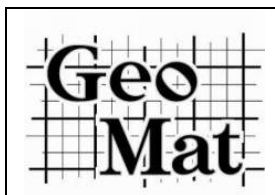


Appendix D – Geotechnical Investigation



GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

July 8, 2020

Project No. 11074-01

TO: Terracina Recovery, LLC
690 East Green Street, Suite 200
Pasadena, CA 91101

ATTENTION: Mr. Mohamad Younes

SUBJECT: Summary and Update of Previous Geotechnical Investigations and Review of Conceptual Grading Plan, Tentative Tract 20320, City of Redlands, California

In accordance with your authorization, GeoMat Testing Laboratories, Inc. has reviewed the provided geotechnical documents, performed additional subsurface exploration at the subject site, and prepared this report. The intent is to accept the responsibility of engineer of record on this project and update the existing geotechnical documents for the site considering the new grading plan.

The accompanying report presents a summary of findings, conclusions, recommendations, and limitation of work for the proposed residential development.

If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Submitted for GeoMat Testing Laboratories, Inc.



Haytham Nabils, GE 2375
Project Engineer



Eirik Haenschke, CEG 1597
Engineering Geologist

Distribution: [1] Addressee

Distribution: (3) Addressee

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
1.1 Scope of Work.....	1
1.2 Existing Site Conditions	1
1.3 Previous Site Use.....	1
1.4 Onsite Structures.....	1
1.5 Proposed Development	1
1.6 Review of Conceptual Grading Plan	2
2.0 SUMMARY OF GEOTECHNICAL CONDITIONS.....	3
2.1 Field Work	3
2.2 Subsurface Findings	4
2.3 Groundwater.....	6
2.4 Laboratory Testing	7
2.5 Seismic Design Parameters	8
3.0 GEOLOGIC FINDINGS.....	9
3.1 Regional and Site Geology	9
3.2 Aerial Photograph Interpretation.....	9
3.3 Secondary Geologic Hazards	10
4.0 CONCLUSIONS.....	13
5.0 RECOMMENDATIONS	14
5.1 Site Preparation.....	14
5.2 Temporary Excavation	18
5.3 Temporary Shoring	19
5.4 Tentative Foundation Recommendations	19
5.5 Static Settlement	19
5.6 Updated Post Tension Foundation Recommendations.....	19
5.7 Concrete Flatwork	21
5.8 Retaining Walls	22
5.9 Suggested Slope Protection and Maintenance.....	23
5.10 Tentative Pavement Design.....	23
5.11 Site Drainage.....	24
5.12 Additional Services.....	24
6.0 GEOTECHNICAL RISK.....	26
7.0 LIMITATION OF INVESTIGATION	26

ATTACHMENTS:

Figure 1	Site Location Map
Figure 2	Regional Geologic Map
Figure 3	Regional Fault Map
Figure 4	Seismic Hazard Zones Map
Plate 1	Geotechnical Site Map
Plate 2	Cut and Fill Grading Plan
Plate 3	Regional Groundwater Map
Plate 4	Surcharge on Retaining Walls
Plate 5	Retaining Wall Drainage Detail

APPENDIX:

Appendix A	References
Appendix B	Geotechnical Boring Logs
Appendix C	Laboratory Test Results
Appendix D	2019 CBC Seismic Design Parameters
Appendix E	Slope Stability Analyses
Appendix F	Slope Maintenance Guidelines
Appendix G	General Earthwork and Grading Specifications

1.0 INTRODUCTION

1.1 Scope of Work

- Review soils, seismic, groundwater data, and maps in our files.
- Review provide grading plan for the residential lots.
- Excavate 12 boreholes at specific location.
- Logging of test hole.
- Sampling of select soils.
- Laboratory testing of select soil samples for classification, direct shear, sulfate, and expansion.
- Prepare 2019 CBC seismic design parameters.
- Preparation of a soil investigation report to include: slope stability analysis, allowable soil bearing value, foundation recommendations, static earth pressure, earthwork recommendations, Site Class, and CBC seismic design parameters.

1.2 Existing Site Conditions

The subject site is located north of and adjacent to the intersection of Reservoir Road and Wabash Avenue in the City of Redlands, California (see Site Location Map, Figure 1). Wabash Avenue divides the site between City of Redlands and San Bernardino County.

Topographically, the site lies within an area of gently sloping terrain. Natural slope gradients range from nearly flat to 2H:1V. Locally, steeper slopes were noted. These slopes may have been associated with previous site use. The total relief at the site is 250 feet.

Drainage across the site is by sheet and rill flow towards the south-southwest into reservoir Road.

1.3 Previous Site Use

Based on a review of previous documents, the area just northwest of the intersection of Reservoir Road and Wabash Avenue may have been utilized for sand and gravel mining. The area has been backfilled. Since no documents are available, this area is designated on the Geotechnical Site Map (Plate 1) as fill area.

1.4 Onsite Structures

Previous documents indicate that at least three buried concrete water pipelines (one is known to be active) traverse the central and west central portion of the property. A gas transmission line is present within the eastern portion of the site (east of Wabash Avenue). Power and telephone lines traverse the site.

1.5 Proposed Development

The residential tract is proposed for 76 single family homes. We anticipate that the proposed structures are to be supported by a combination of isolated square and continuous wall type foundations, and concrete slabs-on-grade. We have not been provided with specific foundation loads. We anticipate however, that continuous wall loads will not exceed 2500 pounds per linear foot and isolated column loads of up to 25 kips.

Based on the provided plan, one detention basin is proposed near Lot 5 of Phase

1.6 Review of Conceptual Grading Plan

We have reviewed the rough grading plans, Plates 1 and 2 prepared by Aguilar Consulting, Inc. dated February 2020 and have summarized the cut and fill proportions per lot in the following table.

LOT NO.	MAX CUT	MAX FILL	LOT NO.	MAX CUT	MAX FILL	LOT NO.	MAX CUT	MAX FILL	LOT NO.	MAX CUT	MAX FILL	LOT NO.	MAX CUT	MAX FILL
1	18	25	16	17	38	31	25	--	46	24	6	61	1	10
2	--	15	17	12	28	32	25	--	47	2	8	62	4	4
3	5	5	18	8	22	33	24	1	48	18	7	63	17	3
4	15	5	19	12	--	34	18	2	49	7	3	64	6	6
5	--	25	20	22	--	35	35	--	50	13	3	65	10	16
6	--	30	21	10	--	36	35	--	51	8	5	66	8	14
7	--	40	22	-7	--	37	17	--	52	11	8	67	37	--
8	--	18	23	20	--	38	8	--	53	5	10			
9	25	4	24	13	10	39	20	13	54	--	14			
10	22	18	25	--	27	40	12	20	55	--	23			
11	--	24	26	--	36	41	--	30	56	--	22			
12	15	30	27	--	37	42	10	20	57	17	15			
13	20	20	28	--	28	43	40	--	58	--	16			
14	15	32	29	23	2	44	28	--	59	--	20			
15	--	25	30	39	14	45	40	--	60	--	16			

All compacted fill slopes programmed for the site should not exceed a gradient steeper than 2:1 (horizontal to vertical) ratio. All cut slopes programmed for the site are similarly anticipated to be 2:1 or shallower.

2.0 SUMMARY OF GEOTECHNICAL CONDITIONS

2.1 Field Work

The geotechnical field work at the subject site has been conducted by Gorian and Associates, Inc. in 2004, LGC in 2005, and by this office in 2017 and into 2018. The resulting exploratory boreholes and trench locations are provided on Plate 1, the Geotechnical Site Map.

2.1.1 Subsurface Work by Gorian and Associates, 2004

Geologic field mapping was conducted by a geologist from Gorian and Associates.

Seventeen boreholes and seven test pits were drilled/excavated at the site. The boreholes were drilled to depths ranging from 21 to 51.5 feet below ground surface utilizing a mobile drill rig equipped with hollow stem augers. The test pits were excavated with a backhoe to depths ranged from 5 to 8 feet below ground surface. Relatively undisturbed samples, SPT samples, and bulk samples were obtained from the subject site.

In addition, seven fault trenches were excavated on hillside and valley areas to depths ranged from 5.5 to 19 feet below ground surface. The total lineal feet of the trenches were 1217 feet. A geologist supervised by an engineering geologist logged these trenches. The excavations were loosely backfilled. These trenches should be located, excavated, backfilled, and compacted to a minimum of 90 percent relative compaction.

Exploratory borehole and trench logs and faults trench logs and cross sections by Gorian and Associates (2004) are presented in Appendix B.

2.1.2 Subsurface Work by LGC, 2005

Subsurface exploration was performed on May 16 and 17, 2005. Seven boreholes were drilled utilizing a mobile drill rig equipped with hollow stem augers. The boreholes were advanced to 26 to 51.5 feet below ground surface. In addition, eight test pits were excavated to depths of 12 to 18 feet below ground surface utilizing a backhoe. Exploratory borehole and trench logs and cross sections by LGC (2005) are presented in Appendix B.

2.1.3 Recent Work by GeoMat, 2017/2018

Nine exploratory borings were made on December 21, 2017 to drill at the site utilizing a CME 85 drill rig equipped with 8- inch diameter augers. The borings were advanced up to 26 to 51.5 feet below ground surface.

Relatively undisturbed samples were obtained with a California Ring Sampler, Test Method D 1587. This sampler has three inches external diameter, 2.5 inches inside diameter, and is lined with one inch high brass rings, with an inside diameter of 2.41-inches. The sample barrel is driven into the ground at the bottom of the boring with 140-pound hammer with a free fall of approximately 30-inches. Sampler driving resistance, expressed as blows per six inches of penetration, is presented on the boring logs at the respective sampling depths. Ring samples were retained in close-fitting, moisture tight canisters for transport to our laboratory for testing

Three additional boreholes were drilled utilizing manual digging and auguring tools. The manual sampling was utilized because the borehole locations were inaccessible to the drilling rig. Sampling was conducted with a Dames and Moore California Ring Sampler. This sampler has three inches external diameter, 2.5 inches inside diameter, and is lined with one inch high brass rings, with an inside diameter of 2.41-inches.

The sample barrel was driven into the ground at the bottom of the excavation with 35-pound hammer with a free fall of approximately 36-inches. Sampler driving resistance, expressed as number of blows for 12-inch of penetration, was recorded. Ring samples were retained in close-fitting, moisture tight canisters for transport to our laboratory for testing. A bulk sample was collected in sealable from the auger cuttings during drilling.

To convert the field blow count to an SPT equivalent, we have utilized the conversion formula by D.M. Burmister, 1948, "The importance and practical use of relative density in soil mechanics: Proceedings of ASTM, v. 48:1249."

$$N_{\text{Corrected}} = N_{\text{raw}} * \frac{(W * H)}{(140) * (30)} * \frac{[(2)^2 - (1.375)^2]}{(D_o)^2 - (D_i)^2}$$

W: hammer weight=35 lb, H: Drop Height=36 in, D_o: Diameter of sample barrel= 3 in, D_i: Diameter of drive sample=2.4 in

The compactness of the material based on SPT blow count is as follows:

Location	Depth (ft)	Field Blow Count (per 12 inches)	SPT (ASTM 1586)	Compactness
B-10	4	75	25	Medium Dense
B-10	6	170	56	Very Dense
B-11	4	60	19	Medium Dense
B-11	6	145	48	Medium Dense
B-12	4	190	63	Very Dense
B-12	6	400	133	Very Dense

Bulk samples were also collected from the auger cuttings during drilling. The sample was collected in plastic bags tied and tagged for the location and depth.

The geotechnical boring logs are presented in Appendix B and may include a description and classification of each stratum, sample locations, blow counts, groundwater conditions encountered during drilling, results from selected types of laboratory tests, and drilling information.

Each boring, unless noted otherwise, was backfilled with cuttings at the completion of the logging and sampling. The backfill, however, may settle with time, and it is the responsibility of owner to ensure that such settlement does not become a liability.

2.2 Subsurface Findings

2.2.1 Gorian and Associates, 2004

2.2.1.1 Bedrock

Gneiss bedrock underlies the site at depth. The only location onsite where bedrock is exposed and mapped was the northwestern intersection of Reservoir Road and Wabash Avenue. Bedrock was encountered between 24 and 46.5 feet below ground surface in boreholes B7, B9 to B11. As encountered in the boreholes, the bedrock generally ranged in color from light yellowish brown to light olive brown.

Typically, the bedrock is weathered, fractured and locally friable becoming more indurated with depth. Based on field mapping, the bedrock is foliated with foliations generally inclined in a southerly direction at a moderate angle 30 degrees. Based on review of geologic maps (Matti et al, 2003) the foliation in the area of the subject site are inclined in a southerly direction at moderate to high angles of 40 to 75 degrees.

2.2.1.2 Older Alluvium

Quaternary age older alluvium was encountered in all of the boreholes except B7, B10, and B12. The older alluvium generally consists of light olive brown to yellowish brown, silty to clean, fine to coarse sand with common gravel, cobbles, and few boulders in a damp to moist and dense to very dense condition. Structurally, the older alluvium is generally horizontally to sub horizontally stratified.

Locally, older alluvium caps level ridges, and generally consists of reddish brown sandy clay in damp and hard condition. This was encountered in B1 and B2 with thickness ranged from 4.5 to 8.5 feet. The older alluvium deposits appears to have been mined.

2.2.1.3 Older Colluvium (Qoc)

Localized deposits, generally reddish brown clayey fine to coarse sand with few gravels and cobbles in a damp to moist and medium dense condition.

2.2.1.4 Recent Alluvium (Qal)

Encountered in all of the borings except B1, B2, and B9. The alluvium varies in thickness from 7.5 to 46.5 feet mantling older alluvium or bedrock. It consist of yellowish brown to dark yellowish brown silty to clayey fine to coarse sand with some gravel in a damp to moist and loose to medium dense condition. These soils are porous in the upper profile and become less porous with depth. Removal of this material is recommended during grading.

2.2.1.5 Solum/Top Soil

Topsoil mantles most of the site and generally consists of brown very silty fine to coarse sand with some gravel in a damp to moist and loose condition. Top soil is friable and porous. Contacts with the underlying units are gradual over 1 to 6 inches.

2.2.1.6 Artificial Fill

Encountered in borings B13, B14, B16, and B17. The depth of fill was noted about 5 feet in thickness and possibly more. Consists of brown, silty fine to coarse sand with gravel and cobbles, in moist and loose condition. Fill is also associated with the onsite water line construction. Another area of artificial fill is associated with existing level pads on the northeast portion of the site.

2.2.2 LGC, 2005

2.2.2.1 Artificial Fill (afu)

Undocumented artificial fill was encountered on the central eastern portion of the site. The fill is classified as olive gray silty sand with abundant gravel and cobbles.

2.2.2.2 Quaternary Wash (Qw)

These deposits were encountered to 40 feet below the ground surface. The deposits are classified as alluvial, yellow brown to medium brown sand to silty sand, with occasional clayey sand.

2.2.2.3 Very Old Alluvium (Qvoa)

Encountered on higher elevations and below Quaternary wash to maximum depth of 50 feet. It is classified as yellow to reddish brown, fine to coarse grained silty sand, fine to sandy clay.

2.2.2.4 Mesozoic Foliated Granitoid Rocks (mzfg)

Generally schist and gneiss bedrock underlies the southeast corner of site. Foliation generally trends to the northeast with dips ranging from 30 to 75 degrees to the south.

2.2.3 GeoMat 2017/2018

Subsurface exploration by GeoMat (2017/2018) consisted of 12 borings at the locations indicated on Plate 1. Borings at lower elevations encountered alluvial wash deposits (Qw) to depths ranging from 3 to 22+ feet. Very Old Alluvium (Qvoa) was encountered beneath the Qw in borings B-1,2,4, and 9. Qvoa was encountered near the surface in borings at higher elevations (B-10,11 and 12).

2.3 Groundwater

2.3.1 Gorian and Associates, 2004

No groundwater was encountered to the total explored depth of 51 feet (B3, B4, and B17) below ground surface. Depth to groundwater within the vicinity of the subject property is reported to be deeper than 300 feet below existing ground surface (Dawson, 2003).

2.3.2 LGC, 2005

Groundwater was not encountered to the maximum depth explored, approximately 51.5 feet. However, a seep was observed adjacent to B1. It appears the seep may possibly be related to a leak in the water main at that location.

2.3.3 GeoMat

Groundwater study is not within the scope of this work. Groundwater was not encountered in our exploratory boreholes nor encountered in exploratory boreholes during previous soil investigations by Gorian in 2004 and LGC in 2005. Depth to groundwater is not expected to impact site grading.

Highest historical groundwater records were researched utilizing the State of California, Department of Water Resources, Steve Mains' Cooperative Well Measuring Program, USGS Groundwater Watch, and USGS National Water Information System. No groundwater wells were found onsite or near the site vicinity.

A contour map showing minimum depths to ground water in the Santa Ana River Valley Region was constructed by the United States Geological Survey (USGS) and subsequently, a report (USGS Map MF-1802) was published in 1985. The map was constructed by contouring the shallowest water level measurements reported to the California Department of Water Resources (CDWR) for the period from 1973-1979. Based on our review of the map, the minimum depth to ground water in the project site area, during this period, was indicated to be at depths greater than 150 feet below ground surface.

CDMG Special Report 113 (Fife, 1974) for Southwestern San Bernardino, shows depth to groundwater contour in the general area of the site, in 1960, to be at about 300 feet.

Based on the USGS, Bulletin 1898, Liquefaction Susceptibility in San Bernardino Valley and Vicinity, Plate 3, groundwater contours in the site area range from 100 to 150 feet between 1973 and 1983.

Please note that the potential for rain or irrigation water locally seeping from elevated areas and showing up near lower grades cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. Fluctuations in perched water elevations are likely to occur in the future due to variations in precipitation, temperature, consumptive uses, and other factors including mounding of perched water over bedrock.

2.4 Laboratory Testing

2.4.1 LGC (2005)

Summary of laboratory test results by LGC (2005) is presented in Appendix C.

2.4.2 Gorian (2004)

Strain controlled direct shear testing was conducted by Gorian and Associates, Inc. during their site investigation. The following table summarizes the design values obtained from the laboratory testing.

Sample	Soil Type (USCS)	Internal Angle of Friction (degrees)	Cohesion (psf)
B-1 @ 10'	SM	43	0
B-2 @ 3'	CL	31	311
B-2 @ 10'	SM	39	147
B-3 @ 15'	SM	19	1581
B-5 @ 23'	SM	38	230
B-6 @ 8'	SM	34	558
B-8 @ 18'	SM	36	419
B-15 @ 5'	SP	36	50
B-15 @ 10'	SP	36	60
B-15 @ 15'	SM	38	230
B-17 @ 5'	ML	36	85
*B-11 @ 5'	SM	34	110

*Sample was remolded to 90% of the maximum dry density

Other laboratory test results is presented in Appendix C.

2.4.3 GeoMat, 2017/2018

Laboratory testing was conducted by Gorian in 2004 that included in-situ moisture/density, shear strength, consolidation, expansion index, and maximum density/optimum moisture. Laboratory testing was also conducted by LGC in 2005 that included Maximum dry density/optimum moisture content, expansion potential, sieve analysis, shear strength, sieve analysis, shear strength, R-value, collapse, sulfate content, and insitu density/moisture content.

Laboratory tests were performed also by GeoMat on selected soil samples. The tests consisted primarily of in place densities, moisture content, maximum density/optimum moisture, and classification. The soil classifications are in conformance with the Unified Soil Classifications System (USCS), as outlined in the Classification and Symbols Chart (Appendix B).

A summary of our laboratory testing, ASTM designation, and graphical presentation of test results is presented in Appendix C. Appendix C also includes laboratory test results by Gorian (2004) and LGC (2005).

2.5 Seismic Design Parameters

2.5.1 Site Class

It is our opinion that structures should be designed in accordance with the current seismic building code as determined by the structural engineer. Considering the Spectral Response Acceleration at short period $S_{DS} > 0.50g$ (CBC Table 1613.5.6(1), and the Spectral Response Acceleration at one second period $S_{D1} > 0.20g$ (CBC Table 1613.5.6(2), the subject site is located in an estimated Site Class "D" as outlined in CBC Table 1613.5.2.

2.5.2 2019 CBC Parameters

The peak ground acceleration (PGA) and 2019 CBC seismic design parameters are presented in Appendix D.

2.5.3 Seismic Design Category

The seismic design category for the residential development is "E"; refer to Appendix D.

3.0 GEOLOGIC FINDINGS

3.1 Regional and Site Geology

3.1.1 Gorian and Associates

The site is underlain by bedrock of the Precambrian age to Mesozoic age foliated granitoid rock (gneiss), extensively mantled with middle to early Pleistocene age very old axial valley deposits (Qvoal), latest Holocene age (Qal) very young wash deposits, older colluvium (Qoc), solum/topsoil and artificial fill.

3.2 Aerial Photograph Interpretation

3.2.1 Gorian (2005)

The following set of aerial photographs were listed as reviewed by Gorian and Associates report dated December 27, 2004 at San Bernardino County Flood Control District.

DATE	FLIGHT NUMBER	FRAMES	SCALE
7-4-1938	AXL-61	52-53	1:2000, black and white print
1938	W-79	5-3, n-1-3	1:1000, black and white print
11-23-1955	F-35	10-11, 10-12	1:1200, black and white print
2-1-1969	C-293	96-97	1:2000, black and white print
2-27-1969	C-295	81, 101	1:2000, black and white print
2-7-1970	C-297	23, 39	1:2000, black and white print
10-30-1972	C-194	58, 76-77	1:2000, black and white print
2-16-1978	C-279	42-43	1:2000, black and white print
2-25-1986	C-450	45-46	1:2000, black and white print
7-1-1991	C-487	62-63	1:2000, black and white print
4-21-1996	C-528	84-85	1:2000, black and white print
6-15-2001	C-541	96-97	1:2000, black and white print

3.2.2 LGC 2005

The following set of aerial photographs were listed as reviewed by LGC in their report dated May 25, 2005.

DATE	FLIGHT NUMBER	SCALE
February 1, 1969	C-293, frames 96 and 97	1"=2.000'
February 27, 1970	C-297, frames 23 and 39	1"=2.000'
October 30, 1972	C-194, frames 58, 76, and 77	1"=2.000'
February 16, 1978	C-279, frames 23 and 39	1"=2.000'
February 25, 1986	C-450, frames 46 and 47	1"=2.000'
July 1, 1991	C-487, frames 62 and 63	1"=2.000'
April 21, 1996	C-528, frames 85 and 86	1"=2.000'
June 15, 2001	C-541, frames 96 and 97	1"=2.000'

No geomorphic lineaments were interpreted to project through the site other than the main splay and secondary splay of Reservoir Canyon Fault. Geomorphic evidence of active faulting was not observed on the site.

3.3 Secondary Geologic Hazards

3.3.1 Faulting

3.3.1.1 Gorian and Associates (2004)

Faults identified by the State of California as active or potentially active are not present onsite. However, the Reservoir Canyon Fault, a normal fault, is shown on the City of Redlands planning maps to be running in a northeast-southwest direction within the southwest to north-central portion of the site (see Plate 1). A geologic map by Matti, et al, (2003), shows the fault traversing through the project site, albeit in slightly different locations. An earlier geologic map by Dibblee (1974) shows an unnamed fault running through the western most drainage of the property; one drainage west of the location shown on present maps.

Reservoir Canyon Fault has been designated as potentially active by the City of Redlands; this fault however, is not designated as a Fault Hazard Study Zone by the California Geologic Survey. Because the City of Redlands designated the fault as a potential geologic hazard, a fault investigation was performed.

In 2003, a 150 feet exploratory trench was excavated to a depth ranged from 15 to 17 feet. The trench was excavated to evaluate the presence of the unnamed fault (presumably Reservoir Canyon Fault). The trench was geologically logged, and no evidence of faulting such as offset or warped beds were present within the excavation. In addition to the trenching, borings B3 through B5 were excavated on either side of the postulated fault trace and no abrupt changes in soil horizons or other evidence suggestive of faulting were noted.

A second fault investigation was made as requested by the County Geologist. The second fault investigation included the excavation of six additional trenches totaling 1217 linear feet to depths ranging from 10 to 19 feet. Two strands of Reservoir Canyon Fault (approximately 17 to 20 feet apart) were found in trenches located on the northwest facing hillside of the central ridge spur within the site. These strands trend through the site on a bearing ranging from N54E to N77E and exhibited normal displacements of 1.5 to 3 feet (refer to Gorian Report of 12/27/04). However, other faulted older alluvium units exhibited offset. That could not be measured. This undetermined offset suggests that the total displacement is much larger. The dip of the fault strands were observed, ranged from 60° to 74° to the northwest.

A secondary fault is shown on Matti et al map traversing parallel along the western most drainage within the project (same drainage that Dibblee (1974) showed the unnamed fault traversing). Two trenches were excavated to a maximum depth of 19 feet below the floor of the drainage. The deep trench bottomed out in older alluvium soils and a continuous contact between Holocene and Pleistocene soils was exposed. No faulting was present.

Age assessment of the last fault displacement was attempted. It was estimated by visual observation that the soil lying unbroken over the fault splays were approximately 20 to 30 thousand years old. This indicates that the fault is not considered active. The older alluvium within the site have been estimated to be approximately 500 thousand years old. This age indicates that the last fault rupture occurred between 20K and 500K years ago. The geomorphology in the vicinity of the fault is not suggestive of recent faulting and appears to be much older than 20 to 30K years old. Based on a review of aerial photographs of the subject site and surrounding area, no geomorphic evidence of active faulting was observed.

3.3.2 Liquefaction

3.3.2.1 Gorian, 2004

Groundwater is not present in the upper 50 feet and therefore the soils within the subject site are not considered susceptible to liquefaction.

3.3.2.2 LGC, 2005

Based on the subsurface exploration, secondary effects of seismic activity such as ground failure including land sliding, ground lurching, shallow ground rupture, and liquefaction are considered unlikely.

Liquefaction analysis was conducted utilizing data from an exploratory borehole and assuming 50 feet depth to water. The analysis indicated no potentially liquefiable soil onsite.

3.3.2.3 GeoMat 2017/2018

Based on the City of Redlands General Plan Safety Element (Figure 7-6) and the San Bernardino County General Plan Geologic Hazard Overlay (Sheet FH31C), the site is not located within an area considered to be susceptible to liquefaction.

3.3.3 Landslides

3.3.3.1 Gorian and Associates, 2004

No landslides are present within or near the site nor are any shown on regional geologic maps. Erosion gullies were observed on the west-facing slope in the southwest corner of the site. Based on aerial photo review, it appears that this erosion was associated with water line rupture in 1930.

3.3.3.2 LGC, 2005

No landslide debris was noted and no ancient landslides are known to exist onsite.

3.3.3.3 GeoMat, 2017/2018

Based on the City of Redlands General Plan, the site is located in an area with potential landsliding. However, based on field mapping and previous work by Gorian and Associates (2004) and LGC (2005), no landslide debris was noted and no ancient landslides are known to exist at the site.

Site reconnaissance performed by GeoMat in the course of our recent, additional subsurface exploration revealed no indications of landslides or other deep-seated slope stability issues at the site. Areas of potential surface erosion and rilling, etc. may be averted by implementation of proper, engineered surface drainage measures in the course of site development.

3.3.4 Tsunami and Seiche

Seismically induced flooding from seiche and tsunami is non-existent because the property is inland and no enclosed bodies of water lie adjacent to the site.

3.3.5 Slope Stability

3.3.5.1 Gorian, 2004

Gross and surficial stability calculation for cut and fill slopes up to 65 feet in height shows the following safety factors:

Soil Type	Cohesion (psf)	Phi	Safety Factor
Old Alluvium	200	36	1.93 Static
	230	41.4	1.69 Seismic
Fill	100	34	1.64
Surficial Stability	200	36	1.73

3.3.5.2 GeoMat 2017/2018

Global stability analysis was performed to evaluate the probable static and dynamic gross stability of the maximum proposed slope configuration as shown in the following table. The analysis projects the slope's general inclination at a maximum gradient of 2H:1V.

Grading	Slope Height (ft)	Location	Material
Cut Slope	70	Lots 20 through 23	Qvoa
Fill Slope	60	Between Lots 16 & 19	Qvoa / Qw

The analysis utilizes the simplified method of slices by Bishop. The shear strength parameters used in the software analysis were obtained from the referenced report by Gorian and Associates (2004).

The results of the stability analysis for homogenous slope material is presented in Appendix E. The results indicated that the slope configuration will be adequate with a safety factor of over 1.5 in static condition and 1.1 in dynamic condition. Summary of the analysis is as follows:

Soil Type	Cohesion (psf)	Phi	Static SF	Seismic SF
Old Alluvium	200	36	2.04	1.90
Fill	100	34	1.64	1.39

Drainage control measures recommended in this report and by the project civil engineer should be implemented during site development.

Considering the shear strength of native soil and the slope inclination, seasonal local surficial sloughing cannot be entirely precluded and should be considered by the project design team. Permanent devices should be designed by the project civil engineer such as but not limited to wall free board, "V" ditches, benches, etc., to minimize and contain any remote pop-outs.

In addition, to minimize the potential for surficial sloughing the slope should be maintained with appropriate deep root vegetation and ground cover. As a minimum the slope maintenance guidelines presented in Appendix F should be followed.

4.0 CONCLUSIONS

- Reservoir Can fault has not moved within the last 20K years and is not considered active. Fault trenches should be located, excavated, and backfilled in a controller manner.
- Based on a review of aerial photographs of the subject site and surrounding area, no geomorphic evidence of active faulting was observed.
- The site is located in a region of generally high seismicity, as is all of southern California. During its design life, the site is expected to experience strong ground motions from earthquakes on regional and/or local causative faults. Therefore, typical structural design mitigations should be considered by the structural engineer.
- Based on City of Redlands and County of San Bernardino General Plan, the site is not located in an area considered to be susceptible to liquefaction. Liquefaction analysis performed by Gorian (2004) showed no liquefiable soil layers at the site and no groundwater was encountered at the site in any boreholes drilled to a depth of 51.5 feet. Therefore, the potential for liquefaction to occur onsite is unlikely.
- The use of conventional and post tension foundation is considered feasible for the proposed development.
- Onsite soil is expected to be very low to low in expansion potential. This should be verified following rough grading.
- Potential for rain or irrigation water moving through from onsite or adjacent and elevated areas cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site excavation, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. Since groundwater may fluctuate throughout the year, we recommend the contractor verify groundwater conditions and evaluate dewatering requirements prior and during to construction.
- Based on the results of our geotechnical investigation of the site, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided the following recommendations are incorporated into the project plans and specifications.

5.0 RECOMMENDATIONS

5.1 Site Preparation

All grading should be performed in accordance with our General Earthwork and Grading Specifications presented in Appendix G.

Fill, debris, abandoned utility lines, irrigation appurtenances, underground structures, deleterious materials, etc., should be removed and hauled offsite. Cavities created during site clearance should be backfilled in a controlled manner.

5.1.1 Anticipated Overexcavations in Quaternary Wash Material

The subsurface conditions of the site were evaluated through the geotechnical borehole logs and trenches conducted by Gorian (2003), LGC (2005), and GeoMat (2017). The following table summarizes the anticipated overexcavation depths at the following locations onsite. Refer to Plate 1 for overexcavation Areas 1 through 9.

Anticipated Overexcavation Depths Onsite									
Area	1	2	3	4	5	6	7	8	9
Overexcavation Depth (ft)	6	6	10	6	6	8	10	6	12

The overexcavation depths were determined from the subsurface characteristics including soil type, dry densities, and field SPT blow-counts, see Appendix B for tables of in-situ dry densities that were encountered in the subsurface explorations by the three consultants. This overexcavation may be extended deeper if loose or unsuitable soil is encountered in the bottom of the overexcavation, as determined during grading.

After any overexcavation, the exposed surfaces should be observed and then scarified to a depth of at least 12-inches, moisture conditioned as necessary and recompactd to at least 90 percent of the maximum dry density, as determined by ASTM D1557 Test Method; prior to placement of fill.

5.1.2 Anticipated Overexcavation in Older Alluvium

Areas to receive fill should be overexcavated to a depth of at least three feet below existing ground surface. Areas proposed for cut grading deeper than three feet may be scarified in place, after reaching pad grade, to provide at least 12 inches of compacted uniform surface at grade. Areas proposed for less than 3 feet of cut grading should be overexcavated until at least three feet of cut grading is accomplished. All overexcavations may be extended deeper if loose soil is encountered in the bottom of the overexcavation.

5.1.3 Cut to Fill Transition Grading

To mitigate distress to structure related to the potential adverse affects of excessive differential settlement, cur/fill transitions should be eliminated from all building areas where the depth of fill placed within the "fill" portion exceeds proposed footing depths. The entire structure should be founded on a uniform bearing material. This should be accomplished by over excavating the "cut" portion and replacing the excavated materials as properly compacted fill. Recommended depths of over excavation are provided in the following table:

Depth of Fill (Fill Portion)	Depth of Overexcavation (Cut Portion)
Up to 5 feet	Equal depth
5 to 10 feet	5 feet
Greater than 10 feet	Half the thickness of placed fill on the fill portion (10 feet maximum)

Over excavation of the “cut” portion should extend beyond the perimeter building lines a horizontal distance equal to the depth of over excavation or to a minimum distance of 5 feet whichever is greater.

5.1.4 Wabash Street Extension

Portion of the street located in older alluvium should be provided with at least 24 inches of compacted fill.

5.1.5 Oversize Material

Oversize rock is expected to be encountered during grading, especially in old fills and areas with granitoid rocks. Therefore, oversized rock (i.e. rock exceeding a maximum dimension of 12 inches) if encountered will require special handling, such as offsite disposal or stockpiled onsite and crushed for future use. The disposal of oversized rock is discussed in General Earthwork and Grading Specifications Appendix G. Onsite rock burial should be surveyed for line and grade and recorded on as-built plans.

5.1.6 Subdrains

If water seepage or saturated condition is encountered, subdrains should be placed in natural drainage areas that will receive engineered compacted fill exceeding 10 feet in thickness. A typical subdrain detail is attached in Appendix G. The subdrains should be located at least 10 feet below the finished grade and should consist of a minimum 6-inch diameter perforated PVC (Schedule 40) pipe, or equivalent (such as corrugated slotted pipe). Where the length exceeds 500 feet, an 8-inch diameter perforated pipe should be used. Where two or more 8-inch pipes coverage into a main trunk pipe, or more than three 6-inch tributary pipes outlet into a main trunk pipe, the main pipe should consist of a 10-inch diameter perforated pipe. Perforations should be no more than ¼ inch diameter.

The subdrains should be encased in 9 cubic feet of drain material per lineal foot of pipe installed in trench or “V” cut made into firm native soils exposed in the canyon cleanouts or along the heel of a bench in the perimeter drain case. The canyon cleanouts may expose a variety of soils ranging from granular to fine grained with mixtures of both. All cleanouts should be to firm native soils and should be observed by the project geotechnical consultant.

It is recommended that the drain material consists of ¾ to 1-inch gravel or equivalent wrapped with filter cloth (such as Supac 4NP or Mirafi 140S or equivalent). Drain pipe wrapped in filter cloth and encased in drain material may be considered an alternative to the above recommended design. Drain material encasing a filter cloth wrapped pipe should consist of No. 4 rock and sand at a 1:1 ratio. Alternates or material equivalents must be approved by the project geotechnical consultant.

The subdrain locations and installation should be verified in the field by the project engineering geologist. As soon as possible after grading is completed around the subdrain outlet, the outlet must be located, protected from future damage and covered with a galvanized screen clamped in place. Subdrain outlets should be established by survey to aid in relocation. To protect the outlet, as a minimum, it should be extended 1 foot past the slope face and marked with a steel post and/or encased in concrete.

5.1.7 Keying and Benching

All fills placed on ground sloping steeper than 5H:1V should be keyed and benched (horizontal benches) into firm competent in-place soil (after all required removals are made). All keyways should be a minimum of 15 feet wide and cut a minimum depth of 2 feet at the toe into firm competent in-place soils. Keyways should be tilted into the slope and should be at least 3 feet deep at the heel (measured from below the slope toe elevation). Horizontal benches should be a minimum of 5 feet wide, i.e. a minimum 5 feet of competent material. The vertical portion of the bench in competent soils should not exceed 5 feet. A representative of this office should observe the keyways and benching.

5.1.8 Cut Slopes

Cut slopes will likely expose older alluvium. A geologist from this office should observe all cut slopes and/or retaining wall back cuts to verify favorable geologic conditions.

5.1.9 Foundation Setback

Footings on or near the top of descending slopes should be deepened or setback to provide footing support and to reduce the impact of changes that can occur on slope faces. Changes to the slope, such as erosion, slumping, overwatering and expansive soil action can affect the support of footings on or near descending slopes. Therefore, deepened footings or setbacks should be used for all buildings and accessory structures including walls or fences that are sensitive to differential movement. Setbacks are also necessary for buildings adjacent to ascending slopes. The minimum setbacks should be per California Building Code. We recommend that the minimum setback for a footing located on or near a descending slope should be 5 horizontal feet measured from the bottom outside edge of the footing to the slope face.

5.1.10 Compacted Fill/Imported Soil

Any soil to be placed as fill, whether presently onsite or import, should be approved by the soil engineer or his representative prior to their placement. All onsite soils to be used as fill should be cleansed of any roots, or other deleterious materials.

All fills should be placed in 6- to -8 inch loose lifts, thoroughly watered, or aerated to near optimum moisture content, mixed and compacted to at least 90 percent relative compaction. This is relative to the maximum dry density determined by ASTM D1557 Test Method.

Any imported soils should be sandy (preferably USCS "SM" or "SW", and very low in expansion potential) and approved by the soil engineer. The soil engineer or his representative should observe the placement of all fill and take sufficient tests to verify the moisture content and the uniformity and degree of compaction obtained.

5.1.11 Deep Fill Settlement Monitoring

Fills over 30 feet thick will require the placement of settlement monuments. Monuments will be required at the base and surface of the fills in order to monitor post construction settlement of alluvial soils and consolidation of fill materials.

Surface monuments may consist of 5 (±) foot lengths of 1-inch diameter pipe driven into the ground and furnished with suitable, well defined measuring point. Locations of the settlement monuments will be determined when detailed grading plans are available.

Elevation readings of survey monuments should be made weekly for the first four (4) weeks, bi-weekly for eight (8) weeks, and then monthly until observed settlement has reached tolerable limits. Construction timing in areas of this fill will be evaluated on a continuing basis, as survey data becomes available.

5.1.12 Shrinkage and Subsidence

Based on laboratory test results, we estimate that shrinkage of soils onsite should be approximately 7 (±2) percent. Shrinkage is defined as the decrease in volume of soil upon removal and re-compaction expressed as a percentage of the in-place volume. The following table summarizes the calculated shrinkage values used in determining the total estimated amount.

Description	Boreholes											
	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10	B-11	B-12
Average In-Situ Density (pcf)	111.6	113.2	107.9	121.0	110.7	109.1	111.4	113.9	118.5	119.8	122.3	120.4
Average Max. Density (pcf)	132.0	132.8	135.5	135.0	135.5	134.0	133.5	132.0	135.0	133.9*	133.9*	133.9*
Estimated Total Depth of Removal (ft)	15	10	15	20	20	20	15	15	20	5	5	5
Percent of Total Removal (%)	9.1	6.1	9.1	12.1	12.1	12.1	9.1	9.1	12.1	3.0	3.0	3.0
Estimated Shrinkage at this Borehole (%)	7.46	6.80	12.37	2.35	10.31	10.60	8.53	5.74	4.23	2.55	0.72	2.13
Factored Shrinkage for all Borings (%)	0.678	0.412	1.124	0.285	1.250	1.285	0.775	0.522	0.513	0.077	0.022	0.065
Total Estimated Shrinkage for Explored Boreholes = $\Sigma(\text{Factored Shrinkage for all Borings (\%)}) = 7.0 \%$												

*Max density values at these locations were obtained by taking a total average of all maxes performed.

This shrinkage is exclusive of any losses due to removal of roots or any underground structures and is based on an average 92 percent relative compaction. An increase in relative compaction obtained would increase the shrinkage factor.

Furthermore, a subsidence of approximately 0.10 (± 0.05) feet may also be considered during site preparation. The above shrinkage and subsidence estimates should be used with caution since they are not absolute values. We recommend that an earthwork balance area should be designated to allow for variations in the indicated shrinkage and subsidence estimates.

5.1.13 Fault Trench Re-Excavation

The initial fault investigation included one trench, T-1. Fault trench T-1 should be re-excavated as it was backfilled without compaction. The depth of the trench ranges from 15 to 17 feet. The trench alignment extends through proposed Lots 17, 18, and 19 of Phase 1, and in the cut slope rear of Lots 1 through 5 of Phase 2.

The supplemental fault investigation included six trenches ranging in depth between 10 and 19 feet. The affected Lots are:

Supplemental Fault Trenches	Affected Lots
1	25
2	29, 38, 39
3	17
4	--
5	--
6	--

5.1.14 Trench Backfill

All utility trenches and retaining wall backfills should be mechanically compacted to the minimum requirements of at least 90 percent relative compaction. Onsite soils derived from trench excavations can be used as trench backfill except for deleterious materials. Soils with sand equivalent greater than 30 may be utilized for pipe bedding and shading. Pipe bedding should be required to provide uniform support for piping. Excavated material from footing trenches should not be placed in slab-on-grade areas unless properly compacted and tested.

5.2 Temporary Excavation

All excavations must comply with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who should also be solely responsible for the means, methods, and sequencing of construction operations.

5.2.1 Soil Type

In accordance with OSHA, the onsite soil may be classified as follows:

Young Alluvium/Fill	Soil Type "B"
Older Alluvium	Soil Type "A"

Locally, some of the younger alluvium is classified as sand which correspond with Soil Type "C".

5.2.2 Safe Vertical Cut

Temporary un-surcharged excavation is summarized in the following table.

Soil Type	Temporary Vertical Cut (ft)	Grade beyond Allowable Vertical Cut
Young Alluvium/Fill	4	Sloped 1H:1V
Young Alluvium (Sand)	4	Inclined to angle of repose
Older Alluvium	8	Sloped 3/4H:1V

Exposed condition during construction should be verified by the project geotechnical engineer. No excavations should take place without the direct supervision of the project geotechnical engineer.

All applicable requirements of the California Construction and general Industry Safety Orders, the Occupational Safety and Health Act, and current amendments, and the Construction Safety Act should be met. Cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

5.2.3 Precaution for Excavations

The Contractor should be aware that unsupported excavation depths should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures.

5.3 Temporary Shoring

If temporary shoring is used during project development, the following earth pressures may be utilized to aid in the design. The following earth pressures are based on drained conditions (no hydrostatic or buoyant conditions) and the assumption that the shoring is vertical (no batter), and the ground surface in front and behind the shoring is level. For different geometries or conditions, the above lateral earth pressures should be reevaluated.

5.3.1 Cantilever Shoring

Assuming average shear strength of onsite soils (32° friction angle and 250 psf cohesion), cantilever shoring may be designed for a triangular load distribution equivalent to the pressure exerted by a fluid weighing 37 pounds per cubic foot (pcf). For an aerial surcharge placed adjacent to the shoring, an equivalent, horizontal (rectangular) pressure of thirty (30) percent of the surcharge may be assumed to act along the entire length of the shoring.

Shoring must extend below the excavation bottom to provide lateral resistance by passive soil pressure. Allowable passive pressures may be taken as equivalent to the pressure exerted by a fluid weighing 260 pcf in alluvium to a maximum value of 2000 psf.

5.3.2 Braced Shoring

For braced shoring, a uniform rectangular pressure distribution should be used from top to bottom of the shoring equivalent to the 24H, where H is the depth of the excavation. For an aerial surcharge placed adjacent to the shoring, an equivalent, horizontal (rectangular) pressure of thirty (50) percent of the surcharge may be assumed to act along the entire length of the shoring.

5.4 Tentative Foundation Recommendations

All recommendations including conventional foundation recommendations presented in the referenced report dated May 25, 2005 remain applicable. Additional recommendations are in the following sections.

5.5 Static Settlement

Foundation will be provided with at least three feet of compacted fill that will possess relatively high strengths and will not be subject to significant stress increases from the foundations of the new structure. Therefore settlements are expected to be within tolerable limits. Total long-term settlement between similarly loaded adjacent foundation systems should not exceed one inch. The structures should be designed to tolerate a differential settlement on the order of 1/2 to 3/4-inch.

5.6 Updated Post Tension Foundation Recommendations

Based on the soils expansion index (EI=34, Gorian (2004)), and the correlation of typical soil properties versus expansion potential provided in the table below, the expansive soil onsite is expected to have a plasticity index of about 15.

Robert W. Day's Geotechnical Engineer's Portable Handbook, 2nd Edition, Table 12.2					
Expansion Index	0-20	21-50	51-90	91-130	130+
Plasticity Index	0-10	10-15	15-25	25-35	35+
Expansion Potential	Very Low	Low	Medium	High	Very High

A value of a PI equal to 15 was utilized in the design of the PT slabs for soils with low expansion potential.

The values below provide minimum geotechnical parameters suggested for the post tensioned foundation slab design criteria based on; "Design of Post Tensioned Slab-on-Ground", 3rd Edition with 2008 Supplement. The slabs should have sufficient stiffness to resist non-uniform shrinkage or swell of the slabs subgrade soils.

Parameter	Value	
Expansion Index or Designated Lots	Low (21-50)	Very Low (<20)
Plasticity Index	15 (assumed)	5 (assumed)
Percent Passing No. 200 Sieve	35 (assumed)	20 (assumed)
Expansion Index	34 (assumed)	10 (LGC)
Minimum slab thickness	5"	5"
Slab saturation	12" min	12" min
Sand layer below Slab	4" min	4" min
Vapor barrier	10 mil	10 mil
Allowable soil bearing value	2000 psf	2000 psf
Modulus of subgrade reaction (k)	200 pci	120 pci
Parameter footing embedment	18" min	18" min
Soil coefficient of friction	0.38	0.38
Thornthwaite Moisture Index	-20	-20
Constant soil suction	pF 3.9	pF 3.9
Center Lift, edge moisture variation Distance (em)	9.0'	9.0'
Center Lift, center lift, ym	0.54"	0.46"
Edge Lift, edge moisture variation Distance (em)	4.7'	5.0'
Edge Lift, edge lift, ym	0.23"	0.19"

Post tensioned slabs may be utilized for the support of proposed structures. If not all of the lots will receive post tensioned slabs, at least the lots nearest to Reservoir Canyon Fault and lots within the young alluvial deposits areas, and lots with deep fills greater than 25 feet in depth. We recommend that the foundation engineer design the foundation system using the geotechnical parameters provided in this report. In utilizing these parameters, the foundation engineer should design the foundation system in accordance with the allowable deflection criteria of applicable codes and requirements of the structural engineer/architect

Please note that the post tensioned design methodology is in part based on the assumption that soil moisture changes around and beneath the post-tensioned slabs are influenced only by climatological conditions. Soil moisture changes below slabs is the major factor in foundation damages relating to expansive soil. The design methodology has no consideration for pre-saturation, owner irrigation, or other non-climate related influences on the moisture content of subgrade soils.

We recommend that prior to foundation construction, slab subgrades be presoaked to 12 inches prior to trenching and maintained at above optimum moisture up to concrete construction. We further recommend that the moisture content of the soil around the immediate perimeter of the slab be maintained near optimum moisture content (or above) during construction and up to occupancy.

The geotechnical parameters provided in this report assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage so ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Sunken planters placed adjacent to the foundation, should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

Based on the design parameters we have provided, and our experience with monitoring similar sites on these types of soils, we anticipate that if the soils become saturated below the perimeter of the foundations due to incorrect landscaping irrigation or maintenance, then up to approximately $\frac{3}{4}$ -inch of uplift could occur at the perimeter of the foundation relative to the central portion of the slab.

Future owners should be informed and educated regarding the importance of maintaining a consistent level of soil moisture. The owners should be made aware of the potential negative consequences of both excessive watering, as well as expansive soils to become too dry. The soil will undergo shrinkage as it dries up, followed by swelling during the rainy winter season, or when irrigation is resumed. This will result in distress to site improvements and structures.

5.7 Concrete Flatwork

Slabs-on-grade should be placed on at least 12 inches of prepared ground (topsoil not included, refer to geotechnical logs for depth of forest topsoil) compacted to a minimum of 90 percent relative compaction. Slabs-on-grade should be at least 5 inches thick and should be reinforced with at least No 4 bars at 12 inches on-center both ways, properly centered in mid thickness of slabs. Slabs-on-grade should be provided with a 10-mil Visqueen moisture barrier, if moisture intrusion is objectionable, and underlain by four inches of clean sand to meet California Residential Green Code.

Where slab or walkway is within 2 feet of the top of a slope, the slope side edge should be equipped with a deepened edge. We suggest an 18 inch deepened edge (embedment depth) for slopes over 5 feet high. Reinforcement in depend edges should be continuous with the slab reinforcement or doweled into the slab.

Shrinkage cracking can become excessive if water is added to the concrete above the allowable limit and proper finishing and curing are not followed. Concrete mixing, placement, finishing, and curing should be performed per the Portland Cement Association Guidelines.

Slab-on-grade thickness and reinforcement should be evaluated by the structural engineer and designed in compliance with applicable codes. Excess soils generated from foundation excavations should not be placed on any building pads without proper moisture and compaction. All slab subgrades should be saturated to a depth of at least 12 inches prior to placement of slab building materials. Moisture content should be tested in the field by the soil engineer. Slabs subgrade should be kept moist and the surface should not be allowed to desiccate.

The addition of fiber mesh in the concrete and careful control of water/cement ratios may lessen the potential for slab cracking. In hot or windy weather, the contractor must take appropriate curing precautions after the placement of concrete. The use of mechanically compacted low slump concrete (not exceeding 4 inches at the time of placement) is recommended. We recommend that a slipsheet (or equivalent) be utilized if grouted tiles or other crack sensitive flooring (such as marble tiles) is planned directly on concrete slabs.

5.8 Retaining Walls

The following lateral earth pressures and soil parameters, in conjunction with an allowable soil bearing capacity of 2000 psf, may be used for design of retaining wall with free draining compacted backfills. The soil bearing value may be increased by 20% for each additional foot depth to a maximum of 3000 psf. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the following recommendations.

Lateral Pressure Condition	Soil Condition	Equivalent Fluid Pressure (pcf)
At Rest Case (Drained)	Soil Level backfill	56
Active Case (Drained)	Soil Level Backfill	37
Active Case (Drained)	2H:1V	72
Passive Case (Drained)	Level Backfill	1260 to a maximum of 2000
Horizontal Coefficient of Friction	0.38	
Unit Soil Weight	120 f	

5.8.1 Wall Surcharge Loading

The term "surcharge" refers to any additional loading on the proposed wall. This term usually refers to loading that is in proximity to the wall system. Use the Spangler Method of analysis (area load of finite length) or Boussinesq Method of analysis to determine the lateral pressure caused by the surcharge loading. The uniform vertical surcharge is usually given a value of 200 psf or an equivalent height of fill. A uniform surcharge of at least 200 psf is always assumed at the top of a wall that has a level backfill. This should be multiplied with appropriate earth pressure coefficient to determine the resulting horizontal pressure on the wall. Additional static lateral pressures due to other surcharge loadings in the vicinity of the wall can be estimated using the guidelines provided in Plate 4.

5.8.2 Retaining Wall Waterproofing

The backfilled side of all retaining walls should be coated with an approved waterproofing compound or covered with a similar material to inhibit migration of moisture through the walls. It is recommended that the waterproofing system should be inspected and approved by the project civil engineer. The use of a water-stop should be considered for all concrete joints. We recommend contacting a waterproofing professional/consultant for specific recommendations for placement, sealing and protection of below grade walls.

5.8.3 Retaining Wall Drainage

The above tabulated earth pressures assume that sufficient drainage will be provided behind the walls to prevent the build-up of hydrostatic pressures from surface and subsurface water infiltration. Back-cut distance for conventional retaining walls should be at least 18 inches to facilitate compaction.

We recommend drainage for retaining walls to be provided in accordance with Plate 5 of this report. The backdrain pipe should be connected to a system of closed pipe(s) (non-perforated) that lead to the storm runoff discharge facilities. Retaining wall backdrain must be observed by GeoMat Testing Laboratories prior to wall backfill.

5.8.4 Retaining Wall Backfill

All retaining wall backfill must be compacted to at least 90 percent relative compaction (ASTM D-1557), utilizing equipment that will not damage the wall. Maximum precautions should be taken when placing drainage materials and during backfilling. Onsite soils may be used as backfill.

5.8.5 Updated Seismic Earth Pressure

The seismic load due to lateral earth pressure may be defined in accordance with NAVFAC.

Dynamic Component, Yielding Condition
Dynamic Component, Non-Yielding Condition

$$P_{AE} = 3/8(k_h)YH^2 = 10H^2$$

$$P_{AE} = 3/8(k_h)YH^2 = 21H^2$$

P_{AE} is in lb/linear foot of wall

k_h is equal to 35% PGA_M for cantilever and 75% PGA_M for restrained condition

H is height of wall in feet

Y is equal to the unit weight of the backfill in pcf, 120 pcf

The resultant dynamic force acts at a distance of 0.6H of the inverted pressure triangle.

PGA_M can be found in Appendix D. Dynamic forces are short term loading. A one-third increase in bearing pressure and passive resistance may be allowed for dynamic analysis.

5.9 Suggested Slope Protection and Maintenance

Proper slope protection and maintenance should help minimize erosion and improve the stability of the existing slopes. As a minimum the slope maintenance guidelines presented in Appendix F of this response should be followed. Additional precautions are:

- Any additional slope planting should be provided by a qualified landscape architect. GeoMat Testing Laboratories, Inc. strongly recommends that erosion and borrowing rodent control measures should be maintained.
- It is critical to provide periodic maintenance and repair of all slopes and drainage systems. Drainage system inlets, outlets, and spillways should be periodically inspected and cleaned of soil and debris.
- It is recommended that all project landscaping be provided with automatic sprinkler shutoffs in order to help prevent over-saturation of slope faces and help mitigate surficial slope instability problems. Leaks in the irrigation system should be fixed without delay.
- The slopes should be periodically inspected for evidence of cracking, erosion, and burrowing animals. Any problems should be repaired immediately.

5.10 Tentative Pavement Design

A laboratory R-value test was conducted by LGC (2005) and yielded an R-value of 62. Accordingly, the minimum recommended pavement thickness is presented in the following table. Final pavement design recommendations should be based on laboratory test results of representative pavement subgrade soils upon the completion of rough grading.

5.10.1 Asphalt Pavement

Location	Assumed Traffic Index	Minimum Recommended Pavement Section	Full Asphalt Section
Local Street	5.0	3.0" AC over 4" Class 2 Base	4.0"
Collector Street	6.0	3.5" AC over 4" Class 2 Base	4.5"
Wabash Street	7.0	4.0" AC over 4" Class 2 Base	6.0"

All pavement subgrade should be cleared of any deleterious material and overexcavated to a depth of at least 12 inches below existing or finished grade, whichever is deeper.

The bottom of the excavation should be further scarified an additional 12 inches, moisture conditioned, and compacted to at least 90 percent of the maximum density as determined by ASTM D1557 test method. Aggregate base should be compacted to at least 95 percent of the maximum density as determined by ASTM D1557 test method.

If subgrade soils possess an R-Value equivalent to 50 or higher and is considered free draining, a full AC pavement depth may be utilized. If the full depth is to be used, subgrade soils should be compacted to at least 95 percent of the maximum density as determined by ASTM D1557 test method.

5.11 Site Drainage

Positive drainage should be provided and maintained for the life of the project around the perimeter of all structures (including slopes and retaining walls) and all foundations toward streets or approved drainage devices to minimize water infiltrating into the underlying natural and engineered fill soils. In addition, finish subgrade adjacent to exterior footings should be sloped down (at least 2%) and away to facilitate surface drainage.

Perimeter water collection devices may be installed around the structure to collect roof/irrigation/natural drainage. Roof drainage should be collected and directed away from foundations via nonerosive devices. Over the slope drainage must not be permitted.

Water, either natural or by irrigation, should not be permitted to pond or saturate the foundation soils. Planter areas and large trees adjacent to the foundations are not recommended. All planters and terraces should be provided with drainage devices. Internal drainage should be directed to approved drainage collection devices.

Location of drainage device should be in accordance with the design civil engineers drainage and erosion control recommendations. The owner should be made aware of the potential problems, which may develop when drainage is altered through construction of retaining walls, patios and other devices.

Ponded water, leaking irrigation systems, over watering or other conditions which could lead to ground saturation should be avoided. Surface and subsurface runoff from adjacent properties should be controlled. Area drainage collection should be directed through approved drainage devices. All drainage devices should be properly maintained.

5.12 Additional Services

5.12.1 Plan Reviews

The recommendations provided in this report are based on preliminary information and subsurface conditions as interpreted from limited exploratory trenches at the site. We should be retained to review final grading and foundation plans to revise our conclusions and recommendations, as necessary. Professional fees will apply for each review.

Our conclusions and recommendations should also be reviewed and verified during site grading, and revised accordingly if exposed geotechnical conditions vary from our preliminary findings and interpretations.

5.12.2 Additional Observation and/or Testing

GeoMat Testing Laboratories, Inc. should observe and/or test at the following stages of construction.

During grading and post grading.

Following footing excavation and prior to placement of footing materials.

During wetting of slab subgrade and prior to placement of slab materials.

During all trench backfill and wall backfill.

When any unusual conditions are encountered.

5.12.3 Final Report of Compaction During Grading

A final report of compaction control should be prepared subsequent to the completion of grading. The report should include a summary of work performed, laboratory test results, and the results and locations of field density tests performed during grading.

6.0 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute GeoMat Testing Laboratories professional estimate of those measures that are necessary for the proposed water line to perform according to the proposed design based on the information generated and referenced during this evaluation, and GeoMat Testing Laboratories experience in working with these conditions.

7.0 LIMITATION OF INVESTIGATION

This report was prepared for the exclusive use on the new construction. The use by others, or for the purposes other than intended, is at the user's sole risk.

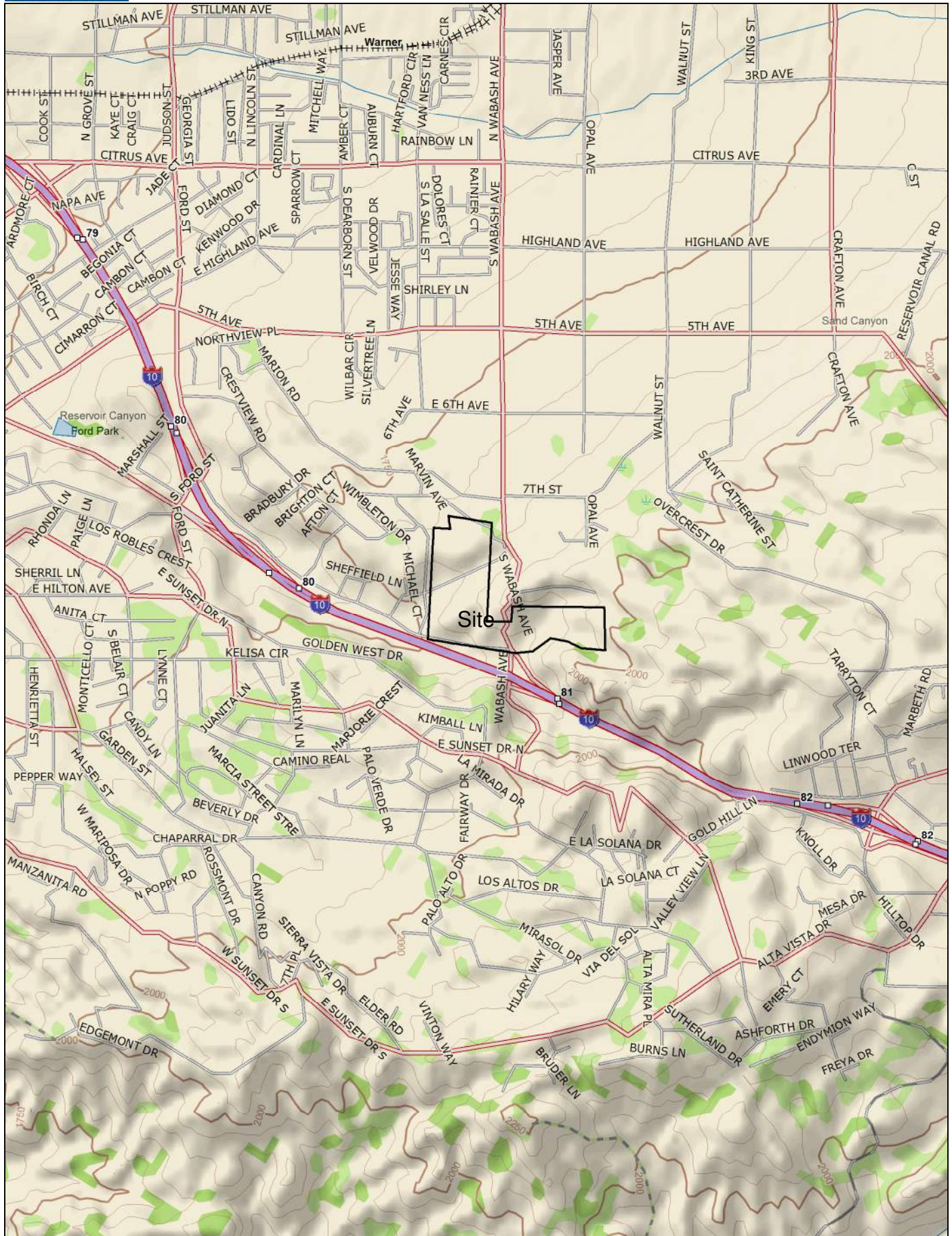
Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations within the limitations of scope, schedule, and budget. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The field and laboratory test data are believed representative of the site; however, soil conditions can vary significantly. As in most projects, conditions revealed during construction may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the engineer for the addition and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractor carry out such recommendations in the field.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

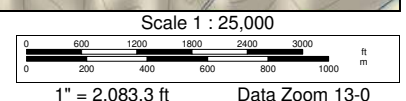
The findings, conclusions, and recommendations presented herein are based on our understanding of the addition and on subsurface conditions observed during our site work, and are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.



