3900.00	3900.00	2.28	OK
10	15.00	21.81	Tieback	1534.27	3900.00	3900.00	2.54	OK
11	18.00	19.83	Tieback	1360.30	3900.00	3900.00	2.87	OK
12	21.00	17.85	Tieback	1186.39	3900.00	3900.00	3.29	OK
13	24.00	16.00	Tieback	1012.49	3900.00	3900.00	3.85	OK
14	27.00	16.71	Tieback	838.64	3900.00	3900.00	4.65	OK
15	30.00	17.19	Tieback	664.82	3900.00	3900.00	5.87	OK
16	33.00	17.50	Tieback	492.16	3900.00	3900.00	7.92	OK
17	36.00	17.60	Tieback	317.83	1900.00	1900.00	5.98	OK
18	39.00	17.41	Tieback	61.23	1900.00	1900.00	31.03	OK
19	42.00	3.97	Tieback	0.00	1900.00	1900.00	277295348	OK
20	45.00	1.98	Tieback	0.00	1900.00	1900.00	277295348	OK

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DETAILED RESULTS OF TIEBACK AND COMPOUND ANALYSES

#	Elevation [ft]	Total Length [ft]	Embedded Length to resist pullout, Le [ft]	Length to slip surface, La [ft]	Strength for: Compound stability (available) T-compound [lb/ft]	Strength for: Tieback (required) T-tieback [lb/ft]	Controlling Mode of Failure
1	0.00	10.32	10.32	0.00	8400.00	1232.61	Compound
2	1.50	11.60	7.01	4.59	8400.00	1189.17	Compound
3	3.00	11.52	7.20	4.32	8400.00	1145.73	Compound
4	4.50	6.17	1.39	4.78	8400.00	1102.30	Tieback
5	6.00	7.45	1.06	6.39	8400.00	1058.88	Tieback
6	7.50	8.74	0.86	7.87	8400.00	1015.46	Tieback
7	9.00	9.46	0.77	8.69	8400.00	972.05	Tieback
8	10.50	10.14	0.67	9.47	8400.00	928.65	Tieback
9	12.00	11.47	1.06	10.41	3900.00	1708.23	Tieback
10	15.00	12.93	0.86	12.06	3900.00	1534.27	Tieback
11	18.00	14.11	0.67	13.44	3900.00	1360.30	Tieback
12	21.00	15.14	0.58	14.57	3900.00	1186.39	Tieback
13	24.00	16.00	0.53	15.47	3900.00	1012.49	Tieback
14	27.00	16.71	0.53	16.18	3900.00	838.64	Tieback
15	30.00	17.19	0.48	16.71	3900.00	664.82	Tieback
16	33.00	17.50	0.43	17.07	3900.00	492.16	Tieback
17	36.00	17.60	0.34	17.27	1900.00	317.83	Tieback
18	39.00	17.41	0.10	17.32	1900.00	61.23	Tieback
19	42.00	0.00	0.00	0.00	1900.00	0.00	Tieback
20	45.00	0.00	0.00	0.00	1900.00	0.00	Tieback

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RESULTS OF DIRECT SLIDING AND DEEPSEATED ANALYSES

DIRECT SLIDING

Required length of bottom layer to produce the
specified Fs-direct sliding = 1.50 is 31.73 ft.
Maximum length based on compound and tieback analyses to insure
Fs-uncertainties = 1.00 and Fs-pullout = 1.50, is 17.60 ft.
Theta-critical = 57.0 degrees

DEEPSEATED

Global deepseated factor of safety, Fs-deepseated, based on Bishop's analysis, is 1.01.
NOTE: Target Fs was smaller than initially computed. Hence, length of reinforcement was increased to meet or exceed the target value, resulting in possibly excessive Fs for direct sliding.

The critical circle is forced to pass outside the reinforced zone defined by the bottom geosynthetic layer; its maximum potential depth is restricted to 28.00 ft.
The critical circle is at: Xc = -20.14, Yc = 60.00, Radius = 79.31 feet. Number of slices = 50.
In case the crest elevation is above H, ReSlope assumes a tension crack between the crest and H (see graphic screen).

NOTE: To obtain satisfactory Fs-deepseated, re-run ReSlope with a larger specified value of Fs-direct sliding. This will force deeper circles that should yield larger deepseated safety factor.

TIEBACK & COMPOUND

Tieback/compound slip surfaces are not restricted from penetrating the foundation soil.

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Dunn MSE Berm Station 19+47

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PROJECT IDENTIFICATION

Title: Dunn MSE Berm Station 19+47
Project Number: 182-442.0002
Designer: JMN

Description:

File path and name: \\svr-boston\projects\2018\182-442\-Calculations\MSE Be.....
.....(Seismic) - Rev1.NAT
Date and time of creating the input data file: Mon Jun 10 17:40:24 2019

Design Philosophy and Program Developed by:

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Newark, Delaware 19711, USA

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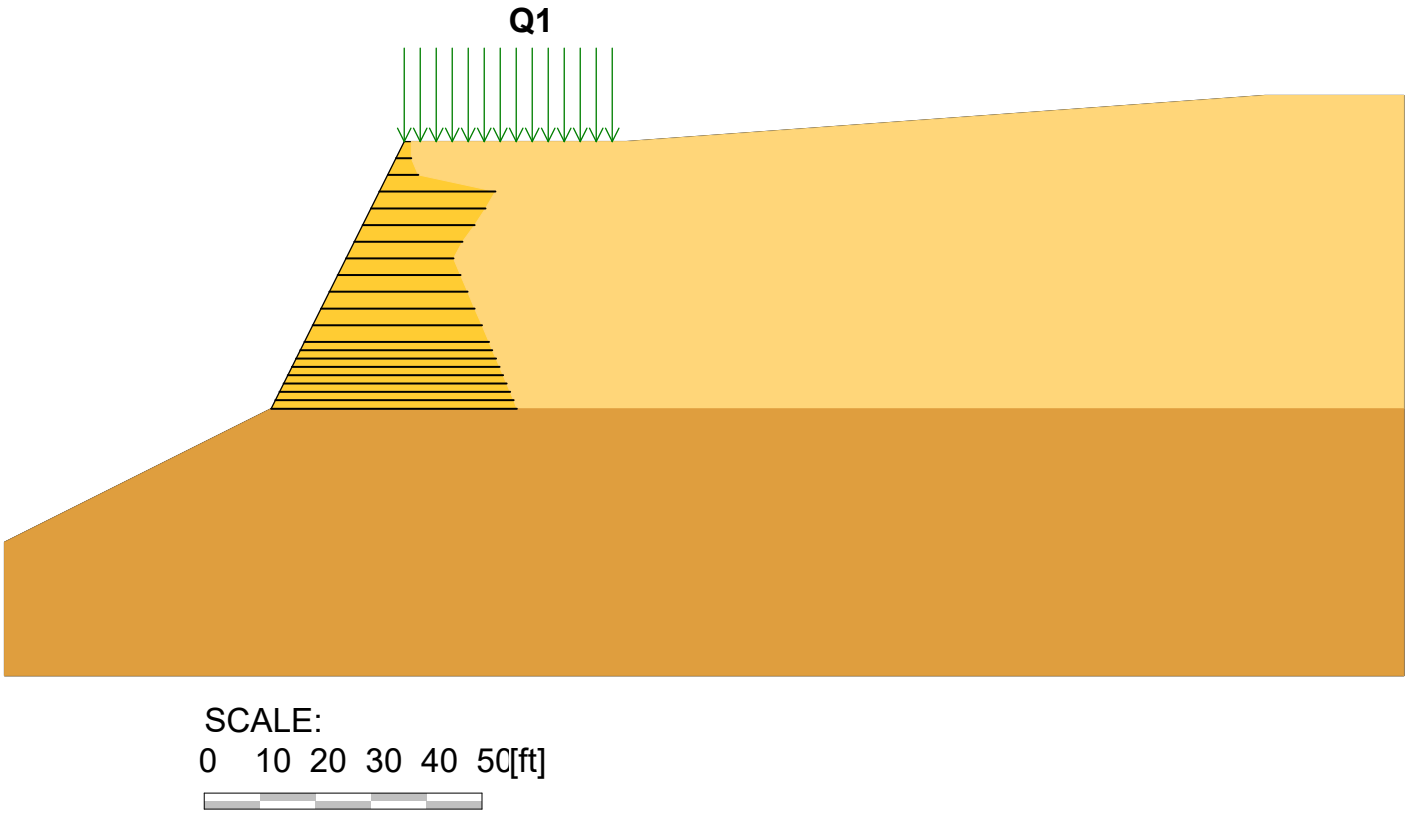
GEOMETRY AND LOADING DATA

Height of slope, H [ft]	48.00
Slope angle, i °	63.43
Horizontal length, A [ft]	40.00
Horizontal length, B [ft]	115.00
Backslope angle, β °	4.10
Slope at bottom of wall, α °	26.57
Surcharge load over A, Q1 [lb/ft ²]	250.00
Surcharge load over backslope B, Q2 [lb/ft ²]	0.00
Surcharge load away from backslope, Q3 [lb/ft ²]	0.00

Water is not present.



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SOIL DATA

REINFORCED SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	100.00
	Moist unit weight, γ [lb/ft ³]	120.00
BACKFILL SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	100.00
	Moist unit weight, γ [lb/ft ³]	120.00
FOUNDATION SOIL:	Internal angle of friction, $\phi°$	30.0
	Cohesion, c [lb/ft ²]	0.00
	Moist unit weight, γ [lb/ft ³]	120.00

GENERAL DATA

Assumed angle of interwedge force (direct sliding analysis), $\delta°$	20.00
Pullout interaction coefficient (reinforced soil), Ci	0.80
Pullout interaction coefficient (foundation soil), Ci	0.80
Direct sliding coefficient (along reinforced soil), Cds	0.80
Direct sliding coefficient (along foundation soil), Cds	0.80

Minimum required length at each elevation was specified.

SEISMIC PARAMETERS

Horizontal seismic coefficient, Kh (100% used)	0.07
Vertical seismic coefficient, Kv	0.00

Kh and Kv ARE being applied to the reinforced mass and surcharge in direct sliding analysis.

FOUNDATION EFFECTS

Slip surfaces in tieback and compound analyses are allowed to penetrate the foundation soil.
Bishop's deepseated analysis was invoked and circles may penetrate the
foundation to a maximum depth of [ft] 28.00

GEOSYNTHETIC DESIGN PARAMETERS

(-------- Manual input data --------)

Reduction factor for installation damage, RFid	1.00
Reduction factor for durability, RFd	1.00
Reduction factor for creep, RFc	1.00
Coverage ratio, Rc	1.00

SPECIFIED FORCE ORIENTATION

Relative orientation of reinforcement is prescribed, ROR	0.00

GENERAL SAFETY FACTORS

Factor of safety on soil shear strength	1.00
Factor of safety on geosynthetic strength	1.00
Factor of safety on pullout resistance	1.50
Factor of safety on direct sliding resistance	1.50

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SUMMARY OF TIEBACK AND COMPOUND RESULTS

#	Elevation [ft]	Length [ft]	Mode of Failure	Strength: Required, Tr [lb/ft]	Ultimate, T-ult [lb/ft]	Long-term (design) T-ltds [lb/ft]	Actual Overall Fs	Status
1	0.00	44.33	Compound	8400.00	8400.00	8400.00	> 1.00	OK
2	1.50	42.94	Compound	8400.00	8400.00	8400.00	> 1.00	OK
3	3.00	41.56	Compound	8400.00	8400.00	8400.00	> 1.00	OK
4	4.50	40.17	Tieback	1402.46	8400.00	8400.00	5.99	OK
5	6.00	38.79	Tieback	1348.99	8400.00	8400.00	6.23	OK
6	7.50	37.40	Tieback	1295.51	8400.00	8400.00	6.48	OK
7	9.00	36.02	Tieback	1242.03	8400.00	8400.00	6.76	OK
8	10.50	34.63	Tieback	1188.59	8400.00	8400.00	7.07	OK
9	12.00	33.25	Tieback	2197.02	3900.00	3900.00	1.78	OK
10	15.00	30.48	Tieback	1982.66	3900.00	3900.00	1.97	OK
11	18.00	27.70	Tieback	1768.32	3900.00	3900.00	2.21	OK
12	21.00	24.93	Tieback	1553.99	3900.00	3900.00	2.51	OK
13	24.00	22.16	Tieback	1339.68	3900.00	3900.00	2.91	OK
14	27.00	19.39	Tieback	1127.03	3900.00	3900.00	3.46	OK
15	30.00	19.48	Tieback	912.10	3900.00	3900.00	4.28	OK
16	33.00	20.15	Tieback	697.01	3900.00	3900.00	5.60	OK
17	36.00	20.62	Tieback	482.51	1900.00	1900.00	3.94	OK
18	39.00	20.91	Tieback	257.48	1900.00	1900.00	7.38	OK
19	42.00	5.54	Tieback	0.00	1900.00	1900.00	277295348	OK
20	45.00	2.77	Tieback	0.00	1900.00	1900.00	277295348	OK

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DETAILED RESULTS OF TIEBACK AND COMPOUND ANALYSES

#	Elevation [ft]	Total Length [ft]	Embedded Length to resist pullout, Le [ft]	Length to slip surface, La [ft]	Strength for: Compound stability (available) T-compound [lb/ft]	Strength for: Tieback (required) T-tieback [lb/ft]	Controlling Mode of Failure
1	0.00	10.32	10.32	0.00	8400.00	1562.96	Compound
2	1.50	12.62	5.86	6.76	8400.00	1509.45	Compound
3	3.00	12.44	6.05	6.40	8400.00	1455.95	Compound
4	4.50	7.42	1.44	5.98	8400.00	1402.46	Tieback
5	6.00	10.07	0.96	9.11	8400.00	1348.99	Tieback
6	7.50	12.03	0.77	11.26	8400.00	1295.51	Tieback
7	9.00	13.25	0.67	12.57	8400.00	1242.03	Tieback
8	10.50	14.11	0.62	13.48	8400.00	1188.59	Tieback
9	12.00	14.94	1.06	13.89	3900.00	2197.02	Tieback
10	15.00	14.47	0.96	13.51	3900.00	1982.66	Tieback
11	18.00	15.17	0.82	14.36	3900.00	1768.32	Tieback
12	21.00	16.53	0.77	15.76	3900.00	1553.99	Tieback
13	24.00	17.69	0.72	16.97	3900.00	1339.68	Tieback
14	27.00	18.67	0.67	18.00	3900.00	1127.03	Tieback
15	30.00	19.48	0.62	18.86	3900.00	912.10	Tieback
16	33.00	20.15	0.58	19.57	3900.00	697.01	Tieback
17	36.00	20.62	0.48	20.14	1900.00	482.51	Tieback
18	39.00	20.91	0.34	20.58	1900.00	257.48	Tieback
19	42.00	0.00	0.00	0.00	1900.00	0.00	Tieback
20	45.00	0.00	0.00	0.00	1900.00	0.00	Tieback

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RESULTS OF DIRECT SLIDING AND DEEPSEATED ANALYSES

DIRECT SLIDING

Required length of bottom layer to produce the
specified Fs-direct sliding = 1.50 is 44.33 ft.
Maximum length based on compound and tieback analyses to insure
Fs-uncertainties = 1.00 and Fs-pullout = 1.50, is 20.91 ft.
Theta-critical = 54.0 degrees

DEEPSEATED

Global deepseated factor of safety, Fs-deepseated, based on Bishop's analysis, is 1.03.
NOTE: Target Fs was smaller than initially computed. Hence, length of reinforcement was increased to meet or exceed the target value, resulting in possibly excessive Fs for direct sliding.

