



CITY OF  
**CHULA VISTA**

# **Village Seven Sectional Planning Area Plan and Tentative Maps**

Technical Appendices

**Volume 2**

EIR- 04-06

SCH No. 2003111050

June 2004

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OTAY RANCH VILLAGE 7**



# Geotechnics Incorporated

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**Principals:**

**Anthony F. Belfast  
Michael P. Imbriglio  
W. Lee Vanderhurst**

**GEOTECHNICAL INVESTIGATION  
MCMILLIN OTAY RANCH, VILLAGE 7  
CHULA VISTA, CALIFORNIA**

prepared for

McMillin Otay Ranch, LLC  
2727 Hoover Avenue  
National City, California 91950

by

**GEOTECHNICS INCORPORATED**  
Project No. 0367-014-00  
Document No. 03-0946

January 23, 2004



# Geotechnics Incorporated

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**Principals:**

**Anthony F. Belfast  
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January 23, 2004

McMillin Otay Ranch, LLC  
2727 Hoover Avenue  
San Diego, California 91950

Project No. 0367-014-00  
Document No. 03-0946

Attention: Mr. Thom Fuller

**SUBJECT: REPORT OF GEOTECHNICAL INVESTIGATION  
McMillin Otay Ranch, Village 7  
Chula Vista, California**

Gentlemen:

In accordance with your request, we have completed a geotechnical investigation of the proposed Village 7 development. Specific conclusions regarding site conditions and recommendations for earthwork construction are presented in the attached report.

We appreciate this opportunity to provide professional services. If you have any questions or comments regarding this report or the services provided, please do not hesitate to contact us.

**GEOTECHNICS INCORPORATED**



W. Lee Vanderhurst, C.E.G.  
Principal Geologist

Distribution: (8) Addressee, Mr. Thom Fuller

**GEOTECHNICAL INVESTIGATION  
MCMILLIN OTAY RANCH, VILLAGE 7  
CHULA VISTA, CALIFORNIA**

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**GEOTECHNICAL INVESTIGATION  
MCMILLIN OTAY RANCH, VILLAGE 7  
CHULA VISTA, CALIFORNIA**

**1.0 INTRODUCTION**

This report presents the results of our geotechnical investigation for the proposed McMillin Otay Ranch, Village 7 project located in Chula Vista, California. The purpose of this investigation was to characterize the pertinent geotechnical conditions at the site, and to provide recommendations for the geotechnical aspects of earthwork construction. The conclusions and recommendations presented in this report are based on field exploration, laboratory testing, engineering analysis, and our experience with similar soils and geologic conditions in the area. The preliminary design criteria are intended to aid in project planning, and should be considered subject to modification based on testing and observation performed during site grading and remedial earthwork.

It should be noted that we have previously submitted an EIR level report for the Village 7 site (Geotechnics, 2003a). The findings of the referenced document are generally consistent with those presented herein. The geotechnical investigation presented herein is based on the current 100-scale Tentative Map for McMillin Otay Ranch, Village 7 (P&D, 2003). This investigation may be updated in a third report to reflect the ultimate site configuration, once the 40-scale grading plans are completed by Rick Engineering. One additional geotechnical report may also be prepared for the project. The final report will consist of a remedial grading and drainage report which summarizes our recommendations on the 40-scale grading plans for use during earthwork construction.

**2.0 SCOPE OF SERVICES**

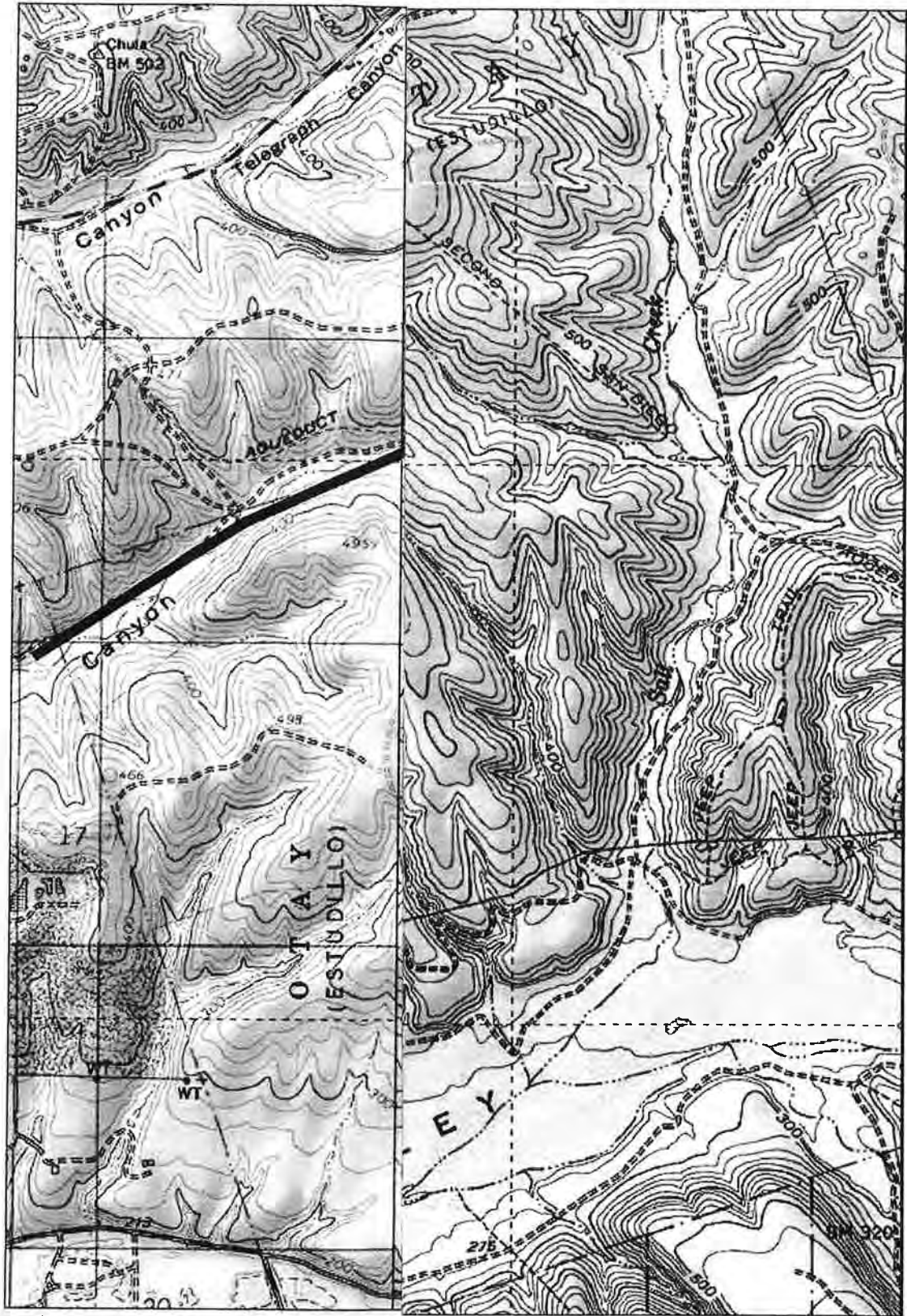
This investigation was conducted in accordance with the authorization provided in the McMillin Land Development Agreement for Job Number 061094, dated September 22, 2003. The scope of services provided during this investigation was generally consistent with that outlined in our Proposal No. 03-209 (Geotechnics, 2003b). In order to evaluate potential geotechnical impacts to the proposed development, and to provide geotechnical recommendations for grading and earthwork, the following services were provided.

- A visual and geologic reconnaissance of the surface characteristics of the site in order to identify geotechnical conditions which may be evident from the exposed features.
- A literature review of pertinent maps, reports, and aerial stereoscopic photographs of the site and adjacent properties. Pertinent references are provided in Appendix A.
- A subsurface exploration of the site including 48 test pits and 8 bucket auger borings. Selected samples of the materials encountered in the borings and test pits were collected for laboratory analysis. Each exploration was geologically logged and backfilled. The approximate boring and test pit locations are shown on the Geotechnical Map and Remedial Grading Plan, Plates 1 and 2. Boring and test pit logs are given in Appendix B.
- Evaluation of the engineering properties of the soil units likely to affect the proposed development using laboratory tests made on selected samples collected during exploration, as well as our database of soil properties from previous investigations in the site vicinity. The laboratory test results are summarized in Appendix C.
- Evaluation of potential geologic hazards that may affect the site, including groundwater conditions, faulting, seismicity, slope stability, fill settlement, and expansive soils.
- Analysis of the field and laboratory data in order to develop geotechnical recommendations for site preparation in fill areas, compaction of fill and backfill, remedial grading, slope stability, and the mitigation of cut/fill transitions and expansive soils beneath pads. Preliminary foundation, slab, retaining wall, and pavement recommendations are provided.
- Preparation of this report summarizing our findings, conclusions and recommendations.

### 3.0 SITE DESCRIPTION

The proposed Village 7 site is located within the City of Chula Vista, California. The site is bound by undeveloped land along the south, west, and east sides. Future development in these areas may include residential units by the Otay Ranch Company to the west, a Sweetwater Union high school to the south, and State Highway 125 to the east. The northern edge of the site is bordered by the existing Birch Road alignment, which is a part of the McMillin Otay Ranch, Village 6 development. The geologic conditions in Village 6 are described in the referenced as-graded report (Geotechnics, 2003c). The approximate location of the site is shown on the Site Location Map, Figure 1.





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Project No. 0367-014-00  
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**FIGURE 1**

The site is characterized by undeveloped natural rolling topography with two prominent east-west trending drainages which are minor tributaries of the Otay River Valley to the south of the site. The larger drainage which transects the central portion of the site is known as Wolf Canyon. Elevation differences are greatest across this portion of the site and range from approximately 440 feet above mean sea level (MSL) in the bottom of Wolf Canyon along the western property line, to approximately 605 feet MSL on the mesa top in the northwest corner of the site. The natural slopes on either side of the two drainages have gentle to moderate gradients, with slope inclinations typically on the order of 3:1 (horizontal to vertical) or flatter. The entire site has been used as farm land, and contains a variety of associated fences and unimproved dirt access roads. Vegetation on site generally consists of low-lying weeds and grasses. The approximate layout of the site is shown on the Geotechnical Map, Plate 1.

#### **4.0 PROPOSED DEVELOPMENT**

Development along the northern half of the site is anticipated to include approximately 345 single family residential lots (Units R-1A, R-1B and R-5), a small neighborhood park (P-2) and associated infrastructure (P&D, 2003). The southern half of the site may contain two multi-family residential neighborhoods (R-6 and R-7), a high school site (S-1), an elementary school site (S-3), and a large community park site (P-1). The site will contain an extensive system of roads and utility corridors.

Preliminary grading plans indicate that earthwork will include excavation of the ridges to generate materials for filling the canyons which traverse the site (P&D, 2003). Maximum cut and fill depths will typically be on the order of 50 to 60 feet. The preliminary plans also indicate that cut and fill slopes up to 40 feet high are being considered.

#### **5.0 GEOLOGY AND SUBSURFACE CONDITIONS**

The site is located within the Peninsular Ranges Geomorphic Province of California. This province, which stretches from the Los Angeles basin to the tip of Baja California, is characterized as a series of northwest trending mountain ranges separated by subparallel fault zones, and a coastal plain of subdued landforms. The mountain ranges are underlain primarily by Mesozoic metamorphic rocks that were intruded by plutonic rocks of the southern California batholith, while the coastal plain is underlain by subsequently deposited marine and nonmarine sedimentary formations.

The site is located within the coastal plain section of the Peninsular Range Geomorphic Province. Specifically, the site is underlain by the Oligocene-age sedimentary Otay Formation. Surficial deposits of alluvium, colluvium and/or residuum mantle the site. Minor amounts of compacted fill associated with the recently graded Birch Road exist in the northern portions of the site. The approximate distribution of the formation, alluvium and fill is shown on the Geotechnical Map, Plate 1. The colluvium and residuum is not differentiated on the Geotechnical Map. The approximate locations of the exploratory test pits and borings conducted for this investigation are also shown on the Geotechnical Map, Plate 1. Generalized descriptions of the units from oldest to youngest are presented below.

### 5.1 Otay Formation (To)

Sedimentary materials associated with the Oligocene-age Otay Formation were encountered in all of the exploratory borings conducted for this investigation. As observed at the site, the Otay Formation (Map symbol To) generally consists of silty, fine grained sandstone (Unified Soil Classification SM), with frequent sandy siltstone (ML) interbeds. The sandstones and siltstones were typically light gray to brown, low plasticity, massive, and weakly to moderately indurated with some beds of strongly cemented sandstone. Claystone beds (CL and CH) were abundant in the formation. These beds were nearly flat-lying, and typically ranged in thickness from several inches to four feet. These medium to high plasticity claystones were typically dusky brown to red-brown, moderately indurated, and often sandy.

Bentonite claystone was observed in bucket auger borings B-2, B-3 and B-4 at elevations ranging from approximately 552 to 548½ feet. The bentonite was typically light red to white to pinkish gray in color with a waxy appearance, and roughly 6 inches in thickness. The bentonite bed was not observed in Boring B-1, which suggests that it may not be continuous in the western portions of the site. The bentonite bed is shown on the Geotechnical Map, Plate 1. It is possible that future grading operations may reveal other beds of bentonite not observed in the exploratory borings. The bentonite has low shear strength, and buttressing will be recommended wherever beds daylight in cut slope faces.

## 5.2 Alluvium (Qal)

Alluvial deposits fill the drainage course bottoms in the canyons on site. As observed in the exploratory test pits, the alluvium generally ranged from a dark gray black to brown medium plasticity sandy clay (CL) to fat clay (CH). This material was very dry on the surface with a blocky, crumbly structure. Moisture typically increased with depth. Alluvium thickness typically ranged between 4 and 12 feet, although alluvium thicknesses in excess of 20 feet were encountered in portions of Wolf Canyon. The alluvium is considered compressible and moderately to highly expansive.

## 5.3 Colluvium/Residuum

The surface of the site is mantled with a variable depth of undifferentiated colluvium and residuum. Colluvium is an accumulation of soil and weathered formational materials formed on slopes as a result of slow downhill creep due to gravity. As observed in the exploratory test pits and borings, this material generally consisted of a fine to medium grained sandy clay (CL). The colluvium was typically dark brown to black, contained nodules and clasts of caliche, and was generally firm to stiff. Colluvium depth typically ranged from 2 to 4 feet.

Residuum is soil that is formed in-situ by chemical or mechanical weathering of underlying materials. Residual soils mantle the ridge tops throughout the site. The residuum is nearly identical to the colluvium in composition, and typically consists of a fine to medium grained sandy clay (CL). The residuum was not differentiated on the Geotechnical Map.

## 5.4 Fill

Previously placed compacted fill was encountered within the northern portion of the site along Birch Road alignment. This fill was placed in an off-site balance area during recent grading operations for the McMillin Otay Ranch, Village 6 development. The approximate limits of the compacted fill are shown on the Geotechnical Map. Further information regarding this fill may be found in the referenced as-graded report (Geotechnics, 2003c).

Our observations indicate that undocumented fills have been stockpiled on top of the compacted fill surface since grading was completed. Note that the approved fill surface was surveyed and documented by Rick Engineering on October 13, 2003. Any materials placed above the elevations shown in that survey are considered compressible, and should be excavated and compacted. No other undocumented fill was observed on site during this investigation. However, due to the agricultural practices that have occurred on site in the past, we anticipate that future grading may reveal areas of undocumented fill.

### 5.5 Groundwater

No significant quantities of groundwater were encountered during this investigation. The soils were generally observed to be dry to moist. It should be noted that changes in rainfall, irrigation practices, or site drainage could produce seepage or locally perched groundwater conditions at any location within the soil or formational units underlying the site. This typically occurs at underlying contacts with less permeable materials, such as the interfaces that exist between sandstone and claystone. Recommendations are provided in the following sections of this report to help reduce the potential for seepage related problems in the future.

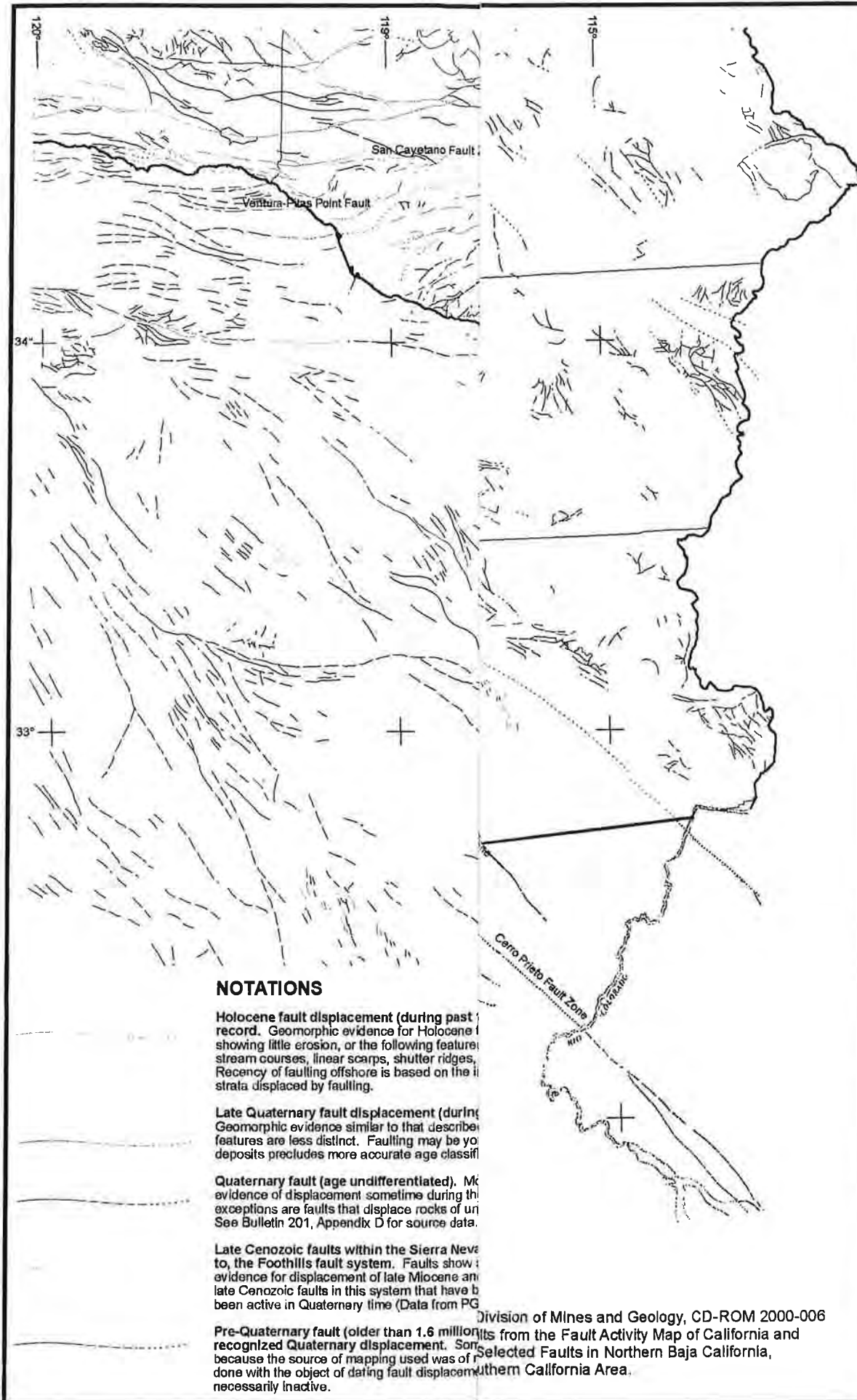
## 6.0 GEOLOGIC HAZARDS

The site is not located within an area previously known for geologic hazards, and no evidence of past faulting was observed in this investigation. Seismic hazards at the site are anticipated from ground shaking during seismic events on distant active faults. The nearest known active fault is within the Rose Canyon fault zone, which is located approximately 17 km northwest of the site. Design of structures should comply with the requirements of the governing jurisdictions, building codes and standard practices of the Association of Structural Engineers of California.

### 6.1 Ground Rupture

Ground rupture is the result of movement on an active fault reaching the surface. There are no known active faults underlying the site or projected toward the site. Active faults within 100 km of the site are shown in the Fault Location Map, Figure 2.

**FAULT LOCATION MAP**



Division of Mines and Geology, CD-ROM 2000-006  
 Data from the Fault Activity Map of California and  
 Selected Faults in Northern Baja California,  
 Northern California Area.

The nearest mapped fault is located approximately 3½ km west of the site, and is part of the La Nacion fault zone. The La Nacion fault zone is considered to be “potentially active” because it has not been shown to offset geologic formations younger than 11,000 years old. The subject site is not located within an Alquist-Priolo Earthquake Fault Zone, and no evidence of active or potentially active faulting was found during our investigation. Consequently, ground rupture is not considered to be a significant geologic hazard at the site.

## 6.2 Seismicity

Table 1 summarizes the seismologic properties of the known active faults within 100 km of the site. The properties shown in Table 1 were developed using the program EQFAULT and supporting documentation. The estimated peak ground accelerations shown in Table 1 are based on the closest distance between the site and the active faults, the estimated maximum moment magnitude for each fault, and published distance attenuation relationships.

The approximate centroid of the subject site is located at latitude 32.6142° north and longitude 116.9743° west. According to the California Geological Survey, the *design basis earthquake* for the site, defined as the peak ground acceleration with a 10 percent probability of being exceeded in a 50 year period, is 0.23g (CGS, 2003).

## 6.3 Liquefaction

Liquefiable soil typically consists of cohesionless sands and silts that are loose to medium dense, and saturated. To liquefy, these soils must be subjected to a ground shaking of sufficient magnitude and duration. The only materials observed during this investigation that were loose to medium dense in consistency were the colluvium, alluvium, and residual soils. However, we recommend that these materials be excavated and replaced as compacted fill during grading. Furthermore, no groundwater was encountered during this investigation. Accordingly, the potential for liquefaction at the site is considered to be low.



| FAULT <sup>1</sup>           | DISTANCE TO SITE [KM] | ESTIMATED PEAK GROUND ACCELERATION <sup>2</sup> | MAXIMUM EARTHQUAKE MAGNITUDE <sup>3,5</sup> | ESTIMATED FAULT AREA <sup>4</sup> [CM <sup>2</sup> ] | SHEAR MODULUS <sup>4</sup> [DYNE/CM <sup>2</sup> ] | ESTIMATED SLIP RATE <sup>4</sup> [MM/YEAR] |
|------------------------------|-----------------------|---|---|--|--|--|
| Rose Canyon                  | 17                    | 0.28  | 7.2   | 9.10E+12   | 3.30E+11   | 1.50                                       |
| Coronado Bank                | 31                    | 0.19  | 7.6   | 2.41E+13   | 3.30E+11   | 3.00                                       |
| San Diego Trough             | 47                    | 0.13  | 7.7   | 3.00E+13   | 3.30E+11   | 2.00                                       |
| Elsinore-Julian              | 66                    | 0.05  | 7.1   | 1.13E+13   | 3.30E+11   | 5.00                                       |
| Elsinore-Coyote Mountain     | 69                    | 0.04  | 6.8   | 5.70E+12   | 3.30E+11   | 4.00                                       |
| Earthquake Valley            | 71                    | 0.03  | 6.5   | 3.00E+12   | 3.30E+11   | 2.00                                       |
| Newport-Inglewood (Offshore) | 74                    | 0.04  | 7.1   | 8.58E+12   | 3.30E+11   | 1.50                                       |
| San Clemente                 | 79                    | 0.09  | 8.1   | 6.00E+13   | 3.30E+11   | 4.00                                       |
| Elsinore-Temecula            | 85                    | 0.03  | 6.8   | 6.30E+12   | 3.30E+11   | 5.00                                       |
| San Jacinto-Coyote Creek     | 97                    | 0.02  | 6.8   | 6.15E+12   | 3.30E+11   | 4.00                                       |
| San Jacinto - Borrego        | 98                    | 0.02  | 6.6   | 3.48E+12   | 3.30E+11   | 4.00                                       |
| Laguna Salada                | 98                    | 0.03  | 7.0   | 1.01E+13   | 3.30E+11   | 3.50                                       |

1. Fault activity determined by Blake (1998), CDMG (1992), Wesnousky (1986), and Jennings (1975).
2. Median peak horizontal ground accelerations (in g's) from Sadigh (1997) for Rock Sites for the Maximum Earthquake Magnitude.
3. Moment magnitudes determined from CDMG (2003), Blake (1998), Wesnousky (1986) and Anderson (1984).
4. Estimated fault areas, shear moduli, and slip rates after fault data for EQFAULT and FRISKSP, Blake (1998).
5. The Maximum Earthquake Magnitude is the estimated median moment magnitude that appears capable of occurring given rupture of the entire estimated fault area.



