SLOPE STABILITY REPORT

GRANITE CAPAY FACILITY

WKA No.
3080.05

June 20, 2001

WALLACE · KUHL & ASSOCIATES INC.

WALLACE - KUHL
& ASSOCIATES INC.

Geotechnical Engineering

Engineering Geology

Environmental Consulting

Remediation Services

Construction Inspection

Materials Testing

Slope Stability Report

GRANITE CAPAY FACILITY

Yolo County, California

WKA No. 3080.05

June 20, 2001

INTRODUCTION

Wallace-Kuhl & Associates have completed a slope stability analysis of the proposed Granite Capay aggregate mining facility located near Esparto, in Yolo County California. The purpose of our work has been to evaluate the stability of the slopes of the mining pits that would result from the removal of the aggregate resource. Our office completed a geotechnical engineering study of this site, including subsurface investigation, laboratory testing and slope stability analysis in 1995 for R. C. Collet, Inc. (WKA No. 3080.01). The geometry of the pits and the depth of the mining have changed since our original analyses, therefore we have been requested by Granite Construction Company (GCCo) to reevaluate the stability of the slopes proposed for the revised plan. Our work has been completed as authorized by Mr. Ben Adamo and Mr. Grant Williams of GCCo

Project Description and History

In November of 1995, R.C. Collet dba Cache Creek Aggregates filed a permit to extract aggregate from an approximate 504± acre site located about 1½ miles northwest of the town of Esparto in Yolo County, California. Following the required public review in 1996, the Yolo County Board of Supervisors approved the permit. In 1999, R.C. Collet sold its interest in the aggregate operation (and permit) to GCCo. Following GCCo's purchase of the aggregate processing operation, GCCo also have purchased the adjoining parcels and have conducted additional and more extensive evaluation of the aggregate resource. Once the purchases were completed and the total gravel and sand quantities were determined, GCCo decided to maximize the resource by revising the mining plan by deepening the extraction of aggregate in several areas. In addition, GCCo reevaluated the location of the fine grain gravel wash settling pond, and are proposing to deepen its placement by approximately 40 feet in one area. The new settling pond is sized

CORPORATE OFFICE
3050 Industrial Blvd.
West Sacramento
CA 95691
Tel 916.372.1434
Fax 916.372.2565

ROCKLIN OFFICE
500 Menlo Drive,
Suite 100
Rocklin, CA 95765
Tel 916.435.9722
Fax 916.435.9822

assuming a more accurate 15 percent wash loss as compared to the 7 percent wash loss assumed during the initial design and development of the project.

Because of GCCo's proposed operational changes Yolo County staff required a revised engineering review of the project. As part of the review, it was further required that a hydrogeologist examine the proposed changes for potential adverse effects to local groundwater. Wallace-Kuhl & Associates has completed a Groundwater Hydrology Report dated June 20, 2001. Information from that report, from our original Geotechnical Engineering Report, as well as the additional subsurface investigation performed by GCCo were used to perform additional slope stability analyses.

Purpose and Scope of Work

Our scope of work for this report has included:

- Review of our previous geotechnical engineering investigation and slope stability analysis of the site.
- Review of logs of borings (CF00-1 through CF00-8) drilled by GCCo during their evaluation of the aggregate resources.
- Slope stability analysis was performed based on the results of the field and laboratory data.
- The geology and seismicity in the vicinity of the site was studied through review of available geologic literature pertaining to the area.
- Preparation of this report containing our findings, conclusions and recommendations regarding slope stability.

Plates and Attachments

A Vicinity Map showing the location of the proposed mining site is included as Plate No. 1. An Overall Mining Site Plan, with the locations of borings drilled by Wallace-Kuhl & Associates and GCCo is included as Plate No. 2. Plate No. 3 presents the ground water elevations across the site. Plates No. 4 through 7 contain the cross-sections used during our supplemental slope stability analyses, as well as graphical displays of the results of our analyses. Appended to this report is the Geotechnical Engineering Report for the Cache Creek Aggregates, dated November 22, 1995 (WKA No. 3080.01)

Project Description

Our understanding of the proposed mining operation is based on information provided by Mr. Ben Adamo, formerly of R.C. Collet, Inc., and now with GCCo, and with Mr. Grant Williams of GCCo. Based on this information, the proposed mining operation will employ both dry and wet pit mining methods to extract sand and gravel resources. Depth of excavation will depend on the resource depth in any specific area and is anticipated to vary between about 165 feet at the east end of the project (Phase 4), to about 32 feet beneath the existing ground surface at the west end of the site (Phase 2). The mining phases correspond to the Mining Plan prepared by Cunningham Engineering, dated May 24, 2001.

Initial procedures will involve excavation and stockpiling of overburden soils with conventional earthmoving equipment for later use during site reclamation. Conventional earthmoving equipment also will be utilized during dry pit mining operations above the water table. It is our understanding that slopes excavated during the dry pit operation may be reclaimed with overburden soils and wash material from an aggregate processing plant prior to beginning wet pit mining with draglines. After completion of wet pit mining, the mined areas will be reclaimed as open waters lakes, agriculture, wildlife habitat, or potentially for ground water recharge uses.

FINDINGS

Site Description

The area of the existing off-channel aggregate mining and processing operation is located approximately 1½ miles northwest of the town of Esparto between County Roads 85 and 87. The site is bounded by Cache Creek to the south and the West Adams Canal to the north (see Plate No. 1). At present, the areas outside of the active mining area consist primarily of un-irrigated seasonal pasture with small irrigated fields used for the cultivation of alfalfa and corn; a small number of cattle and sheep also are grazed on the property.

The site encompasses approximately 504± acres divided between four parcels that include the GCCo's parcels APNs 048-014-020 and 048-022-016 and 048-022-018, and a portion of APN 048-014-022. Site topography slopes gently to the east with approximately 20 feet of elevation change over a distance of 1¼-miles. To the south, the gentle slopes give way to the relatively steep northern bank of Cache Creek. In some locations along this southern site boundary, recent survey information reveals a nearly thirty feet drop to the channel bottom.

Subsurface Conditions

Based upon the borings drilled by Wallace-Kuhl & Associates in 1995 and by GCCo in 1999 and 2000, the site generally is underlain by two to six feet of sandy silts that are underlain by sandy gravels that contain varying percentages of silt and clay. Gravels tend to be on the order of two to three inches in diameter, although larger diameter rock was randomly encountered during drilling. Interbedded layers of sand and pea gravel were encountered within the sandy gravels. Discontinuous layers of silty clays, sandy clays, and clayey sands also were encountered in the borings at various depths. The relatively deep borings drilled by GCCo were terminated in clay soils, which mark the bottom of the mineable aggregate resource.

Ground Water Conditions

As indicated in our Groundwater Hydrology Report (WKA, 1995 and 2001), the site lies within the Upper Cache Creek Basin that is separated from the lower Cache Creek Basin by the northwest trending Dunnigan Hills anticline. Specifically, the site overlies the Madison syncline (west of the Dunnigan Hills anticline) where the thickest deposits of alluvium have accumulated (Todd, 1995). Locally, the Dunnigan Hills anticline appears to have pushed the less permeable Tehama Formation upward where it acts as a semi-permeable barrier to the easterly alluvial groundwater flow (Todd, 1995).

Groundwater in the upper Cache Creek basin is relatively shallow. The upper aquifer beneath the site appears largely unconfined and depth to groundwater ranges from approximately 25 feet below grade near the western property boundary to 40 feet below grade near the easterly property boundary. Based on our experience in the area and the spring 1990, 1993, 1995 and 1996 Groundwater Elevation Contour Maps prepared by Borcalli and Associates for the Yolo County Flood Control and Water Conservation District (YCFCWCD), the regional groundwater flow direction appears to be easterly to northeasterly.

Geology

The site is located at the eastern edge of the Coast Ranges Geomorphic province of California. The Coast Ranges are made up of uplifted, folded and faulted sedimentary, metamorphic and volcanic rocks of Jurassic through upper Pliocene age. The site is underlain by recent (Holocene) alluvial deposits from Cache Creek. The stream channel deposits consist of clay, silt, sand, gravel and cobbles derived from source areas to the west. The alluvial deposits are of varying thickness and are underlain by the Pliocene Tehama Formation (Helley and Harwood, 1985). The Tehama Formation consists of pale-green, gray, and tan sandstone and siltstone with lenses of crossbedded pebble and cobble conglomerate.

The Great Valley Fault is not indicated on the *Fault Activity Map of California (Jennings (1994)*, but is considered to be a factor in determining seismic risk potential. In the north Central Valley, the width of the fault zone extends from the eastern flanks of the Coast Ranges as far easterly as Dunnigan. As modeled by Peterson, Segments 1 though 8 of the Great Valley Fault are located from 0.1 to 100 miles of the site. Although Segment 1 of the Great Valley Fault is modeled very near the site, this is not indicative of an active fault trace, but is simply a tool in modeling the effects of a potential source of earthquake activity on site development. The Great Valley Fault is not considered to be active by Alquist-Priolo Earthquake Fault Zone criteria (Hart, 1997).

This zone of potential faulting is not well understood, but is believed to be connected to the Vacaville-Winters earthquakes of 1892 and the Coalinga earthquake of 1983. Earthquake activity along segments of the Great Valley Fault often occurs on "blind thrusts" in reference to their lack of surface expression and the direction of fault offset.

According to the *Probabilistic Seismic Hazard Assessment for the State of California* (Petersen, et al, 1996) the following faults and fault systems are located within 100 miles of the site.

Fault Name	Distance Miles (Km)	Maximum Magnitude (M_W)
HUNTING CREEK - BERRYESSA	15.7 (25.2)	6.9
CONCORD - GREEN VALLEY	19.9 (32.0)	6.9
WEST NAPA	27.4 (44.1)	6.5
BARTLETT SPRINGS	29.3 (47.2)	7.1
COLLAYOMI	34.9 (56.2)	6.5
MAACAMA (South)	36.5 (58.8)	6.9
RODGERS CREEK	40.0 (64.4)	7.0
FOOTHILLS FAULT SYSTEM	46.9 (75.4)	6.5
HAYWARD (North)	49.8 (80.1)	6.9
HAYWARD (Total Length)	49.8 (80.1)	7.1
GREENVILLE	51.1 (82.2)	6.9
MAACAMA (Central)	52.6 (84.6)	7.1
CALAVERAS (No. of Calaveras Res.)	59.0 (94.9)	6.8
SAN ANDREAS (1906)	59.7 (96.0)	7.9
SAN ANDREAS (North Coast)	59.7 (96.0)	7.6
POINT REYES	63.9 (102.9)	6.8
SAN GREGORIO	66.1 (106.4)	7.3
HAYWARD (South)	67.9 (109.2)	6.9
SAN ANDREAS (Peninsula)	69.3 (111.5)	7.1
GREAT VALLEY 7	73.1 (117.6)	6.7
MAACAMA (North)	80.3 (129.2)	7.1
ROUND VALLEY	80.3 (129.3)	6.8
HAYWARD (SE Extension)	86.5 (139.2)	6.4
MONTE VISTA - SHANNON	88.9 (143.0)	6.8
CALAVERAS (So. of Calaveras Res.)	89.3 (143.7)	6.2
MOHAWK - HONEY LAKE ZONE	99.2 (159.6)	7.3

The nearest known fault to the site with displacement during the last 10,000 years is located six to twelve miles to the northeast (Jennings, 1994). This fault is known as the Dunnigan Hills (or Zamora) fault and is not known to have had any significant activity during the past 200 years. The Dunnigan Hills fault has been estimated to be capable of producing an earthquake of approximate Richter Magnitude 6.5 (Mualchin and Jones, 1992).

Based upon our search of an earthquake epicenter database (Blake, 2000), the largest ground shaking at the site occurred as a result of the Vacaville-Winters earthquake events of 1892. The epicenters of the 6.2 to 6.4 magnitude earthquakes are located about 17 and 22 miles south of the site. The closest earthquake to the site occurred in 1969, and was a Magnitude 4.0 event located about seven miles west of the site.

Liquefaction of loose, saturated, granular soils can occur during seismic shaking if conditions exist that would cause liquefaction. We did not encounter conditions during our field exploration that would indicate the potential for liquefaction to occur. Liquefaction at the site is not likely due to the dense nature of the sand and gravel deposits below the water table.

CONCLUSIONS AND RECOMMENDATIONS

Slope Stability

We reviewed the slope stability analysis performed for our 1995 geotechnical engineering study. **In our opinion, the analyses performed for that study remain valid for the currently proposed Granite Capay aggregate mining operation for the pits less than 100 feet deep.** Where pits are likely to be greater than 100 feet deep, such as in the Phase 3 and Phase 4 areas of the mine (as shown on the May 24, 2001 plan prepared by Cunningham Engineering), additional analyses have been performed to determine the effects, if any, on the stability of the slopes considering the greater depth of mining.

Our 1995 slope stability analyses were performed utilizing the computer program PCSTABL5M developed at Purdue University in 1988. For the analysis of the Phase 3 and Phase 4 areas of the aggregate mining facility, we utilized an updated version of that computer program (XSTABL). To model the soils conditions present within the Phase 3 and Phase 4 areas, we utilized the boring data provided by GCCo, combined with the boring and laboratory data obtained from our 1995 geotechnical study.

For the supplemental analyses, we again utilized the Modified Bishop's Method of Slices with optional seismic input to evaluate slope stability. A peak horizontal ground acceleration of 0.16g was used for dynamic analysis based on an attenuation relationship developed by Boore, Joyner and Fumal (1997). The location of faulting, on which the horizontal acceleration was determined is based upon the model presented in Peterson, et al (1996). We estimate that this ground acceleration has a 50 percent probability of being exceeded in 50 years. This is slightly higher than utilized in our 1995 study, due to the updated attenuation relationship, and use of a more current model of area seismicity.

Based upon available ground water information, we assumed that the water level within the aggregate mining pits would be near the average ground water level for the mined area. A low ground water elevation of +155 feet msl was assumed for the ponds in the Phase 3 and 4 areas. The ground water elevation within the pit wall was assumed as the existing ground water elevation, and a smooth transition between the embankment ground water levels and the pit water level. The expected low ground water and pond water elevations were used in our slope stability models, as these would represent the worst case stability models.

We analyzed two additional soil profiles corresponding to the conditions encountered at GCCo's borings CF00-5 and CF00-7. The probable depths of excavation were provided by Grant Williams of GCCo on the plan dated February 16, 2001, showing the elevation of the base of the mineable aggregate, the regional ground water elevations, the existing site elevations, and approximate shape of the planned mining areas.

We investigated pond wall geometry consisting of a two to one, horizontal to vertical slope (2:1; h:v) above the water table, and extending five feet below the water table. A 1½:1 slope was modeled from five feet below the water table to the base of the mineable aggregate. The factors of safety against rotational failure were determined for the slope under static and psuedo-static (seismic) conditions. The resulting factor of safety represents the ratio of forces resisting slope movement to forces causing movement along a predetermined circular trial surface. For our analysis, a factor of safety of 1.0 against rotational failure was considered to be the minimum acceptable factor of safety for dynamic (seismic) loading conditions, and a factor of safety of 1.4 was considered to be the minimum acceptable value for static (non-seismic) loading conditions (Department of the Army, Office of the Chief of Engineers, 1978).

Each soil profile was analyzed for localized failure circles in the portion of the slope above and below the water table, and for global stability of the entire slope. Both local and global analyses included static and dynamic loading conditions. The results of our global, full height failure circles for slopes of 2:1 above the water table and for slopes of 1½ :1 below the water table are presented as Plates No. 4 through 7. Factors of safety for local failure circles have not been included in this report since they are generally equal to or greater than those for the global failure circles. The results of our global analysis of full height slopes are presented below.

	Slope Gradient		Factors of Safety	
Soil Profile	Above Water*	Below Water	Static	Dynamic
CF00-5	2:1	1½:1	2.0	1.0
CF00-7	2:1	1½:1	1.7	1.0

* *and for a distance at least five feet below the low expected water table.*

Recommended Slope Gradients and Setbacks

Based upon our analysis, we recommend excavation slopes for long-term stability of 2:1 (horizontal: vertical) above the water table and extending at least five feet below the anticipated low pond level at elevation +155 feet msl, and a 1½:1 slope below the water table.

We recommend that at least a 50 foot set back be established from all slopes less than 100 feet in height. A 75 foot setback is sufficient between the Phase 1B pond and the West Adams Canal. For other slopes greater than 100 feet in height, we recommend a minimum setback distance of at least the overall height of the slope from the top of any excavation slope to property lines. It is our understanding that a minimum setback of 200 feet will be utilized from the top of excavation slopes to the active channel bank of Cache Creek.

Levee Construction

Our previous analysis of the existing levee constructed by Syar Industries at the washed out area on the Pryor property indicates that a buttress fill should be constructed on both sides of the levee to reduce the chances of pit capture by Cache Creek once mining operations commence in this area. We understand that the existing levee may also be raised by approximately three feet to provide the necessary freeboard. The following recommendations specifically address construction of a buttress fill next to the existing levee, but also are applicable to general levee and engineered fill construction.

Rubble, debris, and organics should be removed from the construction area prior to the commencement of levee construction. After the construction area is cleared, the area beneath the new buttress fill should be overexcavated to a depth of at least five feet below the existing ground surface. The overexcavation should extend horizontally to a distance of at least five feet beyond the toe of the proposed levee configuration. The exposed ground at the bottom of the overexcavation should be ripped to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and be properly compacted prior to the placement of fill.

Proper compaction will be dependent upon the nature of the soils being compacted. Soils consisting of particles primarily less than ¾-inch should be compacted to at least 90 percent relative compaction based on the ASTM D1557-91 procedure for determination of maximum dry density. Conventional field compaction testing with a nuclear density gauge on rocky soils consisting of particles generally greater than ¾-inch will not be practical due to the large particle size; therefore, we recommend that rocky soils be compacted by at least five passes with a large self-propelled compactor, such as a Caterpillar 825 or the equivalent.

The compacted levee fill should be constructed in a manner so as to achieve the required compaction throughout the fill. Fill materials consisting primarily of particles less than ¾-inch should be placed in level lifts not exceeding a compacted thickness of six inches and compacted to at least 90 percent relative compaction (ASTM D1557-91). Rocky fill material should be placed in lifts not exceeding 12 inches in thickness and be compacted by at least five passes with a Caterpillar 825 (or equivalent size) compactor.

Fill placed on existing levee slopes should be benched into the existing levee material. Benching should be done in no greater than three foot vertical increments and each bench should extend into the existing levee material a horizontal distance of at least three feet. The benches should create a level surface on which fill may be placed.

Areas of new levee construction should be cleared of rubble, debris and organics and should be overexcavated to a distance of at least five feet beyond the toe of each side slope. Areas underlain by loose alluvial soils should be overexcavated to a depth of five feet. Areas not underlain by loose alluvial soils should be overexcavated to a depth of one foot to remove organics and topsoil. Ground exposed at the bottom of the overexcavation should be processed and fill should be placed and compacted in accordance with the recommendations of the previous paragraphs.

Native soils will be acceptable for use as fill material if they are free of rubble, debris, and organics. Gravel and cobbles may be used as fill if they are thoroughly mixed with sand and silt prior to placement to reduce the potential of voids within rocky fill material. Borrow sites should be approved by a Geotechnical Engineer prior to using the soils as fill material.

Permanent levee slopes should be constructed no steeper than a 2 to 1 (horizontal to vertical) slope gradient. Levee embankment slopes should be dressed by trackwalking with a crawler tractor or similar equipment or be over-built and cut back to the required slope gradient. The moisture content of levee slopes should be near the optimum moisture content if trackwalking is performed.

