III-S1
III-S2
GP-2R
GP-10R
III-S3
MW-2
Proposed
PH III-A
Phase III LCRS
Vertical Riser
Interim Cover Grades
III-S3
Closed
Landfill
Phase I & II
III-S4
III-S4
GP-1R
Proposed
PH III-B
Manhole 4
Leachate Sump
III-S5
Kalialinui Gulch
III-S5
MW-3
GP-8
III-S1
III-S2

Legend

- Existing Grades as of 5/13/18
- Approximate Property Line
- Phase III-A Interim Grades
- Phase III-B Protective Soil Grades
- Prepared Phase II Grades
- Phase III Limits of Refuse Fill
- GP-6R — Relocated Landfill Gas Probe
- MW-3 — Existing Groundwater Monitoring Well

GRAPHIC SCALE 1"=60'

0 60 120 180

A-Mehr, Inc.

Central Maui Landfill

Phase III And Related Improvements

Phase 1 Fill Plan - Interim Fill Grades Phase III-A & Protective Soil Grades Phase III-B

FILENAME	Phase II
DRAWN	RM
CHECKED	
DATE	1/17/19
SHEET	14

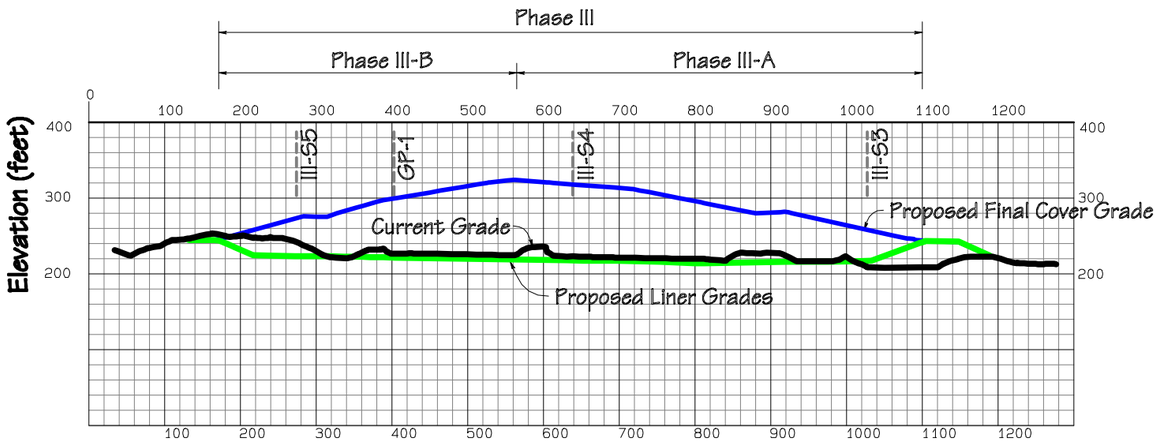
GRAPHIC SCALE 1"=60'
0 60 120 180

III-S1
III-S2
III-S3
III-S4
III-S5
GP-1R
GP-2R
GP-8
GP-10R
MW-2
MW-3
Proposed Phase III Perimeter Access / Drainage Road
Phase III LCRS Vertical Riser
Manhole 4 Leachate Sump
Closed Landfill Phase I & II
Kailalinui Gulch

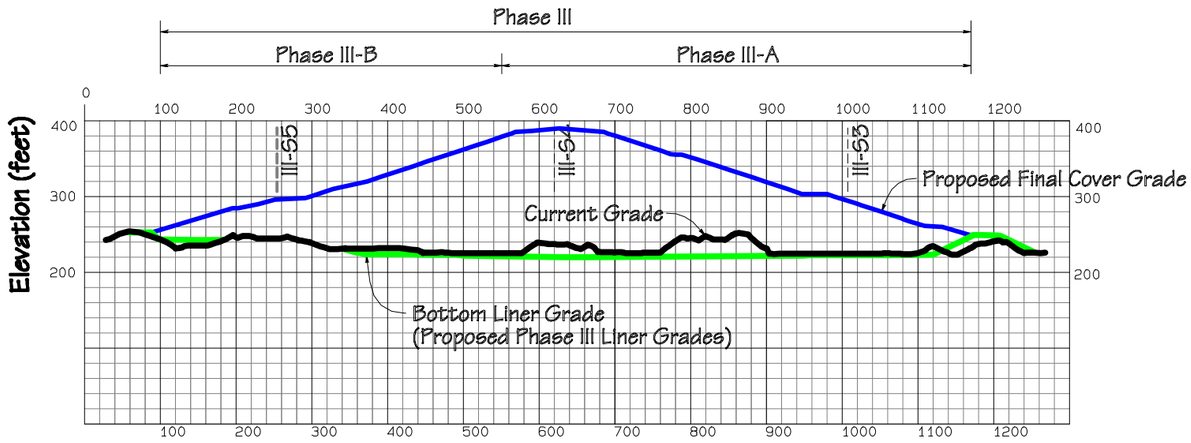
Legend:
- Existing Grades as of 5/13/18
- Proposed Phase III Liner Grades
- Approximate Landfill Phase Limits
- Phase III Final Grades
- Phase III Limits of Refuse Fill
- Proposed Grades
- Approximate Property Line
- GP-6R Relocated Landfill Gas Probe
- MW-3 Existing Groundwater Monitoring Well

A-Mehr, Inc.
Central Maui Landfill
Phase III And Related Improvements
Phase III Refuse Final Grades

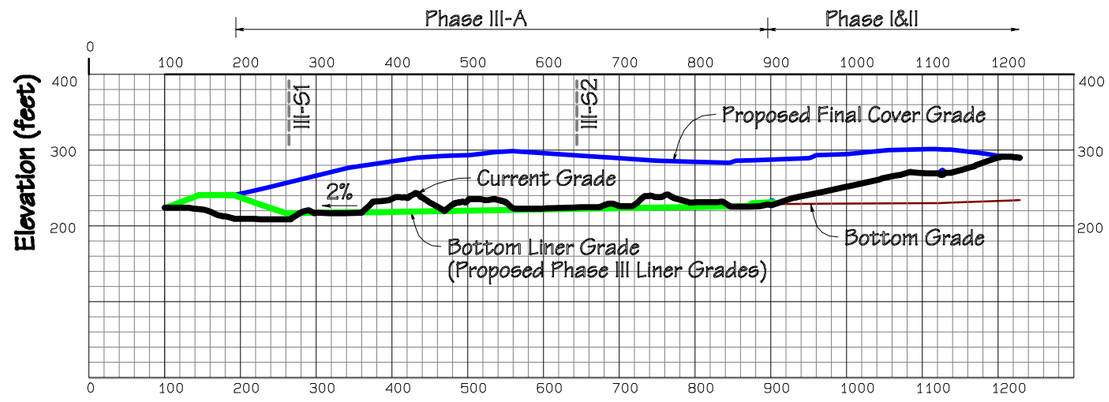
FILENAME Phase III
DRAWN RM
CHECKED
DATE 1/17/19
SHEET 15



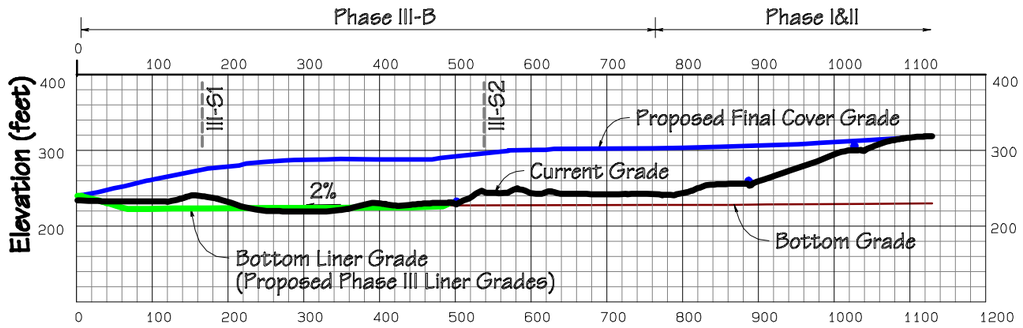
Cross-Section III-S1



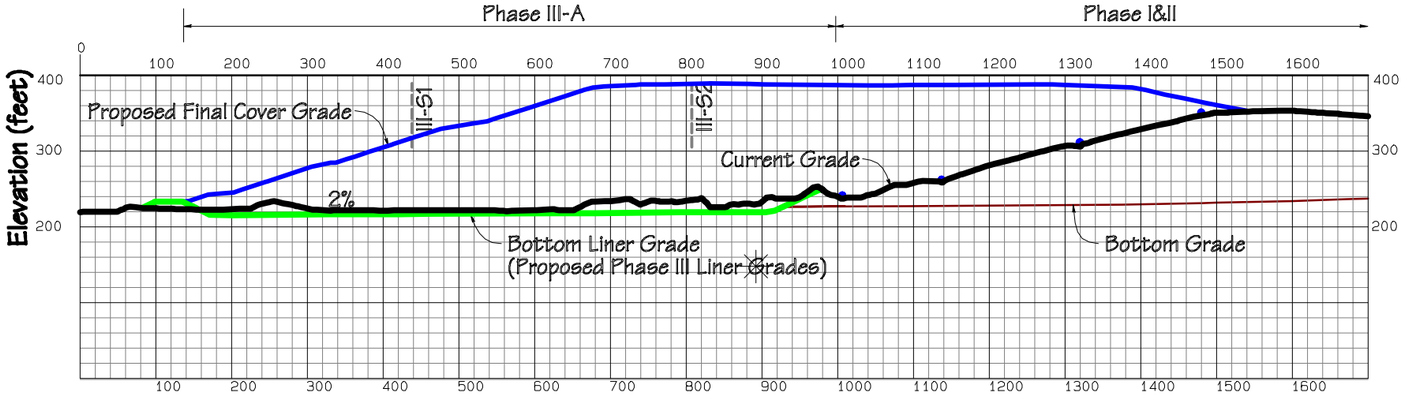
Cross-Section III-S2



Cross-Section III-S3



Cross-Section III-S5



Cross-Section III-S4

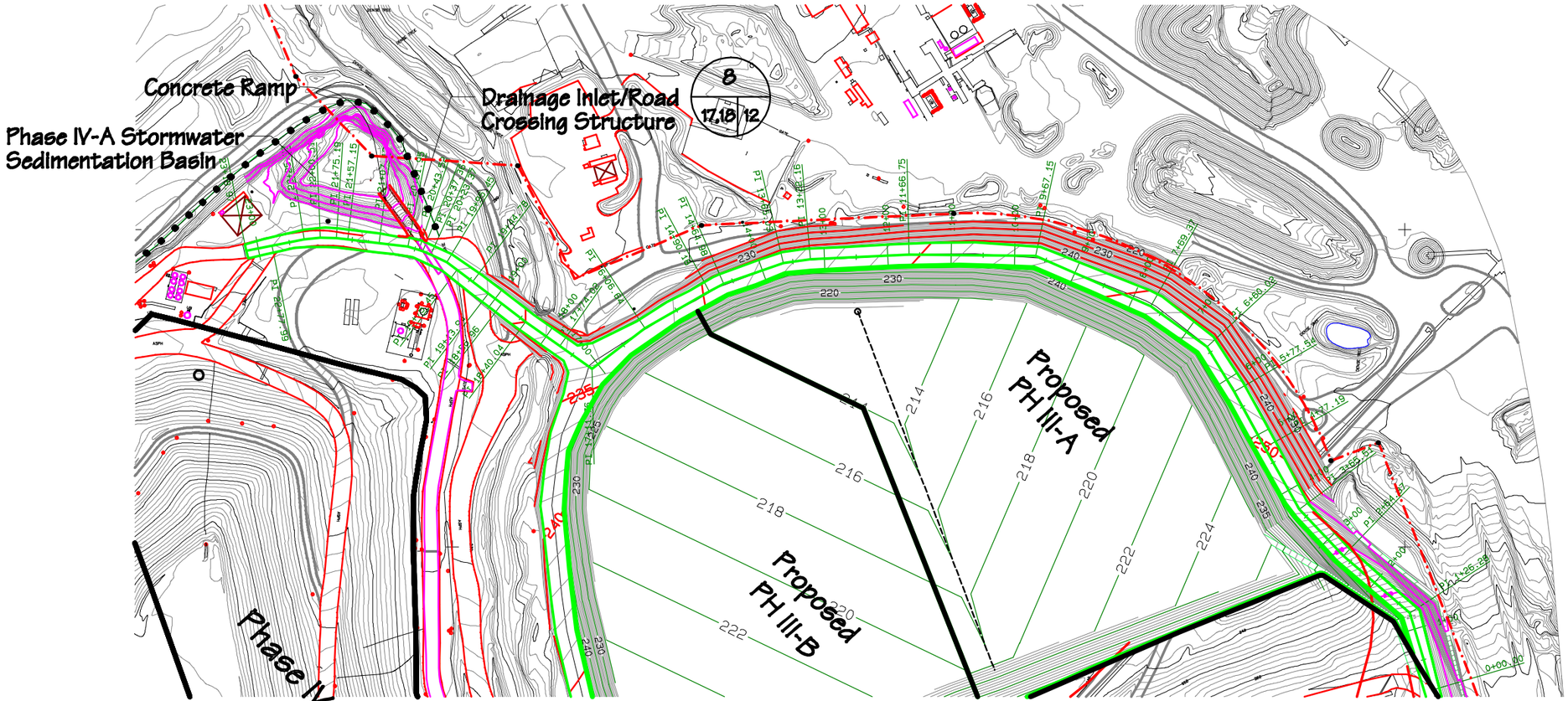
A-Mehr, Inc.

Central Maui Landfill (CML)

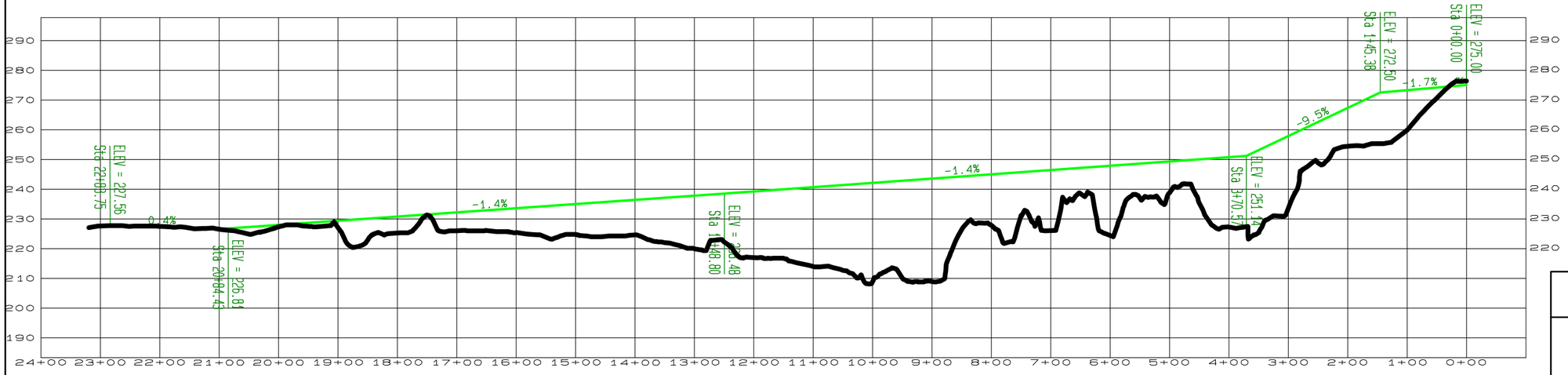
Phase III And Related Improvements

Cross Sections III-S1, III-S2, III-S3, III-S4 and III-S5

FILENAME	Master plan 2016
DRAWN	RM
CHECKED	EEV
DATE	5/9/16
FIGURE	16



Phase III-A Road Profile Plan



Phase III-A Road Profile

A-Mehr, Inc.

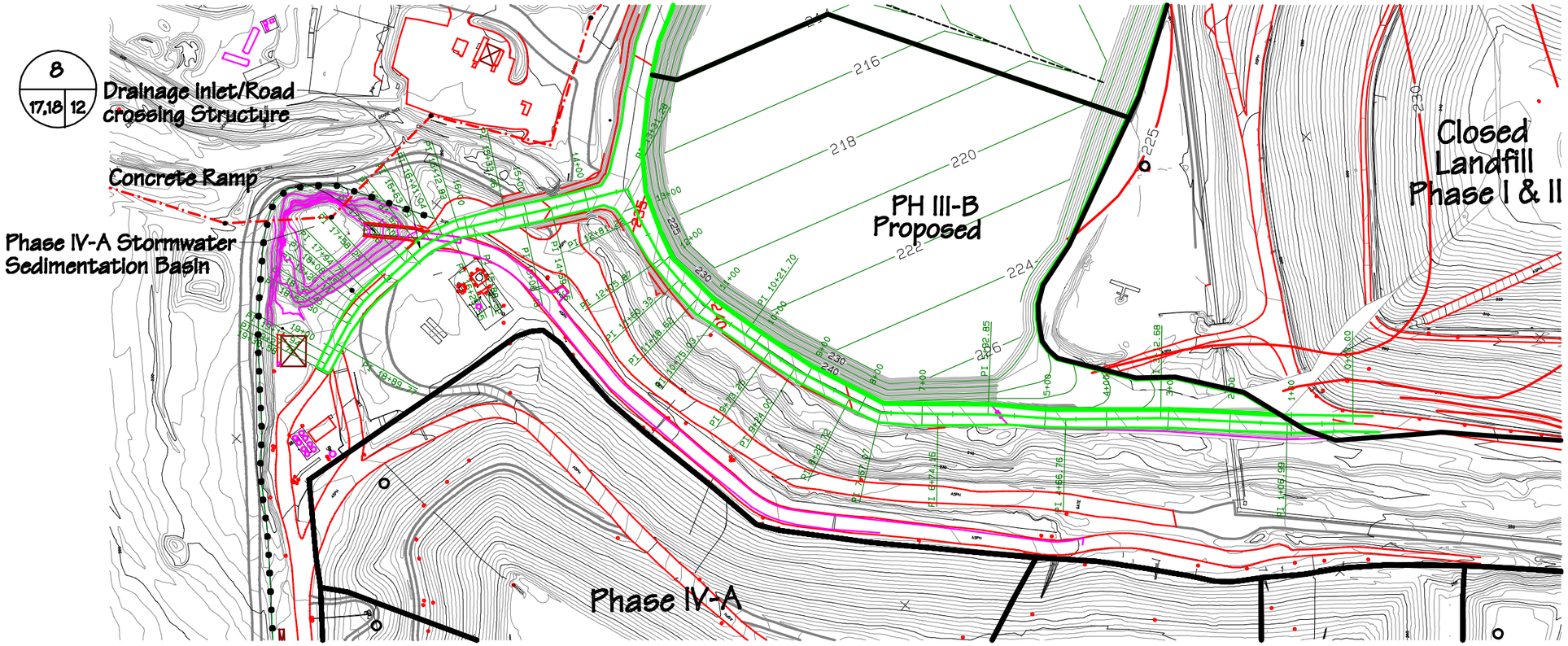
Central Maui Landfill

Phase III And Related Improvements

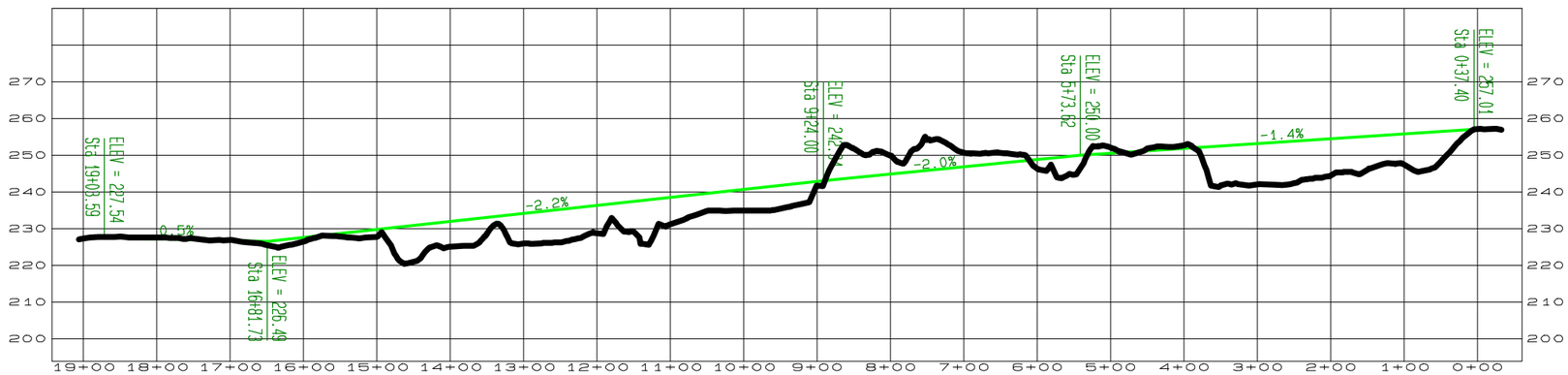
Phase III-A Perimeter Drainage/Access Road Plan and Profile

Existing Topography Grades as of 5/13/18

FILENAME	Phase III
DRAWN	RM
CHECKED	
DATE	1/17/19
SHEET	17



Phase III-B Road Profile Plan



Phase III-B Road Profile

A-Mehr, Inc.

Central Maui Landfill

Phase III And Related Improvements

Phase III-B Perimeter Drainage/Access Road Plan and Profile

Existing Topography Grades as of 5/15/18

FILENAME	Phase III
DRAWN	RM
CHECKED	
DATE	1/17/19
SHEET	18

APPENDIX B

TECHNICAL SPECIFICATIONS AND CONSTRUCTION QUALITY ASSURANCE PLAN

TECHNICAL SPECIFICATIONS
& CONSTRUCTION QUALITY ASSURANCE PLAN

FOR

CENTRAL MAUI LANDFILL
PHASE III DISPOSAL CELL
AND RELATED IMPROVEMENTS

Prepared for

COUNTY OF MAUI
Department of Environmental Management
Solid Waste Division
1 Main Plaza
2200 Main Street, Suite 225
Wailuku, Hawaii 96793

Prepared by

A-MEHR, INC
23016 Mill Creek Drive
Laguna Hills, CA 92653

January 2019

TECHNICAL SPECIFICATIONS & CQA PLAN
CENTRAL MAUI LANDFILL
PHASE III DISPOSAL CELL AND RELATED IMPROVEMENTS

TABLE OF CONTENTS

SECTION 1010
TERMS, ABBREVIATIONS, AND DEFINITIONS

1010.01 Meaning of Terms.

The specifications are generally written in the imperative mood. In sentences using the imperative mood, the subject, "the Contractor shall", is implied. In the material specifications, the subject may also be the supplier, fabricator, or manufacturer supplying material, products, or equipment for use on the project. The word "will" generally pertains to decisions or actions of the County.

When a publication is specified, it refers to the most recent date of issue, including interim publications, before the bid opening date for the project, unless a specific date or year of issue is provided.

1010.02 Abbreviations.

Meanings of abbreviations used in the specifications, on the plans, or in other contract documents are as follows:

AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disability Act
ADAAG	Americans with Disability Act Accessibility Guidelines
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APA	American Plywood Association
ARA	American Railway Association

AREA	American Railway Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWPA	American Wood Preserver's Association
AWWA	American Water Works Association
BMP	Best Management Practice
AWS	American Welding Society
CCO	Contract Change Order
CFR	Code of Federal Regulations
CRSI	Concrete Reinforcing Steel Institute
DCAB	Disability and Communication Access Board
DOA	Department of Agriculture
DOTAX	State Department of Taxation
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration, U.S. Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration
HAR	Hawaii Administrative Rules
HDOT	Hawaii Department of Transportation
HIOSH	Hawaii Occupational Safety and Health

HRS	Hawaii Revised Statutes
ICEA	Insulated Cable Engineers Association (formerly IPCEA)
IMSA	International Municipal Signal Association
IRS	Internal Revenue Service
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways, FHWA, U.S. Department of Transportation
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Forest Products Association
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration/Act, U.S. Department of Labor
SAE	Society of Automotive Engineers
SI	International Systems of Units
UFAS	Uniform Federal Accessibility Standards
UL	Underwriter's Laboratory
USGS	U.S. Geological Survey
VECP	Value Engineering Cost Proposal

1010.03 Definitions.

Whenever the following words or terms are used in the contract documents, unless otherwise prescribed therein and without regards to the use or omission of uppercase letters, the intent and meaning shall be interpreted as follows:

Addendum (plural - Addenda) - A written or graphic document, including drawings and specifications, issued by the Director during the bidding period. This document modifies or interprets the bidding documents, by additions, deletions, clarifications or corrections which shall be considered and made a part of the bid proposal and the contract.

Addition (to the contract sum) **-** Amount added to the contract sum by change order.

Advertisement- A public announcement inviting bids for work to be performed or materials to be furnished.

Amendment - A written document issued to amend the existing contract between the County and Contractor and properly executed by the Contractor and Director.

Award - Written notification to the bidder that the bidder has been awarded a contract.

Bad Weather Day (or Unworkable Day)- A calendar day when weather or other conditions prevent a minimum of four hours of work with the Contractor's normal work force on controlling items of work at the site.

Bag – 94 pounds of cement.

Barrel – 376 pounds of cement.

Base Course - The layer or layers of specified material or selected material of a designed thickness placed on a subbase or subgrade to support a surface course.

Basement Material - The material in excavation or embankments underlying the lowest layer of subbase, base, pavement, surfacing or other specified layer.

Bid - See Proposal

Bidder - An individual, partnership, corporation, joint venture or other legal entity submitting, directly or through a duly authorized representative or agent, a proposal for the work contemplated.

Bidding Documents (or Solicitation Documents) - The published solicitation notice, bid requirements, bid forms and the proposed contract documents including all addenda and clarifications issued prior to receipt of the bid.

Bid Security - The security furnished by the bidder from which the County may recover its damages in the event the bidder breaches its promise to enter into a contract with the County, and fails to execute the required bonds covering the work contemplated, if its proposal is accepted.

Blue Book – "Rental Rate Blue Book for Construction Equipment" published by Equipment Watch, a Premedia Business Directories and Book Group.

Calendar Day – See Day.

Change Order (or Contract Change Order) - A written order signed by the Engineer issued with or without the consent of the Contractor directing changes in the work, contract time or contract price. The purposes of a change order include, but is not limited to (i) establishing a price or time adjustment for changes in the work; (ii) establishing full payment for direct, indirect, and consequential costs, including costs of delay; (iii) establishing price adjustment or time adjustment for work covered and affected by one or more field orders; or (iv) settling Contractor's claims for direct, indirect, and consequential costs, or for additional contract time, in whole or in part.

Completion - See Substantial Completion and Final Completion.

Completion Date - The date specified by the contract for the completion of all work on the project or of a designated portion of the project.

Contract - The written agreement between the Contractor and the County, by which the Contractor shall provide all labor, equipment, and materials and perform the specified work within the contract time stipulated, and by which the County of Maui is obligated to compensate the Contractor at the prices set forth in the contract documents.

Contract Completion Date - The calendar day on which all work on the project, required by the contract, must be completed. See CONTRACT TIME.

Contract Documents - The contract, solicitation, addenda, notice to bidders, Contractor's bid proposal (including wage schedule, list of subcontractors and other documentation's accompanying the bid), the notice to proceed, bonds, general provisions, special provisions, specifications, drawings, all modifications, all written amendments, change orders, field orders, orders for minor changes in the work, Engineer's written interpretations, and clarifications issued on or after the effective date of the contract.

Contract Item (Pay Item) - A specific unit of work for which there is a price in the contract.

Contract Modification(Modification) - A change order that is mutually agreed to and signed by the parties to the contract.

Contract Price - The amount designated on the face of the contract for the performance of work.

Contract Time(or Contract Duration) - The number of calendar or working days provided for completion of the contract, inclusive of authorized time extensions. The number of days shall begin running on the effective date in the notice to proceed. If in lieu of providing a number of calendar or working days, the contract requires completion by a certain date, the work shall be completed by that date.

Contracting Officer – See Engineer.

Contractor– Any individual, partnership, firm, corporation, joint venture, or other legal entity undertaking the execution of the work under the terms of the contract with the County.

County - County of Maui, its Departments and agencies, acting through its authorized representative(s).

Critical Path – Longest logical sequence of activities that must be completed on schedule for the entire project to be completed on schedule.

Day- Any day shown on the calendar, beginning at midnight and ending at midnight the following day. If no designation of calendar or working day is made, "day" shall mean calendar day.

Department - Department of Finance, Department of Environmental Management, or the County of Maui, whichever is applicable**.**

Director - When used in context as Officer-In-Charge, Director shall mean the Director of the Department of Environmental Management, acting through its duly authorized representative.

Drawings - The contract drawings in graphic or pictorial form including the notes, tables and other notations thereon indicating the design, location, character, dimensions and details of the work.

Engineer - When used in context as Contracting Officer, Engineer shall mean the Director of Finance of the County of Maui, acting directly or through its duly authorized representative. When used in context as Officer-In-Charge, Engineer shall mean the Director of the Department of Environmental Management of the County of Maui, acting through its duly authorized representative.

Equipment - All machinery, tools, and apparatus needed to complete the contract.

Field Order - A written order issued by the Engineer or the Engineer's authorized representative to the Contractor requiring a change or changes to the contract work. A field order may (1) establish a price adjustment or time adjustment; or (2) may declare that no adjustment will be made to contract price or contract time; or

(3) may request the Contractor to submit a proposal for an adjustment to the contract price or contract time.

Final Completion - The date set by the Director that all work required by the contract has been completed in full compliance with the contract documents.

Float – The amount of time between when an activity can start and when an activity must start, i.e., the time available to complete non-critical activities required for the performance of the work without affecting the critical path.

Hawaii Administrative Rules (HAR) - Rules adopted by the State in accordance with Chapter 91 of the Hawaii Revised Statures (HRS).

Highway, Street, or Road - A public way within a right-of-way designed, intended, and set aside for use by vehicles, bicyclists, or pedestrians.

Highways Division - The Highways Division, Department of Public Works for the maintenance of county roads work.

Holidays - The days of each year which are set apart and established as State holidays pursuant to HRS Chapter 8 as amended.

Inspector - The Engineer's authorized representative assigned to make detailed inspections of contract performance, prescribed work, and materials supplied.

Laboratory - The testing laboratory designated by the Engineer.

Laws - All Federal, State, and local laws, executive orders, and regulations having the force of law.

Leveling Course - An aggregate mixture course of variable thickness used to restore horizontal and vertical uniformity to existing pavements or shoulders.

Liquidated Damages - The amount prescribed in Subsection 1080.09 - Liquidated Damages for Failure to Complete the Work or Portions of the Work on Time, to be paid to the County or to be deducted from any payments payable to or, which may become payable to the Contractor.

Lump Sum (LS) – When used as a payment method means complete payment for the item of work described in the contract documents.

Material - Any natural or manmade substance or item specified in the contract to be incorporated in the work.

Notice to Bidders - The advertisement for proposals for all work or materials on which bids are required. Such advertisement will indicate the location of the work to be done or the character of the material to be furnished and the time and place for the opening of proposal.

Notice to Proceed - Written notice from the Engineer to the Contractor identifying the date on which work is to begin. This date shall also be the beginning of contract time.

Pavement - The uppermost layer of material placed on the traveled way or shoulders or both. Pavement and surfacing may be interchangeable.

Pavement Structure - The combination of subbase, base, pavement, surfacing or other specified layer of a roadway constructed on a subgrade to support the traffic load.

Payment Bond - The security executed by the Contractor and surety or sureties furnished to the County to guarantee payment by the Contractor to laborers, material suppliers and subcontractors in accordance with the terms of the contract.

Plans - See Drawings.

Profile Grade - The elevation or gradient of a vertical plane intersecting the top surface of the proposed pavement.

Project Acceptance Date - The calendar day on which the Engineer accepts the project as completed. See Final Completion.

Project Warranty - A warranty issued by the Contractor to the County.

Proposal (Bid) - The executed document submitted by an offerer or in response to a solicitation request, to perform the work required by the proposed contract documents, for the price quoted and within the time allotted.

Public Traffic - Vehicular or pedestrian movement on a public way.

Punchlist - A list compiled by the Engineer specifying work yet to be completed or corrected by the Contractor in order to substantially complete or finally complete the contract.

Questionnaire - The specified forms on which the bidder shall furnish required information as to its ability to perform and finance the work.

Request for Change Proposal – A written notice from the Engineer to the Contractor requesting that the Contractor provide a price and/or time proposal for contemplated changes preparatory to the issuance of a field order or change order.

Right-of-Way - Land, property, or property interests acquired by a government agency for, or devoted to transportation purposes.

Roadbed - The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

Roadside - The area between the outside edges of the shoulders and the right-of-way boundaries. Unpaved median areas between inside shoulders of divided highways and infield areas of interchanges are included.

Roadway – In general, the portion of a highway, including shoulders, for vehicular use. In construction specifications, the portion of a highway within the construction limits.

Saturated, Surface-Dry - Condition of an aggregate particle or other porous solid when the permeable voids are filled with water, but there is no water on the exposed surface.

Section and Subsection - Section or subsection shall be understood to refer to these specifications unless otherwise specified.

Shop Drawings - All drawings, diagrams**,** illustrations, schedules and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the work.

Shoulder - The portion of the roadway next to the traveled way for: accommodation of stopped vehicles, placement of underground facilities, emergency use, and lateral support of base and surface courses.

Sidewalk - That portion of the roadway primarily constructed for use by pedestrians.

Solicitation - An invitation to bid or request for proposals or any other document issued by the Department to solicit bids or offers to perform a contract. The solicitation may indicate the time and place to receive the bids or offers and the location, nature and character of the work, construction or materials to be provided.

Specifications - Compilation of provisions and requirements to perform prescribed work.

(A) Standard Specifications.
Specifications by the County intended for general application and repetitive use.

(B) Special Provisions.
Revisions and additions to the standard specifications applicable to an individual project.

Standard Details - Drawings provided by the State or County for specific items of work approved for repetitive use.

State - The State of Hawaii or County of Maui, its Departments and agencies, acting through its authorized representative(s), whichever is applicable.

State Waters – All waters, fresh, brackish, or salt, around and within the State, including but not limited to, coastal waters, streams, rivers, drainage ditches, ponds, reservoirs, canals, ground waters, and lakes; provided that drainage ditches, ponds, and reservoirs required as a part of a water pollution control system are excluded.

Structures - Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, sewers, service pipes, underdrains, foundation drains, and other such features that may be encountered in the work.

Subbase - A layer of specified material of specified thickness between the subgrade and a base.

Subcontract - Any written agreement between the Contractor and its subcontractors, which contains the conditions under which the subcontractor is to perform a portion of the work for the Contractor.

Subcontractor. An individual, partnership, firm, corporation, or joint venture or other legal entity as covered in Chapter 444, Hawaii Revised Statutes, which enters into an agreement with the Contractor to perform a portion of the Work**.**

Subgrade - The top surface of completed earthwork on which subbase, base, surfacing, pavement, or a course of other material is to be placed.

Substantial Completion - The status of the project when the Contractor has completed the work except for plant establishment and;

(1) All utilities and services are connected and working,

(2) All equipment is in acceptable working condition,

(3) Additional activity by the Contractor to correct punchlist items will not prevent or disrupt use of the work or the facility in which the work is located, and

(4) The building, structure, improvement or facility can be used for its intended purpose.

For bridge and highway work, substantial completion is the point at which all bridge deck, parapet, pavement structure, shoulder, permanent traffic signals, signs, and markings, traffic barrier, highway lighting and safety appurtenance work is complete.

Superintendent - The employee of the Contractor who is responsible for all the work and is a Contractor's agent for communications to and from the County.

Surety - The qualified individual, firm, or corporation, other than the Contractor, which executes a bond with and for the Contractor to insure its acceptable performance of the contract.

Surfacing - The uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with pavement.

Traveled Way - The portion of the roadway for the movement of vehicles, exclusive of shoulders.

Unsuitable Material - Materials that contain organic matter, muck, humus, peat, sticks, debris, chemicals, toxic matter, or other deleterious materials not suitable for use in earthwork.

Utility - A line, facility, or system for producing, transmitting, or distributing communications, power, electricity, heat, gas, oil, water, steam, waste, or storm water.

Utility Owner – The entity, whether private or owned by a State, Federal, or County governmental body, that has the power and responsibility to grant approval for or undertake construction work involving a particular utility.

Water Pollutant - Dredged spoil, solid refuse, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical waste, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, sediment, cellar dirt and industrial, municipal, and agricultural waste.

Warranty - Contractor warrants the work for one year after completion.

Water Pollution - (1) Such contamination or other alteration of the physical, chemical, or biological properties of any state waters, including change in temperature, taste, color, turbidity, or odor of the waters, or **(2)** Such discharge of any liquid, gaseous, solid, radioactive, or other substances into any state waters, as will or is likely to create a nuisance or render such waters unreasonably harmful, detrimental, or injurious to public health, safety, or welfare, including harm, detriment, or injury to public water supplies, fish and aquatic life and wildlife, recreational purposes and agricultural and industrial research and scientific uses of such waters or as will or

is likely to violate any water quality standards, effluent standards, treatment and pretreatment standards, or standards of performance for new sources adopted by the Department of Health.

Work - The furnishing of all labor, materials, equipment, and other incidentals necessary or convenient for the successful execution of all the duties and obligations imposed by the contract.

Working Day - A calendar day in which a Contractor is capable of working four or more hours with its normal work force, exclusive of:

(1) Saturdays, Sundays, and recognized legal State holidays and such other days specified by the Contract documents as non-working days,

(2) Days in which the Engineer suspends work for four or more hours through no fault of the Contractor.

*****END OF SECTION 1010*****

SECTION 1020
BIDDING REQUIREMENTS AND CONDITIONS

1020.01 Prequalification of Bidders.

Contractor is directed to SECTION 2.04 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION

1020.02 Contents of Proposal Forms.

The Department will furnish prospective bidders with proposal forms stating:

(1) The location,
(2) Description of the proposed work,
(3) The approximate quantities,
(4) Items of work to be done or materials to be furnished,
(5) A schedule of items, and
(6) The time in which the work shall be completed.

Papers bound with or attached to the proposal form are part of the proposal. The bidder shall not detach or alter the papers bound with or attached to the proposal form when the bidder submits the proposal.

Also, the bidder shall consider other documents including the plans and specifications a part of the proposal form whether attached or not.

1020.03 Estimated Quantities.

Contractor is directed to SECTION 10 AND SECTION 11 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.04 Examination of Bid Documents and Site of Work.

Contractor is directed to SECTIONS 2.07, 2.08 AND SECTION 12 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.05 Preparation of Proposal.

Contractor is directed to SECTION 2.05 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.06 Irregular Proposals.

Contractor is directed to SECTION 2.13 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.07 Proposal Guaranty.

Contractor is directed to SECTION 2.14 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.08 Delivery of Proposal.

The Bidder shall submit, to the office designated in the Notice to Bidders, the proposal in a sealed envelope, bearing on the outside the identity of the project and its name and address. The Department will reject and return a proposal unopened if received after the time set for the opening of bids.

1020.09 Withdrawal or Revision of Proposals.

Contractor is directed to SECTION 2.17 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.10 Public Opening of Proposals.

Contractor is directed to SECTION 2.18 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.11 Disqualification of Bidders.

Contractor is directed to SECTION 2.13 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.12 Substitution of Materials and Equipment Before Bid Opening.

Contractor is directed to SECTION 2.16 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.13 Preferences.

TheHawaiiproductpreferencepursuanttoAct175,SLH2009 maybe applicableto this project.
PersonswishingtocertifyandqualifyaproductnotcurrentlylistedasaHawaiiProductshallsubmit a Certification for Hawaii Product Preference (FormSPO-38) to the County.

1020.14 Certification for Safety and Health Program for Bids in excess of $100,000.

According to Section 396-18 of the Hawaii Revised Statutes, the bidder or offeror, by signing and submitting the proposal, certifies that a written safety and health plan for this project will be available and implemented during the project. Details of the requirements of this plan may be obtained from the State Department of Labor and Industrial Relations, Occupational Safety and Health Division (HIOSH).

1020.15 Addenda.

Contractor is directed to SECTION 2.11 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.16 Pre-Bid Conference.

Contractor is directed to SECTION 2.09 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.17 Contractor's License.

Contractor is directed to SECTION 2.03 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.18 Clarification.

Contractor is directed to SECTION 2.10 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1020.19 Determination of Intended Bid.

Contractor is directed to SECTION 2.12 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

*****END OF SECTION 1020*****

SECTION 1030
AWARD AND EXECUTION OF CONTRACT

1030.01 Consideration of Proposals.

The Department will compare the proposals in terms of the summation of the products of the approximate quantities and the unit bid prices after the Contracts Officer opens and reads the proposals. The Department will make the results immediately available to the public. If a discrepancy occurs between the unit bid price and the bid price, the unit bid price shall govern.

The Department reserves the right to reject proposals, waive technicalities or advertise for new proposals, if the rejection, waiver, or new advertisement favors the Department.

1030.02 Award of Contract.

Contractor is directed to SECTION 3 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.03 Cancellation of Award.

The Department reserves the right to cancel the award of contracts before the execution of said contract by the parties. There will be no liability to the awardee and to other bidders.

1030.04 Requirement of Performance and Payment Bonds.

Contractor is directed to SECTION 3.3 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.05 Execution of the Contract.

Contractor is directed to SECTION 3.2 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.06 Failure to Execute Contract.

Contractor is directed to SECTION 3.8 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.07 Submission of Insurance Certification.

Contractor is directed to SECTION 4.3 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.08 Contract Requirements.

Contractor is directed to SECTIONS 3.4, 3.5, 3.6 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1030.09 Performance of Contract.

Contractor is directed to SECTION 6 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

*****END OF SECTION 1030*****

SECTION 1040
SCOPE OF WORK

1040.01 Changes.

Contractor is directed to SECTION 12 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.02 Construction and Maintenance of Detours.

Contractor is directed to SECTION 6.18 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.03 Quarries and Pits.

Contractor is responsible for hauling quarried materials from approved sites to project area.

1040.04 Method of Price Adjustment.

Contractor is directed to SECTION 11 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.05 Variations in Estimated Quantities.

Contractor is directed to SECTION 10 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.06 Differing Site Conditions.

Contractor is directed to SECTION 12 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.07 Contract Change Orders.

Contractor is directed to SECTION 8 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1040.08 Oversized Vehicle Control.

Contractor is directed to refer to the Hawaii Department of Transportation for information on obtaining permits for hauling.

1040.09 Use of Explosives.

The use of explosives will not be permitted.

*****END OF SECTION 1040*****

SECTION 1050
CONTROL OF WORK

1050.01 Authority.

Contractor is directed to SECTION 6 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.02 Shop Drawings.

Contractor is directed to SECTION 6.21 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.03 Review and Acceptance Process.

The Engineer will complete the review of the submittal within 15 days from the date of receipt unless a different review time is established by the contract documents. The Engineer will advise the Contractor, in writing, as to the acceptability of the submittal. Should the Engineer partially or totally reject the submittal, the Contractor shall modify the submittal as required by the Engineer and resubmit the item within 15 days. At this time, the review and acceptance cycle described above shall begin again. The review and acceptance cycle shall begin again as described above each time the submittal is returned to the Contractor for modification. If the volume of the shop drawings submitted at any time for review is unusually large, the Contractor shall inform the Engineer of its preferred order for reviews, and the Engineer will use reasonable efforts to accommodate the Contractor's priority.

The acceptance by the Engineer of the Contractor's submittal relates only to their sufficiency and compliance with the intention of the contract. Acceptance by the Engineer of the Contractor's submittal does not relieve the Contractor of any responsibility for accuracy of dimensions, details, and proper fit, and for agreement and conformity of submittal with the contract drawings and specifications. Nor will the Engineer's acceptance relieve the Contractor of responsibility for variance from the contract documents unless the Contractor, at the time of submittal, has provided notice and identification of such variances required by this section. Acceptance of a variance shall not justify a contract price or time adjustment unless the contractor requests such adjustment at the time of submittal and the adjustment is explicitly agreed to in writing by the Engineer. Any such request shall include price details and proposed scheduling modification. Acceptance of a variance is subject to all contract terms, stipulations and covenants, and is without prejudice to any and all rights under the surety bond.

If the Engineer returns a submittal to the Contractor that has been rejected, the Contractor, so as not to delay the work, shall promptly make a resubmittal conforming to the requirements of the contract documents and indicating in writing on the transmittal and the subject submittal what portions of the resubmittal has been altered in order to meet the acceptance of the Engineer. Any other differences between the resubmittal and the prior submittal shall also be specifically described in the transmittal.

No mark or notation made by the Engineer on or accompanying the return of any submittal to the Contractor shall be considered a request or order for a change in work. If the Contractor believes any such mark or notation constitutes a request for a change in the work for which it is entitled to an adjustment in contract price and/or time, the Contractor must follow the same procedures established in Subsection 1040.01 – Changes or lose its right to claim for an adjustment.

1050.04 Priority of the Contract Documents; Drawings.

(A) Priority of the Contract Documents.

The contract documents are complimentary. Any requirement occurring in one document is as binding as though occurring in all. The Contractor shall carefully study and compare the contract documents with each other, with field conditions and with the information furnished by the County and shall at once report to the Engineer errors, conflicts, ambiguities, inconsistencies, or omissions discovered. Should an item not be sufficiently detailed or explained in the contract documents, the Contractor shall report to the Engineer immediately and request the Engineer's clarification and interpretation. The Engineer will issue a clarification or interpretation that is consistent with the intent of and reasonably inferred from the contract documents.

In the event of conflict or discrepancy that has not been brought to the attention of and resolved by the Engineer, the following priorities govern:

If a conflict or discrepancy within a document occurs, the stricter requirement governs over less strict requirement. The stricter requirement will be the requirement that provides the greater product life, durability, strength and function. The Engineer will be the sole judge as to which requirement is the stricter requirement.

Special provisions govern over project plans, standard plans, and standard specifications.

Project plans govern over standard plans.

Standard specifications govern over standard plans.

(B) Priority Within Drawings.

(1) Numerical dimensions govern over scaled dimensions, and;

(2) Larger scale drawings govern over smaller scale drawings.

Any requirement occurring in one or more of the sheets is as binding as though occurring in all applicable sheets.

1050.05 Coordination Between the Contractors.

Other work by other Contractors may be in progress within or near the project limits. Each Contractor shall conduct work so as not to hinder the progress of the work by other Contractors within or near the project limit. Contractors shall cooperate with each other, including but not limited to:

(1) Coordinating their work schedules and traffic control plans;

(2) Placing and disposing the materials used;

(3) Operating and storage of equipment.

Each Contractor shall be responsible for any damage done by it to work performed by another Contractor.

1050.06 Construction Stakes, Lines and Grades.

Contractor is directed to SECTION 6.26 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.07 Inspection of the Work and Materials.

Materials and each part or details of the work shall be subject to inspection by the Engineer. The Contractor shall furnish the Engineer information, assistance, and provide appropriate safeguards and equipment to allow a complete inspection to be made.

The Engineer may inspect the production, fabrication, and manufacture of materials and items that are to be incorporated into the work. The Contractor shall ensure that the producer, fabricator, and manufacturer provide access to the Engineer, without adjustment in contract time or price, at the source of such materials and items or at any other place such materials or items may be located before they are incorporated into the work. When government or utility companies are to pay a portion of the cost of the work covered by this contract, they shall have the right to inspect the work. Such inspection shall not make that government or utility company a party to this contract.

For any inspection, the Contractor shall expose or uncover such portions of the work as requested by the Engineer. After inspection, the Contractor shall restore that portion of the work to the standard required by the contract. When the Engineer orders an inspection that is not considered a normal daily, pre-final or final inspection, which requires uncovering, damage to or destruction of or work in place:

(1) If the exposed and inspected work conforms to the contract requirements, the County will reimburse the reasonable costs of exposing, inspecting and or restoring the work, as extra work and extend contract time as appropriate.

(2) If the exposed and inspected work is non-conforming or otherwise non-acceptable, the costs and time relating to the exposing, inspecting and restoring of the work is not reimbursable.

(3) No reimbursement will be allowed for the costs and time of exposing, inspecting and restoring work that the Engineer had not been given reasonable opportunity to inspect before it was covered.

When the contract documents or a written directive from the Engineer requires that certain work not proceed until the Engineer is given notice and the opportunity to inspect, the Engineer may order the work done or materials used without the Engineer having been given notice and opportunity to inspect, to be removed and replaced at no cost to the County and no adjustment in contract time.

The inspection of or the failure to inspect the work shall not relieve the Contractor of obligations to fulfill the contract as prescribed, to make good defective work, and to replace unsuitable or rejected materials regardless of whether payment for such work has been made.

1050.08 Removal of Defective and Unauthorized Work.

Contractor is directed to SECTION 6.30 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.09 Maintenance During Construction.

Maintain the work until the Engineer grants relief of maintenance or until completion or acceptance of the project.

The Engineer will not pay for the above maintenance work separately. The Engineer will consider the price for the above maintenance work included in the bid price of the various contract items.

1050.10 Failure to Maintain.

The Engineer will notify the Contractor of non-compliance if the Contractor fails to comply with Subsection 1050.09 - Maintenance. When failing to remedy the unsatisfactory maintenance within 24 hours after receipt of such notice, the Engineer may proceed to maintain the project. The Engineer will deduct the entire cost of such maintenance from monies due or become due to the Contractor.

1050.11 Cleaning Up.

(A) Daily Clean Up.

After each work day, clean, remove and dispose of any rubbish created as a result of its work from the project area.

(B) Final Clean Up.

Contractor is directed to SECTION 6.36 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

Do not remove warning, regulatory, or guide signs before formal acceptance by the Engineer.

1050.12 Final Acceptance.

Contractor is directed to SECTION 6.37 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.13 Disputes.

Contractor is directed to SECTION 17 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1050.14 Coordination Between the Contractor and the County.

(A) Furnishing Drawings and Special Provisions.

The County will furnish the Contractor 2 sets of the project plans and special provisions. The project plans furnished will be full size drawings. The Contractor shall have and maintain at least one set of plans and specifications on the work site, at all times.

(B) Superintendent.

The Contractor shall have a competent superintendent on the work site while work is being performed under the contract. The superintendent shall be able to read and understand the contract documents, shall be experienced in the type of project being undertaken and the work being performed, and shall be fluent in the English language. If a superintendent is not present at the work site, the Engineer shall have the right to suspend the work as described under Subsection 1080.10 – Suspension of Work.

The Contractor shall provide the Engineer a written statement giving the name of the superintendents assigned to the project. The Contractor shall be responsible for notifying the Engineer in writing of any change in the superintendents in a timely manner.

1050.15 Submittals.

The contract contains the description of various items that the Contractor must submit to the Engineer for review and acceptance. The Contractor shall review all submittals for correctness, conformance with the requirements of the contract documents and completeness before submitting them to the Engineer. The submittal shall indicate the contract items and specifications subsections for which the submittal is provided. The submittal shall be legible and clearly indicate what portion of the submittal is being submitted for review. The Contractor shall provide 2 copies of the required submissions, or 1 electronic, at the earliest possible date.

1050.16 Storage and Handling of Materials and Equipment.

(A) Contractor's Responsibility.

The Contractor as part of the contract price shall provide all storage space. Materials shall be stored and handled to preserve their quality and fitness for the work. The Contractor shall locate stored materials so as to facilitate their prompt inspection by the Engineer. No County land outside the project limits may be used without authority granted by the County agency having jurisdiction over the site. Prior to final inspection, the Contractor at no increase in contract price or contract time shall restore all storage sites within the project limits to their pre-existing or to a different condition approved by the Engineer.

(B) Designated Storage Area.

The Contractor may store materials and equipment only within the areas designated in the contract documents.

(C) No Designated Storage Area.

If no storage area is designated within the contract documents, materials and equipment may be stored anywhere approved by the Engineer,

provided such storage and access to and from such site, within the sole discretion of the Engineer, does not create a public or traffic hazard or an impediment to the movement of traffic.

1050.17 Examination of Contract Documents and Project Site.

Contractor is directed to SECTION 2.07 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

*****END OF SECTION 1050*****

SECTION 1070
LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

1070.01 Laws to be Observed; Indemnity.

Contractor is directed to SECTION 4.6 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

Indemnity:

The Contractor shall defend, protect, hold harmless, compensate, and indemnify the County, its officers and employees, against any claim or liability arising from or based on the violation of any laws, ordinances, rules and regulations, orders or decrees, or the terms and conditions of any permits and licenses, whether such orders or decrees are directed to the Contractor, its subcontractor, vendors, and suppliers or to the County.

1070.02 Wages and Hours Requirements.

Contractor is directed to SECTIONS 6.14 and 6.15 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1070.03 Worker's Compensation Act.

The Contractor shall insure workers employed under this contract from and against personal injury by accident.

1070.04 Labor Discrimination.

The Contractor is directed to Chapter 378, HRS which makes unlawful certain discriminatory practices with respect to employment.

1070.05 Contractor's Licensing Laws.

The Contractor is directed to Chapter 444, HRS.

1070.06 Permits and Licenses.

Contractor is directed to Section 1600 of this document for specific information regarding permits for this project.

1070.07 Conflicts of Interest.

Contractor is directed to SECTION 4 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1070.08 Protection of Persons and Property.

(A) Safety Precautions and Programs.

In the event the Contractor encounters on the site material reasonably believed to be asbestos or other hazardous material that has not been rendered harmless, the Contractor shall stop work in the area and notify the Engineer promptly. The work in the affected area shall be resumed in the absence of hazardous materials or when the hazard has been rendered harmless.

(B) Notification to the Engineer.

The Contractor shall notify the Engineer in writing not later than noon of the following working day whenever:

(1) Police, fire or other public safety officers are called to the work site for any reason or are present at the work site for any public safety related reason.

(2) Any person is treated or evacuated from the work site by emergency medical services personnel.

(3) Any member of the public claims to have been injured at the work site.

(4) The Contractor witnesses a member of the public being involved in an accident at the worksite, or on account of conditions related to the work, whether or not visible injuries occur.

(5) Any representative of a Federal, State, or County regulatory or enforcement agency is present at the work site including but not limited to any representative of Department of Health, EPA, or OSHA.

1070.09 Erosion, Siltation and Pollution Control.

The Contractor shall exercise caution to prevent silting and pollution of oceans, rivers, streams, lakes, and reservoirs and other bodies and conveyances of water.

The Contractor shall provide for pollution and erosion control during the work including periods of suspension of contract performance. If material begins to erode, the Contractor shall act immediately to bring the siltation, erosion, and pollution under control.

1070.10 Archaeological, Historical, and Burial Sites.

Whenever the Contractor encounters sites of potentially historic or archaeological significance such as walls, platforms, pavements and mounds, or remains such as artifacts, burials, concentration of charcoal or shells, work shall cease in the immediate vicinity of the site and the site shall be protected from damage. The Contractor shall suspend any work that may affect the site and inform the Engineer immediately. Upon direction by the Engineer, the Contractor shall provide and install temporary fencing to protect such sites. The Contractor shall not resume the work suspended without the prior written direction of and subject to the conditions set by the Engineer.

1070.11 Contractor's Responsibility for Work.

Contractor is directed to SECTION 4 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1070.12 Utilities and Services.

(A) Contractor’s Duty to Coordinate Utility Work.

Although it is not expected that utilities will be encountered during the course of the project, the Contractor shall contact and cooperate with each affected utility owner in order for the work to progress on schedule and without unreasonable disruption of such utility services. If the work calls for permanent utility service installation and/or corrections and modifications to existing utilities, the Contractor is responsible for scheduling and coordinating such work with appropriate utility owners. If the work required by the contract documents conflicts with the instructions, demands, or requirements of a utility owner, the Contractor shall notify the Engineer immediately. The Contractor shall furnish the Engineer with evidence that the Contractor has provided all relevant utility owners reasonable opportunity to review the drawings.

When the County has a separate agreement with a utility owner for work to be performed within the worksite, at the direction of the Engineer the Contractor shall make available all portions of the work and the worksite necessary for the utility owners to do their work.

The Contractor hereby holds the County harmless against all risks arising from acts or omissions of utility owners that damage the work, or create delays, disruptions, and additional cost to the Contractor in the performance of the work.

The Contractor may relocate or adjust the utility lines or service connections for its convenience with the permission of the owner of the utility and the Engineer at no cost to the County.

(B) Contractor's Duty to Locate and Protect Utility.

Before beginning any work at the worksite, the Contractor shall:

(1) Ascertain and mark the exact location and depth of all utilities within the project area including taking reasonable steps to detect the existence and location of utilities not shown on the drawing.

(2) Acquaint all personnel working near utilities with the type, size, location, and depth of the utilities, as well as the consequences that might result from disturbances.

(3) Take reasonable steps to protect the utilities and prevent service disruption.

(C) Discovery of Unknown Utility; Damage to Utility.

Upon discovery of a utility that was not shown to exist in the contract documents, or is found at a location that is substantially different than shown in the contract documents, the Contractor shall promptly notify the Engineer before the utility and its surrounding area are further disturbed. The Contractor shall be responsible for the safety and protection of the public and the utility subject to further direction from the Engineer. Whenever the Contractor damages a utility or causes any interruption to any utility service, the Contractor shall promptly notify the Engineer, the affected utility owner, and the appropriate governmental authorities. The Contractor shall cooperate with the affected utility owner, and the appropriate governmental authorities in the restoration of service. If the damage is to a known utility, the Contractor shall be responsible for all costs associated with its repair and restoration of service, at no cost to the County.

1070.13 Personal Liability of Public Officials.

The Director, Engineer, or their authorized representatives, either personally or as officials of the County, shall not be liable in carrying out the contract, or in exercising power or authority granted by or within the scope of the contract. The Director, Engineer, or their authorized representatives shall be understood to act solely as agents and representatives of the County.

1070.14 No Waiver of Legal Rights.

Upon completion of the work, the Engineer will expeditiously make final inspection and notify the Contractor of the results of the inspection. Such final acceptance shall not prevent the Engineer from correcting measurement, estimate, or certificate made before or after completion of the work nor recovering from the Contractor or its surety, or both, overpayments made by the County to damages, costs, expenses and liabilities incurred by or assessed against the County arising out of or related to, its failure to fulfill its obligations under the contract. The Contractor shall not assume or interpret the final acceptance as a waiver of rights of the County with respect to breach of contract including subsequent breach of the contract by the Contractor.

The Contractor shall be accountable for and fully compensate the Department for latent defects, fraud, constructive fraud (such gross mistakes as may amount to fraud), and breach or violation of warranty or guaranty.

1070.15 Contaminated and/or Hazardous Item and/or Material; Regulated Items and Material; Waste.

(A) Known or Suspected Contaminated and/or Hazardous Items and/or Material.

If the contract documents have noted an area of known or suspected contaminated and/or hazardous items and/or material within the project limits, in the absence of specific orders from the Engineer or directions in the contract documents, the Contractor shall report the discovery of such items and/or material to the appropriate governmental agencies, cooperate with all investigations and either remediate or remove and dispose of such contaminated and/or hazardous items and/or material as part of the contract price unless otherwise noted in the contract documents. Upon encountering any such contaminated and/or hazardous condition, the Contractor shall immediately notify the Engineer.

(B) Unknown Contaminated and/or Hazardous Items and/or Material.

If the Contractor encounters or exposes any items, material or other conditions within the worksite not previously known or suspected to be contaminated or hazardous, but which exhibits properties which may indicate the presence of hazardous or contaminated items and/or material, the Contractor shall immediately notify the Engineer.

(C) Contractor's Duty to Report.

Whenever the Contractor encounters or exposes any hazardous or contaminated items, material or conditions at the worksite whether the existence of which was previously known, suspected, or unknown, the Contractor shall notify the Engineer.

(D) Material and Waste Brought to the Worksite.

The Contractor shall assume sole responsibility for:

(1) The management of all regulated materials and items brought to the worksite; and

(2) The management of all waste generated by or incidental to the Contractor's operations, including but not limited to lubricants, antifreeze, engine fluids, paints, and solvents.

Management of such materials and items includes, but is not limited to, their transport, storage, handling, and disposal.

(E) Reimbursement of County Expenses.

In addition to all other remedies provided by law or contract, the County may withhold from or recover from the Contractor any money it is required to expend to remediate, remove, or dispose of any such items and material, as well as the cost of any fines or impositions made by appropriate enforcement agencies arising from the management of such items and material, whether or not the Contractor exercised due care.

1070.16 Assignment or Change of Name.

Contractor is directed to SECTION 13 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1070.17 Responsibility For Damage Claims; Indemnity.

Contractor is directed to SECTION 4.6 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1070.18 Right to Audit Records, Records Maintenance, Retention and Access.

Contractor is directed to SECTION 11.4 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

*****END OF SECTION 1070*****

SECTION 1080
PROSECUTION AND PROGRESS

1080.01 Subcontracts.

Contractor is directed to SECTION 6.13 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.02 Notice to Proceed (NTP)

Contractor is directed to SECTION 6.1 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.03 Prosecution of Work.

Contractor is directed to SECTION 6.10 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.04 Preconstruction Data Submittal.

The awardee shall submit to the Engineer for information and review the pre-construction data within 15 days from the date of notice of intent to enter the contract. Until the items listed below are received and found acceptable by the Engineer, the Contractor shall not commence work unless otherwise authorized to do so in writing and subject to such conditions set by the Engineer. No progress payment will be made to the Contractor until the Engineer acknowledges, in writing, receipt of the following preconstruction data submittals acceptable to the Engineer:

(1) List of the Superintendent and other Supervisory Personnel;

(2) Name of person(s) authorized to sign for the Contractor;

(3) Work Schedule;

(4) Initial Progress Schedule (See Subsection 1080.07 – Progress Schedule)

(5) Water Pollution and Siltation Control Submittals;

(6) Tax Rates;

(7) Insurance Rates

(8) Certificate of Insurance satisfactory to the Engineer that the Contractor has in place all insurance coverage required by the contract documents;

(9) Schedule of agreed prices; and

(10) List of Suppliers.

1080.05 Character and Proficiency of Workers.

Contractor is directed to SECTION 6.25 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

The Engineer may direct the removal of any worker(s) who does not carry out the assigned work in a proper and skillful manner or who is disrespectful, intemperate, violent, or disorderly. The worker shall be removed forthwith by the Contractor and will not work again without written permission of the Engineer.

1080.06 Contract Time.

Work under this contract shall be substantially completed no more than (100) calendar days from the Notice to Proceed, not including days in which weather conditions would prohibit the Contractor from commencing/continuing work. Substantial completion includes completion of all work for this project.

1080.07 Progress Schedules.

Contractor is directed to SECTIONS 6.3 and 6.4 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.08 Weekly Meeting.

In addition to the bi-weekly scheduled meetings, the Contractor shall be available to meet once a week with the County at the time and place as determined by the Engineer to discuss the work and its progress including but not limited to, the progress of the project, potential problems, coordination of work, submittals, erosion control reports, etc. The Contractor's personnel attending shall have the authority to make decisions and answer questions.

The Contractor shall bring to weekly meetings a detailed work schedule showing the next three weeks' work. Number of copies of the detailed work schedule to be submitted will be determined by the Engineer. The three-week schedule shall show:

(1) All construction events, traffic control and BMP related activities in such detail that the Engineer will be able to determine at what location and type of work will be done for any day for the next three weeks;

(2) The duration of all events and delays;

(3) The critical path clearly marked in red or marked in a manner that makes it clearly distinguishable from other paths and is acceptable to the Engineer;

(4) Critical submittals and requests for information (RFI's). Critical submittals include, but are not limited to:

(a) Work Plan including Storm Water Best Management Practices (BMPs);
(b) Stockpile plan;
(c) Hauling plan and;
(d) Material submittals

(5) The project title, project number, date created, on the schedule covers, Contractor's name and creator of the schedule on each page.

Two days prior to each weekly meeting, the Contractor shall submit a list of outstanding submittals, RFIs and issues that require discussion.

1080.09 Liquidated Damages for Failure to Complete the Work or Portions of the Work on Time.

Contractor is directed to SECTION 15 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.10 Suspension of Work.

Contractor is directed to SECTION 9 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.11 Termination of Contract.

Contractor is directed to SECTION 15 and 16 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.12 Pre-Final and Final Inspections.

Contractor is directed to SECTION 6 and 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.13 Use of Structure or Improvement.

The County has the right to use the structure, equipment, improvement, or any part thereof, at any time after it is considered by the Engineer as available. In the event that the structure, equipment or any part thereof is used by the County before

final acceptance, the Contractor is not relieved of its responsibility to protect and preserve all the work until final acceptance.

1080.14 Contractor's Responsibility for Work; Risk of Loss or Damage.

Contractor is directed to SECTION 4 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.15 Final Acceptance.

Contractor is directed to SECTION 6 and 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1080.16 Guarantee of Work.

(1) Regardless of and in addition to any manufacturers' warranties, all work and equipment shall be guaranteed by the Contractor against defects in materials, equipment or workmanship for one year from the date of final acceptance or as otherwise specified in the contract documents.

(2) When the Engineer determines that repairs or replacements of any guaranteed work and equipment is necessary due to materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall at no increase in contract price or contract time and within five working days of receipt of written notice from the County, commence to:

(a) Correct all noted defects and make replacements, as directed by the Engineer, in the equipment and work; and

(b) Repair or replace to new or pre-existing condition any damages resulting from such defective materials, equipment or installation thereof.