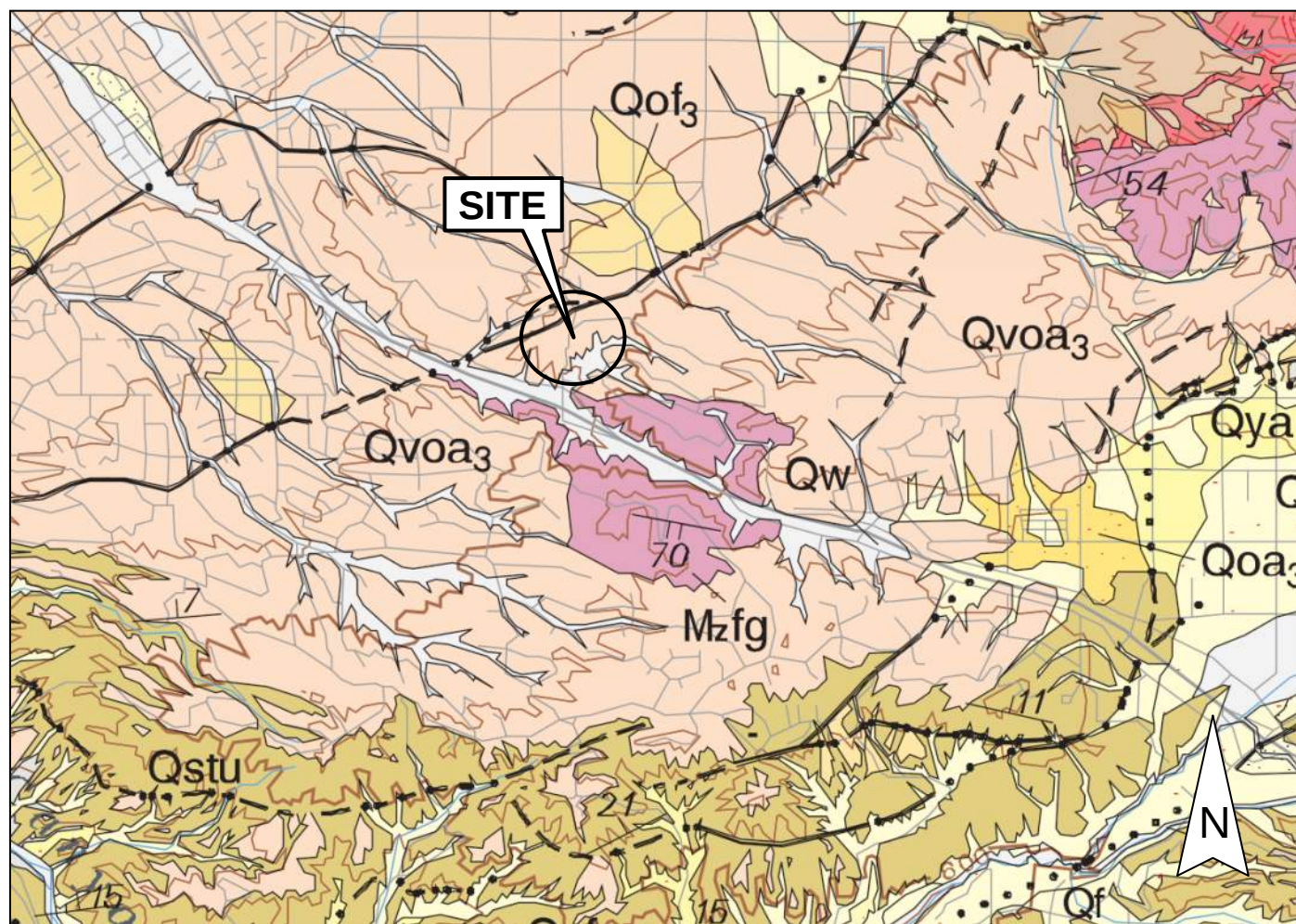
Data use subject to license.

© 2006 DeLorme. Topo USA® 6.0.

www.delorme.com



REGIONAL GEOLOGY MAP



LEGEND:

Qw: Very young wash deposits (late Holocene)—Unconsolidated sand and gravel deposits in active washes, ephemeral river channels of axial-valley streams, and in channels on active surfaces of alluvial fans.

Qvoa₃: Very old axial-channel deposits, Unit 3 (middle to early Pleistocene)—In areas east and west of mouth of Santa Ana River, unit consists of alluvial deposits, but locally includes regolith or pedogenic-soil profile developed on San Timoteo Beds.

Mzfg: Foliated granitoid rocks (Mesozoic)—Fine- to coarse-grained leucocratic granitoid rocks having heterogeneous compositions and textures.

Qof₃: Old alluvial-fan deposits, Unit 3 (late to middle Pleistocene)—On south side of San Bernardino Mountains, moderately dissected interstratified sand and gravel.

Qstu: Upper member (Pleistocene)—Medium-to thick-bedded, moderately to well sorted, moderately indurated, very fine- to coarse-grained sandstone interlayered with subordinate pebbly sandstone and pebble to small-cobble gravel.

From: "Morton, D.M., and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000"

PROJECT: Tentative Tract Map 20320, Redlands, California

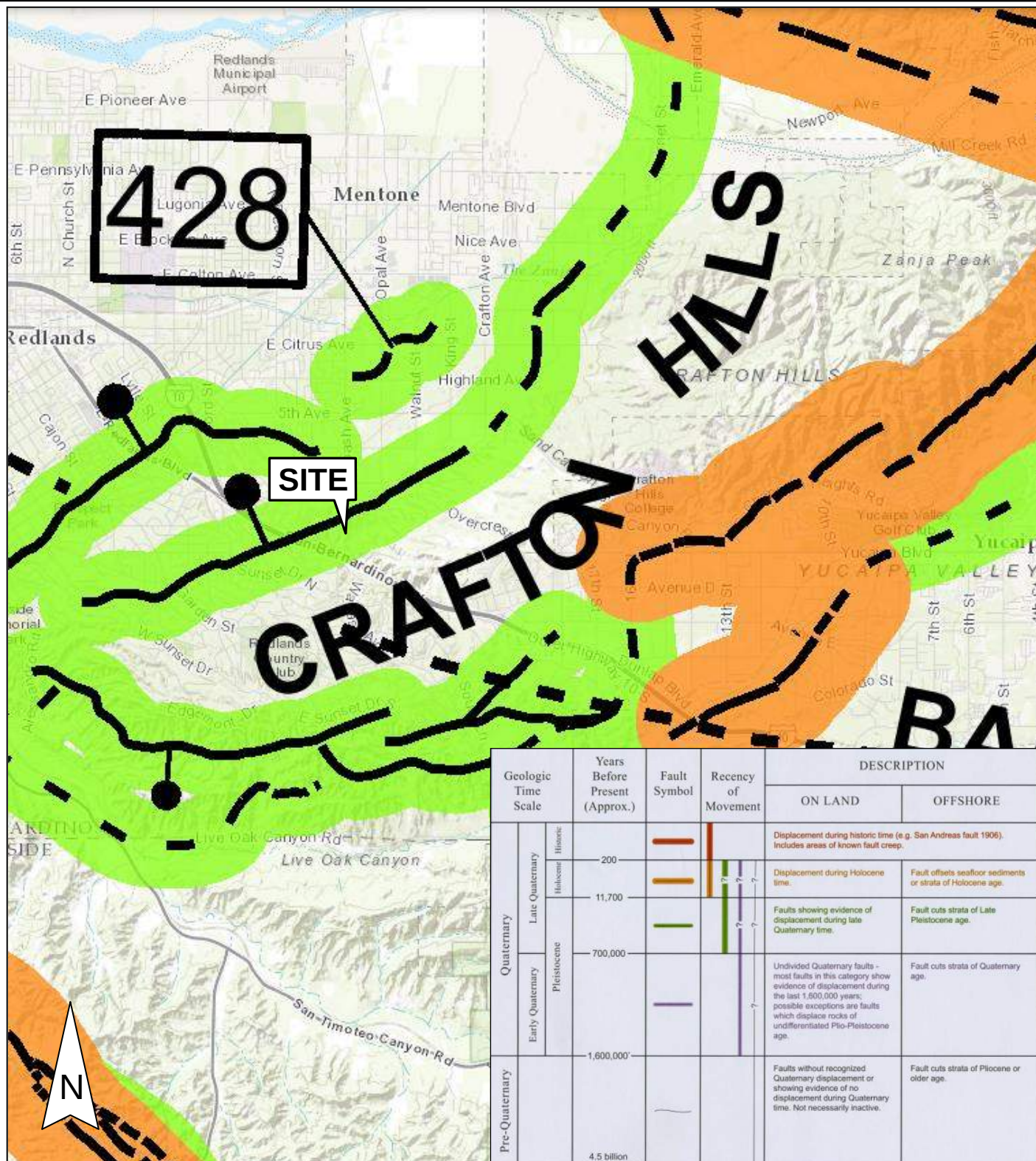


PROJECT NO: 11074-01

DATE: June 1, 2020

FIGURE 2

REGIONAL FAULT MAP



From: "Fault Activity Map of California," compiled by Charles W. Jennings and William A. Bryant, California Geological Survey, Map No. 6, California Geologic Data Map Series, 2010

PROJECT: Tentative Tract Map 20320, Redlands, California



PROJECT NO: 11074-01

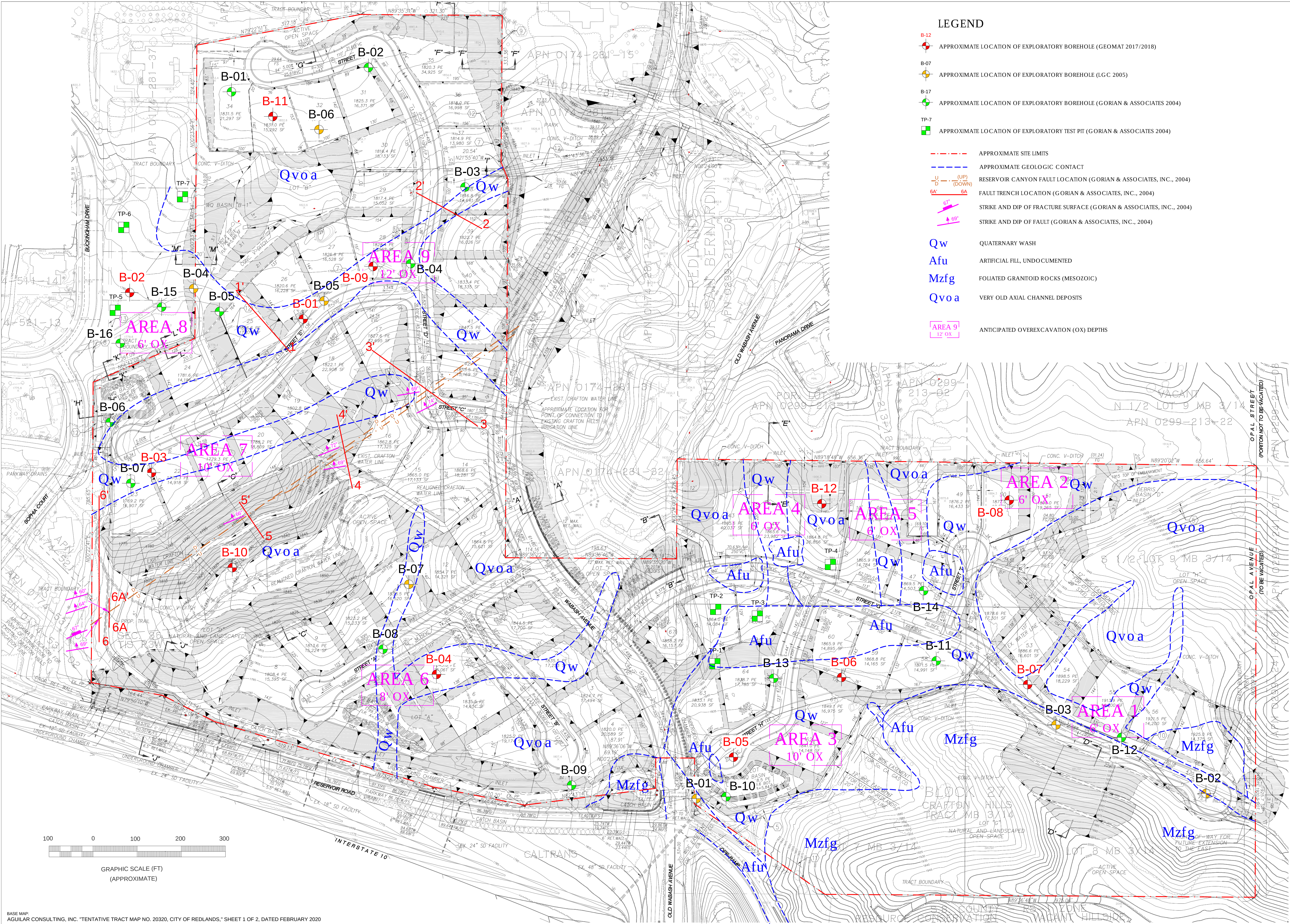
DATE: June 1, 2020

FIGURE 3



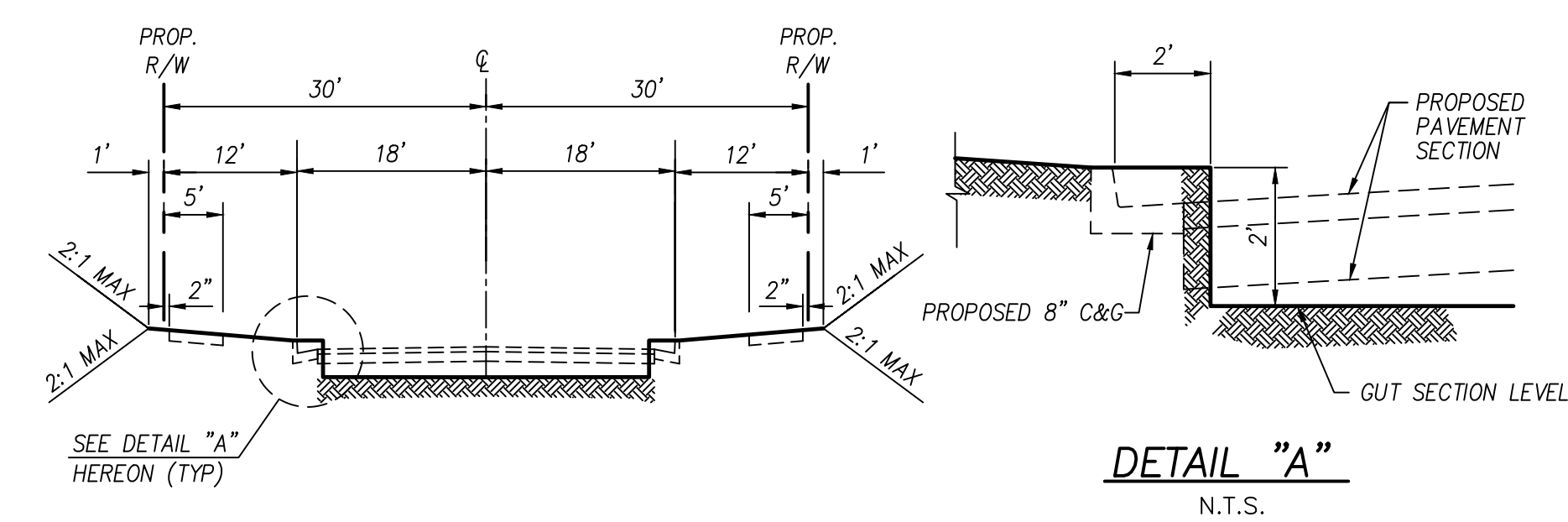
San Bernardino County Land use Plan, General Plan, Geologic Hazard Overlay, Sheet FH31C

Geo Mat

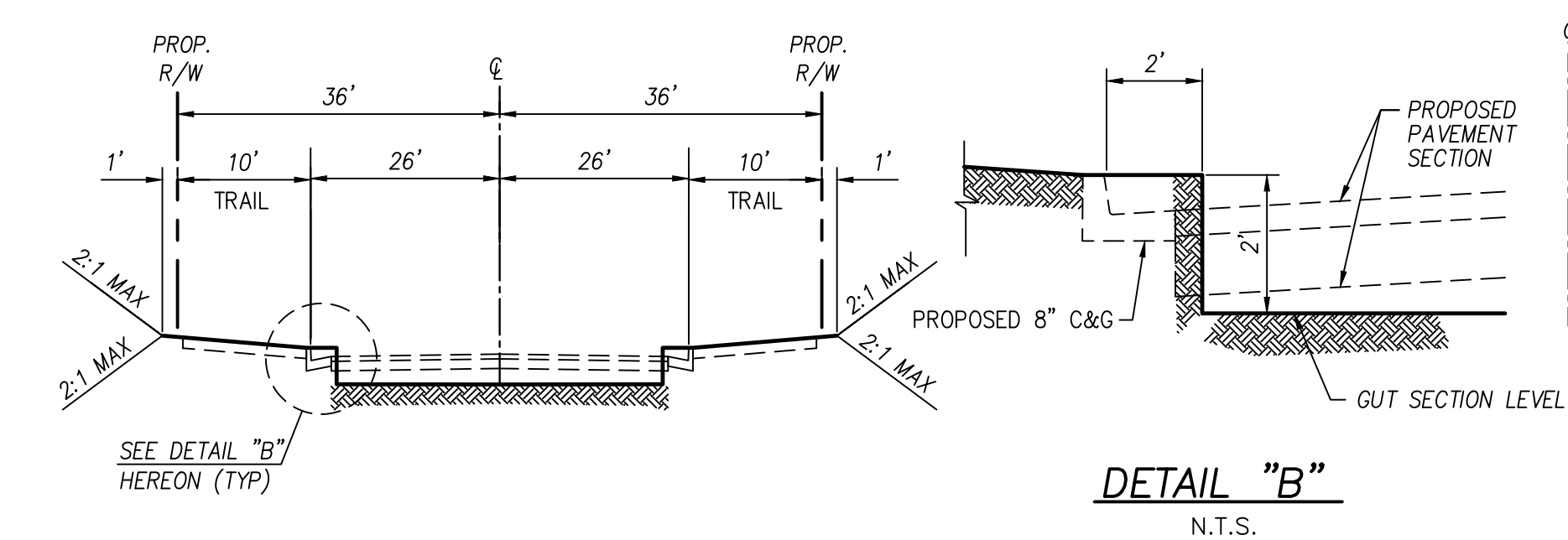


LEGEND

- B-12
- APPROXIMATE LOCATION OF EXPLORATORY BOREHOLE (GEOMAT 2017/2018)
- B-07
- APPROXIMATE LOCATION OF EXPLORATORY BOREHOLE (LGC 2005)
- B-17
- APPROXIMATE LOCATION OF EXPLORATORY BOREHOLE (GORIAN & ASSOCIATES 2004)
- TP-7
- APPROXIMATE LOCATION OF EXPLORATORY TEST PIT (GORIAN & ASSOCIATES 2004)
- APPROXIMATE SITE LIMITS
- APPROXIMATE GEOLOGIC CONTACT
- RESERVOIR CANYON FAULT LOCATION (GORIAN & ASSOCIATES, INC., 2004)
- FAULT TRENCH LOCATION (GORIAN & ASSOCIATES, INC., 2004)
- STRIKE AND DIP OF FRACTURE SURFACE (GORIAN & ASSOCIATES, INC., 2004)
- STRIKE AND DIP OF FAULT (GORIAN & ASSOCIATES, INC., 2004)
- Qw
- QUATERNARY WASH
- Afu
- ARTIFICIAL FILL, UNDOCUMENTED
- Mzfg
- FOLIATED GRANITOID ROCKS (MESOZOIC)
- Qvoa
- VERY OLD AXIAL CHANNEL DEPOSITS
- AREA 9
- 12' OX
- ANTICIPATED OVEREXCAVATION (OX) DEPTHS



LOCAL STREET
TYPICAL ROUGH CUT SECTION
N.T.S.



TYPICAL ROUGH CUT SECTION
WABASH AVENUE
N.T.S.

TENTATIVE TRACT MAP NO. 20320 (PHASES I AND II)
GRADING QUANTITY ESTIMATE

RAW CUT (PHASE I)	442,467	RAW FILL (PHASE I)	389,473
RAW CUT (PHASE II)	134,671	RAW FILL (PHASE II)	81,751
		SUBSIDENCE	9,164
		56.8 AC @ 0.10'	
		SHRINKAGE (ON RAW CUT) @ 12% SHRINK	69,257
OVER EX (PHASE I)			
4' OVER 13.54 AC	87,378		87,378
5' OVER 0.56 AC	4,577		4,577
6' OVER 1.50 AC	14,520		14,520
8' OVER 1.35 AC	17,424		17,424
10' OVER 0.51 AC	8,228		8,228
12' OVER 1.13 AC	21,877		21,877
TOTAL OVER EX (PHASE I)	155,944		155,944
OVER EX (PHASE II)			
4' OVER 5.48 AC	35,364		35,364
5' OVER 0.58 AC	4,679		4,679
6' OVER 2.04 AC	19,747		19,747
10' OVER 2.69 AC	43,399		43,399
TOTAL OVER EX (PHASE II)	103,189		103,189
TOTAL OVER EXCAVATION	257,134		257,134
		SHRINKAGE (ON OVER EX) @ 12% SHRINK	30,856
TOTAL CUT	834,271 CY	TOTAL FILL	837,634 CY
USE: TOTAL CUT	834,000 CY	TOTAL FILL	834,000 CY

PLATE 2
(Cut-Fill Grading Plan)

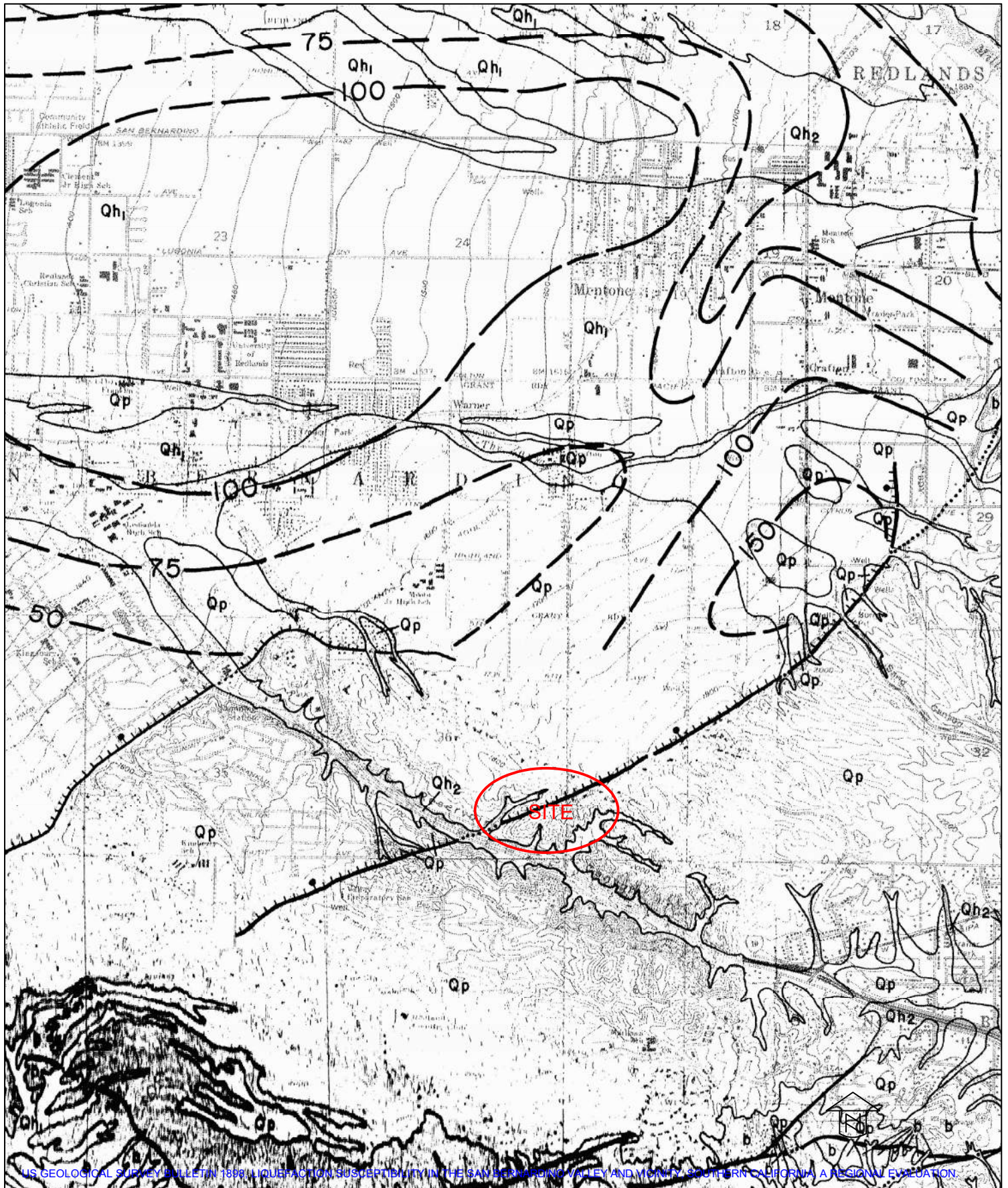


2155 CHICAGO AVENUE, SUITE 301
RIVERSIDE, CA 92507
PH. (951) 380-1431 FAX (951) 380-1432

PREPARED UNDER THE DIRECT SUPERVISION OF:
CEAZAR V. AGUIAR, R.C.E. NO. 41679

DATE:
EXP. 03/31/2022

EARTHWORK EXHIBIT
TERRACINA
TENTATIVE TRACT MAP NO. 20320
PHASES I AND II



U.S. GEOLOGICAL SURVEY BULLETIN 1898 LIQUEFACTION SUSCEPTIBILITY IN THE SAN BERNARDINO VALLEY AND MOUNTY, SOUTHERN CALIFORNIA A REGIONAL ELEVATION

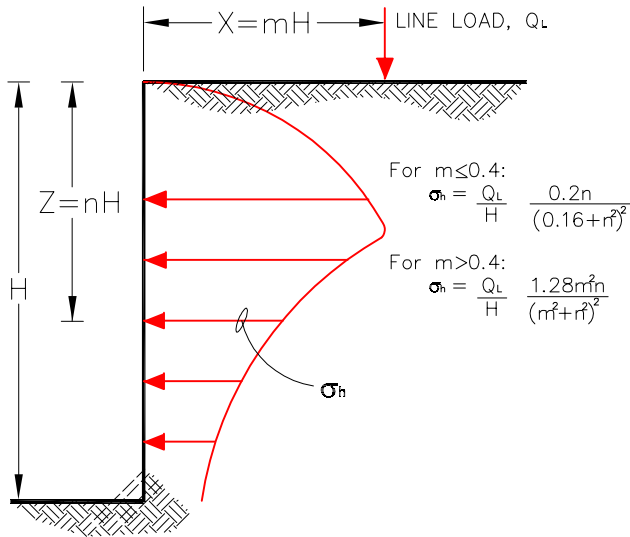


GeoMat Testing Laboratories, Inc.
9980 Indiana Avenue, Suite 14,
Riverside, California

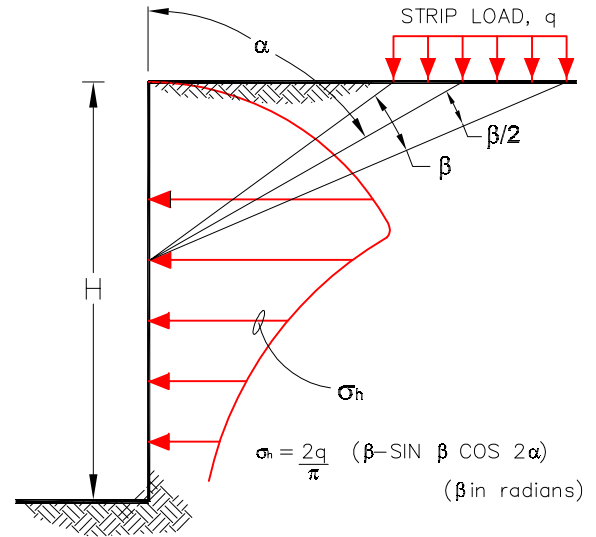
DWN BY: AM
CHK'D BY: MN
DATUM: --
PROJECTION: --
SCALE: N.T.S.
REV. NO.: --

PROJECT: SUMMARY AND REPORT UPDATE
TENTATIVE TRACT 20320
REDLANDS, CALIFORNIA
TITLE: REGIONAL GROUNDWATER MAP

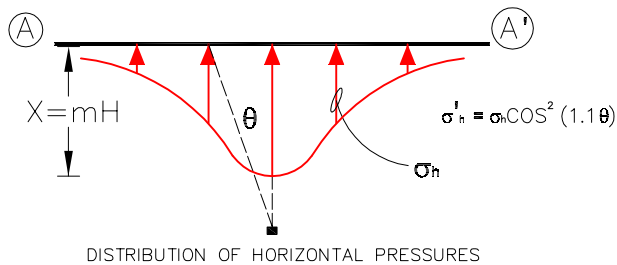
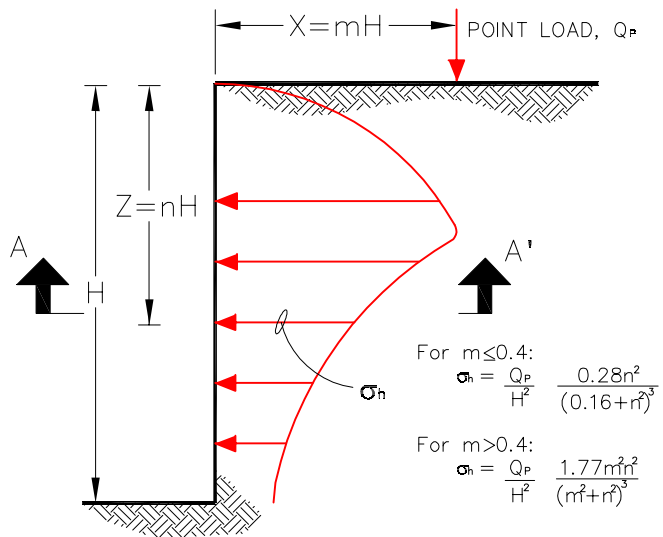
DATE: JUNE 2020
PROJECT NO.: 11074-01
FIGURE NO.: PLATE 3



LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL



DISTRIBUTION OF HORIZONTAL PRESSURES

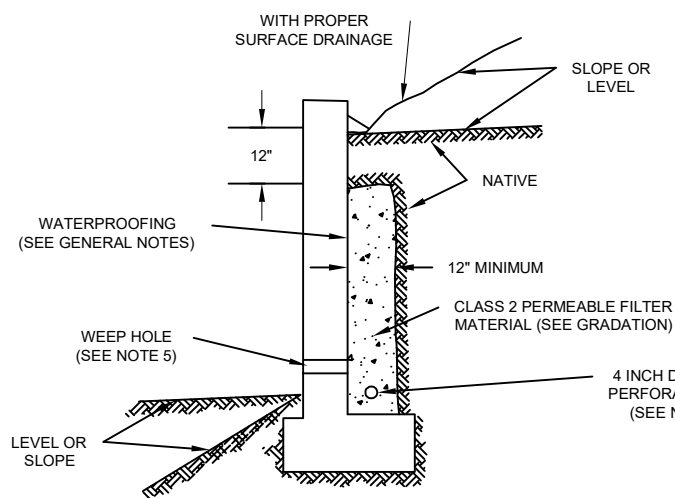
VERTICAL POINT LOAD

NOTES:

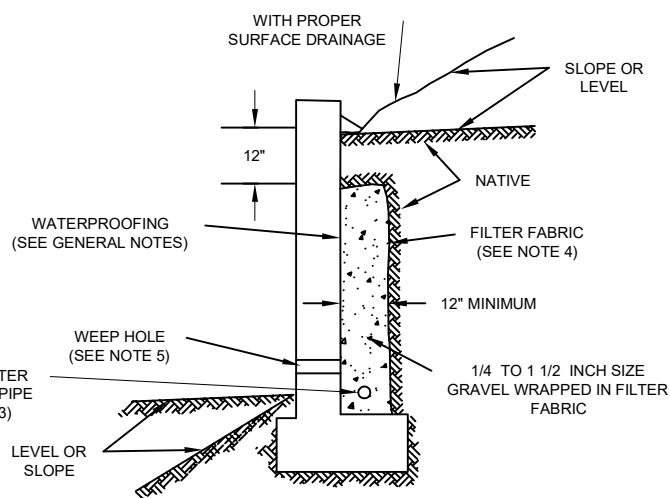
1. These guidelines apply to rigid walls with Poisson's ratio assumed to be 0.5 for backfill materials.
2. Lateral pressures from any combination of above loads may be determined by the principle of superposition.

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX ≤ 50

OPTION 1: PIPE SURROUNDED WITH
CLASS 2 PERMEABLE MATERIAL



OPTION 2: GRAVEL WRAPPED
IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

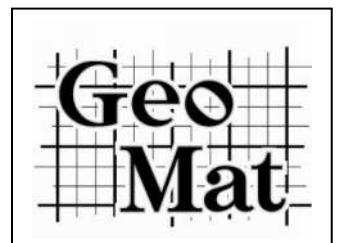
- *Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
- *Water proofing of the walls is not under the purview of the geotechnical engineer.
- *All drains should have a gradient of 1 percent minimum.
- *Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding).
- *Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:

- 1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
- 2) 1 Cu. ft. per ft. of 1/4 - to 1 1/2 -inch size gravel wrapped in filter fabric
- 3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 -inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered).
- 4) Filter Fabric should be Mirafi 140NC or approved equivalent.
- 5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12-inches above finished grade. If exposure is not permitted, such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
- 6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
- 7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.



APPENDIX A



REFERENCES

Gorian and Associates, Inc. "Updated Geotechnical Investigation, 66 Acre Site, Tentative Tract No. 16586, City of Redlands and County of San Bernardino, California," Log No. 23081, Dated December 27, 2004.

LGC "Due-Diligence Geotechnical Investigation, "Redlands 76" Tentative Tract Map 16586, Wabash Avenue North of Interstate 10 in the City of Redlands, San Bernardino, California," Project No. 105905-10, Dated May 25, 2005.

LGC "Feasibility Report for a Proposed Onsite Retention Basins, Tentative Tract 16586, Wabash Avenue and Interstate 10 in the City of Redlands, San Bernardino County, California," Project No. 105905-10, Dated March 22, 2006.

LGC "Preliminary Geotechnical Investigation for a Soil Retention System, Tentative Tract Map 16586, Wabash Avenue, North of Interstate 10 in the City of Redlands, San Bernardino County, California," Project No. 105905-10, Dated July 10, 2006

LGC "Response to the City of Redlands Review Comments Regarding 'Redlands 76', Tentative Tract 16586, Wabash Avenue North of Interstate 10, City of Redlands, San Bernardino County, California," Project No. 105905-50, Dated August 1, 2006.

CDMG, Special Report 113, Southwestern San Bernardino, 1974.

USGS, Liquefaction Susceptibility in the San Bernardino Valley and Vicinity, Southern California, A Regional Evaluation, Bulletin 1898.

City of Redlands General Plan 2035 (Adopted December 5, 2017)

City of Redlands Local Hazard Mitigation Plan, 2005.

Geologic Map of the Redlands 7.5' Quadrangle, San Bernardino and Riverside Counties, California, Open File Report 03-302.

Department of Water Resources, Water Data Library

USGS, National Water Information System, Web Interface, Groundwater Levels for California.

USGS, Groundwater Watch, California Active Water Level Network.

California Geological Survey, Map No. 6, Fault Activity Map of California, Compiled by Charles W. Jennings and William A. Bryant, California Geologic Data Map Series, 2010

Department of the Navy, Design Manual 7.01, Soil Mechanics, September 1986.

Department of the Navy, Design Manual 7.02, Foundation and Earth Structures, September 1986.

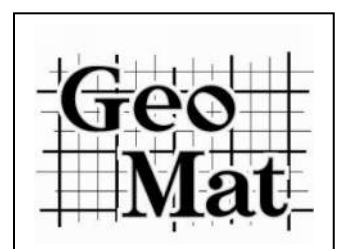
Department of the Army, US Army Corps of Engineers, Engineering and Design, Bearing Capacity of Soils, EM 1110-1-1905.

Robert Day, Geotechnical Engineer's Portable Handbook.

Robert Day, Geotechnical Foundation Handbook.

Foundation Engineering Handbook, Hsai-Yang Fang

APPENDIX B



WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

WATER LEVEL OBSERVATION DESIGNATION

W.D.	While Drilling
A.B.	After Boring
B.C.R.	Before Casing Removal
A.C.R.	After Casing Removal
24 hr.	Water level taken approximately 24 hrs. after boring completion

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
CS	Continuous Sampler
DB	Diamond Bit -NX unless otherwise noted
HA	Hand Auger
HS	Hollow Stem Auger
PA	Power Auger
RB	Rock Bit
SS*	Split-Barrel
ST	Shelby Tube - 2" (51mm) unless otherwise noted
WB	Wash Bore
CR	California Ring Sampler 3" O.D., Lined with 2.5"X1" Rings

*The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot (0.3m) of an 18 in. (0.46m) long, 2 in. (51mm) O.D. split-barrel sampler with a 140 lb. (63.5 kg) hammer falling a distance of 30 in. (0.76m). The Standard Penetration Test is carried out according to ASTM D-1586. (See "N" Value below.)

SOIL PROPERTIES & DESCRIPTIONS

TEXTURE

PARTICLE	SIZE
Clay	< 0.002 mm (< 0.002 mm)
Silt	< #200 Sieve (0.075 mm)
Sand	#4 to #200 Sieve (4.75 to 0.075 mm)
Gravel	3 in. to #4 Sieve (75 mm to 4.75 mm)
Cobbles	12 in. to 3 in. (300 mm to 75 mm)
Boulders	> 12 in. (300 mm)

COMPOSITION

SAND & GRAVEL	
Description	% by Dry Weight
trace	< 15
with	15 - 29
modifier	> 30
FINES	
Description	% by Dry Weight
trace	< 5
with	5 - 12
modifier	> 12

Soil descriptions are based on the Unified Soil Classification System (USCS) as outlined in ASTM Designations D-2487 and D-2488. The USCS group symbol shown on the boring logs correspond to the group names listed below. The description includes soil constituents, consistency, relative density, color and other appropriate descriptive terms. Geologic description of bedrock, when encountered, also is shown in the description column.

GROUP SYMBOL	GROUP NAME	GROUP SYMBOL	GROUP NAME
GW	Well Graded Gravel	CL	Lean Clay
GP	Poorly Graded Gravel	ML	Silt
GM	Silty Gravel	OL	Organic Clay or Silt
GC	Clayey Gravel	CH	Fat Clay
SW	Well Graded Sand	MH	Elastic Silt
SP	Poorly Graded Sand	OH	Organic Clay or Silt
SM	Silty Sand	PT	Peat
SC	Clayey Sand	CL-CH	Lean to Fat Clay

COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (Qu) (psf)	COMPRESSIVE STRENGTH (Qu) (kPa)	PLASTICITY
Very Soft	< 500	(< 24)	Description
Soft	500 - 1000	(24 - 48)	Lean
Medium	1001 - 2000	(48 - 96)	Lean to Fat
Stiff	2001 - 4000	(96 - 192)	Fat
Very Stiff	4001 - 8000	(192 - 383)	
Hard	> 8001	(> 383)	

Cohesive Soils Consistency "N" value

Very Soft	<2
Soft	2-4
Medium	4-8
Stiff (Firm)	8-15
Very Stiff (Very Firm)	15-30
Hard	>30

COHESIONLESS SOILS

RELATIVE DENSITY	"N" VALUE*
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	≥ 50

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD**)

DESCRIPTION OF ROCK QUALITY	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100

**RQD is defined as the total length of sound core pieces, 4 inches (102mm) or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

DEGREE OF WEATHERING

Slightly Weathered	Slight decomposition of parent material in joints and seams.
Weathered	Well-developed and decomposed joints and seams.
Highly Weathered	Rock highly decomposed, may be extremely broken.

SOLUTION AND VOID CONDITIONS

Solid	Contains no voids.
Vuggy	Containing small pits or cavities < 1/2" (13mm).
Porous	Containing numerous voids which may be interconnected.
Cavernous	Containing cavities, sometimes quite large.

When classification of rock materials has been estimated from disturbed samples, core samples and petrographic analysis may reveal other rock types.

HARDNESS & DEGREE OF CEMENTATION

LIMESTONE	
Hard	Difficult to scratch with knife.
Moderately Hard	Can scratch with knife but not with fingernail.
Soft	Can be scratched with fingernail.

SHALE	
Hard	Can scratch with knife but not with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be molded easily with fingers.

SANDSTONE	
Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

BEDDING CHARACTERISTICS

TERM	THICKNESS (inches)	THICKNESS (mm)
Very Thick Bedded	> 36	> 915
Thick Bedded	12 - 36	305 - 915
Medium Bedded	4 - 12	102 - 305
Thin Bedded	1 - 4	25 - 102
Very Thin Bedded	0.4 - 1	10 - 25
Laminated	0.1 - 0.4	2.5 - 10
Thinly Laminated	< 0.1	< 2.5
Bedding Planes	Planes dividing the individual layers, beds or strata of rocks.	
Joint	Fracture in rock, generally more or less vertical or transverse to the bedding.	
Seam	Applies to bedding plane with an unspecified degree of weathering.	

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-1		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 24 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw) dark to medium yellowish brown silty sand fine to coarse grained, moist						
2														
3														
4														
5	R	☒	7	7	4	7			Loose	7.6	113			
6									slightly porous					
7														
8														
9														
10	R	☒	3	3	5	5		Loose	7.2	110				
11								some clay fines and cohesion						
12														
13														
14														
15	R	☒	6	8	12	13		Medium dense	8.5	114				
16														
17	R	☒	5	7	10	11		Medium dense	5.3	112				
18								very little fine content						
19														
20														
21	R	☒	7	11	14	16	SM	OLDER ALLUVIUM (Qvoa)	8.8	113				
22								dark yellowish brown silty sand						
23								moist						
24	R	☒	9	10	13	15		Medium dense	8	115				
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-2		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 18 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw) dark to medium yellowish brown silty sand fine to coarse grained, moist						
2														
3														
4														
5	R	☒	11	22	28	33				11.7	118			
6														
7														
8														
9														
10	R	☒	5	8	13	14				5.8	113			
11														
12														
13														
14														
15	R	☒	5	7	11	12	SP	OLDER ALLUVIUM (Qvoa) dark yellowish brown sand very little fines medium dense	3.3	110				
16														
17	R	☒	14	19	19	25				7.3	112			
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-3		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 16 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw)						
2								dark to medium yellowish brown silty sand						
3								moist						
4	R	☒	3	3	4	5		loose, No Recovery						
5														
6	R	☒	3	3	4	5		loose	6.8	105				
7														
8														
9	R	☒	3	4	5	6		loose	6	107				
10														
11								becoming more coarse grained						
12	R	☒	6	8	9	11		medium dense	7.7	111				
13														
14														
15	R	☒	6	9	11	13		medium dense	8.4	111				
16								moist						
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-4		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 19 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw)						
2								dark to medium yellowish brown silty sand						
3														
4	R	☒	19	34	41	49	SW	OLDER ALLUVIUM (Qvoa)	3.4	120				
5								dark olive brown sand with gravel						
6								dense						
7	R	☒	40	50/	5"	>50		very dense	3.8	138				
8								possibly cobbly						
9														
10	R	☒	50/	6"		>50		No Recovery						
11								very dense						
12														
13	R	☒	50/	3"		>50		very dense	3.4	116				
14														
15														
16	R	☒	50/	4"		>50		No Recovery						
17								very dense						
18														
19	R	☒	50/	5"		>50		very dense	4.2	111				
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-5		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 22 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw)						
2								dark to medium yellowish brown silty sand						
3								fine to coarse grained, moist						
4	R	X	4	4	5	6		loose	5.4	105				
5														
6	R	X	4	6	7	8		loose	5.3	112				
7								slightly porous						
8														
9	R	X	5	5	7	8		loose	6.7	106				
10														
11														
12	R	X	7	8	11	12		medium dense	8.9	113				
13								becoming more coarse grained						
14														
15	R	X	8	8	8	10	SPSM	poorly-graded sand with silt	4.5	112				
16								medium dense						
17								some gravel						
18	R	X	6	11	13	16		medium dense	4	117				
19														
20														
21	R	X	7	7	8	10		medium dense	4.7	109				
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California			Boring No.: B-6		Page 1 of 1							
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By:	MN					
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth:	-- ft					
Drilling Method:		Hollow Stem Auger						Depth to Bedrock:	-- ft					
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth:	22 ft					
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw)						
2								medium yellowish brown silty sand						
3								fine to coarse grained sand, moist						
4	R	X	6	6	6	8		loose	4.9	111				
5														
6	R	X	3	2	3	3		loose	6.5	106				
7								moist						
8														
9	R	X	3	5	5	7		loose	4.7	112				
10								very little fine content						
11														
12	R	X	3	6	11	11		medium dense	7.3	112				
13								dark yellowish brown silty sand						
14														
15	R	X	5	8	12	13		medium dense	6.9	108				
16														
17														
18	R	X	6	9	9	12		medium dense	8.2	107				
19								some pea-sized gravel						
20														
21	R	X	9	6	10	10		medium dense	6.1	115				
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-7		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 16 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SM	ALLUVIUM (Qw)						
2								dark to medium yellowish brown silty sand						
3														
4														
5	R	X	7	6	7	8		Sample Disturbed						
6								loose						
7														
8														
9	R	X	4	6	11	11		medium dense	11.1	116				
10								medium to dark yellowish brown						
11														
12														
13	R	X	6	14	23	24		light yellowish brown	16.1	107				
14								medium dense to dense						
15														
16	R	X	13	36	50/ 5"	62		very dense	11.1	111				
17								gravelly						
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-8		Page 1 of 1						
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN						
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft						
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft						
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 16 ft						
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1								ALLUVIUM (Qw) medium yellowish brown silty sand fine to coarse grained sand, moist						
2														
3														
4														
5	R	X	6	7	7	9		sample disturbed loose						
6														
7														
8														
9	R	X	5	8	9	11		medium dense dark yellowish brown	6.7	111				
10														
11														
12														
13	R	X	6	10	15	16		medium dense	6.8	113				
14														
15														
16	R	X	7	11	14	16	SP	yellowish brown sand with gravel medium dense	1.5	117				
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-9		Page 1 of 1							
		Project No.: 11074-01													
Boring Location:		See Plate 1		Drilling Co.		One Way Drilling		Logged By: MN							
Drilling Date(s):		12/21/2017		Drill Rig:		CME 85		Groundwater Depth: -- ft							
Drilling Method:		Hollow Stem Auger						Depth to Bedrock: -- ft							
Hammer Weight/Drop:		140 lbs./30-inches		Hammer Type:		Automatic		Total Depth: 22 ft							
Sampler Type:		☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA							
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index	
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value									
1							SM	ALLUVIUM (Qw) dark to medium yellowish brown silty sand fine to coarse grained, moist loose	6.5	106					
2															
3	R	☒	4	3	4	5									
4															
5															
6	R	☒	4	5	6	7									
7															
8															
9	R	☒	3	4	7	7									
10															
11															
12	R	☒	7	8	9	11									
13							SP	medium yellowish brown sand medium dense	4.5	111					
14															
15	R	☒	5	7	11	12	SC	yellowish brown clayey sand medium dense, moist	12.3	120					
16															
17															
18	R	☒	10	32	56	57	SM	OLDER ALLUVIUM (Qvoa) dark yellowish brown silty sand some gravel very dense	8.1	129					
19															
20															
21	R	☒	18	34	50/	61									
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34															

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

geomat		Project Name: Tract 16586, Redlands, California				Boring No.: B-10				Page 1 of 1				
		Project No.: 11074-01												
Boring Location:		See Plate 1		Drilling Co.		GeoMat		Logged By:		MN				
Drilling Date(s):		1/27/2018		Drill Rig:		--		Groundwater Depth:		-- ft				
Drilling Method:		Manual with Dames and Moore						Depth to Bedrock:		-- ft				
Hammer Weight/Drop:		35 lbs./--		Hammer Type:		--		Total Depth:		6 ft				
Sampler Type: ☐ Auger Cuttings (C) ☒ California Ring (R) ☐ Split Spoon (S)								LABORATORY TEST DATA						
DEPTH (feet)	SAMPLES		BLOWCOUNTS				USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"	SPT "N" Value								
1							SP	OLDER ALLUVIUM (Qvoa)						
2								dark yellowish brown sand, slightly silty						
3								some gravel						
4	R	X				25		medium dense	2.1	121				
5								dry						
6								very little fines						
7	R	X				56		very dense	1.4	118				
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

		Project Name: Tract 16586, Redlands, California		Boring No.: B-11		Page 1 of 1							
Project No.: 11074-01		Boring Location: See Plate 1		Drilling Co. GeoMat		Logged By: MN							
Drilling Date(s): 1/27/2018		Drill Rig: --		Groundwater Depth: -- ft		Depth to Bedrock: -- ft							
Drilling Method: Manual with Dames and Moore		Hammer Weight/Drop: 35 lbs./--		Hammer Type: --		Total Depth: 6 ft							
Sampler Type: ☒ Auger Cuttings (C)		☒ California Ring (R)		☐ Split Spoon (S)		LABORATORY TEST DATA							
DEPTH (feet)	SAMPLES		BLOWCOUNTS			USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"								
1	R	☒				19	SP	OLDER ALLUVIUM (Qvoa) yellowish brown sand, slightly silty some gravel medium dense	1.6	123			
2													
3													
4													
5	R	☒				48		dry very dense	1.1	122			
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

	Project Name: Tract 16586, Redlands, California		Boring No.: B-12		Page 1 of 1								
Project No.: 11074-01		Drilling Co. GeoMat		Logged By: MN									
Boring Location: See Plate 1		Drill Rig: --		Groundwater Depth: -- ft									
Drilling Date(s): 1/27/2018		Drilling Method: Manual with Dames and Moore		Depth to Bedrock: -- ft									
Hammer Weight/Drop: 35 lbs./--		Hammer Type: --		Total Depth: 6 ft									
Sampler Type: ☒ Auger Cuttings (C) ☒ California Ring (R) ☐ Split Spoon (S)				LABORATORY TEST DATA									
DEPTH (feet)	SAMPLES		BLOWCOUNTS			USGS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
	Sample Type	Sample	0 - 6"	6" - 12"	12" - 18"								
1	R	☒				63	SP OLDER ALLUVIUM (Qvoa) yellowish brown sand, slightly silty some gravel very dense dry	2.2	119				
2													
3													
4													
5	R	☒				133	very dense no recovery						
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.



Applied Earth Sciences

Project: Griffin, Redlands
 Drill Co. and Rig Type: Prosonic, CME 85
 Hammer: 140 lbs. auto Logged by: CHD
 Boring Diameter: 8" Surface Elevation: UNK

BORING: B-1
 Page 1 of 1

Work Order: 2467-0-0-10
 Report Log No.: 22271
 Date: 1/28/03

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0			54/ 12"	9.8	114		CL		OLDER ALLOVIUM At 0 to 4½'; reddish brown (5YR 4/4) sandy clay (damp, hard). At 1'; pinhole porosity. Grading sandier with depth.
			90/ 12"	6.6	120				At 3'; some gravel.
5			80/ 12"	4.7	117		SM-SW		At 4½' to 21'; light olive brown (2.5Y 5/4) silty fine to coarse sand, common gravel (damp, very dense).
10			50/ 12"	5.0	114				At 10'; slightly silty fine to coarse sand, common gravel.
15			42/ 12"	5.2	117				At 15'; becoming medium dense, minor silty fine sand interbeds (moist).
20			60/ 12"	3.2	117				At 20'; clean fine to coarse sand, some gravel (damp, very dense).
									Total depth 21' No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-2

Page 1 of 1

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/28/03

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
0			43/ 12"	10.1	100		CL		OLDER ALLUVIUM At 0 to 6'; reddish brown (5YR 4/4) sandy clay (damp, hard). Grading sandier with depth.
			100 12"	8.3	101				
5			100 12"	8.5	121		CL		At 6' to 8½'; strong brown (7.5YR 5/6) sandy clay (damp, hard).
							SM		At 8½' to 15'; light olive brown (2.5Y 5/4) silty fine to coarse sand, few gravel (damp, very dense).
10			95/ 12"	5.6	117				
15			80/ 12"	5.6	113		SWI: SM		At 15' to 21'; light olive brown (2.5Y 5/4) slightly silty fine to coarse sand, few gravel (damp, very dense).
20			85/ 12"	4.1	122				At 20'; Interbedded with silty fine sand (moist).
									Total depth 21' No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-3

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/28/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0								SM		ALLOVIUM At 0 to 2'; brown (10YR 4/3) silty fine to coarse sand (damp, medium dense). At 1'; porous. Few gravel.
				26/ 12"	4.1	110		SC		At 2' to 4½'; dark yellowish brown (10YR 4/4) clayey fine to coarse sand (damp, medium dense). At 3'; porous.
				27/ 12"	4.5	107		SC		At 4½' to 7'; brown (7.5YR 4/4) clayey fine to coarse sand, few gravel (damp, medium dense). At 5'; porous.
5				26/ 12"	4.5	113		SM		At 7' to 13'; brown (7.5YR 4/4) silty fine to coarse sand, trace clay (damp to moist, medium dense). Few gravel.
10				16/ 12"	6.3	113		SM		
15				52/ 12"	5.5	121		SM		OLDER ALLOVIUM At 13½' to 18'; light olive brown (2.5Y 5/4) silty fine to coarse sand, common gravel (moist, very dense). Below 15'; hard slow drilling.
20				13/ 12/ 10				SM		At 18' to 29'; light olive brown (2.5Y 5/4) silty fine sand interbedded with silty fine to coarse sand (damp, medium dense).
25				13/ 17/ 44						At 25'; becoming moist, very dense.



Date: 1/28/03

[illegible]



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-4

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/27/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0								SM		ALLUVIUM At 0 to 4½'; brown (10YR 4/3) silty fine to coarse sand (damp, loose).
				11/ 12"	4.0	104				At 3'; slight pinhole porosity, few gravel.
				13/ 12"	3.3	106				
5				17/ 12"	3.1	108		SM		At 4½' to 13'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, medium dense). Few gravel.
10				14/ 12"	5.3	111				At 10'; becoming moist.
								SC		At 13' to 22'; dark yellowish brown (10YR 4/4) clayey fine to coarse sand (moist, medium dense).
15				13/ 12"	8.9	111				
20				36/ 12"	9.5	125				At 20'; becoming dense, few gravel.
								SM		OLDER ALLUVIUM At 22' to 51½'; light olive brown (2.5Y 5/4) silty fine to coarse sand, some gravel (moist, very dense).
25				65/ 12"	10.6	114				
30				14/ 23/ 34						Below 30'; hard slow drilling.



Boring Diameter: 8" Surface Elevation: UNK

BORING: B-4

Page 2 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/27/03

[illegible]



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Boring Diameter: 8"

Logged by: CHD

Surface Elevation: UNK

BORING: B-5

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/23/03

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
0			18/ 12"	2.8	111		SM		ALLOVIUM At 0 to 4½'; brown (10YR 4/3) silty fine to coarse sand (damp, medium dense).
			13/ 12"	2.6	105				At 3'; slight porosity.
5			4/ 4/ 3				SM		At 4½' to 14½'; brown (7.5YR 4/4) silty fine to coarse sand (damp, loose).
			15/ 12"	4.9	109				At 8'; pinhole porosity.
10			5/ 4/ 4						At 10'; pinhole porosity.
			19/ 12"	6.8	119				At 13'; becoming damp to moist.
15			7/ 5/ 5				SM		At 14½' to 22'; light yellowish brown (10YR 6/4) silty fine to coarse sand (moist, medium dense).
			20/ 12"	6.6	115				At 18'; few gravel.
20			8/ 7/ 8						
			28/ 12"	5.2	116		SW		OLDER ALLUVIUM At 22' to 50½'; light olive brown (2.5Y 5/4) slightly silty fine to coarse sand, common gravel (damp, medium dense).
25			10/ 22/ 28						At 25'; becoming dense.
			58/ 7"						Below 28'; becoming very dense.
30			38/ 50/ 4"						



Date: 1/23/03

[illegible]



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-6

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/27/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0				15/12"	3.0	107		SM		ALLOVIUM At 0 to 5½'; brown (10YR 4/3) silty fine to coarse sand (damp, medium dense). At 1'; porous. Few gravel.
				16/12"	3.7	103				
5				5/7/7				SM		At 5½' to 7½'; yellowish brown (10YR 5/4) silty fine to coarse sand, some gravel (damp, medium dense).
				46/12"	2.5	125		SM: SW		OLDER ALLOVIUM At 7½' to 12'; light olive brown (2.5Y 5/3) slightly silty to silty fine to coarse sand, common gravel (damp, dense). Heavy chatter.
10				14/20/18						
				50/6"				GM		At 12' to 15½'; light olive brown (2.5Y 5/3) silty fine sand, common gravel (damp, dense).
15				12/19/25				GM		At 15½' to 24'; light olive brown (2.5Y 5/3) silty fine to coarse sand, common gravel (damp, dense).
20				38/50						Below 20'; slow, difficult drilling. Heavy chatter. At 20'; becoming very dense.
25				18/14/26				SM		At 24'; smooth, hard drilling. At 24' to 29'; light olive brown (2.5Y 5/3) silty very fine sand (damp, dense). Few gravel.
30				22/50				SM		At 29' to 35½'; light olive brown (2.5Y 5/4) silty fine to coarse sand, some gravel (damp, very dense).



Date: 1/27/03

[illegible]



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-7

Page 1 of 1

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/27/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
0								SM		ALLOVIUM At 0 to 7½'; brown (10YR 4/3) silty fine to coarse sand (damp, loose). At 1'; porous.
				10/ 12"	4.4	109				At 3'; porous. Few gravel.
				14/ 12"	3.5	103				
5				14/ 12"	3.8	102				At 5'; porous. Some gravel.
								SM		At 7½' to 15½'; brown (7.5YR 5/4) silty fine to coarse sand, few gravel (damp, medium dense).
10				15/ 12"	4.8	107				
								SW		At 15½' to 17'; brown (7.5YR 5/4) slightly silty fine to coarse sand (damp, medium dense).
15				17/ 12"	5.7	111		SC		At 17' to 24'; dark yellowish brown (10YR 4/4) clayey fine to coarse sand, some gravel (moist, medium dense).
20				18/ 12"	7.4	115				
25				50/ 6"	2.4	118				BEDROCK At 24' to 28'; light yellowish brown (10YR 6/4) Gneiss. Damp. Weathered. Friable.
				13/ 2"						Total depth 28'
30										No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Boring Diameter: 8"

Logged by: CHD

Surface Elevation: UNK

BORING: B-8

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/23/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
0								SM		ALLOVIUM At 0 to 4'; brown (10YR 4/3) silty fine to coarse sand, some gravel (damp to moist, loose).
5				9/ 12"	6.8	111		SM		At 4 to 17'; light yellowish brown (10YR 6/4) silty fine to coarse sand, few gravel (damp, medium dense).
				6/ 7/ 8						
				14/ 12"	5.5	116				At 8'; slight pinhole porosity.
10				6/ 5/ 4						At 10'; becoming loose.
				12/ 12"	5.6	120				At 13'; trace clay, becoming moist.
15				6/ 12/ 12						At 15'; becoming medium dense. Some gravel.
				34/ 12"	4.7	121		SW		OLDER ALLUVIUM At 17½' TO 50½'; light olive brown (2.5Y 5/4) slightly silty fine to coarse sand, common gravel (damp, dense).
20				14/ 17/ 22						
				40/ 8"	3.7	114				At 23'; becoming very dense.
25				38/ 50+						
				70/ 4"						At 28'; cobble in tip.
30				50/ 4"						



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8"

Surface Elevation: UNK

BORING: B-8

Page 2 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/23/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
35		■		50/ 5½"						
40		■		36/ 50/ 4½"						
45		■		32/ 37/ 39/ 4"						
50		■		50/ 5"						
55										

Total depth 50½'
No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-9

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/23/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0								SM		OLDER ALLUVIUM
				50/ 12"	6.0	100		SM		At 0 to ½'; light olive brown (2.5Y 5/3) silty fine to coarse sand, some gravel (damp, very dense).
				38/ 8"	4.1	98				At ½' to 10½'; light olive brown (2.5Y 5/3) silty fine sand (damp, dense).
5				12/ 13/ 17						
				50/ 6"	5.8	96				At 9'; few gravel.
10				18/ 28/ 33				SM		At 10'; becoming very dense. At 10½' to 20½'; light olive brown (2.5Y 5/3) silty fine to coarse sand (damp, very dense). Few gravel.
										At 12' to 14'; heavy chatter.
15				19/ 18/ 27						At 15'; becoming dense.
20				17/ 27/ 37				SW		At 20'; becoming very dense. At 20½' to 33'; light olive brown (2.5Y 5/3) slightly silty fine to coarse sand, few gravel (damp, very dense).



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Boring Diameter: 8" Surface Elevation: UNK

Logged by: CHD

BORING: B-9

Page 2 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/23/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
25				25/ 50"						At 25'; common gravel.
30				39/ 53+						At 30'; few gravel.
35				70/ 6"						BEDROCK At 33' to 40½'; light yellowish brown (2.5Y 6/4) Gneiss. Weathered. Friable.
40				50/ 5"						At 40'; becoming white quartz. Total depth 40½' No caving, No groundwater.



Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Boring Diameter: 8"

Logged by: CHD

Surface Elevation: UNK

BORING: B-10

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/24/03

Applied Earth Sciences

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0								SM		ALLUVIUM
				12/12"	6.0	116				At 0 to 4½'; brown (10YR 4/3) silty fine to coarse sand, some gravel (damp, medium dense to loose).
				11/8"	4.5	104				
5				5/4/3				SM		At 4½' to 21'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, loose). Some gravel.
				14/12"	4.2	110				
10				4/4/5						
				12/12"	6.5	112				At 13'; becoming moist.
15				7/8/6						At 15'; becoming medium dense.
				13/12"	7.5	115				
20				5/5/7				SW		At 21' to 23½'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand, some gravel (damp, medium dense).
				23/12"	4.8	114		SM		At 23½' to 27'; yellowish brown (10YR 5/4) silty fine to coarse sand, some gravel (damp, medium dense).



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8" Surface Elevation: UNK

BORING: B-10

Page 2 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/24/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
25				8/ 7/ 8						At 25'; no gravel.
				32/ 12"	3.7	114		SW		At 27' to 34'; yellowish brown (10YR 5/6) slightly silty fine to coarse sand, common gravel (damp, medium dense). Friable.
30				8/ 9/ 11						At 30'; no gravel.
				23/ 12"	4.4	113		SC		At 33'; few gravel.
35				6/ 5" 5						At 34' to 39½'; yellowish brown (10YR 5/4) clayey fine to coarse sand, some gravel (moist, medium dense).
				21/ 12"	5.8	117				
40				6/ 7/ 8				SM		At 39½' to 42'; yellowish brown (10YR 5/4) silty fine to coarse sand, trace clay (moist, medium dense).
				24/ 12"	6.6	124		SM		At 42' to 46½'; brown (10YR 4/3) silty fine to coarse sand, trace clay (moist, medium dense).
45				12/ 25/ 36						At 45'; common gravel, becoming very dense.
										BEDROCK At 46½' to 47'; light olive brown (2.5Y 5/4) Gneiss (damp).
										Total depth 47' (Refusal). No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands
 Drill Co. and Rig Type: Prosonic, CME 85
 Hammer: 140 lbs. auto Logged by: CHD
 Boring Diameter: 8" Surface Elevation: UNK

BORING: B-11

Page 1 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/24/03

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
0							SM		ALLOVIUM
			11/ 12"	5.6	108		SW		At 0 to 1'; brown (10YR 4/3) silty fine to coarse sand (damp to moist, loose).
			7/ 12"	3.6	108		SM		At 1' to 3½'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand (moist, loose). Friable.
							SM		At 3½' to 4½'; brown (10YR 4/3) silty fine to coarse sand (moist, loose).
5			2/ 2/ 2				SM		At 4½' to 7'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, loose).
			10/ 12"	6.0	111		SM		At 7' to 12'; dark yellowish brown (10YR 4/4) silty fine to coarse sand (moist, loose).
10			4/ 3/ 3				SM		At 10'; some gravel, becoming damp.
			14/ 12"	5.3	115		SW		At 12'; to 16'; yellowish brown (10YR 5/4) silty fine to coarse sand, some gravel (damp, medium dense).
15			4/ 5/ 6				SW		At 16' to 18½'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand (damp, medium dense).
			13/ 12"	2.6	118		SM		At 18'; some gravel. At 18½' to 24'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, medium dense).
20			5/ 4/ 6				SW		
			19/ 12"	4.4	111		SW		At 23'; common gravel.
							SW		At 24' to 24½'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand (damp, medium dense).



Applied Earth Sciences

Project: Griffin, Redlands

Drill Co. and Rig Type: Prosonic, CME 85

Hammer: 140 lbs. auto

Logged by: CHD

Boring Diameter: 8"

Surface Elevation: UNK

BORING: B-11

Page 2 of 2

Work Order: 2467-0-0-10

Report Log No.: 22271

Date: 1/24/03

Depth (ft)	Undisturbed	SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/Lithology	Description
25				6/ 7/ 7				SM		At 24½' to 37'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, medium dense). Few gravel.
				23/ 12"	4.2	117				At 28'; common gravel.
30				8/ 6/ 9						
				22/ 12"	3.7	114				At 33'; some gravel.
35				7/ 7/ 10						At 35'; becoming moist, few gravel.
				50/ 12"	4.5	121		SW		OLDER ALLUVIUM At 37' to 45½'; light olive brown (2.5Y 5/4) slightly silty fine to coarse sand, common gravel (damp, very dense). Below 39'; very difficult drilling.
40				20/ 38/ 45						
45				25/ 50+						BEDROCK At 45½' to 46'; brown and white fine-grained Gneiss. Weathered. Friable. Damp. Total depth 46' (Refusal). No caving, No groundwater.