#### 6.4 Landslides and Lateral Spreads

Evidence of ancient landslides or slope instabilities was not observed during this investigation. Recommendations are provided in the following sections of the report which will help to reduce the potential for future slope instabilities. These recommendations focus on the construction of slope stabilization fills and buttresses, as well as irrigation control, and deep rooted landscape planting.

#### 6.5 Tsunamis, Seiches, Earthquake Induced Flooding

The distance between the subject site and the coast, and the elevation of the site above sea level, preclude damage due to seismically induced waves (tsunamis) or seiches. No other bodies of water of appreciable size were observed in close proximity to the site. Consequently the potential for earthquake induced flooding is considered to be low.

## 7.0 CONCLUSIONS

Based on the results of this investigation, it is our opinion that the proposed development is feasible from a geotechnical standpoint provided the following recommendations and appropriate construction practices are followed. No geotechnical conditions were encountered that would preclude construction. However, some geotechnical considerations exist which should be addressed.

- Bentonite beds are relatively common within the Otay Formation. Slope buttresses are recommended in those areas where our analysis indicates that the bentonite may adversely impact the stability of proposed slopes. The approximate buttress locations are shown on the Remedial Grading Plan, Plate 2. The ultimate buttress configurations will be presented when the 40-scale grading plans are available, and this report is finalized.
- Several locally continuous claystone beds were observed which may intersect the proposed cut slopes in various portions of the site. In order to reduce the potential for surficial slope failures and other moisture related problems, we have recommended that these slopes be reconstructed as stabilization fills. The estimated extent of these stabilization fills is also shown on the Remedial Grading Plan, Plate 2. The ultimate configurations should be determined based on the conditions observed by Geotechnics Incorporated during grading.
- Loose, compressible soils are found over much of the site. These materials, which include residuum, colluvium, and alluvium, are susceptible to settlement under increased loads, or due to an increase in moisture content from site irrigation or changes in drainage conditions. Consequently, these materials should be removed and replaced as compacted fill. The estimated remedial excavation depths for compressible soils within the fill portions of the site are shown on the Remedial Grading Plan, Plate 2.
- Deep fills (in excess of 40 feet) may experience substantial long-term settlement. The amount of settlement is related to the fill depth, the amount of groundwater infiltration, the materials from which the fill is composed, and the relative compaction and moisture contents achieved during fill placement. In order to reduce the magnitude of long term fill settlement, we have recommended that any fills placed more than 40 feet below finish grade be compacted to at least 93 percent relative compaction at above optimum moisture content. The deep fill areas are shown on the Remedial Grading Plan, Plate 2.

- Grading will result in numerous cut/fill transitions within future building pad areas. In order to reduce the potential for distress associated with differential settlement, pads should be graded so that structures do not cross such transitions. This may be accomplished by over-excavating the cut portion of the building pad areas so that foundations bear entirely on compacted fill. The approximate locations of the planned cut/fill transitions are shown on the Geotechnical Map, Plate 1. Remedial grading for these cut/fill transitions will be presented when the 40-scale grading plans are completed, and this report is finalized.
- Excavations within the Otay Formation are expected to generate predominately granular soils with low to medium expansion potentials. However, excavations within the alluvium, colluvium, residuum, and claystone of the formation may produce highly expansive material. Heave may occur in areas where these soils are placed or left within foundation or slab subgrade. Remedial grading should be conducted so that highly expansive materials are not left near finish grades, as recommended in the following sections of this report. The areas where highly expansive claystone are anticipated within four feet of finish pad grade within Units R-1A, R-1B and R-5 are shown on the Geotechnical Map, Plate 1.
- Future irrigation of the development will introduce significant quantities of water into the underlying soil. This creates the potential for seepage to develop within existing canyon fills and at the faces of slopes. Subsurface drains will be installed in areas where our observations indicate that a potential for seepage exists, as shown on the Remedial Grading Plan, Plate 2. However, it is not always possible to predict when and where seepage may ultimately occur. Unanticipated seepage conditions may need to be addressed if and when they develop.
- Excavations at the site should be achievable using standard heavy earthmoving equipment. Excavations in the Otay Formation may generate strongly cemented blocks of oversized material that will need to be broken down prior to incorporation into compacted fill. Excavations in alluvium may generate wet soil that will need to be dried or blended with granular soils prior to placement as compacted fill.
- There are no known active faults underlying the project site. Likely seismic hazards that may occur at the site would be associated with significant ground shaking due to an event located within the Rose Canyon Fault zone. Potentially liquefiable soils may exist in the drainage courses at the site. However, removal and compaction of these materials during grading should negate any potential for liquefaction.

## 8.0 RECOMMENDATIONS

The remainder of this report presents recommendations regarding the proposed development. These recommendations are based on empirical and analytical methods typical of the standards of practice in southern California. If these recommendations appear not to cover a specific feature of the project, please contact our office for additions or revisions.

### 8.1 Plan Review

We recommend that foundation and grading plans be reviewed by Geotechnics Incorporated prior to construction. We anticipate that substantial changes in the development may occur from the preliminary plans used for this investigation (P&D, 2003). Such changes may require additional investigation, and may result in modifications to the remedial grading recommendations provided in the following sections of the report.

### 8.2 Excavation and Grading Observation

Foundation excavations and site grading excavations should be observed by Geotechnics Incorporated. During grading, Geotechnics Incorporated should provide observation and testing services continuously. Such observations are considered essential to identify field conditions that differ from those anticipated by the preliminary investigation, to adjust designs to actual field conditions, and to determine that the grading is accomplished in general accordance with the recommendations of this report. Recommendations presented in this report are contingent upon Geotechnics Incorporated performing such services. Our personnel should perform sufficient testing of fill during grading to support our professional opinion as to compliance with the compaction recommendations.

### 8.3 Earthwork

Grading and earthwork should be conducted in general accordance with the Grading Ordinance of the City of Chula Vista, Appendix Chapter 33 of the Uniform Building Code, and the Standard Guidelines for Grading attached as Appendix D of this report. The following recommendations are provided regarding specific aspects of the proposed earthwork construction. These recommendations should be considered subject to revision based on the conditions observed by our personnel during grading.

8.3.1 Site Preparation: Site preparation includes removal of deleterious materials, existing structures, or other improvements from areas to be subjected to fill or structural loads. Deleterious materials, including vegetation, trash, and debris, should be removed from the site. Minor herbaceous vegetation may be incorporated into fills as long as it is thoroughly mixed with soil, and does not exceed 0.5% of the fill by volume. Existing subsurface utilities that are to be abandoned should be removed and the trenches backfilled and compacted as described in Section 8.3.6.

8.3.2 Compressible Soils: The residuum, colluvium, alluvium and undocumented fill throughout the site are compressible and should be removed and compacted prior to development. Removals should expose competent formational material as determined by our personnel during grading. In general, colluvium removals are anticipated to be on the order of 2 to 4 feet, although alluvium removals up to about 25 feet are anticipated in the western portion of Wolf Canyon. The estimated removal depths in the fill portions of the site are shown on the Remedial Grading Plan, Plate 2. The removed soil that is free of deleterious material should be replaced in accordance with Section 8.3.6 as a uniformly compacted fill to the proposed plan elevations. It should be noted that some of the excavated soil may have high moisture contents, and may require drying prior to inclusion in compacted fills.

8.3.3 Expansive Soils: Soil heave may cause differential movement of foundations, slabs and other improvements. The sandstones and siltstones of the Otay Formation are considered to have a low to medium expansion potential, whereas the claystones may be highly or very highly expansive. All of the soil units (residuum, colluvium and alluvium) are considered to be highly to very highly expansive. Figure C-4.1 presents the expansion index testing for the subject site. Our expansion index database for the Otay Formation in the site vicinity is summarized in Figure C-4.2.

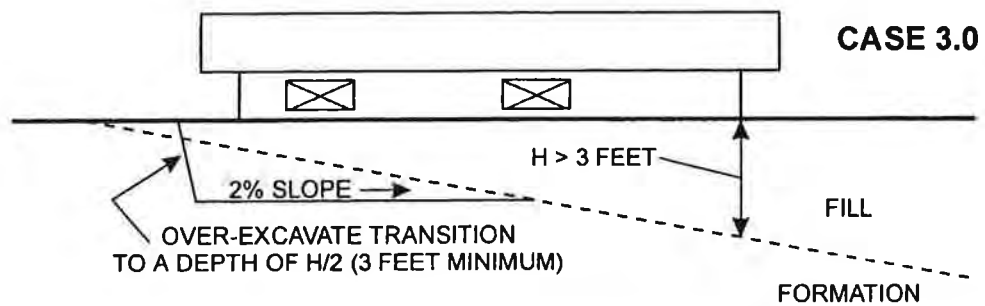
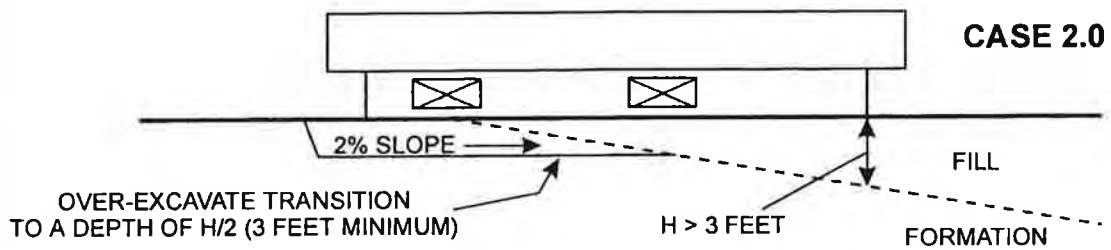
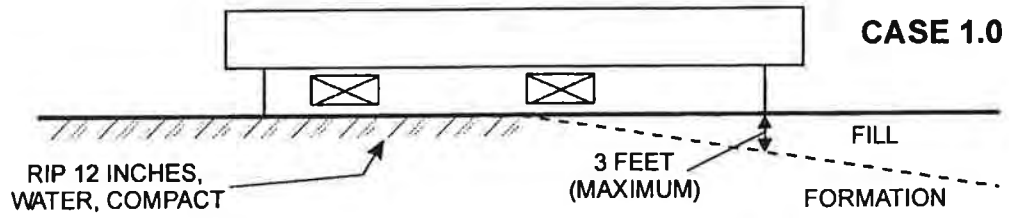
In order to reduce the potential for differential movement, we recommend that highly or very highly expansive soils not be left in cuts nor placed in fills near finish grade. In areas where excavations will result in highly or very highly expansive materials near finish grade, we recommend that these materials be over-excavated a minimum of five feet below finish grade. The expansive material should be placed as compacted fill in the deeper canyon areas. The excavations should then be filled with compacted soil which has a low to medium expansion potential.

The approximate areas that may require over-excavation due to the presence of highly or very highly expansive materials near finish grade are shown on the Geotechnical Map, Plate 1. Note that these areas may change if the grades are adjusted from those shown on the Geotechnical Map. These areas were estimated based on the conditions observed in the exploratory borings. Samples of the finish grade materials should be tested during grading to determine the expansion potential.

**8.3.4 Transition Lots:** Residential structures should not straddle cut/fill nor deep fill transitions, due to the potential for adverse differential settlement. The approximate locations of the cut/fill transitions are shown on the Geotechnical Map, Plate 1. Typical transition conditions are depicted in Figure 3. These conditions include lots with cut/fill transitions, transitions between shallow and deep fills, and lots underlain by deep fills. Our recommended remedial grading is summarized in Figure 3.

Note that for cut/fill transition lots which will be underlain by less than 3 feet of fill (Case 1), we recommend that remedial work consist of scarifying and compacting the surficial 12 inches of material. For cut/fill transition lots and lots with a deep fill transitions, we recommend that the cut or shallow fill portion of the building pad be over-excavated. The depth of the over-excavation should be equal to a depth of  $H/2$ , with a minimum over-excavation of 3 feet and a maximum of 10 feet (Cases 2 and 3), where "H" is equal to the greatest depth of fill underlying the proposed structure. Note that the over-excavation should extend at least 5 feet horizontally beyond the proposed building envelope. The over-excavated portion of the pad should be brought back to grade with compacted fill as discussed in Section 8.3.6.

**8.3.5 Temporary Excavations:** Temporary excavations are anticipated throughout the site, such as for the removal of deleterious materials, utility trenches, and the construction of the stabilization fills and buttresses. Excavations should conform to Cal-OSHA guidelines. Temporary slopes in alluvium or colluvium should be inclined no steeper than 1:1 (horizontal to vertical) for heights up to 30 feet. Temporary excavations in formational material should be inclined no steeper than  $3/4:1$  for heights up to 30 feet. Higher temporary slopes should be evaluated by Geotechnics on a case by case basis during grading operations. Temporary excavations that encounter seepage or other potentially adverse conditions should be evaluated by the geotechnical consultant on a case-by-case basis during grading.



**8.3.6 Fill Compaction:** All fill and backfill to be placed in association with site development should be accomplished at slightly over optimum moisture conditions, and using equipment that is capable of producing a uniformly compacted product. The minimum relative compaction recommended for fill is 90 percent of maximum density based on ASTM D1557. Any fill placed at depths of more than 40 feet below finish grade should be compacted to at least 93 percent relative compaction. Sufficient observation and testing should be performed by Geotechnics so that an opinion can be rendered as to the compaction achieved.

Imported fill sources should be observed prior to hauling onto the site to determine the suitability for use. In general, imported fill soils should have an expansion index less than 50 based on UBC Test Method 29-2 or ASTM D4829. Samples of imported materials should be tested by Geotechnics in order to evaluate their appropriate engineering properties for the planned use. During grading operations, soil types may be encountered by the contractor which do not appear to conform to those discussed within this geotechnical report. The geotechnical consultant should be notified in order to evaluate the suitability of these soils for their proposed use.

**8.3.7 Bulk/Shrink Characteristics:** The distribution of in-situ moisture and density from modified California samples randomly taken within the Otay Formation in Villages 1, 5, 6 and 12 is presented in Figure C-2.1. The distribution of nuclear density tests taken during grading of Villages 1 and 6 is presented in Figure C-2.2. Based on this data, we estimate that cuts in the siltstone and sandstone will bulk an average of 6 to 11 percent (respectively) when excavated and compacted as fill. Based on the relative percentages of sandstone, siltstone and claystone samples from Otay Ranch, we estimate an average bulk of 8 percent in the Otay Formation. More limited data suggests that cuts in the residuum, alluvium, and colluvium will shrink on the order of 5 to 15 percent when excavated and compacted as fill.

Although available data indicates that the Otay Formation will bulk from 6 to 11 percent as tested, the actual bulk may be less due to rapid elastic compression of the compacted fill. For example, an 80 foot deep fill derived entirely of cuts from the Otay Formation may experience an average 2 percent elastic compression. If the average bulk of the material within compacted fill is 8 percent, the apparent bulk after grading would only be 6 percent.



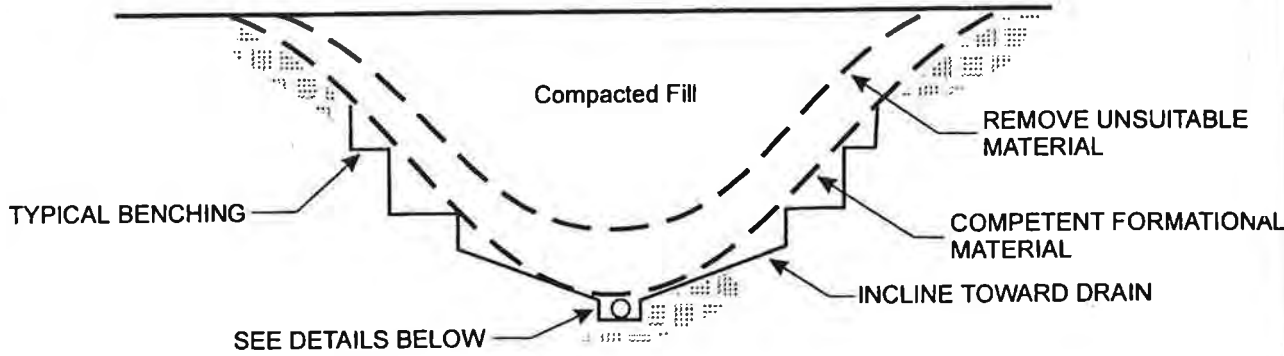
8.3.8 Surface Drainage: Slope, foundation and slab performance depends greatly on how well surface runoff drains from the site. This is true both during construction and over the entire life of the structure. The ground surface around structures should be graded so that water flows rapidly away from the structures and top of slopes without ponding. The surface gradient needed to achieve this may depend on the prevailing landscape. The project engineer should consider these aspects in design.

Planters should be built so that water from them will not seep into the foundation, slab, or pavement areas. If roof drains are used, their drainage should be channeled by pipe to storm drains, or discharge at least 10 feet from buildings. Homeowners should be responsible for limiting irrigation to the minimum necessary to sustain landscaping plants. Should excessive irrigation, surface water intrusion, water line breaks, or unusually high rainfall occur, saturated zones or “perched” groundwater may develop within the underlying soil. Homeowner’s responsibilities include using sound engineering judgment in property improvements, maintaining protective slope vegetation and established lot grades, and minimizing lot and slope irrigation.

8.3.9 Subsurface Drainage: To reduce the potential for various moisture-related problems, we recommend that canyon subdrains be constructed throughout the site. Typical canyon subdrain details are shown in Figure 4. The approximate subdrain locations are shown on the Remedial Grading Plan, Plate 2. The location and extent of all subsurface drainage improvements should be considered subject to revision based on conditions observed by Geotechnics during grading. All subdrains should be connected into permanent outlets such as a storm drain, brow ditch, downstream subdrain, or natural drainage. If subdrains are outlet onto natural ground, a permanent headwall should be constructed to reduce the potential for burying, damaging or clogging the outlet. Subdrain headwall details are shown in Figure 5.

Our experience indicates that seepage may develop in time at any level within a slope face with upslope irrigation. Where geologic conditions conducive to slope seepage are observed during grading, stabilization fills will be constructed during grading, as discussed in Section 8.3.10. However, seepage may occur in areas where prediction is impossible, especially in slopes over 15 feet high, or heavily irrigated areas. These problems are usually addressed when seepage occurs. Mitigation may involve construction of slope toe drains. Slope toe drain details are shown in Figure 6.

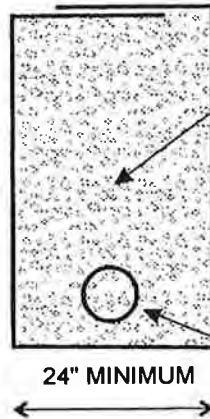
# CANYON SUBDRAIN DETAILS



## DRAIN DETAIL

| SUBDRAIN LENGTH<br>(feet) | PIPE DIAMETER SIZE<br>(inches) |
|---------------------------|--------------------------------|
| first 100                 | 4 (optional)                   |
| 100 - 500                 | 4                              |
| 500 -1000                 | 6                              |
| > 1000                    | 8 (or 2-6")                    |

**Example:** Subdrain length is 800 feet. From 0 to 100 feet pipe is optional, from 100 to 500 feet pipe is 4", and from 500 to 800 feet pipe is 6".