Observation of Excavations

Excavation slopes exposed above the water level in each pit should be observed by a Geotechnical Engineer or by a Certified Engineering Geologist at every 10 to 15 feet of excavation depth or at least once a year during mining activities. Slopes should be checked for subsurface conditions not encountered during our field exploration that could affect slope stability. Slope stability should be re-evaluated if the average low water elevation within a mining excavation is less than our assumed low water elevation of +155 mean sea level for more than six months. Mining pits should not be drained without consultation with a Geotechnical Engineer or Certified Engineering Geologist.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed project, combined with our analysis of site conditions revealed by field exploration and laboratory testing programs. We have used our best engineering judgment based upon the information provided and the data generated from our investigation. If the proposed mining operation is modified or resited; or, if it is found during mining that subsurface conditions differ from those encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

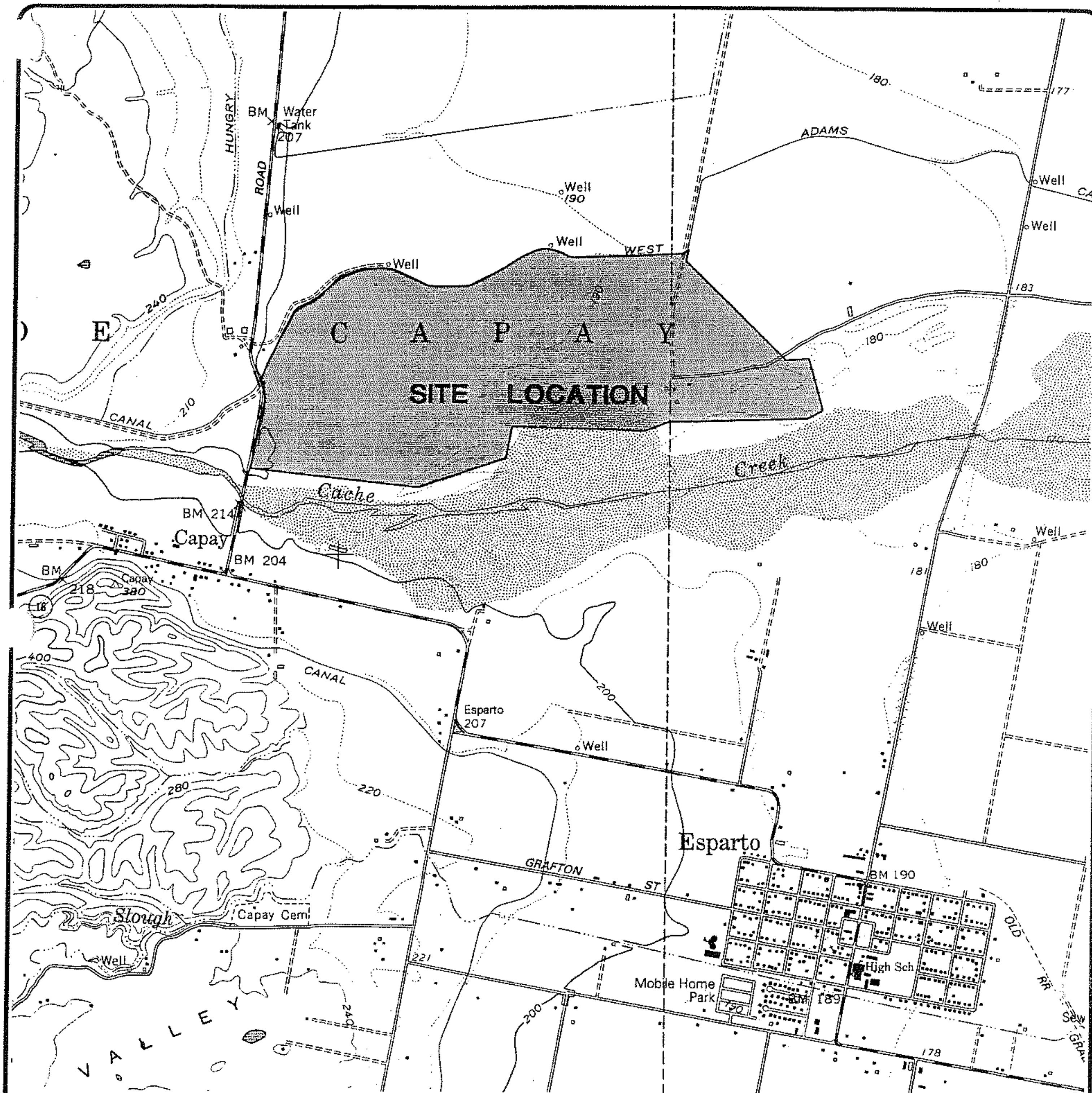
We emphasize that this report is applicable only to the proposed project and the investigated site. This report should not be utilized for any other site.

Wallace - Kuhl & Associates, Inc.

David R. Gius, Jr.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
DAVID R. GIUS, JR.
No. 2318
Exp. 9-30-04
GEOTECHNICAL
STATE OF CALIFORNIA

REGISTERED GEOLOGIST
DAVID R. GIUS, JR.
No. #1681
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

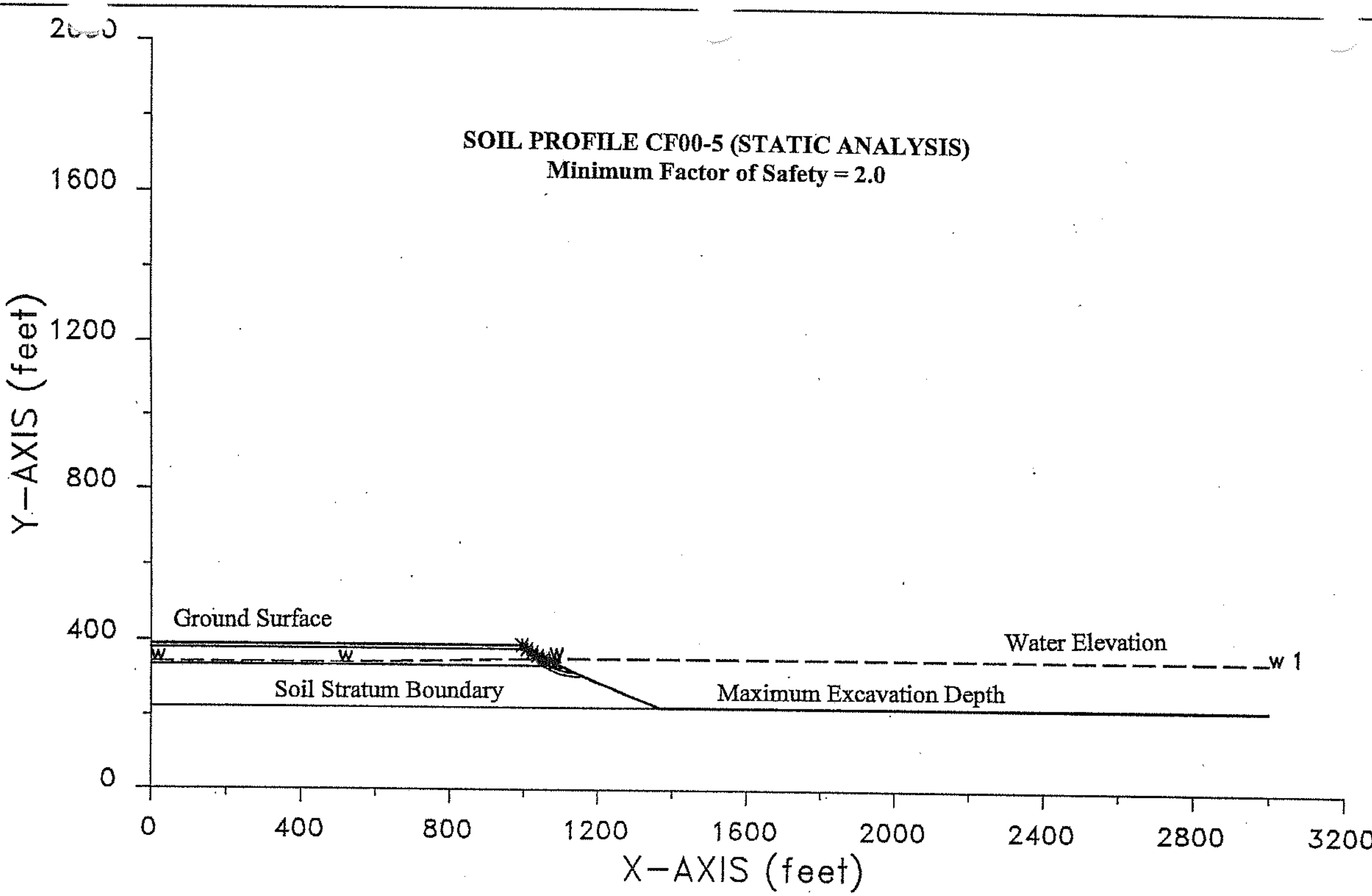


Adapted from the U.S. Geological Survey
7.5 minute Topographic Map of the
Esparto Quadrangle, California, 1993.

0 1000 2000
Scale in Feet

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	**GRANITE, CAPAY** Yolo County, California	WKA NO: 3080.05 DATE: 6/01 PLATE NO: 1

SOIL PROFILE CF00-5 (STATIC ANALYSIS)
Minimum Factor of Safety = 2.0



Notes:

1. Trial surfaces generated by XSTABL computer program.
2. A slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table was utilized for design.
3. The ten most critical failure surfaces, searched out and located by the computer program, are shown above. The failure surface with the lowest factor of safety is indicated with asterisks.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

GRANITE, CAPAY

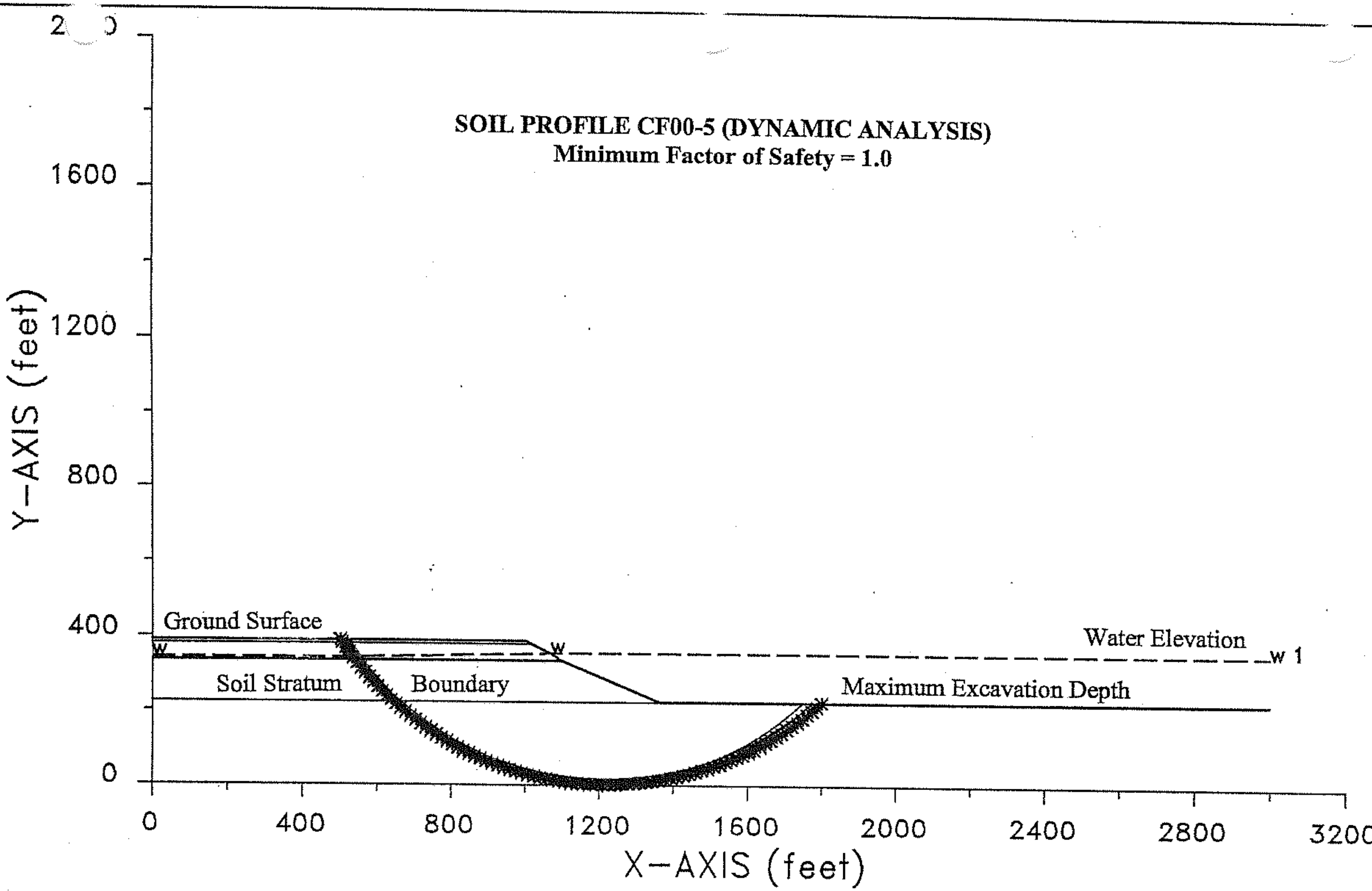
Yolo County, California

WKA NO: 3080.05

DATE: 6/01

PLATE NO: 4

SOIL PROFILE CF00-5 (DYNAMIC ANALYSIS)
Minimum Factor of Safety = 1.0



Notes:

1. Trial surfaces generated by XSTABL computer program.
2. A slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table was utilized for design.
3. The ten most critical failure surfaces, searched out and located by the computer program, are shown above. The failure surface with the lowest factor of safety is indicated with asterisks.

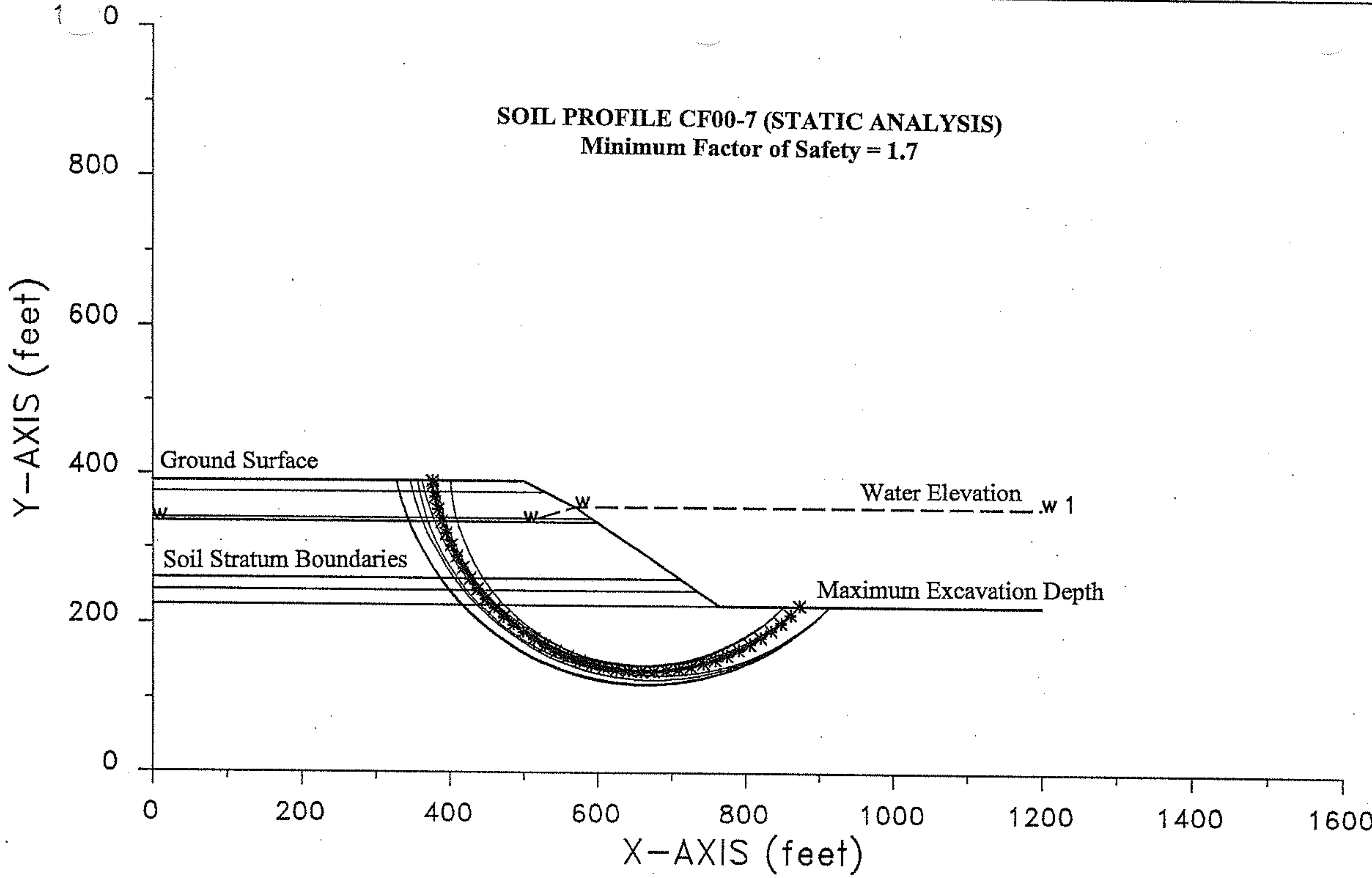
WALLACE - KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

GRANITE, CAPAY

Yolo County, California

WKA NO: 3080.05
DATE: 6/01
PLATE NO: 5

SOIL PROFILE CF00-7 (STATIC ANALYSIS)
Minimum Factor of Safety = 1.7



Notes:

1. Trial surfaces generated by XSTABL computer program.
2. A slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table was utilized for design.
3. The ten most critical failure surfaces, searched out and located by the computer program, are shown above. The failure surface with the lowest factor of safety is indicated with asterisks.

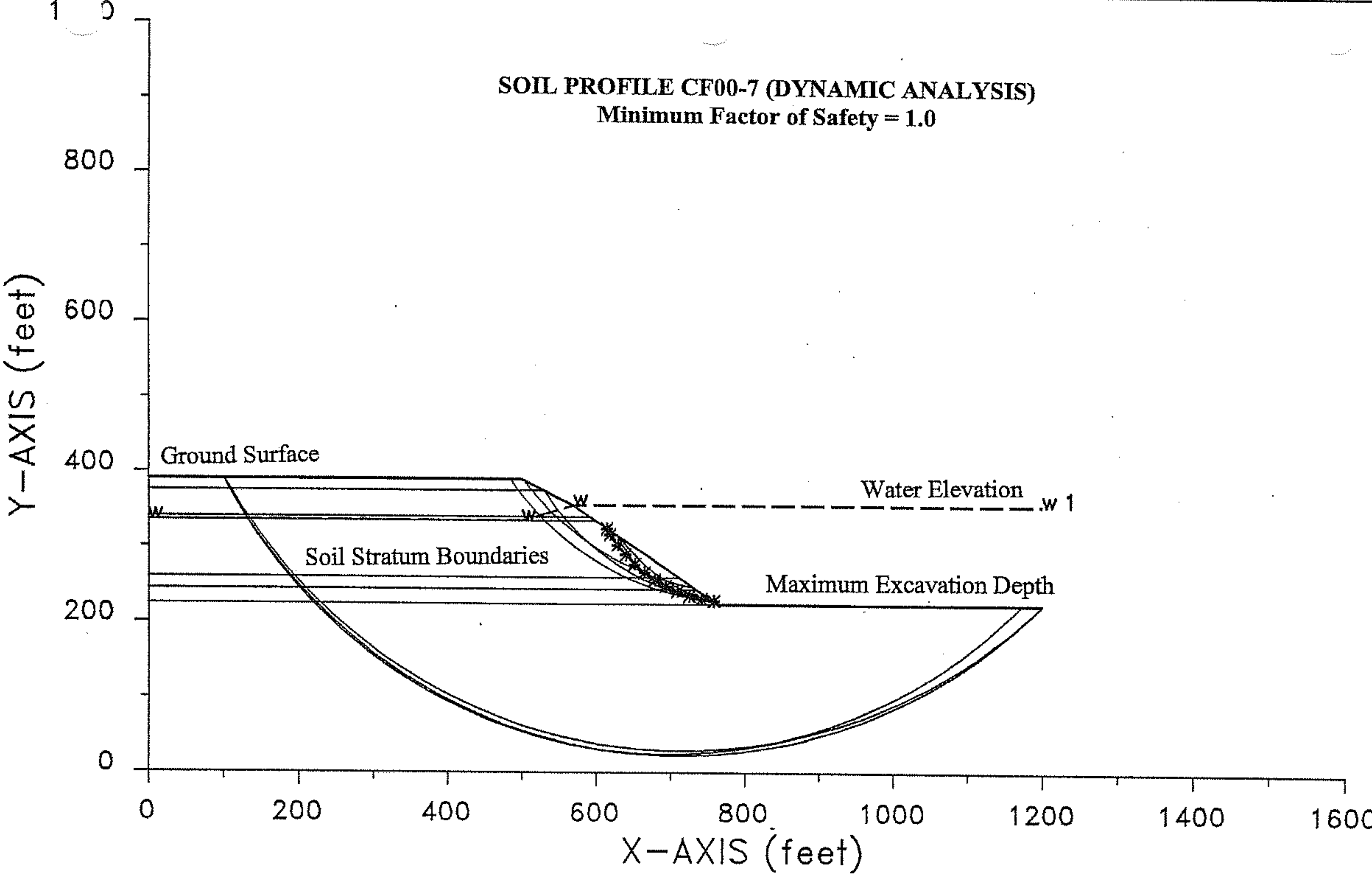
WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

GRANITE, CAPAY

Yolo County, California

WKA NO: 3080.05
DATE: 6/01
PLATE NO: 6

SOIL PROFILE CF00-7 (DYNAMIC ANALYSIS)
Minimum Factor of Safety = 1.0



Notes:

1. Trial surfaces generated by XSTABL computer program.
2. A slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table was utilized for design.
3. The ten most critical failure surfaces, searched out and located by the computer program, are shown above. The failure surface with the lowest factor of safety is indicated with asterisks.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

GRANITE, CAPAY

Yolo County, California

WKA NO: 3080.05

DATE: 6/01

PLATE NO: 7

REFERENCES

REFERENCES

Blake, T.F., 2000, EQSEARCH, A Computer Program for the Estimation of Peak Horizontal Acceleration from California Historical Earthquake Catalogs, Ver. 3.0

Blake, T.F., 2000, FRISKSP, A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra using 3-D Faults as Earthquake Sources, Ver. 4.00.