Applied Earth Sciences

Project: Griffin, Redlands
 Drill Co. and Rig Type: Prosonic, CME 85
 Hammer: 140 lbs. auto Logged by: CHD
 Boring Diameter: 8" Surface Elevation: UNK

BORING: B-12
 Page 1 of 2

Work Order: 2467-0-0-10
 Report Log No.: 22271
 Date: 1/27/03

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
0							SM		ALLOVIUM At 0 to 7½'; brown (10YR 4/3) silty fine to coarse sand (damp, loose).
			6/ 12"	3.6	105				
			9/ 12"	5.2	108				
5			6/ 12"	4.7	111				
							SW		At 7½' to 12½'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand (damp, medium dense).
10			13/ 12"	4.8	112				
							SM		At 12½' to 18'; yellowish brown (10YR 5/4) silty fine to coarse sand (damp, medium dense). Few gravel.
15			14/ 12"	6.6	113				
							SW		At 18' to 36'; yellowish brown (10YR 5/4) slightly silty fine to coarse sand (damp, medium dense). Few gravel.
20			19/ 12"	5.4	105				



Project: Griffin, Redlands
 Drill Co. and Rig Type: Prosonic, CME 85
 Hammer: 140 lbs. auto Logged by: CHD
 Boring Diameter: 8" Surface Elevation: UNK

BORING: B-12
 Page 2 of 2

Work Order: 2467-0-0-10
 Report Log No.: 22271
 Date: 1/27/03

Applied Earth Sciences

Depth (ft)	Undisturbed SPT	Bulk	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	Penetrometer (tsf)	USCS	Soil/ Lithology	Description
25			27/ 12"	3.5	114				
30			32/ 12"	4.0	115				At 30'; becoming dense.
35			35/ 12"	3.7	112				Total depth 36' No caving, No groundwater.



Project: GRIFFIN-WABASH-REDLANDS

Work Order: 2467-1-0-10
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: B-13

Page Number: 1

Date(s) Excavated 9/30/03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1844'
Excavation Dimension 8"	Equipment Contractor	Equipment Type Hollow Stem Auger	Hammer Data 140#, 30" Drop

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
0					ML		FILL (af): Dark yellowish brown (10YR 4/4) to black (10YR 2/1) mottled slightly clayey sandy SILT (moist, loose to medium dense) with debris (asphalt) to 3". Moderately well sorted. Angular debris and rock fragments.	
1840	27/ 12"	6.4	113		SM		ALLUVIUM (Qal): Dark yellowish brown (10YR 4/4) silty medium to coarse SAND (moist, loose to medium dense). Well sorted. Easily friable. Unlayered.	
5								
1835	18/ 12"	6.4	103		ML		Light yellowish brown (10YR 6/4) SILT (damp, medium dense). Unsorted. Unlayered. Easily friable.	
10					SP		Dark yellowish brown (10YR 6/4) fine to medium SAND (moist, medium dense) with silt. Moderately well sorted. Easily friable. Gravel layer near upper contact to above.	
1830	26/ 12"	5.5	113					
15								
1825	11/ 12"	11.0	110		SW		Dark yellowish brown (10YR 4/6) fine to coarse SAND (moist, loose) with coarse gravel and rare angular pebbles. Well sorted. Easily friable.	
20					SW		Brownish yellow (10YR 6/8) to dark brownish yellow (10YR 4/4) speckled fine to coarse SAND (damp, medium dense) with gravel. Well sorted. Rounded gravel. Easily friable.	
1820	38/ 12"	4.3	122					
25								
1815	22/ 12"	5.7	115		SP		Dark yellowish brown (10YR 4/6) SAND (damp, medium dense) with increasing gravel up to 3". 30% gravel. Rounded clasts.	
30					SP		Yellowish brown to dark yellowish brown (10YR 4/6 to 5/6) fine SAND (moist medium dense) with some coarse gravel and rare pebbles. Poorly sorted. Friable.	
1810	35/ 12"	6.3	127					
35								
1805	95/ 10"	7.6	122		SP		OLDER ALLUVIUM (Qoal): Light yellowish brown to light olive brown (10YR 6/4 to 2.5Y 5/4) fine SAND (moist, very dense) with trace coarse subrounded gravel.	



Project: GRIFFIN-WABASH-REDLANDS

SUBSURFACE LOG

Work Order: 2467-1-0-10
Report Log: 23081

Excavation
Number: B-13

Page Number: 2

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
40								
1800	64/12"				SP		Light yellowish brown to light olive brown (10YR 6/4 to 2.5Y 5/4) fine SAND (damp, dense) becoming fine to coarse sand with coarse gravel. Very well sorted. Friable. Rounded clasts.	
45								
	64/12"	5.4	104		ML		At 64"; up to 50% gravel.	
1795					SP		Light olive brown (10YR 5/4) slightly clayey SILT (moist, stiff) with few coarse angular gravel size rocks. Distinctly separate from unit above.	
50	66/12"	8.5	114				Light olive brown (10YR 5/4) fine to coarse SAND to medium to coarse SAND (damp, dense) with gravel. Coarser material occurs in subliothified layers that are friable with difficulty. Fine sand is dense and easily friable.	
1790							Total Depth 51'	
55							No caving, no groundwater.	
1785								
60								
1780								
65								
1775								
70								
1770								
75								
1765								
80								



Project: GRIFFIN-WABASH-REDLANDS

Work Order: 2467-1-0-10
Report Log:

SUBSURFACE LOG

Excavation
Number: B-14

Page Number: 1

Date(s) Excavated 9/30/03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1866±
Excavation Dimension 8"	Equipment Contractor	Equipment Type Hollow Stem Auger	Hammer Data 140#, 30" Drop

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1865	26/ 12"	4.2	120	SM		FILL (af): Yellowish brown (10YR 5/4) silty medium to coarse SAND (damp, loose to medium dense). Moderately well sorted. Friable.		
1860	20/ 12"	4.0	106	SW		ALLUVIUM (Qal): Yellowish brown (10YR 5/4) fine to coarse SAND with gravel (damp, medium dense). Friable. Moderately well sorted.		
1855	23/ 12"	4.4	110			At 11'; becoming slightly more silty.		
1850	33/ 12"	4.3	117	SM		Yellowish brown (10YR 5/4) silty fine to coarse SAND (damp, medium dense) with common large gravel to 3". Easily friable. Moderately well sorted.		
1845	38/ 12"	3.2	116	SP		OLDER ALLUVIUM (Qoal): Light yellowish brown (2.5Y 6/4) fine SAND with yellow to olive yellow (2.5Y 6/6 to 7/6) speckles of medium to coarse SAND (damp, medium dense) with gravel. Well sorted. Easily friable. Roots.		
1840						At 26'; sampler jammed on numerous small cobbles in matrix as above. Rootlets associated with cobbles.		
1835	95/ 10"	3.3	111	GP		Thinly interlayered sandy pebble conglomerate, clast supported matrix of rounded to subrounded 1" pebbles within 2" interbeds of fine sand (dry to damp, dense). Easily friable sand.		
1830	76/ 11"	3.4	115	SP		Light olive brown (2.5Y 5/4) fine SAND (damp, dense) with olive yellow (2.5Y 6/6) speckles of coarse sand. Easily friable.		
				SW		Light olive brown (2.5Y 5/4) to light brownish gray (2.5Y 6/2) fine to coarse SAND (damp, dense) with gravel. Very well sorted. Easily friable. Thin gravelly beds.		



Project: GRIFFIN-WABASH-REDLANDS

Work Order: 2467-1-0-10
Report Log:

SUBSURFACE LOG

Excavation
Number: B-14

Page Number: 2

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1825		74/ 9"			SW		Light olive brown (2.5Y 5/4) fine to coarse SAND (damp, dense) with olive yellow (2.5Y 6/6) speckles of coarse sand. Easily friable.	
1820		87/ 10"						
1815		50/ 3"					Total Depth 51' No caving, no groundwater.	
1810								
1805								
1800								
1795								
1790								
1785								



Project: Griffin-Buckingham Court-Redlands

SUBSURFACE LOG

Work Order: 2467-2-0-10
Report Log: 23081

Excavation
Number: B-15

Page Number: 1

Date(s) Excavated 9/26/03	Logged By ET±	Excavation Location Redlands	Approximate Surface Elevation 1779½'
Excavation Dimension 8"	Equipment Contractor	Equipment Type Hollow Stem Auger	Hammer Data 140#, 30" Drop

Elevation / Depth (ft.)	Bulk Undisturbed	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1775	20/ 12"	4.1	114	SM			ALLUVIUM (Qal): Yellowish brown-dark yellowish brown (10YR 5/6-4/6) silty fine to medium SAND (damp, medium dense) with coarse gravel, rounded gravel, pinpoint porosity, easily friable, trace caliche stains, poorly sorted.	
1770	21/ 12"	4.3	115	SW			At 7'; gradual transition to yellowish brown, dark yellowish brown (10YR 4/6-5/6) fine to coarse SAND (moist, medium dense), trace silt, non porous, friable, moderately well sorted.	
1765	16/ 12"	6.3	114	SP			OLDER ALLUVIUM (Qoal): Yellowish brown to dark yellowish brown (10YR 4/6-5/6) fine to coarse SAND (moist, medium dense to dense), trace silt, non porous, friable with coarse gravel of weathered granite/mafic rock to 3", moderately well sorted, drills harder.	
1760	47/ 12"	7.5	113	SP			Dark yellowish brown (10YR 4/6) medium to coarse SAND with rare spots brownish yellow (10YR 6/8) medium to coarse SAND (damp, dense), with trace medium rounded gravel, friable with difficulty, becoming coarser downward, well sorted.	
1755	71/ 12"	5.2	122	SP			Total Depth 21' No caving. No groundwater	
1750								
1745								
1740								



Project: Griffin-Buckingham Court-Redlands

Work Order: 2467-2-0-10
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: B-16

Page Number: 1

Date(s) Excavated 9/26/03	Logged By ET	Excavation Location Redlands	Approximate Surface Elevation 1778±
Excavation Dimension 8"	Equipment Contractor	Equipment Type Hollow Stem Auger	Hammer Data 140#, 30" Drop

Elevation / Depth (ft.)	Bulk Undisturbed	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1775	60/ 12"	7.5	122	ML			FILL (al): Yellow brown (2.5YR 4/6) sandy SILT (damp, medium dense) with rare reddish brown (5YR 4/4) angular siltstone fragments, poorly sorted (mostly fine sand) friable, strong brown (7.5YR 4/6) to very pale brown (10YR 7/4) mottled silt with trace sand and coarse gravel (dry) friable, rare punky fragments, weathered granite.	
1770	50/ 12"	8.9	122	ML			Strong brown (7.5YR 4/6) to very pale brown (10YR 7/4) mottled SILT (damp, medium dense) with trace of sand and coarse gravel, friable, rare punky fragments weathered granite.	
1765	62/ 12"	9.5	127	SM			Strong brown (7.5YR 5/6) to reddish brown (5YR 4/4) mottled silty SAND (damp, medium dense) with angular to rounded gravel, well sorted, friable with difficulty.	
1760	40/ 12"	10.1	120					
1755	14/ 12"	7.6	121	ML- SM			ALLUVIUM (Qal): Dark yellowish brown (10YR 3/4) to grayish green (Gley 4/5-4/6) fine to medium sandy SILT to silty SAND (moist, loose), poorly sorted, easily friable.	
1750	8/ 12"	7.6	110	SM			Dark yellowish brown (10YR 3/4) silty fine to medium SAND (moist, loose) with trace of coarse rounded gravel, well sorted, easily friable.	
1745	11/ 12"	6.6	117	ML			At 22 1/2': dark yellowish brown (10YR 3/4) fine to medium sandy SILT (moist loose), friable, pinpoint porosity, irregular contact to below.	
1740	12/ 12"	8.6	110	SM			Dark yellowish brown (10YR 3/6) silty fine to coarse SAND (moist, loose to medium dense) with rounded gravel, friable, very well sorted, no porosity observed at 26'.	
1735	34/ 12"	7.3	122	SW			OLDER ALLUVIUM (Qol): At 30': olive brown to light olive brown speckled (2.5Y 4/4-5/6) fine to coarse SAND (moist, medium dense) with trace of silt and rounded coarse gravel, easily friable.	
1730							Total Depth 31' No caving, No groundwater	



Project: Griffin-Buckingham Court-Redlands

Work Order: 2467-2-0-10
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: B-17

Page Number: 1

Date(s) Excavated 9/26/03	Logged By ET	Excavation Location Redlands	Approximate Surface Elevation 1831±
Excavation Dimension 8"	Equipment Contractor	Equipment Type Hollow Stem Auger	Hammer Data

Elevation / Depth (ft.)	Bulk Undisturbed	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1830					ML		FILL (ai): Strong brown (7.5YR 4/6) sandy SILT (dry, loose) with trace gravel.	Hand auger upper 5'
1825		9/ 12"	8.7	100	ML		ALLUVIUM (Qal): Strong brown (7.5YR 4/6) silt to sandy SILT (moist, loose), occasional weathered gravel of punky granite, angular clasts, easily friable, poorly sorted. At 7'; becoming dark yellowish brown (10YR 3/6) sandy SILT (moist, loose) with trace of subrounded gravel, easily friable, speckled white with caliche.	
1820		24/ 12"	6.6	119	SP		Strong brown (7.5YR 5/6) medium to coarse SAND (moist, medium dense), trace silt, some coarse subrounded gravel, well sorted, friable.	
1815		45/ 12"	6.0	115	SP		OLDER ALLUVIUM (Qal): Light olive brown to olive yellow speckled (2.5YR 4/4-5/6) fine SAND (moist, medium dense) with 20-40% medium to coarse sand with rounded gravel to 1/2".	
1810		42/ 12"	5.2	108			At 20'; with rounded weathered pink quartzite pebbles, coarser materials separated from fine sand, poorly defined layers.	
1805		65/ 12"	6.4	118	GP- SP		Coarsening downward to medium to coarse SAND with GRAVEL (moist, medium dense to dense), gravel to 45%, unlayered, very well sorted, easily friable.	
1800		57/ 12"	5.8	113	SW		Yellowish brown to light olive brown (2.5Y 6/4-5/6) fine to coarse SAND (moist, medium dense to dense) with coarse rounded gravel to 1", very well sorted.	
1795		87/ 10"	4.8	133			At 35'; increase up to 50% gravel to 2".	
					SP		Dark yellowish brown (10YR 4/6) fine SAND (moist, dense), trace silt and angular gravel, poorly sorted rare subangular gravel to 2".	



Project: Griffin-Buckingham Court-Redlands

SUBSURFACE LOG

Work Order: 2467-2-0-10
Report Log: 23081

Excavation
Number: B-17

Page Number: 2

Elevation / Depth (ft.)	Bulk Undisturbed	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1790	40	88/10"	6.3	123	ML		Strong brown (10YR 4/6) SILT (moist, dense) with few coarse gravel and rare rounded gravel to 1/2", poorly sorted, unlayered.	
1785	45	65/11"	10.6	124			Very hard drilling at 45'.	
1780	50	95/10"	6.4	121	SM		Yellowish brown (10YR 5/8-6/8) to brownish yellow silty fine SAND (moist, very dense) with oxidized mafic rock to 2", clasts are brittle, easily friable, very poorly sorted.	
							Total Depth 51'	
							No caving, No groundwater	
1775	55							
1770	60							
1765	65							
1760	70							
1755	75							
1750	80							



Project: Wabash Avenue 5 Acre Investigation

Work Order: 2467-0-0-12
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: TP-1

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1845±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1845 0					SM		FILL(af): Grayish brown to light grayish brown (10YR 5/2 to 6/2) silty fine to coarse SAND (dry to damp, loose) with gravel to 3", rootlets, open pores and voids to 3", well sorted, unlayered.	
1840 5					GW		OLDER ALLUVIUM (Qoa): Light gray (10YR 6/1) sandy GRAVEL (dry to damp, loose to medium dense) with cobbles to 6", well graded with partial sorting of cobbles into faint lensoidal beds, non porous, rootlets to 5'. Total Depth 5' No caving, No groundwater.	
1835 10								
1830 15								
1825 20								
1820 25								
1815 30								
1810 35								



Project: Wabash Avenue 5 Acre Investigation

Work Order: 2467-0-0-12
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: TP-2

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location Sec Map	Approximate Surface Elevation 1865±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1865 0					ML		FILL(af): Grayish brown to light grayish brown (10YR 5/2 to 6/2) sandy SILT, (dry, loose), pinpoint porosity, rare pebble of weathered quartzite, some trash and construction debris.	
1860 5					SM-GP		OLDER ALLUVIUM (Goal): Light gray (10YR 6/1) silty SAND to sandy GRAVEL (dry, medium dense), partial sorting of gravel into thin poorly defined beds, porous, easily friable, rare cobbles punky gneiss.	
1855 10							Total Depth 8' No caving, No groundwater.	
1850 15								
1845 20								
1840 25								
1835 30								
1830 35								



Project: Wabash Avenue 5 Acre Investigation

Work Order: 2467-0-0-12
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: TP-3

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1855'±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1855 0					ML- SP		FILL(af): Pale brown (10YR 4/6) to strong brown (7.5YR 4/6) SILT and SAND (dry, loose), with gravel to cobble size rock fragments to 8", mostly silt gradually coarsening to sand, well graded, rootlets, gopher holes to 2", debris fragments of concrete and asphalt to 2'.	
1850 5					SM		ALLUVIUM (Qal): Pale brown (10YR 4/6) silty SAND (dry, medium dense) with gravel and cobbles, angular to rounded clasts, well sorted, larger fragments near upper contact to fill, non porous, rootlets, irregular layer of strong brown (7.5YR 4/6) sandy silt below coarse zone.	
1845 10							Total Depth 8' No caving. No groundwater.	
1840 15								
1835 20								
1830 25								
1825 30								
1820 35								



Project: Wabash Avenue 5 Acre Investigation

Work Order: 2467-0-0-12
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: TP-5

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1778±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
0					SM		OLDER ALLUVIUM (Goal): Yellowish brown to light brown (10YR 5/ 4 to 6/4) silty fine to coarse SAND (damp, loose to medium dense) with gravel and cobbles, crumbly, rootlets to 4½', large pores to 1/4" in upper 2', becoming pin point porosity at 5'.	
1775							Non-porous below 5'. Unlayered, well sorted. Total Depth 5½' No caving, No groundwater.	
5								
1770								
10								
1765								
15								
1760								
20								
1755								
25								
1750								
30								
1745								
35								
1740								



Project: Wabash Avenue 5 Acre Investigation

Work Order: 2467-0-0-12
Report Log: 23081

SUBSURFACE LOG

Excavation
Number: TP-6

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1790±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
1790 0					SW		OLDER ALLUVIUM (Qoal): Brown (7.5YR 4/6) mottled with yellowish brown to light yellowish brown (10YR 5/4 to 6/4) fine to coarse SAND (damp, medium dense), with silt, gravel, and cobbles, well sorted, massive, easily friable, porous.	
1785 5					SP		Yellowish brown to light brown (10YR 5/4 to 6/4) fine to coarse SAND (damp, medium dense to dense) with silt, some gravel in poorly defined lensas, coarsening downward, non-porous, well sorted.	
1780 10							Total Depth 6½' No caving, No groundwater.	
1775 15								
1770 20								
1765 25								
1760 30								
1755 35								



Project: Wabash Avenue 5 Acre Investigation

SUBSURFACE LOG

Work Order: 2467-0-0-12
Report Log: 23081

Excavation
Number: TP-7

Page Number: 1

Date(s) Excavated 9-29-03	Logged By ET	Excavation Location See Map	Approximate Surface Elevation 1812±
Excavation Dimension 24"	Equipment Contractor United Operating	Equipment Type Backhoe with 24" Bucket	Hammer Data

Elevation / Depth (ft.)	Bulk Sample Type	Blow Counts	Moisture Content (% dry weight)	Dry Density (pcf)	USCS	Soil / Lithology	Description	Remarks
0					SW		OLDER ALLUVIUM (Qoal): Yellowish brown to light brown (7.5YR 5/4 to 6/4) fine to coarse SAND (damp, loose to medium dense) with gravel and rare weathered cobbles of felsic granite, easily friable, pores to 1/4" in upper 1', coarsening downward, unlayered, rootlets to 5'. Poorly defined irregular contact at 5'.	
1810					SP		Yellowish brown medium to coarse SAND (damp, loose to medium dense) with gravel and rare cobbles to 6", mostly rounded clasts, rare angular clasts.	
5					GP- SP		Yellowish brown medium to coarse SAND interlayered with sandy gravel (damp, medium dense to dense), some cobbles to 6", mostly rounded clasts, rare angular clasts, material occurs in poorly defined discontinuous lenses, faint imbrication to gravel and cobbles, easily friable, non-porous. Total Depth 8' No caving. No groundwater.	
1805								
10								
1800								
15								
1795								
20								
1790								
25								
1785								
30								
1780								
35								
1775								

Geotechnical Boring Log B- 1

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 1 of 2
Project Number: I05905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1820	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0		Bag-1			Qw	<u>WASH:</u>	Maximum
		0-5			SM	Silty SAND; yellow brown, slightly moist, very loose, fine to coarse sand	Density
	3 3 3	R-1	109.4	3.9			Expansion
5	1 3 3	R-2	106.1	8.0		dark yellow brown, moist	R-Value
	1 3 3	R-3	111.7	8.6		pinhole porosity	Sulfate
10	2 4 6	R-4	110.6	5.2		fine to coarse sand, fine gravel	
15	3 3 5	SPT-1	-	4.6			
20	3 4 6	R-5	109.1	8.7			
25	1 1 1	SPT-2	-	7.5			

Geotechnical Boring Log B- 1

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 2 of 2
Project Number: I05905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1820	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
30	2 2 2	R-6	113.5	9.6	SM		
35	2 2 4	SPT-3	-	11.9	SC	Clayey SAND; medium brown, moist, very loose, fine to coarse sand	
40	25 50	R-7	120.2	7.2	Qvoa SP-SC	<u>VERY OLD ALLUVIUM:</u> SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to coarse gravel, with clay	
45	18 50 for 4"	SPT-4	-	5.2	ML	Sandy SILT; olive green, slightly moist, hard, fine to coarse sand	
50	50 for 5"	R-8	-	5.5	SP-SC	SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to coarse gravel, disturbed	
55						Total Depth: 50.5 feet No Groundwater	
60							

Geotechnical Boring Log B- 2

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 1 of 1
Project Number: 105905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1916	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qw SM	<u>WASH:</u> Silty SAND; dark yellowish brown, slightly moist, very loose, fine to coarse sand	
2	2	R-1	112.9	6.4			
5	2	R-2	108.5	6.6			
8	3	R-3	112.4	6.8			
10	3	R-4	109.4	6.7			
15	6	R-5	107.5	6.6	SP-SM	SAND; dark yellowish brown, slightly moist, loose, fine to coarse sand	
20	10	SPT-1	-	8.9	SC	Clayey SAND; medium brown, slightly moist, medium dense, fine to coarse sand	
25	11	R-6	113.0	15.1		very dense	
26.5	26						
30	50 for 5"						
Total Depth: 26.5 feet No Groundwater							

Geotechnical Boring Log B- 3

Date: 5/16/05

Project Name: Granite - Wabash/I-10

Page 1 of 1

Project Number: 105905-10

Logged By: AW

Drilling Company: 2R

Type of Rig: CME-55

Drive Weight (lbs): 140

Drop (in): 30

Hole Dia (in): 8

Top of Hole Elevation (ft): 1884

Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qw SM	<u>WASH:</u> Silty SAND; dark yellowish brown, slightly moist, loose, fine to coarse sand	
3	3	R-1	114.8	8.6			
4	4						
5	2					pinhole porosity	
6	3	R-2	105.4	9.0			
7	3						
8	1						
9	2	R-3	118.0	10.1			
10	3				SC	Clayey SAND; medium brown, moist, loose, fine to coarse sand	
11	4						
12	4	R-4	110.6	10.1			
13	6						
14					SM-SC	Silty SAND; medium brown, slightly moist, dense, fine to coarse sand with clay	
15	7						
16	21	R-5	116.7	9.1			
17	34						
18							
19	10						
20	13	SPT-1	-	7.1			
21	18						
22							
23							
24					SP	SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to coarse gravel	
25	36	R-6	109.0	5.6			
26	50 for						
27	4						
28							
29							
30							
Total Depth: 26 feet No Groundwater							

LGC
INLAND

Geotechnical Boring Log B- 4

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 1 of 1
Project Number: I05905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1782	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qvoa SM	<u>VERY OLD ALLUVIUM:</u> Silty SAND; dark yellowish brown, slightly moist, loose, fine to coarse sand, fine to coarse gravel	
4	4	R-1	106.3	4.2			
6	6	Bag-1					
7	7						
5	4	5-10'					
6	4	R-2	109.9	2.6			
6	6						
10	6	R-3	111.9	5.5		yellowish brown, dry, medium dense, fine to medium sand, trace coarse sand, fine gravel	
20	20						
10	10	R-4	124.6	9.3	SC	Sandy CLAY; reddish brown, moist, very stiff, fine to coarse sand	
11	11						
24	24						
15	12	R-5	-	5.5	SM	Silty SAND; olive grey, slightly moist, medium dense, fine to coarse sand	
15	15						
30	30						
20	10	SPT-1	-	3.7		dense	
15	15						
19	19						
25	36	R-6	108.6	6.1		very dense	
50 for	50 for						
5'	5'						
Total Depth: 26 feet No Groundwater							
30							

Geotechnical Boring Log B- 5

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 1 of 1
Project Number: 105905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1788	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qw SM	<u>WASH:</u> Silty SAND; dark yellowish brown, slightly moist, loose, fine to coarse sand, fine to coarse gravel	
1	1						
2	2						
2	2	R-1	112.7	7.8			
5	1				SC	Clayey SAND; dark yellowish brown, moist, very loose, fine to coarse sand	
2	2	R-2	107.7	7.2			
2	2						
3	3	R-3	107.5	7.7			
10	2				SM	Silty SAND; dark yellowish brown, moist, loose, fine to coarse sand	
3	3	R-4	109.2	7.1			
4	4						
15	2				SC	Clayey SAND; dark yellowish brown, moist, loose, fine to coarse sand	
4	4	R-5	116.8	10.1			
5	5						
20	9				Qvoa SC	<u>VERY OLD ALLUVIUM:</u> Clayey SAND; yellow brown, slightly moist, medium dense, fine to coarse sand	
10	10	SPT-1	-	7.9			
13	13						
25	31						
40	40	R-6	116.5	10.2			
50 for 5"	50 for 5"						
Total Depth: 26.5 feet No Groundwater							
30		-	-	-			

Geotechnical Boring Log B- 6

Date: 5/16/05	Project Name: Granite - Wabash/I-10	Page 1 of 1
Project Number: I05905-10	Logged By: AW	
Drilling Company: 2R	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft): 1855	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0		Bag-1			Qvoa	<u>VERY OLD ALLUVIUM:</u>	Maximum
		0-5			CL	Sandy CLAY; reddish brown, moist, hard, fine to coarse sand	Density
	18 40 50	R-1	125.3	11.2			Expansion
5							Sulfate
	12 25 37	R-2	126.9	10.2	SC	Clayey SAND; medium brown, slightly moist, medium dense, fine to coarse sand	
	20 50 for 3"	R-3	123.1	8.1	SP	SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to coarse gravel, disturbed	
10					SC	Clayey SAND; yellow brown, moist, stiff, fine to coarse sand	
	17 36 50	R-4	115.9	13.8			
15					SP-SM	SAND; yellow brown, slightly moist, very dense, fine to coarse sand	
	36 50 for 5"	R-5	112.6	4.0			
20					SM	Silty SAND; yellow brown, slightly moist, dense, fine to coarse sand	
	11 29 42	SPT-1	-	4.8			
25							
	12 20 50	R-6	122.0	9.9			
30							
Total Depth: 26½ feet No Groundwater							

Geotechnical Boring Log B- 7							
Date: 5/16/05		Project Name: Granite - Wabash/I-10			Page 1 of 1		
Project Number: 105905-10		Logged By: AW					
Drilling Company: 2R		Type of Rig: CME-55					
Drive Weight (lbs): 140		Drop (in): 30		Hole Dia (in): 8			
Top of Hole Elevation (ft): 1855		Hole Location: See Geotechnical Map					
Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qw SM	<u>WASH:</u> Silty SAND; dark yellowish brown, slightly moist, very loose, fine to coarse sand	
2	2	R-1	116.6	7.2			
4	4						
5	4					loose	
	5	R-2	113.1	7.0			
	8						
					SP-SM	SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to coarse gravel	
	4	R-3	113.9	4.8			
	6						
10	3						
	5	R-4	108.7	6.3			
	8						
15	20	R-5	109.2	9.6	Qvoa	<u>VERY OLD ALLUVIUM:</u>	
	34						
	50						
20	18	SPT-1	-	5.4	SM	Silty SAND; yellow brown, slightly moist, very dense, fine to coarse sand	
	20						
	40						
25	40	R-6	-	-		No Recovery	
	50						
						Total Depth: 26 feet	
						No Groundwater	
30		-	-	-			

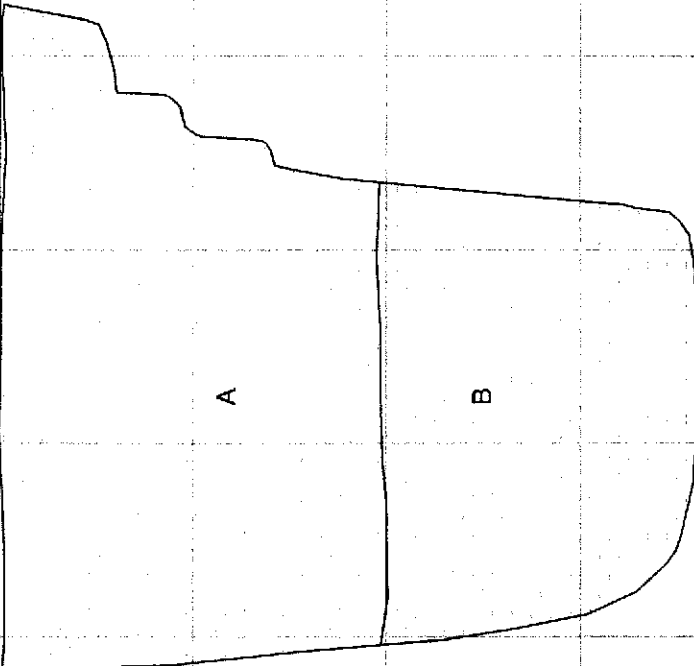
LGC
INLAND

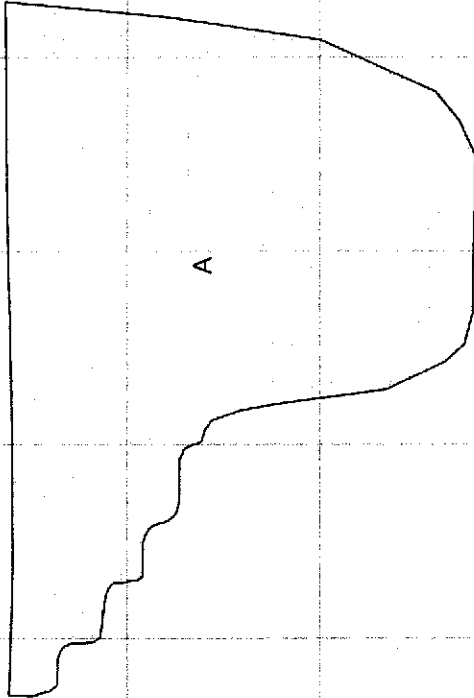
Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 1			
Project Number: 105905			Elevation: 1847		Engineering Properties			
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP		USCS	Sample No.	Moisture (%)	Dry Density (pcf)
Depth	Date: 5-17-05	Description:	Geologic Unit					
0-9'	A	Quaternary Wash: Silty SAND; dark yellow brown, slightly moist, loose, fine to coarse Sand.	Qw	SM	Bag 1 @ 0-5' DC 1 @ 2' DC 2 @ 5'	6.4 6.2	84.5 93.4	
9-15'	B	medium brown, trace Clay.						
GRAPHICAL REPRESENTATION: EAST WALL			SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS	
TOTAL DEPTH= 15.0 FEET NO GROUNDWATER ENCOUNTERED								

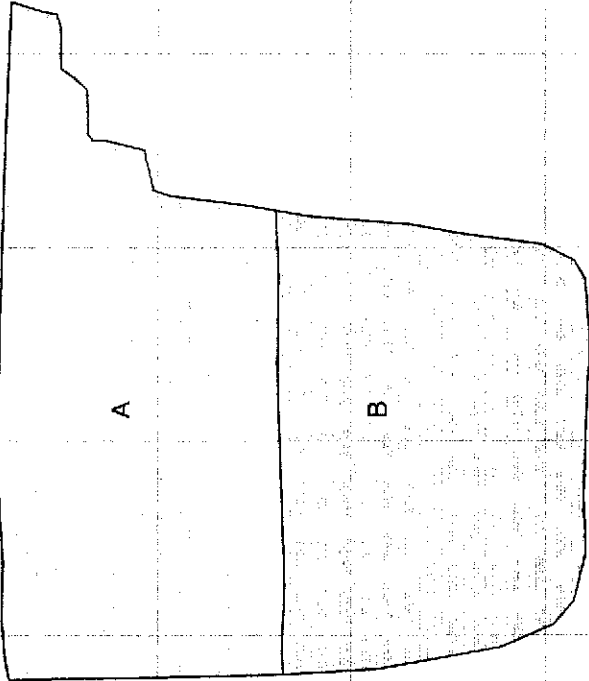
LGC
INLAND

Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW			LOG OF TEST PIT 2		
Project Number: 105905			Elevation: 1875			Engineering Properties		
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP			USCS		
Depth	Date: 5-17-05	Description:	Geologic Unit			Sample No.	Moisture (%)	Dry Density (pcf)
0-6.5'	A	Quaternary Wash: Silty SAND; dark yellow brown, slightly moist, very loose, fine to coarse Sand, porosity.	Qw			DC 1 @ 3'	6.3	93.4
6.5-15'	B	medium brown, porosity.				DC 2 @ 6.5'	4.3	99.7
GRAPHICAL REPRESENTATION: EAST WALL			SCALE: 1" = 5'			SURFACE SLOPE: LEVEL		TREND: NS
TOTAL DEPTH= 15.0 FEET NO GROUNDWATER ENCOUNTERED								
LGC INLAND								

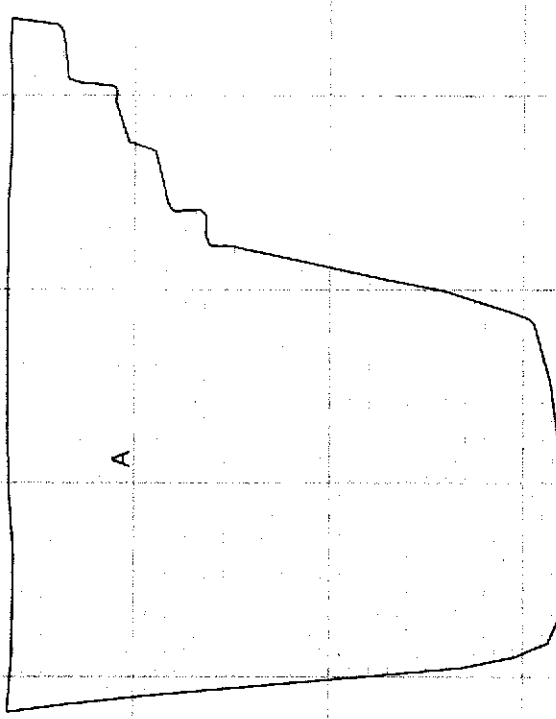
Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 3				
Project Number: 105905			Elevation: 1870				Engineering Properties		
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP						
Depth	Date: 5-17-05	Description:		Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)	
0-6'	A	Artificial Fill, Undocumented:		Afu	SM				
		Silty SAND; olive gray, medium brown, moist, loose, fine to coarse Sand, organic matter, plastic pipes.							
6-12'	B	Quaternary Wash:		Qw	SM				
		Silty SAND; dark yellow brown, moist, loose, fine to coarse Sand, porosity.							
GRAPHICAL REPRESENTATION: EAST WALL				SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS	
TOTAL DEPTH= 12.0 FEET NO GROUNDWATER ENCOUNTERED									
LGC INLAND									

Project Name: GRANITE EQUITIES-REDLANDS				Logged by: AW		LOG OF TEST PIT 4			
Project Number: 105905				Elevation: 1166		Engineering Properties			
Equipment: CASE 580				Location/Grid: SEE GEOTECHNICAL MAP					
Depth	Date: 5-17-05	Description:		Geologic Unit		USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-10'	A	Artificial Fill, Undocumented: Silty SAND; dark yellow brown, slightly moist, loose, cobbles, boulders.		Afu		SM			
10-18'	B	Quaternary Wash: Silty SAND; dark yellow brown, moist, very loose, fine to coarse Sand, porosity.		Qw		SM			
GRAPHICAL REPRESENTATION: EAST WALL				SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS	
									
TOTAL DEPTH= 18.0 FEET NO GROUNDWATER ENCOUNTERED									
LGC INLAND									

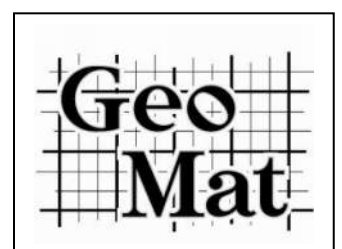
Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 5							
Project Number: 105905			Elevation: 1800				Engineering Properties					
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP				USCS					
Depth		Date: 5-17-05	Description:		Geologic Unit		Sample No.		Moisture (%)		Dry Density (pcf)	
0-12'		A <u>Quaternary Wash</u> : Silty SAND; dark yellow brown, slightly moist, very loose, fine to coarse Sand, porosity.		QW		SM		Bag 1 @ 0-5'				
GRAPHICAL REPRESENTATION: EAST WALL				SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS				
												
TOTAL DEPTH= 12.0 FEET NO GROUNDWATER ENCOUNTERED												
LGC INLAND												

Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 6			
Project Number: 105905			Elevation: 1798		Engineering Properties			
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP					
Depth	Date: 5-17-05	Description:	Geologic Unit		USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-7'	A	Quaternary Wash: Silty SAND; dark yellow brown, slightly moist, medium dense, fine to coarse Sand, porosity.	Qw		SM	Bag 1 @ 0-5' DC 1 @ 3.5'	12.0	118.5
7-15'	B	Clayey SAND; medium brown, moist, medium dense, fine to coarse Sand.			SC	DC 2 @ 6' Bag 2 @ 7-12'	8.9	107.7
GRAPHICAL REPRESENTATION: EAST WALL			SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS	
 TOTAL DEPTH= 15.0 FEET NO GROUNDWATER ENCOUNTERED LGC INLAND								

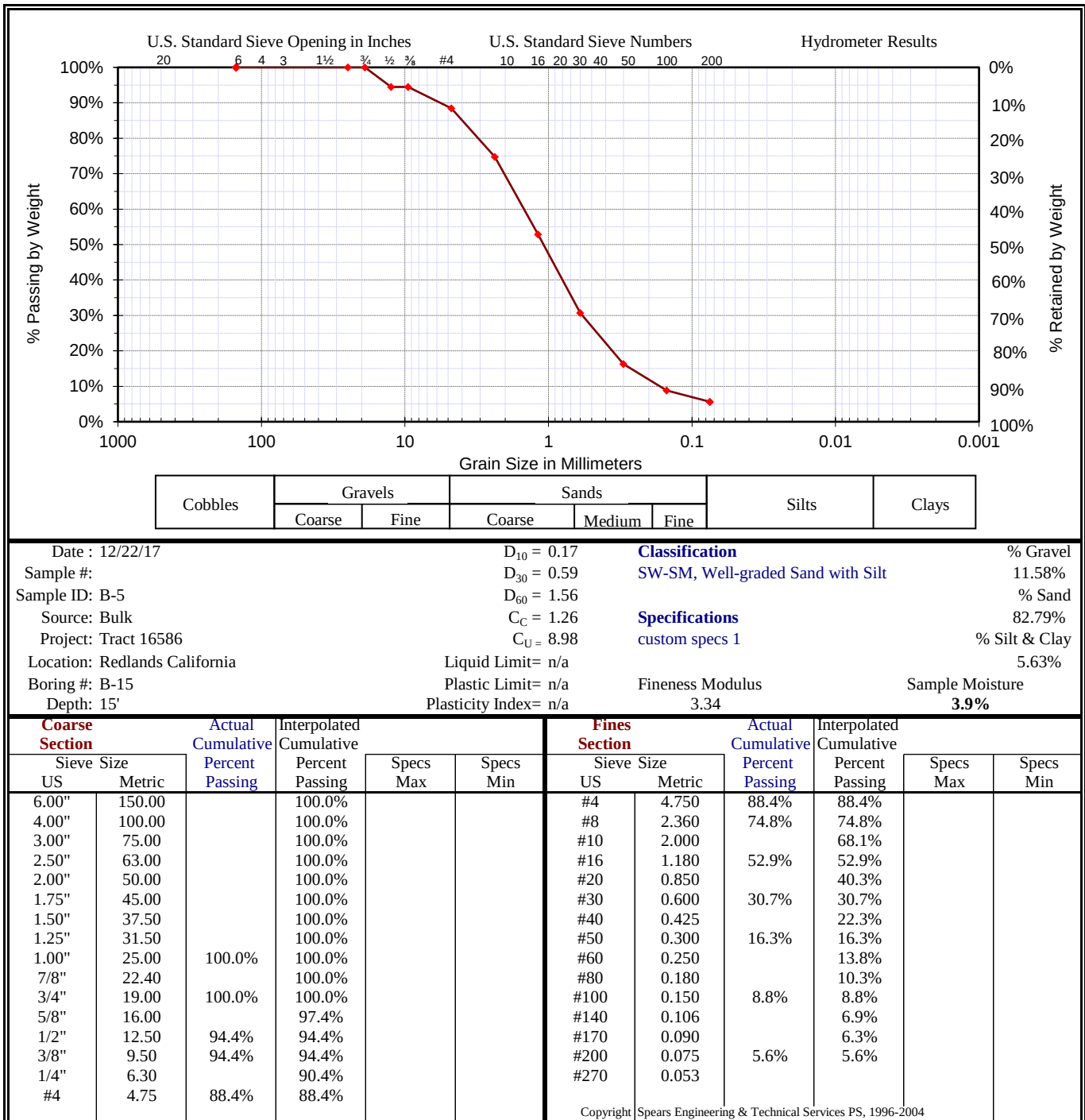
Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 7						
Project Number: 105905			Elevation: 1815				Engineering Properties				
Equipment: CASE 580		Location/Grid: SEE GEOTECHNICAL MAP					USCS				
Date: 5-17-05		Description:		Geologic Unit			Sample No.		Moisture (%)		Dry Density (pcf)
0-14'		A Quaternary Wash: Silty SAND; medium brown, slightly moist, loose, fine to coarse Sand.		Qw			SM DC 1 @ 3' DC 2 @ 6'		4.6 5.3		93.1 103.7
GRAPHICAL REPRESENTATION: NORTH WALL				SCALE: 1" = 5'				SURFACE SLOPE: LEVEL		TREND: WE	
TOTAL DEPTH= 14.0 FEET NO GROUNDWATER ENCOUNTERED											
LGC INLAND											

Project Name: GRANITE EQUITIES-REDLANDS			Logged by: AW		LOG OF TEST PIT 8		
Project Number: 105905			Elevation: 1805				
Equipment: CASE 580			Location/Grid: SEE GEOTECHNICAL MAP				
Depth	Date: 5-17-05	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-14'	A	Quaternary Wash: Silty SAND; dark yellow brown, slightly moist, loose, fine to coarse Sand, porosity.	Qw	SM			
GRAPHICAL REPRESENTATION: EAST WALL			SCALE: 1" = 5'		SURFACE SLOPE: LEVEL		TREND: NS
							
TOTAL DEPTH= 14.0 FEET NO GROUNDWATER ENCOUNTERED							
LGC INLAND							

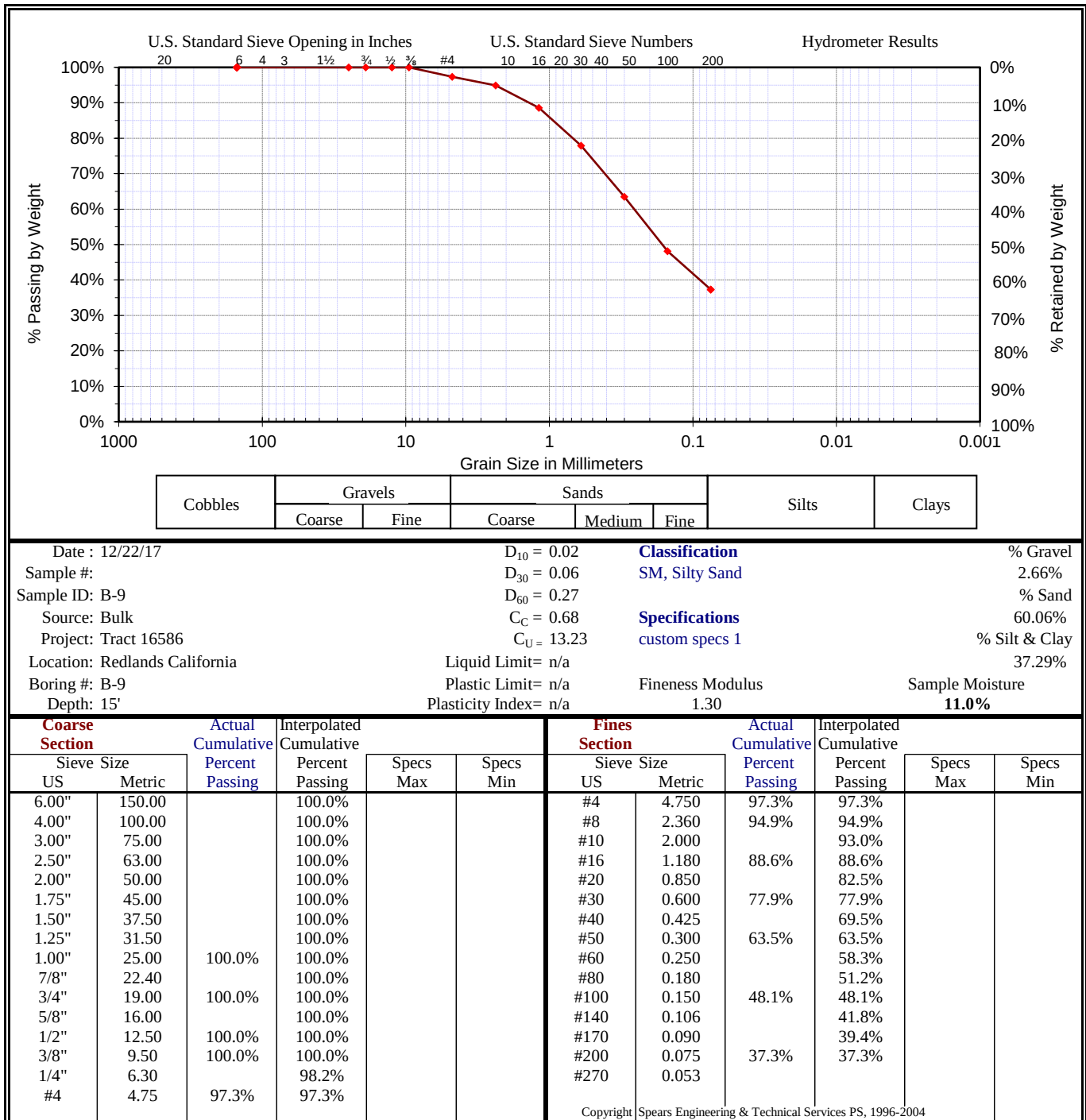
APPENDIX C



LABORATORY TEST RESULTS



LABORATORY TEST RESULTS



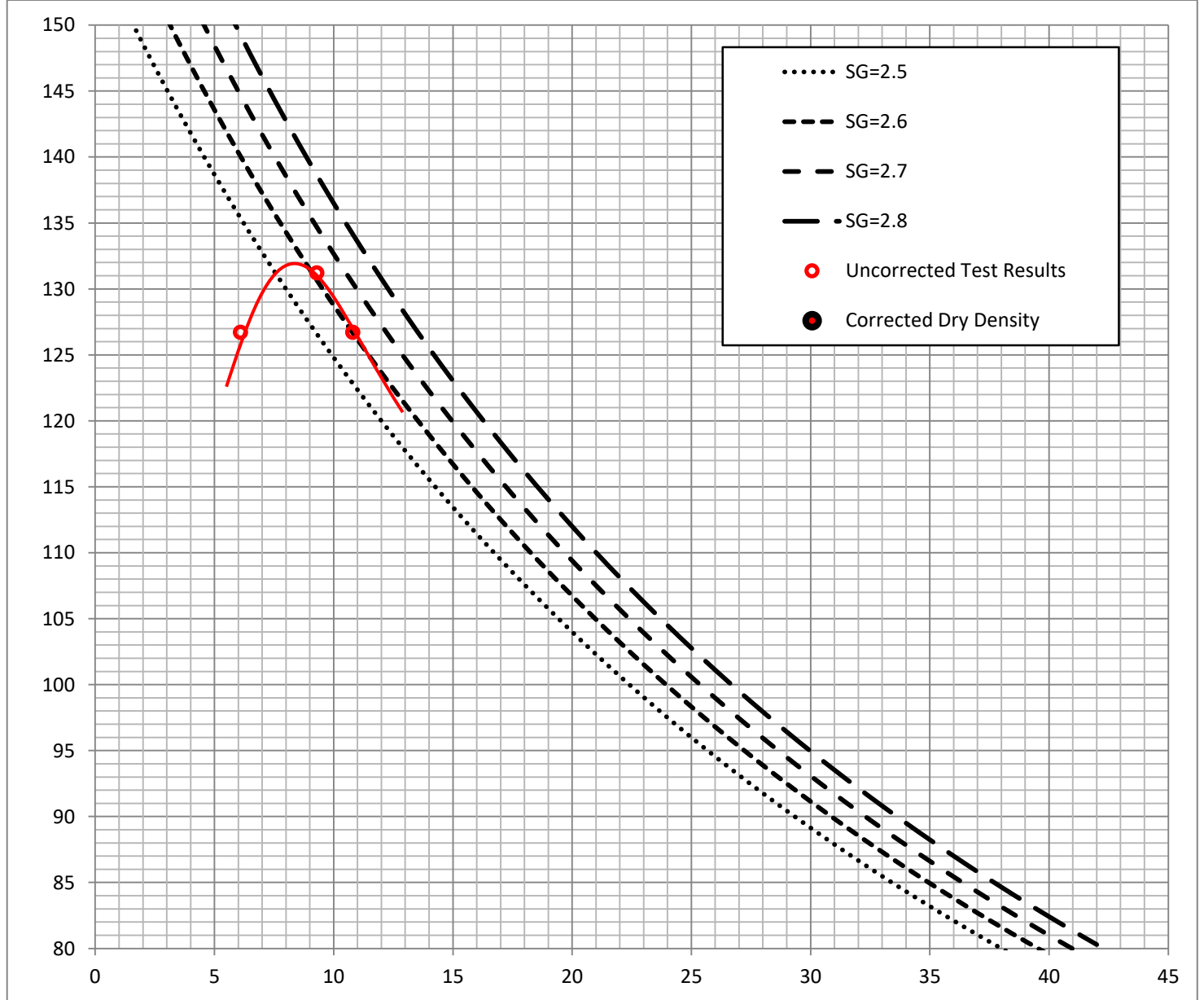
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B1 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B1	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	126.7	131.2	126.7			Maximum Dry Density	132.0 pcf
Compacted Moisture	6.1	9.3	10.8			Optimum Moisture	8.5 %



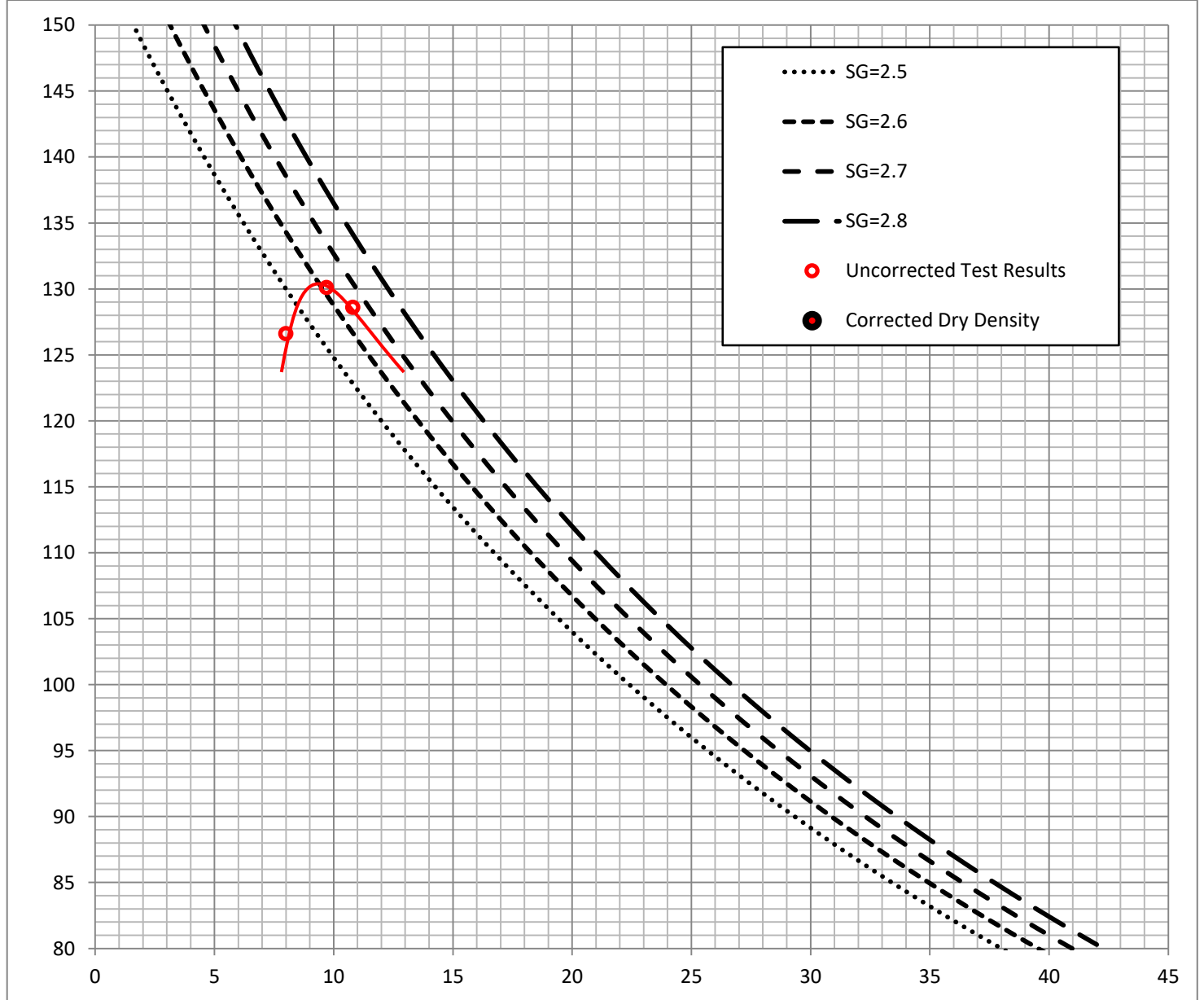
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B2 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B2	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	126.6	130.1	128.6			Maximum Dry Density	130.5 pcf
Compacted Moisture	8.0	9.7	10.8			Optimum Moisture	9.5 %



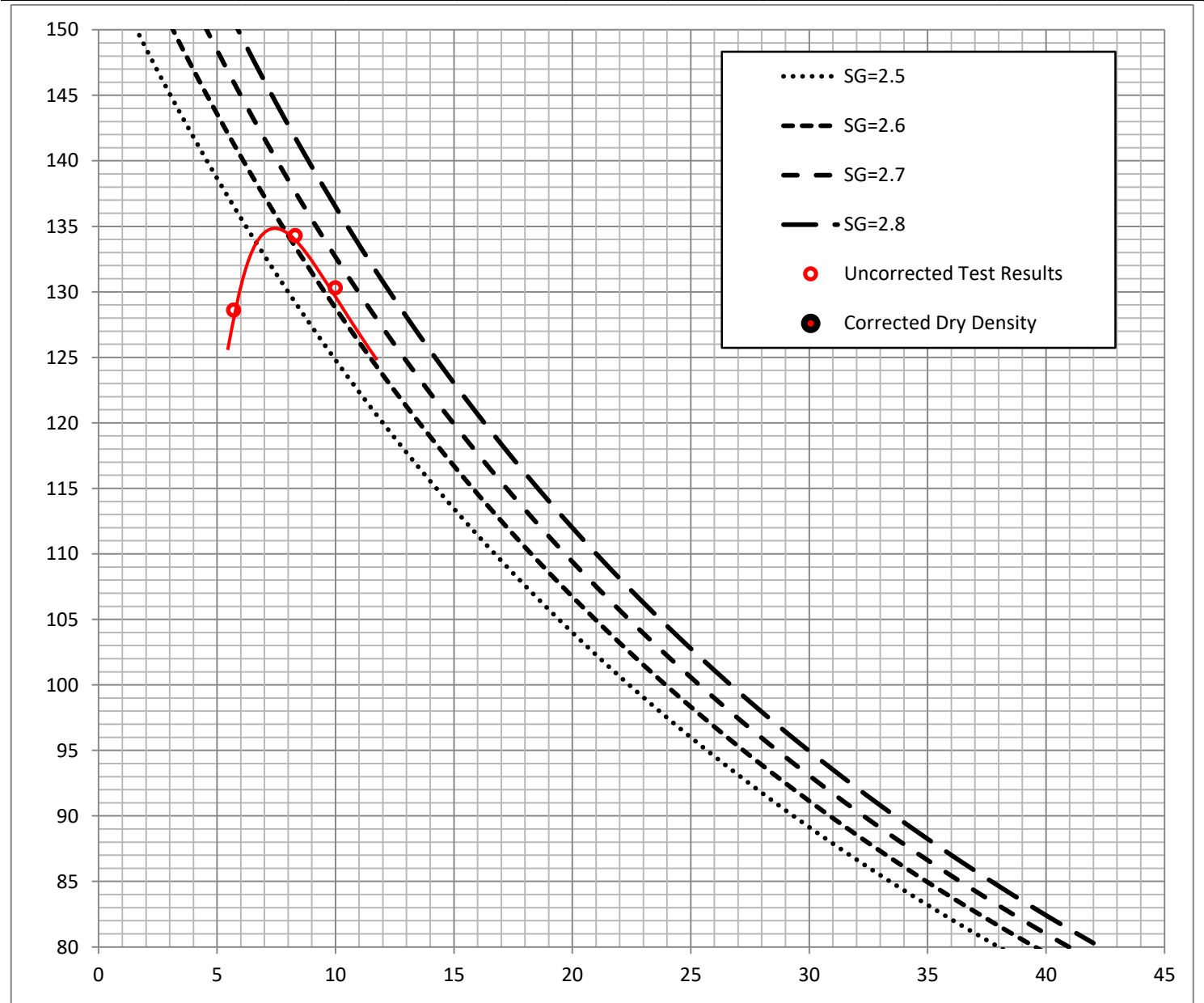
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B2 @ 10-15'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B2	Mold Size	4-inch
Sample Depth	10-15'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.6	134.3	130.3			Maximum Dry Density	135.0 pcf
Compacted Moisture	5.7	8.3	10.0			Optimum Moisture	7.5 %



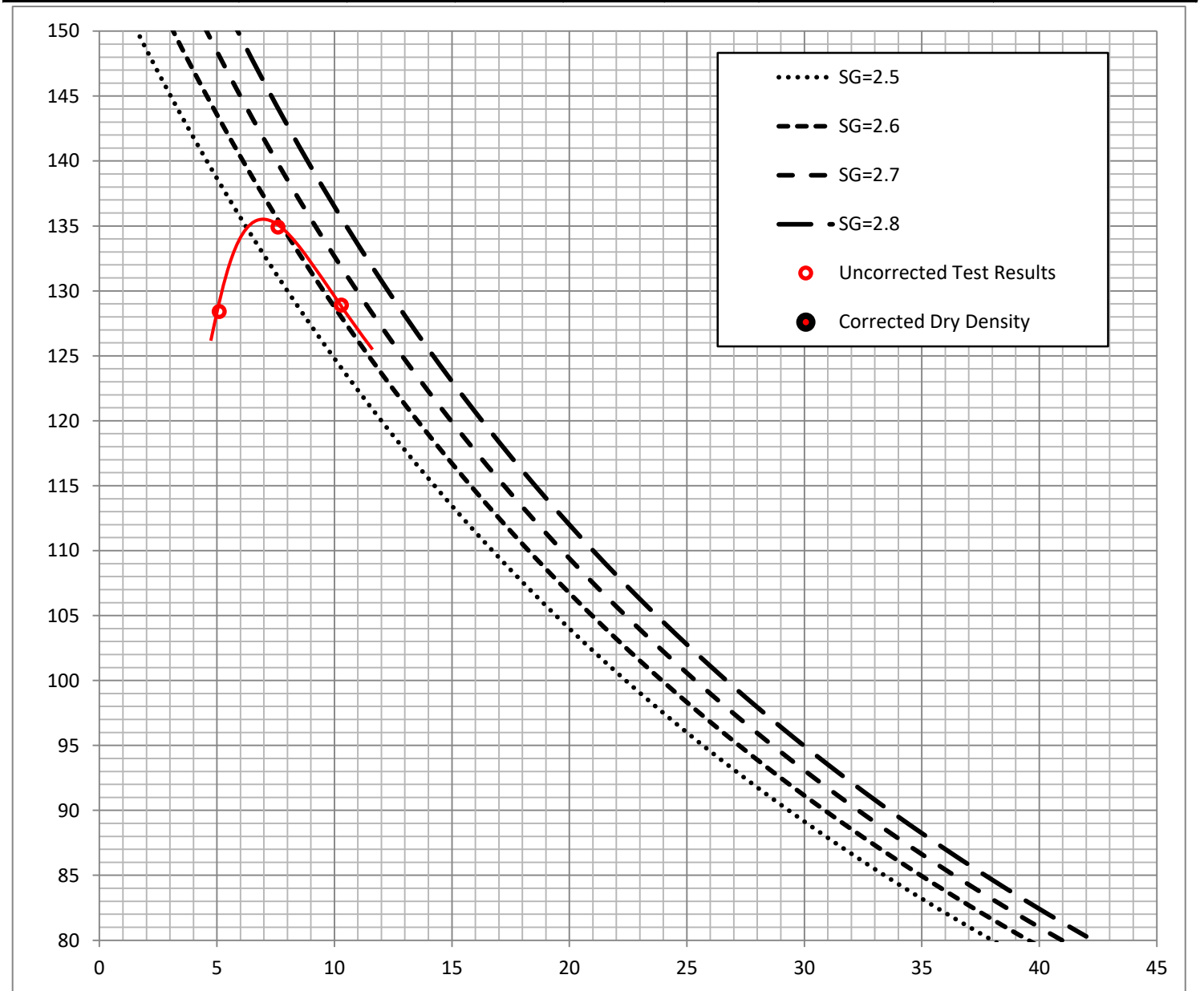
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B3 @ 3-8'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B3	Mold Size	4-inch
Sample Depth	3-8'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.4	134.9	128.9			Maximum Dry Density	135.5 pcf
Compacted Moisture	5.1	7.6	10.3			Optimum Moisture	7.0 %



