Appolo Fuels, Inc.

Permit No. 807-0368

Comprehensive Application

MPA-03

Volume 2

Prepared by
HOWARD ENGINEERING & GEOLOGY, INC.
P.O. Box 271
Harlan, Kentucky 40831
Phone: 606-573-6924
FAX: 606-573-9543
info@howardeng-geo.com

25.3 Provide complete calculations on spoil generation and disposal for the proposed permit area. Include a stability analysis to demonstrate that backfilled benches will meet a minimum static safety factor of 1.3. Submit this information as "Attachment 25.3.A".
See Attachment 25.3.A.

25.4 Describe the measures to be used to seal or manage mine openings, exploration holes, auger holes, bore holes, wells and other openings within the proposed permit area. Provide design specifications for ensuring stability of each each permanent entry seal and down slope barrier. Include all maps, drawings, etc., required to adequately support the description of the proposed measures. Submit this information as "Attachment 25.4.A".
See Attachment 25.4.A.

26. Disposal of Excess Spoil

26.1 Are any excess spoil disposal structures proposed for use in the permit area? [***XX***] YES [ ] NO. If "YES", provide the following information for each proposed structure:

Facility I.D.	Type of Fill	Storage Volume	Type of Underdrain	Natural Ground Slope	Latitude	Longitude
Hollow Fill #1	***Hollow***	***24,020,987***	***Rock Core***	***15°***	***36°35'32"***	***83°50'58"***

26.2 Did construction of any of the above structures start prior to January 18, 1983? [ ] YES [***XX***] NO. If "YES", provide the information required by 405 KAR 8:030, or 8:040 Sections 25 for existing structures. Submit this information as "Attachment 26.2.A".

26.3 For each proposed excess spoil disposal structure provide a detailed plan (including, but not limited to, all engineering design calculations, cross-sections, maps and designs). Each plan shall meet the requirements of 405 KAR 8:030, Section 27; 405 KAR 8:040, Section 28; 405 KAR 16:130; and 405 KAR 18:130.
See Attachment 26.3.A

Spoil Summary

Gross Material	39,829,060
Less Coal (4.8' avg)	-1,938,819
Net Material Generated	37,890,241
Swell @ 20%	7,578,048
Material Generated	45,468,289
Less Backfill	-35,092,256
Excess Spoil	10,376,033
Additional Material TN Permit	14,500,000
Less Hollow Fill #1	-24,020,986
Balance	855,047
	8.2%

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Volume Report 11/7/2008 14:49
Comparing Grid: C:/Carlson Projects/_Surf.grd
and Grid: C:/Carlson Projects/Coal.grd
Grid corner locations: 2552187.80,94912.63 to 2562847.80,111592.63
Grid resolution X: 533, Y: 834 Grid cell size X: 20.00, Y: 20.00
Area in Cut : 10,905,856.6 S.F., 250.36 Acres
Area in Fill: 133,569.9 S.F., 3.07 Acres
Total inclusion area: 11,039,426.6 S.F., 253.43 Acres
Cut to Fill ratio: 1466.70
Average Cut Depth: 98.61 Average Fill Depth: 5.49
Max Cut Depth: 329.72 Max Fill Depth: 31.49
Cut (C.Y.) / Area (acres): 157159.78
Fill (C.Y.) / Area (acres): 107.15
Cut volume: 1,075,384,633.0 C.F., 39,829,060.48 C.Y.
Fill volume: 733,199.1 C.F., 27,155.52 C.Y.
39829060
10905856

Volume Report 11/7/2008 15:03
Comparing Grid: C:/Carlson Projects/_Surf.grd
and Grid: C:/Carlson Projects/HF1.grd
Grid corner locations: 2552187.80,94912.63 to 2562847.80,111592.63
Grid resolution X: 533, Y: 834 Grid cell size X: 20.00, Y: 20.00
Area in Cut : 2,284.8 S.F., 0.05 Acres
Area in Fill: 4,320,531.6 S.F., 99.19 Acres
Total inclusion area: 4,322,816.4 S.F., 99.24 Acres
Cut to Fill ratio: 0.00
Average Cut Depth: 0.28 Average Fill Depth: 150.11
Max Cut Depth: 2.46 Max Fill Depth: 419.56
Cut (C.Y.) / Area (acres): 0.24
Fill (C.Y.) / Area (acres): 242053.81
Cut volume: 633.3 C.F., 23.46 C.Y.
Fill volume: 648,566,641.5 C.F., 24,020,986.72 C.Y.
24020986

Volume Report 12/31/2008 14:34
Comparing Grid: C:/Carlson Projects/Bench.grd
and Grid: C:/Carlson Projects/Backfill.grd
Grid corner locations: 2552872.42,97147.33 to 2561872.42,110507.33
Grid resolution X: 450, Y: 668 Grid cell size X: 20.00, Y: 20.00
Area in Cut : 919,210.2 S.F., 21.10 Acres
Area in Fill: 12,433,109.4 S.F., 285.42 Acres
Total inclusion area: 13,352,319.5 S.F., 306.53 Acres
Cut to Fill ratio: 0.01
Average Cut Depth: 7.40 Average Fill Depth: 76.21
Max Cut Depth: 104.35 Max Fill Depth: 341.76
Cut (C.Y.) / Area (acres): 821.81
Fill (C.Y.) / Area (acres): 114483.38
Cut volume: 6,801,524.3 C.F., 251,908.31 C.Y.
Fill volume: 947,490,913.5 C.F., 35,092,256.06 C.Y.
35092256

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Backfill Soil Parameter Calculations

The Cylindrical Soil Failure Parameters were calculated using proportional values of as indicated in the example on page 14 of the reame training guidelines.

Quote from Page 12

For Standard Fill Material the following parameters are recommended for cylindrical failure

Standard Fill: ι = 30E , | = 200 psf , Φ = 125 psf

Quote from Page 13

For Durable Rockfill Material the following parameters are recommended for cylindrical failure

Shale Rock: ι = 35E , | = 0 , Φ = 125 pcf

Sandstone: ι = 40E , | = 0 , Φ = 130 pcf

The above parameters can be used **ONLY** if the fill material is 100% durable rock. If it is between 80% and 100%, proportionate values should be used.

Quote from Page 14

EXAMPLE: If fill material is 85% durable sandstone and 15% is non-durable material.

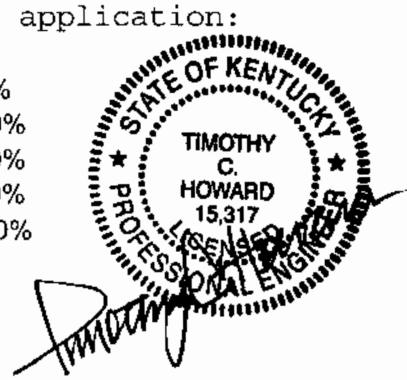
| = (0.85 * 0) + (0.15 * 200) = 30 psf

ι = (0.85 * 40E) + (0.15 * 30E) = 38.5E

Φ = (0.85 * 130) + (0.15 * 125) = 129.25 pcf

The following Soil Failure Parameters were used in this application:

	C	A	U	Ratio		%
Shale	0	35	125	90%	67%	60%
Sandstone	0	40	130	90%	33%	30%
Other	200	30	125	10%	100%	10%
Composite	20.0	36.0	126.5			100%
Slip 80	16.0	28.8	126.5			



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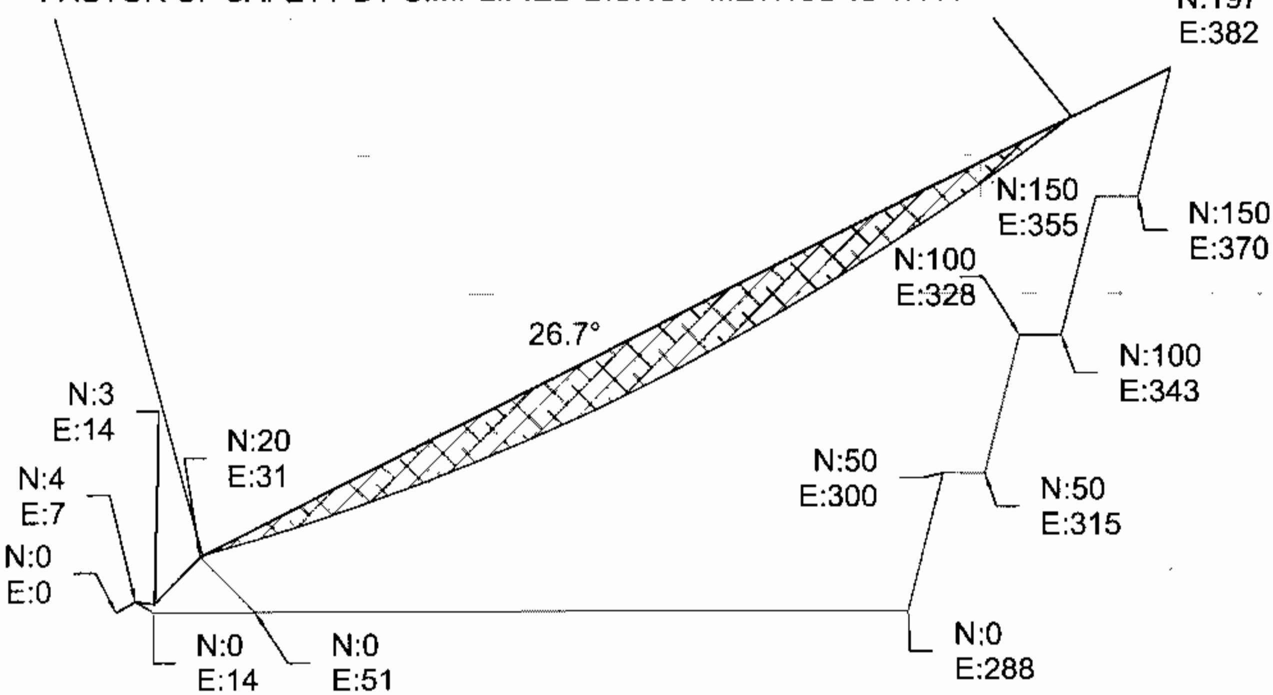
AT CENTER (-208.000 , 889.000) WITH RADIUS 900.739 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.416
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.411



STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317 LICENSED PROFESSIONAL ENGINEER

I, Timothy C. Howard, P.E. No. 15,317

Date: 1/5/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

Appolo Fuels, Inc.

Permit No. 807-0368
Backfilling & Grading Plan
Reame Drawing

N W E S

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Scale: None

Attachment 25.1.A

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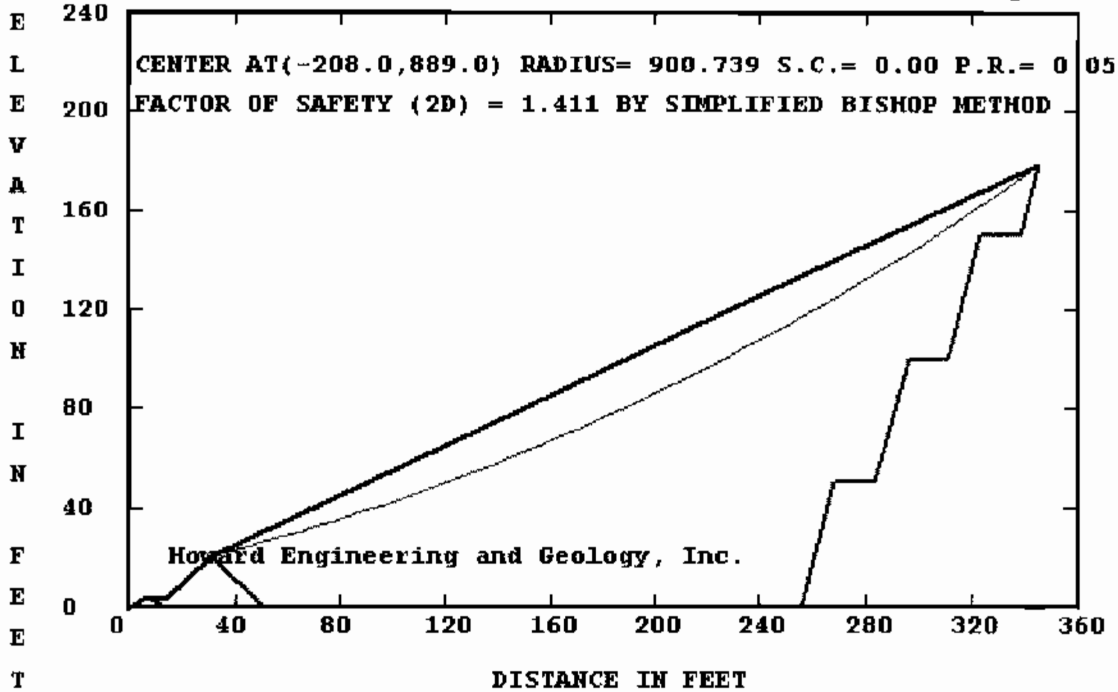
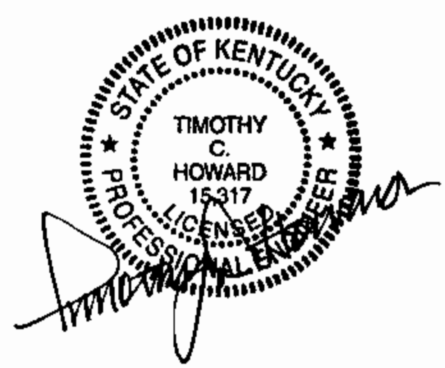
Appolo 807-0368 Backfilling and Grading





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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
THIS 2008 VERSION IS LICENSED BY CIVIL ENGINEERING SOFTWARE CENTER TO

                Howard Engineering and Geology, Inc.

INPUT FILE NAME  -R:\BFG.DAT

TITLE -Appolo 807-0368 Backfilling and Grading

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS ( THREED = 0 )

ANALYSIS BY DETERMINISTIC METHOD   ( PROB = 0 )


CASE NO.  1   SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 4
 1  X COORD.= 0                 Y COORD.= 0
 2  X COORD.= 7                 Y COORD.= 4
 3  X COORD.= 14                Y COORD.= 0
 4  X COORD.= 51                Y COORD.= 0

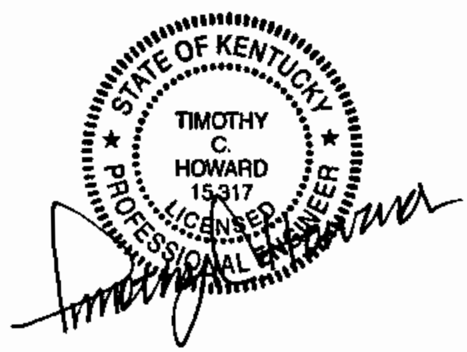
NO. OF POINTS ON BOUNDARY LINE 2 = 13
 1  X COORD.= 0                 Y COORD.= 0
 2  X COORD.= 7                 Y COORD.= 4
 3  X COORD.= 14                Y COORD.= 3
 4  X COORD.= 31                Y COORD.= 20
 5  X COORD.= 51                Y COORD.= 0
 6  X COORD.= 256               Y COORD.= 0
 7  X COORD.= 268               Y COORD.= 50
 8  X COORD.= 283               Y COORD.= 50
 9  X COORD.= 296               Y COORD.= 100
 10 X COORD.= 311               Y COORD.= 100
 11 X COORD.= 323               Y COORD.= 150
 12 X COORD.= 338               Y COORD.= 150
 13 X COORD.= 345               Y COORD.= 178

NO. OF POINTS ON BOUNDARY LINE 3 = 5
 1  X COORD.= 0                 Y COORD.= 0
 2  X COORD.= 7                 Y COORD.= 4
 3  X COORD.= 14                Y COORD.= 3
 4  X COORD.= 31                Y COORD.= 20
 5  X COORD.= 345               Y COORD.= 178

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1        0.571       -0.571        0.000
 2        0.571       -0.143        1.000        -1.000        0.000        4.167
          0.000        3.846        0.000         4.167        0.000        4.000
 3        0.571       -0.143        1.000         0.503

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 2
```



LINE NO. (LINO)	BEG. NO. (NBP)	END NO. (NEP)
1	1	4
2	5	13

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL NO.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	400.000	35.000	130.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 0
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-40 Y COORD. = 505
POINT 2 X COORD. =-40 Y COORD. = 180
POINT 3 X COORD. = 220 Y COORD. = 180

X INCREMENT (XINC) = 24 Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF TOTAL	CIRCLE CRITIC.	RADIUS	LOWEST F.S.	WARNING
-40.0	505.0	11	1	503.200	0.000	0
-40.0	440.0	11	1	438.526	1.437	0
-40.0	375.0	11	8	360.251	1.445	0
-40.0	310.0	11	4	298.415	1.460	0
-40.0	245.0	5	1	245.540	1.489	0
-40.0	180.0	5	1	182.168	1.578	0
25.0	505.0	11	3	448.891	1.435	0
25.0	440.0	11	9	390.371	1.441	0
25.0	375.0	8	1	371.436	1.445	0
25.0	310.0	8	5	270.706	1.460	0
25.0	245.0	8	5	211.283	1.475	0
25.0	180.0	8	5	151.882	1.498	0
90.0	505.0	5	1	414.673	1.447	0
90.0	440.0	11	7	360.524	1.445	0
90.0	375.0	11	9	301.669	1.454	0
90.0	310.0	8	5	242.556	1.466	0
90.0	245.0	8	7	181.523	1.485	0
90.0	180.0	8	7	122.765	1.512	0
155.0	505.0	5	1	378.192	2.124	0
155.0	440.0	5	1	323.642	1.498	0

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155.0	375.0	11	8	271.848	1.459	0
155.0	310.0	11	10	211.727	1.474	0
155.0	245.0	8	6	152.415	1.496	0
155.0	180.0	8	7	94.682	1.541	0
220.0	505.0	1	1	350.077	1000.000	0
220.0	440.0	1	1	290.291	1000.000	0
220.0	375.0	5	1	233.311	1.819	0
220.0	310.0	5	1	181.794	1.483	0
220.0	245.0	11	10	123.262	1.513	0
220.0	180.0	8	7	62.903	1.579	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-40.0	570.0	11	9	537.644	1.428	0
25.0	570.0	5	1	506.028	1.431	0
90.0	570.0	5	1	467.642	1.547	0
155.0	570.0	1	1	435.619	1000.000	0
220.0	570.0	1	1	411.447	1000.000	0
-105.0	570.0	11	9	565.933	1.426	0
-105.0	505.0	11	7	503.870	1.438	0
-105.0	440.0	11	1	450.156	1.457	0
-105.0	375.0	5	1	387.537	1.499	0
-105.0	310.0	5	1	325.853	1.643	0
-105.0	245.0	5	1	265.754	2.377	0
-105.0	180.0	1	1	208.387	1000.000	0

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LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-105.000	-40.000	25.000	90.000	155.000	220.000
570.000	1.426	1.428	1.431	1.547	1000.000	1000.000
505.000	1.438	0.000	1.435	1.447	2.124	1000.000
440.000	1.457	1.437	1.441	1.445	1.498	1000.000
375.000	1.499	1.445	1.445	1.454	1.459	1.819
310.000	1.643	1.460	1.460	1.466	1.474	1.483
245.000	2.377	1.489	1.475	1.485	1.496	1.513
180.000	1000.000	1.578	1.498	1.512	1.541	1.579

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 2 CENTERS

FACTOR OF SAFETY = 1.426 AT (-105.000,570.000)
FACTOR OF SAFETY = 0.000 AT (-40.000,505.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (-40.0 , 505.0) RADIUS 503.200
THE MINIMUM FACTOR OF SAFETY IS 0.000

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X	CENTER Y	NO. OF CIRCLE			LOWEST	WARNING
COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
-40.0	505.0	11	9	478.472	1.433	0
-16.0	505.0	11	4	467.455	1.433	0
-64.0	505.0	11	8	489.473	1.432	0
-88.0	505.0	11	6	499.490	1.431	0
-112.0	505.0	11	8	505.359	1.443	0
-88.0	529.0	11	9	522.117	1.429	0
-88.0	553.0	11	10	543.385	1.428	0
-88.0	577.0	11	10	565.936	1.426	0
-88.0	601.0	11	8	586.899	1.425	0

-88.0	625.0	11	9	609.550	1.423	0
-88.0	649.0	11	8	631.241	1.422	0
-88.0	673.0	11	9	652.445	1.421	0
-88.0	697.0	5	1	675.907	1.420	0
-88.0	721.0	5	1	694.506	1.419	0
-88.0	745.0	5	1	713.427	1.421	0
-64.0	721.0	5	1	679.802	1.424	0
-112.0	721.0	11	8	706.830	1.418	0
-136.0	721.0	11	7	718.160	1.418	0
-160.0	721.0	11	3	726.533	1.418	0
-136.0	745.0	11	2	739.371	1.417	0
-136.0	769.0	5	1	761.999	1.416	0
-136.0	793.0	5	1	780.760	1.416	0
-136.0	817.0	5	1	799.801	1.417	0
-112.0	793.0	5	1	766.208	1.421	0
-160.0	793.0	5	1	795.770	1.415	0
-184.0	793.0	11	3	801.588	1.415	0
-160.0	817.0	5	1	814.461	1.414	0
-160.0	841.0	5	1	833.423	1.415	0
-136.0	817.0	5	1	799.801	1.417	0
-184.0	817.0	11	2	825.362	1.413	0
-208.0	817.0	11	3	832.320	1.418	0
-184.0	841.0	5	1	848.180	1.413	0
-184.0	865.0	5	1	867.070	1.412	0
-184.0	889.0	5	1	886.207	1.414	0
-160.0	865.0	5	1	852.639	1.417	0
-208.0	865.0	11	2	877.985	1.412	0
-232.0	865.0	11	3	885.350	1.418	0
-208.0	889.0	5	1	900.739	1.411	0
-208.0	913.0	5	1	919.801	1.412	0
-184.0	889.0	5	1	886.207	1.414	0
-232.0	889.0	11	3	907.194	1.415	0
-202.0	889.0	5	1	897.067	1.411	0
-214.0	889.0	11	7	902.630	1.411	0
-208.0	895.0	5	1	905.482	1.411	0
-208.0	883.0	5	1	896.010	1.413	0

AT POINT (-208.0 , 889.0) RADIUS 900.739

THE MINIMUM FACTOR OF SAFETY IS 1.411

AFTER SEARCH, MINIMUN F.S. STILL FALLS OUTSIDE THE GRID, SO GRID IS EXPANDED

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-105.0	635.0	11	10	625.682	1.422	0
-40.0	635.0	5	1	597.557	1.424	0
25.0	635.0	5	1	557.897	1.459	0
90.0	635.0	5	1	523.330	2.453	0
155.0	635.0	1	1	494.923	1000.000	0
220.0	635.0	1	1	473.787	1000.000	0
-105.0	700.0	11	2	685.066	1.419	0
-40.0	700.0	5	1	648.621	1.430	0
25.0	700.0	5	1	612.278	1.603	0
90.0	700.0	1	1	580.955	1000.000	0
155.0	700.0	1	1	555.503	1000.000	0
220.0	700.0	1	1	536.758	1000.000	0
-105.0	765.0	5	1	739.641	1.419	0
-40.0	765.0	5	1	701.993	1.478	0
25.0	765.0	4	1	668.557	2.804	0
90.0	765.0	1	1	639.995	1000.000	0
155.0	765.0	1	1	616.984	1000.000	0
220.0	765.0	1	1	600.162	1000.000	0

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-105.0	830.0	5	1	792.215	1.437	0
-40.0	830.0	5	1	757.185	1.664	0
25.0	830.0	1	1	726.295	1000.000	0
90.0	830.0	1	1	700.092	1000.000	0
155.0	830.0	1	1	679.120	1000.000	0
220.0	830.0	1	1	663.874	1000.000	0
-105.0	895.0	5	1	846.516	1.500	0
-40.0	895.0	4	1	813.827	3.180	0
25.0	895.0	1	1	785.168	1000.000	0
90.0	895.0	1	1	760.995	1000.000	0
155.0	895.0	1	1	741.747	1000.000	0
220.0	895.0	1	1	727.815	1000.000	0
-170.0	895.0	5	1	882.788	1.419	0
-170.0	830.0	5	1	830.860	1.413	0
-170.0	765.0	11	3	770.874	1.416	0
-170.0	700.0	11	9	708.987	1.423	0
-170.0	635.0	5	1	655.355	1.436	0
-170.0	570.0	5	1	593.030	1.457	0
-170.0	505.0	5	1	531.347	1.508	0
-170.0	440.0	5	1	470.558	1.653	0
-170.0	375.0	5	1	411.060	2.189	0
-170.0	310.0	5	1	353.499	8.989	0
-170.0	245.0	1	1	298.203	1000.000	0
-170.0	180.0	1	1	247.588	1000.000	0
-235.0	895.0	11	3	913.808	1.415	0
-235.0	830.0	11	1	860.721	1.423	0
-235.0	765.0	5	1	798.552	1.435	0
-235.0	700.0	5	1	736.872	1.461	0
-235.0	635.0	5	1	675.814	1.517	0
-235.0	570.0	5	1	615.565	1.654	0
-235.0	505.0	5	1	556.386	2.050	0
-235.0	440.0	5	1	498.658	3.869	0
-235.0	375.0	1	1	442.549	1000.000	0
-235.0	310.0	1	1	389.005	1000.000	0
-235.0	245.0	1	1	339.485	1000.000	0
-235.0	180.0	1	1	296.015	1000.000	0

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	31.158	3.354	0.000	.285	.132E+05	.126E+05	.846E+07	.340E+07
2	2	31.158	9.137	0.000	.320	.360E+05	.342E+05	.218E+08	.104E+08
3	2	31.158	13.653	0.000	.355	.538E+05	.511E+05	.319E+08	.172E+08
4	2	31.158	16.850	0.000	.389	.664E+05	.631E+05	.386E+08	.233E+08
5	2	31.158	18.667	0.000	.424	.736E+05	.699E+05	.421E+08	.281E+08
6	2	31.158	19.032	0.000	.458	.750E+05	.713E+05	.421E+08	.310E+08
7	2	31.158	17.862	0.000	.493	.704E+05	.669E+05	.387E+08	.313E+08
8	2	31.158	15.053	0.000	.527	.593E+05	.564E+05	.320E+08	.282E+08
9	2	31.158	10.485	0.000	.562	.413E+05	.393E+05	.219E+08	.209E+08
10	2	31.158	4.009	0.000	.597	.158E+05	.150E+05	.858E+07	.849E+07
							SUM	.286E+09	.202E+09

AT CENTER (-208.000 , 889.000) WITH RADIUS 900.739 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.416
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.411

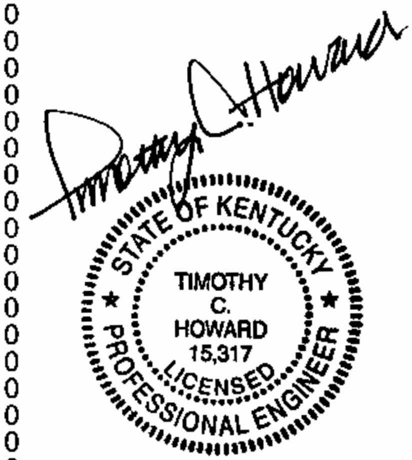
CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-40.0	505.0	11	9	478.472	1.136	0
-40.0	440.0	11	1	438.526	1.139	0
-40.0	375.0	11	8	360.251	1.146	0
-40.0	310.0	11	4	298.415	1.158	0
-40.0	245.0	8	1	245.540	1.182	0
-40.0	180.0	5	1	182.168	1.317	0
25.0	505.0	11	3	448.891	1.138	0
25.0	440.0	11	9	390.371	1.143	0
25.0	375.0	8	1	371.436	1.146	0
25.0	310.0	8	5	270.706	1.158	0
25.0	245.0	8	5	211.283	1.171	0
25.0	180.0	8	5	151.882	1.191	0
90.0	505.0	5	1	414.673	1.147	0
90.0	440.0	11	7	360.524	1.146	0
90.0	375.0	11	9	301.669	1.153	0
90.0	310.0	8	5	242.556	1.164	0
90.0	245.0	8	7	181.523	1.179	0
90.0	180.0	8	7	122.765	1.203	0
155.0	505.0	5	1	378.192	1.711	0
155.0	440.0	5	1	323.642	1.189	0
155.0	375.0	11	2	271.232	1.158	0
155.0	310.0	11	10	211.727	1.170	0
155.0	245.0	8	6	152.415	1.189	0
155.0	180.0	8	7	94.682	1.228	0
220.0	505.0	1	1	350.077	1000.000	0
220.0	440.0	1	1	290.291	1000.000	0
220.0	375.0	5	1	233.311	1.457	0
220.0	310.0	5	1	181.794	1.179	0
220.0	245.0	8	5	120.853	1.210	0
220.0	180.0	8	7	62.903	1.259	0



GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-40.0	570.0	11	9	537.644	1.132	0
25.0	570.0	5	1	506.028	1.134	0
90.0	570.0	5	1	467.642	1.230	0
155.0	570.0	1	1	435.619	1000.000	0
220.0	570.0	1	1	411.447	1000.000	0
-40.0	635.0	5	1	597.557	1.129	0
25.0	635.0	5	1	557.897	1.157	0
90.0	635.0	5	1	523.330	1.986	0
155.0	635.0	1	1	494.923	1000.000	0
220.0	635.0	1	1	473.787	1000.000	0
-40.0	700.0	5	1	648.621	1.133	0
25.0	700.0	5	1	612.278	1.277	0
90.0	700.0	1	1	580.955	1000.000	0
155.0	700.0	1	1	555.503	1000.000	0
220.0	700.0	1	1	536.758	1000.000	0
-105.0	700.0	11	9	684.034	1.124	0
-105.0	635.0	11	10	625.682	1.127	0
-105.0	570.0	11	9	565.933	1.130	0
-105.0	505.0	11	7	503.870	1.140	0
-105.0	440.0	11	1	450.156	1.164	0
-105.0	375.0	5	1	387.537	1.203	0
-105.0	310.0	5	1	325.853	1.311	0
-105.0	245.0	5	1	265.754	1.936	0
-105.0	180.0	1	1	208.387	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-105.000	-40.000	25.000	90.000	155.000	220.000
700.000	1.124	1.133	1.277	1000.000	1000.000	1000.000
635.000	1.127	1.129	1.157	1.986	1000.000	1000.000
570.000	1.130	1.132	1.134	1.230	1000.000	1000.000
505.000	1.140	1.136	1.138	1.147	1.711	1000.000
440.000	1.164	1.139	1.143	1.146	1.189	1000.000
375.000	1.203	1.146	1.146	1.153	1.158	1.457
310.000	1.311	1.158	1.158	1.164	1.170	1.179
245.000	1.936	1.182	1.171	1.179	1.189	1.210
180.000	1000.000	1.317	1.191	1.203	1.228	1.259

ONLY ONE MINIMUM F.S. OF 1.124 EXISTS AT (-105.000,700.000)

AT POINT (-105.0 , 700.0) RADIUS 684.034
THE MINIMUM FACTOR OF SAFETY IS 1.124

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-105.0	700.0	11	9	684.034	1.124	0
-81.0	700.0	5	1	673.766	1.125	0
-129.0	700.0	11	3	694.799	1.124	0
-153.0	700.0	11	3	704.549	1.124	0
-129.0	724.0	11	9	717.481	1.123	0
-129.0	748.0	11	8	738.468	1.122	0
-129.0	772.0	5	1	759.942	1.121	0
-129.0	796.0	5	1	778.845	1.122	0
-105.0	772.0	5	1	745.209	1.124	0
-153.0	772.0	11	2	771.002	1.121	0
-177.0	772.0	11	3	779.939	1.121	0
-153.0	796.0	5	1	793.680	1.120	0
-153.0	820.0	5	1	812.507	1.120	0
-153.0	844.0	5	1	831.601	1.121	0
-129.0	820.0	5	1	798.023	1.124	0
-177.0	820.0	11	7	825.503	1.119	0
-201.0	820.0	11	3	832.820	1.120	0
-177.0	844.0	5	1	846.192	1.119	0
-177.0	868.0	5	1	865.208	1.119	0
-153.0	844.0	5	1	831.601	1.121	0
-201.0	844.0	11	6	855.990	1.119	0
-225.0	844.0	11	9	862.309	1.123	0
-201.0	868.0	11	6	878.990	1.118	0
-201.0	892.0	5	1	898.839	1.118	0
-201.0	916.0	5	1	918.020	1.119	0
-177.0	892.0	5	1	884.466	1.121	0
-225.0	892.0	11	9	908.716	1.118	0
-195.0	892.0	5	1	895.207	1.118	0
-207.0	892.0	5	1	902.497	1.117	0
-213.0	892.0	11	6	905.301	1.117	0
-219.0	892.0	11	8	907.101	1.117	0
-213.0	898.0	5	1	910.914	1.117	0
-213.0	904.0	5	1	915.664	1.117	0
-207.0	898.0	5	1	907.251	1.117	0
-219.0	898.0	11	7	912.809	1.117	0

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AT POINT (-213.0 , 898.0) RADIUS 910.914

THE MINIMUM FACTOR OF SAFETY IS 1.117

AFTER SEARCH, MINIMUN F.S. STILL FALLS OUTSIDE THE GRID, SO GRID IS EXPANDED

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-105.0	765.0	5	1	739.641	1.124	0
-40.0	765.0	5	1	701.993	1.172	0
25.0	765.0	4	1	668.557	2.279	0
90.0	765.0	1	1	639.995	1000.000	0
155.0	765.0	1	1	616.984	1000.000	0
220.0	765.0	1	1	600.162	1000.000	0
-105.0	830.0	5	1	792.215	1.138	0
-40.0	830.0	5	1	757.185	1.328	0
25.0	830.0	1	1	726.295	1000.000	0
90.0	830.0	1	1	700.092	1000.000	0
155.0	830.0	1	1	679.120	1000.000	0
220.0	830.0	1	1	663.874	1000.000	0
-105.0	895.0	5	1	846.516	1.191	0
-40.0	895.0	4	1	813.827	2.592	0
25.0	895.0	1	1	785.168	1000.000	0
90.0	895.0	1	1	760.995	1000.000	0
155.0	895.0	1	1	741.747	1000.000	0
220.0	895.0	1	1	727.815	1000.000	0
-105.0	960.0	5	1	902.233	1.380	0
-40.0	960.0	1	1	871.636	1000.000	0
25.0	960.0	1	1	844.940	1000.000	0
90.0	960.0	1	1	822.526	1000.000	0
155.0	960.0	1	1	804.751	1000.000	0
220.0	960.0	1	1	791.927	1000.000	0
-170.0	960.0	5	1	936.349	1.146	0
-170.0	895.0	5	1	882.788	1.124	0
-170.0	830.0	5	1	830.860	1.119	0
-170.0	765.0	11	3	770.874	1.121	0
-170.0	700.0	11	9	708.987	1.127	0
-170.0	635.0	11	1	655.355	1.143	0
-170.0	570.0	5	1	593.030	1.162	0
-170.0	505.0	5	1	531.347	1.209	0
-170.0	440.0	5	1	470.558	1.339	0
-170.0	375.0	5	1	411.060	1.814	0
-170.0	310.0	5	1	353.499	7.796	0
-170.0	245.0	1	1	298.203	1000.000	0
-170.0	180.0	1	1	247.588	1000.000	0
-235.0	960.0	5	1	973.614	1.117	0
-235.0	895.0	11	3	913.808	1.120	0
-235.0	830.0	11	9	852.803	1.130	0
-235.0	765.0	5	1	798.552	1.142	0
-235.0	700.0	5	1	736.872	1.165	0
-235.0	635.0	5	1	675.814	1.216	0
-235.0	570.0	5	1	615.565	1.338	0
-235.0	505.0	5	1	556.386	1.688	0
-235.0	440.0	5	1	498.658	3.285	0
-235.0	375.0	1	1	442.549	1000.000	0
-235.0	310.0	1	1	389.005	1000.000	0
-235.0	245.0	1	1	339.485	1000.000	0
-235.0	180.0	1	1	296.015	1000.000	0

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	31.233	3.334	0.000	.287	.132E+05	.125E+05	.829E+07	.459E+07

2	2	31.233	9.082	0.000	.321	.359E+05	.341E+05	.212E+08	.136E+08
3	2	31.233	13.569	0.000	.355	.536E+05	.509E+05	.309E+08	.219E+08
4	2	31.233	16.744	0.000	.390	.662E+05	.628E+05	.373E+08	.290E+08
5	2	31.233	18.547	0.000	.424	.733E+05	.696E+05	.404E+08	.343E+08
6	2	31.233	18.907	0.000	.458	.747E+05	.710E+05	.402E+08	.372E+08
7	2	31.233	17.740	0.000	.493	.701E+05	.666E+05	.368E+08	.369E+08
8	2	31.233	14.947	0.000	.527	.591E+05	.561E+05	.303E+08	.329E+08
9	2	31.233	10.408	0.000	.561	.411E+05	.391E+05	.206E+08	.241E+08
10	2	31.233	3.978	0.000	.595	.157E+05	.149E+05	.806E+07	.967E+07
							SUM	.274E+09	.244E+09

AT CENTER (-213.000 , 898.000) WITH RADIUS 910.914 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.123
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.117

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.411

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.117

Timothy C. Howard

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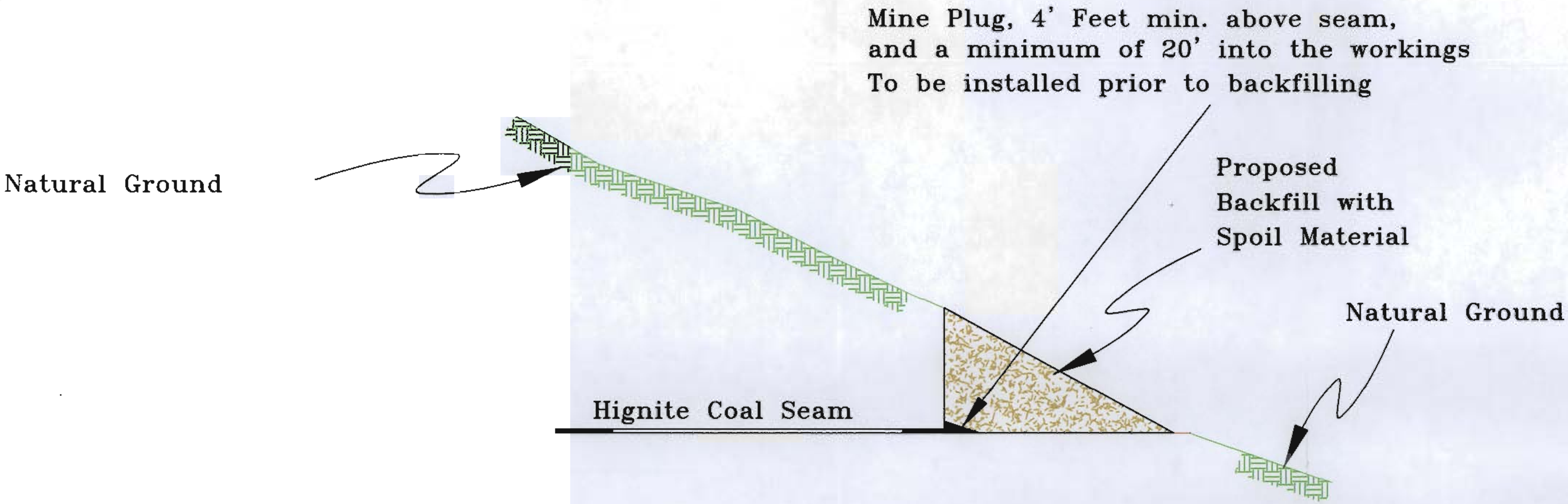
Appolo Fuels, Inc.
#807-0368

ATTACHMENT 25.4.A

AUGER/HIGHWALL MINING HOLE SEALING

After all mining activity has been completed auger/highwall mining hole, well; core drill hole or other exploration hole will be sealed. This will prevent acid or other toxic drainage from entering the ground or surface waters and will protect the hydrologic balance.

The auger/highwall mining holes will be sealed with the best available, non-combustible, non-permeable material available. Two scenarios are proposed for the sealing of auger/highwall mining holes as detailed in the drawings in this attachment. One is a dry seal to be used in areas where the drainage of the auger/highwall mining holes is not deemed necessary and the other is a wet seal to be used in areas deemed necessary to allow for drainage of the auger/highwall mining holes. The application of one or the other seals will be made as conditions in the field warrant. The attached drawings detail the construction of these seals.



I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

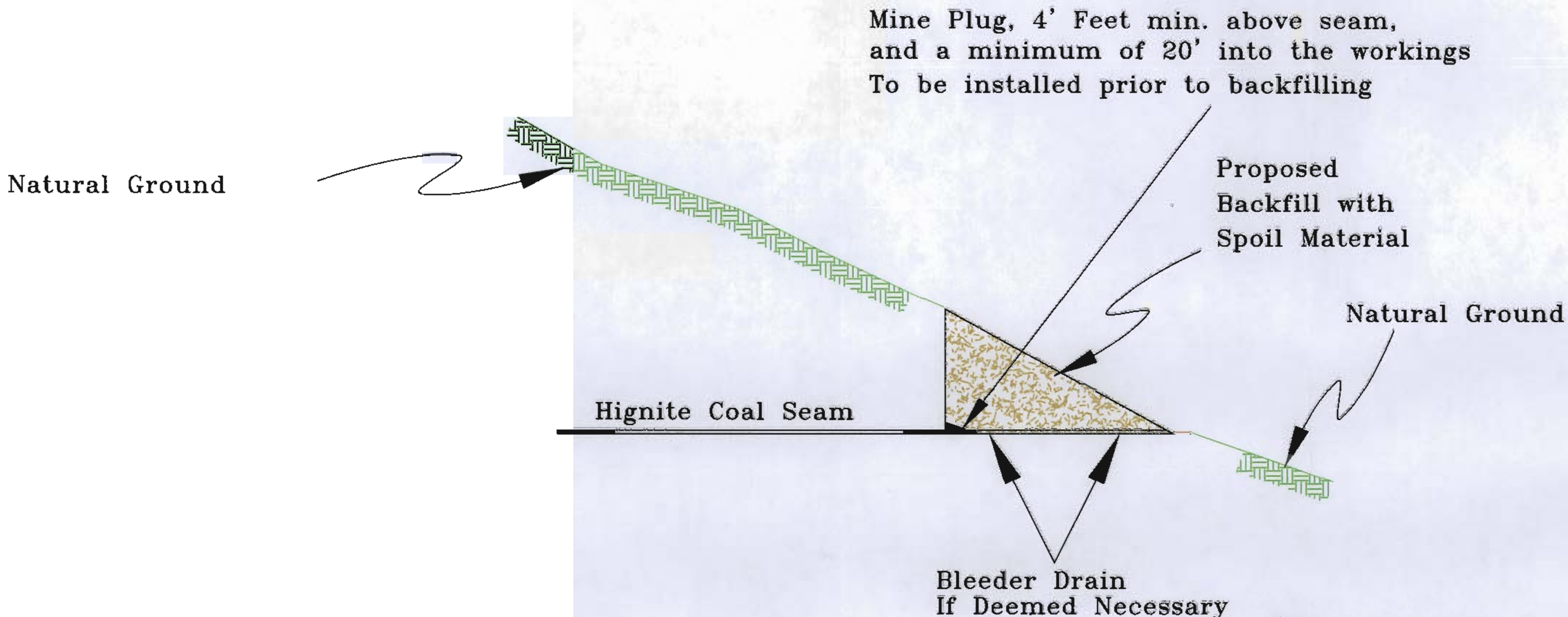
STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

Permit #807-0368
Typical Mine Opening Dry Seal
After Contour Strip and Auger or Highwall Miner

Scale: 1" = 100'	Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.



Notes:

I. Bleeders to be constructed in low spots as dictated by localized dip.

II. Bleeders to be sloped 1 to 2% away from highwall.

III. Bleeders to be constructed only of durable rock.

IV. Bleeders will be routed to natural drainage courses as practical with dip of coal.

V. Bleeders will be routed into sediment control structures.

VI. Bleeders will be constructed prior to backfilling of the highwall.

I, Timothy C Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY ★ TIMOTHY C. HOWARD 15,317 LICENSED ★ PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

Permit #807-0368
Typical Mine Opening Wet Seal, If Deemed Necessary, After Contour Strip and Auger or Highwall Miner

Scale: 1" = 100'	Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.

ATTACHMENT 26.3.A

Hollow Fill #1

The entire area of the proposed hollow fill area was surveyed to determine the location and significance of any seeps, springs or ground water flow. The survey was conducted during the wet weather season. The survey revealed no seeps, springs or ground water flow within the proposed spoil storage area.

Geologic information from Tennessee was reviewed by David W. Howard, P.G. (KY-0050 and TN0365). Hole number BAC-3 is the only geologic data point that is within ½ mile of the state line and HF-1. A review of lithology from this corehole indicates that the geologic strata overlying the Hignite coal bed in Tennessee is very consistent with the strata in Kentucky. The lithology of BAC-3 is very similar to HW-1 and HW-4. Since a correlation of overlying strata can be made, geochemical and geotechnical characteristics of the strata overlying the Hignite coal bed in Tennessee can be inferred to be of similar characteristics as the strata overlying the Hignite coal bed in Kentucky. Also, the application indicates that any acidic or toxic strata encountered will be handled in accordance with Attachment 29.2.A

A pre-law slate dump is located within the footprint of the proposed fill. The pre-law slate dump has already contributed to the degradation of the stream and will be covered by Hollow Fill #1. As the slate dump was created pre-law its make-up and extents are not known.

Prior to placement of material in the hollow fill area the vegetation will be cleared from the proposed spoil storage area with the material being disposed of either by windrowing the trees along the outside edge and/or at the bottom of the hollow fill area. The material may also be alternately disposed of by burning and mixing of the ashes with the spoil. The entire footprint of the hollow fill will be scraped to bedrock prior to placement of fill material. After the vegetation and woody material is removed, available topsoil and subsoils will be stripped from the site and will be stored. This available topsoil and subsoils will be supplemented with selected overburdens from the mining operation to produce an acceptable Alternate Topsoil Material. Surface drainage will be diverted around the fill through a series of constructed diversion ditches. These diversion ditches will be constructed as the fill is advanced, with the final diversions being constructed to 100 year-24 hour design capacity upon completion of material placement. The diversion ditches with a flow of less than 5.0 f.p.s. will be vegetated and those ditches with a flow greater than 5.0 f.p.s. will be lined with durable rock to prevent the effects of erosion.

ATTACHMENT 26.3.A

The underdrain will be constructed by conventional methods in the areas shown on the profile of the design drawing and by natural segregation by end-dumping on the remainder of the underdrain. The strata to be disturbed are graphically depicted in Item 15.2 of this application. The geologic columns identify the durable strata within the mining area. The Slake Durability Index (SDI) for the strata has been reported and the majority of the material is classified as durable. Only the most durable material will be used to construct the initial under-drains. The material for the underdrains will be identified in the field by the job foreman using the available material for rock underdrain identified in the Geologic cross sections of this proposed permit application in Attachment 15.2. The representative rock will be shot during normal blasting operations. The initial under-drain material will be created by controlled blasting as not to reduce the integrity or size of the rock. This durable material will be separated and hauled to the sites and used to form the specified portions of the underdrain to make sure that the most competent material is used in the construction. Any undesirable material encountered within the mining area will not be placed near the under-drain as to prevent the plugging the underdrain. To protect and insure the center under-drain's long-term functioning, the under-drain will be covered with a minimum of four feet (4') of material to prevent equipment from crushing the underdrain and to prevent degraded material from being place around the underdrain. Once the underdrain is covered, the end dumping of the remainder of the fills is acceptable as segregation is no longer an issue. The size of the underdrain will be 16' X 16'. The durable rock will have no more than 10% of the rock less than 12" in diameter and no single rock will be larger than 4'.

Should any seeps or drainage from the coal seam be encountered during the mining proposed within the limits of the hollow fill they will be routed to the rock core drain by the construction of a lateral rock drain. The lateral drains will be formed by natural segregation as a bench will be left from the mining of the seam within the hollow fills limits. As durable rock is dumped within the limits it will traverse across the highwall and stop on the bench and rest against the highwall forming a triangular configuration. The durable materials will segregate naturally as dumped and form a natural lateral drain. All drains will be monitored during construction to insure that the drains are forming properly. Lateral drains will not be installed if the coal seams are not mined within the limits of the hollow fill by this permit.

A rock check dam will be constructed below the toe of the fill in the location shown on the MRP map and plan view drawing. The rock check dam will be inspected on a regular basis and

ATTACHMENT 26.3.A

periodic removal of sediment material as deemed necessary.

The hollow fill area itself will also be constructed by end-dumping the material. The outslope will be graded to a slope of 2:1. A terrace will be constructed at every 50 foot in elevation. The terrace will be sloping from the face of the hollow fill and toward the lateral diversion ditches. The outslope will be vegetated in according to Item 22. Once the hollow fill has been completed a Certificate of Construction will be submitted addressing any deviations, if any, from the proposed design.

It is proposed in this application to mine the coal seams within the footprint of the hollow fill. This will include the Buckeye Springs, Poplar Lick, Sterling and Strays coal seams and any unnamed coal seams.

The Buckeye Springs coal seam will be mined with an 80' highwall for a key cut for Hollow Fill #1.

We are providing the plans, cross-sections, stability analysis, etc. for Hollow Fill #1on the following pages as part of this attachment.

Subsidence Considerations

Of the seams located within the footprint of the hollow fill only two appear to have been underground mined within the fill footprint. These are the Sterling and Mason seam.

Given the type of strata overlying the Sterling and Mason seams being predominantly sandstone and shale that is relatively hard and competent, no amount of works with 100 feet of cover or less underlying the fill and diversion ditches, thickness of the Mason mine void (4'- 5'), Sterling (5'), it is our opinion that adverse impacts due to sinkhole subsidence on the stability and/or performance of the fill proposed by this application is not significant and will not pose an increase in the instability or performance of the fill or diversion ditches. Additionally, the Mason and Sterling seams do not have a history of exhibiting sinkhole subsidence. As can be seen by the overlay of the Mason seam, the interval between the fill and the old works ranges from 120 feet and up and indicates that no extraction rates exceeded 50% within the limits of the proposed fill.

The Sterling seam works are located in the upper reaches of the fill and area proposed for mining within the limits of the fill. An approximate bench width of 100 feet with a highwall of approximately 80feet is proposed. This mining will reduce the possibility of subsidence from the sterling seam by removing any potential subsidence zones from within the mining area.

ATTACHMENT 26.3.A

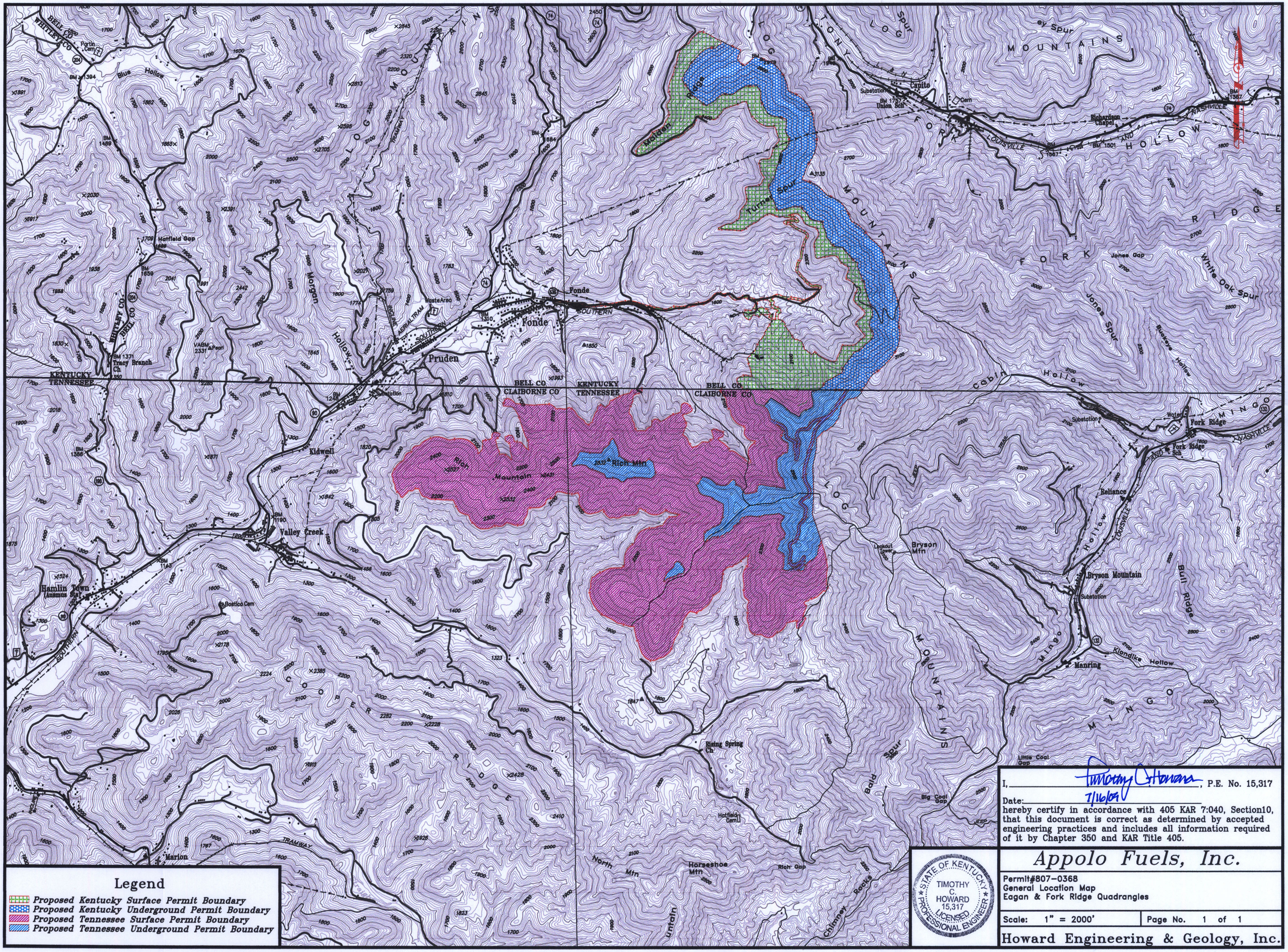
Geotechnical investigation of the fill limits has not recorded any sinkhole subsidence within the limits of the fill area. As these seams were mined within the early and mid to late 20th century it is apparent that subsidence has been minimal in this area.

Given the extent of underground works, mining extraction rates, seam thicknesses, intervals from the works to the fills, physical characteristics of strata in the intervals, type of fill material and construction methods, it is the conclusion of this engineer that the affects of surface subsidence on the stability of this hollow fill and diversions would be minimal and have no significant affects on the safety or performance of the fill and drainage structures. This conclusion is further supported by the results of the geotechnical investigation of the footprint area of the fill revealing no adverse impacts due to subsidence.

Construction – Vegetation Removal and Clearing

The removal and clearing of vegetation will be conducted according as necessary anytime during the year as mist net surveys have proven the absence of Indiana Bats. Vegetation removal and Clearing will however be conducted in a progressive manner as needed.

If for any unforeseen reason the related OSM Tennessee operation should not be mined as planned, the size of the proposed hollow fill will be greatly reduced. The hollow fill has been designed for spoil from this application and an OSM Tennessee operation. The hollow fill design notes the capacity of the fill from this proposed Kentucky application and it is noted in these designs and on the MRP/ERI Map that the additional storage for the Tennessee operation will not be disturbed until the OSM Tennessee permit is issued. Ditches KYHF1-D1 and KYHF1-D3 have been designed for the Kentucky only fill design. Road "D" has been designed for access to the Kentucky fill and will dual usage as road and hollow fill. This design will allow for both the mining of the Kentucky and Tennessee permits.



Legend
Proposed Kentucky Surface Permit Boundary
Proposed Kentucky Underground Permit Boundary
Proposed Tennessee Surface Permit Boundary
Proposed Tennessee Underground Permit Boundary
I, Timothy C. Howard, P.E. No. 15,317
Date: 7/16/09
hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.
STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED
PROFESSIONAL ENGINEER
Appolo Fuels, Inc.
Permit#807-0368
General Location Map
Eagan & Fork Ridge Quadrangles
Scale: 1" = 2000'
Page No. 1 of 1
Howard Engineering & Geology, Inc.
Pruden
Fonde
Valley Creek
Kidwell
Bryson Mountain
Fork Ridge
Rich Mtn
Log Mountains
Fork Ridge
Mingo
Cooper Ridge
KENTUCKY
TENNESSEE
BELL CO.
CLAIBORNE CO.

CERTIFICATION OF DESIGN

STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

I, Timothy C. Howard, (Signature) (Engineer's Seal) 15,317 (Registration No.), 12/29/08 (Date Certified),

hereby certify, in accordance with 405 KAR 7:040, Section 10, that the design of each of the following facilities, whose design is included in this application, Application # 807-0368 :

a) is in accordance with accepted engineering practices and recognized professional standards;
b) complies with the design requirements of KRS Chapter 350 and KAR Title 405; and
c) provided that the facility is properly constructed, operated and maintained, is adequate for the facility to meet the applicable performance standards of KRS Chapter 350 and KAR Title 405 insofar as such performance can reasonably be predicted by accepted engineering practices.

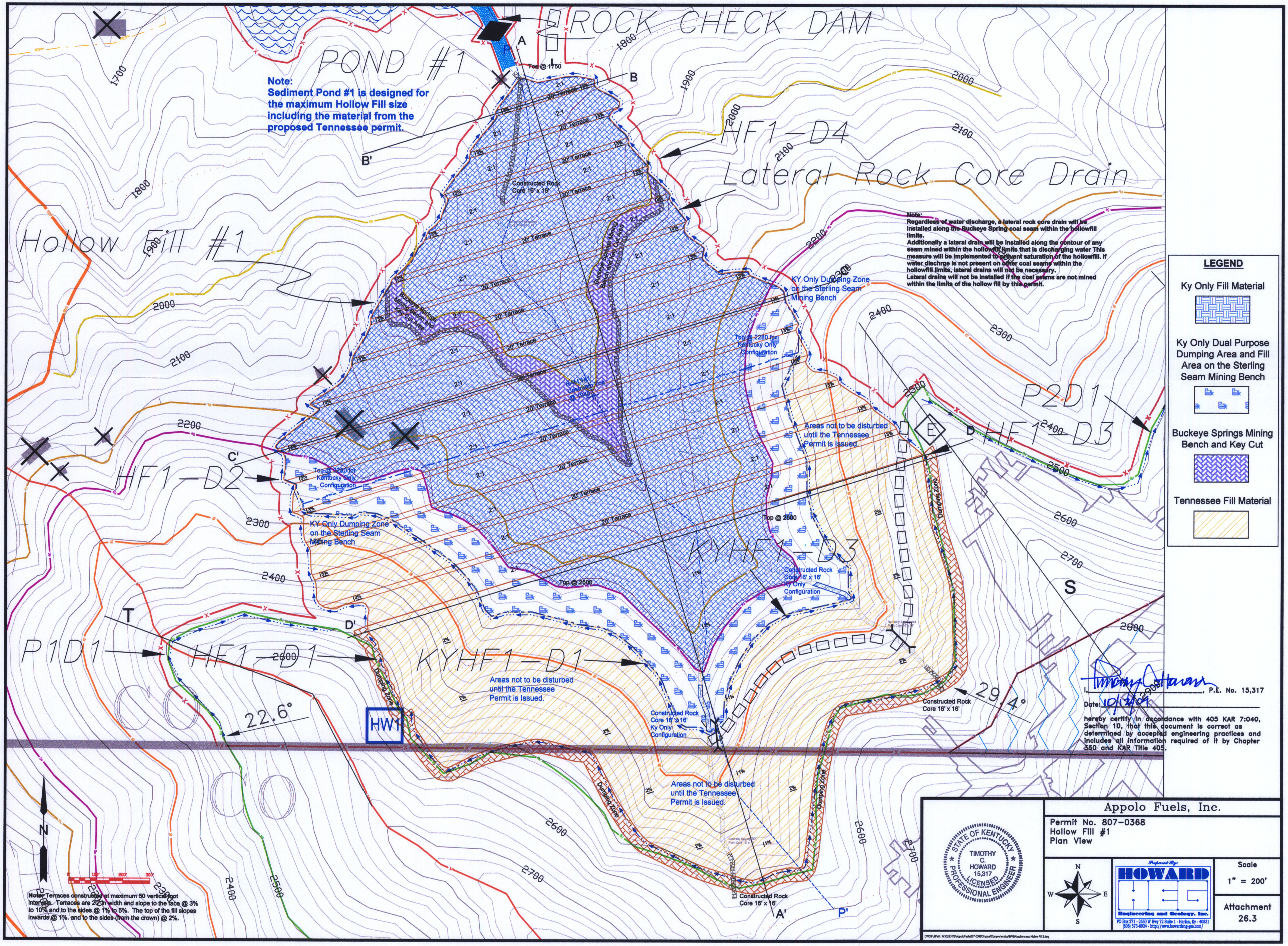
FACILITY TYPE: Excess Spoil Disposal Fill
(One facility type only)

FACILITY ID #	HAZARD CLASS*	DATE OF DESIGN	FACILITY ID #	HAZARD CLASS*	DATE OF DESIGN
1	N/A	12/29/08			

TYPES OF FACILITIES:

- -- sedimentation pond
- -- excess spoil disposal fill
- -- temporary water impoundment
- -- permanent water impoundment
- -- coal processing waste impoundment
- -- coal processing waste dam
- -- coal processing waste bank
- -- road
- -- postmining land use plan
- -- permanent ditches

* Show hazard class, if applicable.


ROCK CHECK DAM
POND #1
Note:
Sediment Pond #1 is designed for the maximum Hollow Fill size including the material from the proposed Tennessee permit.
HF1-D4
Lateral Rock Core Drain
Hollow Fill #1
Note:
Regardless of water discharge, a lateral rock core drain will be installed along the Buckeye Spring coal seam within the hollowfill limits.
Additionally a lateral drain will be installed along the contour of any seam mined within the hollowfill limits that is discharging water This measure will be implemented to prevent saturation of the hollowfill. If water dischrge is not present on other coal seams within the hollowfill limits, lateral drains will not be necessary.
Lateral drains will not be installed if the coal seams are not mined within the limits of the hollow fill by this permit.
Top @ 1750
Constructed Rock Core 16' x 16'
20' Terrace
KY Only Dumping Zone on the Sterling Seam Mining Bench
Top @ 2280 for Kentucky Only Configuration
Areas not to be disturbed until the Tennessee Permit is Issued.
P2D1
HF1-D3
HF1-D2
KYHF1-D3
Top @ 2500
T
S
P1D1
HF1-D1
KYHF1-D1
22.6°
29.4°
HW1
Constructed Rock Core 16' x 16' Ky Only Configuration
Constructed Rock Core 16' x 16'
Dumping Zone
LEGEND
Ky Only Fill Material
Ky Only Dual Purpose Dumping Area and Fill Area on the Sterling Seam Mining Bench
Buckeye Springs Mining Bench and Key Cut
Tennessee Fill Material
I, ______, P.E. No. 15,317
Date: 10/12/09
hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.
Note: Terraces constructed at maximum 50 vertical foot intervals. Terraces are 20' in width and slope to the face @ 3% to 10% and to the sides @ 1% to 5%. The top of the fill slopes inwards @ 1%. and to the sides (from the crown) @ 2%.
0' 100' 200' 300'
STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER
Appolo Fuels, Inc.
Permit No. 807-0368
Hollow Fill #1
Plan View
Prepared By:
HOWARD
Engineering and Geology, Inc.
PO Box 271 - 2550 W Hwy 72 Suite 1 - Harlan, Ky - 40831
(606) 573-6924 - http://www.howardeng-geo.com/
Scale
1" = 200'
Attachment
26.3

I, Timothy C. Howard, P.E. No. 15,317

Date: 10/12/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

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PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

Permit No. 807-0368
Hollow Fill #1
Cross Sections and Profile

N
W E
S

Prepared By:
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HEG
Engineering and Geology, Inc.
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Scale
1" = 100'

Attachment
26.3

DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\BFG\Xsections and Hollow Fill 2.dwg

P-P'

Supplemental section for stability analysis. This secion was taken more closely aligned to the center of the stream to better reflect a proper profile for stability purposes. However, as this alignment is not perfectly perpendicular, stability for the 3d alignment as well as a simulated 2:1 alignment have been provided.

Note: All Proposed Highwall Cuts Shown Are Typical And May Vary In The Field.

I, ____________, P.E. No. 15,317

Date: 10/2/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY — TIMOTHY C. HOWARD 15,317 — LICENSED PROFESSIONAL ENGINEER

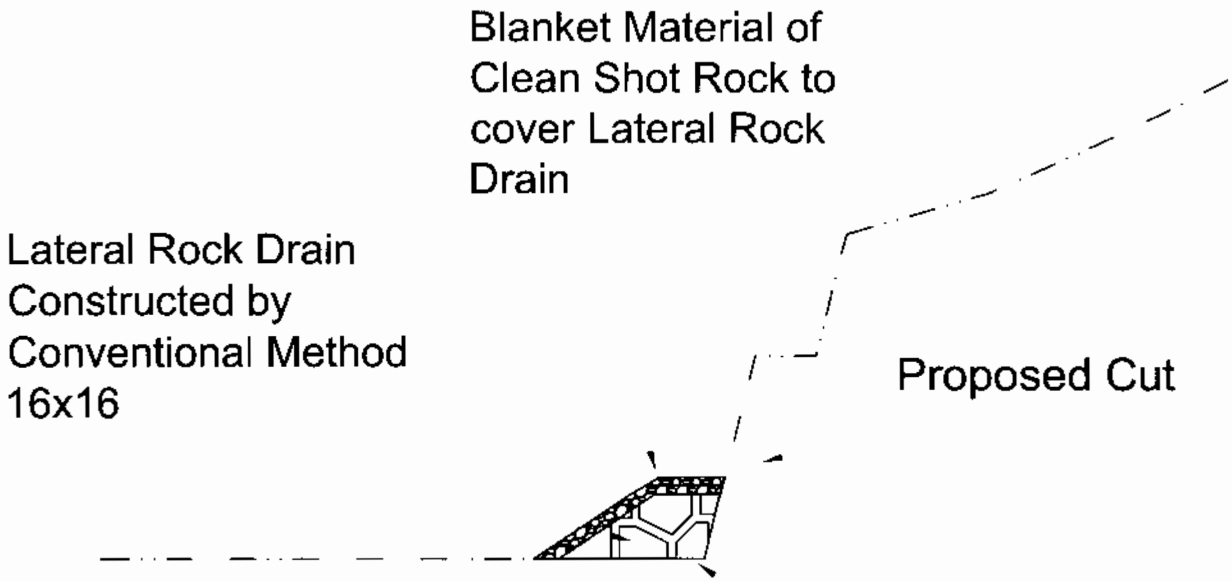
Appolo Fuels, Inc.

Permit No. 807-0368
Hollow Fill #1
Cross Sections and Profile
Supplemental Cross Section

Prepared By: HOWARD Engineering and Geology, Inc.

Scale 1" = 100'

Attachment 26.3



Constructed Rock
Core Lateral Drain
16' x 16' Minimum

Lateral Rock Drain to
be Constructed along
mine bench contour
within hollowfill limits
to groin ditches on
both sides of fill.

I, Timothy C. Howard, P.E. No. 15,317

Date: 8/23/04

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

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Appolo Fuels, Inc.

Permit No. 807-0368
Hollow Fill Laterial Rock Drain Specifics

Scale: As-Shown	Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.

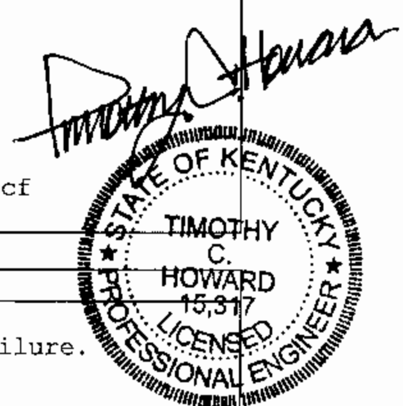
Hollow Fill Soil Parameter Calculations

The Cylindrical Soil Failure Parameters were calculated as indicated in the example on page 14 of the reame training guidelines.

Quote from Page 12
For Standard Fill Material the following parameters are recommended for cylindrical failure Standard Fill: $\iota = 30E$, $| = 200$ psf , $\Phi = 125$ psf

Quote from Page 13
For Durable Rockfill Material the following parameters are recommended for cylindrical failure Shale Rock: $\iota = 35E$, $| = 0$, $\Phi = 125$ pcf Sandstone: $\iota = 40E$, $| = 0$, $\Phi = 130$ pcf The above parameters can be used **ONLY** if the fill material is 100% durable rock. If it is between 80% and 100%, proportionate values should be used.

Quote from Page 14
EXAMPLE: If fill material is 85% durable sandstone and 15% is non-durable material. $| = (0.85 * 0) + (0.15 * 200) = 30$ psf $\iota = (0.85 * 40E) + (0.15 * 30E) = 38.5E$ $\Phi = (0.85 * 130) + (0.15 * 125) = 129.25$ pcf



from Page 13
Standard Fill Material Parameters for Plane Failure. $| = 0.80 * 200 = 160$ psf $\iota = 0.80 * 30E = 24.0E$ $\Phi = 125.00$ pcf $| = 0.10$

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Standard Shale SS Other 60/30/10

	C	A	U	Ratio		%
Shale	0	35	125	90%	67%	60%
Sandstone	0	40	130	90%	33%	30%
Other	200	30	125	10%	100%	10%
Composite	20.0	36.0	126.5			100%
Slip 80	16.0	28.8	126.5			
Standard Interface	160	24	125			

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Appolo 807-0368 Hollow Fill #1

Table of the Differences in Safety Factor by slip surface location

Run	Adjustments	Mid-line	Rock-Line	Difference	% Difference
K-I-2-S	None	2.015	2.019	0.004	0.20%
		1.406	1.404	-0.002	-0.14%
K-X-2-S	1	2.607	2.571	-0.036	-1.40%
		1.674	1.650	-0.024	-1.45%
K-X-V-S	2	2.608	2.569	-0.039	-1.52%
		1.680	1.655	-0.025	-1.51%
T-I-2-S	2	1.532	1.527	-0.005	-0.33%
		1.116	1.113	-0.003	-0.27%
T-X-2-S	2	2.160	2.139	-0.021	-0.98%
		1.485	1.469	-0.016	-1.09%
T-X-V-S	2	2.122	2.103	-0.019	-0.90%
		1.461	1.447	-0.014	-0.97%

It is the opinion of this engineer that for the above referenced stability analysis that the positioning of the slip surface a minimal distance above the rockline has a minimal and insignificant difference to the obtained plane failure safety factor for this fill design. However, it should be noted that moving the slip surface any additional distance away from the rockline may adversely effect the accuracy of the obtained factor of safety and should not be done without careful consideration of the individual fill configuration.

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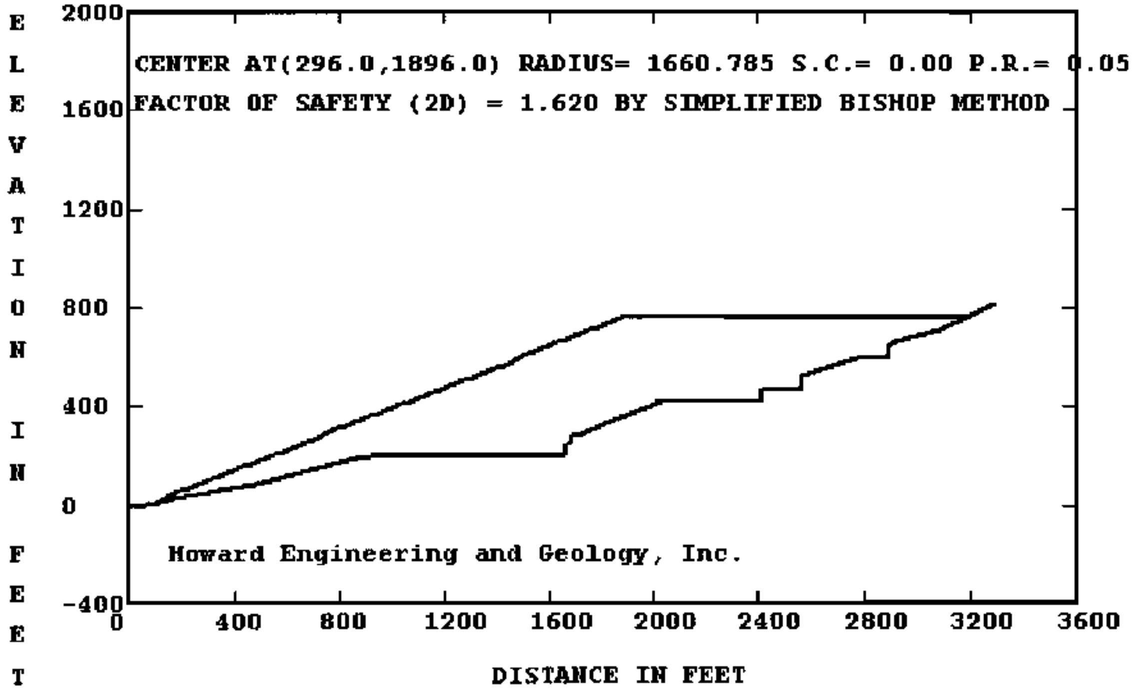
Timothy C. Howard

Appolo 807-0368 HF1



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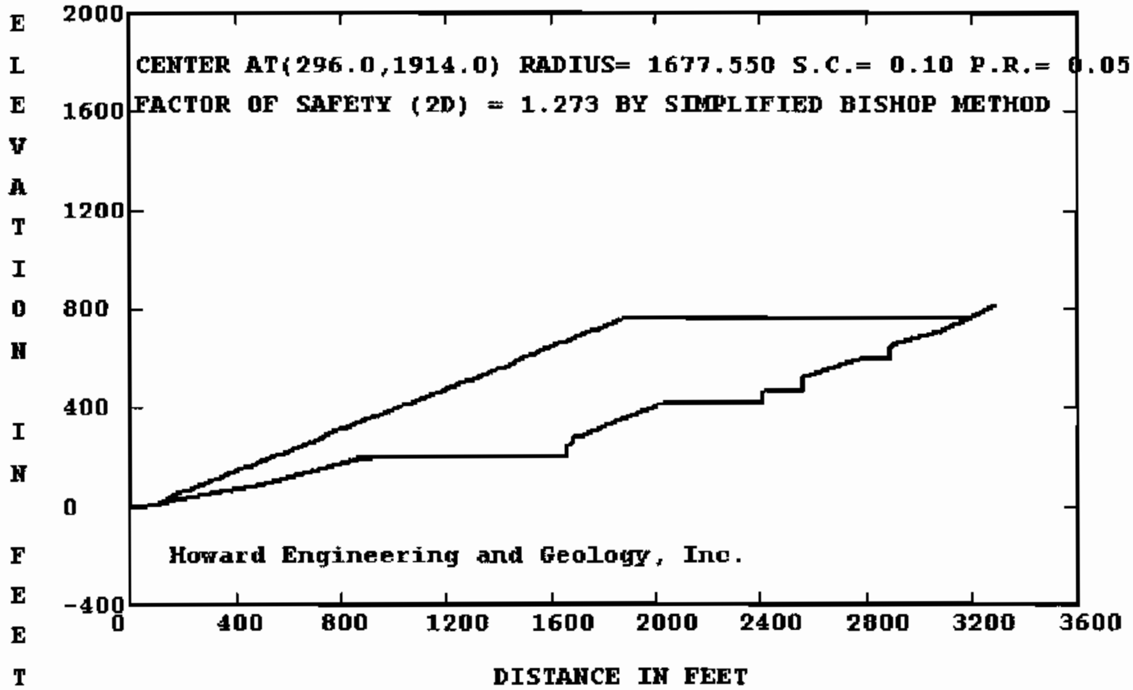
Appolo 807-0368 HF1



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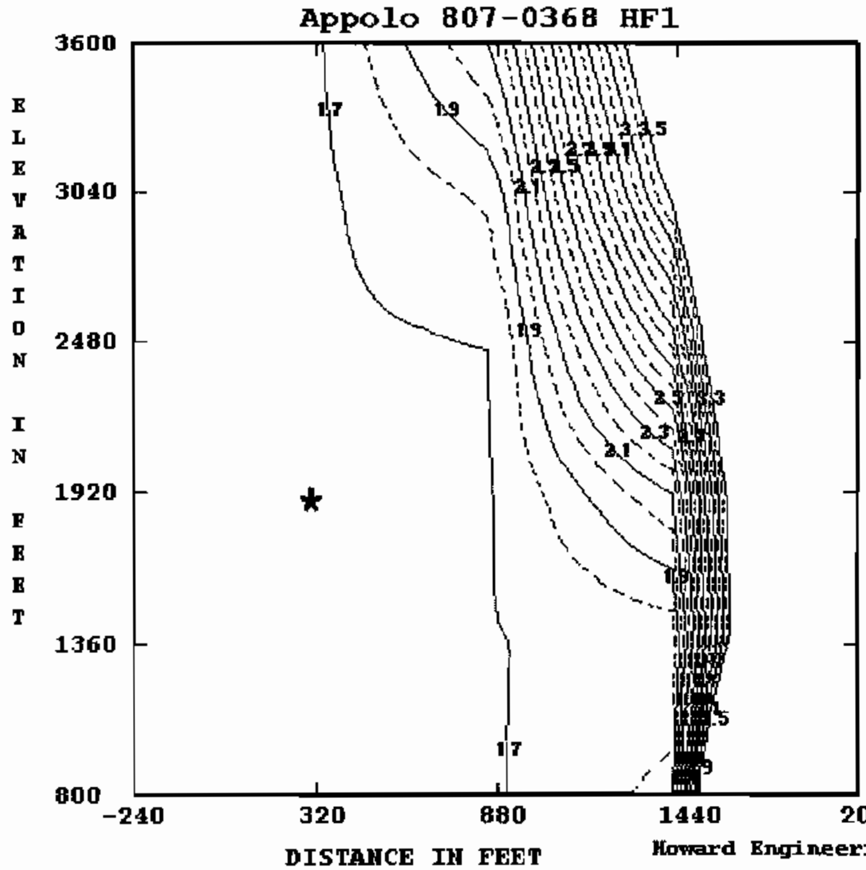
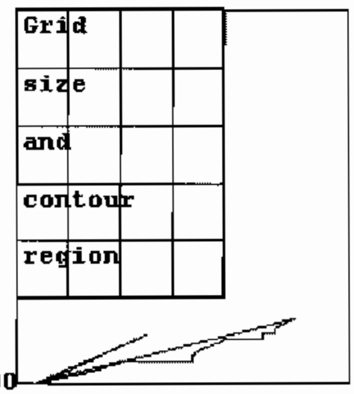


F.S.(2D) = 1.620
by SIMPLIED BISHOP
SEISMIC COEF. = 0

Number on curves
indicates factor
of safety.
Graph below shows
true shape and
location of the
contour region.



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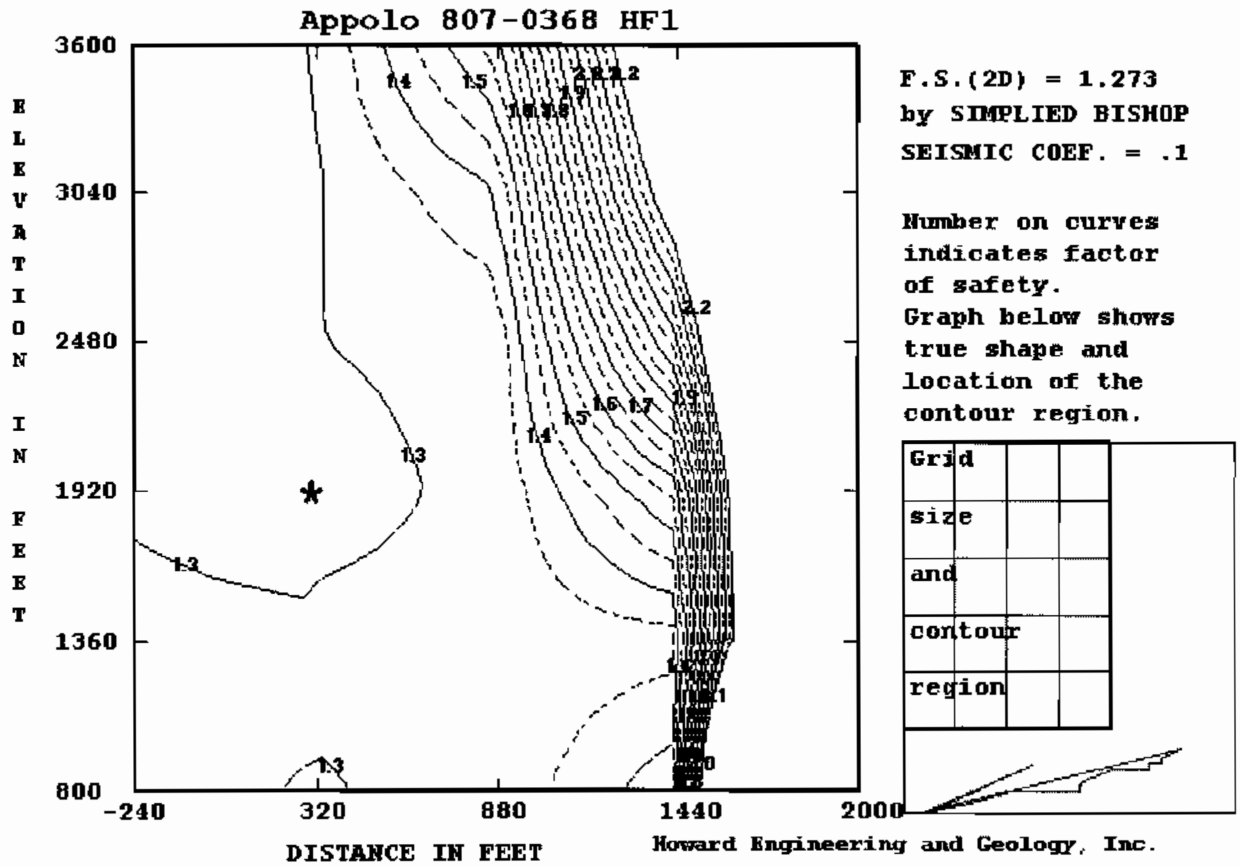

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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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INPUT FILE NAME -R:\HF1.DAT

TITLE -Appolo 807-0368 HF1

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 2

NO. OF POINTS ON BOUNDARY LINE 1 = 26

```
 1  X COORD.= 0          Y COORD.= 0
 2  X COORD.= 59         Y COORD.= 10
 3  X COORD.= 89         Y COORD.= 10
 4  X COORD.= 168        Y COORD.= 30
 5  X COORD.= 481        Y COORD.= 90
 6  X COORD.= 860        Y COORD.= 190
 7  X COORD.= 915        Y COORD.= 200
 8  X COORD.= 1654       Y COORD.= 200
 9  X COORD.= 1666       Y COORD.= 250
 10 X COORD.= 1681       Y COORD.= 250
 11 X COORD.= 1689       Y COORD.= 280
 12 X COORD.= 1723       Y COORD.= 290
 13 X COORD.= 1806       Y COORD.= 330
 14 X COORD.= 2027       Y COORD.= 420
 15 X COORD.= 2223       Y COORD.= 420
 16 X COORD.= 2410       Y COORD.= 420
 17 X COORD.= 2410       Y COORD.= 470
 18 X COORD.= 2561       Y COORD.= 470
 19 X COORD.= 2561       Y COORD.= 521
 20 X COORD.= 2769       Y COORD.= 600
 21 X COORD.= 2891       Y COORD.= 600
 22 X COORD.= 2891       Y COORD.= 643
 23 X COORD.= 2918       Y COORD.= 660
 24 X COORD.= 3083       Y COORD.= 710
 25 X COORD.= 3183       Y COORD.= 760
 26 X COORD.= 3291       Y COORD.= 818
```

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NO. OF POINTS ON BOUNDARY LINE 2 = 34

```
 1  X COORD.= 0          Y COORD.= 0
 2  X COORD.= 59         Y COORD.= 10
 3  X COORD.= 89         Y COORD.= 10
 4  X COORD.= 189        Y COORD.= 60
 5  X COORD.= 209        Y COORD.= 60
 6  X COORD.= 309        Y COORD.= 110
 7  X COORD.= 329        Y COORD.= 110
 8  X COORD.= 429        Y COORD.= 160
 9  X COORD.= 449        Y COORD.= 160
 10 X COORD.= 549        Y COORD.= 210
 11 X COORD.= 569        Y COORD.= 210
```

```
 12 X COORD.= 669            Y COORD.= 260
 13 X COORD.= 689            Y COORD.= 260
 14 X COORD.= 789            Y COORD.= 310
 15 X COORD.= 809            Y COORD.= 310
 16 X COORD.= 909            Y COORD.= 360
 17 X COORD.= 929            Y COORD.= 360
 18 X COORD.= 1029           Y COORD.= 410
 19 X COORD.= 1049           Y COORD.= 410
 20 X COORD.= 1149           Y COORD.= 460
 21 X COORD.= 1169           Y COORD.= 460
 22 X COORD.= 1269           Y COORD.= 510
 23 X COORD.= 1289           Y COORD.= 510
 24 X COORD.= 1389           Y COORD.= 560
 25 X COORD.= 1409           Y COORD.= 560
 26 X COORD.= 1509           Y COORD.= 610
 27 X COORD.= 1529           Y COORD.= 610
 28 X COORD.= 1629           Y COORD.= 660
 29 X COORD.= 1649           Y COORD.= 660
 30 X COORD.= 1749           Y COORD.= 710
 31 X COORD.= 1769           Y COORD.= 710
 32 X COORD.= 1869           Y COORD.= 760
 33 X COORD.= 3183           Y COORD.= 760
 34 X COORD.= 3291           Y COORD.= 818

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1        0.169        0.000        0.253        0.192        0.264        0.182
          0.000        4.167        0.000        3.750        0.294        0.482
          0.407        0.000        0.000    99999.000        0.000    99999.000
          0.380        0.000    99999.000        0.630        0.303        0.500
          0.537
 2        0.169        0.000        0.500        0.000        0.500        0.000
          0.500        0.000        0.500        0.000        0.500        0.000
          0.500        0.000        0.500        0.000        0.500        0.000
          0.500        0.000        0.500        0.000        0.500        0.000
          0.500        0.000        0.500        0.000        0.500        0.000
          0.500        0.000        0.537

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1
LINE NO. (LINO)  BEG. NO. (NBP)  END NO. (NEP)
     1                 1              26

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION    FRIC. ANGLE     UNIT WEIGHTT
 NO.   (TSSE)    (C)         (PHID)           (G)
  1      1     20.000        36.000         126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 0
```

STATE OF KENTUCKY
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15,317
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PROFESSIONAL ENGINEER

INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-240   Y COORD. = 3600
POINT 2 X COORD. =-240   Y COORD. = 800
POINT 3 X COORD. = 2000   Y COORD. = 800

X INCREMENT (XINC) = 24   Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-240.0	3600.0	11	9	3483.769	1.675	0
-240.0	3040.0	11	10	2951.042	1.678	0
-240.0	2480.0	11	11	2419.919	1.675	0
-240.0	1920.0	11	1	1933.262	1.675	0
-240.0	1360.0	11	3	1374.708	1.694	0
-240.0	800.0	1	1	835.225	1000.000	0
320.0	3600.0	8	7	3241.129	1.682	0
320.0	3040.0	8	5	2740.609	1.679	0
320.0	2480.0	8	5	2217.356	1.683	0
320.0	1920.0	8	8	1674.641	1.647	0
320.0	1360.0	8	6	1167.843	1.696	0
320.0	800.0	8	5	651.822	1.671	0
880.0	3600.0	8	8	3025.941	2.122	0
880.0	3040.0	8	8	2503.008	1.828	0
880.0	2480.0	8	7	1999.313	1.701	0
880.0	1920.0	8	6	1492.364	1.696	0
880.0	1360.0	8	7	957.358	1.698	0
880.0	800.0	8	7	435.846	1.693	0
1440.0	3600.0	11	2	3161.423	4.062	0
1440.0	3040.0	8	5	2392.997	3.603	0
1440.0	2480.0	8	8	1791.159	2.855	0
1440.0	1920.0	8	8	1255.486	2.103	0
1440.0	1360.0	8	8	738.322	1.718	0
1440.0	800.0	8	7	239.581	1.837	0
2000.0	3600.0	5	1	3066.954	8.643	0
2000.0	3040.0	5	1	2550.906	7.886	0
2000.0	2480.0	5	1	2030.547	7.413	0
2000.0	1920.0	5	1	1500.243	7.236	0
2000.0	1360.0	5	1	940.388	7.748	0
2000.0	800.0	4	1	380.958	14.902	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-240.000	320.000	880.000	1440.000	2000.000
3600.000	1.675	1.682	2.122	4.062	8.643
3040.000	1.678	1.679	1.828	3.603	7.886
2480.000	1.675	1.683	1.701	2.855	7.413
1920.000	1.675	1.647	1.696	2.103	7.236
1360.000	1.694	1.696	1.698	1.718	7.748
800.000	1000.000	1.671	1.693	1.837	14.902

Timothy C. Howard

STATE OF KENTUCKY
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MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.675 AT (-240.000,3600.000)
FACTOR OF SAFETY = 1.647 AT (320.000,1920.000)
FACTOR OF SAFETY = 1.671 AT (320.000,800.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (320.0 , 1920.0) RADIUS 1674.641
THE MINIMUM FACTOR OF SAFETY IS 1.647

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
320.0	1920.0	8	8	1674.641	1.647	0
344.0	1920.0	8	7	1672.738	1.682	0
296.0	1920.0	8	8	1683.143	1.623	0
272.0	1920.0	8	8	1691.929	1.636	0
296.0	1944.0	8	8	1705.546	1.632	0
296.0	1896.0	8	8	1660.785	1.620	0
296.0	1872.0	8	8	1638.472	1.627	0
320.0	1896.0	8	8	1652.171	1.633	0
272.0	1896.0	8	8	1669.684	1.670	0
302.0	1896.0	8	8	1658.604	1.620	0
290.0	1896.0	8	8	1662.983	1.623	0
296.0	1902.0	8	8	1666.370	1.620	0
296.0	1890.0	8	8	1655.202	1.621	0

AT POINT (296.0 , 1896.0) RADIUS 1660.785

THE MINIMUM FACTOR OF SAFETY IS 1.620

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	10.182	0.410	0.000	.388	.528E+03	.502E+03	.925E+06	.341E+06
2	1	10.182	1.171	0.000	.394	.151E+04	.143E+04	.196E+07	.988E+06
3	1	10.182	1.851	0.000	.401	.238E+04	.227E+04	.287E+07	.159E+07
4	1	10.182	2.450	0.000	.407	.316E+04	.300E+04	.367E+07	.213E+07
5	1	10.182	2.967	0.000	.413	.382E+04	.363E+04	.436E+07	.262E+07
6	1	10.182	3.402	0.000	.419	.438E+04	.416E+04	.493E+07	.305E+07
7	1	10.182	3.753	0.000	.425	.483E+04	.459E+04	.539E+07	.341E+07
8	1	10.182	4.020	0.000	.431	.518E+04	.492E+04	.573E+07	.371E+07
9	1	10.182	4.202	0.000	.437	.541E+04	.514E+04	.595E+07	.393E+07
10	1	1.556	4.267	0.000	.441	.840E+03	.798E+03	.922E+06	.615E+06
11	1	8.627	2.145	0.000	.444	.234E+04	.222E+04	.272E+07	.173E+07
							SUM	.394E+08	.241E+08

AT CENTER (296.000 , 1896.000) WITH RADIUS 1660.785 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.636
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.620

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

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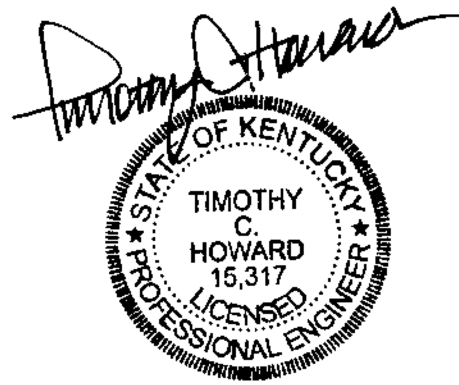
IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-240.0	3600.0	11	11	3469.304	1.293	0
-240.0	3040.0	11	10	2951.042	1.295	0
-240.0	2480.0	11	11	2419.919	1.294	0
-240.0	1920.0	11	1	1933.262	1.294	0
-240.0	1360.0	11	1	1381.014	1.312	0
-240.0	800.0	1	1	835.225	1000.000	0
320.0	3600.0	8	7	3241.129	1.298	0
320.0	3040.0	8	5	2740.609	1.296	0
320.0	2480.0	8	5	2217.356	1.299	0
320.0	1920.0	8	8	1674.641	1.285	0
320.0	1360.0	8	6	1167.843	1.311	0
320.0	800.0	8	5	651.822	1.297	0
880.0	3600.0	8	8	3025.941	1.577	0
880.0	3040.0	8	8	2503.008	1.394	0
880.0	2480.0	8	7	1999.313	1.311	0
880.0	1920.0	8	6	1492.364	1.311	0
880.0	1360.0	8	7	957.358	1.313	0
880.0	800.0	8	7	435.846	1.315	0
1440.0	3600.0	11	9	3071.046	2.549	0
1440.0	3040.0	8	5	2392.997	2.334	0
1440.0	2480.0	8	8	1791.159	1.983	0
1440.0	1920.0	8	8	1255.486	1.567	0
1440.0	1360.0	8	8	738.322	1.328	0
1440.0	800.0	8	7	239.581	1.438	0
2000.0	3600.0	5	1	3066.954	3.907	0
2000.0	3040.0	5	1	2550.906	3.783	0
2000.0	2480.0	5	1	2030.547	3.730	0
2000.0	1920.0	5	1	1500.243	3.786	0
2000.0	1360.0	5	1	940.388	4.146	0
2000.0	800.0	4	1	380.958	7.781	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-240.000	320.000	880.000	1440.000	2000.000
3600.000	1.293	1.298	1.577	2.549	3.907
3040.000	1.295	1.296	1.394	2.334	3.783
2480.000	1.294	1.299	1.311	1.983	3.730
1920.000	1.294	1.285	1.311	1.567	3.786
1360.000	1.312	1.311	1.313	1.328	4.146
800.000	1000.000	1.297	1.315	1.438	7.781



MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.293 AT (-240.000,3600.000)
FACTOR OF SAFETY = 1.285 AT (320.000,1920.000)
FACTOR OF SAFETY = 1.297 AT (320.000,800.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (320.0 , 1920.0) RADIUS 1674.641
THE MINIMUM FACTOR OF SAFETY IS 1.285

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X   CENTER Y   NO. OF CIRCLE   LOWEST   WARNING

COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
320.0	1920.0	8	8	1674.641	1.285	0
344.0	1920.0	8	7	1672.738	1.301	0
296.0	1920.0	8	8	1683.143	1.273	0
272.0	1920.0	8	8	1691.929	1.291	0
296.0	1944.0	8	8	1705.546	1.277	0
296.0	1896.0	8	8	1660.785	1.274	0
302.0	1920.0	8	8	1680.991	1.275	0
290.0	1920.0	8	8	1685.313	1.274	0
296.0	1926.0	8	8	1688.740	1.274	0
296.0	1914.0	8	8	1677.550	1.273	0
296.0	1908.0	8	8	1671.958	1.273	0
302.0	1914.0	8	8	1675.390	1.274	0
290.0	1914.0	8	8	1679.727	1.274	0

AT POINT (296.0 , 1914.0) RADIUS 1677.550

THE MINIMUM FACTOR OF SAFETY IS 1.273

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	10.499	0.455	0.000	.383	.605E+03	.574E+03	.100E+07	.483E+06
2	1	10.499	1.303	0.000	.390	.173E+04	.164E+04	.215E+07	.140E+07
3	1	10.499	2.067	0.000	.396	.275E+04	.261E+04	.318E+07	.225E+07
4	1	10.499	2.746	0.000	.402	.365E+04	.346E+04	.408E+07	.302E+07
5	1	10.499	3.340	0.000	.409	.444E+04	.421E+04	.486E+07	.372E+07
6	1	10.499	3.847	0.000	.415	.511E+04	.485E+04	.552E+07	.433E+07
7	1	10.499	4.266	0.000	.421	.567E+04	.538E+04	.606E+07	.486E+07
8	1	10.499	4.598	0.000	.427	.611E+04	.580E+04	.648E+07	.530E+07
9	1	10.499	4.841	0.000	.434	.643E+04	.611E+04	.678E+07	.565E+07
10	1	0.426	4.932	0.000	.437	.266E+03	.252E+03	.279E+06	.235E+06
11	1	10.073	2.478	0.000	.440	.316E+04	.300E+04	.350E+07	.281E+07
							SUM	.439E+08	.341E+08

AT CENTER (296.000 , 1914.000) WITH RADIUS 1677.550 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.289
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.273

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.620

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.273

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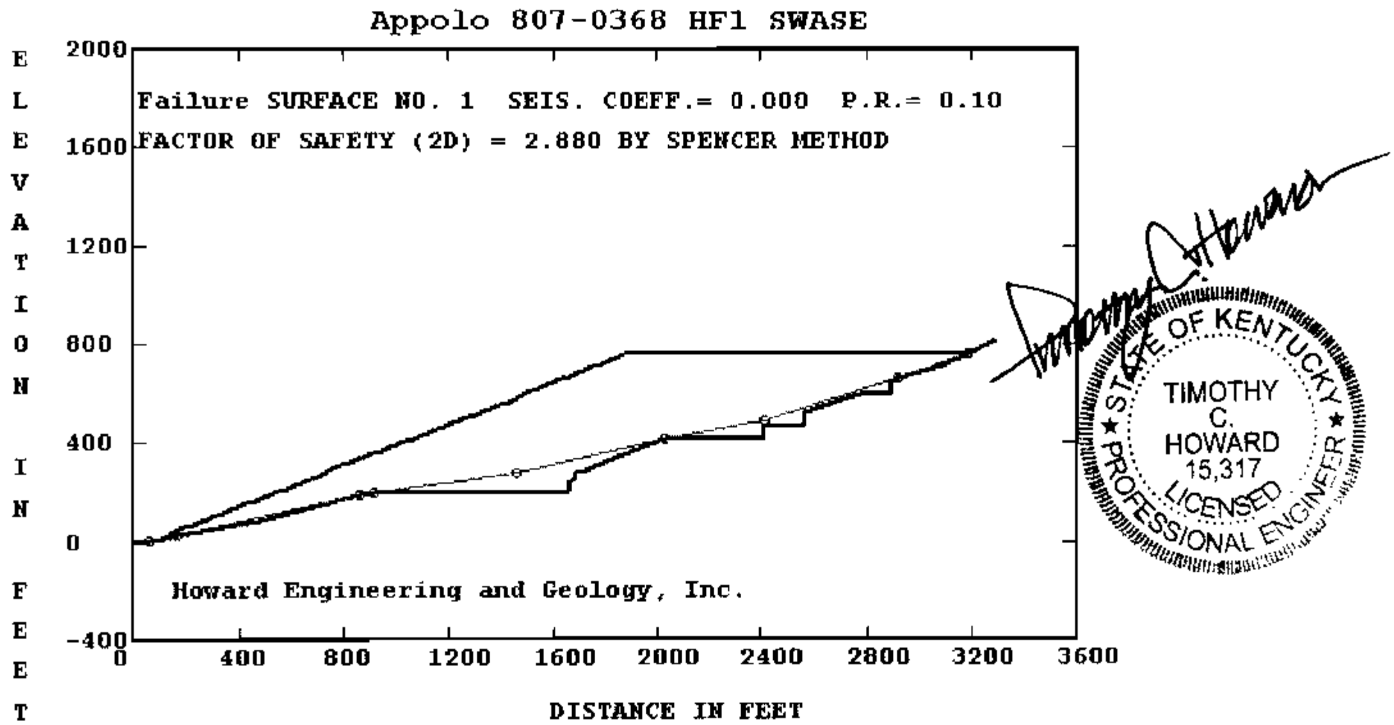
Appolo 807-0368 HF1 SWASE
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.10
FACTOR OF SAFETY (2D) = 2.880 BY SPENCER METHOD
ELEVATION IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
DISTANCE IN FEET
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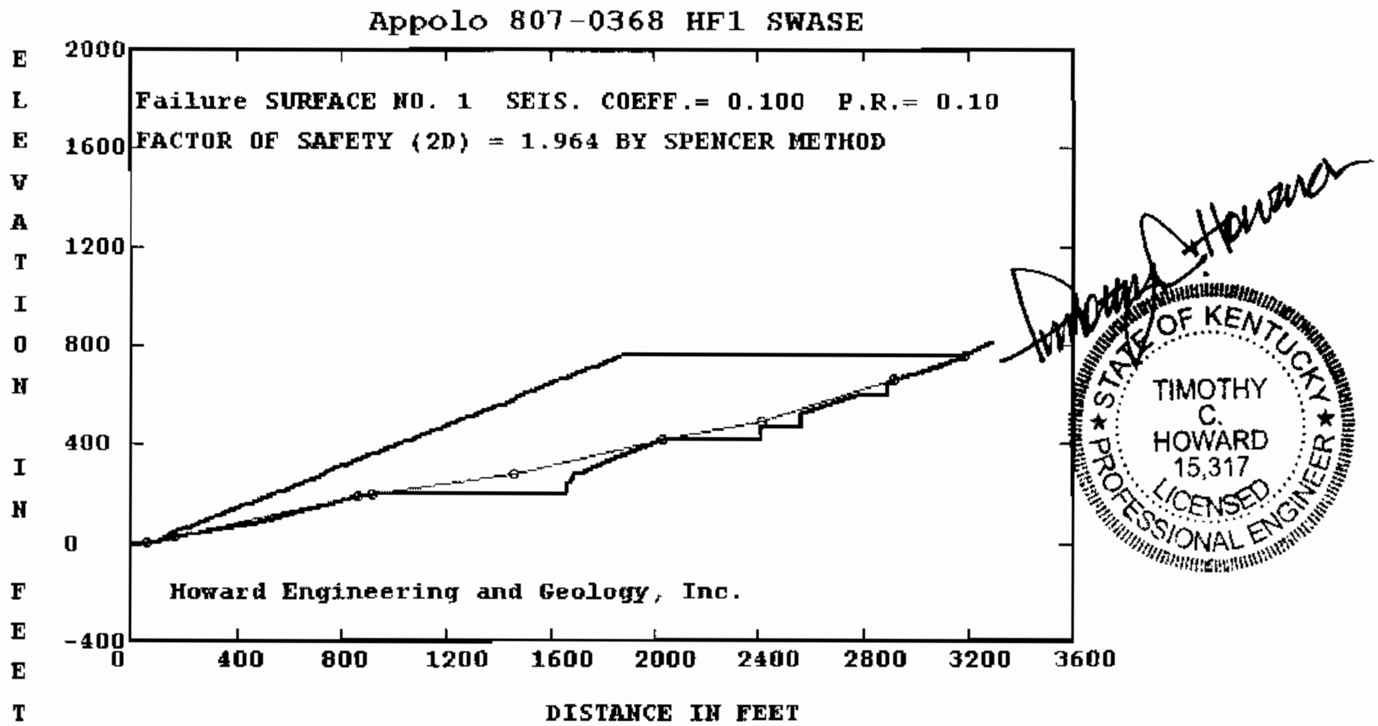
Appolo 807-0368 HF1 SWASE
Failure SURFACE NO. 1 SEIS. COEFF.= 0.100 P.R.= 0.10
FACTOR OF SAFETY (2D) = 1.964 BY SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
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INPUT FILE NAME -R:\HF1 SWASE.DAT

TITLE -Appolo 807-0368 HF1 SWASE

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 2

NO. OF POINTS ON BOUNDARY LINE 1 = 26

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 59	Y COORD.= 10
3	X COORD.= 89	Y COORD.= 10
4	X COORD.= 168	Y COORD.= 30
5	X COORD.= 481	Y COORD.= 90
6	X COORD.= 860	Y COORD.= 190
7	X COORD.= 915	Y COORD.= 200
8	X COORD.= 1654	Y COORD.= 200
9	X COORD.= 1666	Y COORD.= 250
10	X COORD.= 1681	Y COORD.= 250
11	X COORD.= 1689	Y COORD.= 280
12	X COORD.= 1723	Y COORD.= 290
13	X COORD.= 1806	Y COORD.= 330
14	X COORD.= 2027	Y COORD.= 420
15	X COORD.= 2223	Y COORD.= 420
16	X COORD.= 2410	Y COORD.= 420
17	X COORD.= 2410	Y COORD.= 470
18	X COORD.= 2561	Y COORD.= 470
19	X COORD.= 2561	Y COORD.= 521
20	X COORD.= 2769	Y COORD.= 600
21	X COORD.= 2891	Y COORD.= 600
22	X COORD.= 2891	Y COORD.= 643
23	X COORD.= 2918	Y COORD.= 660
24	X COORD.= 3083	Y COORD.= 710
25	X COORD.= 3183	Y COORD.= 760
26	X COORD.= 3291	Y COORD.= 818

NO. OF POINTS ON BOUNDARY LINE 2 = 34

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 59	Y COORD.= 10
3	X COORD.= 89	Y COORD.= 10
4	X COORD.= 189	Y COORD.= 60
5	X COORD.= 209	Y COORD.= 60
6	X COORD.= 309	Y COORD.= 110
7	X COORD.= 329	Y COORD.= 110
8	X COORD.= 429	Y COORD.= 160
9	X COORD.= 449	Y COORD.= 160
10	X COORD.= 549	Y COORD.= 210
11	X COORD.= 569	Y COORD.= 210

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 12 X COORD.= 669           Y COORD.= 260
 13 X COORD.= 689           Y COORD.= 260
 14 X COORD.= 789           Y COORD.= 310
 15 X COORD.= 809           Y COORD.= 310
 16 X COORD.= 909           Y COORD.= 360
 17 X COORD.= 929           Y COORD.= 360
 18 X COORD.= 1029          Y COORD.= 410
 19 X COORD.= 1049          Y COORD.= 410
 20 X COORD.= 1149          Y COORD.= 460
 21 X COORD.= 1169          Y COORD.= 460
 22 X COORD.= 1269          Y COORD.= 510
 23 X COORD.= 1289          Y COORD.= 510
 24 X COORD.= 1389          Y COORD.= 560
 25 X COORD.= 1409          Y COORD.= 560
 26 X COORD.= 1509          Y COORD.= 610
 27 X COORD.= 1529          Y COORD.= 610
 28 X COORD.= 1629          Y COORD.= 660
 29 X COORD.= 1649          Y COORD.= 660
 30 X COORD.= 1749          Y COORD.= 710
 31 X COORD.= 1769          Y COORD.= 710
 32 X COORD.= 1869          Y COORD.= 760
 33 X COORD.= 3183          Y COORD.= 760
 34 X COORD.= 3291          Y COORD.= 818

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1       0.169      0.000      0.253      0.192      0.264      0.182
         0.000      4.167      0.000      3.750      0.294      0.482
         0.407      0.000      0.000  99999.000      0.000  99999.000
         0.380      0.000  99999.000      0.630      0.303      0.500
         0.537
 2       0.169      0.000      0.500      0.000      0.500      0.000
         0.500      0.000      0.500      0.000      0.500      0.000
         0.500      0.000      0.500      0.000      0.500      0.000
         0.500      0.000      0.500      0.000      0.500      0.000
         0.500      0.000      0.500      0.000      0.500      0.000
         0.500      0.000      0.537

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION   FRIC. ANGLE    UNIT WEIGHTT
 No.   (TSSE)    (C)        (PHID)          (G)
  1      1    20.000        36.000        126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SPENCER METHOD (MTHD=4)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.1

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 0
LOCATION OF MOMENT CENTER: X0 = -14486    Y0 =  64882
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)

NO. OF POINTS ON FAILURE SURFACE (NPNC) 1  = 9
 1  X COORD.= 59            Y COORD.= 10
 2  X COORD.= 168           Y COORD.= 30
 3  X COORD.= 860           Y COORD.= 190
 4  X COORD.= 915           Y COORD.= 200
```