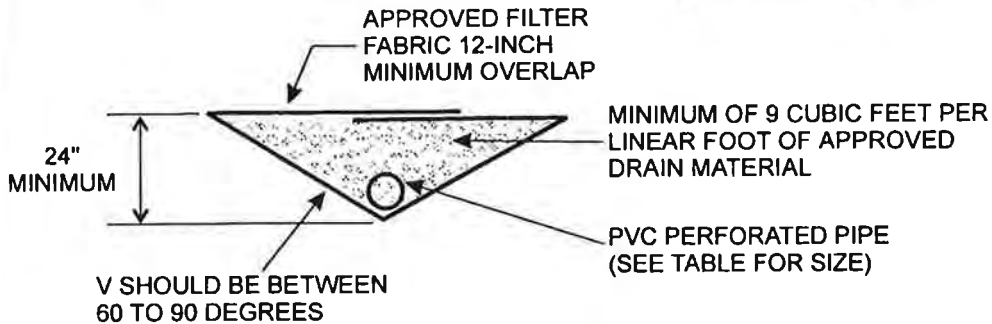


MINIMUM 9 CUBIC FEET PER LINEAR FOOT OF APPROVED DRAIN MATERIAL

APPROVED FILTER FABRIC 12-INCH MINIMUM OVERLAP

PVC PERFORATED PIPE (SEE TABLE FOR SIZE)

## OPTIONAL V-DITCH DETAIL

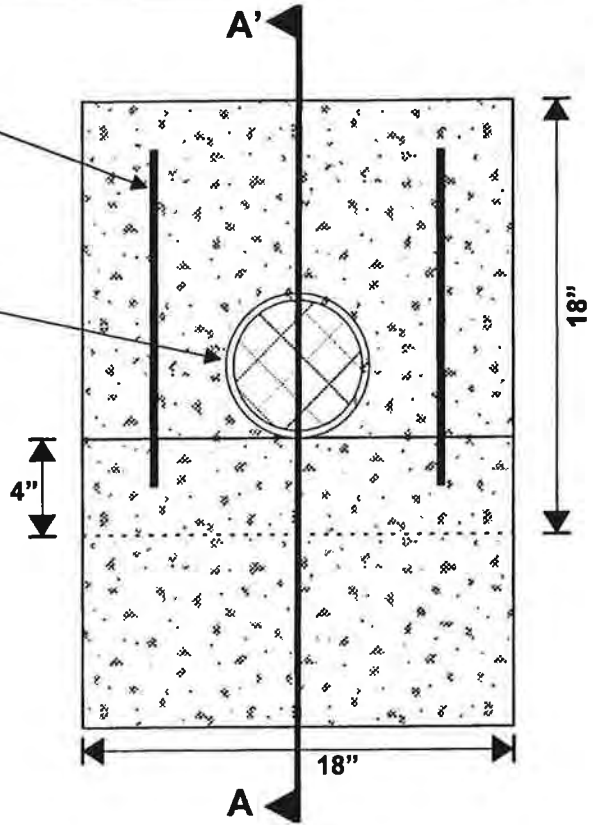


## NOTES

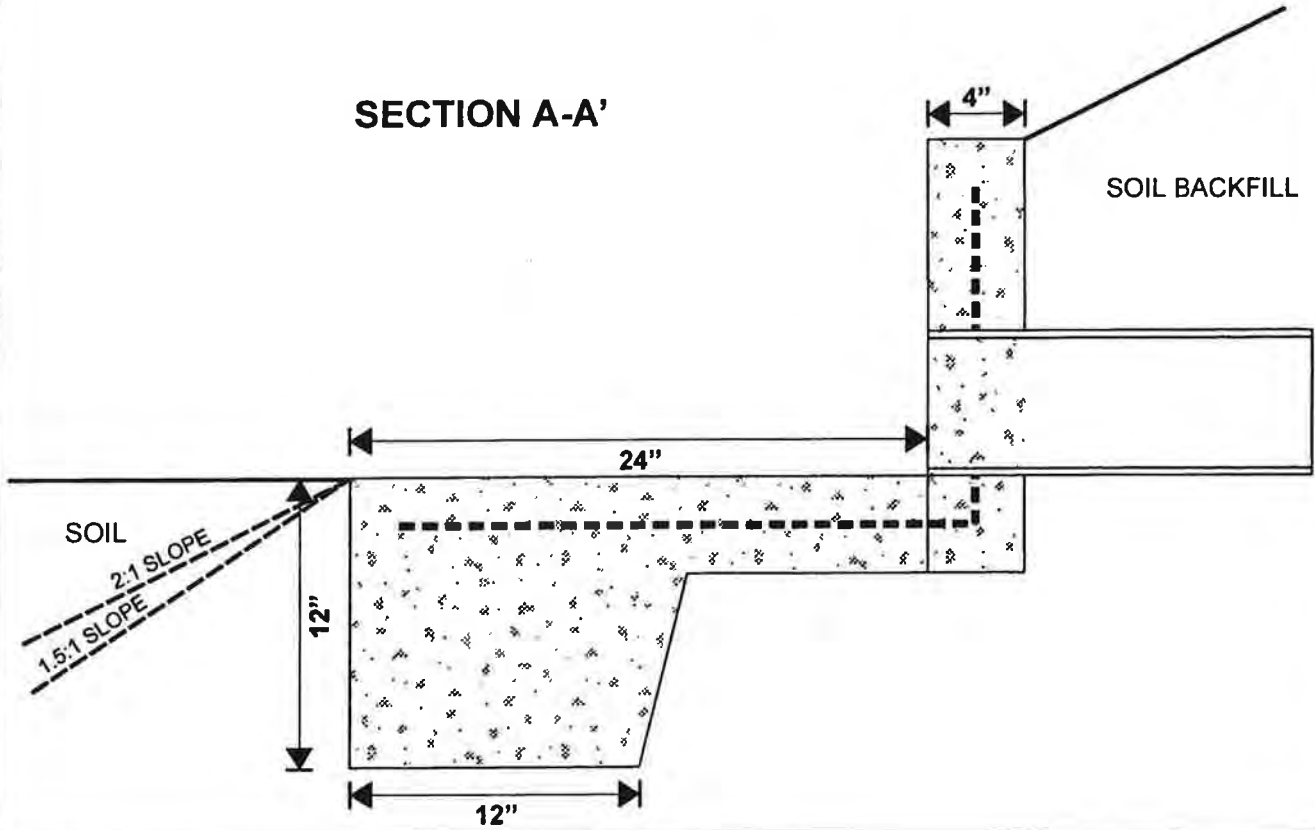
- 1) The need for perforated pipe and pipe diameter to be determined by geotechnical consultant based on field conditions.
- 2) Perforated pipe should outlet through a solid pipe to a free gravity outfall. Perforated pipe and outlet pipe should have a fall of at least 1%.
- 3) Filter fabric should consist of Mirafi 140N, Supac 5NP, Amoco 4599, or similar approved fabric. Filter fabric should be overlapped at least 12-inches.
- 4) Drain material should consist of minus 1½-inch, minus 1-inch, or minus ¾-inch crushed rock.
- 5) Drain installation should be observed by the geotechnical consultant prior to backfilling.

NO. 3 REBAR WITH 90 DEGREE BEND

4 TO 8 INCH DIAMETER SUBDRAIN OUTLET PIPE (WITH 1/4-INCH STAINLESS STEEL MESH COVER)



**SECTION A-A'**

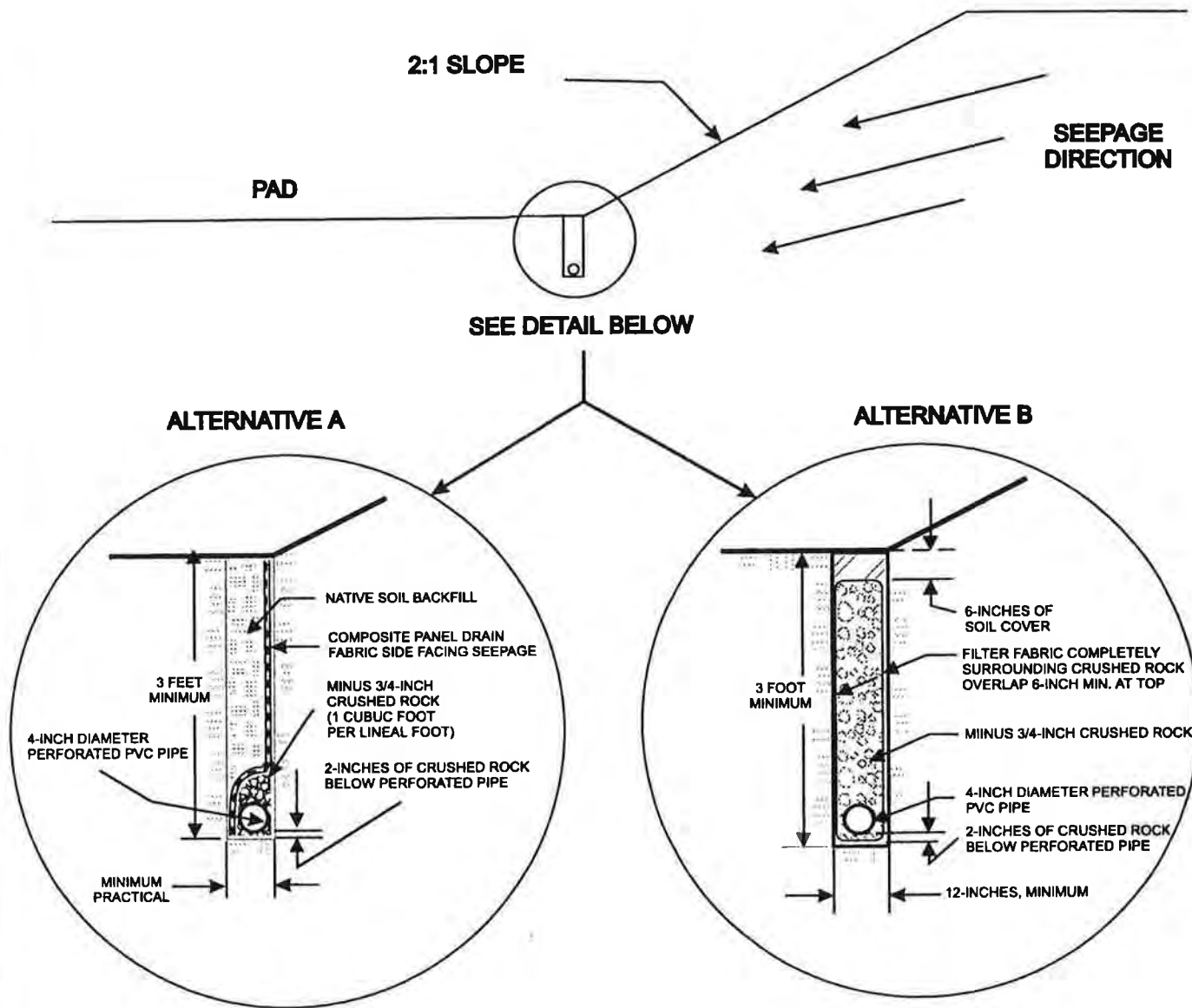


**Geotechnics  
Incorporated**

**SUBDRAIN HEADWALL DETAILS**

Project No. 0367-014-00  
Document No. 03-0946

**FIGURE 5**



**CONSTRUCTION NOTES:**

**Alternative A:**

- 1) Drainage panels should consist of prefabricated geocomposite drain such as Miradrain 6000, Tensar DC1200, TerraDrain 201, or TerraDrain 402.
- 2) Splices in panels should be as recommended by the manufacturer. Interlocking type panels should be overlapped at least six inches. Non-interlocking type should overlap at least twelve inches.

**Alternative B:**

- 1) Filter fabric should consist of spun-bond, needle-punched geosynthetic such as Mirafi 140NL, Supac 4NP, or similar approved fabric.

**Both Alternatives:**

- 1) Subdrains should outlet into the storm drain. Perforated pipe and outlet pipe should have a fall of at least one percent.

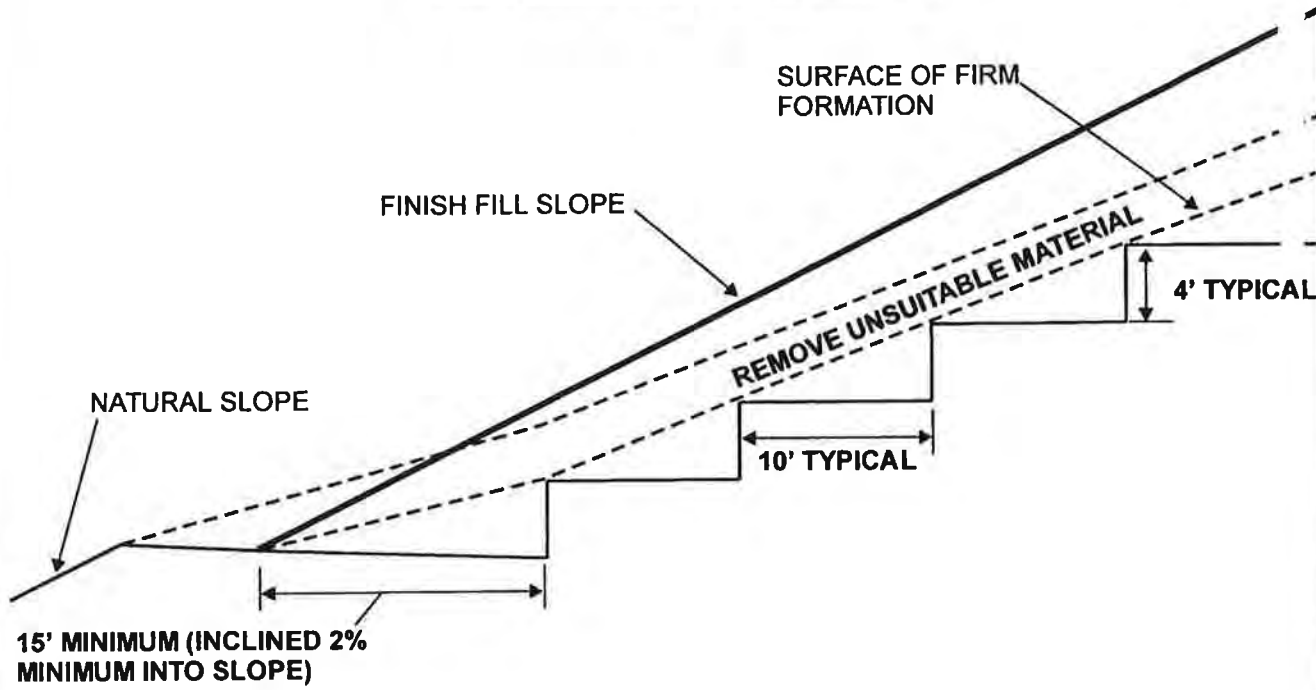
It should be noted that it may be difficult to mitigate seepage problems after the residences are occupied. Consideration should therefore be given to the construction of slope toe drains (or stabilization fills) for all slopes in excess of 15 feet in height in order to decrease the incidence of moisture related problems. Alternatively, rather than constructing slope toe drains during mass grading, provisions for construction of these drains at a later date may be considered. Construction of storm drain laterals and easements at regular intervals throughout the site would aid in the future installation of these drains on an as-needed basis.

**8.3.10 Slope Stability:** The Tentative Map indicates that cut and fill slopes up to about 40 feet high are proposed, as shown on the Geotechnical Map, Plate 1. We recommend that permanent cut and fill slopes be inclined no steeper than 2:1 (horizontal to vertical). Fills over sloping ground should be constructed entirely on prepared bedrock. In areas where the ground surface slopes at more than a 5:1 gradient, it should be benched to produce a level area to receive the fill. Benches should be wide enough to provide complete coverage by the compaction equipment during fill placement. Typical slope construction details are presented in Figure 7.

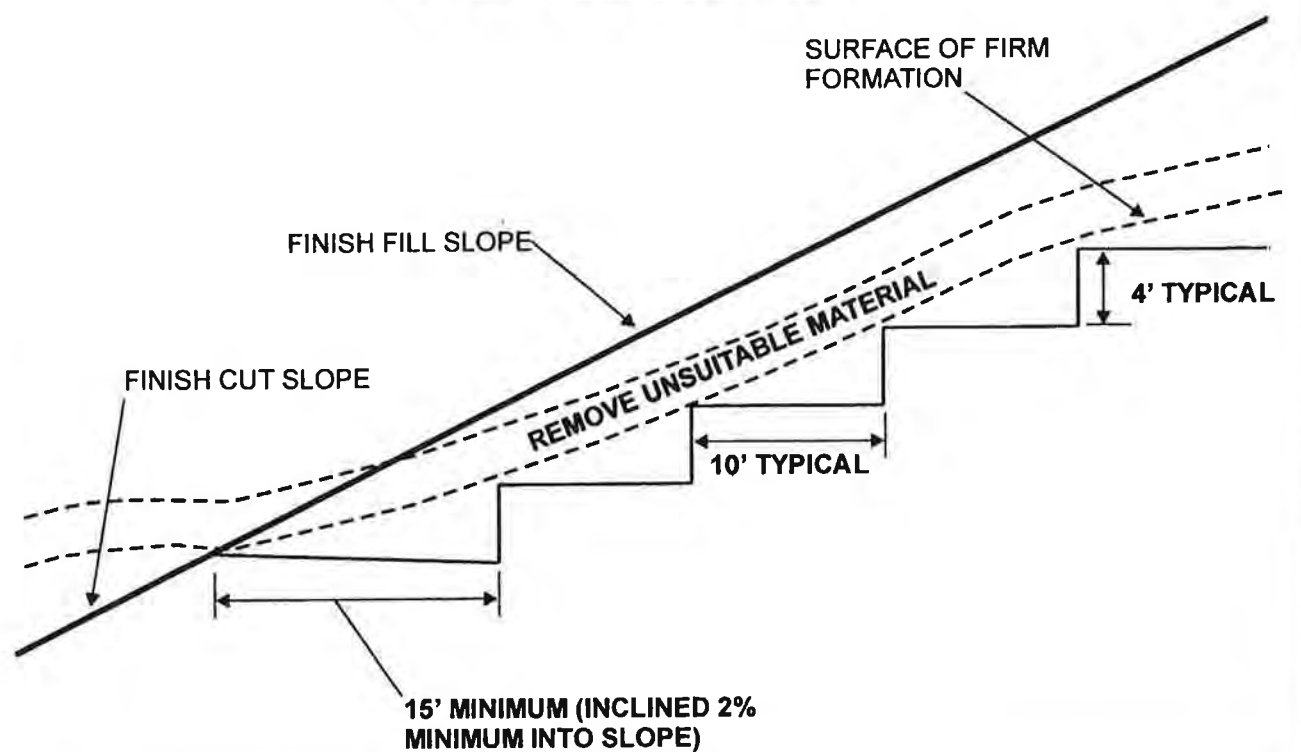
In order to characterize the behavior of the Otay Formation in slopes, samples were tested for shear strength in general accordance with ASTM D3080. The laboratory test results are presented in Figures C-6.1 to C-6.11, and are summarized in Figures C-6.12 and C-6.13. Based on the shear test results, lower bound strength parameters were estimated for use in the various slope stability analyses. A summary of the strength parameters used in the slope stability analyses is presented in Figure C-6.14.

Our analyses indicate that most of the proposed cut and fill slopes have a factor of safety greater than 1.5 against deep seated failure, which is the generally accepted safety factor for slope stability analysis. For these slopes, no remedial grading is recommended. However, several continuous bentonite beds were observed at the site. Laboratory testing and our previous experience with these materials indicate that buttresses will be required where these beds daylight in cut slopes, or below the toe of fill slopes. Consequently, several buttresses are recommended in order to increase the safety factor in these slopes. The extent of the recommended slope buttresses is shown on the Remedial Grading Plan, Plate 2. Typical buttress details are presented in Figure 8.

### FILL OVER NATURAL SLOPE



### FILL OVER CUT SLOPE



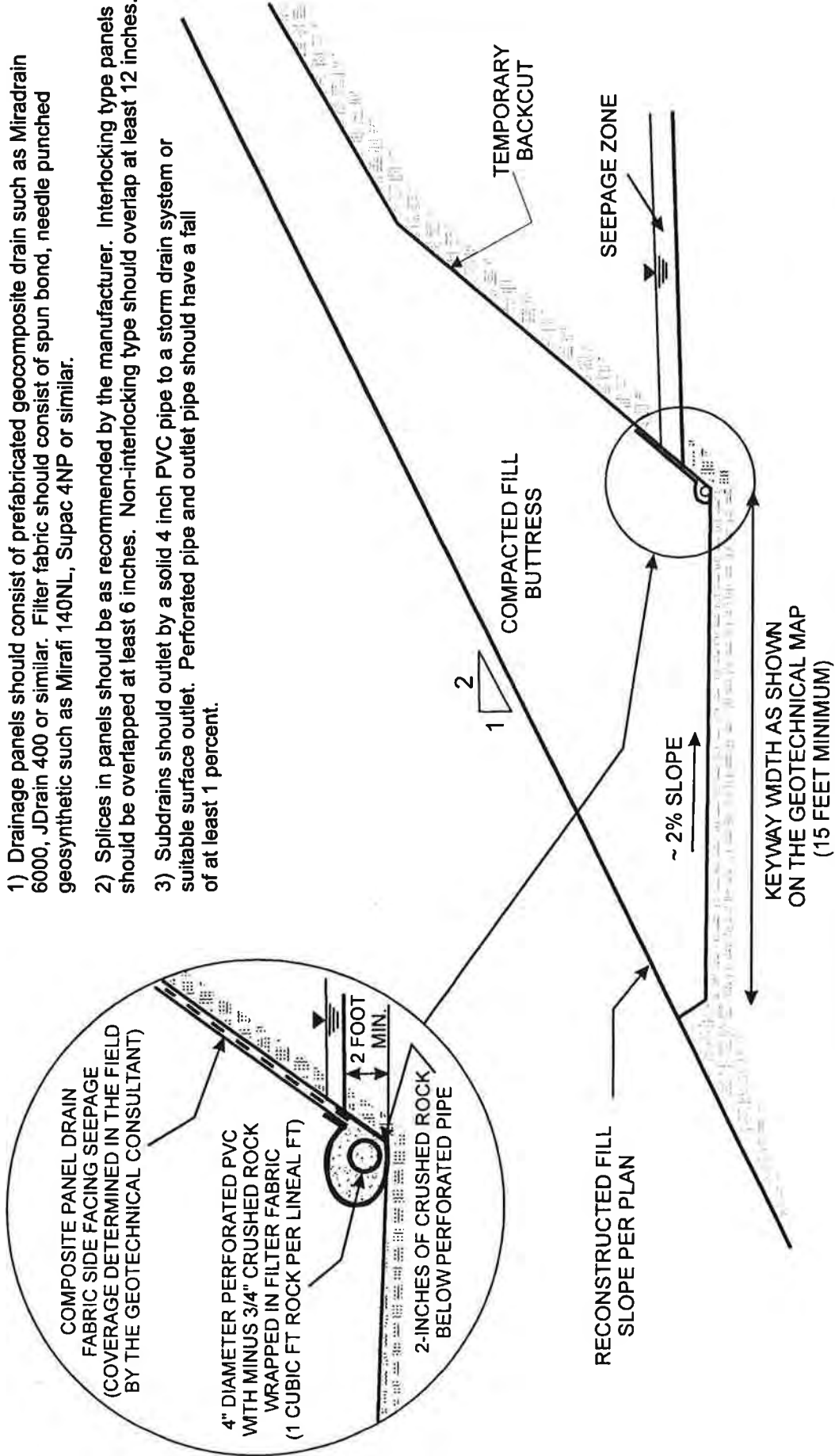
### **SLOPE CONSTRUCTION DETAILS**

Project No. 0367-014-00  
Document No. 03-09 '3

**FIGURE**

**CONSTRUCTION NOTES**

- 1) Drainage panels should consist of prefabricated geocomposite drain such as Miradrain 6000, JDrain 400 or similar. Filter fabric should consist of spun bond, needle punched geosynthetic such as Mirafi 140NL, Supac 4NP or similar.
- 2) Splices in panels should be as recommended by the manufacturer. Interlocking type panels should be overlapped at least 6 inches. Non-interlocking type should overlap at least 12 inches.
- 3) Subdrains should outlet by a solid 4 inch PVC pipe to a storm drain system or suitable surface outlet. Perforated pipe and outlet pipe should have a fall of at least 1 percent.



The buttress key locations and widths shown on the Remedial Grading Plan should be considered approximate. If the ultimate slope configurations are modified for the final 40-scale grading plans, substantial modifications to the buttress configurations may be needed. During grading, Geotechnics Incorporated should reevaluate slope stability throughout the site using the final slope configurations, and taking into consideration the actual conditions observed in the slopes by our project geologists.

Several claystone beds were observed in our investigation which may daylight in cut slope faces. Although these beds are not believed to adversely impact gross slope stability, we anticipate that groundwater from future irrigation may collect on these beds and migrate to the slope faces. Surficial slope stability was analyzed using an idealized infinite slope composed of a cohesive, frictional material, with steady state down slope seepage forces applied parallel to the slope surface (Abrahamson et al, 1996). Our surficial stability analysis suggests that heavy seepage and deep saturation of the slope faces could result in surficial slope failures and erosion.