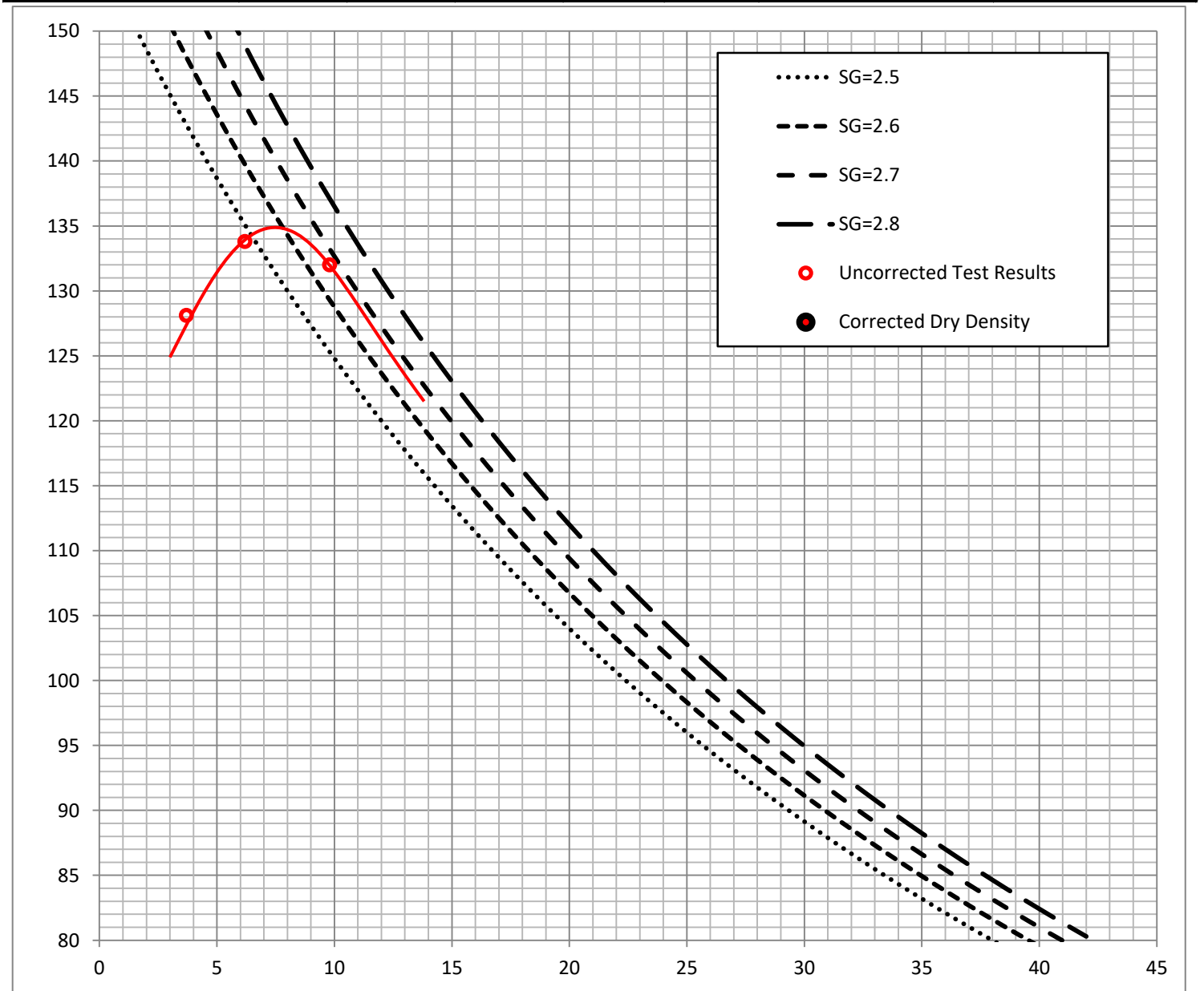
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B4 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B4	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.1	133.8	132.0			Maximum Dry Density	135.0 pcf
Compacted Moisture	3.7	6.2	9.8			Optimum Moisture	7.5 %



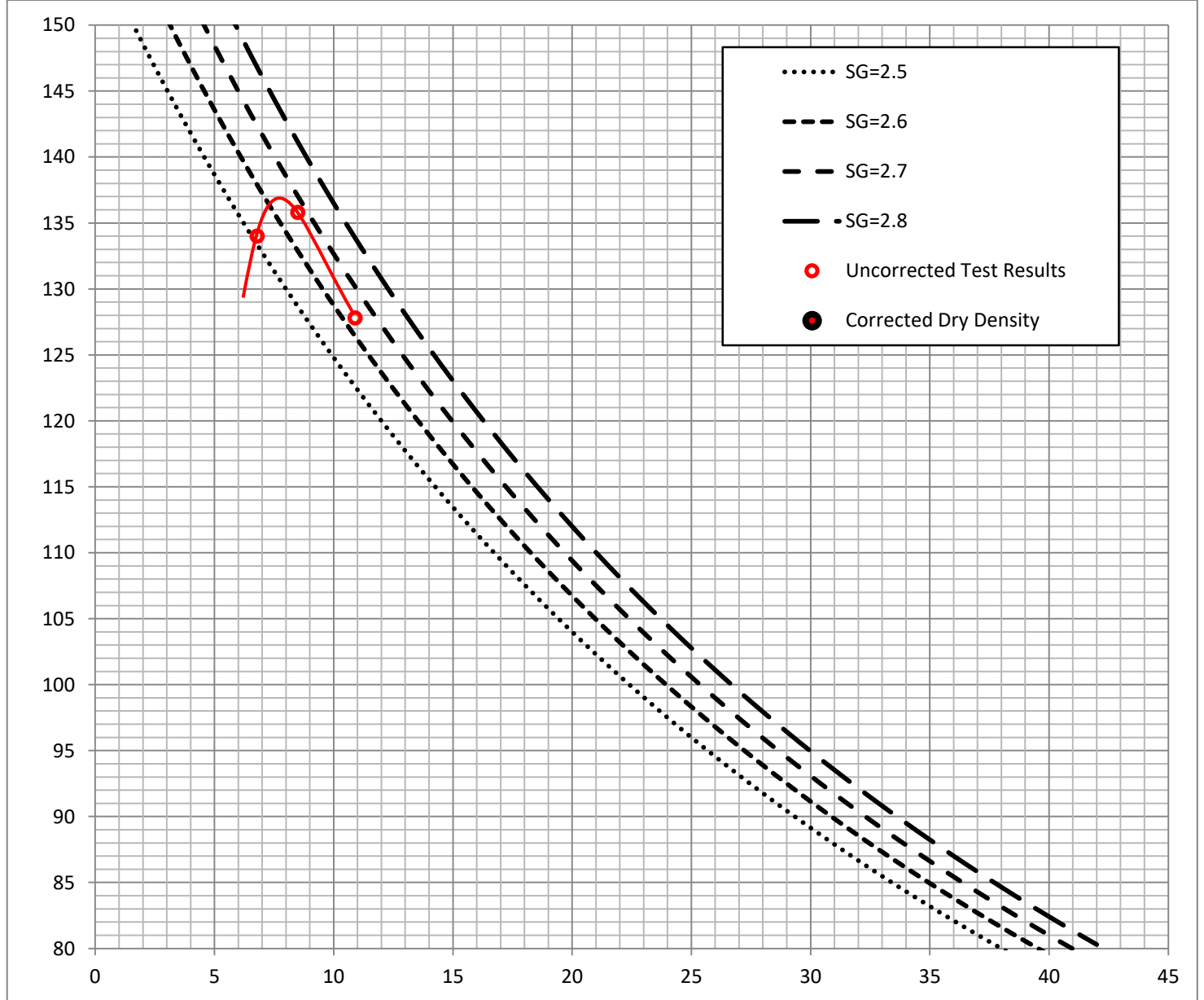
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B5 @ 5-10'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B5	Mold Size	4-inch
Sample Depth	5-10'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	134.0	135.8	127.8			Maximum Dry Density	137.0 pcf
Compacted Moisture	6.8	8.5	10.9			Optimum Moisture	7.5 %



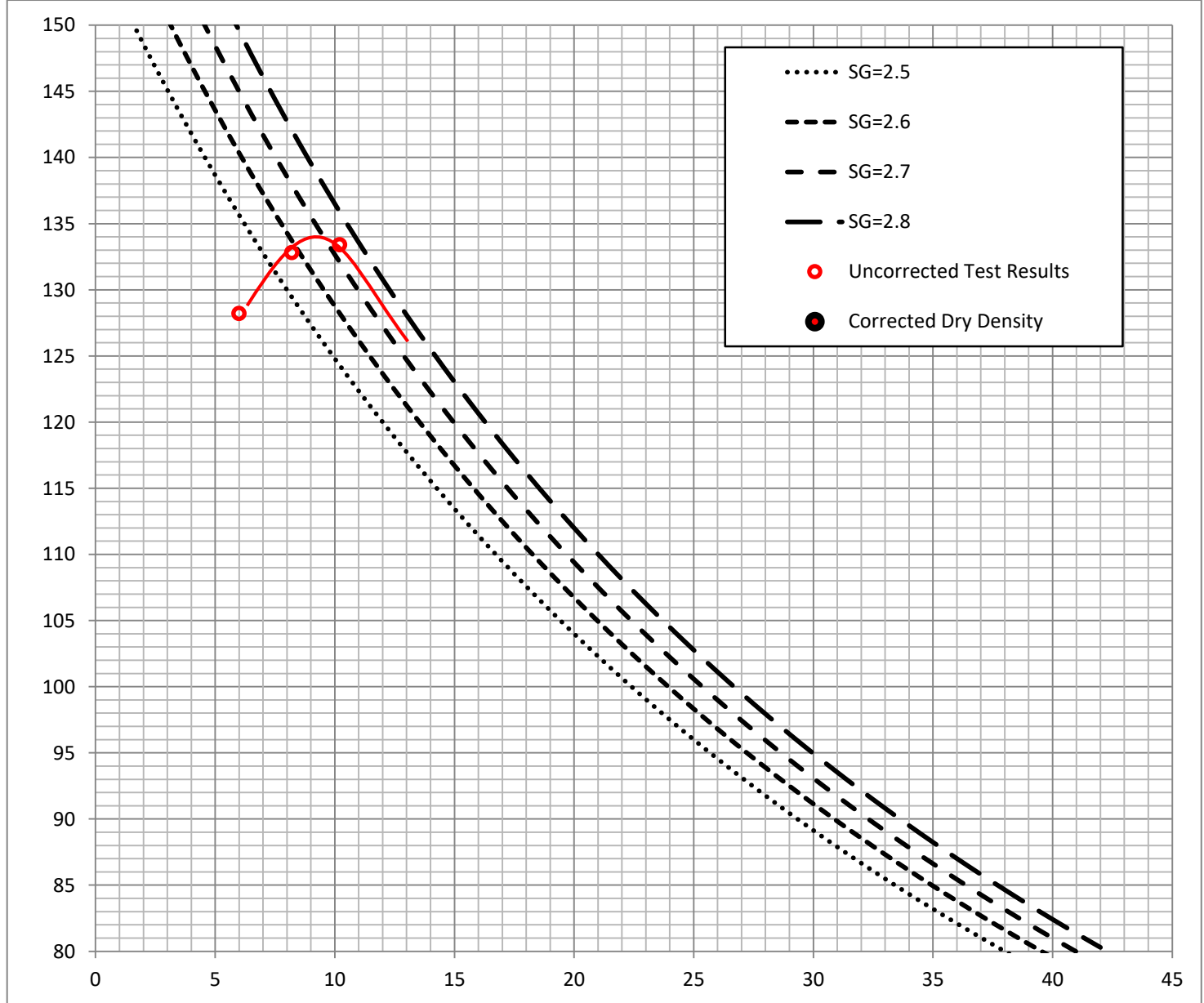
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B5 @ 10-15'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B5	Mold Size	4-inch
Sample Depth	10-15'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.2	132.8	133.4			Maximum Dry Density	134.0 pcf
Compacted Moisture	6.0	8.2	10.2			Optimum Moisture	9.0 %



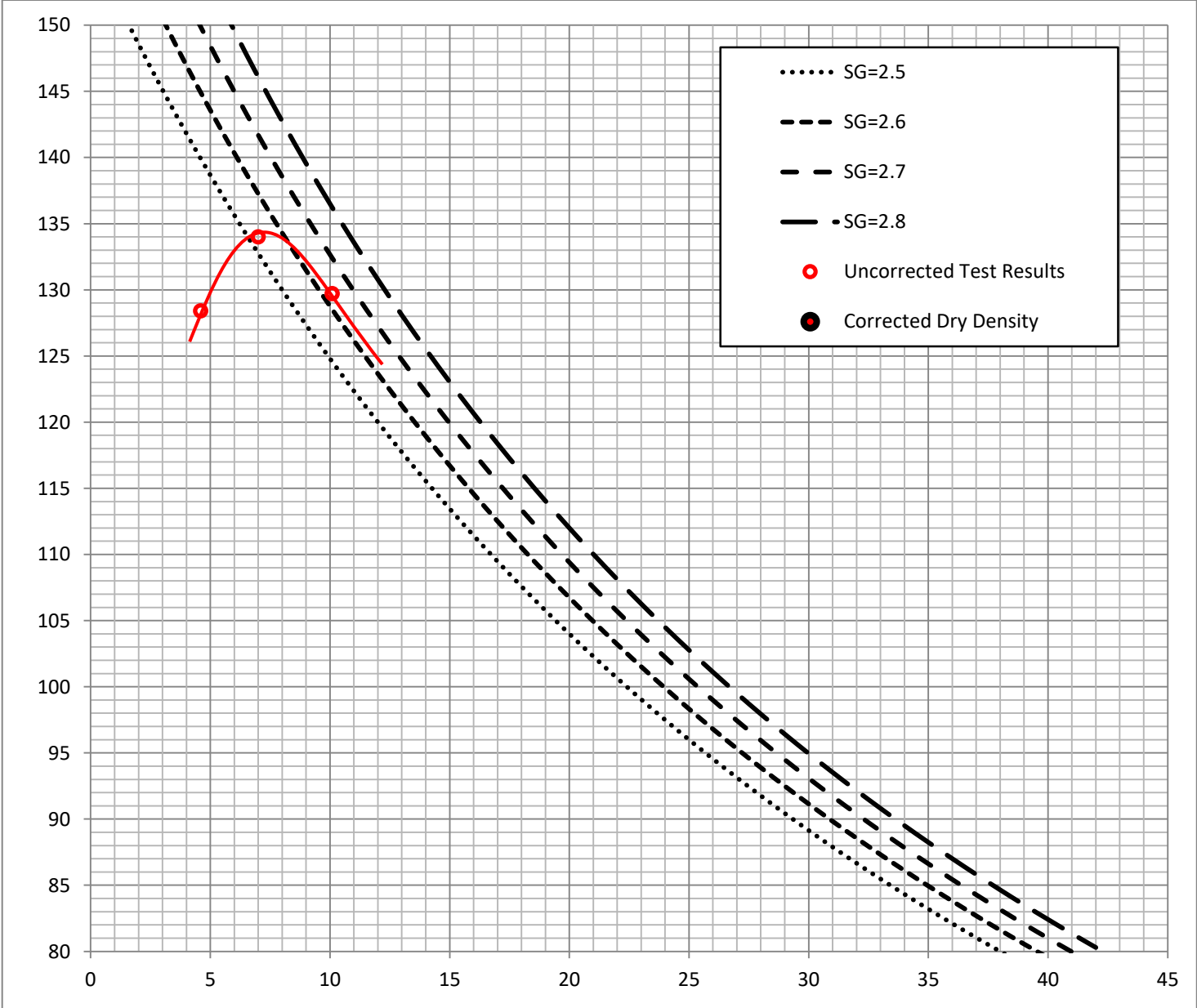
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B6 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B6	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.4	134.0	129.7			Maximum Dry Density	134.0 pcf
Compacted Moisture	4.6	7.0	10.1			Optimum Moisture	7.0 %



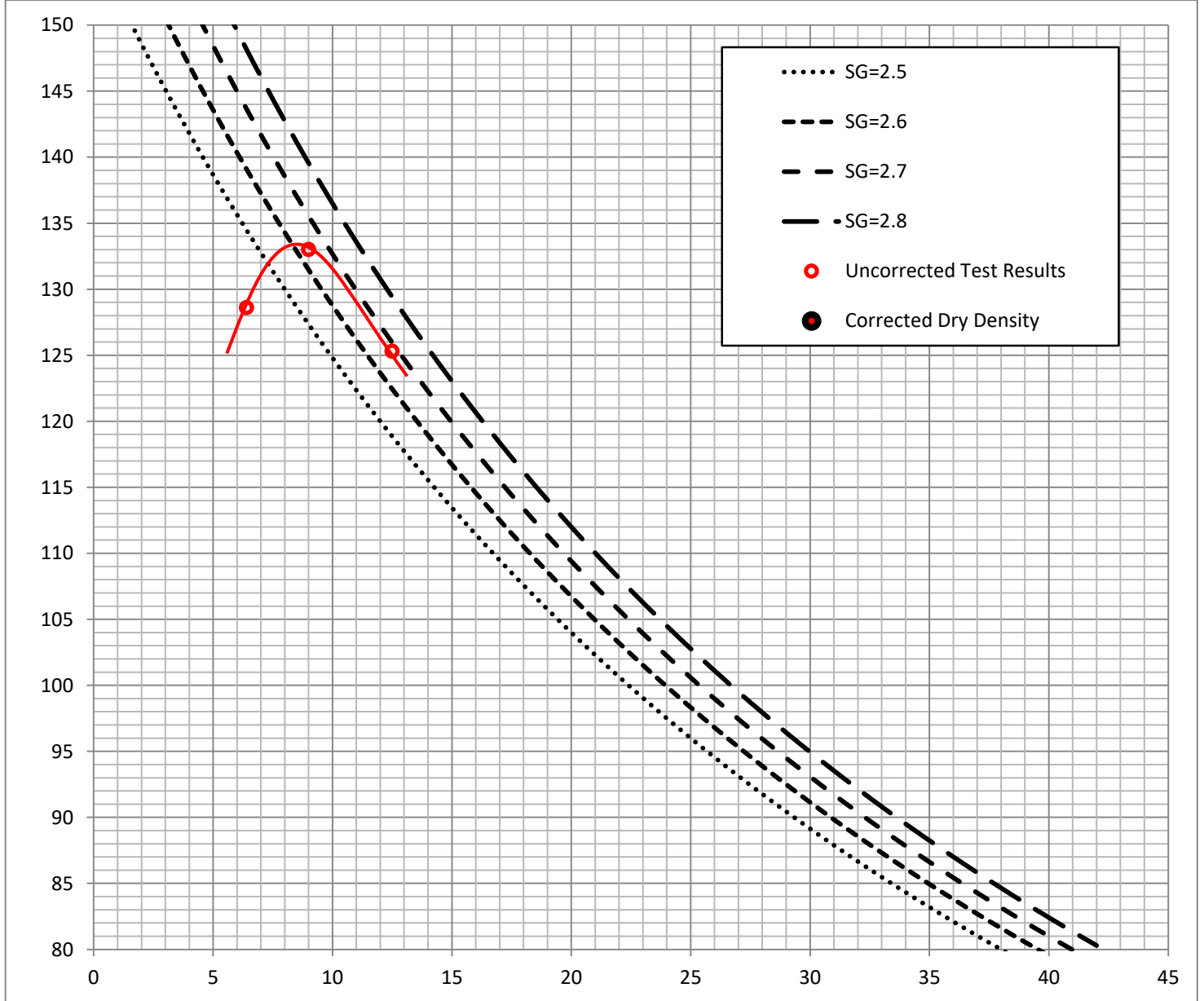
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B7 @ 5-10'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B7	Mold Size	4-inch
Sample Depth	5-10'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.6	133.0	125.3			Maximum Dry Density	133.5 pcf
Compacted Moisture	6.4	9.0	12.5			Optimum Moisture	8.5 %



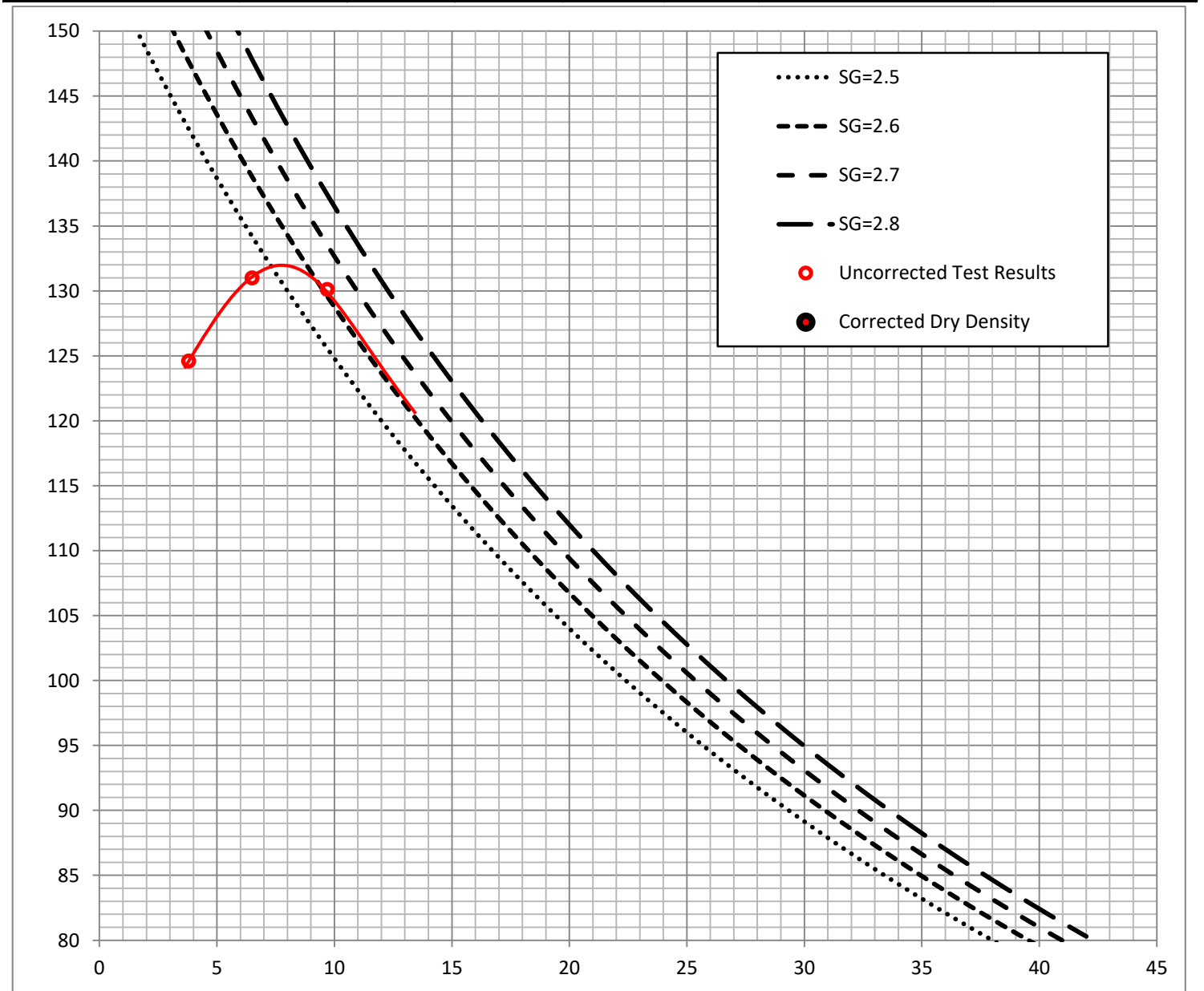
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B8 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B8	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	124.6	131.0	130.1			Maximum Dry Density	132.0 pcf
Compacted Moisture	3.8	6.5	9.7			Optimum Moisture	8.0 %



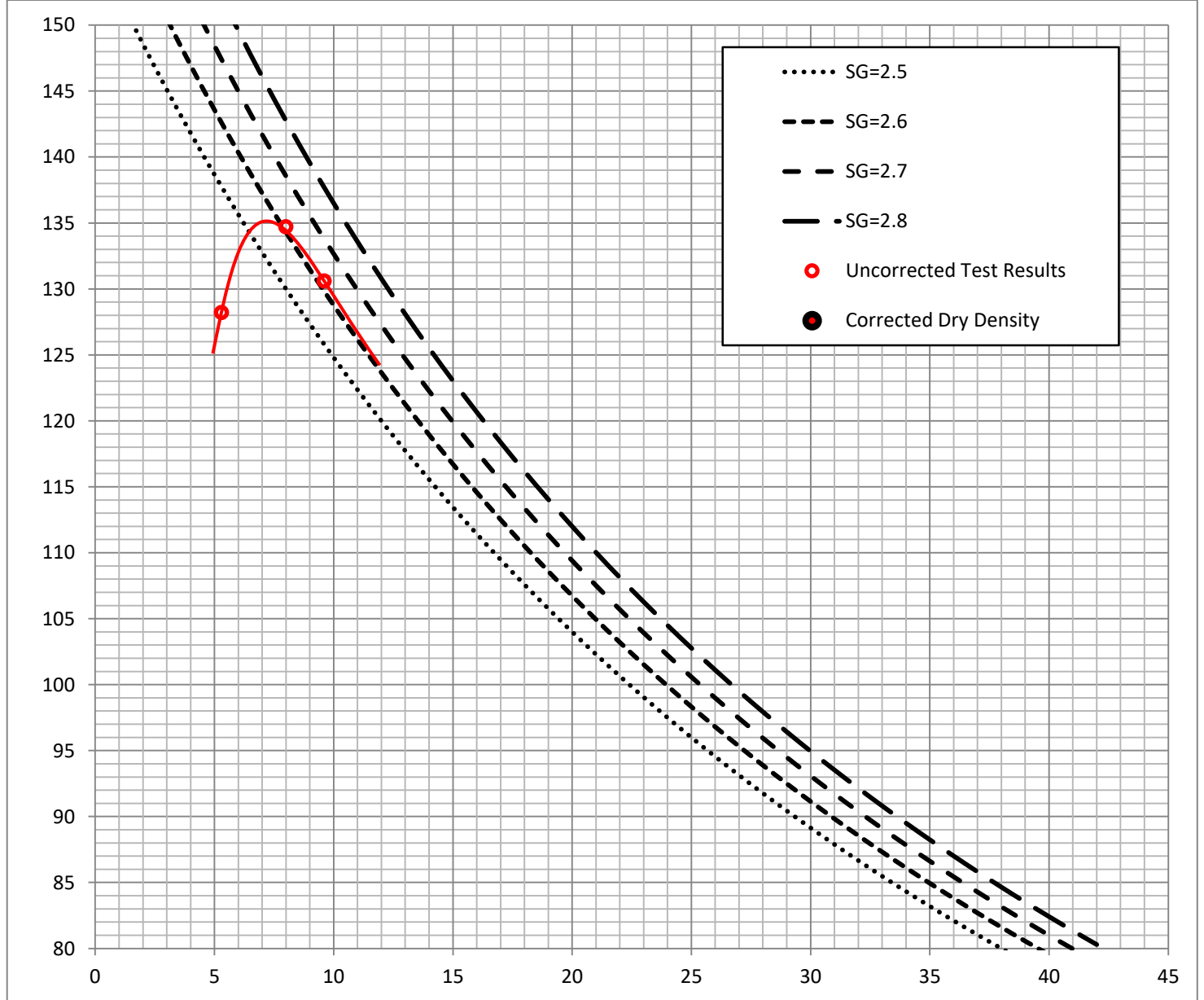
MAXIMUM DRY DENSITY - OPTIMUM MOISTURE

Project Name	Inland Communities - Redlands	Test Date	1/12/2018
Project No.	11074-01	Date Sampled	12/21/2017
Project Location	Tract 16586, Redlands, California	Sampled By	AM
Location In Structure	B9 @ 0-5'	Sample Type	Bulk
Sample Location	Bulk	Tested By	MN

Sample No.	B9	Mold Size	4-inch
Sample Depth	0-5'	No. of Layers	5
Soil Type	SM	Blows per Layer	25
Test Fraction	No.4	Hammer Wt./Drop	10-lb/18-inch

Total Sample Weight	g	Bulk Spec. Grav. of Oversized	2.650
Weight of Oversized	g	Percentage of Dry Fines	%
Weight of Fines	0 g	Percentage of Dry Oversized	<5% %
Moisture Content of Oversized	%	Corrected Dry Density of Soil	pcf
Moisture Content of Fines	%	Corrected Optimum Moisture	%

Test Data	Point 1	Point 2	Point 3	Point 4	Point 5	Test Results (No Oversized Correction)	
Compacted Dry Density	128.2	134.7	130.6			Maximum Dry Density	135.0 pcf
Compacted Moisture	5.3	8.0	9.6			Optimum Moisture	7.0 %



APPENDIX C

Laboratory Testing Procedures and Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Soil Classification: Soils were classified in general accordance with ASTM Test Methods D2487 and D2488. This system utilizes the Atterberg limits and grain size distribution of a soil. The soil classifications (or group symbol) are shown on the laboratory test data, boring logs, and trench logs.

Hydro-consolidation: Hydro-consolidation tests (collapse) were performed on selected, relatively undisturbed ring samples (ASTM D4546). Samples were placed in a consolidometer and a load approximately equal to the in-situ overburden pressure was applied. Water was then added to the sample and the percent hydro-consolidation under the applied load was measured. The percent for the load was calculated as the ratio of the amount of vertical deformation to the original sample height. The results of these tests are presented graphically on Plates C-2 through C-4, and the percent hydroconsolidation is presented below:

<i>SAMPLE LOCATION</i>	<i>IN-SITU OVERBURDEN (psf)</i>	<i>PERCENT HYDROCONSOLIDATION</i>
B-1 @ 10 feet	1,378	0.91
B-1 @ 20 feet	1,378	1.19
B-1 @ 30 feet	2,775	0.59

Note: Positive values of hydro-consolidation represent collapse of the soil structure, while negative values represent heave (or swelling) of the soil structure.

Expansion Index: The expansion potential of selected samples were evaluated by the Expansion Index Test ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results are presented in the table below:

<i>SAMPLE LOCATION</i>	<i>SAMPLE DESCRIPTION</i>	<i>COMPACTED DRY DENSITY (pcf)</i>	<i>EXPANSION INDEX</i>	<i>EXPANSION POTENTIAL*</i>
B-1 @ 0-5'	Silty SAND	122.2	1	VERY LOW
TP-6 @ 7-12'	Silty SAND	118.1	3	VERY LOW

* Per Table 18-1-B of 1997 UBC.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring and/or trench logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

<i>SAMPLE LOCATION</i>	<i>SAMPLE DESCRIPTION</i>	<i>MAXIMUM DRY DENSITY (pcf)</i>	<i>OPTIMUM MOISTURE CONTENT (%)</i>
B-1 @ 0-5'	Dark Brown Silty SAND	134.5	7.5
B-6 @ 0-5'	Dark Yellowish Brown Clayey Fine to Coarse Sand	129.5	9.0

R-Value: The resistance R-value was determined by the ASTM D2844 soils. The sample(s) were prepared and exudation pressure and R-value were determined. These/This result(s) were used for asphaltic concrete pavement design purposes.

<i>SAMPLE LOCATION</i>	<i>SAMPLE DESCRIPTION</i>	<i>R-VALUE</i>
B-1 @ 0-5'	Brown Silty SAND	62

Soluble Sulfates: The soluble sulfate contents of selected sample(s) were determined by standard geochemical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below:

<i>SAMPLE LOCATION</i>	<i>SAMPLE DESCRIPTION</i>	<i>SULFATE CONTENT (% by weight)*</i>	<i>SULFATE EXPOSURE*</i>
TP-5 @ 0-5'	Silty SAND	0.001	Negligible
TP-6 @ 0-5'	Silty SAND	0.002	Negligible
B-1 @ 0-5'	Silty SAND	0.003	Negligible
B-6 @ 0-5'	Clayey SAND	0.002	Negligible

*Based on the 1997 edition of the Uniform Building Code (U.B. C.), Table No. 19-A-4, prepared by the International Conference of Building Officials (ICBO, 1997).

Grain Size Distribution: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve. The portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D422 (CTM 202).

<i>SAMPLE LOCATION</i>	<i>DESCRIPTION</i>	<i>% PASSING # 200 SIEVE</i>
B-1 @ 35'	Clayey SAND	33
B-3 @ 10'	Clayey SAND	21

APPENDIX B

LABORATORY TESTING

General

Laboratory test results on selected relatively undisturbed and bulk samples are presented below. Tests were performed to evaluate the physical and engineering properties of the encountered earth materials, including field moisture and density, compaction characteristics, expansion potential, consolidation and shear strength. Test results presented herein are from the three investigations.

Field Density and Moisture Tests

In-situ dry density and moisture content were determined from the relatively undisturbed samples obtained during drilling operations. The test results and a detailed description of the soils encountered are shown on the attached Logs of Subsurface Data, Appendix A.

Classification

Soils were classified in general accordance with the Unified Soil Classification System.

Maximum Density-Optimum Moisture

Maximum density/optimum moisture tests (compaction characteristics) were performed on selected samples of the encountered materials. The tests were performed per ASTM D 1557 test method. The results are as follows:

Sample	Visual Soil Classification	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-2 @ 1'	Reddish brown sandy clay	125.5	11.5
B-4 @ 15'	Dark yellowish brown clayey fine to coarse sand	133.5	9.0
B-9 @ 5'	Light olive brown silty fine sand	128.0	10.0
B-11 @ 1'	Yellowish brown silty fine to coarse sand	132.0	8.0
B-11 @ 5'	Yellowish brown silty fine to coarse sand	134.5	7.5
B-12 @ 5'	Brown silty fine to coarse sand	136.0	8.0
B-13 @ 13'	Yellowish brown sand	134.5	7.0
B-13 @ 23'	Dark yellowish brown sand with gravel	136.0	7.0
B-15 @ 10'	Yellowish brown fine to coarse sand	135.5	7.5
B-16 @ 15'	Yellowish brown silty sand	136.0	8.0
B-17 @ 10'	Brown sand	133.0	9.0

Soil Expansion Tests

Selected samples of the encountered soils were tested for expansiveness using the Expansion Index Test method (UBC 18-2) and classified in accordance with UBC Table 18-I-B. The results are as follows:

Sample	Expansion Index	Expansion Index Range	Expansion Potential
B-2 @ 1'	34	21 - 50	Low
B-9 @ 5'	1	0 - 20	Very Low
B-11 @ 5'	0	0 - 20	Very Low
B-12 @ 5'	0	0 - 20	Very Low

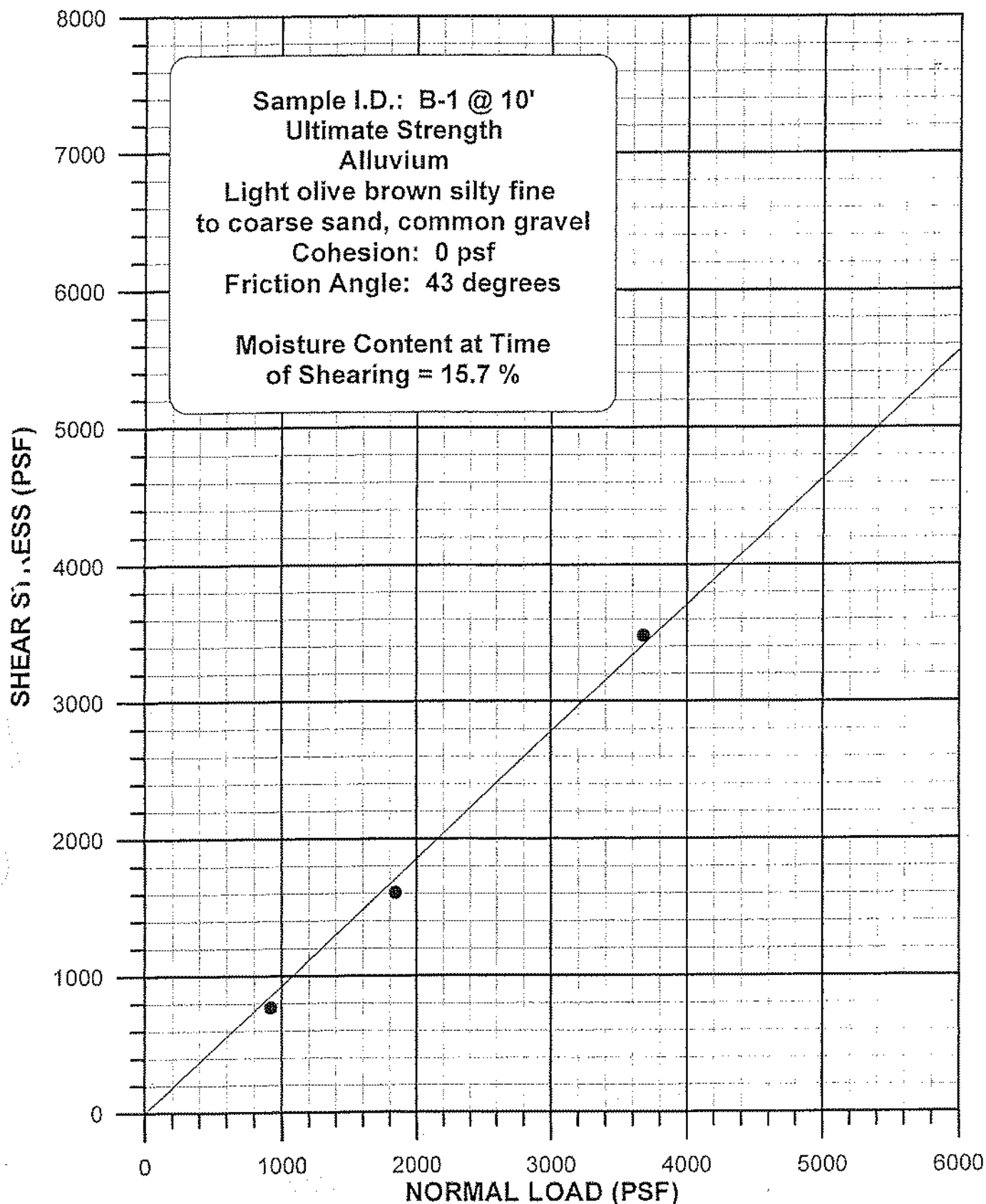
Direct Shear Tests

Strain controlled direct shear testing was performed on eleven relatively undisturbed samples and one remolded sample of the earth materials encountered during our exploratory program. The sample sets were saturated prior to shearing under axial loads ranging from 920 to 3,680 psf. The shear strength results are attached as graphic summaries.

Load Consolidation Tests

Load consolidation tests were conducted on twenty-two relatively undisturbed soil samples. Test loads were added in increments to a maximum of 8,000 psf or 9,400 psf. Water was added at an axial load ranging from 1,000 psf to 1,175 psf to study the effect of moisture infiltration on potential consolidation behavior. The results are attached as graphic summaries.

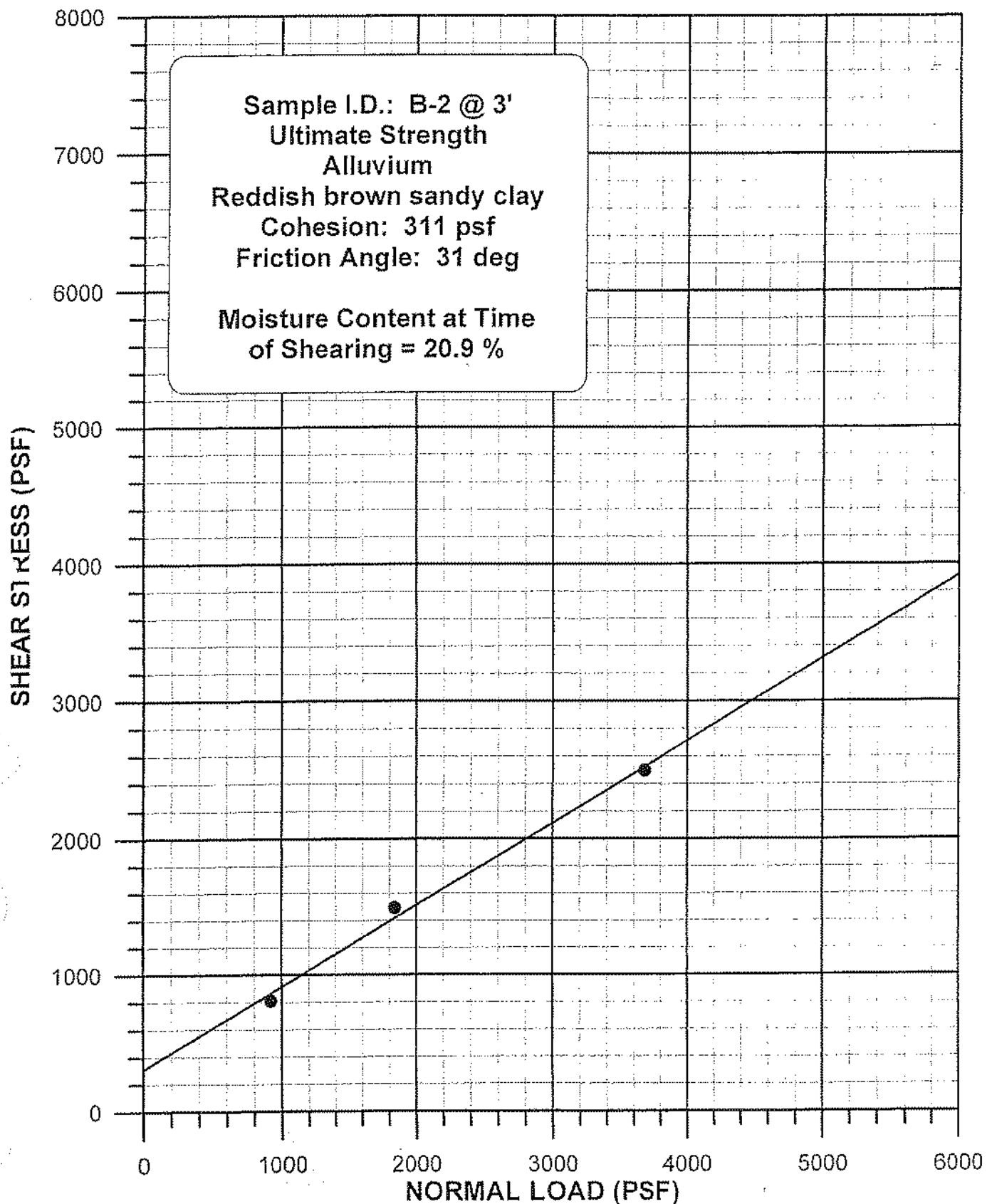
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-1 @ 10' = Sample taken from Boring 1 at a depth of 10'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

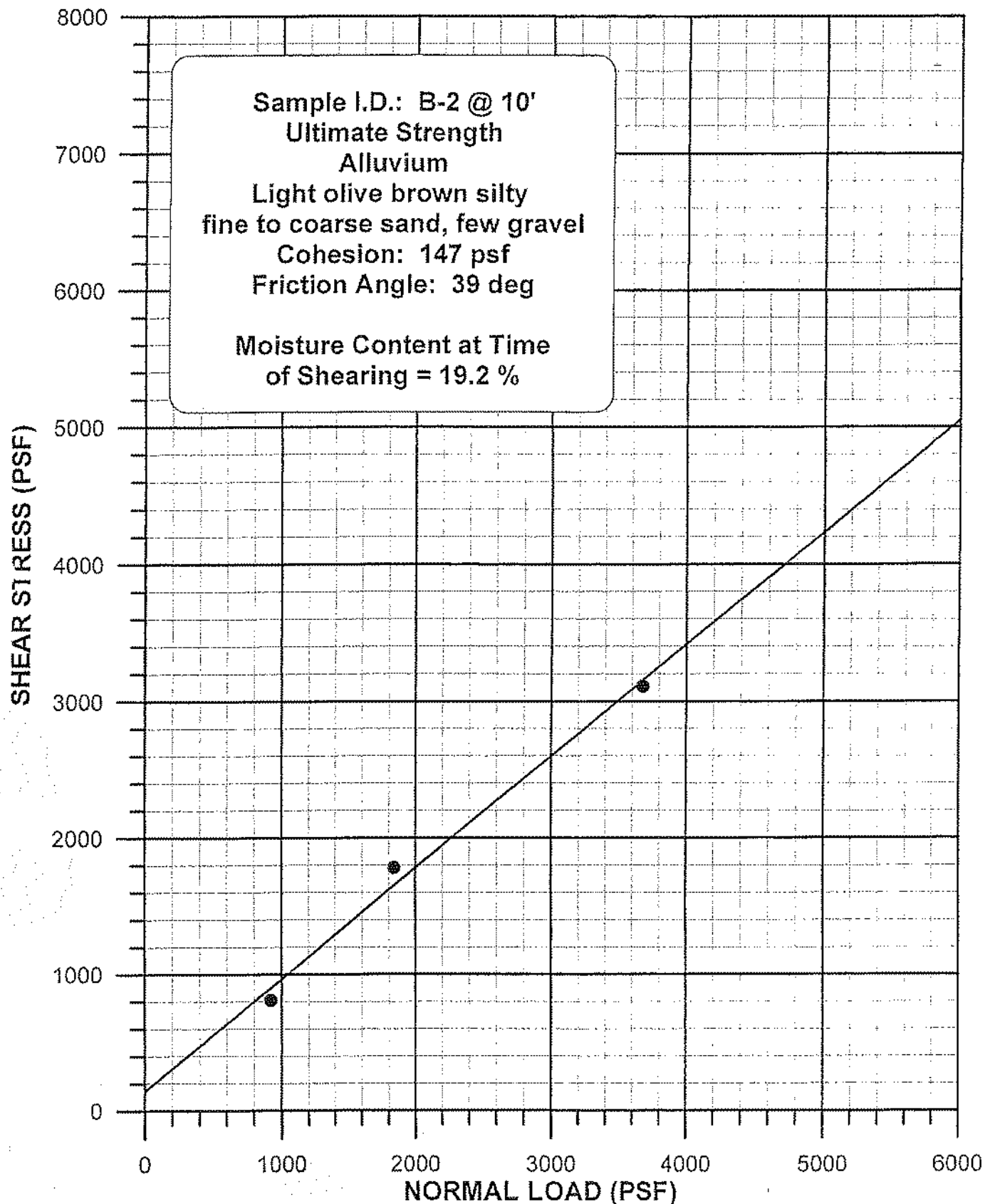
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-2 @ 3' = Sample taken from Boring 2 at a depth of 3'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

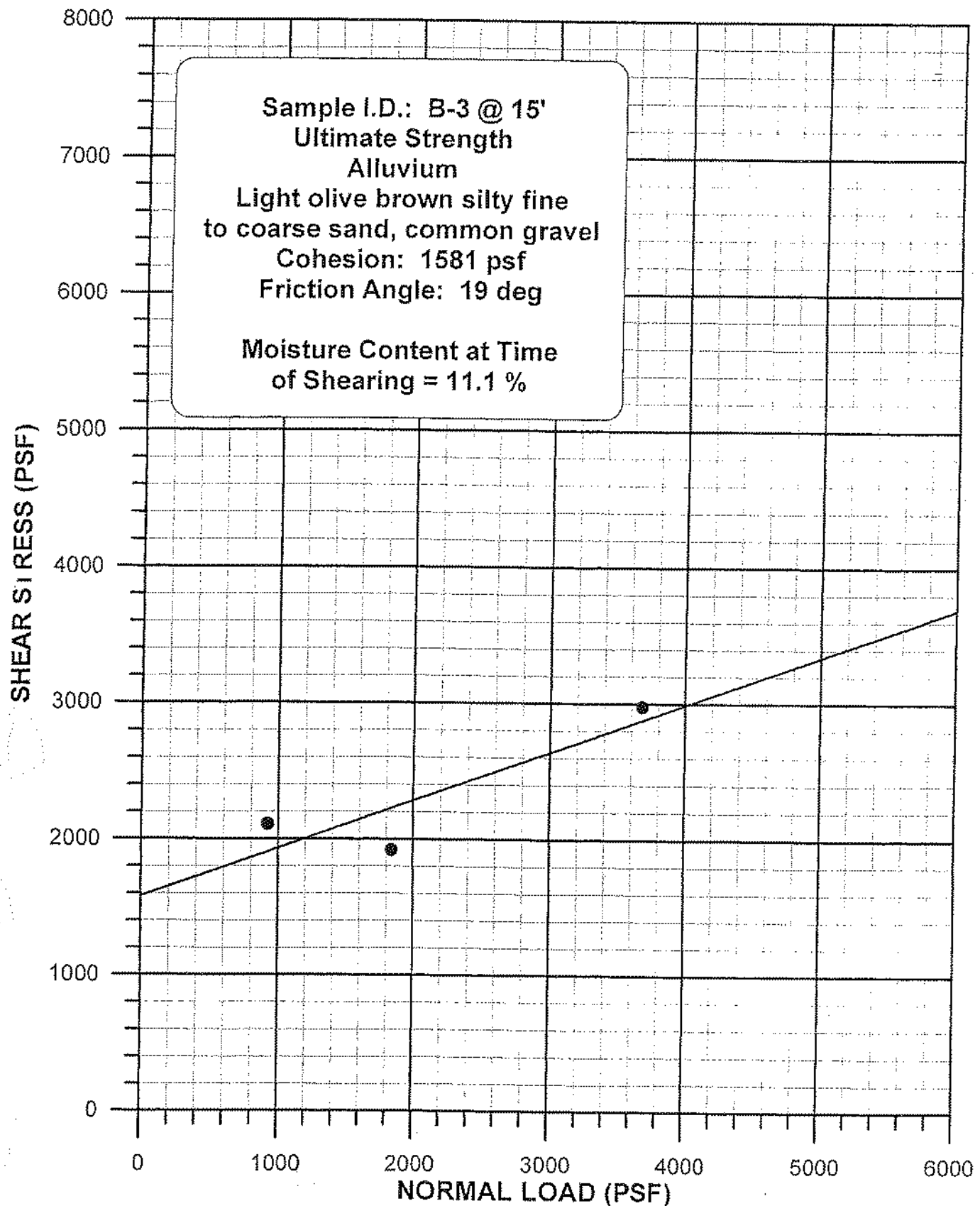
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-2 @ 10' = Sample taken from Boring 2 at a depth of 10'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

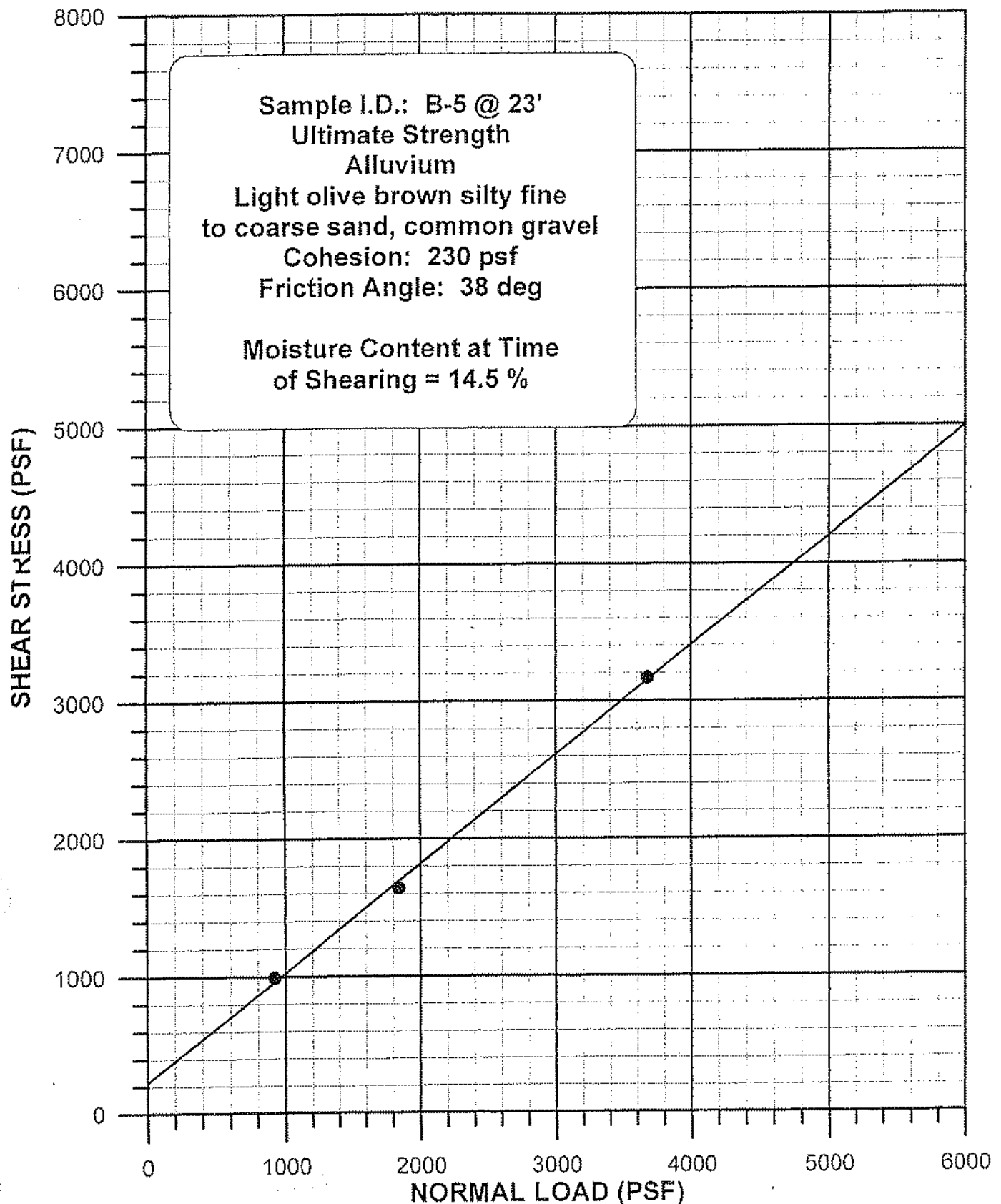
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-3 @ 15' = Sample taken from Boring 3 at a depth of 15'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

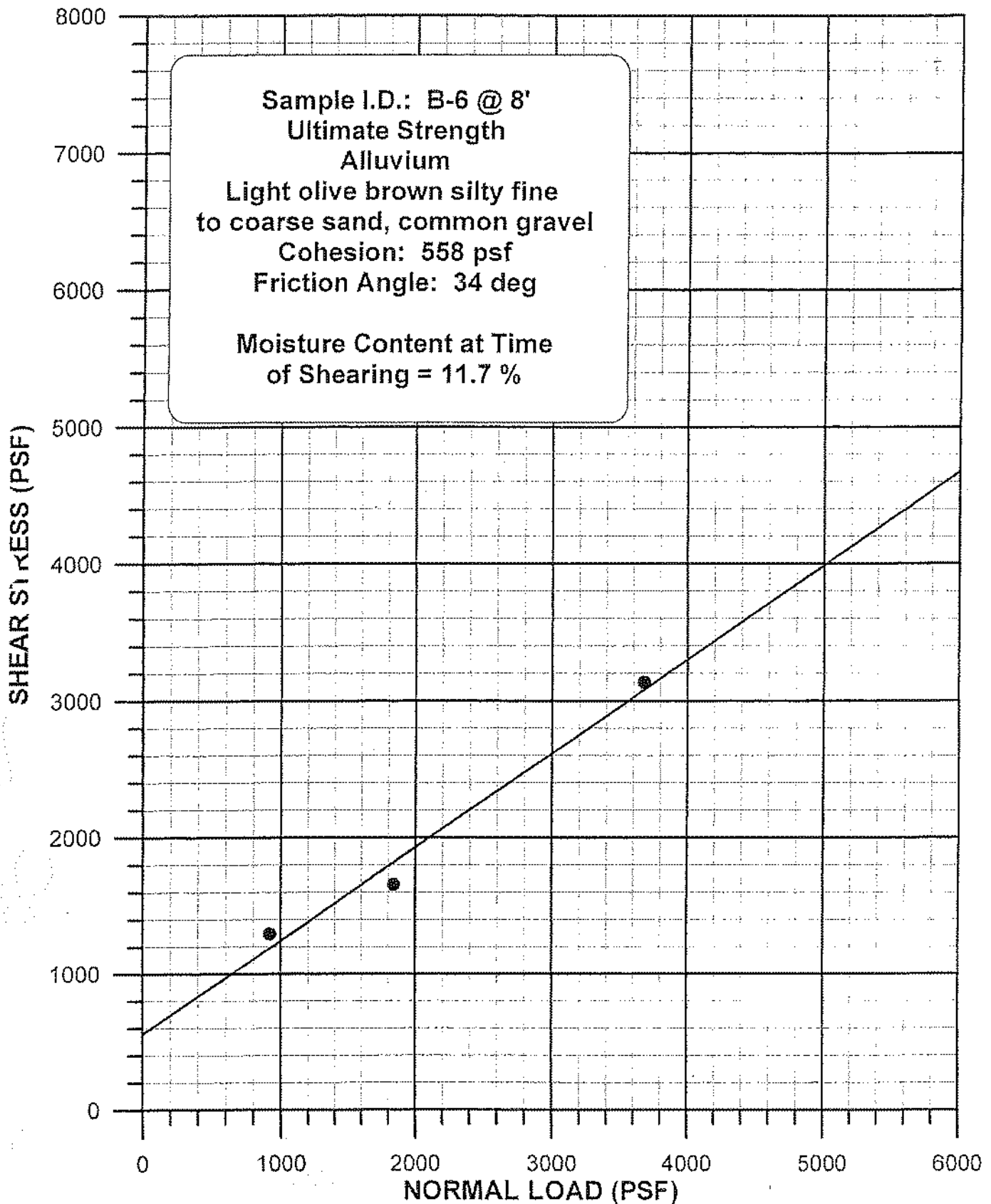
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-5 @ 23' = Sample taken from Boring 5 at a depth of 23'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

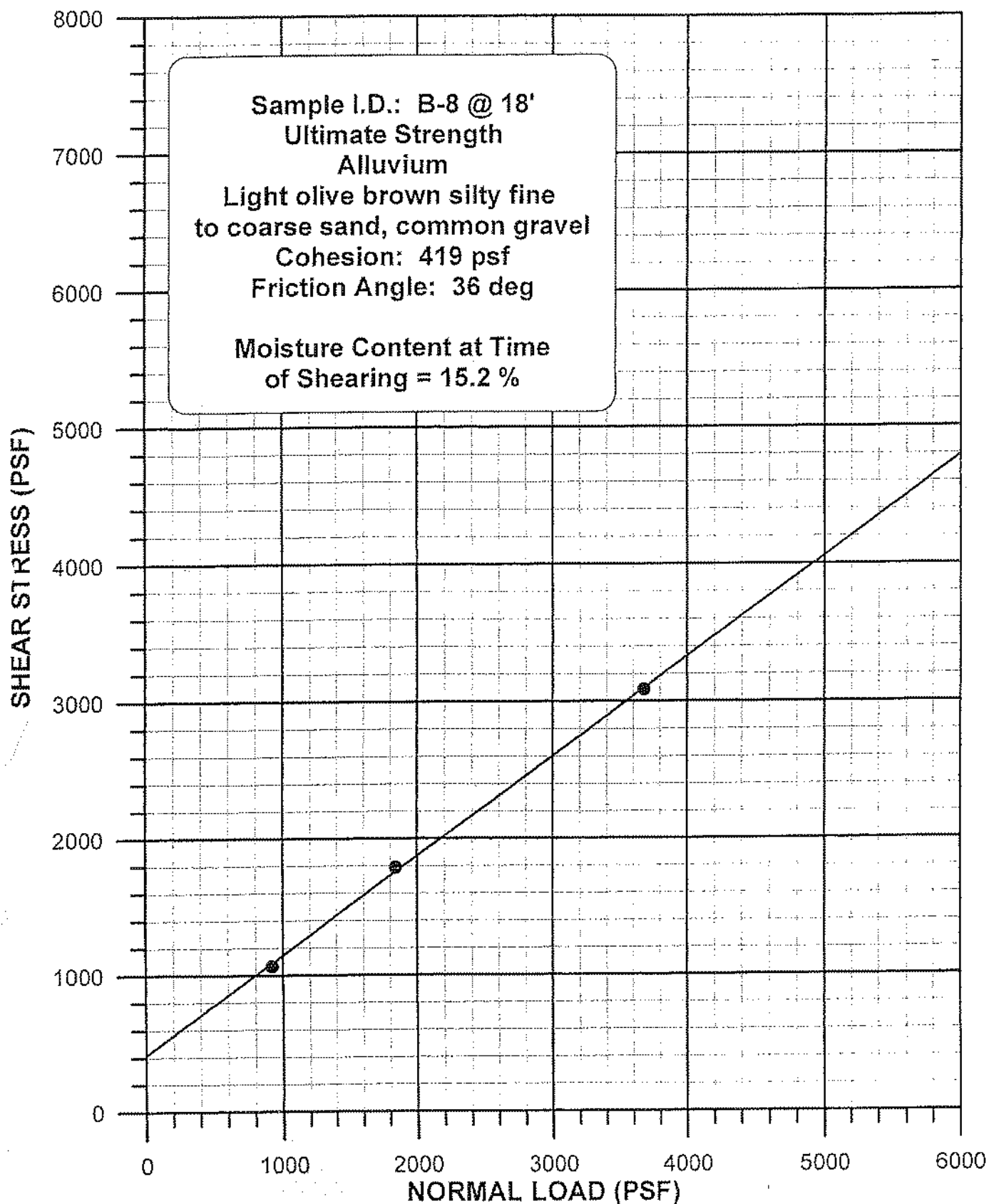
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



Explanation: B-6 @ 8' = Sample taken from Boring 6 at a depth of 8'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

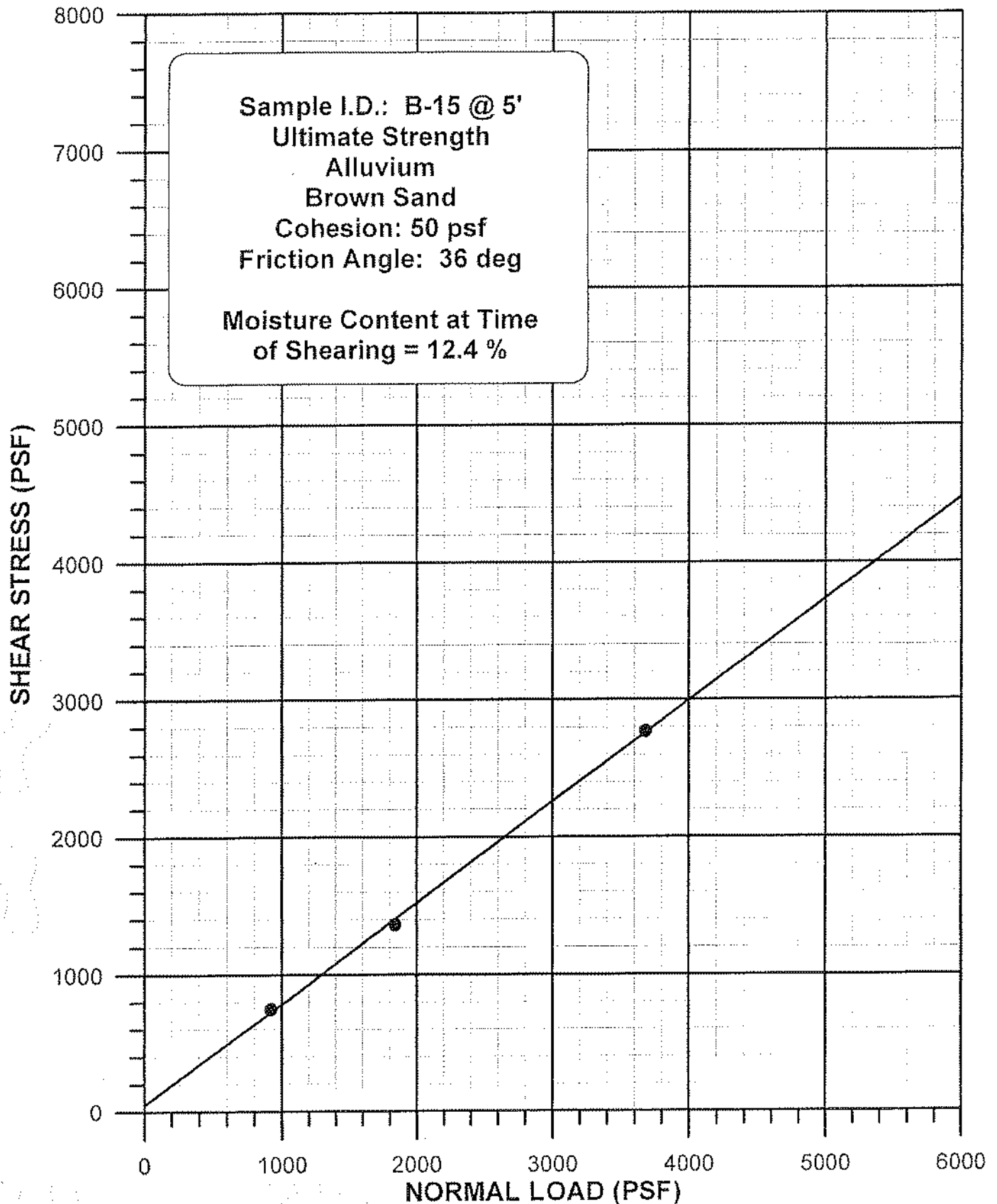
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



