Appendix H-2

Slope Stability Investigation

CHJ Consultants February 2011

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February 15, 2011

Whitewater Rock & Supply Co. Job No. 10369-8
58645 Old Highway 60
Whitewater, California 92282
Attention: Mr. Allan Bankus, Jr.

Dear Mr. Bankus:

This letter transmits eight copies of the slope stability investigation report addressing the existing tailings slopes and the proposed expansion slopes at your Super Creek Quarry, located in the Whitewater area of Riverside County, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
C.H.J., INCORPORATED

Jay J. Martin, E.G.
Vice President

Distribution: Whitewater Rock & Supply Co. (10)

SLOPE STABILITY INVESTIGATION
EXISTING TAILINGS SLOPES AND
PROPOSED EXPANSION SLOPES
OF SUPER CREEK QUARRY
WHITEWATER RIVER AREA
RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR
WHITEWATER ROCK & SUPPLY CO.
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February 15, 2011

Whitewater Rock & Supply Co.
58645 Old Highway 60
Whitewater, CA 92282
Attention: Mr. Allan Bankus, Jr.

Job No. 10369-8

Dear Mr. Bankus:

Attached herewith is the slope stability investigation report, prepared to address the existing tailings slopes and the proposed expansion slopes at Super Creek Quarry, located in the Whitewater River area, Riverside County, California. This report is a revision and expansion of our 2009 report to include the results of large-scale shear testing conducted on the existing tailings slopes in late 2010.

This report was based upon a scope of services generally outlined in our Consulting Services Agreement dated June 24, 2010, and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
C.H.J., INCORPORATED

Jay J. Martin, E.G.
Vice President

JJM/ADE:ndt

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SLOPE STABILITY INVESTIGATION
EXISTING TAILINGS SLOPES AND
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PREPARED FOR
WHITEWATER ROCK & SUPPLY CO.
JOB NO. 07391-3

INTRODUCTION

During late 2010, a slope stability investigation for existing tailings slopes at the Super Creek Quarry was performed by this firm. The purpose of the investigation was to explore and evaluate the stability of the proposed expansion slopes and to provide geotechnical engineering and engineering geologic recommendations for reclamation of the existing tailings slopes. This report includes pertinent information from several prior investigations conducted by this firm in 2007, 2008 and 2009.

To orient our investigation at the site, an electronic copy of the reclamation plan and additional maps indicating the existing topography, prepared by Webber and Webber Mining Consultants, Inc., and revised by Lilburn Corporation, were furnished for our use. The approximate location of the site is shown on the attached Index Map (Appendix "A-1").

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

EXECUTIVE SUMMARY

The approximately 58-acre mine site is located on a hilltop known as Painted Hill in the eastern San Bernardino Mountains. The site has produced decorative rock continuously since the 1950s. Existing tailings slopes are inclined at an overall gradient of 1.5 horizontal to 1 vertical [1.5(h):1(v)]

with some steeper portions, and are planned to remain at an approximate maximum height of 325 feet under the current reclamation plan. Under the proposed revisions the existing slope would be lowered approximately 100 feet, making final reclaimed slopes approximately 225 feet in maximum height.

The approved reclamation plan indicates that the proposed expansion will entail new cut and fill slopes inclined at 2(h):1(v) or flatter. One bedrock cut slope, approximately 150 feet in maximum height, is proposed at 1.2(h):1(v). Bedrock cut slopes are planned at an approximate maximum height of 225 feet. Proposed new tailings (fill) slopes will be approximately 175 feet in maximum height and inclined no steeper than 2(h):1(v). The fill slopes will be provided with terraces at 25-foot intervals, so overall, the proposed fill slopes will be flatter than 2(h):1(v).

The proposed expansion of mining operations requires that the existing approximately 325-feet high tailings slopes be reclaimed, which requires they be "stable" according to criteria in the Surface Mining and Reclamation Act (SMARA). The stability of the existing tailings slopes was addressed by this firm in 2007. We placed two borings in the tailings and conducted conventional laboratory tests on 2.4 inch diameter ring samples. The direct shear test results were highly variable and yielded relatively low tailings strengths. Since there were no economically and/or practically feasible methods to remove or stabilize the slopes, we were requested to provide a protocol for alternative field testing and analysis of tailings strengths.

After evaluating various field test methods, large-scale direct shear testing of the existing tailings was selected and conducted during October and November of 2010. This method is labor and equipment intensive and is consequently very costly. The large-scale testing was conducted to better model the gross strength of the in-situ tailings and yielded more representative results than the standard 2.4-inch diameter ring samples tested in the laboratory.

Static and seismic slope stability calculations utilizing the strengths obtained during the large-scale testing of the existing tailings yield stable slopes for the purposes of reclamation under SMARA. No additional measures with respect to deep-seated slope stability are necessary for reclamation of existing tailings slopes.

The relatively miniscule movement (median of 17 cm, maximum of 66 cm) that could be anticipated from a large seismic event based on Newmark analysis suggests a very low potential for impacts to the creek in the event that a landslide occurs in the existing tailings slopes in the future.

The proposed slopes associated with the proposed waste placement areas and the proposed cut slopes yielded sufficiently high factors of safety for static and seismic conditions, provided the recommendations in this report are followed.

SCOPE OF SERVICES

The scope of services provided during this slope stability investigation included the following:

- Geologic mapping of the site and surrounding area
- Logging and sampling of exploratory borings and surface stockpiles for testing and evaluation
- Laboratory testing on selected samples
- Large-scale direct shear testing of existing tailings, conducted in the field
- Evaluation of the geotechnical and geologic data with respect to the static and seismic stability of the proposed cut and fill (tailings) slopes, as well as the existing tailings slopes

PROJECT CONSIDERATIONS

Review of the approved reclamation plan, which covers the existing quarry and the proposed expansion area, indicates that most proposed cut and fill slopes will be 2(h):1(v) or flatter. One

bedrock cut slope, approximately 150 feet in maximum height, is proposed at 1.2(h):1(v). Bedrock cut slopes are planned at an approximate maximum height of 225 feet. Proposed new tailings (fill) slopes will be approximately 175 feet in maximum height and inclined no steeper than 2(h):1(v). The fill slopes will be provided with terraces at 25-foot intervals, so overall, the proposed fill slopes will be flatter than 2(h):1(v). The reclamation plan is included as Enclosure "A-4".

Existing tailings slopes are inclined at an overall gradient of 1.5(h):1(v) with some steeper portions, and are planned to remain at an approximate maximum height of 325 feet under the existing reclamation plan. These slopes were constructed in accordance with the approved reclamation plan.

SITE DESCRIPTION

The approximately 58-acre site is located on a hilltop (designated as Painted Hill on the U.S.G.S. Whitewater 7.5 minute Quadrangle) in the eastern San Bernardino Mountains. Mining activities have resulted in the construction of cut slopes in the northwestern portion of the site. Sidecast fill (tailings) slopes up to 325 feet high exist in the eastern portion of the site. The cut slopes are inclined at approximately 1(h):1(v), and the tailings slopes are inclined at approximately 1.5(h):1(v).

Current mining activities consist of excavating ore utilizing conventional heavy equipment and hauling spoil (consisting mostly of sand and silt) to temporary placement areas along the west side of the active pit.

PREVIOUS INVESTIGATIONS AND TESTING RATIONALE

We conducted previous shear testing (C.H.J., Incorporated, April 24, 2009) using standard 2.4-inch diameter ring samples obtained from borings drilled into the existing tailings slopes. These samples were tested for shear strength in the laboratory at various normal loads to model the existing slope conditions. The results were variable, possibly due to various factors including sample disturbance, small sample size and small-scale discontinuities (lift boundaries and material pockets). As such, we

utilized a numerical average of the test results in which cohesion = 200 pound per square foot (psf) and phi = 32 degrees, for our earlier slope stability calculations. At the time, the validity of this approach appeared to be supported by the test results obtained years earlier by Byerly (1993). Based on these test results, our calculations yielded a static factor of safety of 1.02 and a seismic factor of safety of 0.71.

Since the date of our 2009 report, questions have been raised about the apparent conflict between the calculated slope stability and the observed performance of the slopes statically and during the Palm Springs earthquake and other large earthquakes, such as the 1992 Landers and Big Bear events. The tailings slopes on the Super Creek Quarry site have accumulated at the site since the 1950's, with no deep-seated slope failures observed by the current owner/operator. There were no deep-seated failures reported as a result of the nearby M5.6 1986 Palm Springs earthquake on July 8, 1986; the owner was on site at the time of this event. No evidence of deep-seated failure, such as modified headscarps, ridges or toes has been observed by geologists from this firm. Peak acceleration contours available on TriNet (U.S.G.S., 2010) show peak ground acceleration at the Super Creek site of approximately 0.59g for the Palm Springs quake. This is a strong ground motion that resulted in no apparent slope failures within the tailings slopes. Numerous landslides and rockfalls were observed in bedrock and alluvial slopes in the area of strong ground motion during this quake and its aftershocks. (Note that the design acceleration for a soft rock subgrade at the site under the 2007/2010 California Building Code (CBC) is 0.58g, slightly below the acceleration that TriNet shows at the site from the Palm Springs quake).

Given the conflict between the small-scale laboratory test results and the observed on-site stability of the slopes, particularly in light of the seismic events, we were requested to provide a protocol for alternative field testing and analysis methods on a larger scale to further evaluate the stability of the existing tailings slopes. The additional testing was designed and expected to produce results that were more accurate and more representative than the prior (laboratory) test results.

PREVIOUS FIELD INVESTIGATION

The soil conditions underlying the subject site were explored during our 2007 investigation by means of four exploratory borings drilled with a truck-mounted drill rig (CME 75) equipped for soil sampling. The exploratory borings were drilled to a maximum depth of 72 feet. The approximate locations of our exploratory borings are indicated on the attached Geologic Map (Enclosure "A-2"). Boring Nos. 3 and 4 were placed in the existing tailings slopes to evaluate the typical strengths of as-placed tailings materials.

Continuous logs of the subsurface conditions, as encountered within the exploratory borings, were recorded at the time of drilling by a staff geologist from this firm. Relatively undisturbed samples were obtained by driving a split-spoon ring sampler ahead of the borings at selected levels. After the required seating of the sampler, the number of hammer blows required to advance the sampler a total of 6 inches was recorded on the boring logs. The number shown on the boring logs is the raw data, and no corrections have been made for sampler or hammer type. Relatively undisturbed as well as bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

Our 2007 exploratory boring logs, together with blowcount data, are presented in Appendix "B". The stratification lines presented on the boring logs represent approximate boundaries between soil types, which may include gradual transitions.

The mining operation produces two types of tailings materials: a 3/8-inch minus material and a 1/4-inch minus material. These materials are referred to as "coarse tailings" and "fine tailings", respectively. Two bag samples of each tailings type were obtained from materials stockpiles at the mine, designated with map symbols C-1, C-2, F-1, and F-2. It was indicated by the owner that most of the future tailings will be the "fine tailings" materials. The moisture-density relationship for the "fine tailings" was used in our analyses of future (proposed) tailings slopes.

Geologic mapping of the site and surrounding area was conducted by an engineering geologist from this firm in 2007 and revised in 2009. Four traverses were conducted along existing cut slopes measuring the attitudes of geologic discontinuities. The locations of the traverses are shown on Enclosure "A-2". Bedrock samples (fresh and weathered) of the two major geologic units were returned to the laboratory for testing.

LABORATORY INVESTIGATION

Included in our 2007 laboratory testing program were field moisture content tests on all samples returned to the laboratory and field dry density tests on all relatively undisturbed samples. The results are included on the boring logs. Sieve analyses, a hydrometer test, and sand equivalent tests were conducted to aid in soil classification and tailings characterization. Direct shear tests were performed on selected relatively undisturbed samples in order to provide shear strength parameters for slope stability evaluation. Optimum moisture content - maximum dry density relationships were established for typical soil types in order that the relative compaction of the tailings materials might be evaluated.

Unconfined compressive strength tests were performed in 2009 on representative bedrock samples. Additionally, densities were obtained for each of the bedrock types. The fresh gneiss (gn) sample was tested with force parallel to and force perpendicular to foliation planes.

For comparison purposes, additional laboratory direct shear tests were conducted on the same material used for the large-scale direct shear tests. Results are described below.

Summaries of the laboratory test results appear in Appendix "C".

2010 LARGE-SCALE DIRECT SHEAR TESTING PROCEDURE AND RESULTS

Various alternative testing and analysis methods were formulated to provide more accurate results regarding slope stability. Initially we considered large-scale field testing such as the load testing that was done in coarse-grained (bouldery) open-pit mine slopes in the City of Irwindale (Irwindale Slope Stability Committee, December 24, 2003). This method involves cutting a vertical face, constructing a reinforced concrete pad above the top, and loading the pad until failure of the vertical face occurs. Since neither the cohesion nor the internal frictional angle was known at Irwindale, this method required assuming a specific internal frictional angle and back-calculating[a] the cohesion by setting the factor of safety result to 1.0. The Irwindale method was ultimately rejected for Super Creek for various reasons, primarily because it requires back-calculation of the cohesion. Although back-calculation is a valid method for many projects, it does introduce uncertainty due to the required assumption for one of two variables (internal frictional angle or cohesion).

It was determined that it was feasible to conduct direct shear testing in the field on large samples, using essentially the same procedures utilized in the laboratory. Such testing would utilize a sample that is many times larger than the standard 2.4 inch diameter ring samples. The large samples would reduce the potential for small-scale anomalies (such as gravel particles and silt/sand pockets) to obscure gross strength trends. Since the tailings are placed in lifts (layers) in a small area (a few feet wide), larger test samples would better reflect the overall strength of the tailings.

The large-scale direct shear testing procedure involved fabrication of a 12" x 12" x 12" shear box from 3/8-inch plate steel, open on the top and bottom. The shear box includes a fixture welded at the bottom to connect a hydraulic ram so that shear force can be exerted at the very bottom of, and normal to, the shear box. The shear box was placed over a suitable tailings sample. Large-scale cutting was first accomplished with a rubber-tire backhoe; finish work was done by hand. The small voids between the shear box and sample were filled with soil cement. The top of the sample was then

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[a] Back-calculation is the reverse of a conventional slope stability analysis, in that the cohesion and phi angle are varied in order to obtain a calculated factor of safety of exactly 1.0.

cut as needed to provide an approximate 1-inch protrusion of the sample above the shear box. A level masonry grout cap approximately 1/2-inch thick was then formed on top of the sample to provide a level base for placement of the normal load.

The hydraulic ram utilized was an Enerpac RC-55 with a capacity of approximately 5 tons. The ram was connected to a calibrated load cell capable of measuring loads (shear force) to one pound. Two transducers were connected to the shear box to measure displacement at two points. The transducers were capable of measuring displacement to thousandths of an inch. The transducers and the load cell were connected to a computer. A plot of time, displacement (two data streams), and shear force was created during each test. The shear force was increased in steps as specified by this firm. The load cell, ram, transducers and computer equipment were provided by and operated by Smith-Emery Laboratories of Los Angeles, California. The equipment utilized is calibrated regularly and certified by AMRL (AASHTO). All field operations were supervised by a Certified Engineering Geologist from this firm. The testing was conducted utilizing the test setup shown on the annotated photograph included as Enclosure "A-5".

The reaction weight (fixed surface that the ram/load cell could push against) consisted of an NPK H-16X hydraulic breaker weighing approximately 5,700 pounds. The breaker was attached to a Cat 235 excavator for stability. The approximately 2-feet long hammer head was fully extended, oriented vertically with the excavator, and inserted/seated into the tailings adjacent to the shear box. The excavator was then used to "downcrowd" (exert force on) the breaker during testing to minimize the deflection of the breaker. No visually detectable deflection of the reaction weight was noted during testing.

The normal loads utilized during testing consisted of various crane test weights. We utilized normal loads of 1,328, 3,338, and 4,538 pounds to simulate the normal forces existing in the tailings slopes. The crane test weights were placed with the use of a crane.

This test method is labor and equipment intensive and is consequently very expensive, requiring numerous operated pieces of construction equipment, test equipment, supervision by registered professionals, and testing by a professional laboratory. The number of tests that could be conducted was limited.

A total of five tests were conducted involving a total of approximately three weeks of field time. The first test (DS-1) failed to obtain a "peak" in the stress-displacement plot and was ultimately rejected. There may have been undue contact between the shear box and the surrounding ground surface in the test of DS-1. The fourth test (DS-4) failed due to compression of the sample, which apparently occurred due to eccentric (non-centered) normal loading on the sample. DS-4 did not produce data. The three successful tests all exhibit a well developed "peak" in the plot of displacement vs. stress, which is expected in the silty sands comprising the tailings.

The tests were conducted within a test plot staked in advance by this firm. The test plot required a relatively large and flat working area outside of the current mined area. An additional requirement was that the test area be accessible continuously for several weeks by the necessary equipment. The only suitable place found on the site is located adjacent to the top of the tailings slope in the northeast portion of the pit area (see Enclosure "A-2"). This is an area of relatively recent, post-SMARA tailings. To remove disturbed surficial soils, the upper 1 to 2 feet was removed from the test plot area prior to testing.

According to the mine owner/operator, the tailings in the test plot area were placed in the mid 1980s. While these tailings would be older (and more consolidated) than the most recently placed tailings, we consider the results to be conservative. The tailings in the test plot have never been loaded by more than 1 to 2 feet of overburden. The average tailings thickness is expected to be approximately 30-40 feet based on our slope stability cross section W-W' (C.H.J., Inc., April 24, 2009). As such, the average overburden is 15 to 20 feet across the site, much greater than the 1 to 2 feet of overburden in the test plot. The average degree of consolidation in the tailings, and the average strength, should be much greater than the materials tested.

Satisfactory results were obtained from tests DS-2, DS-3 and DS-5. Well-developed peak strengths were observed in these 3 test data sets as follows (Enclosure "C-19"):

Sample Classification	Cohesion (lbs./sq.ft.)	Phi (Degrees)
(SM) Silty Sand, fine to coarse with clay	650	31

All samples were tested at field moisture content (approximately 5 to 10 percent).

For comparison with the large-scale direct shear test method, we conducted laboratory shear testing on two sets of ring samples taken from the shear box from DS-2 and DS-5. The shear box was inverted, and the samples were taken utilizing a slide hammer and ring sampler following completion of each test. The bottom ring from each sample was discarded, as this would correspond to the "residual" sheared material in the shear box. These tests were conducted utilizing the in-situ moisture levels.

The results of the laboratory testing show a peak strength of about 330 lbs./sq. ft. and a phi angle of 31 degrees (Enclosures "C-20" and "C-21"). These results are slightly better than previous saturated laboratory testing, but far less than the 2010 large-scale field results.

It is our opinion that the large-scale direct shear test results are more representative of gross strengths than the laboratory (ring sample) tests, due to the larger sample size, and we have utilized the large-scale results to re-calculate the stability of the existing tailings slopes.

SITE GEOLOGY AND SUBSURFACE SOIL CONDITIONS

The site lies in the Whitewater River area of the eastern San Bernardino Mountains. The San Bernardino Mountains are part of the Transverse Ranges Geomorphic Province and are characterized by remnants of a relatively flat, uplifted geomorphic surface as old as Miocene in age. These discontinuous remnants are separated by steep-walled canyons and prominent peaks.

The site is located on Painted Hill as shown on the Whitewater 7.5 Minute Quadrangle map. Dibblee (2004) mapped the site as underlain by gneiss and quartz diorite (Enclosure "A-3"). Geologic mapping of the site was conducted as part of this investigation. The geologic units and their engineering characteristics are discussed below.

fill: All mine spoil is mapped as fill. This unit includes tailings and material placed as fill for roads and equipment pads. The fill at the site is mostly composed of silty sand. As encountered within our exploratory borings placed on the tailings, the fill is in loose to medium dense states and ranges up to 30-1/2 feet below ground surface (bgs).

Qyc: Younger colluvium overlies the bedrock along the slope faces across the site. Only the larger deposits of colluvium were mapped. Many other smaller deposits occur throughout the site. This unit is composed of silty sand with gravel.

Qya: Deposits of younger alluvium are mapped in the stream channel bottoms associated with Super Creek. This unit is primarily composed of silty sand with gravel.

fgg: Foliated granitic/gneissic rock is mapped in the central portion of the site based on exposures in the quarry and on slope faces. This is the unit currently being quarried and is referred to as "Palm Springs Gold". The presence of abundant white mica, probably muscovite, imparts a high sheen or reflectance in outcrops and in hand samples. Exposed on the upper slope faces and along a northeasterly-trending ridge in the proposed expansion area, this unit is a highly weathered light-colored rock with relict sedimentary features. This unit is highly deformed, fractured, and folded. Locally, foliation dips to the north at shallow to steep angles. An analysis of the foliation and jointing within this unit was conducted as part of this investigation. The results of the analysis are discussed later in this report. The contact between the foliated granitic/gneissic and gneissic geologic units appears to be a high angle, northeast-dipping structure. Based on the exposures of the contact in the northeastern and southern portion of the quarry, it appears that the foliated granitic/gneissic unit

may be country rock caught within the major metamorphic unit. Smaller outcrops of the foliated granitic/gneissic unit within the main metamorphic unit appear in various places through the quarry and adjacent to the quarry.

gn: Gneissic rock is exposed in the southwestern and northern portions of the site. The gneissic rock is highly deformed and foliated. It is distinguished from the foliated granitic/gneissic rock by its gray color and more highly-developed foliation. Foliation within this unit dips steeply to the north. Based on the proposed reclamation plan, this unit is less likely to be exposed in the proposed cut slopes. A slope stability analysis of the discontinuities within this unit is discussed in the slope stability section of this report.

GROUNDWATER

No evidence for springs or perched groundwater conditions was observed at the site during the geologic mapping or on the aerial photographs reviewed.

Depth to groundwater data is not available for the site vicinity from the California Department of Water Resources (2007) and the U.S. Geological Survey (2007). The site is underlain by bedrock at shallow depths. Groundwater is anticipated to exist at relatively shallow depths within the Super Creek stream channel located at an elevation ranging from approximately 200 feet to 450 feet below the current mine elevation.

Groundwater was not encountered in our exploratory borings drilled to 72 feet bgs. The current depth to groundwater at the site is not known, but is expected to be greater than 250 feet below proposed quarry elevation. Based on the mine reclamation plans, the expected depth to groundwater, and the presence of non-liquefiable bedrock, the potential for liquefaction and other shallow groundwater-related hazards at the site is considered to be non-existent.

While the site is not underlain by a "typical" aquifer, seasonal precipitation events will create periodic groundwater within joints and fissures within the bedrock. Although rare, these events could occasionally result in minor amounts of ponded water occurring in the retention basin proposed in the southeast portion of the site, allowing for water percolation into the underlying geologic material. In order for this groundwater to pose a hazard, it would have to infiltrate laterally into the tailings. Given the thoroughly fractured character of the bedrock, the arid climate, and the infrequent and light precipitation events, it appears unlikely that significant amounts of groundwater will ever reach the contact between tailings and bedrock. The assumption that groundwater will saturate the tailings slopes, requiring "saturated" tailings strengths to be utilized, is overly conservative, particularly for a site whose only potential reclaimed use is as open space. Therefore, we have utilized unsaturated strengths (native moisture) for use in analysis of the stability of the existing tailings slopes.

We have previously analyzed the stability of the proposed fill slopes associated with the proposed expansion (C.H.J., Incorporated, April 24, 2009). We utilized saturated strengths in those analyses, and those analyses are included in this report, under the highly conservative, saturated assumption.

SLOPE STABILITY

The term "landslide", as used in this report, refers to deep-seated slope failures with a rupture surface at least 25 feet deep. Landslides are typically related to the underlying structure of the parent material. Surficial failures refer to shallow failures that affect the upper geologic material. Evidence for deep-seated landsliding was not observed in the quarry walls or on the aerial photographs reviewed. Evidence of minor surficial failures both as talus and as shallow rotational failure within the tailings slope was observed in the quarry area during this investigation. These surficial failures are manifested as an accumulation of talus on the quarry benches and toes of slopes as well as minor failures within the upper tailings slopes.

The susceptibility of a geologic unit to landsliding is dependent upon various factors that primarily include: 1) the presence and orientation of weak structures, such as fractures, faults, and/or clay

seams; 2) the height and steepness of the natural and/or cut slope; 3) the presence and quantity of groundwater; and 4) the potential/occurrence of strong seismic shaking.

The geologic units at the site, though foliated, are relatively strong from a slope stability standpoint, with no continuous weak clay or schist interbeds observed in natural or mined exposures. The foliation primarily dips to the north and is oriented favorably with respect to the planned reclamation slopes. Dibblee mapped overturned beds in the northwest portion of the site. Geologic mapping conducted by this firm found no evidence of overturned foliation or bedding of the geologic units exposed at the site. The geologic contact between the two bedrock units is a steeply east-dipping contact composed of weathered and metamorphosed rock. Folding and warping of the dominant foliation becomes more prevalent adjacent to the geologic contact between the two bedrock units. Joints show more variability in orientation in outcrop, but are less continuous in exposure than the foliation mapped. The existing cut slopes provide exposure of the underlying bedrock. Jointing was the dominant discontinuity and the dominant factor in slope formation of the natural slopes.

The gross stability of the proposed final quarry slopes, as depicted in the Reclamation Plan (Enclosure "A-4", Sections W-W', X-X', Y-Y' and Z-Z'), was analyzed under both static and seismic conditions for rotational failures utilizing the SLIDE computer program (Roscience, Inc., 2007 and 2010). Except as noted below, with respect to the existing tailings slopes, the past seismic stability calculations were performed using a lateral pseudostatic coefficient "k" of 0.20 due to the proximity of the San Andreas Fault zone. The factor of safety was calculated by Spencer's Method. Our past slope stability analyses were conducted in accordance with procedures outlined by Blake and others (2002) and the California Division of Mines and Geology (1997).

The rock strengths were modeled utilizing the most conservative data from the unconfined compressive strengths included in Appendix "C". Friction angles were estimated from published data on similar rock types (Wyllie and Mah, 2004). Strength parameters utilized in our slope stability for

the proposed fill slope and for the proposed bedrock cut slope calculations were averaged values obtained from our laboratory testing and in-place density data from our exploratory borings (Appendix "C").

The results of our slope stability calculations for rotational failure are discussed below. Our calculations are included as Appendix "D".

2010 SLOPE STABILITY CALCULATIONS:

Geologic Cross Section W-W': The existing tailings slope was analyzed for gross stability against rotational failures. The existing tailings slope has an overall inclination of approximately 1.5(h):1(v) with steeper portions. The total height of the existing tailings slope is approximately 325 feet.

The existing tailings slope was re-evaluated in 2010 using the new strength data from the large scale direct shear testing. We utilized cross section W-W' from our previous report (C.H.J., Incorporated, April 24, 2009). We utilized the SLIDE computer program and Spencer's method. For the 2010 seismic analysis, we utilized a seismic coefficient of 0.15, which is the minimum acceptable seismic coefficient for the State of California. While this proposed reclamation is not a "code" building project and is not subject to any building code provisions, it is reasonable to note that various public agencies consider 0.15 the minimum seismic coefficient[b]. The following results were obtained for the existing tailings slope (Enclosures "D-1.1" and "D-1.2"):

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[b] Determination of the k is an exercise in judgment as there is no specific k professionally-prescribed or agreed-upon to be applied to a quarry. A minumum k of 0.15 is required by many agencies in California, including the City and County of Los Angeles for code building projects. CGS Special Publication 117 (1997) also set the minimum for code building projects at 0.15. A later revison, CGS Special Publication 117A (2008), suggests an elaborate calculation of k based on the maximum ground shaking, earthquake distance and earthquake magnitude that would produce, for sites near a major fault such as the Super Creek quarry, a very high, overly conservative and impractical k. Because the only forseeable use for the remote, reclaimed Super Creek site is as open space, and there are no life safety or structure damage issues, it would be overly conservative and unwarranted to apply a k that exceeds the minimum required for code building projects; therefore, in our judgment, 0.15 is an appropriate k for use at this site.

Slope Analyzed	Factor of Safety (Static)	Factor of Safety (Seismic)
W-W'	1.34	1.04

These results are slightly below the standard minima of 1.5 static and 1.1 seismic applied to building code development projects in California, but are by definition "stable" with respect to reclamation requirements under SMARA. During previous conversations with State Mining and Geology Board (SMGB) personnel it has been noted that SMARA does not specify minimum factors of safety and that SMGB generally accepts minima that are within about 90 percent of the code standards of 1.5 static and 1.1 seismic.

Newmark Analysis – Existing Tailings Slopes:

Since the pseudostatic stability is slightly below the 1.1 factor of safety that is commonly used for "code" building projects, a Newmark analysis was conducted on the tailings slopes through Section W-W'. The purpose of the Newmark analysis is to estimate the displacement of the landslide (modeled as a sliding block) that could be expected during the modeled seismic event or events. The displacement is a function of the critical seismic coefficient (the seismic coefficient required to yield a pseudostatic stability of 1.0), and the parameters of the seismic event(s) selected such as magnitude, distance, and fault type. Since SMARA does not specify a ground motion for design of reclaimed slopes, we cite the ground motion specified by the CBC for new construction projects. The CBC ground motion is conservative in that it applies to human occupancy structures. It is logical that usage for reclamation (open space), where life safety is not an issue, should be subject to a lower design ground motion.

Based on our laboratory data, observation of surface exposures at the site, and the geologic setting, the site is considered to be a Type "C/D" soil profile according to the 2010 CBC. The anticipated exposure period (project lifetime) for the reclaimed slopes cannot be specified at this time. The 2010 CBC establishes a design earthquake hazard level of 2 percent probability of exceedance[c] in 50 years;

[c]The probability that an earthquake will generate a level of ground motion that exceeds a specified reference level during a given exposure time.

this acceleration is then scaled (multiplied) by two-thirds for most new construction. The return period corresponding to a 2 percent probability of exceedance in a 50-year exposure period is 2,475 years. A design peak ground acceleration value of 0.58g was calculated according to the requirements of the 2010 CBC using U.S. Geological Survey Java Ground Motion Parameter Calculator.

The Newmark analysis was conducted utilizing the updated Java programs by Jibson and Jibson (2005). Our analysis selected records from soft rock and stiff soil sites for earthquakes with moment magnitude of 6.0 to 8.3 and at focal distances of 6 to 20 kilometers. Records with peak acceleration of 0.20 to 1.0g were included in the analysis and scaled to the design acceleration. Strike-slip and reverse focal mechanisms were utilized to capture nearby potential earthquake scenarios. A total of 48 seismic records were selected under these criteria and included in the analysis.

