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GEOTECHNICAL ENGINEERING REPORT
PROPOSED OAK VISTA NO. 7
DRAPER, UTAH

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED OAK VISTA NO. 7
DRAPER, UTAH

Prepared For

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PSI PROJECT 710-45012

February 24, 2004

the proposed roads and utilities provided the recommendations of this report are properly followed. Portions of the site are underlain by highly expansive soils, which will require special precautions to be undertaken to minimize potential pavement distress. Additional details are provided in the attached report.

It has been a pleasure to serve you on this project. Please call us if you have any questions or need additional information.

Respectfully,
Professional Service Industries, Inc.

SCOTT GREENBERG, E.I.T.
Field Engineer

Reviewed By:

JAMES W. NIEHOFF, P.E.
Chief Engineer

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SG/JWN/CTS

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February 24, 2004

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Wells Fargo Center
299 South Main Street
Suite 1700
Salt Lake City, Utah 84111

Geotechnical Engineering Report
Proposed Oak Vista No. 7
Draper, Utah

PSI Project No. 710-45012

Dear Mr. Baird:

We are pleased to submit this report of our geotechnical engineering report for the proposed Oak Vista No. 7 that will be constructed north of Traverse Ridge Road and west of the proposed Oak Vista No. 11 in Draper, Utah. This report is a revision of a previous preliminary report submitted to SunCrest on July 3, 2002 under PSI File No. 710-25043. Details of our findings and recommendations along with the supporting field data are presented in the attached report.

A total of four (4) test pits (Test Pits TP-9 to TP-12) were excavated within the proposed development extending to depths ranging from 12 to 20 feet below existing site grades. An additional seventeen (17) test pits were excavated within the proposed Oak Vista Nos. 11, 12, and Special Use area.

In general, the subsurface soils across the site consists of up to 2-feet of clayey silty topsoil underlain by tertiary block and ash flows, andesitic lava flows and pyroclastic ash and tuff deposits. The andesite is usually slightly to completely weathered with either a fat clay matrix or a sand-gravel-silt matrix. Groundwater was not encountered during the field investigation.

Based upon our field and laboratory tests, the site appears to be generally suitable for

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INTRODUCTION

Authorization

This report presents the findings of a geotechnical study for the proposed Oak Vista No. 7 in Draper, Utah. The work was performed in general accordance with our proposal dated February 11, 2003.

Purpose and Scope of Services

The purpose of this investigation was to generally characterize subsurface conditions at the site and to provide recommendations regarding site development. The scope of the exploration and analysis included the following:

- PSI excavated a total of four (4) test pits utilizing a track-mounted hoe. A graphical representation of the soils encountered and other pertinent information is presented on the test pit logs included in the Appendix of this report.
- PSI conducted a geotechnical engineering evaluation of the available data to provide recommendations regarding site development including slope stability of cuts/fills, compaction criteria, erodability, and excavation requirements of the soil and bedrock, pavement design, subdrains, and alternatives to cut and fill slope angles (if necessary).

The geotechnical scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below or around this site.

Project Information

PSI understands that the site development will consist of grading operations, which will include cuts of up to 16 feet and fills of up to 13 feet in thickness. Asphalt paved roads and underground utility installation will also be a part of the development.

The geotechnical recommendations presented in this report are based on the available project information and the subsurface materials described in this document. The recommendations provided in this report pertain to Oak Vista No. 7 at SunCrest. Additional test pits were excavated outside the project area and consist of TP-0 through TP-8 and TP- 13 to TP-20. Although the test pit logs for these borings are not provided in this report, the laboratory data for the materials are presented herein based on similar soil types and it is anticipated those materials may be utilized as part of the grading process.

If the project is developed differently than the current plan, then PSI should be notified of those changes to reevaluate the recommendations provided herein. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

Oak Vista No. 7 is located on the north side of the Traverse Mountains at SunCrest in Draper, Utah. The site is bordered by undeveloped land to the east, west, and north, and by Traverse Ridge Road to the south. The site is covered with scrub oak, sagebrush, rabbit brush and some sparse native grasses.

Regional Geology

SunCrest is located within the east Traverse Mountains. Most of the area of SunCrest is within that part of the Traverse Mountains underlain by Tertiary volcanic rocks of inferred Oligocene age. The rocks have been described as volcanic breccias, flows and tuffs, unconsolidated deposits of Quaternary age that include old Quaternary age landslide deposits and widespread alluvium and colluvium (slopewash) deposits of clay to boulder size sediments. The geology of the site and the age and distribution of potential landslide deposits, have been described in previous reports (see the Landslide Inventory Map of SunCrest, dated February 2004, and the Geology and Geologic Hazards Report for SunCrest, Dated February 2004).

In the area of Oak Vista No. 7, the alluvial and colluvial deposits consist of silty clays to silty fine sands and clays (generally expansive) with sub-angular pebble to cobble-sized rock fragments. Tertiary rocks (typically block and ash flows, andesitic lava flows and pyroclastic ash and tuff deposits) underlie these deposits at depths of only a few feet.

Landslides are known to exist at SunCrest (see the Landslide Inventory Map of SunCrest). Several specific areas have been identified for detailed landslide analysis. There are no landslides mapped or suspected in the study area of this report. The nearest area identified is located to the west. Oak Vista No. 7 sits on the east side of a bedrock ridge separating the planned development from the landslide. We conclude there is no potential impact on the site area. but what about vice versa?

A geologic hazards evaluation for SunCrest has been prepared and was submitted under separate cover. This report follows the "Guidelines for Preparing Engineering Geologic Reports in Utah" published by the Utah Geological Survey (Utah Section of AEG, 1986). The landslide portion of the report follows the UGS report "Guidelines for Evaluating Landslide Hazards in Utah" (Hylland, 1996).

Of the 15 geologic hazards commonly encountered in Utah (Utah Section of AEG, 1986), we found negligible potential in SunCrest for 6 of them (**surface and groundwater pollution, rock fall, collapsible soil, subsidence, erosion** and **liquefaction**). Six other hazards were also found to have negligible potential in Oak Vista No. 7 (**flood inundation, debris flow, deposition, snow avalanche, surface fault rupture** and **landslides**).

There is remote potential (return period of about 1,300 years) for **strong earthquake ground shaking**, associated with magnitude 7+ earthquakes on the Wasatch fault. Such earthquakes could produce **surface fault rupture** in a small area in the extreme northeastern part of SunCrest but not in the area of Oak Vista No. 7. **Landslides** do not exist within the areas of Oak Vista No. 7 (see Landslide Inventory Map, February 2004). Landslides that exist elsewhere at SunCrest are being addressed by site-specific landslide studies. **Shallow groundwater** was not found in test pits in Oak Vista 7. **Expansive soils** do exist at natural grades, but should be addressed by standard engineering practices during grading operations.

There is no evidence of faults passing near the site, see Figure A-2 (Interim Map & Report by Biek, 2003).

Site Analysis

Field Investigation

Four test pits (TP-9 through TP-12) were excavated for this project. An additional seventeen (17) test pits (TP-0 to TP-8 and TP-13 to TP-20) were excavated within the proposed Oak Vista Nos. 11, 12, and Special Use area. The test pits locations were determined by PSI and located in the field by The Keith Companies using land survey techniques. Test pits were excavated to depths ranging from 12 to 20 feet below the existing ground surface. The test pits were excavated using a track-mounted hoe. During the course of the field exploration program, both disturbed grab samples and undisturbed samples were collected at select intervals for laboratory testing. Additionally, soils encountered were logged by a field engineer from PSI, which included field classification of the various stratas encountered.

Locations of these test pits are shown on Figure A-2, *Site Plan and Approximate Locations of Test Pits* presented in the Appendix. The soil profiles encountered are described in the (Soil Profile) section of this report.

Laboratory Testing

The soil samples collected were visually classified using the Unified Soil Classification System (USCS) in the field. Representative soil samples were subsequently tested to assess applicable engineering properties of the soils. Tests included mechanical sieve analysis, Atterberg Limits, and moisture-density relationships as per ASTM 698. The results of the analyses are presented in Table 1: Summary of Laboratory Testing included in the Appendix B of this report.

Subsurface Conditions

Soil Profile

Based on data from the test pits, the subsurface soils across the site consists of 12-inches to 24-inches of clayey silty topsoil underlain by tertiary block and ash flows, andesitic lava flows and pyroclastic ash and tuff deposits. The andesite is usually slightly to completely weathered with either a fat clay matrix or a sand-gravel-silt matrix. In accordance with the Unified Soil Classification System, the soils below the topsoil classify as CH, CL, SP, and SM soils. Lean or fat clay was encountered extending to the maximum depth explored in Test Pits TP-10 through TP-12. Silty sand and poorly graded sand was encountered in Test Pits TP-9 and TP-13 with no clay encountered.

Please refer to the Test Hole Logs, Figures A-11 through A-14 in Appendix A. Figure A-15 is the key to symbols and abbreviations used on the Test Pit Logs.

The above subsurface description is of a generalized nature, provided to highlight the major subsurface stratification features and material characteristics. The Test Pit Logs included in the Appendix should be reviewed for specific information as to individual test pit locations. The stratifications shown on the Test Pit Logs represent the conditions only at the actual test pit locations. Variations may occur and should be expected between test pit locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

Groundwater Measurements

Groundwater was not encountered during the field investigation. It should be noted that it is possible for the groundwater table to fluctuate during the year depending upon climatic and rainfall conditions. Additionally, discontinuous zones of perched water may exist within the overburden materials. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. We recommend that the building contractors evaluate the groundwater levels at the site at the time of the construction activities.

EVALUATION AND RECOMMENDATIONS

Geotechnical Discussion

The primary concern at this site that will affect construction and the performance of the proposed development is the presence of expansive clays encountered throughout the site. Based upon the results of our exploration for this development, normal construction practices can be used for this site provided the procedures below are followed regarding handling of highly expansive clays.

We recommend overexcavation of at least 3 feet of any expansive clay encountered beneath roadways. Expansive clay is defined as any material that shrinks or swells significantly with changes in moisture. These materials generally have a Liquid Limit of

35 or greater and a Plastic Index of 15 or greater

Where feasible, planning should be done to allow for placement of the highly expansive material in the lower portions of deep fill areas. We recommend that all roadway areas and utility trench backfilling be observed and tested to determine the nature of the exposed ground and whether overexcavation is necessary.

Slope Stability Analysis

A slope stability analysis was completed for three proposed cut slopes (slopes 4, 5 and 6) and four proposed fill slopes (1, 2, 3, and 7). The seven slopes are shown on Figure A-2 in the Appendix. Analysis for the cut and fill slopes followed the Simplified Bishop method of slices. An infinite slope analysis was also performed to address surficial slope stability.

The proposed cut slopes incorporate 1.5H:1V grades. The fill slopes will incorporate 2H:1V grades.

The strength parameters of the soil employed in the analyses were determined based on similar soil characteristics from those tested in the laboratory using direct shear testing. Laboratory tests were performed on soil samples obtained from Maple Hollow No. 10, 11, and 13 and Eagle Crest No. 4. The parameters used in our analyses are presented in the following table:

Material/Parameter	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Saturated Unit Weight (pcf)
Clay/Fill (EC-4 TP7 @ 3')	21	500	114	120
Sand (MH TP4 @ 8')	37	0	123	130

Landslide studies being conducted for SunCrest follow the recommendations presented in the "***Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California***". For consistency, slope stability analyses follow the same evaluation criteria as are being used for landslide stability analyses. As recommended, a factor of safety (FS) of 1.5 under static conditions is used, and a factor of safety of 1.0 under seismic conditions is used in the analyses. A peak horizontal ground acceleration of between 0.20g and 0.25g was taken from the U.S.G.S. National Seismic Hazard Map (1996) representing a 10% probability of exceedance in 50 years. Consistent with the guidelines, a maximum ***k***-value (seismic coefficient) of 0.15 was used in the calculations.

Based on the results of stability analyses performed, all sections analyzed meet acceptable factors of safety. As recommended in those guidelines, no additional analyses are required for slopes that initially meet acceptable factors of safety. Slope stability results are shown in Figures C-1 to C-14 in Appendix C.

Site Preparation Recommendations

Site Stripping

Topsoil and vegetation should be stripped from all areas which will support structures, pavements and new fill. Generally, the topsoil is expected to range from 1 to 2-feet in thickness. The topsoil may be stockpiled for later use (e.g. for re-vegetation of slopes). Topsoil may be placed on manufactured slopes in thicknesses of up to 12 inches.

After topsoil has been stripped, any remaining major root systems must also be removed to achieve an organic content of 5% or less. The depth of removal for the major root systems is estimated to be on the order of an additional 1 to 3 feet below the topsoil. The soils removed during this operation may be used as structural fill if they meet or can be processed to meet the structural fill requirements. A qualified engineer or his representative from PSI should supervise all stripping, grubbing and stockpiling of materials.

General Site Preparation

Expansive soils that are encountered near subgrade elevations for roadways should be removed and replaced with at least 3 feet of properly compacted, non-expansive native soil or structural fill. Expansive clay is defined as any material that shrinks or swells significantly with changes in moisture. These materials generally have a Liquid Limit of 35 or greater and a Plastic Index of 15 or greater. Laboratory testing for swell potential can be conducted on questionable materials at the time of earthwork operations.

After stripping the topsoil and excavating the expansive soil to the recommended depths, as required, the subgrade should be observed by the geotechnical engineer, or his technical representative. Exposed subgrade areas should be proof-rolled with a loaded tandem axle dump truck or similar rubber tired vehicle, with an axle load on the order of 9 tons. Soils that are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load should be undercut and replaced with properly compacted fill. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. Once accepted, the subgrade soils should be scarified to a depth of 12-inches, moisture conditioned and recompacted to 95 percent of the maximum density as determined in accordance with ASTM D1557. If the subgrade is too soft/wet to proof-roll, we recommend that a stabilization fill be placed prior to placement of mass grading fills. A qualified engineer from PSI or his representative should supervise all site preparation work.

Shrinkage Factor

When borrow material is worked into a compacted state, the shrinkage factor is the ratio of the volume of compacted material to the volume of borrow material. The factor is used as an indicator of the loss or increase of the volume of borrow material after placement as fill. In order to determine the shrinkage factor, in place dry density tests were determined. Representative samples were then collected and transported to our

laboratory where standard Proctor density tests (ASTM 698) were performed. The following tables summarize the field and laboratory results.

TEST PIT NO.	DEPTH (Ft.)	IN-PLACE NUCLEAR GAUGE RESULTS		LABORATORY CORRECTED STANDARD PROCTOR RESULTS (ASTM 698)		USCS SOIL CLASS.	Shrinkage Factor
		IN-PLACE DRY DENSITY (PCF)	MOIST. CONTENT (%)	MAX. DRY DENSITY (PCF)	OPT. MOIST. CONTENT (%)		
TP-5	4	90.3	30.9	96	27.0	SC	1%
TP-7	4	91.0	21.5	103	22.5	SC	8%
TP-7	6	109.0	13.7	93	23.5	SC	-19%
TP-13	4	126.0	8.1	115	16.5	GP-GM	-13%
TP-18	4	88.3	30.0	98	25.0	CL	5%

Note that a negative value for Shrinkage Factor indicates a volume increase

We assumed that the fill soils would be placed at 95 percent of the modified Proctor values. However, standard proctor tests were performed on these samples. Therefore, the shrinkage factor was calculated by dividing 95 percent of the corrected standard Proctor values by the in-place dry density of the on-site soils. Based upon our soil studies, the shrinkage factors were then weighted according to the anticipated volume of each material. Based these data, we expect shrinkage representing a 5% loss in volume of on-site soils during placement or recompaction.

Mass Grading Fill

Fill for mass grading may consist of on-site soils, which are relatively free of organic or other deleterious materials. However, the best fill among native soils will be clayey sand or sandy clay where these materials are not highly expansive and will require less water for earthwork. The fill should have a maximum particle size less than 12 inches without full-time observation by PSI of placement. Larger particle sized cobble and boulders up to 2-feet in diameter may be used provided they are not nested to create large voids. Full-time inspection will be required where oversized materials are being placed. Oversize material should not be placed within 5 vertical feet of finished grade or within 5 horizontal feet of a slope face.

The soil characteristics of materials brought from off-site sources, other than those previously tested, will need to be tested for engineering strength properties prior to placement on fill slopes. This should consist of at least a gradation or Atterberg limit and a Direct Shear test.

Structural fill should be placed in maximum lifts of 8 inches of loose material and compacted on a horizontal plane. Moisture should be maintained at optimum or 2 percent above optimum moisture content as determined in accordance with ASTM D 1557. The fill should be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D 1557. If water must be added, it should be

uniformly applied and thoroughly mixed into the soil. Each lift of compacted fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts.

Stabilization Fill

We do not anticipate that stabilization fill will be required for this site if the site is graded during periods of dry weather. However, if saturated conditions are encountered, areas of extremely soft subgrade may require stabilization prior to structural fill placement. Stabilization fill consists of granular materials that have less than 5 percent fines. The fill is usually underlain by a stabilization geo-grid such as a Tensar BS 1100 or the placement of 4-inch rock pounded into the soft subgrade in 4-inch lifts until the rock no longer can be push into the subgrade.

Cut Slopes and Excavation Considerations

Based on provided site plans, we have identified three minor permanent cut slopes (Alignments 4, 5, and 6), which were analyzed to evaluate the overall factor of safety against instability. According to the plans provided, we understand that permanent cut slopes will be no steeper than 1.5H:1V. Based on the results of our stability analysis, we determined the planned cut slopes to have factors of safety greater than 1.5 and 1.1 under static and seismic conditions respectively. During construction of the cut slopes, we recommend interceptor ditches be provided at the top of cuts to collect and transmit surface runoff to designated areas where it can be collected and disposed of in a controlled manner. Ditches should be sloped as steep as possible to prevent ponding of water above the slope.

Normal construction practices can be employed over the site. It has been our experience that bedrock materials if encountered, should fracture sufficiently to allow for ripping and crushing using conventional excavation equipment.