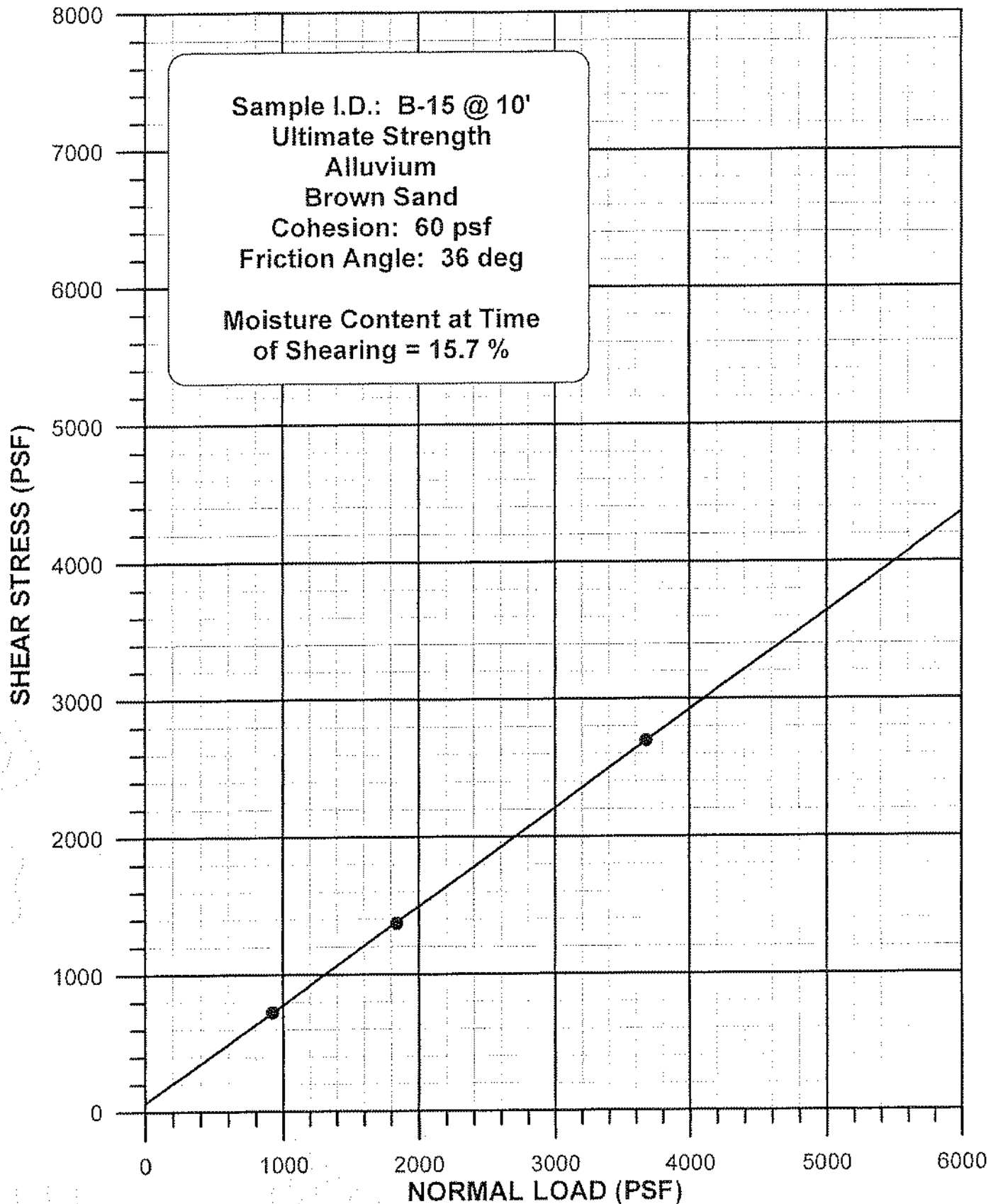
Explanation: B-8 @ 18' = Sample taken from Boring 8 at a depth of 18'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

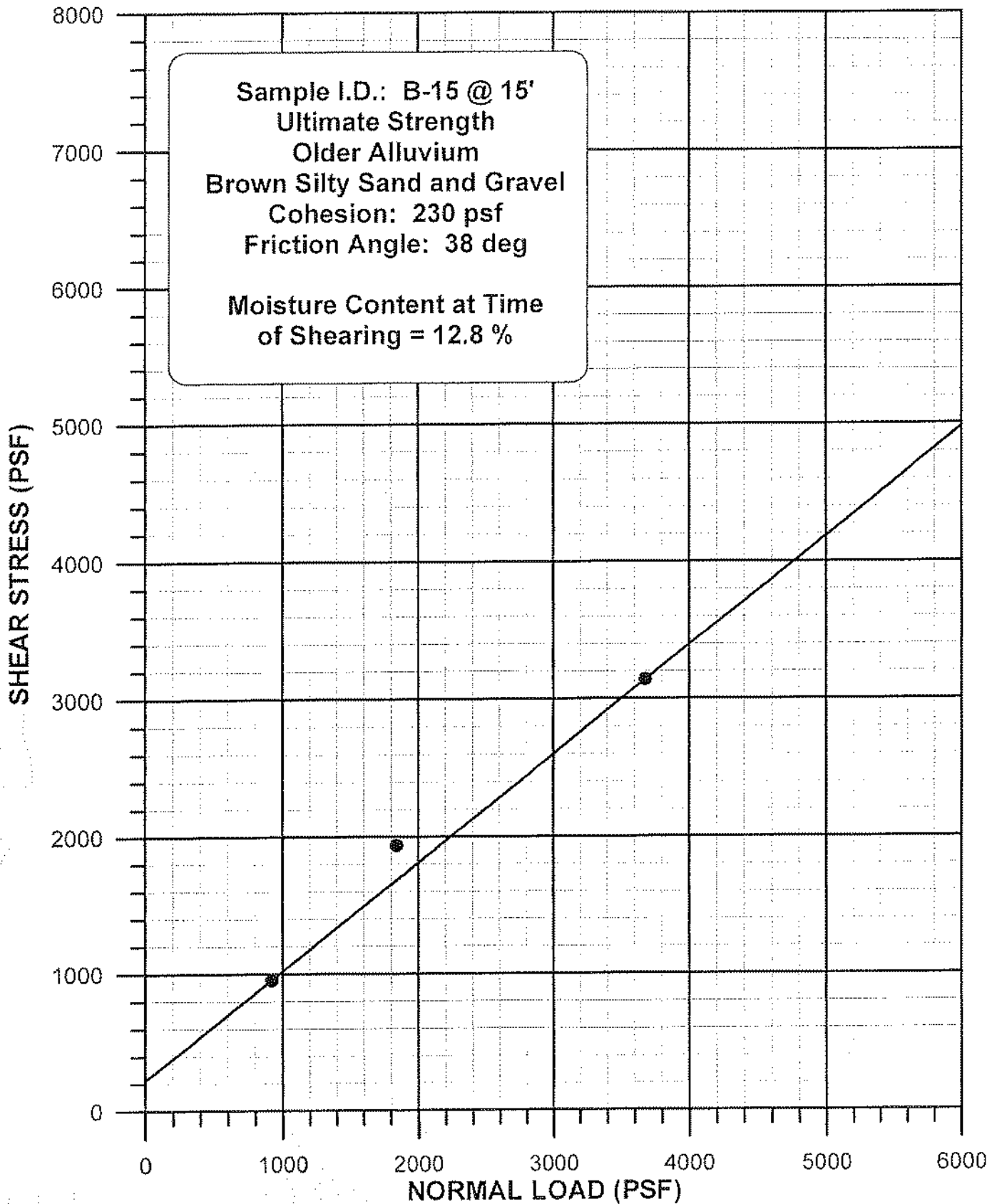
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



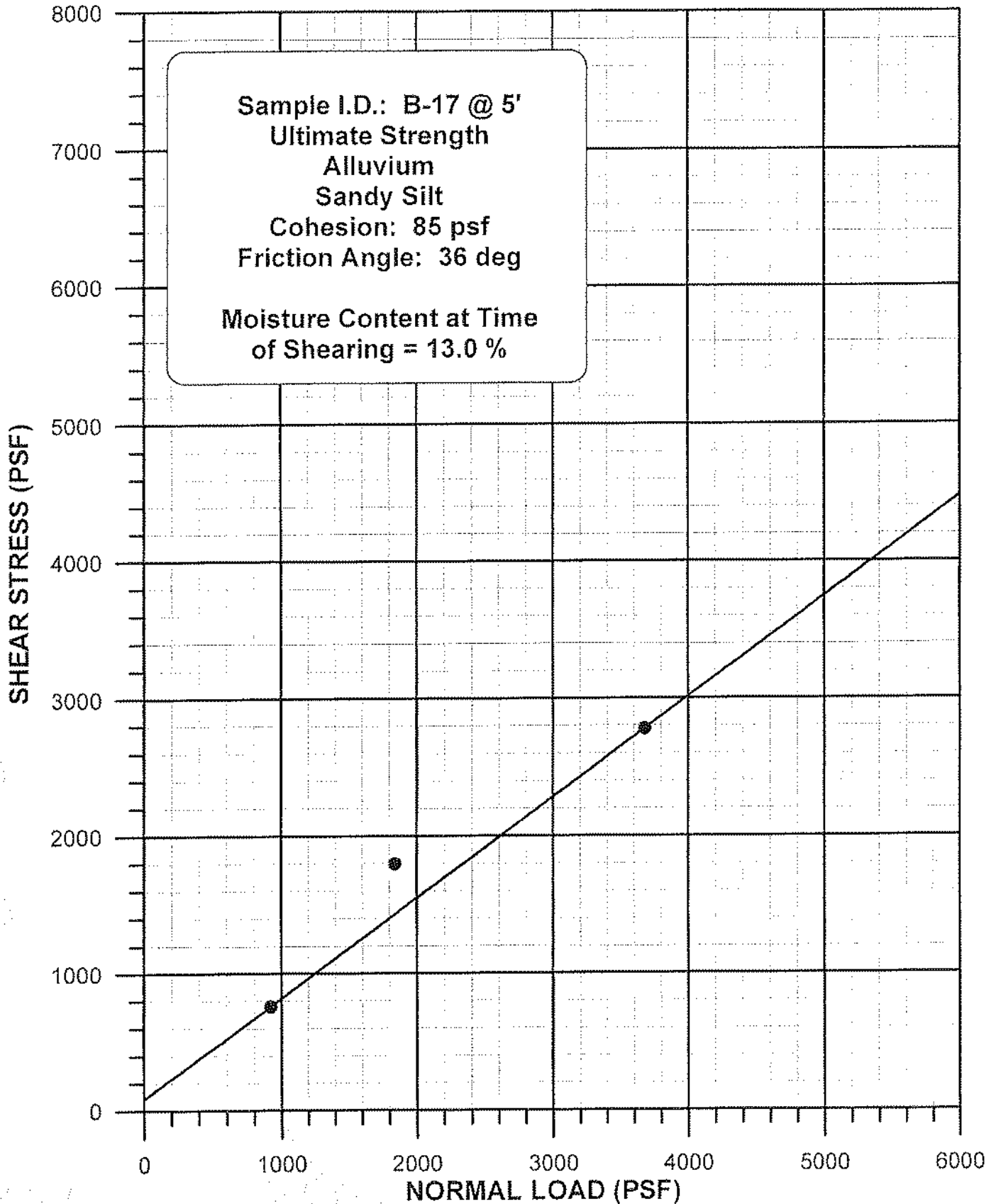
RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE

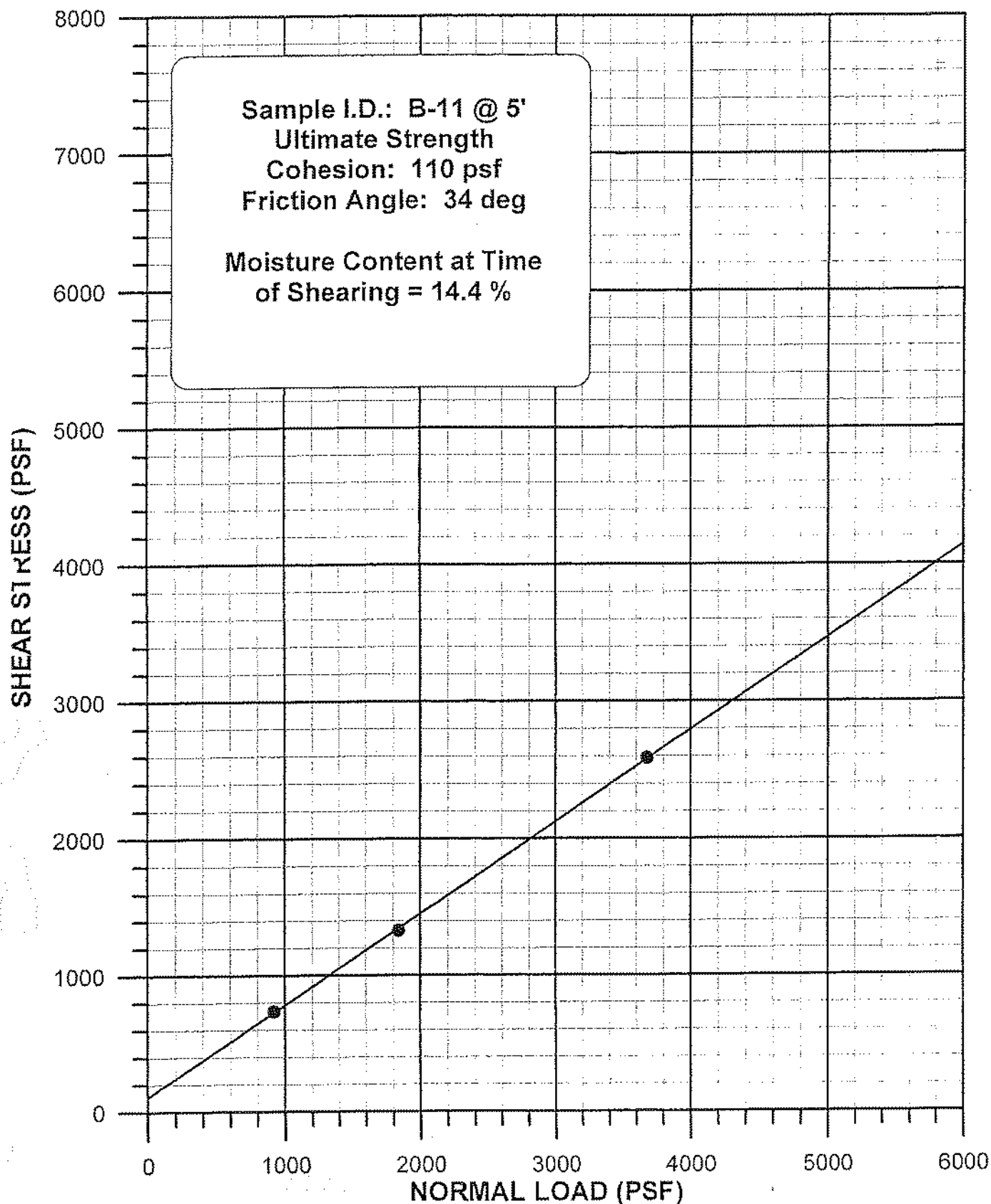


RESULTS OF DIRECT SHEAR TEST UNDISTURBED, SATURATED SAMPLE



RESULTS OF DIRECT SHEAR TEST

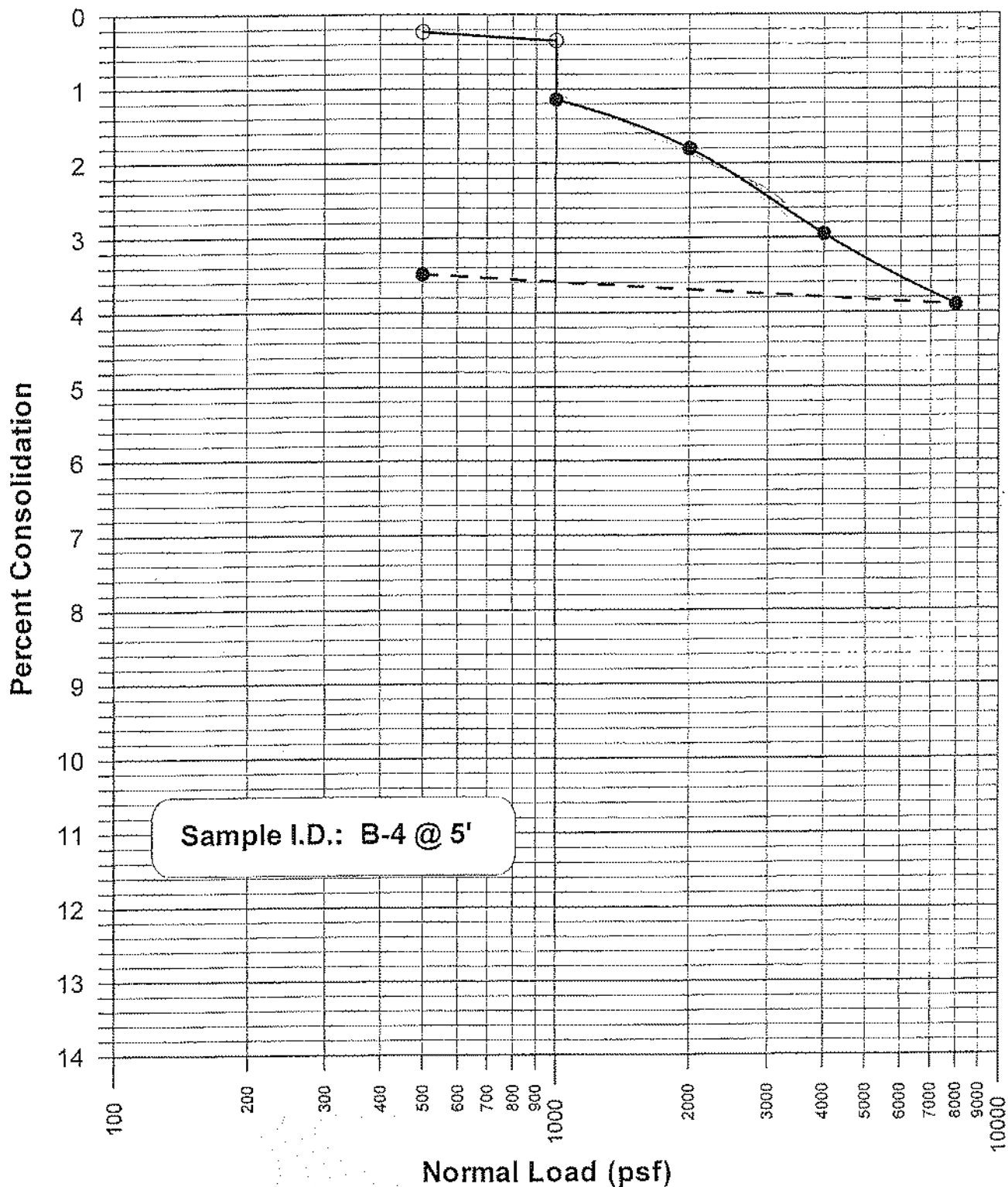
SAMPLE REMOLDED TO 90% OF MAXIMUM DRY DENSITY AND SATURATED



Explanation: B-11 @ 5' = Sample taken from Boring 11 at a depth of 5'

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

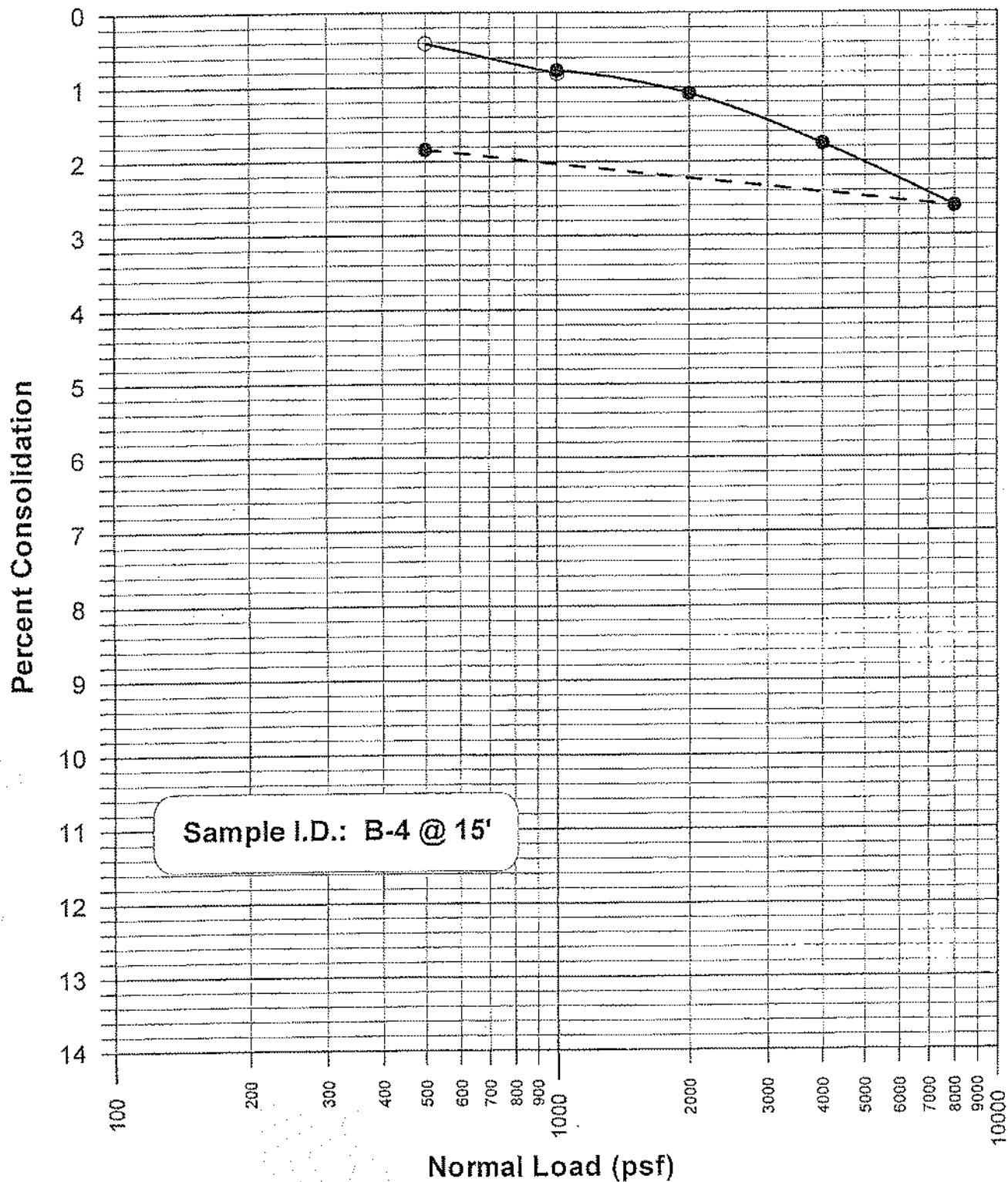
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

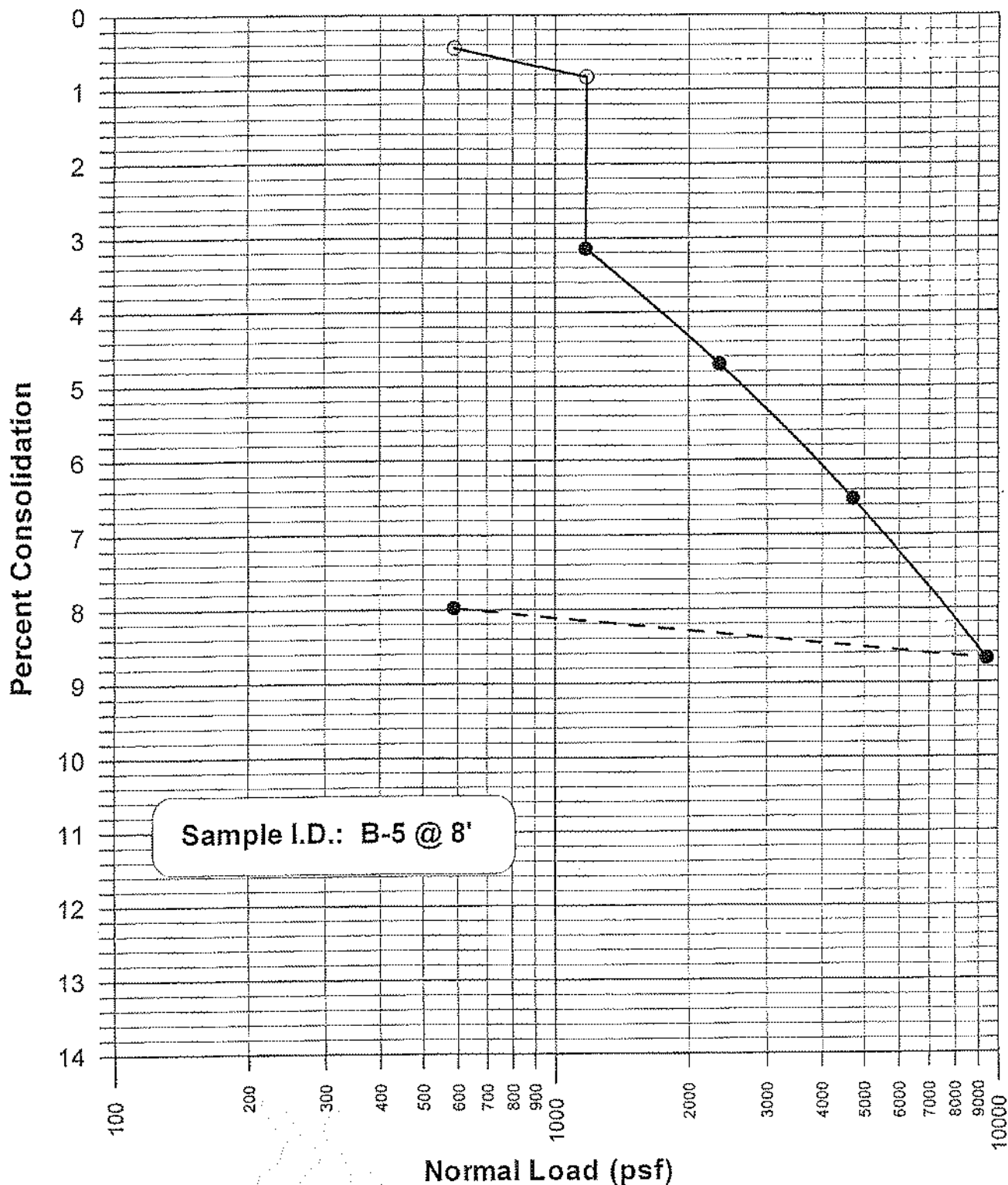
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

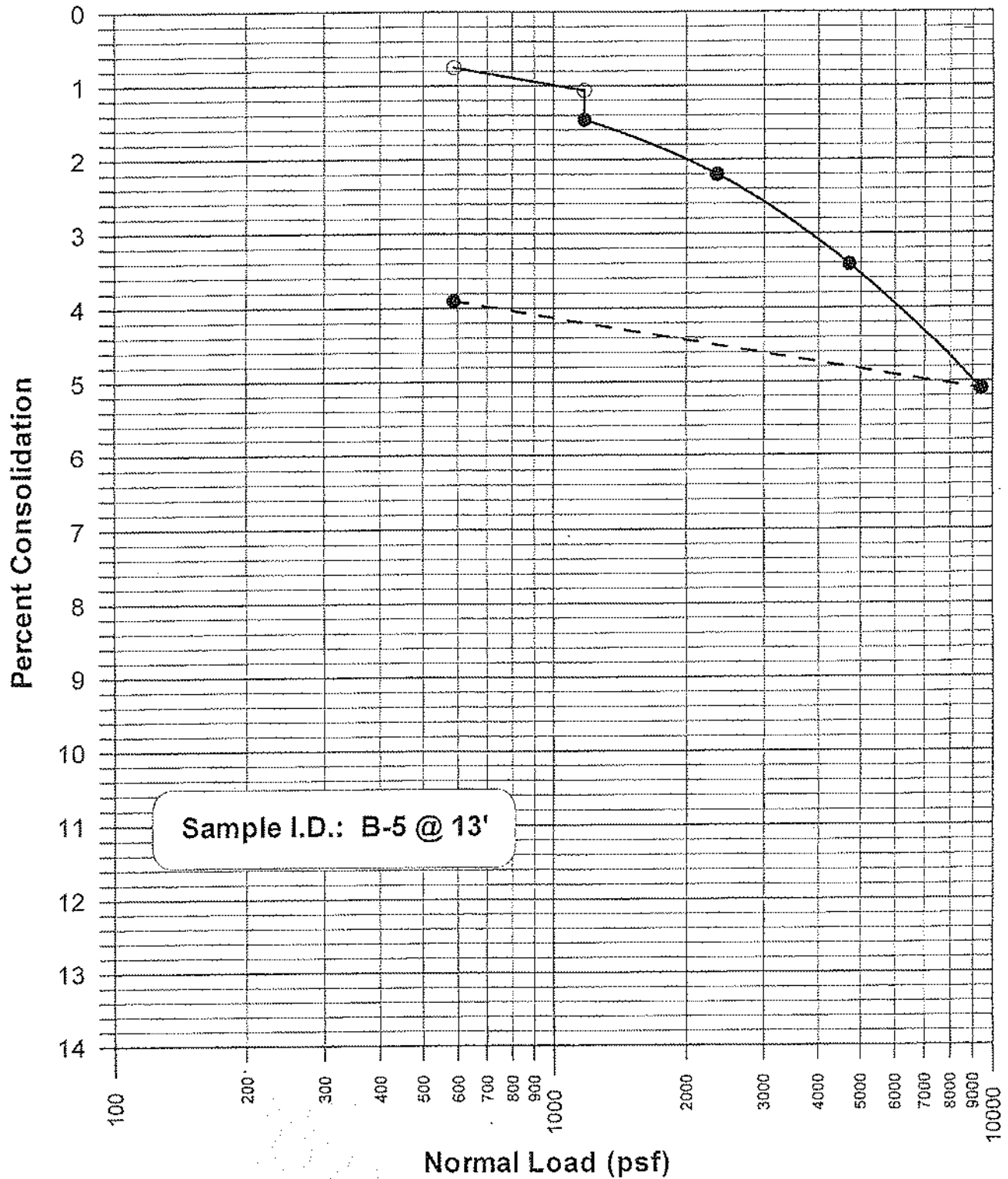
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

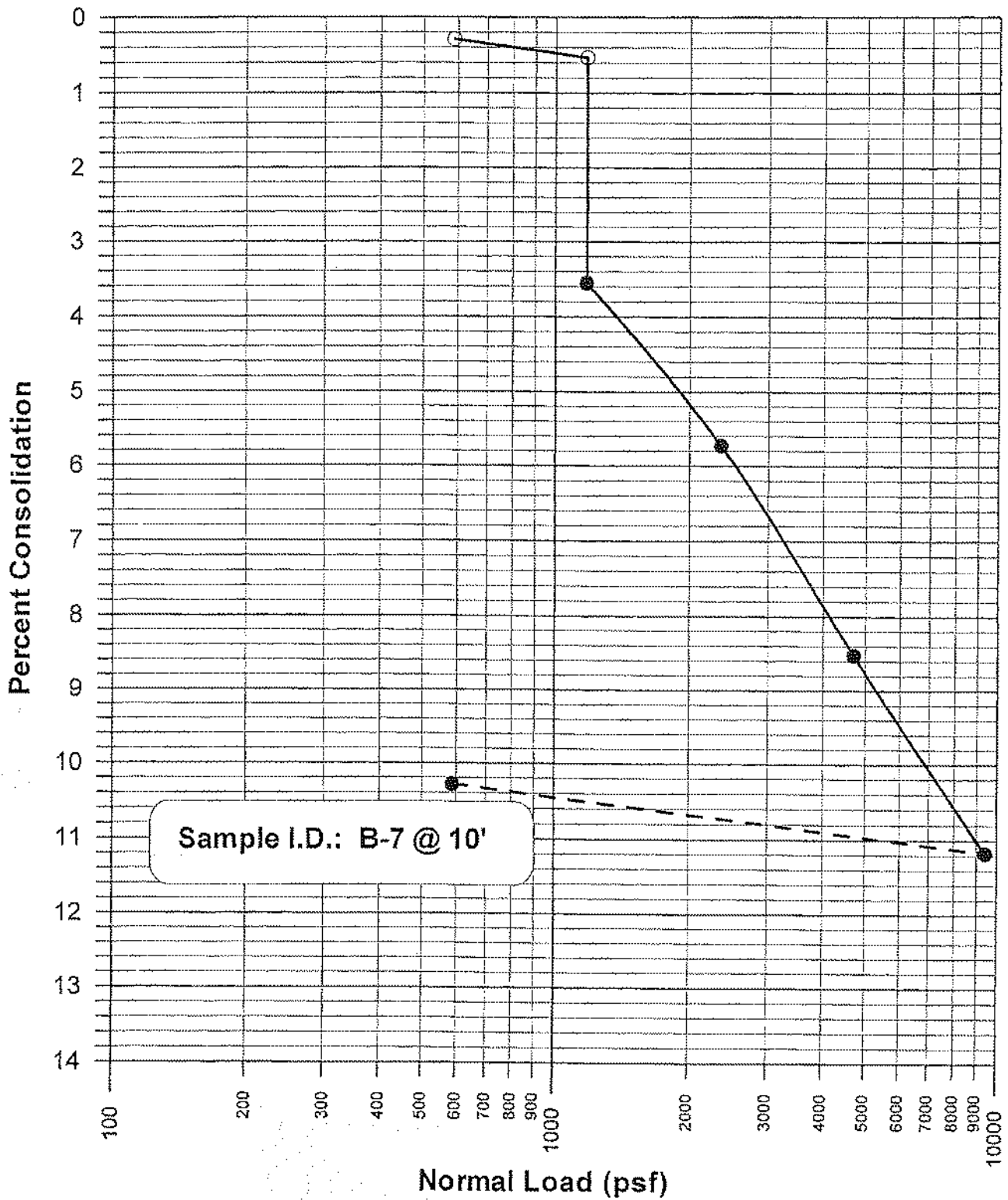
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

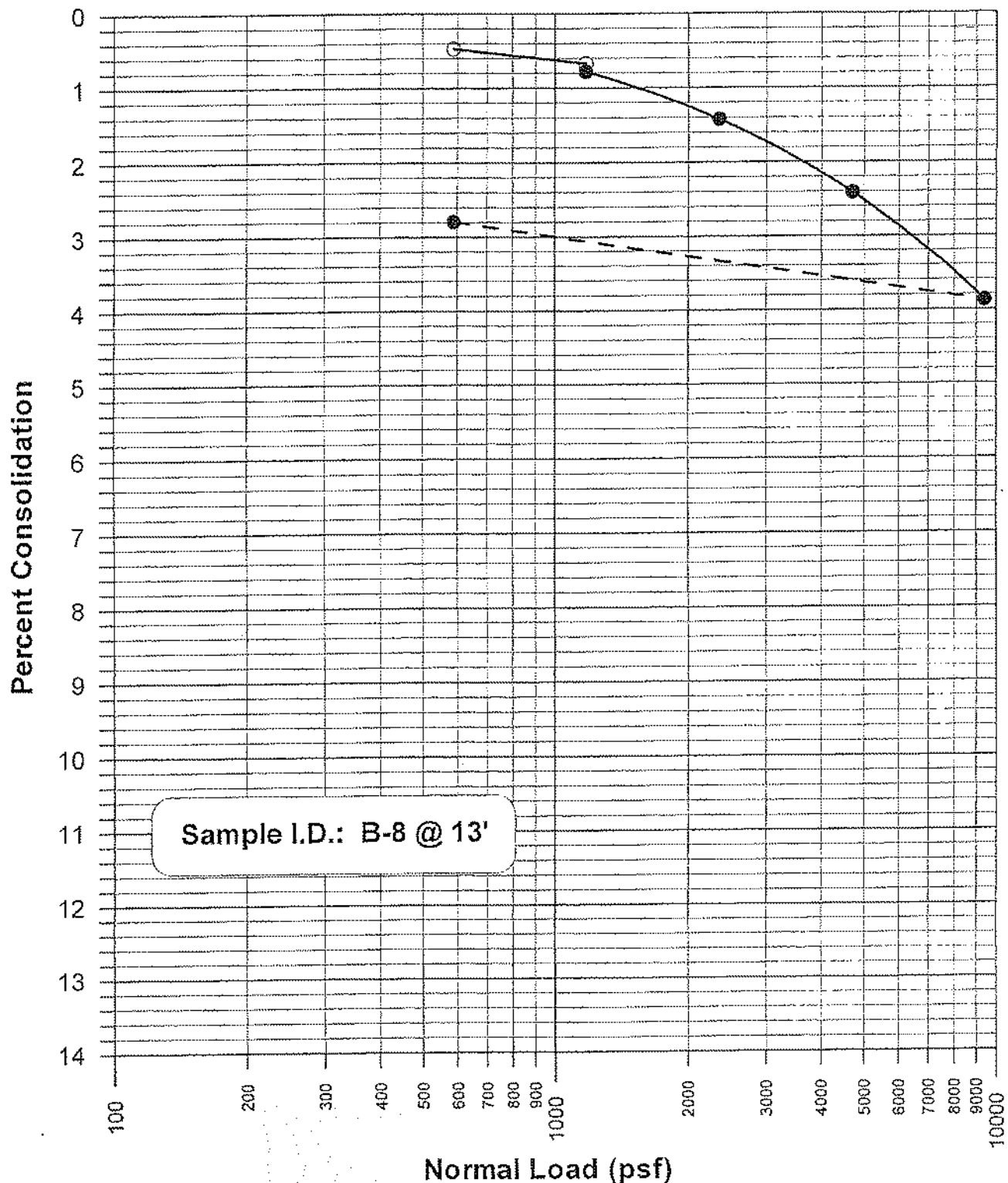
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

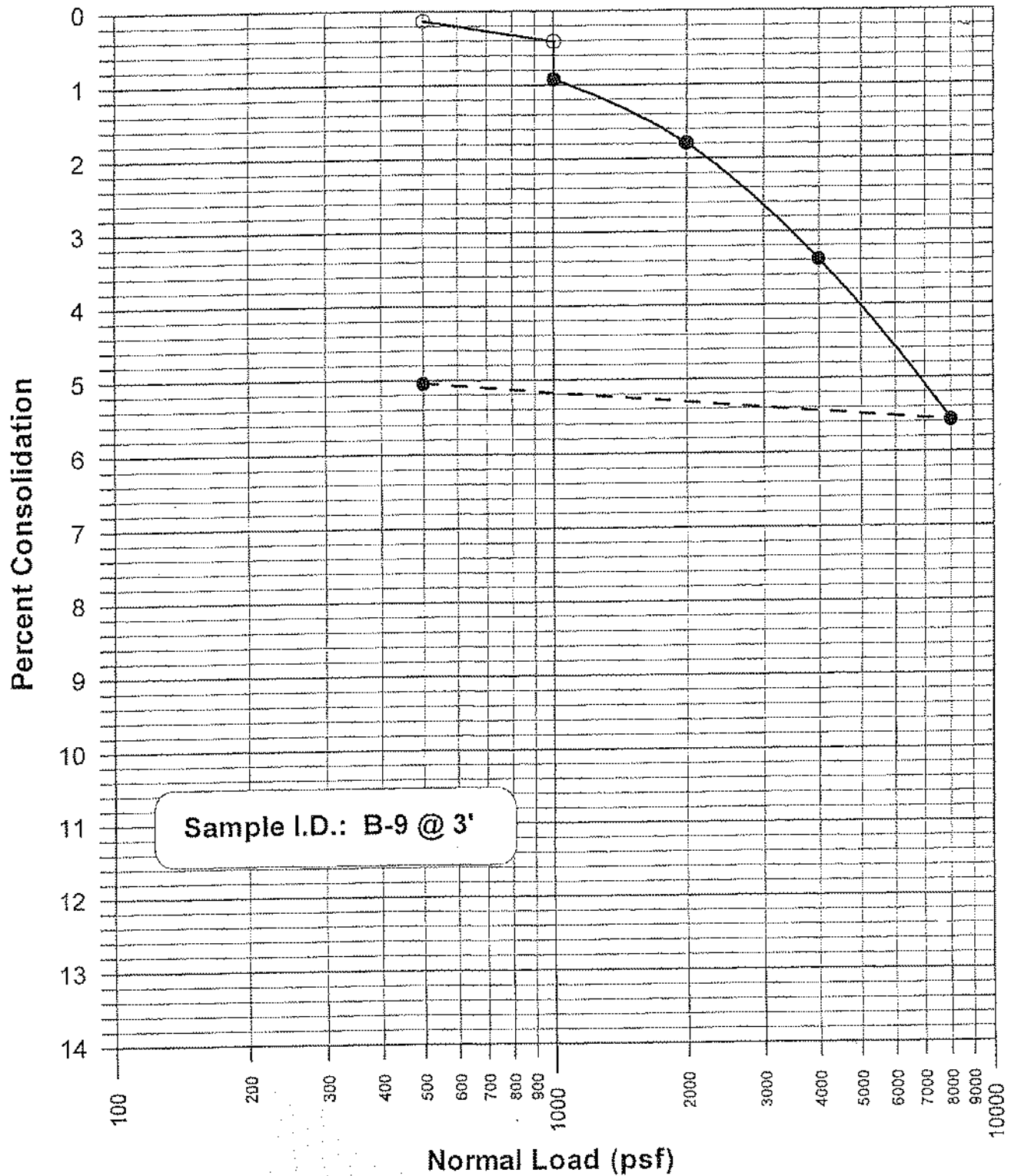
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

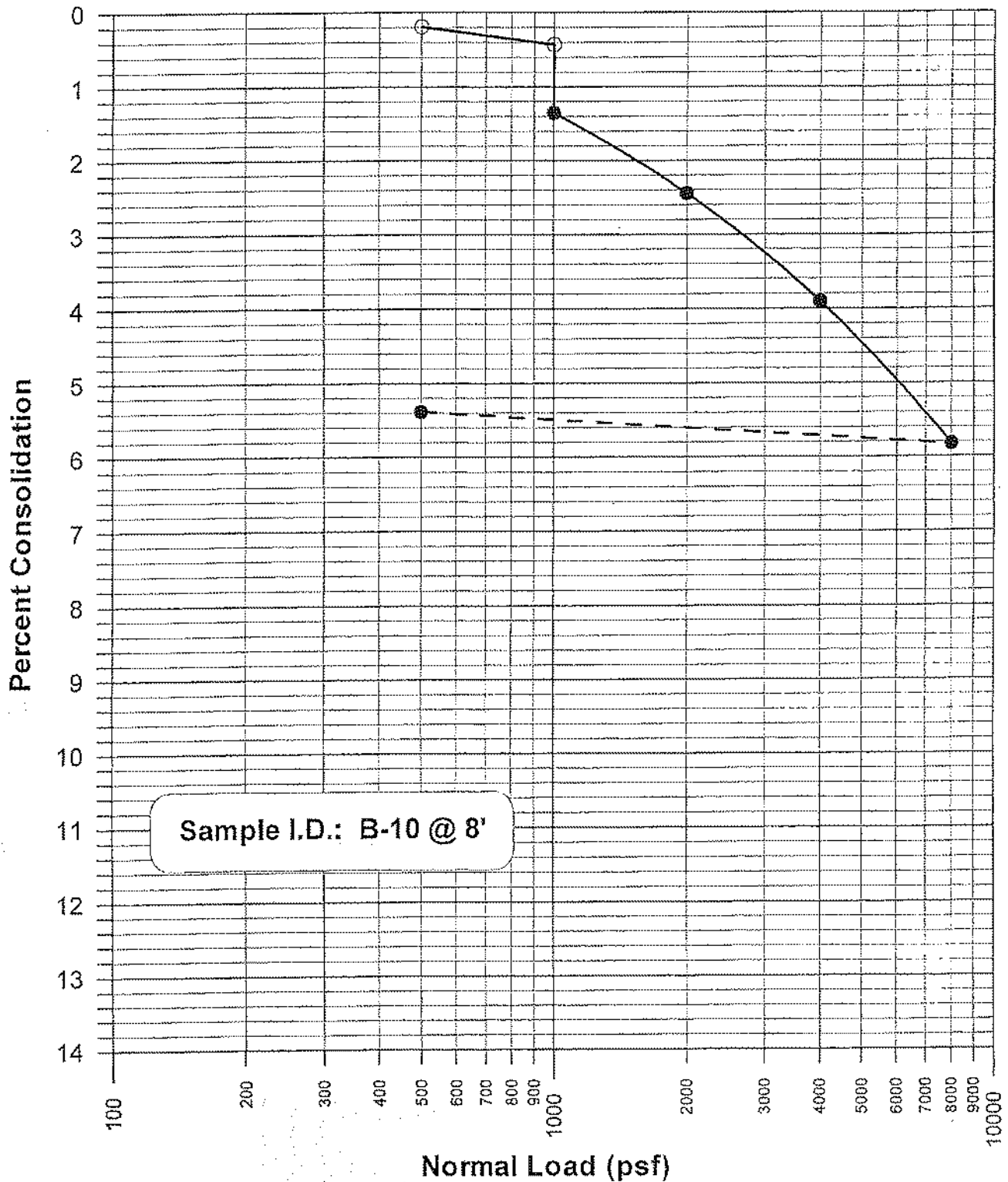
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

LOAD CONSOLIDATION TEST

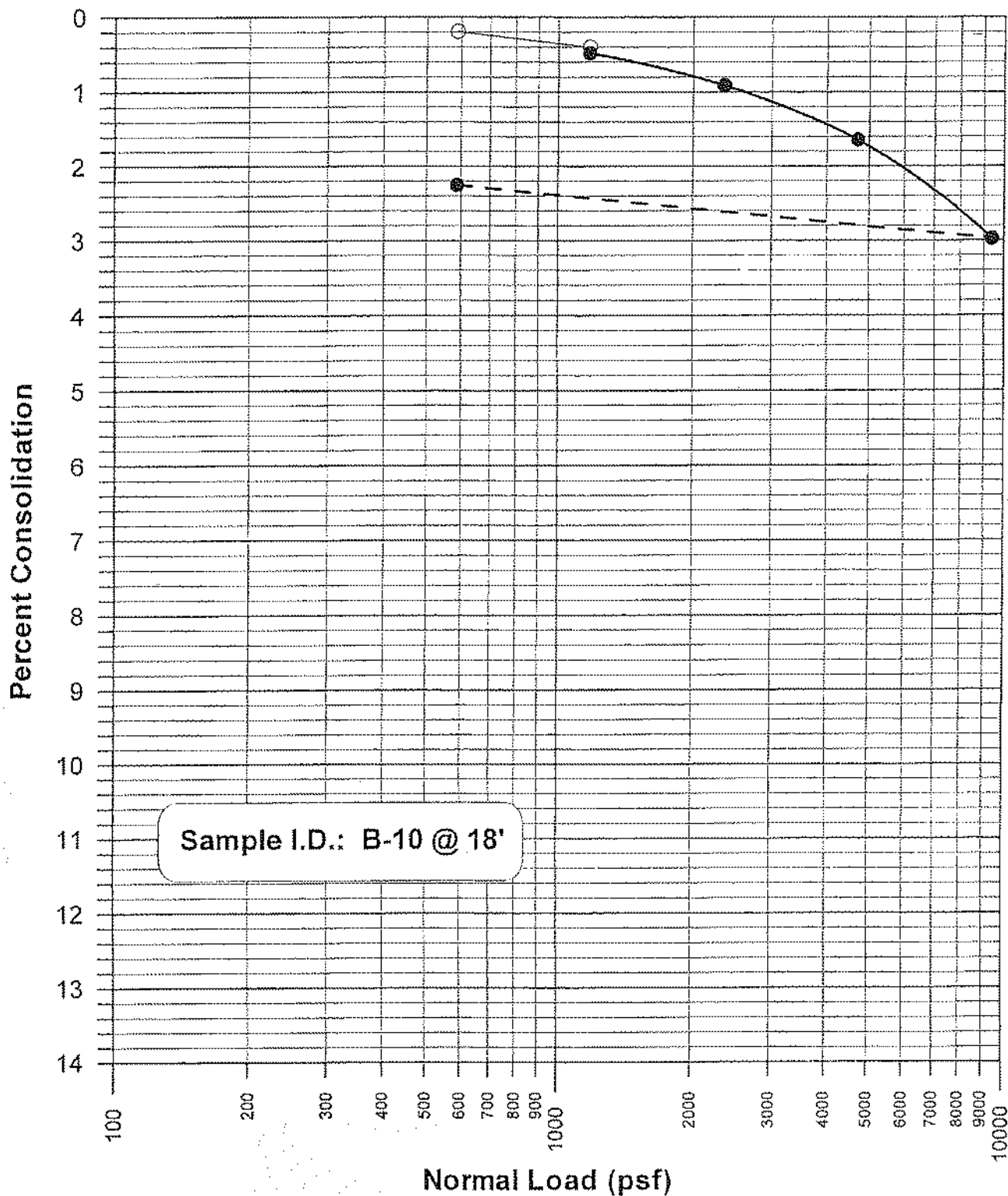


Sample I.D.: B-10 @ 8'

- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

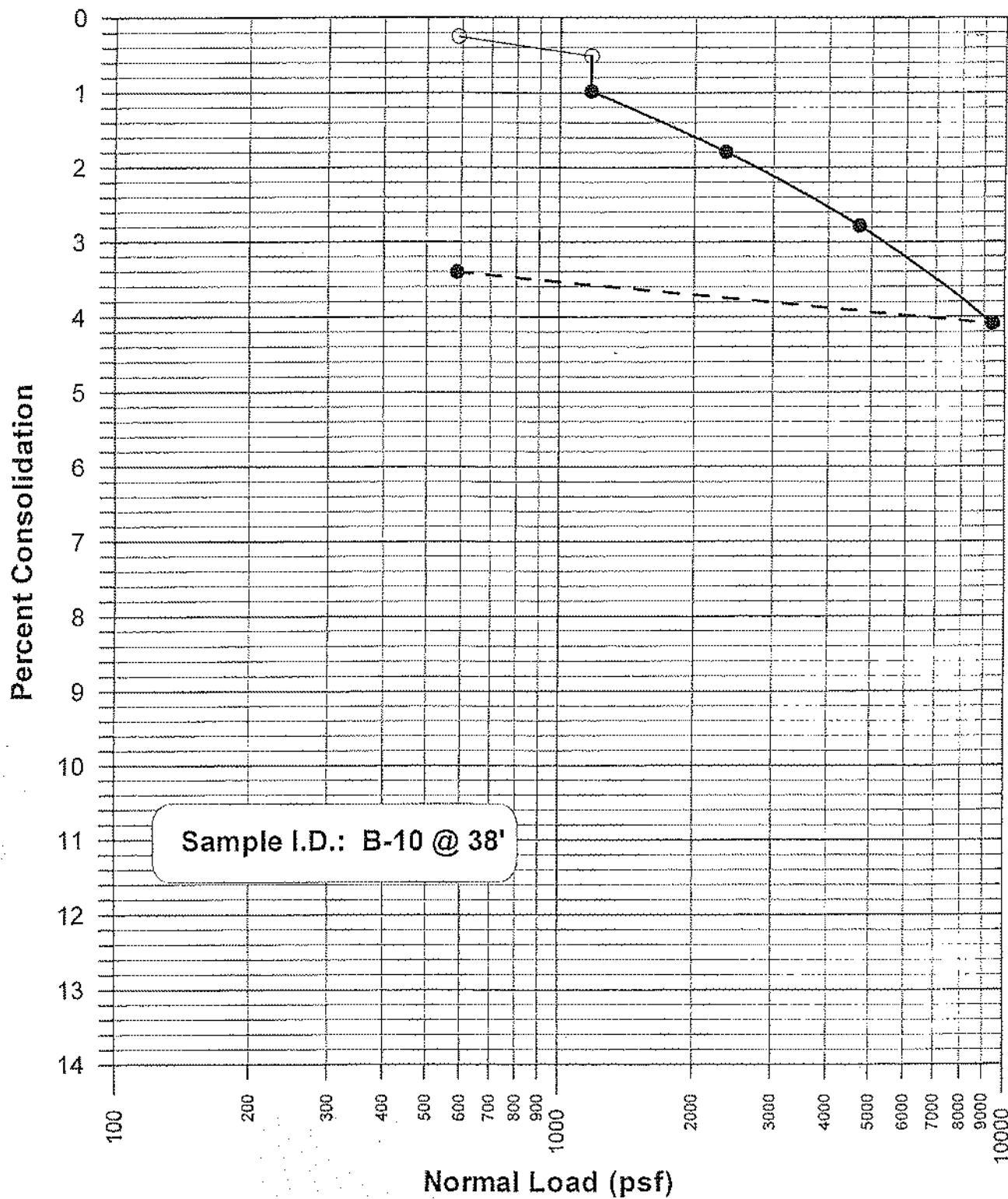
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2647-0-0-10
GORIAN AND ASSOCIATES, INC.

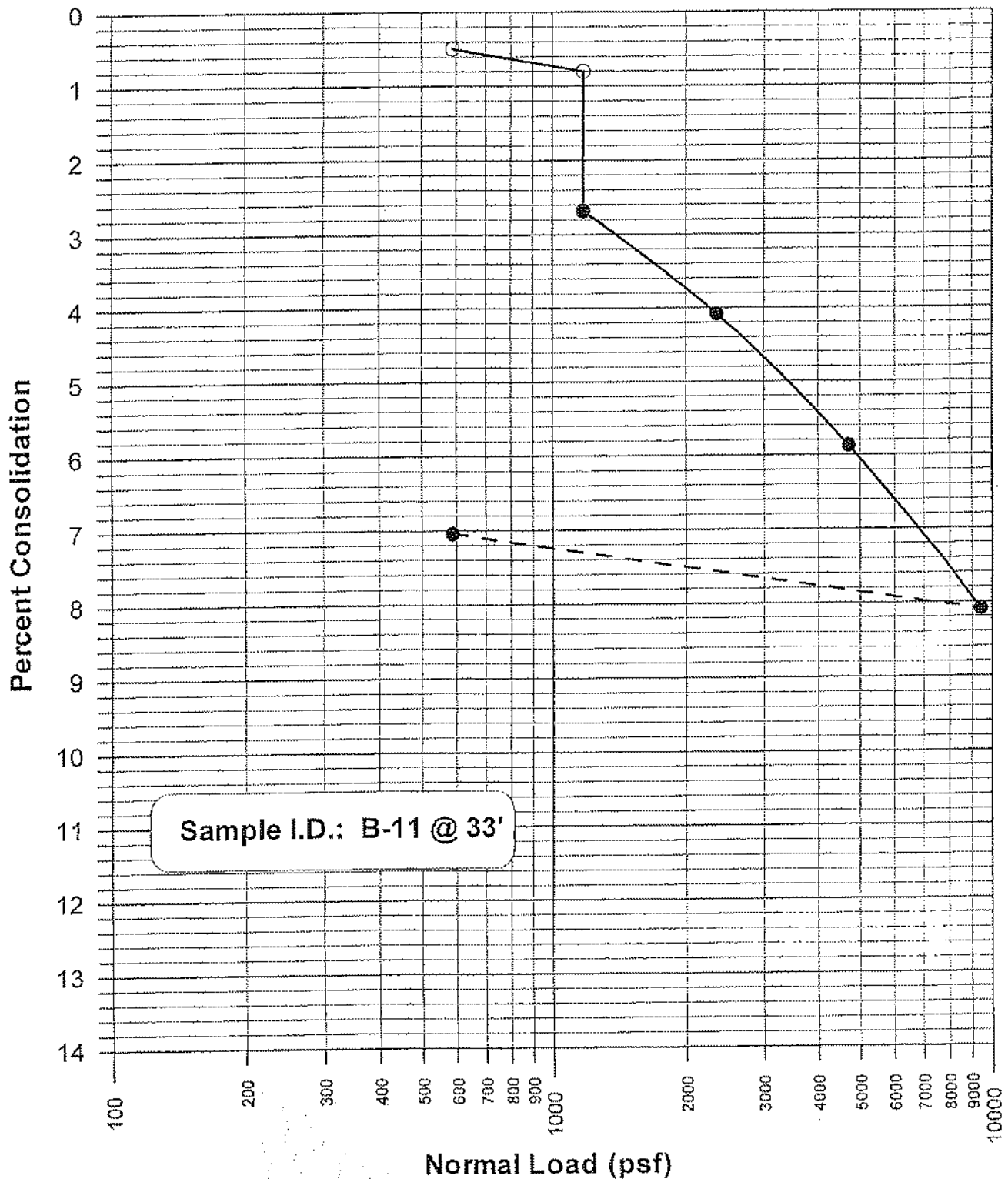
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2647-0-0-10
GORIAN AND ASSOCIATES, INC.

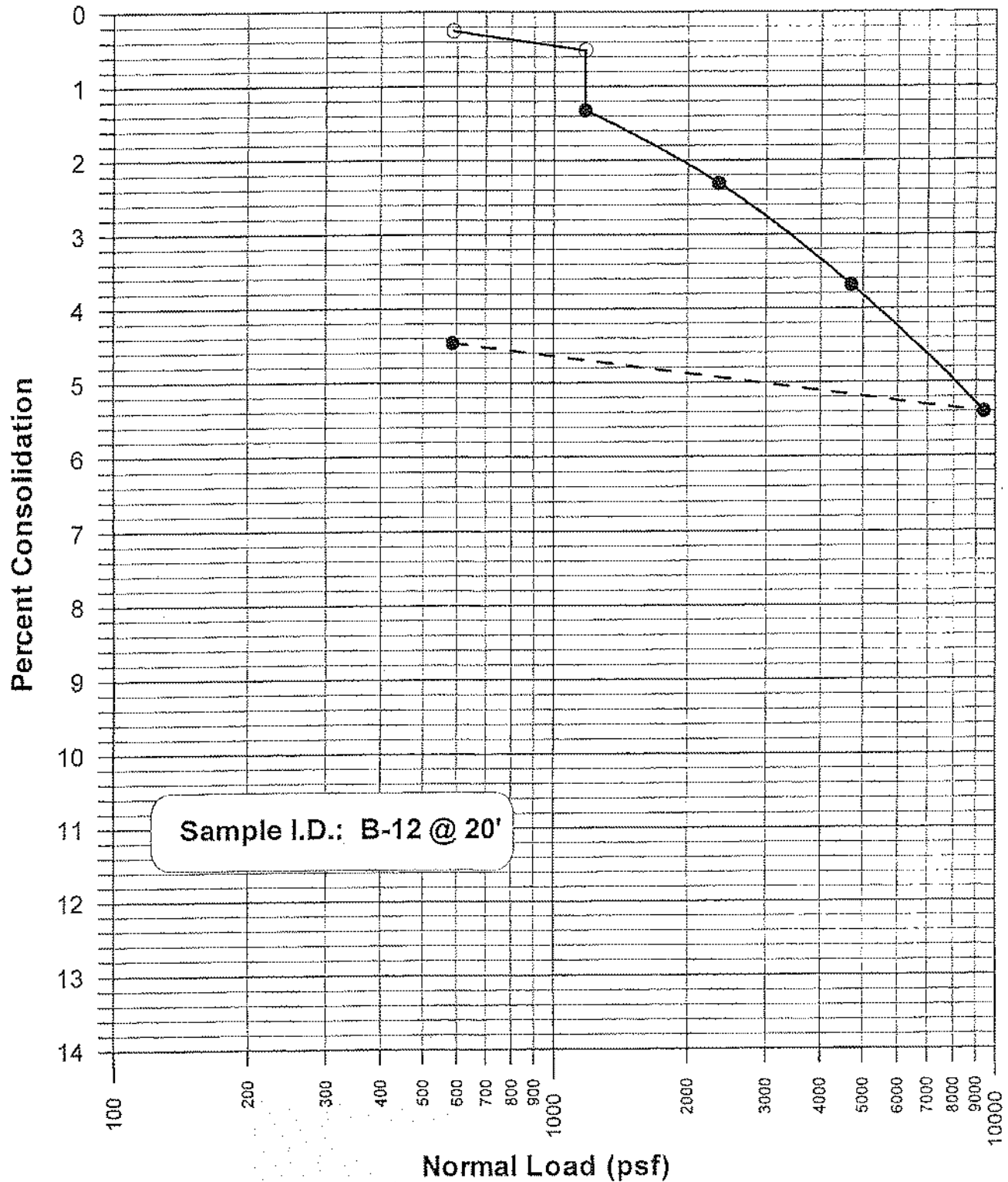
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2647-0-0-10
GORIAN AND ASSOCIATES, INC.