A critical seismic acceleration (ky) of 0.17g (Enclosure "D-1.3") was determined based on a sensitivity analysis of the results of Section W-W'. A median displacement of 17 centimeters and a maximum displacement of 66 centimeters were calculated for the design earthquake event. This displacement is miniscule compared to the width of the creek. Since the minimum horizontal setback of the toe of the tailings slopes to the drainage bottom is approximately 40 feet according to our geologic mapping (C.H.J., Incorporated, April 24, 2009) and Google earth imagery, the tailings slopes appear to be adequately set back from the drainage bottom should the anticipated seismically-induced slope failure occur.

The relatively tiny movement that could be anticipated from a large seismic event based on Newmark analysis suggests a very low potential for impacts to the creek should a landslide occur. Since the current and future land use is as open space, the site is on federal land, and the site is remotely situated from the built environment, the risk to any people or structures is very small even in the event of a slope failure.

EXPANSION AREA SLOPES:

Geologic Cross Sections X-X' and Z-Z': Two proposed waste placement areas are shown on the reclamation plan. Geologic Cross Sections X-X' and Z-Z' were constructed across the Northwest and Southwest Waste Placement areas to analyze the proposed slopes for gross stability against circular/rotational failures. The highest slope associated with these areas (Northwest Waste Placement area) is approximately 175 feet high and is inclined overall at approximately 2.4(h):1(v). The Southwest Waste Placement area shows a slope of approximately 125 feet high and inclined similarly to the Northwest Waste Placement area slope. The calculations were performed for rotational failures under static and seismic conditions utilizing the SLIDE computer program, version 5.029 (Rocscience, Inc., 2007).

Direct shear testing was conducted on samples remolded to approximately 85 percent relative compaction and no added moisture to represent material being placed and spread by conventional heavy equipment rather than sidecast as the existing tailings slopes were constructed. The obtained shear test values were used in our slope stability analysis, and the results are tabulated below (Enclosures "D-2.1", "D-2.2", "D-4.1", and "D-4.2").

Slope Analyzed	Factor of Safety (Static)	Factor of Safety (Seismic)
X-X'	1.74	1.10
Z-Z'	1.81	1.14

Geologic Cross Section Y-Y': The proposed cut slope represented by cross section Y-Y' was analyzed for gross stability against rotational failure using the procedures described above. The slope is inclined at an approximate 1.2(h):1(v) and is to be constructed entirely in bedrock. The results of our slope stability calculations are tabulated below (Enclosures "D-3.1" and "D-3.2").

Slope Analyzed	Factor of Safety (Static)	Factor of Safety (Seismic)
Y-Y'	3.03	2.09

Stereonet analysis for each of the significant cut slopes was performed utilizing mapped geologic structures at the site. During the field mapping, joints, foliation, and shear zones were mapped along Traverse Nos. 1 through 4 and are shown on the attached Geologic Map (Enclosure "A-2"). The measured attitudes are included as Appendix "F". The geologic discontinuities used in our kinematic analysis are highlighted on the attached enclosure.

The proposed slopes were analyzed for both wedge and plane failures where appropriate. As previously described, jointing of the exposed bedrock was prevalent throughout the site. The joints exposed within the quarry exhibited little to no lining and were tight and dry. Joints within the more weathered bedrock were mostly lined with soil or clay. A few instances of calcite lining were found among the upper exposures of bedrock. Joint and foliation spacing generally decreased with depth and freshness of the underlying bedrock. The results of our kinematic analysis are discussed below. Parameters utilized in our kinematic analysis were obtained from field and laboratory tests (Appendix "C").

During our field investigation all of the discontinuities mapped were dry and most showed no evidence of water infilling. However, due to the occurrence of seasonal precipitation events, the proposed slopes were evaluated with water infilling the discontinuities. Geologic features listed as minor joints were not evaluated for potential failure, due to the lack of continuity within the exposures at the site. These features were generally less than 10 feet in length. Due to the variety of infilling materials within foliation and joints, a conservative friction angle of zero degrees (0º) was used in our kinematic analyses. Friction angles for rock are generally within 28 to 32 degrees. If these values are applied to the initial Markland's test, most of the potential wedge and planar failures analyzed would not meet the criteria for potential failure.

Geologic Cross Section W-W': Geologic discontinuities from all of the traverses and the mapped discontinuities were included in the analysis of the proposed slope represented by Geologic Cross Section W-W', due to the length and location of the proposed slope spanning the quarry. Initially, each of the discontinuities was evaluated using Markland's test to identify potential planar failures.

The plotted discontinuities do not fall within the critical zone as shown on Enclosure "E-1". Minor discontinuous jointing and or foliation may result in out-of-slope planes that may lead to localized failures resulting in talus piles at the toe of slope or along benches.

Markland's test revealed potential for wedge failures along the intersection of two or more discontinuities. These potential failures were analyzed for areas, and the results are included as Enclosures "E-5" and "E-6". The calculated factors of safety ranged from 1.87 to 49.93. Even though the calculated factors of safety for wedge failures were sufficient, scaling of the quarry walls (removal of loose blocks) should be conducted during excavation and construction of the final reclaimed slopes. Minor wedge failures due to changes in dip and orientation are anticipated, but are expected to be relatively minor and localized.

Geologic Cross Section Y-Y': The proposed reclamation slope represented by Geologic Cross Section Y-Y' was evaluated for potential planar failures and wedge failures for all the east facing, northeast facing, and southeast facing components of the proposed slope. The measured discontinuities from Traverses 1 through 3 were used in our analysis. Markland's tests showed a potential for failure along a planar surface for all three faces. Planar failure analyses were performed for each of the potential failures using Plane (Rockware, 2007, RockPack III) for both seismic and static conditions. The resulting factors of safety ranged from 1.29 to 4.46 for seismic and 2.92 to 8.66 for static. The results of our planar failure analyses for Geologic Cross Section Y-Y' are included as Enclosures "E-2", "E-3", and "E-4".

Markland's test for potential wedge failures revealed a potential for wedge failures on the proposed slope. Due to the number of intersections indicating potential failure for each of the slope faces, zones of intersection were analyzed in certain cases. The results of our wedge failure analyses varied from a factor of safety of 0 to 54.93. The results of our wedge failure analysis are included as Enclosures "E-7" through "E-11". A discussion of the calculations yielding insufficient factors of safety follows.

Our wedge failure calculations yielded very low factors of safety for some of the intersections and areas analyzed of the east face of the slope represented by Geologic Cross Section Y-Y' (Enclosures "E-7", "E-8", and "E-9"). The proposed slope forms a man-made ridge that generally trends east/west. The eastern face is the "nose" of the man-made ridge. The actual three dimensional results of these potential failures would result in small block failures along the nose of the ridge line, accumulating at the base of the slope. The potential for this type of failure can be mitigated by scaling of finished slope faces, as recommended in this report.

CONCLUSIONS

Large-scale direct shear testing of the existing tailings at Super Creek was conducted during October and November of 2010. This method is labor and equipment intensive and is consequently very costly. It was conducted to better model the gross strength of the in-situ tailings and yielded more representative results than the standard 2.4-inch diameter ring samples.

Static and seismic slope stability calculations utilizing the strengths obtained during the 2010 large-scale testing yield stable slopes for the purposes of reclamation under SMARA. No additional measures with respect to deep-seated slope stability are necessary for reclamation of existing tailings slopes.

The relatively miniscule movement (median of 17 cm, maximum of 66 cm) that could be anticipated from a large seismic event based on Newmark analysis suggests a very low potential for impacts to the creek in the event that a landslide occurs in the existing tailings slopes in the future. Since the current and future land use is as open space, the site is on federal land, and the site is remotely situated from the built environment, the risk to any people or structures is very small even in the event of a slope failure.

The proposed slopes associated with the proposed waste placement areas yielded sufficiently high factors of safety against static and seismic conditions, provided the recommendations in this report are followed.

The proposed cut slopes are considered to be stable against gross rotational and planar failure as proposed. Minor wedge failures are anticipated to occur as small rock falls, accumulating as talus debris cones along the base of the slopes.

RECOMMENDATIONS

SEISMIC SHAKING HAZARD:

Severe seismic shaking of the site can be expected to occur during the lifetime of the proposed mining and reclamation. This potential has been considered in our analyses and evaluation of slope stability.

EXISTING TAILINGS SLOPES:

The existing tailings slopes are considered suitable for reclamation in their as-built condition. No additional measures with respect to deep-seated slope stability are necessary for reclamation of existing tailings slopes under the existing reclamation plan.

PROPOSED FILL SLOPE CONSTRUCTION (EXPANSION SLOPES):

The slopes associated with the proposed waste placement/tailings areas are considered stable if the following recommendations are followed. All loose alluvial soils should be removed below the proposed slopes and fill material should be placed, not dumped, and spread evenly in lifts with conventional heavy equipment. Moisture content should be at least 7 percent by weight, which is the typical post-plant moisture content of tailings. The addition of water during the placement process should facilitate compaction of the tailings.

Our analyses for the proposed tailings slopes are based upon a relative compaction of 85 percent using ASTM D 1557 as a laboratory standard. The as-built tailings materials will generally need to meet or exceed 85 percent relative compaction to satisfy minimum standards for static and seismic slope stability.

The on-site soils should continue to provide adequate quality fill material for construction of tailings slopes with minimal compactive effort. These slopes should be constructed no steeper than 2(h):1(v) with 10-foot wide benches at 25-foot vertical intervals to provide adequate safety against static and seismic slope failure.

The finished fill slopes should be re-vegetated, where practical, with appropriate native, drought-tolerant vegetation.

PROPOSED CUT SLOPE CONSTRUCTION (EXPANSION SLOPES):

The proposed cut slopes are considered grossly stable as shown on the reclamation plans.

SLOPE PROTECTION:

Inasmuch as the native materials are susceptible to erosion by running water, runoff should not be allowed to flow over the reclaimed slopes. Slopes should be protected with berms and/or levees as necessary to prevent slope erosion. Where water is directed into an excavation, surface water should be conveyed as necessary through piping or riprap-lined downdrains with splash pads to prevent erosion.

Existing tailings slopes are being vegetated in accordance with the existing reclamation plan.

ALTERNATE END USES OF THE SITE:

This report and the investigation performed in order to prepare this report are intended to be suitable for mine reclamation only. Future uses of the site for anything other than reclamation of the mine as open space are beyond the scope of this investigation and report. It is our opinion that alternate end

uses of the site are highly unlikely in the foreseeable future. Based on the results of the deformation analysis (maximum Newmark displacement of 66 cm), the contemplated (and proposed) end use as open space is compatible with the reclamation of existing tailings slopes as proposed, even in the event that slope failure should occur.

If other uses of the site are planned or considered, then an additional investigation to address other end uses should be conducted.

LIMITATIONS

C.H.J., Incorporated has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of C.H.J., Incorporated. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where

observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions be encountered in the field, by the client or any firm performing services for the client or the client's assign, that appear different than those described herein, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,

C.H.J., INCORPORATED

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FY/JJM:ndt

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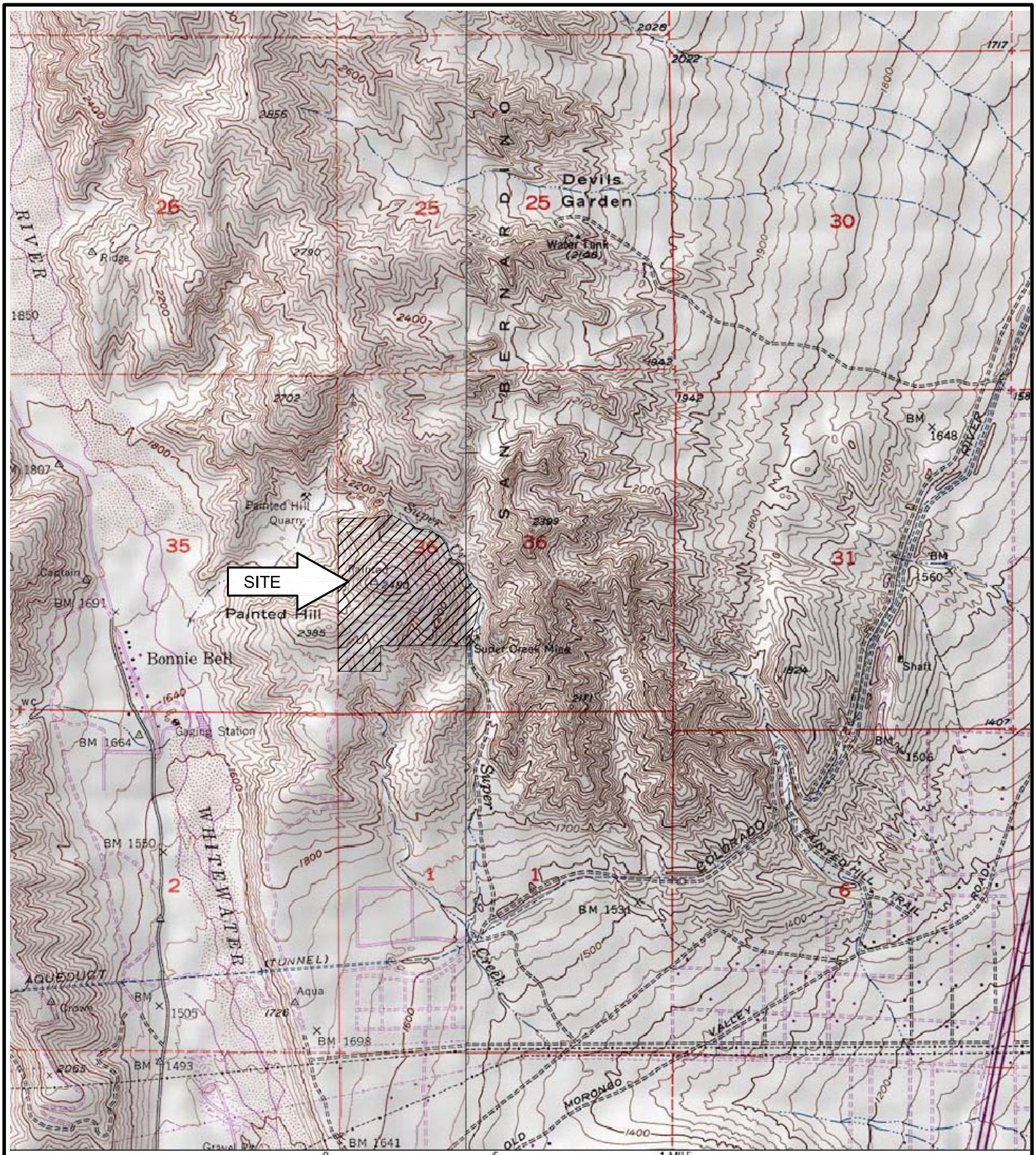
APPENDIX "A"

GEOTECHNICAL MAPS AND PHOTOGRAPH



-N-

SCALE: 1"= 2,000'

INDEX MAP

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-1"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

GEOLOGIC UNITS AND LEGEND:

f - fill (mine spoil)
Qc - Younger colluvium (Holocene)
Qa - Younger alluvium (Holocene)
fgg - Foliated granitic/gneissic rock (Mesozoic and older)
gn - gneiss (Precambrian?)

geologic contact (dashed where uncertain)

84 strike and dip of foliation

87 strike and dip of jointing

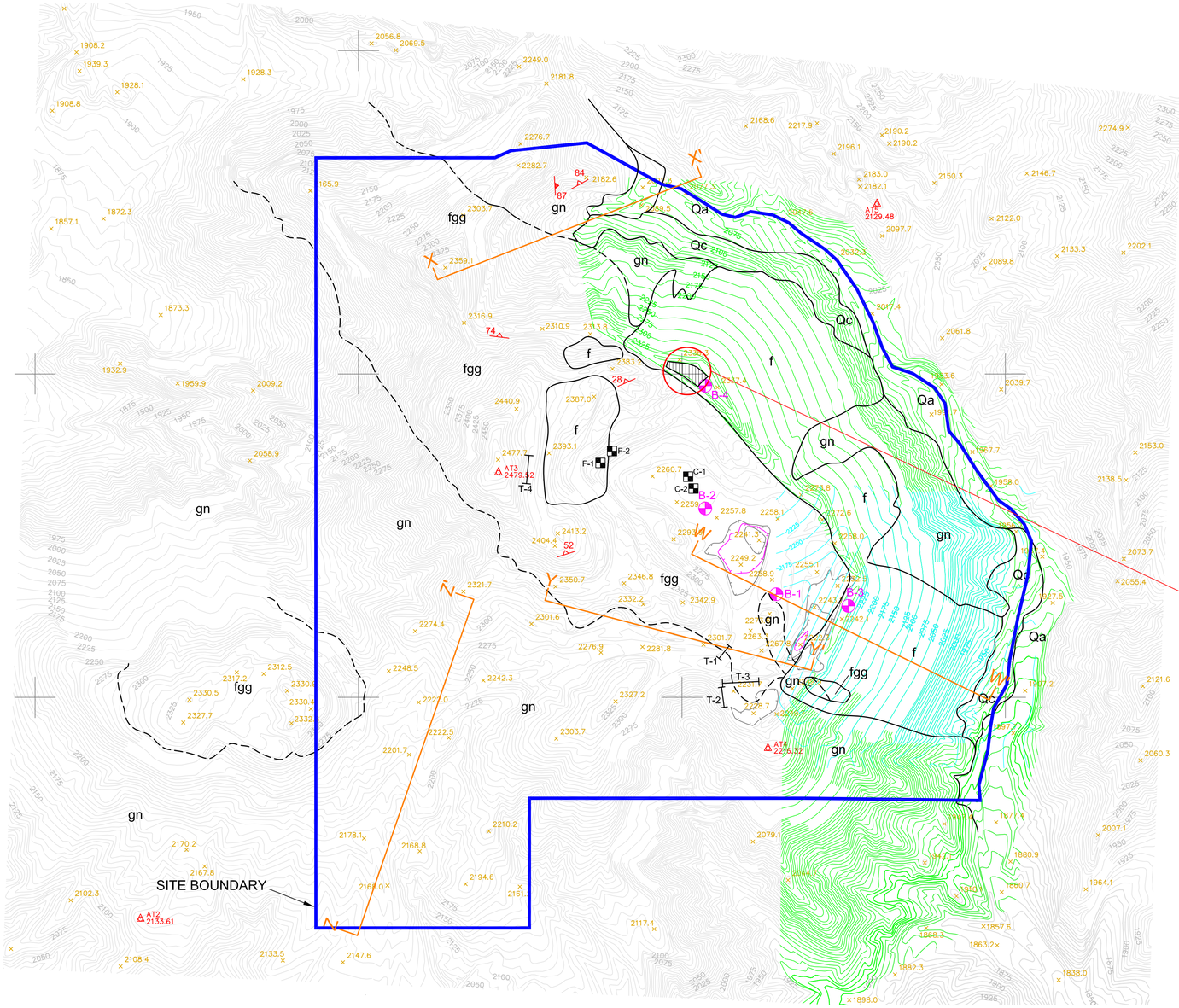
Z — Z' geologic cross section

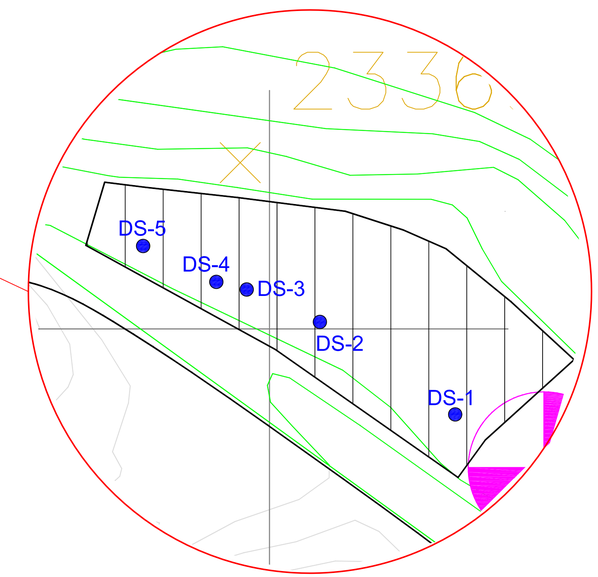
B-4 exploratory boring location

F-2 bag sample location

T-4 geologic traverse

DS-5 direct shear tests





LARGE SCALE DIRECT SHEAR
TEST AREA
SCALE 1"= 20'

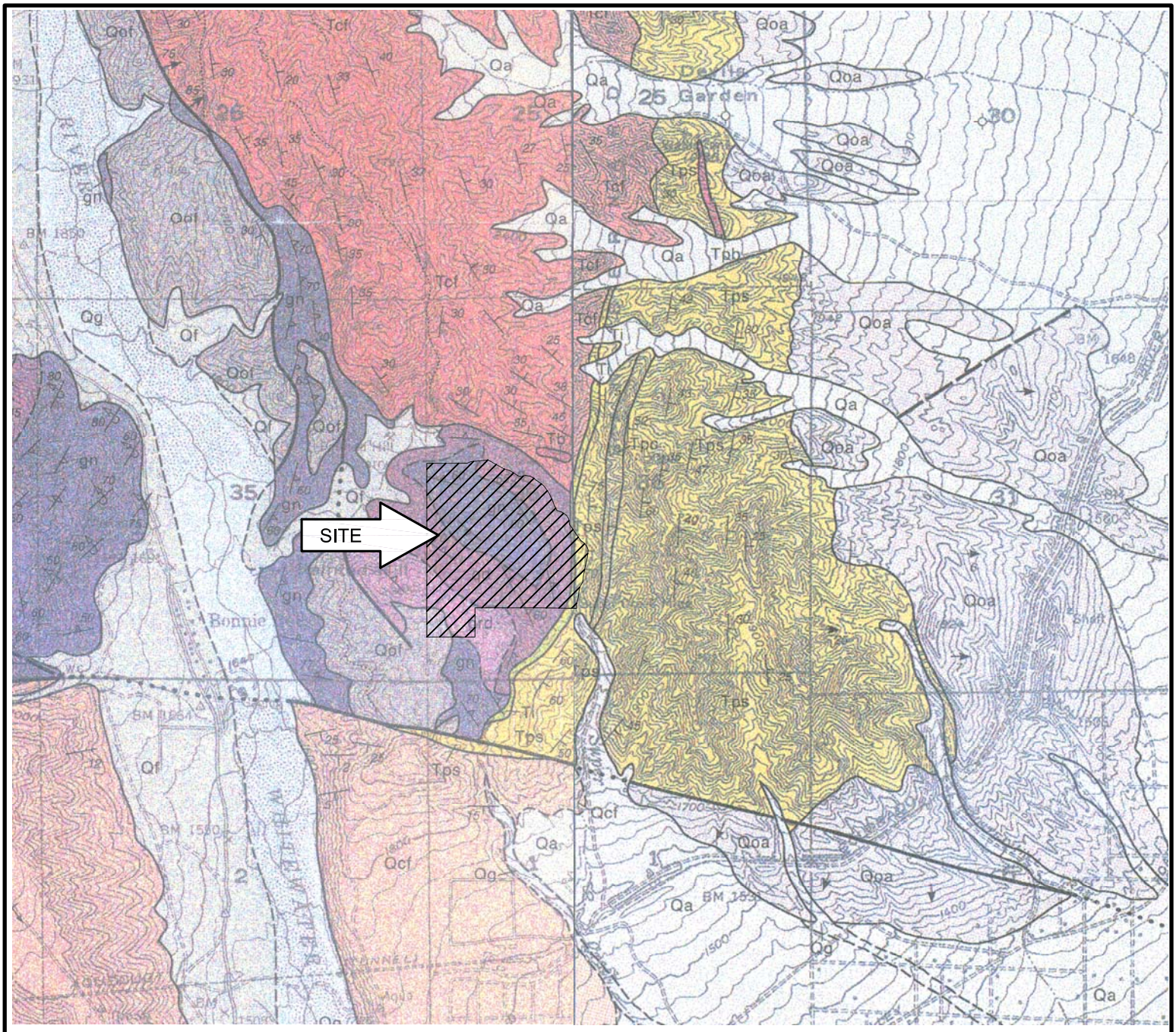
N

SCALE 1"= 200'

0 200 400

GEOLOGIC MAP		
FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-2"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated



GEOLOGIC UNITS:

Qg - Alluvial sand and gravelly sand of stream channel washes (Holocene)
Qa - Alluvial sand and gravel of valley areas (Holocene)
Qf - Alluvial fan boulder-cobble gravel (Holocene)
Qoa - Older alluvial fan gravel and sand (Pleistocene)
Qof - Older alluvial fan (Pleistocene)
Qcf - Cabazon fanglomerate (Pleistocene)
Tps - Palm Springs formation (Pliocene)
Tcf - Coachella fanglomerate (Miocene)
qd - quartz diorite (Cretaceous)
grd - granodiorite (Cretaceous)
gn - gneiss (PreCambrian to Mesozoic)

geologic contact

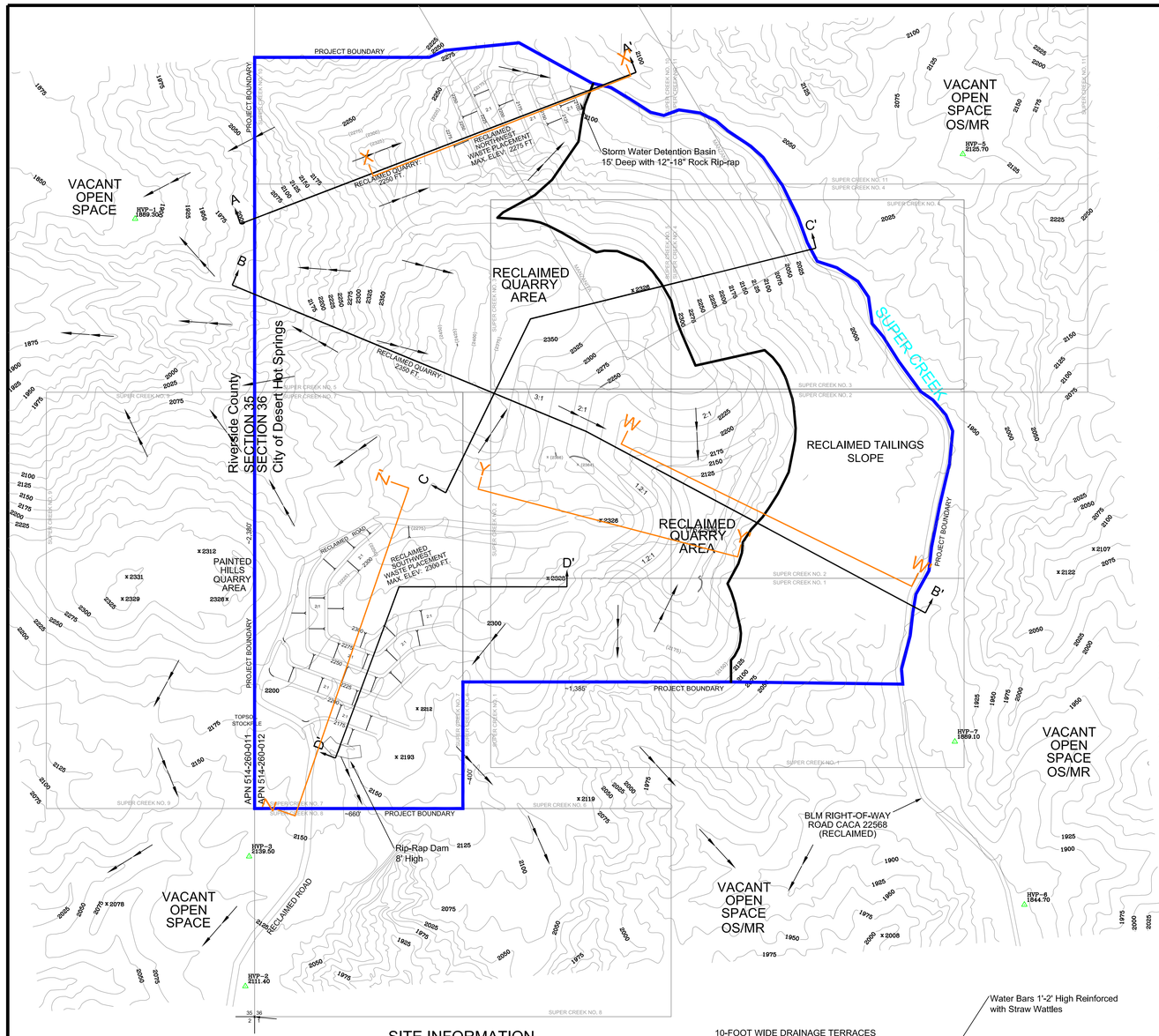
-N-

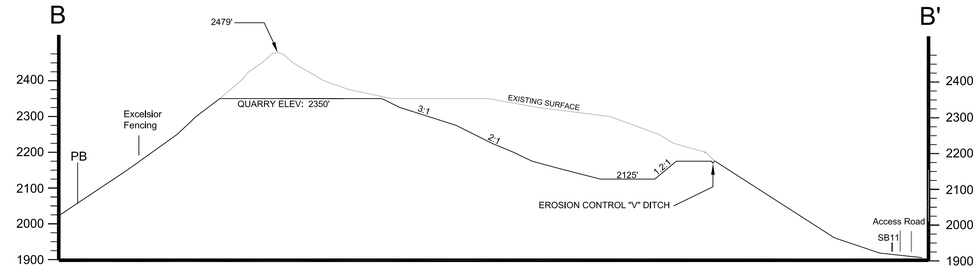
SCALE: 1"= 2,000'

GEOLOGIC INDEX MAP

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-3"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

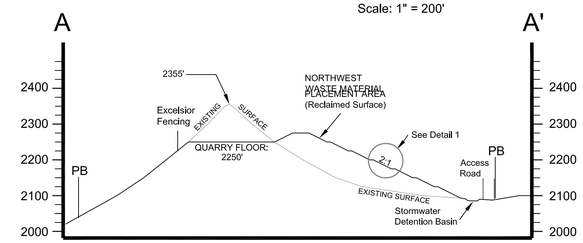
C.H.J. Incorporated





CROSS SECTION B - B'

Scale: 1" = 200'



CROSS SECTION A - A'

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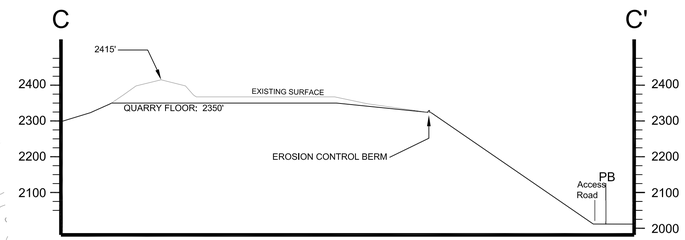

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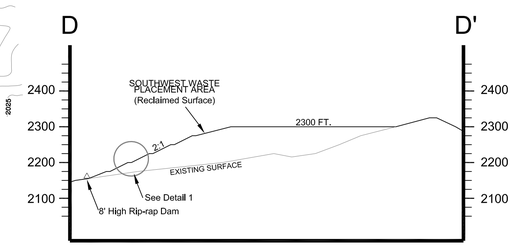


CROSS SECTION D - D'

Scale: 1" = 200'

DRAFT
2008 SUPER CREEK QUARRY EXPANSION

RECLAMATION PLAN

SITE INFORMATION

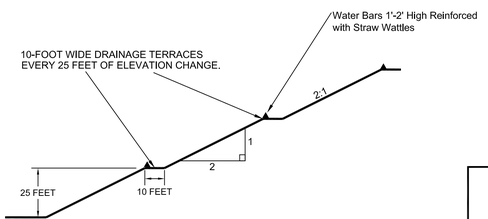
EXISTING QUARRY AREA:	23.8 Acres
Existing Eastern Waste Tailings Slopes:	27 Acres
PROPOSED EXPANSION AREA:	44.4 Acres
TOTAL PROJECT AREA :	95.2 Acres
ASSESSOR'S PARCEL NUMBER(s):	514-260-012-0001

LEGAL DESCRIPTION:

The possessory interest and all other rights, title and interest in and to land and inprovements thereon described as Super Creek #1 through #7, Super Creek #10 and #11, and the Manzanita claims in Sections 35 and 36, Township 2 South, Range 3 East, SBBM.