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5	X COORD.= 1456	Y COORD.= 280
6	X COORD.= 2027	Y COORD.= 420
7	X COORD.= 2410	Y COORD.= 490
8	X COORD.= 2918	Y COORD.= 660
9	X COORD.= 3183	Y COORD.= 760

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FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.880

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	BOTTOM TANGENT	BOTTOM SHEAR	INTERSLICE FORCE NORMAL	INTERSLICE FORCE SHEAR	RESISTING FORCE	DRIVING FORCE	THRUST HEIGHT
					0.000E+00				0.000
1		30.000	0.183	0.000E+00	-1.557E-02	-3.654E-03	.00E+00	-.67E-03	0.767
2	1	79.000	0.183	1.616E+04	3.448E+03	8.089E+02	.47E+05	.13E+05	2.020
3	1	21.000	0.231	1.319E+04	3.281E+03	7.699E+02	.39E+05	.14E+05	2.196
4	1	20.000	0.231	1.284E+04	3.116E+03	7.311E+02	.38E+05	.13E+05	2.383
5	1	100.000	0.231	9.516E+04	1.548E+03	3.632E+02	.28E+06	.99E+05	5.313
6	1	20.000	0.231	2.522E+04	1.086E+03	2.548E+02	.75E+05	.26E+05	7.655
7	1	42.400	0.231	5.746E+04	1.102E+01	2.586E+00	.17E+06	.60E+05	761.396
8	1	57.600	0.231	9.959E+04	-1.965E+03	-4.610E+02	.29E+06	.10E+06	-4.173
9	1	20.000	0.231	3.760E+04	-2.723E+03	-6.390E+02	.11E+06	.39E+05	-2.952
10	1	100.000	0.231	2.190E+05	-7.257E+03	-1.703E+03	.65E+06	.23E+06	-0.873
11	1	20.000	0.231	4.998E+04	-8.312E+03	-1.950E+03	.15E+06	.52E+05	-0.698
12	1	100.000	0.231	2.808E+05	-1.433E+04	-3.362E+03	.83E+06	.29E+06	-0.135
13	1	14.800	0.231	4.639E+04	-1.533E+04	-3.598E+03	.14E+06	.49E+05	-0.077
14	1	5.200	0.231	1.597E+04	-1.568E+04	-3.679E+03	.47E+05	.17E+05	-0.058
15	1	100.000	0.231	3.427E+05	-2.318E+04	-5.438E+03	.10E+07	.36E+06	0.247
16	1	20.000	0.231	7.474E+04	-2.483E+04	-5.825E+03	.22E+06	.78E+05	0.297
17	1	51.000	0.231	1.970E+05	-2.918E+04	-6.847E+03	.58E+06	.21E+06	0.414
18	1	49.000	0.182	2.123E+05	1.211E+04	2.842E+03	.62E+06	.17E+06	-2.822
19	1	6.000	0.182	2.723E+04	1.740E+04	4.084E+03	.80E+05	.22E+05	-1.695
20	1	14.000	0.148	6.364E+04	3.935E+04	9.232E+03	.19E+06	.42E+05	0.126
21	1	67.200	0.148	3.262E+05	1.518E+05	3.562E+04	.95E+06	.22E+06	3.703
22	1	32.800	0.148	1.757E+05	2.123E+05	4.982E+04	.51E+06	.12E+06	5.087
23	1	20.000	0.148	1.096E+05	2.501E+05	5.869E+04	.32E+06	.73E+05	5.923
24	1	100.000	0.148	5.940E+05	4.548E+05	1.067E+05	.17E+07	.40E+06	9.981
25	1	20.000	0.148	1.280E+05	4.989E+05	1.171E+05	.37E+06	.85E+05	10.757
26	1	100.000	0.148	6.861E+05	7.352E+05	1.725E+05	.20E+07	.46E+06	14.581
27	1	20.000	0.148	1.464E+05	7.856E+05	1.843E+05	.43E+06	.98E+05	15.325
28	1	19.600	0.148	1.446E+05	8.354E+05	1.960E+05	.42E+06	.96E+05	16.061
29	1	80.400	0.148	6.336E+05	1.054E+06	2.472E+05	.18E+07	.42E+06	18.988
30	1	20.000	0.148	1.648E+05	1.110E+06	2.605E+05	.48E+06	.11E+06	19.708
31	1	47.000	0.148	3.965E+05	1.247E+06	2.926E+05	.12E+07	.26E+06	21.405
32	1	53.000	0.245	4.560E+05	1.209E+06	2.836E+05	.14E+07	.51E+06	21.514
33	1	20.000	0.245	1.745E+05	1.194E+06	2.802E+05	.52E+06	.19E+06	21.566
34	1	92.000	0.245	8.262E+05	1.125E+06	2.639E+05	.25E+07	.92E+06	21.894
35	1	8.000	0.245	7.467E+04	1.118E+06	2.624E+05	.22E+06	.83E+05	21.932
36	1	20.000	0.245	1.859E+05	1.103E+06	2.588E+05	.55E+06	.21E+06	22.030
37	1	100.000	0.245	9.579E+05	1.022E+06	2.399E+05	.28E+07	.11E+07	22.667
38	1	20.000	0.245	1.973E+05	1.006E+06	2.360E+05	.59E+06	.22E+06	22.828
39	1	100.000	0.245	1.015E+06	9.205E+05	2.160E+05	.30E+07	.11E+07	23.838
40	1	64.400	0.245	6.623E+05	8.649E+05	2.029E+05	.20E+07	.74E+06	24.671
41	1	93.600	0.245	9.123E+05	7.882E+05	1.849E+05	.27E+07	.10E+07	26.033
42	1	218.800	0.183	1.977E+06	1.163E+06	2.729E+05	.58E+07	.16E+07	27.163
43	1	164.200	0.183	1.321E+06	1.414E+06	3.317E+05	.39E+07	.11E+07	30.108
44	1	148.200	0.335	9.894E+05	9.547E+05	2.240E+05	.30E+07	.15E+07	26.198
45	1	312.400	0.335	1.431E+06	2.920E+05	6.851E+04	.43E+07	.22E+07	18.956
46	1	47.400	0.335	1.395E+05	2.276E+05	5.340E+04	.42E+06	.21E+06	18.911
47	1	265.000	0.377	3.600E+05	1.563E-02	0.000E+00	.11E+07	.61E+06	0.000

SUM .51E+08 .18E+08

FOR FAILURE SURFACE NO. 1 WITH SEISMIC COEFFICIENT 0.000
BY SPENCER METHOD, DEL ANGLE = 0.230 AND FACTOR OF SAFETY IS 2.880

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.964

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	BOTTOM TANGENT	BOTTOM SHEAR	INTERSLICE FORCE NORMAL	INTERSLICE FORCE SHEAR	RESISTING FORCE	DRIVING FORCE	THRUST HEIGHT
					0.000E+00				0.000
1		30.000	0.183	0.000E+00	-3.387E-01	-2.620E-01	.00E+00	-.48E-01	8.850
2	1	79.000	0.183	2.403E+04	4.035E+03	3.121E+03	.48E+05	.20E+05	17.238
3	1	21.000	0.231	1.879E+04	3.730E+03	2.885E+03	.38E+05	.20E+05	12.756
4	1	20.000	0.231	1.830E+04	3.428E+03	2.652E+03	.37E+05	.19E+05	5.967
5	1	100.000	0.231	1.355E+05	6.743E+02	5.216E+02	.27E+06	.14E+06	-886.436
6	1	20.000	0.231	3.589E+04	-1.318E+02	-1.019E+02	.72E+05	.38E+05	6463.776
7	1	42.400	0.231	8.176E+04	-1.999E+03	-1.546E+03	.16E+06	.86E+05	753.676
8	1	57.600	0.231	1.417E+05	-5.411E+03	-4.185E+03	.29E+06	.15E+06	557.897
9	1	20.000	0.231	5.348E+04	-6.721E+03	-5.199E+03	.11E+06	.56E+05	544.272
10	1	100.000	0.231	3.114E+05	-1.452E+04	-1.123E+04	.63E+06	.33E+06	559.910
11	1	20.000	0.231	7.107E+04	-1.633E+04	-1.263E+04	.14E+06	.75E+05	570.121
12	1	100.000	0.231	3.993E+05	-2.665E+04	-2.061E+04	.80E+06	.42E+06	633.912
13	1	14.800	0.231	6.596E+04	-2.838E+04	-2.195E+04	.13E+06	.69E+05	644.829
14	1	5.200	0.231	2.270E+04	-2.897E+04	-2.241E+04	.46E+05	.24E+05	648.131
15	1	100.000	0.231	4.873E+05	-4.181E+04	-3.234E+04	.98E+06	.51E+06	723.799
16	1	20.000	0.231	1.062E+05	-4.463E+04	-3.452E+04	.21E+06	.11E+06	739.493
17	1	51.000	0.231	2.801E+05	-5.209E+04	-4.029E+04	.56E+06	.29E+06	778.378
18	1	49.000	0.182	3.141E+05	-6.980E+03	-5.399E+03	.63E+06	.27E+06	6974.700
19	1	6.000	0.182	4.027E+04	-1.203E+03	-9.301E+02	.80E+05	.35E+05	41308.700
20	1	14.000	0.148	9.692E+04	2.409E+04	1.863E+04	.19E+06	.73E+05	-2151.035
21	1	67.200	0.148	4.968E+05	1.537E+05	1.189E+05	.99E+06	.37E+06	-392.510
22	1	32.800	0.148	2.676E+05	2.235E+05	1.728E+05	.53E+06	.20E+06	-285.225
23	1	20.000	0.148	1.669E+05	2.670E+05	2.065E+05	.33E+06	.13E+06	-244.650
24	1	100.000	0.148	9.045E+05	5.028E+05	3.889E+05	.18E+07	.68E+06	-136.335
25	1	20.000	0.148	1.949E+05	5.536E+05	4.282E+05	.39E+06	.15E+06	-123.344
26	1	100.000	0.148	1.045E+06	8.258E+05	6.388E+05	.21E+07	.78E+06	-74.568
27	1	20.000	0.148	2.230E+05	8.839E+05	6.837E+05	.44E+06	.17E+06	-66.959
28	1	19.600	0.148	2.202E+05	9.413E+05	7.280E+05	.44E+06	.17E+06	-59.767
29	1	80.400	0.148	9.648E+05	1.193E+06	9.224E+05	.19E+07	.72E+06	-34.599
30	1	20.000	0.148	2.510E+05	1.258E+06	9.730E+05	.50E+06	.19E+06	-28.980
31	1	47.000	0.148	6.038E+05	1.415E+06	1.095E+06	.12E+07	.45E+06	-16.300
32	1	53.000	0.245	6.412E+05	1.367E+06	1.057E+06	.13E+07	.71E+06	-11.994
33	1	20.000	0.245	2.453E+05	1.348E+06	1.043E+06	.50E+06	.27E+06	-10.806
34	1	92.000	0.245	1.162E+06	1.260E+06	9.745E+05	.23E+07	.13E+07	-9.691
35	1	8.000	0.245	1.050E+05	1.252E+06	9.683E+05	.21E+06	.12E+06	-10.091
36	1	20.000	0.245	2.613E+05	1.232E+06	9.530E+05	.53E+06	.29E+06	-11.134
37	1	100.000	0.245	1.347E+06	1.130E+06	8.740E+05	.27E+07	.15E+07	-23.712
38	1	20.000	0.245	2.774E+05	1.109E+06	8.577E+05	.56E+06	.31E+06	-27.930
39	1	100.000	0.245	1.427E+06	1.001E+06	7.739E+05	.29E+07	.16E+07	-59.944
40	1	64.400	0.245	9.311E+05	9.299E+05	7.192E+05	.19E+07	.10E+07	-89.431
41	1	93.600	0.245	1.283E+06	8.325E+05	6.439E+05	.26E+07	.14E+07	-135.395
42	1	218.800	0.183	2.921E+06	1.240E+06	9.593E+05	.58E+07	.26E+07	-97.148
43	1	164.200	0.183	1.953E+06	1.513E+06	1.170E+06	.39E+07	.17E+07	-47.143
44	1	148.200	0.335	1.305E+06	1.019E+06	7.882E+05	.27E+07	.19E+07	-44.507
45	1	312.400	0.335	1.888E+06	3.060E+05	2.367E+05	.39E+07	.27E+07	-33.944

```
46     1  47.400  0.335 1.841E+05 2.367E+05 1.831E+05  .38E+06  .26E+06 -34.785
47     1 265.000  0.377 4.624E+05 1.563E-02 0.000E+00  .97E+06  .73E+06   0.000
         SUM                                           .49E+08  .25E+08
```

FOR FAILURE SURFACE NO. 1 WITH SEISMIC COEFFICIENT 0.100
BY SPENCER METHOD, DEL ANGLE = 0.658 AND FACTOR OF SAFETY IS 1.964

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.880

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.964

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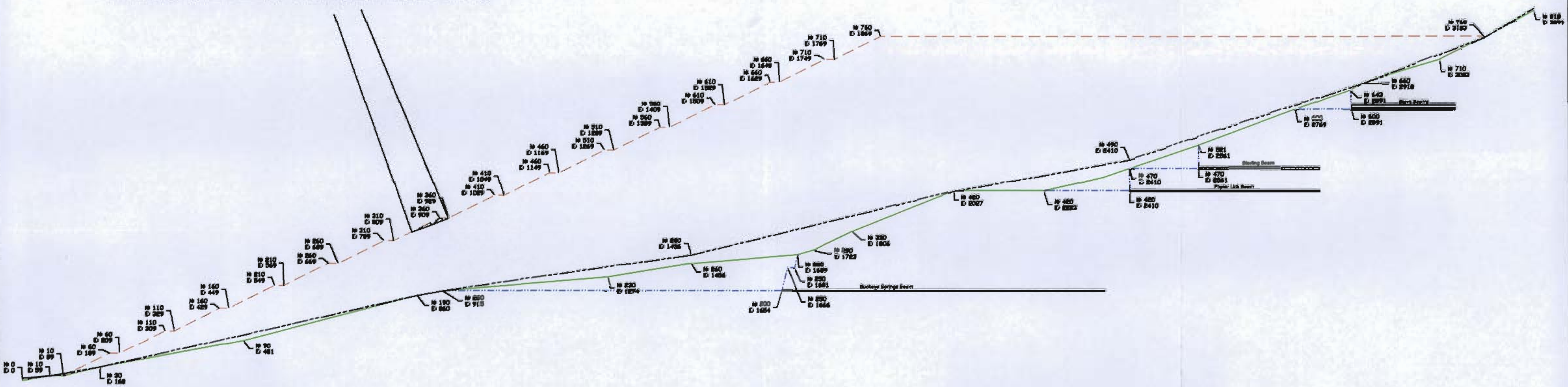
AT CENTER (296.0,1896.0) WITH RADIUS 1660.785 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.636
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.620



Pre-Mining:
During Mining:
Post Mining:
SWASE Failure:

I, Timothy C. Howard, P.E. No. 15,317

Date: 7/19/04

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

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Appolo Fuels, Inc.

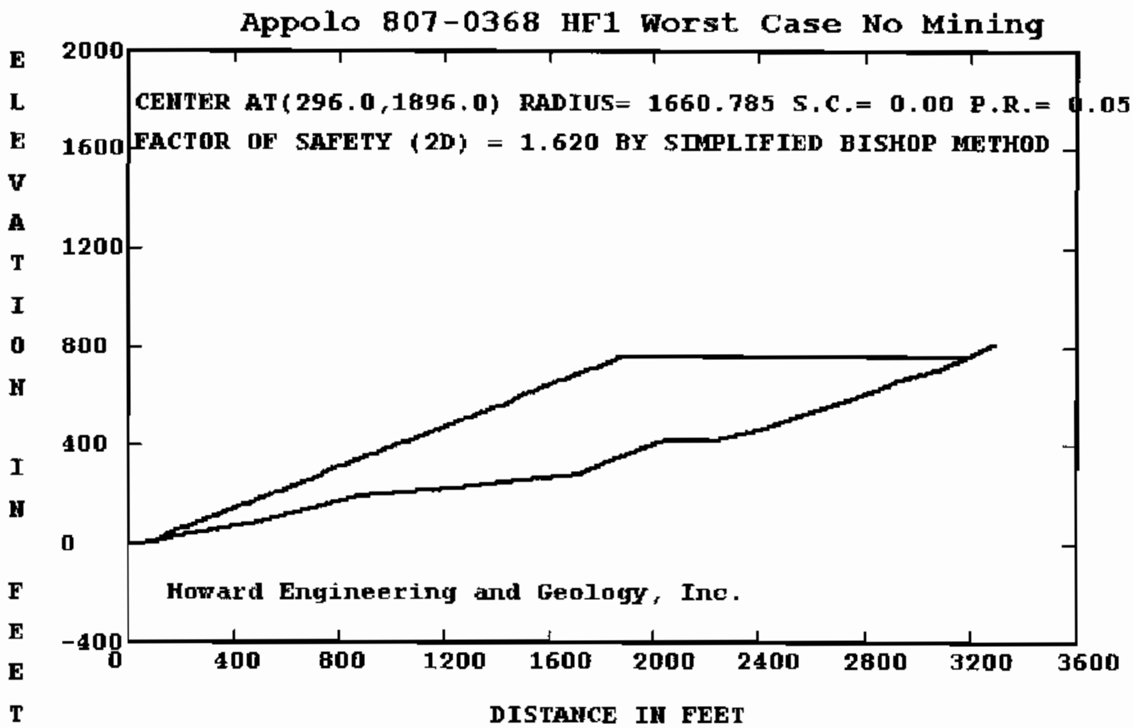
Permit No. 807-0368
Backfilling & Grading Plan
Hollow Fill #1
Reame Drawing

N
W E
S

HOWARD
Engineering and Geology, Inc.

Scale: None

Attachment 26.3.A



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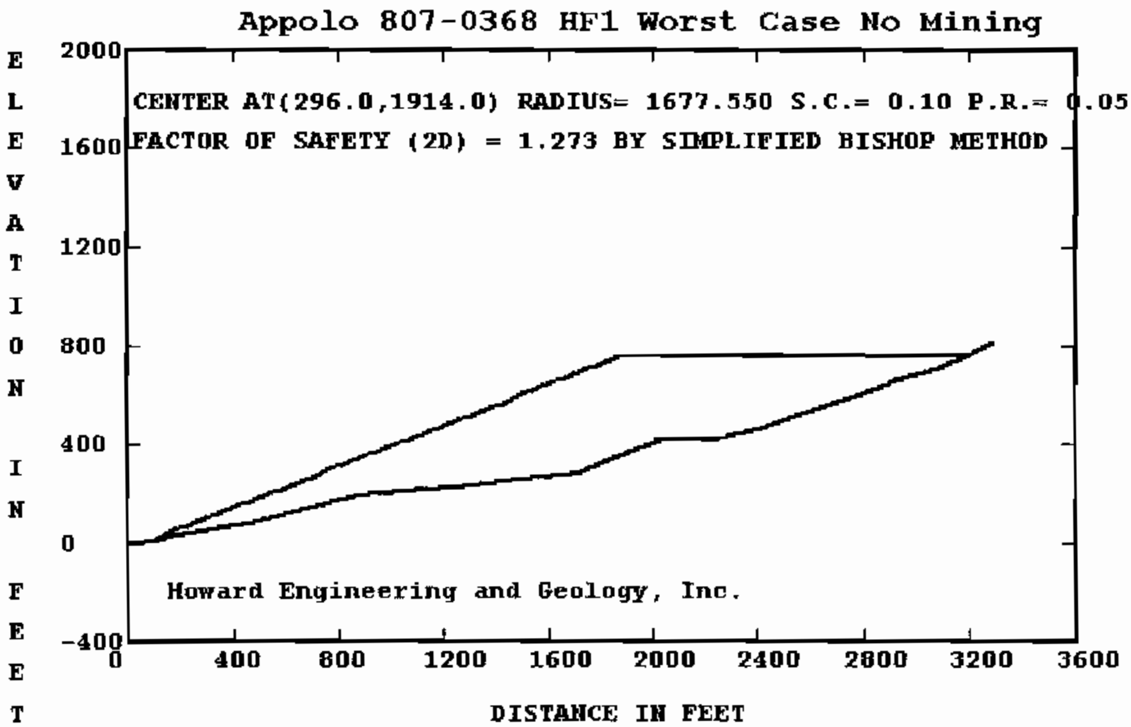

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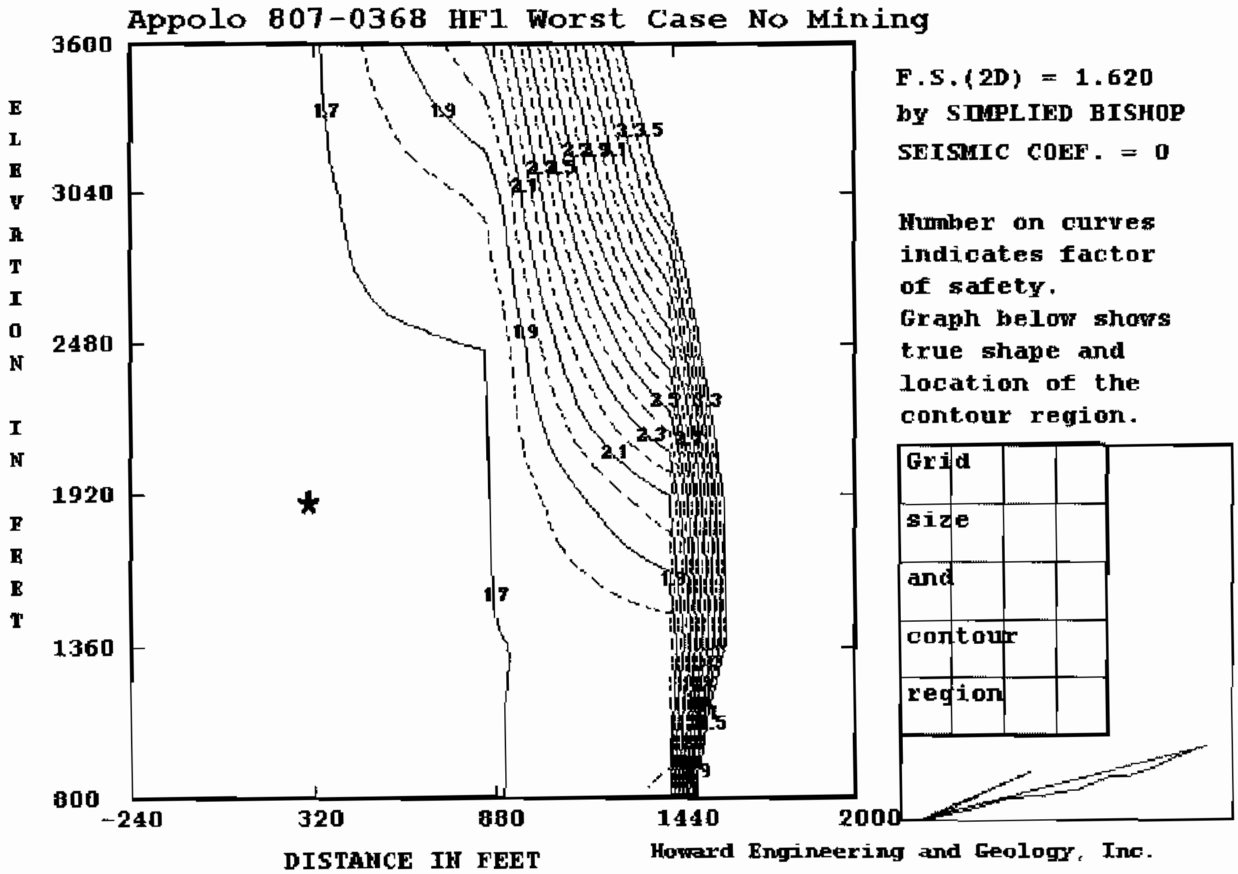
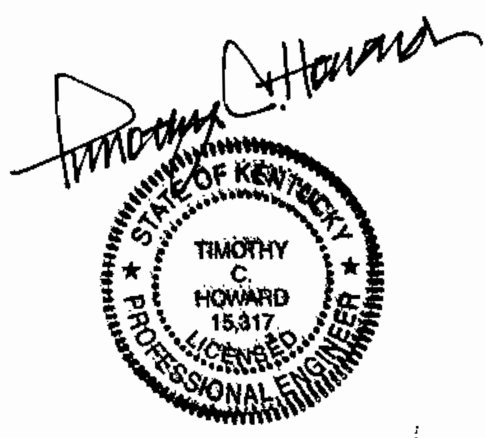

Appolo 807-0368 HF1 Worst Case No Mining
ELEVATION IN FEET
3600
3040
2480
1920
1360
800
-240
320
880
1440
2000
DISTANCE IN FEET
1.7
1.9
2.1
2.3
2.5
F.S.(2D) = 1.620
by SIMPLIED BISHOP
SEISMIC COEF. = 0
Number on curves indicates factor of safety.
Graph below shows true shape and location of the contour region.
Grid size and contour region
Howard Engineering and Geology, Inc.


Timothy C. Howard
STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
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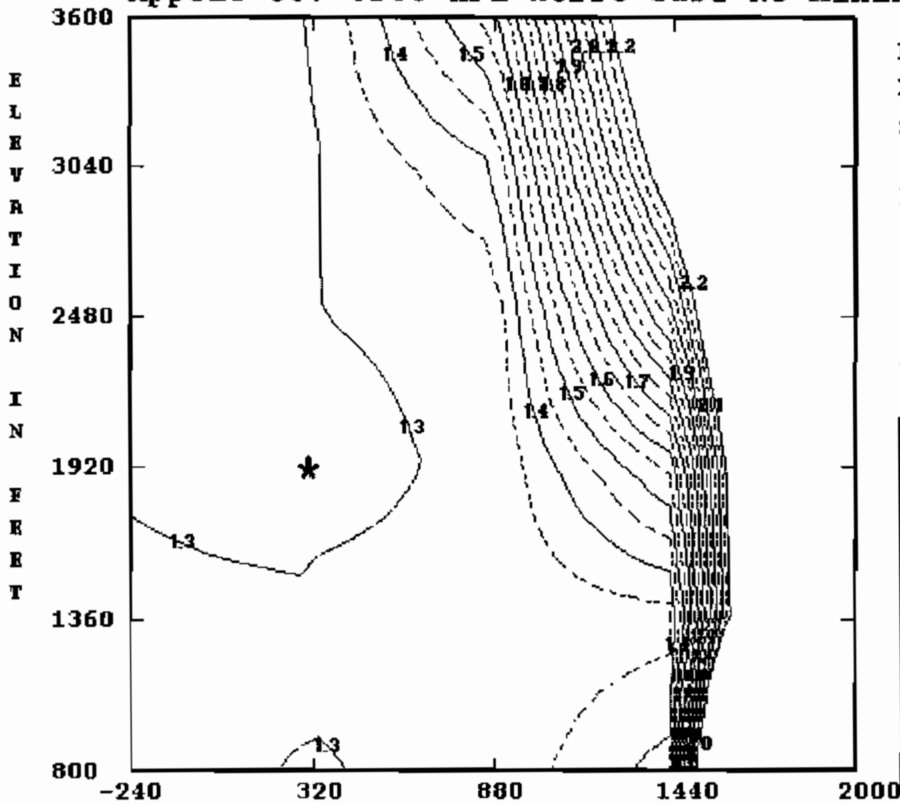
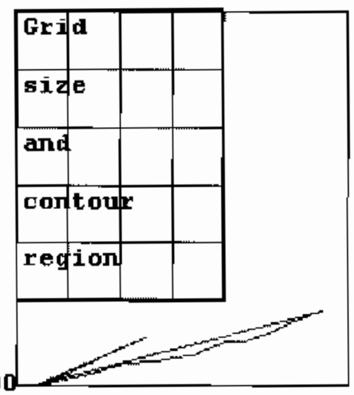
Appolo 807-0368 HF1 Worst Case No Mining



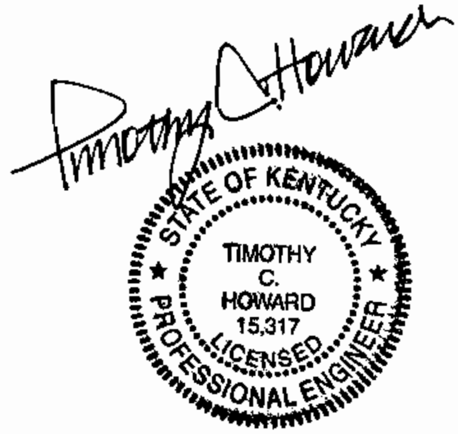
DISTANCE IN FEET

F.S.(2D) = 1.273
by SIMPLIED BISHOP
SEISMIC COEF. = .1

Number on curves
indicates factor
of safety.
Graph below shows
true shape and
location of the
contour region.



Howard Engineering and Geology, Inc.



REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
THIS 2008 VERSION IS LICENSED BY CIVIL ENGINEERING SOFTWARE CENTER TO

Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\HF1 Worst Case No Mining.DAT

TITLE -Appolo 807-0368 HF1 Worst Case No Mining

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 2

NO. OF POINTS ON BOUNDARY LINE 1 = 22

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 59	Y COORD.= 10
3	X COORD.= 89	Y COORD.= 10
4	X COORD.= 168	Y COORD.= 30
5	X COORD.= 481	Y COORD.= 90
6	X COORD.= 860	Y COORD.= 190
7	X COORD.= 915	Y COORD.= 200
8	X COORD.= 1274	Y COORD.= 230
9	X COORD.= 1456	Y COORD.= 260
10	X COORD.= 1689	Y COORD.= 280
11	X COORD.= 1723	Y COORD.= 290
12	X COORD.= 1806	Y COORD.= 330
13	X COORD.= 2027	Y COORD.= 420
14	X COORD.= 2223	Y COORD.= 420
15	X COORD.= 2410	Y COORD.= 470
16	X COORD.= 2561	Y COORD.= 521
17	X COORD.= 2769	Y COORD.= 600
18	X COORD.= 2891	Y COORD.= 643
19	X COORD.= 2918	Y COORD.= 660
20	X COORD.= 3083	Y COORD.= 710
21	X COORD.= 3183	Y COORD.= 760
22	X COORD.= 3291	Y COORD.= 818

NO. OF POINTS ON BOUNDARY LINE 2 = 34

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 59	Y COORD.= 10
3	X COORD.= 89	Y COORD.= 10
4	X COORD.= 189	Y COORD.= 60
5	X COORD.= 209	Y COORD.= 60
6	X COORD.= 309	Y COORD.= 110
7	X COORD.= 329	Y COORD.= 110
8	X COORD.= 429	Y COORD.= 160
9	X COORD.= 449	Y COORD.= 160
10	X COORD.= 549	Y COORD.= 210
11	X COORD.= 569	Y COORD.= 210
12	X COORD.= 669	Y COORD.= 260
13	X COORD.= 689	Y COORD.= 260
14	X COORD.= 789	Y COORD.= 310
15	X COORD.= 809	Y COORD.= 310

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 16 X COORD.= 909              Y COORD.= 360
 17 X COORD.= 929              Y COORD.= 360
 18 X COORD.= 1029             Y COORD.= 410
 19 X COORD.= 1049             Y COORD.= 410
 20 X COORD.= 1149             Y COORD.= 460
 21 X COORD.= 1169             Y COORD.= 460
 22 X COORD.= 1269             Y COORD.= 510
 23 X COORD.= 1289             Y COORD.= 510
 24 X COORD.= 1389             Y COORD.= 560
 25 X COORD.= 1409             Y COORD.= 560
 26 X COORD.= 1509             Y COORD.= 610
 27 X COORD.= 1529             Y COORD.= 610
 28 X COORD.= 1629             Y COORD.= 660
 29 X COORD.= 1649             Y COORD.= 660
 30 X COORD.= 1749             Y COORD.= 710
 31 X COORD.= 1769             Y COORD.= 710
 32 X COORD.= 1869             Y COORD.= 760
 33 X COORD.= 3183             Y COORD.= 760
 34 X COORD.= 3291             Y COORD.= 818

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1       0.169       0.000       0.253       0.192       0.264       0.182
         0.084       0.165       0.086       0.294       0.482       0.407
         0.000       0.267       0.338       0.380       0.352       0.630
         0.303       0.500       0.537
 2       0.169       0.000       0.500       0.000       0.500       0.000
         0.500       0.000       0.500       0.000       0.500       0.000
         0.500       0.000       0.500       0.000       0.500       0.000
         0.500       0.000       0.500       0.000       0.500       0.000
         0.500       0.000       0.500       0.000       0.500       0.000
         0.500       0.000       0.537

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1
LINE NO. (LINO)  BEG. NO. (NBP)  END NO. (NEP)
     1                1               22

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION    FRIC. ANGLE     UNIT WEIGHTT
 No.   (TSSE)    (C)         (PHID)           (G)
  1       1    20.000        36.000         126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 0
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-240    Y COORD. = 3600
POINT 2 X COORD. =-240    Y COORD. = 800
POINT 3 X COORD. = 2000   Y COORD. = 800
```

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X INCREMENT (XINC) = 24   Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-240.0	3600.0	11	9	3483.769	1.675	0
-240.0	3040.0	11	10	2951.042	1.678	0
-240.0	2480.0	11	11	2419.919	1.675	0
-240.0	1920.0	11	1	1933.262	1.675	0
-240.0	1360.0	11	3	1374.708	1.694	0
-240.0	800.0	1	1	835.225	1000.000	0
320.0	3600.0	8	7	3241.129	1.682	0
320.0	3040.0	8	5	2740.609	1.679	0
320.0	2480.0	8	5	2217.356	1.683	0
320.0	1920.0	8	8	1674.641	1.647	0
320.0	1360.0	8	6	1167.843	1.696	0
320.0	800.0	8	5	651.822	1.671	0
880.0	3600.0	8	8	3025.941	2.122	0
880.0	3040.0	8	8	2502.650	1.827	0
880.0	2480.0	8	7	1998.786	1.700	0
880.0	1920.0	8	6	1491.851	1.696	0
880.0	1360.0	8	7	957.194	1.698	0
880.0	800.0	8	7	435.827	1.693	0
1440.0	3600.0	11	2	3161.423	4.062	0
1440.0	3040.0	8	5	2392.997	3.603	0
1440.0	2480.0	8	8	1791.159	2.855	0
1440.0	1920.0	8	8	1255.486	2.103	0
1440.0	1360.0	8	8	738.322	1.718	0
1440.0	800.0	8	7	235.866	1.825	0
2000.0	3600.0	5	1	3066.954	8.643	0
2000.0	3040.0	5	1	2550.906	7.886	0
2000.0	2480.0	5	1	2030.547	7.413	0
2000.0	1920.0	5	1	1500.243	7.236	0
2000.0	1360.0	5	1	940.388	7.748	0
2000.0	800.0	4	1	380.958	14.902	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-240.000	320.000	880.000	1440.000	2000.000
3600.000	1.675	1.682	2.122	4.062	8.643
3040.000	1.678	1.679	1.827	3.603	7.886
2480.000	1.675	1.683	1.700	2.855	7.413
1920.000	1.675	1.647	1.696	2.103	7.236
1360.000	1.694	1.696	1.698	1.718	7.748
800.000	1000.000	1.671	1.693	1.825	14.902

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.675 AT (-240.000,3600.000)
FACTOR OF SAFETY = 1.647 AT (320.000,1920.000)
FACTOR OF SAFETY = 1.671 AT (320.000,800.000)

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AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (320.0 , 1920.0) RADIUS 1674.641
THE MINIMUM FACTOR OF SAFETY IS 1.647

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
320.0	1920.0	8	8	1674.641	1.647	0
344.0	1920.0	8	7	1672.738	1.682	0
296.0	1920.0	8	8	1683.143	1.623	0
272.0	1920.0	8	8	1691.929	1.636	0
296.0	1944.0	8	8	1705.546	1.632	0
296.0	1896.0	8	8	1660.785	1.620	0
296.0	1872.0	8	8	1638.472	1.627	0
320.0	1896.0	8	8	1652.171	1.633	0
272.0	1896.0	8	8	1669.684	1.670	0
302.0	1896.0	8	8	1658.604	1.620	0
290.0	1896.0	8	8	1662.983	1.623	0
296.0	1902.0	8	8	1666.370	1.620	0
296.0	1890.0	8	8	1655.202	1.621	0

AT POINT (296.0 , 1896.0) RADIUS 1660.785

THE MINIMUM FACTOR OF SAFETY IS 1.620

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	10.182	0.410	0.000	.388	.528E+03	.502E+03	.925E+06	.341E+06
2	1	10.182	1.171	0.000	.394	.151E+04	.143E+04	.196E+07	.988E+06
3	1	10.182	1.851	0.000	.401	.238E+04	.227E+04	.287E+07	.159E+07
4	1	10.182	2.450	0.000	.407	.316E+04	.300E+04	.367E+07	.213E+07
5	1	10.182	2.967	0.000	.413	.382E+04	.363E+04	.436E+07	.262E+07
6	1	10.182	3.402	0.000	.419	.438E+04	.416E+04	.493E+07	.305E+07
7	1	10.182	3.753	0.000	.425	.483E+04	.459E+04	.539E+07	.341E+07
8	1	10.182	4.020	0.000	.431	.518E+04	.492E+04	.573E+07	.371E+07
9	1	10.182	4.202	0.000	.437	.541E+04	.514E+04	.595E+07	.393E+07
10	1	1.556	4.267	0.000	.441	.840E+03	.798E+03	.922E+06	.615E+06
11	1	8.627	2.145	0.000	.444	.234E+04	.222E+04	.272E+07	.173E+07
							SUM	.394E+08	.241E+08

AT CENTER (296.000 , 1896.000) WITH RADIUS 1660.785 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.636
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.620

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE   CENTER Y COORDINATE   NO. OF CIRCLE TOTAL CRITIC. RADIUS   LOWEST F.S.   WARNING

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-240.0	3600.0	11	11	3469.304	1.293	0
-240.0	3040.0	11	10	2951.042	1.295	0
-240.0	2480.0	11	11	2419.919	1.294	0
-240.0	1920.0	11	1	1933.262	1.294	0
-240.0	1360.0	11	1	1381.014	1.312	0
-240.0	800.0	1	1	835.225	1000.000	0
320.0	3600.0	8	7	3241.129	1.298	0
320.0	3040.0	8	5	2740.609	1.296	0
320.0	2480.0	8	5	2217.356	1.299	0
320.0	1920.0	8	8	1674.641	1.285	0
320.0	1360.0	8	6	1167.843	1.311	0
320.0	800.0	8	5	651.822	1.297	0
880.0	3600.0	8	8	3025.941	1.577	0
880.0	3040.0	8	8	2502.650	1.394	0
880.0	2480.0	8	7	1998.786	1.311	0
880.0	1920.0	8	6	1491.851	1.310	0
880.0	1360.0	8	7	957.194	1.312	0
880.0	800.0	8	7	435.827	1.315	0
1440.0	3600.0	11	9	3071.046	2.549	0
1440.0	3040.0	8	5	2392.997	2.334	0
1440.0	2480.0	8	8	1791.159	1.983	0
1440.0	1920.0	8	8	1255.486	1.567	0
1440.0	1360.0	8	8	738.322	1.328	0
1440.0	800.0	8	7	235.866	1.426	0
2000.0	3600.0	5	1	3066.954	3.907	0
2000.0	3040.0	5	1	2550.906	3.783	0
2000.0	2480.0	5	1	2030.547	3.730	0
2000.0	1920.0	5	1	1500.243	3.786	0
2000.0	1360.0	5	1	940.388	4.146	0
2000.0	800.0	4	1	380.958	7.781	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-240.000	320.000	880.000	1440.000	2000.000
3600.000	1.293	1.298	1.577	2.549	3.907
3040.000	1.295	1.296	1.394	2.334	3.783
2480.000	1.294	1.299	1.311	1.983	3.730
1920.000	1.294	1.285	1.310	1.567	3.786
1360.000	1.312	1.311	1.312	1.328	4.146
800.000	1000.000	1.297	1.315	1.426	7.781

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.293 AT (-240.000,3600.000)
FACTOR OF SAFETY = 1.285 AT (320.000,1920.000)
FACTOR OF SAFETY = 1.297 AT (320.000,800.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (320.0 , 1920.0) RADIUS 1674.641
THE MINIMUM FACTOR OF SAFETY IS 1.285

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
320.0	1920.0	8	8	1674.641	1.285	0
344.0	1920.0	8	7	1672.738	1.301	0
296.0	1920.0	8	8	1683.143	1.273	0
272.0	1920.0	8	8	1691.929	1.291	0

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296.0	1944.0	8	8	1705.546	1.277	0
296.0	1896.0	8	8	1660.785	1.274	0
302.0	1920.0	8	8	1680.991	1.275	0
290.0	1920.0	8	8	1685.313	1.274	0
296.0	1926.0	8	8	1688.740	1.274	0
296.0	1914.0	8	8	1677.550	1.273	0
296.0	1908.0	8	8	1671.958	1.273	0
302.0	1914.0	8	8	1675.390	1.274	0
290.0	1914.0	8	8	1679.727	1.274	0

AT POINT (296.0 , 1914.0) RADIUS 1677.550

THE MINIMUM FACTOR OF SAFETY IS 1.273

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	10.499	0.455	0.000	.383	.605E+03	.574E+03	.100E+07	.483E+06
2	1	10.499	1.303	0.000	.390	.173E+04	.164E+04	.215E+07	.140E+07
3	1	10.499	2.067	0.000	.396	.275E+04	.261E+04	.318E+07	.225E+07
4	1	10.499	2.746	0.000	.402	.365E+04	.346E+04	.408E+07	.302E+07
5	1	10.499	3.340	0.000	.409	.444E+04	.421E+04	.486E+07	.372E+07
6	1	10.499	3.847	0.000	.415	.511E+04	.485E+04	.552E+07	.433E+07
7	1	10.499	4.266	0.000	.421	.567E+04	.538E+04	.606E+07	.486E+07
8	1	10.499	4.598	0.000	.427	.611E+04	.580E+04	.648E+07	.530E+07
9	1	10.499	4.841	0.000	.434	.643E+04	.611E+04	.678E+07	.565E+07
10	1	0.426	4.932	0.000	.437	.266E+03	.252E+03	.279E+06	.235E+06
11	1	10.073	2.478	0.000	.440	.316E+04	.300E+04	.350E+07	.281E+07
							SUM	.439E+08	.341E+08

AT CENTER (296.000 , 1914.000) WITH RADIUS 1677.550 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.289
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.273

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.620

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.273

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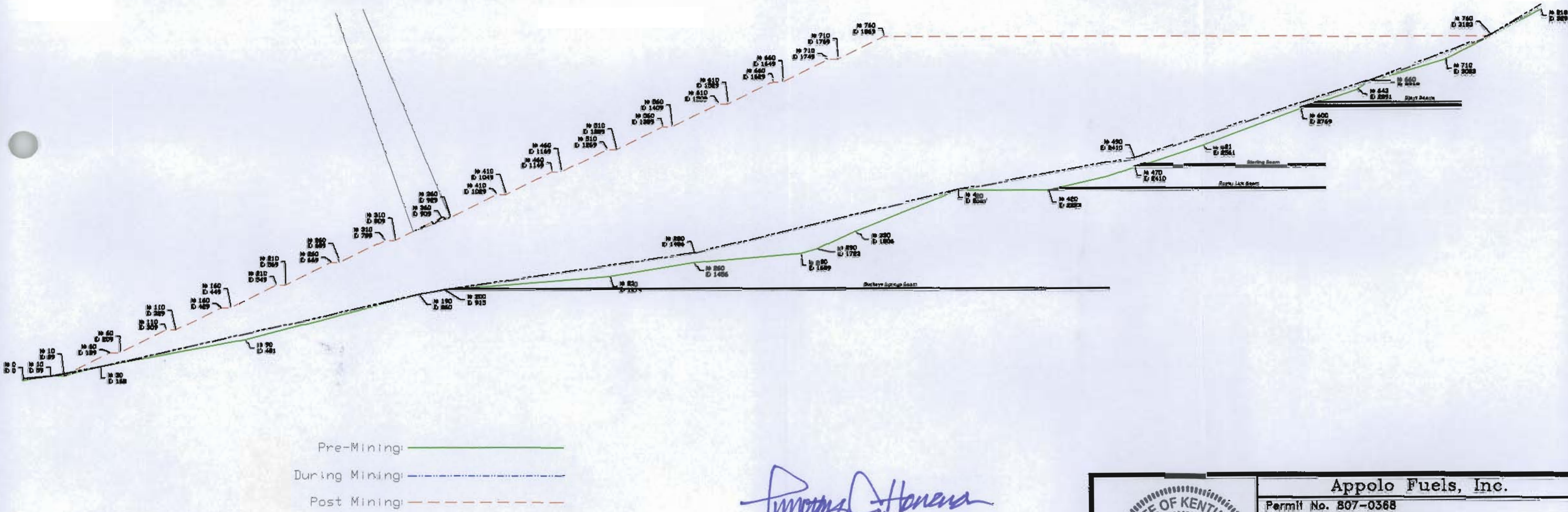
AT CENTER (296.0,1896.0) WITH RADIUS 1660.785 AND S.C.= 0.00 P.R.= 0.05
FACTOR OF SAFETY= 1.620 BY SIMPLIFIED BISHOP METHOD IS



I, Timothy C. Howard, P.E. No. 15,317

Date: 8/31/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

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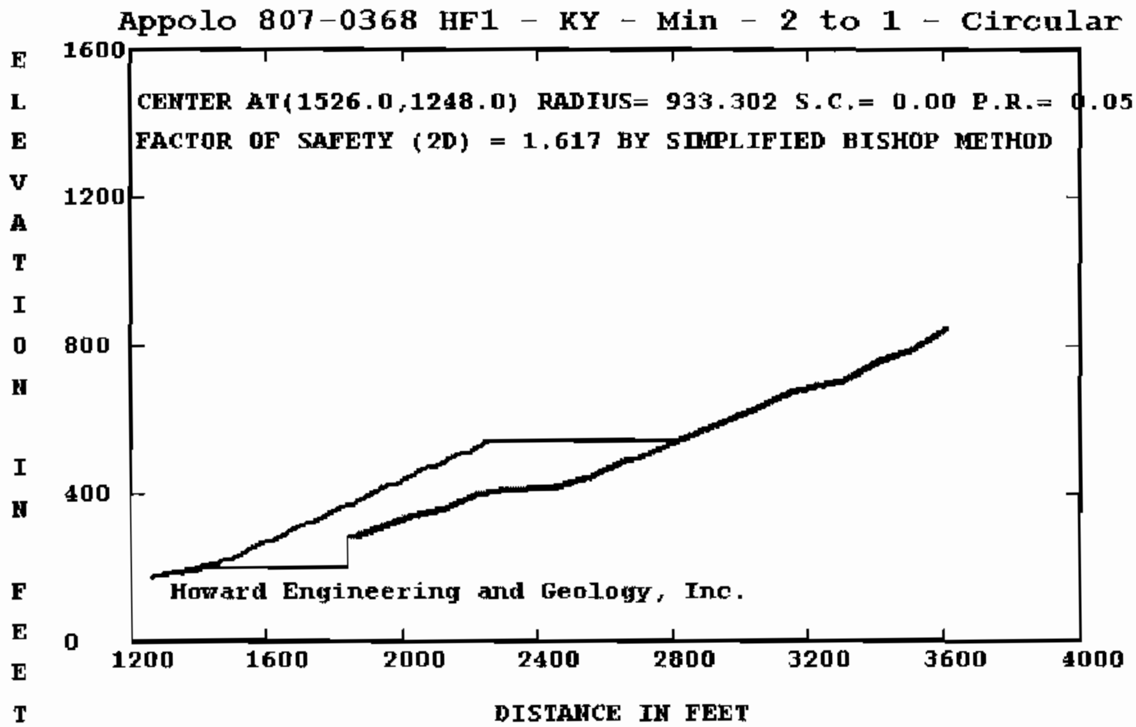
Appolo Fuels, Inc.

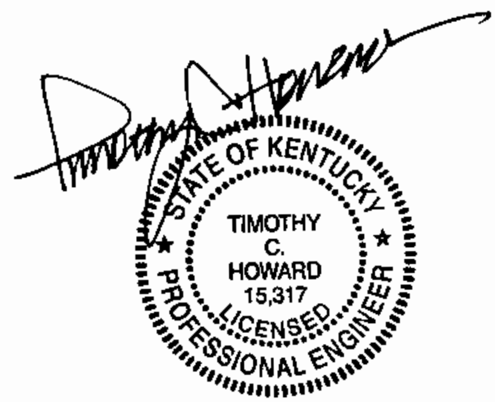
Permit No. 807-0368
Backfilling & Grading Plan
Hollow Fill #1 Worst Case No Mining
Reame Drawing

HOWARD
Engineering and Geology, Inc.

Scale: None

Attachment 26.3.A


Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Circular
CENTER AT(1526.0,1248.0) RADIUS= 933.302 S.C.= 0.00 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.617 BY SIMPLIFIED BISHOP METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
1600
1200
800
400
0
1200
1600
2000
2400
2800
3200
3600
4000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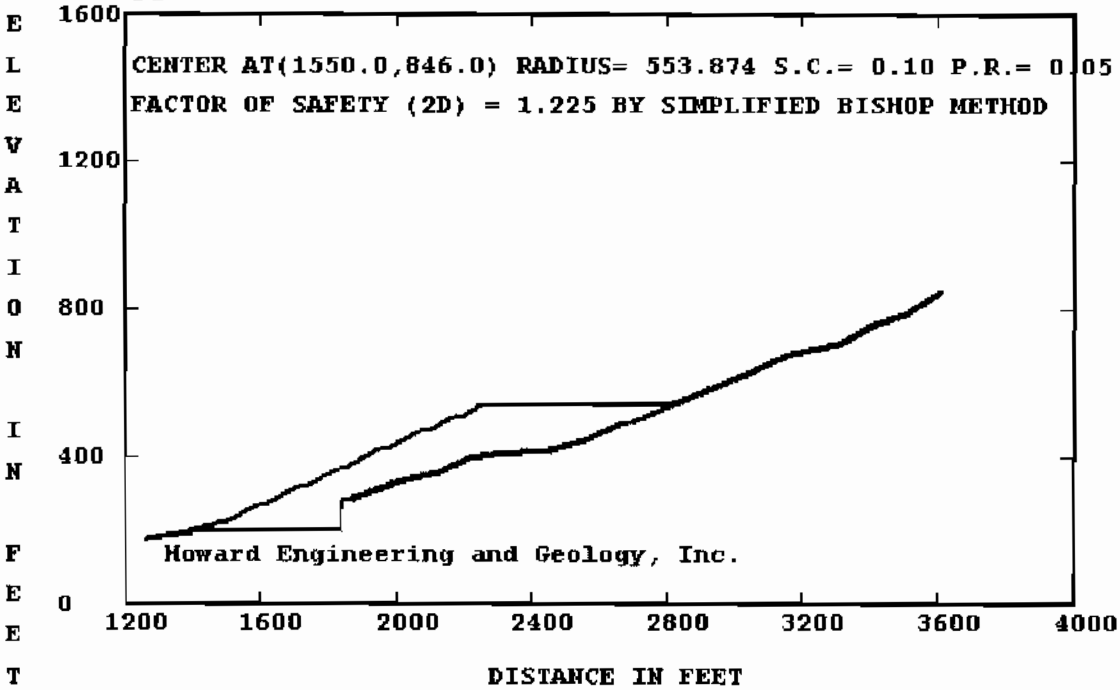
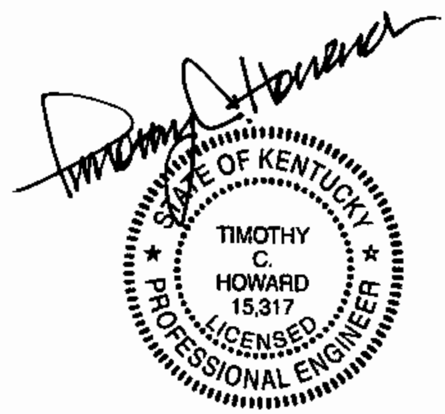
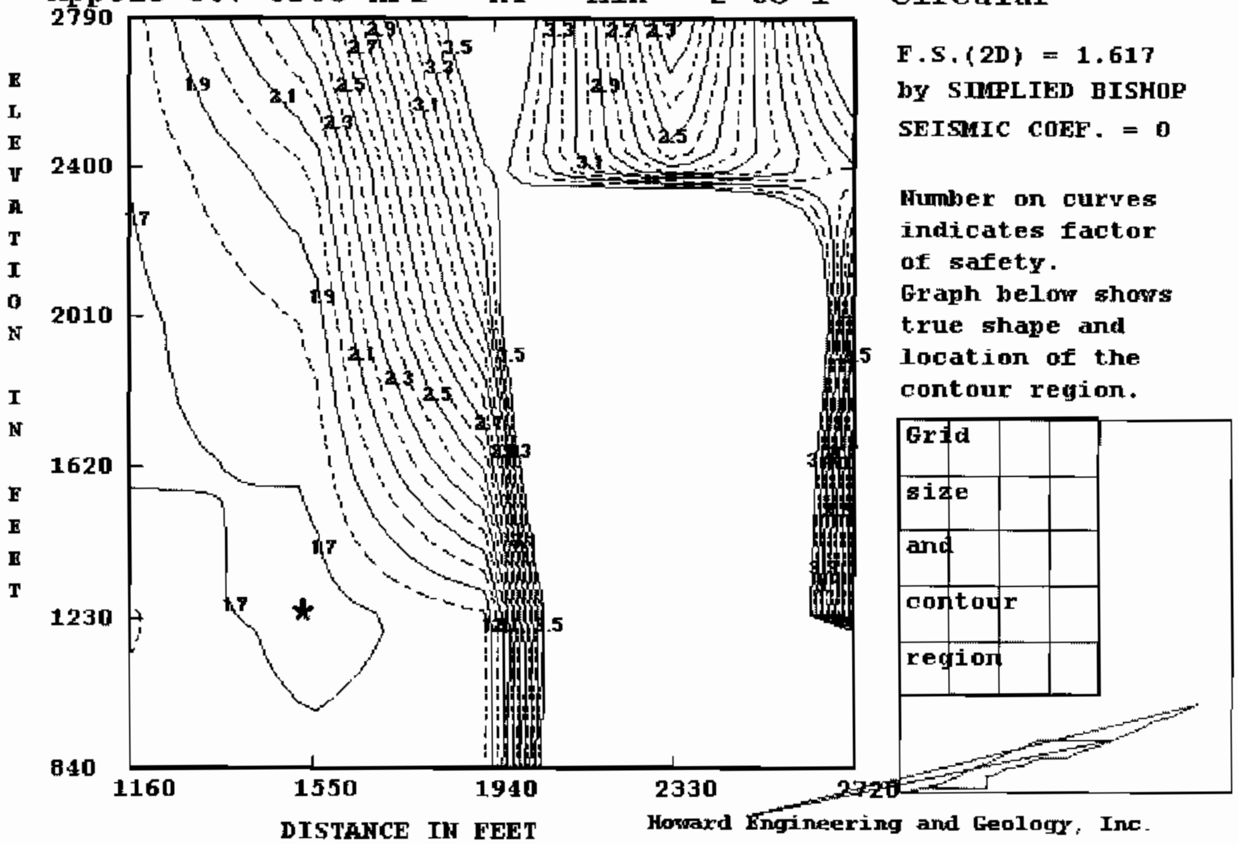




Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Circular



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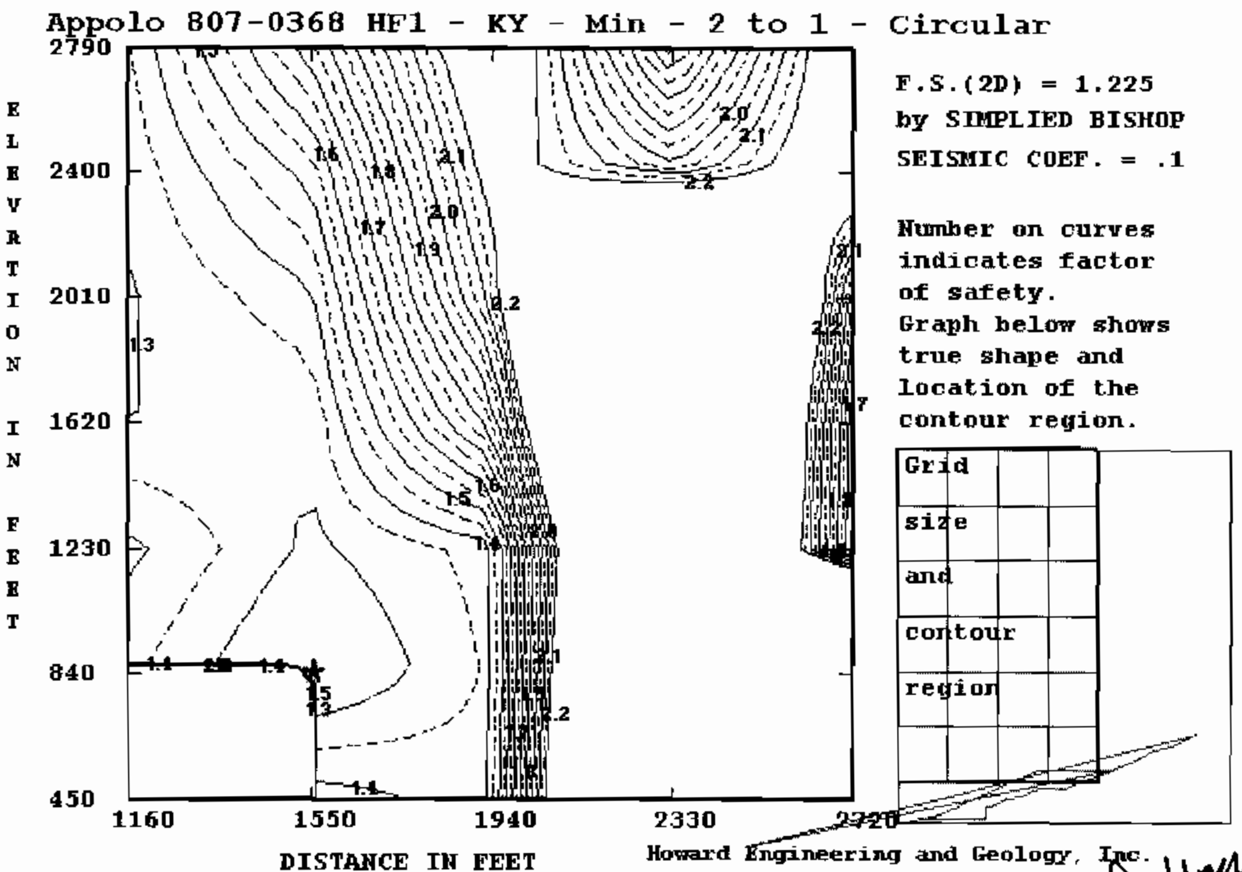
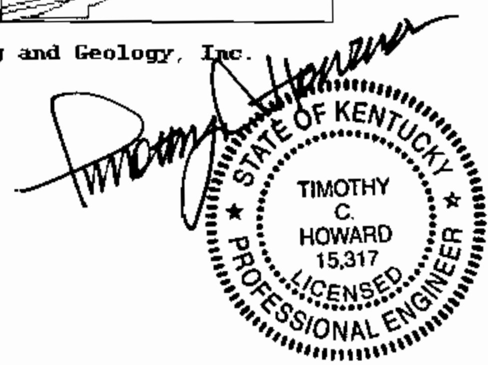

Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Circular
F.S.(2D) = 1.225
by SIMPLIED BISHOP
SEISMIC COEF. = .1
Number on curves
indicates factor
of safety.
Graph below shows
true shape and
location of the
contour region.
Grid size and contour region
ELEVATION IN FEET
2790
2400
2010
1620
1230
840
450
1160
1550
1940
2330
2720
DISTANCE IN FEET
Howard Engineering and Geology, Inc.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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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INPUT FILE NAME -R:\K-I-2-C.DAT

TITLE -Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

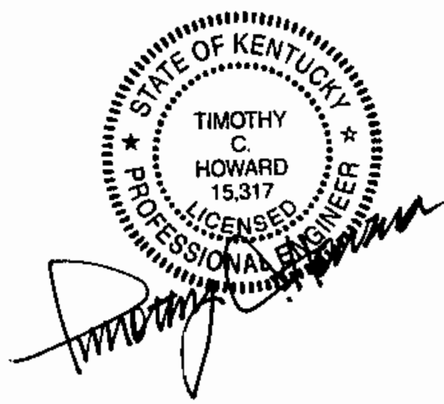
ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 22

1	X COORD.= 1262	Y COORD.= 180
2	X COORD.= 1393	Y COORD.= 195
3	X COORD.= 1409	Y COORD.= 200
4	X COORD.= 1840	Y COORD.= 200
5	X COORD.= 1840	Y COORD.= 279
6	X COORD.= 1874	Y COORD.= 285
7	X COORD.= 2023	Y COORD.= 335
8	X COORD.= 2125	Y COORD.= 355
9	X COORD.= 2216	Y COORD.= 395
10	X COORD.= 2284	Y COORD.= 405
11	X COORD.= 2456	Y COORD.= 415
12	X COORD.= 2562	Y COORD.= 445
13	X COORD.= 2663	Y COORD.= 485
14	X COORD.= 2705	Y COORD.= 495
15	X COORD.= 3055	Y COORD.= 625
16	X COORD.= 3113	Y COORD.= 655
17	X COORD.= 3170	Y COORD.= 675
18	X COORD.= 3310	Y COORD.= 705
19	X COORD.= 3419	Y COORD.= 755
20	X COORD.= 3505	Y COORD.= 785
21	X COORD.= 3600	Y COORD.= 836
22	X COORD.= 3613	Y COORD.= 849



NO. OF POINTS ON BOUNDARY LINE 2 = 22

1	X COORD.= 1262	Y COORD.= 180
2	X COORD.= 1392	Y COORD.= 200
3	X COORD.= 1409	Y COORD.= 200
4	X COORD.= 1840	Y COORD.= 200
5	X COORD.= 1840	Y COORD.= 279
6	X COORD.= 1864	Y COORD.= 287
7	X COORD.= 1873	Y COORD.= 290
8	X COORD.= 2021	Y COORD.= 340
9	X COORD.= 2123	Y COORD.= 360
10	X COORD.= 2215	Y COORD.= 400
11	X COORD.= 2284	Y COORD.= 410
12	X COORD.= 2455	Y COORD.= 420
13	X COORD.= 2560	Y COORD.= 450
14	X COORD.= 2662	Y COORD.= 490
15	X COORD.= 2704	Y COORD.= 500

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 16 X COORD.= 3053            Y COORD.= 630
 17 X COORD.= 3111            Y COORD.= 660
 18 X COORD.= 3169            Y COORD.= 680
 19 X COORD.= 3309            Y COORD.= 710
 20 X COORD.= 3417            Y COORD.= 760
 21 X COORD.= 3503            Y COORD.= 790
 22 X COORD.= 3613            Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 27
 1  X COORD.= 1262            Y COORD.= 180
 2  X COORD.= 1392            Y COORD.= 200
 3  X COORD.= 1425            Y COORD.= 210
 4  X COORD.= 1457            Y COORD.= 213
 5  X COORD.= 1469            Y COORD.= 220
 6  X COORD.= 1489            Y COORD.= 220
 7  X COORD.= 1589            Y COORD.= 270
 8  X COORD.= 1609            Y COORD.= 270
 9  X COORD.= 1709            Y COORD.= 320
 10 X COORD.= 1729            Y COORD.= 320
 11 X COORD.= 1829            Y COORD.= 370
 12 X COORD.= 1849            Y COORD.= 370
 13 X COORD.= 1949            Y COORD.= 420
 14 X COORD.= 1969            Y COORD.= 420
 15 X COORD.= 2069            Y COORD.= 470
 16 X COORD.= 2089            Y COORD.= 470
 17 X COORD.= 2169            Y COORD.= 510
 18 X COORD.= 2189            Y COORD.= 510
 19 X COORD.= 2249            Y COORD.= 540
 20 X COORD.= 2811            Y COORD.= 540
 21 X COORD.= 3053            Y COORD.= 630
 22 X COORD.= 3111            Y COORD.= 660
 23 X COORD.= 3169            Y COORD.= 680
 24 X COORD.= 3309            Y COORD.= 710
 25 X COORD.= 3417            Y COORD.= 760
 26 X COORD.= 3503            Y COORD.= 790
 27 X COORD.= 3613            Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1       0.115       0.313       0.000   99999.000      0.176      0.336
         0.196       0.440       0.147       0.058      0.283      0.396
         0.238       0.371       0.517       0.351      0.214      0.459
         0.349       0.537       1.000
 2       0.154       0.000       0.000   99999.000      0.333      0.333
         0.338       0.196       0.435       0.145      0.058      0.286
         0.392       0.238       0.372       0.517      0.345      0.214
         0.463       0.349       0.536
 3       0.154       0.303       0.094       0.583      0.000      0.500
         0.000       0.500       0.000       0.500      0.000      0.500
         0.000       0.500       0.000       0.500      0.000      0.500
         0.000       0.372       0.517       0.345      0.214      0.463
         0.349       0.536

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1
LINE NO. (LINO)  BEG. NO. (NBP)  END NO. (NEP)
     1                1              22

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.
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SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. = 1160   Y COORD. = 2790
POINT 2 X COORD. = 1160   Y COORD. = 840
POINT 3 X COORD. = 2720   Y COORD. = 840

X INCREMENT (XINC) = 24   Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

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CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1160.0	2790.0	8	7	2502.695	1.753	0
1160.0	2400.0	8	5	2147.940	1.706	0
1160.0	2010.0	17	14	1796.333	1.676	0
1160.0	1620.0	11	8	1437.092	1.681	0
1160.0	1230.0	5	1	1054.787	1.814	0
1160.0	840.0	1	1	667.835	1000.000	0
1550.0	2790.0	8	6	2375.547	2.393	0
1550.0	2400.0	8	8	1993.293	2.003	0
1550.0	2010.0	8	6	1640.372	1.816	0
1550.0	1620.0	8	5	1283.095	1.715	0
1550.0	1230.0	8	8	907.505	1.645	0
1550.0	840.0	11	10	570.093	1.731	0
1940.0	2790.0	5	1	2409.681	3.925	0
1940.0	2400.0	5	1	2023.821	3.572	0
1940.0	2010.0	8	1	1638.414	3.222	0
1940.0	1620.0	8	7	1136.572	2.553	0
1940.0	1230.0	8	8	761.735	1.774	0
1940.0	840.0	8	6	409.797	1.759	0
2330.0	2790.0	5	1	2274.052	2.092	0
2330.0	2400.0	5	1	1912.620	2.559	0
2330.0	2010.0	5	1	1550.769	9.841	0
2330.0	1620.0	5	1	1182.842	8.870	0
2330.0	1230.0	5	1	815.272	7.782	0
2330.0	840.0	5	1	431.597	8.207	0
2720.0	2790.0	1	1	2136.570	1000.000	0

2720.0	2400.0	5	1	1782.730	3.294	0
2720.0	2010.0	5	1	1408.803	2.456	0
2720.0	1620.0	5	1	1041.957	2.075	0
2720.0	1230.0	5	1	683.785	2.097	0
2720.0	840.0	2	1	318.189	19.091	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	1160.000	1550.000	1940.000	2330.000	2720.000
2790.000	1.753	2.393	3.925	2.092	1000.000
2400.000	1.706	2.003	3.572	2.559	3.294
2010.000	1.676	1.816	3.222	9.841	2.456
1620.000	1.681	1.715	2.553	8.870	2.075
1230.000	1.814	1.645	1.774	7.782	2.097
840.000	1000.000	1.731	1.759	8.207	19.091

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 2.092 AT (2330.000,2790.000)
FACTOR OF SAFETY = 1.676 AT (1160.000,2010.000)
FACTOR OF SAFETY = 2.075 AT (2720.000,1620.000)
FACTOR OF SAFETY = 1.645 AT (1550.000,1230.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (1550.0 , 1230.0) RADIUS 907.505
THE MINIMUM FACTOR OF SAFETY IS 1.645

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

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CENTER X	CENTER Y	NO. OF CIRCLE			LOWEST	WARNING
COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
1550.0	1230.0	8	8	907.505	1.645	0
1574.0	1230.0	8	1	987.500	1.680	0
1526.0	1230.0	8	8	916.300	1.625	0
1502.0	1230.0	11	9	951.293	1.709	0
1526.0	1254.0	8	8	938.978	1.618	0
1526.0	1278.0	8	8	961.134	1.640	0
1550.0	1254.0	8	8	929.165	1.679	0
1502.0	1254.0	8	5	960.418	1.697	0
1532.0	1254.0	8	8	936.943	1.625	0
1520.0	1254.0	8	8	940.935	1.620	0
1526.0	1260.0	8	8	944.658	1.621	0
1526.0	1248.0	8	8	933.302	1.617	0
1526.0	1242.0	8	8	927.631	1.617	0
1532.0	1248.0	8	8	931.368	1.620	0
1520.0	1248.0	8	8	935.272	1.624	0

AT POINT (1526.0 , 1248.0) RADIUS 933.302

THE MINIMUM FACTOR OF SAFETY IS 1.617

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	8.755	0.445	0.000	.372	.493E+03	.469E+03	.471E+06	.171E+06
2	2	8.755	1.259	0.000	.382	.139E+04	.132E+04	.101E+07	.497E+06
3	2	8.755	1.969	0.000	.391	.218E+04	.207E+04	.147E+07	.796E+06
4	2	8.755	2.573	0.000	.400	.285E+04	.271E+04	.186E+07	.107E+07

5	2	8.755	3.071	0.000	.410	.340E+04	.323E+04	.218E+07	.130E+07
6	2	8.755	3.461	0.000	.419	.383E+04	.364E+04	.242E+07	.150E+07
7	2	8.755	3.740	0.000	.429	.414E+04	.394E+04	.259E+07	.166E+07
8	2	8.755	3.908	0.000	.438	.433E+04	.411E+04	.269E+07	.177E+07
9	2	8.755	3.964	0.000	.447	.439E+04	.417E+04	.271E+07	.183E+07
10	2	1.094	3.944	0.000	.453	.546E+03	.519E+03	.336E+06	.231E+06
11	2	7.661	1.981	0.000	.457	.192E+04	.182E+04	.126E+07	.820E+06
							SUM	.190E+08	.116E+08

AT CENTER (1526.000 , 1248.000) WITH RADIUS 933.302 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.632
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.617

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1160.0	2790.0	8	1	2601.446	1.348	0
1160.0	2400.0	8	5	2147.940	1.316	0
1160.0	2010.0	17	14	1796.333	1.295	0
1160.0	1620.0	11	8	1437.092	1.299	0
1160.0	1230.0	5	1	1054.787	1.413	0
1160.0	840.0	1	1	667.835	1000.000	0
1550.0	2790.0	8	6	2375.547	1.733	0
1550.0	2400.0	8	8	1993.293	1.519	0
1550.0	2010.0	8	6	1640.372	1.386	0
1550.0	1620.0	8	1	1368.716	1.309	0
1550.0	1230.0	8	8	907.505	1.288	0
1550.0	840.0	8	8	548.153	1.231	0
1940.0	2790.0	5	1	2409.681	2.393	0
1940.0	2400.0	5	1	2023.821	2.259	0
1940.0	2010.0	8	1	1638.414	2.122	0
1940.0	1620.0	8	7	1136.572	1.828	0
1940.0	1230.0	8	8	761.735	1.372	0
1940.0	840.0	8	6	409.797	1.358	0
2330.0	2790.0	5	1	2274.052	1.618	0
2330.0	2400.0	5	1	1912.620	2.033	0
2330.0	2010.0	5	1	1550.769	4.105	0
2330.0	1620.0	5	1	1182.842	3.873	0
2330.0	1230.0	5	1	815.272	3.649	0
2330.0	840.0	5	1	431.597	3.903	0
2720.0	2790.0	1	1	2136.570	1000.000	0
2720.0	2400.0	5	1	1782.730	2.362	0
2720.0	2010.0	5	1	1408.803	1.839	0
2720.0	1620.0	5	1	1041.957	1.636	0
2720.0	1230.0	5	1	683.785	1.617	0
2720.0	840.0	2	1	318.189	5.241	0

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GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

1160.0	450.0	1	1	288.624	1000.000	0
1550.0	450.0	11	10	203.924	1.431	0
1940.0	450.0	1	1	135.431	1000.000	0
2330.0	450.0	1	0	42.254	1000.000	0
2720.0	450.0	1	0	47.434	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	1160.000	1550.000	1940.000	2330.000	2720.000
2790.000	1.348	1.733	2.393	1.618	1000.000
2400.000	1.316	1.519	2.259	2.033	2.362
2010.000	1.295	1.386	2.122	4.105	1.839
1620.000	1.299	1.309	1.828	3.873	1.636
1230.000	1.413	1.288	1.372	3.649	1.617
840.000	1000.000	1.231	1.358	3.903	5.241
450.000	1000.000	1.431	1000.000	1000.000	1000.000

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 1.618 AT (2330.000,2790.000)
FACTOR OF SAFETY = 1.295 AT (1160.000,2010.000)
FACTOR OF SAFETY = 1.617 AT (2720.000,1230.000)
FACTOR OF SAFETY = 1.231 AT (1550.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (1550.0 , 840.0) RADIUS 548.153
THE MINIMUM FACTOR OF SAFETY IS 1.231

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1550.0	840.0	8	8	548.153	1.231	0
1574.0	840.0	11	9	564.677	1.340	0
1526.0	840.0	8	6	564.572	1.318	0
1550.0	864.0	11	9	596.830	1.332	0
1550.0	816.0	8	6	534.278	1.331	0
1556.0	840.0	11	9	572.403	1.338	0
1544.0	840.0	8	8	549.988	1.280	0
1550.0	846.0	8	8	553.874	1.225	0
1550.0	852.0	11	10	581.339	1.339	0
1556.0	846.0	11	9	578.022	1.336	0
1544.0	846.0	8	8	555.689	1.253	0

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AT POINT (1550.0 , 846.0) RADIUS 553.874

THE MINIMUM FACTOR OF SAFETY IS 1.225

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	9.143	0.576	0.000	.354	.666E+03	.633E+03	.337E+06	.165E+06
2	2	9.143	1.588	0.000	.371	.184E+04	.175E+04	.735E+06	.472E+06
3	2	9.143	2.412	0.000	.387	.279E+04	.265E+04	.105E+07	.741E+06
4	2	9.143	3.044	0.000	.404	.352E+04	.334E+04	.129E+07	.966E+06
5	2	9.143	3.478	0.000	.421	.402E+04	.382E+04	.144E+07	.114E+07
6	2	9.143	3.710	0.000	.437	.429E+04	.408E+04	.152E+07	.125E+07
7	2	9.143	3.734	0.000	.454	.432E+04	.410E+04	.151E+07	.130E+07
8	2	9.143	3.546	0.000	.470	.410E+04	.390E+04	.142E+07	.127E+07
9	2	9.143	3.137	0.000	.487	.363E+04	.345E+04	.126E+07	.115E+07
10	2	4.947	2.669	0.000	.499	.167E+04	.159E+04	.585E+06	.542E+06
11	2	4.196	1.242	0.000	.508	.659E+03	.626E+03	.258E+06	.217E+06
							SUM	.114E+08	.921E+07

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AT CENTER (1550.000 , 846.000) WITH RADIUS 553.874 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.239
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.225

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES =  2

CASE 1  SEISMIC COEFFICIENT =  0
FACTOR OF SAFETY = 1.617

CASE 2  SEISMIC COEFFICIENT =  0.1
FACTOR OF SAFETY = 1.225
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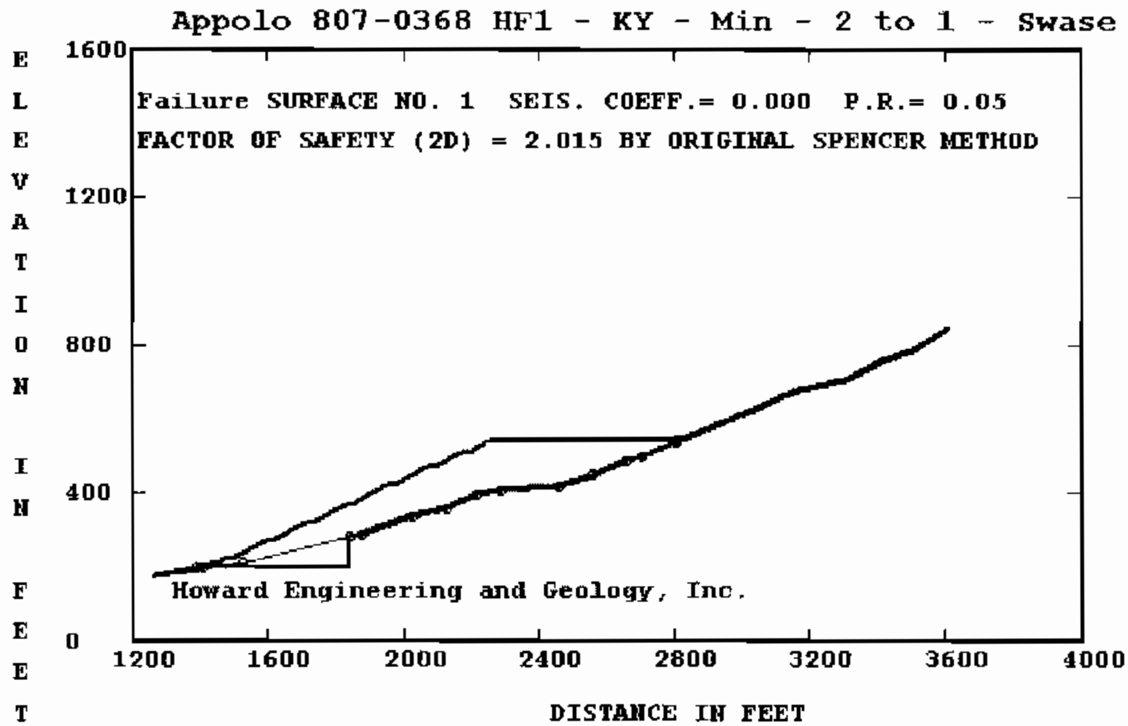
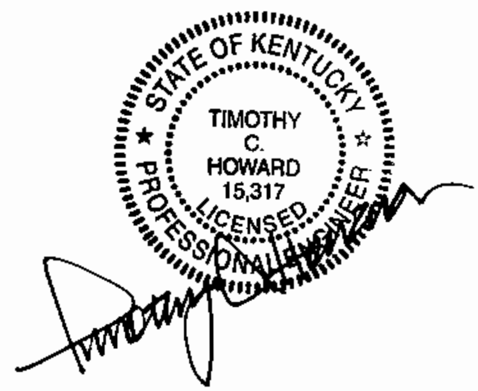

Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.05
FACTOR OF SAFETY (2D) = 2.015 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
1600
1200
800
400
0
1200
1600
2000
2400
2800
3200
3600
4000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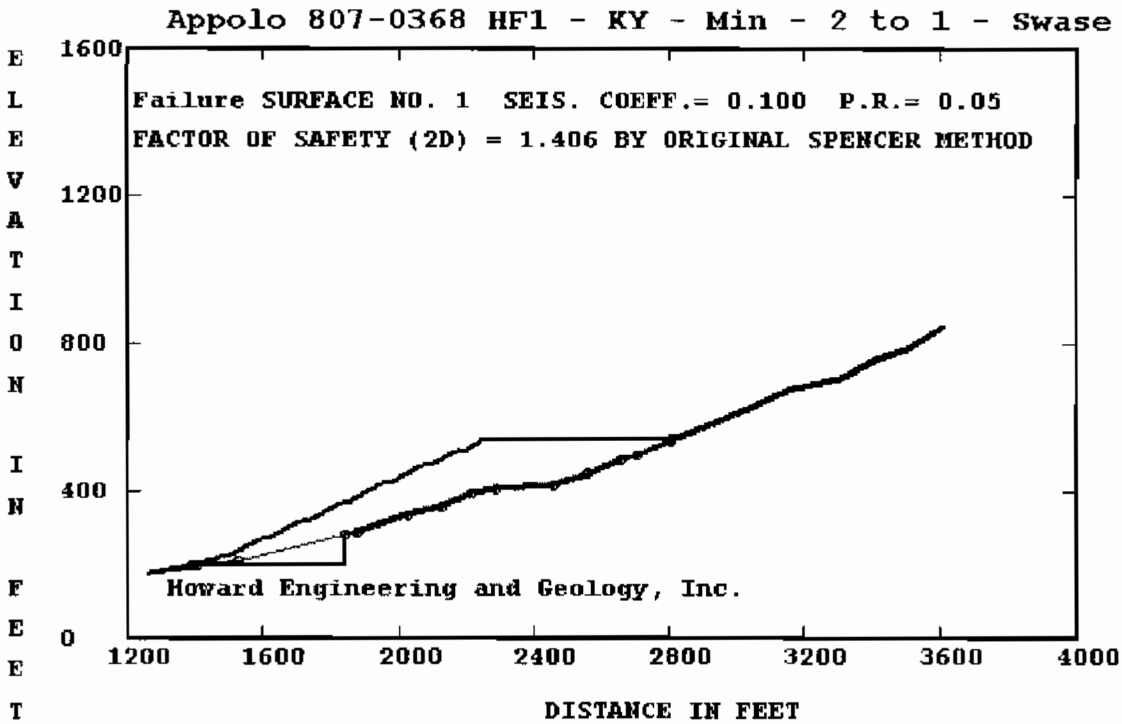
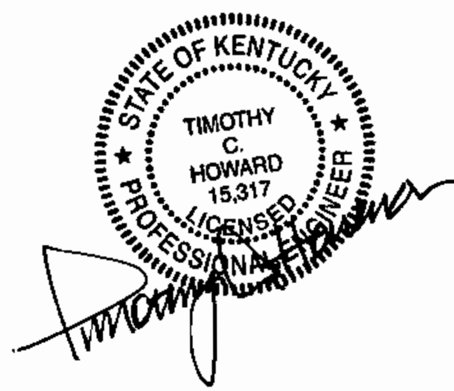

Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.100 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.406 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
1600
1200
800
400
0
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET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INPUT FILE NAME  -R:\K-I-2-S.DAT

TITLE -Appolo 807-0368 HF1 - KY - Min - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS ( THREED = 0 )

ANALYSIS BY DETERMINISTIC METHOD   ( PROB = 0 )


CASE NO.  1   SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 22
 1  X COORD.= 1262           Y COORD.= 180
 2  X COORD.= 1393           Y COORD.= 195
 3  X COORD.= 1409           Y COORD.= 200
 4  X COORD.= 1840           Y COORD.= 200
 5  X COORD.= 1840           Y COORD.= 279
 6  X COORD.= 1874           Y COORD.= 285
 7  X COORD.= 2023           Y COORD.= 335
 8  X COORD.= 2125           Y COORD.= 355
 9  X COORD.= 2216           Y COORD.= 395
 10 X COORD.= 2284           Y COORD.= 405
 11 X COORD.= 2456           Y COORD.= 415
 12 X COORD.= 2562           Y COORD.= 445
 13 X COORD.= 2663           Y COORD.= 485
 14 X COORD.= 2705           Y COORD.= 495
 15 X COORD.= 3055           Y COORD.= 625
 16 X COORD.= 3113           Y COORD.= 655
 17 X COORD.= 3170           Y COORD.= 675
 18 X COORD.= 3310           Y COORD.= 705
 19 X COORD.= 3419           Y COORD.= 755
 20 X COORD.= 3505           Y COORD.= 785
 21 X COORD.= 3600           Y COORD.= 836
 22 X COORD.= 3613           Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 22
 1  X COORD.= 1262           Y COORD.= 180
 2  X COORD.= 1392           Y COORD.= 200
 3  X COORD.= 1409           Y COORD.= 200
 4  X COORD.= 1840           Y COORD.= 200
 5  X COORD.= 1840           Y COORD.= 279
 6  X COORD.= 1864           Y COORD.= 287
 7  X COORD.= 1873           Y COORD.= 290
 8  X COORD.= 2021           Y COORD.= 340
 9  X COORD.= 2123           Y COORD.= 360
 10 X COORD.= 2215           Y COORD.= 400
 11 X COORD.= 2284           Y COORD.= 410
 12 X COORD.= 2455           Y COORD.= 420
 13 X COORD.= 2560           Y COORD.= 450
 14 X COORD.= 2662           Y COORD.= 490
 15 X COORD.= 2704           Y COORD.= 500
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 16 X COORD.= 3053          Y COORD.= 630
 17 X COORD.= 3111          Y COORD.= 660
 18 X COORD.= 3169          Y COORD.= 680
 19 X COORD.= 3309          Y COORD.= 710
 20 X COORD.= 3417          Y COORD.= 760
 21 X COORD.= 3503          Y COORD.= 790
 22 X COORD.= 3613          Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 27
 1  X COORD.= 1262          Y COORD.= 180
 2  X COORD.= 1392          Y COORD.= 200
 3  X COORD.= 1425          Y COORD.= 210
 4  X COORD.= 1457          Y COORD.= 213
 5  X COORD.= 1469          Y COORD.= 220
 6  X COORD.= 1489          Y COORD.= 220
 7  X COORD.= 1589          Y COORD.= 270
 8  X COORD.= 1609          Y COORD.= 270
 9  X COORD.= 1709          Y COORD.= 320
 10 X COORD.= 1729          Y COORD.= 320
 11 X COORD.= 1829          Y COORD.= 370
 12 X COORD.= 1849          Y COORD.= 370
 13 X COORD.= 1949          Y COORD.= 420
 14 X COORD.= 1969          Y COORD.= 420
 15 X COORD.= 2069          Y COORD.= 470
 16 X COORD.= 2089          Y COORD.= 470
 17 X COORD.= 2169          Y COORD.= 510
 18 X COORD.= 2189          Y COORD.= 510
 19 X COORD.= 2249          Y COORD.= 540
 20 X COORD.= 2811          Y COORD.= 540
 21 X COORD.= 3053          Y COORD.= 630
 22 X COORD.= 3111          Y COORD.= 660
 23 X COORD.= 3169          Y COORD.= 680
 24 X COORD.= 3309          Y COORD.= 710
 25 X COORD.= 3417          Y COORD.= 760
 26 X COORD.= 3503          Y COORD.= 790
 27 X COORD.= 3613          Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1        0.115     0.313     0.000   99999.000      0.176      0.336
          0.196     0.440     0.147       0.058      0.283      0.396
          0.238     0.371     0.517       0.351      0.214      0.459
          0.349     0.537     1.000
 2        0.154     0.000     0.000   99999.000      0.333      0.333
          0.338     0.196     0.435       0.145      0.058      0.286
          0.392     0.238     0.372       0.517      0.345      0.214
          0.463     0.349     0.536
 3        0.154     0.303     0.094       0.583      0.000      0.500
          0.000     0.500     0.000       0.500      0.000      0.500
          0.000     0.500     0.000       0.500      0.000      0.500
          0.000     0.372     0.517       0.345      0.214      0.463
          0.349     0.536


ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION     FRIC. ANGLE     UNIT WEIGHTT
 No.   (TSSE)     (C)         (PHID)            (G)
  1       1    160.000        24.000          125.000
  2       1     20.000        36.000          126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
```

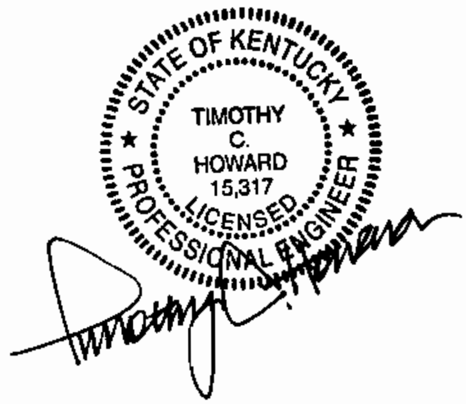

ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 15

1	X COORD.= 1392	Y COORD.= 200
2	X COORD.= 1409	Y COORD.= 202
3	X COORD.= 1526	Y COORD.= 212
4	X COORD.= 1839	Y COORD.= 282
5	X COORD.= 1874	Y COORD.= 287
6	X COORD.= 2022	Y COORD.= 337
7	X COORD.= 2124	Y COORD.= 357
8	X COORD.= 2215	Y COORD.= 397
9	X COORD.= 2284	Y COORD.= 407
10	X COORD.= 2456	Y COORD.= 417
11	X COORD.= 2561	Y COORD.= 447
12	X COORD.= 2662	Y COORD.= 487
13	X COORD.= 2705	Y COORD.= 497
14	X COORD.= 2807	Y COORD.= 535
15	X COORD.= 2811	Y COORD.= 540

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FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.015

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	17.000	1.576	0.000	0.117	.339E+04	.322E+04	.422E+07	.627E+06
2	2	16.000	4.892	0.000	0.085	.990E+04	.941E+04	.110E+08	.130E+07
3	2	32.000	6.765	0.000	0.085	.274E+05	.260E+05	.300E+08	.360E+07
4	2	12.000	9.885	0.000	0.085	.150E+05	.143E+05	.163E+08	.197E+07
5	2	20.000	12.017	0.000	0.085	.304E+05	.289E+05	.329E+08	.399E+07
6	2	37.000	18.831	0.000	0.085	.881E+05	.837E+05	.947E+08	.116E+08
7	2	7.900	27.592	0.000	0.218	.276E+05	.262E+05	.322E+08	.103E+08
8	2	55.100	36.297	0.000	0.218	.253E+06	.240E+06	.295E+09	.948E+08
9	2	20.000	41.674	0.000	0.218	.105E+06	.100E+06	.123E+09	.395E+08
10	2	66.800	48.668	0.000	0.218	.411E+06	.391E+06	.478E+09	.154E+09
11	2	33.200	62.486	0.000	0.218	.262E+06	.249E+06	.305E+09	.983E+08
12	2	20.000	64.837	0.000	0.218	.164E+06	.156E+06	.190E+09	.615E+08
13	2	88.700	74.857	0.000	0.218	.840E+06	.798E+06	.974E+09	.315E+09
14	2	11.300	88.675	0.000	0.218	.127E+06	.120E+06	.147E+09	.475E+08
15	2	10.000	89.118	0.000	0.218	.113E+06	.107E+06	.131E+09	.422E+08
16	2	10.000	87.286	0.000	0.141	.110E+06	.105E+06	.121E+09	.249E+08
17	2	7.500	87.911	0.000	0.141	.834E+05	.792E+05	.911E+08	.188E+08
18	1	17.500	92.375	0.000	0.141	.204E+06	.184E+06	.134E+09	.461E+08
19	1	75.000	101.581	0.000	0.320	.963E+06	.867E+06	.708E+09	.577E+09
20	1	10.600	105.872	0.000	0.320	.142E+06	.128E+06	.104E+09	.850E+08
21	1	9.400	102.493	0.000	0.320	.122E+06	.110E+06	.896E+08	.730E+08
22	1	53.000	105.203	0.000	0.320	.705E+06	.635E+06	.518E+09	.422E+09
23	1	47.000	116.642	0.000	0.192	.693E+06	.624E+06	.465E+09	.221E+09
24	1	20.000	121.824	0.000	0.192	.308E+06	.277E+06	.206E+09	.983E+08
25	1	12.500	121.762	0.000	0.192	.192E+06	.173E+06	.129E+09	.614E+08

26	1	22.500	127.081	0.000	0.192	.362E+06	.325E+06	.242E+09	.115E+09
27	1	45.000	131.860	0.000	0.402	.750E+06	.675E+06	.572E+09	.610E+09
28	1	20.000	128.824	0.000	0.402	.326E+06	.293E+06	.249E+09	.265E+09
29	1	26.000	125.214	0.000	0.402	.412E+06	.371E+06	.314E+09	.335E+09
30	1	28.400	131.042	0.000	0.143	.471E+06	.424E+06	.294E+09	.104E+09
31	1	5.600	137.078	0.000	0.143	.971E+05	.874E+05	.606E+08	.214E+08
32	1	35.000	135.536	0.000	0.143	.600E+06	.540E+06	.375E+09	.132E+09
33	1	101.300	130.055	0.000	0.058	.167E+07	.150E+07	.924E+09	.131E+09
34	1	70.700	125.055	0.000	0.058	.112E+07	.101E+07	.621E+09	.878E+08
35	1	71.200	112.829	0.000	0.275	.102E+07	.914E+06	.742E+09	.514E+09
36	1	33.800	97.829	0.000	0.275	.418E+06	.376E+06	.307E+09	.211E+09
37	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.745E+09	.701E+09
38	1	7.100	52.174	0.000	0.227	.468E+05	.421E+05	.334E+08	.182E+08
39	1	35.900	47.174	0.000	0.227	.214E+06	.193E+06	.154E+09	.832E+08
40	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.268E+09	.217E+09
41	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.373E+07	.281E+07
42	2	0.163	0.102	0.000	0.781	.211E+01	.200E+01	.176E+05	.473E+04
		SUM						.113E+11	.606E+10

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 1.869

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.996	1.976
0.300	2.021	2.024
0.600	2.067	2.083

FROM ORIGINAL SPENCER METHOD, DEL = 0.249 AND F. S. = 2.015

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.406

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	17.000	1.576	0.000	0.117	.339E+04	.322E+04	.418E+07	.116E+07
2	2	16.000	4.892	0.000	0.085	.990E+04	.941E+04	.109E+08	.282E+07
3	2	32.000	6.765	0.000	0.085	.274E+05	.260E+05	.298E+08	.778E+07
4	2	12.000	9.885	0.000	0.085	.150E+05	.143E+05	.162E+08	.426E+07
5	2	20.000	12.017	0.000	0.085	.304E+05	.289E+05	.326E+08	.863E+07
6	2	37.000	18.831	0.000	0.085	.881E+05	.837E+05	.939E+08	.250E+08
7	2	7.900	27.592	0.000	0.218	.276E+05	.262E+05	.315E+08	.149E+08
8	2	55.100	36.297	0.000	0.218	.253E+06	.240E+06	.288E+09	.136E+09
9	2	20.000	41.674	0.000	0.218	.105E+06	.100E+06	.120E+09	.568E+08
10	2	66.800	48.668	0.000	0.218	.411E+06	.391E+06	.467E+09	.221E+09
11	2	33.200	62.486	0.000	0.218	.262E+06	.249E+06	.298E+09	.141E+09
12	2	20.000	64.837	0.000	0.218	.164E+06	.156E+06	.186E+09	.882E+08
13	2	88.700	74.857	0.000	0.218	.840E+06	.798E+06	.953E+09	.451E+09
14	2	11.300	88.675	0.000	0.218	.127E+06	.120E+06	.144E+09	.680E+08
15	2	10.000	89.118	0.000	0.218	.113E+06	.107E+06	.128E+09	.604E+08
16	2	10.000	87.286	0.000	0.141	.110E+06	.105E+06	.119E+09	.417E+08
17	2	7.500	87.911	0.000	0.141	.834E+05	.792E+05	.898E+08	.315E+08
18	1	17.500	92.375	0.000	0.141	.204E+06	.184E+06	.132E+09	.770E+08
19	1	75.000	101.581	0.000	0.320	.963E+06	.867E+06	.685E+09	.739E+09
20	1	10.600	105.872	0.000	0.320	.142E+06	.128E+06	.101E+09	.109E+09
21	1	9.400	102.493	0.000	0.320	.122E+06	.110E+06	.866E+08	.934E+08
22	1	53.000	105.203	0.000	0.320	.705E+06	.635E+06	.501E+09	.541E+09
23	1	47.000	116.642	0.000	0.192	.693E+06	.624E+06	.456E+09	.328E+09

24	1	20.000	121.824	0.000	0.192	.308E+06	.277E+06	.202E+09	.145E+09
25	1	12.500	121.762	0.000	0.192	.192E+06	.173E+06	.126E+09	.909E+08
26	1	22.500	127.081	0.000	0.192	.362E+06	.325E+06	.237E+09	.171E+09
27	1	45.000	131.860	0.000	0.402	.750E+06	.675E+06	.547E+09	.739E+09
28	1	20.000	128.824	0.000	0.402	.326E+06	.293E+06	.238E+09	.321E+09
29	1	26.000	125.214	0.000	0.402	.412E+06	.371E+06	.301E+09	.406E+09
30	1	28.400	131.042	0.000	0.143	.471E+06	.424E+06	.290E+09	.171E+09
31	1	5.600	137.078	0.000	0.143	.971E+05	.874E+05	.597E+08	.352E+08
32	1	35.000	135.536	0.000	0.143	.600E+06	.540E+06	.369E+09	.218E+09
33	1	101.300	130.055	0.000	0.058	.167E+07	.150E+07	.919E+09	.343E+09
34	1	70.700	125.055	0.000	0.058	.112E+07	.101E+07	.617E+09	.230E+09
35	1	71.200	112.829	0.000	0.275	.102E+07	.914E+06	.722E+09	.682E+09
36	1	33.800	97.829	0.000	0.275	.418E+06	.376E+06	.298E+09	.281E+09
37	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.717E+09	.868E+09
38	1	7.100	52.174	0.000	0.227	.468E+05	.421E+05	.326E+08	.257E+08
39	1	35.900	47.174	0.000	0.227	.214E+06	.193E+06	.150E+09	.117E+09
40	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.259E+09	.272E+09
41	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.362E+07	.303E+07
42	2	0.163	0.102	0.000	0.781	.211E+01	.200E+01	.173E+05	.510E+04
		SUM						.111E+11	.837E+10

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.322

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.385	1.354
0.300	1.392	1.382
0.600	1.417	1.420

FROM ORIGINAL SPENCER METHOD, DEL = 0.495 AND F. S. = 1.406

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.015

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.406

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AT CENTER (1526.000 , 1248.000) WITH RADIUS 933.302 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.632
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.617
AT CENTER (1550.000 , 846.000) WITH RADIUS 553.874 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.239
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.225

0 =	1262 ,	180	35 =	3169 ,	680
1 =	1393 ,	195	36 =	3309 ,	710
2 =	1409 ,	200	37 =	3417 ,	760
3 =	1840 ,	200	38 =	3503 ,	790
4 =	1840 ,	279	39 =	1425 ,	210
5 =	1874 ,	285	40 =	1457 ,	213
6 =	2023 ,	335	41 =	1469 ,	220
7 =	2125 ,	355	42 =	1489 ,	220
8 =	2216 ,	395	43 =	1589 ,	270
9 =	2284 ,	405	44 =	1609 ,	270
10 =	2456 ,	415	45 =	1709 ,	320
11 =	2562 ,	445	46 =	1729 ,	320
12 =	2663 ,	485	47 =	1829 ,	370
13 =	2705 ,	495	48 =	1849 ,	370
14 =	3055 ,	625	49 =	1949 ,	420
15 =	3113 ,	655	50 =	1969 ,	420
16 =	3170 ,	675	51 =	2069 ,	470
17 =	3310 ,	705	52 =	2089 ,	470
18 =	3419 ,	755	53 =	2169 ,	510
19 =	3505 ,	785	54 =	2189 ,	510
20 =	3600 ,	836	55 =	2249 ,	540
21 =	3613 ,	849	56 =	2811 ,	540
22 =	1392 ,	200			
23 =	1864 ,	287			
24 =	1873 ,	290			
25 =	2021 ,	340			
26 =	2123 ,	360			
27 =	2215 ,	400			
28 =	2284 ,	410			
29 =	2455 ,	420			
30 =	2560 ,	450			
31 =	2662 ,	490			
32 =	2704 ,	500			
33 =	3053 ,	630			
34 =	3111 ,	660			

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Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing

Prepared By
HOWARD
Engineering and Geology, Inc.