Boore, D.M., Joyner, W.B. and., Fumal, T.E., 1997, Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes: A Summary of Recent Work, Seismological Research Letters, Volume 68, Number 1, January/February 1997, p. 128-153.

Borcalli and Associates, 1990, Groundwater Contours-Spring 1990 prepared for the Yolo County Flood Control and Water Conservation District

Borcalli and Associates, May 1992, 1993, Groundwater Contours-Spring 1993 prepared for the Yolo County Flood Control and Water Conservation District

Department of the Army, Office of the Chief of Engineers, 1978, Design and Construction of Levees, Engineer Manual EM 1110-2-1913.

Hart, E.W., 1997, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, DMG Special Publication 42.

Helley, E.J., and Harwood, D.S., 1985, Geologic map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California, USGS Map MF-1790.

Interactive Software Designs, Inc., 1998, XSTABL, An Interactive Slope Stability Analysis Program for Personal Computers, Version 5.0.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas, California Department of Conservation, Division of Mines and Geology, DMG Map No. 6.

Mualchin, L. and Jones, A.L., 1992, Peak Acceleration from Maximum Credible Earthquakes in California (Rock and Stiff-Soil Sites), California Department of Conservation, Division of Mines and Geology, DMG Open-File Report 92-1.

Petersen, M. D., Bryant, W. A, Cramer, C. H., and Reichle, M. S., 1996, Probabilistic Seismic Hazard Assessment for the State of California, DMG Open-File Report 96-08; USGS Open-File Report 96-706.

Todd, D. K.,1995, Technical Study of Groundwater Hydrology, Consultant's report by David Kieth Todd Consulting Engineers.

Wallace-Kuhl & Associates, Inc., 1995, Geotechnical Engineering Report, Cache Creek Aggregates, Consultant's report to R.C. Collet, WKA No. 3080.01.

Wallace-Kuhl & Associates, Inc., 1995, Groundwater Hydrology Report, Cache Creek Aggregates, Consultant's report to R.C. Collet, WKA No. 3080.02.

Wallace-Kuhl & Associates, Inc., 2001, Groundwater Hydrology Report, Granite Capay Facility, Consultant's report to GCCo, WKA No. 3080.04.

APPENDIX

GEOTECHNICAL ENGINEERING REPORT
CACHE CREEK AGGREGATES
WKA NO. 3080.01
1995

WALLACE · KUHL & ASSOCIATES INC.

Geotechnical Engineering Report

CACHE CREEK AGGREGATES

WKA No.
3080.01

Prepared
November 22, 1995

WALLACE • KUHL & ASSOCIATES INC.

Geotechnical Engineering Report
CACHE CREEK AGGREGATES
Yolo County, California
WKA No. 3080.01
November 22, 1995

INTRODUCTION

General

This report presents the results of our geotechnical engineering investigation at the site of the proposed aggregate mining operation north of Cache Creek near the towns of Capay and Esparto in Yolo County, California. Our report specifically addresses issues related to slope stability as required by Yolo County for off-channel surface mining use permit application. We also have completed an investigation of ground water issues at the site; the results of our ground water study are presented in a separate report (WKA No. 3080.02).

Purpose and Scope of Work

The purposes of this investigation were to determine existing subsurface conditions within the proposed mining site and to evaluate the short-term and long-term stability of off-channel mining slopes. Minimum excavation setbacks from the boundaries of the property also have been evaluated.

Our scope of work for this report has included the drilling and sampling of five test borings to a maximum depth of approximately 100 feet beneath the surface. Relatively undisturbed soil samples were obtained at various depths from the borings and were taken to our laboratory for further classification and selection of samples for testing to determine engineering characteristics of the soils. Slope stability analysis was performed based on the results of the field and laboratory data. The geology and seismicity in the vicinity of the site was studied through review of available geologic literature pertaining to the area. Our findings have been summarized in this report; our report also presents our conclusions and recommendations regarding slope stability, minimum excavation setbacks, and levee construction.

Plates and Attachments

A Vicinity Map showing the location of the proposed mining site is included as Plate No. 1. A Test Boring Location Plan is included as Plate No. 2 and our Logs of Test Borings are presented as Plates No. 3 through 7. An explanation of the symbols and classification system used on the logs appears on Plate No. 8. Plates No. 9 through 18 present cross-sections used during our slope stability analyses, as well as graphical displays of the results of our

Geotechnical Engineering
Engineering Geology
Environmental Consulting
Foundation Services
Construction Inspection
Materials Testing
3050 Industrial Blvd.
West Sacramento
CA 95691

analyses. General information regarding this investigation, descriptions of the field exploration and laboratory testing programs, and the results of laboratory tests that do not appear on the logs of borings are presented in the Appendix.

Project Description

Our understanding of the proposed mining operation is based on information provided by Mr. Ben Adamo of R.C. Collet, Inc. Based on this information, the proposed mining operation will employ both dry and wet pit mining methods to extract sand and gravel resources. Depth of excavation will depend on the resource depth in any specific area and is anticipated to vary between 20 and 95 feet beneath the surface.

Initial procedures will involve excavation and stockpiling of overburden soils with conventional earthmoving equipment for later use during site reclamation. Conventional earthmoving equipment also will be utilized during dry pit mining operations above the water table. It is our understanding that slopes excavated during the dry pit operation may be reclaimed with overburden soils and wash material from an aggregate processing plant prior to beginning wet pit mining with draglines. After completion of wet pit mining, the mined areas will be reclaimed for agriculture, wildlife habitat, and ground water recharge uses.

FINDINGS

Site Description

The proposed project involves mining of approximately 360 acres north of Cache Creek in Yolo County, California. The project includes portions of Parcels 48-14-20 and 48-14-22 of the Porter property, and portions of Parcels 48-22-02 and 48-22-16 of the Pryor property. The site is generally located east of County Road 85, south of West Adams Canal, west of County Road 87, and north of Cache Creek. Access to the property is currently provided by a gated, unpaved road from County Road 85, and by Fulton and Frank Road from County Road 87.

An existing house, barn and several smaller structures are located on the Pryor property and a large stockpile of aggregate is located on the Porter property. A large meander of Cache Creek has washed out an area near the barn on the Pryor property. Two levees have been constructed in the southern portion of the washed out area to prevent further meandering of Cache Creek into this area. The northern levee was recently constructed by Syar Industries and is approximately five to ten feet in height with sides sloping at an estimated slope gradient of 1 to 1 (horizontal to vertical). Wire fences cross the site on both properties. Current land use includes dry pasture and agriculture.

Subsurface Conditions

Detailed descriptions of subsurface conditions encountered by our test borings are included on our Logs of Test Borings. In general, our test borings encountered five to six feet of sandy silts at the locations of Borings D1, D2 and D5 and less than two feet of sandy silts at the locations of Borings D3 and D4. The near surface soils are underlain by sandy gravels which contain varying percentages of silt and clay. Gravels tend to be on the order of two to three inches in diameter, although larger diameter rock was randomly encountered during drilling at depths noted on the logs. Interbedded layers of sand and pea gravel were encountered within the sandy gravels. Thick sequences of silty clays, sandy clays, and clayey sands were encountered in Borings D1 between 20 and 50 feet, Boring D4 between 49 and 81 feet, and in Boring D5 between 62 and 81 feet. Thick sequences of clay soils were not encountered in Borings D2 or D3, which were drilled to a maximum depth of approximately 100 feet.

Ground water was encountered in each of the five borings at depths noted on the Logs of Test Borings, and monitoring wells were installed in each boring for future ground water monitoring. A detailed description of ground water conditions at the site is presented in a separate report prepared by Wallace - Kuhl & Associates, Inc. (WKA No. 3080.02).

Geology

The site is located at the eastern edge of the Coast Ranges Geomorphic provence of California. The Coast Ranges are made up of uplifted, folded and faulted sedimentary, metamorphic and volcanic rocks of Jurassic through upper Pliocene age. The site is underlain by recent (Holocene) alluvial deposits from Cache Creek. The stream channel deposits consist of clay, silt, sand, gravel and cobbles derived from source areas to the west. The alluvial deposits are of varying thickness and are underlain by the Pliocene Tehama Formation (Helley and Harwood, 1985). The Tehama Formation consists of pale-green, grey, and tan sandstone and siltstone with lenses of crossbedded pebble and cobble conglomerate.

The nearest known fault to the site with displacement during the last 10,000 years is located six to twelve miles to the northeast (Jennings, 1994). This fault is known as the Dunnigan Hills (or Zamora) fault and is not known to have had any significant activity during the past 200 years. The Dunnigan Hills fault has been estimated to be capable of producing an earthquake of approximate Richter Magnitude 6.5 (Mualchin and Jones, 1992).

Two earthquakes occurred near Winters in 1892 along a yet to be identified fault. Magnitude estimates of these events are from 6.4 to 7.0 (Mualchin and Jones, 1992). The seismic source for these events is considered to represent interaction along the Coast Ranges-Sierran Block Boundary Zone. This seismic zone passes through the estimated location of the 1892 earthquakes southward through the earthquake sources that produced earthquakes near Coalinga in 1983 and has been estimated as being capable of producing an earthquake of approximate magnitude 7.0 (Mualchin and Jones, 1992).

Liquefaction of loose, saturated, granular soils can occur during seismic shaking if conditions exist that would cause liquefaction. We did not encounter conditions during our field exploration that would indicate the potential for liquefaction to occur. Liquefaction at the site is not likely due to the dense nature of the sand and gravel deposits below the water table.

CONCLUSIONS AND RECOMMENDATIONS

Slope Stability

Slope stability analysis was performed utilizing the computer program PCSTABL5M developed at Purdue University in 1988. For our analysis, we utilized the Modified Bishop's Method of Slices with optional seismic input to evaluate slope stability. A peak horizontal ground acceleration of 0.12g was used for dynamic analysis based on an attenuation relationship developed by Joyner and Boore (1982), the distance from known faults, and the earthquake magnitudes of the nearest known faults as described in the Geology section of this report. We estimate that this ground acceleration has a 50 percent probability of being exceeded in 50 years. Soil parameters used for analysis were based on the results of our laboratory tests presented on the Logs of Test Borings and in the Appendix. A ground water elevation of +141 feet mean sea level (msl) was utilized during our analysis. This water elevation is the lowest anticipated ground water level at the site and represents a worst case model for our slope stability analysis.

We analyzed five soil profiles corresponding to the conditions encountered at our five boring locations with probable depths of excavation provided by Mr. Ben Adamo of Cache Creek Aggregates. Where appropriate, surcharge loading at or near the top of an excavation was considered and effects of slope saturation resulting from seepage from the unlined West Adams Canal were taken into account during our analysis. We also performed a stability analysis of the levee constructed by Syar Industries near the washed out area on the Pryor property.

Various slope geometries were investigated to determine factors of safety against rotational failure. A factor of safety represents the ratio of forces resisting slope movement to forces causing movement along a predetermined circular trial surface. For our analysis, a factor of safety of 1.2 against rotational failure was considered to be the minimum acceptable factor of safety for dynamic (seismic) loading conditions, and a factor of safety of 1.5 was considered to be the minimum acceptable value for static (non-seismic) loading conditions.

Each soil profile was analyzed for localized failure circles in the portion of the slope above and below the water table, and for global stability of the entire slope. Both local and global analyses included static and dynamic loading conditions. The results of our global, full height failure circles for slopes of 2 to 1 (horizontal to vertical) above the water table and for slopes of 1½ to 1 (horizontal to vertical) below the water table are presented as Plates No. 9 through 18. Factors of safety for local failure circles have not been included in this report since they are generally equal to or greater than those for the global failure circles. The results of our global analysis of full height slopes are presented below.

Soil Profile	Slope Gradient Above Water	Slope Gradient Below Water	Factors of Safety Static	Factors of Safety Dynamic
Boring D1	2:1	1½:1	2.2	1.6
Boring D2	2:1	1½:1	1.8	1.2
Boring D3	2:1	1½:1	1.8	1.3
Boring D4	2:1	1½:1	1.7	1.3
Boring D5	2:1	1½:1	1.8	1.3

We also analyzed the possibility of mining below the water table at a slope gradient of 1 to 1. Although the factor of safety for static conditions is near the minimum acceptable value of 1.5, the factor of safety for dynamic conditions is less than the minimum acceptable value of 1.2. Therefore, a 1 to 1 slope below the water table should not be considered stable under dynamic conditions.

The effect of water seepage from West Adams Canal on slope stability was analyzed. Our results indicate that seepage from the unlined canal does not have a significant impact on slope stability, assuming the minimum slope setback from the canal as recommended in our report is utilized. Seepage of water through the face of the excavated slope is not anticipated.

Our analysis of the stability of the existing levee built by Syar Industries on the Pryor property indicates safety factors below the acceptable minimums. Therefore, the existing levee should not be relied on for long-term stability unless a buttress fill is placed on both sides of the levee. Recommendations for placement of buttress fill are presented in a later section of this report.

Reclamation may include placement of stockpiled overburden soils on the face of slopes excavated above the water table prior to proceeding with wet pit mining. Our analysis indicates that placement of overburden soils at a slope gradient of 3 to 1 (horizontal to vertical) or flatter increases the local stability of the portion of the slope above the water but does not significantly increase the stability of the full height slope since the portion of the slope below the water controls the stability of the entire slope.

Recommended Slope Gradients and Setbacks

Based upon our analysis, we recommend excavation slopes for long-term stability of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 (horizontal to vertical) below the water table. Short-term slopes below the water table may be excavated at a slope gradient of 1 to 1 during mining operations provided the excavated areas are backfilled during reclamation so that no long-term unrestrained slopes steeper than 1½ to 1 exist after mining is complete.

Fill should be placed on both sides of the levee constructed by Syar Industries for long-term stability. We recommend the side slopes be constructed at a slope gradient of 2 to 1 (horizontal to vertical) or flatter and that the levee be at least 50 feet wide at the top. Levee construction should be performed in accordance with the recommendations of the following section.

We recommend a minimum setback distance of 50 feet from the top of any excavation slope to the top of the bank of West Adams Canal or to any property line. It is our understanding that a minimum setback of 200 feet will be utilized from the top of excavation slopes to the active channel bank of Cache Creek.

Levee Construction

Our analysis of the existing levee constructed by Syar Industries at the washed out area on the Pryor property indicates that a buttress fill should be constructed on both sides of the levee to reduce the chances of pit capture by Cache Creek once mining operations commence in this area. We understand that the existing levee may also be raised by approximately three feet to provide the necessary freeboard. The following recommendations specifically address construction of a buttress fill next to the existing levee, but also are applicable to general levee construction.

Rubble, debris, and organics should be removed from the construction area prior to the commencement of levee construction. After the construction area is cleared, the area beneath the new buttress fill should be overexcavated to a depth of at least five feet below the existing ground surface. The overexcavation should extend horizontally to a distance of at least five feet beyond the toe of the proposed levee configuration. The exposed ground at the bottom of the overexcavation should be ripped to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and be properly compacted prior to the placement of fill.

Proper compaction will be dependent upon the nature of the soils being compacted. Soils consisting of particles primarily less than ¾-inch should be compacted to at least 90 percent relative compaction based on the ASTM D1557-91 procedure for determination of maximum dry density. Conventional field compaction testing with a nuclear density gauge on rocky soils consisting of particles generally greater than ¾-inch will not be practical due to the large particle size; therefore, we recommend that rocky soils be compacted by at least five passes with a large self-propelled compactor, such as a Caterpillar 825 or the equivalent.

The compacted levee fill should be constructed in a manner so as to achieve the required compaction throughout the fill. Fill materials consisting primarily of particles less than ¾-inch should be placed in level lifts not exceeding a compacted thickness of six inches and compacted to at least 90 percent relative compaction (ASTM D1557-91). Rocky fill material should be placed in lifts not exceeding 12 inches in thickness and be compacted by at least five passes with a Caterpillar 825 (or equivalent size) compactor.

Fill placed on existing levee slopes should be benched into the existing levee material. Benching should be done in no greater than three foot vertical increments and each bench should extend into the existing levee material a horizontal distance of at least three feet. The benches should create a level surface on which fill may be placed.

Areas of new levee construction should be cleared of rubble, debris and organics and should be overexcavated to a distance of at least five feet beyond the toe of each side slope. Areas underlain by loose alluvial soils should be overexcavated to a depth of five feet. Areas not underlain by loose alluvial soils should be overexcavated to a depth of one foot to remove organics and topsoil. Ground exposed at the bottom of the overexcavation should be processed and fill should be placed and compacted in accordance with the recommendations of the previous paragraphs.

Native soils will be acceptable for use as fill material if they are free of rubble, debris, and organics. Gravel and cobbles may be used as fill if they are thoroughly mixed with sand and silt prior to placement to reduce the potential of voids within rocky fill material. Borrow sites should be approved by a Geotechnical Engineer prior to using the soils as fill material.

Permanent levee slopes should be constructed no steeper than a 2 to 1 (horizontal to vertical) slope gradient. Levee embankment slopes should be dressed by trackwalking with a crawler tractor or similar equipment or be over-built and cut back to the required slope gradient. The moisture content of levee slopes should be near the optimum moisture content if trackwalking is performed.

Observation of Excavations

Mining excavations should be observed by a Geotechnical Engineer or by a Certified Engineering Geologist at every 10 to 15 feet of excavation depth or at least once a year during mining activities. Slopes should be checked for subsurface conditions not encountered during our field exploration that could affect slope stability. Slope stability should be re-evaluated if the average low water elevation within a mining excavation is less than our assumed low water elevation of +141 mean sea level for more than six months. Mining pits should not be drained without consultation by a Geotechnical Engineer or Certified Engineering Geologist.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed project, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our best engineering judgment based upon the information provided and the data generated from our investigation. If the proposed mining operation is modified or resited; or, if it is found during mining that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed project and the investigated site. This report should not be utilized for any other site.

Wallace - Kuhl & Associates, Inc.

