CITY OF STOCKTON

OFFICE OF THE CITY MANAGER
City Hall • 425 N. El Dorado Street • Stockton, CA 95202-1997 • 209 / 937-8212 • Fax 209 / 937-7149
www.stocktongov.com

September 1, 2016

Tyson Fulmer, PG
Applied Water Resources
2363 Mariner Square Dr., Suite 245
Alameda, CA 94501

Re: California Public Records Act Request dated August 29, 2016 – Delta Walter Supply Project Geotechnical Services Report – Intake Facility

*****Response sent via email to tfulmer@awrcorp.net *****

Dear Mr. Fulmer,

I am writing in response to your request for public records dated August 29, 2016, pursuant to the Public Records Act ("Act") (California Gov. Code § 6250, *et seq*.), requesting a copy of the Delta Water Supply Project Intake Facility Geotechnical Services Report.

Attached please find a copy of the 2007 report, which was revised in 2009.

If you have any questions, please contact me at (209) 937-8827.

Sincerely,

Connie Cochran
City Manager's Office

Cc: Tara Mazzanti, Deputy City Attorney

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GEOTECHNICAL SERVICES REPORT
DELTA WATER SUPPLY INTAKE
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

DECEMBER 21, 2007
REVISED JUNE 30, 2009

KLEINFELDER
Bright People. Right Solutions.

2001 Arch-Airport Road, Suite 100
Stockton, CA
95206

p| 209.948.1345
f| 209.234.4700
kleinfelder.com

File No. 77229.G01
June 30, 2009

Mr. Rich Stratton, P.E.
HDR Engineering, Inc.
2365 Iron Point Road, Suite 300
Folsom, CA 95630

Subject: **Geotechnical Services Report (Revised)**
Delta Water Supply Intake
Empire Tract
San Joaquin County, California

Dear Mr. Stratton:

Kleinfelder is pleased to present the results of our geotechnical services performed for the proposed Delta Water Supply Intake facility to be located on Empire Tract in San Joaquin County, California. The accompanying report includes background information regarding the anticipated construction, the purpose of our services, and scope of services provided. In addition, discussions regarding our investigative procedures and the site conditions encountered during our field exploration are presented. Finally, geotechnical conclusions and recommendations are provided for project design and construction. The appendices of the report include logs of borings, summaries of laboratory test calculations and excerpts from reports for the current and previous investigations completed for the site. We have also included an information sheet published by ASFE. Our firm is a member of ASFE, and we feel this sheet will help you better understand geotechnical engineering reports.

We appreciate the opportunity to provide our services for this project. If you have questions regarding this report or if we may be of further assistance, please contact us.

Sincerely,

KLEINFELDER WEST, INC.

REGISTERED PROFESSIONAL ENGINEER
CARL FRANCISCO HENDERSON
No. 71115
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

Carl Henderson, Ph.D., CE, No. 71115
Area Manager

Reviewed by:

REGISTERED PROFESSIONAL ENGINEER
RONALD TERRY HEINZEN
No. 388
Exp. 3-31-11
GEOTECHNICAL
STATE OF CALIFORNIA

Ron Heinzen, G.E., No. 388
Vice President, Project Management

CFH:lr 4c: Client

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APPENDIX

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER06085.0MRP

GEOTECHNICAL SERVICES REPORT
PROPOSED DELTA WATER SUPPLY INTAKE
STOCKTON, CALIFORNIA

1.0 INTRODUCTION

In this report we present the results of our geotechnical services performed for a proposed intake facility to be located on Empire Tract in San Joaquin County, California. The site location relative to existing streets and waterways is shown on Plate 1.

We understand that design of the proposed development is currently underway and final grading and structure criteria are not available as of this writing. On a preliminary basis, we understand the project will include the widening of the existing levee in order to construct the new intake facility. Facility construction will include two intake structures, various auxiliary pump and electrical station structures, a new access road, and pavement and storage areas. The proposed intake structures will be supported on deep foundations, with the east intake being constructed first. The west intake structure is for future expansion.

Preliminary grading plans and existing conditions indicate that cuts and fills during earthwork are anticipated to be moderate (as much as 25 feet in vertical extent). Cuts for the intake structure will require dewatering and the use of temporary shoring. New fill will be required for the widening of the existing levee to the north.

A plan showing the existing site topography is presented on Plate 1. In the event this description of structural or grading is inconsistent with the final design criteria, our firm should be contacted prior to final design in order that we may update our recommendations as needed.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to explore and evaluate the subsurface conditions at various locations on the site in order to develop recommendations related to the geotechnical aspects of project design and construction.

The scope of our services was outlined in our proposal dated December 11, 2006 (Proposal No. STO6P417) and included the following:

- A visual site reconnaissance to investigate the surface conditions at the project site
- A field investigation that consisted of drilling borings and conducting cone penetration tests (CPT) within the area of the proposed development to explore the subsurface conditions
- Laboratory testing of representative samples obtained during the field investigation to evaluate relevant physical and engineering parameters of the subsurface soils
- A review of selected literature regarding the known geology and seismicity of the project area
- A review of a preliminary geotechnical study (2005) completed by AGS, Inc. for the Delta Water Supply Project, and review of a test levee investigation (1962) completed by the Department of Water Resources (DWR)
- Evaluation of the data obtained and an engineering analysis to develop our geotechnical conclusions and recommendations
- Preparation of this report which includes:
  - ➢ A description of the proposed project
  - ➢ A description of the field and laboratory investigations
  - ➢ A summary of the geologic conditions within the project area

- A description of the surface and subsurface conditions encountered during our field investigation
- Conclusions and recommendations related to the geotechnical aspects of the project design and construction
- A vicinity map/boring location plan, and
- Appendices that include logs of borings, summaries of laboratory test results, and excerpts from reports for the current and previous investigations completed at the site.

3.0 PREVIOUS GEOTECHNICAL INVESTIGATIONS

A preliminary geotechnical study (2005) for the proposed Delta Water Supply Project was performed by AGS, Inc. As a part of this investigation, two test borings (B-19 and B-20) were drilled for the "landside" portion of the intake facility. Three borings (B-21, B-22, and B-23) were drilled approximately 80 to 120 feet off shore in the San Joaquin River from the southwest point of Empire Tract. Test boring locations are presented on Plate 1. Logs of borings and laboratory test results for this investigation are presented in Appendix C.

DWR completed an investigation in 1962 for the existing levee location. As a part of this investigation, predicted settlement of underlying foundation peat soils was compared to actual field measurements taken during and after embankment (levee) construction. Various drainage improvement schemes were installed and evaluated within the foundation soil in order to facilitate "faster" consolidation settlement within peat. These drainage schemes included:

- Horizontal sand drains at 10 foot centers
- Vertical sand drains (average 19 feet deep, 18-inch diameter) at 10, 14 and 20 foot centers
- Sand blankets and trenches

It was determined that most of the settlement took place shortly after loading. Although variable, about 1/3 of the total settlement occurred during the first week, and after two months, the rate of settlement slowed considerably. Often, over half of the measured surface settlement was observed in the lowest third of the soft, peaty soil. Excerpts from this study, including laboratory and field vane shear test results, are presented in Appendix D.

4.0 CURRENT FIELD AND LABORATORY INVESTIGATIONS

4.1 FIELD INVESTIGATION

The subsurface conditions at the site were explored for the current investigation between April 19 and May 2, 2007, by drilling three borings to depths ranging from about 30 to 71½ feet and advancing two CPT's to depths of approximately 49½ to 70 feet below existing grade. Two of the borings (B-1 and B-2) and the CPT's were located on the existing levee crown. The third boring was located at the landside toe of the levee. The approximate boring and CPT locations are presented on Plate 1.

Borings B-1 and B-2 were advanced to approximately 71½ feet using a CME 75 truck-mounted drill rig and rotary wash drilling methods. Boring B-3 was advanced to approximately 30 feet using a Simco 2400 truck-mounted drill rig equipped with 4½-inch O.D. solid-stem auger. During the drilling operations, penetration tests were performed in accordance with ASTM D-1586 at regular intervals using a Modified California Sampler to evaluate the relative density of coarse-grained (cohesionless) soil and to retain soil samples for laboratory testing. A pocket penetrometer was used to evaluate the consistency of fine-grained (cohesive) soil samples retained. In the absence of pocket penetrometer test results, the consistency of fine-grained soils was estimated from penetration tests. The penetration tests were performed by initially driving the sampler 6 inches into the bottom of the bore hole using a cathead or automatic system with a 140 pound trip-hammer falling 30 inches to penetrate loose soil cuttings and "seat" the sampler. Thereafter, the sampler was progressively driven an additional 12 inches, with the results recorded as the corresponding number of blows required to advance the sampler 12 inches, or any part thereof. A representative with our firm maintained a log of the borings and visually classified the soils encountered according to the Unified Soil Classification System (see Plate A-1 of Appendix A) Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance and brought to our Stockton laboratory for testing.

The CPT's were performed by John Sarmiento & Associates Cone Penetration Services by hydraulically pushing a 1.4-inch diameter Dutch Cone Penetrometer into the subsurface soils using a truck-mounted, 20-ton ram system. During penetration, the cone or tip resistance and sleeve friction resistance is recorded on a nearly continuous basis to the depth of exploration. Based on published correlations, the data obtained is used to estimate stratigraphy, soil type, groundwater depth, and in situ soil parameters such as undrained shear strength and standard penetration (N) values.

A key to the Logs of Borings is presented on Plate A-2 of Appendix A. The Logs of Borings are presented on Plates A-3, A-4, and A-5 of Appendix A. CPT results are presented on Plates A-6 through A-13 of Appendix A. The borings and CPT's were located in the field by visual sighting and pacing from existing site features; therefore, the locations shown on Plate 1 should be considered approximate. The penetration resistance (blows/foot) shown on the logs of borings represents field penetration that has not been corrected for overburden pressure, sampler size, hammer type, borehole diameter, rod length, sampling method or any other correction factor.

4.2 LABORATORY INVESTIGATION

Laboratory tests for the current investigation were performed in accordance with current ASTM standards on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of natural moisture content, in-place density, grain-size distribution, percent soil passing the #200 sieve, plasticity, consolidation potential, undrained shear strength, consolidated drained shear strength and organic content of the materials encountered. In addition, pH, minimum resistivity, sulfate concentration and chloride concentration tests were performed on a near-surface soil sample to evaluate the general corrosivity of the soils to buried concrete and ferrous metals.

The results of laboratory tests are summarized on Plate A-14 in the Appendix A. Unconfined compressive strength, direct shear and consolidation test results are presented on Plates A-15 through A-21. Results from analytical corrosion tests performed by STL Sacramento are presented on Plates A-22 to A-37. This information, along with the field observations, was used to prepare the final test boring logs. Results from gradation testing are presented on Plates A-14A and A-14B.

5.0 SITE CONDITIONS

5.1 SURFACE CONDITIONS

At the time of our field exploration, the existing levee crown was approximately 8 to 9 feet above mean sea level at the project location. Over a horizontal distance of about 100 feet, the levee sloped to a landside toe elevation of approximately -5 feet. The landside slope ranged between 4:1 (horizontal:vertical) to 5:1. The waterside slope was much steeper, at 2:1 or less. The landside slope of the levee was covered with native vegetation; the waterside toe was protected with riprap. A dock existed on the west side of the levee, with various documentation indicating it has been there for over 50 years. A drainage ditch ran along the landside toe of the levee. The crown of the existing levee was approximately 20 feet wide.

5.2 SUBSURFACE CONDITIONS

The subsurface conditions encountered at the levee in test borings B-1 and B-2 consisted predominantly of gravel along the crown of the levee underlain by a combination of loose to medium-dense, fine- to coarse-grained silty sand or silt and medium-stiff to stiff clay to about 7 to 10 feet. Below the upper 10 feet, soft to medium-stiff organic silts and clays were encountered, underlain by 20 to 25 feet of very-loose/soft peat. Beneath the peat was medium-dense to dense silty sand and "clean" sand with occasional interbedded stiff clays and silts within the stratigraphy of the soil to about 71½ feet. The soil encountered in boring B-3 completed in the area of the landside toe of the levee consisted of a mix of medium-stiff/loose, fine-grained sand, silt, and clay underlain by soft, highly-organic silt followed by approximately 12 feet of very-soft/very-loose peat. Beneath the peat was another very-soft layer of organic silt followed by fine-grained clayey sand, "clean" sand, and silty sand to about 30 feet. There was an approximate 12-foot difference in elevation between the borings on the crown of the levee and the boring in the area of the levee toe.

Test boring B-3 was checked for the presence of groundwater during and immediately following drilling operations. Groundwater or seepage was encountered at approximately 4 feet. The first two borings were rotary wash borings, consequently groundwater levels were not recorded. Groundwater elevations and soil moisture conditions within the project area will vary depending on seasonal rainfall, irrigation practices, land use, water level in the adjacent river, and/or runoff conditions not apparent at the time of our field investigation. The evaluation of such factors is beyond the scope of this investigation.

Detailed descriptions of the subsurface conditions encountered during our current field investigation are presented on the Logs of Borings, Plates A-3, A-4, and A-5 of Appendix A.

5.3 SOIL LIQUEFACTION

5.3.1 General

Liquefaction describes a phenomenon in which saturated soil loses shear strength and deforms as a result of increased pore water pressure induced by strong ground shaking during an earthquake. Dissipation of the excess pore pressures will produce volume changes within the liquefied soil layer, which can be manifest at the ground surface as settlement of structures, floating of buried structures, failure of retaining walls and/or lateral migration (lateral spreading), and extensional ground cracking of liquefied material. Factors known to influence liquefaction include soil type, structure, grain size, relative density, confining pressure, depth to groundwater, and the intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated, loose sandy soils.

5.3.2 Liquefaction Evaluation

A liquefaction analysis was performed based on the CPT data, assuming a groundwater depth of 4 feet below the crown of the levee, a peak ground acceleration of 0.15g, an earthquake magnitude of 7.0, and empirical methods developed by Robertson and Wride (1998) as summarized by the NCEER Liquefaction Workshop expert panel (Youd, et al., 2001) with modifications proposed by Seed (2003). The peak ground acceleration and earthquake magnitude used in our analysis was obtained from recommendations provided in the AGS, Inc. 2005 report. The most conservative result of our analysis (CPT-2) indicated there is the potential for seismic settlement within sand at depths between 33 to 34 feet (approximate elevation -25 to -26 feet) below existing levee crown. Using an empirical method proposed by Tokimatsu and Seed (1987), we estimate that the maximum cumulative settlement at the top of the upper most liquefiable sand layer could be in the range of about 1/4 inch, with a differential settlement of approximately 1/8 inch. In our opinion, these values are low and can be accommodated by the proposed structures.

5.3.3 Ground Surface Disturbance

Another major concern during an earthquake is some form of ground surface disturbance or ground failure. The ground failure can be in the form of sand boils, small ground fissures, ground oscillation such as buckled pavements, curbs, broken pipelines, etc., and lateral ground displacement. One of the major reasons for ground surface disruption is insufficient cover thickness of a non-liquefiable layer over a liquefiable layer (Ishihara, 1985; Youd and Garris, 1995). Ground surface disruption estimates have been performed using Youd and Garris (1995). The results of our analysis indicate that ground surface disruption is not likely during a seismic event.

5.3.4 Lateral Spreading

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material or sensitive clays. This phenomenon typically occurs adjacent to free faces such as creek channels, sloughs, harbors, and canals. Because the potentially liquefiable layer (elevation -25 to -26) is below the slough channel and the proposed intake structures are pile supported, the potential impact of lateral spreading is considered low.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

Based on our findings, it is our professional opinion that the site should be suitable from a geotechnical standpoint for support of the proposed intake facility provided the recommendations contained herein are incorporated into the project design. Given the site conditions encountered, we believe a deep foundation system will be necessary to provide adequate support for the anticipated structural loading of the main intake structures. Auxiliary pump and electrical station structures not connected to the main intake housing structures may be supported on conventional spread foundations. The primary consideration identified from a geotechnical standpoint is settlement. Specific conclusions and recommendations regarding the geotechnical aspects of design and construction are presented in the following sections.

6.2 CONSTRUCTION SEQUENCING

6.2.1 Site Stripping and Grubbing

Prior to general site grading, existing vegetation, organic topsoil, and any debris should be removed and disposed of outside the construction limits. Deeper stripping may be required where concentrations of organic soils are encountered during site grading. Stripped topsoil may be stockpiled and reused for landscape purposes. This material (less any green vegetation), however, could be thoroughly mixed with the levee fill provided the organic content of the mixture does not exceed 5 percent by dry weight.

6.2.2 Levee Widening Foundation Preparation

Prior to placement of levee fill, a minimum 4-foot deep toe key should be excavated into the native soils approximately below the proposed widened landside toe (Section 6.2.3). The keyway would be excavated in an effort to remove a portion of the soft, compressible and weak organic clay/silt, peat, buried debris, or other deleterious materials that lie below the proposed levee widening area. Excavations below this depth will likely be difficult due to wet and unstable soil conditions. A representative from Kleinfelder should observe the keyway prior to backfill. Any organic clay/silt, peat, debris, or other deleterious materials should be removed and replaced with suitable engineered fill. The keyway should be at least 15 feet wide at the bottom or a width equal to ½ the vertical slope height, whichever is greater, with the bottom inclined down and back into the slope at 2 percent. It is possible that the base of the keyway will be very moist and unstable to heavy scraper type equipment. Track equipment or excavators may be needed to complete the lower portion of the keyway. As filling progresses, benches should also be cut into the existing levee slope to reduce the possibility of forming a slippage plane between the existing soil and new fill and to allow new fill compaction on a relatively horizontal plane. Each bench should consist of a level terrace at least 5 feet wide with a minimum and maximum rise to the next bench of 1 and 2 feet, respectively. A levee widening detail is presented on Plate 3. A phased fill section and preliminary grading schedule are presented on Plate 5.

6.2.3 Levee Widening Embankment Fill

The proposed landside slope of the widened levee will be constructed at a 4:1 slope. Preliminary plans indicate that the north to south distance from the edge of the existing levee road (near water) to the toe of the proposed landside levee widening is approximately 240 feet. The widened levee will encroach on an existing wetlands which is being relocated to the landside of the proposed levee toe. In order to make future modifications to the widened levee without encroaching on the relocated wetlands, an 85-foot wide berm will be constructed at the levee toe at about elevation -5 feet. As measured from the projection of the 4:1 slope, the bench is approximately 50 feet wide as requested by Reclamation District 2029. In addition to acting as a separator between the widened levee and the relocated wetlands, the berm will also help with the levee stability by increasing the resisting force against slope failure. Similar to the levee slope, the edge of the berm should also be constructed at a 4:1 slope. A typical levee widening detail is presented on Plate 3.

The embankment slopes should be constructed by overfilling and trimming back or by track walking with a sheepsfoot compactor to provide a firm, well-compacted slope face. As a minimum, the exposed landside levee embankments should be vegetated to reduce the potential for erosion and gullying from surface flows due to precipitation. All exposed embankments should be planted with deep-rooted vegetation (i.e., grass) suited to the area. The embankments should be inspected periodically for erosion and repaired immediately if adverse conditions are detected.

Relatively large magnitudes of settlements in foundation (peat) soils are anticipated under the proposed embankment loads. For approximately 15 feet of fill placed on the existing landside slope, the total estimated settlement (not counting creep) is in the range of 3 feet. This assumes the fill is underlain by up to 15 feet of compressible peat. The anticipated earthwork quantities should take into account this compression of the underlying soils. Locations where 15 feet of fill coincides with 15 feet of peat constitutes the worst case condition. In our opinion, the magnitude of settlement representing the "average" condition would likely be in the range of ⅔ or ¾ of 3 feet, or approximately 2 to 2¼ feet. Interestingly, the 1963 DWR report indicated that 3 feet of settlement occurred with the placement of approximately 6 feet of fill. In our opinion, the peat soils at this location have experienced additional consolidation since the DWR study and therefore the rate of consolidation is less. It must be noted that long-term creep settlement of peat soils (due to particle degradation and disintegration) will not be arrested by these measures. Therefore, periodic maintenance of paved areas should be anticipated as is required throughout the San Joaquin Delta.

It is anticipated that much of the consolidation settlement in foundation peat soils will occur relatively quickly, based on our analysis that the footprint of the levee widening is located within the locations of the vertical and horizontal drains noted in excerpts of the DWR report presented in Appendix D. The only portion of the new fill not underlain by these drainage features is the middle portion just south of the landside top of slope. We considered the installation of additional sand drains in this area but were concerned with the impact on levee seepage.

Monitoring of settlement and pore pressure dissipation within foundation soils during levee construction should be performed using instrumentation such as settlement platforms, vibrating wire settlement cells, slope inclinometers, survey points (optical surveys), and vibrating wire piezometers. A description of this instrumentation program is provided in Section 6.6.

6.2.4 Dewatering

Preliminary plans indicate that the bottom elevation of the main intake structures will be located at elevation -15 feet and will be designed assuming a minimum waterside elevation of 0.8 feet. Boring data indicate that peat soils will be present at the foundation level (elevation -15 feet). If exposed below the groundwater level, these soils could become unstable or even "quick" due to upward seepage forces, losing their ability to support foundations and maintain stable excavations. Therefore, some form of dewatering will be necessary to permit the required excavation for the intake structure. The sequence of dewatering is generally left to the contractor. In other words, once the permanent and temporary sheeting is in place, dewatering could occur before or after excavation. Groundwater should be lowered and continuously maintained at least 3 feet below the bottom of the proposed excavation until the structure and backfill weight are adequate to provide uplift resistance and backfill is complete at least 3 feet above the normal stabilized water level.

Based on our experience, well point or deep well systems that are installed around the periphery of the excavation are the most common dewatering systems in use today to permit stable construction in the dry. The well points are small screen wells attached to riser pipes and connected at the surface by a common header that is further attached to a well point pump. The pump removes the water that drains to the well points. A single stage of well points can lower the water table approximately 15 feet. The most practical use of the conventional well point is where the excavation is less than about 25 to 30 feet deep and no artesian pressures are encountered. Deep well systems are similar to conventional water wells and are used to dewater deep pervious soil requiring high pumping rates or to relieve artesian pressures. Pumping is performed by means of turbines or submersible pumps. The primary disadvantage of these methods is typically cost.

Based on gradation data presented on sheets A-14A and A-14B of Appendix A, preliminary quantities of groundwater flow have been estimated by Kleinfelder for a range of permeability from 0.001 to 0.01 feet per minute (FPM). In our analysis, two aquifers were considered: a shallow aquifer immediately below the peat (approximate elevations -30 to -60 feet) and a deep aquifer (approximate elevations -60 to -80 feet). Considering the proximity of the river to the proposed construction, a pumping test performed on a well that could later be used for dewatering may be warranted to better estimate groundwater flows.

- **OPTION #1 - SHEET PILES TERMINATING INTO CLAY AT APPROXIMATE ELEVATION -60 FEET**

  This analysis assumes a total hydraulic cut-off from the shallow aquifer by steel sheet piles. Integrity of the sheet pile seals will dictate how much water leaking through the sheets must be pumped from sumps inside the excavation (inside of sheets). It has been our experience that these flows may range between 10 gallons per minute (GPM) for tightly sealed sheets to 200 GPM for poorly sealed sheets. Flow from wells on the outside of the excavation (outside of sheets) would range from 50 to 250 GPM (0.001 to 0.01 FPM hydraulic conductivity). For comparison purposes, at least 8 wells would be necessary, with the wells about 60 to 70 feet deep and 30 inches in diameter.

- **OPTION #2 - SHEET PILES TERMINATING AT APPROXIMATE ELEVATION - 40 FEET**

  This analysis assumes only half of the shallow aquifer is hydraulically cut off by the steel sheet piles. Groundwater is assumed to flow into the excavation (inside of sheets) between the bottom of the sheet piles and the top of the clay. Flow from wells within the excavation (inside of the sheet piles) would likely range from 25 to 120 GPM but require at least 8 wells, 50 feet deep.

It is suggested that at least one observation well be constructed in the shallow aquifer to monitor drawdown during construction. For added factor of safety, construction of an observation well in the deep aquifer may also be considered. Additional samples for grain-size distribution may be obtained during observation well construction and/or during construction of a dewatering pumping test well. Hydraulic conductivity is better estimated with grain size data and even more reliably with a pumping test.

The dewatering system for the project should be designed by an experienced consultant hired by the contractor to appropriately filter the native soils and reduce any dispersion, piping, and associated loss of ground. The dewatering consultant should also account for any improvements near the project such as structures, buried pipelines, etc. The lowering of the groundwater table produces additional effective stresses on the soils below the original water table. These additional pressures will cause consolidation of the soils and settlement of the nearby levee improvements. The amount of additional consolidation is dependent on the type of dewatering system selected by the contractor. As a guide, every foot of draw down is roughly equivalent to 6 inches of additional surcharge loading. Settlement estimates can be made by reviewing the information in Section 6.2.3, Levee Widening Embankment Fill. As noted in this section, we anticipate that settlement will occur relatively quickly due to the drainage features installed many years ago and by the dewatering wells themselves. Kleinfelder can assist in this design upon request.

A survey program before and during dewatering as described in Section 6.6 will be helpful to monitor settlements in adjacent improvements.

6.2.5 Intake Excavation

Following dewatering and the installation of shoring (design discussed in Section 6.5.2), excavation for the main intake structures can occur. During initial earthwork, we anticipate exposed peat soils at the base of the excavations will not be fully drained by the dewatering and will be soft and/or pliant. To facilitate construction on top of these peat soils, the contractor should cover the bottom of the excavations with 12 to 18 inches of Class 2 permeable material overlain by 12 to 18 inches of clean, 1-inch diameter, crushed gravel (drain rock) that is firmly tamped into place. The Class 2 permeable material will act as a filter while the crushed gravel will serve to stabilize the base of the excavation and also serve as a collection medium for seepage that can be removed by pumping from shallow sumps (2 to 3 feet deep) at the edge of the excavations. This should also serve to provide a stable work platform for pile installation. We do not recommend that a filter cloth be placed under these aggregate materials as pipe piles still must be driven or vibrated through the base of excavation.

6.3 MAIN INTAKE STRUCTURE FOUNDATIONS

6.3.1 General

We understand that the main intake structures will be supported on piles. Initially, several pile types were considered for structural support. In recent years, precast, prestressed concrete displacement piles have been used extensively in the delta area. Specifically, 12-, 14-, and/or 16-inch square precast piles have been specified. Piles of this type are fabricated locally. From a cost standpoint, these piles have traditionally been less expensive than steel pipe piles or H-piles. However, this type of pile is susceptible to damage during difficult driving and is difficult to work with on sites where variable depth piles are required since the piles must be cast to predetermined lengths. Also, preliminary analysis has indicated that due to the presence of a thick peat layer between approximate elevations 4 to -30 feet, sufficient lateral resistance may not be obtained from these piles.

As a result of the above concerns, 2-foot diameter (approximately ¾ inch thickness) concrete filled pipe piles are being considered. In California, these piles are commonly called CISS (cast-in-steel shell) piles. CISS piles can be driven either open or closed end. Closed end CISS piles can be driven conventionally from the pile head, bottom driven with a mandrel, or by a mandrel engaged at both the pile head and toe. Open end CISS piles are usually driven from the pile head. Piles that are driven open ended require internal clean out to allow the pile to be filled with concrete. Before concrete placement, steel reinforcement and uplift resisting dowels can be added, as necessary.

Close end CISS piles are displacement piles and have the effect of increasing lateral ground stresses. Open end CISS piles are nondisplacement piles and often have low driving resistances in soft clay or loose sand deposits. Suitable situations for CISS piles include the marine conditions encountered for this project. Advantages of CISS piles include the possible use of hardened tips to drive through dense formations, piles can be inspected, piles are easy to splice or cut, they can be filled with concrete, and they can develop high vertical and lateral capacity. Typically, a disadvantage of these types of piles is that they can be expensive. Preliminary guide pile specifications for CISS piles are provided in Appendix E.

6.3.2 Axial Pile Capacities

The Federal Highway Administration's DRIVEN computer software program was used to estimate axial pile capacities. The DRIVEN program follows the methods and equations presented by Nordlund (1963, 1979), Thurman (1964), Meyerhof (1976), Cheney and Chassie (1982), Tomlinson (1980, 1985), and Hannigan, et al. (1997). Generalized subsurface soil profiles were created based on the following considerations and assumptions for our analysis. A summary of our DRIVEN analysis for axial pile capacity is presented in Appendix B.

- Kleinfelder borings B-1 and B-2 were used to model the subsurface soil profile for approximate elevations 9 to -65 feet. The water table was assumed to be at elevation 4 feet.

- AGS, Inc. borings B-19, B-20, B-22, and B-23 were used to model the subsurface profile for approximate elevations -65 to -80 feet.

- Kleinfelder laboratory test results (direct shear and unit weights) were used to model material and strength properties of soil.

- The upper two generalized soil layers were considered to provide negligible capacity for axial pile design.

- Pile capacity is developed based on a combination of side shear and toe resistance. Due to the presence of isolated clay and silt lenses noted in the boring logs, the shear strength parameters obtained from laboratory testing were reduced in our soil model.

The subsurface soil model used for the analysis is being summarized below:

Approximate Elevation (feet)	Generalized Soil Layer and Description	Average Uncorrected Blow Counts	Average Total Unit Weight (pcf)	Average Effective Unit Weight (pcf)
9 to 4	(GM, SM, CL, ML,)	8 (B-1) 11 (B-2)	114.6 (B-1) 120.8 (B-2)	114.6 (B-1) 120.8 (B-2)
4 to -25 (B-1) 4 to -30 (B-2)	(PT, OH, OL)	2 (B-1) 3 (B-2)	66.8 (B-1) 70.6 (B-2)	4.4 (B-1) 8.2 (B-2)
-25 to -65 (B-1) -30 to -65 (B-2)	(SM, SP, SC with some CL and ML)	30 (B-1) 24 (B-2)	125.0 (B-1) 118.8 (B-2)	62.6 (B-1) 56.4 (B-2)
-65 to -80	(SM, SP-SM with some ML)	37	130.0	67.6

The following allowable axial pile capacity table may be used for foundation design assuming the piles penetrate within the sandy strata encountered between approximate elevations -55 to -75 feet. A factor of safety of 2.5 was used in estimating the allowable axial capacity of the piles. We emphasize that tip elevations presented below are for preliminary design purposes. If closed end CISS piles are selected, it is suggested that actual criteria be developed on the basis of indicator pile data discussed in Section 6.3.5.

Allowable Pile Capacity versus Pile Tip Elevation

Loading Condition	Approximate Pile Tip Elevation (feet)	Allowable Capacities – Tons	
		24-inch Open End Pipe Pile (CISS)	24-inch Closed End Pipe Pile (CISS)
Allowable Axial Load	-55	71	74
Allowable Uplift Load		*53*	*55*
Allowable Axial Load	-60	83	87
Allowable Uplift Load		*62*	*65*
Allowable Axial Load	-65	96	100
Allowable Uplift Load		*72*	*75*
Allowable Axial Load	-70	151	155
Allowable Uplift Load		*113*	*116*
Allowable Axial Load	-75	171	174
Allowable Uplift Load		*128*	*130*

A review of experimental observations for driven group piles in sand indicate for spacing of about 3 pile diameters or greater, the pile capacity of the group may be assumed to equal the sum of individual piles without the group effect. Reductions in pile capacity for consideration of group action are unnecessary, provided piles are spaced no closer (center-to-center) than 3 times the side dimension of the pile. Furthermore, the weight of the pile cap concrete extending below final subgrade and the weight of each pile may be disregarded in determination of the net compressive load transmitted to the supporting soils. The indicated uplift pile capacities are based upon the assumption that the piles will be properly reinforced to transfer pullout forces to the pile tips.

Maximum total and differential settlement of an individual pile designed and constructed in accordance with the recommendations provided herein are expected to be in the range of ½ to ¾ inch and ¼ to ½ inch, respectively, not including elastic compression of the pile under design loads.

6.3.3 Negative Skin Friction (Downdrag)

Negative skin friction or downdrag occurs when a soil layer surrounding a portion of the pile shaft settles more than the pile. This condition most commonly occurs where a soft or loose soil stratum located anywhere above the pile tip is subjected to new compressive loading, such as for surcharging. If the soft or loose soil layer settles after the pile has been installed, the skin friction adhesion developing in this zone is in the direction of the soil pulling downward on the pile. Extra loading is thus imposed onto the pile. Accordingly, if piles are driven soon after new fills or surcharge fills are placed and settlement of the compressible soil is not complete, it will be necessary to subtract negative skin friction values from the total load that the piles can support in order to know what building loads can be carried.

It is our professional opinion that negative skin friction will not have a significant influence on design of the proposed structures due to the required construction sequencing of the project. In addition, long term creep of peat surrounding the upper portion of piles should not significantly add to axial loading upon piles. If negative skin friction is still a concern in design, a common practice is to provide the pile with a protective sleeve or coating for the section that is embedded in the settling soil. For piles driven through the crushed rock/Class 2 permeable material noted above, some of this protective sleeve/coating may be removed during pile driving operations.

6.3.4 Lateral Resistance

Resistance to lateral loads will be provided by the resistance of the soil against the piles and by the bending stiffness of the piles themselves. The proposed CISS piles supporting intake structures were evaluated using the computer program LPILE. The following soil criteria were used in the analysis. There are limitations to the flexibility of certain parameters used in the LPILE or COM624P program; therefore, a generalized soil profile was used in the analysis.

Depth Interval, elevation (feet)	Soil Type	Soil Type (P-Y Criteria)	Effective Unit Weight, pcf (pci)	Angle of Internal Friction, degree	Undrained Shear Strength, psf	Strain at 50% Stress Level (e_{50})	Static Soil Modulus (k), pci
9 to 4	Loose or soft mixture of sand, clay and silt	Sand above the water table	115	30	NA for analysis	NA for analysis	25
4 to -30	Soft Peat	Soft clays below the water table	6	NA for analysis	200 psf	0.02	100
-30 to -65	Medium Dense Sand	Sands below the water table	60	33	NA for analysis	NA for analysis	90
Below -65	Medium Dense to Dense Sand	Sands bellow the water table	67.6	35	NA for analysis	NA for analysis	110

Based on the results of the computer program LPILE Plus 4.0 by ENSOFT, Inc., the following table presents estimated ultimate lateral resistance capacities and maximum induced bending moments for 24 inch diameter pipe piles piles. Deflection, moment, and shear diagrams for this analysis are presented in Appendix B.

Pile Size (inches)	Lateral Resistance (kips)		Maximum Induced Moment (kip-foot)		Depth to Maximum Moment (feet)		Depth to Zero Moment (feet)	
	Fixed Head	Free Head	Fixed Head	Free Head	Fixed Head	Free Head	Fixed Head	Free Head
Top of Pile Elevation at +10 Feet – ½-Inch Deflection								
24	44	25	-335	+130	0	12½	49	38
Top of Pile Elevation at -17 Feet – ½-Inch Deflection								
24	54	18½	-525	+220	0	15	31	28½

Pile Size (inches)	Lateral Resistance (kips)			Maximum Induced Moment (kip-foot)			Depth to Maximum Negative (1) and Positive (2) Moment (feet)			Depth to Zero Moment (feet)		
	75% Fixity	50% Fixity	25% Fixity	75% Fixity	50% Fixity	25% Fixity	75% Fixity	50% Fixity	25% Fixity	75% Fixity	50% Fixity	25% Fixity
Top of Pile Elevation at +10 Feet – ½-Inch Deflection												
24	39	35	30	-250 +85	-170 +95	-85 +110	(1)0 (2)24	(1)0 (2)21	(1)0 (2)17	55	55	55
Top of Pile Elevation at -17 Feet – ½-Inch Deflection												
24	46	37	27	-400 +245	-260 +230	-125 +220	(1)0 (2)17	(1)0 (2)16	(1)0 (2)16	43	43	43

- Maximum Negative Moment
+ Maximum Positive Moment

Notes regarding the tables above:

1. Lateral resistance values and moments were provided for pile-head deflections of ½ inch. Lateral resistances and moments for other deflections and/or pile diameters can be provided upon request.

2. Lateral resistance values are for a single, isolated pile subjected to a short-term lateral load. The resistance of a single, isolated pile subjected to a sustained lateral load may be taken as 80 percent of the values provided above. Additionally, the lateral resistance of each individual pile within a pile group should be reduced by the factors provided below to account for group action effects (in direction of load only).

Center-to Center Pier Spacing (Diameters)	Lateral Resistance Reduction Factor
6	1.0
5	0.9
4	0.8
3	0.7
2	0.6

3. The above values were obtained using an assumed pile length of at least 40 feet. Piles in excess of 40 feet should have essentially the same lateral resistances and moments.

4. Depths specified above are depths below the bottom of the pile cap (if present) or lowest, final adjacent grade, whichever is lower.

5. The above values of maximum moment are due only to a lateral load (equal to the lateral resistance) imposed at the pile head.

6. Depth to Zero Moment refers to the first point of counterflexure for a free-head pile and the second point of counterflexure for a fixed-head pile.

Resistance to lateral loads (including those due to wind or seismic forces) may also be provided by passive resistance of the soil against pile caps. The passive pressures available in peat, undisturbed native soils (excluding peat) and engineered fill may be taken as equivalent to pressures exerted by fluids weighing 100, 300, and 400 pounds per cubic foot (pcf), respectively.

6.3.5 Indicator Piles

We suggest that if closed end CISS piles are used, at a minimum, indicator piles be driven by the contractor at each end of the main intake structures. During the indicator pile program, a dynamic pile driving analyzer should be used to monitor the driving stresses in the piles and to evaluate the pile capacity during pile retaps after the piles have had an opportunity to set up. A minimum of 1 day setup time should be allowed between the driving of the indicator piles and the beginning of the retap. The longer the setup time, the more reliable the information to estimate the long term pile capacities. A indicator pile program will serve to establish the following:

- Estimates of production pile lengths
- Drivability of production piles
- Performance of pile driving equipment
- Variations in driving resistance relative to depth and location of piles

The indicator piles should be spliced/extended at least 10 feet longer than the design length for monitoring equipment and for additional penetration into the bearing materials. Following driving of indicator piles, we can provide minimum tip elevations and assist the general contractor and piling contractor in determining production pile splice lengths. Production piles should not be allowed to be cut to design elevation until the results of the indicator pile program are available, about 2 weeks after completion of the pile retap.

6.3.6 Additional Considerations

Based on our experience, a pile-driving hammer having a minimum rated energy of 50,000 but not more than 75,000 foot-pounds per blow is recommended. To avoid overstressing the piles during driving, plywood cushions with appropriate thickness or some other equivalent cushion should be used at all times. It is possible that some piles may encounter refusal prior to reaching the design depths, especially in pile groups with minimum pile spacing. Refusal criteria will be determined by the Geotechnical Engineer based on the results of the suggested indicator pile program and the actual hammer used for the project. The acceptability of piles reaching refusal above the design tip elevation will need to be assessed on an individual basis during the indicator pile program and the production pile driving.

All individual piles within a pile group should be monitored for vertical heave during driving of adjacent piles. The pile top elevation should be determined immediately upon completion of the driving of each pile and checked after all piles within the group have been installed. Heaved piles should be redriven to the design driving criteria.

6.4 AUXILIARY STRUCTURE FOUNDATIONS

Auxiliary structures not connected to the main intake structures may be supported on shallow, reinforced concrete spread footings founded on undisturbed native soil (excluding organic and peat soils), engineered fill, or a combination of both. A net allowable bearing pressure of 2,000 pounds per square foot (psf) for dead plus sustained live loading may be used to size column and continuous footings supported by these materials. This assumes at least 5 feet of engineered fill or moderately dense native soil is present below footings. If not, the allowable bearing pressure would need to be reduced. Kleinfelder should be contacted if this situation arises. A one-third increase in the allowable bearing pressure may be applied when considering short-term loading due to wind or seismic forces. Even though computed footing dimensions may be less, continuous bearing wall and column footings should have minimum widths of 12 and 24 inches, respectively, to facilitate hand cleaning of the footing excavations and reduce the potential for localized punching shear failure. All footings should be embedded at least 18 inches below the lowest final adjacent subgrade[1].

Total settlement of an individual shallow foundation will vary depending on the plan dimensions of the foundation and the actual load supported. Based on the anticipated/assumed foundation dimensions and loads, we estimate maximum total and differential foundation settlements should be on the order of ¾ and ½ inch, respectively. This assumes that survey measurements indicate that fill, if placed below the structure, has completed primary consolidation. Rigid structures such as the proposed 10 to 12 foot high concrete masonry wall around the auxiliary pump and electrical station, should be designed with sufficient control joints to accommodate this differential movement.

Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. If shrinkage cracks appear in the footing excavations, the

[1] *Within this report, subgrade refers to the top surface of undisturbed native soil, native soil compacted during site preparation, or engineered fill.*

excavations should be thoroughly moistened to close all cracks prior to placement of concrete. All footing excavations should be observed by the project Geotechnical Engineer just prior to placing steel or concrete to confirm that the recommendations contained herein are implemented during construction.

The structural engineer should evaluate footing configurations and reinforcement requirements to account for loading, shrinkage, and temperature stresses. At a minimum, continuous footings should be reinforced with at least two No. 4 reinforcement bars, one top and one bottom, to provide structural continuity and permit spanning of local subgrade irregularities.

Resistance to lateral loads (including those due to wind or seismic forces) may be determined using an coefficient of friction of 0.45 between the bottom of cast-in-place concrete foundations and the underlying soils. This again assumes that foundations will be bear on engineered levee fill or moderately dense non organic native soil. Lateral resistance for foundations can alternatively be provided by the passive soil pressure acting against the vertical face of the footings. The passive pressures available in undisturbed native soils (excluding organic and peat soils) and engineered fill may be taken as equivalent to pressures exerted by fluids weighing 300 and 400 pcf, respectively. These two modes of resistance can be combined. However, since horizontal movement is required to mobilize passive resistance, the allowable at-rest frictional resistance should be reduced by 50 percent.

Lateral resistance parameters provided above are ultimate values. Therefore, a suitable factor of safety should be applied for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project Structural Engineer.

6.5 LATERAL EARTH RETAINING STRUCTURES

6.5.1 General Retaining Wall Design

Retaining walls should be designed to resist the earth pressure exerted by the retained, compacted backfill plus any additional lateral force due to surcharge loading, i.e., construction equipment, foundations, roadways, etc., at or near the wall. The following equivalent fluid earth pressures are recommended.

Earth Pressure Condition	Backfill Slope	Drained Lateral Earth Pressure (pcf)	Undrained Lateral Earth Pressure (pcf)
Active	Level	35	80
At-Rest	Level	55	95

Retaining walls capable of deflecting a minimum of 0.1 percent of their height at the top may be designed using the active earth pressure. Retaining walls incapable of this deflection or that are fully constrained against deflection should be designed for the at-rest earth pressure. Where uniform surcharge loads are located within a lateral distance from constrained and unconstrained retaining walls equal to the wall height, 45 and 30 percent of the surcharge load, respectively, should be applied uniformly over the entire height of the wall.

If the friction between the wall and backfill is considered in design (Coulomb earth pressures), a coefficient of friction of 0.45 should be used for free draining, granular backfill.

Above an assumed high tide elevation of 5 feet, wall backfill should be free draining, and provisions should be made to collect and dispose of excess water away from the wall structure. Wall drainage may be provided by either a minimum 1-foot wide layer of clean drainrock/gravel enclosed by geosynthetic filter fabric or by prefabricated drainage panels (such as Miradrain, Enkadrain, or an equivalent substitute) installed per the manufacturer's recommendations. In either case, drainage should be collected by perforated pipes and directed to a sump, storm drain, weep holes, or other suitable location for disposal. Drainrock should consist of clean, durable stone having 100 percent passing the 1-inch sieve and zero percent passing the No. 4 sieve. Synthetic filter fabric should conform to the requirement in Section 88 "Engineering Fabrics" of the Caltrans Standard Specifications. Caltrans Class 2 Permeable Material meeting the requirements of Section 68-1.025 of the Standard Specifications can be substituted for the clean drainrock and filter fabric following review and approval by the Geotechnical Engineer. The upper 12 inches of engineered backfill above the wall drainage should consist of native soils, concrete, asphalt concrete, or similar backfill to reduce surface drainage into the wall drain system.

All backfill should be placed and compacted in accordance with recommendations provided herein for engineered fill. During grading and backfilling adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall or within a lateral distance equal to the wall height, whichever is greater, to avoid overstressing of the wall. Within this zone, only hand operated equipment ("wackers," vibratory plates, or pneumatic compactors) should be used to compact backfill soils.

Expansive soils, i.e., clays, plastic silts, and/or clayey sands, should not be used for backfill against retaining walls unless approved by the geotechnical engineer. The wedge of nonexpansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 1:1 or flatter.

Once the dewatering system is turned off following construction, upward buoyant forces can be resisted by the weight of the wall structure and the weight of the soils within a cone defined by a project line extending outward and upward from the foundation edge of the structure at an angle of 30 degrees from vertical. The following soil unit weights may be used for design.

Approximate Elevation, feet	Unit Weight Above Water Table (pcf)	Unit Weight Below Water Table (pcf)
9 to 4	115	52.6
4 to -30	68	6
-30 to -65	122	60
Below -65	130	67.6

6.5.2 Permanent and Temporary Shoring

Shoring should be designed to resist the earth pressure exerted by the retained soil plus any additional lateral force due to surcharge loading, i.e., construction equipment, foundations, roadways, etc., at or near the shoring. A conventional shoring system consisting of closely-spaced soldier piles or sheet piles may be used. Required embedment depths for permanent and temporary sheet piles should be determined using methods for evaluating sheet pile walls based on the principles of force and moment equilibrium. A computer program commonly used to estimate the required depths for sheet piling is the software program SPW911, version 2, by Pilebuck International.

To account for three-dimensional effects, the passive pressure may be assumed to act on an area two times the width of the embedded portion of the pile, provided adjacent piles are spaced at least three diameters, center-to center. Based on dewatering concerns and uplift potential, permanent and temporary sheet piles should be installed to a tip elevation of at least -45 feet. If pumping tests are performed prior to sheet pile installation, further evaluation of required pile tip elevations may be warranted.

The following equivalent fluid earth pressures are recommended assuming a level ground surface:

Drained Conditions

Approximate Elevation, feet	Effective Unit Weight (pcf)	Active Earth Pressure Condition (pcf)	At-Rest Earth Pressure Condition (pcf)	Passive Earth Pressure Condition (pcf)
9 to 4	115	35	55	300
4 to -30	68			100
-30 to -65	122			350
Below -65	130			400

Undrained Conditions

Approximate Elevation, feet	Effective Unit Weight (pcf)	Active Earth Pressure Condition (pcf)	At-Rest Earth Pressure Condition (pcf)	Passive Earth Pressure Condition (pcf)
9 to 4	115	80	95	300
4 to -30	6			50
-30 to -65	60			180
Below -65	68			240

Thirty percent of any areal surcharge placed adjacent to the shoring may be assumed to act as a uniform pressure against the shoring. Special cases, such as combinations of sloping and shoring or other surcharge loads, may require an increase in the design values recommended above.

Riprap will be used for erosion protection in front of permanent sheet piles at the water side face of the levee. A common riprap specification used by reclamation districts in this area is approximately 2 feet of 18 inches minus quarry stone underlain by approximately 1 foot of 6 inches minus bedding fill. A typical gradation specification for the larger stone is as follows:

Weight of pieces in pounds	Percent small by weight
300	100
200	90-100
100	50-90
50	25-50
20	5-25
5	0-5

This material should also have a minimum specific gravity of 2.60, a maximum loss per ASTM C88 (Sodium Sulfate) of 15 percent, and a maximum loss per ASTM C535 (Abrasion) of 50 percent.

The gradation specification for 6 inches minus bedding stone is as follows:

Sieve/Sizes (inches)	Percent Passing
6	100
5	85-95
4	80-95
3	75-85
2	60-75
1½	55-70
1	35-55

Sieve/Sizes (inches)	Percent Passing
¾	25-40
½	15-30
⅜	15-25
No. 4	0-15

Detailed guidelines regarding placement, equipment requirements, and measurement can be furnished if needed.

Alternate rock sizes for riprap can be selected by the contractor based on rock availability and costs provided these minimum rock sizes are met. The specific riprap gradation plan provided by the contractor should be reviewed by the Geotechnical Engineer. We anticipate that riprap will be placed from a barge and configured using an excavator or drag line.

The Contractor should consult with an experienced consultant to design the required temporary shoring systems prior to earthwork activities. HDR and Kleinfelder will be responsible for design of permanent sheet pile systems. Horizontal and vertical movements of the shoring system should be monitored by a surveyor and the results reviewed by the Project Engineer. Detailed recommendations should be provided during the design phase after a review of the planned shoring system.

6.5.3 Deadman Anchors

Deadman anchors should be used to provide additional resistance for shoring systems through the development of passive pressure. These anchors are suitable for use where they can be installed below the level of the original ground. Deadman anchors may be constructed in short lengths or in one continuous beam. For this project, it is assumed that short deadman anchors will be installed near the ground surface. For design purposes, the following equation may be used for design assuming all deadman anchors will be installed in compacted embankment levee fill with a minimum embedment depth of 3 feet:

$$Tult \leq L(Pp - Pa) + qu(H \times H)$$

where:

Tult = ultimate Capacity of Deadman, lb/ lineal feet
L = length of the deadman anchor, feet
Pp = Total passive pressure, lb/lineal feet
Pa = Total Active pressure, lb/lineal feet
H = height of deadman anchor
Qu = unconfined compression strength of the soil = 2,000 psf
γ = unit weight of soil = 120 pcf
Kp = coefficient of passive pressure = 3.333
Ka = coefficient of active pressure = 0.28
angle of internal friction of soil = 28 degrees

Plate 4A presents a typical detail for use in determining ultimate capacity for design of deadman anchor.

Deadman anchorage is useless if it is located within the sliding wedge of the backfill. Full capacity of a deadman is available when:

- The active sliding wedge of the backfill does not interfere with the passive sliding wedge in front of the deadman.
- The deadman is located below the slope line starting from the bottom of the sheetpiling and making an angle, equivalent to the angle of internal friction of the soil, with the horizontal.

Plate 4B presents a detail showing where the location of deadman will mobilize it's full capacity. Deadmen should be located outside of the estimated sliding wedge indicated on the Plate.

6.5.4 Horizontal Spring Constants for Deadman Anchors

Per our discussions with HDR, we understand that spring constants will be used in a finite element/finite difference model for the design of deadman anchors in conjunction with the design for permanent sheet pile walls. We have analyzed spring constants for a rigid rectangular base resting on elastic half space, per an equation (Gorbunov-Possadov, 1961) presented in "Soil Mechanics," by Lambe and Whitman. Our spring constant sensitivity analysis for various assumed deadman anchor sizes is presented in Appendix B. There are many variables in the analysis of spring constants. For our analysis the following was conservatively assumed:

- The deadman will be supported primarily on native clays and silts in the levee with the possibility of some engineered fill at the top.
- For a mixture of clay, silt, sand, and peat, a modulus of elasticity (E) of 5,000 psi was selected. This value is representative of a medium stiff clay.
- A poisson's ratio (μ) of 0.4 was selected. This value lies between commonly assumed poisson's ratios for saturated and unsaturated medium stiff clay.
- A shear modulus (G) of 1,000 psi was selected.

The geometry of the deadman anchor directly influences the estimated spring constant for the above mentioned equation. Accordingly, the following spring constants were calculated for a range of dimensions. We would be glad to provide additional spring constants for specific design dimensions upon request.

B (ft)	L (ft)	Approximate Spring Constant (lbs/in)
3	5	124,000
3	10	180,000
5	10	226,000
5	15	282,000
7	15	327,000

Most design charts indicate that passive pressure is fully mobilized after a lateral displacement of about 2 percent of the height of the resisting structure. For added factor of safety and to remain within the "elastic" range of the system, we generally recommend an allowable of ½ to ¾ this amount. It is important to note that the bottom of sheet piles will be terminated in sand, but the upper portion will be located in the fill material described above or peat which would have a much lower spring constant. Therefore the soil structure interaction of the sheet pile system will be more complicated than the soil structure interaction of the deadman.

6.5.5 Horizontal Spring Constants for Sheet Pile Walls Design

In accordance with "Foundation Analysis and Design, Fifth Edition, pages 504 and 505" by Bowles, the horizontal modulus of subgrade reaction (horizontal spring constants for sheet pile walls design) for sand may be assumed to increase with depth and corresponding overburden stress. Assuming this condition is applicable to sand and peat layers, the following table summarizes estimates of horizontal modulus of subgrade reaction in the passive pressure region below the dredge line in front of the proposed sheet pile walls:

Depth Interval, Elevation (feet)	Soil Type	Horizontal Modulus of Subgrade Reaction (pci)
-17	Peat	7
-18	Peat	7
-19	Peat	7
-20	Peat	7
-21	Peat	7
-22	Peat	7
-23	Peat	7
-24	Peat	7
-25	Peat	7
-26	Peat	7
-27	Peat	8
-28	Peat	8
-29	Peat	8

Depth Interval, Elevation (feet)	Soil Type	Horizontal Modulus of Subgrade Reaction (pci)
-30	Peat	8
-31	Medium Dense Sand	159
-32	Medium Dense Sand	170
-33	Medium Dense Sand	180
-34	Medium Dense Sand	191
-35	Medium Dense Sand	202
-36	Medium Dense Sand	213
-37	Medium Dense Sand	224
-38	Medium Dense Sand	235
-39	Medium Dense Sand	246
-40	Medium Dense Sand	257
-41	Medium Dense Sand	268
-42	Medium Dense Sand	279
-43	Medium Dense Sand	290
-44	Medium Dense Sand	301
-45	Medium Dense Sand	312
-46	Medium Dense Sand	323
-47	Medium Dense Sand	334
-48	Medium Dense Sand	345
-49	Medium Dense Sand	356
-50	Medium Dense Sand	367
-51	Medium Dense Sand	378
-52	Medium Dense Sand	389
-53	Medium Dense Sand	400
-54	Medium Dense Sand	411
-55	Medium Dense Sand	422
-56	Medium Dense Sand	433
-57	Medium Dense Sand	443
-58	Medium Dense Sand	454
-59	Medium Dense Sand	465
-60	Medium Dense Sand	476

6.6 INSTRUMENTATION AND MONITORING

The following geotechnical instrumentation and monitoring should be considered during and after construction:

- At least 11 vertical settlement platforms installed within the foundation soil and new levee embankment. This will serve to obtain settlement information for foundation soils under new levee embankment loads.

- At least 4 vibrating wire settlement cells, each located near one of the settlement plates. These will be installed in order to correlate with survey measurements and to act as a replacement monitoring point should any of the poles for the plates be damaged during construction.

- At least 4 locations should be fit with 3 vibrating wire piezometers within the foundation soil to monitor pore pressure dissipation under new levee embankment loads. The piezometers should be installed near vertical settlement platforms.

- At least two lines of survey points with 5 points per line per each of the five grading operations. In addition, upon completion of each embankment, survey points should be placed per the Geotechnical Engineer's field recommendation for a total of at least 7 points.

- At least 7 horizontal slope inclinometers to measure deflections near shoring excavations and within proposed levee.

- During the indicator pile program, a dynamic pile driving analyzer (PDA) should be used to monitor the driving stresses in the piles and to evaluate the pile capacity during pile retaps after the piles have had an opportunity to setup.

- Vibration monitoring of the levee should occur during pile driving operations with a vibration monitoring device such as the Blastmate III.

The recommended instrumentation plan is presented on Plate 5.

6.7 LEVEE DRAINAGE

A chimney drain should be placed along the landside top of levee as shown on Plate 7A. The purpose of the drain is to intercept any seepage that may occur should settlement of the peat material cause cracks to develop in the engineered fill. This drain should be 3 feet wide from elevation -8.5 feet to +7 feet and extend along the proposed levee realignment. The chimney drain should be filled with appropriate filter material. The filter soil should fall within the gradation band presented on Plate 6B. We understand that Vernalis Concrete Sand produced by Teichert Construction fits within the specified gradation band. It is likely that other suppliers can meet this criteria as well. Filter material should be compacted as engineered fill.

1-millimeter perforated collection pipes should be installed 6 inches above the base of the chimney drain to collect and mobilize seepage to outlet pipes. Non-perforated horizontal outlet pipes should be connected perpendicular to collection piping every 100 feet. The non-perforated piping should be placed at a 2 percent slope to discharge near the toe of levee or cutoff ditch. All collection and outlet piping should be 8 inches inner diameter. Levee drainage details are presented on Plate 7.

6.8 CONCRETE FLOOR SLABS FOR AUXILIARY STRUCTURES

6.8.1 Subgrade Preparation

All areas to support concrete floor slabs or engineered fill should be scarified to a depth of at least 12 inches, uniformly moisture conditioned to between 1 and 4 percentage points above the optimum moisture content, and compacted as engineered fill. Additional criteria regarding general earthwork are presented in Section 6.13.

6.8.2 Additional Considerations

The project Structural Engineer should provide the final design floor slab thickness and reinforcement requirements. Care should be taken to place, consolidate, and cure concrete in accordance with American Concrete Institute (ACI) standards and criteria.

Following rough grading, construction and trenching activities often loosen or otherwise disturb the subgrade soils. On occasion, this disturbance can lead to isolated movement of the subgrade soils following construction and cracking of the overlying slabs. Accordingly, loose/disturbed areas should be repaired and trench backfill should be properly compacted prior to placement of concrete.

For slab on grade floors supporting storage or light equipment loads where vapor transmission is not an issue, it is common to place approximately 6 inches of Class 2 aggregate base compacted to at least 90 percent relative compaction. The aggregate base provides added support for concentrated loads and less deflection at the slab joints.

6.9 ASPHALT CONCRETE PAVEMENTS

6.9.1 Subgrade Preparation

Following site stripping (if necessary), all subgrade soils to support the proposed new access road on the widened levee should be scarified to a minimum depth of 6 inches below the finished subgrade elevation, uniformly moisture conditioned to between 1 and 4 percentage points above the optimum moisture content, and compacted as engineered fill to at least 95 percent relative compaction. The subgrade soils should be in a stable, non-pumping condition at the time the reinforcement fabric and aggregate base materials are placed and compacted.

Concrete and related debris in the proposed lay down storage area may be left in place provided they are crushed, partially pulverized and spread out. The materials should be in a stable, non-movement condition at the time the reinforcement fabric and aggregate base materials are placed and compacted.

6.9.2 Pavement Sections

The proposed new access road and lay down storage area must accommodate increased construction and maintenance traffic. Pavement recommendations for the new access road and lay down storage area were developed in an effort to exceed the performance characteristics of the existing levee access road section. The following pavement section is recommended for the proposed new access road and lay down storage area.

- 3 inches of asphalt concrete
- 6 inches of Class 2 or recycled aggregate base.
- Aggregate base should be underlain by a Mirafi 600X reinforcement fabric or equivalent

The pavement section provided above is contingent on the following recommendations being implemented during and following construction.

- Aggregate base and asphalt concrete materials and placement methods should conform to the current Caltrans Standard Specifications. Class 2 or recycled aggregate should be compacted as engineered fill to at least 95 percent relative compaction.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet. Pavement sections should be isolated from intrusion of water at all locations where pavements are adjacent to irrigated landscaping or areas that may pond water. For long-term performance, pavement edge drains should be placed to collect water and to convey it to a storm drain or other drainage facility. As an alternative, although less preferable, edge barriers, such as concrete curbs, polyethylene membranes and the like, should be placed that extend a minimum of 4 inches below the aggregate base and into the subgrade in order to reduce the lateral migration of water into the pavement section. Additional details regarding these systems can be provided upon request.

- Periodic maintenance should be performed to repair degraded areas and seal cracks with appropriate filler.

The pavement sections provided above are based on the soil conditions encountered during our field investigation, our assumptions regarding final site grades, and limited laboratory testing. The actual pavement subgrade materials exposed during grading may differ from those tested because of earthwork operations or natural variations in soil conditions. A representative from our firm should observe subgrade conditions following rough grading.

6.10 SITE DRAINAGE

Foundation and slab performance depends greatly on how well runoff water drains from the site. Accordingly, positive drainage should be provided away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices without ponding. The drainage should be maintained both during construction and over the life span of the project.

6.11 SEISMIC DESIGN CONSIDERATIONS

6.11.1 CBC Seismic Design Criteria

The current building code is the 2001 CBC. However, the new 2007 CBC, to be enforced next year, will be based on the 2006 IBC and ASCE 7-05. Therefore, our seismic design parameters are based on the 2007 CBC.

The Maximum Considered Earthquake (MCE) mapped spectral accelerations for 0.2 second and 1 second periods (S_S and S_1) were estimated using Section 1613 of the 2007 CBC. The mapped acceleration values and associated soil amplification factors (F_a and F_v) based on 2007 CBC are presented in the table below. Corresponding site modified (S_{MS} and S_{M1}) and design spectral accelerations (S_{DS} and S_{D1}) are also included.

Ground Motion Parameters Based on 2007 CBC

Parameter	Value	2007 CBC Reference
S_S	0.998 g	Section 1613.5.1
S_1	0.339 g	Section 1613.5.1
Site Class	D	Table 1613.5.2
F_a	1.101	Table 1613.5.3(1)
F_v	1.722	Table 1613.5.3(2)
S_{MS}	1.099 g	Section 1613.5.3
S_{M1}	0.583 g	Section 1613.5.3
S_{DS}	0.733 g	Section 1613.5.4
S_{D1}	0.389 g	Section 1613.5.4

6.11.2 Seismically-Induced Earth Pressures

Buried walls will be subject to increased lateral earth pressures during seismic shaking. As an alternative to CBC design procedures, the increase in lateral earth pressure due to earthquake loading can be estimated using the Mononobe-Okabe theory as described by Seed and Whitman (1970).

The Mononobe-Okabe theory is based on the assumption that sufficient wall movement (unrestrained walls) occurs during seismic shaking to allow active earth pressure conditions to develop. In this approach, the total dynamic earth pressure can be divided into static and dynamic components. To estimate this pressure, a dynamic fluid earth pressure of 45 pcf should be added to the static active earth pressure and hydrostatic pressures and subtracted from the passive equivalent fluid earth pressure. The dynamic pressure component is distributed on the wall as an inverted triangle in shape with the maximum value at the top of the wall. The resultant of the earthquake-induced earth pressure may be assumed to act on the wall at a point (0.6 x wall height) above the base of the wall.

The application of dynamic earth pressures to below-grade rigid or restrained walls is currently the subject of wide debate in the geotechnical engineering profession and a wide range of acceptable design practices, with supporting literature, exist. We are not aware of a documented failure of a restrained below-grade wall founded in firm ground as the result of seismic ground shaking. Seed and Whitman (1970) indicated that for ground accelerations of 0.2g or less, many walls adequately designed for static earth pressures will have the capacity to withstand earthquake forces and, in many cases, additional seismic earth pressures need not be required in design. Based on our site specific seismic hazards analysis, the expected peak ground acceleration at the site is 0.2g or less for the UBE. Accordingly, in our professional opinion, restrained below-grade walls may be designed for at-rest pressures only with no dynamic component.

6.12 SOIL CORROSION

A representative soil sample was collected and tested for chloride and sulfate concentrations. The chloride and sulfate concentrations were determined by STL Sacramento to be 44.5 and 35.7 parts per million, respectively. Kleinfelder is not a corrosion consultant or expert. We understand that a corrosion engineer has been retained to design corrosion protection systems appropriate for this project.

6.13 GENERAL EARTHWORK

The following presents recommendations for general earthwork criteria. Previous sections should be reviewed for specific or supplemental earthwork recommendations.

6.13.1 Fill Materials

We anticipate that the majority of fill material will be imported, however, mixtures of the native sand, clay, and silt encountered in our borings, minus any material with more than 5 percent organics, debris, and/or other deleterious materials, should also be suitable for use as embankment fill provided they are placed and compacted as discussed in Sections 6.12.2 and 6.12.3. Fill material should fall within the shaded gradation band presented on Plate 6A and have a maximum Liquid Limit of 60, a minimum Plasticity Index of 8, and a maximum dry density of no less than 90 pounds per cubic foot (pcf) per ASTM D-1557. The dredge fill soils located on Roberts Island will likely meet this criteria once properly blended. The native sand soils will need to be mixed with either clay or silt prior to placement on the levees.