Scale: None

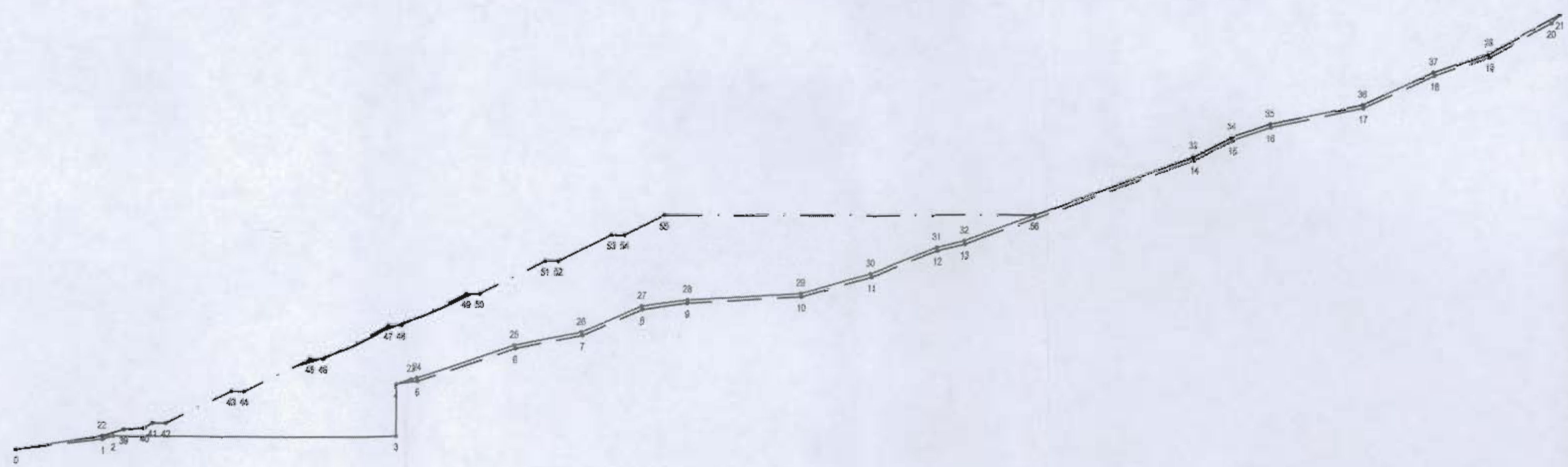
Attachment 26.3.A

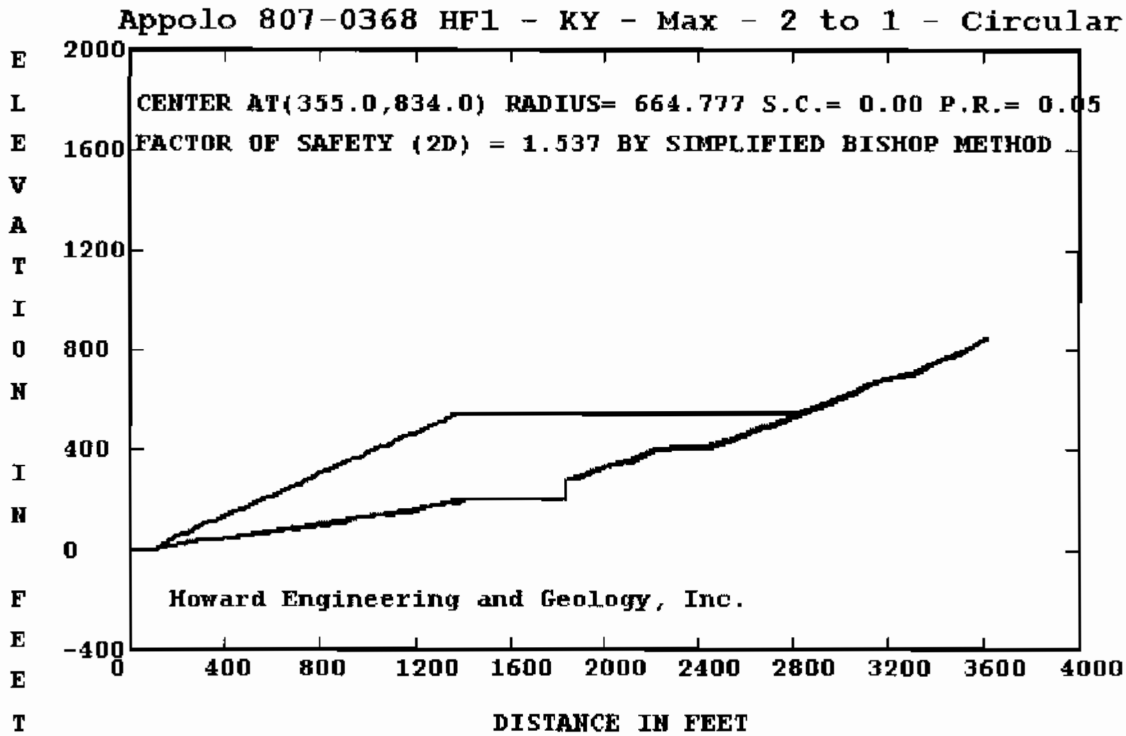
DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\BFG\Reame 0910\K-I-2-C.dwg

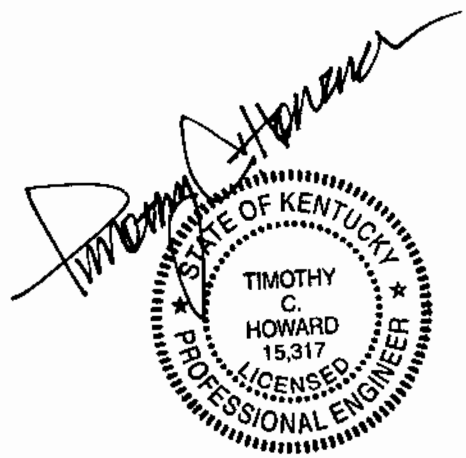
I, Timothy C. Howard, P.E. No. 15,317

Date: 10/6/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.




Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Circular
CENTER AT(355.0,834.0) RADIUS= 664.777 S.C.= 0.00 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.537 BY SIMPLIFIED BISHOP METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET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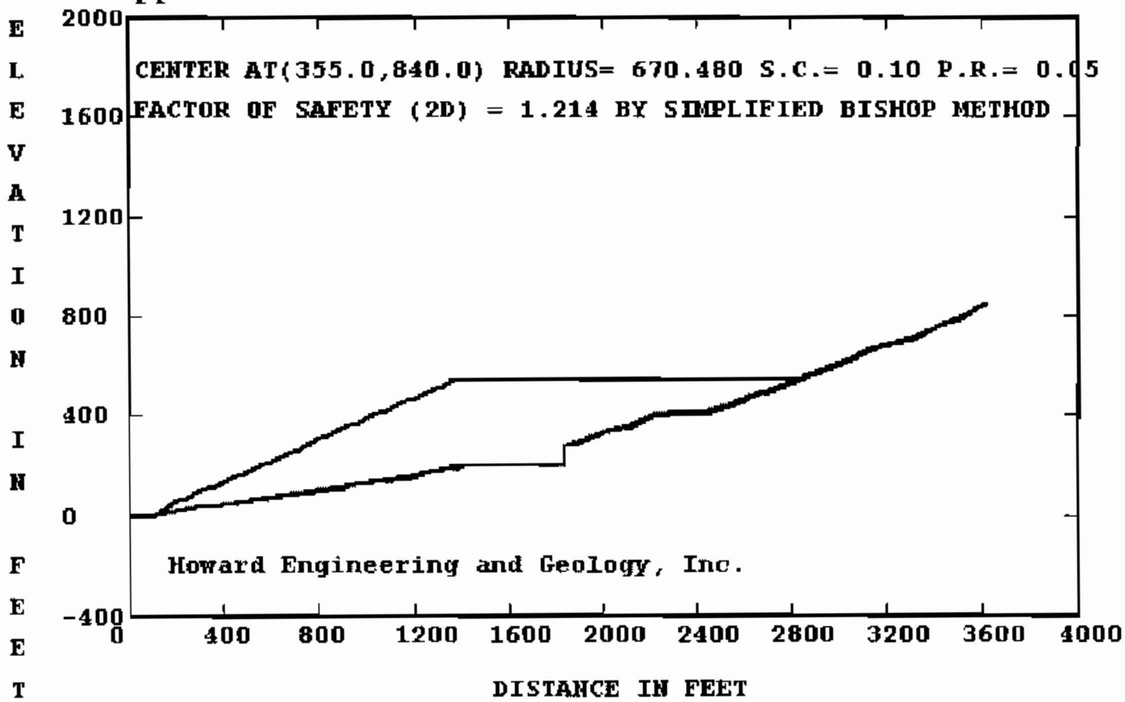
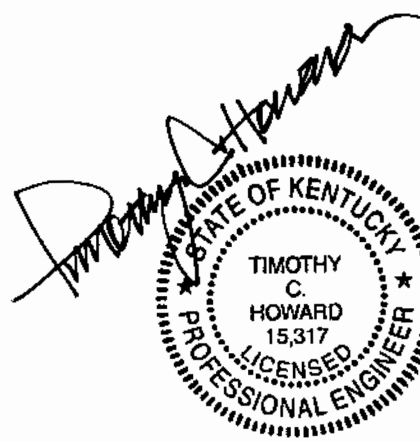
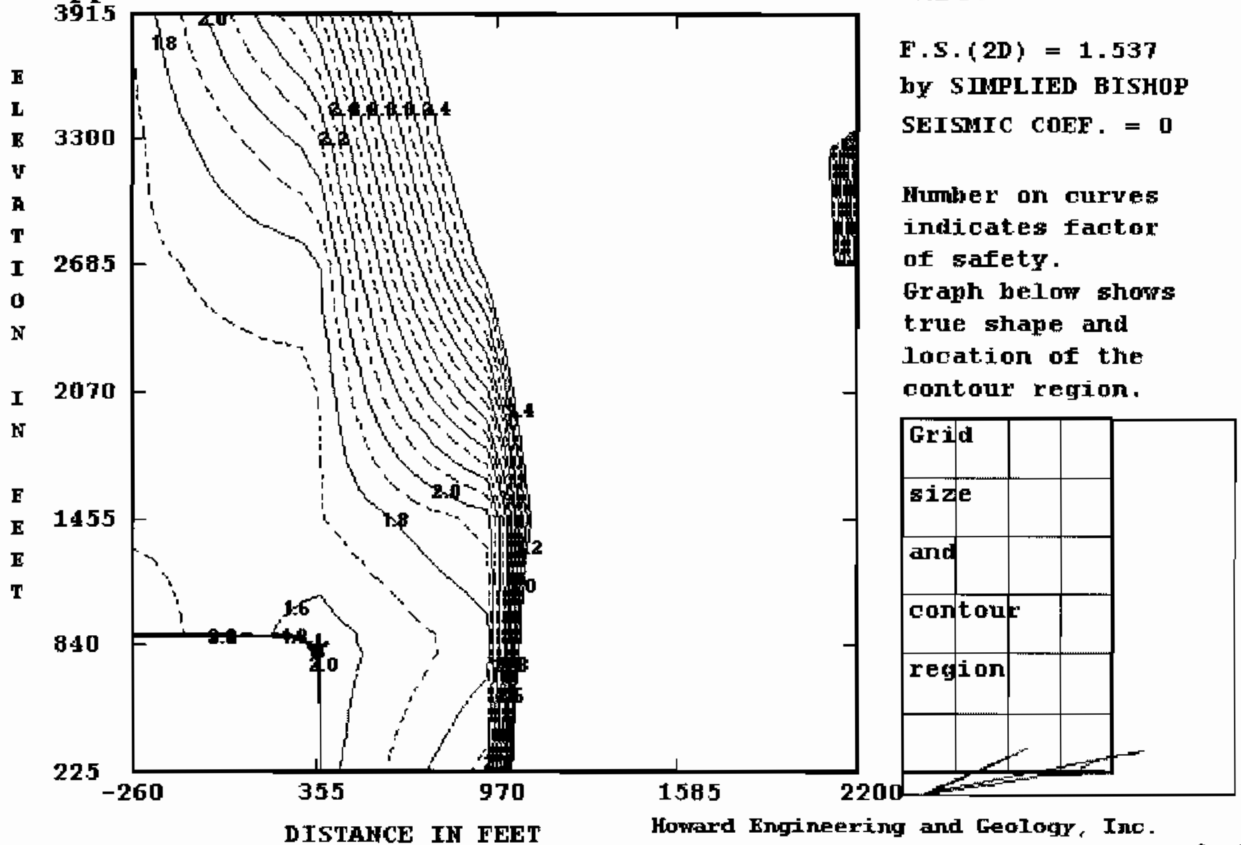




Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Circular



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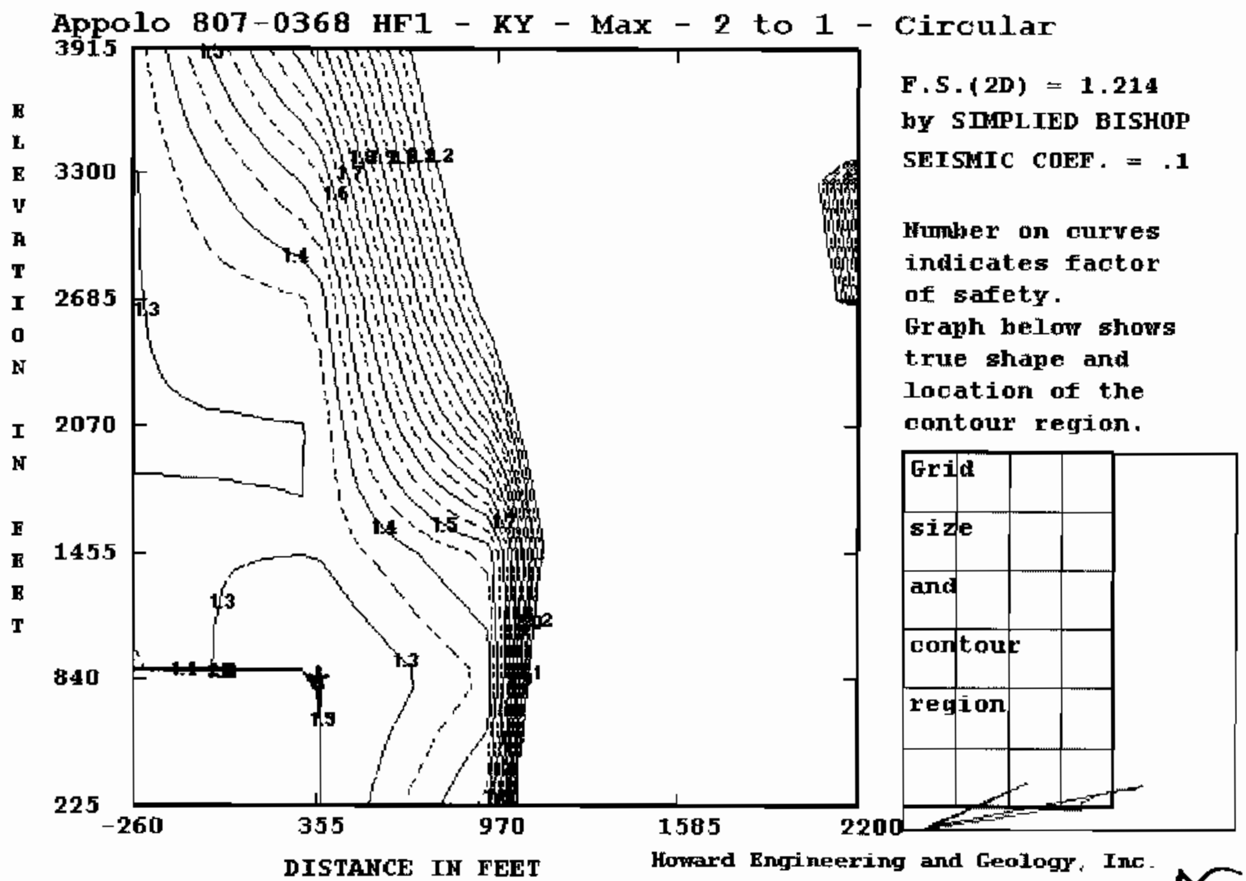

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INPUT FILE NAME -R:\K-X-2-C.DAT

TITLE -Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

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15,317
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 8   X COORD.= 1262             Y COORD.= 180
 9   X COORD.= 1392             Y COORD.= 200
 10  X COORD.= 1840             Y COORD.= 200
 11  X COORD.= 1840             Y COORD.= 279
 12  X COORD.= 1859             Y COORD.= 285
 13  X COORD.= 1873             Y COORD.= 290
 14  X COORD.= 2021             Y COORD.= 340
 15  X COORD.= 2123             Y COORD.= 360
 16  X COORD.= 2215             Y COORD.= 400
 17  X COORD.= 2284             Y COORD.= 410
 18  X COORD.= 2455             Y COORD.= 420
 19  X COORD.= 2560             Y COORD.= 450
 20  X COORD.= 2662             Y COORD.= 490
 21  X COORD.= 2704             Y COORD.= 500
 22  X COORD.= 3053             Y COORD.= 630
 23  X COORD.= 3111             Y COORD.= 660
 24  X COORD.= 3169             Y COORD.= 680
 25  X COORD.= 3309             Y COORD.= 710
 26  X COORD.= 3417             Y COORD.= 760
 27  X COORD.= 3503             Y COORD.= 790
 28  X COORD.= 3613             Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 31
 1   X COORD.= 0                Y COORD.= 0
 2   X COORD.= 105              Y COORD.= 10
 3   X COORD.= 205              Y COORD.= 60
 4   X COORD.= 225              Y COORD.= 60
 5   X COORD.= 325              Y COORD.= 110
 6   X COORD.= 345              Y COORD.= 110
 7   X COORD.= 445              Y COORD.= 160
 8   X COORD.= 465              Y COORD.= 160
 9   X COORD.= 565              Y COORD.= 210
 10  X COORD.= 585              Y COORD.= 210
 11  X COORD.= 685              Y COORD.= 260
 12  X COORD.= 705              Y COORD.= 260
 13  X COORD.= 805              Y COORD.= 310
 14  X COORD.= 825              Y COORD.= 310
 15  X COORD.= 925              Y COORD.= 360
 16  X COORD.= 945              Y COORD.= 360
 17  X COORD.= 1045             Y COORD.= 410
 18  X COORD.= 1065             Y COORD.= 410
 19  X COORD.= 1165             Y COORD.= 460
 20  X COORD.= 1185             Y COORD.= 460
 21  X COORD.= 1285             Y COORD.= 510
 22  X COORD.= 1305             Y COORD.= 510
 23  X COORD.= 1365             Y COORD.= 540
 24  X COORD.= 2811             Y COORD.= 540
 25  X COORD.= 3053             Y COORD.= 630
 26  X COORD.= 3111             Y COORD.= 660
 27  X COORD.= 3169             Y COORD.= 680
 28  X COORD.= 3309             Y COORD.= 710
 29  X COORD.= 3417             Y COORD.= 760
 30  X COORD.= 3503             Y COORD.= 790
 31  X COORD.= 3613             Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1       -0.250      0.086      0.169      0.096      0.135      0.233
          0.123      0.274      0.154      0.313      0.000  99999.000
          0.176      0.336      0.196      0.440      0.147      0.058
          0.283      0.396      0.238      0.371      0.517      0.351
          0.214      0.459      0.349      0.537      1.000
 2        0.095      0.169      0.096      0.135      0.233      0.123
          0.274      0.154      0.000  99999.000      0.316      0.357
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TIMOTHY
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15,317
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	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.372
	0.517	0.345	0.214	0.463	0.349	0.536

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1

LINE NO. (LINO)	BEG. NO. (NBP)	END NO. (NEP)
1	1	30

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-260 Y COORD. = 3915
POINT 2 X COORD. =-260 Y COORD. = 840
POINT 3 X COORD. = 2200 Y COORD. = 840

X INCREMENT (XINC) = 24 Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

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AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	8	3746.356	1.711	0
-260.0	3300.0	8	5	3197.833	1.678	0
-260.0	2685.0	8	1	2697.559	1.680	0
-260.0	2070.0	11	3	2065.661	1.679	0
-260.0	1455.0	11	8	1476.348	1.679	0

-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	8	3538.540	2.444	0
355.0	3300.0	8	8	2953.532	2.048	0
355.0	2685.0	8	8	2378.233	1.757	0
355.0	2070.0	8	8	1808.358	1.673	0
355.0	1455.0	8	1	1401.544	1.685	0
355.0	840.0	8	8	670.480	1.538	0
970.0	3915.0	5	1	3731.650	4.309	0
970.0	3300.0	5	1	3130.930	4.035	0
970.0	2685.0	8	1	2523.479	3.590	0
970.0	2070.0	8	8	1597.034	2.843	0
970.0	1455.0	8	8	1011.967	1.958	0
970.0	840.0	8	7	455.060	1.764	0
1585.0	3915.0	5	1	3576.110	10.748	0
1585.0	3300.0	5	1	2972.740	10.339	0
1585.0	2685.0	5	1	2375.344	9.938	0
1585.0	2070.0	5	1	1789.433	9.076	0
1585.0	1455.0	5	1	1201.154	9.527	0
1585.0	840.0	4	1	616.235	14.563	0
2200.0	3915.0	1	1	3375.933	1000.000	0
2200.0	3300.0	3	1	2798.105	2.119	0
2200.0	2685.0	2	1	2225.864	2.449	0
2200.0	2070.0	1	1	1651.240	2567.762	0
2200.0	1455.0	1	1	1053.355	1000.000	0
2200.0	840.0	1	1	442.593	1000.000	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-260.0	225.0	1	1	343.839	1000.000	0
355.0	225.0	8	7	106.772	1.542	0
970.0	225.0	1	0	96.428	1000.000	0
1585.0	225.0	1	0	25.000	1000.000	0
2200.0	225.0	1	0	149.190	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.711	2.444	4.309	10.748	1000.000
3300.000	1.678	2.048	4.035	10.339	2.119
2685.000	1.680	1.757	3.590	9.938	2.449
2070.000	1.679	1.673	2.843	9.076	2567.762
1455.000	1.679	1.685	1.958	9.527	1000.000
840.000	1000.000	1.538	1.764	14.563	1000.000
225.000	1000.000	1.542	1000.000	1000.000	1000.000

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MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 1.678 AT (-260.000,3300.000)
FACTOR OF SAFETY = 2.119 AT (2200.000,3300.000)
FACTOR OF SAFETY = 1.673 AT (355.000,2070.000)
FACTOR OF SAFETY = 1.538 AT (355.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (355.0 , 840.0) RADIUS 670.480
THE MINIMUM FACTOR OF SAFETY IS 1.538

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X   CENTER Y   NO. OF CIRCLE   LOWEST   WARNING

COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
355.0	840.0	8	8	670.480	1.538	0
379.0	840.0	8	8	662.279	1.595	0
331.0	840.0	8	1	795.325	1.671	0
355.0	864.0	8	1	815.888	1.686	0
355.0	816.0	8	8	647.703	1.554	0
361.0	840.0	8	1	791.300	1.697	0
349.0	840.0	8	8	672.346	1.542	0
355.0	846.0	8	8	676.187	1.541	0
355.0	834.0	8	8	664.777	1.537	0
355.0	828.0	8	8	659.081	1.538	0
361.0	834.0	8	8	662.943	1.540	0
349.0	834.0	8	8	666.659	1.549	0

AT POINT (355.0 , 834.0) RADIUS 664.777

THE MINIMUM FACTOR OF SAFETY IS 1.537

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.319	0.632	0.000	.357	.826E+03	.784E+03	.501E+06	.196E+06
2	2	10.319	1.750	0.000	.372	.228E+04	.217E+04	.112E+07	.566E+06
3	2	10.319	2.666	0.000	.388	.348E+04	.331E+04	.162E+07	.898E+06
4	2	10.319	3.378	0.000	.404	.441E+04	.419E+04	.200E+07	.118E+07
5	2	10.319	3.881	0.000	.419	.507E+04	.481E+04	.226E+07	.141E+07
6	2	10.319	4.170	0.000	.435	.544E+04	.517E+04	.240E+07	.157E+07
7	2	10.319	4.240	0.000	.450	.553E+04	.526E+04	.242E+07	.166E+07
8	2	10.319	4.084	0.000	.466	.533E+04	.507E+04	.232E+07	.165E+07
9	2	10.319	3.698	0.000	.481	.483E+04	.459E+04	.210E+07	.154E+07
10	2	4.979	3.258	0.000	.493	.205E+04	.195E+04	.895E+06	.672E+06
11	2	5.340	1.552	0.000	.500	.105E+04	.996E+03	.498E+06	.349E+06
							SUM	.181E+08	.117E+08

AT CENTER (355.000 , 834.000) WITH RADIUS 664.777 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.551
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.537

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	8	3746.356	1.324	0
-260.0	3300.0	8	5	3197.833	1.295	0
-260.0	2685.0	8	4	2640.598	1.297	0
-260.0	2070.0	11	3	2065.661	1.296	0
-260.0	1455.0	11	8	1476.348	1.306	0
-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	7	3554.193	1.763	0
355.0	3300.0	8	8	2953.532	1.532	0
355.0	2685.0	8	8	2378.233	1.351	0
355.0	2070.0	8	7	1819.022	1.298	0
355.0	1455.0	8	1	1401.544	1.301	0
355.0	840.0	8	8	670.480	1.214	0

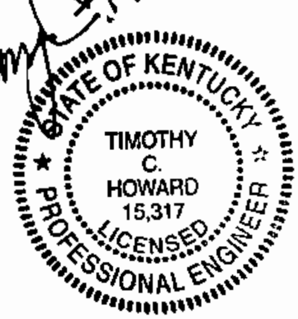
970.0	3915.0	5	1	3731.650	2.613	0
970.0	3300.0	11	1	3130.930	2.526	0
970.0	2685.0	8	1	2523.479	2.329	0
970.0	2070.0	8	8	1597.034	1.980	0
970.0	1455.0	8	8	1011.967	1.478	0
970.0	840.0	8	8	441.074	1.364	0
1585.0	3915.0	5	1	3576.110	4.211	0
1585.0	3300.0	5	1	2972.740	4.182	0
1585.0	2685.0	5	1	2375.344	4.167	0
1585.0	2070.0	5	1	1789.433	3.971	0
1585.0	1455.0	5	1	1201.154	4.250	0
1585.0	840.0	4	1	616.235	6.141	0
2200.0	3915.0	1	1	3375.933	1000.000	0
2200.0	3300.0	3	1	2798.105	1.620	0
2200.0	2685.0	2	1	2225.864	1.934	0
2200.0	2070.0	1	1	1651.240	7.139	0
2200.0	1455.0	1	1	1053.355	1000.000	0
2200.0	840.0	1	1	442.593	1000.000	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-260.0	225.0	1	1	343.839	1000.000	0
355.0	225.0	8	7	106.772	1.228	0
970.0	225.0	1	0	96.428	1000.000	0
1585.0	225.0	1	0	25.000	1000.000	0
2200.0	225.0	1	0	149.190	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.324	1.763	2.613	4.211	1000.000
3300.000	1.295	1.532	2.526	4.182	1.620
2685.000	1.297	1.351	2.329	4.167	1.934
2070.000	1.296	1.298	1.980	3.971	7.139
1455.000	1.306	1.301	1.478	4.250	1000.000
840.000	1000.000	1.214	1.364	6.141	1000.000
225.000	1000.000	1.228	1000.000	1000.000	1000.000



MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 1.295 AT (-260.000,3300.000)
FACTOR OF SAFETY = 1.620 AT (2200.000,3300.000)
FACTOR OF SAFETY = 1.296 AT (-260.000,2070.000)
FACTOR OF SAFETY = 1.214 AT (355.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (355.0 , 840.0) RADIUS 670.480
THE MINIMUM FACTOR OF SAFETY IS 1.214

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
355.0	840.0	8	8	670.480	1.214	0
379.0	840.0	8	8	662.279	1.249	0
331.0	840.0	8	1	795.325	1.292	0
355.0	864.0	8	1	815.888	1.306	0
355.0	816.0	8	8	647.703	1.233	0
361.0	840.0	8	1	791.300	1.314	0

349.0	840.0	8	8	672.346	1.221	0
355.0	846.0	8	8	676.187	1.215	0
355.0	834.0	8	8	664.777	1.215	0

AT POINT (355.0 , 840.0) RADIUS 670.480

THE MINIMUM FACTOR OF SAFETY IS 1.214

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.484	0.667	0.000	.353	.885E+03	.841E+03	.519E+06	.265E+06
2	2	10.484	1.851	0.000	.369	.246E+04	.233E+04	.117E+07	.760E+06
3	2	10.484	2.831	0.000	.384	.375E+04	.357E+04	.169E+07	.120E+07
4	2	10.484	3.603	0.000	.400	.478E+04	.454E+04	.209E+07	.157E+07
5	2	10.484	4.161	0.000	.416	.552E+04	.524E+04	.237E+07	.187E+07
6	2	10.484	4.502	0.000	.431	.597E+04	.567E+04	.253E+07	.209E+07
7	2	10.484	4.619	0.000	.447	.613E+04	.582E+04	.257E+07	.220E+07
8	2	10.484	4.507	0.000	.463	.598E+04	.568E+04	.248E+07	.221E+07
9	2	10.484	4.160	0.000	.478	.552E+04	.524E+04	.228E+07	.209E+07
10	2	4.117	3.776	0.000	.489	.197E+04	.187E+04	.813E+06	.760E+06
11	2	6.367	1.835	0.000	.497	.148E+04	.140E+04	.658E+06	.578E+06
							SUM	.192E+08	.156E+08

AT CENTER (355.000 , 840.000) WITH RADIUS 670.480 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.229
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.214

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.537

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.214

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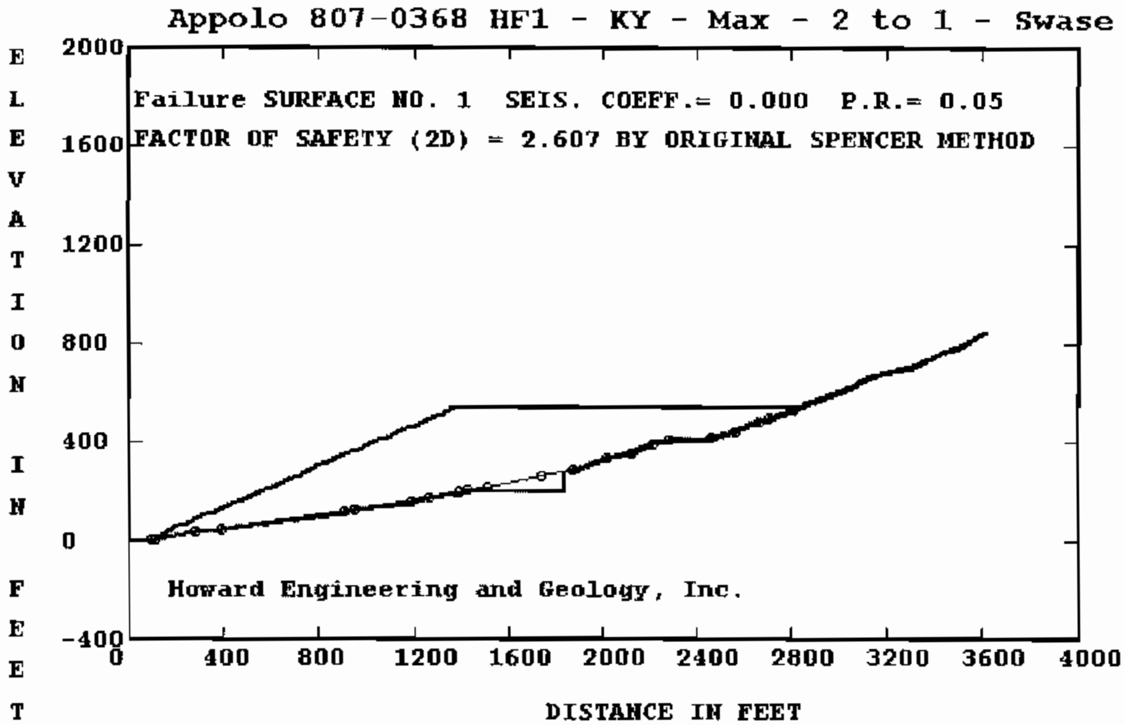
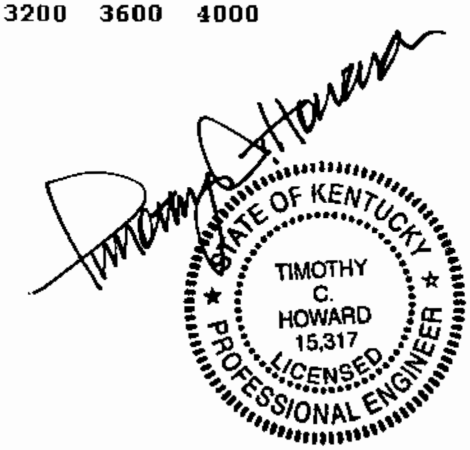
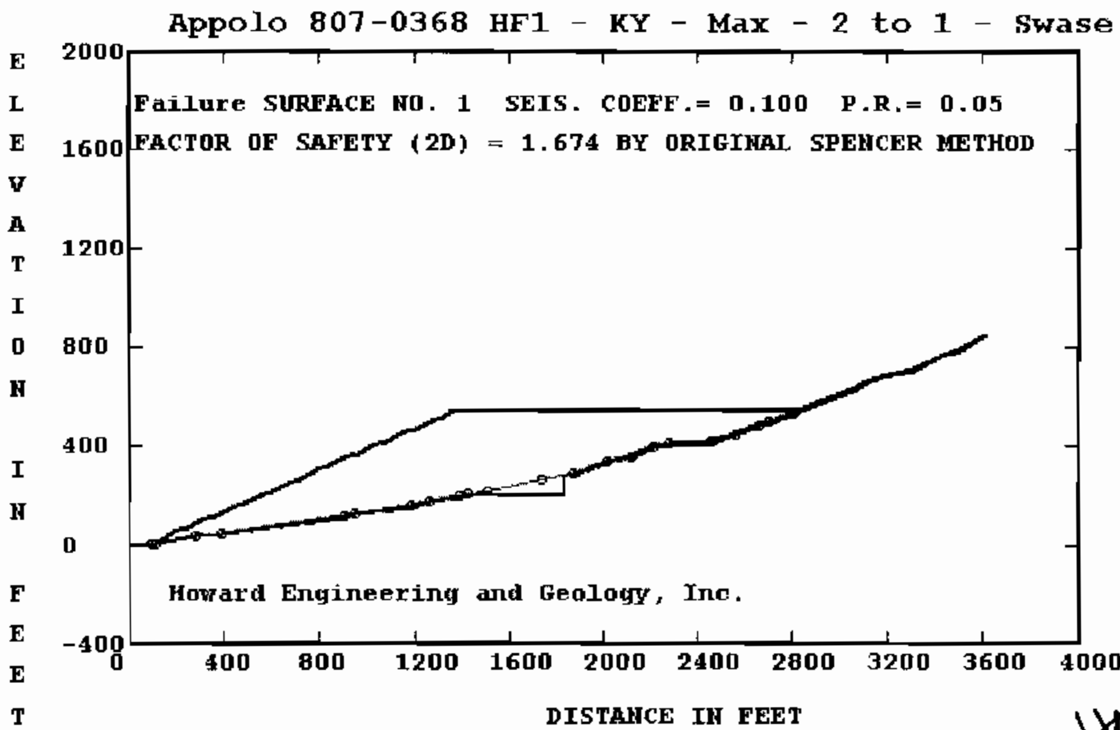


Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.05
FACTOR OF SAFETY (2D) = 2.607 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET



STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER



STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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                Howard Engineering and Geology, Inc.

INPUT FILE NAME  -R:\K-X-2-S.DAT

TITLE -Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS ( THREED = 0 )

ANALYSIS BY DETERMINISTIC METHOD   ( PROB = 0 )


CASE NO.  1   SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30
 1  X COORD.= 0               Y COORD.= 0
 2  X COORD.= 12              Y COORD.=-3
 3  X COORD.= 105             Y COORD.= 5
 4  X COORD.= 283             Y COORD.= 35
 5  X COORD.= 387             Y COORD.= 45
 6  X COORD.= 904             Y COORD.= 115
 7  X COORD.= 947             Y COORD.= 125
 8  X COORD.= 1190            Y COORD.= 155
 9  X COORD.= 1263            Y COORD.= 175
 10 X COORD.= 1393            Y COORD.= 195
 11 X COORD.= 1409            Y COORD.= 200
 12 X COORD.= 1840            Y COORD.= 200
 13 X COORD.= 1840            Y COORD.= 279
 14 X COORD.= 1874            Y COORD.= 285
 15 X COORD.= 2023            Y COORD.= 335
 16 X COORD.= 2125            Y COORD.= 355
 17 X COORD.= 2216            Y COORD.= 395
 18 X COORD.= 2284            Y COORD.= 405
 19 X COORD.= 2456            Y COORD.= 415
 20 X COORD.= 2562            Y COORD.= 445
 21 X COORD.= 2663            Y COORD.= 485
 22 X COORD.= 2705            Y COORD.= 495
 23 X COORD.= 3055            Y COORD.= 625
 24 X COORD.= 3113            Y COORD.= 655
 25 X COORD.= 3170            Y COORD.= 675
 26 X COORD.= 3310            Y COORD.= 705
 27 X COORD.= 3419            Y COORD.= 755
 28 X COORD.= 3505            Y COORD.= 785
 29 X COORD.= 3600            Y COORD.= 836
 30 X COORD.= 3613            Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 28
 1  X COORD.= 0               Y COORD.= 0
 2  X COORD.= 105             Y COORD.= 10
 3  X COORD.= 282             Y COORD.= 40
 4  X COORD.= 386             Y COORD.= 50
 5  X COORD.= 903             Y COORD.= 120
 6  X COORD.= 946             Y COORD.= 130
 7  X COORD.= 1189            Y COORD.= 160
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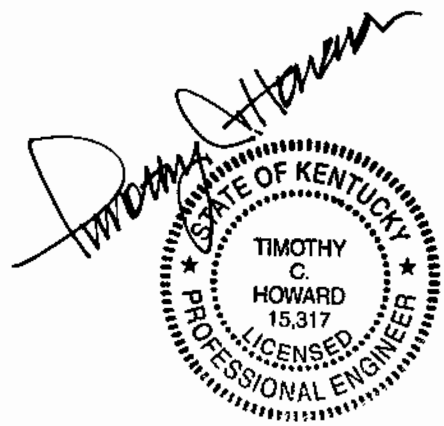
8	X COORD.= 1262	Y COORD.= 180
9	X COORD.= 1392	Y COORD.= 200
10	X COORD.= 1840	Y COORD.= 200
11	X COORD.= 1840	Y COORD.= 279
12	X COORD.= 1859	Y COORD.= 285
13	X COORD.= 1873	Y COORD.= 290
14	X COORD.= 2021	Y COORD.= 340
15	X COORD.= 2123	Y COORD.= 360
16	X COORD.= 2215	Y COORD.= 400
17	X COORD.= 2284	Y COORD.= 410
18	X COORD.= 2455	Y COORD.= 420
19	X COORD.= 2560	Y COORD.= 450
20	X COORD.= 2662	Y COORD.= 490
21	X COORD.= 2704	Y COORD.= 500
22	X COORD.= 3053	Y COORD.= 630
23	X COORD.= 3111	Y COORD.= 660
24	X COORD.= 3169	Y COORD.= 680
25	X COORD.= 3309	Y COORD.= 710
26	X COORD.= 3417	Y COORD.= 760
27	X COORD.= 3503	Y COORD.= 790
28	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 31

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 205	Y COORD.= 60
4	X COORD.= 225	Y COORD.= 60
5	X COORD.= 325	Y COORD.= 110
6	X COORD.= 345	Y COORD.= 110
7	X COORD.= 445	Y COORD.= 160
8	X COORD.= 465	Y COORD.= 160
9	X COORD.= 565	Y COORD.= 210
10	X COORD.= 585	Y COORD.= 210
11	X COORD.= 685	Y COORD.= 260
12	X COORD.= 705	Y COORD.= 260
13	X COORD.= 805	Y COORD.= 310
14	X COORD.= 825	Y COORD.= 310
15	X COORD.= 925	Y COORD.= 360
16	X COORD.= 945	Y COORD.= 360
17	X COORD.= 1045	Y COORD.= 410
18	X COORD.= 1065	Y COORD.= 410
19	X COORD.= 1165	Y COORD.= 460
20	X COORD.= 1185	Y COORD.= 460
21	X COORD.= 1285	Y COORD.= 510
22	X COORD.= 1305	Y COORD.= 510
23	X COORD.= 1365	Y COORD.= 540
24	X COORD.= 2811	Y COORD.= 540
25	X COORD.= 3053	Y COORD.= 630
26	X COORD.= 3111	Y COORD.= 660
27	X COORD.= 3169	Y COORD.= 680
28	X COORD.= 3309	Y COORD.= 710
29	X COORD.= 3417	Y COORD.= 760
30	X COORD.= 3503	Y COORD.= 790
31	X COORD.= 3613	Y COORD.= 849



LINE NO. AND SLOPE OF EACH SEGMENT ARE:

1	-0.250	0.086	0.169	0.096	0.135	0.233
	0.123	0.274	0.154	0.313	0.000	99999.000
	0.176	0.336	0.196	0.440	0.147	0.058
	0.283	0.396	0.238	0.371	0.517	0.351
	0.214	0.459	0.349	0.537	1.000	
2	0.095	0.169	0.096	0.135	0.233	0.123
	0.274	0.154	0.000	99999.000	0.316	0.357

	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.372
	0.517	0.345	0.214	0.463	0.349	0.536

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

STATE OF KENTUCKY
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15,317
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NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 23

1	X COORD.= 93	Y COORD.= 8
2	X COORD.= 105	Y COORD.= 7
3	X COORD.= 282	Y COORD.= 37
4	X COORD.= 387	Y COORD.= 47
5	X COORD.= 904	Y COORD.= 117
6	X COORD.= 947	Y COORD.= 127
7	X COORD.= 1190	Y COORD.= 157
8	X COORD.= 1263	Y COORD.= 177
9	X COORD.= 1392	Y COORD.= 197
10	X COORD.= 1426	Y COORD.= 207
11	X COORD.= 1509	Y COORD.= 217
12	X COORD.= 1740	Y COORD.= 267
13	X COORD.= 1874	Y COORD.= 287
14	X COORD.= 2022	Y COORD.= 337
15	X COORD.= 2124	Y COORD.= 357
16	X COORD.= 2215	Y COORD.= 397
17	X COORD.= 2284	Y COORD.= 407
18	X COORD.= 2456	Y COORD.= 417
19	X COORD.= 2561	Y COORD.= 447
20	X COORD.= 2662	Y COORD.= 487
21	X COORD.= 2705	Y COORD.= 497
22	X COORD.= 2807	Y COORD.= 535
23	X COORD.= 2811	Y COORD.= 540

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.607

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	16.800	1.500	0.000	-0.083	.315E+04	.284E+04	.636E+07	-.421E+06
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.184E+09	.667E+08
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.607E+08	.235E+08
4	1	57.000	42.081	0.000	0.167	.303E+06	.273E+06	.209E+09	.820E+08
5	1	43.000	60.202	0.000	0.095	.327E+06	.295E+06	.222E+09	.500E+08
6	1	20.000	67.952	0.000	0.095	.172E+06	.155E+06	.116E+09	.263E+08
7	1	15.480	70.133	0.000	0.095	.137E+06	.124E+06	.923E+08	.210E+08
8	1	26.520	78.633	0.000	0.095	.264E+06	.237E+06	.176E+09	.403E+08
9	1	58.000	94.574	0.000	0.134	.694E+06	.624E+06	.462E+09	.151E+09
10	1	20.000	103.793	0.000	0.134	.263E+06	.236E+06	.174E+09	.571E+08
11	1	100.000	120.669	0.000	0.134	.153E+07	.137E+07	.101E+10	.332E+09
12	1	20.000	137.546	0.000	0.134	.348E+06	.313E+06	.229E+09	.756E+08
13	1	47.760	144.898	0.000	0.134	.875E+06	.788E+06	.576E+09	.190E+09
14	1	52.240	163.128	0.000	0.134	.108E+07	.970E+06	.707E+09	.234E+09
15	1	20.000	171.298	0.000	0.134	.433E+06	.390E+06	.284E+09	.942E+08
16	1	100.000	188.174	0.000	0.134	.238E+07	.214E+07	.156E+10	.517E+09
17	1	20.000	205.050	0.000	0.134	.519E+06	.467E+06	.339E+09	.113E+09
18	1	79.000	218.098	0.000	0.134	.218E+07	.196E+07	.142E+10	.474E+09
19	1	1.040	232.639	0.000	0.227	.306E+05	.275E+05	.203E+08	.116E+08
20	1	19.960	235.447	0.000	0.227	.594E+06	.535E+06	.395E+09	.226E+09
21	1	20.000	235.791	0.000	0.227	.596E+06	.537E+06	.396E+09	.227E+09
22	1	2.000	233.733	0.000	0.227	.591E+05	.532E+05	.393E+08	.225E+08
23	1	98.000	252.451	0.000	0.123	.313E+07	.282E+07	.203E+10	.616E+09
24	1	20.000	269.667	0.000	0.123	.682E+06	.614E+06	.441E+09	.134E+09
25	1	100.000	287.259	0.000	0.123	.363E+07	.327E+07	.235E+10	.716E+09
26	1	12.320	305.326	0.000	0.123	.476E+06	.428E+06	.307E+09	.937E+08
27	1	7.680	304.091	0.000	0.123	.295E+06	.266E+06	.191E+09	.582E+08
28	1	5.000	304.559	0.000	0.123	.193E+06	.173E+06	.124E+09	.379E+08
29	1	73.000	313.750	0.000	0.264	.290E+07	.261E+07	.196E+10	.133E+10
30	1	22.000	325.795	0.000	0.153	.907E+06	.816E+06	.591E+09	.226E+09
31	1	20.000	328.039	0.000	0.153	.830E+06	.747E+06	.541E+09	.207E+09
32	1	60.000	336.837	0.000	0.153	.256E+07	.230E+07	.167E+10	.638E+09
33	1	27.000	345.093	0.000	0.153	.118E+07	.106E+07	.767E+09	.294E+09
34	1	10.200	341.500	0.000	0.282	.441E+06	.397E+06	.302E+09	.220E+09
35	2	23.800	336.500	0.000	0.282	.101E+07	.962E+06	.119E+10	.505E+09
36	2	23.600	331.578	0.000	0.120	.990E+06	.940E+06	.107E+10	.187E+09
37	2	59.400	326.578	0.000	0.120	.245E+07	.233E+07	.266E+10	.465E+09
38	2	212.880	299.961	0.000	0.212	.808E+07	.767E+07	.927E+10	.291E+10
39	2	18.120	274.961	0.000	0.212	.630E+06	.599E+06	.724E+09	.227E+09
40	2	134.000	263.000	0.000	0.148	.446E+07	.424E+07	.489E+10	.106E+10
41	1	120.160	232.703	0.000	0.320	.354E+07	.318E+07	.255E+10	.212E+10
42	1	27.840	207.703	0.000	0.320	.731E+06	.658E+06	.529E+09	.438E+09
43	1	102.000	193.000	0.000	0.192	.249E+07	.224E+07	.165E+10	.794E+09
44	1	91.000	163.000	0.000	0.402	.188E+07	.169E+07	.142E+10	.152E+10
45	1	51.440	139.273	0.000	0.143	.906E+06	.815E+06	.565E+09	.200E+09
46	1	17.560	134.273	0.000	0.143	.298E+06	.268E+06	.186E+09	.658E+08
47	1	172.000	128.000	0.000	0.058	.278E+07	.251E+07	.154E+10	.219E+09
48	1	82.720	111.183	0.000	0.275	.116E+07	.105E+07	.850E+09	.588E+09
49	1	22.280	96.183	0.000	0.275	.271E+06	.244E+06	.199E+09	.137E+09
50	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.745E+09	.701E+09
51	1	43.000	48.000	0.000	0.227	.261E+06	.235E+06	.187E+09	.101E+09
52	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.268E+09	.217E+09
53	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.373E+07	.281E+07
54	2	0.164	0.102	0.000	0.781	.211E+01	.200E+01	.177E+05	.474E+04
		SUM						.505E+11	.201E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 2.515

THRUST INCLINATION MOMENT F.S. FORCE F.S.

STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15317
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0.000	2.614	2.580
0.300	2.608	2.619
0.600	2.628	2.666

FROM ORIGINAL SPENCER METHOD, DEL = 0.215 AND F. S. = 2.607

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.674

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	16.800	1.500	0.000	-0.083	.315E+04	.284E+04	.638E+07	.845E+05
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.181E+09	.106E+09
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.598E+08	.372E+08
4	1	57.000	42.081	0.000	0.167	.303E+06	.273E+06	.205E+09	.130E+09
5	1	43.000	60.202	0.000	0.095	.327E+06	.295E+06	.220E+09	.102E+09
6	1	20.000	67.952	0.000	0.095	.172E+06	.155E+06	.115E+09	.532E+08
7	1	15.480	70.133	0.000	0.095	.137E+06	.124E+06	.915E+08	.425E+08
8	1	26.520	78.633	0.000	0.095	.264E+06	.237E+06	.175E+09	.815E+08
9	1	58.000	94.574	0.000	0.134	.694E+06	.624E+06	.455E+09	.259E+09
10	1	20.000	103.793	0.000	0.134	.263E+06	.236E+06	.172E+09	.978E+08
11	1	100.000	120.669	0.000	0.134	.153E+07	.137E+07	.995E+09	.567E+09
12	1	20.000	137.546	0.000	0.134	.348E+06	.313E+06	.226E+09	.129E+09
13	1	47.760	144.898	0.000	0.134	.875E+06	.788E+06	.568E+09	.324E+09
14	1	52.240	163.128	0.000	0.134	.108E+07	.970E+06	.698E+09	.398E+09
15	1	20.000	171.298	0.000	0.134	.433E+06	.390E+06	.280E+09	.160E+09
16	1	100.000	188.174	0.000	0.134	.238E+07	.214E+07	.154E+10	.876E+09
17	1	20.000	205.050	0.000	0.134	.519E+06	.467E+06	.334E+09	.190E+09
18	1	79.000	218.098	0.000	0.134	.218E+07	.196E+07	.140E+10	.798E+09
19	1	1.040	232.639	0.000	0.227	.306E+05	.275E+05	.199E+08	.162E+08
20	1	19.960	235.447	0.000	0.227	.594E+06	.535E+06	.386E+09	.315E+09
21	1	20.000	235.791	0.000	0.227	.596E+06	.537E+06	.387E+09	.316E+09
22	1	2.000	233.733	0.000	0.227	.591E+05	.532E+05	.384E+08	.314E+08
23	1	98.000	252.451	0.000	0.123	.313E+07	.282E+07	.200E+10	.107E+10
24	1	20.000	269.667	0.000	0.123	.682E+06	.614E+06	.436E+09	.233E+09
25	1	100.000	287.259	0.000	0.123	.363E+07	.327E+07	.232E+10	.124E+10
26	1	12.320	305.326	0.000	0.123	.476E+06	.428E+06	.304E+09	.162E+09
27	1	7.680	304.091	0.000	0.123	.295E+06	.266E+06	.189E+09	.100E+09
28	1	5.000	304.559	0.000	0.123	.193E+06	.173E+06	.123E+09	.655E+08
29	1	73.000	313.750	0.000	0.264	.290E+07	.261E+07	.191E+10	.176E+10
30	1	22.000	325.795	0.000	0.153	.907E+06	.816E+06	.582E+09	.356E+09
31	1	20.000	328.039	0.000	0.153	.830E+06	.747E+06	.532E+09	.326E+09
32	1	60.000	336.837	0.000	0.153	.256E+07	.230E+07	.164E+10	.100E+10
33	1	27.000	345.093	0.000	0.153	.118E+07	.106E+07	.756E+09	.462E+09
34	1	10.200	341.500	0.000	0.282	.441E+06	.397E+06	.294E+09	.286E+09
35	2	23.800	336.500	0.000	0.282	.101E+07	.962E+06	.115E+10	.659E+09
36	2	23.600	331.578	0.000	0.120	.990E+06	.940E+06	.106E+10	.326E+09
37	2	59.400	326.578	0.000	0.120	.245E+07	.233E+07	.263E+10	.809E+09
38	2	212.880	299.961	0.000	0.212	.808E+07	.767E+07	.907E+10	.412E+10
39	2	18.120	274.961	0.000	0.212	.630E+06	.599E+06	.708E+09	.322E+09
40	2	134.000	263.000	0.000	0.148	.446E+07	.424E+07	.482E+10	.170E+10
41	1	120.160	232.703	0.000	0.320	.354E+07	.318E+07	.247E+10	.269E+10
42	1	27.840	207.703	0.000	0.320	.731E+06	.658E+06	.511E+09	.557E+09
43	1	102.000	193.000	0.000	0.192	.249E+07	.224E+07	.162E+10	.117E+10
44	1	91.000	163.000	0.000	0.402	.188E+07	.169E+07	.136E+10	.185E+10
45	1	51.440	139.273	0.000	0.143	.906E+06	.815E+06	.557E+09	.329E+09
46	1	17.560	134.273	0.000	0.143	.298E+06	.268E+06	.184E+09	.108E+09

47	1	172.000	128.000	0.000	0.058	.278E+07	.251E+07	.154E+10	.573E+09
48	1	82.720	111.183	0.000	0.275	.116E+07	.105E+07	.827E+09	.781E+09
49	1	22.280	96.183	0.000	0.275	.271E+06	.244E+06	.194E+09	.182E+09
50	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.717E+09	.868E+09
51	1	43.000	48.000	0.000	0.227	.261E+06	.235E+06	.183E+09	.143E+09
52	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.259E+09	.272E+09
53	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.362E+07	.303E+07
54	2	0.164	0.102	0.000	0.781	.211E+01	.200E+01	.173E+05	.511E+04
		SUM						.495E+11	.295E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.675

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.718	1.651
0.300	1.710	1.674
0.600	1.720	1.703

FROM ORIGINAL SPENCER METHOD, DEL = 0.300 AND F. S. = 1.674

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.607

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.674

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Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Circular [K-X-2-C.TXT]

AT CENTER (355.000 , 834.000) WITH RADIUS 664.777 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.551
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.537
AT CENTER (355.000 , 840.000) WITH RADIUS 670.480 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.229
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.214

0 =	0 ,	0	35 =	1189 ,	160	70 =	1165 ,	460
1 =	12 ,	-3	36 =	1262 ,	180	71 =	1185 ,	460
2 =	105 ,	5	37 =	1392 ,	200	72 =	1285 ,	510
3 =	283 ,	35	38 =	1859 ,	285	73 =	1305 ,	510
4 =	387 ,	45	39 =	1873 ,	290	74 =	1365 ,	540
5 =	904 ,	115	40 =	2021 ,	340	75 =	2811 ,	540
6 =	947 ,	125	41 =	2123 ,	360			
7 =	1190 ,	155	42 =	2215 ,	400			
8 =	1263 ,	175	43 =	2284 ,	410			
9 =	1393 ,	195	44 =	2455 ,	420			
10 =	1409 ,	200	45 =	2560 ,	450			
11 =	1840 ,	200	46 =	2662 ,	490			
12 =	1840 ,	279	47 =	2704 ,	500			
13 =	1874 ,	285	48 =	3053 ,	630			
14 =	2023 ,	335	49 =	3111 ,	660			
15 =	2125 ,	355	50 =	3169 ,	680			
16 =	2216 ,	395	51 =	3309 ,	710			
17 =	2284 ,	405	52 =	3417 ,	760			
18 =	2456 ,	415	53 =	3503 ,	790			
19 =	2562 ,	445	54 =	205 ,	60			
20 =	2663 ,	485	55 =	225 ,	60			
21 =	2705 ,	495	56 =	325 ,	110			
22 =	3055 ,	625	57 =	345 ,	110			
23 =	3113 ,	655	58 =	445 ,	160			
24 =	3170 ,	675	59 =	465 ,	160			
25 =	3310 ,	705	60 =	565 ,	210			
26 =	3419 ,	755	61 =	585 ,	210			
27 =	3505 ,	785	62 =	685 ,	260			
28 =	3600 ,	836	63 =	705 ,	260			
29 =	3613 ,	849	64 =	805 ,	310			
30 =	105 ,	10	65 =	825 ,	310			
31 =	282 ,	40	66 =	925 ,	360			
32 =	386 ,	50	67 =	945 ,	360			
33 =	903 ,	120	68 =	1045 ,	410			
34 =	946 ,	130	69 =	1065 ,	410			

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Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing

N W E S

Prepared By
HOWARD
Engineering and Geology, Inc.
PO Box 271 - 2550 W Hwy 72 Suite 1 - Harlan, Ky - 40831
(606) 573-6924 - http://www.howardeng-geo.com/

Scale: None

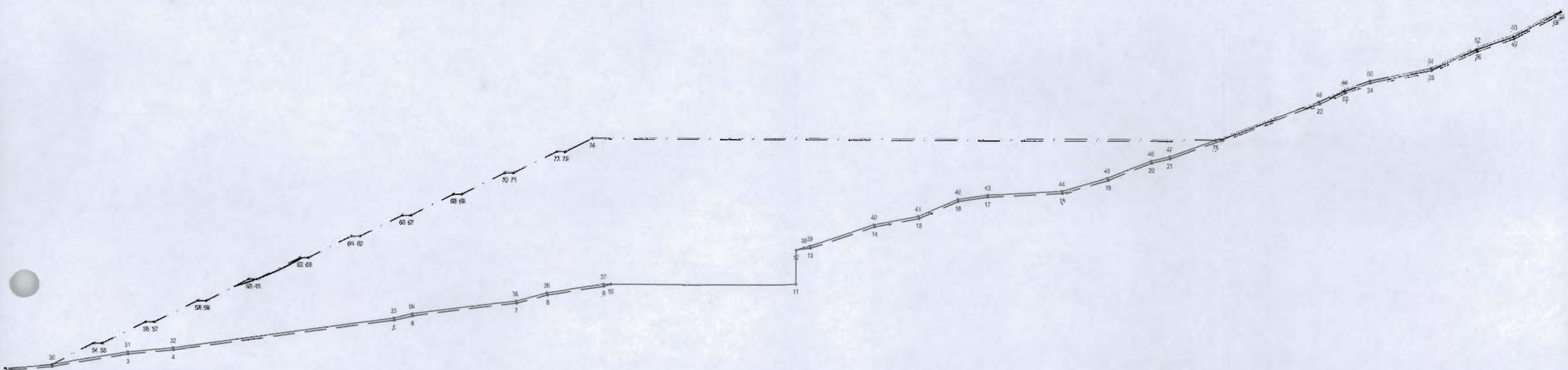
Attachment 26.3.A

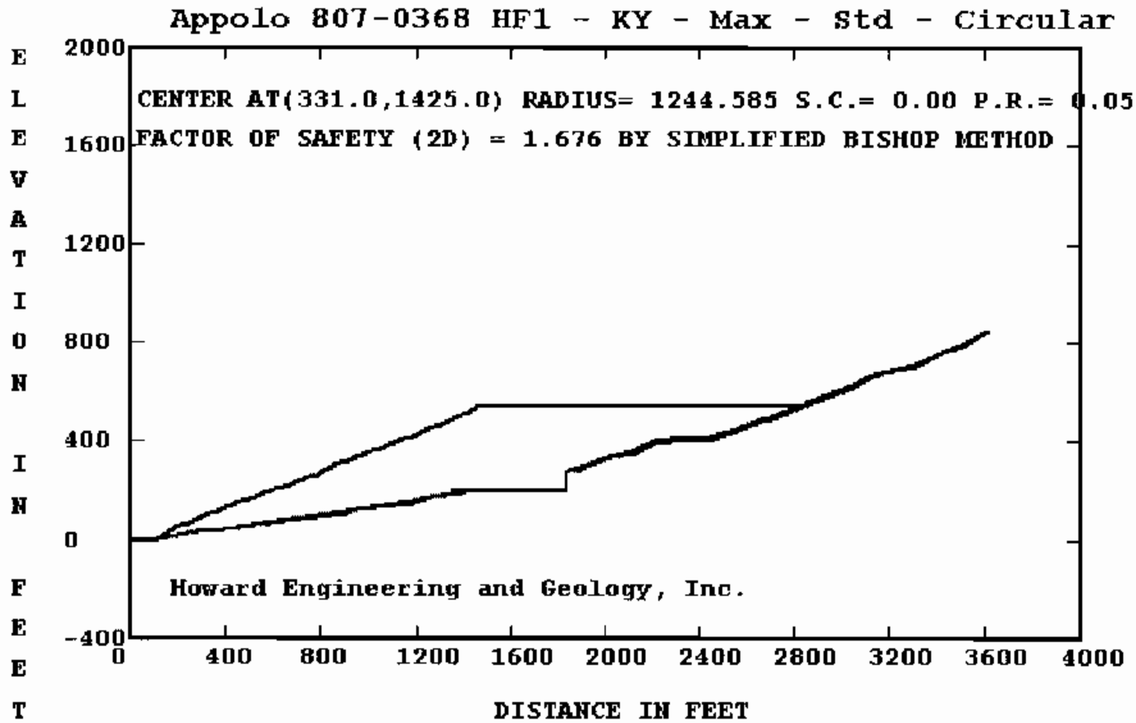
DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\original\comprehensive\ara\Reame 0910\K-X-2-C.dwg

I, Timothy C. Howard, P.E. No. 15,317

Date: 10/6/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.





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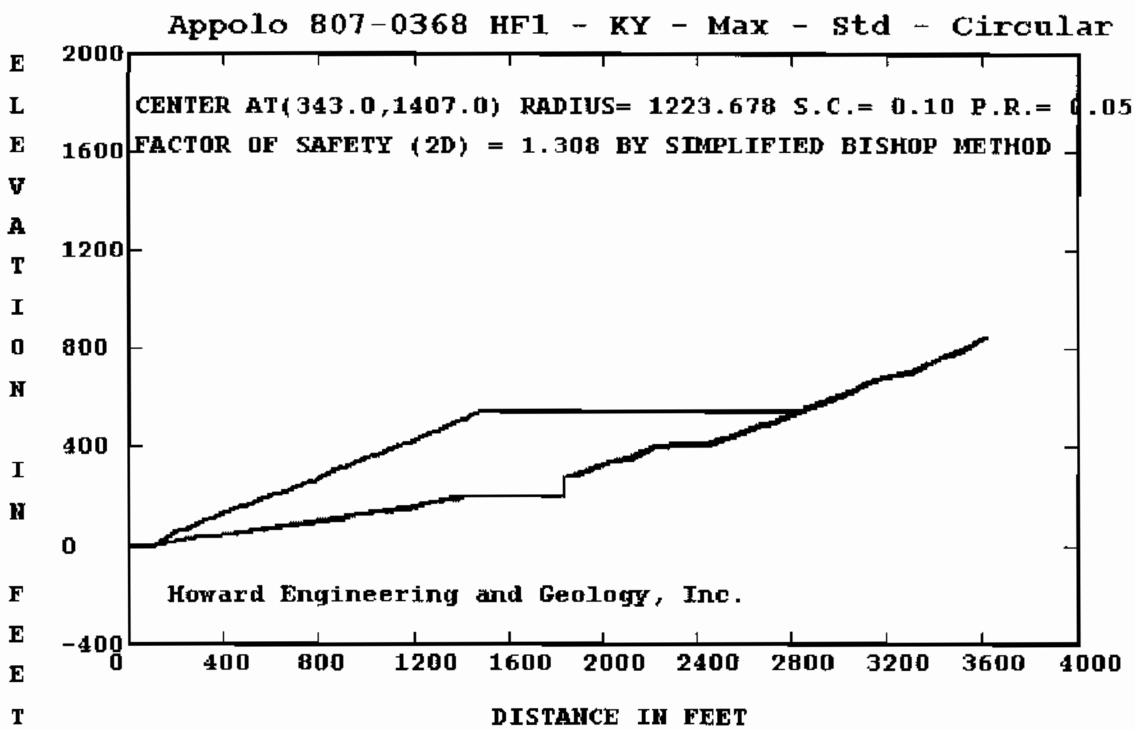
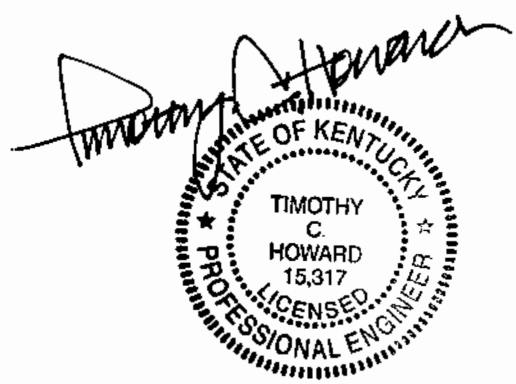

Appolo 807-0368 HF1 - KY - Max - Std - Circular
CENTER AT(343.0,1407.0) RADIUS= 1223.678 S.C.= 0.10 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.308 BY SIMPLIFIED BISHOP METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000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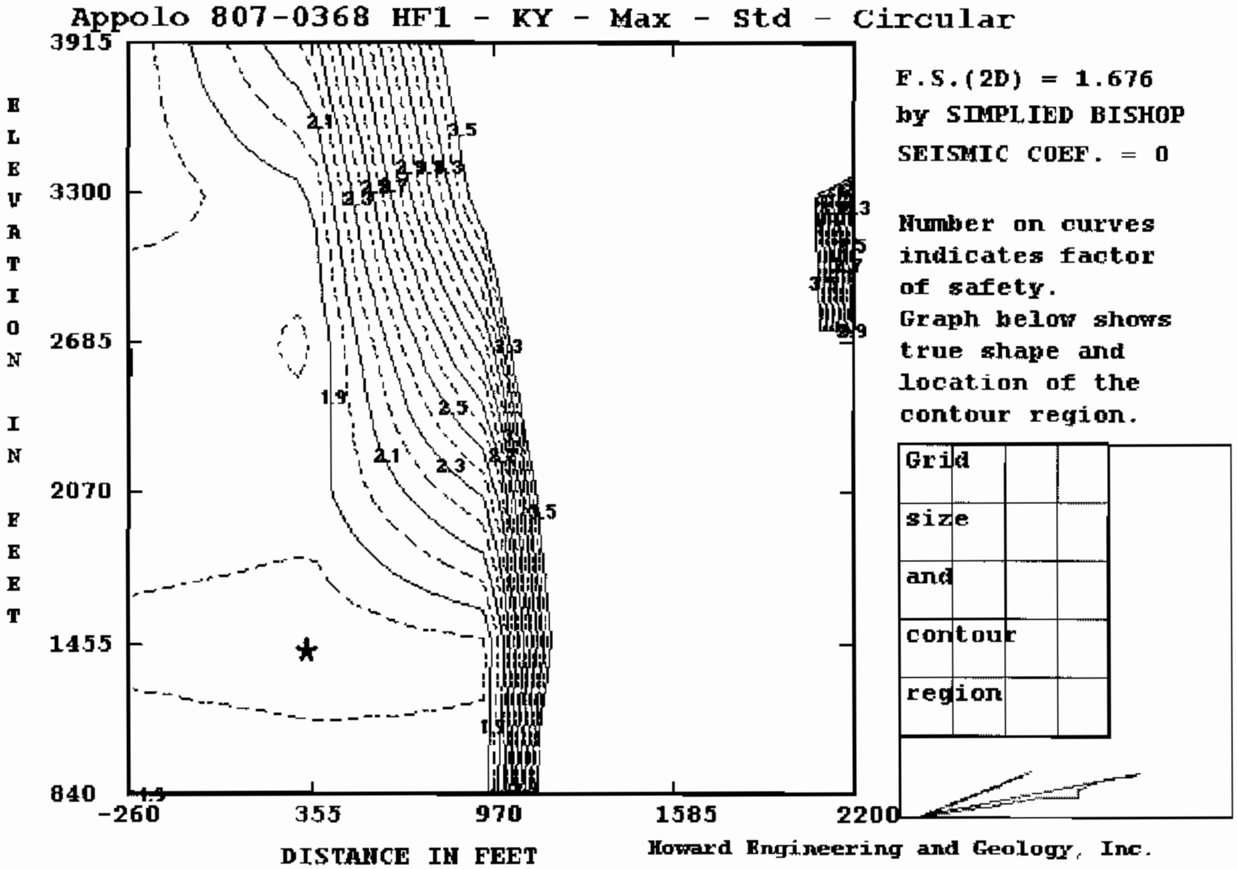

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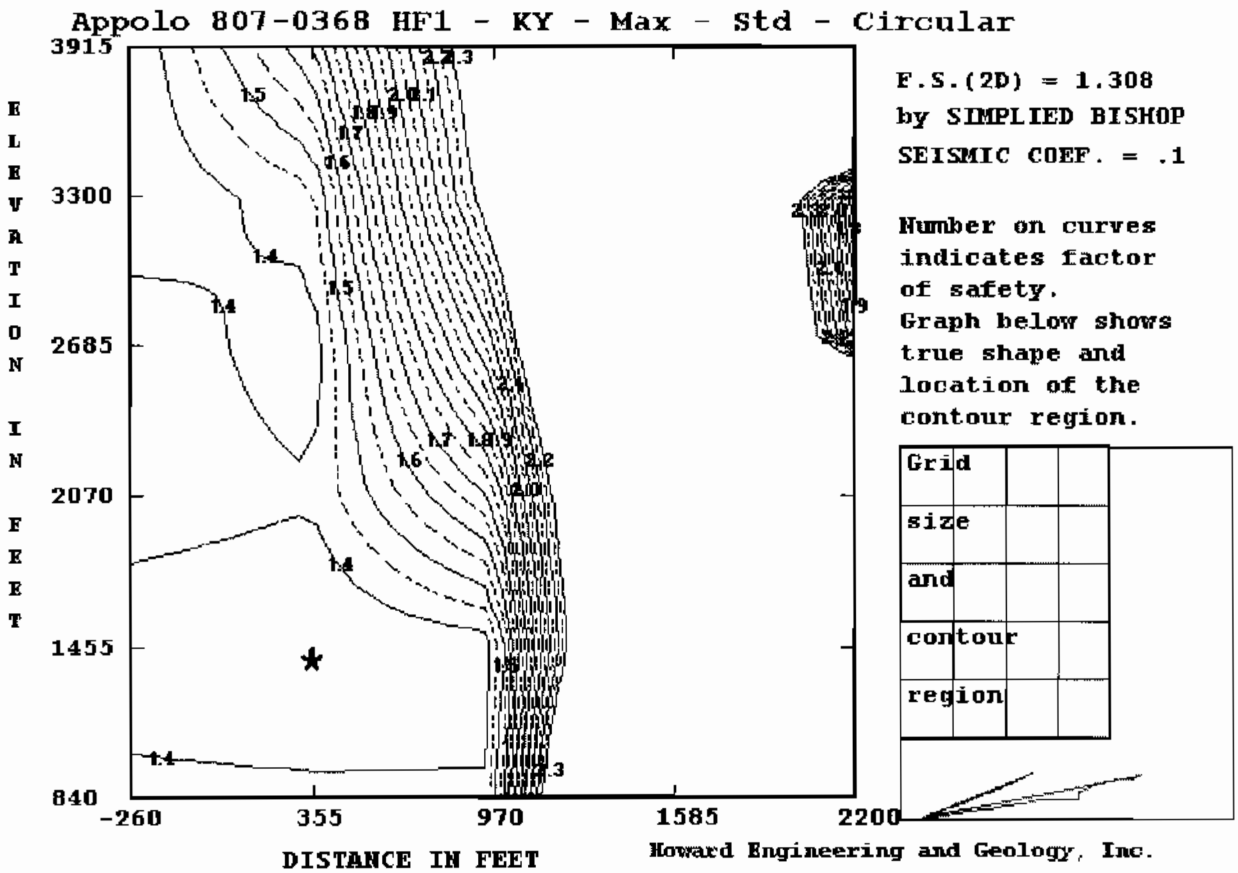
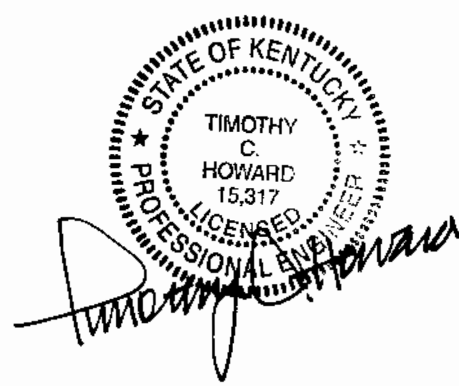
Timothy C. Howard


Appolo 807-0368 HF1 - KY - Max - Std - Circular
F.S.(2D) = 1.308
by SIMPLIED BISHOP
SEISMIC COEF. = .1
Number on curves indicates factor of safety.
Graph below shows true shape and location of the contour region.
Grid size and contour region
ELEVATION IN FEET
3915
3300
2685
2070
1455
840
-260
355
970
1585
2200
DISTANCE IN FEET
Howard Engineering and Geology, Inc.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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\K-X-V-C.DAT

TITLE -Appolo 807-0368 HF1 - KY - Max - Std - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

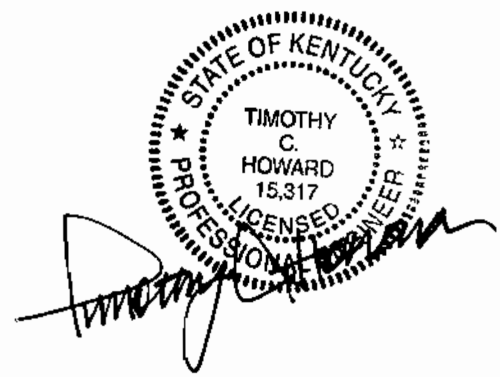
TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30
```
 1  X COORD.= 0          Y COORD.= 0
 2  X COORD.= 12         Y COORD.=-3
 3  X COORD.= 105        Y COORD.= 5
 4  X COORD.= 283        Y COORD.= 35
 5  X COORD.= 387        Y COORD.= 45
 6  X COORD.= 904        Y COORD.= 115
 7  X COORD.= 947        Y COORD.= 125
 8  X COORD.= 1190       Y COORD.= 155
 9  X COORD.= 1263       Y COORD.= 175
 10 X COORD.= 1393       Y COORD.= 195
 11 X COORD.= 1409       Y COORD.= 200
 12 X COORD.= 1840       Y COORD.= 200
 13 X COORD.= 1840       Y COORD.= 279
 14 X COORD.= 1874       Y COORD.= 285
 15 X COORD.= 2023       Y COORD.= 335
 16 X COORD.= 2125       Y COORD.= 355
 17 X COORD.= 2216       Y COORD.= 395
 18 X COORD.= 2284       Y COORD.= 405
 19 X COORD.= 2456       Y COORD.= 415
 20 X COORD.= 2562       Y COORD.= 445
 21 X COORD.= 2663       Y COORD.= 485
 22 X COORD.= 2705       Y COORD.= 495
 23 X COORD.= 3055       Y COORD.= 625
 24 X COORD.= 3113       Y COORD.= 655
 25 X COORD.= 3170       Y COORD.= 675
 26 X COORD.= 3310       Y COORD.= 705
 27 X COORD.= 3419       Y COORD.= 755
 28 X COORD.= 3505       Y COORD.= 785
 29 X COORD.= 3600       Y COORD.= 836
 30 X COORD.= 3613       Y COORD.= 849
```



NO. OF POINTS ON BOUNDARY LINE 2 = 28
```
 1  X COORD.= 0          Y COORD.= 0
 2  X COORD.= 105        Y COORD.= 10
 3  X COORD.= 282        Y COORD.= 40
 4  X COORD.= 386        Y COORD.= 50
 5  X COORD.= 903        Y COORD.= 120
 6  X COORD.= 946        Y COORD.= 130
 7  X COORD.= 1189       Y COORD.= 160
```

```
 8  X COORD.= 1262           Y COORD.= 180
 9  X COORD.= 1392           Y COORD.= 200
 10 X COORD.= 1840           Y COORD.= 200
 11 X COORD.= 1840           Y COORD.= 279
 12 X COORD.= 1859           Y COORD.= 285
 13 X COORD.= 1873           Y COORD.= 290
 14 X COORD.= 2021           Y COORD.= 340
 15 X COORD.= 2123           Y COORD.= 360
 16 X COORD.= 2215           Y COORD.= 400
 17 X COORD.= 2284           Y COORD.= 410
 18 X COORD.= 2455           Y COORD.= 420
 19 X COORD.= 2560           Y COORD.= 450
 20 X COORD.= 2662           Y COORD.= 490
 21 X COORD.= 2704           Y COORD.= 500
 22 X COORD.= 3053           Y COORD.= 630
 23 X COORD.= 3111           Y COORD.= 660
 24 X COORD.= 3169           Y COORD.= 680
 25 X COORD.= 3309           Y COORD.= 710
 26 X COORD.= 3417           Y COORD.= 760
 27 X COORD.= 3503           Y COORD.= 790
 28 X COORD.= 3613           Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 31
 1  X COORD.= 0              Y COORD.= 0
 2  X COORD.= 105            Y COORD.= 10
 3  X COORD.= 205            Y COORD.= 60
 4  X COORD.= 225            Y COORD.= 60
 5  X COORD.= 327            Y COORD.= 110
 6  X COORD.= 349            Y COORD.= 110
 7  X COORD.= 460            Y COORD.= 160
 8  X COORD.= 482            Y COORD.= 160
 9  X COORD.= 602            Y COORD.= 210
 10 X COORD.= 627            Y COORD.= 210
 11 X COORD.= 749            Y COORD.= 260
 12 X COORD.= 771            Y COORD.= 260
 13 X COORD.= 876            Y COORD.= 310
 14 X COORD.= 897            Y COORD.= 310
 15 X COORD.= 1011           Y COORD.= 360
 16 X COORD.= 1035           Y COORD.= 360
 17 X COORD.= 1145           Y COORD.= 410
 18 X COORD.= 1166           Y COORD.= 410
 19 X COORD.= 1268           Y COORD.= 460
 20 X COORD.= 1288           Y COORD.= 460
 21 X COORD.= 1389           Y COORD.= 510
 22 X COORD.= 1410           Y COORD.= 510
 23 X COORD.= 1470           Y COORD.= 540
 24 X COORD.= 2811           Y COORD.= 540
 25 X COORD.= 3053           Y COORD.= 630
 26 X COORD.= 3111           Y COORD.= 660
 27 X COORD.= 3169           Y COORD.= 680
 28 X COORD.= 3309           Y COORD.= 710
 29 X COORD.= 3417           Y COORD.= 760
 30 X COORD.= 3503           Y COORD.= 790
 31 X COORD.= 3613           Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1       -0.250       0.086       0.169       0.096       0.135       0.233
          0.123       0.274       0.154       0.313       0.000   99999.000
          0.176       0.336       0.196       0.440       0.147       0.058
          0.283       0.396       0.238       0.371       0.517       0.351
          0.214       0.459       0.349       0.537       1.000
 2        0.095       0.169       0.096       0.135       0.233       0.123
          0.274       0.154       0.000   99999.000       0.316       0.357
```

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	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.490	0.000	0.450
	0.000	0.417	0.000	0.410	0.000	0.476
	0.000	0.439	0.000	0.455	0.000	0.490
	0.000	0.495	0.000	0.500	0.000	0.372
	0.517	0.345	0.214	0.463	0.349	0.536

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1

LINE NO. (LINO)	BEG. NO. (NBP)	END NO. (NEP)
1	1	30

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

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PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-260 Y COORD. = 3915
POINT 2 X COORD. =-260 Y COORD. = 840
POINT 3 X COORD. = 2200 Y COORD. = 840

X INCREMENT (XINC) = 24 Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

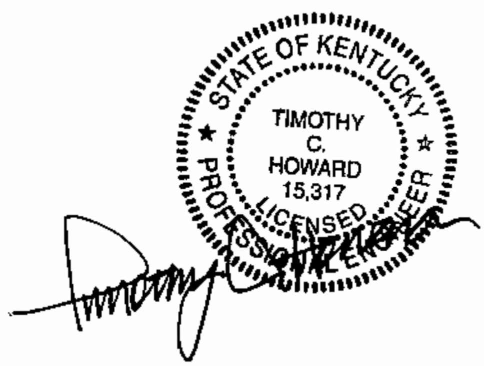
IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	8	3782.498	1.736	0
-260.0	3300.0	11	1	3309.845	1.736	0
-260.0	2685.0	5	1	2697.559	1.902	0
-260.0	2070.0	5	1	2086.265	1.896	0
-260.0	1455.0	11	2	1475.941	1.756	0

-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	8	3568.490	2.236	0
355.0	3300.0	8	8	2988.156	1.884	0
355.0	2685.0	8	8	2415.804	1.774	0
355.0	2070.0	8	6	1858.433	1.848	0
355.0	1455.0	8	8	1265.140	1.728	0
355.0	840.0	8	1	792.105	1.869	0
970.0	3915.0	5	1	3731.650	4.026	0
970.0	3300.0	11	10	2902.726	3.755	0
970.0	2685.0	8	8	2218.553	3.043	0
970.0	2070.0	8	8	1625.022	2.339	0
970.0	1455.0	8	8	1047.693	1.782	0
970.0	840.0	8	7	488.501	1.834	0
1585.0	3915.0	5	1	3576.110	9.032	0
1585.0	3300.0	5	1	2972.740	8.564	0
1585.0	2685.0	5	1	2375.344	8.075	0
1585.0	2070.0	5	1	1789.433	7.181	0
1585.0	1455.0	5	1	1201.154	7.079	0
1585.0	840.0	5	1	616.235	8.944	0
2200.0	3915.0	1	1	3375.933	1000.000	0
2200.0	3300.0	3	1	2798.105	2.119	0
2200.0	2685.0	2	1	2225.864	2.449	0
2200.0	2070.0	1	1	1651.240	2567.762	0
2200.0	1455.0	1	1	1053.355	1000.000	0
2200.0	840.0	1	1	442.593	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.736	2.236	4.026	9.032	1000.000
3300.000	1.736	1.884	3.755	8.564	2.119
2685.000	1.902	1.774	3.043	8.075	2.449
2070.000	1.896	1.848	2.339	7.181	2567.762
1455.000	1.756	1.728	1.782	7.079	1000.000
840.000	1000.000	1.869	1.834	8.944	1000.000



MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 2.119 AT (2200.000,3300.000)
FACTOR OF SAFETY = 1.774 AT (355.000,2685.000)
FACTOR OF SAFETY = 1.728 AT (355.000,1455.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (355.0 , 1455.0) RADIUS 1265.140
THE MINIMUM FACTOR OF SAFETY IS 1.728

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X	CENTER Y	NO. OF CIRCLE			LOWEST	WARNING
COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
355.0	1455.0	8	8	1265.140	1.728	0
379.0	1455.0	8	8	1255.718	1.792	0
331.0	1455.0	8	8	1272.936	1.684	0
307.0	1455.0	8	8	1280.816	1.704	0
331.0	1479.0	8	8	1295.669	1.700	0
331.0	1431.0	8	8	1250.249	1.676	0
331.0	1407.0	8	8	1227.613	1.682	0
355.0	1431.0	8	8	1242.620	1.705	0
307.0	1431.0	8	8	1258.269	1.784	0

337.0	1431.0	8	8	1248.305	1.678	0
325.0	1431.0	8	8	1252.218	1.679	0
331.0	1437.0	8	8	1255.916	1.677	0
331.0	1425.0	8	8	1244.585	1.676	0
331.0	1419.0	8	8	1238.924	1.676	0
337.0	1425.0	8	8	1242.632	1.676	0
325.0	1425.0	8	8	1246.563	1.682	0

AT POINT (331.0 , 1425.0) RADIUS 1244.585

THE MINIMUM FACTOR OF SAFETY IS 1.676

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.460	0.457	0.000	.364	.605E+03	.575E+03	.764E+06	.274E+06
2	2	10.460	1.290	0.000	.373	.171E+04	.162E+04	.164E+07	.792E+06
3	2	10.460	2.012	0.000	.381	.266E+04	.253E+04	.240E+07	.126E+07
4	2	10.460	2.624	0.000	.390	.347E+04	.330E+04	.303E+07	.168E+07
5	2	10.460	3.122	0.000	.398	.413E+04	.393E+04	.354E+07	.205E+07
6	2	10.460	3.507	0.000	.406	.464E+04	.441E+04	.393E+07	.235E+07
7	2	10.460	3.777	0.000	.415	.500E+04	.475E+04	.419E+07	.258E+07
8	2	10.460	3.930	0.000	.423	.520E+04	.494E+04	.433E+07	.274E+07
9	2	10.460	3.965	0.000	.432	.525E+04	.498E+04	.435E+07	.282E+07
10	2	2.498	3.926	0.000	.437	.124E+04	.118E+04	.103E+07	.675E+06
11	2	7.962	1.966	0.000	.441	.198E+04	.188E+04	.175E+07	.109E+07
							SUM	.310E+08	.183E+08

AT CENTER (331.000 , 1425.000) WITH RADIUS 1244.585 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.691
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.676

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	8	3782.498	1.352	0
-260.0	3300.0	11	1	3309.845	1.352	0
-260.0	2685.0	5	1	2697.559	1.442	0
-260.0	2070.0	11	8	2079.505	1.436	0
-260.0	1455.0	11	2	1475.941	1.354	0
-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	8	3568.490	1.646	0
355.0	3300.0	8	8	2988.156	1.432	0
355.0	2685.0	8	8	2415.804	1.364	0
355.0	2070.0	8	6	1858.433	1.407	0
355.0	1455.0	8	8	1265.140	1.337	0
355.0	840.0	8	1	792.105	1.413	0
970.0	3915.0	11	1	3731.650	2.498	0
970.0	3300.0	8	5	2870.125	2.404	0
970.0	2685.0	8	8	2218.553	2.079	0
970.0	2070.0	8	8	1625.022	1.706	0
970.0	1455.0	8	8	1047.693	1.368	0
970.0	840.0	8	7	488.501	1.408	0

1585.0	3915.0	5	1	3576.110	3.905	0
1585.0	3300.0	5	1	2972.740	3.844	0
1585.0	2685.0	5	1	2375.344	3.783	0
1585.0	2070.0	5	1	1789.433	3.540	0
1585.0	1455.0	5	1	1201.154	3.650	0
1585.0	840.0	5	1	616.235	4.794	0
2200.0	3915.0	1	1	3375.933	1000.000	0
2200.0	3300.0	3	1	2798.105	1.620	0
2200.0	2685.0	2	1	2225.864	1.934	0
2200.0	2070.0	1	1	1651.240	7.139	0
2200.0	1455.0	1	1	1053.355	1000.000	0
2200.0	840.0	1	1	442.593	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.352	1.646	2.498	3.905	1000.000
3300.000	1.352	1.432	2.404	3.844	1.620
2685.000	1.442	1.364	2.079	3.783	1.934
2070.000	1.436	1.407	1.706	3.540	7.139
1455.000	1.354	1.337	1.368	3.650	1000.000
840.000	1000.000	1.413	1.408	4.794	1000.000

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.620 AT (2200.000,3300.000)
FACTOR OF SAFETY = 1.364 AT (355.000,2685.000)
FACTOR OF SAFETY = 1.337 AT (355.000,1455.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

STATE OF KENTUCKY
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AT POINT (355.0 , 1455.0) RADIUS 1265.140
THE MINIMUM FACTOR OF SAFETY IS 1.337

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
355.0	1455.0	8	8	1265.140	1.337	0
379.0	1455.0	8	8	1255.718	1.379	0
331.0	1455.0	8	8	1272.936	1.313	0
307.0	1455.0	8	8	1280.816	1.340	0
331.0	1479.0	8	8	1295.669	1.321	0
331.0	1431.0	8	8	1250.249	1.311	0
331.0	1407.0	8	8	1227.613	1.321	0
355.0	1431.0	8	8	1242.620	1.323	0
307.0	1431.0	8	1	1384.202	1.371	0
337.0	1431.0	8	8	1248.305	1.310	0
343.0	1431.0	8	8	1246.385	1.312	0
337.0	1437.0	8	8	1253.980	1.311	0
337.0	1425.0	8	8	1242.632	1.309	0
337.0	1419.0	8	8	1236.963	1.309	0
337.0	1413.0	8	8	1231.296	1.310	0
343.0	1419.0	8	8	1235.025	1.309	0
349.0	1419.0	8	8	1233.113	1.312	0
343.0	1425.0	8	8	1240.704	1.310	0
343.0	1413.0	8	8	1229.350	1.308	0
343.0	1407.0	8	8	1223.678	1.308	0
343.0	1401.0	8	8	1218.009	1.308	0
349.0	1407.0	8	8	1221.748	1.308	0

337.0 1407.0 8 8 1225.633 1.311 0
AT POINT (343.0 , 1407.0) RADIUS 1223.678

THE MINIMUM FACTOR OF SAFETY IS 1.308

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.806	0.508	0.000	.359	.694E+03	.660E+03	.810E+06	.384E+06
2	2	10.806	1.436	0.000	.368	.196E+04	.186E+04	.176E+07	.111E+07
3	2	10.806	2.245	0.000	.377	.307E+04	.291E+04	.259E+07	.176E+07
4	2	10.806	2.934	0.000	.386	.401E+04	.381E+04	.328E+07	.234E+07
5	2	10.806	3.501	0.000	.395	.479E+04	.455E+04	.384E+07	.285E+07
6	2	10.806	3.945	0.000	.403	.539E+04	.512E+04	.427E+07	.326E+07
7	2	10.806	4.265	0.000	.412	.583E+04	.554E+04	.457E+07	.359E+07
8	2	10.806	4.459	0.000	.421	.610E+04	.579E+04	.474E+07	.382E+07
9	2	10.806	4.525	0.000	.430	.619E+04	.588E+04	.479E+07	.394E+07
10	2	1.608	4.504	0.000	.435	.916E+03	.870E+03	.707E+06	.588E+06
11	2	9.198	2.261	0.000	.439	.263E+04	.250E+04	.215E+07	.170E+07
							SUM	.335E+08	.253E+08

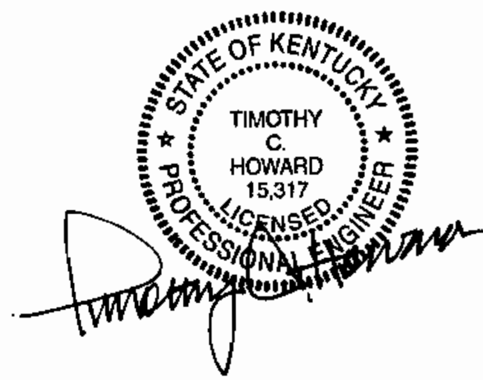
AT CENTER (343.000 , 1407.000) WITH RADIUS 1223.678 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.323
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.308

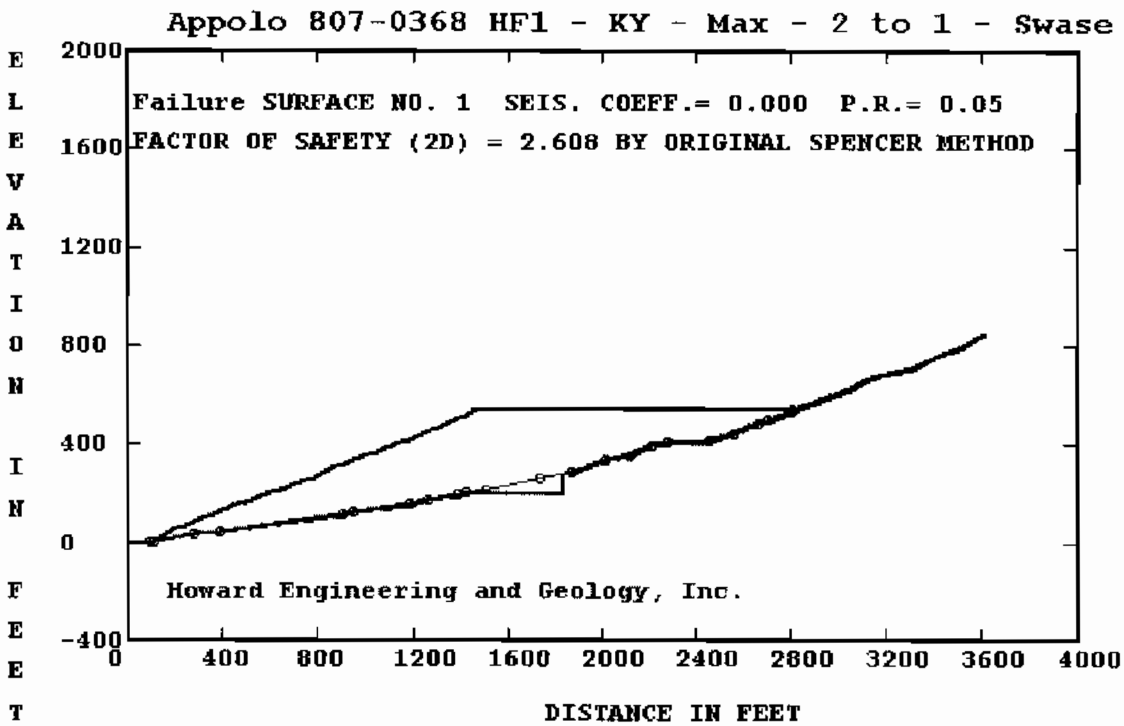
SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.676

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.308





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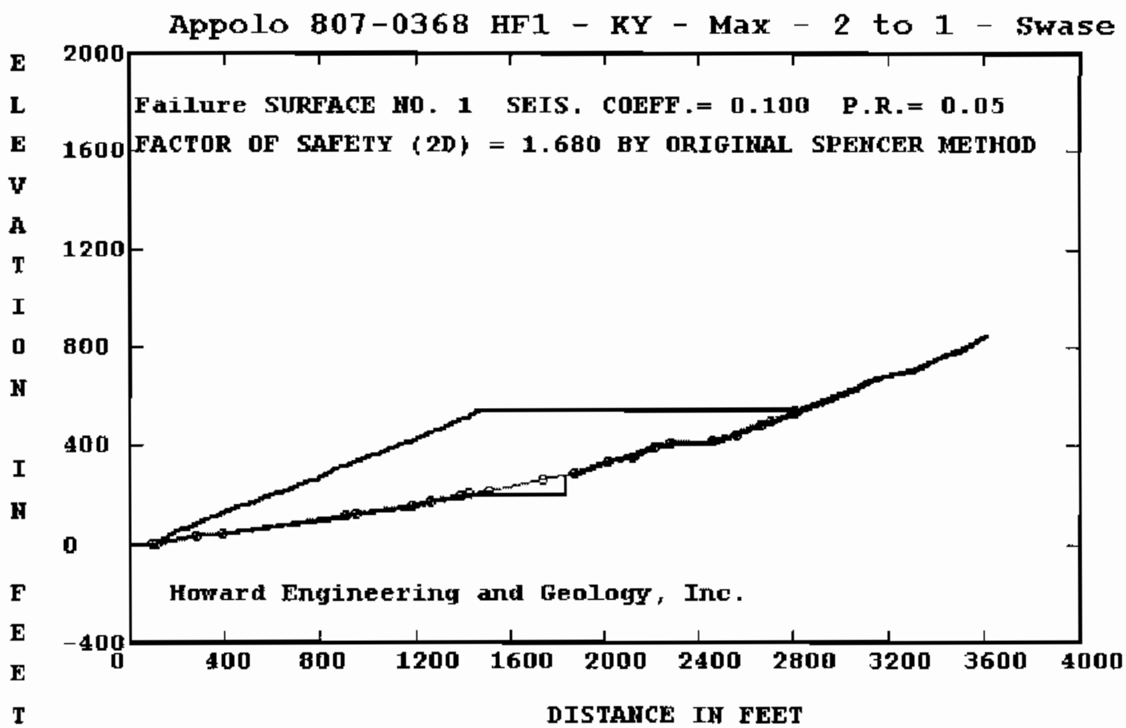
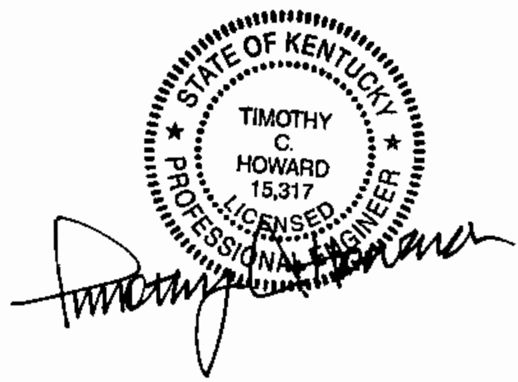

Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.100 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.680 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000


STATE OF KENTUCKY
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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\K-X-V-S.DAT

TITLE -Appolo 807-0368 HF1 - KY - Max - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

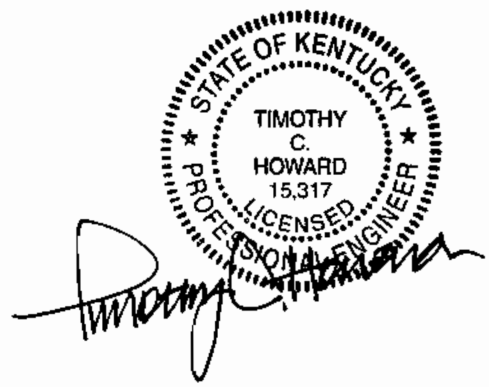
ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849



NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

8	X COORD.= 1262	Y COORD.= 180
9	X COORD.= 1392	Y COORD.= 200
10	X COORD.= 1840	Y COORD.= 200
11	X COORD.= 1840	Y COORD.= 279
12	X COORD.= 1859	Y COORD.= 285
13	X COORD.= 1873	Y COORD.= 290
14	X COORD.= 2021	Y COORD.= 340
15	X COORD.= 2123	Y COORD.= 360
16	X COORD.= 2215	Y COORD.= 400
17	X COORD.= 2284	Y COORD.= 410
18	X COORD.= 2455	Y COORD.= 420
19	X COORD.= 2560	Y COORD.= 450
20	X COORD.= 2662	Y COORD.= 490
21	X COORD.= 2704	Y COORD.= 500
22	X COORD.= 3053	Y COORD.= 630
23	X COORD.= 3111	Y COORD.= 660
24	X COORD.= 3169	Y COORD.= 680
25	X COORD.= 3309	Y COORD.= 710
26	X COORD.= 3417	Y COORD.= 760
27	X COORD.= 3503	Y COORD.= 790
28	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 31

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 205	Y COORD.= 60
4	X COORD.= 225	Y COORD.= 60
5	X COORD.= 327	Y COORD.= 110
6	X COORD.= 349	Y COORD.= 110
7	X COORD.= 460	Y COORD.= 160
8	X COORD.= 482	Y COORD.= 160
9	X COORD.= 602	Y COORD.= 210
10	X COORD.= 627	Y COORD.= 210
11	X COORD.= 749	Y COORD.= 260
12	X COORD.= 771	Y COORD.= 260
13	X COORD.= 876	Y COORD.= 310
14	X COORD.= 897	Y COORD.= 310
15	X COORD.= 1011	Y COORD.= 360
16	X COORD.= 1035	Y COORD.= 360
17	X COORD.= 1145	Y COORD.= 410
18	X COORD.= 1166	Y COORD.= 410
19	X COORD.= 1268	Y COORD.= 460
20	X COORD.= 1288	Y COORD.= 460
21	X COORD.= 1389	Y COORD.= 510
22	X COORD.= 1410	Y COORD.= 510
23	X COORD.= 1470	Y COORD.= 540
24	X COORD.= 2811	Y COORD.= 540
25	X COORD.= 3053	Y COORD.= 630
26	X COORD.= 3111	Y COORD.= 660
27	X COORD.= 3169	Y COORD.= 680
28	X COORD.= 3309	Y COORD.= 710
29	X COORD.= 3417	Y COORD.= 760
30	X COORD.= 3503	Y COORD.= 790
31	X COORD.= 3613	Y COORD.= 849

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
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LINE NO. AND SLOPE OF EACH SEGMENT ARE:

1	-0.250	0.086	0.169	0.096	0.135	0.233
	0.123	0.274	0.154	0.313	0.000	99999.000
	0.176	0.336	0.196	0.440	0.147	0.058
	0.283	0.396	0.238	0.371	0.517	0.351
	0.214	0.459	0.349	0.537	1.000	
2	0.095	0.169	0.096	0.135	0.233	0.123
	0.274	0.154	0.000	99999.000	0.316	0.357

	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.490	0.000	0.450
	0.000	0.417	0.000	0.410	0.000	0.476
	0.000	0.439	0.000	0.455	0.000	0.490
	0.000	0.495	0.000	0.500	0.000	0.372
	0.517	0.345	0.214	0.463	0.349	0.536

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL NO.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

STATE OF KENTUCKY
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NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 23

1	X COORD.= 93	Y COORD.= 8
2	X COORD.= 105	Y COORD.= 7
3	X COORD.= 282	Y COORD.= 37
4	X COORD.= 387	Y COORD.= 47
5	X COORD.= 904	Y COORD.= 117
6	X COORD.= 947	Y COORD.= 127
7	X COORD.= 1190	Y COORD.= 157
8	X COORD.= 1263	Y COORD.= 177
9	X COORD.= 1392	Y COORD.= 197
10	X COORD.= 1426	Y COORD.= 207
11	X COORD.= 1509	Y COORD.= 217
12	X COORD.= 1740	Y COORD.= 267
13	X COORD.= 1874	Y COORD.= 287
14	X COORD.= 2022	Y COORD.= 337
15	X COORD.= 2124	Y COORD.= 357
16	X COORD.= 2215	Y COORD.= 397
17	X COORD.= 2284	Y COORD.= 407
18	X COORD.= 2456	Y COORD.= 417
19	X COORD.= 2561	Y COORD.= 447
20	X COORD.= 2662	Y COORD.= 487
21	X COORD.= 2705	Y COORD.= 497
22	X COORD.= 2807	Y COORD.= 535
23	X COORD.= 2811	Y COORD.= 540

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.608

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	16.800	1.500	0.000	-0.083	.315E+04	.284E+04	.636E+07	-.421E+06
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.184E+09	.667E+08
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.607E+08	.235E+08
4	1	57.000	41.801	0.000	0.167	.301E+06	.271E+06	.207E+09	.814E+08
5	1	45.000	59.828	0.000	0.095	.340E+06	.306E+06	.231E+09	.520E+08
6	1	22.000	67.667	0.000	0.095	.188E+06	.169E+06	.127E+09	.288E+08
7	1	11.480	68.658	0.000	0.095	.997E+05	.897E+05	.671E+08	.152E+08
8	1	26.520	75.407	0.000	0.095	.253E+06	.228E+06	.170E+09	.387E+08
9	1	73.000	91.617	0.000	0.134	.846E+06	.761E+06	.563E+09	.184E+09
10	1	22.000	101.627	0.000	0.134	.283E+06	.254E+06	.188E+09	.615E+08
11	1	120.000	117.014	0.000	0.134	.178E+07	.160E+07	.117E+10	.386E+09
12	1	25.000	132.197	0.000	0.134	.418E+06	.376E+06	.275E+09	.909E+08
13	1	5.760	131.295	0.000	0.134	.956E+05	.861E+05	.631E+08	.208E+08
14	1	116.240	148.036	0.000	0.134	.218E+07	.196E+07	.143E+10	.473E+09
15	1	22.000	162.497	0.000	0.134	.452E+06	.407E+06	.297E+09	.983E+08
16	1	105.000	178.899	0.000	0.134	.238E+07	.214E+07	.156E+10	.517E+09
17	1	21.000	195.369	0.000	0.134	.519E+06	.467E+06	.339E+09	.113E+09
18	1	7.000	195.009	0.000	0.134	.173E+06	.155E+06	.113E+09	.375E+08
19	1	1.040	196.177	0.000	0.227	.258E+05	.232E+05	.172E+08	.981E+07
20	1	41.960	200.607	0.000	0.227	.106E+07	.958E+06	.709E+09	.405E+09
21	1	64.000	215.014	0.000	0.123	.174E+07	.157E+07	.113E+10	.343E+09
22	1	24.000	223.617	0.000	0.123	.679E+06	.611E+06	.440E+09	.134E+09
23	1	110.000	240.346	0.000	0.123	.334E+07	.301E+07	.217E+10	.659E+09
24	1	21.000	257.259	0.000	0.123	.683E+06	.615E+06	.442E+09	.135E+09
25	1	11.320	258.039	0.000	0.123	.369E+06	.333E+06	.239E+09	.728E+08
26	1	12.680	262.440	0.000	0.123	.421E+06	.379E+06	.272E+09	.829E+08
27	1	73.000	272.657	0.000	0.264	.252E+07	.227E+07	.171E+10	.115E+10
28	1	5.000	281.387	0.000	0.153	.178E+06	.160E+06	.116E+09	.444E+08
29	1	20.000	280.674	0.000	0.153	.710E+06	.639E+06	.463E+09	.177E+09
30	1	101.000	296.295	0.000	0.153	.379E+07	.341E+07	.247E+10	.945E+09
31	1	3.000	313.233	0.000	0.153	.119E+06	.107E+06	.775E+08	.297E+08
32	1	10.200	311.500	0.000	0.282	.402E+06	.362E+06	.276E+09	.200E+09
33	2	7.800	308.853	0.000	0.282	.305E+06	.290E+06	.357E+09	.152E+09
34	2	16.000	309.353	0.000	0.282	.626E+06	.595E+06	.733E+09	.312E+09
35	2	23.600	315.478	0.000	0.120	.942E+06	.895E+06	.102E+10	.178E+09
36	2	20.400	323.828	0.000	0.120	.836E+06	.794E+06	.907E+09	.158E+09
37	2	39.000	325.349	0.000	0.120	.161E+07	.152E+07	.174E+10	.304E+09
38	2	212.880	299.961	0.000	0.212	.808E+07	.767E+07	.927E+10	.291E+10
39	2	18.120	274.961	0.000	0.212	.630E+06	.599E+06	.724E+09	.227E+09
40	2	134.000	263.000	0.000	0.148	.446E+07	.424E+07	.489E+10	.106E+10
41	1	120.160	232.703	0.000	0.320	.354E+07	.318E+07	.255E+10	.212E+10
42	1	27.840	207.703	0.000	0.320	.731E+06	.658E+06	.529E+09	.438E+09
43	1	102.000	193.000	0.000	0.192	.249E+07	.224E+07	.165E+10	.794E+09
44	1	91.000	163.000	0.000	0.402	.188E+07	.169E+07	.142E+10	.152E+10
45	1	51.440	139.273	0.000	0.143	.906E+06	.815E+06	.565E+09	.200E+09
46	1	17.560	134.273	0.000	0.143	.298E+06	.268E+06	.186E+09	.658E+08
47	1	172.000	128.000	0.000	0.058	.278E+07	.251E+07	.154E+10	.219E+09
48	1	82.720	111.183	0.000	0.275	.116E+07	.105E+07	.850E+09	.588E+09
49	1	22.280	96.183	0.000	0.275	.271E+06	.244E+06	.199E+09	.137E+09
50	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.745E+09	.701E+09
51	1	43.000	48.000	0.000	0.227	.261E+06	.235E+06	.187E+09	.101E+09
52	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.268E+09	.217E+09
53	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.373E+07	.281E+07
54	2	0.164	0.102	0.000	0.781	.211E+01	.200E+01	.177E+05	.474E+04
		SUM						.479E+11	.191E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 2.512

THRUST INCLINATION MOMENT F.S. FORCE F.S.