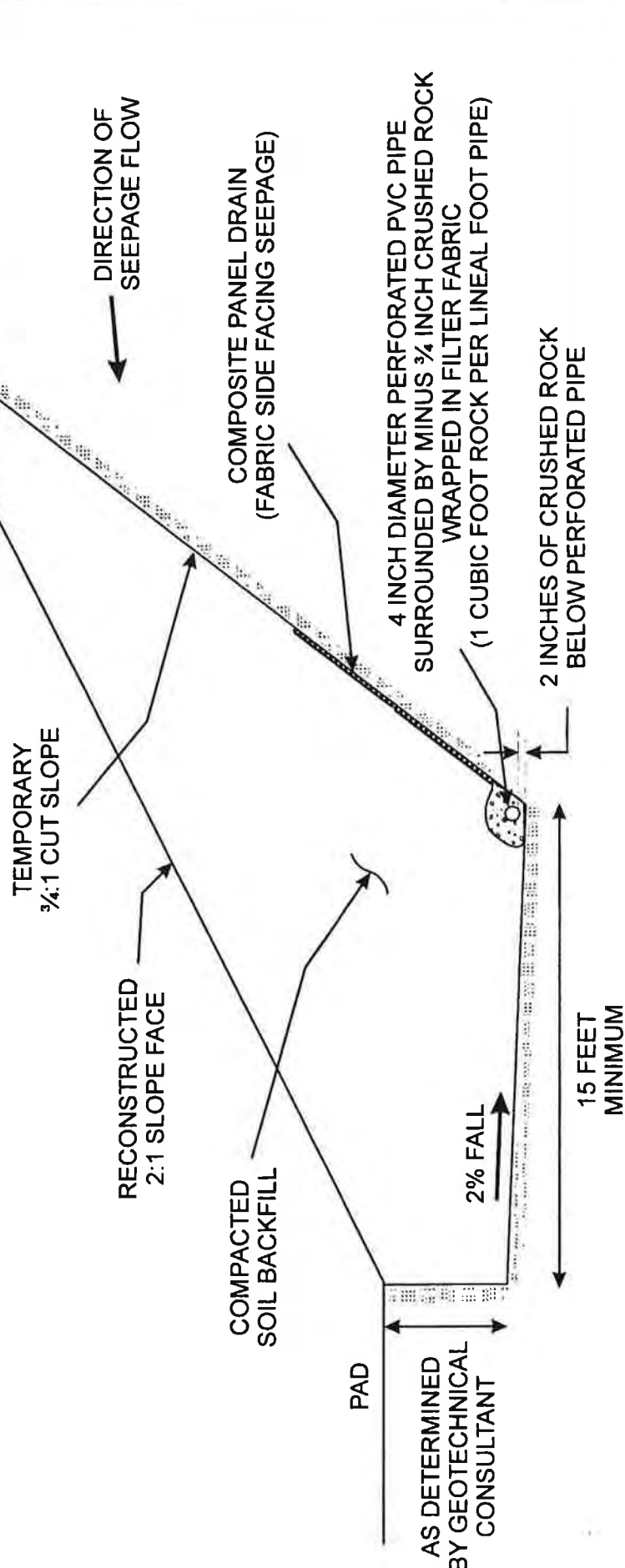
In order to improve surficial stability and reduce the potential for a variety of other moisture related problems, several stabilization fills are recommended for the site. The anticipated locations of the stabilization fills are shown on the Remedial Grading Plan, Plate 2. Details of the proposed stabilization fills are shown in Figure 9. The actual configuration of the stabilization fills (including the drainage panel coverage and depth of the key below pad grade) should be determined in the field based on the conditions observed by Geotechnics Incorporated during grading.

Surficial slope stability may be further enhanced by providing proper drainage. The site should be graded so that water from the surrounding areas is not able to flow over the slope tops. Diversion structures should be provided where necessary. Surface runoff should be confined to gunit-lined swales or other appropriate devices to reduce the potential for erosion. It is recommended that slopes be planted with vegetation that will increase their surficial stability. Ice plant is generally not recommended. We recommend that vegetation include woody plants and ground cover. All plants should be adapted for growth in semi-arid climates with little or no irrigation. A landscape architect should be consulted in order to develop a planting palette suitable for slope stabilization.



**CONSTRUCTION NOTES:**

- 1) The drainage panels should consist of prefabricated geocomposite drain such as Miradrain 6000, Jdrain 200, or similar approved products. Filter fabric should consist of spun-bond, needle punched geosynthetic such as Mirafi 140NL, Supac 4NP, or similar fabric.
- 2) Splices should be conducted in accordance with the manufacturer recommendations. Interlocking type panels should be overlapped at least 6 inches. Non-interlocking type should be overlapped at least 12 inches.
- 3) Subdrains should outlet to storm drains. Subdrain and outlet should have a minimum 1 percent fall.
- 4) Composite panel drain coverage to be determined in the field by geotechnical consultant.



All slopes experience slope creep. Slope creep is the very slow, down-slope movement of the near surface soil along the slope face. The degree and depth of the movement is influenced by soil type and the moisture conditions. This movement is typical in slopes and is not considered a hazard. However, it may affect structures built on or near the slope face. We recommend that settlement-sensitive structures not be located within 5 feet of the top of the slope unless specific evaluation of the structure's foundation is conducted by the geotechnical consultant.

#### 8.4 Preliminary Foundation Considerations

The design of the foundation system should be performed by the project structural engineer, incorporating the geotechnical parameters developed in the as-graded geotechnical report prepared after site grading is completed. We anticipate two design conditions at the project site, based on the remedial grading recommendations shown in Figure 3. The design of foundations on lots underlain by Otay Formation or shallow fill should be controlled by the expansion potential of the foundation soils. Because of the selective grading recommended, we anticipate that soils having an expansion index of no greater than 90 (medium expansion) will be present in the foundation influence zone for these structures. The second design condition is expected to include lots with deep fill or a large differential fill depth across the building area. In general, deep fills are considered to be those in excess of 40 feet. The design of structures on these lots may be controlled by the potential differential settlement.

#### 8.5 Reactive Soils

To assess the reactivity of the site soils with metal pipe, several pH and resistivity tests were conducted, as shown in Figure C-5.1. The test results suggest that the site soils are corrosive to metal pipes. A corrosion engineer should be contacted for specific recommendations.

In order to assess the potential for degradation of concrete in contact with the site soils, the sulfate and chloride content of selected soil samples was determined. The results of these laboratory tests are also shown in Figure C-5.1. The results of other sulfate tests conducted on the Otay Formation throughout Otay Ranch Villages 1, 5 and 6 are summarized in Figure C-5.2. The sulfate tests indicate that the site soils typically have a "negligible" sulfate exposure based on UBC criteria. Supplemental sulfate content testing may be conducted on a lot by lot basis during grading, and presented in the as-graded report.

## 8.6 Lateral Earth Pressures

Backfilling retaining walls and other subgrade walls with expansive soil can increase lateral pressures well beyond normal active or at-rest pressures. We recommend that retaining walls be backfilled with granular soil having an expansion index of 20 or less. The backfill area should include the zone defined by a 1:1 sloping plane, back from the base of the wall. Retaining wall backfill should be compacted to at least 90 percent relative compaction. Backfill should not be placed until walls have achieved adequate structural strength. Heavy compaction equipment which could cause distress to walls should not be used.

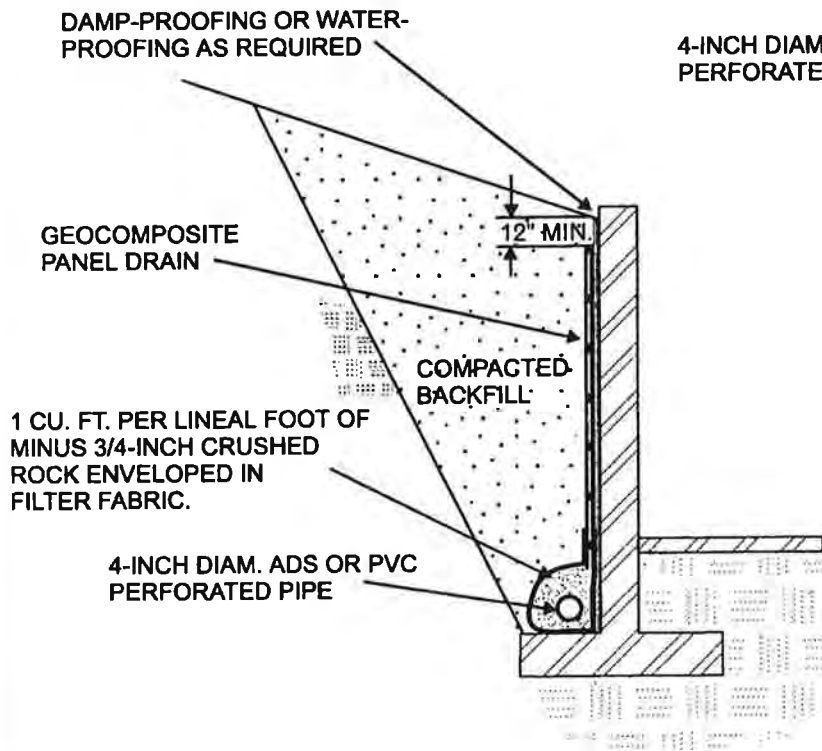
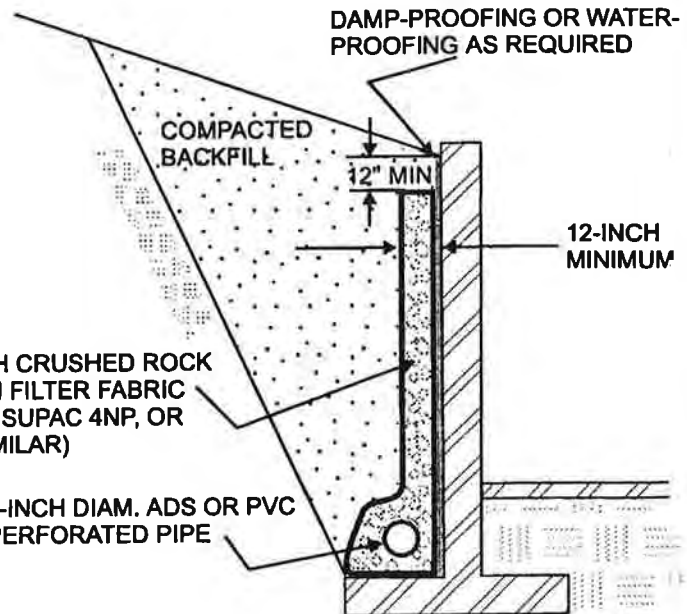
Cantilever retaining walls backfilled with granular soil may be designed for an active earth pressure approximated by an equivalent fluid pressure of 35 lbs/ft<sup>3</sup>. The active pressure should be used for walls free to yield at the top at least 1 percent of the wall height. For cantilever walls with 2:1 sloping backfill, or walls with level backfill that are restrained so that 1 percent movement is not permitted, an equivalent fluid pressure of 55 lbs/ft<sup>3</sup> should be used for design. The above pressures do not consider any hydrostatic pressures or surcharge loads. If these are applicable, they will increase the lateral pressures on the wall and we should be contacted for additional recommendations. Retaining walls should contain an adequate subdrain to eliminate any hydrostatic forces. Typical retaining wall drain details are provided in Figure 10.

Retaining walls founded on compacted fill or formational materials may be designed using an allowable bearing pressure of 2,000 lbs/ft<sup>2</sup>. Lateral loads against the walls may be resisted by friction between the bottom of the wall footings and the soil, as well as passive pressure against the portion of the wall foundation or base key embedded into competent material. A coefficient of friction of 0.30 and passive pressure of 300 lbs/ft<sup>2</sup> is recommended.

## 8.7 Preliminary Pavement Sections

In order to aid in preliminary planning and pavement design, several R-Value tests were conducted in general accordance with CTM 301. These R-Value test results are shown in Figures C-7.1 through C-7.4. A summary of R-Value test results for samples derived from the Otay Formation in Otay Ranch is presented in Figure C-7.5. We anticipate that a broad range of R-Values may be encountered on site, typically ranging from about 10 to 40. For preliminary design, we assumed a design R-Value of 20.

## ROCK AND FABRIC ALTERNATIVE



## PANEL DRAIN ALTERNATIVE

### NOTES

- 1) Perforated pipe should outlet through a solid pipe to a free gravity outfall. Perforated pipe and outlet pipe should have a fall of at least 1%.
- 2) Drain installation should be observed by the geotechnical consultant prior to backfilling.
- 3) Filter fabric should consist of Mirafi 140N, Supac 5NP, Amoco 4599, or similar approved fabric. Filter fabric should be overlapped at least 6-inches.
- 4) Geocomposite panel drain should consist of Miradrain 6000, J-DRain 400, Supac DS-15, or approved similar product.
- 5) Composite panel drain and gravel drain should extend to at least two-thirds of the height of the wall.

The following preliminary pavement sections are for estimation purposes only. During grading, pavement subgrade should be sampled, and additional R-Value tests performed. Design sections will then be provided by the City Engineer. For the preliminary pavement sections given below, typical street types and traffic indices were taken from Table 3-405.3 of the City of Chula Vista Subdivision Manual. Based on these traffic indices, and a typical design R-Value of 20, the following pavement sections would be recommended in general accordance with the Caltrans design method (Topic 608.4). The City's minimum pavement sections are also given in the table (in parentheses) for comparison. The City's minimum sections are based on an R-Value of approximately 40.

| <b>STREET TYPE</b>     | <b>TRAFFIC INDEX</b> | <b>A.C. SECTION<br/>(City Minimum)</b> | <b>BASE SECTION<br/>(City Minimum)</b> |
|------------------------|----------------------|--|--|
| Prime Arterial         | 9.5                  | 6 Inches (5 Inches)                    | 17 Inches (12 Inches)                  |
| 6 Lane Major           | 9.5                  | 6 Inches (5 Inches)                    | 17 Inches (11 Inches)                  |
| 4 Lane Major           | 9.0                  | 5 Inches (4 Inches)                    | 17 Inches (12 Inches)                  |
| Class I Collector      | 8.5                  | 5 Inches (4 Inches)                    | 15 Inches (11 Inches)                  |
| Class II Collector     | 8.0                  | 4 Inches (4 Inches)                    | 15 Inches (10 Inches)                  |
| Class III Collector    | 7.5                  | 4 Inches (4 Inches)                    | 14 Inches (8 Inches)                   |
| Residential            | 6.0                  | 3 Inches (3 Inches)                    | 11 Inches (7 Inches)                   |
| Residential Cul-de-sac | 5.0                  | 3 Inches (3 Inches)                    | 7 Inches (4 Inches)                    |

Immediately prior to placing base, the upper 12 inches of the pavement subgrade should be scarified, brought to about optimum moisture, and compacted. Pavement subgrade and base should be compacted to at least 95 percent of the maximum dry density determined in general accordance with ASTM D1557. The City of Chula Vista now requires that asphalt concrete be compacted to between 92 and 96 percent relative compaction based on the Maximum Theoretical (Rice) unit weight determined in general accordance with ASTM D2041. Asphalt concrete should conform to the *Standard Specifications for Public Works Construction (SSPWC) Section 203-6*. Aggregate base should conform to *SSPWC Section 200-2* for crushed aggregate base.

## 8.8 Pipelines

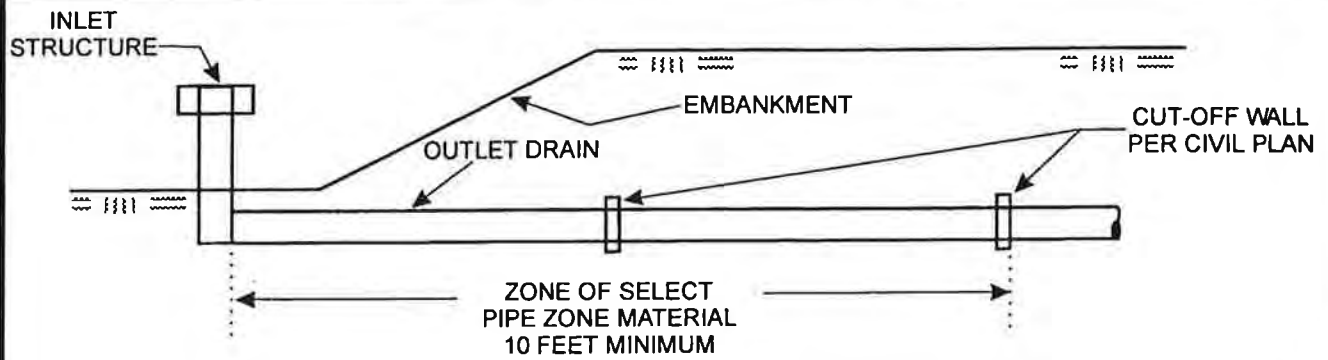
It is our understanding that the proposed development will include a variety of pipelines such as storm drains and sewers. Geotechnical aspects of pipeline design include lateral earth pressures for thrust blocks, modulus of soil reaction, and pipe bedding. Each of these parameters is discussed separately below.

8.8.1 Thrust Blocks: Lateral resistance for thrust blocks may be determined by a passive pressure value of 400 lbs/ft<sup>2</sup> for every foot of embedment, assuming a triangular pressure distribution. This value may be used for thrust blocks embedded in either compacted fill or formational materials.

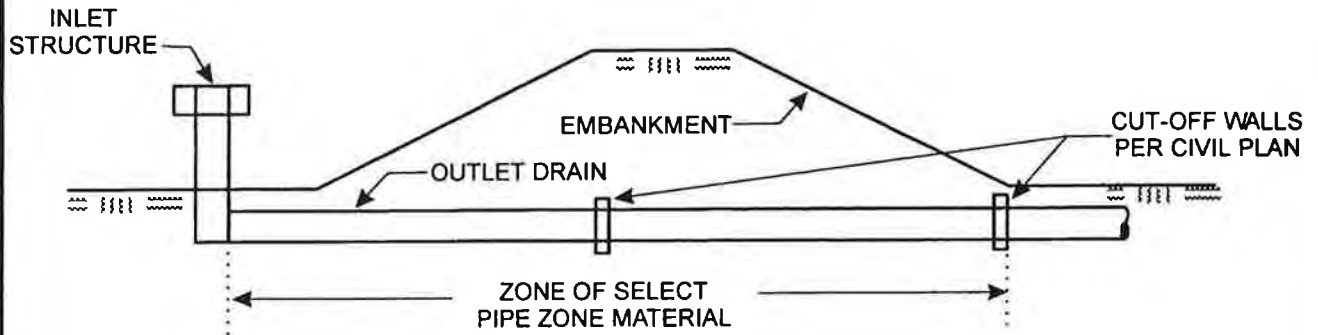
8.8.2 Modulus of Soil Reaction: The modulus of soil reaction (E') is used to characterize the stiffness of soil backfill placed along the sides of buried flexible pipelines. For the purpose of evaluating deflection due to the load associated with trench backfill over the pipe, a value of 1,500 lbs/in<sup>2</sup> is recommended for the general site conditions, assuming granular bedding material is placed adjacent to the pipe.

8.8.3 Pipe Bedding: Typical pipe bedding as specified in the *Standard Specifications for Public Works Construction* may be used. As a minimum, we recommend that pipes be supported on at least 4 inches of granular bedding material such as minus 3/4-inch crushed rock or disintegrated granite. Where pipeline or trench excavation inclinations exceed 15 percent, we do not recommend that open graded rock be used for pipe bedding or backfill because of the potential for piping and internal erosion of the overlying backfill. Our recommendations for sloping utilities are summarized in Figure 11.

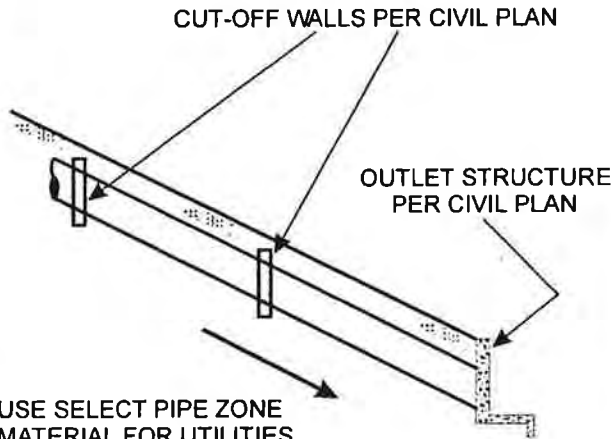
For sloping utilities, we recommend that coarse sand bedding be used, with a sand equivalent value greater than 30. Alternatively, sand-cement slurry can be used for the bedding and in the pipe zone. The slurry should consist of at least a 2-sack mix having a slump no greater than 5 inches. If the sand-cement slurry is used for the pipe bedding and as backfill to at least 1 foot over the top of the pipe, cut-off walls may not be necessary. This recommendation should be evaluated by the project civil engineer designing the pipe system.



**DESILTING AND DETENTION BASINS**



**SCHEMATIC ONLY  
NOT FOR CONSTRUCTION**



USE SELECT PIPE ZONE MATERIAL FOR UTILITIES SLOPING 15% OR MORE

**SLOPING UTILITIES**

Note: Where storm drains outlet through rip-rap protection, a suitable filter zone (or geotextile filter) should be provided to prevent erosion of bedding sand through rip-rap.

**SELECT PIPE ZONE MATERIAL**

- 1) Pipe bedding should consist of clean sand with a sand equivalent value of 30 or greater, or cement-sand slurry.
- 2) Gravel or crushed rock should not be used in the pipe zone.
- 3) Pipe zone above bedding should consist of clean sand (SE >30), cement-sand slurry, or soil.
- 4) Clean sand should be jetted in accordance with 'Green Book' Section 306.1.2.1 or otherwise compacted uniformly to 90% relative compaction.
- 5) Sand-cement slurry should consist of a two-sack mix.
- 6) Soil in pipe zone should be compacted by hand compactors to at least 90% relative compaction.

## 9.0 LIMITATIONS OF INVESTIGATION


This investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No warranty, express or implied, is made as to the conclusions and professional opinions included in this report. The samples taken and used for testing and the observations made are believed representative of the project site. However, soil and geologic conditions can vary significantly between borings. As in most projects, conditions revealed by excavation may be at variance with preliminary findings. Changed conditions must be evaluated by the geotechnical consultant.

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


The findings of this report are valid as of the present date. However, changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of man on this or adjacent properties. In addition, changes in applicable or appropriate standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.


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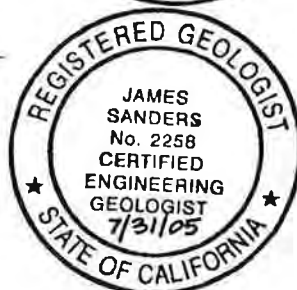
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**APPENDIX A**

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**APPENDIX B**

**SUBSURFACE EXPLORATION**

## APPENDIX B

### SUBSURFACE EXPLORATION

Field exploration consisted of a visual and geologic reconnaissance of the site, the excavation of exploratory test pits, and the drilling of exploratory borings. The exploratory test pits were excavated using a rubber-tired JD 710 backhoe mounted with a 24-inch wide bucket. Exploratory borings were conducted using a 30-inch diameter, bucket-auger drill rig. Bulk and relatively undisturbed soil samples were collected for laboratory testing. The maximum depth of exploration was 90 feet. The approximate locations of the test pits and borings are shown on the Geotechnical Map. Logs describing the subsurface conditions encountered are presented in Figures B-1 to B-70.

Relatively undisturbed samples were collected from the bucket auger borings using a 3-inch outside diameter, ring lined sampler (modified California sampler). Ring samples were sealed in plastic bags, placed in rigid plastic containers, labeled, and returned to the laboratory for testing. The relatively undisturbed samples collected from the bucket-auger borings were driven with the Kelly bar using a free fall of 12 inches. The Kelly bar weighed 4,500 pounds at depths between 0 and 27 feet; 3,500 pounds at depths between 27 and 52 feet; 2,500 pounds at depths between 52 and 80 feet; and 1,000 pounds at depths between 80 and 109 feet. For each sample, the number of blows needed to drive the sampler 12 inches was recorded on the attached logs under "blows per ft." Bulk samples were also collected from the bucket at selected intervals. Bulk samples are indicated on the boring logs with shading, whereas California ring samples are indicated with "CAL".

The boring locations were surveyed by Rick Engineering prior to commencing the subsurface exploration. Test pits were located by surveyed elevation stakes and visually estimating and pacing distances from landmarks shown on the Geotechnical Maps. The locations shown should not be considered more accurate than is implied by the method of measurement used and the scale of the map. The lines designating the interface between differing soil materials on the logs may be abrupt or gradational. Further, soil conditions at locations between the excavations may be substantially different from those at the specific locations explored. It should be recognized that the passage of time can result in changes in the soil conditions reported in our logs.