Edward J. Uhlir
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. UHLIR
NO. 2163
Exp. 9-30-99
GEOTECHNICAL
STATE OF CALIFORNIA

David R. Gius
Certified Engineering Geologist

REGISTERED GEOLOGIST
DAVID R. GIUS, JR.
No. #1681
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

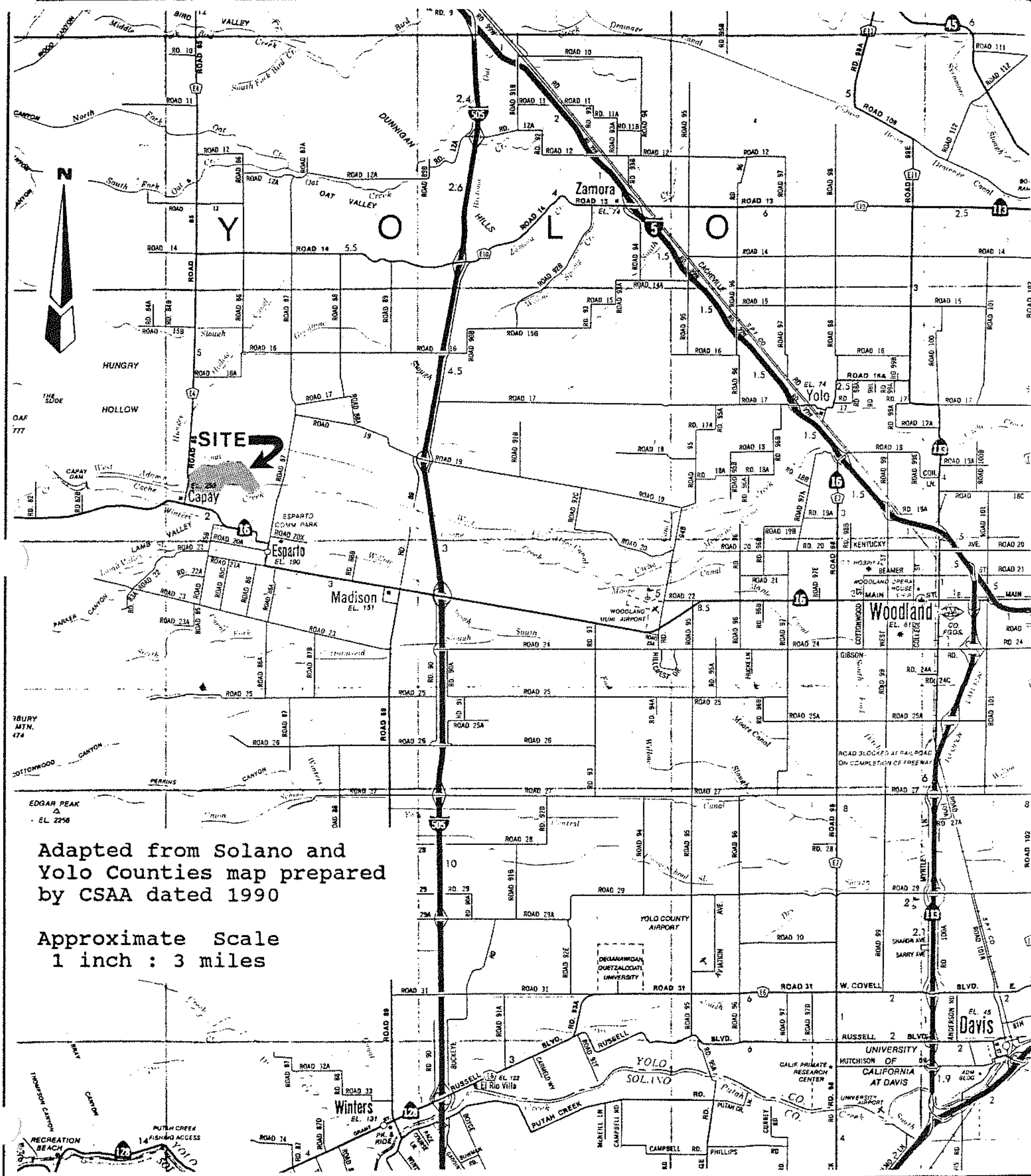
EJU:DRG:cnq

REFERENCES

Helley, E.J., and Harwood, D.S., 1985, Geologic Map of the Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California, U.S. Geological Survey, Miscellaneous Field Studies Map MF-1790.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas, California Department of Conservation, Division of Mines and Geology, DMG Map No. 6.

Mualchin, L. and Jones, A.L., 1992, Peak Acceleration from Maximum Credible Earthquakes in California (Rock and Stiff-Soil Sites), California Department of Conservation, Division of Mines and Geology, DMG Open-File Report 92-1.



Adapted from Solano and Yolo Counties map prepared by CSAA dated 1990

Approximate Scale 1 inch : 3 miles

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 1

BORING NUMBER: D1
DATE DRILLED: 10/20/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, dry, sandy silt
5									
							GM		Brown, dry to moist, moderately dense, sandy gravel
10									
		D1-1	20						gravel generally less than two inches in diameter
									approximately 25% silt and sand between 6 and 15 feet
15		D1-2	50/3"						about 10% silt and sand between 15 and 19 feet
									▽ water at 19.5' after drilling
20							CL/CH		Brown, moist, hard sandy clay
		D1-3	60	107.1	20.0				
25		D1-4	44						
							SC		Mottled grey and brown, moist, moderately dense, clayey sand
30									

(continued on next page)

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D1 DATE DRILLED: 10/20/95 LOGGED BY: EU	DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS
									SOIL DESCRIPTION AND REMARKS	
									(continued from previous page)	
30		D1-5	48				SC		Mottled grey and brown, moist, moderately dense, clayey sand	
									water initially observed at 34 feet during drilling	
35		D1-6	31							
40		D1-7	86							
45										
50										
55										
60										

NOTES:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 8.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 3

BORING NUMBER: D2
DATE DRILLED: 10/23/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, dry to moist, sandy silt
5							GM		Brown, moist, moderately dense to dense, sandy gravel
10									approximately 70% gravel and 30% sand and silt
									rock is generally less than two inches in diameter
									some small cobbles at 13 feet
15		D2-1	73	117.0	3.4				
20									
									pea gravel between 22 and 24 feet
25									attempted to sample at 25 and 30 feet but encountered refusal in gravel
30									

(continued on next page)

BORING NUMBER: D2
DATE DRILLED: 10/23/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
30							GM		Brown, moist, moderately dense to dense, sandy gravel
									pea gravel between 32 and 34 feet
									moisture increases between 30 and 35 feet
35		D2-2	85			TR			
							GM		Brown, wet, dense, clayey and sandy gravel
40									approximately 35% to 40% sand and clay
									rock averages about two inches in diameter
									water at 44 feet after drilling
45		D2-3	50/5"	117.4	10.3				
50		D2-4	90			TR			
							GM		Brown, wet, dense, sandy gravel
55		D2-5	50/5"	119.4	13.2				less than 10% silt and clay
60									*(continued on next page)*

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D2 DATE DRILLED: 10/23/95 LOGGED BY: EU — DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS — SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
60		D2-6	85/9"				GM		Brown, wet, dense, sandy gravel
65		D2-7	90/9"						
70									
75		D2-8	78						little or no silt and clay beyond 75 feet
80		D2-9	50/5"						
85		D2-10	50/3"						
90									(continued on next page)

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 4

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D2 DATE DRILLED: 10/23/95 LOGGED BY: EU SOIL DESCRIPTION AND REMARKS	DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS
									(continued from previous page)	
90							GM		Brown, wet, dense, sandy gravel	
95										
100										
105										
110										
115										
120										

NOTES:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 8.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: 4

BORING NUMBER: D3	DRILL RIG/METHOD:
DATE DRILLED: 10/24/95 LOGGED BY: EU	MOBILE B-61/8-INCH HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, dry, sandy silt with gravel
							GM		Brown, dry, moderately dense to dense, sandy gravel
5									approximately 80% gravel and 20% sand and silt
10	◩	D3-1	57						moisture increases at 10 feet
15	◩	D3-2	80						small cobbles between 15 and 25 feet
20									approximately 10% to 15% silt and clay content with depth
25	◩	D3-3	94						water in sample at 25 feet
30									

(continued on next page)

BORING NUMBER: D3
DATE DRILLED: 10/24/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
30		D3-4	85			TR	GM		Brown, moist, moderately dense to dense, sandy gravel
									decreasing percentage of gravel between 30 and 35 feet
35		D3-5	50/6"			TR			water at 36.5 feet after drilling
							SM		Brown, wet, dense, silty coarse sand with some small gravel
40		D3-6	60	123.2	12.7				
45		D3-7	62						
							GM		Brown, wet, dense, sandy gravel
50									approximately 10% silt and clay
55									
							SP		Brown, wet, dense, fine to coarse sand with silt
60									(continued on next page)

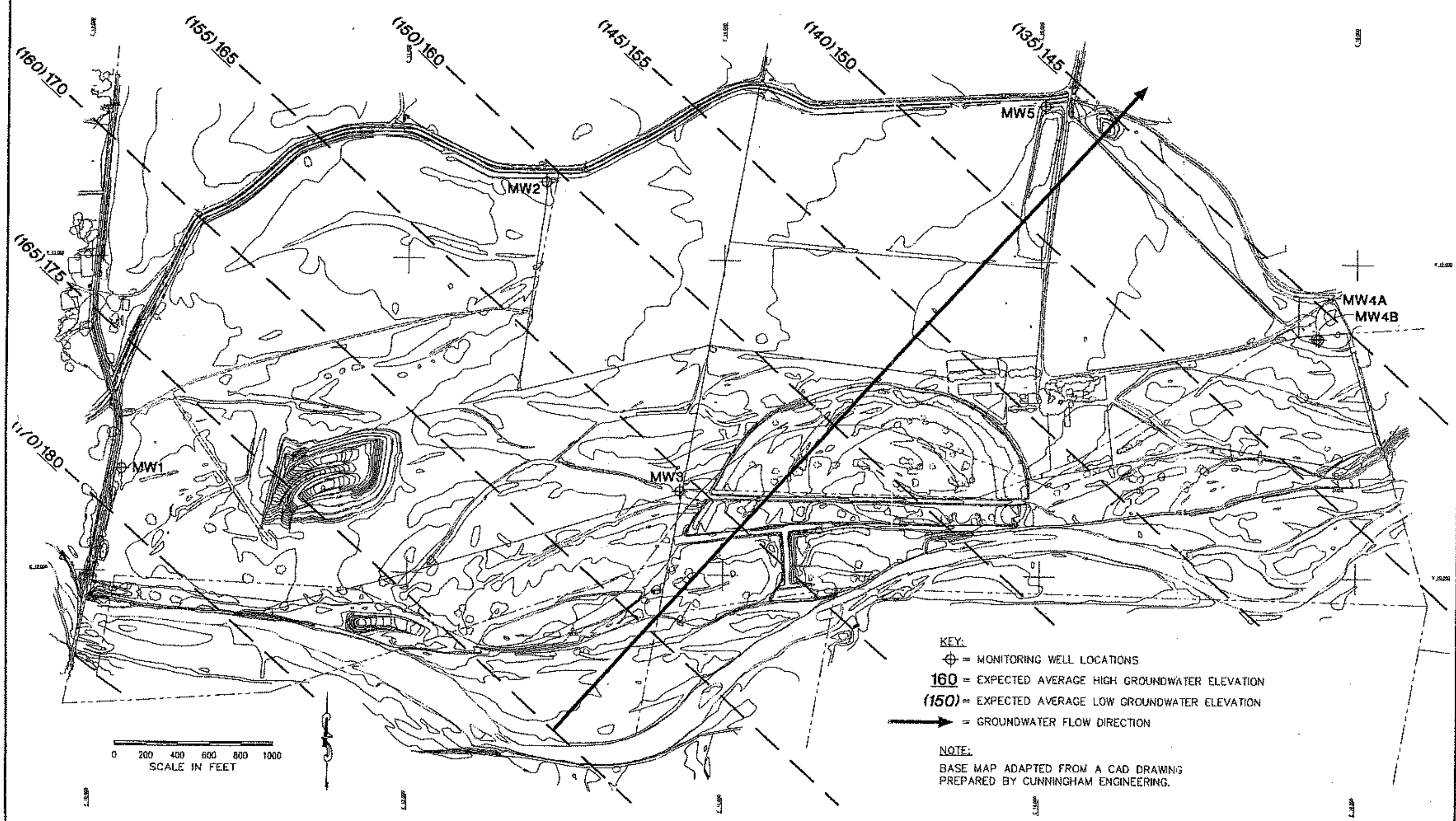
DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D3 DATE DRILLED: 10/24/95 LOGGED BY: EU DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
60							SP		Brown, wet, dense, fine to coarse sand with silt
65		D3-8	38			TR			
							GM		Brown, wet, dense, sandy gravel
70									
75		D3-9	100						
80									
85		D3-10	67/10"						
90									*(continued on next page)*

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES
Yolo County, California

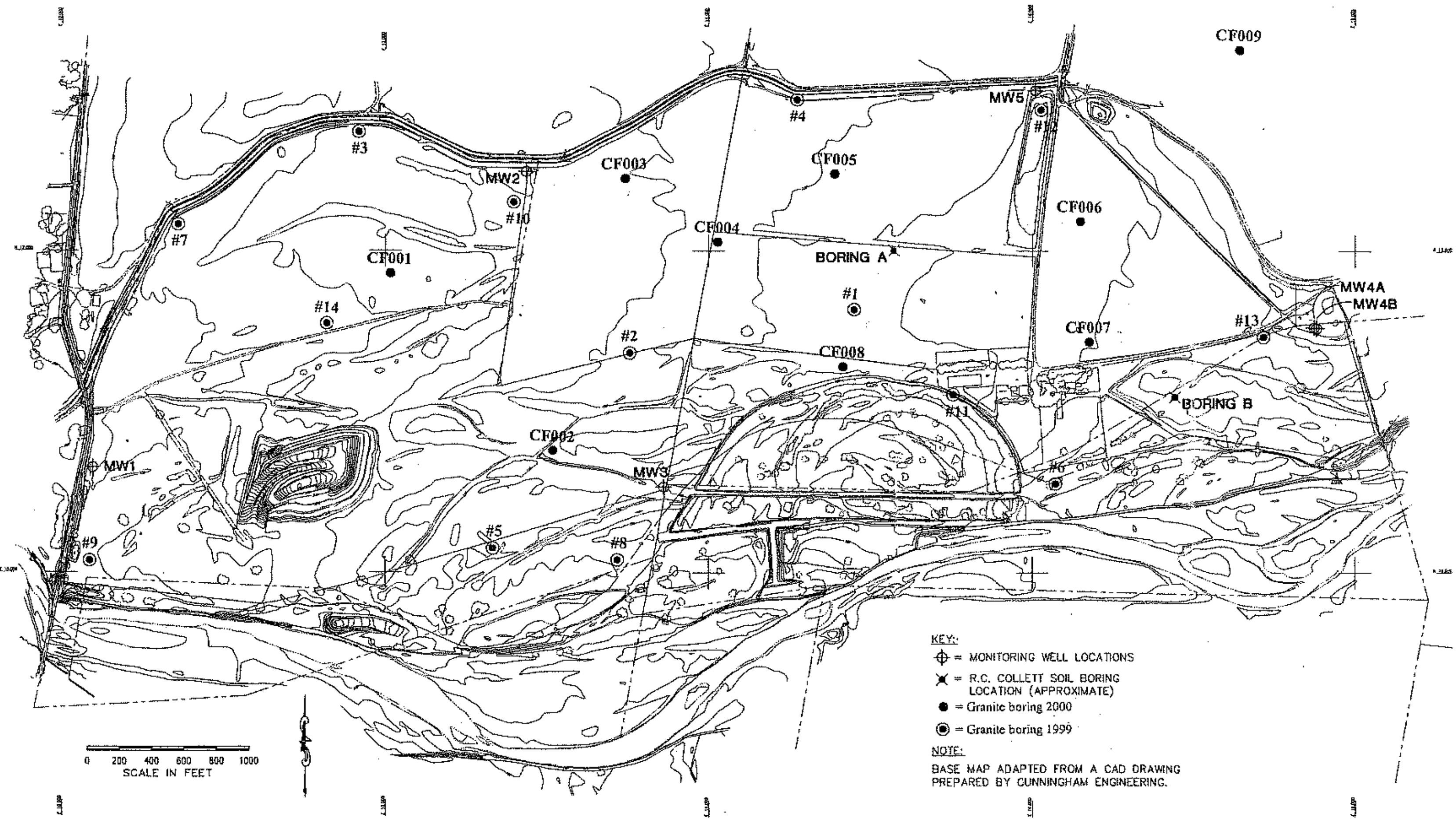
WKA NO: 3080.01
DATE: 11/95
PLATE NO: 5

159463

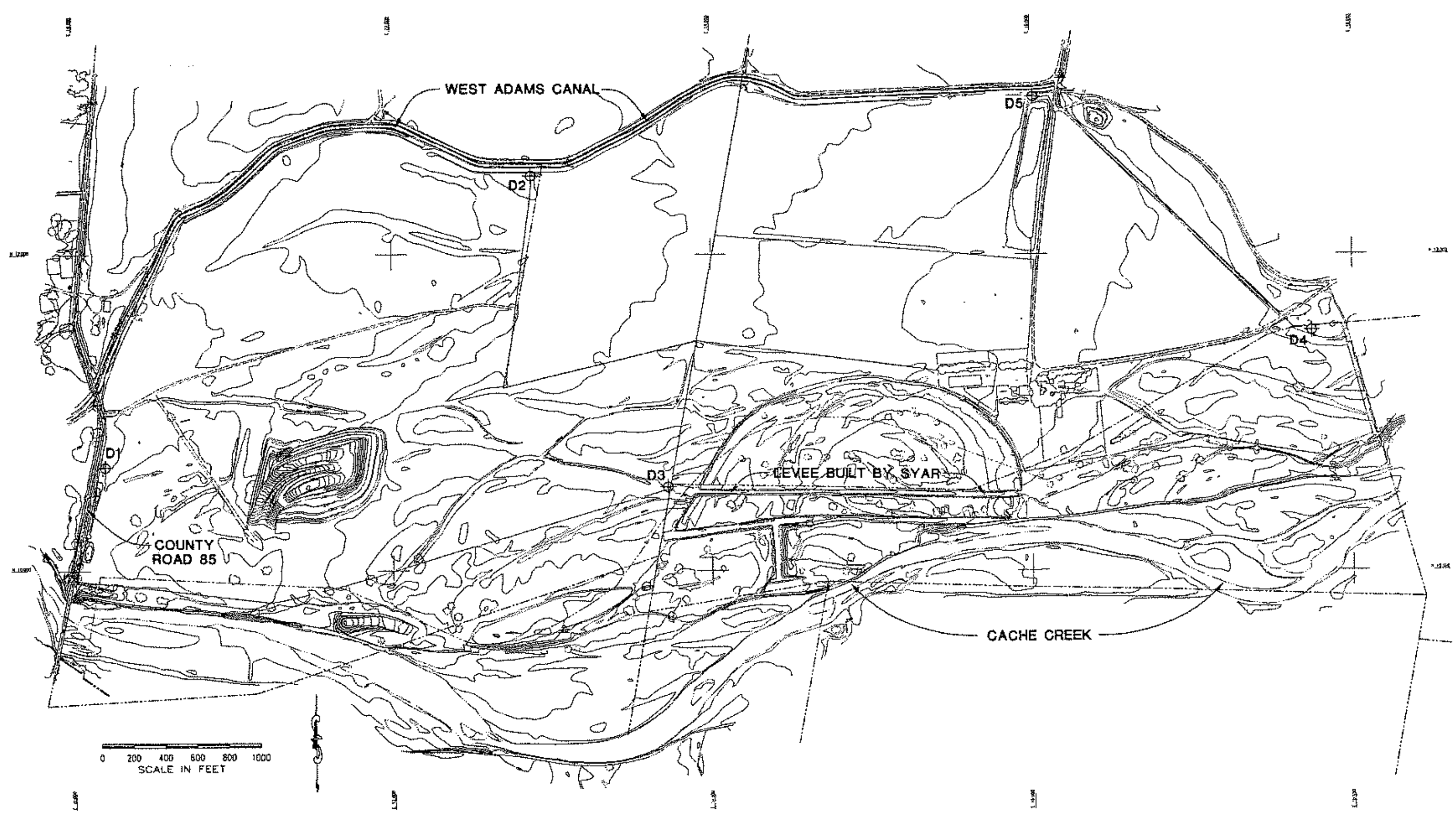


WALLACE · KUHL & ASSOCIATES INCORPORATED Geotechnical Consultants / Construction Testing	DRAWN BY: CHECKED BY: KMB	GRANITE, CAPAY Yolo County, California	WKA NO: 3080.05 DATE: 6/01 PLATE NO: 2

159463



WALLACE · KUHL & ASSOCIATES INCORPORATED Geotechnical Consultants / Construction Testing	DRAWN BY: CHECKED BY: KMB	GRANITE, CAPAY Yolo County, California		WKA NO: 3080.05 DATE: 6/01 PLATE NO: 3



WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	TEST BORING LOCATION PLAN		WKA NO: 3080.01 DATE: 11/95 PLATE NO: 2

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D3 DATE DRILLED: 10/24/95 LOGGED BY: EU DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
90		D3-11	95				GM		Brown, wet, dense, sandy gravel
95									
100		D3-12	85/9"						
105									
110									
115									
120									

NOTES:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 8.