(3) The County will be entitled to the benefit of all manufacturers and installers warranties that extend beyond the terms of the Contractor's guaranty regardless of whether or not such extended warranty is required by the contract documents. The Contractor shall prepare and submit all documents required by the providers of such warranties to make them effective, and submit copies of such documents to the Engineer. If an available extended warranty cannot be transferred or assigned to the County as the ultimate user, the Contractor shall notify the Engineer who may direct that the warranted items be acquired in the name of the County as purchaser.

(4) If a defect is discovered during a guarantee period, all repairs and corrections to the defective items when corrected shall be guaranteed for a new duration equal to the original full guarantee period. The running of the guarantee period shall be suspended for all other work affected by any defect. The guarantee period for all other work affected by any such defect shall restart for its remaining duration upon confirmation by the Engineer that the deficiencies have been repaired or remedied.

(5) Nothing in this section is intended to limit or affect the County's rights and remedies arising from the discovery of latent defects in the work after the expiration of any guarantee period.

1080.17 No Waiver of Legal Rights.

The following will not operate or be considered as a waiver of any portion of the contract, or any power herein reserved, or any right to damages provided herein or by law:

(1) Any payment for or acceptance of the whole or any part of the work, or

(2) Any extension of time, or

(3) Any possession taken by the Engineer.

A waiver of any notice requirement or of any noncompliance with the contract will not be held to be a waiver of any other notice requirement or any other noncompliance with the contract.

1080.18 Final Settlement of Contract.

(A) Closing Requirements.

The contract will be considered settled after the project acceptance date and when the following items have been satisfactorily submitted, where applicable:

(1) All written guarantees required by the contract.

(2) Complete and certified weekly payrolls for the Contractor and its Subcontractor's.

(3) Tax Clearance.

(4) All other documents required by the Contract or by law.

(B) Failure to Meet Closing Requirements.

The Contractor shall meet the applicable closing requirements within 60 days from the date of Project Acceptance or the agreed to Punchlist complete date. Should the Contractor fail to comply with these requirements, the Contractor will be considered in breach of contract and the County may take appropriate action.

1080.19 Work Hours.

Contractor shall inform Engineer of project work hours.

1080.20 Access to Project Area.

Contractor will provide his or her own lock, to be interlocked with the County's lock, for access to the project area.

*****END OF SECTION 1080*****

SECTION 1090
MEASUREMENT AND PAYMENT

1090.01 Measurement of Quantities.

The work will be measured in accordance with United States standard measure, or as otherwise stated in this contract. Final measurement shall be verified or determined by the Engineer. If the Contractor has a dispute about the measurement of the work, the Contractor must demonstrate the existence of an error by actual physical measurement before the work has progressed in a manner that would make a proper verification of the contested measurements impractical. If the Contractor's claim cannot be physically verified, the Engineer's measurements will be deemed as correct.

A station, when used as a definition or term of measurement, is 100 linear feet.

Longitudinal measurements for area computations of the various surfaces will be made in the horizontal projection of the actual surface. Transverse measurements for area computations will be the neat dimensions shown in the contract documents or the horizontal projection of the actual surface or as ordered in writing by the Engineer. No deductions in measurement for unit price payment purposes will be made for fixtures or structures in place having a combined area of nine square feet or less.

Work will be measured to the pay limits shown in the contract documents.

Engineer shall measure the volume of any material through computing volumetric differences in before and after surveys of the work site.

Measurement of items that are measured by the linear foot will be made parallel to the base or foundation.

The term 'gage' refers to the U. S. steel wire gage or U.S. standard gage for uncoated hot and cold rolled sheets.

The term 'ton' will mean the short ton of 2,000 pounds avoirdupois weight. The Contractor shall weigh materials measured or proportioned by weight on properly certified scales.

Every vehicle hauling material specified for measurement and payment by "loose measurement" or "measurement by vehicle" shall be made available to the Engineer for verification of its load volume or capacity. A vehicle's full load shall be its water level capacity. The Engineer may direct that any load in a vehicle be leveled for purposes of measurement and/or payment.

The Contractor shall notify the Engineer 24 hours before hauling material, payment for which is based upon weight. Unless otherwise directed by the Engineer, the truck used to haul material paid by weight shall be weighed with no load on a properly certified scale before each load is added.

When identifying standard manufactured items by gage, unit weight, or section dimensions, such identification will be nominal weights or dimensions. Standard manufactured items shall be such items as fence, wire, plates, rolled shapes, and pipe conduit. Unless specific allowable tolerances are set by the contract documents, tolerances generally accepted or established by the industries involved in the manufacture of the product are acceptable.

1090.02 Full Compensation

Contractor is directed to SECTION 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.03 Allowances for Overhead and Profit.

Contractor is directed to SECTION 11 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.04 Force Account Provisions and Compensation.

Contractor is directed to SECTION 11 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.05 Withholding of Payment for Unsatisfactory Progress.

Contractor is directed to SECTION 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.06 Assignment of Payments.

The Contractor may not assign its right to receive monies due under the contract without the written consent of the County and the surety.

1090.07 Progress Payments.

Contractor is directed to SECTION 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.08 Final Payment.

Contractor is directed to SECTION 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.09 Records, Accounts, And Documents.

Contractor is directed to SECTION 6 and 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

1090.10 Prompt Payment.

Contractor is directed to SECTION 6 and 7 of COUNTY OF MAUI GENERAL TERMS AND CONDITIONS FOR CONSTRUCTION.

*****END OF SECTION 1090*****

SECTION 1300
CONSTRUCTION QUALITY CONTROL AND QUALITY ASSURANCE

1300.01 Parties

The parties described below are associated with the ownership, design, supply, manufacture, transportation, installation, and quality assurance of the construction work. The definitions, responsibilities, qualifications, and submittals of these parties are outlined in the following subsections.

(A) Project Manager

The Project Manager is the official representative of the Owner, defined as the individual who coordinates construction and quality assurance activities for the project. The Project Manager is responsible for coordination of all construction quality assurance activities, including communications, coordination and resolution of all quality assurance issues that arise during construction.

(B) Engineer

The Engineer is the individual and/or firm who prepares the design, including project plans and specifications for the construction work. The Engineer is responsible for approving all design and specification changes and making design clarifications necessitated during the construction work.

(C) Manufacturer

The Manufacturer is the firm that produces any of the various components used in the construction work (e.g. geosynthetic, concrete, metallic products). Each Manufacturer is responsible for the production of its product. In addition, each Manufacturer is responsible for the condition of the product until the material is accepted by the Project Manager upon delivery. Each Manufacturer shall produce a consistent product that meets the project specifications. Each Manufacturer shall provide quality control documentation for its product as required in these Specifications.

(D) Earthwork Contractor

The Earthwork Contractor is the firm that performs the site earthwork preparation and construction of the soil components of the lining system. The Earthwork Superintendent is the individual responsible for the Earthwork Contractor's field crew. The Earthwork Superintendent may represent the Earthwork Contractor at all site meetings and acts as the Earthwork Contractor's spokesman on the project.

The Earthwork Contractor is responsible for constructing soil components of the project in conformance to the project plan and specifications. The Earthwork Contractor may also be responsible for supplying and transporting the required earth and granular materials, concrete, piping, and other work, as outlined in the project specifications.

(E) Geosynthetic Installer

The Geosynthetic Installer (Installer) is the firm which installs the geosynthetic components of the lining system. The Geosynthetic Superintendent is the individual responsible for the Installer's field crew. The Geosynthetic Superintendent shall represent the Installer at all site meetings and act as the Installer's spokesman on the project.

The Installer is responsible for field handling, storing, deploying, seaming, temporary restraining and all other aspects of the geosynthetics installation. The Installer may also be responsible for transportation of these materials to the site and for anchor systems, if required by the project specifications.

(F) Soil Quality Assurance Consultant

The Soil Quality Assurance Consultant (Soil QAC) is the firm which observes and documents activities related to the quality assurance of the installation of the soil components of the lining system on behalf of the Owner. The Soil QAC and Geosynthetic QAC may be the same party.

The term Soil Quality Assurance Engineer (Soil QAE) refers to the engineer employed by the QAC who is personally in charge of the quality assurance work. The personnel of the Soil QAC also include Soil Quality Assurance Monitors (Soil QA Monitors) who are located at the site for construction observation and documentation.

The Soil QAC is responsible for observing and documenting activities related to the quality assurance of the construction of the soil components of the lining systems and other earthwork related to the project. The Soil QAC is responsible for the implementation of the project Quality Assurance Plan (QAP) prepared by the Project Manager. The Soil QAC is also responsible for issuing a final Quality Assurance Report, sealed by a qualified Professional Engineer. Other duties of the Soil QAC shall include overseeing the soil laboratory testing.

The specific duties of the Soil QAC personnel are as follows:

1. The Soil QAE:
    a. Reviews all project plans and specifications.
    b. Reviews other site-specific documentation.
    c. Develops site-specific addenda for quality assurance of soil components with the assistance of the Project Manager as necessary.

d. Administers the soil portions of the QAP, including assigning and managing all soil quality assurance personnel, reviews all field reports, and provides engineering review of all quality assurance related issues.
e. Familiarizes himself with all applicable changes to project plans and specifications as issued by the Designer.
f. Acts as on-site (resident) representative of the Soil QAC.
g. Familiarizes all Soil QA Monitors with the site and the project QAP.
h. Assigns Soil QA Monitors to observe and document all activities requiring monitoring.
i. Attends all quality assurance related meetings, including resolution, pre-construction, daily, weekly meetings.
j. Reviews the calibration certification of the on-site soil testing equipment.
k. Manages the preparation of the record drawings.
l. Reviews the Soil QA Monitors' daily reports, logs, and photographs.
m. Notes any on-site activities that could result in damage to the installed soil components.
n. Reports to the Project Manager, and logs in the daily report, any relevant observations reported by the Soil QA Monitors.
o. Prepares his own daily report.
p. Prepares a daily summary of the soil component quantities estimates installed each day of construction activity.
q. Prepares a weekly summary of soil quality assurance activities at the end of each week of the construction activity.
r. Oversees marking, packaging and shipping of all laboratory test samples.
s. Reviews the results of laboratory testing and makes appropriate recommendations.
t. Recommends the approval of the final soils acceptance to the Project Manager.
u. Designates a Soil QA Monitor to represent the QAE whenever he is absent from the site while operations are ongoing.
v. Reports any unapproved deviations from the QAP to the Project Manager.
w. Maintains field files of all logs and reports.
x. Maintains qualifications of all personnel and calibration of equipment.
y. Prepares the final Quality Assurance Report.

2. The Soil QA Monitor:
   a. Monitors, logs, photographs and/or documents all soil component installation operations. Photographs shall be taken routinely and in critical areas of the installation sequence. These duties shall be assigned by the Soil QAE.
   b. Monitors and documents the following operations for all soil components:
      (1) Material delivery
      (2) Unloading and on-site transport and storage
      (3) Sampling and conformance testing
      (4) Deployment operations
      (5) Condition of the soil components as placed
      (6) Visual observation, by walkover, of the finished soil components

(7) Sampling and field testing of the finished soil components
(8) Repair operations, if and when necessary

c. Conducts soil sampling and testing.
d. Documents any on-site activities that could result in damage to the constructed soil components. Any problems noted shall be reported as soon as possible to the Soil QAE.

Any differences of the Soil QAC's interpretation of the project plans and specifications from the Earthwork Contractor's interpretation shall be properly and adequately assessed by the Soil QAC through discussion with the Earthwork Contractor. If such assessment indicates any actual or suspected work deficiencies, the Soil QAC shall inform the Earthwork Contractor of these deficiency issues.

(G) Geosynthetic Quality Assurance Consultant

The Geosynthetic Quality Assurance Consultant (Geosynthetic QAC) is the firm which observes and documents activities related to the quality assurance of the production and installation of the geosynthetic components of the lining systems on behalf of the Owner. The Geosynthetic QAC and Soil QAC may be the same party.

The term Geosynthetic Quality Assurance Engineer (Geosynthetic QAE) shall be used to designate the engineer working for the Geosynthetic QAC in charge of the quality assurance work. The personnel of the Geosynthetic QAC also include Geosynthetic Quality Assurance Monitors who are located at the site for construction observation and documentation.

The Geosynthetic QAC is responsible for observing and documenting activities related to the quality assurance of the production and installation of the geosynthetic components of the lining systems. The Geosynthetic QAC is responsible for reviewing work products of the Geosynthetic Quality Assurance Laboratory. The Geosynthetic QAC is also responsible for issuing a final Quality Assurance Report, sealed by a Professional Engineer.

The specific duties of the Geosynthetic QAC personnel are as follows:

1. The Geosynthetic QAE:
   a. Familiarizes himself with all project plans and specifications.
   b. Reviews other site-specific documentation, including proposed layouts, and manufacturer and installer's literature.
   c. Develops site-specific addenda for quality assurance of geosynthetics with the assistance of the Project Manager, as necessary.
   d. Administers the geosynthetic portions of the QAP, including assigning and managing all geosynthetic quality assurance personnel, reviewing all field reports, and providing engineering review of all quality assurance related issues.

e. Reviews for familiarity all appropriate changes to design drawings and project specifications as issued by the Designer.
f. Acts as the on-site (resident) representative of the Geosynthetic QAC.
g. Familiarizes all Geosynthetic Quality Assurance Monitors with the site and the project QAP.
h. Assigns Geosynthetic Quality Assurance personnel to observe and document geosynthetic installation activities requiring certification.
i. Attends all quality assurance related meetings, including resolution, pre-construction, daily, weekly.
j. Reviews all Manufacturer and Installer certifications and documentation and makes appropriate recommendations.
k. Reviews the Installer's personnel qualifications for conformance with those qualifications pre-approved for work on site.
l. Manages the preparation of the record drawings.
m. Reviews the calibration certification of the on-site testing equipment, as required.
n. Reviews all Geosynthetic Quality Assurance Monitor's daily reports, logs and photographs.
o. Notes any on-site activities that could result in damage to the geosynthetics.
p. Reports to the Project Manager, and logs in the daily report, any relevant observations reported by the Geosynthetic Quality Assurance Monitors.
q. Prepares his own daily report.
r. Prepares a daily summary of the quantities estimates of geosynthetics installed that day.
s. Prepares the weekly summary of geosynthetic quality assurance activities.
t. Oversees the marking, packaging and shipping of all laboratory test samples.
u. Reviews the results of laboratory testing and makes appropriate recommendations.
v. Recommends the approval of the final liner acceptance to the Project Manager.
w. Designates a Geosynthetic Quality Assurance Monitor to represent the QAE whenever he is absent from the site while operations are ongoing.
x. Reports any unapproved deviations from the QAP immediately to the Project Manager.
y. Prepares the final Quality Assurance Report.

2. The Geosynthetic Quality Assurance Monitor:
   a. Monitors, logs, photographs and/or documents all geosynthetic installation operations. Photographs shall be taken routinely and in critical areas of the installation. These duties shall be assigned by the Geosynthetic QAE.
   b. Monitors the following operations for all geosynthetics:
      (1) Material delivery, as required
      (2) Unloading and on-site transport and storage
      (3) Sampling for conformance testing
      (4) Deployment operations
      (5) Joining and/or seaming operations

(6) Condition of panels as placed
(7) Visual inspection by walkover
(8) Repair operations

c. Monitors and documents the geomembrane seaming operations, including:
   (1) Trial seams
   (2) Seam preparation
   (3) Seaming
   (4) Nondestructive seam testing
   (5) Destructive seam testing
   (6) Field tensiometer testing
   (7) Laboratory sample marking
   (8) Repair operations
   (9) Measurements of uninstalled quantities
d. Documents any on-site activities that could result in damage to the geosynthetics. Any problems noted shall be reported as soon as possible to the Geosynthetic QAE.

Any differences between the Geosynthetic QAC's and Installer's interpretation of the project plans and specifications shall be properly and adequately assessed by the Geosynthetic QAC. If such assessment indicates any actual or suspected work deficiencies, the Geosynthetic QAC shall inform the Installer, or the Installer's representative, of these deficiencies.

(H) Soil Quality Assurance Laboratory

The Soil Quality Assurance Laboratory (Soil QAL) is the firm which conducts tests on soil samples taken from the site. The Soil QAL and Geosynthetic QAL may be the same party. The Soil QAL is responsible for conducting the appropriate laboratory tests as directed by the Soil QAE. The test procedures shall be done in accordance with the test methods outlined in these specifications.

(I) Geosynthetic Quality Assurance Laboratory

The Geosynthetic Quality Assurance Laboratory (Geosynthetic QAL) is the firm which conducts tests on samples of geosynthetics taken from the site. The Geosynthetic QAL and the Soil QAL may be the same party.

The Geosynthetic QAL is responsible for conducting the appropriate laboratory tests as directed by the Geosynthetic QAE. The test procedures shall be done in accordance with the test methods outlined in these specifications.

1300.02 Communications

Communications shall be facilitated by the following meetings.

(A) Pre-Construction Meeting

A pre-construction meeting shall be held at the site prior to beginning of project. For lining system installation, the meeting shall be attended by the Project Manager, Designer, Earthwork Contractor, Geosynthetic Installer, Soil/Geosynthetic QAE, surveyor, and the Owner's technical representative. Specific topics considered for this pre-construction meeting include review of the project QAP for any problems or additions. The responsibilities of each party should also be reviewed and understood clearly. The meeting shall be documented by a person designated at the beginning of the meeting, and minutes shall be transmitted to all parties.

(B) Progress Meetings

Progress meetings shall be held weekly, or as directed by the Project Manager, between the Soil/Geosynthetic QAE, Earthwork Contractor's/Installer's Superintendent, Project Manager and any other concerned parties. This meeting shall discuss current progress, planned activities for the next week, issues requiring resolution, and any new business or revisions to the work. The Soil/Geosynthetic QAE shall log any problems, decisions, or questions arising at this meeting in his weekly report. If any matter remains unresolved at the end of this meeting, the Project Manager shall be responsible for the resolution of the matter and the communication of the decision to the appropriate parties. The Project Manager may require daily progress meetings at his discretion.

1300.03 Soil Components Acceptance

Upon written recommendation by the Soil QAC, the Project Manager shall consider accepting the soil components of the project, including lining system. The Earthwork Contractor will retain all ownership and responsibility for the soil lining components until acceptance by the Project Manager. At the Project Manager's discretion, the lining system may be accepted in sections or at points of substantial completion.

The soil components of the project, including lining system will be accepted by the Project Manager when:

1. The installation of the soil components is finished.
2. Verification of the adequacy of the constructed components, including repairs, if any, is completed in accordance with the specifications.
3. All documentation of installation is completed.
4. The Soil QAC is able to recommend acceptance.

The Soil QAC shall certify that installation of the soil components has proceeded in accordance with the soil portions of the specifications except as noted to the Project Manager.

1300.04 Geosynthetic Components Acceptance

Upon written recommendation by the Geosynthetic QAC, the Project Manager shall consider accepting the geosynthetic components of the project, including lining system. The Installer will retain all ownership and responsibility for the geosynthetics in the lining system until acceptance by the Project Manager. At the Project Manager's discretion, the lining system may be accepted in sections or at points of substantial completion.

The geosynthetic components of the project, including lining system will be accepted by the Project Manager when:

1. The installation of the geosynthetic components is finished.
2. Verification of the adequacy of all seams including associated testing and repairs, if any, is completed in accordance with the specifications.
3. All documentation of installation is completed.
4. The Geosynthetic QAC is able to recommend acceptance.

The Geosynthetic QAC shall certify that installation has proceeded in accordance with the geosynthetic portions of the specifications except as noted to the Project Manager.

*****END OF SECTION*****

SECTION 1400
HEALTH AND SAFETY

1400.01 References

The Contractor shall be familiar with the Safety Guidelines as prepared by the Solid Waste Association of North America (SWANA) National Landfill Gas Committee in December 1983, or latest version. Copies may be obtained by writing to SWANA, 1100 Wayne Avenue, Suite 650, Silver Spring, Maryland 20910, telephone number (301) 589-7068. Some available publications may be found at www.swana/products/publications.aspx.

1400.02 Quality Assurance

Nothing in this Section shall preclude the Contractor from complying with any more stringent requirements of applicable Federal, State, County, Owner and Industry Standards, rules and regulations.

1400.03 Hazardous Site Conditions

The Contractor is advised that the construction of the project is being performed over and adjacent to buried wastes and refuse. As these buried materials decompose anaerobically, they will generate landfill gas (LFG), which normally consists of carbon dioxide (CO2), methane (CH4), and occasionally hydrogen sulfide (H2S) and other gases, depending on the composition of the buried materials.

The following landfill and LFG related information is included to assist the Contractor in developing his Safety Program, and is not intended to encompass all steps that may be necessary to protect the workers or to comply with applicable regulations. A copy of the Safety program shall be submitted to the Engineer for approval seven (7) days prior to beginning construction.

1. Landfill gases usually vent to the atmosphere through the cover soils, but may migrate up to 1,000 feet laterally to adjacent areas depending on site and weather conditions.
2. Landfills have the potential to create hazardous conditions if working conditions are not controlled or recognized. Some of the hazards are:

    a. Fires may start spontaneously from exposed and/or decomposing refuse.
    b. Fires and explosions may occur from the presence of methane gas (CH4).
    c. Landfill gases may cause an oxygen deficiency in underground trenches, vaults, conduits, and structures.

d. Hydrogen sulfide (H2S), a highly toxic and flammable gas, or other toxic gas may be present.
e. Possible caving of trenches and excavations when working over or in refuse fills.
f. Splash hazard associated with landfill leachate and LFG condensate.

1400.04 Safety Monitor

A. The Contractor shall provide a person who will be designated as the LFG Safety Monitor. The Safety Monitor shall be thoroughly trained in rescue procedures, and in the use of safety equipment and gas detectors. He/she shall be present at all times during working hours whenever open trenches or excavations are greater than 2 feet in depth, when refuse is exposed, or when LFG is likely to be present.

B. The Safety Monitor shall have appropriate instruments (detectors) to test for oxygen deficiency and for the presence of methane and hydrogen sulfide gas. A personal gas monitor (such as Lumidor Safety Products PGM13, Gas Tech GX-82, Model 1641, or similar unit(s) shall be available for this purpose). The Safety Monitor shall periodically calibrate the instruments and regularly test the excavation areas and other work space for safe working conditions and ensure the appropriate safety equipment is available at the site.

C. The Safety Monitor shall have the delegated authority to order workers on the project site to comply with the LFG safety requirements. Failure to comply with orders of the Safety Monitor shall be cause for removal of a worker from the project.

1400.05 Safety Program

A. Supplemental to the Contractor's regular safety program, the Contractor shall develop and institute a Site Safety Plan to inform all workers and site visitors of the potential for the presence of methane and other landfill gases, and the importance of safety precautions to ensure the safety of workers and the public. The Contractor shall also instruct all workers and maintain strict control of construction activities to protect and maintain the integrity of the work features as they are installed.

1400.06 Safety Precautions

A. In addition to conforming to the safety rules and regulations of governmental authorities having jurisdiction, the Contractor shall take the following precautionary measures:

1. Periodically during construction, the work space should be monitored for concentrations of methane, oxygen and hydrogen sulfide. Workers shall not be permitted to enter a workspace where there is an oxygen deficiency or a combustible mixture of gases without appropriate protection. Positive fan-forced ventilation to dilute gas mixtures and avoid oxygen deficiency should be provided when work is necessary in any workspace.

2. Smoking shall be prohibited at all times.

3. In the event toxic gases are present at concentrations hazardous to the workers or the general public, the Contractor shall immediately evacuate all persons from the area until the area is determined safe by the Safely Monitor.

4. Soil shall be stockpiled for fire fighting purposes adjacent to the work space in areas of exposed refuse.

5. Safety fencing and safety signs shall be placed around the perimeter of any open excavation.

6. The use of explosives or firearms shall not be permitted on the site.

7. When refuse is exposed during construction activities, it shall be covered as soon as possible after exposure with plastic sheeting or equivalent alternative. In no event shall the refuse remain exposed overnight, unless otherwise approved by the Owner/Engineer and/or the local health authorities.

8. Refuse may only be temporarily stockpiled if covered with plastic sheeting or similar material. Refuse stockpiles shall be removed from the work site before the end of work each day.

9. No welding shall be permitted in trenches, enclosed areas, or over refuse, unless performed in areas of the site tested and approved by the Safety Monitor.

10. Combustion engine powered construction equipment used in excavating activities and/or refuse removal operations shall be equipped with vertical exhaust and spark arrestors.
11. Electric motors and controls utilized in excavation areas and in below-ground work spaces shall be explosion-proof.

B. If not already included in the standard safety practices, the Contractor shall include Occupational Health and Safety Act (OSHA) training (19 CFR 1910) and the following measures in his safety program:

1. For all excavations, the Contractor shall comply with OSHA regulation 29 CFR 1926, Subpart P.

2. Inhalation of landfill gases shall be avoided. Such gases or oxygen-deficient air may cause nausea and dizziness, which could lead to accidents. Work upwind of any excavation in refuse where possible, unless the excavation is constantly monitored and declared safe.

3. Workers should avoid contact with exposed refuse, condensate, or leachate. Irritants or hazardous materials may be present.

4. No excavation or drilled hole greater than two feet deep shall be left unattended or left open at any time unless it is appropriately marked with safety tape and/or sign.

5. Fire extinguishers with a rating of at least A, B, and C shall be available at all times on the site.

6. Startup and shutdown of equipment shall be avoided in areas of exposed refuse.

7. Personnel, when in an open excavation or in the presence of landfill gas, shall be fully clothed with non-sparking cloth, wear shoes with non-metallic soles, and wear a hard hat and safety goggles or glasses. The excavation shall be monitored continuously in a manner satisfactory to the Safety Monitor for the presence of methane, hydrogen sulfide and oxygen for the duration that personnel are in an excavation. Workers should immediately vacate an excavation if methane, hydrogen sulfide, or oxygen deficiency is detected therein, and shall not be permitted to re-enter the excavation until the Safety Monitor has verified that satisfactory precautionary measures for a safe work environment are implemented and that hazardous concentrations of gases are not present.

8. Assembly of construction work shall be performed outside of excavations. Prefabricated items shall be lowered into excavations.

C. Contractor shall comply with all other Federal Health and Safety Regulations.

*****END OF SECTION 1400*****

SECTION 1500
PROJECT RECORD DOCUMENTS

1500.01 Maintenance of Record Documents

A. Contractor shall maintain at the job site one copy of the following Contract Documents for record purposes:

1. Contract Drawings
2. Specifications
3. Addenda
4. Change Orders
5. Owner/Engineer's Field Orders
6. Reviewed Shop Drawings
7. Clarifications or Explanatory Drawings and Specifications
8. Inspection Reports
9. Field Test Records

B. Record documents shall be stored in the field office or other approved location, apart from documents used in the field for construction.

C. Record documents shall not be used for construction purposes.

D. Documents shall be made available at all times for inspection by the Owner / Engineer and their authorized representatives.

1500.02 Record Drawings

A. Project Drawings

1. Contractor shall maintain "as-built" or Record Drawings of all work and subcontracts, continuously as the job progresses. A separate set of prints, for this purpose only, shall be kept at the job site at all times.

2. These drawings shall be kept up-to-date and may be reviewed and approved by the Engineer prior to approval of monthly progress payments.

3. All deviations from the drawings, exact locations of permanent property markers or monuments, all utilities and services, mechanical and electrical lines, details and other work shall be finally incorporated on the Record Drawings.

4. No work shall be permanently concealed until the required information has been recorded.

5. Where the Owner/Engineer's Drawings are not of sufficient size, scale or detail, contractor shall furnish his own drawings for incorporation of details and dimensions.

6. The final set of Record Drawings shall be signed and dated by the Contractor and shall include sufficient record survey data, signed and sealed by a registered land surveyor in the State of Hawaii, and shall be delivered to the Engineer prior to the Owner's acceptance of the Project.

B. Addenda and Change Orders

1. Changes to the Contract Drawings effected by Addenda, Change Orders or Owner/Engineer's Field Orders shall be identified by number and effective date.

2. When revised drawings are issued as the basis of or along with addenda, these revised drawings shall be incorporated into the Record Drawings with appropriate annotation.

C. Shop Drawings

1. One complete set of shop drawings, including manufacturers' printed catalog cuts and data, shall be collected and maintained for record purposes.

1500.03 Record Specifications

A. Project Specifications

1. Information, changes and notes shall be recorded in the specifications in blank areas, such as page margins or the back of opposite pages, or on separate sheets incorporated into the specifications book. All such information, changes and notes shall be recorded in red.

2. In each section, in an appropriate location, record the manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

3. The record specifications book shall be complete and shall include all documents and forms listed under Bidding Requirements, Contract Forms, and Terms and Conditions.

4. The record specifications book shall be delivered to the Engineer prior to the Owner's acceptance of the project.

B. Addenda, Change Orders, and Field Orders

1. All Addenda, Change Orders and Engineer's Field Orders shall be incorporated into the front of the specifications book in reverse chronological order.

2. In addition, the changes to the specifications effected by Addenda, Change Order of Field Order shall be annotated on the affected page or pages of the specifications, or adjacent thereto.

1500.04 Submittal

A. At completion of the project, and before submitting invoice for final payment, Contractor shall deliver record documents to Owner/Engineer.

B. For project drawings, submit two (2) sets or one (1) electronic of blueline or blackline prints.

C. Submittal of record drawings shall be accompanied by a transmittal letter containing the following information:

1. Date of submittal.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each record document. Shop drawings may be grouped in basic categories or divisions of work.
5. Certification that each document as submitted is complete and accurate.
6. Signature of Contractor or authorized representative.

*****END OF SECTION 1500*****

SECTION 1600
PERMITS

1600.01 Permits and Licenses

As part of the contract price, the Contractor shall obtain all permits and licenses required by law to perform the work and pay charges, fees, and taxes incidental to obtaining such permits and licenses. The Contractor assumes exclusive responsibility for identifying and acquiring all permits and licenses necessary to perform the work, except for those permits and licenses identified in the contract documents as being the responsibility of the County.

The terms and conditions of any permit or license required for performance of the work, whether or not issued in the name of the Contractor, are incorporated into the contract. Compliance with such terms and conditions are duties owed by the Contractor to the County under the contract. Notwithstanding the enforcement authority of the permitting or licensing agency, whether or not a State/County agency, non-compliance by the Contractor with any term or condition of such license or permit shall be deemed non-compliance with the contract and may constitute grounds for default.

The Engineer may grant time and/or cost adjustment to the extent the Engineer determines that the Contractor was not a contributing factor for such delay.

*****END OF SECTION 1600*****

SECTION 2010
MOBILIZATION

PART I GENERAL

A. Mobilization includes preparatory work and operations necessary for the:

1. Movement of personnel, equipment, and supplies to and from the project site;
2. Acquisition of false work materials;
3. Costs incurred on operations that must be performed before starting work on the various items on the project site; and
4. Performance and payment bond premiums for contract work excluding force account items, allowances, and extra work amount.

B. Applicability.

The maximum bid allowed for the mobilization/demobilization item is an amount not to exceed 10% of the sum of all items excluding the bid price of this item.

The Engineer will reduce the indicated amount to the allowable maximum if the proposal shows an amount over the allowable maximum. The Engineer will adjust the "Sum Of Contract Items" to reflect such reduction. The Engineer will use the "Sum Of Contract Items" adjusted as if the bidder submitted its proposal in the amounts as reduced and adjusted.

PART II MATERIALS (not used)

PART III EXECUTION (not used)

PART IV MEASUREMENT AND PAYMENT

A. Method of Measurement.

Mobilization will be paid on a lump sum basis. Measurement for payment will not apply.

B. Basis of Payment.

The Engineer will pay for the accepted mobilization on a contract lump sum basis. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	Pay Unit
Mobilization (Not to exceed 10% of the sum of all items excluding the bid price of this item)	Lump Sum

The Engineer will make partial payments as follows:

1. Pay 10% of the amount bid for mobilization when earning 1% of the original contract amount.

2. Pay 50% of the amount bid for mobilization when earning 2.5% of the original contract amount.

3. Pay 75% of the amount bid for mobilization when earning 5% of the original contract amount.

4. Pay 100% of the amount bid for mobilization when earning 10% of the original contract amount.

Payment for the performance and payment bonds shall be considered part of the mobilization paid to date and shall be deducted from the 'partial payments' in this section."

*****END OF SECTION 2010*****

SECTION 2020
FIELD ENGINEERING

PART I GENERAL

A. All surveying of construction will be surveyed by a Hawaii Licensed Surveyor and staked by Contractor in accordance with the Project Drawings.

B. Surveys will be used for measurement of payment. Contractor shall refer to Section 1090 for further details.

C. Contractor will be responsible for protecting survey control and reference points. Contractor shall pay for the costs of an independent surveyor to replace any stakes or control points damaged or removed as a result of the Contractor's activities. The baseline survey will provide a grid topography of the area of work. The Engineer will provide the AutoCad data.

PART II MEASUREMENT AND PAYMENT

A. Surveying shall be paid as a lump sum upon 100% completion of the work specified in the contract.

PART III SUBMITTALS

(None)

*****END OF SECTION 2020*****

SECTION 2030
DUST CONTROL

PART I GENERAL

A. This work shall consist of applying water for the alleviation or prevention of dust nuisance. The Contractor shall control dust resulting from the Contractor's performance of the work, either inside or outside the work area. Contractor will not be prevented from applying water for his convenience if he so desires.

B. Contractor shall provide water from an off-site water source.

*****END OF SECTION 2030*****

SECTION 2200
EXCAVATION

PART I - GENERAL

A. Work shall consist primarily of excavating and removing soil and rock as shown on the drawings.

PART II - MATERIALS - Not used.

PART III - EXECUTION

A. Identify required lines, levels, contours, and datum.

B. Locate, identify, and protect utilities, groundwater monitoring wells, gas monitoring probes from damage.

C. For excavation beyond the limits of work coordinate with the Engineer.

D. Excavate to lines and grades shown on plans, or as directed by Engineer's representative.

E. Excavate materials to comply with all regulatory requirements and provide a safe working environment.

F. Notify Engineer of unexpected subsurface conditions and discontinue work in the affected area until notified to resume Work.

G. Field inspection will be performed by CQA Consultant.

H. Provide for visual inspection of bearing surfaces.

I. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

J. Contractor should assume that excavation of native material will be rock excavation. The nature of material to be excavated will be similar to existing material exposed on the West quarry wall of the site areas. If the Contractor proposes to use blasting for rock excavation, Contractor shall submit to the Engineer for approval a work plan, safety plan and schedule.

K. Excavation includes excavation, processing and removal or use of any and all piles of native soil, rock, debris and other materials located above native material subgrade in the project area, not including processed compost material that will be removed by others. Piles contain significant quantities of vegetative matter, refuse

and other materials unsuitable for use as structural fill. Processing and disposition of piled material shall be as follows.

1. The material shall be screened into two fractions, larger and smaller than 6 inches in the largest dimension.

2. Material smaller than 6 inches (6” minus material) shall be stockpiled outside the project area, but within the work area for use by landfill operations as daily cover material. The transport of the material from the stockpile area to the landfill will be by others, as needed. The 6” minus material stockpile will remain throughout the duration of the project.

3. Material larger than 6 inches (6” plus material) shall be processed to remove any vegetation, wood, trash or other deleterious material. The remaining material, which may includes rock, asphaltic concrete, and concrete, shall be crushed to 6-inch minus for use as structural fill or other use by the Contractor in the project.

4. Unsuitable materials, or any excess excavated materials, shall be stockpiled on the landfill premises in a location directed by the Engineer. No soil or rock materials shall be removed from the premises unless specifically authorized by the Engineer.

*****END OF SECTION 2200*****

SECTION 2205
STRUCTURAL FILL

PART I GENERAL

A. Work shall consist primarily of processing, moisture conditioning, placing, and compacting soils and/or rock to construct roads, berms and liner base subgrade.

B. The Contractor shall submit the results of structural fill material conformance test results to Project Manager.

PART II MATERIALS

A. Structural fill material shall be on-site or imported soils as approved by the Engineer.

B. Material shall be predominantly free from roots, wood, organic matter, refuse or other deleterious matter. The fill shall contain no lumps over 3 inches and no rocks over 6 inches in the largest dimension, with the exception of a limited amount of oversize material which may be placed in accordance with Part III (I) below.

PART III EXECUTION

A. Contractor's equipment shall be inspected daily for safety requirements and the equipment shall not leak any oil.

B. Contractor's shall obtain approval from the QAC that area to receive structural fill material is free of debris and is either certified fill or natural undisturbed soil.

C. If required, the general fill material shall be processed such that it does not contain particles exceeding the maximum size established herein.

D. Structural fill shall conform to contours and elevations of the design grades.

E. Contractor's construction method shall not disturb or damage other work.

F. Place and compact materials in loose lifts not exceeding 12 inches in thickness.

G. Finished surface of the structural fill shall be plus 2 inches and minus 2 inches from design grades.

H. The structural fill material shall be compacted to 90 percent relative compaction at a moisture content that is no less than three (3) percent below optimum.

I. Oversize rocks, boulders or concrete rubble larger than 6 inches in diameter may be placed in the structural fill in conformance with the following conditions:

1. Concrete rubble containing reinforcing steel shall have any exposed steel bars cut off at the surface of concrete.
2. Oversize rocks or concrete rubble shall be placed in the fill such that adjacent oversize rocks are separated by sufficient distance to allow compaction equipment to operate effectively between adjacent oversize rocks.
3. No surface of an oversize rock or concrete material shall be closer than twenty (20) feet from the top surface of a side slope surface or ten (10) feet from the top surface of the floor of the structural fill when brought to final design grade. It is acceptable to over-excavate the subgrade in order to achieve the 20-foot (slope) and 10-foot (floor) cover requirement.
4. Material complying with Part II shall be placed and compacted around and above oversize rocks in conformance with these specifications.

J. The Engineer may direct Contractor to construct designated portions of the structural fill using fine-grained soil material supplied by the Owner.

K. The Soil QAC shall conduct the following tests:

1. Laboratory compaction (ASTM 1557)
2. Field density (ASTM D2922, D1556 or D2167) and moisture content (ATSM D2216)

All tests except field density shall be performed at the frequency of an average of one test per 5,000 yd^3 of constructed structural fill. The field density shall be performed at the frequency of an average of one test per 1,000 yd^3 of constructed structural fill. The periodic checks and verification of nuclear density test shall be an average of one sand cone test for every 50 nuclear density tests.

L. The Soil QAC shall verify that the requirements of the project specifications are met. The Soil QAC shall report any nonconformance to the Project Manager. If a defect is identified in the finished general earthwork, the Soil QAC shall determine the extent and the nature of the defect. If the defect is indicated by an unsatisfactory test result, the Soil QAC shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the Soil QAC deems appropriate. After determining the extent and nature of the defect, the Soil QAC shall promptly notify the Earthwork Contractor and the Project Manager. A work deficiency meeting shall be held as needed between the Earthwork Contractor, Soil QAC, Designer, Project Manager and other necessary parties to assess the problem, review alternative solutions, and implement an action plan.

M. The Earthwork Contractor shall correct all deficiencies to meet the project specifications. If a project specification criteria cannot be met, or unusual weather conditions hinder work, the Soil QAC shall develop and present to the Project Manager suggested solutions for his approval. The Soil QAC shall schedule appropriate re-tests, if any required, when the work defect has been corrected. All re-tests by the Soil QAC must verify that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency. The Soil QAC shall observe any repair and report any noncompliance with the above requirements in writing to the Project Manager.

*****END OF SECTION 2205*****

SECTION 2220
SUBGRADE PREPARATION

PART I GENERAL

A. Work shall consist primarily of final preparation of the base areas of the liner system, and preparing the surface of the subgrade on floor and side slope areas of the liner system, and roads.

B. The floor and slope liner shall be constructed of material placed in accordance with Section 2205.

PART II MATERIALS

A. Native soils from the project area, or imported soil, or other on-site soils as directed by the QAC, shall be placed and compacted to form the liner subgrade.

PART III EXECUTION

A. Contractor's equipment shall be inspected daily for safety requirements and the equipment shall not leak any oil.

B. Contractor's construction method shall not disturb or damage other work.

C. Finished surface of liner subgrade shall be plus one (1) and minus one (1) inch from design grades.

D. The finished surface of base or side slope liner subgrade shall not contain any visible rocks or gravel greater than 1 inch maximum size.

E. Finished surface of liner subgrade shall be hand trimmed or rolled with a smooth drum roller to provide a smooth and uniform surface for placement of HDPE Liner.

F. The earthwork contractor shall be responsible for protecting liner subgrade from desiccation or erosion until it is accepted, in segments, by geosynthetic contractor.

*****END OF SECTION 2220*****

SECTION 2224
LOW PERMEABILITY COVER SOIL – PHASE II SLOPE

PART I GENERAL

A. Work shall consist primarily of placing, moisture conditioning, compacting, grading and protecting select low permeability cover soil materials on the Phase II slope to lines and grades shown on the Drawings

PART II MATERIALS

A. Low permeability cover soil material shall be classified according to the Unified Soil Classification System as *CL, ML, CH, or MH*. Material shall be predominantly free from roots, wood, organic matter, refuse or other deleterious matter.

B. Not less than 70 percent of low permeability cover soil material shall pass sieve number 200 when tested according to ASTM D1140, D6913 or D422.

C. Laboratory saturated hydraulic conductivity shall be tested according to ASTM D5084 at a compaction of 90 percent as determined by ASTM D1557, and more than 4 percent above optimum moisture content. The hydraulic conductivity of each lift of in-place low permeability cover soil shall be not greater than 1.0×10^{-5} cm/sec.

D. Prior to construction of low permeability cover soil, soil evaluation tests shall be performed to confirm the adequacy of soil materials from each on-site or off-site source area. All tests shall be performed in a qualified geotechnical laboratory approved by the Engineer. The Earthwork Contractor shall submit the results of source evaluation tests to the Engineer. Previous testing and evaluation of the soil source may be accepted, at the discretion of the Engineer. Results shall be submitted for the following laboratory tests:

1. Moisture content (ASTM D2216)
2. Particle size (ASTM D1140, D422, D6913)
3. Atterberg limits (ASTM D4318)
4. Compaction (ASTM 1557)
5. Saturated Hydraulic Conductivity at a specified compaction (ASTM D5084)

E. If identification of additional low permeability cover soil material sources becomes necessary during construction, the same material qualification and testing procedures shall be applied to each new source.

F. The Contractor shall submit the results of low permeability cover soil material conformance test results to the Engineer.

PART III EXECUTION

A. Contractor's equipment shall be inspected daily for OSHA requirements and the equipment shall not leak any oil.

B. If low permeability cover soil material is stockpiled prior to placement and compaction, stockpiles shall be maintained separate from other materials such that soil material is not mixed with other materials.

C. Compacted low permeability cover soil shall conform to contours and elevations of the design grades. There shall be no significant lamination between lifts. Contractor's construction methods shall not disturb or damage other work.

D. Low permeability cover soil material shall be placed and compacted in lifts approximately 8 inches thick. Each lift shall be tested and accepted by the QAC prior to placement of a subsequent lift.

E. Each lift of low permeability cover soil shall be compacted to a minimum density of 90 percent of maximum dry density as determined by ASTM D1557, at a moisture content of more than 4 percent above optimum moisture content, or to such alternate density and moisture as may be determined by the Soil QAC and Engineer to achieve the required hydraulic conductivity.

F. Areas of compacted low permeability cover soil having moisture content or density outside the acceptable range as specified herein shall be conditioned and recompacted, or removed and replaced, until acceptable test results are achieved as determined.

G. Finished surface of low permeability cover soil shall be plus 0.2 feet and minus zero feet from design grades shown on the plans. Surface shall be rolled smooth and shall be free of all rocks or clods larger than ½ inch in maximum dimension.

H. Water trucks are permitted on the compacted low permeability cover soil for maintaining the work. However, damage or surface irregularities resulting therefrom shall be repaired.

I. The compacted low permeability cover soil shall be protected by the Earthwork Contractor until placement of the lateral drainage/protective soil layer. The surface of compacted low permeability cover soil shall not develop cracks deeper than 1 inch or wider than 0.1 inch. Surface cracks exceeding either of these limits, and any damage from any cause, shall be repaired by the Earthwork Contractor at his own expense.

J. The Soil QAC shall observe and record the following during construction of low permeability cover soil:

1. Moisture content and consistency of the soil during processing, placement and compaction
2. Type and level of compactive effort (roller type, roller weight, number of passes)
3. Action of compaction equipment on the soil surface (sheepsfoot penetration, pumping, cracking, etc.)
4. Maximum clod size
5. Loose and compacted lift thickness
6. Method of bonding lifts together
7. Stones which may damage overlying geosynthetic components
8. Areas where damage due to excess moisture or insufficient moisture may occur.

K. The Soil QAC shall conduct the following conformance tests on compacted low permeability cover soil at the specified frequency:

1. At a minimum frequency of one test per 1,000 cubic yards of compacted low permeability cover soil:

   - In-place moisture-density (nuclear-gauge method) (ASTM D6938)
   - Moisture content (ASTM D2216)

2. At a minimum frequency of one laboratory test per 5,000 cubic yards of compacted low permeability cover soil:

   - Particle size (ASTM D1140, D6913, D422)
   - Atterberg limits (ASTM D4318)
   - Compaction (ASTM D1557)
   - Hydraulic conductivity (ASTM D5084) on undisturbed samples of constructed soil liner.

3. At a minimum frequency of one test per 15,000 cubic yards of compacted low permeability cover soil, or a minimum of one test for the project:

   - Field (BAT) hydraulic conductivity test
   - In-place density, sand cone method (ASTM D1556) for nuclear gauge correlation.

*****END OF SECTION 2224*****

SECTION 2225
LOW PERMEABILITY SOIL LINER– PHASE III LINER

PART I GENERAL

A. Work shall consist primarily of placing, moisture conditioning, compacting, grading and protecting select low permeability soil materials on the Phase III cell floor and sideslopes to lines and grades shown on the Drawings

PART II MATERIALS

A. Low permeability soil liner material shall be classified according to the Unified Soil Classification System as *CL, ML, CH, or MH*. Material shall be predominantly free from roots, wood, organic matter, refuse or other deleterious matter.

B. Not less than 70 percent of soil liner material shall pass sieve number 200 when tested according to ASTM D1140, D6913 or D422.

C. Laboratory saturated hydraulic conductivity shall be tested according to ASTM D5084 at a compaction of 90 percent as determined by ASTM D1557, and more than 4 percent above optimum moisture content. The hydraulic conductivity of each lift of in-place liner shall be not greater than 1.0×10^{-7} cm/sec.

D. Prior to construction of soil liner, soil evaluation tests shall be performed to confirm the adequacy of soil liner materials from each on-site or off-site source area. All tests shall be performed in a qualified geotechnical laboratory approved by the Engineer. The Earthwork Contractor shall submit the results of source evaluation tests to the Engineer. Previous testing and evaluation of the soil source may be accepted, at the discretion of the Engineer. Results shall be submitted for the following laboratory tests:

1. Moisture content (ASTM D2216)
2. Particle size (ASTM D1140, D422, D6913)
3. Atterberg limits (ASTM D4318)
4. Compaction (ASTM 1557)
5. Saturated Hydraulic Conductivity at a specified compaction (ASTM D5084)

E. If identification of additional soil liner material sources becomes necessary during construction, the same material qualification and testing procedures shall be applied to each new source.

F. The Contractor shall submit the results of low permeability material conformance test results to the Engineer.

PART III EXECUTION

A. Contractor's equipment shall be inspected daily for OSHA requirements and the equipment shall not leak any oil.

B. If soil liner material is stockpiled prior to placement and compaction, stockpiles shall be maintained separate from other materials such that soil liner material is not mixed with other materials.

C. Compacted soil liner shall conform to contours and elevations of the design grades. There shall be no significant lamination between lifts. Contractor's construction methods shall not disturb or damage other work.

D. Soil liner material shall be placed and compacted in lifts approximately 8 inches thick. Each lift shall be tested and accepted by the QAC prior to placement of a subsequent lift.

E. Each lift of soil liner shall be compacted to a minimum density of 90 percent of maximum dry density as determined by ASTM D1557, at a moisture content of more than 4 percent above optimum moisture content, or to such alternate density and moisture as may be determined by the Soil QAC and Engineer to achieve the required hydraulic conductivity.

F. Areas of compacted soil liner having moisture content or density outside the acceptable range as specified herein shall be conditioned and recompacted, or removed and replaced, until acceptable test results are achieved as determined.

G. Finished surface of soil liner shall be plus 0.2 feet and minus zero feet from design grades shown on the plans. Surface shall be rolled smooth and shall be free of all rocks or clods larger than ½ inch in maximum dimension.

H. Water trucks are permitted on the compacted soil liner for maintaining the work. However, damage or surface irregularities resulting therefrom shall be repaired.

I. The compacted soil liner shall be protected by the Earthwork Contractor until placement of geomembrane by the Geosynthetic Contractor. The surface of compacted soil liner shall not develop cracks deeper than 1 inch or wider than 0.1 inch. Surface cracks exceeding either of these limits, and any damage from any cause, shall be repaired by the Earthwork Contractor at his own expense.

J. The Soil QAC shall observe and record the following during construction of low permeability soil liner:

1. Moisture content and consistency of the soil during processing, placement and compaction
2. Type and level of compactive effort (roller type, roller weight, number of passes)
3. Action of compaction equipment on the soil surface (sheepsfoot penetration, pumping, cracking, etc.)

4. Maximum clod size
5. Loose and compacted lift thickness
6. Method of bonding lifts together
7. Stones which may damage overlying geosynthetic components
8. Areas where damage due to excess moisture or insufficient moisture may occur.

K. The Soil QAC shall conduct the following conformance tests on compacted soil liner at the specified frequency:

1. At a minimum frequency of one test per 1,000 cubic yards of compacted soil liner:

   - In-place moisture-density (nuclear-gauge method) (ASTM D6938)
   - Moisture content (ASTM D2216)

2. At a minimum frequency of one laboratory test per 5,000 cubic yards of compacted soil liner:

   - Particle size (ASTM D1140, D6913, D422)
   - Atterberg limits (ASTM D4318)
   - Compaction (ASTM D1557)
   - Hydraulic conductivity (ASTM D5084) on undisturbed samples of constructed soil liner.

3. At a minimum frequency of one test per 15,000 cubic yards of compacted soil liner, or a minimum of one test for the project:

   - Field (BAT) hydraulic conductivity test
   - In-place density, sand cone method (ASTM D1556) for nuclear gauge correlation.

*****END OF SECTION 2225*****

SECTION 2226
EXPOSURE OF EXISTING TERMINATION TRENCH – PHASE II FINAL COVER

PART I GENERAL

A. Work shall consist primarily of excavating existing soil located immediately adjacent to the termination trench of the existing Phase II final cover.

B. Contractor shall cooperate with Engineer and/or CQA Consultant to develop work methods.

C. Contractor shall maintain strict adherence to Section 1400, Health and Safety, when exposing and working around exposed refuse.

PART II MATERIALS- Not used.

PART III EXECUTION

A. Contractor shall conduct exploratory excavation along the edge the existing Phase II final cover to determine the location of the final cover termination trench along the approximately 1,600 common boundary between the new Phase III floor liner and the existing Phase II final cover as shown on the Project Drawings.

B. Following exploratory excavation, Contractor shall excavate soil as required to expose the 2 feet vertical outer edge of the Phase II final covert termination trench plus an additional three (3) vertical feet of subgrade soil beneath the termination trench the existing subgrade as shown on the Project Drawings. This excavation will run the length of the approximately 1,600 common boundary between the new Phase III floor liner and the existing Phase II final cover and will have a width of 10 feet.

C. It is anticipated that Contractor's work plan may include hand excavation as well as excavation by earthmoving equipment.

D. Excavated refuse, if encountered, shall be hauled by the Contractor and deposited at the Owner's active landfill area, as directed by the Owner, at no cost to Contractor.

E. Following inspection of the existing Phase II final cover termination trench by the Soil QAE to verify its exposure, Contractor shall cover the exposed low permeability soil layer with plastic sheeting or similar cover until the new Phase III liner system has been constructed along the exposed edge of the termination trench.

F. Exposed refuse shall be covered with soil by the conclusion of each work day.

*****END OF SECTION 2226*****

SECTION 2230
ANCHOR TRENCH EXCAVATION AND BACKFILL

PART I GENERAL

A. Work shall consist primarily of excavating for geomembrane anchor trench and moisture conditioning, placing, compacting, trimming and protection of backfill in the anchor trench.

B. The Contractor shall submit the results of backfill material conformance test results to the project manager.

PART II MATERIALS

A. Anchor trench backfill material shall be select fine-grained soil from on-site stockpiles or imported soils as designated by the Engineer.

PART III EXECUTION

A. Contractor's equipment shall be inspected daily for safety requirements and the equipment shall not leak any oil. Excavated material from the anchor trench may be placed near the trench such that surface water cannot drain into the anchor trench excavation.

B. Protect excavation to prevent cave-in on loose soil from falling into excavation. Hand trimming of the excavation and removing the loose matter shall be required. Corners of the anchor trench shall be curved to allow geosynthetics to easily conform to grades.

C. Backfill shall not be placed at ambient temperatures below 41 degrees Fahrenheit or above 100 degrees Fahrenheit unless otherwise specified by the Engineer. Backfill material shall be placed in a manner that does not cause movement or excess wrinkling of the geosynthetics. Contractor shall not operate any equipment directly on any geosynthetics.

D. The anchor trench backfill shall be moisture conditioned and compacted to at least 85 percent of the maximum dry density in accordance with ASTM D1557.

E. Contractor's construction method shall not disturb or damage other work.

F. Compacted anchor trench backfill shall conform to contours and elevations of the design grades. The surface of anchor trench backfill shall be plus 2 inches and minus zero inches from design grades.

*****END OF SECTION 2230*****

SECTION 2240
GRAVEL AND SAND DRAINAGE MEDIA– PHASE III LINER

PART I GENERAL

A. Work shall consist primarily of placing, grading and protecting gravel drainage media in the Phase III leachate collection trench and floor grade drainage layer, as shown on the project drawings.

B. The Contractor shall submit the results of conformance tests to the Engineer. Laboratory hydraulic conductivity testing shall be performed on uncompacted laboratory samples.

PART II MATERIALS

A. Gravel drainage media shall be non-calcareous hard gravel or crushed rock meeting the following:

- 100 percent passing a 1.5 inch sieve
- 0 to 5 percent passing a No. 4 sieve according to ASTM C136

B. Sand used for drainage media shall be concrete sand meeting the following requirements:

- Hydraulic conductivity greater than 1.0 cm/sec according to ASTM D5084
- 100 percent passing a 3/8- inch sieve
- 90 percent passing a No. 4 sieve
- 0 to 5 percent passing a No. 200 sieve according to ASTM C136

C. A minimum of one series of tests shall be performed on the proposed source of gravel and sand drainage media, and submitted by the Contractor to the QAC for approval prior to delivery of material to the Work.

PART III EXECUTION

A. Verify that the underlying layers including earthwork and geosynthetic materials have been accepted by QAC and Engineer.

B. Drainage media shall be placed within 7 days after the underlying layer has been installed.

C. Drainage media shall be deposited and spread to required dimensions over the floor liner and leachate collection trench, according to project drawings.

D. Compaction of drainage media is not required.

E. Placement of materials on the geomembrane shall not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless otherwise approved.

F. Equipment used for placing materials shall not be driven directly on the geomembrane.

G. Construction methods shall be employed that do not disturb or damage other work including geosynthetic materials or leachate collection piping. Equipment used for spreading or grading gravel drainage media shall be low ground pressure dozers or tracked vehicles exerting a ground pressure of less than 5 psi, and shall not operate on less than 1 foot of gravel or soil above the geomembrane.

H. In any areas traversed by any vehicles other than low ground pressure vehicles approved by the Engineer, geomembrane shall be protected by a soil layer with a minimum thickness of 3 ft. This requirement may be waived if provisions are made to protect the geomembrane through an engineered design approved by the Engineer. Drivers shall proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.

I. Contractor shall implement measures to minimize wrinkle generation in the geosynthetic materials during placement of gravel drainage media. Measures may include placing materials during early morning hours when the geosynthetic materials are cool, and monitoring and walking out wrinkles in the geosynthetic materials that appear at the face of the placement operations.

*****END OF SECTION 2240*****

SECTION 2245
LATERAL DRAINAGE/PROTECTIVE SOIL LAYER – PHASE II SLOPE

PART I GENERAL

A. Work shall consist primarily of placing, grading and protecting lateral drainage/protective soil layer on the Phase II slope, as shown on the project drawings.

B. The Contractor shall submit the results of conformance tests to the Engineer. Laboratory hydraulic conductivity testing shall be performed on uncompacted laboratory samples.

PART II MATERIALS

A. Lateral drainage/protective soil material shall be non-calcareous hard gravel or crushed rock meeting the following:

- 100 percent passing a 1.5 inch sieve
- 0 to 5 percent passing a No. 4 sieve according to ASTM C136

C. Sand used for lateral drainage/protective soil layer shall be concrete sand meeting the following requirements:

- Hydraulic conductivity greater than 8.0 cm/sec according to ASTM D5084
- 100 percent passing a 3/8- inch sieve
- 90 percent passing a No. 4 sieve
- 0 to 5 percent passing a No. 200 sieve according to ASTM C136

C. A minimum of one series of tests shall be performed on the proposed source of lateral drainage/protective soil, and submitted by the Contractor to the QAC for approval prior to delivery of material to the Work.

PART III EXECUTION

A. Verify that the underlying layers of earthwork have been accepted by QAC and Engineer.

B. Lateral drainage/protective soil layer material shall be placed in coordination with the CML landfill operations supervisor to ensure minimal interference with landfill operations and to ensure ongoing availability of landfill disposal capacity.

C. Lateral drainage/protective soil layer material shall be deposited and spread to required dimensions over the Phase II slope, according to project drawings.

D. Compaction of lateral drainage/protective soil layer material is not required.

E. Construction methods shall be employed that do not disturb or damage other work. Equipment used for spreading or grading lateral drainage/protective soil material shall be low ground pressure dozers or tracked vehicles exerting a ground pressure of less than 5 psi.

*****END OF SECTION 2245*****

SECTION 2250
PROTECTIVE SOIL COVER

PART I GENERAL

A. Work shall consist primarily of placing, grading and protecting protective soil above the liner and leachate collection system.

B. The Contractor shall submit the results of Conformance Tests to the Engineer.

PART II MATERIALS

A. Protective soil shall conform to the following:

- On side slopes, 100 percent passing a 2 inch sieve according to ASTM C136
- On the cell floor above leachate collection gravel and geotextile, 100 percent smaller than 6 inches in the largest dimension

B. Prior to construction of the protective soil cover, source evaluation tests shall be performed to confirm the adequacy of protective soil cover materials procured from each on or off-site source area. The Earthwork Contractor shall submit the results of source evaluation tests to the Engineer. The material shall be accepted or rejected by the Engineer according to these results.

PART III EXECUTION

A. Verify that underlying layers such as geosynthetic and compacted soil materials have been accepted by QAC and Engineer.

B. Protective cover material shall be deposited and spread to required thickness. Compaction is not required.

C. Construction methods shall not disturb or damage other work, such as geosynthetic materials or leachate collection system or other appurtenances.

D. Placement of soils on the geomembrane shall not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless otherwise specified.

E. Placement of soil on the geomembrane should be done during the coolest part of the day to minimize the development of wrinkles in the geomembrane.

F. Equipment used for placing soil shall not be driven directly on the geomembrane.

G. A minimum thickness of 1 ft of soil is specified between a light dozer, ground pressure of 5 psi or lighter, and the geomembrane.

H. In any areas traversed by construction traffic (any vehicles other than deployment equipment approved by the Engineer) the soil layer (or combination of leachate collection gravel and soil) shall have a minimum thickness of 3 ft. This requirement may be waived if provisions approved by the Engineer are made to protect the geomembrane through an engineered design. Drivers shall proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.

I. The Geosynthetic QAC shall measure soil thickness and verify that the required thickness is present. The Geosynthetic QAC shall also verify that final thickness is consistent with the design and verify that placement of the soil is done in such a manner that geomembrane damage is unlikely. The Geosynthetic QAE shall inform the Engineer if the above conditions are not fulfilled.

*****END OF SECTION 2250*****

SECTION 2500
ASPHALT CONCRETE PAVING

PART I GENERAL

A. Work shall consist primarily of furnishing, placing and finishing aggregate base, tack coat, and asphalt concrete paving to form roads, curbs, and drainage channels.

B. The work shall generally conform to HDOT Standard Specifications, Section 401 (Hot-Mix Asphalt Concrete Pavement), 407 (Tack Coat), and Section 703 (Aggregates).

PART II MATERIALS

A. Aggregate base shall conform to HDOT Standard Specifications Section 703.17 (Aggregate for Subbase) with grading as follows:

Sieve Size	Percent Passing by Weight
2 1/2”	100
1 ½ “	90-100
¾ “	50-90
No. 4	20-60
No. 200	0-15

B. Aggregate used in asphalt concrete shall conform to HDOT Standard Specifications Section 703.09 (Aggregate for Hot Plant Mix Bituminous Pavement), Mix No.III or Mix No. IV.

C. Tack coat used shall conform to HDOT Standard Specifications Section 407.02.

PART III EXECUTION

A. Before placing aggregate base, check subgrade as to soundness, outline and contours. Prepare subgrade by smoothing irregularities to obtain an even, uniform surface across the area to be paved. Remove material from any soft or spongy spots and replace with aggregate.

B. Compact the subgrade to 95 percent relative compaction as determined by ASTM D1557. Finish subgrade by rolling with a smooth drum roller.

C. Place aggregate base in layers not exceeding eight (8) inches. Compact to 95 percent relative compaction as determined by ASTM D1557. Finish using a smooth drum vibratory roller.

D. Asphalt concrete shall be mixed, delivered, spread and compacted in accordance with HDOT Standard Specifications Section 401.

E. Tack coat shall be applied in accordance with HDOT Standard Specifications Section 407.03.

F. Asphalt Curb.

1. Surface Preparation.

- Clean fresh laid asphalt surfaces before placing curb.
- Clean other existing surfaces with compressed air and dry surface.
- Apply tack coat, in accordance with HDOT Standard Specifications Section 407 – Tack Coat, at rate of 0.05 to 0.15 gallon per square yard of surface, and allow to cure before placing curb. Prevent spread of tack coat beyond area of curb.

2. Placing.

- Unless otherwise approved by the Engineer, construct asphalt curb with self-propelled automatic curb machine, or paver with curbing attachments that conform to the following:

  (1) Machine weight compacts without riding above bed.

  (2) Machine forms curbs of uniform texture, shape, and density.

  (3) Painting and Sealing. Paint or seal curbs in accordance with manufacturer's recommendations.

*****END OF SECTION 2500*****

SECTION 2730
STAINLESS STEEL WELL SCREEN LCRS RISER

PART I GENERAL

A. The work includes furnishing and installing the perforated well screen pipe in the leachate collection sump.

PART II MATERIALS

A. Pipe shall be Type 316 stainless steel, nominal pipe size 18 inches in diameter. Weld rings shall be 6” x 2”, Type 316 stainless steel.

B. Well screen assembly shall be supplied by an established manufacturer of well screen material, Johnson Screens (949-707-5918), or equivalent.

C. Pipe slots shall be 0.050 inch. Type 316 stainless steel Screen shall have an open area not less than 19.9 percent, and shall have a minimum transmitting capacity of not less than 42 gallons per minute per foot of length at a velocity of 0.1 ft/sec.

PART III EXECUTION

A. Contractor shall submit shop drawings for Engineer’s approval before fabrication of well screen. Shop drawings shall include proposed materials and methods for mounting well screen within sump and riser assembly.

B. Installation shall be in accordance with manufacturer’s recommendations and the construction drawings for the Work.

*****END OF SECTION 2730*****

SECTION 2751
GEOMEMBRANE

PART I GENERAL

A. Work shall consist of manufacturing, deployment, seaming, quality control and protection of geomembrane lining.

B. Geomembrane material shall be manufactured in North America. Project-specific plant inspection will not be required.

PART II MATERIAL

A. The geomembrane liner materials shall be high density polyethylene (HDPE) in the following configurations (thickness and surface texture):

Floor: 80 mil, textured both sides

Slopes: 80 mil, smooth top and textured bottom

B. Specifications for HDPE geomembrane are presented in Table 1 and Table 2, included at the end of this section.

C. Pre-manufacturing Conformance Tests: Prior to the purchase or manufacture of any geomembrane, the Manufacturer shall submit to the Project Manager the results of one set of conformance tests on the specific products proposed for supply to the project. Pre-manufacturing Conformance Tests shall be conducted at the Manufacturer's expense, according to methods specified in these specifications. The submittal shall include the results of all tests specified in Section H and I below. The Project Manager shall review the submitted data and accept or reject the proposed geomembrane material. Pre-manufacturing Conformance Tests do not replace or reduce the requirements for conformance tests of material delivered to the project, as specified in Section H and I below.

D. Prior to the installation of any geomembrane, the Manufacturer or Installer shall provide the Project Manager with the following information:

1. Copies of dated quality control certificates issued by the resin supplier.

2. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.

3. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. At a minimum, results shall be given for:

    a. Density (ASTM D1505 or ASTM D792)
    b. Carbon black content (ASTM D1603 or ASTM D4218[1])
    c. Carbon black dispersion (ASTM D5596)
    d. Thickness (ASTM D5994)
    e. Tensile properties (ASTM D6693)

    These quality control tests shall be performed in accordance with the test methods for every 20,000 lbs. of resin.

4. Results of environmental stress crack resistance tests (ASTM D5397 - single point). At a minimum, tests shall be performed once every resin lot (180,000 lbs.).

E. The following shall be maintained by the Manufacturer and will be available upon request:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin used to manufacture the geomembrane.
2. Results of tests conducted by the Manufacturer to verify that the resin used to manufacture the geomembrane meets the project specifications.
3. A list of the materials which comprise the geomembrane, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.

F. The Manufacturer shall identify all rolls of geomembrane with the following:

1. Manufacturer's name
2. Product identification
3. Thickness
4. Roll number
5. Roll dimensions

[1] If Manufacturer uses ASTM D4218 to determine carbon black content, test results shall be accompanied by Manufacturer's correlation of ASTM D4218 test results with ASTM D1603.

G. The Geosynthetic QAE shall review the documents submitted pursuant to B, D and E above, and shall report any discrepancies with the above requirements to the Project Manager. The Geosynthetic QAE shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Rolls are appropriately labeled.
5. Certified minimum properties meet the project specifications.
6. Project specifications are provided by the Project Manager to the Installer

H. Conformance Testing

Prior to delivery of the rolls of geomembrane to the job site, the Geosynthetic QAC shall ensure that conformance test samples are obtained for the geomembrane. The geomembrane rolls to be sampled shall be selected by the Geosynthetic QAC. Samples shall be taken across the entire width of the roll. Unless otherwise specified by the Project Manager, samples shall be 3 ft (1 m) long by the roll width. The Geosynthetic QAC shall mark the machine direction on the samples with an arrow.

Samples shall be taken at a rate of not less than one per 100,000 ft^2 (10,000 m^2) of geomembrane. These samples shall be forwarded to the Geosynthetic QAL for testing.

The following conformance tests shall be conducted:

1. Density (ASTM D1505)
2. Carbon black content (ASTM D1603)
3. Carbon black dispersion (ASTM D5596)
4. Thickness (ASTM D5994)
5. Tensile properties (ASTM D6693)

All conformance test results shall be reviewed and accepted or rejected by the Geosynthetic QAE prior to delivery or deployment of the geomembrane. The Geosynthetic QAE shall examine all results from laboratory conformance testing and shall report any nonconformance to the Project Manager. The Geosynthetic QAE shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that non-conforming tests may be the result of the Geosynthetic QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be re-tested by the Geosynthetic QAL with a technical representative of the Manufacturer present during the testing. Alternatively, the Manufacturer may have the sample re-tested at a different Geosynthetic QAL agreed upon by both the Owner and the Manufacturer. If the second laboratory produces conforming results, the material shall be accepted and the Owner shall be responsible for the cost of the re-testing. If the second test produces non-conforming results, the Manufacturer shall bear the cost of re-testing and the material shall be replaced at no cost to the Owner. The use of these procedures for dealing with non-conforming test results is subject to the approval of the Project Manager.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out-of-specification and rejected. Alternatively, at the option of the Project Manager, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line. To isolate the out-of- specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

I. Interface Shear Testing

Interface shear testing shall be performed on samples of 80-mil textured HDPE in accordance with ASTM D5321, as summarized in Table 2. The frequency of testing shall be one set of tests for each lot of 80-mil geomembrane, for the following interface between the geomembrane and low- permeability clay soil liner.

Interface shear testing shall be performed at the following confining pressures:

5,000 psf
10,000 psf
15,000 psf

Low permeability soil used in interface shear testing shall be taken from stockpiles of material used to construct low permeability soil liner in accordance with Section 02225. Low permeability soil shall be compacted to a minimum 90 percent of maximum dry density, at 3 to 4 percent above optimum moisture content.

Before shearing, the interface materials shall be consolidated under the confining pressure for at least 48 hours. Shear tests shall be performed under moist conditions at a shear rate of no more than 0.04 inch per minute. Moist condition is achieved by spraying the HDPD liner until it is wet before it is placed over the low permeability soil sample and confining pressure is applied.

Minimum interface shear strength parameters shall be as set forth in Table 2.

PART III EXECUTION

A. Installer

1. Installation of geomembrane shall be performed according to a written Quality Control Manual supplied by or approved by the Manufacturer of the geomembrane material.
2. Installer's field personnel shall include, at all times during installation of geomembrane, a Quality Control Supervisor whose sole duties shall be related to implementation of the approved Quality Control Manual. The Quality Control Supervisor shall not be responsible for supervising or conducting the deployment or seaming of geomembrane.

B. Submittals

1. Contractor shall submit the following to Geosynthetic QAC not less than 30 days before mobilization of the geomembrane installer:
   - The Manufacturer's Quality Control Manual for field installation of geomembrane;
   - The Installer's proposed panel layout drawing. This drawing shall present all the proposed seams of the lining system; and
   - The Installer's proposed staffing plan, including resumes and qualifications of the Installer's on-site Field Supervisor, Quality Control Supervisor and lead seamers. This plan may be amended in writing at any time, subject to approval of the QAE.

2. The Geosynthetic QAE shall review the Manufacturer or Installer's Quality Control Manual for field installation of geomembrane and may require the Manufacturer or Installer to correct any areas of noncompliance with the procedures and methods contained in the most recent version of the following industry standards:
   - International Association of Geosynthetics Installers, HDPE Geomembrane Installation Specification
   - Geosynthetic Research Institute, GRI Test Method GM19, Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes
3. The Geosynthetic QAE shall review the proposed panel layout drawing and may require correction of any conditions of noncompliance with industry standards or these specifications.
4. The Manufacturer or Installer shall make corrections required by the Geosynthetic QAE and resubmit required documents to the Engineer and QAC.

C. Subgrade Acceptance

The Earthwork Contractor shall be responsible for preparing the underlying soil prior to geomembrane placement. The Project Manager shall coordinate the work of the Earthwork Contractor and the Installer so that the requirements of the project-specific QAP are met.

Before the geomembrane installation begins, the Geosynthetic QAC shall verify that:

1. A land surveyor qualified according to project requirements has verified all lines and grades.
2. A Professional Engineer qualified according to project requirements has verified that the underlying soil meets the criteria specified in the project specifications.
3. The underlying soil surface to be lined has been rolled, compacted, or hand-worked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.
4. The surface of the underlying soil does not contain stones which may be damaging to the geomembrane.
5. There is no area excessively softened by high water content.
6. There is no area where the underlying soil surface contains desiccation cracks which may damage the geomembrane.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. A certificate of

acceptance shall be given by the Installer to the Geosynthetic QAC prior to commencement of geomembrane deployment in the area under consideration. The Project Manager shall be given a copy of this certificate by the Geosynthetic QAC.

After the underlying soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the Project Manager any change in the underlying soil condition that may require repair work. The Project Manager may consult with the Geosynthetic QAC regarding the need for repairs. If the Geosynthetic QAC concurs with the Installer, the Project Manager shall ensure that the underlying soil is repaired.

At any time before or during the geomembrane installation, the Geosynthetic QAC shall indicate to the Project Manager any locations which may not be adequately prepared for the geomembrane.

D. Anchor Trench Acceptance

The Geosynthetic QAC shall verify:

1. The anchor trench has been constructed according to the project plans and specifications.
2. Rounded corners are provided in the trench so as to avoid sharp bends in the geomembrane.
3. Excessive amounts of loose soil are not allowed to underlie the geomembrane in the anchor trench.
4. The anchor trench is adequately drained to prevent ponding or softening of the adjacent soils while the trench is open.
5. The anchor trench is backfilled and compacted promptly after geomembrane deployment as outlined in the project specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetic components. The Geosynthetic QAC shall observe the backfilling operation and advise the Project Manager of any problems. Any problems shall be documented by the Geosynthetic QAC in his daily report.

E. Panel Deployment Procedure

The Geosynthetic QAC shall review the panel deployment progress of the Installer and advise the Project Manager on changes in panel deployment. The Geosynthetic QAC shall also review the panel deployment for suitability to actual field condition such as issues relating to wind, rain, soil liner desiccation and other site-specific conditions. The Geosynthetic QAC shall verify that the condition of the underlying soil does not change detrimentally during installation. The Geosynthetic QAC shall record the identification code, location, and date of installation of each field panel.

F. Deployment Weather Conditions

Geomembrane deployment shall not be undertaken if weather conditions will preclude material seaming following deployment.

The normal acceptable weather conditions for seaming are as follows:

1. Ambient temperature between 32°F (0°C) and 104°F (40°C).
2. Dry conditions (no precipitation or other excessive moisture)
3. No excessive winds.

Ambient temperature shall be measured and ambient conditions appraised by the Geosynthetic QAC in the area in which the panels are to be placed.

The Geosynthetic QAC shall inform the Project Manager of any weather-related problems which may not allow geomembrane placement to proceed. The Project Manager will determine if the installation is to be stopped or special procedures are to be used.

G. Method of Deployment

Before the geomembrane is handled on site, the Geosynthetic QAC shall verify that deployment equipment and method of deployment proposed by the Installer to be used on the site is adequate and does not pose risk of damage to the geomembrane or underlying subgrade. If vehicles are used which must operate on the geomembrane, drivers shall proceed with caution during deployment of the geomembrane to prevent spinning of tires, sharp turns and quick stops. During handling, the Geosynthetic QAC shall observe and verify that the Installer's personnel handle the geomembrane with care.

The Geosynthetic QAC shall verify the following:

1. Equipment used does not damage the geomembrane or underlying subgrade by handling.
2. The prepared surface underlying the geomembrane is acceptable immediately prior to geomembrane placement.

3. Geosynthetic elements immediately underlying the geomembrane are clean and free of debris.
4. Personnel do not smoke or wear damaging shoes while working on the geomembrane, or engage in other activities which could damage the geomembrane.
5. The method used to unroll the panels does not cause excessive scratches or crimps in the geomembrane and does not damage the supporting soil.
6. The method used to place the panels minimizes wrinkles especially differential wrinkles between adjacent panels.
7. Adequate temporary loading and/or anchoring (such as sand bags or tires), not likely to damage the geomembrane, are placed to prevent uplift by wind. In case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels.
8. Direct contact with the geomembrane is minimized, and the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where repeated traffic use may be expected.
9. Liner has promptly been anchored in trench where applicable.

The Geosynthetic QAC shall inform the Project Manager if the above conditions are not fulfilled.

H. Damage and Defects

Upon delivery to the site, the Geosynthetic QAC shall conduct a surface observation of all rolls for defects and for damage. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected. The Geosynthetic QAC shall advise the Project Manager, in writing, of any rolls or portions of rolls which should be rejected and removed from the site because they have severe flaws, and/or minor repairable flaws.

The Geosynthetic QAC shall examine each panel, after placement and prior to seaming, for damage and/or defects. The Geosynthetic QAC shall advise the Project Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels, or portions of damaged panels, which have been rejected shall be marked and their removal from the work area recorded by the

Geosynthetic QAC. Repairs shall be made using procedures described herein.

I. Writing on the Liner

To avoid confusion, the Installer and the Geosynthetic QAC shall each use different colored markers or other materials approved by the Project Manager that are readily visible for writing on the geomembrane. The markers used must be semi-permanent and compatible with the geomembrane. The Installer shall use a white marker to write on the geomembrane while the Geosynthetic QAC shall use a yellow marker.

J. Field Seaming

Seam Layout

Before installation begins, the Installer shall provide the Project Manager and the Geosynthetic QAC with a panel layout drawing. This drawing shall present all the proposed seams of the lining system at the facility. The Geosynthetic QAE shall review the panel layout drawing and verify that it is consistent with accepted state-of-practice.

In general, seams should be oriented parallel to the line of maximum slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam shall be allowed on slopes unless otherwise authorized by the Engineer.

The Geosynthetic QAC shall use a seam numbering system compatible with the panel numbering system.

Accepted Seaming Methods

Approved processes for field seaming are fusion welding and extrusion welding. Acceptance criteria for seams are set forth in Table 3.

Fusion Process

The Geosynthetic QAC shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any non-compliance to the Project Manager.

The Geosynthetic QAC shall also verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus agreed upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane and any fuel spills promptly cleaned up. Fuel shall not be stored on liner surface.
4. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs to the geomembrane.
5. A movable protective layer is used as required by the Installer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets and to prevent debris from collecting around the pressure rollers.
6. In general, the geomembrane panels are aligned to have an overlap of 4 to 6 in (100 mm to 150 mm) for fusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
7. No solvent or adhesive is used.
8. The geomembrane is protected from damage in heavy traffic areas.

Extrusion Process

The Geosynthetic QAC shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any non-compliance to the Project Manager.

The Geosynthetic QAC shall verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus agreed upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the barrel.
4. Clean and dry welding rods or extrudate pellets are used.
5. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
6. Grinding is completed no more than one hour prior to seaming.
7. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs.

8. The geomembrane is protected from damage in heavy traffic areas.
9. Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than ¼ in (6 mm) from the finished seamed area.
10. In general, the geomembrane panels are aligned to have a nominal overlap of 3 in (75 mm) for extrusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
11. No solvent or adhesive is used.
12. The procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the geomembrane is not damaged.

Seam Preparation

The Geosynthetic QAC shall verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, the Geosynthetic QAC must ensure that the process is completed according to the Manufacturer's instructions within one hour of the seaming operation, and in a way that does not damage the geomembrane. The Geosynthetic QAC shall also verify that seams are aligned with the fewest number of wrinkles and "fishmouths".

Trial Seams

Trial seams shall be made on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming. Such trial seams shall be made at the beginning of each seaming period, and at least once each five hours, for each production seaming apparatus used that day. Trial seams shall be made under the same conditions as production seams.

The trial seam sample shall be at least 5 ft (1.6 m) long by 1 ft (0.3 m) wide (after seaming) with the seam centered lengthwise. Two specimens shall be cut from the sample with a 1 in (25 mm) wide die. The specimens shall be cut by the Installer at locations selected randomly along the trial seam sample by the Geosynthetic QAC.

The specimens shall be tested in peel using a field tensiometer. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If a specimen fails, the entire trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be

accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. The Geosynthetic QAC shall observe all trial seam procedures.

The remainder of the successful trial seam sample shall be retained until project completion in the QAC's archives for possible laboratory testing. Each sample shall be assigned a number and marked accordingly by the Geosynthetic QAC, who shall also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.

If agreed upon between the Project Manager and the Geosynthetic QAE, and documented by the Geosynthetic QAE in his daily report, the remaining portion of the trial seam sample can be subjected to destructive testing. If a trial seam sample fails a test conducted by the Geosynthetic QAL, then a destructive seam test sample shall be taken from each of the seams completed by the seamer during the shift related to the subject trial seam. These samples shall be forwarded to the Geosynthetic QAL and, if they fail the tests, the procedure in this section under Destructive Test Failure (page 02751-18) shall apply. The conditions of this paragraph shall be considered satisfied for a given seam if a destructive seam test sample has already been taken.

General Seaming Procedures

During general seaming, the Geosynthetic QAC shall ensure the following:

1. “Fishmouths” or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in (150 mm) beyond the cut in all directions.
2. If seaming operations are carried out at night, adequate illumination shall be provided.
3. Seaming shall extend to the outside edge of panels placed in the anchor trench.
4. All cross seam tees should be extrusion welded to a minimum distance of 4 in (100 mm) on each side of the tee.
5. A firm substrate may be required to be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

The Geosynthetic QAC shall verify that the above seaming procedures or any other procedures agreed upon and indicated in

the project QAP are followed, and shall inform the Project Manager of any nonconformance.

Seaming Weather Conditions

Cold Weather Conditions

To ensure a quality installation, if seaming is conducted when the ambient temperature is below 32°F (0°C), the following conditions shall be met:

1. Geomembrane surface temperatures shall be determined by the Geosynthetic QAC at intervals of at least once per 100 feet (30 m) of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32°F (0°C).
2. For fusion welding, preheating may be waived by the Project Manager based on a recommendation from the Geosynthetic QAE, if the Installer demonstrates to the Geosynthetic QAE's satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the Geosynthetic QAC shall observe all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that wind chill does not adversely affect the pre-heat requirements specified for welding. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall be approved prior to use by the Project Manager.
6. Sheet grinding may be performed before preheating, if applicable.
7. Trial seaming shall be conducted under the same ambient temperature and preheating conditions as the production seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 10°F from the initial trial seam test conditions. Such new seams shall be conducted upon completion of seams in progress during temperature drop.

Warm Weather Conditions

At ambient temperatures above 104°F, no seaming of the geomembrane shall be permitted unless the Installer can demonstrate to the satisfaction of the Project Manager that geomembrane seam quality is not compromised. Trial seaming shall be conducted under the same ambient temperature conditions as the production seams. At the option of the Geosynthetic QAC, additional destructive tests may be required for any suspect areas.

K. NONDESTRUCTIVE SEAM TESTING

General

The Installer shall nondestructively test all field seams over their full length using an air pressure test (for double fusion seams only), a vacuum test or other approved method. Nondestructive testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

For all seams, the Geosynthetic QAC shall:

1. Observe nondestructive testing procedures.
2. Record location, data, test unit number, name of tester, and outcome of all testing.
3. Inform the Installer and Project Manager of any required repairs.

Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam with an enclosed space.

1. The equipment for air pressure testing shall consist of the following:
   a. An air pump (manual or motor driven), equipped with pressure gauge and capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa) and mounted on a cushion to protect the geomembrane.
   b. A rubber hose with fittings and connections.
   c. A sharp hollow needle, or other pressure feed device, approved by Project Manager.

2. The following procedures shall be followed:
   a. Seal both ends of the seam to be tested.
   b. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
   c. Insert a protective cushion between the air pump and the geomembrane.

d. Pressurize the air channel to a pressure of approximately 30 psi (200K Pa). Close valve, allow 2 minutes for pressure to stabilize, and sustain pressure for at least 5 minutes.
e. If loss of pressure exceeds the maximum permissible pressure differential as outlined in the project specifications or does not stabilize, locate faulty area and repair in accordance with Section K. DEFECTS AND REPAIRS, Repair Procedures (page 02751-19).
f. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Seam the cut end of the air channel.
g. Remove needle or other approved pressure feed device and seal the hole in the geomembrane.

Vacuum Testing

Vacuum testing is applicable to extrusion welding and to non-seam areas of the liner.

1. The equipment shall consist of the following:
   a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.
   b. A pump assembly equipped with a pressure controller and pipe connections.
   c. A rubber pressure/vacuum hose with fittings and connections.
   d. A soapy solution. (Geosynthetic QAC shall ensure solution makes bubbles when air is passed through. Windshield washer fluid shall be used as anti-freeze in cold weather.)
   e. A bucket and wide paint brush, or other means of applying the soapy solution.
2. The following procedures shall be followed:
   a. Wet a strip of geomembrane approximately 12 in x 48 in (0.3 m x 1.2 m) with the soapy solution.
   b. Place the box over the wetted area.
   c. Close the bleed valve and open the vacuum valve.
   d. Ensure that a leak-tight seal is created.
   e. Energize the vacuum/venturi pump and reduce the applied pressure to approximately 5 psi (10 in of Hg/35 kPa) gauge.
   f. For a minimum of 10 seconds, apply vacuum with the box placed and maintaining a seal, examine the geomembrane through the viewing window for the presence of soap bubbles.

g. If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in (75 mm) overlap, and repeat the process.
h. All areas where soap bubbles appear shall be marked and repaired in accordance with Section M. DEFECTS AND REPAIRS.

Test Failure Procedures

The Installer shall complete any required repairs in accordance with Section M. DEFECTS AND REPAIRS. For repairs, the Geosynthetic QAC shall:

1. Observe the repair and testing of the repair.
2. Mark on the geomembrane that the repair has been made.
3. Document the repair procedures and test results.

L. DESTRUCTIVE SEAM TESTING

General

Destructive seam tests shall be performed at selected locations. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

Location and Frequency

The Geosynthetic QAC shall select where seam samples will be cut out for laboratory testing. The frequency and locations shall be established as follows:

1. A minimum frequency of one test location per 600 ft (305 m) of production seam length performed by each welding machine. This frequency is to be determined as an average taken throughout the entire facility.
2. Test locations shall be determined during seaming at the Geosynthetic QAC's discretion. Special consideration shall be given to locations where the potential for imperfect welding, such as overheating, contamination, offset welds exists.

The Installer shall not be informed in advance of the locations where the seam samples will be taken.

Sampling Procedures

Samples shall be cut by the Installer at locations chosen by the Geosynthetic QAC as the seaming progresses so that laboratory test results are available before the geomembrane is covered by another material. The Geosynthetic QAC shall:

1. Observe sample cutting.
2. Assign a number to each sample, and mark it accordingly.
3. Record sample location on layout drawing.
4. Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described herein immediately following receipt of successful test results. The continuity of the new seams in the repaired area shall be tested as provided herein.

Sample Dimensions

At each sampling location, two types of samples shall be taken by the Installer. First, two specimens for field testing should be taken. Each of these samples shall be cut with a 1 in (25 mm) wide die, with the seam centered parallel to the width. The distance between these two samples shall be 30 in (0.8 m). If both samples pass the field test described in Section 9.9.5, a sample for laboratory testing shall be taken.

The sample for laboratory testing shall be located between the samples for field testing. The sample for laboratory testing shall be 12 in (0.3 m) wide by 30 in (0.8 m) long with the seam centered lengthwise. The sample shall be cut into two parts and distributed as follows:

1. One 12 in wide x 18 in long (0.3 m x 0.5 m) portion for Geosynthetic QAL testing.
2. One 12 in wide x 12 in long (0.3 m x 0.3 m) portion to the QAC.

Final determination of the sample sizes shall be made at the pre-construction meeting.

Field Testing

The two 1 in (25 mm) wide specimens mentioned in Trial Seams (page 02751-13) and Sample Dimensions (page 02751-18) shall be tested in the field using a tensiometer for peel adhesion and shall not fail according to the criteria in Table 3. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If the test passes in accordance with this section, the sample qualifies for testing in the laboratory. If it is non-conforming, the seam should be repaired in accordance with the procedure in this section under Destructive Test Failure (page 02751-17). Final judgement regarding seam acceptability, based on the conformance criteria provided in the project specifications, rests with the Geosynthetic QAE.

The Geosynthetic QAC shall witness all field tests and mark all samples and portions with their number. The Geosynthetic QAC shall also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.

Laboratory Testing(on or off-site)

Destructive test samples shall be packaged and shipped, if necessary, under the responsibility of the Geosynthetic QAC in a manner which will not damage the test sample. The sample shall be shipped as soon as possible to expedite laboratory testing. The QAC will be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetic QAL.

Testing shall include seam strength and peel adhesion (ASTM D6392). The minimum acceptable values to be obtained in these tests shall be as stated in Table 3. At least 4 specimens shall be tested successfully, each in both shear and peel. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear). A passing test shall meet the minimum acceptable values in at least 4 of the 5 specimens tested for each method.

The Geosynthetic QAL shall provide test results within 24 hours of receiving the samples. The Geosynthetic QAE shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Project Manager.

Destructive Test Failure

When a sample fails a destructive test, whether that test is conducted by the Geosynthetic QAL or by field tensiometer, the Installer has two options:

1. The Installer can repair the seam between any two passing destructive test locations.
2. The Installer can trace the welding path to an intermediate location 10 ft (3 m) minimum from the point of the failed test in each direction and take a sample with a 1 in (25 mm) wide die for an additional field test at each location. If these additional samples pass the test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is repaired between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be repaired.

All acceptable repaired seams shall be bound by two locations from which samples passing laboratory destructive tests have been taken. Passing laboratory destructive tests of trial seam samples may be used as a boundary for the failing seam. In cases exceeding 150 ft (50 m) of repaired seam, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with these Specifications.

The Geosynthetic QAC shall document all actions taken in conjunction with destructive test failures.

M. DEFECTS AND REPAIRS

Identification

All seams and non-seam areas of the geomembrane shall be examined by the Geosynthetic QAC for identification of defects, holes, blisters, undispersed raw materials, large wrinkles and any sign of contamination by foreign matter. The geomembrane surface shall be cleaned by the Installer prior to examination if the Geosynthetic QAC determines that the amount of dust or mud inhibits examination.

Evaluation

Each suspect location both in seam and non-seam areas shall be nondestructively tested. Each location which fails the nondestructive testing shall be marked by the Geosynthetic QAC and repaired by the Installer. Work shall not proceed with any materials which will cover locations which have been repaired until successful nondestructive and/or laboratory tests are obtained.

When seaming of the geomembrane is completed, and prior to placing overlying materials, the Geosynthetic QAC shall indicate to the Project Manager any large wrinkles which should be cut and re-seamed by the Installer. The number of wrinkles to be repaired should be kept to an absolute minimum. Therefore, wrinkles should be located during the coldest part of the installation period, while keeping in mind the forecasted weather to which the uncovered geomembrane may be exposed. Wrinkles are considered to be large when the geomembrane can be folded over on to itself which is generally a wrinkle that extends 12 in (0.3 m) from the subgrade. Seams produced while repairing wrinkles shall be nondestructively tested.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials shall be observed by the Geosynthetic QAC to ensure that wrinkle formation is minimized and that, in all cases, the geomembrane is not folded over on itself.

Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Manager, Installer, Designer, and Geosynthetic QAC.

1. The repair procedures available include:

    a. Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter.
    b. Spot welding used to repair pinholes, or other minor, localized flaws.
    c. Capping, used to repair large lengths of failed seams.
    d. Extrusion welding the flap, used to repair areas of inadequate fusion seams which have an exposed edge.
    e. Removing bad seam and replacing with a strip of new material welded into place.
2. For any repair method, the following provisions shall be satisfied:
    a. Surfaces of the geomembrane which are to be repaired using extrusion methods shall be ground no more than one hour prior to the repair.
    b. All surfaces shall be clean and dry at the time of the repair.

c. All seaming equipment used in repairing procedures shall meet the requirements of the project QAP.
d. Patches or caps shall extend at least 6 in (150 mm) beyond the edge of the defect, and all corners of patches shall be rounded with a radius of approximately 3 in (75 mm).

Repair Verification

The Geosynthetic QAC shall observe all nondestructive testing of repairs and shall record the number of each repair, date and test outcome. Each repair shall be nondestructively tested. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150 consecutive feet (50 m) long require destructive test sampling. Failed tests require that the repair shall be redone and re-tested until a passing test results.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather available. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials shall be observed by the Geosynthetic QAC to ensure that wrinkle formation is minimized and that, in all cases, the geomembrane is not folded over on itself.

N. Sumps and Appurtenances

The Geosynthetic QAC shall verify that:

1. Installation of the geomembrane in sump and appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made according to project specifications.
2. Extreme care is taken while welding around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas.
3. The geomembrane has not been visibly damaged while making connections to sumps and appurtenances.
4. A representative of the Geosynthetic QAC shall be present at all times when the Installer is welding geomembrane to appurtenant structures.

The Geosynthetic QAC shall inform the Project Manager in writing if the above conditions are not fulfilled.

GEOSYNTHETIC MATERIAL SPECIFICATIONS				
TABLE 1 - HDPE TEXTURED GEOMEMBRANE				
Property	**Qualifier**	**Unit**	**Specified Value**	**Test Method**
Thickness	min. average	mils	80	ASTM D5994
Thickness	min. reading	mils	72	ASTM D5994
Density (geomembrane)	min.	g/cc	0.940	ASTM D1505 or ASTM D792
Melt Index (resin)	max.	g/10 min.	1.0	ASTM D1238
Asperity Height	min. avg.	mil.	29	*ASTM D7466*
Tensile Properties: (each direction)				
1. Yield strength	Min.	lb./in. width	173	ASTM D6693
2. Break strength	min.	lb./in	120	ASTM D6693
3. Elongation at yield	min.	%	13	ASTM D6693 (1.3" gage length)
4. Elongation at break	min.	%	150	ASTM D6693 (1.3" gage length)
Tear Strength	Min.	lb.	56	ASTM D1004
Puncture Resistance	Min.	lb.	144	ASTM D4833
Carbon Black Content	Range	%	2.0 to 3.0	ASTM D1603 or ASTM D4218[2]
Carbon Black Dispersion	Rating	N/A	Categories 1,2,3	ASTM D5596

[2] If ASTM D4218 is used, laboratory shall provide correlation of ASTM D4218 results with ASTM D1603

GEOSYNTHETIC MATERIAL SPECIFICATIONS				
TABLE 2 - HDPE TEXTURED GEOMEMBRANE				
Property	**Qualifier**	**Unit**	**Specified Value**	**Test Method**
Interface Friction Angle(1),(2),(3) Geomembrane/low permeability soil	Min.	degrees	18	ASTM D5321

Notes:

(1) Friction angle shall be determined based on an assumed cohesion intercept of zero.
(2) Interface friction angle shall be based on shear strength at 3.0 inches deformation
(3) See Specifications Part II.I for test procedure details

GEOSYNTHETIC MATERIAL SPECIFICATIONS					
TABLE 3- HDPE GEOMEMBRANE SEAMS					
Property	**Qualifier**	**Unit**	**Specified Value**		**Test Method**
Thickness of Seamed Materials	Min. average	mils	80 / 80	80 / 60	
Bonded Shear Strength	min.	lb./in	160	120	ASTM D6392
Peel Adhesion: Fusion Extrusion	 min. min.	 lb./in lb./in	 120 104	 98 78	 ASTM D6392 ASTM D6392
Locus of Break (See Note)			SE1, SIP AD-BRK-25%		ASTM D6392

Note: For fusion welds tested for peel adhesion, Break Code AD is unacceptable and constitutes a failed test. Break Code AD-BRK with greater than 25% incursion is unacceptable and constitutes a failed test. Unacceptable Break Codes for extrusion weld seams are AD1 and AD2; AD-WLD is unacceptable unless strength requirements are achieved.

*****END OF SECTION 02751*****

SECTION 2752
GEOTEXTILES

PART I GENERAL

A. Work shall consist primarily of manufacturing, deployment, security, quality control and protection of geotextiles.

B. Geotextile material shall be manufactured in North America. Project specific plant inspection shall not be required.

PART II MATERIALS

A. Geotextile materials supplied for filtration or cushion applications shall be non-woven geotextile as shown on the project plans. The material specification shall be manufacturer's minimum roll values.

B. Non-woven geotextile materials shall meet the following specifications:

Table 1

PROPERTY	TEST METHOD	TEST FREQUENCY 1 TEST PER:	AVERAGE ROLL VALUE 16-OUNCE
Mass per Unit Area	ASTM D5261	200,000 s.f.	16 oz/yd^2
Grab Breaking (Load and Elongation	ASTM D4632	200,000 s.f.	390 lb.
Trapezoidal Tear Strength	ASTM D4533	200,000 s.f.	150 lb.
Puncture Strength	*ASTM D6241*	200,000 s.f.	*1,100 lb.*
Apparent Opening Size of Geotextile	ASTM D4751	540,000 s.f.	Sieve No. 100 (0.150 mm)

C. Prior to the installation of any non-woven geotextile, the Manufacturer or Installer shall provide the Engineer with the following information:

1. Reports on quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.

2. A specification for the geotextile which includes all properties published by the Manufacturer, measured using the appropriate test methods.

3. Written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle-free.

4. Written quality control certificates, signed by a responsible party employed by the Manufacturer and stating that the product will meet the minimum values given in the specification are guaranteed by the Manufacturer. The quality control certificates shall include roll identification numbers, testing procedures and results of quality control tests. At a minimum, results shall be given in Table 1.

   These quality control tests shall be performed in accordance with the test methods at the frequency specified in Part II (B) above.

   The following shall be maintained by the Manufacturer of non-woven geotextiles and will be available upon request:

   1. The origin (resin supplier's name and resin production plant) and identification (brand name and number) of the resin used to manufacture the geotextile.
   2. Reports on tests conducted by the Manufacturer to verify that resin used to manufacture the geotextile meets the Manufacturer's resin specifications.
   3. A list of the materials which comprise the geotextile, expressed in the following categories as percent by weight: base polymer, carbon black, other additives.

   The Manufacturer shall identify all rolls of geotextiles with the following:

   1. Manufacturer's name
   2. Product identification
   3. Roll number
   4. Roll dimensions

   The Geosynthetic QAE shall review these documents and shall report any discrepancies with the above requirements to the Project Manager. The Geosynthetic QAE shall verify that:

   1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
   2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
   3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
   4. Roll packages are appropriately labeled.

5. Certified minimum roll properties meet the project specifications.
6. Project specifications and a copy of the QAP were submitted by the Project Manager to the Installer.

D. Conformance Testing

Sampling Procedures

Upon delivery of the rolls of geotextiles, the Geosynthetic QAC shall ensure that conformance test samples are obtained for the geotextile. The rolls to be sampled shall be selected by the Geosynthetic QAC. Samples shall be taken from any portion of a roll which has not been damaged. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Geosynthetic QAC shall mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the Geosynthetic QAC based on a review of all roll information including quality control documentation and manufacturing records.

Samples shall be taken at a rate of not less than one per 200,000 ft^2 (10,000 m^2) of geotextile. These samples shall then be forwarded to the Geosynthetic QAL for testing to ensure conformance with the project specifications.

Conformance Tests

At a minimum, the conformance tests listed in Table 1 shall be performed on geotextiles.

Test Results

All conformance test results shall be reviewed and accepted or rejected by the Geosynthetic QAC prior to the deployment of the geotextile. The Geosynthetic QAC shall examine all results from laboratory conformance testing and shall report any nonconformance to the Project Manager. The Geosynthetic QAC shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the Geosynthetic QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be re-tested by the Geosynthetic QAL with a technical representative of the Manufacturer present during the testing. Alternatively, the Manufacturer may have the sample re-tested at a different Geosynthetic QAL agreed upon by both the Owner and the Manufacturer. If the second laboratory produces

conforming results, the material shall be accepted and the Owner shall be responsible for the cost of the re-testing. If the second test produces non-conforming results, the Manufacturer shall bear the cost of re-testing and the material shall be replaced at no cost to the Owner. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out-of-specification and rejected. Alternatively, at the option of the Project Manager, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting project specifications (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out-of- specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

PART III EXECUTION

A. All geotextiles on slopes and bottoms shall be continuously sewn, except when connecting to existing geotextile if sewing is not practical due to the condition of the existing geotextile. In such an event, joining by heat will be acceptable.

B. During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, moisture, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings. Wrappings shall not be removed until shortly before deployment.

The Geosynthetic QAC shall observe rolls upon delivery at the site. Any apparently damaged or improperly wrapped rolls shall be reported to the Project Manager.

C. The Installer shall ensure that geotextiles are not damaged during handling. The geotextile shall be deployed as described below:

1. On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.
2. In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sand bags shall be installed during deployment and shall remain until replaced with cover material.
3. Geotextiles shall be cut using a geotextile cutter (hook blade) only. If in place, special care shall be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

4. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
5. During placement of geotextiles, care shall be taken not to entrap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seaming.

The Geosynthetic QAC shall note any noncompliance and report it to the Project Manager.

D. Seaming Procedures

Geotextiles shall be overlapped a minimum of 3 in (75 mm) prior to seaming. In general, no horizontal seams shall be allowed on sideslopes (seams along, not across, the slope) except as part of a patch. When horizontal seams are necessary, adjacent seams shall be offset in adjacent panels and shall be "shingled" downhill.

On slopes steeper than 10:1 (horizontal: vertical), all geotextiles shall be continuously sewn. Dry clean material may also be fusion heat bonded. Spot sewing is not allowed. On bottoms and slopes shallower than 10:1, geotextiles shall be continually sewn or thermally bonded with the written approval of the Project Manager.

Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the sewing thread shall contrast the background color of the geotextile. Sewing shall be done using machinery and stitch types specified in the project specifications or as approved in writing by the Project Manager and the Geosynthetic QAE.

E. Defects and Repairs

If a defect is identified in the geotextile, the Geosynthetic QAC shall determine the extent and nature of the defect. If the defect is indicated by unsatisfactory test result, the Geosynthetic QAC shall determine the extent of the deficient area by additional tests, observations, a review of records and other means that the Geosynthetic QAC deems appropriate.

After determining the extent and nature of the defect, the Geosynthetic QAC shall promptly notify the Installer and Project Manager. A work deficiency meeting shall be held as required between the Installer, Geosynthetic QAC, Designer, Project Manager and any other necessary parties to assess the problem, review alternative solutions, and implement an action plan.
The final decision as to the appropriate repair shall be agreed upon between the Project Manager, Installer, Designer, and Geosynthetic QAE.

Any holes or tears in the geotextile shall be repaired using the following two procedures.

On sideslopes, a patch made from the same geotextile shall be thermally bonded or sewn into place in accordance with the project specifications.

On non-sideslope areas, a patch made from the same geotextile shall be thermally bonded or sewn into place with a minimum of 12-inch overlap in all directions. Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

The Geosynthetic QAC shall observe any repair and report any noncompliance with the above requirements in writing to the Project Manager.

F. Geotextile Protection

All soil materials located on top of a geotextile shall be deployed in such a manner as to ensure:

1. The geotextile and underlying lining materials are not damaged.
2. Minimal slippage of the geotextile on underlying layers occurs.
3. No excess tensile stresses occur in the geotextile.

Exposed UV protection sacrificial geotextile on side slopes shall be weighted by sandbags to prevent wind uplift.

Any noncompliance with these guidelines shall be noted by the Geosynthetic QAC and reported to the Project Manager.

*****END OF SECTION 2752*****

SECTION 2754
RAIN CAP

PART I GENERAL

A. Scope

1. This section covers the work necessary to furnish and install plastic rain cap sheeting. Completing the work includes furnishing all labor, supervision, tools, construction equipment, and materials necessary to install the Rain Cap as shown on the Drawings.

B. Related Sections

Section 2751	Geomembrane
Section 2250	Protective Cover Soil

C. References

1. Drawings

D. Warranty

1. The Rain Cap manufacturer shall warrant the material against defects or failure or deterioration due to exposure to the elements, including UV radiation and ozone for a period of one (1) year. A sample warranty shall be submitted within 14 calendar days after Notice to Proceed, and shall state all conditions and exclusions, which are subject to review and approval by the ENGINEER. The final Warranty shall be submitted within 14 calendar days following completion of the Rain Cap installation.

E. Submittals

1. Complete material specifications, descriptive drawings, and literature.

2. Recommended method for handling and storage prior to installation.

3. Manufacturer's certification that the personnel, equipment, and HDPE materials used for installing the materials are approved and meeting requirements of this section.

PART II MATERIALS

A. Rain Cap

1. Rain Cap material shall be Dura-Skrim 12WB as manufactured by Raven Industries Flexible Film Dept., Sioux Falls, SD, or approved equal. Color of Rain Cap material shall be black on top.

2. Rain Cap material shall meet the following minimum specifications:

Nominal Thickness	12 mil
Weight	7.9 oz/yd^2
Tensile Strength (ASTM D7003)	75 lb/in
Grab Tensile Strength (ASTM D7004)	100 lb/in

3. Accessories for seaming, fabricating, patching, installing, and maintaining the plastic sheeting shall be as recommended by the sheeting manufacturer and required herein.

4. Rain Cap sheets shall be at a minimum 50 feet wide.

5. Factory-seamed sheets of rain cap shall be at least 28,000 square feet in area when shipped to the site.

6. Rain Cap shall be delivered to the site rolled and accordion-folded.

A. Sandbags

1. Sandbags shall be UV resistant and made from the same material as the Rain Cap and shall weigh 40 pounds at a minimum. Sandbags shall be factory seamed. Field seaming will not be allowed.

2. Sandbags shall be filled with on-site soil from designated stockpiles.

B. Rope

1. Rope lines shall be minimum 3/4-inch-thick polypropylene material with an average strength of 5,800 pounds.

2. CONTRACTOR to provide Manufacturer certificates with each batch of rope.

C. Tape

1. Tape shall be Raven R25B or approved equal.

PART III EXECUTION

A. Rain Cap shall be phased to cover the incrementally placed Phase II slope lateral drainage/protective soil in areas projected to be approximately 2.0 acres. Rain Cap shall be placed on the Phase II lateral drainage/protective cover soil layer within 10 days of the completion and acceptance of the protective cover soil layer and horizontal gas collector pipes, if applicable.

B. Prior to Placement of Rain Cap, submit a panel layout and seaming plan in for approval by the ENGINEER. The plan shall be to scale and shall show phasing of the Rain Cap placement, anchors, ropes, and sandbags.

C. Anchor the Rain Cap sheets as required herein, and as recommended by the manufacturer. Place sand bags on the sheeting to protect it from wind uplift. Sandbags shall be placed on all Rain Cap material in a grid pattern as recommended by the manufacturer, at intervals not exceeding 10 feet on center in the width direction and 5 feet on center in the length direction. Berm areas may require a special configuration of sandbags to avoid wind damage. Sandbags shall lay directly on top of rope for additional support.

D. Rope lines shall be straight up and down the slope. Cross-ropes shall be installed every 50 feet on all compound slopes or as directed by ENGINEER. No slack will be permitted. Rope lines shall be supported by an anchor at the top of each slope. A minimum 1-foot by 1-foot anchor trench shall used to anchor the Rain Cap and the rope anchor. The anchor trench shall be backfilled with compacted protective cover material. The number of sandbags used to anchor the top of each rope line shall be such that one sandbag shall be used to anchor each 10 bags on the rope line. The unanchored (bottom) end of a rope line shall be anchored with two 70-pound sand bags.

E. The Rain Cap sheets shall be overlapped and seamed in the same manner as the individual panels were seamed by the Manufacturer and as recommended by the Manufacturer. Each field seam shall have a 2-inch overlap. All seams shall be folded to promote water drainage. No horizontal seams will be permitted. Taping will only be allowed as instructed by the ENGINEER.

F. The completed Rain Cap shall be tight without loose areas that can flap in the wind. The completed Rain Cap must be leak-proof as determined by the ENGINEER before it is accepted. Water ponding or leaking through the Rain Cap will not be allowed. Unanchored Rain Cap edges, if allowed by the engineer, shall be covered with continuous sandbags along the entire unanchored edge. Damaged sandbags shall be removed and replaced.

*****END OF SECTION 2754*****

SECTION 2800
SEDIMENT AND EROSION CONTROL

PART I GENERAL

A. Installation and maintenance of all erosion and siltation control devices, wash down areas necessary to effectively prevent storm water pollution of adjacent or downstream areas as a result of Contractor's construction activities.

B. Erosion Control Materials and Installation

C. Silt Fence

PART II MATERIALS

A. Manufacturer's specifications and installation recommendations shall be included in Contractor's Erosion Control Plan for silt fencing, erosion control blankets, and other commercial products referenced in the Plan.

B. Silt Fence

1. Silt Fencing Fabric:
    a. Fabric for silt fencing shall be a woven material with a minimum width of 36". The top edge of the fabric shall be hemmed or otherwise modified so that a cord or woven belt can be suitably attached for loop tying to fence posts. The cord or belt shall have a minimum tensile strength of 150 pounds.
    b. The fabric may be reinforced with plastic netting of nominal 3/4" strand spacing and a minimum three strand grab strength of 40 pounds and 15 pounds after the accelerated weathering as required for the fabric. Fabric that is reinforced in this manner may have lower grab strengths as indicated.
    c. The fabric and any reinforcing plastic netting shall contain or be treated with ultraviolet stabilizers, sufficient to prevent damaging deterioration for 2 years of outdoor exposure. The fabric shall have the following properties:
        1. Grab strength, dry, min. ave; fill direction: 100 pounds.
        2. Grab strength, dry, min. ave; run direction: 150 pounds.
        3. Grab strength after 500 hour in a UV weatherometer with a cycle of 4 hours UV at 60 degrees C and 4 hours COND at 40 degrees C, min. ave. value in either principal direction: 50 lbs.

(a) When plastic net reinforcing is used, the minimum average grab strength requirement for fabric, before and after accelerated weathering, shall be 100 pounds and 35 pounds, respectively. The grab strength shall apply to both the fill and run direction.

4. Filtering Efficiency: 25 to 50 percent. Fabric exceeding the maximum filtering efficiency will not be considered.
5. Flow Time, maximum: 15 minutes.

2. Steel Posts: T-Section steel posts.
   a. Provide lugs to prevent the fabric from moving vertically.
   b. Provide steel anchor plate of adequate size and firmly attached.

C. Erosion Control Mat

1. Top Net: Woven, 100% biodegradable, natural organic fiber 9.3 lbs/1000 sq ft approximate weight.
2. Straw/Coconut Matrix:
   a. 70% straw at 0.35 lbs/sq yard (0.19 kg/sq m).
   b. 30% coconut at 0.15lbs/sq yd (0.08 kg/sq m).
3. Bottom Net: Woven, 100% biodegradable, natural organic fiber 9.3 lbs/1000 sq ft approximate weight.
4. Thread: Biodegradable
5. Provide product SC-150 by North American Green or Engineer-approved equivalent.

PART III EXECUTION

1. TEMPORARY SEDIMENT AND SILTATION CONTROLS DURING CONSTRUCTION

A. Temporary sediment and siltation control devices shall be installed in the entire project area prior to excavation or grading. Storm water runoff from the project area shall not be allowed to enter the existing facility surface water management system without passing through appropriate sediment control devices installed by the contractor.

B. Unless otherwise approved by the Owner, sediment control devices shall include silt fencing installed in the downgradient perimeter of the work area or other appropriate locations.

C. Contractor shall inspect erosion and sediment control devices prior to any forecast rain event and conduct maintenance as required. Controls shall be inspected following each rain event, and repaired or maintained are needed to ensure proper functioning.

D. Sediment trapping devices installed as part of Contractor's Erosion Control Plan shall be cleaned whenever the sediment level reaches 25% of the device's capacity.

E. Contractor shall maintain a copy of the Erosion Control Plan on site at all times and revise it whenever sediment and siltation control devices are modified or added.

2. POST-CONSTRUCTION EROSION AND SEDIMENT CONTROLS

A. At the conclusion of grading activities, erosion and sediment control measures listed in this Section shall be installed in disturbed areas in the project work limits that are not within active landfill areas.

B. Silt Fence

1. Install silt fence or sandbag berms at the toe of all constructed slopes.
2. Install to effectively minimize and control soil erosion from the project.
3. All compaction of backfill shall be accomplished with a mechanical or pneumatic tamper.

C. Erosion Control Blanket

1. Channel Installation
   a. Verify that finished grading is complete and area is free of rocks, clods and foreign material.
   b. Prepare soil before installing blankets.
   c. Begin at the top of the channel by anchoring the blanket in a 6" deep x 6" wide trench. Backfill and compact the trench after stapling.
   d. Roll center blanket in direction of water flow on bottom of channel.
   e. Place blankets end over end (shingle style) with a 6" overlap. Use a double row of staggered staples 4" apart to secure blankets.
   f. Full length edge of blankets at top of side slopes must be anchored in 6" deep x 6" wide trench. Backfill and compact the trench after stapling.
   g. Blankets on side slopes must be overlapped 4" over the

center blanket and stapled (2" for C350 matting).

h. In high flow channel applications, a staple check slot is recommended at 30 to 40 foot intervals. Use a row of staples 4" apart over entire width of the channel. Place a second row 4" below the first row in a staggered pattern.

i. The terminal end of the blankets must be anchored in a 6" deep x 6" wide trench. Backfill and compact the trench after stapling.

2. Slope Installation

a. Where designated by the Engineer, install erosion control blanket on slopes.

b. Begin at the top of the slope by anchoring the blanket in a 6" deep x 6" wide trench. Backfill and compact the trench after stapling.

c. Roll the blankets down the slope

d. The edges of parallel blankets must be stapled with approximately 2" overlap.

e. When blankets must be spliced down the slope, place blankets end over end (shingle style) with approximately 4" overlap. Staple through overlapped area, approximately 12" apart.

D. Straw Wattle

1. Install straw wattle on slopes over ten (10) feet high, along the slope face at 10 feet maximum vertical intervals.
2. Install straw wattle per manufacturer's recommendations.

PART IV SUBMITTALS

A. Prior to beginning work, Contractor shall submit for Owner's approval an Erosion Control Plan containing a narrative, plan and sketches of proposed temporary measures that will be installed to control sediment and erosion.

B. Product data for silt fence, erosion control mat, erosion control blanket, and straw wattles. Submittal to include applicable data on erosion resistance, UV stability, and material biodegradability.

C. Manufacturers' Certificates: Certify that materials meet or exceed specified requirements.

*****END SECTION 2800*****

SECTION 3300
CONCRETE AND SHOTCRETE

PART I GENERAL

A. The Contractor shall furnish all labor, materials, tools, transportation, and equipment necessary to install concrete and shotcrete to the limits shown on the Contract Drawings and as specified herein.

PART II MATERIALS

A. Concrete / Shotcrete

1. The Contractor shall provide normal weight concrete and shotcrete with a 28-day compressive strength of 5,000 psi.

2. The water-cement ratio shall not exceed 0.5.

3. Cement shall conform with ASTM C 150 Type II.

4. Aggregates shall conform with ASTM C 33.

5. Water shall be clean, fresh potable water and shall not contain substances deleterious to the concrete.

6. Admixtures shall be submitted to and approved by the Engineer.

B. Reinforcing Steel:

1. Reinforcing steel bars shall be fabricated in accordance with ACI 315 and shall conform with ASTM A 615 Grade 60 deformed bars for all #4 and #5 and larger bars.

2. Welded wire fabric. shall conform to the requirements of ASTM A 497. Tie wire shall be a minimum 10 gage annealed wire. Supports and spacers shall be as specified in the CRSI "Manual of Standard Practice."

C. Concrete Accessory Products:

1. Curing materials shall be of the liquid-membrane forming type in accordance with ASTM C 309, Type 1. These materials shall be clear or translucent with fugitive dye. Cure-seal hardener shall be in accordance with ASTM C 309, Type 1, Class A or B. Acceptable materials are Burke, Spartan-Cote, Euclid Pliocure, or equivalent.

2. Expansion joint filler shall be closed cell copolymer foam plastic material,

A.P.S. Cross Linked E.V.A. Foam (APS Supply Company, Beverly, New Jersey) or equivalent. Contractor shall submit proposed material for Engineer's approval.

PART III EXECUTION

A. Shotcrete

1. Excavation for surface-water control ditches and channels shall be to the lines and grades shown on the Contract Drawings or as directed by the Engineer. Materials excavated shall be stockpiled at locations approved by the Owner or representative.

2. Where drainage channels and ditches are to be located in fill, the fill shall be overbuilt and the ditches subsequently excavated into the compacted fill materials to the required lines and grades. The Contractor shall provide sufficient grade check control for locations and gradients of the drain foundations.

3. The foundation, which includes all surfaces on which concrete or shotcrete is to be placed, shall be evenly graded so that no point on the grade surface shall be above the designated plane. If unsuitable material is encountered at the elevation of the foundation, such material shall be removed and disposed of as directed by the Engineer. The resulting space shall be filled with material suitable for the foundation. The foundation areas shall be thoroughly compacted with moisture sufficient to allow a firm foundation and to prevent absorption of water from the concrete or shotcrete; however, foundation areas shall not contain free surface water.

4. Concrete or shotcrete shall be placed, consolidated, finished, and cured in conformance with the requirements of ACI 304 or equivalent standard.

5. After striking off tograde, the concrete/shotcrete shall be hand-floated with wooden floats no less than 4 in. in width and not less than 30 in. in length. The entire surface shall be broomed with a fine-texture hair push broom to produce a uniform surface. Brooming shall be done when the surface is sufficiently set to prevent deep scarring and shall be accomplished by drawing the broom side down the slope leaving the marks parallel to the flow of water. Concrete/ shotcrete edges shall be trimmed smooth.

6. Expansion joints or weakened plain joints shall be installed transversely along the basin at intervals of 20 ft.

7. Transitions between any two drainage structures are shown on the Contract Drawings or shall be performed as directed by the Engineer.

8. Waterstops must be used in all construction or “cold joints” and shall be approved by the Engineer.

9. Samples for compressive strength testing for each class of concrete/shotcrete shall be taken not less than once a day nor less than once for each 150 cubic yards of concrete/shotcrete placed. Samples will be cured on-site for 24 hours then delivered to the laboratory for testing in accordance with ASTM C 31 and C 39.

10. Slump tests are required with maximum slump of 5 in. Slump tests shall be performed in accordance with ASTM C 143 at a frequency of 1 test per 1 concrete truck.

11. The minimum shotcrete thickness shall be as shown in the Contract Drawings. The unhardened shotcrete shall be checked for thickness using a probe by the nozzleman or laborer at the time of placement. All low or thin areas shall be corrected by applying additional shotcrete.

A. Concrete

1. Design, erect, support, brace and maintain form-work to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct forms so concrete work is of correct size, shape alignment, elevation and position. Clean forms before placement of concrete, and retighten and brace forms after placement of concrete as required to eliminate mortar leaks and maintain proper alignment

2. Place concrete in conformance with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”, or comparable international standard. During hot weather applications, place concrete in conformance with ACI 305 or equivalent standard for hot weather concrete placement, and the following:

   - Cool mixing water as required to maintain mix temperature below 32 ^{c}o at time of placement

   - Cool reinforcing steel by covering with water-soaked cloth so that steel temperature does not exceed ambient air temperature immediately before embedment in concrete

   - Fog spray forms, reinforcing steel/wire mesh and subgrade just before concrete is placed

   - Use water-reducing retarding mixture (Type D)

3. Concrete shall be cured with a liquid membrane-type curing compound, placed in accordance with the manufacturer's application instructions. The use of burlap or other wet covering, plastic sheeting, water proof paper or other covering, or curing with water, is not allowed.

4. Samples for compressive strength testing for each class of concrete/shotcrete shall be taken not less than once a day nor less than once for each 150 cubic yards of concrete/shotcrete placed. Samples will be cured on-site for 24 hours then delivered to the laboratory for testing in accordance with ASTM C 31 and C 39.

5. Slump tests are required with maximum slump of 5 in. Slump tests shall be performed in accordance with ASTM C 143 at a frequency of 1 test per 1 concrete truck.

C. Reinforcing Steel

1. Before concrete is placed, reinforcement shall be cleaned of loose rust and other substances that would impair bonds with the concrete. Rust shall be removed to the satisfaction of the Engineer by vigorous rubbing with burlap cloth or wire brushing.

2. Reinforcement shall be placed in accordance with the Contract Drawings and the CRSI "Recommended Practice for Placing Reinforcing Bars." Reinforcement shall be tied securely in place to prevent displacement during placement of concrete. Reinforcing bars and welded wire fabric shall be spliced as indicated by lapping and securely wiring components together. Splices at locations other than those indicated in the Contract Drawings or approved shop drawings shall be subject to the approval of the Engineer and, if allowed, shall conform to the requirements of ACI 318.

   The Contractor shall notify the Engineer when reinforcing steel is in place so that the Engineer may observe the reinforcing steel prior to placement of concrete for conformance with these Technical Specifications and the Contract Documents. Concrete placed in violation of this requirement may be subject to rejection and removal.

*****END SECTION 3300*****

SECTION 3400
EPOXY COATED REINFORCING STEEL

PART I GENERAL

A. The work includes furnishing, installing and completing the epoxy coated reinforcing steel.

PART II MATERIALS

A. Reinforcing steel shall be Grade 60 billet steel conforming to ASTM A615.

B. Epoxy coated reinforcing shall be in accordance with ASTM D3963 and A775 finish.

C. Steel bending processes shall conform to the requirements of ACI-318. Bending processes shall be accomplished so that the steel will not be damaged.

D. Spacers, chairs, shim plates or other supports for reinforcing steel shall be submitted to and approved by the Engineer prior to use.

PART III EXECUTION

A. Reinforcing bars shall be furnished, cut, bent and placed as indicated on the project drawings.

B. All reinforcing steel shall be tied together and supported in such a manner that displacement during placing of concrete will not occur.

C. When there is a delay between placing reinforcement and pouring concrete, the reinforcement shall be reinspected and cleaned as needed.

D. The clear distance between parallel bars shall be not less than one and one-half times the diameter of the bars, and unless specifically authorized, shall in no case be less than 1 inch, nor less than the maximum size of coarse aggregate in the concrete design mix.

E. Except as shown by detail on the drawings, reinforcing steel shall not be spliced at any location without specific approval of the Engineer. Where approved, splices in adjacent bars shall be staggered. Splices shall have sufficient overlap to transfer full strength of the bar by bond and shear. In no event shall overlap be less than 24 diameters of the spliced bar.

F. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved high-density “adobes”, chairs, spacers or shim plates. Supports shall be of sufficient strength and stability to maintain the reinforcement

in place during concrete placement. Supports must be completely concealed in the concrete.

G. Where reinforcing steel has to be cut to permit passage of pipe or to create openings, and should no detail be shown for extra reinforcing in such areas, additional steel shall be placed equally around the openings, equivalent to twice the area of steel removed by creation of the openings.

H. Unless specifically dimensioned and detailed on the plans, all reinforcing steel shall be covered by a minimum of 3 inches of concrete.

*****END SECTION 3400*****

SECTION 3500
REINFORCED CONCRETE VERTICAL RISER PIPE

PART I GENERAL

A. The work includes furnishing, installing and completing the vertical riser pipe for the leachate collection sump.

B. Contract supply may include pipe to be installed at later date by Owner. If so, Contractor shall deliver and store pipe as directed by Owner.

PART II MATERIALS

A. Concrete shall have a 28-day compressive strength of no less than 5,000 psi.

B. Reinforced concrete pipe shall conform to ASTM *C478* and Hawaii Department of Transportation (HDOT) Standard Specifications Section *604*.

C. Pipe joints shall be tongue-and groove.

D. Pipe inside diameter shall be no less than 36-inchand no greater than 48-inch and have a wall thickness of 4-inches. Pipe shall be delivered in four (4) foot lengths.

E. Pipe shall be coated on all surfaces (interior, exterior, and joint surfaces) with Carboline Bitumastic 300M (or equivalent).

PART III EXECUTION

A. Riser pipe sections shall be placed with no more than ¼ inch deviation from vertical in each 4-foot section.

B. Mortar*, gasket, or seal material* shall be placed in joints per manufacturer's recommendations.

C. Pipe shall be cured and surface prepared in accordance with coating manufacturer's recommendations. Prime coat and coating to be applied in accordance with manufacturer's recommendations. Finished coating, excluding prime coat, shall have a minimum dry film thickness of 16 mils.

D. Soil backfill shall be placed and compacted around pipe in six-inch lifts. Contractor shall take care not to damage pipe *or pipe coating* while placing backfill.

*****END SECTION 3500*****

SECTION 15510
POLYETHYLENE PIPING

PART I GENERAL

A. The work consists of supplying and installing: (1) leachate collection and removal system pipe; and (2) horizontal gas collection pipe as shown on the project plans.

PART II MATERIALS

A. Pipe shall be high density polyethylene (HDPE) pipe as shown on the drawings.

B. HDPE pipe shall conform to the applicable requirements of ASTM D3350 as having a cell classification of 345464C (black). Dimensions and workmanship shall be as specified by ASTM F714. Fittings shall be molded from or manufactured using a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe specified herein. To ensure compatibility of polyethylene resins, all fittings shall be of the same manufacture as the pipe being supplied.

C. The pipe supplied as specified shall have a nominal IPS (Iron Pipe Size) outside dimension unless otherwise specified. Pipe shall be SDR 11 as specified in ASTM F714-85.

D. Leachate collection pipe shall be perforated as shown on the drawings.

PART III EXECUTION

A. Installation shall conform to pipe manufacturer's instructions and recommendations unless otherwise specified. Contractor shall furnish QAC the manufacturer's data on pipe and fittings and printed installation instructions before pipe installation.

B. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. Handling of pipe shall be done in such a manner that the pipe is not damaged. Segments of pipe having cuts or gouges in excess of 10 percent of the wall thickness of the pipe should be cut out and removed.

C. Sections of HDPE pipe should be joined in continuous lengths on the job site above ground. The joining method shall be the butt fusion method in conformance with ASTM D3261-87 and the pipe manufacturer's recommended written instructions including, but not limited to, temperature requirements, alignment and fusion pressures.

D. Pipe interior shall be maintained smooth after joining is complete.

E. Whenever pipe laying is stopped, the open end of the line shall be sealed with an approved mechanical watertight or airtight plug.

F. Pipe shall be supported in a manner that permits construction and accommodates expansion due to temperature changes, and/or as noted on the drawings.

G. Pipe and fittings shall be carefully inspected for cracks and other defects while suspended immediately before installation in final position. Spigot ends of pipe shall be examined with particular care. Defective, damaged, or unsound pipe and fittings shall be rejected and removed from the site of the work. Complete specifications, data and detailed drawings covering the items furnished and placed under this specification shall be submitted for approval and records.

H. The Geosynthetics QAC shall observe, monitor and document that the pipe has been handled, installed, joined and protected in conformance to these project specifications.

*****END OF SECTION 15510*****

SECTION 15530
LEACHATE SUMP PUMP

PART 1 GENERAL

A. Work covers supply and installation of centrifugal submersible leachate sump pump.

PART II MATERIALS

A. Pump shall be equipped with a 2 HP, submersible, hermetically sealed electric motor for operation on 208 Volts, 3 phase, 60 Hertz service. The motor shall be designed for continuous duty, capable of sustaining up to 100 starts per day. The motor shall be connected to the pump via a motor adaptor and coupling in 304 stainless steel.

B. Pump shall be supplied with a minimum 50 feet of power cable. The power cable shall have a waterproof and chemically resistant jacket over 600 Volt insulation.

C. Pump shall have a 1½ inch MNPT threaded discharge nozzle and be capable of delivering 50 GPM at 100 feet of total dynamic head. Each pump will be fitted with 80 feet of stainless steel lifting cable of sufficient strength to raise and lower the pump unit.

D. A transmitter mount shall be welded to the pump for liquid level control.

E. The pump design shall permit "pump down" to within 12 inches of the sump or wet well bottom without any loss of performance or damage to the pump.

F. External "priming" shall not be required nor allowed. The pump shall be equipped with a vent valve to assist with the evacuation of air from the unit.

G. Major pump components and fasteners shall be made of 304 stainless steel.

H. Pump shall include a built-in check valve with non-metallic seat, and housing and disc of 304 stainless steel.

PART III - EXECUTION

A. Pump shall be installed according to the Drawings and Manufacturer’s recommendations.

*****END SECTION 15530*****

SECTION 15540
LIQUID LEVEL PRESSURE SENSOR

PART I GENERAL

A. Work covers supply and installation of a pressure sensor used to control the leachate sump pump based on liquid level.

PART II MATERIALS

A. Level sensor shall be designed specifically for operation in conjunction with the leachate sump pump and controller, and shall be mounted on the pump.

B. Sensor shall be supplied with a chemical resistant jacketed cable with water block containing a vent tube for atmospheric pressure compensation.

C. Sensor shall have a range of 0 to 11 feet water head.

D. Sensor shall have built-in temperature compensation and calibration providing an accuracy of ±1.0% at ambient temperature and a combined repeatability and hysteresis error of ±.125%.

E. Sensor shall be fully submersible in any liquid compatible with 316 stainless steel and a chemical resistant polyurethane cable jacket.

F. Additional specifications include:

- Static Accuracy (combined errors due to nonlinearity, hysteresis and non-repeatability on a best-fit-straight-line basis, at 25° C per ISA S51.1.): ±1.0% BFSL FSL maximum
- Thermal Error: 0.05% FSO/°C worst case
- Proof Depth: 1.5 x rated depth
- Burst Depth: 2.0 x rated depth
- Resolution: Infinitesimal
- Excitation: 10 to 40 VDC, Red = (+) excitation, Black = (-) signal
- Input Current: 20 mA maximum
- Output: 4-20 mA (2 wire)
- Zero Offset (max): 4-20 mA, ±.12mA
- Output Impedance: <10 ohms
- Insulation Resistance: 100 megohms at 50VDC
- Circuit Protection: Polarity, surge & shorted output
- Power Supply Rejection: <±.05% FSO/VDC (mA output)

- Electrical Termination: 2-24 AWG conductors in a shielded cable with sensor breather and
- polyurethane jacket
- Compensated Temp Range: 0° to 50° C
- Operating Temp Range: -20° to 70° C

PART III EXECUTION

A. Installation shall be according to the Drawings and Manufacturer's recommendations

*****END SECTION 15540*****

SECTION 15550
PUMP CONTROL PANEL

PART I – GENERAL

A. Work includes furnish and installation of pump control panel for leachate sump pump.

B. The controller shall be designed to start and stop a pump using a submersible pressure transmitter. The pump starts at the pump start level set point and continues to run until the liquid level decreases to the pump stop level set point as programmed in the control meter. If the liquid level rises to the high level alarm set point, a high level alarm will be annunciated. If the liquid level rises to the high-high level fail-safe set point, the pump motor will shut off. The pressure transmitter level sensor shall have a 4-20 mA output signal.

C. Controller shall be EPG Companies Inc., UL listed 509A/698A, Series L925PT controller, or equal unit meeting these specifications.

PART II – MATERIALS

A. Controller shall be designed to operate a pump motor and auxiliary equipment in manual or automatic mode.

B. The control panel enclosure shall be NEMA type 4X (stainless steel) and shall be equipped with a window in the outer door, an inner door, a stainless steel drip shield, and a tamper resistant latch.

C. The control system will operate from a 208 Volt, 60 Hertz, 3 phase power supply. Pump control components shall be sized to operate a pump motor of two (2) horsepower.