The critical circle is forced to pass outside the reinforced zone defined by the bottom geosynthetic layer; its maximum potential depth is restricted to 28.00 ft.
The critical circle is at: Xc = -19.84, Yc = 72.00, Radius = 96.44 feet. Number of slices = 50.
In case the crest elevation is above H, ReSlope assumes a tension crack between the crest and H (see graphic screen).

NOTE: To obtain satisfactory Fs-deepseated, re-run ReSlope with a larger specified value of Fs-direct sliding. This will force deeper circles that should yield larger deepseated safety factor.

TIEBACK & COMPOUND

Tieback/compound slip surfaces are not restricted from penetrating the foundation soil.

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ATTACHMENT C

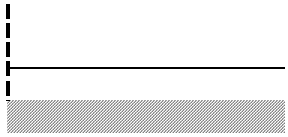
GEOGRID STRENGTH WORKSHEETS

Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205

PROJECT	Dunn C&D Landfill	NUMBER	182-442
CALCULATED BY	NAB	DATE	May-19
CHECKED BY		DATE	
DESCRIPTION	North Perimeter Berm		

Geosynthetic Reinforcement Parameters

Geosynthetic Reinforcement Type:	Miragrid® XT Geogrids
Start of Geosynthetic Reinforcement:	Does not start at base of wall
Reinforced Soil Friction Angle (°):	30
Foundation Soil Friction Angle (°):	30



Miragrid® XT Geogrids — **Selected Product**

Products	2XT	3XT	5XT	7XT	8XT	10XT	20XT	22XT	24XT	5XT
	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	T_{ult} (lbs/ft)
Ultimate Tensile Strength, T_{ult} (1)	2000	3500	4700	5900	7400	9500	13705	20559	27415	**4,700**
Creep Reduction Factor, RF_{CR}										RF_{CR}
114-year design life	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	**1.58**
Creep Limited Strength, T_{CLS}										RF_{ID}
114-year design life	1266	2215	2975	3734	4684	6013	8674	13012	17351	**1.05**
Installation Damage Reduction Factor, RF_{ID}										RF_D
Type 3 Backfill (Sand, Silt, Clay)	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	**1.10**
Type 2 Backfill (Sandy Gravel)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
Type 1 Backfill (Gravel)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	T_{ALL} (lbs/ft) (3)
User Specified RF_{ID} (Table 3-9) (2)										**2,575**
1.80										
										p (°) (4)
Durability Reduction Factor, RF_D	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	**21**

(1) - Ultimate Tensile Strength (MARV) in Machine Direction as measured per ASTM D6637 guidelines
(2) - Table 3-9 "Installation Damage Reduction Factors", FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-32
(3) - Allowable tensile strength, per Equation (3-12), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-28
(4) - Interface Shear, per Equation (3-9), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-21

Coefficient of Shear Stress Interaction, C_i, and Coefficient of Direct Sliding, C_{ds} — **Selected Values**

Soil Type	U.S.C.S.	C_i	C_{ds}	C_i
Silty clay, sandy clay, clayey silt	(ML, CL)	0.7 - 0.8	0.70	**0.8 - 0.9**
Silty sands, fine to medium sands	(SM, SP, SW)	0.8 - 0.9	0.80	C_{ds}
Dense well- graded sand, sand and gravel	(SW, GP, GW)	0.9 - 1.0	0.90	**0.8**

C_i and C_{ds} values from Tencate's Determination of the Long Term Propoerties for Miragrid and Mirafi PET Geosynthetics.

Equation 3-9, Interface Shear

$$p = \tan^{-1}\left(\frac{2}{3}\tan\phi\right)$$

Where: ϕ = 30 °

p = tan-1(2/3 tan (30 °) = **21.1 °**

Equation 3-12, Allowable Tensile Strength (for Global Stability Analysis and Passive Force Application Method)

$$T_{ALL} = \frac{T_{ULT}}{RF_{ID} \times RF_{CR} \times RD_D}$$

Where: T_{ULT} = 4700 LBS/FT
RF_{ID} = 1.05
RF_{CR} = 1.58
RF_D = 1.10

T_{ALL} = (4700 LBS/FT / (1.05 X 1.58 X 1.1) = **2575 LBS/FT**

Equation 9-17, Reinforcement Strength (for Global Stability Analysis and Active Force Application Method)

Geotechnical Parameters are: Well-Defined and Reinforced/Active Zone Does not Contrain a Structural Element

$$T_R = \phi \times T_{ALL}$$

Where: T_{ALL} = 2575 LBS/FT
ϕ = 0.75

T_R = (0.75) X (2575 LBS/FT) = **1932 LBS/FT**

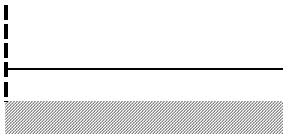
Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205

PROJECT	Dunn C&D Landfill	NUMBER	182-442
CALCULATED BY	NAB	DATE	May-19
CHECKED BY		DATE	
DESCRIPTION	North Perimeter Berm		

Geosynthetic Reinforcement Parameters

Geosynthetic Reinforcement Type:	Miragrid® XT Geogrids
Start of Geosynthetic Reinforcement:	Does not start at base of wall
Reinforced Soil Friction Angle (°):	30
Foundation Soil Friction Angle (°):	30

Reinforcement location



Reinforced Soil 30 °

Foundation Soil

Miragrid® XT Geogrids — **Selected Product**

Products	2XT	3XT	5XT	7XT	8XT	10XT	20XT	22XT	24XT	10XT
	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	T_{ult} (lbs/ft)
Ultimate Tensile Strength, T_{ult} (1)	2000	3500	4700	5900	7400	9500	13705	20559	27415	**9,500**
Creep Reduction Factor, RF_{CR}										RF_{CR}
114-year design life	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	**1.58**
Creep Limited Strength, T_{CLS}										RF_{ID}
114-year design life	1266	2215	2975	3734	4684	6013	8674	13012	17351	**1.05**
Installation Damage Reduction Factor, RF_{ID}										RF_D
Type 3 Backfill (Sand, Silt, Clay)	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	**1.10**
Type 2 Backfill (Sandy Gravel)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
Type 1 Backfill (Gravel)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	T_{ALL} (lbs/ft) (3)
User Specified RF_{ID} (Table 3-9) (2)										**5,206**
1.80										
										p (°) (4)
Durability Reduction Factor, RF_D	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	**21**

(1) - Ultimate Tensile Strength (MARV) in Machine Direction as measured per ASTM D6637 guidelines
(2) - Table 3-9 "Installation Damage Reduction Factors", FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-32
(3) - Allowable tensile strength, per Equation (3-12), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-28
(4) - Interface Shear, per Equation (3-9), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-21

Coefficient of Shear Stress Interaction, C_i, and Coefficient of Direct Sliding, C_{ds} — **Selected Values**

Soil Type	U.S.C.S.	C_i	C_{ds}	C_i
Silty clay, sandy clay, clayey silt	(ML, CL)	0.7 - 0.8	0.70	**0.8 - 0.9**
Silty sands, fine to medium sands	(SM, SP, SW)	0.8 - 0.9	0.80	C_{ds}
Dense well- graded sand, sand and gravel	(SW, GP, GW)	0.9 - 1.0	0.90	**0.8**

C_i and C_{ds} values from Tencate's Determination of the Long Term Propoerties for Miragrid and Mirafi PET Geosynthetics.

Equation 3-9, Interface Shear

$$p = \tan^{-1}\left(\frac{2}{3}\tan\phi\right)$$

Where: ϕ = 30 °

p = tan-1(2/3 tan (30 °) = **21.1 °**

Equation 3-12, Allowable Tensile Strength (for Global Stability Analysis and Passive Force Application Method)

$$T_{ALL} = \frac{T_{ULT}}{RF_{ID} \times RF_{CR} \times RD_D}$$

Where: T_{ULT} = 9500 LBS/FT
RF_{ID} = 1.05
RF_{CR} = 1.58
RF_D = 1.10

T_{ALL} = (9500 LBS/FT / (1.05 X 1.58 X 1.1) = **5206 LBS/FT**

Equation 9-17, Reinforcement Strength (for Global Stability Analysis and Active Force Application Method)

Geotechnical Parameters are: Well-Defined and Reinforced/Active Zone Does not Contrain a Structural Element

$$T_R = \phi \times T_{ALL}$$

Where: T_{ALL} = 5206 LBS/FT
ϕ = 0.75

T_R = (0.75) X (5206 LBS/FT) = **3904 LBS/FT**

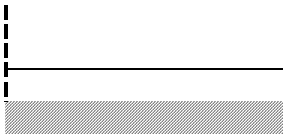
Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205

PROJECT	Dunn C&D Landfill	NUMBER	182-442
CALCULATED BY	NAB	DATE	May-19
CHECKED BY		DATE	
DESCRIPTION	North Perimeter Berm		

Geosynthetic Reinforcement Parameters

Geosynthetic Reinforcement Type:	Miragrid® XT Geogrids
Start of Geosynthetic Reinforcement:	Does not start at base of wall
Reinforced Soil Friction Angle (°):	30
Foundation Soil Friction Angle (°):	30

Reinforcement location



Reinforced Soil 30 °

Foundation Soil

Miragrid® XT Geogrids — **Selected Product**

Products	2XT	3XT	5XT	7XT	8XT	10XT	20XT	22XT	24XT	22XT
	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	lbs/ft	T_{ult} (lbs/ft)
Ultimate Tensile Strength, T_{ult} (1)	2000	3500	4700	5900	7400	9500	13705	20559	27415	**20,559**
Creep Reduction Factor, RF_{CR}										RF_{CR}
114-year design life	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	**1.58**
Creep Limited Strength, T_{CLS}										RF_{ID}
114-year design life	1266	2215	2975	3734	4684	6013	8674	13012	17351	**1.05**
Installation Damage Reduction Factor, RF_{ID}										RF_D
Type 3 Backfill (Sand, Silt, Clay)	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	**1.10**
Type 2 Backfill (Sandy Gravel)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	
Type 1 Backfill (Gravel)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	T_{ALL} (lbs/ft) (3)
User Specified RF_{ID} (Table 3-9) (2)										**11,266**
1.80										
										p (°) (4)
Durability Reduction Factor, RF_D	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	**21**

(1) - Ultimate Tensile Strength (MARV) in Machine Direction as measured per ASTM D6637 guidelines
(2) - Table 3-9 "Installation Damage Reduction Factors", FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-32
(3) - Allowable tensile strength, per Equation (3-12), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-28
(4) - Interface Shear, per Equation (3-9), FHWA NHI-10-024, MSE Walls and RSS - Vol I, Nov. 2009, p 3-21

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Soil Type	U.S.C.S.	C_i	C_{ds}	C_i
Silty clay, sandy clay, clayey silt	(ML, CL)	0.7 - 0.8	0.70	**0.8 - 0.9**
Silty sands, fine to medium sands	(SM, SP, SW)	0.8 - 0.9	0.80	C_{ds}
Dense well- graded sand, sand and gravel	(SW, GP, GW)	0.9 - 1.0	0.90	**0.8**

C_i and C_{ds} values from Tencate's Determination of the Long Term Propoerties for Miragrid and Mirafi PET Geosynthetics.