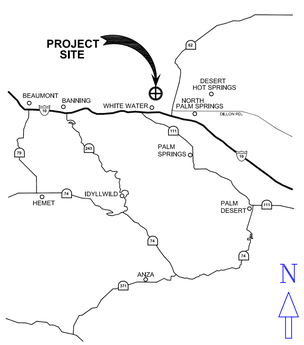
UTILITIES

Telephone - Mobile Service
Water - Offsite Well
Electricity - Diesel Generator
Gas - None
Sewer - Portable Toilets



DETAIL 1
TYPICAL WASTE PLACEMENT AREA SLOPE
Scale: N.T.S.

LOCATION MAP



THOMAS BROS. GUIDE LOCATION INFORMATION

San Bernardino and Riverside Counties Street Guide and Directory (1999 Edition), Page 695, Grid D-5

LEGEND

- PROJECT BOUNDARY
- QUARRY/TAILINGS BOUNDARY
- EXISTING CONTOUR
- DRAINAGE FLOW DIRECTION
- PB — PROJECT BOUNDARY

N

C.H.J. LEGEND:

Z — Z' Geologic Cross Section

NO.	DATE	REVISION	BY
1	11/2008	Added Erosion Control Measures; Included Eastern Tailings Area in Rec. Plan; Revised Acreages	MD

RECLAMATION PLAN

FOR: WHITEWATER ROCK AND SUPPLY

DATE: DECEMBER 2010

SLOPE STABILITY INVESTIGATION
SUPER CREEK QUARRY
WHITEWATER RIVER AREA
RIVERSIDE COUNTY, CALIFORNIA

ENCLOSURE "A-4"

JOB NUMBER 10369-8

C.H.J. Incorporated

2008 Super Creek Quarry Expansion
BLM PLAN OF OPERATIONS MINE PLAN

MINERAL: Decorative Rock

APPLICANT: OPERATOR:	Whitewater Rock & Supply Co. 58645 Old Highway 60 Whitewater, California 92282 (760) 325-2747
MINERAL RIGHTS: LANDOWNER:	Bureau of Land Management 690 W. Garnet Avenue North Palm Springs, California 92258 (760) 251-4800
MINING ENGINEER: MAP PREPARER: REPRESENTATIVE:	Webber & Webber Mining Consultants, Inc. 101 E. Redlands Blvd., Ste. 240 Redlands, California 92373 (909) 793-3416
MAP SOURCE: CONTOUR INTERVAL:	USGS 7.5' Quad: White Water & Desert Hot Springs, CA 25 Feet

Scale: 1" = 200'
Date: November 30, 2008
Drawn by: L. Richtmyer
Designed by: G. Webber

REVISION REFERENCE		
NO.	DATE	BY
1	11/2008	MD

EXPLANATION

1. TRANSDUCERS (2)
2. SHEAR BOX (12"x12") WITH MANUALLY CUT SAMPLE INSIDE
3. NORMAL LOAD
4. HYDRAULIC RAM
5. LOAD CELL
6. ROCK BREAKER (REACTION WEIGHT)

ANNOTATED PHOTOGRAPH OF TEST SETUP		
FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION PROPOSED EXPANSION OF SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-5"
DATE: DECEMBER 2010		JOB NUMBER 10369-8
		C.H.J. Incorporated

N.T.S.

APPENDIX "B"

EXPLORATORY LOGS

KEY TO LOGS

LEGEND OF LAB/FIELD TESTS:

Bulk	Indicates Disturbed or Bulk Sample
Dist.	Indicates Disturbed Sample
DS	Direct Shear Test (ASTM D 3080)
Exp.	Expansion Test (California Building Code Standard Test Method 18-2)
MDC	Maximum Density Optimum Moisture Determination (ASTM D 1557)
N.R.	Indicates No Recovery of Sample
Ring	Indicates Relatively Undisturbed Ring Sample. Relatively Undisturbed Ring Samples are obtained with a "California Sampler" (3.25" O.D. and 2.42" I.D.) driven with a 140-pound weight falling 30 inches. The blows per foot are converted to equivalent SPT values.
SA	Sieve Analysis (ASTM C 136)

ENGINEERING PROPERTIES FROM SPT BLOWS

Relationship of Penetration Resistance to Relative Density for Cohesionless Soils*
(After Mitchell and Katti, 1981)

Number of SPT Blows (N_{60})	Descriptive Relative Density	Approximate Relative Density (%)
<4	Very Loose	0-15
4-10	Loose	15-35
10-30	Medium Dense	35-65
30-50	Dense	65-85
>50	Very Dense	85-100

*At an effective overburden pressure of 1 ton per square foot (100 kPa)

Approximate Values of Undrained Shear Strength for Cohesive Soils
(Terzaghi and Peck, 1967)

Number of SPT Blows (N_{60})	Soil Consistency	Approximate Undrained Shear Strength (psf)
<2	Very Soft	Less Than 250
2-4	Soft	250-500
4-8	Medium Stiff	500-1000
8-15	Stiff	1000-2000
15-30	Hard	2000-4000
>30	Hard	More Than 4000

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS 50% OR MORE OF COARSE FRACTION PASSING NO. 4 SEIVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRANED SOILS 50% OR MORE OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTY, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

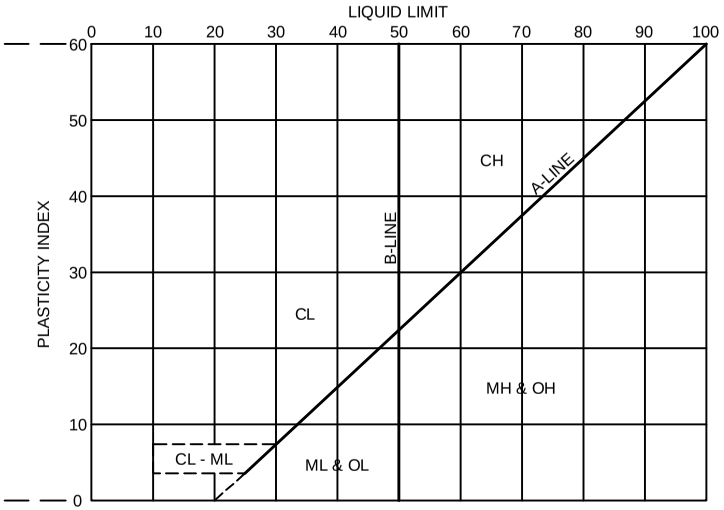
FOR LABROATORY CLASSIFICATION OF FIN-GRAINED SOILS

GRADATION CHART

MATERIAL SIZE	PARTICLE SIZE			
	LOWER LIMIT		UPPER LIMIT	
	MILLIMETERS	SIEVE SIZE	MILLIMETERS	SIEVE SIZE
SAND				
FINE	.075	#200x	0.425	#40 x
MEDIUM	0425	#40 x	2.00	#10 x
COARSE	200	#10 x	4.75	# 4 x
GRAVEL				
FINE	4.75	# 4 X	19	3/4"●
COARSE	19	3/4"●	75	3" ●
COBBLES	75	3"	300	12"
BOULDERS	200	12	N/A	N/A

x US STANDARD ● CLEAR SQUARE OPENINGS

PLASTICITY CHART



UNIFIED SOIL CLASSIFICATION SYSTEM

C.H.J. Incorporated

EXPLORATORY BORING NO. 1 -

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine with medium, light brown	Fill				1.6		
						21 50/4"	1.8	135	Ring
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown	Bedrock						
5						50/3"	N.R.	N.R.	
10		END OF BORING				50/1"	N.R.	N.R.	
		BEDROCK AT 3.0', REFUSAL AT 10.0' FILL TO 3.0', SLIGHT CAVING NO FREE GROUNDWATER							
15									
20									
25									
30									

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-1

EXPLORATORY BORING NO. 2

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION -	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine to coarse with gravel to 1/2", light brown	Fill				3.2		SA
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown	Bedrock			16 40 35	3.9	122	Ring
5						50/2"	4.2	110	Ring
10						50/3"	4.1	111	Ring
15						50/3"	5.2	111	Ring
20						50/1.5"	3.9	113	Ring
25						50/1"			Ring
30						50/1"			Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-2a

EXPLORATORY BORING NO. 2 -

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown							
		END OF BORING							
		BEDROCK AT 1.5', REFUSAL AT 36.0' FILL TO 1.5', SLIGHT CAVING NO FREE GROUNDWATER							
40									
45									
50									
55									
60									
65									

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-2b

EXPLORATORY BORING NO. 3

Date Drilled: 5/21/07 | Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig | Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft): | Logged by: TAD | Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine to coarse, light brown	Fill		X		5.1		SA, MDC
				X		5 10 15	4.8	118	Ring
5				X		4 5 5	7.5	112	Ring, DS
10				X		4 3 6	7.1	114	Ring
15				X		2 3 4	7.4	112	Ring
20				X		3 4 3	7.3	110	Ring, DS
25				X		3 6 10	9.1	118	Ring
30		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown	Bedrock	X		5 14 15	4.8	122	Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8 | Enclosure B-3a

EXPLORATORY BORING NO. 3 -

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown				50/2"			Ring
		END OF BORING BEDROCK AT 30.5', REFUSAL AT 37.0' FILL TO 30.5', SLIGHT CAVING NO FREE GROUNDWATER							
40									
45									
50									
55									
60									
65									

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-3b

EXPLORATORY BORING NO. 4

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine to coarse with clay, light brown	Fill				4.1		SA, MDC
				X		3 4 6	4.2	112	Ring
5									
				X		2 2 4	3.0	105	Ring, DS
10									
				X		3 5 6	2.9	104	Ring
15									
				X		4 3 7	3.6	111	Ring, DS
20									
				X		5 8 12	4.3	113	Ring
25									
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown	Bedrock	X		21 50/5"	4.9	108	Ring
30									
				X		21 50	5.2	99	Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-4a

EXPLORATORY BORING NO. 4

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown							
				X		28 28 35	3.7	128	Ring
40									
				X		10 19 34	3.7	118	Ring, DS
45									
				X		13 40 33	6.2	124	Ring
50									
				X		22 27 50	9.0	118	Ring
55									
				X		50/5"	2.4	118	Ring
60									
				X		50/2"	1.9		Ring
65									
				X		50/2"	1.5	122	Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-4b

EXPLORATORY BORING NO. 4 -

Date Drilled: 5/21/07

Client: Whitewater Rock & Supply

Equipment: CME 75 Drill Rig

Driving Weight / Drop: 140 lbs/30 in

Surface Elevation(ft):

Logged by: TAD

Measured Depth to Water(ft): N.A.

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		Bedrock, recovered as (SM) Silty Sand, fine with medium, light brown							
		END OF BORING				50/3"			Ring
		BEDROCK AT 27.0', NO REFUSAL FILL TO 27.0', SLIGHT CAVING NO FREE GROUNDWATER							
75									
80									
85									
90									
95									
100									

BORING LOG - NO EQUIV & BLOW PER 6 IN 10369-8.GPJ CHJ.GDT 12/27/10

C.H.J.

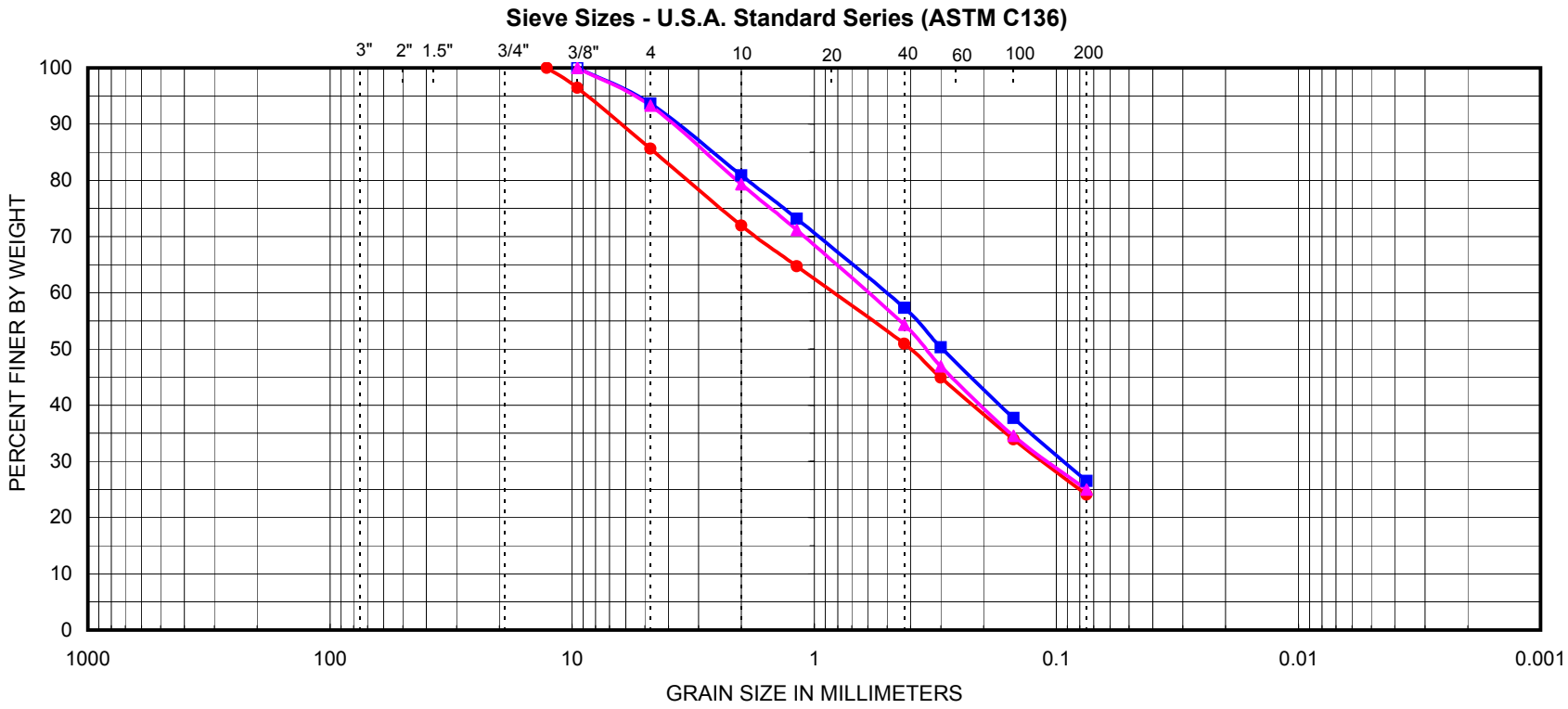
SUPER CREEK MINE SLOPE STABILITY
WHITEWATER RIVER AREA

Job No. 10369-8

Enclosure B-4c

APPENDIX "C"

LABORATORY AND FIELD TEST RESULTS



Cobbles & Boulders	Gravel		Sand			Silt	Clay
	Coarse	Fine	Coarse	Medium	Fine		

Symbol	Boring No.	Depth (ft)	Classification	D_{10} (mm)	D_{30} (mm)	D_{50} (mm)	D_{60} (mm)	C_u	C_c	SE
●	2	0	(SM) Silty sand, fine to coarse with gravel to 1/2", light brown		0.114	0.403	0.833			
■	3	0	(SM) Silty sand, fine to coarse, light brown		0.093	0.295	0.506			
▲	4	0	(SM) Silty Sand, fine to coarse with clay, light brown		0.108	0.347	0.600			

C.H.J. Incorporated

GRAIN SIZE DISTRIBUTION

Project:	Proposed Expansion of Super Creek Quarry - Slope Stability Investigation		
Location:	Whitewater River Area, Riverside County, CA		
Job Number:	10369-8	Enclosure:	C-1

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Cobbles & Boulders	Gravel		Sand			Silt	Clay
	Coarse	Fine	Coarse	Medium	Fine		

Symbol	Boring No.	Depth (ft)	Classification	D_{10} (mm)	D_{30} (mm)	D_{50} (mm)	D_{60} (mm)	C_u	C_c	SE
●	C-1	0	(SM) Silty Sand, fine to coarse, with gravel to 3/8", reddish brown		0.194	0.584	0.998			33
■	F-2	0	(SM) Silty Sand, fine to coarse, light brown		0.134	0.369	0.640			25
▲	F-2	0	(SM) Silty Sand, fine to coarse, light brown	0.0020				0.000		

C.H.J. Incorporated

GRAIN SIZE DISTRIBUTION

Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, California		
Job Number:	10369-8	Enclosure:	C-2

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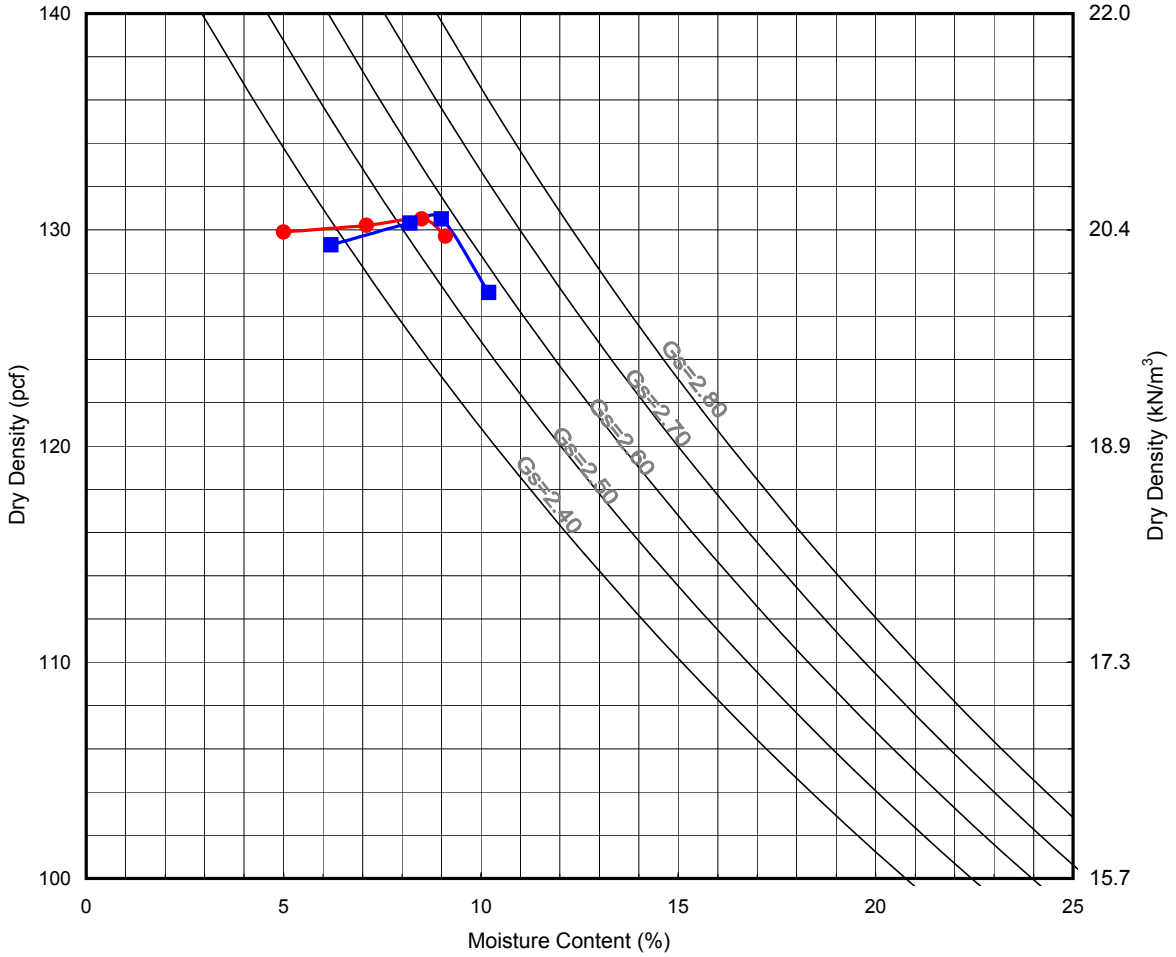
Optimum Moisture - Maximum Density Determination Test (ASTM D 1557)



Boring No.		Depth (ft)	Soil/Sample Type	γ_{max} (pcf)	w_{opt} (%)
●	3	0	(SM) Silty sand, fine to coarse, light brown	130.5	8.5
■	4	0	(SM) Silty sand, fine to coarse with clay, light brown	130.5	9.0

C.H.J. Incorporated

MOISTURE-DENSITY RELATIONSHIP

Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, CA		
Job No.:	10369-8	Enclosure:	C-3

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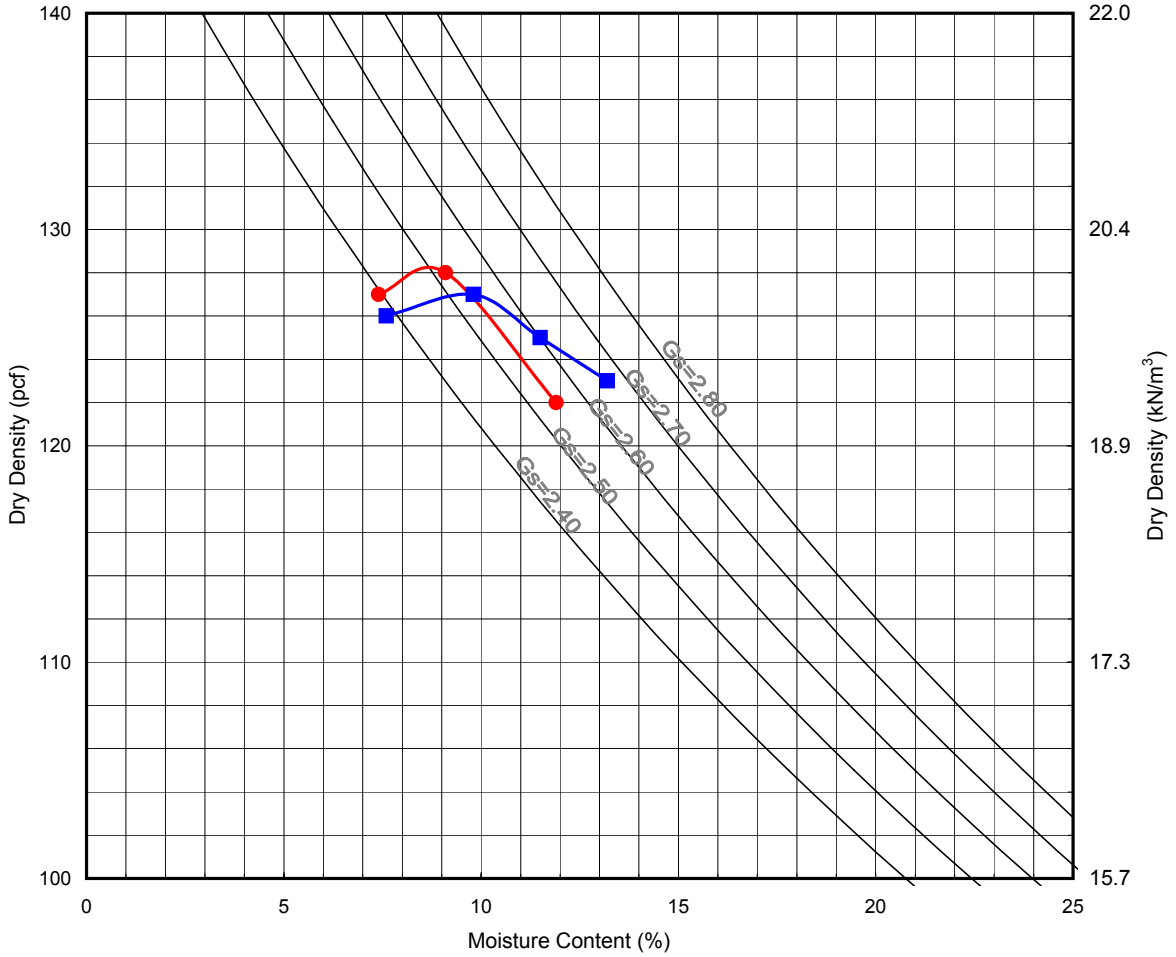
Optimum Moisture - Maximum Density Determination Test (ASTM D 1557)



	Boring No.	Depth (ft)	Soil/Sample Type	γ_{max} (pcf)	w_{opt} (%)
●	C-1	0	(SM) Silty Sand, fine to coarse, with gravel to 3/8", reddish brown	129.0	10.0
■	F-2	0	(SM) Silty Sand, fine to coarse, light brown	128.0	10.5

C.H.J. Incorporated

MOISTURE-DENSITY RELATIONSHIP

Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, California		
Job No.:	10369-8	Enclosure:	C-4

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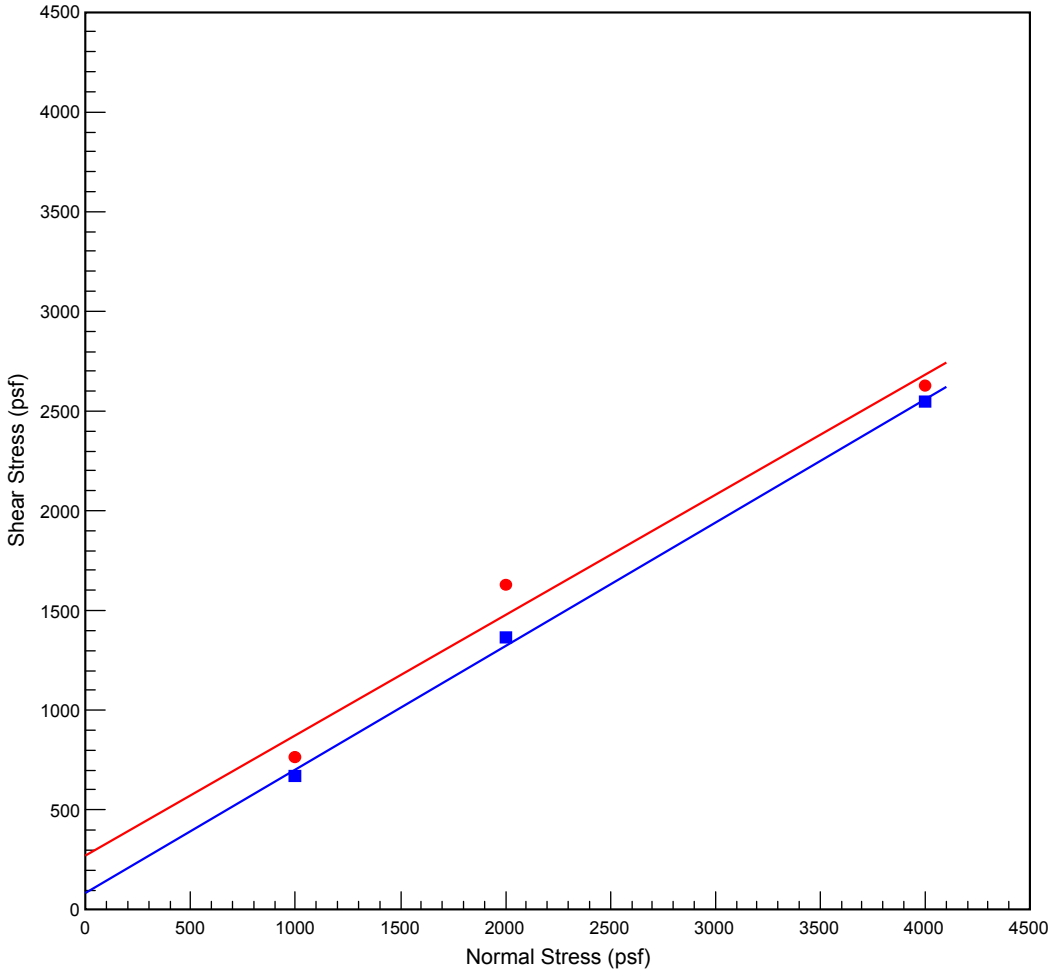

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	3	5	(SM) Silty sand, fine to coarse / undisturbed	112	7.5	270	31.1
■	3	20	(SM) Silty sand, fine to coarse / undisturbed	110	7.3	84	31.8

C.H.J. Incorporated

DIRECT SHEAR TEST			
Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, CA		
Job No.:	10369-8	Enclosure:	C-5