D. The control panel shall include the following features:

- **Main Disconnect Switch:** The main disconnect switch shall be 10 Amp rated and will prevent opening of the control panel while the power is on, and includes 240 Volt, 10 Amp dual element fuses.

- **"Hand-Off-Auto" Selector Switch:** Allows manual or automatic operation of the pump motor. The selector switch shall be a heavy duty, oil tight, NEMA 4 rated switch mounted on the inner door. The hand position shall be momentary with a spring return.

- **Motor Contactor:** The motor contactor shall be sized to the pump motor horsepower.

- **Motor Start Winding Control with Start Capacitor and Start Winding Relay:** A capacitor is used to start the motor, and a relay is used to remove the start winding from the circuit when the motor reaches operating speed.

- **Control Transformer:** A transformer with fused primary and secondary shall isolate the control circuit from the power circuit and provide easier and safer field wiring of accessories. It shall lower incoming voltage to 120 Volts.

- **Run Light:** Indicates energizing of motor circuit. It shall be heavy duty, oil tight, NEMA 4 rated and shall have a voltage surge suppressor built in to prolong lamp life. The light shall be mounted on the inner door and shall be green in color.

- **Level Control Meter:** The level control meter shall be mounted on the inner door. The meter shall have a digital readout and the capability to monitor and maintain liquid levels as well as output a high level alarm. It shall also provide a high-high level alarm fail safe feature that shuts off the pump motor. The high-high alarm may indicate level sensor failure or a problem with the pump. Level control shall be accurate to within 0.1 inch.

- **Level Simulator:** The level simulator shall be mounted on the inner door. The level simulator is a built-in test circuit designed to simulate a 4-20 mA load to assist in level meter setup and troubleshooting.

- **Intrinsically Safe Barrier:** The level sensor circuit shall be protected by an intrinsically safe barrier.

- **Heater with Adjustable Thermostat:** A heater with adjustable thermostat shall promote even distribution of heat and elimination of hot spots and condensation. It shall also maintain the minimum temperature required for the operation of the level control meter. The heater element shall be mounted in space between the sub-panel and the back of the enclosure.

- **Lightning Arrestor:** Shall be grounded, metal-to-metal, to water strata. When properly grounded, the lightning arrestor will protect electrical equipment against lightning induced surges.

- **Terminal Strip:** A labeled and numbered terminal strip provides easy connection of external components.

- **Corrosion Inhibitor Emitter:** Inclusion of an industrial corrosion inhibitor emitter shall protect internal components of control panel from corrosion for up to one year and shall be replaceable.

PART III - EXECUTION

A. Control panel shall be mounted using Unistrut posts set in a 12-inch diameter concrete-filled hole, a minimum three (3) feet deep in the subgrade.

B. Electrical connections shall be made according to Manufacturer's recommendations and local codes.

*****END SECTION 15550*****

SECTION 15560
BREAKOUT JUNCTION BOX

PART I – GENERAL

A. Work consists of supply and installation of breakout junction box to isolate electrical connections with a vapor tight barrier between sump riser and control panel, while facilitating removal of pump and sensor for service or replacement.

PART II – MATERIALS

A. Junction box shall be housed in aNEMA 4X fiberglass or stainless steel enclosure with minimum size of 10"x 8"x 6" deep.

B. Unit shall include a labeled terminal strip with appropriately sized connectors for pump power leads and level control sensor conductors.

C. Junction box shall also include:

- Non-metallic cord restraint to seal and secure pump power cord or sensor lead to junction box
- Waterproof exit hub with FNPT connection
- Explosion proof gas seal-off fitting suitable for vertical or horizontal installation with pipe nipple
- Sealing compound to make vapor-tight seal
- Dryer tube and bellows to seal out moisture from level sensor

PART III – INSTALLATION

A. Mount breakout junction box on existing portable connection panel as shown on Drawings.

B. Electrical connections shall be made according to Manufacturer’s recommendations and local codes.

*****END SECTION 15560*****

SECTION 15570
PVC PIPING

PART I GENERAL

A. PVC piping, complete with fittings, jointing material and other accessories shall be furnished and installed where shown on the Construction Drawings, or are required for proper installation and functioning of the piping.

B. The Contractor shall thoroughly review these Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. The submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- PVC pipe and fittings, general
- Double containment piping system
- Flange gaskets
- Bolts, nuts and washers
- Solvent primer
- Solvent cement
- Paint

PART II MATERIALS

A. General PVC pipe shall be Schedule 80 unless noted or specified otherwise herein or on the Construction Drawings and shall conform to ASTM D1785, PVC 1120.

B. Plastic Pipe Compounds The rigid unplasticized compound from which PVC pipe, fittings, and appurtenances shall conform to ASTM D1784, Class 12454B - for polyvinyl chloride.

C. Double Containment Piping System Pipe specified on the Drawings as double-wall pipe shall be a double-containment piping system of uniform materials. Subject to the compliance with requirements, acceptable products include PRO-LOCK PVC Double Containment by Asahi/America, Inc., of Lawrence, Massachusetts, 1-800-343-3618. Double containment piping shall conform to the following:

1. Carrier pipe shall be nominal 2 inches in diameter and containment pipe shall be 4 inches.

2. Annular space must be maintained throughout the pipe, fittings, and all accessories.

3. Supports, guides, etc. for product pipe shall be provided of same resin as product pipe. Supports shall be placed in a manner that a maximum of 0.1" deflection is allowed between supports. Supports shall allow axial movement of product pipe within containment pipe. Supports shall maintain a concentric relationship between product pipe and containment pipe.

4. Anchors shall be provided of same resin and shall be manufactured by same manufacturer as product pipe and containment pipe. Anchors shall be of same wall thickness as product and containment pipe, and must be of unitary construction. Anchors shall be fully pressure rated.

5. Support disks used to centralize fittings shall lock the product (carrier) fitting to the containment fitting. Free-floating fittings are not allowed. Support disks shall be designed to allow for flow in the annular space.

C. Fittings Schedule 80 fittings shall conform to the requirements of ASTM D2467 for socket type joints and shall have a minimum pressure rating of 100 psi at 73°F. Large diameter fittings may be fabricated conforming to the above pressure rating. All double contained flange connections shall consist of a double o-ring flange and a flat- faced flange. The flange design shall provide adequate flow of fluid through the annular space. All flanges shall be of the same resin as the pipe. Consult factory for pressure ratings on double contained flanges

D. Flange Gaskets Blue Guard, non asbestos (or equivalent) full-face gaskets 1/8-inch thick of 45 to 60 durometer (shore "A") hardness are required for flanged joints.

E. Flange Bolting Bolts, washers, and nuts for making up flanged joints on PVC pipe shall be cadmium-plate steel, Type A307.

F. Solvent Primer Socket type connections shall be primed with primer furnished by the supplier of the PVC pipe and fittings.

G. Solvent Cement Socket type connections shall only be joined by heavy duty solvent cement furnished by the supplier of the PVC pipe and fittings, and shall conform to ASTM D2564.

H. Paint Paint on above-ground PVC pipe shall be acrylic water-borne high gloss enamel paint, Pitt-Tech 90-3474 or approved equal. Paint coating shall have a minimum dry thickness of 4 microns (7 microns wet).

PART III EXECUTION

A. Storage Plastic pipe, fittings and appurtenances shall be stored in a flat, horizontal position until ready for installation and protected from direct sunlight for extended periods of time.

B. Joints

1. PVC pipe fittings and appurtenance shall be provided with solvent joints, except where otherwise shown.

2. Install double-containment piping to comply with manufacturer's recommended procedures.

3. All Joining shall be done utilizing a two-step process of primer and cement in accordance with ASTM D2564

4. Prior to installing double containment piping, Manufacturer or Manufacturer's Representative shall be hired by installing firm for on-site training in the assembly, installation, and operation of double-containment systems. This requirement may be waived by Engineer if Contractor presents evidence of installer's prior experience in installation of Manufacturer's double containment piping system.

5. Care shall be exercised in assembling a pipeline with solvent welded joints so that stress on previously made joints is avoided. Handling of the pipe following jointing, such as lowering the assembled pipeline into the trench, shall not occur prior to set times specified in ASTM D2855.

6. All jointing of PVC pipe shall be by pipe and socket fittings. No tapping shall be permitted.

C. Painting and Protection PVC piping installed above ground shall be protected against the effects of ultra violet (UV) light by the application of high gloss water-borne acrylic enamel paint. Paint coating shall have a minimum dry thickness of 4 microns (7 microns wet). The paint shall be applied in accordance with the manufacturer's recommendations.

D. Pressure Testing

1. Testing shall be conducted in accordance with manufacturer's recommendations. Owner's Representative shall be given advance notice of the time of test.

2. The procedure and equipment to be used shall be approved by the Engineer prior to testing any line. Leakage tests shall be performed on all piping after installation and before backfilling where pipe is buried or encased.

3. Product pipe shall be tested hydrostatically to 120 psi per ASME B31.3 part 345 or per local code.

4. The containment piping in double containment systems shall be air tested at 5 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse.

*****END SECTION 15570*****

APPENDIX C

HELP MODEL ANALYSIS

HELP MODEL ANALYSIS

for

CENTRAL MAUI LANDFILL
PHASE III
PUUNENE, HAWAII

Prepared for:

COUNTY OF MAUI
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SOLID WASTE DIVISION

1 Main Plaza
2200 Main Street, Suite 225
Wailuku, Hawaii 96793

Prepared by:

A-Mehr Inc.
23016 Mill Creek Drive
Laguna Hills, California 92653

January 2019

Hydrologic Evaluation of Landfill Performance (HELP) Model
Analysis of Proposed Phase II Slope Improvements
Phase III Disposal Area Design Report
January 2019

1. PROJECT DESCRIPTION

The Phase III area will encompass approximately 16.8 acres of composite lined disposal area located immediately north of the closed Phase II landfill. As a result of the immediate proximity of the existing Phase II landfill, Phase III refuse fill will overlay approximately 11.3 additional acres of the adjacent Phase II slope. The total area to receive refuse fill in the Phase III development is approximately 28.1 acres. See Figure A.

The 11.3 acre area of Phase II that will receive additional refuse fill during the operation of the Phase III disposal area is the north facing slope of the Phase II landfill. The affected Phase II slope is capped with a final closure cover installed in 2007 and presently slopes at an average of 23% to the north and toward the proposed Phase III lined area. The Phase II final closure cover consists of (from top to bottom):

- 0.5-foot low permeability vegetative soil cover,
- Average of 2.4-foot low permeability soil (average of 3.2×10^{-6} cm/s), and
- Foundation layer (minimum 1 foot)

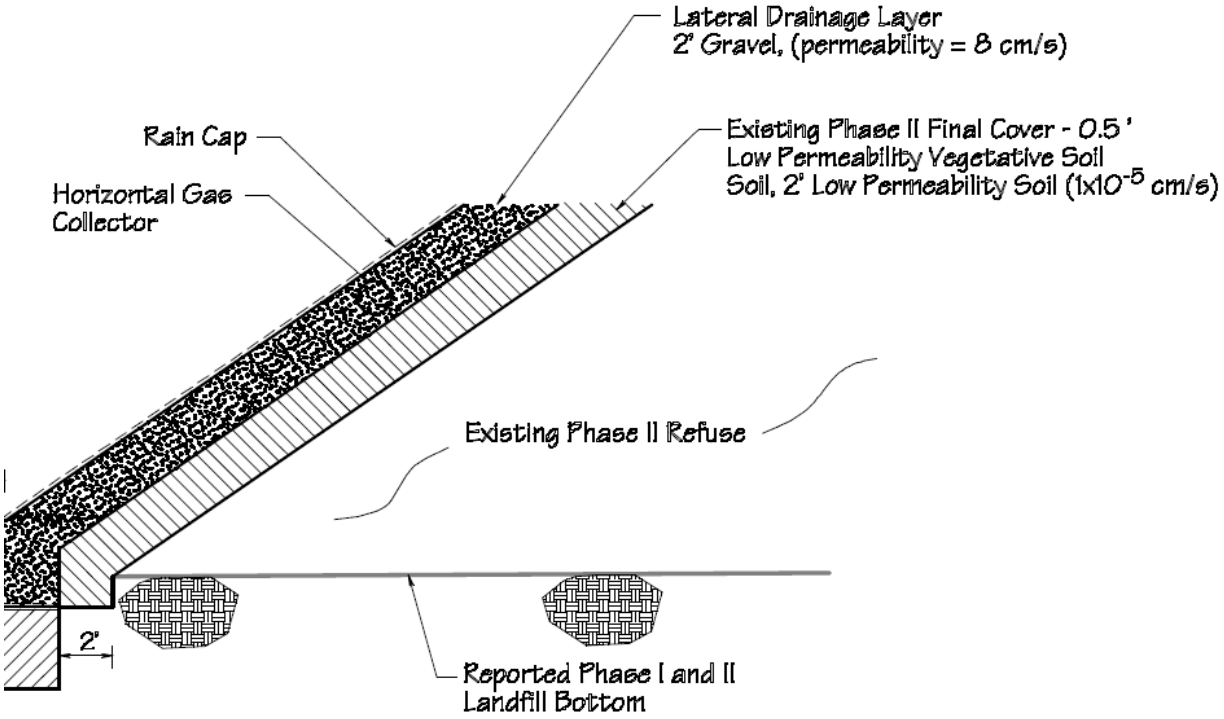
Prior to placement of refuse over the Phase II slope, the County has identified improvements it proposes to make to the existing Phase II slope to improve the conveyance of leachate, that may be generated in the refuse to be placed on the slope, from the Phase II slope to the LCRS system in the adjacent composite lined area of Phase III. The efficient conveyance of leachate off the Phase II slope will provide additional protections to the underlying groundwater resources. The proposed Phase II slope protections are described in the following paragraphs.

To ensure positive drainage of leachate from the Phase II slope to the Phase III LCRS, the existing Phase II slope will be modified to provide for a positive slope in all areas. Most areas of the existing Phase II slope ranges in grade from 25% to 35%, however some areas, such as bench roads, are flatter. Portions of the slope graded at less than 10% will be modified by placement of additional compacted soil fill. The resulting overall slope will average no less than 24%. Figure B illustrates the existing Phase II grades and the proposed slope grade modifications described.

Two feet of compacted low permeability soil, equivalent to the Phase II final cover low permeability soil layer, will be placed over the areas of the slope receiving additional soil fill and subject to any grading earthwork. Along the perimeter of areas receiving additional soil fill, the additional low permeability soil layer will be tied into the low permeability soil

layer of the existing Phase II final cover to provide a continuous low permeability layer across the entire prepared Phase II slope area. The entire prepared Phase II slope, within the Phase III refuse limits, will slope towards the Phase III liner/LCRS where any leachate generated within the overlying refuse fill will be managed.

Above the regraded Phase II slope, a 2-foot thick lateral drainage/protective soil layer, consisting of highly permeable (k = 8 cm/s) crushed rock, will be placed over the 11.3 acres area of the affected Phase II slope. This highly permeable drainage layer in combination with the regraded slope will provide an efficient means to direct and convey any leachate generated within the refuse placed over the Phase II slope to the leachate collection and removal system (LCRS) in the adjacent Phase III lined area where it will be managed. See Figure B (sheet 5) which illustrates the grading modifications associated with the proposed Phase II slope improvements. The detail below illustrates the Phase II slope improvement components in cross-section.



2. HELP MODEL ANALYSIS OF SLOPE IMPROVEMENTS

In definition of "permeability" does not specify a thickness or depth of liner; also synthetic liners are included in definition.

HAR 11-58.1 defines a ~~2-foot thick~~ soil liner with a permeability of 1 x 10^{-7} cm/sec as impermeable. Further, the regulations require leachate head over any liner be maintained at less than 30 centimeters (12 inches). For purposes of performance evaluation and comparison, the percolation rate for a 2-foot thick soil liner (permeability of 1 x 10^{-7}

cm/sec) with a head of 12 inches can be calculated, and that percolation rate is 18.5 cf/acre/day.

The performance of the Phase II slope improvements is analyzed using the HELP Model. To determine the acceptability of the performance of the proposed Phase II slope improvements, the rate of leakage, measured in cubic feet/acre/day (cf/acre/day), is compared to the above noted percolation rate for a 2-foot thick soil liner (permeability of 1×10^{-7} cm/sec).

To provide context and comparison to the benefits provided by the proposed Phase II slope improvements, the performance of the Phase II slope was modeled in two conditions. The first condition modeled is the performance of the existing slope conditions using conservative minimum final cover thickness of 2-foot thick of low permeability soil (1×10^{-5} cm/sec) instead of the average 2.4-foot of low permeability soil (3.2×10^{-6} cm/sec). The second is the performance of the slope with the combination of additional grading and application of the 2-foot thick lateral drainage/protective soil layer using the same conservative minimum final cover thickness and permeability.

The HELP model, using local weather data and project specific input, representing the Phase II refuse, Phase II final cover, proposed slope improvements, Phase III refuse, and Phase III final cover, calculates on a unit acre basis the water balance of the various layers of soil and refuse modeled, leachate head on low permeability layers, and leakage from the base of the landfill.

The HELP model is run to evaluate the slope improvements for two time periods: 1) 10-year landfill operational period; and 2) 30-year landfill post closure period.

The landfill operational period represents the operational period of the landfill before final cover is installed. In the case of Phase III, the operational period is projected to be approximately 10 years.

The post closure period represents the 30-year post closure maintenance period following installation of final cover.

2.1 Model Input

Data required for the HELP model (Visual HELP, Waterloo Hydraulics, Inc.) consist of three general categories: case and surface water settings; landfill profile; and weather.

Weather data was synthetically generated based on input of average monthly historical rainfall data recorded at the Kahului Airport (National Weather Service, 1981 – 2010) and temperature based on the latitude of Central Maui Landfill. See Figure C for historical rainfall data, Kahului Airport.

Tables A through D, Appendix A provide the specific input to the HELP model for the two different time periods and the two different Phase II slope conditions, as previously described.

In 10-year operational period the landfill was assumed to be covered with 12 inches of bare (unvegetated) interim cover soil with an average slope of 30 percent (3 horizontal: 1 vertical slope). Why 30%? Per 4.2 Slope Improvements, avg slope 24%.

In the 30-year post closure period the landfill was assumed to be covered with a final cover consisting of the following from top to bottom:

1. one foot of vegetative cover with a "fair" stand of grass and an average slope of 30% (3 horizontal: 1 vertical slope);
2. two feet of low permeability soil with a hydraulic conductivity of 5.0×10^{-6} cm/sec; and
3. one foot of foundation layer soil (interim cover soil).

Typical and conservative initial moisture content were used for the semi-arid CML location, all other layers in the model used the conservative model default values.

The final moisture content for the waste and soil layers at the end of the 10-year operational phase were used as the initial moisture content for those layers in the 30-year post closure phase and for layers representing the Phase III final cover, the conservative model default values for moisture content were used.

2.2 Unit Acre Model Output Results

The HELP model results for the 10-year operational phase and the 30-year post closure phase for both conditions modeled, existing Phase II slope and Phase II slope with proposed improvements, are summarized in Table 1 and provide a comparison with the percolation rate for an impermeable soil liner as defined in HAR 11-58.1. Model output reports are provided in Appendix B.

The critical item of comparison between the impermeable liner performance and that of the existing Phase II slope and the Phase II slope with the proposed improvements is the model output for the rate of leakage through the base of the Phase II refuse. In both the 10-year operational phase and the 30-year post closure phase and for both the existing Phase II slope and the Phase II slope with the proposed improvements, the rate of leakage through the base of the Phase II refuse was extremely low and substantially lower than the percolation rate for the HAR 11-58.1 impermeable liner; lower by factors ranging from 285 times lower to 1250 times lower.

An additional item of critical comparison between the impermeable liner performance and that of the existing Phase II slope and the Phase II slope with the proposed improvements is the liquid head levels over the impermeable layer. Maximum liquid head on a liner per

regulation is 12 inches. The HELP model results indicate maximum head levels far below the regulatory maximum with values between 0 inches and 0.038 inches as shown in the table.

Table 1 - HELP Model Analysis Results

Period of Model Analysis	Liquid Head on Phase II Final Cover Low Permeability Layer (inches)		Rate of Leakage Through Base of Phase II Refuse (cf/acre/day)		Impermeable Liner - Rate of Percolation (cf/acre/day)	Phase II Slope Improvements Exceed Performance of Impermeable Liner?	Factor by which Phase II Exceeds Impermeable Liner Performance
	Existing Phase II Slope	Phase II Slope with 2' Lateral Drainage/ Protective Layer	Existing Phase II Slope*	Phase II Slope with 2' Lateral Drainage/ Protective Layer			
Operational - 10 Years	0.000	0.000	0.0148	0.0148	18.5	Yes	1250
Post Closure - 30 Years	0.027	0.038	0.2208	0.0649	18.5	Yes	285

* -Please note the existing final cover with no additional improvement also meets the regulatory definition of impermeable liner of 18.5 cf/acre/day.

The model analysis indicates that both the existing Phase II slope and the Phase II slope modified with the proposed improvements will perform in a manner that exceeds the performance an impermeable soil liner as defined in HAR 11-58.1.

FIGURES

GRAPHIC SCALE 1"=60'
0 60 120 180

III-S1
III-S2
III-S3
III-S4
III-S5
GP-1R
GP-2R
GP-10R
MW-2
MW-3
Structural Fill
Proposed Phase III Perimeter Access / Drainage Road
Phase III LCRS Sump
LCRS Trench
2% Min
Proposed Phase III-A Subgrade
Proposed Phase III-B Subgrade
Manhole 4 Leachate Sump
Closed Landfill Phase I & II
Kalialinui Gulch
GATE
ASPH
UB

Legend:
- Existing Grades as of 5/13/18
- Proposed Phase III Liner Grades
- Approximate Landfill Phase Limits
- Prepared Phase II Grades
- Phase III Limits of Refuse Fill
- Proposed Grades
- Approximate Property Line
- GP-6R — Relocated Landfill Gas Probe
- MW-3 — Existing Groundwater Monitoring Well

A-Mehr, Inc.
Central Maui Landfill
Phase III And Related Improvements
Phase III Subgrades & Phase II Prepared Grades

FILENAME: Phase II
DRAWN: KM
CHECKED:
DATE: 12/14/18
SHEET:

Figure A

GRAPHIC SCALE 1"=60'
0 60 120 180

III-S1
III-S2
III-S3
III-S4
III-S5
GP-1R
GP-2R
GP-10R
MW-2
MW-3
Structural Fill
Proposed Phase III Perimeter Access / Drainage Road
Phase III LCRS Sump and Vertical Riser
LCRS Trench
Proposed Phase III-A Liner Grades
Proposed Phase III-B Liner Grades
LCRS Collection Drains
Manhole 4 Leachate Sump
Closed Landfill Phase I & II
Kailalinui Gulch
GATE
ASPH
UB

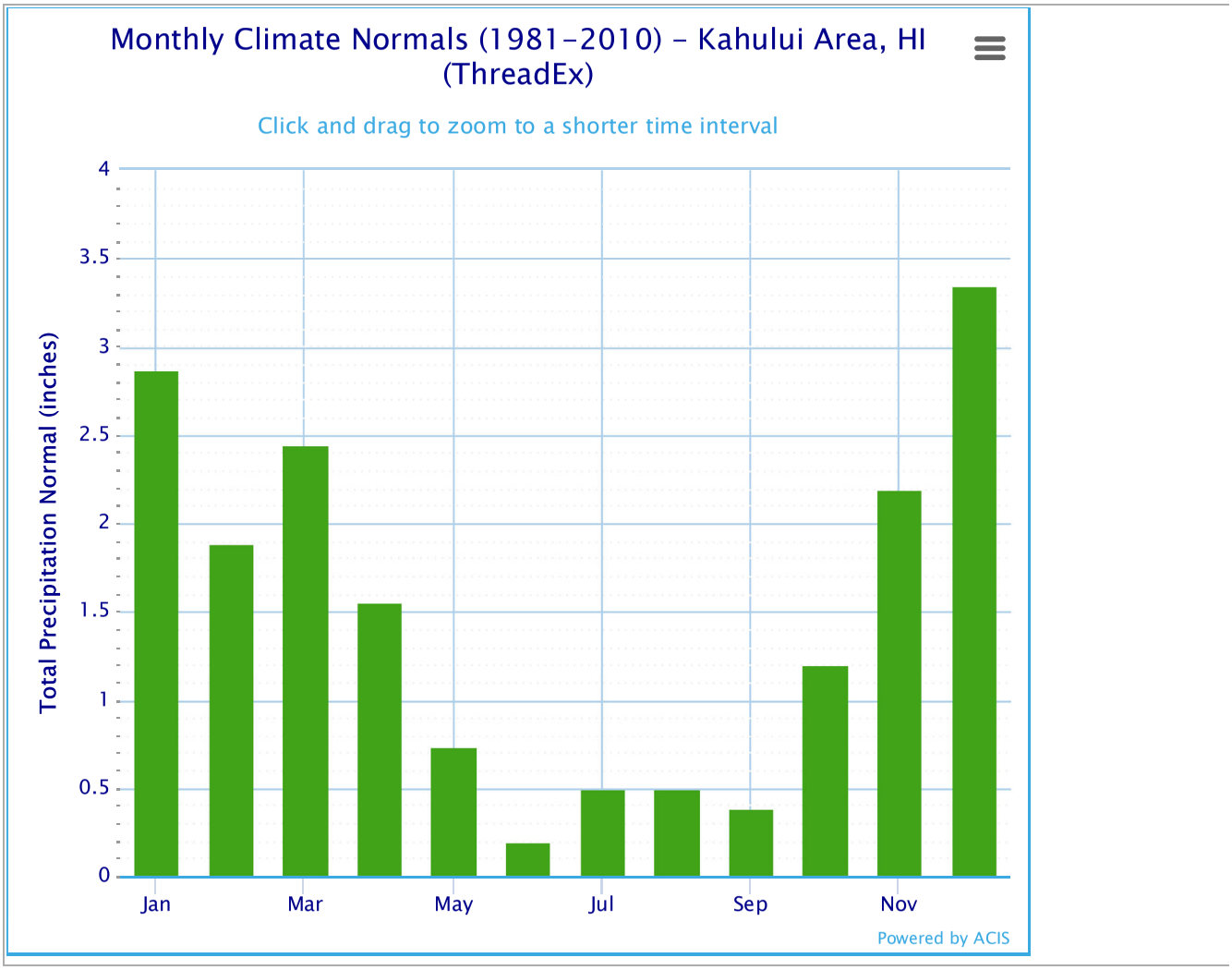
Legend:
- Existing Grades as of 5/13/18
- Prepared Phase II Grades
- Phase III Limits of Refuse Fill
- Liner Grades
- Proposed Grades
- Approximate Property Line
- GP-6R — Relocated Landfill Gas Probe
- MW-3 — Existing Groundwater Monitoring Well

A-Mehr, Inc.
Central Maui Landfill
Phase III And Related Improvements
Phase III LCRS & Liner Grades

FILENAME: Phase III
DRAWN: RM
CHECKED:
DATE: 12/14/18
SHEET:

Figure B

Figure C - Historical Rainfall Data, Kahului Airport



Month	Total Precipitation Normal (inches)
January	2.87
February	1.89
March	2.45
April	1.55
May	0.74
June	0.20
July	0.50
August	0.50
September	0.38
October	1.20
November	2.20
December	3.35
Annual	17.83

Source: National Weather Service
https://w2.weather.gov/climate/xmacis.php?wfo=hnl

DATA USED IN HELP MODEL

APPENDIX A

HELP Model Input Tables

Table A - Model Input: Existing Phase II Slope, 10-Year Operational Period

Layer No.	Layer Name	Layer Data	Existing Phase II Slope
1	Interim Cover		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1.9x10E-4
		Initial Moisture (vol/vol)	0.28
2	Ph III Refuse		
		Thickness (ft)	65
		Slope (%)	30
		Initial Moisture (vol/vol)	0.247
3	Ph II Final Cover		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	1x10E-5
4	Ph II Refuse		
		Thickness (ft)	45
		Slope (%)	22
		Initial Moisture (vol/vol)	0.276
	Case Settings		
		Runoff Method	Model Calculated
		Initial Mositure	User Specified
	Surface Water Settings		
		Runoff Area %	100
		Initial Surface Water	0
		Vegetation Class	Bare Soil

Table B - Model Input: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 10-Year Operational Period

Layer No.	Layer Name	Layer Data	Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer
1	Interim Cover		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1.9x10E-4
		Initial Moisture (vol/vol)	0.28
2	Ph III Refuse		
		Thickness (ft)	65
		Slope (%)	30
		Initial Moisture (vol/vol)	0.247
3	Ph III Gravel Drain Layer		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	8
		Initial Moisture (vol/vol)	0.03
4	Ph II Final Cover		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	1x10E-5
5	Ph II Refuse		
		Thickness (ft)	45
		Slope (%)	22
		Initial Moisture (vol/vol)	0.276
	Case Settings		
		Runoff Method	Model Calculated
		Initial Mositure	User Specified
	Surface Water Settings		
		Runoff Area %	100
		Initial Surface Water	0
		Vegetation Class	Bare Soil

Table C - Model Input: Existing Phase II Slope, 30-Year Post Closure Period

Layer No.	Layer Name	Layer Data	Existing Phase II Slope
1	Final Cover Vegetative Layer		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1.9x10E-4
		Initial Moisture (vol/vol)	0.28
2	Final Cover		
		Thickness (ft)	2
		Slope (%)	30
		K (cm/s)	5x10E-5
3	Interim Cover		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1.9x10E-4
		Initial Moisture (vol/vol)	0.1565
4	Ph III Refuse		
		Thickness (ft)	65
		Slope (%)	30
		Initial Moisture (vol/vol)	0.2531
5	Ph II Final Cover		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	1x10E-5
6	Ph II Refuse		
		Thickness (ft)	45
		Slope (%)	22
		Initial Moisture (vol/vol)	0.276
	Case Settings		
		Runoff Method	Model Calculated
		Initial Mositure	Moisture Values Output from 10-Yr Operational Period Model
	Surface Water Settings		
		Runoff Area %	100
		Initial Surface Water	0
		Vegetation Class	Fair Stand of Grass

Table D - Model Input: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 30-Year Post Closure Period

Layer No.	Layer Name	Layer Data	Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer
1	Final Cover Vegetative Layer		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1.9x10E-4
		Initial Moisture (vol/vol)	0.28
2	Final Cover		
		Thickness (ft)	2
		Slope (%)	30
		K (cm/s)	5x10E-5
3	Interim Cover		
		Thickness (ft)	1
		Slope (%)	30
		K (cm/s)	1x10E-4
		Initial Moisture (vol/vol)	0.1565
4	Ph III Refuse		
		Thickness (ft)	65
		Slope (%)	30
		Initial Moisture (vol/vol)	0.2531
5	Ph III Gravel Drain Layer		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	8
		Initial Moisture (vol/vol)	0.03
6	Ph II Final Cover		
		Thickness (ft)	2
		Slope (%)	22
		K (cm/s)	1x10E-5
7	Ph II Refuse		
		Thickness (ft)	45
		Slope (%)	22
		Initial Moisture (vol/vol)	0.276
	Case Settings		
		Runoff Method	Model Calculated
		Initial Mositure	Moisture Values Output from 10-Yr Operational Period Model
	Surface Water Settings		
		Runoff Area %	100
		Initial Surface Water	0
		Vegetation Class	Fair Stand of Grass

APPENDIX B

HELP Model Summary Output Reports

(Summary output reports provide pages summarizing model input and model output results for the end of period modeled. Output pages for individual year calculations are not included but are available from A-Mehr, Inc. upon request)

Model Input Pages: Existing Phase II Slope, 10-Year Operational Period

```
 ******************************************************************************
 ******************************************************************************
 **                                                  **
 **                                                  **
 **          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:\WHI\VHELP22\data\P2172.VHP\_weather1.dat
 TEMPERATURE DATA FILE:      C:\WHI\VHELP22\data\P2172.VHP\_weather2.dat
 SOLAR RADIATION DATA FILE:  C:\WHI\VHELP22\data\P2172.VHP\_weather3.dat
 EVAPOTRANSPIRATION DATA:    C:\WHI\VHELP22\data\P2172.VHP\_weather4.dat
 SOIL AND DESIGN DATA FILE:  C:\WHI\VHELP22\data\P2172.VHP\I_387668.inp
 OUTPUT DATA FILE:           C:\WHI\VHELP22\data\P2172.VHP\O_387668.prt

 TIME:  11:21     DATE:   1/ 9/2019

*******************************************************************************
    TITLE:  PhIII Refuse & Int Cvr Over Ph II 22% NO GRAVEL

            Ph III Refuse Thickness 65';  Ph I-II Refuse  Thickness 45';
            Initial Moist (85%/95% of default) Ph III = 0.247, Ph II = 0.276
            NO LATERAL DRAINAGE LAYER between Ph I/II Final Cvr & Ph III Refuse
            Kahului Airport Rainfall Data

Output File:  PhIII IntCvr ovr PhII FinCvr-Avg 22%,10yr No gravel
 ******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
           WERE SPECIFIED BY THE USER.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
          THICKNESS               =     30.48   CM
          POROSITY                =      0.5010 VOL/VOL
          FIELD CAPACITY          =      0.2840 VOL/VOL
          WILTING POINT           =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2800 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
               FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  18
          THICKNESS               =   1981.20   CM
          POROSITY                =      0.6710 VOL/VOL
          FIELD CAPACITY          =      0.2920 VOL/VOL
          WILTING POINT           =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2470 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-02 CM/SEC
```

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 99
THICKNESS = 60.96 CM
POROSITY = 0.4750 VOL/VOL
FIELD CAPACITY = 0.3780 VOL/VOL
WILTING POINT = 0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4750 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-04 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1371.60 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2760 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000224000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 30. METERS.

SCS RUNOFF CURVE NUMBER = 92.71
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 25.4 CM
INITIAL WATER IN EVAPORATIVE ZONE = 7.112 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 12.725 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 3.429 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 905.408 CM
TOTAL INITIAL WATER = 905.408 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Kahului HI

STATION LATITUDE = 20.86 DEGREES
MAXIMUM LEAF AREA INDEX = 5.00
START OF GROWING SEASON (JULIAN DATE) = 0
END OF GROWING SEASON (JULIAN DATE) = 365
EVAPORATIVE ZONE DEPTH = 10.0 INCHES
AVERAGE ANNUAL WIND SPEED = 11.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 70.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.87	1.89	2.45	1.55	0.74	0.20
0.50	0.50	0.38	1.20	2.20	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
72.60	72.90	74.40	75.70	77.50	79.10
80.10	81.00	80.60	79.50	76.60	74.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI
AND STATION LATITUDE = 20.86 DEGREES

Model Output Pages: Existing Phase II Slope, 10-Year Operational Period

```
********************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH   10
--------------------------------------------------------------------------------

                 JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                 -------  -------  -------  -------  -------  -------
 PRECIPITATION
 -------------
  TOTALS            1.76     2.05     1.94     1.18     1.08     0.16
                    0.61     0.43     0.39     1.42     2.56     3.51

  STD. DEVIATIONS   0.74     1.37     0.72     0.78     0.61     0.11
                    0.33     0.20     0.19     0.69     1.28     1.57

 RUNOFF
 ------
  TOTALS           0.067    0.084    0.148    0.070    0.001    0.000
                   0.000    0.000    0.001    0.020    0.157    0.361

  STD. DEVIATIONS  0.069    0.114    0.202    0.146    0.003    0.000
                   0.000    0.000    0.002    0.033    0.193    0.379

 EVAPOTRANSPIRATION
 ------------------
  TOTALS           1.939    2.119    1.832    1.185    1.013    0.253
                   0.604    0.419    0.403    1.375    2.230    2.474

  STD. DEVIATIONS  0.869    0.908    0.613    0.643    0.588    0.176
                   0.331    0.192    0.192    0.644    1.112    0.755

 PERCOLATION/LEAKAGE THROUGH LAYER  3
 -------------------------------------
  TOTALS           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

 PERCOLATION/LEAKAGE THROUGH LAYER  4
 -------------------------------------
  TOTALS           0.0015   0.0000   0.0000   0.0000   0.0000   0.0000
                   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

  STD. DEVIATIONS  0.0047   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         0.0000   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

********************************************************************************
```

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES		CU. FEET	PERCENT
PRECIPITATION	17.09	(1.156)	62020.8	100.00
RUNOFF	0.910	(0.4913)	3302.39	5.325
EVAPOTRANSPIRATION	15.846	(1.2534)	57519.98	92.743
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.00000	(0.00000)	0.000	0.00000
AVERAGE HEAD ON TOP OF LAYER 3	0.000	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00149	(0.00472)	5.416	0.00873
CHANGE IN WATER STORAGE	0.329	(0.7474)	1193.04	1.924

****
****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	1.78	6461.25917	3570007
RUNOFF	0.651	2364.78242	3460008
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000000	0.00000	0
AVERAGE HEAD ON TOP OF LAYER 3	0.000		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.014921	54.16135	10001
SNOW WATER	0.00	0.0000	0
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3475		
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1350		

****

_
****

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	1.8774	0.1565
2	197.4441	0.2531
3	11.4000	0.4750
4	149.0251	0.2760
SNOW WATER	0.000	

****
****

Model Input: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 10-Year Operational Period

```
 ******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **          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:\WHI\VHELP22\data\P1298.VHP\_weather1.dat
 TEMPERATURE DATA FILE:      C:\WHI\VHELP22\data\P1298.VHP\_weather2.dat
 SOLAR RADIATION DATA FILE:  C:\WHI\VHELP22\data\P1298.VHP\_weather3.dat
 EVAPOTRANSPIRATION DATA:    C:\WHI\VHELP22\data\P1298.VHP\_weather4.dat
 SOIL AND DESIGN DATA FILE:  C:\WHI\VHELP22\data\P1298.VHP\I_386620.inp
 OUTPUT DATA FILE:           C:\WHI\VHELP22\data\P1298.VHP\O_386620.prt

 TIME:  11:38     DATE:   1/ 9/2019


 ******************************************************************************
     TITLE:  Ph III MSW, Gravel & Int Cvr Overlay of Ph II 22%

               Ph III Refuse Thickness 65';  Ph I-II Refuse  Thickness 45';
              Initial Moist for 10 yr run (85%/95% of default) Ph III = 0.247, Ph II = 0.276
              2' LATERAL DRAINAGE LAYER (k = 8 cm/s) between Ph I/II Final Cvr & Ph III Refuse
              Kahului Airport Rainfall Data

 Output File:  PhIII IntCvr ovr PhII FinCvr - Avg 22% slope,10 yr,Gravel
 ******************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
            WERE SPECIFIED BY THE USER.

                          LAYER  1        daily cover?
                          --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   9
            THICKNESS               =     30.48   CM
            POROSITY                =      0.5010 VOL/VOL
            FIELD CAPACITY          =      0.2840 VOL/VOL
            WILTING POINT           =      0.1350 VOL/VOL
            INITIAL SOIL WATER CONTENT =      0.2800 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
           NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2        SW Ph 3
                          --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER  18
            THICKNESS               =   1981.20   CM
            POROSITY                =      0.6710 VOL/VOL
            FIELD CAPACITY          =      0.2920 VOL/VOL
            WILTING POINT           =      0.0770 VOL/VOL
            INITIAL SOIL WATER CONTENT =      0.2470 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-02 CM/SEC
```

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 90
THICKNESS = 60.96 CM
POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0300 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 8.00000000000 CM/SEC
SLOPE = 22.00 PERCENT
DRAINAGE LENGTH = 121.9 METERS

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 99
THICKNESS = 60.96 CM
POROSITY = 0.4750 VOL/VOL
FIELD CAPACITY = 0.3780 VOL/VOL
WILTING POINT = 0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4750 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-04 CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER SW Ph 2
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1371.60 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2760 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000224000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE
GROUND CONDITIONS, A SURFACE SLOPE OF 30.% AND
A SLOPE LENGTH OF 30. METERS.

SCS RUNOFF CURVE NUMBER = 92.71
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 25.4 CM
INITIAL WATER IN EVAPORATIVE ZONE = 7.112 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 12.725 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 3.429 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 907.237 CM
TOTAL INITIAL WATER = 907.237 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Kahului HI

STATION LATITUDE = 20.86 DEGREES
MAXIMUM LEAF AREA INDEX = 5.00
START OF GROWING SEASON (JULIAN DATE) = 0
END OF GROWING SEASON (JULIAN DATE) = 365
EVAPORATIVE ZONE DEPTH = 10.0 INCHES
AVERAGE ANNUAL WIND SPEED = 11.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 70.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.87	1.89	2.45	1.55	0.74	0.20
0.50	0.50	0.38	1.20	2.20	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
72.60	72.90	74.40	75.70	77.50	79.10
80.10	81.00	80.60	79.50	76.60	74.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI
AND STATION LATITUDE = 20.86 DEGREES

Model Output Pages: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 10-Year Operational Period

```
********************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH   10
 ------------------------------------------------------------------------------

                  JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                  -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
   TOTALS            1.76     2.05     1.94     1.18     1.08     0.16
                     0.61     0.43     0.39     1.42     2.56     3.51

   STD. DEVIATIONS   0.74     1.37     0.72     0.78     0.61     0.11
                     0.33     0.20     0.19     0.69     1.28     1.57

  RUNOFF
  ------
   TOTALS           0.067    0.084    0.148    0.070    0.001    0.000
                    0.000    0.000    0.001    0.020    0.157    0.361

   STD. DEVIATIONS  0.069    0.114    0.202    0.146    0.003    0.000
                    0.000    0.000    0.002    0.033    0.193    0.379

  EVAPOTRANSPIRATION
  ------------------
   TOTALS           1.939    2.119    1.832    1.185    1.013    0.253
                    0.604    0.419    0.403    1.375    2.230    2.474

   STD. DEVIATIONS  0.869    0.908    0.613    0.643    0.588    0.176
                    0.331    0.192    0.192    0.644    1.112    0.755

  LATERAL DRAINAGE COLLECTED FROM LAYER  3
  ----------------------------------------
   TOTALS           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  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

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  -------------------------------------
   TOTALS           0.0015   0.0000   0.0000   0.0000   0.0000   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

   STD. DEVIATIONS  0.0047   0.0000   0.0000   0.0000   0.0000   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000


 ------------------------------------------------------------------------------
        AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
 ------------------------------------------------------------------------------

  DAILY AVERAGE HEAD ON TOP OF LAYER  4
  -------------------------------------
   AVERAGES         0.0000   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

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	17.09 (1.156)	62020.8	100.00
RUNOFF	0.910 (0.4913)	3302.39	5.325
EVAPOTRANSPIRATION	15.846 (1.2534)	57519.98	92.743
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.00000 (0.00000)	0.000	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000 (0.00000)	0.000	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00149 (0.00472)	5.416	0.00873
CHANGE IN WATER STORAGE	0.329 (0.7474)	1193.04	1.924

****

_

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	1.78	6461.25917	3570007
RUNOFF	0.651	2364.78242	3460008
DRAINAGE COLLECTED FROM LAYER 3	0.00000	0.00000	0
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00000	0
AVERAGE HEAD ON TOP OF LAYER 4	0.000		
MAXIMUM HEAD ON TOP OF LAYER 4	0.000		
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.014921	54.16135	10001
SNOW WATER	0.00	0.0000	0
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3475		
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1350		

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	1.8774	0.1565
2	197.4441	0.2531
3	0.7200	0.0300
4	11.4000	0.4750
5	149.0251	0.2760

SNOW WATER 0.000

****
****

Model Input Pages: Existing Phase II Slope, 30-Year Post Closure Period

```
 ******************************************************************************
 ******************************************************************************
 **                                                  **
 **                                                  **
 **          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:\WHI\VHELP22\data\P2278.VHP\_weather1.dat
 TEMPERATURE DATA FILE:      C:\WHI\VHELP22\data\P2278.VHP\_weather2.dat
 SOLAR RADIATION DATA FILE:  C:\WHI\VHELP22\data\P2278.VHP\_weather3.dat
 EVAPOTRANSPIRATION DATA:    C:\WHI\VHELP22\data\P2278.VHP\_weather4.dat
 SOIL AND DESIGN DATA FILE:  C:\WHI\VHELP22\data\P2278.VHP\I_387795.inp
 OUTPUT DATA FILE:           C:\WHI\VHELP22\data\P2278.VHP\O_387795.prt

 TIME:  11:30     DATE:   1/ 9/2019

 ******************************************************************************
    TITLE:  PhIII Refuse & Fin Cvr Overl PhII 22% NO GRAVEL

            Ph III Refuse Thickness 65';  Ph I-II Refuse  Thickness 45';
            Initial Moist for 10 yr run (85%/95% of default) Ph III = 0.247, Ph II = 0.276
            NO LATERAL DRAINAGE LAYER between Ph I/II Final Cvr & Ph III Refuse
            Kahului Airport Rainfall Data

Output File:  PhIII FinCvr ovr PhII FinCvr-Avg 22%,30yr No gravel
 ******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
           WERE SPECIFIED BY THE USER.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
          THICKNESS               =    30.48   CM
          POROSITY                =     0.5010 VOL/VOL
          FIELD CAPACITY          =     0.2840 VOL/VOL
          WILTING POINT           =     0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =     0.2800 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   = 0.190000000000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
               FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  88
          THICKNESS               =    60.96   CM
          POROSITY                =     0.4750 VOL/VOL
          FIELD CAPACITY          =     0.3780 VOL/VOL
          WILTING POINT           =     0.2650 VOL/VOL
          INITIAL SOIL WATER CONTENT =     0.4750 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   = 0.500000000000E-05 CM/SEC
```

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 9
THICKNESS = 30.48 CM
POROSITY = 0.5010 VOL/VOL
FIELD CAPACITY = 0.2840 VOL/VOL
WILTING POINT = 0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1565 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.190000000000E-03 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1981.20 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2531 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-02 CM/SEC

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 99
THICKNESS = 60.96 CM
POROSITY = 0.4750 VOL/VOL
FIELD CAPACITY = 0.3780 VOL/VOL
WILTING POINT = 0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4750 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-04 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1371.60 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2760 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000224000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 30.%
AND A SLOPE LENGTH OF 0. METERS.

SCS RUNOFF CURVE NUMBER = 0.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 25.4 CM

INITIAL WATER IN EVAPORATIVE ZONE = 7.112 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 12.725 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 3.429 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 951.220 CM
TOTAL INITIAL WATER = 951.220 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Kahului HI

STATION LATITUDE = 20.86 DEGREES
MAXIMUM LEAF AREA INDEX = 5.00
START OF GROWING SEASON (JULIAN DATE) = 0
END OF GROWING SEASON (JULIAN DATE) = 365
EVAPORATIVE ZONE DEPTH = 10.0 INCHES
AVERAGE ANNUAL WIND SPEED = 11.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 70.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.87	1.89	2.45	1.55	0.74	0.20
0.50	0.50	0.38	1.20	2.20	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
72.60	72.90	74.40	75.70	77.50	79.10
80.10	81.00	80.60	79.50	76.60	74.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Kahului HI
AND STATION LATITUDE = 20.86 DEGREES

Model Output Pages: Existing Phase II Slope, 30-Year Post Closure Period

```
 ******************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH   30
 ------------------------------------------------------------------------------

                  JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                  -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
   TOTALS            2.62     1.56     2.20     1.33     0.82     0.23
                     0.55     0.38     0.41     1.23     2.33     3.36

   STD. DEVIATIONS   1.37     1.09     0.95     0.77     0.55     0.18
                     0.27     0.24     0.20     0.57     1.07     1.78

  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            2.324    1.981    2.023    1.463    0.838    0.280
                     0.543    0.388    0.421    1.181    2.133    2.327

   STD. DEVIATIONS   0.878    0.978    0.821    0.829    0.541    0.190
                     0.260    0.251    0.197    0.561    0.919    0.978

  PERCOLATION/LEAKAGE THROUGH LAYER  2
  -------------------------------------
   TOTALS            0.5631   0.0767   0.0331   0.0463   0.0016   0.0000
                     0.0000   0.0000   0.0000   0.0004   0.0168   0.4354

   STD. DEVIATIONS   0.9360   0.3179   0.1750   0.1585   0.0088   0.0000
                     0.0001   0.0000   0.0000   0.0017   0.0425   0.5543

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  -------------------------------------
   TOTALS            0.0620   0.0205   0.0000   0.0153   0.0000   0.0000
                     0.0000   0.0000   0.0000   0.0000   0.0062   0.0070

   STD. DEVIATIONS   0.2042   0.0862   0.0000   0.0829   0.0000   0.0000
                     0.0000   0.0000   0.0000   0.0000   0.0340   0.0384

  PERCOLATION/LEAKAGE THROUGH LAYER  6
  -------------------------------------
   TOTALS            0.0117   0.0026   0.0000   0.0072   0.0000   0.0000
                     0.0000   0.0000   0.0000   0.0000   0.0000   0.0008

   STD. DEVIATIONS   0.0386   0.0120   0.0000   0.0393   0.0000   0.0000
                     0.0000   0.0000   0.0000   0.0000   0.0000   0.0042


 ------------------------------------------------------------------------------
          AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
 ------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  2
  -------------------------------------
   AVERAGES          0.2510   0.0117   0.0102   0.0080   0.0000   0.0000
                     0.0000   0.0000   0.0000   0.0000   0.0008   0.1159

   STD. DEVIATIONS   0.6776   0.0602   0.0559   0.0390   0.0002   0.0000
```

0.0000 0.0000 0.0000 0.0000 0.0033 0.2260

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES 0.0006 0.0002 0.0000 0.0002 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0001 0.0001

STD. DEVIATIONS 0.0021 0.0010 0.0000 0.0008 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0004 0.0004

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	17.04 (2.667)	61870.8	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	15.904 (2.3597)	57729.79	93.307
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.17340 (0.96189)	4259.337	6.88424
AVERAGE HEAD ON TOP OF LAYER 2	0.033 (0.056)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.11100 (0.29188)	402.909	0.65121
AVERAGE HEAD ON TOP OF LAYER 5	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.02221 (0.06053)	80.607	0.13028
CHANGE IN WATER STORAGE	1.119 (1.1336)	4060.40	6.563

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	2.70	9800.78638	3390013
RUNOFF	0.000	0.00000	0
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.232861	845.26582	230015
AVERAGE HEAD ON TOP OF LAYER 2	8.860		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.091814	333.27916	230027
AVERAGE HEAD ON TOP OF LAYER 5	0.027		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.052091	189.08685	280027
SNOW WATER	0.00	0.0000	0

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4431

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1350

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.3820	0.1985
2	11.4000	0.4750
3	3.4080	0.2840
4	227.7600	0.2920
5	11.4000	0.4750
6	151.7037	0.2809

SNOW WATER 0.000

****
****

Model Input: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 30-Year Post Closure Period

```
 ******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **          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:\WHI\VHELP22\data\P1494.VHP\_weather1.dat
 TEMPERATURE DATA FILE:      C:\WHI\VHELP22\data\P1494.VHP\_weather2.dat
 SOLAR RADIATION DATA FILE:  C:\WHI\VHELP22\data\P1494.VHP\_weather3.dat
 EVAPOTRANSPIRATION DATA:    C:\WHI\VHELP22\data\P1494.VHP\_weather4.dat
 SOIL AND DESIGN DATA FILE:  C:\WHI\VHELP22\data\P1494.VHP\I_386855.inp
 OUTPUT DATA FILE:           C:\WHI\VHELP22\data\P1494.VHP\O_386855.prt

 TIME:  11:43     DATE:   1/ 9/2019

 ******************************************************************************
    TITLE:  Ph III MSW, Gravel & Fin Cvr Overlay of Ph II 22%

            Ph III Refuse Thickness 65';  Ph I-II Refuse  Thickness 45';
            Initial Moist for 10 yr run (85%/95% of default) Ph III = 0.247, Ph II = 0.276
            NO LATERAL DRAINAGE LAYER between Ph I/II Final Cvr & Ph III Refuse
            Kahului Airport Rainfall Data

Output File:  PhIII FinCvr ovr PhII FinCvr-Avg 22%,30yr,Gravel
 ******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
           WERE SPECIFIED BY THE USER.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
          THICKNESS               =    30.48   CM
          POROSITY                =     0.5010 VOL/VOL
          FIELD CAPACITY          =     0.2840 VOL/VOL
          WILTING POINT           =     0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =     0.2800 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
               FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  88
          THICKNESS               =    60.96   CM
          POROSITY                =     0.4750 VOL/VOL
          FIELD CAPACITY          =     0.3780 VOL/VOL
          WILTING POINT           =     0.2650 VOL/VOL
          INITIAL SOIL WATER CONTENT =     0.4750 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.500000000000E-05 CM/SEC
```

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 9
THICKNESS = 30.48 CM
POROSITY = 0.5010 VOL/VOL
FIELD CAPACITY = 0.2840 VOL/VOL
WILTING POINT = 0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1565 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.190000000000E-03 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1981.20 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2531 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-02 CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 90
THICKNESS = 60.96 CM
POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0300 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 8.00000000000 CM/SEC
SLOPE = 22.00 PERCENT
DRAINAGE LENGTH = 121.9 METERS

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 99
THICKNESS = 60.96 CM
POROSITY = 0.4750 VOL/VOL
FIELD CAPACITY = 0.3780 VOL/VOL
WILTING POINT = 0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4750 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000000000E-04 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18
THICKNESS = 1371.60 CM
POROSITY = 0.6710 VOL/VOL
FIELD CAPACITY = 0.2920 VOL/VOL
WILTING POINT = 0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2760 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000224000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 0. METERS.

SCS RUNOFF CURVE NUMBER = 0.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 25.4 CM
INITIAL WATER IN EVAPORATIVE ZONE = 7.112 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 12.725 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 3.429 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 953.049 CM
TOTAL INITIAL WATER = 953.049 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM Kahului HI

STATION LATITUDE = 20.86 DEGREES
MAXIMUM LEAF AREA INDEX = 5.00
START OF GROWING SEASON (JULIAN DATE) = 0
END OF GROWING SEASON (JULIAN DATE) = 365
EVAPORATIVE ZONE DEPTH = 10.0 INCHES
AVERAGE ANNUAL WIND SPEED = 11.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 70.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.87	1.89	2.45	1.55	0.74	0.20
0.50	0.50	0.38	1.20	2.20	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR Kahului HI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
72.60	72.90	74.40	75.70	77.50	79.10
80.10	81.00	80.60	79.50	76.60	74.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR Kahului HI AND STATION LATITUDE = 20.86 DEGREES

Model Output Pages: Regraded Phase II Slope w/ 2' Lateral Drainage/Protective Soil Layer, 30-Year Post Closure Period

```
 ******************************************************************************

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH   30
 ------------------------------------------------------------------------------

                  JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                  -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
   TOTALS            2.62     1.56     2.20     1.33     0.82     0.23
                     0.55     0.38     0.41     1.23     2.33     3.36

   STD. DEVIATIONS   1.37     1.09     0.95     0.77     0.55     0.18
                     0.27     0.24     0.20     0.57     1.07     1.78

  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           2.324    1.981    2.023    1.463    0.838    0.280
                    0.543    0.388    0.421    1.181    2.133    2.327

   STD. DEVIATIONS  0.878    0.978    0.821    0.829    0.541    0.190
                    0.260    0.251    0.197    0.561    0.919    0.978

  PERCOLATION/LEAKAGE THROUGH LAYER  2
  -------------------------------------
   TOTALS           0.5631   0.0767   0.0331   0.0463   0.0016   0.0000
                    0.0000   0.0000   0.0000   0.0004   0.0168   0.4354

   STD. DEVIATIONS  0.9360   0.3179   0.1750   0.1585   0.0088   0.0000
                    0.0001   0.0000   0.0000   0.0017   0.0425   0.5543

  LATERAL DRAINAGE COLLECTED FROM LAYER  5
  -----------------------------------------
   TOTALS           0.0245   0.0219   0.0001   0.0062   0.0003   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0013   0.0019

   STD. DEVIATIONS  0.1055   0.0852   0.0004   0.0340   0.0018   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0073   0.0084

  PERCOLATION/LEAKAGE THROUGH LAYER  6
  -------------------------------------
   TOTALS           0.0166   0.0192   0.0017   0.0066   0.0022   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0023   0.0046

   STD. DEVIATIONS  0.0576   0.0586   0.0054   0.0353   0.0118   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0124   0.0174

  PERCOLATION/LEAKAGE THROUGH LAYER  7
  -------------------------------------
   TOTALS           0.0018   0.0041   0.0000   0.0000   0.0000   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0000   0.0006