BORING NUMBER: D4
DATE DRILLED: 10/25/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, dry, sandy silt with gravel
							GM		Brown, dry, moderately dense to dense, sandy gravel
5									gravel is generally less than two inches in diameter small cobbles at 6 feet
10									approximately 25% sand and silt
15		D4-1	84						
							SW		Brown, moist, moderately dense to dense, fine to coarse sand with small gravel
20		D4-2	61	118.0	8.7				
25		D4-3	80/10"			TR			wet at 25 feet
							GM		Brown, wet, dense, sandy gravel water at 28 feet after drilling
30									

(continued on next page)

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: 6

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D4 DATE DRILLED: 10/25/95 LOGGED BY: EU DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
30		D4-4	90/9"				GM		Brown, wet, dense, sandy gravel
35		D4-5	80						
40		D4-6	55						
45		D4-7	70/9"						
							CL/CH		Brown, moist, hard, silty clay
50		D4-8	50			TR			
55		D4-9	19						small gravel at 55 feet
60									thin sand lenses at 60 feet
									(continued on next page)

WALLACE - KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 6

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D4 DATE DRILLED: 10/25/95 LOGGED BY: EU — DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS — SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
60							CL/CH		Brown, moist, hard, silty clay
		D4-10	38	96.8	26.4				
65									sandy clay at 65 feet
		D4-11	44						
70									varying percentages of silt and sand in clay from 60 to 80 feet
		D4-12	60						
75									
		D4-13	59						
80									
		D4-14	70				GM		Brown, wet, dense, sandy gravel with interbedded sand lenses
85									
		D4-15	76						
90									

(continued on next page)

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: 6

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D4 DATE DRILLED: 10/25/95 LOGGED BY: EU — DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS — SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
90		D4-16	67				GM		Brown, wet, dense, sandy gravel with interbedded sand lenses
95									some large diameter rock between 90 and 100 feet
100									
105									
110									
115									
120									

NOTES:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 8.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 6

BORING NUMBER: D5
DATE DRILLED: 10/27/95
LOGGED BY: EU

DRILL RIG/METHOD:
MOBILE B-61/8-INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, dry, sandy silt
5							GM		Brown, dry, moderately dense to dense, sandy gravel with interbedded sand layers
15									moist at 15 feet
	◪	D5-1	29						gravel diameter is generally two to three inches
20									increase in moisture at 20 feet
	◪	D5-2	95						
25									soil wet at 25 feet
	◪	D5-3	53	119.3	11.4				
30									

(continued on next page)

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D5 DATE DRILLED: 10/27/95 LOGGED BY: EU	DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS
									SOIL DESCRIPTION AND REMARKS	
									(continued from previous page)	
30		D5-4	50/5"				GM		Brown, moist, moderately dense to dense, sandy gravel with interbedded sand layers	
									larger diameter rock between 30 and 45 feet	
35		D5-5	50/3"						approximately 10% clay in gravel deeper than 35 feet	
40		D5-6	50/6"							
45		D5-7	70			TR				
50		D5-8	55	120.4	10.8					
55		D5-9	84						cobbles between 55 and 60 feet	
60										

(continued on next page)

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: 7

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	BORING NUMBER: D5 DATE DRILLED: 10/27/95 LOGGED BY: EU DRILL RIG/METHOD: MOBILE B-61/8-INCH HOLLOW STEM AUGERS SOIL DESCRIPTION AND REMARKS
									(continued from previous page)
60		D5-10	68/9"				GM		Brown, moist, moderately dense to dense, sandy gravel with interbedded sand layers
							SC		Mottled grey and brown, wet, dense, clayey sand
65		D5-11	84						
							CL/CH		Brown, wet, hard to very hard, silty clay
70		D5-12	67						
75		D5-13	88						
80		D5-14	73						
85									
90									

NOTES:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 8.

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING

CACHE CREEK AGGREGATES

Yolo County, California

WKA NO: 3080.01

DATE: 11/95

PLATE NO: 7

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOLS	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 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 & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. California sampler

= Drive Sample: no recovery

i = Initial Water Level

f = Final Water Level

— — — = Estimated or gradational material change line

——— = Observed material change line

Laboratory Tests

PI = Plasticity Index

EI = Expansion Index

UCC = Unconfined Compression Test

TR = Triaxial Compression Test

GR = Gradational Analysis (Sieve)

CON = Consolidation Test

GRAIN SIZE CLASSIFICATION

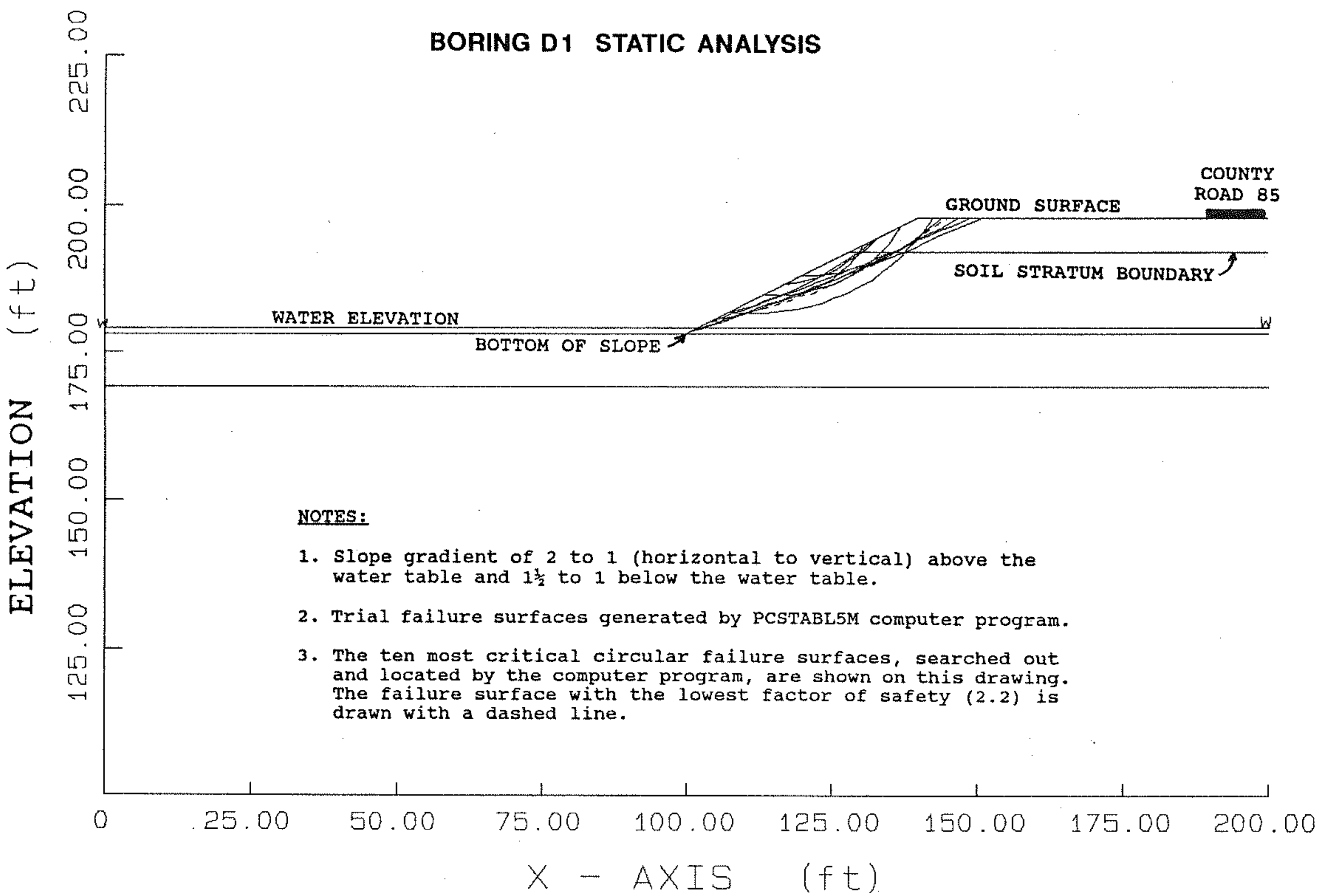
CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

CONSISTENCY CLASSIFICATION

COHESIVE SOILS		GRANULAR SOILS	
Description	Blows/ft.*	Description	Blows/ft.*
Very Soft	< 3	Very Loose	< 5
Soft	3 - 5	Loose	5 - 15
Medium (firm)	6 - 10	Medium Dense	16 - 40
Stiff	11 - 20	Dense	41 - 65
Very Stiff	21 - 40	Very Dense	> 65
Hard	> 40		*SPT

WALLACE - KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 8

BORING D1 STATIC ANALYSIS

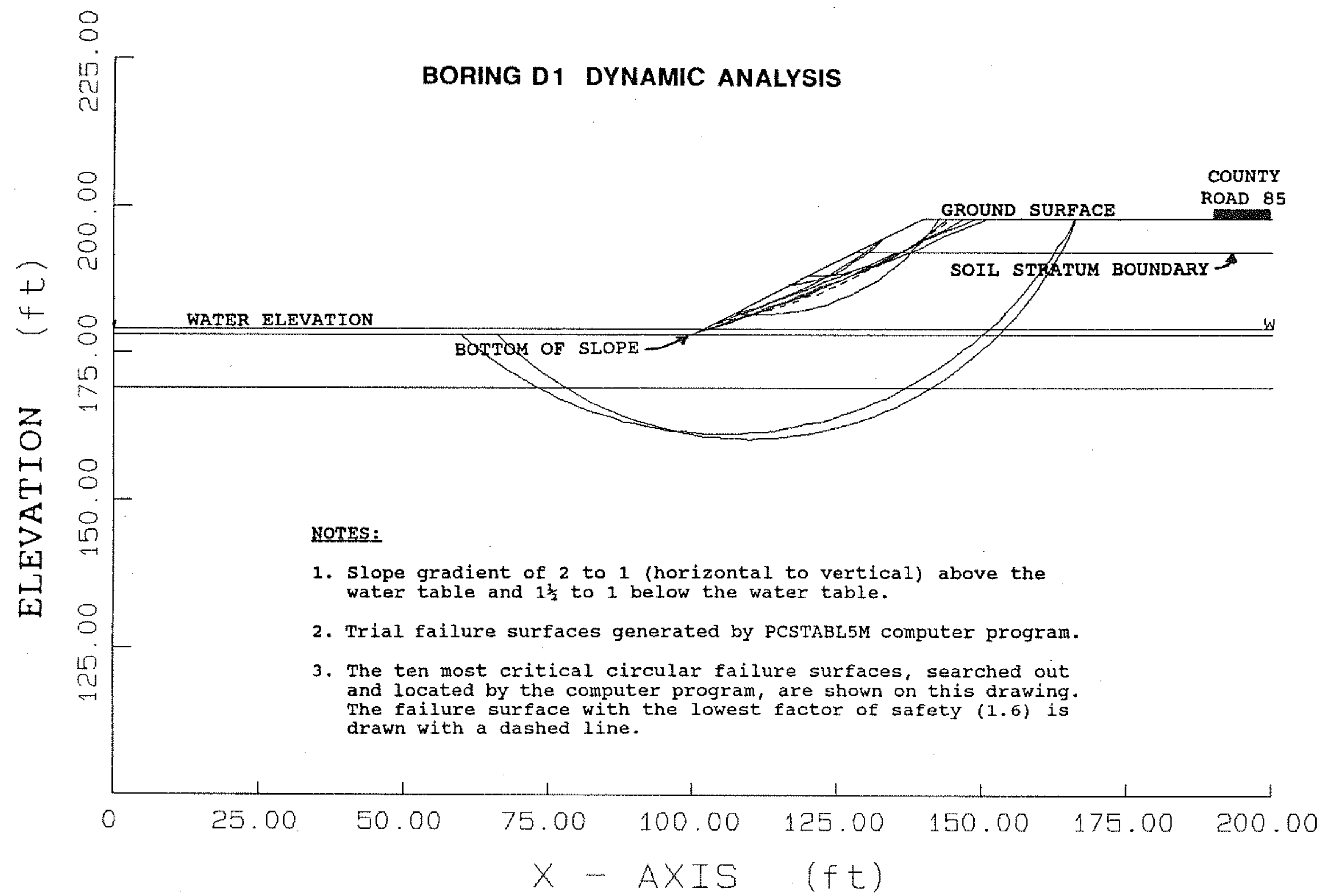


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (2.2) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 9

BORING D1 DYNAMIC ANALYSIS

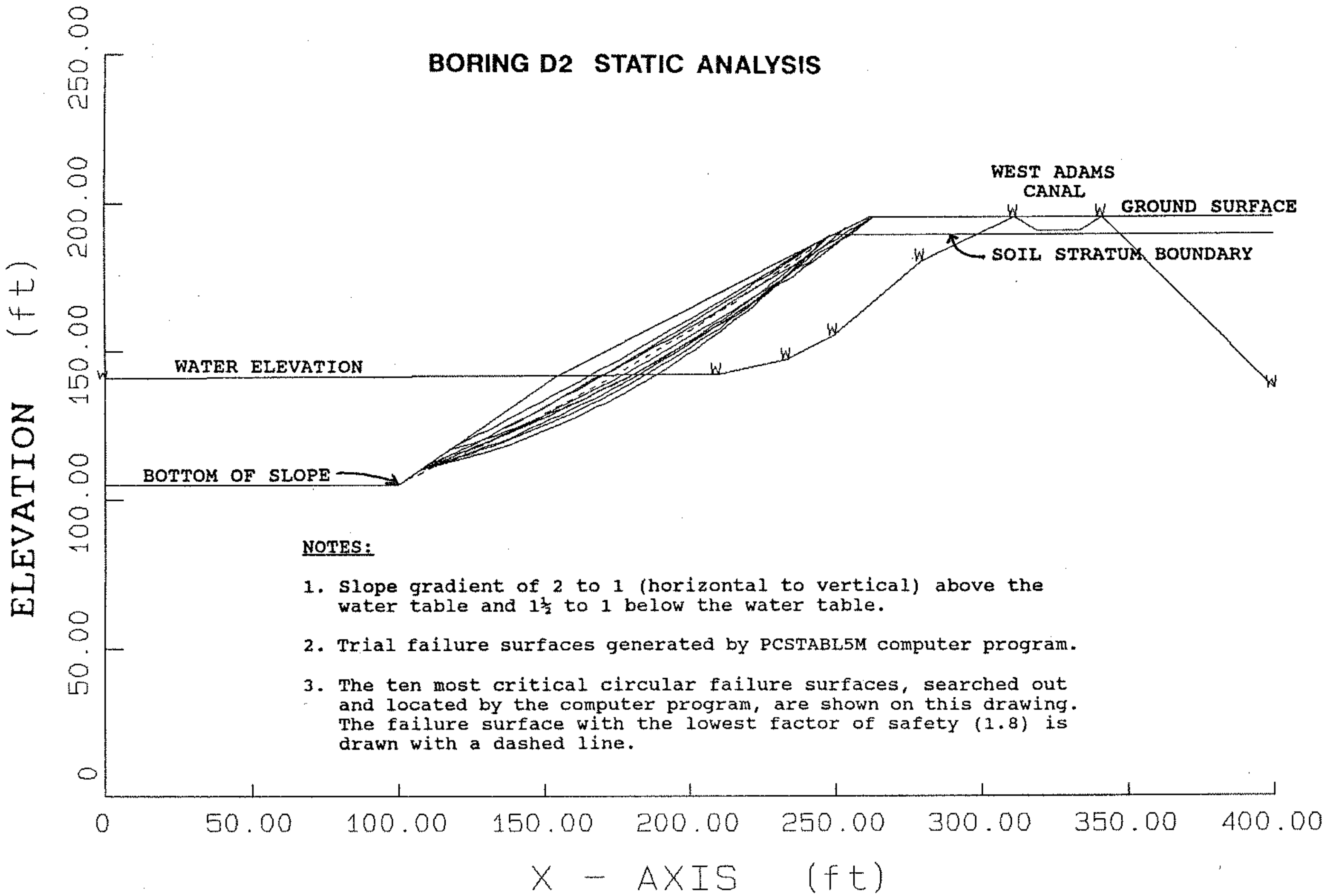


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.6) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 10

BORING D2 STATIC ANALYSIS

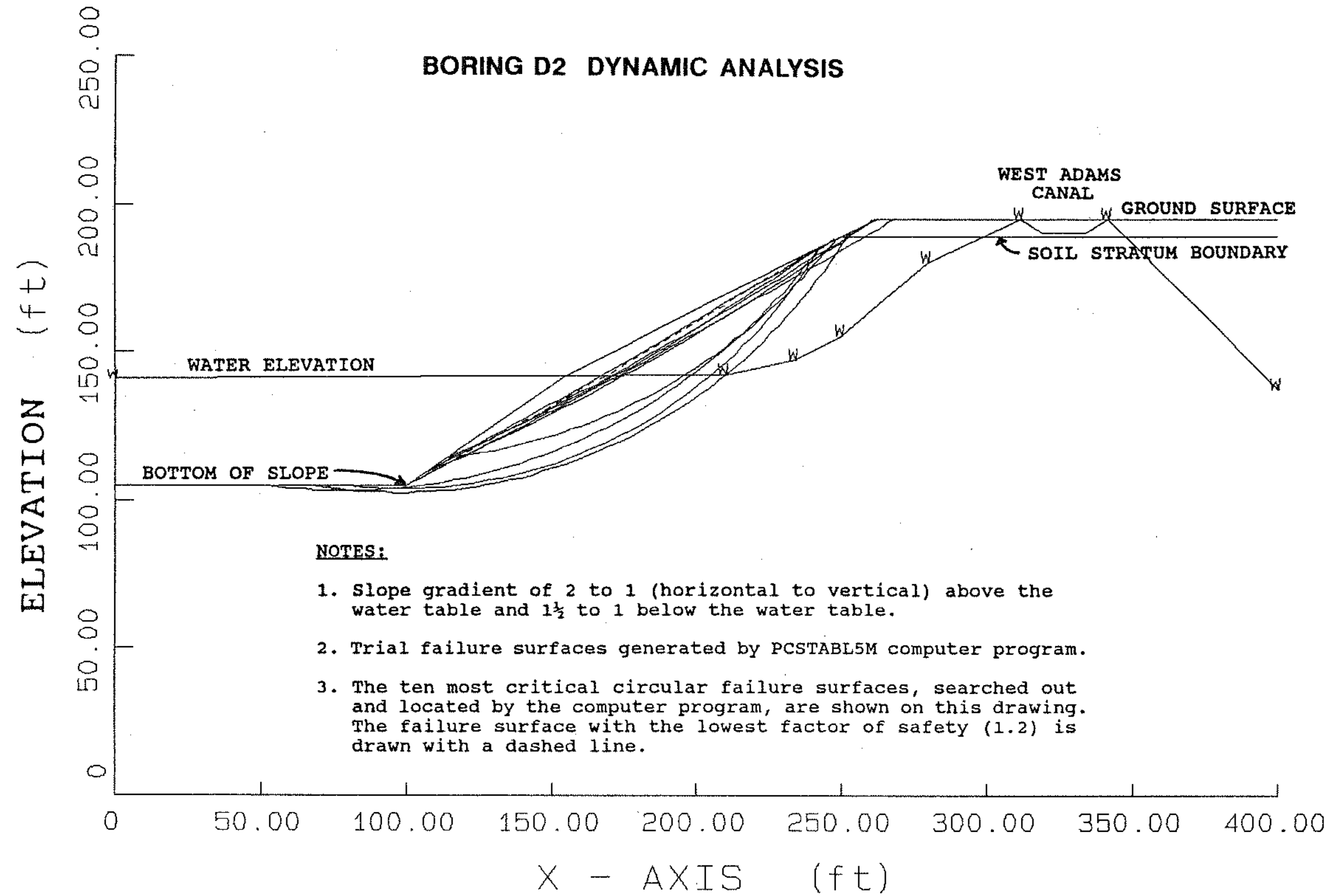


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.8) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 11