Equation 3-9, Interface Shear

$$p = \tan^{-1}\left(\frac{2}{3}\tan\phi\right)$$

Where: ϕ = 30 °

p = tan-1(2/3 tan (30 °) = **21.1 °**

Equation 3-12, Allowable Tensile Strength (for Global Stability Analysis and Passive Force Application Method)

$$T_{ALL} = \frac{T_{ULT}}{RF_{ID} \times RF_{CR} \times RD_D}$$

Where: T_{ULT} = 20559 LBS/FT
RF_{ID} = 1.05
RF_{CR} = 1.58
RF_D = 1.10

T_{ALL} = (20559 LBS/FT / (1.05 X 1.58 X 1.1) = **11266 LBS/FT**

Equation 9-17, Reinforcement Strength (for Global Stability Analysis and Active Force Application Method)

Geotechnical Parameters are: Well-Defined and Reinforced/Active Zone Does not Contrain a Structural Element

$$T_R = \phi \times T_{ALL}$$

Where: T_{ALL} = 11266 LBS/FT
ϕ = 0.75

T_R = (0.75) X (11266 LBS/FT) = **8449 LBS/FT**

ATTACHMENT D

REFERENCES

October 5, 2010
Revised May 13, 2011
Revised June 14, 2011

Hydrogeologic Report
Dunn Sand & Gravel Mined Land Use Plan Modification/C&D Landfill
Rensselaer County, New York

Prepared for:

Mr. Michael Dunn, President
S.A. Dunn & Company, LLC
209 Partition Street Ext.
Rensselaer, New York 12144

Prepared by:

C.T. MALE ASSOCIATES, P.C.
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FAX (518) 786-7299

C.T. Male Project No: 09.9520

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170 feet below grade (above the mine floor). Maps EM2, EM3, and EM4 in Appendix A contain geologic cross sections that depict the site geology. As shown, several distinct unconsolidated deposits exist within the site, several of which are discontinuous across the site. A major deposit of sand, sand and gravel, and silt lie beneath the floor of the mine, and are underlain by a deposit of sand, gravel and silt which represents a glacial till deposit that lacks the typical coarse sediment load embedment within a silt and clay matrix. The standard penetration values within this deposit were generally in the range of 80 to 90 blows per 12 inch sampling increment. The soils above the glacial till deposits represent a sequence characteristic of ice contact and lacustrine depositional environments. Shale bedrock was encountered at one boring location (MW-6D) at a depth of approximately 198 feet below grade, this being approximately nine (9) feet below mean sea level.

3.3 Water Well Survey

Based on the water well survey, no private water wells were observed. Based on a response to the FOIL request (Appendix F) Rensselaer County indicated that they do not possess any records regarding private water wells in the vicinity to the project site. It is possible that some private water supply wells exist out of view of our survey; however, based on the observation of fire hydrants on or near every street within the surveyed area and the County's FOIL response; it appears that the entire area is serviced by municipal water.

The likelihood that private water wells are being used as a potable water source within a one (1) mile radius of the site is very low. Figure 4 Water Well Survey Area, in Appendix A shows the area in which the water well survey was performed.

3.4 Water Level Measurements and Groundwater Movement

Monthly water levels were recorded at MW-1, MW-2, MW-3 and MW-4 between November 2009 and June 2010. Each month it was observed that the end of the electronic water level indicator probe was covered in silt while taking water level measurements of MW-2 and MW-4. Based on the subsurface information developed as function of the 2010/11 test borings, it has been determined that monitoring wells MW-2 and MW-4 were not installed at depths that intercept the aquifer beneath the site. The limited water noted in these well are likely water condensation that has settled in the

3.0 RESULTS OF INVESTIGATION

The following sections provide the results and interpretation of the data prepared by others (boring logs) and the investigative work conducted by C.T. Male since 2009.

3.1 Regional Geology

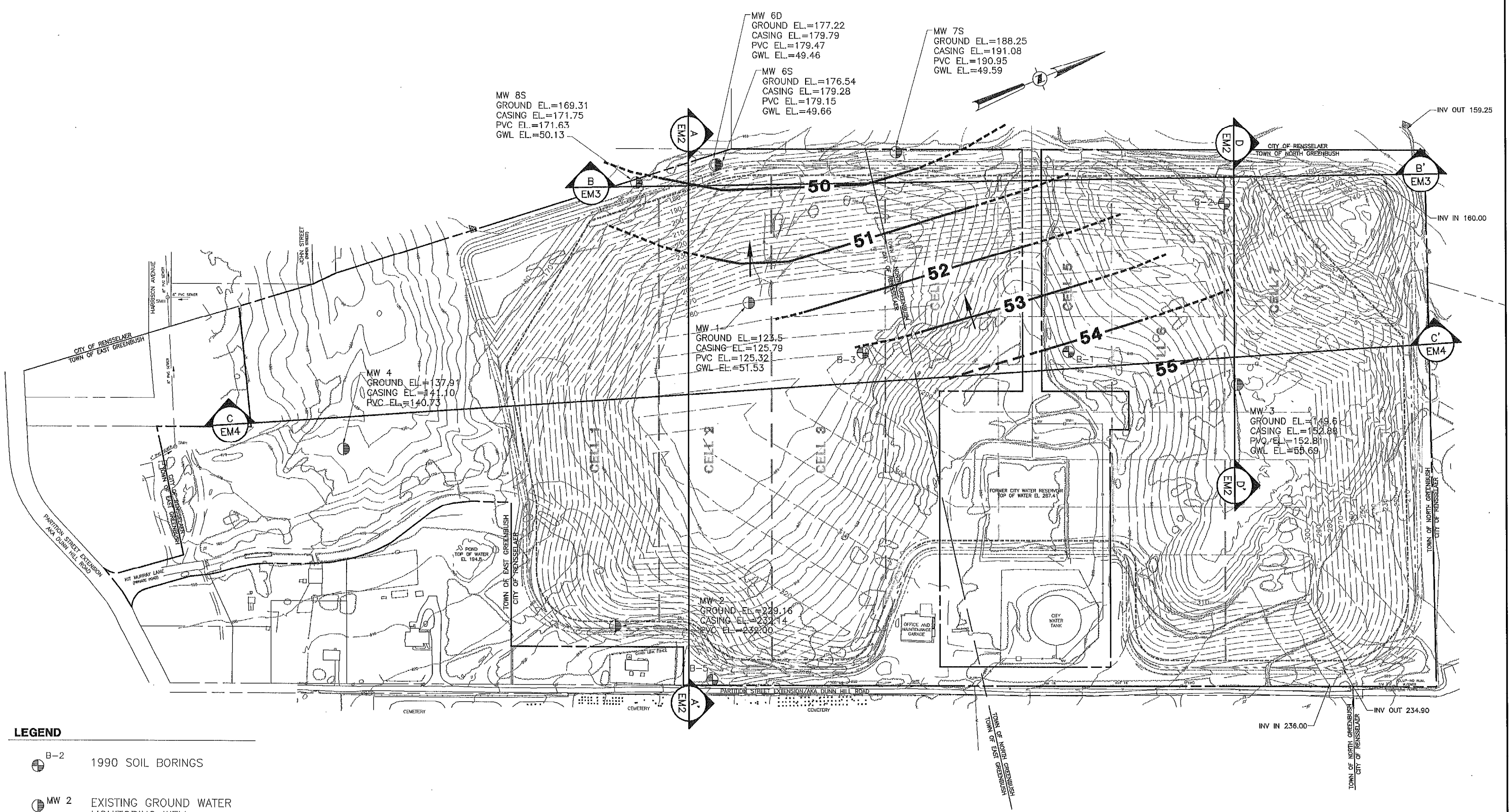
The Taconic Mountains are located to the east of the site, and the Helderberg Escarpment associated with the Catskill Mountains is located to the west of the site. Bedrock underlying the site is mapped as the Upper to Middle Ordovician Canajoharie/Normanskill Shale Formation (Appendix A, Figure 2, Bedrock Geology Map). Glacial sediments deposited during the waning stages of deglaciation in the vicinity of the site are dominated by glaciolacustrine sand and silt sediments and kame deposits (Appendix A, Figure 3, Surficial Geology Map). The kame deposits consist of a thick sequence of ice-contact sand and gravel sediments that have historically been mined at the site, resulting in the excavated north and south pits. Glaciolacustrine sand and clay deposits are mapped around the kame deposits.

3.2 Site Geology

The site is located within the Hudson-Mohawk Lowlands physiographic province of New York. This province is characterized by a general low-lying topography surrounding the Mohawk and Hudson Rivers that resulted from erosion of weak underlying bedrock formations and the subsequent deposition of glacial sediments. The topography in the vicinity of the site ranges from approximately 200 to 300 feet above mean sea level and generally decreases to the west towards the Hudson River.

Based on review of the test boring and monitoring well data, the stratigraphy beneath the proposed C&D landfill (and the current mine floors) consists of glaciolacustrine silts and glaciolacustrine sands, interbedded with deposits of finer and coarser materials, underlain by shale bedrock. The glaciolacustrine clay unit is present at the MW-4, MW-6S/6D, and MW-8S locations and extends to the boundary of the south pit, whereas the glaciolacustrine sand is present in the other three (3) locations. The thickness of unconsolidated sediments ranges from approximately 130 feet (below the mine floor) to

DLF-BASE 125 SCALE.DWG :XREFS



LEGEND

B-2 — 1990 SOIL BORINGS

MW 2 — EXISTING GROUND WATER MONITORING WELL

GROUND WATER CONTOUR, INFERRED WHERE DASHED. ARROW DEPICTS INFERRED DIRECTION OF GROUNDWATER MOVEMENT

NOTE:
GROUNDWATER CONTOURS DEVELOPED USING WATER LEVEL DATA COLLECTED ON 3/31/11

BAR SCALE
250 0 125 250 500
1 inch = 250 ft.

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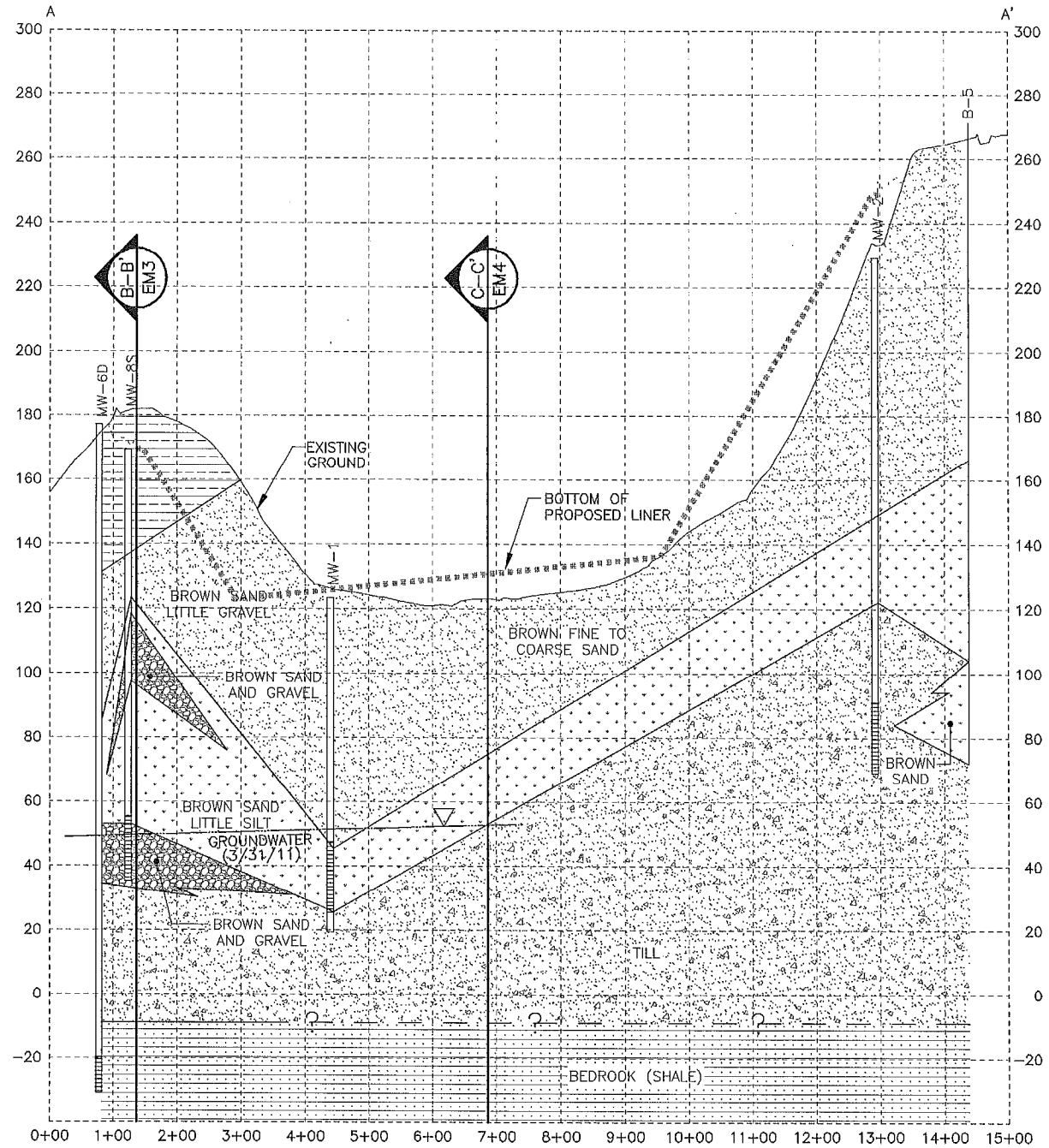
EM1a
GROUNDWATER CONTOUR MAP

DUNN SAND AND GRAVEL MINED LAND USE PLAN MODIFICATION/C&D LANDFILL

PROJ. NO.: 09.9520	DRAFTED: NGK	SCALE: AS SHOWN	DATE: MAY 2011	CITY OF RENSSELAER & TOWN OF N. GREENBUSH RENSSELAER COUNTY, NEW YORK