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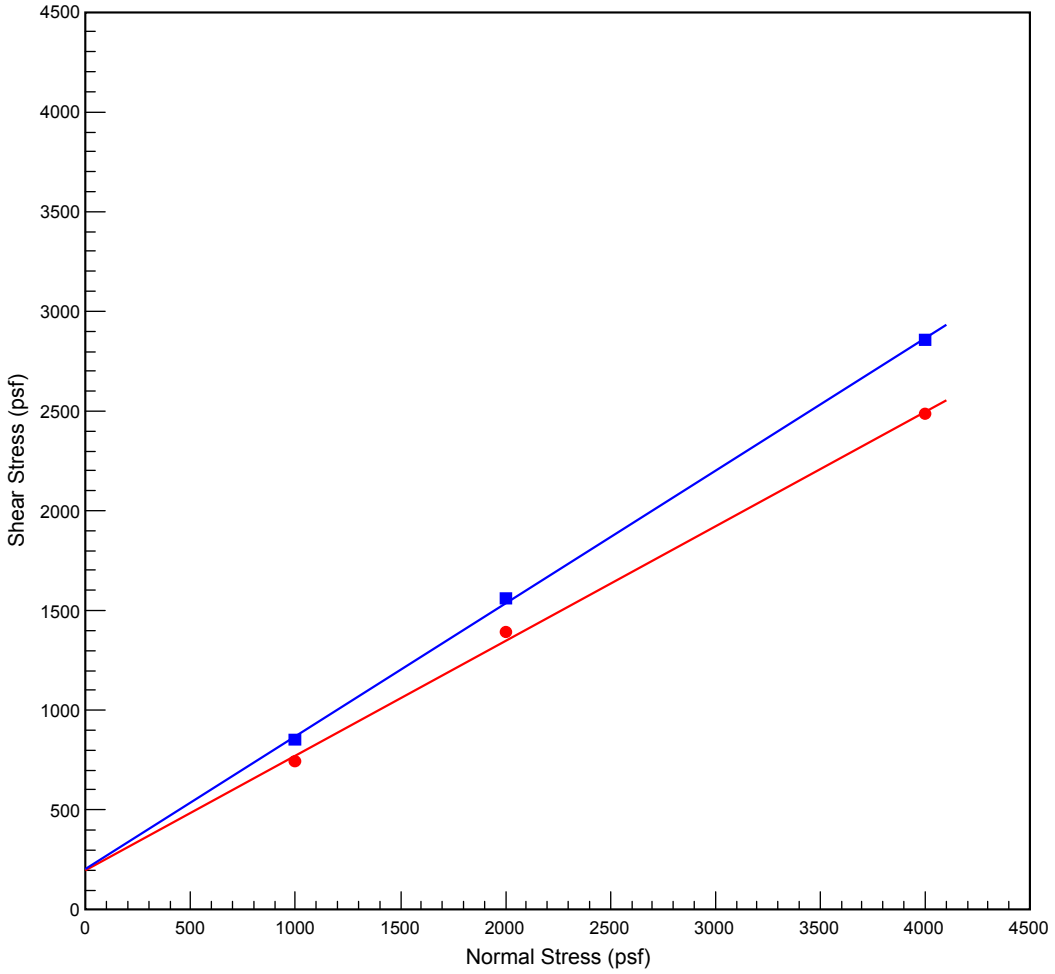

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	4	7	(SM) Silty sand, fine to coarse with clay / undisturbed	105	3.0	198	30
■	4	17	(SM) Silty sand, fine to coarse with clay / undisturbed	111	3.6	204	34

C.H.J. Incorporated

DIRECT SHEAR TEST			
Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, CA		
Job No.:	10369-8	Enclosure:	C-6

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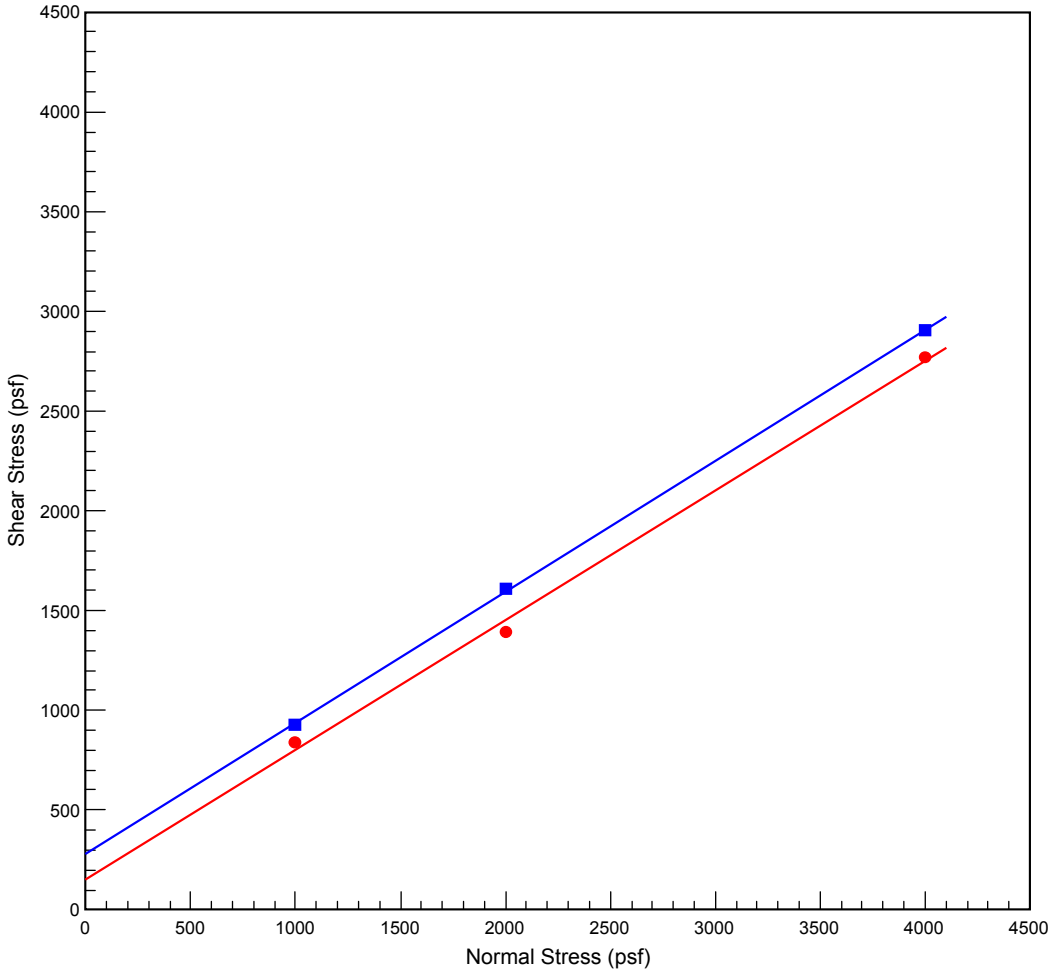

Sample No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	F-1	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% unsaturated	118	5.0	150	33
■	F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% unsaturated	118	5.0	276	33

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, California		
Job No.:	10369-8	Enclosure:	C-7

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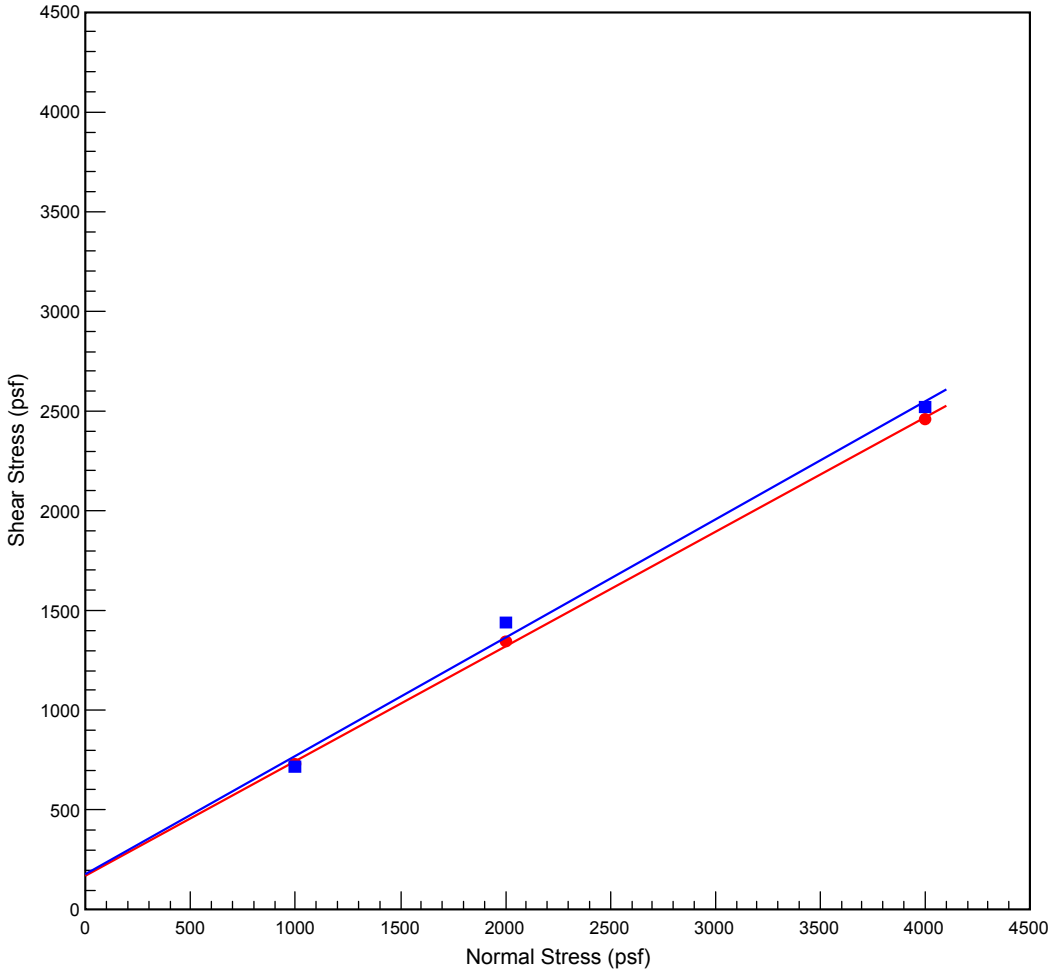

Sample No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% saturated	118	5.0	174	30
■	F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 90% saturated	134	7.0	180	31

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, California		
Job No.:	10369-8	Enclosure:	C-8

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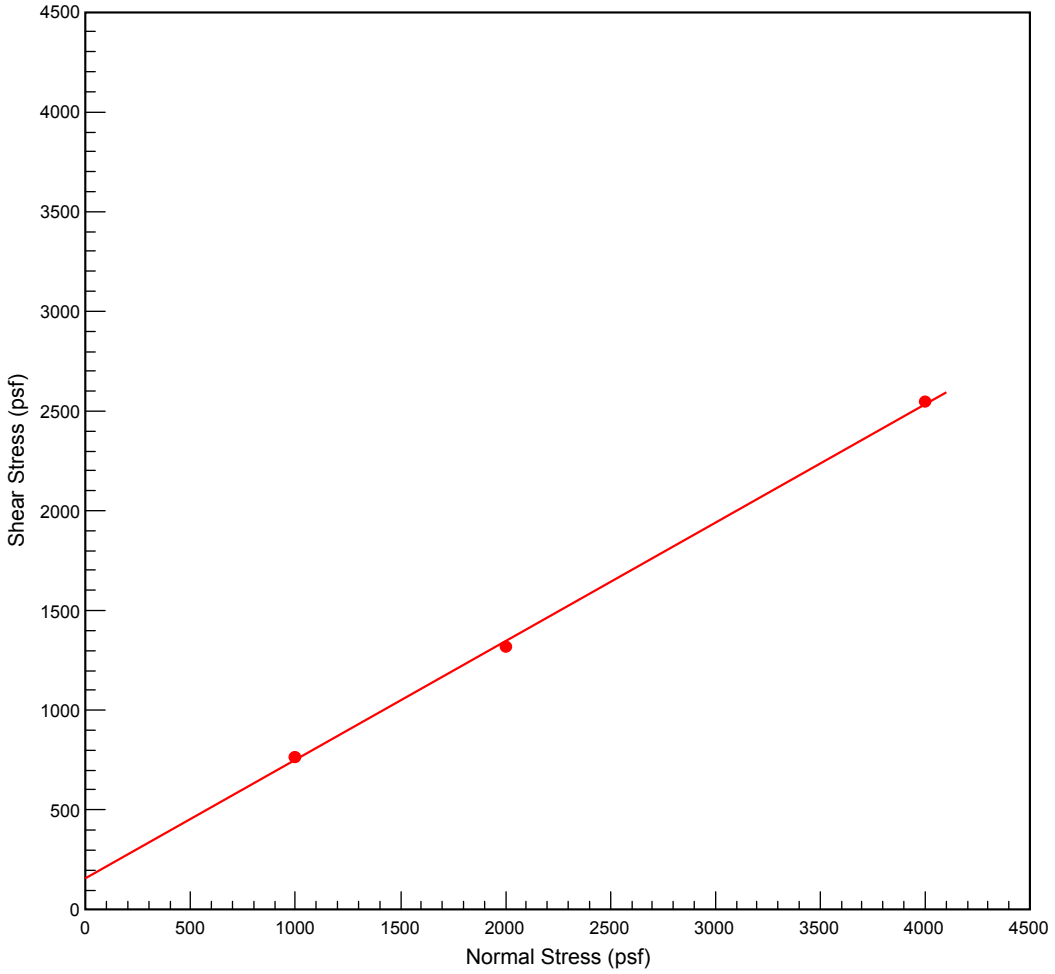

Sample No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	C-1	0	(SM) Silty Sand, fine to coarse, with gravel to 3/8", reddish brown; remolded to 85% saturated	119	5.0	156	31

C.H.J. Incorporated

DIRECT SHEAR TEST			
Project:	Super Creek Quarry Fill Slopes		
Location:	Whitewater River Area, Riverside County, California		
Job No.:	10369-8	Enclosure:	C-9

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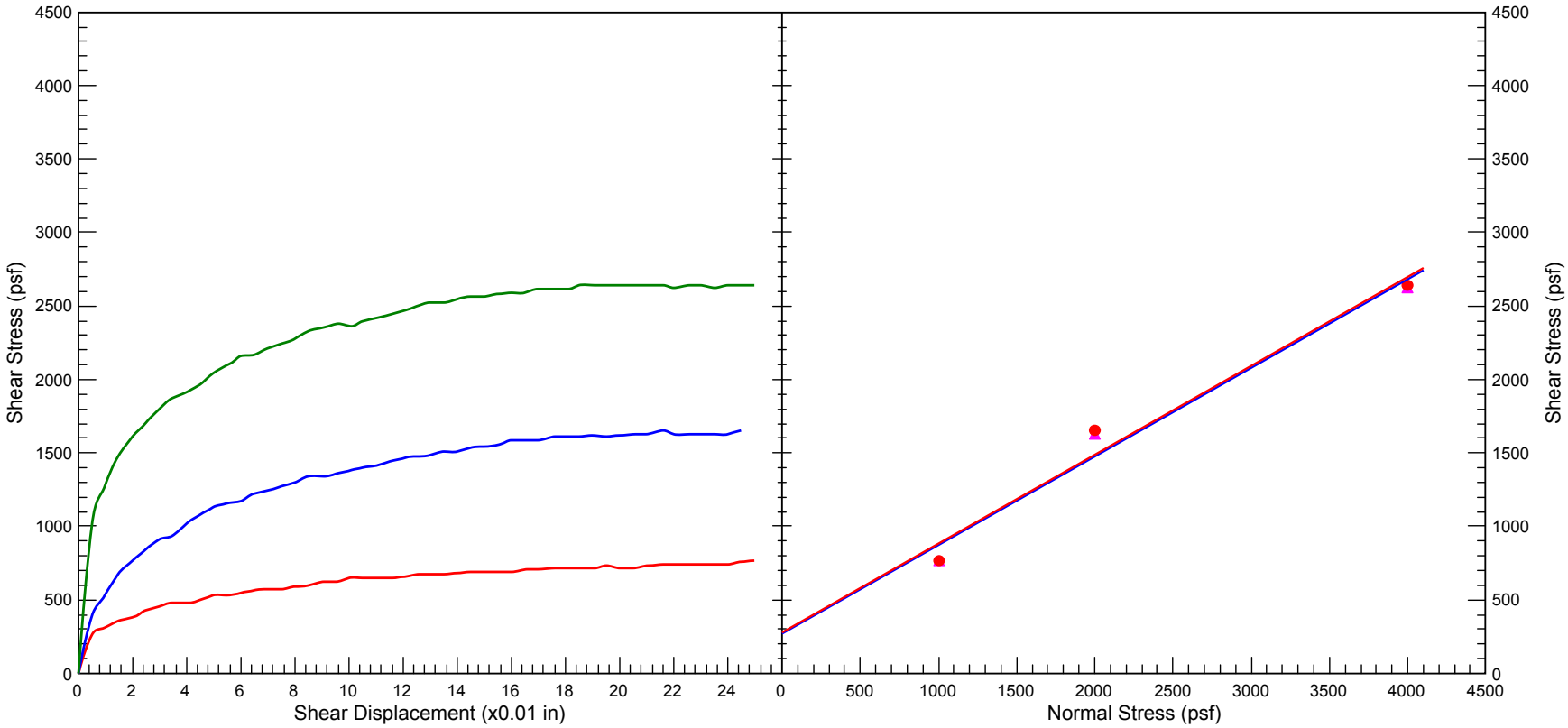

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	3	5	(SM) Silty sand, fine to coarse / undisturbed	112.0	7.5	276	31.2	270	31.1

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-10

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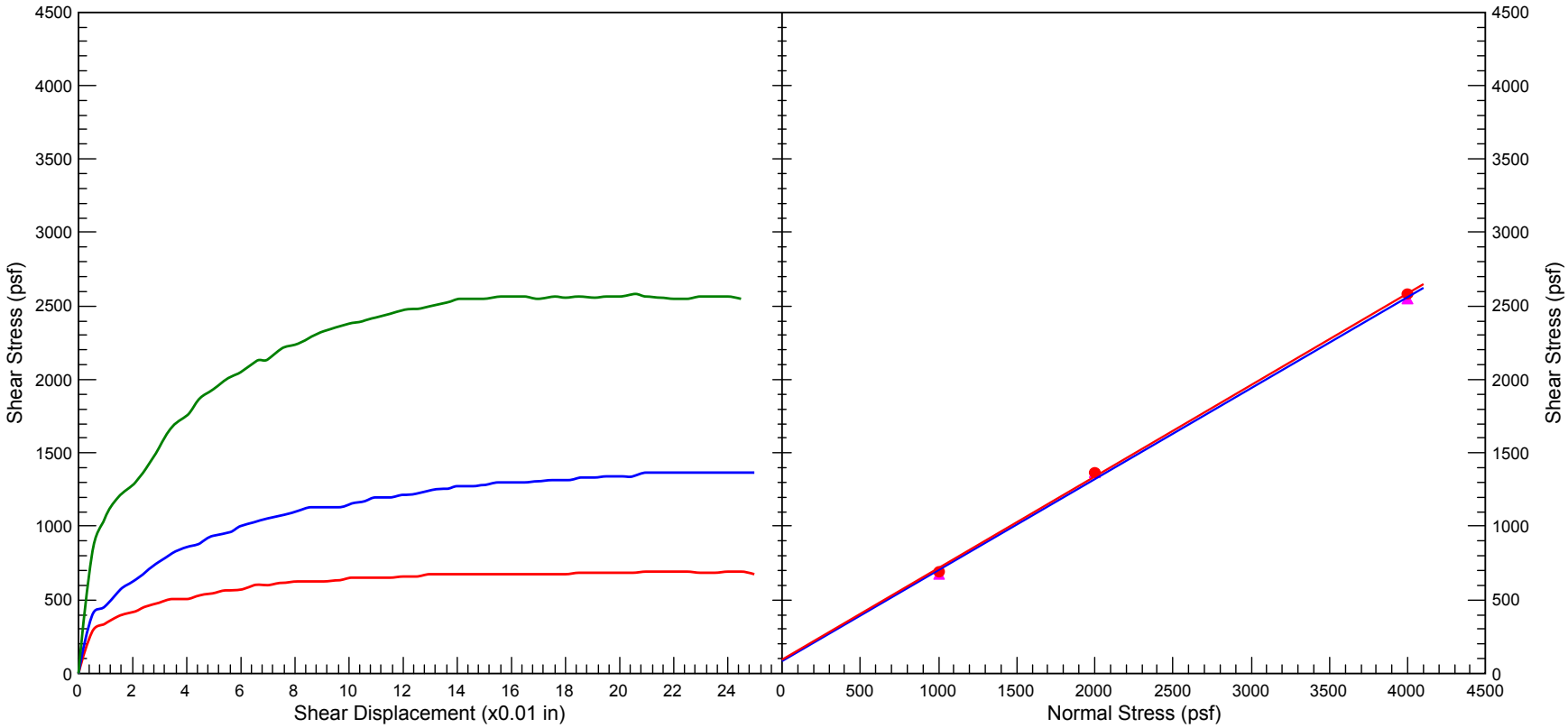

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	3	20	(SM) Silty sand, fine to coarse / undisturbed	110.0	7.3	90	32.0	84	31.8

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-11

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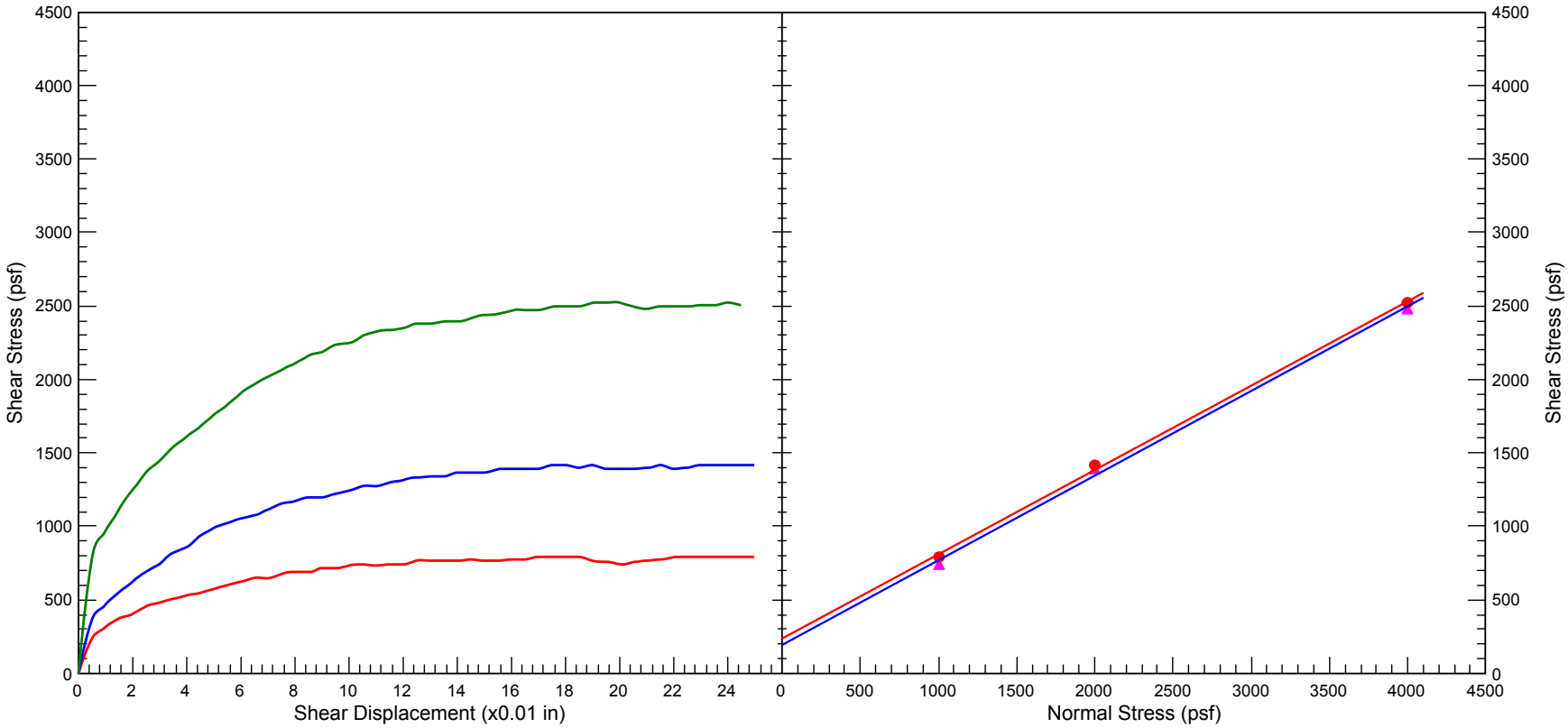

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	4	7	(SM) Silty sand, fine to coarse with clay / undisturbed	105.0	3.0	240	29.8	198	29.9

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-12

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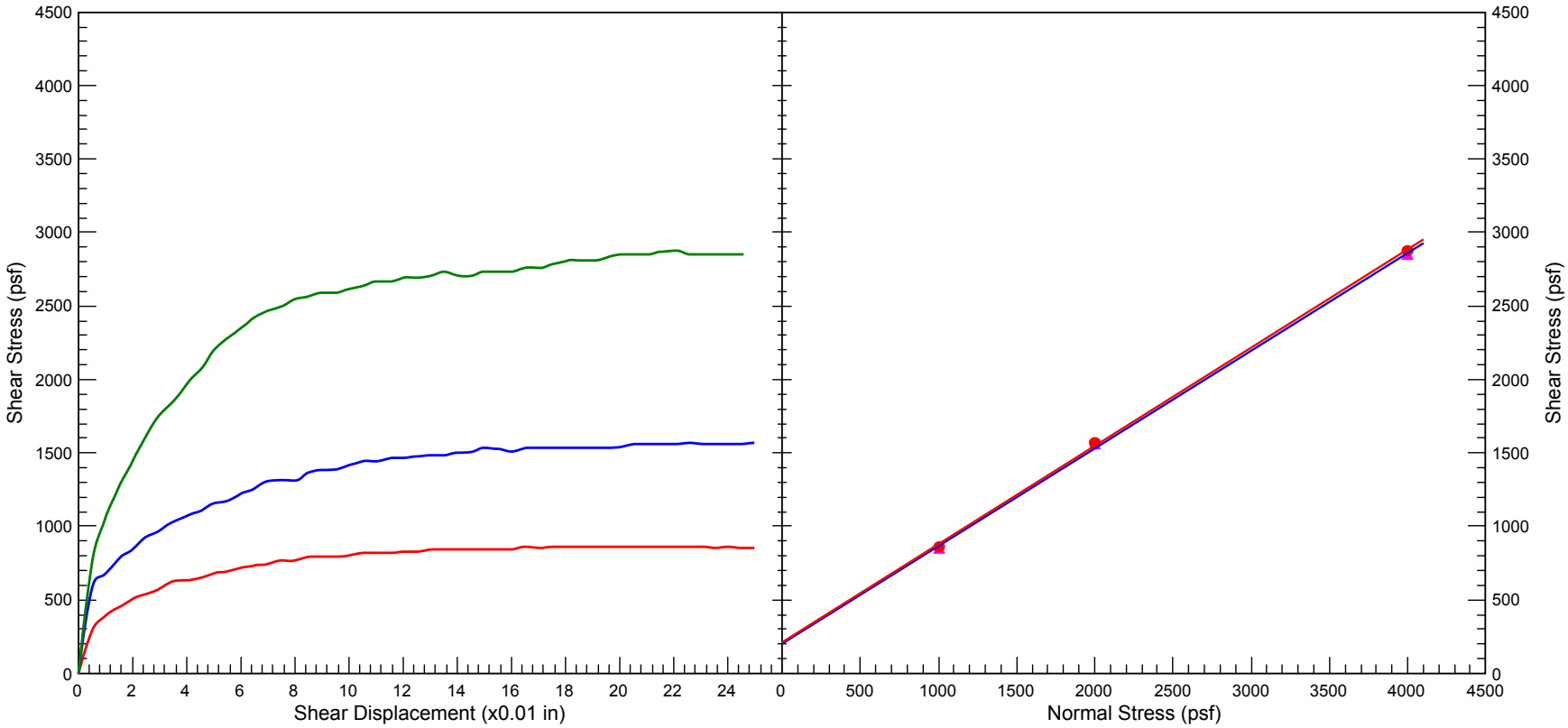

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	4	17	(SM) Silty sand, fine to coarse with clay / undisturbed	111.0	3.6	210	33.8	204	33.6

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-13

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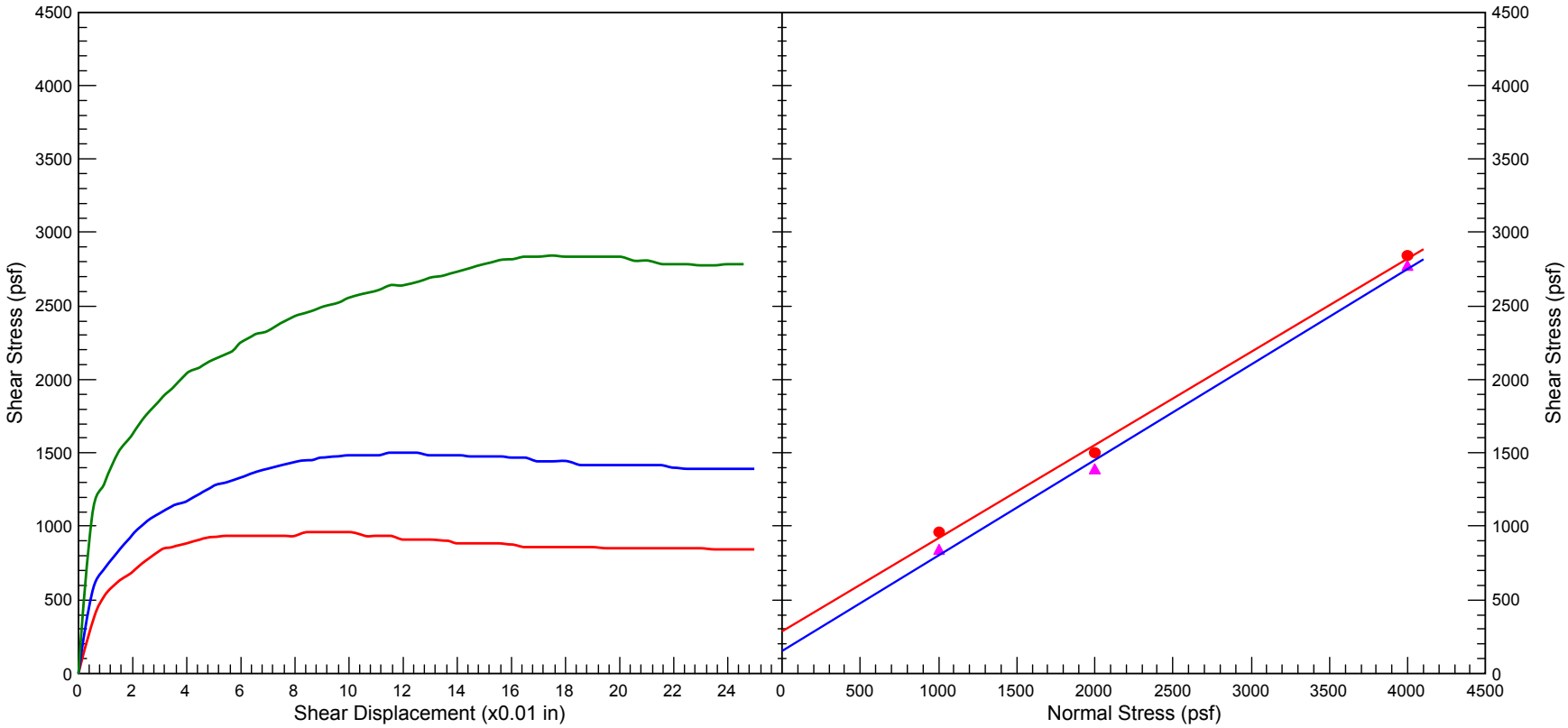