   STD. DEVIATIONS  0.0056   0.0188   0.0000   0.0000   0.0000   0.0000
                    0.0000   0.0000   0.0000   0.0000   0.0000   0.0034
```

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	0.2510	0.0117	0.0102	0.0080	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0008	0.1159
STD. DEVIATIONS	0.6776	0.0602	0.0559	0.0390	0.0002	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0033	0.2260

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0004	0.0005	0.0000	0.0001	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
STD. DEVIATIONS	0.0017	0.0016	0.0001	0.0008	0.0001	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0002	0.0003

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	17.04 (2.667)	61870.8	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	15.904 (2.3597)	57729.79	93.307
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.17340 (0.96189)	4259.337	6.88424
AVERAGE HEAD ON TOP OF LAYER 2	0.033 (0.056)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.05630 (0.15827)	204.354	0.33029
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.05310 (0.13010)	192.747	0.31153
AVERAGE HEAD ON TOP OF LAYER 6	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00653 (0.02000)	23.692	0.03829
CHANGE IN WATER STORAGE	1.078 (1.1580)	3912.96	6.324

****

_

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	2.70	9800.78638	3390013
RUNOFF	0.000	0.00000	0
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.232861	845.26582	230015
AVERAGE HEAD ON TOP OF LAYER 2	8.860		
DRAINAGE COLLECTED FROM LAYER 5	0.09211	334.33842	300027
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.039401	143.02097	390026
AVERAGE HEAD ON TOP OF LAYER 6	0.038		
MAXIMUM HEAD ON TOP OF LAYER 6	0.008		
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.021498	78.03659	380026
SNOW WATER	0.00	0.0000	0
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4431		
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1350		

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****
****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.3820	0.1985
2	11.4000	0.4750
3	3.4080	0.2840
4	227.7600	0.2920
5	0.7680	0.0320
6	11.4000	0.4750
7	150.4372	0.2786
SNOW WATER	0.000	

****
****

APPENDIX D

SLOPE STABILITY REPORT

SLOPE STABILITY ANALYSIS

for

CENTRAL MAUI LANDFILL
PHASE III
PUUNENE, HAWAII

Prepared for:

COUNTY OF MAUI
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SOLID WASTE DIVISION

1 Main Plaza
2200 Main Street, Suite 225
Wailuku, Hawaii 96793

Prepared by:

A-Mehr Inc.
23016 Mill Creek Drive
Laguna Hills, California 92653

January 2019

Slope Stability Analysis
Central Maui Landfill – Phases III
January 2019

Introduction

Central Maui Landfill (CML) is located within a "seismic impact zone", defined by Hawaii Administrative Rules (HAR) Section 11-58.1-13(e), as an area with a ten percent or greater probability of experiencing a horizontal acceleration in lithified earth material, due to seismic shaking, of more than 0.10 g in a 250 year period.

The United States Geological Survey (USGS) has classified the island of Maui in UBC Seismic Zone 2B, defined as having a ten percent probability of exceeding a peak ground acceleration of 0.15 g in 50 years. (USGS, 2004a) USGS earthquake hazard maps estimate the peak horizontal ground acceleration in central Maui to be 0.36 g with a 2% probability of occurrence in 50 years (See Figure 1). A probability of exceedance of 2% in 50 years is approximately equivalent to a probability of 10% in 250 years (USGS, 2004b), and represents an event expected to occur one time in approximately 2,400 years (USGS, 1996).

HAR 1.58.1-13(e) prohibits municipal solid waste landfills to be constructed or expanded in a seismic impact zone unless the landfill operator or owner demonstrates that the containment structures of the landfill are designed to withstand the maximum horizontal acceleration due to an earthquake. A-Mehr, Inc. has prepared the following analysis to make the required demonstration.

Methodology

A-Mehr, Inc. used the slope stability analysis computer program STABL5M as well as STED (which is a pre- and post-processor program for data input and output) to compute the static factor of safety and yield acceleration. The program uses the Modified Bishop and Modified Janbu methods, to determine the location of the lowest factor of safety for failure planes through the liner system for static and pseudostatic conditions.

The analysis is based on a gross slope stability evaluation of the landfill at the time when the landfill has reached its maximum permitted elevation, with design final slope gradients generally 3:1 (horizontal to vertical), and no steeper than 2.5:1 (horizontal to vertical).

Five critical cross-sections were developed for analysis, located as shown on Figures 1, and 2 on site plans displaying Phase III landfill liner grades existing final cover, and schematic grades of the refuse bottom in Phases I and II, and proposed final refuse over Phase III, which blend into the adjacent Phases I and II area. These sections, designated as III-S1, III-S2, III-S3, III-S4, and III-S5, show maximum thickness of refuse over the liner system roughly on the order of 70 to 170 feet.

The analysis was conducted according to procedures specified in the document "RCRA Subtitle D (248) Seismic Design Guidance for Municipal Solid Waste Facilities (U.S. Environmental

Protection Agency, April 1995). The document provides a straightforward procedure for evaluating the seismic stability[1] of refuse slopes, as follows:

- Establish cross-sections and assign appropriate shear strength parameters.
- Conduct static stability analyses, using appropriate programs to search for the most critical locations in the cross-section to determine the lowest static factor of safety.
- Determine the seismic coefficient, k_s. The generally recommended value for k_s is 50% of the peak horizontal acceleration during the design earthquake (USAPE, 1995).
- Conduct pseudo-static stability analyses of the most critical locations for each cross-section, applying a horizontal load equivalent to the selected seismic coefficient k_s.
- Based on Newmark-type slope material model for seismic analyses, if the resulting pseudo-static factor of safety is greater than 1.0, or the corresponding yield acceleration, K_y, is greater and the applied horizontal acceleration, K_s, there are no seismically-induced permanent slope displacements for the design earthquake event, and the seismic stability analysis is complete.

Input Data

The analysis requires shear strength properties to be assigned to each material in the system. Table 1 lists the components forming the liner–waste system in the Phase III. Liner components are the essentially same on the floor and side slopes, except for the presence of leachate collection gravel media on the floor. Table 2 lists the properties for each component and interface, including the existing final cover soil over the Phase II area.

The seismic coefficient used in the pseudo-static stability analysis is 50% of the peak horizontal acceleration as recommended by USEPA (1995), and the design earthquake is 0.5 x 0.36 = 0.18g.

Table 1
System Components – From Bottom to Top

Prepared subgrade
Two (2) feet of low permeability soil liner
80 mil HDPE textured (both sides) geomembrane
16 ounce/square yard nonwoven geotextile
12 inches leachate collection sand or gravel
16 ounce/square yard nonwoven geotextile
2 ft. sandy clay soil (operations/protecting layer)
Solid waste

Analyses of gross stability of landfill slopes, including the liner system, and the existing Phase II final cover were conducted for the most critical conditions. These analyses evaluated the cross-sections illustrated on Figure 3, with shear strength properties typical of solid waste, the soil, liner, and existing final cover materials present at the landfill, including a refuse mass unit weight of 65 pounds per cubic foot (pcf) based on site-specific waste compaction and soil use data for CML.

Appendix C presents the data and calculations used to estimate the site-specific refuse mass unit weight of 65 pcf. Table 2 summarizes the input values for the stability analyses.

[1] Seismic stability as evaluated in this report refers to stability against potential movements of significant volumes of refuse or soil, as distinguished from minor slippage of surface materials.

Table 2
Shear Strength Properties for Gross Slope Stability Analysis

Material	Friction angle (degrees)	Cohesion (lb./sq. ft.)	Unit Weight (lb./cu. ft.)
Natural Subgrade (Rock)	45	2000	140
Low-permeability bottom and side-slope soil liner, as well as structural fill against quarry walls	25	250	120
Solid Waste	33	0	65
Liner Interface System Low permeability soil liner vs. textured HDPE liner interface	18	0	100
Phase II Final Cover Low permeability soil	18	0	100

Results

The computer output sheets for the STABL5M stability analyses are presented in Appendix A. The results are summarized in the following discussion.

Static Slope Stability:

Each of the Five cross-sections was evaluated for gross (or deep-seated) slope stability using the material properties listed in Table 2. The liner system was assigned the properties of the most critical interface, the low permeability soil liner / textured HDPE interface, and the Phase II final cover materials.

Cross-sections analyzed were determined to have computed static factors of safety (FS) equal to or greater than 1.5 for all cases. As shown in Table 3, the lowest FS determined using wedge [W] type of potential sliding surfaces (including weakest bottom and slide-slope liner interface elements), as well as circular [C] surfaces, for each cross section was:

Cross-section III-S1 2.58 [W], 3.20 [C]