6.13.2 Engineered Fill

All fill soils required to bring the proposed levee to final grade should be compacted as engineered fill. Engineered fill should be uniformly moisture conditioned to between 1 and 4 percentage points above the optimum moisture content, placed in horizontal lifts less than 6 inches in loose thickness, and compacted to at least 90 percent relative compaction. Additional fill lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable. Discing and/or blending may be required to uniformly moisture condition soils used for engineered fill.

6.13.3 Unstable/Wet Soil

Based on our findings, groundwater levels could have an impact on grading operations at the site. Soils excavated near or below the water level will also be significantly above the optimum moisture content. If not accounted for, these conditions could seriously delay grading by causing an unstable subgrade and/or excavation condition. Typical measures to remediate unstable/wet soils include discing and aerating the soils during dry weather, mixing the soils with dryer materials, or removing and replacing the soils with an approved fill material.

Construction dewatering is discussed in Section 6.2.4. If groundwater is encountered, the magnitude of groundwater infiltration may also be reduced by limiting the lateral extent of keyway excavation, to approximately 50 feet, for example, at any one time.

Our firm should be consulted prior to implementing any remedial measure to observe the unstable/wet subgrade condition and provide specific recommendations. Prior to bidding, we suggest that the site be made available to potential bidders to explore the moisture condition of the existing levee toe fill materials. Earthwork contractors should include wet soil mitigation costs (if any) in their bids.

6.13.4 Temporary Excavations

Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Flatter slopes and/or trench shields may be required if loose, cohesionless soils and/or water are encountered along the slope face. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a lateral distance equal to one-third the slope height from the top of any excavation.

7.0 ADDITIONAL SERVICES

The review of plans and specifications, field observations, and testing by Kleinfelder is an integral part of the conclusions and recommendations made in this report. If Kleinfelder is not retained for these services, the client agrees to assume Kleinfelder's responsibility for any potential claims that may arise during construction. The actual tests and observations by Kleinfelder during construction will vary depending on type of project and soil conditions. The tests and observations would be additional services provided by our firm. The costs for these services are not included in our current fee arrangements.

As a minimum, our construction services should include observation and testing during site preparation, grading, and placement of engineered fill, observation of foundation excavations and pile installation.

8.0 LIMITATIONS

1. The conclusions and recommendations of this report are for design purposes for the Delta Water Supply Intake project as described in the text of this report. The conclusions and recommendations in this report are invalid if:

   - The assumed structural or grading details change
   - The report is used for adjacent or other property
   - Changes of grades and/or groundwater occur between the issuance of this report and construction
   - Any other change is implemented which materially alters the project from that proposed at the time this report was prepared

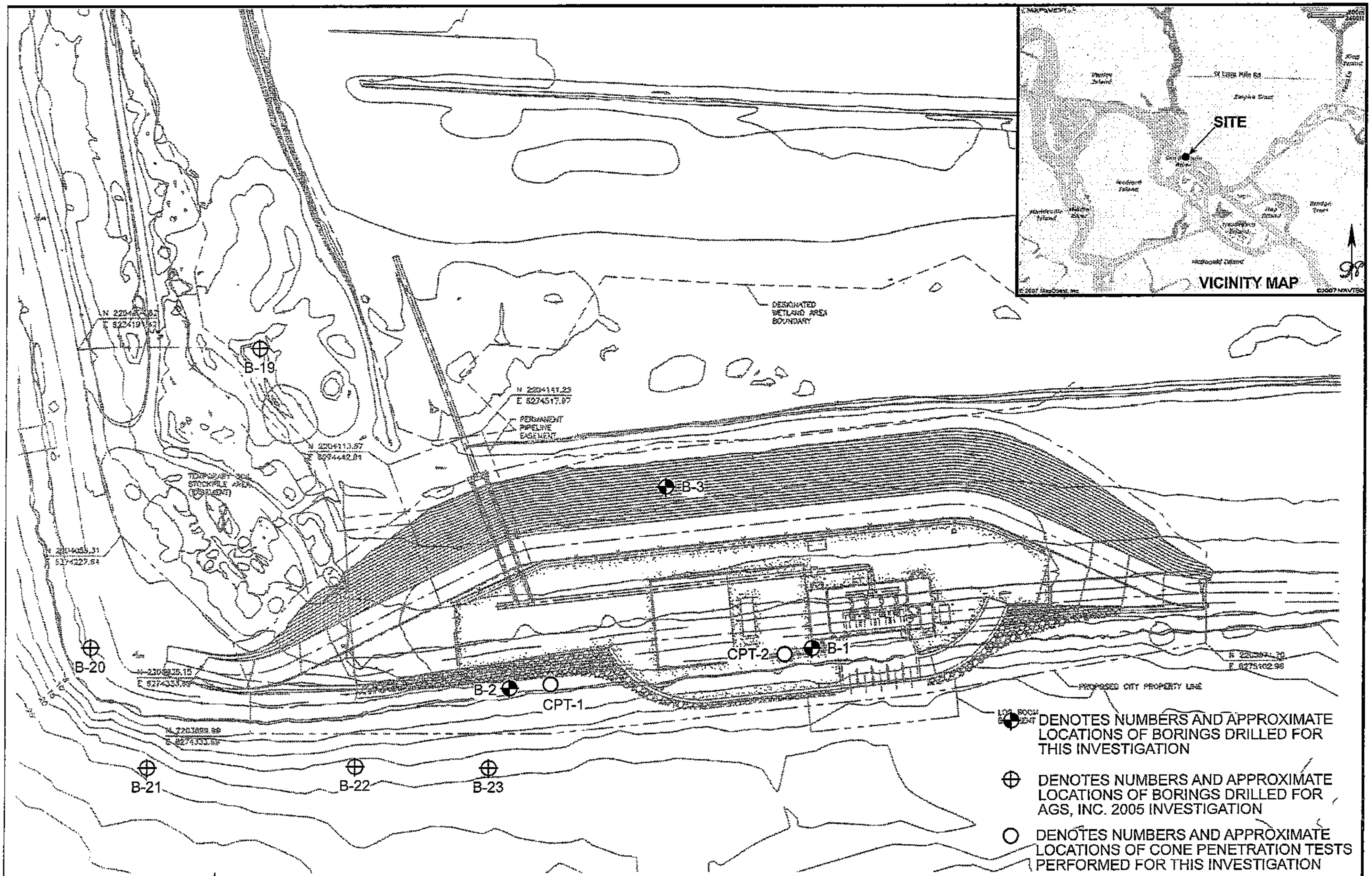
2. The conclusions and recommendations in this report are based on the borings drilled for this investigation. It is possible that variations in the soil conditions exist between or beyond the points of exploration, or the groundwater elevation may change, both of which may require additional investigations, consultation, and possible design revisions.

4. It is emphasized that we are not floor moisture proofing experts. We make no guarantee nor provide any assurance that the slab underlayment discussed in Section 6.8 will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. Qualified specialists with local knowledge of slab moisture protection systems, flooring design, and other potential components that may be influenced by moisture should be consulted.

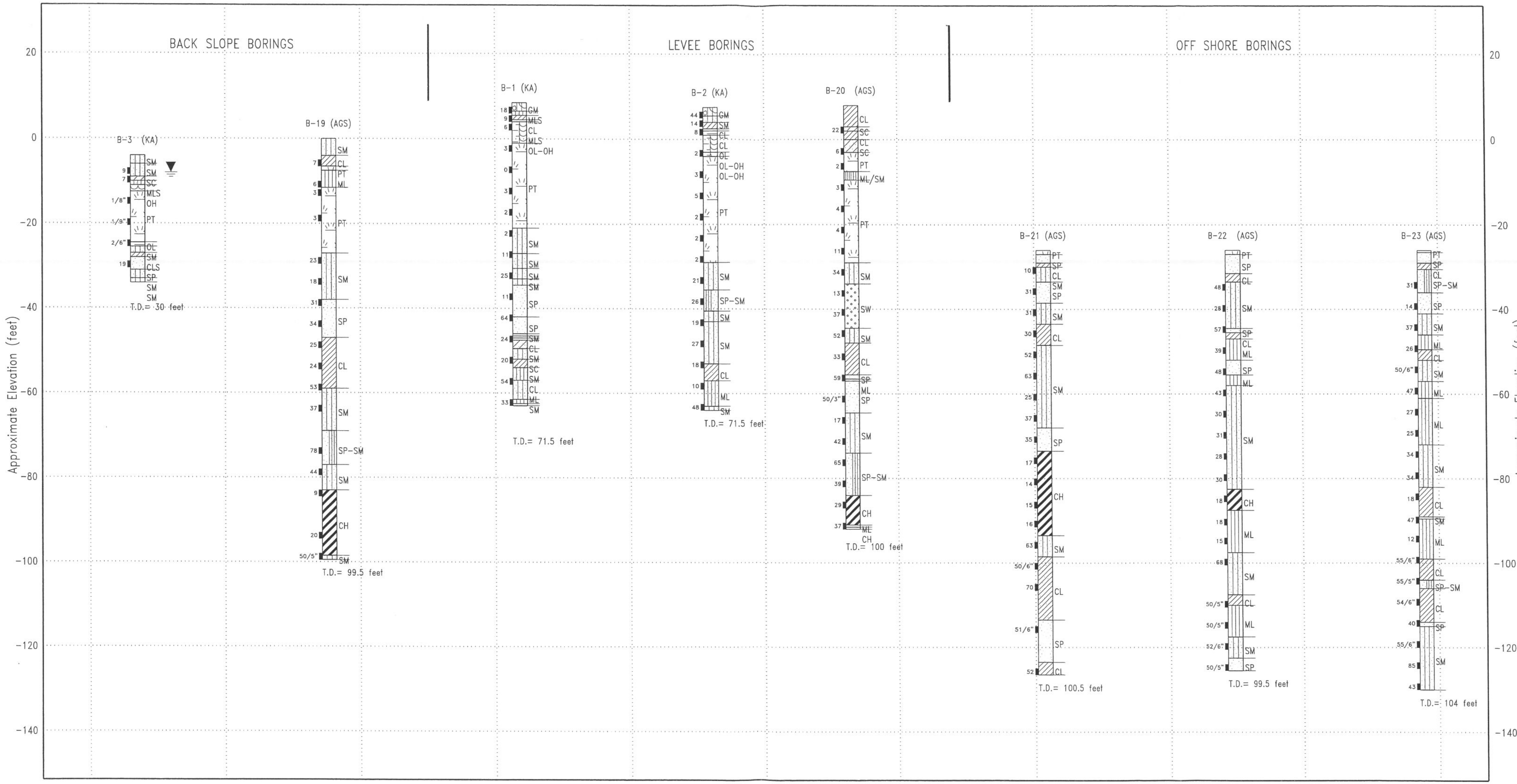
5. This report was prepared in accordance with the generally accepted standard of practice that existed in San Joaquin County at the time the report was written. No warranty, expressed or implied, is made.

6. It is the CLIENT'S responsibility to see that all parties to the project, including the designer, contractor, subcontractor, etc., are made aware of this report in its entirety.

7. This report may be used only by the client and only for the purposes stated within a reasonable time from its issuance, but in no event later than three years from the date of the report. Land use, site conditions (both on- and off-site), or other factors may change over time, and additional work may be required. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else, unless specifically agreed to in advance by Kleinfelder in writing, will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.



KLEINFELDER www.Kleinfelder.com	Project Number: 77229.G01	**VICINITY AND EXPLORATION PLAN MAP** **DELTA WATER SUPPLY PROJECT** **EMPIRE TRACT** **SAN JOAQUIN COUNTY, CALIFORNIA**	Plate 1
	Graphic Date: 6/22/09		
	Graphic By: G. GOMEZ		
	Checked By:		
	File Name: STO7D232r.FH11		



KA – Kleinfelder Borings

AGS – AGS, INC. Borings

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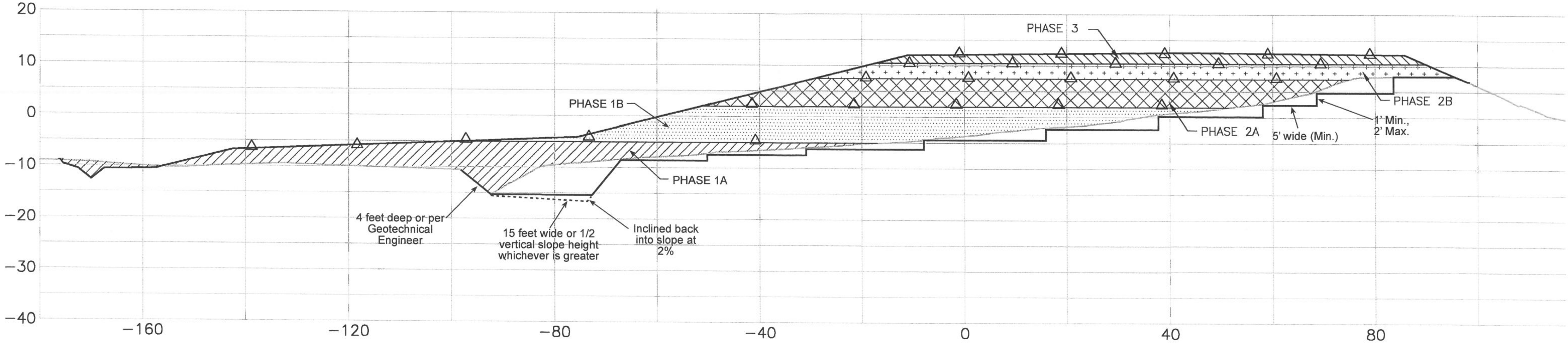
DATE PRODUCED: 6/22/09	FENCE DIAGRAM
PROJ. No.: 77229.G01	DELTA WATER SUPPLY PROJECT
DRAWN BY: G. GOMEZ	EMPIRE TRACT
CHECKED BY: C.H.	SAN JOAQUIN COUNTY, CALIFORNIA
FILE NAME: CROSS.CAD	

PLATE
2

LEVEE WIDENING DETAIL



NOTES:

ORGANIC CLAY/SILT, PEAT, DEBRIS, OR OTHER DELETERIOUS MATERIAL SHOULD BE REMOVED FROM KEYWAY AND REPLACED WITH ENGINEERED FILL

THE BASE OF KEYWAY MAY BE VERY MOIST AND UNSTABLE TO SCRAPER EQUIPMENT. TRACK EQUIPMENT OR EXCAVATORS MAY BE NEEDED TO COMPLETE THE LOWER PORTION OF THE KEYWAY.

THE MAGNITUDE OF GROUNDWATER INFILTRATION WITHIN THE KEYWAY MAY BE REDUCED BY LIMITING THE LATERAL EXTENT OF KEYWAY EXCAVATION FROM 25 TO 50 FEET AT ONE TIME.

NOT TO SCALE

KLEINFELDER www.Kleinfelder.com	Project Number: 77229.G01	LEVEE WIDENING DETAIL DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA	Plate 3
	Graphic Date: 6/22/09		
	Graphic By: G. GOMEZ		
	Checked By: C.H.		
	File Name: STO7D398.FH11		

where L = length of the deadman, ft;

P_p, P_a = total passive and active earth pressure, lb per lin. ft;

K_0 = coefficient of earth pressure at rest. It may be taken as 0.4 for design of deadman;

γ = unit weight of soil, pcf;

K_p, K_a = coefficients of passive and active earth pressure;

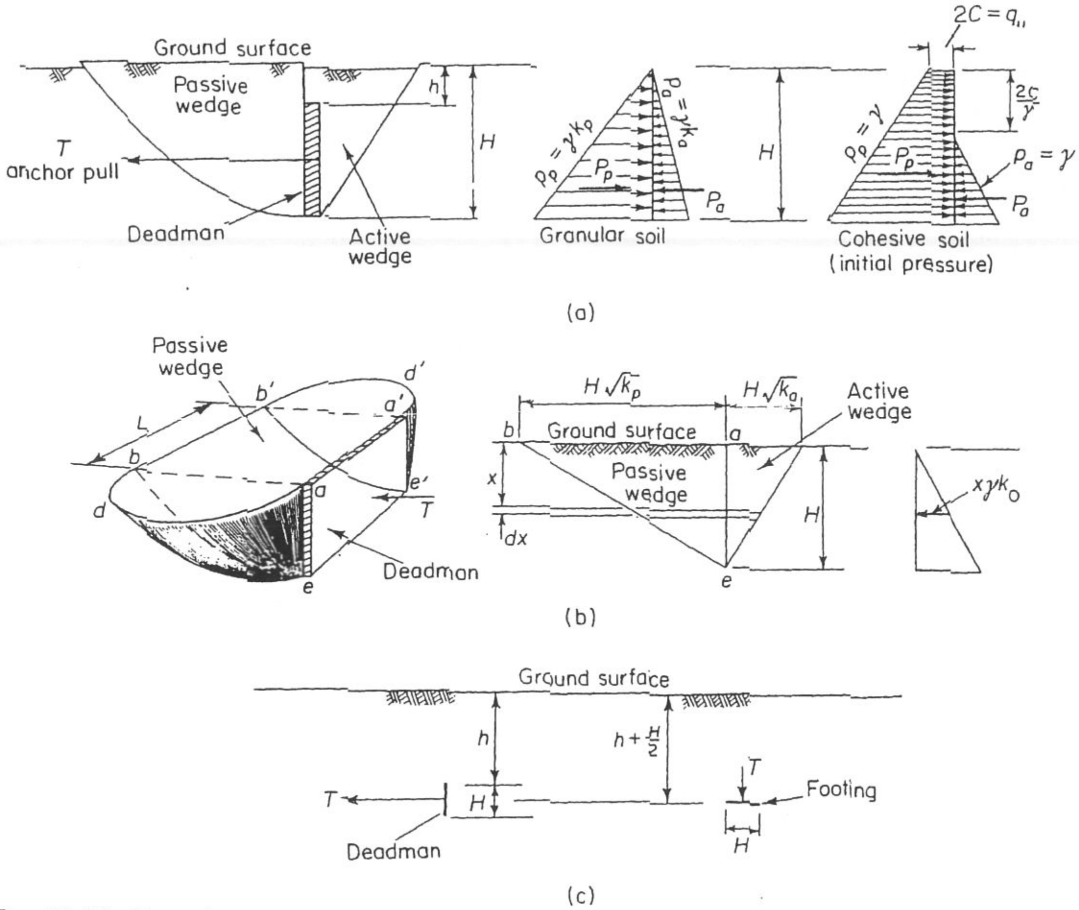


Fig. 12-20 Capacity of deadmen: (a) continuous deadmen near ground surface ($h/H < 1/3 \sim 1/2$); (b) short deadmen near ground surface; (c) deadmen at great depth below ground surface.

REFERENCE: "FOUNDATION DESIGN", BY WAYNE C. TENG, 1962

KLEINFELDER	Project Number: 77229.G01	DEADMAN ANCHOR DETAIL (ULTIMATE CAPACITY) DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA	Plate
	Graphic Date: 6/22/09		4A
	Graphic By: G. GOMEZ		
	Checked By: C.H.		
www.Kleinfelder.com	File Name: DEADMAN-A.FH11		

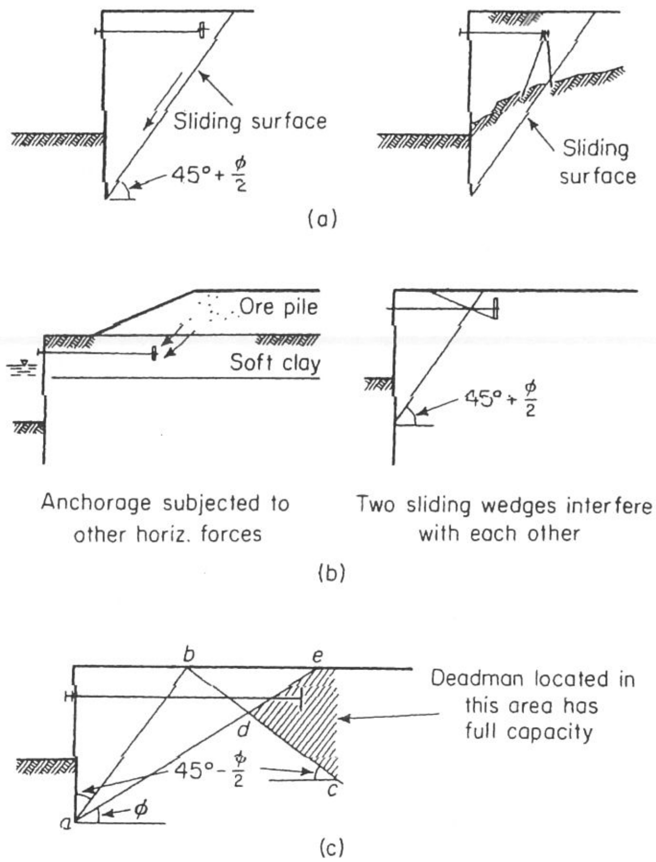
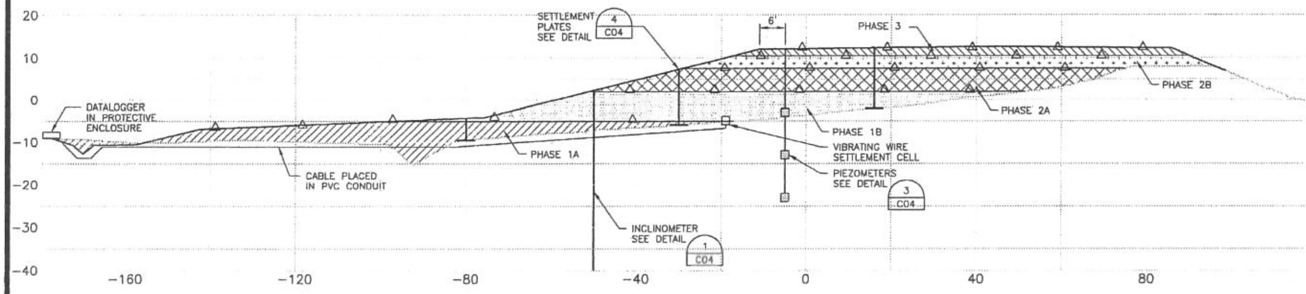


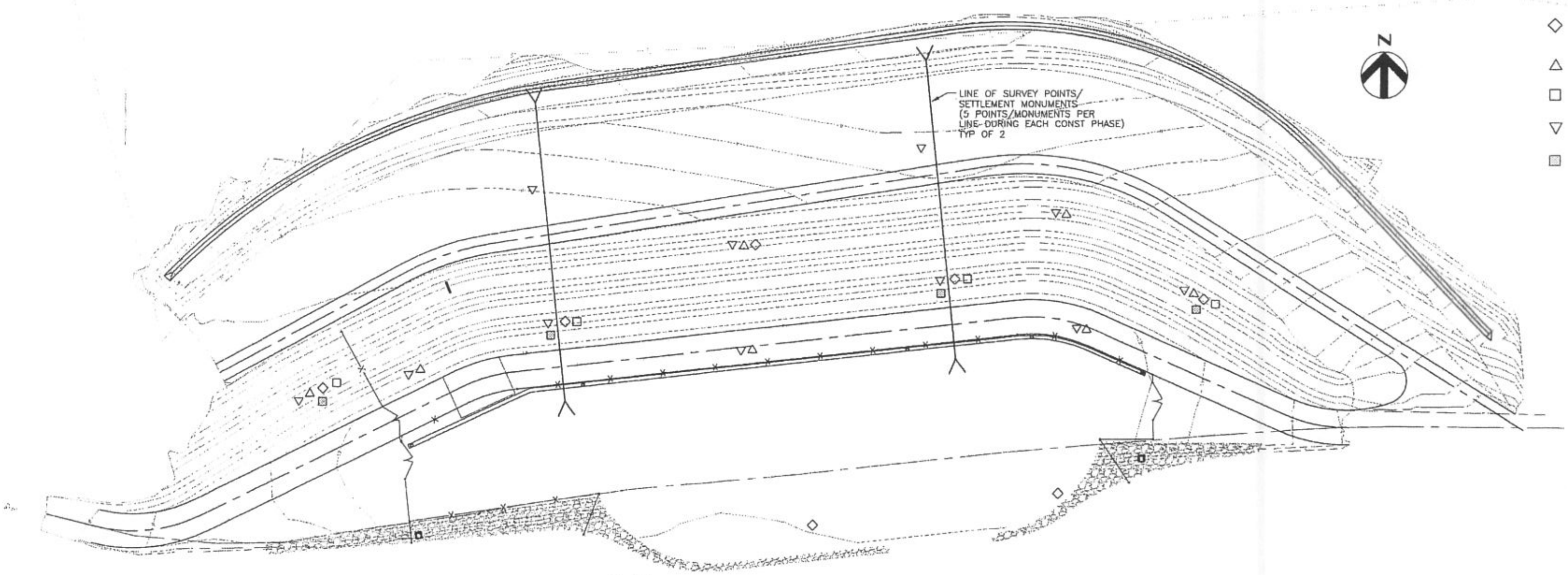
Fig. 12-21 Location of deadman: (a) offers no resistance; (b) efficiency greatly impaired; (c) full capacity.

REFERENCE: "FOUNDATION DESIGN", BY WAYNE C. TENG, 1962

KLEINFELDER www.Kleinfelder.com	Project Number: 77229.G01 Graphic Date: 6/22/09 Graphic By: G. GOMEZ Checked By: C.H. File Name: DEADMAN-B.FH11	**DEADMAN ANCHOR DETAIL (ANCHORAGE LOCATION) DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA**	Plate 4B



GRADING PHASE	DESCRIPTION	START DATE	COMPLETION DATE	APPROX. DEPTH / TOP ELEV
1A	TOE BERM AND KEYWAY	9/14/2009	10/2/2009	10'/−6.0
1B	BACKUP LEVEE BASE (YEAR 1)	10/12/2009	10/30/2009	7'/1.0
2A	BACKUP LEVEE (YEAR 2)	5/10/2010	5/28/2010	5.5'/6.5
2B	BACKUP LEVEE (YEAR 2)	6/7/2010	6/25/2010	3.0'/9.5
3	BACKUP LEVEE TOPOUT	7/5/2010	7/23/2010	2.5'/12.0



PLAN
1" = 40'

INSTRUMENTATION LEGEND:

- ◇ HORIZONTAL SLOPE INCLINOMETER (EMBEDDED TO BOTTOM ELEVATION OF −40 FT) SEE NOTE 1
- △ SURVEY POINTS / SETTLEMENT MONUMENTS SEE NOTES 5 AND 6.
- □ VIBRATING WIRE SETTLEMENT CELLS SEE NOTE 4
- ▽ VERTICAL SETTLEMENT PLATES SEE NOTE 3
- ▣ VIBRATING WIRE PIEZOMETERS (3 PER LOCATION, ELEVATIONS −3, −13, AND −23 FEET) SEE NOTE 2

NOTES:

1. HORIZONTAL SLOPE INCLINOMETERS: INSTRUMENTATION CONTRACTOR TO INSTALL INCLINOMETERS SUCH THAT THE BOTTOM OF THE INCLINOMETERS SHALL BE EMBEDDED IN SAND AT ELEVATION −40.0 FEET. SEE DETAIL 1 SHEET C04.

2. VIBRATING WIRE PIEZOMETERS: THREE PIEZOMETERS EACH SHALL BE INSTALLED AT FOUR LOCATIONS FOR A TOTAL OF 12. PIEZOMETERS SHALL BE INSTALLED WITHIN PEAT/ORGANIC SOIL AT DEPTHS OF −3.0, −13.0, AND −23.0. SEE DETAIL 3 SHEET C04. IN LOCATIONS WHERE SUBSEQUENT FILLS WILL BE PLACED ABOVE INITIAL LOCATION, EXTEND CASING AS NEEDED PRIOR TO PLACEMENT OF NEW LIFTS.

3. VERTICAL SETTLEMENT PLATES: INSTALL SETTLEMENT PLATES PER DETAIL 4 SHEET C04.

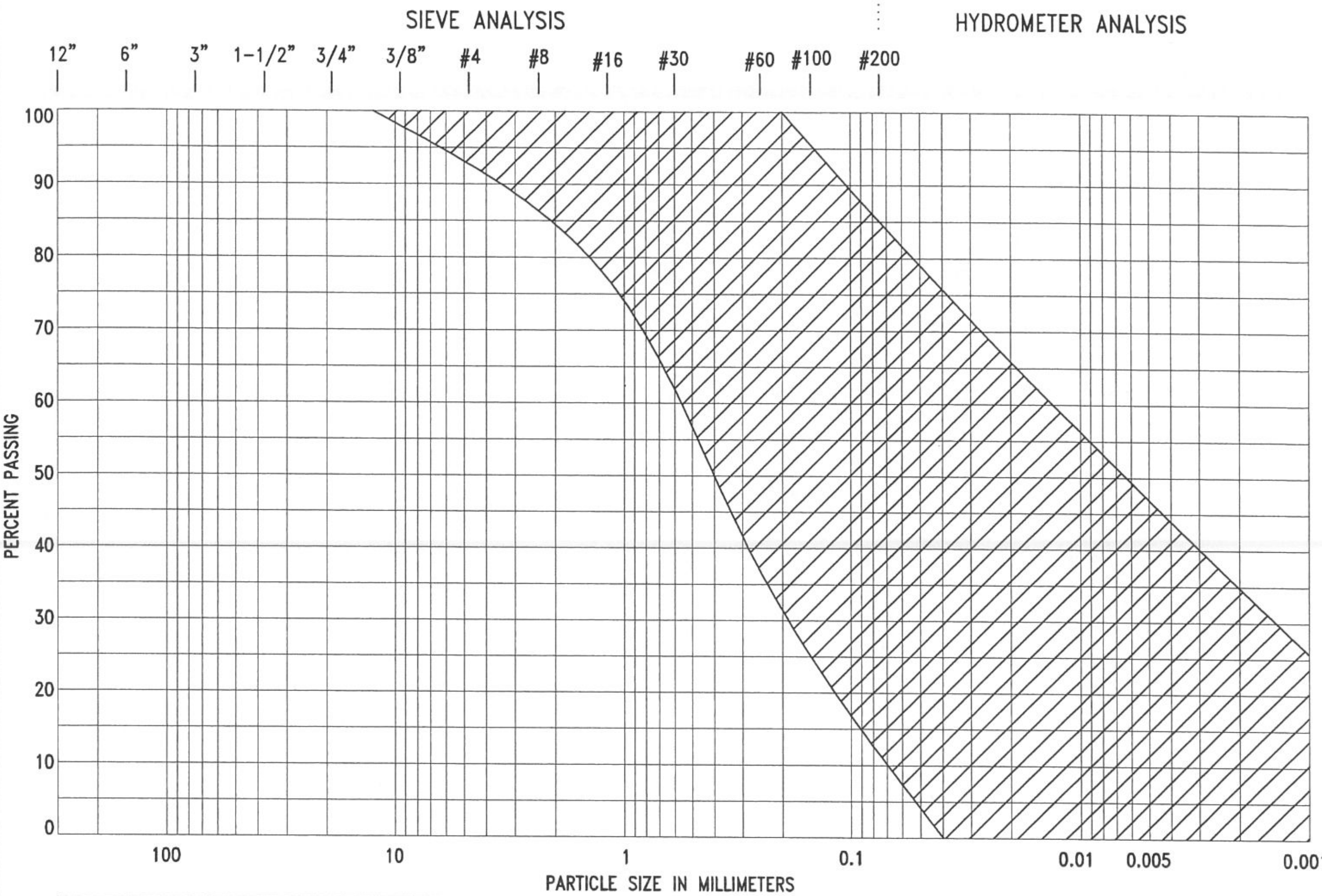
4. VIBRATING WIRE SETTLEMENT CELLS: SEE PHASED FILL SECTION FOR DETAIL.

5. TWO LINES OF TEMPORARY AND PERMANENT SURVEY POINTS/SETTLEMENT MONUMENTS: CONTRACTOR TO INSTALL 2 SURVEY LINES WITH 5 SURVEY POINTS EACH. THE SURVEY LINES SHALL BE PROVIDED AFTER EACH PHASE OF FILL PLACEMENT (TOTAL OF 5 PHASES). BASED ON 5 PHASES AND 5 POINTS FOR EACH SURVEY LINE, A TOTAL OF 45 POINTS SHALL BE INSTALLED. SEE DETAIL 2 SHEET C04.

6. EIGHT PERMANENT SURVEY POINTS/SETTLEMENT MONUMENTS: CONTRACTOR TO INSTALL SETTLEMENT MONUMENTS AT THE SURFACE UPON COMPLETION OF ALL EMBANKMENT FILLS. THE EXACT LOCATION OF EACH MONUMENT WILL BE MARKED IN THE FIELD BY THE GEOTECHNICAL ENGINEER UPON COMPLETION OF EACH PHASE OF FILL. SEE DETAIL 2 SHEET C04.

KLEINFELDER www.Kleinfelder.com	Project Number: 77229.G01 Graphic Date: 6/22/09 Graphic By: G. GOMEZ Checked By: A.K. File Name: STO9D158.fh11	CONSTRUCTION PHASING/ INSTRUMENTATION PLAN DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA

Plate 5



COBBLE	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

LEGEND:	SOURCE	DEPTH (ft)	COBBLE %	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	DESCRIPTION

ROBERT ISLAND DREDGE FILL MATERIAL

DESIGN BASE BAND

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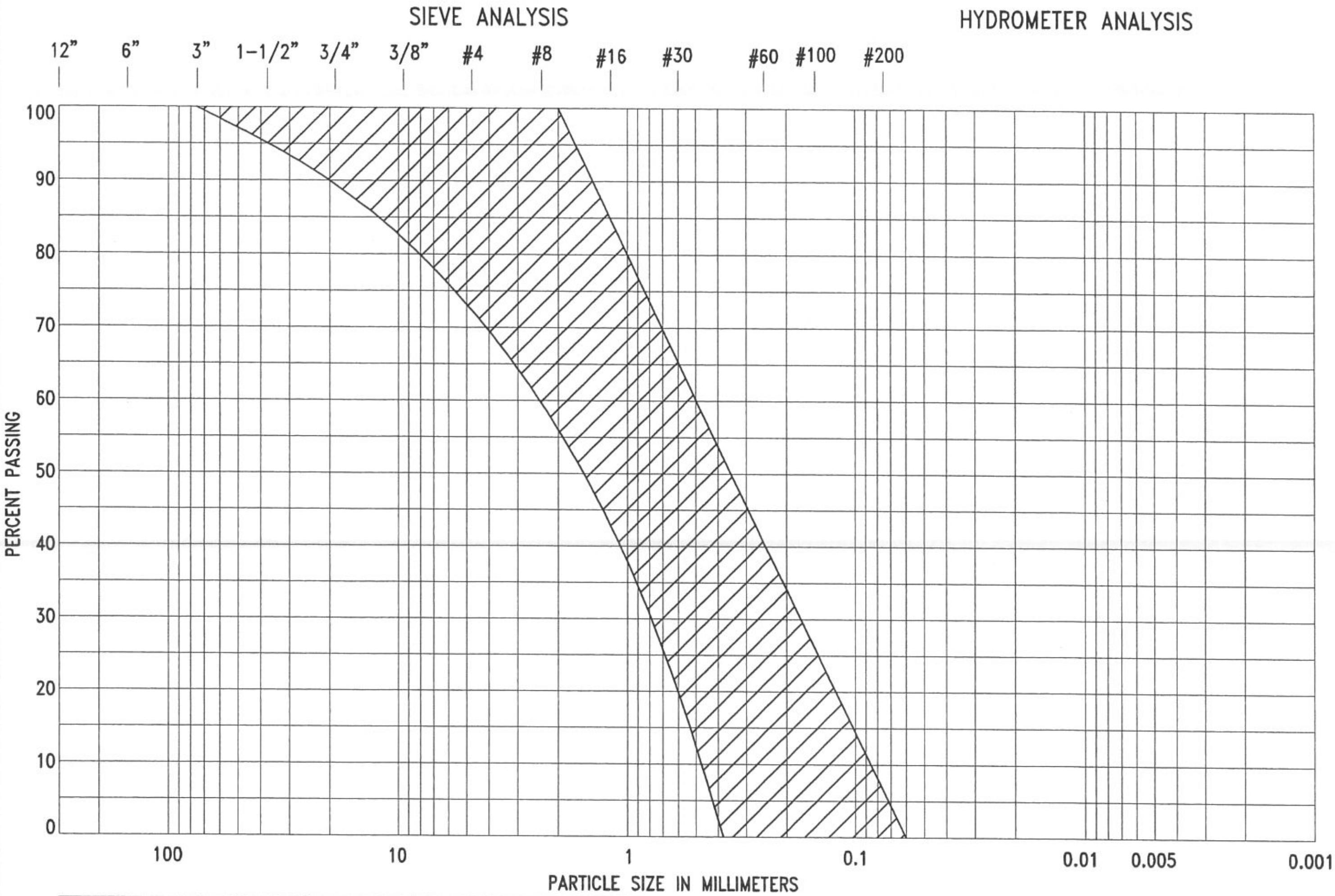
Date: 6/12/2009
Project No.: 77229.G01
File Number: BASE.CAD

BASE BAND
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
6A

KA_GRAIN_SIZE ST09G047.GPJ 6/12/09



COBBLE	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

LEGEND:	SOURCE	DEPTH (ft)	COBBLE %	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	DESCRIPTION

DESIGN FILTER BAND

KA_GRAIN_SIZE OTTO.GPJ 6/11/09

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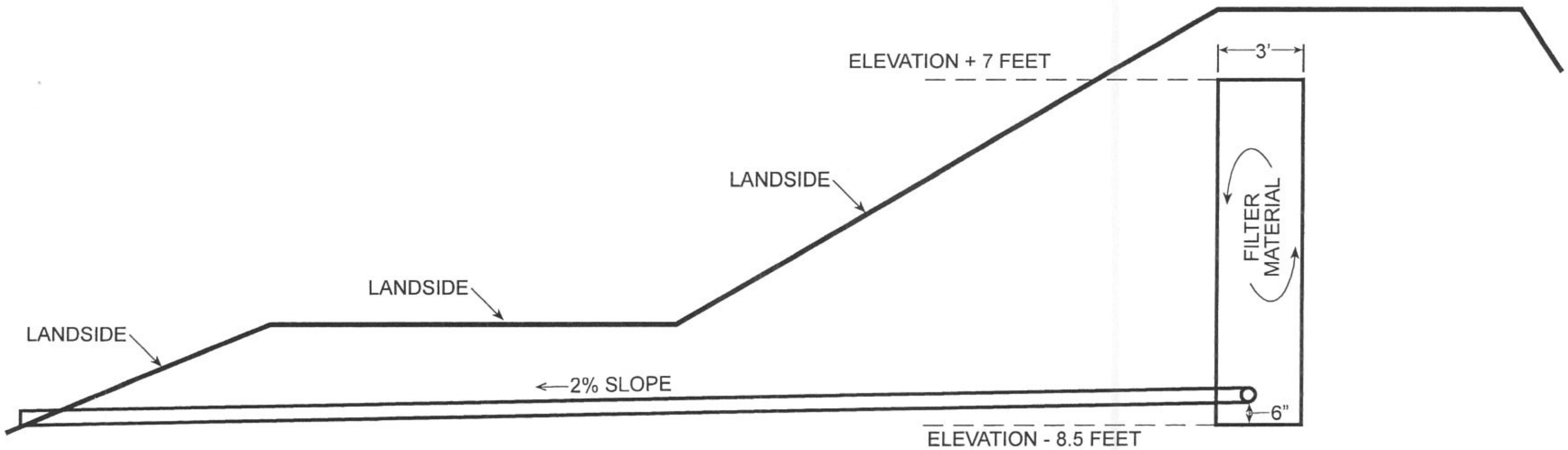
Date: 6/11/2009
Project No.: 77229.G01
File Number: FILTER.CAD

FILTER BAND
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
6B



Project Number: 77229.G01	LEVEE DRAINAGE DETAIL DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA
Graphic Date: 6/22/09	
Graphic By: G. GOMEZ	
Checked By: A.K.	
File Name: 7A.FH11	

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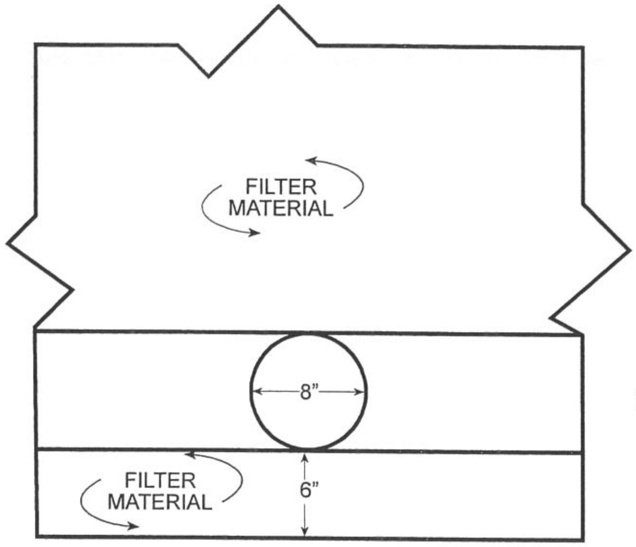
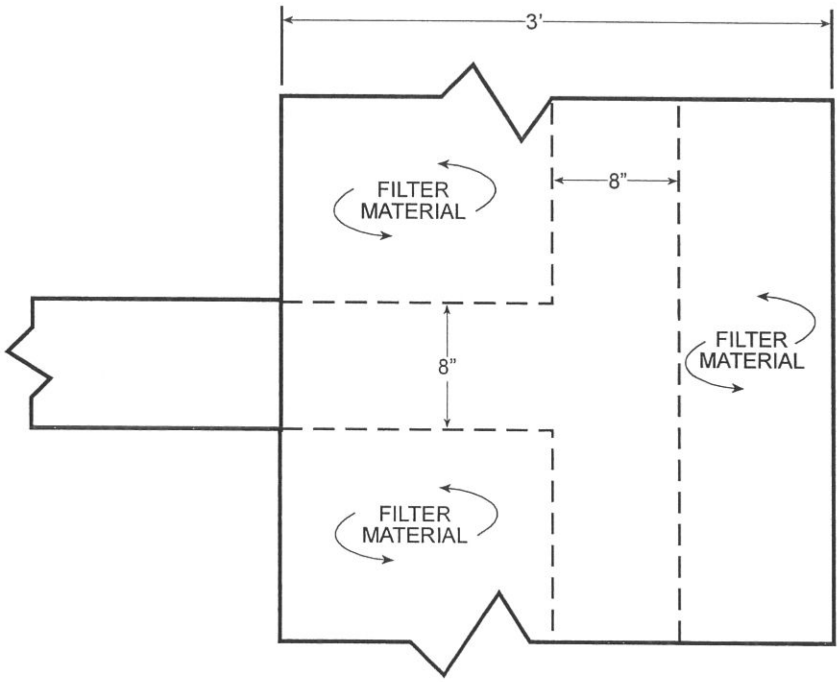
Plate 7A



NOTE: 1mm SLOTTED PIPE

PROFILE



NOTE: 1mm SLOTTED PIPE

PLAN

KLEINFELDER www.Kleinfelder.com	Project Number: 77229.G01	LEVEE DRAINAGE DETAIL DELTA WATER SUPPLY PROJECT EMPIRE TRACT SAN JOAQUIN COUNTY, CALIFORNIA	Plate
	Graphic Date: 6/10/09		7B
	Graphic By: G. GOMEZ		
	Checked By: A.K.		
	File Name: 7B.fh11		

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APPENDIX A
LOGS OF BORINGS, CPT RESULTS AND SUMMARY OF LABORATORY TESTS FOR CURRENT STUDY

LIST OF ATTACHMENTS

The following plates are attached and complete this appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2488)

MAJOR DIVISIONS				*GRAPHIC LOG*		*TYPICAL DESCRIPTIONS*
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH <5% FINES	Cu≥4 and 1≤Cc≤3		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/or 1>Cc>3		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5 to 12% FINES	Cu≥4 and 1≤Cc≤3		GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/or 1>Cc>3		GP-GM	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH >12% FINES			GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3		SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/or 1>Cc>3		SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5 to 12% FINES	Cu≥6 and 1≤Cc≤3		SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/or 1>Cc>3		SP-SM	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH >12% FINES			SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)				ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY,
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
					CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
					OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
					CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
					OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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Date: 6/29/2009 | File Number: STO7G086

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2488)
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
A-1

USCS (2487) STO7G086.GPJ 6/29/09

LOG SYMBOLS

BULK / BAG SAMPLE		-4	PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136)
MODIFIED CALIFORNIA SAMPLER (2-1/2 inch outside diameter)		-200	PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117)
CALIFORNIA SAMPLER (3 inch outside diameter)		LL	LIQUID LIMIT (ASTM Test Method D 4318)
STANDARD PENETRATION SPLIT SPOON SAMPLER (2 inch outside diameter)		PI	PLASTICITY INDEX (ASTM Test Method D 4318)
CONTINUOUS CORE		TXCU	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (EM 1110-1-1906)
SHELBY TUBE		EI	EXPANSION INDEX (UBC STANDARD 18-2)
ROCK CORE		COL	COLLAPSE POTENTIAL
WATER LEVEL (level where first encountered)		UC	UNCONFINED COMPRESSION (ASTM Test Method D 2166)
WATER LEVEL (level after completion)			
SEEPAGE		MC	MOISTURE CONTENT (ASTM Test Method D 2216)

GENERAL NOTES

1. *Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.*
2. *No warranty is provided as to the continuity of soil conditions between individual sample locations.*
3. *Logs represent general soil conditions observed at the point of exploration on the date indicated.*
4. *In general, Unified Soil Classification System designations presented on the logs were evaluated by visual methods. Where laboratory tests were performed, the designations reflect the laboratory test results.*

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Date: 6/29/2009   File Number: STO7G086

LOG KEY
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
A-2

KA-LOG_KEY STO7G086.GPJ 6/29/09

Surface Conditions:	Top of levee, relatively level, covered by aggregate base material	Date Completed:	4/19/2007
Groundwater:	Not applicable.	Logged By:	
		Total Depth:	71.5 feet
Method:	Mud rotary wash methods	Boring Diameter:	4 Inches inches
Equipment:	CME 75, With automatic 140 lb. hammer system		

Approximate Elevation: 8.5 feet
Approximate Northing: 38.00 feet
Approximate Easting: 121.00 feet

Elevation (feet)	Depth (feet)	Sample Type	Sample No. (FIELD)	Blows/Foot (FIELD)	Pocket Penetrometer (tsf) (FIELD)	Dry Density (pcf) (LABORATORY)	Moisture Content (%) (LABORATORY)	Liquid Limit (LABORATORY)	Plasticity Index (LABORATORY)	Passing #4 Sieve (%) (LABORATORY)	Passing #200 Sieve (%) (LABORATORY)	Other Tests	Graphic Log	DESCRIPTION
														(GM) SILTY GRAVEL - Tan to gray, moist, fine grained
			1-1-1	18	>4.5	106	18							
														(ML) SANDY SILT WITH CLAY - Brown, mottled black, moist, hard
			1-3-1	9	3.0	84	24	40	14					**(CL) SILTY CLAY** - Dark brown, moist, hard
														(ML) SANDY SILT - Brown, mottled rust, moist, very stiff
4	5													**(OH/OL) ORGANIC CLAY/ORGANIC SILT** - Black, moist, very stiff
			1-5-1	6	3.0		21	55	24			Organic content = 4.9%		
-2	10													**(PT) PEAT** - Black, very moist, soft to medium stiff
			1-10-1	3	0.5	16	312							
			1-12-1			15	288					Consolidation test		
-7	15		1-15-1	0		12	452							
-12	20		1-20-1	3		13	430							
-17	25		1-25-1	2		12	451							

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

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Drafted By: G. GOMEZ
Date: 6/29/2009
Project No.: 77229.G01
File Number: STO7G086

LOG OF BORING B-1
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE

A-3

Elevation (feet)	Depth (feet)	Sample No.	Blows/Foot	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests
-22	30	1-30-1	2		16	318					
-27	35	1-35-1	11		122	11					Direct shear phi = 39 Deg. C = 250 psf
-32	40	1-40-1	25		103	20				9	
-37	45	1-45-1	11		115	12					Direct shear phi = 41 Deg. C = 60 psf
-42	50	1-50-1	64								
-47	55	1-55-1	24		95	27			100	20	Gradation
-52	60	1-60-1	20	2.5	94	28					Unconfined compresion = 2 ksf

DESCRIPTION

(SM) SILTY SAND - Olive-green, very moist, loose, fine grained

Grades less silty, fine to medium grained, medium dense, wet

Grayish-green, fine to coarse grained

Fine to medium grained, loose

(SP) SAND - Grayish green, fine to medium grained

(SP) SAND WITH SILT - Olive-green, wet, dense, fine to medium grained

(SM) SILTY SAND - Olive-green, wet, fine to medium grained

(CL) SANDY CLAY - Moist

(SM) CLAYEY SAND - Olive-green, wet

(SC) CLAYEY SAND - Olive-green, moist, medium dense

(SM) SILTY SAND - Olive-green, wet, fine to medium grained

(CL) SANDY CLAY - Olive-green, moist, very stiff, medium to low plasticity

(ML) SANDY SILT - Olive-green, moist, very stiff to hard

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Drafted By: G. GOMEZ | Project No.: 77229.G01
Date: 6/29/2009 | File Number: STO7G086

LOG OF BORING B-1
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE

A-3

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

Elevation (feet)	Depth (feet)	Sample Type	Sample No.	Blows/Foot	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Graphic Log	DESCRIPTION
		FIELD				LABORATORY								
-57	65		1-65-1	54		103	17			100	12	Gradation		**(SM) SILTY SAND** - Olive-green, wet, dense, fine to medium grained
-62	70		1-70-1	33		103	22							**(ML) SANDY SILT** - Dark gray, moist
														(SM) SILTY SAND - Dark gray, wet, medium dense, fine grained
														Completed at a depth of 71.5 feet below existing site grade.
-67	75													
-72	80													
-77	85													
-82	90													
-87	95													

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

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Date: 6/29/2009
Project No.: 77229.G01
File Number: STO7G086

LOG OF BORING B-1
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
3 of 3
A-3

Surface Conditions:	Top of levee, relatively level, covered by aggregate base material	Date Completed:	4/20/2007
Groundwater:	Not applicable.	Logged By:	
		Total Depth:	71.5 feet
Method:	Mud rotary wash methods	Boring Diameter:	4 Inches inches
Equipment:	CME 75, With automatic 140 lb. hammer system		

Approximate Elevation: 7.5 feet
Approximate Northing: 38.10 feet
Approximate Easting: 121.10 feet

Elevation (feet)	Depth (feet)	Sample No.	Blows/Foot	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	DESCRIPTION
												(GM) SILTY GRAVEL WITH CLAY - Tan to light brown, moist, fine grained
		2-1-1	44									
												(SM) SILTY SAND WITH GRAVEL - Dark gray-brown, moist, dense, fine to coarse grained
		2-3-1	14	>4.5	102	33						**(CL) SANDY CLAY** - Olive-gray, moist, hard
3	5											Brown, with gravel
		2-5-1	8	1.25	79	34	37	13				**(OL) ORGANIC SILT WITH SAND** - Black to gray, moist
												(OH/OL) ORGANIC CLAY/ORGANIC SILT - Black, moist, stiff
-3	10											
		2-10-1	2	<0.5	29	174						Grades more organic, soft
												(PT) PEAT - Black, very moist, very soft
		2-12-1			13	357					Consolidation test	
-8	15											
		2-15-1	3		30	155						
-13	20											
		2-20-1	5		18	268						
-18	25											
		2-25-1	2		14	370						

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

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Drafted By: G. GOMEZ
Date: 6/29/2009
Project No.: 77229.G01
File Number: STO7G086

LOG OF BORING B- 2
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE

A-4

Elevation (feet)	Depth (feet)	Sample Type	Sample No.	Blows/Foot	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Graphic Log	DESCRIPTION
-23	30		2-30-1	2		11	489							
-28	35		NR	2										
														(SM) SILTY SAND - Gray to gray-green, wet, fine grained
-33	40		NR	21										
														Medium dense
														(SP-SM) SAND WITH SILT - Gray, wet, medium dense, fine to medium grained
-38	45		2-45-1	26										
														Fine grained
														(SM) SILTY SAND - Gray, wet, fine to medium grained
-43	50		2-50-1	19		99	18					Direct shear phi = 41 Deg. C = 0 psf		Caved in, medium dense
-48	55		2-55-1	27		97	26			100	20	Gradation		
-53	60		2-60-1	18	3.5	91	30					Unconfined compression = 1 ksf		**(CL) SANDY CLAY** - Gray-green, moist, very stiff

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

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Drafted By: G. GOMEZ
Date: 6/29/2009
Project No.: 77229.G01
File Number: STO7G086

LOG OF BORING B- 2
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
2 of 3
A-4

Elevation (feet)	Depth (feet)	Sample Type	Sample No.	Blows/Foot	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Graphic Log	DESCRIPTION
-58	65		2-65-1	10	1.0	88	30							**(ML) SANDY SILT** - Gray-green, moist, medium stiff to stiff
-63	70		2-70-1	48		101	21			100	12	Gradation		**(SM) SILTY SAND** - Gray, wet, dense, fine grained
														Completed at a depth of 71.5 feet below existing site grade.
-68	75													
-73	80													
-78	85													
-83	90													
-88	95													

FIELD / LABORATORY

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Drafted By: G. GOMEZ
Date: 6/29/2009

Project No.: 77229.G01
File Number: STO7G086

LOG OF BORING B- 2
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
3 of 3
A-4

Surface Conditions:	Toe of levee, weeds	Date Completed:	5/2/2007
Groundwater:	Groundwater encountered at a depth of about 4 feet below existing site grade.	Logged By:	
Method:	Continuous flight solid stem auger	Total Depth:	30 feet
Equipment:	Simco 2400 truck mounted drill rig with 140 lb. cathead hammer system	Boring Diameter:	4-1/2" inches

Approximate Elevation: -4.0 feet
Approximate Northing: 38.20 feet
Approximate Easting: 121.20 feet

Elevation (feet)	Depth (feet)	Sample Type	Sample No. (FIELD)	Blows/Foot (FIELD)	Pocket Penetrometer (tsf) (FIELD)	Dry Density (pcf) (LABORATORY)	Moisture Content (%) (LABORATORY)	Liquid Limit (LABORATORY)	Plasticity Index (LABORATORY)	Passing #4 Sieve (%) (LABORATORY)	Passing #200 Sieve (%) (LABORATORY)	Other Tests (LABORATORY)	Graphic Log	DESCRIPTION
														CLAYEY SILTY SAND - Light brown, slightly moist, very mixed, fine grained
			3-1-1	9		91	14							
														(SM) SILTY SAND - Light brown, moist, very mixed, with clayey silty balls, fine grained
			3-3-1	9										
-9	5													
														(SC) CLAYEY SAND - Brown, moist, fine grained
			3-5-1	7		65	45							
														(ML) SANDY SILT - Gray-brown, moist, fine grained
														(OH) VERY ORGANIC SILT - Dark gray-brown, very moist, very soft, light weight
														(PT) PEAT -
-14	10													
			3-10-1	1/8"										
			3-12-1											
-19	15													
			3-15-1	1/9"			370					Organic content 57.2%		
-24	20													
			3-20-1	2/6"		111	18							**(OL) ORGANIC SILT** - Light brown, very organic
														(SM) SILTY SAND - Light gray
														(CL) CLAYEY SAND - Light gray
														(SP) SAND - Light brown, fine grained
-29	25													
			3-25-1	19										
														(SM) SILTY SAND - Light brown, fine grained
														Very silty
-34	30													Completed at a depth of 30 feet below existing site grade.