Temporary construction excavations not exceeding 4 feet in height can be constructed with near-vertical side slopes. Deeper excavations not exceeding 10 feet in depth within fractured bedrock or cohesive soils, and not encountering groundwater, should be constructed with side slopes not steeper than 1:1. In fairly massive bedrock, steeper slopes may be considered. OSHA regulations should be observed for all excavations. If water is encountered, flatter slopes may be required. Actual slope angles will depend on soil or bedrock conditions exposed in the excavation.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor should evaluate the soil exposed in the excavations as part of his/her safety procedures. In no case should slope height, slope inclination, or excavation depth including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's (or other parties) compliance with local, state, and federal safety or other regulations.

Permanent Fill Slopes

We understand that the permanent fill slopes for the project will incorporate slopes no steeper than 2H:1V. Fill slopes (Alignments 1, 2, 3, and 7) were analyzed to evaluate the overall factor of safety against instability. The following recommendations are based on the assumption that on-site soil will be used for site grading and what is needed to obtain a factor of safety greater than 1.5 and 1.0 under static and seismic conditions respectively. Based on stability analysis results, all alignments analyzed meet acceptable factors of safety and no additional analyses are called for.

Deep Fills

Fills greater than 20 feet are not anticipated at this site.

Canyon Subdrains

We do not anticipate the need for canyon subdrains for Oak Vista No. 7 at SunCrest.

Import Fill

If needed, import fill may be used at this site. Imported fill should consist of a well-graded sand or gravel material that is relatively free of organic or other deleterious materials. Granular select material from on-site or off-site sources is generally easier to compact than on-site grading fill and less susceptible to long term consolidation. The structural fill should have a maximum particle size less than 6 inches, retain less than 40 percent on the ¾ inch sieve, and contain less than 25 percent fines (materials passing the No. 200 sieve). The liquid limit of the fines should not exceed 35 percent and the plasticity index should be less than 15. The fill should be placed in accordance with mass grading specifications.

Imported structural fill should meet the following minimum specifications:

Import Guideline Specification for Structural Fill	
Sieve Size	Percent by Weight Passing
6 Inch	100
3/4 Inch	50 – 100
No. 40	10 – 100
No. 200	10 – 60
Liquid Limit	<35 %
Plastic Index	<15 %

These recommendations are intended as guidelines to specify a readily available, prequalified material, if imported. Adjustments to the recommended limits can be provided to allow the use of other material. Any such adjustments must be made and approved by a PSI engineer in writing prior to importing fill to the site.

Utility Trenches

Utility trenches may be backfilled with the on-site soils. The on-site soils were predominately clayey but will likely be adequate for use as backfill material. Backfill soils used in areas not structurally loaded should be placed in maximum 8-inch lifts and compacted to 95 percent of the modified proctor maximum dry density (ASTM D 1557).

Backfill to at least 12 inches above the pipe crown of rigid (pipe bedding) should consist of materials meeting the following gradation limits.

Rigid Pipe Bedding Gradation Limits	
Sieve Size	Percent Passing by Weight
2"	100%
¾"	90%-100%
#16	45%-80%
Material finer than #200	Up to 12%

Flexible pipes should be bedded according to the manufactures specifications. Considering the moisture-sensitive condition of native soil conditions, the presence of a higher percentage of –200 material is desirable to prevent channeling of water through the trenches. However, clay lumps should not be allowed in the bedding material, as they will prevent uniform placement and compaction.

With the hilly topography of the site, we recommend that periodic clay cut-off walls be installed in the trenches. The cut off-off walls should be approximately 4 feet long and PSI inspectors under the direction of the engineer should verify placement. The clay cut-off should be installed at the top of grade breaks and at the following intervals:

1. Trenches with slopes <10% = cut-off at 500' intervals
2. Trenches with slopes >10% = cut-off at 100' intervals

If unstable soils are encountered at invert elevations, it may be necessary to excavate an additional depth and replace the unstable soils with structural/stabilization fill. The depth of over-excavation, if necessary, should be determined by field observation.

Special attention should be given to the installation of the eight inch diameter (HDPE DR-17) sewer line. The sewer line is planned along the north end of Oak Vista 7, connecting with the existing sewer line along Traverse Ridge Road. While the sewer right-of-way runs downslope along the vacated headscarp of polygon #12 (see Landslide Inventory Map of SunCrest, 2004), it appears to stay outside of the landslide deposit as mapped. The trenches should be constructed with a clay cut-off or equivalent on 50 foot centers along the steep portions of the right-of-way. For construction along the vacated headscarp, full time inspection by a geotechnical engineer from PSI will be necessary. Depending upon the character of ground uncovered along the right-of-way, design details may be modified during construction.

Surface Drainage Considerations

Water should not be allowed to collect on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water beneath the paved areas. The grades should be sloped and surface drainage should be collected and discharged such that water is not permitted to infiltrate the subgrade soils.

Soil Erodibility

A topsoil erodibility study was not performed for Oak Vista No. 7. However, based on similar soil types, erodibility values determined from nearby developments are representative for Oak Vista No. 7. Two (2) topsoil samples were collected in the Oak Vista No. 10 development. Sieve analysis, Atterberg Limits, hydrometer analysis and organic content laboratory tests were performed on this topsoil samples. The soil sample was then classified according to the Unified Soil Classification System (USCS). The laboratory tests results were evaluated as to their potential for erosion on identified slopes 1.5:1 Cut and 2:1 Fill slopes.

Data obtained from the topsoil sample was used in combination with data obtained from technical guides and the U.S. Department of Agriculture (USDA) Soil Conservation Service to estimate the soil-erodibility factor for post construction. For this report, post construction is defined as after topsoil placement, but before vegetation begins growing.

The K value, or soil-erodibility factor, was determined from the laboratory test results and a USDA nomograph. The nomograph uses the percent of silt plus very fine sand, the percent sand, the percent organic material, the soil structure, and permeability (very slow, slow, etc.) to graphically produce an estimate of the K value. PSI used reasonable, but conservative values for those parameters used to determine the K value (soil structure, and permeability) that were not the result of our laboratory testing program. The topsoil sample collected for this evaluation is assumed to be representative of how the topsoil will be placed on cut and fill slopes over this portion of the project. The K factor value obtained was K = 0.15. Typical values for K factors at SunCrest range from 0.1 to 0.2. These k values indicate low susceptibility to soil erosion.

PAVEMENT RECOMMENDATIONS

Pavement Design

PSI has completed a pavement analysis for the proposed residential roads for Oak Vista No.7. For design purposes, we used the minimum subgrade CBR value of 7 as determined from laboratory CBR tests for Oak Vista No. 6. The CBR value of 50 was used for the ¾-inch road base. For the traffic loads, we used an 18k Equivalent Daily

Single Axle Load of 6. This correlates to 200 cars and 1 heavy truck per day. We also assumed that the subgrade would be prepared as recommended to achieve a compacted and unyielding surface. Based on our analysis and Draper City Minimum Pavement section for SunCrest, we recommend that the minimum pavement section for the residential roadways consist of 5-inches of asphalt underlain by 8-inches of ¾-inch road base supported on 12-inches scarified and recompacted native soils. The 12-inches of scarification does not apply if fat clays are encountered and overexcavation and recompaction of non-expansive soils occurs.

The long-term performance of the pavement will be dependent upon the proper preparation of the subgrade. The upper 12 inches of the subgrade should be compacted to at least 95 percent of the maximum density determined by ASTM D1557 to reduce compressibility of the material and its susceptibility to frost heave. After compaction efforts are complete, the subgrade should be proof-rolled with a 9-ton loaded dump truck. Areas that rut or deflect excessively through the proof-rolling (typically greater than 1 inch) should be removed and backfilled with granular fill.

Subdrains

Based on our experience with the pavement conditions at SunCrest, frost heave from saturated sub-base and base course materials has occurred. A method to prevent damage to pavement from frost is to keep the paving system from becoming saturated with the use of subdrains at selected locations. Generally, the locations are where hillside runoff directs water below the pavement. Based on a review of the existing site plan, we do not anticipate the need for subdrains for Oak Vista No. 7.

Open Graded Base

Open graded base has been used in some locations of SunCrest to address drainage issues in concert with or in lieu of subdrains. Based on our review of the plans for Oak Vista No. 7, we do not anticipate the need for open graded base course.

MATERIALS PLACEMENT AND INSPECTION

The following are testing and inspection intervals that PSI recommends for site and pavement preparation. The inspection and testing recommendations set forth below are the minimum that should be followed. The City Engineer or the testing firm may require additional inspection, directives, tests, testing frequencies, or alternate tests as may be reasonably necessary to determine the soundness of related improvements.

MINIMUM STANDARD COMPACTION REQUIREMENTS				
	% Compaction Standard Proctor	**% Compaction Modified Proctor**	**Depth of Lifts**	**Frequency of Tests**
Mass Excavation				
General	100	95	8"	One test per 500 cy moved or one test per 10,000 SF per lift
Roads	100	95	8"	One test per 500 cy moved or one test per 7,000 SF per lift
Lots	100	95	8"	One test per lot per lift
Utilities				
Trenches	100	95	8"	One test per 100 LF per lift
MH & Structures	100	95	8"	3 to 4 test per lift randomly around structure
Paved Areas				
Subbase	100	95	8"	One test per 2000 SF
Road Base	100	95	8"	One test per 2000 SF
C&G	100	95	8"	One test per 100 LF
Paving	100	95	4"	One test per 2000 SF
Landscaping	95	90	10"	One test per 10,000 SF per lift

Mass Grading

Soil Classification: One per material source

Soil Proctor: One determination for each significant change in soil type as necessary to provide required compaction testing.

Earth Fill Moisture/Density Determination: One test per 500 cubic yards of fill placed in an embankment.

Subgrade Moisture/Density Determination: One test per 7,000 sq. feet of surface area.

Laboratory Test Method: Proctors for all earthwork compaction shall be determined using ASTM D1557 modified Proctor method.

Trench Backfill Testing: The following tests are for structural backfill for every 100 lineal feet of trench or portion thereof:

Pipe Zone: One Test

Backfill Zone: One test per 2 feet of depth measured

from the bottom of the subgrade to the top of the pipe zone. Test shall be evenly spaced vertically through the trench backfill

Subgrade: One test

Manholes and Structures: Three to four tests per lift around each structure

Additional testing may be required by the City Engineer or testing lab to verify compaction.

Base Course Gravel

Gradation Tests:	*Roadway*	One test per 15,000 sq. feet of surface area or fraction thereof
	Curb & Gutter	One test per 500 lineal feet (each side) or fraction thereof
	Sidewalk & Drives	One test per 1,350 sq. feet (combination of sidewalk and driveway) or fraction thereof

Moisture/Density Tests: One test per 2,000 sq. feet of roadway surface area or fraction thereof. Moisture content shall be at optimum plus or minus 2 percent for test to pass and shall be maintained until prime coat is applied.

Thickness: One random boring or test hole per 5,000 sq. feet of surface area or fraction thereof to verify required thickness. If sufficient inspection has been made by an inspector to verify required thickness, the engineer may waive thickness testing for base course gravel placed in public roadway construction. No single measured thickness shall be less than the required design thickness.

Bituminous Surface Course

Material Certification: Each project shall submit independent written certification through the material supplier that surface course materials comply with specifications.
Certification for a material source previously approved for the current construction season will be acceptable provided sources of the individual

components of the combined surface course mix have not changed.

Extraction Gradation Test: One test per 500 tons of material placed or one per day whichever is less.

Density Tests: One per 2,000 sq. ft. of surface area or fraction thereof.

Thickness Tests: One core sample from each section of approximately 9,000 sq. ft. or fraction thereof. At the discretion of the geotechnical engineer, thickness testing may be waived for material placed in public roadway construction if sufficient inspection has been made by an inspector to verify required thickness.

REPORT LIMITATIONS

This report has been prepared with the understanding that PSI will be afforded the opportunity to provide engineering inspection and quality control for this project. This report is intended for use in mass grading, roadway and utility construction. **This report should not be used as a basis for construction of structures. Additional geotechnical studies should be conducted for any other construction.**

The recommendations submitted are based on the available subsurface information obtained by PSI, and information provided by SunCrest L.L.C and their design consultants. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation, or other recommendations are required. If PSI is not retained to perform these functions, PSI cannot be responsible for the impact of those conditions on the performance of the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

If changes are made to the final plans provided to PSI, the geotechnical engineer should be retained and provided the opportunity to review the changes to the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of SunCrest L.L.C. for the specific application to the proposed Oak Vista No. 7 at SunCrest in Draper, Utah.

SUNCREST

MOUNTAIN—SKY—HOME

OAK VISTA No. 7
TRAVERSE RIDGE ROAD
OAK VISTA No. 1
SUNCREST DRIVE
OAK VISTA No. 8
OAK VISTA No. 5
OAK VISTA No. 9
DEER RIDGE No. 2
DEER RIDGE No. 1
DEER RIDGE DRIVE
TRAVERSE RIDGE ROAD
EAGLE CREST No. 1
SUNCREST BOUNDARY
OAK VISTA No. 3 & 4
DEER RIDGE No. 3
DEER RIDGE No. 6
OAK VISTA No. 10
SUNCREST BOUNDARY
SUNCREST DRIVE
EAGLE CREST No. 3
MAPLE HOLLOW No. 2
DEER RIDGE No. 4
MAPLE HOLLOW No. 4
EAGLE CREST No. 2
DEER RIDGE DRIVE
MAPLE HOLLOW No. 1
MAPLE HOLLOW No. 3
DEER RIDGE No. 5
MAPLE HOLLOW No. 12
EAGLE CREST No. 5
EAGLE CREST No. 4
SUNCREST DRIVE
SUNCREST BOUNDARY
MAPLE HOLLOW No. 11
MAPLE HOLLOW No. 13
MAPLE HOLLOW No. 10

SCALE 1" = 1500'

0 1500 3000 4500
SCALE IN FEET

SUNCREST
MOUNTAIN—SKY—HOME

NO.	REVISIONS DESCRIPTIONS	DATE

VICINITY MAP

OAK VISTA NO. 7
AT SUNCREST

TKC
The Keith Companies
960 West LeVoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0536

PROJECT NO. 132159-60.007
SCALE 1" = 1500'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-1

K:\SUNCREST\132960\ENG\2016ECH\01-VIC-MAP

SUNCREST BOUNDARY

DETENTION BASIN 13

ALIGNMENT 7

ALIGNMENT 6

ALIGNMENT 5

ALIGNMENT 4

ALIGNMENT 3

ALIGNMENT 2

ALIGNMENT 1

LUD BB

LUD CC

LUD AA

WOODS LANDING COURT

TRAVERSE RIDGE ROAD

EXISTING DETENTION BASIN "E"

TEST-PIT #12
N 784181.9790
E 1904924.5105

TEST-PIT #11
N 783857.3391
E 1905145.5288

TEST-PIT #9
N 783501.4494
E 1905474.0210

TEST-PIT #10
N 783503.5965
E 1905187.0214

0 100 200 300
SCALE IN FEET

SCALE 1"=100'

SUNCREST
MOUNTAIN-SET-HOME

NO.	REVISIONS DESCRIPTIONS	DATE

CROSS SECTION KEY SHEET

OAK VISTA NO. 7
AT SUNCREST

The Keith Companies
TKC
960 West Levoy Drive, Suite 100 Salt Lake City, Utah 84123
Phone (801) 743-0955

PROJECT NO. 12359-60.007
SCALE 1" = 100'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-2

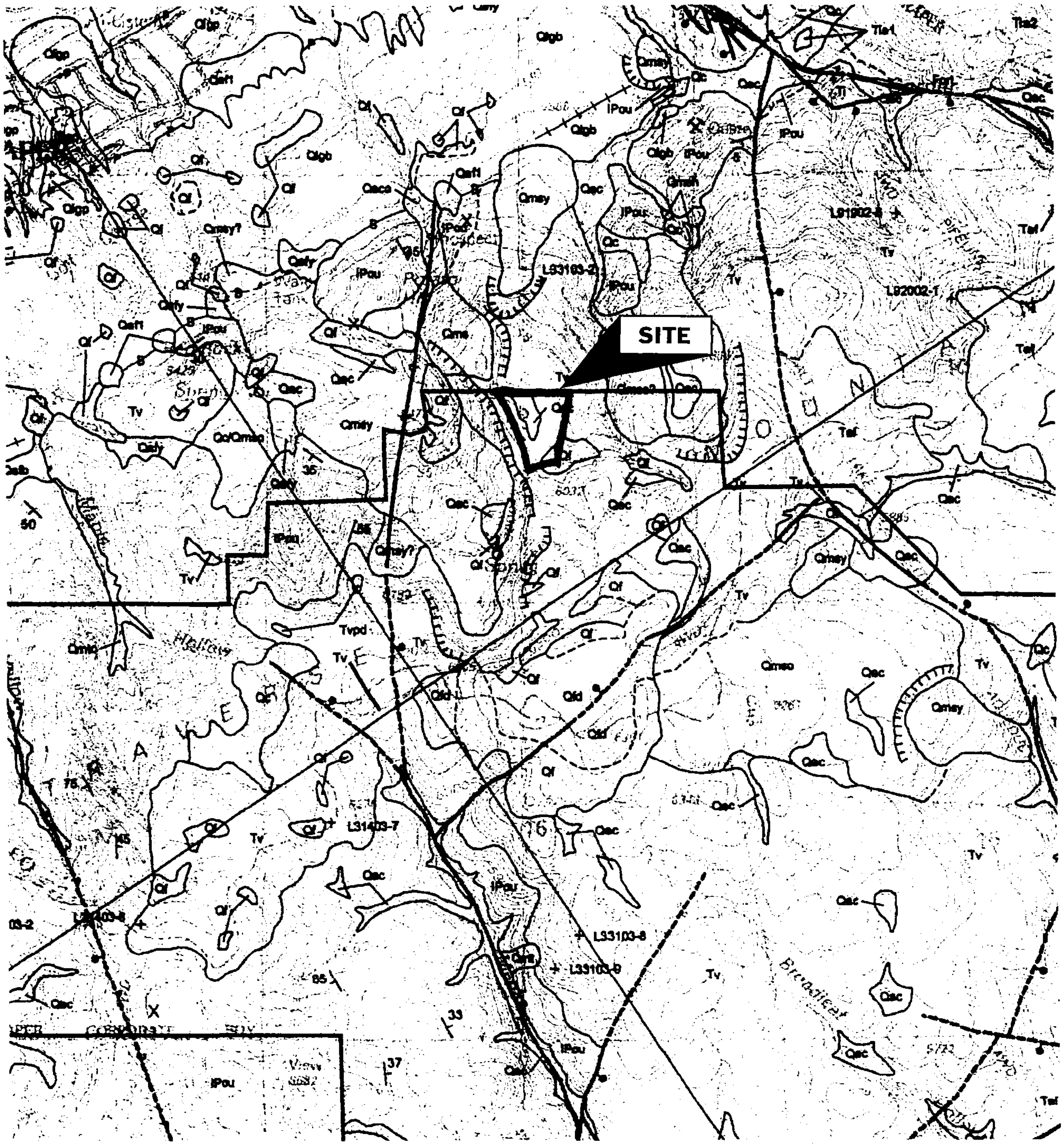
K:\SUNCREST\12359601\DWG\GEOTECH\02-KEY

GEOTECHNICAL SERVICES
2779 South 600 West
Salt Lake City, Utah 84115
(801) 484-8827

psi Information To Build On
Engineering · Consulting · Testing

PROJECT NAME: OAK VISTA NO. 7 SUNCREST DEVELOPMENT, DRAPER, UTAH	DRAWN BY: SG	DATE: 02/24/04	SCALE: NO SCALE
TITLE: SITE PLAN & SEWER LINE LOCATION	APPROVED BY: AT	PROJECT NO.: 710-45012	FIGURE NO.: A-2A