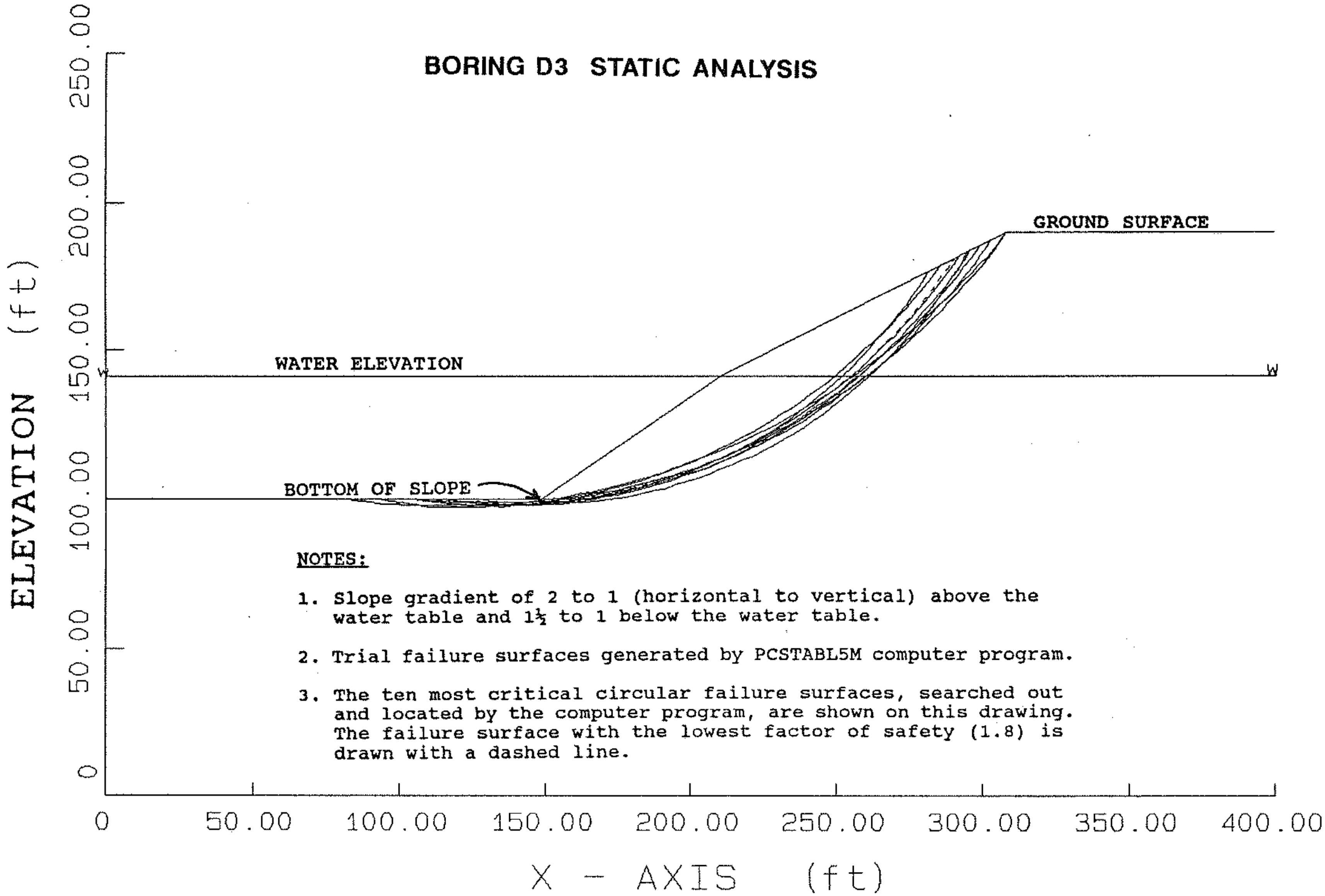
BORING D2 DYNAMIC ANALYSIS



NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.2) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 12

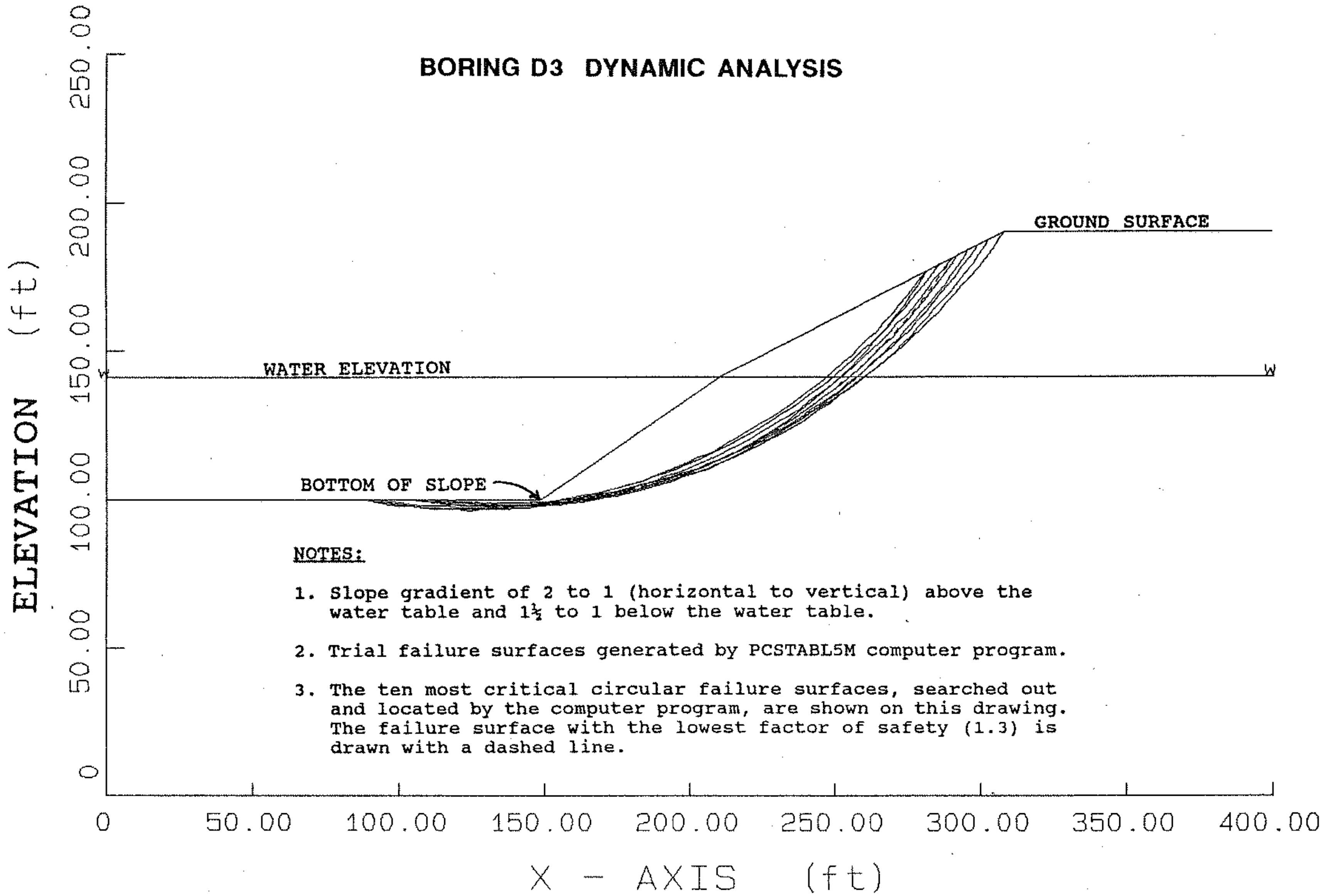


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.8) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 13

BORING D3 DYNAMIC ANALYSIS

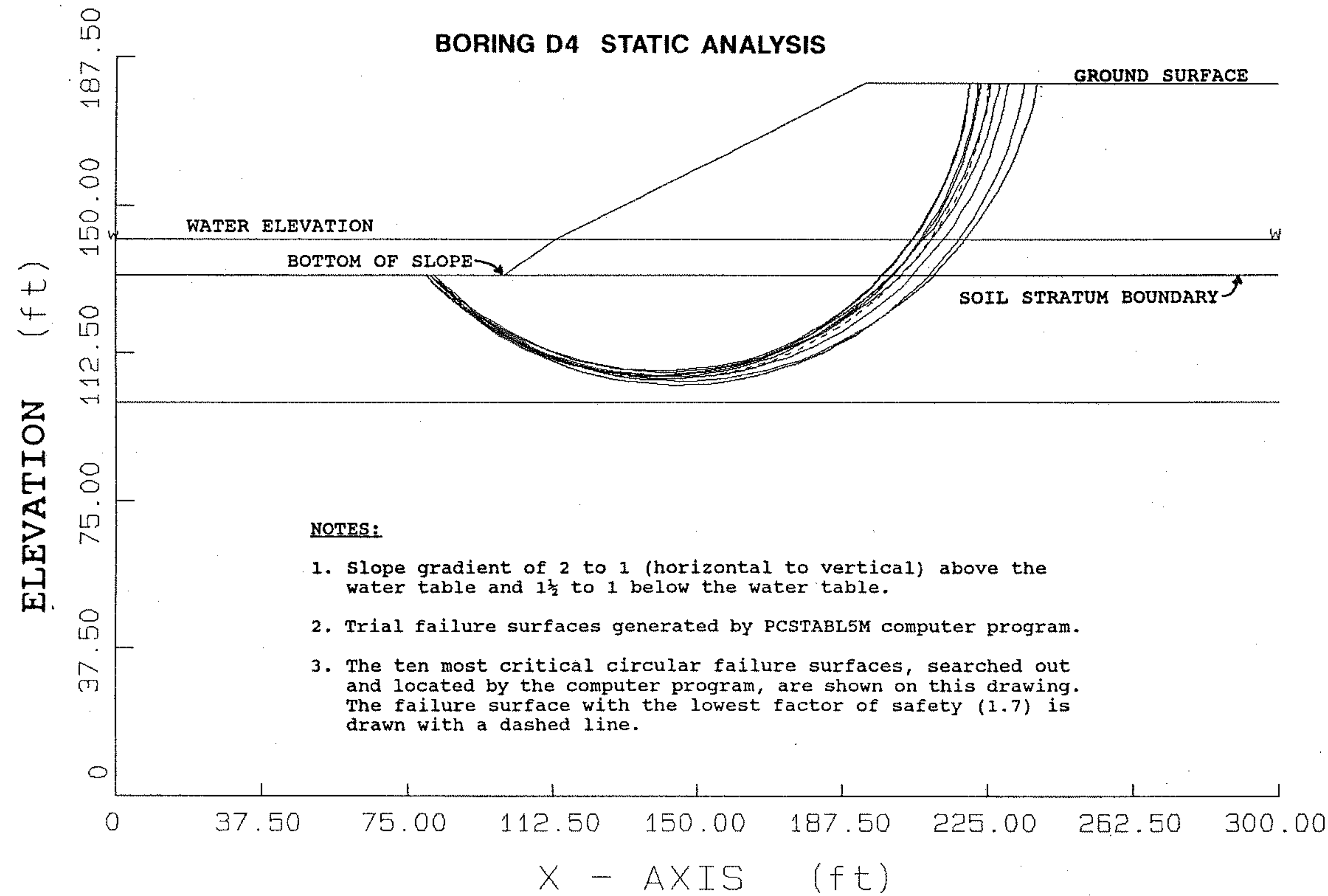


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.3) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 14

BORING D4 STATIC ANALYSIS

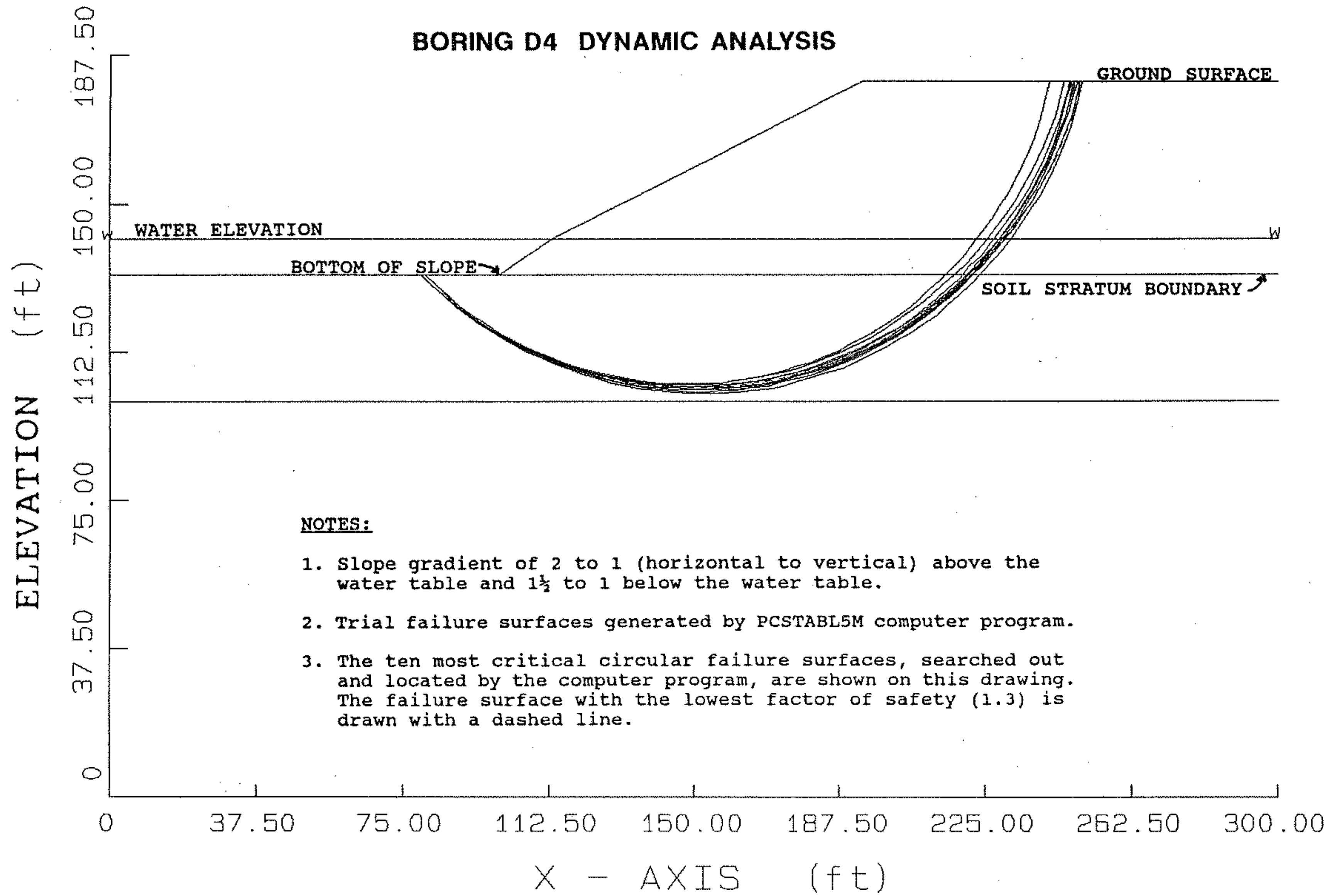


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.7) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 15

BORING D4 DYNAMIC ANALYSIS



NOTES:

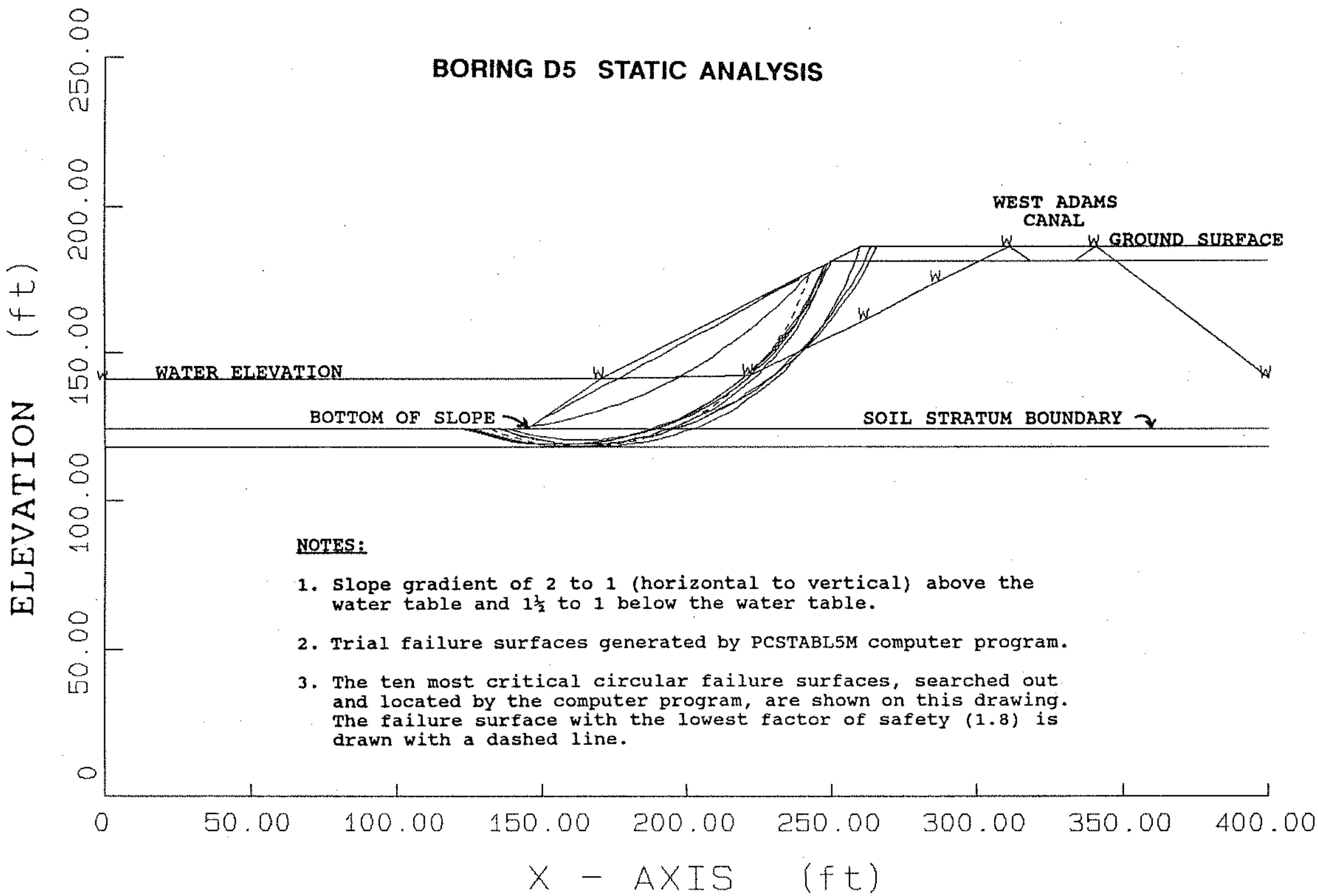
1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.

2. Trial failure surfaces generated by PCSTABL5M computer program.

3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.3) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 16

BORING D5 STATIC ANALYSIS

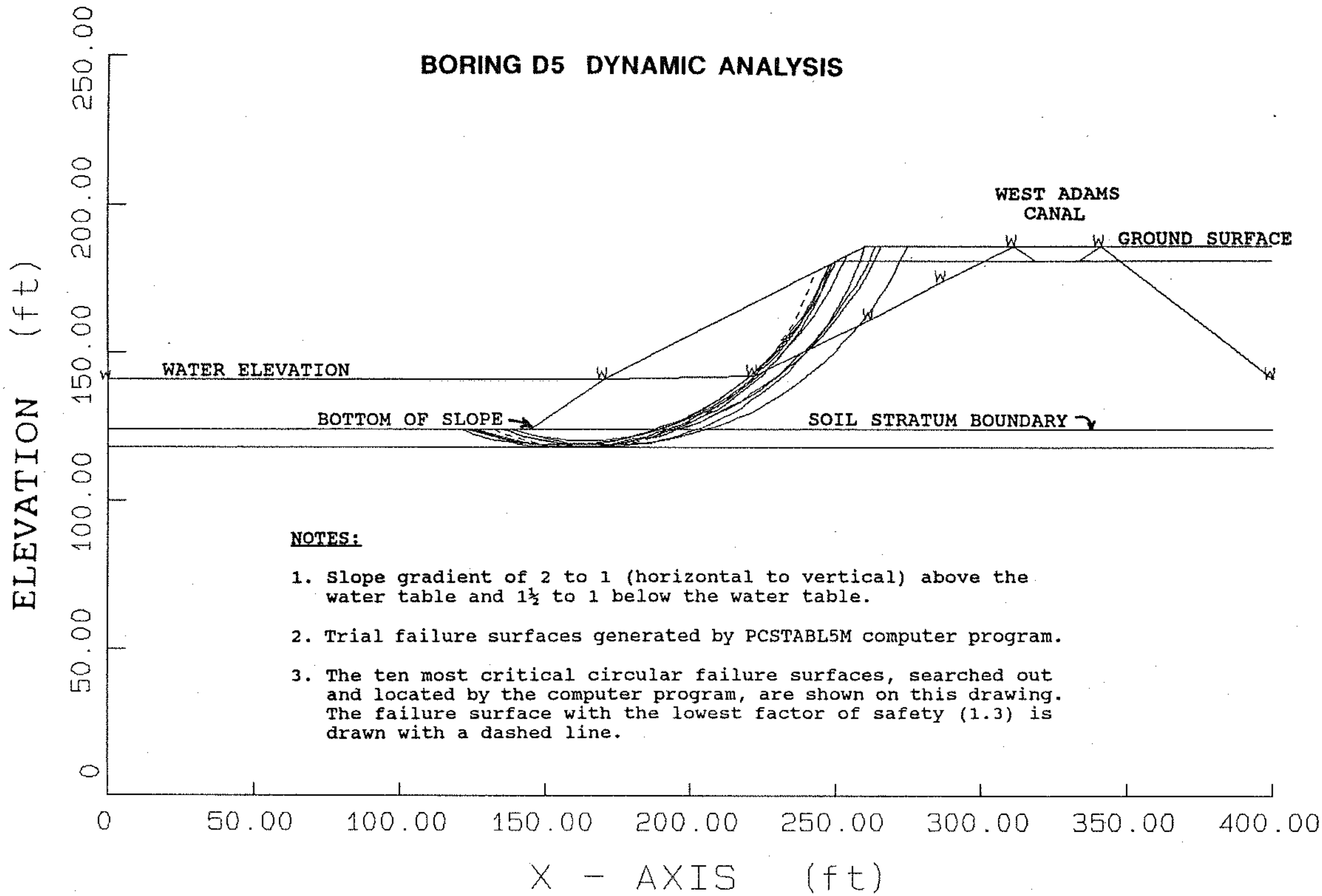


NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.8) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 17

BORING D5 DYNAMIC ANALYSIS



NOTES:

1. Slope gradient of 2 to 1 (horizontal to vertical) above the water table and 1½ to 1 below the water table.
2. Trial failure surfaces generated by PCSTABL5M computer program.
3. The ten most critical circular failure surfaces, searched out and located by the computer program, are shown on this drawing. The failure surface with the lowest factor of safety (1.3) is drawn with a dashed line.