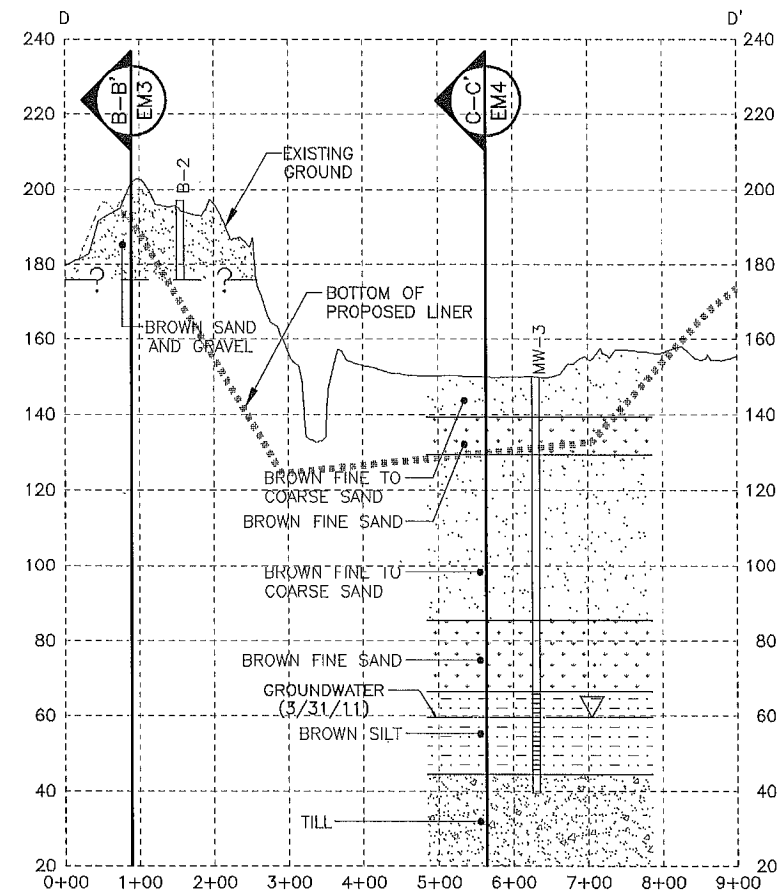
CAD DWG. FILE NAME: DLF-EM1A ENVIRON MON PLAN.DWG



A–A' EM2

GEOLOGIC CROSS SECTION

SCALE: HORZ. 1"=250'
VERT. 1"=50'
CROSS REFERENCE: NONE



D–D' EM2

GEOLOGIC CROSS SECTION

SCALE: HORZ. 1"=250'
VERT. 1"=50'
CROSS REFERENCE: NONE

NOTE:
GROUNDWATER CONTOURS DEVELOPED USING WATER LEVEL DATA COLLECTED ON 3/31/11

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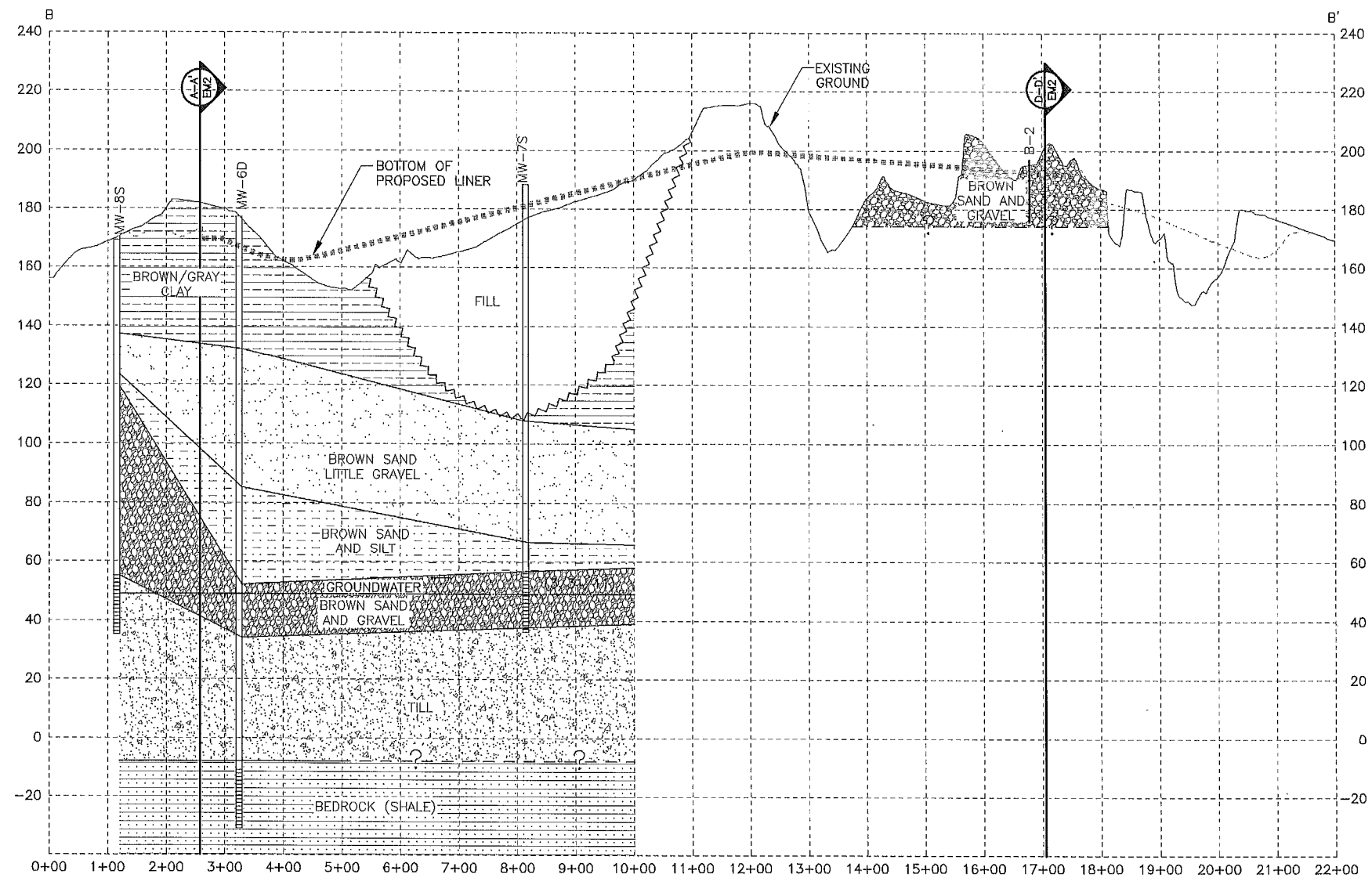
EM2
ENVIRONMENTAL MONITORING SECTION

DUNN SAND AND GRAVEL MINED LAND USE PLAN MODIFICATION/C&D LANDFILL

PROJ. NO.: 09.9520	DRAFTED: NGK	SCALE: AS SHOWN	DATE: MAY 2011	CITY OF RENSSELAER & TOWN OF N. GREENBUSH RENSSELAER COUNTY, NEW YORK

GEOXSECTS2.DWG :XREFS
CAD DWG. FILE NAME: DLF-EM2 ENVIRON MON SECT.DWG



B–B'
EM3

GEOLOGIC CROSS SECTION

SCALE: HORZ. 1"=250'
VERT. 1"=50'
CROSS REFERENCE: NONE

NOTE:
GROUNDWATER CONTOURS DEVELOPED USING WATER LEVEL DATA COLLECTED ON 3/31/11

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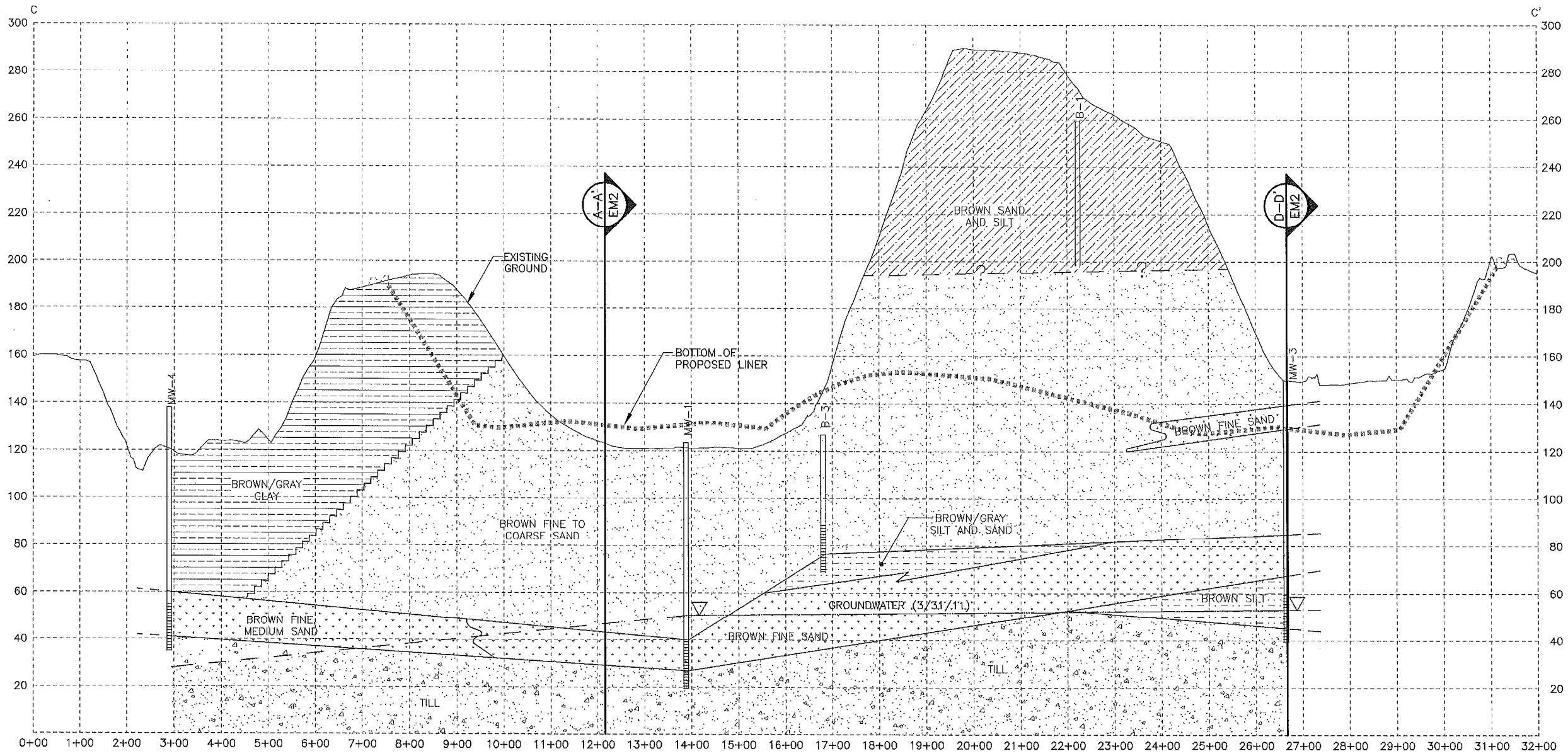
EM3
ENVIRONMENTAL MONITORING SECTION

DUNN SAND AND GRAVEL MINED LAND USE PLAN MODIFICATION/C&D LANDFILL

PROJ. NO.: 09.9520	DRAFTED: NGK	SCALE: AS SHOWN	DATE: MAY 2011	CITY OF RENSSELAER & TOWN OF N. GREENBUSH RENSSELAER COUNTY, NEW YORK

GEOXSECTS2.DWG :XREFS
CAD DWG. FILE NAME: DLF-EM3 ENVIRON MON SECT.DWG

GEOXSECTS2.DWG :XREFS



C-C' EM4

GEOLOGIC CROSS SECTION

SCALE: HORZ. 1"=250'
VERT. 1"=50'
CROSS REFERENCE: NONE

NOTE:
GROUNDWATER CONTOURS DEVELOPED USING WATER LEVEL DATA COLLECTED ON 3/31/11

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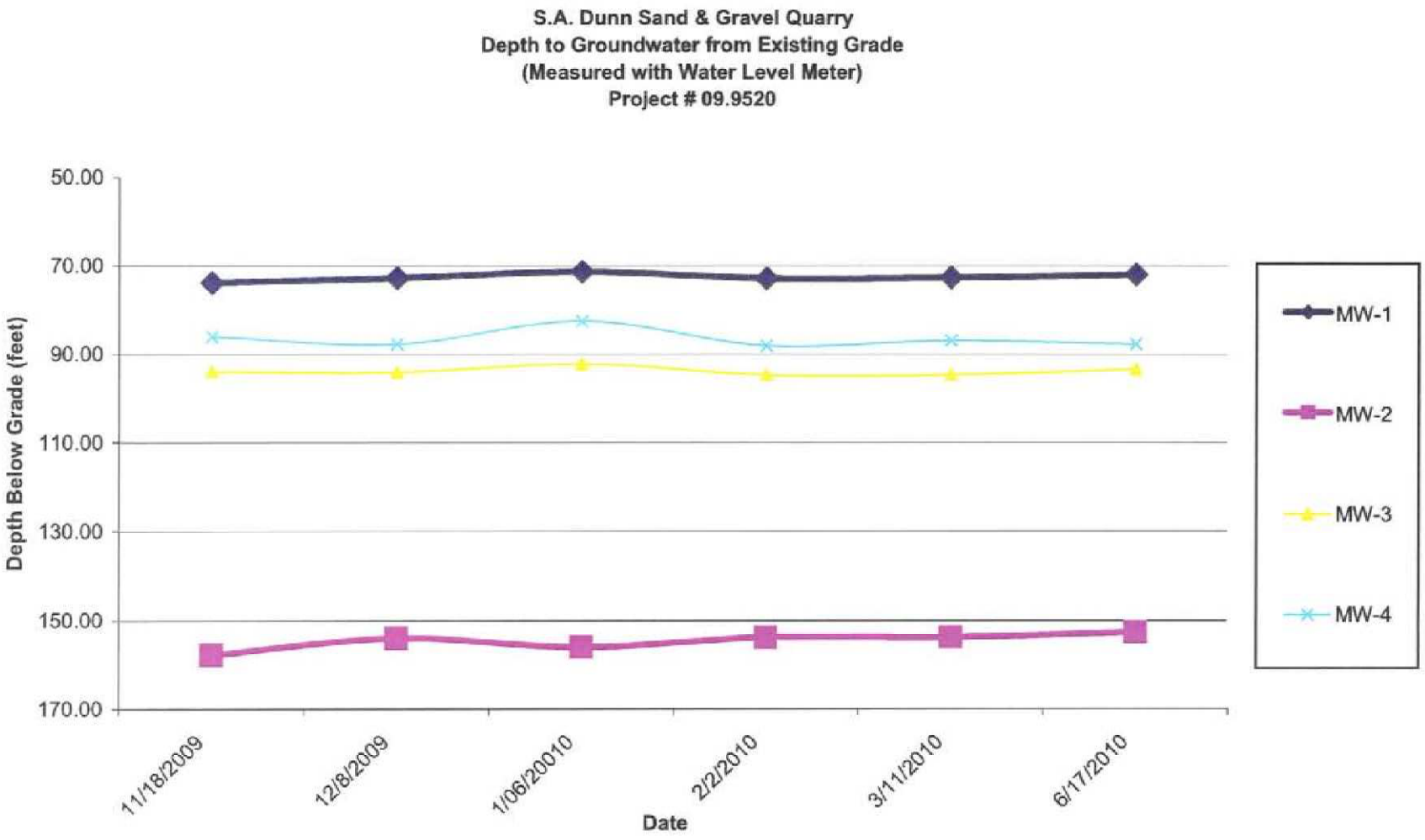
EM4
ENVIRONMENTAL MONITORING SECTION