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0.000	2.614	2.579
0.300	2.609	2.620
0.600	2.629	2.668

FROM ORIGINAL SPENCER METHOD, DEL = 0.216 AND F. S. = 2.608

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.680

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	16.800	1.500	0.000	-0.083	.315E+04	.284E+04	.638E+07	.845E+05
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.181E+09	.106E+09
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.598E+08	.372E+08
4	1	57.000	41.801	0.000	0.167	.301E+06	.271E+06	.204E+09	.129E+09
5	1	45.000	59.828	0.000	0.095	.340E+06	.306E+06	.229E+09	.106E+09
6	1	22.000	67.667	0.000	0.095	.188E+06	.169E+06	.126E+09	.583E+08
7	1	11.480	68.658	0.000	0.095	.997E+05	.897E+05	.665E+08	.309E+08
8	1	26.520	75.407	0.000	0.095	.253E+06	.228E+06	.168E+09	.782E+08
9	1	73.000	91.617	0.000	0.134	.846E+06	.761E+06	.556E+09	.316E+09
10	1	22.000	101.627	0.000	0.134	.283E+06	.254E+06	.185E+09	.105E+09
11	1	120.000	117.014	0.000	0.134	.178E+07	.160E+07	.116E+10	.660E+09
12	1	25.000	132.197	0.000	0.134	.418E+06	.376E+06	.272E+09	.155E+09
13	1	5.760	131.295	0.000	0.134	.956E+05	.861E+05	.622E+08	.355E+08
14	1	116.240	148.036	0.000	0.134	.218E+07	.196E+07	.141E+10	.805E+09
15	1	22.000	162.497	0.000	0.134	.452E+06	.407E+06	.293E+09	.167E+09
16	1	105.000	178.899	0.000	0.134	.238E+07	.214E+07	.154E+10	.875E+09
17	1	21.000	195.369	0.000	0.134	.519E+06	.467E+06	.335E+09	.191E+09
18	1	7.000	195.009	0.000	0.134	.173E+06	.155E+06	.111E+09	.634E+08
19	1	1.040	196.177	0.000	0.227	.258E+05	.232E+05	.168E+08	.137E+08
20	1	41.960	200.607	0.000	0.227	.106E+07	.958E+06	.693E+09	.567E+09
21	1	64.000	215.014	0.000	0.123	.174E+07	.157E+07	.112E+10	.600E+09
22	1	24.000	223.617	0.000	0.123	.679E+06	.611E+06	.435E+09	.234E+09
23	1	110.000	240.346	0.000	0.123	.334E+07	.301E+07	.214E+10	.115E+10
24	1	21.000	257.259	0.000	0.123	.683E+06	.615E+06	.437E+09	.234E+09
25	1	11.320	258.039	0.000	0.123	.369E+06	.333E+06	.236E+09	.127E+09
26	1	12.680	262.440	0.000	0.123	.421E+06	.379E+06	.269E+09	.144E+09
27	1	73.000	272.657	0.000	0.264	.252E+07	.227E+07	.166E+10	.154E+10
28	1	5.000	281.387	0.000	0.153	.178E+06	.160E+06	.114E+09	.703E+08
29	1	20.000	280.674	0.000	0.153	.710E+06	.639E+06	.456E+09	.280E+09
30	1	101.000	296.295	0.000	0.153	.379E+07	.341E+07	.243E+10	.149E+10
31	1	3.000	313.233	0.000	0.153	.119E+06	.107E+06	.763E+08	.467E+08
32	1	10.200	311.500	0.000	0.282	.402E+06	.362E+06	.268E+09	.261E+09
33	2	7.800	308.853	0.000	0.282	.305E+06	.290E+06	.346E+09	.199E+09
34	2	16.000	309.353	0.000	0.282	.626E+06	.595E+06	.712E+09	.408E+09
35	2	23.600	315.478	0.000	0.120	.942E+06	.895E+06	.101E+10	.311E+09
36	2	20.400	323.828	0.000	0.120	.836E+06	.794E+06	.896E+09	.275E+09
37	2	39.000	325.349	0.000	0.120	.161E+07	.152E+07	.172E+10	.529E+09
38	2	212.880	299.961	0.000	0.212	.808E+07	.767E+07	.907E+10	.412E+10
39	2	18.120	274.961	0.000	0.212	.630E+06	.599E+06	.708E+09	.322E+09
40	2	134.000	263.000	0.000	0.148	.446E+07	.424E+07	.482E+10	.170E+10
41	1	120.160	232.703	0.000	0.320	.354E+07	.318E+07	.247E+10	.269E+10
42	1	27.840	207.703	0.000	0.320	.731E+06	.658E+06	.511E+09	.557E+09
43	1	102.000	193.000	0.000	0.192	.249E+07	.224E+07	.162E+10	.117E+10
44	1	91.000	163.000	0.000	0.402	.188E+07	.169E+07	.136E+10	.185E+10
45	1	51.440	139.273	0.000	0.143	.906E+06	.815E+06	.557E+09	.329E+09
46	1	17.560	134.273	0.000	0.143	.298E+06	.268E+06	.184E+09	.108E+09

47	1	172.000	128.000	0.000	0.058	.278E+07	.251E+07	.154E+10	.573E+09
48	1	82.720	111.183	0.000	0.275	.116E+07	.105E+07	.827E+09	.781E+09
49	1	22.280	96.183	0.000	0.275	.271E+06	.244E+06	.194E+09	.182E+09
50	1	101.000	73.000	0.000	0.368	.932E+06	.839E+06	.717E+09	.868E+09
51	1	43.000	48.000	0.000	0.227	.261E+06	.235E+06	.183E+09	.143E+09
52	1	102.000	24.000	0.000	0.349	.309E+06	.278E+06	.259E+09	.272E+09
53	1	3.837	2.602	0.000	0.781	.125E+04	.113E+04	.362E+07	.303E+07
54	2	0.164	0.102	0.000	0.781	.211E+01	.200E+01	.173E+05	.511E+04
		SUM						.470E+11	.280E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.676

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.720	1.656
0.300	1.713	1.680
0.600	1.724	1.710

FROM ORIGINAL SPENCER METHOD, DEL = 0.300 AND F. S. = 1.680

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.608

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.680

Timothy Howard

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Appolo 807-0368 HF1 - KY - Max - Std - Circular [K-X-V-C.TXT]

AT CENTER (331.000 , 1425.000) WITH RADIUS 1244.585 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.691
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.676
AT CENTER (343.000 , 1407.000) WITH RADIUS 1223.678 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.323
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.308

0 =	0 ,	0	35 =	1189 ,	160	70 =	1268 ,	460
1 =	12 ,	-3	36 =	1262 ,	180	71 =	1288 ,	460
2 =	105 ,	5	37 =	1392 ,	200	72 =	1389 ,	510
3 =	283 ,	35	38 =	1859 ,	285	73 =	1410 ,	510
4 =	387 ,	45	39 =	1873 ,	290	74 =	1470 ,	540
5 =	904 ,	115	40 =	2021 ,	340	75 =	2811 ,	540
6 =	947 ,	125	41 =	2123 ,	360			
7 =	1190 ,	155	42 =	2215 ,	400			
8 =	1263 ,	175	43 =	2284 ,	410			
9 =	1393 ,	195	44 =	2455 ,	420			
10 =	1409 ,	200	45 =	2560 ,	450			
11 =	1840 ,	200	46 =	2662 ,	490			
12 =	1840 ,	279	47 =	2704 ,	500			
13 =	1874 ,	285	48 =	3053 ,	630			
14 =	2023 ,	335	49 =	3111 ,	660			
15 =	2125 ,	355	50 =	3169 ,	680			
16 =	2216 ,	395	51 =	3309 ,	710			
17 =	2284 ,	405	52 =	3417 ,	760			
18 =	2456 ,	415	53 =	3503 ,	790			
19 =	2562 ,	445	54 =	205 ,	60			
20 =	2663 ,	485	55 =	225 ,	60			
21 =	2705 ,	495	56 =	327 ,	110			
22 =	3055 ,	625	57 =	349 ,	110			
23 =	3113 ,	655	58 =	460 ,	160			
24 =	3170 ,	675	59 =	482 ,	160			
25 =	3310 ,	705	60 =	602 ,	210			
26 =	3419 ,	755	61 =	627 ,	210			
27 =	3505 ,	785	62 =	749 ,	260			
28 =	3600 ,	836	63 =	771 ,	260			
29 =	3613 ,	849	64 =	876 ,	310			
30 =	105 ,	10	65 =	897 ,	310			
31 =	282 ,	40	66 =	1011 ,	360			
32 =	386 ,	50	67 =	1035 ,	360			
33 =	903 ,	120	68 =	1145 ,	410			
34 =	946 ,	130	69 =	1166 ,	410			

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Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing

N
W E
S

Prepared By
HOWARD
Engineering and Geology, Inc.

Scale: None

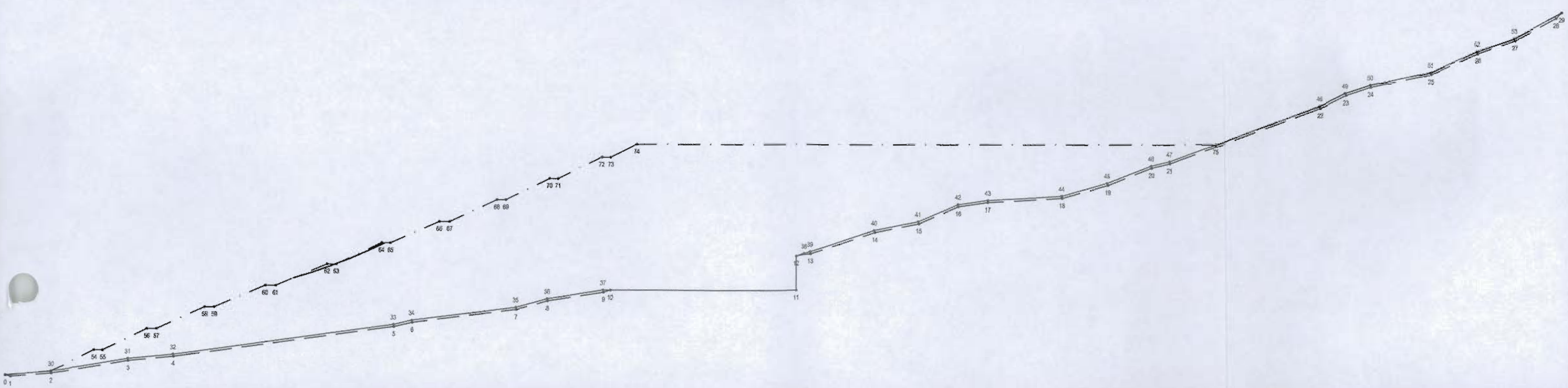
Attachment 26.3.A

DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\BFG\Reame 0910\K-X-V-C.dwg

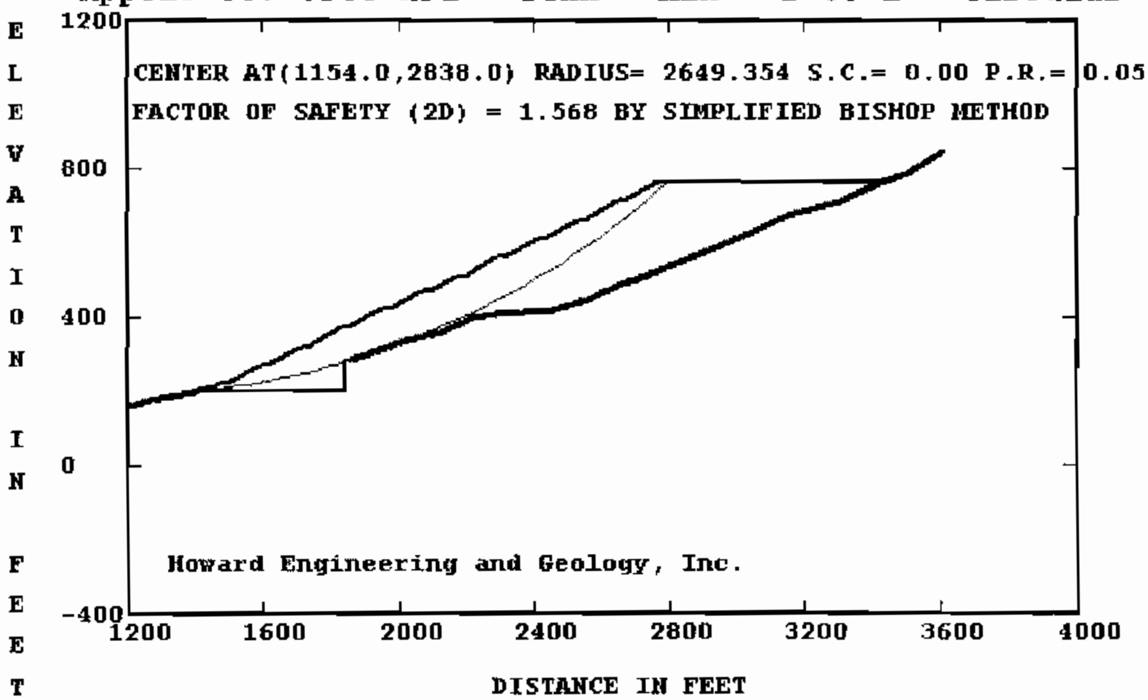
I, Timothy C. Howard, P.E. No. 15,317

Date: 10/6/04

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.



Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Circular



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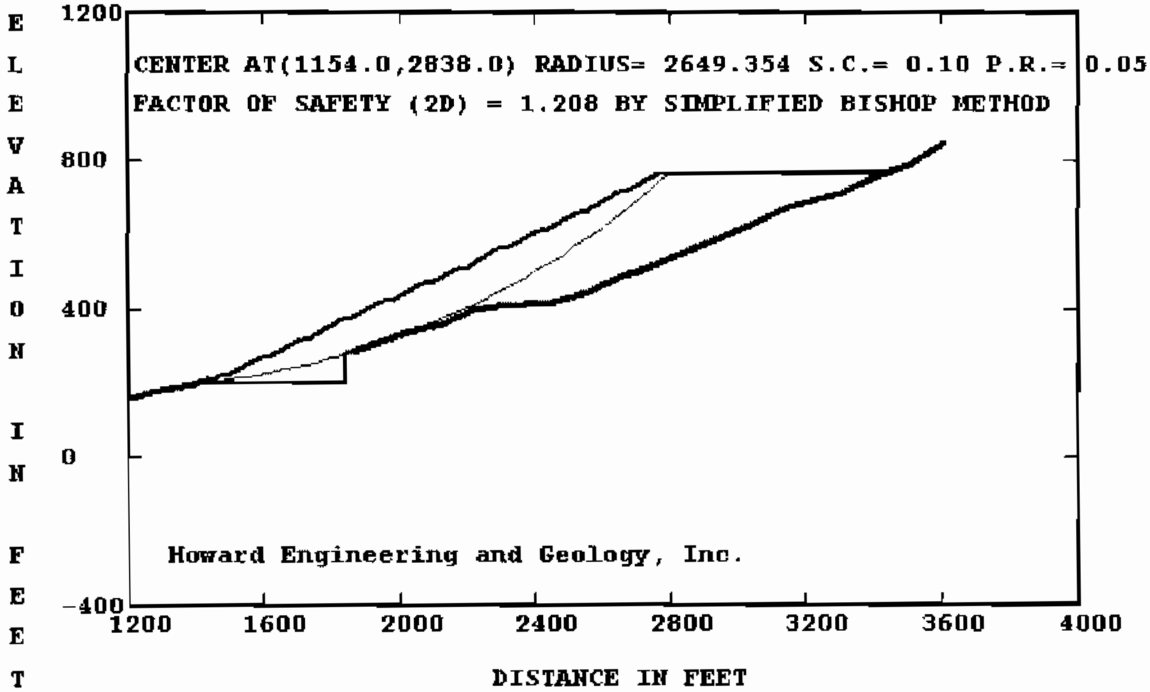
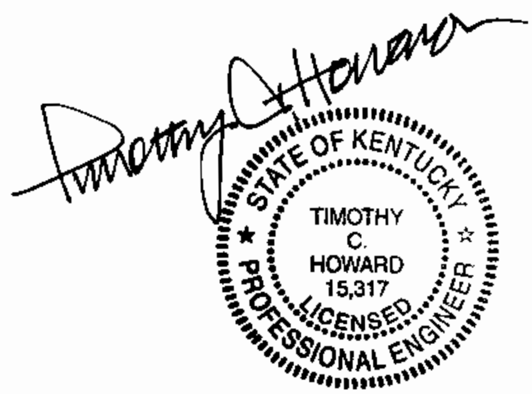
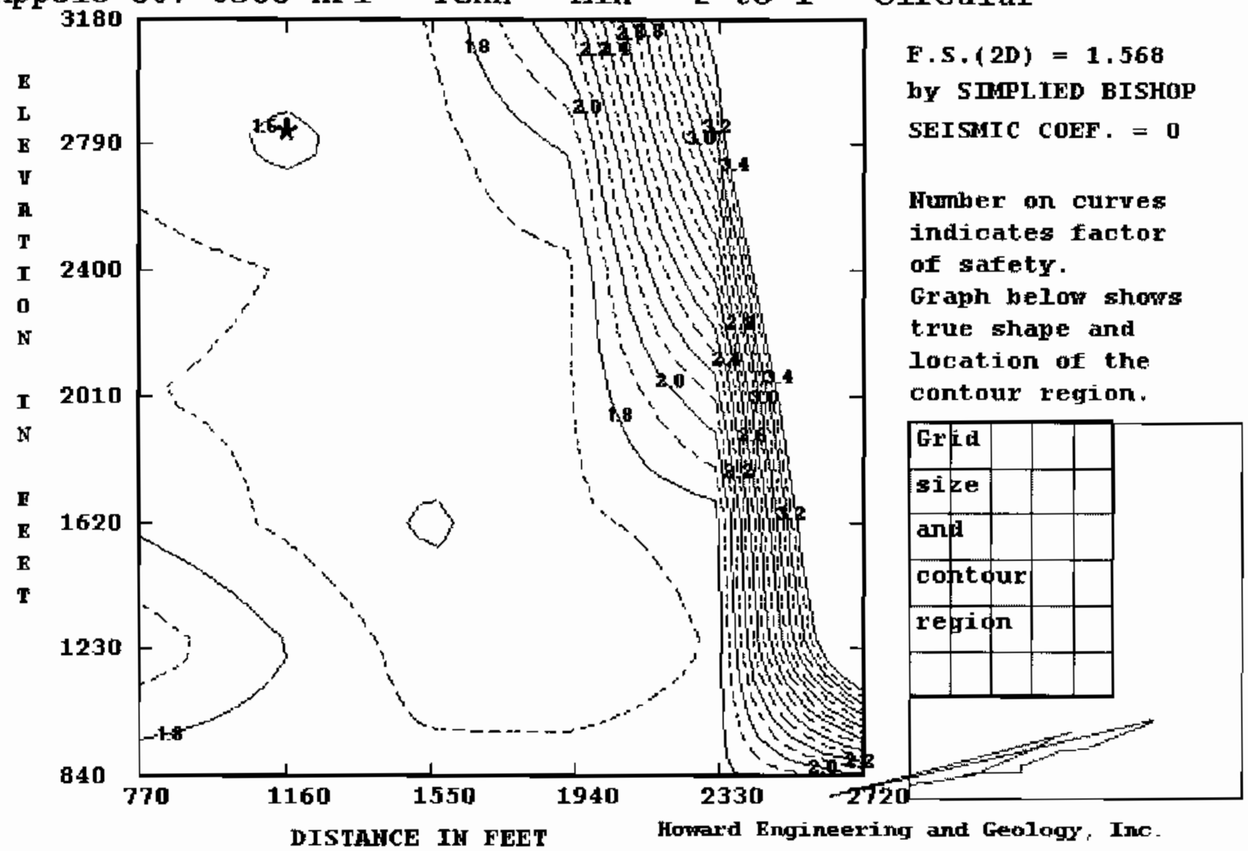
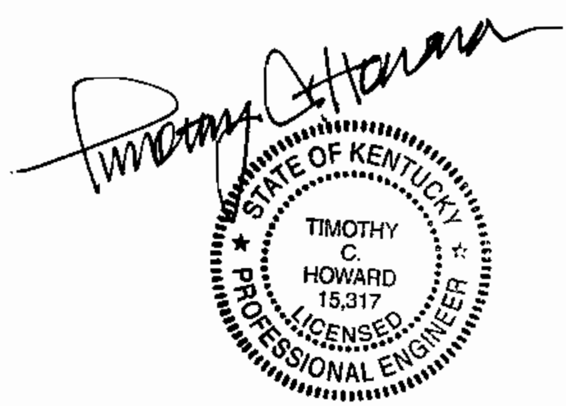


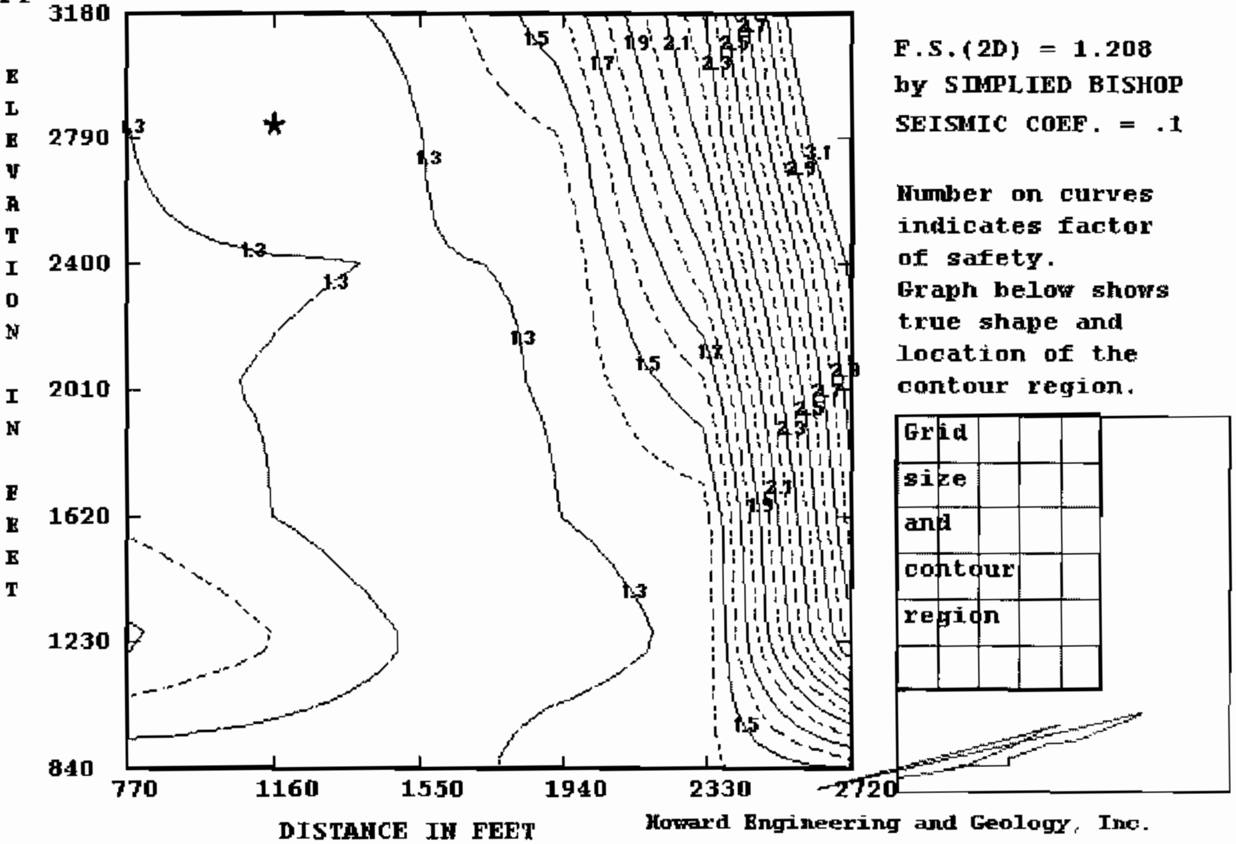


Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Circular





Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Circular



F.S.(2D) = 1.208
by SIMPLIED BISHOP
SEISMIC COEF. = .1

Number on curves indicates factor of safety.
Graph below shows true shape and location of the contour region.

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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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INPUT FILE NAME -R:\T-I-2-C.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849

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NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

```
 8  X COORD.= 1262          Y COORD.= 180
 9  X COORD.= 1392          Y COORD.= 200
 10 X COORD.= 1840          Y COORD.= 200
 11 X COORD.= 1840          Y COORD.= 279
 12 X COORD.= 1859          Y COORD.= 285
 13 X COORD.= 1873          Y COORD.= 290
 14 X COORD.= 2021          Y COORD.= 340
 15 X COORD.= 2123          Y COORD.= 360
 16 X COORD.= 2215          Y COORD.= 400
 17 X COORD.= 2284          Y COORD.= 410
 18 X COORD.= 2455          Y COORD.= 420
 19 X COORD.= 2560          Y COORD.= 450
 20 X COORD.= 2662          Y COORD.= 490
 21 X COORD.= 2704          Y COORD.= 500
 22 X COORD.= 3053          Y COORD.= 630
 23 X COORD.= 3111          Y COORD.= 660
 24 X COORD.= 3169          Y COORD.= 680
 25 X COORD.= 3309          Y COORD.= 710
 26 X COORD.= 3417          Y COORD.= 760
 27 X COORD.= 3503          Y COORD.= 790
 28 X COORD.= 3613          Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 30
 1  X COORD.= 1262          Y COORD.= 180
 2  X COORD.= 1392          Y COORD.= 200
 3  X COORD.= 1425          Y COORD.= 210
 4  X COORD.= 1457          Y COORD.= 213
 5  X COORD.= 1469          Y COORD.= 220
 6  X COORD.= 1489          Y COORD.= 220
 7  X COORD.= 1589          Y COORD.= 270
 8  X COORD.= 1609          Y COORD.= 270
 9  X COORD.= 1709          Y COORD.= 320
 10 X COORD.= 1729          Y COORD.= 320
 11 X COORD.= 1829          Y COORD.= 370
 12 X COORD.= 1849          Y COORD.= 370
 13 X COORD.= 1949          Y COORD.= 420
 14 X COORD.= 1969          Y COORD.= 420
 15 X COORD.= 2069          Y COORD.= 470
 16 X COORD.= 2089          Y COORD.= 470
 17 X COORD.= 2169          Y COORD.= 510
 18 X COORD.= 2189          Y COORD.= 510
 19 X COORD.= 2289          Y COORD.= 560
 20 X COORD.= 2309          Y COORD.= 560
 21 X COORD.= 2409          Y COORD.= 610
 22 X COORD.= 2429          Y COORD.= 610
 23 X COORD.= 2529          Y COORD.= 660
 24 X COORD.= 2549          Y COORD.= 660
 25 X COORD.= 2649          Y COORD.= 710
 26 X COORD.= 2669          Y COORD.= 710
 27 X COORD.= 2769          Y COORD.= 760
 28 X COORD.= 3417          Y COORD.= 760
 29 X COORD.= 3503          Y COORD.= 790
 30 X COORD.= 3613          Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250       0.086       0.169       0.096       0.135       0.233
         0.123       0.274       0.154       0.313       0.000   99999.000
         0.176       0.336       0.196       0.440       0.147       0.058
         0.283       0.396       0.238       0.371       0.517       0.351
         0.214       0.459       0.349       0.537       1.000
 2       0.095       0.169       0.096       0.135       0.233       0.123
         0.274       0.154       0.000   99999.000       0.316       0.357
         0.338       0.196       0.435       0.145       0.058       0.286
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15,317
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PROFESSIONAL ENGINEER

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          0.392       0.238       0.372       0.517       0.345       0.214
          0.463       0.349       0.536
  3       0.154       0.303       0.094       0.583       0.000       0.500
          0.000       0.500       0.000       0.500       0.000       0.500
          0.000       0.500       0.000       0.500       0.000       0.500
          0.000       0.500       0.000       0.500       0.000       0.500
          0.000       0.500       0.000       0.349       0.536

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1
LINE NO. (LINO)  BEG. NO. (NBP)  END NO. (NEP)
      1                1              30

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION    FRIC. ANGLE     UNIT WEIGHTT
 NO.   (TSSE)    (C)         (PHID)           (G)
  1       1   160.000        24.000         125.000
  2       1    20.000        36.000         126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. = 1160   Y COORD. = 2790
POINT 2 X COORD. = 1160   Y COORD. = 840
POINT 3 X COORD. = 2720   Y COORD. = 840

X INCREMENT (XINC) = 24      Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER  X   CENTER  Y      NO. OF CIRCLE          LOWEST   WARNING
COORDINATE  COORDINATE   TOTAL CRITIC. RADIUS      F.S.
  1160.0      2790.0       11     1   2601.446     1.575       0
  1160.0      2400.0       11    10   2156.203     1.695       0
  1160.0      2010.0       17    14   1796.333     1.676       0
  1160.0      1620.0       11     8   1437.092     1.681       0
  1160.0      1230.0        5     1   1054.943     1.806       1
  1160.0       840.0        1     1    667.835  1000.000       1
```

1550.0	2790.0	8	8	2350.272	1.663	0
1550.0	2400.0	8	8	1989.350	1.649	0
1550.0	2010.0	8	1	1740.504	1.649	0
1550.0	1620.0	8	1	1368.716	1.584	0
1550.0	1230.0	8	8	907.505	1.645	0
1550.0	840.0	11	10	570.093	1.731	0
1940.0	2790.0	8	8	2203.594	1.820	0
1940.0	2400.0	8	8	1842.254	1.682	0
1940.0	2010.0	8	5	1505.999	1.693	0
1940.0	1620.0	8	6	1134.899	1.683	0
1940.0	1230.0	8	8	761.548	1.592	0
1940.0	840.0	8	6	409.797	1.759	0
2330.0	2790.0	8	6	2106.495	3.209	0
2330.0	2400.0	8	7	1719.228	2.678	0
2330.0	2010.0	8	8	1336.144	2.117	0
2330.0	1620.0	8	8	975.220	1.743	0
2330.0	1230.0	8	8	614.316	1.714	0
2330.0	840.0	8	6	271.450	1.773	0
2720.0	2790.0	5	1	2136.570	6.986	0
2720.0	2400.0	5	1	1782.730	5.892	0
2720.0	2010.0	5	1	1408.803	5.298	0
2720.0	1620.0	5	1	1041.957	4.817	0
2720.0	1230.0	11	1	683.785	4.182	0
2720.0	840.0	8	8	104.704	1.945	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

1160.0	3180.0	11	1	2973.011	1.663	0
1550.0	3180.0	8	8	2711.464	1.699	0
1940.0	3180.0	8	8	2569.319	2.131	0
2330.0	3180.0	11	1	2642.087	3.582	0
2720.0	3180.0	5	1	2496.199	8.251	0
770.0	3180.0	14	5	3009.033	1.641	1
770.0	2790.0	11	6	2649.488	1.658	1
770.0	2400.0	1	1	2273.865	1000.000	1
770.0	2010.0	1	0	1892.484	1000.000	0
770.0	1620.0	1	0	1505.423	1000.000	0
770.0	1230.0	1	0	1119.086	1000.000	0
770.0	840.0	1	0	736.424	1000.000	0

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LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	770.000	1160.000	1550.000	1940.000	2330.000	2720.000
3180.000	1.641	1.663	1.699	2.131	3.582	8.251
2790.000	1.658	1.575	1.663	1.820	3.209	6.986
2400.000	1000.000	1.695	1.649	1.682	2.678	5.892
2010.000	1000.000	1.676	1.649	1.693	2.117	5.298
1620.000	1000.000	1.681	1.584	1.683	1.743	4.817
1230.000	1000.000	1.806	1.645	1.592	1.714	4.182
840.000	1000.000	1000.000	1.731	1.759	1.773	1.945

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 1.641 AT (770.000,3180.000)
FACTOR OF SAFETY = 1.575 AT (1160.000,2790.000)
FACTOR OF SAFETY = 1.584 AT (1550.000,1620.000)
FACTOR OF SAFETY = 1.592 AT (1940.000,1230.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (1160.0 , 2790.0) RADIUS 2601.446
THE MINIMUM FACTOR OF SAFETY IS 1.575

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1160.0	2790.0	11	1	2601.446	1.575	0
1184.0	2790.0	11	1	2594.367	1.578	0
1136.0	2790.0	11	8	2547.274	1.695	0
1160.0	2814.0	11	1	2624.619	1.573	0
1160.0	2838.0	11	1	2647.508	1.572	0
1160.0	2862.0	11	1	2670.261	1.579	0
1184.0	2838.0	11	1	2639.873	1.587	0
1136.0	2838.0	11	1	2652.088	1.607	0
1166.0	2838.0	11	1	2645.599	1.577	0
1154.0	2838.0	11	1	2649.354	1.568	0
1148.0	2838.0	11	1	2650.880	1.571	0
1154.0	2844.0	11	1	2655.105	1.569	0
1154.0	2832.0	11	1	2643.559	1.569	0

AT POINT (1154.0 , 2838.0) RADIUS 2649.354

THE MINIMUM FACTOR OF SAFETY IS 1.568

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SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	9.802	0.326	0.000	.088	.399E+03	.359E+03	.459E+07	.930E+05
2	2	33.000	4.102	0.000	.096	.171E+05	.163E+05	.329E+08	.436E+07
3	2	32.000	7.263	0.000	.108	.294E+05	.279E+05	.552E+08	.844E+07
4	2	12.000	9.773	0.000	.117	.148E+05	.141E+05	.276E+08	.458E+07
5	2	20.000	11.344	0.000	.123	.287E+05	.273E+05	.532E+08	.933E+07
6	2	34.725	16.499	0.000	.133	.725E+05	.689E+05	.133E+09	.255E+08
7	2	65.275	34.303	0.000	.152	.283E+06	.269E+06	.515E+09	.114E+09
8	2	20.000	43.714	0.000	.168	.111E+06	.105E+06	.200E+09	.492E+08
9	2	56.252	50.994	0.000	.182	.363E+06	.345E+06	.655E+09	.175E+09
10	2	43.748	66.223	0.000	.201	.366E+06	.348E+06	.659E+09	.195E+09
11	2	20.000	70.407	0.000	.213	.178E+06	.169E+06	.319E+09	.101E+09
12	2	77.780	78.695	0.000	.232	.774E+06	.736E+06	.138E+10	.475E+09
13	2	22.220	91.270	0.000	.251	.257E+06	.244E+06	.455E+09	.170E+09
14	2	11.002	92.468	0.000	.257	.129E+06	.122E+06	.228E+09	.876E+08
15	1	8.998	89.789	0.000	.261	.102E+06	.920E+05	.109E+09	.706E+08
16	1	99.307	99.378	0.000	.281	.125E+07	.112E+07	.132E+10	.929E+09
17	1	0.693	109.197	0.000	.300	.957E+04	.862E+04	.100E+08	.761E+07
18	1	20.000	106.094	0.000	.304	.268E+06	.241E+06	.280E+09	.216E+09
19	1	86.646	110.125	0.000	.324	.121E+07	.109E+07	.125E+10	.104E+10
20	2	13.354	117.442	0.000	.343	.198E+06	.188E+06	.342E+09	.180E+09
21	2	20.000	114.630	0.000	.349	.290E+06	.276E+06	.498E+09	.268E+09
22	2	0.834	110.932	0.000	.353	.117E+05	.111E+05	.201E+08	.109E+08
23	2	79.166	115.466	0.000	.368	.116E+07	.110E+07	.197E+10	.113E+10
24	2	20.000	115.041	0.000	.387	.291E+06	.277E+06	.492E+09	.298E+09
25	2	42.361	112.314	0.000	.399	.602E+06	.572E+06	.101E+10	.636E+09
26	2	57.639	114.963	0.000	.418	.838E+06	.796E+06	.140E+10	.927E+09
27	2	20.000	111.153	0.000	.432	.281E+06	.267E+06	.465E+09	.322E+09
28	2	63.888	106.567	0.000	.448	.861E+06	.818E+06	.141E+10	.102E+10
29	2	36.112	105.843	0.000	.467	.484E+06	.459E+06	.784E+09	.598E+09
30	2	20.000	99.843	0.000	.477	.253E+06	.240E+06	.407E+09	.320E+09
31	2	85.415	91.771	0.000	.497	.992E+06	.942E+06	.158E+10	.131E+10
32	2	14.585	87.374	0.000	.516	.161E+06	.153E+06	.253E+09	.220E+09
33	2	20.000	80.506	0.000	.523	.204E+06	.193E+06	.319E+09	.282E+09
34	2	100.000	67.597	0.000	.545	.855E+06	.812E+06	.132E+10	.124E+10

35	2	6.942	56.871	0.000	.566	.499E+05	.474E+05	.758E+08	.748E+08
36	2	13.058	49.979	0.000	.569	.826E+05	.784E+05	.125E+09	.125E+09
37	2	100.000	34.721	0.000	.591	.439E+06	.417E+06	.655E+09	.687E+09
38	2	28.469	11.180	0.000	.615	.403E+05	.382E+05	.600E+08	.656E+08
							SUM	.209E+11	.134E+11

AT CENTER (1154.000 , 2838.000) WITH RADIUS 2649.354 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.559
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.568

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1160.0	2790.0	11	1	2601.446	1.213	0
1160.0	2400.0	11	10	2156.203	1.307	0
1160.0	2010.0	17	14	1796.333	1.295	0
1160.0	1620.0	11	8	1437.092	1.299	0
1160.0	1230.0	5	1	1054.943	1.406	1
1160.0	840.0	1	1	667.835	1000.000	1
1550.0	2790.0	8	8	2350.272	1.297	0
1550.0	2400.0	8	8	1989.350	1.295	0
1550.0	2010.0	8	1	1740.504	1.277	0
1550.0	1620.0	8	1	1368.716	1.223	0
1550.0	1230.0	8	8	907.505	1.288	0
1550.0	840.0	8	8	548.153	1.231	0
1940.0	2790.0	8	8	2203.594	1.393	0
1940.0	2400.0	8	8	1842.254	1.306	0
1940.0	2010.0	8	5	1505.999	1.308	0
1940.0	1620.0	8	6	1134.899	1.302	0
1940.0	1230.0	8	8	761.548	1.247	0
1940.0	840.0	8	6	409.797	1.358	0
2330.0	2790.0	8	6	2106.495	2.154	0
2330.0	2400.0	8	7	1719.228	1.889	0
2330.0	2010.0	8	8	1336.144	1.578	0
2330.0	1620.0	8	8	975.220	1.343	0
2330.0	1230.0	8	7	624.893	1.327	0
2330.0	840.0	8	6	271.450	1.382	0
2720.0	2790.0	5	1	2136.570	3.488	0
2720.0	2400.0	5	1	1782.730	3.159	0
2720.0	2010.0	5	1	1408.803	2.989	0
2720.0	1620.0	5	1	1041.957	2.876	0
2720.0	1230.0	8	1	683.785	2.672	0
2720.0	840.0	8	8	104.704	1.497	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

1160.0	3180.0	11	1	2973.011	1.276	0
1550.0	3180.0	8	7	2719.467	1.314	0
1940.0	3180.0	8	8	2569.319	1.587	0
2330.0	3180.0	11	1	2642.087	2.313	0
2720.0	3180.0	5	1	2496.199	3.767	0
770.0	3180.0	14	5	3009.033	1.291	1
770.0	2790.0	11	1	2655.968	1.301	1
770.0	2400.0	1	1	2273.865	1000.000	1

STATE OF KENTUCKY
TIMOTHY C. HOWARD
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770.0	2010.0	1	0	1892.484	1000.000	0
770.0	1620.0	1	0	1505.423	1000.000	0
770.0	1230.0	1	0	1119.086	1000.000	0
770.0	840.0	1	0	736.424	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	770.000	1160.000	1550.000	1940.000	2330.000	2720.000
3180.000	1.291	1.276	1.314	1.587	2.313	3.767
2790.000	1.301	1.213	1.297	1.393	2.154	3.488
2400.000	1000.000	1.307	1.295	1.306	1.889	3.159
2010.000	1000.000	1.295	1.277	1.308	1.578	2.989
1620.000	1000.000	1.299	1.223	1.302	1.343	2.876
1230.000	1000.000	1.406	1.288	1.247	1.327	2.672
840.000	1000.000	1000.000	1.231	1.358	1.382	1.497

MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 4 CENTERS

FACTOR OF SAFETY = 1.213 AT (1160.000,2790.000)
FACTOR OF SAFETY = 1.223 AT (1550.000,1620.000)
FACTOR OF SAFETY = 1.247 AT (1940.000,1230.000)
FACTOR OF SAFETY = 1.231 AT (1550.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (1160.0 , 2790.0) RADIUS 2601.446
THE MINIMUM FACTOR OF SAFETY IS 1.213

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
1160.0	2790.0	11	1	2601.446	1.213	0
1184.0	2790.0	11	1	2594.367	1.216	0
1136.0	2790.0	11	9	2536.897	1.307	0
1160.0	2814.0	11	1	2624.619	1.212	0
1160.0	2838.0	11	1	2647.508	1.211	0
1160.0	2862.0	11	1	2670.261	1.216	0
1184.0	2838.0	11	1	2639.873	1.223	0
1136.0	2838.0	11	1	2652.088	1.239	0
1166.0	2838.0	11	1	2645.599	1.215	0
1154.0	2838.0	11	1	2649.354	1.208	0
1148.0	2838.0	11	1	2650.880	1.210	0
1154.0	2844.0	11	1	2655.105	1.208	0
1154.0	2832.0	11	1	2643.559	1.208	0

AT POINT (1154.0 , 2838.0) RADIUS 2649.354

THE MINIMUM FACTOR OF SAFETY IS 1.208

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SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	9.802	0.326	0.000	.088	.399E+03	.359E+03	.459E+07	.198E+06
2	2	33.000	4.102	0.000	.096	.171E+05	.163E+05	.326E+08	.887E+07
3	2	32.000	7.263	0.000	.108	.294E+05	.279E+05	.546E+08	.162E+08
4	2	12.000	9.773	0.000	.117	.148E+05	.141E+05	.273E+08	.848E+07
5	2	20.000	11.344	0.000	.123	.287E+05	.273E+05	.525E+08	.169E+08
6	2	34.725	16.499	0.000	.133	.725E+05	.689E+05	.131E+09	.445E+08

7	2	65.275	34.303	0.000	.152	.283E+06	.269E+06	.508E+09	.188E+09
8	2	20.000	43.714	0.000	.168	.111E+06	.105E+06	.197E+09	.779E+08
9	2	56.252	50.994	0.000	.182	.363E+06	.345E+06	.643E+09	.269E+09
10	2	43.748	66.223	0.000	.201	.366E+06	.348E+06	.645E+09	.289E+09
11	2	20.000	70.407	0.000	.213	.178E+06	.169E+06	.312E+09	.146E+09
12	2	77.780	78.695	0.000	.232	.774E+06	.736E+06	.135E+10	.672E+09
13	2	22.220	91.270	0.000	.251	.257E+06	.244E+06	.444E+09	.235E+09
14	2	11.002	92.468	0.000	.257	.129E+06	.122E+06	.222E+09	.120E+09
15	1	8.998	89.789	0.000	.261	.102E+06	.920E+05	.106E+09	.962E+08
16	1	99.307	99.378	0.000	.281	.125E+07	.112E+07	.128E+10	.124E+10
17	1	0.693	109.197	0.000	.300	.957E+04	.862E+04	.970E+07	.997E+07
18	1	20.000	106.094	0.000	.304	.268E+06	.241E+06	.272E+09	.282E+09
19	1	86.646	110.125	0.000	.324	.121E+07	.109E+07	.121E+10	.133E+10
20	2	13.354	117.442	0.000	.343	.198E+06	.188E+06	.329E+09	.228E+09
21	2	20.000	114.630	0.000	.349	.290E+06	.276E+06	.480E+09	.339E+09
22	2	0.834	110.932	0.000	.353	.117E+05	.111E+05	.193E+08	.138E+08
23	2	79.166	115.466	0.000	.368	.116E+07	.110E+07	.189E+10	.141E+10
24	2	20.000	115.041	0.000	.387	.291E+06	.277E+06	.471E+09	.368E+09
25	2	42.361	112.314	0.000	.399	.602E+06	.572E+06	.968E+09	.779E+09
26	2	57.639	114.963	0.000	.418	.838E+06	.796E+06	.133E+10	.112E+10
27	2	20.000	111.153	0.000	.432	.281E+06	.267E+06	.443E+09	.388E+09
28	2	63.888	106.567	0.000	.448	.861E+06	.818E+06	.134E+10	.122E+10
29	2	36.112	105.843	0.000	.467	.484E+06	.459E+06	.743E+09	.709E+09
30	2	20.000	99.843	0.000	.477	.253E+06	.240E+06	.385E+09	.377E+09
31	2	85.415	91.771	0.000	.497	.992E+06	.942E+06	.149E+10	.153E+10
32	2	14.585	87.374	0.000	.516	.161E+06	.153E+06	.238E+09	.256E+09
33	2	20.000	80.506	0.000	.523	.204E+06	.193E+06	.299E+09	.327E+09
34	2	100.000	67.597	0.000	.545	.855E+06	.812E+06	.123E+10	.142E+10
35	2	6.942	56.871	0.000	.566	.499E+05	.474E+05	.706E+08	.856E+08
36	2	13.058	49.979	0.000	.569	.826E+05	.784E+05	.116E+09	.142E+09
37	2	100.000	34.721	0.000	.591	.439E+06	.417E+06	.607E+09	.781E+09
38	2	28.469	11.180	0.000	.615	.403E+05	.382E+05	.554E+08	.740E+08
							SUM	.200E+11	.166E+11

AT CENTER (1154.000 , 2838.000) WITH RADIUS 2649.354 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.204
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.208

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.568

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.208

STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
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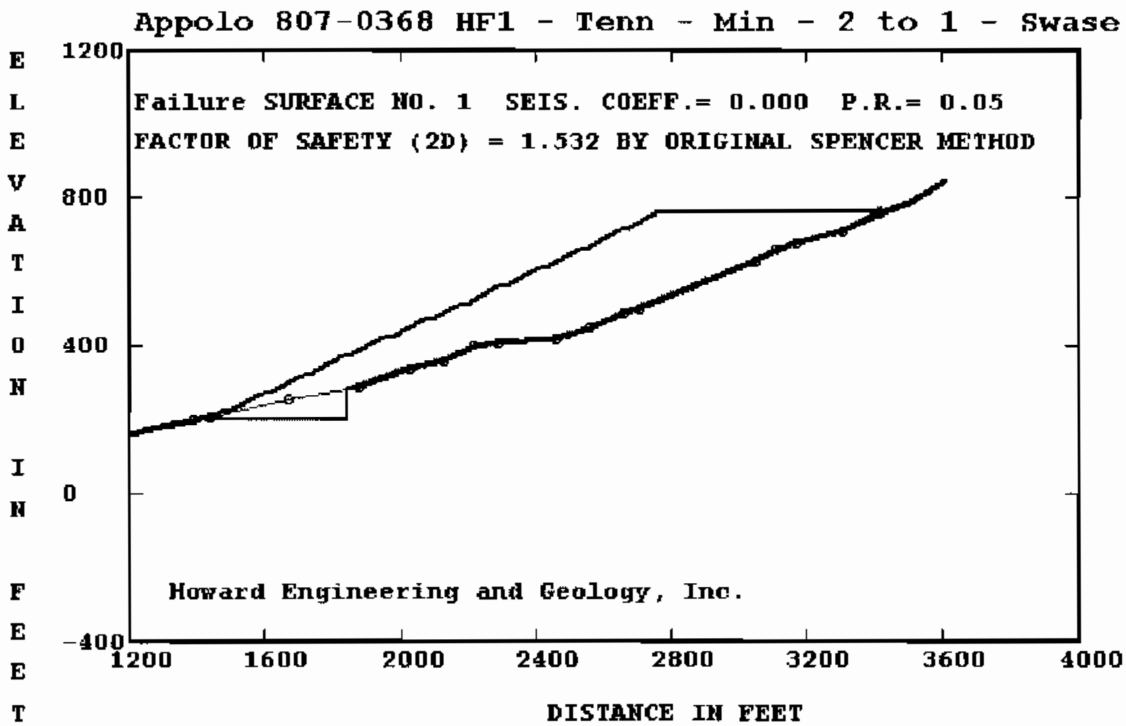
Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.532 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
1200
800
400
0
-400
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET


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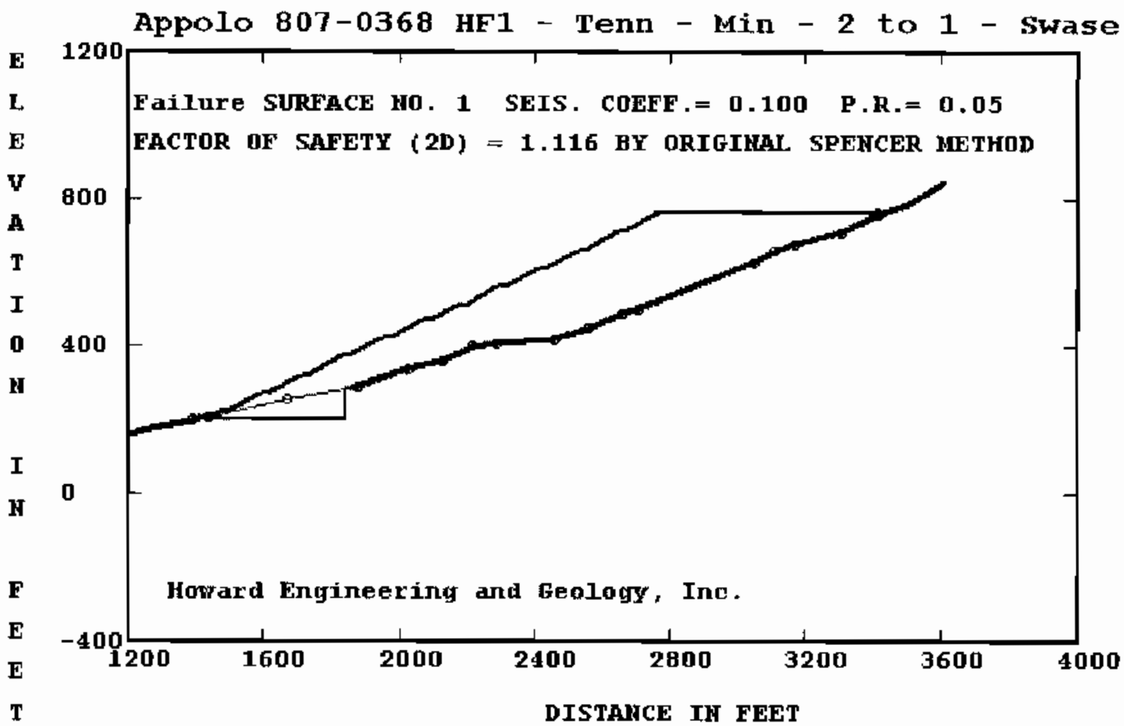
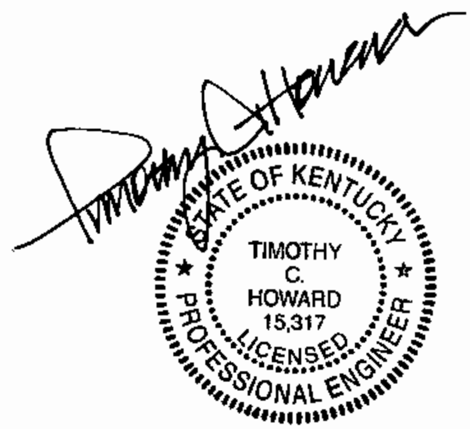

Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.100 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.116 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
1200
800
400
0
-400
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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INPUT FILE NAME -R:\T-I-2-S.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

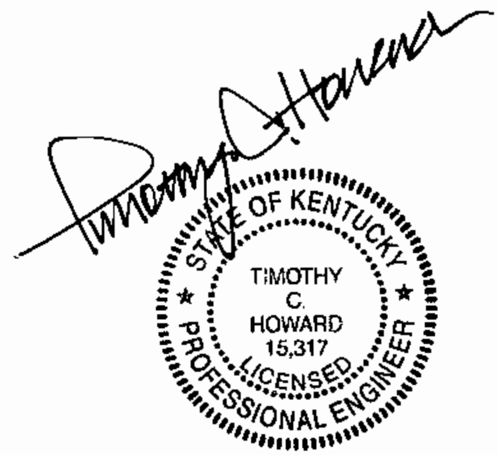
NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3



NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

```
 8  X COORD.= 1262         Y COORD.= 180
 9  X COORD.= 1392         Y COORD.= 200
 10 X COORD.= 1840         Y COORD.= 200
 11 X COORD.= 1840         Y COORD.= 279
 12 X COORD.= 1859         Y COORD.= 285
 13 X COORD.= 1873         Y COORD.= 290
 14 X COORD.= 2021         Y COORD.= 340
 15 X COORD.= 2123         Y COORD.= 360
 16 X COORD.= 2215         Y COORD.= 400
 17 X COORD.= 2284         Y COORD.= 410
 18 X COORD.= 2455         Y COORD.= 420
 19 X COORD.= 2560         Y COORD.= 450
 20 X COORD.= 2662         Y COORD.= 490
 21 X COORD.= 2704         Y COORD.= 500
 22 X COORD.= 3053         Y COORD.= 630
 23 X COORD.= 3111         Y COORD.= 660
 24 X COORD.= 3169         Y COORD.= 680
 25 X COORD.= 3309         Y COORD.= 710
 26 X COORD.= 3417         Y COORD.= 760
 27 X COORD.= 3503         Y COORD.= 790
 28 X COORD.= 3613         Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 30
 1  X COORD.= 1262         Y COORD.= 180
 2  X COORD.= 1392         Y COORD.= 200
 3  X COORD.= 1425         Y COORD.= 210
 4  X COORD.= 1457         Y COORD.= 213
 5  X COORD.= 1469         Y COORD.= 220
 6  X COORD.= 1489         Y COORD.= 220
 7  X COORD.= 1589         Y COORD.= 270
 8  X COORD.= 1609         Y COORD.= 270
 9  X COORD.= 1709         Y COORD.= 320
 10 X COORD.= 1729         Y COORD.= 320
 11 X COORD.= 1829         Y COORD.= 370
 12 X COORD.= 1849         Y COORD.= 370
 13 X COORD.= 1949         Y COORD.= 420
 14 X COORD.= 1969         Y COORD.= 420
 15 X COORD.= 2069         Y COORD.= 470
 16 X COORD.= 2089         Y COORD.= 470
 17 X COORD.= 2169         Y COORD.= 510
 18 X COORD.= 2189         Y COORD.= 510
 19 X COORD.= 2289         Y COORD.= 560
 20 X COORD.= 2309         Y COORD.= 560
 21 X COORD.= 2409         Y COORD.= 610
 22 X COORD.= 2429         Y COORD.= 610
 23 X COORD.= 2529         Y COORD.= 660
 24 X COORD.= 2549         Y COORD.= 660
 25 X COORD.= 2649         Y COORD.= 710
 26 X COORD.= 2669         Y COORD.= 710
 27 X COORD.= 2769         Y COORD.= 760
 28 X COORD.= 3417         Y COORD.= 760
 29 X COORD.= 3503         Y COORD.= 790
 30 X COORD.= 3613         Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250      0.086      0.169       0.096      0.135      0.233
         0.123      0.274      0.154       0.313      0.000  99999.000
         0.176      0.336      0.196       0.440      0.147      0.058
         0.283      0.396      0.238       0.371      0.517      0.351
         0.214      0.459      0.349       0.537      1.000
 2       0.095      0.169      0.096       0.135      0.233      0.123
         0.274      0.154      0.000   99999.000      0.316      0.357
         0.338      0.196      0.435       0.145      0.058      0.286
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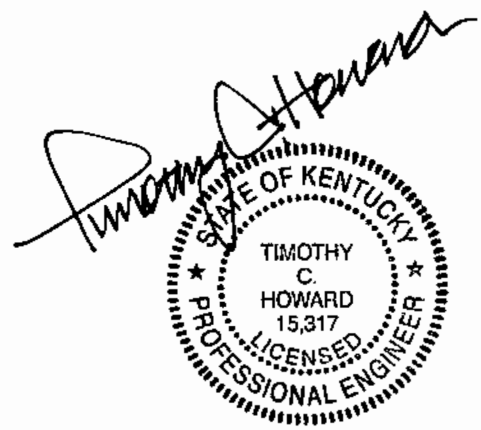


	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.154	0.303	0.094	0.583	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.349	0.536	

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 18

1	X COORD.= 1392	Y COORD.= 200
2	X COORD.= 1439	Y COORD.= 203
3	X COORD.= 1668	Y COORD.= 254
4	X COORD.= 1874	Y COORD.= 287
5	X COORD.= 2022	Y COORD.= 337
6	X COORD.= 2124	Y COORD.= 357
7	X COORD.= 2215	Y COORD.= 397
8	X COORD.= 2284	Y COORD.= 407
9	X COORD.= 2456	Y COORD.= 417
10	X COORD.= 2561	Y COORD.= 447
11	X COORD.= 2662	Y COORD.= 487
12	X COORD.= 2705	Y COORD.= 497
13	X COORD.= 3054	Y COORD.= 627
14	X COORD.= 3112	Y COORD.= 657
15	X COORD.= 3170	Y COORD.= 677
16	X COORD.= 3310	Y COORD.= 707
17	X COORD.= 3414	Y COORD.= 755
18	X COORD.= 3417	Y COORD.= 760

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.532

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	33.000	3.947	0.000	0.064	.165E+05	.157E+05	.182E+08	.159E+07
2	2	14.000	8.103	0.000	0.064	.144E+05	.136E+05	.154E+08	.139E+07
3	2	18.000	7.152	0.000	0.217	.163E+05	.155E+05	.193E+08	.604E+07

4	2	12.000	8.155	0.000	0.217	.124E+05	.118E+05	.146E+08	.459E+07
5	2	20.000	8.092	0.000	0.217	.205E+05	.194E+05	.242E+08	.759E+07
6	2	100.000	19.729	0.000	0.217	.250E+06	.237E+06	.290E+09	.925E+08
7	2	5.500	32.981	0.000	0.217	.229E+05	.218E+05	.266E+08	.851E+07
8	2	14.500	30.754	0.000	0.217	.564E+05	.536E+05	.653E+08	.209E+08
9	2	59.000	37.320	0.000	0.217	.279E+06	.265E+06	.322E+09	.103E+09
10	2	41.000	52.466	0.000	0.158	.272E+06	.259E+06	.302E+09	.698E+08
11	2	20.000	57.830	0.000	0.158	.146E+06	.139E+06	.162E+09	.375E+08
12	2	68.000	67.782	0.000	0.158	.583E+06	.554E+06	.647E+09	.150E+09
13	2	32.000	84.772	0.000	0.158	.343E+06	.326E+06	.381E+09	.881E+08
14	2	20.000	88.607	0.000	0.158	.224E+06	.213E+06	.249E+09	.575E+08
15	2	7.411	88.264	0.000	0.158	.827E+05	.786E+05	.917E+08	.212E+08
16	1	17.589	92.512	0.000	0.158	.206E+06	.185E+06	.137E+09	.528E+08
17	1	75.000	101.581	0.000	0.320	.963E+06	.867E+06	.708E+09	.577E+09
18	1	20.000	104.284	0.000	0.320	.264E+06	.237E+06	.194E+09	.158E+09
19	1	30.500	103.378	0.000	0.320	.399E+06	.359E+06	.293E+09	.239E+09
20	1	22.500	107.676	0.000	0.320	.306E+06	.276E+06	.225E+09	.184E+09
21	1	47.000	116.642	0.000	0.192	.693E+06	.624E+06	.465E+09	.221E+09
22	1	20.000	121.824	0.000	0.192	.308E+06	.277E+06	.206E+09	.983E+08
23	1	35.000	125.181	0.000	0.192	.554E+06	.499E+06	.371E+09	.177E+09
24	1	45.000	131.860	0.000	0.402	.750E+06	.675E+06	.572E+09	.610E+09
25	1	20.000	128.824	0.000	0.402	.326E+06	.293E+06	.249E+09	.265E+09
26	1	13.000	124.821	0.000	0.402	.205E+06	.185E+06	.157E+09	.167E+09
27	1	13.000	125.607	0.000	0.402	.207E+06	.186E+06	.158E+09	.168E+09
28	1	69.000	138.250	0.000	0.143	.121E+07	.109E+07	.753E+09	.266E+09
29	1	5.000	151.605	0.000	0.058	.959E+05	.863E+05	.530E+08	.753E+07
30	1	20.000	152.128	0.000	0.058	.385E+06	.346E+06	.213E+09	.302E+08
31	1	95.500	172.645	0.000	0.058	.209E+07	.188E+07	.115E+10	.164E+09
32	1	4.500	194.738	0.000	0.058	.111E+06	.998E+05	.610E+08	.871E+07
33	1	20.000	195.151	0.000	0.058	.494E+06	.444E+06	.272E+09	.388E+08
34	1	27.000	200.535	0.000	0.058	.685E+06	.616E+06	.377E+09	.538E+08
35	1	73.000	214.321	0.000	0.275	.198E+07	.178E+07	.143E+10	.100E+10
36	1	20.000	219.286	0.000	0.275	.555E+06	.499E+06	.400E+09	.281E+09
37	1	12.000	217.714	0.000	0.275	.330E+06	.297E+06	.238E+09	.167E+09
38	1	46.000	221.391	0.000	0.368	.129E+07	.116E+07	.996E+09	.969E+09
39	1	42.000	225.965	0.000	0.368	.120E+07	.108E+07	.928E+09	.903E+09
40	1	13.000	225.574	0.000	0.368	.371E+06	.334E+06	.287E+09	.279E+09
41	1	7.000	222.186	0.000	0.227	.197E+06	.177E+06	.134E+09	.765E+08
42	1	36.000	226.186	0.000	0.227	.103E+07	.927E+06	.700E+09	.400E+09
43	1	64.000	235.080	0.000	0.349	.190E+07	.171E+07	.146E+10	.133E+10
44	1	40.500	231.618	0.000	0.349	.119E+07	.107E+07	.908E+09	.831E+09
45	1	202.500	186.360	0.000	0.349	.477E+07	.430E+07	.366E+10	.334E+10
46	1	42.000	140.822	0.000	0.349	.748E+06	.673E+06	.578E+09	.524E+09
47	1	58.000	118.000	0.000	0.459	.865E+06	.779E+06	.731E+09	.912E+09
48	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.519E+09	.430E+09
49	1	44.500	78.232	0.000	0.210	.440E+06	.396E+06	.287E+09	.147E+09
50	1	95.500	63.232	0.000	0.210	.763E+06	.687E+06	.502E+09	.255E+09
51	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.349E+09	.355E+09
52	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.381E+07	.272E+07
		SUM						.233E+11	.164E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 1.427

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.546	1.503
0.300	1.533	1.537
0.600	1.553	1.582

FROM ORIGINAL SPENCER METHOD, DEL = 0.268 AND F. S. = 1.532

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.116

TIMOTHY C. HOWARD 15,317 STATE OF KENTUCKY LICENSED PROFESSIONAL ENGINEER

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	33.000	3.947	0.000	0.064	.165E+05	.157E+05	.181E+08	.407E+07
2	2	14.000	8.103	0.000	0.064	.144E+05	.136E+05	.153E+08	.354E+07
3	2	18.000	7.152	0.000	0.217	.163E+05	.155E+05	.189E+08	.872E+07
4	2	12.000	8.155	0.000	0.217	.124E+05	.118E+05	.143E+08	.663E+07
5	2	20.000	8.092	0.000	0.217	.205E+05	.194E+05	.237E+08	.110E+08
6	2	100.000	19.729	0.000	0.217	.250E+06	.237E+06	.284E+09	.134E+09
7	2	5.500	32.981	0.000	0.217	.229E+05	.218E+05	.260E+08	.123E+08
8	2	14.500	30.754	0.000	0.217	.564E+05	.536E+05	.639E+08	.301E+08
9	2	59.000	37.320	0.000	0.217	.279E+06	.265E+06	.315E+09	.149E+09
10	2	41.000	52.466	0.000	0.158	.272E+06	.259E+06	.297E+09	.112E+09
11	2	20.000	57.830	0.000	0.158	.146E+06	.139E+06	.160E+09	.604E+08
12	2	68.000	67.782	0.000	0.158	.583E+06	.554E+06	.637E+09	.240E+09
13	2	32.000	84.772	0.000	0.158	.343E+06	.326E+06	.374E+09	.141E+09
14	2	20.000	88.607	0.000	0.158	.224E+06	.213E+06	.245E+09	.922E+08
15	2	7.411	88.264	0.000	0.158	.827E+05	.786E+05	.903E+08	.340E+08
16	1	17.589	92.512	0.000	0.158	.206E+06	.185E+06	.135E+09	.843E+08
17	1	75.000	101.581	0.000	0.320	.963E+06	.867E+06	.685E+09	.739E+09
18	1	20.000	104.284	0.000	0.320	.264E+06	.237E+06	.187E+09	.202E+09
19	1	30.500	103.378	0.000	0.320	.399E+06	.359E+06	.283E+09	.306E+09
20	1	22.500	107.676	0.000	0.320	.306E+06	.276E+06	.217E+09	.235E+09
21	1	47.000	116.642	0.000	0.192	.693E+06	.624E+06	.456E+09	.328E+09
22	1	20.000	121.824	0.000	0.192	.308E+06	.277E+06	.202E+09	.145E+09
23	1	35.000	125.181	0.000	0.192	.554E+06	.499E+06	.364E+09	.261E+09
24	1	45.000	131.860	0.000	0.402	.750E+06	.675E+06	.547E+09	.739E+09
25	1	20.000	128.824	0.000	0.402	.326E+06	.293E+06	.238E+09	.321E+09
26	1	13.000	124.821	0.000	0.402	.205E+06	.185E+06	.150E+09	.202E+09
27	1	13.000	125.607	0.000	0.402	.207E+06	.186E+06	.151E+09	.203E+09
28	1	69.000	138.250	0.000	0.143	.121E+07	.109E+07	.742E+09	.438E+09
29	1	5.000	151.605	0.000	0.058	.959E+05	.863E+05	.527E+08	.196E+08
30	1	20.000	152.128	0.000	0.058	.385E+06	.346E+06	.211E+09	.788E+08
31	1	95.500	172.645	0.000	0.058	.209E+07	.188E+07	.114E+10	.425E+09
32	1	4.500	194.738	0.000	0.058	.111E+06	.998E+05	.606E+08	.225E+08
33	1	20.000	195.151	0.000	0.058	.494E+06	.444E+06	.270E+09	.100E+09
34	1	27.000	200.535	0.000	0.058	.685E+06	.616E+06	.374E+09	.139E+09
35	1	73.000	214.321	0.000	0.275	.198E+07	.178E+07	.139E+10	.132E+10
36	1	20.000	219.286	0.000	0.275	.555E+06	.499E+06	.388E+09	.369E+09
37	1	12.000	217.714	0.000	0.275	.330E+06	.297E+06	.231E+09	.220E+09
38	1	46.000	221.391	0.000	0.368	.129E+07	.116E+07	.958E+09	.119E+10
39	1	42.000	225.965	0.000	0.368	.120E+07	.108E+07	.892E+09	.111E+10
40	1	13.000	225.574	0.000	0.368	.371E+06	.334E+06	.276E+09	.342E+09
41	1	7.000	222.186	0.000	0.227	.197E+06	.177E+06	.131E+09	.106E+09
42	1	36.000	226.186	0.000	0.227	.103E+07	.927E+06	.684E+09	.555E+09
43	1	64.000	235.080	0.000	0.349	.190E+07	.171E+07	.140E+10	.165E+10
44	1	40.500	231.618	0.000	0.349	.119E+07	.107E+07	.874E+09	.103E+10
45	1	202.500	186.360	0.000	0.349	.477E+07	.430E+07	.353E+10	.416E+10
46	1	42.000	140.822	0.000	0.349	.748E+06	.673E+06	.557E+09	.653E+09
47	1	58.000	118.000	0.000	0.459	.865E+06	.779E+06	.694E+09	.107E+10
48	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.502E+09	.546E+09
49	1	44.500	78.232	0.000	0.210	.440E+06	.396E+06	.281E+09	.211E+09
50	1	95.500	63.232	0.000	0.210	.763E+06	.687E+06	.492E+09	.367E+09
51	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.335E+09	.427E+09
52	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.370E+07	.288E+07
		SUM						.227E+11	.214E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.061

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.131	1.082
0.300	1.115	1.105
0.600	1.128	1.138

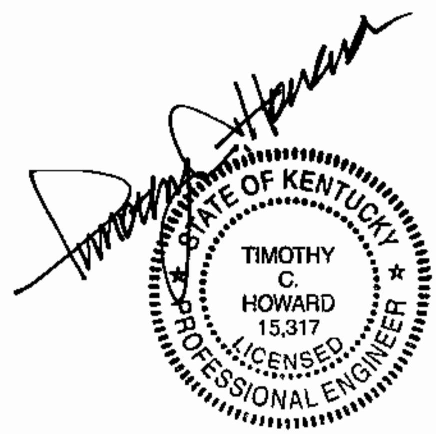
FROM ORIGINAL SPENCER METHOD, DEL = 0.420 AND F. S. = 1.116

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.532

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.116



Appolo 807-0368 HF1 - Tenn - Min - 2 to 1 - Circular [T-I-2-C.TXT]

AT CENTER (1154.000 , 2838.000) WITH RADIUS 2649.354 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.559
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.568
AT CENTER (1154.000 , 2838.000) WITH RADIUS 2649.354 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.204
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.208

0 =	0 ,	0	35 =	1189 ,	160	70 =	2289 ,	560
1 =	12 ,	-3	36 =	1262 ,	180	71 =	2309 ,	560
2 =	105 ,	5	37 =	1392 ,	200	72 =	2409 ,	610
3 =	283 ,	35	38 =	1859 ,	285	73 =	2429 ,	610
4 =	387 ,	45	39 =	1873 ,	290	74 =	2529 ,	660
5 =	904 ,	115	40 =	2021 ,	340	75 =	2549 ,	660
6 =	947 ,	125	41 =	2123 ,	360	76 =	2649 ,	710
7 =	1190 ,	155	42 =	2215 ,	400	77 =	2669 ,	710
8 =	1263 ,	175	43 =	2284 ,	410	78 =	2769 ,	760
9 =	1393 ,	195	44 =	2455 ,	420			
10 =	1409 ,	200	45 =	2560 ,	450			
11 =	1840 ,	200	46 =	2662 ,	490			
12 =	1840 ,	279	47 =	2704 ,	500			
13 =	1874 ,	285	48 =	3053 ,	630			
14 =	2023 ,	335	49 =	3111 ,	660			
15 =	2125 ,	355	50 =	3169 ,	680			
16 =	2216 ,	395	51 =	3309 ,	710			
17 =	2284 ,	405	52 =	3417 ,	760			
18 =	2456 ,	415	53 =	3503 ,	790			
19 =	2562 ,	445	54 =	1425 ,	210			
20 =	2663 ,	485	55 =	1457 ,	213			
21 =	2705 ,	495	56 =	1469 ,	220			
22 =	3055 ,	625	57 =	1489 ,	220			
23 =	3113 ,	655	58 =	1589 ,	270			
24 =	3170 ,	675	59 =	1609 ,	270			
25 =	3310 ,	705	60 =	1709 ,	320			
26 =	3419 ,	755	61 =	1729 ,	320			
27 =	3505 ,	785	62 =	1829 ,	370			
28 =	3600 ,	836	63 =	1849 ,	370			
29 =	3613 ,	849	64 =	1949 ,	420			
30 =	105 ,	10	65 =	1969 ,	420			
31 =	282 ,	40	66 =	2069 ,	470			
32 =	386 ,	50	67 =	2089 ,	470			
33 =	903 ,	120	68 =	2169 ,	510			
34 =	946 ,	130	69 =	2189 ,	510			

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Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing

N
W E
S

HOWARD
Engineering and Geology, Inc.

Scale: None

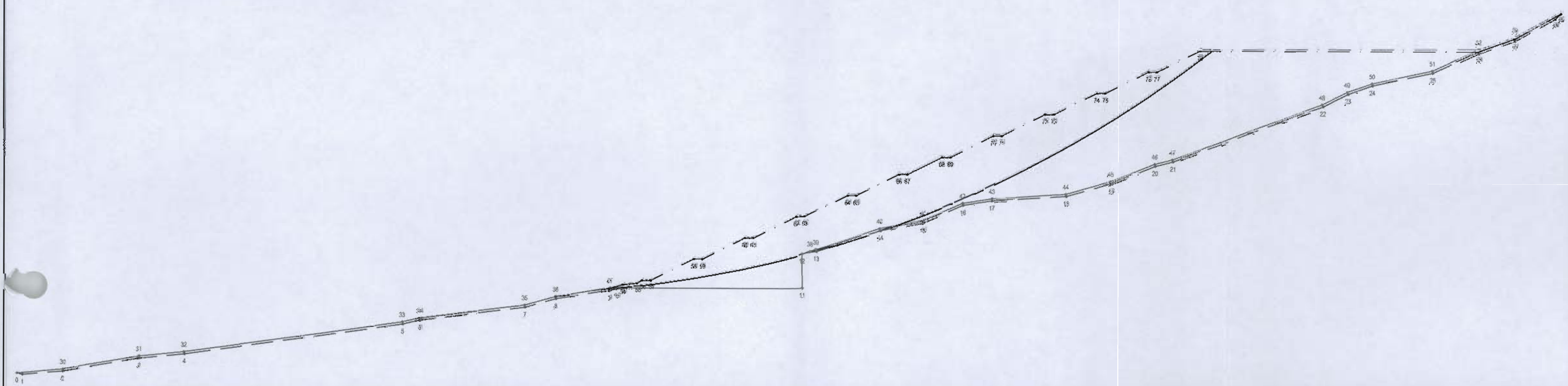
Attachment 26.3.A

DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\PFS\Reame 0910\T-I-2-C.dwg

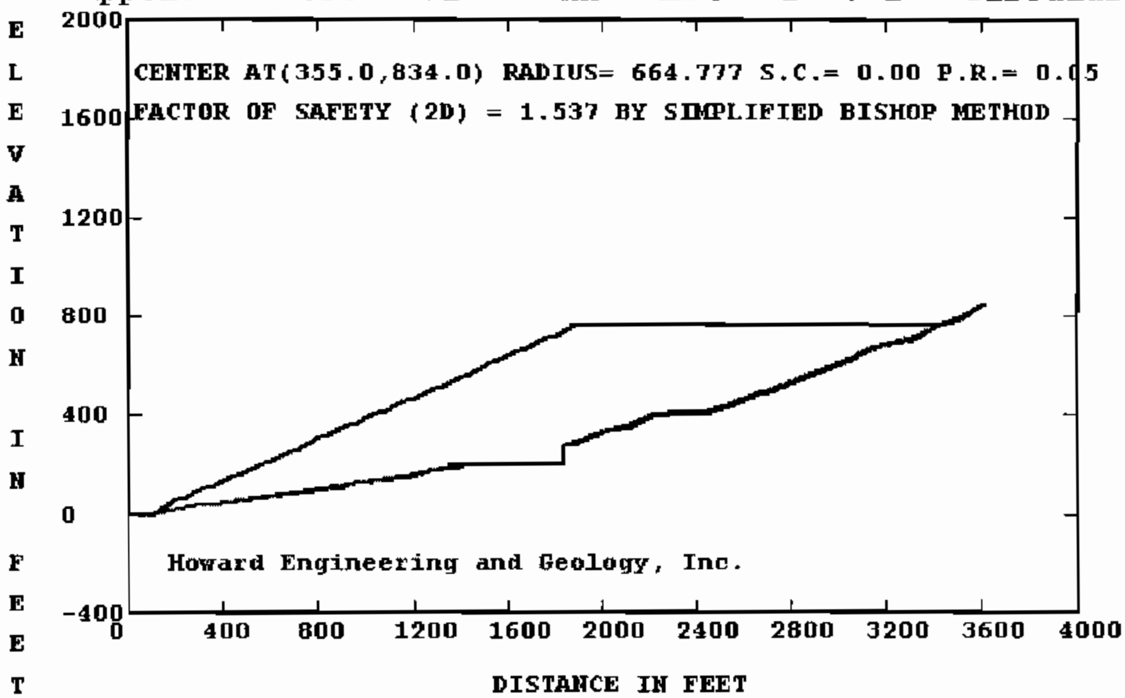
I, Timothy C. Howard, P.E. No. 15,317

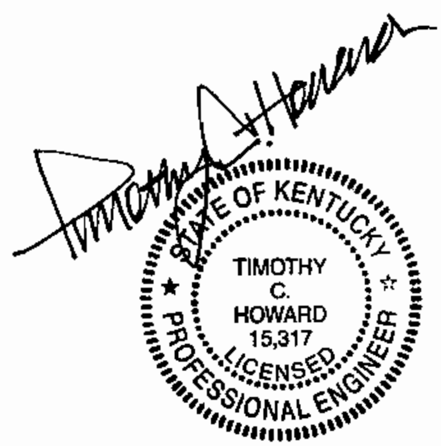
Date: 10/6/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

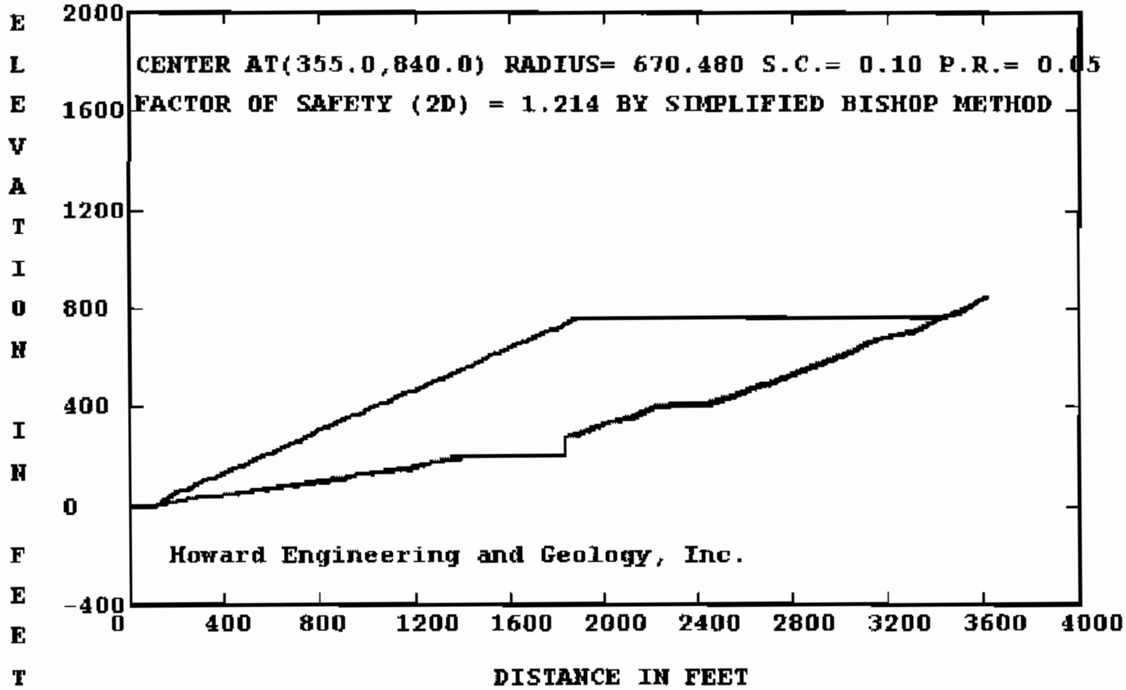


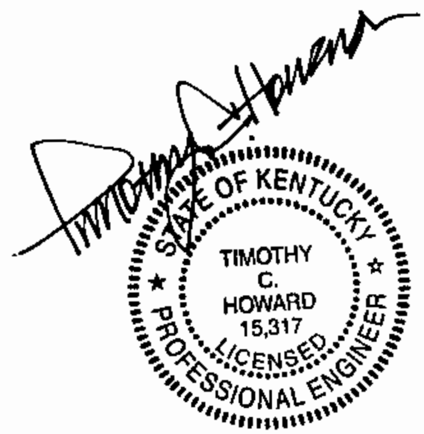
Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Circular



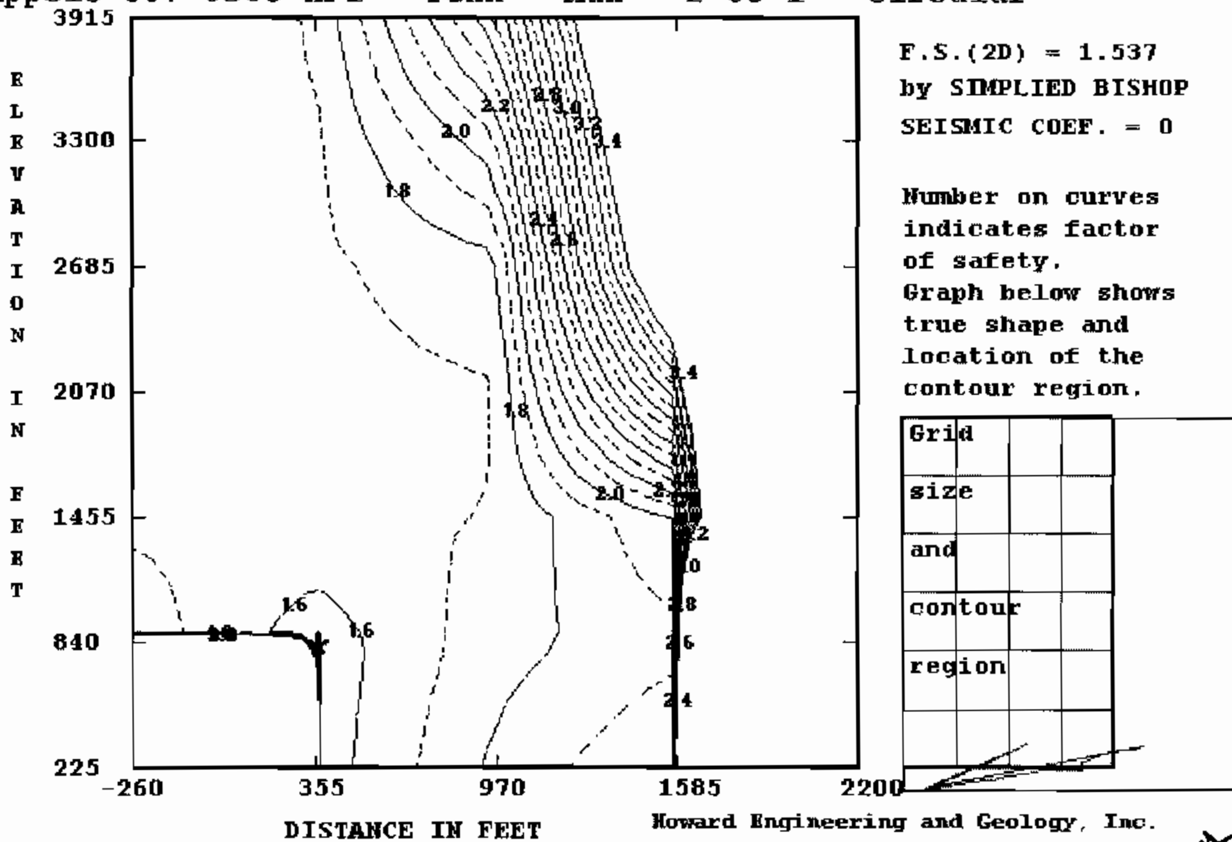


Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Circular





Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Circular



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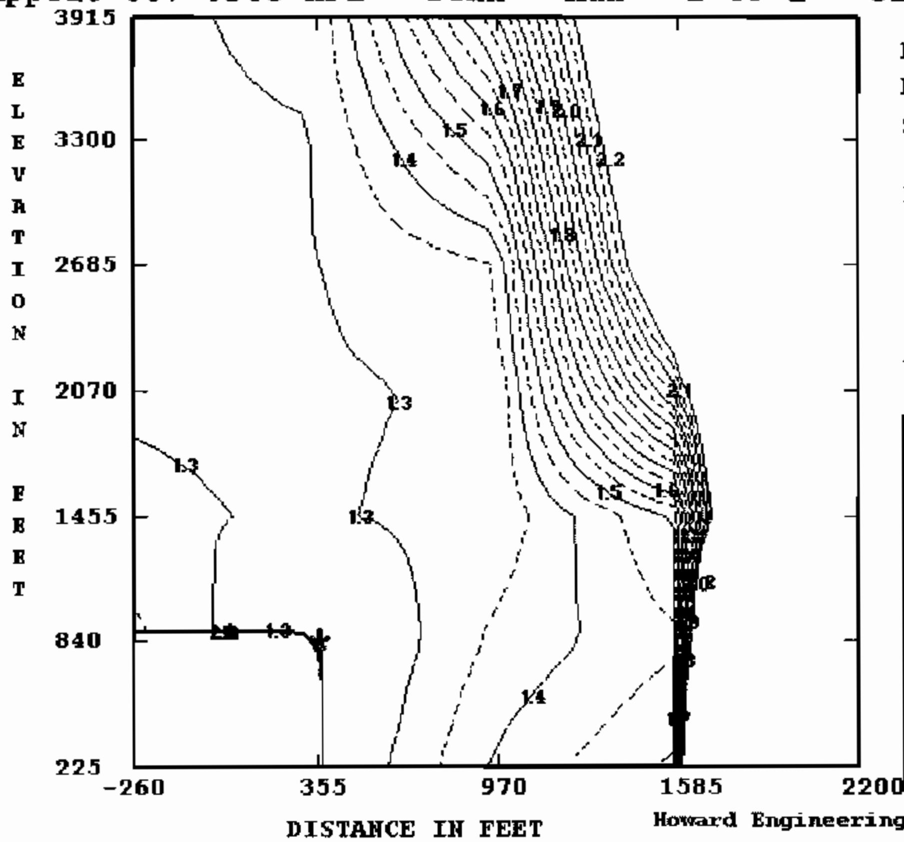
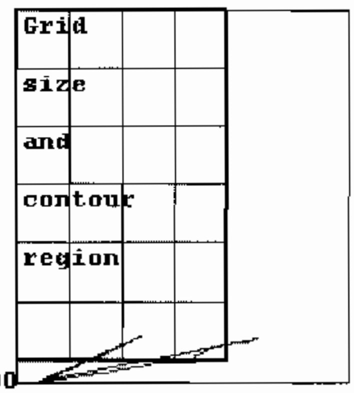


F.S.(2D) = 1.214
by SIMPLIED BISHOP
SEISMIC COEF. = .1

Number on curves indicates factor of safety.
Graph below shows true shape and location of the contour region.



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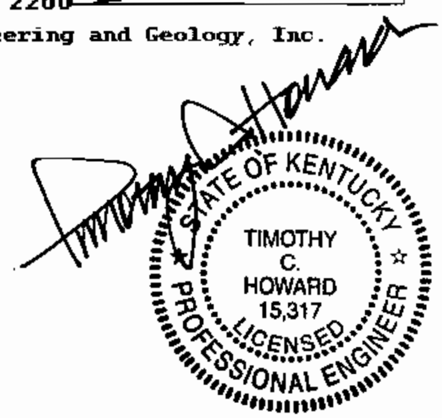

REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
THIS 2008 VERSION IS LICENSED BY CIVIL ENGINEERING SOFTWARE CENTER TO

Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\T-X-2-C.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

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```
 8  X COORD.= 1262              Y COORD.= 180
 9  X COORD.= 1392              Y COORD.= 200
 10 X COORD.= 1840              Y COORD.= 200
 11 X COORD.= 1840              Y COORD.= 279
 12 X COORD.= 1859              Y COORD.= 285
 13 X COORD.= 1873              Y COORD.= 290
 14 X COORD.= 2021              Y COORD.= 340
 15 X COORD.= 2123              Y COORD.= 360
 16 X COORD.= 2215              Y COORD.= 400
 17 X COORD.= 2284              Y COORD.= 410
 18 X COORD.= 2455              Y COORD.= 420
 19 X COORD.= 2560              Y COORD.= 450
 20 X COORD.= 2662              Y COORD.= 490
 21 X COORD.= 2704              Y COORD.= 500
 22 X COORD.= 3053              Y COORD.= 630
 23 X COORD.= 3111              Y COORD.= 660
 24 X COORD.= 3169              Y COORD.= 680
 25 X COORD.= 3309              Y COORD.= 710
 26 X COORD.= 3417              Y COORD.= 760
 27 X COORD.= 3503              Y COORD.= 790
 28 X COORD.= 3613              Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 34
 1  X COORD.= 0                 Y COORD.= 0
 2  X COORD.= 105               Y COORD.= 10
 3  X COORD.= 205               Y COORD.= 60
 4  X COORD.= 225               Y COORD.= 60
 5  X COORD.= 325               Y COORD.= 110
 6  X COORD.= 345               Y COORD.= 110
 7  X COORD.= 445               Y COORD.= 160
 8  X COORD.= 465               Y COORD.= 160
 9  X COORD.= 565               Y COORD.= 210
 10 X COORD.= 585               Y COORD.= 210
 11 X COORD.= 685               Y COORD.= 260
 12 X COORD.= 705               Y COORD.= 260
 13 X COORD.= 805               Y COORD.= 310
 14 X COORD.= 825               Y COORD.= 310
 15 X COORD.= 925               Y COORD.= 360
 16 X COORD.= 945               Y COORD.= 360
 17 X COORD.= 1045              Y COORD.= 410
 18 X COORD.= 1065              Y COORD.= 410
 19 X COORD.= 1165              Y COORD.= 460
 20 X COORD.= 1185              Y COORD.= 460
 21 X COORD.= 1285              Y COORD.= 510
 22 X COORD.= 1305              Y COORD.= 510
 23 X COORD.= 1405              Y COORD.= 560
 24 X COORD.= 1425              Y COORD.= 560
 25 X COORD.= 1525              Y COORD.= 610
 26 X COORD.= 1545              Y COORD.= 610
 27 X COORD.= 1645              Y COORD.= 660
 28 X COORD.= 1665              Y COORD.= 660
 29 X COORD.= 1765              Y COORD.= 710
 30 X COORD.= 1785              Y COORD.= 710
 31 X COORD.= 1885              Y COORD.= 760
 32 X COORD.= 3417              Y COORD.= 760
 33 X COORD.= 3503              Y COORD.= 790
 34 X COORD.= 3613              Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250      0.086      0.169      0.096      0.135      0.233
         0.123      0.274      0.154      0.313      0.000  99999.000
         0.176      0.336      0.196      0.440      0.147      0.058
         0.283      0.396      0.238      0.371      0.517      0.351
```

```
         0.214        0.459        0.349        0.537        1.000
 2       0.095        0.169        0.096        0.135        0.233        0.123
         0.274        0.154        0.000    99999.000        0.316        0.357
         0.338        0.196        0.435        0.145        0.058        0.286
         0.392        0.238        0.372        0.517        0.345        0.214
         0.463        0.349        0.536
 3       0.095        0.500        0.000        0.500        0.000        0.500
         0.000        0.500        0.000        0.500        0.000        0.500
         0.000        0.500        0.000        0.500        0.000        0.500
         0.000        0.500        0.000        0.500        0.000        0.500
         0.000        0.500        0.000        0.500        0.000        0.500
         0.000        0.349        0.536

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1
LINE NO. (LINO)  BEG. NO. (NBP)  END NO. (NEP)
      1                1               30

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL  ENVELOPE COHESION    FRIC. ANGLE    UNIT WEIGHTT
 NO.   (TSSE)    (C)         (PHID)          (G)
  1       1   160.000        24.000        125.000
  2       1    20.000        36.000        126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-260     Y COORD. = 3915
POINT 2 X COORD. =-260     Y COORD. = 840
POINT 3 X COORD. = 2200    Y COORD. = 840

X INCREMENT (XINC) = 24     Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER  X   CENTER  Y       NO. OF CIRCLE          LOWEST   WARNING
COORDINATE  COORDINATE    TOTAL CRITIC. RADIUS       F.S.
 -260.0       3915.0        8     6   3764.404       1.672       0
```

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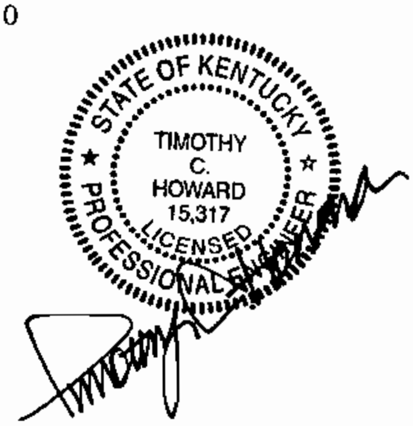
-260.0	3300.0	8	1	3309.845	1.673	0
-260.0	2685.0	8	1	2697.559	1.680	0
-260.0	2070.0	11	3	2065.661	1.679	0
-260.0	1455.0	11	8	1476.348	1.679	0
-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	8	3518.036	1.703	0
355.0	3300.0	8	6	2977.872	1.681	0
355.0	2685.0	8	6	2403.727	1.683	0
355.0	2070.0	8	1	2010.984	1.673	0
355.0	1455.0	8	1	1401.544	1.675	0
355.0	840.0	8	8	670.480	1.538	0
970.0	3915.0	8	8	3307.336	2.487	0
970.0	3300.0	8	8	2721.340	2.076	0
970.0	2685.0	8	8	2148.726	1.758	0
970.0	2070.0	8	7	1597.489	1.693	0
970.0	1455.0	8	8	1011.013	1.704	0
970.0	840.0	8	7	455.060	1.764	0
1585.0	3915.0	5	1	3576.110	4.595	0
1585.0	3300.0	5	1	2972.740	4.311	0
1585.0	2685.0	11	8	2140.435	3.993	0
1585.0	2070.0	8	8	1366.188	3.072	0
1585.0	1455.0	8	8	779.193	2.012	0
1585.0	840.0	8	8	211.062	1.866	0
2200.0	3915.0	5	1	3375.933	12.237	0
2200.0	3300.0	5	1	2798.105	11.222	0
2200.0	2685.0	5	1	2225.864	10.328	0
2200.0	2070.0	5	1	1651.240	10.170	0
2200.0	1455.0	4	1	1053.355	12.464	0
2200.0	840.0	2	1	442.593	54.196	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-260.0	225.0	1	1	343.839	1000.000	0
355.0	225.0	8	7	106.772	1.542	0
970.0	225.0	1	0	96.428	1000.000	0
1585.0	225.0	1	0	25.000	1000.000	0
2200.0	225.0	1	0	149.190	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.672	1.703	2.487	4.595	12.237
3300.000	1.673	1.681	2.076	4.311	11.222
2685.000	1.680	1.683	1.758	3.993	10.328
2070.000	1.679	1.673	1.693	3.072	10.170
1455.000	1.679	1.675	1.704	2.012	12.464
840.000	1000.000	1.538	1.764	1.866	54.196
225.000	1000.000	1.542	1000.000	1000.000	1000.000



MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.672 AT (-260.000,3915.000)
FACTOR OF SAFETY = 1.673 AT (355.000,2070.000)
FACTOR OF SAFETY = 1.538 AT (355.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (355.0 , 840.0) RADIUS 670.480
THE MINIMUM FACTOR OF SAFETY IS 1.538

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE

MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
355.0	840.0	8	8	670.480	1.538	0
379.0	840.0	8	8	662.279	1.595	0
331.0	840.0	8	1	795.325	1.671	0
355.0	864.0	8	1	815.888	1.686	0
355.0	816.0	8	8	647.703	1.554	0
361.0	840.0	8	1	791.300	1.697	0
349.0	840.0	8	8	672.346	1.542	0
355.0	846.0	8	8	676.187	1.541	0
355.0	834.0	8	8	664.777	1.537	0
355.0	828.0	8	8	659.081	1.538	0
361.0	834.0	8	8	662.943	1.540	0
349.0	834.0	8	8	666.659	1.549	0

AT POINT (355.0 , 834.0) RADIUS 664.777

THE MINIMUM FACTOR OF SAFETY IS 1.537

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.319	0.632	0.000	.357	.826E+03	.784E+03	.501E+06	.196E+06
2	2	10.319	1.750	0.000	.372	.228E+04	.217E+04	.112E+07	.566E+06
3	2	10.319	2.666	0.000	.388	.348E+04	.331E+04	.162E+07	.898E+06
4	2	10.319	3.378	0.000	.404	.441E+04	.419E+04	.200E+07	.118E+07
5	2	10.319	3.881	0.000	.419	.507E+04	.481E+04	.226E+07	.141E+07
6	2	10.319	4.170	0.000	.435	.544E+04	.517E+04	.240E+07	.157E+07
7	2	10.319	4.240	0.000	.450	.553E+04	.526E+04	.242E+07	.166E+07
8	2	10.319	4.084	0.000	.466	.533E+04	.507E+04	.232E+07	.165E+07
9	2	10.319	3.698	0.000	.481	.483E+04	.459E+04	.210E+07	.154E+07
10	2	4.979	3.258	0.000	.493	.205E+04	.195E+04	.895E+06	.672E+06
11	2	5.340	1.552	0.000	.500	.105E+04	.996E+03	.498E+06	.349E+06
							SUM	.181E+08	.117E+08

AT CENTER (355.000 , 834.000) WITH RADIUS 664.777 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.551
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.537

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	6	3764.404	1.290	0
-260.0	3300.0	8	1	3309.845	1.291	0
-260.0	2685.0	8	4	2640.598	1.297	0
-260.0	2070.0	11	3	2065.661	1.296	0
-260.0	1455.0	11	8	1476.348	1.306	0
-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	8	3518.036	1.313	0
355.0	3300.0	8	6	2977.872	1.297	0
355.0	2685.0	8	6	2403.727	1.299	0

355.0	2070.0	8	1	2010.984	1.293	0
355.0	1455.0	8	1	1401.544	1.295	0
355.0	840.0	8	8	670.480	1.214	0
970.0	3915.0	8	8	3307.336	1.785	0
970.0	3300.0	8	8	2721.340	1.547	0
970.0	2685.0	8	8	2148.726	1.348	0
970.0	2070.0	8	7	1597.489	1.308	0
970.0	1455.0	8	8	1011.013	1.317	0
970.0	840.0	8	8	441.074	1.364	0
1585.0	3915.0	5	1	3576.110	2.757	0
1585.0	3300.0	11	1	2972.740	2.669	0
1585.0	2685.0	8	5	2033.658	2.523	0
1585.0	2070.0	8	8	1366.188	2.091	0
1585.0	1455.0	8	8	779.193	1.512	0
1585.0	840.0	8	8	211.062	1.442	0
2200.0	3915.0	5	1	3375.933	4.515	0
2200.0	3300.0	5	1	2798.105	4.382	0
2200.0	2685.0	5	1	2225.864	4.248	0
2200.0	2070.0	5	1	1651.240	4.307	0
2200.0	1455.0	5	1	1053.355	5.061	0
2200.0	840.0	2	1	442.593	11.675	0

GRID IS EXPANDED AS FOLLOWS SO MINIMUM FACTOR OF SAFETY FALLS WITHIN THE GRID

-260.0	225.0	1	1	343.839	1000.000	0
355.0	225.0	8	7	106.772	1.228	0
970.0	225.0	1	0	96.428	1000.000	0
1585.0	225.0	1	0	25.000	1000.000	0
2200.0	225.0	1	0	149.190	1000.000	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.290	1.313	1.785	2.757	4.515
3300.000	1.291	1.297	1.547	2.669	4.382
2685.000	1.297	1.299	1.348	2.523	4.248
2070.000	1.296	1.293	1.308	2.091	4.307
1455.000	1.306	1.295	1.317	1.512	5.061
840.000	1000.000	1.214	1.364	1.442	11.675
225.000	1000.000	1.228	1000.000	1000.000	1000.000