Sample No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
F-1	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% unsaturated	117.5	5.0	288	32	150	33

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, California		
Job Number	10369-8	Enclosure	C-14

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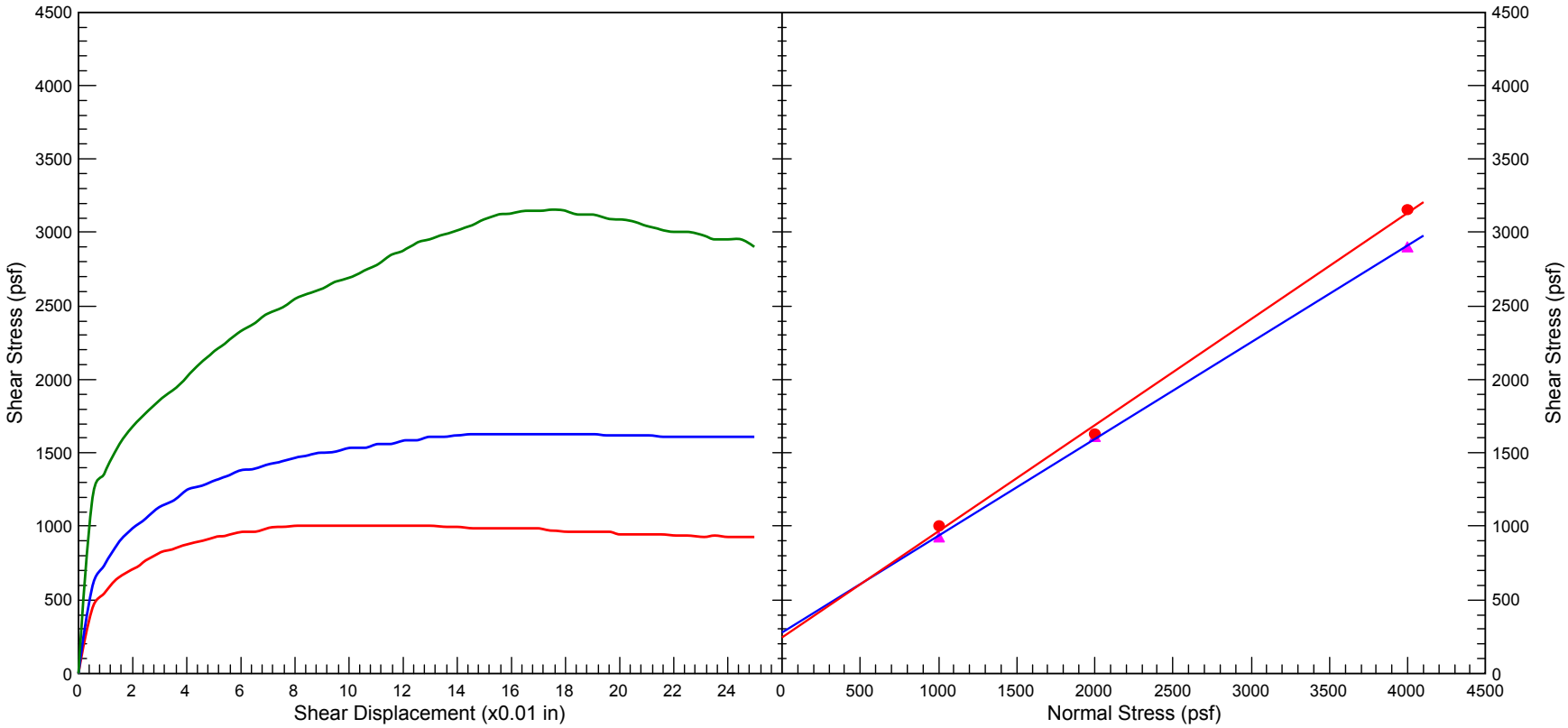

Sample No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% unsaturated	117.5	5.0	246	36	276	33

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, California		
Job Number	10369-8	Enclosure	C-15

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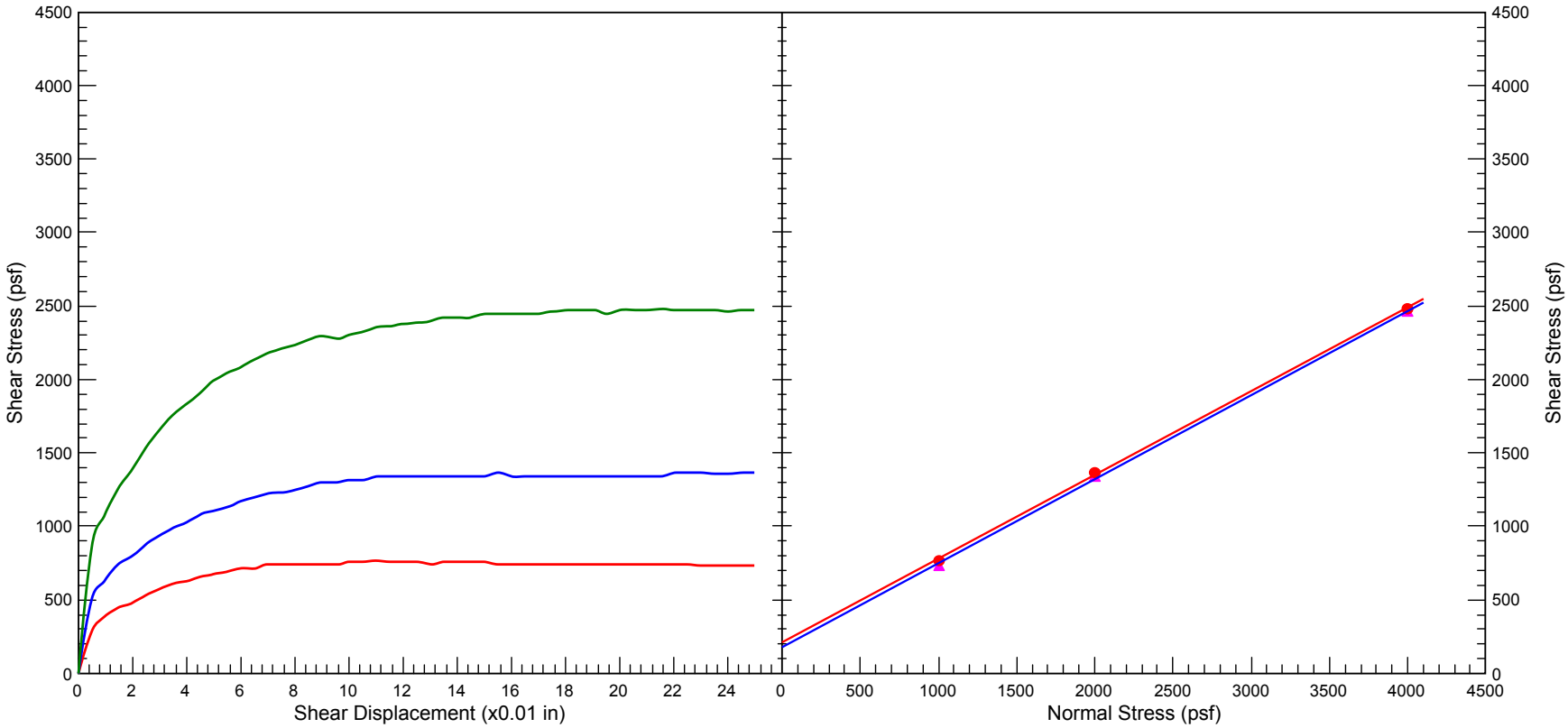

Sample No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 85% saturated	117.5	5.0	210	30	174	30

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, California		
Job Number	10369-8	Enclosure	C-16

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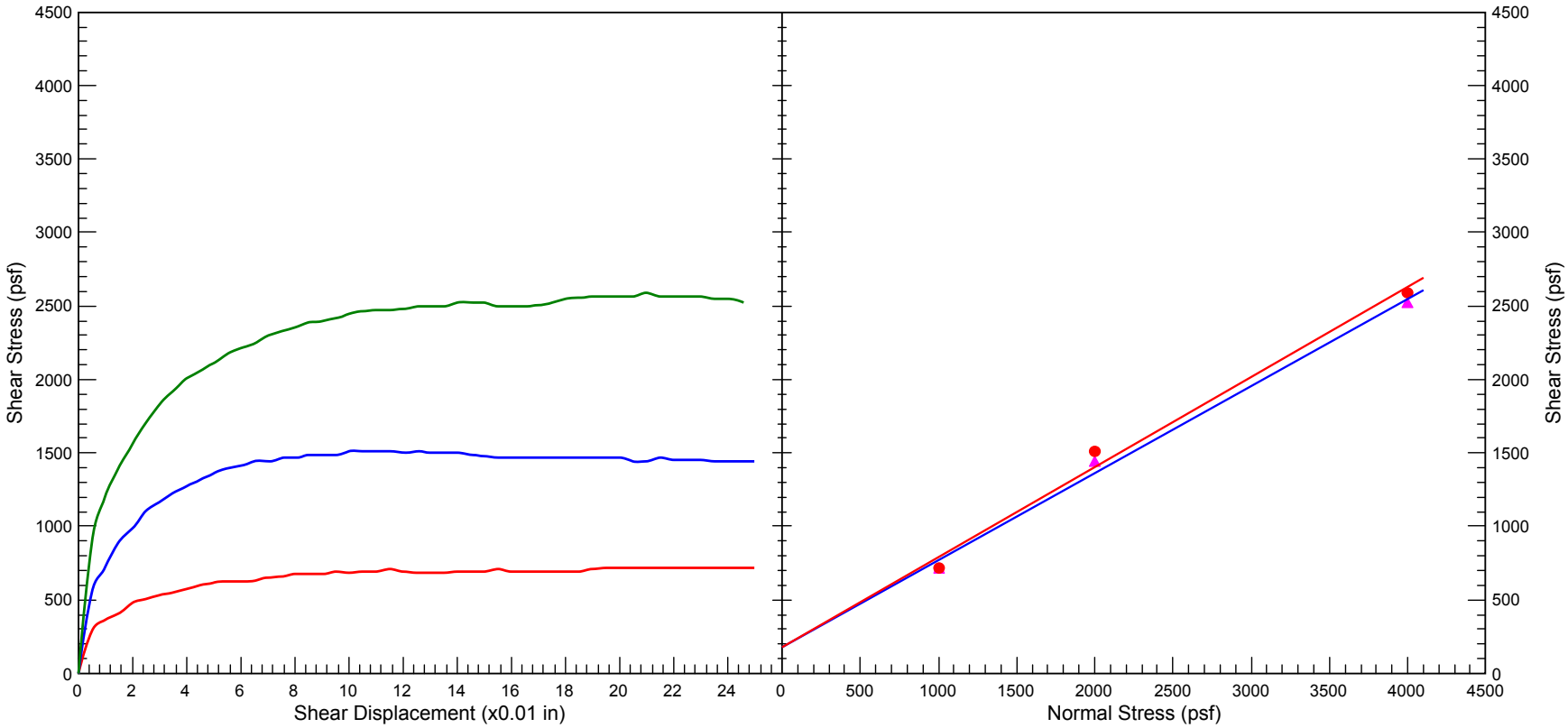

Sample No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
F-2	0	(SM) Silty Sand, fine to coarse, light brown; remolded to 90% saturated	133.7	7.0	180	31	180	31

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, California		
Job Number	10369-8	Enclosure	C-17

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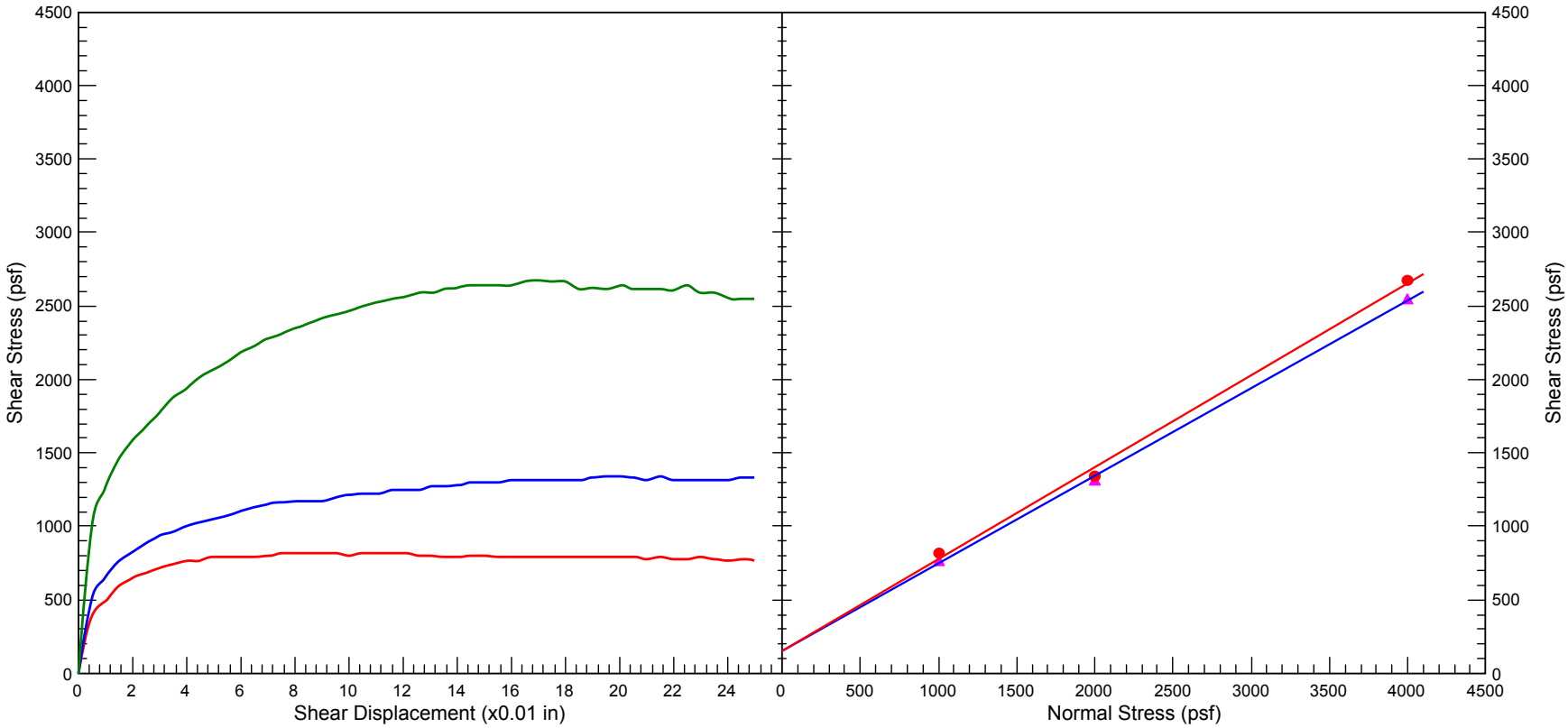

Sample No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
C-1	0	(SM) Silty Sand, fine to coarse, with gravel to 3/8", reddish brown; remolded to 85% saturated	118.5	5.0	150	32	156	31

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Super Creek Quarry Fill Slopes		
Location	Whitewater River Area, Riverside County, California		
Job Number	10369-8	Enclosure	C-18

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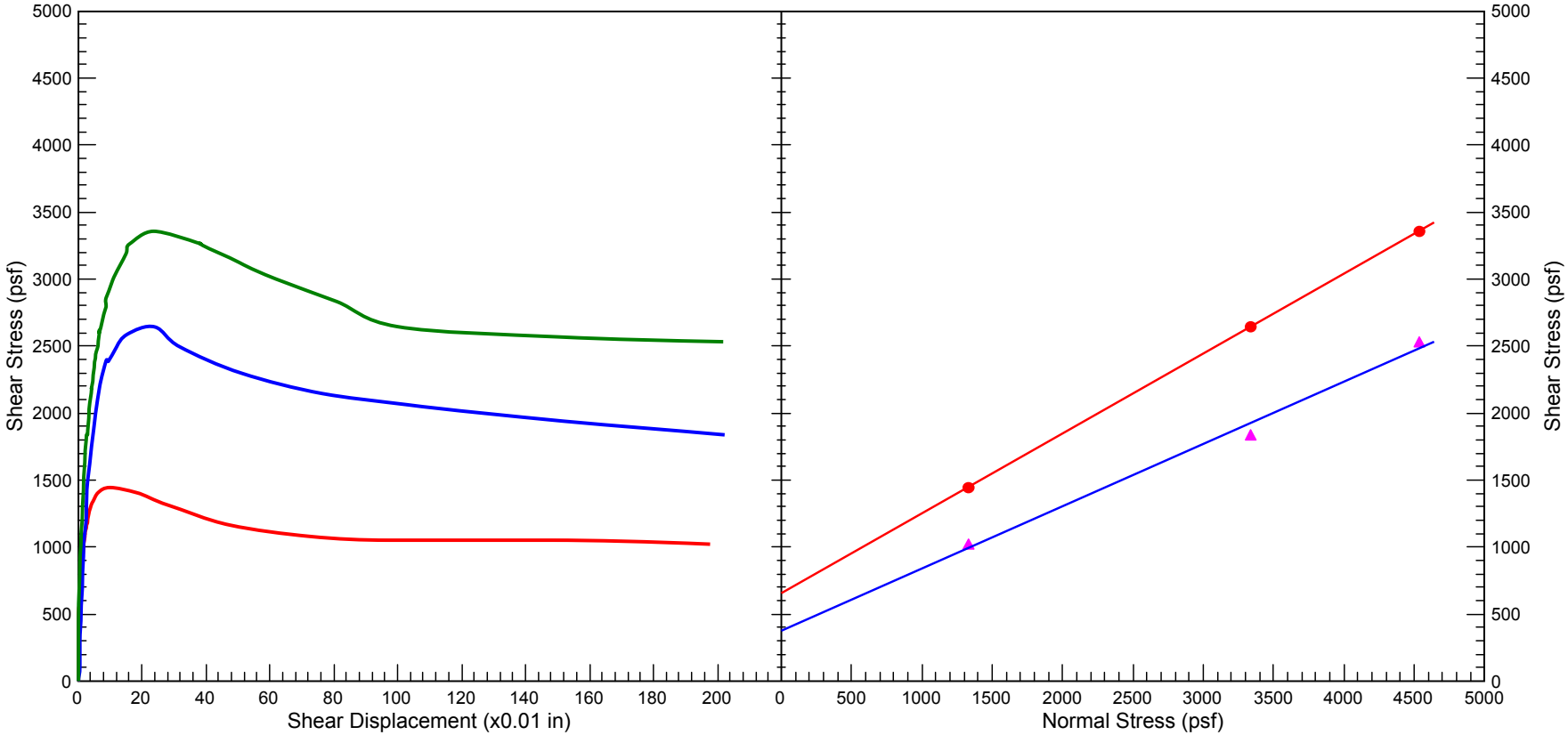
Enclosure "C-19"
Job No. 10369-8

UNCONFINED COMPRESSIVE STRENGTHS OF BEDROCK UNITS

Sample	Maximum Load (psi)	Density
gn (fresh) *	13,540	164.5
gn (weathered) *	15,800	158.0
gn (fresh) **	3,820	
gn (weathered) **	3,370	
fgg (fresh)	13,800	162.0
fgg (weathered)	12,870	161.5

* Tested with force perpendicular to foliation

** Tested with force parallel to foliation



Boring No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
Field DS		(SM) Silty sand,fine to coarse with clay	118.0	3.5	653	31	374	25

C.H.J. Incorporated

FIELD DIRECT SHEAR TEST (Dry)

Project:	Proposed Expansion of Super Creek Quarry - Slope Stability Investigation		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-20

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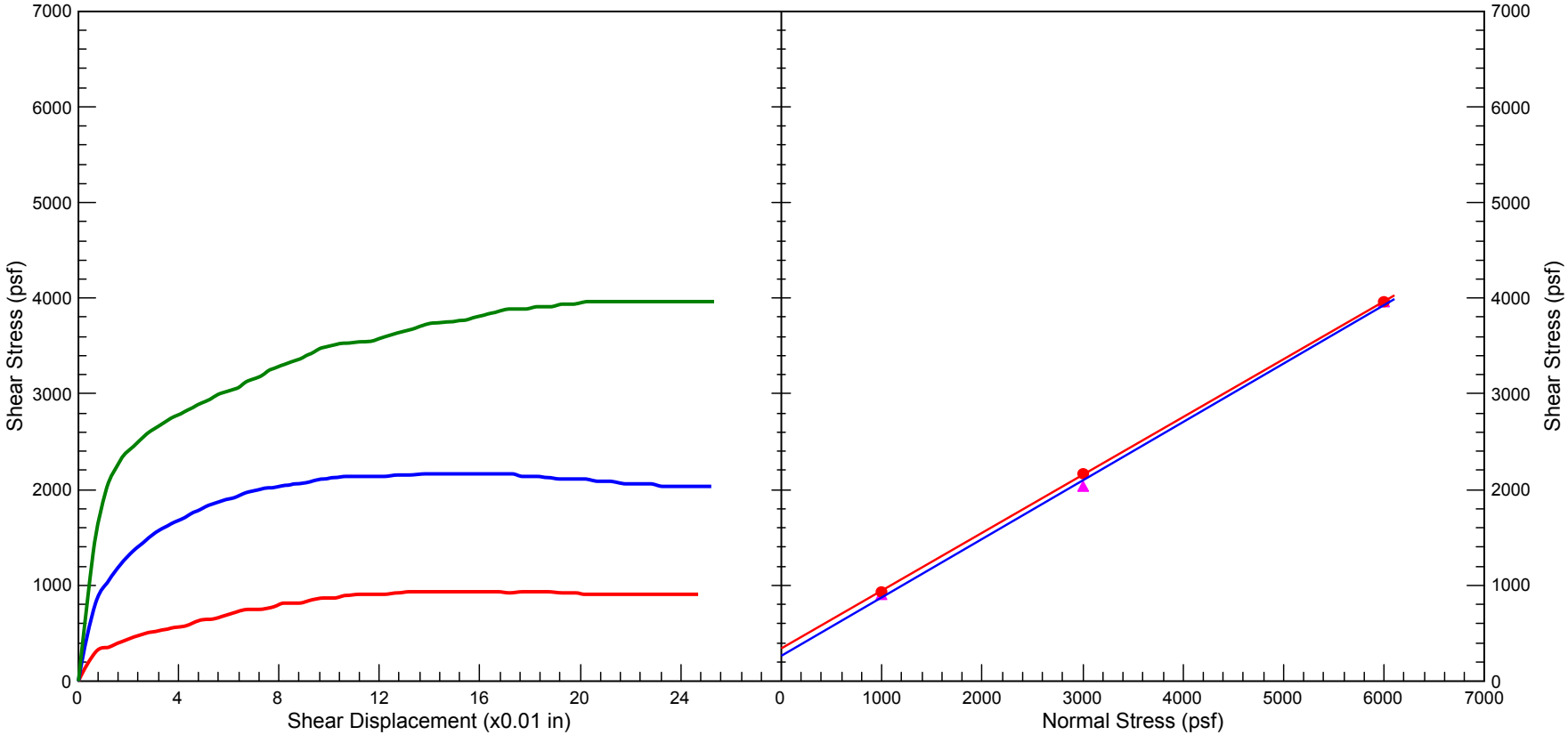

Boring No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
DS-5	0.5 to 1.0	(SM) Silty sand, fine to coarse with clay			337	31	259	31

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Expansion of Super Creek Quarry - Slope Stability Investigation		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-21

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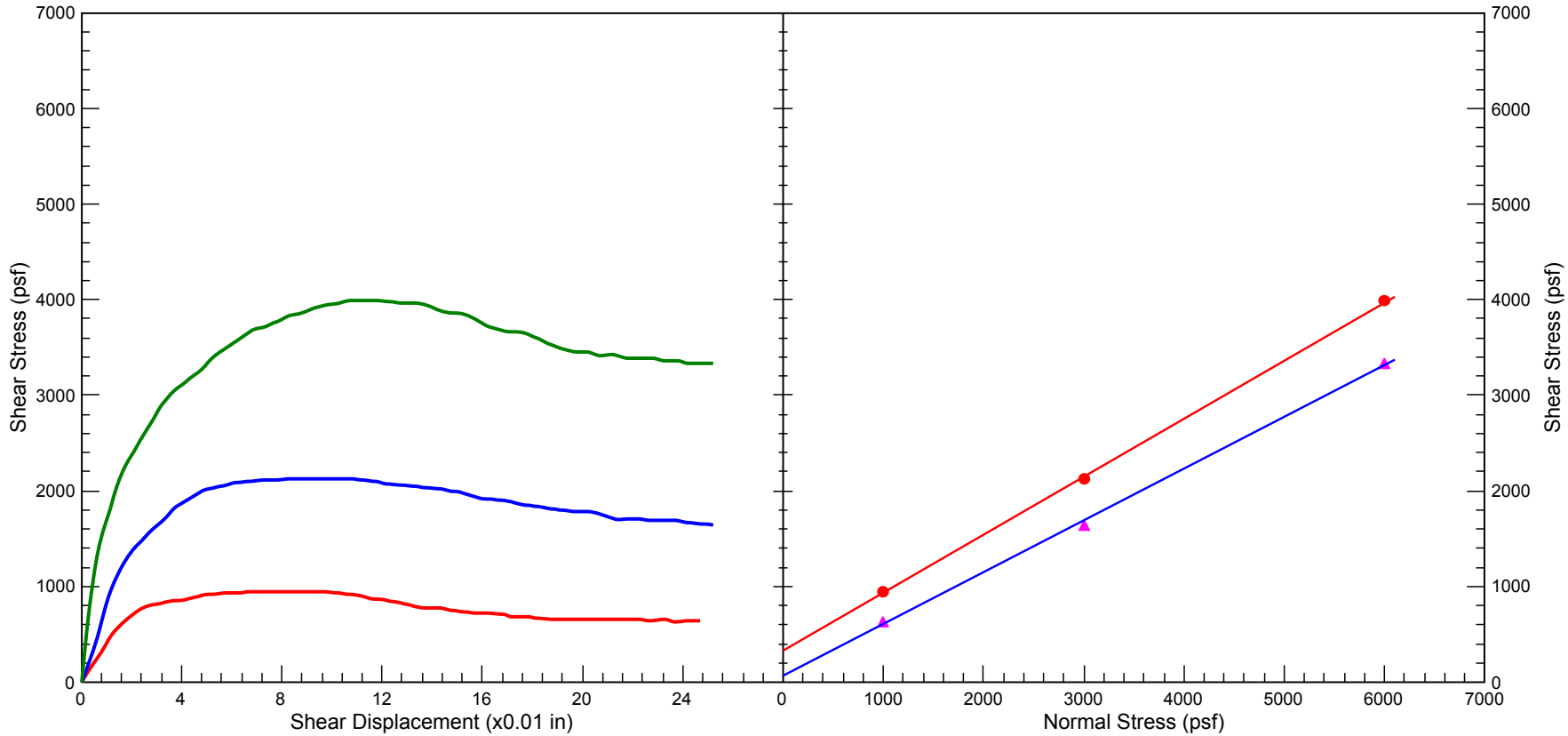

Boring No.	Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
DS-2		(SM) Silty sand, fine to coarse with clay			329	31	60	28

C.H.J. Incorporated

DIRECT SHEAR TEST

Project:	Proposed Expansion of Super Creek Quarry - Slope Stability Investigation		
Location	Whitewater River Area, Riverside County, CA		
Job Number	10369-8	Enclosure	C-22

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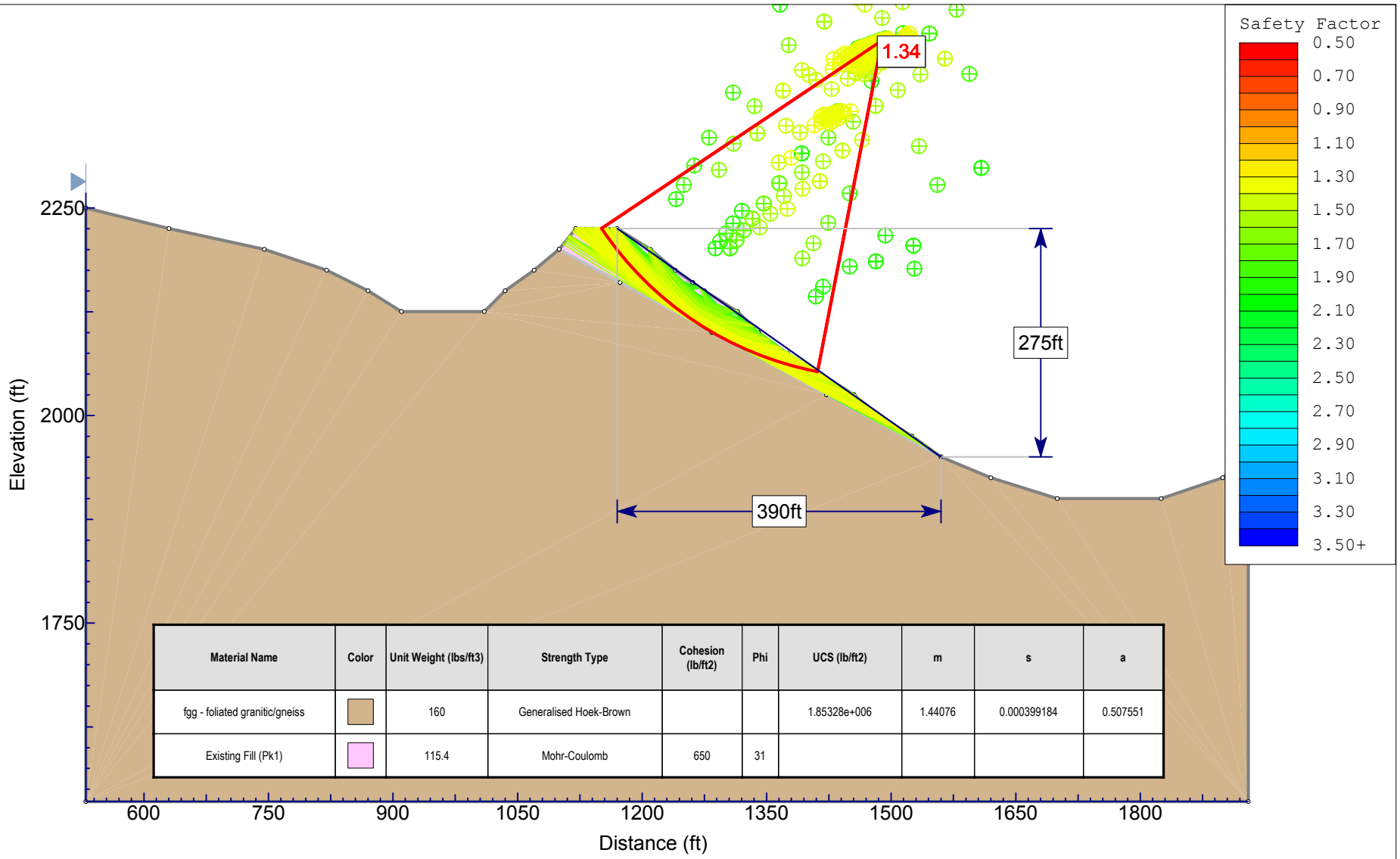
APPENDIX "D"