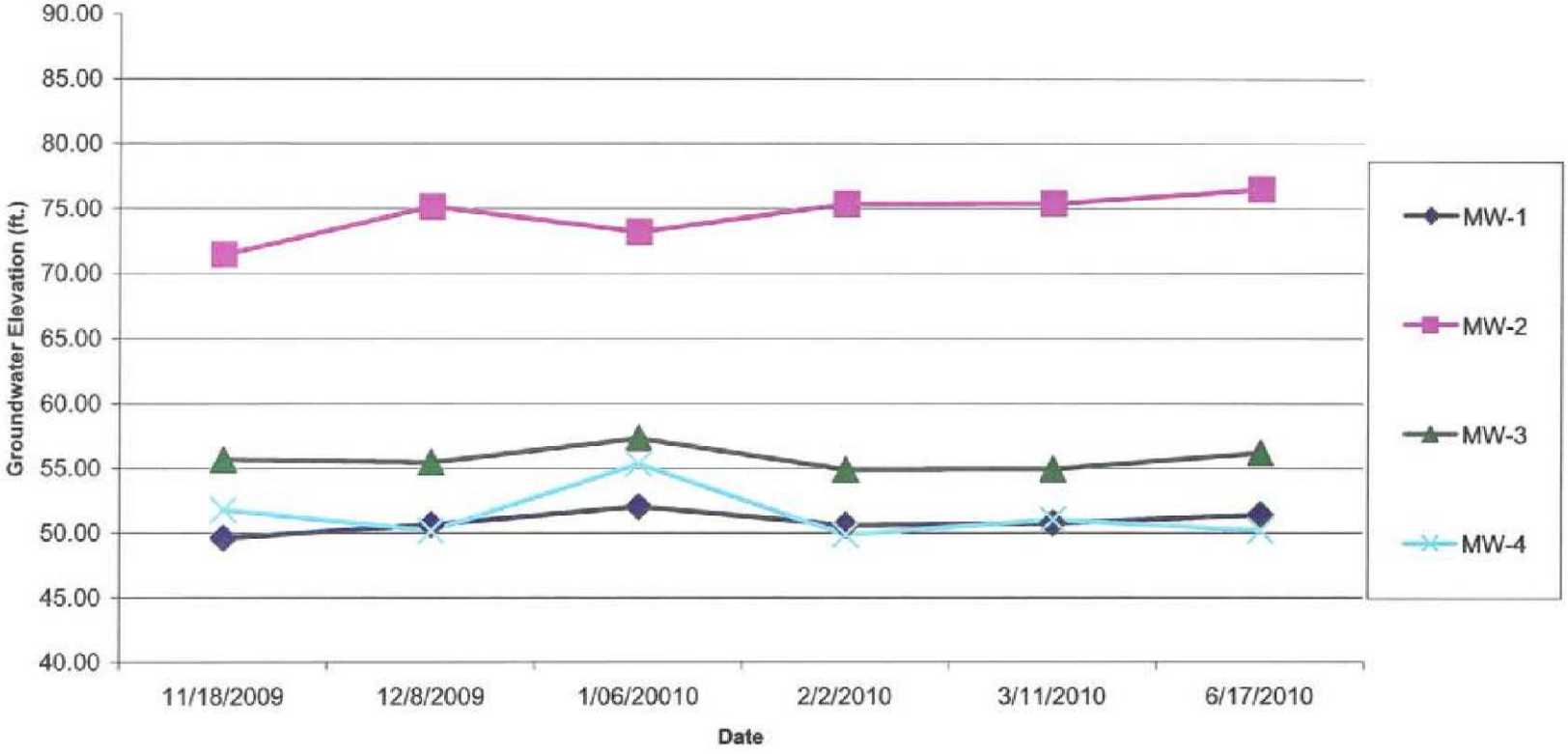
DUNN SAND AND GRAVEL MINED LAND USE PLAN MODIFICATION/C&D LANDFILL

PROJ. NO.: 09.9520	DRAFTED: NGK	SCALE: AS SHOWN	DATE: MAY 2011	CITY OF RENSSELAER & TOWN OF N. GREENBUSH RENSSELAER COUNTY, NEW YORK

CAD DWG. FILE NAME: DLF-EM4 ENVIRON MON SECT.DWG


S.A. Dunn Sand & Gravel Quarry
Depth to Groundwater from Existing Grade
(Measured with Water Level Meter)
Project # 09.9520
Depth Below Grade (feet)
50.00
70.00
90.00
110.00
130.00
150.00
170.00
11/18/2009
12/8/2009
1/06/20010
2/2/2010
3/11/2010
6/17/2010
Date
MW-1
MW-2
MW-3
MW-4

S.A. Dunn Sand & Gravel Quarry
Groundwater Elevation
(Measured with Water Level Meter)
C.T. Male Associates, P.C. Proj. No. 09.9520



United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Rensselaer County, New York

May 14, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....12
Rensselaer County, New York.....14
ChA—Chenango very gravelly loam, 0 to 3 percent slopes.....14
ChB—Chenango very gravelly loam, 3 to 8 percent slopes.....15
FlA—Fluvaquents-Udifluvents complex, 0 to 3 percent slopes.....17
FrA—Fredon silt loam, 0 to 4 percent slopes.....19
HbB—Haven silt loam, 3 to 8 percent slopes.....20
HoA—Hoosic gravelly sandy loam, 0 to 3 percent slopes.....22
HoB—Hoosic gravelly sandy loam, 3 to 8 percent slopes.....23
HoC—Hoosic gravelly sandy loam, rolling.....24
HoD—Hoosic gravelly sandy loam, hilly.....25
HoE—Hoosic gravelly sandy loam, steep.....27
HuB—Hudson silt loam, 3 to 8 percent slopes.....28
HuC—Hudson silt loam, 8 to 15 percent slopes.....29
HuD—Hudson silt loam, hilly.....31
HuE—Hudson silt loam, steep.....32
LmA—Limerick silt loam, 0 to 3 percent slopes.....33
Pg—Pits, gravel.....35
RhA—Rhinebeck silt loam, 0 to 3 percent slopes.....35
RhB—Rhinebeck silt loam, 3 to 8 percent slopes.....37
SwA—Shaker very fine sandy loam, sandy substratum, 0 to 4 percent slopes.....38
Ud—Udorthents, loamy.....40
Ue—Udorthents, sandy.....41
W—Water.....42
WnB—Windsor loamy sand, 3 to 8 percent slopes.....42
References.....44

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

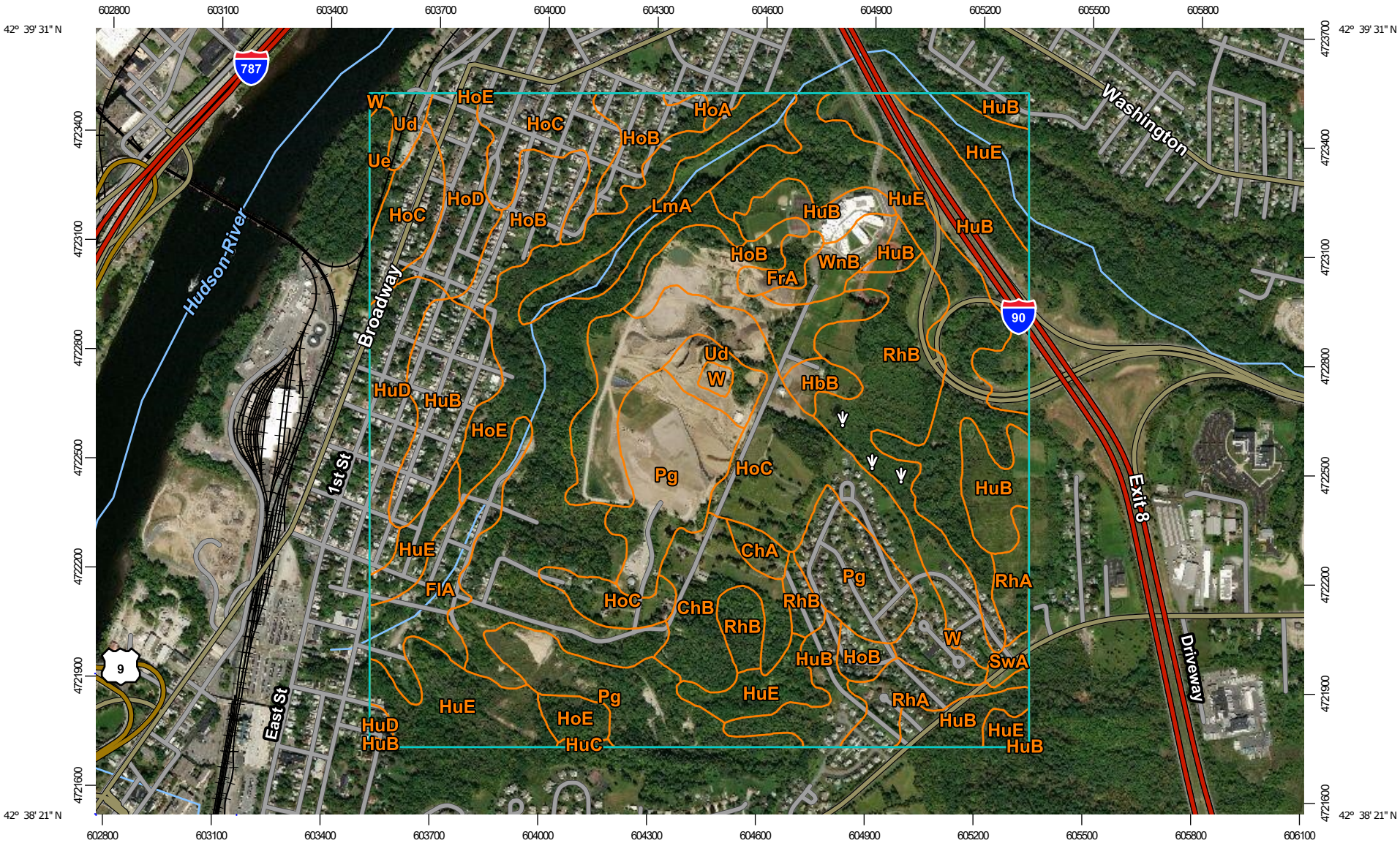
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:15,200 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Rensselaer County, New York
Survey Area Data: Version 15, Sep 3, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 1, 2014—Sep 22, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ChA	Chenango very gravelly loam, 0 to 3 percent slopes	3.7	0.5%
ChB	Chenango very gravelly loam, 3 to 8 percent slopes	24.1	3.0%
FlA	Fluvaquents-Udifluvents complex, 0 to 3 percent slopes	22.8	2.8%
FrA	Fredon silt loam, 0 to 4 percent slopes	4.9	0.6%
HbB	Haven silt loam, 3 to 8 percent slopes	4.8	0.6%
HoA	Hoosic gravelly sandy loam, 0 to 3 percent slopes	2.0	0.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	58.5	7.2%
HoC	Hoosic gravelly sandy loam, rolling	115.2	14.2%
HoD	Hoosic gravelly sandy loam, hilly	19.4	2.4%
HoE	Hoosic gravelly sandy loam, steep	104.6	12.9%
HuB	Hudson silt loam, 3 to 8 percent slopes	109.2	13.5%
HuC	Hudson silt loam, 8 to 15 percent slopes	0.7	0.1%
HuD	Hudson silt loam, hilly	21.9	2.7%
HuE	Hudson silt loam, steep	118.1	14.6%
LmA	Limerick silt loam, 0 to 3 percent slopes	18.1	2.2%
Pg	Pits, gravel	78.7	9.7%
RhA	Rhinebeck silt loam, 0 to 3 percent slopes	18.2	2.3%
RhB	Rhinebeck silt loam, 3 to 8 percent slopes	55.0	6.8%
SwA	Shaker very fine sandy loam, sandy substratum, 0 to 4 percent slopes	2.6	0.3%
Ud	Udorthents, loamy	12.4	1.5%
Ue	Udorthents, sandy	4.1	0.5%
W	Water	2.4	0.3%
WnB	Windsor loamy sand, 3 to 8 percent slopes	9.0	1.1%
Totals for Area of Interest		**810.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas

shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Rensselaer County, New York

ChA—Chenango very gravelly loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9v1n
Elevation: 600 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chenango and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chenango