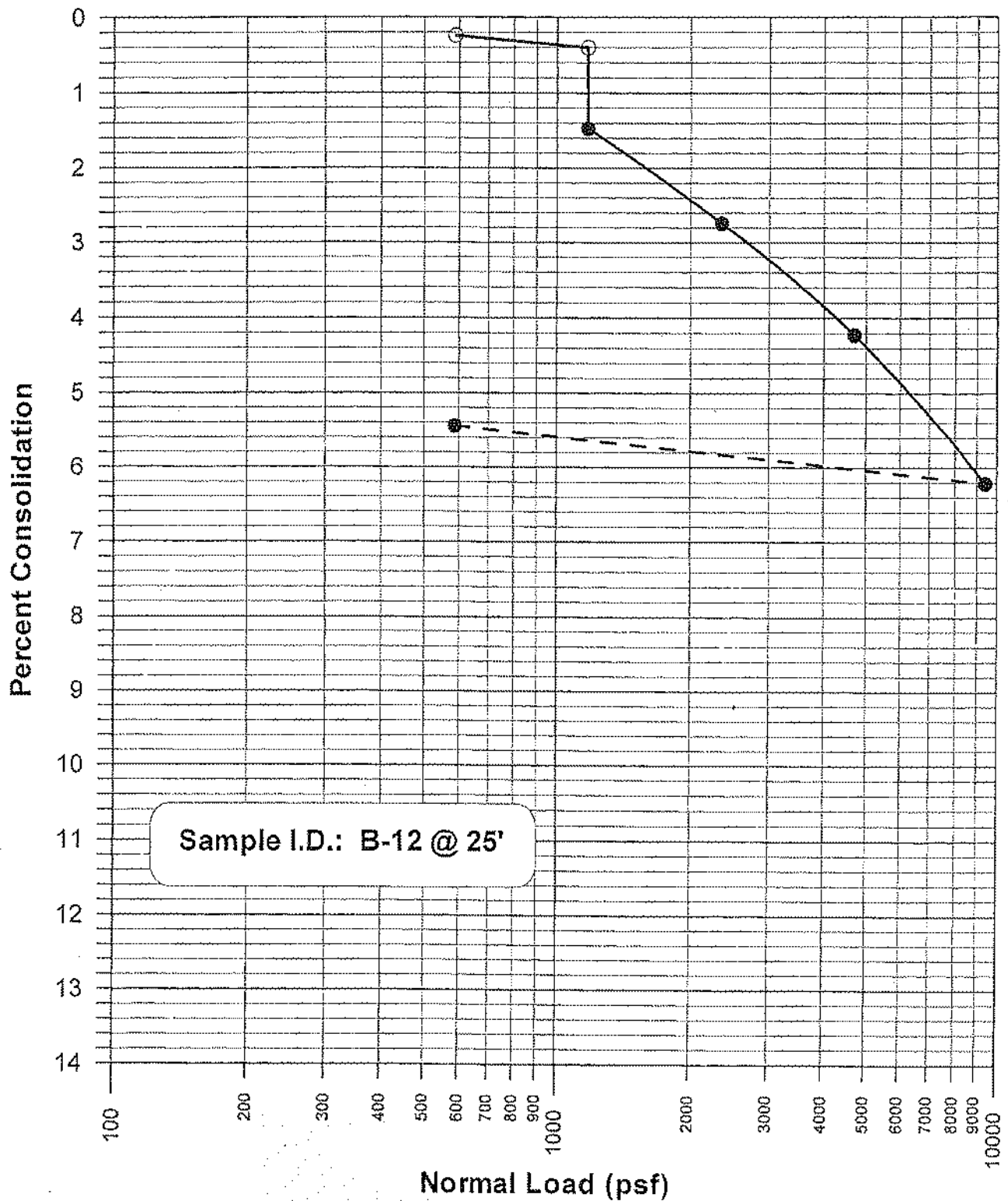
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

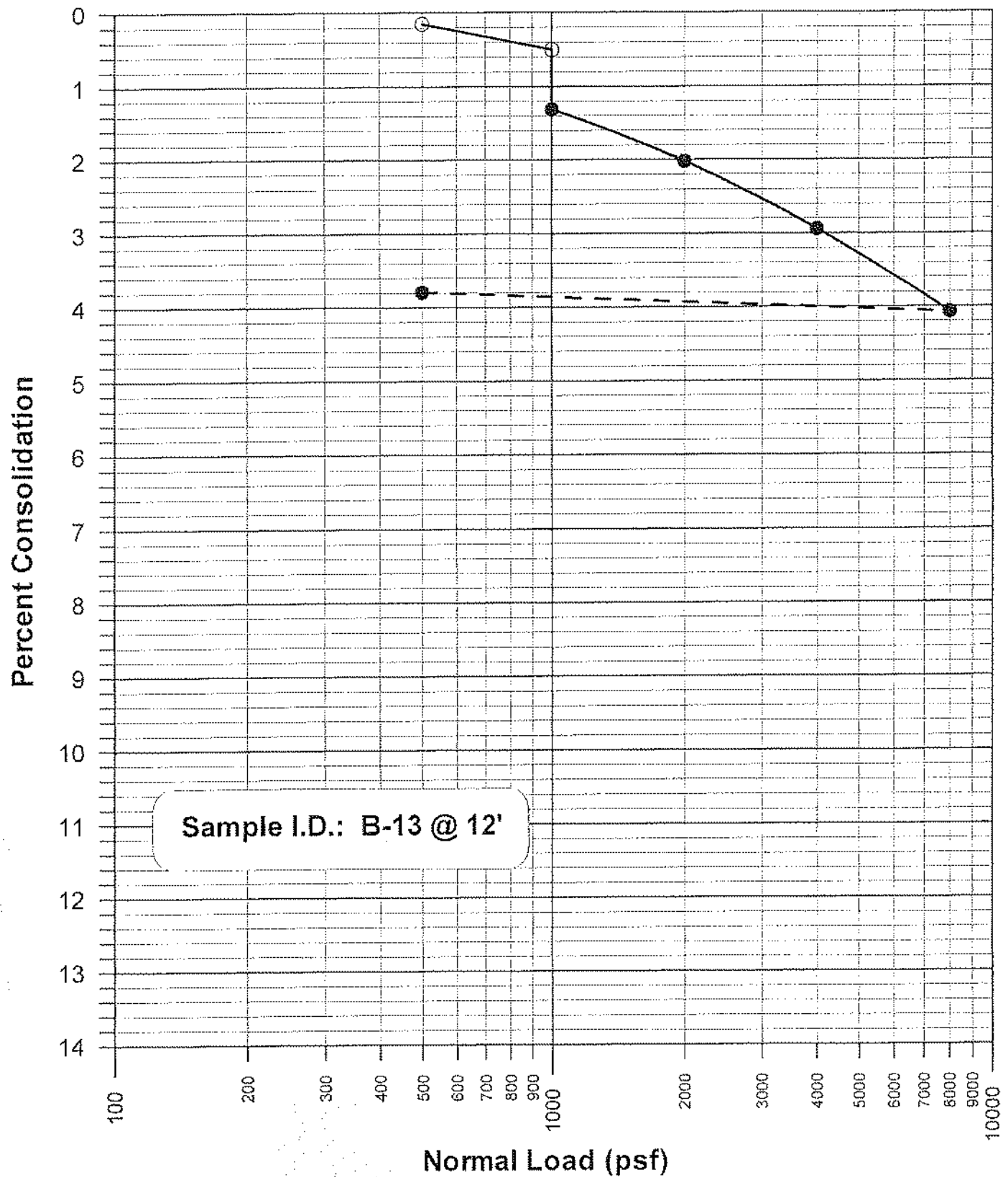
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

Work Order: 2467-0-0-10
GORIAN AND ASSOCIATES, INC.

LOAD CONSOLIDATION TEST

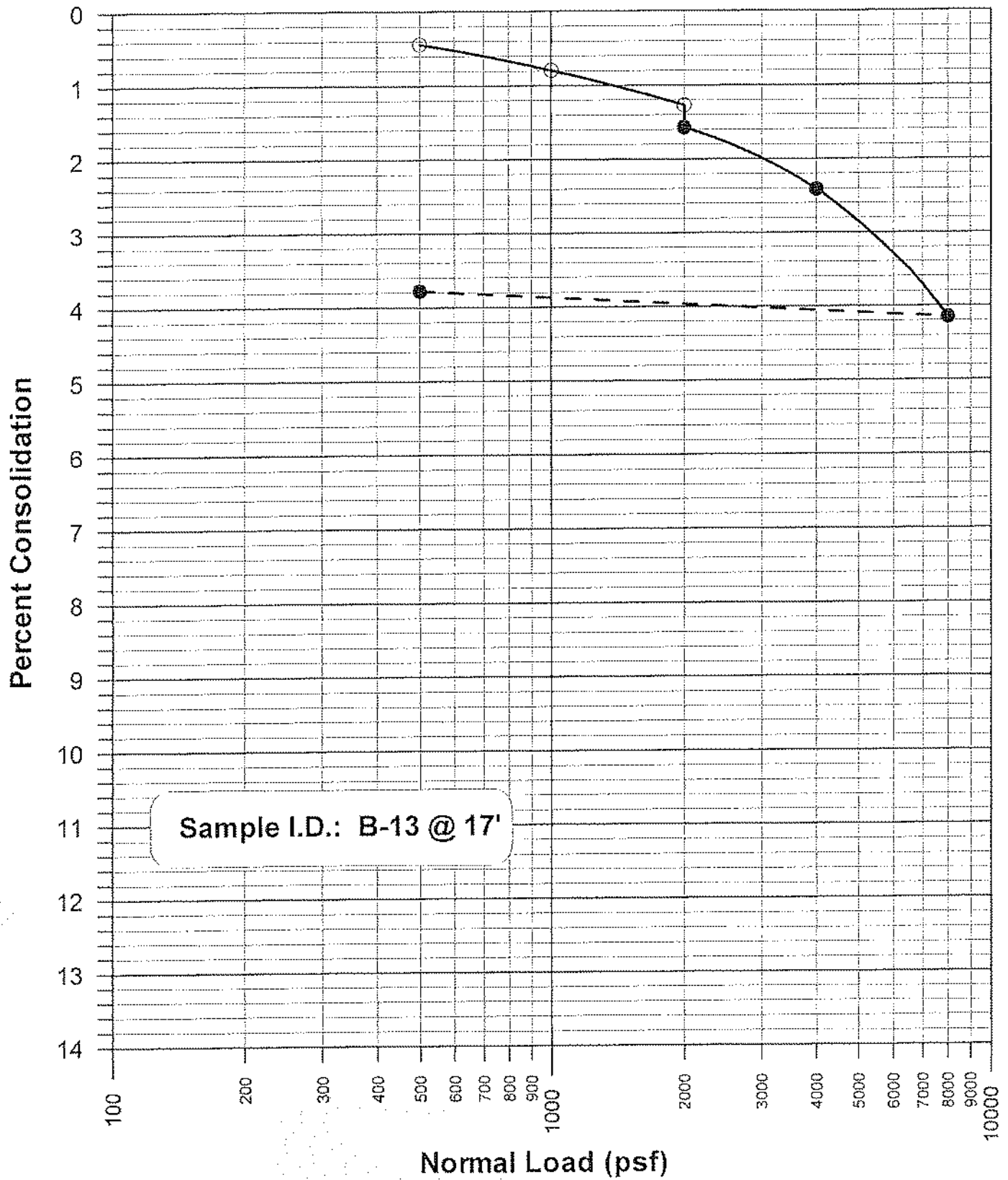


Sample I.D.: B-13 @ 12'

- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

Work Order: 2467-1-0-10
GORIAN AND ASSOCIATES, INC.

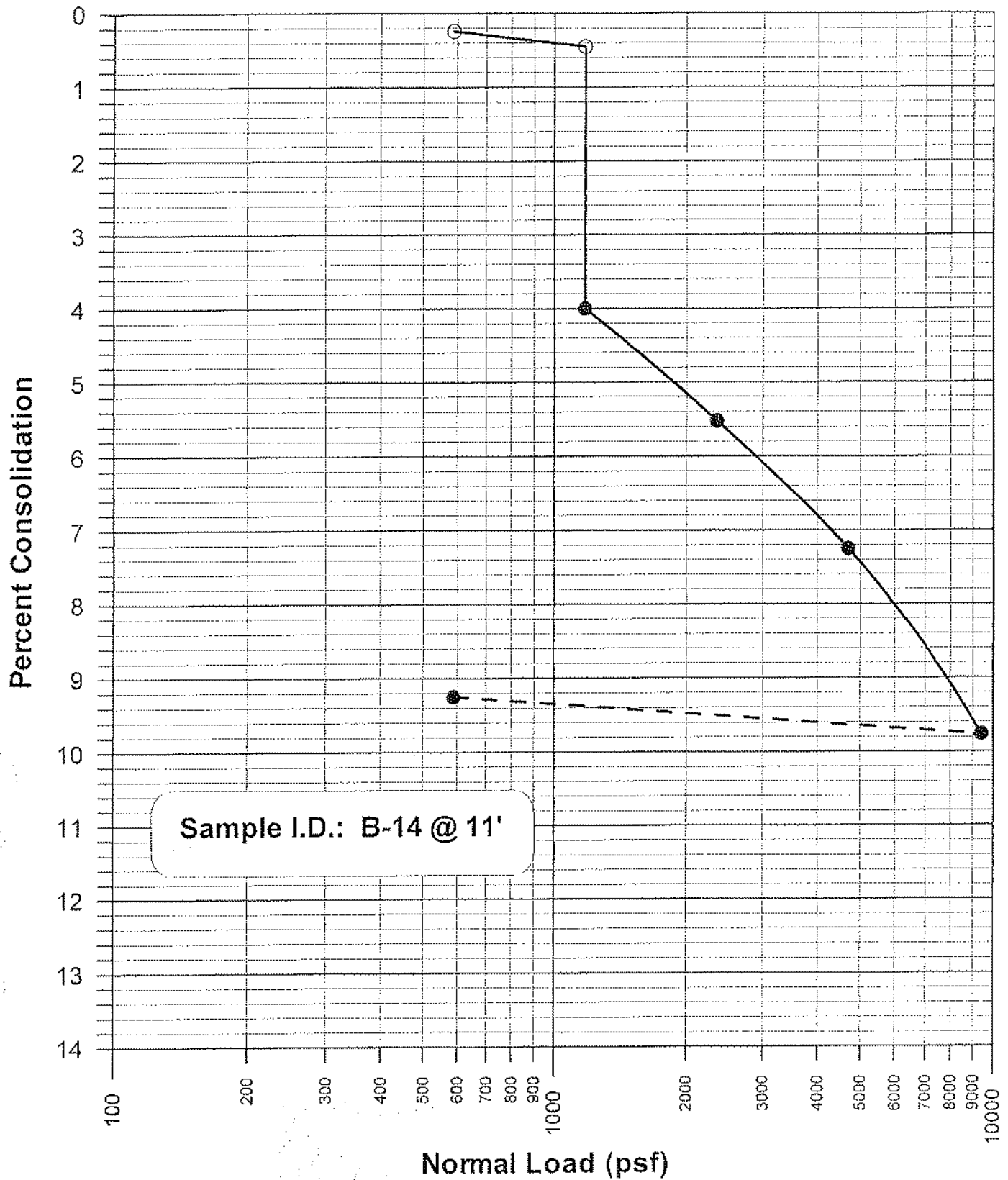
LOAD CONSOLIDATION TEST



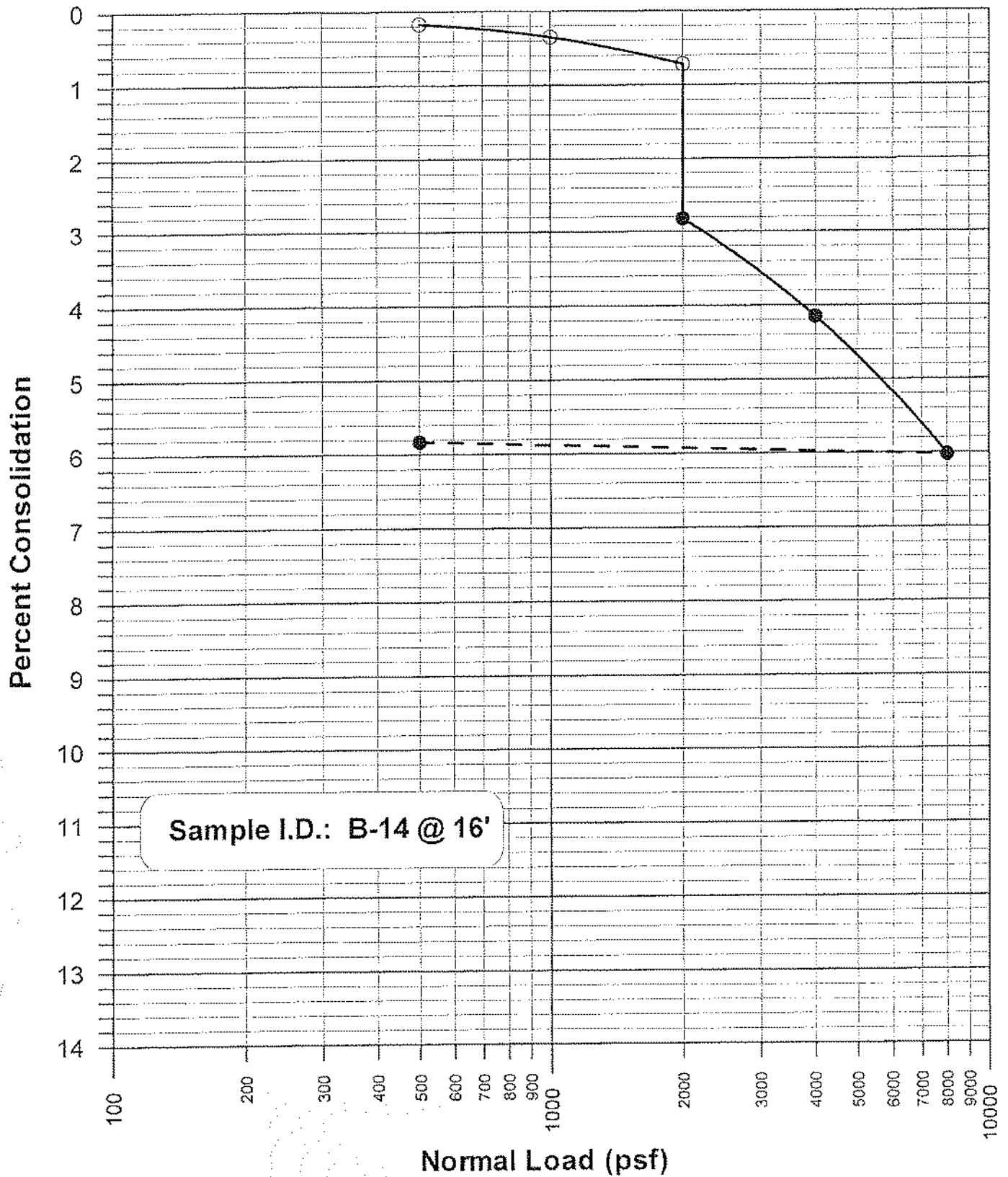
- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

Work Order: 2467-1-0-10
GORIAN AND ASSOCIATES, INC.

LOAD CONSOLIDATION TEST



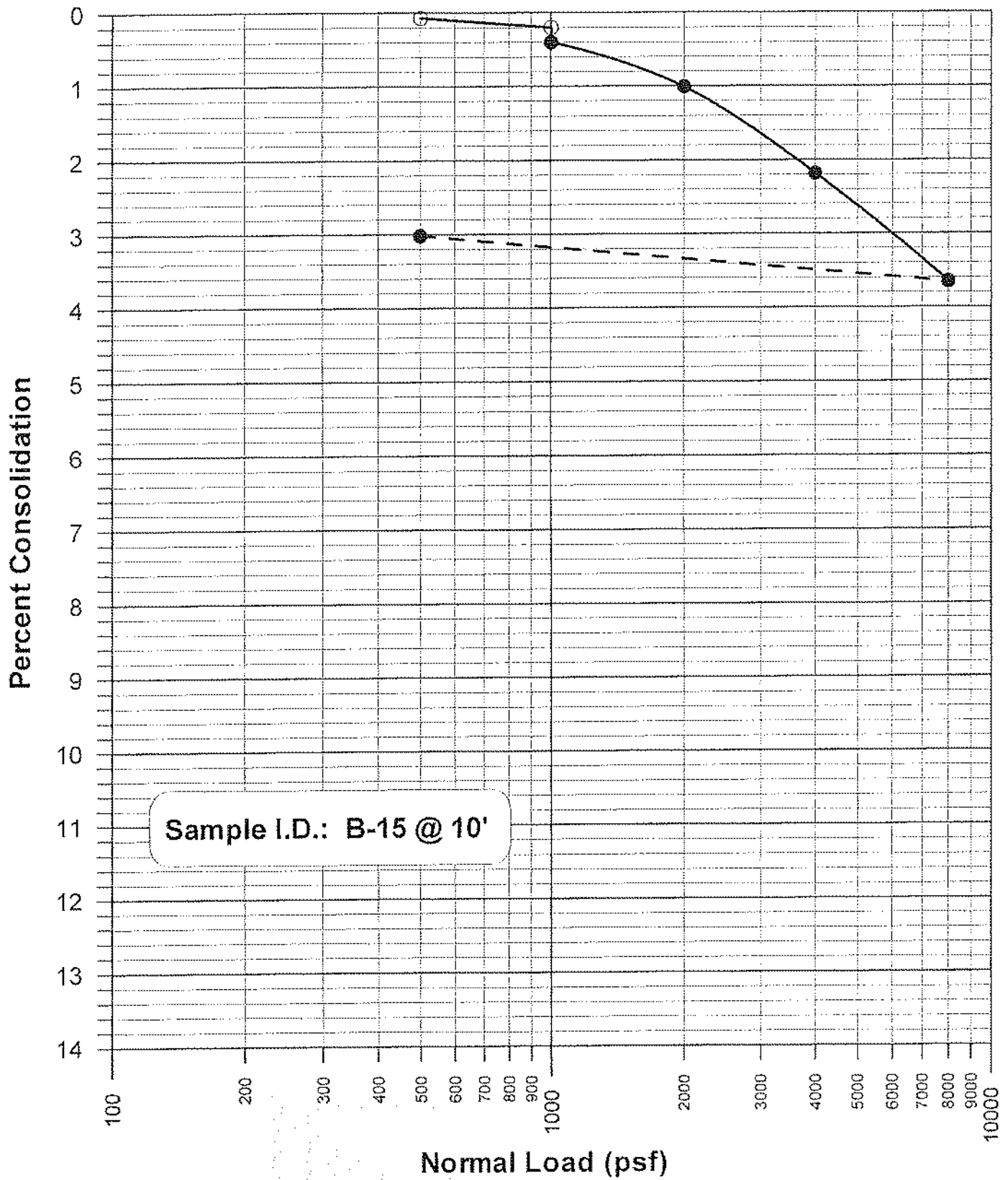
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

Work Order: 2467-1-0-10
GORIAN AND ASSOCIATES, INC.

LOAD CONSOLIDATION TEST

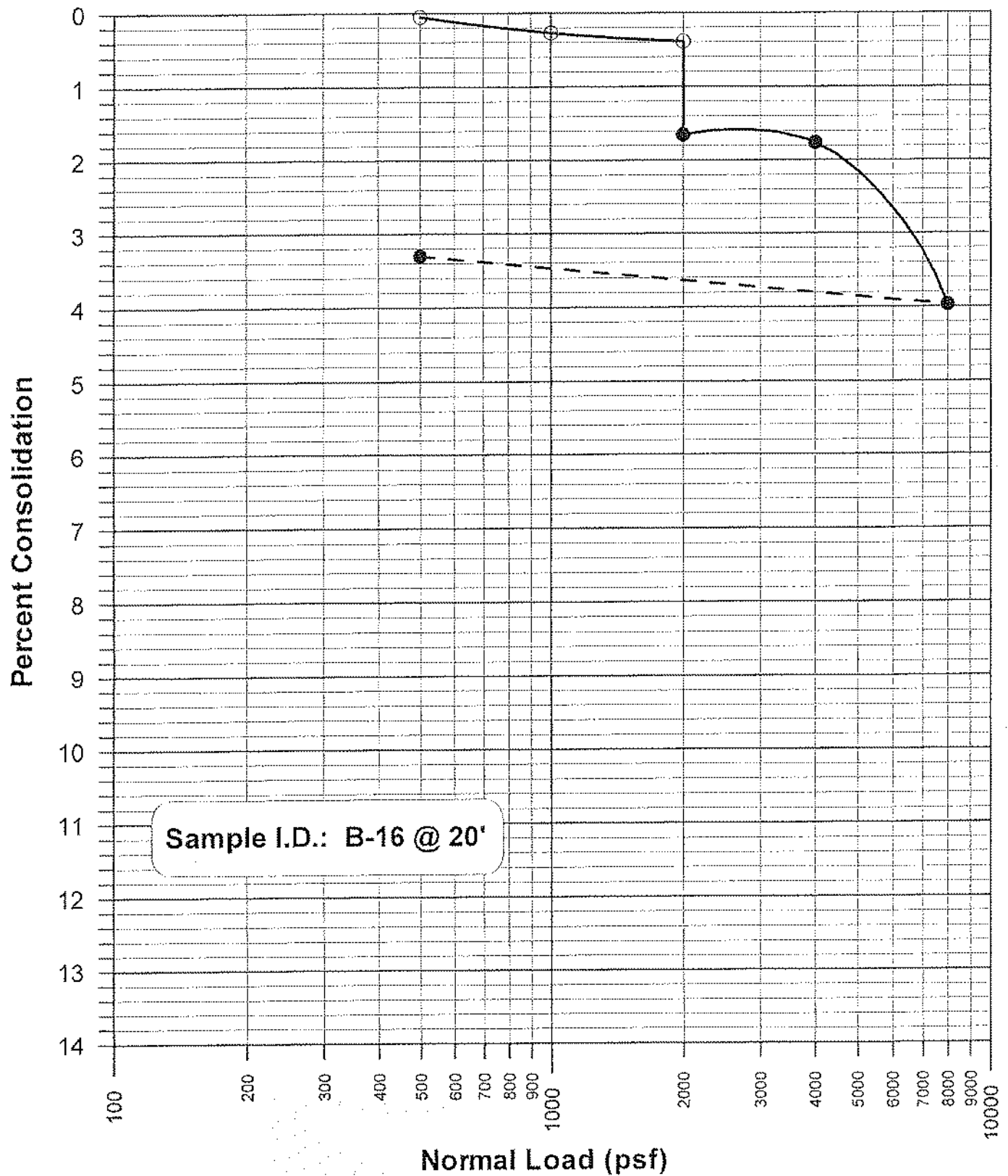


Sample I.D.: B-15 @ 10'

- Field Moisture
- Effect of Adding Moisture
- - - - - Rebound

Work Order: 2467-2-0-10
GORIAN AND ASSOCIATES, INC.

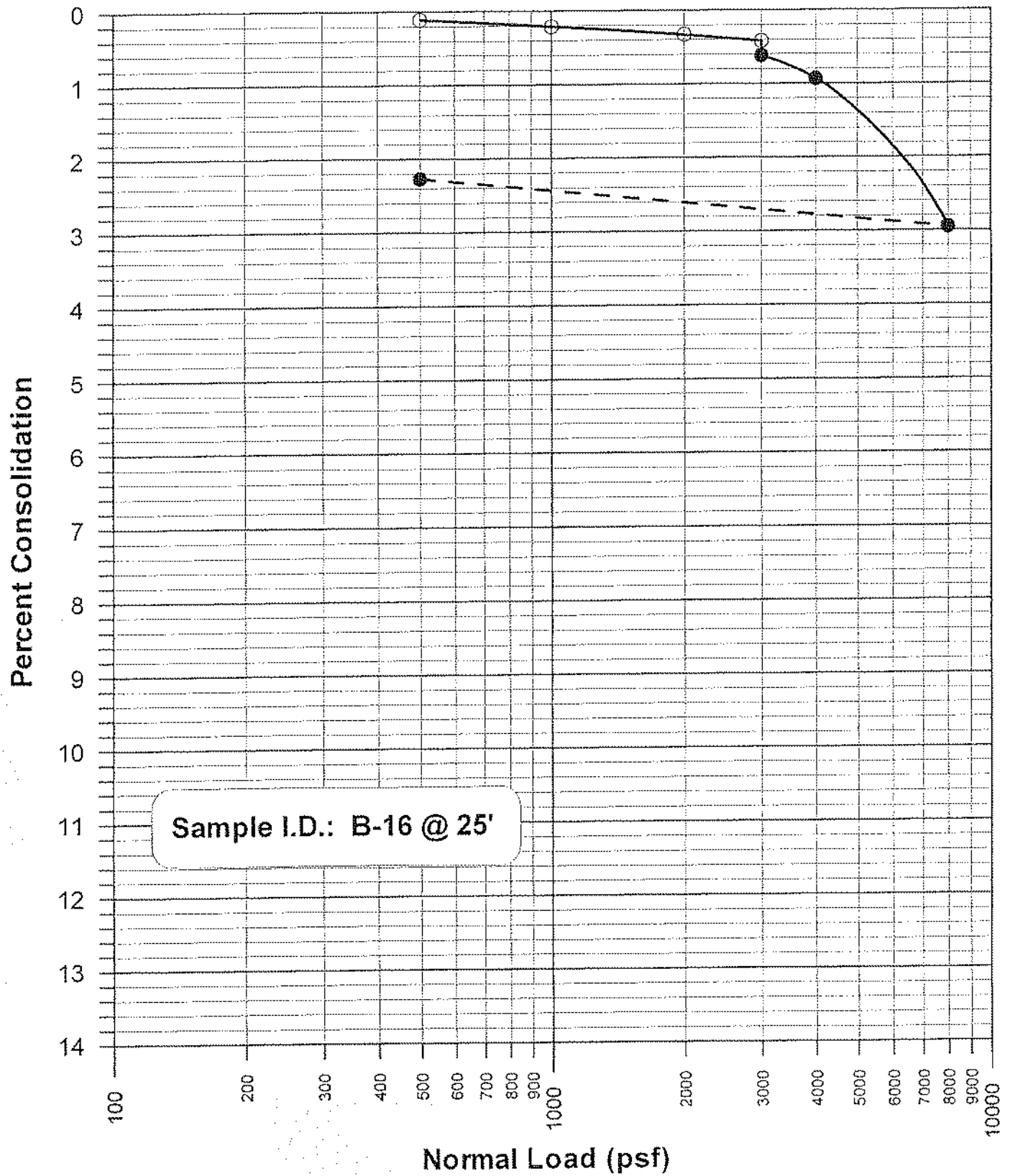
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- Rebound

Work Order: 2467-2-0-10
GORIAN AND ASSOCIATES, INC.

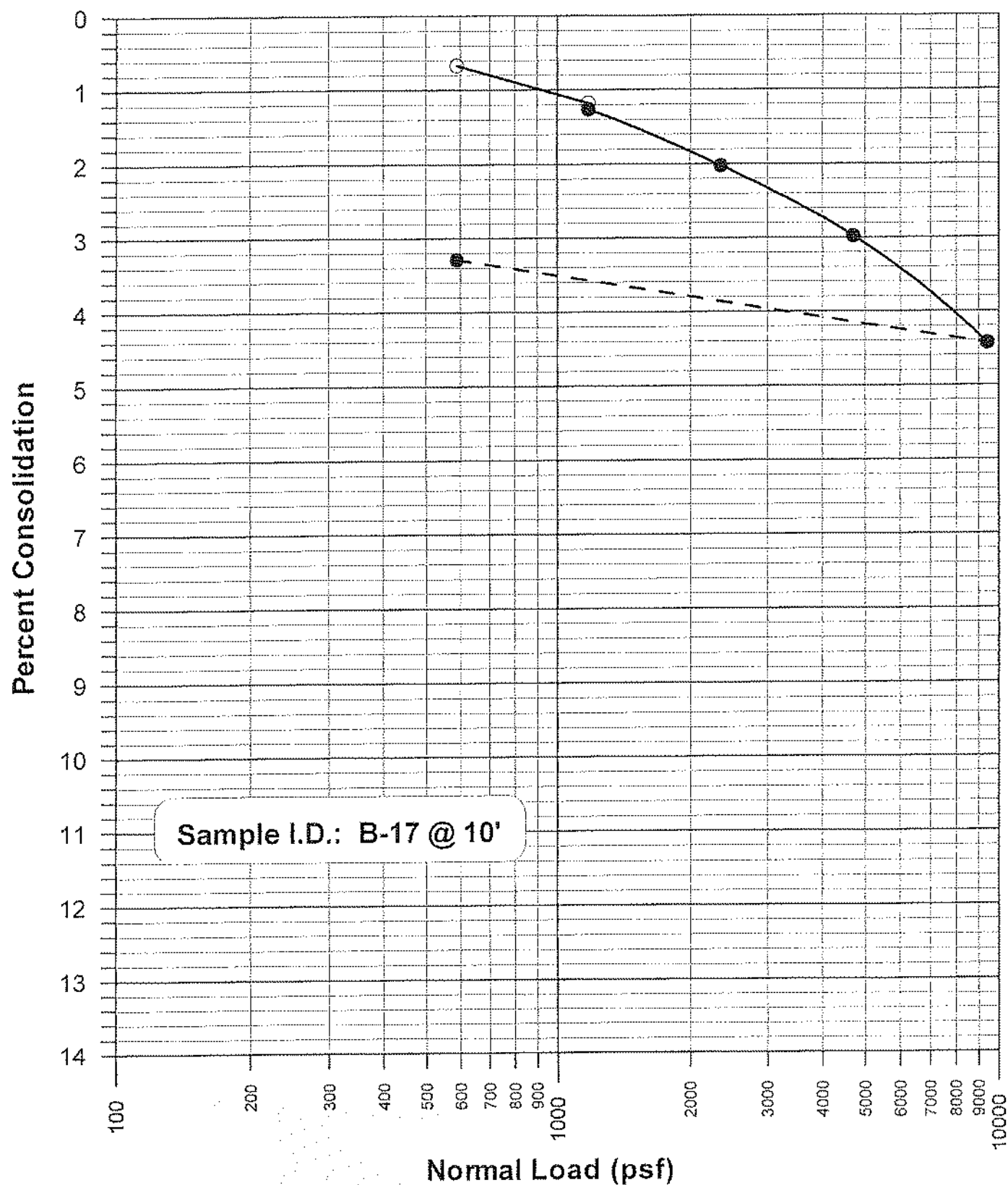
LOAD CONSOLIDATION TEST



- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

Work Order: 2467-2-0-10
GORIAN AND ASSOCIATES, INC.

LOAD CONSOLIDATION TEST

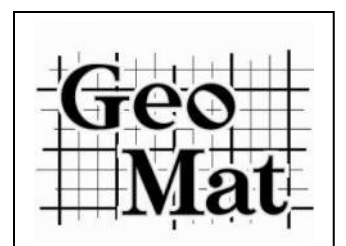


Sample I.D.: B-17 @ 10'

- Field Moisture
- Effect of Adding Moisture
- - - - Rebound

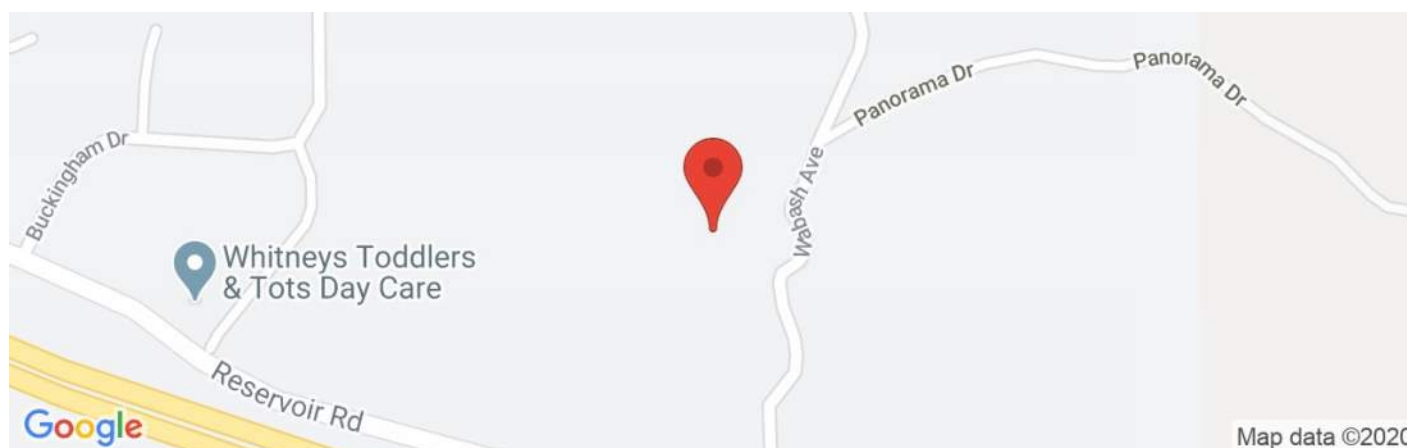
Work Order: 2467-2-0-10
GORIAN AND ASSOCIATES, INC.

APPENDIX D





Latitude, Longitude: 34.036464, -117.139388



Date	6/1/2020, 12:00:53 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

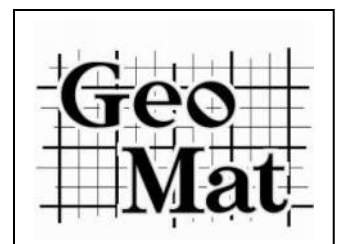
Type	Value	Description
S_S	1.662	MCE_R ground motion. (for 0.2 second period)
S_1	0.673	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.994	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.329	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.718	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.861	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
S_{sRT}	2.404	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	2.624	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.662	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.945	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	1.06	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.673	Factored deterministic acceleration value. (1.0 second)
$PGAd$	0.718	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.916	Mapped value of the risk coefficient at short periods
C_{R1}	0.892	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC / OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

APPENDIX E



FoS Ranges

≤ 1.00

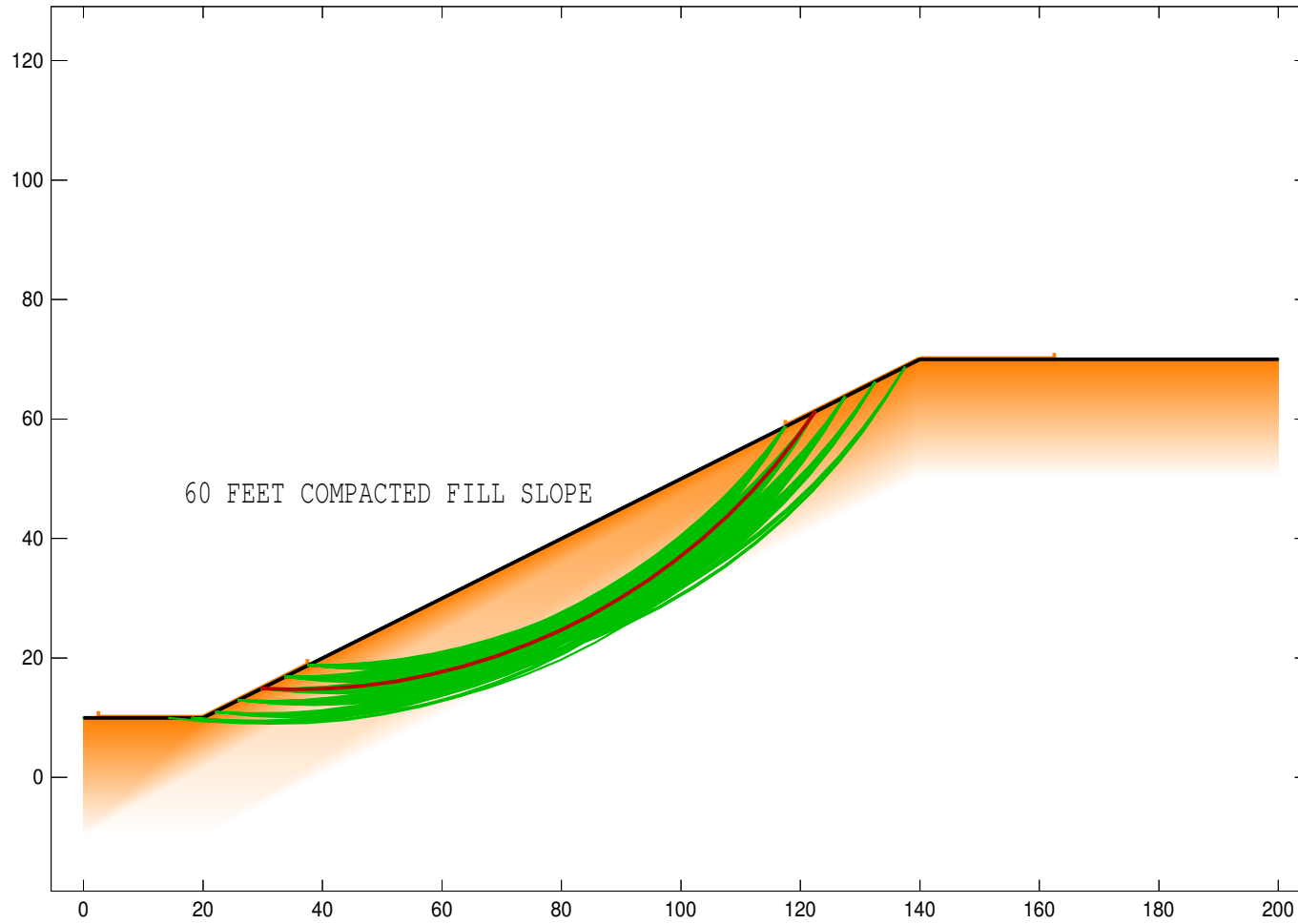
$> 1.00 \leq 1.20$

$> 1.20 \leq 1.40$

> 1.40

Material Keys

1: Compacted Fill



GALENA Version 7.1

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.77

Project Tentative Tract 16586, Redlands
Static, 60 Feet Fill Slope

File: C:\Users\H...\Static 60 Slope.gmf

Edited: 8 Jul 2020

Processed: 8 Jul 2020

GeoMat Testing Laboratories, Inc.

Project: Tentative Tract 16586, Redlands
 File: C:\Users\Haytham\OneDrive - Geomat Testing Laboratories\GeoMat Reports\ANNUAL REPORTS\2011 REPORT...\Static 60 Slope.gmf
 Processed: 08 Jul 2020 12:51:08

RESULTS: Analysis 1 - Static, 60 Feet Fill Slope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.890

There were: 901 successful analyses from a total of 901 trial surfaces

Critical (minimum) Factor of Safety: 1.77

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	29.72	14.86	122.50	61.25	35.28	119.71	105.00	1.765	<-- Critical Surface
2	25.83	12.92	117.50	58.75	30.68	117.80	105.00	1.765	
3	33.61	16.81	127.50	63.75	39.89	121.62	105.00	1.765	
4	37.50	18.75	132.50	66.25	44.49	123.52	105.00	1.766	
5	37.50	18.75	127.50	63.75	41.28	123.68	105.00	1.766	
6	21.94	10.97	117.50	58.75	29.30	115.71	105.00	1.766	
7	33.61	16.81	122.50	61.25	36.69	121.76	105.00	1.767	
8	25.83	12.92	122.50	61.25	33.91	117.61	105.00	1.767	
9	25.83	12.92	117.50	58.75	31.32	116.52	103.75	1.768	
10	29.72	14.86	117.50	58.75	32.10	119.83	105.00	1.768	
11	29.72	14.86	122.50	61.25	35.93	118.43	103.75	1.768	
12	37.50	18.75	127.50	63.75	41.92	122.41	103.75	1.768	
13	29.72	14.86	127.50	63.75	38.52	119.49	105.00	1.768	
14	33.61	16.81	127.50	63.75	40.53	120.32	103.75	1.769	
15	33.61	16.81	122.50	61.25	37.32	120.49	103.75	1.769	
16	37.50	18.75	132.50	66.25	45.14	122.22	103.75	1.769	
17	21.94	10.97	117.50	58.75	29.95	114.41	103.75	1.770	
18	33.61	16.81	132.50	66.25	43.13	121.37	105.00	1.770	
19	29.72	14.86	117.50	58.75	32.73	118.57	103.75	1.770	
20	37.50	18.75	127.50	63.75	42.56	121.12	102.50	1.771	
21	25.83	12.92	117.50	58.75	31.97	115.23	102.50	1.771	
22	25.83	12.92	122.50	61.25	34.56	116.30	103.75	1.771	
23	33.61	16.81	122.50	61.25	37.96	119.21	102.50	1.771	
24	29.72	14.86	122.50	61.25	36.57	117.13	102.50	1.771	
25	37.50	18.75	137.50	68.75	47.75	123.25	105.00	1.772	
26	33.61	16.81	127.50	63.75	41.18	119.03	102.50	1.772	
27	29.72	14.86	117.50	58.75	33.37	117.30	102.50	1.772	
28	29.72	14.86	127.50	63.75	39.17	118.18	103.75	1.772	
29	18.06	10.00	117.50	58.75	28.51	114.48	105.00	1.772	
30	37.50	18.75	122.50	61.25	38.13	123.75	105.00	1.772	
31	21.94	10.97	122.50	61.25	32.56	115.43	105.00	1.773	
32	37.50	18.75	132.50	66.25	45.79	120.91	102.50	1.773	
33	21.94	10.97	117.50	58.75	30.60	113.11	102.50	1.774	
34	37.50	18.75	127.50	63.75	43.21	119.84	101.25	1.774	
35	33.61	16.81	122.50	61.25	38.60	117.93	101.25	1.774	
36	37.50	18.75	122.50	61.25	38.75	122.49	103.75	1.774	
37	25.83	12.92	117.50	58.75	32.61	113.94	101.25	1.774	
38	33.61	16.81	132.50	66.25	43.79	120.05	103.75	1.774	
39	29.72	14.86	117.50	58.75	34.00	116.02	101.25	1.774	
40	29.72	14.86	122.50	61.25	37.22	115.83	101.25	1.775	
41	25.83	12.92	127.50	63.75	37.18	117.30	105.00	1.775	
42	33.61	16.81	117.50	58.75	33.54	121.81	105.00	1.775	
43	25.83	12.92	122.50	61.25	35.22	114.99	102.50	1.775	
44	37.50	18.75	122.50	61.25	39.38	121.23	102.50	1.775	
45	33.61	16.81	127.50	63.75	41.83	117.72	101.25	1.776	
46	33.61	16.81	117.50	58.75	34.17	120.55	103.75	1.776	
47	37.50	18.75	137.50	68.75	48.41	121.92	103.75	1.776	
48	18.06	10.00	117.50	58.75	29.16	113.15	103.75	1.776	
49	33.61	16.81	122.50	61.25	39.25	116.65	100.00	1.777	
50	29.72	14.86	127.50	63.75	39.83	116.86	102.50	1.777	
51	37.50	18.75	127.50	63.75	43.85	118.55	100.00	1.777	
52	29.72	14.86	117.50	58.75	34.64	114.74	100.00	1.777	
53	37.50	18.75	132.50	66.25	46.45	119.60	101.25	1.777	
54	37.50	18.75	122.50	61.25	40.02	119.97	101.25	1.777	
55	29.72	14.86	132.50	66.25	41.81	119.16	105.00	1.777	
56	21.94	10.97	122.50	61.25	33.22	114.11	103.75	1.777	
57	33.61	16.81	117.50	58.75	34.80	119.30	102.50	1.777	
58	25.83	12.92	117.50	58.75	33.26	112.64	100.00	1.777	
59	21.94	10.97	117.50	58.75	31.26	111.79	101.25	1.778	
60	29.72	14.86	122.50	61.25	37.87	114.53	100.00	1.778	
61	33.61	16.81	132.50	66.25	44.45	118.73	102.50	1.779	
62	33.61	16.81	117.50	58.75	35.42	118.04	101.25	1.779	
63	37.50	18.75	122.50	61.25	40.65	118.70	100.00	1.779	
64	25.83	12.92	122.50	61.25	35.87	113.67	101.25	1.779	
65	29.72	14.86	117.50	58.75	35.29	113.45	98.75	1.779	
66	25.83	12.92	127.50	63.75	37.85	115.97	103.75	1.780	
67	33.61	16.81	127.50	63.75	42.49	116.41	100.00	1.780	

68	33.61	16.81	122.50	61.25	39.89	115.36	98.75	1.780
69	33.61	16.81	137.50	68.75	46.43	121.02	105.00	1.780
70	37.50	18.75	127.50	63.75	44.50	117.25	98.75	1.780
71	33.61	16.81	117.50	58.75	36.06	116.78	100.00	1.780
72	18.06	10.00	117.50	58.75	29.81	111.82	102.50	1.781
73	18.06	10.00	122.50	61.25	31.77	114.10	105.00	1.781
74	37.50	18.75	137.50	68.75	49.08	120.59	102.50	1.781
75	37.50	18.75	122.50	61.25	41.29	117.43	98.75	1.781
76	37.50	18.75	132.50	66.25	47.11	118.29	100.00	1.781
77	25.83	12.92	117.50	58.75	33.92	111.34	98.75	1.781
78	29.72	14.86	127.50	63.75	40.50	115.54	101.25	1.781
79	21.94	10.97	117.50	58.75	31.92	110.47	100.00	1.782
80	21.94	10.97	122.50	61.25	33.89	112.77	102.50	1.782
81	33.61	16.81	117.50	58.75	36.69	115.51	98.75	1.782
82	29.72	14.86	132.50	66.25	42.48	117.82	103.75	1.782
83	29.72	14.86	122.50	61.25	38.53	113.22	98.75	1.782
84	29.72	14.86	117.50	58.75	35.93	112.16	97.50	1.783
85	33.61	16.81	122.50	61.25	40.54	114.06	97.50	1.783
86	14.17	10.00	117.50	58.75	28.24	114.05	105.00	1.783
87	37.50	18.75	122.50	61.25	41.93	116.15	97.50	1.783
88	33.61	16.81	132.50	66.25	45.12	117.40	101.25	1.783
89	37.50	18.75	127.50	63.75	45.15	115.95	97.50	1.783
90	33.61	16.81	127.50	63.75	43.15	115.09	98.75	1.784
91	25.83	12.92	122.50	61.25	36.54	112.34	100.00	1.784
92	21.94	10.97	127.50	63.75	35.88	115.04	105.00	1.784
93	33.61	16.81	117.50	58.75	37.33	114.23	97.50	1.784
94	25.83	12.92	127.50	63.75	38.52	114.63	102.50	1.785
95	33.61	16.81	137.50	68.75	47.11	119.67	103.75	1.785
96	25.83	12.92	117.50	58.75	34.57	110.02	97.50	1.785
97	18.06	10.00	117.50	58.75	30.47	110.49	101.25	1.785
98	37.50	18.75	132.50	66.25	47.77	116.96	98.75	1.786
99	18.06	10.00	122.50	61.25	32.43	112.75	103.75	1.786

Critical Failure Surface (circle 1)

Intersects:	XL:	29.72	YL:	14.86	XR:	122.50	YR:	61.25				
Centre:	XC:	35.28	YC:	119.71		Radius:	R:	105.00				
Generated failure surface: (20 points)												
	29.72	14.86		35.43		14.71		41.14	14.88		46.83	15.35
	58.09	17.22		63.62		18.61		69.08	20.30		74.43	22.29
	84.78	27.11		89.74		29.94		94.53	33.03		99.16	36.38
	107.83	43.80		111.85		47.86		115.64	52.13		119.19	56.60
											122.50	61.25

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S		Base						PoreWater	Normal	Test	
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	29.72	2.14	-1.5	2.85	2.85	1	100.00	34.0	256.91	0.00	92.40	1.01
2	32.58	6.42	-1.5	2.85	2.85	1	100.00	34.0	770.74	0.00	274.25	1.01
3	35.43	10.48	1.6	2.85	2.85	1	100.00	34.0	1257.88	0.00	434.45	0.99
4	38.28	14.32	1.6	2.85	2.85	1	100.00	34.0	1718.47	0.00	594.12	0.99
5	41.14	17.88	4.8	2.84	2.85	1	100.00	34.0	2145.27	0.00	726.30	0.97
6	43.98	21.25	4.8	2.84	2.85	1	100.00	34.0	2550.09	0.00	864.21	0.97
7	46.83	24.25	7.9	2.83	2.85	1	100.00	34.0	2909.56	0.00	969.86	0.96
8	49.65	27.14	7.9	2.83	2.85	1	100.00	34.0	3256.70	0.00	1086.46	0.96
9	52.48	29.53	11.0	2.80	2.85	1	100.00	34.0	3543.55	0.00	1166.93	0.95
10	55.28	31.93	11.0	2.80	2.85	1	100.00	34.0	3831.80	0.00	1262.69	0.95
11	58.09	33.69	14.1	2.77	2.85	1	100.00	34.0	4042.51	0.00	1319.24	0.94
12	60.86	35.59	14.1	2.77	2.85	1	100.00	34.0	4271.36	0.00	1394.66	0.94
13	63.62	36.70	17.2	2.73	2.85	1	100.00	34.0	4404.22	0.00	1428.49	0.94
14	66.35	38.12	17.2	2.73	2.85	1	100.00	34.0	4573.84	0.00	1484.11	0.94
15	69.08	38.57	20.3	2.68	2.85	1	100.00	34.0	4628.93	0.00	1496.41	0.93
16	71.75	39.50	20.3	2.68	2.85	1	100.00	34.0	4740.21	0.00	1532.82	0.93
17	74.43	39.33	23.4	2.62	2.85	1	100.00	34.0	4719.43	0.00	1524.77	0.94
18	77.05	39.78	23.4	2.62	2.85	1	100.00	34.0	4773.95	0.00	1542.63	0.94
19	79.67	39.01	26.6	2.55	2.85	1	100.00	34.0	4680.91	0.00	1515.43	0.94
20	82.22	39.01	26.6	2.55	2.85	1	100.00	34.0	4680.90	0.00	1515.43	0.94
21	84.78	37.67	29.7	2.48	2.85	1	100.00	34.0	4520.93	0.00	1470.37	0.95
22	87.26	37.24	29.7	2.48	2.85	1	100.00	34.0	4469.30	0.00	1453.28	0.95
23	89.74	35.41	32.8	2.40	2.85	1	100.00	34.0	4249.41	0.00	1391.70	0.95
24	92.14	34.58	32.8	2.40	2.85	1	100.00	34.0	4149.65	0.00	1358.34	0.95
25	94.53	32.32	35.9	2.31	2.85	1	100.00	34.0	3878.20	0.00	1281.70	0.97
26	96.85	31.12	35.9	2.31	2.85	1	100.00	34.0	3734.38	0.00	1232.97	0.97
27	99.16	28.51	39.0	2.22	2.85	1	100.00	34.0	3421.23	0.00	1142.86	0.98
28	101.38	26.98	39.0	2.22	2.85	1	100.00	34.0	3237.93	0.00	1079.75	0.98
29	103.59	24.12	42.1	2.12	2.85	1	100.00	34.0	2894.16	0.00	977.92	1.00
30	105.71	22.30	42.1	2.12	2.85	1	100.00	34.0	2676.44	0.00	901.49	1.00
31	107.83	19.28	45.3	2.01	2.85	1	100.00	34.0	2314.14	0.00	789.93	1.03
32	109.84	17.23	45.3	2.01	2.85	1	100.00	34.0	2067.48	0.00	701.33	1.03
33	111.85	14.16	48.4	1.90	2.85	1	100.00	34.0	1699.71	0.00	582.26	1.05
34	113.74	11.92	48.4	1.90	2.85	1	100.00	34.0	1429.89	0.00	482.75	1.05
35	115.64	8.92	51.5	1.78	2.85	1	100.00	34.0	1070.40	0.00	358.75	1.09
36	117.42	6.53	51.5	1.78	2.85	1	100.00	34.0	783.50	0.00	249.70	1.09
37	119.19	3.72	54.6	1.65	2.85	1	100.00	34.0	446.53	0.00	123.78	1.12
38	120.85	1.24	54.6	1.65	2.85	1	100.00	34.0	148.84	0.00	6.69	1.12
X-S Area:		957.91	Path Length:		108.48	X-S Weight:		114949.37				

FoS Ranges

≤ 1.00

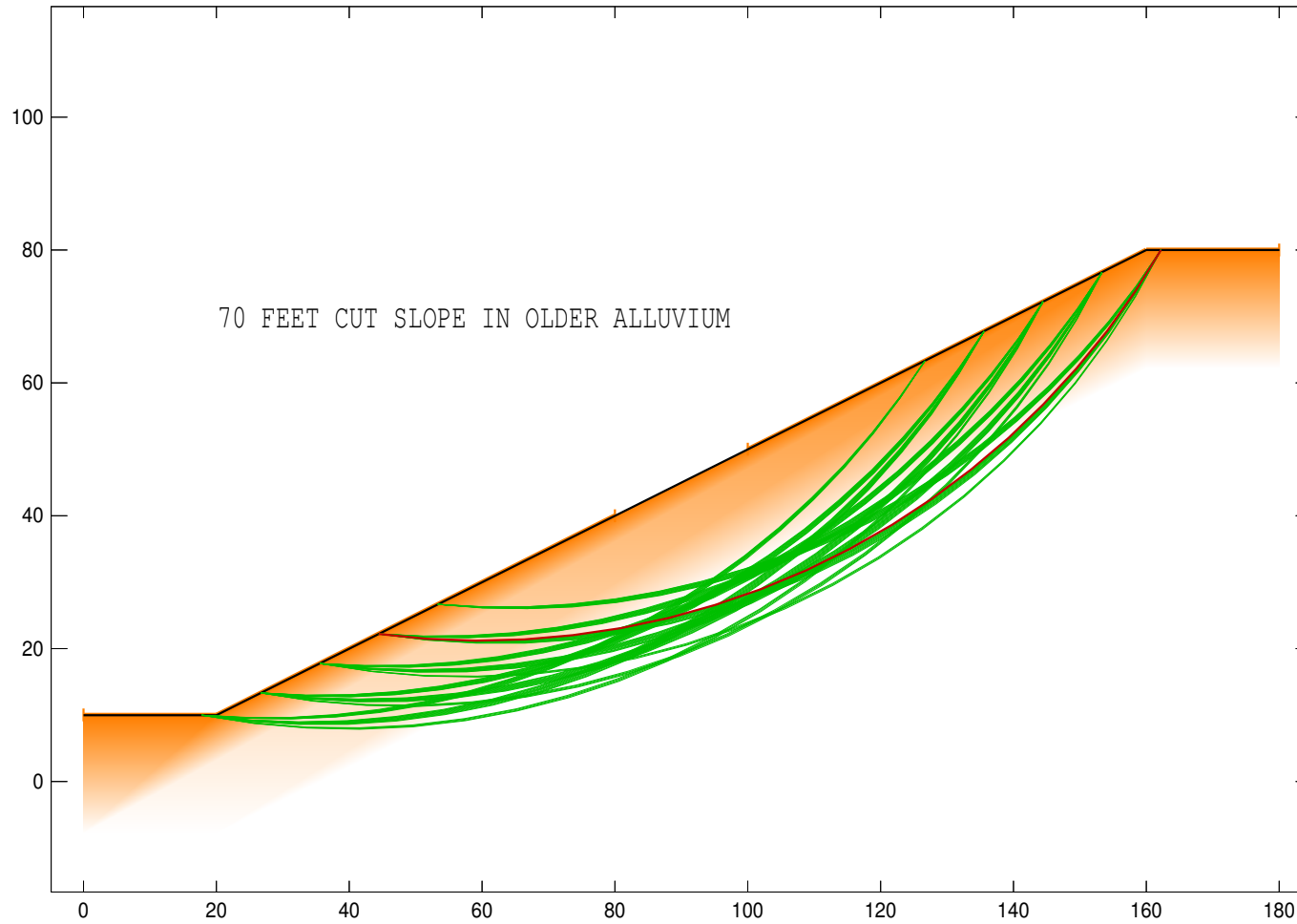
$> 1.00 \leq 1.20$

$> 1.20 \leq 1.40$

> 1.40

Material Keys

1: Old Alluvium



GALENA Version 7.1

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.04

Project Tentative Tract 16586, Redlands
Static, 70 Feet Cut Slope

File: C:\Users\H...\Static 70 Slope.gmf

Edited: 14 Feb 2018 Processed: 14 Feb 2018

GeoMat Testing Laboratories, Inc.