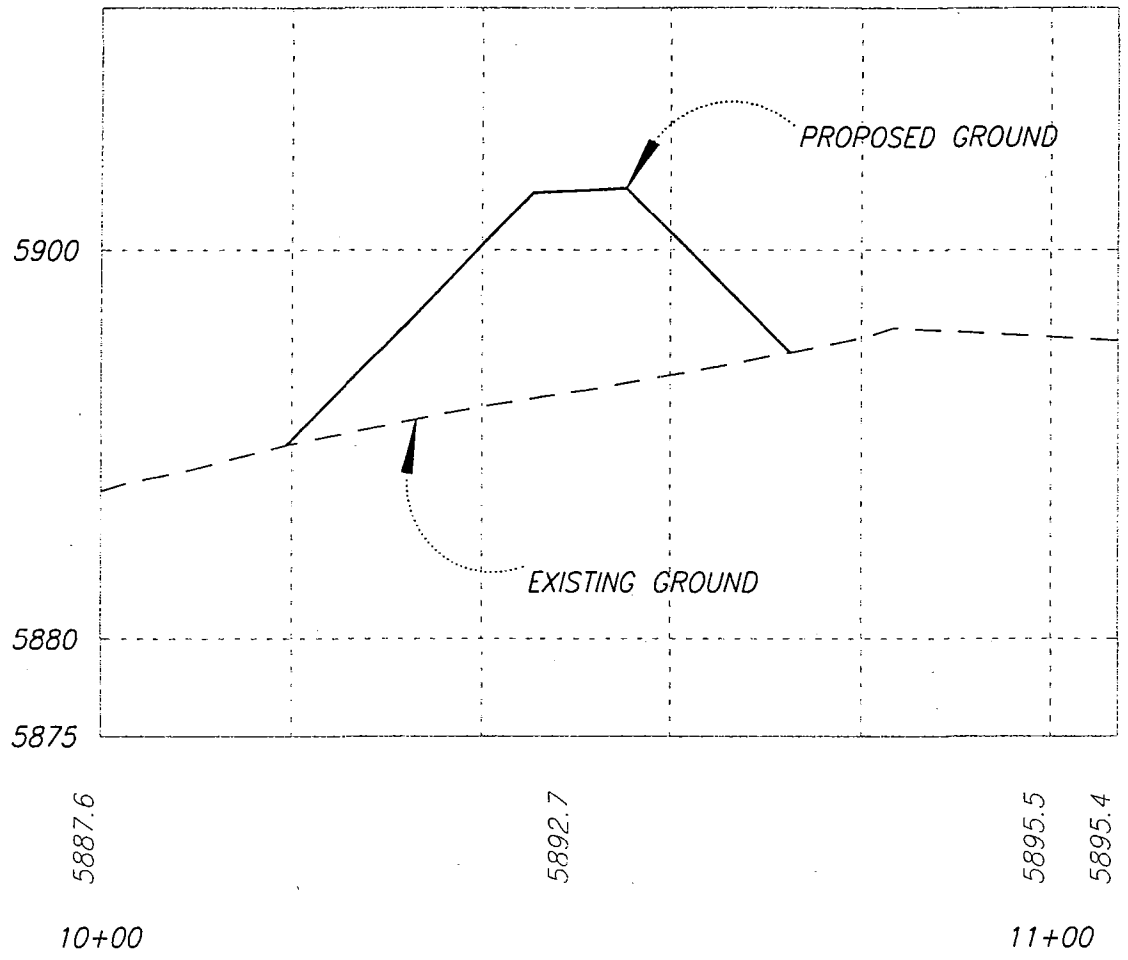
LEGEND



USGS GEOLOGIC MAP

psi® Information To Build On
Engineering • Consulting • Testing

Drawn By: SG	Scale: NA
Checked By: AT	Project No: 710-25043 (REVISED)
Date: 02/16/03	Figure No: A-3



CROSS-SECTION 1

0 20 40 60
SCALE IN FEET

SUNCREST
MOUNTAIN-SKY-HOME

NO.	REVISIONS DESCRIPTIONS	DATE

CROSS-SECTION 1

OAK VISTA NO. 7
AT SUNCREST

The Keith Companies
960 West LeVoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0696
TKC

PROJECT NO. 12359-60.007
SCALE 1" = 20'
DATE 02/18/04
DR. BY JMJ
CK. BY JRD

SHEET NUMBER
A-4

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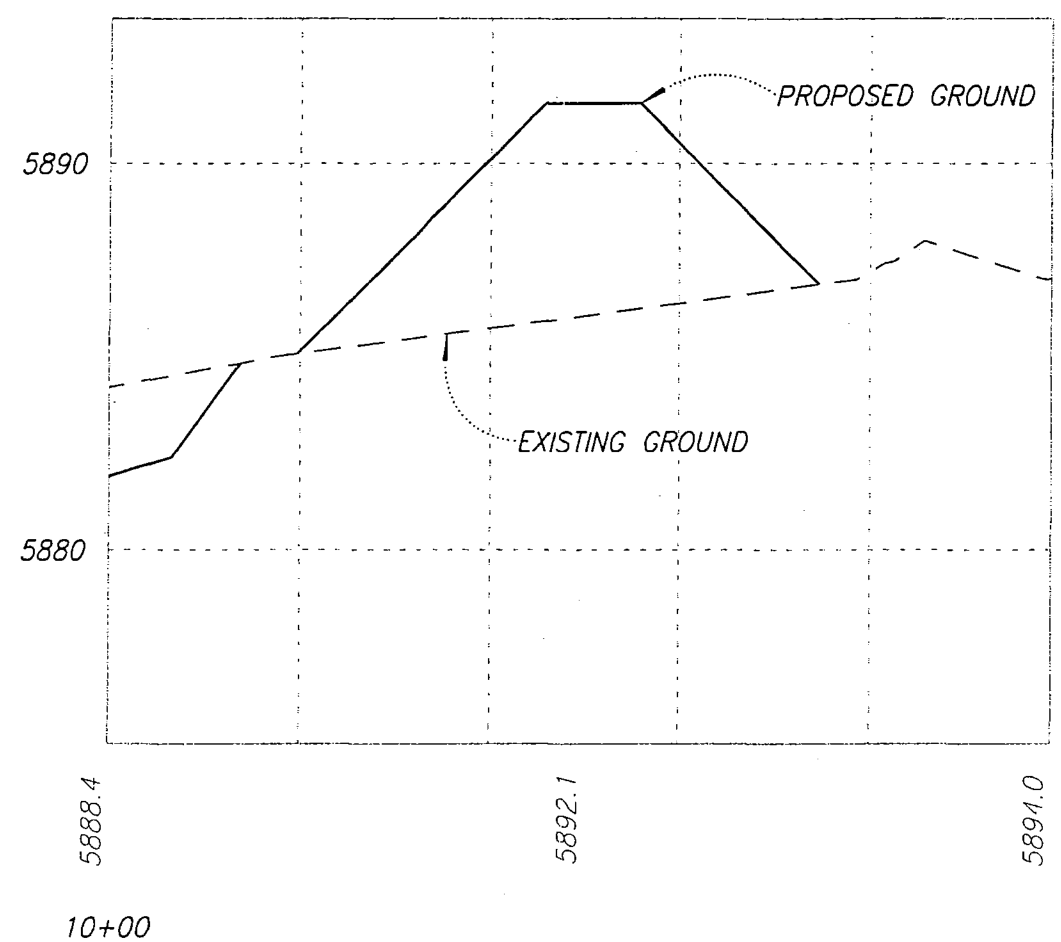

CROSS-SECTION 2

0 20 40 60
SCALE IN FEET

SUNCREST
MOUNTAIN~SKY~HOME

NO.	REVISIONS DESCRIPTIONS	DATE

CROSS-SECTION 2

OAK VISTA
NO. 7
AT SUNCREST

The Keith Companies
TKC
960 West LeVoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0696

PROJECT NO. 132359-60.007
SCALE 1" = 20'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-5

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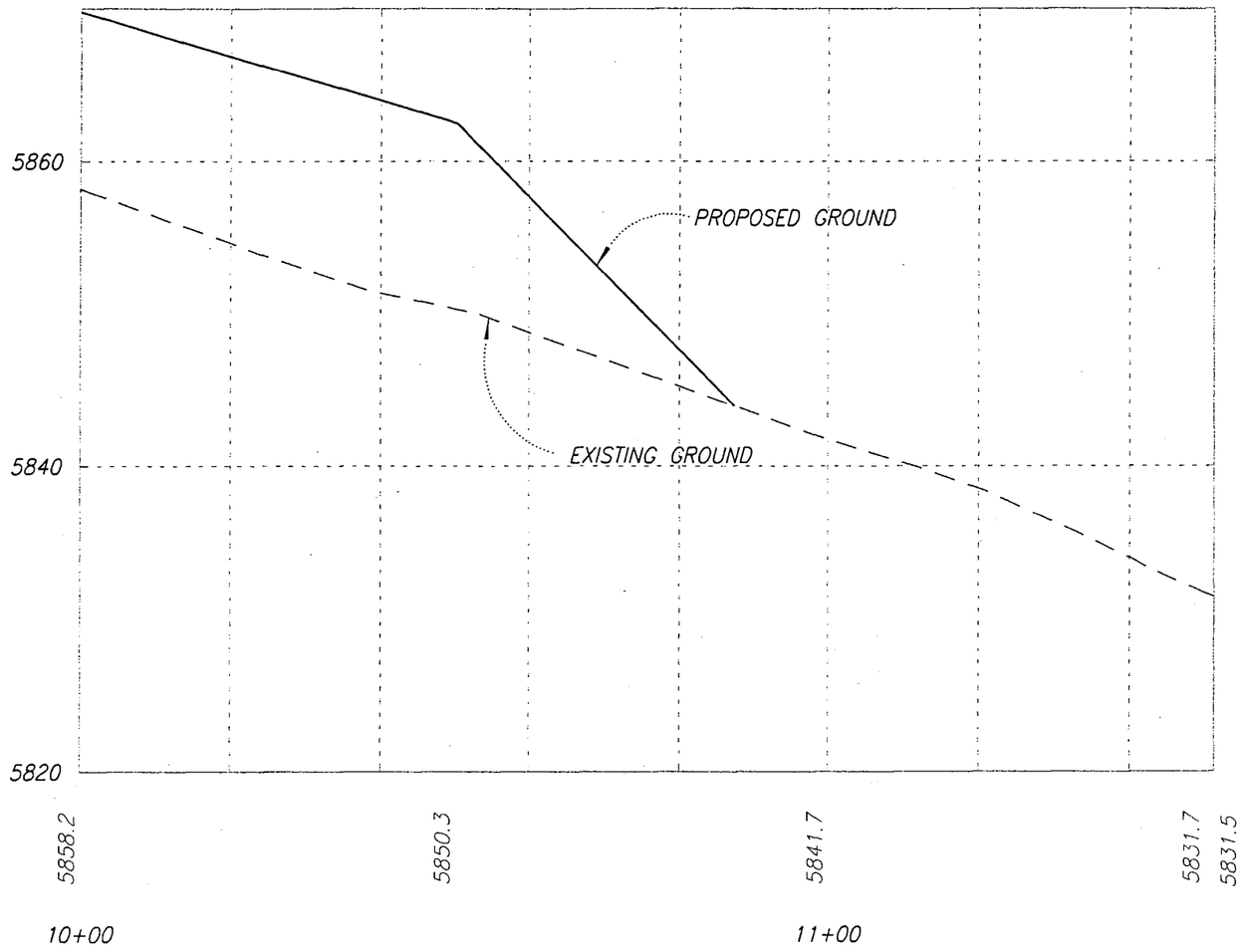


CROSS-SECTION 3

0 20 40 60
SCALE IN FEET

SUNCREST
MOUNTAIN-SKY-HOME

NO.	REVISIONS DESCRIPTIONS	DATE

CROSS-SECTION 3

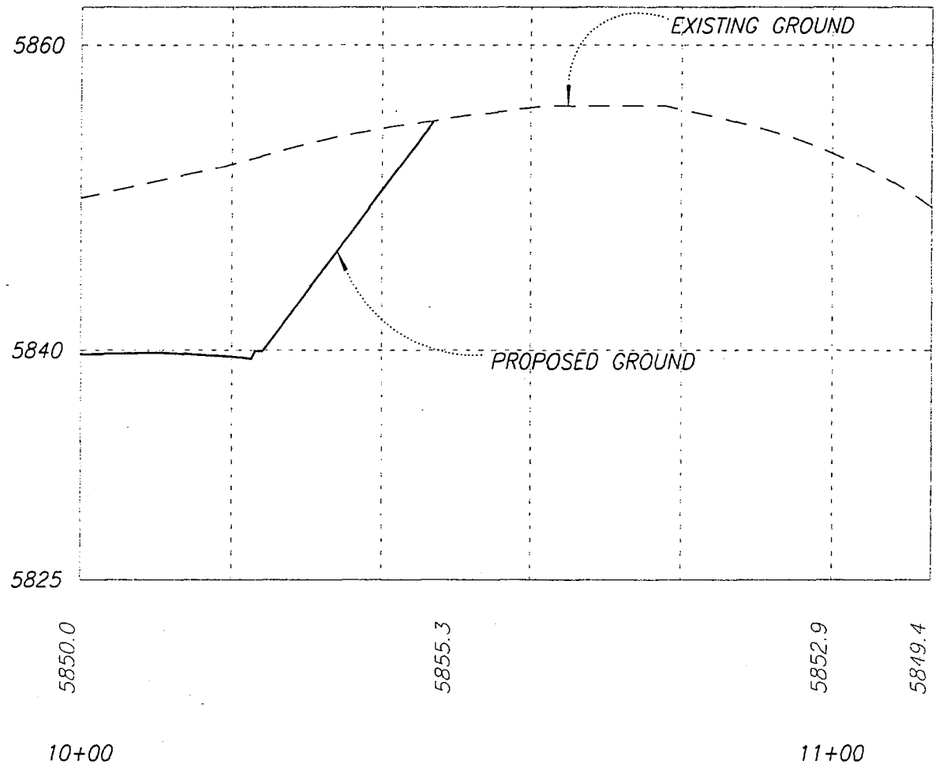
OAK VISTA NO. 7
AT SUNCREST

The Keith Companies
960 West Levoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0696

PROJECT NO. 132359-60.007
SCALE 1" = 20'
DATE 02/18/04
DR. BY JMJ
CK. BY JRU

SHEET NUMBER
A-6

K:\SUNCREST\235960\ENG\GEOTECH\05-X-SECTS



CROSS-SECTION 4

0 20 40 60
SCALE IN FEET

SUNCREST
MOUNTAIN—SKY—HOME

REVISIONS		
NO.	DESCRIPTIONS	DATE

CROSS-SECTION 4

OAK VISTA NO. 7
AT SUNCREST

The Keith Companies TKC
960 West LeVoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0696

PROJECT NO. 123159-60.007
SCALE 1" = 20'
DATE 02/16/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-7

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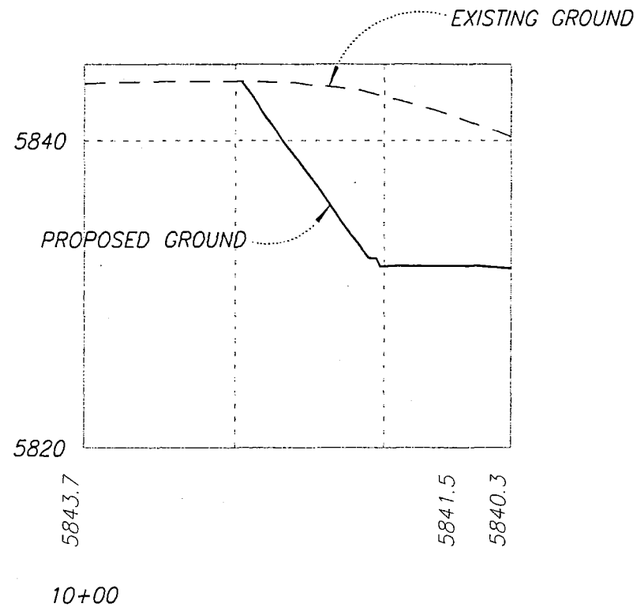