P-LOG_2007 BLOWS PER 6 INCHES STO7G086.GPJ 6/29/09

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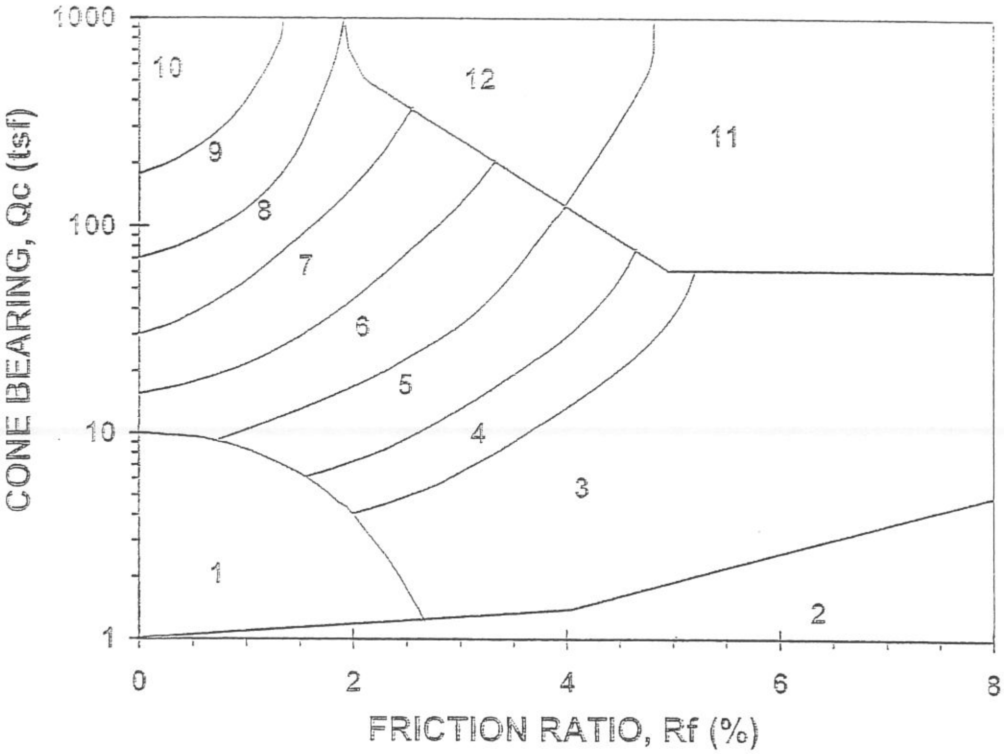
Drafted By: G. GOMEZ Project No.: 77229.G01
Date: 6/29/2009 File Number: STO7G086

LOG OF BORING B- 3
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
1 of 1
A-5

SIMPLIFIED SOIL BEHAVIOR TYPE CLASSIFICATION FOR STANDARD ELECTRONIC CONE PENETROMETER



ZONE	Qc/N[1]	Su Factor (Nk)[2]	SOIL BEHAVIOR TYPE[1]
1	2		Sensitive Fine Grained
2	1	for Zones 1 to 6	Organic Material
3	1	10 for Qc <= 9 tsf	CLAY
4	1.5	12 for Qc = 9 to 12 tsf	Silty CLAY to CLAY
5	2	15 for Qc > 12 tsf	Clayey SILT to Silty CLAY
6	2.5		Sandy SILT to Clayey SILT
7	3	---	Silty SAND to Sandy SILT
8	4	---	SAND to Silty SAND
9	5	---	SAND
10	6	---	Gravelly SAND to SAND
11	1	15	Very Stiff Fine Grained (*)
12	2	---	SAND to Clayey SAND (*)

(*) Overconsolidated or Cemented

Qc = Tip Bearing
Fs = Sleeve Friction
Rf = Fs/Qc*100 = Friction Ratio

References: [1]Robertson, 1986, Olsen, 1988
[2]Bonaparte & Mitchell, 1979 (young bay mud Qc <= 9)
[2]Estimated from local experience (fine grained soils Qc > 9)

Note: Testing performed in accordance with ASTM D3441

John Sarmiento & Associates
Cone Penetrometer Testing Services

PROJECT: DELTA INTAKE SITE
LOCATION: Stockton CA
PROJ. NO.: 77229.G01(KLF-154)
Terminated at 70.0 feet

CPT NO.: CPT-1
DATE : 04-26-2007
TIME : 10:45:00
Groundwater measured at 8.2 feet

KLEINFELDER, INC.
cpts by John Sarmiento & Associates

DEPTH (feet)	Qc (tsf)	Qc' (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT' (N')	EffVtStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
0.55	53.0	84.80	2.61	4.9	35	57	0.06	----	7.06	Silty CLAY to CLAY	130-140
1.06	44.3	70.88	3.05	6.9	44	71	0.13	----	5.90	CLAY	"
1.55	59.0	94.40	3.29	5.6	59	94	0.20	----	7.85	Very Stiff Fine Grained *	"
2.07	243.7	389.92	3.05	1.3	49	78	0.27	46	----	SAND	"
2.57	108.8	174.08	4.92	4.5	109	174	0.34	----	14.48	Very Stiff Fine Grained *	"
3.07	23.5	37.60	1.69	7.2	24	38	0.40	----	3.11	CLAY	"
3.56	21.4	34.24	1.39	6.5	21	34	0.47	----	2.82	"	"
4.05	57.0	91.20	2.37	4.2	29	46	0.54	----	7.56	Clayey SILT to Silty CLAY	"
4.56	25.9	41.44	1.67	6.4	26	41	0.61	----	3.41	CLAY	"
5.07	17.7	28.32	0.97	5.5	18	28	0.67	----	2.32	"	"
5.50	17.2	27.52	0.86	5.0	17	28	0.73	----	2.24	"	120-130
6.03	8.4	13.44	0.39	4.6	8	13	0.79	----	1.60	"	110-120
6.55	4.3	6.71	0.22	5.1	4	7	0.84	----	0.78	"	90-100
7.08	4.3	6.50	0.16	3.7	4	6	0.89	----	0.77	"	"
7.53	2.6	3.82	0.11	4.2	3	4	0.93	----	0.43	"	"
8.07	2.3	3.27	0.10	4.3	2	3	0.98	----	0.36	"	85-90
8.52	2.6	3.67	0.10	3.8	3	4	0.99	----	0.42	"	"
9.06	2.3	3.22	0.09	3.9	2	3	1.00	----	0.35	"	"
9.53	1.7	2.37	0.10	5.9	2	2	1.02	----	0.23	Organic Material	"
10.07	4.8	6.62	0.38	7.9	5	7	1.04	----	0.84	"	100-110
10.52	2.1	2.88	0.17	8.1	2	3	1.05	----	0.30	"	90-100
11.06	2.2	3.00	0.23	10.5	2	3	1.07	----	0.31	"	"
11.50	4.7	6.35	0.59	12.0	5	6	1.09	----	0.81	"	110-120
12.02	5.3	7.09	0.67	12.0	5	7	1.12	----	0.92	"	"
12.55	6.8	8.97	0.71	10.4	7	9	1.15	----	1.22	"	120-130
13.04	5.9	7.71	0.56	9.5	6	8	1.18	----	1.03	"	110-120
13.59	5.4	6.97	0.42	7.8	5	7	1.21	----	0.92	CLAY	"
14.04	5.8	7.42	0.58	10.0	6	7	1.23	----	1.00	Organic Material	"
14.57	4.6	5.83	0.43	9.3	5	6	1.26	----	0.75	"	100-110
15.01	3.0	3.78	0.27	9.0	3	4	1.27	----	0.43	"	90-100
15.54	2.6	3.26	0.10	3.8	3	3	1.28	----	0.35	CLAY	85-90
16.07	2.8	3.49	0.16	5.7	3	3	1.30	----	0.38	"	90-100
16.57	4.2	5.19	0.41	9.8	4	5	1.32	----	0.65	Organic Material	100-110
17.07	3.4	4.17	0.33	9.7	3	4	1.34	----	0.49	"	"
17.57	3.1	3.77	0.31	10.0	3	4	1.36	----	0.42	"	90-100
18.06	3.4	4.11	0.35	10.3	3	4	1.38	----	0.48	"	100-110
18.57	6.8	8.12	0.53	7.8	7	8	1.41	----	1.15	CLAY	110-120
19.06	4.1	4.86	0.40	9.8	4	5	1.43	----	0.61	Organic Material	100-110
19.55	3.6	4.23	0.42	11.7	4	4	1.45	----	0.50	"	"
20.05	3.7	4.31	0.35	9.5	4	4	1.47	----	0.52	"	"
20.54	3.1	3.59	0.31	10.0	3	4	1.49	----	0.39	"	90-100
21.02	7.6	8.70	0.64	8.4	8	9	1.52	----	1.29	CLAY	120-130
21.50	7.8	8.85	0.57	7.3	8	9	1.54	----	1.32	"	110-120
22.03	4.4	4.96	0.32	7.3	4	5	1.56	----	0.64	"	100-110
22.52	6.8	7.60	0.53	7.8	7	8	1.59	----	1.11	"	110-120
23.00	4.7	5.22	0.42	8.9	5	5	1.61	----	0.69	Organic Material	100-110
23.57	3.9	4.30	0.30	7.7	4	4	1.63	----	0.52	"	"
24.06	1.5	1.65	0.04	2.7	2	2	1.65	----	0.04	CLAY	85-90
24.55	0.2	0.22	0.01	5.0	0	0	1.66	----	0.00	Organic Material	"
25.02	1.6	1.74	0.16	10.0	2	2	1.67	----	0.05	"	90-100
25.50	1.7	1.84	0.20	11.8	2	2	1.69	----	0.06	"	"
26.08	2.6	2.79	0.26	10.0	3	3	1.71	----	0.24	"	"
26.57	3.3	3.53	0.28	8.5	3	4	1.73	----	0.37	"	"
27.06	3.2	3.40	0.26	8.1	3	3	1.74	----	0.35	"	"
27.55	2.2	2.33	0.23	10.5	2	2	1.76	----	0.14	"	"

PROJECT: DELTA INTAKE SITE
LOCATION: Stockton CA
PROJ. NO.: 77229.G01(KLF-154)
Terminated at 70.0 feet

CPT NO.: CPT-1
DATE : 04-25-2007
TIME : 10:45:00
Groundwater measured at 8.2 feet

KLEINFELDER, INC.
cpts by John Sarmiento & Associates

DEPTH (feet)	Qc (tsf)	Qc' (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT' (N')	EffVtStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
28.04	2.7	2.85	0.31	11.5	3	3	1.77	----	0.24	"	"
28.57	3.3	3.47	0.29	8.8	3	3	1.79	----	0.35	"	"
29.06	3.0	3.14	0.20	6.7	3	3	1.81	----	0.29	"	"
29.55	2.3	2.40	0.18	7.8	2	2	1.82	----	0.14	"	"
30.03	2.2	2.29	0.18	8.2	2	2	1.84	----	0.12	"	"
30.52	3.1	3.21	0.25	8.1	3	3	1.85	----	0.29	"	"
31.01	2.9	2.99	0.25	8.6	3	3	1.87	----	0.25	"	"
31.51	3.4	3.49	0.19	5.6	3	3	1.89	----	0.35	CLAY	"
32.08	2.4	2.46	0.12	5.0	2	2	1.90	----	0.14	"	"
32.56	2.7	2.75	0.09	3.3	3	3	1.92	----	0.20	"	85-90
33.05	2.8	2.85	0.08	2.9	3	3	1.93	----	0.21	"	"
33.56	3.0	3.04	0.09	3.0	3	3	1.94	----	0.25	"	"
34.05	9.6	9.68	0.37	3.9	10	10	1.97	----	1.30	"	110-120
34.53	12.9	12.94	0.20	1.6	6	6	1.99	----	1.48	Clayey SILT to Silty CLAY	100-110
35.05	20.9	20.89	0.44	2.1	8	8	2.02	----	2.54	Sandy SILT to Clayey SILT	120-130
35.53	16.5	16.48	0.24	1.5	7	7	2.05	----	1.95	"	110-120
36.01	9.8	9.79	0.16	1.6	5	5	2.07	----	1.32	Clayey SILT to Silty CLAY	100-110
36.58	11.0	10.98	0.41	3.7	11	11	2.10	----	1.51	CLAY	110-120
37.06	31.7	31.62	0.86	2.7	13	13	2.13	----	3.96	Sandy SILT to Clayey SILT	130-140
37.54	41.6	41.47	0.49	1.2	14	14	2.16	33	----	Silty SAND to Sandy SILT	120-130
38.01	58.2	57.98	0.64	1.1	19	19	2.19	35	----	"	"
38.52	67.9	67.59	1.48	2.2	23	23	2.23	36	----	"	130-140
39.07	22.9	22.78	0.81	3.5	11	11	2.27	----	2.77	Clayey SILT to Silty CLAY	"
39.55	33.6	33.40	0.73	2.2	13	13	2.30	----	4.20	Sandy SILT to Clayey SILT	"
40.02	101.2	100.52	1.87	1.8	34	34	2.34	38	----	Silty SAND to Sandy SILT	"
40.55	117.4	116.52	3.22	2.7	39	39	2.37	39	----	"	"
41.06	131.9	130.81	2.92	2.2	44	44	2.41	40	----	"	"
41.56	125.8	124.67	3.01	2.4	42	42	2.45	39	----	"	"
42.01	160.4	158.86	3.35	2.1	53	53	2.48	41	----	"	"
42.55	228.2	224.40	5.40	2.4	76	75	2.52	43	----	"	"
43.01	227.3	221.02	5.63	2.5	76	74	2.55	43	----	"	"
43.52	215.8	207.21	5.59	2.6	72	69	2.59	42	----	"	"
44.05	149.9	142.03	3.84	2.6	50	47	2.63	40	----	"	"
44.53	108.9	101.82	5.87	5.4	109	102	2.67	----	14.19	Very Stiff Fine Grained *	>140
45.02	105.1	97.05	2.68	2.5	35	32	2.70	38	----	Silty SAND to Sandy SILT	130-140
45.51	76.9	70.10	4.31	5.6	77	70	2.74	----	9.92	Very Stiff Fine Grained *	"
46.01	56.0	50.38	4.39	7.8	56	50	2.77	----	7.12	CLAY	"
46.51	78.0	69.25	1.95	2.5	31	28	2.81	----	10.05	Sandy SILT to Clayey SILT	"
47.01	81.5	71.37	2.48	3.0	33	29	2.85	----	10.51	"	"
47.53	86.3	74.50	2.40	2.8	35	30	2.88	----	11.15	"	"
48.03	73.9	62.91	1.95	2.6	30	25	2.92	----	9.49	"	"
48.54	89.7	75.26	2.09	2.3	30	25	2.96	36	----	Silty SAND to Sandy SILT	"
49.06	104.4	86.30	2.22	2.1	35	29	3.00	37	----	"	"
49.56	127.7	104.89	2.10	1.6	32	26	3.03	38	----	SAND to Silty SAND	"
50.00	86.6	70.90	0.61	0.7	22	18	3.05	36	----	"	110-120
50.52	57.5	46.82	1.16	2.0	19	16	3.09	34	----	Silty SAND to Sandy SILT	130-140
51.04	61.0	49.41	2.07	3.4	24	20	3.13	----	7.75	Sandy SILT to Clayey SILT	"
51.56	71.6	57.69	2.27	3.2	29	23	3.17	----	9.15	"	"
52.07	107.4	86.07	4.00	3.7	43	34	3.21	----	13.92	"	"
52.52	42.4	33.82	2.13	5.0	42	34	3.24	----	5.25	CLAY	"
53.04	35.3	28.00	1.14	3.2	18	14	3.28	----	4.30	Clayey SILT to Silty CLAY	"
53.58	26.4	20.83	1.28	4.8	26	21	3.31	----	3.11	CLAY	"
54.04	22.4	17.58	1.04	4.6	22	18	3.35	----	2.57	"	"
54.54	25.9	20.22	1.28	4.9	26	20	3.38	----	3.03	"	"
55.01	29.5	22.92	1.61	5.5	30	23	3.42	----	3.51	"	"

PROJECT: DELTA INTAKE SITE
LOCATION: Stockton CA
PROJ. NO.: 77229.G01(KLF-154)
Terminated at 70.0 feet

CPT NO.: CPT-1
DATE : 04-25-2007
TIME : 10:45:00
Groundwater measured at 8.2 feet

KLEINFELDER, INC.
cpts by John Sarmiento & Associates

DEPTH (feet)	Qc (tsf)	Qc' (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT' (N')	EffVtStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
55.55	31.2	24.10	1.78	5.7	31	24	3.46	----	3.73	"	"
56.02	30.7	23.59	1.81	5.9	31	24	3.49	----	3.66	"	"
56.53	87.0	66.46	4.89	5.6	87	66	3.53	----	11.16	Very Stiff Fine Grained *	>140
57.02	153.7	116.78	5.36	3.5	77	58	3.57	39	----	SAND to Clayey SAND *	130-140
57.52	53.9	40.73	4.05	7.5	54	41	3.60	----	6.74	CLAY	"
58.03	45.4	34.11	2.07	4.6	30	23	3.64	----	5.60	Silty CLAY to CLAY	"
58.52	43.7	32.66	2.28	5.2	44	33	3.68	----	5.37	CLAY	"
59.02	35.9	26.68	1.79	5.0	36	27	3.71	----	4.33	"	"
59.51	27.5	20.32	1.32	4.8	28	20	3.75	----	3.20	"	"
60.02	26.3	19.32	1.10	4.2	18	13	3.78	----	3.04	Silty CLAY to CLAY	"
60.54	25.1	18.33	1.16	4.6	25	18	3.82	----	2.87	CLAY	"
61.01	27.0	19.61	0.98	3.6	14	10	3.86	----	3.12	Clayey SILT to Silty CLAY	"
61.56	25.3	18.26	1.29	5.1	25	18	3.90	----	2.89	CLAY	"
62.00	23.8	17.09	1.05	4.4	16	11	3.93	----	2.69	Silty CLAY to CLAY	"
62.53	20.0	14.29	0.74	3.7	13	10	3.96	----	2.18	"	120-130
63.06	21.2	15.07	0.77	3.6	14	10	3.99	----	2.33	"	"
63.51	20.1	14.23	0.64	3.2	10	7	4.02	----	2.18	Clayey SILT to Silty CLAY	"
64.57	19.4	13.63	0.70	3.6	13	9	4.09	----	2.08	Silty CLAY to CLAY	"
65.03	18.5	12.95	0.66	3.6	12	9	4.12	----	1.96	"	"
65.55	15.4	10.74	0.63	4.1	15	11	4.15	----	1.54	CLAY	"
66.06	30.8	21.38	1.30	4.2	21	14	4.19	----	3.59	Silty CLAY to CLAY	130-140
66.57	19.3	13.34	0.85	4.4	19	13	4.22	----	2.05	CLAY	120-130
67.01	19.9	13.70	0.98	4.9	20	14	4.25	----	2.12	"	130-140
67.52	27.9	19.12	1.39	5.0	28	19	4.29	----	3.19	"	"
68.03	22.3	15.22	0.99	4.4	22	15	4.33	----	2.44	"	"
68.53	43.1	29.27	2.03	4.7	29	20	4.36	----	5.20	Silty CLAY to CLAY	"
69.03	79.7	53.89	3.63	4.6	80	54	4.40	----	10.08	Very Stiff Fine Grained *	"
69.51	137.2	92.36	3.61	2.6	46	31	4.43	38	----	Silty SAND to Sandy SILT	"
70.04	187.5	125.61	5.67	3.0	63	42	4.47	39	----	"	"

DEPTH = Sampling interval (.1 feet)
Qc = Tip bearing resistance
TotStr = Total Stress using est. density**
Fs = Sleeve friction resistance
Phi = Soil friction angle*
Rf = Tip/Sleeve ratio
Su = Undrained Soil Strength* (Nk=10 for Qc<9 tsf)
SPT = Equivalent Standard Penetration Test* (Nk=12 for Qc=9 to 12 tsf) (Nk=15 for Qc>12 tsf)

References: * Robertson and Campanella, 1988
** Olsen, 1989 *** Durgunoglu & Mitchell, 1975

PROJECT: DELTA INTAKE SITE
LOCATION: Stockton CA
PROJ. NO.: 77229.G01(KLF-154)
Terminated at 49.5 feet

CPT NO.: CPT-2
DATE : 04-25-2007
TIME : 11:35:00
Groundwater measured at 9.2 feet

KLEINFELDER, INC.
cpts by John Sarmiento & Associates

DEPTH (feet)	Qc (tsf)	Qc' (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT' (N')	EffVtStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
0.50	52.1	83.36	3.76	7.2	52	83	0.06	----	6.94	CLAY	"
1.01	68.8	110.08	4.30	6.3	69	110	0.13	----	9.16	Very Stiff Fine Grained *	"
1.57	89.7	143.52	4.30	4.8	90	144	0.20	----	11.95	"	"
2.07	31.2	49.92	2.52	8.1	31	50	0.27	----	4.14	CLAY	"
2.53	22.9	36.64	1.69	7.4	23	37	0.33	----	3.03	"	"
3.02	19.6	31.36	1.57	8.0	20	31	0.40	----	2.59	"	"
3.51	17.0	27.20	1.30	7.6	17	27	0.46	----	2.24	"	"
4.01	9.6	15.36	0.89	9.3	10	15	0.53	----	1.56	"	120-130
4.52	4.6	7.36	0.57	12.0	5	7	0.59	----	0.86	Organic Material	110-120
5.01	2.0	3.20	0.37	12.0	2	3	0.63	----	0.34	"	90-100
5.55	12.6	20.16	0.69	5.5	13	20	0.70	----	1.63	CLAY	120-130
6.07	24.9	39.84	0.65	2.6	12	20	0.76	----	3.27	Clayey SILT to Silty CLAY	"
6.52	6.3	9.98	0.47	7.5	6	10	0.82	----	1.18	CLAY	110-120
7.05	1.8	2.76	0.26	12.0	2	3	0.87	----	0.27	Organic Material	90-100
7.50	2.1	3.13	0.22	10.5	2	3	0.91	----	0.33	"	"
8.04	1.3	1.87	0.20	12.0	1	2	0.96	----	0.16	"	"
8.55	0.6	0.84	0.22	12.0	1	1	1.01	----	0.02	"	"
9.00	6.0	8.21	0.65	10.8	6	8	1.06	----	1.09	"	110-120
9.54	5.0	6.77	0.79	12.0	5	7	1.09	----	0.89	"	"
10.07	2.9	3.89	0.71	12.0	3	4	1.11	----	0.46	"	100-110
10.55	3.5	4.66	0.54	12.0	4	5	1.13	----	0.58	"	"
11.01	1.8	2.38	0.42	12.0	2	2	1.15	----	0.23	"	90-100
11.51	3.5	4.59	0.57	12.0	4	5	1.17	----	0.57	"	100-110
12.04	3.1	4.03	0.43	12.0	3	4	1.19	----	0.48	"	"
12.57	1.7	2.20	0.26	12.0	2	2	1.21	----	0.20	"	90-100
13.03	2.8	3.60	0.35	12.0	3	4	1.22	----	0.41	"	"
13.56	1.1	1.40	0.23	12.0	1	1	1.24	----	0.07	"	"
14.02	1.3	1.65	0.31	12.0	1	2	1.26	----	0.10	"	"
14.55	2.3	2.89	0.45	12.0	2	3	1.28	----	0.30	"	100-110
15.01	1.5	1.87	0.44	12.0	2	2	1.29	----	0.13	"	90-100
15.51	2.0	2.48	0.39	12.0	2	2	1.31	----	0.23	"	"
16.04	2.1	2.59	0.44	12.0	2	3	1.33	----	0.24	"	"
16.51	1.6	1.96	0.35	12.0	2	2	1.34	----	0.14	"	"
17.04	1.4	1.70	0.34	12.0	1	2	1.36	----	0.09	"	"
17.57	1.3	1.57	0.39	12.0	1	2	1.38	----	0.07	"	"
18.03	1.2	1.44	0.43	12.0	1	1	1.39	----	0.04	"	"
18.54	1.8	2.15	0.38	12.0	2	2	1.41	----	0.16	"	"
19.07	2.3	2.73	0.40	12.0	2	3	1.43	----	0.25	"	"
19.53	4.7	5.53	0.45	9.6	5	6	1.45	----	0.73	"	100-110
20.06	2.9	3.39	0.27	9.3	3	3	1.46	----	0.36	"	90-100
20.52	4.6	5.33	0.43	9.3	5	5	1.48	----	0.70	"	100-110
21.05	4.1	4.71	0.41	10.0	4	5	1.50	----	0.59	"	"
21.50	5.9	6.72	0.59	10.0	6	7	1.53	----	0.95	"	110-120
22.04	4.3	4.87	0.50	11.6	4	5	1.55	----	0.62	"	100-110
22.58	4.8	5.38	0.55	11.5	5	5	1.58	----	0.72	"	110-120
23.03	2.9	3.23	0.39	12.0	3	3	1.60	----	0.33	"	100-110
23.56	3.0	3.32	0.43	12.0	3	3	1.62	----	0.35	"	"
24.01	2.1	2.31	0.39	12.0	2	2	1.64	----	0.16	"	90-100
24.54	2.7	2.95	0.47	12.0	3	3	1.66	----	0.28	"	100-110
25.01	2.5	2.71	0.41	12.0	3	3	1.68	----	0.23	"	"
25.57	3.1	3.34	0.44	12.0	3	3	1.70	----	0.35	"	"
26.05	2.6	2.78	0.40	12.0	3	3	1.72	----	0.24	"	"
26.54	2.4	2.55	0.38	12.0	2	3	1.74	----	0.20	"	90-100
27.02	2.5	2.64	0.42	12.0	3	3	1.76	----	0.21	"	100-110
27.57	2.6	2.74	0.42	12.0	3	3	1.78	----	0.23	"	"

PROJECT: DELTA INTAKE SITE
LOCATION: Stockton CA
PROJ. NO.: 77229.G01(KLF-154)
Terminated at 49.5 feet

CPT NO.: CPT-2
DATE : 04-25-2007
TIME : 11:35:00
Groundwater measured at 9.2 feet

KLEINFELDER, INC.
cpts by John Sarmiento & Associates

DEPTH (feet)	Qc (tsf)	Qc' (tsf)	Fs (tsf)	Rf (%)	SPT (N)	SPT' (N')	EffVtStr (ksf)	PHI (deg.)	SU (ksf)	SOIL BEHAVIOR TYPE	DENSITY RANGE (pcf)
28.57	2.3	2.40	0.34	12.0	2	2	1.82	----	0.16	"	90-100
29.05	2.7	2.81	0.32	11.9	3	3	1.83	----	0.23	"	"
29.52	1.8	1.87	0.26	12.0	2	2	1.85	----	0.05	"	"
30.07	2.6	2.68	0.37	12.0	3	3	1.86	----	0.20	"	"
30.54	2.8	2.88	0.34	12.0	3	3	1.88	----	0.24	"	"
31.01	2.5	2.56	0.24	9.6	3	3	1.89	----	0.17	"	"
31.50	2.5	2.55	0.22	8.8	3	3	1.91	----	0.17	"	"
32.05	2.9	2.95	0.19	6.6	3	3	1.93	----	0.24	"	"
32.52	2.3	2.33	0.13	5.7	2	2	1.94	----	0.12	"	"
33.06	52.8	53.08	0.67	1.3	18	18	1.98	34	----	Silty SAND to Sandy SILT	120-130
33.52	26.6	26.60	0.33	1.2	11	11	2.00	----	3.31	Sandy SILT to Clayey SILT	110-120
34.07	23.3	23.29	0.26	1.1	9	9	2.03	----	2.87	"	"
34.56	21.8	21.77	0.39	1.8	9	9	2.06	----	2.66	"	120-130
35.03	19.9	19.86	0.36	1.8	8	8	2.09	----	2.41	"	"
35.51	18.0	17.96	0.34	1.9	7	7	2.12	----	2.15	"	110-120
36.05	13.7	13.66	0.34	2.5	7	7	2.14	----	1.57	Clayey SILT to Silty CLAY	"
36.52	20.1	20.03	0.84	4.2	13	13	2.17	----	2.42	Silty CLAY to CLAY	120-130
37.06	58.6	58.35	1.41	2.4	23	23	2.21	----	7.55	Sandy SILT to Clayey SILT	130-140
37.56	65.0	64.68	1.36	2.1	22	22	2.25	35	----	Silty SAND to Sandy SILT	"
38.01	41.2	40.97	1.96	4.8	27	27	2.28	----	5.22	Silty CLAY to CLAY	"
38.55	69.8	69.35	1.23	1.8	23	23	2.32	36	----	Silty SAND to Sandy SILT	"
39.01	77.9	77.35	1.45	1.9	26	26	2.35	37	----	"	"
39.54	79.9	79.27	1.74	2.2	27	26	2.39	37	----	"	"
40.06	78.9	78.22	1.78	2.3	26	26	2.43	37	----	"	"
40.57	92.4	91.53	1.83	2.0	31	31	2.47	37	----	"	"
41.01	94.7	93.75	1.72	1.8	32	31	2.50	38	----	"	"
41.52	88.2	86.24	1.66	1.9	29	29	2.54	37	----	"	"
42.04	87.9	84.86	1.93	2.2	29	28	2.57	37	----	"	"
42.54	91.2	86.94	2.00	2.2	30	29	2.61	37	----	"	"
43.04	76.8	72.30	1.51	2.0	26	24	2.65	36	----	"	"
43.56	150.4	139.71	2.71	1.8	38	35	2.69	40	----	SAND to Silty SAND	"
44.04	209.0	192.05	2.19	1.0	42	38	2.72	42	----	SAND	120-130
44.51	186.6	169.39	2.99	1.6	47	42	2.75	41	----	SAND to Silty SAND	130-140
45.06	245.2	219.35	4.87	2.0	49	44	2.79	43	----	SAND	"
45.53	196.6	173.53	13.85	7.0	197	174	2.83	----	25.87	Very Stiff Fine Grained *	>140
46.05	266.1	231.28	27.16	10.2	266	231	2.87	----	35.13	"	"
46.51	248.3	212.88	16.83	6.8	248	213	2.90	----	32.76	"	"
47.02	175.1	147.86	14.26	8.1	175	148	2.94	----	22.99	"	"
47.55	135.8	112.95	3.89	2.9	45	38	2.98	39	----	Silty SAND to Sandy SILT	130-140
48.02	168.8	138.99	4.00	2.4	56	46	3.01	40	----	"	"
48.56	155.4	127.25	2.89	1.9	39	32	3.05	39	----	SAND to Silty SAND	"
49.03	170.5	138.95	4.46	2.6	57	46	3.09	40	----	Silty SAND to Sandy SILT	"
49.53	289.7	234.90	4.82	1.7	58	47	3.12	43	----	SAND	"

DEPTH = Sampling interval (.1 feet)
Qc = Tip bearing resistance　　TotStr = Total Stress using est. density**
Fs = Sleeve friction resistance　　Phi = Soil friction angle*
Rf = Tip/Sleeve ratio　　Su = Undrained Soil Strength* (Nk=10 for Qc<9 tsf)
SPT = Equivalent Standard Penetration Test* (Nk=12 for Qc=9 to 12 tsf) (Nk=15 for Qc>12 tsf)

References: * Robertson and Campanella, 1988
** Olsen, 1989 *** Durgunoglu & Mitchell, 1975

PROJECT: DELTA INTAKE SITE

LOCATION: Stockton CA

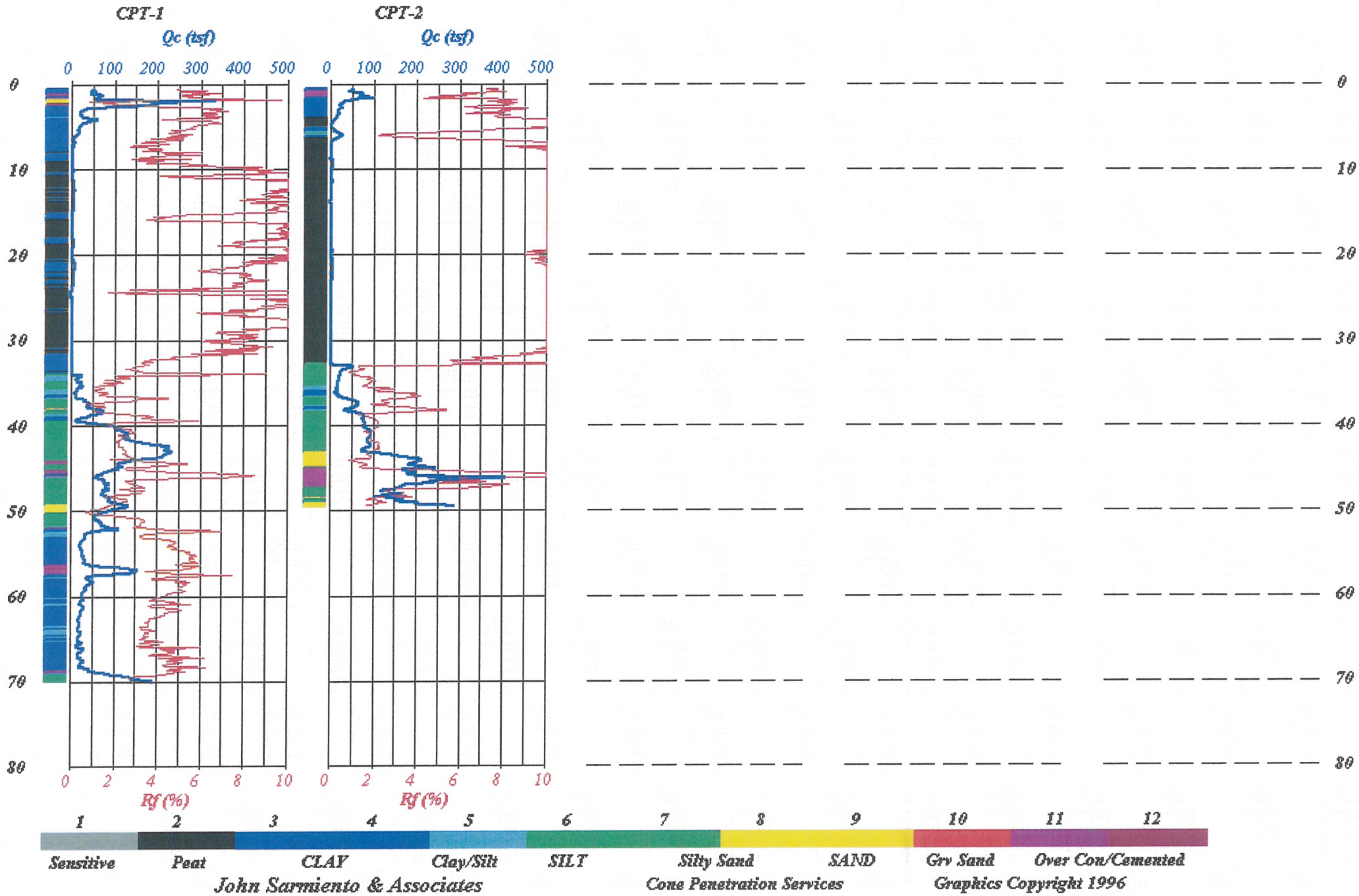
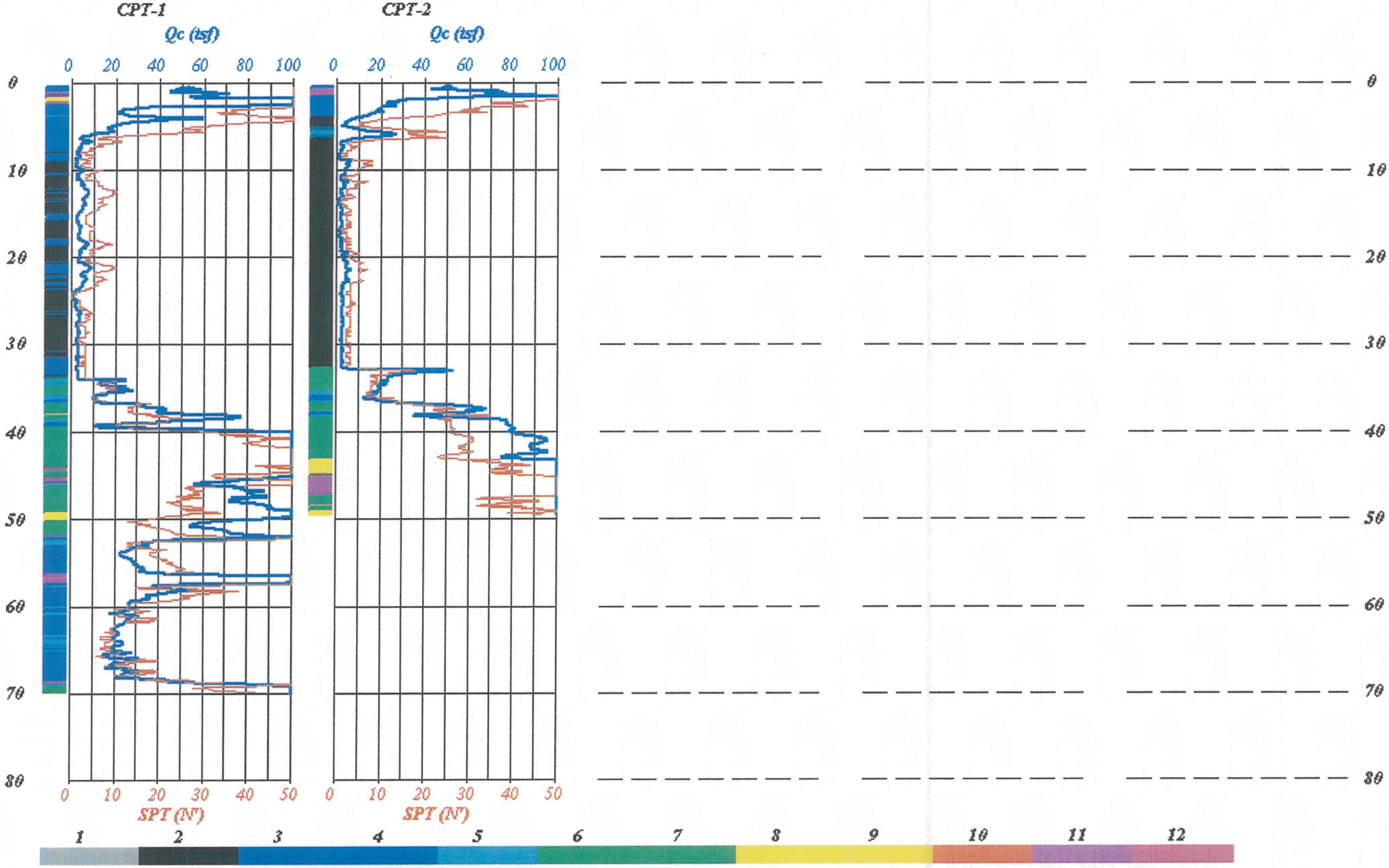


PLATE A-12

PROJECT: DELTA INTAKE SITE

LOCATION: Stockton CA



John Sarmiento & Associates

Cone Penetration Services

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PLATE A-13

BORING NO.	SAMPLE DEPTH (ft)	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (% of dry weight)	PARTICLE SIZE SIEVE SIZE (percent passing)							ATTERBERG LIMITS		OTHER TESTS
				#4	#8	#16	#30	#50	#100	#200	L.L.	P.I.	
B- 1	1.0	106	18										
B- 1	3.0	84	24								40	14	
B- 1	5.0		21								55	24	Organic content = 4.9%
B- 1	10.0	16	312										
B- 1	12.0	15	288										Consolidation test
B- 1	15.0	12	452										
B- 1	20.0	13	430										
B- 1	25.0	12	451										
B- 1	30.0	16	318										
B- 1	35.0	122	11										Direct shear phi = 39 Deg. C = 250 psf
B- 1	40.0	103	20							9			
B- 1	45.0	115	12										Direct shear phi = 41 Deg. C = 60 psf
B- 1	55.0	95	27	100	100	97	92	69	33	20			Gradation
B- 1	60.0	94	28										Unconfined compresion = 2 ksf
B- 1	65.0	103	17	100	100	99	89	58	21	12			Gradation
B- 1	70.0	103	22										
B- 2	3.0	102	33										
B- 2	5.0	79	34								37	13	
B- 2	10.0	29	174										
B- 2	12.0	13	357										Consolidation test
B- 2	15.0	30	155										
B- 2	20.0	18	268										
B- 2	25.0	14	370										
B- 2	30.0	11	489										
B- 2	50.0	99	18										Direct shear phi = 41 Deg. C = 0 psf
B- 2	55.0	97	26	100	100	97	92	69	33	20			Gradation
B- 2	60.0	91	30										Unconfined compression = 1 ksf
B- 2	65.0	88	30										
B- 2	70.0	101	21	100	100	99	89	58	21	12			Gradation
B- 3	1.0	91	14										
B- 3	5.0	65	45										
B- 3	15.0		370										Organic content 57.2%
B- 3	20.0	111	18										

KLEINFELDER
Bright People. Right Solutions.

Drafted By: G. GOMEZ Project No.: 77229.G01
Date: 6/29/2009 File Number: STO7G086

SUMMARY OF LABORATORY TESTS
DELTA WATER SUPPLY PROJECT
EMPIRE TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE
1 of 1
A-14

KA-LABSUM STO7G086.GPJ 6/29/09

SIEVE ANALYSIS

ASTM C136

Sieve Size	Percent Passing by Weight	*Specifications
#8/2.36mm	100	
#16/1.18mm	97	
#30/.600mm	92	
#50/.300mm	69	
#100/.150mm	33	
#200/.075mm	20	

FINENESS MODULUS 1.1

Sample I.D.: G0709002

Sample Description: Gray Silty Sand

Sample Date: Not Specified

Sample Location: **B 1-55-1**
B 2-55-1

KLEINFELDER		**Sieve Analysis** **Delta Water Supply Project** **Empire Tract** **San Joaquin County, California**	PLATE **A-14A**
Drafted By: **PM**	File No.: **77229.G01**		

SIEVE ANALYSIS

ASTM C136

Sieve Size	Percent Passing by Weight	*Specifications
#8/2.36mm	100	
#16/1.18mm	99	
#30/.600mm	89	
#50/.300mm	58	
#100/.150mm	21	
#200/.075mm	12	

FINENESS MODULUS 1.3

Sample I.D.: G0709002

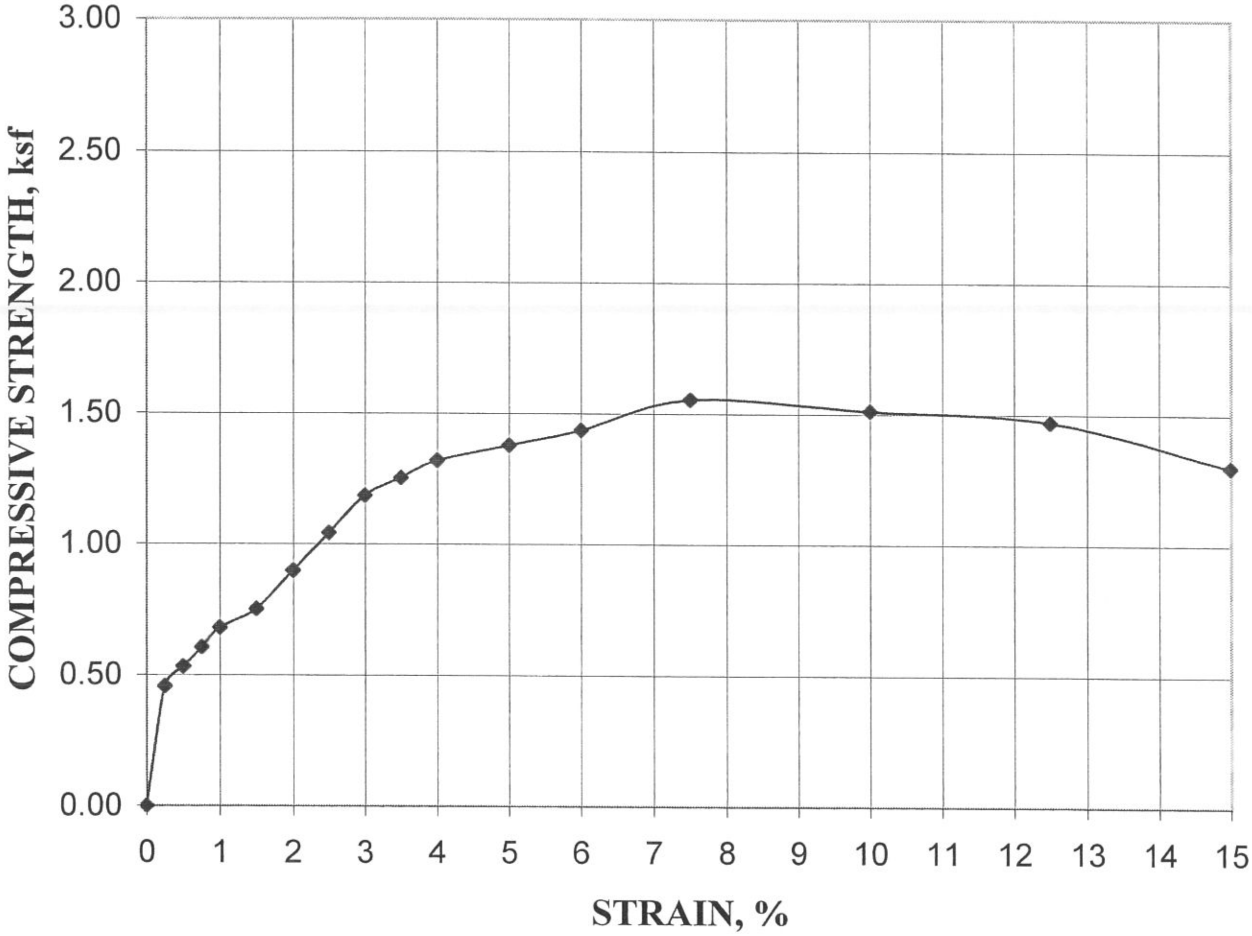
Sample Description: Gray Clayey Silty Sand

Sample Date: Not Specified

Sample Location: **B 1-65-1**
B 2-70-1

KLEINFELDER		**Sieve Analysis** **Delta Water Supply Project** **Empire Tract** **San Joaquin County, California**	PLATE **A-14B**
Drafted By: **PM**	File No.: **77229.G01**		

UNCONFINED COMPRESSIVE STRENGTH



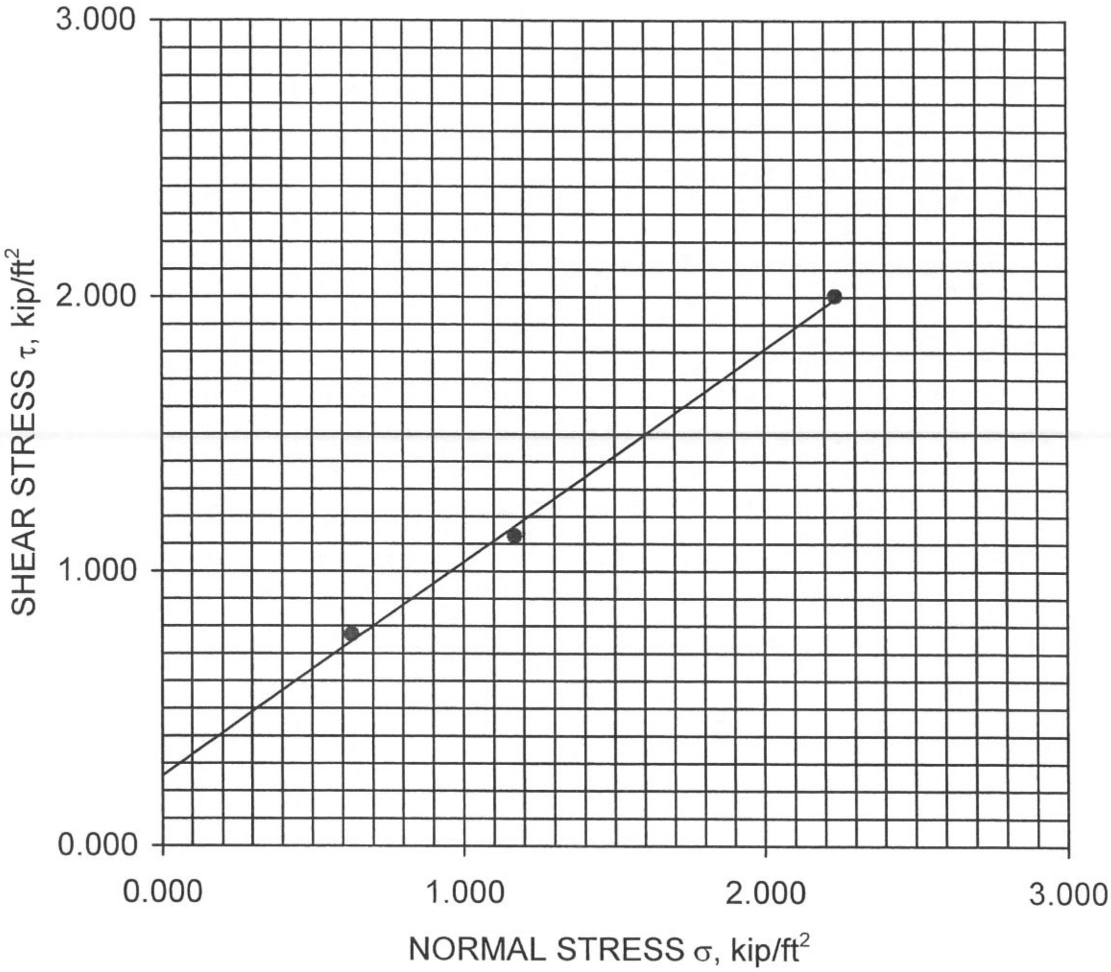
Sample Location: **B 2-60-1**
Sample I.D.: G0705007

Sample Data

Sample Description: Gray-Green Sandy Clay
Maximum Strength: 1 ksf
Moisture Content: 30 %
Density: 91 pcf

KLEINFELDER				Unconfined Compressive Strength Delta Water Supply Project Empire Tract San Joaquin County, California	PLATE A-16
Drafted By:	PM	File No.:	77229.G01		

DIRECT SHEAR GRAPH



Boring No.	B-1	**Sample No.**	1	**Depth, ft.**	35'

Soil Description	Olive-green Silty Sand		
Initial Dry Density, lb./ft³	124.7	121.7	120.0
Initial Water Content, %	10.6	11.4	11.1
Final Water Content %	11.8	13.7	12.8
Normal Stress, kip/ft²	0.632	1.171	2.236
Shear Stress, kip/ft²	0.769	1.129	2.005
Angle of Internal Friction, ϕ	Approx. 39°		
Cohesion, kip/ft²	Approx. 0.25 (apparent)		
Final Saturation %	77.1	87.3	81.0

FOR INFORMATIONAL PURPOSES ONLY NOT TO SCALE

Project: DWS Intake

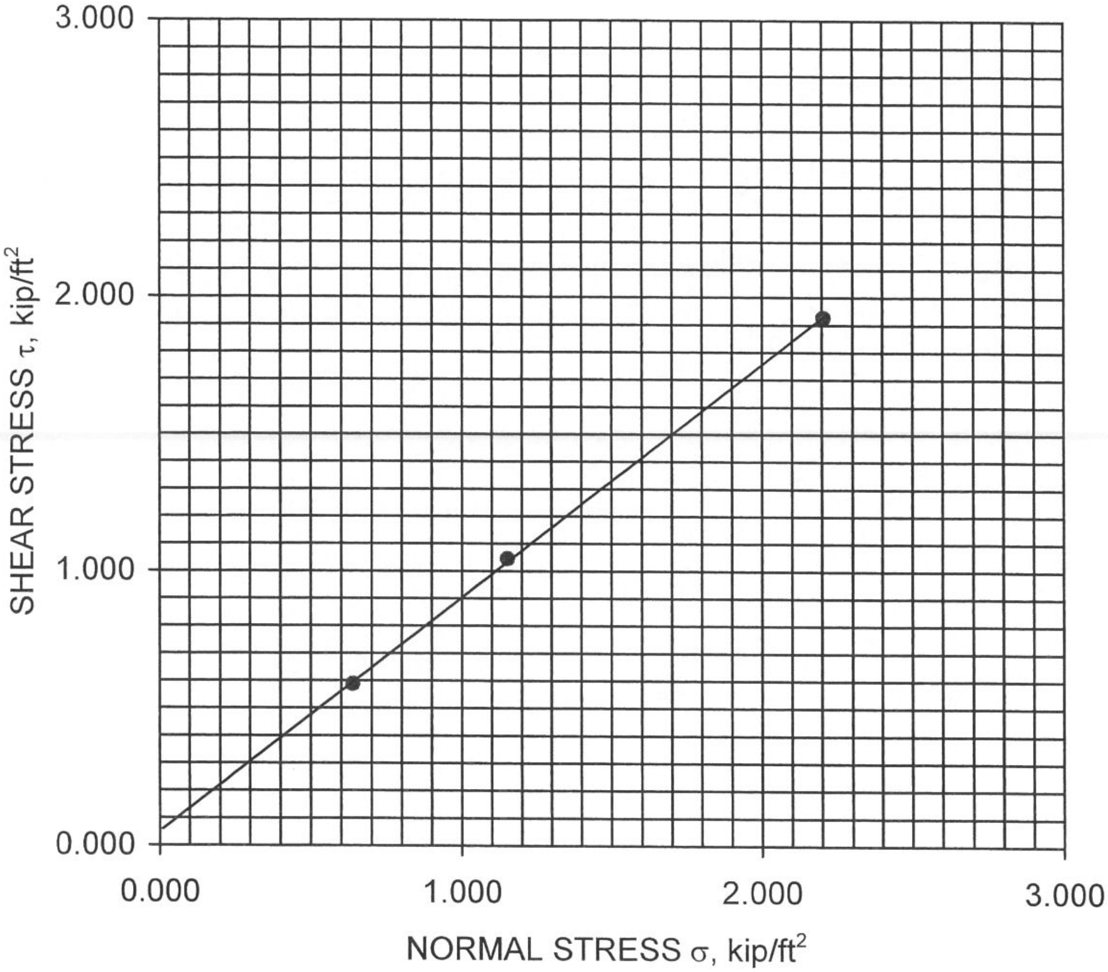
File Number: 77229.G01

KLEINFELDER

PLATE

A-17

DIRECT SHEAR GRAPH



Boring No. B-1 **Sample No.** 1 **Depth, ft.** 45'

Soil Description	Grayish Green Sand		
Initial Dry Density, lb./ft³	117.0	116.1	112.8
Initial Water Content, %	11.2	11.0	12.8
Final Water Content %	14.6	15.1	15.2
Normal Stress, kip/ft²	0.639	1.155	2.205
Shear Stress, kip/ft²	0.588	1.045	1.926
Angle of Internal Friction, ϕ	Approx. 40.8°		
Cohesion, kip/ft²	Approx. 0.06 (apparent)		
Final Saturation %	86.6	84.2	83.9

FOR INFORMATIONAL PURPOSES ONLY NOT TO SCALE

Project: DWS Intake

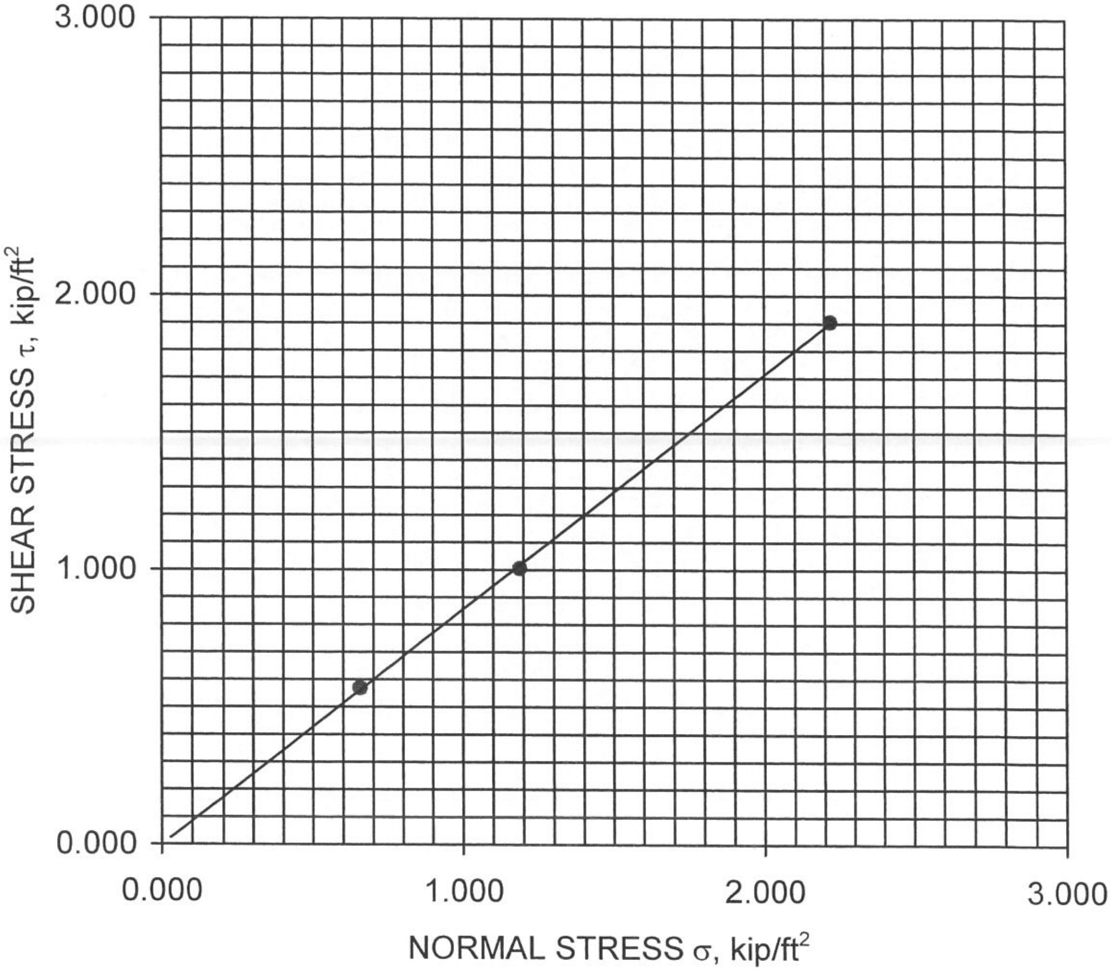
File Number: 77229.G01

KLEINFELDER

PLATE

A-18

DIRECT SHEAR GRAPH



Boring No.	B-2	**Sample No.**	1	**Depth, ft.**	50'

Soil Description	Olive Gray Sand		
Initial Dry Density, lb./ft³	97.9	100.0	100.2
Initial Water Content, %	17.5	18.8	18.6
Final Water Content %	22.7	23.2	23.0
Normal Stress, kip/ft²	0.657	1.188	2.221
Shear Stress, kip/ft²	0.569	1.005	1.905
Angle of Internal Friction, ϕ	Approx. 40.8°		
Cohesion, kip/ft²	Approx. 0.00 (apparent)		
Final Saturation %	82.9	88.7	87.4

FOR INFORMATIONAL PURPOSES ONLY NOT TO SCALE

Project: DWS Intake

File Number: 77229.G01

KLEINFELDER

PLATE

A-19

Laboratory Test Data

Project Name: DWS Intake

Project No.: 77229.G01

Report Date: 6/12/07

Sample No.: B1

Sample Depth: 12'

One-Dimensional Consolidation of Soil (ASTM D 2435)

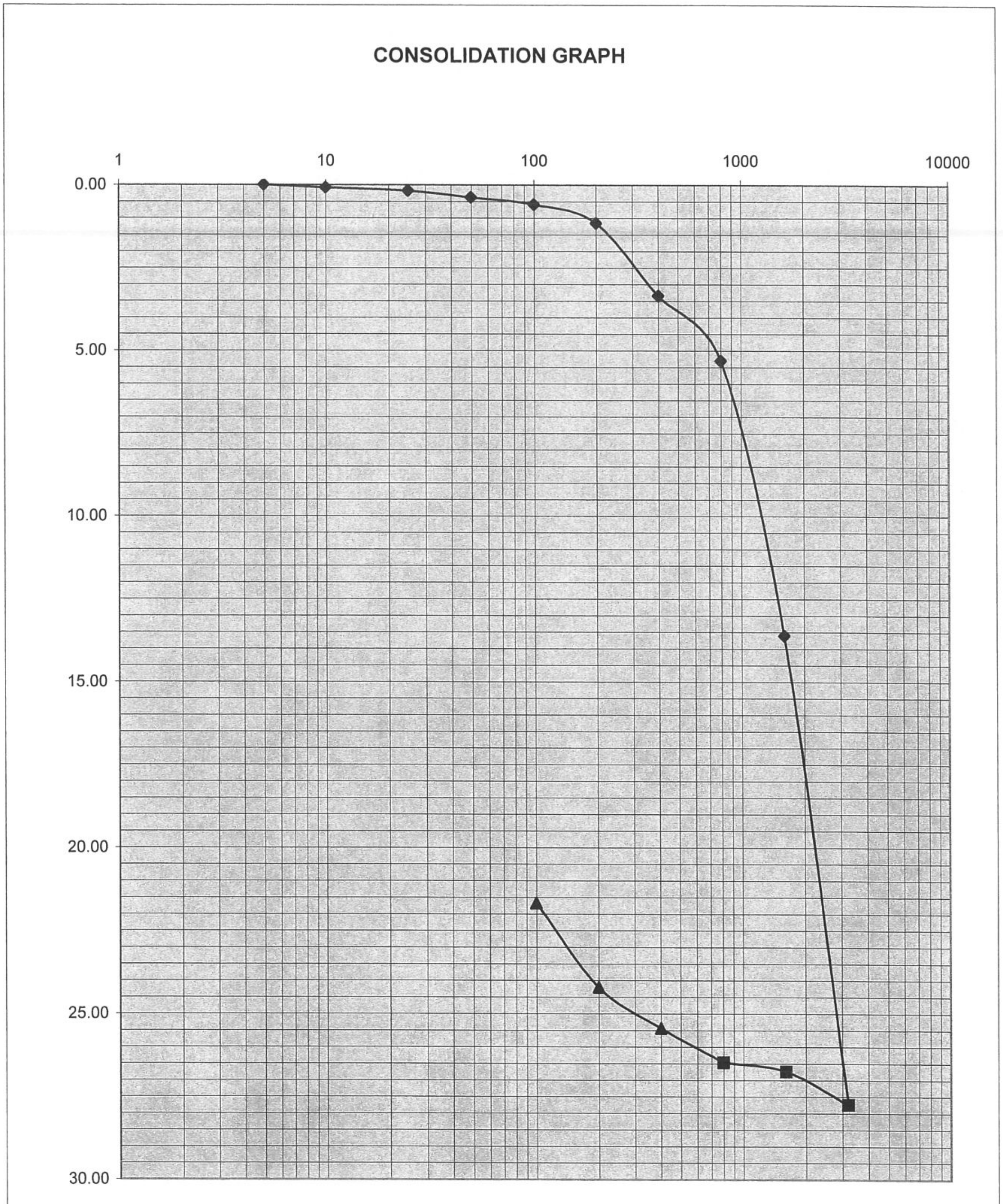


PLATE A-20

Laboratory Test Data

Project Name: DWS Intake

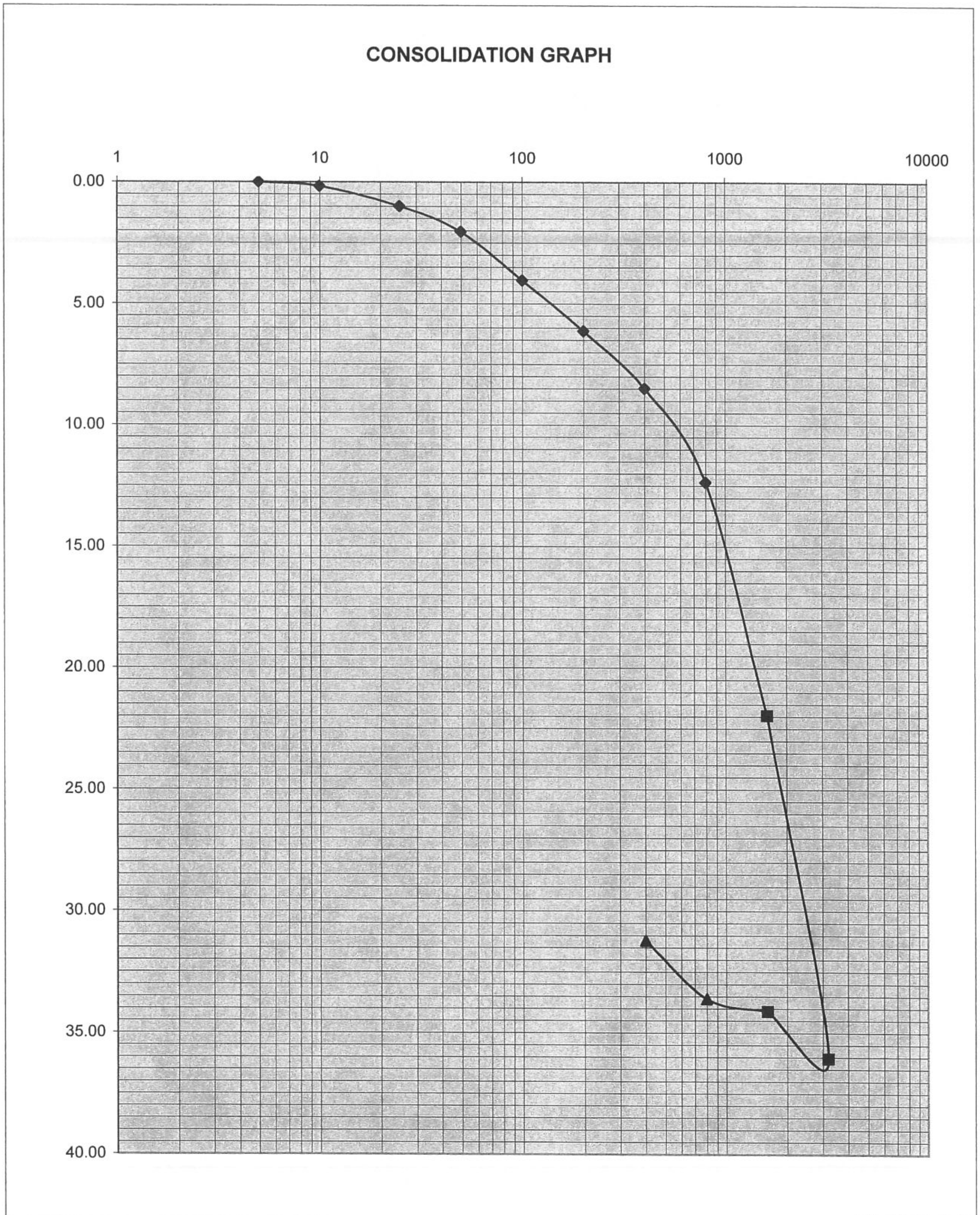
Project No.: 77229.G01

Report Date:

Sample No.: B2

Sample Depth: 12'

One-Dimensional Consolidation of Soil (ASTM D 2435)



STL

STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Tel: 916 373 5600
Fax: 916 372 1059
www.stl-inc.com

May 30, 2007

STL SACRAMENTO PROJECT NUMBER: G7E110385
PO/CONTRACT:

RECEIVED
JUN 0 4 2007
KLEINFELDER, INC.

Patricia Morales
Kleinfelder Inc
2825 East Myrtle Street
Stockton, CA 95205

Dear Ms. Morales,

This report contains the analytical results for the sample received under chain of custody by STL Sacramento on May 11, 2007. This sample is associated with your 77229.G01 project.

The test results in this report meet all NELAC requirements for parameters that accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The case narrative is an integral part of this report.

If you have any questions, please feel free to call me at (916) 374-4362.

Sincerely,

for
Linda Laver
Project Manager

TABLE OF CONTENTS

STL SACRAMENTO PROJECT NUMBER G7E110385

CASE NARRATIVE

STL SACRAMENTO PROJECT NUMBER G7E110385

General Comments

The sample was received ambient. No cooling agents were provided with the sample. The container lists a collection time of 13:55 which does not concur with the CoC collection time of 13:54. The sample is logged in based on the chain of custody.

There were no other anomalies associated with this project.

STL

STL Sacramento Certifications/Accreditations

Certifying State	Certificate #	Certifying State	Certificate #
Alaska	UST-055	Oregon*	CA 200005
Arizona	AZ0616	Pennsylvania	68-1272
Arkansas	04-067-0	South Carolina	87014002
California*	01119CA	Texas	TX 270-2004A
Colorado	NA	Utah*	QUAN1
Connecticut	PH-0691	Virginia	00178
Florida*	E87570	Washington	C087
Georgia	960	West Virginia	9930C, 334
Hawaii	NA	Wisconsin	998204680
Louisiana*	01944	NFESC	NA
Michigan	9947	USACE	NA
Nevada	CA44	USDA Foreign Plant	37-82605
New Jersey*	CA005	USDA Foreign Soil	S-46613
New York*	11666		

*NELAP accredited. A more detailed parameter list is available upon request. Update 1/27/05

QC Parameter Definitions

QC Batch: The QC batch consists of a set of up to 20 field samples that behave similarly (i.e., same matrix) and are processed using the same procedures, reagents, and standards at the same time.

Method Blank: An analytical control consisting of all reagents, which may include internal standards and surrogates, and is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD): An aliquot of blank matrix spiked with known amounts of representative target analytes. The LCS (and LCSD as required) is carried through the entire analytical process and is used to monitor the accuracy of the analytical process independent of potential matrix effects. If an LCSD is performed, it may also be used to evaluate the precision of the process.

Duplicate Sample (DU): Different aliquots of the same sample are analyzed to evaluate the precision of an analysis.

Surrogates: Organic compounds not expected to be detected in field samples, which behave similarly to target analytes. These are added to every sample within a batch at a known concentration to determine the efficiency of the sample preparation and analytical process.

Matrix Spike and Matrix Spike Duplicate (MS/MSD): An MS is an aliquot of a matrix fortified with known quantities of specific compounds and subjected to an entire analytical procedure in order to indicate the appropriateness of the method for a particular matrix. The percent recovery for the respective compound(s) is then calculated. The MSD is a second aliquot of the same matrix as the matrix spike, also spiked, in order to determine the precision of the method.

Isotope Dilution: For isotope dilution methods, isotopically labeled analogs (internal standards) of the native target analytes are spiked into the sample at time of extraction. These internal standards are used for quantitation, and monitor and correct for matrix effects. Since matrix effects on method performance can be judged by the recovery of these analogs, there is little added benefit of performing MS/MSD for these methods. MS/MSD are only performed for client or QAPP requirements.

Control Limits: The reported control limits are either based on laboratory historical data, method requirements, or project data quality objectives. The control limits represent the estimated uncertainty of the test results.