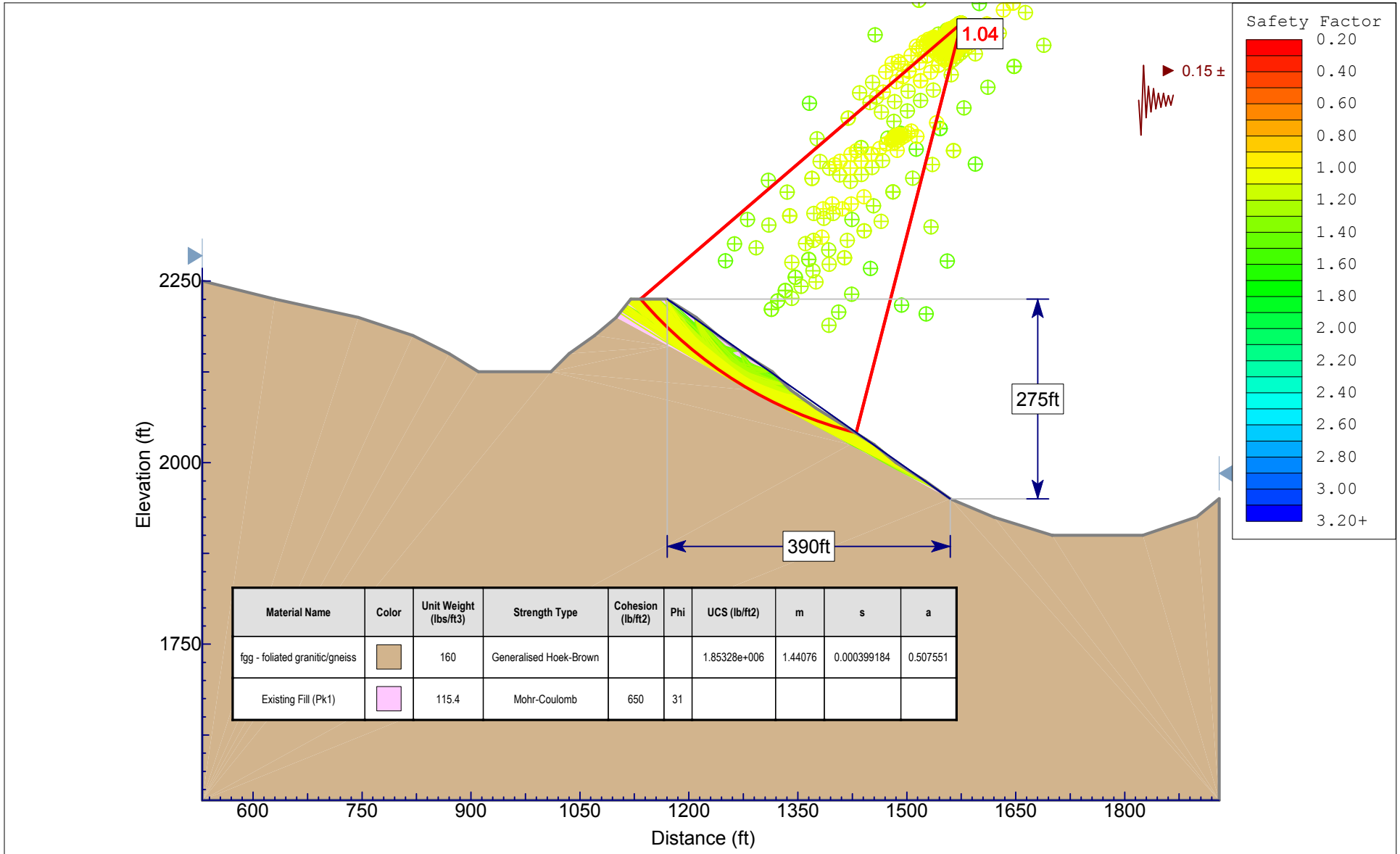
SLOPE STABILITY CROSS SECTIONS AND CALCULATIONS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	UCS (lb/ft2)	m	s	a
fgg - foliated granitic/gneiss		160	Generalised Hoek-Brown			1.85328e+006	1.44076	0.000399184	0.507551
Existing Fill (Pk1)		115.4	Mohr-Coulomb	650	31				

SLIDEINTERPRET 6.007

Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Existing Slope with Field Shear Results (Peak)		
Drawn By	C.H.J., Incorporated	*Author*	*Scale* 1:2100
File Name	Existing slope WW-Field DS_10-29-2010-(pk c650,phi31)-Static.slim	*Date* 1/14/2011	*Enclosure* "D-1.1"



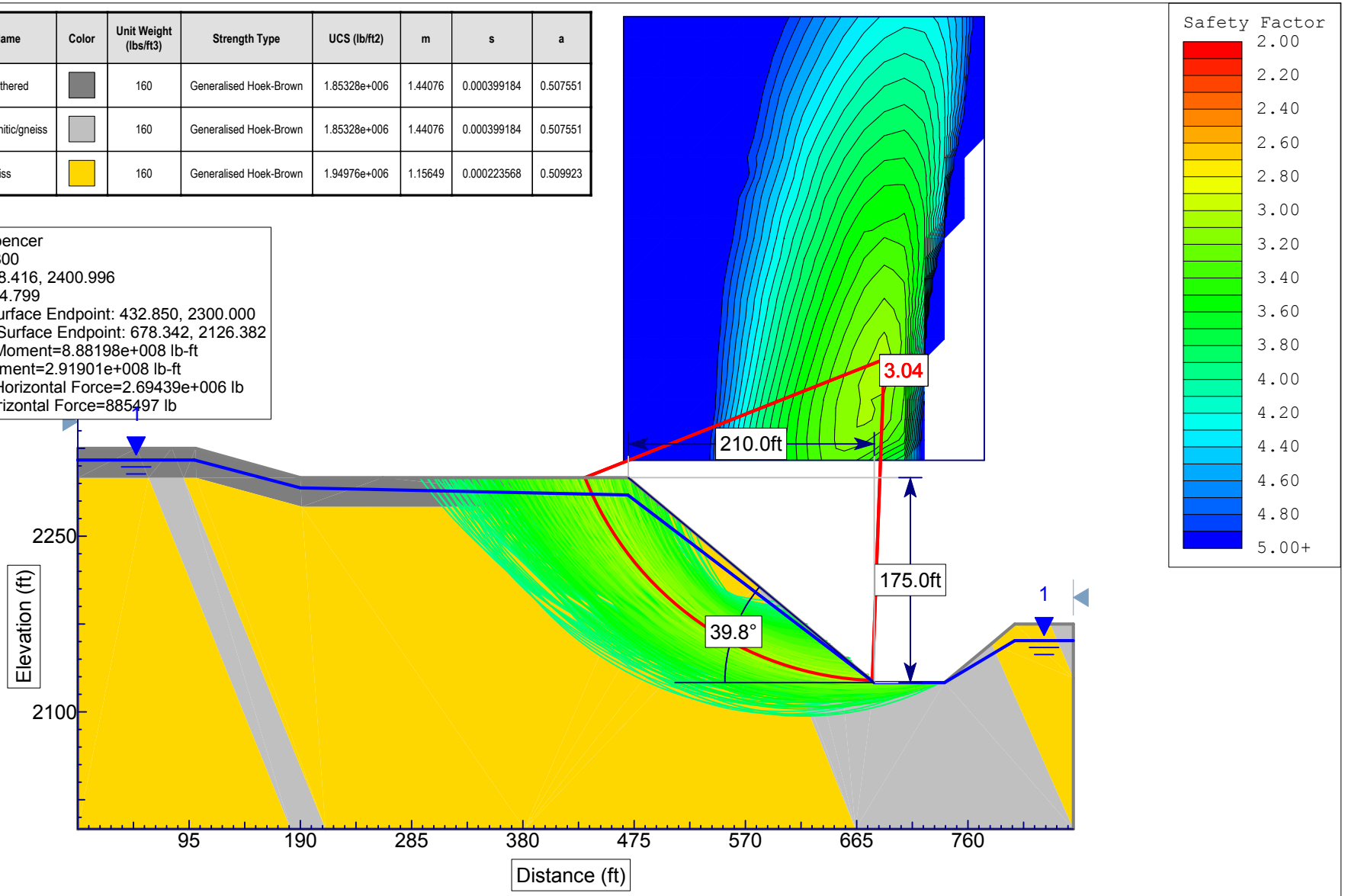
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	UCS (lb/ft2)	m	s	a
fgg - foliated granitic/gneiss		160	Generalised Hoek-Brown			1.85328e+006	1.44076	0.000399184	0.507551
Existing Fill (Pk1)		115.4	Mohr-Coulomb	650	31				

SLIDEINTERPRET 6.007

Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Existing Slope with Field Shear Results (Peak)		
Drawn By	C.H.J., Incorporated	*Author*	*Scale* 1:2300
File Name	Existing slope WW-Field DS_10-20-2010-seismic (pk)kh=.15.slim	*Date* 1/14/2011	*Enclosure* "D-1.2"

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (lb/ft2)	m	s	a
fgg/gn - weathered		160	Generalised Hoek-Brown	1.85328e+006	1.44076	0.000399184	0.507551
fgg - foliated granitic/gneiss		160	Generalised Hoek-Brown	1.85328e+006	1.44076	0.000399184	0.507551
gn - gneiss		160	Generalised Hoek-Brown	1.94976e+006	1.15649	0.000223568	0.509923

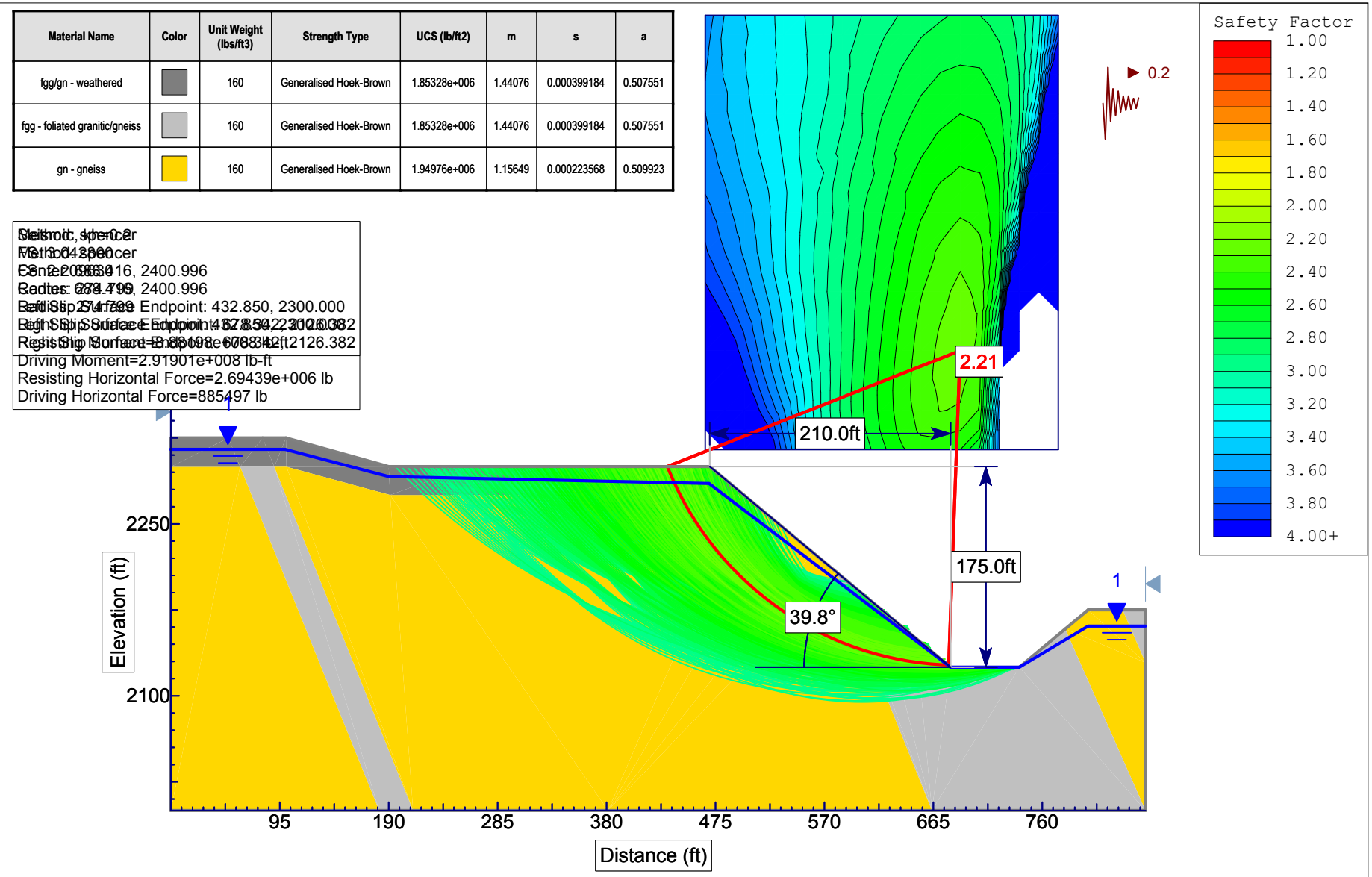
Method: spencer
FS: 3.042800
Center: 688.416, 2400.996
Radius: 274.799
Left Slip Surface Endpoint: 432.850, 2300.000
Right Slip Surface Endpoint: 678.342, 2126.382
Resisting Moment=8.88198e+008 lb-ft
Driving Moment=2.91901e+008 lb-ft
Resisting Horizontal Force=2.69439e+006 lb
Driving Horizontal Force=885497 lb



SLIDEINTERPRET 6.008

Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Proposed Fill Slope, Section Y-Y'		
Drawn By	C.H.J., Incorporated	Author	Scale 1:1500
File Name	prop rock cut slope YY.slim	Date 1/17/2011	Enclosure "D-3.1"

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (lb/ft2)	m	s	a
fgg/gn - weathered		160	Generalised Hoek-Brown	1.85328e+006	1.44076	0.000399184	0.507551
fgg - foliated granitic/gneiss		160	Generalised Hoek-Brown	1.85328e+006	1.44076	0.000399184	0.507551
gn - gneiss		160	Generalised Hoek-Brown	1.94976e+006	1.15649	0.000223568	0.509923



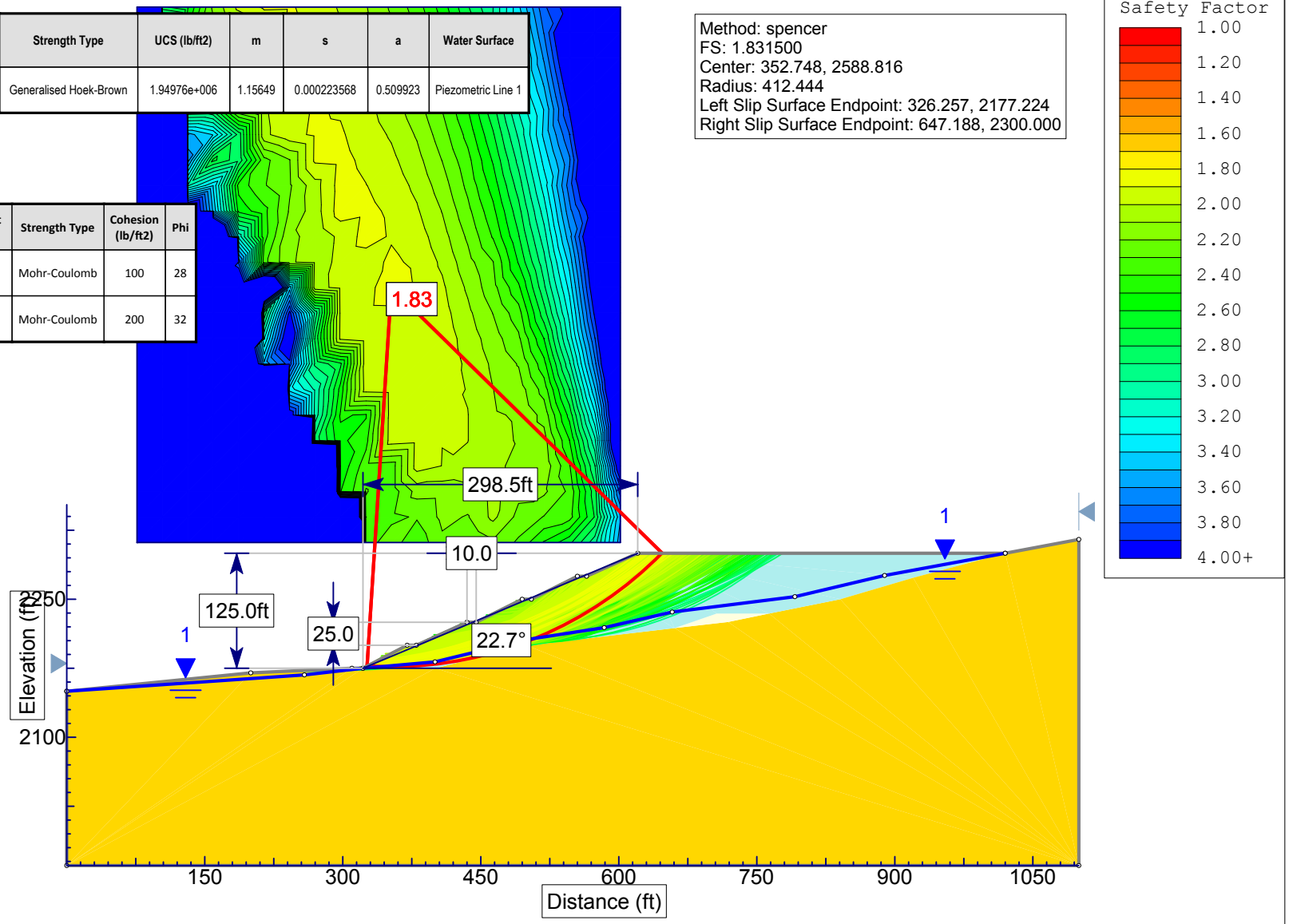
Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Proposed Fill Slope, Section Y-Y'		
Drawn By	C.H.J., Incorporated	Author	Scale 1:1500
File Name	prop rock cut slope YY_seis.slim	Date 1/17/2011	Enclosure "D-3.2"

SLIDEINTERPRET 6.008

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (lb/ft2)	m	s	a	Water Surface
gn - gneiss		160	Generalised Hoek-Brown	1.94976e+006	1.15649	0.000223568	0.509923	Piezometric Line 1

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Qa - native soil		120	Mohr-Coulomb	100	28
Mine Fill		118	Mohr-Coulomb	200	32

Method: spencer
FS: 1.831500
Center: 352.748, 2588.816
Radius: 412.444
Left Slip Surface Endpoint: 326.257, 2177.224
Right Slip Surface Endpoint: 647.188, 2300.000

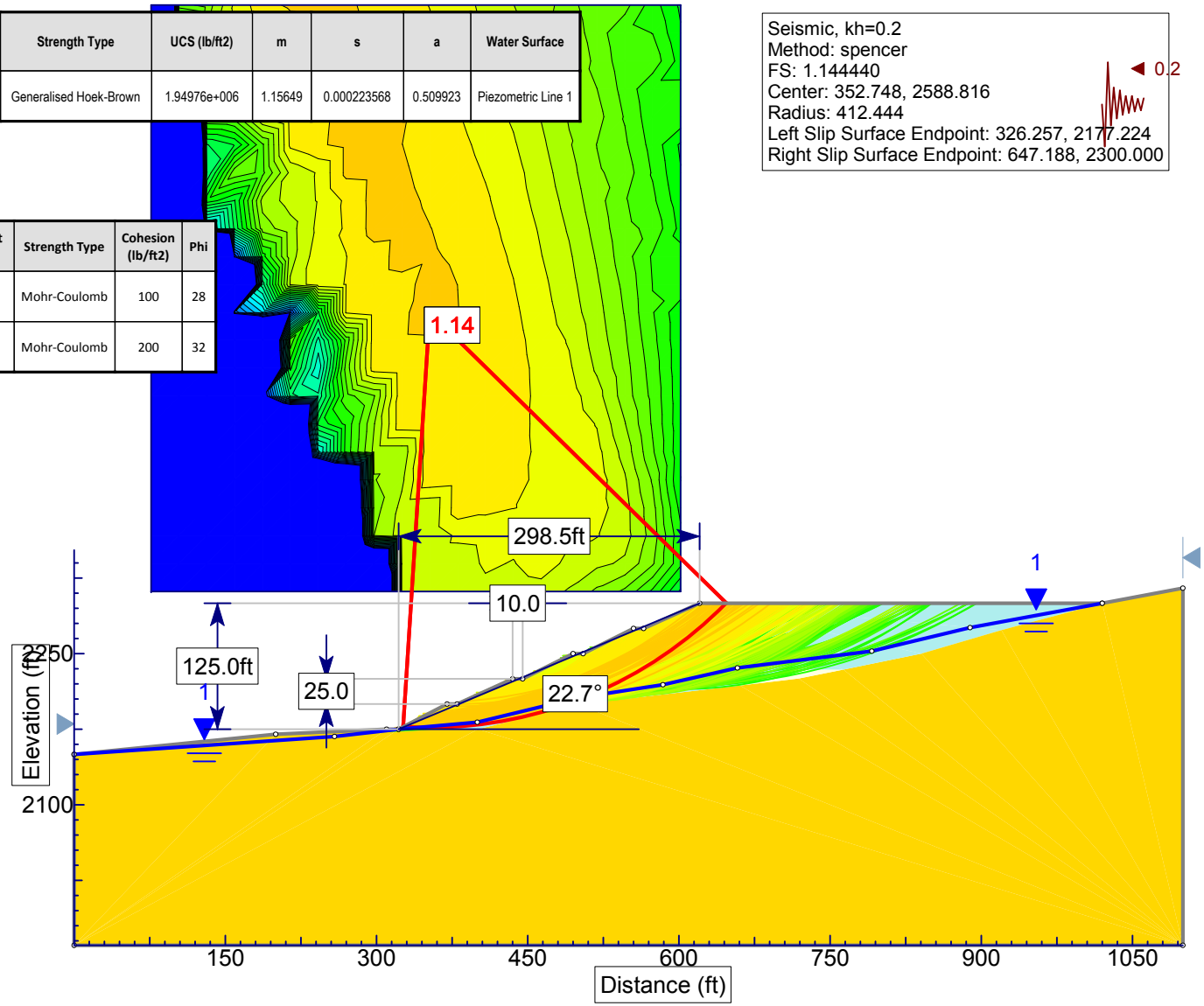


Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Proposed Fill Slope, Section Z-Z'		
Drawn By	C.H.J., Incorporated	Author	Scale 1:2000
File Name	prop tails ZZ.slim	Date 1/17/2011	Enclosure "D-4.1"

SLIDEINTERPRET 6.008

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (lb/ft2)	m	s	a	Water Surface
gn - gneiss		160	Generalised Hoek-Brown	1.94976e+006	1.15649	0.000223568	0.509923	Piezometric Line 1

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Qa - native soil		120	Mohr-Coulomb	100	28
Mine Fill		118	Mohr-Coulomb	200	32

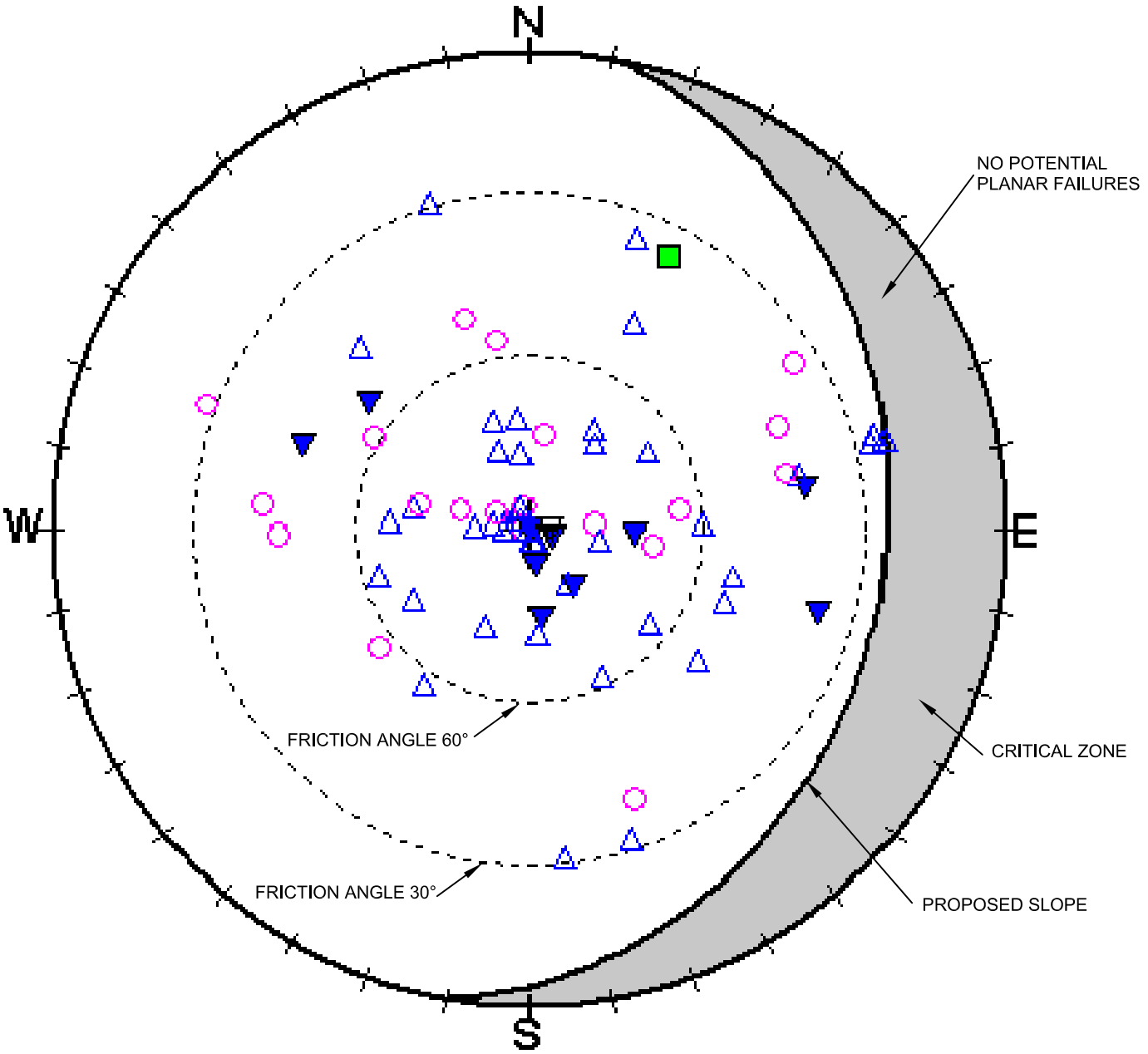


Project	Super Creek Mine Slope Stability		
Analysis Description	Slope Stability Analysis - Proposed Fill Slope, Section Z-Z'		
Drawn By	C.H.J., Incorporated	Author	Scale 1:2000
File Name	prop tails zz_seis.slim	Date 1/17/2011	Enclosure "D-4.2"

SLIDEINTERPRET 6.008

APPENDIX "E"

KINEMATIC SLOPE STABILITY ANALYSIS



DIP VECTORS:

- ▼ MAJOR JOINT
- △ MINOR JOINT
- ■ SHEAR
- ○ FOLIATION
- ● CONTACT

W-W' PLANAR ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-1"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

SEISMIC

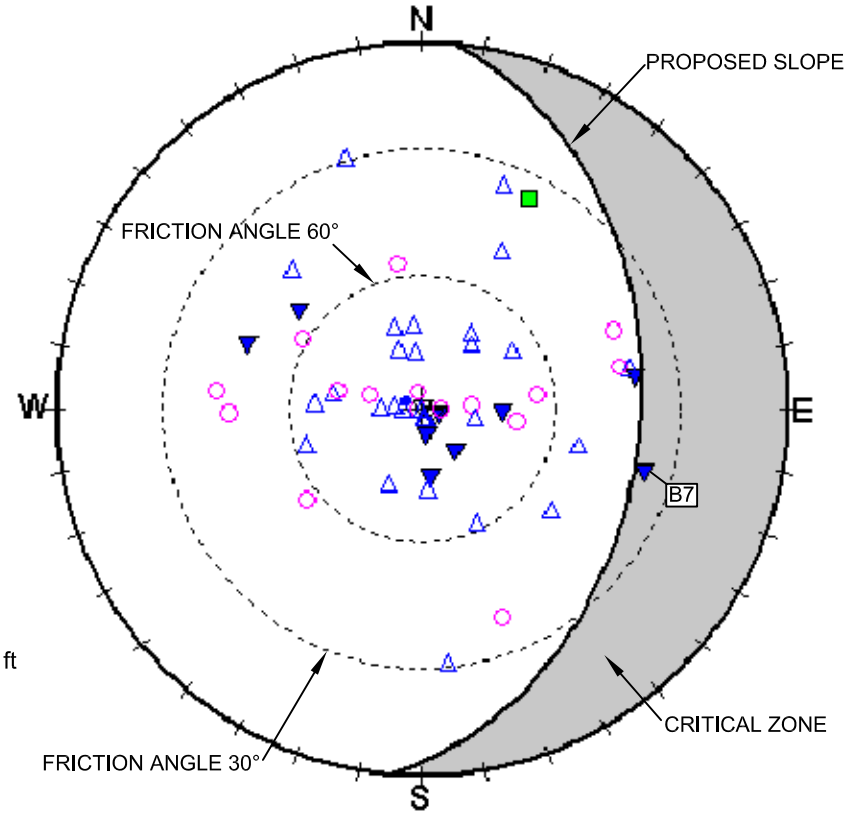
Plane Failure Analysis Input Data

(H) Height = 175ft
(SF) Inclination of Slope Face = 40°
(SS) Inclination of Upper Slope = 0°
(SP) Inclination of Failure Plane = 37°
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30°
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AC) Horizontal Acceleration = 0.69 G
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 290.79 ft ²
(W) Weight of Slice = 335606.84 lb(f)
(U) Water Force Normal to Failure Plane = 793848.68 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 23.68 ft
(F) Factor of Safety = 1.64