CROSS-SECTION 5

0 20 40 60
SCALE IN FEET

SUNCREST
MOUNTAIN-SKY-HOME

REVISIONS		
NO.	DESCRIPTIONS	DATE

CROSS-SECTION 5

OAK VISTA NO. 7
AT SUNCREST

The Keith Companies
960 West Levoy Drive, Suite 100 Salt Lake City, Utah 84123
phone (801) 743-0595
TKC

PROJECT NO. 132359-60.007
SCALE 1" = 20'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-8

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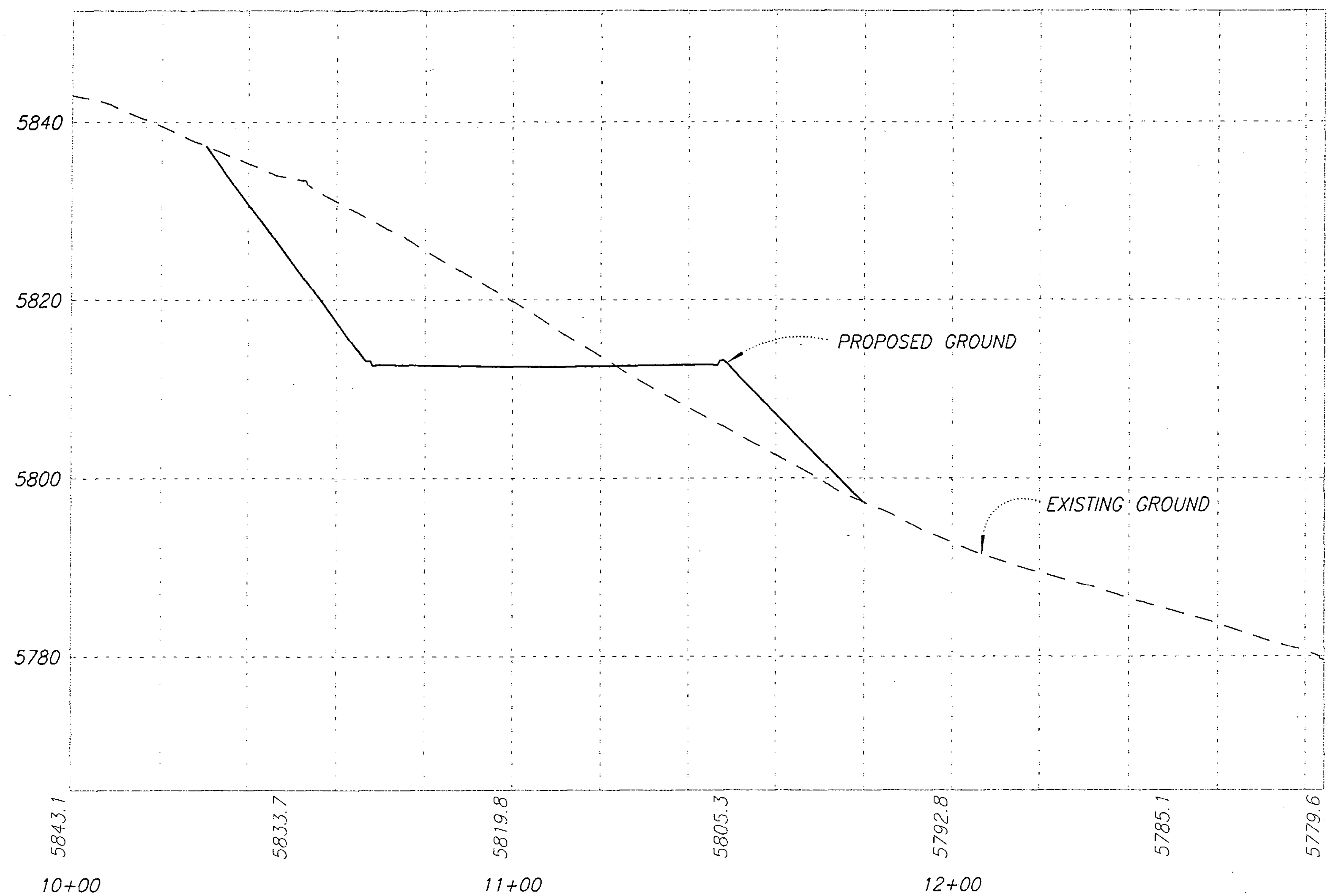


CROSS-SECTION 6

0 30 60 90
SCALE IN FEET

SUNCREST
MOUNTAIN–SKY–HOME

REVISIONS		
NO.	DESCRIPTIONS	DATE

CROSS-SECTION 6

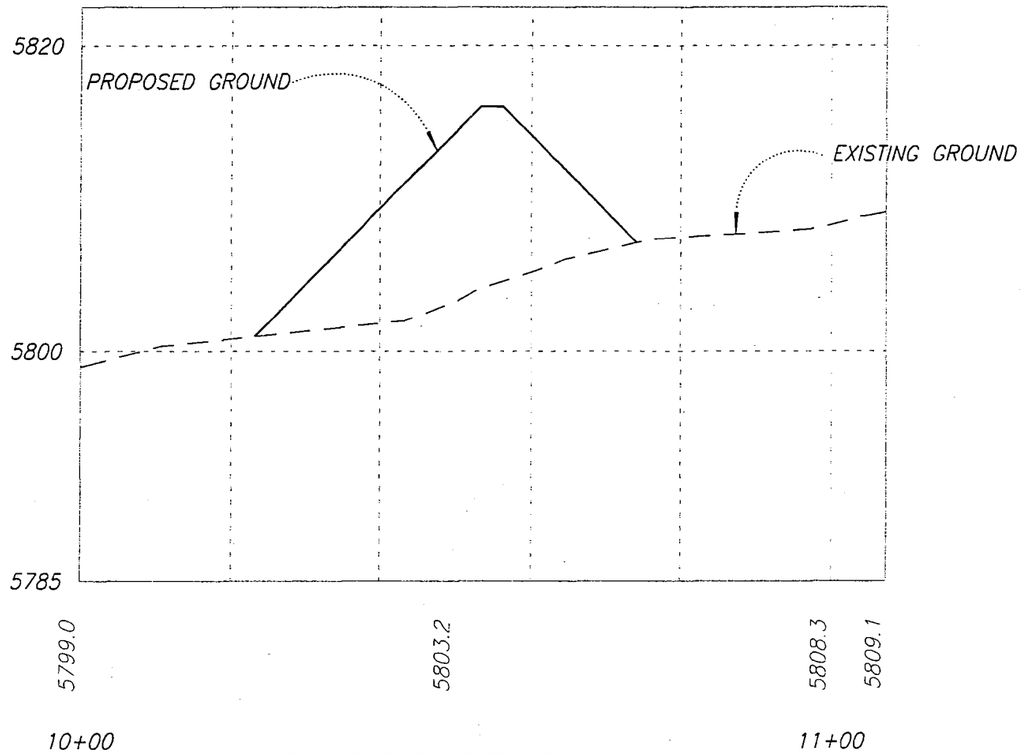
OAK VISTA
NO. 7
AT SUNCREST

TKC
The Keith Companies
960 West LeVoy Drive, Suite 100, Salt Lake City, Utah 84123
Phone (801) 743-0696

PROJECT NO. 132359-60.007
SCALE 1" = 30'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-9

K:\SUNCREST\235960\ENG\GEOTECH\08-X-SEC16



CROSS-SECTION 7

0 20 40 60

SCALE IN FEET

SUNCREST
MOUNTAIN-SKI-HOME

REVISIONS NO.	DESCRIPTIONS	DATE

CROSS-SECTION 7

OAK VISTA NO. 7
AT SUNCREST

The Keith Companies TKC
960 West Levoy Drive, Suite 100 Salt Lake City, Utah 84123
Phone (801) 743-0696

PROJECT NO. 12359-60.007
SCALE 1" = 20'
DATE 02/18/04
DR. BY JMJ
CK. BY JRJ

SHEET NUMBER
A-10

K:\SUNCREST\12359601\ENG\GEOTECH\09-X-SECT7

2779 South 600 West
South Salt Lake, UT 84115
Telephone: (801) 954-8442
Fax: (801) 954-8485

LOG OF TEST PIT: 9

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Drilling Method:
Sampling Method:
Hammer Type:
Latitude:
Longitude:

WATER LEVELS

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch	Dry Density (pcf)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (1–25–50) STRENGTH, tsf ▲ ✳ Qp Qu (0–2.0–4.0)	NOTES
	0				Surface Elev.: ft						
					TOPSOIL, silty, organics, loose, moist, dark brown.	ML					
				1	SAND, silty, clayey, gravelly, dense, moist, yellowish brown to dark brown.	SM					
	5										
				2	SAND, gravelly, with cobbles and boulders, loose, moist, dark brown.						
	10										
						SP					
	15			3							
	20				Test pit terminated @ 20 feet. Ground water not encountered.						

Completion Depth: 20.0 ft
Date Excavation Started: 4/25/02
Date Excavation Completed: 4/25/02
Logged By: A.Payton
Excavator: -

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Grab Sample
Mod. California

Remarks:

Figure A-11

2779 South 600 West
South Salt Lake, UT 84115
Telephone: (801) 954-8442
Fax: (801) 954-8485

LOG OF TEST PIT: 10

PSI Job No.:	710-45012	Drilling Method:	WATER LEVELS
Project:	Oak Vista No. 7	Sampling Method:	
Location:	Suncrest Development	Hammer Type:	
	-	Latitude:	
		Longitude:	

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch	Dry Density (pcf)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (1 – 25 – 50) STRENGTH, tsf ▲ ✳ Qp Qu (0 – 2.0 – 4.0)	NOTES
	0				Surface Elev.: ft						
					TOPSOIL, silty, organics, loose, moist, dark brown.	ML					
				1	CLAY, sandy, stiff, moist, brown.						
	5			2		CL					
	10				Test pit terminated @ 14 feet. Ground water not encountered.						

Completion Depth:	14.0 ft	Sample Types:	Remarks:
Date Excavation Started:	4/25/02	Auger Cutting / Shelby Tube	
Date Excavation Completed:	4/25/02	Split-Spoon / Grab Sample	
Logged By:	A.Payton	Rock Core / Mod. California	
Excavator:	-		

Figure A-12

2779 South 600 West
South Salt Lake, UT 84115
Telephone: (801) 954-8442
Fax: (801) 954-8485

LOG OF TEST PIT: 11

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Drilling Method:
Sampling Method:
Hammer Type:
Latitude:
Longitude:

WATER LEVELS

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch	Dry Density (pcf)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (1 – 25 – 50) STRENGTH, tsf ▲ ✳ Qp Qu (0 – 2.0 – 4.0)	NOTES
	0				Surface Elev.: ft						
					TOSOIL, silty, organics, loose, moist, dark brown.	ML					
					CLAY, silty, sandy, stiff, brown to dark brown.						
	5			1		CL					
				2	CLAY, silty, sandy, with cobbles, stiff, moist, brown.						
	10					CL					
	15				Test pit terminated @ 15 feet. Ground water not encountered.						

Completion Depth: 15.0 ft
Date Excavation Started: 4/25/02
Date Excavation Completed: 4/25/02
Logged By: A.Payton
Excavator: -

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Grab Sample
Mod. California

Remarks:

Figure A-13

2779 South 600 West
South Salt Lake, UT 84115
Telephone: (801) 954-8442
Fax: (801) 954-8485

LOG OF TEST PIT: 12

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Drilling Method:
Sampling Method:
Hammer Type:
Latitude:
Longitude:

WATER LEVELS

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch	Dry Density (pcf)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (1–25–50) STRENGTH, tsf ▲ ✳ Qp Qu (0–2.0–4.0)	NOTES
	0				Surface Elev.: ft						
					TOPSOIL, silty, organics, loose, moist, dark brown.	ML					
				1	CLAY, silty, sandy, stiff, dark brown.	CH					
	5			2	CLAY, silty, sandy, with cobbles, stiff, moist, reddish brown.	CL					
	10				Test pit terminated @ 12 feet. Groud water not encountered.						

Completion Depth: 12.0 ft
Date Excavation Started: 4/25/02
Date Excavation Completed: 4/25/02
Logged By: A.Payton
Excavator: -

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Grab Sample
Mod. California

Remarks:

Figure A-14

KEY TO SYMBOLS


USCS Silt


USCS Silty Sand


USCS Poorly-graded Sand


USCS Clayey Gravel


USCS High Plasticity Clay


USCS Low Plasticity Clay


USCS Clayey Sand


USCS Poorly-graded Gravel


Boulders and cobbles

HSA = Hollow Stem Auger

CFA = Continuous Flight Auger

SS = Split-spoon Sampler

ST = Shelby Tube Sampler

RC = Rock Core

DD = Dry Density

LL = Liquid Limit

PL = Plastic Limit

Qu = Unconfined Compressive Strength

Qp = Pocket Penetrometer

RQD = Rock Quality Designation

REC'D = Rock Core Recovery Percentage

PID = Photo Ionic Detector (ppm)

MR* = Unable to determine depth of water due to mud rotary drilling methods

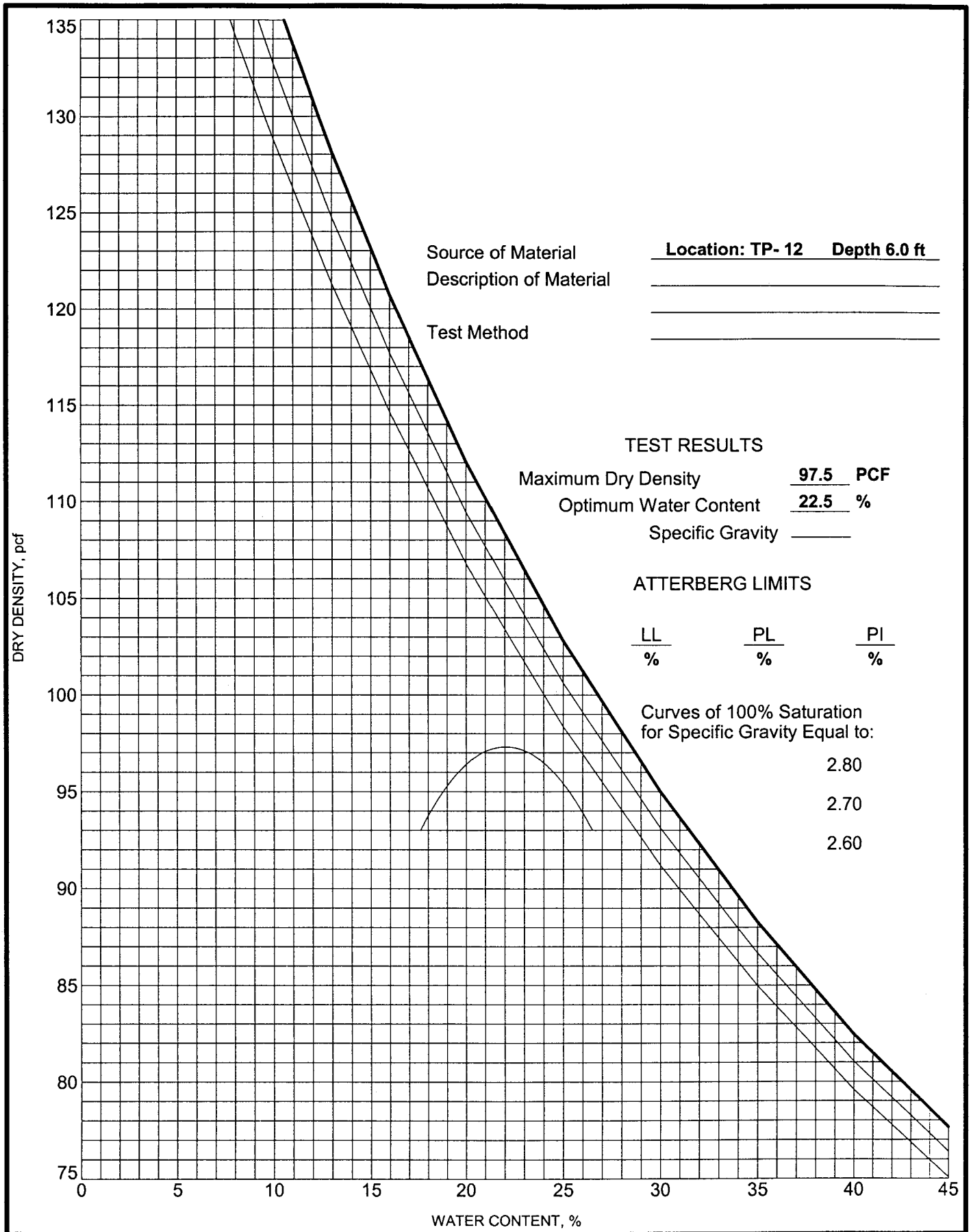
The borings were advanced into the ground using hollow stem augers. At regular intervals throughout the test pit depths, soil samples were obtained with either a 1.4-inch I.D., 2.0-inch O.D., split spoon sampler or a 2-inch diameter Modified California tube. The split-spoon sampler was first seated 6-inches to penetrate any loose cuttings and then driven an additional foot where possible with blows of a 140 pound hammer falling 30-inches. The penetration resistance "N-value" is redesignated as the number of hammer blows required to drive the sampler the final foot and, and when properly evaluated, is an index to cohesion for clays and relative density for sands. The split-spoon sampling procedures used during this exploration are in general accordance with ASTM Designation D 1586.

Relatively undisturbed Modified California tube samples were obtained by forcing a section of 2-inch diameter rings into the soil at the desired sampling levels. This sampling procedure was in general accordance with ASTM Designation D 1587. Each tube, together with the encased soil, was carefully removed from the ground, sealed and transported to the laboratory for testing.