Sample Summary
G7E110385

WO#	Sample #	Client Sample ID	Sampling Date	Received Date
JWT1V	1	31773	5/10/2007 01:54 PM	5/11/2007 07:20 AM

Notes(s):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity, pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight

KLEINFELDER

PROJECT NO.: 77229.G01
PROJECT NAME: DWS Intake
L.P. NO. (P.O. NO.):
SAMPLERS: (Signature/Number): P Morales
RECEIVING LAB: STL

ANALYSIS: Sulfate, Chloride

	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX	NO. OF CONTAINERS	TYPE OF CONTAINERS	Sulfate	Chloride	INSTRUCTIONS/REMARKS
1	05/10/07	1:54:00	31773	Soil	1	tube			
2									
3									
4									
5									
6									
7	x Labeled @		1:55 - on 5/11/07						
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Instructions/Remarks:	Send Results To:
P Morales	5/10/07 2:00pm	[signature] 5/11/07 0910	Please email results	KLEINFELDER 2825 EAST MYRTLE STREET STOCKTON, CA 95205 (209) 948-1345
Relinquished by: (Signature)	Date/Time	Received by: (Signature)		
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)		Attn: pmorales@kleinfelder.com

M-60 White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

№ 4526

PLATE A-27

SEVERN TRENT **STL**

LOT RECEIPT CHECKLIST
STL Sacramento

CLIENT Kleinfelder PM LL LOG # 45217

LOT# (QUANTIMS ID) G7E110385 QUOTE# 74955 LOCATION W19A

		Initials	Date
DATE RECEIVED 5/11/07	TIME RECEIVED 0720	CV	5/11/07

DELIVERED BY ☐ FEDEX ☐ CA OVERNIGHT ☐ CLIENT ☐ AIRBORNE ☑ GOLDENSTATE ☐ DHL ☐ UPS ☐ BAX GLOBAL ☐ GO-GETTERS ☐ STL COURIER ☐ COURIERS ON DEMAND ☐ OTHER

CUSTODY SEAL STATUS ☐ INTACT ☐ BROKEN ☑ N/A

CUSTODY SEAL #(S)

SHIPPPING CONTAINER(S) ☐ STL ☑ CLIENT ☐ N/A

TEMPERTURE RECORD (IN °C) IR 1☐ 3 ☐ ☐ OTHER NA

COC #(S) 4526

TEMPERATURE BLANK Observed:____ Corrected: NA

SAMPLE TEMPERATURE

Observed: ambient Average:____ Corrected Average:____

COLLECTOR'S NAME: ☑ Verified from COC ☐ Not on COC

pH MEASURED ☐ YES ☐ ANOMALY ☑ N/A

LABELED BY..........

LABELS CHECKED BY..........

PEER REVIEW ____ ☑ NA

SHORT HOLD TEST NOTIFICATION

SAMPLE RECEIVING

WETCHEM ☑ N/A

VOA-ENCORES ☑ N/A

☐ METALS NOTIFIED OF FILTER/PRESERVE VIA VERBAL & EMAIL ☑ N/A

☐ COMPLETE SHIPMENT RECEIVED IN GOOD CONDITION WITH APPROPRIATE TEMPERATURES, CONTAINERS, PRESERVATIVES ☑ N/A

☑ Clouseau ☑ TEMPERATURE EXCEEDED (2 °C – 6 °C)*1 ☐ N/A

☐ WET ICE ☐ BLUE ICE ☐ GEL PACK ☑ NO COOLING AGENTS USED ☑ PM NOTIFIED

Notes: labeled @ 1:55, coc list 1:45.

*1 Acceptable temperature range for State of Wisconsin samples is ≤4°C.

LEAVE NO SPACES BLANK. USE "N/A" IF NOT APPLICABLE. INITIAL AND DATE ALL "N/A" ENTRIES.

SEVERN TRENT **STL**

Bottle Lot Inventory

Lot ID: G7E110385

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VOA*																				
VOAh*																				
AGB																				
AGBs																				
250AGB																				
250AGBs																				
250AGBn																				
500AGB																				
____AGJ																				
500AGJ																				
250AGJ																				
125AGJ																				
____CGJ																				
500CGJ																				
250CGJ																				
125CGJ																				
PJ																				
PJn																				
500PJ																				
500PJn																				
500PJna																				
500PJzn/na																				
250PJ																				
250PJn																				
250PJna																				
250PJzn/na																				
Acetate Tube																				
6 "CT	1																			
Encore																				
Folder/filter																				
PUF																				
Petri/Filter																				
XAD Trap																				
Ziploc																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

h = hydrochloric acid s = sulfuric acid na = sodium hydroxide n = nitric acid zn = zinc acetate

*Number of VOAs with air bubbles present / total number of VOA's

QA-185 3/05 EM

Page 2

General Chemistry - Various Methods

Kleinfelder Inc

Client Sample ID: 31773

General Chemistry

Lot-Sample #...: G7E110385-001 Work Order #...: JWT1V Matrix.........: SOLID
Date Sampled...: 05/10/07 Date Received..: 05/11/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride	44.5	5.0	mg/kg	MCAWW 300.0A	05/16/07	7136439
		Dilution Factor: 1				
Sulfate	35.7	5.0	mg/kg	MCAWW 300.0A	05/16/07	7136443
		Dilution Factor: 1				

PLATE A-31

QC DATA ASSOCIATION SUMMARY

G7E110385

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	SOLID	MCAWW 300.0A		7136439	7136248
	SOLID	MCAWW 300.0A		7136443	7136249

PLATE A-32

METHOD BLANK REPORT

General Chemistry

Client Lot #...: G7E110385 **Matrix.........:** SOLID

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride		Work Order #: JW4F01AA		MB Lot-Sample #: G7E160000-439		
	ND	5.0	mg/kg	MCAWW 300.0A	05/16/07	7136439
		Dilution Factor: 1				
Sulfate		Work Order #: JW4F91AA		MB Lot-Sample #: G7E160000-443		
	ND	5.0	mg/kg	MCAWW 300.0A	05/16/07	7136443
		Dilution Factor: 1				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

PLATE A-33

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Client Lot #...: G7E110385 **Matrix..........:** SOLID

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride			Work Order #: JW4F01AC LCS Lot-Sample#: G7E160000-439				
	50.0	47.5	mg/kg	95	MCAWW 300.0A	05/16/07	7136439
			Dilution Factor: 1				
Sulfate			Work Order #: JW4F91AC LCS Lot-Sample#: G7E160000-443				
	50.0	48.3	mg/kg	97	MCAWW 300.0A	05/16/07	7136443
			Dilution Factor: 1				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

PLATE A-34

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: G7E110385 **Matrix.........:** SOLID

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride		Work Order #: JW4F01AC LCS Lot-Sample#: G7E160000-439			
	95	(85 - 115)	MCAWW 300.0A	05/16/07	7136439
		Dilution Factor: 1			
Sulfate		Work Order #: JW4F91AC LCS Lot-Sample#: G7E160000-443			
	97	(85 - 115)	MCAWW 300.0A	05/16/07	7136443
		Dilution Factor: 1			

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

PLATE A-35

MATRIX SPIKE SAMPLE DATA REPORT

General Chemistry

Client Lot #...: G7E110385 **Matrix.........:** SOLID
Date Sampled...: 05/10/07 **Date Received..:** 05/11/07

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride			WO#: JWT1V1AD-MS/JWT1V1AE-MSD				MS Lot-Sample #: G7E110385-001		
	44.5	50.0	94.5	mg/kg	100		MCAWW 300.0A	05/16/07	7136439
	44.5	50.0	93.2	mg/kg	97	1.4	MCAWW 300.0A	05/16/07	7136439
			Dilution Factor: 1						
Sulfate			WO#: JWT1V1AF-MS/JWT1V1AG-MSD				MS Lot-Sample #: G7E110385-001		
	35.7	50.0	84.1	mg/kg	97		MCAWW 300.0A	05/16/07	7136443
	35.7	50.0	83.3	mg/kg	95	0.98	MCAWW 300.0A	05/16/07	7136443
			Dilution Factor: 1						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

PLATE A-36

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: G7E110385 **Matrix.........:** SOLID
Date Sampled...: 05/10/07 **Date Received..:** 05/11/07

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chloride		WO#:	JWT1V1AD-MS/JWT1V1AE-MSD		MS Lot-Sample #:	G7E110385-001	
	100	(85 - 115)			MCAWW 300.0A	05/16/07	7136439
	97	(85 - 115)	1.4	(0-15)	MCAWW 300.0A	05/16/07	7136439
		Dilution Factor: 1					
Sulfate		WO#:	JWT1V1AF-MS/JWT1V1AG-MSD		MS Lot-Sample #:	G7E110385-001	
	97	(85 - 115)			MCAWW 300.0A	05/16/07	7136443
	95	(85 - 115)	0.98	(0-15)	MCAWW 300.0A	05/16/07	7136443
		Dilution Factor: 1					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

PLATE A-37

APPENDIX B
GEOTECHNICAL ANALYSIS FOR CURRENT INVESTIGATION

LIST OF ATTACHMENTS

The following plates are attached and complete this appendix.

Filename: C:\PROGRA~1\DRIVEN\INTAKEO.DVN

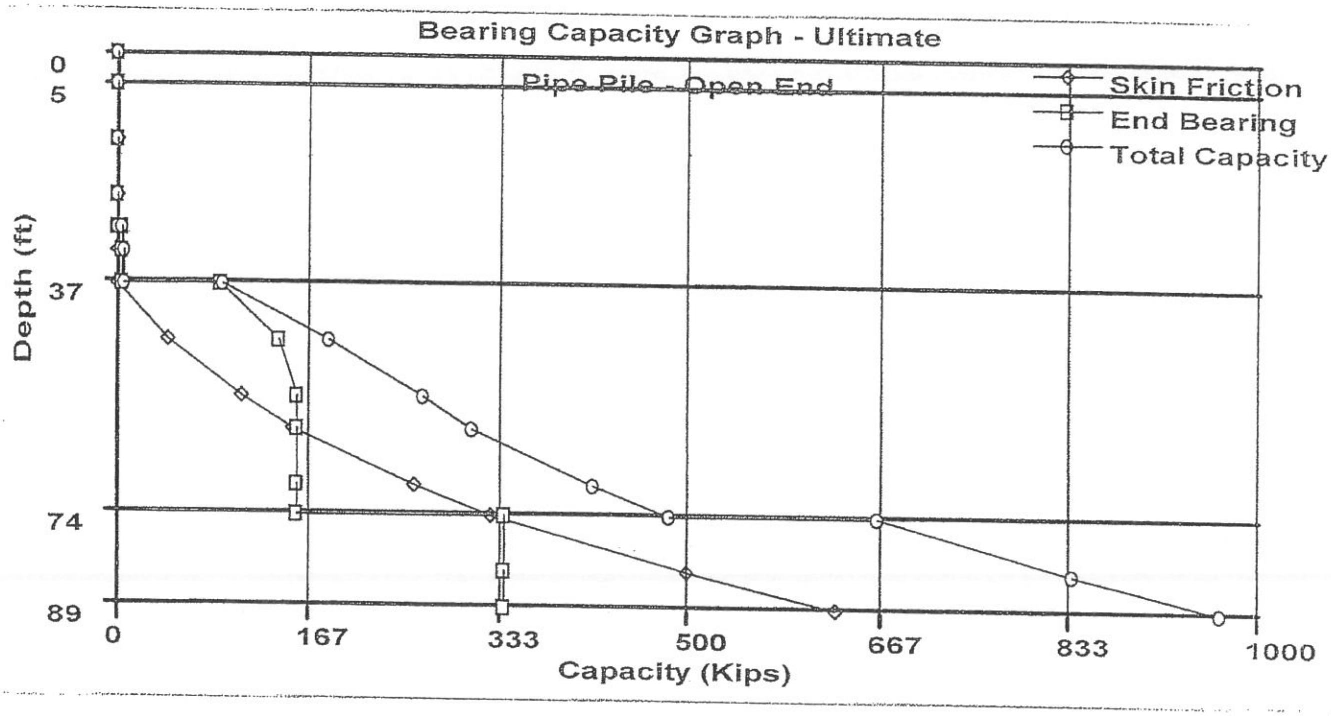


PLATE
B-1

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\INTAKEO.DVN
Project Name: DWS Intake
Project Date: 08/23/2007
Project Client: HDR
Computed By: AJK
Project Manager: CFH

PILE INFORMATION

Pile Type: Pipe Pile - Open End
Top of Pile: 0.00 ft
Diameter of Pile: 24.00 in
Shell Thickness: 0.75 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	8.00 ft
	- Driving/Restrike	8.00 ft
	- Ultimate:	8.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	28.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	5.00 ft	0.00%	117.00 pcf	30.0/30.0	Nordlund
2	Cohesive	32.00 ft	0.00%	68.00 pcf	200.00 psf	User Def.
3	Cohesionless	37.00 ft	0.00%	122.00 pcf	33.0/33.0	Nordlund
4	Cohesionless	15.00 ft	0.00%	130.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.58 psf	27.72	N/A	0.00 Kips
4.99 ft	Cohesionless	291.91 psf	27.72	N/A	4.26 Kips
5.01 ft	Cohesive	N/A	N/A	25.00 psf	4.28 Kips
14.01 ft	Cohesive	N/A	N/A	25.00 psf	5.69 Kips
23.01 ft	Cohesive	N/A	N/A	25.00 psf	7.11 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	8.52 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	9.30 Kips
37.01 ft	Cohesionless	951.70 psf	30.50	N/A	9.34 Kips
46.01 ft	Cohesionless	1219.90 psf	30.50	N/A	53.86 Kips
55.01 ft	Cohesionless	1488.10 psf	30.50	N/A	117.94 Kips
59.99 ft	Cohesionless	1636.50 psf	30.50	N/A	161.81 Kips
60.01 ft	Cohesionless	2322.50 psf	26.33	N/A	162.01 Kips
69.01 ft	Cohesionless	2590.70 psf	26.33	N/A	266.97 Kips
73.99 ft	Cohesionless	2739.10 psf	26.33	N/A	334.40 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	334.71 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	506.25 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	636.90 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.17 psf	30.00	41.85 Kips	0.06 Kips
4.99 ft	Cohesionless	583.83 psf	30.00	41.85 Kips	31.91 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	91.14 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	140.66 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	157.08 Kips
59.99 ft	Cohesionless	2321.60 psf	47.20	157.08 Kips	157.08 Kips
60.01 ft	Cohesionless	2322.80 psf	47.20	157.08 Kips	157.08 Kips
69.01 ft	Cohesionless	2859.20 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.06 Kips	0.06 Kips
4.99 ft	4.26 Kips	31.91 Kips	36.18 Kips
5.01 ft	4.28 Kips	5.65 Kips	9.93 Kips
14.01 ft	5.69 Kips	5.65 Kips	11.35 Kips
23.01 ft	7.11 Kips	5.65 Kips	12.76 Kips
32.01 ft	8.52 Kips	5.65 Kips	14.18 Kips
36.99 ft	9.30 Kips	5.65 Kips	14.96 Kips
37.01 ft	9.34 Kips	91.14 Kips	100.48 Kips
46.01 ft	53.86 Kips	140.66 Kips	194.51 Kips
55.01 ft	117.94 Kips	157.08 Kips	275.02 Kips
59.99 ft	161.81 Kips	157.08 Kips	318.89 Kips
60.01 ft	162.01 Kips	157.08 Kips	319.09 Kips
69.01 ft	266.97 Kips	157.08 Kips	424.05 Kips
73.99 ft	334.40 Kips	157.08 Kips	491.48 Kips
74.01 ft	334.71 Kips	338.04 Kips	672.75 Kips
83.01 ft	506.25 Kips	338.04 Kips	844.28 Kips
88.99 ft	636.90 Kips	338.04 Kips	974.93 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.58 psf	27.72	N/A	0.00 Kips
4.99 ft	Cohesionless	291.91 psf	27.72	N/A	4.26 Kips
5.01 ft	Cohesive	N/A	N/A	25.00 psf	4.28 Kips
14.01 ft	Cohesive	N/A	N/A	25.00 psf	5.69 Kips
23.01 ft	Cohesive	N/A	N/A	25.00 psf	7.11 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	8.52 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	9.30 Kips
37.01 ft	Cohesionless	951.70 psf	30.50	N/A	9.34 Kips
46.01 ft	Cohesionless	1219.90 psf	30.50	N/A	53.86 Kips
55.01 ft	Cohesionless	1488.10 psf	30.50	N/A	117.94 Kips
59.99 ft	Cohesionless	1636.50 psf	30.50	N/A	161.81 Kips
60.01 ft	Cohesionless	2322.50 psf	26.33	N/A	162.01 Kips
69.01 ft	Cohesionless	2590.70 psf	26.33	N/A	266.97 Kips
73.99 ft	Cohesionless	2739.10 psf	26.33	N/A	334.40 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	334.71 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	506.25 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	636.90 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.17 psf	30.00	41.85 Kips	0.00 Kips
4.99 ft	Cohesionless	583.83 psf	30.00	41.85 Kips	0.00 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	0.00 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	0.00 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	0.00 Kips
59.99 ft	Cohesionless	2321.60 psf	47.20	157.08 Kips	0.00 Kips
60.01 ft	Cohesionless	2322.80 psf	47.20	157.08 Kips	157.08 Kips
69.01 ft	Cohesionless	2859.20 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.99 ft	4.26 Kips	0.00 Kips	4.26 Kips
5.01 ft	4.28 Kips	0.00 Kips	4.28 Kips
14.01 ft	5.69 Kips	0.00 Kips	5.69 Kips
23.01 ft	7.11 Kips	0.00 Kips	7.11 Kips
32.01 ft	8.52 Kips	0.00 Kips	8.52 Kips
36.99 ft	9.30 Kips	0.00 Kips	9.30 Kips
37.01 ft	9.34 Kips	0.00 Kips	9.34 Kips
46.01 ft	53.86 Kips	0.00 Kips	53.86 Kips
55.01 ft	117.94 Kips	0.00 Kips	117.94 Kips
59.99 ft	161.81 Kips	0.00 Kips	161.81 Kips
60.01 ft	162.01 Kips	157.08 Kips	319.09 Kips
69.01 ft	266.97 Kips	157.08 Kips	424.05 Kips
73.99 ft	334.40 Kips	157.08 Kips	491.48 Kips
74.01 ft	334.71 Kips	338.04 Kips	672.75 Kips
83.01 ft	506.25 Kips	338.04 Kips	844.28 Kips
88.99 ft	636.90 Kips	338.04 Kips	974.93 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
5.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
23.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
27.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
28.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	0.63 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	1.41 Kips
37.01 ft	Cohesionless	951.70 psf	30.50	N/A	1.45 Kips
46.01 ft	Cohesionless	1219.90 psf	30.50	N/A	45.97 Kips
55.01 ft	Cohesionless	1488.10 psf	30.50	N/A	110.05 Kips
59.99 ft	Cohesionless	1636.50 psf	30.50	N/A	153.92 Kips
60.01 ft	Cohesionless	2322.50 psf	26.33	N/A	154.12 Kips
69.01 ft	Cohesionless	2590.70 psf	26.33	N/A	259.08 Kips
73.99 ft	Cohesionless	2739.10 psf	26.33	N/A	326.50 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	326.82 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	498.36 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	629.01 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
4.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
27.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
28.00 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	91.14 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	140.66 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	157.08 Kips
59.99 ft	Cohesionless	2321.60 psf	47.20	157.08 Kips	157.08 Kips
60.01 ft	Cohesionless	2322.80 psf	47.20	157.08 Kips	157.08 Kips
69.01 ft	Cohesionless	2859.20 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
23.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
27.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
28.00 ft	0.00 Kips	5.65 Kips	5.65 Kips
32.01 ft	0.63 Kips	5.65 Kips	6.28 Kips
36.99 ft	1.41 Kips	5.65 Kips	7.07 Kips
37.01 ft	1.45 Kips	91.14 Kips	92.59 Kips
46.01 ft	45.97 Kips	140.66 Kips	186.62 Kips
55.01 ft	110.05 Kips	157.08 Kips	267.13 Kips
59.99 ft	153.92 Kips	157.08 Kips	311.00 Kips
60.01 ft	154.12 Kips	157.08 Kips	311.20 Kips
69.01 ft	259.08 Kips	157.08 Kips	416.16 Kips
73.99 ft	326.50 Kips	157.08 Kips	483.58 Kips
74.01 ft	326.82 Kips	338.04 Kips	664.86 Kips
83.01 ft	498.36 Kips	338.04 Kips	836.39 Kips
88.99 ft	629.01 Kips	338.04 Kips	967.04 Kips

Filename: C:\PROGRA~1\DRIVEN\INTAKEC.DVN

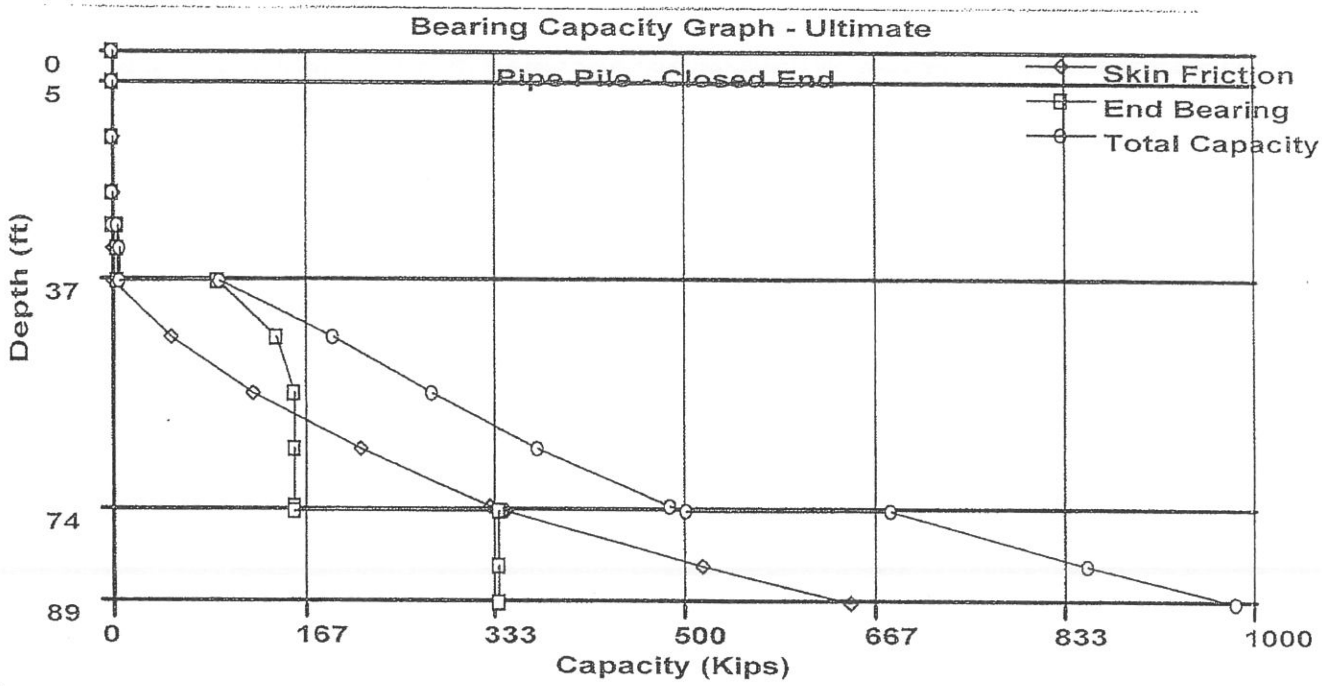


PLATE
B-9

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\INTAKEC.DVN
Project Name: DWS Intake   Project Date: 08/23/2007
Project Client: HDR
Computed By: AJK
Project Manager: CFH

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 24.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	8.00 ft
	- Driving/Restrike	8.00 ft
	- Ultimate:	8.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	28.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	5.00 ft	0.00%	117.00 pcf	30.0/30.0	Nordlund
2	Cohesive	32.00 ft	0.00%	68.00 pcf	200.00 psf	User Def.
3	Cohesionless	37.00 ft	0.00%	122.00 pcf	33.0/33.0	Nordlund
4	Cohesionless	15.00 ft	0.00%	130.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.58 psf	23.94	N/A	0.00 Kips
4.99 ft	Cohesionless	291.91 psf	23.94	N/A	4.53 Kips
5.01 ft	Cohesive	N/A	N/A	25.00 psf	4.55 Kips
14.01 ft	Cohesive	N/A	N/A	25.00 psf	5.96 Kips
23.01 ft	Cohesive	N/A	N/A	25.00 psf	7.38 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	8.79 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	9.57 Kips
37.01 ft	Cohesionless	951.70 psf	26.33	N/A	9.62 Kips
46.01 ft	Cohesionless	1219.90 psf	26.33	N/A	59.05 Kips
55.01 ft	Cohesionless	1488.10 psf	26.33	N/A	130.21 Kips
64.01 ft	Cohesionless	1756.30 psf	26.33	N/A	223.11 Kips
73.01 ft	Cohesionless	2024.50 psf	26.33	N/A	337.73 Kips
73.99 ft	Cohesionless	2053.70 psf	26.33	N/A	351.53 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	351.84 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	523.38 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	654.03 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.17 psf	30.00	41.85 Kips	0.06 Kips
4.99 ft	Cohesionless	583.83 psf	30.00	41.85 Kips	31.91 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	91.14 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	140.66 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	157.08 Kips
64.01 ft	Cohesionless	2561.20 psf	47.20	157.08 Kips	157.08 Kips
73.01 ft	Cohesionless	3097.60 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.06 Kips	0.06 Kips
4.99 ft	4.53 Kips	31.91 Kips	36.44 Kips
5.01 ft	4.55 Kips	5.65 Kips	10.20 Kips
14.01 ft	5.96 Kips	5.65 Kips	11.62 Kips
23.01 ft	7.38 Kips	5.65 Kips	13.03 Kips
32.01 ft	8.79 Kips	5.65 Kips	14.45 Kips
36.99 ft	9.57 Kips	5.65 Kips	15.23 Kips
37.01 ft	9.62 Kips	91.14 Kips	100.75 Kips
46.01 ft	59.05 Kips	140.66 Kips	199.71 Kips
55.01 ft	130.21 Kips	157.08 Kips	287.29 Kips
64.01 ft	223.11 Kips	157.08 Kips	380.19 Kips
73.01 ft	337.73 Kips	157.08 Kips	494.81 Kips
73.99 ft	351.53 Kips	157.08 Kips	508.61 Kips
74.01 ft	351.84 Kips	338.04 Kips	689.88 Kips
83.01 ft	523.38 Kips	338.04 Kips	861.41 Kips
88.99 ft	654.03 Kips	338.04 Kips	992.06 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.58 psf	23.94	N/A	0.00 Kips
4.99 ft	Cohesionless	291.91 psf	23.94	N/A	4.53 Kips
5.01 ft	Cohesive	N/A	N/A	25.00 psf	4.55 Kips
14.01 ft	Cohesive	N/A	N/A	25.00 psf	5.96 Kips
23.01 ft	Cohesive	N/A	N/A	25.00 psf	7.38 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	8.79 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	9.57 Kips
37.01 ft	Cohesionless	951.70 psf	26.33	N/A	9.62 Kips
46.01 ft	Cohesionless	1219.90 psf	26.33	N/A	59.05 Kips
55.01 ft	Cohesionless	1488.10 psf	26.33	N/A	130.21 Kips
64.01 ft	Cohesionless	1756.30 psf	26.33	N/A	223.11 Kips
73.01 ft	Cohesionless	2024.50 psf	26.33	N/A	337.73 Kips
73.99 ft	Cohesionless	2053.70 psf	26.33	N/A	351.53 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	351.84 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	523.38 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	654.03 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.17 psf	30.00	41.85 Kips	0.06 Kips
4.99 ft	Cohesionless	583.83 psf	30.00	41.85 Kips	31.91 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	91.14 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	140.66 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	157.08 Kips
64.01 ft	Cohesionless	2561.20 psf	47.20	157.08 Kips	157.08 Kips
73.01 ft	Cohesionless	3097.60 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.06 Kips	0.06 Kips
4.99 ft	4.53 Kips	31.91 Kips	36.44 Kips
5.01 ft	4.55 Kips	5.65 Kips	10.20 Kips
14.01 ft	5.96 Kips	5.65 Kips	11.62 Kips
23.01 ft	7.38 Kips	5.65 Kips	13.03 Kips
32.01 ft	8.79 Kips	5.65 Kips	14.45 Kips
36.99 ft	9.57 Kips	5.65 Kips	15.23 Kips
37.01 ft	9.62 Kips	91.14 Kips	100.75 Kips
46.01 ft	59.05 Kips	140.66 Kips	199.71 Kips
55.01 ft	130.21 Kips	157.08 Kips	287.29 Kips
64.01 ft	223.11 Kips	157.08 Kips	380.19 Kips
73.01 ft	337.73 Kips	157.08 Kips	494.81 Kips
73.99 ft	351.53 Kips	157.08 Kips	508.61 Kips
74.01 ft	351.84 Kips	338.04 Kips	689.88 Kips
83.01 ft	523.38 Kips	338.04 Kips	861.41 Kips
88.99 ft	654.03 Kips	338.04 Kips	992.06 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
4.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
5.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
23.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
27.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
28.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
32.01 ft	Cohesive	N/A	N/A	25.00 psf	0.63 Kips
36.99 ft	Cohesive	N/A	N/A	25.00 psf	1.41 Kips
37.01 ft	Cohesionless	951.70 psf	26.33	N/A	1.46 Kips
46.01 ft	Cohesionless	1219.90 psf	26.33	N/A	50.89 Kips
55.01 ft	Cohesionless	1488.10 psf	26.33	N/A	122.05 Kips
64.01 ft	Cohesionless	1756.30 psf	26.33	N/A	214.95 Kips
73.01 ft	Cohesionless	2024.50 psf	26.33	N/A	329.57 Kips
73.99 ft	Cohesionless	2053.70 psf	26.33	N/A	343.37 Kips
74.01 ft	Cohesionless	3156.94 psf	27.93	N/A	343.68 Kips
83.01 ft	Cohesionless	3461.14 psf	27.93	N/A	515.22 Kips
88.99 ft	Cohesionless	3663.26 psf	27.93	N/A	645.87 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
4.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
5.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
27.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
28.00 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
36.99 ft	Cohesive	N/A	N/A	N/A	5.65 Kips
37.01 ft	Cohesionless	952.00 psf	47.20	157.08 Kips	91.14 Kips
46.01 ft	Cohesionless	1488.40 psf	47.20	157.08 Kips	140.66 Kips
55.01 ft	Cohesionless	2024.80 psf	47.20	157.08 Kips	157.08 Kips
64.01 ft	Cohesionless	2561.20 psf	47.20	157.08 Kips	157.08 Kips
73.01 ft	Cohesionless	3097.60 psf	47.20	157.08 Kips	157.08 Kips
73.99 ft	Cohesionless	3156.00 psf	47.20	157.08 Kips	157.08 Kips
74.01 ft	Cohesionless	3157.28 psf	64.00	338.04 Kips	338.04 Kips
83.01 ft	Cohesionless	3765.68 psf	64.00	338.04 Kips	338.04 Kips
88.99 ft	Cohesionless	4169.92 psf	64.00	338.04 Kips	338.04 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
23.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
27.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
28.00 ft	0.00 Kips	5.65 Kips	5.65 Kips
32.01 ft	0.63 Kips	5.65 Kips	6.28 Kips
36.99 ft	1.41 Kips	5.65 Kips	7.07 Kips
37.01 ft	1.46 Kips	91.14 Kips	92.59 Kips
46.01 ft	50.89 Kips	140.66 Kips	191.55 Kips
55.01 ft	122.05 Kips	157.08 Kips	279.13 Kips
64.01 ft	214.95 Kips	157.08 Kips	372.03 Kips
73.01 ft	329.57 Kips	157.08 Kips	486.65 Kips
73.99 ft	343.37 Kips	157.08 Kips	500.45 Kips
74.01 ft	343.68 Kips	338.04 Kips	681.72 Kips
83.01 ft	515.22 Kips	338.04 Kips	853.25 Kips
88.99 ft	645.87 Kips	338.04 Kips	983.90 Kips

Top of Pile Elev. at 10' - 24" CISS Pile - Free Head

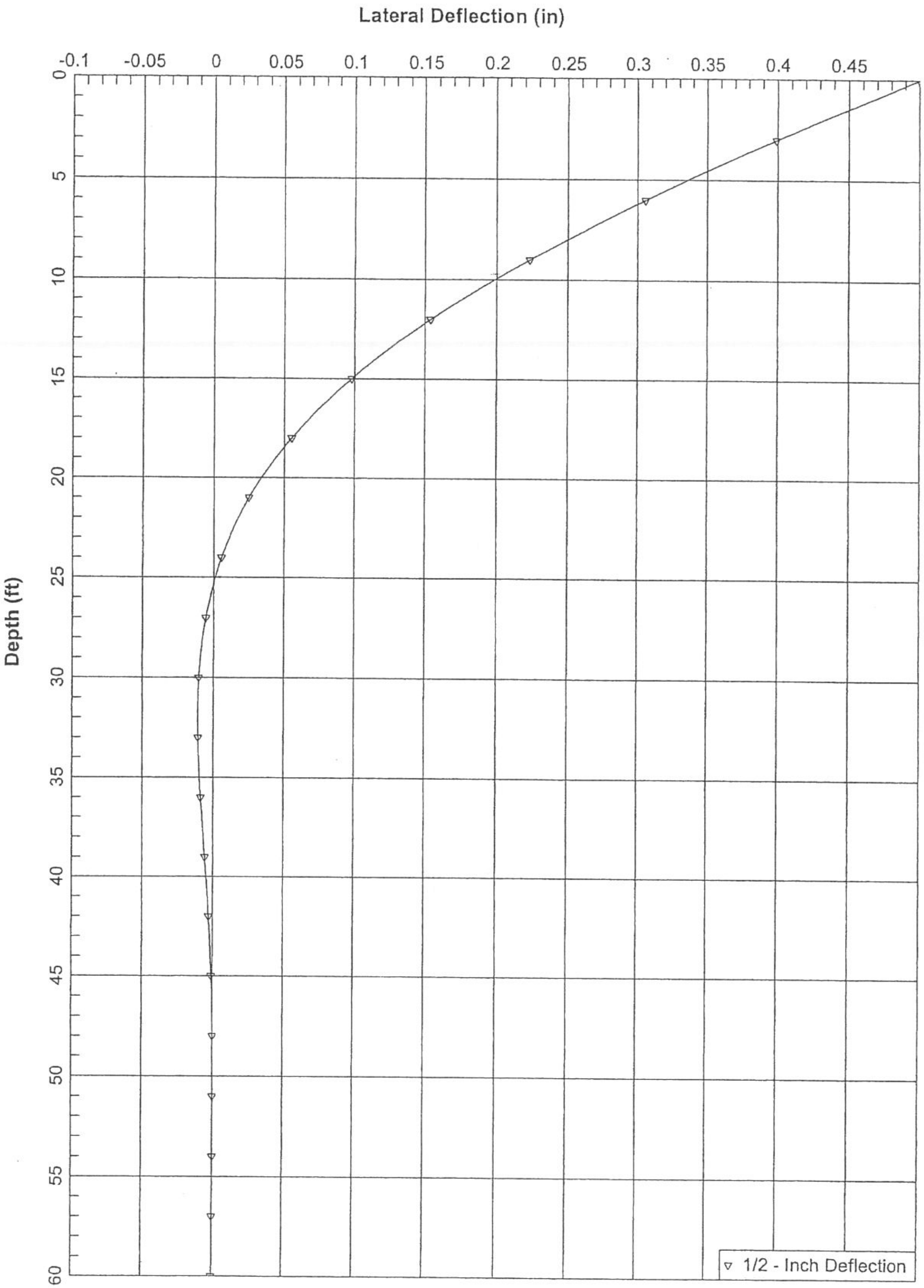
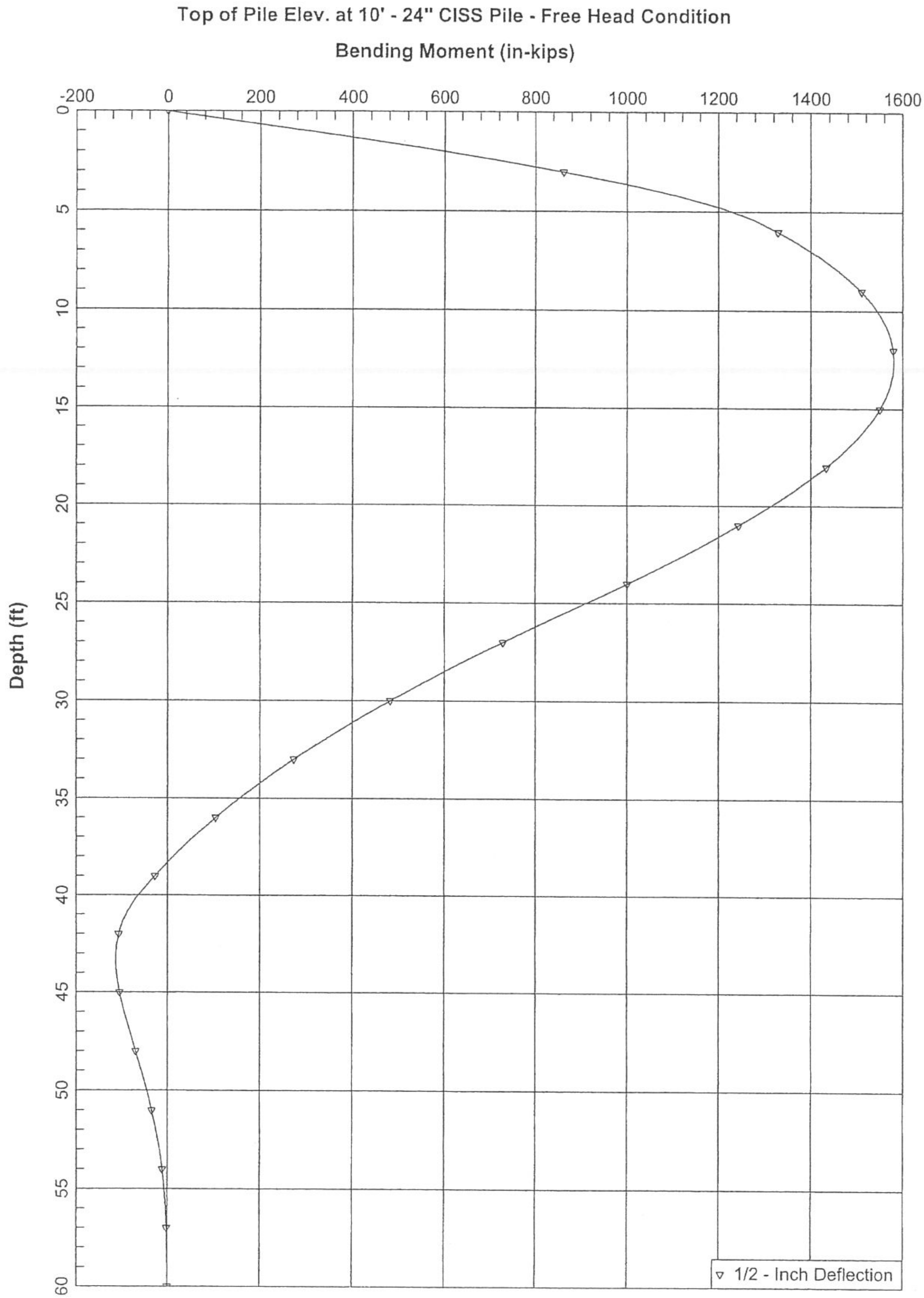


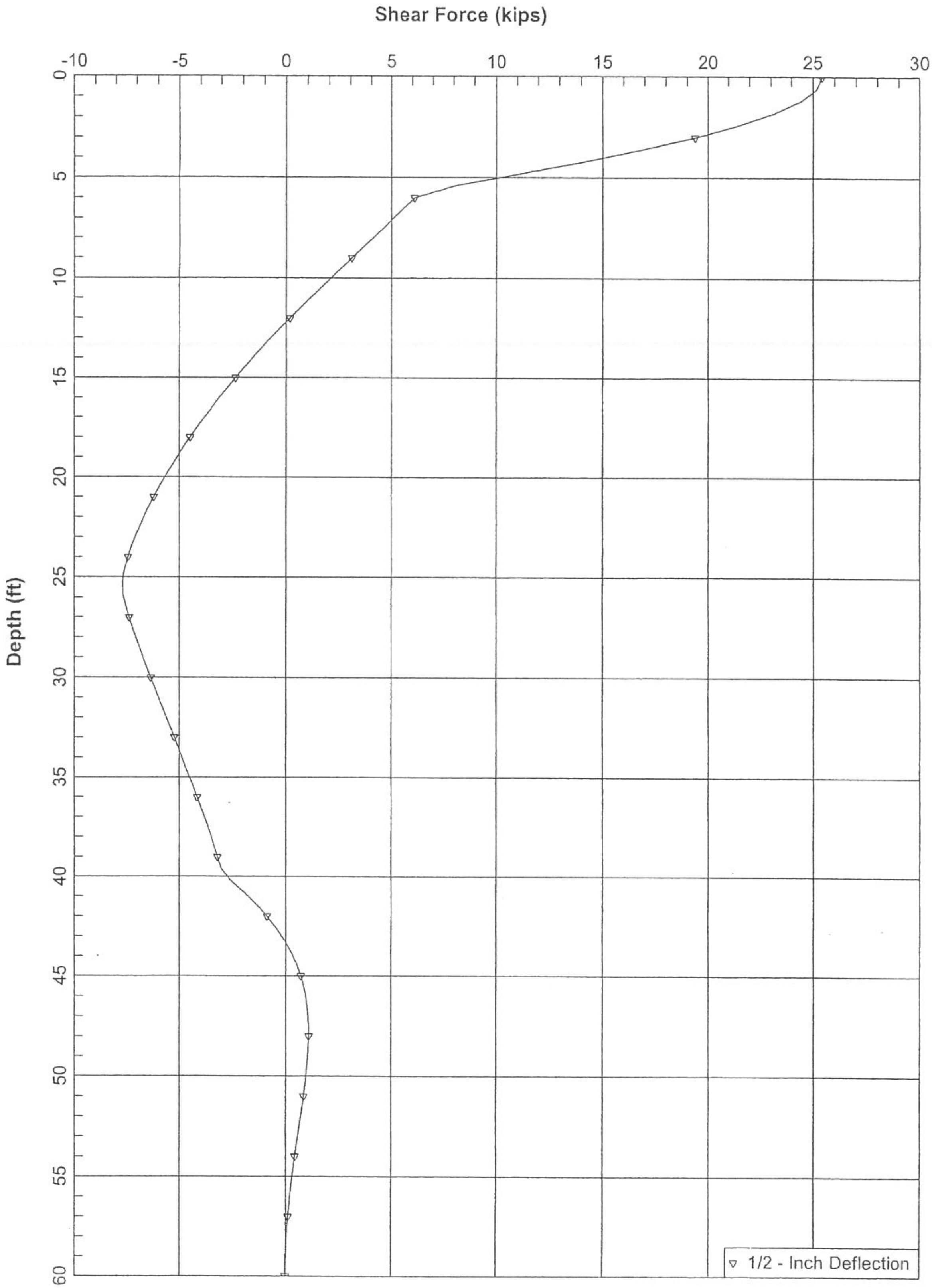
PLATE
B-17



Top of Pile Elev. at 10' - 24" CISS Pile - Free Head Condition
Bending Moment (in-kips)
-200
0
200
400
600
800
1000
1200
1400
1600
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection

PLATE
B-18

Top of Pile Elev. at 10' - 24" CISS Pile - Free Head Condition



Top of Pile Elev. at 10' - 24" CISS Pile - Fixed Head

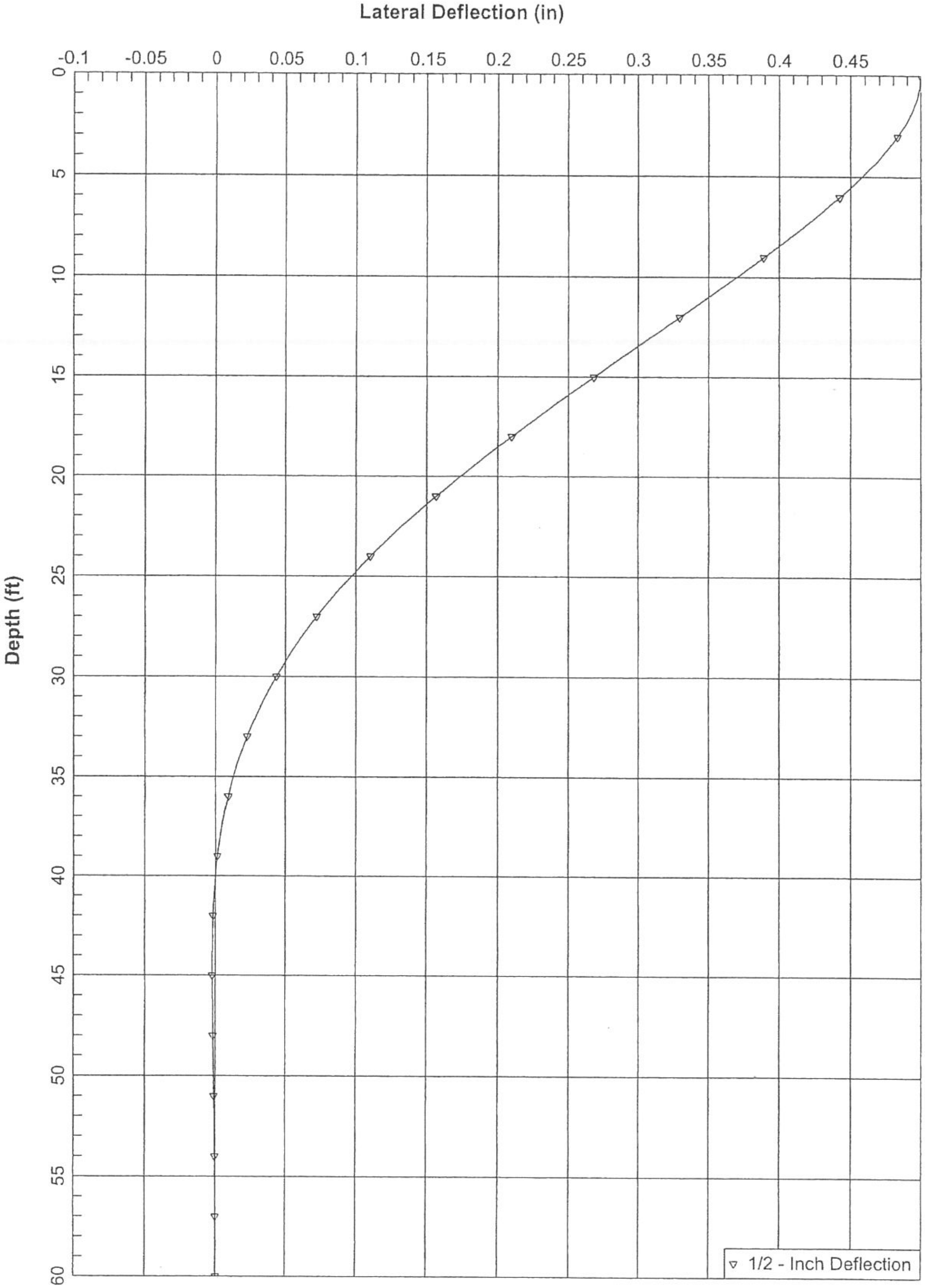
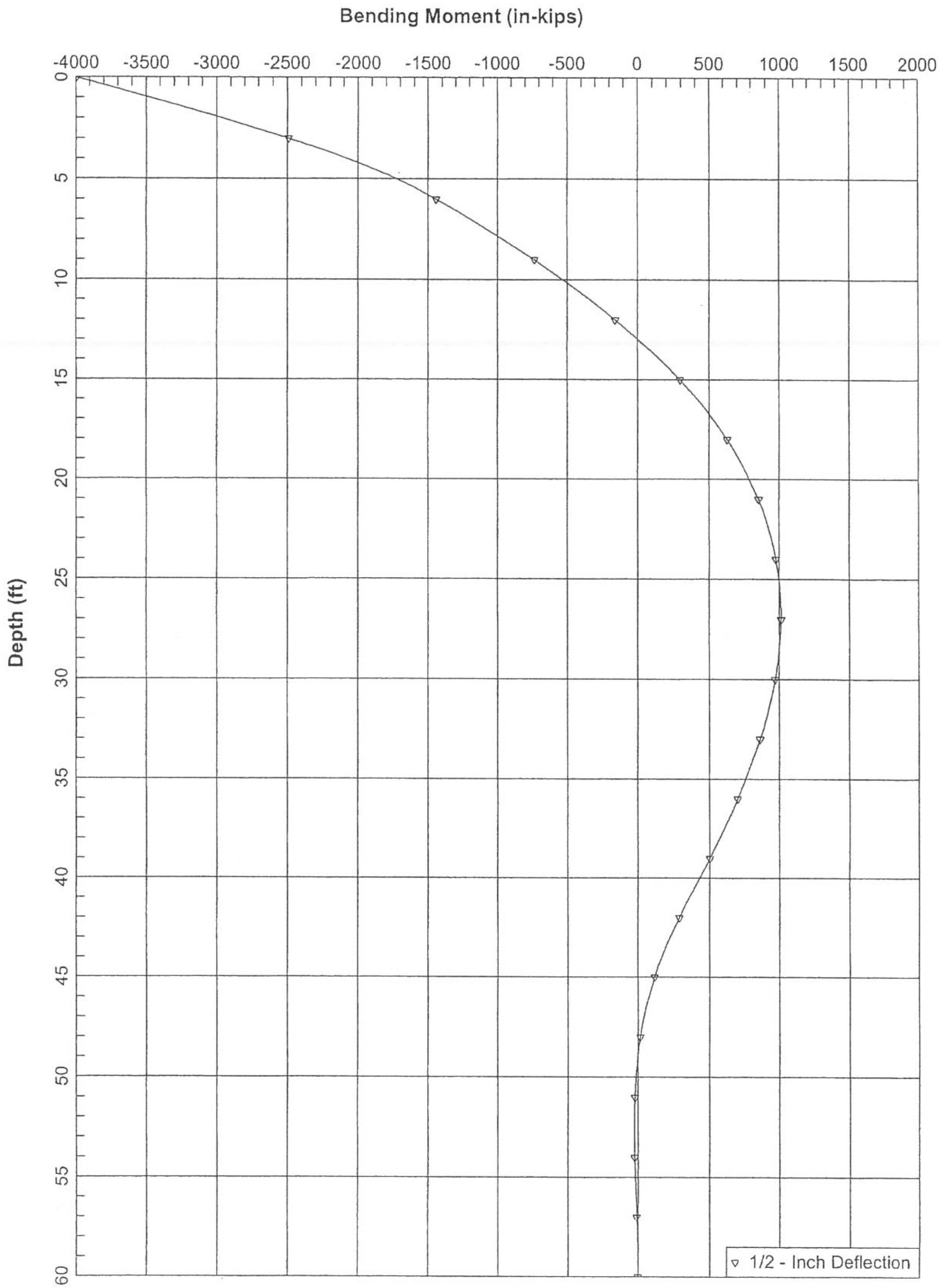
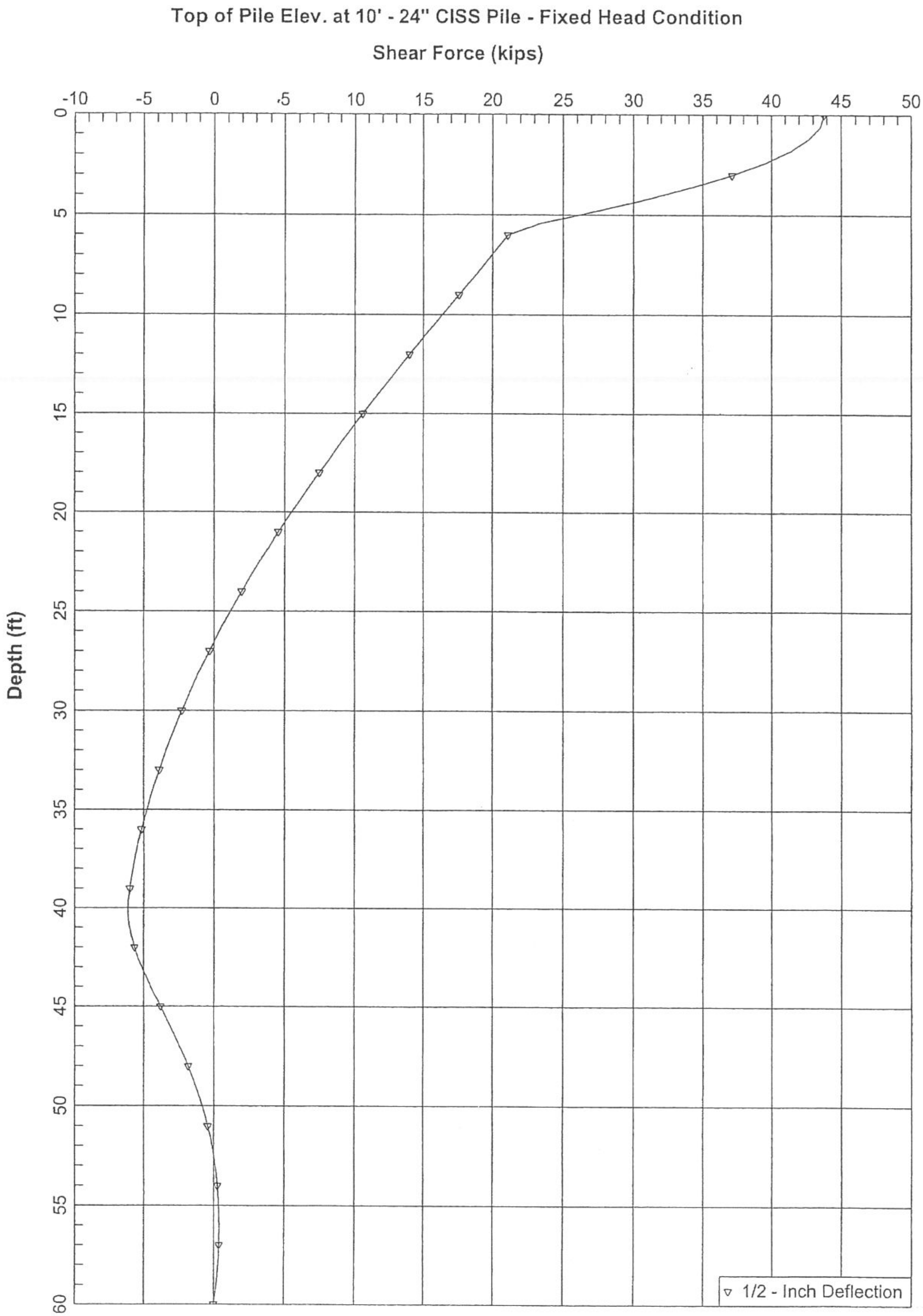
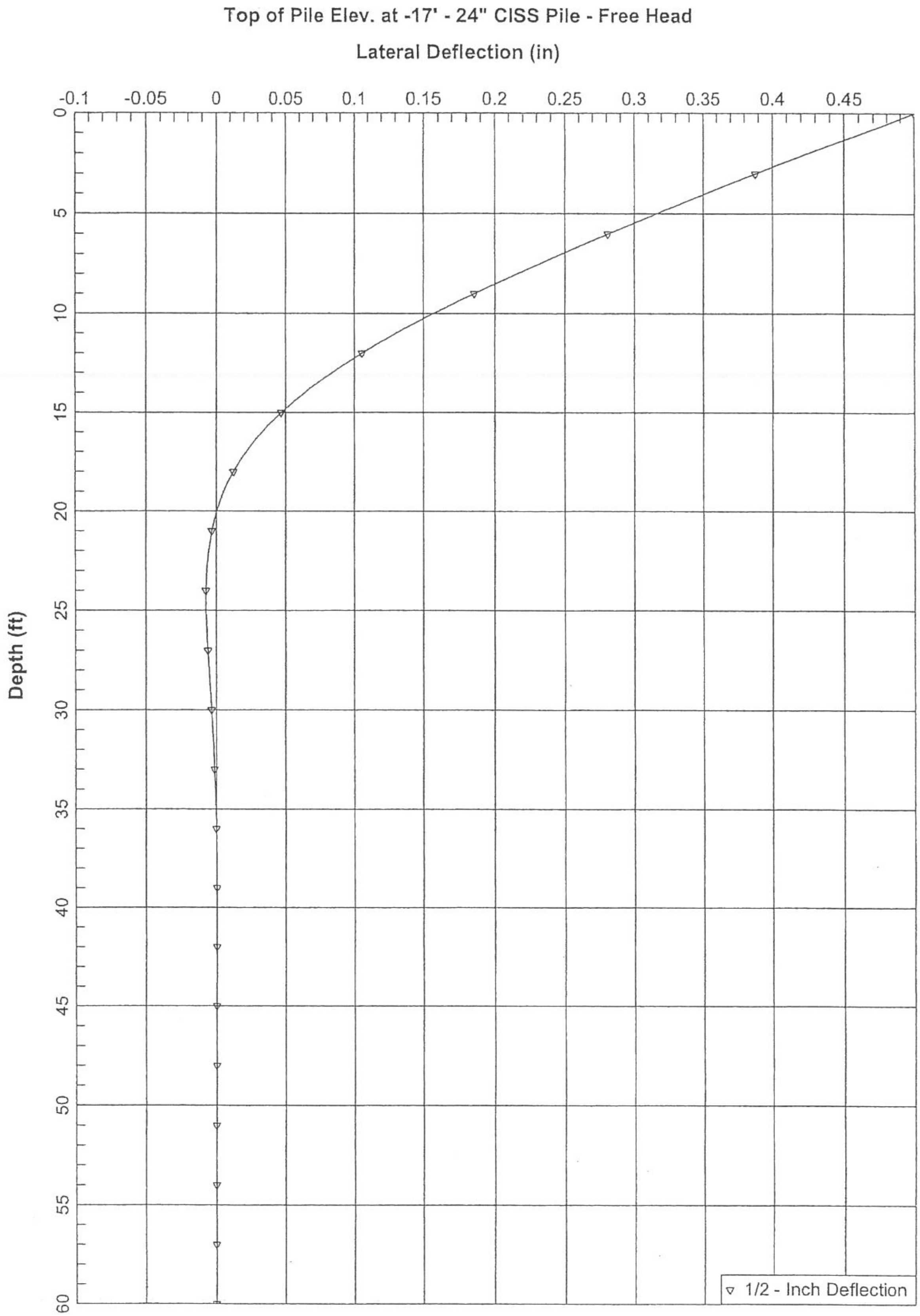


PLATE
B-20

Top of Pile Elev. at 10' - 24" CISS Pile - Fixed Head Condition

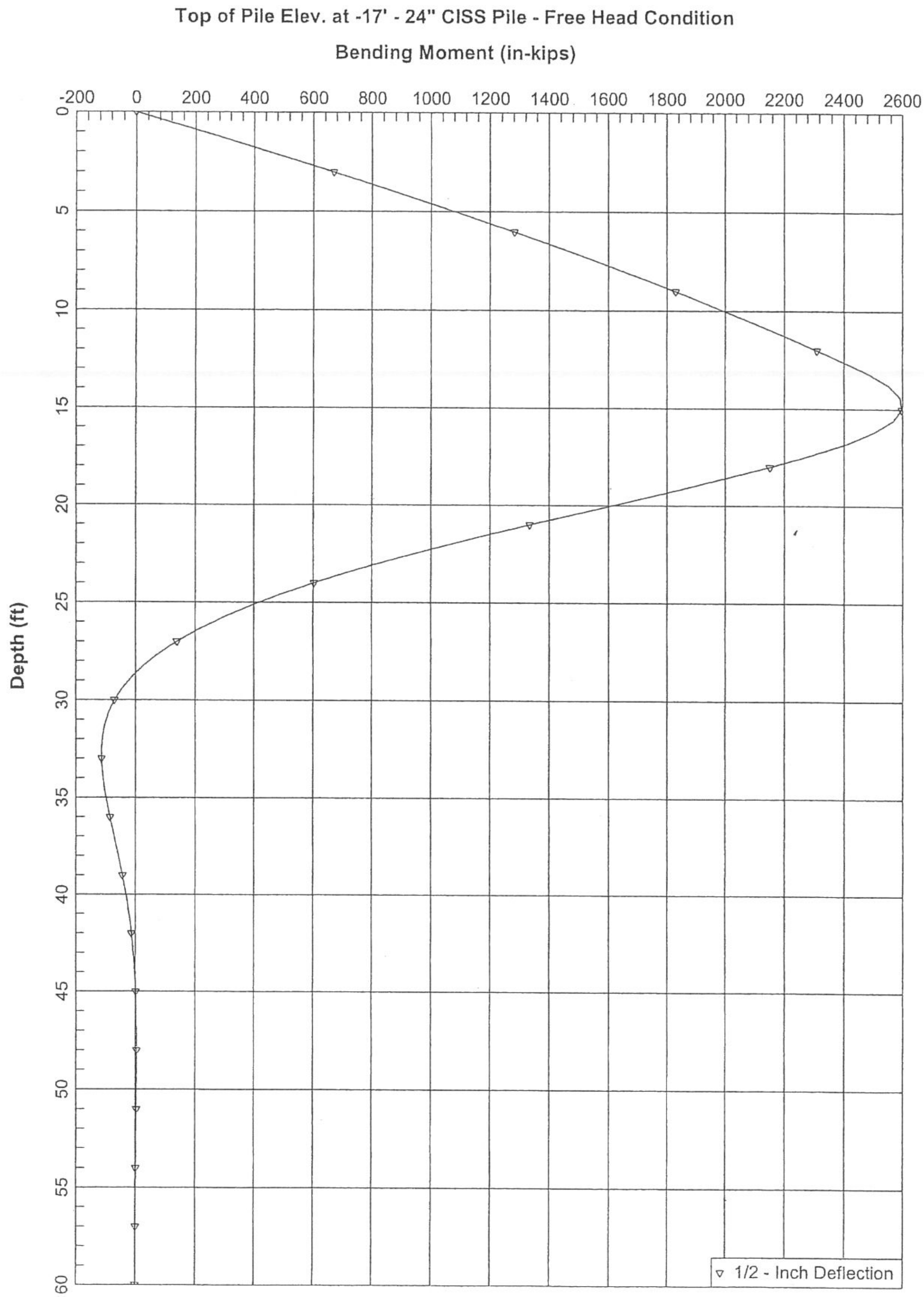


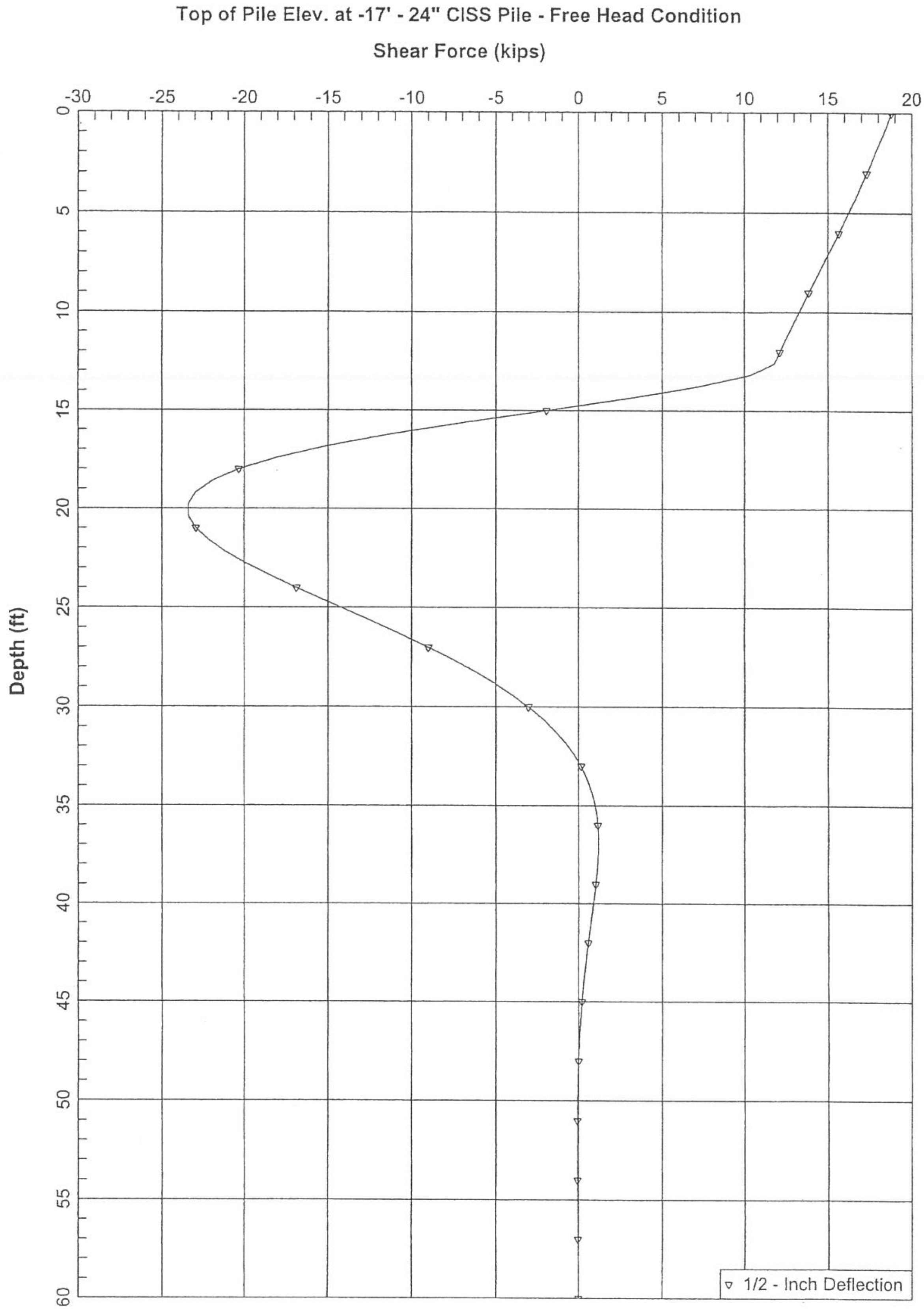

Top of Pile Elev. at 10' - 24" CISS Pile - Fixed Head Condition
Shear Force (kips)
Depth (ft)
-10
-5
0
5
10
15
20
25
30
35
40
45
50
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection

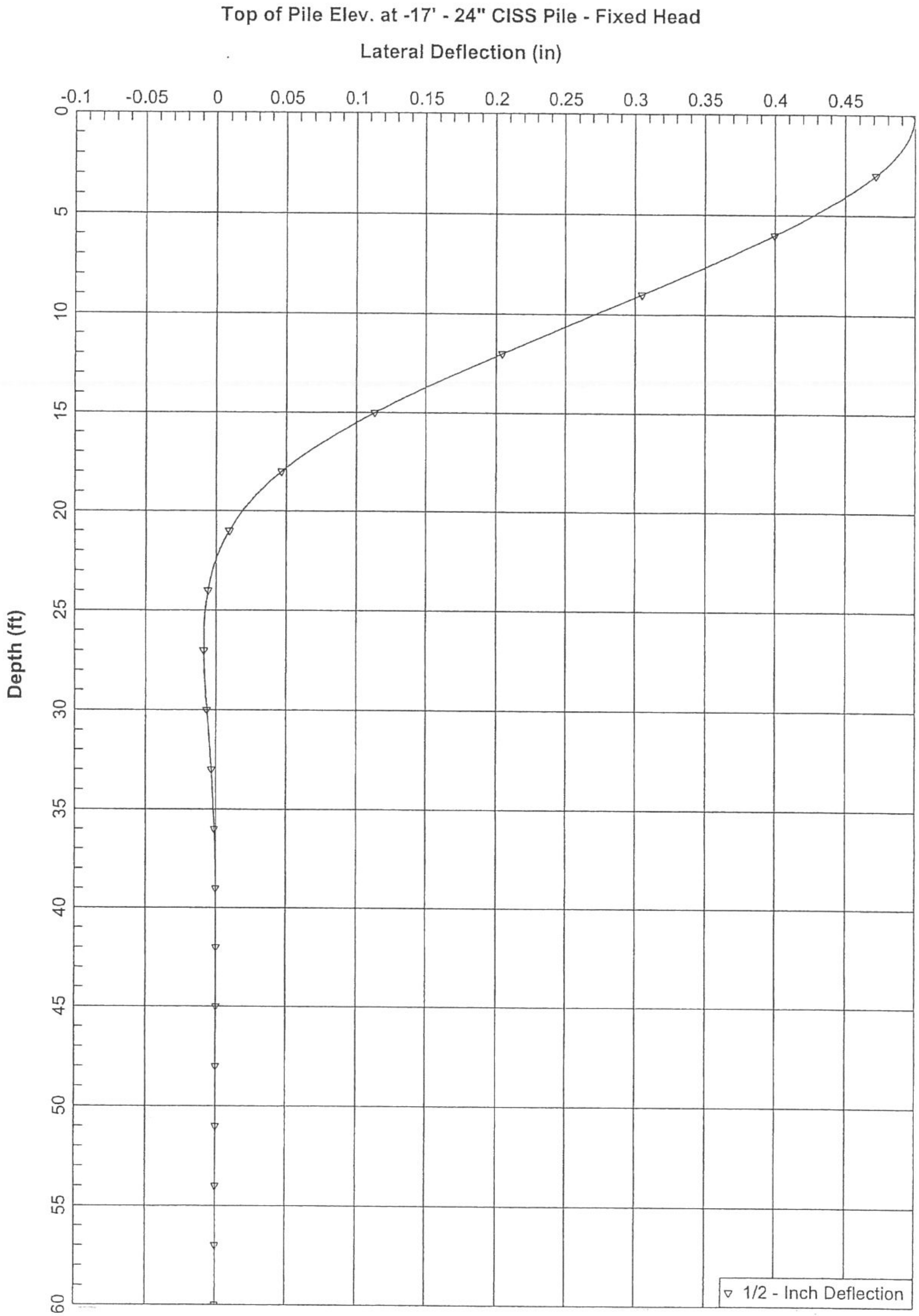


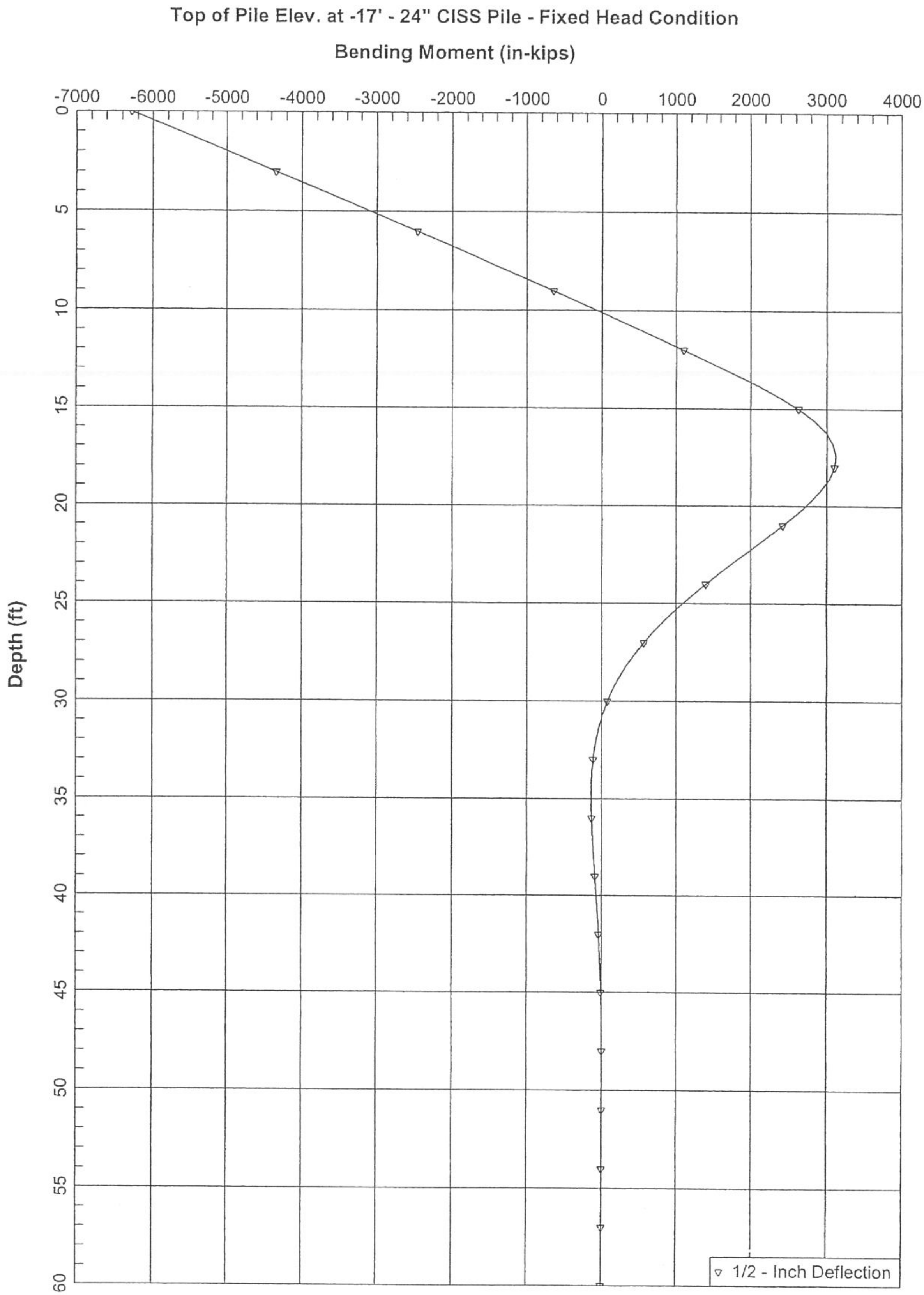
Top of Pile Elev. at -17' - 24" CISS Pile - Free Head
Lateral Deflection (in)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection

PLATE
B-23


Top of Pile Elev. at -17' - 24" CISS Pile - Free Head Condition
Bending Moment (in-kips)
-200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection


Top of Pile Elev. at -17' - 24" CISS Pile - Free Head Condition
Shear Force (kips)
-30
-25
-20
-15
-10
-5
0
5
10
15
20
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection


Top of Pile Elev. at -17' - 24" CISS Pile - Fixed Head
Lateral Deflection (in)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
1/2 - Inch Deflection


Top of Pile Elev. at -17' - 24" CISS Pile - Fixed Head Condition
Bending Moment (in-kips)
-7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000
Depth (ft)
0 5 10 15 20 25 30 35 40 45 50 55 60
1/2 - Inch Deflection

Top of Pile Elev. at -17' - 24" CISS Pile - Fixed Head Condition

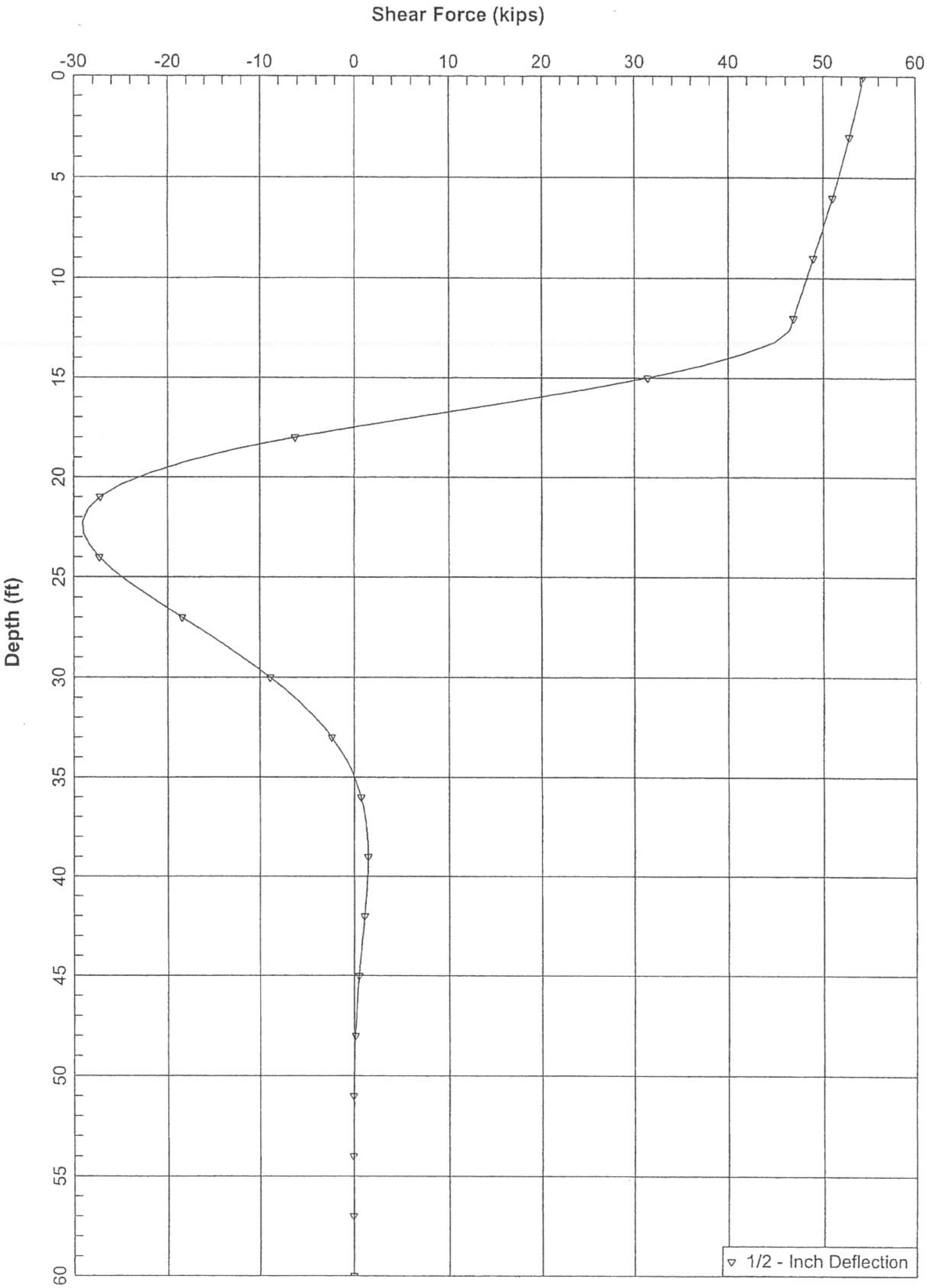
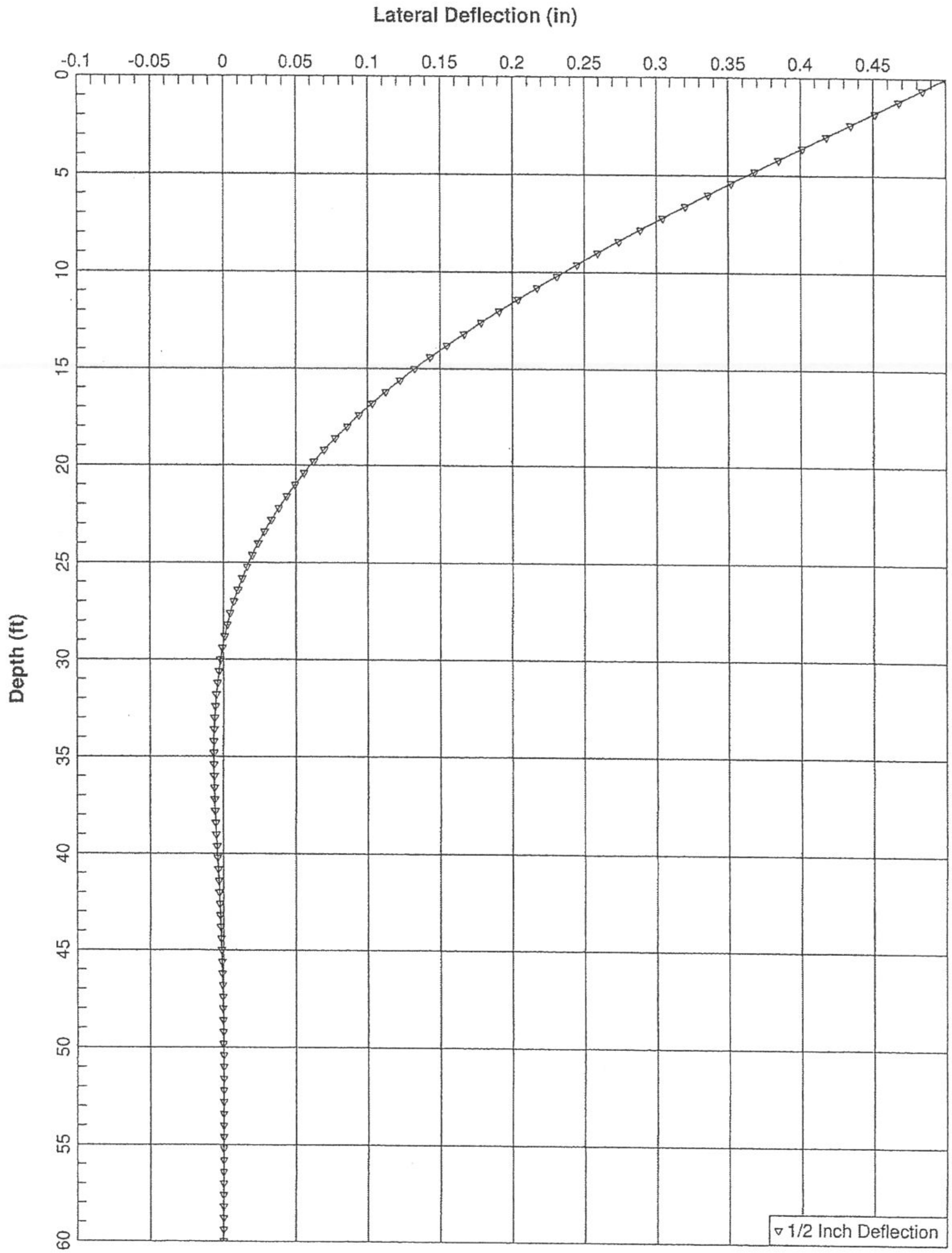
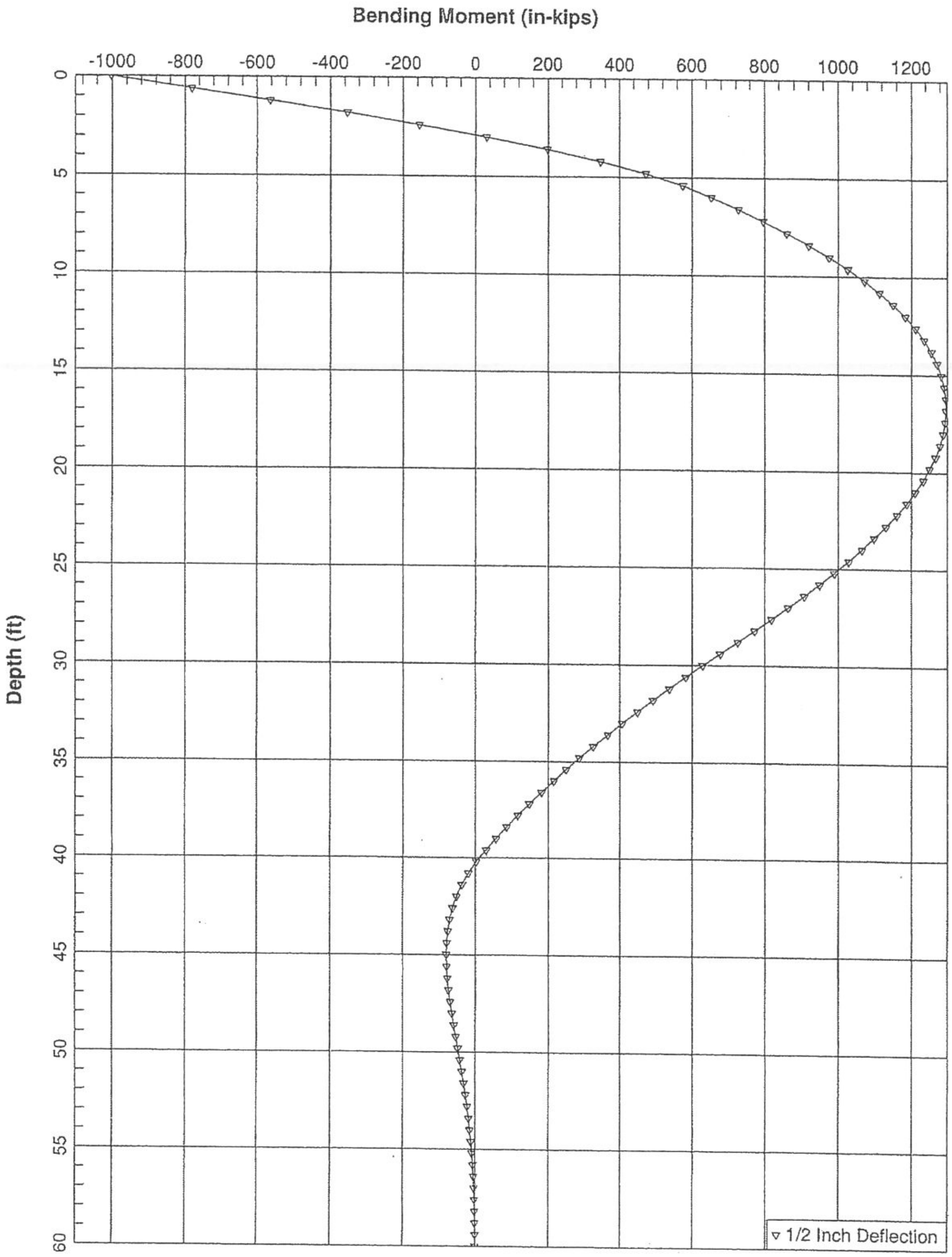