B7 Discontinuity Analyzed

STATIC

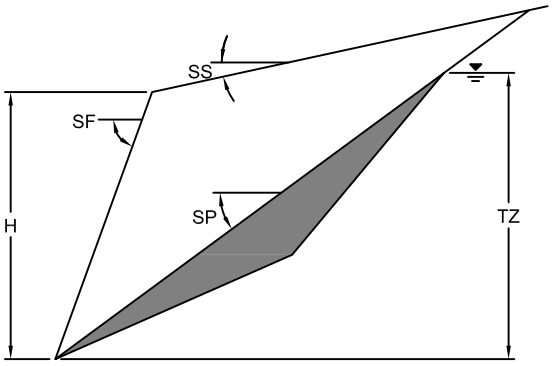
Plane Failure Analysis Input Data

(H) Height = 175 ft
(SF) Inclination of Slope Face = 40°
(SS) Inclination of Upper Slope = 0°
(SP) Inclination of Failure Plane = 37°
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30°
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AC) Horizontal Accleration = 0 G
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 290.79 ft ²
(W) Weight of Slice = 335606.84 lb(f)
(U) Water Force Normal to Failure Plane = 793848.68 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 23.68 ft
(F) Factor of Safety = 3.54



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR
- FOLIATION
- CONTACT

Y-Y' EAST FACE PLANAR ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-2"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

SEISMIC

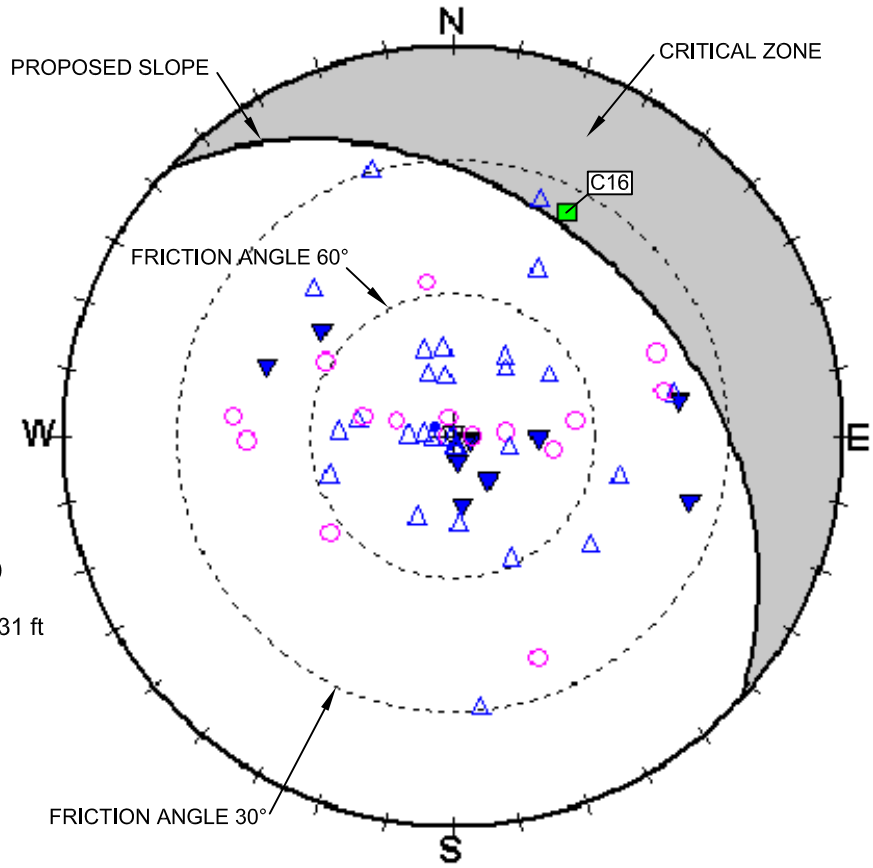
Plane Failure Analysis Input Data

(H) Height = 175ft
(SF) Inclination of Slope Face = 40 °
(SS) Inclination of Upper Slope = 0 °
(SP) Inclination of Failure Plane = 36 °
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30 °
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AC) Horizontal Acceleration = 0.69 G
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 297.73 ft ²
(W) Weight of Slice = 457993.69 lb(f)
(U) Water Force Normal to Failure Plane = 812796.95 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 32.31 ft
(F) Factor of Safety = 1.29



C16 Discontinuity Analyzed

STATIC

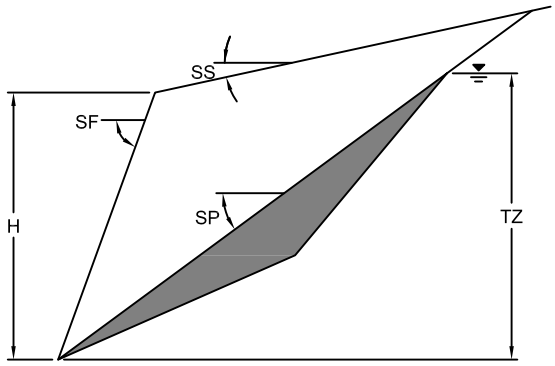
Plane Failure Analysis Input Data

(H) Height = 200 ft
(SF) Inclination of Slope Face = 40 °
(SS) Inclination of Upper Slope = 0 °
(SP) Inclination of Failure Plane = 36 °
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30 °
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 297.73 ft ²
(W) Weight of Slice = 457993.69 lb(f)
(U) Water Force Normal to Failure Plane = 812796.95 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 32.31 ft
(F) Factor of Safety = 2.92



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR
- FOLIATION
- CONTACT

Y-Y' NORTH EAST PLANAR ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-3"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

SEISMIC

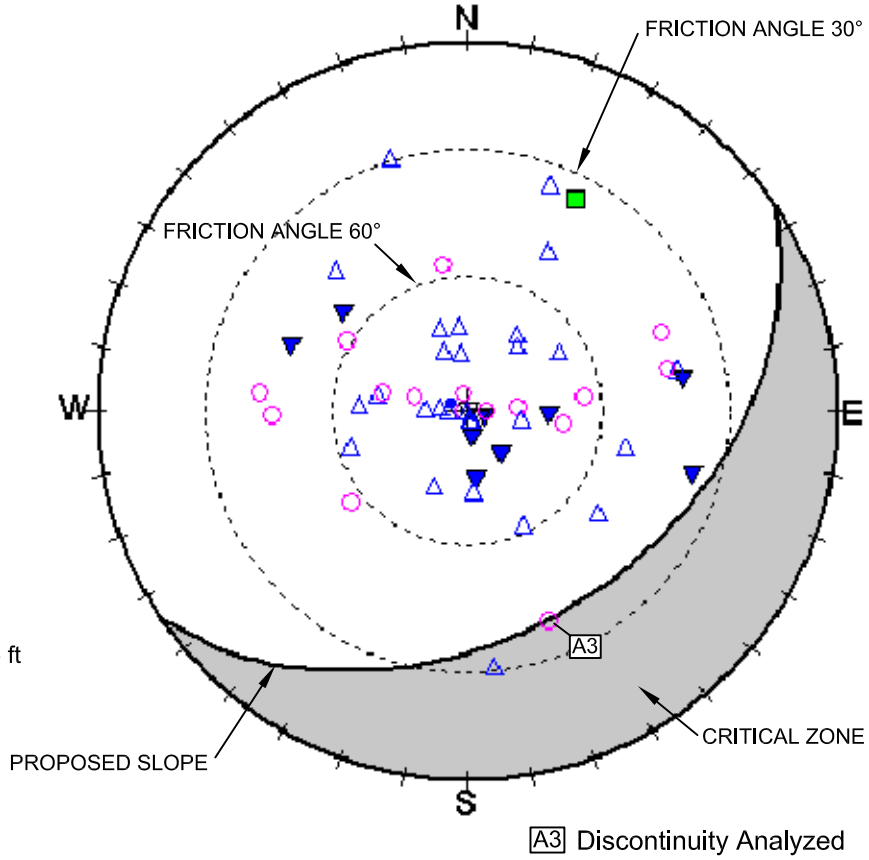
Plane Failure Analysis Input Data

(H) Height = 175ft
(SF) Inclination of Slope Face = 40°
(SS) Inclination of Upper Slope = 0°
(SP) Inclination of Failure Plane = 39°
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30°
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AC) Horizontal Acceleration = 0.69 G
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 278.08 ft ²
(W) Weight of Slice = 107023.01 lb(f)
(U) Water Force Normal to Failure Plane = 759152.36 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 7.55 ft
(F) Factor of Safety = 4.46



STATIC

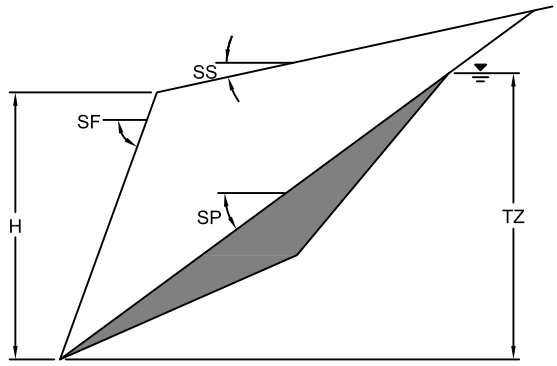
Plane Failure Analysis Input Data

(H) Height = 175 ft
(SF) Inclination of Slope Face = 40°
(SS) Inclination of Upper Slope = 0°
(SP) Inclination of Failure Plane = 39°
(CO) Cohesive Strength of Failure Surface = 3500 lb(f)
(PH) Friction Angle of Failure Surface = 30°
(GR) Density of Rock = 162 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(TZ) Amount of Discontinuity = 1 decimal%

No Tension Crack

Plane Failure Analysis Output Data

(A) Contact Area = 278.08 ft ²
(W) Weight of Slice = 107023.01 lb(f)
(U) Water Force Normal to Failure Plane = 759152.36 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Horizontal Distance of Tension Crack from Crest = 7.55 ft
(F) Factor of Safety = 8.66



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR
- FOLIATION
- CONTACT

Y-Y' SOUTHEAST PLANAR ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-4"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

ZONE #1 INTERSECTION 1A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 84°
(E1) Dip Direction = 82°
Plane 2 : (D2) Dip Value = 36°
(E2) Dip Direction = 27°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 1.87
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #1 INTERSECTION 1B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 48°
(E2) Dip Direction = 170°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 19.88
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #1 INTERSECTION 1C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

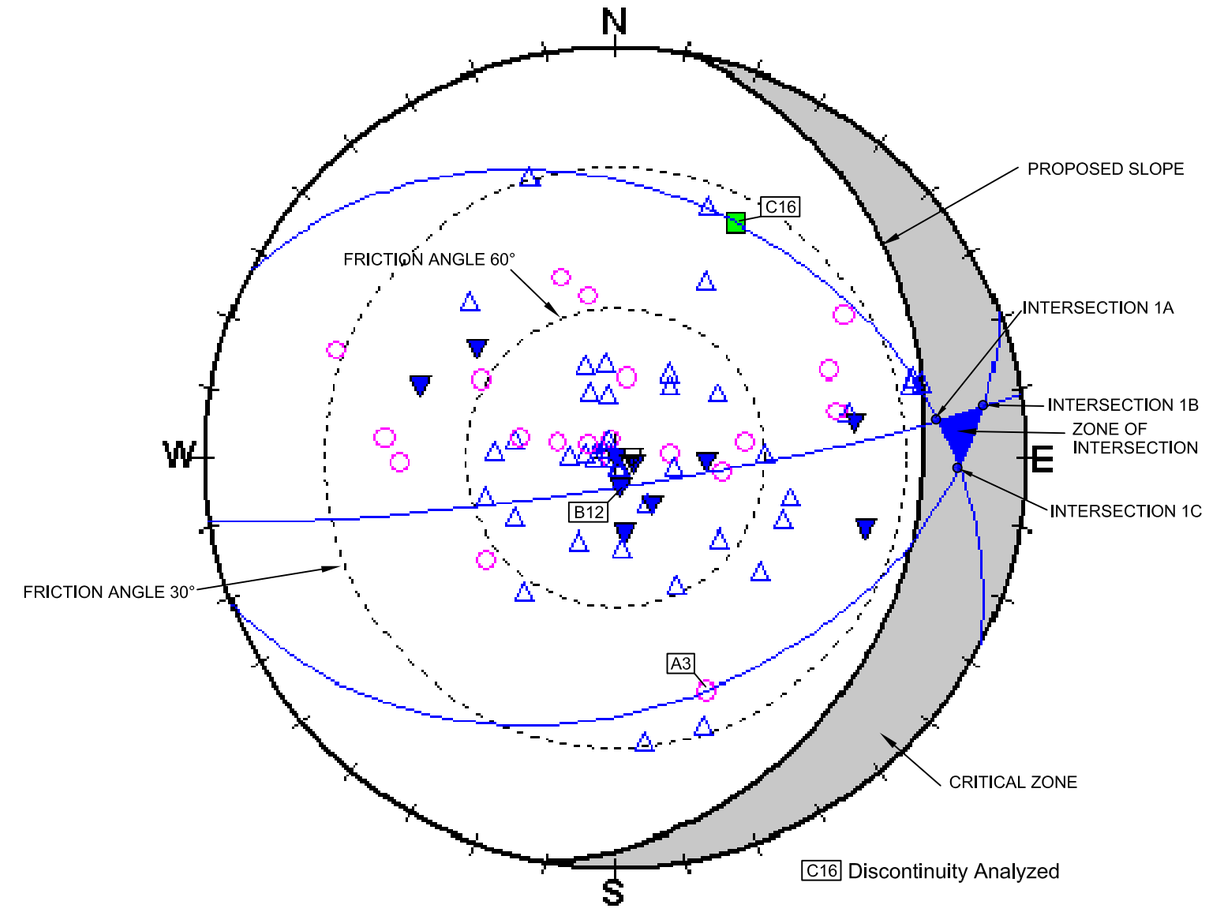
Plane 1 : (D1) Dip Value = 390°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 36°
(E2) Dip Direction = 27°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

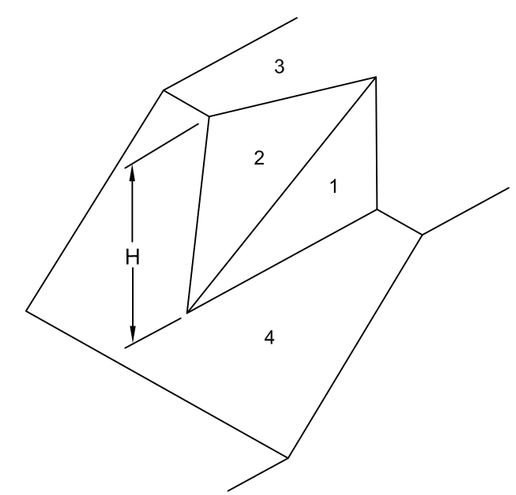
Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.98
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.





DIP VECTORS:
- MAJOR JOINT
- MINOR JOINT
- SHEAR
- FOLIATION
- CONTACT

W-W' WEDGE ANALYSIS ZONE 1

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-5"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

INTERSECTION 2A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 44°
(E2) Dip Direction = 78°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 10.38
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 2B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 43°
(E2) Dip Direction = 68°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 16.32
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 2C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

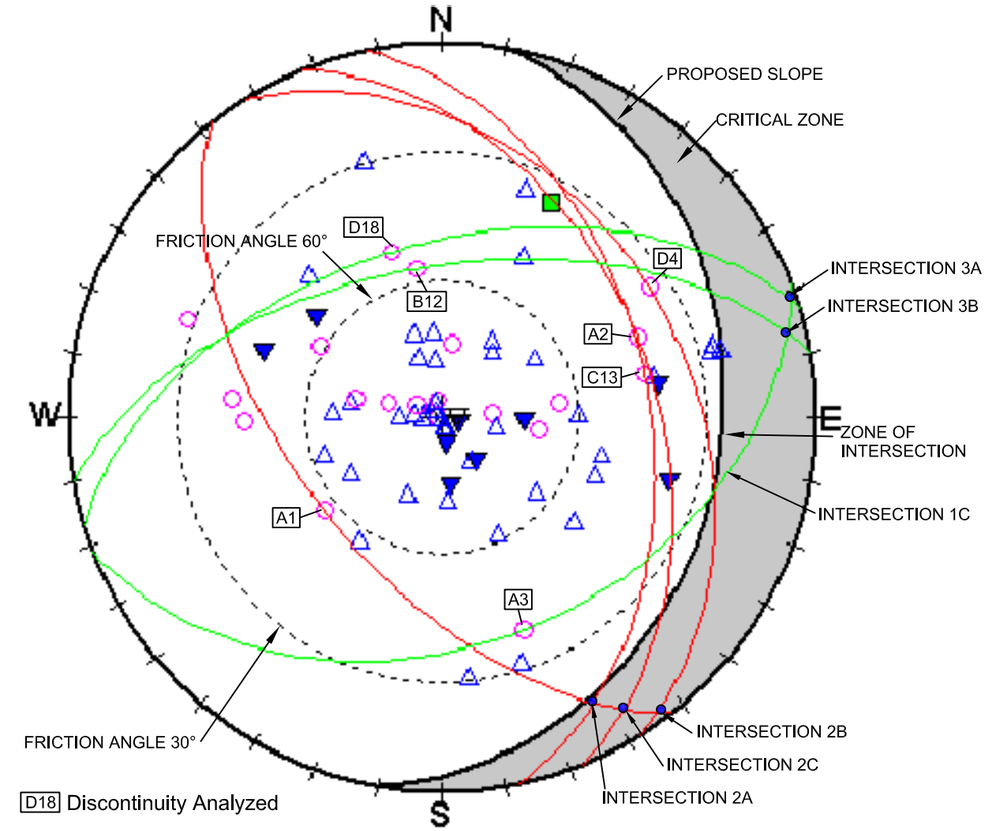
Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 35°
(E2) Dip Direction = 58°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 35.34
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



INTERSECTION 3A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 52°
(E2) Dip Direction = 343°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 49.93
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 3B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

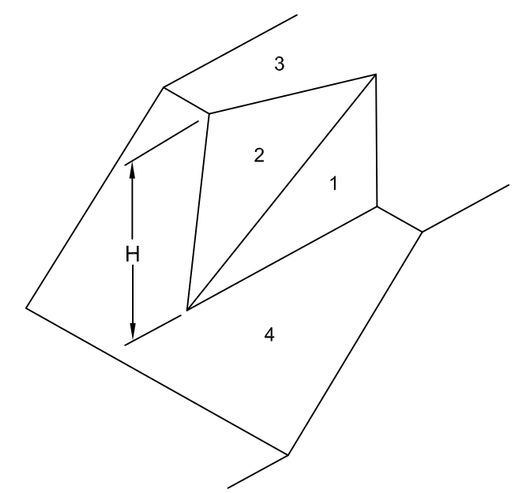
Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 57°
(E2) Dip Direction = 350°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 26.5°
(E4) Dip Direction = 100°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 14.75
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR
- FOLIATION
- CONTACT

W-W' WEDGE ANALYSIS 2 AND 3

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-6"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

ZONE #1 INTERSECTION 1A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 142°
Plane 2 : (D2) Dip Value = 36°
(E2) Dip Direction = 27°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0
Water Pressure = 520 lb(f)/ft ²
CONTACT LOST ON BOTH PLANES . THE WEDGE FLOATS AS A RESULT OF WATER PRESSURE ACTING ON PLANES 1 AND 2

ZONE #1 INTERSECTION 1A (Dry Condition)

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 142°
Plane 2 : (D2) Dip Value = 36°
(E2) Dip Direction = 27°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

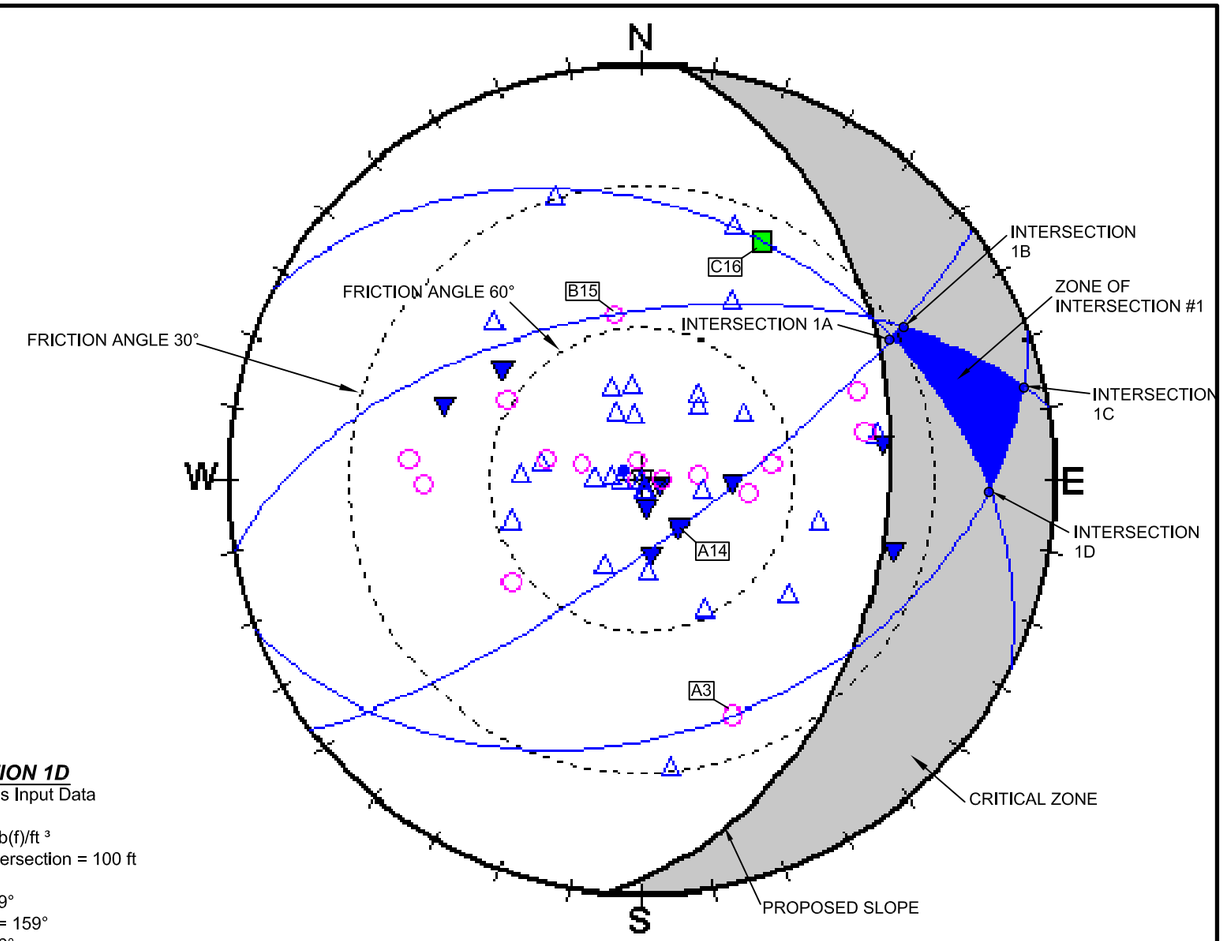
Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Dry slope

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 11.44
Water Pressure = 0 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



ZONE #1 INTERSECTION 1B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 142°
Plane 2 : (D2) Dip Value = 57°
(E2) Dip Direction = 345°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 9.23
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #1 INTERSECTION 1C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 57°
(E2) Dip Direction = 345°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 32.24
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #1 INTERSECTION 1D

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

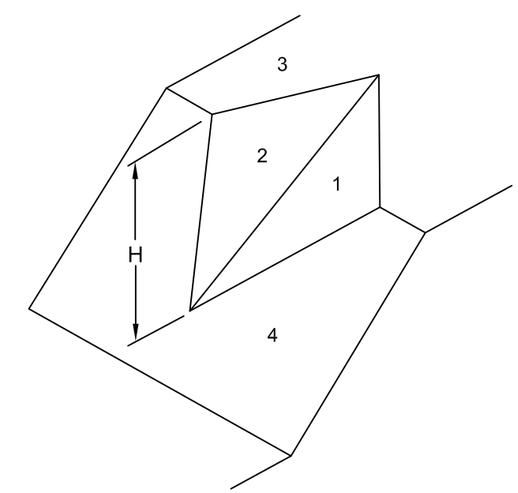
Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 36°
(E2) Dip Direction = 27°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.13
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR PLANE
- FOLIATION
- CONTACT

Y-Y' EAST FACE WEDGE ANALYSIS ZONE 1

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-7"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

ZONE #2 INTERSECTION 2A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 285°
Plane 2 : (D2) Dip Value = 48°
(E2) Dip Direction = 290°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0
Water Pressure = 520 lb(f)/ft ²
CONTACT LOST ON BOTH PLANES . THE WEDGE FLOATS AS A RESULT OF WATER PRESSURE ACTING ON PLANES 1 AND 2.