2779 South 600 West
South Salt Lake, UT 84115
Telephone: (801) 954-8442
Fax: (801) 954-8485

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Figure A-15



Source of Material **Location: TP- 12 Depth 6.0 ft**

Description of Material _____

_____

Test Method _____

TEST RESULTS

Maximum Dry Density **97.5** **PCF**

Optimum Water Content **22.5** **%**

Specific Gravity _____

ATTERBERG LIMITS

LL	PL	PI
%	%	%

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

2779 South 600 West
Salt Lake City, Ut 84115
Phone: 801/484-8827
Fax: 801/487-3312

MOISTURE-DENSITY RELATIONSHIP

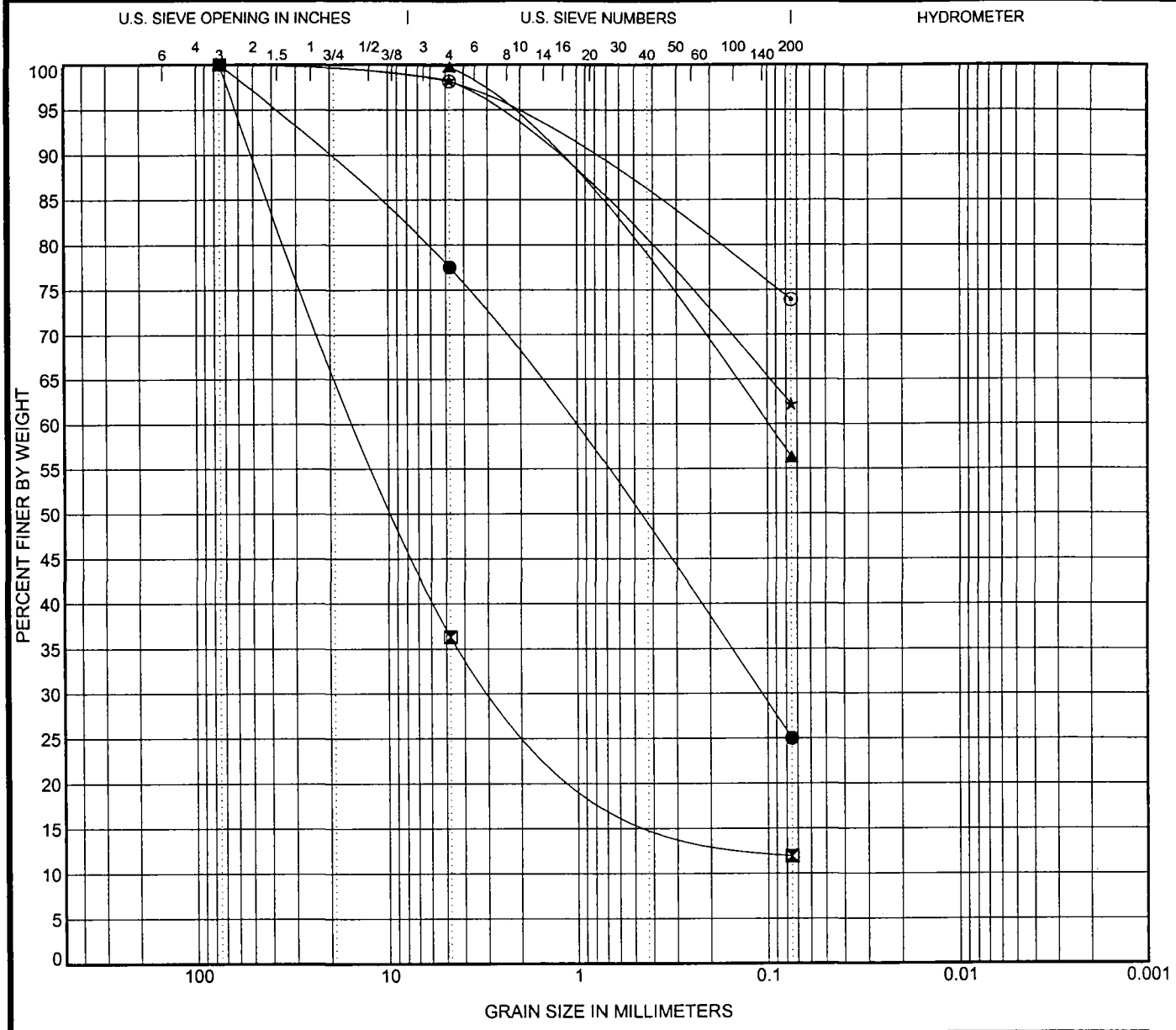
PSI Job No.: 710-45012

Project: Oak Vista No. 7

Location: Suncrest Development

-

Figure B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	TP- 9	Depth 3.0						
⊠	TP- 9	Depth 15.0					3.68	244.22
▲	TP- 10	Depth 5.0						
★	TP- 11	Depth 3.0		47	27	19		
⊙	TP- 11	Depth 7.0		50	16	34		

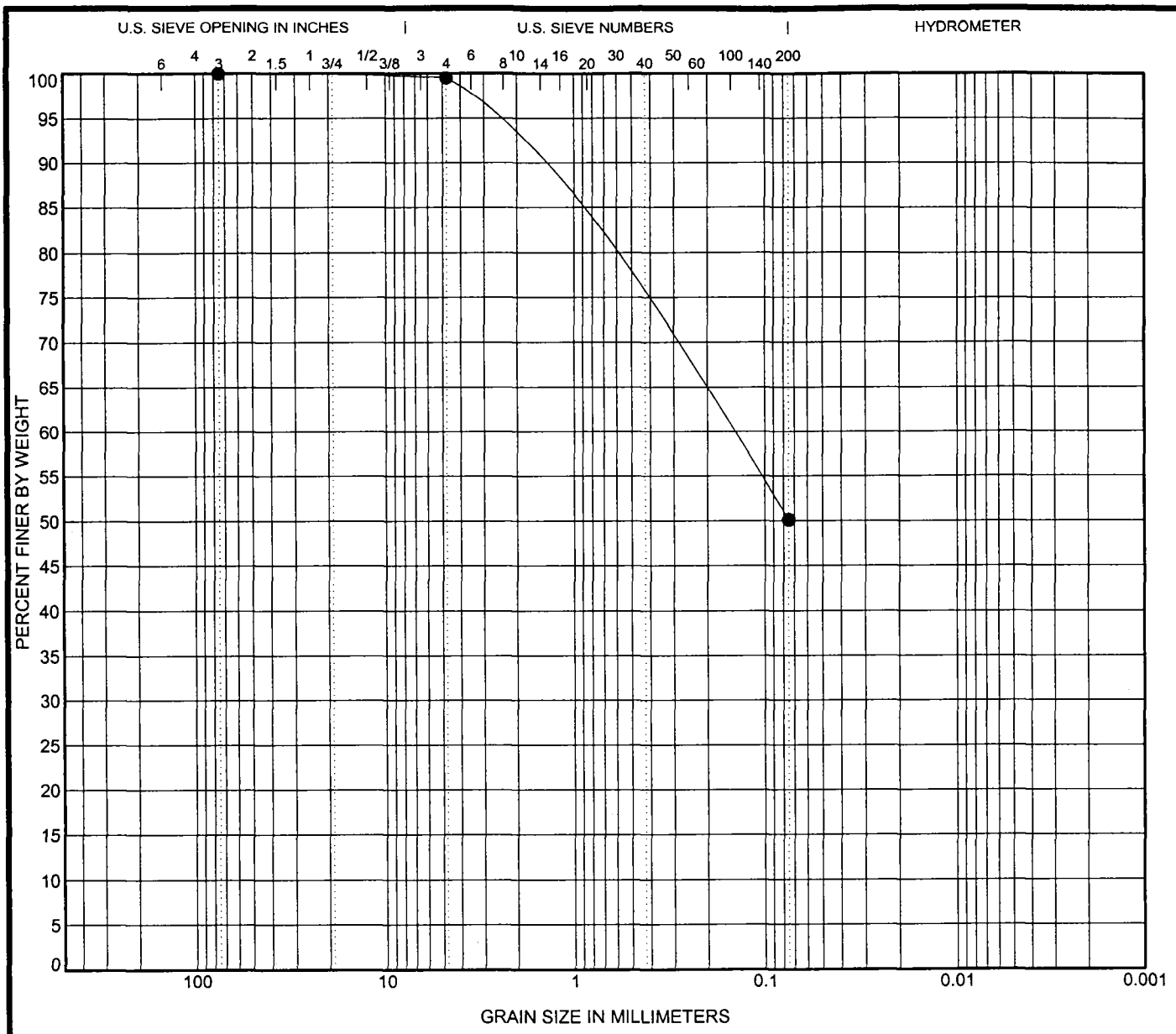
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP- 9	Depth 3.0	75	1.192	0.111		22.5	52.5	25.0	
⊠	TP- 9	Depth 15.0	75	13.26	1.627		63.7	24.4	11.9	
▲	TP- 10	Depth 5.0	75	0.107			0.2	43.5	56.3	
★	TP- 11	Depth 3.0	75				1.8	36.0	62.2	
⊙	TP- 11	Depth 7.0	75				1.9	24.2	73.9	

2779 South 600 West
Salt Lake City, Utah 84115
Phone: 801/484-8827
Fax: 801/487-3312

GRAIN SIZE DISTRIBUTION

Project: Oak Vista No. 7
PSI Job No.: 710-45012
Location: Suncrest Development
-

Figure No: B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **TP- 12 Depth 3.0**		**66**	**19**	**47**		

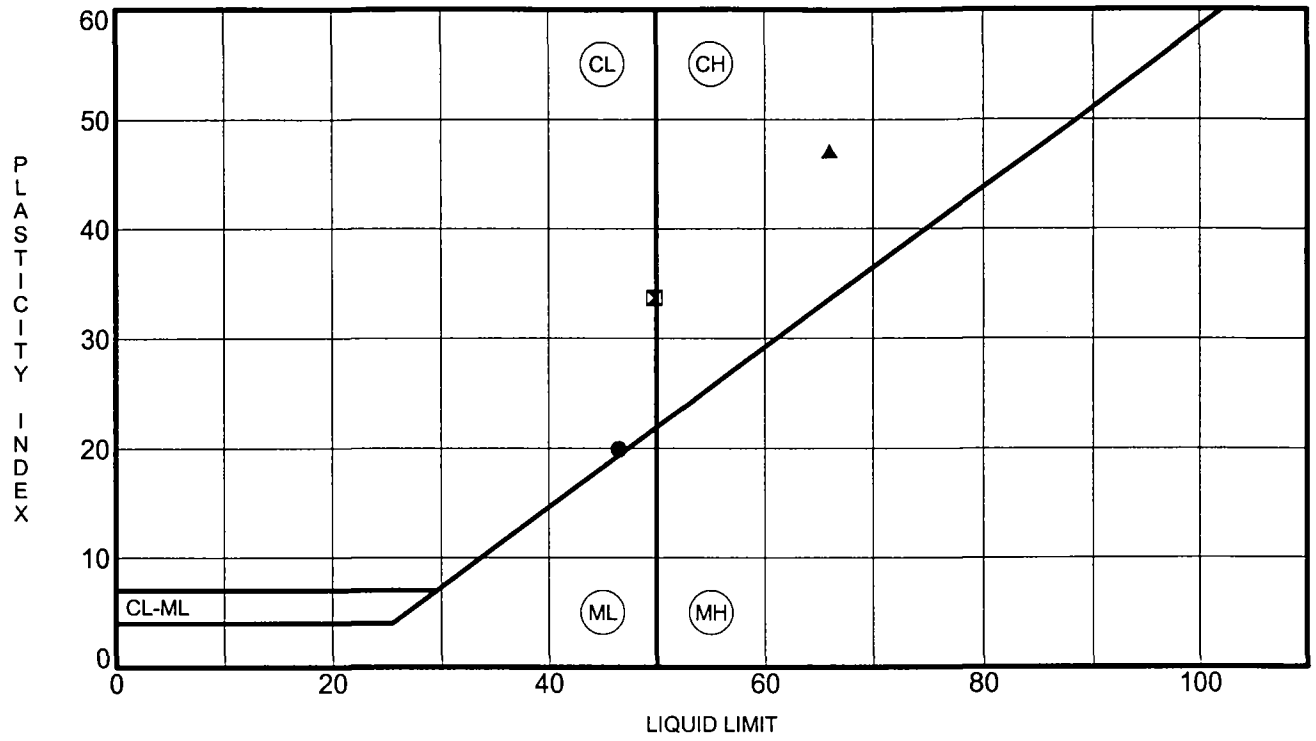
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **TP- 12 Depth 3.0**	**75**	**0.172**			**0.5**	**49.4**	**50.1**	

2779 South 600 West
Salt Lake City, Utah 84115
Phone: 801/484-8827
Fax: 801/487-3312

GRAIN SIZE DISTRIBUTION

Project: Oak Vista No. 7
PSI Job No.: 710-45012
Location: Suncrest Development
-

Figure No: B-3



	Boring	Depth (ft)	LL	PL	PI	Fines	Classification
●	11	3.0	47	27	19	62	CH
⊠	11	7.0	50	16	34	74	CH
▲	12	3.0	66	19	47	50	CH

ATTERBERG LIMITS' RESULTS

2779 South 600 West
Salt Lake City, Ut 84115
Phone: 801/484-8827
Fax: 801/487-3312

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Figure No: B-4

Borehole	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Qu (tsf)	Void Ratio	Saturation (%)	Classification
0	10.0	43	75	99	37	62					
1	5.0			36	21	15	49				
1	10.0			36	19	17	61				
10	5.0						56				
11	3.0			47	27	20	62				
11	7.0			50	16	34	74				
12	3.0			66	19	47	50				
13	3.0						7				
14	5.0						12				
15	5.0			37	15	22	4				
16	3.0			40	17	23	23				
16	5.0						9				
17	3.0			35	14	21	66				
17	5.0						53				
18	3.5			73	28	45	75				
18	7.0						21				
19	3.5			52	17	35	16				
2	3.0			38	22	16	28				
2	5.0						24				
20	3.0						22				
3	3.0						8				
4	3.0			45	22	23	37				
4	10.0						11				
5	6.0	21	91	45	22	23	30				
5	7.0			48	26	22	30				
6	3.0			42	26	16	18				
6	5.0			42	25	17	16				
7	3.5			55	24	32	36				
7	10.0			47	27	20	18				
8	5.0						2				
9	3.0						25				
9	15.0						12				

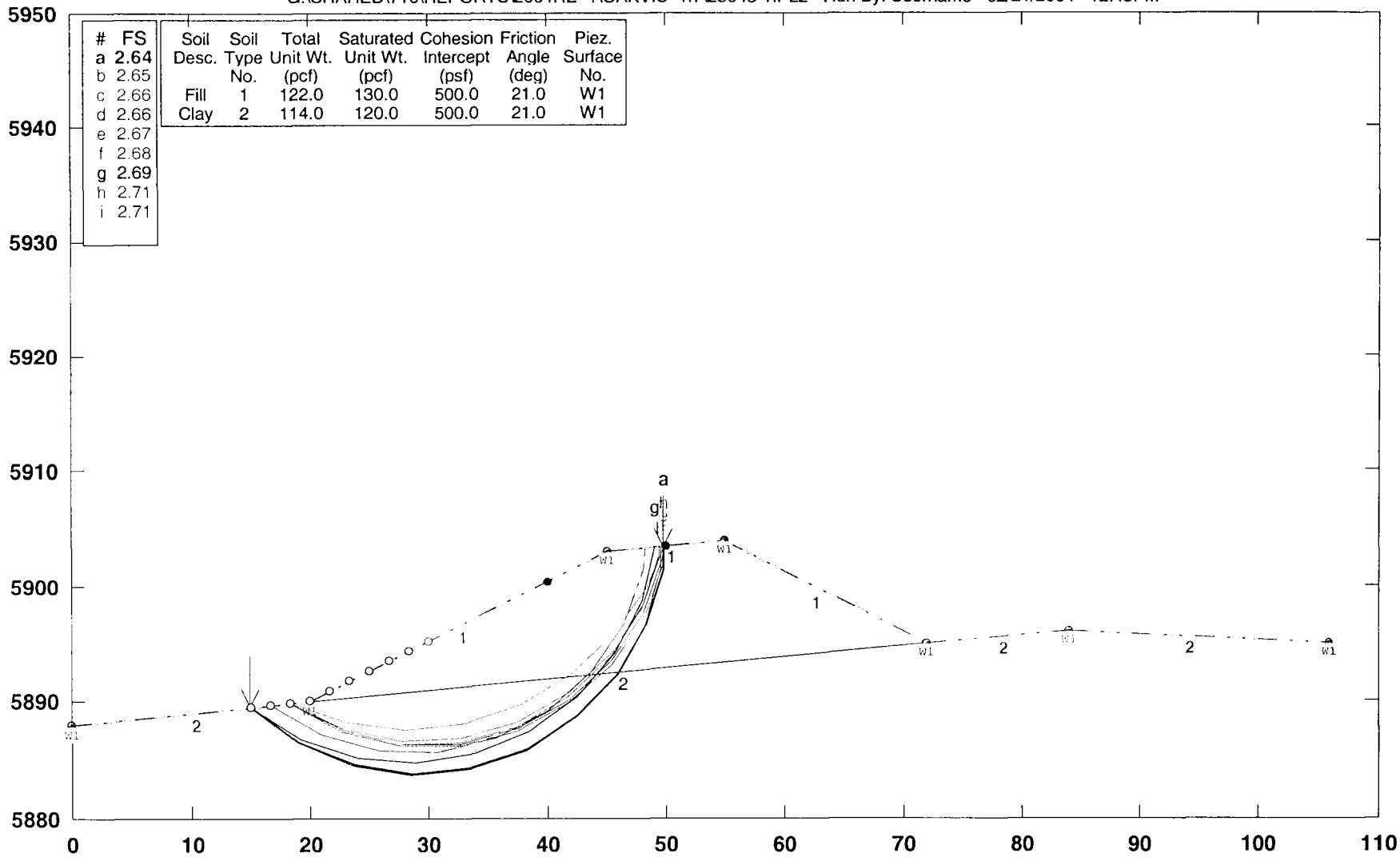
Summary of Laboratory Results

PSI Job No.: 710-45012
Project: Oak Vista No. 7
Location: Suncrest Development
-

Figure B-5

710-45012/Oak Vista No. 7/Alignment 1/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-1.PL2 Run By: Username 02/21/2004 12:43PM



#	FS
a	2.64
b	2.65
c	2.66
d	2.66
e	2.67
f	2.68
g	2.69
h	2.71
i	2.71

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	122.0	130.0	500.0	21.0	W1
Clay	2	114.0	120.0	500.0	21.0	W1