PLATE
B-28

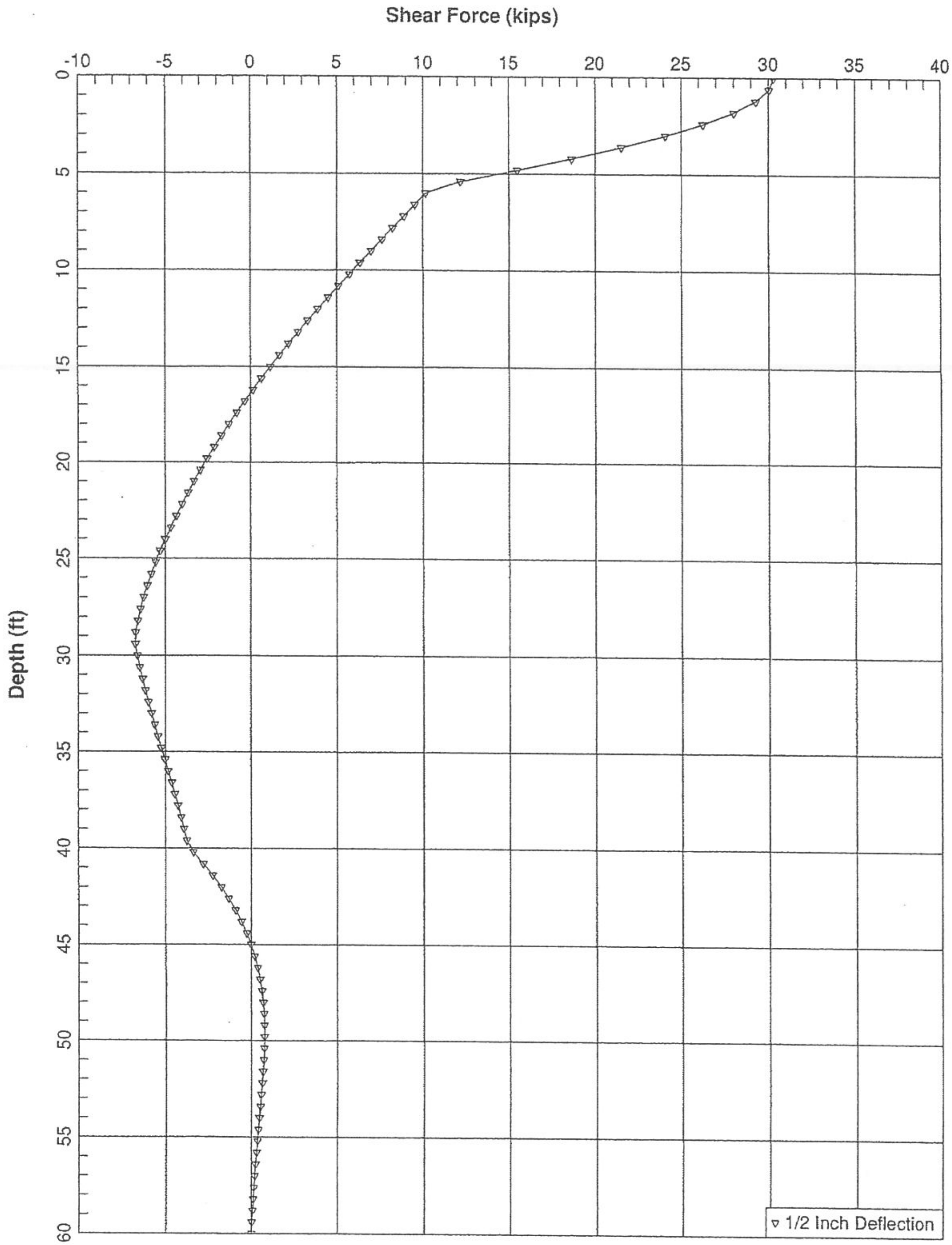


+10 Elevation 25% Fixity 24 in CISS

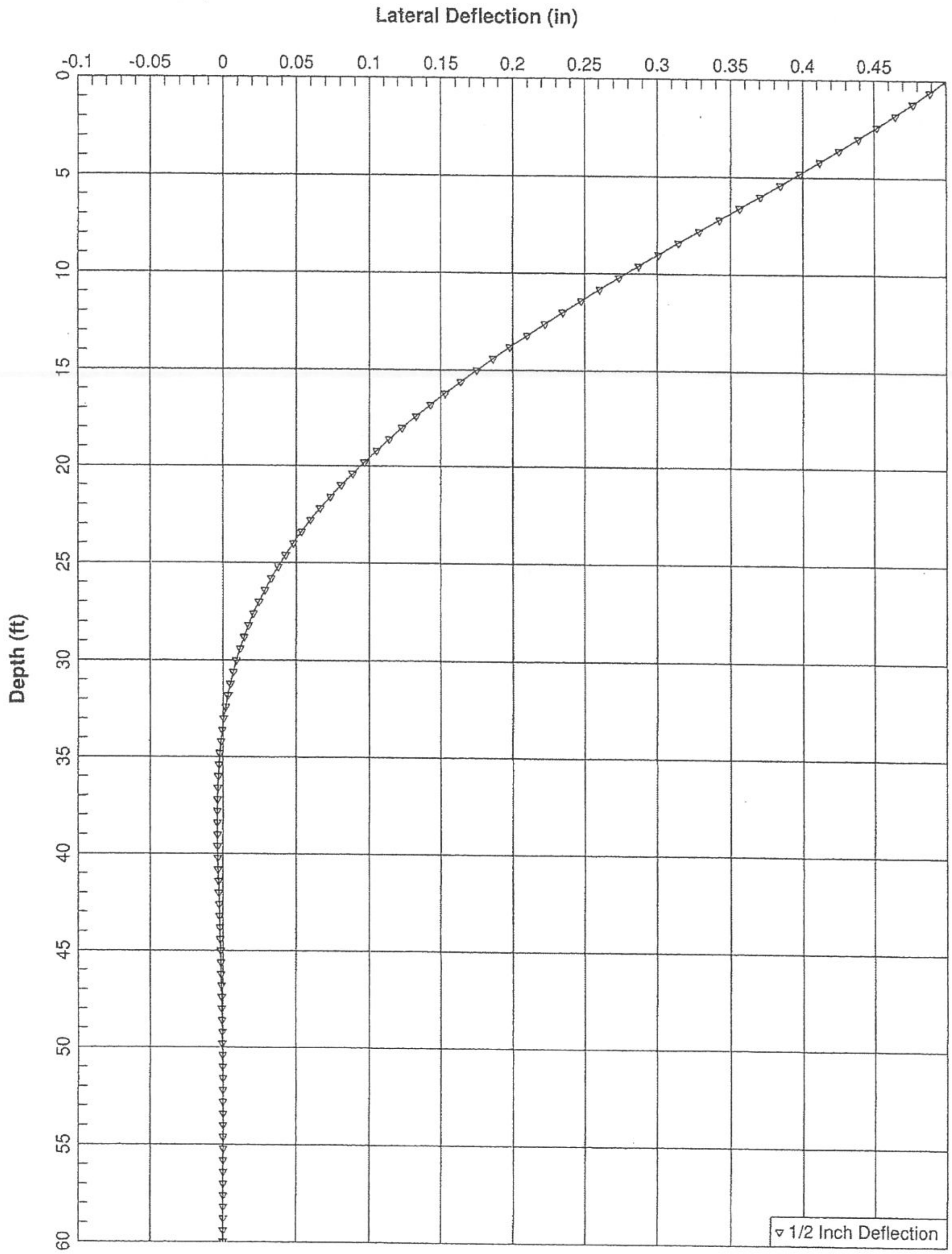


+10 Elevation 25% Fixity 24 in CISS

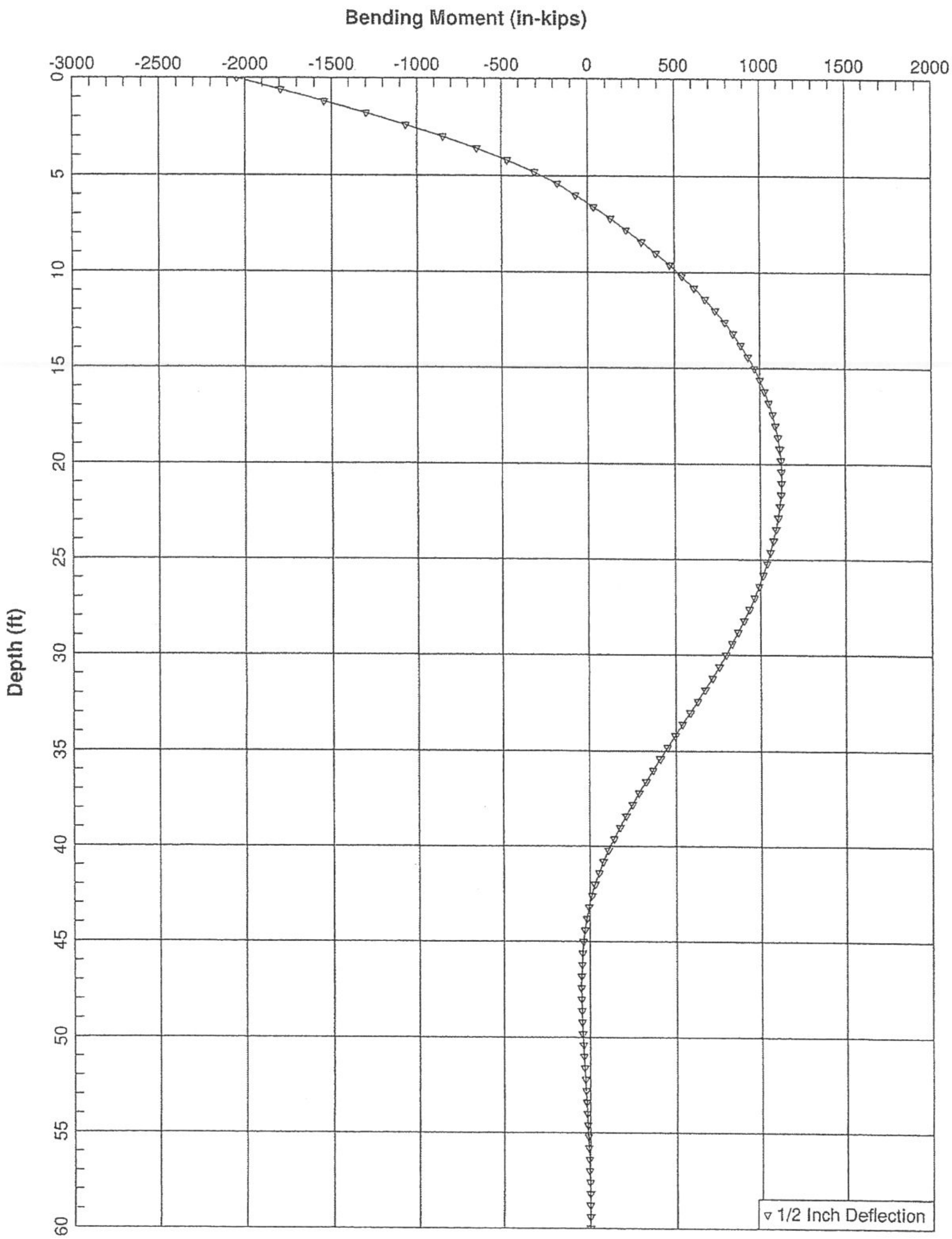
PLATE
B-30



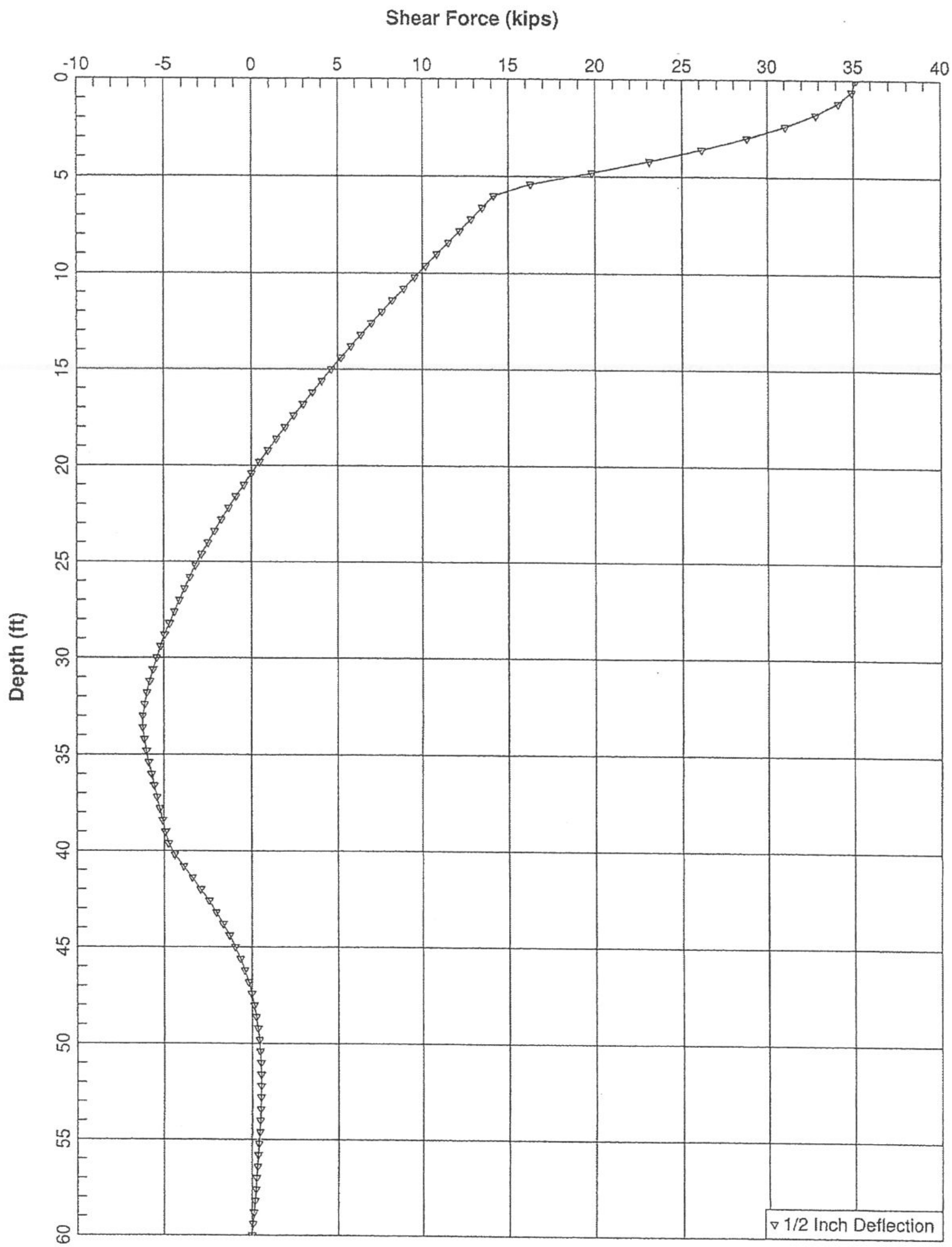
+10 Elevation 25% Fixity 24 in CISS



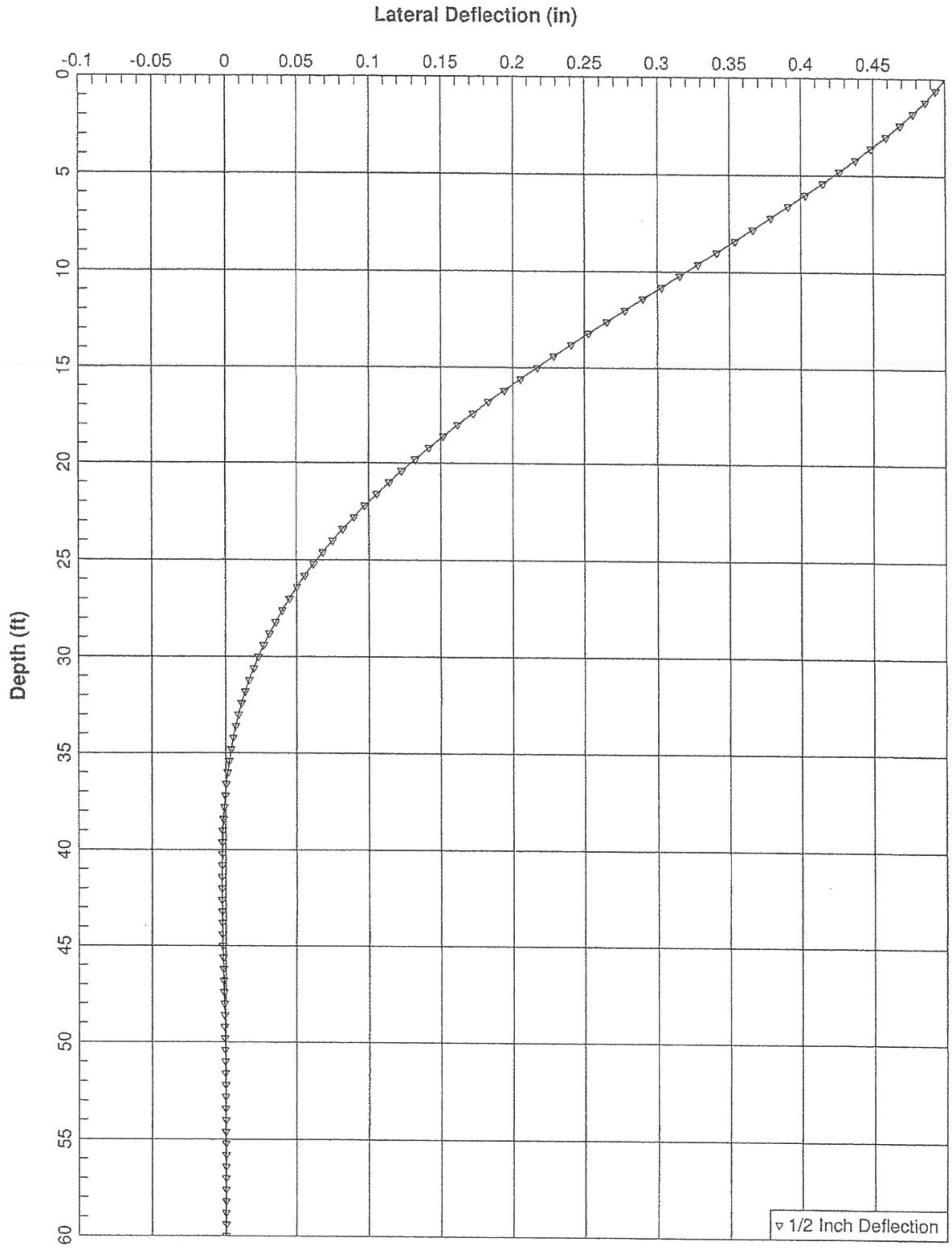
+10 Elevation 50% Fixity 24 in CISS



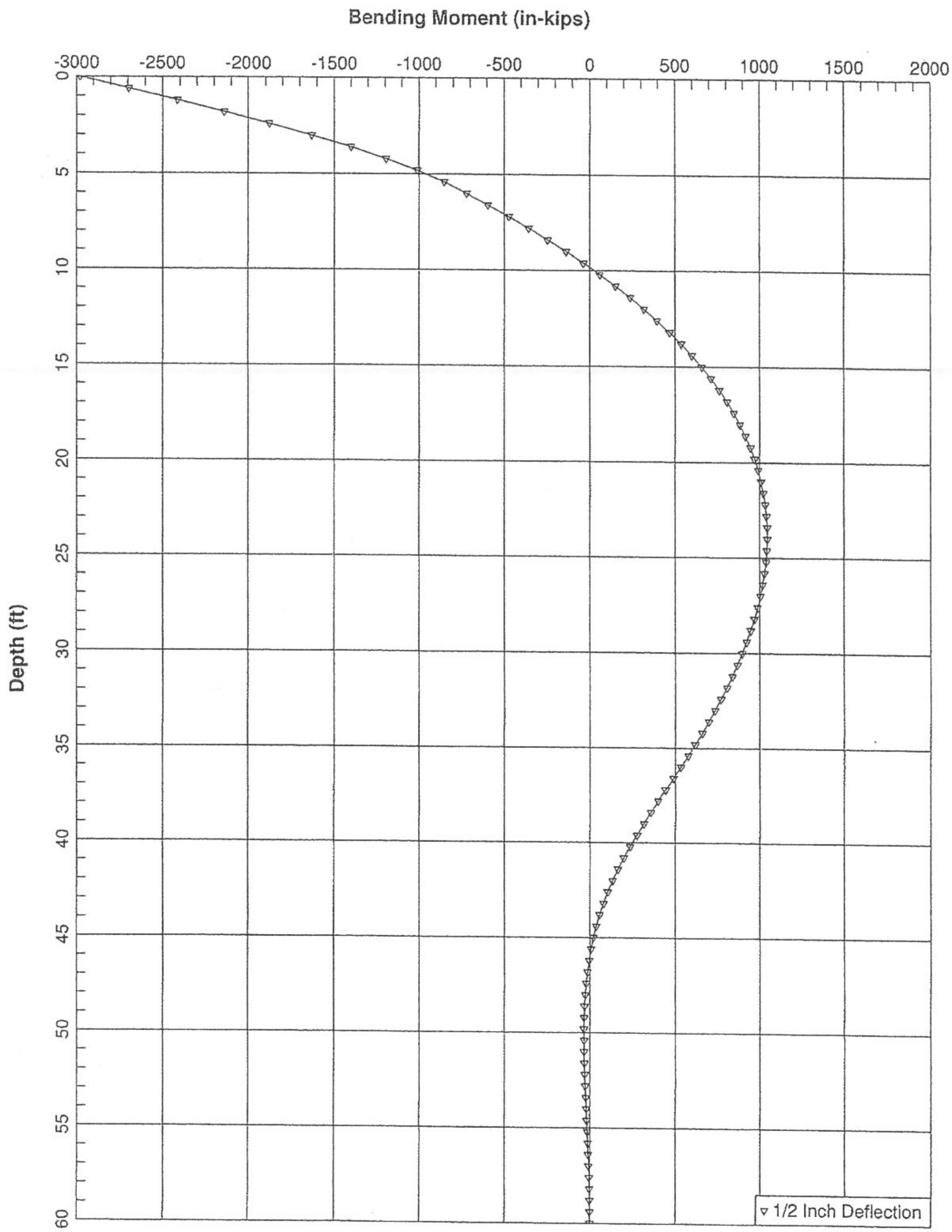
+10 Elevation 50% Fixity 24 in CISS



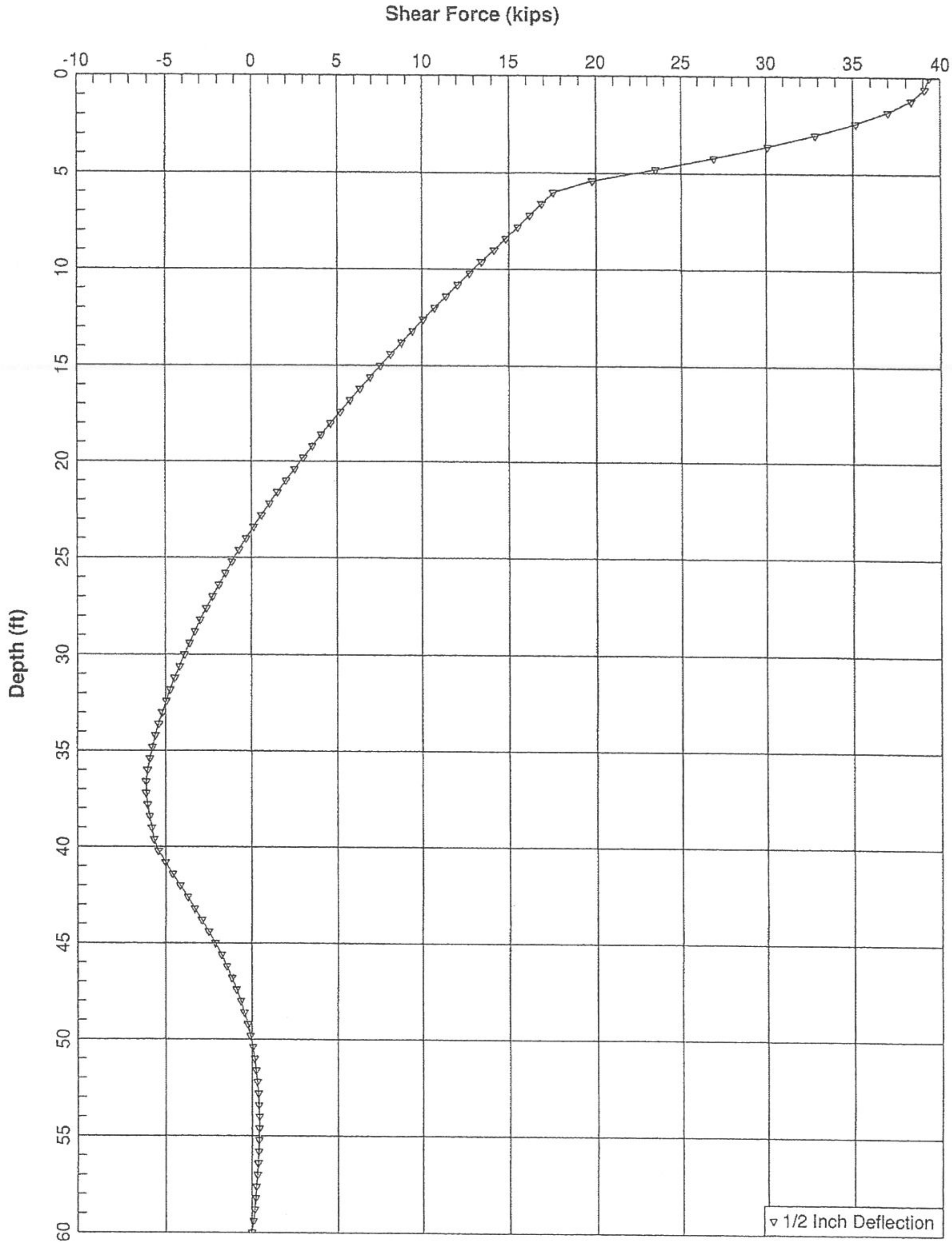
+10 Elevation 50% Fixity 24 in CISS



+10 Elevation 75% Fixity 24 in CISS

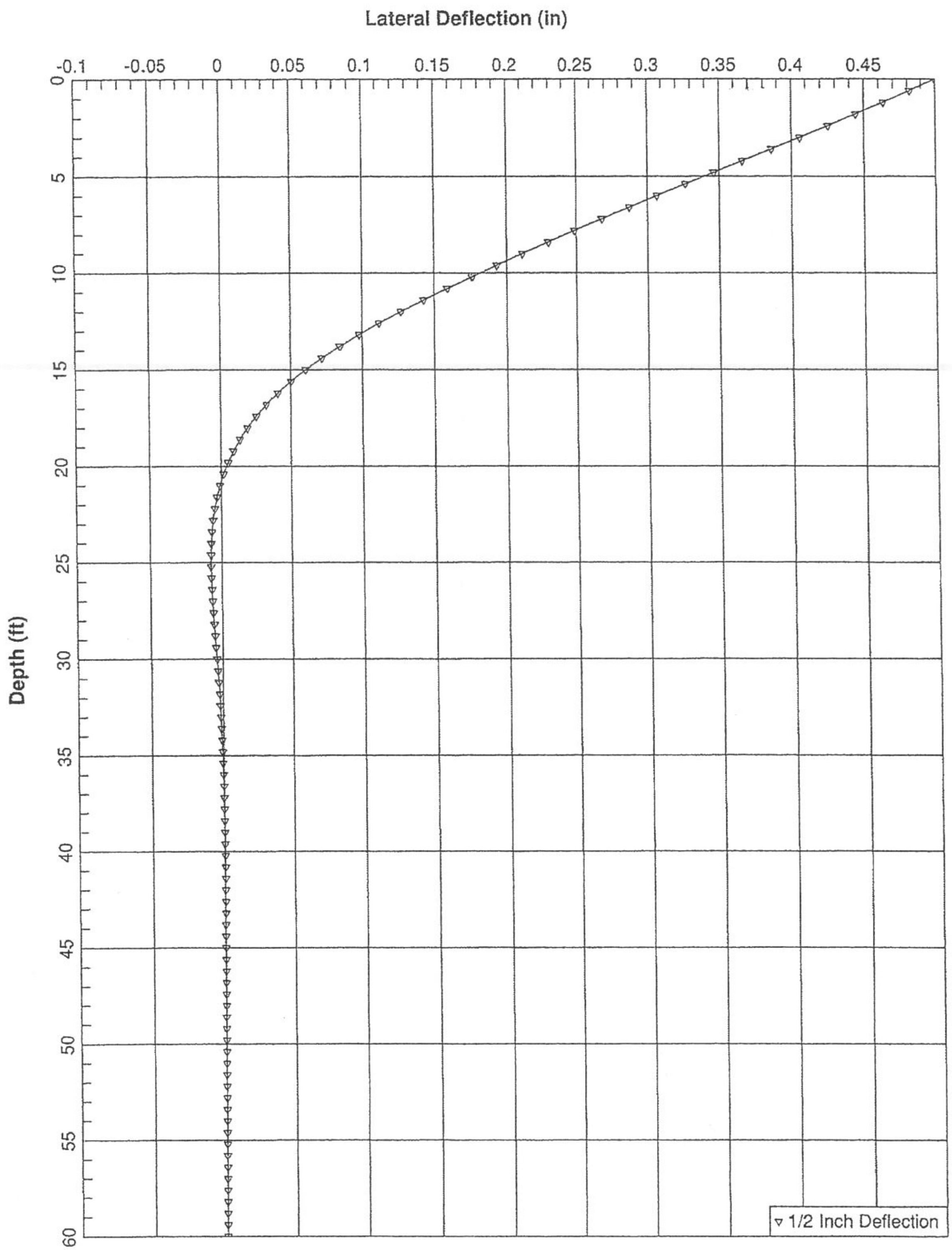


+10 Elevation 75% Fixity 24 in CISS



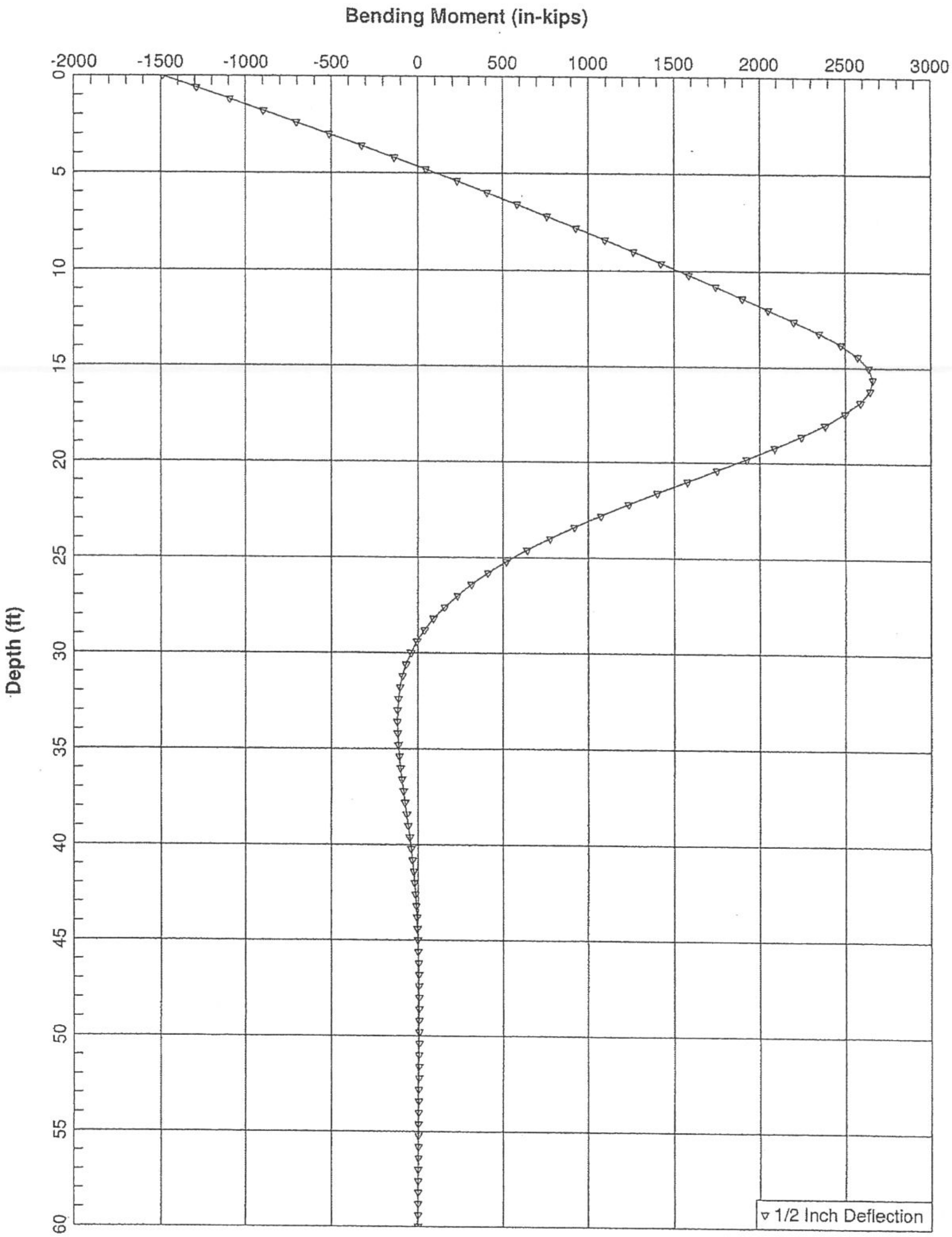
+10 Elevation 75% Fixity 24 in CISS

PLATE
B-37

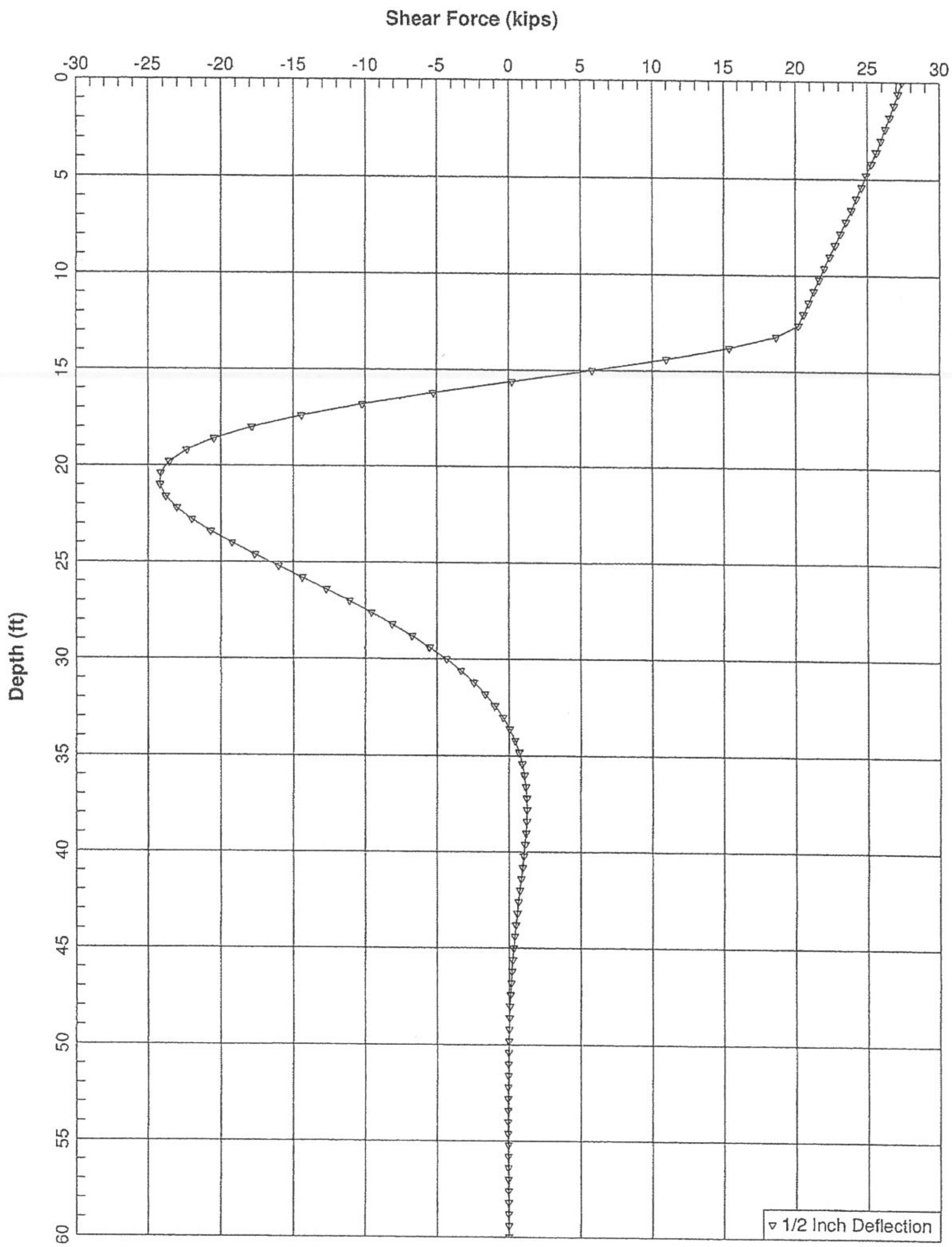


-17 Elevation 25% Fixity 24 in CISS

PLATE
B-38

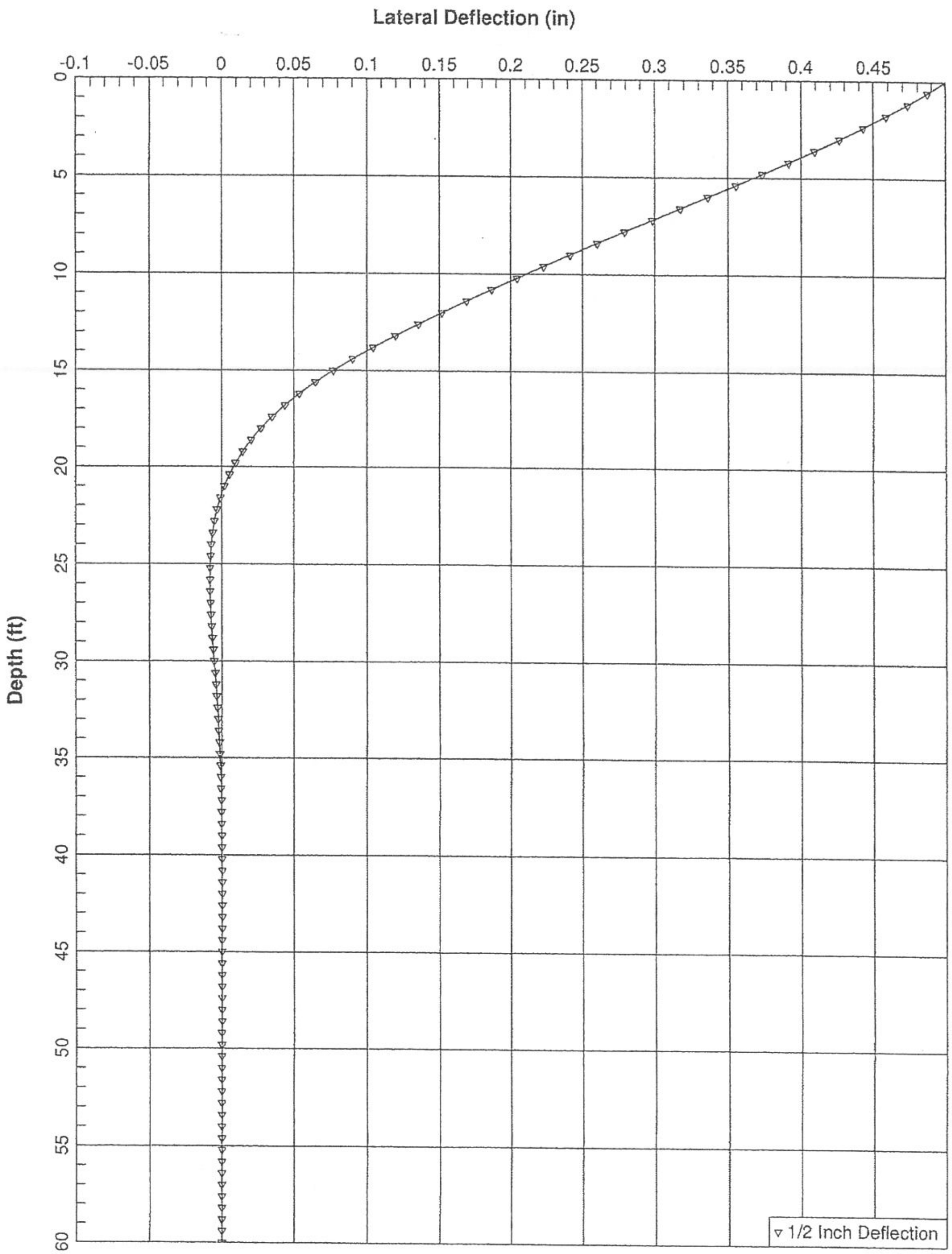


-17 Elevation 25% Fixity 24 in CISS

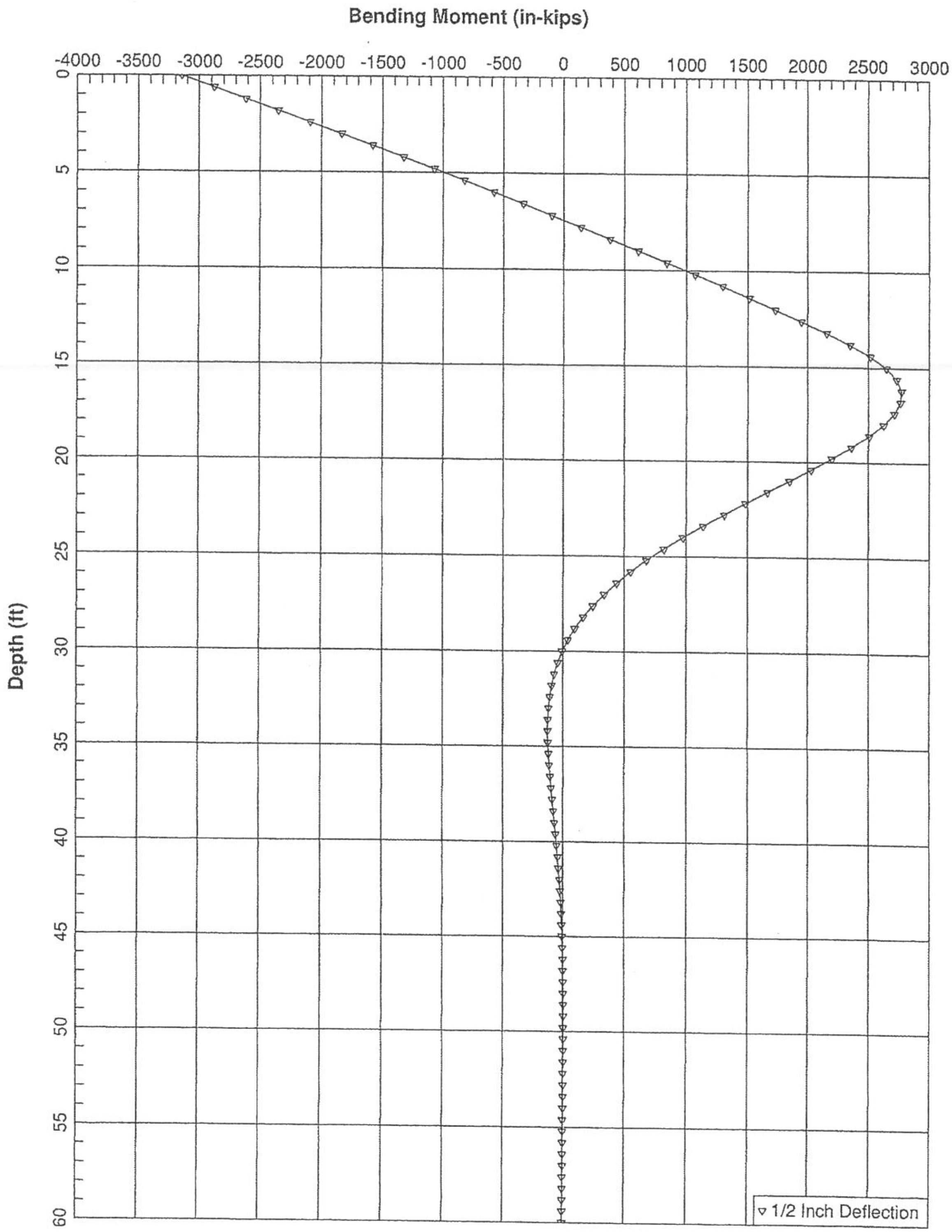


-17 Elevation 25% Fixity 24 in CISS

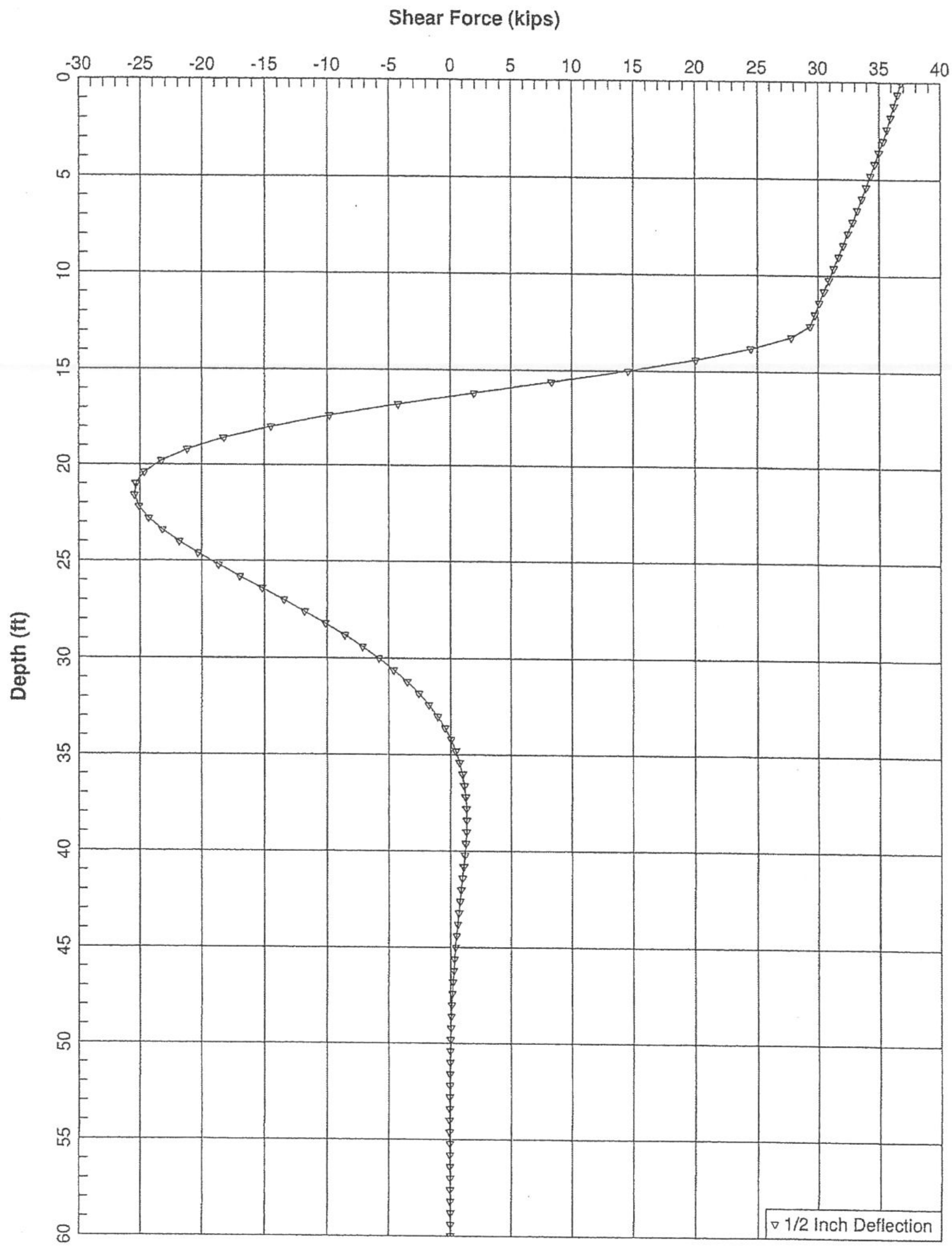
PLATE
B-40



-17 Elevation 50% Fixity 24 in CISS

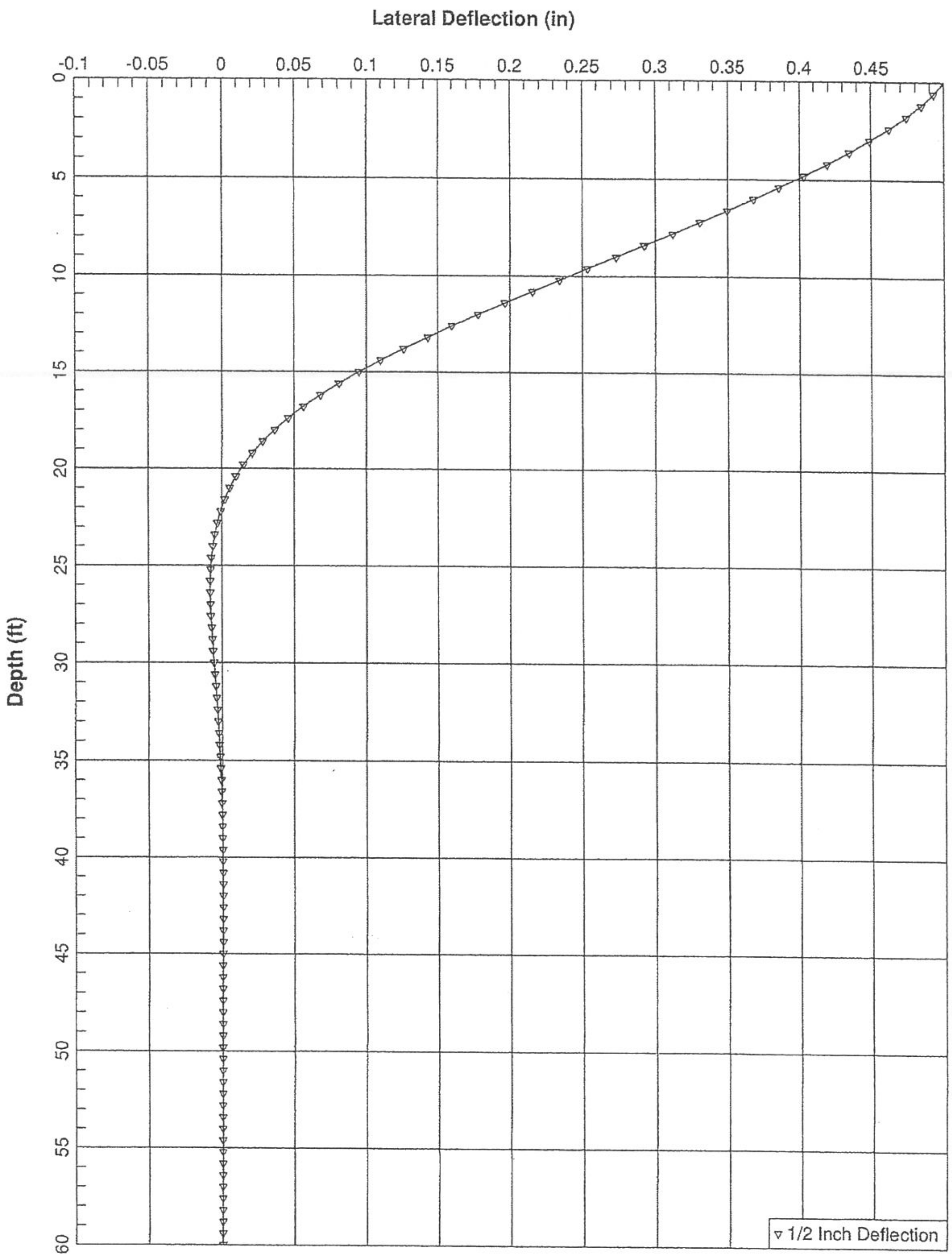


-17 Elevation 50% Fixity 24 in CISS

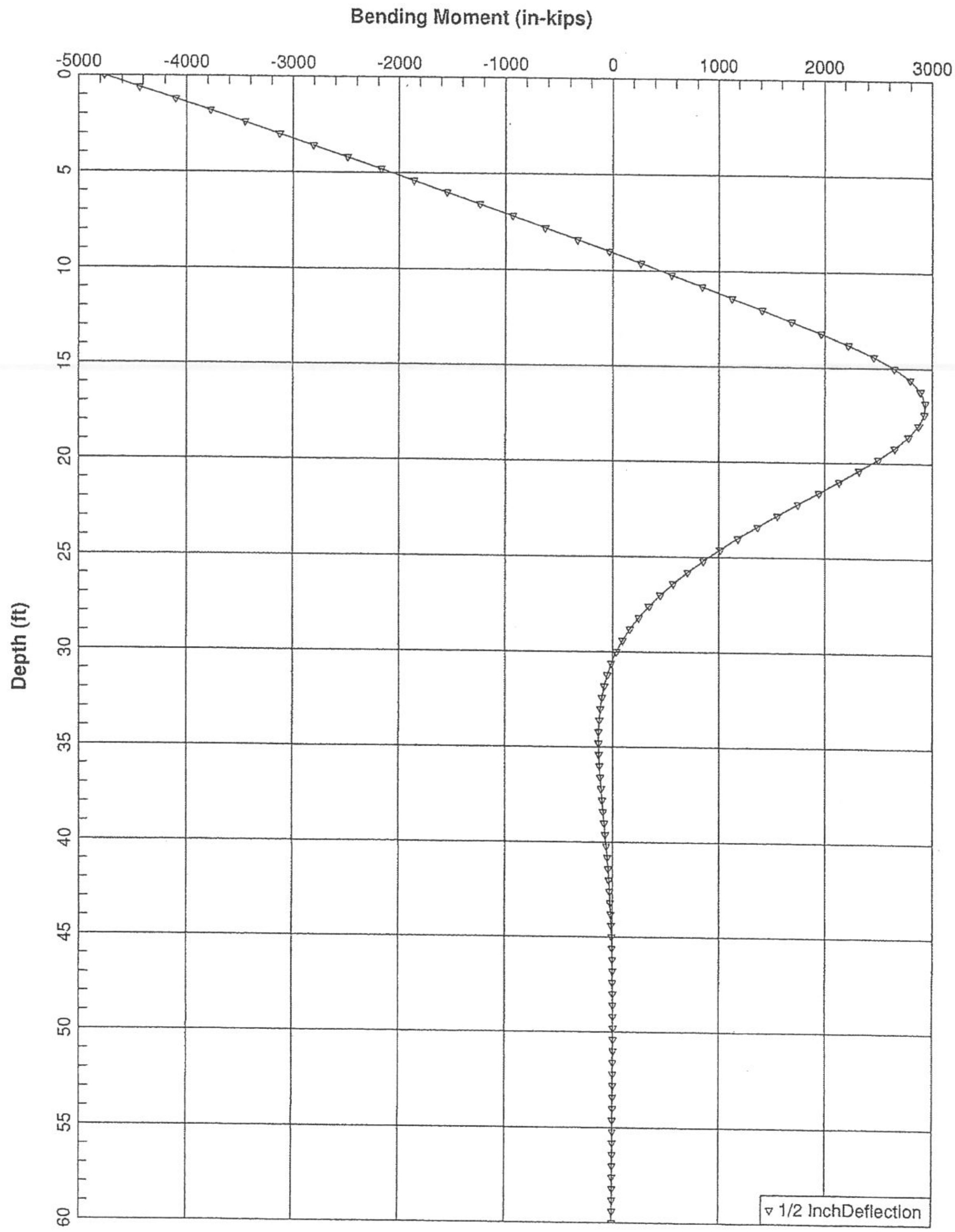


-17 Elevation 50% Fixity 24 in CISS

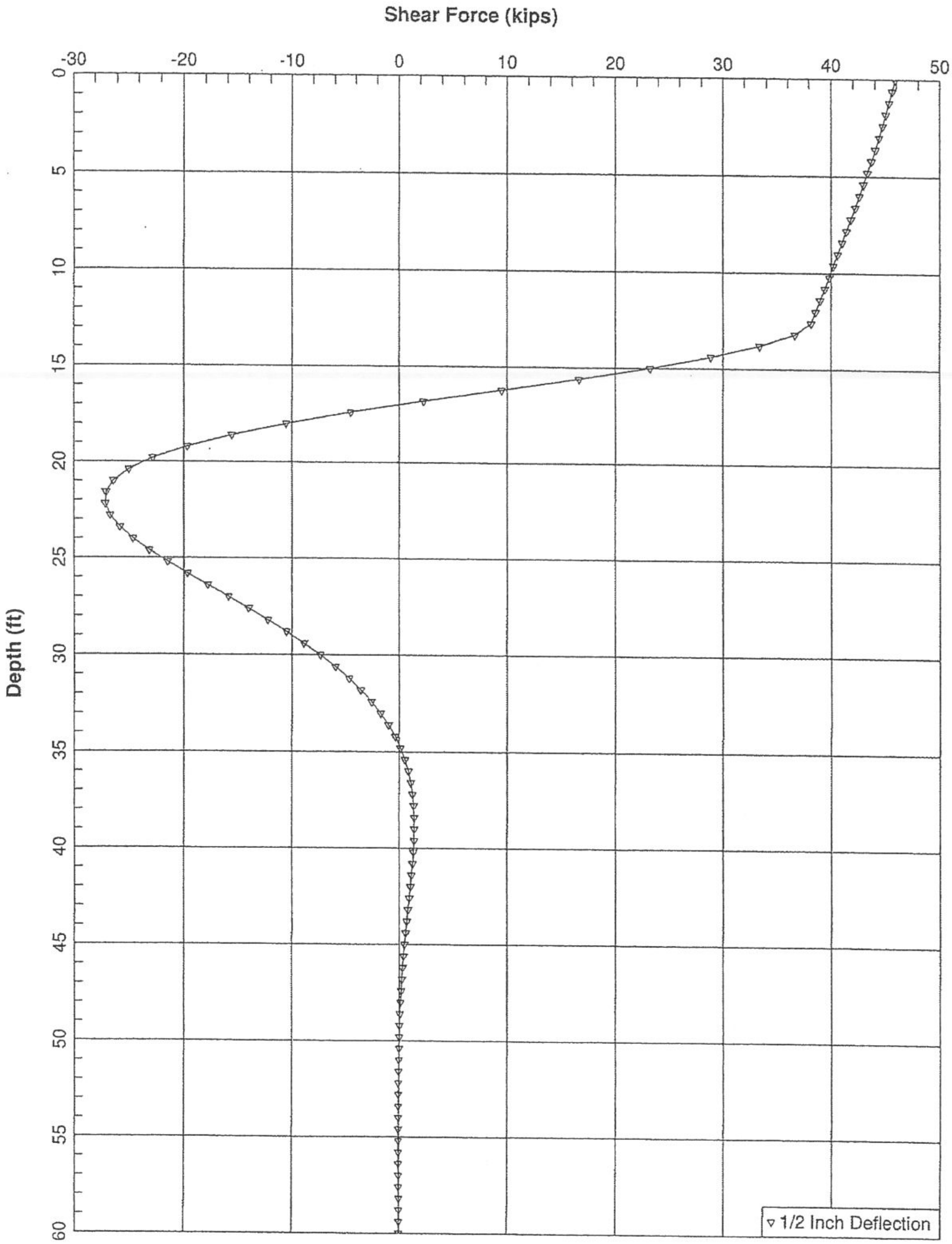
PLATE
B-43



-17 Elevation 75% Fixity 24 in CISS



-17 Elevation 75% Fixity 24 in CISS



-17 Elevation 75% Fixity 24 in CISS

SPRING CONSTANT FOR RIGID RECTANGULAR BASE RESTING ON ELASTIC HALF-SPACE (HORIZONTAL)

LAMBE AND WHITMAN

$$k_x=2(1+\mu)G\beta_x(BL)^{1/2}$$

	INPUT
Poisson's Ratio.....μ=	0.4
Shear Modulus.....G (psi)=	1000
Length of Foundation.....L (ft)=	5
Width of Foundation.....B (ft)=	3
See Figure 15.6 Lambe and Whitman.....βx=	0.95

L/B= 1.666667

Spring Constant (k_x)= 123626 lbs/in.

SPRING CONSTANT FOR RIGID RECTANGULAR BASE RESTING ON ELASTIC HALF-SPACE (HORIZONTAL)

LAMBE AND WHITMAN

$$k_x=2(1+\mu)G\beta_x(BL)^{1/2}$$

	INPUT
Poisson's Ratio.....μ=	0.4
Shear Modulus.....G (psi)=	1000
Length of Foundation.....L (ft)=	10
Width of Foundation.....B (ft)=	3
See Figure 15.6 Lambe and Whitman.....βx=	0.98

L/B= 3.333333

Spring Constant (k_x)= 180354 lbs/in.

SPRING CONSTANT FOR RIGID RECTANGULAR BASE RESTING ON ELASTIC HALF-SPACE (HORIZONTAL)

LAMBE AND WHITMAN

$$k_x = 2(1+\mu)G\beta_x(BL)^{1/2}$$

	INPUT
Poisson's Ratio.....μ=	0.4
Shear Modulus.....G (psi)=	1000
Length of Foundation.....L (ft)=	10
Width of Foundation.....B (ft)=	5
See Figure 15.6 Lambe and Whitman.....βx=	0.95

L/B= 2

Spring Constant (k_x)= 225708 lbs/in.

SPRING CONSTANT FOR RIGID RECTANGULAR BASE RESTING ON ELASTIC HALF-SPACE (HORIZONTAL)

LAMBE AND WHITMAN

$$k_x = 2(1+\mu)G\beta_x(BL)^{1/2}$$

	INPUT
Poisson's Ratio.....μ=	0.4
Shear Modulus.....G (psi)=	1000
Length of Foundation.....L (ft)=	15
Width of Foundation.....B (ft)=	5
See Figure 15.6 Lambe and Whitman.....βx=	0.97

L/B= 3

Spring Constant (k_x)= 282255 lbs/in.

SPRING CONSTANT FOR RIGID RECTANGULAR BASE RESTING ON ELASTIC HALF-SPACE (HORIZONTAL)

LAMBE AND WHITMAN

$$k_x = 2(1+\mu)G\beta_x(BL)^{1/2}$$

	INPUT
Poisson's Ratio.....μ=	0.4
Shear Modulus.....G (psi)=	1000
Length of Foundation.....L (ft)=	15
Width of Foundation.....B (ft)=	7
See Figure 15.6 Lambe and Whitman.....βx=	0.95

L/B= 2.142857

Spring Constant (k_x)= 327083 lbs/in.

KLEINFELDER
Bright People. Right Solutions.

APPENDIX C
LOGS OF BORINGS AND SUMMARY OF LABORATORY TESTING FROM AGS, INC. GEOTECHNICAL STUDY

LOG OF BORING B-19	DRILLING DATE: 12/1/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 0.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
				SILTY SAND WITH GRAVEL (SM), reddish-brown, fine-grained, fine to coarse gravel, trace clay, dry to moist, loose to medium dense. [FILL]					
5		1	2 3 4	CLAY (CL), black, trace fine-grained sand, organic odor, moist, soft to medium stiff.					
				∇ PEAT (PT), black, fibrous, compacted plant remains, organic odor, low density, trace fine-grained sand, moist, medium stiff.					
10				SILT (ML), dark gray, trace fine to medium-grained sand, wet, very soft.					
		2A B	2 3 3	PEAT (PT), dark reddish-brown to black, fibrous, compacted plant matter with thin seams of organic clay from 1/4 to 1-inch-thick, organic odor, low density, wet, medium stiff.	47	105			WA (93)
15		3	2 1 2	strong organic odor, soft					
20		4	1 1 2						
25									
30		5	8 10 13	SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.		23			WA (15)
				change to grayish-green					
35		6A B	6 8 10		104	23			WA (18)
40		7	11 16	SAND (SP), greenish-gray, fine-grained, wet, medium dense.		25			WA (3)

LOG OF BORING B-19	DRILLING DATE: 12/1/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 0.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			25		SILTY SAND (SM), dark greenish-gray to black, fine-grained, wet, dense, with minor clay layers up to 1/4-inch-thick, that are moist, medium stiff.					
85		15	3 3 6		CLAY (CH), greenish-gray, trace silt, very sticky, moist, stiff.					
90										
95		16	8 8 12		very stiff					
100		17A B	22 36 50/5"		SILTY SAND (SM), greenish-gray, fine-grained, wet, very dense.					
					Boring completed to 99.5 feet. Groundwater encountered at 7.0 feet. Backfilled with cement grout.					
105										
110										
115										
120										

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LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
0					CLAY (CL), yellowish-brown, trace silt, moist, soft. [FILL]					
5		1A B	8 9 13		CLAYEY SAND (SC), light reddish-yellow mottled, fine-grained, moist, loose. [FILL] CLAY (CL), dark brownish-gray to black, scattered organics, moist, very stiff.					
					CLAYEY SAND (SC), light greenish-gray, fine-grained, moist to wet, loose.					
10		2A B C	3 2 4		PEAT (PT), dark brown to black, fibrous, 100% plant matter, very low density, slight organic odor, moist, soft.	106	19			WA (34)
15		3	2 1 1		strong organic odor becoming wet, very soft					
					SANDY SILT/SILTY SAND (ML/SM), dark brown, fine-grained, trace medium-grained, wet, very soft/very loose.					
					PEAT (PT), dark brown to black, fibrous, 100% plant matter, very low density, strong organic odor, wet, soft.					
20		4	2 1 2		No recovery.					
25		5	2 2 2		moist					
30		6	1 2 2		No recovery.					
35		7	4 4 7		medium stiff No recovery.					
					SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.					
40		8	7							

LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			13 21		SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.	113	17			WA (16)
					SAND (SW), greenish-gray, fine to coarse-grained, trace well-rounded fine gravel, wet, medium dense.					
45		9	5 5 7							
50		10	14 17 20		dense	107	23			WA (4)
					SILTY SAND (SM), greenish-gray, fine to medium-grained, trace well-rounded coarse-grained sand, trace clay, micaceous, wet, dense.					
55		11	16 25 27				27			WA (38)
					CLAY (CL), greenish-gray to grayish-green, moist, hard.					
60		12A B	6 15 18		change to grayish-green, with silt and trace fine-grained sand, very stiff					
					change to greenish gray, less silt and sand					
65		13	14 27 32		SAND (SP), greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense. SANDY SILT (ML), dark greenish-gray, fine-grained sand, moist, hard. SAND (SP), greenish-gray, fine to medium-grained, wet, dense.					
					very dense					
70		14	46 50/3"		No recovery.					
					SILTY SAND (SM), dark greenish-gray, fine-grained, wet, medium dense.					
75		15	7 8 9				36			WA (37)
					change to with trace of plant fragments and charcoal					
					dense					
80		16	10							

LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			20 22		SILTY SAND (SM), dark greenish-gray, fine-grained, wet, dense.		31			WA (21)
85		17	21 24 41		SAND WITH SILT (SP-SM), dark greenish-gray, fine to medium-grained, trace medium to coarse-grained sand layers with planar cross-bedding, minor clay and silt layers, wet, very dense.		25			WA (9)
90		18	11 12 27		dense 2-inch-thick soft clay layer at 89.5 feet					
95		19	6 15 14		CLAY (CH), greenish-gray, sticky, moist, very stiff.					
100		20	18 20 17		SANDY SILT (ML), dark greenish-gray to black, fine-grained sand, moist, hard. CLAY (CH), dark greenish-gray, moist, hard. Boring completed to 100.0 feet. Groundwater encountered at 8.0 feet and measured at 10.0 feet after 20 minutes. Backfilled with cement grout.					
105										
110										
115										
120										

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LOG OF BORING B-21		
DRILLING DATE: 10/26/04	SURFACE ELEVATION: -26.0 ft	AGS, Inc. Consulting Engineers
DRILLING METHOD: Rotary Wash from 14' x 23' barge	DATUM: NAD83	
DRILL RIG TYPE: CME 45	LOGGED BY: DH	
HAMMER TYPE: 140-lb falling 30 inches	CHECKED BY: MV	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
					SAND (SP), light gray, fine-grained, trace silt, wet, very loose. (Logged from cuttings)					
					SANDY CLAY (CL), greenish-gray to black, fine-grained sand, wet, medium stiff. (Logged from cuttings)					
5		1A B	9 6 4		SILTY SAND (SM), dark greenish-gray, fine-grained, trace coarse-grained sand and concretions, wet, medium dense.	97	31			WA (50)
					SAND (SP), grayish-brown, fine to medium-grained, trace fine gravel and shells, wet, medium dense.					
10		2A B	10 11 20			101	23			WA (2)
					SILTY SAND (SM), light grayish-brown, fine-grained, minor clayey areas, wet, medium dense.					
15		3A B	7 11 20							
					SILTY CLAY (CL), gray, trace fine-grained sand, moist, very stiff.					
20		4A B C	10 11 19							
					SILTY SAND (SM), dark greenish-gray, fine-grained, wet, dense.					
25		5A	11 18 34			95	30			WA (41)
30		6A B C	15 24 39		change to dark gray, trace coarse concretions, very dense	100	26			WA (23)
35		7A B	9 11 14		medium dense					
40					No recovery.					

LOG OF BORING B-21	DRILLING DATE: 10/26/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			5 8 19		SILTY SAND (SM), dark grey, fine-grained, wet, medium dense.					
					SAND (SP), dark gray, fine-grained, micaceous, wet, medium dense.					
45		8A B	9 14 21							
					SILTY CLAY (CH), dark greenish-gray, moist, stiff.					
50		9A B C	7 7 10			72	51			WA (99)
55		10 A B	3 4 10							
60		11A B C	4 5 10							
65			4 6 10							
					SILTY SAND (SM), greenish-brown, fine-grained, moist, very dense.					
70		12A B C	14 24 37			118	17			WA (40)
					SILTY CLAY WITH SAND (CL), greenish-gray, fine-grained sand, moist, hard.					
75		13A B	39 50/6"			112	20			WA (77)
80										

LBG KD0101.GPJ 12/22/04

LOG OF BORING B-21	DRILLING DATE: 10/26/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
		14A B C	19 26 44		SILTY CLAY WITH SAND (CL), greenish-gray, fine-grained sand, moist, hard, with 3-inch-thick layer of SILTY SAND (SM), greenish-gray, fine-grained, moist, at 80 feet.					
85										
					SAND (SP), brownish-gray, fine to medium-grained, wet, very dense.					
90		15	27 34 51/6"							
95										
					CLAY (CL), greenish-gray, trace fine-grained sand, moist, hard.					
100		16	21 24 28							
					Boring completed to 100.5 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
105										
110										
115										
120										

LOG KD0101.GPJ 12/22/04

JOB NO. KD0101 | PROJECT: Stockton Delta Water Supply Project | SHEET 3 OF 3 | PLATE A-1.21

LOG OF BORING B-22

DRILLING DATE: 10/27/04
DRILLING METHOD: Rotary Wash from 14' x 23' barge
DRILL RIG TYPE: CME 45
HAMMER TYPE: 140-lb falling 30 inches

SURFACE ELEVATION: -26.0 ft
DATUM: NAD83
LOGGED BY: DH
CHECKED BY: MV

AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
0					PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
					SAND (SP), light gray, fine-grained, trace silt, wet, loose. (Logged from cuttings)					
5										
					CLAY (CL), light gray, trace medium to coarse sand-sized shell fragments, wet, soft. (Logged from cuttings)					
					SILTY SAND (SM), dark greenish-gray, fine-grained, trace fine gravel to 3/8-inch-size, occasional shell fragments, wet, dense.					
10		1A B	13 22 26			97	27			WA (45)
					trace coarse-grained sand, medium dense					
			9 11 17		No recovery.					
15										
		2A B	12 18 39		SAND (SP), dark greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense.					
20					SILTY CLAY (CL), greenish-gray, wet, medium stiff.					
					SILT (ML), dark greenish-gray, moist, hard.					
25		3A B C	6 11 27			90	33			WA (89)
					SAND (SP), dark greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense.					
30		4A B	24 24 24		SILT (ML), green, moist, hard.					
					SILTY SAND (SM), dark gray to black, fine-grained, occasional roots, wet, dense.					
35		5A	18 21 22							
					medium dense					
40		6A B	7 12							

LOG OF BORING B-22	DRILLING DATE: 10/27/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			18		SILTY SAND (SM), dark gray to black, fine-grained, with hard silty clay layers to 1/4-inch-thick, clay is moist, sand is wet, medium dense.					
45		7	12 14 17				31			WA (16)
50		8A B C	11 11 17							
55		9A B	7 11 19							
					CLAY (CH), dark greenish-brown, moist, stiff.					
60		10A B	7 8 10							
					SANDY SILT (ML), dark brown, fine-grained sand, moist, stiff.					
65		11	6 8 10				35			WA (66)
70			4 5 10		No recovery.					
					SILTY SAND (SM), dark brownish-gray, fine-grained, trace medium to coarse-grained sand and concretions, wet, very dense.					
75		12A B	18 27 41			116	17			WA (38)
80										

LOG OF BORING B-22	DRILLING DATE: 10/27/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					SILTY SAND (SM), dark brownish-gray, fine-grained, trace medium to coarse-grained sand and concretions, wet, very dense.					
					SILTY CLAY (CL), brownish-gray, trace fine-grained sand, moist, hard.					
85		13A B C	17 37 50/5"		SILT WITH SAND (ML), light brownish-gray, fine-grained sand, moist, hard.	98	26			WA (81)
90			45 50/5"		No recovery.					
95		14	26 52/6"		SILTY SAND (SM), dark greenish-gray to black, fine to medium-grained, trace coarse-grained, wet, very dense.					
100		15A B	31 43 50/5"		SAND (SP), gray, fine to medium-grained, trace coarse-grained, wet, very dense.	111	21			WA (3)
105					Boring completed to 99.5 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
110										
115										
120										

LOG OF BORING B-23

DRILLING DATE: 10/28/04
DRILLING METHOD: Rotary Wash from 14' x 23' barge
DRILL RIG TYPE: CME 45
HAMMER TYPE: 140-lb falling 30 inches

SURFACE ELEVATION: -26.0 ft
DATUM: NAD83
LOGGED BY: DH
CHECKED BY: MV

AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE NUMBER	BLOW COUNT	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
			SAND (SP), gray, fine-grained, trace silt, wet, loose. (Logged from cuttings)					
			SANDY CLAY (CL), light gray, fine-grained sand, wet, very soft. (Logged from cuttings)					
5			SAND WITH SILT (SP-SM), dark greenish-gray, fine to medium-grained, wet, medium dense.					
10		12 14 17	No recovery.					
			SAND (SP), dark grayish-green to black, fine to medium-grained, trace coarse-grained sand and silt, wet, medium dense.					
15	1A B	5 6 8		106	22			WA (3)
			SILTY SAND (SM), dark greenish-gray, fine-grained, moist, dense.					
20	2A B	8 14 23		98	27			WA (43)
			CLAYEY SILT (ML), dark greenish-gray, trace fine-grained sand, micaceous, moist, very stiff.					
25	3A B	8 11 15	CLAY (CL), dark greenish-gray, moist, very stiff.					
			SILTY SAND (SM), dark greenish-gray, fine-grained, wet, very dense.					
30	4A B	11 23 50/6"		99	27			WA (50)
			SANDY SILT (ML), dark greenish-gray to black, fine-grained sand, trace clay, micaceous, wet, hard.					
35	5	9 18 29		101	26			WA (63)
			SILT WITH SAND (ML), dark gray to black, fine-grained sand, wet, very stiff.					
40	6A B	6 9 18		83	40			WA (71)

LOG OF BORING B-23	DRILLING DATE: 10/28/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					CLAY (CL), greenish-gray, moist, hard.					
		13A B	38 54/6"							
85										
		14A B	21 22 18		SAND (SP), greenish-gray, fine-grained, wet, dense. SILTY SAND (SM), grayish-green, fine-grained, moist, dense.					
90										
		15A B	17 47 55/6"		change to dark greenish-gray, fine to medium-grained, wet, very dense					
95						109	19			WA (13)
		16	23 38 47							
100										
			13 18 25		dense					
105					Boring completed to 104.0 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
110										
115										
120										

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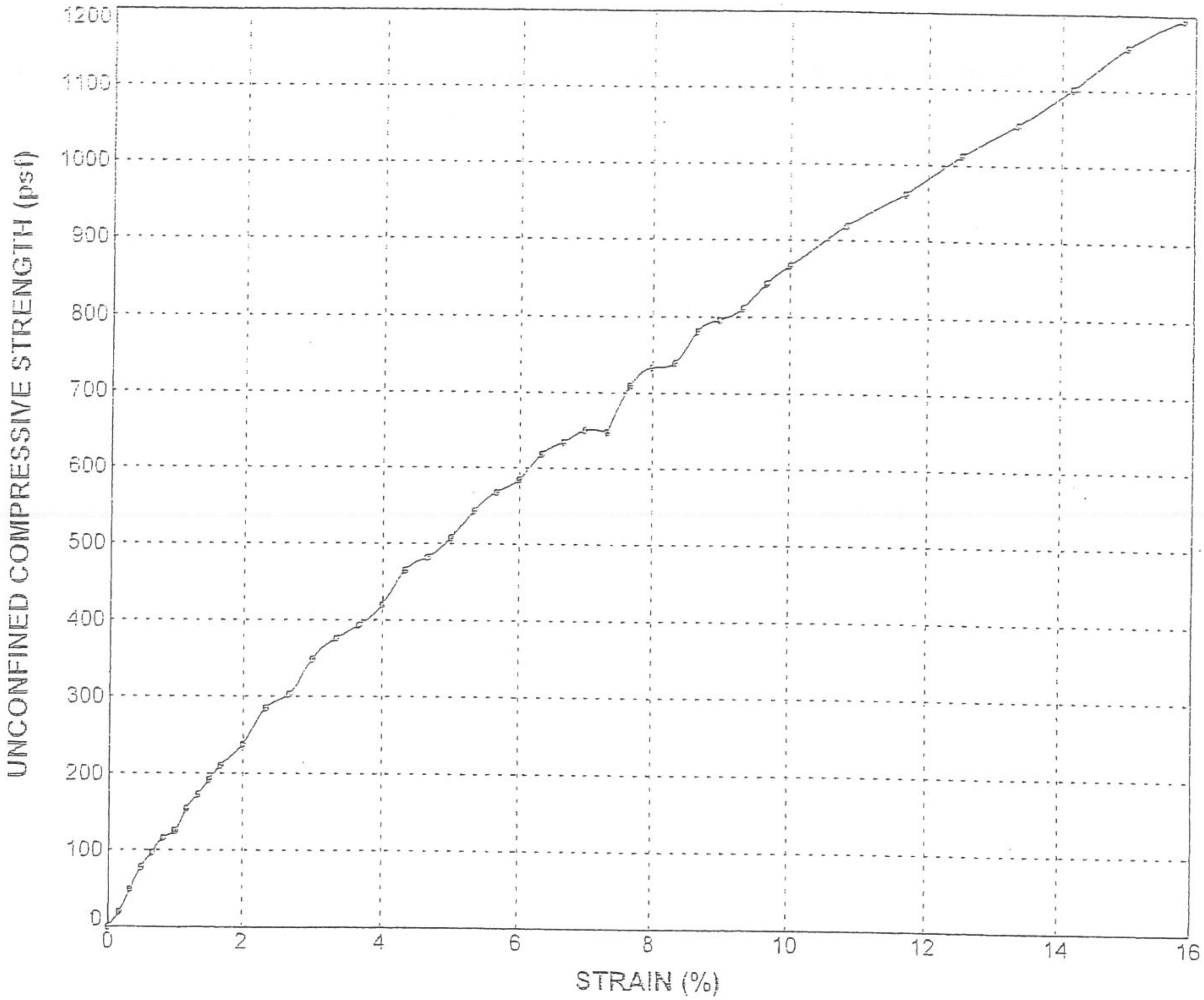


Sample Source	Classification	Type of Test		Ultimate Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
@ B-19 @ 14.0'	Peat (PT)	UC		1194	16	-	-

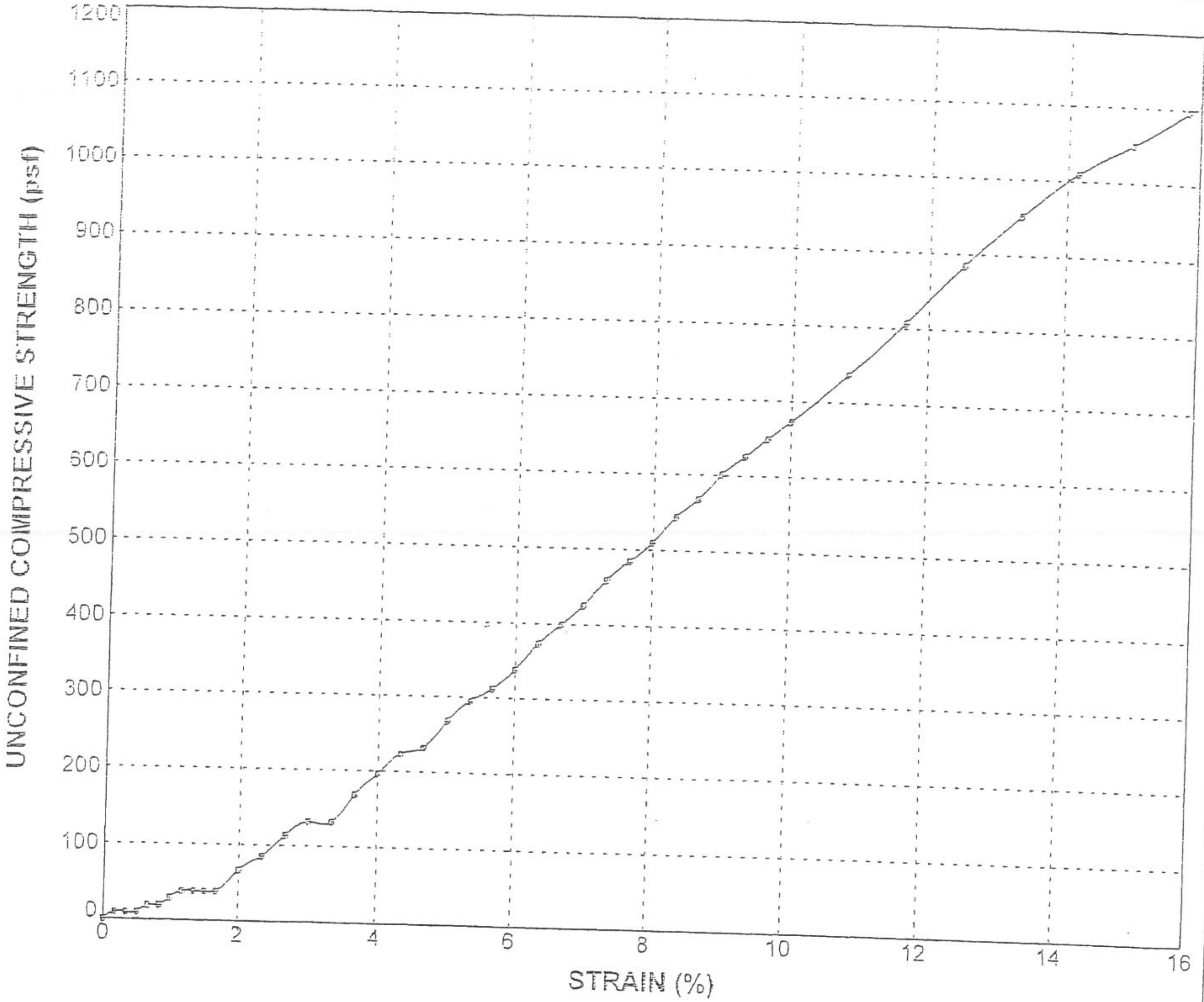
UC = Unconfined Compression

UNCONFINED COMPRESSIVE STRENGTH

Stockton Delta Water Supply Project
Stockton, California

AGS, Inc.
Consulting Engineers

JOB NO.	KD0101	DATE	Jan 2005	PLATE B-3.1



Sample Source	Classification	Type of Test		Ultimate Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
● B-20 @ 24.5'	Peat (PT)	UC		1096	16	-	-

UC = Unconfined Compression

UNCONFINED COMPRESSIVE STRENGTH

Stockton Delta Water Supply Project
Stockton, California

AGS, Inc.
Consulting Engineers

JOB NO. KD0101	DATE Jan 2005		PLATE B-3.2

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APPENDIX C
LOGS OF BORINGS AND SUMMARY OF LABORATORY TESTING FROM AGS, INC. GEOTECHNICAL STUDY

LOG OF BORING B-19	DRILLING DATE: 12/1/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 0.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
0					SILTY SAND WITH GRAVEL (SM), reddish-brown, fine-grained, fine to coarse gravel, trace clay, dry to moist, loose to medium dense. [FILL]					
5					CLAY (CL), black, trace fine-grained sand, organic odor, moist, soft to medium stiff.					
		1	2 3 4							
					∇ PEAT (PT), black, fibrous, compacted plant remains, organic odor, low density, trace fine-grained sand, moist, medium stiff.					
10					SILT (ML), dark gray, trace fine to medium-grained sand, wet, very soft.					
		2A B	2 3 3		PEAT (PT), dark reddish-brown to black, fibrous, compacted plant matter with thin seams of organic clay from 1/4 to 1-inch-thick, organic odor, low density, wet, medium stiff.	47	105			WA (93)
15		3	2 1 2		strong organic odor, soft					
20		4	1 1 2							
25										
					SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.					
30		5	8 10 13				23			WA (15)
					change to grayish-green					
35		6A B	6 8 10			104	23			WA (18)
		7	11 16		SAND (SP), greenish-gray, fine-grained, wet, medium dense.					
40							25			WA (3)

LOG OF BORING B-19	DRILLING DATE: 12/1/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 0.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			25		SILTY SAND (SM), dark greenish-gray to black, fine-grained, wet, dense, with minor clay layers up to 1/4-inch-thick, that are moist, medium stiff.					
85		15	3 3 6		CLAY (CH), greenish-gray, trace silt, very sticky, moist, stiff.					
90										
95		16	8 8 12		very stiff					
100		17A B	22 36 50/5"		SILTY SAND (SM), greenish-gray, fine-grained, wet, very dense.					
					Boring completed to 99.5 feet. Groundwater encountered at 7.0 feet. Backfilled with cement grout.					
105										
110										
115										
120										

LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					CLAY (CL), yellowish-brown, trace silt, moist, soft. [FILL]					
5										
		1A B	8 9 13		CLAYEY SAND (SC), light reddish-yellow mottled, fine-grained, moist, loose. [FILL] CLAY (CL), dark brownish-gray to black, scattered organics, moist, very stiff.					
					CLAYEY SAND (SC), light greenish-gray, fine-grained, moist to wet, loose.					
10										
		2A B C	3 2 4		PEAT (PT), dark brown to black, fibrous, 100% plant matter, very low density, slight organic odor, moist, soft.	106	19			WA (34)
15		3	2 1 1		strong organic odor becoming wet, very soft					
					SANDY SILT/SILTY SAND (ML/SM), dark brown, fine-grained, trace medium-grained, wet, very soft/very loose.					
					PEAT (PT), dark brown to black, fibrous, 100% plant matter, very low density, strong organic odor, wet, soft.					
20		4	2 1 2		No recovery.					
25		5	2 2 2		moist					
30		6	1 2 2		No recovery.					
					medium stiff					
35		7	4 4 7		No recovery.					
					SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.					
40		8	7							

LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			13 21		SILTY SAND (SM), light greenish-gray, fine to medium-grained, wet, medium dense.	113	17			WA (16)
					SAND (SW), greenish-gray, fine to coarse-grained, trace well-rounded fine gravel, wet, medium dense.					
45		9	5 5 7							
50		10	14 17 20		dense	107	23			WA (4)
					SILTY SAND (SM), greenish-gray, fine to medium-grained, trace well-rounded coarse-grained sand, trace clay, micaceous, wet, dense.					
55		11	16 25 27				27			WA (38)
					CLAY (CL), greenish-gray to grayish-green, moist, hard.					
60		12A B	6 15 18		change to grayish-green, with silt and trace fine-grained sand, very stiff					
					change to greenish gray, less silt and sand					
65		13	14 27 32		SAND (SP), greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense.					
					SANDY SILT (ML), dark greenish-gray, fine-grained sand, moist, hard.					
					SAND (SP), greenish-gray, fine to medium-grained, wet, dense.					
					very dense					
70		14	46 50/3"		No recovery.					
					SILTY SAND (SM), dark greenish-gray, fine-grained, wet, medium dense.					
75		15	7 8 9				36			WA (37)
					change to with trace of plant fragments and charcoal					
					dense					
80		16	10							

LOG OF BORING B-20	DRILLING DATE: 11/30/04 DRILLING METHOD: Solid Flight Auger and Rotary Wash DRILL RIG TYPE: Diedrich D-120 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: 8.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			20 22		SILTY SAND (SM), dark greenish-gray, fine-grained, wet, dense.		31			WA (21)
					SAND WITH SILT (SP-SM), dark greenish-gray, fine to medium-grained, trace medium to coarse-grained sand layers with planar cross-bedding, minor clay and silt layers, wet, very dense.					
85		17	21 24 41				25			WA (9)
					dense					
90		18	11 12 27		2-inch-thick soft clay layer at 89.5 feet					
					CLAY (CH), greenish-gray, sticky, moist, very stiff.					
95		19	6 15 14							
100		20	18 20 17		SANDY SILT (ML), dark greenish-gray to black, fine-grained sand, moist, hard. CLAY (CH), dark greenish-gray, moist, hard. Boring completed to 100.0 feet. Groundwater encountered at 8.0 feet and measured at 10.0 feet after 20 minutes. Backfilled with cement grout.					
105										
110										
115										
120										

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LOG OF BORING B-21	DRILLING DATE: 10/26/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE NUMBER	BLOW COUNT	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
			SAND (SP), light gray, fine-grained, trace silt, wet, very loose. (Logged from cuttings)					
			SANDY CLAY (CL), greenish-gray to black, fine-grained sand, wet, medium stiff. (Logged from cuttings)					
5	1A B	9 6 4	SILTY SAND (SM), dark greenish-gray, fine-grained, trace coarse-grained sand and concretions, wet, medium dense.	97	31			WA (50)
10	2A B	10 11 20	SAND (SP), grayish-brown, fine to medium-grained, trace fine gravel and shells, wet, medium dense.	101	23			WA (2)
15	3A B	7 11 20	SILTY SAND (SM), light grayish-brown, fine-grained, minor clayey areas, wet, medium dense.					
20	4A B C	10 11 19	SILTY CLAY (CL), gray, trace fine-grained sand, moist, very stiff.					
25	5A	11 18 34	SILTY SAND (SM), dark greenish-gray, fine-grained, wet, dense.	95	30			WA (41)
30	6A B C	15 24 39	change to dark gray, trace coarse concretions, very dense	100	26			WA (23)
35	7A B	9 11 14	medium dense					
40			No recovery.					

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LOG OF BORING B-21	DRILLING DATE: 10/26/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			5 8 19		SILTY SAND (SM), dark grey, fine-grained, wet, medium dense.					
					SAND (SP), dark gray, fine-grained, micaceous, wet, medium dense.					
45		8A B	9 14 21							
					SILTY CLAY (CH), dark greenish-gray, moist, stiff.					
50		9A B C	7 7 10			72	51			WA (99)
55		10 A B	3 4 10							
60		11A B C	4 5 10							
65			4 6 10							
					SILTY SAND (SM), greenish-brown, fine-grained, moist, very dense.					
70		12A B C	14 24 37			118	17			WA (40)
					SILTY CLAY WITH SAND (CL), greenish-gray, fine-grained sand, moist, hard.					
75		13A B	39 50/6"			112	20			WA (77)
80										

LOG OF BORING B-21	DRILLING DATE: 10/26/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
		14A B C	19 26 44		SILTY CLAY WITH SAND (CL), greenish-gray, fine-grained sand, moist, hard, with 3-inch-thick layer of SILTY SAND (SM), greenish-gray, fine-grained, moist, at 80 feet.					
85										
					SAND (SP), brownish-gray, fine to medium-grained, wet, very dense.					
90		15	27 34 51/6"							
95										
					CLAY (CL), greenish-gray, trace fine-grained sand, moist, hard.					
100		16	21 24 28							
					Boring completed to 100.5 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
105										
110										
115										
120										

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LOG OF BORING B-22

DRILLING DATE: 10/27/04
DRILLING METHOD: Rotary Wash from 14' x 23' barge
DRILL RIG TYPE: CME 45
HAMMER TYPE: 140-lb falling 30 inches

SURFACE ELEVATION: -26.0 ft
DATUM: NAD83
LOGGED BY: DH
CHECKED BY: MV

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
				PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
5				SAND (SP), light gray, fine-grained, trace silt, wet, loose. (Logged from cuttings)					
				CLAY (CL), light gray, trace medium to coarse sand-sized shell fragments, wet, soft. (Logged from cuttings)					
10	◣	1A B	13 22 26	SILTY SAND (SM), dark greenish-gray, fine-grained, trace fine gravel to 3/8-inch-size, occasional shell fragments, wet, dense.	97	27			WA (45)
15	◣		9 11 17	trace coarse-grained sand, medium dense No recovery.					
20	◣	2A B	12 18 39	SAND (SP), dark greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense. SILTY CLAY (CL), greenish-gray, wet, medium stiff.					
25	◣	3A B C	6 11 27	SILT (ML), dark greenish-gray, moist, hard.	90	33			WA (89)
30	◣	4A B	24 24 24	SAND (SP), dark greenish-gray, fine to medium-grained, trace coarse-grained, wet, dense.					
				SILT (ML), green, moist, hard.					
35	◣	5A	18 21 22	SILTY SAND (SM), dark gray to black, fine-grained, occasional roots, wet, dense.					
40	◣	6A B	7 12	medium dense					

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LOG OF BORING B-22	DRILLING DATE: 10/27/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
			18		SILTY SAND (SM), dark gray to black, fine-grained, with hard silty clay layers to 1/4-inch-thick, clay is moist, sand is wet, medium dense.					
45		7	12 14 17				31			WA (16)
50		8A B C	11 11 17							
55		9A B	7 11 19							
					CLAY (CH), dark greenish-brown, moist, stiff.					
60		10A B	7 8 10							
					SANDY SILT (ML), dark brown, fine-grained sand, moist, stiff.					
65		11	6 8 10				35			WA (66)
70			4 5 10		No recovery.					
					SILTY SAND (SM), dark brownish-gray, fine-grained, trace medium to coarse-grained sand and concretions, wet, very dense.					
75		12A B	18 27 41			116	17			WA (38)
80										

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LOG OF BORING B-22	DRILLING DATE: 10/27/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					SILTY SAND (SM), dark brownish-gray, fine-grained, trace medium to coarse-grained sand and concretions, wet, very dense.					
					SILTY CLAY (CL), brownish-gray, trace fine-grained sand, moist, hard.					
85		13A B C	17 37 50/5"		SILT WITH SAND (ML), light brownish-gray, fine-grained sand, moist, hard.	98	26			WA (81)
90			45 50/5"		No recovery.					
					SILTY SAND (SM), dark greenish-gray to black, fine to medium-grained, trace coarse-grained, wet, very dense.					
95		14	26 52/6"							
					SAND (SP), gray, fine to medium-grained, trace coarse-grained, wet, very dense.					
100		15A B	31 43 50/5"			111	21			WA (3)
					Boring completed to 99.5 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
105										
110										
115										
120										

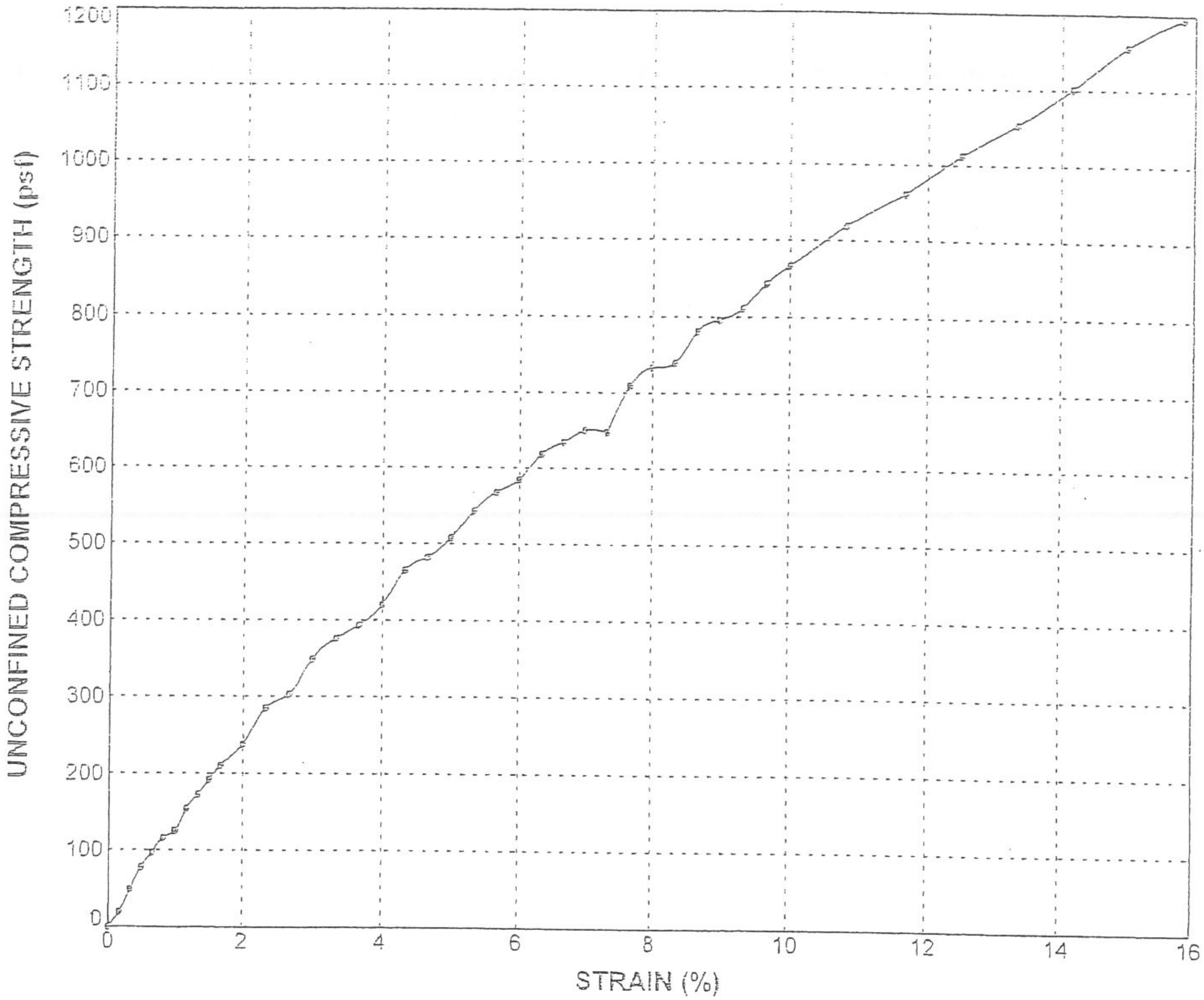
LOG OF BORING B-23	DRILLING DATE: 10/28/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					PEAT (PT), dark green to dark brown, fibrous plant fragments, leaves and river plants, wet, very soft. (Logged from cuttings)					
					SAND (SP), gray, fine-grained, trace silt, wet, loose. (Logged from cuttings)					
					SANDY CLAY (CL), light gray, fine-grained sand, wet, very soft. (Logged from cuttings)					
5					SAND WITH SILT (SP-SM), dark greenish-gray, fine to medium-grained, wet, medium dense.					
10			12 14 17		No recovery.					
15		1A B	5 6 8		SAND (SP), dark grayish-green to black, fine to medium-grained, trace coarse-grained sand and silt, wet, medium dense.	106	22			WA (3)
20		2A B	8 14 23		SILTY SAND (SM), dark greenish-gray, fine-grained, moist, dense.	98	27			WA (43)
		3A B	8 11 15		CLAYEY SILT (ML), dark greenish-gray, trace fine-grained sand, micaceous, moist, very stiff.					
25					CLAY (CL), dark greenish-gray, moist, very stiff.					
30		4A B	11 23 50/6"		SILTY SAND (SM), dark greenish-gray, fine-grained, wet, very dense.	99	27			WA (50)
35		5	9 18 29		SANDY SILT (ML), dark greenish-gray to black, fine-grained sand, trace clay, micaceous, wet, hard.	101	26			WA (63)
40		6A B	6 9 18		SILT WITH SAND (ML), dark gray to black, fine-grained sand, wet, very stiff.	83	40			WA (71)

LOG OF BORING B-23	DRILLING DATE: 10/28/04 DRILLING METHOD: Rotary Wash from 14' x 23' barge DRILL RIG TYPE: CME 45 HAMMER TYPE: 140-lb falling 30 inches	SURFACE ELEVATION: -26.0 ft DATUM: NAD83 LOGGED BY: DH CHECKED BY: MV	AGS, Inc. Consulting Engineers

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	ADDITIONAL TESTS
					CLAY (CL), greenish-gray, moist, hard.					
		13A B	38 54/6"							
85										
		14A B	21 22 18		SAND (SP), greenish-gray, fine-grained, wet, dense. SILTY SAND (SM), grayish-green, fine-grained, moist, dense.					
90										
		15A B	17 47 55/6"		change to dark greenish-gray, fine to medium-grained, wet, very dense					
95						109	19			WA (13)
		16	23 38 47							
100										
			13 18 25		dense					
105					Boring completed to 104.0 feet. Groundwater not measured due to rotary wash method. Backfilled with cement grout to within 5 feet of river bottom. Conductor casing flushed with clear water until return was clear and then casing withdrawn. River bottom allowed to collapse into last 5 feet of hole.					
110										
115										
120										

LBG KD0101.GPJ 12/22/04



Sample Source	Classification	Type of Test		Ultimate Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
@ B-19 @ 14.0'	Peat (PT)	UC		1194	16	-	-

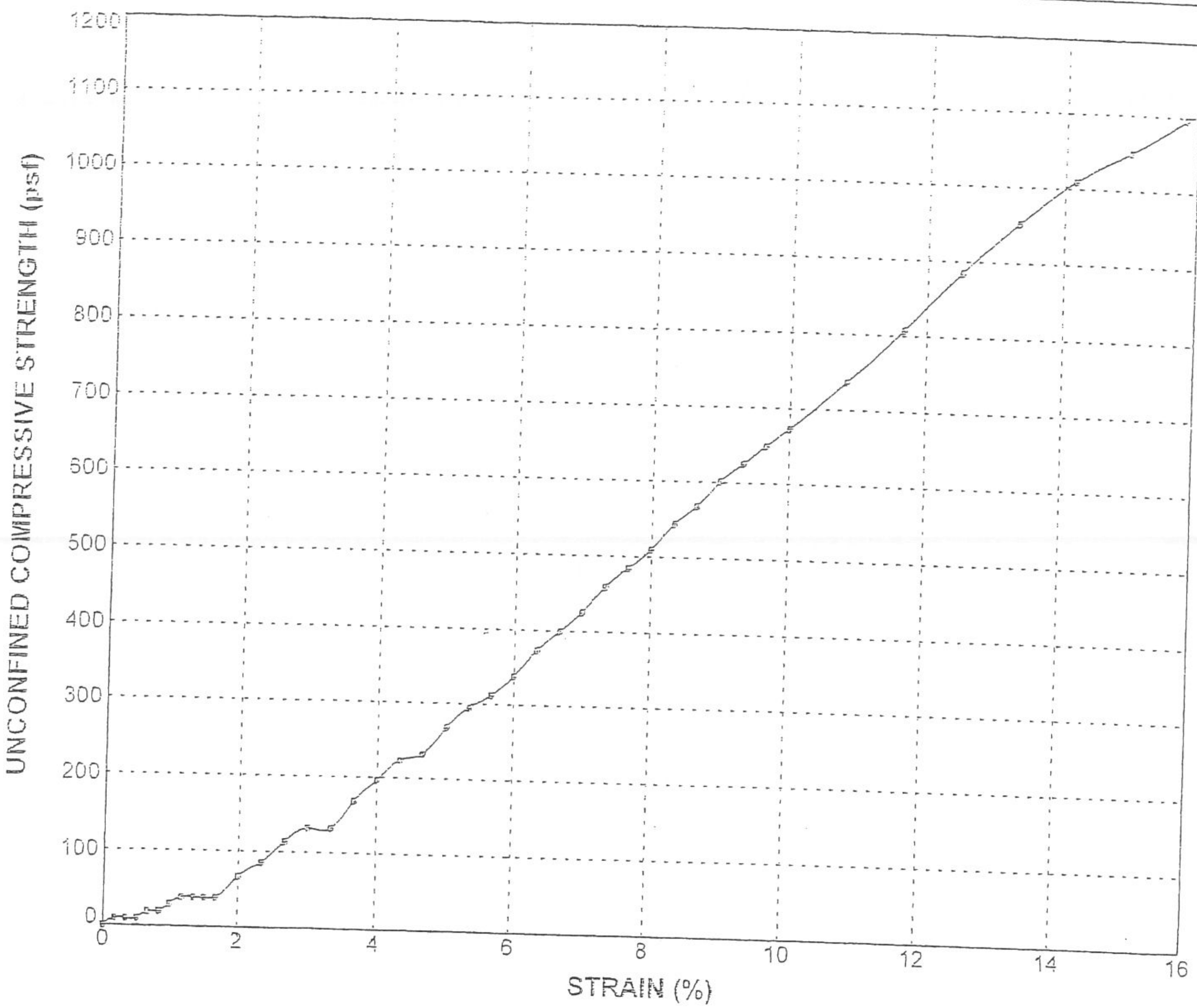
UC = Unconfined Compression

UNCONFINED COMPRESSIVE STRENGTH

Stockton Delta Water Supply Project
Stockton, California

AGS, Inc.
Consulting Engineers

JOB NO. KD0101 | DATE Jan 2005 | PLATE B-3.1



Sample Source	Classification	Type of Test		Ultimate Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊕ B-20 @ 24.5'	Peat (PT)	UC		1096	16	-	-

UC = Unconfined Compression

UNCONFINED COMPRESSIVE STRENGTH

Stockton Delta Water Supply Project
Stockton, California

AGS, Inc.
Consulting Engineers

JOB NO.	KD0101	DATE	Jan 2005	PLATE B-3.2

APPENDIX D
DEPARTMENT OF WATER RESOURCES EMPIRE TRACT TEST LEVEE INVESTIGATION

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in the bottom third of the peat. Often, over half of the measured surface settlement was observed in the lowest third of the soft, peaty soil.