Setting

Landform: Valley trains, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, derived mainly from sandstone, shale, and siltstone

Typical profile

H1 - 0 to 7 inches: very gravelly loam
H2 - 7 to 43 inches: very gravelly loam
H3 - 43 to 78 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Riverhead

Percent of map unit: 3 percent
Hydric soil rating: No

Unadilla
Percent of map unit: 3 percent
Hydric soil rating: No

Hoosic
Percent of map unit: 3 percent
Hydric soil rating: No

Castile
Percent of map unit: 3 percent
Hydric soil rating: No

Palms
Percent of map unit: 1 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Carlisle
Percent of map unit: 1 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Fredon
Percent of map unit: 1 percent
Hydric soil rating: No

ChB—Chenango very gravelly loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 9v1p
Elevation: 600 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Chenango and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chenango

Setting
Landform: Terraces, valley trains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, derived mainly from sandstone, shale, and siltstone

Typical profile

H1 - 0 to 7 inches: very gravelly loam
H2 - 7 to 43 inches: very gravelly loam
H3 - 43 to 78 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Unadilla

Percent of map unit: 3 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 3 percent
Hydric soil rating: No

Hoosic

Percent of map unit: 3 percent
Hydric soil rating: No

Castile

Percent of map unit: 3 percent
Hydric soil rating: No

Carlisle

Percent of map unit: 1 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Fredon

Percent of map unit: 1 percent
Hydric soil rating: No

Palms

Percent of map unit: 1 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

FlA—Fluvaquents-Udifluvents complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9v1t
Elevation: 100 to 3,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 45 percent
Udifluvents and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium with highly variable texture

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 60 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium with a wide range of texture

Typical profile

H1 - 0 to 9 inches: gravelly fine sandy loam
H2 - 9 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Teel

Percent of map unit: 5 percent
Hydric soil rating: No

Limerick

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Saprists

Percent of map unit: 5 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Fredon

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, moderately deep

Percent of map unit: 2 percent
Hydric soil rating: Unranked

FrA—Fredon silt loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 9v1v
Elevation: 250 to 1,200 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Fredon, poorly drained, and similar soils: 50 percent
Fredon, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fredon, Poorly Drained

Setting

Landform: Terraces, valley trains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 23 inches: gravelly silt loam
H3 - 23 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Fredon, Somewhat Poorly Drained

Setting

Landform: Terraces, valley trains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 23 inches: gravelly silt loam
H3 - 23 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Castile

Percent of map unit: 10 percent
Hydric soil rating: No

Unnamed soils, mucky surface

Percent of map unit: 5 percent
Hydric soil rating: Yes

HbB—Haven silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9v21
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Haven and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haven

Setting

Landform: Outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 30 inches: silt loam
H3 - 30 to 60 inches: stratified gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Riverhead

Percent of map unit: 10 percent
Hydric soil rating: No

Chenango

Percent of map unit: 5 percent
Hydric soil rating: No

Hoosic

Percent of map unit: 5 percent
Hydric soil rating: No

HoA—Hoosic gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9v22
Elevation: 100 to 1,100 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hoosic and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoosic

Setting

Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: gravelly sandy loam
H2 - 9 to 23 inches: very gravelly sandy loam
H3 - 23 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Castile
Percent of map unit: 5 percent
Hydric soil rating: No

Chenango
Percent of map unit: 5 percent
Hydric soil rating: No

Fredon
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, sandy surface
Percent of map unit: 2 percent
Hydric soil rating: No

HoB—Hoosic gravelly sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 9v23
Elevation: 100 to 1,100 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Hoosic and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoosic

Setting
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile
H1 - 0 to 9 inches: gravelly sandy loam
H2 - 9 to 23 inches: very gravelly sandy loam
H3 - 23 to 60 inches: very gravelly sand

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Castile
Percent of map unit: 5 percent
Hydric soil rating: No

Chenango
Percent of map unit: 5 percent
Hydric soil rating: No

Fredon
Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, sandy surface
Percent of map unit: 2 percent
Hydric soil rating: No

HoC—Hoosic gravelly sandy loam, rolling

Map Unit Setting
National map unit symbol: 9v24
Elevation: 100 to 1,100 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Hoosic and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoosic

Setting
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: gravelly sandy loam
H2 - 9 to 23 inches: very gravelly sandy loam
H3 - 23 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed soils, silty surface

Percent of map unit: 5 percent
Hydric soil rating: No

HoD—Hoosic gravelly sandy loam, hilly

Map Unit Setting

National map unit symbol: 9v25
Elevation: 100 to 1,100 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hoosic and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoosic

Setting

Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: gravelly sandy loam
H2 - 9 to 23 inches: very gravelly sandy loam
H3 - 23 to 60 inches: very gravelly sand

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Hoosic, severely eroded

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, sandy surface

Percent of map unit: 2 percent
Hydric soil rating: No

HoE—Hoosic gravelly sandy loam, steep

Map Unit Setting

National map unit symbol: 9v26
Elevation: 100 to 1,100 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hoosic and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoosic

Setting

Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: gravelly sandy loam
H2 - 9 to 23 inches: very gravelly sandy loam
H3 - 23 to 60 inches: very gravelly sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Riverhead
Percent of map unit: 5 percent
Hydric soil rating: No

Windsor
Percent of map unit: 5 percent
Hydric soil rating: No

Hoosic, very steep
Percent of map unit: 5 percent
Hydric soil rating: No

Hoosic, severely eroded
Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed soils, sandy surface
Percent of map unit: 5 percent
Hydric soil rating: No

HuB—Hudson silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 9v27
Elevation: 300 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Hudson and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting
Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile
H1 - 0 to 8 inches: silt loam
H2 - 8 to 16 inches: silty clay
H3 - 16 to 28 inches: silty clay

H4 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Rhinebeck

Percent of map unit: 10 percent
Hydric soil rating: No

Nassau

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, gravelly or sandy surface

Percent of map unit: 2 percent
Hydric soil rating: No

HuC—Hudson silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9v28
Elevation: 300 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hudson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 16 inches: silty clay
H3 - 16 to 28 inches: silty clay
H4 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Rhinebeck

Percent of map unit: 10 percent
Hydric soil rating: No

Scio

Percent of map unit: 5 percent
Hydric soil rating: No

Nassau

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed soils, gravelly or lfs surface

Percent of map unit: 2 percent
Hydric soil rating: No

HuD—Hudson silt loam, hilly

Map Unit Setting

National map unit symbol: 9v29
Elevation: 300 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hudson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 16 inches: silty clay
H3 - 16 to 28 inches: silty clay
H4 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Unnamed soils, gravelly or lfs surface

Percent of map unit: 10 percent
Hydric soil rating: No

Nassau

Percent of map unit: 5 percent
Hydric soil rating: No

Hudson, severely eroded

Percent of map unit: 5 percent
Hydric soil rating: No

HuE—Hudson silt loam, steep

Map Unit Setting

National map unit symbol: 9v2b
Elevation: 300 to 1,800 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hudson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 16 inches: silty clay
H3 - 16 to 28 inches: silty clay
H4 - 28 to 60 inches: silty clay

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Unadilla
Percent of map unit: 5 percent
Hydric soil rating: No

Windsor
Percent of map unit: 5 percent
Hydric soil rating: No

Hudson, severely eroded
Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed soils, gravelly surface
Percent of map unit: 4 percent
Hydric soil rating: No

Unnamed soils, alluvial
Percent of map unit: 1 percent
Hydric soil rating: Unranked

LmA—Limerick silt loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 9v2c
Elevation: 50 to 500 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Limerick and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Limerick

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium that is dominantly silt and very fine sand

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 13.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Teel

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed soils, gravelly or sandy surface

Percent of map unit: 5 percent
Hydric soil rating: Yes

Hamlin

Percent of map unit: 3 percent
Hydric soil rating: No

Saprists

Percent of map unit: 2 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Pg—Pits, gravel

Map Unit Setting

National map unit symbol: 9v2r
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits, gravel: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Gravel

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Udorthents, loamy and clayey

Percent of map unit: 10 percent
Hydric soil rating: No

RhA—Rhinebeck silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9v2x
Elevation: 80 to 1,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Rhinebeck and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rhinebeck

Setting

Landform: Lake plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 36 inches: silty clay
H3 - 36 to 62 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Madalin

Percent of map unit: 8 percent
Landform: Depressions
Hydric soil rating: Yes

Hudson

Percent of map unit: 5 percent
Hydric soil rating: No

Nassau

Percent of map unit: 2 percent
Hydric soil rating: No

RhB—Rhinebeck silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9v2y
Elevation: 80 to 1,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Rhinebeck and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rhinebeck

Setting

Landform: Lake plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 36 inches: silty clay
H3 - 36 to 62 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Madalin

Percent of map unit: 8 percent
Landform: Depressions
Hydric soil rating: Yes

Hudson

Percent of map unit: 5 percent
Hydric soil rating: No

Nassau

Percent of map unit: 2 percent
Hydric soil rating: No

SwA—Shaker very fine sandy loam, sandy substratum, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 9v39
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Shaker, poorly drained, and similar soils: 50 percent
Shaker, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shaker, Poorly Drained

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy over clayey glaciolacustrine or glaciomarine deposits

Typical profile

H1 - 0 to 9 inches: very fine sandy loam
H2 - 9 to 23 inches: fine sandy loam
H3 - 23 to 48 inches: silty clay
H4 - 48 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification

Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Shaker, Somewhat Poorly Drained

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy over clayey glaciolacustrine or glaciomarine deposits

Typical profile

H1 - 0 to 9 inches: very fine sandy loam
H2 - 9 to 23 inches: fine sandy loam
H3 - 23 to 48 inches: silty clay
H4 - 48 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Madalin, loamy surface

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Elmridge
Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed soils, sandy surface
Percent of map unit: 5 percent
Hydric soil rating: Yes

Ud—Udorthents, loamy

Map Unit Setting
National map unit symbol: 9v3c
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents, loamy, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Typical profile
H1 - 0 to 60 inches: loam

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Unnamed soils, fragmental
Percent of map unit: 3 percent
Hydric soil rating: No

Udorthents, intermittently ponded
Percent of map unit: 2 percent
Hydric soil rating: No

Udorthents, sandy
Percent of map unit: 2 percent
Hydric soil rating: No

Udorthents, clayey
Percent of map unit: 2 percent
Hydric soil rating: No

Urban land
Percent of map unit: 1 percent
Hydric soil rating: Unranked

Ue—Udorthents, sandy

Map Unit Setting
National map unit symbol: 9v3d
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents, sandy, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Sandy

Typical profile
H1 - 0 to 60 inches: very gravelly loamy sand

Properties and qualities
Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Minor Components

Teel
Percent of map unit: 4 percent
Hydric soil rating: No

Limerick

Percent of map unit: 3 percent
Landform: Flood plains
Hydric soil rating: Yes

Hamlin

Percent of map unit: 3 percent
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 9v3k
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WnB—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Outwash plains, dunes, outwash terraces, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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RSA GEOLAB, LLC

1017 Greeley Avenue North
Union, New Jersey 07083
908-964-0786 (P)
www.RSAgeolab.com

Letter of Transmittal

Date: 5-16-18 Job No.: 848 Lab Log: 18-115

Attention: Amy Knight
Civil Environmental Consultants, Inc.
31 Bellows Rd.
Raynham, MA 02767

CC:

Re: Dunn C&D Facility – Phase 6

Sample(s) ID: **SG-1 (Subgrade)**

Dear Ms. Knight,

Please find attached results for the samples referenced above. The following lab testing was performed:

- ASTM D3080 Direct Shear (500, 7500, 15000 psf)

Regards,
RSA Geolab, LLC

Remarks: If you have any questions, please call 908-964-0786.

Signed: _____

Dr. Raza S. Ahmed
President RSA Geolab, LLC

RSA's Geolab's Geotechnical Laboratory testing was performed and results reported in accordance with ASTM standards and accepted industry standards. No other representations or warranties either express or implied are given. RSA Geolab, LLC neither accepts responsibility for nor makes claim to the final use and purpose of the material tested.
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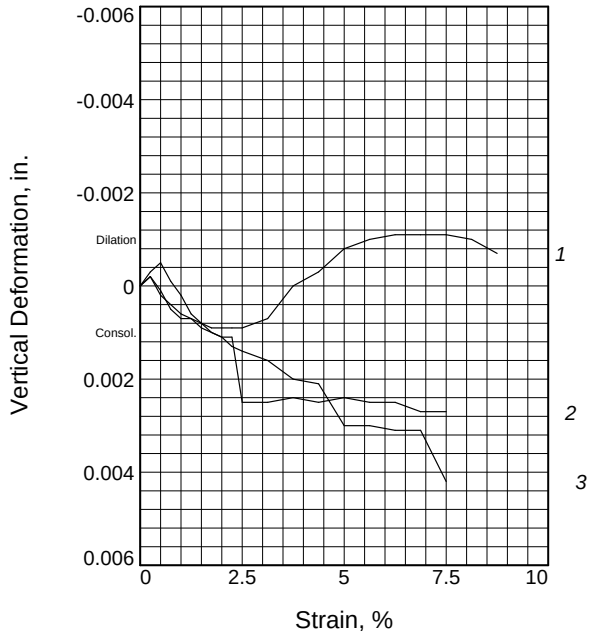
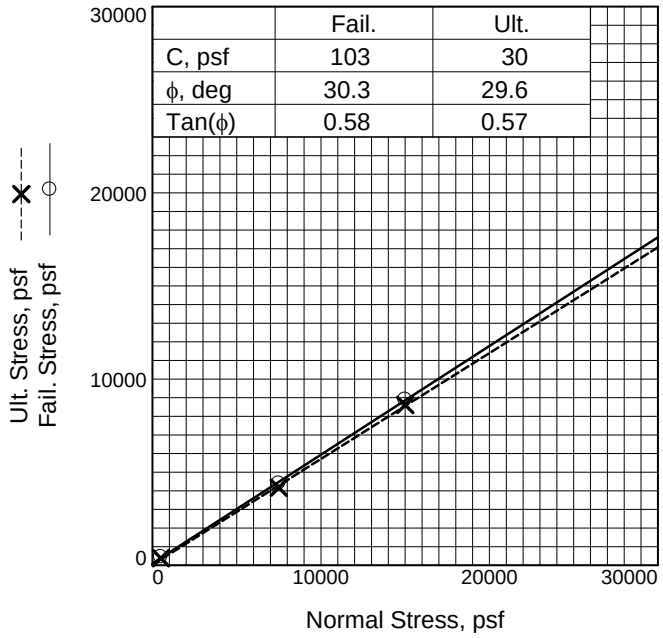
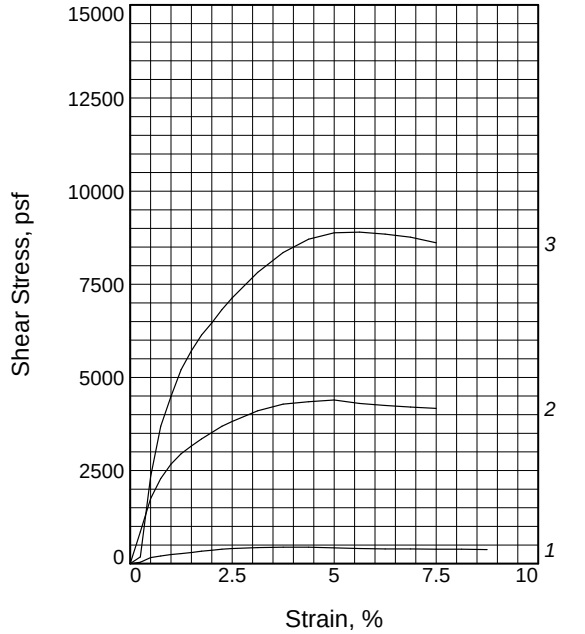