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MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.290 AT (-260.000,3915.000)
FACTOR OF SAFETY = 1.293 AT (355.000,2070.000)
FACTOR OF SAFETY = 1.214 AT (355.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (355.0 , 840.0) RADIUS 670.480
THE MINIMUM FACTOR OF SAFETY IS 1.214

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X	CENTER Y	NO. OF CIRCLE			LOWEST	WARNING
COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
355.0	840.0	8	8	670.480	1.214	0
379.0	840.0	8	8	662.279	1.249	0
331.0	840.0	8	1	795.325	1.292	0
355.0	864.0	8	1	815.888	1.306	0

355.0	816.0	8	8	647.703	1.233	0
361.0	840.0	8	1	791.300	1.314	0
349.0	840.0	8	8	672.346	1.221	0
355.0	846.0	8	8	676.187	1.215	0
355.0	834.0	8	8	664.777	1.215	0

AT POINT (355.0 , 840.0) RADIUS 670.480

THE MINIMUM FACTOR OF SAFETY IS 1.214

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	10.484	0.667	0.000	.353	.885E+03	.841E+03	.519E+06	.265E+06
2	2	10.484	1.851	0.000	.369	.246E+04	.233E+04	.117E+07	.760E+06
3	2	10.484	2.831	0.000	.384	.375E+04	.357E+04	.169E+07	.120E+07
4	2	10.484	3.603	0.000	.400	.478E+04	.454E+04	.209E+07	.157E+07
5	2	10.484	4.161	0.000	.416	.552E+04	.524E+04	.237E+07	.187E+07
6	2	10.484	4.502	0.000	.431	.597E+04	.567E+04	.253E+07	.209E+07
7	2	10.484	4.619	0.000	.447	.613E+04	.582E+04	.257E+07	.220E+07
8	2	10.484	4.507	0.000	.463	.598E+04	.568E+04	.248E+07	.221E+07
9	2	10.484	4.160	0.000	.478	.552E+04	.524E+04	.228E+07	.209E+07
10	2	4.117	3.776	0.000	.489	.197E+04	.187E+04	.813E+06	.760E+06
11	2	6.367	1.835	0.000	.497	.148E+04	.140E+04	.658E+06	.578E+06
							SUM	.192E+08	.156E+08

AT CENTER (355.000 , 840.000) WITH RADIUS 670.480 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.229
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.214

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.537

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.214

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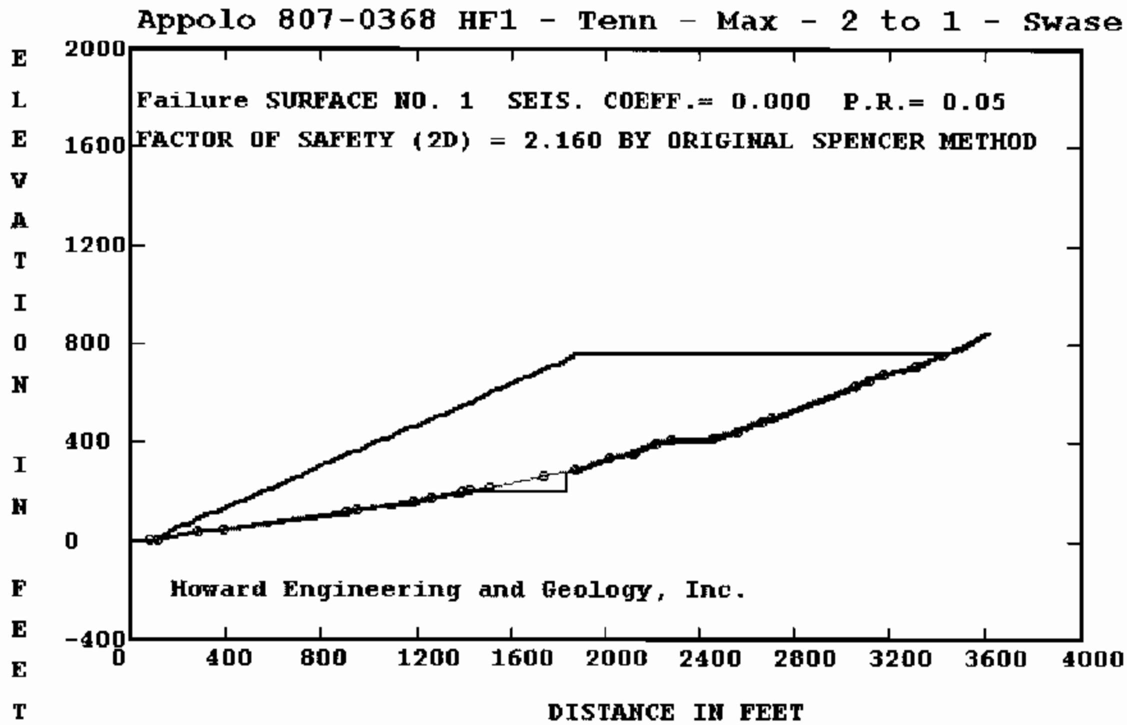
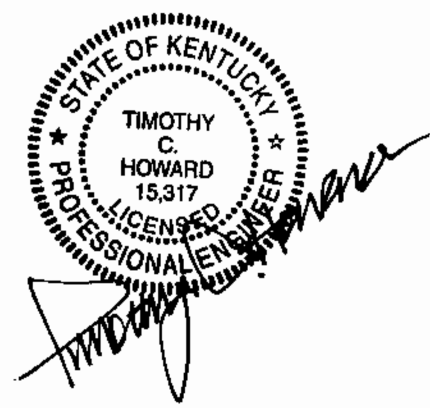

Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.05
FACTOR OF SAFETY (2D) = 2.160 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000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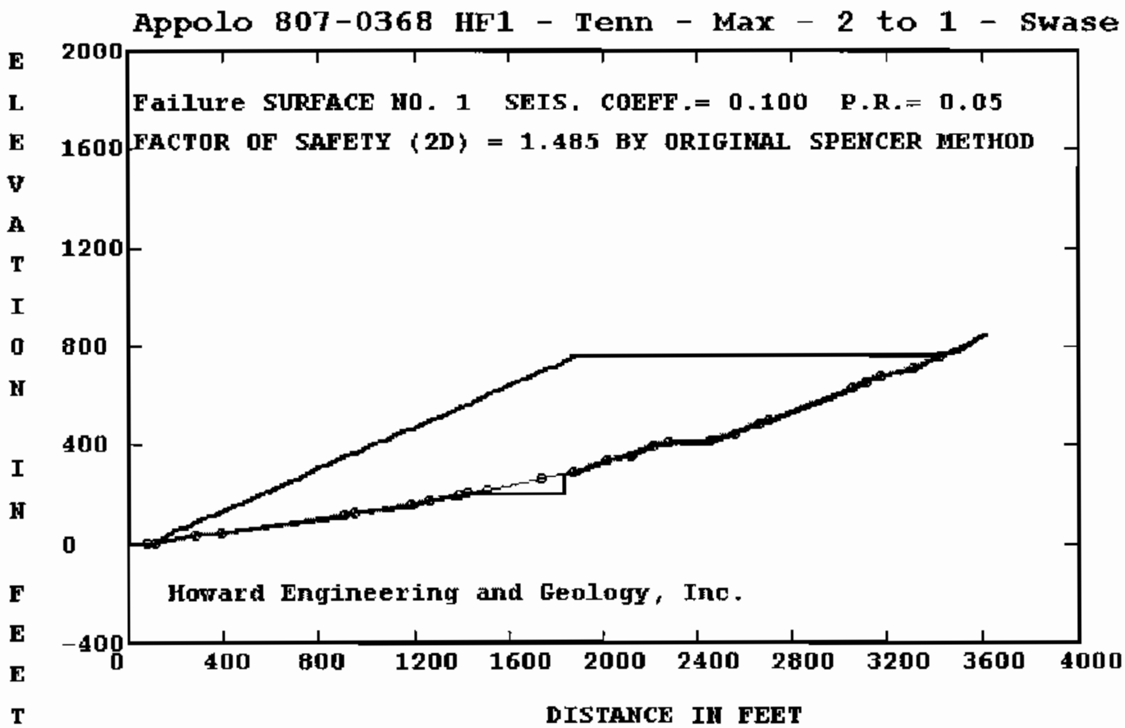
Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.100 P.R.= 0.05
FACTOR OF SAFETY (2D) = 1.485 BY ORIGINAL SPENCER METHOD
Howard Engineering and Geology, Inc.
ELEVATION IN FEET
DISTANCE IN FEET
2000
1600
1200
800
400
0
-400
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000


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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\T-X-2-S.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

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NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

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 8  X COORD.= 1262          Y COORD.= 180
 9  X COORD.= 1392          Y COORD.= 200
 10 X COORD.= 1840          Y COORD.= 200
 11 X COORD.= 1840          Y COORD.= 279
 12 X COORD.= 1859          Y COORD.= 285
 13 X COORD.= 1873          Y COORD.= 290
 14 X COORD.= 2021          Y COORD.= 340
 15 X COORD.= 2123          Y COORD.= 360
 16 X COORD.= 2215          Y COORD.= 400
 17 X COORD.= 2284          Y COORD.= 410
 18 X COORD.= 2455          Y COORD.= 420
 19 X COORD.= 2560          Y COORD.= 450
 20 X COORD.= 2662          Y COORD.= 490
 21 X COORD.= 2704          Y COORD.= 500
 22 X COORD.= 3053          Y COORD.= 630
 23 X COORD.= 3111          Y COORD.= 660
 24 X COORD.= 3169          Y COORD.= 680
 25 X COORD.= 3309          Y COORD.= 710
 26 X COORD.= 3417          Y COORD.= 760
 27 X COORD.= 3503          Y COORD.= 790
 28 X COORD.= 3613          Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 34
 1  X COORD.= 0             Y COORD.= 0
 2  X COORD.= 105           Y COORD.= 10
 3  X COORD.= 205           Y COORD.= 60
 4  X COORD.= 225           Y COORD.= 60
 5  X COORD.= 325           Y COORD.= 110
 6  X COORD.= 345           Y COORD.= 110
 7  X COORD.= 445           Y COORD.= 160
 8  X COORD.= 465           Y COORD.= 160
 9  X COORD.= 565           Y COORD.= 210
 10 X COORD.= 585           Y COORD.= 210
 11 X COORD.= 685           Y COORD.= 260
 12 X COORD.= 705           Y COORD.= 260
 13 X COORD.= 805           Y COORD.= 310
 14 X COORD.= 825           Y COORD.= 310
 15 X COORD.= 925           Y COORD.= 360
 16 X COORD.= 945           Y COORD.= 360
 17 X COORD.= 1045          Y COORD.= 410
 18 X COORD.= 1065          Y COORD.= 410
 19 X COORD.= 1165          Y COORD.= 460
 20 X COORD.= 1185          Y COORD.= 460
 21 X COORD.= 1285          Y COORD.= 510
 22 X COORD.= 1305          Y COORD.= 510
 23 X COORD.= 1405          Y COORD.= 560
 24 X COORD.= 1425          Y COORD.= 560
 25 X COORD.= 1525          Y COORD.= 610
 26 X COORD.= 1545          Y COORD.= 610
 27 X COORD.= 1645          Y COORD.= 660
 28 X COORD.= 1665          Y COORD.= 660
 29 X COORD.= 1765          Y COORD.= 710
 30 X COORD.= 1785          Y COORD.= 710
 31 X COORD.= 1885          Y COORD.= 760
 32 X COORD.= 3417          Y COORD.= 760
 33 X COORD.= 3503          Y COORD.= 790
 34 X COORD.= 3613          Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250      0.086      0.169      0.096      0.135      0.233
         0.123      0.274      0.154      0.313      0.000  99999.000
         0.176      0.336      0.196      0.440      0.147      0.058
         0.283      0.396      0.238      0.371      0.517      0.351
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	0.214	0.459	0.349	0.537	1.000	
2	0.095	0.169	0.096	0.135	0.233	0.123
	0.274	0.154	0.000	99999.000	0.316	0.357
	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.500	0.000	0.500	0.000	0.500
	0.000	0.349	0.536			

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

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PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 27

1	X COORD.= 81	Y COORD.= 7
2	X COORD.= 105	Y COORD.= 7
3	X COORD.= 282	Y COORD.= 37
4	X COORD.= 387	Y COORD.= 47
5	X COORD.= 904	Y COORD.= 117
6	X COORD.= 947	Y COORD.= 127
7	X COORD.= 1190	Y COORD.= 157
8	X COORD.= 1263	Y COORD.= 177
9	X COORD.= 1392	Y COORD.= 197
10	X COORD.= 1426	Y COORD.= 207
11	X COORD.= 1509	Y COORD.= 217
12	X COORD.= 1740	Y COORD.= 267
13	X COORD.= 1874	Y COORD.= 287
14	X COORD.= 2022	Y COORD.= 337
15	X COORD.= 2124	Y COORD.= 357
16	X COORD.= 2215	Y COORD.= 397
17	X COORD.= 2284	Y COORD.= 407
18	X COORD.= 2456	Y COORD.= 417
19	X COORD.= 2561	Y COORD.= 447
20	X COORD.= 2662	Y COORD.= 487
21	X COORD.= 2705	Y COORD.= 497
22	X COORD.= 3054	Y COORD.= 627
23	X COORD.= 3112	Y COORD.= 657
24	X COORD.= 3170	Y COORD.= 677
25	X COORD.= 3310	Y COORD.= 707
26	X COORD.= 3414	Y COORD.= 755

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

27 X COORD.= 3417 Y COORD.= 760

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.160

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	31.500	1.500	0.000	0.000	.591E+04	.532E+04	.120E+08	.000E+00
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.184E+09	.667E+08
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.607E+08	.235E+08
4	1	57.000	42.081	0.000	0.167	.303E+06	.273E+06	.209E+09	.820E+08
5	1	43.000	60.202	0.000	0.095	.327E+06	.295E+06	.222E+09	.500E+08
6	1	20.000	67.952	0.000	0.095	.172E+06	.155E+06	.116E+09	.263E+08
7	1	42.000	75.500	0.000	0.095	.401E+06	.361E+06	.269E+09	.613E+08
8	1	20.850	87.801	0.000	0.134	.231E+06	.208E+06	.154E+09	.503E+08
9	1	37.150	98.374	0.000	0.134	.462E+06	.416E+06	.307E+09	.100E+09
10	1	20.000	103.793	0.000	0.134	.263E+06	.236E+06	.174E+09	.571E+08
11	1	100.000	120.669	0.000	0.134	.153E+07	.137E+07	.101E+10	.332E+09
12	1	20.000	137.546	0.000	0.134	.348E+06	.313E+06	.229E+09	.756E+08
13	1	100.000	154.422	0.000	0.134	.195E+07	.176E+07	.128E+10	.425E+09
14	1	20.000	171.298	0.000	0.134	.433E+06	.390E+06	.284E+09	.942E+08
15	1	37.200	176.726	0.000	0.134	.831E+06	.748E+06	.545E+09	.181E+09
16	1	62.800	194.956	0.000	0.134	.155E+07	.139E+07	.101E+10	.337E+09
17	1	20.000	205.050	0.000	0.134	.519E+06	.467E+06	.339E+09	.113E+09
18	1	79.000	218.098	0.000	0.134	.218E+07	.196E+07	.142E+10	.474E+09
19	1	21.000	235.308	0.000	0.227	.625E+06	.562E+06	.415E+09	.238E+09
20	1	20.000	235.791	0.000	0.227	.596E+06	.537E+06	.396E+09	.227E+09
21	1	2.000	233.733	0.000	0.227	.591E+05	.532E+05	.393E+08	.225E+08
22	1	98.000	252.451	0.000	0.123	.313E+07	.282E+07	.203E+10	.616E+09
23	1	20.000	269.667	0.000	0.123	.682E+06	.614E+06	.441E+09	.134E+09
24	1	11.550	270.607	0.000	0.123	.395E+06	.356E+06	.256E+09	.779E+08
25	1	88.450	289.434	0.000	0.123	.324E+07	.291E+07	.209E+10	.638E+09
26	1	20.000	304.852	0.000	0.123	.771E+06	.694E+06	.498E+09	.152E+09
27	1	5.000	304.559	0.000	0.123	.193E+06	.173E+06	.124E+09	.379E+08
28	1	73.000	313.750	0.000	0.264	.290E+07	.261E+07	.196E+10	.133E+10
29	1	22.000	325.795	0.000	0.153	.907E+06	.816E+06	.591E+09	.226E+09
30	1	20.000	328.039	0.000	0.153	.830E+06	.747E+06	.541E+09	.207E+09
31	1	87.000	341.494	0.000	0.153	.376E+07	.338E+07	.245E+10	.938E+09
32	1	10.200	357.550	0.000	0.282	.461E+06	.415E+06	.316E+09	.230E+09
33	2	2.800	358.888	0.000	0.282	.127E+06	.121E+06	.149E+09	.634E+08
34	2	5.900	358.309	0.000	0.282	.267E+06	.254E+06	.313E+09	.133E+09
35	2	14.100	355.368	0.000	0.282	.634E+06	.602E+06	.742E+09	.316E+09
36	2	1.000	353.397	0.000	0.282	.447E+05	.425E+05	.524E+08	.223E+08
37	2	83.000	369.250	0.000	0.120	.388E+07	.368E+07	.421E+10	.734E+09
38	2	16.000	387.268	0.000	0.212	.784E+06	.745E+06	.900E+09	.282E+09
39	2	20.000	387.372	0.000	0.212	.980E+06	.931E+06	.112E+10	.353E+09
40	2	100.000	399.385	0.000	0.212	.505E+07	.480E+07	.580E+10	.182E+10
41	2	20.000	411.398	0.000	0.212	.104E+07	.989E+06	.119E+10	.374E+09
42	2	75.000	419.867	0.000	0.212	.398E+07	.378E+07	.457E+10	.143E+10
43	2	5.250	431.421	0.000	0.148	.287E+06	.272E+06	.314E+09	.679E+08
44	2	19.750	435.805	0.000	0.148	.109E+07	.103E+07	.119E+10	.258E+09
45	2	20.000	437.776	0.000	0.148	.111E+07	.105E+07	.121E+10	.262E+09
46	2	72.566	449.010	0.000	0.148	.412E+07	.392E+07	.452E+10	.977E+09
47	1	16.434	464.618	0.000	0.148	.966E+06	.869E+06	.619E+09	.229E+09
48	1	11.000	468.392	0.000	0.320	.652E+06	.587E+06	.467E+09	.391E+09
49	1	137.000	446.142	0.000	0.320	.773E+07	.696E+07	.554E+10	.463E+10
50	1	57.600	417.353	0.000	0.192	.304E+07	.274E+07	.200E+10	.970E+09
51	1	44.400	407.353	0.000	0.192	.229E+07	.206E+07	.150E+10	.730E+09
52	1	91.000	383.000	0.000	0.402	.441E+07	.397E+07	.330E+10	.358E+10

53	1	69.000	358.000	0.000	0.143	.312E+07	.281E+07	.192E+10	.689E+09
54	1	129.950	349.222	0.000	0.058	.574E+07	.517E+07	.314E+10	.451E+09
55	1	42.050	344.222	0.000	0.058	.183E+07	.165E+07	.100E+10	.144E+09
56	1	105.000	328.000	0.000	0.275	.436E+07	.392E+07	.312E+10	.220E+10
57	1	101.000	293.000	0.000	0.368	.374E+07	.337E+07	.288E+10	.282E+10
58	1	43.000	268.000	0.000	0.227	.146E+07	.131E+07	.988E+09	.567E+09
59	1	43.300	254.936	0.000	0.349	.140E+07	.126E+07	.107E+10	.978E+09
60	1	305.700	189.936	0.000	0.349	.734E+07	.661E+07	.564E+10	.514E+10
61	1	28.650	125.590	0.000	0.459	.455E+06	.410E+06	.383E+09	.480E+09
62	1	29.350	110.590	0.000	0.459	.410E+06	.369E+06	.347E+09	.433E+09
63	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.519E+09	.430E+09
64	1	140.000	68.000	0.000	0.210	.120E+07	.108E+07	.789E+09	.403E+09
65	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.349E+09	.355E+09
66	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.381E+07	.272E+07
		SUM						.818E+11	.403E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 2.029

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	2.203	2.122
0.300	2.153	2.171
0.600	2.155	2.229

FROM ORIGINAL SPENCER METHOD, DEL = 0.237 AND F. S. = 2.160

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.485

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	31.500	1.500	0.000	0.000	.591E+04	.532E+04	.120E+08	.958E+06
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.181E+09	.106E+09
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.598E+08	.372E+08
4	1	57.000	42.081	0.000	0.167	.303E+06	.273E+06	.205E+09	.130E+09
5	1	43.000	60.202	0.000	0.095	.327E+06	.295E+06	.220E+09	.102E+09
6	1	20.000	67.952	0.000	0.095	.172E+06	.155E+06	.115E+09	.532E+08
7	1	42.000	75.500	0.000	0.095	.401E+06	.361E+06	.266E+09	.124E+09
8	1	20.850	87.801	0.000	0.134	.231E+06	.208E+06	.152E+09	.864E+08
9	1	37.150	98.374	0.000	0.134	.462E+06	.416E+06	.303E+09	.172E+09
10	1	20.000	103.793	0.000	0.134	.263E+06	.236E+06	.172E+09	.978E+08
11	1	100.000	120.669	0.000	0.134	.153E+07	.137E+07	.995E+09	.567E+09
12	1	20.000	137.546	0.000	0.134	.348E+06	.313E+06	.226E+09	.129E+09
13	1	100.000	154.422	0.000	0.134	.195E+07	.176E+07	.127E+10	.722E+09
14	1	20.000	171.298	0.000	0.134	.433E+06	.390E+06	.280E+09	.160E+09
15	1	37.200	176.726	0.000	0.134	.831E+06	.748E+06	.538E+09	.306E+09
16	1	62.800	194.956	0.000	0.134	.155E+07	.139E+07	.999E+09	.569E+09
17	1	20.000	205.050	0.000	0.134	.519E+06	.467E+06	.334E+09	.190E+09
18	1	79.000	218.098	0.000	0.134	.218E+07	.196E+07	.140E+10	.798E+09
19	1	21.000	235.308	0.000	0.227	.625E+06	.562E+06	.406E+09	.332E+09
20	1	20.000	235.791	0.000	0.227	.596E+06	.537E+06	.387E+09	.316E+09
21	1	2.000	233.733	0.000	0.227	.591E+05	.532E+05	.384E+08	.314E+08
22	1	98.000	252.451	0.000	0.123	.313E+07	.282E+07	.200E+10	.107E+10
23	1	20.000	269.667	0.000	0.123	.682E+06	.614E+06	.436E+09	.233E+09
24	1	11.550	270.607	0.000	0.123	.395E+06	.356E+06	.253E+09	.135E+09
25	1	88.450	289.434	0.000	0.123	.324E+07	.291E+07	.207E+10	.110E+10
26	1	20.000	304.852	0.000	0.123	.771E+06	.694E+06	.492E+09	.262E+09

27	1	5.000	304.559	0.000	0.123	.193E+06	.173E+06	.123E+09	.655E+08
28	1	73.000	313.750	0.000	0.264	.290E+07	.261E+07	.191E+10	.176E+10
29	1	22.000	325.795	0.000	0.153	.907E+06	.816E+06	.582E+09	.356E+09
30	1	20.000	328.039	0.000	0.153	.830E+06	.747E+06	.532E+09	.326E+09
31	1	87.000	341.494	0.000	0.153	.376E+07	.338E+07	.241E+10	.147E+10
32	1	10.200	357.550	0.000	0.282	.461E+06	.415E+06	.307E+09	.299E+09
33	2	2.800	358.888	0.000	0.282	.127E+06	.121E+06	.145E+09	.825E+08
34	2	5.900	358.309	0.000	0.282	.267E+06	.254E+06	.304E+09	.174E+09
35	2	14.100	355.368	0.000	0.282	.634E+06	.602E+06	.721E+09	.411E+09
36	2	1.000	353.397	0.000	0.282	.447E+05	.425E+05	.508E+08	.290E+08
37	2	83.000	369.250	0.000	0.120	.388E+07	.368E+07	.416E+10	.127E+10
38	2	16.000	387.268	0.000	0.212	.784E+06	.745E+06	.880E+09	.396E+09
39	2	20.000	387.372	0.000	0.212	.980E+06	.931E+06	.110E+10	.495E+09
40	2	100.000	399.385	0.000	0.212	.505E+07	.480E+07	.567E+10	.255E+10
41	2	20.000	411.398	0.000	0.212	.104E+07	.989E+06	.117E+10	.524E+09
42	2	75.000	419.867	0.000	0.212	.398E+07	.378E+07	.447E+10	.201E+10
43	2	5.250	431.421	0.000	0.148	.287E+06	.272E+06	.309E+09	.107E+09
44	2	19.750	435.805	0.000	0.148	.109E+07	.103E+07	.118E+10	.406E+09
45	2	20.000	437.776	0.000	0.148	.111E+07	.105E+07	.120E+10	.413E+09
46	2	72.566	449.010	0.000	0.148	.412E+07	.392E+07	.445E+10	.153E+10
47	1	16.434	464.618	0.000	0.148	.966E+06	.869E+06	.609E+09	.357E+09
48	1	11.000	468.392	0.000	0.320	.652E+06	.587E+06	.451E+09	.488E+09
49	1	137.000	446.142	0.000	0.320	.773E+07	.696E+07	.535E+10	.580E+10
50	1	57.600	417.353	0.000	0.192	.304E+07	.274E+07	.196E+10	.139E+10
51	1	44.400	407.353	0.000	0.192	.229E+07	.206E+07	.147E+10	.105E+10
52	1	91.000	383.000	0.000	0.402	.441E+07	.397E+07	.316E+10	.429E+10
53	1	69.000	358.000	0.000	0.143	.312E+07	.281E+07	.190E+10	.110E+10
54	1	129.950	349.222	0.000	0.058	.574E+07	.517E+07	.312E+10	.112E+10
55	1	42.050	344.222	0.000	0.058	.183E+07	.165E+07	.995E+09	.357E+09
56	1	105.000	328.000	0.000	0.275	.436E+07	.392E+07	.303E+10	.288E+10
57	1	101.000	293.000	0.000	0.368	.374E+07	.337E+07	.277E+10	.344E+10
58	1	43.000	268.000	0.000	0.227	.146E+07	.131E+07	.966E+09	.783E+09
59	1	43.300	254.936	0.000	0.349	.140E+07	.126E+07	.103E+10	.121E+10
60	1	305.700	189.936	0.000	0.349	.734E+07	.661E+07	.543E+10	.639E+10
61	1	28.650	125.590	0.000	0.459	.455E+06	.410E+06	.364E+09	.565E+09
62	1	29.350	110.590	0.000	0.459	.410E+06	.369E+06	.330E+09	.510E+09
63	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.502E+09	.546E+09
64	1	140.000	68.000	0.000	0.210	.120E+07	.108E+07	.773E+09	.579E+09
65	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.335E+09	.427E+09
66	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.370E+07	.288E+07
		SUM						.800E+11	.558E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.434

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.532	1.428
0.300	1.490	1.458
0.600	1.489	1.496

FROM ORIGINAL SPENCER METHOD, DEL = 0.520 AND F. S. = 1.485

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.160

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.485

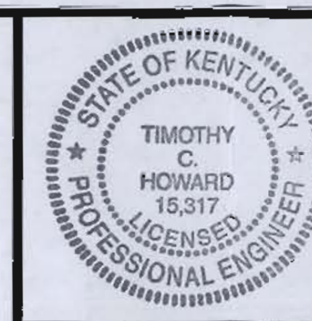
Timothy Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Circular [T-X-2-C.TXT]

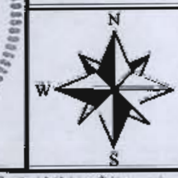
AT CENTER (355.000 , 834.000) WITH RADIUS 664.777 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.551
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.537
AT CENTER (355.000 , 840.000) WITH RADIUS 670.480 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.229
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.214

0 =	0 ,	0	35 =	1189 ,	160	70 =	1165 ,	460
1 =	12 ,	-3	36 =	1262 ,	180	71 =	1185 ,	460
2 =	105 ,	5	37 =	1392 ,	200	72 =	1285 ,	510
3 =	283 ,	35	38 =	1859 ,	285	73 =	1305 ,	510
4 =	387 ,	45	39 =	1873 ,	290	74 =	1405 ,	560
5 =	904 ,	115	40 =	2021 ,	340	75 =	1425 ,	560
6 =	947 ,	125	41 =	2123 ,	360	76 =	1525 ,	610
7 =	1190 ,	155	42 =	2215 ,	400	77 =	1545 ,	610
8 =	1263 ,	175	43 =	2284 ,	410	78 =	1645 ,	660
9 =	1393 ,	195	44 =	2455 ,	420	79 =	1665 ,	660
10 =	1409 ,	200	45 =	2560 ,	450	80 =	1765 ,	710
11 =	1840 ,	200	46 =	2662 ,	490	81 =	1785 ,	710
12 =	1840 ,	279	47 =	2704 ,	500	82 =	1885 ,	760
13 =	1874 ,	285	48 =	3053 ,	630			
14 =	2023 ,	335	49 =	3111 ,	660			
15 =	2125 ,	355	50 =	3169 ,	680			
16 =	2216 ,	395	51 =	3309 ,	710			
17 =	2284 ,	405	52 =	3417 ,	760			
18 =	2456 ,	415	53 =	3503 ,	790			
19 =	2562 ,	445	54 =	205 ,	60			
20 =	2663 ,	485	55 =	225 ,	60			
21 =	2705 ,	495	56 =	325 ,	110			
22 =	3055 ,	625	57 =	345 ,	110			
23 =	3113 ,	655	58 =	445 ,	160			
24 =	3170 ,	675	59 =	465 ,	160			
25 =	3310 ,	705	60 =	565 ,	210			
26 =	3419 ,	755	61 =	585 ,	210			
27 =	3505 ,	785	62 =	685 ,	260			
28 =	3600 ,	836	63 =	705 ,	260			
29 =	3613 ,	849	64 =	805 ,	310			
30 =	105 ,	10	65 =	825 ,	310			
31 =	282 ,	40	66 =	925 ,	360			
32 =	386 ,	50	67 =	945 ,	360			
33 =	903 ,	120	68 =	1045 ,	410			
34 =	946 ,	130	69 =	1065 ,	410			



Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing



HOWARD Engineering and Geology, Inc.

Scale: None

Attachment 26.3.A

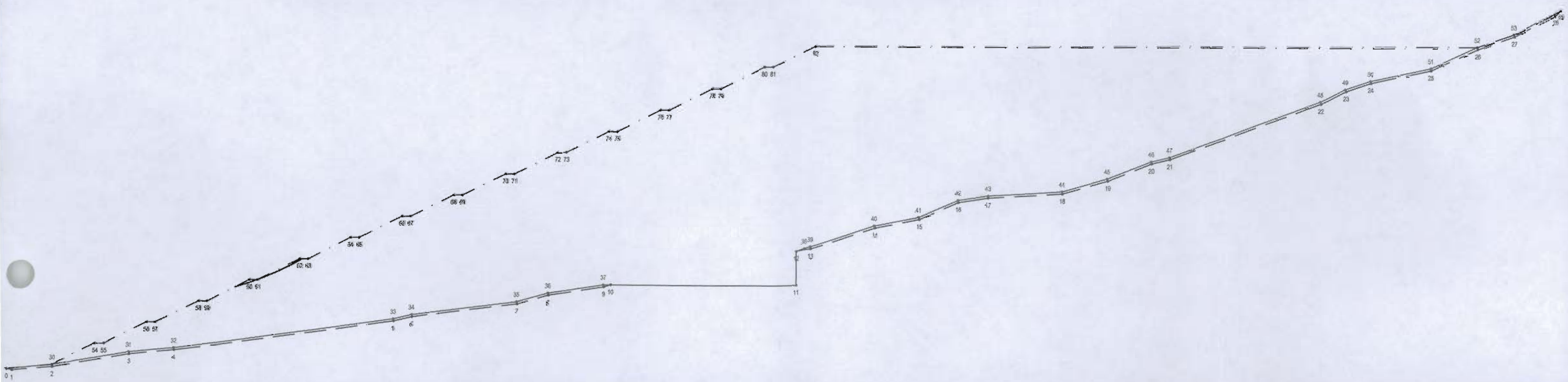
DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\DFG\Reame Drw\T-X-2-C.dwg

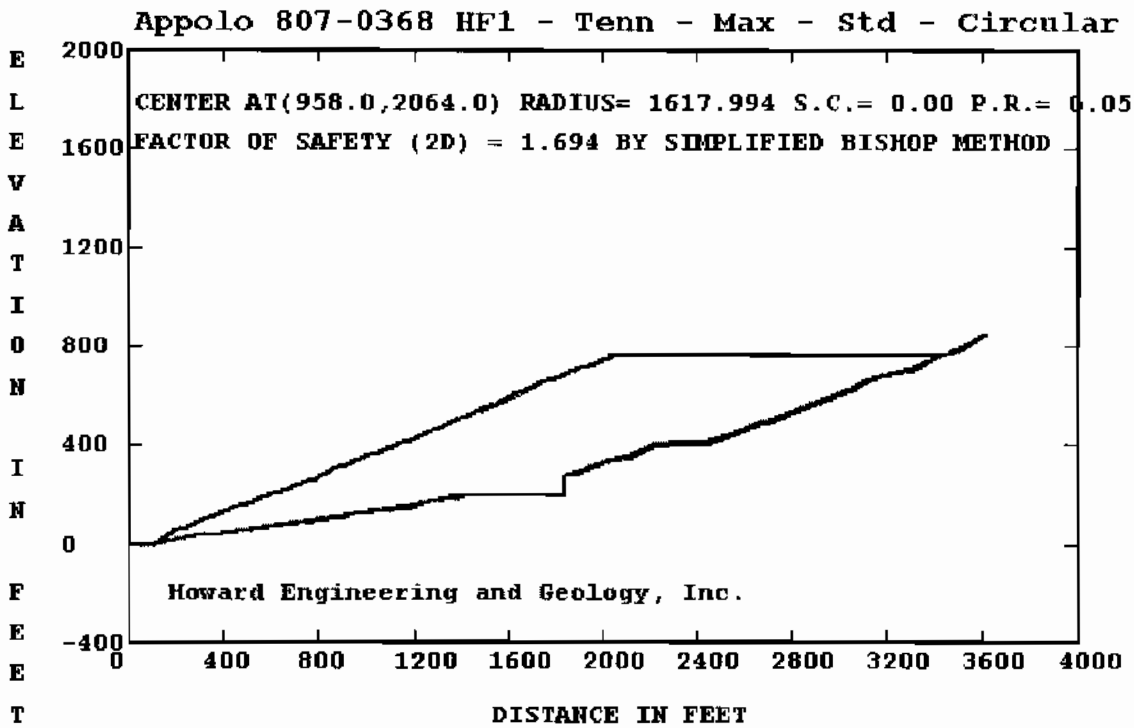
Timothy C. Howard

I, ____________, P.E. No. 15,317

Date: 10/6/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.





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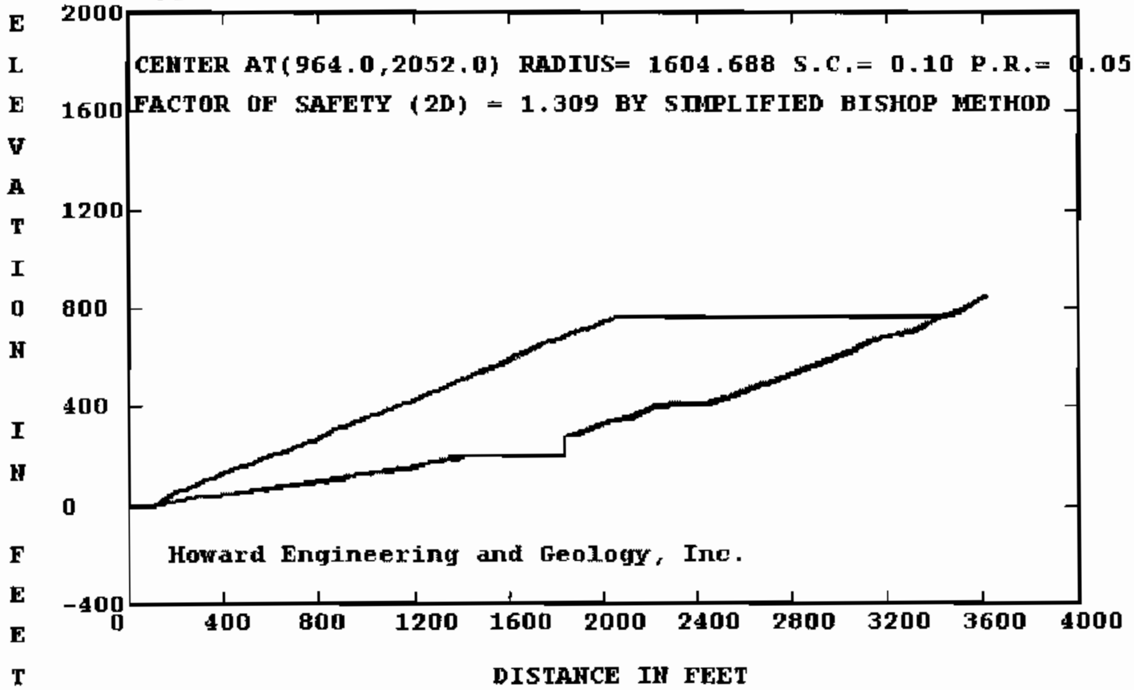
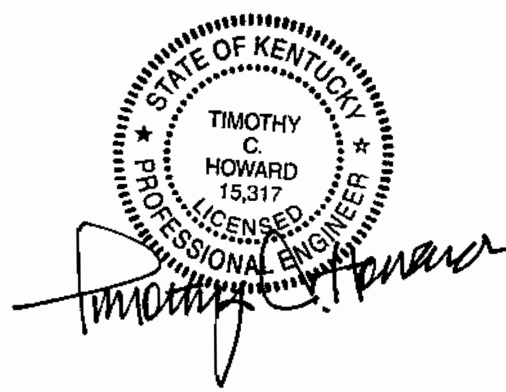
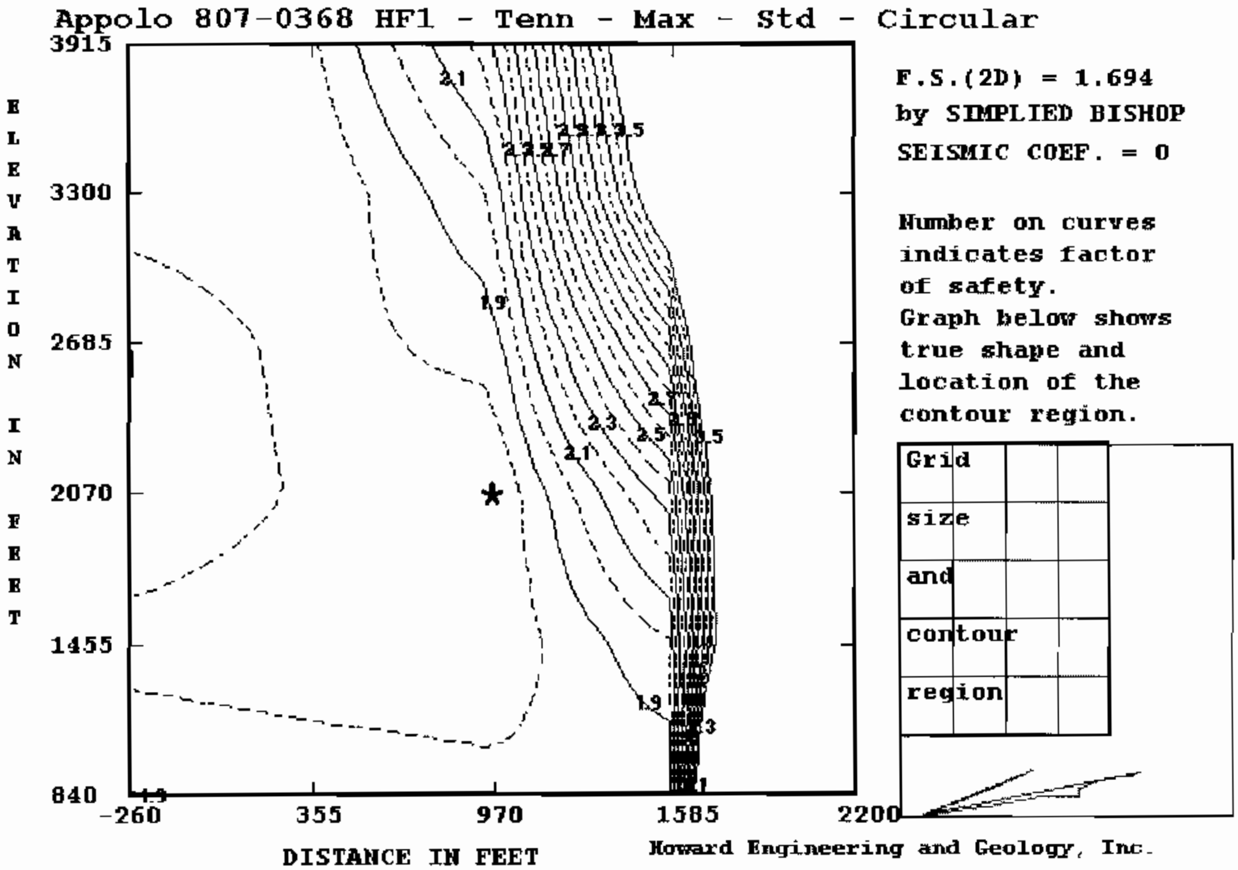
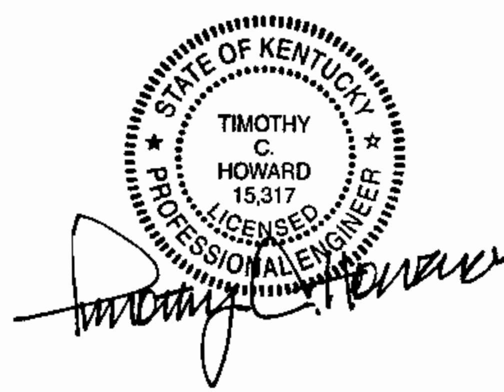
Appolo 807-0368 HF1 - Tenn - Max - Std - Circular






Appolo 807-0368 HF1 - Tenn - Max - Std - Circular
ELEVATION IN FEET
3915
3300
2685
2070
1455
840
-260
355
970
1585
2200
DISTANCE IN FEET
F.S.(2D) = 1.694
by SIMPLIED BISHOP
SEISMIC COEF. = 0
Number on curves indicates factor of safety.
Graph below shows true shape and location of the contour region.
Grid size and contour region
Howard Engineering and Geology, Inc.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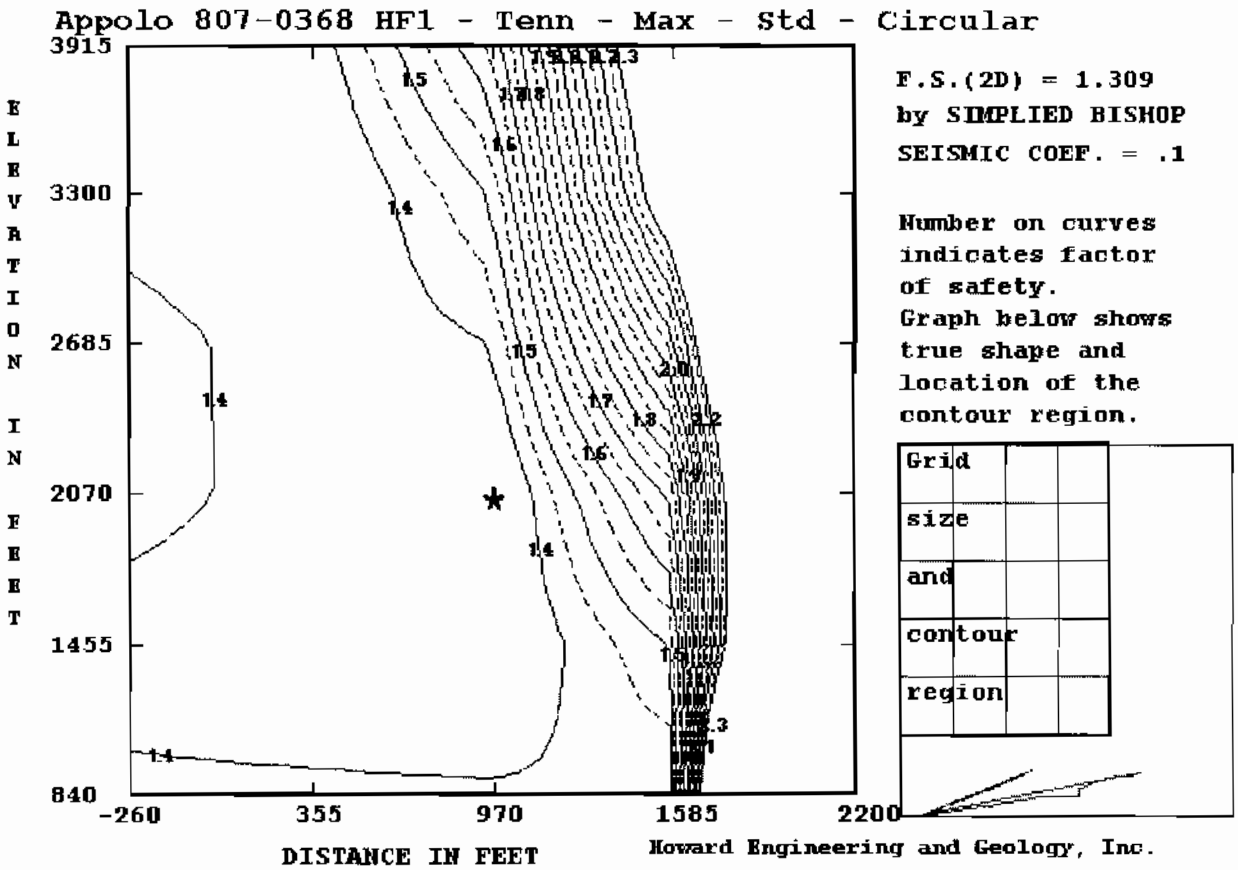

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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
THIS 2008 VERSION IS LICENSED BY CIVIL ENGINEERING SOFTWARE CENTER TO

Howard Engineering and Geology, Inc.

INPUT FILE NAME -R:\T-X-V-C.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Max - Std - Circular

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 0

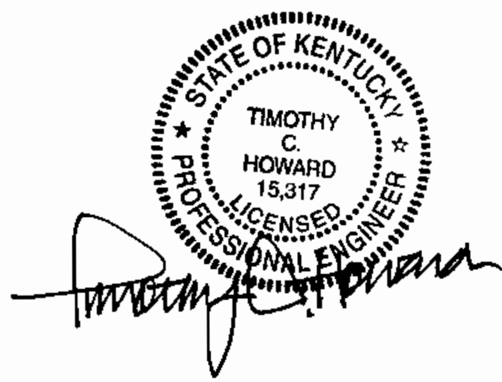
TWO-DIMENSIONAL ANALYSIS (THREED = 0)

ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30
1 X COORD.= 0 Y COORD.= 0
2 X COORD.= 12 Y COORD.=-3
3 X COORD.= 105 Y COORD.= 5
4 X COORD.= 283 Y COORD.= 35
5 X COORD.= 387 Y COORD.= 45
6 X COORD.= 904 Y COORD.= 115
7 X COORD.= 947 Y COORD.= 125
8 X COORD.= 1190 Y COORD.= 155
9 X COORD.= 1263 Y COORD.= 175
10 X COORD.= 1393 Y COORD.= 195
11 X COORD.= 1409 Y COORD.= 200
12 X COORD.= 1840 Y COORD.= 200
13 X COORD.= 1840 Y COORD.= 279
14 X COORD.= 1874 Y COORD.= 285
15 X COORD.= 2023 Y COORD.= 335
16 X COORD.= 2125 Y COORD.= 355
17 X COORD.= 2216 Y COORD.= 395
18 X COORD.= 2284 Y COORD.= 405
19 X COORD.= 2456 Y COORD.= 415
20 X COORD.= 2562 Y COORD.= 445
21 X COORD.= 2663 Y COORD.= 485
22 X COORD.= 2705 Y COORD.= 495
23 X COORD.= 3055 Y COORD.= 625
24 X COORD.= 3113 Y COORD.= 655
25 X COORD.= 3170 Y COORD.= 675
26 X COORD.= 3310 Y COORD.= 705
27 X COORD.= 3419 Y COORD.= 755
28 X COORD.= 3505 Y COORD.= 785
29 X COORD.= 3600 Y COORD.= 836
30 X COORD.= 3613 Y COORD.= 849



NO. OF POINTS ON BOUNDARY LINE 2 = 28
1 X COORD.= 0 Y COORD.= 0
2 X COORD.= 105 Y COORD.= 10
3 X COORD.= 282 Y COORD.= 40
4 X COORD.= 386 Y COORD.= 50
5 X COORD.= 903 Y COORD.= 120
6 X COORD.= 946 Y COORD.= 130
7 X COORD.= 1189 Y COORD.= 160