GSTABL7 FSmin=2.64

Safety Factors Are Calculated By The Modified Bishop Method

psi Information To Build On
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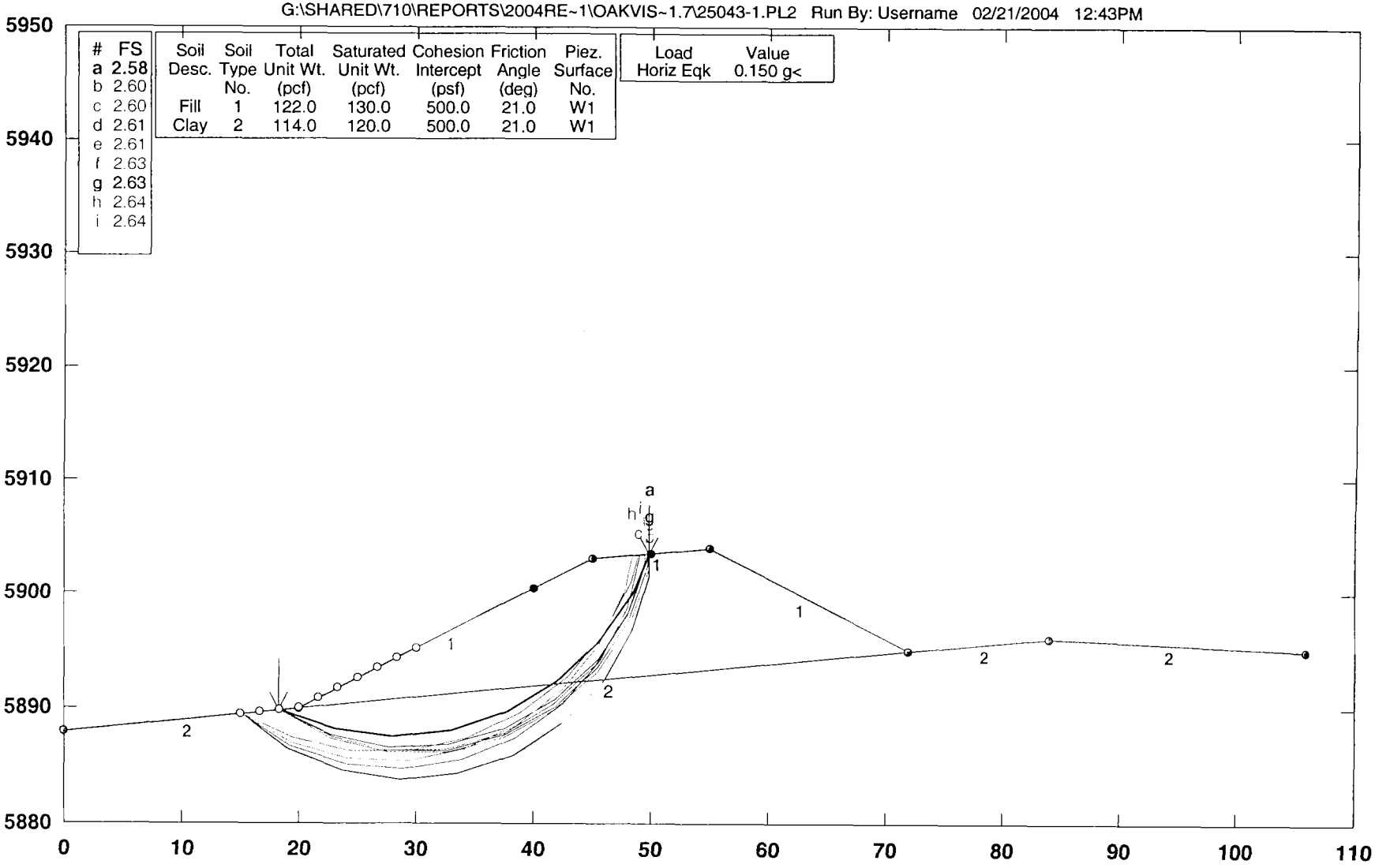
Figure C-1

710-45012/Oak Vista No. 7/Alignment 1/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-1.PL2 Run By: Username 02/21/2004 12:43PM



GSTABL7 FSmin=2.58

Safety Factors Are Calculated By The Modified Bishop Method

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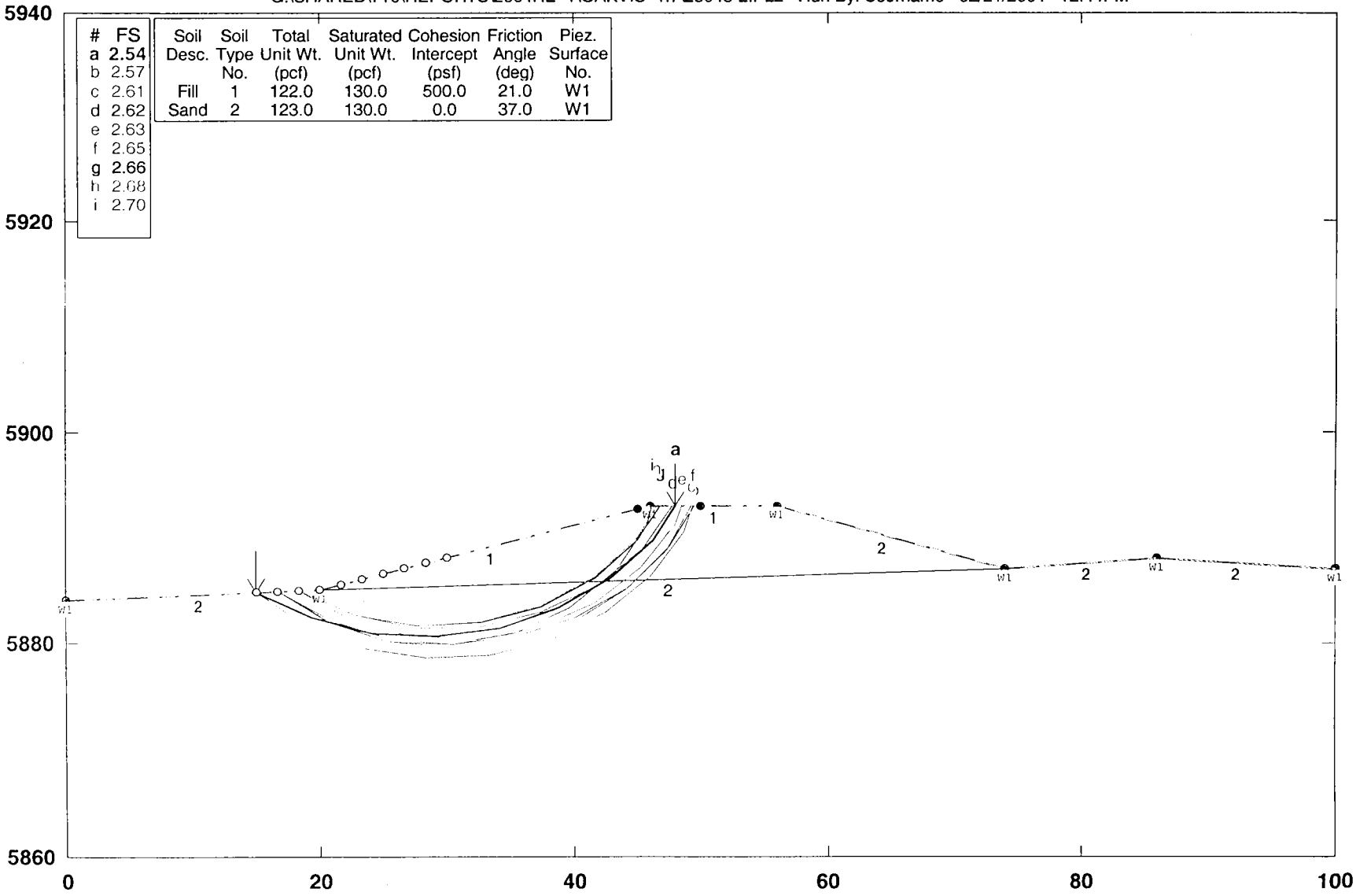
Figure C-2

710-45012/Oak Vista No. 7/Alignment 2/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-2.PL2 Run By: Username 02/21/2004 12:44PM



GSTABL7 FSmin=2.54

Safety Factors Are Calculated By The Modified Bishop Method

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Figure C-3

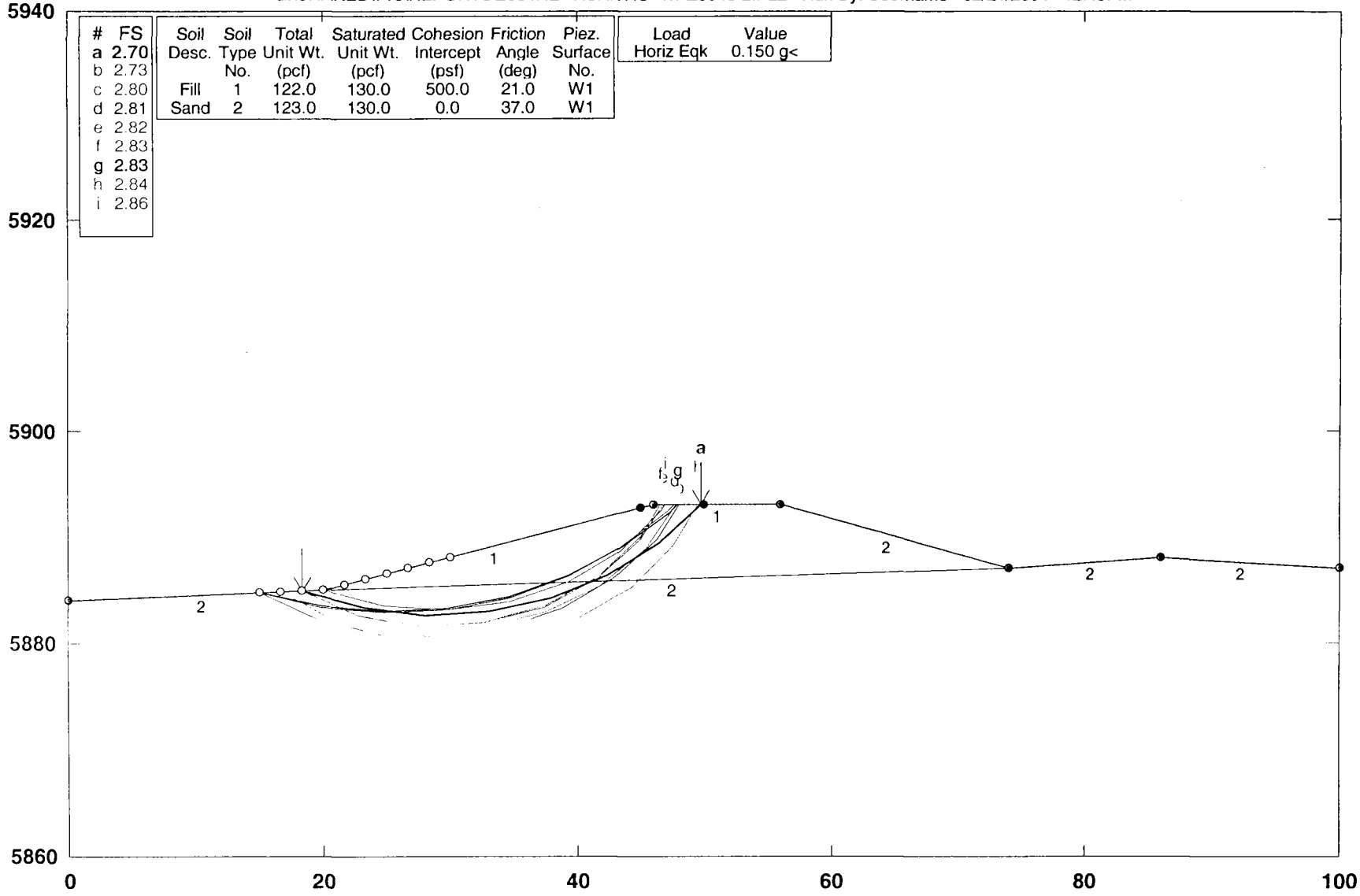
710-45012/Oak Vista No. 7/Alignment 2/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-2.PL2 Run By: Username 02/21/2004 12:45PM

#	FS
a	2.70
b	2.73
c	2.80
d	2.81
e	2.82
f	2.83
g	2.83
h	2.84
i	2.86

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	122.0	130.0	500.0	21.0	W1
Sand	2	123.0	130.0	0.0	37.0	W1

Load	Value
Horiz Eqk	0.150 g<



GSTABL7 FSmin=2.70

Safety Factors Are Calculated By The Modified Bishop Method

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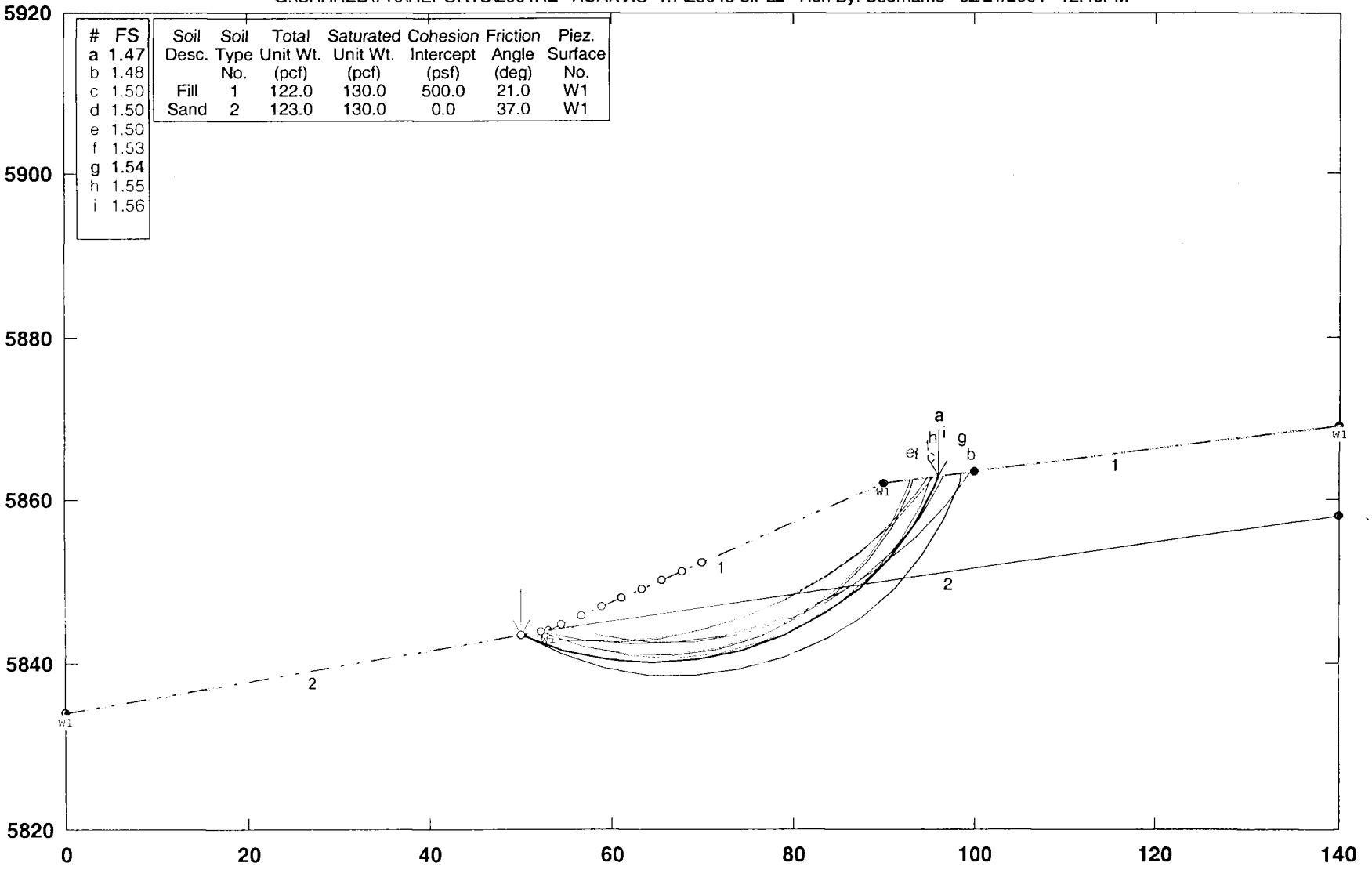
Figure C-4

710-45012/Oak Vista No. 7/Alignment 3/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-3.PL2 Run By: Username 02/21/2004 12:46PM



#	FS
a	1.47
b	1.48
c	1.50
d	1.50
e	1.50
f	1.53
g	1.54
h	1.55
i	1.56

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	122.0	130.0	500.0	21.0	W1
Sand	2	123.0	130.0	0.0	37.0	W1