	Fail.	Ult.
C, psf	103	30
ϕ, deg	30.3	29.6
Tan(ϕ)	0.58	0.57



	Sample No.	1	2	3
Initial	Water Content, %	17.7	19.0	17.3
	Dry Density, pcf	109.3	108.0	109.7
	Saturation, %	86.8	90.6	85.7
	Void Ratio	0.5534	0.5715	0.5480
	Side Length, in.	4.00	4.00	4.00
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	15.6	15.1	14.4
	Dry Density, pcf	111.0	109.6	111.4
	Saturation, %	80.0	75.0	74.7
	Void Ratio	0.5293	0.5489	0.5240
	Side Length, in.	4.00	4.00	4.00
	Height, in.	0.98	0.99	0.98
Normal Stress, psf		500	7500	15000
Fail. Stress, psf		441	4392	8901
Strain, %		3.8	5.0	5.6
Ult. Stress, psf		378	4167	8613
Strain, %		8.8	7.5	7.5
Strain rate, in./min.		0.008	0.008	0.008

Sample Type: ASTM D3080
Description: Dark Grayish Brown, Pale Yellow poorly graded sand
LL= NV **PI=** NP
Assumed Specific Gravity= 2.72
Remarks: Recompacted sample. -3/8" material tested. Tested with water in box. Consolidate/Saturate 1 hr.

Figure _____

Client: Civil Environmental Consultants, Inc.

Project: Dunn C & D Facility - Phase 6

Sample Number: SG-1 (Subgrade)

Proj. No.: 848 **Date Sampled:** 5-16-18

DIRECT SHEAR TEST REPORT
RSA Geolab
Union, New Jersey

Tested By: RP **Checked By:** KP

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

42.65261

Time Horizon

Return period in years

2475

Longitude

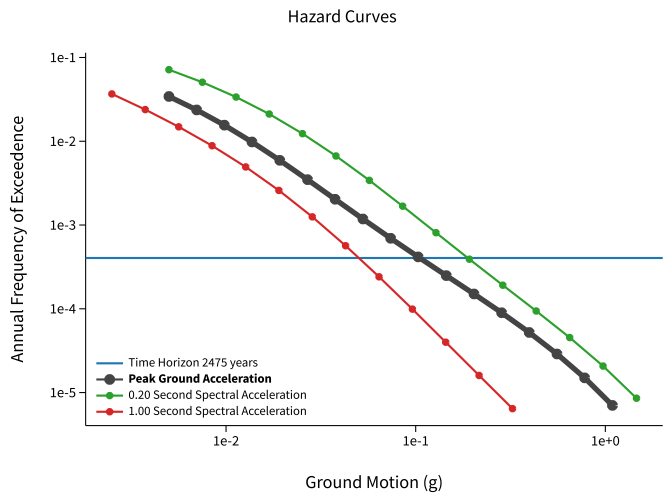
Decimal degrees, negative values for western longitudes

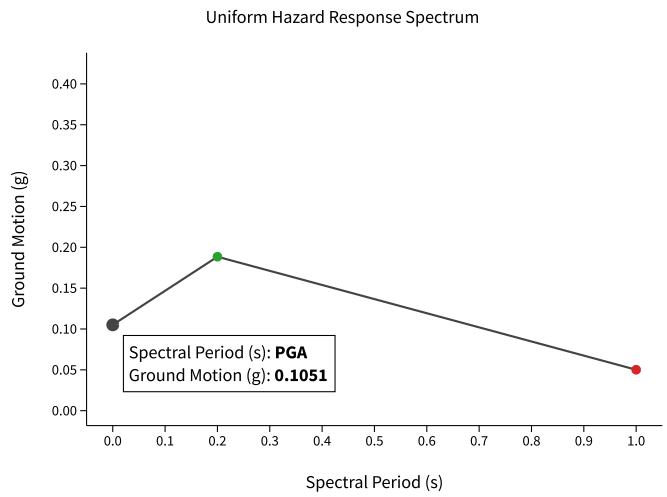
-73.72475

Site Class

760 m/s (B/C boundary)

Hazard Curve





View Raw Data

Transactions on the Built Environment vol 14, © 1995 WIT Press, www.witpress.com, ISSN 1743-3509

Seismic response of municipal solid waste landfills

S. Singh
Department of Civil Engineering, Santa Clara University, Santa Clara CA 95053, USA

ABSTRACT

A brief but critical evaluation of the seismic response of Municipal solid Waste Landfills (MSWL) have been presented.

Parametric studies on the dynamic response using range of values for shear modulus and damping characteristics of the refuse material were carried out. Results of seismic response analyses (for different levels of base motion) performed by the authors and other investigators are examined to evaluate the impact of stiffness and height of the refuse fill on the overall response. A strong influence by a moderate increase in dynamic strength (stiffness) properties on the response has been noted. Based on these analyses the influence of shear wave velocity is discussed. The importance of low and high frequency contents of the base motions is also addressed. Simplified procedures to estimate amplification of seismic ground motions by MSWL have been developed and are presented in this paper.

INTRODUCTION

The seismic response of Municipal Solid Waste Landfills are typically carried out using procedures developed for soil slopes or earth dams. Accordingly assessment of landfill stability under earthquake loading is carried out using deformational analysis. Typical deformation analyses employ a combination of one dimensional seismic response analyses, e.g. (SHAKE 1972) and Newmark [10] sliding block deformation procedures to evaluate permanent deformations which are assumed to take place along a sliding surface. An accurate estimation of the material properties, especially the dynamic strength properties are essential for use in the above analyses. The refuse is a highly heterogeneous material and its dynamic strength properties are yet to established through a reasonable set of data measured or observed. There are other aspects of the MSWL which differ from a well compacted homogeneous earth dam. For example the light weight of refuse and existence of layers of soils and liner systems. All these have raised concerns regarding the applicability of the conventional geotechnical earthquake engineering procedures to refuse slope.

This paper attempts to address the unique concerns related to the seismic response of MSWL and presents simplified procedures for preliminary assessment of the amplification effects of the refuse fill to base motions.

SEISMIC RESPONSE OF MUNICIPAL SOLID WASTE LANDFILLS (MSWL)

Factors that could influence seismic response of landfills include: (1) height of refuse, (2) stiffness (or shear wave velocity) of refuse, (3) dynamic properties of refuse, (4) presence of clay liner, (5) refuse geometry, and (6) characteristics of base motions.

Height and stiffness of the refuse influence the basic vibrating characteristics of the landfills. In a preliminary assessment of landfill response, these are the two most significant factors that should be considered. Shear wave velocity measurements in landfills are not that uncommon nowadays. Conventional methods of downhole and crosshole measurements have been successfully used at landfill sites. Although, all the aforementioned methods require drilling or puncturing a probe into the refuse, more recently, a new method of using surface wave measurements was successfully used to determine the shear wave velocity of refuse Kavazanjian et al. [6]. The benefit of this new technology is that this non-destructive method does not require puncturing any hole into the refuse, and more importantly the surface wave measurement uses a much larger volume of materials in determining the average stiffness of the extremely heterogeneous materials, as compared to crosshole and downhole methods.

Measurements made in landfills typically show that the shear wave velocity ranges between 500 to 1000 feet per second (fps). Although shear wave velocity in excess of 1000 fps have also been reported. The velocity profiles at some landfill sites show that the stiffness increases with depths. It should be noted that unlike conventional soil fills, the refuse fill compacts under its own weight with time, thus the stiffness and in turn the shear wave velocity also increase with time. Thus the velocity of a newly closed landfill may be significantly different when the measurements were made 10 or 20 years later. In the following section, the authors present simplified charts using the refuse height and the average shear wave velocity to assess the response of landfills.

SIMPLIFIED METHOD OF LANDFILL RESPONSE EVALUATION

The relationships shown in Figures 1 and 2 are derived from the authors' experience, publised results, and field instrumentation records on landfill response during earthquakes.

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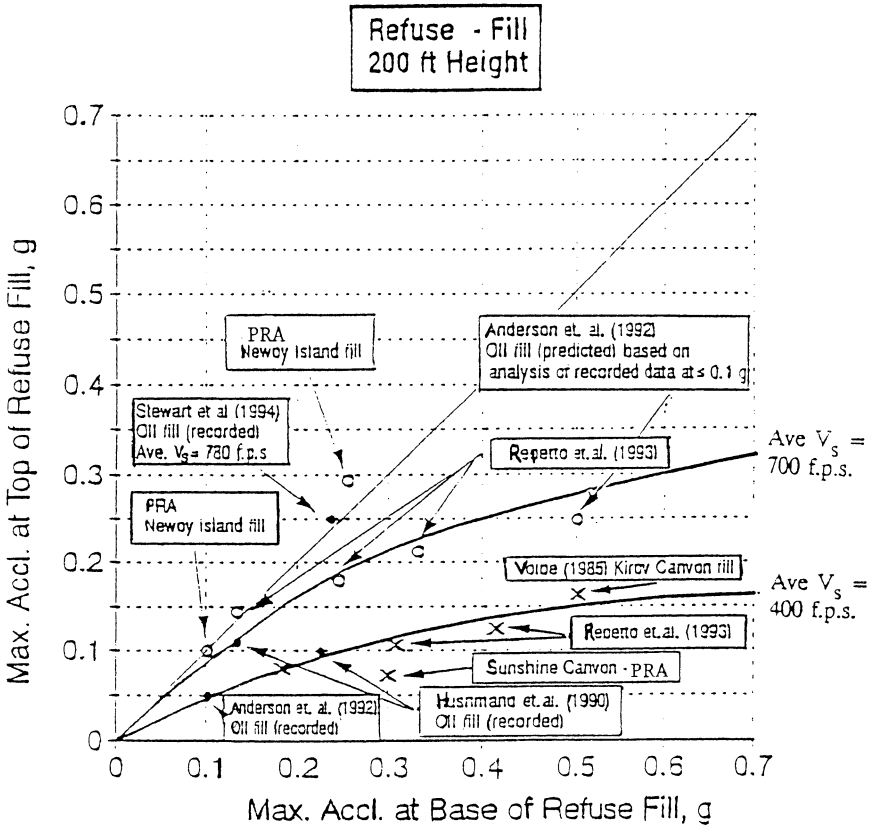

Fig. 1 Approximate Relationship Between Maximum Accelerations at the Base and Crest

The horizontal axis represents the anticipated ground motion at the toe or base of the landfill. In using these charts for preliminary design purposes, this can be determined either from conventional deterministic or probabilistic seismic hazard evaluation. The vertical axis represents the anticipated ground acceleration at the top or crest of the landfill.

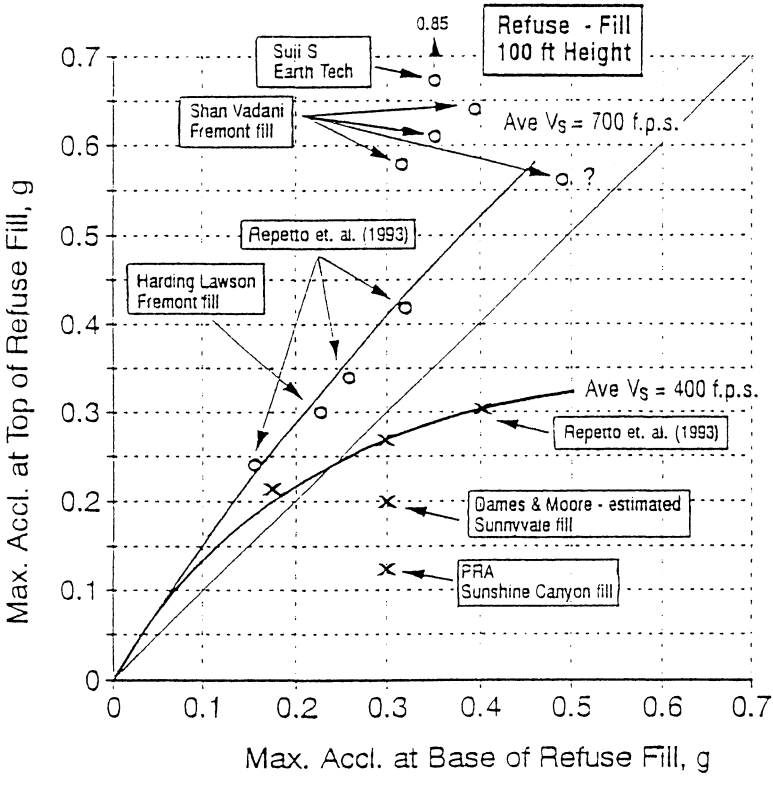

Fig. 2 Approximate Relationship Between Maximum Accelerations at the Base and Crest

As stated in the previous paragraph, the two key parameters used in these two charts and refuse height and refuse average shear wave velocity. Fig. 1 shows the response of 200-ft high landfill and Fig. 2 shows the response of a 100 ft. high landfill. In each plot, the authors developed two curves; they correspond to average refuse shear wave velocity of 400 fps and 700 fps (ft/sec).