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 8  X COORD.= 1262          Y COORD.= 180
 9  X COORD.= 1392          Y COORD.= 200
 10 X COORD.= 1840          Y COORD.= 200
 11 X COORD.= 1840          Y COORD.= 279
 12 X COORD.= 1859          Y COORD.= 285
 13 X COORD.= 1873          Y COORD.= 290
 14 X COORD.= 2021          Y COORD.= 340
 15 X COORD.= 2123          Y COORD.= 360
 16 X COORD.= 2215          Y COORD.= 400
 17 X COORD.= 2284          Y COORD.= 410
 18 X COORD.= 2455          Y COORD.= 420
 19 X COORD.= 2560          Y COORD.= 450
 20 X COORD.= 2662          Y COORD.= 490
 21 X COORD.= 2704          Y COORD.= 500
 22 X COORD.= 3053          Y COORD.= 630
 23 X COORD.= 3111          Y COORD.= 660
 24 X COORD.= 3169          Y COORD.= 680
 25 X COORD.= 3309          Y COORD.= 710
 26 X COORD.= 3417          Y COORD.= 760
 27 X COORD.= 3503          Y COORD.= 790
 28 X COORD.= 3613          Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 34
 1  X COORD.= 0             Y COORD.= 0
 2  X COORD.= 105           Y COORD.= 10
 3  X COORD.= 205           Y COORD.= 60
 4  X COORD.= 225           Y COORD.= 60
 5  X COORD.= 327           Y COORD.= 110
 6  X COORD.= 349           Y COORD.= 110
 7  X COORD.= 460           Y COORD.= 160
 8  X COORD.= 482           Y COORD.= 160
 9  X COORD.= 602           Y COORD.= 210
 10 X COORD.= 627           Y COORD.= 210
 11 X COORD.= 749           Y COORD.= 260
 12 X COORD.= 771           Y COORD.= 260
 13 X COORD.= 876           Y COORD.= 310
 14 X COORD.= 897           Y COORD.= 310
 15 X COORD.= 1011          Y COORD.= 360
 16 X COORD.= 1035          Y COORD.= 360
 17 X COORD.= 1145          Y COORD.= 410
 18 X COORD.= 1166          Y COORD.= 410
 19 X COORD.= 1268          Y COORD.= 460
 20 X COORD.= 1288          Y COORD.= 460
 21 X COORD.= 1389          Y COORD.= 510
 22 X COORD.= 1410          Y COORD.= 510
 23 X COORD.= 1511          Y COORD.= 560
 24 X COORD.= 1531          Y COORD.= 560
 25 X COORD.= 1633          Y COORD.= 610
 26 X COORD.= 1653          Y COORD.= 610
 27 X COORD.= 1755          Y COORD.= 660
 28 X COORD.= 1777          Y COORD.= 660
 29 X COORD.= 1898          Y COORD.= 710
 30 X COORD.= 1922          Y COORD.= 710
 31 X COORD.= 2043          Y COORD.= 760
 32 X COORD.= 3417          Y COORD.= 760
 33 X COORD.= 3503          Y COORD.= 790
 34 X COORD.= 3613          Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250       0.086       0.169       0.096       0.135       0.233
         0.123       0.274       0.154       0.313       0.000   99999.000
         0.176       0.336       0.196       0.440       0.147       0.058
         0.283       0.396       0.238       0.371       0.517       0.351
```

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	0.214	0.459	0.349	0.537	1.000	
2	0.095	0.169	0.096	0.135	0.233	0.123
	0.274	0.154	0.000	99999.000	0.316	0.357
	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.490	0.000	0.450
	0.000	0.417	0.000	0.410	0.000	0.476
	0.000	0.439	0.000	0.455	0.000	0.490
	0.000	0.495	0.000	0.495	0.000	0.490
	0.000	0.490	0.000	0.413	0.000	0.413
	0.000	0.349	0.536			

MIN. DEPTH OF TALLEST SLICE (DMIN) = 0
NO. OF RADIUS CONTROL ZONES (NRCZ) = 1

RADIUS DECREMENT (RDEC) FOR ZONE 1 = 0
NO. OF CIRCLES (NCIR) FOR ZONE 1 = 5
NO. OF BOTTOM LINES (NOL) FOR ZONE 1 = 1

LINE NO. (LINO)	BEG. NO. (NBP)	END NO. (NEP)
1	1	30

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
USE GRID
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY SIMPLIFIED BISHOP METHOD (MTHD=2)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
INPUT COORD. OF GRID POINTS 1,2,AND 3

POINT 1 X COORD. =-260 Y COORD. = 3915
POINT 2 X COORD. =-260 Y COORD. = 840
POINT 3 X COORD. = 2200 Y COORD. = 840

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X INCREMENT (XINC) = 24 Y INCREMENT (YINC) = 24
NO. OF DIVISIONS BETWEEN POINTS 1 AND 2 (ND12) = 5
NO. OF DIVISIONS BETWEEN POINTS 2 AND 3 (ND23) = 4
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X	CENTER Y	NO. OF CIRCLE			LOWEST	WARNING
COORDINATE	COORDINATE	TOTAL	CRITIC.	RADIUS	F.S.	
-260.0	3915.0	8	8	3782.498	1.736	0

-260.0	3300.0	5	1	3309.845	1.736	0
-260.0	2685.0	5	1	2697.559	1.902	0
-260.0	2070.0	5	1	2086.265	1.896	0
-260.0	1455.0	11	2	1475.941	1.756	0
-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	7	3572.572	1.782	0
355.0	3300.0	8	7	2999.460	1.706	0
355.0	2685.0	8	7	2426.574	1.758	0
355.0	2070.0	8	1	2010.984	1.783	0
355.0	1455.0	8	8	1265.140	1.728	0
355.0	840.0	8	1	792.105	1.869	0
970.0	3915.0	8	8	3352.429	2.264	0
970.0	3300.0	8	8	2770.218	2.007	0
970.0	2685.0	8	7	2206.996	1.842	0
970.0	2070.0	8	8	1619.188	1.699	0
970.0	1455.0	8	7	1061.662	1.724	0
970.0	840.0	8	7	488.501	1.834	0
1585.0	3915.0	5	1	3576.110	4.185	0
1585.0	3300.0	8	8	2600.551	3.878	0
1585.0	2685.0	8	8	1998.565	3.042	0
1585.0	2070.0	8	8	1407.839	2.369	0
1585.0	1455.0	8	7	847.375	1.996	0
1585.0	840.0	8	8	254.019	1.816	0
2200.0	3915.0	5	1	3375.933	9.853	0
2200.0	3300.0	5	1	2798.105	8.966	0
2200.0	2685.0	5	1	2225.864	8.122	0
2200.0	2070.0	5	1	1651.240	7.702	0
2200.0	1455.0	5	1	1053.355	8.471	0
2200.0	840.0	4	1	442.593	16.494	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.736	1.782	2.264	4.185	9.853
3300.000	1.736	1.706	2.007	3.878	8.966
2685.000	1.902	1.758	1.842	3.042	8.122
2070.000	1.896	1.783	1.699	2.369	7.702
1455.000	1.756	1.728	1.724	1.996	8.471
840.000	1000.000	1.869	1.834	1.816	16.494

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MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.706 AT (355.000,3300.000)
FACTOR OF SAFETY = 1.699 AT (970.000,2070.000)
FACTOR OF SAFETY = 1.816 AT (1585.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (970.0 , 2070.0) RADIUS 1619.188
THE MINIMUM FACTOR OF SAFETY IS 1.699

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE
MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
970.0	2070.0	8	8	1619.188	1.699	0
994.0	2070.0	8	8	1609.721	1.715	0
946.0	2070.0	8	7	1643.151	1.727	0
970.0	2094.0	8	8	1641.162	1.705	0
970.0	2046.0	8	8	1597.035	1.695	0

970.0	2022.0	8	8	1574.446	1.695	0
994.0	2046.0	8	8	1587.676	1.709	0
946.0	2046.0	8	7	1620.574	1.722	0
976.0	2046.0	8	8	1594.846	1.697	0
964.0	2046.0	8	8	1599.042	1.694	0
958.0	2046.0	8	8	1601.068	1.695	0
964.0	2052.0	8	8	1604.688	1.694	0
964.0	2058.0	8	8	1610.338	1.694	0
970.0	2052.0	8	8	1602.689	1.695	0
958.0	2052.0	8	8	1606.708	1.694	0
952.0	2052.0	8	7	1624.212	1.727	0
958.0	2058.0	8	8	1612.350	1.694	0
958.0	2064.0	8	8	1617.994	1.694	0
958.0	2070.0	8	8	1623.642	1.694	0
964.0	2064.0	8	8	1615.990	1.695	0
952.0	2064.0	8	8	1620.019	1.694	0

AT POINT (958.0 , 2064.0) RADIUS 1617.994

THE MINIMUM FACTOR OF SAFETY IS 1.694

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	35.009	3.440	0.000	.291	.152E+05	.145E+05	.175E+08	.718E+07
2	2	35.009	9.668	0.000	.313	.428E+05	.407E+05	.466E+08	.217E+08
3	2	28.902	14.582	0.000	.333	.533E+05	.506E+05	.571E+08	.287E+08
4	2	6.107	15.444	0.000	.344	.119E+05	.113E+05	.127E+08	.663E+07
5	2	13.893	11.747	0.000	.350	.206E+05	.196E+05	.221E+08	.117E+08
6	2	21.116	10.270	0.000	.361	.274E+05	.261E+05	.293E+08	.160E+08
7	2	35.009	12.872	0.000	.378	.570E+05	.542E+05	.602E+08	.349E+08
8	2	35.009	15.257	0.000	.400	.676E+05	.642E+05	.704E+08	.437E+08
9	2	10.866	16.288	0.000	.414	.224E+05	.213E+05	.231E+08	.150E+08
10	2	20.000	11.838	0.000	.423	.299E+05	.285E+05	.310E+08	.205E+08
11	2	4.143	7.151	0.000	.431	.375E+04	.356E+04	.393E+07	.261E+07
12	2	35.009	7.240	0.000	.443	.321E+05	.305E+05	.334E+08	.230E+08
13	2	35.009	6.574	0.000	.465	.291E+05	.277E+05	.301E+08	.219E+08
14	2	27.839	5.048	0.000	.484	.178E+05	.169E+05	.184E+08	.139E+08
15	2	7.170	2.047	0.000	.495	.186E+04	.176E+04	.207E+07	.149E+07
							SUM	.458E+09	.269E+09

AT CENTER (958.000 , 2064.000) WITH RADIUS 1617.994 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.703
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.694

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CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

AUTOMATIC SEARCH WILL FOLLOW AFTER GRID

FACTORS OF SAFETY BASED ON GRID

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
-260.0	3915.0	8	8	3782.498	1.352	0
-260.0	3300.0	5	1	3309.845	1.352	0
-260.0	2685.0	5	1	2697.559	1.442	0
-260.0	2070.0	11	8	2079.505	1.436	0
-260.0	1455.0	11	2	1475.941	1.354	0

-260.0	840.0	1	1	879.318	1000.000	0
355.0	3915.0	8	7	3572.572	1.362	0
355.0	3300.0	8	7	2999.460	1.314	0
355.0	2685.0	8	7	2426.574	1.349	0
355.0	2070.0	8	1	2010.984	1.359	0
355.0	1455.0	8	8	1265.140	1.337	0
355.0	840.0	8	1	792.105	1.413	0
970.0	3915.0	8	8	3352.429	1.658	0
970.0	3300.0	8	8	2770.218	1.505	0
970.0	2685.0	8	7	2206.996	1.401	0
970.0	2070.0	8	8	1619.188	1.312	0
970.0	1455.0	8	7	1061.662	1.329	0
970.0	840.0	8	7	488.501	1.408	0
1585.0	3915.0	11	1	3576.110	2.592	0
1585.0	3300.0	8	7	2620.140	2.452	0
1585.0	2685.0	8	8	1998.565	2.076	0
1585.0	2070.0	8	8	1407.839	1.720	0
1585.0	1455.0	8	7	847.375	1.507	0
1585.0	840.0	8	8	254.019	1.407	0
2200.0	3915.0	5	1	3375.933	4.132	0
2200.0	3300.0	5	1	2798.105	3.973	0
2200.0	2685.0	5	1	2225.864	3.799	0
2200.0	2070.0	5	1	1651.240	3.763	0
2200.0	1455.0	5	1	1053.355	4.202	0
2200.0	840.0	4	1	442.593	7.627	0

LOWEST FACTOR OF SAFETY AT EACH GRID POINT IS TABULATED BELOW

COORDINATE	-260.000	355.000	970.000	1585.000	2200.000
3915.000	1.352	1.362	1.658	2.592	4.132
3300.000	1.352	1.314	1.505	2.452	3.973
2685.000	1.442	1.349	1.401	2.076	3.799
2070.000	1.436	1.359	1.312	1.720	3.763
1455.000	1.354	1.337	1.329	1.507	4.202
840.000	1000.000	1.413	1.408	1.407	7.627

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MINIMUM FACTORS OF SAFETY OCCUR AT THE FOLLOWING 3 CENTERS

FACTOR OF SAFETY = 1.314 AT (355.000,3300.000)
FACTOR OF SAFETY = 1.312 AT (970.000,2070.000)
FACTOR OF SAFETY = 1.407 AT (1585.000,840.000)

AUTOMATIC SEARCH WILL BE MADE ONLY ON THE CENTER WITH THE SMALLEST F.S.

AT POINT (970.0 , 2070.0) RADIUS 1619.188
THE MINIMUM FACTOR OF SAFETY IS 1.312

FACTORS OF SAFETY BASED ON SEARCH

IN THE FOLLOWING TABLE WARNING INDICATES HOW MANY TIMES THE MAXIMUM RADIUS IS LIMITED BY THE END POINTS OF GROUND LINES

CENTER X COORDINATE	CENTER Y COORDINATE	NO. OF CIRCLE TOTAL	CRITIC.	RADIUS	LOWEST F.S.	WARNING
970.0	2070.0	8	8	1619.188	1.312	0
994.0	2070.0	8	8	1609.721	1.322	0
946.0	2070.0	8	7	1643.151	1.329	0
970.0	2094.0	8	8	1641.162	1.316	0
970.0	2046.0	8	8	1597.035	1.309	0
970.0	2022.0	8	8	1574.446	1.310	0
994.0	2046.0	8	8	1587.676	1.318	0
946.0	2046.0	8	7	1620.574	1.326	0
976.0	2046.0	8	8	1594.846	1.310	0

964.0	2046.0	8	8	1599.042	1.309	0
958.0	2046.0	8	8	1601.068	1.309	0
964.0	2052.0	8	8	1604.688	1.309	0
964.0	2058.0	8	8	1610.338	1.309	0
970.0	2052.0	8	8	1602.689	1.309	0
958.0	2052.0	8	8	1606.708	1.309	0

AT POINT (964.0 , 2052.0) RADIUS 1604.688

THE MINIMUM FACTOR OF SAFETY IS 1.309

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	2	34.973	3.457	0.000	.290	.153E+05	.145E+05	.169E+08	.947E+07
2	2	34.973	9.716	0.000	.312	.430E+05	.408E+05	.449E+08	.281E+08
3	2	28.434	14.622	0.000	.332	.526E+05	.500E+05	.540E+08	.359E+08
4	2	6.539	15.391	0.000	.343	.127E+05	.121E+05	.130E+08	.892E+07
5	2	13.461	11.703	0.000	.349	.199E+05	.189E+05	.204E+08	.142E+08
6	2	21.512	10.344	0.000	.360	.281E+05	.267E+05	.287E+08	.205E+08
7	2	34.973	12.981	0.000	.378	.574E+05	.546E+05	.577E+08	.433E+08
8	2	34.973	15.376	0.000	.399	.680E+05	.646E+05	.673E+08	.536E+08
9	2	10.543	16.405	0.000	.414	.219E+05	.208E+05	.214E+08	.177E+08
10	2	20.000	11.955	0.000	.423	.302E+05	.287E+05	.296E+08	.249E+08
11	2	4.430	7.273	0.000	.431	.408E+04	.387E+04	.404E+07	.341E+07
12	2	34.973	7.362	0.000	.443	.326E+05	.309E+05	.320E+08	.278E+08
13	2	34.973	6.688	0.000	.465	.296E+05	.281E+05	.288E+08	.263E+08
14	2	27.624	5.154	0.000	.484	.180E+05	.171E+05	.175E+08	.165E+08
15	2	7.349	2.101	0.000	.495	.195E+04	.186E+04	.204E+07	.182E+07
							SUM	.438E+09	.332E+09

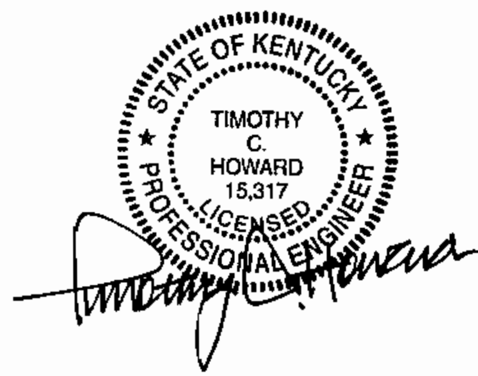
AT CENTER (964.000 , 2052.000) WITH RADIUS 1604.688 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.319
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.309

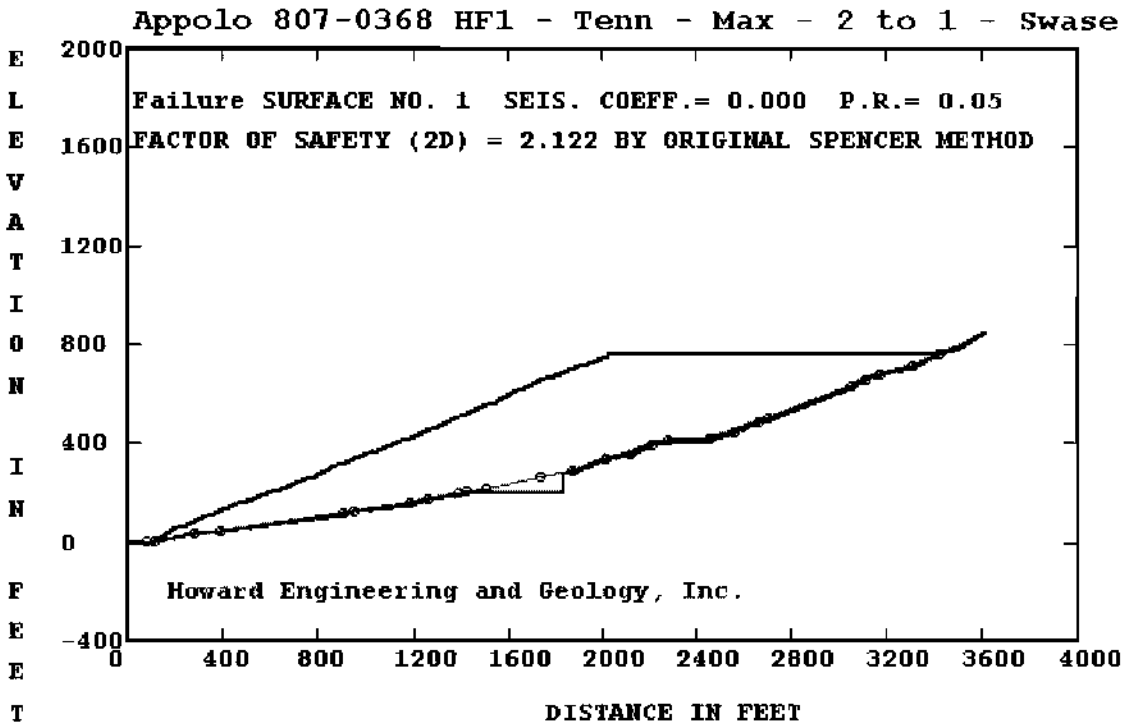
SUMMARY OF STABILITY ANALYSIS

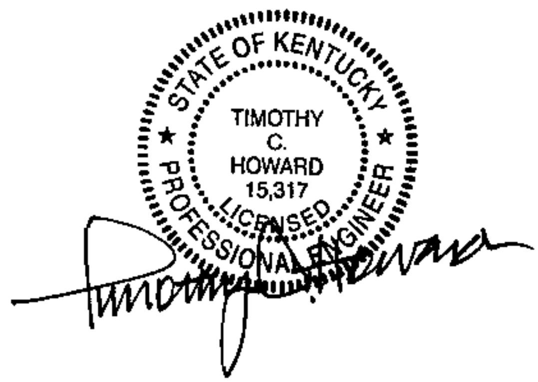
FACTOR OF FAFETY IS DETERMINED BY SIMPLIFIED BISHOP METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FACTOR OF SAFETY = 1.694

CASE 2 SEISMIC COEFFICIENT = 0.1
FACTOR OF SAFETY = 1.309




Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Swase
Failure SURFACE NO. 1 SEIS. COEFF.= 0.000 P.R.= 0.05
FACTOR OF SAFETY (2D) = 2.122 BY ORIGINAL SPENCER METHOD
ELEVATION IN FEET
2000
1600
1200
800
400
0
-400
Howard Engineering and Geology, Inc.
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
DISTANCE IN FEET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HOWARD
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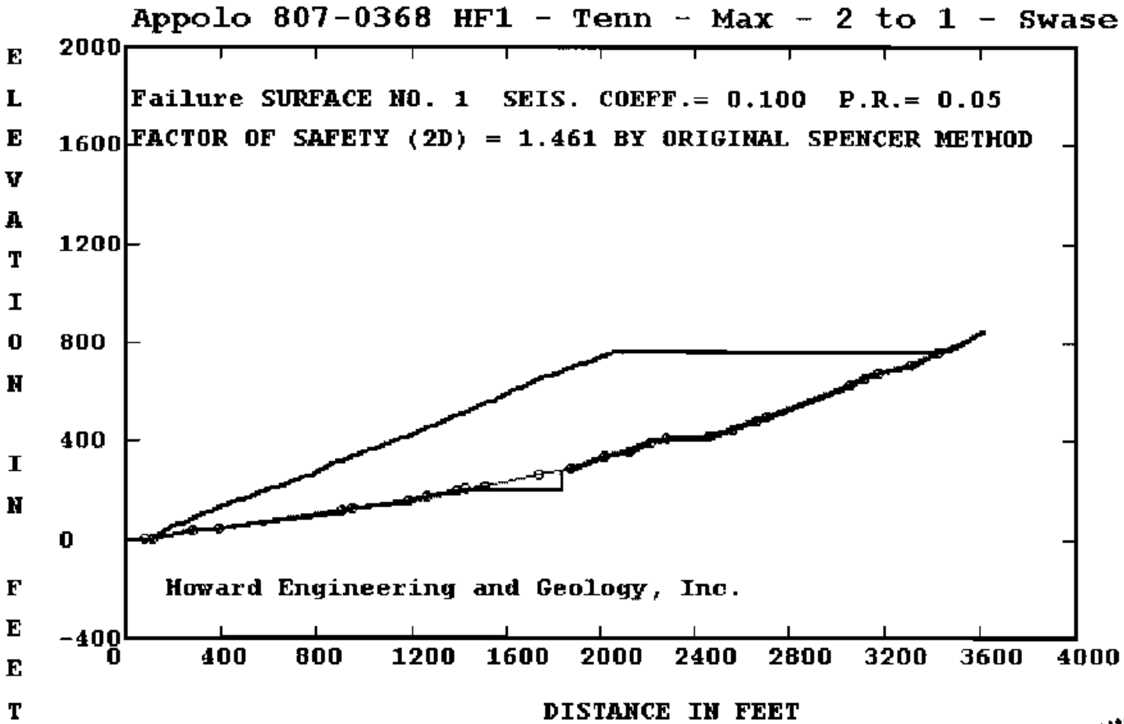

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REAME (ROTATIONAL EQUILIBRIUM ANALYSIS OF MULTILAYERED EARTHWORKS)
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INPUT FILE NAME -R:\T-X-V-S.DAT

TITLE -Appolo 807-0368 HF1 - Tenn - Max - 2 to 1 - Swase

NO. OF STATIC AND SEISMIC CASES (NCASE) = 2

NO. OF NONCIRCULAR FAILURE SURFACES (NNS) = 1

TWO-DIMENSIONAL ANALYSIS (THREED = 0)

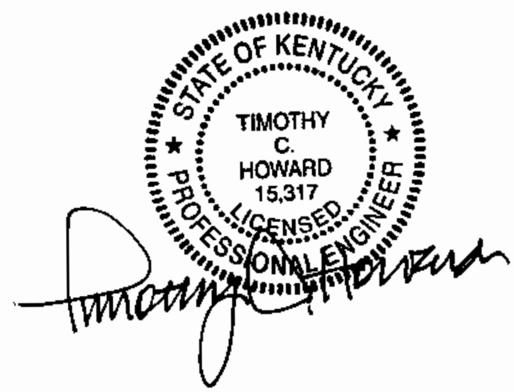
ANALYSIS BY DETERMINISTIC METHOD (PROB = 0)

CASE NO. 1 SEISMIC COEFFICIENT (SEIC) =0.000

NO. OF BOUNDARY LINES (NBL) = 3

NO. OF POINTS ON BOUNDARY LINE 1 = 30

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 12	Y COORD.=-3
3	X COORD.= 105	Y COORD.= 5
4	X COORD.= 283	Y COORD.= 35
5	X COORD.= 387	Y COORD.= 45
6	X COORD.= 904	Y COORD.= 115
7	X COORD.= 947	Y COORD.= 125
8	X COORD.= 1190	Y COORD.= 155
9	X COORD.= 1263	Y COORD.= 175
10	X COORD.= 1393	Y COORD.= 195
11	X COORD.= 1409	Y COORD.= 200
12	X COORD.= 1840	Y COORD.= 200
13	X COORD.= 1840	Y COORD.= 279
14	X COORD.= 1874	Y COORD.= 285
15	X COORD.= 2023	Y COORD.= 335
16	X COORD.= 2125	Y COORD.= 355
17	X COORD.= 2216	Y COORD.= 395
18	X COORD.= 2284	Y COORD.= 405
19	X COORD.= 2456	Y COORD.= 415
20	X COORD.= 2562	Y COORD.= 445
21	X COORD.= 2663	Y COORD.= 485
22	X COORD.= 2705	Y COORD.= 495
23	X COORD.= 3055	Y COORD.= 625
24	X COORD.= 3113	Y COORD.= 655
25	X COORD.= 3170	Y COORD.= 675
26	X COORD.= 3310	Y COORD.= 705
27	X COORD.= 3419	Y COORD.= 755
28	X COORD.= 3505	Y COORD.= 785
29	X COORD.= 3600	Y COORD.= 836
30	X COORD.= 3613	Y COORD.= 849



NO. OF POINTS ON BOUNDARY LINE 2 = 28

1	X COORD.= 0	Y COORD.= 0
2	X COORD.= 105	Y COORD.= 10
3	X COORD.= 282	Y COORD.= 40
4	X COORD.= 386	Y COORD.= 50
5	X COORD.= 903	Y COORD.= 120
6	X COORD.= 946	Y COORD.= 130
7	X COORD.= 1189	Y COORD.= 160

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 8  X COORD.= 1262          Y COORD.= 180
 9  X COORD.= 1392          Y COORD.= 200
 10 X COORD.= 1840          Y COORD.= 200
 11 X COORD.= 1840          Y COORD.= 279
 12 X COORD.= 1859          Y COORD.= 285
 13 X COORD.= 1873          Y COORD.= 290
 14 X COORD.= 2021          Y COORD.= 340
 15 X COORD.= 2123          Y COORD.= 360
 16 X COORD.= 2215          Y COORD.= 400
 17 X COORD.= 2284          Y COORD.= 410
 18 X COORD.= 2455          Y COORD.= 420
 19 X COORD.= 2560          Y COORD.= 450
 20 X COORD.= 2662          Y COORD.= 490
 21 X COORD.= 2704          Y COORD.= 500
 22 X COORD.= 3053          Y COORD.= 630
 23 X COORD.= 3111          Y COORD.= 660
 24 X COORD.= 3169          Y COORD.= 680
 25 X COORD.= 3309          Y COORD.= 710
 26 X COORD.= 3417          Y COORD.= 760
 27 X COORD.= 3503          Y COORD.= 790
 28 X COORD.= 3613          Y COORD.= 849

NO. OF POINTS ON BOUNDARY LINE 3 = 34
 1  X COORD.= 0             Y COORD.= 0
 2  X COORD.= 105           Y COORD.= 10
 3  X COORD.= 205           Y COORD.= 60
 4  X COORD.= 225           Y COORD.= 60
 5  X COORD.= 327           Y COORD.= 110
 6  X COORD.= 349           Y COORD.= 110
 7  X COORD.= 460           Y COORD.= 160
 8  X COORD.= 482           Y COORD.= 160
 9  X COORD.= 602           Y COORD.= 210
 10 X COORD.= 627           Y COORD.= 210
 11 X COORD.= 749           Y COORD.= 260
 12 X COORD.= 771           Y COORD.= 260
 13 X COORD.= 876           Y COORD.= 310
 14 X COORD.= 897           Y COORD.= 310
 15 X COORD.= 1011          Y COORD.= 360
 16 X COORD.= 1035          Y COORD.= 360
 17 X COORD.= 1145          Y COORD.= 410
 18 X COORD.= 1166          Y COORD.= 410
 19 X COORD.= 1268          Y COORD.= 460
 20 X COORD.= 1288          Y COORD.= 460
 21 X COORD.= 1389          Y COORD.= 510
 22 X COORD.= 1410          Y COORD.= 510
 23 X COORD.= 1511          Y COORD.= 560
 24 X COORD.= 1531          Y COORD.= 560
 25 X COORD.= 1633          Y COORD.= 610
 26 X COORD.= 1653          Y COORD.= 610
 27 X COORD.= 1755          Y COORD.= 660
 28 X COORD.= 1777          Y COORD.= 660
 29 X COORD.= 1898          Y COORD.= 710
 30 X COORD.= 1922          Y COORD.= 710
 31 X COORD.= 2043          Y COORD.= 760
 32 X COORD.= 3417          Y COORD.= 760
 33 X COORD.= 3503          Y COORD.= 790
 34 X COORD.= 3613          Y COORD.= 849

LINE NO. AND SLOPE OF EACH SEGMENT ARE:
 1      -0.250       0.086       0.169       0.096       0.135       0.233
         0.123       0.274       0.154       0.313       0.000   99999.000
         0.176       0.336       0.196       0.440       0.147       0.058
         0.283       0.396       0.238       0.371       0.517       0.351
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	0.214	0.459	0.349	0.537	1.000	
2	0.095	0.169	0.096	0.135	0.233	0.123
	0.274	0.154	0.000	99999.000	0.316	0.357
	0.338	0.196	0.435	0.145	0.058	0.286
	0.392	0.238	0.372	0.517	0.345	0.214
	0.463	0.349	0.536			
3	0.095	0.500	0.000	0.490	0.000	0.450
	0.000	0.417	0.000	0.410	0.000	0.476
	0.000	0.439	0.000	0.455	0.000	0.490
	0.000	0.495	0.000	0.495	0.000	0.490
	0.000	0.490	0.000	0.413	0.000	0.413
	0.000	0.349	0.536			

ENGLISH UNITS ARE USED WITH DISTANCE IN FEET AND FORCE IN POUND.

SOIL No.	ENVELOPE (TSSE)	COHESION (C)	FRIC. ANGLE (PHID)	UNIT WEIGHTT (G)
1	1	160.000	24.000	125.000
2	1	20.000	36.000	126.500

USE PORE PRESSURE RATIO
NO. OF SLICES (NSLI) = 10
NO. OF ADD. CIRCLES (NAC) = 3
ANALYSIS BY ORIGINAL SPENCERS METHOD (MTHD=3)
NUMBER OF FORCES (NFO)= 0
SOFT SOIL NUMBER (SSN)= 0

PORE PRESSURE RATIO (RU) = 0.05

NO. OF SOILS WITH DIFFERENT PORE PRESSURE RATIO (NSDP) = 1
SOIL NO. 1 PORE PRESSURE RATIO= 0.1
ONLY A SUMMARY TABLE IS PRINTED (NPRT = 0)
SLICES WILL BE SUBDIVIDED (NSUB = 1)
CENTER AT (0.0 , 1630.0)

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NO. OF POINTS ON FAILURE SURFACE (NPNC) 1 = 27

1	X COORD.= 81	Y COORD.= 7
2	X COORD.= 105	Y COORD.= 7
3	X COORD.= 282	Y COORD.= 37
4	X COORD.= 387	Y COORD.= 47
5	X COORD.= 904	Y COORD.= 117
6	X COORD.= 947	Y COORD.= 127
7	X COORD.= 1190	Y COORD.= 157
8	X COORD.= 1263	Y COORD.= 177
9	X COORD.= 1392	Y COORD.= 197
10	X COORD.= 1426	Y COORD.= 207
11	X COORD.= 1509	Y COORD.= 217
12	X COORD.= 1740	Y COORD.= 267
13	X COORD.= 1874	Y COORD.= 287
14	X COORD.= 2022	Y COORD.= 337
15	X COORD.= 2124	Y COORD.= 357
16	X COORD.= 2215	Y COORD.= 397
17	X COORD.= 2284	Y COORD.= 407
18	X COORD.= 2456	Y COORD.= 417
19	X COORD.= 2561	Y COORD.= 447
20	X COORD.= 2662	Y COORD.= 487
21	X COORD.= 2705	Y COORD.= 497
22	X COORD.= 3054	Y COORD.= 627
23	X COORD.= 3112	Y COORD.= 657
24	X COORD.= 3170	Y COORD.= 677
25	X COORD.= 3310	Y COORD.= 707
26	X COORD.= 3414	Y COORD.= 755

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27 X COORD.= 3417 Y COORD.= 760

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 2.122

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	31.500	1.500	0.000	0.000	.591E+04	.532E+04	.120E+08	.000E+00
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.184E+09	.667E+08
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.607E+08	.235E+08
4	1	57.000	41.801	0.000	0.167	.301E+06	.271E+06	.207E+09	.814E+08
5	1	45.000	59.828	0.000	0.095	.340E+06	.306E+06	.231E+09	.520E+08
6	1	22.000	67.667	0.000	0.095	.188E+06	.169E+06	.127E+09	.288E+08
7	1	38.000	73.368	0.000	0.095	.353E+06	.317E+06	.237E+09	.539E+08
8	1	20.850	83.402	0.000	0.134	.220E+06	.198E+06	.147E+09	.478E+08
9	1	52.150	94.901	0.000	0.134	.626E+06	.563E+06	.416E+09	.136E+09
10	1	22.000	101.627	0.000	0.134	.283E+06	.254E+06	.188E+09	.615E+08
11	1	120.000	117.014	0.000	0.134	.178E+07	.160E+07	.117E+10	.386E+09
12	1	25.000	132.197	0.000	0.134	.418E+06	.376E+06	.275E+09	.909E+08
13	1	115.200	146.313	0.000	0.134	.213E+07	.192E+07	.140E+10	.464E+09
14	1	6.800	163.053	0.000	0.134	.140E+06	.126E+06	.920E+08	.305E+08
15	1	22.000	162.497	0.000	0.134	.452E+06	.407E+06	.297E+09	.983E+08
16	1	105.000	178.899	0.000	0.134	.238E+07	.214E+07	.156E+10	.517E+09
17	1	21.000	195.369	0.000	0.134	.519E+06	.467E+06	.339E+09	.113E+09
18	1	7.000	195.009	0.000	0.134	.173E+06	.155E+06	.113E+09	.375E+08
19	1	43.000	200.500	0.000	0.227	.109E+07	.981E+06	.726E+09	.415E+09
20	1	64.000	215.014	0.000	0.123	.174E+07	.157E+07	.113E+10	.343E+09
21	1	24.000	223.617	0.000	0.123	.679E+06	.611E+06	.440E+09	.134E+09
22	1	41.550	229.014	0.000	0.123	.120E+07	.108E+07	.780E+09	.237E+09
23	1	68.450	247.224	0.000	0.123	.214E+07	.193E+07	.139E+10	.422E+09
24	1	21.000	257.259	0.000	0.123	.683E+06	.615E+06	.442E+09	.135E+09
25	1	24.000	260.364	0.000	0.123	.790E+06	.711E+06	.512E+09	.156E+09
26	1	73.000	272.657	0.000	0.264	.252E+07	.227E+07	.171E+10	.115E+10
27	1	5.000	281.387	0.000	0.153	.178E+06	.160E+06	.116E+09	.444E+08
28	1	20.000	280.674	0.000	0.153	.710E+06	.639E+06	.463E+09	.177E+09
29	1	101.000	296.295	0.000	0.153	.379E+07	.341E+07	.247E+10	.945E+09
30	1	3.000	313.233	0.000	0.153	.119E+06	.107E+06	.775E+08	.297E+08
31	1	10.200	311.500	0.000	0.282	.402E+06	.362E+06	.276E+09	.200E+09
32	2	7.800	308.853	0.000	0.282	.305E+06	.290E+06	.357E+09	.152E+09
33	2	0.900	307.796	0.000	0.282	.350E+05	.333E+05	.410E+08	.175E+08
34	2	15.100	309.404	0.000	0.282	.591E+06	.561E+06	.692E+09	.295E+09
35	2	83.000	326.465	0.000	0.120	.343E+07	.326E+07	.372E+10	.649E+09
36	2	2.000	342.289	0.000	0.212	.866E+05	.823E+05	.994E+08	.311E+08
37	2	20.000	340.403	0.000	0.212	.861E+06	.818E+06	.988E+09	.310E+09
38	2	102.000	352.199	0.000	0.212	.454E+07	.432E+07	.522E+10	.163E+10
39	2	20.000	363.996	0.000	0.212	.921E+06	.875E+06	.106E+10	.331E+09
40	2	87.000	373.739	0.000	0.212	.411E+07	.391E+07	.472E+10	.148E+10
41	2	5.250	386.542	0.000	0.148	.257E+06	.244E+06	.281E+09	.608E+08
42	2	9.750	389.099	0.000	0.148	.480E+06	.456E+06	.526E+09	.114E+09
43	2	22.000	389.119	0.000	0.148	.108E+07	.103E+07	.119E+10	.257E+09
44	2	80.566	398.111	0.000	0.148	.406E+07	.385E+07	.445E+10	.961E+09
45	1	16.434	410.914	0.000	0.148	.854E+06	.769E+06	.548E+09	.202E+09
46	1	24.000	413.987	0.000	0.320	.126E+07	.113E+07	.901E+09	.753E+09
47	1	24.000	410.838	0.000	0.320	.125E+07	.112E+07	.894E+09	.747E+09
48	1	100.000	410.553	0.000	0.320	.519E+07	.467E+07	.372E+10	.311E+10
49	1	21.000	416.602	0.000	0.192	.111E+07	.996E+06	.727E+09	.353E+09
50	1	36.600	415.294	0.000	0.192	.192E+07	.173E+07	.126E+10	.613E+09
51	1	44.400	407.353	0.000	0.192	.229E+07	.206E+07	.150E+10	.730E+09
52	1	91.000	383.000	0.000	0.402	.441E+07	.397E+07	.330E+10	.358E+10

53	1	69.000	358.000	0.000	0.143	.312E+07	.281E+07	.192E+10	.689E+09
54	1	129.950	349.222	0.000	0.058	.574E+07	.517E+07	.314E+10	.451E+09
55	1	42.050	344.222	0.000	0.058	.183E+07	.165E+07	.100E+10	.144E+09
56	1	105.000	328.000	0.000	0.275	.436E+07	.392E+07	.312E+10	.220E+10
57	1	101.000	293.000	0.000	0.368	.374E+07	.337E+07	.288E+10	.282E+10
58	1	43.000	268.000	0.000	0.227	.146E+07	.131E+07	.988E+09	.567E+09
59	1	43.300	254.936	0.000	0.349	.140E+07	.126E+07	.107E+10	.978E+09
60	1	305.700	189.936	0.000	0.349	.734E+07	.661E+07	.564E+10	.514E+10
61	1	28.650	125.590	0.000	0.459	.455E+06	.410E+06	.383E+09	.480E+09
62	1	29.350	110.590	0.000	0.459	.410E+06	.369E+06	.347E+09	.433E+09
63	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.519E+09	.430E+09
64	1	140.000	68.000	0.000	0.210	.120E+07	.108E+07	.789E+09	.403E+09
65	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.349E+09	.355E+09
66	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.381E+07	.272E+07
		SUM						.759E+11	.382E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.000
FACTOR OF SAFETY BY NORMAL METHOD IS 1.990

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	2.167	2.085
0.300	2.116	2.133
0.600	2.118	2.192

FROM ORIGINAL SPENCER METHOD, DEL = 0.237 AND F. S. = 2.122

STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
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PROFESSIONAL ENGINEER

CASE NO. 2 SEISMIC COEFFICIENT (SEIC) =0.100

FAILURE SURFACE NO. 1

FOR FAILURE SURFACE NO. 1 FACTOR OF SAFETY IS 1.461

SUMMARY OF SLICE INFORMATION FOR MOST CRITICAL FAILURE SURFACE

SL. NO.	SOIL NO.	SLICE WIDTH	SLICE HEIGHT	WATER HEIGHT	BOTTOM SINE	TOTAL WEIGHT	EFFEC. WEIGHT	RESIS. MOMENT	DRIVING MOMENT
1	1	31.500	1.500	0.000	0.000	.591E+04	.532E+04	.120E+08	.958E+06
2	1	100.000	19.525	0.000	0.167	.247E+06	.222E+06	.181E+09	.106E+09
3	1	20.000	34.356	0.000	0.167	.868E+05	.781E+05	.598E+08	.372E+08
4	1	57.000	41.801	0.000	0.167	.301E+06	.271E+06	.204E+09	.129E+09
5	1	45.000	59.828	0.000	0.095	.340E+06	.306E+06	.229E+09	.106E+09
6	1	22.000	67.667	0.000	0.095	.188E+06	.169E+06	.126E+09	.583E+08
7	1	38.000	73.368	0.000	0.095	.353E+06	.317E+06	.234E+09	.109E+09
8	1	20.850	83.402	0.000	0.134	.220E+06	.198E+06	.145E+09	.822E+08
9	1	52.150	94.901	0.000	0.134	.626E+06	.563E+06	.411E+09	.233E+09
10	1	22.000	101.627	0.000	0.134	.283E+06	.254E+06	.185E+09	.105E+09
11	1	120.000	117.014	0.000	0.134	.178E+07	.160E+07	.116E+10	.660E+09
12	1	25.000	132.197	0.000	0.134	.418E+06	.376E+06	.272E+09	.155E+09
13	1	115.200	146.313	0.000	0.134	.213E+07	.192E+07	.138E+10	.789E+09
14	1	6.800	163.053	0.000	0.134	.140E+06	.126E+06	.908E+08	.518E+08
15	1	22.000	162.497	0.000	0.134	.452E+06	.407E+06	.293E+09	.167E+09
16	1	105.000	178.899	0.000	0.134	.238E+07	.214E+07	.154E+10	.875E+09
17	1	21.000	195.369	0.000	0.134	.519E+06	.467E+06	.335E+09	.191E+09
18	1	7.000	195.009	0.000	0.134	.173E+06	.155E+06	.111E+09	.634E+08
19	1	43.000	200.500	0.000	0.227	.109E+07	.981E+06	.710E+09	.581E+09
20	1	64.000	215.014	0.000	0.123	.174E+07	.157E+07	.112E+10	.600E+09
21	1	24.000	223.617	0.000	0.123	.679E+06	.611E+06	.435E+09	.234E+09
22	1	41.550	229.014	0.000	0.123	.120E+07	.108E+07	.771E+09	.414E+09
23	1	68.450	247.224	0.000	0.123	.214E+07	.193E+07	.137E+10	.734E+09
24	1	21.000	257.259	0.000	0.123	.683E+06	.615E+06	.437E+09	.234E+09
25	1	24.000	260.364	0.000	0.123	.790E+06	.711E+06	.505E+09	.271E+09
26	1	73.000	272.657	0.000	0.264	.252E+07	.227E+07	.166E+10	.154E+10

27	1	5.000	281.387	0.000	0.153	.178E+06	.160E+06	.114E+09	.703E+08
28	1	20.000	280.674	0.000	0.153	.710E+06	.639E+06	.456E+09	.280E+09
29	1	101.000	296.295	0.000	0.153	.379E+07	.341E+07	.243E+10	.149E+10
30	1	3.000	313.233	0.000	0.153	.119E+06	.107E+06	.763E+08	.467E+08
31	1	10.200	311.500	0.000	0.282	.402E+06	.362E+06	.268E+09	.261E+09
32	2	7.800	308.853	0.000	0.282	.305E+06	.290E+06	.346E+09	.199E+09
33	2	0.900	307.796	0.000	0.282	.350E+05	.333E+05	.398E+08	.228E+08
34	2	15.100	309.404	0.000	0.282	.591E+06	.561E+06	.672E+09	.385E+09
35	2	83.000	326.465	0.000	0.120	.343E+07	.326E+07	.368E+10	.113E+10
36	2	2.000	342.289	0.000	0.212	.866E+05	.823E+05	.972E+08	.439E+08
37	2	20.000	340.403	0.000	0.212	.861E+06	.818E+06	.967E+09	.437E+09
38	2	102.000	352.199	0.000	0.212	.454E+07	.432E+07	.510E+10	.230E+10
39	2	20.000	363.996	0.000	0.212	.921E+06	.875E+06	.103E+10	.466E+09
40	2	87.000	373.739	0.000	0.212	.411E+07	.391E+07	.462E+10	.208E+10
41	2	5.250	386.542	0.000	0.148	.257E+06	.244E+06	.277E+09	.963E+08
42	2	9.750	389.099	0.000	0.148	.480E+06	.456E+06	.518E+09	.180E+09
43	2	22.000	389.119	0.000	0.148	.108E+07	.103E+07	.117E+10	.406E+09
44	2	80.566	398.111	0.000	0.148	.406E+07	.385E+07	.438E+10	.152E+10
45	1	16.434	410.914	0.000	0.148	.854E+06	.769E+06	.539E+09	.318E+09
46	1	24.000	413.987	0.000	0.320	.126E+07	.113E+07	.871E+09	.944E+09
47	1	24.000	410.838	0.000	0.320	.125E+07	.112E+07	.864E+09	.937E+09
48	1	100.000	410.553	0.000	0.320	.519E+07	.467E+07	.360E+10	.390E+10
49	1	21.000	416.602	0.000	0.192	.111E+07	.996E+06	.713E+09	.506E+09
50	1	36.600	415.294	0.000	0.192	.192E+07	.173E+07	.124E+10	.880E+09
51	1	44.400	407.353	0.000	0.192	.229E+07	.206E+07	.147E+10	.105E+10
52	1	91.000	383.000	0.000	0.402	.441E+07	.397E+07	.316E+10	.429E+10
53	1	69.000	358.000	0.000	0.143	.312E+07	.281E+07	.190E+10	.110E+10
54	1	129.950	349.222	0.000	0.058	.574E+07	.517E+07	.312E+10	.112E+10
55	1	42.050	344.222	0.000	0.058	.183E+07	.165E+07	.995E+09	.357E+09
56	1	105.000	328.000	0.000	0.275	.436E+07	.392E+07	.303E+10	.288E+10
57	1	101.000	293.000	0.000	0.368	.374E+07	.337E+07	.277E+10	.344E+10
58	1	43.000	268.000	0.000	0.227	.146E+07	.131E+07	.966E+09	.783E+09
59	1	43.300	254.936	0.000	0.349	.140E+07	.126E+07	.103E+10	.121E+10
60	1	305.700	189.936	0.000	0.349	.734E+07	.661E+07	.543E+10	.639E+10
61	1	28.650	125.590	0.000	0.459	.455E+06	.410E+06	.364E+09	.565E+09
62	1	29.350	110.590	0.000	0.459	.410E+06	.369E+06	.330E+09	.510E+09
63	1	58.000	93.000	0.000	0.326	.682E+06	.614E+06	.502E+09	.546E+09
64	1	140.000	68.000	0.000	0.210	.120E+07	.108E+07	.773E+09	.579E+09
65	1	104.000	29.000	0.000	0.419	.381E+06	.343E+06	.335E+09	.427E+09
66	1	3.000	2.500	0.000	0.857	.941E+03	.847E+03	.370E+07	.288E+07
		SUM						.742E+11	.527E+11

FAILURE SURFACE 1 WITH CENTER (0.000,1630.000) AND SEISMIC COEFF. 0.100
FACTOR OF SAFETY BY NORMAL METHOD IS 1.409

THRUST INCLINATION	MOMENT F.S.	FORCE F.S.
0.000	1.507	1.408
0.300	1.466	1.438
0.600	1.466	1.477

FROM ORIGINAL SPENCER METHOD, DEL = 0.489 AND F. S. = 1.461

SUMMARY OF STABILITY ANALYSIS

FACTOR OF FAFETY IS DETERMINED BY ORIGINAL SPENCER METHOD
NUMBER OF CASES = 2

CASE 1 SEISMIC COEFFICIENT = 0
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 2.122

CASE 2 SEISMIC COEFFICIENT = 0.1
FOR FAILURE SURFACE 1 FACTOR OF SAFETY = 1.461

STATE OF KENTUCKY TIMOTHY C. HOWARD 15,317 LICENSED PROFESSIONAL ENGINEER

Appolo 807-0368 HF1 - Tenn - Max - Std - Circular [T-X-V-C.TXT]

AT CENTER (958.000 , 2064.000) WITH RADIUS 1617.994 AND SEIS. COEFF. 0.00
FACTOR OF SAFETY BY NORMAL METHOD IS 1.703
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.694
AT CENTER (964.000 , 2052.000) WITH RADIUS 1604.688 AND SEIS. COEFF. 0.10
FACTOR OF SAFETY BY NORMAL METHOD IS 1.319
FACTOR OF SAFETY BY SIMPLIFIED BISHOP METHOD IS 1.309

0	=	0 ,	0	35	=	1189 ,	160	70	=	1268 ,	460
1	=	12 ,	-3	36	=	1262 ,	180	71	=	1288 ,	460
2	=	105 ,	5	37	=	1392 ,	200	72	=	1389 ,	510
3	=	283 ,	35	38	=	1859 ,	285	73	=	1410 ,	510
4	=	387 ,	45	39	=	1873 ,	290	74	=	1511 ,	560
5	=	904 ,	115	40	=	2021 ,	340	75	=	1531 ,	560
6	=	947 ,	125	41	=	2123 ,	360	76	=	1633 ,	610
7	=	1190 ,	155	42	=	2215 ,	400	77	=	1653 ,	610
8	=	1263 ,	175	43	=	2284 ,	410	78	=	1755 ,	660
9	=	1393 ,	195	44	=	2455 ,	420	79	=	1777 ,	660
10	=	1409 ,	200	45	=	2560 ,	450	80	=	1898 ,	710
11	=	1840 ,	200	46	=	2662 ,	490	81	=	1922 ,	710
12	=	1840 ,	279	47	=	2704 ,	500	82	=	2043 ,	760
13	=	1874 ,	285	48	=	3053 ,	630				
14	=	2023 ,	335	49	=	3111 ,	660				
15	=	2125 ,	355	50	=	3169 ,	680				
16	=	2216 ,	395	51	=	3309 ,	710				
17	=	2284 ,	405	52	=	3417 ,	760				
18	=	2456 ,	415	53	=	3503 ,	790				
19	=	2562 ,	445	54	=	205 ,	60				
20	=	2663 ,	485	55	=	225 ,	60				
21	=	2705 ,	495	56	=	327 ,	110				
22	=	3055 ,	625	57	=	349 ,	110				
23	=	3113 ,	655	58	=	460 ,	160				
24	=	3170 ,	675	59	=	482 ,	160				
25	=	3310 ,	705	60	=	602 ,	210				
26	=	3419 ,	755	61	=	627 ,	210				
27	=	3505 ,	785	62	=	749 ,	260				
28	=	3600 ,	836	63	=	771 ,	260				
29	=	3613 ,	849	64	=	876 ,	310				
30	=	105 ,	10	65	=	897 ,	310				
31	=	282 ,	40	66	=	1011 ,	360				
32	=	386 ,	50	67	=	1035 ,	360				
33	=	903 ,	120	68	=	1145 ,	410				
34	=	946 ,	130	69	=	1166 ,	410				

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

Permit No. 867-0368
Hollow Fill #1
Reame Drawing

N W E S

Prepared By:
HOWARD
Engineering and Geology, Inc.

Scale: None

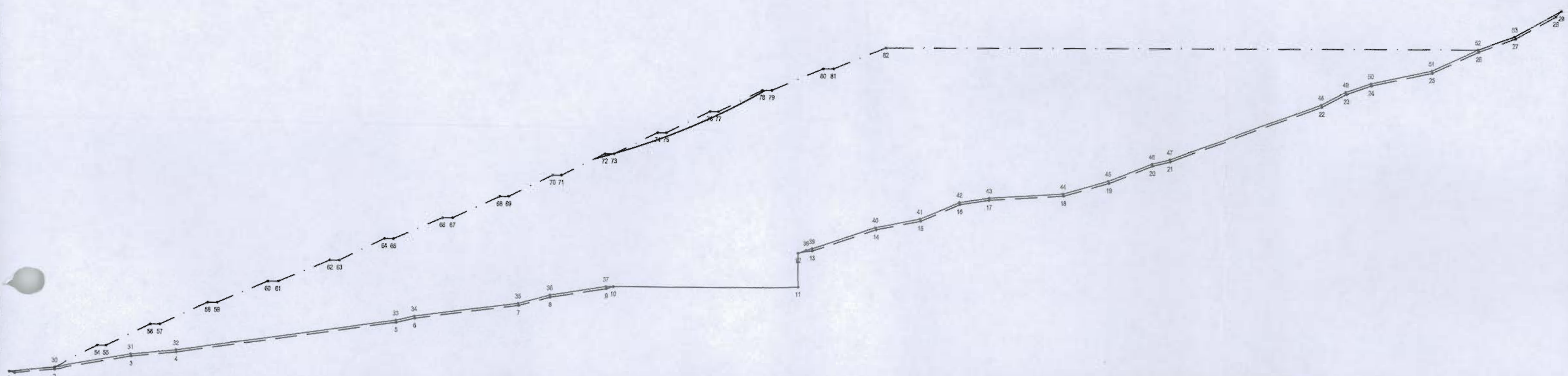
Attachment 26.3.A

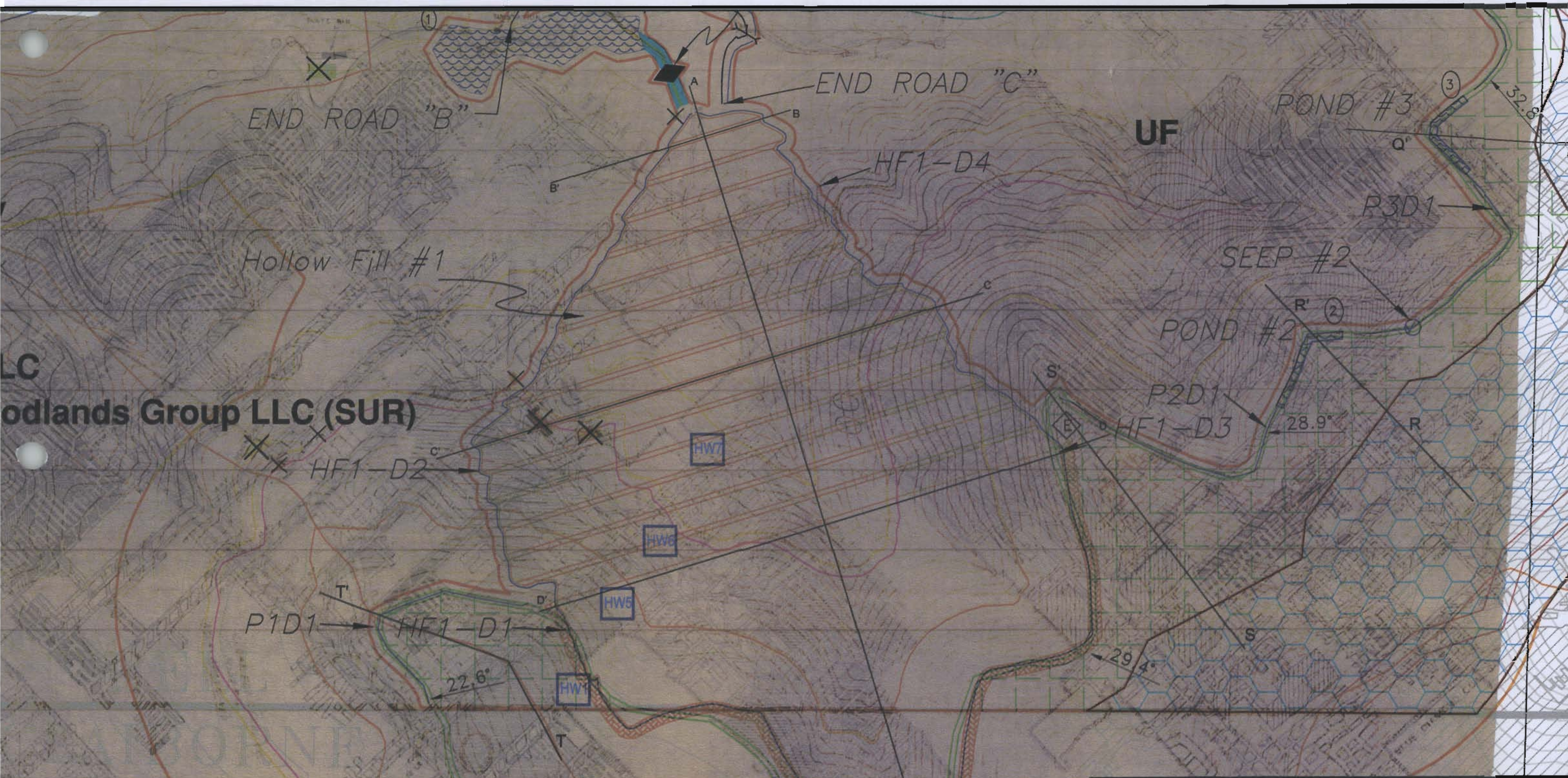
DWG FullPath: W:\CLIENTS\AppoloFuels\807-0368\Original\Comprehensive\BFG\Reame 0910\T-X-V-C.dwg

I, Timothy C. Howard, P.E. No. 15,317

Date: 10/6/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.





Note: The mine workings on this map were obtained from the Kentucky Mine Mapping Information System files and are Clear Fork Mining Co., Mine No. 6, State File No. 00613-2. These works have been oriented using accepted engineering practices. In using this existing map, no certification is being made as to accuracy or extent of these mine workings.

I, Timothy C. Howard, P.E. No. 15,317

Date: 7/17/09

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY ★ TIMOTHY C. HOWARD 15,317 LICENSED PROFESSIONAL ENGINEER ★

Appolo Fuels, Inc.

Permit No. 807-0368
Attachment 26.3.A
Hollow Fill #1
Old Mingo Mine Works Supplement

N
W E
S

Prepared By:
HOWARD
HEG
Engineering and Geology, Inc.

Scale: 1" = 400'

Page No.

27. Coal Mine Waste

27.1 Will any coal processing waste or underground development waste be generated or disposed of within the proposed permit area? [ ] YES [***XX***] NO. If "YES", provide the following information for each disposal area:

Facility I.D.	Type	Storage Volume Cu. Yds.	Latitude	Longitude	Anticipated Construction Date

27.2 Did construction of any of the above structures begin prior to January 18, 1983? [ ] YES [***XX***] NO. If "YES", provide the information required by 405 KAR 8:030, or 8:040, Section 25 for existing structures. Submit this information as "Attachment 27.2.A".

27.3 Will any coal mine waste be disposed of in abandoned underground mines? [ ] YES [***XX***] NO. If "YES", provide as "Attachment 27.3.A", the information to satisfy the requirements of 405 KAR 8:040, Sections 27 and 28.

27.4 Will coal mine waste materials, from activities located outside the proposed permit area, be disposed of within the proposed permit area? [ ] YES [***XX***] NO. If "YES", provide as "Attachment 27.4.A", a detailed discussion (based on relevant hydrologic, geotechnical, physical, and chemical analyses) to make a showing in accordance with 405 KAR 16:140 or 18:140, Section 1, that the disposal of such waste will not:

(a) Adversely affect water quality, water flow, or vegetation;
(b) Create public health hazards; and
(c) Cause instability in the disposal area(s).

27.5 Provide a detailed plan (including all engineering design calculations, cross-sections, maps and drawings) for each proposed structure. Each plan shall meet the applicable requirements of 405 KAR 8:030, Section 34, or 405 KAR 8:040, Section 34, as appropriate. The plan(s) shall be provided as "Attachment 27.5.A, 27.5.B., etc."
N/A None Proposed.

28. Disposal of Waste Other Than Coal, Soil or Rock

28.1 Provide as "Attachment 28.1.A", a description of the measures to be used for the temporary storage and final disposal of waste such as: grease, lubricants, paints, flammable liquids, garbage, abandoned machinery, timber, brush, and other combustibles generated during mining activities. Show all storage and/or disposal sites on the MRP Map.
See Attachment 28.1.A.

29. Toxic Materials Handling Plan

29.1 Based on the results of the premining geologic sampling program, identify all acidic or toxic strata which will be encountered during the proposed mining operation:
N/A - No Acidic Strata Identified.

Site No.	Thickness	Lithology	Elevation	Potential Acidity	Neutralization Potential

29.2 Describe how acidic and/or toxic strata will be handled to avoid contamination of surface and ground water resources within, and adjacent to the proposed permit area, and to minimize adverse effects on plant growth and land uses. Submit the description, if applicable, as "Attachment 29.2.A".
See Attachment 29.2.A

30. Surface and Ground Water Monitoring

30.1 Provide a detailed description of the in-stream surface water quality and quantity monitoring program to be used during the mining and reclamation operations. The description shall specifically address all of the following:

(a) the location of each sampling point and the rationale for selection
(b) the frequency of sample collection
(c) the method(s) to be used for sample collection
(d) the parameters to be tested
(e) the procedures to be used for reporting the analytical results of the testing program to DSMRE

Submit the description as "Attachment 30.1.A", and show the location of all monitoring points on the MRP Map.
See Attachment 30.1.A.

ATTACHMENT 28.1.A

WASTE DISPOSAL PLAN

All waste products which are generated during the normal operations of the surface mine, such as grease, lubricants, flammable liquids, trash, timber, wood or other combustible material will be temporarily stored within the proposed permit area. This material will be placed at a designated site within the permit area which is also located away from the mining operations. Locating this material away from the mine operations will prevent any possible danger of igniting the material. After this material is accumulated, it will be permanently disposed of by hauling this material to an approved public landfill or transfer station where it would be disposed of with other similar waste products. A permanent non-coal waste site has not been shown on the MRP map as a permanent site is not proposed. The temporary waste disposal site will move with the operation as mining advances but will be within the proposed permit boundary.

Abandoned machinery will be sold for scrap and removed from the site. Timber, brush, and other combustibles generated during the mining activities will either be placed in piles or burned out of the streams and natural drainageways. Timber that is removed from the surface mining area will either be windrowed along the outcrop or burned, no windrows will be placed outside the permit boundary.

Appolo Fuels, Inc.
#807-0368

ATTACHMENT 29.2.A

TOXIC MATERIALS HANDLING PLAN

Although no potential acidic units have been identified, this plan will be implemented in the event acidic units are encountered. Precautions will be taken to ensure that the strata are totally segregated during the excavation process. This material will not be mixed with other overburden material. The potentially acid strata will be placed in the backfill so that it is surrounded on all sides, top and bottom with a minimum of four (4) feet of non-toxic and non-acidic material. The acidic material shall be buried or otherwise treated within thirty (30) days of exposure. Although the acid-base account would ensure neutralization of the strata, these precautions should prevent any adverse impacts to the revegetation process or to the groundwater supply.

ATTACHMENT 30.1.A

During-Mining Surface Water Monitoring Plan

The during-mining surface water monitoring program will consist of monitoring one (1) existing monitoring station. The location of the site is detailed on the MRP/ERI map included in this application. The coordinates of the site is as follows:

SW004 - Latitude 36° 35' 21" N(4,053,206)
Longitude 82° 53' 37" W(241,134)

The site was chosen for the following reasons:

1) The site is located downstream of a portion or all of the proposed disturbances.
2) There is a sustained flow at the site.
3) Samples collected at the site will accurately reflect the condition of the watershed affected by the proposed disturbances.
4) There is a history of the water quality and quantity at the site.

Samples taken at the site will be analyzed for the following parameters using the methods listed:

PARAMETER	METHOD
Flow Rate	Flow Estimation Meter
pH	SM #423*
Acidity	SM #402*
Alkalinity	SM #403*
Total Iron	SM #303A*
Total Manganese	SM #303A*
Sulfate	SM #426C*
Total Suspended Solids	SM #209C*
Specific Conductance	SM #205*

*"Standard Methods for the examination of water and Wastewater." 16th Edition, 1985.

Results of all analyses will be reported to the Department no later than the end of the month at the end of each quarter. Reporting will be done on Department approved water quality data entry forms. During Mining Sample Frequency: One (1) per three (3) months until final bond release.

30.2 Submit as "Attachment 30.2.A", a description of the applicant's proposed KPDES point source discharge monitoring program. Discharges from sediment ponds, underground mines and other similar discharge points within the proposed permit area shall be monitored. The description shall, at a minimum, address (a) the frequency of sample collection; (b) the parameters to be tested; and (c) the procedures to be used for reporting the analytical results of the laboratory tests. Show the location of all sampling points on the MRP Map.

See Attachment 30.2.A.

30.3 Provide, as "Attachment 30.3.A", a detailed description of the ground water quality and quantity monitoring program to be used during the mining and reclamation operations. The description shall specifically address all the following:

(a) the location of each sampling point and the rationale for selection
(b) the frequency of sample collection
(c) the method(s) to be used for sample collection
(d) the parameters to be tested
(e) the procedures to be used for reporting the results of the testing program to DSMRE

Show the location of all sampling points on the MRP Map.

See Attachment 30.3.A.

30.4 Provide a detailed description of each monitoring point proposed for use in the ground water monitoring program. The description shall address:

(a) the aquifer(s) to be monitored
(b) the construction specifications of each monitoring point
(c) the adequacy of each monitoring point, taking into account design, construction, and location to fulfill its intended use.

Submit the description as "Attachment 30.4.A".

See Attachment 30.4.A.

30.5 Provide the following information for the surface and ground water monitoring locations. If additional pages are necessary, submit as "Item 30.5 continued".

I.D. Number	Pond Number if Applicable	Type Surface/Ground	Latitude	Longitude
STA 1	***N/A***	***Ground***	***36-36-52***	***83-49-55***
GW5	***N/A***	***Ground***	***36-35-40***	***83-52-09***
SW-004	***N/A***	***Surface***	***36-35-21***	***83-53-37***
Pond 1	***#1***	***KPDES***	***36-35-36***	***83-51-02***
Pond 2	***#2***	***KPDES***	***36-35-21***	***83-50-28***
Pond 3	***#3***	***KPDES***	***36-35-31***	***83-50-21***
Pond 4	***#4***	***KPDES***	***36-35-41***	***83-50-21***

See Item 30.5 Continued

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#807-0368

ATTACHMENT 30.2.A