GSTABL7 FSmin=1.47

Safety Factors Are Calculated By The Modified Bishop Method

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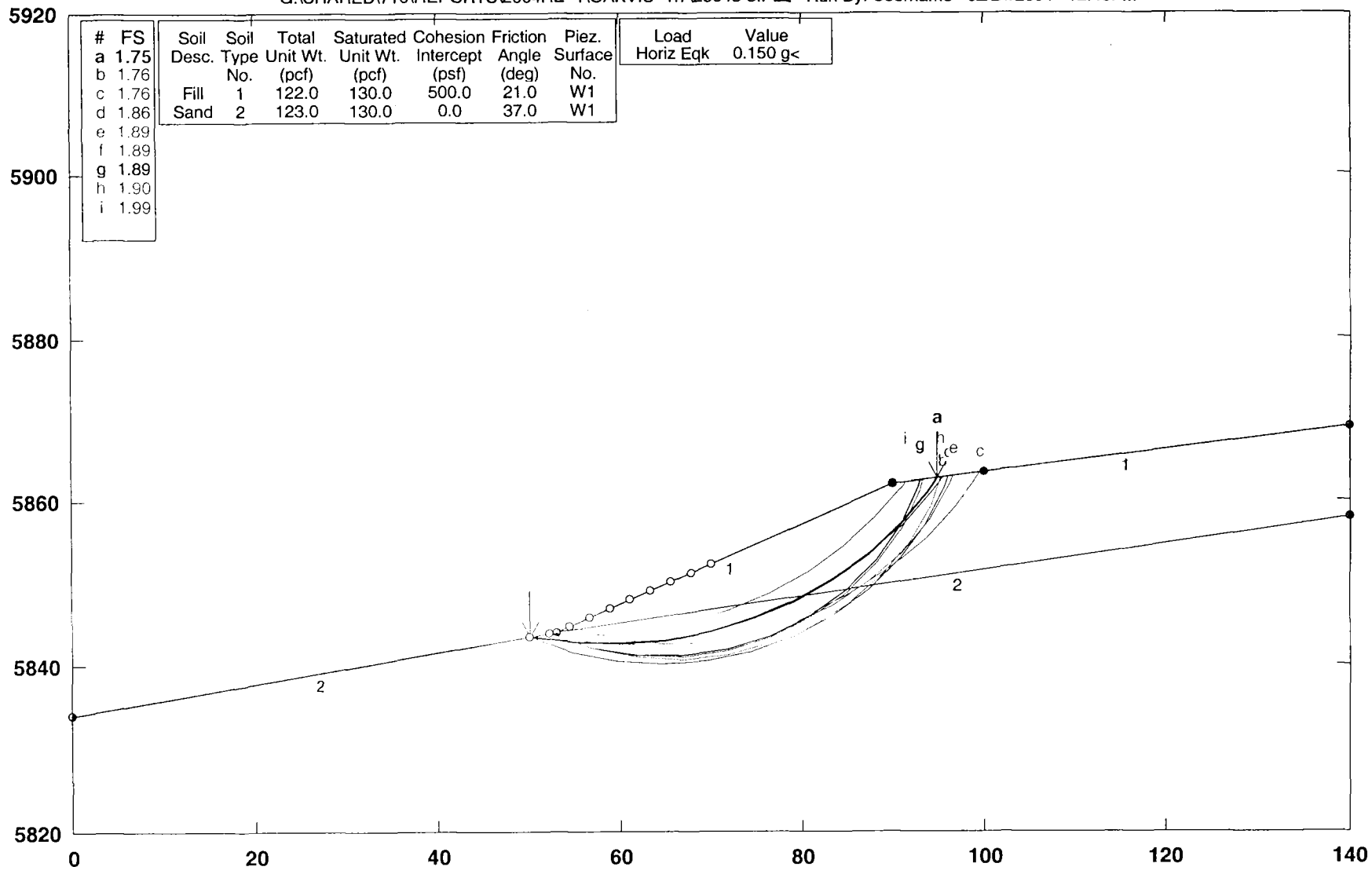
Figure C-5

710-45012/Oak Vista No. 7/Alignment 3/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-3.PL2 Run By: Username 02/21/2004 12:46PM



#	FS
a	1.75
b	1.76
c	1.76
d	1.86
e	1.89
f	1.89
g	1.89
h	1.90
i	1.99

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	122.0	130.0	500.0	21.0	W1
Sand	2	123.0	130.0	0.0	37.0	W1

Load	Value
Horiz Eqk	0.150 g<

GSTABL7 FSmin=1.75

Safety Factors Are Calculated By The Modified Bishop Method

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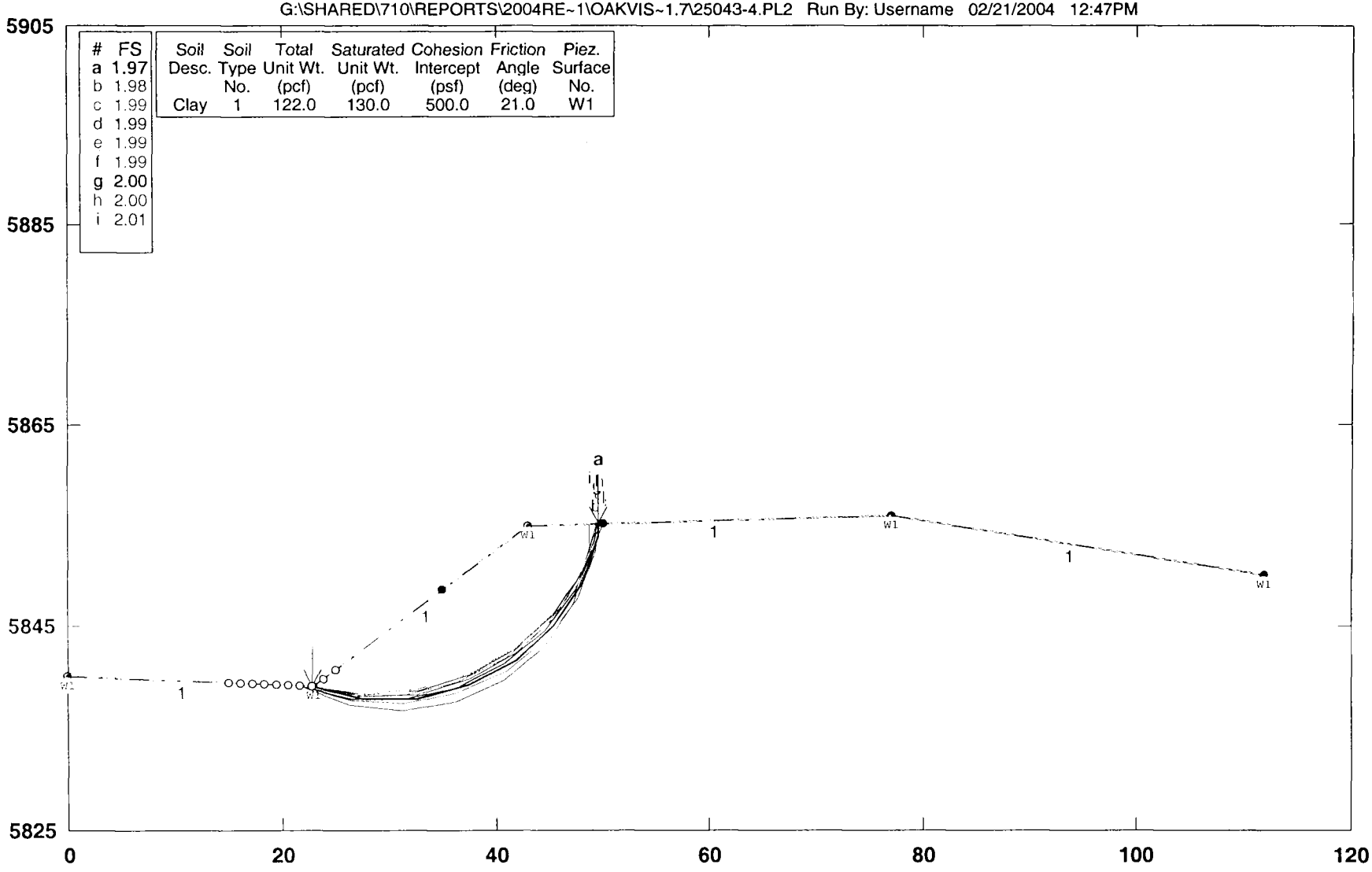
Figure C-6

710-45012/Oak Vista No. 7/Alignment 4 Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-4.PL2 Run By: Username 02/21/2004 12:47PM



GSTABL7 FSmin=1.97

Safety Factors Are Calculated By The Modified Bishop Method

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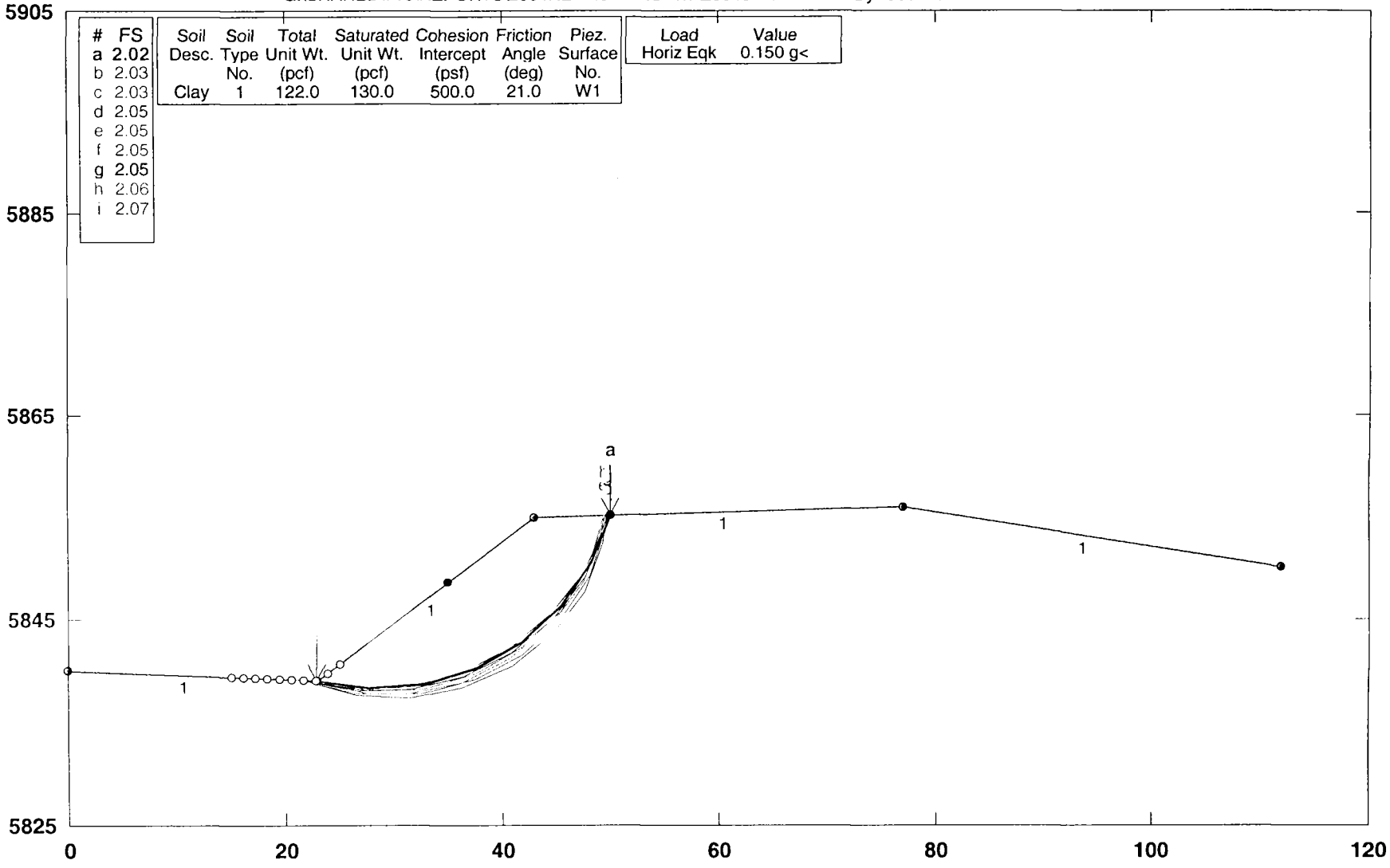
Figure C-7

710-45012/Oak Vista No. 7/Alignment 4 Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-4.PL2 Run By: Username 02/21/2004 12:47PM



GSTABL7 FSmin=2.02

Safety Factors Are Calculated By The Modified Bishop Method

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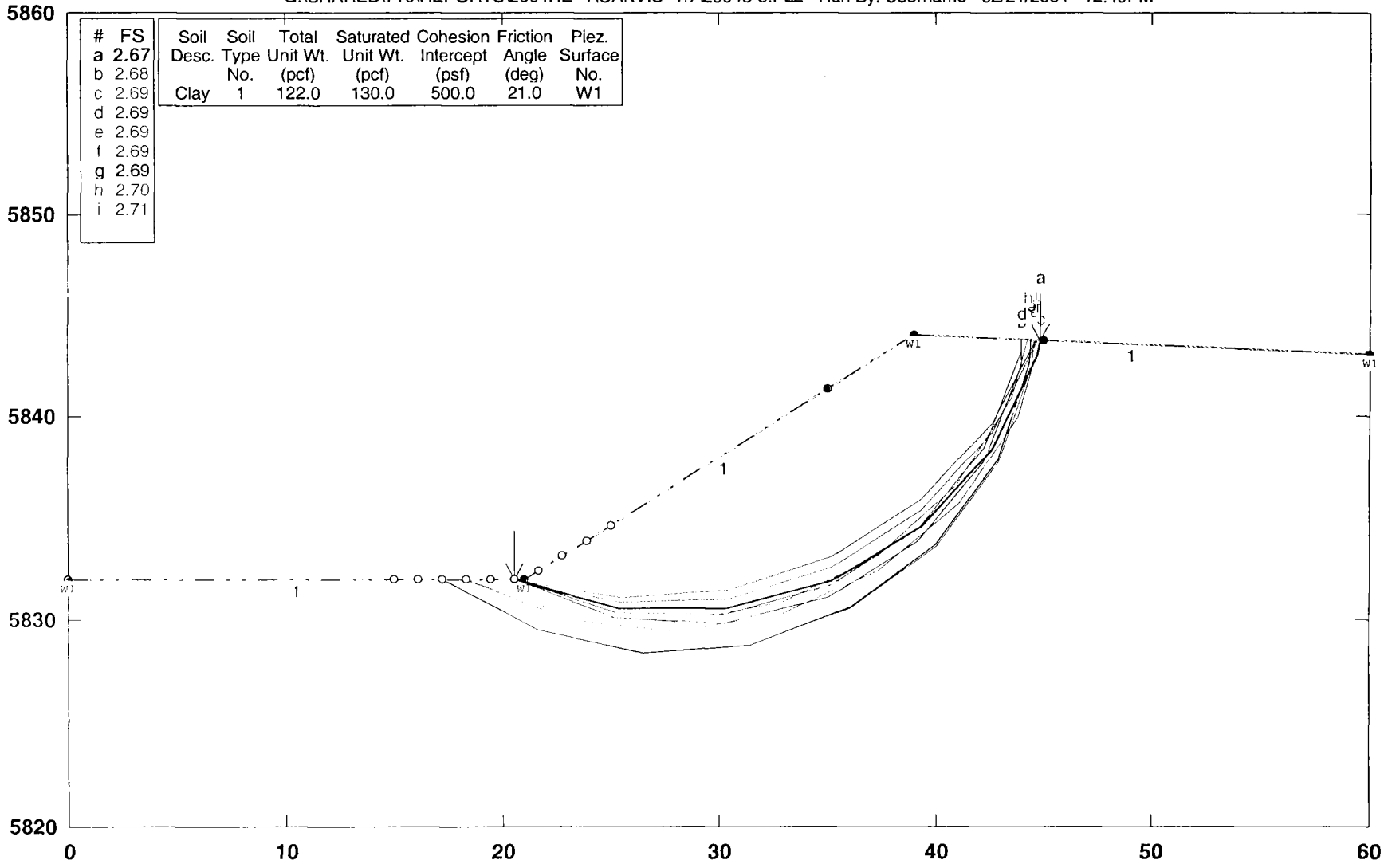
Figure C-8

710-45012/Oak Vista No. 7/Alignment 5/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-5.PL2 Run By: Username 02/21/2004 12:49PM



GSTABL7 FSmin=2.67

Safety Factors Are Calculated By The Modified Bishop Method

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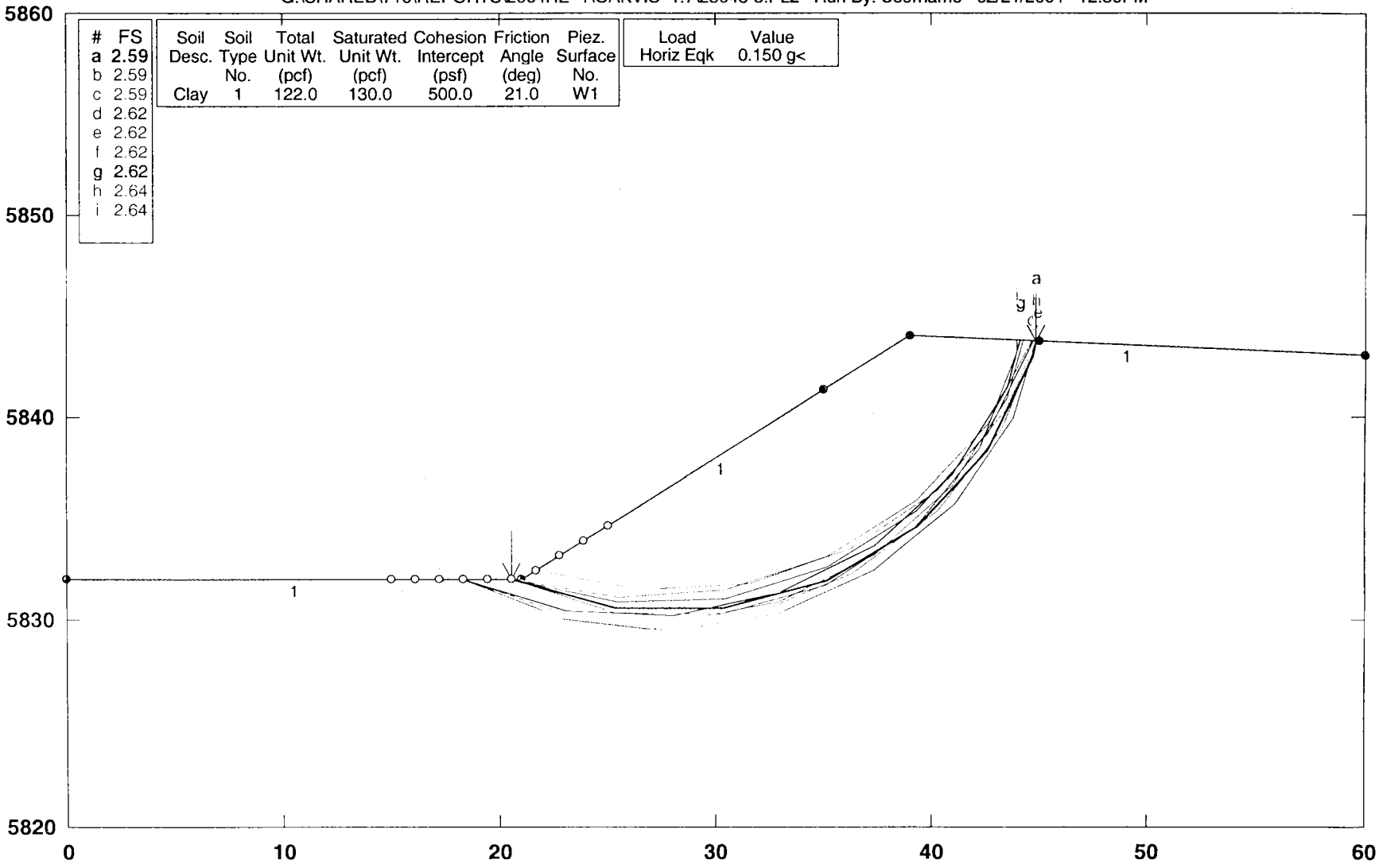
Figure C-9