# LOG OF EXPLORATION BORING NO. 1

Logged by: JCS

Date Drilled: 9/30/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 585½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION   | LAB TESTS                               |
|------------|--------------|--------------|-------------|---------------|--------------|---|---|
| 1          |              |              |             |               |              | <b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine grained, moist, moderately indurated, massive. Caliche in upper five feet.<br><br>@ 8 feet Claystone, brown, moderately indurated, 6 inches thick. |   |
| 2          |              |              |             |               |              |   |   |
| 3          |              |              |             |               |              |   |   |
| 4          |              |              |             |               |              |   |   |
| 5          |              |              |             |               |              |   |   |
| 6          |              |              |             |               |              |   |   |
| 7          |              |              |             |               |              |   |   |
| 8          |              |              |             |               |              |   |   |
| 9          |              |              |             |               |              |   |   |
| 10         | 8/10"        |              |             | 111           | 11           |   |   |
| 11         |              | CAL          |             |               |              |   |   |
| 12         |              |              |             |               |              | Sandy siltstone, reddish orange, fine to medium grained, moist, moderately cemented, massive.   |   |
| 13         |              |              |             |               |              |   |   |
| 14         |              |              |             |               |              |   |   |
| 15         |              |              |             |               |              | Claystone, olive brown, medium plasticity, moist, moderately indurated, punky appearance, caliche modules.  |   |
| 16         |              |              |             |               |              |   |   |
| 17         |              |              |             |               |              |   |   |
| 18         |              |              |             |               |              | Siltstone/ claystone, light brown, low plasticity, moist, moderately indurated.   |   |
| 19         |              |              |             |               |              |   |   |
| 20         |              |              |             | 97            | 26           |   | Gradation<br>Hydrometer<br>Direct shear |
| 21         | 6            | CAL          |             |               |              |   |   |
| 22         |              |              |             |               |              |   |   |
| 23         |              |              |             |               |              |   |   |
| 24         |              |              |             |               |              | Silty sandstone, light brown, fine grained, low plasticity, moist, moderately cemented.   |   |
| 25         |              |              |             |               |              |   |   |
| 26         |              |              |             |               |              | Siltstone, light brown to olive brown, moist, moderately indurated, massive.  |   |
| 27         |              |              |             |               |              |   |   |
| 28         |              |              |             |               |              |   |   |
| 29         |              |              |             |               |              |   |   |
| 30         |              |              |             |               |              |   |   |

# LOG OF EXPLORATION BORING NO. 1 (continued)

Logged by: JCS

Date Drilled: 9/30/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 585½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|--|---------------------------------|
| 31         | 10           | CAL          |             | 98            | 30           | <u>OTAY FORMATION (To) continued:</u> Siltstone, light brown, moist, moderately indurated. | Unit weight<br>Moisture conten  |
| 32         |              |              |             |               |              |  |                                 |
| 33         |              |              |             |               |              |  |                                 |
| 34         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented, massive.           |                                 |
| 35         |              |              |             |               |              |  |                                 |
| 36         |              |              |             |               |              |  |                                 |
| 37         |              |              |             |               |              |  |                                 |
| 38         |              |              |             |               |              |  |                                 |
| 39         |              |              |             |               |              | Siltstone or claystone, light brown, moist, moderately indurated.                          |                                 |
| 40         |              |              |             |               |              |  |                                 |
| 41         | 11           | CAL          |             | 107           | 20           | Silty sandstone, light brown, fine grained, moist, moderately cemented.                    | Unit weight<br>Moisture conten  |
| 42         |              |              |             |               |              |  |                                 |
| 43         |              |              |             |               |              |  |                                 |
| 44         |              |              |             |               |              |  |                                 |
| 45         |              |              |             |               |              |  |                                 |
| 46         |              |              |             |               |              |  |                                 |
| 47         |              |              |             |               |              |  |                                 |
| 48         |              |              |             |               |              |  |                                 |
| 49         |              |              |             |               |              |  |                                 |
| 50         |              |              |             |               |              |  |                                 |
| 51         | 14           | CAL          |             | 109           | 18           | Siltstone, light brown, fine grained, moist, moderately cemented.                          | Unit weight<br>Moisture content |
| 52         |              |              |             |               |              |  |                                 |
| 53         |              |              |             |               |              |  |                                 |
| 54         |              |              |             |               |              |  |                                 |
| 55         |              |              |             |               |              |  |                                 |
| 56         |              |              |             |               |              |  |                                 |
| 57         |              |              |             |               |              |  |                                 |
| 58         |              |              |             |               |              |  |                                 |
| 59         |              |              |             |               |              | Silty sandstone, light brown to olive gray, fine grained, moist, moderately cemented.      |                                 |
| 60         |              |              |             |               |              |  |                                 |



# LOG OF EXPLORATION BORING NO. 1 (continued)

Logged by: JCS

Date Drilled: 9/30/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 585½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION   | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|---|---------------------------------|
| 61         | 20           | CAL          |             | 101           | 23           | <p><b>OTAY FORMATION (To) continued:</b> Siltstone or claystone, brown, low to medium plasticity, moist, moderately indurated, crowds used.</p> <hr style="border-top: 1px dashed black;"/> <p>Silty sandstone, light brown, fine grained, moist, moderately cemented, massive.</p> | Unit weight<br>Moisture content |
| 62         |              |              |             |               |              |   |                                 |
| 63         |              |              |             |               |              |   |                                 |
| 64         |              |              |             |               |              |   |                                 |
| 65         |              |              |             |               |              |   |                                 |
| 66         |              |              |             |               |              |   |                                 |
| 67         |              |              |             |               |              |   |                                 |
| 68         |              |              |             |               |              |   |                                 |
| 69         |              |              |             |               |              |   |                                 |
| 70         |              |              |             |               |              |   |                                 |
| 71         |              |              |             |               |              | Total Depth: 70 feet<br>No Groundwater  |                                 |
| 72         |              |              |             |               |              |   |                                 |
| 73         |              |              |             |               |              |   |                                 |
| 74         |              |              |             |               |              |   |                                 |
| 75         |              |              |             |               |              |   |                                 |
| 76         |              |              |             |               |              |   |                                 |
| 77         |              |              |             |               |              |   |                                 |
| 78         |              |              |             |               |              |   |                                 |
| 79         |              |              |             |               |              |   |                                 |
| 80         |              |              |             |               |              |   |                                 |
| 81         |              |              |             |               |              |   |                                 |
| 82         |              |              |             |               |              |   |                                 |
| 83         |              |              |             |               |              |   |                                 |
| 84         |              |              |             |               |              |   |                                 |
| 85         |              |              |             |               |              |   |                                 |
| 86         |              |              |             |               |              |   |                                 |
| 87         |              |              |             |               |              |   |                                 |
| 88         |              |              |             |               |              |   |                                 |
| 89         |              |              |             |               |              |   |                                 |
| 90         |              |              |             |               |              |   |                                 |

# LOG OF EXPLORATION BORING NO. 2

Logged by: JCS

Date Drilled: 9/30/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 584 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION   | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|---|---------------------------------|
| 1          |              |              |             |               |              | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), light brown, medium to fine, moist, moderately cemented.   |                                 |
| 2          |              |              |             |               |              |   |                                 |
| 3          |              |              |             |               |              | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, moist, moderately indurated. |                                 |
| 4          |              |              |             |               |              |   |                                 |
| 5          |              |              |             |               |              | Claystone, olive brown to brown, medium plasticity, moist, moderately indurated.                      |                                 |
| 6          |              |              |             |               |              |   |                                 |
| 7          |              |              |             |               |              | @ 34 feet Becomes brown.  |                                 |
| 8          |              |              |             |               |              |   |                                 |
| 9          |              |              |             |               |              |   |                                 |
| 10         | 2            | CAL          |             | 104           | 24           | Siltstone/ claystone, brown, medium plasticity, moist, moderately indurated.                          | Unit weight<br>Moisture content |
| 11         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented.                               |                                 |
| 12         |              |              |             |               |              |   |                                 |
| 13         |              |              |             |               |              | Siltstone, olive brown, moist, moderately indurated, massive.   |                                 |
| 14         |              |              |             |               |              |   |                                 |
| 15         |              |              |             |               |              |   |                                 |
| 16         |              |              |             |               |              |   |                                 |
| 17         |              |              |             |               |              |   |                                 |
| 18         |              |              |             |               |              |   |                                 |
| 19         |              |              |             |               |              |   |                                 |
| 20         | 3            | CAL          |             | 86            | 20           | Silty sandstone, light brown, fine, moist, moderately cemented.                                       | Unit weight<br>Moisture content |
| 21         |              |              |             |               |              |   |                                 |
| 22         |              |              |             |               |              |   |                                 |
| 23         |              |              |             |               |              |   |                                 |
| 24         |              |              |             |               |              |   |                                 |
| 25         |              |              |             |               |              | Siltstone, brown, moist, moderately indurated.  |                                 |
| 26         |              |              |             |               |              |   |                                 |
| 27         |              |              |             |               |              |   |                                 |
| 28         |              |              |             |               |              | Claystone, light gray to brown, medium plasticity, moist, moderately indurated.                       |                                 |
| 29         |              |              |             |               |              |   |                                 |
| 30         |              |              |             |               |              |   |                                 |



# LOG OF EXPLORATION BORING NO. 3

Logged by: JCS

Date Drilled: 10/1/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 595 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS   |
|------------|--------------|--------------|-------------|---------------|--------------|--|---|
| 1          |              |              |             |               |              | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine, dry to moist, moderately cemented, massive.                  |   |
| 2          |              |              |             |               |              | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, dry to moist, moderately cemented, massive. |   |
| 3          |              |              |             |               |              |  |   |
| 4          |              |              |             |               |              |  |   |
| 5          |              |              |             |               |              |  |   |
| 6          |              |              |             |               |              |  |   |
| 7          |              |              |             |               |              |  |   |
| 8          |              |              |             |               |              |  |   |
| 9          |              |              |             |               |              |  |   |
| 10         | 2            | CAL          |             | 90            | 25           |  | Claystone, brown, medium plasticity, moist, moderately indurated. |
| 11         |              |              |             |               |              |  |   |
| 12         |              |              |             |               |              |  |   |
| 13         |              |              |             |               |              |  |   |
| 14         |              |              |             |               |              | Siltstone, brown, medium plasticity, moderately indurated.   |   |
| 15         |              |              |             |               |              |  |   |
| 16         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented.  |   |
| 17         |              |              |             |               |              |  |   |
| 18         |              |              |             |               |              |  |   |
| 19         |              |              |             |               |              |  |   |
| 20         | 6            | CAL          |             | 112           | 19           | Siltstone, light brown, moist, moderately indurated.   | Unit weight<br>Moisture content                                   |
| 21         |              |              |             |               |              |  |   |
| 22         |              |              |             |               |              |  |   |
| 23         |              |              |             |               |              | Claystone, brown, medium plasticity, moist, moderately indurated.  |   |
| 24         |              |              |             |               |              |  |   |
| 25         |              |              |             |               |              |  |   |
| 26         |              |              |             |               |              | @ 26 feet Interbedded claystone or siltstone, brown to olive brown, moist, medium plasticity, moderately indurated.  |   |
| 27         |              |              |             |               |              |  |   |
| 28         |              |              |             |               |              |  |   |
| 29         |              |              |             |               |              |  |   |
| 30         |              |              |             |               |              |  |   |

# LOG OF EXPLORATION BORING NO. 3 (continued)

Logged by: JCS

Date Drilled: 10/1/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 595 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                                  |
|------------|--------------|--------------|-------------|---------------|--------------|--|--|
| 31         | 7/6"         | CAL          |             | 106           | 8            | <b>OTAY FORMATION (To) continued:</b> Interbedded claystone/ siltstone, light brown, medium plasticity, moist, moderately indurated.               | Unit weight<br>Moisture content<br>R-Value |
| 32         |              |              |             |               |              | Siltstone, gray, fine grained, moist, moderately cemented.   |  |
| 33         |              |              |             |               |              | @ 33 feet Red to orange iron oxide stained beds.   |  |
| 34         |              |              |             |               |              |  |  |
| 35         |              |              |             |               |              | Claystone, brown, medium plasticity, moist, moderately indurated.  |  |
| 36         |              |              |             |               |              |  |  |
| 37         |              |              |             |               |              | Siltstone, brown to olive brown, moist, moderately indurated, massive, interbedded claystone, brown, high plasticity, moist, moderately indurated. |  |
| 38         |              |              |             |               |              |  |  |
| 39         |              |              |             |               |              |  |  |
| 40         |              | CAL          |             | 116           | 11           |  |  |
| 41         | 12           |              |             |               |              |  |  |
| 42         |              |              |             |               |              |  |  |
| 43         |              |              |             |               |              |  |  |
| 44         |              |              |             |               |              |  |  |
| 45         |              |              |             |               |              | @ 46½ feet Bentonite claystone, gray to pink, 6 inches thick.  |  |
| 46         |              |              |             |               |              |  |  |
| 47         |              |              |             |               |              |  |  |
| 48         |              |              |             |               |              |  |  |
| 49         |              |              |             |               |              |  |  |
| 50         |              |              |             |               |              |  |  |
| 51         |              |              |             |               |              | Total Depth: 50 feet<br>No Groundwater   |  |
| 52         |              |              |             |               |              |  |  |
| 53         |              |              |             |               |              |  |  |
| 54         |              |              |             |               |              |  |  |
| 55         |              |              |             |               |              |  |  |
| 56         |              |              |             |               |              |  |  |
| 57         |              |              |             |               |              |  |  |
| 58         |              |              |             |               |              |  |  |
| 59         |              |              |             |               |              |  |  |
| 60         |              |              |             |               |              |  |  |

# LOG OF EXPLORATION BORING NO. 4

Logged by: JCS

Date Drilled: 10/1/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 605 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                     |
|------------|--------------|--------------|-------------|---------------|--------------|--|-------------------------------|
| 1          |              |              |             |               |              | <u>COLLUVIUM (Qcol)</u> : Silty sandstone (SM), brown, fine grained, dry, loose.                     |                               |
| 2          |              |              |             |               |              |  |                               |
| 3          |              |              |             |               |              | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, moist, moderately cemented. |                               |
| 4          |              |              |             |               |              |  |                               |
| 5          |              |              |             |               |              |  |                               |
| 6          |              |              |             |               |              |  |                               |
| 7          |              |              |             |               |              | Claystone, light brown, moist, moderately indurated.   |                               |
| 8          |              |              |             |               |              |  |                               |
| 9          |              |              |             |               |              |  |                               |
| 10         | 4/9"         | CAL          |             | 115           | 16           | Siltstone, light brown, moist, moderately indurated.   | Unit weight<br>Moisture coner |
| 11         |              |              |             |               |              |  |                               |
| 12         |              |              |             |               |              |  |                               |
| 13         |              |              |             |               |              | @ 13 feet Claystone, 6 inches thick, brown, moist, moderately indurated.                             |                               |
| 14         |              |              |             |               |              |  |                               |
| 15         |              |              |             |               |              | Silty sandstone, gray, fine grained, moist, moderately cemented.                                     |                               |
| 16         |              |              |             |               |              |  |                               |
| 17         |              |              |             |               |              | @ 17 feet Claystone, 18 inches thick, brown, medium to high plasticity, moist, moderately indurated. |                               |
| 18         |              |              |             |               |              |  |                               |
| 19         |              |              |             |               |              | Interbedded siltstone, light brown, moist, moderately indurated.                                     |                               |
| 20         | 6/10"        | CAL          |             | 109           | 14           |  | Gradation<br>Direct shear     |
| 21         |              |              |             |               |              |  |                               |
| 22         |              |              |             |               |              | @ 23 feet Siltstone bed, 12 inches thick, light brown, moderately indurated.                         |                               |
| 23         |              |              |             |               |              |  |                               |
| 24         |              |              |             |               |              |  |                               |
| 25         |              |              |             |               |              |  |                               |
| 26         |              |              |             |               |              | Claystone, olive brown, medium plasticity, moist, moderately indurated.                              |                               |
| 27         |              |              |             |               |              |  |                               |
| 28         |              |              |             |               |              | Interbedded claystone/ siltstone, olive brown, medium plasticity, moderately indurated.              |                               |
| 29         |              |              |             |               |              |  |                               |
| 30         |              |              |             |               |              |  |                               |

# LOG OF EXPLORATION BORING NO. 4 (continued)

Logged by: JCS

Date Drilled: 10/1/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 605 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION   | LAB TESTS  |
|------------|--------------|--------------|-------------|---------------|--------------|---|--|
| 31         | 14/6"        | CAL          |             | 109           | 10           | <u>OTAY FORMATION (To) continued:</u> Siltstone, brown, moist, moderately indurated, massive.                                       | Gradation<br>Direct shear  |
| 32         |              |              |             |               |              |   |  |
| 33         |              |              |             |               |              |   |  |
| 34         |              |              |             |               |              | Grades to claystone, brown, high plasticity, moist, moderately indurated.   | Gradation<br>Hydrometer<br>Atterberg Limits<br>Soluble Sulfate<br>pH and Resistivity<br>Expansion index<br>R-Value |
| 35         |              |              |             |               |              |   |  |
| 36         |              |              |             |               |              |   |  |
| 37         |              |              |             |               |              |   |  |
| 38         |              |              |             |               |              |   |  |
| 39         |              |              |             |               |              |   |  |
| 40         |              |              |             |               |              |   |  |
| 41         |              |              |             |               |              |   |  |
| 42         |              |              |             |               |              | Silty sandstone, reddish gray, fine grained, moist, moderately cemented.  |  |
| 43         |              |              |             |               |              |   |  |
| 44         |              |              |             |               |              |   |  |
| 45         |              |              |             |               |              |   |  |
| 46         |              |              |             |               |              |   |  |
| 47         |              |              |             |               |              |   |  |
| 48         |              |              |             |               |              | Siltstone, olive brown, moist, moderately indurated.  |  |
| 49         |              |              |             |               |              |   |  |
| 50         |              |              |             |               |              |   |  |
| 51         |              |              |             |               |              |   |  |
| 52         |              |              |             |               |              | Silty sandstone, gray, fine grained, moist, moderately cemented.  |  |
| 53         |              |              |             |               |              |   |  |
| 54         |              |              |             |               |              |   |  |
| 55         |              |              |             |               |              |   |  |
| 56         |              |              |             |               |              | @ 56½ feet Bentonite claystone, 6 inches thick, gray and pink, moderately indurated, locally fractured, 1 inch spacing from bucket. |  |
| 57         |              |              |             |               |              |   |  |
| 58         |              |              |             |               |              | Siltstone, olive brown, moist, moderately indurated.  |  |
| 59         |              |              |             |               |              |   |  |
| 60         |              |              |             |               |              |   |  |

# LOG OF EXPLORATION BORING NO. 4 (continued)

Logged by: JCS

Date Drilled: 10/1/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 605 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION                            | LAB TESTS |
|------------|--------------|--------------|-------------|---------------|--------------|--|-----------|
| 61         |              |              |             |               |              | Total Depth: 60 feet<br>No Groundwater |           |
| 62         |              |              |             |               |              |  |           |
| 63         |              |              |             |               |              |  |           |
| 64         |              |              |             |               |              |  |           |
| 65         |              |              |             |               |              |  |           |
| 66         |              |              |             |               |              |  |           |
| 67         |              |              |             |               |              |  |           |
| 68         |              |              |             |               |              |  |           |
| 69         |              |              |             |               |              |  |           |
| 70         |              |              |             |               |              |  |           |
| 71         |              |              |             |               |              |  |           |
| 72         |              |              |             |               |              |  |           |
| 73         |              |              |             |               |              |  |           |
| 74         |              |              |             |               |              |  |           |
| 75         |              |              |             |               |              |  |           |
| 76         |              |              |             |               |              |  |           |
| 77         |              |              |             |               |              |  |           |
| 78         |              |              |             |               |              |  |           |
| 79         |              |              |             |               |              |  |           |
| 80         |              |              |             |               |              |  |           |
| 81         |              |              |             |               |              |  |           |
| 82         |              |              |             |               |              |  |           |
| 83         |              |              |             |               |              |  |           |
| 84         |              |              |             |               |              |  |           |
| 85         |              |              |             |               |              |  |           |
| 86         |              |              |             |               |              |  |           |
| 87         |              |              |             |               |              |  |           |
| 88         |              |              |             |               |              |  |           |
| 89         |              |              |             |               |              |  |           |
| 90         |              |              |             |               |              |  |           |



# LOG OF EXPLORATION BORING NO. 5

Logged by: JCS

Date Drilled: 9/29/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 531 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS  |
|------------|--------------|--------------|-------------|---------------|--------------|--|--|
| 1          |              |              |             |               |              | <b>COLLUVIUM (Qcol):</b> Silty sand (SM), brown, fine to medium, dry, roots, caliche blebs.                                  |  |
| 2          |              |              |             |               |              |  |  |
| 3          |              |              |             |               |              | <b>OTAY FORMATION (To):</b> Silty sandstone/sandy siltstone, light brown, fine grained, moist, moderately cemented, massive. |  |
| 4          |              |              |             |               |              |  |  |
| 5          | 8            | CAL          |             | 110           | 10           |  | Unit weight<br>Moisture content<br>Gradation<br>Atterberg Limits<br>Soluble Sulfate<br>pH and Resistivity<br>Maximum density<br>Remolded shear |
| 6          |              |              |             |               |              |  |  |
| 7          |              |              |             |               |              |  |  |
| 8          |              |              |             |               |              |  |  |
| 9          |              |              |             |               |              |  |  |
| 10         | 7            | CAL          |             | 111           | 15           |  |  |
| 11         |              |              |             |               |              |  |  |
| 12         |              |              |             |               |              |  |  |
| 13         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated.   |  |
| 14         |              |              |             |               |              |  |  |
| 15         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented.  |  |
| 16         |              |              |             |               |              |  |  |
| 17         |              |              |             |               |              |  |  |
| 18         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.  |  |
| 19         |              |              |             |               |              |  |  |
| 20         | 6            | CAL          |             | 107           | 18           |  | Unit weight<br>Moisture content  |
| 21         |              |              |             |               |              |  |  |
| 22         |              |              |             |               |              |  |  |
| 23         |              |              |             |               |              |  |  |
| 24         |              |              |             |               |              |  |  |
| 25         |              |              |             |               |              | Silty sandstone or sandy siltstone, light brown, fine grained, moist, moderately cemented.                                   |  |
| 26         |              |              |             |               |              |  |  |
| 27         |              |              |             |               |              |  |  |
| 28         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.  |  |
| 29         |              |              |             |               |              |  |  |
| 30         |              |              |             |               |              |  |  |

# LOG OF EXPLORATION BORING NO. 5 (continued)

Logged by: JCS

Date Drilled: 9/29/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 531 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|--|---------------------------------|
| 31         | 5            | CAL          |             | 88            | 33           | <b>OTAY FORMATION (To):</b> Siltstone, light brown, moist, moderately indurated, massive, some cemented zones up to 12 inches thick. | Direct shear                    |
| 32         |              |              |             |               |              |  |                                 |
| 33         |              |              |             |               |              |  |                                 |
| 34         |              |              |             |               |              |  |                                 |
| 35         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented, few strongly cemented zones up to 12 inches thick.           |                                 |
| 36         |              |              |             |               |              |  |                                 |
| 37         |              |              |             |               |              |  |                                 |
| 38         |              |              |             |               |              |  |                                 |
| 39         |              |              |             |               |              |  |                                 |
| 40         | 15/3"        | CAL          |             |               |              |  |                                 |
| 41         |              |              |             |               |              |  |                                 |
| 42         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.  |                                 |
| 43         |              |              |             |               |              |  |                                 |
| 44         |              |              |             |               |              |  |                                 |
| 45         |              |              |             |               |              |  |                                 |
| 46         |              |              |             |               |              |  |                                 |
| 47         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented, massive.   |                                 |
| 48         |              |              |             |               |              |  |                                 |
| 49         |              |              |             |               |              |  |                                 |
| 50         | 15/10"       | CAL          |             | 114           | 11           |  | Unit weight<br>Moisture content |
| 51         |              |              |             |               |              |  |                                 |
| 52         |              |              |             |               |              |  |                                 |
| 53         |              |              |             |               |              |  |                                 |
| 54         |              |              |             |               |              |  |                                 |
| 55         |              |              |             |               |              |  |                                 |
| 56         |              |              |             |               |              |  |                                 |
| 57         |              |              |             |               |              |  |                                 |
| 58         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.  |                                 |
| 59         |              |              |             |               |              |  |                                 |
| 60         |              |              |             |               |              |  |                                 |