ZONE #2 INTERSECTION 2A (Dry Conditions)

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

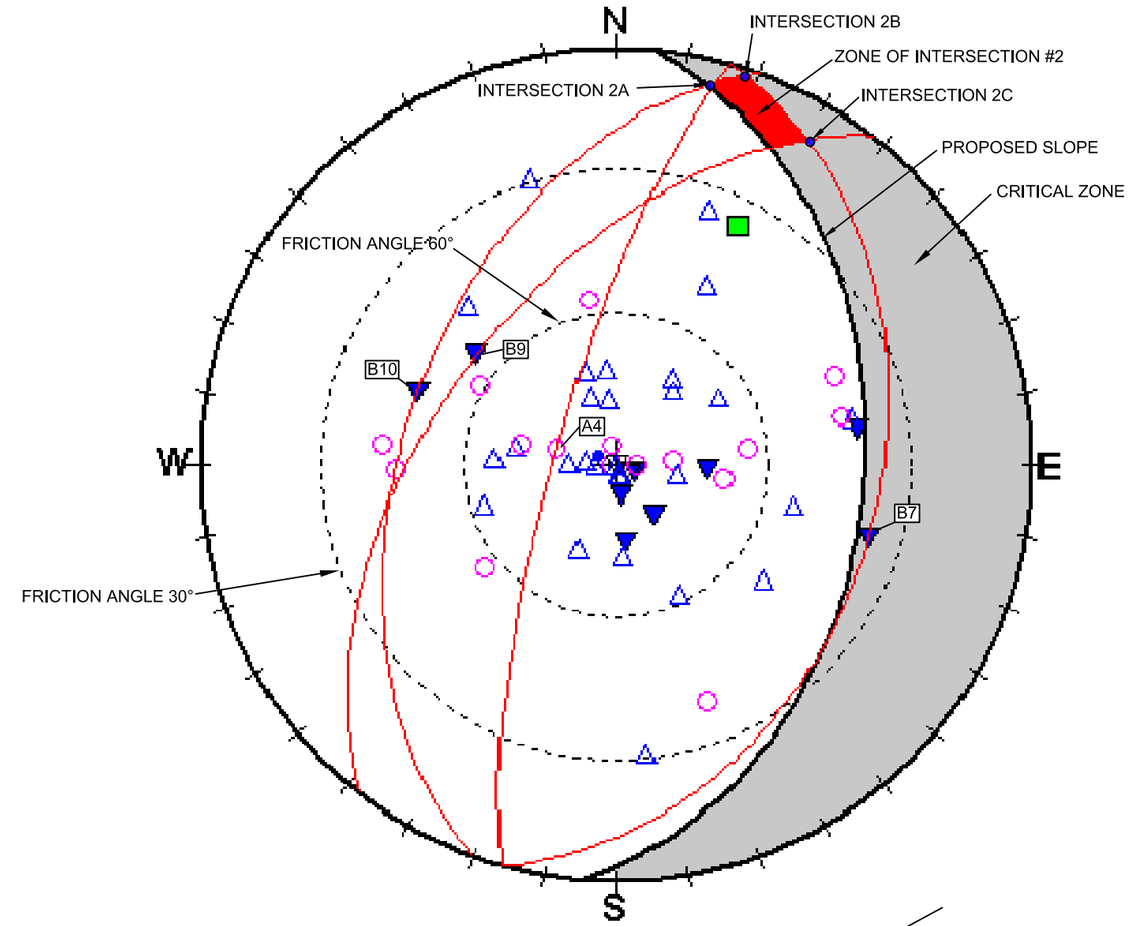
Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 285°
Plane 2 : (D2) Dip Value = 48°
(E2) Dip Direction = 290°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Dry Slope
(The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.08
Water Pressure = 0 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



ZONE #2 INTERSECTION 2B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 37°
(E1) Dip Direction = 106°
Plane 2 : (D2) Dip Value = 48°
(E2) Dip Direction = 290°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 54.93
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #2 INTERSECTION 2C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

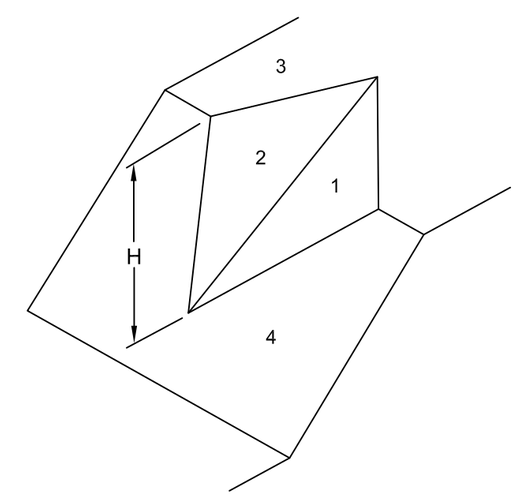
Plane 1 : (D1) Dip Value = 37°
(E1) Dip Direction = 106°
Plane 2 : (D2) Dip Value = 55°
(E2) Dip Direction = 308°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 13.19
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- ▼ MAJOR JOINT
- △ MINOR JOINT
- ■ SHEAR PLANE
- ○ FOLIATION
- ● CONTACT

Y-Y' EAST FACE WEDGE ANALYSIS ZONE 2

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-8"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

ZONE #3 INTERSECTION 3A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 43°
(E1) Dip Direction = 68°
Plane 2 : (D2) Dip Value = 39°
(E2) Dip Direction = 159°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 8.08
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #3 INTERSECTION 3B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

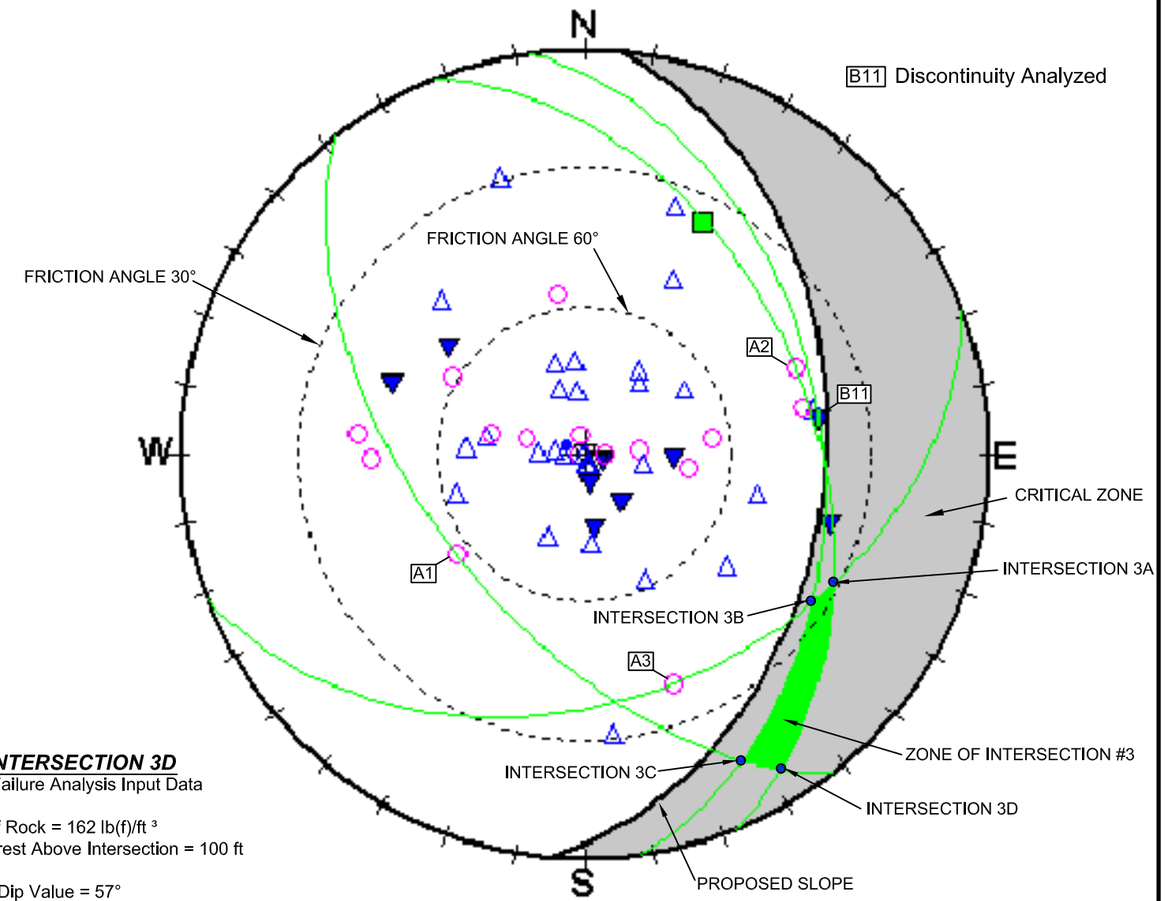
Plane 1 : (D1) Dip Value = 41°
(E1) Dip Direction = 82°
Plane 2 : (D2) Dip Value = 39°
(E2) Dip Direction = 159°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 0
Water Pressure = 520 lb(f)/ft ²
CONTACT LOST ON BOTH PLANES . THE WEDGE FLOATS AS A RESULT OF WATER PRESSURE ACTING ON PLANES 1 AND 2



ZONE #3 INTERSECTION 3B (Dry Conditions)

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 41°
(E1) Dip Direction = 82°
Plane 2 : (D2) Dip Value = 39°
(E2) Dip Direction = 159°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Dry Slope
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 14.53
Water Pressure = 0 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #3 INTERSECTION 3C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 43°
(E2) Dip Direction = 68°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 13.65
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

ZONE #3 INTERSECTION 3D

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

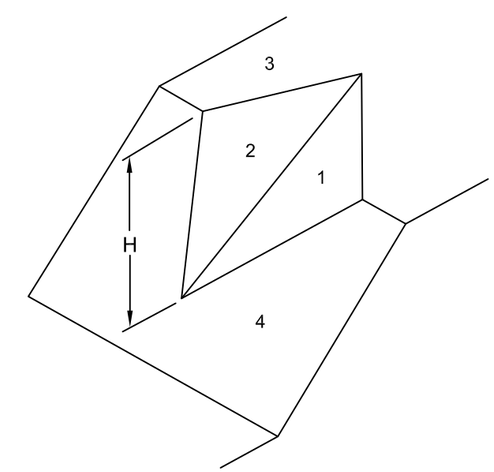
Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 41°
(E2) Dip Direction = 82°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 95°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 11.31
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- MAJOR JOINT
- MINOR JOINT
- SHEAR PLANE
- FOLIATION
- CONTACT

Y-Y' EAST FACE WEDGE ANALYSIS ZONE 3

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-9"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

INTERSECTION 1A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 71°
(E1) Dip Direction = 282°
Plane 2 : (D2) Dip Value = 37°
(E2) Dip Direction = 106°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 37.65
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 1B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 37°
(E2) Dip Direction = 106°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 6.14
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 1C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

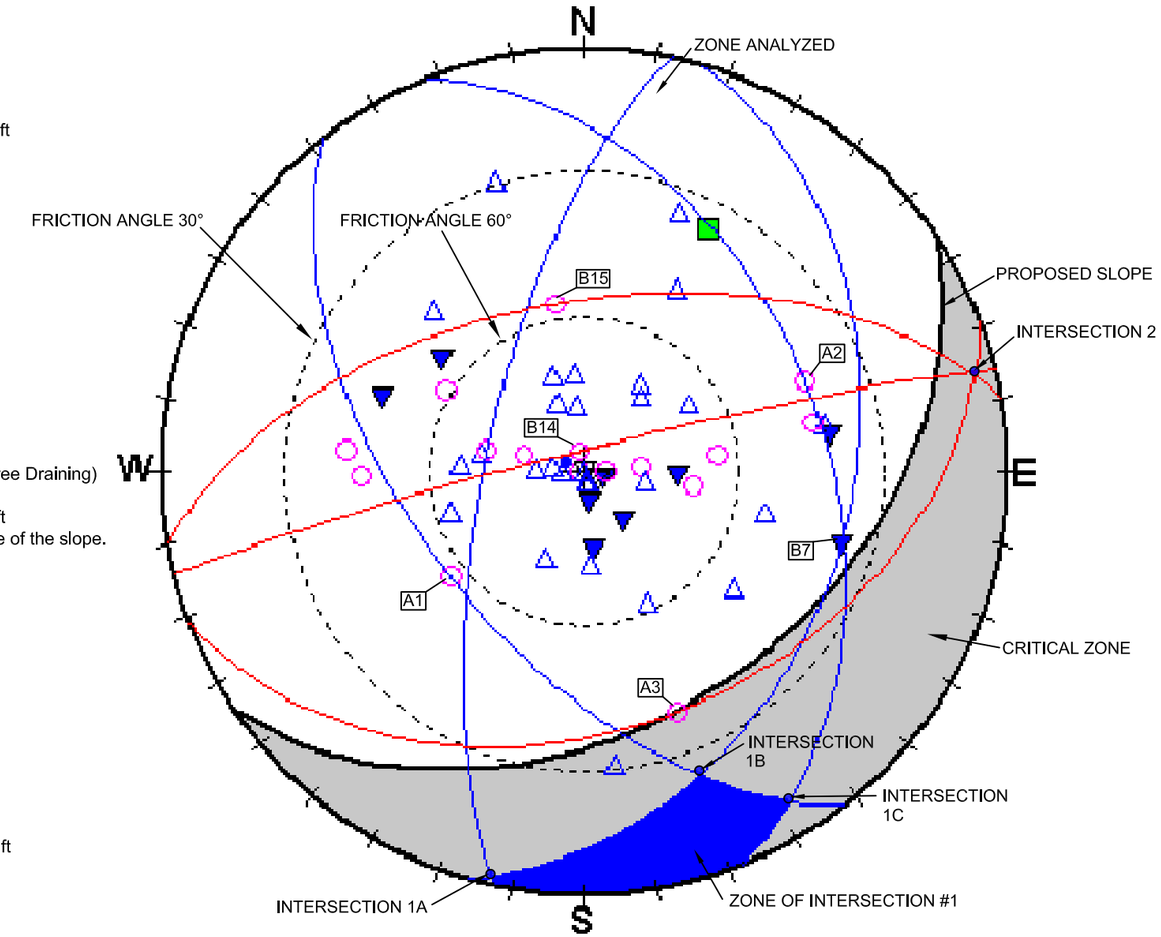
Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 232°
Plane 2 : (D2) Dip Value = 43°
(E2) Dip Direction = 68°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 12.54
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



INTERSECTION 2A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 86°
(E1) Dip Direction = 345°
Plane 2 : (D2) Dip Value = 57°
(E2) Dip Direction = 350°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 33.26
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 2B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 86°
(E1) Dip Direction = 345°
Plane 2 : (D2) Dip Value = 39°
(E2) Dip Direction = 159°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 200 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 27.15
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

INTERSECTION 2C

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

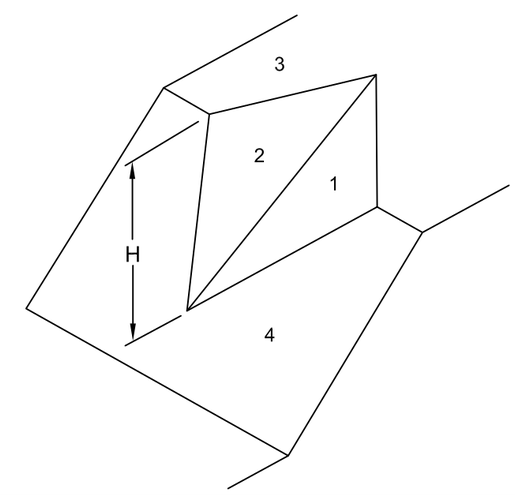
Plane 1 : (D1) Dip Value = 57°
(E1) Dip Direction = 350°
Plane 2 : (D2) Dip Value = 39°
(E2) Dip Direction = 159°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 146°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 21.06
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- ▼ MAJOR JOINT
- △ MINOR JOINT
- ■ SHEAR PLANE
- ○ FOLIATION
- ● CONTACT

Y-Y' SOUTHEAST FACE WEDGE ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY

DATE: DECEMBER 2010

SLOPE STABILITY INVESTIGATION
SUPER CREEK QUARRY
WHITEWATER RIVER AREA
RIVERSIDE COUNTY, CALIFORNIA

ENCLOSURE "E-10"

JOB NUMBER 10369-8

C.H.J. Incorporated

WEDGE #1 INTERSECTION 1A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 43°
(E1) Dip Direction = 275°
Plane 2 : (D2) Dip Value = 85°
(E2) Dip Direction = 79°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 43°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 200 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 10.74
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

WEDGE #1 INTERSECTION 1B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

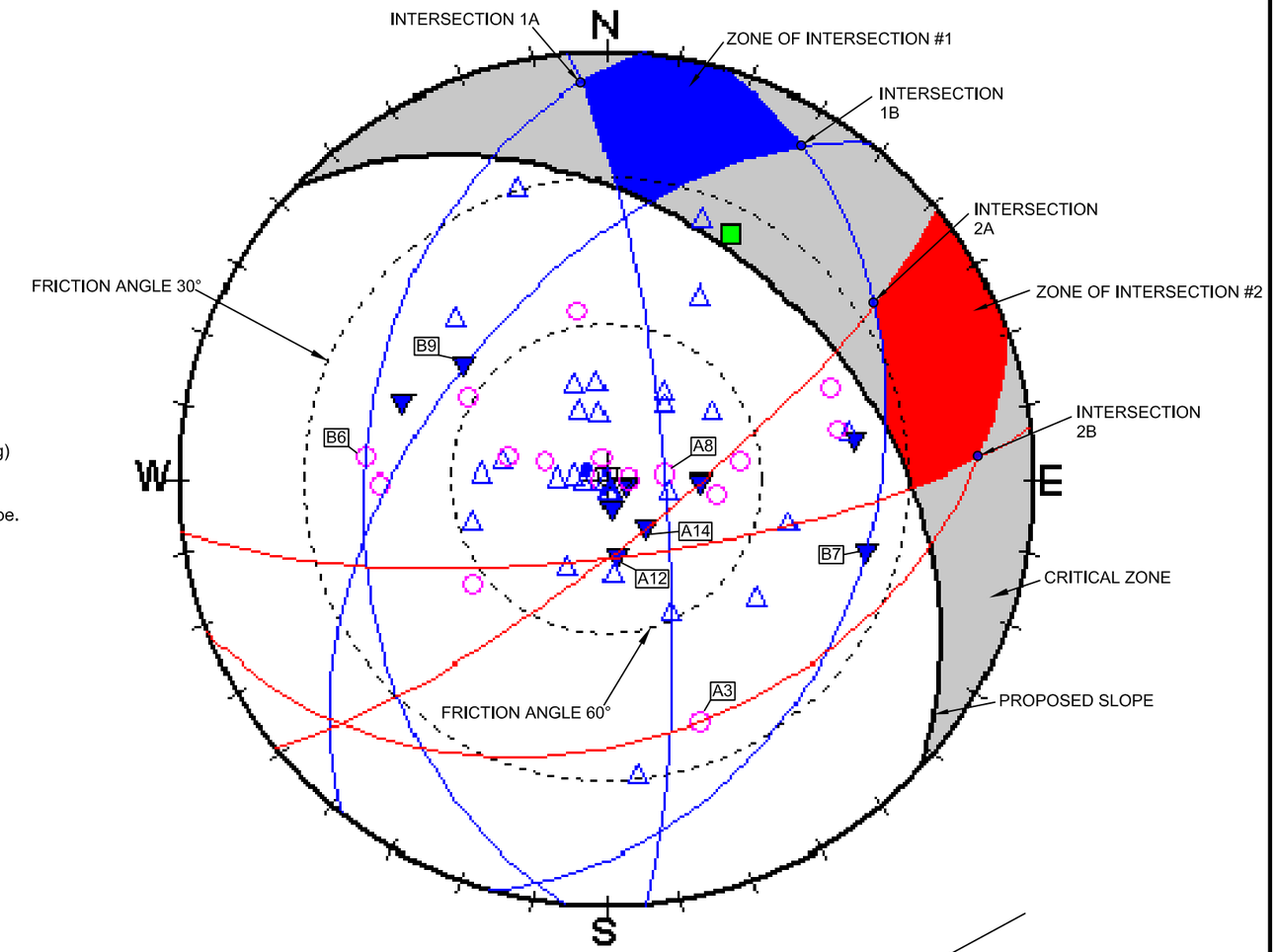
Plane 1 : (D1) Dip Value = 55°
(E1) Dip Direction = 308°
Plane 2 : (D2) Dip Value = 37°
(E2) Dip Direction = 106°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 43°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 10.16
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



WEDGE #2 INTERSECTION 2A

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

Plane 1 : (D1) Dip Value = 78°
(E1) Dip Direction = 142°
Plane 2 : (D2) Dip Value = 37°
(E2) Dip Direction = 106°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 43°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 10.07
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.

WEDGE #2 INTERSECTION 2B

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 162 lb(f)/ft ³
(H) Height of Crest Above Intersection = 100 ft

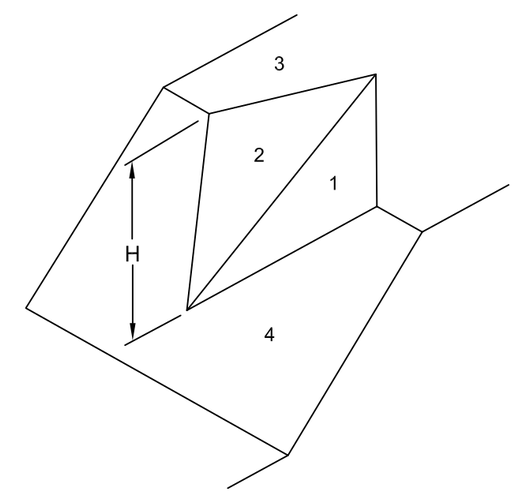
Plane 1 : (D1) Dip Value = 39°
(E1) Dip Direction = 159°
Plane 2 : (D2) Dip Value = 75°
(E2) Dip Direction = 173°
Plane 3 : (D3) Dip Value = 0°
(E3) Dip Direction = 0°
Plane 4 : (D4) Dip Value = 40°
(E4) Dip Direction = 43°

Plane 1 : (C1) Cohesion = 3500 lb(f)/ft ²
(P1) Friction Angle = 30°
Plane 2 : (C2) Cohesion = 3500 lb(f)/ft ²
(P2) Friction Angle = 30°

Water Pressure : Cracks completely filled (Free Draining)
(GW) Density of Water = 62.4 lb(f)/ft³
(HW) Overall Vertical Height of Wedge = 50 ft
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 18.66
Water Pressure = 520 lb(f)/ft ²
THERE IS CONTACT ON BOTH PLANES.



DIP VECTORS:

- ▼ MAJOR JOINT
- △ MINOR JOINT
- ■ SHEAR PLANE
- ○ FOLIATION
- ● CONTACT

Y-Y' NORTHEAST FACE WEDGE ANALYSIS

FOR: WHITEWATER ROCK AND SUPPLY	SLOPE STABILITY INVESTIGATION SUPER CREEK QUARRY WHITEWATER RIVER AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "E-11"
DATE: DECEMBER 2010		JOB NUMBER 10369-8

C.H.J. Incorporated

APPENDIX "F"

DISCONTINUITY DATA

Discontinuity Measurements

Traverse Trend: 50 **Traverse Number:** 1 **Traverse Length:** 55' **Job Number:** 10369-8

Discontinuity No.	Distance (ft.)	Geologic Unit	Hardness	Structure	Zone Width	Joint Spacing	Dip Direction	Dip value	Discontinuity Length (ft.)	Continuous (in outcrop)	Filling Type	Thickness (inches)	Filling Hardness	Roughness	Water	Remarks
A1	8	gn	11	foliation	8"	1"-2"	232	57	15	yes	none	>1/16	N/A	rough	none	wavy
A2	16	gn	11	foliation	3'-6'	1/4"	68	43	10	no	none	0	N/A	rough	none	chevron folds
A3	18	gn	11	foliation	3'-6'	1/4"	159	39	12	no	none	0	N/A	rough	none	chevron folds
A4	21	gn	11	foliation	3'	2"-6"	285	78	15	yes	clay	>1/16	2	smooth	none	
A5	25	gn	11	joint	3'-4'	6"-12"	281	70	8	no	clay	0.25	2	smooth	none	
A6	35	gn/fgg	11	foliation	10'-12'	3"-6"	270	89	10	no	clay	0.0625	2	rough	none	wavy
A7	36	gn/fgg	11	foliation	10'-12'	3"-6"	85	79	12	no	clay	0.0625	2	rough	none	wavy
A8	37	gn/fgg	11	contact	2'-4'	N/A	295	86	15	yes	weathered	0	2	rough	none	undulatory
A9	41	fgg	11	fold	4'	1/2"-2"	282	71	15	yes	clay	1/16-1/4	2	rough	none	wavy
A10	41	fgg	11	fold	4'	1/2"-2"	97	69	8	yes	clay	1/16-1/5	3	rough	none	wavy
A11	42	fgg	11	fold	5'	1/2"-2"	269	46	8	no	none	0	N/A	smooth	none	wavy
A12	42	fgg	11	joint	5'	1/2"-2"	173	75	7	no	none	0	N/A	smooth	none	wavy
A13	45	fgg	11	joint	4'	1/2"-2"	108	86	7	no	none	0	N/A	smooth	none	tight
A14	48	fgg	11	joint	4'	1/2"-2"	142	78	7	no	none	0	N/A	smooth	none	wavy
A15	49	fgg	11	foliation	3'-6'	2"-4"	83	64	15	yes	clay	1/16-1/8	2	smooth	none	steep limb

Highlighted discontinuities used in analysis

Enclosure "F-1"

Discontinuity Measurements

Traverse Trend: 394 **Traverse Number:** **2** **Job Number:** 10369-8

Discontinuity No.	Distance (ft.)	Geologic Unit	Hardness	Structure	Zone Width	Joint Spacing	Dip Direction	Dip value	Discontinuity Length (ft.)	Continuous (in outcrop)	Filling Type	Thickness (inches)	Filling Hardness	Roughness	Water	Remarks
B1	0	fgg	11	joint	1'	1"-2"	37	72	2'-3'	no	none	0	N/A	smooth	none	planar
B2	0	fgg	11	joint	5'	1"-2"	342	71	2'-3'	no	none	0	N/A	smooth	none	planar
B3	0	fgg	11	joint	25'	1"-2"	103	54	2'-3'	no	none	0	N/A	smooth	none	wavy
B4	0	fgg	11	joint	25'	1"-2"	27	84	2'-3'	no	none	0	N/A	smooth	none	
B5	0	fgg	11	joint	20'-50'	1"-2"	57	66	2'-3'	no	none	0	N/A	smooth	none	planar
B6	5	fgg	11	foliation	3'	1'-2'	275	43	10	semi	none	1/16	1	rough	none	undulatory
B7	18	fgg	11	joint	30'	1"-2"	106	37	6"-1'	no	none	0	N/A	smooth	none	joint set
B8	18	fgg	11	joint	30'	1"-2"	24	90	6"-1'	no	none	0	N/A	smooth	none	
B9	18	fgg	11	joint	4"	1"-2"	308	55	6"-1'	no	none	0	N/A	rough	none	
B10	27	fgg	11	joint	25'	1/2"-3"	290	48	6"-1'	no	none	0-1/8	1	rough	none	
B11	27	fgg	11	joint	6"	1/2"-3"	82	41	6"-1'	no	none	0-1/8	1	rough	none	
B12	27	fgg	11	joint	3'	1/2"-3"	170	84	6"-1'	no	none	0-1/8	1	rough	none	planar
B13	27	fgg	11	joint	20'	1/2"-3"	116	87	6"-1'	no	none	0-1/8	1	rough	none	
B14	28	fgg	11	foliation	3"	3" single	345	86	6'+	yes	clay	1/16	2	smooth	none	planar
B15	36	fgg	11	foliation	6"	7.5"	350	57	6'+	yes	clay	1/16	2	rough	none	wavy
B16	47	fgg	11	joint	6"	7.5"	163	88	2'-3'	no	none	1/16	1	smooth	none	
B17	47	fgg	11	joint	6"	7.5"	204	72	2'-3'	no	none	0-1/16	2	smooth	none	some soil infilling
B18	47	fgg	11	joint	6"	7.5"	317	47	2'-3'	no	none	0-1/16	3	smooth	none	
B19	49	fgg	11	joint	10'	1"-2'	79	42	2'-3'	no	none	0-1/16	N/A	smooth	none	planar
B20	49	fgg	11	joint	12"	1"-2'	273	66	2'-3'	no	none	0-1/16	N/A	smooth	none	planar
B21	49	fgg	11	joint	10'	1"-2'	33	70	2'-3'	no	none	0-1/16	N/A	smooth	none	
B22	49	fgg	11	joint	10'	1"-2'	355	71	2'-3'	no	none	0-1/16	N/A	smooth	none	wavy

Highlighted discontinuities used in analysis

Enclosure "F-2"

Discontinuity Measurements

Traverse Trend: 198 **Traverse Number:** **3** **Job Number:** 10369-8

Discontinuity No.	Distance (ft.)	Geologic Unit	Hardness	Structure	Zone Width	Joint Spacing	Dip Direction	Dip value	Discontinuity Length (ft.)	Continuous (in outcrop)	Filling Type	Thickness (inches)	Filling Hardness	Roughness	Water	Remarks
C1	0	fgg	11	joint	6'-10'	1/2"-1"	20	35	5'-10'	no	none	0-1/8	1	rough	none	joint set
C2	0	fgg	11	joint	6'-10'	1/2"-1"	339	76	5'-10'	no	none	0-1/8	1	rough	none	joint set
C3	0	fgg	11	joint	6'-10'	1/2"-1"	253	63	5'-10'	no	none	0-1/8	1	rough	none	planar
C4	0	fgg	11	joint	6'-10'	1/2"-1"	154	62	5'-10'	no	none	0-1/8	1	rough	none	
C5	5'	fgg	11	shear	3'	1"-3"	272	86	15'	yes	clay	0-1/8	2	rough	none	undulatory
C6	9	fgg	11	joint	10'	1/2"-6"	343	29	2'-10'	no	none	0-1/8	N/A	rough	none	
C7	9	fgg	11	joint	10'	1/2"-6"	354	77	2'-10'	no	none	0-1/8	N/A	rough	none	
C8	9	fgg	11	joint	10'	1/2"-6"	128	53	2'-10'	no	none	0	N/A	rough	none	
C9	26	fgg	11	joint	6'	3"-1'	80	90	5'-10'	yes	calcite?	1/16	9	smooth	none	joint set
C10	26	fgg	11	joint	6'	3"-1'	174	31	5'-10'	yes	calcite?	1/16	10	smooth	none	joint set
C11	26	fgg	11	joint	6'	3"-1'	274	81	5'-10'	yes	calcite?	1/16	11	smooth	none	intersecting
C12	26	fgg	11	joint	6'	3"-1'	157	88	5'-10'	yes	calcite?	1/16	12	smooth	none	
C13	32	fgg	11	foliation	1'-2'	1/4"	78	44	15	yes	clay	1/8	2	smooth	none	zone
C14	39	fgg	11	foliation	1'-3'	1/2"-2"	300	59	10	no	none	0	N/A	smooth	none	planar
C15	40	fgg	11	joint	1"	single	93	72	15	no	none	0	N/A	smooth	none	planar
C16	73	fgg	11	shear	1"-3"	single	27	36	20	no	clay	1"	2	rough	none	
C17	77	fgg	11	joint	8'-10'	1"-6"	99	78	5'-7'	no	none	0	N/A	smooth	none	wavy
C18	77	fgg	11	joint	8'-10'	1"-6"	176	72	5'-7'	no	none	0	N/A	smooth	none	
C19	77	fgg	11	joint	8'-10'	1"-6"	27	50	5'-7'	no	none	0	N/A	smooth	none	
C20	92	fgg	11	foliation	20'	6"-18"	91	86	20'-30'	yes	none	0/1/2	2	smooth	none	undulatory

Highlighted discontinuities used in analysis

Enclosure "F-3"

Discontinuity Measurements

Traverse Trend: 14 **Traverse Number:** **4** **Job Number:** 10369-8

Discontinuity No.	Distance (ft.)	Geologic Unit	Hardness	Structure	Zone Width	Joint Spacing	Dip Direction	Dip value	Discontinuity Length (ft.)	Continuous (in outcrop)	Filling Type	Thickness (inches)	Filling Hardness	Roughness	Water	Remarks
D1	0	fgg	11	joint	4'-6'	1'-2'	146	79	15	yes	soil	1/8	9	rough	none	planar
D2	0	fgg	11	joint	4'-6'	1'-2'	239	67	15	yes	soil	1/8	9	rough	none	planar
D3	0	fgg	11	joint	4'-6'	1'-2'	76	27	15	yes	soil	1/8	9	rough	none	planar
D4	6	fgg	11	foliation	8'	1/2"-2"	58	35	15	yes	soil	1/8	N/A	smooth	none	wavy
D5	14	fgg	11	joint	10'	1/2"-6"	88	60	20	yes	soil	1/16	N/A	rough	none	wavy
D6	14	fgg	11	joint	10'	1/2"-6"	128	64	20	yes	soil	1/16	N/A	rough	none	
D7	14	fgg	11	joint	10'	1/2"-6"	162	32	20	yes	soil	1/16	N/A	rough	none	
D8	24	fgg	11	joint	12'	6"-2'	342	86	20	yes	soil	1/16	N/A	rough	none	
D9	24	fgg	11	joint	12'	6"-2'	110	54	20	yes	none	0	N/A	rough	none	planar
D10	24	fgg	11	joint	12'	6"-2'	75	26	20	yes	none	0	N/A	rough	none	planar
D11	38	fgg	11	joint	44'	3'-6'	76	24	20	yes	calcite	0-1/4	10	rough	none	wavy
D12	38	fgg	11	joint	44'	3'-6'	322	88	20	yes	calcite	0-1/4	10	rough	none	planar
D13	38	fgg	11	joint	44'	3'-6'	214	58	20	yes	calcite	0-1/4	10	rough	none	joint set
D14	38	fgg	11	joint	N/A	3'-6'	291	28	20	yes	calcite	0-1/4	10	rough	none	mapped attitudes
D15	38	fgg	11	joint	N/A	3'-6'	298	84	20	yes	calcite	0-1/4	10	rough	none	mapped attitudes
D16	38	fgg	11	joint	N/A	3'-6'	86	87	20	yes	calcite	0-1/4	10	rough	none	mapped attitudes
D17	38	fgg	11	joint	N/A	3'-6'	8	74	20	yes	calcite	0-1/4	10	rough	none	mapped attitudes
D18	38	fgg	11	joint	N/A	3'-6'	343	52	20	yes	calcite	0-1/4	10	rough	none	mapped attitudes

Highlighted discontinuities used in analysis

Enclosure "F-4"