WALLACE • KUHL & ASSOCIATES, INC. GEOTECHNICAL ENGINEERING GEOLOGIC & ENVIRONMENTAL SERVICES	DRAWN BY: HLA CHECKED BY: EU	CACHE CREEK AGGREGATES Yolo County, California	WKA NO: 3080.01 DATE: 11/95 PLATE NO: 18

APPENDIX

APPENDIX

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation for the proposed Cache Creek Aggregates mining operation was authorized by Mr. Ben Adamo on October 13, 1995. Authorization was for an investigation as described in our proposal letter dated October 11, 1995 sent to our client, R.C. Collet, Inc. whose mailing address is P.O. Box 1965, Woodland, California 95776-1965; telephone (916) 662-9383. In performing this investigation, we made reference to a 1" = 200' topographic map of the site prepared by Cunningham Engineering.

B. FIELD EXPLORATION

Test borings were accomplished on October 20 through October 27, 1995, utilizing a Mobile B-61 truck-mounted drill rig. At the locations indicated on Plate No. 2, five test borings were drilled to a maximum depth of about 100 feet using eight-inch diameter hollow stem augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D. 2-inch I.D. California sampler driven by a 140 pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded with the sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, being designated the penetration resistance or "blow count" for that particular drive.

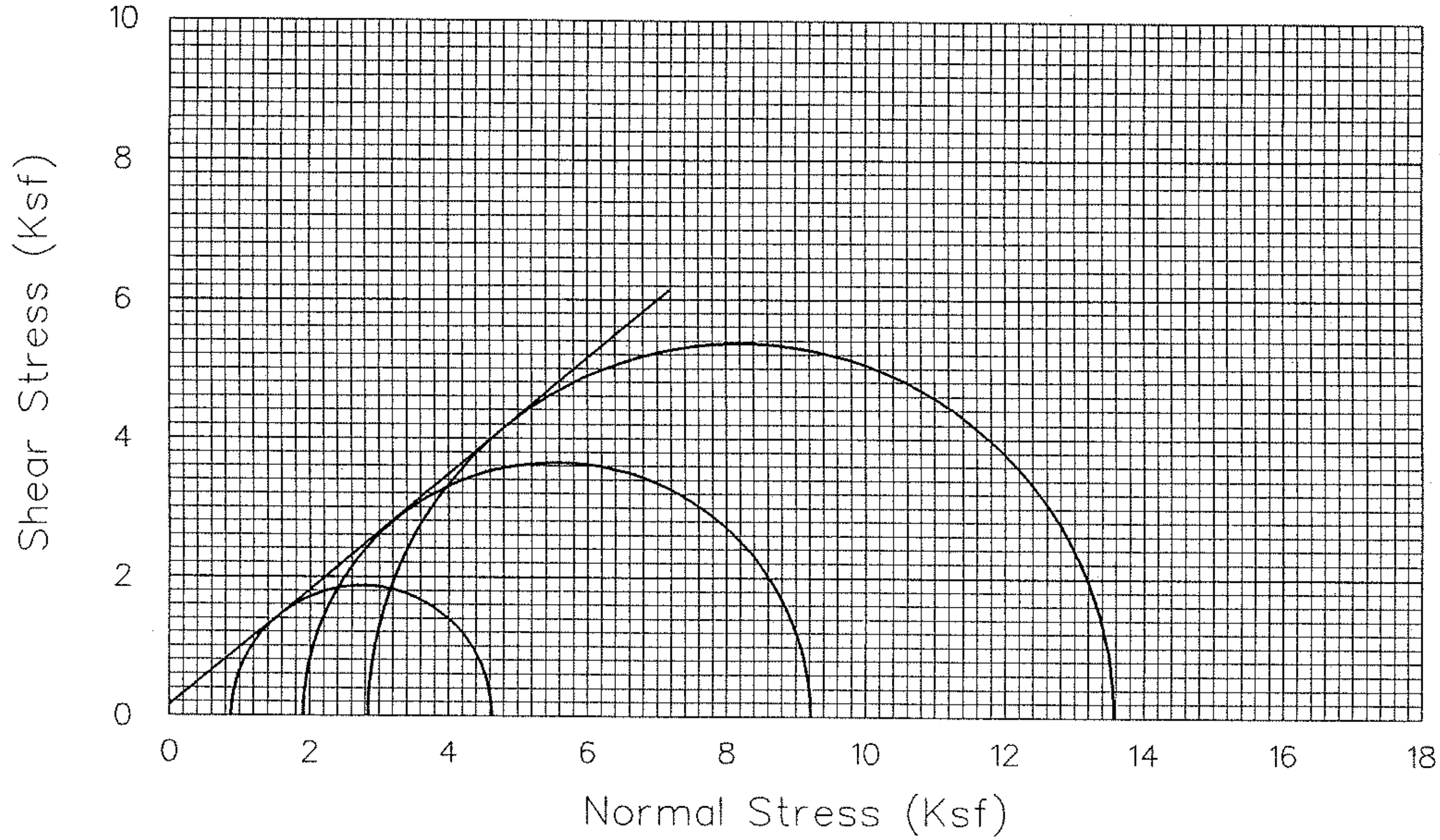
The samples were retained in 2-inch diameter by 6-inch long thin-walled brass tubes contained within the sampler. Immediately after recovery, the soils in the tubes were visually classified by the field engineer and the ends of the tubes were sealed to preserve the natural moisture contents. All samples were taken to our laboratory for soil classification and selection of samples for testing. The Logs of Test Borings, Plates No. 3 through 7 contain descriptions of the soils encountered in each boring. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained in Plate No. 8.

C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D2216) and shear strength parameters from triaxial compression testing (ASTM D4767). The results of the moisture/density tests are included on the boring logs at the depth each sample was obtained. Results of triaxial compression tests are contained on Plates No. A1 through A9.

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D2-2

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, sandy gravel

DRY DENSITY (PCF) : 124
INITIAL MOISTURE (%) : 9.1
FINAL MOISTURE (%) : 9.1

ANGLE OF INTERNAL FRICTION (Ø) : 40°
COHESION (PSF) : 150

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

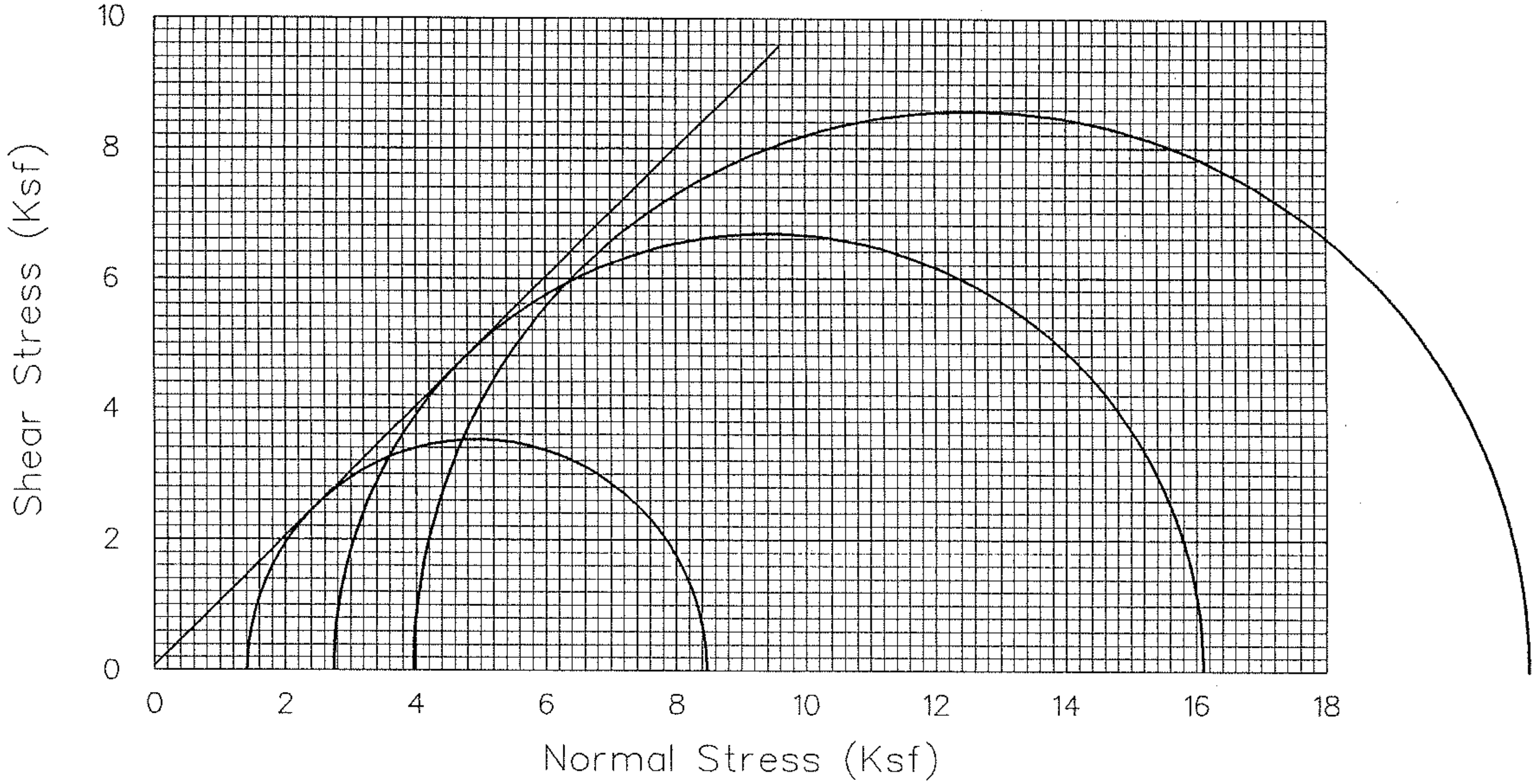
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A1

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D2-4

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, sandy gravel

DRY DENSITY (PCF) : 128
INITIAL MOISTURE (%) : 12.0
FINAL MOISTURE (%) : 9.8

ANGLE OF INTERNAL FRICTION (Ø) : 45°
COHESION (PSF) : 70

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

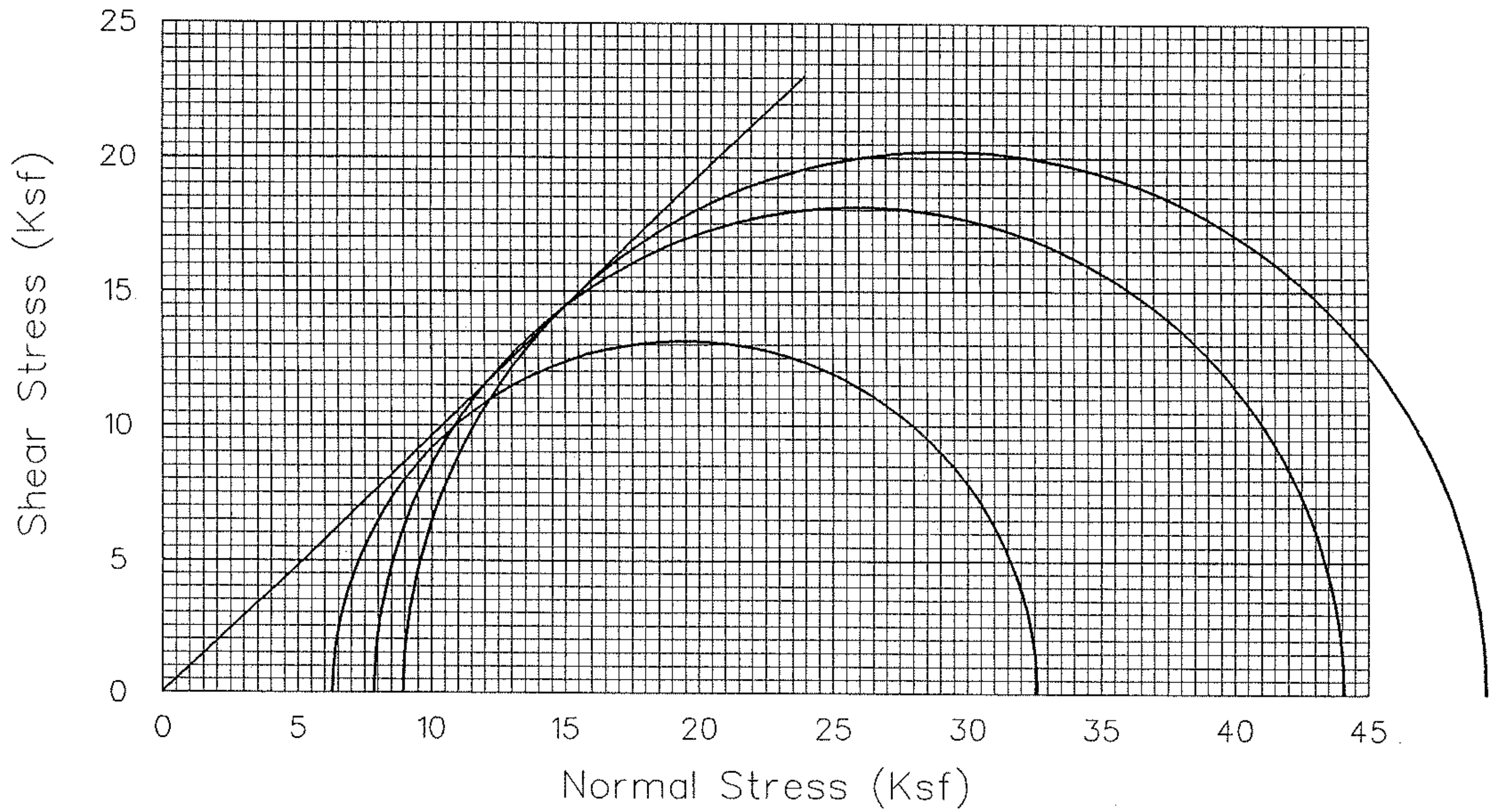
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A2

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D3-4

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, sandy gravel

DRY DENSITY (PCF) :	123
INITIAL MOISTURE (%) :	13.2
FINAL MOISTURE (%) :	10.6
ANGLE OF INTERNAL FRICTION (Ø) :	44°
COHESION (PSF) :	0

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

DRAWN BY: HLA

CHECKED BY: EU

CACHE CREEK AGGREGATES

Yolo County, California

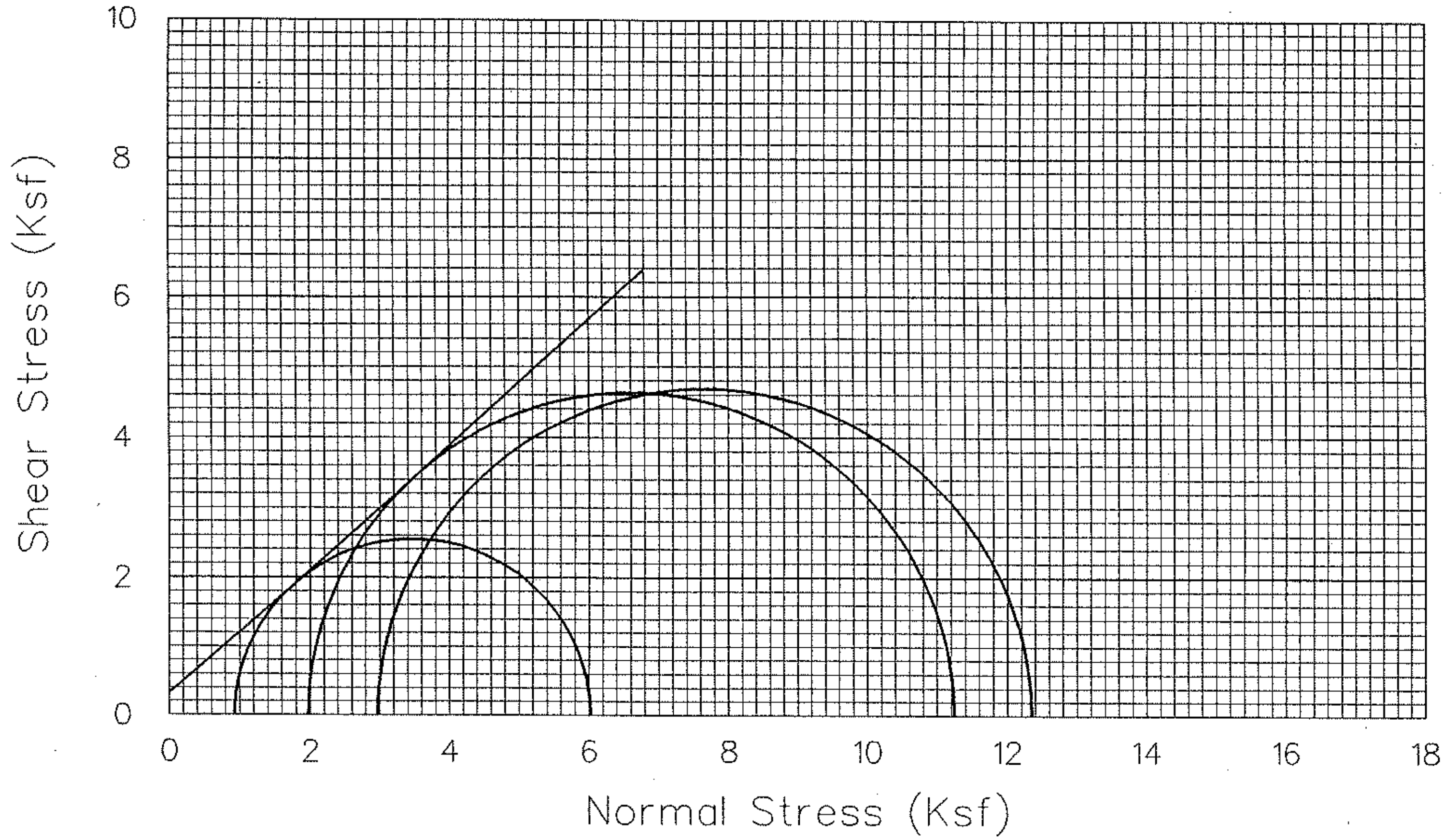
WKA NO: 3080.01

DATE: 11/95

PLATE NO: A3

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D3-5

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, sandy gravel

DRY DENSITY (PCF) :	126
INITIAL MOISTURE (%) :	11.7
FINAL MOISTURE (%) :	11.1
ANGLE OF INTERNAL FRICTION (Ø) :	42°
COHESION (PSF) :	300