Cross-section III-S2 2.16 [W], 2.31 [C]
Cross-section III-S3 2.58 [W], 2.69 [C]
Cross-section III-S4 2.03 [W], 2.28 [C]
Cross-section III-S5 2.68 [W], 3.28 [C]

Pseudostatic Stability Analysis:

All cross-sections were determined to have pseudo-static factors of safety (FS) in excess of 1.0 when analyzed using the seismic coefficient k_s = 0.18g.

As shown in Table 3, the lowest seismic FS values for each cross-section are:

Cross-section III-S1 1.25 [W], 1.72 [C]
Cross-section III-S2 1.13 [W], 1.34 [C]
Cross-section III-S3 1.25 [W], 1.48 [C]
Cross-section III-S4 1.11 [W], 1.31 [C]
Cross-section III-S5 1.26 [W], 1.66 [C]

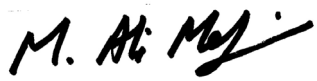
Table 3
Summary of Gross Slope Stability Analysis Results - Liner System
Static and Pseudo-Static Factors of Safety and Yield Acceleration

Cross Section	Analysis Type	Static Factor of Safety FS	Pseudo-Static PSFS (for 0.18g)	Yield Acceleration, Ky	Search Area
III-S1	Static, W	2.58	1.32	0.29	≈ 215-845' liner
	Static, C	3.20	1.73	0.44	W 3:1 (H:V) Slope
	Static, W	2.78	1.25	0.26	≈ 455-1085' liner
		2.82	1.32	0.28	≈ 265-455' liner
		3.60	1.69	0.39	≈ 200-265' liner
	Static, C	3.38	1.72	0.42	E 3:1 (H:V) Slope
III-S2	Static, W	2.61	1.47	0.36	≈ 365-740' liner
		2.80	1.54	0.37	≈ 340-365' liner
		2.81	1.57	0.41	≈ 320-340' liner
		3.04	1.70	0.44	≈ 270-320' liner
		3.35	1.85	0.58	≈ 230-270' liner
		3.68	2.14	0.57	≈ 208-230' liner
		3.77	2.21	0.63	≈ 195-208' liner
		3.93	2.34	0.84	≈ 185-195' liner
		2.19	1.34	0.33	≈ 100-185' liner
	Static, C	2.32	1.37	0.32	W 3:1 (H:V) Slope
	Static, W	2.26	1.13	0.84	≈ 560-935' liner
		2.16	1.15	0.33	≈ 180-560' liner
		5.33	2.36	0.62	≈ 130-180' liner
	Static, C	2.31	1.34	0.32	E 3:1 (H:V) Slope
III-S3	Static, W	7.72	1.47	0.28	≈ 1167-1220' liner
		7.06	1.46	0.28	≈ 1115-1167' liner
		6.96	1.47	0.28	≈ 930-1115' liner
		2.58	1.25	0.26	≈ 290-900' liner
		2.82	1.47	0.34	≈ 220-290' liner
	Static, C	2.69	1.48	0.35	NW 3:1 (H:V) Slope
III-S4	Static, W	3.99	1.43	0.30	≈ 1090-1255' liner
		3.88	1.42	0.29	≈ 1060-1090' liner
		3.84	1.41	0.29	≈ 1040-1060' liner
		3.81	1.41	0.29	≈ 1025-1040' liner
		3.79	1.42	0.29	≈ 980-1025' liner
Cross Section	**Analysis Type**	**Static Factor of Safety FS**	**Pseudo-Static PSFS (for 0.18g)**	**Yield Acceleration, Ky**	**Search Area**
		3.74	1.44	0.30	≈ 955-980' liner
		3.22	1.28	0.26	≈ 900-955' liner
		3.22	1.28	0.26	≈ 865-900' liner
		2.03	1.11	0.22	≈ 120-865' liner
	Static, C	2.28	1.31	0.30	NW 3:1 (H:V) Slope
III-S5	Static, W	2.68	1.26	0.26	≈ 175-480' liner
		3.55	1.64	0.37	≈ 115-175' liner
	Static, C	3.28	1.66	0.40	NW 3:1 (H:V) Slope

It should be noted that the analysis of gross slope stability was conducted using the interface shear strength of the textured HDPE against low-permeability soil liner, and the existing Phase II final cover, with a friction angle of 18 degrees for the lined area of Phase III and Phase II final cover materials. The areas of Phases I and II were evaluated using the parameters for natural subgrade (rock), with a friction angle of 45 degrees and a cohesion of 2000 psf as indicated in Table 2. With computed pseudo-static factors of safety greater than 1.0, or the corresponding computed yield acceleration greater than the applied horizontal acceleration, it can be concluded there will be no permanent seismically-induced displacement of the liner system during the design earthquake event.

Based on this analysis, we conclude that the containment system for the landfill is designed to resist the maximum horizontal acceleration from the design earthquake, and therefore meets the requirements of HAR 11-58.1-13(e).

Respectfully Submitted,



A-MEHR, INC.
M. Ali Mehrazarin, P.E.
Principal Engineer

References

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

USGS, 2004a. Earthquake Hazards and Zoning in Hawaii. http://hvo.wr.usgs.gov/earthquakes/hazards/. June 2004.

USGS, 2004b. Frequently Asked Questions (FAQ) About Return Periods. http://equhazmaps.usgs.gov/faq/. United States Geological Survey website accessed September 2004.

USGS, 1996. Hawaii Hazard Maps 1996. http://eqhazmaps.usgs.gov/html/his.html. United States Geological Survey website accessed June 2004.

FIGURES

GRAPHIC SCALE 1"=200'

0 200 400 600

N

III-S1
III-S2
III-S3
III-S4
III-S5

GP-1
GP-2
GP-3.1
GP-7
GP-8
GP-10

MW-2
MW-3
MW-4
MW-5

Proposed Phase III-A Area

Future Phase III-B Area

Phase IV-A

Phase IV-A Sump

Phase IV-B Sump

Phase IV-B Leachate Manhole

Phase VB-E Sump

Manhole 4 Leachate Sump

Closed Landfill Phase I & II

Existing Conveyor Belt to be Removed

Kalilimui Gulch

Stormwater Sedimentation Basin

Leachate Storage Tanks

Stormwater

Legend

- Existing Grades as of 5/13/18
- Limits of Disposal/Cell Areas
- As-Built Liner Grades
- Phase III and VI Liner Grades
- III-S5 III-S5 Cross Section

A-Mehr, Inc.

Central Maui Landfill (CML)
Phase III Design Plan
Slope Stability Report

Proposed Liner Grades

FILENAME	Master plan DSR
DRAWN	RM
CHECKED	
DATE	1/10/19
FIGURE	1

GRAPHIC SCALE 1"=200'

0 200 400 600

N

III-S1

III-S2

III-S3

III-S4

III-S5

Proposed Phase III-A Area

Future Phase III-B Area

Closed Landfill Phase I & II

Manhole 4 Leachate Sump

Kalilinui Gulch

Stormwater Sedimentation Basin

Leachate Storage Tanks

Phase IV-B Leachate Manhole

Phase IV-A Sump

Phase IV-A

Phase IV-B Sump

Stormwater

Phase VB-E Sump

Legend

Existing Grades as of 5/13/18

Proposed Refuse Final Grades

Limits of Disposal/Cell Areas

III-S5 III-S5 Cross Section

A-Mehr, Inc.

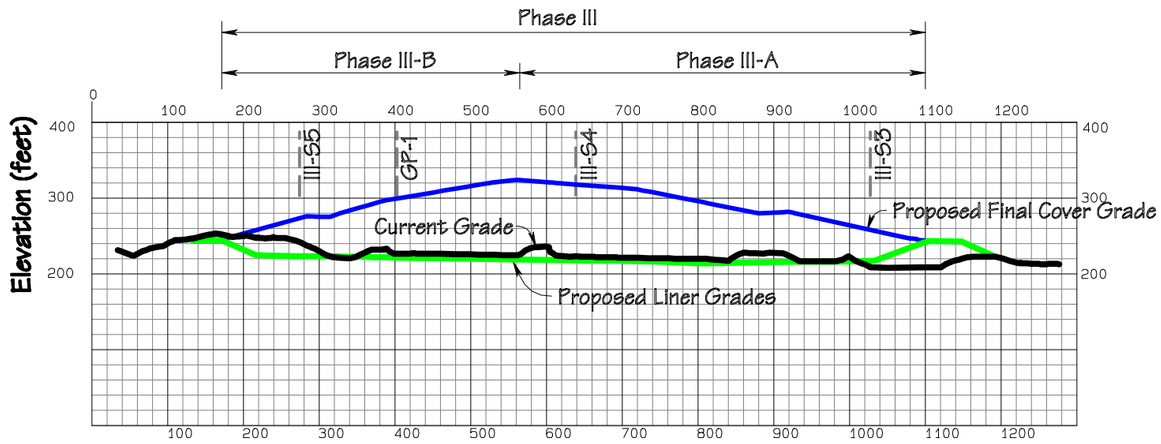
Central Maui Landfill (CML)

Phase III Design Plan

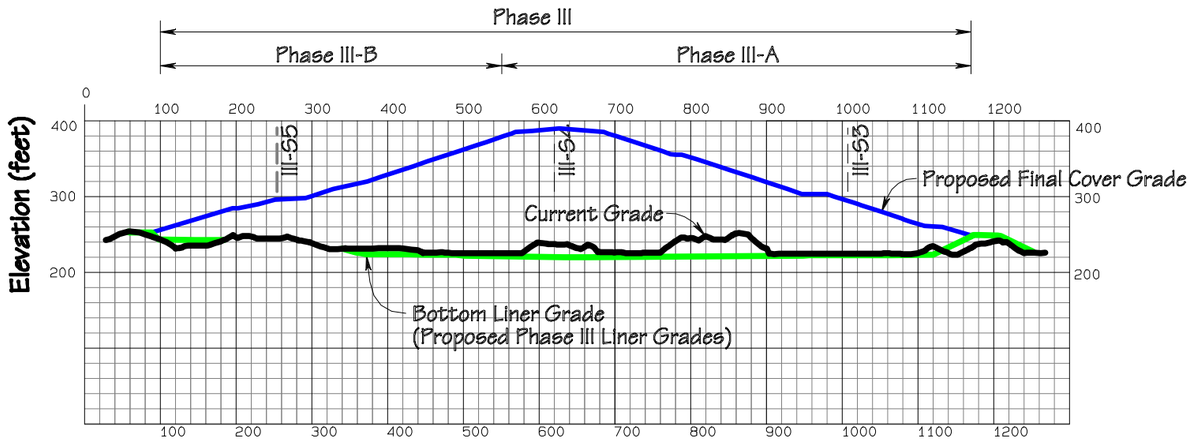
Slope Stability Report

Proposed Final Cover Grades

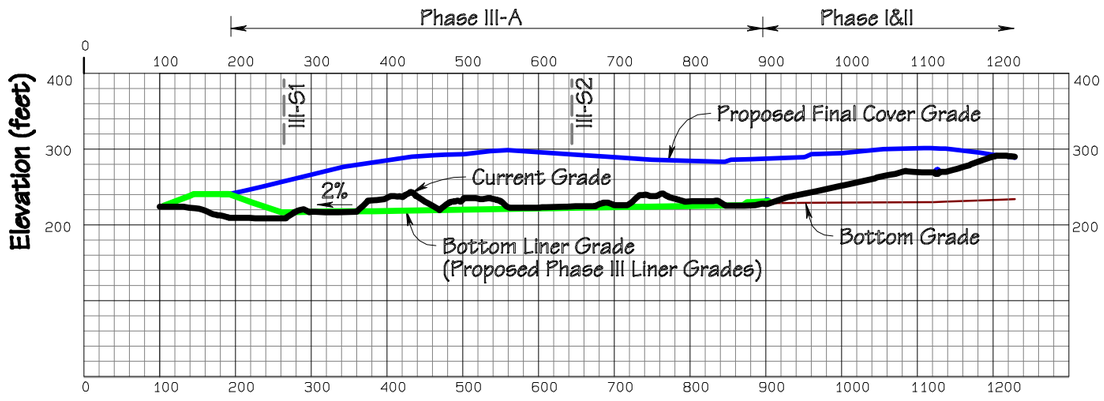
FILENAME	Master plan SSR
DRAWN	RM
CHECKED	EEV
DATE	1/10/19
FIGURE	2



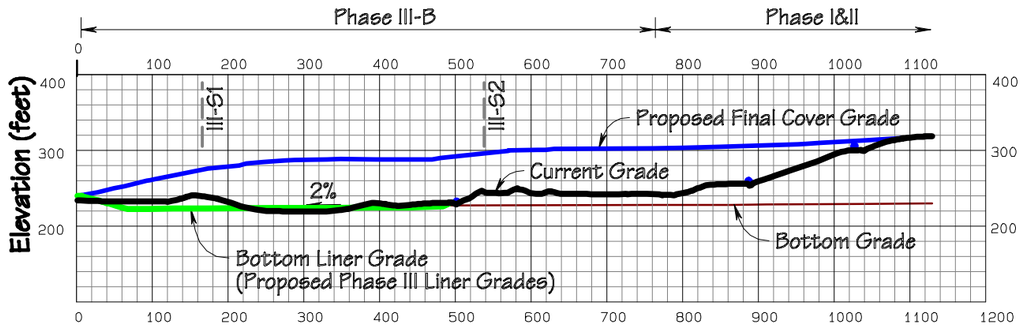
Cross-Section III-S1



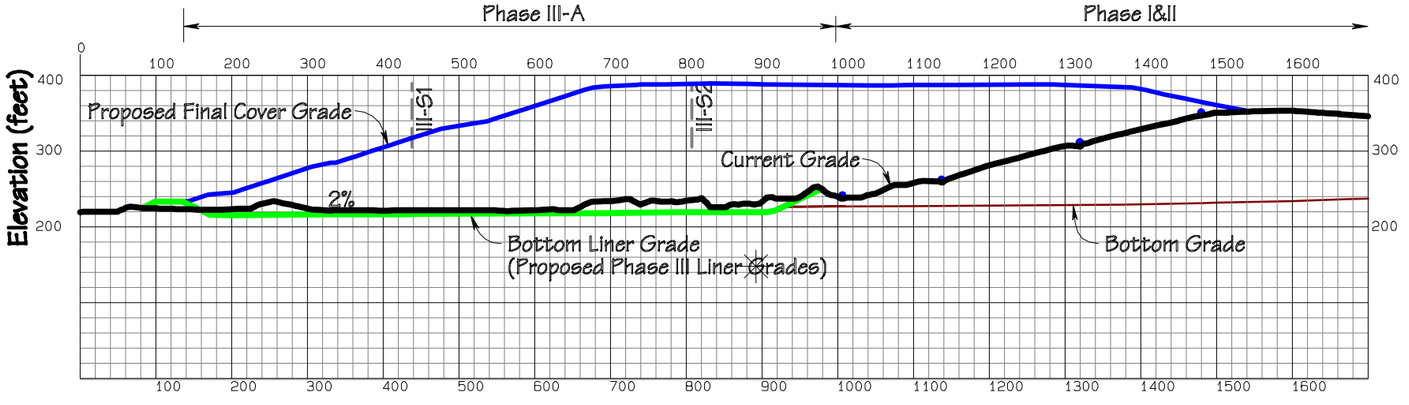
Cross-Section III-S2



Cross-Section III-S3



Cross-Section III-S5



Cross-Section III-S4

A-Mehr, Inc.

Central Maui Landfill (CML)

Phase III Design Plan
Slope Stability Report

Cross Sections III-S1, III-S2, III-S3, III-S4 and III-S5

FILENAME	Master plan.DGN
DRAWN	RM
CHECKED	EEV
DATE	1/10/19
FIGURE	3

APPENDIX A

STABILITY ANALYSIS RESULTS

Summary of Gross Stability Analysis - Liner System

Cross Section	Analysis	FS	PSFS @ 0.18g	Ky	Search Area
III-S1	Static, W	2.58	1.32	0.29	≈ 215-845' liner
	Static, C	3.20	1.73	0.44	W 3:1 (H:V) Slope
	Static, W	2.78	1.25	0.26	≈ 455-1085' liner
		2.82	1.32	0.28	≈ 265-455' liner
		3.60	1.69	0.39	≈ 200-265' liner
	Static, C	3.38	1.72	0.42	E 3:1 (H:V) Slope
III-S2	Static, W	2.61	1.47	0.36	≈ 365-740' liner
		2.80	1.54	0.37	≈ 340-365' liner
		2.81	1.57	0.41	≈ 320-340' liner
		3.04	1.70	0.44	≈ 270-320' liner
		3.35	1.85	0.58	≈ 230-270' liner
		3.68	2.14	0.57	≈ 208-230' liner
		3.77	2.21	0.63	≈ 195-208' liner
		3.93	2.34	0.84	≈ 185-195' liner
		2.19	1.34	0.33	≈ 100-185' liner
	Static, C	2.32	1.37	0.32	W 3:1 (H:V) Slope
	Static, W	2.26	1.13	0.84	≈ 560-935' liner
		2.16	1.15	0.33	≈ 180-560' liner
		5.33	2.36	0.62	≈ 130-180' liner
	Static, C	2.31	1.34	0.32	E 3:1 (H:V) Slope
III-S3	Static, W	7.72	1.47	0.28	≈ 1167-1220' liner
		7.06	1.46	0.28	≈ 1115-1167' liner
		6.96	1.47	0.28	≈ 930-1115' liner
		2.58	1.25	0.26	≈ 290-900' liner
		2.82	1.47	0.34	≈ 220-290' liner
	Static, C	2.69	1.48	0.35	NW 3:1 (H:V) Slope
III-S4	Static, W	3.99	1.43	0.30	≈ 1090-1255' liner
		3.88	1.42	0.29	≈ 1060-1090' liner
		3.84	1.41	0.29	≈ 1040-1060' liner
		3.81	1.41	0.29	≈ 1025-1040' liner
		3.79	1.42	0.29	≈ 980-1025' liner
		3.74	1.44	0.30	≈ 955-980' liner
		3.22	1.28	0.26	≈ 900-955' liner
		3.22	1.28	0.26	≈ 865-900' liner
		2.03	1.11	0.22	≈ 120-865' liner
	Static, C	2.28	1.31	0.30	NW 3:1 (H:V) Slope
III-S5	Static, W	2.68	1.26	0.26	≈ 175-480' liner
		3.55	1.64	0.37	≈ 115-175' liner
	Static, C	3.28	1.66	0.40	NW 3:1 (H:V) Slope

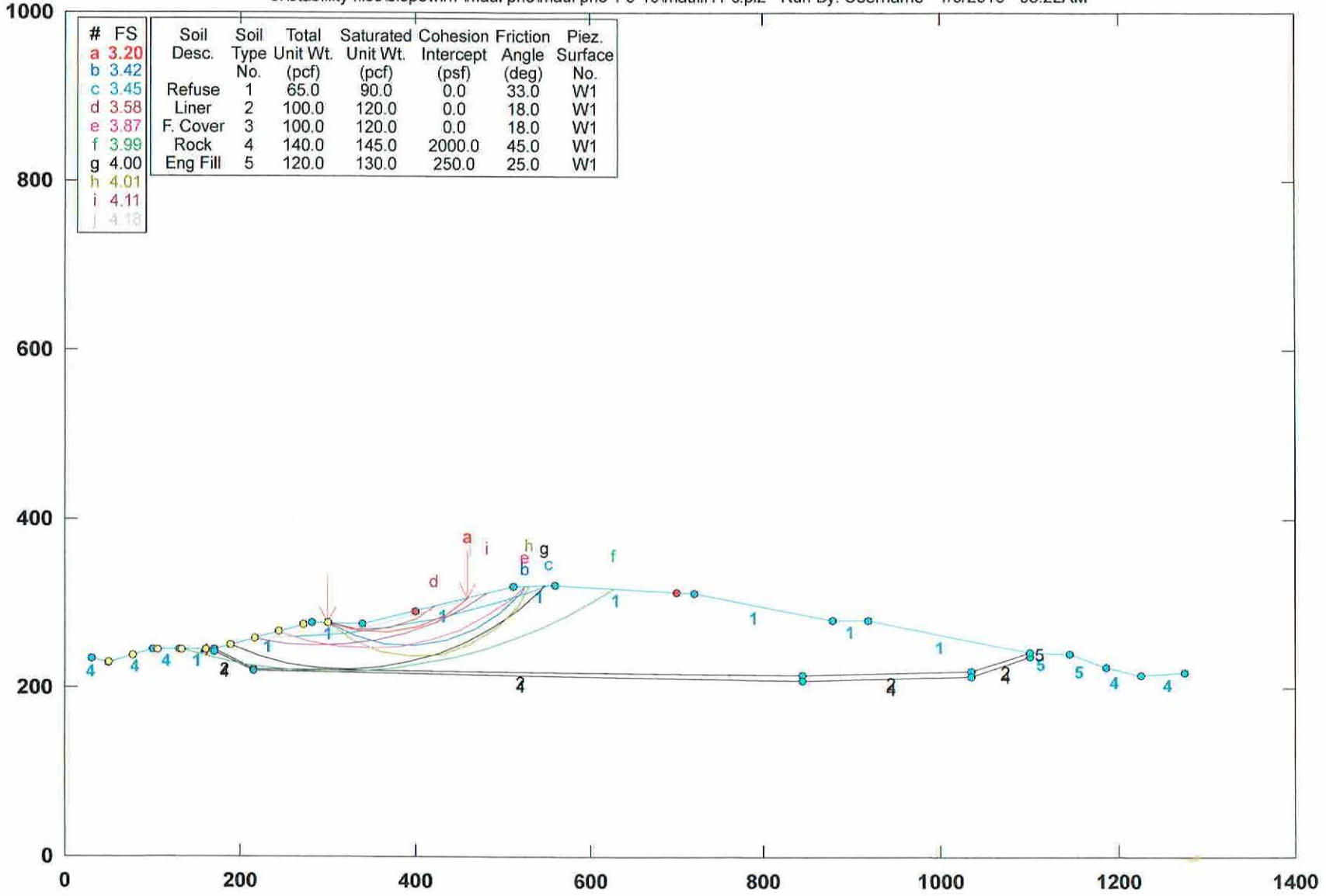
CROSS SECTION
III-S1

CML - ph III Slope Stab. Section III-S1 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-c.pl2 Run By: Username 1/9/2019 08:22AM

#	FS
a	3.20
b	3.42
c	3.45
d	3.58
e	3.87
f	3.99
g	4.00
h	4.01
i	4.11
j	4.18

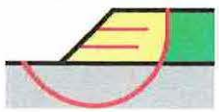
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=3.20

Safety Factors Are Calculated By The Modified Bishop Method

STED

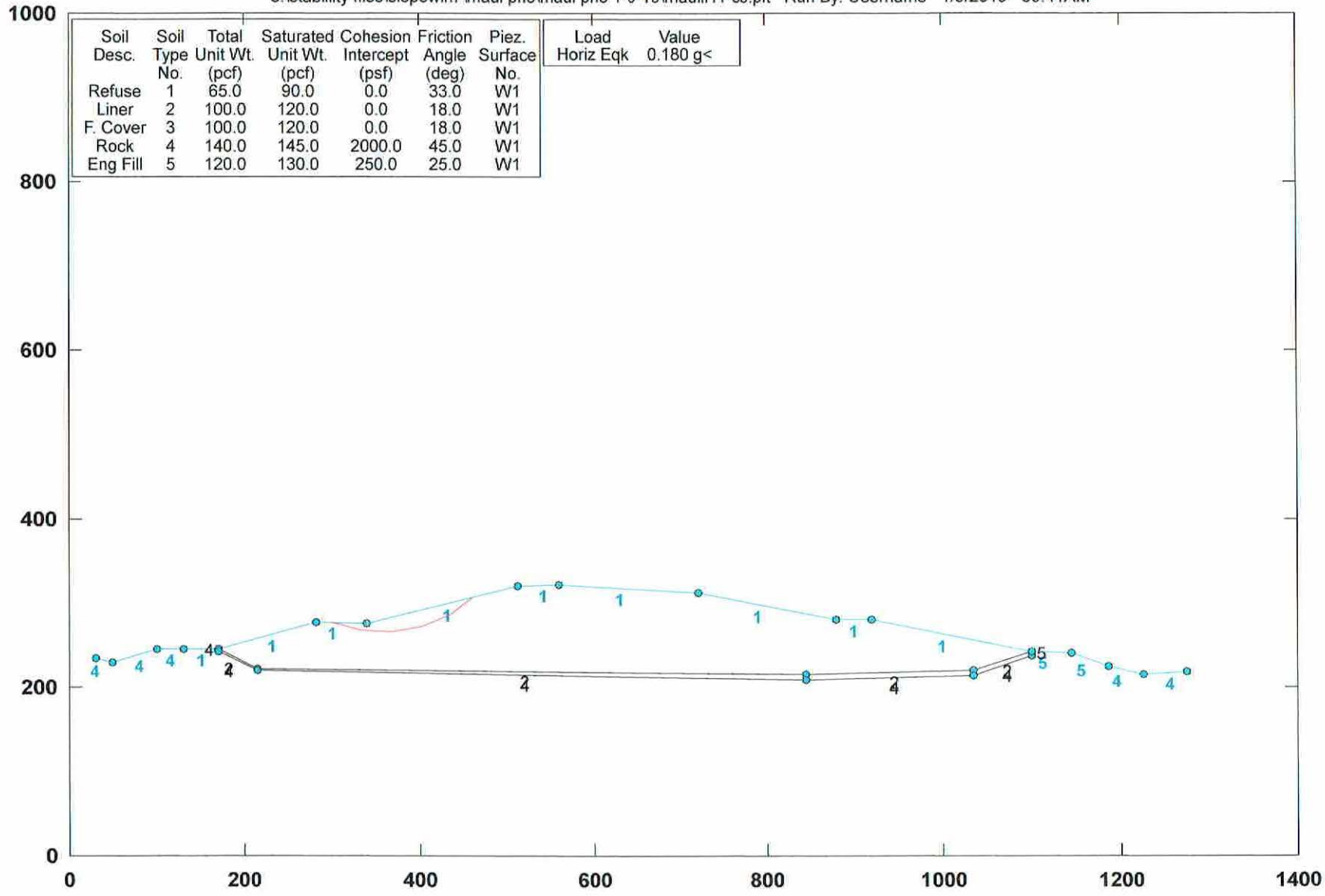


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-cs.plt Run By: Username 1/9/2019 09:41AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

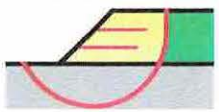
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.73

Factor Of Safety Is Calculated By The Modified Bishop Method

STED

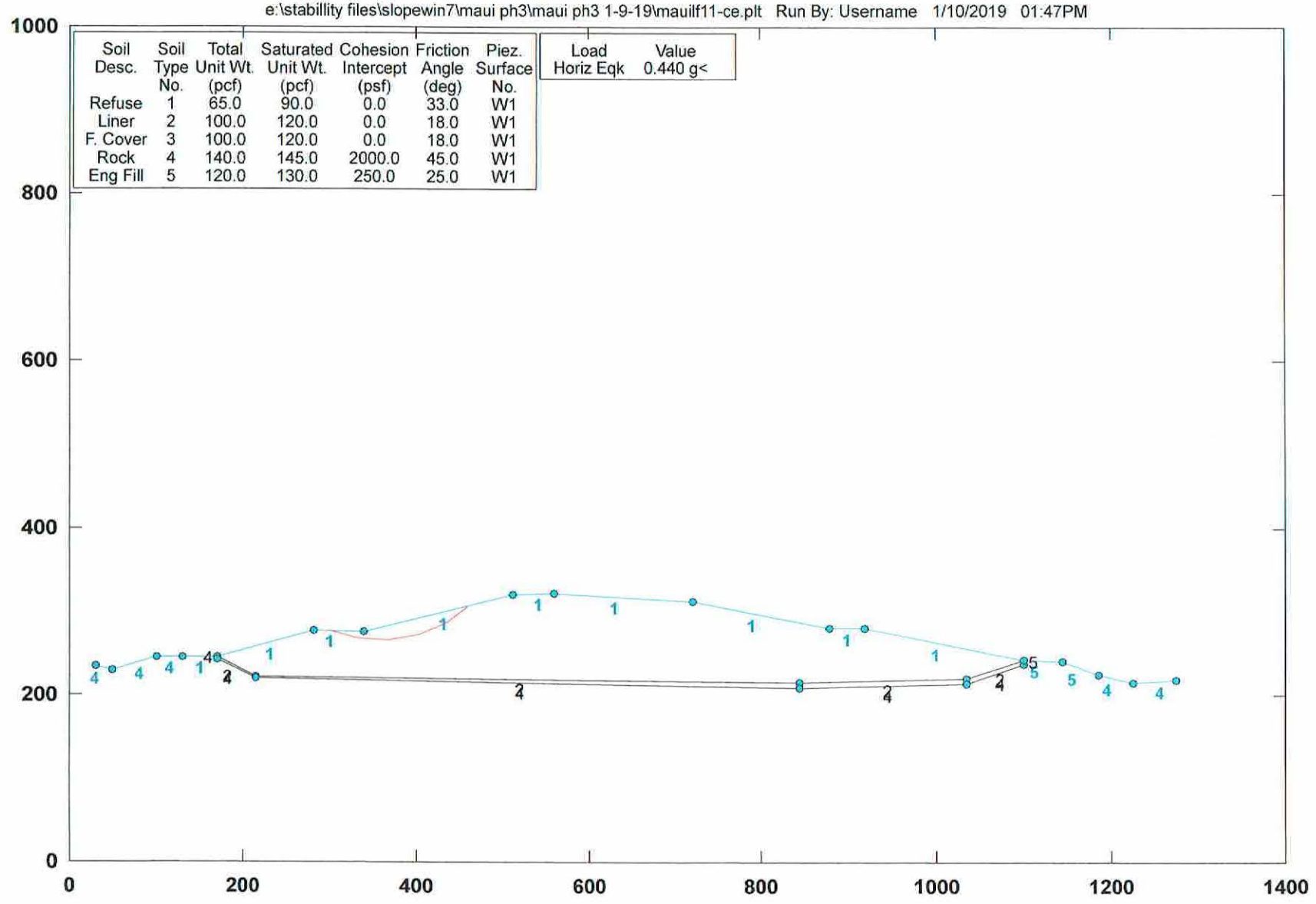


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-ce.plt Run By: Username 1/10/2019 01:47PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

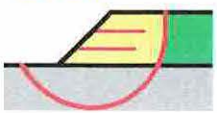
Load	Value
Horiz Eqk	0.440 g<



PCSTABL5M/si FSmin=1.01

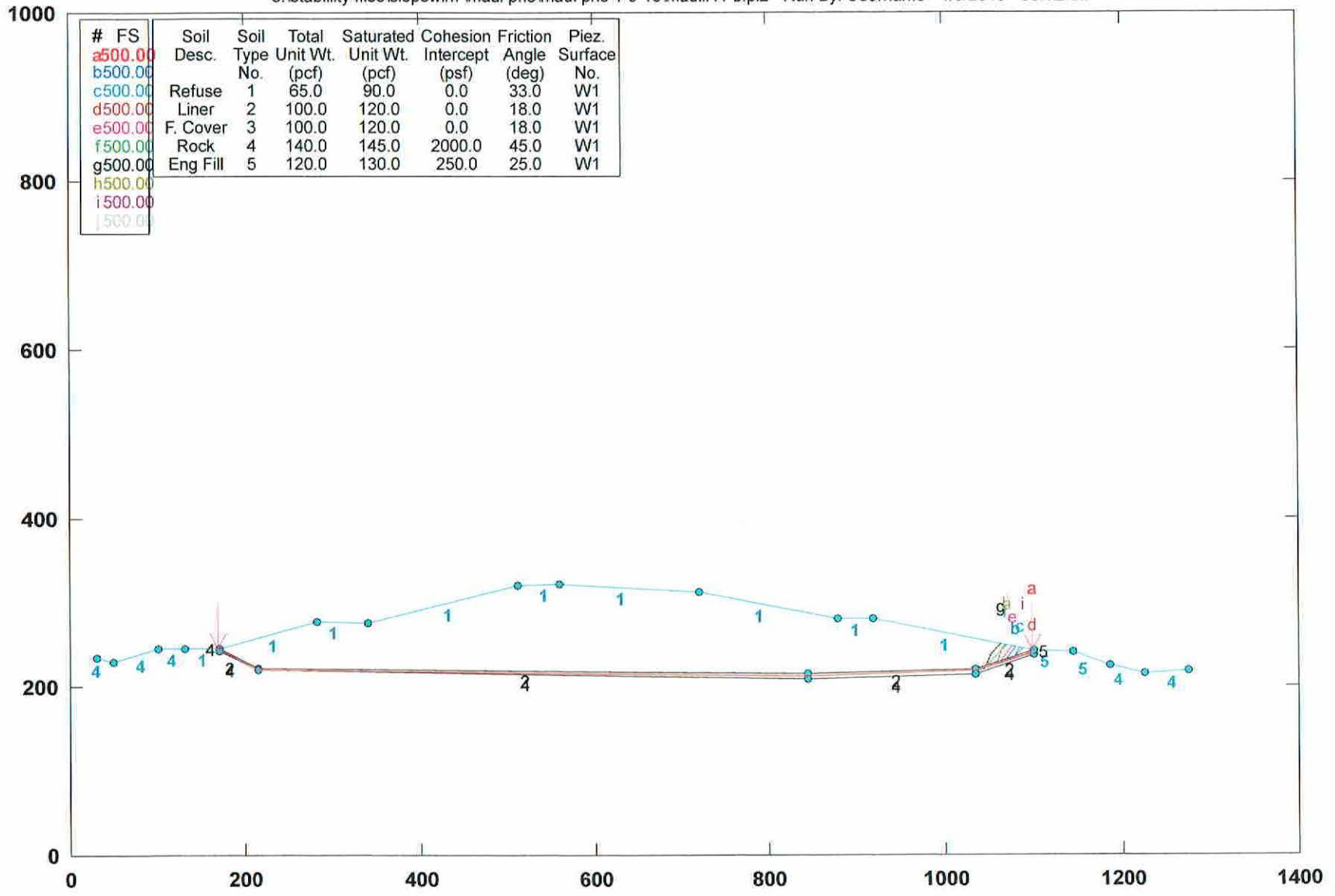
Factor Of Safety Is Calculated By The Modified Bishop Method

STED



CML - ph III Slope Stab. Section III-S1 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-b.pl2 Run By: Username 1/9/2019 08:12AM



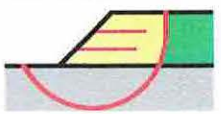
#	FS
a	500.00
b	500.00
c	500.00
d	500.00
e	500.00
f	500.00
g	500.00
h	500.00
i	500.00
j	500.00

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=500.00

Safety Factors Are Calculated By The Modified Janbu Method

STED

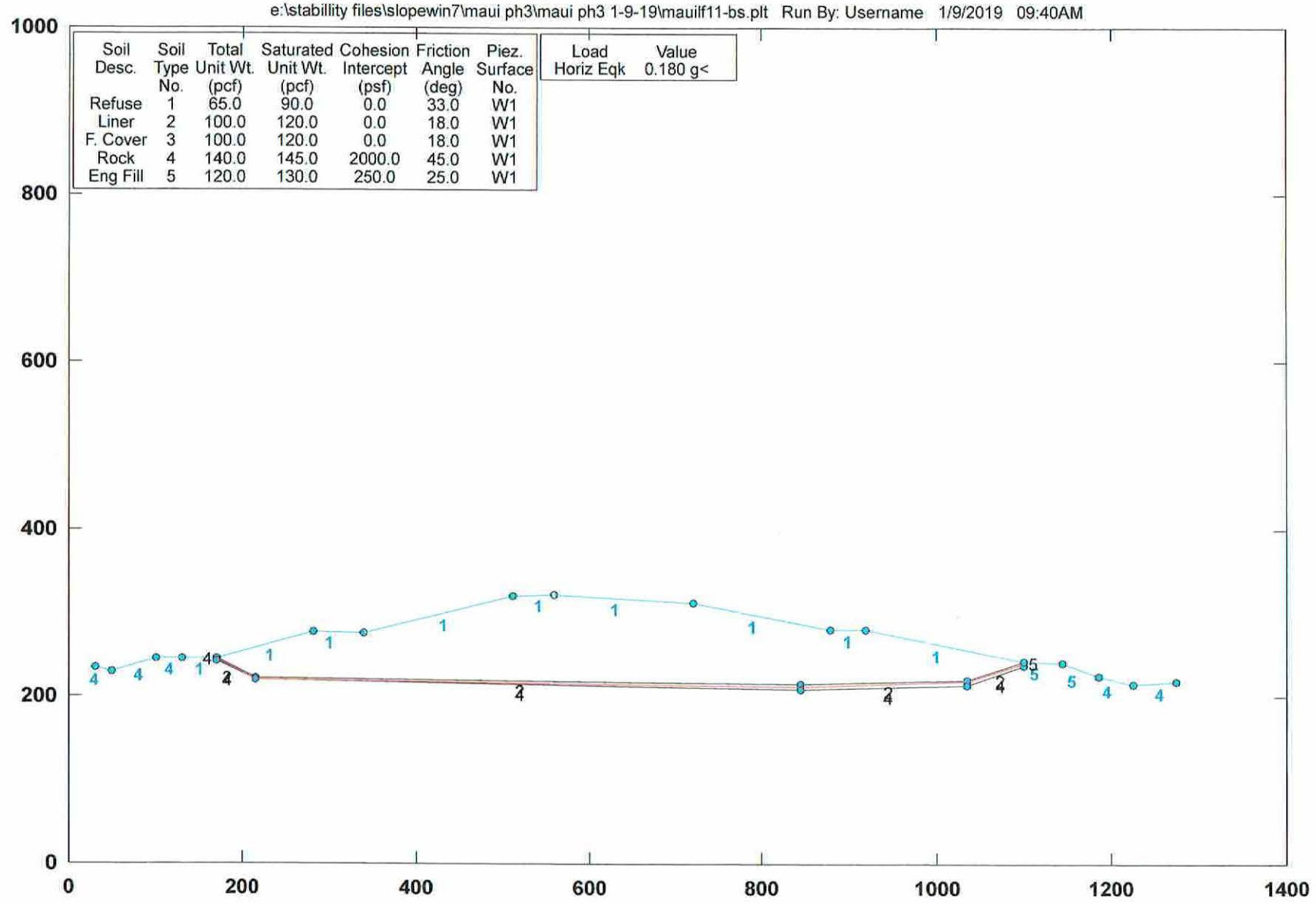


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-bs.plt Run By: Username 1/9/2019 09:40AM

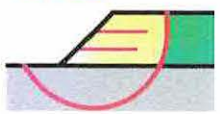
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.87
Factors of Safety Calculated by Janbu Method

STED

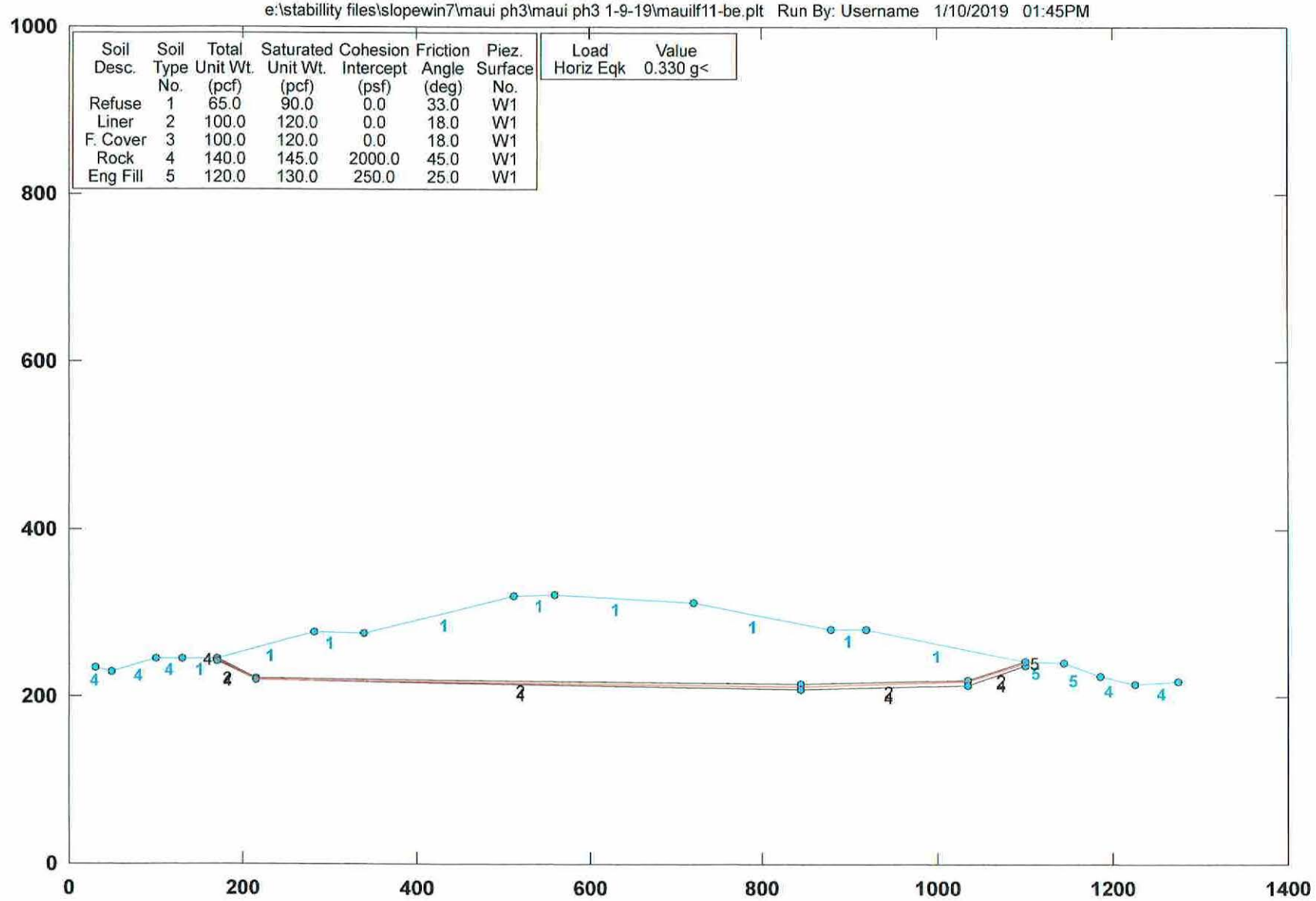