It is proposed to monitor the discharges from ponds 1 thru 16 as described in this application. This monitoring will meet the requirements of the KPDES Point Discharge Monitoring Program. The ponds to be monitored are designated as Sediment Ponds 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16. The locations of the ponds are detailed on the Mining and Reclamation Plan Map. The coordinates of the sites are provided in Item 30.5.

Grab samples will be taken at the discharge point of the pond on the 1st and 3rd Wednesday of each month. Additionally, a water sample will be taken during the first significant rainfall event during the month. This sample may be substituted for one of the scheduled samples.

Samples collected at each site will be analyzed for the following parameters using the methods listed:

PARAMETER	**METHOD**
Discharge (in gal/min)	Flow Estimation Meter
Ph	SM #423*
Acidity	SM #402*
Alkalinity	SM #403*
Total Iron	SM #303A*
Total Manganese	SM #303A*
Total Suspended Solids	SM #209C*

" Standard Methods for the Examination of Water and Wastewater."
16th Edition, 1985.

Results of all analyses will be reported to the Department by month at the end of each quarter. Reporting will be done on Department-approved Discharge Monitoring Report forms.

The monitoring program described above will be followed from the time active mining begins until a Phase I Bond Release is obtained.

ATTACHMENT 30.3.A

During-Mining Groundwater Monitoring Plan

The during-mining ground water monitoring program will consist of monitoring three (3) existing monitoring stations. These sites are identified as GW1 and GW5. The location of these sites are detailed on the M.R.P./E.R.I. Map included in this application. The coordinates of these sites are as follows:

STA1	-	Latitude 36° 36' 52"N(4,055,636) Longitude 83° 49' 55"W(246,722)
GW5	-	Latitude 36° 35' 40"N(4,053,520) Longitude 83° 52' 09"W(243,420)

These sites were chosen for the following reasons:

1) These sites will monitor the groundwater from the aquifers which have been identified in this area.
2) There is history of water quality and quantity at the sites.

Samples taken at these sites will be analyzed for the following parameters using the methods listed:

Parameter	Method
Water level	Water level indicator
pH (standard units)	423*
acidity (mg/l)	402*
alkalinity (mg/l)	403*
dissolved iron (mg/l)	303*
dissolved manganese (mg/l)	303*
total sulfate (mg/l)	426c*
specific conductance (micromhos/cm)or	205*
total dissolved solids (mg/l)	209B*
temperature (^{O}F)	

*"Standard Methods for the examination of Water and Wastewater." 16th Edition, 1985.

Results of all analyses will be reported to the Department no later than the end of the month at the end of each quarter. Reporting will be done on Department approved water quality data entry forms. During Mining Sample Frequency: One (1) per three (3) months until final bond release.

Appolo Fuels, Inc.
#807-0368

ATTACHMENT 30.4.A

Ground Water Monitoring Point Descriptions

STA1

a) Mason coal seam void

b) 8" casing – 125' deep

c) This site is currently being sampled as part of the during mining ground-water and reclamation monitoring program for existing permits.

GW5

a) Colluvium

b) 6" casing

c) This site is currently being sampled as part of the during mining ground-water and reclamation monitoring program for existing permits.

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#807-0368

ATTACHMENT 30.5.A

I.D. Number	Pond Number If Applicable	Type Surface/Ground	Latitude	Longitude
5	5	KPDES	36-35-55	83-50-29
6	6	KPDES	36-36-04	83-50-37
7	7	KPDES	36-36-10	83-50-58
8	8	KPDES	36-36-08	83-51-13
9	9	KPDES	36-36-21	83-51-01
10	10	KPDES	36-36-39	83-50-54
11	11	KPDES	36-36-50	83-51-11
12	12	KPDES	36-36-42	83-51-33
13	13	KPDES	36-36-33	83-51-56
14	14	KPDES	36-36-46	83-51-41
15	15	KPDES	36-37-04	83-51-38
16	16	KPDES	36-37-14	83-51-29

J.6 List the name and address of the laboratory which will perform required testing of water samples.

Name **_Technical Water Laboratories,Inc._**
Address **_P.O. Box 309, Bledsoe Kentucky 40810_**

31. Sediment Ponds and Impoundments

31.1 Complete the following table for each proposed sediment pond and impoundment. The numbers preceding the rows refer to the list of titles below the chart.

1	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	**A**	**A**	**A**	**A**	**A**	**A**	**A**
3	**198.35**	**30.30**	**50.67**	**52.03**	**52.24**	**40.49**	**52.67**
4	**129.40**	**14.61**	**10.30**	**11.40**	**15.06**	**14.82**	**14.44**
5	**16.250**	**1.850**	**1.296**	**1.449**	**1.888**	**1.862**	**1.810**
6	**16.250**	**1.850**	**1.296**	**1.449**	**1.888**	**1.862**	**1.810**
7	**25.385**	**3.151**	**2.143**	**2.502**	**2.502**	**2.502**	**2.502**
8	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**
9	**31.353**	**3.783**	**2.617**	**3.055**	**3.055**	**3.055**	**3.055**
10	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**	**Dug-out**
11	**36-35-36**	**36-35-21**	**36-35-31**	**36-35-41**	**36-35-55**	**36-36-04**	**36-36-10**
12	**83-51-02**	**83-50-28**	**83-50-21**	**83-50-21**	**83-50-29**	**83-50-37**	**83-50-58**

1.) Facility I.D. No.
2.) Hazard Classification (A, B, or C)
3.) Total Drainage Area (Acres)
4.) Disturbed Drainage Area (Acres)
5.) Sediment Storage Capacity (Acre-Feet)
6.) Storage Capacity at Principal Spillway (Acre-Feet)
7.) Storage Capacity at Emergency Spillway (Acre-Feet)
8.) Structure Height at Emergency Spillway Measured from Upstream Toe (Feet)
9.) Storage Capacity at Top of Dam (Acre-Feet)
10.) Structure Height at Top of Dam Measured from Downstream Toe (Feet)
11.) Latitude
12.) Longitude

See Attachment 31.1 cont.

Appolo Fuels, Inc.
#807-0368

ATTACHMENT 31.1.A

Sediment Pond Summary							
1	8	9	10	11	12	13	14
2	A	A	A	A	A	A	A
3	23.13	21.30	94.69	85.84	25.76	11.20	16.36
4	23.13	11.46	23.43	28.52	19.54	11.20	16.36
5	2.893	1.448	2.947	3.583	2.465	1.417	2.070
6	2.893	1.448	2.947	3.583	2.465	1.417	2.070
7	4.147	2.407	5.815	5.815	4.158	2.177	3.282
8	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out
9	5.143	2.823	6.811	6.811	5.064	2.416	3.641
10	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out	Dug-Out
11	36-36-08	36-36-21	36-36-39	36-36-50	36-36-42	36-36-33	36-36-46
12	83-51-13	83-51-01	83-50-54	83-51-11	83-51-33	83-51-56	83-51-41

1.) Facility ID No.
2.) Hazard Classification (A, B or C)
3.) Total Drainage Area (Acres)
4.) Disturbed Drainage Area (Acres)
5.) Sediment Storage Capacity (Acre-Feet)
6.) Storage Capacity at Principal Spillway (Acre-Feet)
7.) Storage Capacity at Emergency Spillway (Acre-Feet)
8.) Structure Height at Emergency Spillway Measured from Upstream Toe (Feet)
9.) Storage Capacity at Top of Dam (Acre-Feet)
10.) Structure Height at Top of Dam Measured from Downstream Toe (Feet)
11.) Latitude
12.) Longitude

ATTACHMENT 31.1.A

Sediment Pond Summary

1	15	16					
2	A	A					
3	34.03	56.16					
4	21.11	20.36					
5	2.676	2.590					
6	2.676	2.590					
7	4.158	6.310					
8	Dug-Out	Dug-Out					
9	5.064	6.811					
10	Dug-Out	Dug-Out					
11	36-37-04	36-37-14					
12	83-51-38	83-51-29					

1.) Facility ID No.
2.) Hazard Classification (A, B or C)
3.) Total Drainage Area (Acres)
4.) Disturbed Drainage Area (Acres)
5.) Sediment Storage Capacity (Acre-Feet)
6.) Storage Capacity at Principal Spillway (Acre-Feet)
7.) Storage Capacity at Emergency Spillway (Acre-Feet)
8.) Structure Height at Emergency Spillway Measured from Upstream Toe (Feet)
9.) Storage Capacity at Top of Dam (Acre-Feet)
10.) Structure Height at Top of Dam Measured from Downstream Toe (Feet)
11.) Latitude
12.) Longitude

1.2 Were any of the structures listed in chart 30.1, constructed prior to January 18, 1983? [ ] YES **[XX]** NO. If "YES", identify each structure and submit as "Attachment 31.2.A, 31.2.B", etc., the descriptions and compliance plan(s) required by 405 KAR 8:030, Section 25, or 405 KAR 8:040, Section 25,as appropriate.

31.3 For each proposed impoundment submit the applicable design plans and descriptions, including compliance demonstration documents, as required by 405 KAR 8:030 or 8:040, Section 34. Design plans and descriptions shall be submitted as "Attachment 31.3.A, 31.3.B," etc. Compliance demonstration documents shall be appropriately labeled and submitted in a separate document cover entitled "Sediment Ponds - Compliance Demonstration Documents". Put the applicant's name and the application number on the face of the document cover. If other state or federal agencies receive a copy of the permit application, a copy of the compliance demonstration documents shall also be provided to such agencies unless specifically waived. ***See Compliance Demonstration.***

NOTE: If any proposed sediment ponds are to be retained as permanent impoundments, the applicant shall ensure that such structures have been designed to meet the requirements of 405 KAR 16:100 or 405 KAR 18:100 as appropriate.

31.4 Will water be chemically treated at any of the proposed or existing sediment structures? [ ] YES **[XX]** NO. If "YES", provide the following information.

I.D. Number	TREATMENT CHEMICALS	Described the method of treatment application and special structures or facilities to be used

If additional pages are necessary, submit as "Item 31.4 continued". If special structures are to be utilized, submit as "Attachment 31.4.A, 31.4.B" etc., supporting engineering designs and calculations

Appolo Fuels, Inc.
#807-0368

ATTACHMENT 31.3.A

SEDIMENT CONTROL

The mining activity proposed in this amendment application will consist of contour strip and highwall/ auger mining of the Hignite coal seam and the Buckeye Springs, Poplar Lick, Sterling and Strays coal seams within the foot print of Hollow Fill #1. This operation is located near the community of Fonde in Bell County in the named watersheds of Clear Fork, Sowder Branch and Marsee Branch on the Fork Ridge and Eagan 7 ½ Minute U.S.G.S. Maps.

In order to provide sediment control for the activities described in this application, it will be necessary to construct sixteen (16) sediment ponds; they are 1 thru 16. The locations of these ponds are detailed on the M.R.P. Map. Sediment Pond #1 is proposed as an off-bench dug-out structure. The sediment ponds 2 thru 16 are proposed as on bench dug-out structures. Sediment control will be provided by temporary ditches, with all drainage remaining on bench contained in the pit, until the location of the proposed structure has been mined, and then the respective pond will be constructed and certified. If sediment control is a problem prior to the construction of these ponds, straw bales and/or silt fence will be used to aid in sediment control.

As a result of new policy from the Division of Mine Permits, the permittee is proposing supplemental sediment control to satisfy the new two (2) acre disturbance limit set by the Division. This supplemental sediment control will be a temporary sediment pond constructed as per the typical design shown in item 31 of this application. This temporary sediment pond will be constructed in advance of the last constructed on-bench sediment pond and will be constructed for each two (2) acres of mining disturbance that is created beyond the last on-bench sediment pond that is constructed. These ponds will be temporary in nature and will be removed once mining advances to a point that the next designed on-bench pond can be constructed and certified. No water detained in these temporary sediment ponds will be directly discharged from the permit area. The exit channel of the temporary sediment pond will be constructed such that the surface water will flow in series through each temporary sediment pond constructed and back to the last constructed on-bench sediment pond. In the event gravity flow will not allow the surface water to flow from the temporary sediment ponds back to the on-bench sediment pond, the water will be pumped. Only the sediment ponds proposed will be designated as KPDES discharge sites since the temporary sediment ponds are only acting as a temporary detention basin. In addition to the proposed temporary sediment ponds, all surface water runoff on the bench areas in advance of the last constructed pond will be intercepted and controlled within the mine pit area. No water from the mining areas shall be released without flowing through an on-bench sediment pond that is designated as a KPDES discharge point.

The dug-out ponds will be constructed by excavating material from the existing ground. These ponds will have single open channel spillways and/or principal pipes. Each spillway will be rip-rapped from the inlet through the embankment all the way to natural ground to dissipate energy and prevent erosion. The spillways will be placed at their design elevation and size and configuration. The ponds will be inspected and the sediment elevation will be checked regularly and if sediment is near the clean-out level it will be cleaned out. The sediment will be placed in a truck and will be hauled to and placed in the backfill areas. If the sediment should prove to be toxic by chemical analysis, it will be disposed of in a pit excavated on the mine bench. This disposal pit would be lined with four (4') feet of the best available impermeable material clay on all sides and the bottom. After the sediment is placed in the pit, the pit will be covered with an additional four (4') feet of clay material.

If the sediment should prove to be non-toxic, the material will be mixed with spoil material and used for backfill and grading operations.

The emergency spillway and the outlet end of the principal spillway pipe will be rip-rapped from the inlet side through the embankment all the way to natural ground to dissipate energy and prevent erosion. The rip-rap which will be used in spillways will be pit rock obtained from the job site or will be purchased from a local quarry. All material will be durable rock which will not slake in water. It is anticipated that the durable rock which will be used use as rip-rap will be properly sized and graded to use for this purpose.

The ponds will be constructed under the supervision of a registered professional engineer during all phases of construction. The ponds will be inspected after each significant rainfall event to determine if the pond needs to be cleaned out. The sediment in the ponds will be removed when the sediment level exceeds the design sediment volume used in the design of the sediment pond. This will ensure that these ponds will always produce an effluent which will meet the performance standards. Also, the sediment pond will be inspected by a registered professional engineer annually to certify that the ponds are

ATTACHMENT 31.3.A

maintained in such a manner that it always meets the performance standards.

We have provided the following information on this design in this attachment:

1) Watershed Map - This map details the drainage area served by the pond and its breakdown into subwatersheds.
2) Stage-Storage Curve
3) "SEDCAD" Computer Printouts for the 25yr-24hr storm events during Mining and Reclamation
4) Cumulative Impact Assessment - Pre-Mining computer run
5) Certified Design Drawing
6) Engineer's Certification of Design

In addition, we are proposing to utilize alternate sediment control for any portion of the surface mining areas which field conditions and/or the operator deems necessary to control runoff from the site. The surface runoff will be controlled by berms around the perimeter of the site and the alternate sediment control will be either straw bale check dams or silt fences. The use of the proposed alternate sediment control measures are in addition to the sediment ponds included in this application.

ATTACHMENT 31.3.A

ALTERNATE SEDIMENT CONTROL

Department for Natural Resources
Division of Mining Permits
#2 Hudson Hollow
U.S. 127 South
Frankfort, Kentucky 40601

RE: Appolo Fuels, Inc.
Permit #807-0368

To Whom It May Concern:

We request a waiver in order to utilize alternate sediment control for any portion of the surface mining area for which field conditions or the operator deem necessary to control runoff from the site. The use of alternate sediment control will be in addition to the sediment ponds included in this permit application. The primary areas will be at the toe of the backfilled areas which drain into the associated watersheds. These areas will require supplemental alternate sediment control until field conditions are met.

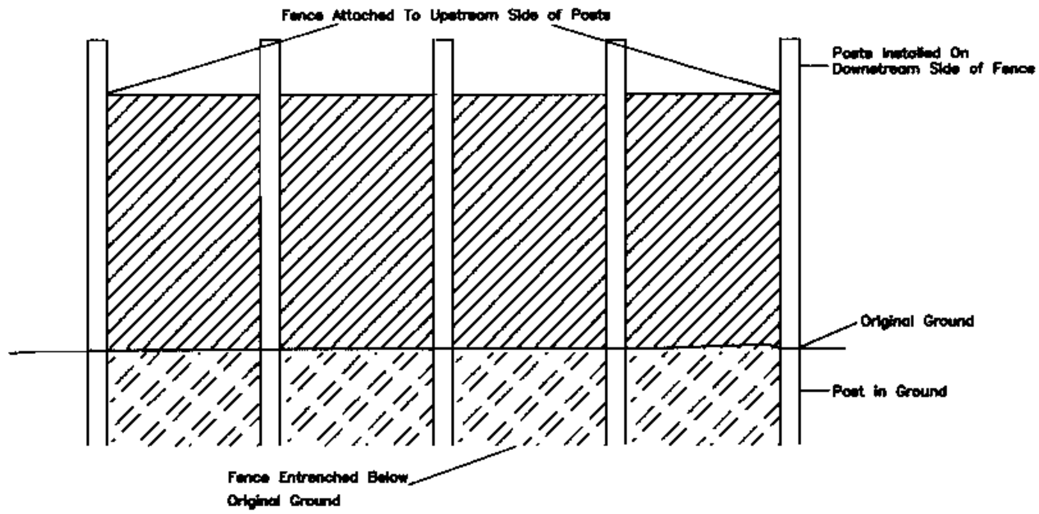
A filter barrier of silt fence or straw bales will be placed around the perimeter of the area if necessary to provide sediment control for the site. This filter will be maintained throughout the time for vegetation to establish itself on the reclaimed areas.

The alternate sediment control proposed in this application for these areas will provide supplemental sediment control and will aid in the protection of the environment.

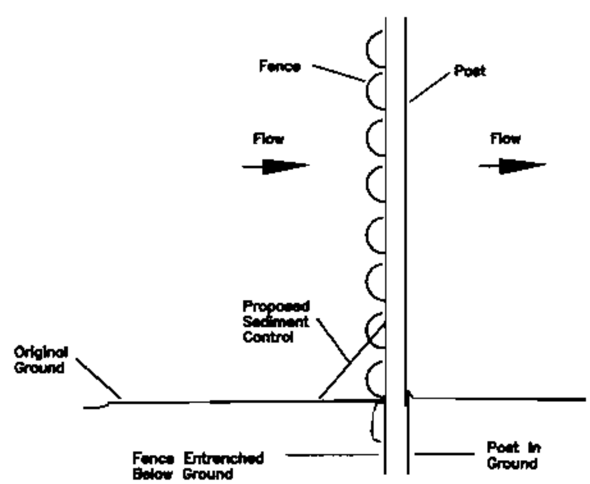
Sincerely,

Danny Caudill
Howard Engineering and Geology, Inc.

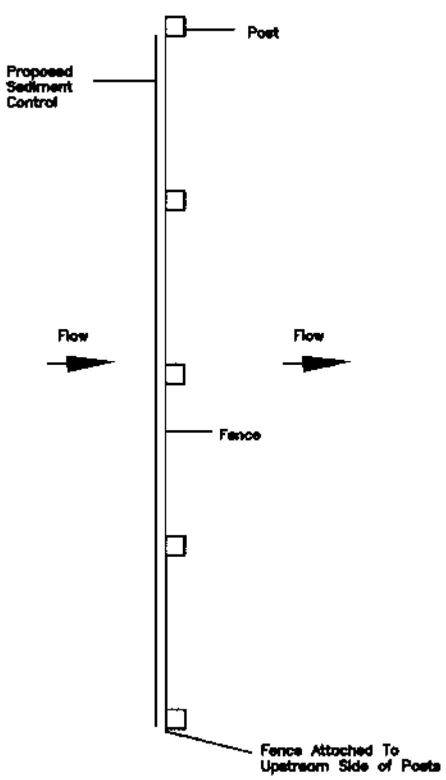
Profile



Cross Section



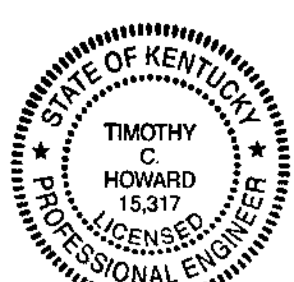
Plan View



I, Timothy C. Howard, P.E. No. 15,317

Date: 12/29/08

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.



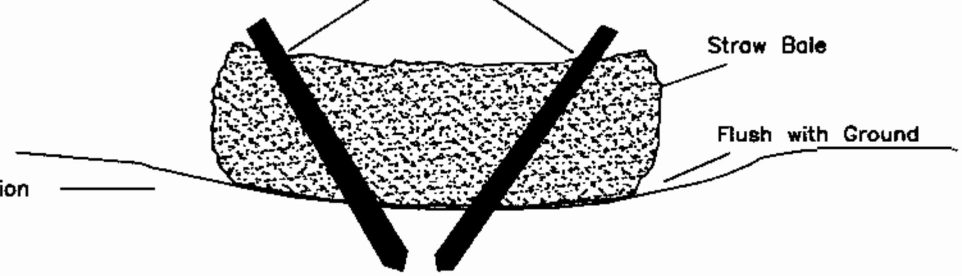
Appolo Fuels, Inc.

Permit #807-0368
Typical Straw Bale Details
Attachment 31.3.A

Scale: NONE

Prepared By:
Howard Engineering & Geology, Inc.

Plan View



Cross-Sectional View

I, Timothy C. Howard, P.E. No. 15,317

Date: 12/29/08

hereby certify in accordance with 405 KAR 7:040, Section 10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

Permit #807-0368
Typical Sediment Fence Details
Attachment 31.3.A

Scale: NONE

Prepared By:
Howard Engineering & Geology, Inc.

31.5 Provide a plan for the periodic maintenance of all sediment structures and discuss the proposed sediment clean-out schedule. Provide information as "Attachment 31.5.A".
See Attachment 31.5.A.

31.6 Provide a removal plan for all temporary impoundments. Submit as "Attachment 31.6.A".
See Attachment 31.6.A.

32. Diversions

32.1 Is authorization to conduct mining and reclamations or to construct mining related facilities within 100 feet of an intermittent or perennial stream being requested? [***XX***] YES [ ] NO. If "YES", provide the following information for all of the following.

(a) A map showing the location(s) where such authorization is requested, and the proposed disturbance(s)/facility(ies) with an indication of the specific distance to the stream(s). Submit as "Attachment 32.1.A".
See MRP Map.

(b) Cross-sections and a longitudinal profile of the stream's premining and postmining configuration. Submit as "Attachment 32.1.B".
See Hollow Fill #1 Profile and Cross Sections.

(c) A description, including maps, plans, drawings, etc., of the specific measures to be taken to protect the stream(s) during the mining and reclamation operation. Submit as "Attachment 32.1.C".
See Hollow Fill #1 Construction Plans and Drawings.

32.2 Will the disturbances referenced in item 32.1 result in the temporary or permanent diversion of an intermittent or perennial stream?
[***XX***] YES [ ] NO. If "YES", provide as "Attachment 32.2.A", the design calculations and other pertinent information to demonstrate compliance with 405 KAR 16:080, Section 2, or 405 KAR 18:080, Section 2, as appropriate.

32.3 Complete the following chart for all diversions:

Diversion Number	Length of Diversion	Design Storm	Type of Channel	Design Velocity	Av. Slope	Erosion Control Methods
HF1-D1	***1790'***	***100 Yr.***	***Trap.***	***4.98 ft/s***	***1%***	***Rip-Rap***
HF1-D2	***2600'***	***100 Yr.***	***Trap.***	***21.40 ft/s***	***50%***	***Rip-Rap***
HF1-D3	***2400'***	***100 Yr.***	***Trap.***	***5.48 ft/s***	***1%***	***Rip-Rap***
HF1-D4	***2165'***	***100 Yr.***	***Trap.***	***23.19 ft/s***	***50%***	***Rip-Rap***
P1D1	***1060'***	***25 Tr.***	***V-Ditch***	***3.44 ft/s***	***1%***	***See Note***
P2D1	***1169'***	***25 Tr.***	***V-Ditch***	***4.25 ft/s***	***1%***	***See Note***
P3D1	***1107'***	***25 Tr.***	***V-Ditch***	***4.62 ft/s***	***1%***	***See Note***
P4D1	***842'***	***25 Tr.***	***V-Ditch***	***4.64 ft/s***	***1%***	***See Note***
P5D1	***1347'***	***25 Tr.***	***V-Ditch***	***4.64 ft/s***	***1%***	***See Note***
P6D1	***1685'***	***25 Tr.***	***V-Ditch***	***4.45 ft/s***	***1%***	***See Note***

Note: *Ditches with Flow Velocity Less Than 5 ft/s will be vegetated*
Ditches with Flow Velocity Greater Than 5 ft/s Will Be Cut In Solid or Rock Lined

ATTACHMENT 31.5.A

The sediment structures that will be constructed and utilized under this application will be inspected after each significant rainfall event to insure the integrity and stability of the structures and to insure that the spillways are clear and functioning properly. Also, these structures will be inspected by a registered professional engineer annually, at a minimum, to certify that the structures are being maintained in such a manner that the effluent from the structures will continue to meet the performance standards of the "Permanent Program".

The sediment structures will be maintained and when sediment level reaches the elevation designated in the pond designs, they will be cleaned out. The sediment will be placed in a truck and will be hauled to the backfill areas and the material will be mixed with spoil material and used for backfill and grading operations. Although no potential acidic strata has been identified, the material taken from the pond during clean-out shall be analyzed to determine if the material is toxic. If the analysis shows the material to be toxic it will be disposed of as described in Attachment 29.2.A (Toxic Materials Handling Plan).

ATTACHMENT 31.6.A

Prior to removal of any embankment or dugout sediment structures, all water will be removed from the structures either by pump or siphon. Removal of water by any means will be done in such a manner as to prevent excessive erosion to the surrounding areas.

After all water has been removed from the structure, the remaining sediment will be allowed to dry. The rip-rap used for erosion control around the structures will be excavated and temporarily stored within the permit area for later use in the reclamation of the sediment structure sites.

Once the remaining sediment in the structures has dried thoroughly, the dried sediment material will be removed and mixed with the material being used to backfill the mining operation. Dugout structures located on-bench will be filled in and a small depression of one (1) to two (2) feet in depth will be left to comply with the reclamation plan. Sediment structure sites will be regraded, seeded, and mulched to establish ground cover and prevent erosion. The sediment structure sites will be revegetated with a variety of grasses and legumes immediately after the structures have been removed and reclaimed.

Although no potential acidic strata has been identified, the material taken from the pond during clean-out shall be analyzed to determine if the material is toxic. If the analysis shows the material to be toxic it will be disposed of as described in Attachment 29.2.A (Toxic Materials Handling Plan).

Stream Channel Restoration Plan

Existing Conditions: All of the areas proposed for stream channel restoration, from toe of HF through toe of Pond #1, have been previously disturbed by mining, logging and oil/gas exploration. As a result of these previous disturbances, the channels exhibit non-native channel characteristics. The size of the water shed above the lower most disturbance proposed is approximately 195.1 acres. The existing slope of the stream is approximately 2%. Riffle/Run/Pool ratio for this stream 40/50/10. The steam channel is approximately eight feet wide with the high water mark occupying approximately five feet. Current riparian vegetation consists of native and non-native herbaceous species, with minor amounts of multi-flora rose and blackberry. Woody species consists of both native and non-native and include American beech, white pine, sycamore, tuliptree, autumn olive. Existing substrate consists of unsorted boulders, cobble, gravel, sand, and silt. This substrate provides fair habitat with for aquatic macro-invertebrates. Riffle sections are characterized as predominantly cobble sized particles of sandstone for Pond #1. Pool sections at Pond #1 are characterized as predominantly gravel sized particles and smaller with a thin coating of silt deposits.

Mitigation: The first phase of stream channel restoration will be implemented by using a small excavator to dip and remove the sediment between the toe of the fill and the toe of the pond. The second phase of channel restoration will be re-constructing a natural, normal flow channel (bed width) and full bank width designed as shown on the post-mining cross sections and in accordance with the pre-mining dimensions by the use of an excavator after approval to remove Pond #1 have been granted. This channel will be constructed along the entire reach from the toe of Hollow Fill through the toe of Pond #1. Pre-disturbance characteristic information gathered from the site will be used as a reference for mitigation dimensions and substrate. The natural channel will be constructed in an irregular shape and similar to the pre-mining reach to encourage the development of natural stream sinuosity with riffle-pool complexes using a mixed substrate material at least 6 inches in depth. Substrate material will be gathered from the overburden material generated during the mining process and harvested during the backfilling operations. Cobble sized material and larger will be predominantly sandstone. Gravel sized material and smaller will be layered siltstone or durable shale. All substrate material will be non-toxic, non-acidic, and durable. Natural channel design techniques shall be utilized, using the existing morphology to design the restored channel. Details of the mitigation plan are included in the next section and associated drawings. This method of channel restoration will allow the operation to restore stream impacts as an integral part of satisfying the DNR regulations. The result of this methodology will be a minimization of the temporal stream impacts.

The next phase of stream channel restoration will occur after the natural channel has been constructed. Riparian revegetation will be planted as prescribed in Table 1 in the proposed riparian zone of 50 linear feet from the normal water height of the reconstructed channel. The revegetation plan has been designed to provide both short-term erosion control through immediate herbaceous groundcover along with long-term restoration of stream function and bank stability. Proposed riparian species were chosen based on their value to stream function, availability, non-invasiveness, tolerance to mine spoil type soil conditions, and native occurrences and are from Appendix 4 of "Guidelines for Stream & Wetland Protection in Kentucky" by the Kentucky Division of Water. Shellbark hickory was chosen as a hardwood exfoliating bark tree species for its value as potential roost habitat for the Indiana Bat (*Myotis sodalis*), as required by DNR. Woody stems will be planted on five feet centers.

Detailed Restoration Plan

The stream channel restoration plan in detail will involve stream reconstruction methods designed for steep gradient streams in this region.

Less than 10%: Riffle-pool complex structures will be constructed at intervals of 60-80 feet with an excavator using durable sandstone boulders in a cross vane configuration or using log vane structures. Stream banks will be stabilized with durable sandstone boulders, and root wad revetments alternating bank sides. The bank full widths will be in accordance with the pre-impact widths with the reference reaches used as a guide.

After the channels have been constructed, a riparian zone of 50 feet from the centerline of the stream channel will be established utilizing the following:

P.O. Box 271 • 2550 W Hwy 72 SUITE 1 • Harlan, Ky 40831 • Phone/Fax: (606) 573-6924 • Email: info@howardeng-geo.com

Table 1

Riparian Zone Revegetation

Common Name	Scientific Name	Seeding Rate
HERBACEOUS GROUNDCOVER		
Sedge	*Carex granularis*	10 lbs./ac.
Annual Rye	*Secale cereale*	25 lbs./ac.
Deertongue grass	*Panicum clandestinum*	2 lbs/ac.
TREES		
Red maple	*Acer rubrum*	20/ac.
Green ash	*Fraxinus pennsylvanica*	30/ac.
Shellbark hickory	*Carya laciniosa*	30/ac.
Yellow poplar	*Liriodendron tulipifera*	100/ac.
SHRUBS		
Alder	*Alnus serrulata*	40/ac.
Silky Dogwood	*Cornus amomum*	30/ac.
Spicebush	*Lindera benzoin*	50/ac.

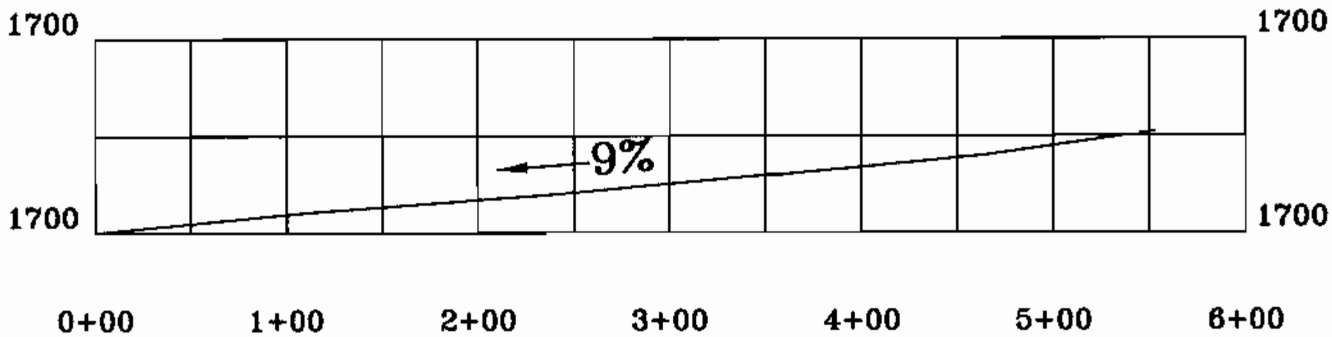
Note: Additional species may be added for nitrogen fixing capability.

Herbaceous groundcover will be planted by hydroseeder method with soil amendments included. Fiber mulch will be included in the process at a rate of 1500 lbs. /ac. Tree and shrub seedlings will be planted during the early spring or late fall planting periods using the dibble bar or mattock method. The trees and shrubs will be planted in a random/irregular, mixed distribution pattern starting at the average depth and extending 50 feet each side of the channel. Seed mixtures planted will be 98% pure and free of any noxious or invasive plant species.

If any exotic or undesirable species should occur within the riparian zone control techniques described by the Nature Conservancy that follow NPS IPM guidelines will be utilized. The methods utilized will be by mechanical means and will include: Power tools (chain saws, weed whips, winches); and or hand tools (shovels, pulaskis, loppers, Weed Wrenches™, grip hoists, machetes, chokers); and manual removal of herbaceous and shallowly-rooted plants is relatively inexpensive and can be used for plowing or pulling out large individual plants.

DIMENSIONS

Riffle/Pool/Run % = 0/15/85
Riffle Length = 0
Pool Length = 1' - 2'



STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

I, [signature], P.E. No. 15,317

Date: 2/25/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

Appolo Fuels, Inc.

Permit No. 807-0368
Existing Profile
Attachment 32.1.C

Scale: As Shown

Page No. 1 of 1

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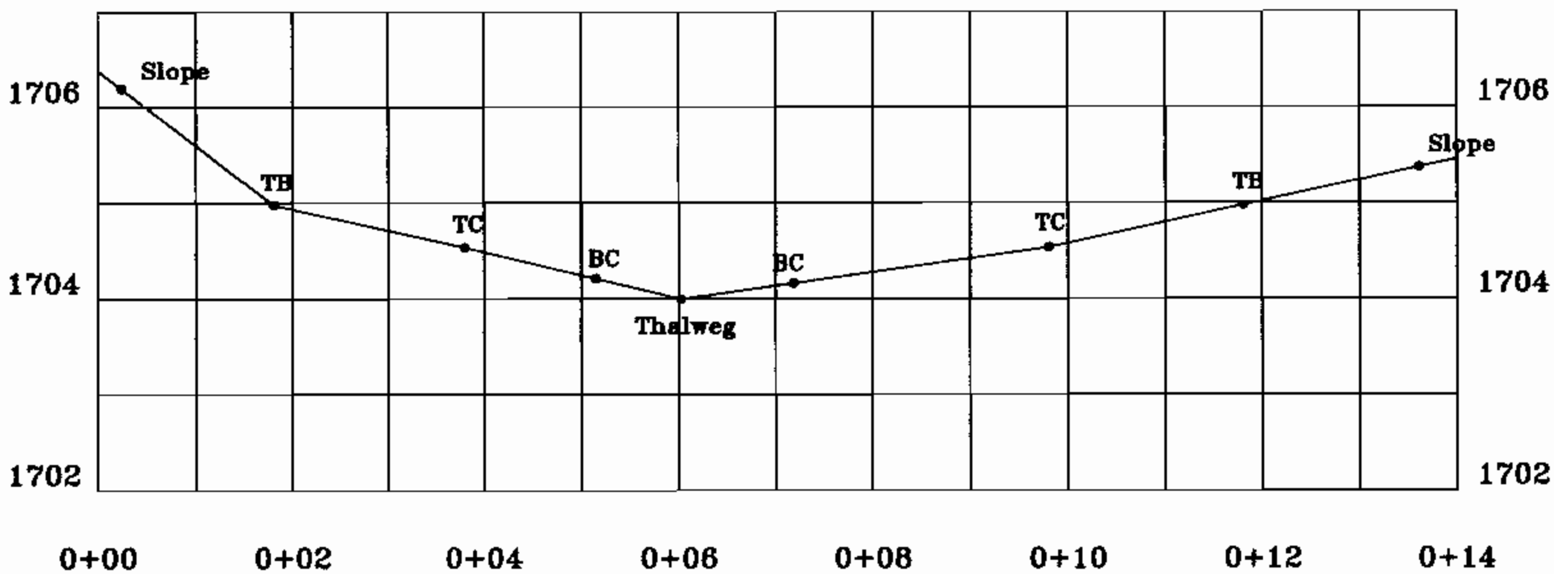
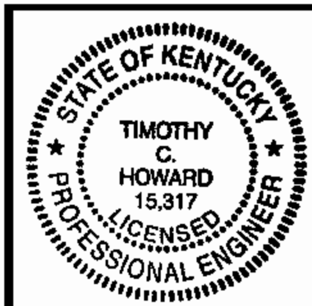
DIMENSIONS

Bankfull Width = 5' - 6'
Flood Prone Width = 7' - 8'
Pool Depth = 6" - 12"





I, Timothy C. Howard, P.E. No. 15,317
Date: 2/25/09
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Appolo Fuels, Inc.

Permit No. 807-0368
Existing Cross Section
Attachment 32.1.C

Scale: As Shown | Page No. 1 of 1

Prepared for
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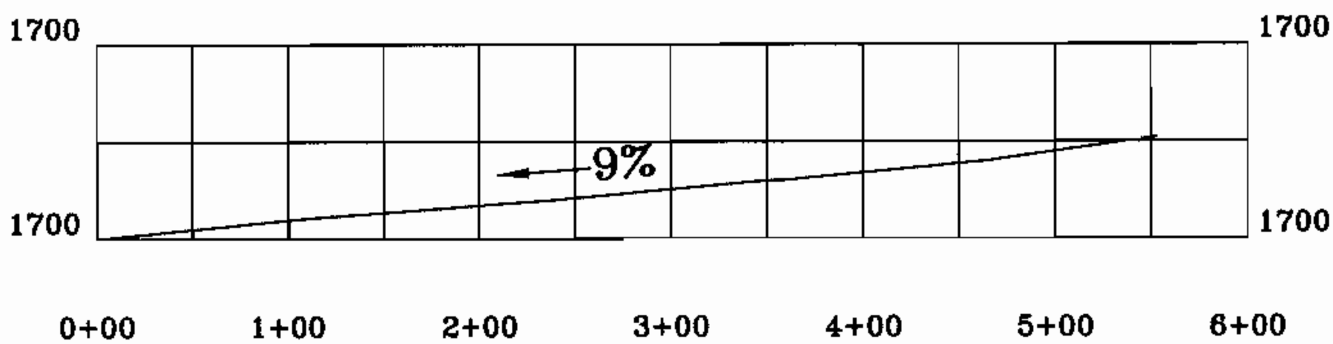
DIMENSIONS

Riffle/Pool/Run % = 0/15/85
Riffle Length = 0
Pool Length = 1' - 2'



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TIMOTHY C. HOWARD 15,317
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I, Timothy C. Howard, P.E. No. 15,317

2/25/09

Date

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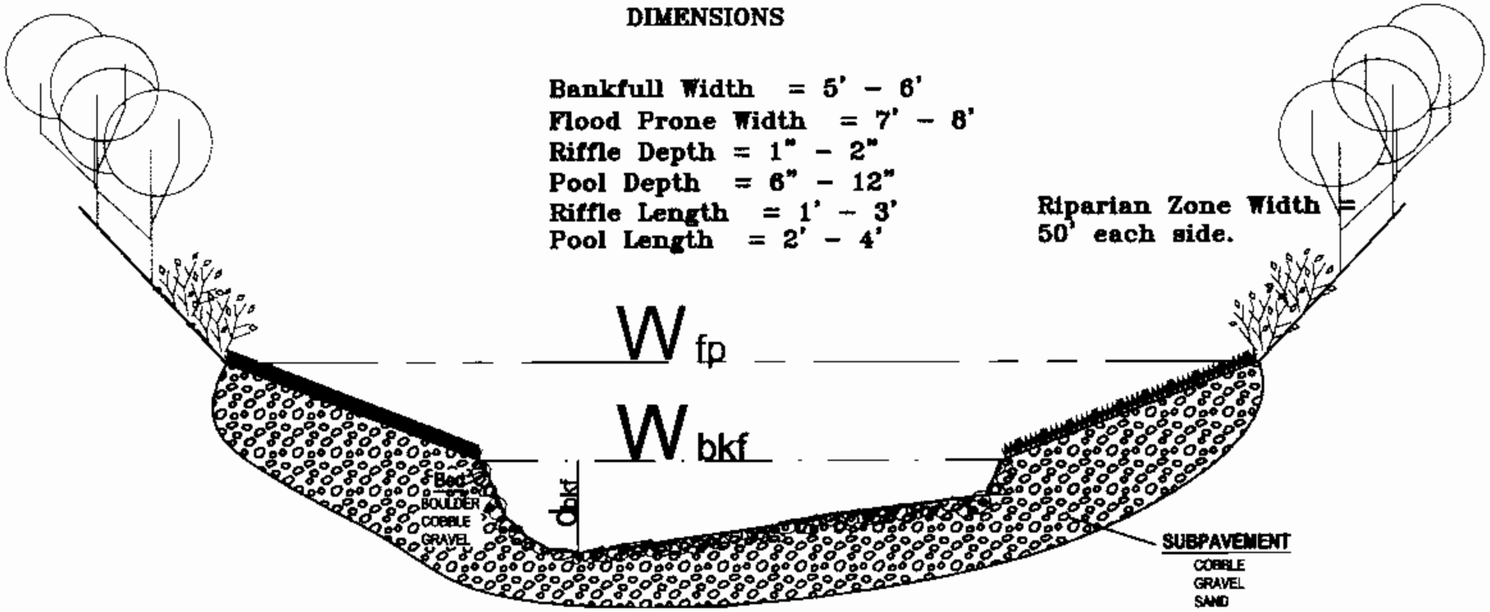
Appolo Fuels, Inc.	
Permit No. 807-0368 Proposed Profile Attachment 32.1.C	
Scale: As Shown	Page No. 1 of 1
Prepared for Howard Engineering & Geology, Inc.	

DIMENSIONS

Bankfull Width = 5' - 6'
Flood Prone Width = 7' - 8'
Riffle Depth = 1" - 2"
Pool Depth = 6" - 12"
Riffle Length = 1' - 3'
Pool Length = 2' - 4'



GENERAL CHANNEL BED AND SUBPAVEMENT MATERIALS

General PARTICLE Size-Classes

Boulder - Large: 20 inches +
- Small: 10 to 20 inches
Cobble - 2.5 to 10 inches
Gravel - .08 to 2.5 inches
Sand - .062 to 2.0 millimeters
Silt/Clay - < .062 millimeters

STATE OF KENTUCKY
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Appolo Fuels, Inc.

Permit No. 807-0368
Proposed Cross Section
Attachment 32.1.C

Scale: None	Page No. 1 of 1

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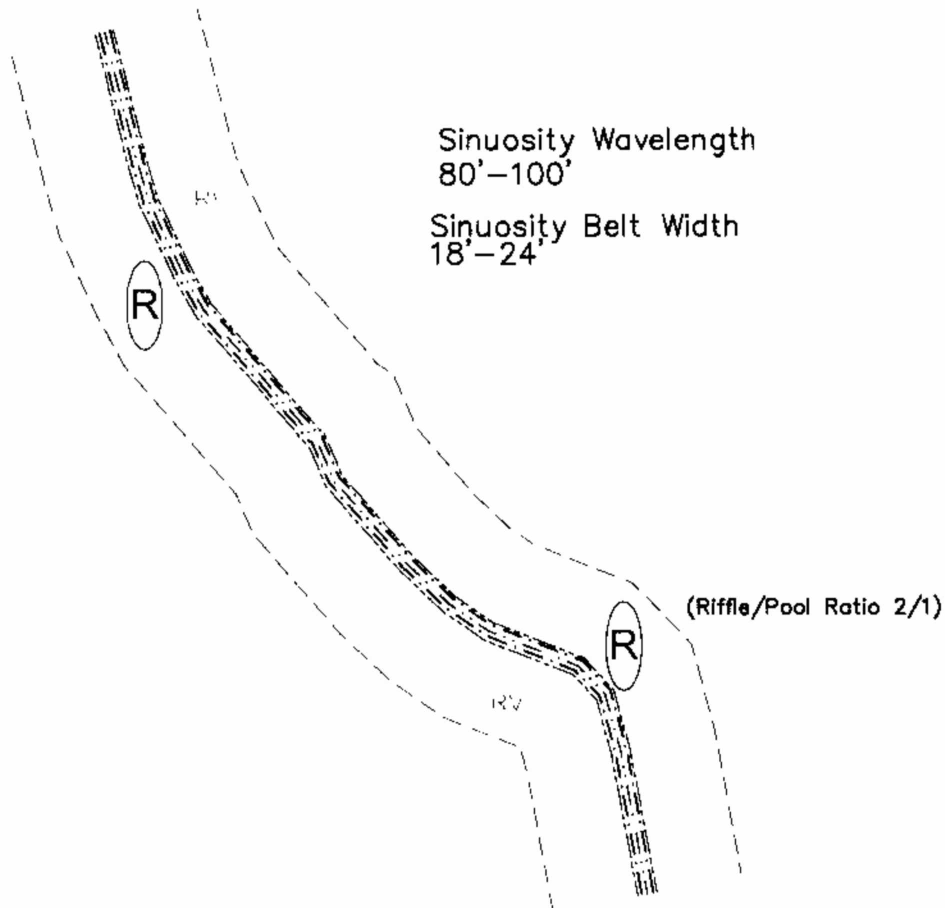

IN–STREAM STRUCTURES

R Root Wad Revetment

Log Vane

RV Rock Vane

- – – Riparian Zone 50' ea.
- Flood Prone Width
- Stream Thalweg
- Bankfull Width

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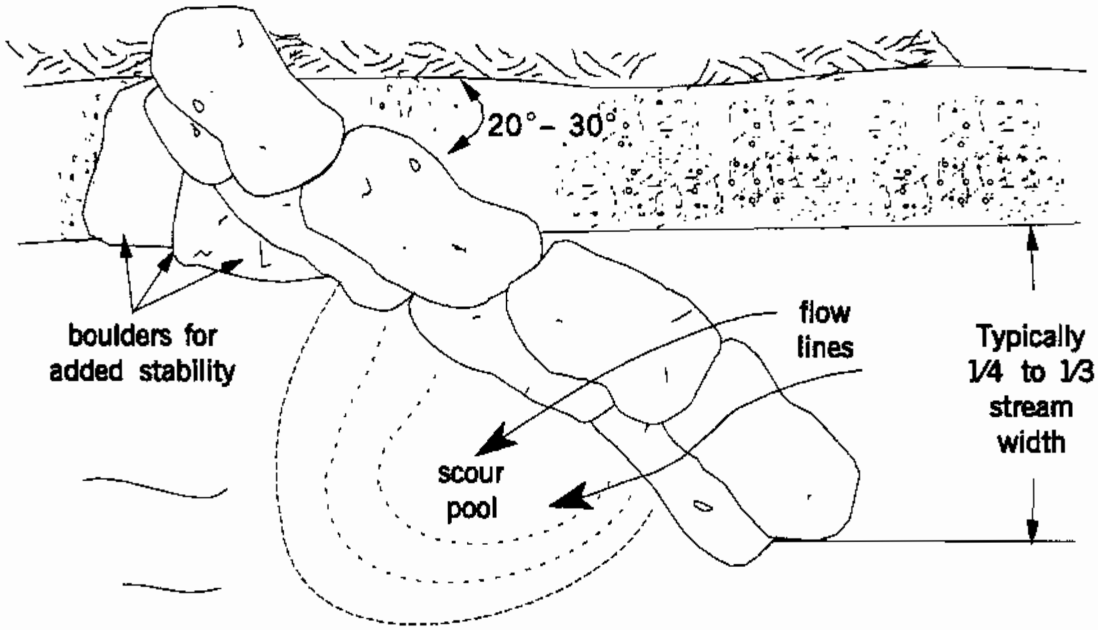
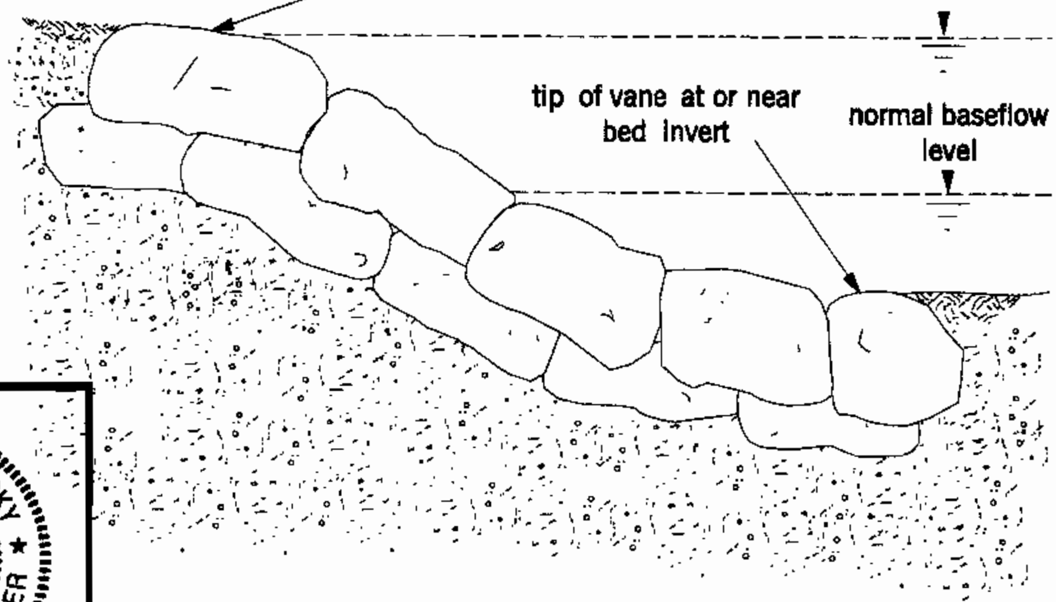
Appolo Fuels, Inc.	
Permit No. 807-0368 **Plan View – Stream Channel Restoration Plan** **Attachment 32.1.C**	
Scale: 1" = 100'	Page No. 1 of 1
Prepared by **Howard Engineering & Geology, Inc.**	

Section & Plan Views Adapted
From Rosgen (1999)

PLAN VIEW: ROCK VANE



SECTION VIEW: ROCK VANE



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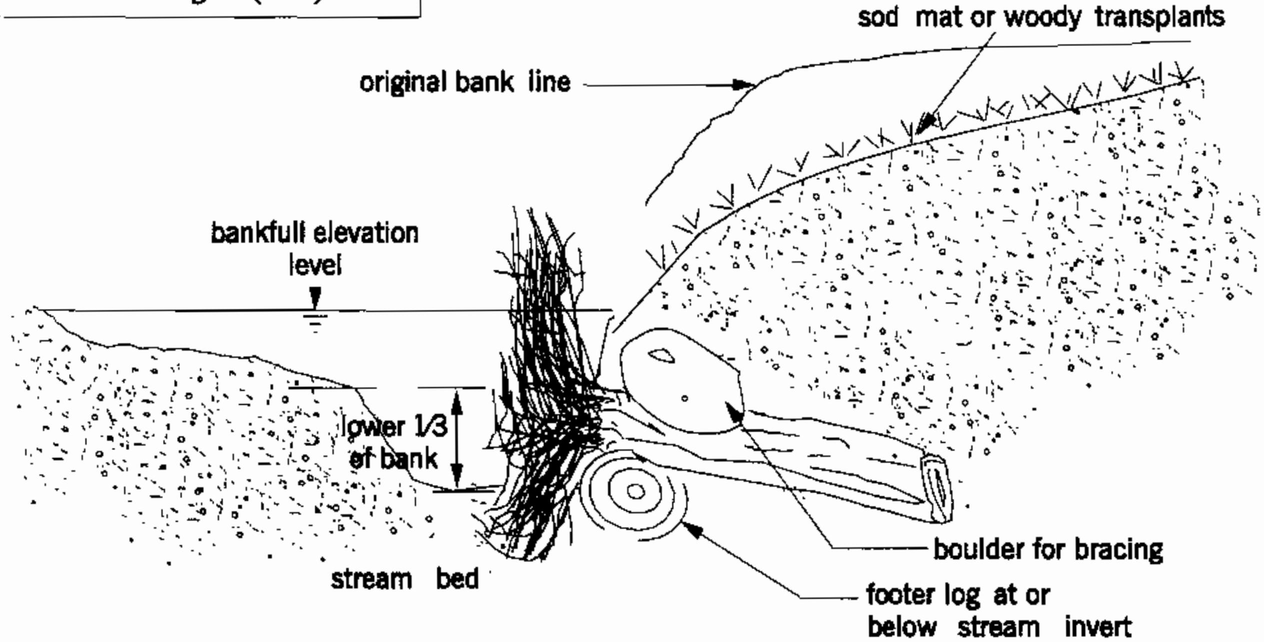
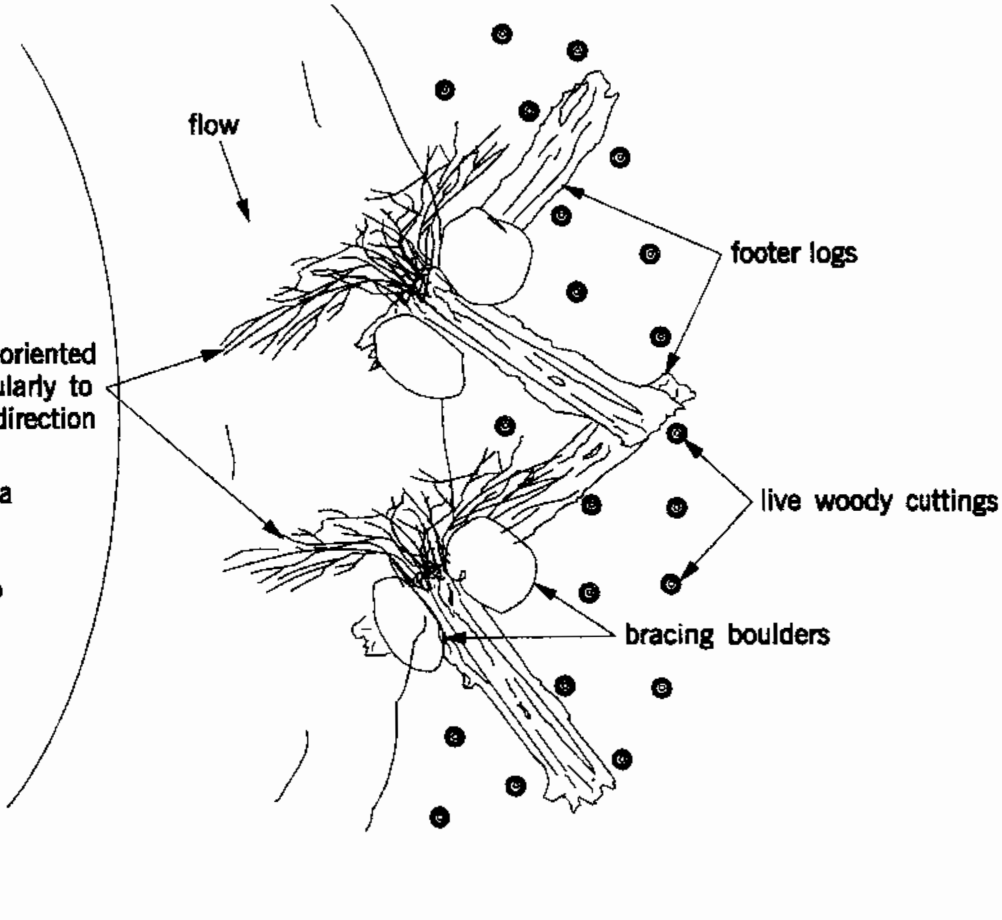
Appolo Fuels, Inc.	
Permit No. 807-0368 Typical Rock Vane Attachment 32.1.C	
Scale: None	Page No. 1 of 1
Prepared by: Howard Engineering & Geology, Inc.	

Section & Plan Views Adapted From Rosgen (1999)

SECTION VIEW



PLAN VIEW



Construction Note: a brace log can be used for additional stability and should be pinned to adjacent rootwads

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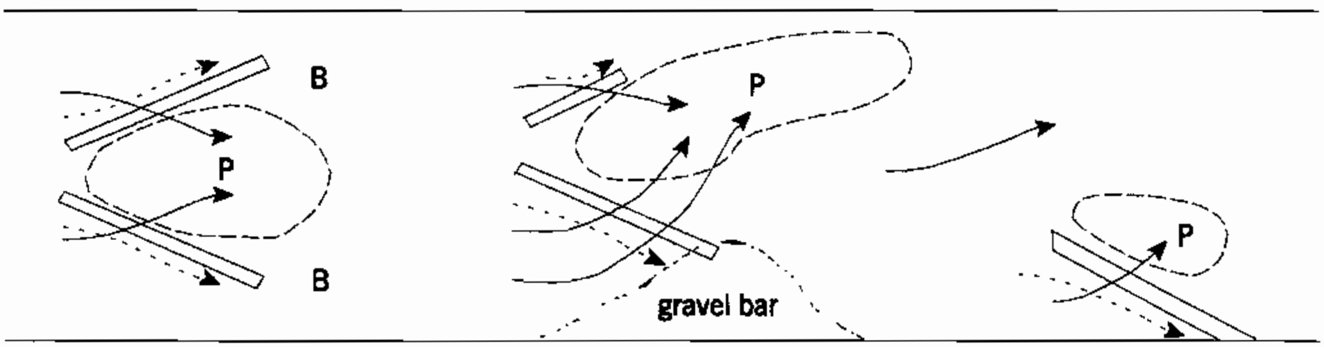
Appolo Fuels, Inc.	
Permit No. 807-0368 Typical Root Wad Revetment Attachment 32.1.C	
Scale: None	Page No. 1 of 1
Prepared by: Howard Engineering & Geology, Inc.	

PLAN VIEW: ALTERNATIVE VANE CONFIGURATIONS

Source: Hey (1995)



Symmetrical Asymmetrical Straight

LEGEND:

P, pool; B, bar; E, bank erosion; ———▷ main/surface flow; - - - - ▷ near bed flow;
— — —▷ over topping flow

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I, Timothy C. Howard, P.E. No. 15,317

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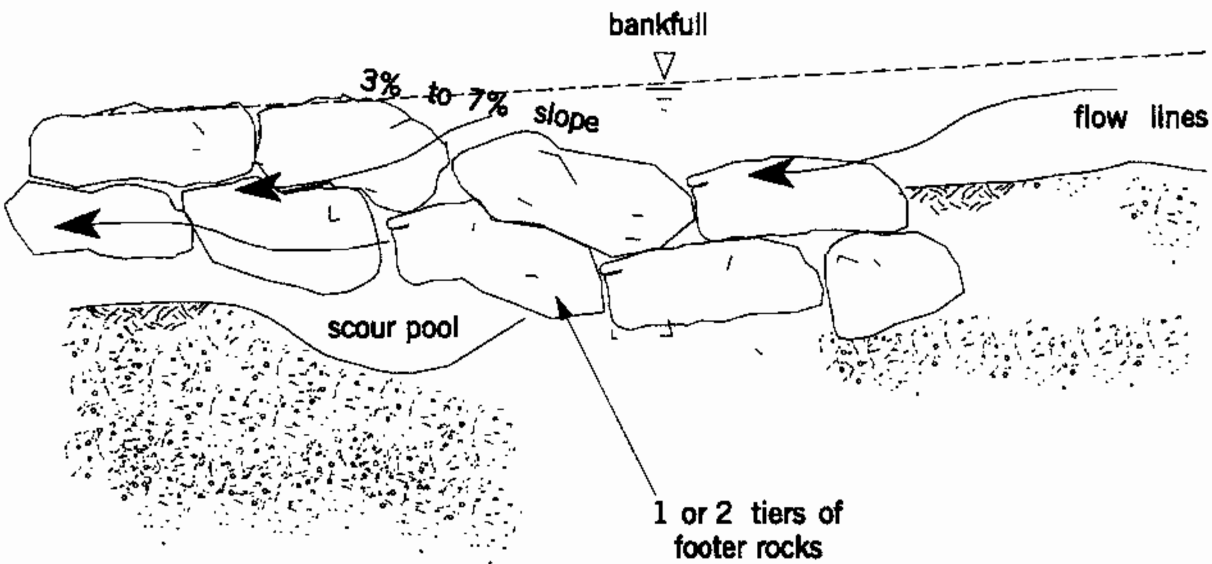
Appolo Fuels, Inc.	
Permit No. 807-0368 Typical Log Vane Attachment 32.1.C	
Scale: None	Page No. 1 of 1
Prepared by Howard Engineering & Geology, Inc.	

Section & Plan Views Adapted From Rosgen (1999)

PROFILE VIEW: STRAIGHT VANE



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Appolo Fuels, Inc.	
Permit No. 807-0368 Typical Rock Vane Attachment 32.1.C	
Scale: None	Page No. 1 of 1
Prepared by: Howard Engineering & Geology, Inc.	

ATTACHMENT 32.2.A

The diversions proposed in this application have been designed to prevent detrimental effects to the water quantity and quality of the intermittent or perennial streams in the area affected by the proposed mining operation. As required the channel, bank and flood plain configuration of the diversion ditches which diverts an intermittent or perennial stream has been designed to safely pass the 100 year, twenty-four hour storm event. The capacity of the diversion channel itself is equal to or greater than the unmodified stream channel. The diversions shall be lined with riprap. The material used for the riprap shall be provided by the proposed operation. The riprap material shall be free of acid-forming material and toxic-forming material and shall comply with the durability requirements of 405 KAR 16:130, Section 1(6)2, except that sand and gravel shall not be used. No diversion shall be located so as to increase the potential for land slides. No diversion shall be constructed on existing land slides, unless approved by the cabinet. The diversions have been designed and certified by a registered professional engineer. The diversion shall be maintained to pass their respective storms. The stream areas pertinent to this attachment are located in Hollowfill #1 situated in an unnamed tributary of Clear Fork. This fill will be left permanently after mining. Consequently, it is not possible to restore this area of stream to its pre-mining configuration.

ATTACHMENT 32.3.A Continued

DIVERSIONS

Diversion Number	Length of Diversion	Design Storm	Type of Channel	Design Velocity	Average Slope	Erosion Control Methods
P7D1	1161'	25 Yr.	V-Ditch	4.64 ft/s	1 %	See Note
P8D1	3325'	25 Yr.	V-Ditch	4.05 ft/s	1 %	See Note
P9D1	967'	25 Yr.	V-Ditch	4.02 ft/s	1 %	See Note
P10D1	2064'	25 Yr.	V-Ditch	5.12 ft/s	1 %	See Note
P11D1	1709'	25 Yr.	V-Ditch	5.04 ft/s	1 %	See Note
P12D1	936'	25 Yr.	V-Ditch	4.15 ft/s	1 %	See Note
P13D1	1590'	25 Yr.	V-Ditch	3.58 ft/s	1 %	See Note
P14D1	1702'	25 Yr.	V-Ditch	3.84 ft/s	1 %	See Note
P15D1	1265'	25 Yr.	V-Ditch	4.36 ft/s	1 %	See Note
P16D1	909'	25 Yr.	V-Ditch	4.66 ft/s	1%	See Note
KYHF1-D1	1965'	100 Yr.	Trap.	5.18 ft/s	1%	See Note
KYHF1-D3	1855'	100 Yr.	Trap.	5.57 ft/s	1%	See Note

NOTE: Ditches with Flow Velocity Less Than 5 ft/s will be vegetated
Ditches with Flow Velocity Greater Than 5 ft/s Will Be Cut In Solid or Rock Lined

32.3 Are any of the proposed diversions to be retained as permanent facilities? **[*XX*]** YES [ ] NO. If "YES", list the identification numbers of those diversions. ***HF1-D1, HF1-D2, HF1-D3, HF1-D4, KYHF1-D1 and KYHF1D3*** . Additionally, provide as "Attachment 32.3.A", detailed designs, cross-sections, calculations, and drawings for each proposed diversion ditch to demonstrate compliance with 405 KAR 16:080 or 18:080, Section 1, as appropriate.
See Attachment 32.3.A.

33. Transportation Facilities Plan

33.1 Describe the transportation plan for the proposed permit area. The plan shall include a discussion of road maintenance, appropriate maps, cross sections, and specifications for each road width, gradient, surface, cut, fill embankment, culvert, bridge, drainage ditch, and drainage structure. Submit the description as "Attachment 33.1.A".
See Attachment 33.1.A.

33.2 Are roads for which construction began prior to January 18, 1983 proposed for use within the permit area? [ ] YES **[*XX*]** NO. If "YES", clearly identify the extent of such roads on the MRP Map and submit the information required to demonstrate compliance with 405 KAR 8:030, Section 25, or 405 KAR 8:040, Section 25 as appropriate. Submit the information as "Attachment 33.2.A".

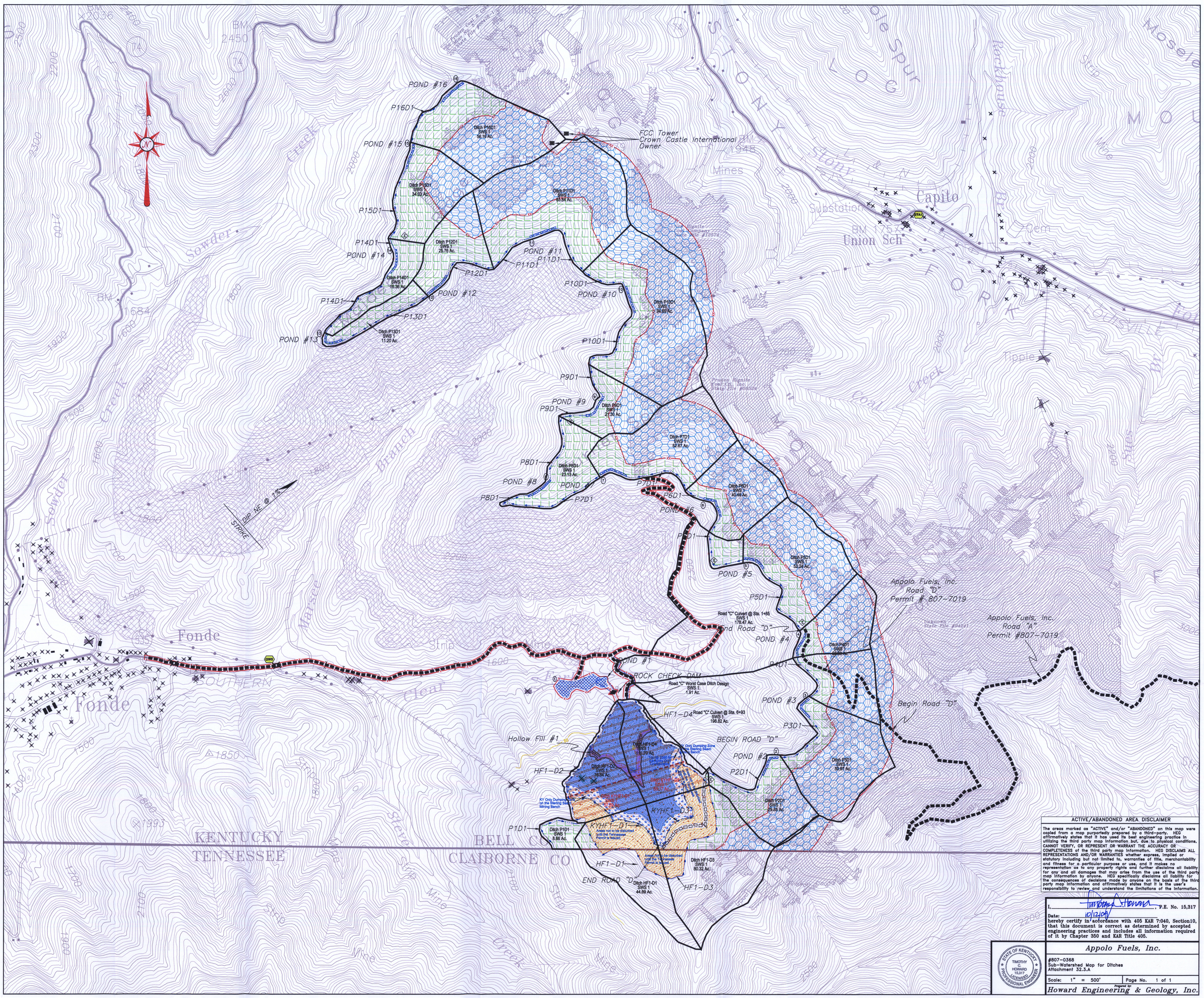
33.3 Will conveyors and/or rail systems be located within the proposed permit area? [ ] YES [***XX***] NO. If "YES", submit a description as "Attachment 33.3.A" and show on the MRP Map.

33.4 Does the applicant propose to use alternate specifications for any road or portions of road within the permit area? [ ] YES [***XX***] NO. If "YES", describe the specification to be modified and provide required justification. Submit as "Attachment 33.4.A".

33.5 Describe the measures to be used to ensure that interests of the public are protected if a waiver to conduct surface disturbances within 100' from the right-of-way of any public road or to relocate a public road is being requested. Submit this description as "Attachment 33.5.A".
N/A

34. Air Pollution Control Plan

34.1 For proposed permit area, describe the fugitive dust control plan to be employed during site preparation, mining, and reclamation. When required, provide an air quality monitoring program and locate monitoring station(s) on the MRP Map. Submit this information as "Attachment 34.1.A".
See Attachment 34.1.A.



ACTIVE/ABANDONED AREA DISCLAIMER

The areas marked as "ACTIVE" and/or "ABANDONED" on this map were copied from a map purportedly prepared by a third-party. HEG affirmatively states that it has used its best engineering practice in utilizing the third party map information but, due to physical conditions, CANNOT VERIFY, OR REPRESENT OR WARRANT THE ACCURACY OR COMPLETENESS of the third party map information. HEG DISCLAIMS ALL REPRESENTATIONS AND/OR WARRANTIES whether express, implied or statutory including but not limited to, warranties of title, merchantability and fitness for a particular purpose or use, and it makes no representation as to any property rights and further disclaims all liability for any and all damages that may arise from the use of the third party map information by anyone. HEG specifically disclaims all liability for the consequences of decisions made by anyone on the basis of the third party map information and affirmatively states that it is the user's responsibility to review and understand the limitations of the information.

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Date: 10/12/09

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STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

#807-0368
Sub-Watershed Map for Ditches
Attachment 32.3.A

Scale: 1" = 500'

Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.

Appolo Fuels #807-0368 Diversion HF1-D1
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	187.20	cfs

Results		
Depth	2.25	ft
Flow Area	37.58	ft²
Wetted Perimeter	24.20	ft
Top Width	23.47	ft
Critical Depth	1.83	ft
Critical Slope	0.021884	ft/ft
Velocity	4.98	ft/s
Velocity Head	0.39	ft
Specific Energy	2.63	ft
Froude Number	0.69	
Flow is subcritical.		

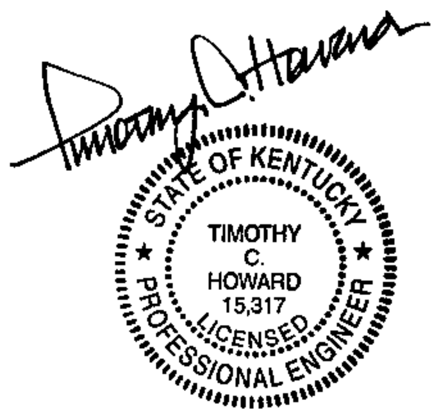
Timothy C. Howard

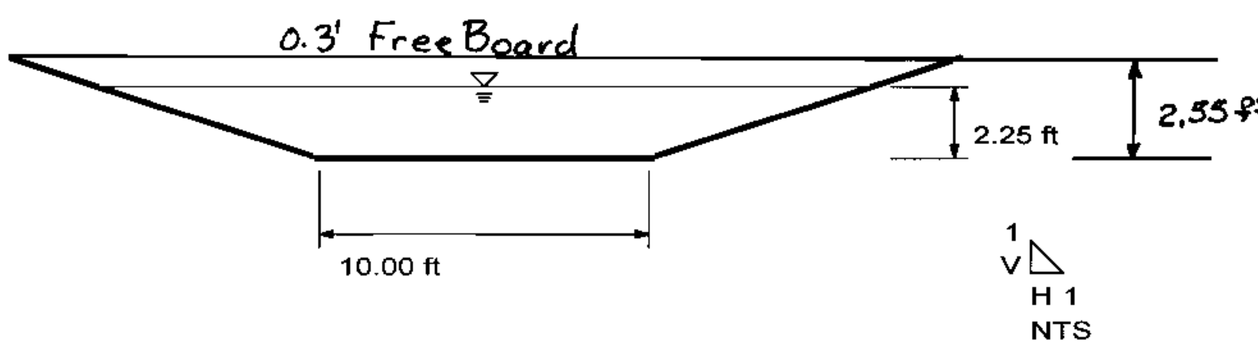
STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

Appolo Fuels #807-0368 Diversion HF1-D1
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Depth	2.25	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	187.20	cfs





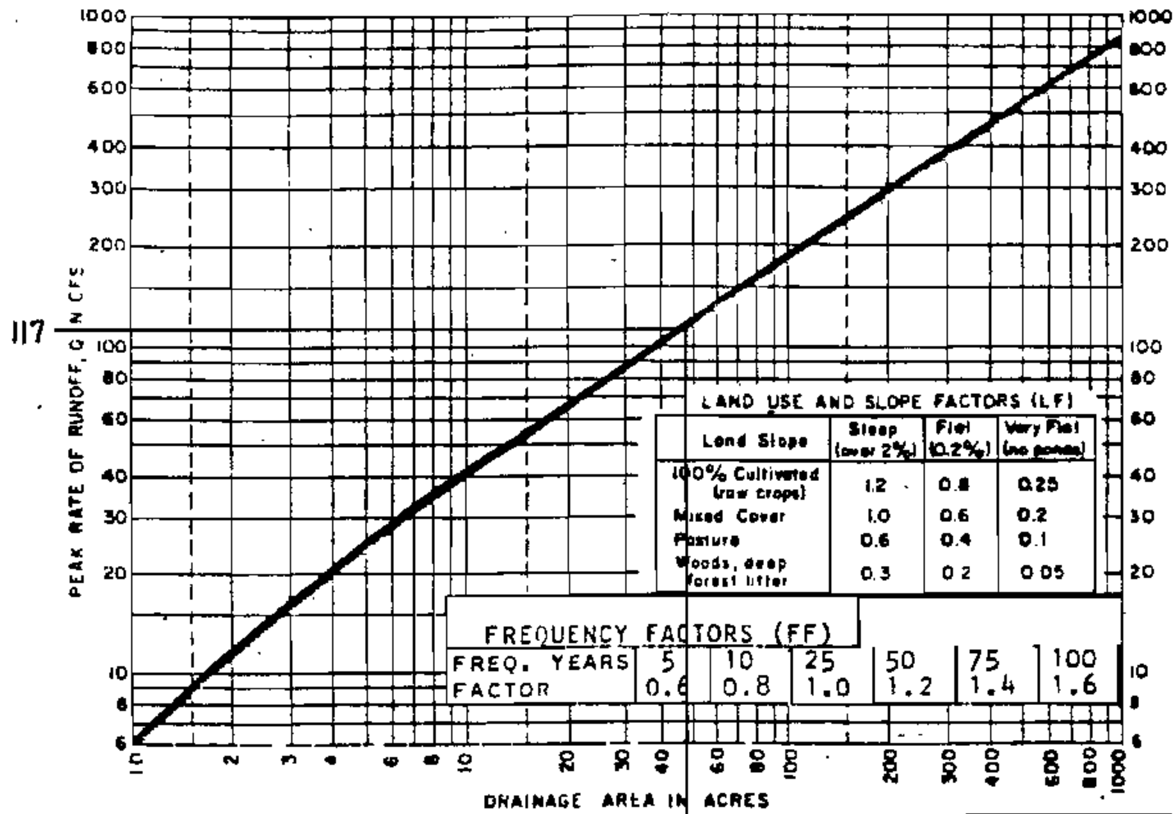
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

HF1-D1



LAND USE AND SLOPE FACTORS (LF)

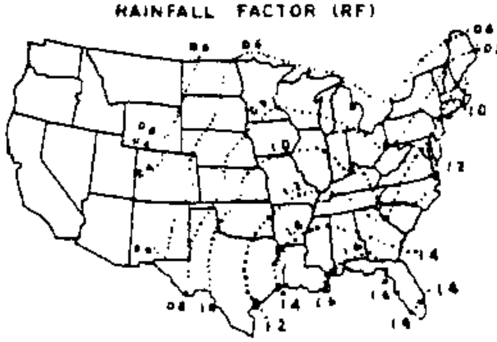
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

44.89 Ac.

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.6 \times 117$

$= 187.20$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Appolo Fuels #807-0368 Diversion HF1-D2
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	50.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	248.00	cfs

Results		
Depth	0.91	ft
Flow Area	11.59	ft²
Wetted Perimeter	15.76	ft
Top Width	15.46	ft
Critical Depth	2.14	ft
Critical Slope	0.021010	ft/ft
Velocity	21.40	ft/s
Velocity Head	7.12	ft
Specific Energy	8.03	ft
Froude Number	4.36	
Flow is supercritical.		

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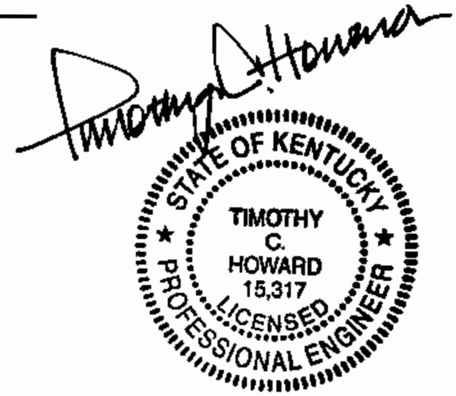
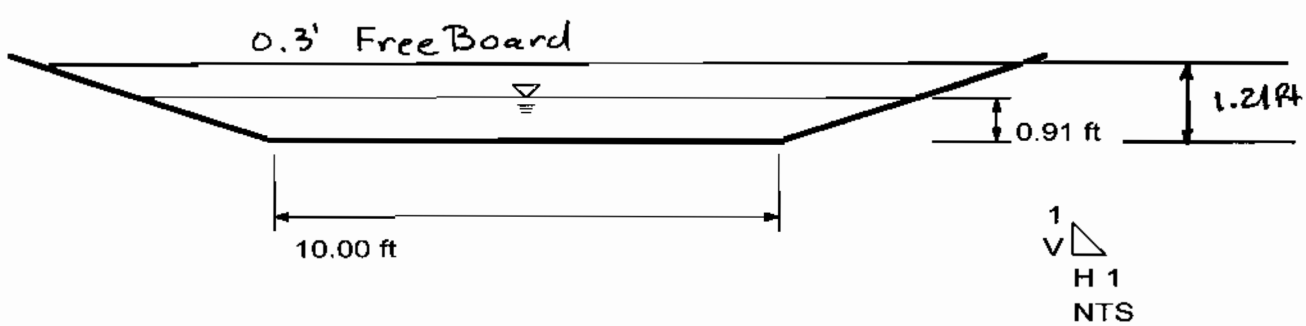
Appolo Fuels #807-0368 Diversion HF1-D2
Cross Section for Trapezoidal Channel

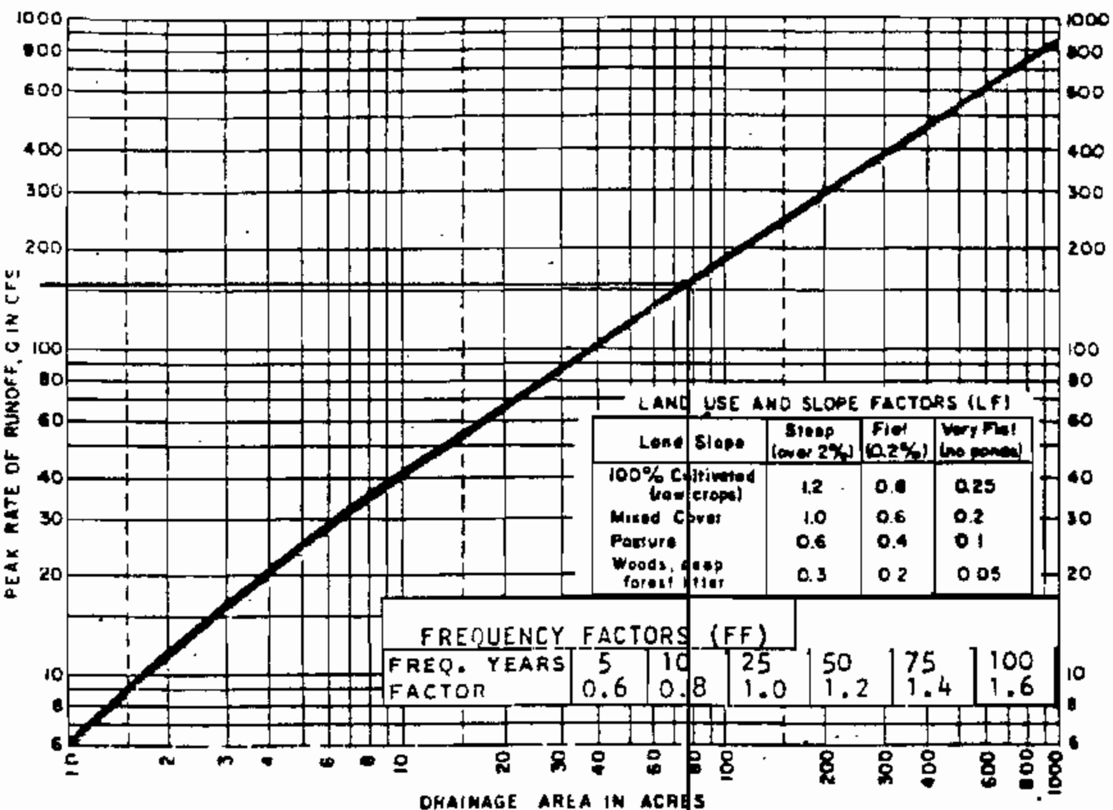
Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	50.00	%
Depth	0.91	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	248.00	cfs





Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: #807-0368 Diversion Ditch HF1-D2



LAND USE AND SLOPE FACTORS (LF)

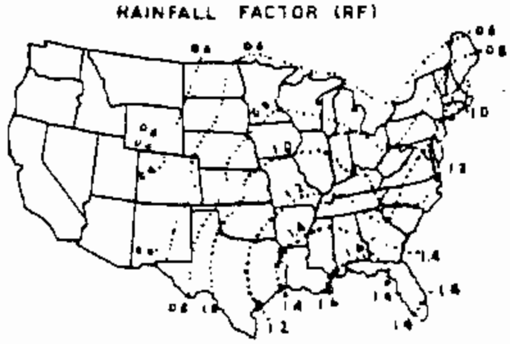
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

76.84 Ac.

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.6 \times 155$