Project: Tentative Tract 16586, Redlands
 File: C:\Users\Haytham\Documents\GEOMAT DATA\ANNUAL REPORTS\2011 REPORTS\11074.Inland Communities Corp...\Static 70 Slope.gmf
 Processed: 14 Feb 2018 13:51:40

DATA: Analysis 1 - Static, 70 Feet Cut Slope

Material Properties (1 material)

Material: 1 (Mohr-Coulomb Isotropic) - Old Alluvium
 Cohesion Phi UnitWeight Ru
 200.00 36.0 120.00 0.00

Material Profiles (1 profile)

Profile: 1 (2 points) Material beneath: 1 - Old Alluvium
 0.00 90.00 180.00 90.00

Slope Surface (4 points)

0.00 10.00 20.00 10.00 160.00 80.00 180.00 80.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 44.44 YL: 22.22 XR: 162.22 YR: 80.00
 Centre: XC: 59.87 YC: 139.71 Radius: R: 118.50

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 80.00 80.00 5.00
 Trial positions within range: 10 10 10

RESULTS: Analysis 1 - Static, 70 Feet Cut Slope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 2.076

There were: 971 successful analyses from a total of 1001 trial surfaces
 30 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 2.04

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	44.44	22.22	162.22	80.00	59.87	139.71	118.50	2.044	<-- Critical Surface
2	26.67	13.33	144.44	72.22	41.49	130.90	118.50	2.044	
3	35.56	17.78	153.33	76.67	50.38	135.35	118.50	2.044	
4	44.44	22.22	162.22	80.00	60.16	139.11	117.94	2.045	
5	35.56	17.78	153.33	76.67	50.68	134.75	117.94	2.046	
6	26.67	13.33	144.44	72.22	41.79	130.30	117.94	2.046	
7	53.33	26.67	162.22	80.00	62.99	144.77	118.50	2.046	
8	44.44	22.22	162.22	80.00	60.46	138.51	117.39	2.047	
9	35.56	17.78	153.33	76.67	50.98	134.15	117.39	2.047	
10	26.67	13.33	144.44	72.22	42.09	129.70	117.39	2.047	
11	53.33	26.67	162.22	80.00	63.28	144.19	117.94	2.047	
12	53.33	26.67	162.22	80.00	63.56	143.61	117.39	2.049	
13	17.78	10.00	135.56	67.78	33.20	127.49	118.50	2.049	
14	26.67	13.33	144.44	72.22	42.39	129.10	116.83	2.049	
15	35.56	17.78	153.33	76.67	51.28	133.55	116.83	2.049	
16	44.44	22.22	153.33	76.67	53.42	140.38	118.50	2.049	
17	26.67	13.33	135.56	67.78	35.64	131.49	118.50	2.049	
18	35.56	17.78	144.44	72.22	44.53	135.94	118.50	2.049	
19	44.44	22.22	162.22	80.00	60.75	137.91	116.83	2.049	
20	53.33	26.67	162.22	80.00	63.85	143.03	116.83	2.050	
21	44.44	22.22	153.33	76.67	53.71	139.80	117.94	2.050	
22	35.56	17.78	144.44	72.22	44.82	135.36	117.94	2.050	
23	26.67	13.33	135.56	67.78	35.93	130.91	117.94	2.050	
24	17.78	10.00	135.56	67.78	33.50	126.89	117.94	2.051	
25	53.33	26.67	162.22	80.00	64.13	142.44	116.28	2.051	
26	35.56	17.78	144.44	72.22	45.11	134.78	117.39	2.051	
27	26.67	13.33	135.56	67.78	36.22	130.33	117.39	2.051	
28	44.44	22.22	153.33	76.67	54.00	139.22	117.39	2.051	
29	26.67	13.33	144.44	72.22	42.69	128.50	116.28	2.051	
30	35.56	17.78	153.33	76.67	51.58	132.95	116.28	2.051	
31	44.44	22.22	162.22	80.00	61.05	137.31	116.28	2.051	
32	53.33	26.67	162.22	80.00	64.42	141.86	115.72	2.052	
33	44.44	22.22	153.33	76.67	54.29	138.64	116.83	2.052	
34	26.67	13.33	135.56	67.78	36.51	129.75	116.83	2.052	
35	35.56	17.78	144.44	72.22	45.40	134.20	116.83	2.052	

36	17.78	10.00	135.56	67.78	33.79	126.29	117.39	2.052
37	26.67	13.33	135.56	67.78	36.80	129.17	116.28	2.053
38	44.44	22.22	153.33	76.67	54.58	138.06	116.28	2.053
39	35.56	17.78	144.44	72.22	45.69	133.61	116.28	2.053
40	35.56	17.78	153.33	76.67	51.88	132.34	115.72	2.053
41	26.67	13.33	144.44	72.22	43.00	127.90	115.72	2.053
42	53.33	26.67	162.22	80.00	64.71	141.27	115.17	2.053
43	44.44	22.22	162.22	80.00	61.34	136.70	115.72	2.054
44	17.78	10.00	135.56	67.78	34.09	125.69	116.83	2.054
45	35.56	17.78	144.44	72.22	45.99	133.03	115.72	2.054
46	44.44	22.22	153.33	76.67	54.87	137.47	115.72	2.054
47	26.67	13.33	135.56	67.78	37.10	128.58	115.72	2.054
48	53.33	26.67	162.22	80.00	64.99	140.68	114.61	2.055
49	35.56	17.78	153.33	76.67	52.19	131.74	115.17	2.055
50	26.67	13.33	144.44	72.22	43.30	127.29	115.17	2.055
51	44.44	22.22	153.33	76.67	55.17	136.89	115.17	2.055
52	35.56	17.78	144.44	72.22	46.28	132.44	115.17	2.055
53	26.67	13.33	135.56	67.78	37.39	128.00	115.17	2.055
54	17.78	10.00	135.56	67.78	34.38	125.09	116.28	2.056
55	44.44	22.22	162.22	80.00	61.64	136.10	115.17	2.056
56	53.33	26.67	162.22	80.00	65.28	140.09	114.06	2.056
57	26.67	13.33	153.33	76.67	47.51	129.99	118.50	2.056
58	44.44	22.22	153.33	76.67	55.46	136.30	114.61	2.057
59	35.56	17.78	144.44	72.22	46.57	131.86	114.61	2.057
60	26.67	13.33	135.56	67.78	37.68	127.41	114.61	2.057
61	17.78	10.00	144.44	72.22	39.14	126.56	118.50	2.057
62	35.56	17.78	153.33	76.67	52.49	131.13	114.61	2.057
63	26.67	13.33	144.44	72.22	43.60	126.69	114.61	2.057
64	53.33	26.67	162.22	80.00	65.57	139.50	113.50	2.057
65	17.78	10.00	135.56	67.78	34.68	124.48	115.72	2.057
66	35.56	17.78	162.22	80.00	56.91	134.34	118.50	2.058
67	44.44	22.22	153.33	76.67	55.75	135.72	114.06	2.058
68	35.56	17.78	144.44	72.22	46.86	131.27	114.06	2.058
69	26.67	13.33	135.56	67.78	37.98	126.83	114.06	2.058
70	44.44	22.22	162.22	80.00	61.94	135.49	114.61	2.058
71	26.67	13.33	153.33	76.67	47.82	129.37	117.94	2.059
72	44.44	22.22	153.33	76.67	56.05	135.13	113.50	2.059
73	35.56	17.78	144.44	72.22	47.16	130.68	113.50	2.059
74	26.67	13.33	135.56	67.78	38.27	126.24	113.50	2.059
75	17.78	10.00	135.56	67.78	34.98	123.88	115.17	2.059
76	17.78	10.00	144.44	72.22	39.44	125.94	117.94	2.060
77	35.56	17.78	153.33	76.67	52.79	130.52	114.06	2.060
78	26.67	13.33	144.44	72.22	43.91	126.08	114.06	2.060
79	44.44	22.22	162.22	80.00	62.24	134.88	114.06	2.060
80	35.56	17.78	162.22	80.00	57.22	133.72	117.94	2.060
81	17.78	10.00	126.67	63.33	27.44	128.11	118.50	2.061
82	17.78	10.00	135.56	67.78	35.27	123.27	114.61	2.061
83	17.78	10.00	126.67	63.33	27.72	127.52	117.94	2.061
84	26.67	13.33	153.33	76.67	48.13	128.74	117.39	2.062
85	26.67	13.33	144.44	72.22	44.21	125.47	113.50	2.062
86	35.56	17.78	153.33	76.67	53.10	129.91	113.50	2.062
87	17.78	10.00	126.67	63.33	28.01	126.94	117.39	2.062
88	17.78	10.00	144.44	72.22	39.75	125.31	117.39	2.062
89	44.44	22.22	162.22	80.00	62.54	134.27	113.50	2.063
90	17.78	10.00	126.67	63.33	28.29	126.36	116.83	2.063
91	17.78	10.00	135.56	67.78	35.57	122.66	114.06	2.063
92	35.56	17.78	162.22	80.00	57.53	133.09	117.39	2.063
93	17.78	10.00	126.67	63.33	28.58	125.78	116.28	2.063
94	17.78	10.00	126.67	63.33	28.86	125.19	115.72	2.064
95	26.67	13.33	153.33	76.67	48.44	128.12	116.83	2.065
96	17.78	10.00	144.44	72.22	40.05	124.69	116.83	2.065
97	17.78	10.00	126.67	63.33	29.15	124.60	115.17	2.065
98	17.78	10.00	135.56	67.78	35.87	122.05	113.50	2.065
99	17.78	10.00	126.67	63.33	29.44	124.02	114.61	2.066

Critical Failure Surface (circle 1)

Intersects:	XL:	44.44	YL:	22.22	XR:	162.22	YR:	80.00						
	Centre:	XC:	59.87	YC:	139.71		Radius:	R:	118.50					
Generated failure surface: (20 points)														
	44.44	22.22	51.72	21.49	59.03	21.22	66.35	21.39	73.64	22.02				
	80.87	23.09	88.03	24.61	95.08	26.57	101.99	28.96	108.75	31.77				
	115.32	34.99	121.67	38.61	127.80	42.62	133.66	46.99	139.24	51.72				
	144.52	56.79	149.47	62.17	154.09	67.85	158.34	73.80	162.22	80.00				

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S		Base							PoreWater Force	Normal Stress	Test Factor
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight			
1	44.44	3.97	-5.7	3.64	3.66	1	200.00	36.0	476.92	0.00	146.00	1.04
2	48.08	11.92	-5.7	3.64	3.66	1	200.00	36.0	1430.76	0.00	417.72	1.04
3	51.72	19.56	-2.2	3.66	3.66	1	200.00	36.0	2347.01	0.00	654.63	1.01
4	55.38	26.75	-2.2	3.66	3.66	1	200.00	36.0	3209.48	0.00	893.80	1.01
5	59.03	33.54	1.4	3.66	3.66	1	200.00	36.0	4024.37	0.00	1088.92	0.99
6	62.69	39.90	1.4	3.66	3.66	1	200.00	36.0	4788.47	0.00	1296.11	0.99
7	66.35	45.69	4.9	3.64	3.66	1	200.00	36.0	5483.16	0.00	1451.80	0.97
8	69.99	51.19	4.9	3.64	3.66	1	200.00	36.0	6143.37	0.00	1627.59	0.97
9	73.64	55.86	8.4	3.62	3.66	1	200.00	36.0	6703.04	0.00	1745.89	0.96
10	77.26	60.46	8.4	3.62	3.66	1	200.00	36.0	7255.40	0.00	1890.90	0.96
11	80.87	63.91	12.0	3.58	3.66	1	200.00	36.0	7669.30	0.00	1973.66	0.95

FoS Ranges

≤ 1.00

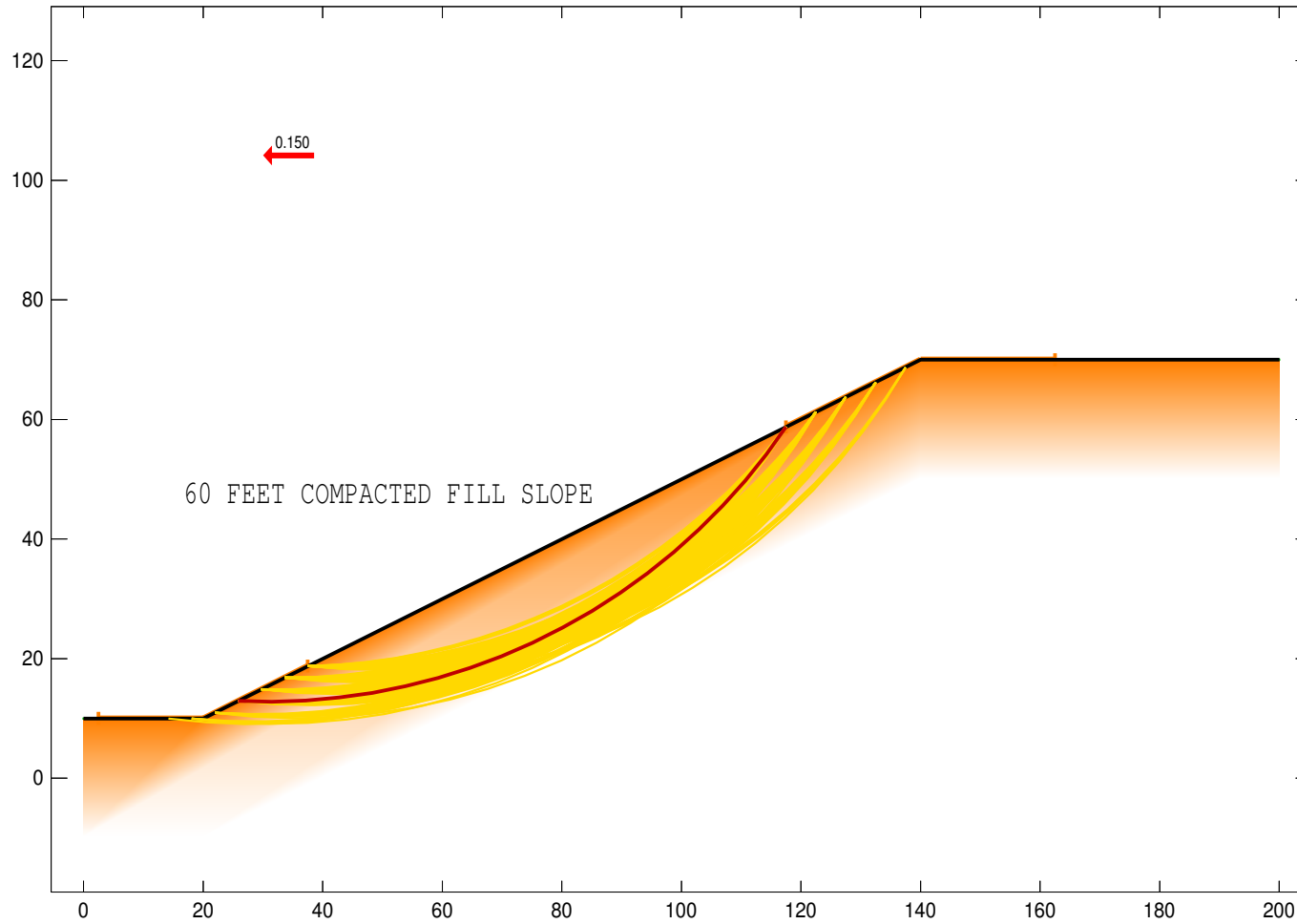
$> 1.00 \leq 1.20$

$> 1.20 \leq 1.40$

> 1.40

Material Keys

1: Compacted Fill



GALENA Version 7.1

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.28

Project Tentative Tract 16586, Redlands
Static, 60 Feet Fill Slope

File: C:\Users\H...\Seismic 60 Slope.gmf

Edited: 8 Jul 2020

Processed: 8 Jul 2020

GeoMat Testing Laboratories, Inc.

Project: Tentative Tract 16586, Redlands
 File: C:\Users\Haytham\OneDrive - Geomat Testing Laboratories\GeoMat Reports\ANNUAL REPORTS\2011 REPOR...\Seismic 60 Slope.gmf
 Processed: 08 Jul 2020 12:56:47

RESULTS: Analysis 1 - Static, 60 Feet Fill Slope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.385

There were: 901 successful analyses from a total of 901 trial surfaces

Critical (minimum) Factor of Safety: 1.28

Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	25.83	12.92	117.50	58.75	30.68	117.80	105.00	1.285	<-- Critical Surface
2	29.72	14.86	122.50	61.25	35.28	119.71	105.00	1.285	
3	37.50	18.75	127.50	63.75	41.28	123.68	105.00	1.285	
4	33.61	16.81	127.50	63.75	39.89	121.62	105.00	1.285	
5	33.61	16.81	122.50	61.25	36.69	121.76	105.00	1.285	
6	37.50	18.75	132.50	66.25	44.49	123.52	105.00	1.285	
7	21.94	10.97	117.50	58.75	29.30	115.71	105.00	1.286	
8	29.72	14.86	117.50	58.75	32.10	119.83	105.00	1.286	
9	25.83	12.92	122.50	61.25	33.91	117.61	105.00	1.287	
10	25.83	12.92	117.50	58.75	31.32	116.52	103.75	1.287	
11	37.50	18.75	127.50	63.75	41.92	122.41	103.75	1.287	
12	29.72	14.86	122.50	61.25	35.93	118.43	103.75	1.287	
13	33.61	16.81	122.50	61.25	37.32	120.49	103.75	1.287	
14	33.61	16.81	127.50	63.75	40.53	120.32	103.75	1.287	
15	29.72	14.86	127.50	63.75	38.52	119.49	105.00	1.288	
16	29.72	14.86	117.50	58.75	32.73	118.57	103.75	1.288	
17	37.50	18.75	132.50	66.25	45.14	122.22	103.75	1.288	
18	21.94	10.97	117.50	58.75	29.95	114.41	103.75	1.289	
19	37.50	18.75	127.50	63.75	42.56	121.12	102.50	1.289	
20	33.61	16.81	132.50	66.25	43.13	121.37	105.00	1.289	
21	33.61	16.81	122.50	61.25	37.96	119.21	102.50	1.289	
22	25.83	12.92	117.50	58.75	31.97	115.23	102.50	1.289	
23	37.50	18.75	122.50	61.25	38.13	123.75	105.00	1.289	
24	29.72	14.86	117.50	58.75	33.37	117.30	102.50	1.289	
25	29.72	14.86	122.50	61.25	36.57	117.13	102.50	1.290	
26	25.83	12.92	122.50	61.25	34.56	116.30	103.75	1.290	
27	33.61	16.81	127.50	63.75	41.18	119.03	102.50	1.290	
28	37.50	18.75	122.50	61.25	38.75	122.49	103.75	1.290	
29	37.50	18.75	137.50	68.75	47.75	123.25	105.00	1.290	
30	18.06	10.00	117.50	58.75	28.51	114.48	105.00	1.291	
31	29.72	14.86	127.50	63.75	39.17	118.18	103.75	1.291	
32	33.61	16.81	117.50	58.75	33.54	121.81	105.00	1.291	
33	33.61	16.81	122.50	61.25	38.60	117.93	101.25	1.291	
34	37.50	18.75	132.50	66.25	45.79	120.91	102.50	1.291	
35	37.50	18.75	127.50	63.75	43.21	119.84	101.25	1.291	
36	21.94	10.97	122.50	61.25	32.56	115.43	105.00	1.291	
37	29.72	14.86	117.50	58.75	34.00	116.02	101.25	1.291	
38	25.83	12.92	117.50	58.75	32.61	113.94	101.25	1.292	
39	37.50	18.75	122.50	61.25	39.38	121.23	102.50	1.292	
40	21.94	10.97	117.50	58.75	30.60	113.11	102.50	1.292	
41	33.61	16.81	117.50	58.75	34.17	120.55	103.75	1.292	
42	29.72	14.86	122.50	61.25	37.22	115.83	101.25	1.292	
43	33.61	16.81	132.50	66.25	43.79	120.05	103.75	1.292	
44	25.83	12.92	122.50	61.25	35.22	114.99	102.50	1.293	
45	33.61	16.81	117.50	58.75	34.80	119.30	102.50	1.293	
46	25.83	12.92	127.50	63.75	37.18	117.30	105.00	1.293	
47	37.50	18.75	122.50	61.25	40.02	119.97	101.25	1.293	
48	33.61	16.81	127.50	63.75	41.83	117.72	101.25	1.293	
49	33.61	16.81	122.50	61.25	39.25	116.65	100.00	1.293	
50	29.72	14.86	117.50	58.75	34.64	114.74	100.00	1.293	
51	37.50	18.75	127.50	63.75	43.85	118.55	100.00	1.294	
52	37.50	18.75	137.50	68.75	48.41	121.92	103.75	1.294	
53	18.06	10.00	117.50	58.75	29.16	113.15	103.75	1.294	
54	33.61	16.81	117.50	58.75	35.42	118.04	101.25	1.294	
55	37.50	18.75	132.50	66.25	46.45	119.60	101.25	1.294	
56	29.72	14.86	127.50	63.75	39.83	116.86	102.50	1.294	
57	25.83	12.92	117.50	58.75	33.26	112.64	100.00	1.294	
58	37.50	18.75	122.50	61.25	40.65	118.70	100.00	1.295	
59	21.94	10.97	117.50	58.75	31.26	111.79	101.25	1.295	
60	21.94	10.97	122.50	61.25	33.22	114.11	103.75	1.295	
61	29.72	14.86	132.50	66.25	41.81	119.16	105.00	1.295	
62	29.72	14.86	122.50	61.25	37.87	114.53	100.00	1.295	
63	33.61	16.81	117.50	58.75	36.06	116.78	100.00	1.296	
64	29.72	14.86	117.50	58.75	35.29	113.45	98.75	1.296	
65	33.61	16.81	122.50	61.25	39.89	115.36	98.75	1.296	
66	33.61	16.81	132.50	66.25	44.45	118.73	102.50	1.296	

67	37.50	18.75	127.50	63.75	44.50	117.25	98.75	1.296
68	33.61	16.81	127.50	63.75	42.49	116.41	100.00	1.296
69	25.83	12.92	122.50	61.25	35.87	113.67	101.25	1.296
70	37.50	18.75	122.50	61.25	41.29	117.43	98.75	1.296
71	25.83	12.92	127.50	63.75	37.85	115.97	103.75	1.297
72	33.61	16.81	117.50	58.75	36.69	115.51	98.75	1.297
73	33.61	16.81	137.50	68.75	46.43	121.02	105.00	1.297
74	25.83	12.92	117.50	58.75	33.92	111.34	98.75	1.297
75	18.06	10.00	117.50	58.75	29.81	111.82	102.50	1.297
76	37.50	18.75	132.50	66.25	47.11	118.29	100.00	1.298
77	37.50	18.75	137.50	68.75	49.08	120.59	102.50	1.298
78	18.06	10.00	122.50	61.25	31.77	114.10	105.00	1.298
79	29.72	14.86	127.50	63.75	40.50	115.54	101.25	1.298
80	29.72	14.86	117.50	58.75	35.93	112.16	97.50	1.298
81	37.50	18.75	122.50	61.25	41.93	116.15	97.50	1.298
82	21.94	10.97	117.50	58.75	31.92	110.47	100.00	1.298
83	29.72	14.86	122.50	61.25	38.53	113.22	98.75	1.298
84	33.61	16.81	122.50	61.25	40.54	114.06	97.50	1.298
85	33.61	16.81	117.50	58.75	37.33	114.23	97.50	1.299
86	21.94	10.97	122.50	61.25	33.89	112.77	102.50	1.299
87	29.72	14.86	132.50	66.25	42.48	117.82	103.75	1.299
88	14.17	10.00	117.50	58.75	28.24	114.05	105.00	1.299
89	37.50	18.75	127.50	63.75	45.15	115.95	97.50	1.299
90	37.50	18.75	117.50	58.75	35.01	123.72	105.00	1.299
91	37.50	18.75	117.50	58.75	35.63	122.48	103.75	1.300
92	33.61	16.81	127.50	63.75	43.15	115.09	98.75	1.300
93	33.61	16.81	132.50	66.25	45.12	117.40	101.25	1.300
94	25.83	12.92	122.50	61.25	36.54	112.34	100.00	1.300
95	37.50	18.75	117.50	58.75	36.25	121.24	102.50	1.300
96	37.50	18.75	122.50	61.25	42.57	114.87	96.25	1.300
97	25.83	12.92	117.50	58.75	34.57	110.02	97.50	1.301
98	37.50	18.75	117.50	58.75	36.88	120.00	101.25	1.301
99	21.94	10.97	127.50	63.75	35.88	115.04	105.00	1.301

Critical Failure Surface (circle 1)

Intersects: XL: 25.83	YL: 12.92	XR: 117.50	YR: 58.75
Centre: XC: 30.68	YC: 117.80	Radius: R: 105.00	
Generated failure surface: (20 points)			
25.83	12.92	31.47	12.81
53.82	15.38	59.28	16.77
80.14	25.18	85.04	27.97
102.93	41.61	106.91	45.60
		37.10	13.00
		64.65	18.45
		89.78	31.02
		110.67	49.79
		42.71	13.50
		69.93	20.42
		94.35	34.31
		114.21	54.18
			48.29
			75.10
			98.74
			117.50
			58.75

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S		Base				PoreWater		Normal Stress	Test Factor
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
1	25.83	2.06	-1.1	2.82	2.82	1	100.00	34.0	247.22	0.00
2	28.65	6.18	-1.1	2.82	2.82	1	100.00	34.0	741.65	0.00
3	31.47	10.08	2.0	2.82	2.82	1	100.00	34.0	1209.95	0.00
4	34.28	13.77	2.0	2.82	2.82	1	100.00	34.0	1652.92	0.00
5	37.10	17.19	5.0	2.81	2.82	1	100.00	34.0	2062.83	0.00
6	39.90	20.43	5.0	2.81	2.82	1	100.00	34.0	2451.97	0.00
7	42.71	23.31	8.1	2.79	2.82	1	100.00	34.0	2797.01	0.00
8	45.50	26.09	8.1	2.79	2.82	1	100.00	34.0	3130.59	0.00
9	48.29	28.38	11.2	2.76	2.82	1	100.00	34.0	3405.88	0.00
10	51.05	30.69	11.2	2.76	2.82	1	100.00	34.0	3682.81	0.00
11	53.82	32.38	14.3	2.73	2.82	1	100.00	34.0	3885.10	0.00
12	56.55	34.21	14.3	2.73	2.82	1	100.00	34.0	4104.92	0.00
13	59.28	35.27	17.3	2.69	2.82	1	100.00	34.0	4232.79	0.00
14	61.96	36.63	17.3	2.69	2.82	1	100.00	34.0	4395.71	0.00
15	64.65	37.08	20.4	2.64	2.82	1	100.00	34.0	4449.19	0.00
16	67.29	37.97	20.4	2.64	2.82	1	100.00	34.0	4556.11	0.00
17	69.93	37.81	23.5	2.58	2.82	1	100.00	34.0	4537.07	0.00
18	72.52	38.25	23.5	2.58	2.82	1	100.00	34.0	4589.45	0.00
19	75.10	37.51	26.6	2.52	2.82	1	100.00	34.0	4501.40	0.00
20	77.62	37.51	26.6	2.52	2.82	1	100.00	34.0	4501.39	0.00
21	80.14	36.24	29.6	2.45	2.82	1	100.00	34.0	4349.38	0.00
22	82.59	35.83	29.6	2.45	2.82	1	100.00	34.0	4299.72	0.00
23	85.04	34.09	32.7	2.37	2.82	1	100.00	34.0	4090.29	0.00
24	87.41	33.29	32.7	2.37	2.82	1	100.00	34.0	3994.31	0.00
25	89.78	31.13	35.8	2.29	2.82	1	100.00	34.0	3735.43	0.00
26	92.06	29.97	35.8	2.29	2.82	1	100.00	34.0	3596.97	0.00
27	94.35	27.48	38.9	2.19	2.82	1	100.00	34.0	3297.94	0.00
28	96.54	26.01	38.9	2.19	2.82	1	100.00	34.0	3121.33	0.00
29	98.74	23.27	41.9	2.10	2.82	1	100.00	34.0	2792.53	0.00
30	100.83	21.52	41.9	2.10	2.82	1	100.00	34.0	2582.54	0.00
31	102.93	18.63	45.0	1.99	2.82	1	100.00	34.0	2235.50	0.00
32	104.92	16.64	45.0	1.99	2.82	1	100.00	34.0	1997.29	0.00
33	106.91	13.70	48.1	1.88	2.82	1	100.00	34.0	1644.21	0.00
34	108.79	11.53	48.1	1.88	2.82	1	100.00	34.0	1383.26	0.00
35	110.67	8.64	51.2	1.77	2.82	1	100.00	34.0	1037.13	0.00
36	112.44	6.33	51.2	1.77	2.82	1	100.00	34.0	759.19	0.00
37	114.21	3.61	54.2	1.65	2.82	1	100.00	34.0	433.49	0.00
38	115.85	1.20	54.2	1.65	2.82	1	100.00	34.0	144.50	0.00
X-S Area:		921.92	Path Length:		107.05	X-S Weight:		110630.94		

FoS Ranges

≤ 1.00

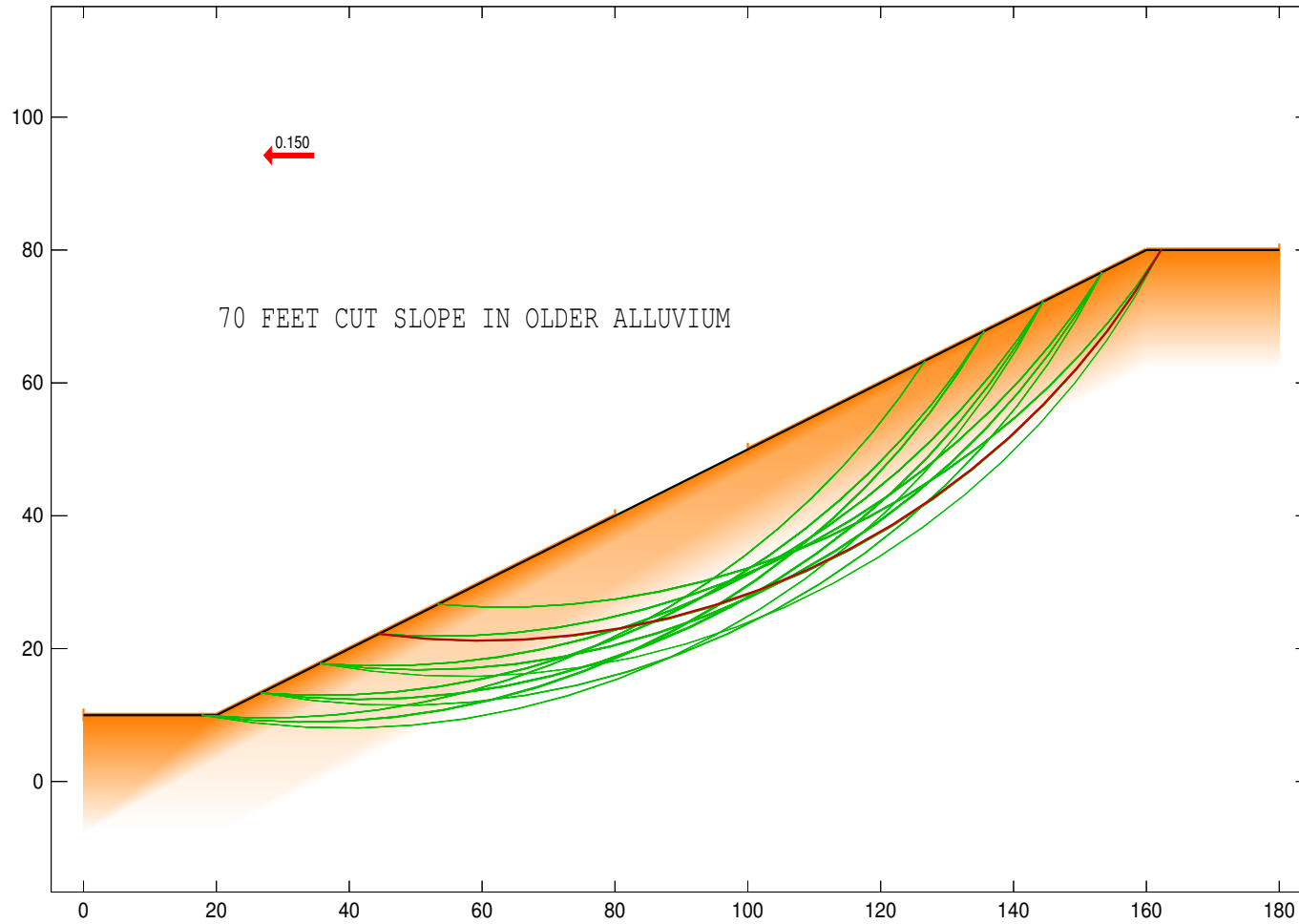
$> 1.00 \leq 1.20$

$> 1.20 \leq 1.40$

> 1.40

Material Keys

1: Old Alluvium



GALENA Version 7.1

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.49

Project Tentative Tract 16586, Redlands
Seismic, 70 Feet Cut Slope

File: C:\Users\H...\Seismic 70 Slope.gmf

Edited: 14 Feb 2018 Processed: 14 Feb 2018

GeoMat Testing Laboratories, Inc.

Project: Tentative Tract 16586, Redlands
 File: C:\Users\Haytham\Documents\GEOMAT DATA\ANNUAL REPORTS\2011 REPORTS\11074.Inland Communities Corp...\Seismic 70 Slope.gmf
 Processed: 14 Feb 2018 13:48:47

DATA: Analysis 1 - Seismic, 70 Feet Cut Slope

Material Properties (1 material)

Material: 1 (Mohr-Coulomb Isotropic) - Old Alluvium
 Cohesion Phi UnitWeight Ru
 200.00 36.0 120.00 0.00

Material Profiles (1 profile)

Profile: 1 (2 points) Material beneath: 1 - Old Alluvium
 0.00 90.00 180.00 90.00

Slope Surface (4 points)

0.00 10.00 20.00 10.00 160.00 80.00 180.00 80.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R

Intersects: XL: 44.44 YL: 22.22 XR: 162.22 YR: 80.00
 Centre: XC: 59.87 YC: 139.71 Radius: R: 118.50

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.150

Variable Restraints

Parameter descriptor: XL XR R
 Range of variation: 80.00 80.00 1.00
 Trial positions within range: 10 10 10

RESULTS: Analysis 1 - Seismic, 70 Feet Cut Slope

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.517

There were: 971 successful analyses from a total of 1001 trial surfaces
 30 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.49

Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	44.44	22.22	162.22	80.00	59.87	139.71	118.50	1.494	<-- Critical Surface
2	44.44	22.22	162.22	80.00	59.93	139.59	118.39	1.495	
3	35.56	17.78	153.33	76.67	50.38	135.35	118.50	1.495	
4	26.67	13.33	144.44	72.22	41.49	130.90	118.50	1.495	
5	44.44	22.22	162.22	80.00	59.99	139.47	118.28	1.495	
6	26.67	13.33	144.44	72.22	41.55	130.78	118.39	1.495	
7	35.56	17.78	153.33	76.67	50.44	135.23	118.39	1.495	
8	44.44	22.22	162.22	80.00	60.04	139.35	118.17	1.495	
9	35.56	17.78	153.33	76.67	50.50	135.11	118.28	1.495	
10	26.67	13.33	144.44	72.22	41.61	130.66	118.28	1.495	
11	53.33	26.67	162.22	80.00	62.99	144.77	118.50	1.495	
12	35.56	17.78	153.33	76.67	50.56	134.99	118.17	1.496	
13	26.67	13.33	144.44	72.22	41.67	130.54	118.17	1.496	
14	44.44	22.22	162.22	80.00	60.10	139.23	118.06	1.496	
15	53.33	26.67	162.22	80.00	63.05	144.66	118.39	1.496	
16	53.33	26.67	162.22	80.00	63.11	144.54	118.28	1.496	
17	26.67	13.33	144.44	72.22	41.73	130.42	118.06	1.496	
18	35.56	17.78	153.33	76.67	50.62	134.87	118.06	1.496	
19	44.44	22.22	162.22	80.00	60.16	139.11	117.94	1.496	
20	53.33	26.67	162.22	80.00	63.16	144.42	118.17	1.496	
21	53.33	26.67	162.22	80.00	63.22	144.31	118.06	1.496	
22	35.56	17.78	153.33	76.67	50.68	134.75	117.94	1.496	
23	26.67	13.33	144.44	72.22	41.79	130.30	117.94	1.496	
24	44.44	22.22	162.22	80.00	60.22	138.99	117.83	1.496	
25	53.33	26.67	162.22	80.00	63.28	144.19	117.94	1.496	
26	35.56	17.78	153.33	76.67	50.74	134.63	117.83	1.496	
27	26.67	13.33	144.44	72.22	41.85	130.18	117.83	1.496	
28	53.33	26.67	162.22	80.00	63.33	144.07	117.83	1.496	
29	44.44	22.22	162.22	80.00	60.28	138.87	117.72	1.496	
30	53.33	26.67	162.22	80.00	63.39	143.96	117.72	1.497	

31	35.56	17.78	153.33	76.67	50.80	134.51	117.72	1.497
32	26.67	13.33	144.44	72.22	41.91	130.06	117.72	1.497
33	44.44	22.22	162.22	80.00	60.34	138.75	117.61	1.497
34	53.33	26.67	162.22	80.00	63.45	143.84	117.61	1.497
35	53.33	26.67	162.22	80.00	63.50	143.73	117.50	1.497
36	26.67	13.33	144.44	72.22	41.97	129.94	117.61	1.497
37	35.56	17.78	153.33	76.67	50.86	134.39	117.61	1.497
38	44.44	22.22	162.22	80.00	60.40	138.63	117.50	1.497
39	35.56	17.78	153.33	76.67	50.92	134.27	117.50	1.497
40	26.67	13.33	144.44	72.22	42.03	129.82	117.50	1.497
41	44.44	22.22	153.33	76.67	53.42	140.38	118.50	1.498
42	35.56	17.78	144.44	72.22	44.53	135.94	118.50	1.498
43	26.67	13.33	135.56	67.78	35.64	131.49	118.50	1.498
44	44.44	22.22	153.33	76.67	53.48	140.27	118.39	1.498
45	26.67	13.33	135.56	67.78	35.70	131.38	118.39	1.498
46	35.56	17.78	144.44	72.22	44.59	135.82	118.39	1.498
47	44.44	22.22	153.33	76.67	53.54	140.15	118.28	1.498
48	26.67	13.33	135.56	67.78	35.76	131.26	118.28	1.498
49	35.56	17.78	144.44	72.22	44.65	135.71	118.28	1.498
50	26.67	13.33	135.56	67.78	35.82	131.15	118.17	1.498
51	44.44	22.22	153.33	76.67	53.59	140.03	118.17	1.498
52	35.56	17.78	144.44	72.22	44.71	135.59	118.17	1.498
53	44.44	22.22	153.33	76.67	53.65	139.92	118.06	1.498
54	26.67	13.33	135.56	67.78	35.87	131.03	118.06	1.498
55	35.56	17.78	144.44	72.22	44.76	135.47	118.06	1.498
56	26.67	13.33	135.56	67.78	35.93	130.91	117.94	1.499
57	35.56	17.78	144.44	72.22	44.82	135.36	117.94	1.499
58	44.44	22.22	153.33	76.67	53.71	139.80	117.94	1.499
59	44.44	22.22	153.33	76.67	53.77	139.69	117.83	1.499
60	35.56	17.78	144.44	72.22	44.88	135.24	117.83	1.499
61	26.67	13.33	135.56	67.78	35.99	130.80	117.83	1.499
62	17.78	10.00	135.56	67.78	33.20	127.49	118.50	1.499
63	35.56	17.78	144.44	72.22	44.94	135.13	117.72	1.499
64	44.44	22.22	153.33	76.67	53.83	139.57	117.72	1.499
65	26.67	13.33	135.56	67.78	36.05	130.68	117.72	1.499
66	26.67	13.33	135.56	67.78	36.11	130.57	117.61	1.499
67	44.44	22.22	153.33	76.67	53.88	139.45	117.61	1.499
68	35.56	17.78	144.44	72.22	45.00	135.01	117.61	1.499
69	17.78	10.00	135.56	67.78	33.26	127.37	118.39	1.499
70	35.56	17.78	144.44	72.22	45.05	134.89	117.50	1.499
71	26.67	13.33	135.56	67.78	36.16	130.45	117.50	1.499
72	44.44	22.22	153.33	76.67	53.94	139.34	117.50	1.499
73	17.78	10.00	135.56	67.78	33.32	127.25	118.28	1.499
74	17.78	10.00	135.56	67.78	33.38	127.13	118.17	1.499
75	17.78	10.00	135.56	67.78	33.44	127.01	118.06	1.500
76	17.78	10.00	135.56	67.78	33.50	126.89	117.94	1.500
77	17.78	10.00	135.56	67.78	33.55	126.77	117.83	1.500
78	17.78	10.00	135.56	67.78	33.61	126.65	117.72	1.501
79	17.78	10.00	135.56	67.78	33.67	126.53	117.61	1.501
80	17.78	10.00	135.56	67.78	33.73	126.41	117.50	1.501
81	26.67	13.33	153.33	76.67	47.51	129.99	118.50	1.505
82	26.67	13.33	153.33	76.67	47.57	129.86	118.39	1.506
83	17.78	10.00	144.44	72.22	39.14	126.56	118.50	1.506
84	26.67	13.33	153.33	76.67	47.63	129.74	118.28	1.506
85	35.56	17.78	162.22	80.00	56.91	134.34	118.50	1.506
86	17.78	10.00	144.44	72.22	39.20	126.44	118.39	1.506
87	26.67	13.33	153.33	76.67	47.69	129.61	118.17	1.507
88	17.78	10.00	126.67	63.33	27.44	128.11	118.50	1.507
89	17.78	10.00	126.67	63.33	27.49	127.99	118.39	1.507
90	35.56	17.78	162.22	80.00	56.98	134.21	118.39	1.507
91	17.78	10.00	144.44	72.22	39.26	126.31	118.28	1.507
92	17.78	10.00	126.67	63.33	27.55	127.87	118.28	1.507
93	17.78	10.00	126.67	63.33	27.61	127.76	118.17	1.507
94	26.67	13.33	153.33	76.67	47.75	129.49	118.06	1.507
95	17.78	10.00	126.67	63.33	27.66	127.64	118.06	1.507
96	17.78	10.00	126.67	63.33	27.72	127.52	117.94	1.507
97	17.78	10.00	144.44	72.22	39.32	126.19	118.17	1.507
98	35.56	17.78	162.22	80.00	57.04	134.09	118.28	1.507
99	17.78	10.00	126.67	63.33	27.78	127.41	117.83	1.507

Critical Failure Surface (circle 1)

Intersects: XL:	44.44	YL:	22.22	XR:	162.22	YR:	80.00				
Centre: XC:	59.87	YC:	139.71			Radius: R:	118.50				
Generated failure surface: (20 points)											
44.44	22.22	51.72	21.49	59.03	21.22	66.35	21.39	73.64	22.02		
80.87	23.09	88.03	24.61	95.08	26.57	101.99	28.96	108.75	31.77		
115.32	34.99	121.67	38.61	127.80	42.62	133.66	46.99	139.24	51.72		
144.52	56.79	149.47	62.17	154.09	67.85	158.34	73.80	162.22	80.00		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S		Base						PoreWater Force	Normal Stress	Test Factor
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi			
1	44.44	3.97	-5.7	3.64	3.66	1	200.00	36.0	476.92	151.79	1.06
2	48.08	11.92	-5.7	3.64	3.66	1	200.00	36.0	1430.76	427.24	1.06
3	51.72	19.56	-2.2	3.66	3.66	1	200.00	36.0	2347.01	659.32	1.02
4	55.38	26.75	-2.2	3.66	3.66	1	200.00	36.0	3209.48	899.70	1.02
5	59.03	33.54	1.4	3.66	3.66	1	200.00	36.0	4024.37	1084.72	0.99
6	62.69	39.90	1.4	3.66	3.66	1	200.00	36.0	4788.47	1291.27	0.99

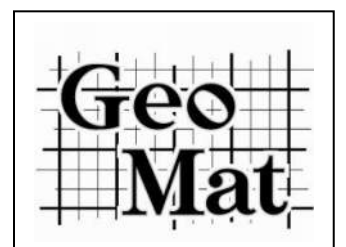
7	66.35	45.69	4.9	3.64	3.66	1	200.00	36.0	5483.16	0.00	1433.21	0.96
8	69.99	51.19	4.9	3.64	3.66	1	200.00	36.0	6143.37	0.00	1607.11	0.96
9	73.64	55.86	8.4	3.62	3.66	1	200.00	36.0	6703.04	0.00	1709.33	0.94
10	77.26	60.46	8.4	3.62	3.66	1	200.00	36.0	7255.40	0.00	1851.71	0.94
11	80.87	63.91	12.0	3.58	3.66	1	200.00	36.0	7669.30	0.00	1917.14	0.93
12	84.45	67.60	12.0	3.58	3.66	1	200.00	36.0	8111.51	0.00	2029.16	0.93
13	88.03	69.78	15.5	3.52	3.66	1	200.00	36.0	8373.43	0.00	2060.41	0.91
14	91.56	72.54	15.5	3.52	3.66	1	200.00	36.0	8704.89	0.00	2143.26	0.91
15	95.08	73.44	19.1	3.46	3.66	1	200.00	36.0	8812.61	0.00	2142.76	0.91
16	98.54	75.29	19.1	3.46	3.66	1	200.00	36.0	9034.39	0.00	2197.68	0.91
17	101.99	74.92	22.6	3.38	3.66	1	200.00	36.0	8990.30	0.00	2167.78	0.90
18	105.37	75.88	22.6	3.38	3.66	1	200.00	36.0	9105.12	0.00	2196.05	0.90
19	108.75	74.30	26.1	3.28	3.66	1	200.00	36.0	8915.81	0.00	2139.05	0.90
20	112.03	74.40	26.1	3.28	3.66	1	200.00	36.0	8928.02	0.00	2142.05	0.90
21	115.32	71.70	29.7	3.18	3.66	1	200.00	36.0	8604.49	0.00	2060.30	0.90
22	118.50	71.00	29.7	3.18	3.66	1	200.00	36.0	8520.04	0.00	2039.49	0.90
23	121.67	67.31	33.2	3.06	3.66	1	200.00	36.0	8076.76	0.00	1935.42	0.91
24	124.73	65.86	33.2	3.06	3.66	1	200.00	36.0	7903.04	0.00	1892.36	0.91
25	127.80	61.32	36.7	2.93	3.66	1	200.00	36.0	7358.45	0.00	1768.55	0.92
26	130.73	59.20	36.7	2.93	3.66	1	200.00	36.0	7104.23	0.00	1704.91	0.92
27	133.66	54.00	40.3	2.79	3.66	1	200.00	36.0	6479.97	0.00	1564.17	0.93
28	136.45	51.29	40.3	2.79	3.66	1	200.00	36.0	6155.23	0.00	1481.76	0.93
29	139.24	45.63	43.8	2.64	3.66	1	200.00	36.0	5475.94	0.00	1327.15	0.95
30	141.88	42.43	43.8	2.64	3.66	1	200.00	36.0	5091.73	0.00	1227.88	0.95
31	144.52	36.54	47.4	2.48	3.66	1	200.00	36.0	4384.30	0.00	1062.85	0.97
32	146.99	32.94	47.4	2.48	3.66	1	200.00	36.0	3952.63	0.00	948.83	0.97
33	149.47	27.05	50.9	2.31	3.66	1	200.00	36.0	3245.95	0.00	777.29	0.99
34	151.78	23.16	50.9	2.31	3.66	1	200.00	36.0	2779.48	0.00	650.77	0.99
35	154.09	17.53	54.4	2.13	3.66	1	200.00	36.0	2104.04	0.00	477.24	1.02
36	156.21	13.47	54.4	2.13	3.66	1	200.00	36.0	1615.94	0.00	340.68	1.02
37	158.34	7.40	58.0	1.66	3.13	1	200.00	36.0	887.74	0.00	180.95	1.06
38	160.00	3.95	58.0	2.22	4.19	1	200.00	36.0	473.65	0.00	-0.46	1.06

X-S Area: 1822.67

Path Length: 139.00

X-S Weight: 218720.98

APPENDIX F



SLOPE MAINTENANCE GUIDELINES

Hillside lots in general, and hillside slopes in particular, need maintenance to continue to function and retain their value. Many homeowners are unaware of this and allow deterioration of their property. In addition to his own property, the homeowner may be subject to liability for damage occurring to neighboring properties as a result of his negligence. It is therefore important to familiarize homeowners with some guidelines for maintenance of their properties and make them aware of the importance of maintenance.

Nature slowly wears away land, but human activities such as construction increase the rate of erosion 200, even 2,000 times that amount. When we remove vegetation or other objects that hold soil in place, we expose it to the action of wind and water, and increase its chance of eroding.

The following guidelines are provided for the protection of the homeowner's investment, and should be employed throughout the year.

- (a) Care should be taken that slopes, terraces, berms (ridges at crown of slopes), and proper lot drainage are not disturbed. Surface drainage should be conducted from the rear yard to the street by a graded swale through the sideyard, or alternative approved devices.
- (b) In general, roof and yard runoff should be conducted to either the street or storm drain by nonerosive devices such as sidewalks, drainage pipes, ground gutters, and driveways. Drainage systems should not be altered without expert consultation.
- (c) All drains should be kept cleaned and unclogged, including gutters and downspouts. Terrace drains or gunite ditches should be kept free of debris to allow proper drainage. During heavy rain periods, performance of the drainage system should be inspected. Problems, such as gulying and ponding, if observed, should be corrected as soon as possible.
- (d) Any leakage from pools, waterlines, etc. or bypassing of drains should be repaired as soon as possible.
- (e) Animal burrows should be filled since they may cause diversion of surface runoff, promote accelerated erosion, and even trigger shallow soil failures.
- (f) Slopes should not be altered without expert consultation. Whenever a homeowner plans a significant topographic modification of the lot or slope, a qualified geotechnical consultant should be contacted.
- (g) If plans for modification of cut, fill, or natural slopes within a property are considered, an engineering geologist should be consulted. Any oversteepening may result in a need for

expensive retaining devices. Undercutting of the bottom of a slope might possibly lead to slope instability or failure and should not be undertaken without expert consultation.

- (h) If unusual racking, settling, or earth slippage occurs on the property, the homeowner should consult a qualified soil engineer or an engineering geologist immediately.
- (i) The most common causes of slope erosion and shallow slope failures are as follows:
 - ❖ Gross negligent of the care and maintenance of the slopes and drainage devices.
 - ❖ Inadequate and/or improper planting. (Barren areas should be replanted as soon as possible.)
 - ❖ Excessive or insufficient irrigation or diversion of runoff over the slope.
 - ❖ Foot traffic on slopes destroying vegetation and exposing soil to erosion potential.
- (j) Homeowners should not let conditions on their property create a problem for their neighbors. Cooperation with neighbors could prevent problems; also increase the aesthetic attractiveness of the property.

WINTER ALERT

It is especially important to "winterize" your property by mid-September. Don't wait until spring to put in landscaping. You need winter protection. Final landscaping can be done later. Inexpensive measures installed by mid-September will give you protection quickly that will last all during the wet season.

- ❖ Check before storms to see that drains, gutters, downspouts, and ditches are not clogged by leaves and rubble.
- ❖ Check after major storms to be sure drains are clear and vegetation is holding on slopes. Repair as necessary.
- ❖ Spot seed any bare areas. Broadcast seeds or use a mechanical seeder. A typical slope or bare areas can be done in less than an hour.
- ❖ Give seeds a boost with fertilizer.
- ❖ Mulch if you can, with grass clippings and leaves, bark chips or straw.
- ❖ Use netting to hold soil and seeds on steep slopes.

- ❖ Check with your landscape architect or local nursery for advice.
- ❖ Prepare berms and ditches to drain surface runoff water away from problem areas such as steep, bare slopes.
- ❖ Prepare base areas on slopes for seeding by raking the surface to loosen and roughen soil so it will hold seeds.

CONSTRUCTION

- ❖ Plan construction activities during spring and summer, so that erosion control measures can be in place when the rain comes.
- ❖ Examine your site carefully before building. Be aware of the slope, drainage patterns and soil types. Proper site design will help you avoid expensive stabilization work.
- ❖ Preserve existing vegetation as much as possible. Vegetation will naturally curb erosion, improve the appearance and value of your property, and reduce the cost of landscaping later.
- ❖ Use fencing to protect plants from fill material and traffic. If you have to pave near trees, do so with permeable asphalt or porous paving blocks.
- ❖ Minimize the length and steepness of slopes by benching, terracing, or constructing diversion structures. Landscape benched areas to stabilize the slope and improve its appearance.
- ❖ As soon as possible after grading a site, plant vegetation on all areas that are not to be paved or otherwise covered.

TEMPORARY MEASURES TO STABILIZE THE SOIL

Grass provides the cheapest and most effective short-term erosion control. It grows quickly and covers the ground completely. To find the best seed mixtures and plants for your area, check with your local landscape architect, local nursery, or the U.S. Department of Agriculture Soil Conservation Service. Mulches hold soil moisture and provide ground protection from rain drainage. They also provide a favorable environment for starting and growing plants. Easy-to-obtain mulches are grass clippings, leaves, sawdust, bark chips, and straw.

Straw mulch is nearly 100 percent effective when held in place by spraying with an organic glue or wood fiber (tackifiers), by punching it into the soil with a shovel or roller, or by tacking a netting over it.

Commercial applications of wood fibers combined with various seeds and fertilizers (hydraulic mulching) are effective in stabilizing sloped areas. Hydraulic mulching with a tackifier should be done in two separate applications; the first composed of seed fertilizer and half the mulch, the second composed of the remaining mulch and tackifier. Commercial hydraulic mulch applicators – who also provide

other erosion control services – are listed under “landscaping” in the phone book.

Mats of excelsior, jute netting, and plastic sheets can be effective temporary covers, but they must be in contact with the soil and fastened securely to work effectively.

Roof drainage can be collected in barrels or storage containers or touted into lawns, planter boxes, and gardens. Be sure to cover stored water so you don't collect mosquitoes. Excessive runoff should be directed away from your house. Too much water can damage trees and make foundations unstable.

STRUCTURAL RUNOFF CONTROLS

Even with proper timing and planting, you may need to protect disturbed areas from rainfall until the plants have time to establish themselves. Or you may need permanent ways to transport water across your property so that it doesn't cause erosion.

To keep water from carrying soil from your site and dumping it into nearby lots, streets, streams and channels, you need ways to reduce its volume and speed. Some examples of what you might use are:

- ❖ Riprap (rock lining) – to protect channel banks from erosive water flow.
- ❖ Sediment trap – to stop runoff carrying sediment and trap the sediment.
- ❖ Storm drain outlet protection – to reduce the speed of water flowing from a pipe onto open ground or into a natural channel.
- ❖ Diversion dike or perimeter dike – to divert excess water to places where it can be disposed of properly.
- ❖ Straw bale dike – to stop and detain sediment from small-unprotected areas (a short-term measure).
- ❖ Perimeter swale – to divert runoff from a disturbed area or to contain runoff within a disturbed area.
- ❖ Grade stabilization structure – to carry concentrated runoff down a slope.

APPENDIX G

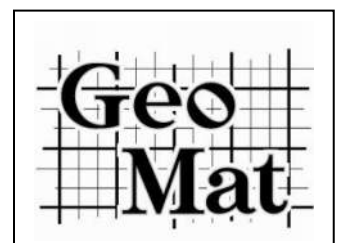


TABLE OF CONTENT

	Page
GENERAL	I
DEFINITION OF TERMS	I
OBLIGATIONS OF PARTIES	III
SITE PREPARATION	IV
SITE PROTECTION	IV
EXCAVATIONS	V
Unsuitable Materials	V
Cut Slopes.....	V
Pad Areas	V
COMPACTED FILL	VI
Placement	VI
Moisture	VII
Fill Material.....	VII
Fill Slopes.....	VIII
Off-Site Fill	VIII
DRAINAGE	IX
STAKING	IX
SLOPE MAINTENANCE.....	IX
Landscape Plants	IX
Irrigation	IX
Maintenance.....	IX
Repairs.....	X
TRENCH BACKFILL	X
STATUS OF GRADING	X

GENERAL

The guidelines contained herein and the standard details attached hereto represent this firm's standard recommendation for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications.

All plates attached hereto shall be considered as part of these guidelines.

The Contractor should not vary from these guidelines without prior recommendation by the Geotechnical Consultant and the approval of the Client or his authorized representative. Recommendation by the Geotechnical Consultant and/or Client should not be considered to preclude requirements for the approval by the controlling agency prior to the execution of any changes.

These Standard Grading Guidelines and Standard Details may be modified and/or superseded by recommendations contained in the text of the preliminary Geotechnical Report and/or subsequent reports.

If disputes arise out of the interpretation of these grading guidelines or standard details, the Geotechnical Consultant shall provide the governing interpretation.

DEFINITION OF TERMS

ALLUVIUM

Unconsolidated soil deposits resulting from flow of water, including sediments deposited in river beds, canyons, flood plains, lakes, fans and estuaries.

AS-GRADED (AS-BUILT): The surface and subsurface conditions at completion of grading.

BACKCUT: A temporary construction slope at the rear of earth retaining structures such as buttresses, shear keys, stabilization fills or retaining walls.

BACKDRAIN: Generally a pipe and gravel or similar drainage system placed behind earth retaining structures such as buttresses, stabilization fills, and retaining walls.

BEDROCK: Relatively undisturbed formational rock, more or less solid, either at the surface or beneath superficial deposits of soil.

BENCH: A relatively level step and near vertical rise excavated into sloping ground on which fill is to be placed.

BORROW (Import): Any fill material hauled to the project site from off-site areas.

BUTTRESS FILL: A fill mass, the configuration of which is designed by engineering calculations to retain slope conditions containing adverse geologic features. A buttress is generally specified by minimum key width and depth and by maximum backcut angle. A buttress normally contains a back-drainage system.

CIVIL ENGINEER: The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topographic conditions.

CLIENT: The Developer or his authorized representative who is chiefly in charge of the project. He shall have the responsibility of reviewing the findings and recommendations made by the Geotechnical Consultant and shall authorize the Contractor and/or other consultants to perform work and/or provide services.

COLLUVIUM: Generally loose deposits usually found near the base of slopes and brought there chiefly by gravity through slow continuous downhill creep (also see Slope Wash).

COMPACTION : Densification of man-placed fill by mechanical means.

CONTRACTOR – A person or company under contract or otherwise retained by the Client to perform demolition, grading and other site improvements.

DEBRIS: All products of clearing, grubbing, demolition, and contaminated soil materials unsuitable for reuse as compacted fill, and/or any other material so designated by the Geotechnical Consultant.

ENGINEERING GEOLOGIST: A Geologist holding a valid certificate of registration in the specialty of Engineering Geology.

ENGINEERED FILL: A fill of which the Geotechnical Consultant or his representative, during grading, has made sufficient tests to enable him to conclude that the fill has been placed in substantial compliance with the recommendations of the Geotechnical Consultant and the governing agency requirements.

EROSION: The wearing away of ground surface as a result of the movement of wind, water, and/or ice.

EXCAVATION: The mechanical removal of earth materials.

EXISTING GRADE: The ground surface configuration prior to grading.

FILL: Any deposits of soil, rock, soil-rock blends or other similar materials placed by man.

FINISH GRADE: The ground surface configuration at which time the surface elevations conform to the approved plan.

GEOFABRIC: Any engineering textile utilized in geotechnical applications including subgrade stabilization and filtering.

GEOLOGIST: A representative of the Geotechnical Consultant educated and trained in the field of geology.

GEOTECHNICAL CONSULTANT: The Geotechnical Engineering and Engineering Geology consulting firm retained to provide technical services for the project. For the purpose of these specifications, observations by the Geotechnical Consultant include observations by the Soil Engineer, Geotechnical Engineer, Engineering Geologist and those performed by persons employed by and responsible to the Geotechnical Consultants.

GEOTECHNICAL ENGINEER: A licensed Geotechnical Engineer or Civil Engineer who applies scientific methods, engineering principles and professional experience to the acquisition, interpretation and use of knowledge of materials of the earth's crust for the evaluation of engineering problems. Geotechnical Engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology and related sciences.

GRADING: Any operation consisting of excavation, filling or combinations thereof and associated operations.

LANDSIDE DEBRIS: Material, generally porous and of low density, produced from instability of natural or man-made slopes.

MAXIMUM DENSITY: Standard laboratory test for maximum dry unit weight. Unless otherwise specified, the maximum dry unit weight shall be determined in accordance with ASTM Method of Test D 1557-91.

OPTIMUM MOISTURE – Soil moisture content at the test maximum density.

RELATIVE COMPACTION: The degree of compaction (expressed as a percentage) of dry unit weight of a material as compared to the maximum dry unit weight of the material.

ROUGH GRADE: The ground surface configuration at which time the surface elevations approximately conform to the approved plan.

SITE: The particular parcel of land where grading is being performed.

SHEAR KEY: Similar to buttress, however, it is generally constructed by excavating a slot within a natural slope, in order to stabilize the upper portion of the slope without grading encroaching into the lower portion of the slope.

SLOPE: An inclined ground surface, the steepness of which is generally specified as a ratio of horizontal:vertical (e.g., 2:1)

SLOPE WASH: Soil and/or rock material that has been transported down a slope by action of gravity assisted by runoff water not confined by channels (also see Colluvium).

SOIL: Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof.

SOIL ENGINEER: Licensed Geotechnical Engineer or Civil Engineer experienced in soil mechanics (also see Geotechnical Engineer).

STABILIZATION FILL: A fill mass, the configuration of which is typically related to slope height and specified by the standards of practice for enhancing the stability of locally adverse conditions. A stabilization fill is normally specified by minimum key width and depth and by maximum backcut angle. A stabilization fill may or may not have a backdrainage system specified.

SUBDRAIN: Generally a pipe and gravel or similar drainage system placed beneath a fill in the alignment of canyons or formed drainage channels.

SLOUGH: Loose, non-compacted fill material generated during grading operations.

TAILINGS: Non-engineered fill which accumulates on or adjacent to equipment haul-roads.

TERRACE: Relatively level step constructed in the face of a graded slope surface for drainage control and maintenance purposes.

TOPSOIL: The presumable fertile upper zone of soil, which is usually darker in color and loose.

WINDROW: A string of large rocks buried within engineered fill in accordance with guidelines set forth by the Geotechnical Consultant.

OBLIGATIONS OF PARTIES

The Geotechnical Consultant should provide observation and testing services and should make evaluations in order to advise the Client on Geotechnical matters. The Geotechnical Consultant should report his findings and recommendations to the Client or his authorized representative.

The client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the Geotechnical Consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services.

During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project.

The Contractor should be responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including but not limited to, earthwork in accordance with the project plans, specifications and controlling agency requirements. During grading, the Contractor or his authorized representative should remain on-site. Overnight and on days off, the Contractor should remain accessible.

SITE PREPARATION

The Client, prior to any site preparation or grading, should arrange and attend a meeting among the Grading Contractor, the Design Engineer, the Geotechnical Consultant, representatives of the appropriate governing authorities as well as any other concerned parties. All parties should be given at least 48 hours notice.

Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, roots of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.

Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or re-routing pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the Geotechnical Consultant at the time of the demolition.

Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the Contractor from damage or injury.

Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the Geotechnical Consultant.

The Client or Contractor should obtain the required approvals for the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

SITE PROTECTION

Protection of the site during the period of grading should be the responsibility of the Contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the Geotechnical Consultant, the Client and the regulating agencies.

The Contractor should be responsible for the stability of all temporary excavations. Recommendations by the Geotechnical Consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and therefore, should not be considered to preclude the responsibilities of the Contractor. Recommendations by the Geotechnical Consultant should not be considered to preclude more restrictive requirements by the regulating agencies.

Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding, or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas can not be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.

During periods of rainfall, plastic sheeting should be kept reasonably accessible to prevent unprotected slopes from becoming saturated. Where necessary during periods of rainfall, the Contractor should install check-dams de-silting basins, rip-rap, sandbags or other devices or methods necessary to control erosion and provide safe conditions.

During periods of rainfall, the Geotechnical Consultant should be kept informed by the Contractor as to the nature of remedial or preventative work being performed (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

Following periods of rainfall, the Contractor should contact the Geotechnical Consultant and arrange a walk-over of the site in order to visually assess rain related damage. The Geotechnical Consultant may also recommend excavations and testing in order to aid in his assessments. At the request of the Geotechnical Consultant, the Contractor shall make excavations in order to evaluate the extent of rain related damage.

Rain-related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions identified by the Geotechnical Consultant. Soil adversely affected should be classified as Unsuitable Materials and should be subject to overexcavation and replaced with compacted fill or other remedial grading as recommended by the Geotechnical Consultant.

Relatively level areas, where saturated soils and/or erosion gullies exist to depths greater than 1 foot, should be overexcavated to unaffected, competent material. Where less than 1 foot in depth, unsuitable materials may be processed in-place to achieve near optimum moisture conditions, then thoroughly recompacted in accordance with the applicable specifications. If the desired results are not achieved, the affected materials should be overexcavated then replaced in accordance with the applicable specifications.

In slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1 foot, should be over-excavated to unaffected, competent material. Where affected materials exist to depths of 1 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. As field conditions dictate, other slope repair procedures may be recommended by the Geotechnical Consultant.

EXCAVATIONS

UNSUITABLE MATERIALS:

Materials which are unsuitable should be excavated under observation and recommendations of the Geotechnical Consultant. Unsuitable materials include, but may not be limited to dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft, bedrock and nonengineered or otherwise deleterious fill materials.

Materials identified by the Geotechnical Consultant as unsatisfactory due to its moisture conditions should be overexcavated, watered or dried, as needed, and thoroughly blended to uniform near optimum moisture condition (per Moisture guidelines presented herein) prior to placement as compacted fill.

CUT SLOPES:

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal:vertical).

If excavations for cut slopes expose loose, cohesionless, significantly fractured or otherwise suitable material, overexcavation and replacement of the unsuitable materials with a compacted stabilization fill should be accomplished as recommended by the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, stabilization fill construction should conform to the requirements of the Standard Details.

The Geotechnical Consultant should review cut slopes during excavation. The Geotechnical Consultant should be notified by the contractor prior to beginning slope excavations.

If during the course of grading, adverse or potentially adverse geotechnical conditions are encountered which were not anticipated in the preliminary report, the Geotechnical Consultant should explore, analyze and make recommendations to treat these problems.

When cuts slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top-of-cut.

PAD AREAS:

All lot pad areas, including side yard terraces, above stabilization fills or buttresses should be over-excavated to provide for a minimum of 3-feet (refer to Standard Details) of compacted fill over the entire pad area. Pad areas with both fill and cut materials exposed and pad areas containing both very shallow (less than 3-feet) and deeper fill should be over- thickness (refer to Standard Details).

Cut areas exposing significantly varying material types should also be overexcavated to provide for at least a 3-foot thick compacted fill blanket. Geotechnical conditions may require greater depth of overexcavation. The actual depth should be delineated by the Geotechnical Consultant during grading.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slope of 2 percent or greater is recommended.

COMPACTED FILL

All fill materials should be compacted as specified below or by other methods specifically recommended by the Geotechnical Consultant. Unless otherwise specified, the minimum degree of compaction (relative compaction) should be 90 percent of the laboratory maximum density.

PLACEMENT

Prior to placement of compacted fill, the Contractor should request a review by the Geotechnical Consultant of the exposed ground surface. Unless otherwise recommended, the exposed ground surface should then be scarified (6-inches minimum), watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions, then thoroughly compacted to a minimum of 90 percent of the maximum density. The review by the Geotechnical Consultants should not be considered to preclude requirements of inspection and approval by the governing agency.

Compacted fill should be placed in thin horizontal lifts not exceeding 8-inches in loose thickness prior to compaction. Each lift should be watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions then thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The Contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials. If necessary, excavation equipment should be "shut down" temporarily in order to permit proper compaction of fills. Earth moving equipment should only be considered a supplement and not substituted for conventional compaction equipment.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal:vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least 6-foot wide benches and minimum of 4-feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area subsequent to keying and benching until the area has been reviewed by the Geotechnical Consultant. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill. Typical keying and benching details have been included within the accompanying Standard Details.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Fill should be tested for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Testing D 1556-64, D 2922-78 and/or D2937-71. Tests should be provided for about every 2 vertical feet or 1,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the Geotechnical Consultant.

The Contractor should assist the Geotechnical Consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill.

As recommended by the Geotechnical Consultant, the Contractor should "shutdown" or remove any grading equipment from an area being tested.

The Geotechnical Consultant should maintain a plan with estimated locations of field tests. Unless the client provides for actual surveying of test locations, by the Geotechnical Consultant should only be considered rough estimates and should not be utilized for the purpose of preparing cross sections showing test locations or in any case for the purpose of after-the-fact evaluating of the sequence of fill placement.

MOISTURE

For field testing purposes, “near optimum” moisture will vary with material type and other factors including compaction procedures. “Near optimum” may be specifically recommended in Preliminary Investigation Reports and/or may be evaluated during grading.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface of previously compacted fill should be processed by scarification, watered or dried as needed, thoroughly blended to near-optimum moisture conditions, then recompact to a minimum of 90 percent of laboratory maximum dry density. Where wet or other dry or other unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be overexcavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

FILL MATERIAL

Excavated on-site materials which are acceptable to the Geotechnical Consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement.