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf11-be.plt Run By: Username 1/10/2019 01:45PM

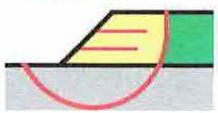
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.330 g<



PCSTABL5M/si FSmin=1.01
Factors of Safety Calculated by Janbu Method

STED

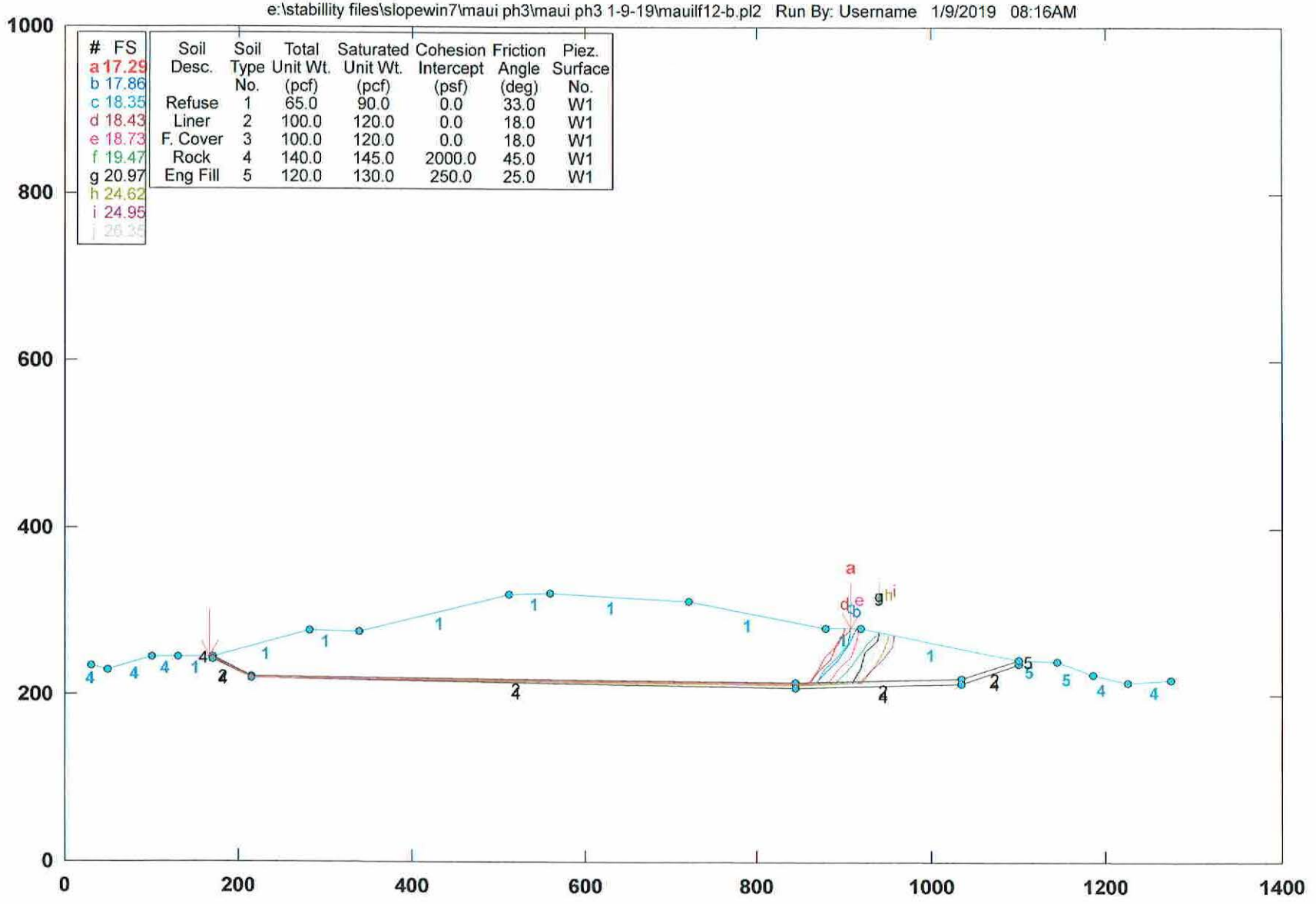


CML - ph III Slope Stab. Section III-S1 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf12-b.pl2 Run By: Username 1/9/2019 08:16AM

#	FS
a	17.29
b	17.86
c	18.35
d	18.43
e	18.73
f	19.47
g	20.97
h	24.62
i	24.95
j	26.35

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=17.29

Safety Factors Are Calculated By The Modified Janbu Method

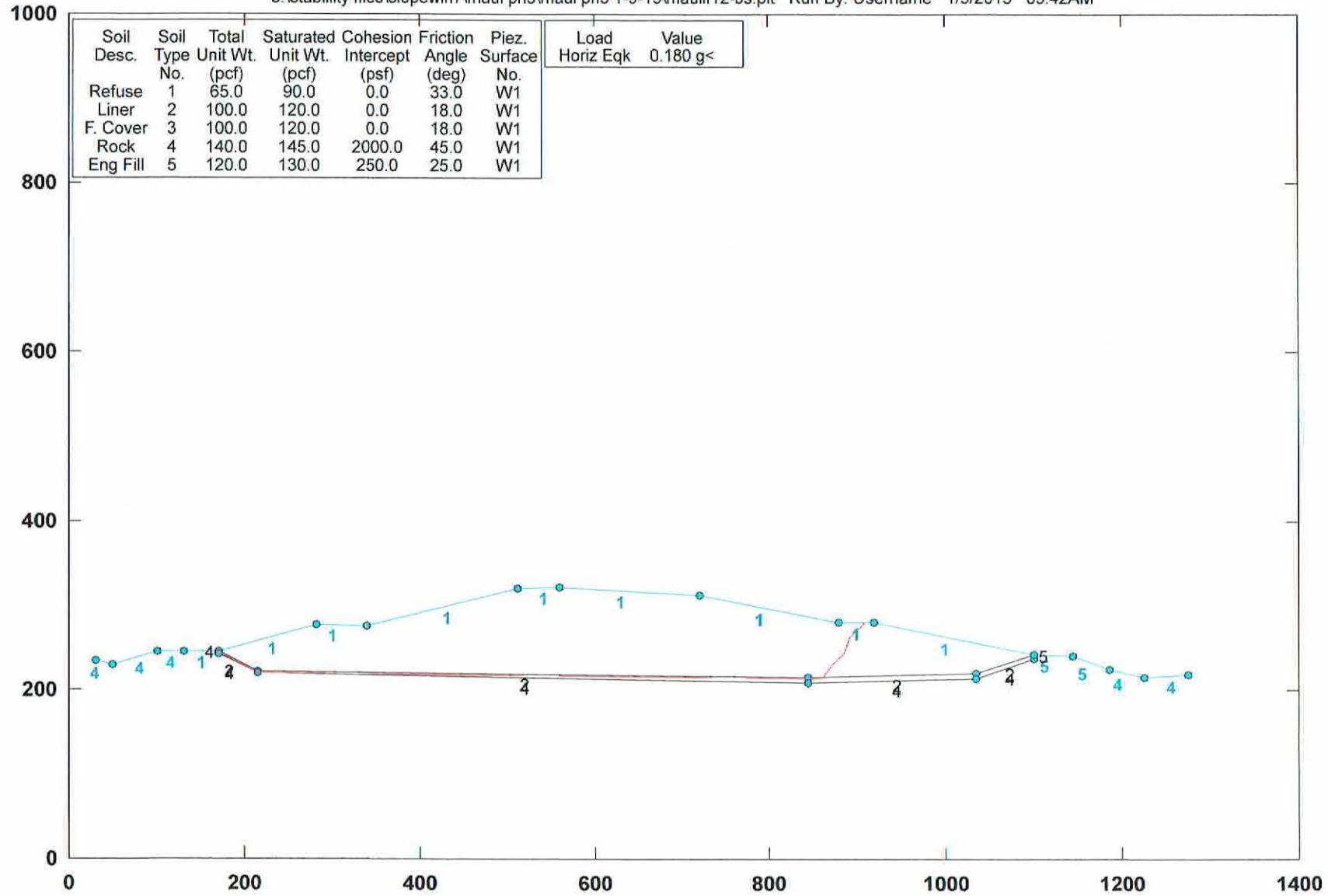
STED

CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf12-bs.plt Run By: Username 1/9/2019 09:42AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

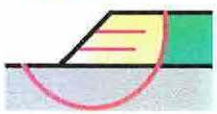
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.76

Factors of Safety Calculated by Janbu Method

STED

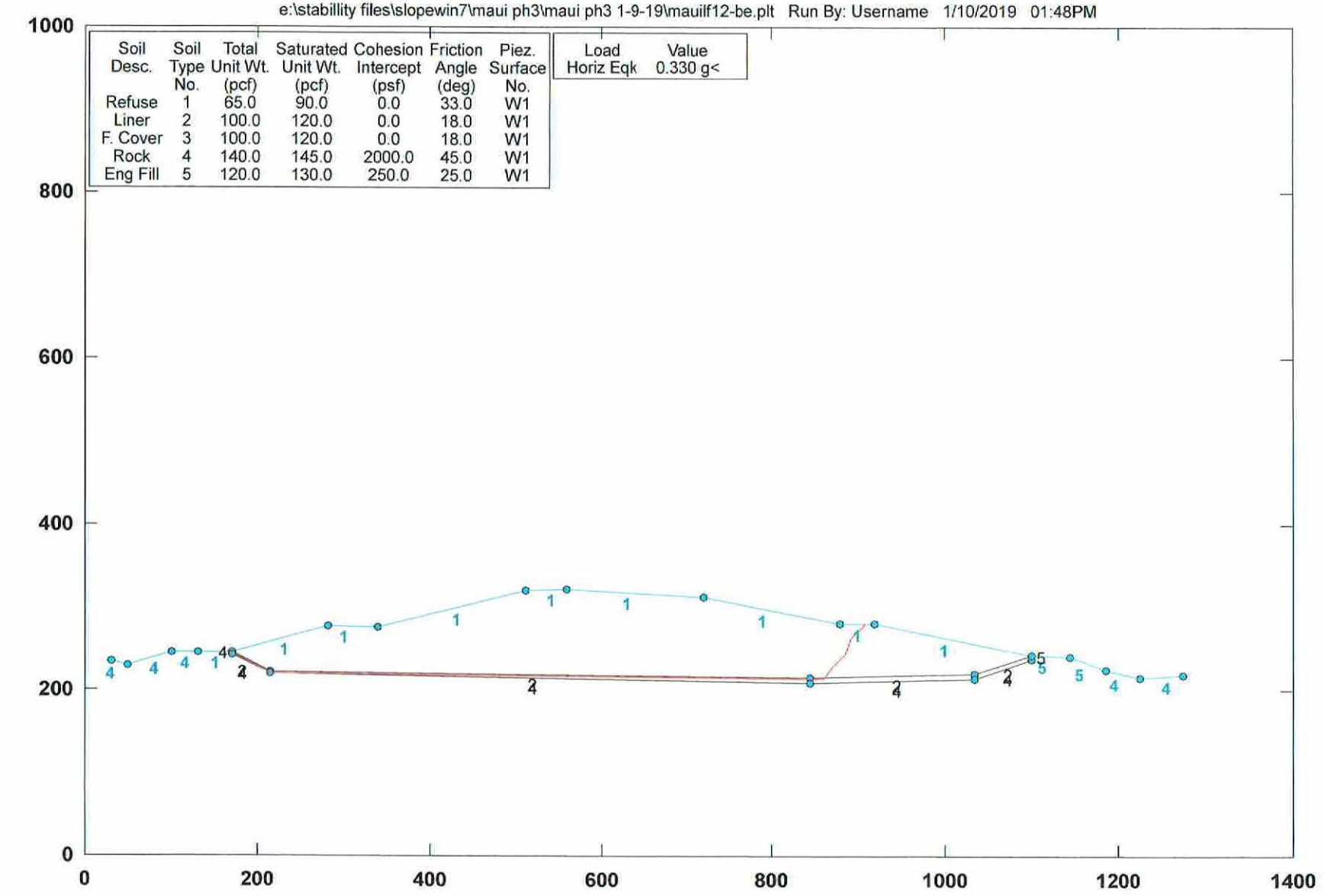


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf12-be.plt Run By: Username 1/10/2019 01:48PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

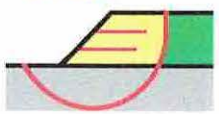
Load	Value
Horiz Eqk	0.330 g<



PCSTABL5M/si FSmin=0.99

Factors of Safety Calculated by Janbu Method

STED

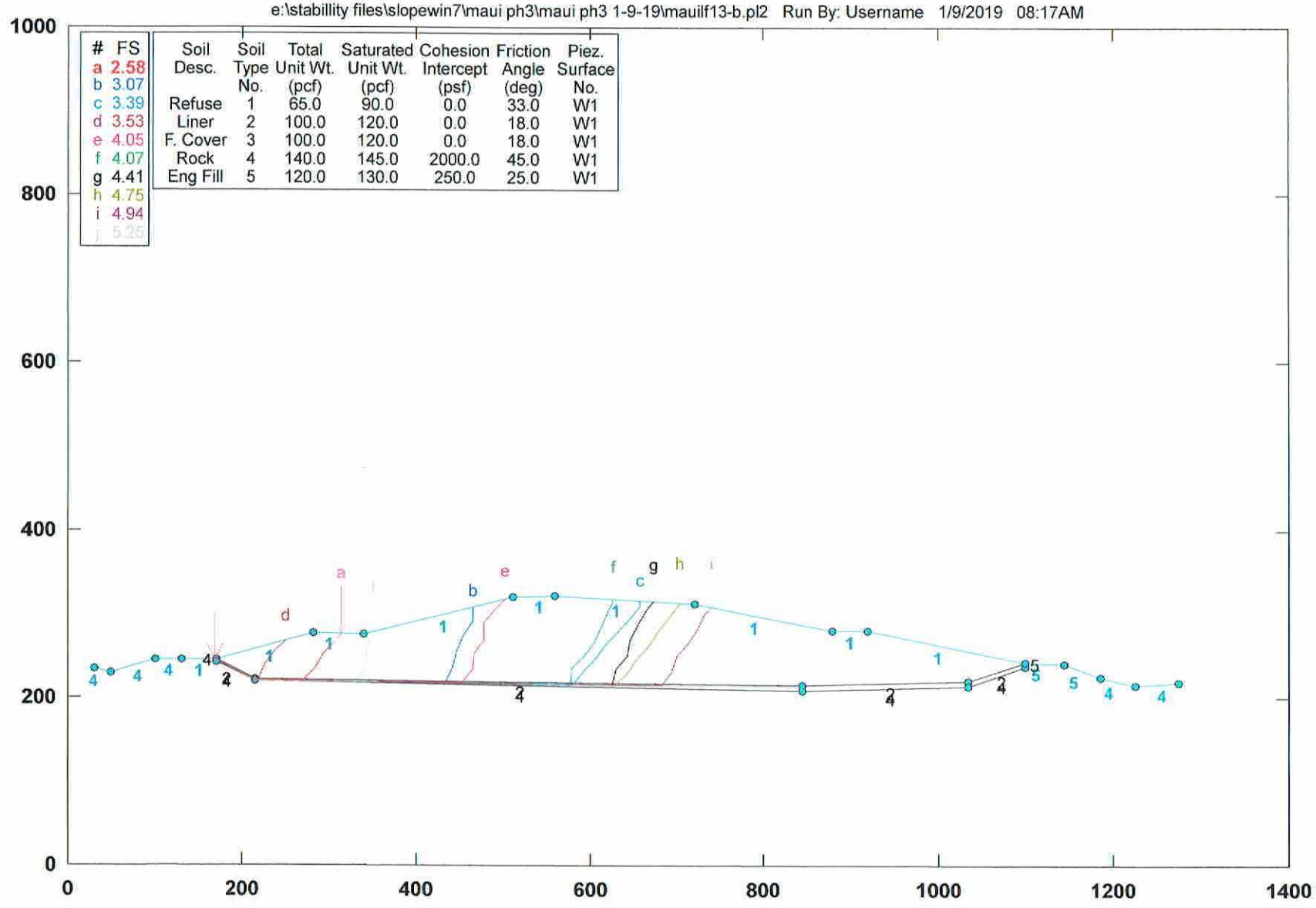


CML - ph III Slope Stab. Section III-S1 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf13-b.pl2 Run By: Username 1/9/2019 08:17AM

#	FS
a	2.58
b	3.07
c	3.39
d	3.53
e	4.05
f	4.07
g	4.41
h	4.75
i	4.94
j	5.25

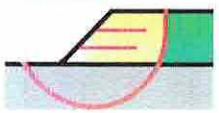
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.58

Safety Factors Are Calculated By The Modified Janbu Method

STED

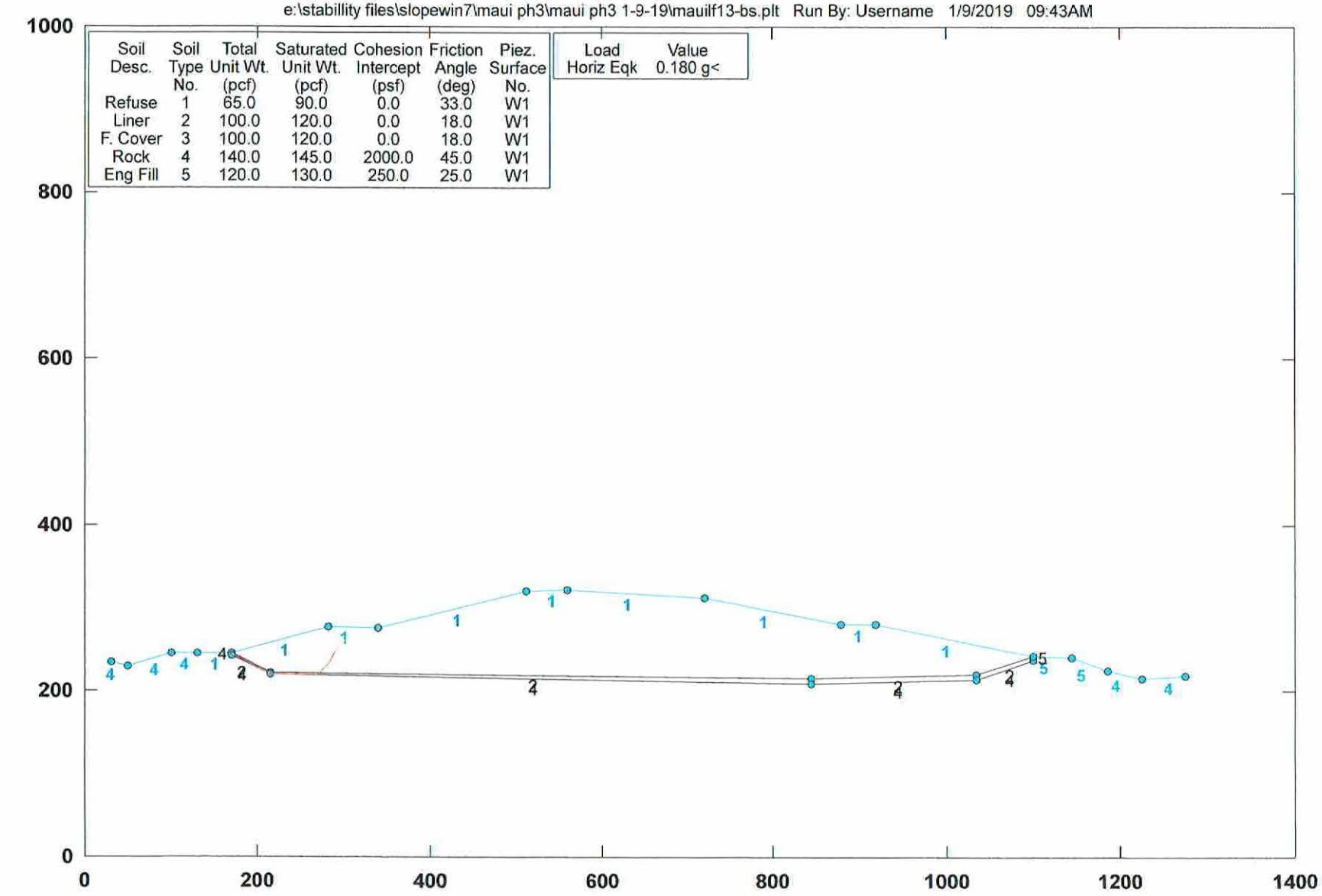


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf13-bs.plt Run By: Username 1/9/2019 09:43AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.32

Factors of Safety Calculated by Janbu Method

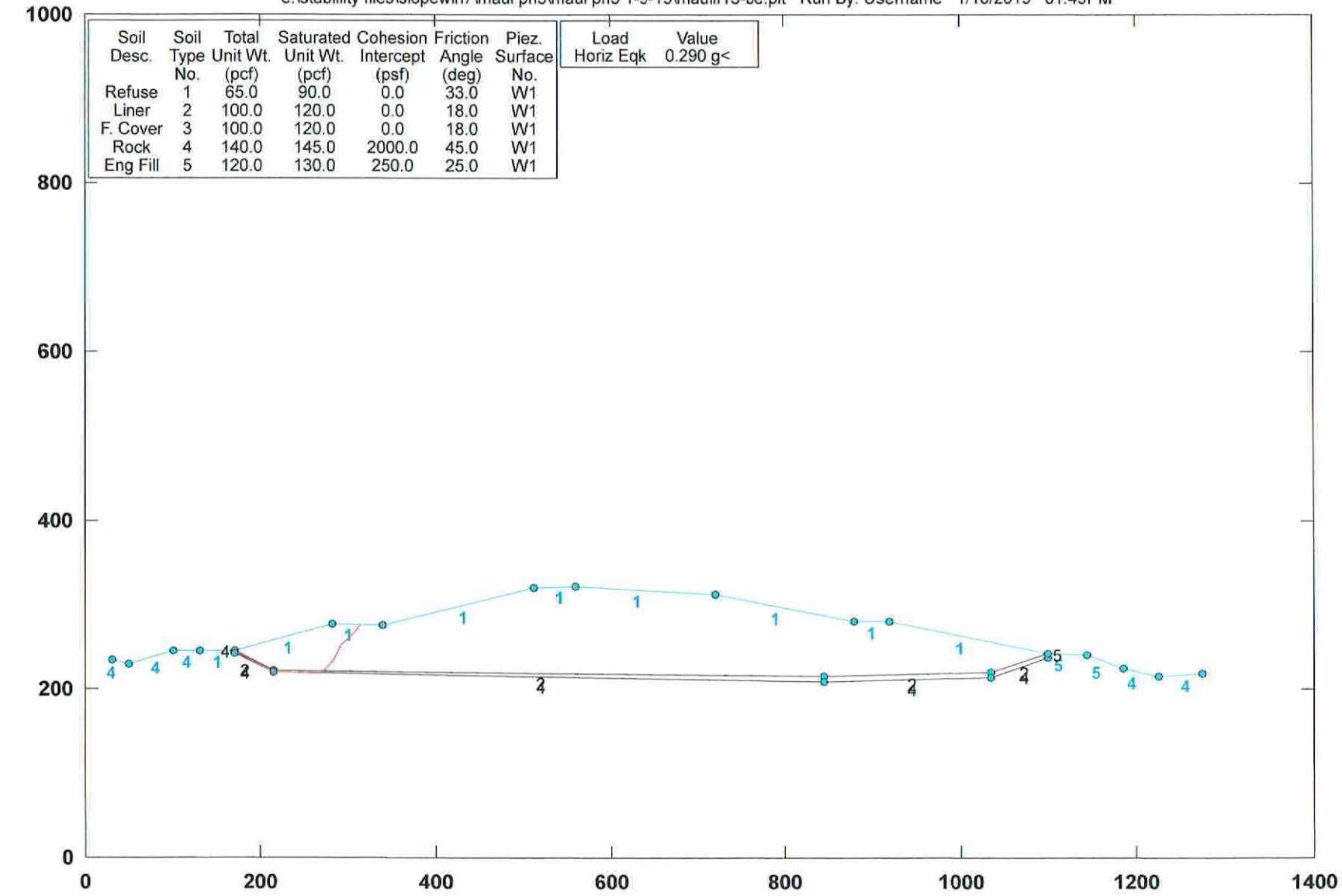
STED

CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf13-be.plt Run By: Username 1/10/2019 01:49PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

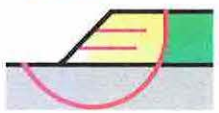
Load	Value
Horiz Eqk	0.290 g<



PCSTABL5M/si FSmin=0.99

Factors of Safety Calculated by Janbu Method

STED

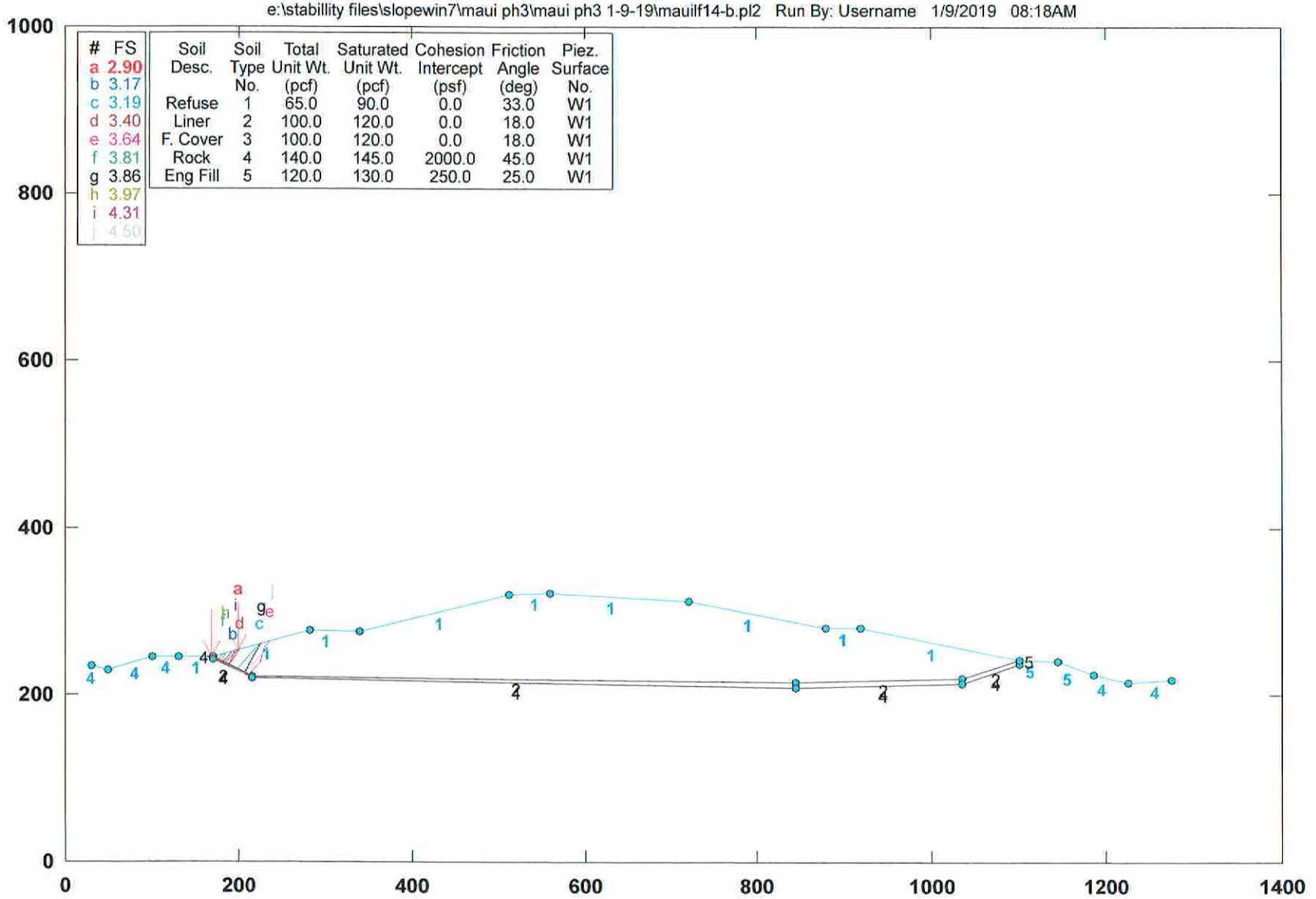


CML - ph III Slope Stab. Section III-S1 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf14-b.pl2 Run By: Username 1/9/2019 08:18AM

#	FS
a	2.90
b	3.17
c	3.19
d	3.40
e	3.64
f	3.81
g	3.86
h	3.97
i	4.31
j	4.50

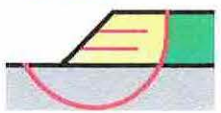
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.90

Safety Factors Are Calculated By The Modified Janbu Method

STED

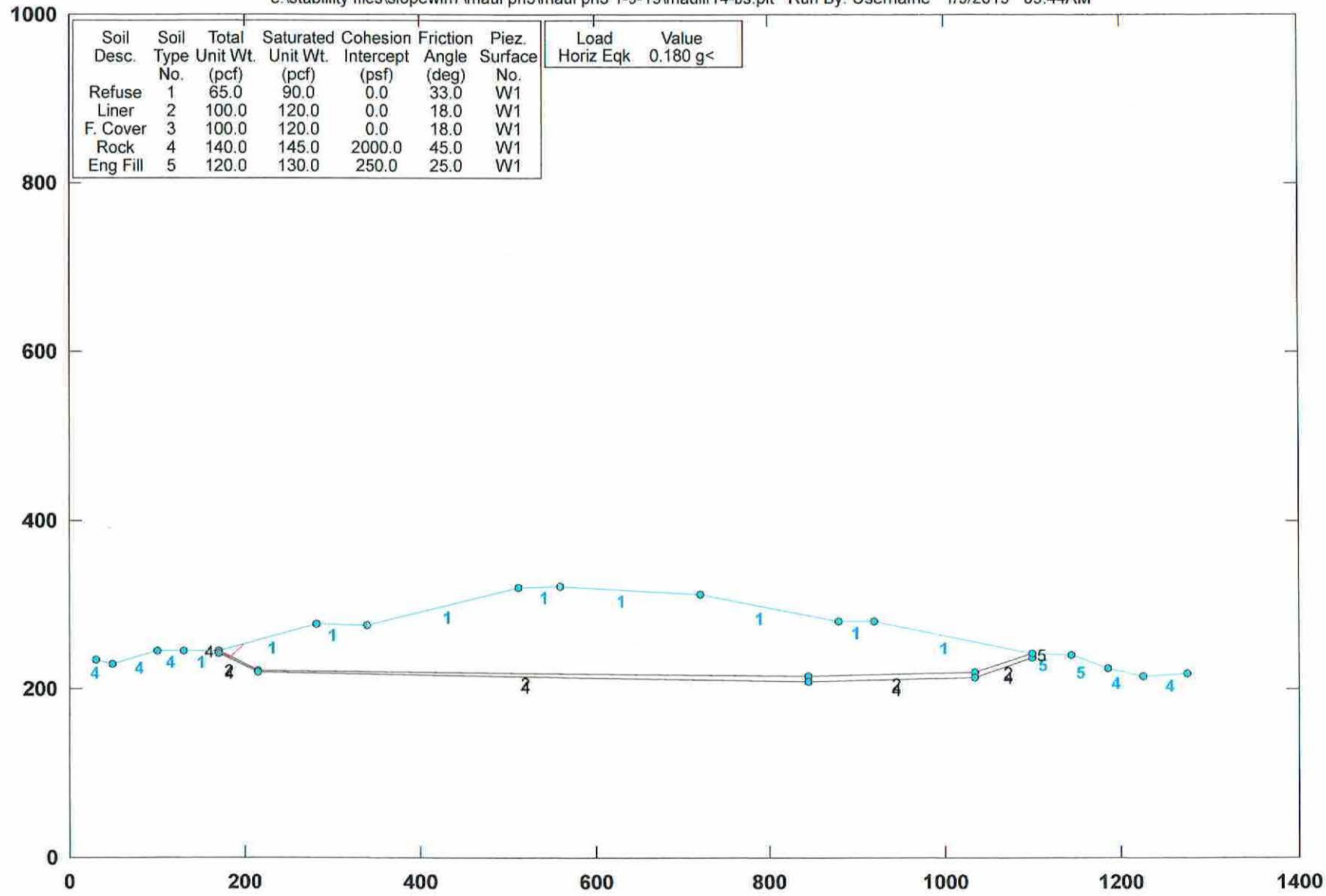


CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf14-bs.plt Run By: Username 1/9/2019 09:44AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.60

Factors of Safety Calculated by Janbu Method

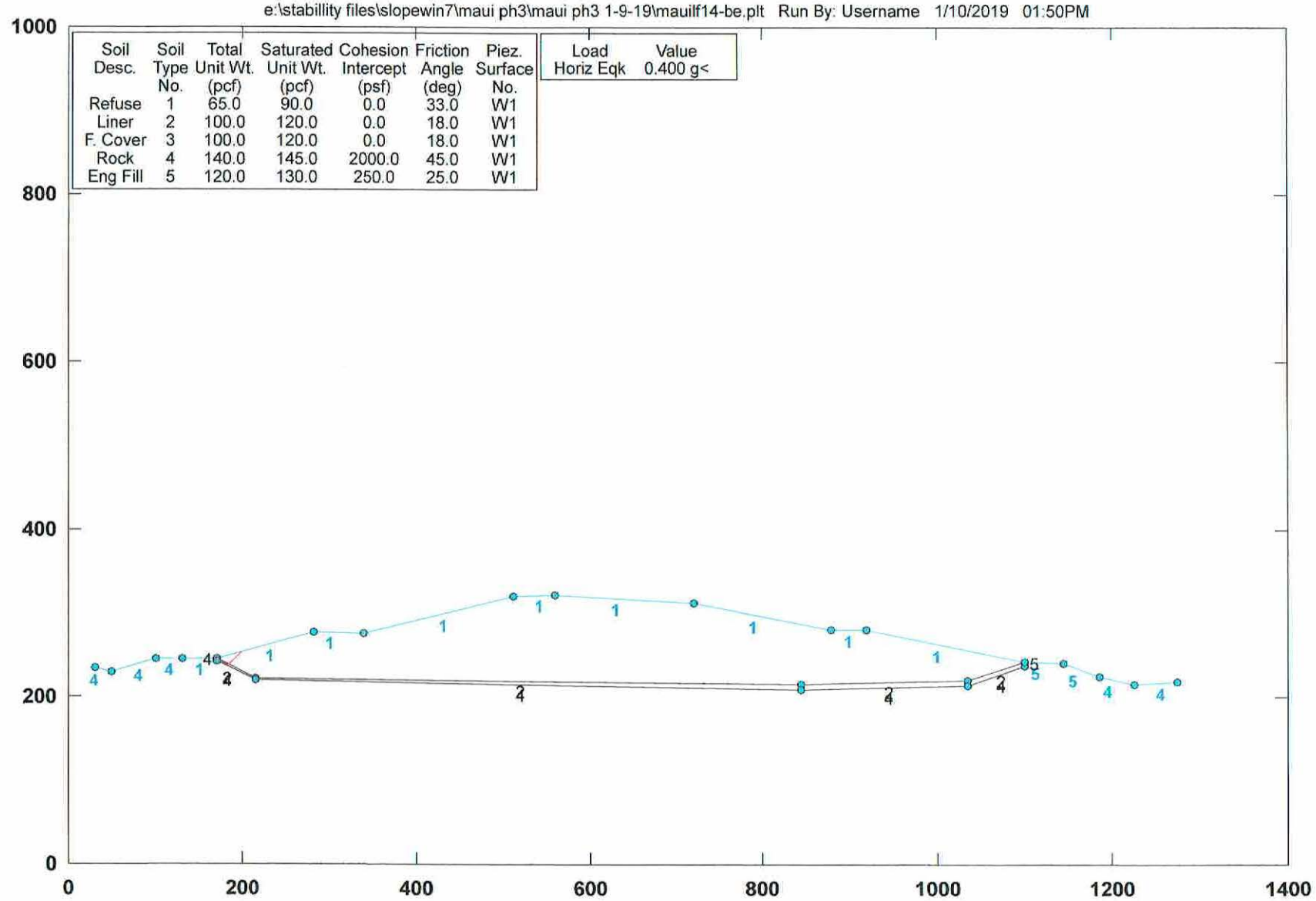
STED

CML - ph III Slope Stab. Section III-S1 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf14-be.plt Run By: Username 1/10/2019 01:50PM

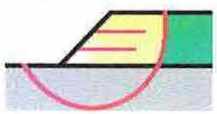
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.400 g<



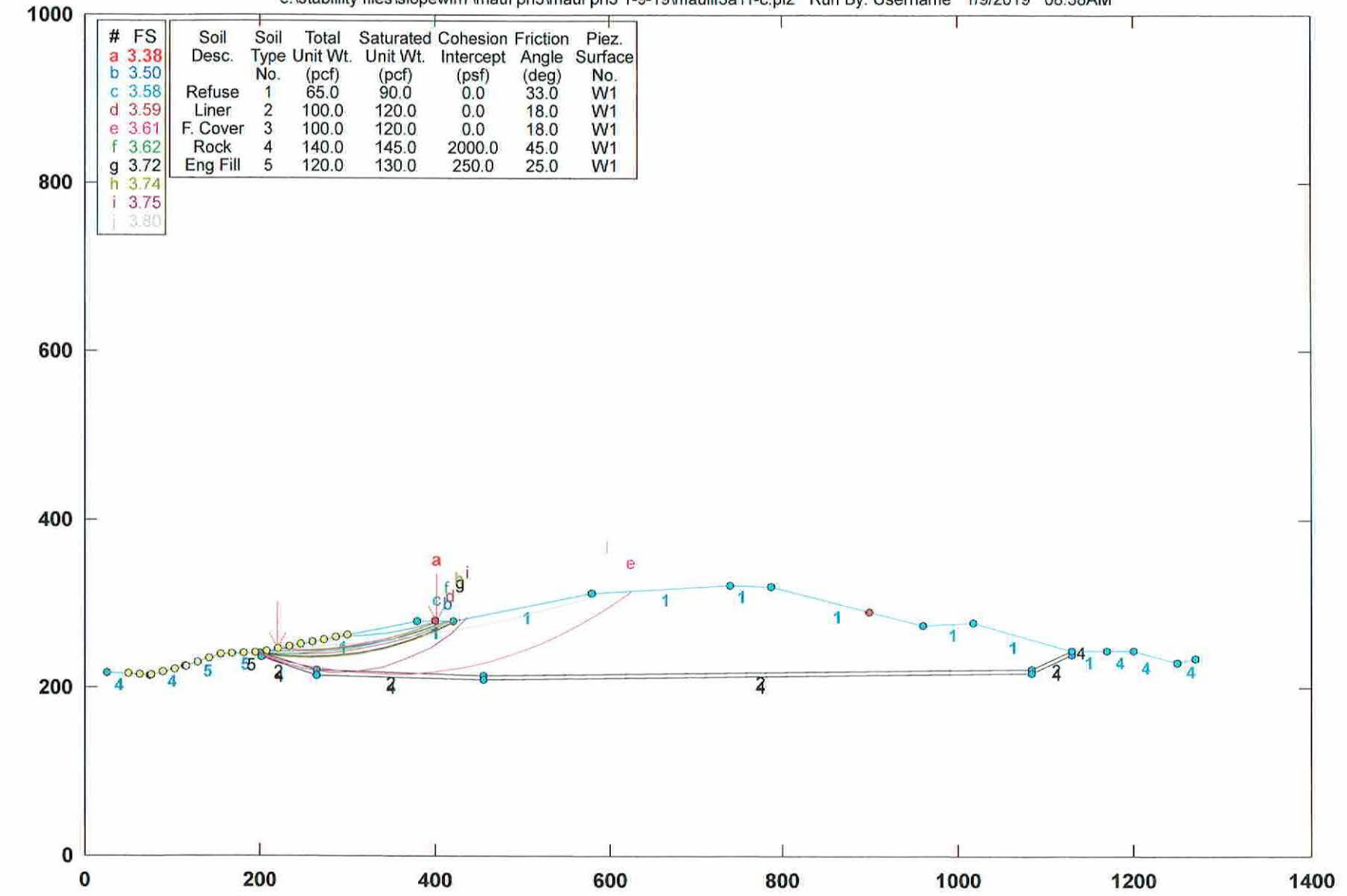
PCSTABL5M/si FSmin=1.00
Factors of Safety Calculated by Janbu Method

STED



CML - ph III Sl. Stab. Section III-S1-3AStatic

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-c.pl2 Run By: Username 1/9/2019 08:38AM



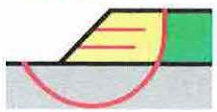
#	FS
a	3.38
b	3.50
c	3.58
d	3.59
e	3.61
f	3.62
g	3.72
h	3.74
i	3.75
j	3.80

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=3.38

Safety Factors Are Calculated By The Modified Bishop Method

STED

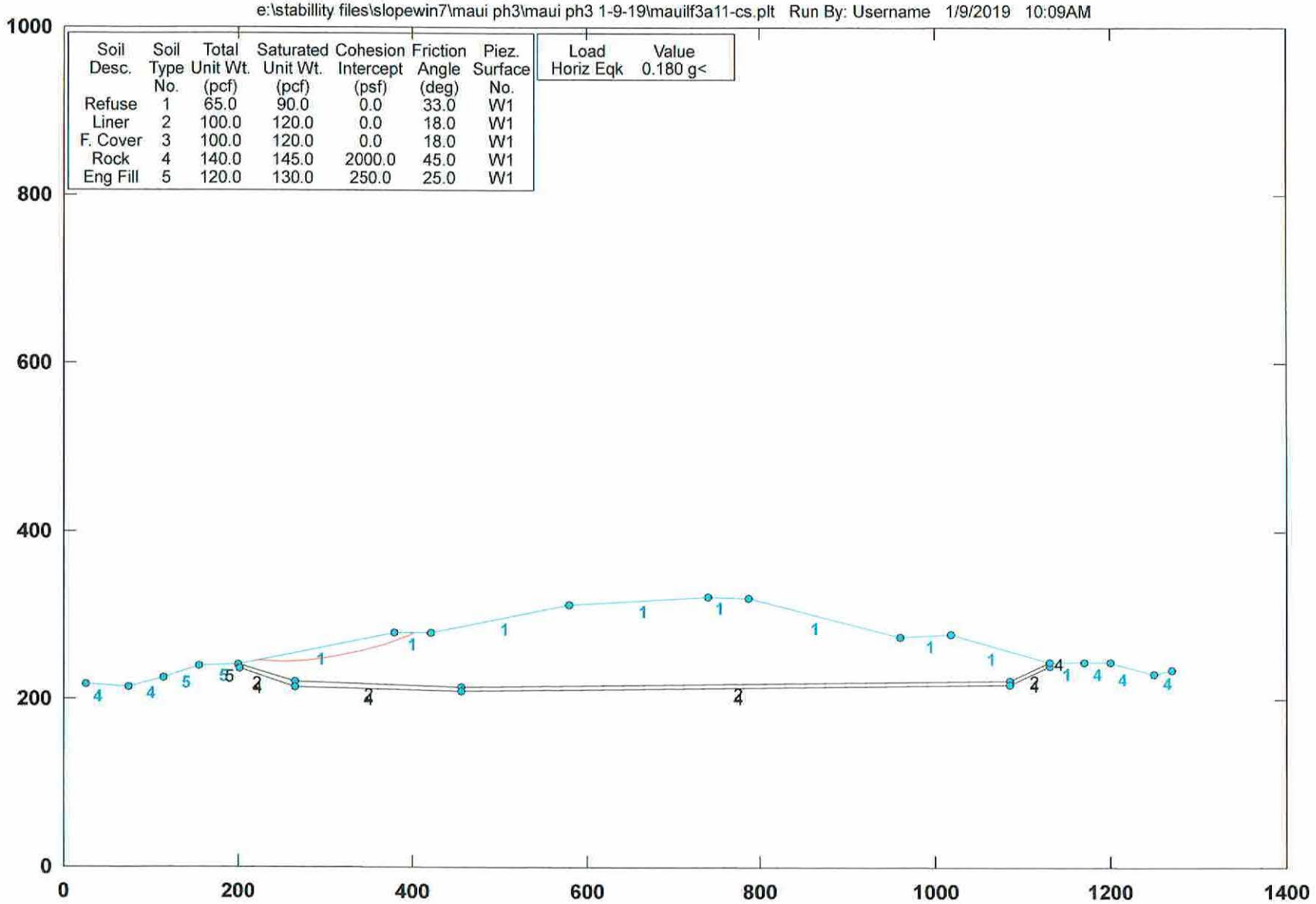


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-cs.plt Run By: Username 1/9/2019 10:09AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

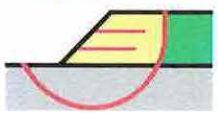
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.72

Factor Of Safety Is Calculated By The Modified Bishop Method

STED

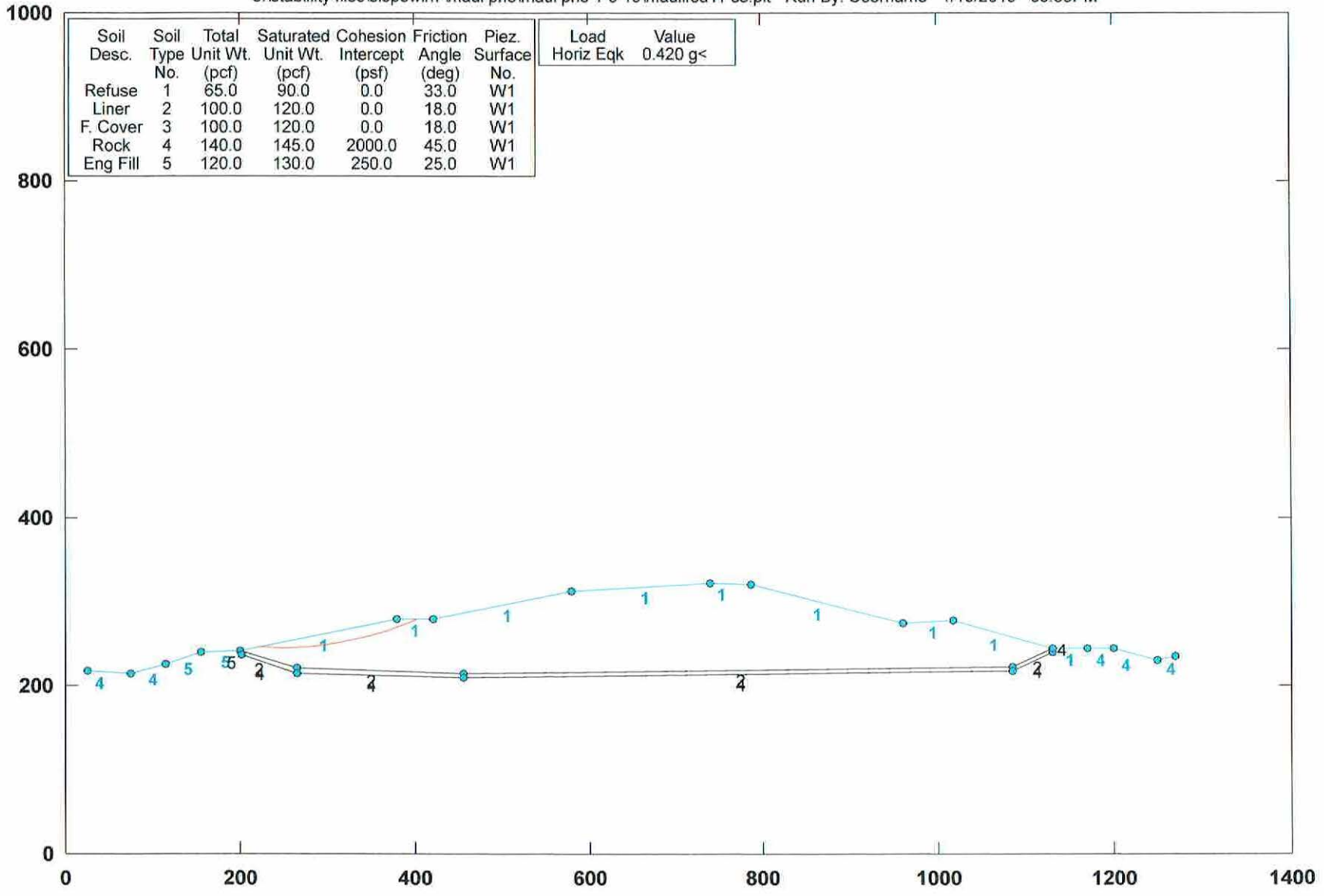


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-ce.plt Run By: Username 1/10/2019 03:35PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

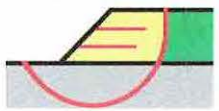
Load	Value
Horiz Eqk	0.420 g<



PCSTABL5M/si FSmin=1.00

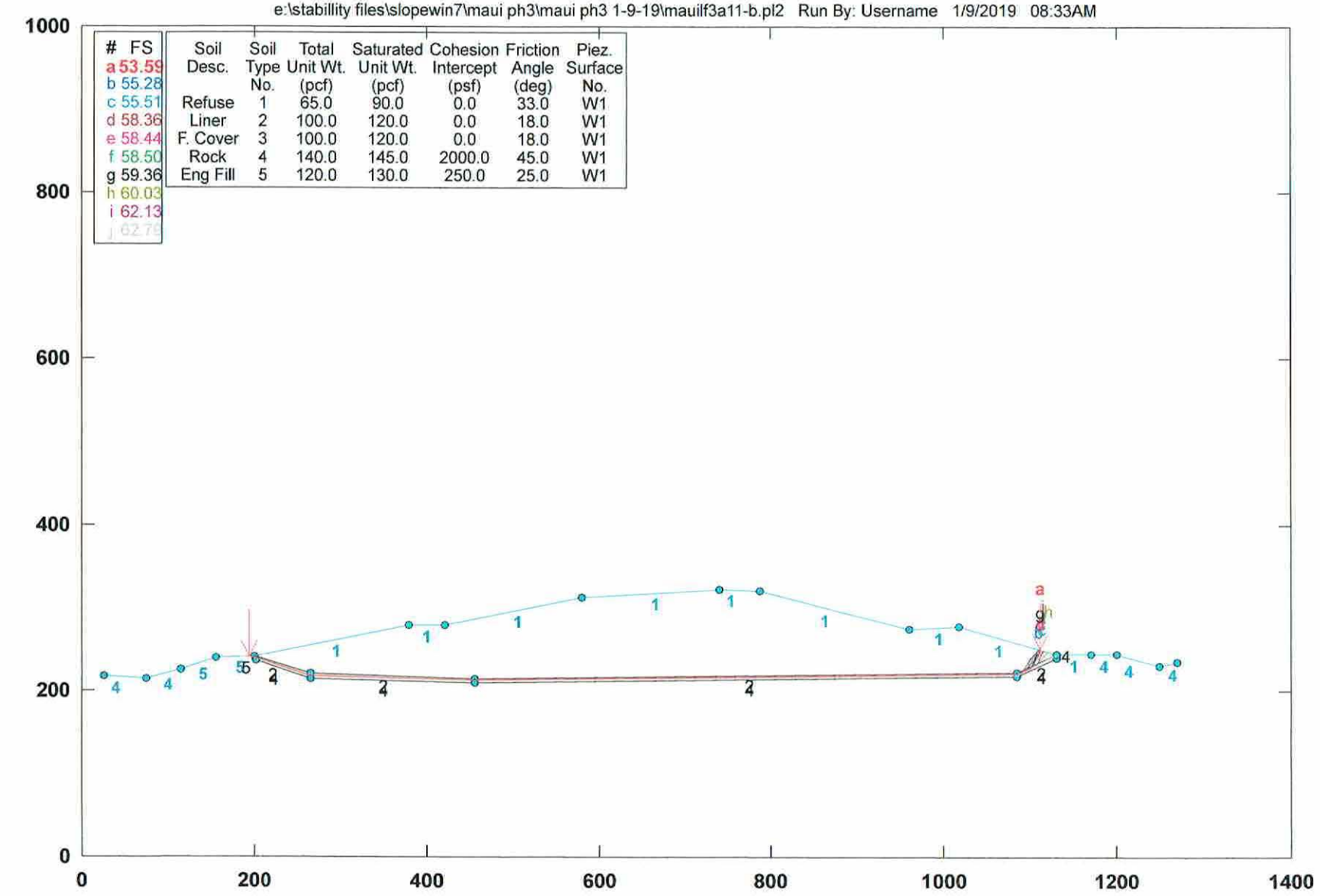
Factor Of Safety Is Calculated By The Modified Bishop Method

STED



CML - ph III Sl. Stab. Section III-S1-3AStatic

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-b.pl2 Run By: Username 1/9/2019 08:33AM



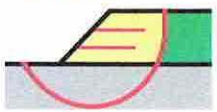
#	FS
a	53.59
b	55.28
c	55.51
d	58.36
e	58.44
f	58.50
g	59.36
h	60.03
i	62.13
j	62.75

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=53.59

Safety Factors Are Calculated By The Modified Janbu Method

STED

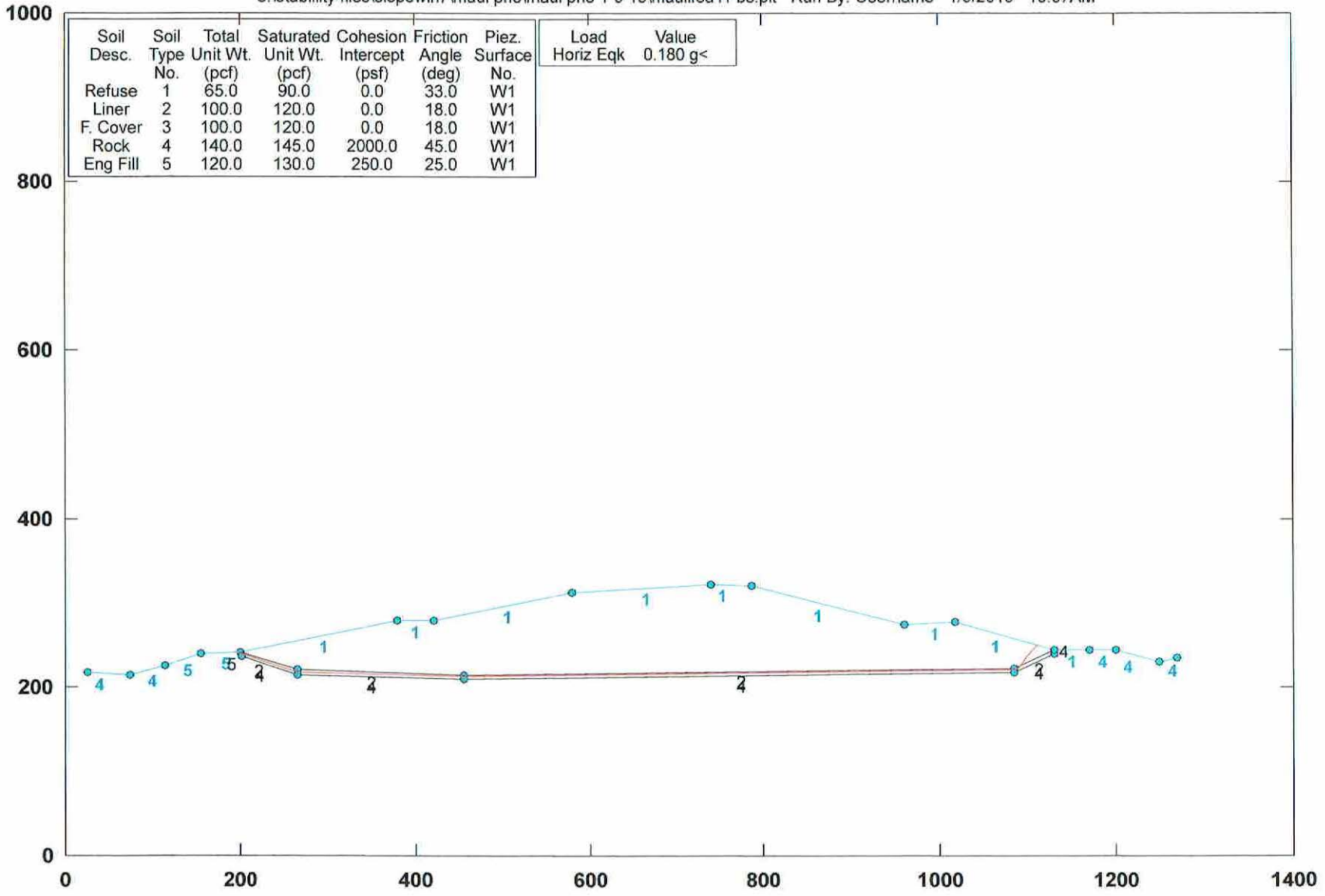


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-bs.plt Run By: Username 1/9/2019 10:07AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

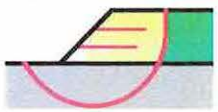
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.78

Factors of Safety Calculated by Janbu Method

STED

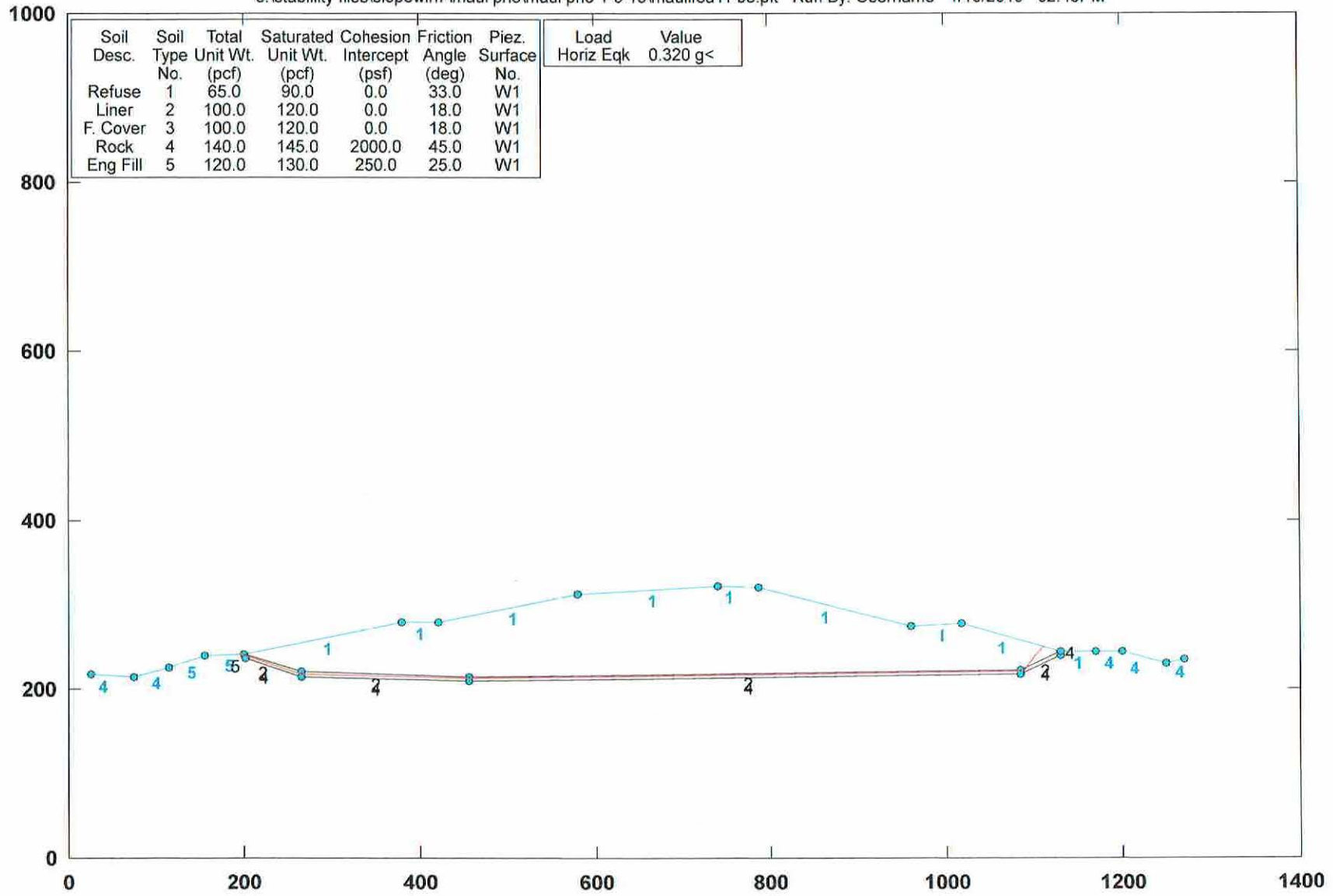


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a11-be.plt Run By: Username 1/10/2019 02:46PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.320 g<



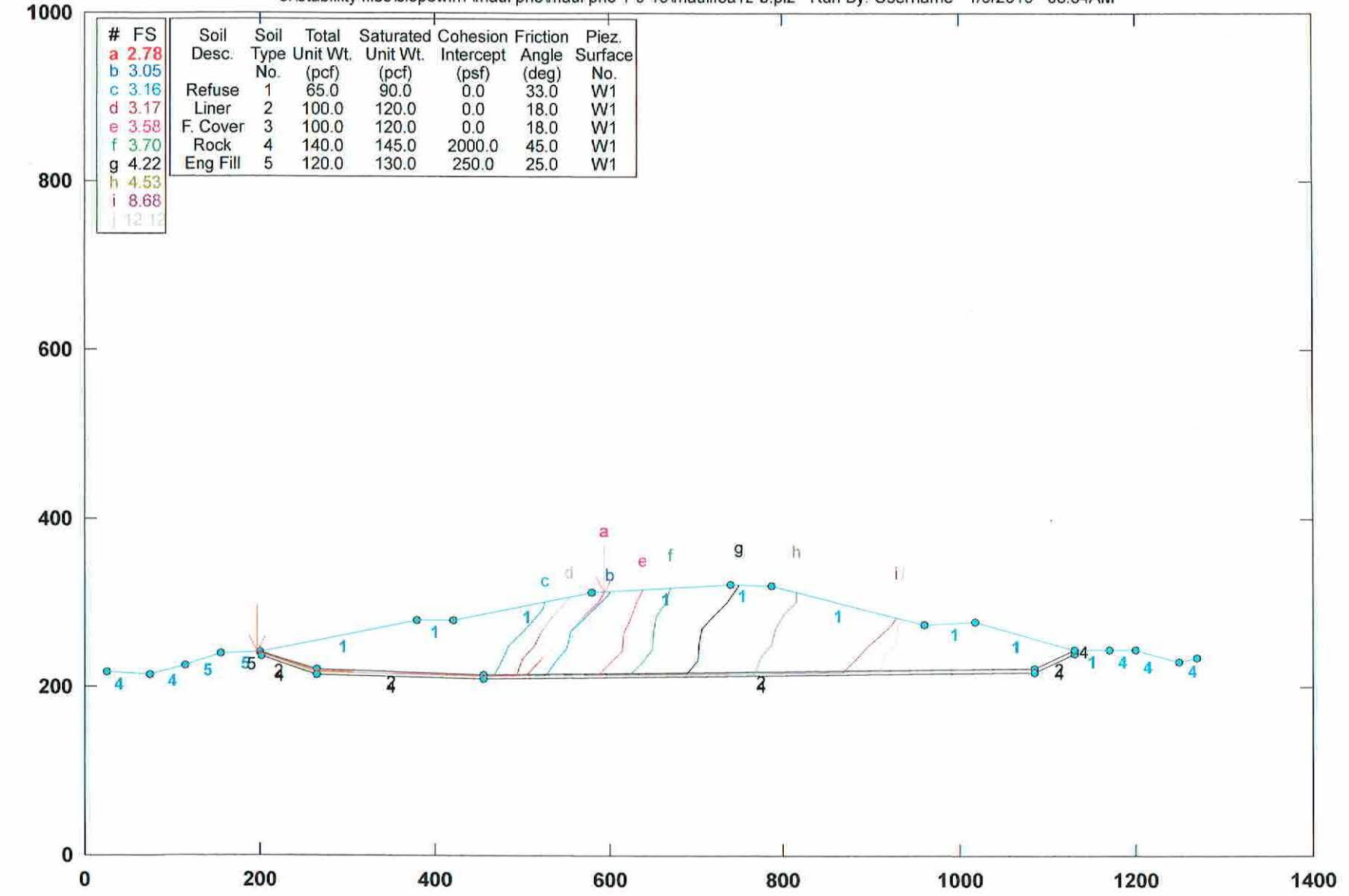
PCSTABL5M/si FSmin=1.01

Factors of Safety Calculated by Janbu Method

STED

CML - ph III Sl. Stab. Section III-S1-3AStatic

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a12-b.pl2 Run By: Username 1/9/2019 08:34AM



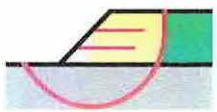
#	FS
a	2.78
b	3.05
c	3.16
d	3.17
e	3.58
f	3.70
g	4.22
h	4.53
i	8.68

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=2.78

Safety Factors Are Calculated By The Modified Janbu Method

STED

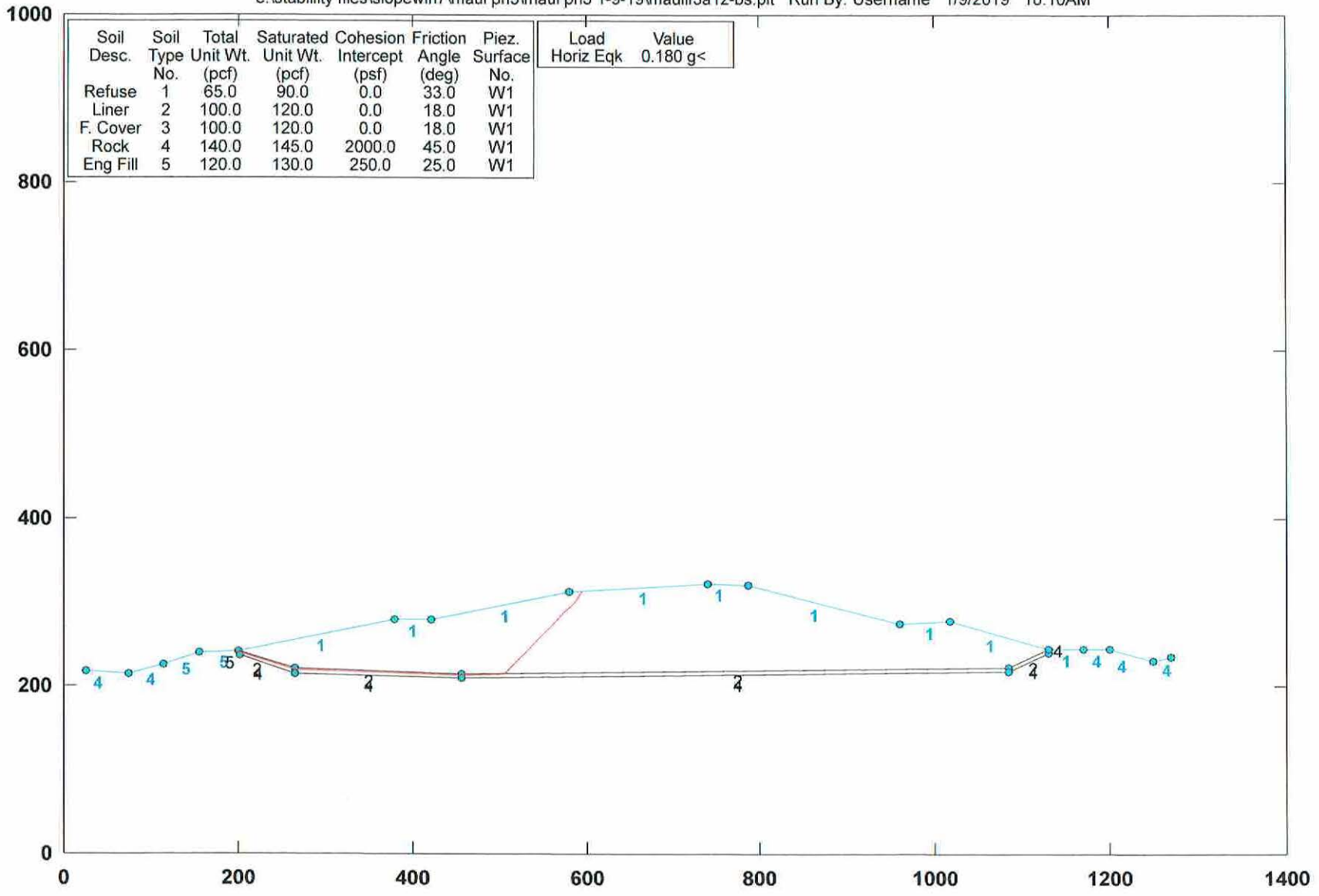


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a12-bs.plt Run By: Username 1/9/2019 10:10AM

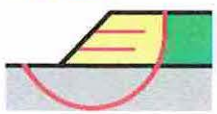
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.25
Factors of Safety Calculated by Janbu Method

STED

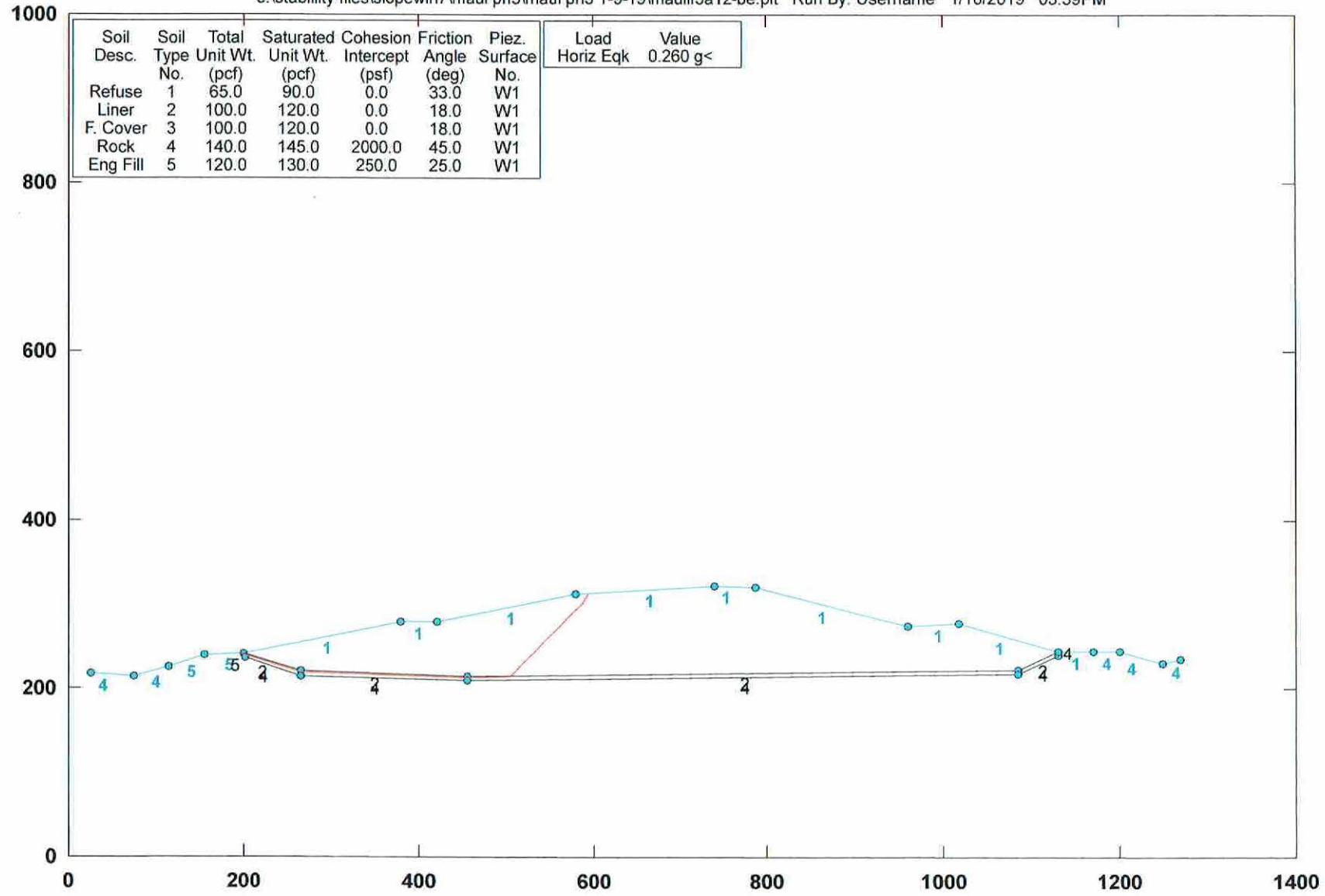


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a12-be.plt Run By: Username 1/10/2019 03:39PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

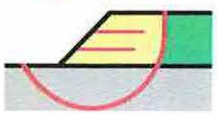
Load	Value
Horiz Eqk	0.260 g<



PCSTABL5M/si FSmin=0.99

Factors of Safety Calculated by Janbu Method

STED

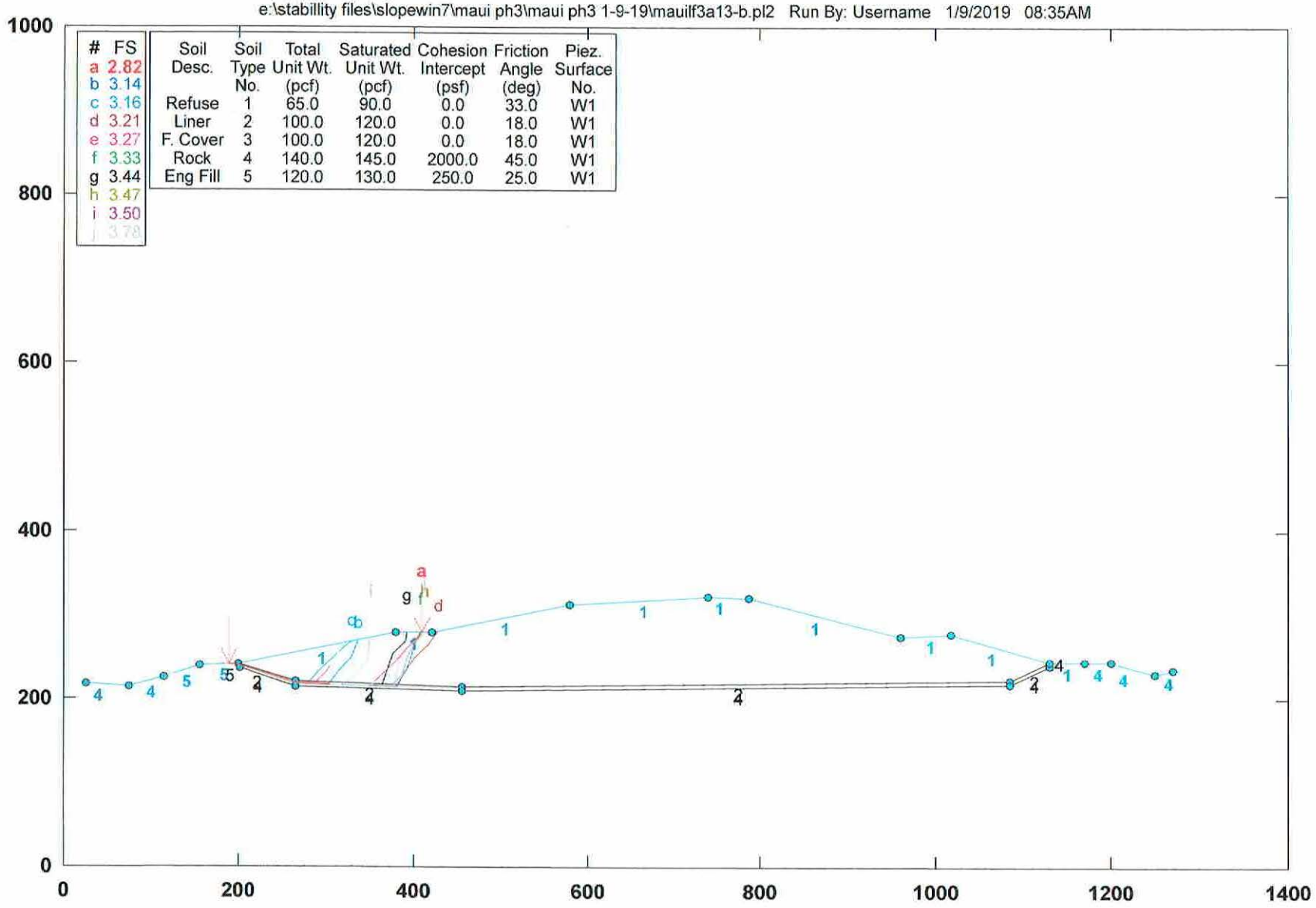


CML - ph III Sl. Stab. Section III-S1-3AStatic

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a13-b.pl2 Run By: Username 1/9/2019 08:35AM

#	FS
a	2.82
b	3.14
c	3.16
d	3.21
e	3.27
f	3.33
g	3.44
h	3.47
i	3.50
j	3.78

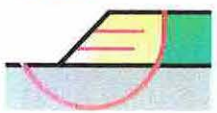
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.82

Safety Factors Are Calculated By The Modified Janbu Method

STED

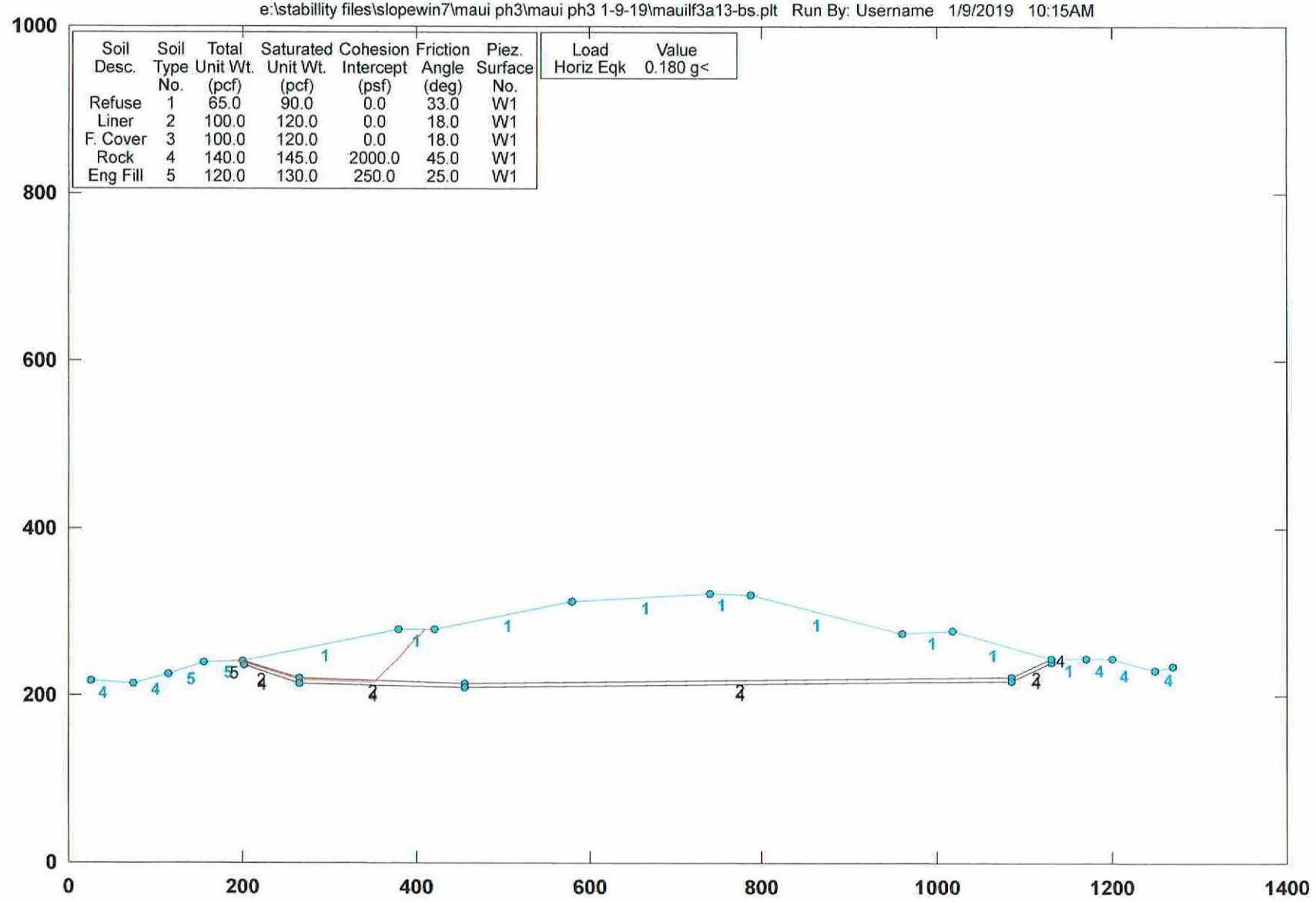


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a13-bs.plt Run By: Username 1/9/2019 10:15AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

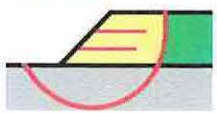
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.32

Factors of Safety Calculated by Janbu Method

STED

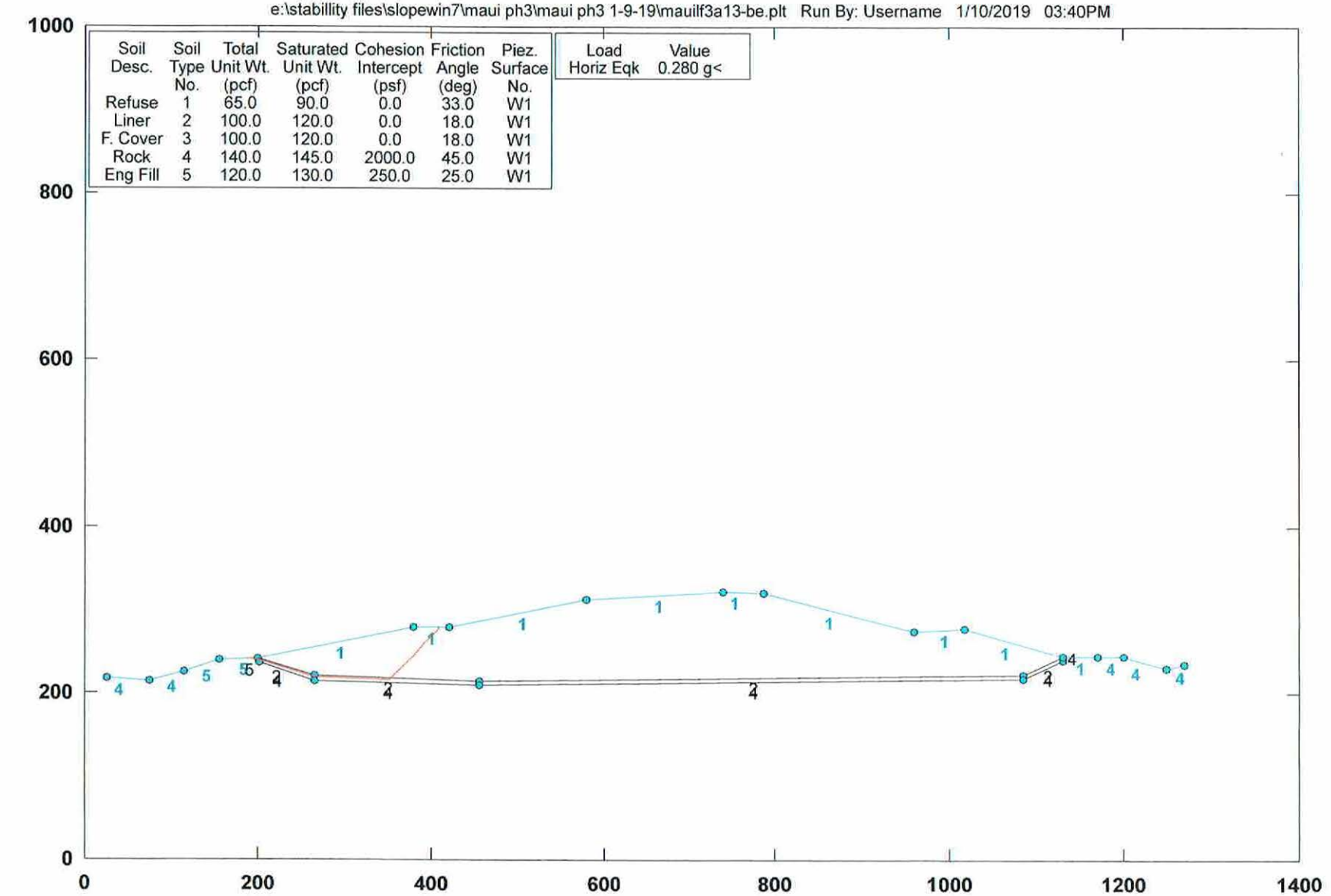


CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a13-be.plt Run By: Username 1/10/2019 03:40PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

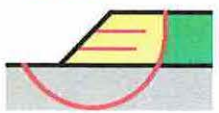
Load	Value
Horiz Eqk	0.280 g<



PCSTABL5M/si FSmin=1.00

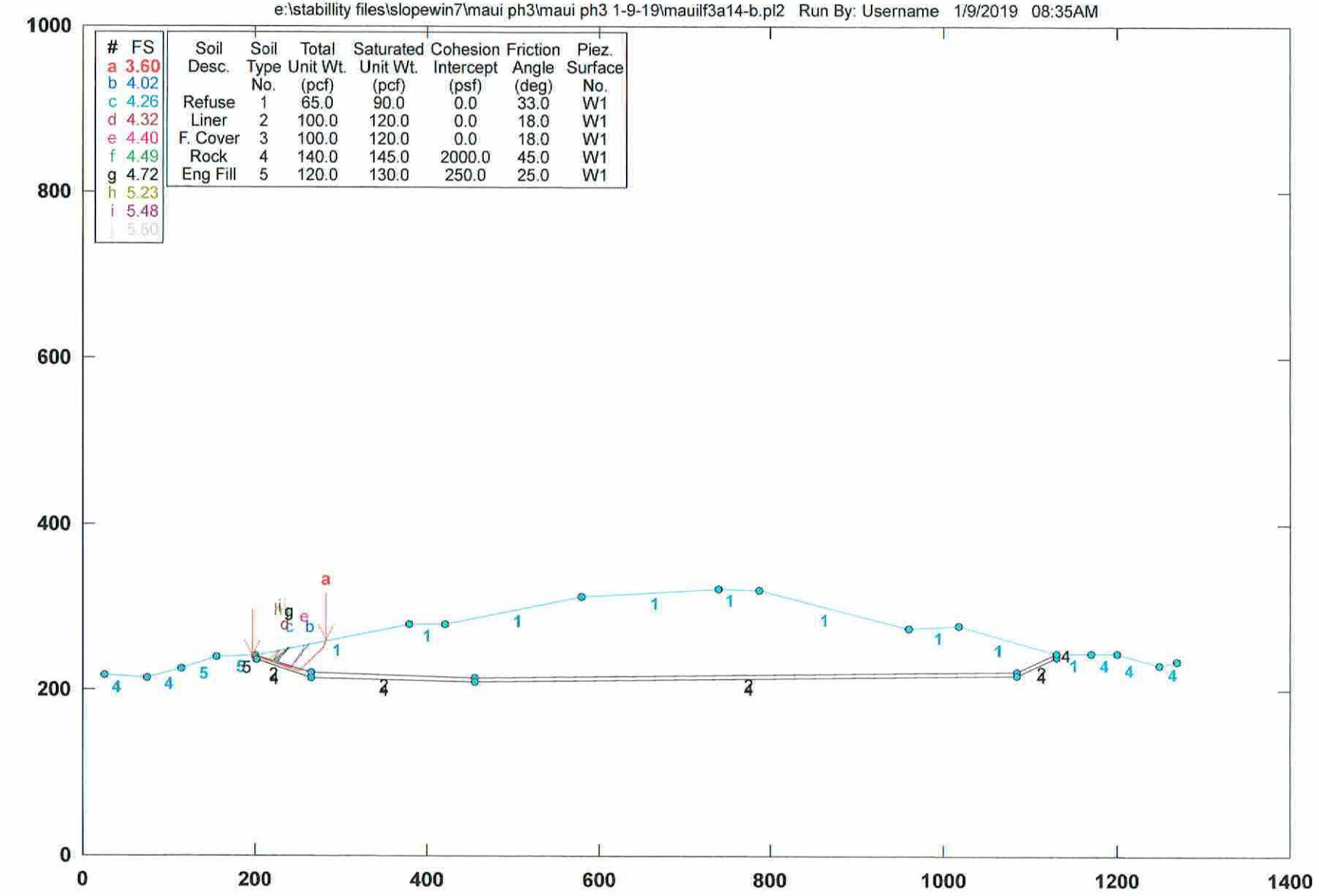
Factors of Safety Calculated by Janbu Method

STED



CML - ph III Sl. Stab. Section III-S1-3AStatic

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a14-b.pl2 Run By: Username 1/9/2019 08:35AM



#	FS
a	3.60
b	4.02
c	4.26
d	4.32
e	4.40
f	4.49
g	4.72
h	5.23
i	5.48
j	5.60

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=3.60

Safety Factors Are Calculated By The Modified Janbu Method

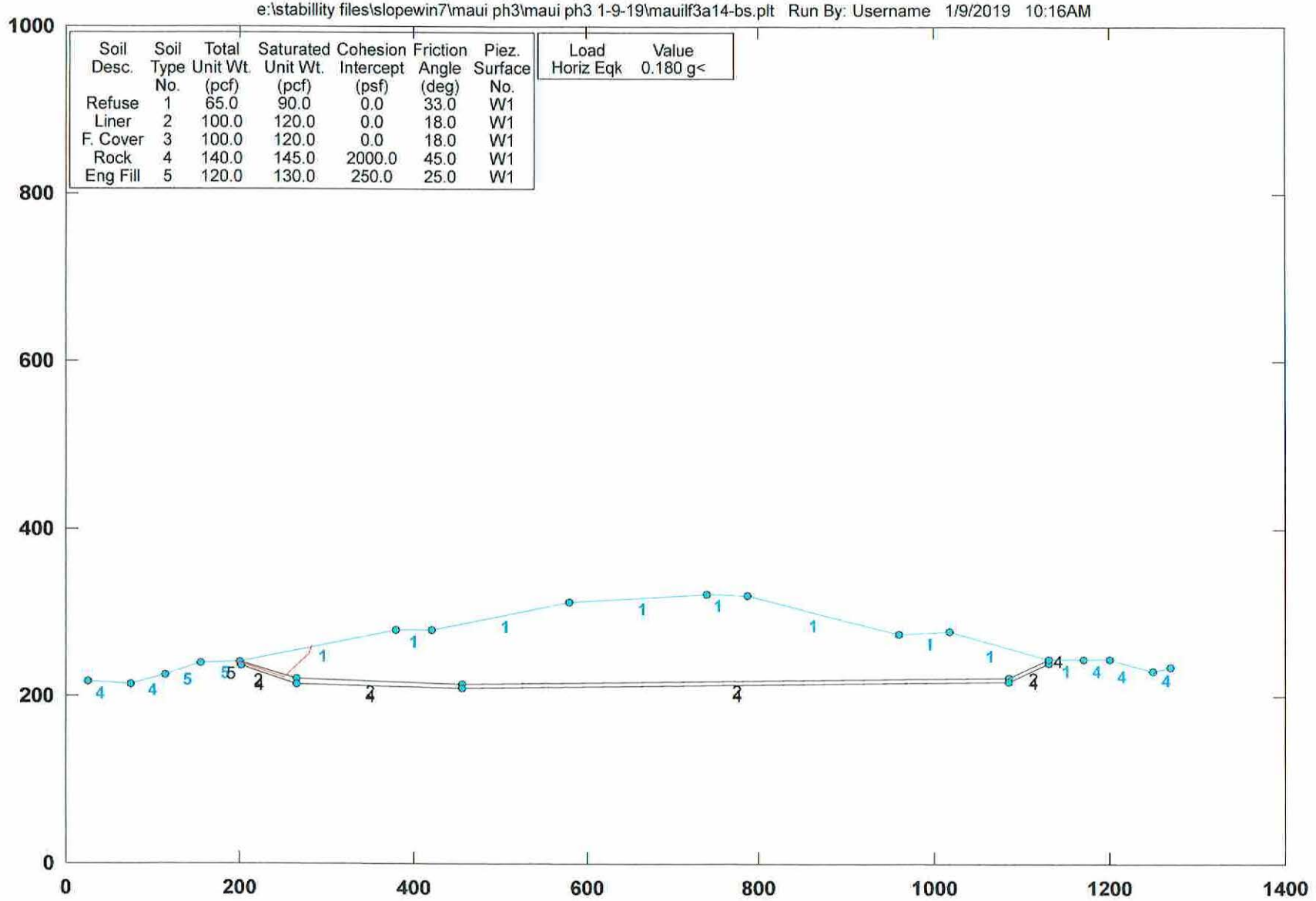
STED

CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a14-bs.plt Run By: Username 1/9/2019 10:16AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.69

Factors of Safety Calculated by Janbu Method

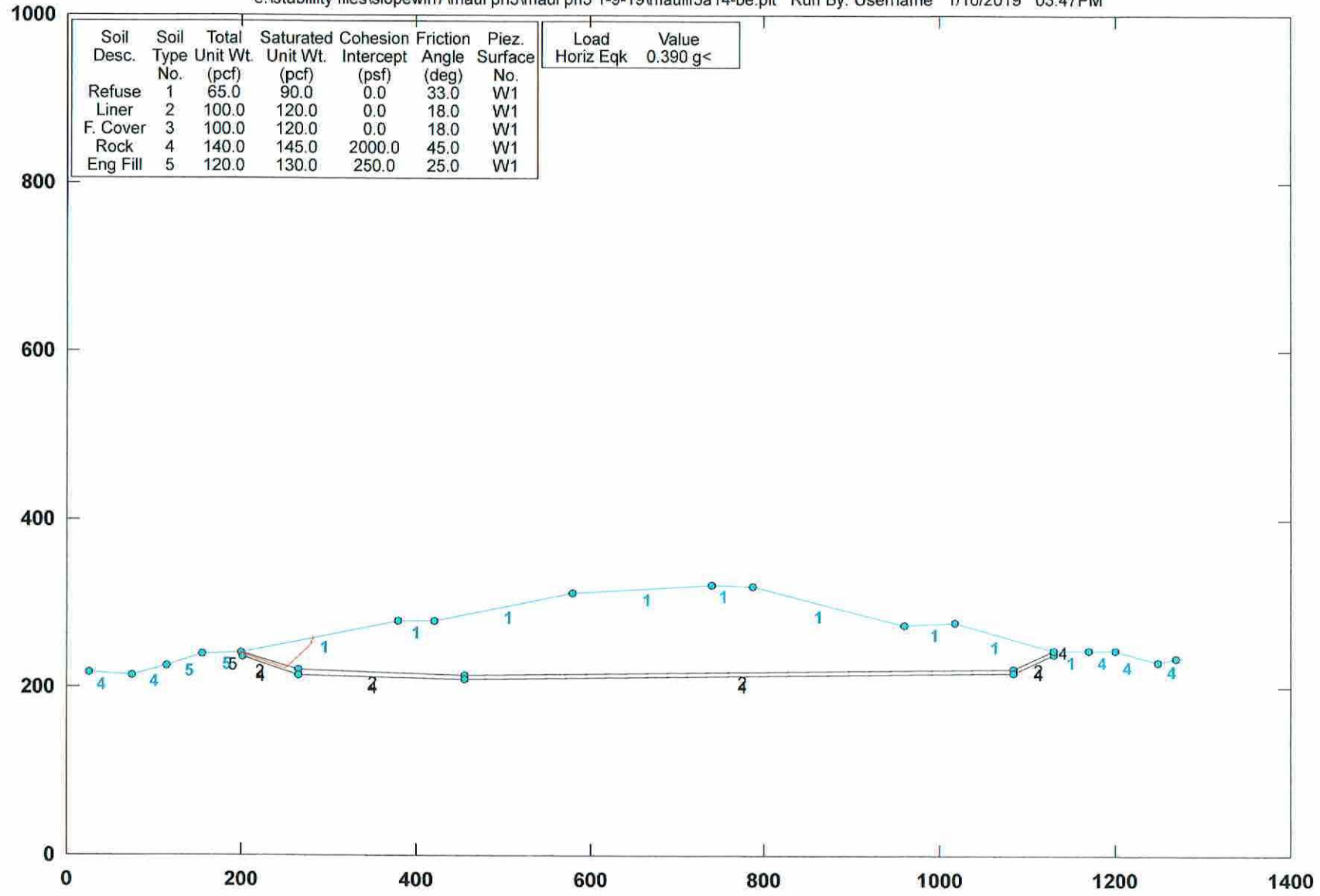
STED

CML - ph III Sl. Stab. Section III-S1-3APseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf3a14-be.plt Run By: Username 1/10/2019 03:47PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

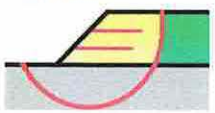
Load	Value
Horiz Eqk	0.390 g<



PCSTABL5M/si FSmin=1.00

Factors of Safety Calculated by Janbu Method

STED



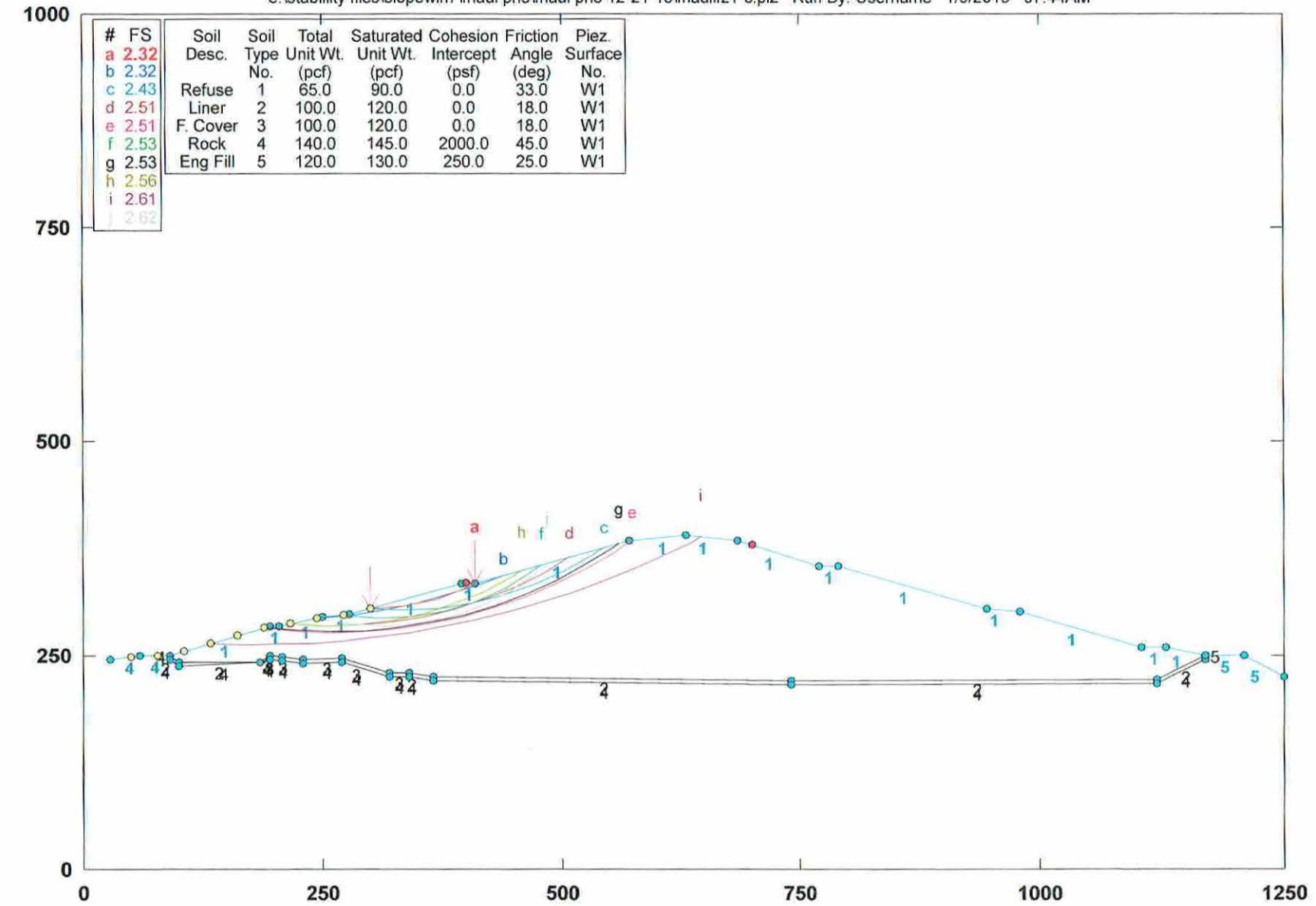
CROSS SECTION
III-S2

CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf21-c.pl2 Run By: Username 1/9/2019 07:44AM

#	FS
a	2.32
b	2.32
c	2.43
d	2.51
e	2.51
f	2.53
g	2.53
h	2.56
i	2.61
j	2.62

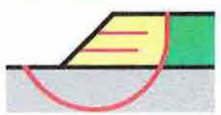
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.32

Safety Factors Are Calculated By The Modified Bishop Method

STED

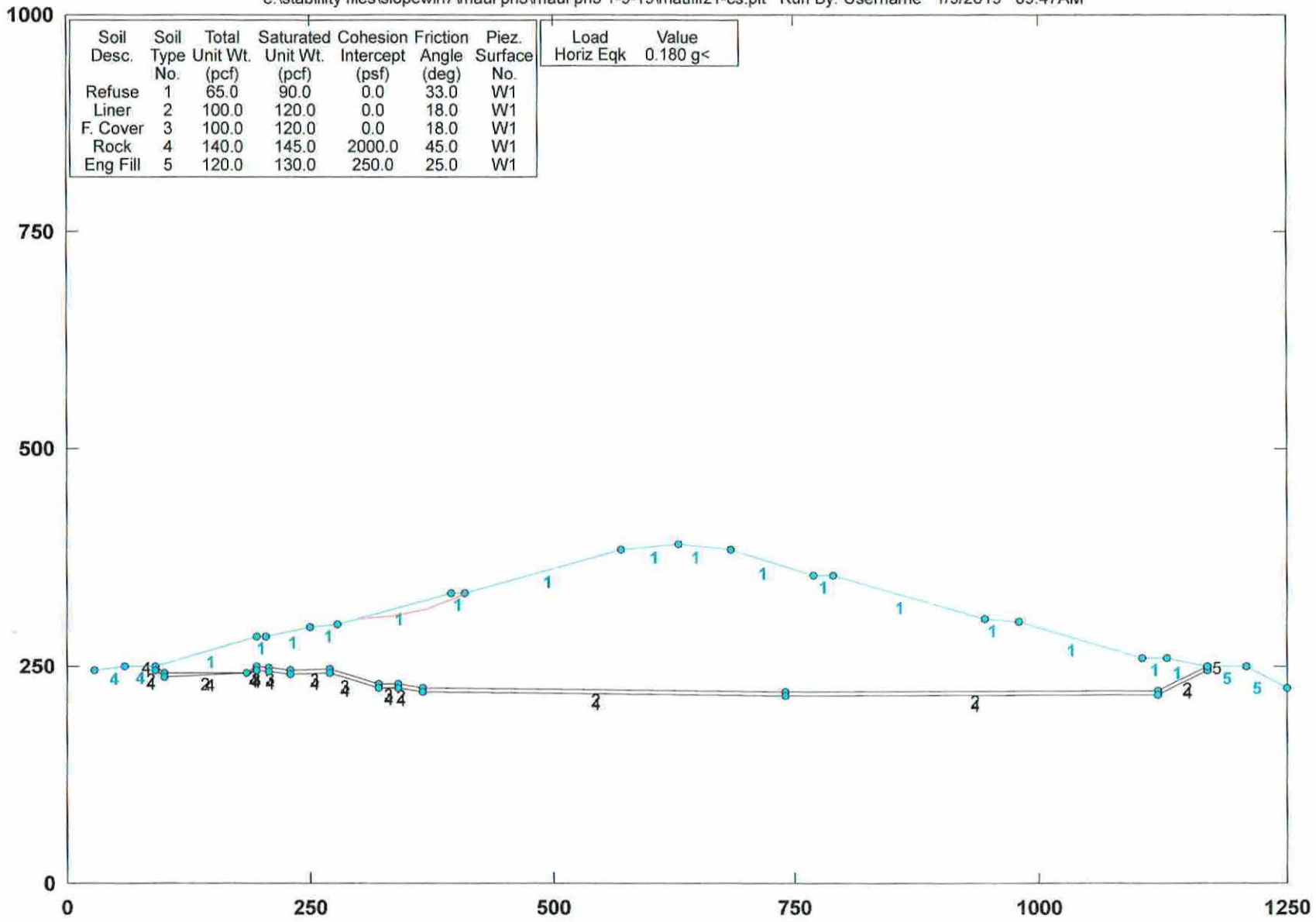


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf21-cs.plt Run By: Username 1/9/2019 09:47AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

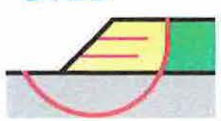
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.37

Factor Of Safety Is Calculated By The Modified Bishop Method

STED

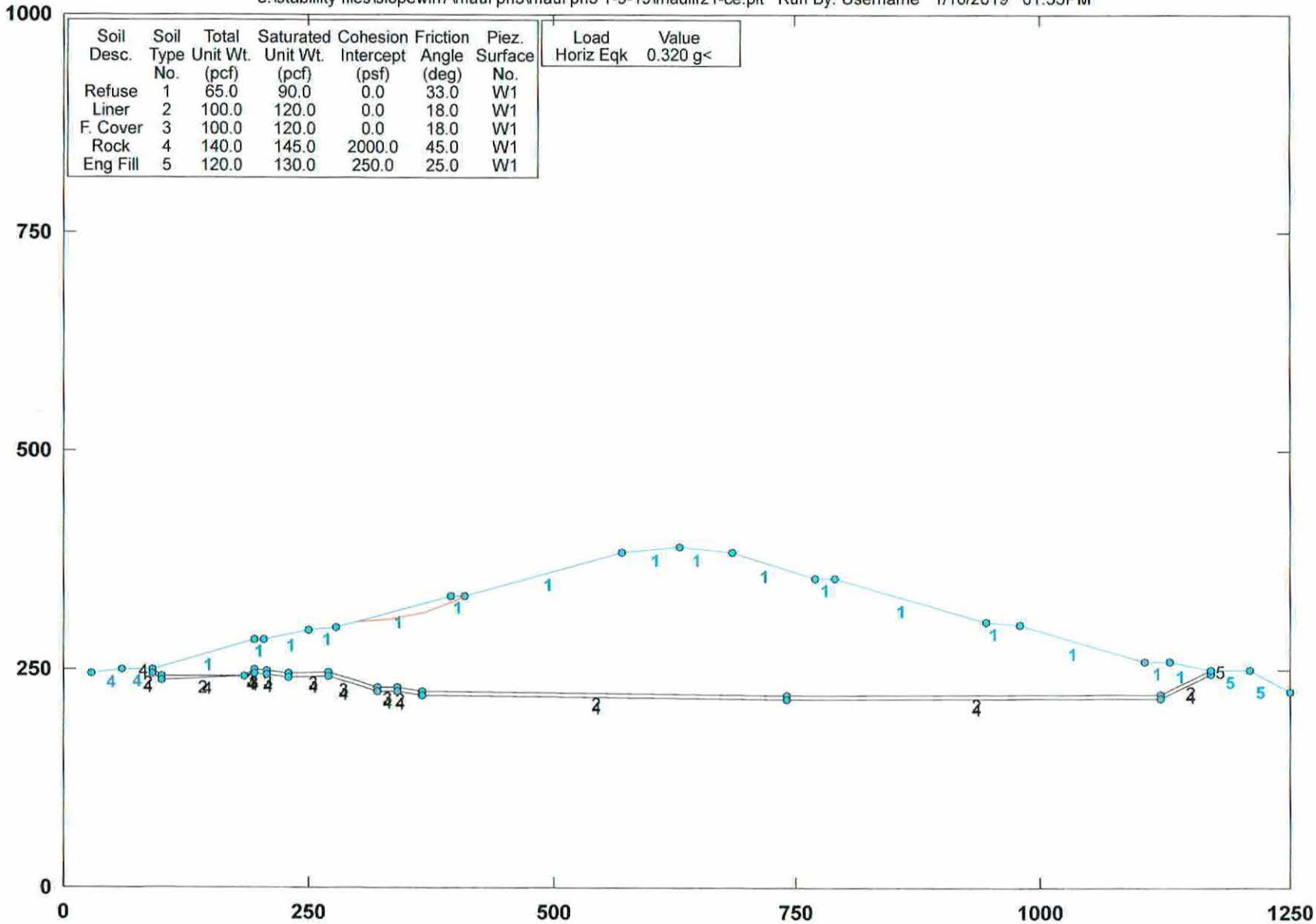


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf21-ce.plt Run By: Username 1/10/2019 01:55PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

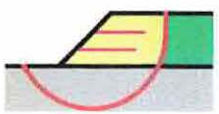