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

DRAWN BY: HLA

CHECKED BY: EU

CACHE CREEK AGGREGATES

Yolo County, California

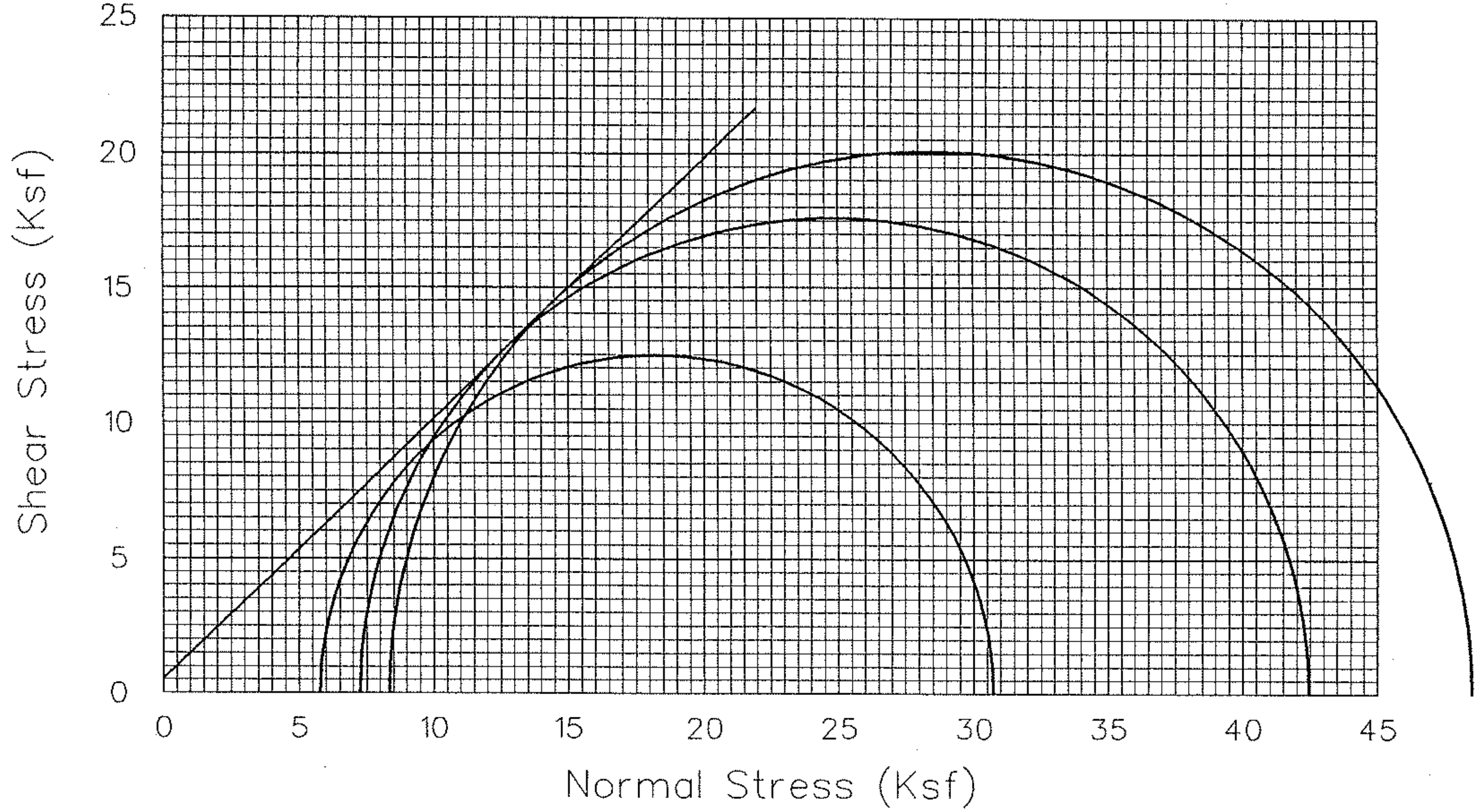
WKA NO: 3080.01

DATE: 11/95

PLATE NO: A4

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D3-8

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, fine to coarse sand

DRY DENSITY (PCF) : 120
INITIAL MOISTURE (%) : 15.6
FINAL MOISTURE (%) : 14.1

ANGLE OF INTERNAL FRICTION (Ø) : 44°
COHESION (PSF) : 500

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

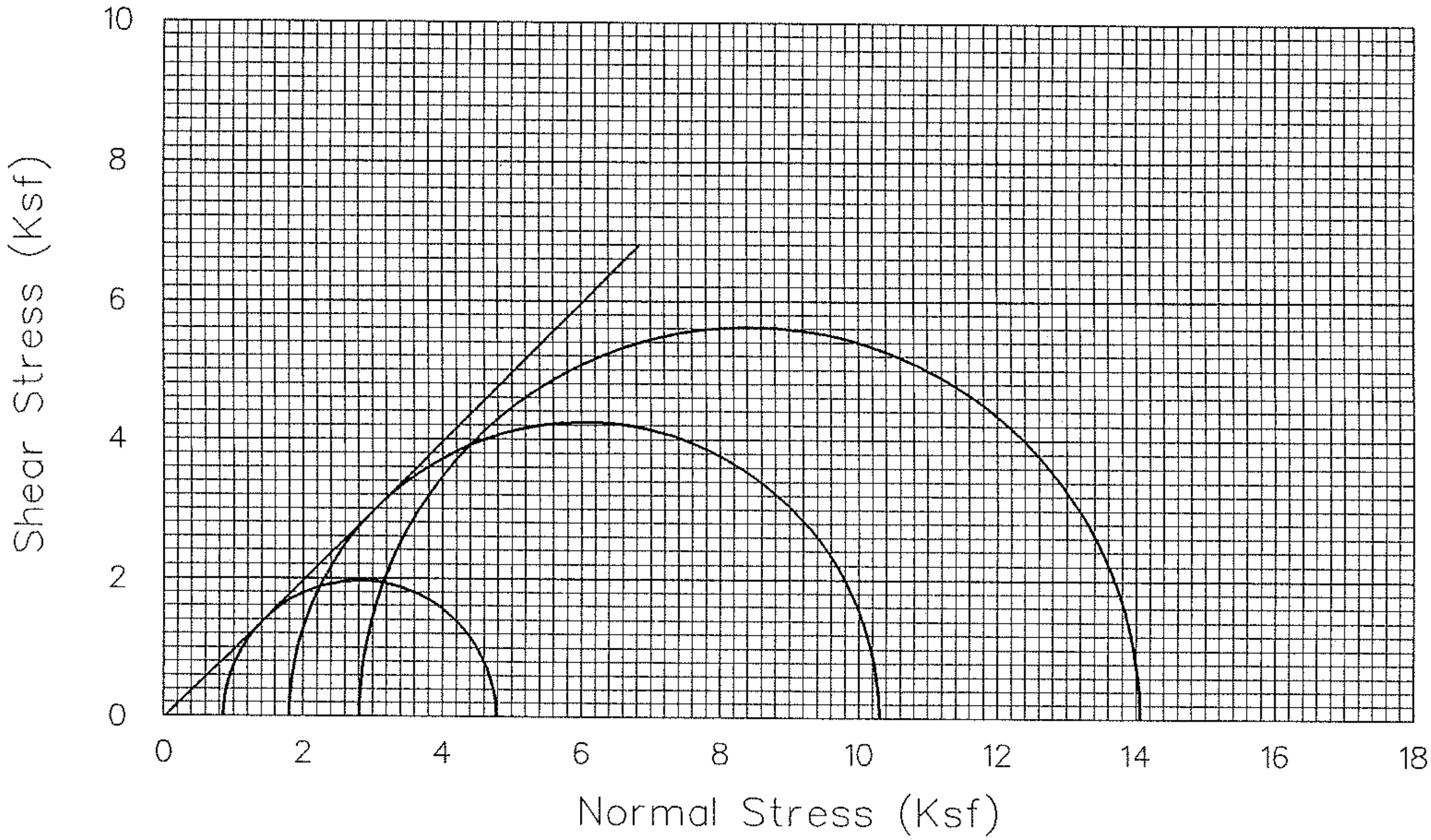
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A5

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D4-3

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, coarse sand with gravel

DRY DENSITY (PCF) : 118
INITIAL MOISTURE (%) : 9.3
FINAL MOISTURE (%) : 8.6

ANGLE OF INTERNAL FRICTION (Ø) : 45°
COHESION (PSF) : 0

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

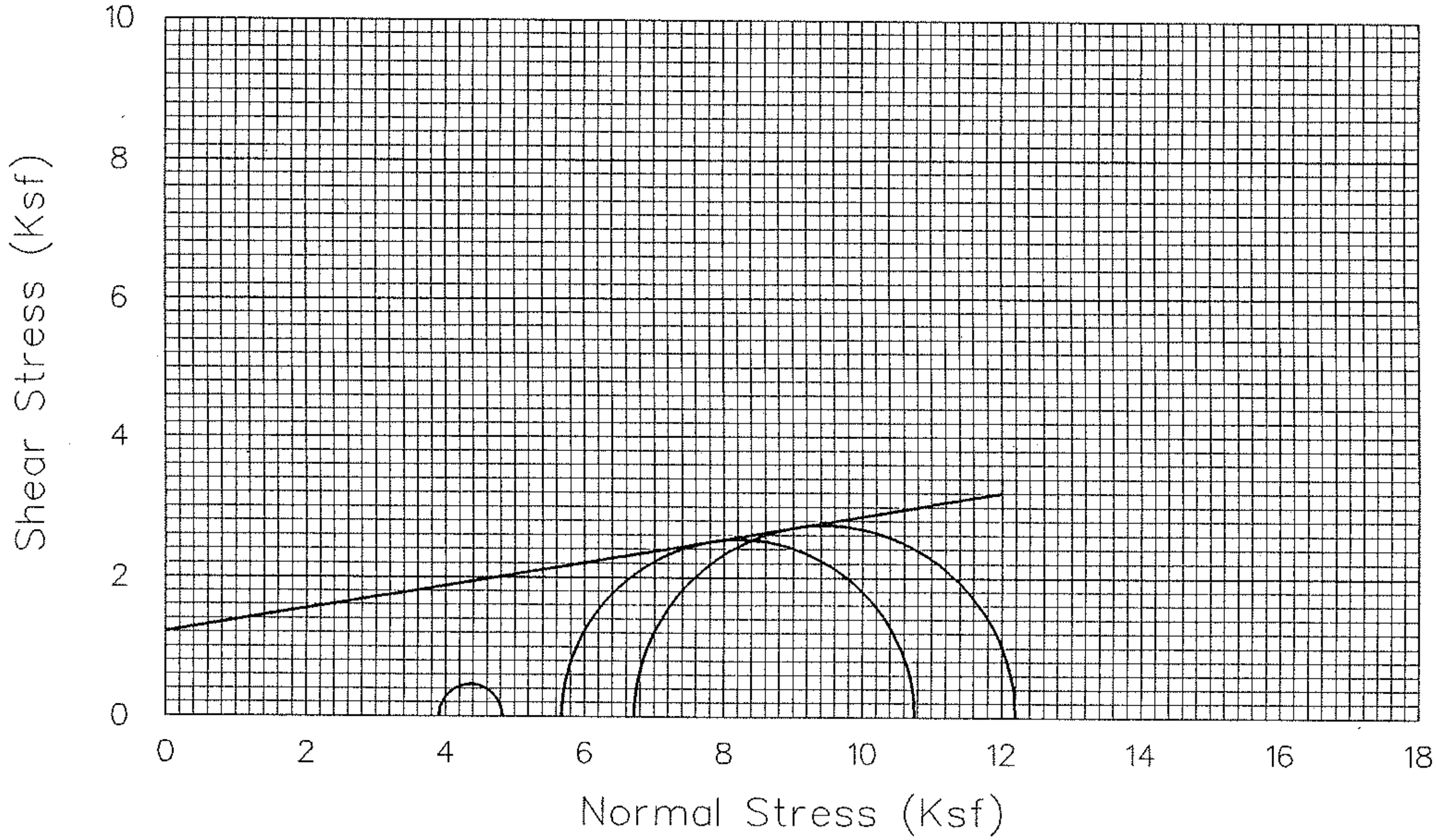
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A6

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D4-8

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, silty clay

DRY DENSITY (PCF) : 93
INITIAL MOISTURE (%) : 28.3
FINAL MOISTURE (%) : 25.9

ANGLE OF INTERNAL FRICTION (Ø) : 9°
COHESION (PSF) : 1200

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

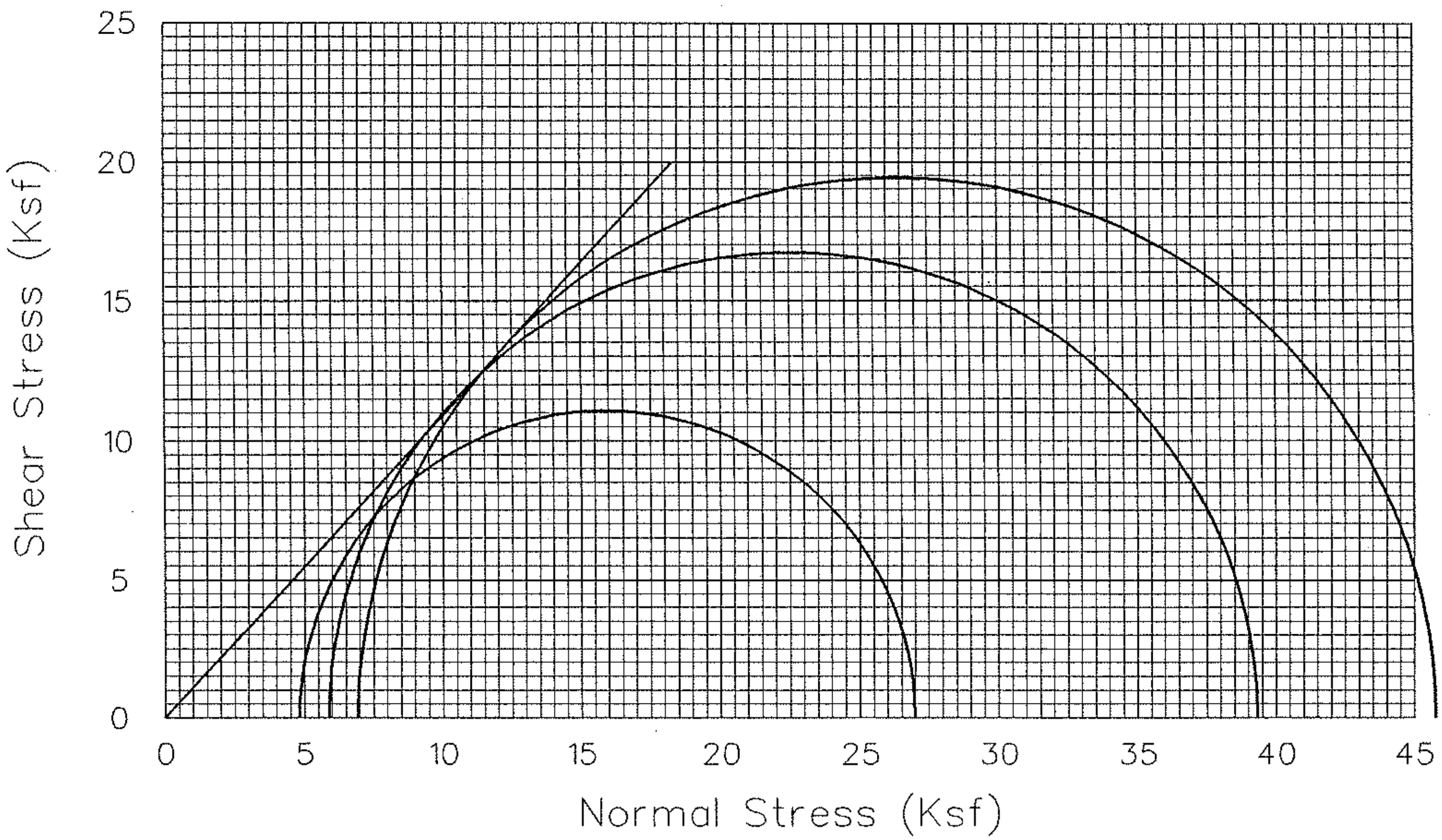
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A7

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : D5-7

SAMPLE CONDITION : Undisturbed

SOIL DESCRIPTION : Brown, sandy gravel

DRY DENSITY (PCF) : 124
INITIAL MOISTURE (%) : 14.3
FINAL MOISTURE (%) : 8.5

ANGLE OF INTERNAL FRICTION (Ø) : 47°
COHESION (PSF) : 0

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

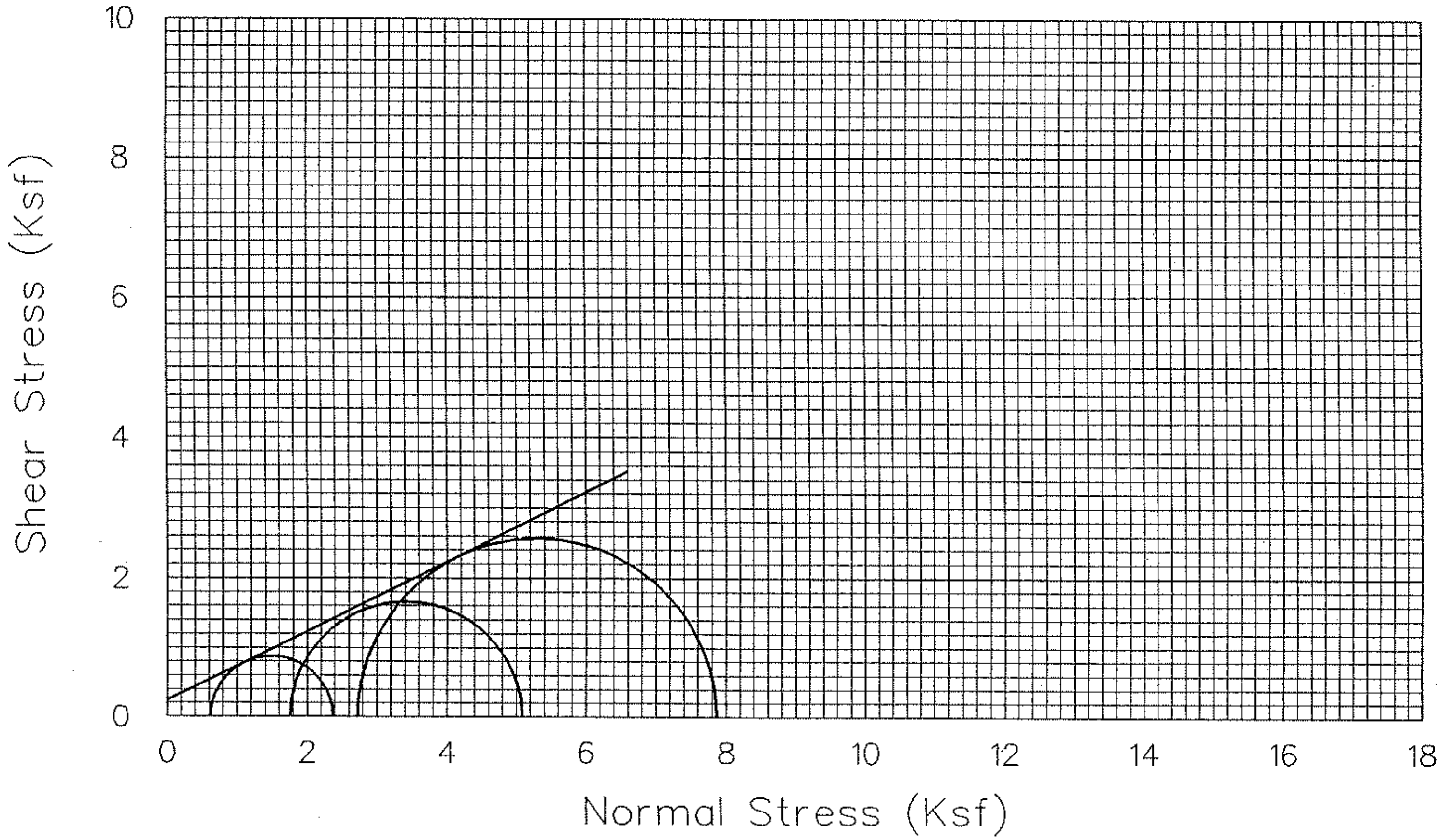
DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A8

TRIAXIAL COMPRESSION TEST

ASTM D4767-88



SAMPLE NO. : B

SAMPLE CONDITION : Remolded disturbed sample

SOIL DESCRIPTION : Brown, sandy silt

DRY DENSITY (PCF) : 110
INITIAL MOISTURE (%) : 10.3
FINAL MOISTURE (%) : 17.4

ANGLE OF INTERNAL FRICTION (Ø) : 27°
COHESION (PSF) : 200

WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

DRAWN BY: HLA
CHECKED BY: EU

CACHE CREEK AGGREGATES
Yolo County, California

WKA NO: 3080.01
DATE: 11/95
PLATE NO: A9