# LOG OF EXPLORATION BORING NO. 5 (continued)

Logged by: JCS

Date Drilled: 9/29/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 531 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|--|---------------------------------|
| 61         | 30/10"       | CAL          |             | 114           | 15           | <u>OTAY FORMATION (To):</u> Siltstone, light brown, moist, moderately indurated.   | Unit weight<br>Moisture content |
| 62         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented, massive, few strongly cemented layers up to 12 inches thick. |                                 |
| 63         |              |              |             |               |              |  |                                 |
| 64         |              |              |             |               |              |  |                                 |
| 65         |              |              |             |               |              |  |                                 |
| 66         |              |              |             |               |              |  |                                 |
| 67         |              |              |             |               |              |  |                                 |
| 68         |              |              |             |               |              |  |                                 |
| 69         |              |              |             |               |              |  |                                 |
| 70         | 20/6"        | CAL          |             | 121           | 9            |  | Unit weight<br>Moisture content |
| 71         |              |              |             |               |              |  |                                 |
| 72         |              |              |             |               |              |  |                                 |
| 73         |              |              |             |               |              |  |                                 |
| 74         |              |              |             |               |              |  |                                 |
| 75         |              |              |             |               |              |  |                                 |
| 76         |              |              |             |               |              |  |                                 |
| 77         |              |              |             |               |              |  |                                 |
| 78         |              |              |             |               |              |  |                                 |
| 79         |              |              |             |               |              |  |                                 |
| 80         | 20/6"        | CAL          |             | 102           | 8            |  | Direct shear                    |
| 81         |              |              |             |               |              |  |                                 |
| 82         |              |              |             |               |              |  |                                 |
| 83         |              |              |             |               |              |  |                                 |
| 84         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.  |                                 |
| 85         |              |              |             |               |              |  |                                 |
| 86         |              |              |             |               |              |  |                                 |
| 87         |              |              |             |               |              |  |                                 |
| 88         |              |              |             |               |              | Siltstone, reddish brown, moist, moderately indurated, thinly bedded (less than 6 inches).   |                                 |
| 89         |              |              |             |               |              |  |                                 |
| 90         |              |              |             |               |              |  |                                 |

# LOG OF EXPLORATION BORING NO. 5 (continued)

Logged by: JCS

Date Drilled: 9/29/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 531 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION                            | LAB TESTS |
|------------|--------------|--------------|-------------|---------------|--------------|--|-----------|
| 91         |              |              |             |               |              | Total Depth: 90 feet<br>No Groundwater |           |
| 92         |              |              |             |               |              |  |           |
| 93         |              |              |             |               |              |  |           |
| 94         |              |              |             |               |              |  |           |
| 95         |              |              |             |               |              |  |           |
| 96         |              |              |             |               |              |  |           |
| 97         |              |              |             |               |              |  |           |
| 98         |              |              |             |               |              |  |           |
| 99         |              |              |             |               |              |  |           |
| 100        |              |              |             |               |              |  |           |
| 101        |              |              |             |               |              |  |           |
| 102        |              |              |             |               |              |  |           |
| 103        |              |              |             |               |              |  |           |
| 104        |              |              |             |               |              |  |           |
| 105        |              |              |             |               |              |  |           |
| 106        |              |              |             |               |              |  |           |
| 107        |              |              |             |               |              |  |           |
| 108        |              |              |             |               |              |  |           |
| 109        |              |              |             |               |              |  |           |
| 110        |              |              |             |               |              |  |           |
| 111        |              |              |             |               |              |  |           |
| 112        |              |              |             |               |              |  |           |
| 113        |              |              |             |               |              |  |           |
| 114        |              |              |             |               |              |  |           |
| 115        |              |              |             |               |              |  |           |
| 116        |              |              |             |               |              |  |           |
| 117        |              |              |             |               |              |  |           |
| 118        |              |              |             |               |              |  |           |
| 119        |              |              |             |               |              |  |           |
| 120        |              |              |             |               |              |  |           |

# LOG OF EXPLORATION BORING NO. 6

Logged by: JCS

Date Drilled: 10/2/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 556 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                    |
|------------|--------------|--------------|-------------|---------------|--------------|--|------------------------------|
| 1          |              |              |             |               |              | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine, dry, loose.  |                              |
| 2          |              |              |             |               |              | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, dry to moist, moderately cemented, caliche.   |                              |
| 3          |              |              |             |               |              |  |                              |
| 4          |              |              |             |               |              | Silty sandstone, light brown, moist, moderately indurated.   |                              |
| 5          |              |              |             |               |              |  |                              |
| 6          |              |              |             |               |              |  |                              |
| 7          |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented.  |                              |
| 8          |              |              |             |               |              |  |                              |
| 9          |              |              |             |               |              | @ 9 feet Claystone, brown, 6 inches thick, medium to high plasticity, moderately indurated.  |                              |
| 10         |              |              |             |               |              | Siltstone or claystone, brown, moist, moderately indurated.  |                              |
| 11         |              |              |             |               |              |  |                              |
| 12         |              |              |             |               |              |  |                              |
| 13         |              |              |             |               |              |  |                              |
| 14         |              |              |             |               |              | Siltstone, light brown to olive brown, moist, moderately indurated, massive.   |                              |
| 15         |              |              |             |               |              |  |                              |
| 16         |              |              |             |               |              |  |                              |
| 17         |              |              |             |               |              |  |                              |
| 18         |              |              |             |               |              |  |                              |
| 19         |              |              |             |               |              |  |                              |
| 20         | 4            | CAL          |             | 111           | 17           | Silty sandstone/sandy siltstone, light brown to gray, fine grained, moist, moderately cemented, massive, few strongly cemented layers up to 12 inches thick. | Direct shear                 |
| 21         |              |              |             |               |              |  |                              |
| 22         |              |              |             |               |              |  |                              |
| 23         |              |              |             |               |              |  |                              |
| 24         |              |              |             |               |              |  |                              |
| 25         |              |              |             |               |              |  | Gradation<br>Expansion index |
| 26         |              |              |             |               |              |  |                              |
| 27         |              |              |             |               |              |  |                              |
| 28         |              |              |             |               |              |  |                              |
| 29         |              |              |             |               |              |  |                              |
| 30         |              |              |             |               |              |  |                              |

# LOG OF EXPLORATION BORING NO. 6 (continued)

Logged by: JCS

Date Drilled: 10/2/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 556 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|--|---------------------------------|
| 31         | 14           | CAL          |             | 108           | 16           | <p><b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine grained, moist, moderately indurated.</p> <hr style="border-top: 1px dashed black;"/> <p>Siltstone, light brown, moist, moderately indurated, massive.</p> | Unit weight<br>Moisture conten  |
| 32         |              |              |             |               |              |  |                                 |
| 33         |              |              |             |               |              |  |                                 |
| 34         |              |              |             |               |              |  |                                 |
| 35         |              |              |             |               |              |  |                                 |
| 36         |              |              |             |               |              |  |                                 |
| 37         |              |              |             |               |              |  |                                 |
| 38         |              |              |             |               |              |  |                                 |
| 39         |              |              |             |               |              |  |                                 |
| 40         | 14           | CAL          |             | 106           | 22           | <p>Silty sandstone, light brown, fine grained, moist, moderately cemented.</p> <hr style="border-top: 1px dashed black;"/> <p>Siltstone, light brown, moist, moderately indurated, massive.</p>                              | Unit weight<br>Moisture conten  |
| 41         |              |              |             |               |              |  |                                 |
| 42         |              |              |             |               |              |  |                                 |
| 43         |              |              |             |               |              |  |                                 |
| 44         |              |              |             |               |              |  |                                 |
| 45         |              |              |             |               |              |  |                                 |
| 46         |              |              |             |               |              |  |                                 |
| 47         |              |              |             |               |              |  |                                 |
| 48         |              |              |             |               |              |  |                                 |
| 49         |              |              |             |               |              |  |                                 |
| 50         | 11           | CAL          |             | 100           | 24           | <p>Siltstone, light brown, moist, moderately indurated, massive.</p>   | Unit weight<br>Moisture content |
| 51         |              |              |             |               |              |  |                                 |
| 52         |              |              |             |               |              |  |                                 |
| 53         |              |              |             |               |              |  |                                 |
| 54         |              |              |             |               |              |  |                                 |
| 55         |              |              |             |               |              |  |                                 |
| 56         |              |              |             |               |              |  |                                 |
| 57         |              |              |             |               |              |  |                                 |
| 58         |              |              |             |               |              |  |                                 |
| 59         |              |              |             |               |              |  |                                 |
| 60         |              |              |             |               |              |  |                                 |

# LOG OF EXPLORATION BORING NO. 6 (continued)

Logged by: JCS

Date Drilled: 10/2/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 556 Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                       |
|------------|--------------|--------------|-------------|---------------|--------------|--|---------------------------------|
| 61         | 12           | CAL          |             | 88            | 33           | <b>OTAY FORMATION (To):</b> Siltstone, light brown, moist, moderately indurated, massive.                                  | Unit weight<br>Moisture content |
| 62         |              |              |             |               |              |  |                                 |
| 63         |              |              |             |               |              |  |                                 |
| 64         |              |              |             |               |              |  |                                 |
| 65         |              |              |             |               |              |  |                                 |
| 66         |              |              |             |               |              |  |                                 |
| 67         | 30/8"        |              |             | 112           | 16           | Silty sandstone, light gray, fine grained, moist, moderately cemented, few strongly cemented layers up to 12 inches thick. | Unit weight<br>Moisture content |
| 68         |              |              |             |               |              |  |                                 |
| 69         |              |              |             |               |              |  |                                 |
| 70         |              |              |             |               |              |  |                                 |
| 71         |              |              |             |               |              |  |                                 |
| 72         |              |              |             |               |              |  |                                 |
| 73         |              |              |             |               |              |  |                                 |
| 74         |              |              |             |               |              |  |                                 |
| 75         |              |              |             |               |              |  |                                 |
| 76         |              |              |             |               |              |  |                                 |
| 77         |              |              |             |               |              |  |                                 |
| 78         |              |              |             |               |              |  |                                 |
| 79         |              |              |             |               |              |  |                                 |
| 80         |              |              |             |               |              |  |                                 |
| 81         |              |              |             |               |              |  |                                 |
| 82         |              |              |             |               |              |  |                                 |
| 83         |              |              |             |               |              |  |                                 |
| 84         |              |              |             |               |              |  |                                 |
| 85         |              |              |             |               |              |  |                                 |
| 86         |              |              |             |               |              |  |                                 |
| 87         |              |              |             |               |              |  |                                 |
| 88         |              |              |             |               |              |  |                                 |
| 89         |              |              |             |               |              | Total Depth: 88 feet<br>No Groundwater   |                                 |
| 90         |              |              |             |               |              |  |                                 |

# LOG OF EXPLORATION BORING NO. 7

Logged by: JCS

Date Drilled: 10/3/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 591½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS  |
|------------|--------------|--------------|-------------|---------------|--------------|--|--|
| 1          |              |              |             |               |              | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine, dry, loose, roots, caliche blebs.            |  |
| 2          |              |              |             |               |              | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, moist, moderately cemented. |  |
| 3          |              |              |             |               |              |  |  |
| 4          |              |              |             |               |              |  |  |
| 5          |              |              |             |               |              |  |  |
| 6          |              |              |             |               |              |  |  |
| 7          |              |              |             |               |              |  |  |
| 8          |              |              |             |               |              |  |  |
| 9          |              |              |             |               |              |  |  |
| 10         | 2            | CAL          |             | 98            | 27           |  | Siltstone, light brown, moist, moderately indurated. |
| 11         |              |              |             |               |              |  |  |
| 12         |              |              |             |               |              |  |  |
| 13         |              |              |             |               |              |  |  |
| 14         |              |              |             |               |              |  |  |
| 15         |              |              |             |               |              | Claystone, brown, medium plasticity, moist, moderately indurated.                                    |  |
| 16         |              |              |             |               |              |  |  |
| 17         |              |              |             |               |              |  |  |
| 18         |              |              |             |               |              | Silty sandstone, light brown to gray, fine grained, moist, moderately cemented.                      |  |
| 19         |              |              |             |               |              |  |  |
| 20         | 5/6"         | CAL          |             | 120           | 15           | Siltstone, light brown, moist, moderately indurated, massive.  | Unit weight<br>Moisture conten                       |
| 21         |              |              |             |               |              |  |  |
| 22         |              |              |             |               |              |  |  |
| 23         |              |              |             |               |              |  |  |
| 24         |              |              |             |               |              |  |  |
| 25         |              |              |             |               |              |  |  |
| 26         |              |              |             |               |              |  |  |
| 27         |              |              |             |               |              |  |  |
| 28         |              |              |             |               |              |  |  |
| 29         |              |              |             |               |              |  |  |
| 30         |              |              |             |               |              |  |  |



# LOG OF EXPLORATION BORING NO. 7 (continued)

Logged by: JCS

Date Drilled: 10/3/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 591½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS   |
|------------|--------------|--------------|-------------|---------------|--------------|--|---|
| 31         | 5/6"         | CAL          |             | 120           | 15           | <b>OTAY FORMATION (To):</b> Siltstone, light brown, moist, moderately indurated, massive.  | Unit weight<br>Moisture content   |
| 32         |              |              |             |               |              |  |   |
| 33         |              |              |             |               |              |  |   |
| 34         |              |              |             |               |              |  |   |
| 35         |              |              |             |               |              |  |   |
| 36         |              |              |             |               |              |  |   |
| 37         |              |              |             |               |              |  |   |
| 38         |              |              |             |               |              |  |   |
| 39         |              |              |             |               |              |  |   |
| 40         | 12           | CAL          |             | 105           | 21           |  | Direct shear<br>Expansion index   |
| 41         |              |              |             |               |              |  |   |
| 42         |              |              |             |               |              |  |   |
| 43         |              |              |             |               |              | Silty sandstone, olive brown, fine to medium, moist, moderately cemented.  | Gradation<br>Hydrometer<br>Atterberg Limits<br>R-Value                                |
| 44         |              |              |             |               |              |  |   |
| 45         |              |              |             |               |              |  |   |
| 46         |              |              |             |               |              |  |   |
| 47         |              |              |             |               |              | Silty sandstone/sandy siltstone, light brown, gray, fine grained, moist, moderately cemented, few strongly cemented layers up to 6 inches thick. |   |
| 48         |              |              |             |               |              |  |   |
| 49         |              |              |             |               |              |  |   |
| 50         | 15/10"       | CAL          |             | 106           | 9            |  | Gradation<br>Soluble Sulfate<br>pH and Resistivity<br>Direct shear<br>Expansion index |
| 51         |              |              |             |               |              |  |   |
| 52         |              |              |             |               |              |  |   |
| 53         |              |              |             |               |              |  |   |
| 54         |              |              |             |               |              |  |   |
| 55         |              |              |             |               |              |  |   |
| 56         |              |              |             |               |              | Siltstone, light brown to olive brown, moist, moderately indurated.  |   |
| 57         |              |              |             |               |              |  |   |
| 58         |              |              |             |               |              |  |   |
| 59         |              |              |             |               |              |  |   |
| 60         |              | CAL          |             |               |              |  |   |

# LOG OF EXPLORATION BORING NO. 7 (continued)

Logged by: JCS

Date Drilled: 10/3/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 591½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION                            | LAB TESTS                      |
|------------|--------------|--------------|-------------|---------------|--------------|--|--------------------------------|
| 61         | 30           | CAL          |             | 96            | 27           | Total Depth: 61 feet<br>No Groundwater | Unit weight<br>Moisture conten |
| 62         |              |              |             |               |              |  |                                |
| 63         |              |              |             |               |              |  |                                |
| 64         |              |              |             |               |              |  |                                |
| 65         |              |              |             |               |              |  |                                |
| 66         |              |              |             |               |              |  |                                |
| 67         |              |              |             |               |              |  |                                |
| 68         |              |              |             |               |              |  |                                |
| 69         |              |              |             |               |              |  |                                |
| 70         |              |              |             |               |              |  |                                |
| 71         |              |              |             |               |              |  |                                |
| 72         |              |              |             |               |              |  |                                |
| 73         |              |              |             |               |              |  |                                |
| 74         |              |              |             |               |              |  |                                |
| 75         |              |              |             |               |              |  |                                |
| 76         |              |              |             |               |              |  |                                |
| 77         |              |              |             |               |              |  |                                |
| 78         |              |              |             |               |              |  |                                |
| 79         |              |              |             |               |              |  |                                |
| 80         |              |              |             |               |              |  |                                |
| 81         |              |              |             |               |              |  |                                |
| 82         |              |              |             |               |              |  |                                |
| 83         |              |              |             |               |              |  |                                |
| 84         |              |              |             |               |              |  |                                |
| 85         |              |              |             |               |              |  |                                |
| 86         |              |              |             |               |              |  |                                |
| 87         |              |              |             |               |              |  |                                |
| 88         |              |              |             |               |              |  |                                |
| 89         |              |              |             |               |              |  |                                |
| 90         |              |              |             |               |              |  |                                |

# LOG OF EXPLORATION BORING NO. 8

Logged by: JCS

Date Drilled: 10/3/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 571½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION  | LAB TESTS                                  |   |
|------------|--------------|--------------|-------------|---------------|--------------|--|--|---|
| 1          | 30           | CAL          |             | 96            | 27           | <b>COLLUVIUM (Qcol):</b> Silty sand (SM), dark brown, fine, dry, loose.        | Unit weight<br>Moisture content            |   |
| 2          |              |              |             |               |              |  |  |   |
| 3          |              |              |             |               |              |  |  | <b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine grained, moist, moderately cemented. |
| 4          |              |              |             |               |              |  |  |   |
| 5          |              |              |             |               |              |  |  |   |
| 6          |              |              |             |               |              |  |  |   |
| 7          |              |              |             |               |              | Siltstone, olive brown, moist, moderately cemented.                            |  |   |
| 8          |              |              |             |               |              |  | Gradation<br>Hydrometer<br>Expansion index |   |
| 9          |              |              |             |               |              |  |  |   |
| 10         | 2            | CAL          |             | 112           | 14           |  |  |   |
| 11         |              |              |             |               |              |  |  | Unit weight<br>Moisture content   |
| 12         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately indurated.       |  |   |
| 13         |              |              |             |               |              |  |  |   |
| 14         |              |              |             |               |              |  |  |   |
| 15         |              |              |             |               |              | Claystone or siltstone, brown, medium plasticity, moist, moderately indurated. |  |   |
| 16         |              |              |             |               |              |  |  |   |
| 17         |              |              |             |               |              | Siltstone, light brown, moist, moderately indurated, massive.                  |  |   |
| 18         |              |              |             |               |              |  |  |   |
| 19         |              |              |             |               |              |  |  |   |
| 20         | 5            | CAL          |             | 104           | 24           |  | Unit weight<br>Moisture content            |   |
| 21         |              |              |             |               |              |  |  |   |
| 22         |              |              |             |               |              |  |  |   |
| 23         |              |              |             |               |              | Silty sandstone, light brown, fine grained, moist, moderately cemented.        |  |   |
| 24         |              |              |             |               |              |  |  |   |
| 25         |              |              |             |               |              |  |  |   |
| 26         |              |              |             |               |              |  |  |   |
| 27         |              |              |             |               |              |  |  |   |
| 28         |              |              |             |               |              |  |  |   |
| 29         |              |              |             |               |              |  |  |   |
| 30         |              |              |             |               |              |  |  |   |

# LOG OF EXPLORATION BORING NO. 8 (continued)

Logged by: JCS

Date Drilled: 10/3/03

Method of Drilling: 30-Inch diameter bucket auger

Elevation: 571½ Feet

| DEPTH (FT) | BLOWS PER FT | DRIVE SAMPLE | BULK SAMPLE | DENSITY (PCF) | MOISTURE (%) | DESCRIPTION                            | LAB TESTS |
|------------|--------------|--------------|-------------|---------------|--------------|--|-----------|
| 31         |              |              |             |               |              | Total Depth: 30 feet<br>No Groundwater |           |
| 32         |              |              |             |               |              |  |           |
| 33         |              |              |             |               |              |  |           |
| 34         |              |              |             |               |              |  |           |
| 35         |              |              |             |               |              |  |           |
| 36         |              |              |             |               |              |  |           |
| 37         |              |              |             |               |              |  |           |
| 38         |              |              |             |               |              |  |           |
| 39         |              |              |             |               |              |  |           |
| 40         |              |              |             |               |              |  |           |
| 41         |              |              |             |               |              |  |           |
| 42         |              |              |             |               |              |  |           |
| 43         |              |              |             |               |              |  |           |
| 44         |              |              |             |               |              |  |           |
| 45         |              |              |             |               |              |  |           |
| 46         |              |              |             |               |              |  |           |
| 47         |              |              |             |               |              |  |           |
| 48         |              |              |             |               |              |  |           |
| 49         |              |              |             |               |              |  |           |
| 50         |              |              |             |               |              |  |           |
| 51         |              |              |             |               |              |  |           |
| 52         |              |              |             |               |              |  |           |
| 53         |              |              |             |               |              |  |           |
| 54         |              |              |             |               |              |  |           |
| 55         |              |              |             |               |              |  |           |
| 56         |              |              |             |               |              |  |           |
| 57         |              |              |             |               |              |  |           |
| 58         |              |              |             |               |              |  |           |
| 59         |              |              |             |               |              |  |           |
| 60         |              |              |             |               |              |  |           |

# LOG OF EXPLORATION TEST PIT NO. 1

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 550 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><b>COLLUVIUM (Qcol):</b> Silty sand (SM), brown, fine to medium, low plasticity, moist, loose to medium dense. Caliche blebs, pinhole porosity.</p> |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             | <p><b>OTAY FORMATION (To):</b> Light brown silty sandstone, fine to medium grained, low plasticity, moist, moderately cemented.</p>                    |           |
| 6          |             | <p>Total Depth: 5 feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

## LOG OF EXPLORATION TEST PIT NO. 2

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 560 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine to medium, dense, dry.   |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine to medium, dense, dry, |           |
| 3          |             | moderately cemented.  |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                              |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

## LOG OF EXPLORATION TEST PIT NO. 3

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 572 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM) brown, fine, dry, caliche blebs.       |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine to medium grained, dry, |           |
| 3          |             | moderately cemented.   |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                               |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 4

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 500 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qco)</u> : Silty sand (SM), light brown, fine, dry, loose.                                |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION</u> : Silty sandstone, light brown, fine to medium grained, dry, moderately cemented. |           |
| 4          |             |   |           |
| 5          |             | Total Depth: 4 Feet   |           |
| 6          |             | No Groundwater  |           |
| 7          |             | No Caving   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |



## LOG OF EXPLORATION TEST PIT NO. 5

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 520 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), light brown, fine to medium, dry, caliche.                       |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light gray, fine to medium grained, dry, moderately cemented. |           |
| 5          |             | Total Depth: 4½ Feet<br>No Groundwater<br>No Caving   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 6

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 520 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qco)</u> : Clayey sand (SC), brown, dry, loose, caliche.         |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown, dry, moderately cemented. |           |
| 3          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                             |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 7