The amount of surface settlement for various estimated loads has been summarized as a percentage of original peat thickness and is shown on Figure 7-1. These results include the effect of soil failure.

The measured surface settlement occurring during 1962 was compared with settlement predicted by the method employed for previous cost-estimating work. This comparison was rather limited, being based on a total of 10 Swedish foil sampling holes, 5 at each site. The results indicated that the previous master levee settlement estimates were about 20 percent low.

Most of the settlement took place shortly after loading. Although extremely variable, on the average about one-third of the total settlement occurred during the first week. After two months had elapsed the rate slowed considerably.

Laboratory consolidation tests after an initial phase indicate a linear relationship between settlement and time, if time is plotted on a square-root scale. (Refer to Figure 5-7 in Chapter V.) However, field settlement is more complex. There is a seasonal effect due to the fall rains. During early winter, settlement was observed to slow and, in some instances, to reverse slightly. This change is probably due to the rise in water table, which reduces the effective load on the soil foundation. On Empire Tract, blading of the fill after initial loading also accounts for some of the settlement irregularitie

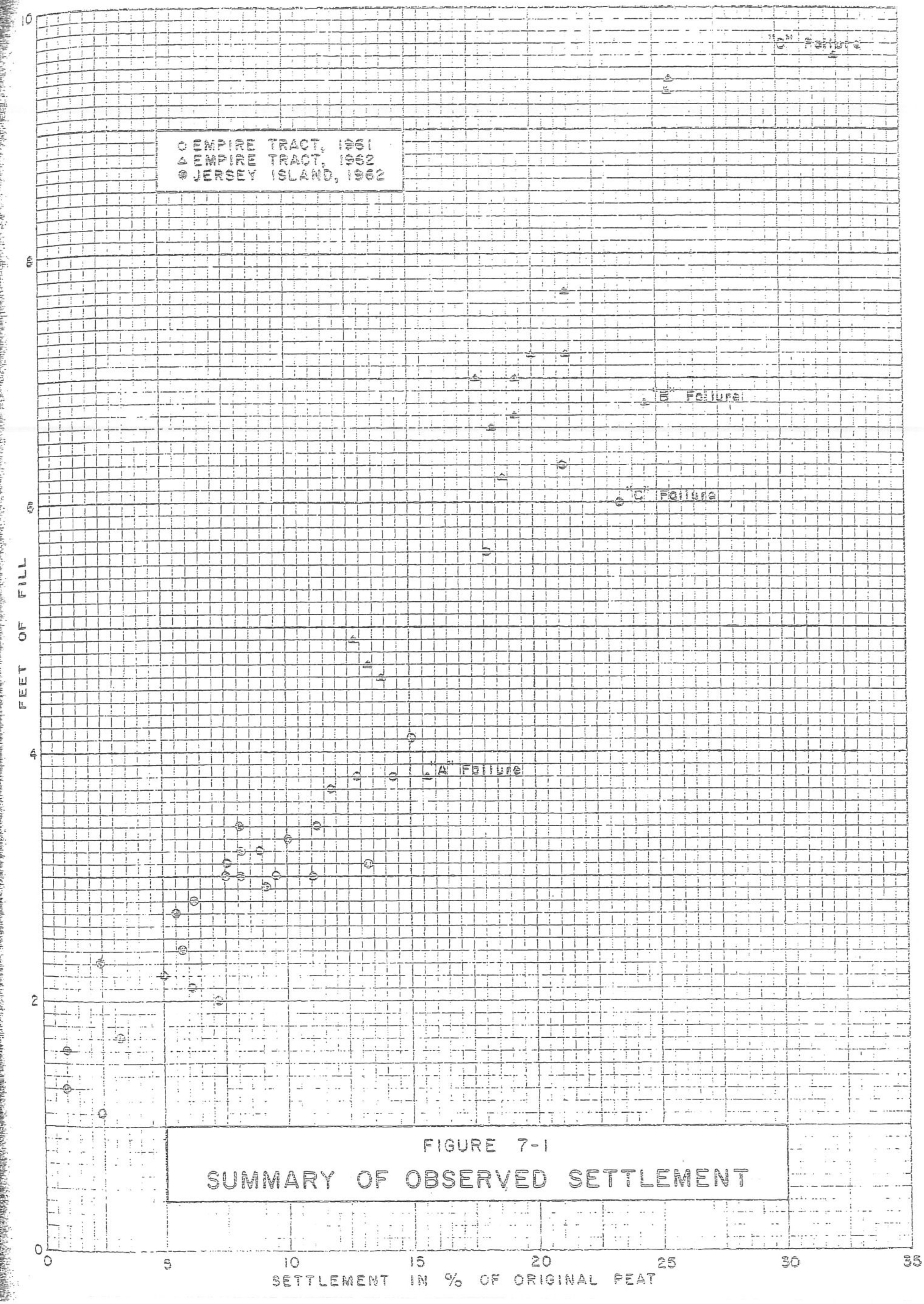


FIGURE 7-1

SUMMARY OF OBSERVED SETTLEMENT

TABLE C-1
EMPIRE TRACT TEST LEVEE
SUMMARY OF ONE-INCH DRILLING

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Ft. Triax. Shear 10% Str.	One-Ft. Triax. Shear 20% Str.	One-Ft. Triax. Shear Max. Str.	One-Ft. Triax. Shear % Str @ Max	Other Tests
1E-1	4-57	B-1288	7.5- 8.0		Silty Peat		67.9	18.4	270.0	36.6			.14	7					
		B-1288	8.0- 8.5		Silty Peat														
		B-1289	13.0-13.5		Peat					58.9	.14	.26							
		B-1290	17.0-17.5		Peat					58.1	.15	.28							
		B-1291	25.5-26.0		Peat					43.7									
		B-1291	26.0-26.5		Peat		75.9	12.0	533.0		.33	.42	.42	20					
1E-2	4-57	B-1292	4.5- 5.0	200	Silty Sand					7.0									
		B-1293	8.0- 8.5		Peat		68.3	12.5	446.0										
		B-1293	8.5- 9.0		Peat					47.0	.10	.17							
		B-1293	9.0- 9.5		Peat														
		B-1294	13.0-13.5		Peat														
		B-1294	13.5-14.0		Peat					43.7	.14	.19							
		B-1294	14.0-14.5		Peat		69.3	10.1	587.0										
		B-1295	18.0-18.5		Peat		83.3	24.3	243.0	58.1									
		B-1295	18.5-19.0		Organic Silt					24.7	.26		.31	18					
		B-1295	19.0-19.5		Silty Sand					6.3									
		B-1296	24.0-24.5	200	Silty Sand					1.2									
1E-3	4-57	B-1297	3.5- 4.0		Peat		61.0			62.1	.07	.10							
		B-1297	4.0- 4.5		Peat		66.5	5.9	1018.0										
		B-1298	8.5- 9.0		Peat		59.3			52.3	.08	.13							
		B-1298	9.0- 9.5		Peat		72.0	9.6	648.0										
		B-1299	13.5-14.0		Organic Silt		71.0			34.5	.16	.19	.14						
		B-1299	14.0-14.5		Organic Silt					40.0									
		B-1300	19.0-19.5		Silty Sand					0.9									
ETS-X1A	3-60	0-1839	9.0- 9.5	200	Silty Peat		68.3	13.7	397.6	52.0	.71		.71	10					
		0-1840	13.5-14.0	200	Fibrous Peat	1.89	65.9	15.6	321.0	45.3	.50	.77							
		0-1841	18.5-19.0		Silty Peat		NG	NG	230.3	25.3									
		0-1842	23.5-24.0		Silty Peat		71.0	11.6	510.3	58.8	1.20	1.26	1.36	20					
		0-1843	29.0-29.5		Silty Peat		76.8	13.3	476.9	44.8	.49	.52	.54	15					
		0-1844	38.5-39.0	200	Clayey Sand	2.69	127.8	106.9	19.5				.98	5					
ETS-X1B	3-60	0-1845	9.0- 9.5		Lean Clay	2.62	84.0	45.1	86.2	10.7	.35	.37	.37	20					
		0-1846	19.0-19.5		Fibrous Peat		56.0	9.4	495.4	54.2									
		0-1847	23.0-23.5		Silty Peat		69.9	11.1	530.4	51.6	.88	1.15							
		0-1848	29.0-29.5		Silty Peat		68.0	14.5	369.0	58.8	.36	.43	.43	20					

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-1 (continued)

Hole No.	Date	Lab No	Sample Depth	#MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETS-X1C	3-60	0-1849	4.5- 5.0	200	Silty Sand	2.64	106.3	83.2	27.7	2.9			.35	5					
		0-1850	9.5-10.0		Fibrous Peat		57.7	7.1	713.8	61.1									
		0-1851	17.5-18.0		Fibrous Peat		62.8	9.5	563.5	51.8	.52	.66							
		0-1852	23.5-24.0		Peaty Silt		81.0	31.9	154.2	18.0	.43		.45	12					
		0-1853	24.0-24.5	200	Silty Sand	2.61	111.5	79.9	39.5	4.2	.32		.39	19					
ETS-X1D	3-60	0-1854	4.0- 4.5		Silty Peat		68.6	9.5	621.1	54.8	.25	.43							
		0-1855	13.5-14.0		Fibrous Peat		69.8	10.4	570.5	45.4	.19	.29							
		0-1856	24.5-25.0	200	Sand	2.69	126.1	103.7	21.6										
ETS-X1E	3-60	0-1857	4.0- 4.5		Fibrous Peat		62.4	5.9	964.4	65.7	.10	.18							
		0-1858	14.5-15.0		Fibrous Peat		51.2	5.4	855.4	52.2	.11	.21							
		0-1859	19.5-20.0	200	Silty Sand	2.68	132.7	111.6	18.9										
		0-1860	24.0-24.5	200	Fine Sand	2.70	121.0	97.5	24.2										
ETS-1	3-60	0-1861	3.5- 4.0		Fibrous Peat		67.4	8.8	663.0	48.8	.13	.23							
		0-1862	9.5-10.0		Silty Peat		62.0	6.9	798.7	53.7	.18	.24	.24	20					
		0-1863	14.5-15.0		Peaty Silt		60-2	7.0	765.4	53.4	.18		.20	14					
		0-1864	18.0-18.5		Clayey Silt	2.44	84.2	34.2	146.2	14.8	.18		.19	15					
		0-1865	19.0-19.5	200	Clayey Sand	2.67	131.1	111.6	17.5				.50	6					
		0-1866	24.0-24.5	200	Fine Sand	2.66	120.0	100.9	19.0										
ETS-2	3-60	0-1867	8.5-9.0		Fibrous Peat		65.1	6.1	967.7	58.2									
		0-1868	14.0-14.5		Fibrous Peat		67.0	7.8	762.8	46.5	.16		.19	19					
		0-1869	19.5-20.0	200	Sand	2.62	102.0	69.9	45.9	3.41			.60	2					
ETS-X2A	3-60	0-2105	3.0- 3.5		Peaty Silt		102.5	61.7	66.3	9.3	.80		.86	14					
		0-2106	9.0- 9.5		Organic Silt	2.51	96.2	50.9	89.1	13.6			1.07	9					
		0-2107	14.0-14.5		Silty Peat		66.2	18.7	254.2	43.2									
		0-2108	24.0-24.5		Silty Peat		62.1	10.6	484.3	57.6	1.11	1.32	1.32	20					
		0-2109	27.5-28.0		Silty Peat		65.5	10.5	520.6	56.9	.73		.75	15					
		0-2110	34.0-34.5	200	Clayey Sand	2.69	127.2	109.0	16.7		1.23		1.36	15					
ETS-X2B	3-60	0-2111	2.5- 3.0		Lean Clay		76.4	28.2	170.9	18.1	.14	.16	.16	20					
		0-2112	13.0-13.5		Silty Peat		64.4	7.8	730.1	54.6	.15	.21							
		0-2113	19.5-20.0		Organic Silt		79.1	25.2	213.7	20.5	.20		.22	15					

Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-1 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density		Moist. Cont.	Org. Burn	Uncon. Compression				One-Pt. Triax. Shear				Other Tests
							Wet	Dry			10% Str.	20% Str.	Max. Str.	% Str @ Max	10% Str.	20% Str.	Max. Str.	% Str @ Max	
ETS-X2C	3-60	0-2114	4.0- 4.5		Silty Peat		65.6	7.1	819.2	65.5									
		0-2115	14.5-15.0		Silty Peat		68.1	7.7	780.5	54.3									
		0-2116	19.0-19.5	200	Fine Sand	2.68	126.4	109.0	16.0										
		0-2117		200	Clayey Sand		94.9	59.8	58.8	4.7	.30		.38	19					
ETS-X2D	3-60	0-2118	4.0- 4.5		Fibrous Peat		60.4	NG	NG	68.6									
		0-2119	13.5-14.0		Fibrous Peat		60.9	7.5	717.1	51.0									
		0-2120	18.5-19.0		Organic Silt		91.3	52.7	72.3	6.5	.16	.20							
ETS-X3A	3-60	0-2121	3.5- 4.0		Silty Sand	2.67	89.4	69.8	28.1	3.9									
		0-2122	7.5- 8.0		Fine Sand		110.2	79.1	39.4	1.3									
		0-2123	10.0-10.5		Silty Peat		66.1	21.9	201.7	34.4	.55		.62	19					
		0-2124	18.0-18.5		Silty Peat		68.7	11.1	516.5	53.5	.74	.98	.98	20					
		0-2125	24.0-24.5		Silty Peat		74.6	17.3	332.1	38.4	.65		.52	15					
		0-2126	29.5-30.0		Clayey Sand	2.70	116.7	94.6	23.3	2.1	.87	1.18							
ETS-X3B	3-60	0-2127	4.0- 4.5		Fibrous Peat		64.2	6.9	829.7	59.4									
		0-2128	13.5-14.0		Silty Peat		71.3	11.1	540.7	42.5	.15	.25							
		0-2129	19.5-20.0	200	Clayey Sand	2.68	127.1	107.2	18.6	2.1			1.74	6					
ETS-X3C	3-60	0-2130	4.0- 4.5		Fibrous Peat		63.7	6.4	891.5	83.5	.32	.47							
		0-2131	14.5-15.0	200	Clayey Sand	2.66	120.6	99.9	20.7	1.9			.36	2					
ET-STC	10-61	1-4056	11.0-11.5	200	Clayey Sand		119.7	100.9	18.6										
		1-4057	11.5-12.0		Silty Peat		72.4	27.0	168.4	18.7	.33		.34	15					
		1-4058	14.0-14.5		Silty Peat		81.9	34.8	135.3	16.2	.43		.43	10					
		1-4059	14.5-15.0		Sandy Silt		106.1	69.9	51.7										
		1-4060	15.5-16.0		Fibrous Peat		63.2	9.3	577.8	50.8	.43		.52	18					
		1-4061	16.0-16.5		Fibrous Peat		66.8	9.9	576.8	50.2	.11		.11	10					
		1-4062	16.5-17.0		Fibrous Peat		65.7	11.2	488.5	47.8	.52	.69							
		1-4063	17.0-17.5		Fibrous Peat		65.5	10.3	537.1	54.6	.47		.54	18					
		1-4064	17.5-18.0		Fibrous Peat		65.7	12.3	434.4	43.4	.65		.84	18					
		1-4065	19.0-19.5		Silty Peat		84.8	22.8	272.4	22.5	.40		.42	12					
		1-4066	19.5-20.0		Silty Peat		67.2	16.6	304.8	22.4	.18	.21	.21	20					
		1-4067	20.0-20.5		Silty Sand		79.7	34.4	131.3		.19	.31							
		1-4068	20.5-21.0	200	Silty Sand		125.7	104.6	20.2										
		1-4069	23.0-23.5	200	Silty Sand		113.1	96.4	17.4										
		1-4070	23.5-24.0	200	Silty Sand		130.4	111.0	17.4										

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-1 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETS-1R	11-61	1-4804	8.5- 9.0		Fibrous Peat					59.4	.42	.57							
		1-4805	9.0- 9.5		Fibrous Peat														
		1-4806	9.5-10.0		Fibrous Peat					63.2									
		1-4807	12.5-13.0		Fibrous Peat					61.4	.25	.42							
		1-4808	13.0-13.5		Fibrous Peat														
		1-4809	13.5-14.0		Fibrous Peat					51.9	.27	.46							
		1-4810	14.0-14.5		Fibrous Peat														
		1-4811	18.0-18.5		Fibrous Peat														
		1-4812	18.5-19.0		Fibrous Peat														
		1-4813	19.0-19.5		Peaty Silt					21.7	.49		.55	15					
ETS-2R	11-61	1-4545	10.0-10.5		Fibrous Peat		66.2	8.4	668.0	48.4	.29	.42							
		1-4546	9.5-10.0		Fibrous Peat		64.0	8.5	653.0	50.8	.24	.26		12					
		1-4547	9.0- 9.5		Fibrous Peat		66.0	8.4	684.0	52.8	.30	.39							
		1-4548	8.5- 9.0		Fibrous Peat		65.2	7.5	767.0	67.0	.29	.40							
		1-4549	15.0-15.5		Fibrous Peat		61.6	9.1	575.0	48.5	.29		.34	15					
		1-4550	14.5-15.0		Fibrous Peat		67.3	10.2	560.0	43.5	.28		.30	15					
		1-4551	14.0-14.5		Fibrous Peat		62.6	7.5	736.0	53.9	.29	.37							
		1-4552	13.5-14.0		Fibrous Peat		61.4	7.8	684.0	49.0	.34	.44							
		1-4553	19.5-20.0		Silty Peat		75.8	16.6	356.0	24.0	.19		.24	15					
		1-4554	19.0-19.5		Organic Silt		80.0	15.3	422.0	20.7	.20		.25	15					
		1-4555	24.0-24.5	200	Fine Sand		129.0	114.5	12.6										
		1-4556	23.5-24.0	200	Fine Sand		154.3	130.5	18.2										
ETS-X1CR	11-61	1-4773	4.5- 5.0		Sandy Silt														
		1-4774	5.0- 5.5		Sandy Silt														
		1-4775	9.0- 9.5		Fibrous Peat		53.5	7.6	606.6	54.6	.18	.29							
		1-4776	9.5-10.0		Fibrous Peat														
		1-4777	10.0-10.5		Fibrous Peat		55.2	7.0	687.7	61.4									
		1-4778	13.5-14.0		Fibrous Peat														
		1-4779	14.0-14.5		Fibrous Peat														
		1-4780	14.5-15.0		Fibrous Peat		61.8	8.0	672.8	64.8	.37	.54							
		1-4781	15.0-15.5		Fibrous Peat														
		1-4782	18.0-18.5		Fibrous Peat														
		1-4783	18.5-19.0		Fibrous Peat														
		1-4784	19.0-19.5		Fibrous Peat		70.2	11.2	525.0	42.4	.44	.51							
		1-4785	19.5-20.0		Fibrous Peat														
		1-4786	23.5-24.0		Silty Peat		68.5	16.6	311.2	26.3	.37		.38	12					
		1-4787	24.5-25.0		Silty Peat														

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-1 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETS-X1DR	11-61	1-4788	4.5- 5.0		Silty Peat		73.5	28.8	155.3	26.8			.39	8					
		1-4789	9.5-10.0		Fibrous Peat		60.9	8.0	664.2	61.5									
		1-4790	10.0-10.5		Fibrous Peat														
		1-4791	13.5-14.0		Fibrous Peat														
		1-4792	14.0-14.5		Fibrous Peat		68.7	11.2	510.5	40.7	.33		.41	19					
		1-4793	14.5-15.0		Fibrous Peat														
		1-4794	15.0-15.5		Fibrous Peat														
		1-4795	19.0-19.5		Silty Peat														
		1-4796	19.5-20.0		Silty Peat		75.1	27.1	177.4	13.5									
ETS-X1ER	11-61	1-4797	3.0- 3.5		Fibrous Peat														
		1-4798	3.5- 4.0		Fibrous Peat														
		1-4799	4.0- 4.5		Fibrous Peat					69.4	.17	.26							
		1-4800	4.5- 5.0		Fibrous Peat														
		1-4801	9.0- 9.5		Fibrous Peat														
		1-4802	9.5-10.0		Fibrous Peat					59.0									
		1-4803	14.5-15.0		Fibrous Peat					53.6	.22		.27	19					
ETS-2AR	11-61	1-4557	4.5- 5.0		Fat Clay		122.8	93.6	31.1		1.77		1.80	15					
		1-4558	10.0-10.5		Fibrous Peat		62.4	9.3	568.0	64.4	.63	1.04							
		1-4559	9.5-10.0		Fibrous Peat		70.2	26.8	162.0	34.2			.59	6					
		1-4560	15.0-15.5		Silty Peat		67.2	9.2	629.0	53.9	.44	.64							
		1-4561	14.5-15.0		Silty Peat		68.8	12.5	451.0	44.6	.56	.71							
		1-4562	14.0-14.5		Silty Peat		67.9	9.4	623.0	56.7	.53	.67							
		1-4563	13.5-14.0		Fibrous Peat		69.4	9.6	624.0	55.3	.62	.81							
		1-4564	13.0-13.5		Fibrous Peat		63.2	8.5	643.0	58.1	.58	.86							
		1-4565	20.0-20.5		Fibrous Peat		65.7	16.9	289.0	30.7	.35		.44	15					
		1-4566	19.5-20.0		Silty Peat		62.6	10.1	522.0	47.3	.72	.96							
		1-4567	19.0-19.5		Silty Peat		63.4	9.9	540.0	49.8	.45		.52	15					
		1-4568	18.5-19.0		Silty Peat		59.0	9.3	535.0	45.9	.49	.59	.59	20					
		1-4569	18.0-18.5		Fibrous Peat		64.9	10.1	544.0	48.3	.55	.59	.59	20					
		1-4570	25.0-25.5	200	Clayey Sand		157.5	136.6	15.3										
		1-4571	24.5-25.0	200	Clayey Sand		107.9	91.8	17.5										

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-1 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density		Moist. Cont.	Org. Burn	Uncon. Compression				One-Pt. Triax. Shear				Other Tests
							Wet	Dry			10% Str.	20% Str.	Max. Str.	% Str @ Max	10% Str.	20% Str.	Max. Str.	% Str @ Max	
ETS-2BR	11-61	1-4572	5.0- 5.5		Organic Silt		89.4	43.0	108.0		.65		.69	15					
		1-4573	4.5- 5.0		Organic Silt		95.6	48.7	96.4										
		1-4574	10.0-10.5		Silty Peat		83.6	31.0	170.0	18.2	.40		.41	11					
		1-4575	9.5-10.0		Silty Peat		88.8	34.1	160.6	18.6	.28	.45							
		1-4576	9.0- 9.5		Silt		99.7	54.7	82.2		.50		.59	16					
		1-4577	15.0-15.5		Fibrous Peat		65.5	22.6	190.0	29.0	1.40	1.60	.16	20					
		1-4578	14.5-15.0		Fibrous Peat		82.1	47.2	73.6	19.9			.47	8					
		1-4579	14.0-14.5		Fibrous Peat		86.0	50.0	72.1	18.6			.48	6					
		1-4580	13.5-14.0		Fibrous Peat		88.8	52.8	68.2	16.2	.48		.48	10					
		1-4581	20.0-20.5		Fibrous Peat		66.4	15.3	333.3	26.7	.40		.43	12					
		1-4582	19.5-20.0		Fibrous Peat		74.8	19.3	287.7	24.9	.39		.39	10					
		1-4583	19.0-19.5		Fibrous Peat		79.6	15.1	425.9	33.8	.28	.34	.34	20					
		1-4584	25.0-25.5	200	Fine Sand		131.2	112.6	16.5										
ETS-2CR	11-61	1-4585	5.0- 5.5		Fibrous Peat		68.8	8.0	759.0	55.0	.215	.32							
		1-4586	4.5- 5.0		Fibrous Peat		65.8	7.6	763.6	65.8	.177	.30							
		1-4587	4.0- 4.5		Peat		74.5	7.8	861.0	62.4	.127	.19							
		1-4588	10.0-10.5		Peat		59.7	6.3	842.0	64.6	.127		.13	10					
		1-4589	9.5-10.0		Peat		61.6	5.8	962.0	56.6	.090	.16							
		1-4590	15.0-15.5		Peat		59.9	6.7	797.0	54.8	.114		.15	14					
		1-4591	19.5-20.0		Silty Peat		77.7	20.6	277.0	19.4	.190		.20	11					
		1-4592	19.0-19.5		Silty Peat		59.4	9.9	502.0	32.0	.170		.22	14					
		1-4593	18.5-19.0		Silty Peat		78.2	17.7	343.0	21.7	.140		.22	18					
ETS-2DR	11-61	1-4594	5.0- 5.5		Peat		65.3	8.2	698.0	56.7	.202		.34						
		1-4595	4.5- 5.0		Peat		62.4	8.6	629.0	57.0	.215		.34						
		1-4596	4.0- 4.5		Peat		63.3	8.0	688.0	67.6	.250		.26						
		1-4597	10.0-10.5		Peat		64.0	6.7	856.0	60.3	.140		.19	18					
		1-4598	9.5-10.0		Peat		62.2	7.3	754.0	48.5	.139		.20						
		1-4599	15.0-15.5		Peat		69.9	9.7	621.0	41.3	.177		.20	16					
		1-4600	14.5-15.0		Peat		70.1	9.2	658.0	46.4	.190		.22	18					
		1-4601	14.0-14.5		Peat		66.9	8.6	677.0	49.6	.151	.24							
		1-4602	20.0-20.5		Silty Peat		64.2	7.0	811.0	48.8	.050		.05	10					
		1-4603	19.5-20.0		Silty Peat		69.7	8.0	775.0	48.6	.039	.06							
		1-4604	19.0-19.5		Silty Peat		69.7	7.8	799.0	48.4									
		1-4605	18.5-19.0		Peat		71.1	12.9	452.0	35.9	.200		.22	11					
		1-4606	22.5-23.0	200	Fine Sand		128.9	109.7	17.5										
ETS-3BR	11-61		No Testing																

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2
EMPIRE TRACT TEST LEVEE
SUMMARY OF TWO-INCH AND TWO AND ONE HALF INCH DRILLING

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETX-1	10-57	B-3223	8.0- 8.5		Peat														
		B-3224	13.0-13.5		Peat														
		B-3225	17.5-18.0		Peat		61.7	9.9	522.0	58.3	0.18	0.24							
		B-3226	18.0-18.5		Peat		60.1	9.0	571.0	63.6	0.50								
		B-3227	23.0-23.5		Peat		62.4	9.0	593.0	66.3									
		B-3228	23.5-24.0		Peat						0.18	0.27							
		B-3229	30.0-30.5		Peat		65.8	16.4	301.0	40.4	0.40		0.43	15					
		B-3230	30.5-31.0		Peat						0.26	0.46							
		B-3231	31.0-31.5		Peat		65.8	14.8	346.0	43.0			0.29	9					
		B-3232	33.0-33.5		Silty Peat		73.6	24.5	200.0	18.6			0.40	10					
		B-3233	33.5-34.0		Sandy Silt	2.65	104.2	82.3	26.6		0.17	0.21	0.21	20					
		B-3234	34.0-34.5	200	Silty Sand		134.3	114.5	17.3	4.1									
		B-3235	34.5-35.0	200	Silty Sand		134.7	121.5	10.9										
		B-3236	37.5-38.0		Silty Sand		126.3	103.4	22.2										
		B-3237	38.0-38.5	200	Silty Sand		129.5	108.9	18.9										
		B-3238	43.5-44.0	50	Sand		127.7	107.1	19.2										
		B-3239	44.0-44.5	200	Sand		130.1	109.3	19.0										
		B-3240	47.5-48.0		Silt-Clay	2.78	120.1	91.3	31.5										
		B-3241	48.0-48.5		Silty Clay		123.9	102.3	21.1				3.68	8					
		B-3242	53.5-54.0		Fat Clay	2.80	125.5	97.0	29.4				1.59	5					
		B-3243	54.0-54.5		Clay		125.5	101.5	23.6		2.44		2.60	15					
		B-3244	58.0-58.5		Clay	2.76	123.3	97.1	27.0										
		B-3245	62.5-63.0		Clay		120.6	91.6	31.6		1.20	1.60							
		B-3246	63.0-63.5		Clay		120.6	91.4	32.0										
		B-3247	67.0-67.5		Clay	2.79	127.9	99.8	28.1		2.30		3.13	16					
		B-3248	73.0-73.5	200	Silty Sand		124.7	102.9	21.2										
		B-3249	77.5-78.0	200	Sand		124.3	97.8	27.1										
		B-3250	78.0-78.5		Sand		127.6	103.2	23.6										
		B-3251	82.0-82.5		Silt Clay	2.75	111.6	79.3	40.8		1.10	1.57	1.57	20					
		B-3252	82.5-83.0		Silt Clay	2.75	110.8	81.5	35.9										
		B-3253	83.0-83.5		Silt Clay	2.76	112.0	78.0	43.5		1.55	2.12	2.12	20					
ETX-2	10-57	B-3300	3.0- 3.5		Organic Silt				48.4	8.3									
		B-3301	3.5- 4.0		Organic Silt		84.9	53.1	59.9	16.5			0.26	8					
		B-3302	8.0- 8.5		Peat		62.8	9.4	569.0	57.7	0.16	0.20							
		B-3303	8.5- 9.0		Peat		59.7	13.4	345.0	61.0									
		B-3304	12.0-12.5		Peat		64.9	11.3	475.0	41.8	0.16		0.19	19					
		B-3305	12.5-13.0		Peat		63.3	8.3	664.0	53.7									
		B-3306	13.0-13.5		Peat														
		B-3307	17.5-18.0		Silty Peat		67.6	16.0	322.0	24.0									
		B-3308	18.0-18.5		Silty Peat		64.0	16.2	296.0	28.0	0.12		0.14	15					
		B-3309	25.0-25.5	200	Silty Sand		125.7	81.9	53.4										

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETX-2	10-57	B-3310	25.5-26.0		Silty Sand		127.0	104.9	21.1										
		B-3311	26.0-26.5	200	Silty Sand		128.3	105.9	21.1										
		B-3312	29.5-30.0		Silty Sand	2.77	136.1	115.2	18.2				5.60	8					
		B-3313	30.0-30.5		Lean Clay		128.6	107.1	20.1				6.55	5					
		B-3314	35.0-35.5		Lean Clay		124.8	101.2	23.3		2.30	3.29	3.29	20					
		B-3315	35.5-36.0		Lean Clay	2.75	129.5	106.6	21.5										
		B-3316	39.5-40.0		Lean Clay	2.86	123.5	95.5	29.3										
		B-3317	40.0-40.5		Sandy Clay	2.77	126.8	65.9	92.3										
		B-3318	45.0-45.5		Sand		127.3	102.7	23.9										
		B-3319	45.5-46.0	50	Sand		128.3	106.5	20.5										
		B-3320	46.0-46.5	200	Silty Sand		128.4	104.1	23.3										
		B-3321	51.5-52.0		Silt-Clay	2.77	118.8	87.5	35.8		0.31	0.55							
		B-3322	52.0-52.5		Silt Clay		119.6	90.6	32.0										
		B-3323	57.5-58.0		Sandy Clay	2.72	122.7	96.3	27.4		0.31	0.53							
		B-3324	58.0-58.5		Sandy Clay	2.75	126.0	101.9	23.6										
		B-3325	63.0-63.5		Sandy Clay		118.2	89.7	31.7		0.32	0.52							
		B-3326	63.5-64.0		Sandy Clay	2.76	120.6	89.8	34.3										
		B-3327	64.0-64.5		Sandy Clay		121.0	90.6	33.6		0.51		0.52	11					
ETX-3	10-57	B-3328	2.5- 3.0		Silty Peat		63.7	17.5	260.0	43.6									
		B-3329	3.0- 3.5		Silty Peat														
		B-3330	7.5- 8.0		Peat		63.6	7.8	717.0	63.2	0.10	0.16							
		B-3331	11.5-12.0		Peat	1.71	63.9	11.0	480.0	48.8									
		B-3332	14.5-15.0		Peat														
		B-3333	15.0-15.5		Peat		65.9	10.6	520.0	44.7	0.11		0.12	12					
		B-3334	17.0-17.5	200	Silty Sand		131.5	109.0	20.6										
		B-3335	17.5-18.0		Silty Sand		130.3	107.7	21.0										
		B-3336	18.0-18.5	200	Silty Sand		135.6	116.0	16.9										
		B-3337	22.0-22.5		Silty Sand														
		B-3338	22.5-23.0	200	Silty Sand		128.5	106.7	20.4										
		B-3339	23.0-23.5		Silty Sand		131.3	110.0	19.1										
		B-3340	27.0-27.5		Sandy Clay	2.76	131.7	110.0	19.8				7.00	8					
		B-3341	32.5-33.0		Silt-Clay	2.77	124.5	99.6	25.0										
		B-3342	33.0-33.5		Silt-Clay	2.77	125.4	99.5	26.0		2.20	3.40							
		B-3343	33.5-34.0		Silt-Clay	2.76	126.8	101.4	25.0										
		B-3344	38.0-38.5		Sandy Silt	2.74	123.9	100.0	23.8										
		B-3345	38.5-39.0		Silt-Clay	2.78	122.6	94.4	29.9				1.28	6					
		B-3346	43.0-43.5		Fat Clay	2.76	119.2	86.3	38.1		1.20	1.48							
		B-3347	43.5-44.0		Fat Clay		114.9	88.1	30.4										

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETX-3	10-57	B-3348	44.0-44.5		Fat Clay		116.9	84.3	38.6		0.58	1.24							
		B-3349	48.5-49.0		Sandy Clay	2.76	116.3	86.4	34.6				0.58	9					
		B-3350	49.0-49.5		Sandy Clay		117.3	85.6	37.1										
		B-3351	53.5-54.0		Sandy Silt	2.73	120.4	90.1	33.7		0.35	0.70							
		B-3352	54.0-54.5		Sandy Silt		121.0	93.7	29.2										
		B-3353	58.0-58.5	200	Silty Sand		120.2	97.2	32.7										
		B-3354	58.5-59.0		Silty Sand		124.3	100.5	23.7										
		B-3355	59.5-60.0	200	Silty Sand		131.8	110.9	18.8										
		B-3356	63.0-63.5		Silty Sand	2.75	115.6	83.8	38.0										
		B-3357	63.5-64.0		Silt-Clay		114.6	83.3	36.7										
		B-3358	64.0-64.5		Silt-Clay	2.74	114.9	82.7	39.0		.540	.870							
ETX-4	10-57	B-3359	8.0- 8.5		Peat		62.8	39.4	59.3	74.6	0.13	0.19							
		B-3360	13.0-13.5		Peat		64.8	9.9	555.0	49.6	0.12	0.16							
		B-3361	16.0-16.5		Peat														
		B-3362	17.0-17.5	200	Silty Sand		132.2	111.9	18.1										
		B-3363	17.5-18.0		Silty Sand		132.3	113.4	16.7										
		B-3364	18.0-18.5	200	Silty Sand		137.6	119.9	14.8										
		B-3365	20.0-20.5	200	Silty Sand		130.0	108.1	20.2										
		B-3366	20.5-21.0	200	Silty Sand		130.8	110.5	18.4										
		B-3367	21.0-21.5		Silty Sand	2.70	131.8	111.9	17.8										
		B-3368	22.5-23.0		Silty Sand														
		B-3369	23.0-23.5	200	Silty Sand		129.7	106.5	21.8										
		B-3370	23.5-24.0	200	Silty Sand		130.9	109.5	19.5										
ETX-6	10-57	B-3371	8.5- 9.0	50	Sand		127.9	119.7	6.5										
		B-3372	13.0-13.5		Organic Silt														
		B-3373	13.5-14.0		Organic Silt	2.36	88.9	51.9	71.4	20.7	0.32		0.33	13					
		B-3374	18.0-18.5		Silty Peat		65.8	17.0	288.0	49.6									
		B-3375	18.5-19.0		Organic Silt	2.47	72.8	38.1	91.0	18.6	0.32	0.72							
		B-3376	23.5-24.0		Silty Peat														
		B-3377	28.5-29.0		Silty Peat		66.5	15.7	323.0	18.3	0.27		0.32	16					
		B-3378	33.0-33.5	200	Silt-Clay		133.0	120.9	10.0										
		B-3379	33.5-34.0	200	Silt-Clay		132.0	114.0	15.8										
		B-3380	37.5-38.0	200	Silt-Clay		130.0	109.0	19.3										
		B-3381	38.0-38.5	200	Silt-Clay		133.7	116.2	15.1										
		B-3382	41.5-42.0		Silt-Clay		133.0	112.2	18.5				6.15	8					
		B-3383	42.0-42.5		Silty Sand	2.73	126.6	105.6	20.5										
		B-3384	48.5-49.0		Silty Sand	2.75	125.8	101.4	24.1		1.33	2.23							
		B-3385	49.0-49.5		Silty Sand	2.73	127.9	103.4	23.7										

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
ETX-6	10-57	B-3386	53.5-54.0		Silty Sand		124.9	98.4	26.9				1.29	9					
		B-3387	54.0-54.5		Silt-Clay		117.5	90.1	30.4		2.67	3.14							
		B-3388	59.0-59.5	200	Silty Sand		132.1	106.2	24.4										
		B-3389	63.5-64.0		Silt-Clay	2.76			36.4										
		B-3390	64.0-64.5		Silt-Clay		119.6	89.3	34.0		0.46	0.68							
		B-3391	64.5-65.0		Silt-Clay	2.76	122.3	93.6	30.6										
		B-3392	69.0-69.5	200	Silty Sand		124.8	102.5	21.8										
		B-3393	69.5-60.0	200	Silty Sand		125.9	101.9	23.5										
		B-3394	73.0-73.5		Silty Sand		122.6	93.9	30.5										
		B-3395	73.5-74.0		Silty Sand		124.3	98.2	26.6										
		B-3396	74.0-74.5		Sandy Silt		122.5	94.9	29.1										
ETL-XIA	4-60	0-3467	5.0- 5.5		Fibrous Peat														
		0-3468	5.5- 6.0		Fibrous Peat		75.5	33.0	128.6	23.1									
		0-3469	6.5- 7.0		Fibrous Peat														
		0-3470	7.0- 7.5		Fibrous Peat		62.1	14.7	323.3	52.0									
		0-3471	8.5- 9.0		Fibrous Peat		71.3	20.6	245.6	33.2									
		0-3472	9.0- 9.5		Fibrous Peat		66.3	18.5	258.7	35.5									
		0-3473	11.0-11.5		Fibrous Peat		74.6	26.1	185.7	28.5									
		0-3474	13.0-13.5		Fibrous Peat														
		0-3475	13.5-14.0		Fibrous Peat		58.2	11.0	428.8	74.6									
		0-3476	14.5-15.0		Fibrous Peat														
		0-3477	15.0-15.5		Fibrous Peat		62.0	10.8	474.9	65.8									
		0-3478	20.5-21.0		Peat		61.1	10.2	501.7	75.3									
		0-3479	30.5-31.0		Peat		75.2	11.0	584.2	48.4									
		0-3480	34.5-35.0		Silty Sand	2.70				1.0									K=.0016 Ft/Day
		0-3481	35.0-35.5		Silty Sand		130.5	113.7	14.7	1.3									
		0-3482	36.0-36.5		Silty Sand		124.6	103.5	20.4										
		0-3483	36.5-37.0		Silty Sand		N.G.	N.G.	20.5	0.9									
		0-3484	37.5-38.0		Silty Sand		129.6	109.0	18.9										
		0-3485	38.5-39.0		Silty Sand														
		0-3486	39.0-39.5		Silty Sand		129.6	107.0	21.1	1.7									
		0.3487	40.0-40.5		Silty Sand														
		0.3488	40.5-41.0		Silty Sand		110.3	92.3	19.5	1.3									
		0.3489	45.0-45.5		Clayey Silt		128.0	93.6	36.8	3.2									
		0.3490	46.5-47.0		Clayey Silt		128.1	103.6	23.7	2.5									
		0-3491	47.5-48.0		Clayey Silt	2.80	124.6	95.3	30.7	2.2									

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
[illegible]	4-60	0-3492	48.0-48.5		Clayey Silt		122.5	95.4	28.4	2.1									K .039 Ft/Day
		0-3493	51.0-51.5		Clayey Silt		127.0	101.9	24.6	4.1									
		0-3494	52.5-53.0		Silty Clay														
		0-3495	53.0-53.5		Silty Clay		124.7	100.2	24.5	4.0									
		0-3496	54.0-54.5		Silty Clay	2.79	124.4	25.6	99.0	3.6									
		0-3497	54.5-55.0		Silty Clay		129.5	110.2	17.5	2.6									
		0-3498	56.0-56.5		Sandy Silt														
		0-3499	56.5-57.0		Sandy Silt		126.8	102.7	23.5	2.7									
		0-3500	58.5-59.0		Silty Clay														
		0-3501	59.0-59.5		Silty Clay		127.1	103.8	22.4	4.1									
		0-3502	60.5-61.0		Silty Clay														
		0-3503	61.0-61.5		Silty Clay		123.6	99.8	23.9	3.8									
		0-3509	63.0-63.5		Sandy Silt														
		0-3510	63.5-64.0		Sandy Silt		125.9	101.9	23.6	2.2									
		0-3511	65.0-65.5		Sandy Silt														
		0-3512	65.5-66.0		Silty Sand		125.8	92.0	36.7	1.4									
		0-3513	67.5-68.0		Silty Sand														
		0-3514	68.0-68.5		Clayey Silt		126.7	103.6	22.3	2.3									
		0-3515	68.5-69.0		Clayey Silt														
		0-3516	69.0-69.5		Clayey Silt		132.6	112.3	18.1	1.6									
		0-3517	70.5-71.0		Silty Clay														
		0-3518	71.0-71.5		Silty Clay		123.7	98.9	25.1										
ETL-X1B	5-60			No Testing															
ETL-X1C	5-60			No Testing															
ETL-X2A	5-60			No Testing															
ETL-X2B	5-60			No Testing															
ETL-X2C	5-60			No Testing															
ETL-X3A	5-60			No Testing															
ETL-X3B	6-60			No Testing															
ETL-X3C	6-60			No Testing															
ETL-X3D	6-60			No Testing															
1E	3-62	2-1049	1.0- 1.5		Peat		56.8	10.2	459.4	56.8					0.44	0.71			
		2-1050	3.0- 3.5		Peat		60.6	5.8	949.6	68.6					0.18	0.26			
		2-1232	6.0- 6.5		Peat		61.2	6.1	900.0	57.7					0.15	0.20			
		2-1233	9.0- 9.5		Peat		62.1	6.8	818.2	58.6					0.17	0.22			
		2-1234	12.0-12.5		Peat		62.5	8.8	609.2	48.5					0.11		0.12	15	
		2-1235	14.5-15.0		Organic Silt		82.0	35.0	134.7	13.0					0.16		0.16	10	

* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Unconf. Compression 10% Str.	Unconf. Compression 20% Str.	Unconf. Compression Max. Str.	Unconf. Compression % Str @ Max	Cons-Tr. Triax. 10% Str.	Cons-Tr. Triax. 20% Str.	Cons-Tr. Triax. Max. Str.	Cons-Tr. Triax. % Str @ Max	Other Tests
2E	3-62	2-1003	7.0- 7.5		Peat														
		2-1004	9.5-10.0		Peat		61.5	8.3	642.9	63.6									
		2-1005	13.5-14.0		Peat		63.9	8.8	630.1	51.2					0.29	0.41			
		2-1006	14.0-14.5		Peat														
		2-1007	16.0-16.5		Peat		64.3	9.7	565.6	47.2					0.32	0.44			
		2-1008	18.0-18.5		Silty Peat		70.0	16.1	322.2	26.6									
		2-1009	19.0-19.5		Sandy Clay		103.5	68.6	51.0	4.6					0.24		0.26	15	
3E	3-62	2-1051	9.0- 9.5		Peat W/Sand		60.3	12.7	372.9						0.42		0.42	10	
		2-1052	12.5-13.0		Peat W/Sand		61.6	7.5	717.7	66.2					0.31	0.44			
		2-1053	15.5-16.0		Peat W/Sand														Consolidation
		2-1054	16.5-17.0		Silty Peat		64.0	13.5	374.2	38.6					0.39		0.40	12	
		2-1055	18.5-19.0		Clayey Silt		94.7	54.5	73.6	7.4					0.22		0.24	17	
		2-1056	19.0-19.5	200	Clayey Sand		125.6	103.0	22.0	1.8									
4E	3-62	2-1236	6.5- 7.0		Peat														
		2-1237	10.0-10.5		Peat														Consolidation
		2-1238	13.0-13.5		Peat		62.6	8.3	656.3	51.6					0.18	0.24			
		2-1239	15.5-16.0		Peat														
		2-1240	19.5-20.0		Peat														
5E	3-62	2-1241	3.0- 3.5		Peat														
		2-1242	8.0- 8.5		Peat		61.6	6.6	837.4	54.2					0.13	0.18			
		2-1243	11.5-12.0		Peat														
		2-1244	14.0-14.5		Peat														Consolidation
		2-1245	16.5-17.0		Silty Peat		70.5	17.0	315.5	29.0					0.10		0.13	17	
		2-1246	17.5-18.0		Silty Peat		72.0	20.2	256.4	22.5									
6E	3-62	2-1247	5.0- 5.5		Peat														
		2-1248	8.0- 8.5		Peat		61.2	8.4	628.1	49.1					0.15	0.21			
		2-1249	11.0-11.5		Peat														
		2-1250	14.0-14.5		Peat														
		2-1251	17.0-17.5		Silty Peat		70.9	19.4	264.8	25.0									
		2-1252	20.5-21.0		Silty Sand														
7E	3-62	2-1253	5.5- 6.0		Peat														Consolidation
		2-1254	8.0- 8.5		Peat														
		2-1255	11.0-11.5		Peat														
		2-1256	14.0-14.5		Peat		63.7	8.5	648.4	58.6					0.25	0.36			
		2-1257	16.0-16.5		Peat														
		2-1258	19.5-20.0		Organic Silt		77.2	27.3	182.4	16.4					0.20		0.21	15	

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
8E	3-62	2-1259	5.5- 6.0		Clayey Silt														
		2-1260	8.0- 8.5		Silty Peat		80.0	39.5	102.6	25.2					0.61		0.64	12	
		2-1261	11.0-11.5		Silty Peat		62.5	8.6	628.5	61.5					0.28	0.47			
		2-1262	14.0-14.5		Silty Peat		60.7	7.8	681.4	64.0					0.24	0.35			
		2-1263	17.5-18.0		Silty Peat		56.5	8.5	561.1	74.1									
		2-1264	20.0-20.5		Silty Peat		73.7	23.1	219.4	20.6					0.19		0.20	15	
9-E	3-62	2-1270	2.0- 2.5		Silty Peat														
		2-1271	4.0- 4.5		Silty Peat														
		2-1272	7.0- 7.5		Silty Peat														
		2-1273	9.5-10.0		Silty Peat		62.6	7.7	710.7	52.5					0.19	0.26			
		2-1274	13.0-13.5		Peat														
		2-1275	16.0-16.5		Peat														
		2-1276	21.0-21.5		Organic Silt		93.6	53.0	76.7	7.0					0.18		0.19	16	
10E	4-62	2-1265	6.0- 6.5		Peat														
		2-1266	9.0- 9.5		Peat														
		2-1267	12.0-12.5		Peat														
		2-1268	15.0-15.5		Peat		60.7	6.5	831.3	53.2					0.12	0.16			
		2-1269	19.5-20.0		Organic Silt				182.8	15.5									
EVC-1	8-62	2-6822	9.5-10.0		Peat		60.9	9.5		57.5					0.21	0.28			
		2-6823	11.0-11.5		Peat		60.5	8.1	641.9	53.0					0.15	0.21			
		2-6824	11.5-12.0		Peat		61.5	6.6	828.7	55.3									Triax. Series
		2-6825	13.0-13.5		Peat		61.5	7.7	697.9	52.3									Triax. Series
		2-6826	13.5-14.0		Peat														
		2-6827	14.0-14.5		Peat		60.6	11.7	416.0	48.4					0.08	0.11			
		2-6828	15.5-16.0		Peat														
		2-6829	16.0-16.5		Peat		63.8	13.4	375.2	53.4									
		2-6830	18.0-18.5		Peat														
		2-6831	18.5-19.0		Peat														
		2-6832	19.0-19.5		Peat														
EVC-2	8-62	2-6833	11.5-12.0		Peat		62.8	13.2	377.3	65.3					0.28	0.38			
		2-6834	12.0-12.5		Peat		61.9	7.7	706.0	61.5									Triax. Series
		2-6835	12.5-13.0		Peat		62.3	9.0	593.6	56.2									Triax. Series
		2-6836	14.0-14.5		Peat		58.3	11.4	410.4	57.8									
		2-6837	14.5-15.0		Peat		62.5	9.5	558.9	63.7									Triax. Series
		2-6838	16.0-16.5		Peat		64.9	17.0	281.6	46.6						0.17			
		2-6839	16.5-17.0		Peat		62.2	10.1	515.9	49.6									Triax. Series
		2-6840	19.5-20.0		Silty Peat		67.0	19.5	244.4	28.5							0.22	9	
		2-6841	20.5-21.0		Organic Silt														
		2-6842	21.0-21.5		Clay		99.6	61.5	62.0	7.2					0.63		0.63	10	
		2-6843	21.5-22.0		Sandy Clay														
		2-6844	22.0-22.5		Sandy Clay														

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

TABLE C-2 (continued)

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	Uncon. Compression 20% Str.	Uncon. Compression Max. Str.	Uncon. Compression % Str @ Max	One-Pt. Triax. Shear 10% Str.	One-Pt. Triax. Shear 20% Str.	One-Pt. Triax. Shear Max. Str.	One-Pt. Triax. Shear % Str @ Max	Other Tests
EVC-3	9-62	2-7060	8.0- 8.5		Peat														
		2-7061	8.5- 9.0		Peat	1.26	59.3	6.2	860.6	73.5									
		2-7062	10.0-10.5		Peat		63.4	8.3	663.1						0.16		0.21	17	
		2-7063	10.5-11.0		Peat														
		2-7064	11.0-11.5		Peat														
		2-7065	11.5-12.0	200	Silty Sand	2.06	N.G.	N.G.	392.4	32.4									
		2-7066	12.0-12.5		Peat														
		2-7067	12.5-13.0		Peat														
		2-7068	13.0-13.5		Peat														
		2-7069	13.5-14.0		Peat		63.9	8.3	670.2						0.15	0.23			
		2-7070	14.0-14.5		Peat														
		2-7071	14.5-15.0		Peat	1.67	65.3	9.6	577.6	48.9					0.17	0.21			
		2-7072	15.0-15.5		Peat														
		2-7073	15.5-16.0		Peat	1.80	62.2	10.1	515.7	50.4									
		2-7074	16.0-16.5		Peat														
		2-7075	16.5-17.0		Peat		68.3	11.5	493.7	35.1					0.26		0.26	9	
		2-7076	17.0-17.5		Peat														
		2-7077	17.5-18.0		Sandy Clay	2.14	75.1	17.1	338.6	27.8					0.18		0.19	13	
		2-7078	18.5-19.0		Sandy Clay														
		2-7079	19.0-19.5		Lean Clay	2.51	91.1	47.7	91.0	9.1					0.17		0.18	15	
		2-7080	19.5-20.0		Sand														
EVC-4	9-62	2-7081	11.0-11.5		Peat														
		2-7082	11.5-12.0		Peat	1.39	61.6	8.6	616.6	56.2					0.30		0.34	15	
		2-7083	13.0-13.5		Peat		63.0	12.6	398.9	62.9					0.56		0.56	10	
		2-7084	13.5-14.0		Peat	1.47	61.6	8.9	592.1	61.6									
		2-7085	14.5-15.0		Peat														
		2-7086	15.0-15.5		Peat														
		2-7087	15.5-16.0		Peat	1.66	64.2	11.0	481.8	54.1					0.35		0.38	16	
		2-7088	16.5-17.0		Peat														
		2-7089	17.0-17.5		Peat	1.74	64.9	11.7	455.2	44.2					0.40		0.41	12	
		2-7090	17.5-18.0		Peat														
		2-7091	18.0-18.5		Peat														
		2-7092	18.5-19.0		Sandy Clay	2.07	68.4	14.2	382.7	35.3									
		2-7093	19.0-19.5		Clayey Peat		70.7	26.0	172.4	29.8							0.49	6	
		2-7094	19.5-20.0		Clayey Peat														

*Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

Hole No.	Date	Lab No	Sample Depth	*MA	Visual Classification	Spec Grav	Density Wet	Density Dry	Moist. Cont.	Org. Burn	Uncon. Compression 10% Str.	20% Str.	Max. Str.	% Str @ Max	One-Ft. Triax. Shear 10% Str.	20% Str.	Max. Str.	% Str @ Max	Other Tests
ESF-14	7-62	2-5450	9.4- 9.8		Organic Silt		92.0	57.6	59.8	9.1									
		2-5451	15.7-16.1	200	Silty Sand		122.2	101.5	20.4	1.2									
		2-5452	17.9-18.6		Black Peat														
		2-5453	19.5-19.9		Black Peat				475.4	41.9									
		2-5454	19.9-20.6		Black Peat														
		2-5455	21.6-22.3		Silty Peat														
		2-5456	22.3-22.6		Silty Peat				218.0	24.1									
		2-5457	22.9-23.4		Organic Silt				150.5	15.4									
ESF-16	7-62	2-5458	8.1- 8.4		Silty Peat				98.2	22.0									
		2-5459	9.8-10.2		Black Peat				556.9	53.3									
		2-5460	10.9-11.2		Black Peat				849.6	54.5									
		2-5461	11.9-12.5		Black Peat														
		2-5462	13.0-13.4		Black Peat				516.8	45.5									
		2-5463	14.7-15.3		Black Peat														
		2-5464	15.7-16.1		Black Peat				695.1	59.5									
		2-5465	16.6-17.1		Black Peat														
		2-5466	17.1-17.7		Black Peat														
		2-5467	17.9-18.5		Black Peat														
		2-5468	18.5-19.0		Black Peat														
		2-5469	20.3-20.6		Black Peat				409.4	39.0									
		2-5470	21.6-22.0		Organic Silt				136.7	12.4									
		2-5471	22.0-22.4		Organic Silt				54.3	3.5									
ESF-17	7-62	2-5535	7.0- 7.4		Black Peat				721.8	51.7									
		2-5536	7.6- 8.3		Black Peat														
		2-5537	9.0- 9.4		Black Peat				745.8	59.4									
		2-5538	10.0-10.4		Black Peat				727.6	62.2									
		2-5539	11.2-11.6		Black Peat				858.2	71.2									
		2-5540	12.6-13.2		Black Peat														
		2-5541	13.9-14.2		Black Peat				642.5	49.3									
		2-5542	14.2-15.0		Black Peat														
		2-5543	16.0-16.7		Black Peat														
		2-5544	16.7-17.5		Black Peat														
		2-5545	18.1-18.9		Black Peat														
		2-5546	18.9-19.2		Silty Peat				368.4	32.5									
		2-5547	19.8-20.1		Silty Peat				410.0	32.5									
		2-5548	20.9-21.4		Organic Silt				152.7	14.4									
		2-5549	23.0-23.7		Clayey Sand														
		2-5550	23.7-24.1		Clayey Sand														
ESF-18	7-62	2-5551	6.6- 7.0		Organic Silt				152.0	18.6									
		2-5552	7.7- 8.1		Organic Silt				86.7	8.8									
		2-5553	17.0-17.4		Silty Peat				321.8	34.4									
		2-5554	18.0-18.4		Black Peat				458.3	40.9									
		2-5555	20.9-21.3		Silty Peat				351.7	28.2									
		2-5556	21.6-22.0		Silty Peat				274.1	30.0									
		2-5557	22.5-22.9		Organic Silt				145.0	11.9									

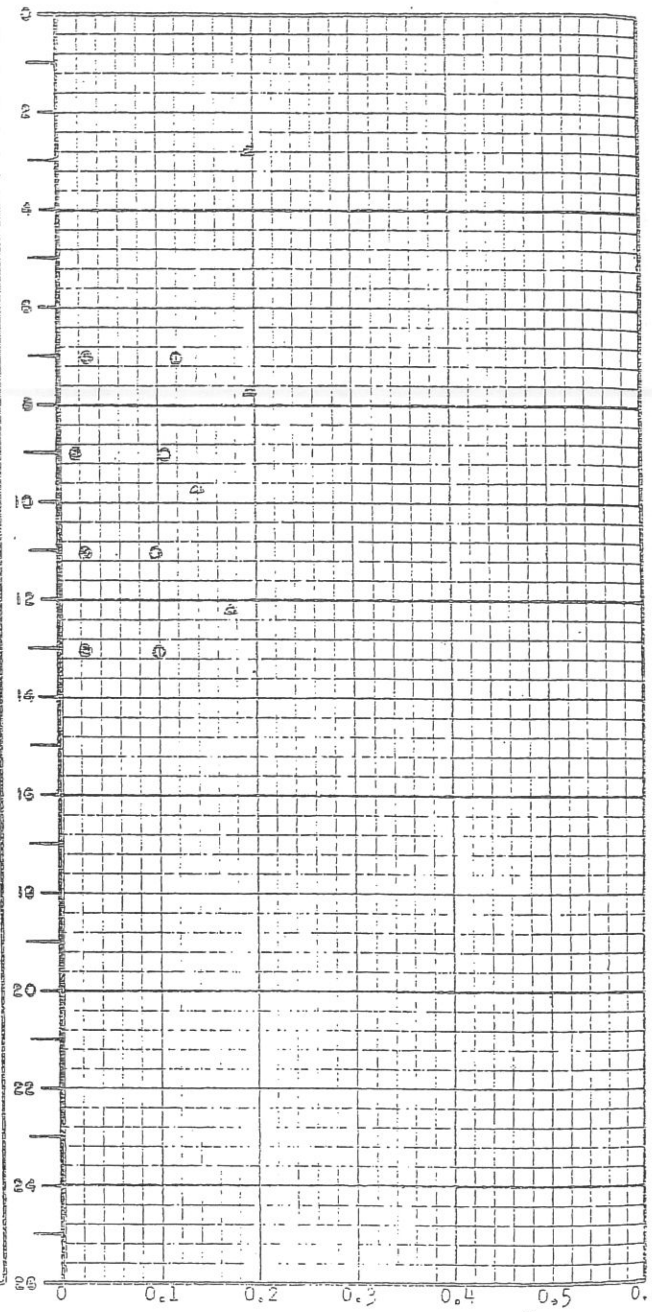
* Mechanical Analysis: Maximum sieve size retaining 50% of sample by weight.