Where import materials are required for use on-site, the Geotechnical Consultant should be notified at least 72 hours in advance of importing, in order to sample and test materials from proposed borrow sites. No import materials should be delivered for use on-site without prior sampling and testing by Geotechnical Consultant.

Where oversized rock or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off-site or on-site in areas designated as “nonstructural rock disposal areas”. Rock placed in disposal areas should be placed with sufficient fines to fill voids. The rock should be compacted in lifts to an unyielding condition. The disposal area should be covered with at least 3-feet of compacted fill, which is free of oversized material. The upper 3-feet should be placed in accordance with the guidelines for compacted fill herein.

Rocks 3 inches in maximum dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of the rock is avoided. Fill should be placed and thoroughly compacted over and around all rock. The amount of rock should not exceed 40 percent by dry weight passing the $\frac{3}{4}$ -inch sieve size. The 3-inch and 40 percent recommendations herein may vary as field conditions dictate.

During the course of grading operations, rocks or similar irreducible materials greater than 3-inch maximum dimension (oversized material) may be generated. These rocks should not be placed within the compacted fill unless placed as recommended by the Geotechnical Consultant.

Where rocks or similar irreducible materials of greater than 3-inches but less than 4-feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the accompanying Standard Details is recommended. Rocks greater than 4 feet should be broken down or disposed off-site. Rocks up to 4-feet maximum dimension should be placed below the upper 10-feet of any fill and should not be closer than 20-feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures of deep utilities are proposed.

Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so that successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the Geotechnical Consultant at time of placement.

Material that is considered unsuitable by the Geotechnical Consultant should not be utilized in the compacted fill.

During grading operations, placing and mixing the materials from the cut and/or borrow areas may result in soil mixtures which possess unique physical properties. Testing may be required of samples obtained directly from the fill areas in order to verify conformance with the specifications. Processing of these additional samples may take two or more working days. The Contractor may elect to move the operation to other areas within the project, or may continue placing compacted fill pending laboratory and field test results. Should he elect the second alternative, fill placed is done so at the Contractor's risk.

Any fill placed in areas not previously reviewed and evaluated by the Geotechnical Consultant, and/or in other areas, without prior notification to the Geotechnical Consultant may require removal and recompaction at the Contractor's expense. Determination of overexcavations should be made upon review of field conditions by the Geotechnical Consultant.

FILL SLOPES

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal to vertical).

Except as specifically recommended otherwise or as otherwise provided for in these grading guidelines (Reference Fill Materials), compacted fill slopes should be overbuilt and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the Geotechnical Consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the Contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

Although no construction procedure produces a slope free from risk of future movement, overfilling and cutting back of slope to a compacted inner core is, given no other constraints, the most desirable procedure. Other constraints, however, must often be considered. These constraints may include property line situations, access, the critical nature of the development, and cost. Where such constraints are identified, slope face compaction may be attempted by conventional construction procedures including backrolling techniques upon specific recommendations by the Geotechnical Consultant.

As a second best alternative for slopes of 2:1 (horizontal to vertical) or flatter, slope construction may be attempted as outlined herein. Fill placement should proceed in thin lifts, (i.e., 6 to 8 inch loose thickness). Each lift should be moisture conditioned and thoroughly compacted. The desired moisture condition should be maintained and/or reestablished, where necessary, during the period between successive lifts. Selected lifts should be tested to ascertain that desired compaction is being achieved. Care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately establish desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding 4-feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly backrolled utilizing a conventional sheepsfoot-type roller. Care should be taken to maintain the desired moisture conditions and/or reestablishing same as needed prior to backrolling. Upon achieving final grade, the slopes should again be moisture conditioned and thoroughly backrolled. The use of a side-boom roller will probably be necessary and vibratory methods are strongly recommended. Without delay, so as to avoid (if possible) further moisture conditioning, the slopes should then be grid-rolled to achieve a relatively smooth surface and uniformly compact condition.

In order to monitor slope construction procedures, moisture and density tests will be taken at regular intervals. Failure to achieve the desired results will likely result in a recommendation by the Geotechnical Consultant to overexcavate the slope surfaces followed by reconstruction of the slopes utilizing overfilling and cutting back procedures and/or further attempt at the conventional backrolling approach. Other recommendations may also be provided which would be commensurate with field conditions.

Where placement of fill above a natural slope or above a cut slope is proposed, the fill slope configuration as presented in the accompanying standard Details should be adopted.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and pad gradients of at least 2-percent in soil area.

OFF-SITE FILL

Off-site fill should be treated in the same manner as recommended in these specifications for site preparation, excavation, drains, compaction, etc.

Off-site canyon fill should be placed in preparation for future additional fill, as shown in the accompanying Standard Details.

Off-site fill subdrains temporarily terminated (up canyon) should be surveyed for future relocation and connection.

DRAINAGE

Canyon sub-drain systems specified by the Geotechnical Consultant should be installed in accordance with the Standard Details.

Typical sub-drains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications of the accompanying Standard Details.

Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, concrete swales).

For drainage over soil areas immediately away from structures (i.e., within 4-feet), a minimum of 4 percent gradient should be maintained. Pad drainage of at least 2 percent should be maintained over soil areas. Pad drainage may be reduced to at least 1 percent for projects where no slopes exist, either natural or man-made, or greater than 10-feet in height and where no slopes are planned, either natural or man-made, steeper than 2:1 (horizontal to vertical slope ratio).

Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns can be detrimental to slope stability and foundation performance.

STAKING

In all fill areas, the fill should be compacted prior to the placement of the stakes. This particularly is important on fill slopes. Slope stakes should not be placed until the slope is thoroughly compacted (backrolled). If stakes must be placed prior to the completion of compaction procedures, it must be recognized that they will be removed and/or demolished at such time as compaction procedures resume.

In order to allow for remedial grading operations, which could include overexcavations or slope stabilization, appropriate staking offsets should be provided. For finished slope and stabilization backcut areas, we recommend at least 10-foot setback from proposed toes and tops-of-cut.

SLOPE MAINTENANCE LANDSCAPE PLANTS

In order to enhance superficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the Southern California area and plants relative to native plants are generally desirable. Plants native to other semiarid and arid areas may also be appropriate. A Landscape Architect would be the best party to consult regarding actual types of plants and planting configuration.

IRRIGATION

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.

Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.

Though not a requirement, consideration should be given to the installation of near-surface moisture monitoring control devices. Such devices can aid in the maintenance of relatively uniform and reasonably constant moisture conditions.

Property owners should be made aware that overwatering of slopes is detrimental to slope stability.

MAINTENANCE

Periodic inspections of landscaped slope areas should be planned and appropriate measures should be taken to control weeds and enhance growth of the landscape plants. Some areas may require occasional replanting and/or reseeding.

Terrace drains and drowndrains should be periodically inspected and maintained free of debris. Damage to drainage improvements should be repaired immediately.

Property owners should be made aware that burrowing animals can be detrimental to slope stability. A preventative program should be established to control burrowing animals.

As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period of time prior to landscape planting.

REPAIRS

If slope failures occur, the Geotechnical Consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

If slope failure occurs as a result of exposure to periods of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer 1 foot to 3 feet of a slope face).

TRENCH BACKFILL

Utility trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 95 percent of the laboratory maximum density.

Approved granular material (sand equivalent greater than 30) should be used to bed and backfill utilities to a depth of at least 1 foot over the pipe. This backfill should be uniformly watered, compacted and/or wheel-rolled from the surface to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to at least 3 percent above the optimum moisture content, and mechanically compacted to at least 95 percent of maximum dry density (based on ASTM D1557).

Backfill of exterior and interior trenches extending below a 1:1 projection from the outer edge of foundations should be mechanically compacted to a minimum of 95 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to 1 foot wide and 2 feet deep may be backfilled with sand and consolidated by uniformly watering or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of back-fill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the Contractor may elect the utilization of light weight compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the Geotechnical Consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the Geotechnical Consultant.

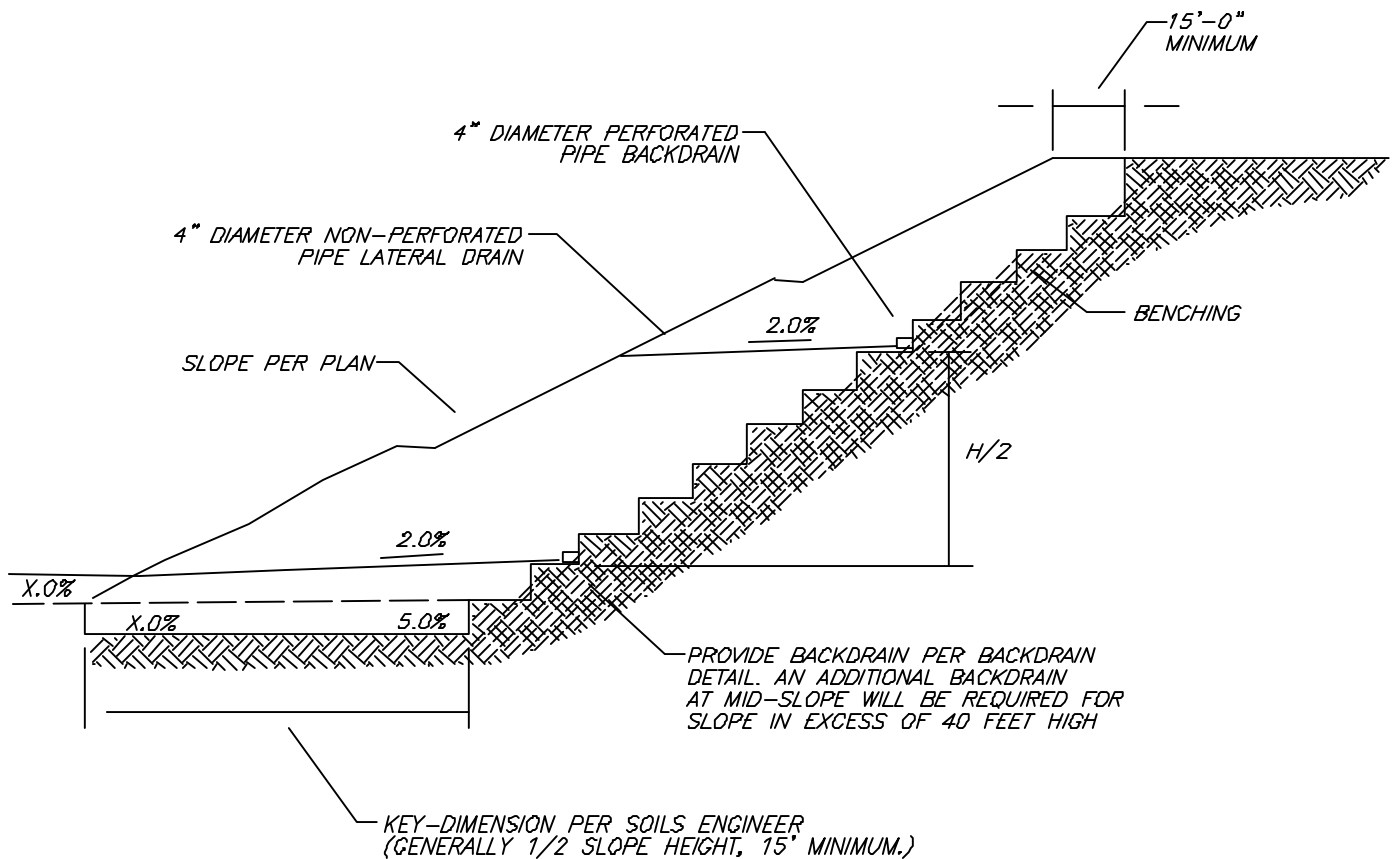
Clean Granular backfill and/or bedding are not recommended in slope areas unless provisions are made for a drainage system to mitigate the potential build-up of seepage forces.

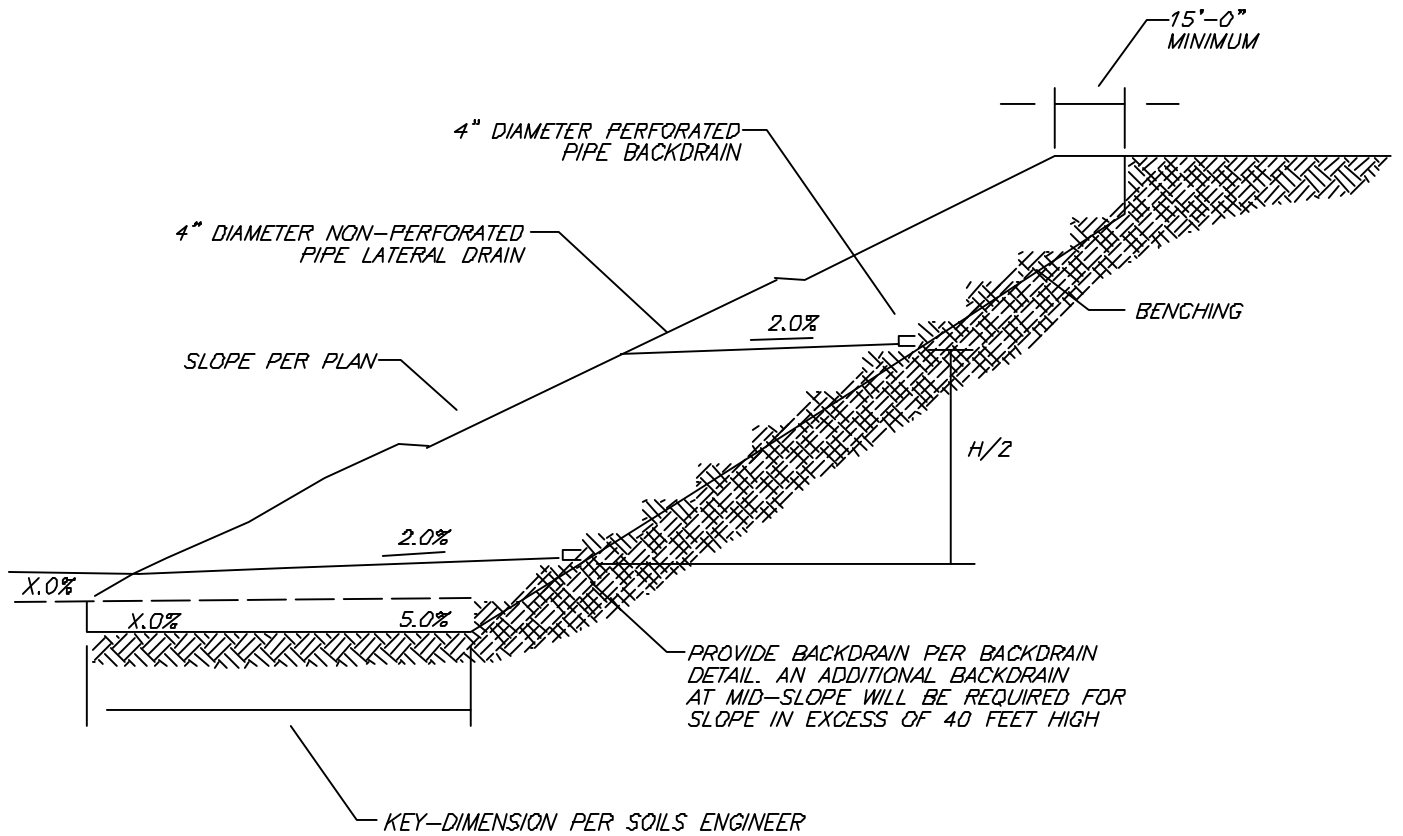
STATUS OF GRADING

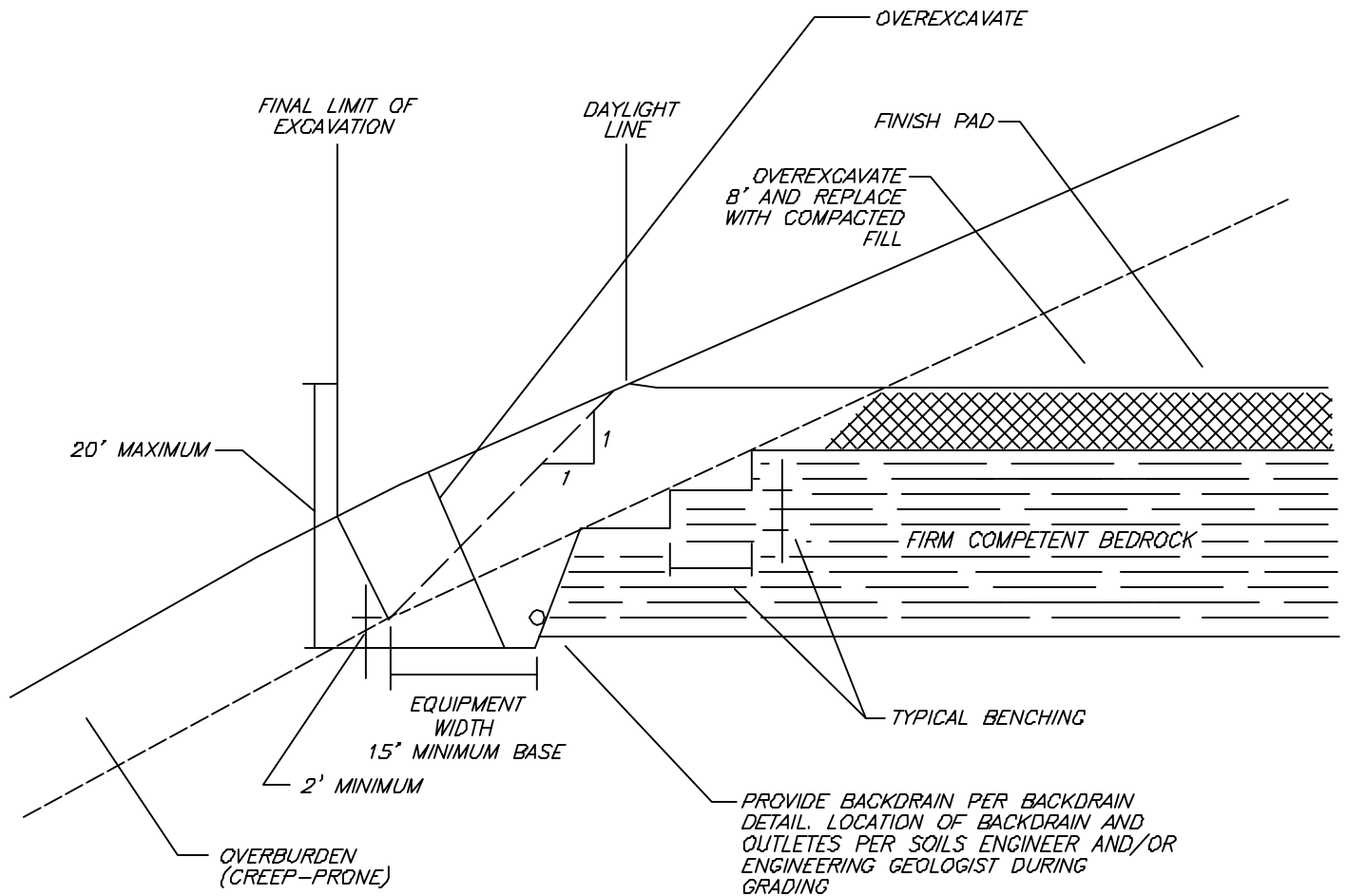
Prior to proceeding with any grading operation, the Geotechnical Consultant should be notified at least two working days in advance in order to schedule the necessary observation and testing services.

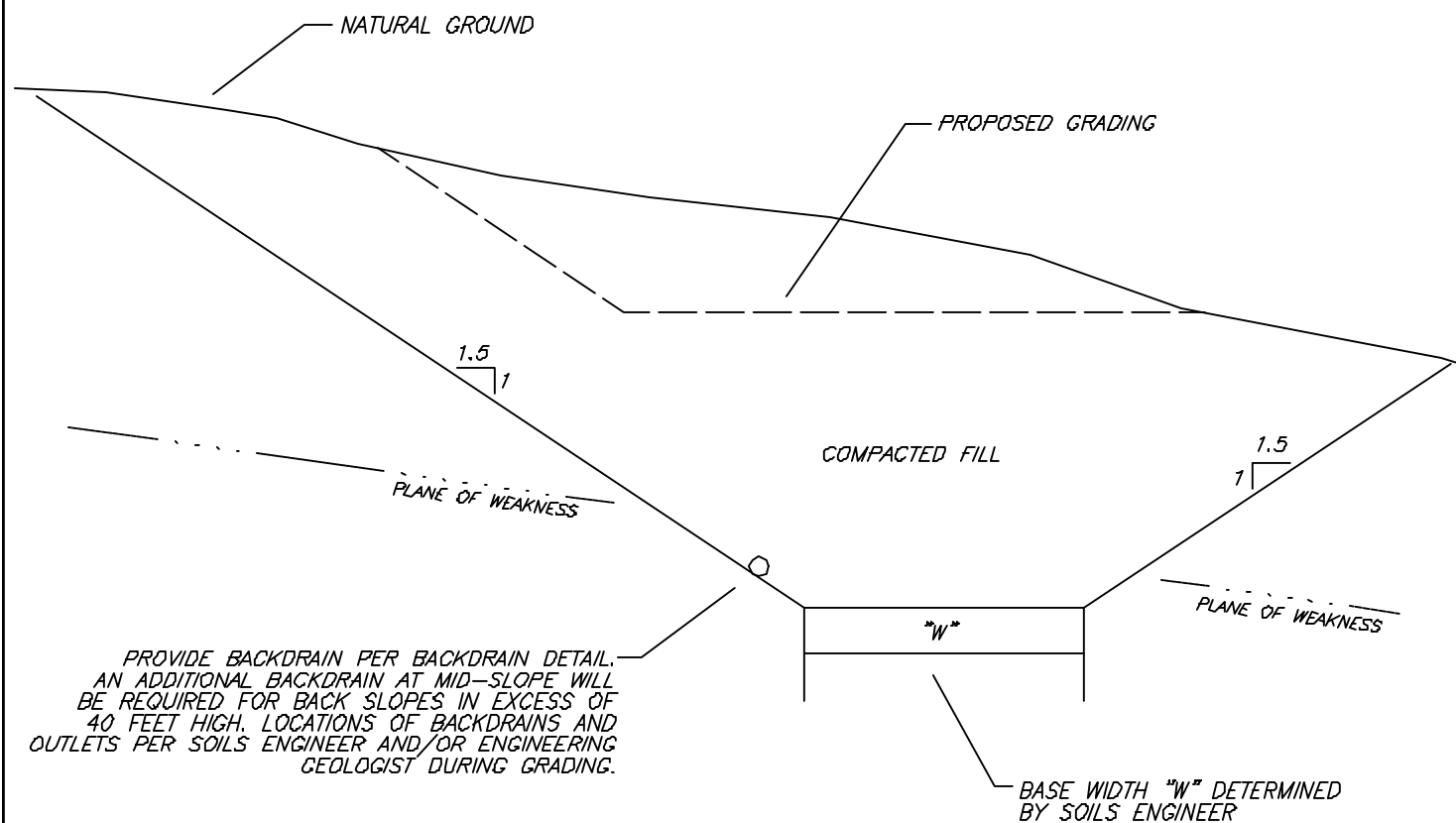
Prior to any significant expansion of cut back in the grading operation, the Geotechnical Consultant should be provided with adequate notice (i.e., two days) in order to make appropriate adjustments in observation and testing services.

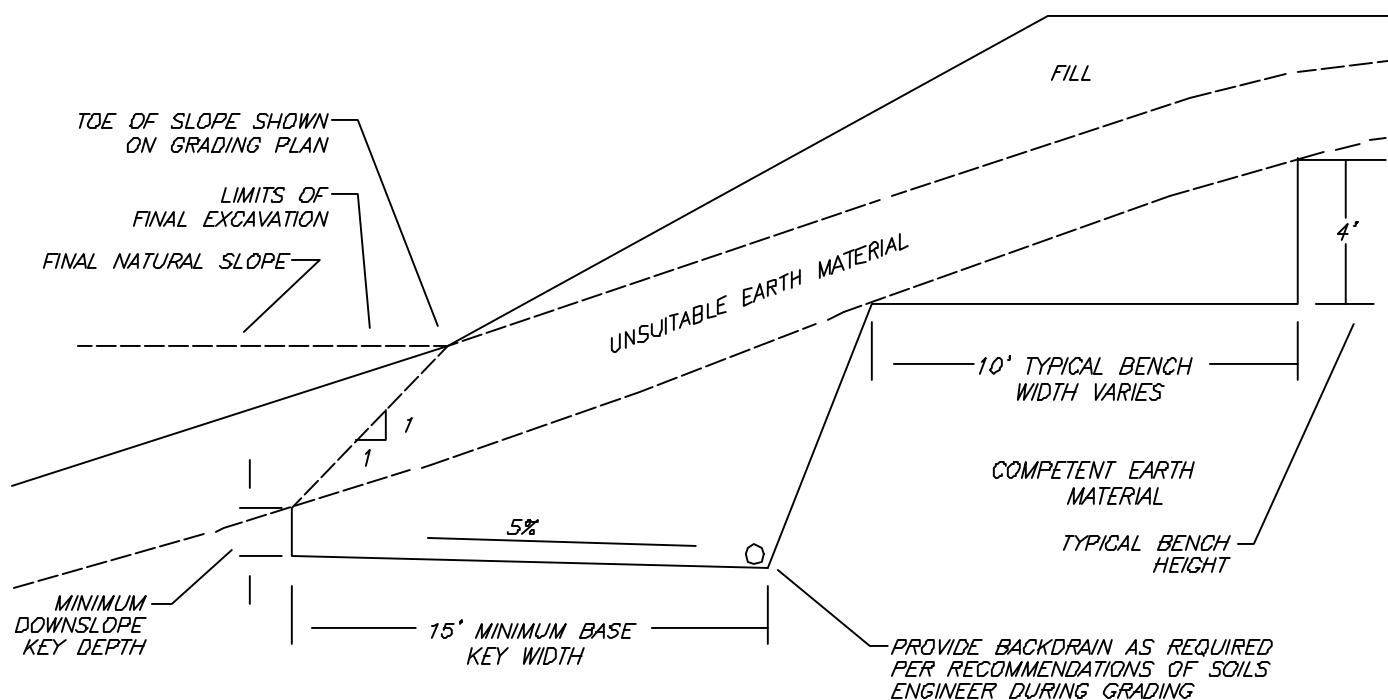
Following completion of grading operations and/or between phases of a grading operation, the Geotechnical Consultant should be provided with at least two working days notice in advance of commencement of additional grading operations.



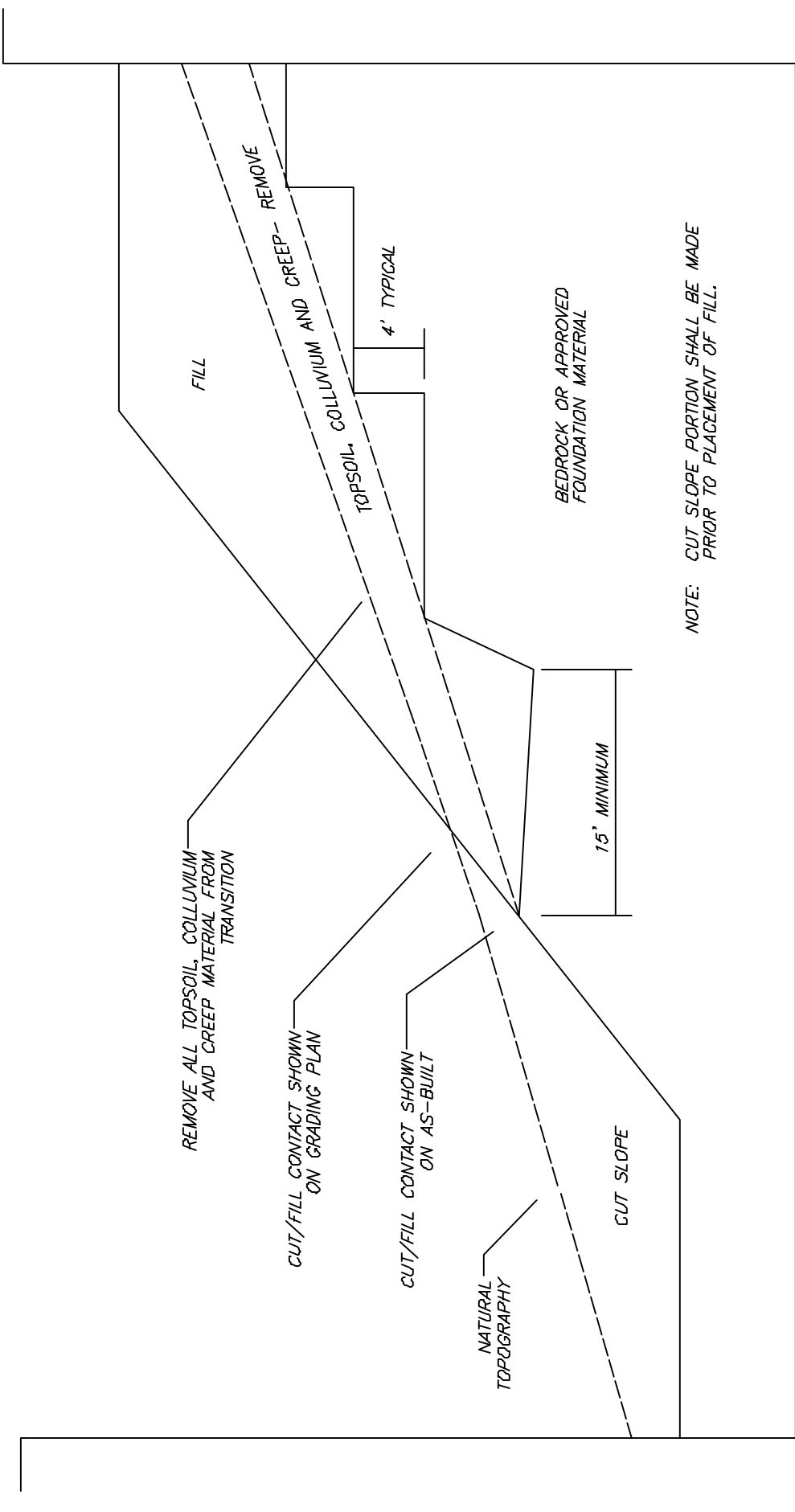




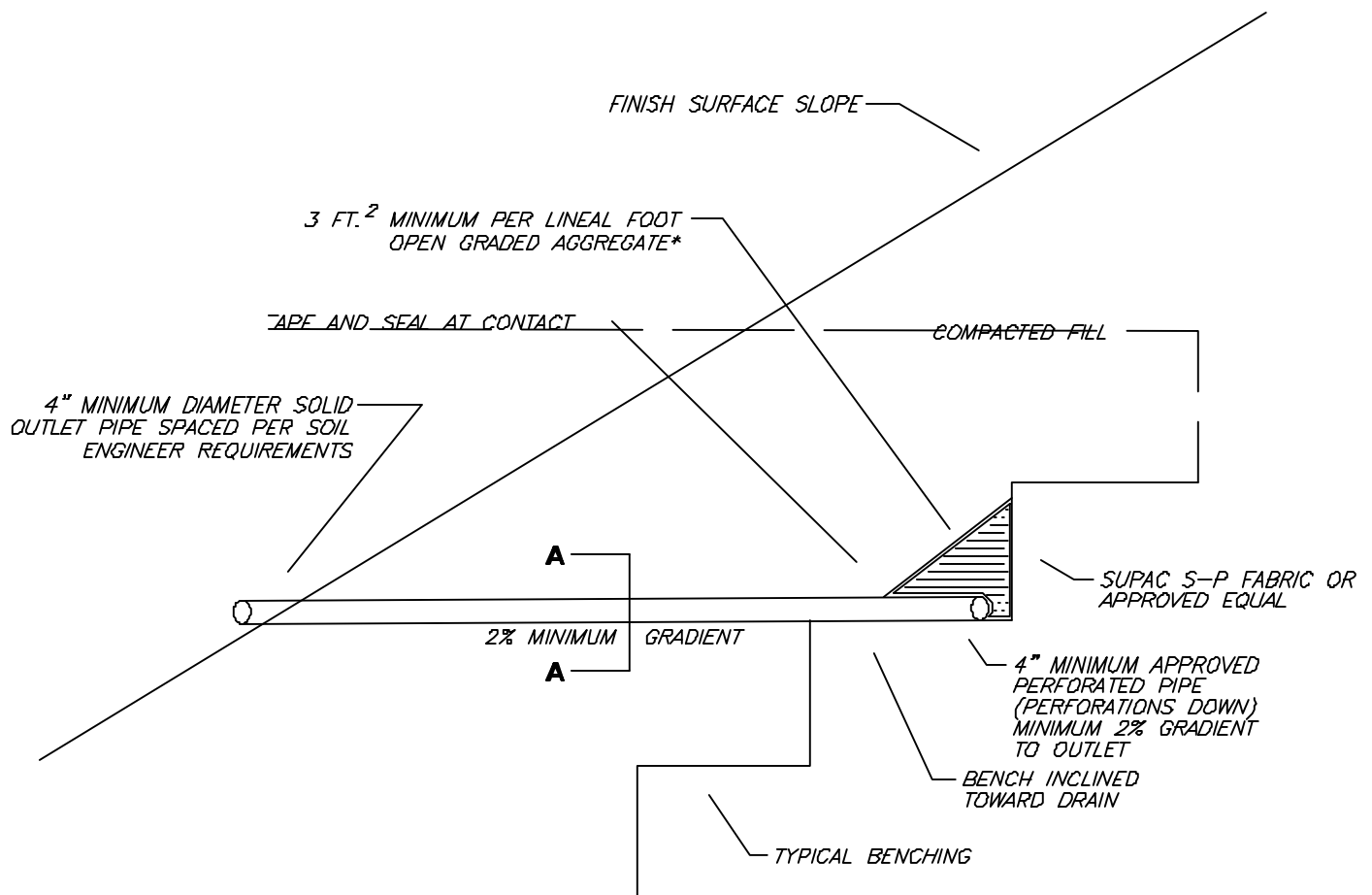




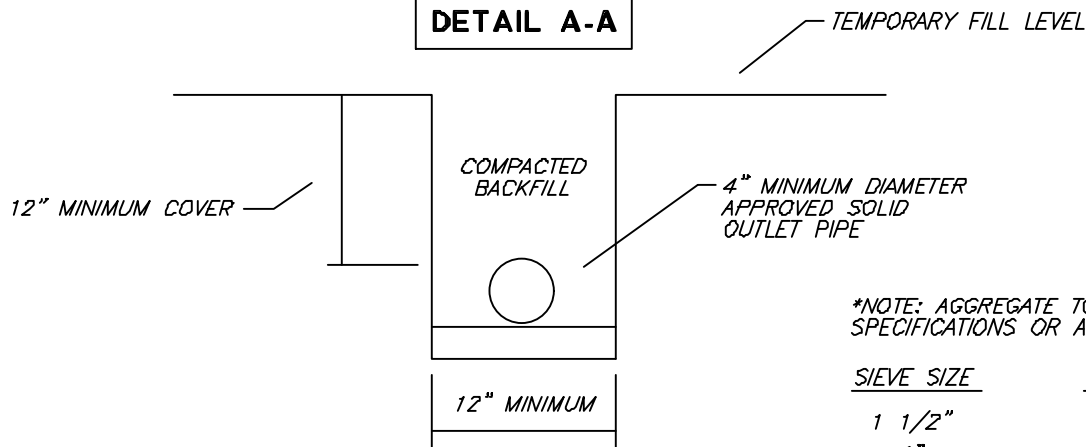
WHERE NATURAL SLOPE IS 5:1 OR LESS,
BENCHING IS NOT NECESSARY, HOWEVER, FILL IS
NOT TO BE PLACED ON COMPRESSIBLE OR
UNSUITABLE MATERIAL.



FILL SLOPE ABOVE CUT SLOPE
DETAIL



DETAIL A-A



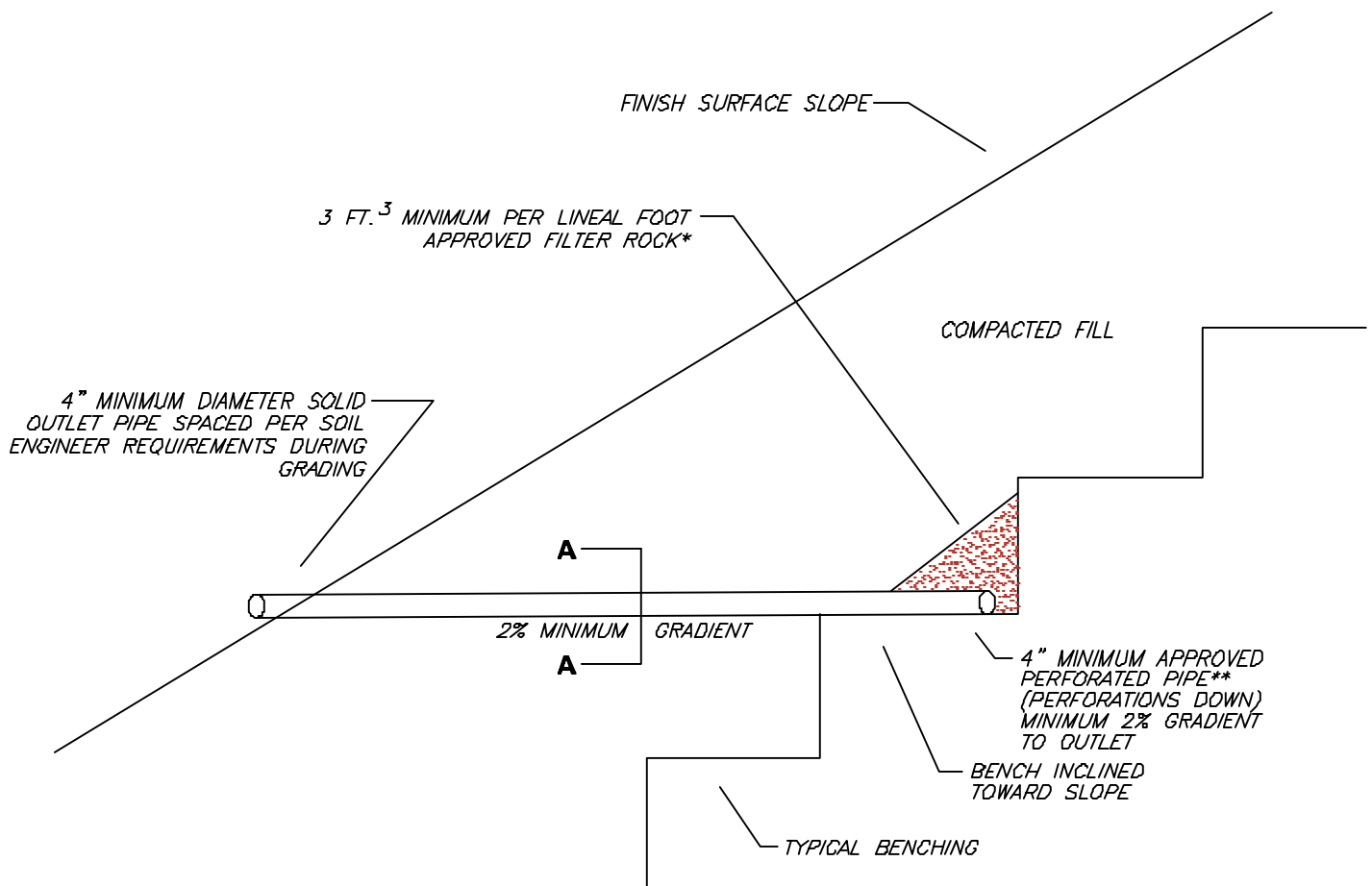
*NOTE: AGGREGATE TO MEET FOLLOWING
SPECIFICATIONS OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	100
1"	5-40
3/4"	0-17
3/8"	0-7
NO. 200	0-3

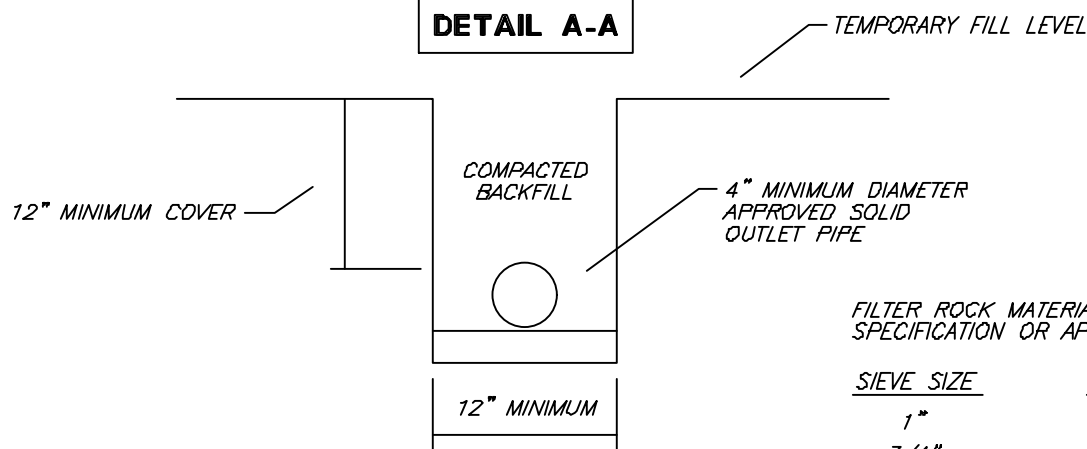


BACKDRAIN DETAIL (GEOFABRIC)

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 7



DETAIL A-A



****APPROVED PIPE TYPE:**

SCHEDULE 40 POLYVINYL CHLORIDE
(P.V.C.) OR APPROVED EQUAL.
MINIMUM CRUSH STRENGTH 1000 PSI.

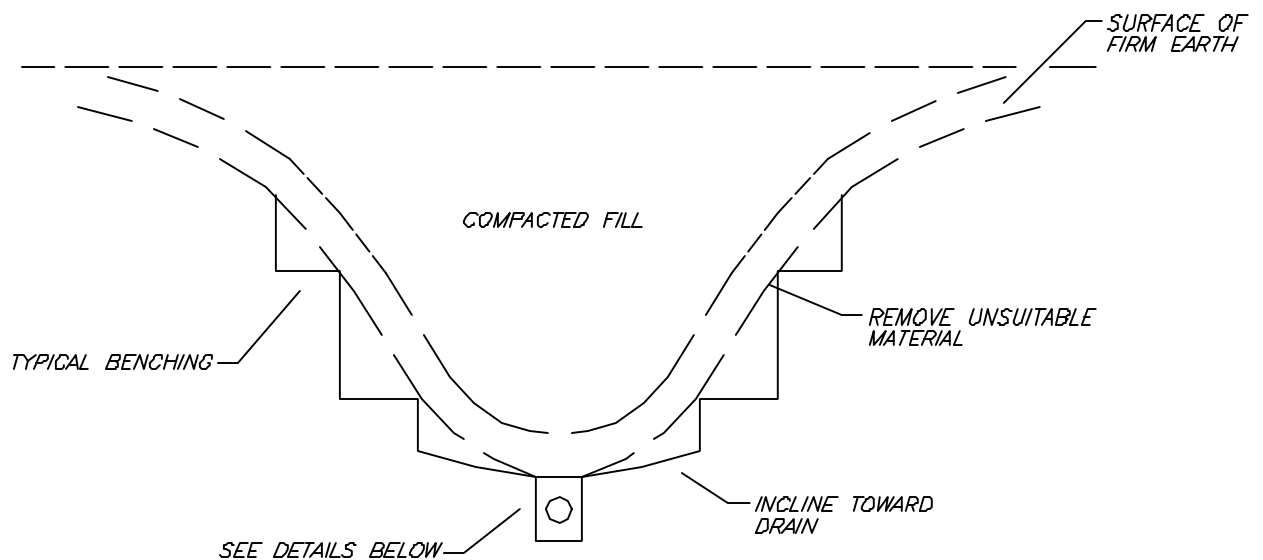
FILTER ROCK MATERIAL TO MEET FOLLOWING
SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3



TYPICAL BACKDRAIN DETAIL

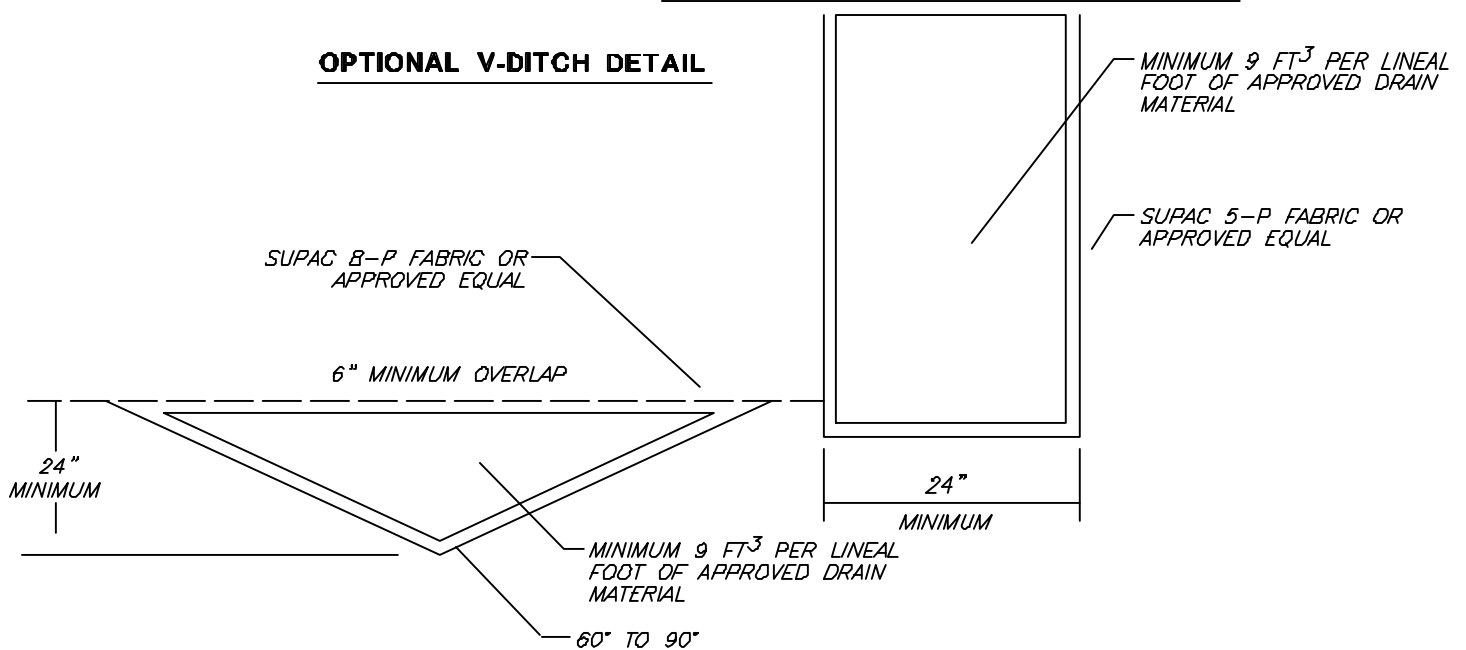
GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 8



TRENCH DETAIL

6" MINIMUM OVERLAP

OPTIONAL V-DITCH DETAIL



DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1-1/2"	88-100
1"	5-40
3/4"	0-17
3/8"	0-7
NO.:200	0-3

ADD MINIMUM 4" DIAMETER APPROVED PERFORATED PIPE WHEN GRADIENT IS LESS THAN 2%

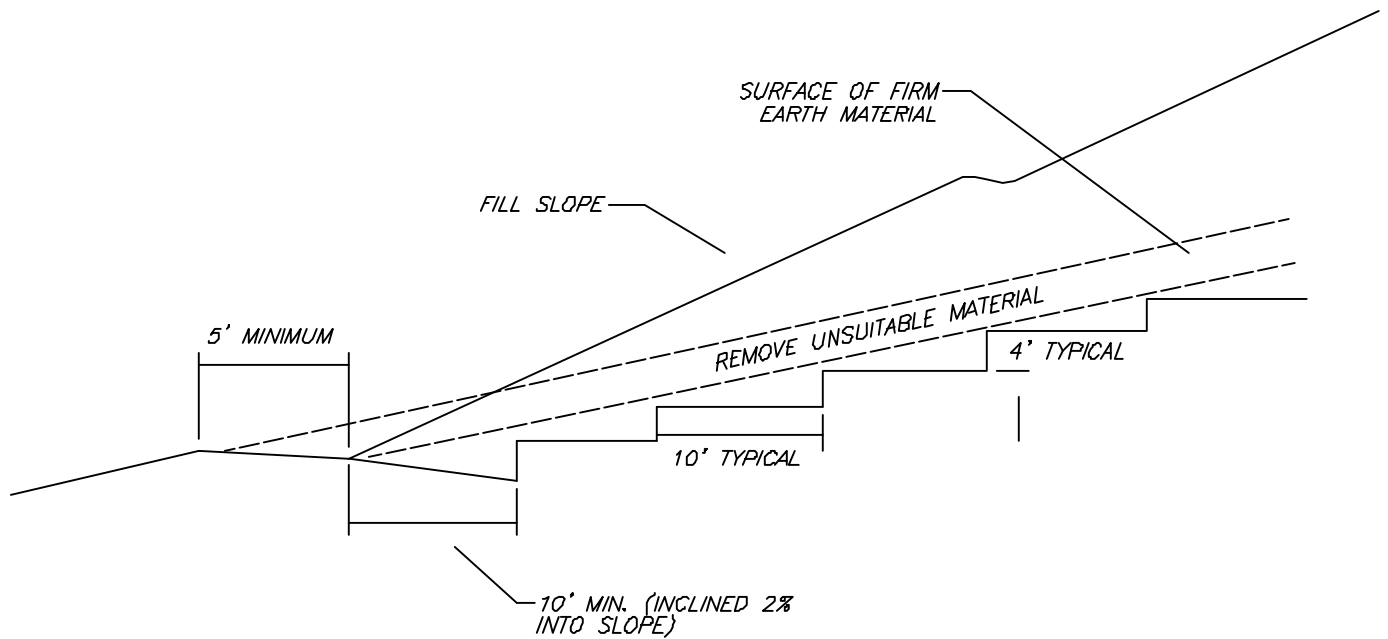
APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.



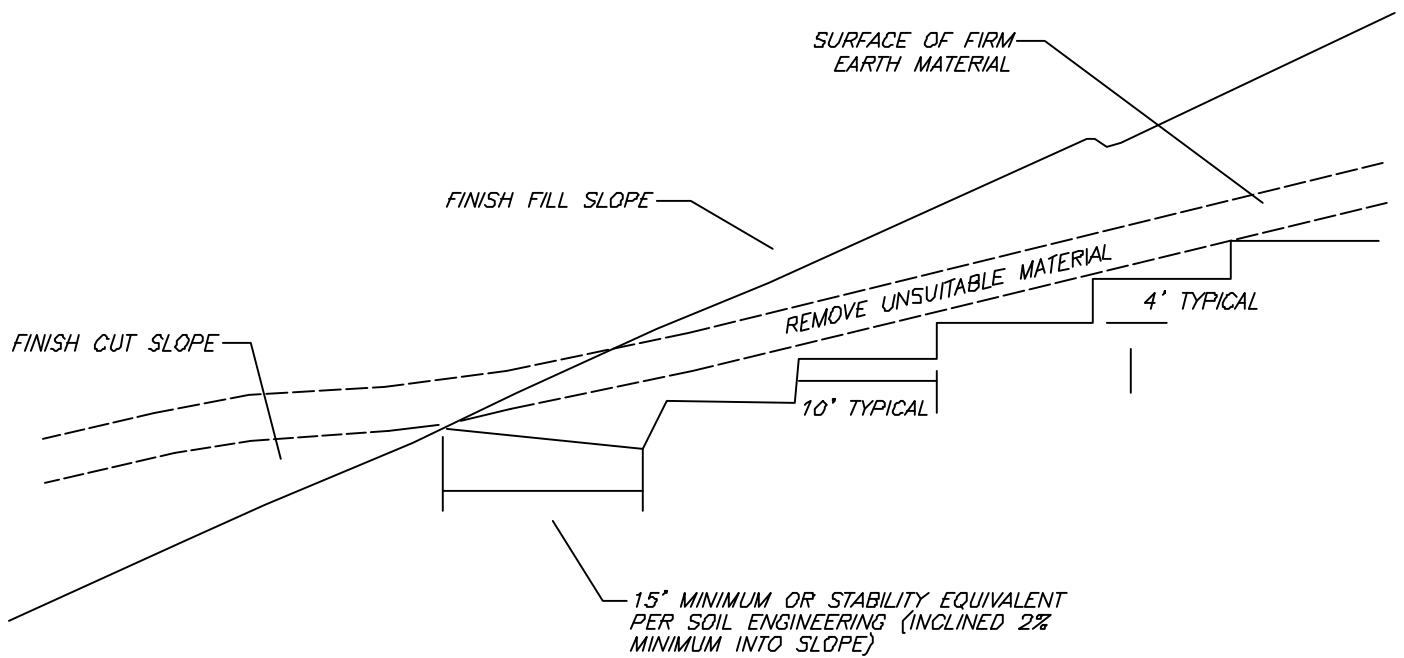
GEOFABRIC SUBDRAIN DETAIL

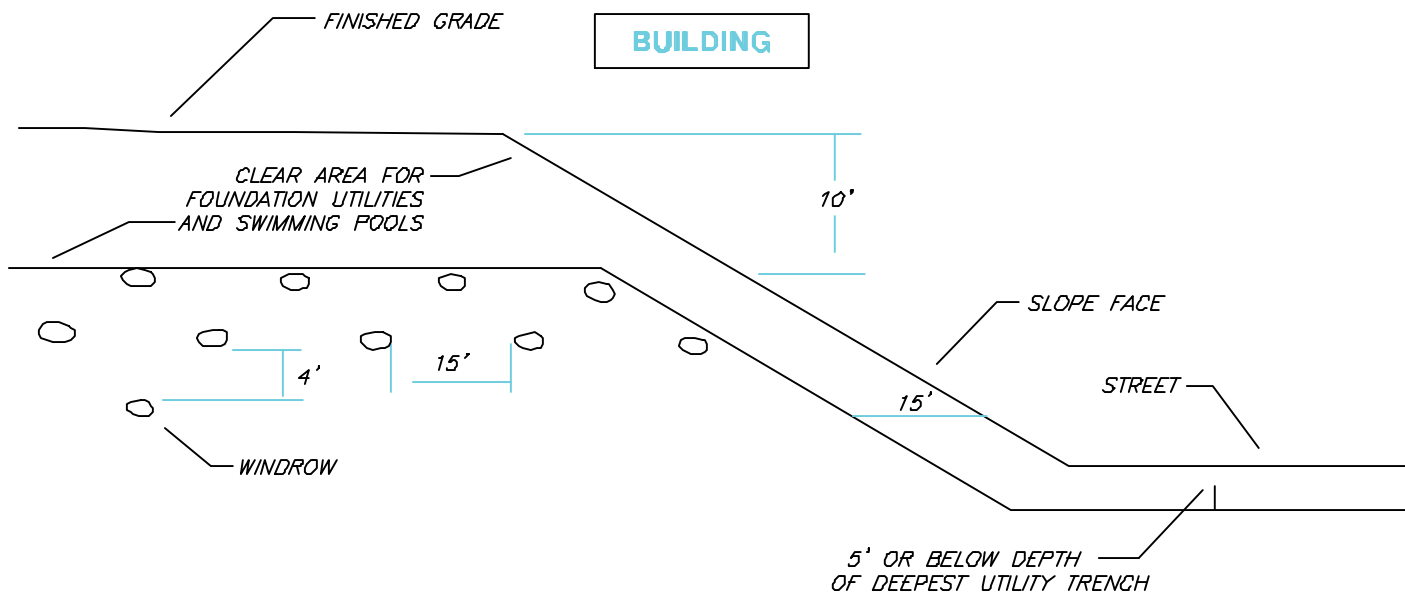
GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 9

BENCHING FILL OVER NATURAL

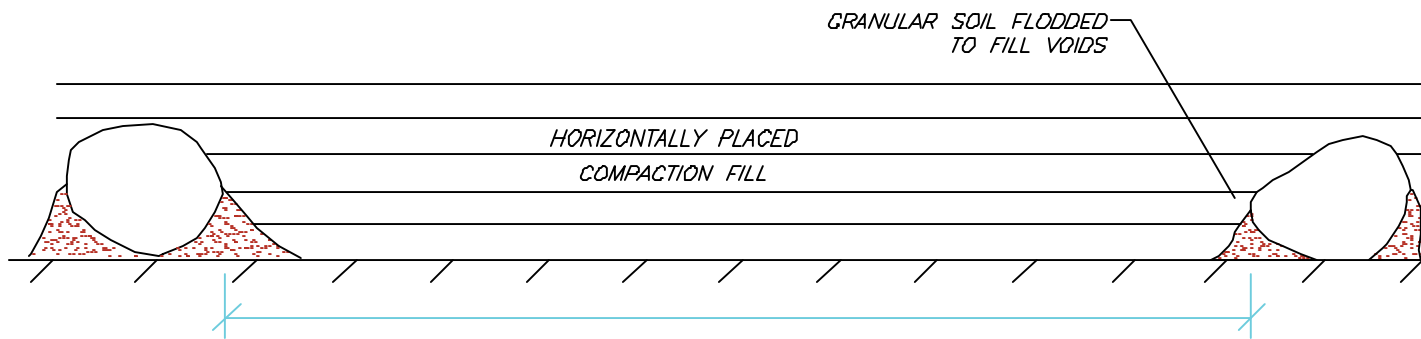


BENCHING FILL OVER CUT

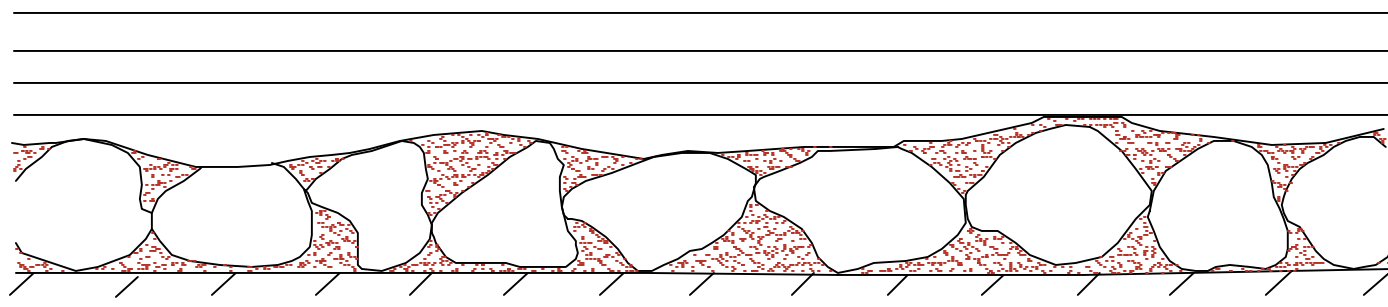




TYPICAL WINDROW DETAIL (EDGE VIEW)

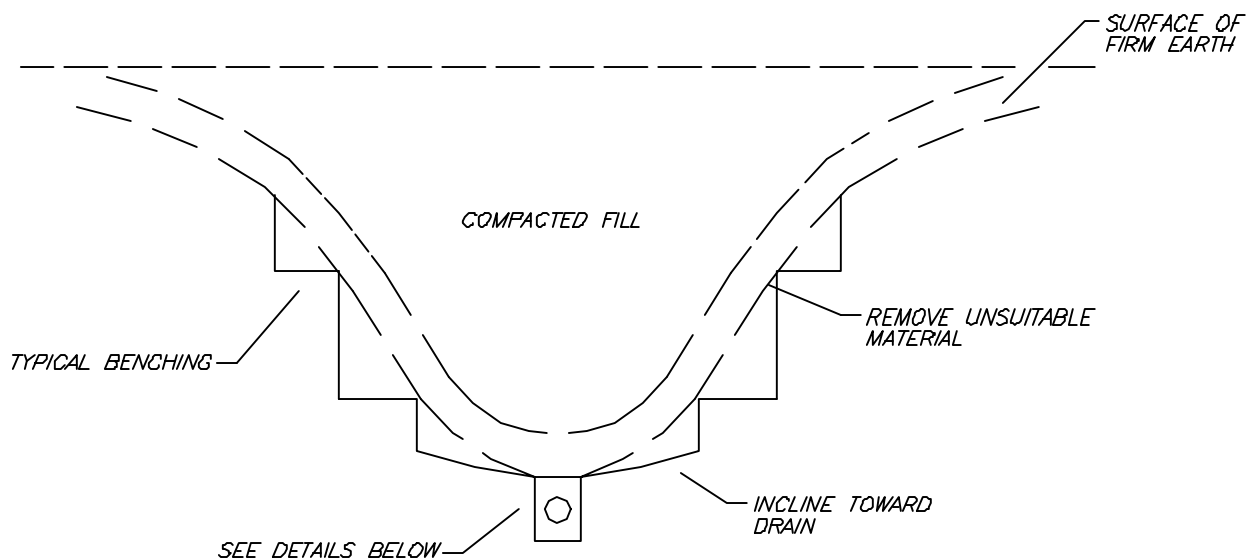


PROFILE VIEW

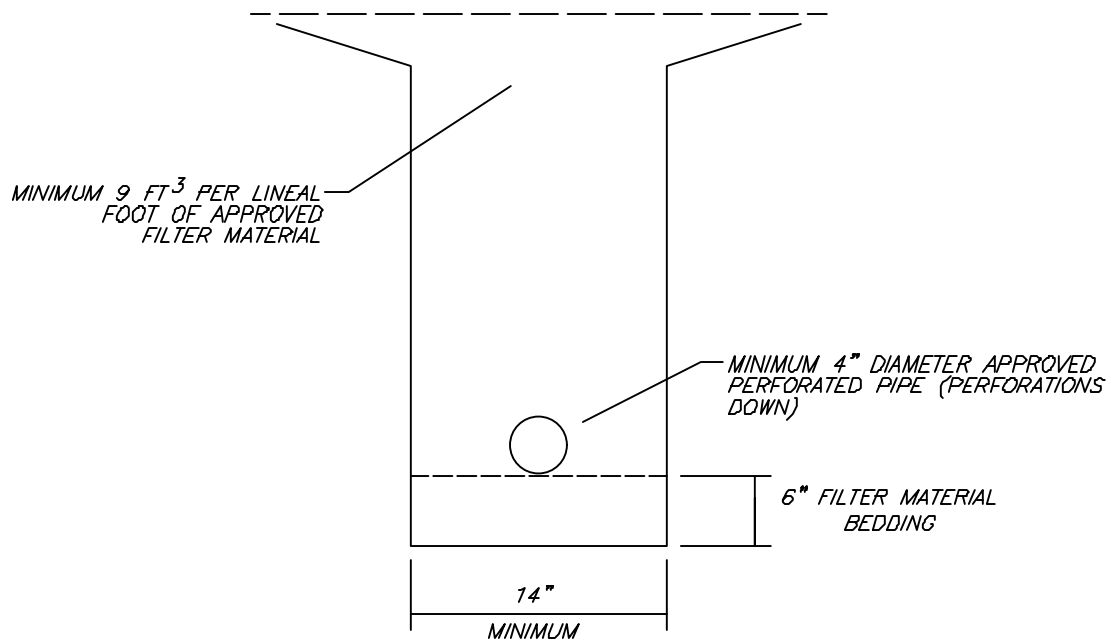


ROCK DISPOSAL DETAIL

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 11



TRENCH DETAIL



FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

<u>SIEVE SIZE</u>	<u>PERCENTAGE</u>
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA. SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING.

<u>LENGTH OF RUN</u>	<u>PIPE DIAMETER</u>
UPPER 500'	4"
NEXT 1000'	6"
> 1500'	8"



TYPICAL CANYON SUBDRAIN DETAIL

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 12