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 520 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine to medium, dry.                                |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine to medium grained, dry, moderately cemented. |           |
| 3          |             |   |           |
| 4          |             | Total Depth: 3 Feet   |           |
| 5          |             | No Groundwater  |           |
| 6          |             | No Caving   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 8

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 495 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>Colluvium (Qcol)</u> : Clayey sand (SC), brown, dry to moist, pinhole porosity, caliche.              |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine to medium grained, dry,<br>Moderately cemented. |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving   |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 9

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 530 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, dry, fine to medium, caliche.             |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine grained, dry, moderately cemented. |           |
| 3          |             | Total Depth: 2 Feet<br>No Groundwater<br>No Caving  |           |
| 4          |             |   |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 10

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 495 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Clay (CL), dark brown, medium plasticity.  |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine to medium grained, moist, moderately cemented. |           |
| 4          |             |  |           |
| 5          |             | Total Depth: 4 Feet  |           |
| 6          |             | No Groundwater   |           |
| 7          |             | No Caving  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 11

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 510 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine to medium, dry.                                |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, gray, fine to medium grained, dry, moderately cemented. |           |
| 3          |             | Total Depth: 2½ Feet<br>No Groundwater<br>No Caving   |           |
| 4          |             |   |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 12

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 542 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine, dry, caliche.                                       |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light gray, fine to medium grained, dry, moderately cemented. |           |
| 3          |             | Total Depth: 2 Feet<br>No Groundwater<br>No Caving  |           |
| 4          |             |   |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |



## LOG OF EXPLORATION TEST PIT NO. 13

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 540 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine to medium, dry, caliche blebs.                |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine to medium, dry, moderately cemented. |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving   |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 14

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 460 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), light brown, fine to medium, dry, caliche, pinhole porosity, few roots. |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine to medium grained, dry, moderately cemented.       |           |
| 4          |             |  |           |
| 5          |             | Total Depth: 4½ Feet<br>No Groundwater<br>No Caving  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 15

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 480 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Silty sand (SM), brown, fine to medium, dry, pinhole porosity, caliche. |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown, moderately indurated.                        |           |
| 4          |             |   |           |
| 5          |             | Total Depth: 4 Feet   |           |
| 6          |             | No Groundwater  |           |
| 7          |             | No Caving   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 16

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 435 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Silty sand(SM), light brown, fine to medium, dry to moist, caliche. |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             | Layers of sandy clay, brown, medium plasticity, moist, hard.                                |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             | Light brown and sandy near bottom.  |           |
| 19         |             | Limit of excavator.   |           |
| 20         |             | Total Depth: 19 Feet<br>No Groundwater<br>No Caving   |           |

# LOG OF EXPLORATION TEST PIT NO. 17

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 450 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS  |
|------------|-------------|---|--|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Silty sand (SM), light brown, fine to medium, moist, caliche blebs.       |  |
| 2          |             |   |  |
| 3          |             |   |  |
| 4          |             | Sandy fat clay (CH) dark brown, high plasticity, moist, hard, caliche blebs.                      | Gradation<br>Hydrometer<br>Atterberg Limits<br>Expansion Index |
| 5          |             |   |  |
| 6          |             |   |  |
| 7          |             |   |  |
| 8          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, fine to medium grained, moist, moderately cemented. |  |
| 9          |             |   |  |
| 10         |             | Total Depth: 9 Feet   |  |
| 11         |             | No Groundwater  |  |
| 12         |             | No Caving   |  |
| 13         |             |   |  |
| 14         |             |   |  |
| 15         |             |   |  |
| 16         |             |   |  |
| 17         |             |   |  |
| 18         |             |   |  |
| 19         |             |   |  |
| 20         |             |   |  |

# LOG OF EXPLORATION TEST PIT NO. 18

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 465 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><b>ALLUVIUM (Qal):</b> Sandy clay (CL), dark brown, medium plasticity, moist, firm to hard, caliche blebs.</p>    |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             | <p><b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine to medium grained, moist, moderately cemented.</p> |           |
| 5          |             |  |           |
| 6          |             | <p>Total Depth: 5 Feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 19

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 470 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <p><u>ALLUVIUM (Qal)</u>: Sandy clay (CL), dark brown, medium plasticity, moist, firm to hard, caliche.</p> |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             | <p><u>OTAY FORMATION (To)</u>: Silty sandstone, light brown, fine grained, moist, moderately cemented.</p>  |           |
| 6          |             | <p>Total Depth: 5 Feet<br/>No Groundwater<br/>No Caving</p>   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 20

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 505 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <p><b>COLLUVIUM (Qcol):</b> Clay (CL), dark brown, dry, medium plasticity.</p>                            |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             | <p><b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine, dry to moist, moderately cemented.</p> |           |
| 6          |             | <p>Total Depth: 5 Feet<br/>No Groundwater<br/>No Caving</p>   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |



# LOG OF EXPLORATION TEST PIT NO. 21

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 480 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Sandy clay (CL), dark brown, low plasticity, moist, firm, caliche, blebs. |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             | <u>OTAY FORMATIOIN (To)</u> : Silty sandstone, light brown, fine, moist, moderately cemented.     |           |
| 5          |             |   |           |
| 6          |             | Total Depth: 5 Feet   |           |
| 7          |             | No Groundwater  |           |
| 8          |             | No Caving   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 22

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 520 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS                                  |
|------------|-------------|---|--|
| 1          |             | <u>COLLUVIUM (Qco)</u> : Clay with sand (CL), dark brown, medium plasticity.      | Gradation<br>Hydrometer<br>Expansion Index |
| 2          |             |   |  |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown, moist, moderately indurated. |  |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                                |  |
| 5          |             |   |  |
| 6          |             |   |  |
| 7          |             |   |  |
| 8          |             |   |  |
| 9          |             |   |  |
| 10         |             |   |  |
| 11         |             |   |  |
| 12         |             |   |  |
| 13         |             |   |  |
| 14         |             |   |  |
| 15         |             |   |  |
| 16         |             |   |  |
| 17         |             |   |  |
| 18         |             |   |  |
| 19         |             |   |  |
| 20         |             |   |  |

## LOG OF EXPLORATION TEST PIT NO. 23

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 498 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <p><b>ALLUVIUM (Qal):</b> Sandy clay (CL), dark brown, medium plasticity, moist, firm.</p>                |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             | <p><b>Silty sand (SM),</b> brown, fine to medium, moist, caliche, pinhole porosity.</p>                   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             | <p><b>OTAY FORMATION (To):</b> Silty sandstone, light brown, finegrained, moist, moderately cemented.</p> |           |
| 14         |             | <p>Total Depth: 13 Feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 24

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 505 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS  |
|------------|-------------|--|--|
| 1          |             | <p><u>ALLUVIUM Qal</u>: Clayey sand (SC), brown, fine to medium, moist, caliche blebs.</p> |  |
| 2          |             |  |  |
| 3          |             |  |  |
| 4          |             |  |  |
| 5          |             |  |  |
| 6          |             |  |  |
| 7          |             |  |  |
| 8          |             |  |  |
| 9          |             |  |  |
| 10         |             |  |  |
| 11         |             |  |  |
| 12         |             | <p>Silty sand (SM), light brown, fine to medium grained, moist.</p>                        |  |
| 13         |             |  |  |
| 14         |             |  |  |
| 15         |             |  |  |
| 16         |             |  |  |
| 17         |             |  |  |
| 18         |             |  |  |
| 19         |             | <p>Limit of excavator.</p>   |  |
| 20         |             |  | <p>Total Depth: 18 Feet<br/>No Groundwater<br/>No Caving</p> |

# LOG OF EXPLORATION TEST PIT NO. 25

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 510 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><u>ALLUVIUM (Qal)</u>: Clayey sand (SC), brown, fine, moist, few roots.</p><br><br><br><br><p>Caliche</p><br><br><br><br><p><u>OTAY FORMATION (To)</u>: Silty sandstone, light gray, fine grained, moist.</p> |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             | <p>Total Depth: 8 Feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 26

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 515 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Clay (CL), dark brown, medium plasticity, dry to moist.   |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown, moist, moderately indurated. |           |
| 4          |             |   |           |
| 5          |             | Total Depth: 4 Feet   |           |
| 6          |             | No Groundwater  |           |
| 7          |             | No Caving   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 27

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 535 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Co)</u> : Clay (CL), dark brown, dry to moist, medium plasticity.                             |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine grained, dry to moist, moderately cemented. |           |
| 3          |             |   |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving  |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 28

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 535 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Clay (CL), dark brown, dry to moist, medium plasticity.   |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             | <u>OTAY FORMATION (To)</u> : Silt stone, light brown, moist, moderately cemented. |           |
| 5          |             | Total Depth: 4 Feet<br>No Groundwater<br>No Caving                                |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |



# LOG OF EXPLORATION TEST PIT NO. 29

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 550 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <p><u>ALLUVIUM (Qal)</u>: Clay (CL), dark brown, medium plasticity, moist, caliche blebs.</p> |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             | <p><u>OTAY FORMATION (To)</u>: Siltstone, light brown, moist, moderately cemented.</p>        |           |
| 10         |             | <p>Total Depth: 9 Feet<br/>No Groundwater<br/>No Caving</p>                                   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 30

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 505 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Clay (CL), dark brown, medium plasticity, dry.                     |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine, moist, moderately cemented. |           |
| 3          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving   |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 31

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 525 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Sandy clay (CL), dark brown, dry, medium plasticity. |           |
| 2          |             | <u>OTAY (To)</u> : Siltstone, light brown, dry, moderately indurated.          |           |
| 3          |             | Total Depth: 2 Feet<br>No Groundwater<br>No Caving                             |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 32

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 515 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Sandy clay (CL), dark brown, dry to moist, medium plasticity. |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown to gray, dry, moderately indurated. |           |
| 3          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                                      |           |
| 4          |             |   |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

## LOG OF EXPLORATION TEST PIT NO. 33

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 538 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Sandy clay (CL), dark brown, moist, medium plasticity, caliche blebs. |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light gray, dry, moderately indurated.                  |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving  |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 34

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 500 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><u>ALLUVIUM (Qal)</u>: Sandy clay (CL), dark brown, moist, medium plasticity, caliche blebs.</p>                |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             | <p><u>OTAY FORMATION (To)</u>: Silty sandstone, light brown to gray, fine grained, moist, moderately cemented.</p> |           |
| 6          |             | <p>Total Depth: 5½ Feet<br/>No Groundwater<br/>No Caving</p>   |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 35

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 490 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |  |
|------------|-------------|---|-----------|--|
| 1          |             | <b>ALLUVIUM (Qal):</b> Sandy clay (CL), dark brown, medium plasticity, moist, caliche blebs.                  |           |  |
| 2          |             |   |           |  |
| 3          |             |   |           |  |
| 4          |             |   |           |  |
| 5          |             | <b>OTAY FORMATION (To):</b> Silty sandstone, light brown, fine to medium grained, moist, moderately cemented. |           |  |
| 6          |             |   |           |  |
| 7          |             | Total Depth: 6 Feet<br>No Groundwater<br>No Caving  |           |  |
| 8          |             |   |           |  |
| 9          |             |   |           |  |
| 10         |             |   |           |  |
| 11         |             |   |           |  |
| 12         |             |   |           |  |
| 13         |             |   |           |  |
| 14         |             |   |           |  |
| 15         |             |   |           |  |
| 16         |             |   |           |  |
| 17         |             |   |           |  |
| 18         |             |   |           |  |
| 19         |             |   |           |  |
| 20         |             |   |           |  |

# LOG OF EXPLORATION TEST PIT NO. 36

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 480 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><u>ALLUVIUM (Qal)</u>: Sandy clay (CL), dark brown, moist, medium plasticity, caliche blebs.</p>        |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             | <p><u>OTAY FORMATION (To)</u>: Silty sandstone, light brown to gray, fine, moist, moderately cemented.</p> |           |
| 6          |             | <p>Total Depth: 5 Feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |



## LOG OF EXPLORATION TEST PIT NO. 37

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 473 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><u>ALLUVIUM Qal</u>: Sandy clay (CL), dark brown, dry to moist, medium plasticity, caliche blebs.</p>             |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             | <p><u>OTAY FORMATION (To)</u>: Silty sandstone, light brown, fine to medium grained, moist, moderately cemented.</p> |           |
| 7          |             |  |           |
| 8          |             | <p>Total Depth: 7½ Feet<br/>No Groundwater<br/>No Caving</p>   |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 38

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 510 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <p><u>COLLUVIUM (Qcol)</u>: Sandy clay (CL), dark brown, dry to moist, caliche blebs.</p> |           |
| 2          |             |   |           |
| 3          |             |   |           |
| 4          |             |   |           |
| 5          |             | <p><u>OTAY FORMATION (To)</u>: Siltstone, light brown, moist, moderately cemented.</p>    |           |
| 6          |             | <p>Total Depth: 5 Feet<br/>No Groundwater<br/>No Caving</p>                               |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

## LOG OF EXPLORATION TEST PIT NO. 39

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 510 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Clay (CL), brown, dry to moist, medium plasticity, caliche blebs.                    |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown to gray, fine grained, moist, moderately cemented. |           |
| 5          |             | Total Depth: 4½ Feet<br>No Groundwater<br>No Caving  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 40

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 530 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Clay (CL), dark brown, dry to moist, medium plasticity, caliche blebs.    |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light gray, fine grained, moist, moderately cemented. |           |
| 4          |             |   |           |
| 5          |             | Total Depth: 4 Feet<br>No Groundwater<br>No Caving  |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 41

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 525 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>ALLUVIUM (Qa1)</u> : Sandy clay (CL), dark brown, dry to moist, medium plasticity, caliche blebs. |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, light brown, moist, moderately cemented.                     |           |
| 4          |             |  |           |
| 5          |             | Total Depth: 4 Feet  |           |
| 6          |             | No Groundwater   |           |
| 7          |             | No Caving  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 42

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 535 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION   | LAB TESTS |
|------------|-------------|---|-----------|
| 1          |             | <u>COLLUVIUM (Qco)</u> : Sandy clay (CL), dark brown, medium plasticity, dry. |           |
| 2          |             |   |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Siltstone, gray, moderately indurated.           |           |
| 4          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving                            |           |
| 5          |             |   |           |
| 6          |             |   |           |
| 7          |             |   |           |
| 8          |             |   |           |
| 9          |             |   |           |
| 10         |             |   |           |
| 11         |             |   |           |
| 12         |             |   |           |
| 13         |             |   |           |
| 14         |             |   |           |
| 15         |             |   |           |
| 16         |             |   |           |
| 17         |             |   |           |
| 18         |             |   |           |
| 19         |             |   |           |
| 20         |             |   |           |

# LOG OF EXPLORATION TEST PIT NO. 43

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 550 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qco)</u> : Sandy clay (CL), dark brown, dry to moist, medium plasticity.                     |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown to gray, fine grained, dry, moderately cemented. |           |
| 3          |             | Total Depth: 3 Feet<br>No Groundwater<br>No Caving   |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 44

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 540 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>ALLUVIUM (Qal)</u> : Sandy clay (CL), brown, moist, medium plasticity.  |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown to gray, fine to medium grained, moist, moderately cemented. |           |
| 5          |             | Total Depth: 5 Feet<br>No Groundwater<br>No Caving   |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |



## LOG OF EXPLORATION TEST PIT NO. 45

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 545 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <p><b>COLLUVIUM (Qcol):</b> Sandy clay (CL), dark brown, dry to moist, medium plasticity, caliche blebs.</p> |           |
| 2          |             |  |           |
| 3          |             |  |           |
| 4          |             |  |           |
| 5          |             | <p><b>OTAY FORMATION (To):</b> Siltstone, light brown, moist, moderately indurated.</p>                      |           |
| 6          |             |  |           |
| 7          |             | <p>Total Depth: 6 Feet<br/>No Groundwater<br/>No Caving</p>  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 46

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 562 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Sandy clay (CL), dark brown, dry, medium plasticity.                                 |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown, fine to medium grained, moist, moderately cemented. |           |
| 4          |             |  |           |
| 5          |             | Total Depth: 4½ Feet<br>No Groundwater<br>No Caving  |           |
| 6          |             |  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

## LOG OF EXPLORATION TEST PIT NO. 47

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 565 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM (Qcol)</u> : Sandy clay (CL), brown, dry to moist, medium plasticity.               |           |
| 2          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown to gray, fine grained, dry, moderately |           |
| 3          |             | cemented.  |           |
| 4          |             | Total Depth: 3 Feet  |           |
| 5          |             | No Groundwater   |           |
| 6          |             | No Caving  |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

# LOG OF EXPLORATION TEST PIT NO. 48

Logged by: JCS

Date: 10/16/03

Equipment Used: CAT 430D with 24-inch Bucket

Elevation: 555 Feet

| DEPTH (FT) | BULK SAMPLE | DESCRIPTION  | LAB TESTS |
|------------|-------------|--|-----------|
| 1          |             | <u>COLLUVIUM Qcol</u> : Clayey sand or sandy clay (SC/CL), brown, moist, medium plasticity.                |           |
| 2          |             |  |           |
| 3          |             | <u>OTAY FORMATION (To)</u> : Silty sandstone, light brown to gray, fine grained, dry, moderately cemented. |           |
| 4          |             |  |           |
| 5          |             |  |           |
| 6          |             | Total Depth: 5 Feet<br>No Groundwater<br>No Caving   |           |
| 7          |             |  |           |
| 8          |             |  |           |
| 9          |             |  |           |
| 10         |             |  |           |
| 11         |             |  |           |
| 12         |             |  |           |
| 13         |             |  |           |
| 14         |             |  |           |
| 15         |             |  |           |
| 16         |             |  |           |
| 17         |             |  |           |
| 18         |             |  |           |
| 19         |             |  |           |
| 20         |             |  |           |

**APPENDIX C**

**LABORATORY TESTING**

## APPENDIX C

### LABORATORY TESTING

Laboratory testing was conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions and in the same locality. No warranty, express or implied, is made as to the correctness or serviceability of the test results, or the conclusions derived from these tests. Where a specific laboratory test method has been referenced, such as ASTM, Caltrans, or AASHTO, the reference applies only to the specified laboratory test method and not to associated referenced test method(s) or practices, and the test method referenced has been used only as a guidance document for the general performance of the test and not as a "Test Standard". A brief description of the tests performed follows.

**Classification:** Soils were classified visually according to the Unified Soil Classification System as established by the American Society of Civil Engineers. Visual classification was supplemented by laboratory testing of selected soil samples and classification in general accordance with the laboratory soil classification tests outlined in ASTM test method D2487-00. The resultant soil classifications are shown on the boring logs in Appendix B.

**Particle Size Analysis:** Particle size analyses were performed in general accordance with ASTM D422-63, and were used to supplement visual soil classifications. The results are presented in Figures C-1.1 through C-1.15.

**Atterberg Limits:** ASTM D4318-00 was used to determine the liquid and plastic limits, and plasticity index of selected soils. The results are shown in selected Figures C-1.1 through C-1.15.

**In-Situ Moisture/Density:** The in-place moisture contents and dry unit weights of selected soil samples were determined using relatively undisturbed samples from the liner rings of a 2.5-inch ID modified California sampler. The dry unit weights and moisture contents are shown on the boring logs. Statistical summaries of in-situ moisture and density test results from the Otay Formation within McMillin Otay Ranch Villages 1, 5, 6, 7 and 12 are presented in Figures C-2.1a and C-2.1b. The normal distributions shown in these figures are based on the mean and standard deviation for each soil type (sandstone, siltstone and claystone). Summaries of moisture and density tests taken by our field personnel during fill compaction operations at McMillin Otay Ranch, Villages 1, 5 and 6 are presented in Figures C-2.2a and C-2.2b for comparison. The nuclear gage test data were presented in the referenced as-graded reports (Geotechnics, 2003c, 2000c, 1999, 1998a).

## APPENDIX C

### LABORATORY TESTING (Continued)

**Maximum Density/Optimum Moisture:** The maximum dry densities and optimum moisture contents of selected soil samples were determined using ASTM D1557-00 as a guideline. The test results are summarized in Figure C-3.

**Expansion Index:** The expansion potential of selected soils was estimated in general accordance with the laboratory procedures outlined in ASTM test method D4829-95. The test results are summarized on Figure C-4.1. Figure C-4.1 also presents the UBC criteria for evaluating the expansion potential based on the expansion index. A statistical summary of expansion index tests on soil derived from the Otay Formation in Otay Ranch Villages 1, 5 and 6 is presented in Figure C-4.2.

**pH and Resistivity:** To assess the potential for reactivity with metal, representative samples were tested for pH and resistivity using CALTRANS method 643. The results are shown in Figure C-5.1.

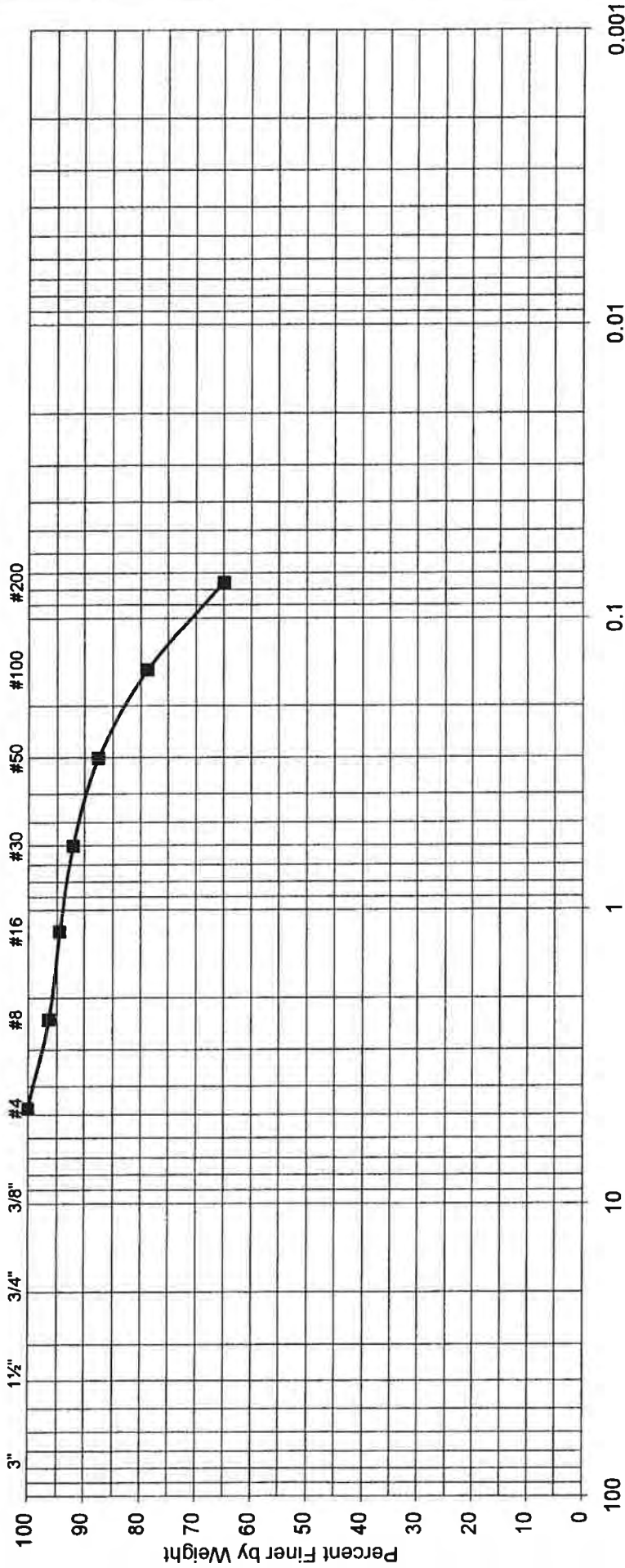
**Chloride Content:** Selected soil samples were tested for water-soluble chloride content using EPA Test Method SMEWW 4500 CLC. The results are also shown in Figure C-5.1.