Load	Value
Horiz Eqk	0.320 g<



PCSTABL5M/si FSmin=1.01

Factor Of Safety Is Calculated By The Modified Bishop Method

STED

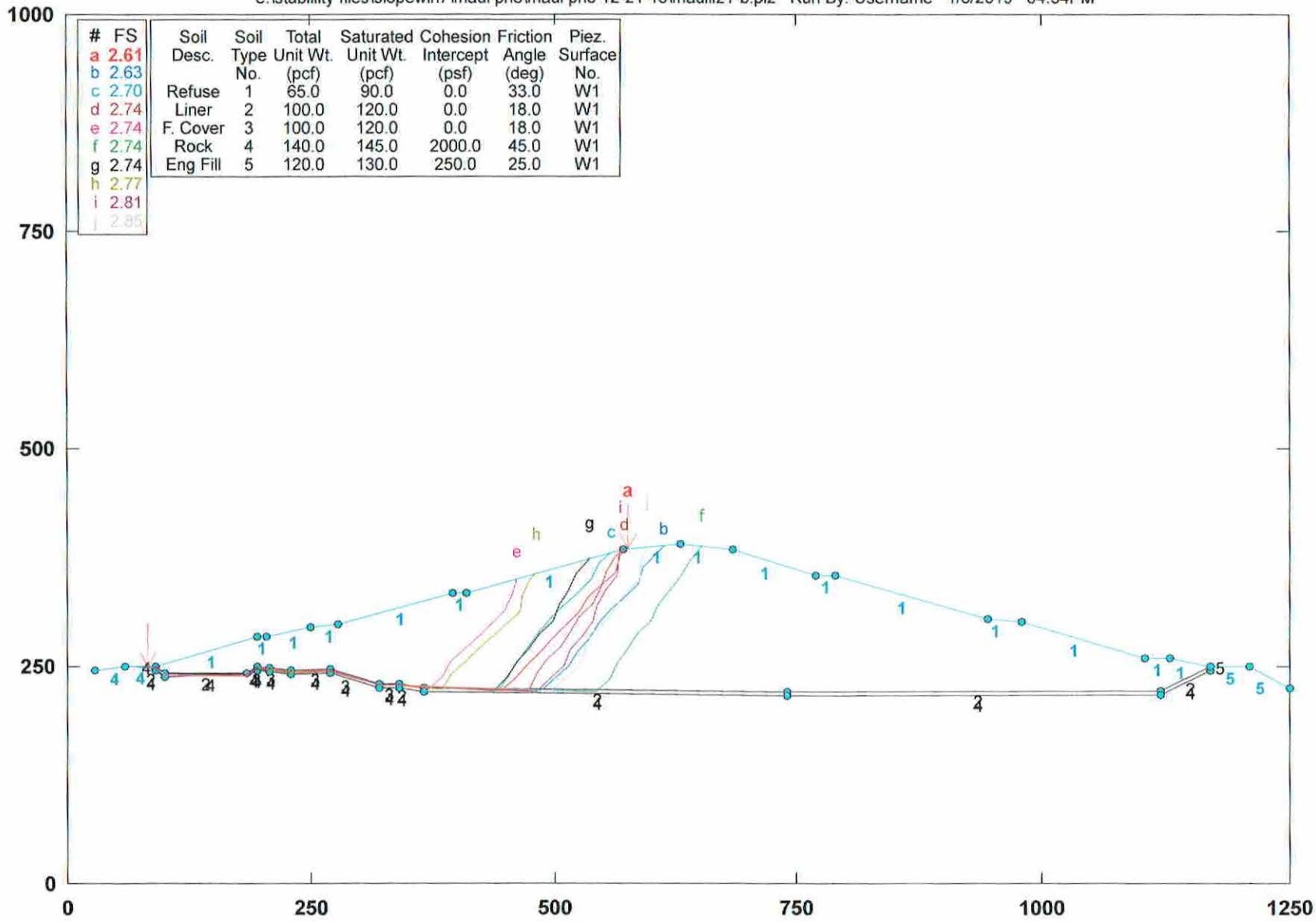


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf21-b.pl2 Run By: Username 1/8/2019 04:54PM

#	FS
a	2.61
b	2.63
c	2.70
d	2.74
e	2.74
f	2.74
g	2.74
h	2.77
i	2.81
j	2.85

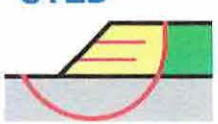
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.61

Safety Factors Are Calculated By The Modified Janbu Method

STED

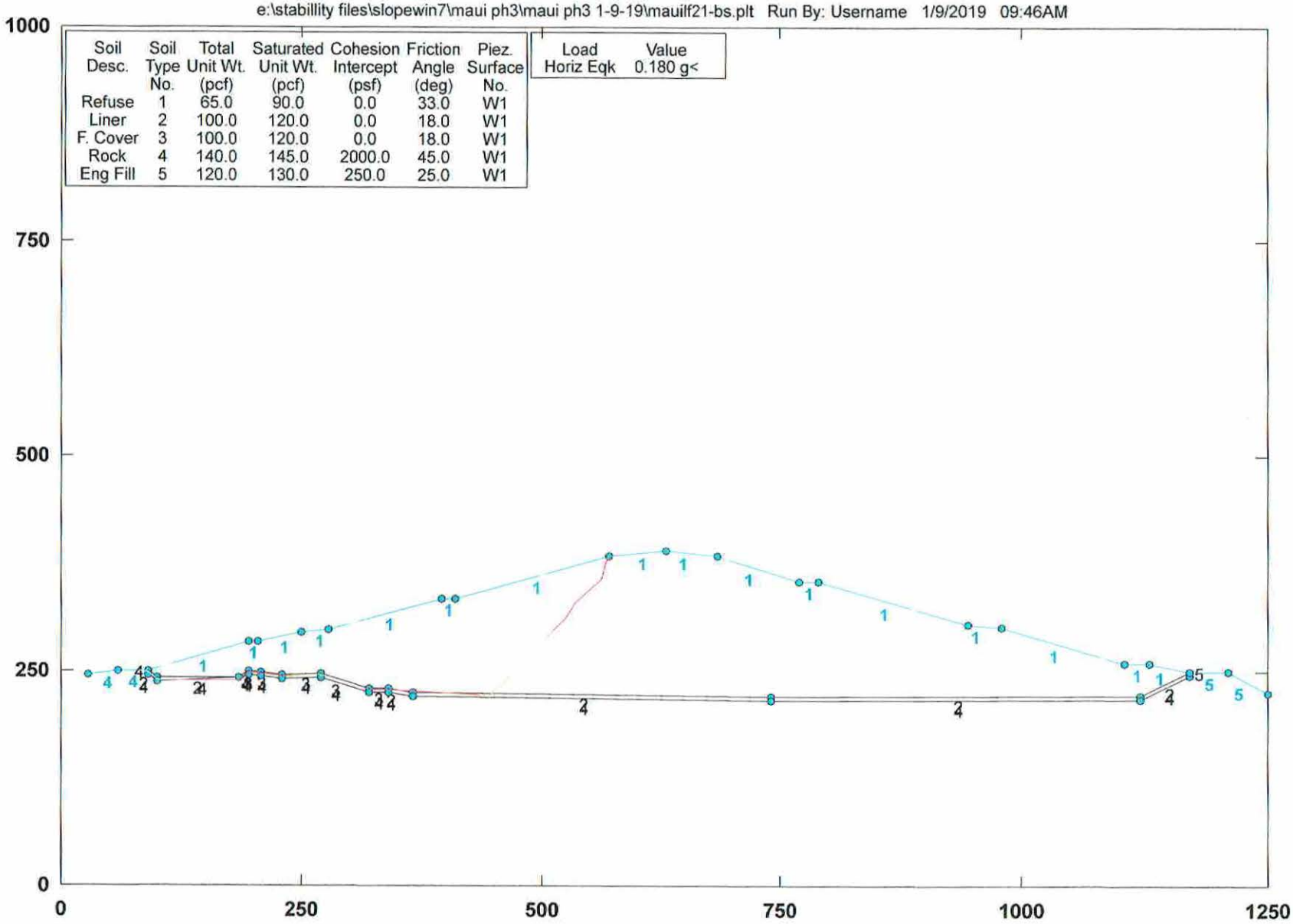


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf21-bs.plt Run By: Username 1/9/2019 09:46AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

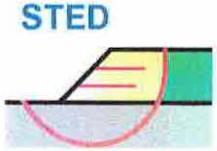
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.47

Factors of Safety Calculated by Janbu Method

STED

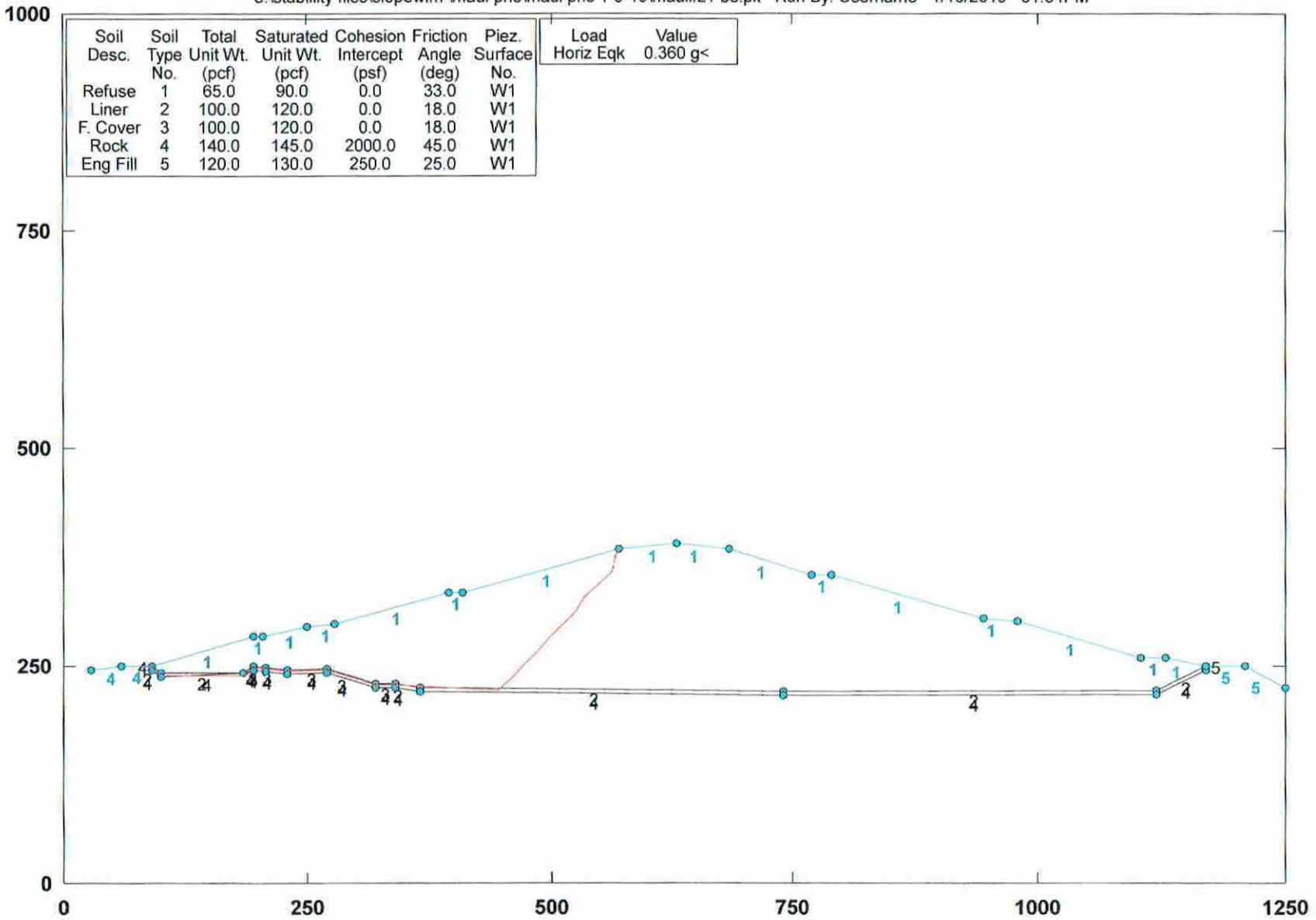


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf21-be.plt Run By: Username 1/10/2019 01:54PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

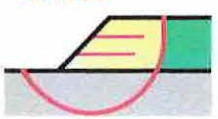
Load	Value
Horiz Eqk	0.360 g<



PCSTABL5M/si FSmin=1.00

Factors of Safety Calculated by Janbu Method

STED

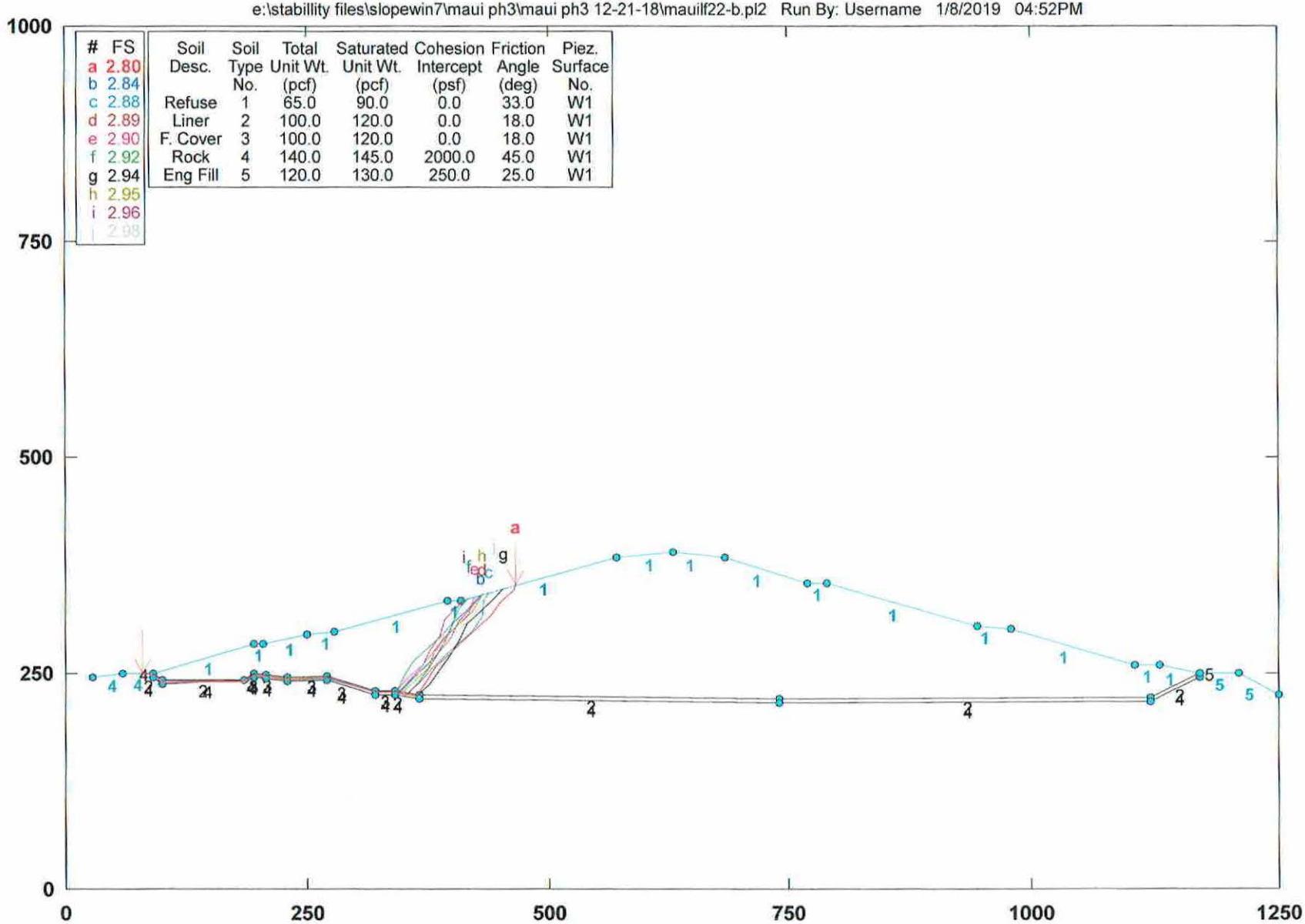


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf22-b.pl2 Run By: Username 1/8/2019 04:52PM

#	FS
a	2.80
b	2.84
c	2.88
d	2.89
e	2.90
f	2.92
g	2.94
h	2.95
i	2.96
j	2.98

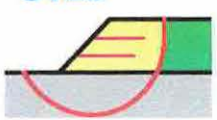
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.80

Safety Factors Are Calculated By The Modified Janbu Method

STED

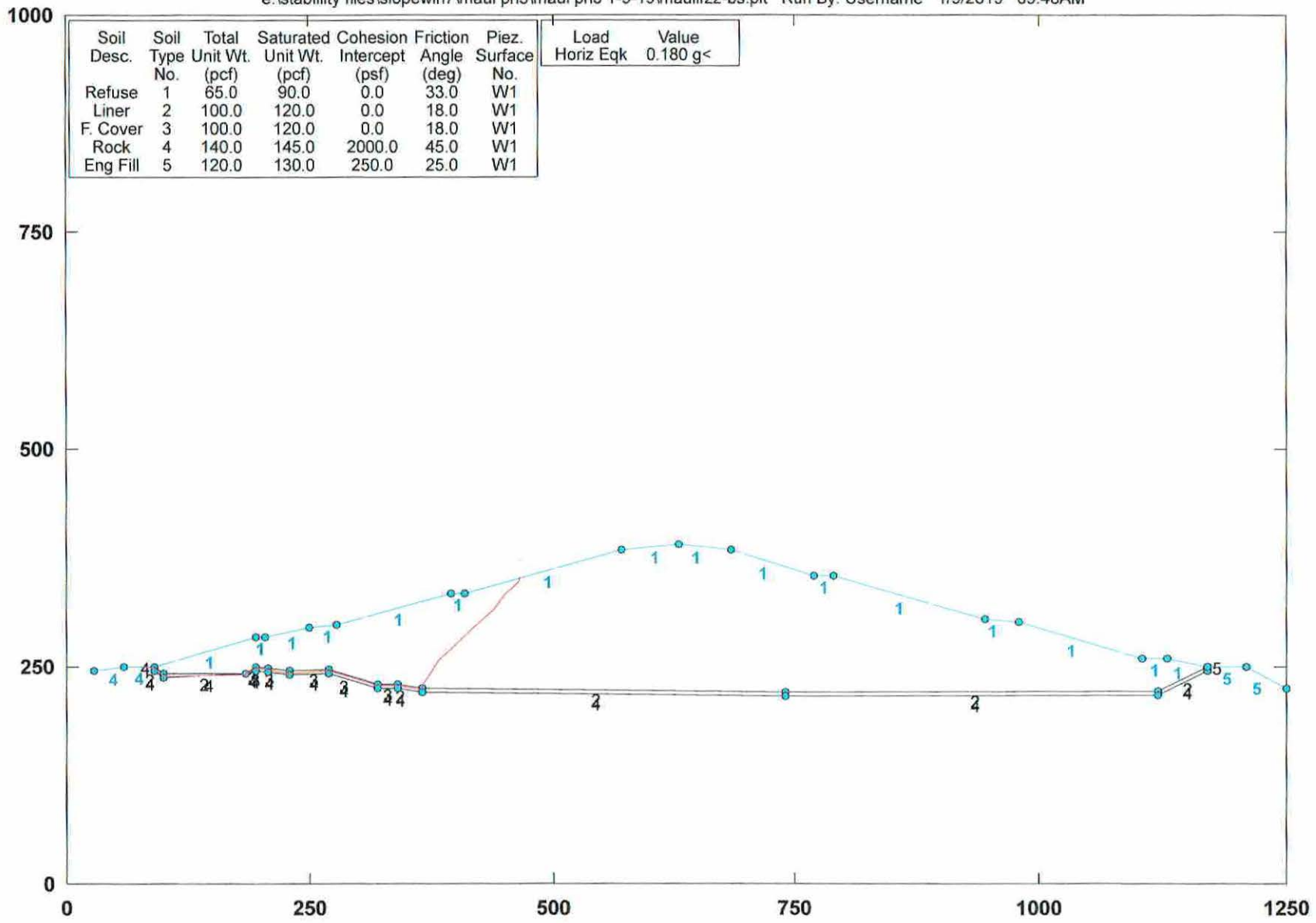


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf22-bs.plt Run By: Username 1/9/2019 09:48AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

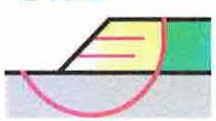
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.54

Factors of Safety Calculated by Janbu Method

STED

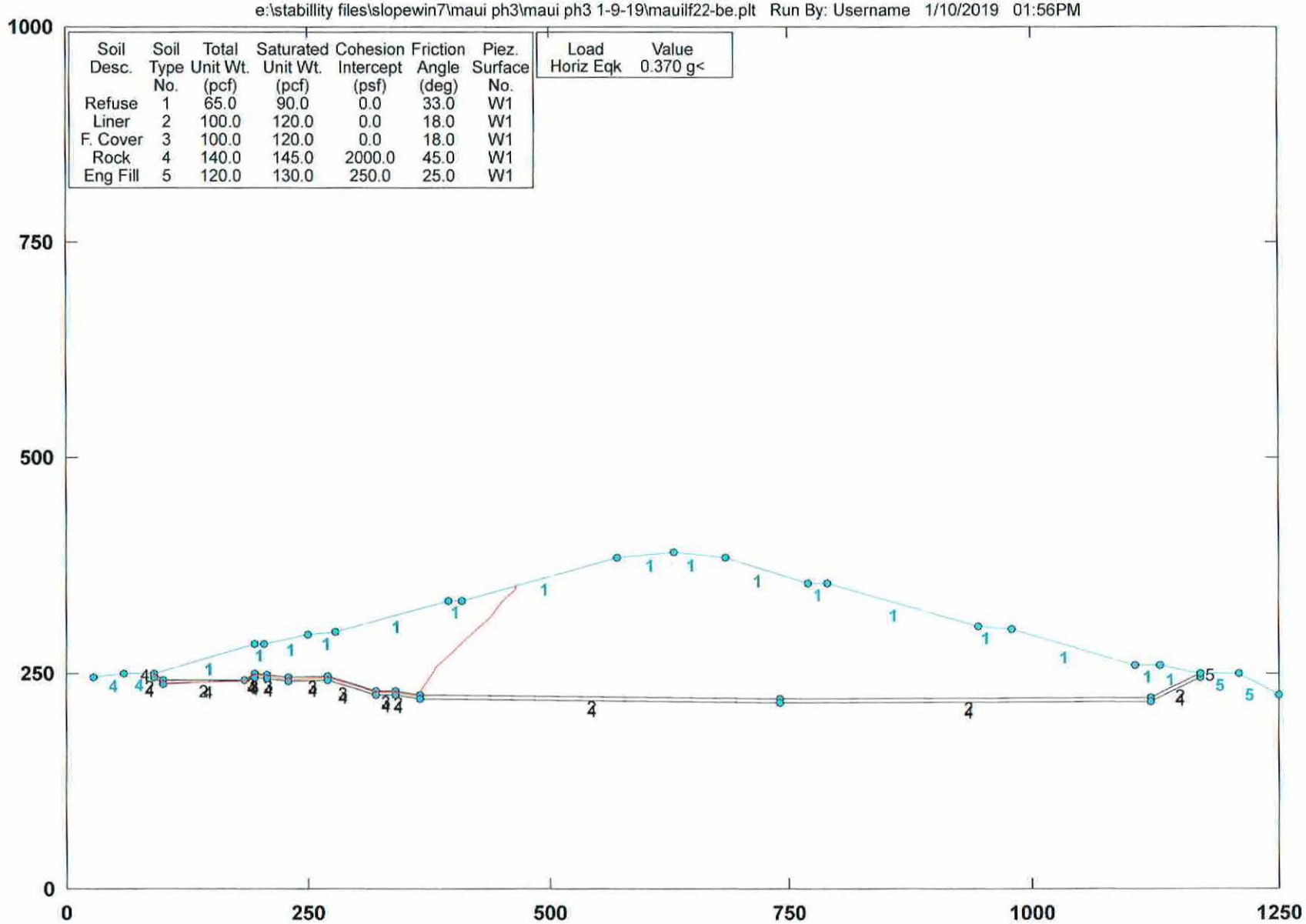


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf22-be.plt Run By: Username 1/10/2019 01:56PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

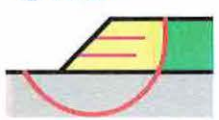
Load	Value
Horiz Eqk	0.370 g<



PCSTABL5M/si FSmin=1.01

Factors of Safety Calculated by Janbu Method

STED

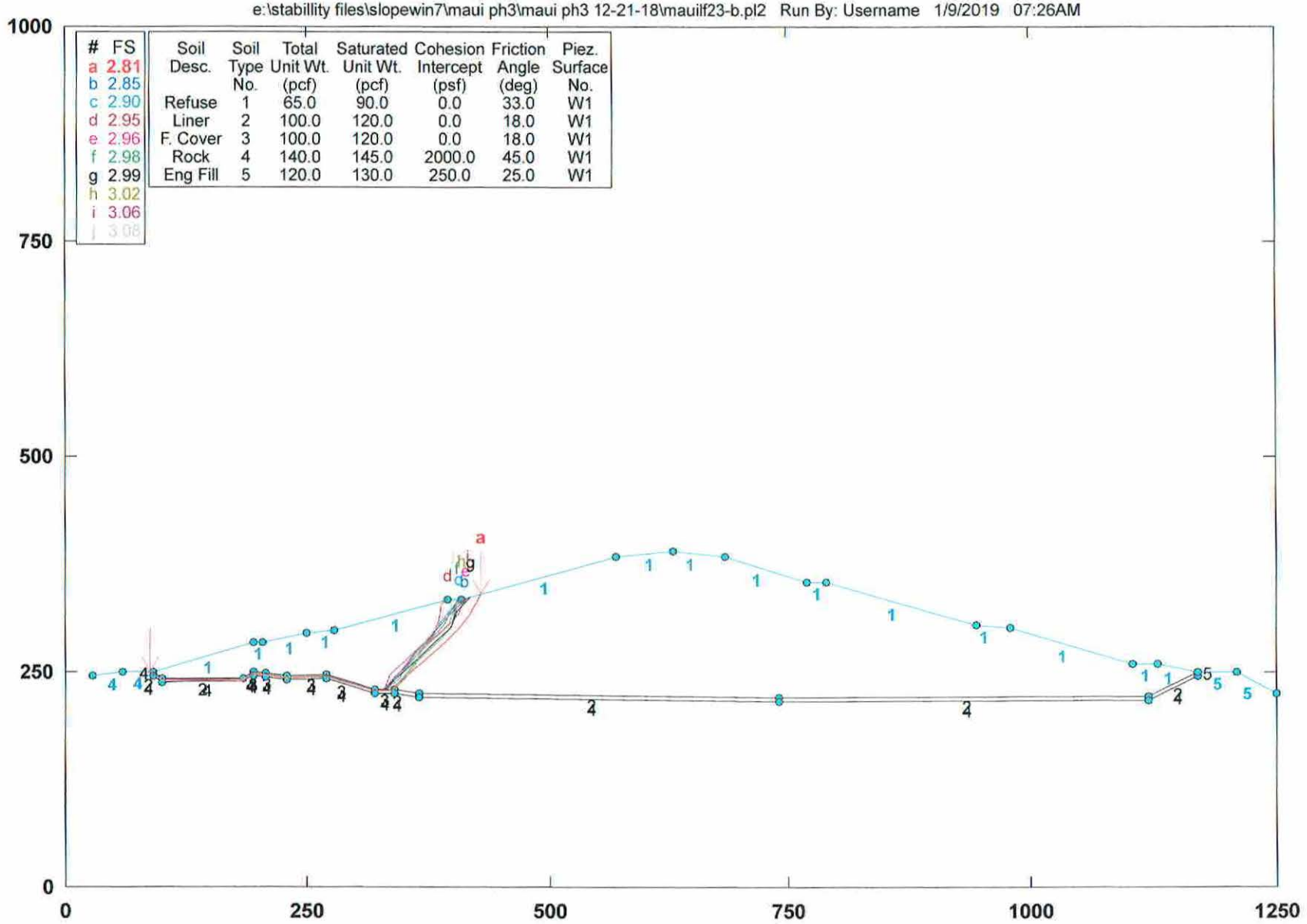


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf23-b.pl2 Run By: Username 1/9/2019 07:26AM

#	FS
a	2.81
b	2.85
c	2.90
d	2.95
e	2.96
f	2.98
g	2.99
h	3.02
i	3.06
j	3.08

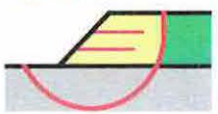
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.81

Safety Factors Are Calculated By The Modified Janbu Method

STED

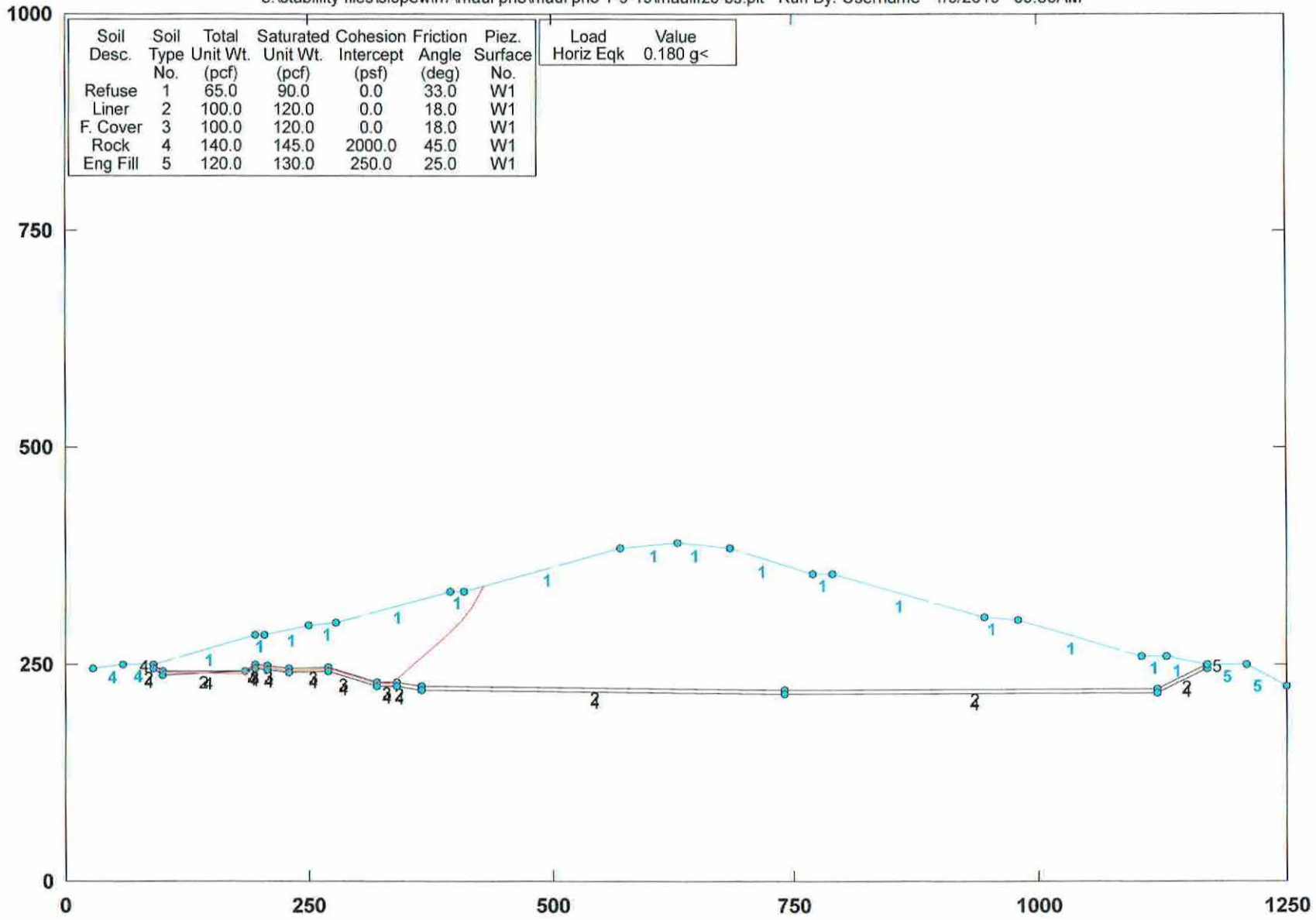


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf23-bs.plt Run By: Username 1/9/2019 09:50AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.57

Factors of Safety Calculated by Janbu Method

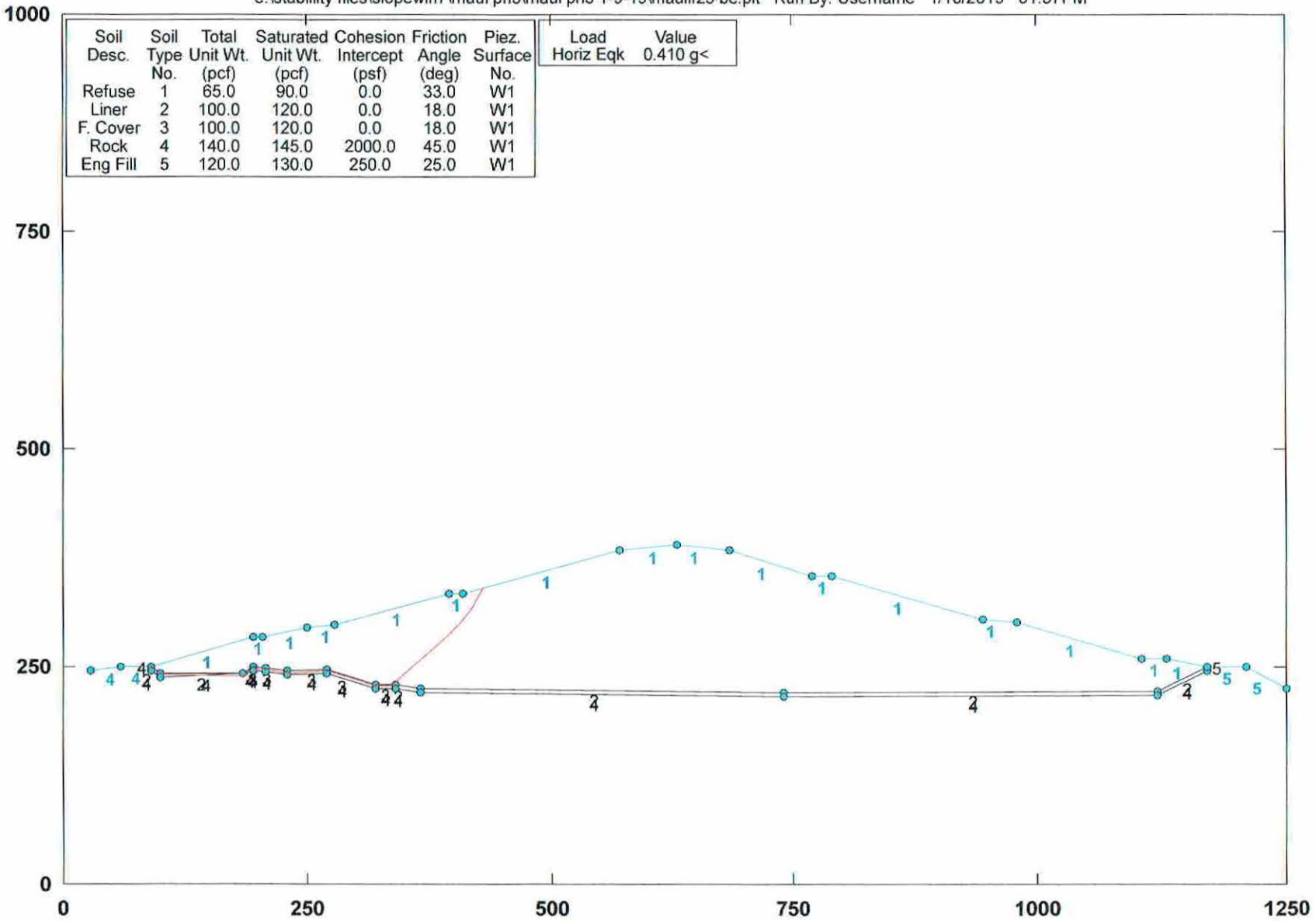
STED

CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf23-be.plt Run By: Username 1/10/2019 01:57PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

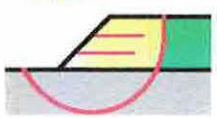
Load	Value
Horiz Eqk	0.410 g<



PCSTABL5M/si FSmin=1.01

Factors of Safety Calculated by Janbu Method

STED

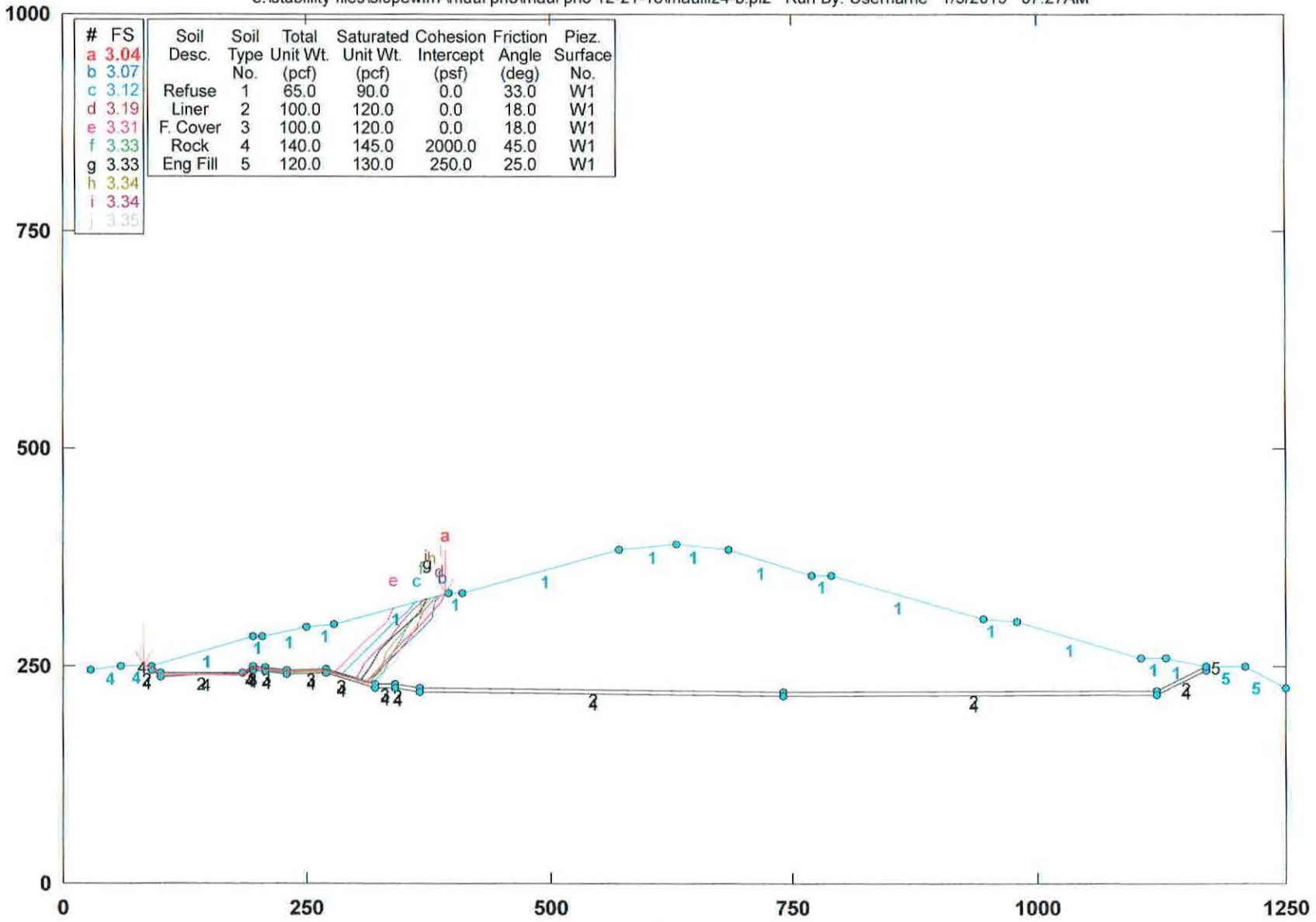


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf24-b.pl2 Run By: Username 1/9/2019 07:27AM

#	FS
a	3.04
b	3.07
c	3.12
d	3.19
e	3.31
f	3.33
g	3.33
h	3.34
i	3.34
j	3.35

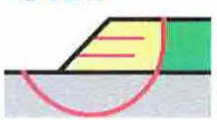
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=3.04

Safety Factors Are Calculated By The Modified Janbu Method

STED

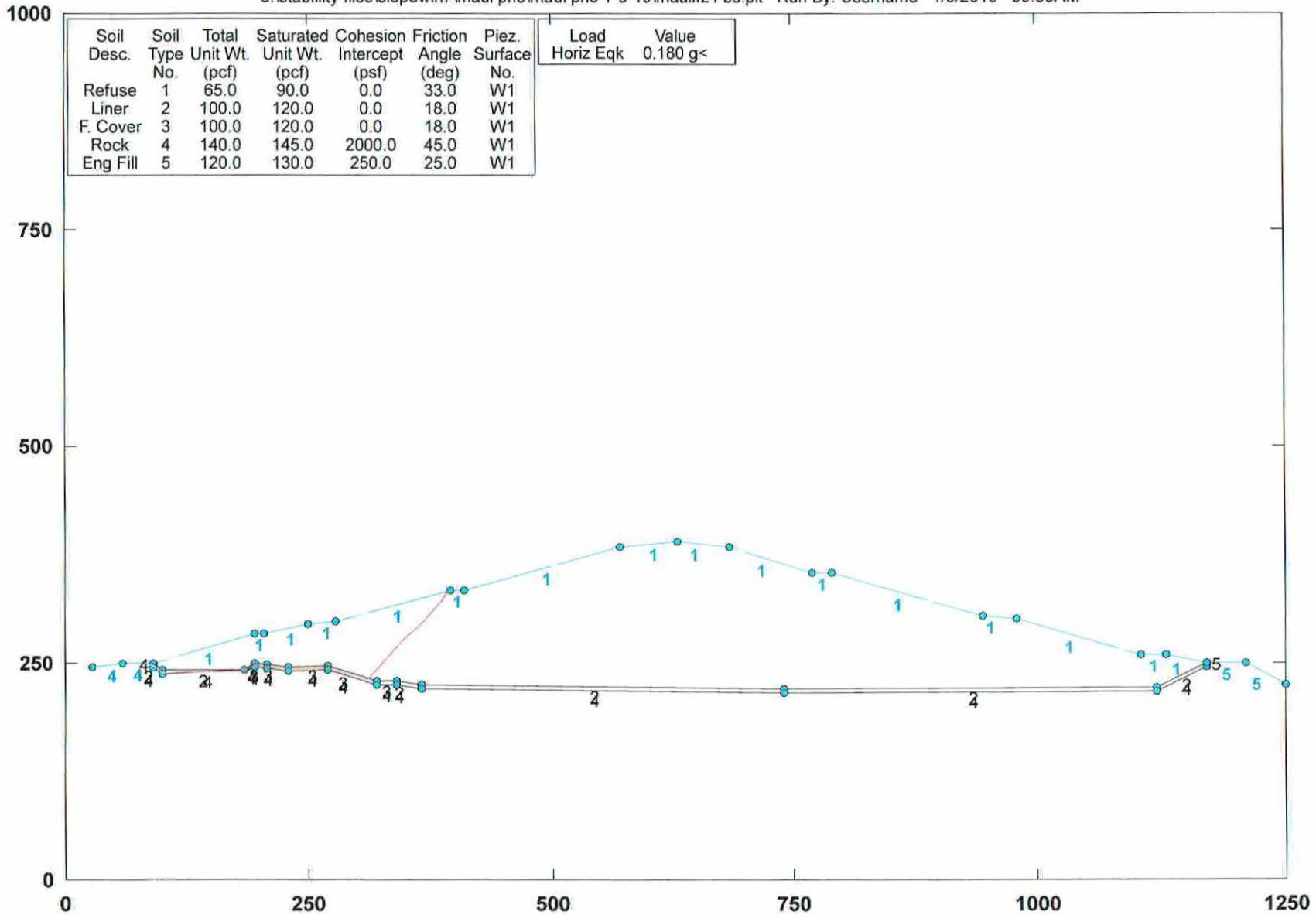


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf24-bs.plt Run By: Username 1/9/2019 09:50AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.70

Factors of Safety Calculated by Janbu Method

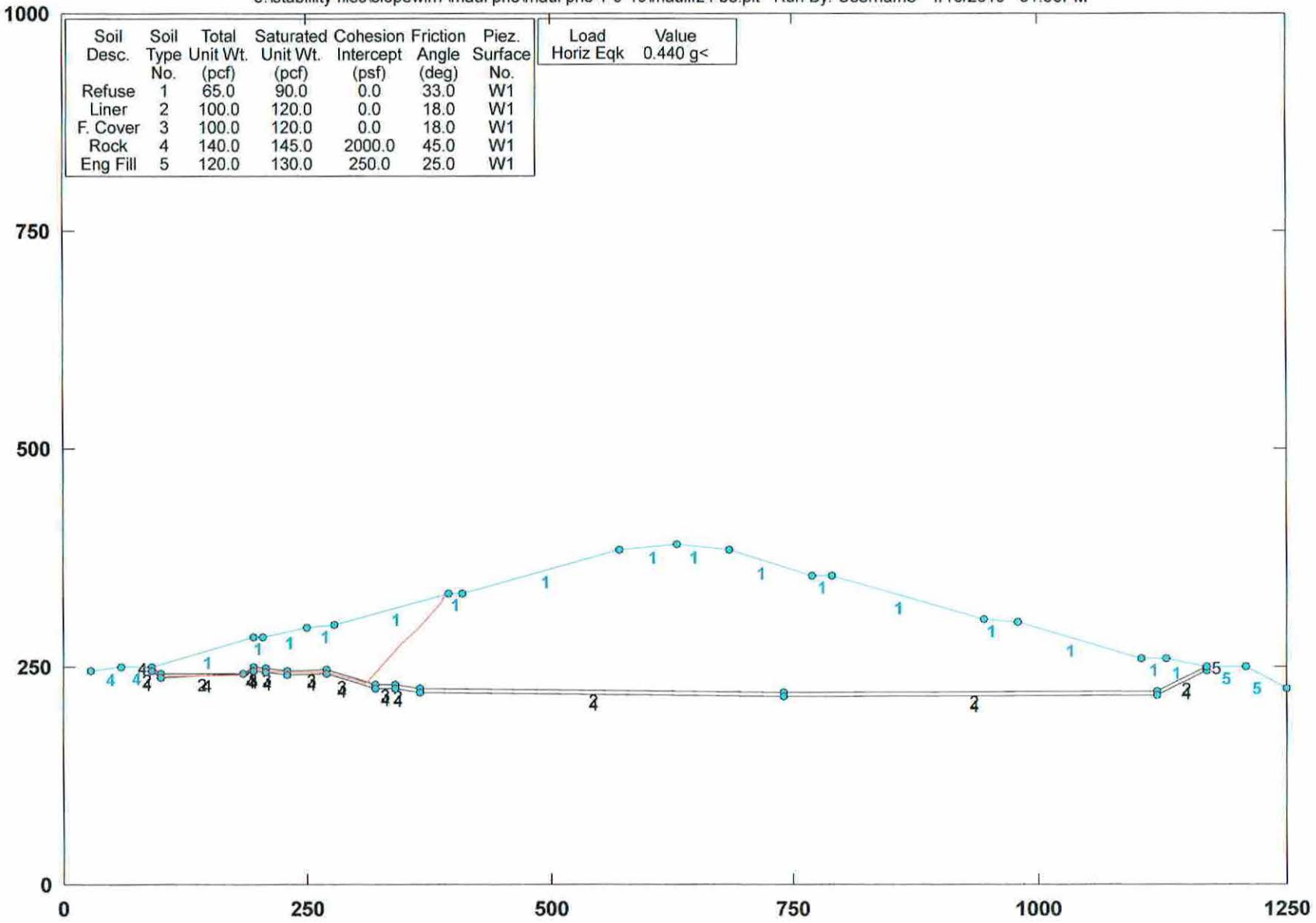
STED

CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf24-be.plt Run By: Username 1/10/2019 01:58PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.440 g<



PCSTABL5M/si FSmin=1.00
Factors of Safety Calculated by Janbu Method

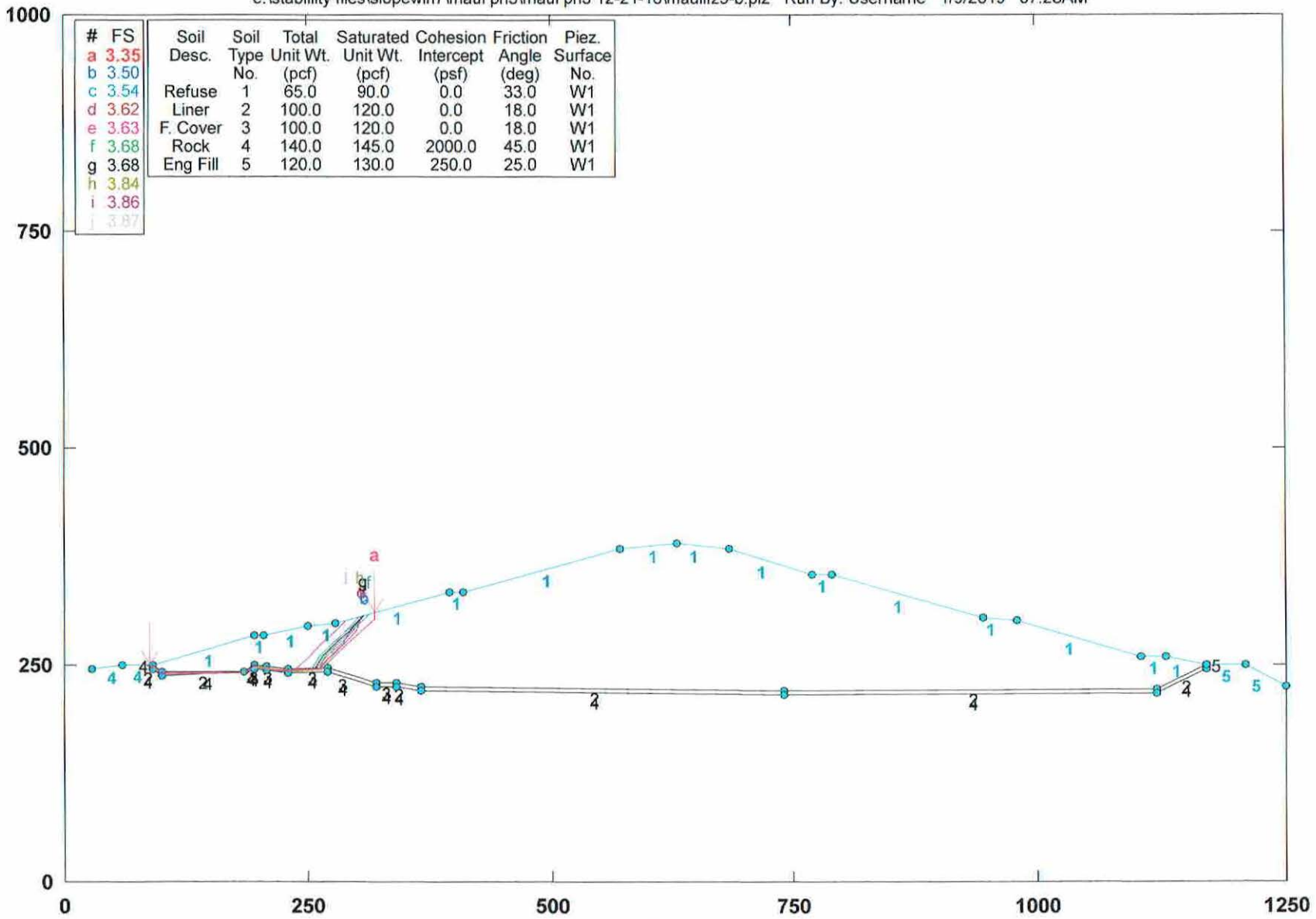
STED

CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf25-b.pl2 Run By: Username 1/9/2019 07:28AM

#	FS
a	3.35
b	3.50
c	3.54
d	3.62
e	3.63
f	3.68
g	3.68
h	3.84
i	3.86
j	3.87

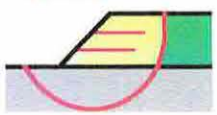
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=3.35

Safety Factors Are Calculated By The Modified Janbu Method

STED

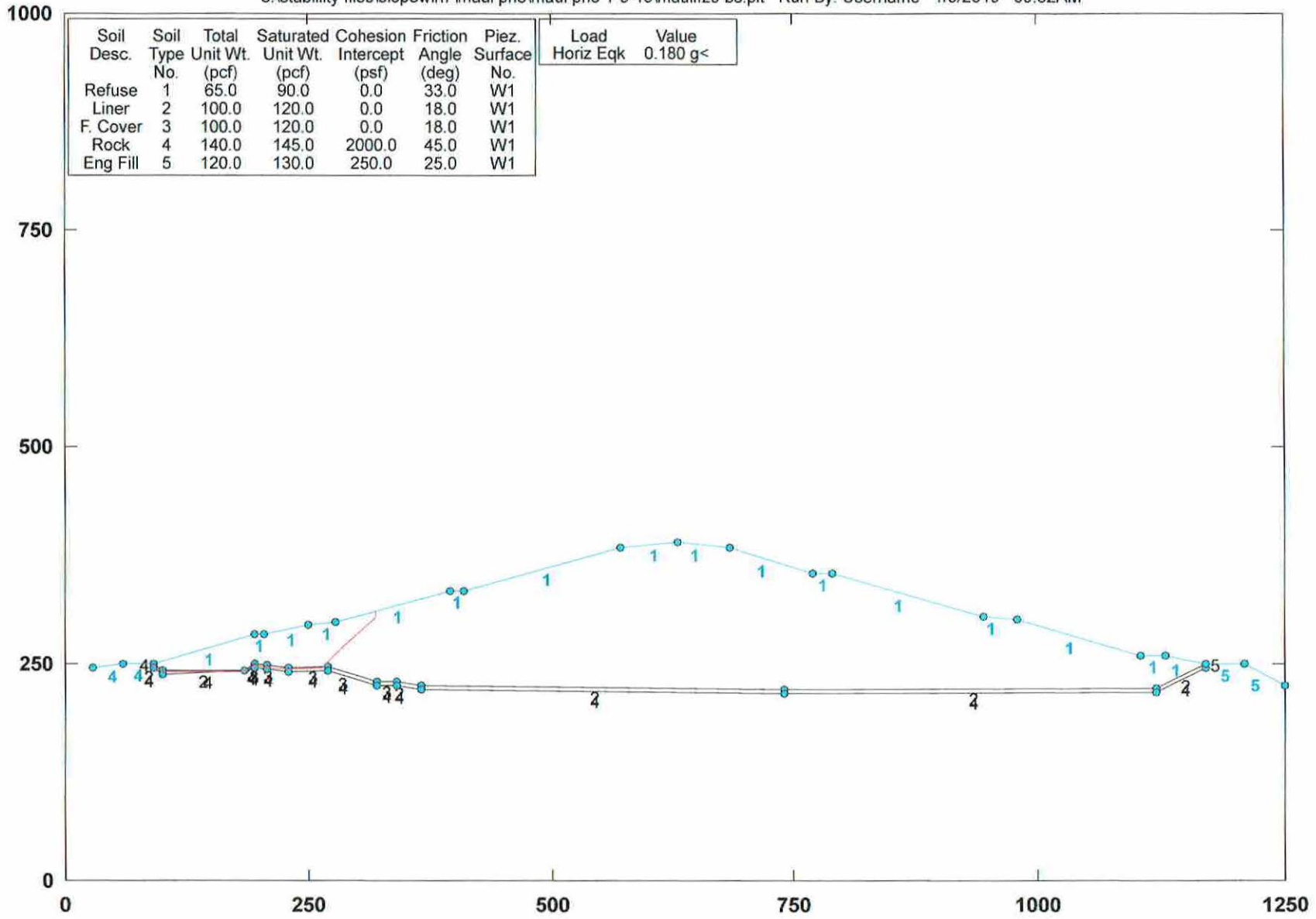


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf25-bs.plt Run By: Username 1/9/2019 09:52AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

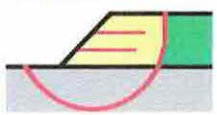
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.85

Factors of Safety Calculated by Janbu Method

STED

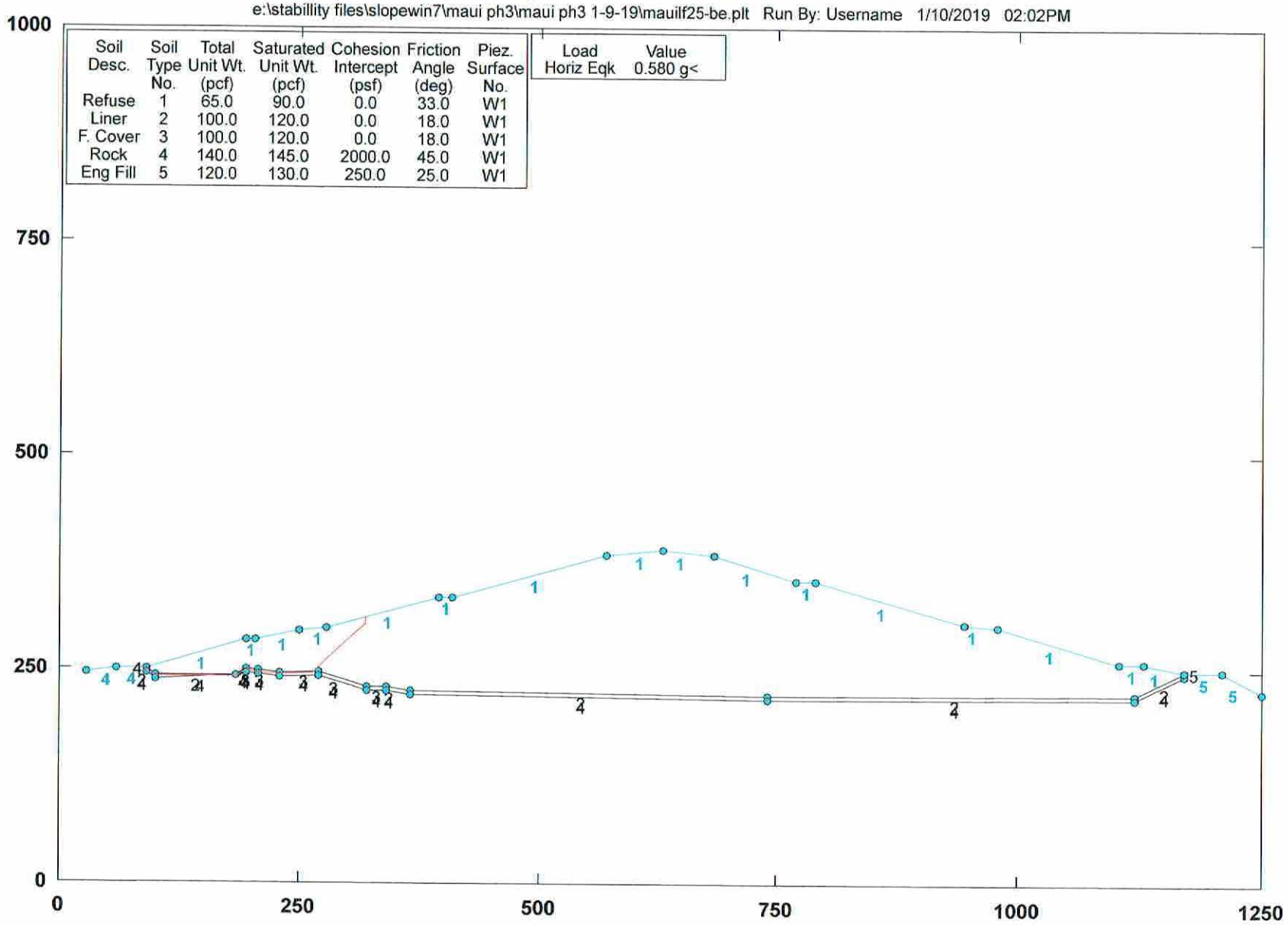


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf25-be.plt Run By: Username 1/10/2019 02:02PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

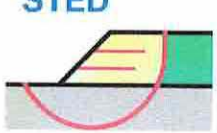
Load	Value
Horiz Eqk	0.580 g<



PCSTABL5M/si FSmin=0.95

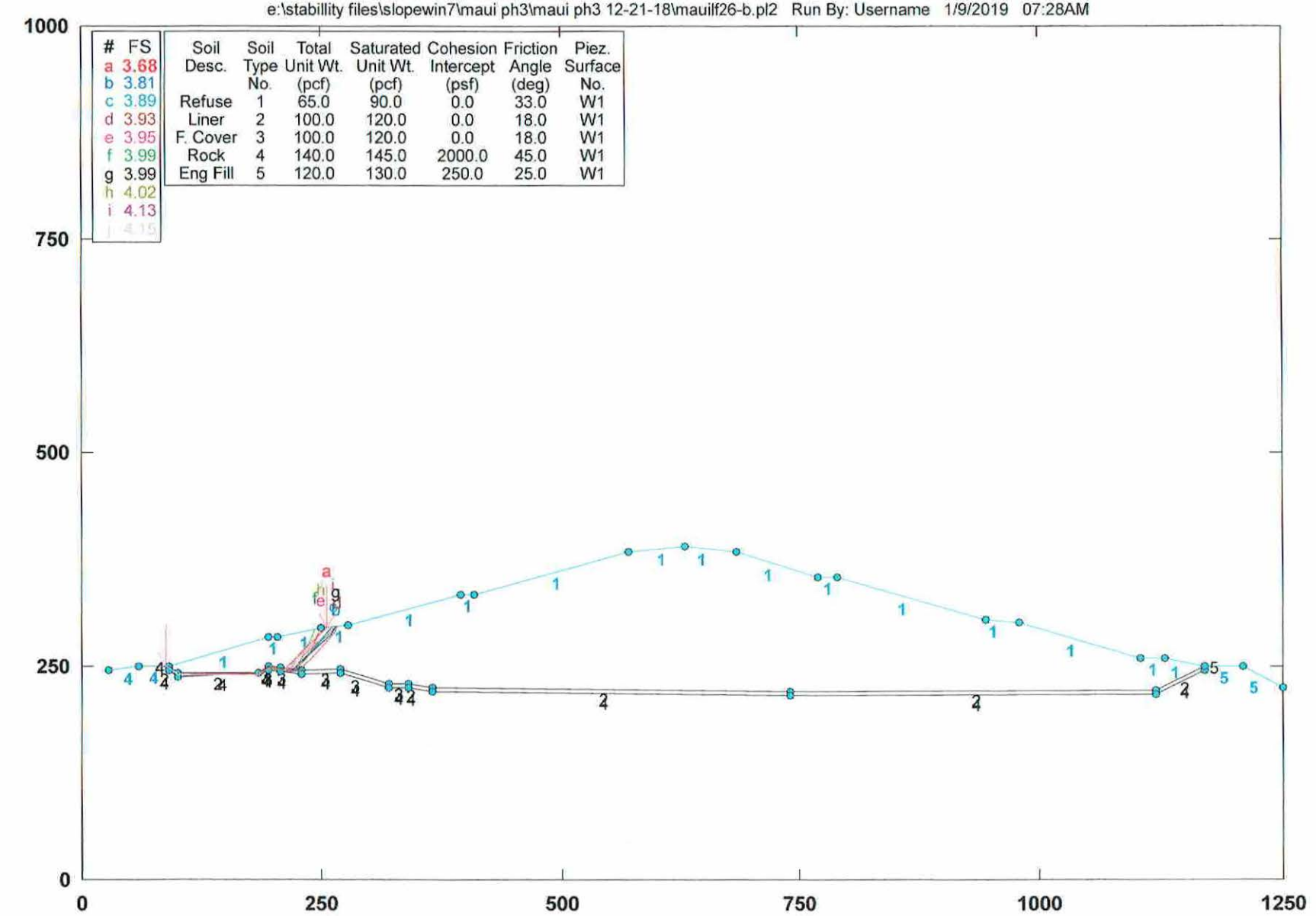
Factors of Safety Calculated by Janbu Method

STED



CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf26-b.pl2 Run By: Username 1/9/2019 07:28AM



#	FS
a	3.68
b	3.81
c	3.89
d	3.93
e	3.95
f	3.99
g	3.99
h	4.02
i	4.13
j	4.15

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

PCSTABL5M/si FSmin=3.68

Safety Factors Are Calculated By The Modified Janbu Method

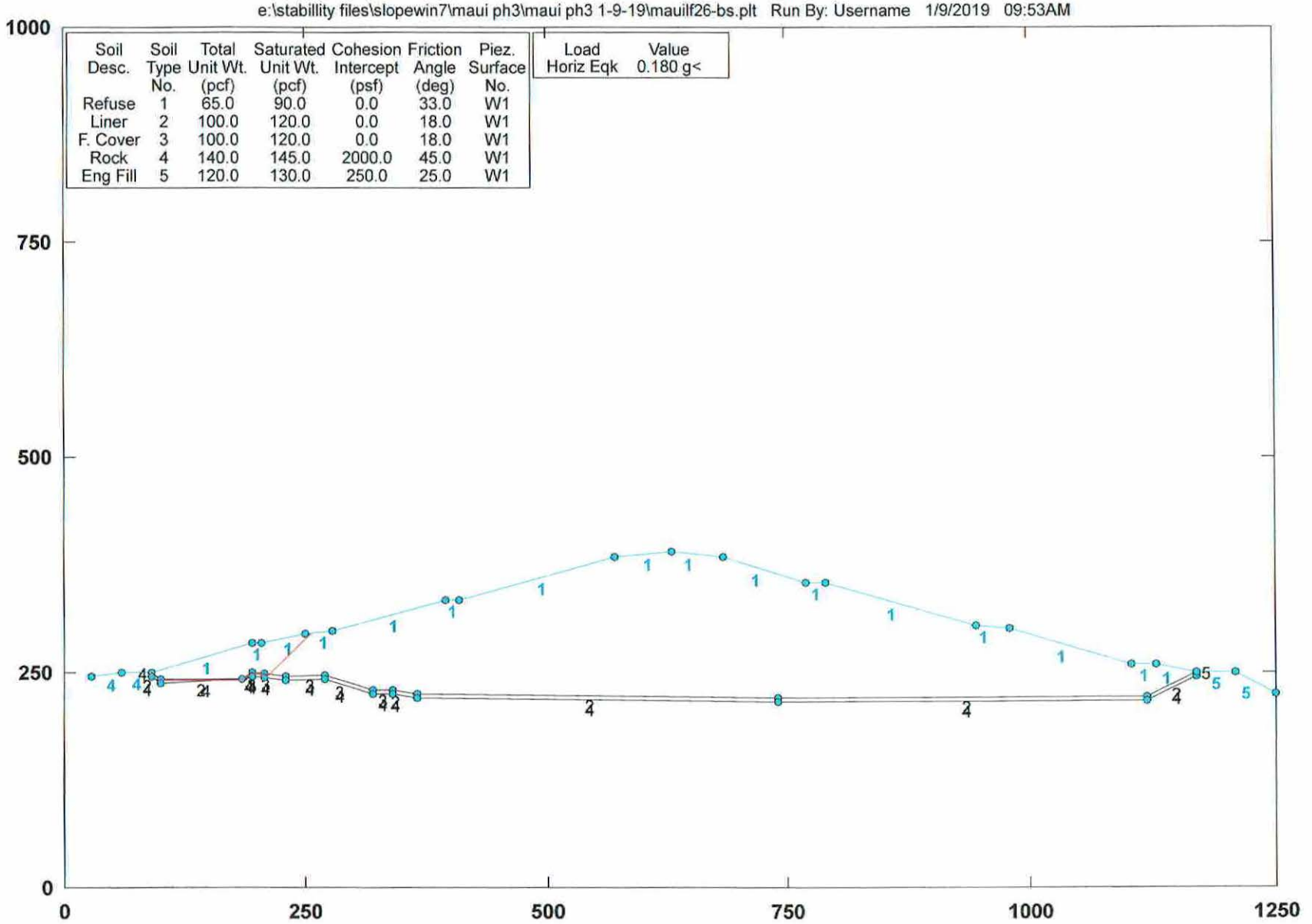
STED

CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf26-bs.plt Run By: Username 1/9/2019 09:53AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

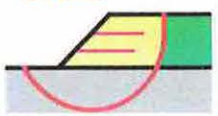
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=2.14

Factors of Safety Calculated by Janbu Method

STED

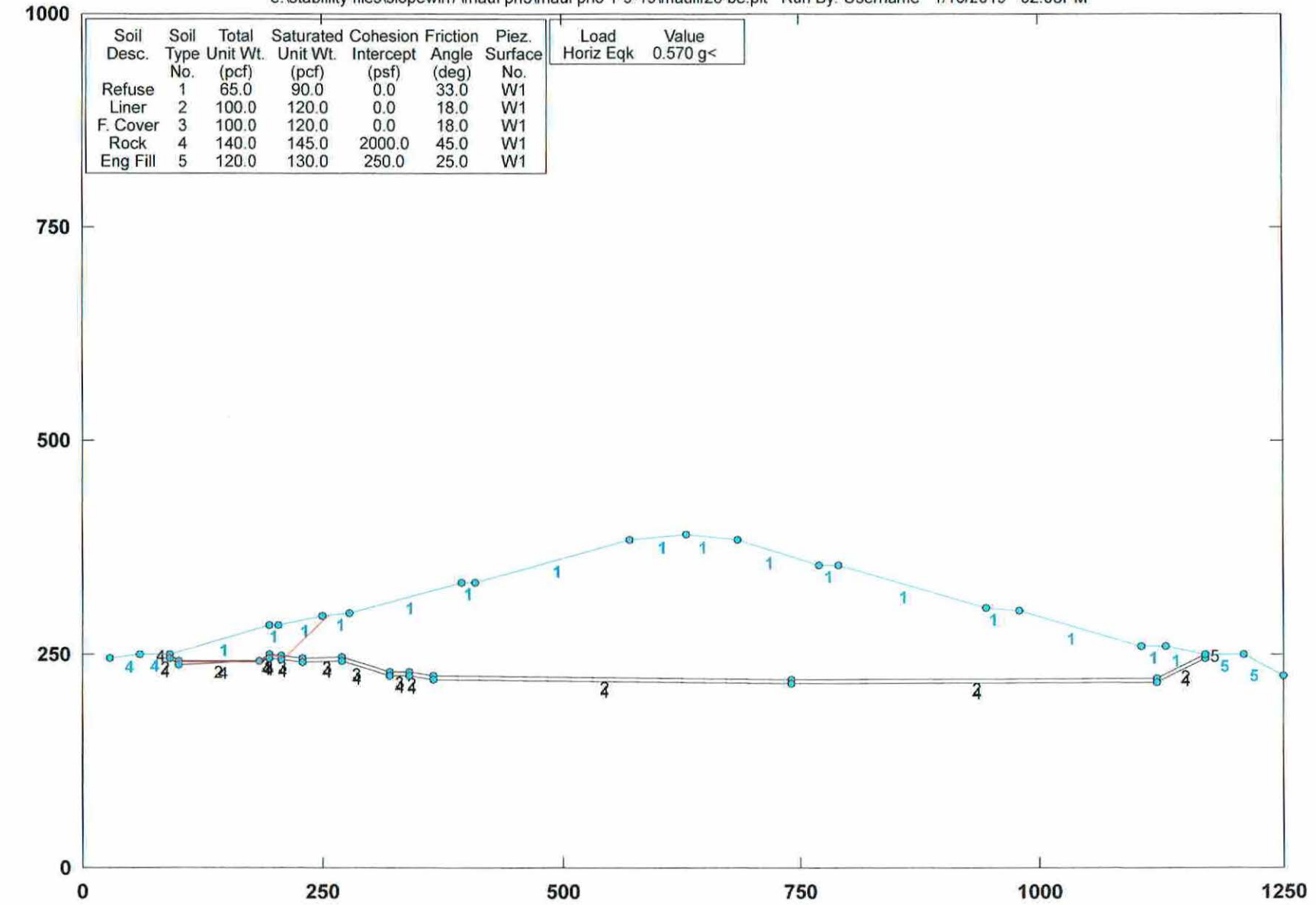


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf26-be.plt Run By: Username 1/10/2019 02:06PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

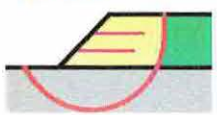
Load	Value
Horiz Eqk	0.570 g<



PCSTABL5M/si FSmin=1.18

Factors of Safety Calculated by Janbu Method

STED

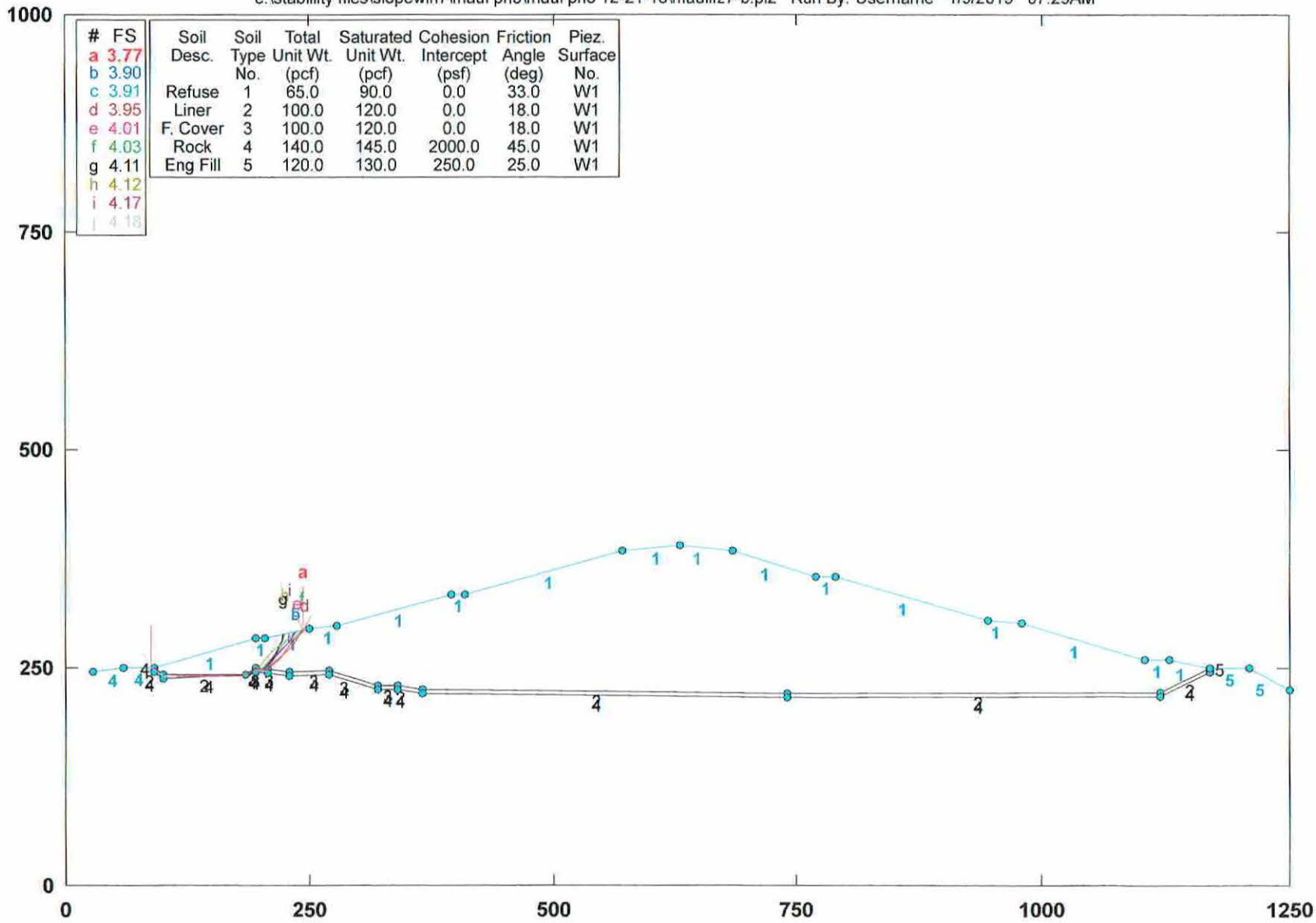


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf27-b.pl2 Run By: Username 1/9/2019 07:29AM

#	FS
a	3.77
b	3.90
c	3.91
d	3.95
e	4.01
f	4.03
g	4.11
h	4.12
i	4.17
j	4.18

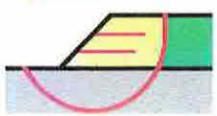
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=3.77

Safety Factors Are Calculated By The Modified Janbu Method

STED

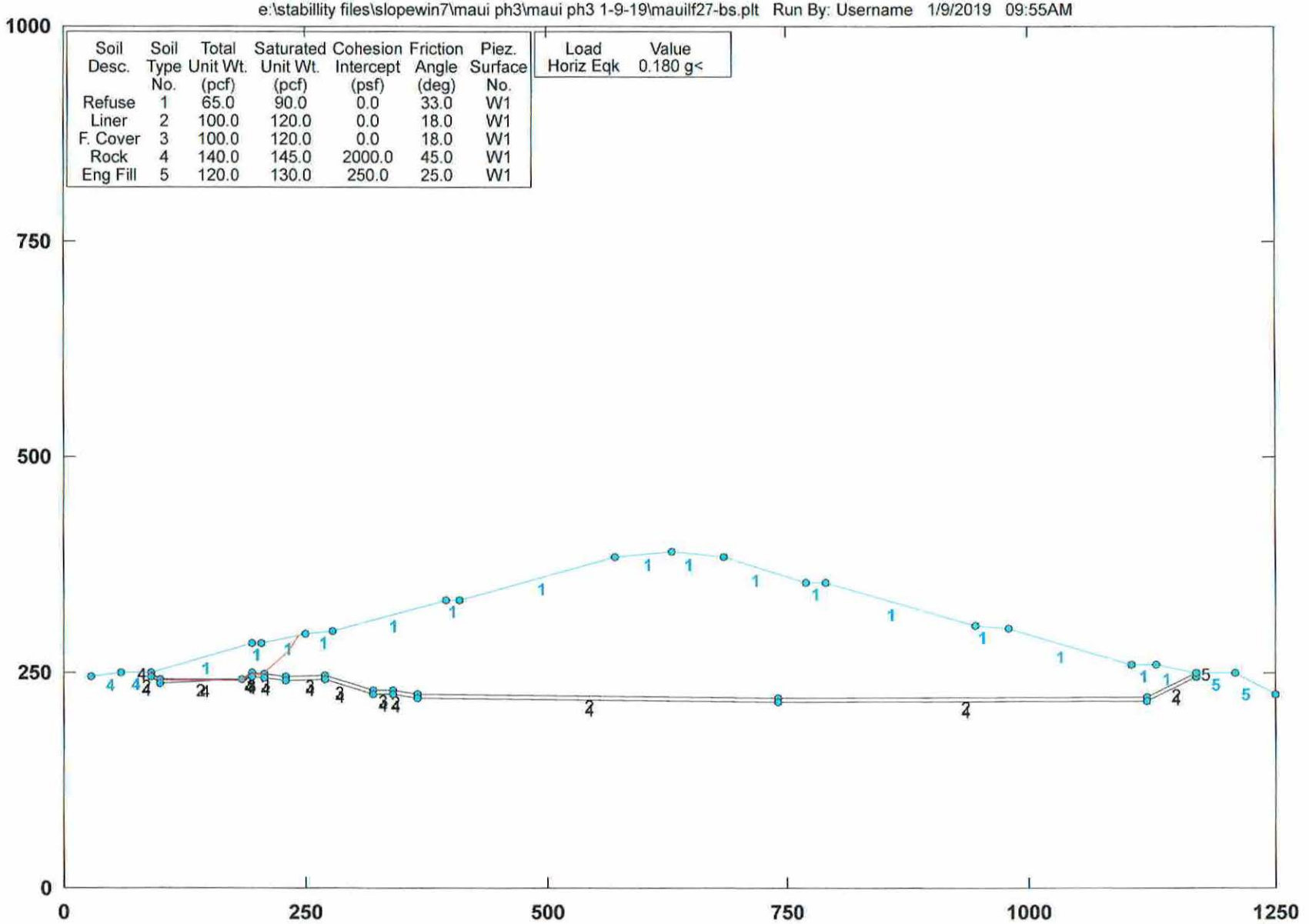


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf27-bs.plt Run By: Username 1/9/2019 09:55AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

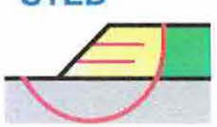
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=2.21

Factors of Safety Calculated by Janbu Method

STED

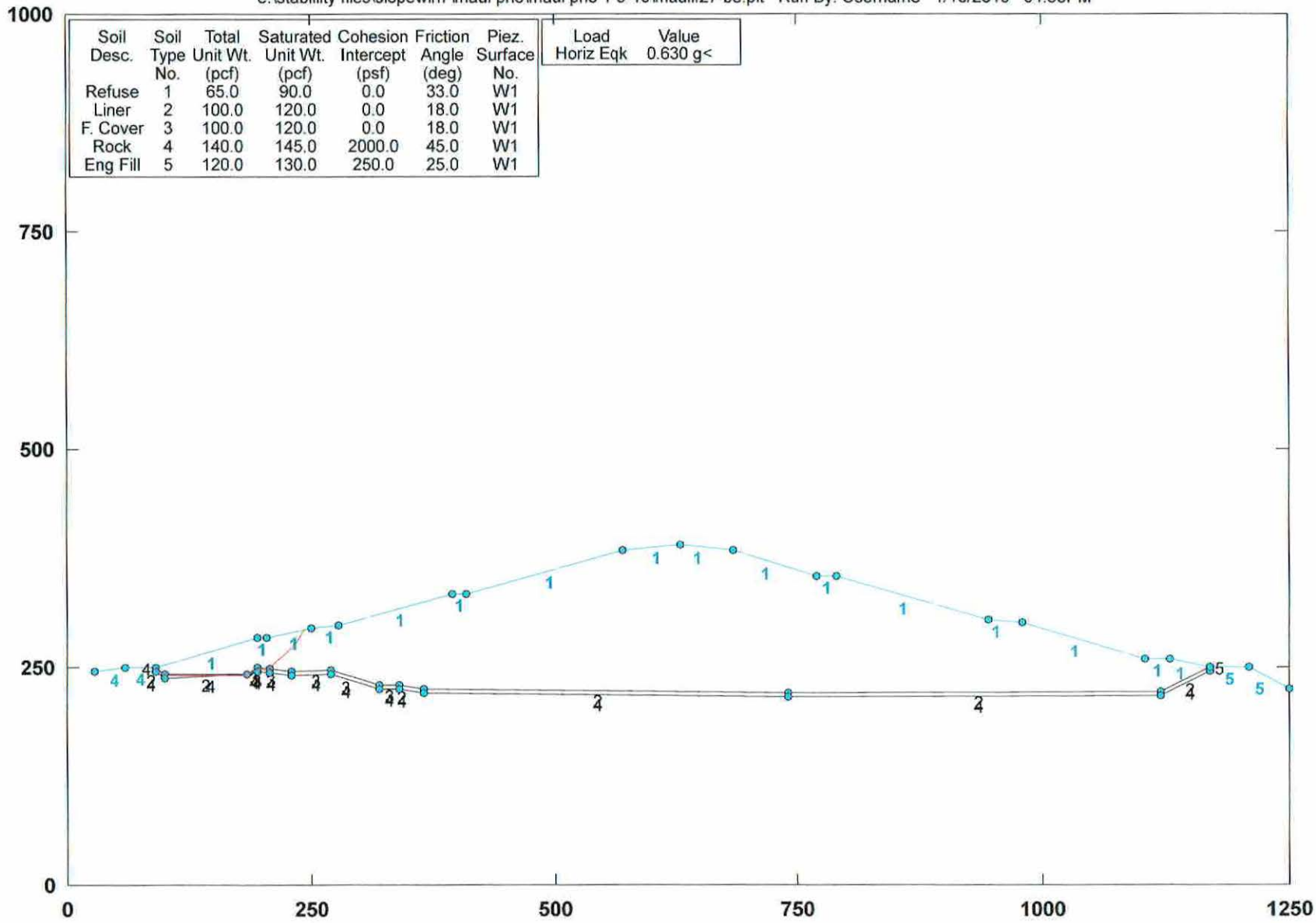


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf27-be.plt Run By: Username 1/10/2019 04:53PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

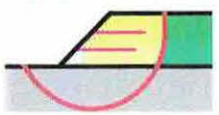
Load	Value
Horiz Eqk	0.630 g<



PCSTABL5M/si FSmin=1.16

Factors of Safety Calculated by Janbu Method

STED

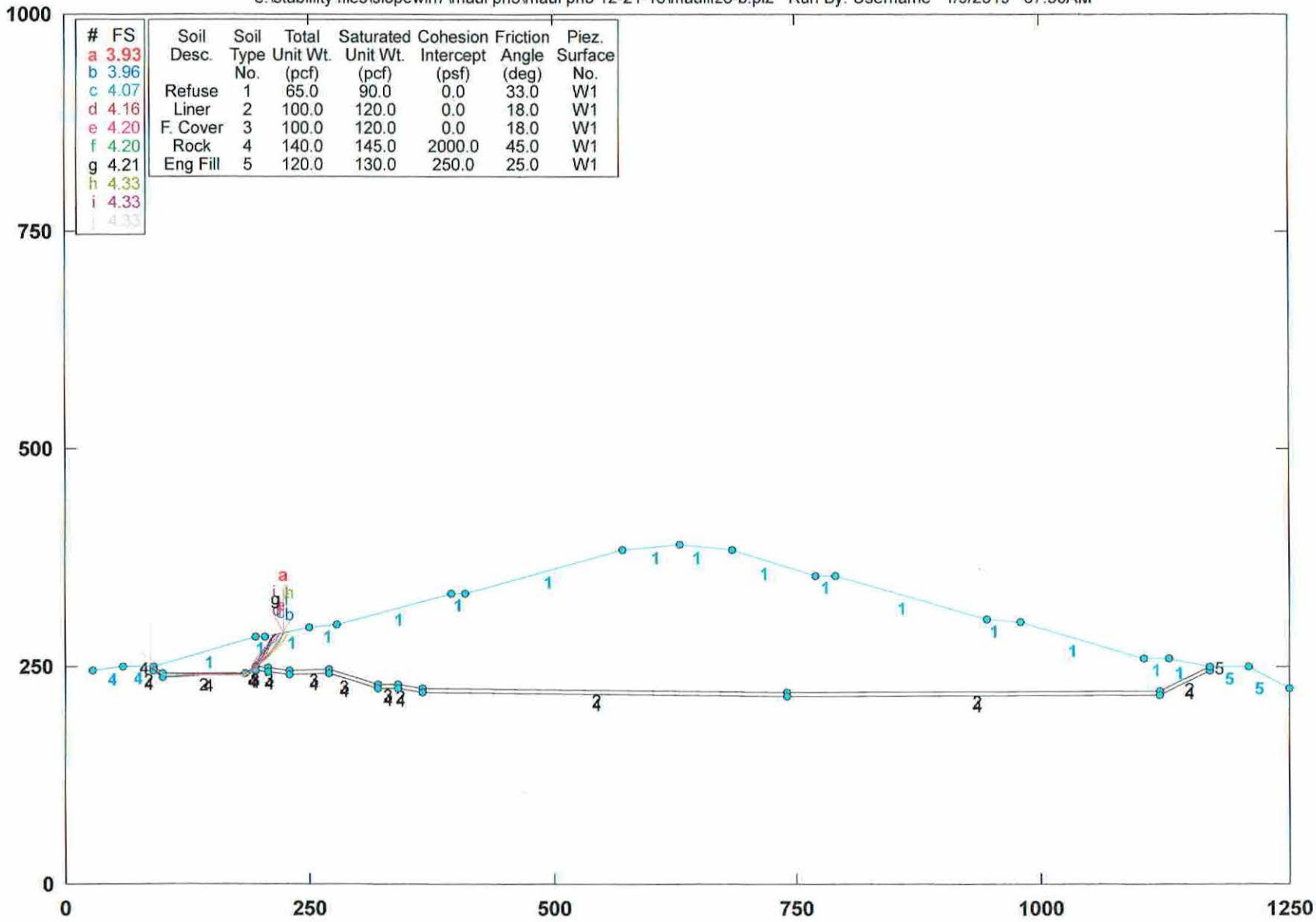


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf28-b.pl2 Run By: Username 1/9/2019 07:30AM

#	FS
a	3.93
b	3.96
c	4.07
d	4.16
e	4.20
f	4.20
g	4.21
h	4.33
i	4.33
j	4.33

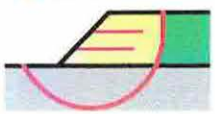
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=3.93

Safety Factors Are Calculated By The Modified Janbu Method

STED

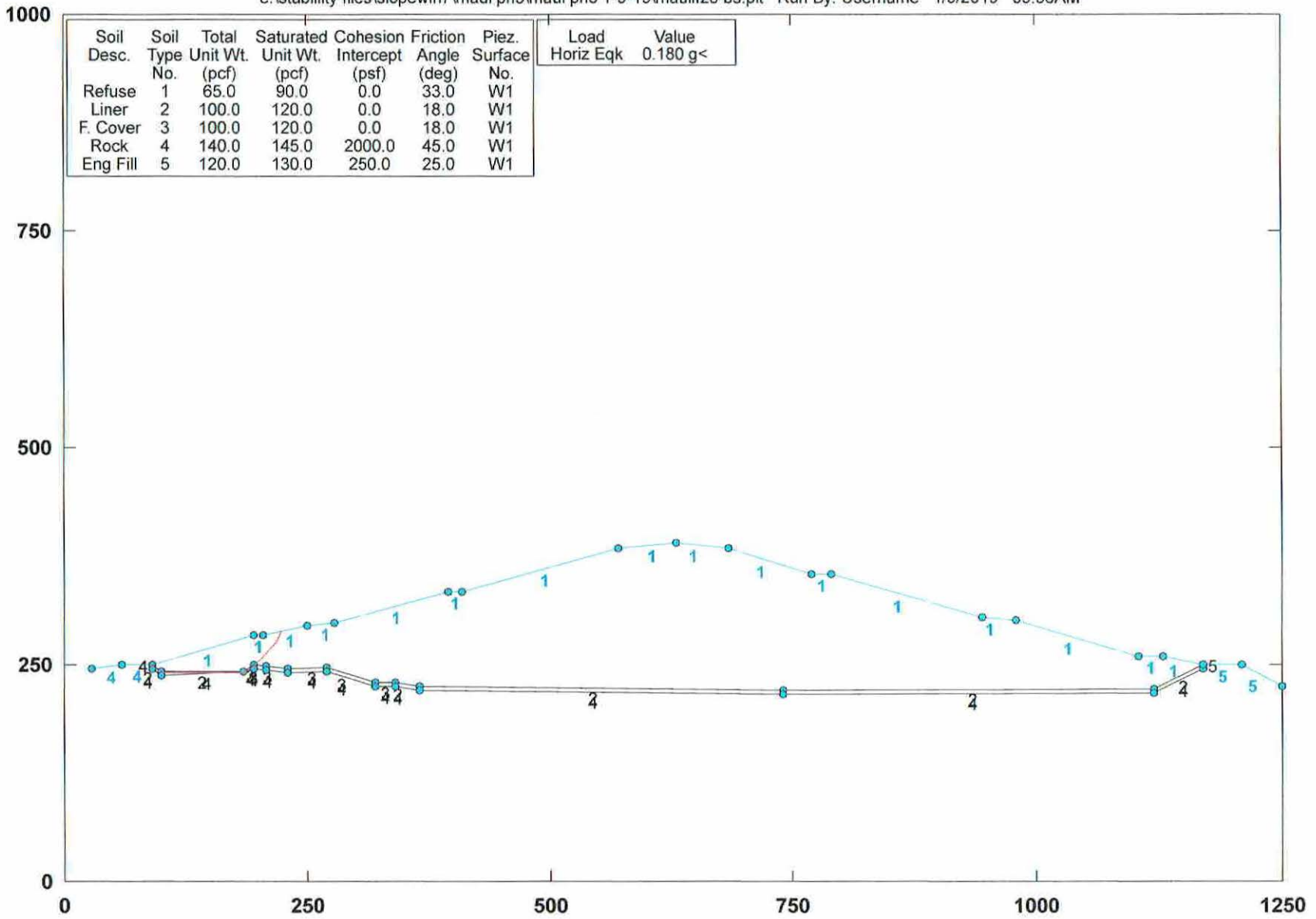


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf28-bs.plt Run By: Username 1/9/2019 09:56AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

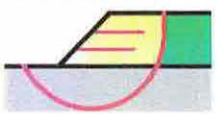
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=2.34

Factors of Safety Calculated by Janbu Method

STED

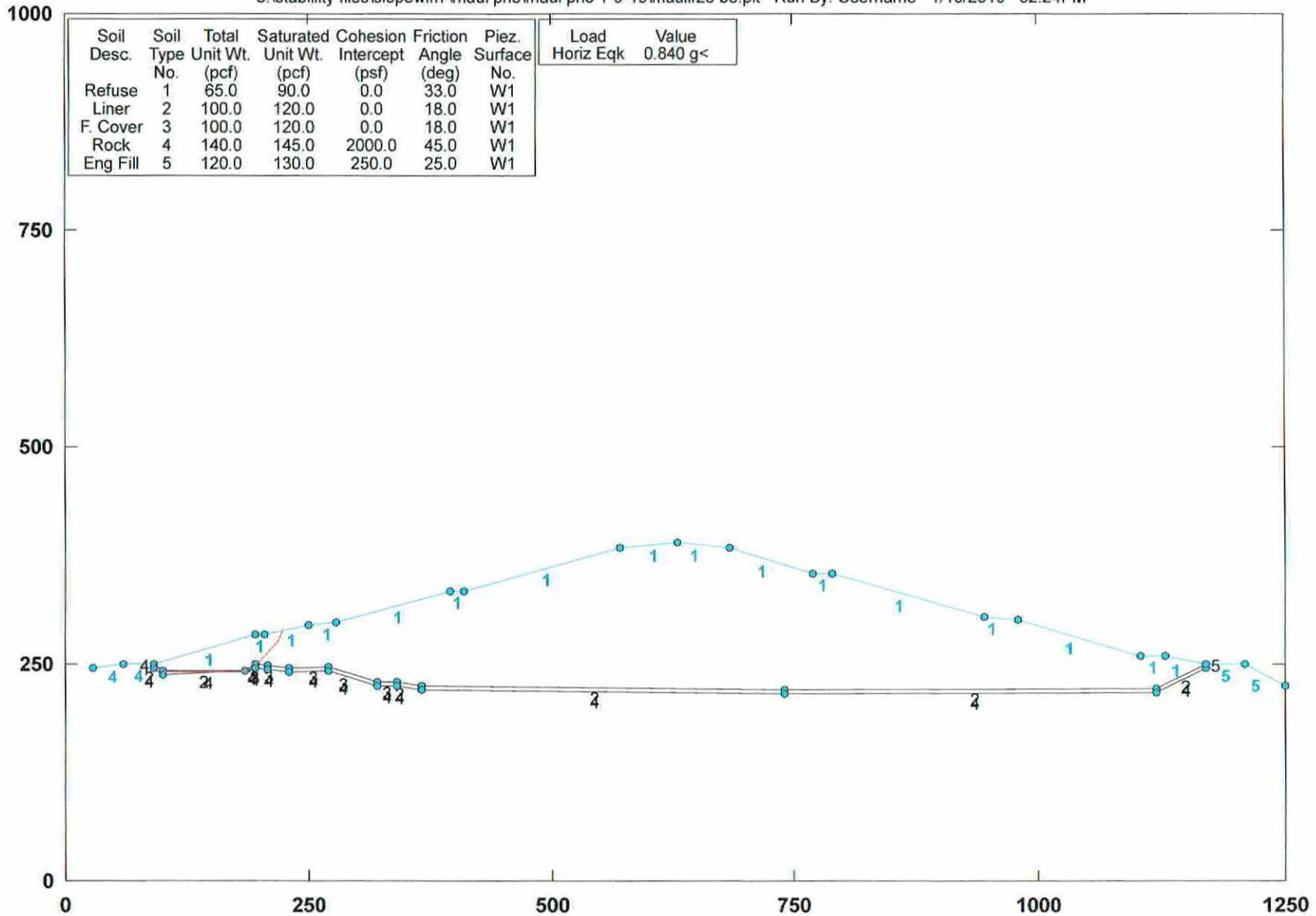


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf28-be.plt Run By: Username 1/10/2019 02:24PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

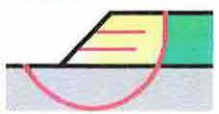
Load	Value
Horiz Eqk	0.840 g<



PCSTABL5M/si FSmin=1.00

Factors of Safety Calculated by Janbu Method

STED

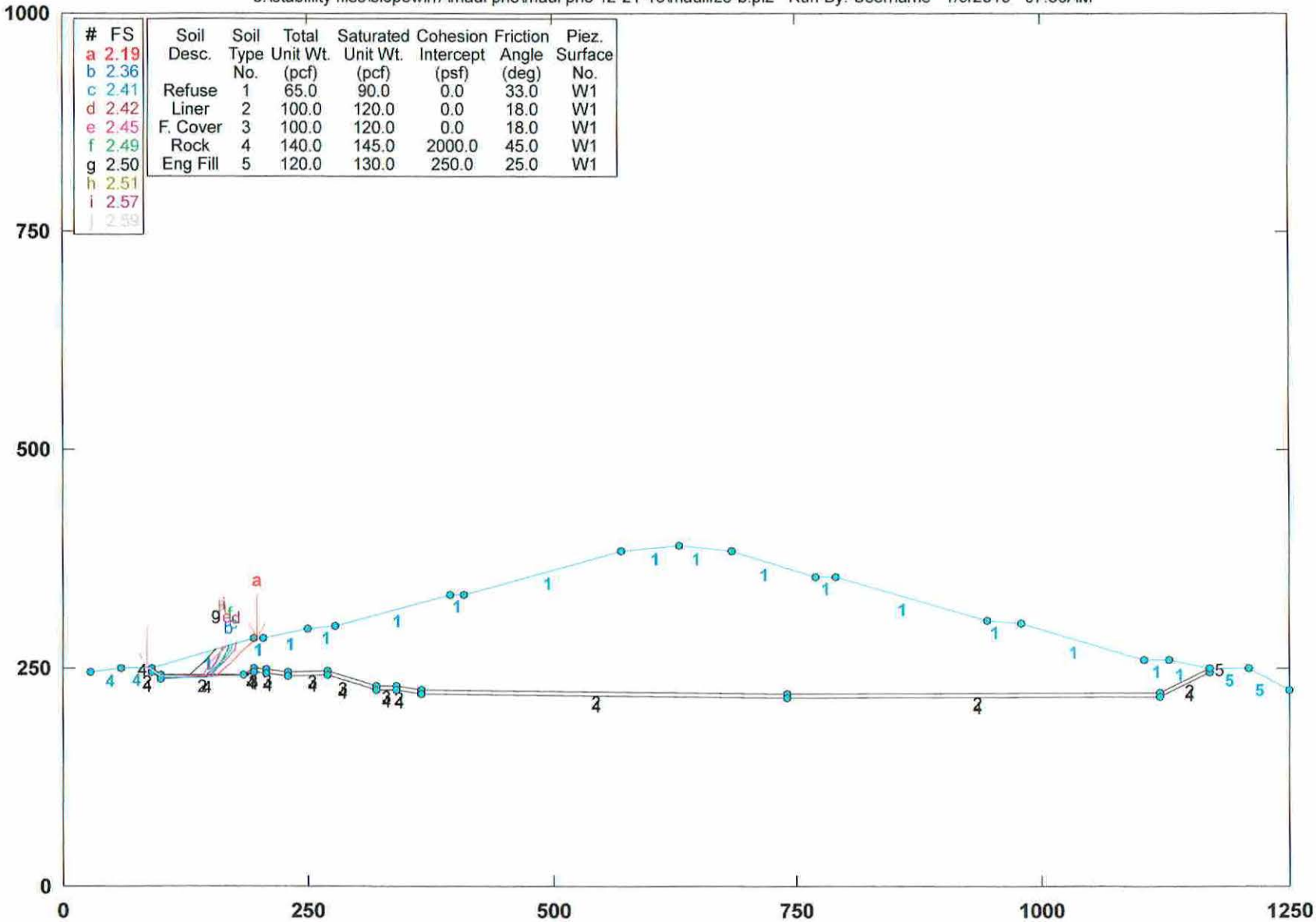


CML - ph III Slope Stab. Section III-S2 Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 12-21-18\mauilf29-b.pl2 Run By: Username 1/9/2019 07:30AM

#	FS
a	2.19
b	2.36
c	2.41
d	2.42
e	2.45
f	2.49
g	2.50
h	2.51
i	2.57
j	2.59

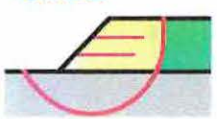
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1



PCSTABL5M/si FSmin=2.19

Safety Factors Are Calculated By The Modified Janbu Method

STED

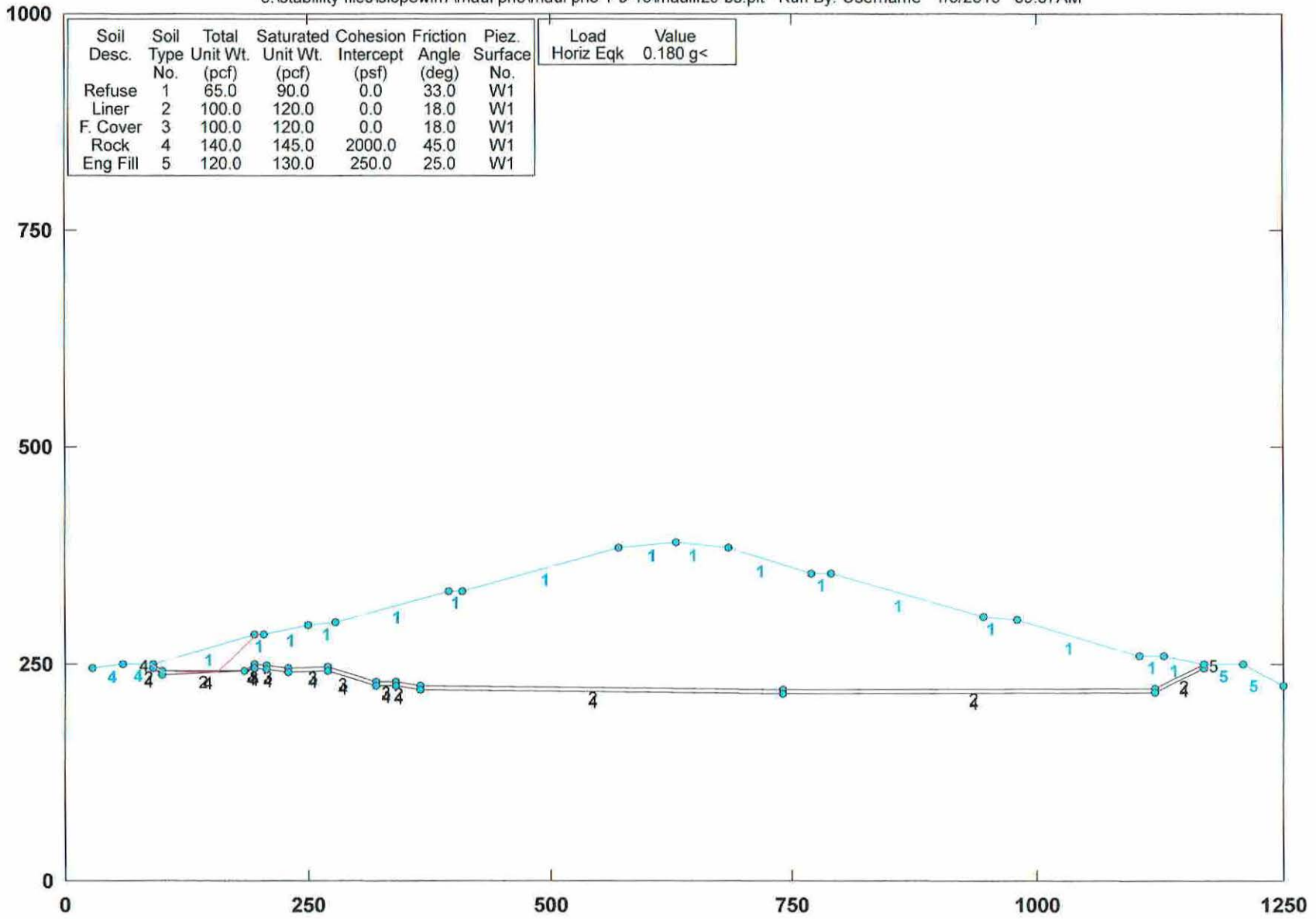


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf29-bs.plt Run By: Username 1/9/2019 09:57AM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

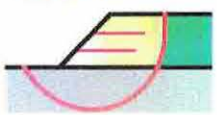
Load	Value
Horiz Eqk	0.180 g<



PCSTABL5M/si FSmin=1.34

Factors of Safety Calculated by Janbu Method

STED

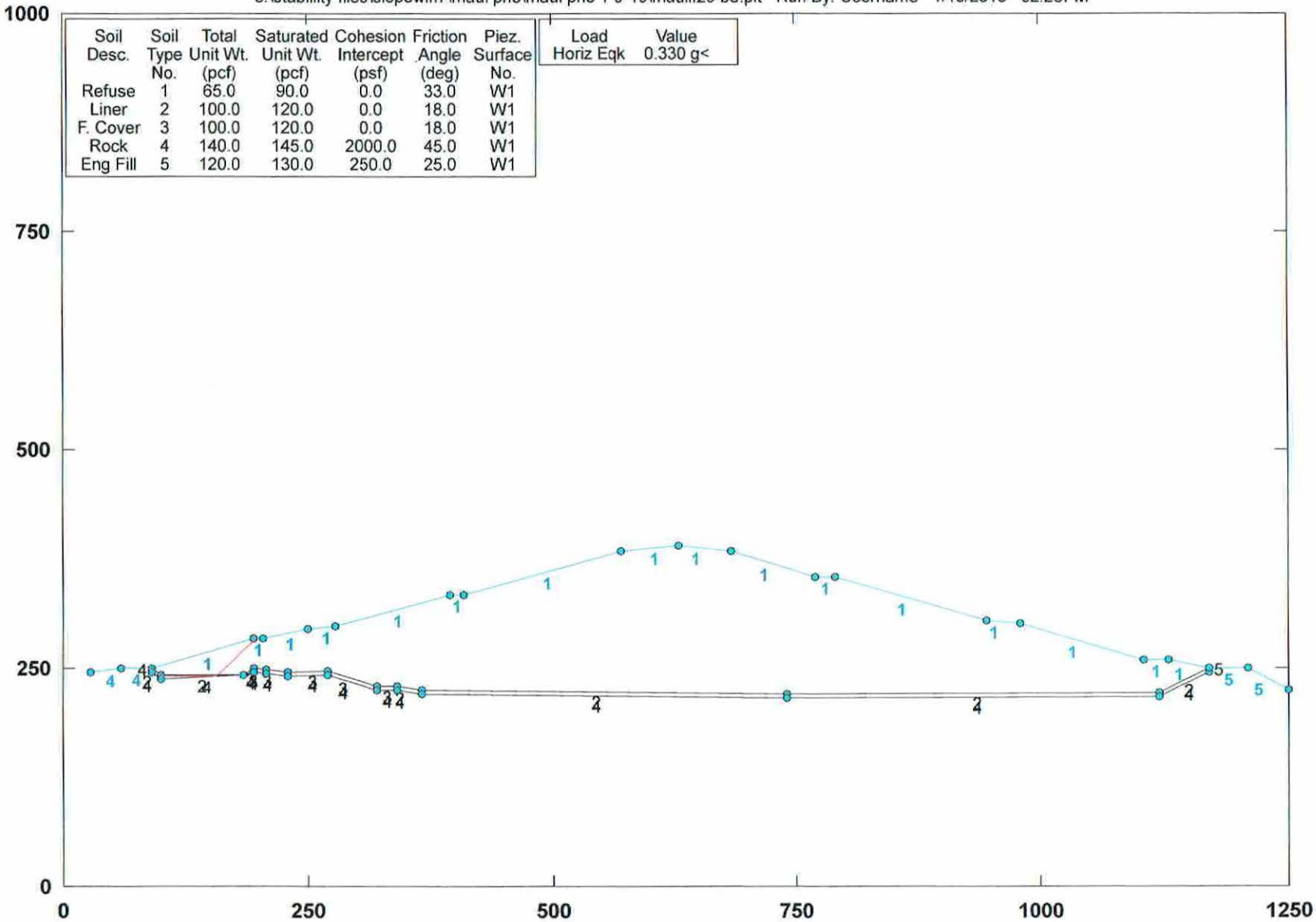


CML - ph III Slope Stab. Section III-S2 Pseudo-Static

e:\stabillity files\slopewin7\maui ph3\maui ph3 1-9-19\mauilf29-be.plt Run By: Username 1/10/2019 02:26PM

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Refuse	1	65.0	90.0	0.0	33.0	W1
Liner	2	100.0	120.0	0.0	18.0	W1
F. Cover	3	100.0	120.0	0.0	18.0	W1
Rock	4	140.0	145.0	2000.0	45.0	W1
Eng Fill	5	120.0	130.0	250.0	25.0	W1

Load	Value
Horiz Eqk	0.330 g<



PCSTABL5M/si FSmin=1.01

Factors of Safety Calculated by Janbu Method

STED