Figure C-1

SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
2-2243					
2-2244			364	68	
2-2245	58	7	776	65	
2-2246					Cons.
2-2247					
2-2248					Cons.
2-2249			386	55	
2-2250			950		
2-2251	60	7	707	55	1/
2-2252	62	7	751	50	1/
2-2253	61	7	726	50	1/
2-2254					1/
2-2255			521	53	
2-2256	61	8	689	50	
2-2257					Cons.
2-2258			371	42	
2-2259					Cons.
2-2260					

1/ Triax. Series

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev. -10.6' USGS   Vane Shear Hole No. EVSF-1   SHEAR STRESS IN TONS/FT²

LEGEND

PEAT
CLAY
SILT
ORGANIC CLAY
ORGANIC SILT
SAND

○ FIELD VANE SHEAR, UNDISTURBED
⊕ FIELD VANE SHEAR, REMOLDED
△ ONE-POINT TRIAXIAL SHEAR
△ UNCONFINED COMPRESSION

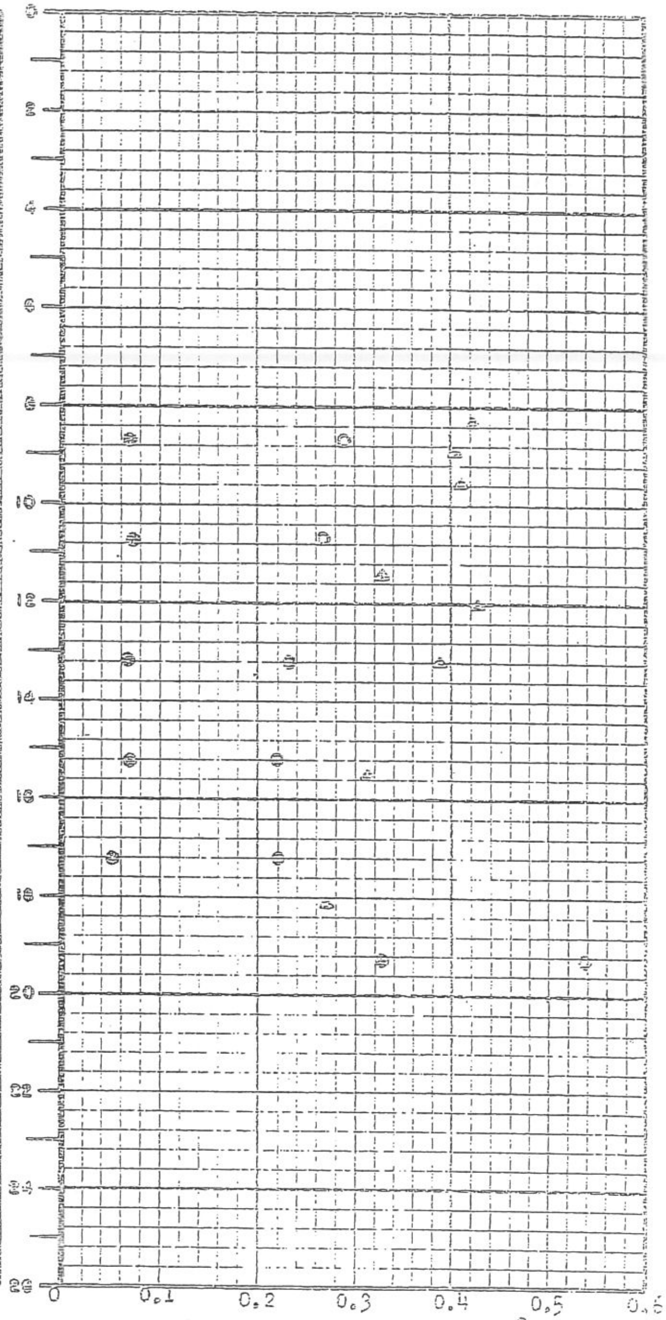
STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DELTA BRANCH

DELTA LEVEES INVESTIGATION
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-1
April 1962

Figure C-2

Soils Laboratory Sample No.	Wet Density Lb/CF	Dry Density Lb/CF	Moisture Content % Dry Wt	Organic Burn	Other
2-2261			239	74	
2-2262	58	7	718	75	
2-2263					
2-2264	65	11	490	41	
2-2265			635		
2-2266			464	59	
2-2267	60	9	590	53	
2-2268	58	7	698	66	
2-2269					Cons.
2-2270					
2-2271	63	11	460	46	
2-2272			243	35	
2-2273					Cons.
2-2274			285	32	
2-2275					

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



Ground Elev. -7.0' USGS   Vane Shear Hole No. EVH-1

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊖ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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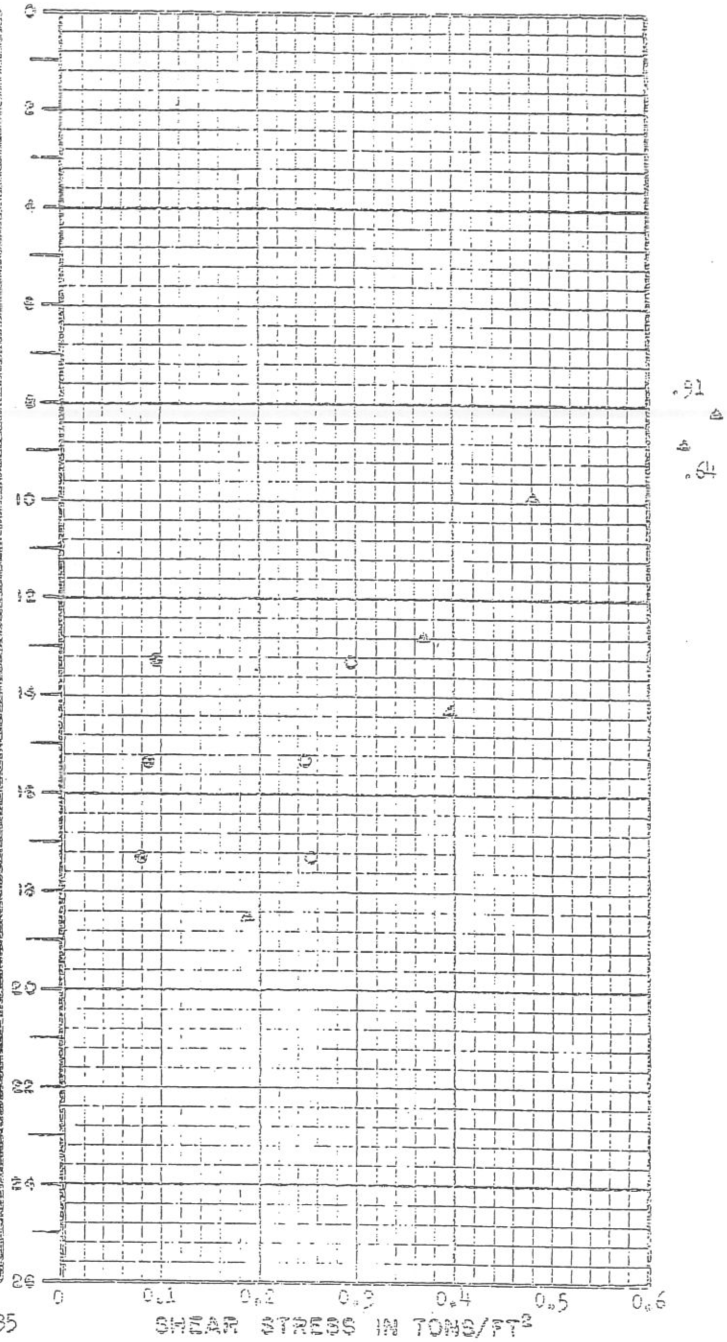
DELTA BRANCH

DELTA LEVEES INVESTIGATION

SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-2
April 1962

SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
2-2276	107	85	25		
2-2277	60	14	340	59	
2-2278					
2-2279					Cons.
2-2280					
2-2281			578	61	
2-2282					
2-2283	60	9	549	53	
2-2284	60	11	450	47	
2-2285	64	14	377	47	
2-2286			287	33	
2-2287					
2-2288	61	9	569		

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev -7.3' USGS   Vane Shear Hole No. EVS-35

LEGEND

PEAT
CLAY
SILT
ORGANIC CLAY
ORGANIC SILT
SAND

○ FIELD VANE SHEAR, UNDISTURBED
⊚ FIELD VANE SHEAR, REMOLDED
△ ONE-POINT TRIAXIAL SHEAR
△ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
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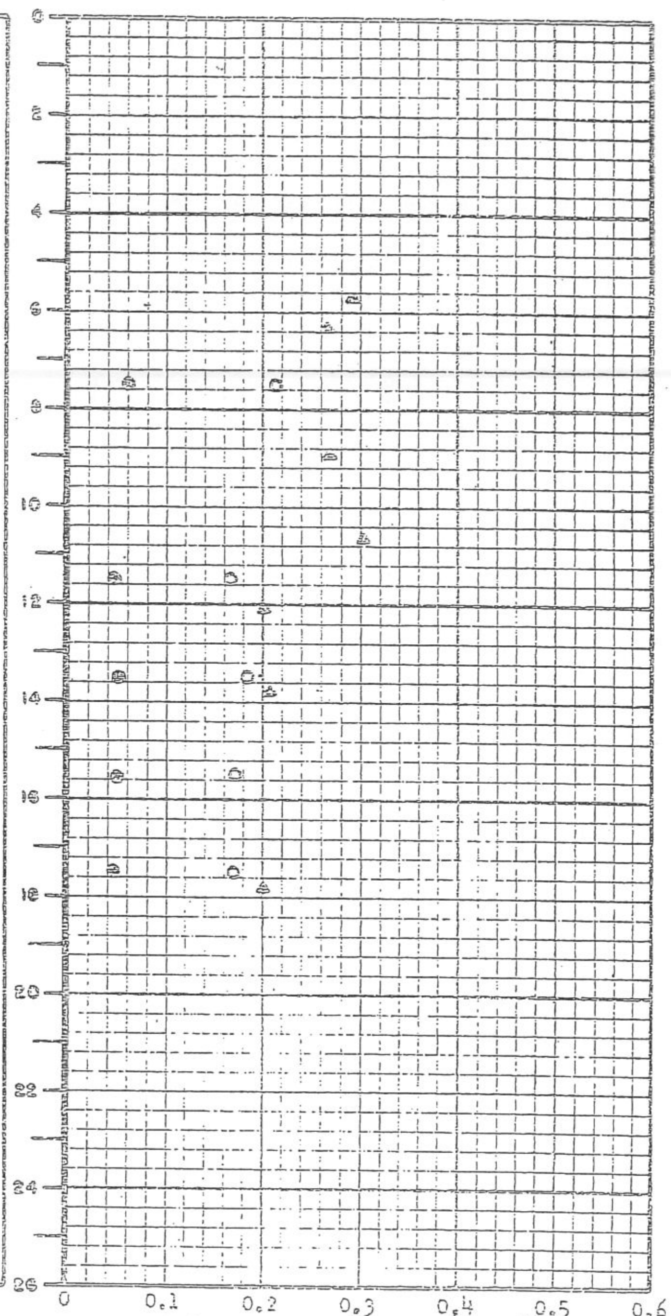
DELTA LEVEES INVESTIGATION
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-3
April 1962

Figure C-4

DEPTH IN FEET	DRILL LOG*	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
		2-2378			759	78	
		2-2379	56	7	681	74	
		2-2380					
		2-2381					
		2-2382					
		2-2383					
		2-2384			741	73	
		2-2385	58	8	674	61	
		2-2386			698	50	
		2-2387					
		2-2388	61	9	569	48	
		2-2389					
		2-2390					Cons.
		2-2391					Cons.
		2-2392			269	27	
		2-2393	97	63	56		
		2-2394			21		

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev. -8.1' USGS   Vane Shear Hole No. EVS-32

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ◎ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- ▲ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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DEPARTMENT OF WATER RESOURCES
DELTA BRANCH

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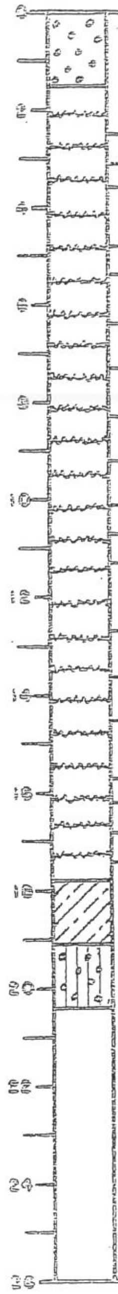
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-4
April 1962

DEPTH IN FEET	DRILL LOG*	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
		2-2396	58	10	490	61	
		2-2397	60	8	662	62	
		2-2398			806	69	
		2-2399					Cons.
		2-2400	58	7	743		
		2-2401			752	66	
		2-2402	58	6	798	68	
		2-2403			815	58	
		2-2404			931	66	
		2-2405	60	7	788	53	1/
		2-2406	64	13	397	47	1/
		2-2407	64	11	484	50	
		2-2408	62	9	622	52	
		2-2409			733	56	
		2-2410	62	10	531		
		2-2411			434	40	
		2-2412	68	10	598	24	
		2-2413					
		2-2414	82	38	113	10	

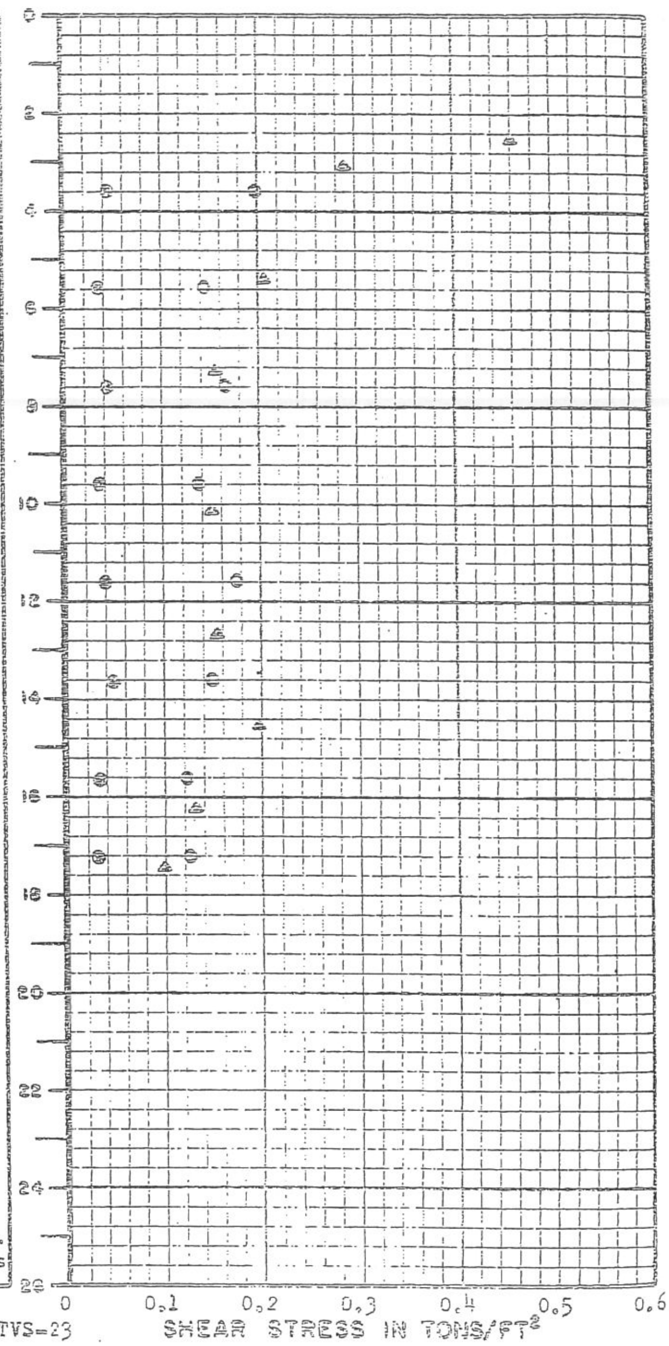
1/ Triax. Series



*Ground Elev. -8.1' USGS

Vane Shear Hole No. ETVS-23

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊚ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

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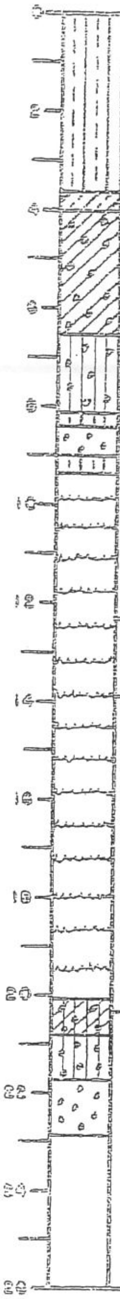
DELTA LEVEES INVESTIGATION

SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-5
April 1962

Figure C-6

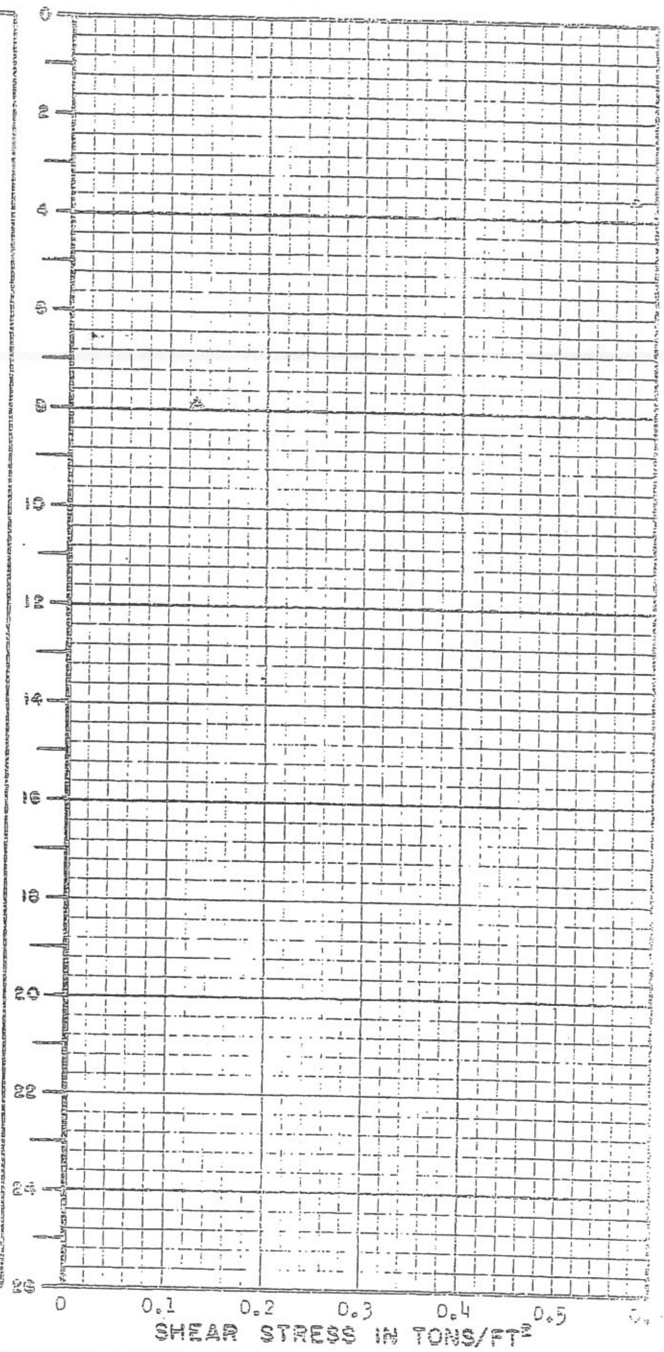
DEPTH IN FEET	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC [illegible]	OTHER
	2-2454	85	43	101		
	2-2455	108	80	35		
	2-2456	92	63	47		
	2-2457			567	67	
	2-2458			585	57	
	2-2459			72	7	

DRILL LOG *



*Ground Elev. -6.0' USGS

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊕ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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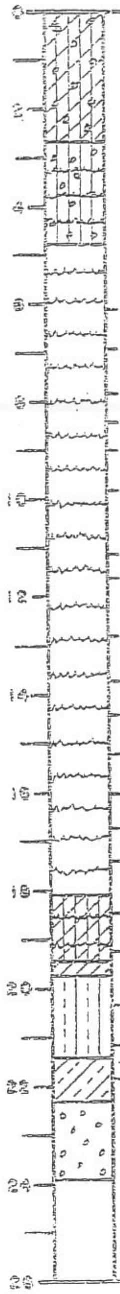
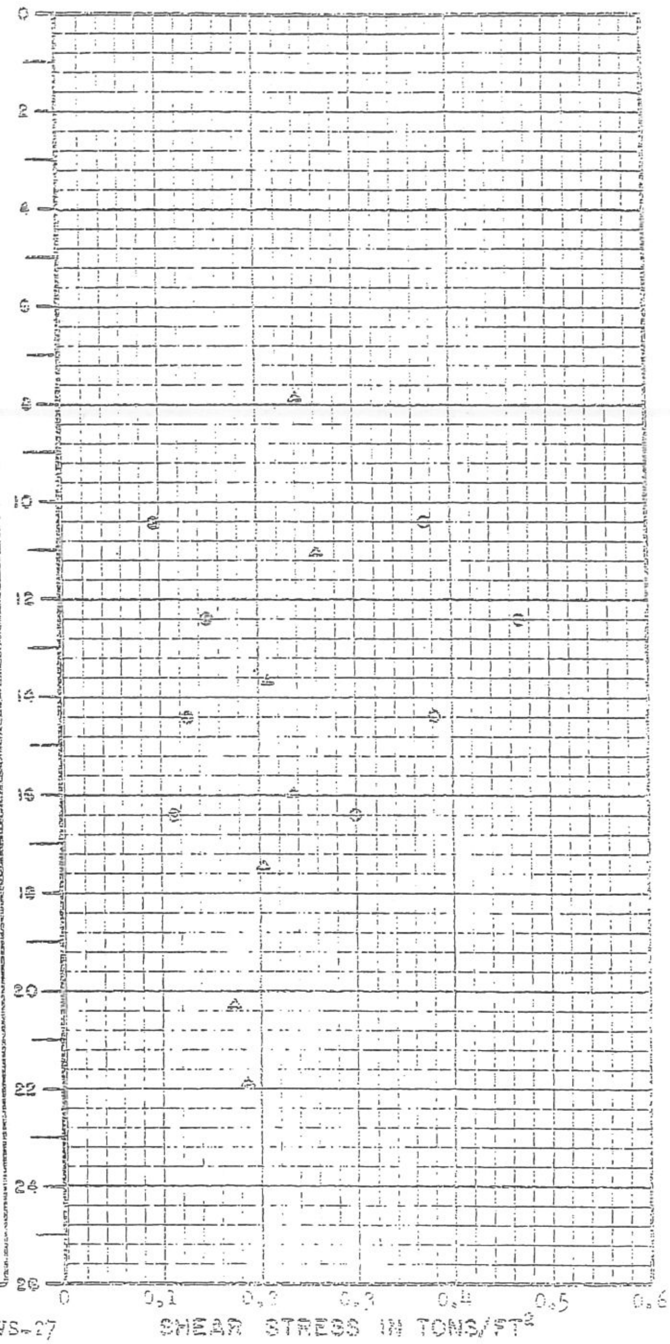
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-6
April 1962

SOIL STRENGTH COMPARISON FIELD VANE SHEAR AND LABORATORY TESTING



Soils Laboratory Sample No.	Wet Density Lb/CF	Dry Density Lb/CF	Moisture Content % Dry Wt.	Organic Ourr	Other
2-2460			686	73	
2-2461			702	82	
2-2462	57	8	658	74	
2-2463			792	65	
2-2464					
2-2465			785	72	
2-2466					
2-2467			754	70	
2-2468			698	57	
2-2469	60	8	654	56	
2-2470					Cons.
2-2471			601	48	
2-2472	61	6	918	40	
2-2473					
2-2474					
2-2475			364	33	
2-2476	66	17	289	23	
2-2477	74	24	209	9	
2-2478					
2-2479					



*Ground Elev. -5.6' USGS

Vane Shear Hole No. EVS-27

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊖ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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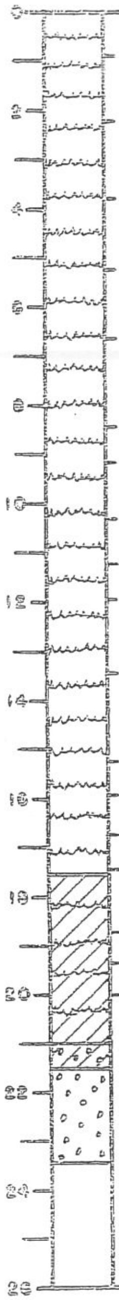
DELTA LEVEES INVESTIGATION

SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-7
April 1962

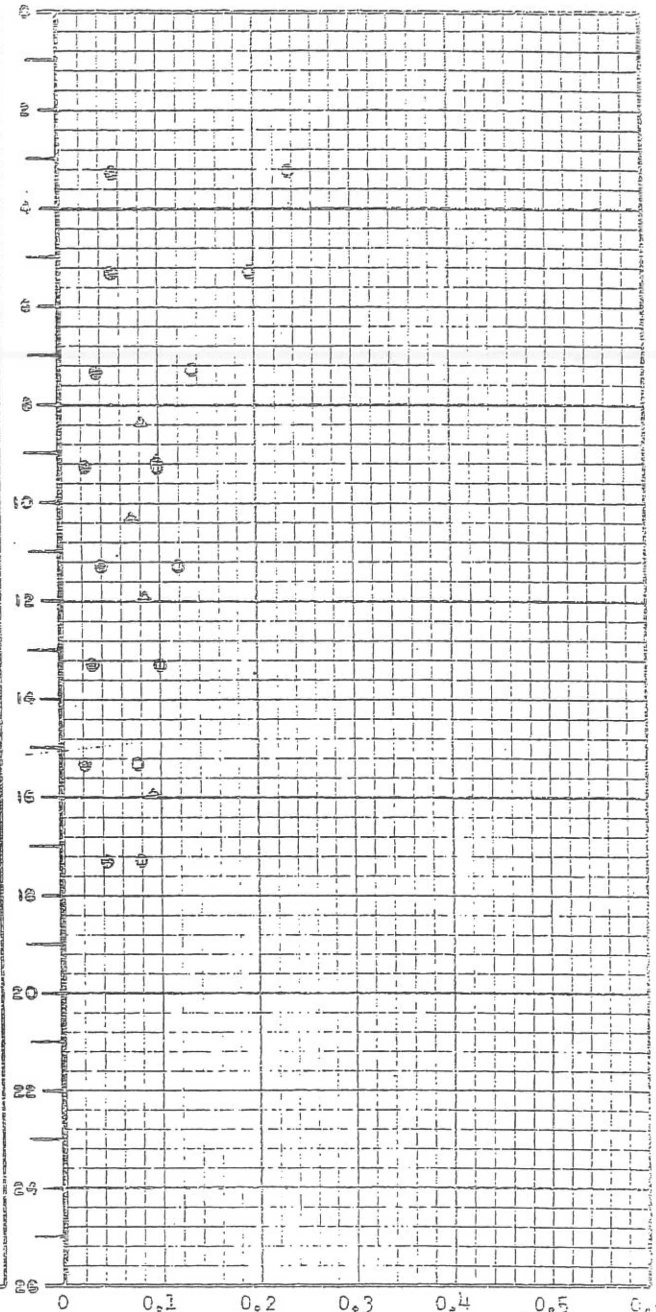
Figure C-8

SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
2-2480	58	12	385	64	
2-2481	54	5	911	67	
2-2482			953	65	
2-2483			1053	64	
2-2484			551	48	
2-2485	59	7	717	55	
2-2486	61	9	587	44	
2-2487					
2-2488			986	52	
2-2489	62	8	639	44	
2-2490			768	54	
2-2491					Cons.
2-2492	69	18	280	24	
2-2493	66	13	410	32	
2-2494			311	24	
2-2495			148	11	
2-2496			131	10	
2-2497			74	6	

DEPTH IN FEET / DRILL LOG *



SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev. -6.0' USGS

Vane Shear Hole No. ETVS-24

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊕ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

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SWEDISH FOIL DRILLING
SOILS TEST DATA
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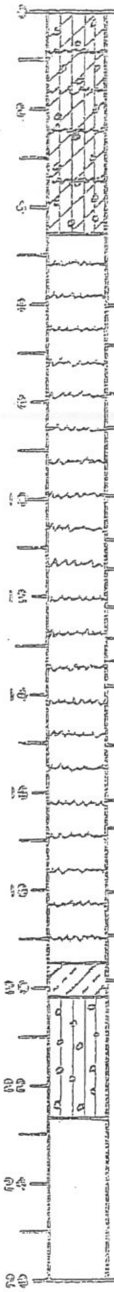
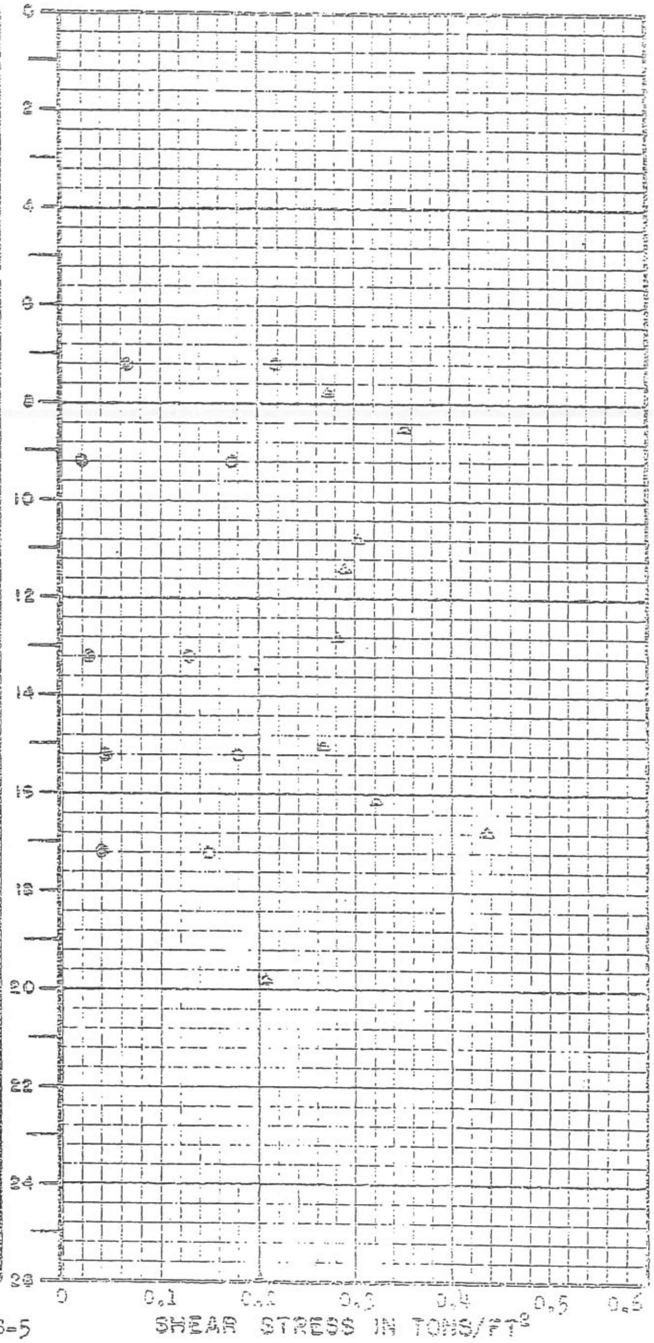
April 1962



DEPTH IN FEET	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC (%)	OTHER
	2-2498	61	10	527	59	
	2-2499			610	66	
	2-2500	59	8	668	65	
	2-2501					
	2-2502			539	51	
	2-2503	59	7	719	62	
	2-2504					
	2-2505					
	2-2506					
	2-2507			596	60	
	2-2508			656	61	
	2-2509	61	9	565	51	
	2-2510					
	2-2511	67	11	485	39	
	2-2512					
	2-2513	68	18	268	21	
	2-2514	96	56	70	7	

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev. -5.9' USGS Vane Shear Hole No. EVS-5

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ◉ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-9
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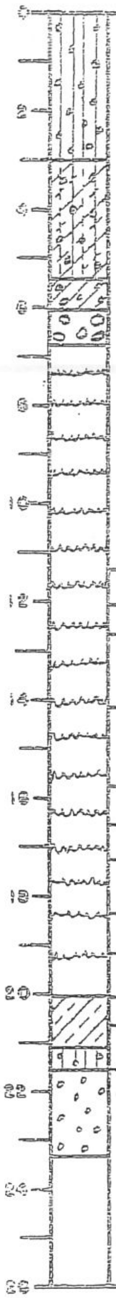
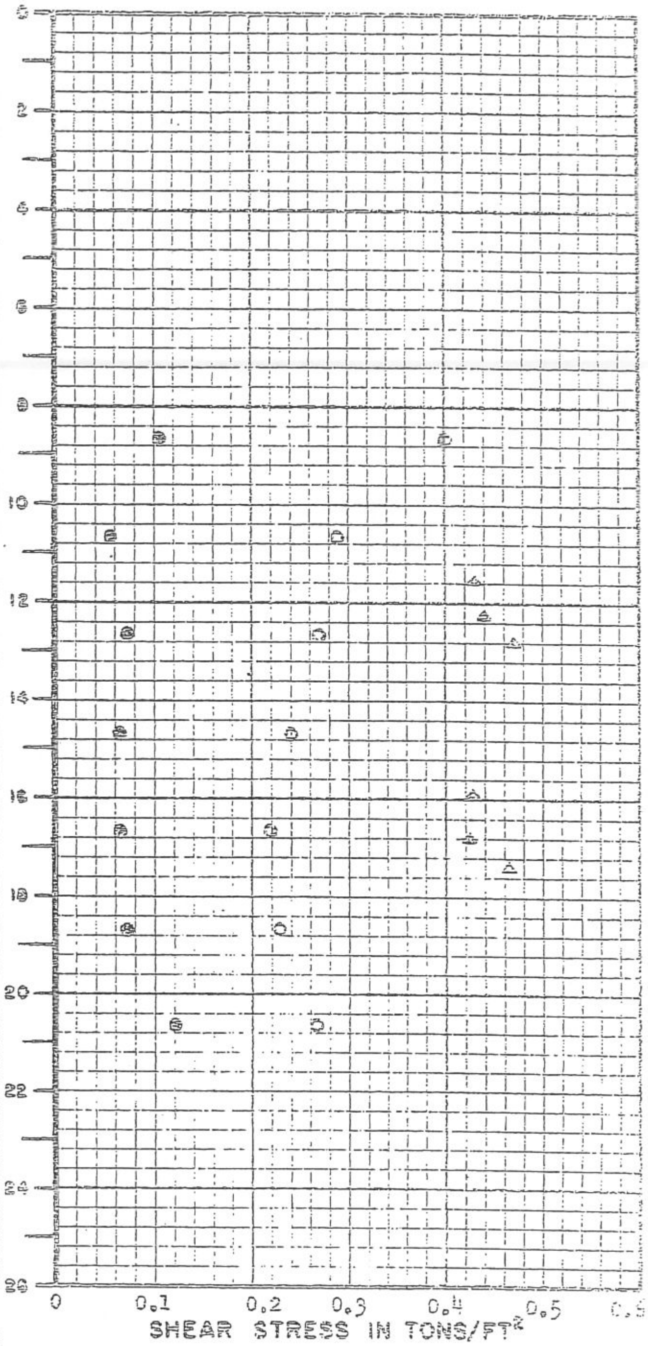
DEPTH IN FEET	DRILL LOG *	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
		2-2540	60	9	570	61	
		2-2541					
		2-2542	59	9	531	57	
		2-2543			654	75	
		2-2544	60	9	585	59	
		2-2545					
		2-2546	62	8	598	52	
		2-2547			350	37	
		2-2548			300	28	
		2-2549			250	27	
		2-2550			177	17	
		2-2551			53	1	



SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



*Ground Elev. -5.3' USGS Vane Shear Hole No. EVS-3

LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊕ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- ▲ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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DEPARTMENT OF WATER RESOURCES
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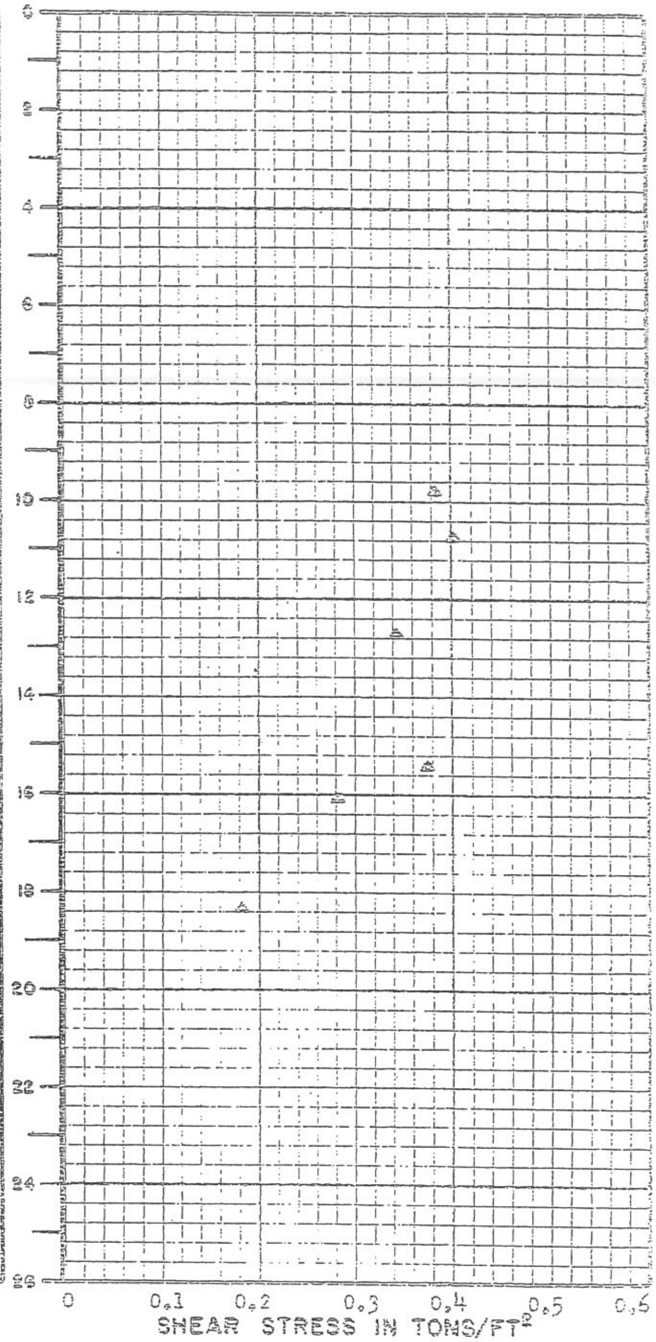
DELTA LEVEES INVESTIGATION
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-10
April 1962

Figure C-11

DEPTH IN FEET	DRILL LOG*	SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
4		2-2552			465	46	
6		2-2553			84	16	
		2-2554	59	12	397	61	
8		2-2555					
10		2-2556	59	7	689	70	
		2-2557			532	45	
12		2-2558					
		2-2559	60	8	602	54	
14		2-2560			545	50	
		2-2561					
16		2-2562	61	10	513	49	
		2-2563					
18		2-2564	67	17	299	32	
		2-2565					
		2-2566			687	71	

*Ground Elev. -6.3? USGS

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ◎ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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DEPARTMENT OF WATER RESOURCES
DELTA BRANCH

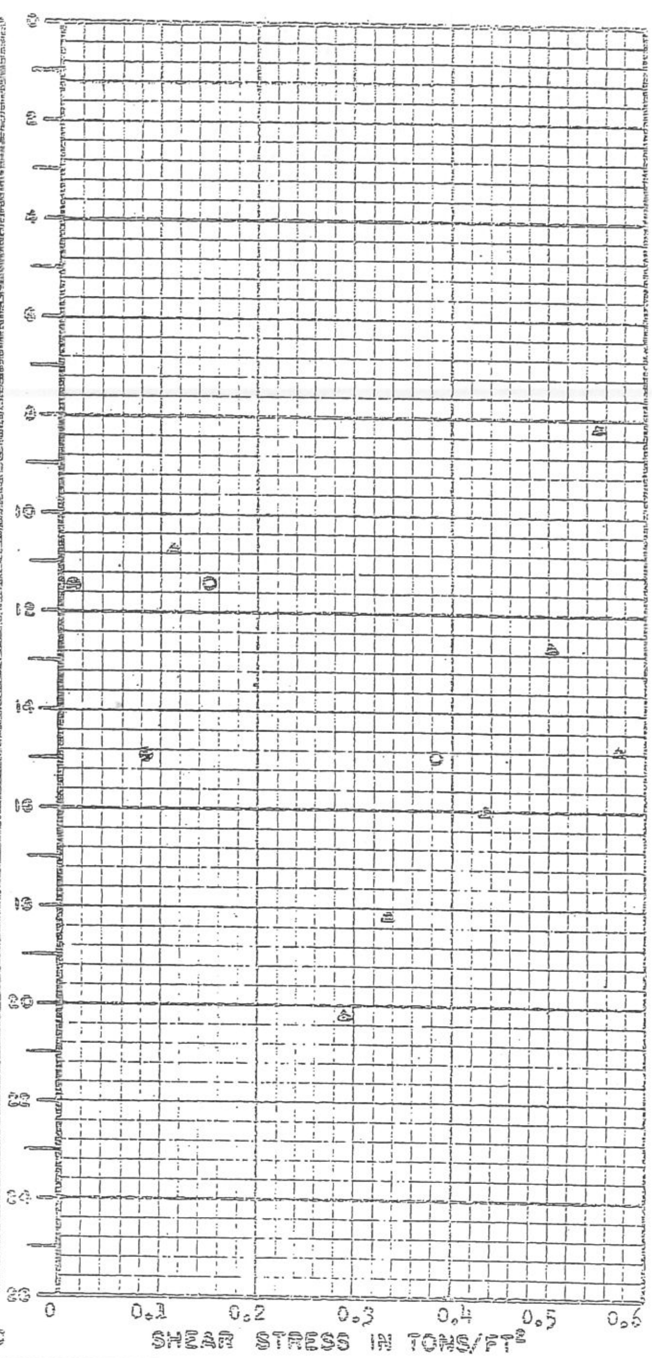
DELTA LEVEES INVESTIGATION
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-11
April 1962

Figure C-12

SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
2-2595	90	55	65	11	
2-2596	70	20	244	32	
2-2597	67	12	360	61	
2-2598					
2-2599					
2-2600					
2-2601	61	11	448	56	
2-2602			481	56	
2-2603	62	12	421	50	
2-2604			497	60	
2-2605	65	14	364	39	
2-2606			303	29	
2-2607					

*Ground Elev. -5.9' USGS Vane Shear Hole No. EVS-9

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



LEGEND

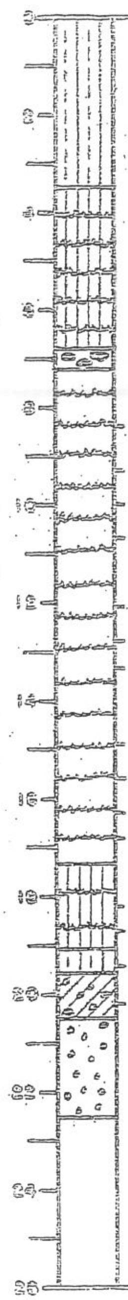
- PEAT
- SILT
- ORGANIC SILT
- CLAY
- ORGANIC CLAY
- SAND
- O FIELD VANE SHEAR, UNDISTURBED
- ⊗ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- △ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DELTA BRANCH

DELTA LEVEES INVESTIGATION

SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-12
April 1962

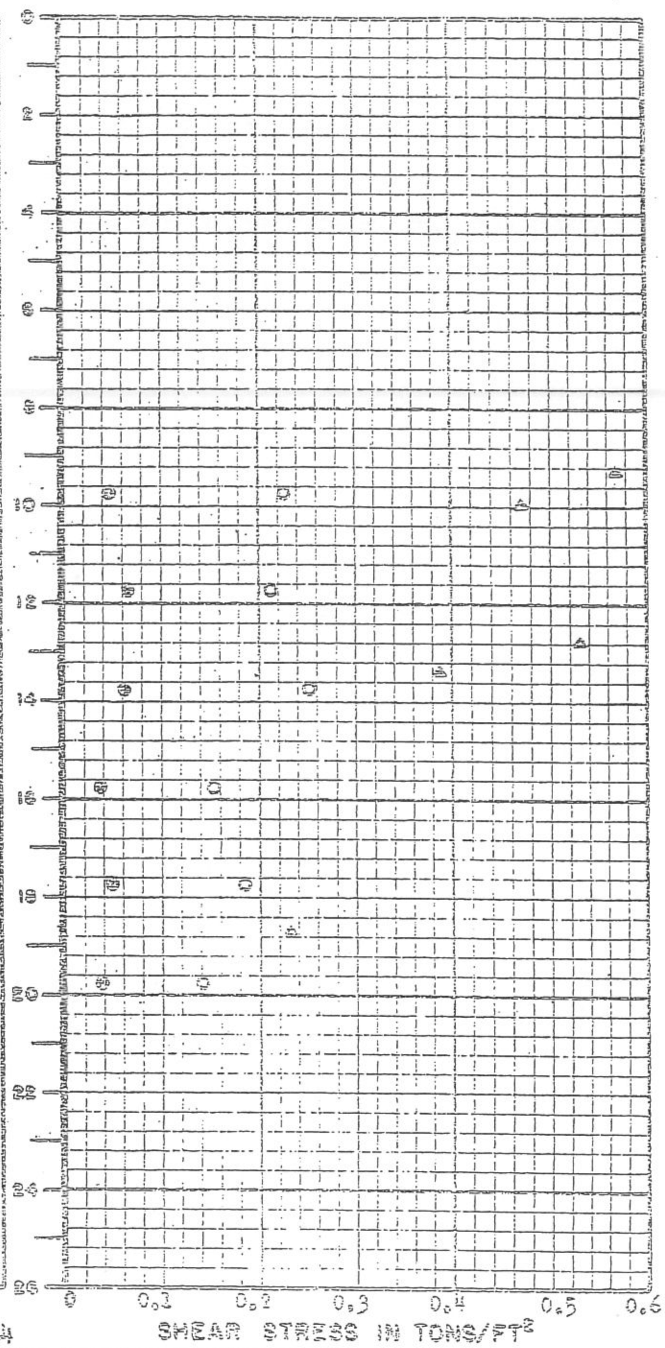
Figure C-13



SOILS LABORATORY SAMPLE NO.	WET DENSITY LB/CF	DRY DENSITY LB/CF	MOISTURE CONTENT % DRY WT.	ORGANIC BURN	OTHER
2-2608	74	35	112	26	
2-2609					
2-2610	58	9	542	70	
2-2611			619	70	
2-2612					
2-2613					
2-2614	61	9	562	52	
2-2615					
2-2616					
2-2617			763	61	
2-2618			634	61	
2-2619			227	23	
2-2620	68	18	277	26	
2-2621					
2-2622					

*Ground Elev. -6.2' USGS Vane Shear Hole No. EVS-4

SOIL STRENGTH COMPARISON
FIELD VANE SHEAR
AND
LABORATORY TESTING



LEGEND

- PEAT
- CLAY
- SILT
- ORGANIC CLAY
- ORGANIC SILT
- SAND
- ○ FIELD VANE SHEAR, UNDISTURBED
- ⊕ FIELD VANE SHEAR, REMOLDED
- △ ONE-POINT TRIAXIAL SHEAR
- ◬ UNCONFINED COMPRESSION

STATE OF CALIFORNIA
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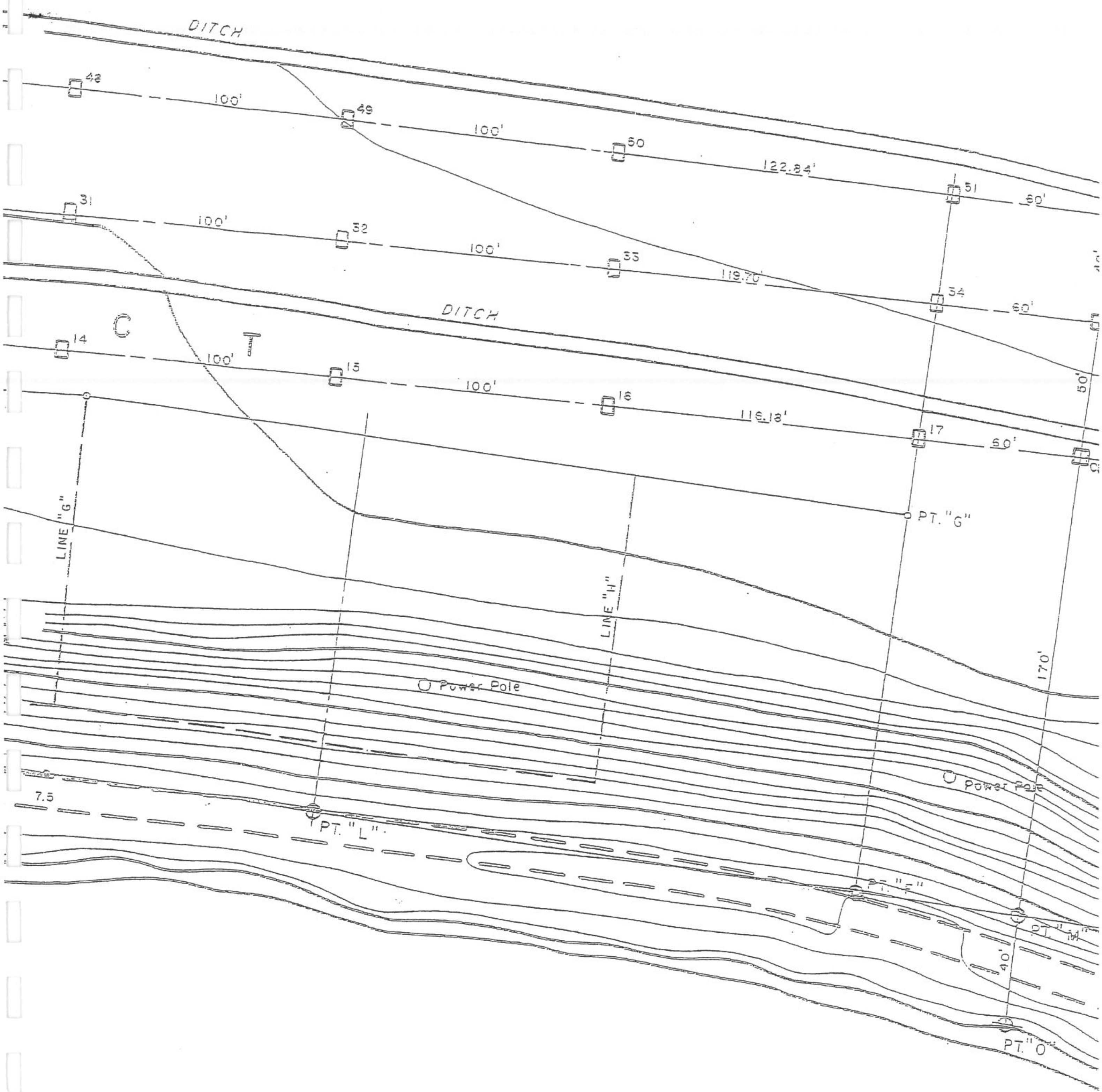
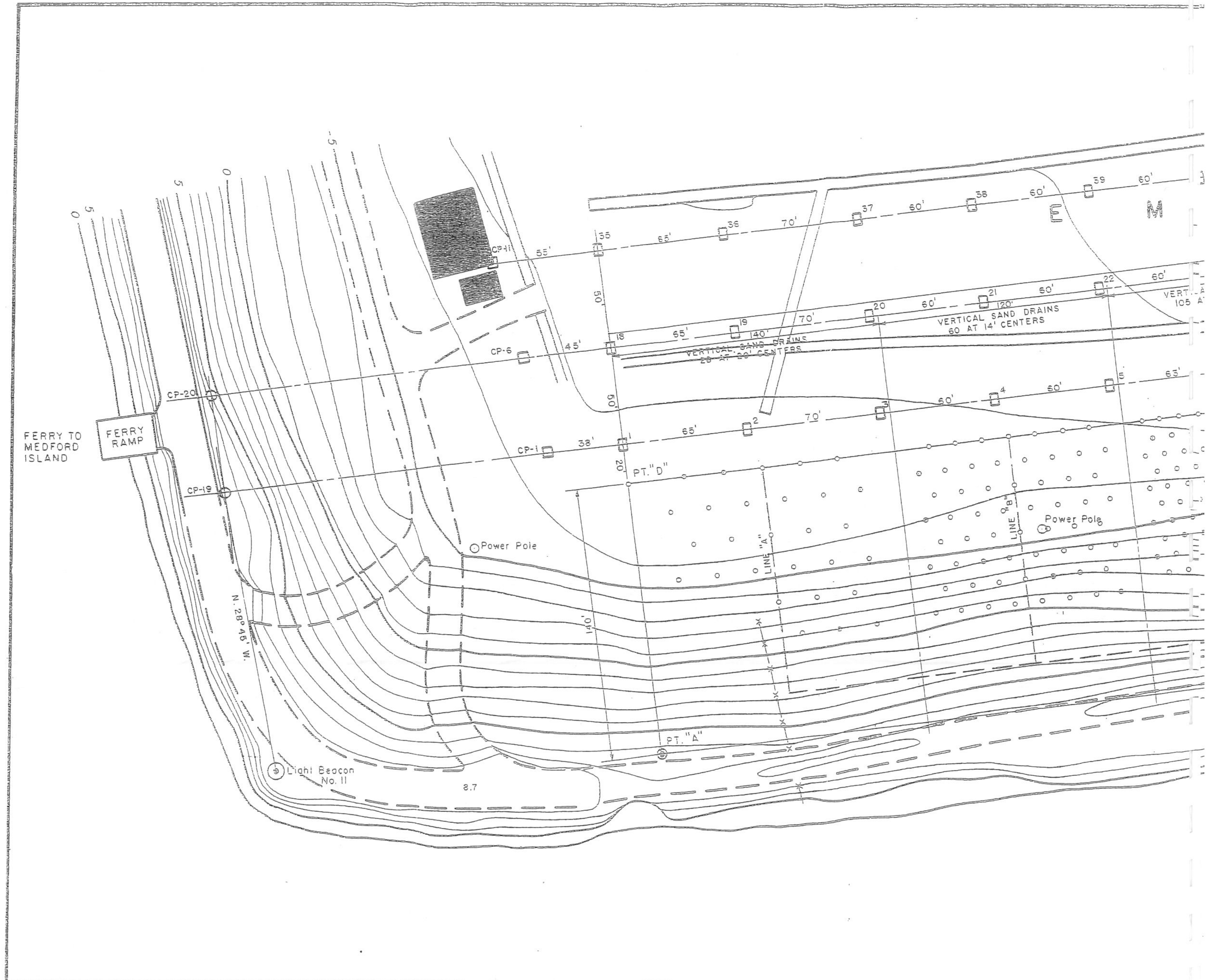
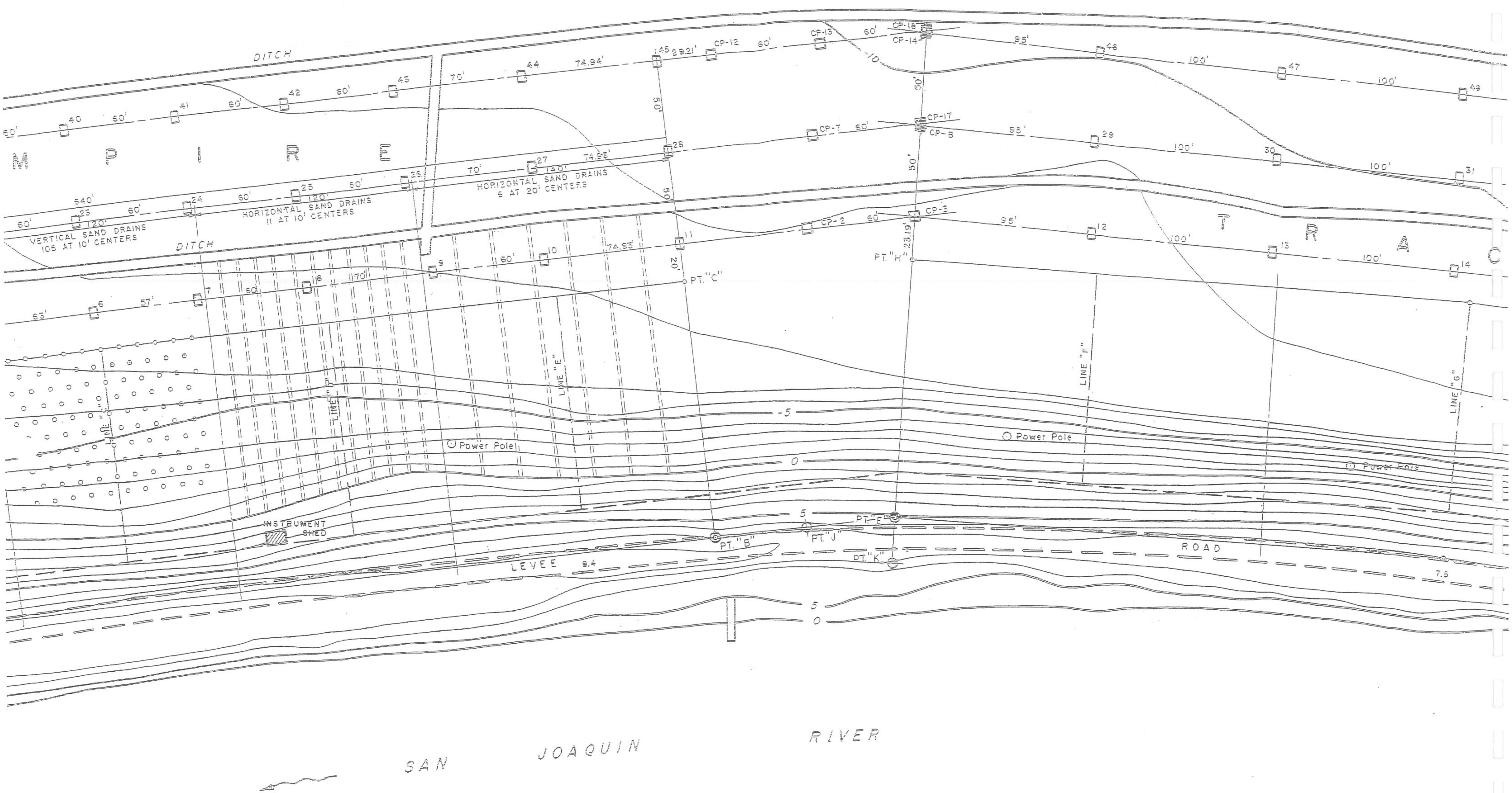
DELTA LEVEES INVESTIGATION
SWEDISH FOIL DRILLING
SOILS TEST DATA
ESF-13
April 1962


DITCH
48
100'
49
100'
50
122.84'
51
60'
31
100'
32
100'
33
119.70'
34
60'
DITCH
14
100'
15
100'
16
116.18'
17
60'
50'
LINE "G"
PT. "G"
LINE "H"
170'
Power Pole
Power Pole
7.5
PT. "L"
PT. "F"
PT. "M"
40'
PT. "O"



FERRY TO MEDFORD ISLAND
FERRY RAMP
CP-20
CP-19
CP-1
CP-6
CP-11
N. 28°45' W.
Light Beacon No. 11
8.7
Power Pole
Power Pole
PT. "A"
PT. "D"
LINE "A"
LINE "B"
VERTICAL SAND DRAINS 28 AT 20' CENTERS
VERTICAL SAND DRAINS 60 AT 14' CENTERS
140'
120'



DITCH
M P I R E
T R A C
VERTICAL SAND DRAINS
105 AT 10' CENTERS
HORIZONTAL SAND DRAINS
11 AT 10' CENTERS
HORIZONTAL SAND DRAINS
6 AT 20' CENTERS
CP-12
CP-13
CP-14
CP-15
CP-17
CP-7
CP-8
CP-2
CP-3
PT. "C"
PT. "H"
PT. "B"
PT. "E"
PT. "J"
PT. "K"
LINE "C"
LINE "D"
LINE "E"
LINE "F"
LINE "G"
Power Pole
Power Pole
Power Pole
INSTRUMENT SHED
LEVEE
ROAD
SAN JOAQUIN RIVER

Kleinfelder
Bright People. Right Solutions.

APPENDIX E
CISS PILE GUIDE SPECIFICATIONS

APPENDIX E

CISS PILE GUIDE SPECIFICATIONS

1. GENERAL
General and Special Conditions shall apply to all work hereunder.

2. SCOPE
Furnish all labor, materials, tools and equipment required to install, complete and in place, all piles shown on Drawings and specified herein.

3. WORK NOT INCLUDED UNDER THIS SECTION
3.1 Concrete piles caps: Section ________.
3.2 Excavations: Section ________.
3.3 Shoring and bracing of earth banks: Section _________.
3.4 Dewatering: Section ________.

4. GENERAL REQUIREMENTS
4.1 All piles shall be installed by a piling contractor qualified to install the type of pile to be driven in accordance with the Drawings and Specification, and under conditions existing at the site. The minimum requirements for qualification shall be five (5) years pile driving experience and evidence of the satisfactory completion of ten (10) pile installations comparable in scope to the work specified hereunder.

4.2 A Geotechnical Engineering report dated December 21, 2007, has been prepared by Kleinfelder, Inc. of Stockton, California, hereinafter designated the Geotechnical Engineer. That report is available for review at the Architect's office and at the office of Kleinfelder, Inc.

4.2.1 The Owner does not guarantee that the information contained in the Geotechnical Engineering Report is correct or that the conditions revealed at the actual boring locations will be continuous over the entire site. This report was prepared for purposes of design only. Making the report available to contractors shall not be construed in any way as a waiver of this position. The Piling Contractor shall be responsible for any conclusions he may draw from this report. Should he prefer not to assume such risk, he is under obligation to employ his own experts to analyze available information and/or to make his own tests upon which to base his conclusions.

4.3 Before any piles are driven, the Piling Contractor shall examine all excavation faces from the standpoint of stability during pile driving. If, in his opinion, the excavation faces would be unstable, he shall inform the General Contractor of that opinion and shall not proceed until corrective action has been taken.

4.4 During production pile driving the Piling Contractor shall monitor adjacent structures and streets to evaluate their response to hammer-induced vibrations.

Should adverse reaction of such structures or streets be observed, the Piling Contractor shall notify the Architect and shall propose to him means of minimizing damage.

4.5 Work shall comply with all Municipal, State and Federal regulations regarding safety, including the requirements of the Williams-Steiger Occupational Safety and Health Act of 1970.

5. PILE TYPES

5.1 Piles shall be 24 inch OD, ¾ inch thick, _______ ended cast in steel shell (CISS) piles. The piles shall be designed for an allowable axial dead plus live load of _____________ tons per pile.

6. INDICATOR PILES

Two (2) 24 inch OD, ¾ inch thick, ______ ended CISS indicator piles, shall be manufactured and provided to extend to an elevation of ____ feet, ______ datum. The piles may be driven as production piles if properly staked out at locations determined by the Geotechnical Engineer, with each pile either being driven to the proper butt elevation shown on the accepted plans or being stopped and cut off at that elevation, as determined by the Geotechnical Engineer.

7. PRODUCTION CISS PILES

7.1 Following the driving of indicator piles, the Geotechnical Engineer shall establish the tip elevations or depths at which those piles meet the driving criteria established by him. The Piling Contractor shall establish the splice lengths for the remaining production piles, with assistance from the Geotechnical Engineer.

7.2. Piles should meet production requirements for concrete, steel casing and steel shells as noted in Section 49-4.01 and 49-4.04 of Caltrans Standard Specifications, May 2006.

8. INSPECTION OF CISS PILES

Piles shall be inspected after driving as noted in Section 49-4.05 of Caltrans Standard Specifications, May 2006.

9. PILE DRIVING REQUIREMENTS

9.1 Driving Criteria: All piles shall be driven to meet the blow count criteria for the design loading established by the Geotechnical Engineer following completion of the indicator pile program. All piles will be driven to final design elevation, or to within at least five feet (5') of final design elevation when damage to the pile may occur. The suitability of overdriving in lieu of cutting off of CISS piles above final design tip elevation shall be determined by the Piling Contractor.

9.2 Equipment: Pile driving equipment shall be in first class condition with piles properly held in correct position while being driven. The hammer shall develop at least fifty thousand foot-pounds (50,000 ft-lbs) but no more than seventy-five foot pounds (75,000 ft-lbs) of energy per blow.

9.3 Driving and Inspection: All piles shall be driven straight and true at the locations shown on the Drawing.

9.3.1 Driving of piles shall not be undertaken within ten feet (10') of concrete cured less than three (3) days.

9.3.2 Heads of CISS piles shall be protected during driving with an approved cushion head block, which shall be maintained in good condition during the entire driving operation.

9.3.3 Pile driving shall proceed only in the presence of the Geotechnical Engineer, who shall make a continuos record of the penetration resistance behavior during driving and final elevation of every pile.

9.4 Alignment and Tolerances: All piles shall be driven so that the center of the pile head is not more than tree inches (3") from the design locations shown and no pile shall be more that two percent (2%) of its length out of plumb. Piles exceeding these tolerances shall be corrected as directed by the Structural Engineer and at no increase in cost to the Owner.

9.5 Pile Damage and Replacement: Cracking, splitting, distortion, bending, spalling or other damage sustained by piles during driving shall be corrected as directed by the Architect or Structural Engineer without cost to the Owner.

9.5.1 Additional piles required by the Architect or Structural Engineer to replace damaged or misaligned piles shall be driven and all changes in pile cap design and construction, including costs of formwork, steel, concrete and labor shall be accomplished without cost to the Owner.

9.6 Heaving: Survey level readings shall be taken on individual piles during at least the initial portion of the pile driving, when requested by the Geotechnical Engineer. If it is determined that piles have been unseated, redriving of affected piles and all subsequent piles so affected shall be accomplished at no cost to the Owner.

9.7 Cutting Off: tops of all piles projecting above final design elevation after driving shall be cut off at the proper elevation, following approval of the Geotechnical Engineer, and the cut off ends shall be removed from the job site.

11. CLEANUP

Upon completion of pile driving, remove all equipment, excess materials, etc., and leave the site clean and free of debris.

12. BASIS OF PAYMENT

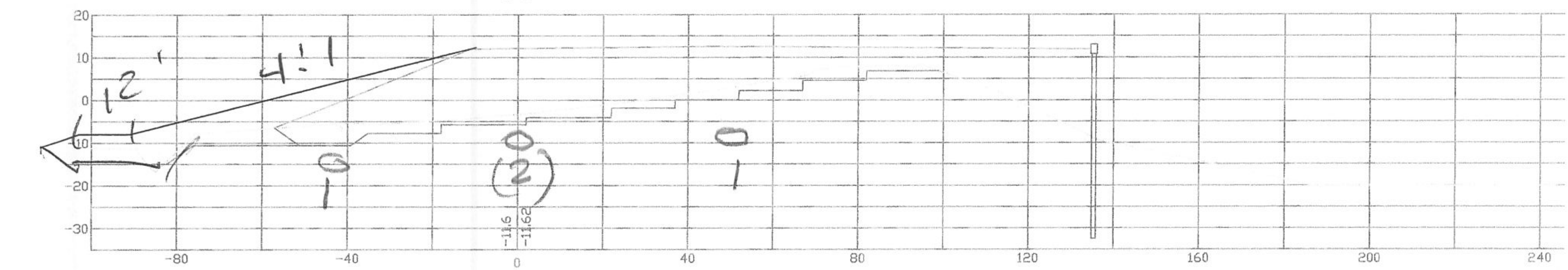
12.1 For bidding purposes, the Contractor shall include in his bid a lump sum for all work embraced by this section, complete, based upon the number and length of piles as shown on the Drawings.

12.2 The contract sum will be subjected to adjustment up or down depending upon the variation from the total lineal footage of piling inferred from the Drawings and the total lineal footage of piling calculated from the approved tip elevation or depth information for the indicator piles provided by the Geotechnical Engineer.

12.3 For purposes of adjusting the contract sum, the Contractor shall submit one add/deduct unit price which will include consideration for manufacturing, furnishing, driving, cutting off (if required) and all incidental items necessary to drive the piles in the proper positions and to the required elevations.

12.4 Payment for extra piles ordered by the Architect or Structural Engineer for purposes other than replacement of damaged or misaligned piles shall be in accordance with the above unit price.

5+00



5+75