It should be noted that due to the limited instrumentation on landfills, Figs 1 and 2 also incorporate some of the authors' analytical work as well as simulations presented by others.

Harder [3] presented a similar chart for earth dams, where he compared the acceleration recorded at the base (or abutment) of the dam with those recorded at the crest of the dam. The authors believe that he proposed upper bound correlation by Harder can be also viewed as an upper bound for response of landfills. The basis of this assessment are (1) the two dimensional geometry of a typical earth dam will respond more than that of a landfill which responds more in a one-dimensional manner, (2) the refuse will have a higher damping than that of an earth fill dam.

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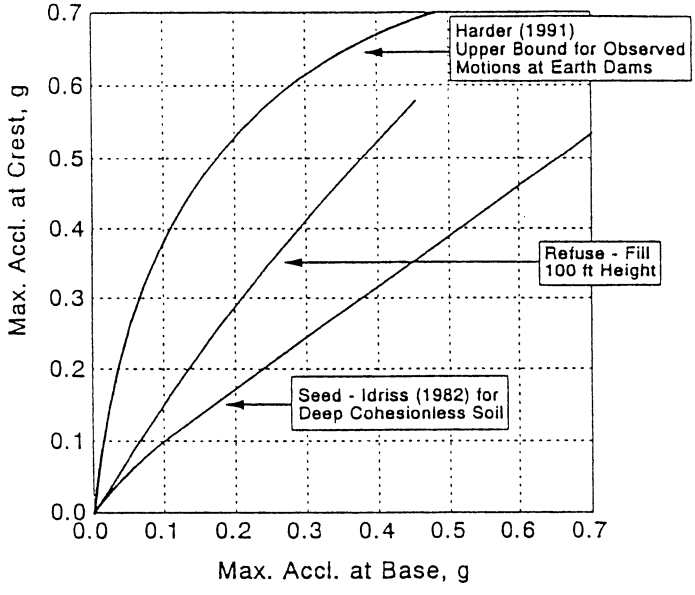

Fig. 3 Approximate Relationships Between Maximum Accelerations at the Base and Crest

Fig. 3 shows the comparison of Harder's proposed relationship with the 700 fps curve shown in Fig. 2. Also shown on Fig. 3 is the correlation proposed by Seed and Idriss [14] for deep cohesionless sites. It can be seen that all three curves are reasonably similar. It is the authors' opinion that on a preliminary basis the upper bound for the response of the MSWL should be between the Harder curve and the authors' 100 ft. curve in Fig. 3.

It should be pointed out that if one compares Figs. 1 and 2, it could easily be seen that the acceleration for 100 ft. landfill is much higher than the 200 ft. high landfill. However, one important aspect that these two charts do not show is the effect of straining. The reason that lower acceleration is anticipated for 200 ft. high landfill is that much of the motion is anticipated to be damped out before the motions can reach to the top with the accompanying strain. Thus the strain developed in the 200 ft. landfill is higher than the 100 ft. landfill.

Frequency dependence aspects of the response is also very important. It is now well known that the maximum response depends primarily on the fundamental period of

the landfill and the frequency characteristics of the base motions, and typically high acceleration levels are associated with higher frequency motions. On the basis of several analyses made by the authors using SHAKE program and the Singh and Murphy [15] modules degradation and damping curves; and more recently analyses made by Hushmand Associates [5] and Stewart et al. [16], it appears that a MSWL with height over 200 ft. will have fundamental periods on the order of one second or more. Accordingly, it is likely that as the fill height increases, the high frequency high motion will be attenuated. This trend is evident from Figs. 1 and 2. It may be noted that on the basis of the evaluation of the recorded data at the base and the top of the OII Landfill in Monterey Park, in the Los Angeles area, during the Northridge earthquake, Stewart et al. [16] pointed out that "there was attenuation in the high frequency range, but at periods beyond approximately 0.6 seconds, there was amplification of the motions from the base to the top." The OII Landfill is located 48 km from the epicenter. Accordingly, if significant energy from a seismic shaking at an MSWL site is dominant in relatively low frequency, an amplification can be expected. In this context it appears that for a given peak acceleration at the base, the distinction between a near field and a far field seismic event is a significant consideration in evaluating the response of MSWL.

LANDFILL PERFORMANCE DURING RECENT EARTHQUAKES

An evaluation of the performance of solid waste landfills during the Loma Prieta Earthquake was reported by Orr and Finch, [11]. They examined ten solid waste landfills located in the area impacted by the earthquake. The landfill sites accelerations ranged from 0.10 to 0.45g. However, none of these landfills were equipped with liners, nor were any one of them instrumented. According to Orr and Finch [11], "The limited surface damage, given the peak horizontal accelerations estimated for the 10 solid waste landfills, suggests that the properties of the solid waste may tend to dampen or attenuate the effects of earthquakes." It also suggests that landfills behave more elastically than what we normally conceive and that damping may also play a significant role in the seismic response of MSWL. It is important to note, however, that the Buena Vista Landfill suffered minor slope cracking and minor cracking to a buried landfill gas header line. The two-foot gunit-lined drainage ditch at the Newby Island site was also damaged.

The solid waste landfills located in the Los Angeles area that were shaken during the Northridge earthquake have performed much better than expected (Kavanzanjian,[6] and Stewart et al., [16]. Compared to the very high levels of accelerations, the damage was relatively insignificant. Unfortunately, because of the lack of instrumentation, recorded data on the seismic response is available only for one landfill, the OII fill. Preliminary information, however, indicates that the MSWL has inherently moderate to strong energy absorption characteristics; especially for the high frequency motions. The existence of interlocking, large-strain capacity and the light-weight, appear to contribute to this response.

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CONCLUSIONS

On the basis of the studies reported in this paper, the following conclusions may be drawn:

1. The height and stiffness (or shear wave velocity) of the refuse material in a MSWL are the significant factors which influence the basic vibrating characteristics of the landfills.
2. Results of seismic response analyses (for different levels of base motion) indicate a strong influence by a moderate increase in dynamic strength (stiffness) properties of refuse on the seismic response of MSWL.
3. Preliminary evaluation of landfill response which includes the influence of height and stiffness of refuse can be made from figures 1 and 2.

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Miragrid® Geogrids
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Miragrid® 5XT

TenCate develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

The Difference Miragrid® Geogrids Make:

- High long-term design strengths (LTDS). Miragrid® geogrids have more than 100,000 hours of tension creep testing performed at an independent test laboratory. Credible, dependable long term strength assured.
- Cost effective. Creep resistant polyester fibers provide higher allowable tensile strength, minimizing the required number of geogrid layers. Wide rolls significantly reducing placement time, lowering cost.
- Light weight, easy to handle. No sharp edges.
- Flexible, tough. Minimizes movement of soil structure.
- Custom fabrication. Rolls fabricated to meet your specific project requirements.
- Miragrid® geogrids provide the widest strength range, and are the highest strength geogrid material in the market today.

APPLICATIONS

Miragrid® geogrids can be used in most MSE applications for soil reinforcement including internally reinforced soil walls, segmental retaining wall reinforcement, steep reinforced slopes, and reinforcement in a variety of landfill applications including potential voids bridging and veneer stability. When a project specifies for long-term design strength for structure stability use Miragrid® geogrids.

INSTALLATION GUIDELINES

Before placing Miragrid® geogrids, the surface should be cleared of all debris and the foundation base proofrolled. The grids should be rolled out, cut to length, thus eliminating field connections and laid at the proper elevation, location and orientation. Since geogrids vary in strength with roll direction, Miragrid® geogrids should be laid in the direction of main reinforcement.

After rolling out, the geogrid should be tensioned by hand until it is taut, free of wrinkles, and lying flat. Adjacent geogrid rolls may be butted together side-by-side without overlap. Splices in the main reinforcement direction should be avoided.

Certain fill placement procedures may require the reinforcement to be held in place by stakes, sandbags, or fills, as directed by an engineer. A razor blade, sharp knife or scissors may be used to cut the geogrid. Fill placement should follow the standard practice, or as defined in the project specifications or directed by the Engineer. Care should be taken to prevent wrinkles and/or slippage of reinforcement during fill placement and spreading.

These guidelines serve as a general basis for installation. Detailed instructions are available from your TenCate representative.

TENCATE
Mirafi®

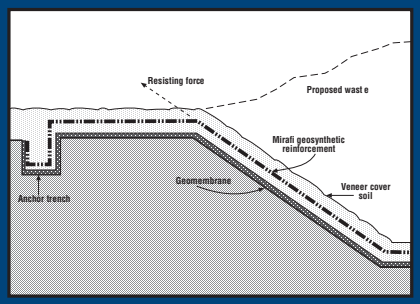
Miragrid® Geogrids
for Soil Reinforcement

Property	Test Method	Units	2XT[4]	3XT	5XT	7XT	8XT	10XT	20XT	22XT	24XT
Polymer (coating)	–	–	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)	PET (PVC)
Tensile Strength @ Ultimate (MARV)[1]	ASTM D6637 (Method B)	lbs/ft (kN/m)	2000 (29.0)	3500 (51.1)	4700 (68.6)	5900 (86.1)	7400 (108.0)	9500 (138.6)	13705 (200.0)	20559 (300.0)	27415 (400.0)
Creep Reduced Strength[2]	ASTM D5262/ D6992	lbs/ft (kN/m)	1379 (20.0)	2414 (35.2)	3241 (47.3)	4069 (59.4)	5103 (74.5)	6552 (95.6)	9452 (137.9)	14179 (206.9)	18907 (275.9)
Long Term Design Strength[3]		lbs/ft (kN/m)	1142 (17.0)	1999 (29.2)	2684 (39.2)	3370 (49.2)	3927 (57.3)	5042 (73.6)	7540 (110.0)	11311 (165.0)	15083 (220.1)

Packaging	Units	2XT[5]	3XT[5]	5XT[5]	7XT[5]	8XT[5]	10XT[5]	20XT[5]	22XT[5]	24XT[5]
Roll Width	ft (m)	4 6 12 (1.2) (1.8) (3.6)	6 12 (1.8) (3.6)	6 12 (1.8) (3.6)	6 12 (1.8) (3.6)	6 12 (1.8) (3.6)	12 (3.6)	12 (3.6)	12 (3.6)	12 (3.6)
Roll Length	ft (m)	50 150 1000 (15) (46) (305)	150 300 1000 (46) (91) (305)	150 300 1000 (46) (91) (305)	200 300 1000 (61) (91) (305)	200 300 1000 (61) (91) (305)	200 1000 (61) (305)	200 1000 (61) (305)	200 (61)	200 1000 (61) (305)
Estimate Roll Weight	lbs (kg)	25 50 109 (11) (23) (49)	115 115 670 (52) (52) (304)	135 135 831 (61) (61) (376)	130 179 846 (58) (81) (383)	140 205 975 (64 (93) (442)	255 1235 (116) (559)	360 1725 (163) (781)	470 (213)	595 2840 (270) (1287)
Area	yd^2 (m^2)	22 100 109 (18) (84) (167)	200 200 1333 (167) (167) (1114)	200 200 1333 (167) (167) (1114)	200 267 1333 (168) (220) (1114)	200 267 1333 (168) (220) (1114)	267 1333 (220) (1114)	267 1333 (220) (1114)	267 (220)	267 1333 (220) (1114)

[1]Minimum Average Roll Values (MARV) shown above are based on QC Testing per a defined lot not to exceed 12 months. Testing Frequency follows ASTM D4354, Table 1.
[2]75-year design life based on NTPEP Report REGEO-2011-01-001 and REGEO-2015-01-002.
[3]Long Term Design Strength for Type 3 Backfill (Sifty Sand), 6-inch lift / 25,000-lb roller.
[4]Note: Values shown for Miragrid 2XT® are both machine and cross-machine direction. Values for other Mirafi® products are machine direction only.
[5]Available in various roll widths and roll lengths.

Miragrid® Geogrids Typical Applications



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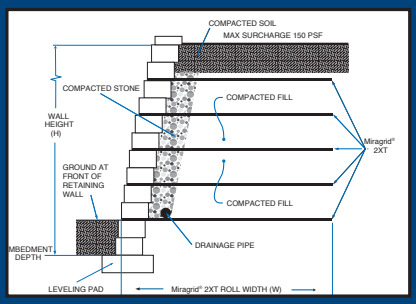

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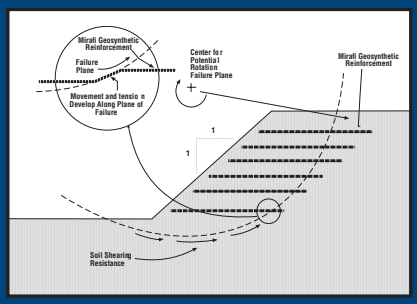

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