$= 248$

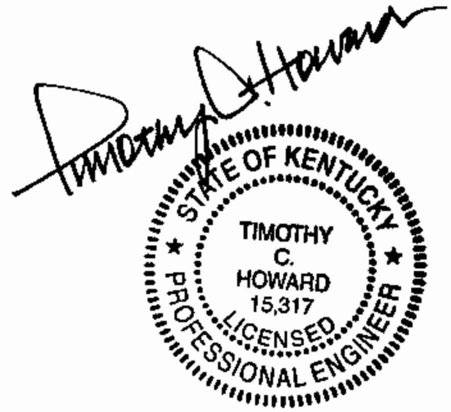
STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR WATERSHEDS UNDER 1,000 ACRES

Appolo Fuels #807-0368 Diversion HF1-D3
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	264.00	cfs



Results		
Depth	2.67	ft
Flow Area	48.19	ft²
Wetted Perimeter	26.91	ft
Top Width	26.04	ft
Critical Depth	2.22	ft
Critical Slope	0.020823	ft/ft
Velocity	5.48	ft/s
Velocity Head	0.47	ft
Specific Energy	3.14	ft
Froude Number	0.71	
Flow is subcritical.		

Appolo Fuels #807-0368 Diversion HF1-D3
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Depth	2.67	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	264.00	cfs

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
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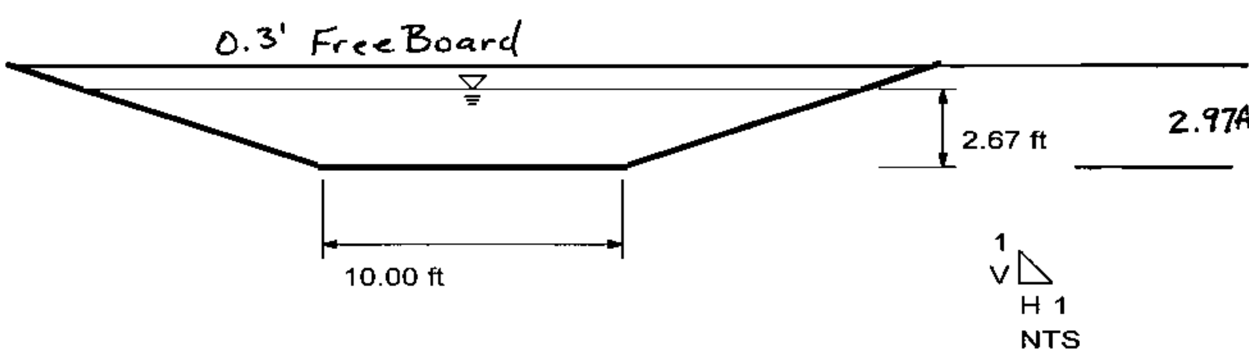


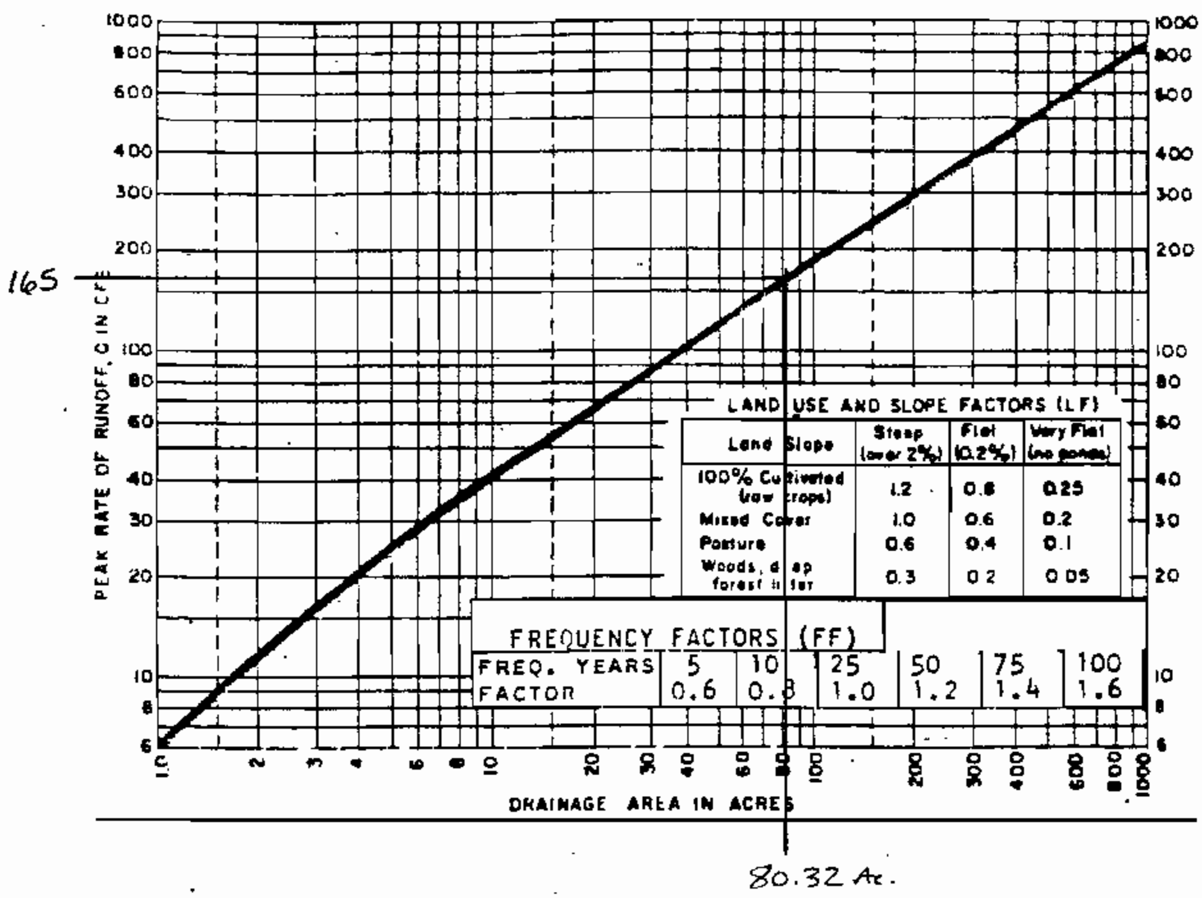
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

HF1-D3



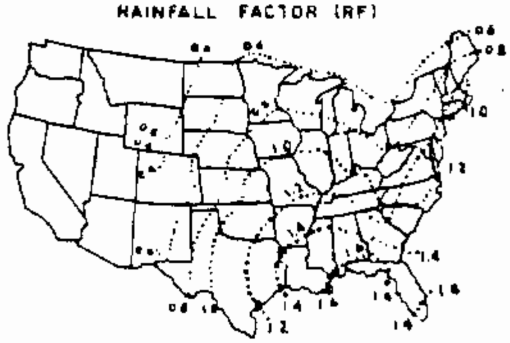
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.6 \times 165$

$= 264$

Timothy C. Howard

STATE OF KENTUCKY
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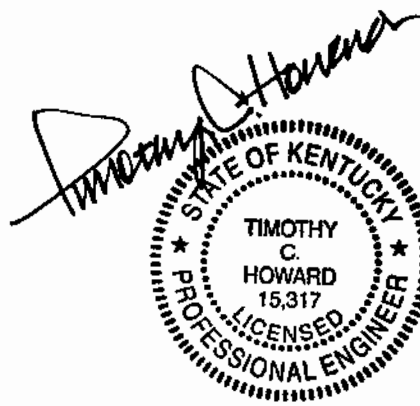
PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Appolo Fuels #807-0368 Diversion HF1-D4
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	50.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	320.00	cfs

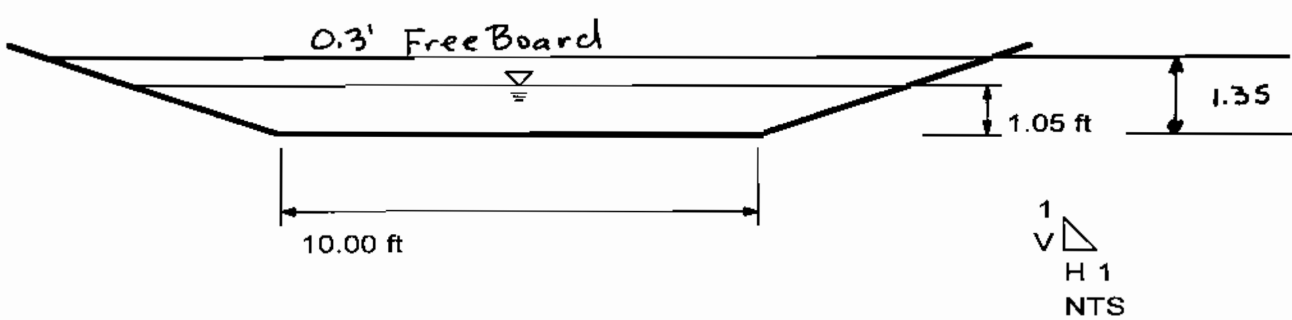


Results		
Depth	1.05	ft
Flow Area	13.80	ft^2
Wetted Perimeter	16.64	ft
Top Width	16.30	ft
Critical Depth	2.47	ft
Critical Slope	0.020262	ft/ft
Velocity	23.19	ft/s
Velocity Head	8.36	ft
Specific Energy	9.41	ft
Froude Number	4.44	
Flow is supercritical.		

Appolo Fuels #807-0368 Diversion HF1-D4
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368hf1-.fm2
Worksheet	Appolo Fuels #807-0368 Diversions
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	50.00	%
Depth	1.05	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	320.00	cfs



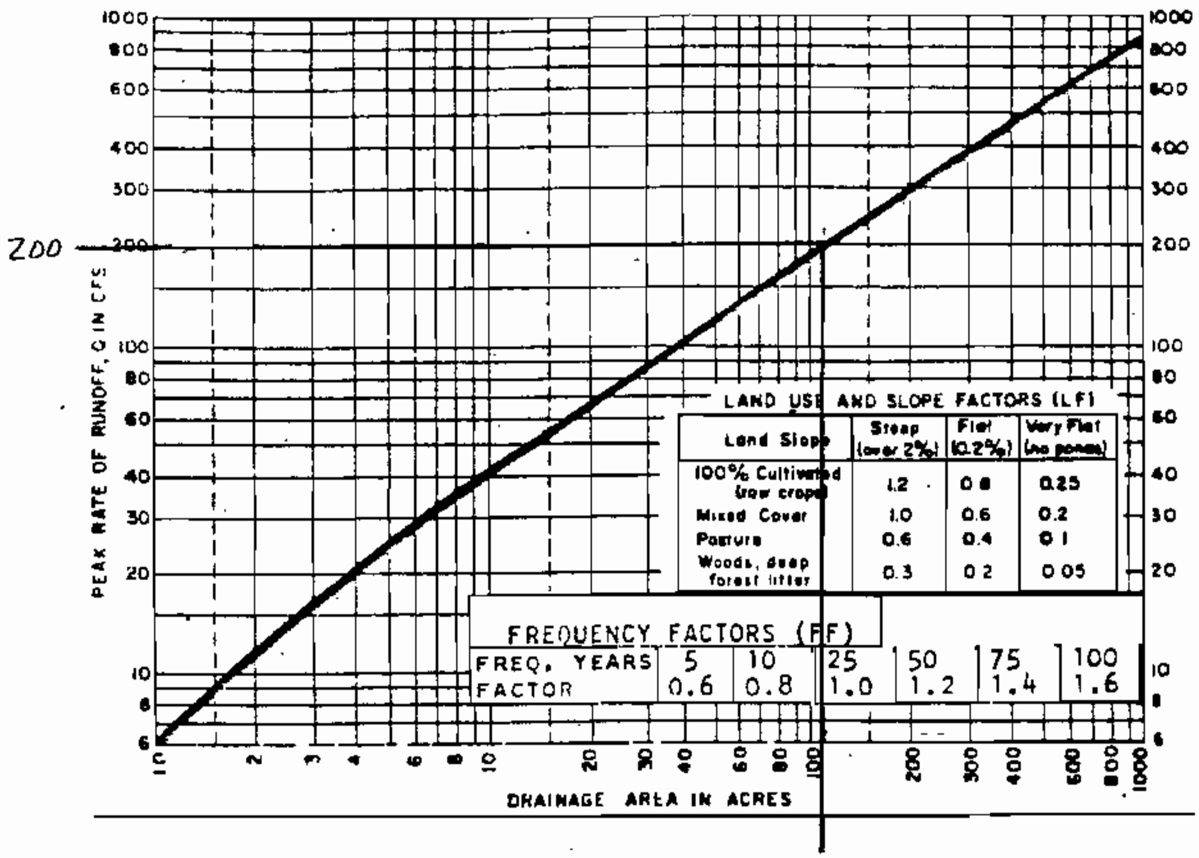
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

HF1-D4



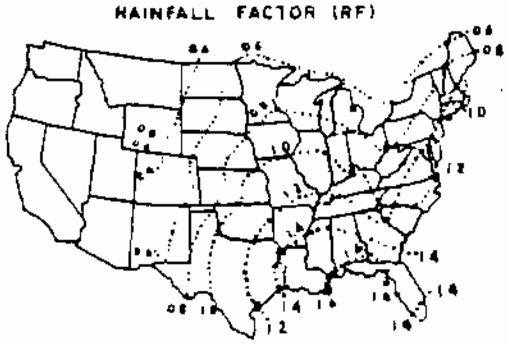
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.6 \times 200$

$= 320$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P1D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	37.00	cfs

Results		
Depth	1.89	ft
Flow Area	10.74	ft^2
Wetted Perimeter	12.03	ft
Top Width	11.35	ft
Critical Depth	1.57	ft
Critical Slope	0.027328	ft/ft
Velocity	3.44	ft/s
Velocity Head	0.18	ft
Specific Energy	2.08	ft
Froude Number	0.62	
Flow is subcritical.		

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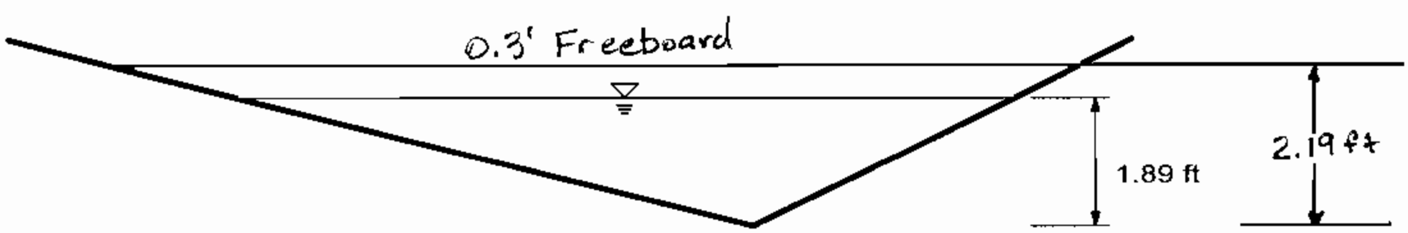
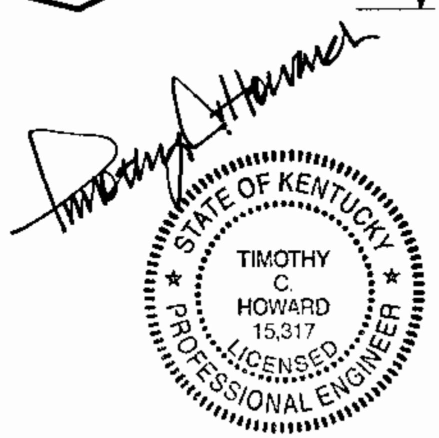
#807-0368 Diversion P1D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	1.89	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	37.00	cfs





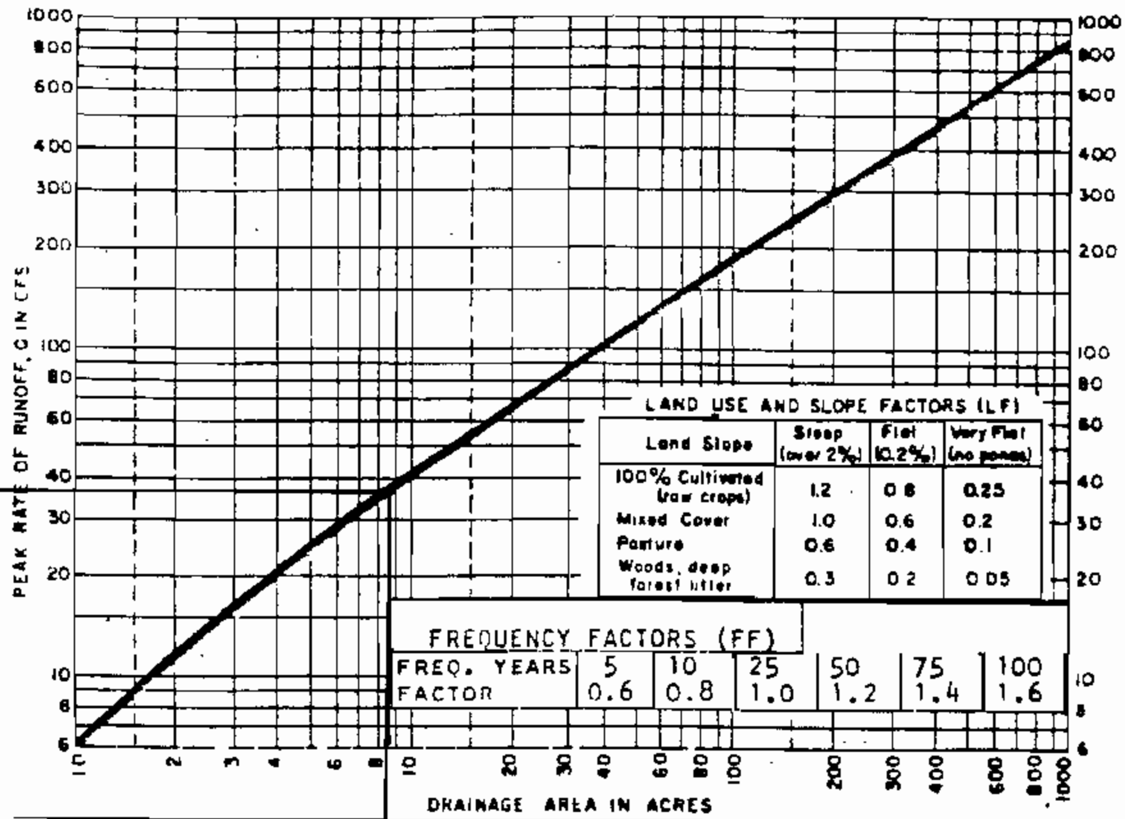
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

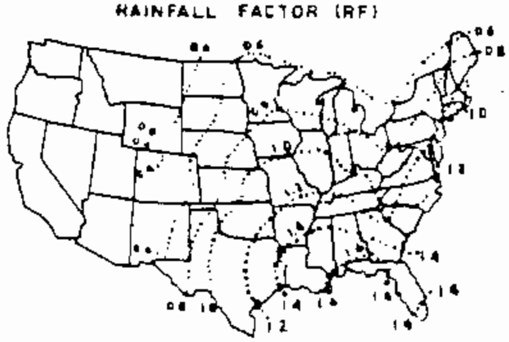
Project: #807-0368

Diversion Ditch

P1D1



RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 37$

$= 37$

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STATE OF KENTUCKY
TIMOTHY C. HOWARD
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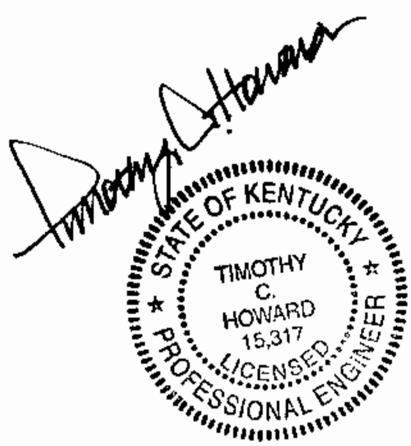
PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P2D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	86.00	cfs

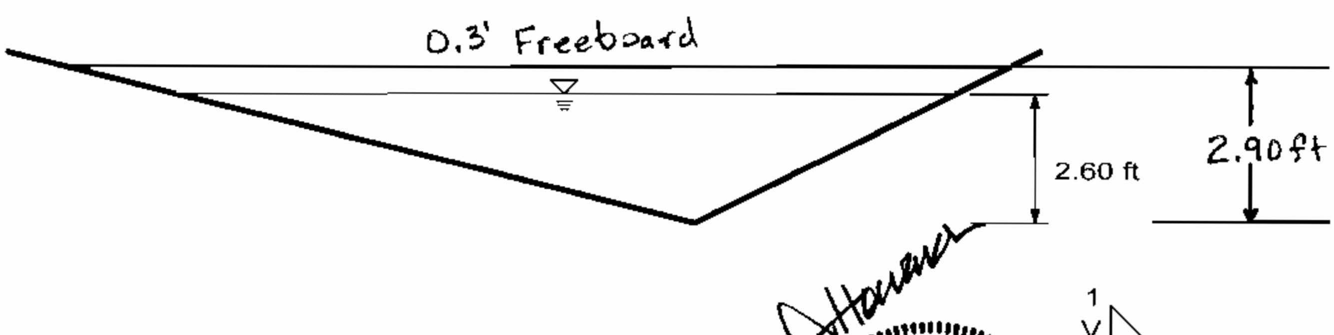
Results		
Depth	2.60	ft
Flow Area	20.22	ft²
Wetted Perimeter	16.51	ft
Top Width	15.58	ft
Critical Depth	2.20	ft
Critical Slope	0.024421	ft/ft
Velocity	4.25	ft/s
Velocity Head	0.28	ft
Specific Energy	2.88	ft
Froude Number	0.66	
Flow is subcritical		



#807-0368 Diversion P2D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

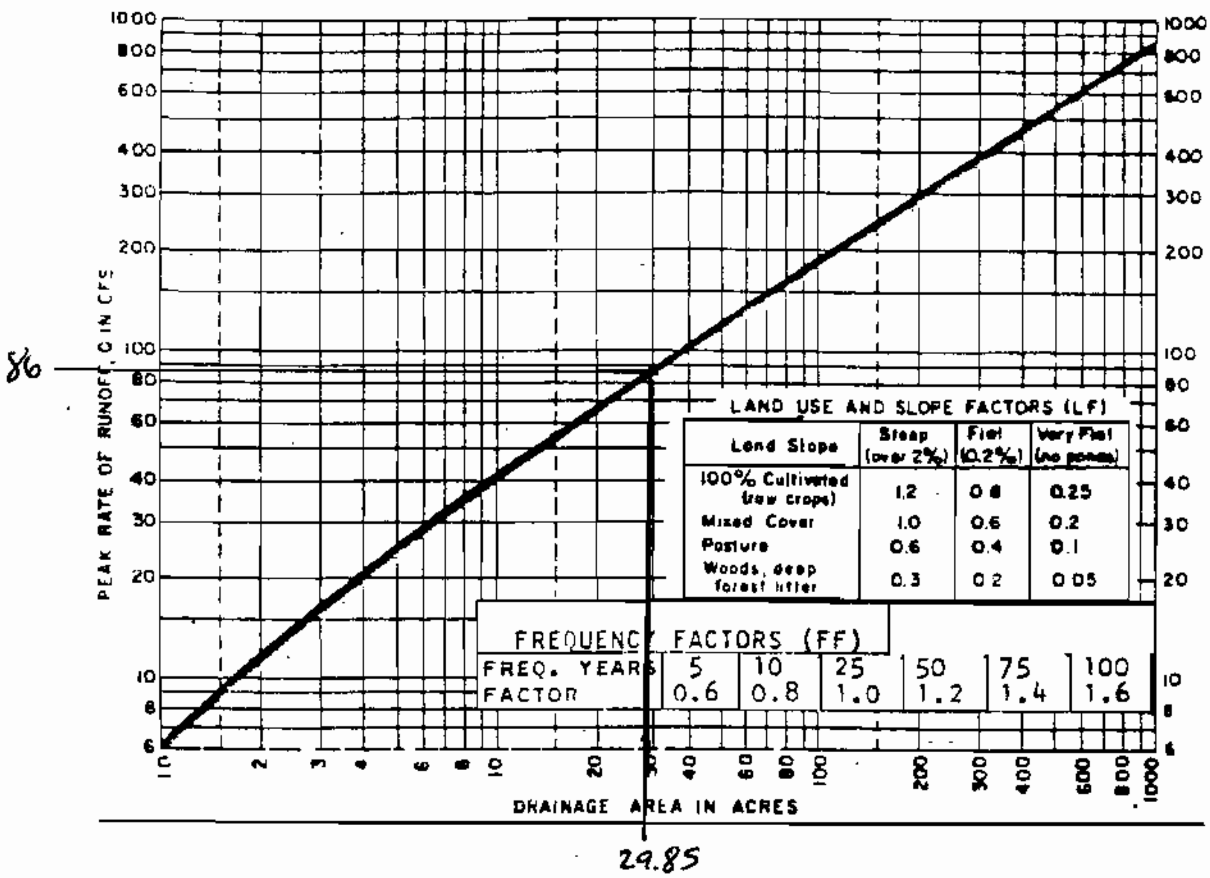
Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.60	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	86.00	cfs



STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc
Project: #807-0368
Diversion Ditch
P2 D1



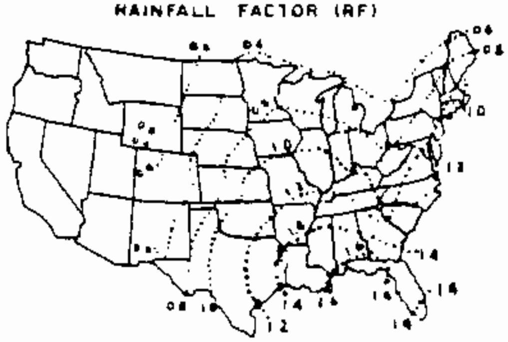
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 86$

$= 86$

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
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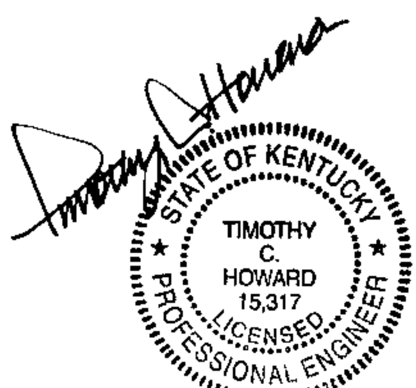
PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P3D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	120.00	cfs

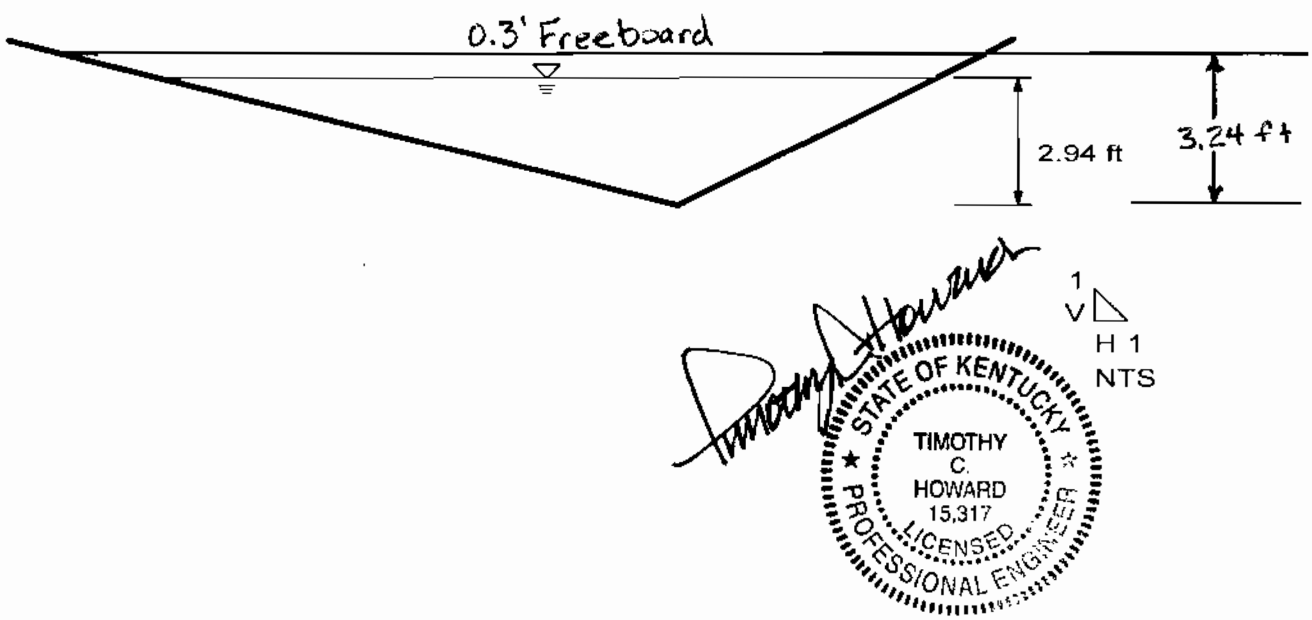
Results		
Depth	2.94	ft
Flow Area	25.96	ft²
Wetted Perimeter	18.71	ft
Top Width	17.65	ft
Critical Depth	2.51	ft
Critical Slope	0.023359	ft/ft
Velocity	4.62	ft/s
Velocity Head	0.33	ft
Specific Energy	3.27	ft
Froude Number	0.67	
Flow is subcritical.		



#807-0368 Diversion P3D1
Cross Section for Triangular Channel

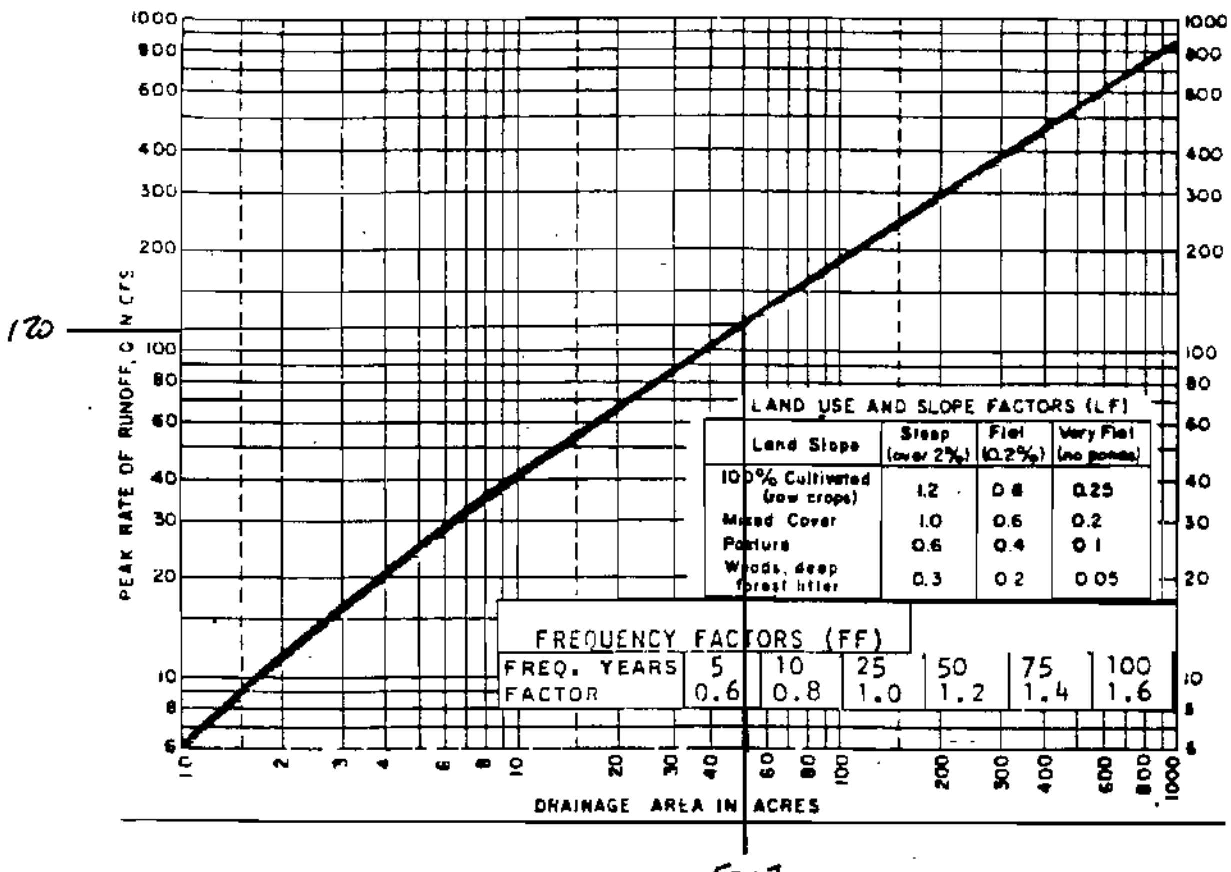
Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.94	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	120.00	cfs



Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.
Project: #807-0368
Diversion Ditch
P3 D1



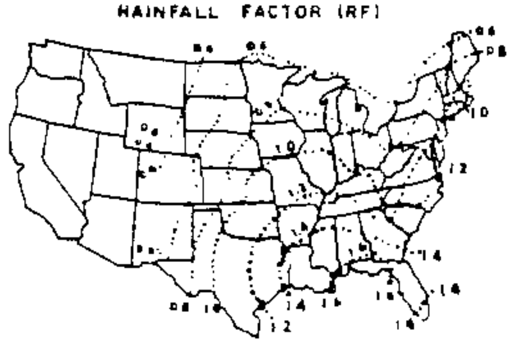
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 120$

$= 120$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P4D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2 00	H : V
Discharge	122.00	cfs

Results		
Depth	2.96	ft
Flow Area	26.29	ft²
Wetted Perimeter	18.82	ft
Top Width	17.76	ft
Critical Depth	2.53	ft
Critical Slope	0.023308	ft/ft
Velocity	4.64	ft/s
Velocity Head	0.33	ft
Specific Energy	3.29	ft
Froude Number	0.67	
Flow is subcritical.		

Timothy C. Howard

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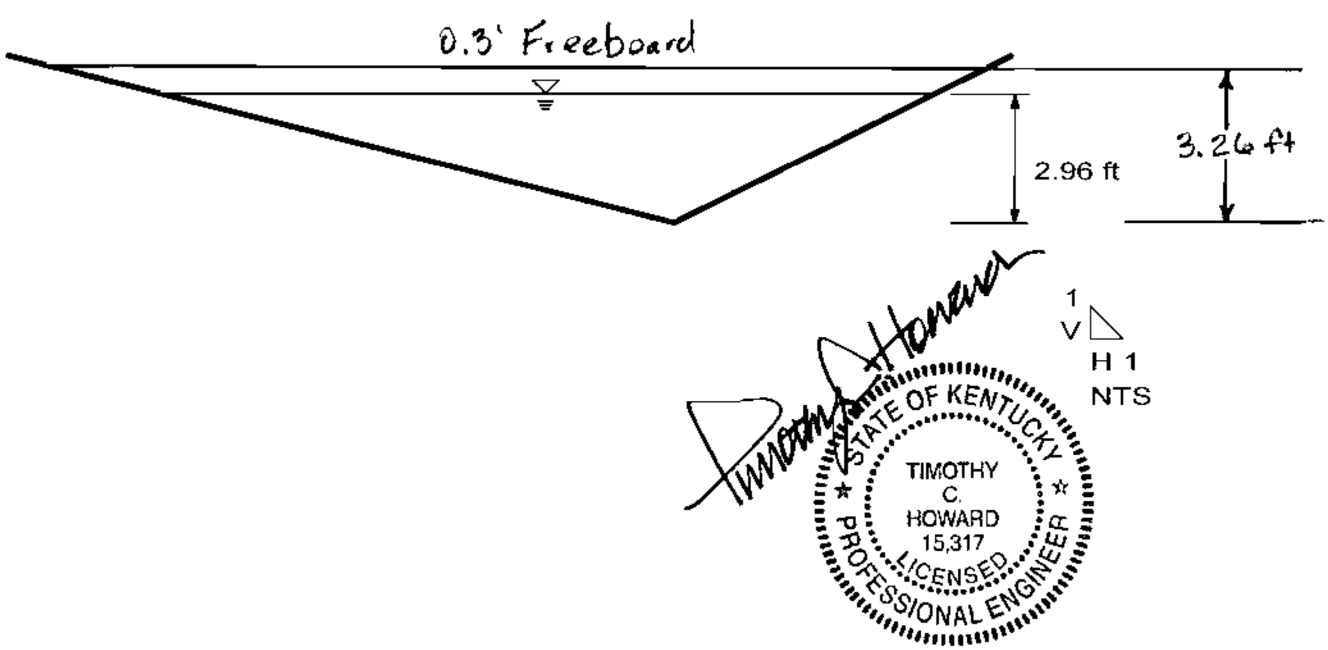
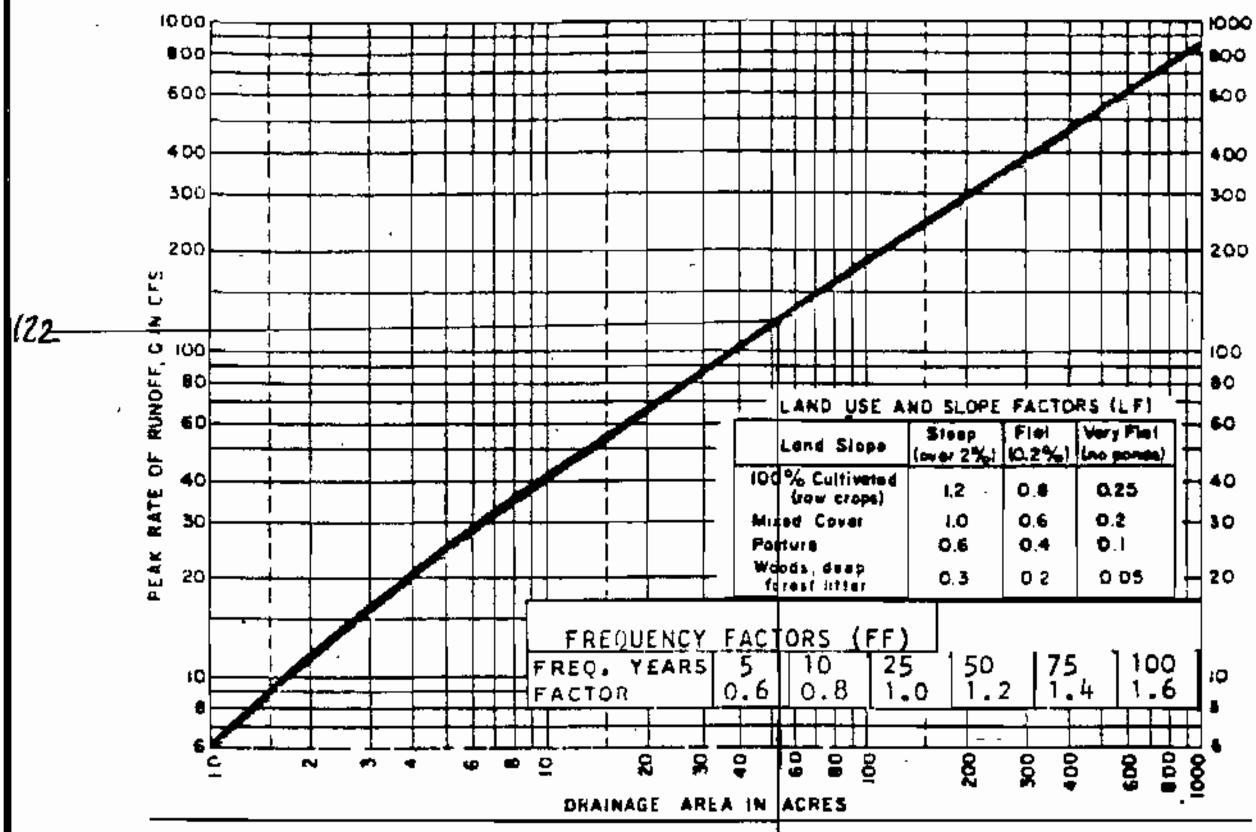
#807-0368 Diversion P4D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.96	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	122.00	cfs



Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels Inc. Project: #807-0368 Diversion Ditch P4 D1



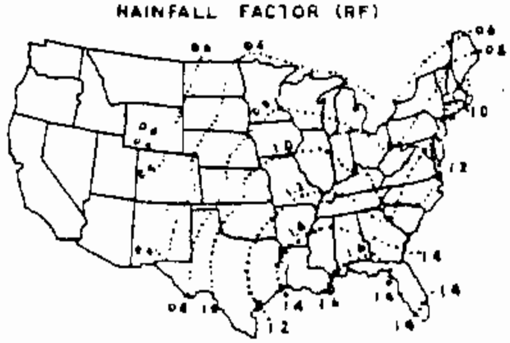
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 122$

$= 122$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR

WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P5D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0 040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	122.00	cfs

Results		
Depth	2.96	ft
Flow Area	26.29	ft²
Wetted Perimeter	18.82	ft
Top Width	17.76	ft
Critical Depth	2.53	ft
Critical Slope	0.023308	ft/ft
Velocity	4.64	ft/s
Velocity Head	0.33	ft
Specific Energy	3.29	ft
Froude Number	0.67	
Flow is subcritical.		

STATE OF KENTUCKY
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15,317
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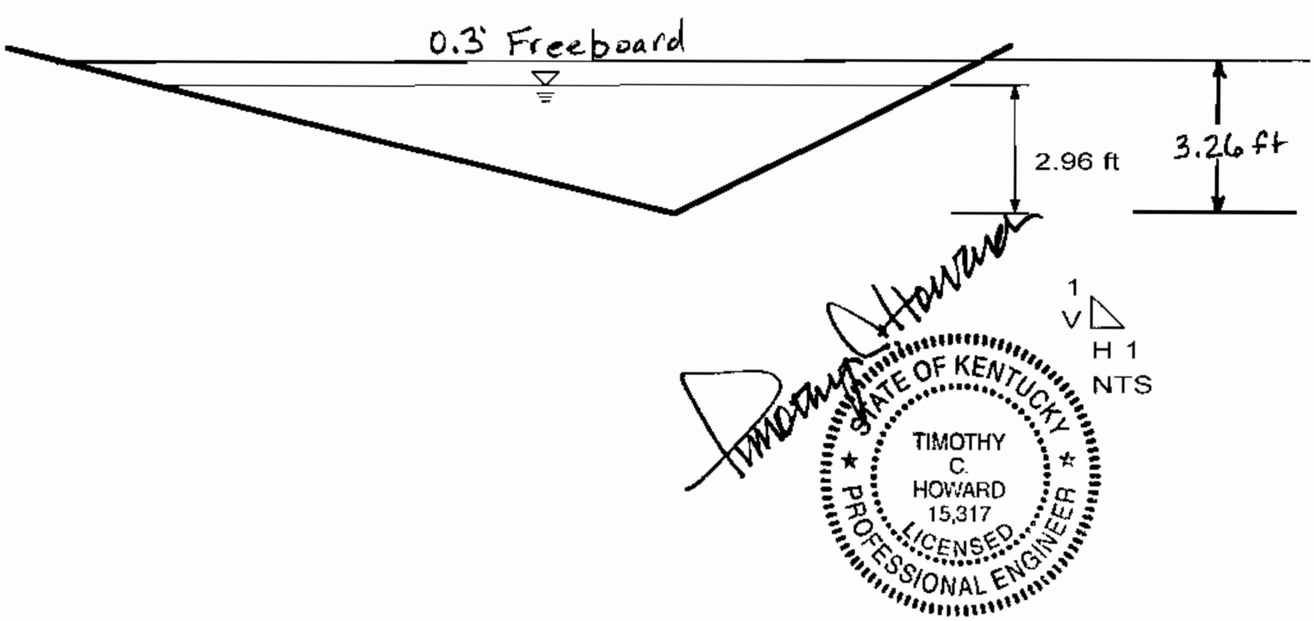
#807-0368 Diversion P5D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.96	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	122.00	cfs



Howard Engineering & Geology, Inc.

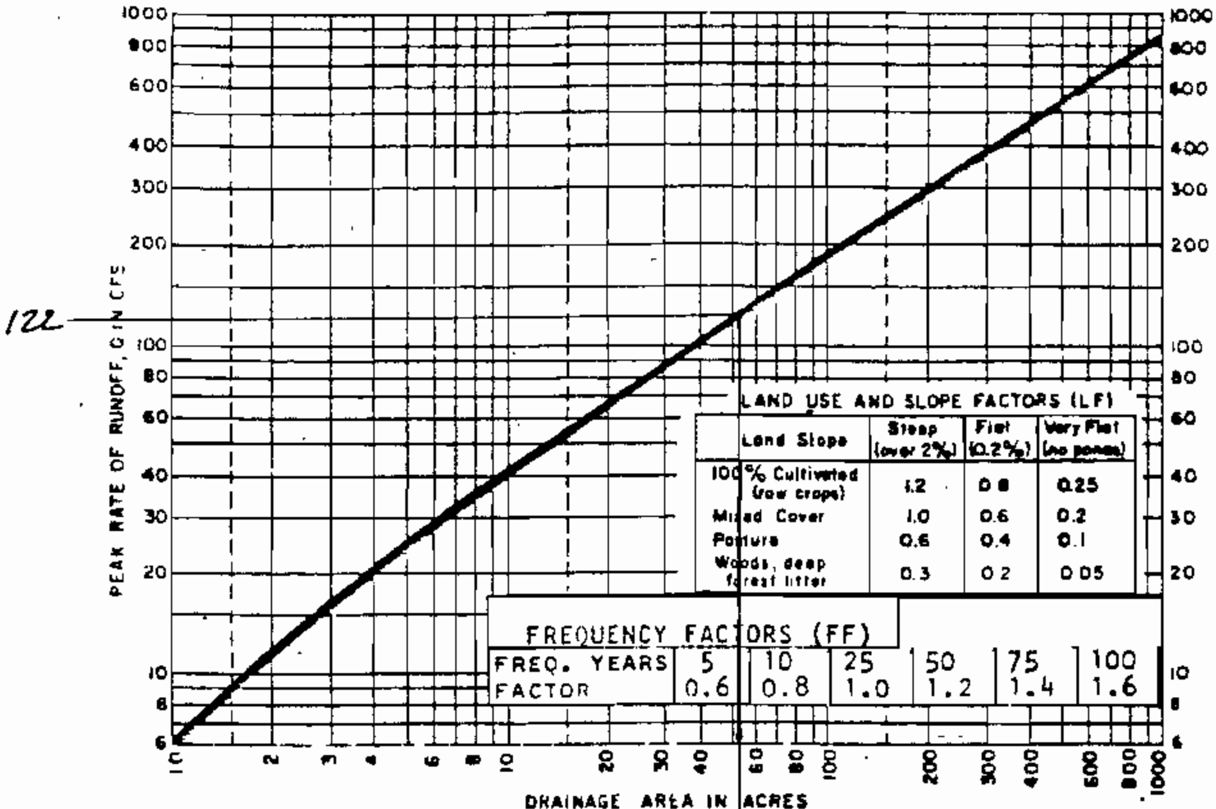
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

PS D1



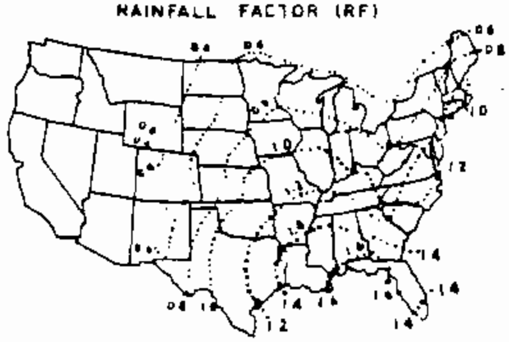
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 122$

$= 122$

Timothy C. Howard

STATE OF KENTUCKY
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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P6D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

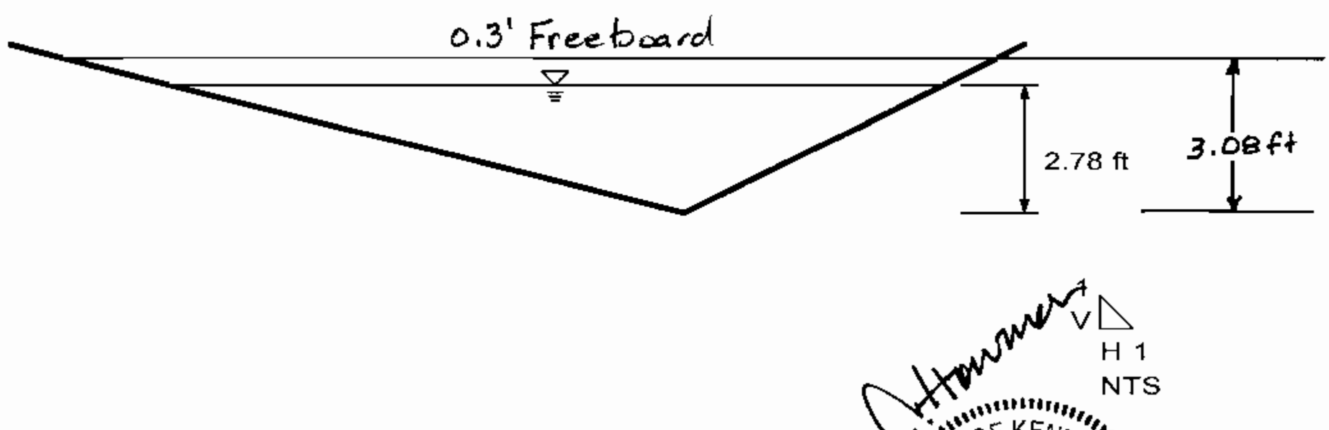
Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	103.00	cfs

Results		
Depth	2.78	ft
Flow Area	23.15	ft^2
Wetted Perimeter	17.67	ft
Top Width	16.67	ft
Critical Depth	2.36	ft
Critical Slope	0.023840	ft/ft
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	3.09	ft
Froude Number	0.67	
Flow is subcritical.		

#807-0368 Diversion P6D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.78	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	103.00	cfs



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Howard Engineering & Geology, Inc.
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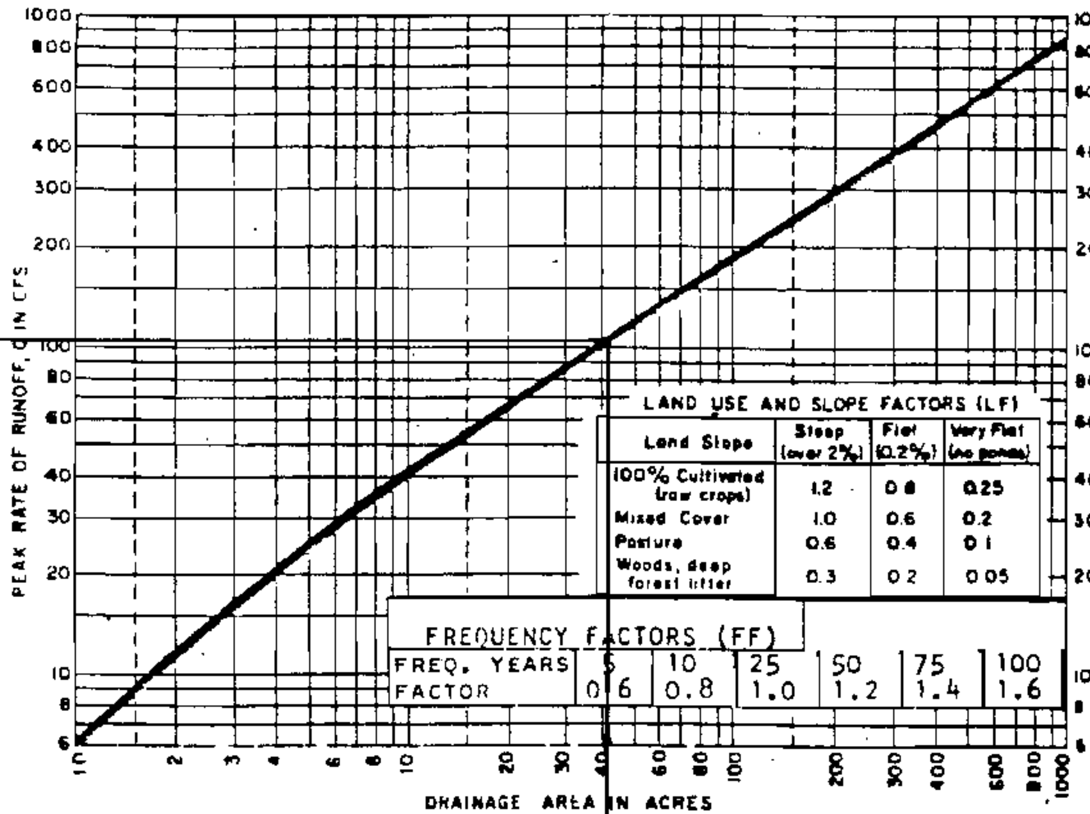
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc
Project: #817-0368
Diversion Ditch
P6 D1



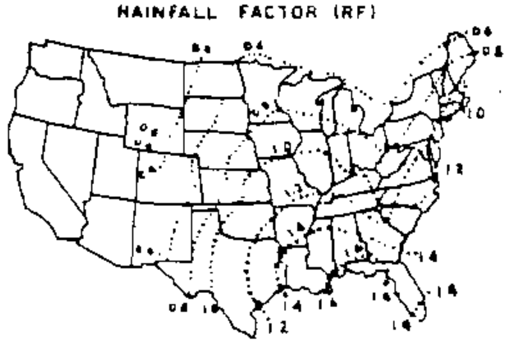
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 103$

$= 103$

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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P7D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	122.00	cfs

Results		
Depth	2.96	ft
Flow Area	26.29	ft^2
Wetted Perimeter	18.82	ft
Top Width	17.76	ft
Critical Depth	2 53	ft
Critical Slope	0.023308	ft/ft
Velocity	4.64	ft/s
Velocity Head	0 33	ft
Specific Energy	3 29	ft
Froude Number	0.67	
Flow is subcritical.		

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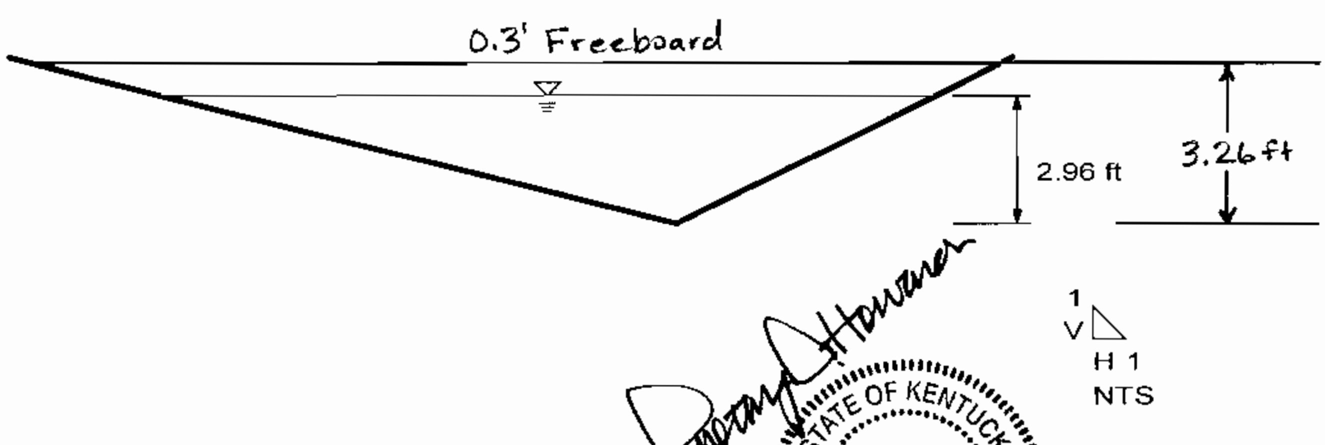
#807-0368 Diversion P7D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.96	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	122.00	cfs



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Howard Engineering & Geology, Inc.
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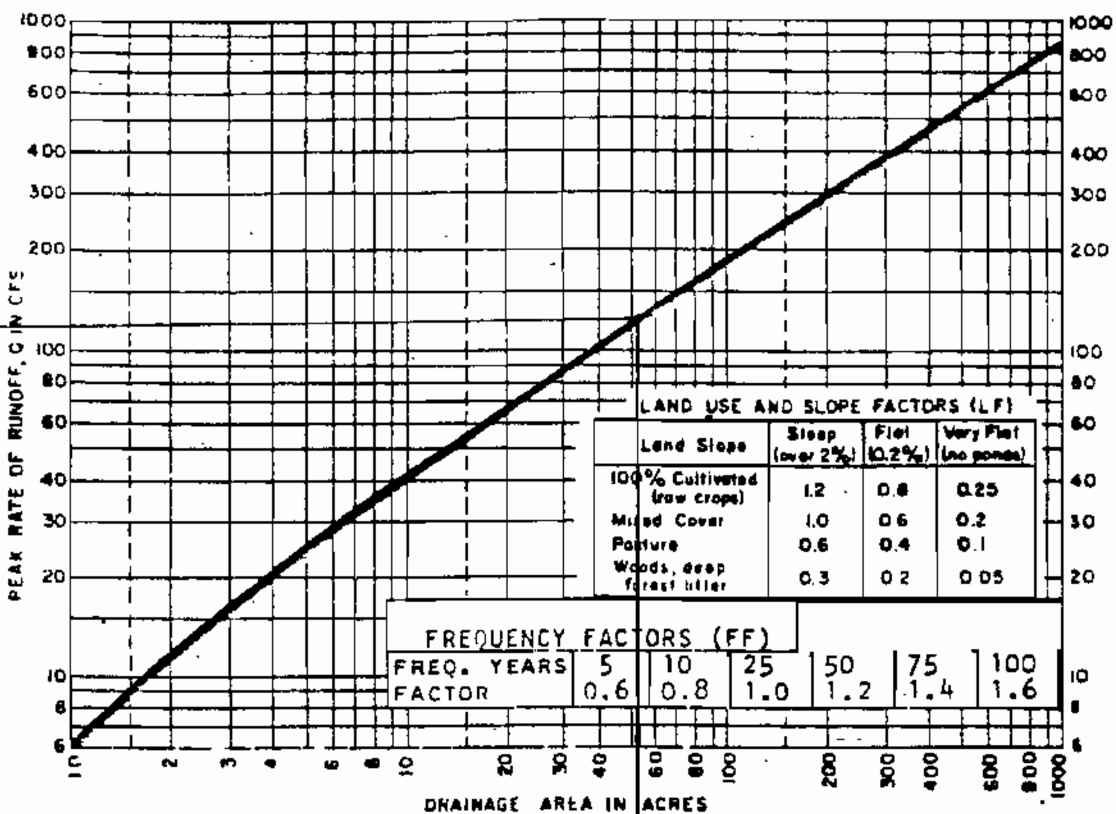
Harlan, KY 40831

Company Name: *Appolo Fuels, Inc*

Project: *#807-0368*

Diversion Ditch

P7 D1



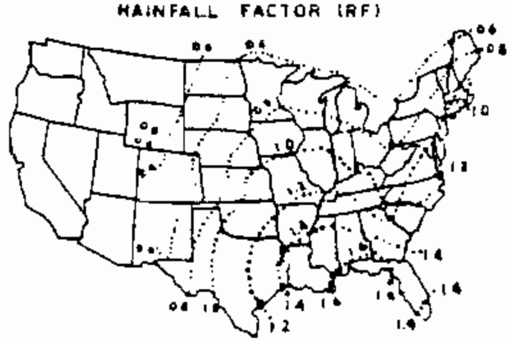
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

Q_{design} = RF x LF x FF x Q

= *1.0 x 1.0 x 1.0 x 122*

= *122*

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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P8D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4 00	H : V
Right Side Slope	2 00	H : V
Discharge	71.00	cfs

Results		
Depth	2.42	ft
Flow Area	17.52	ft^2
Wetted Perimeter	15.37	ft
Top Width	14.50	ft
Critical Depth	2.03	ft
Critical Slope	0.025053	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.26	ft
Specific Energy	2.67	ft
Froude Number	0.65	
Flow is subcritical.		

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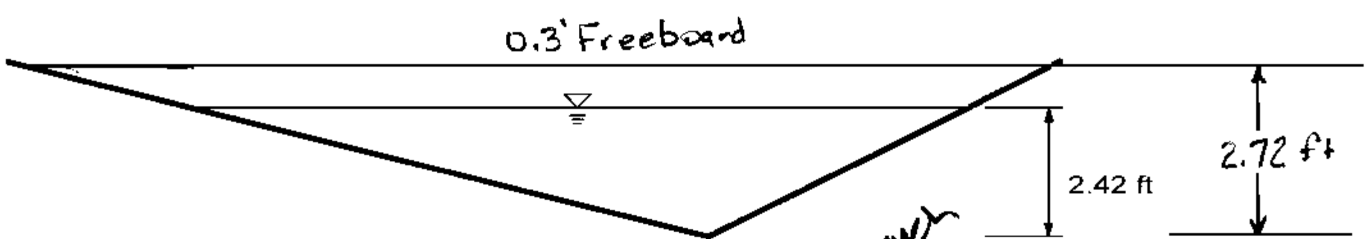
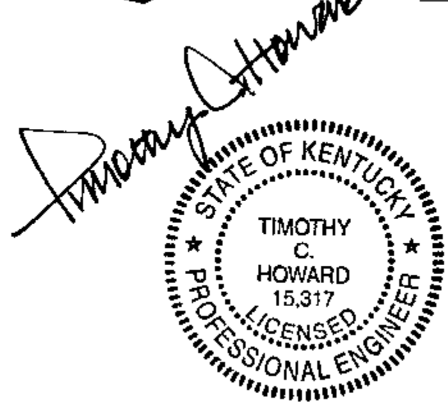
#807-0368 Diversion P8D1
Cross Section for Triangular Channel

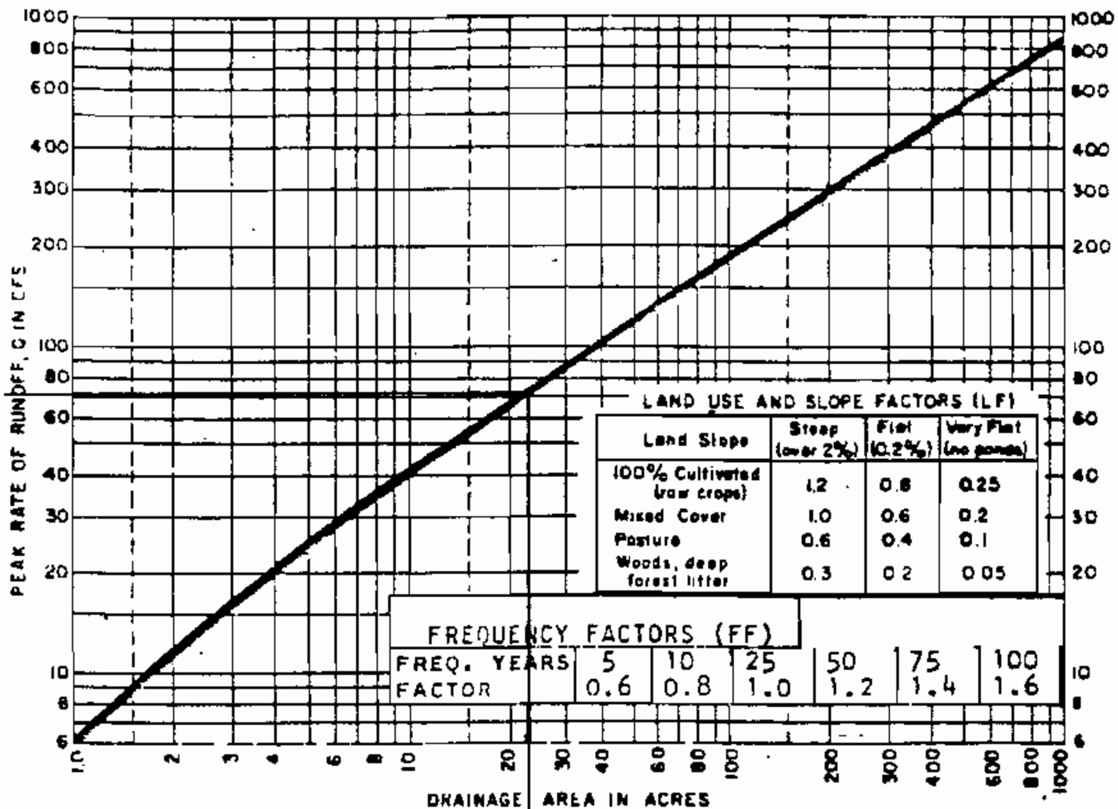
Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.42	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	71.00	cfs

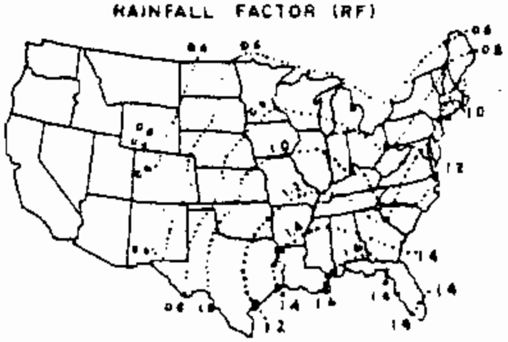




Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels Inc. Project: #807-0368 Diversion Ditch P8D1



RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 71$

$= 71$

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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P9D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	69.00	cfs

Results		
Depth	2.39	ft
Flow Area	17.14	ft^2
Wetted Perimeter	15 20	ft
Top Width	14.34	ft
Critical Depth	2.01	ft
Critical Slope	0.025149	ft/ft
Velocity	4.02	ft/s
Velocity Head	0.25	ft
Specific Energy	2.64	ft
Froude Number	0.65	
Flow is subcritical.		

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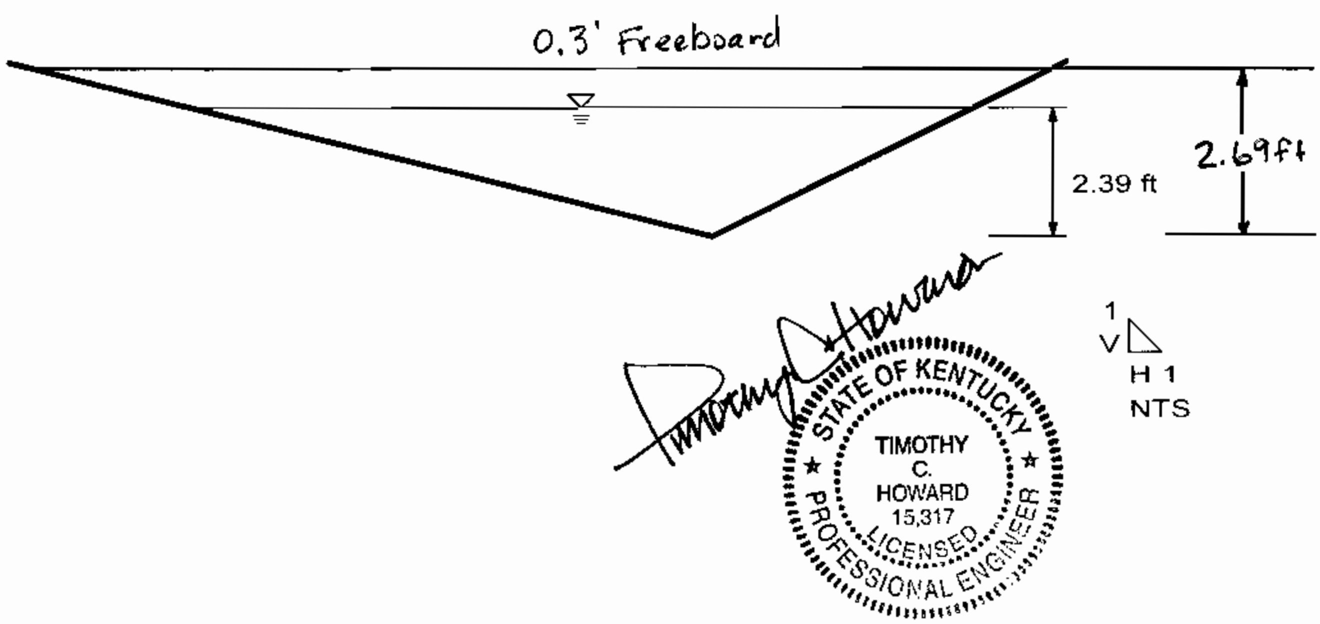
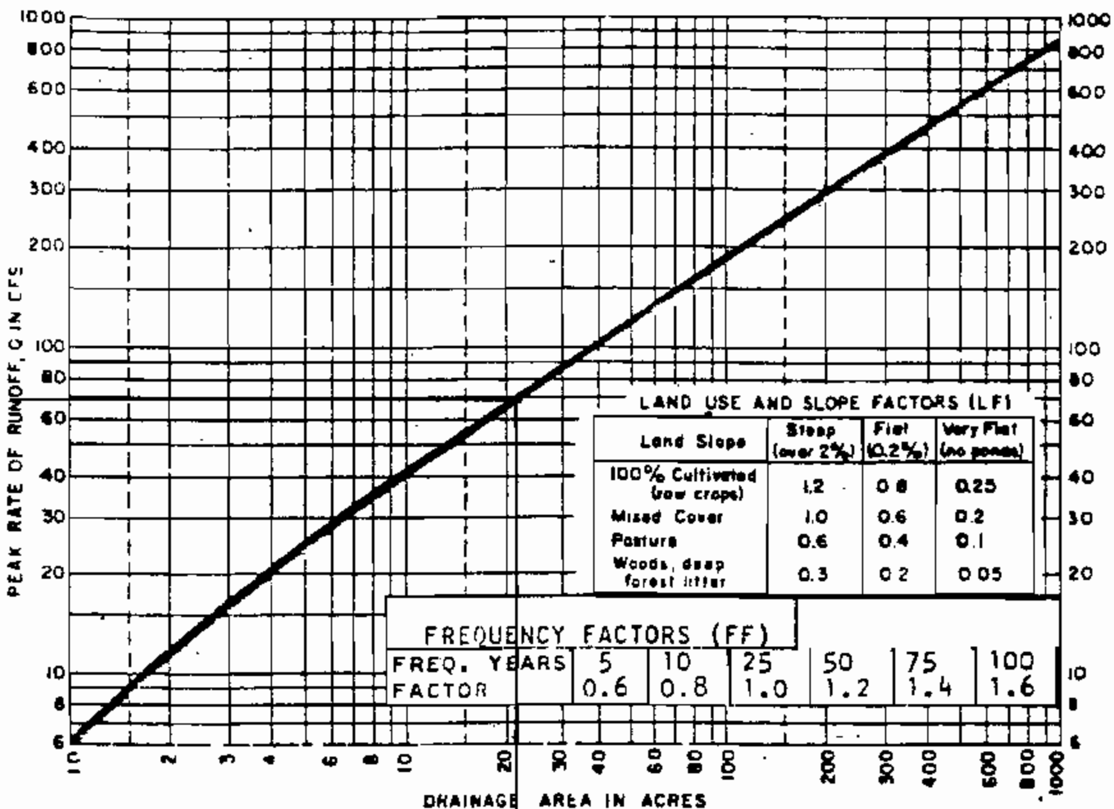
#807-0368 Diversion P9D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.39	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	69.00	cfs



Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: #807-0368 Diversion Ditch P9D1



LAND USE AND SLOPE FACTORS (LF)

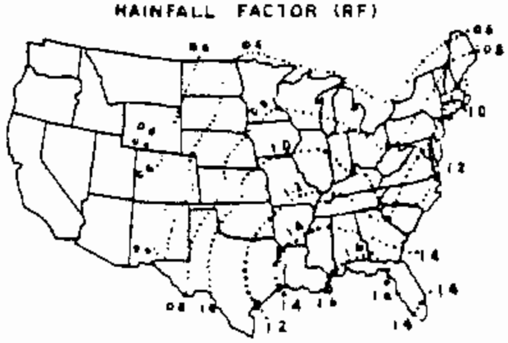
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

21.30 Ac.

RAINFALL FACTOR (RF)



FORMULA:

Q_{design} = RF x LF x FF x Q

= 1.0 x 1.0 x 1.0 x 69

= 69

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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P10D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	180.00	cfs

Results		
Depth	3.42	ft
Flow Area	35.19	ft^2
Wetted Perimeter	21.78	ft
Top Width	20.55	ft
Critical Depth	2.95	ft
Critical Slope	0.022130	ft/ft
Velocity	5.12	ft/s
Velocity Head	0.41	ft
Specific Energy	3.83	ft
Froude Number	0.69	
Flow is subcritical.		

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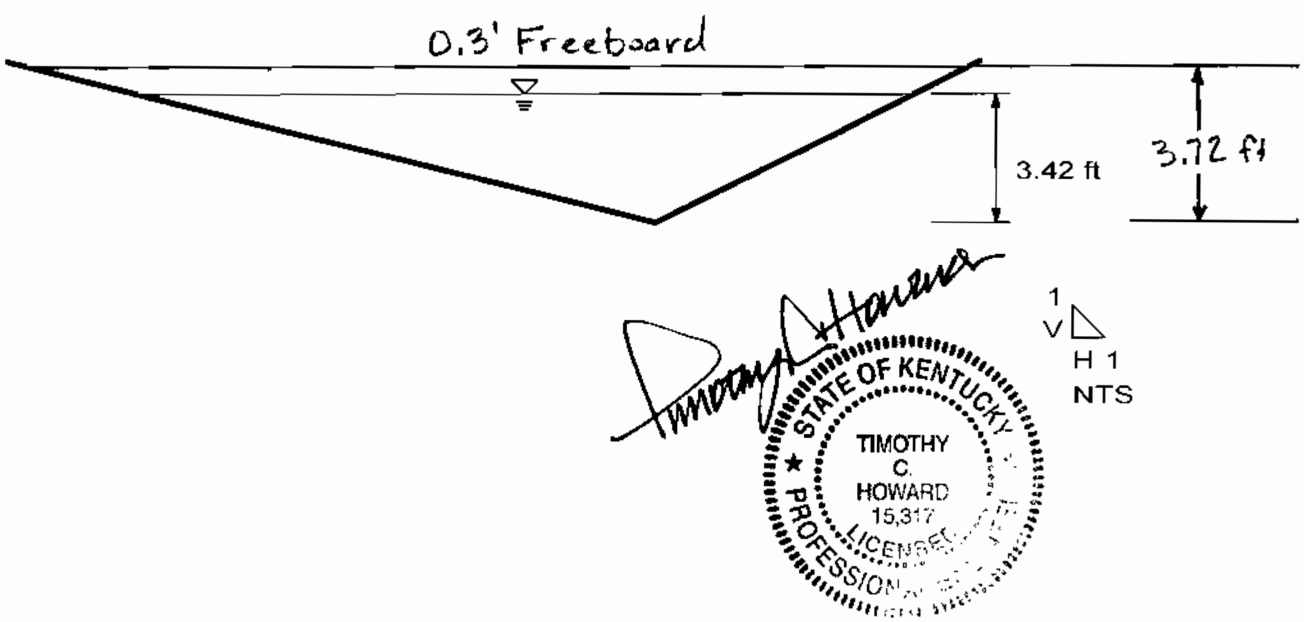
#807-0368 Diversion P10D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	3 42	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	180.00	cfs



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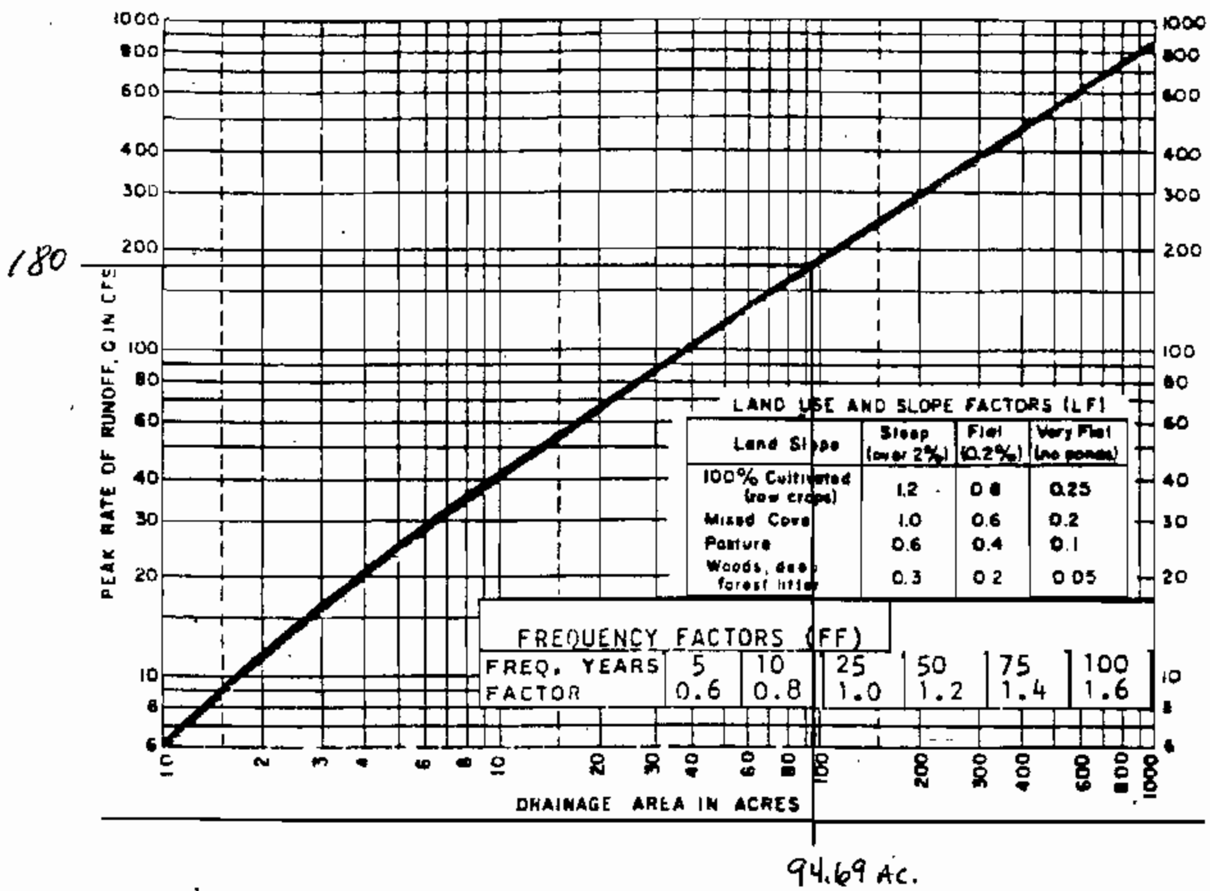
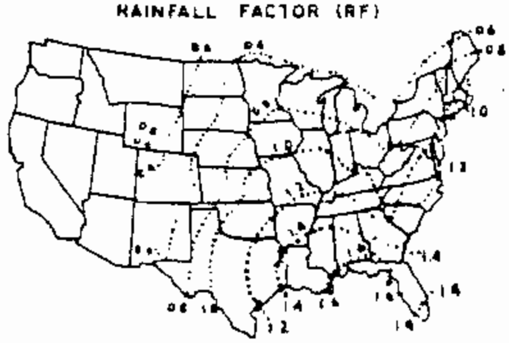
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.
Project: # 807-0368
Diversion Ditch
P10 D1



RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 180$

$= 180$

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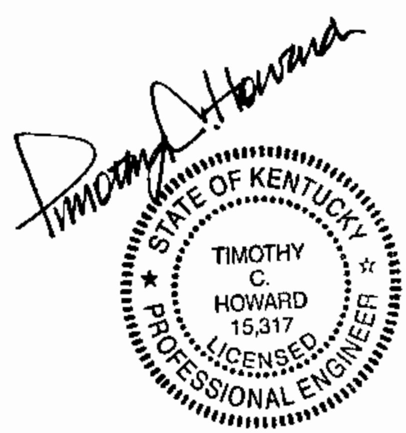
PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P11D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	170.00	cfs

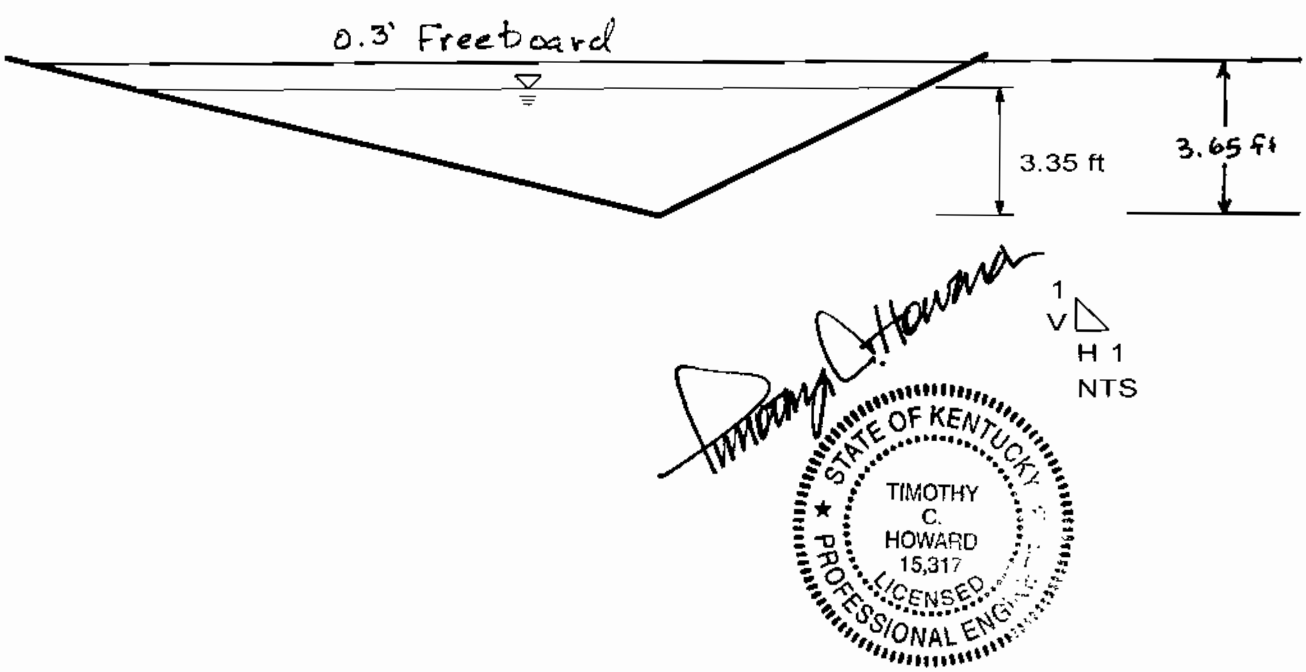
Results		
Depth	3.35	ft
Flow Area	33.71	ft^2
Wetted Perimeter	21 32	ft
Top Width	20.11	ft
Critical Depth	2.88	ft
Critical Slope	0.022299	ft/ft
Velocity	5.04	ft/s
Velocity Head	0.40	ft
Specific Energy	3.75	ft
Froude Number	0.69	
Flow is subcritical.		



#807-0368 Diversion P11D1
Cross Section for Triangular Channel

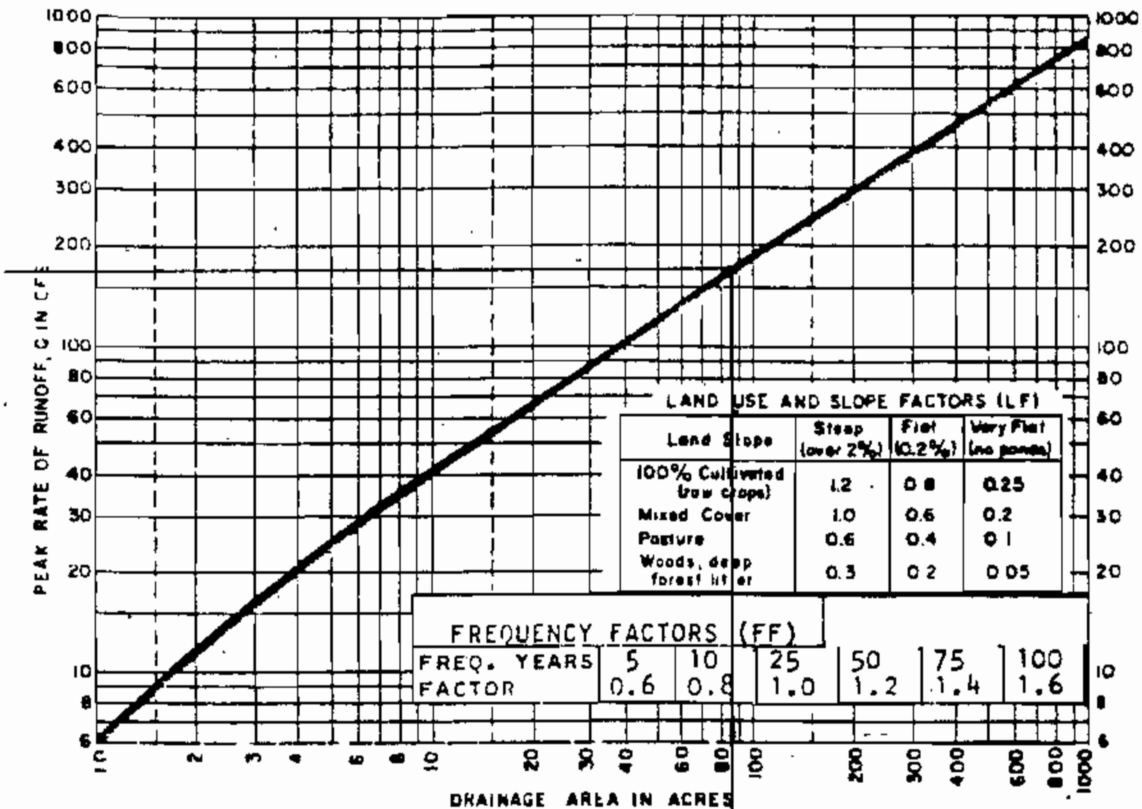
Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	3.35	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	170.00	cfs



Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.
Project: #807-0368
Diversion Ditch
P11 D1



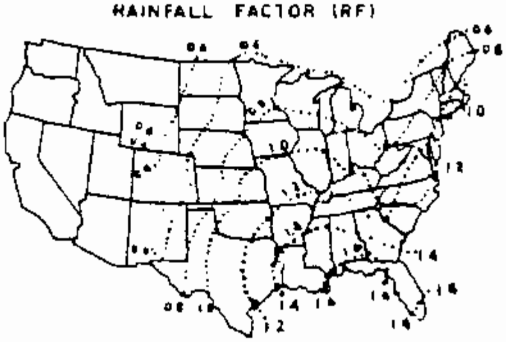
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 170$

$= 170$

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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P12D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	78.00	cfs

Results		
Depth	2.50	ft
Flow Area	18.79	ft^2
Wetted Perimeter	15.92	ft
Top Width	15.02	ft
Critical Depth	2.11	ft
Critical Slope	0.024741	ft/ft
Velocity	4.15	ft/s
Velocity Head	0.27	ft
Specific Energy	2.77	ft
Froude Number	0.65	
Flow is subcritical.		

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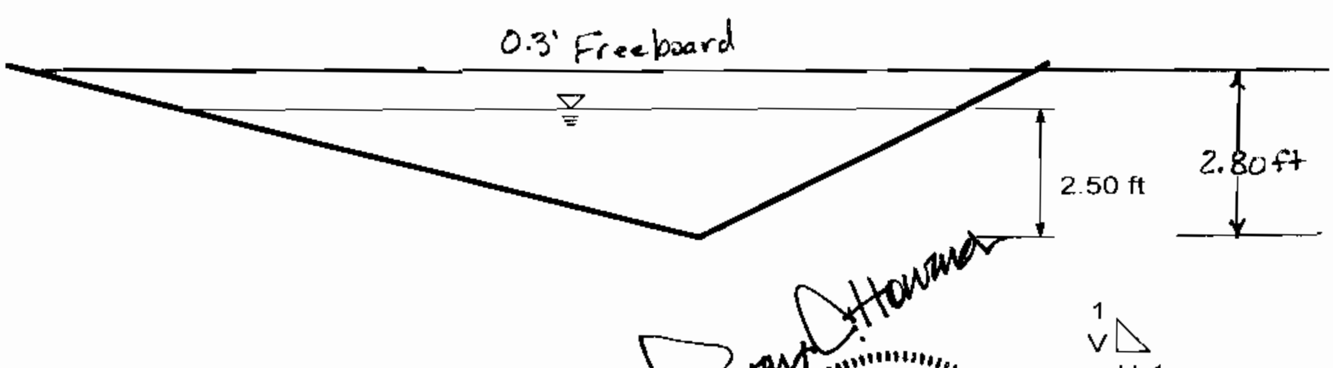
#807-0368 Diversion P12D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.50	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	78.00	cfs



Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

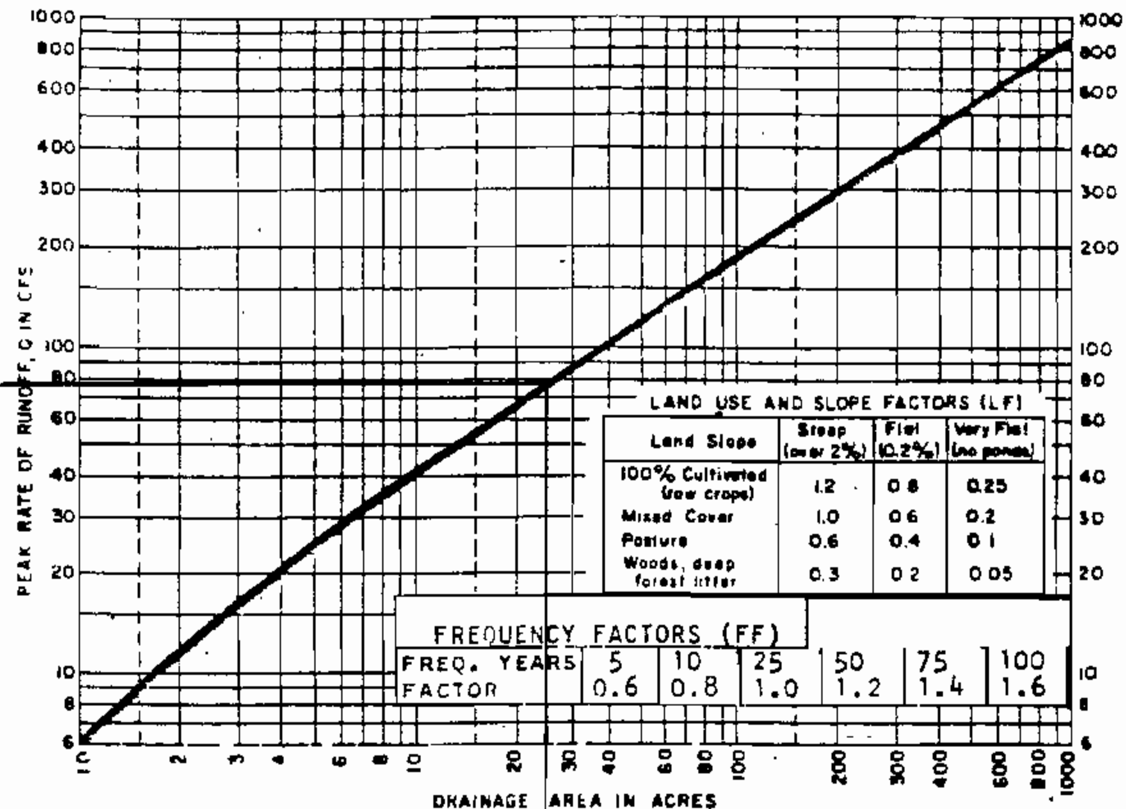
Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

P12 D1

98



LAND USE AND SLOPE FACTORS (LF)

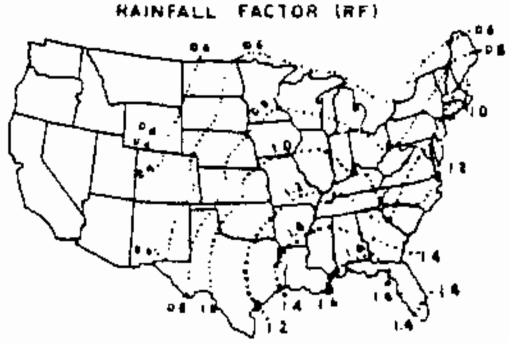
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

25.76 Ac

RAINFALL FACTOR (RF)



FORMULA:

Q_{design} = RF x LF x FF x Q

= 1.0x1.0x1.0x98

= 78

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15317
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PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P13D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	43.00	cfs

Results		
Depth	2.00	ft
Flow Area	12.02	ft^2
Wetted Perimeter	12.73	ft
Top Width	12.01	ft
Critical Depth	1.66	ft
Critical Slope	0.026786	ft/ft
Velocity	3.58	ft/s
Velocity Head	0.20	ft
Specific Energy	2.20	ft
Froude Number	0.63	
Flow is subcritical.		

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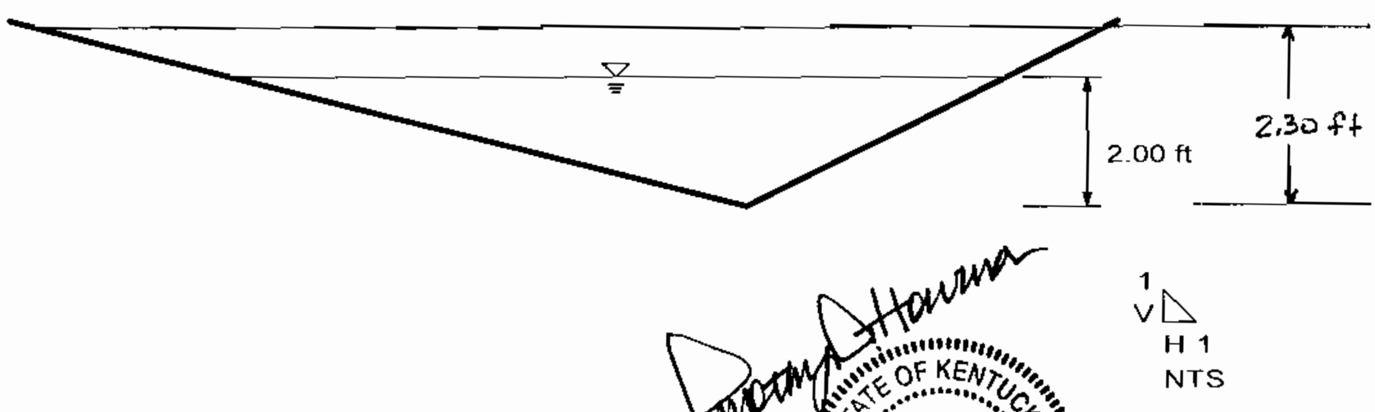
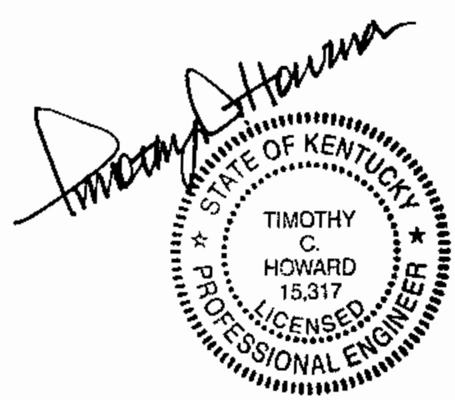
#807-0368 Diversion P13D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.00	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	43.00	cfs





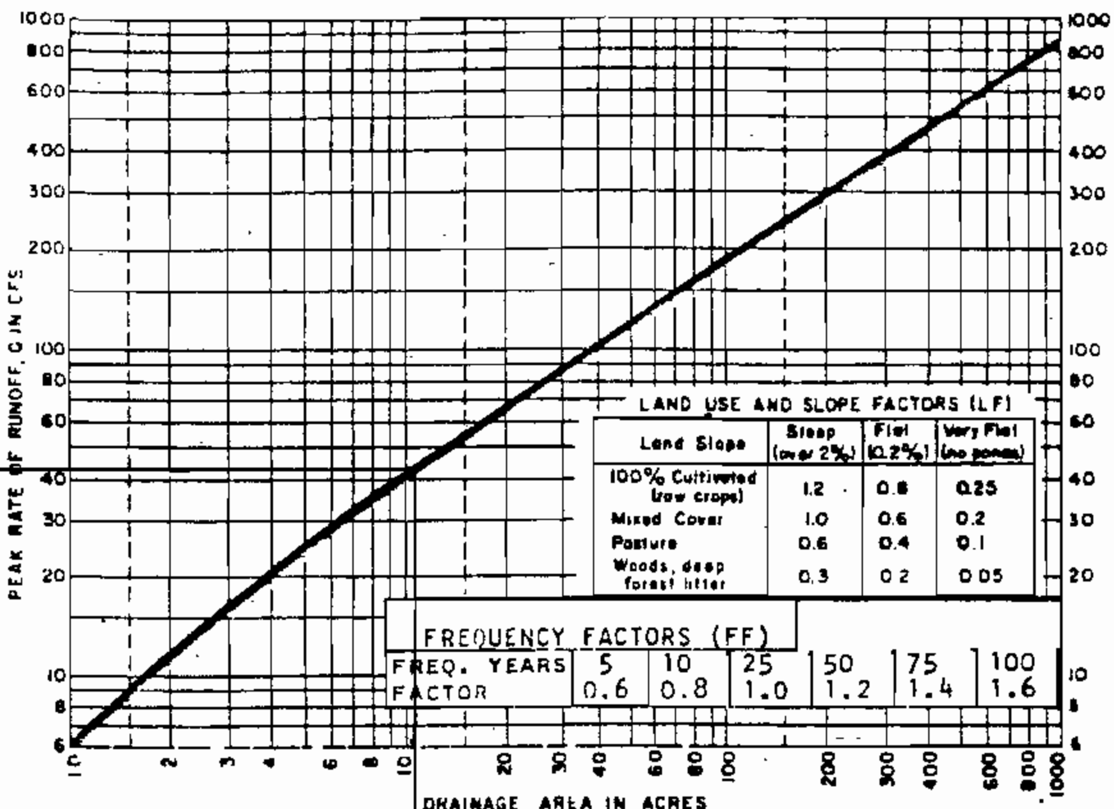
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels Inc.

Project: #807-0369

Diversion Ditch

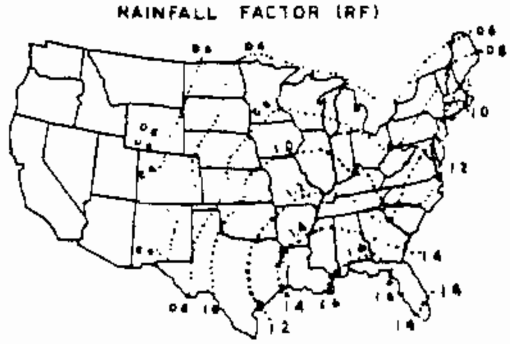
P13 D1



LAND USE AND SLOPE FACTORS (LF)			
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)						
FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 43$

$= 43$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
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PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P14D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	57.00	cfs

Results		
Depth	2.23	ft
Flow Area	14.86	ft^2
Wetted Perimeter	14.15	ft
Top Width	13.35	ft
Critical Depth	1.86	ft
Critical Slope	0.025798	ft/ft
Velocity	3.84	ft/s
Velocity Head	0.23	ft
Specific Energy	2.45	ft
Froude Number	0.64	
Flow is subcritical.		

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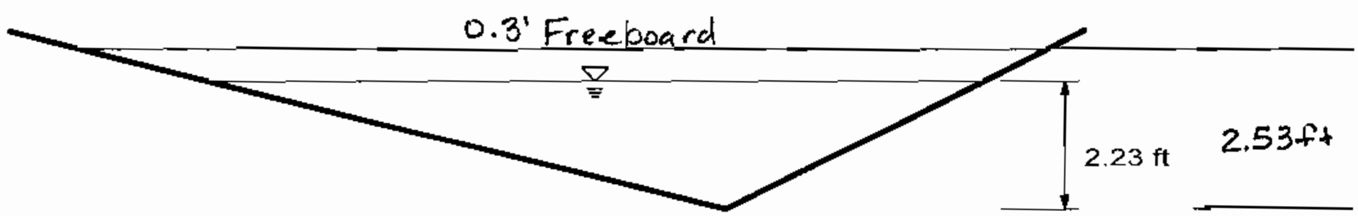
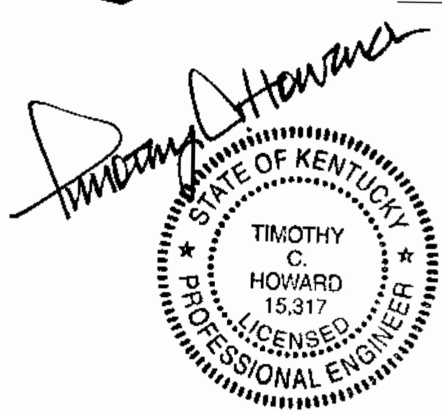
#807-0368 Diversion P14D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit- fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.23	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	57.00	cfs





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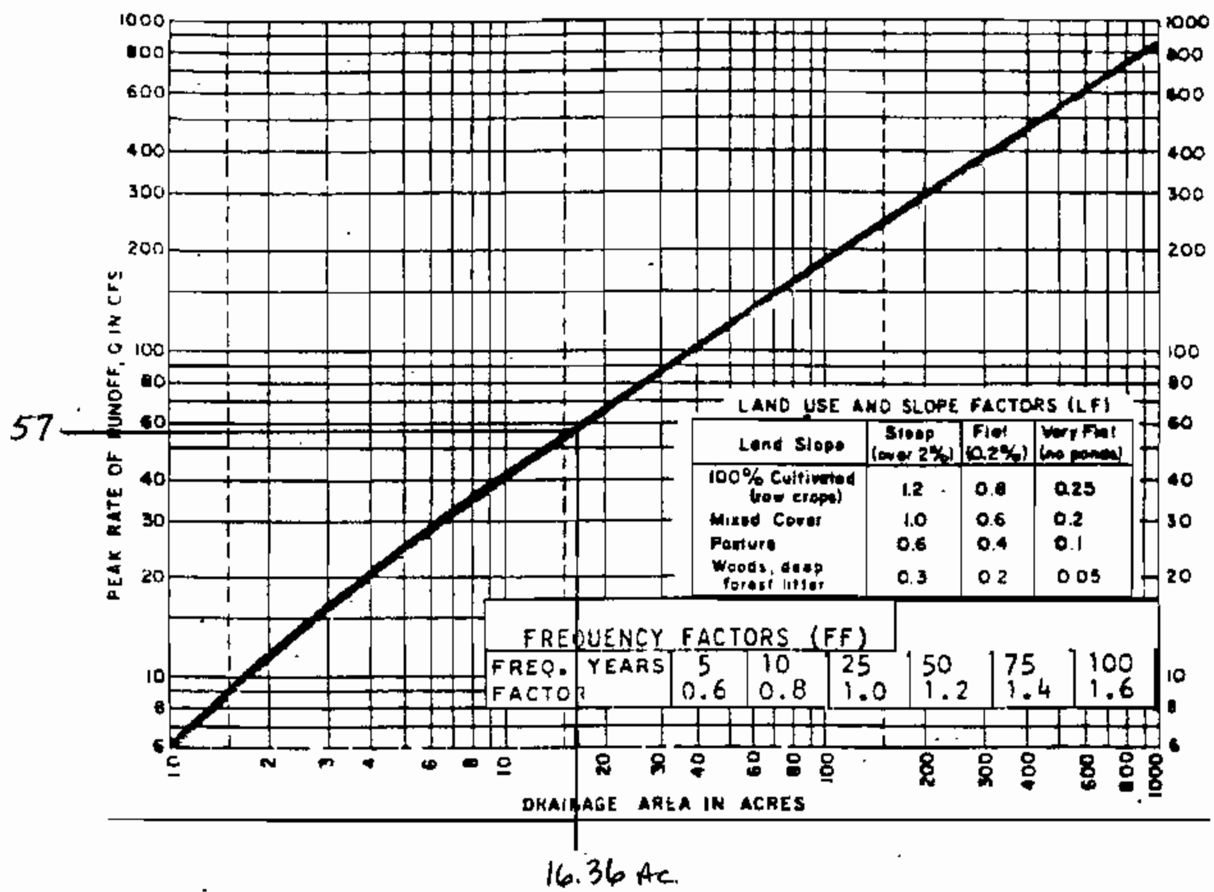
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

P14 D1



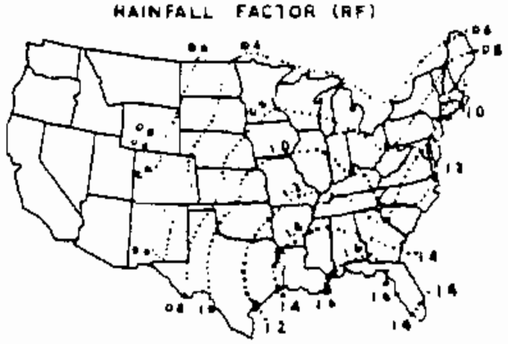
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 57$

$= 57$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P15D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	95.00	cfs

Results		
Depth	2.70	ft
Flow Area	21.79	ft^2
Wetted Perimeter	17.14	ft
Top Width	16.17	ft
Critical Depth	2.29	ft
Critical Slope	0.024099	ft/ft
Velocity	4.36	ft/s
Velocity Head	0.30	ft
Specific Energy	2.99	ft
Froude Number	0.66	
Flow is subcritical.		

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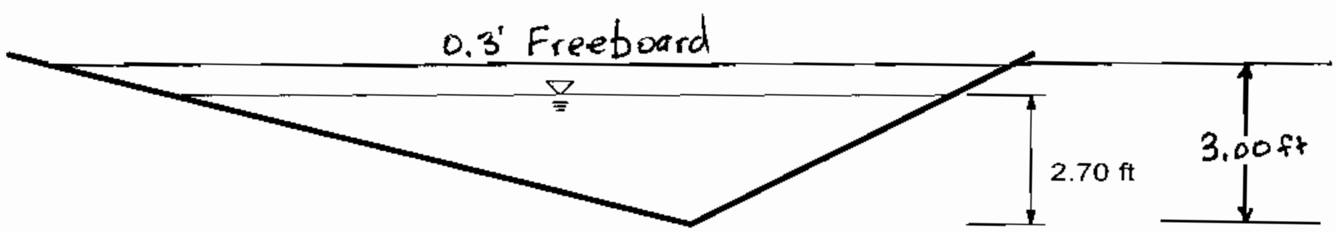
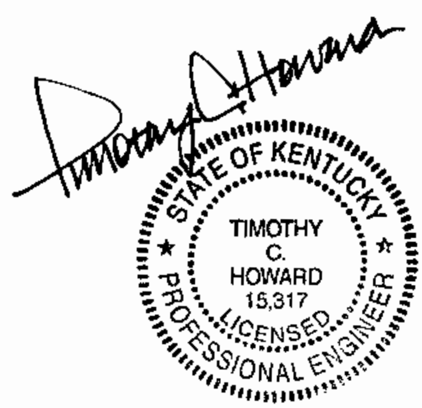
#807-0368 Diversion P15D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.70	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	95.00	cfs





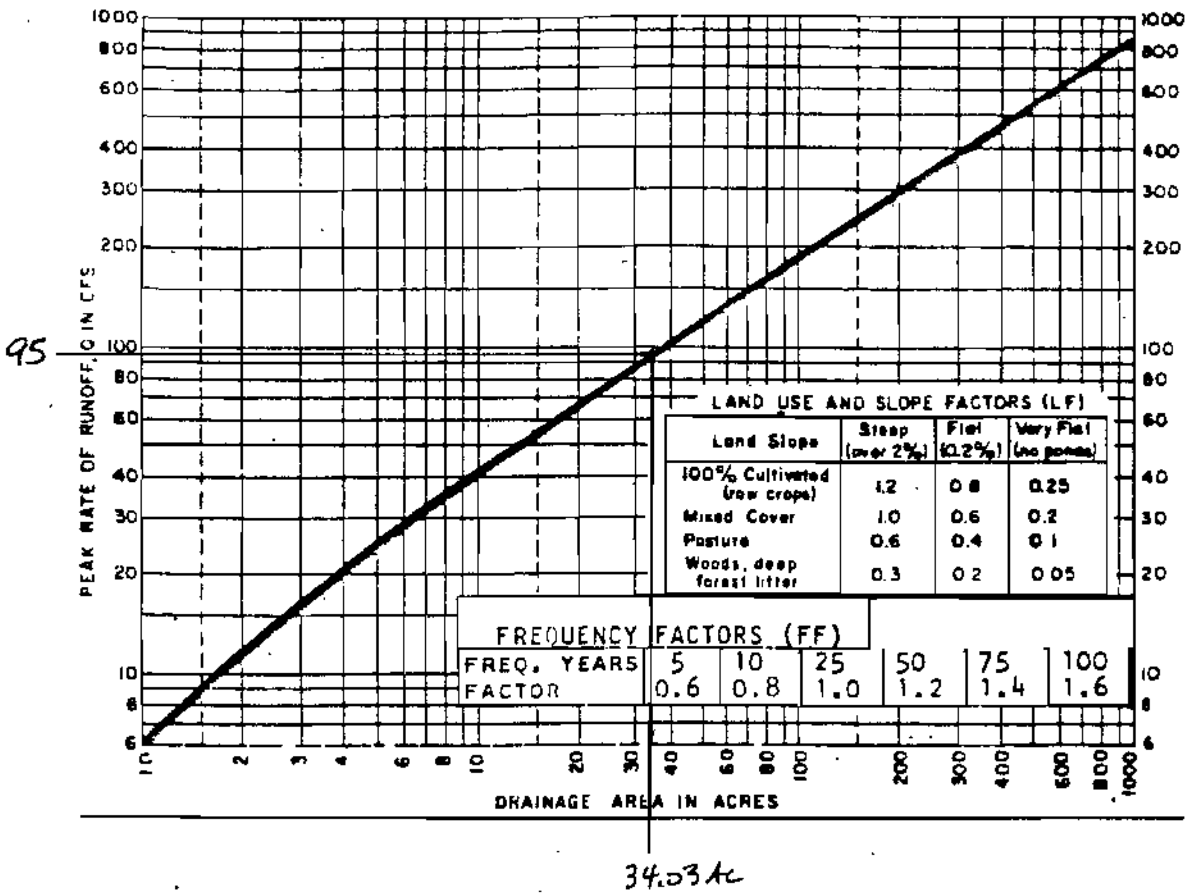
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0368

Diversion Ditch

P15 D1



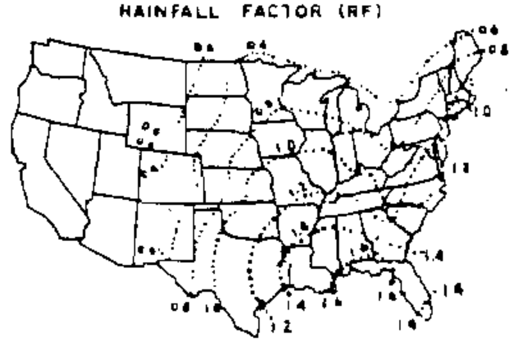
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 95$

$= 95$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

#807-0368 Diversion P16D1
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	124.00	cfs

Results		
Depth	2.98	ft
Flow Area	26.61	ft^2
Wetted Perimeter	18.94	ft
Top Width	17.87	ft
Critical Depth	2.54	ft
Critical Slope	0.023258	ft/ft
Velocity	4.66	ft/s
Velocity Head	0.34	ft
Specific Energy	3.32	ft
Froude Number	0.67	
Flow is subcritical.		

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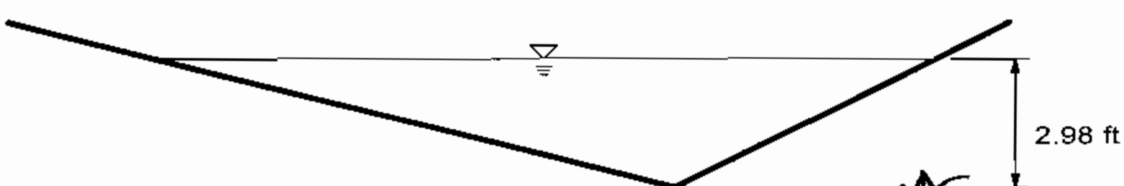
#807-0368 Diversion P16D1
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368dit-.fm2
Worksheet	#807-0368 On-Bench Diversion Ditches
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1	%
Depth	2.98	ft
Left Side Slope	4.00	H : V
Right Side Slope	2.00	H : V
Discharge	124.00	cfs



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NTS

Timothy C. Howard

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TIMOTHY C. HOWARD 15,317
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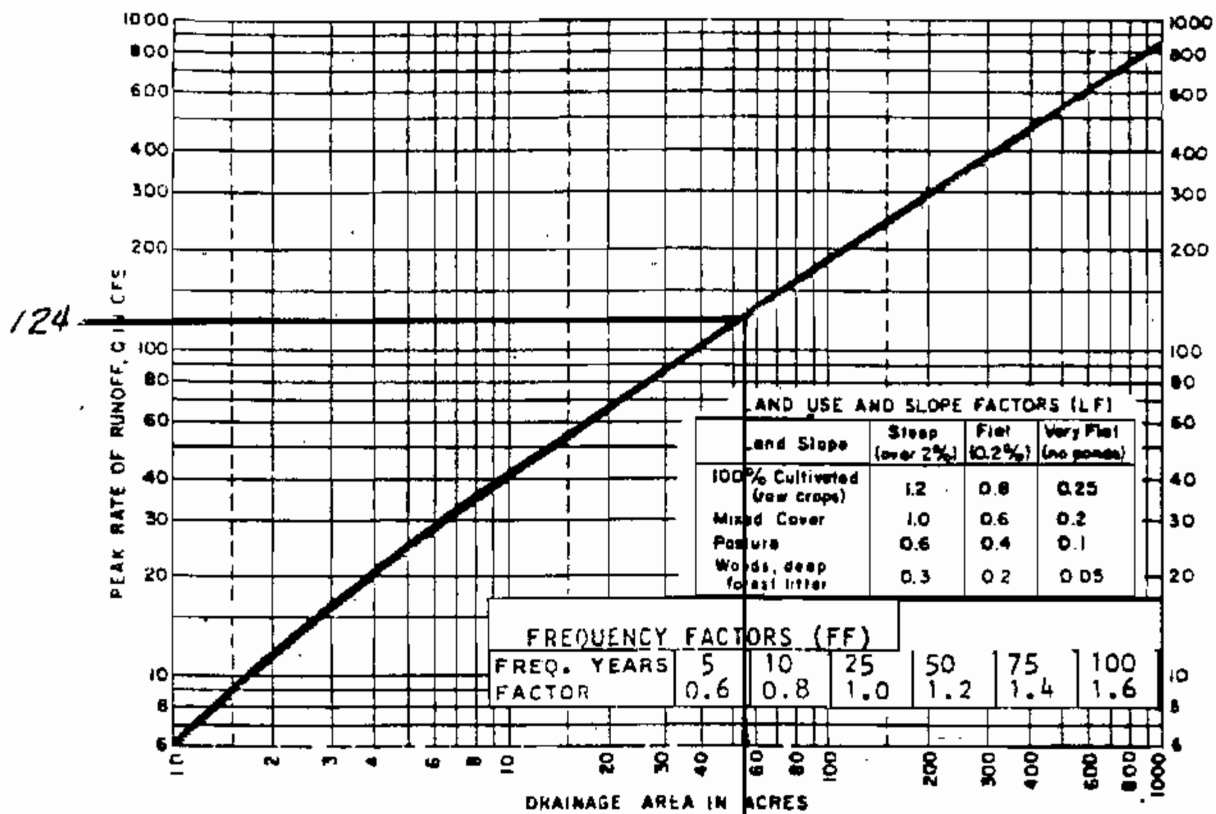
PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: #807-0368 Diversion Ditch P16 D1



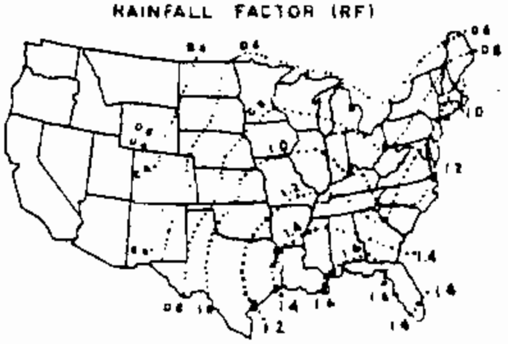
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 124$

$= 124$

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PEAK RUNOFF METHOD FOR WATERSHEDS UNDER 1,000 ACRES

Appolo Fuels #807-0368 KYHF1-D1
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368kyhf.fm2
Worksheet	Appolo Fuels 807-0368 Diversion KYHF1-D1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	216.00	cfs

Results		
Depth	2.42	ft
Flow Area	41.67	ft²
Wetted Perimeter	25.28	ft
Top Width	24.50	ft
Critical Depth	1.99	ft
Critical Slope	0.021432	ft/ft
Velocity	5.18	ft/s
Velocity Head	0.42	ft
Specific Energy	2.83	ft
Froude Number	0.70	
Flow is subcritical.		

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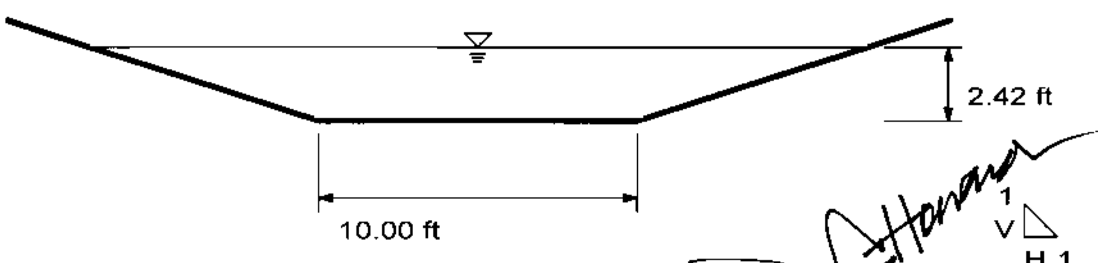
Appolo Fuels #848-0368 KYHF1-D1
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368kyhf.fm2
Worksheet	Appolo Fuels 807-0368 Diversion KYHF1-D1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Depth	2.42	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	216.00	cfs



STATE OF KENTUCKY
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Howard Engineering & Geology, Inc.

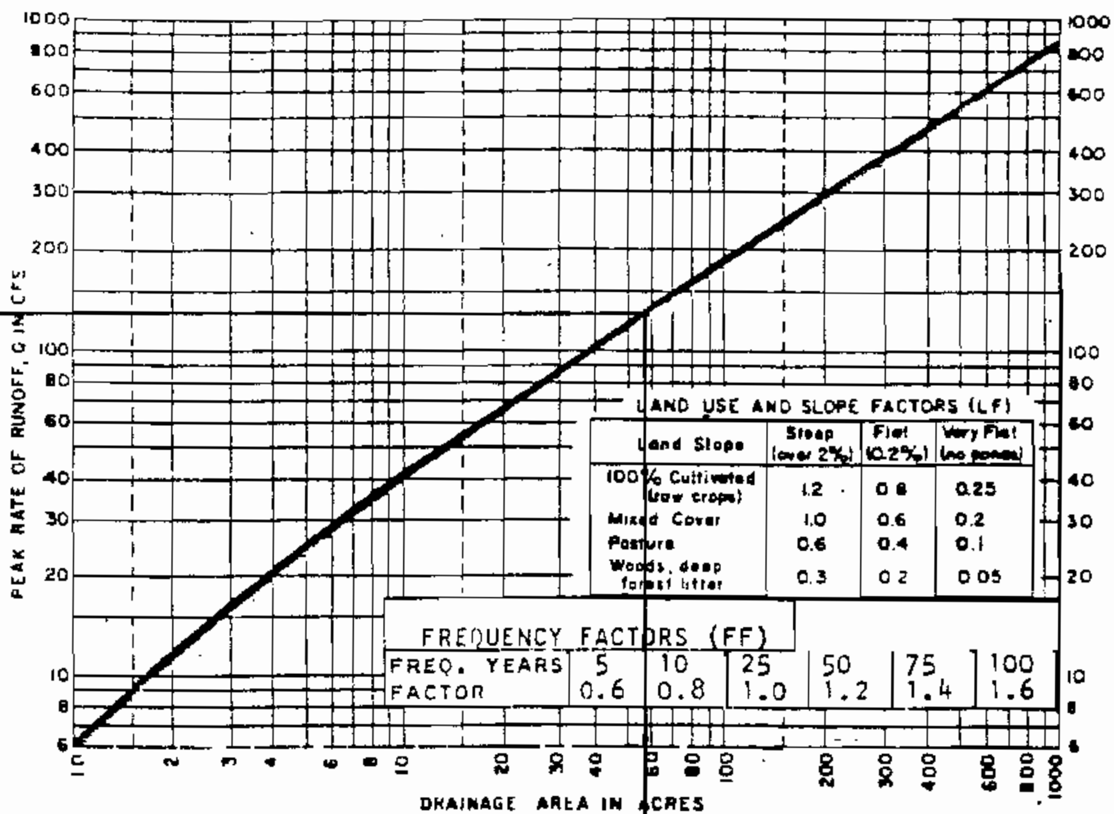
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: #807-0364B

Diversion Ditch

KY HE1-D1



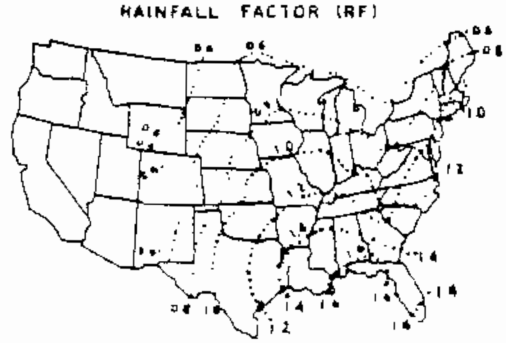
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

Q_{design} = RF x LF x FF x Q

= 1.0 x 1.0 x 1.6 x 135

= 216.0

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LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Appolo Fuels #807-0368 KYHF1-D3
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368kyhf.fm2
Worksheet	Appolo Fuels 807-0368 Diversion KYHF1-D1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	280.00	cfs

Results		
Depth	2.75	ft
Flow Area	50.30	ft^2
Wetted Perimeter	27.42	ft
Top Width	26.53	ft
Critical Depth	2.29	ft
Critical Slope	0.020649	ft/ft
Velocity	5.57	ft/s
Velocity Head	0.48	ft
Specific Energy	3.24	ft
Froude Number	0.71	
Flow is subcritical.		

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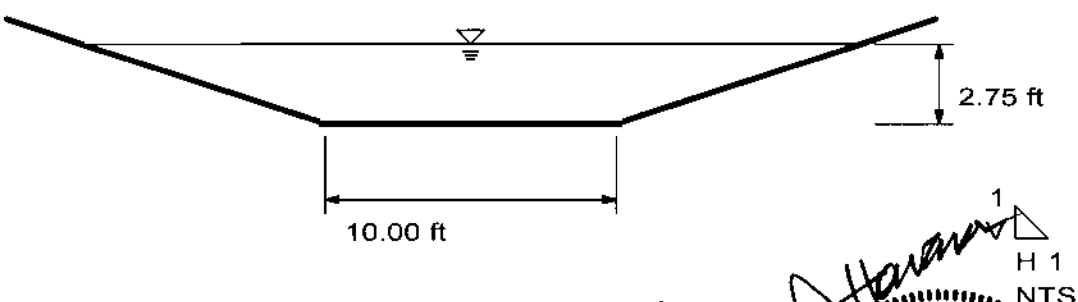
Appolo Fuels #848-0368 KYHF1-D3
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368kyhf.fm2
Worksheet	Appolo Fuels 807-0368 Diversion KYHF1-D1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Depth	2.75	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	10.00	ft
Discharge	280.00	cfs



STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317 LICENSED
PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

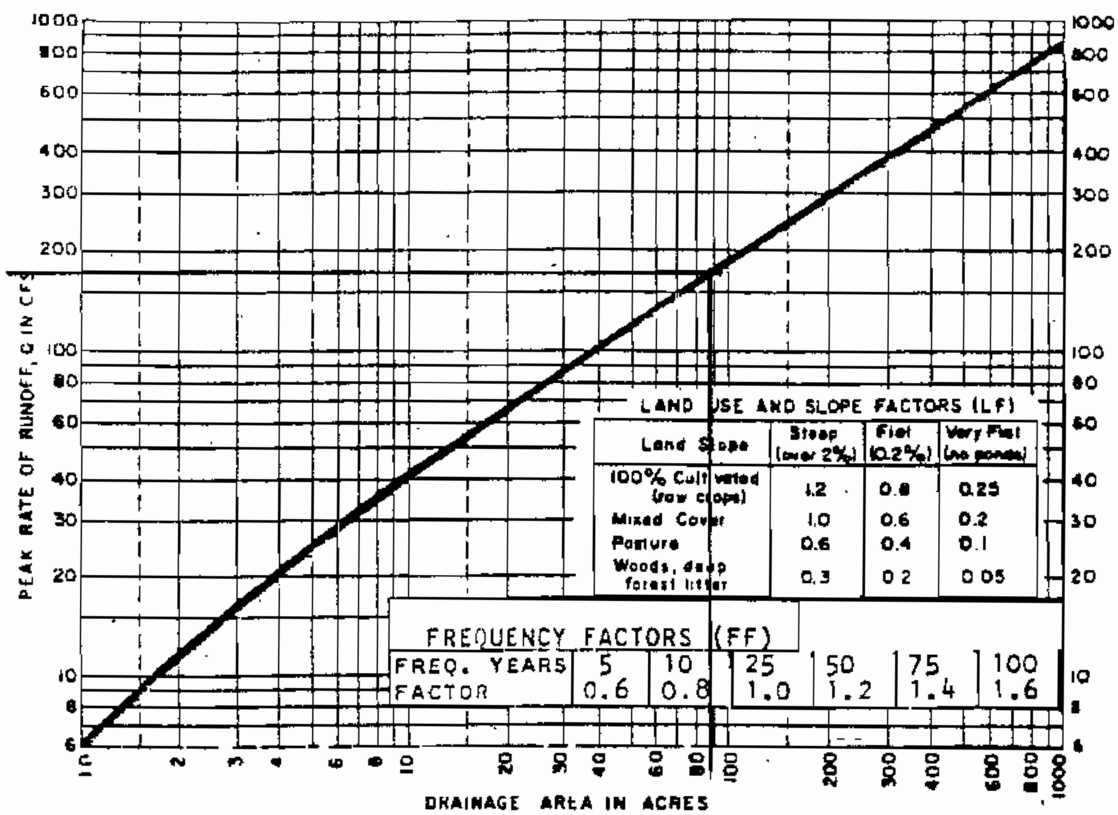
Company Name: Appolo Fuels, Inc.

Project: # 807- 0368

Diversion Ditch

KY HF1 - D3

175



LAND USE AND SLOPE FACTORS (LF)

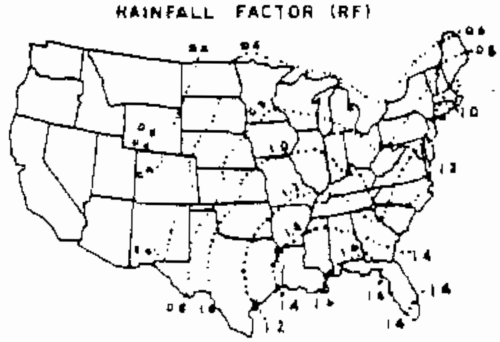
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

98.17 Ac.

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.6 \times 175$

$= 280$

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

ATTACHMENT 33.1.A

TRANSPORTATION PLAN

Access to and coal haulage from the proposed mining areas will be provided by haul roads "A", "C", "D" and Appolo Fuels, Inc. road only permit #807-7019. Road "B" is proposed as a pond access road. The roads will be constructed at the locations shown on the MRP/ERI map included in this attachment.

Road "A" is existing with ditches and culverts in place and functioning properly. The ditches and culverts will not be re-designed by this application. The only changes proposed to Road "A" is widening in areas (i.e. curves) and the upgrade of the berm.

Roads "C" and "D" are proposed and culvert and ditch designs have been provided in this attachment.

Road "B" is existing and will be used for pond access and no culverts proposed.

The roads will be maintained by grading, revegetating side slopes, cut and fill slopes. The roads are proposed to be permanent structures, used for the support and achievement of the post-mining landuse.

CERTIFICATION OF DESIGN

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

I, Timothy C. Howard (Signature), (Engineer's Seal) 15,317 (Registration No.), 10/5/09 (Date Certified),

hereby certify, in accordance with 405 KAR 7:040, Section 10, that the design of each of the following facilities, whose design is included in this application, Application # 807-0368 :

a) is in accordance with accepted engineering practices and recognized professional standards;
b) complies with the design requirements of KRS Chapter 350 and KAR Title 405; and
c) provided that the facility is properly constructed, operated and maintained, is adequate for the facility to meet the applicable performance standards of KRS Chapter 350 and KAR Title 405 insofar as such performance can reasonably be predicted by accepted engineering practices.

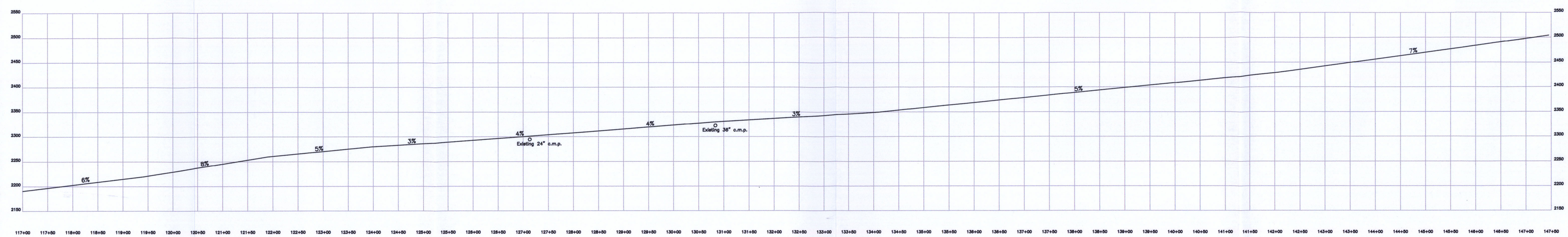
FACILITY TYPE: Road (Permanent)
(One facility type only)

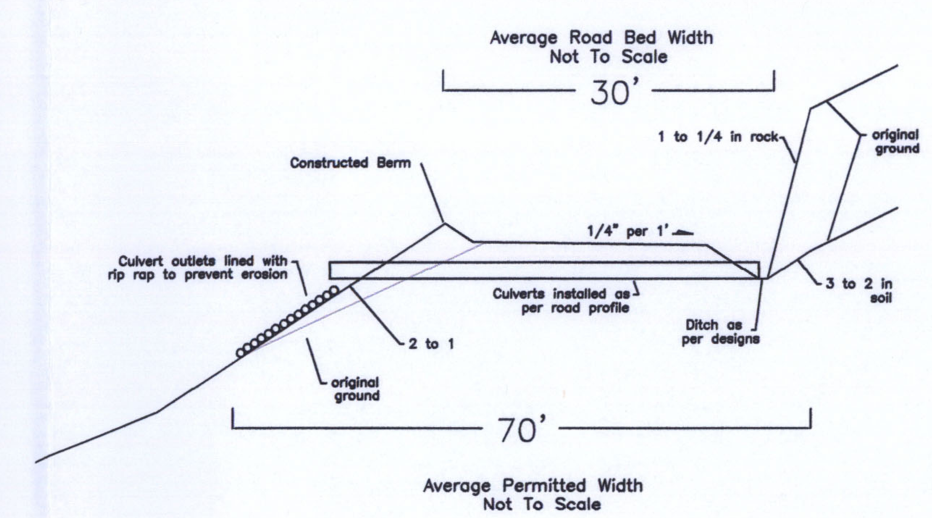
FACILITY ID #	HAZARD CLASS*	DATE OF DESIGN	FACILITY ID #	HAZARD CLASS*	DATE OF DESIGN
A	N/A	12/28/08	B	N/A	12/28/08
C	N/A	06/24/09	D	N/A	10/01/09

TYPES OF FACILITIES:

- -- sedimentation pond
- -- excess spoil disposal fill
- -- temporary water impoundment
- -- permanent water impoundment
- -- coal processing waste impoundment
- -- coal processing waste dam
- -- coal processing waste bank
- -- road
- -- postmining land use plan
- -- permanent ditches

* Show hazard class, if applicable.





I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

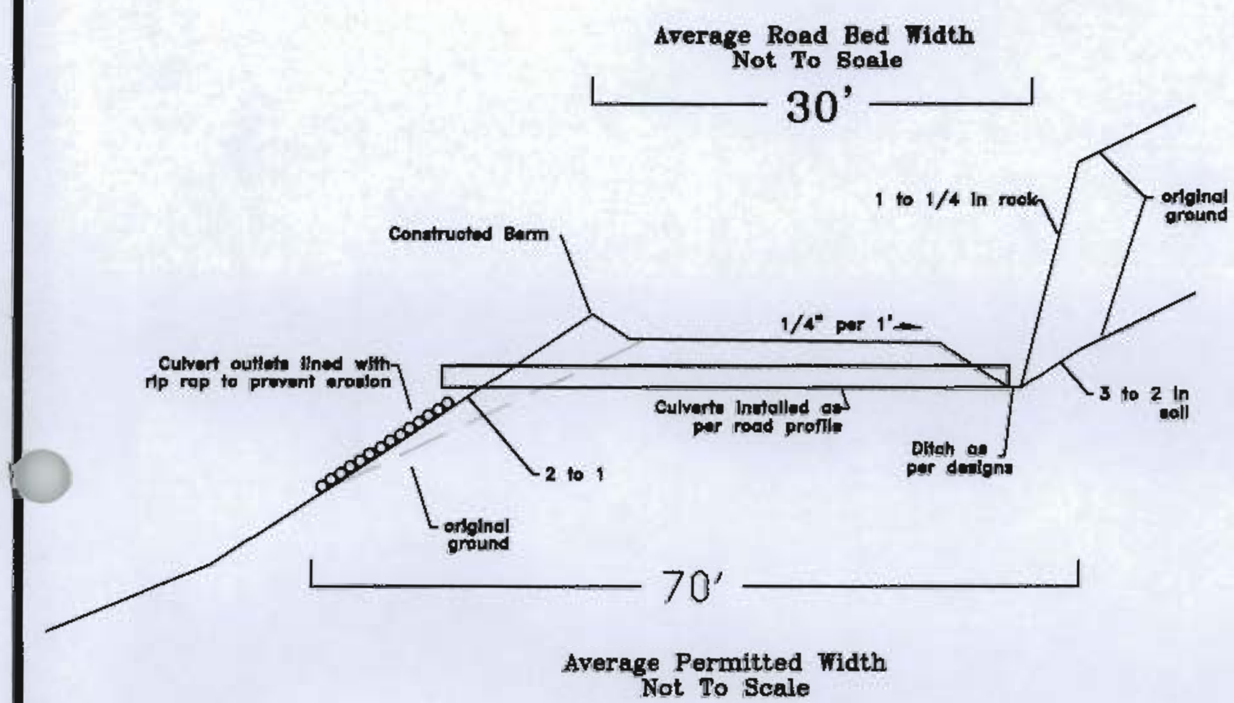
STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

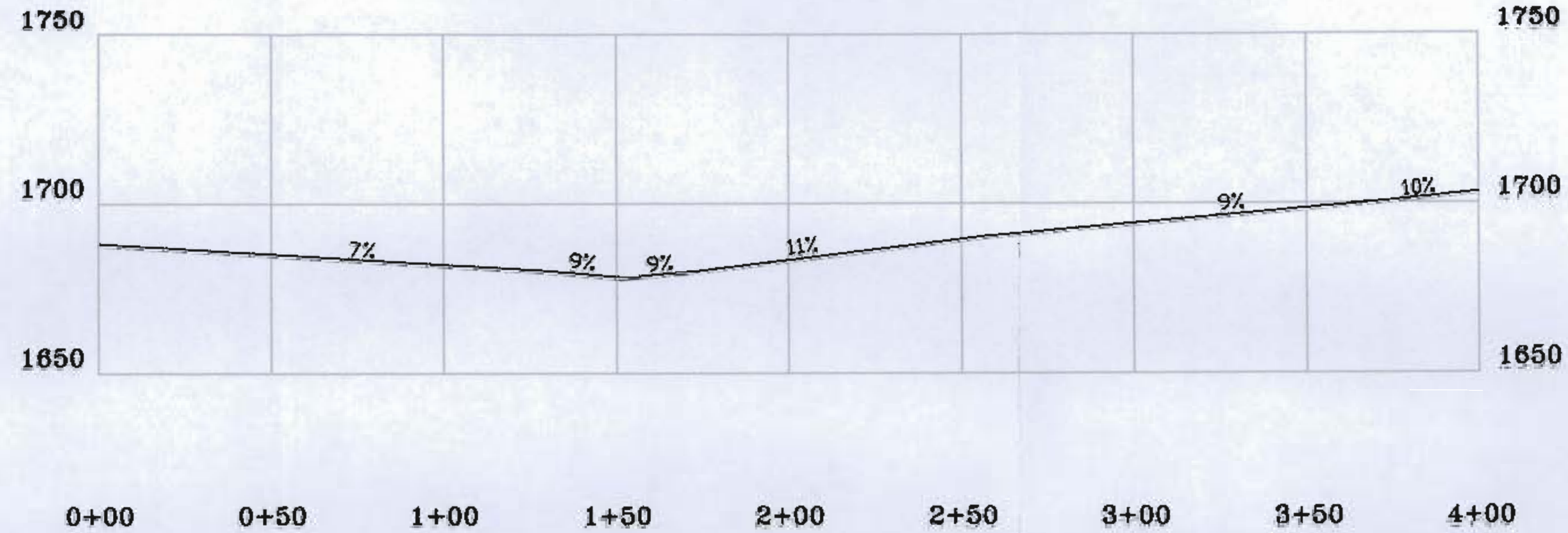
Appolo Fuels, Inc.

Permit #807-0368
Profile and Cross Section Drawing of Road "A"
Attachment 33.1.A

Scale: 1" = 100' | Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.





I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

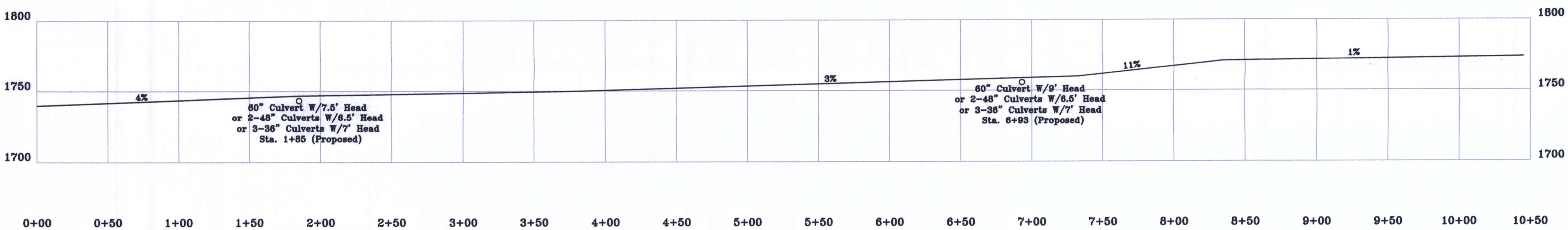
STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

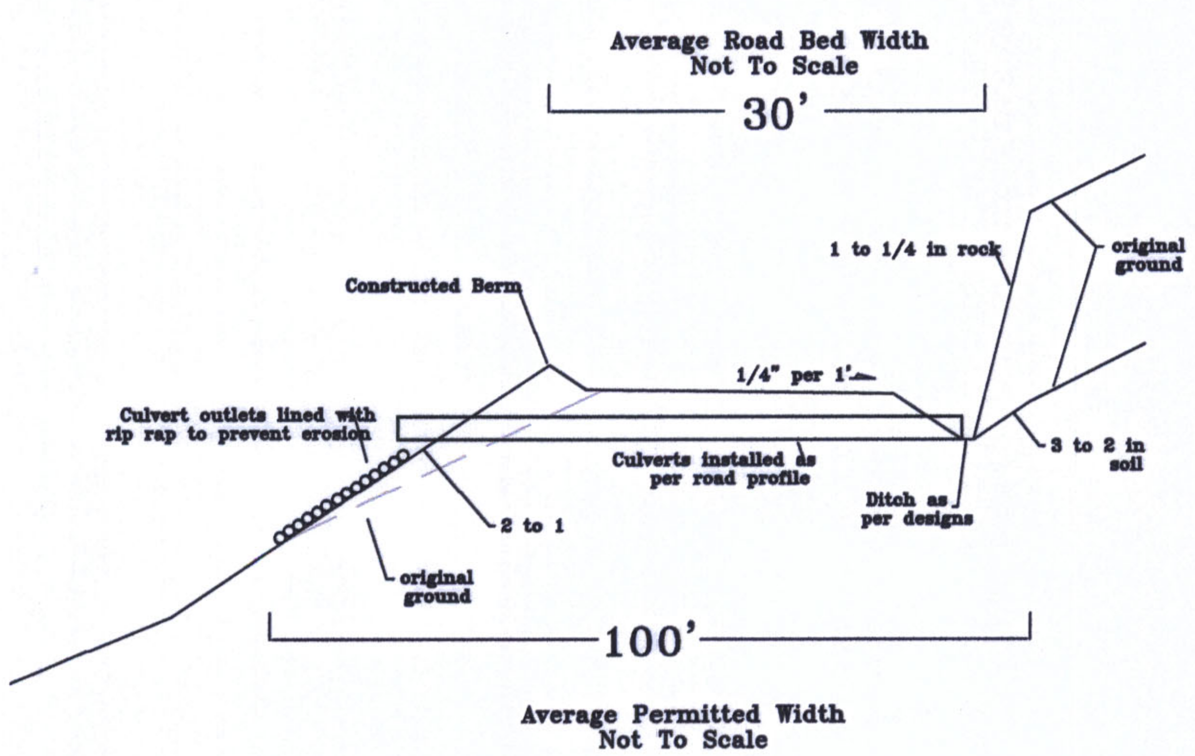
Appolo Fuels, Inc

Permit #848-0368
Road "B"
Profile & Typical Cross-Section
Attachment 33.1.A

Scale: 1" = 50' | Page No.

Prepared by:
Howard Engineering & Geology, Inc.





I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/04

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY ★ TIMOTHY C. HOWARD 15,317 LICENSED PROFESSIONAL ENGINEER ★

Appolo Fuels, Inc

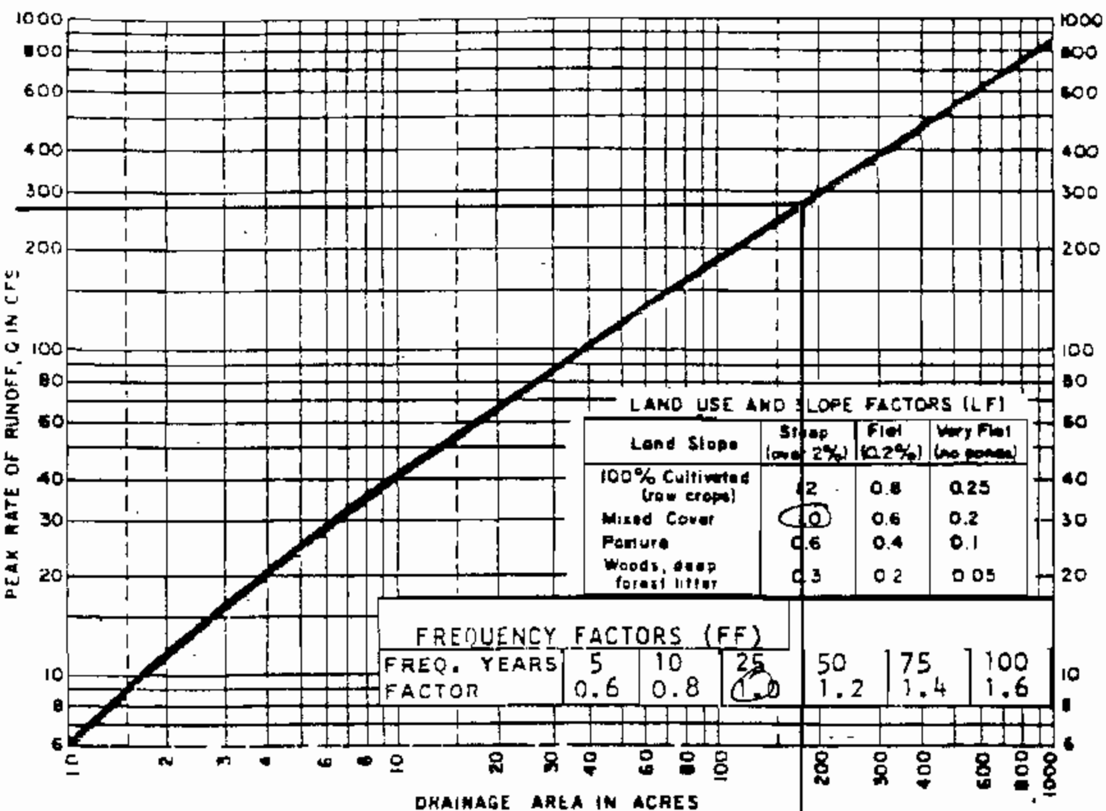
Permit #848-0368
Road "C"
Profile & Typical Cross-Section
Attachment 33.1.A

Scale: 1" = 50'	Page No.

Prepared by:
Howard Engineering & Geology, Inc.

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.
Project: # 807-0368
Road "C" Culvert Design
@ Station 1+85



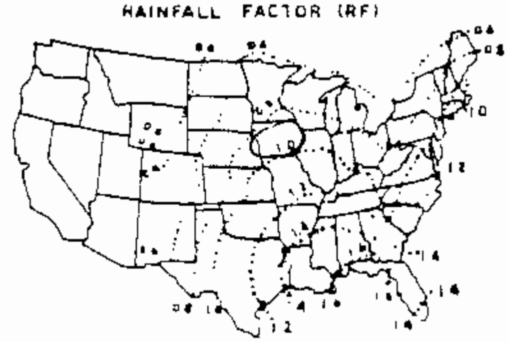
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 273$

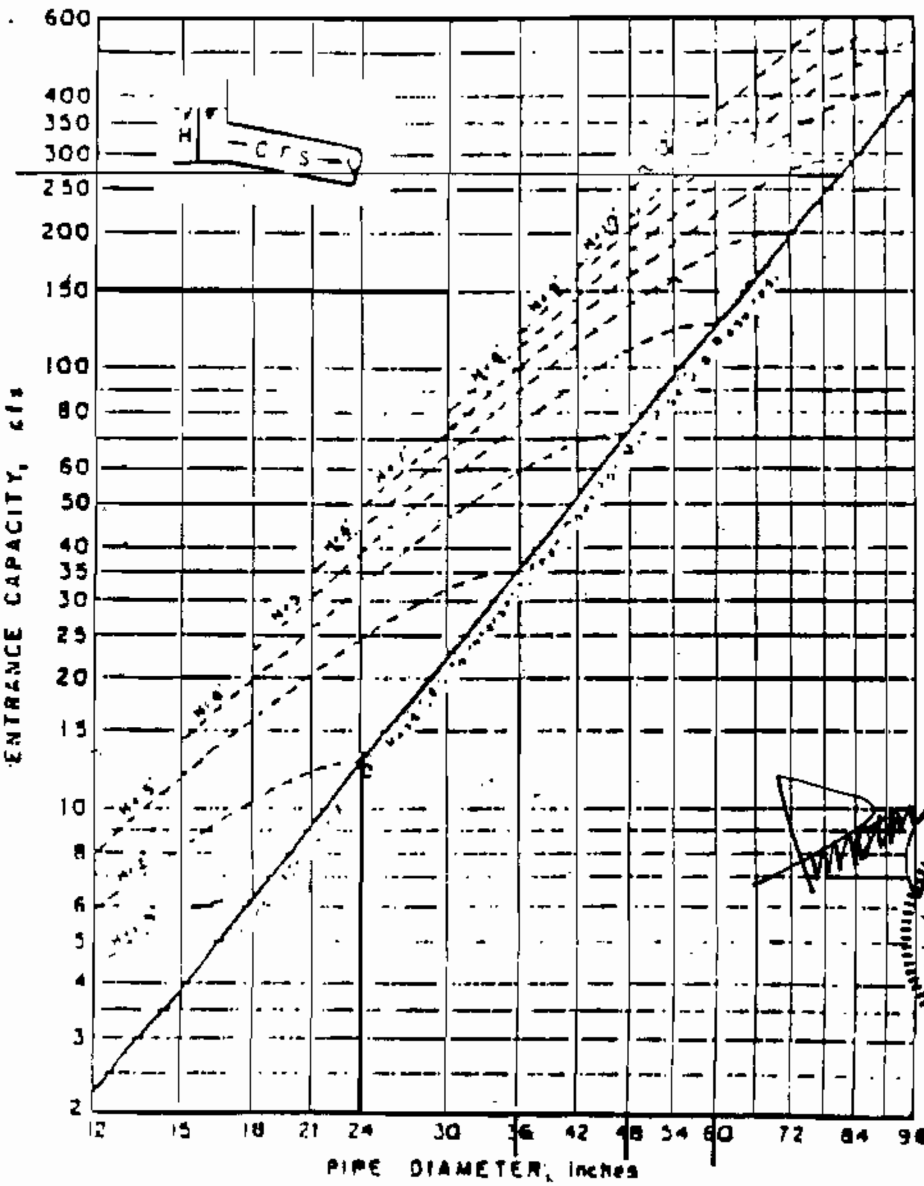
$= 273$

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.
Project: # 807-0368
Road "C" Culvert Design
@ Station 1+85
Date: Scale: Dwn By:



Graph showing pipe culvert capacity

1-60" Culvert W/7.5' Head (CMP, Steel or Plastic)
OR
2-48" Culverts W/6.5' Head (CMP, Steel or Plastic)
Or
3-36" Culverts W/7' Head (CMP, Steel or Plastic)

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

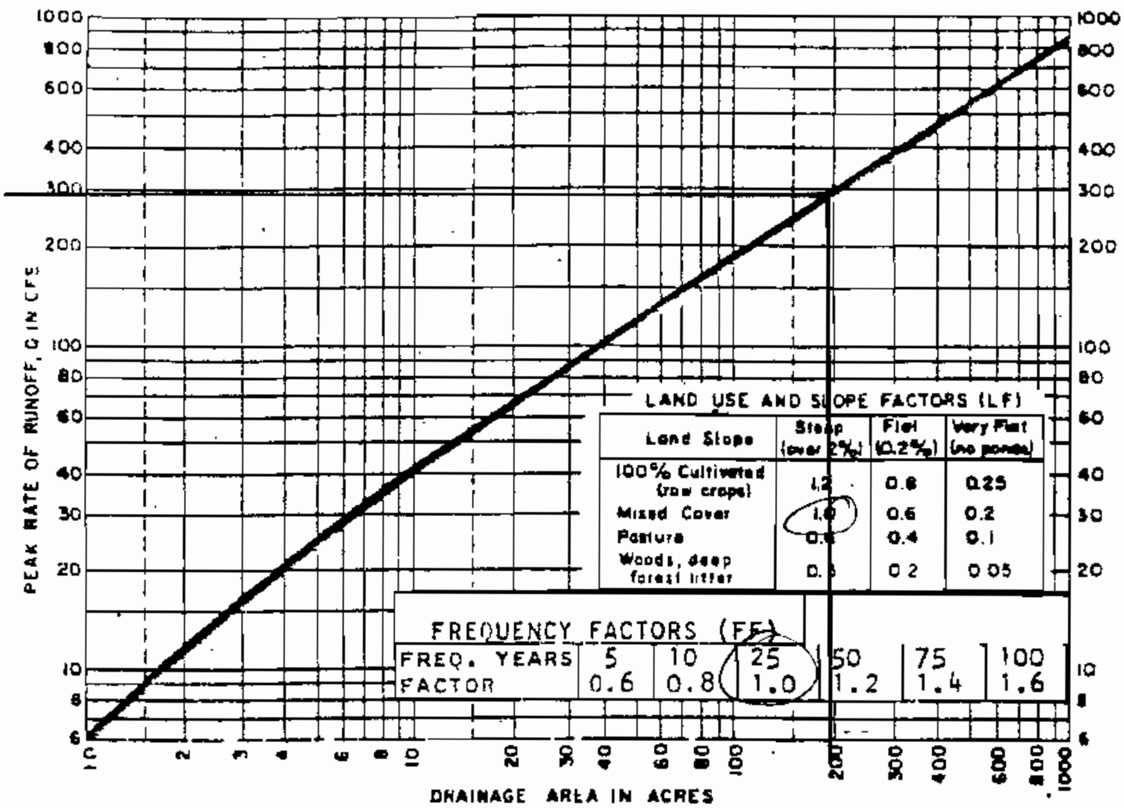
Company Name: Appolo Fuels, Inc.

Project: #807-0368

Road "C" Culvert Design

@ Station 6+93

287



LAND USE AND SLOPE FACTORS (LF)

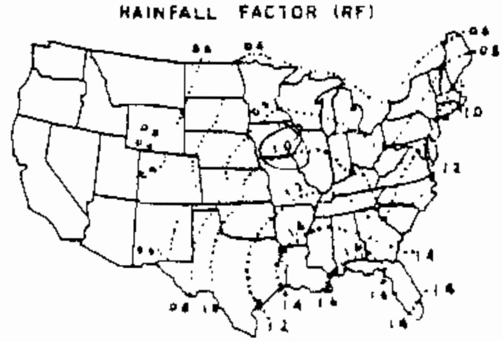
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.8	0.4	0.1
Woods, deep forest litter	0.5	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

198.82 Ac.

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

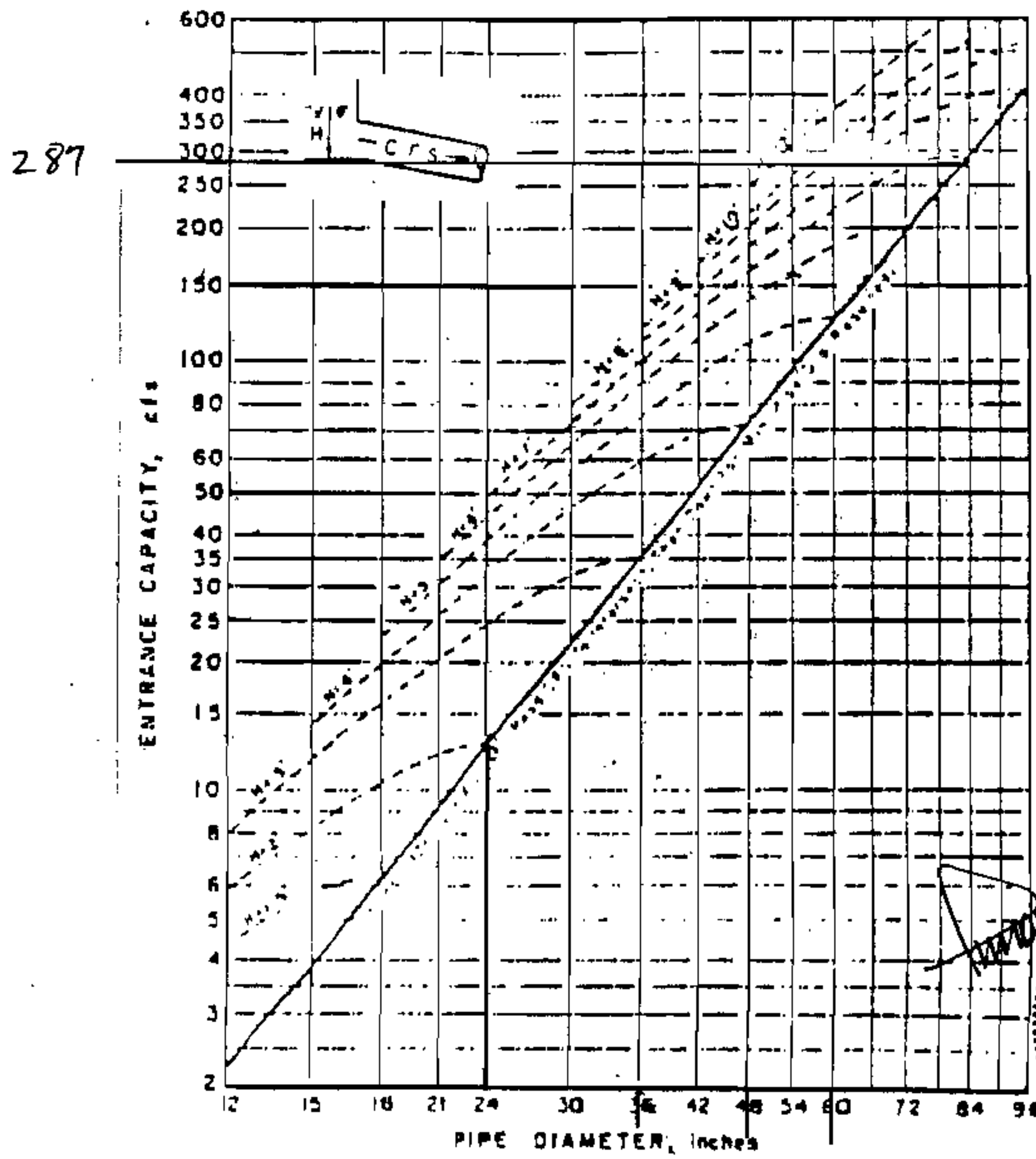
$= 1.0 \times 1.0 \times 1.0 \times 287$

$= 287$

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: # 807-0368 Road "C" Culvert Design @ Station 6 + 93 Date: Scale: Dwn By:



Graph showing pipe culvert capacity

1-60" Culvert W/9' Head (CMP, Steel or Plastic)

OR

2-48" Culverts W/6.5' Head (CMP, Steel or Plastic)

or

3-36' Culverts W/7' Head (CMP, Steel or Plastic)

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

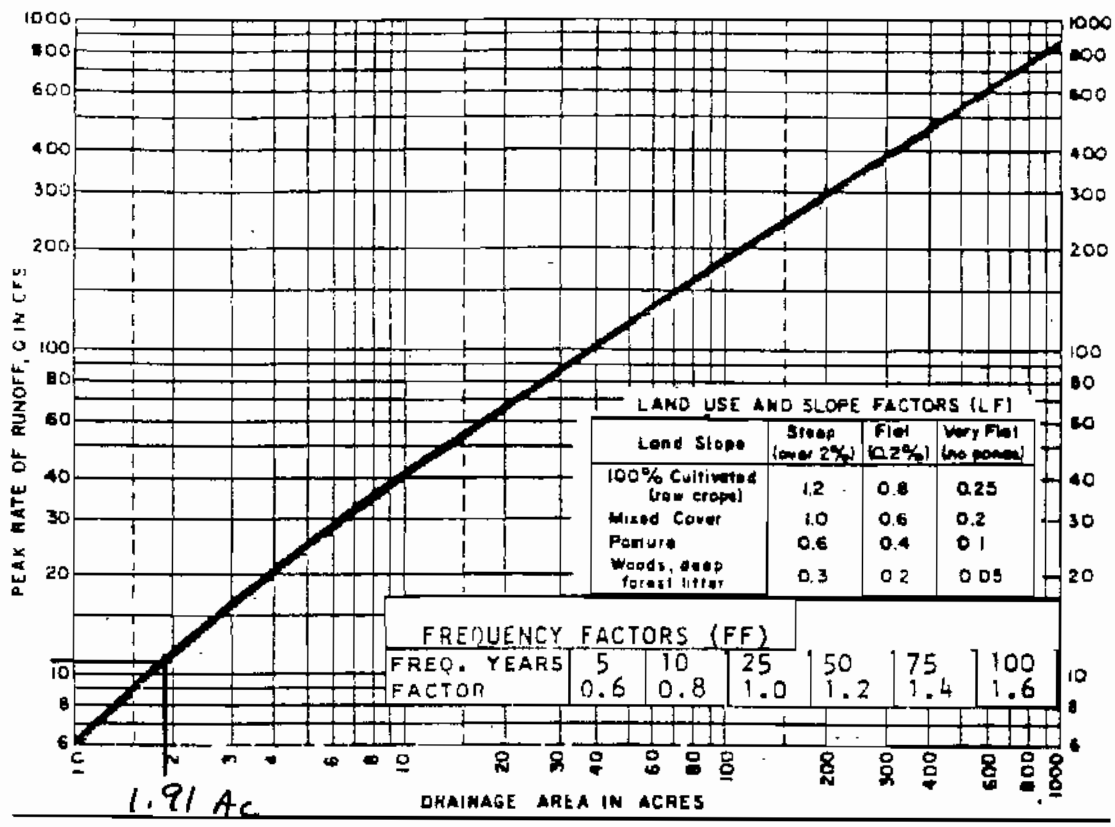
Howard Engineering & Geology, Inc.
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc

Project: #807-0368

Road "C" Worst Case

Ditch Design



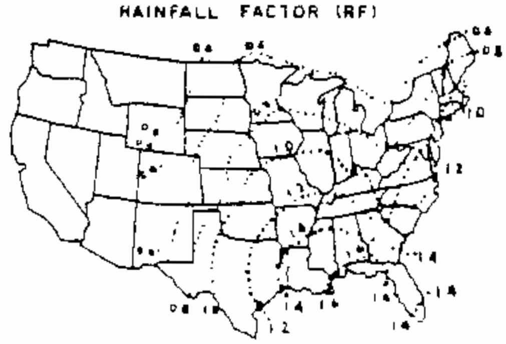
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

Timothy C. Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

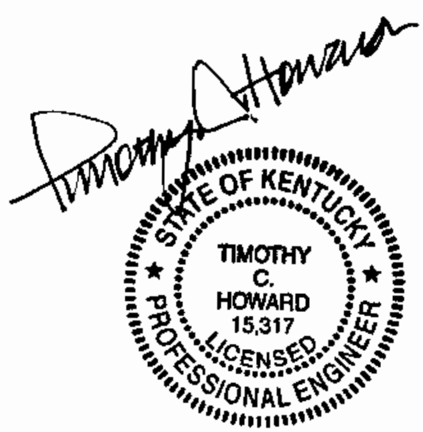
PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

807-0368 Road C Worst Case Ditch Design
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368-r-c.fm2
Worksheet	807-0368 Road C Worst Case Ditch Design
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Left Side Slope	0.33	H : V
Right Side Slope	3.00	H : V
Discharge	11.00	cfs

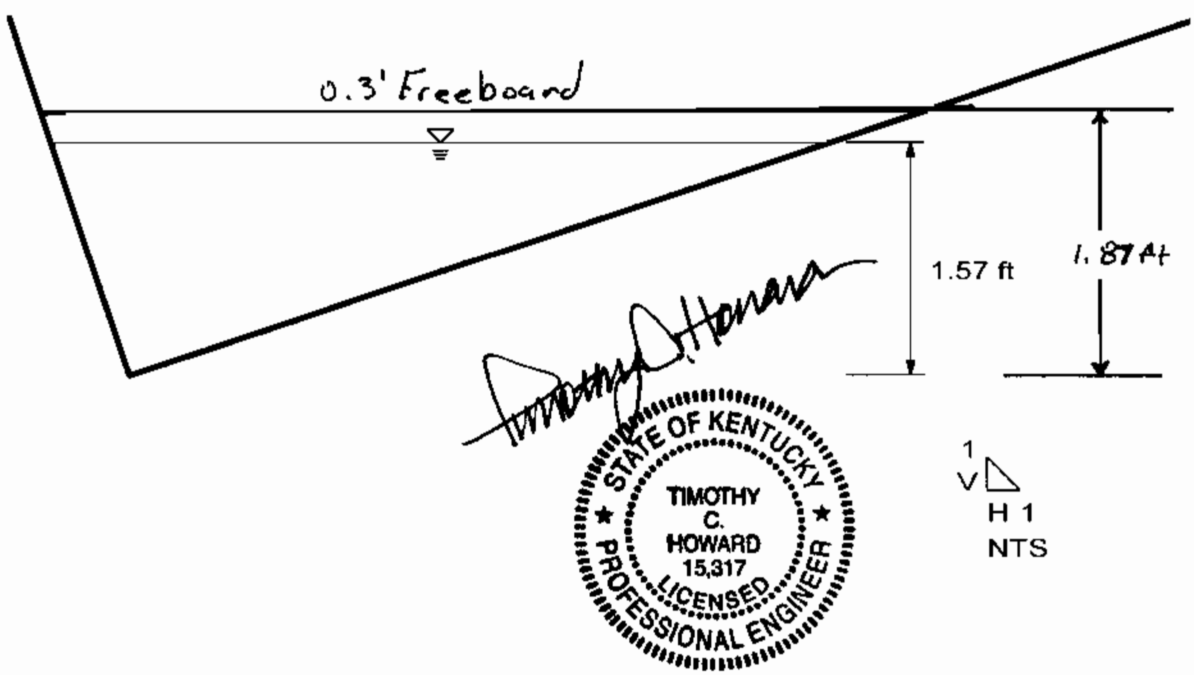
Results		
Depth	1.57	ft
Flow Area	4.08	ft^2
Wetted Perimeter	6.60	ft
Top Width	5.21	ft
Critical Depth	1.22	ft
Critical Slope	0.037636	ft/ft
Velocity	2.70	ft/s
Velocity Head	0.11	ft
Specific Energy	1.68	ft
Froude Number	0.54	
Flow is subcritical.		

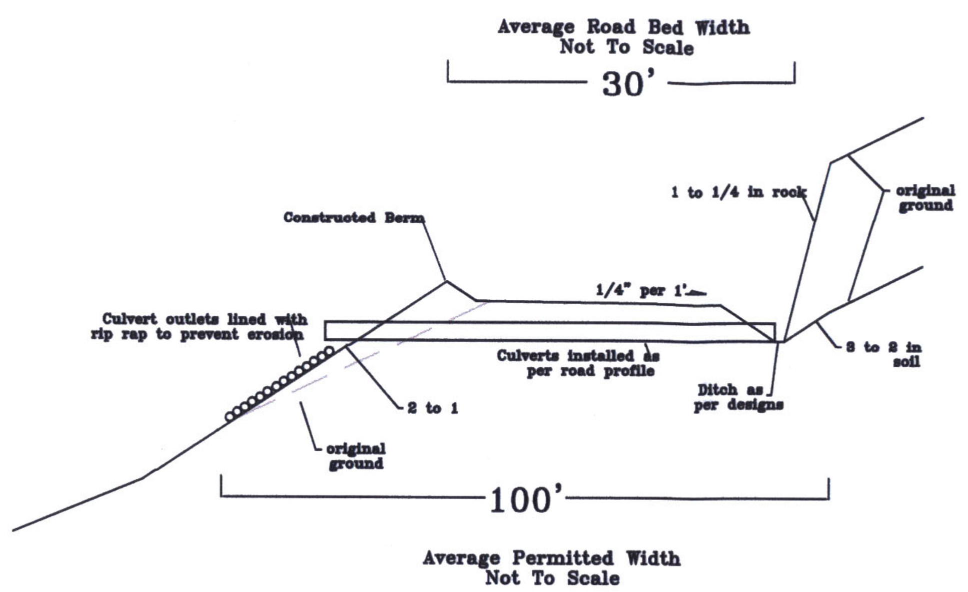


807-0368 Road C Worst Case Ditch Design
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368-r-c.fm2
Worksheet	807-0368 Road C Worst Case Ditch Design
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	1.00	%
Depth	1.57	ft
Left Side Slope	0.33	H : V
Right Side Slope	3.00	H : V
Discharge	11.00	cfs





I, Timothy C. Howard, P.E. No. 15,317

Date: 10/5/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

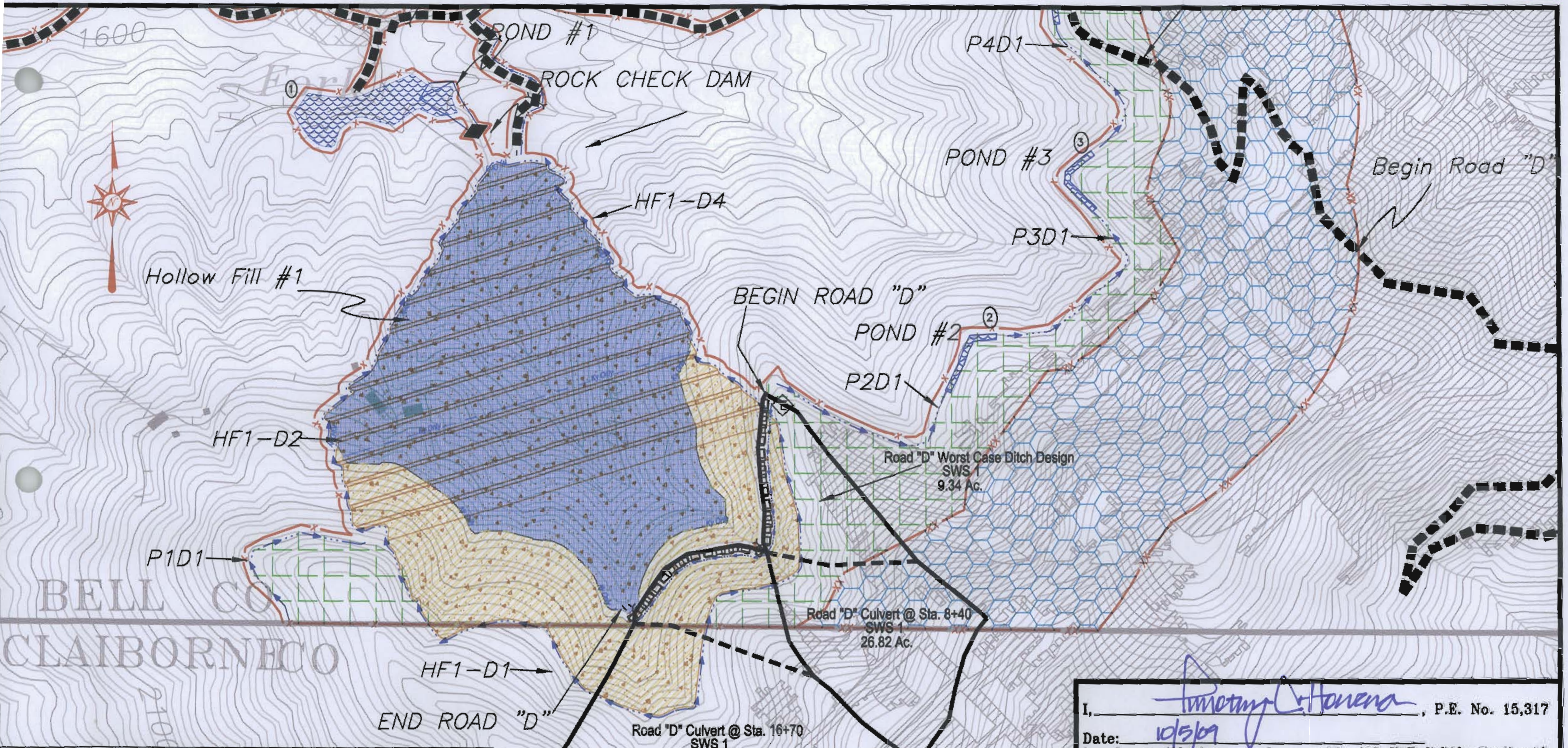
STATE OF KENTUCKY ★ TIMOTHY C. HOWARD 15,317 LICENSED ★ PROFESSIONAL ENGINEER

Appolo Fuels, Inc

Permit #848-0368
Road "D"
Profile & Typical Cross-Section
Attachment 33.1.A

Scale: 1" = 50'	Page No.

Prepared by:
Howard Engineering & Geology, Inc.



ACTIVE/ABANDONED AREA DISCLAIMER

The areas marked as "ACTIVE" and/or "ABANDONED" on this map were copied from a map purportedly prepared by a third-party. HEG affirmatively states that it has used its best engineering practice in utilizing the third party map information but, due to physical conditions, CANNOT VERIFY, OR REPRESENT OR WARRANT THE ACCURACY OR COMPLETENESS of the third party map information. HEG DISCLAIMS ALL REPRESENTATIONS AND/OR WARRANTIES whether express, implied or statutory including but not limited to, warranties of title, merchantability and fitness for a particular purpose or use, and it makes no representation as to any property rights and further disclaims all liability for any and all damages that may arise from the use of the third party map information by anyone. HEG specifically disclaims all liability for the consequences of decisions made by anyone on the basis of the third party map information and affirmatively states that it is the user's responsibility to review and understand the limitations of the information.

I, Timothy C. Howard, P.E. No. 15,317

Date: 10/5/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

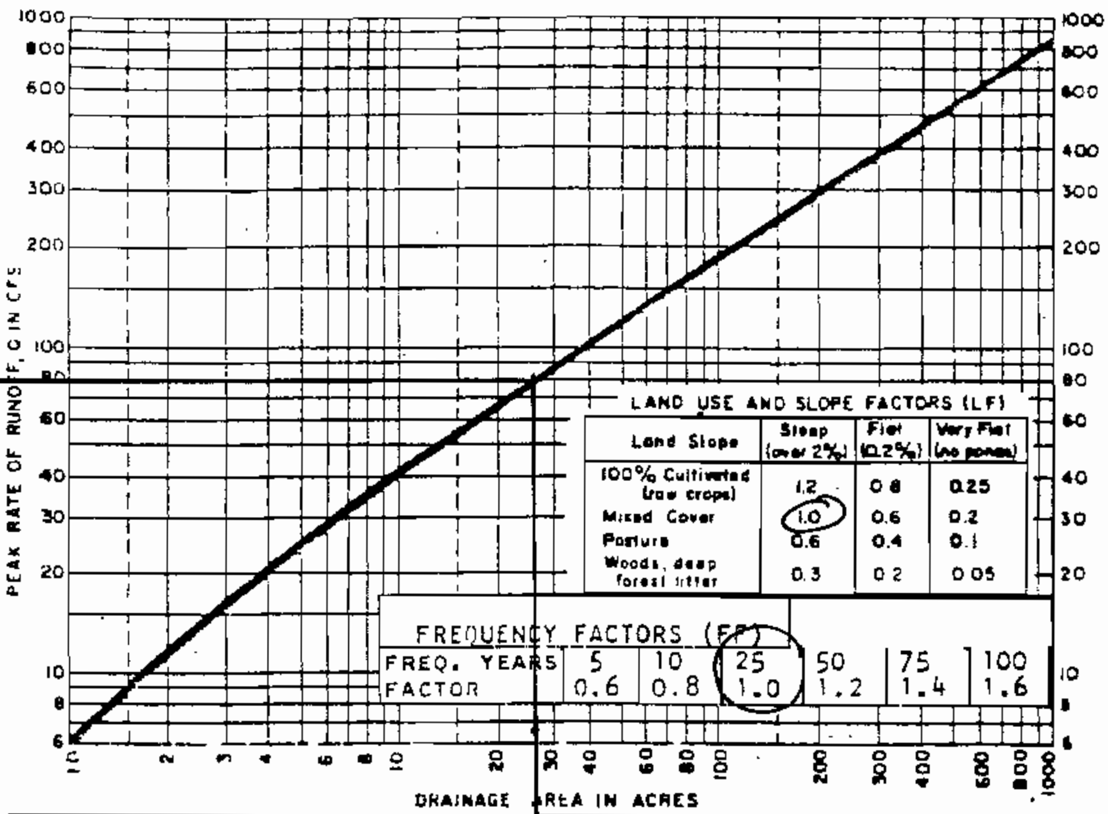
#807-0368
Road "D" Culverts and Ditch Watersheds
Attachment 33.1.A

Scale: 1" = 500'	Page No. 1 of 1

Howard Engineering & Geology, Inc.

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: # 807-0368 Road "D" Culvert Design @ Station 8+40

80



LAND USE AND SLOPE FACTORS (LF)

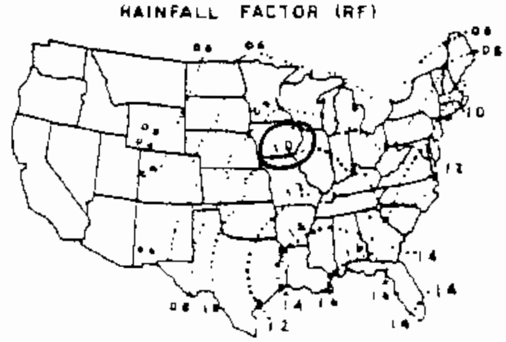
Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

26.82

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 80$

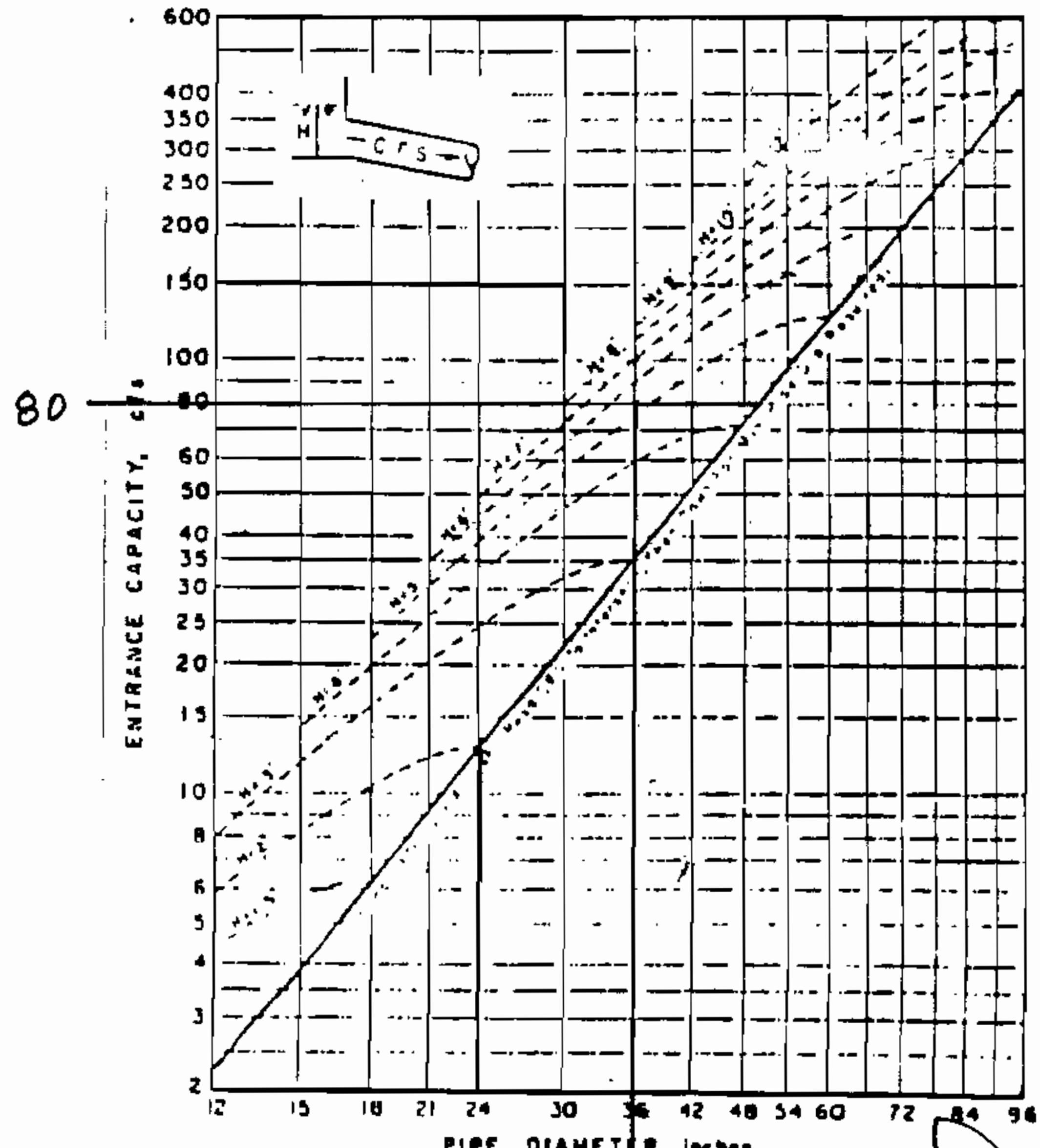
$= 80$

Timothy Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: #807-0369 Road "D" Culvert Design @ Station 8+40

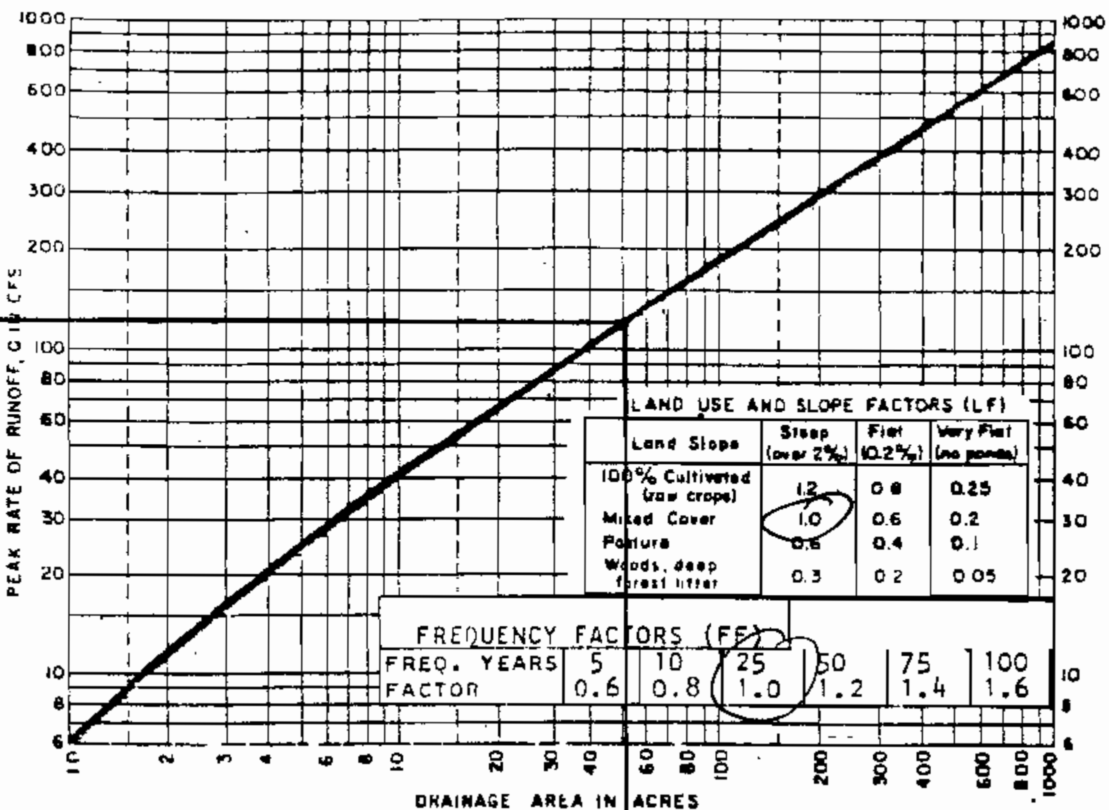


Graph showing pipe culvert capacity

36" Culvert W/5.5' Head
(CMP, Steel or plastic)

STATE OF KENTUCKY
TIMOTHY C. HOWARD 15,317
LICENSED PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: # 807-0368 Road "D" Culvert Design @ Station 16+70



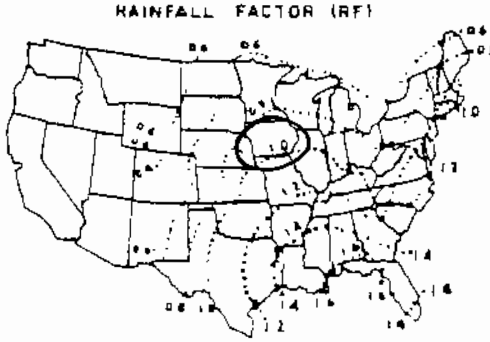
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$Q_{design} = RF \times LF \times FF \times Q$

$= 1.0 \times 1.0 \times 1.0 \times 125$

$= 125$

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

Howard Engineering & Geology, Inc.

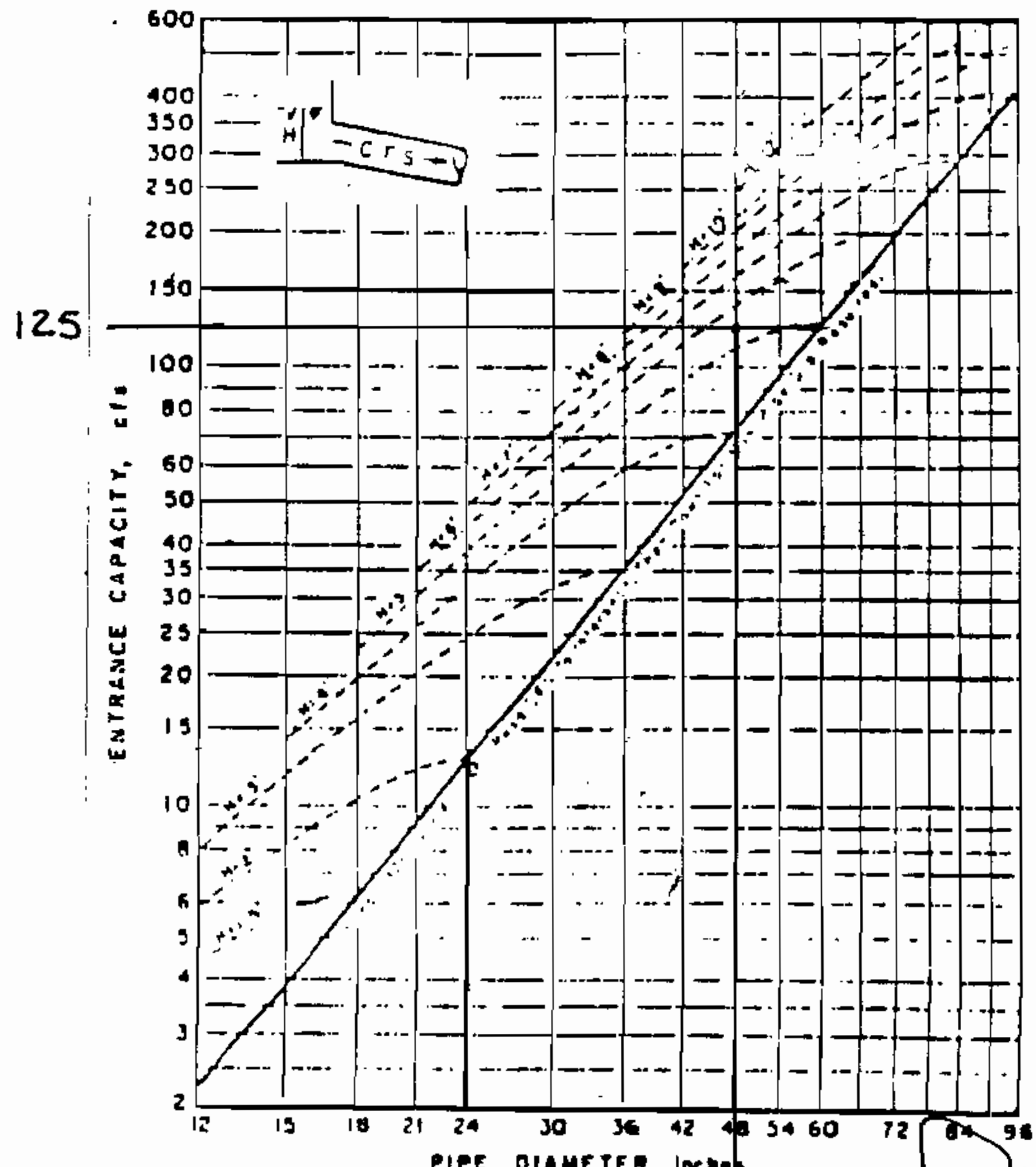
P.O. Box 271
2550 W. Hwy. 72, Suite 1
Harlan, KY 40831

Company Name: Appolo Fuels, Inc.

Project: # 807-0368

Road "D" Culvert Design

@ Station 16+70



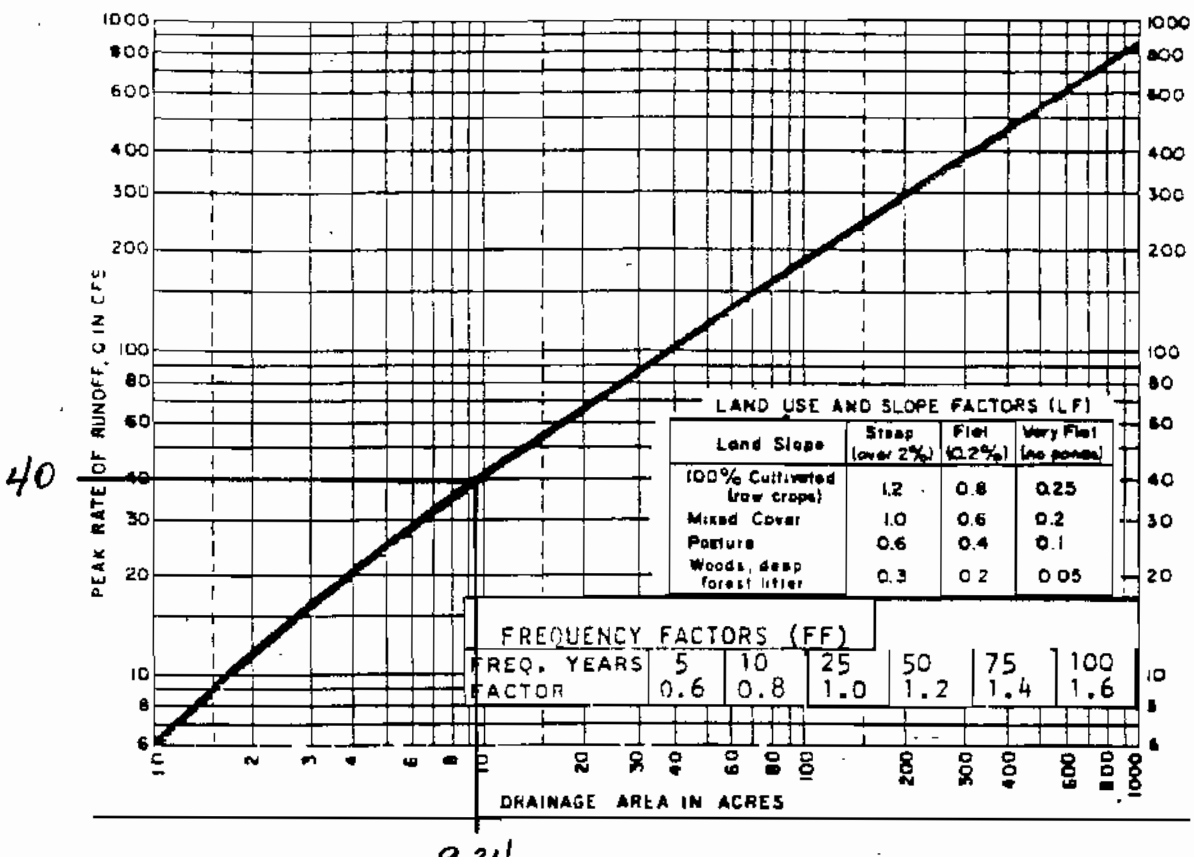
Graph showing pipe culvert capacity

48" culvert W/ 5.5' Head
(CMP, Steel or plastic)

Timothy Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Howard Engineering & Geology, Inc. P.O. Box 271 2550 W. Hwy. 72, Suite 1 Harlan, KY 40831	Company Name: Appolo Fuels, Inc. Project: #807-0368 Road "D" Worst Case Ditch Design



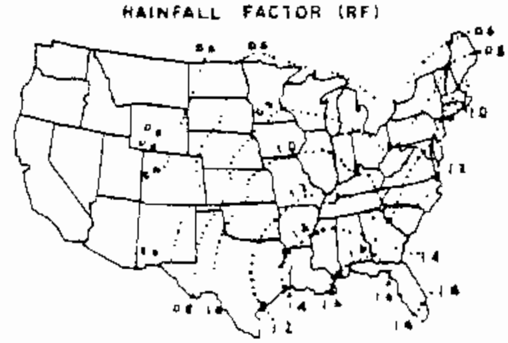
LAND USE AND SLOPE FACTORS (LF)

Land Slope	Steep (over 2%)	Flat (0.2%)	Very Flat (no ponds)
100% Cultivated (row crops)	1.2	0.8	0.25
Mixed Cover	1.0	0.6	0.2
Pasture	0.6	0.4	0.1
Woods, deep forest litter	0.3	0.2	0.05

FREQUENCY FACTORS (FF)

FREQ. YEARS	5	10	25	50	75	100
FACTOR	0.6	0.8	1.0	1.2	1.4	1.6

RAINFALL FACTOR (RF)



FORMULA:

$$Q_{design} = RF \times LF \times FF \times Q$$

Timothy Howard

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

PEAK RUNOFF METHOD FOR
WATERSHEDS UNDER 1,000 ACRES

807-0368 Road D Worst Case Ditch Design
Worksheet for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368road.fm2
Worksheet	907-0368 Road D Worst Case Ditch Design
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	10.00	%
Left Side Slope	0.33	H : V
Right Side Slope	3.00	H : V
Discharge	40.00	cfs

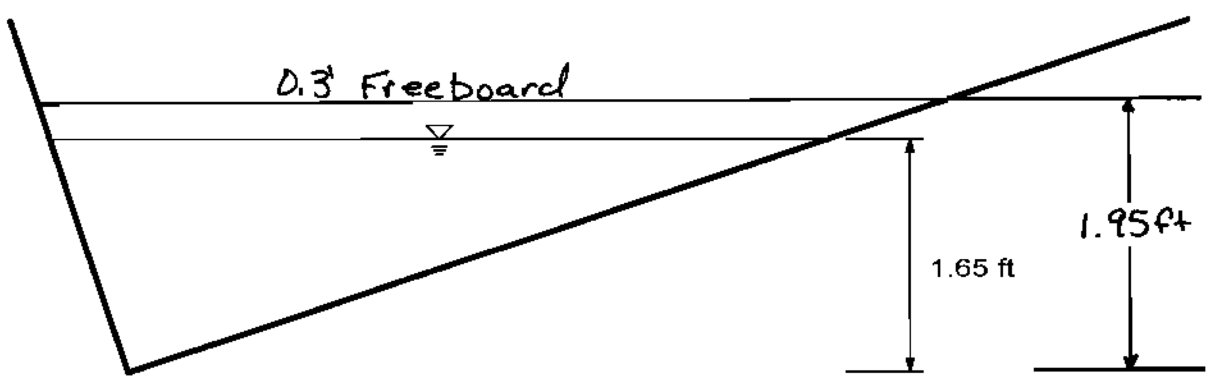
Results		
Depth	1.65	ft
Flow Area	4.53	ft^2
Wetted Perimeter	6.95	ft
Top Width	5.49	ft
Critical Depth	2.05	ft
Critical Slope	0.031684	ft/ft
Velocity	8.83	ft/s
Velocity Head	1.21	ft
Specific Energy	2.86	ft
Froude Number	1.71	
Flow is supercritical.		

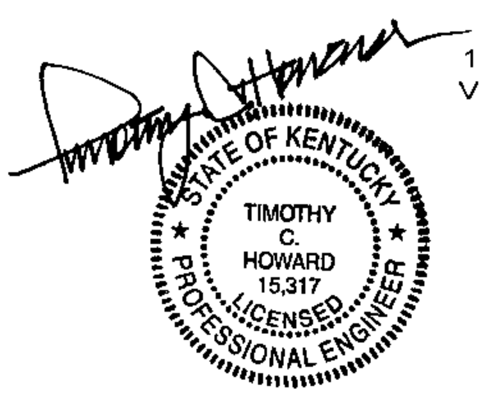
STATE OF KENTUCKY
TIMOTHY
C.
HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

807-0368 Road D Worst Case Ditch Design
Cross Section for Triangular Channel

Project Description	
Project File	c:\program files\flow master - haestead\fmw\0368road.fm2
Worksheet	907-0368 Road D Worst Case Ditch Design
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	10.00	%
Depth	1.65	ft
Left Side Slope	0.33	H : V
Right Side Slope	3.00	H : V
Discharge	40.00	cfs





1
V
H 1
NTS

Appolo Fuels, Inc.
#807-0368

ATTACHMENT 34.1.A

FUGITIVE DUST CONTROL PLAN

Fugitive dust will be controlled during surface mining activities by utilizing the following procedures as they become necessary:

1) Periodic watering of access and haul roads.
2) Prompt removal of coal, rock, soil and other dust forming debris from roads and frequent scraping and compaction of unpaved roads to stabilize the road surface.
3) Revegetating, mulching or otherwise stabilizing the surface or all areas adjoining roads that are sources of fugitive dust.
4) Restricting the travel of vehicles on other than established roads.
5) Minimizing the area of disturbance.
6) Prompt revegetation or other stabilization of disturbed land.

Air Quality Monitoring Stations are not proposed as a part of this application.

35. Subsidence Control

35.1 If this is an application which includes underground or auger mining, provide as "Attachment 35.1.A", the information required to demonstrate compliance with 405 KAR 8:040, Section 26.
See Attachment 35.1.A.

35.2 Does the proposed method of operation include standard room and pillar mining?
[ ] YES [***XX***] NO. If "YES", describe the thickness and engineering properties of clays and soft rock located immediately above and below the coal seam(s) to be mined. If none exists, briefly describe the stratum immediately above and below all coal seams to be mined with this method. Submit description and related information as "Attachment 35.2.A".

35.3 If this application is for a surface mine, indicate if any portion of the proposed permit area have been "undermined". [***XX***] YES [ ] NO. If "YES", provide a map showing the extent of the underground workings and describe the potential affects subsidence may have on structures such as dams, coal waste disposal areas, fills and other such structures. Submit this information as "Attachment 35.3.A".
See Attachment 35.3.A.

36. Applicant/Authorized Agent Signature

36.1 The undersigned, being first duly sworn, states that he/she has read all the information provided in Form MPA-03 Technical Information for a Mining Permit, of this application and has found it to be true and correct. The undersigned further acknowledges that any information provided or omitted herein for the purpose of defrauding or misleading the Natural Resources and Environmental Protection Cabinet may result in criminal charges being instituted pursuant to applicable state laws.

Applicant Company Name ***Appolo Fuels, Inc.***

Name of Applicant or Agent
Whose Signature Appears Below ***Gary Asher***

Signature of Applicant or Agent* Gary Asher

Date of Signature 12-29-08

Subscribed and sworn to before me by ***Gary Asher***

This the 29th Day of December, 20***08***.

Notary Public D. L. Cordell

My Commission Expires 7-13-10 State in which Commissioned Kentucky

*NOTE: If signer is other than president or secretary of a corporation attach a notarized copy of power of attorney, or resolution of board of directors which grants signer the legal authority to represent the applicant in this application. (Does not apply to a single proprietorship or partnership.)

ATTACHMENT 35.1.A

SUBSIDENCE CONTROL PLAN

The surface area overlying the auger mining areas included in this application has been delineated on the Mining and Reclamation Plan Map in this application. A "Subsidence Survey" of this area has been made to determine if there are any structures or renewable resources located on any of these surface areas. The results of this survey are as follows:

1) There are no dwellings, commercial or public buildings, nor other facilities such as pipelines, oil or gas wells, etc., located on the surface area overlying the proposed auger/highwall workings.

2) A reconnaissance was made of the area above the proposed auger workings. During this survey, it was determined that there were no aquifers located above the proposed the proposed auger workings that could be affected by subsidence

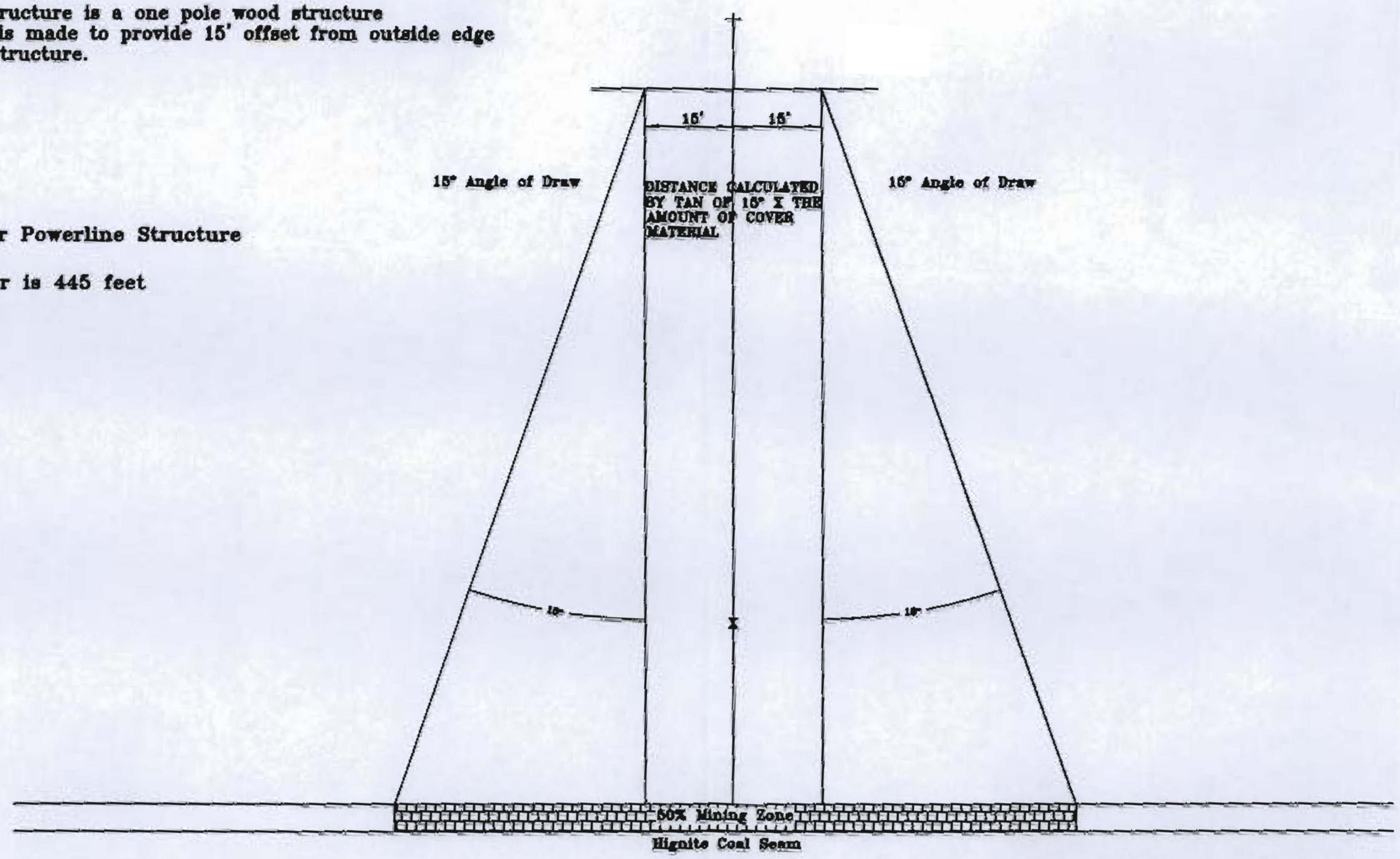
3) The reconnaissance did reveal that there is power transmission line support structures located within the proposed underground auger/highwall mining area. 50% subsidence protection zone calculations have been provided on the following drawings and shown on the MRP/ERI map.

Powerline Structure is a one pole wood structure
Assumption is made to provide 15' offset from outside edge
of support structure.

Calculation for Protection Zone for Powerline Structure

Maximum depth of cover is 445 feet

R = 15 + Xtan15
R = 15 + (445)(0.268)
R = 135 feet



I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

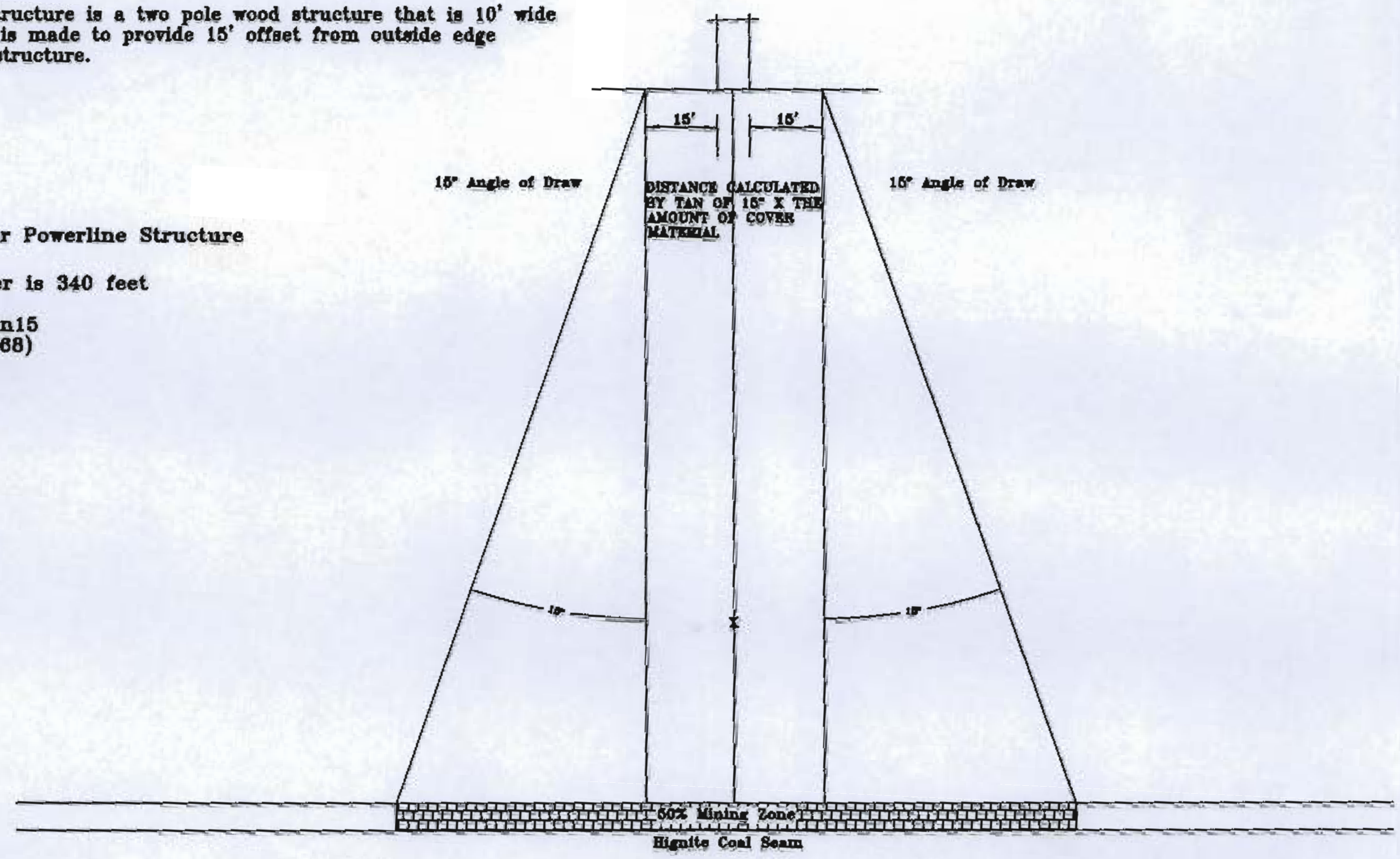
Appolo Fuels, Inc.

#807-0368
Subsidence Angle of Draw Calculation
One (1) Pole Structure
Attachment 35.1.A

Scale: As-Shown	Page No. 1 of 1

Prepared by:
Howard Engineering & Geology, Inc.

Powerline Structure is a two pole wood structure that is 10' wide
Assumption is made to provide 15' offset from outside edge
of support structure.



Calculation for Protection Zone for Powerline Structure

Maximum depth of cover is 340 feet

$R = 0.5(10) + 15 + X\tan 15$
$R = 5 + 15 + (340)(0.268)$
$R = 112$ feet

I, Timothy C. Howard, P.E. No. 15,317

Date: 7/13/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

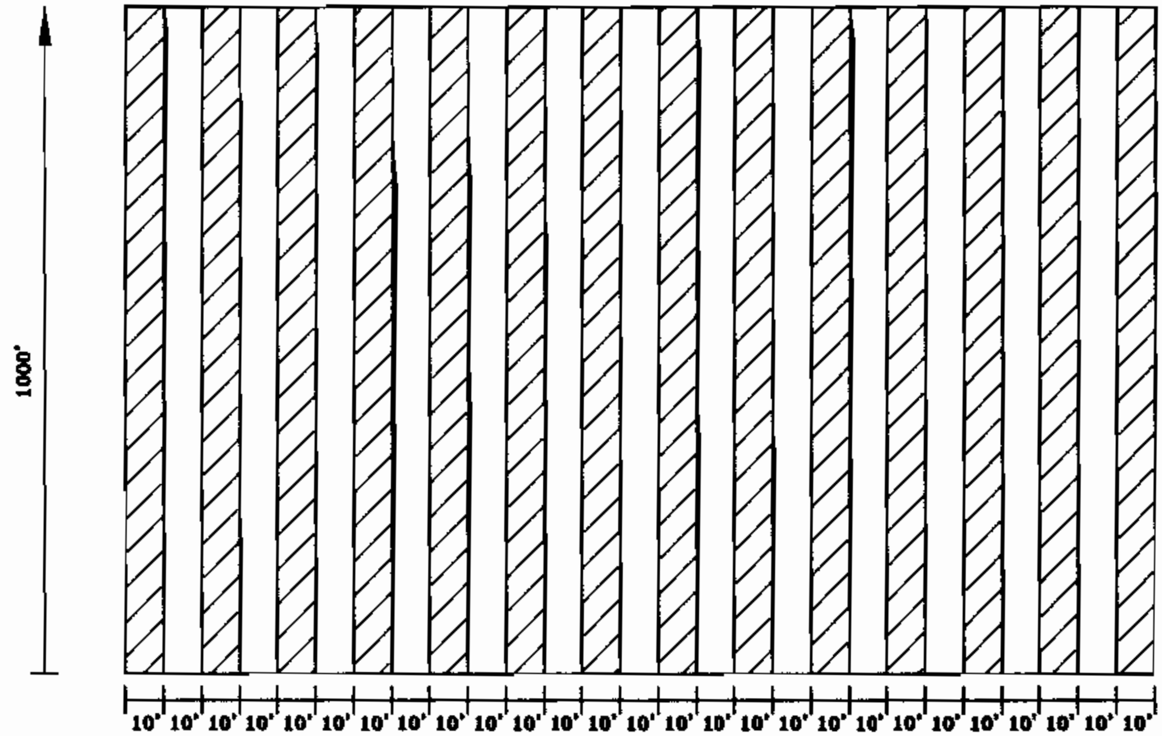
STATE OF KENTUCKY
TIMOTHY C. HOWARD
15,317
LICENSED
PROFESSIONAL ENGINEER

Appolo Fuels, Inc.

#807-0368
Subsidence Angle of Draw Calculation
Two (2) Pole Structure
Attachment 35.1.A

Scale: As-Shown	Page No. 1 of 1

Prepared by
Howard Engineering & Geology, Inc.



50% Extraction Ratio

Web sizes, entry widths, etc. may vary from those depicted due to mining conditions or other circumstances, but will be configured to remain within the 50% extraction limitations.

NOTE:
This design to be used as a **guide** for highwall mining in areas of subsidence protection on this permit. The permitee may choose to design and submit to the local field inspector an alternate protection plan for these areas and this alternate plan will be acceptable provided the plan contains subsidence protection equal to or greater that the plan shown on this drawing **or** will be acceptable if the alternate plan has been approved by the Mine Safety and Health Adminstration and made a part of the permitee's (or approved operator's) Approved Ground Control Plan.

I, Timothy C. Howard, P.E. No. 15,317

Date: 8/11/09

hereby certify in accordance with 405 KAR 7:040, Section10, that this document is correct as determined by accepted engineering practices and includes all information required of it by Chapter 350 and KAR Title 405.

LEGEND:

AREAS COAL REMOVED

COAL LEFT IN PLACE

Appolo Fuels, Inc.

Permit No. 807-0368
Mining Plan in Subsidence Protection Zones
Attachment 35.1.A

Scale: 1" = 50'	**Page No. 1 of 1**

Prepared by:
Howard Engineering & Geology, Inc.

ATTACHMENT 35.3.A

The Buckeye Springs, Poplar Lick, Sterling and Strays seams have been mined beneath and/or adjacent to the proposed permit area. The extent of the underground workings in these seams, adjacent to the proposed permit area, is shown on the Underground Workings Map included in Item 11.4 of this application. Any subsidence from these workings is unlikely to have adverse effects on this proposed mining, due to the age of the workings and the fact that subsidence, if occurred, would be expected to have been completed.

As part of the hollow fill construction, the permittee is proposing to surface mine the Buckeye Springs, Poplar Lick, Sterling, Stray coal seams and any splits or riders associated with these coal beds within the footprint of hollow fill #1. This surface mining within the foot print of the hollow fill will provide open benches along these coal beds that will act as key cuts in the construction of the hollow fill and will thus promote stability.


COMBINATION MINING & RECLAMATION PLAN AND ENVIRONMENTAL RESOURCES MAP
COMPANY: APPOLO FUELS, INC.
ADDRESS: P.O. BOX 1727, MIDDLESBORO, KY 40965
APPLICATION NUMBER: 807-0368 TYPE OF APPLICATION: ORIGINAL
LATITUDE: 36°35'41" LONGITUDE: 83°52'34" MAP SCALE: 1" = 500'
COUNTY: BELL CONTOUR INTERVAL: 20' QUADRANGLE: KAYJAY, FORK RIDGE, EAGAN & FRAKES
NEAREST NAMED STREAM: CLEAR FORK NEAREST PUBLIC ROAD INTERSECTION: 1.56 MILES NORTHEAST OF THE JUNCTION OF KY 74's AND KY 535
MAP LEGEND
OCCUPIED DWELLING
EXISTING STRUCTURE
NON-EXISTING STRUCTURE
WELLS (type indicated)
PROPOSED SURFACE PERMIT
PROPOSED UNDERGROUND PERMIT
EXISTING SURFACE PERMIT
EXISTING UNDERGROUND PERMIT
COAL CROP LINE
ENVIRONMENTAL RESOURCES LEGEND
MINING & RECLAMATION PLAN LEGEND
AREAS AND ACREAGES
ACTIVE/ABANDONED AREA DISCLAIMER
Corrigan TLP LLC
C/O Molpus Woodlands Group LLC (SUR)
WPP LLC (MIN)
Appolo Fuels, Inc. Road "A" Permit #807-7019
SUBSIDENCE PROTECTION ZONE
FCC Tower Crown Castle International Owner
KENTUCKY
TENNESSEE
BELL CO
CLAIBORNE CO
Garmeada
Capito
Fonde
Pruden
Rich Mtn
AML
UF
I, (ENGINEER) 15,317 (REGISTRATION No.) 10/12/09 DATE
HEREBY CONFIRM, IN ACCORDANCE WITH 405 KAR 7:040 E, SECTION 10 THAT THIS MAP IS CORRECT AS DETERMINED BY ACCEPTED ENGINEERING PRACTICES AND INCLUDES ALL INFORMATION REQUIRED OF IT BY KRS CHAPTER 350 KAR TITLE.
STATE OF KENTUCKY TIMOTHY C. HOWARD 15,317 LICENSED PROFESSIONAL ENGINEER
Prepared By
HOWARD
HEG
Engineering and Geology, Inc.