710-45012/Oak Vista No. 7/Alignment 5/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-5.PL2 Run By: Username 02/21/2004 12:50PM



GSTABL7 FSmin=2.59

Safety Factors Are Calculated By The Modified Bishop Method

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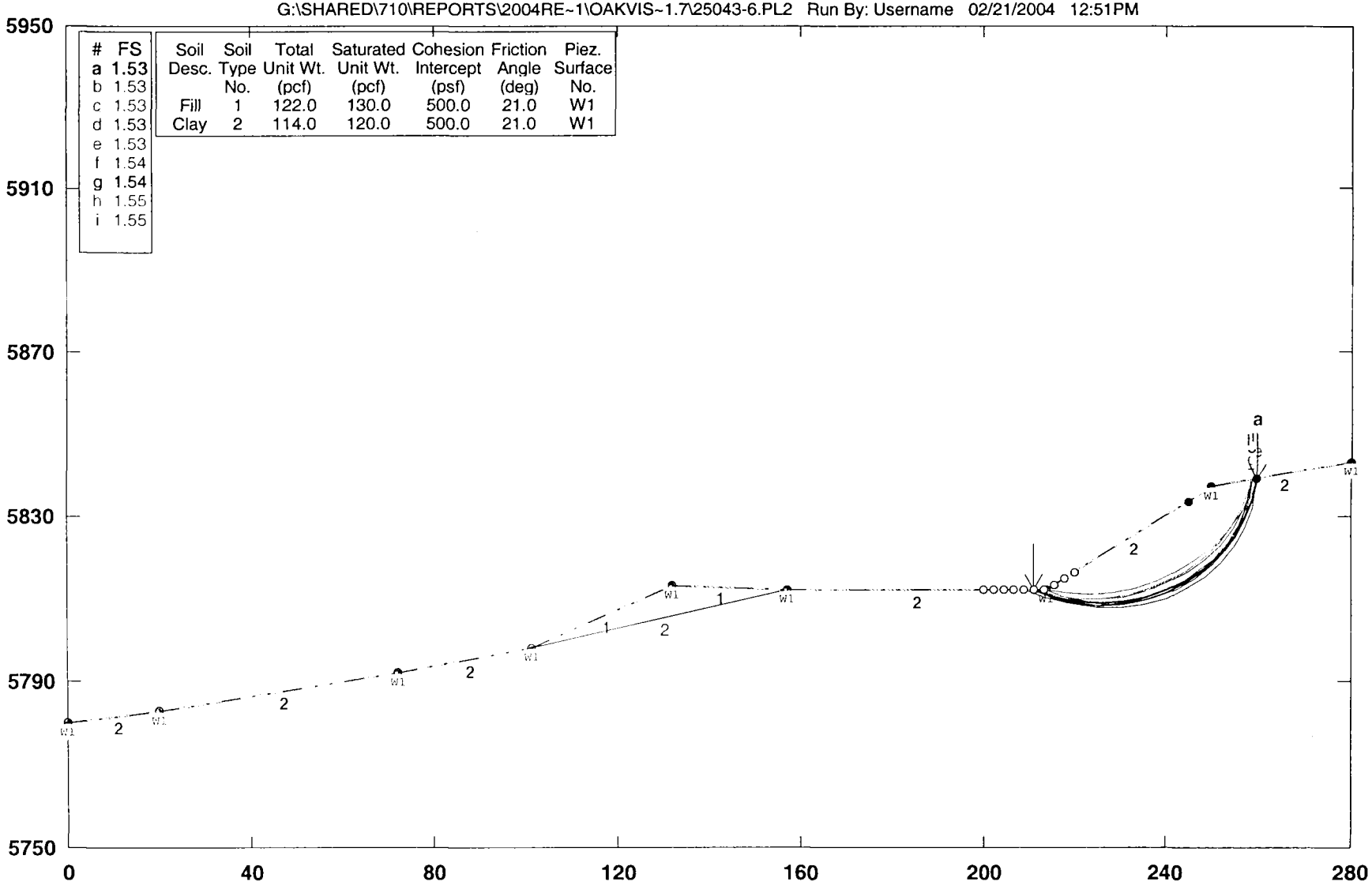
Figure C-10

710-45012/Oak Vista No. 7/Alignment 6/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-6.PL2 Run By: Username 02/21/2004 12:51PM



#	FS
a	1.53
b	1.53
c	1.53
d	1.53
e	1.53
f	1.54
g	1.54
h	1.55
i	1.55

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	122.0	130.0	500.0	21.0	W1
Clay	2	114.0	120.0	500.0	21.0	W1

GSTABL7 FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

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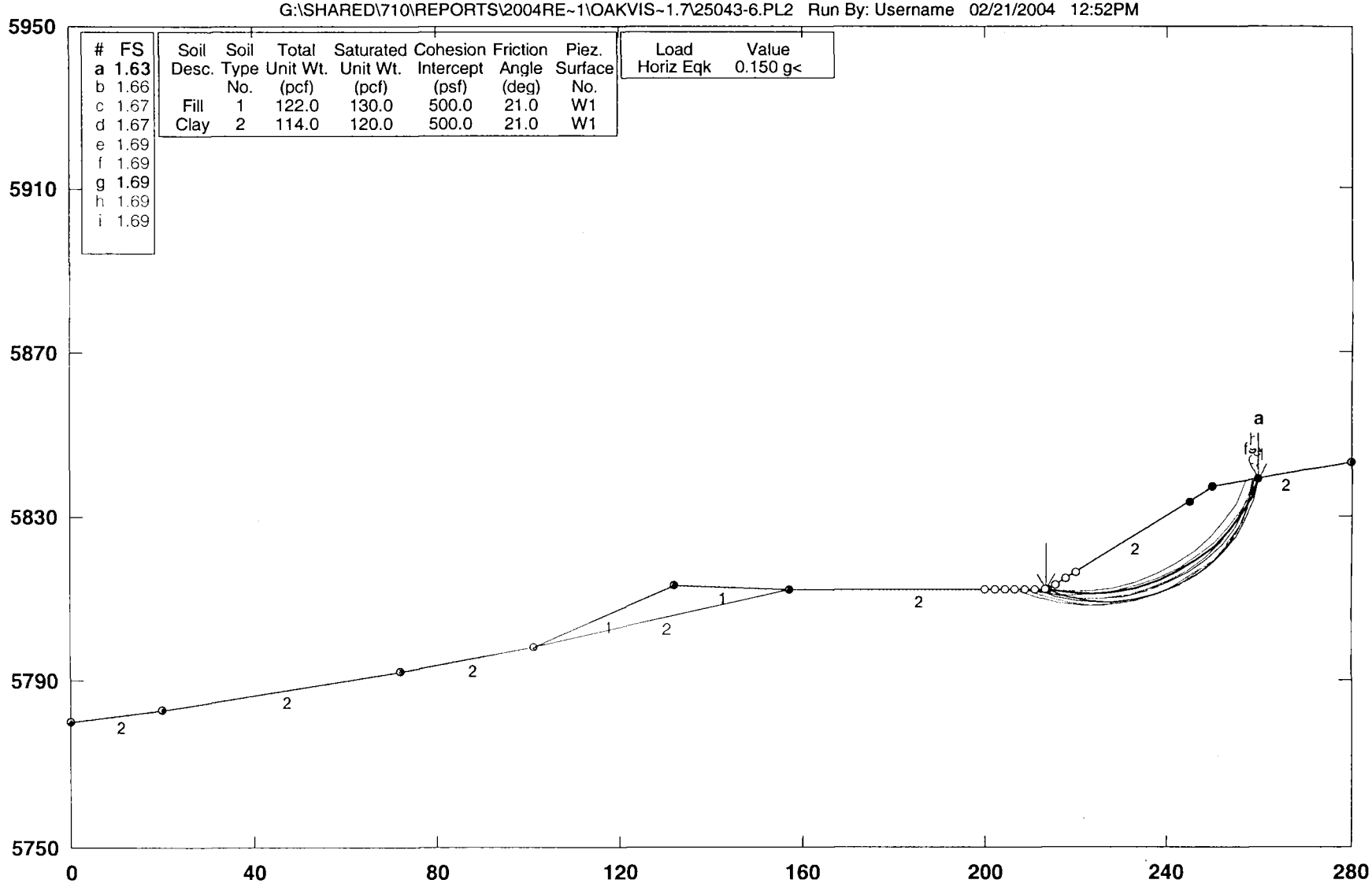
Figure C-11

710-45012/Oak Vista No. 7/Alignment 6/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-6.PL2 Run By: Username 02/21/2004 12:52PM



GSTABL7 FSmin=1.63

Safety Factors Are Calculated By The Modified Bishop Method

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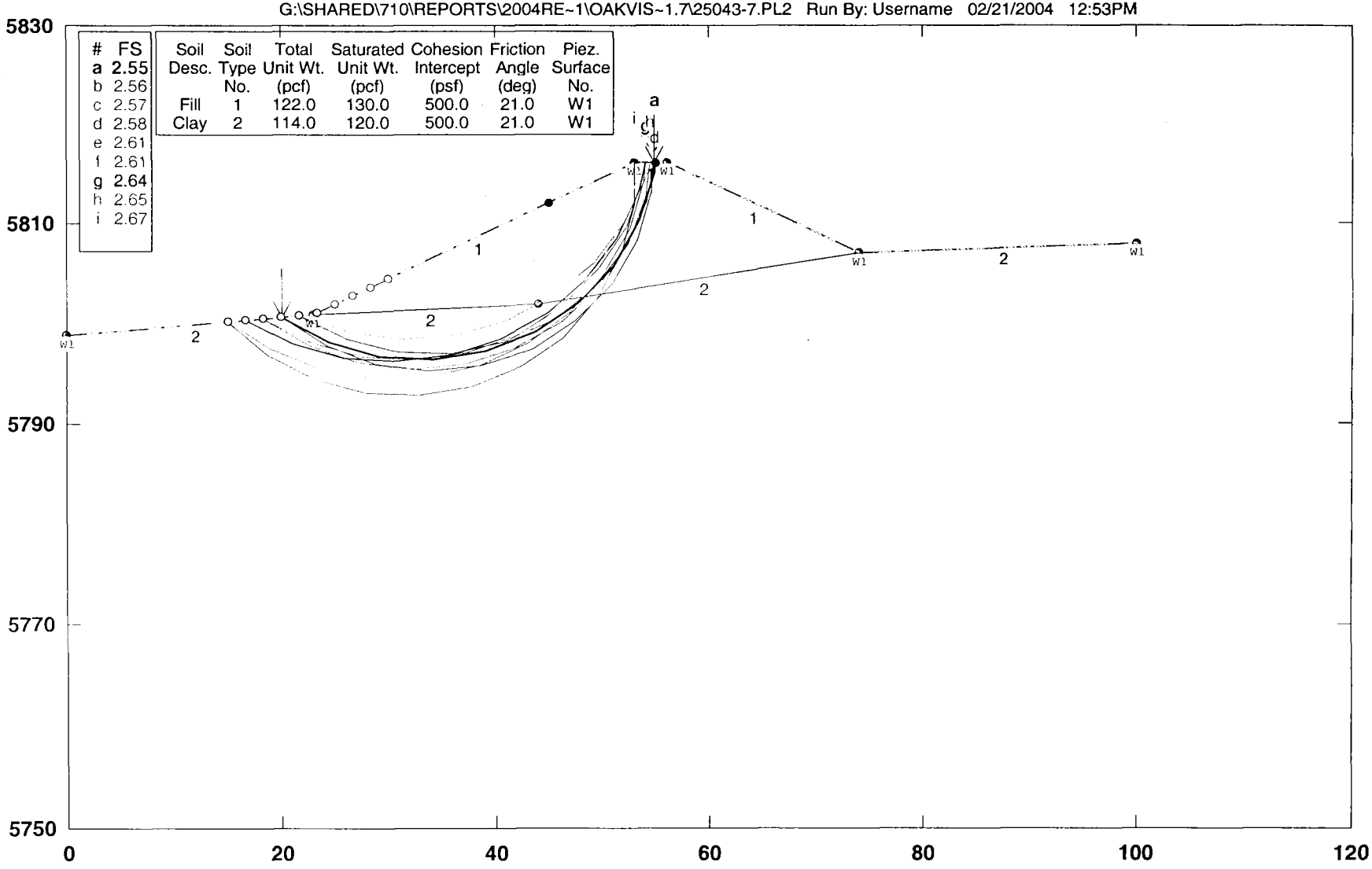
Figure C-12

710-45012/Oak Vista No. 7/Alignment 7/ Static

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-7.PL2 Run By: Username 02/21/2004 12:53PM



GSTABL7 FSmin=2.55

Safety Factors Are Calculated By The Modified Bishop Method

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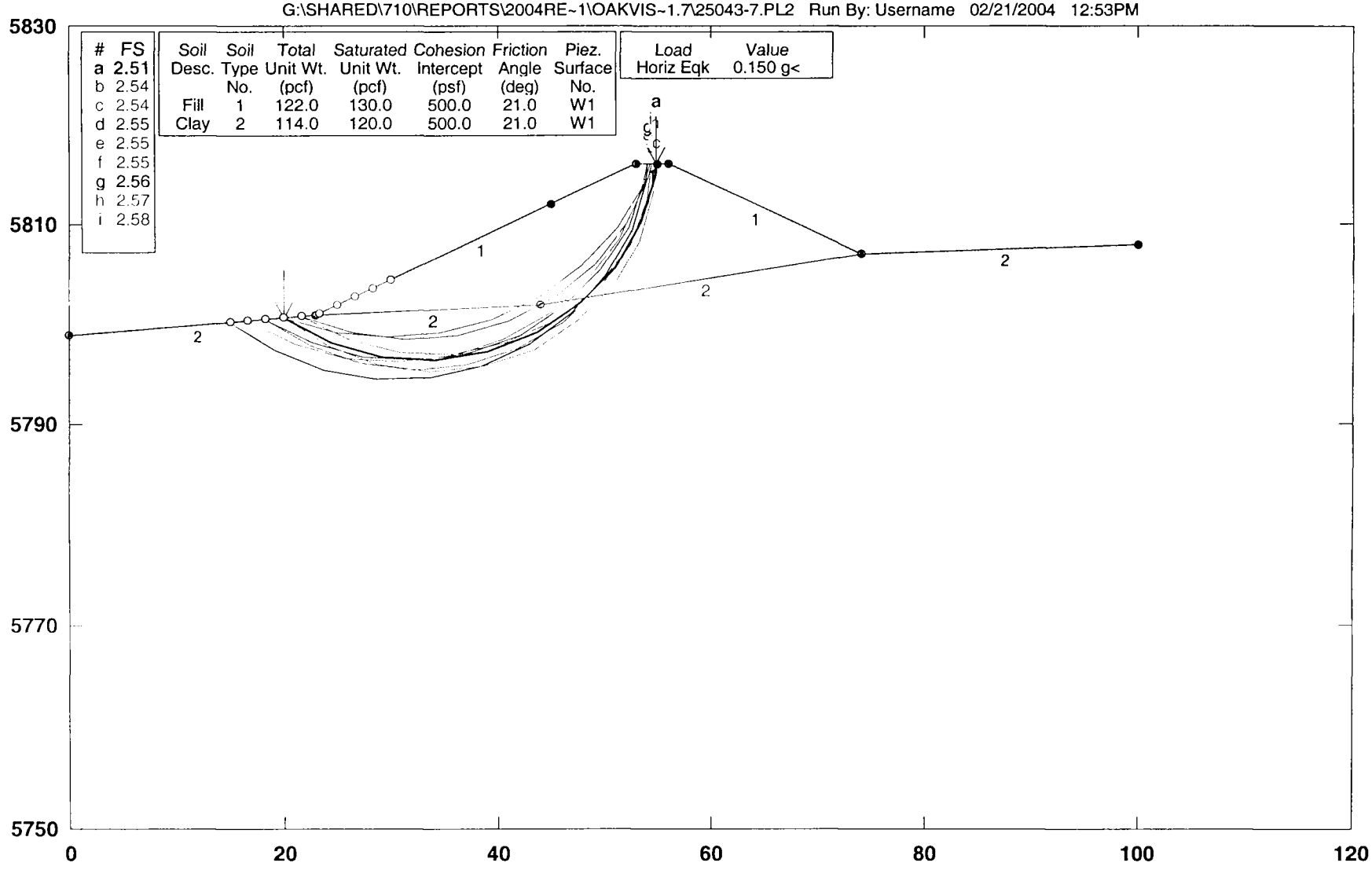
Figure C-13

710-45012/Oak Vista No. 7/Alignment 7/ Seismic

G:\SHARED\710\REPORTS\2004RE~1\OAKVIS~1.7\25043-7.PL2 Run By: Username 02/21/2004 12:53PM



GSTABL7 FSmin=2.51

Safety Factors Are Calculated By The Modified Bishop Method

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Figure C-14