**Sulfate Content:** To assess the potential for reactivity with concrete, soil samples were tested for water soluble sulfate. The sulfate was extracted from the soil under vacuum, typically using a 20:1 (water to dry soil) dilution ratio. The extracted solution was tested for water soluble sulfate in general accordance with ASTM D516-02. The test results are presented in Figure C-5.1. Figure C-5.1 also presents the UBC criteria for evaluating soluble sulfate content. A summary of soluble sulfate tests from the Otay Formation in Otay Ranch Villages 1, 5 and 6 is presented in Figure C-5.2.

**Direct Shear:** To supplement shear tests conducted previously on the Otay Formation, the shear strength of selected soil samples was assessed using direct shear testing performed in general accordance with ASTM D3080-98. The results are shown in Figures C-6.1 to C-6.11. An overview of shear tests conducted on the Otay Formation is presented in Figures C-6.12 through C-6.14.

**R-Value:** R-Value tests were performed on four selected subgrade samples in general accordance with California Test Method 301. The results are presented in Figures C-7.1 through C-7.4. A statistical summary of R-Value tests conducted on soil derived from the Otay Formation in Otay Ranch Villages 1, 5, and 6 is presented in Figure C-7.5.

U.S. Standard Sieve Sizes



Grain Size in Millimeters

|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-1  
 SAMPLE LOCATION: 10' - 12'

**UNIFIED SOIL CLASSIFICATION: ML**  
**DESCRIPTION: SANDY SILT**

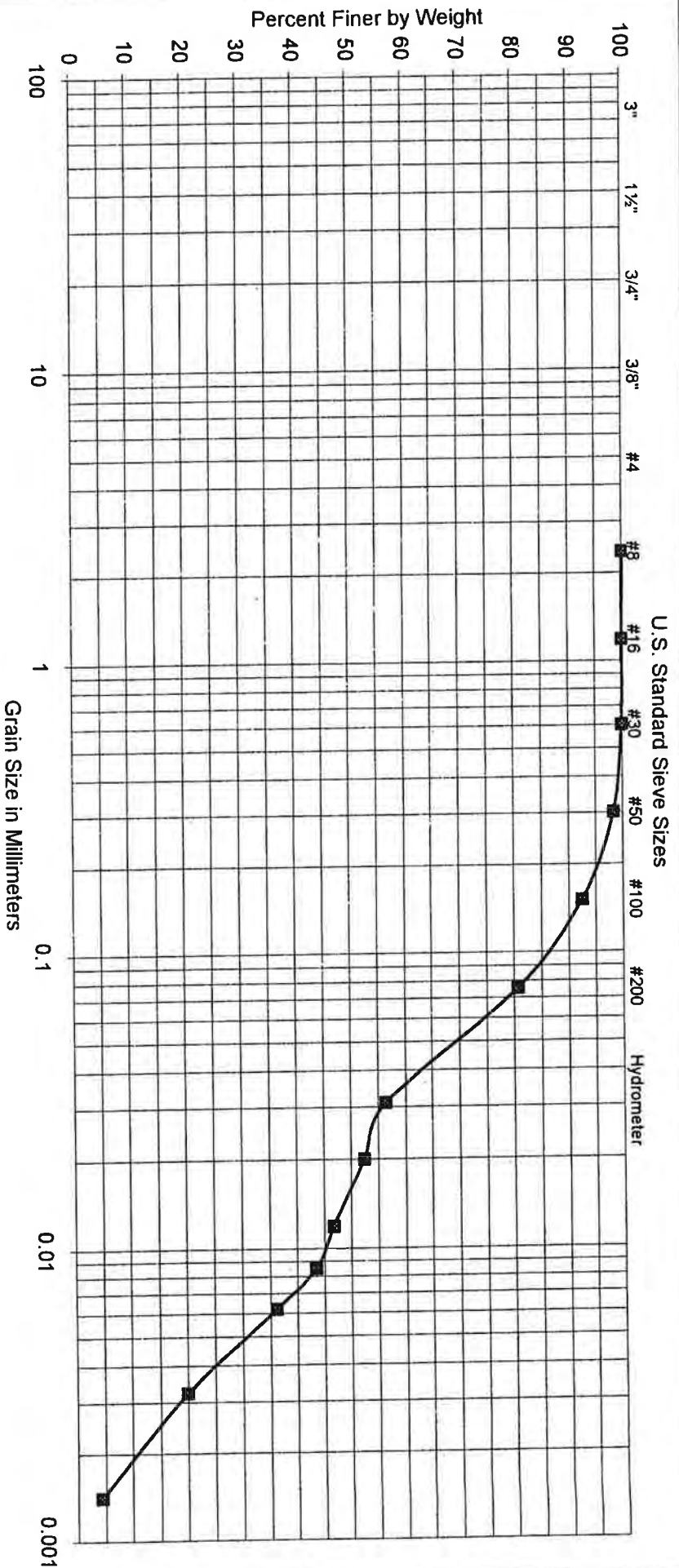
**ATTEBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.1**





|        |        |      |        |        |      |               |
|--------|--------|------|--------|--------|------|---------------|
| GRAVEL | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|--------|--------|------|--------|--------|------|---------------|

**SAMPLE**  
 SAMPLE NUMBER: B-1  
 SAMPLE LOCATION: 20' - 21'

**UNIFIED SOIL CLASSIFICATION:** CL  
**DESCRIPTION:** LEAN CLAY WITH SAND

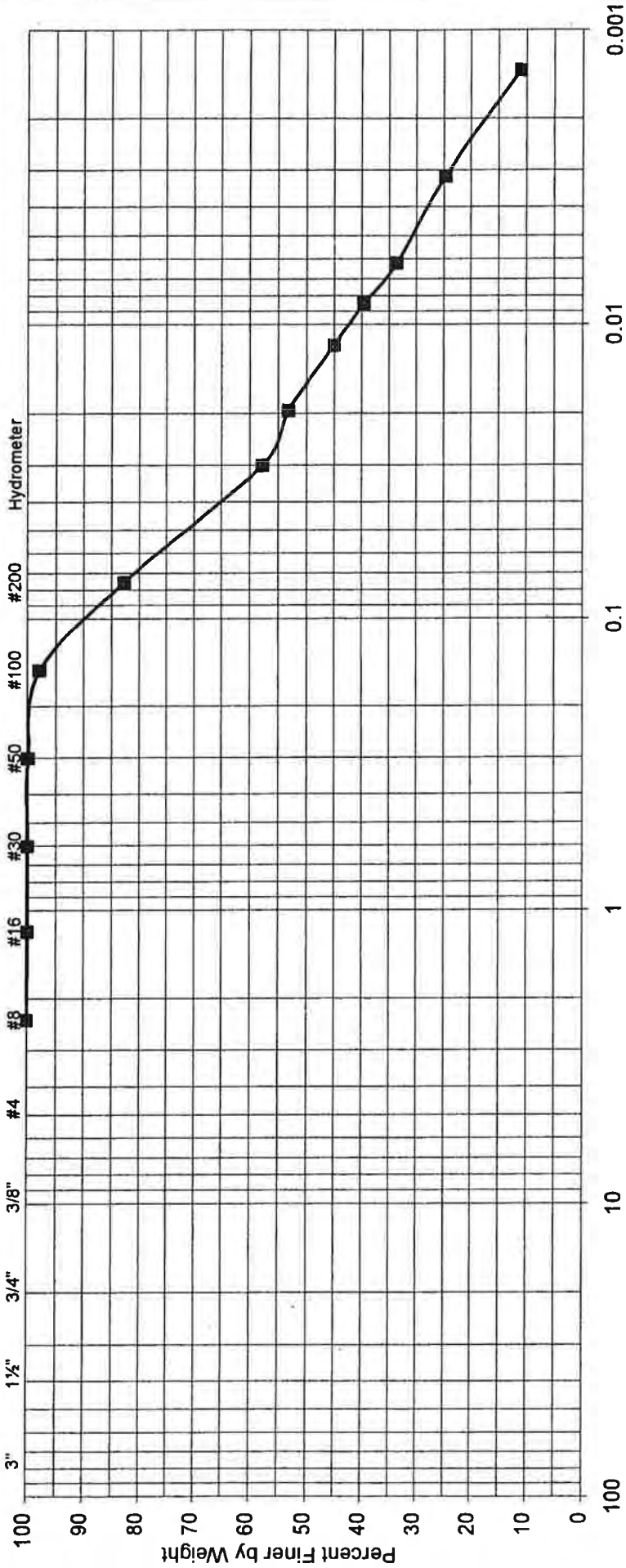
**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.2**

U.S. Standard Sieve Sizes



|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-2  
 SAMPLE LOCATION: 30' - 31'

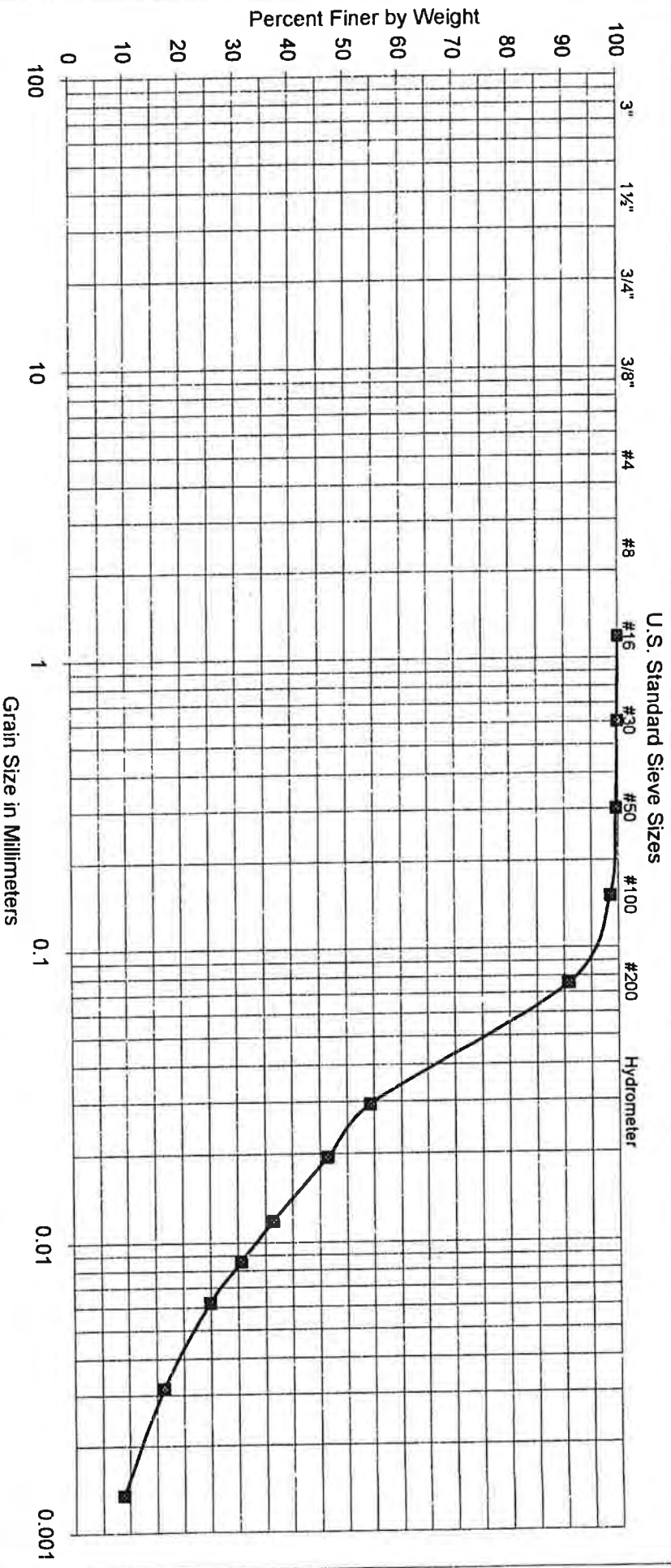
**UNIFIED SOIL CLASSIFICATION:** CL  
**DESCRIPTION:** LEAN CLAY WITH SAND

**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.3**



|        |        |      |        |        |      |               |
|--------|--------|------|--------|--------|------|---------------|
| GRAVEL | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|--------|--------|------|--------|--------|------|---------------|

**SAMPLE**  
 SAMPLE NUMBER: B-2  
 SAMPLE LOCATION: 35' - 37'

**UNIFIED SOIL CLASSIFICATION:** CH  
**DESCRIPTION:** FAT CLAY

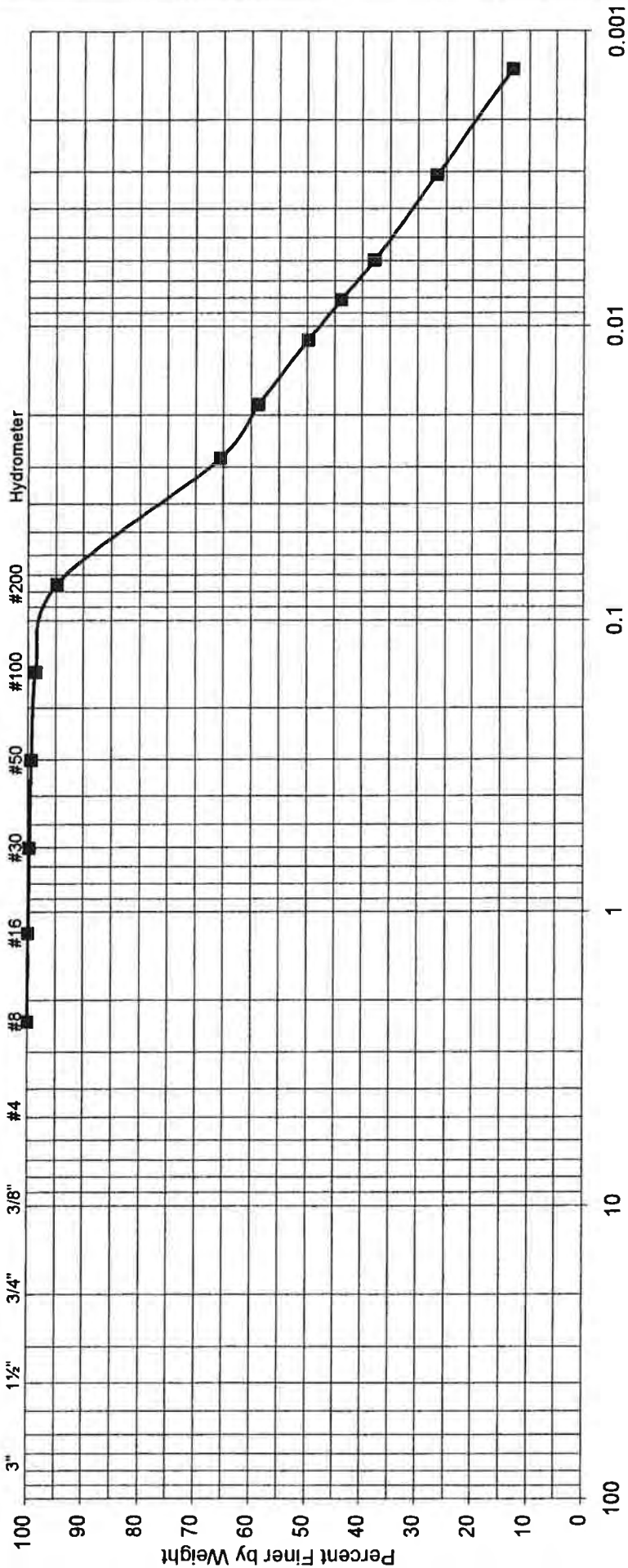
**ATTERBERG LIMITS**  
 LIQUID LIMIT: 68  
 PLASTIC LIMIT: 31  
 PLASTICITY INDEX: 37



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.4**

U.S. Standard Sieve Sizes



|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-3  
 SAMPLE LOCATION: 39' - 41'

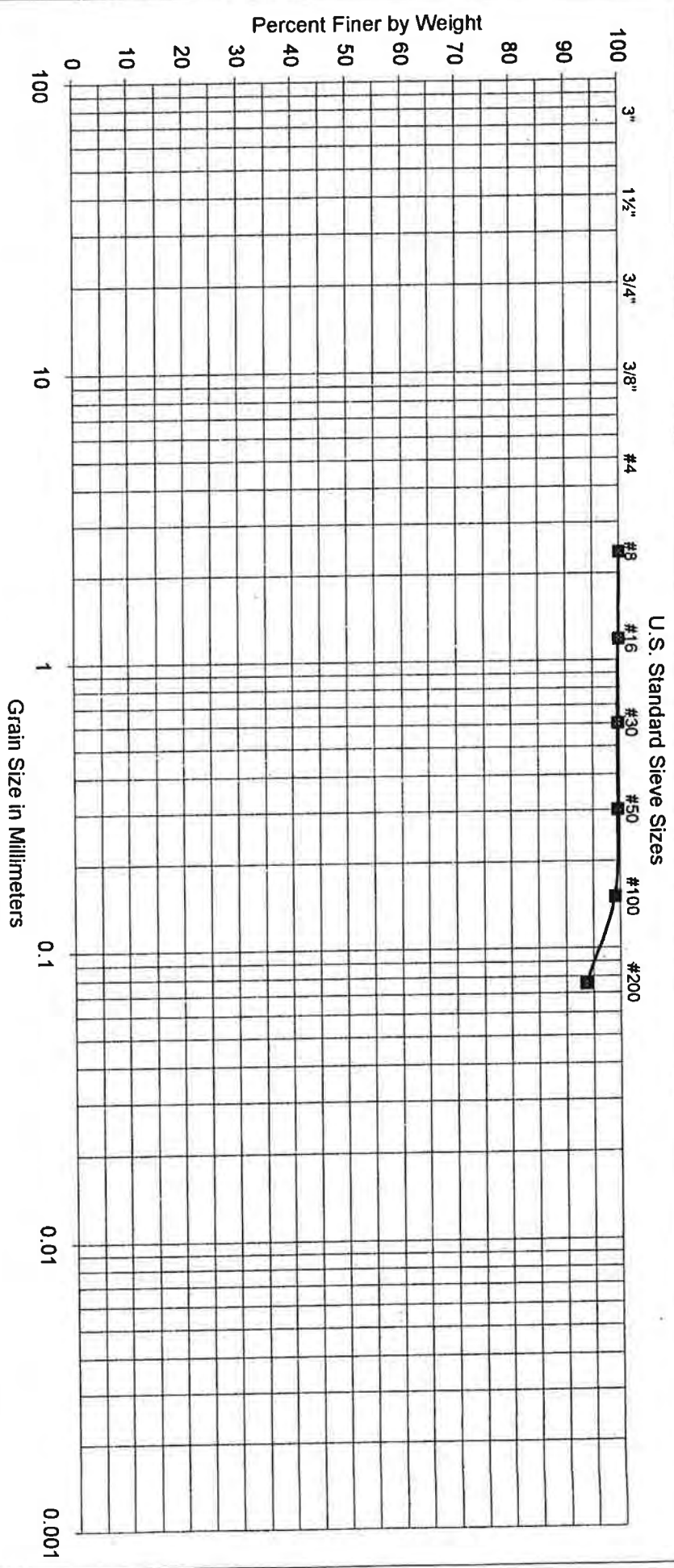
**UNIFIED SOIL CLASSIFICATION:** CH  
**DESCRIPTION:** FAT CLAY

**ATTEBERG LIMITS**  
 LIQUID LIMIT: 50  
 PLASTIC LIMIT: 25  
 PLASTICITY INDEX: 25



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.5**



|        |        |      |        |        |      |               |
|--------|--------|------|--------|--------|------|---------------|
| GRAVEL | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|--------|--------|------|--------|--------|------|---------------|

**SAMPLE**  
 SAMPLE NUMBER: B-4  
 SAMPLE LOCATION: 20' - 21'

**UNIFIED SOIL CLASSIFICATION:** ML  
**DESCRIPTION:** SILT

**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



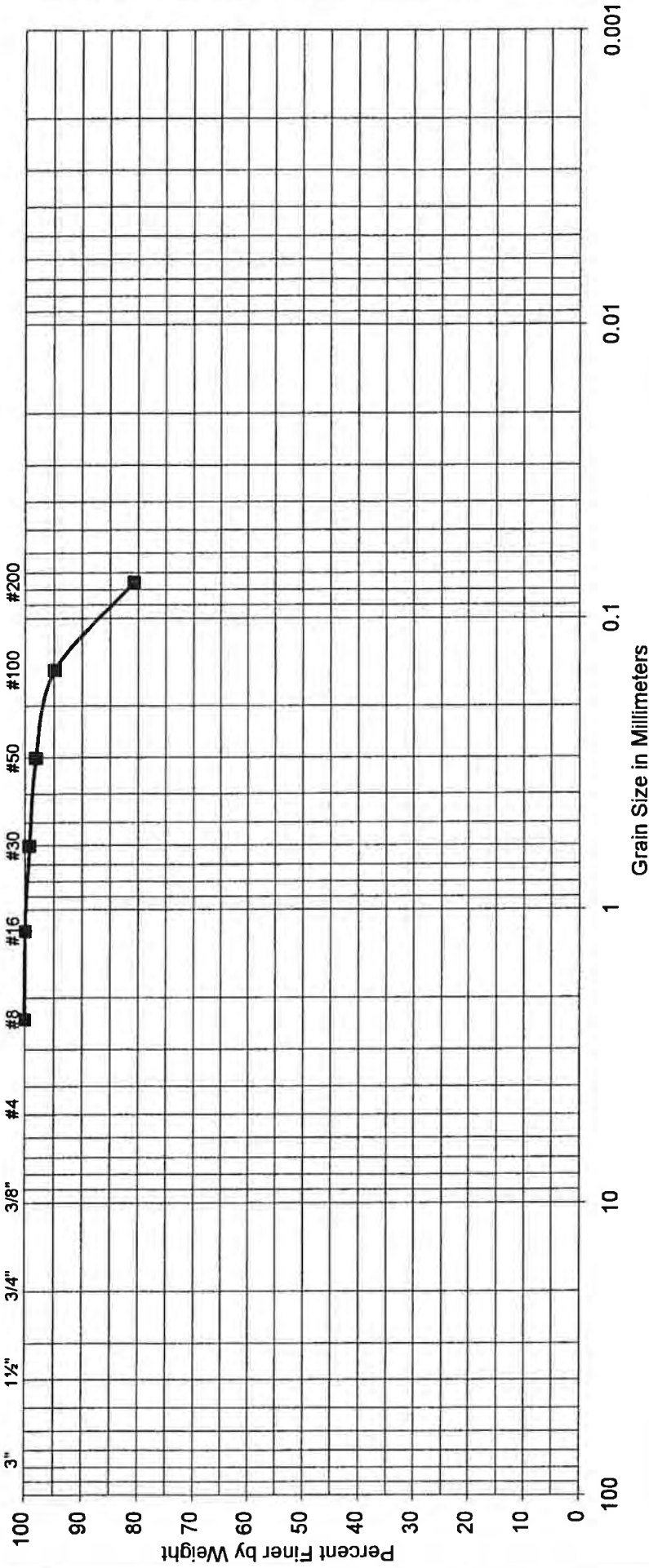
**Geotechnics Incorporated**

**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.6**



U.S. Standard Sieve Sizes



|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-4  
 SAMPLE LOCATION: 30' - 31'

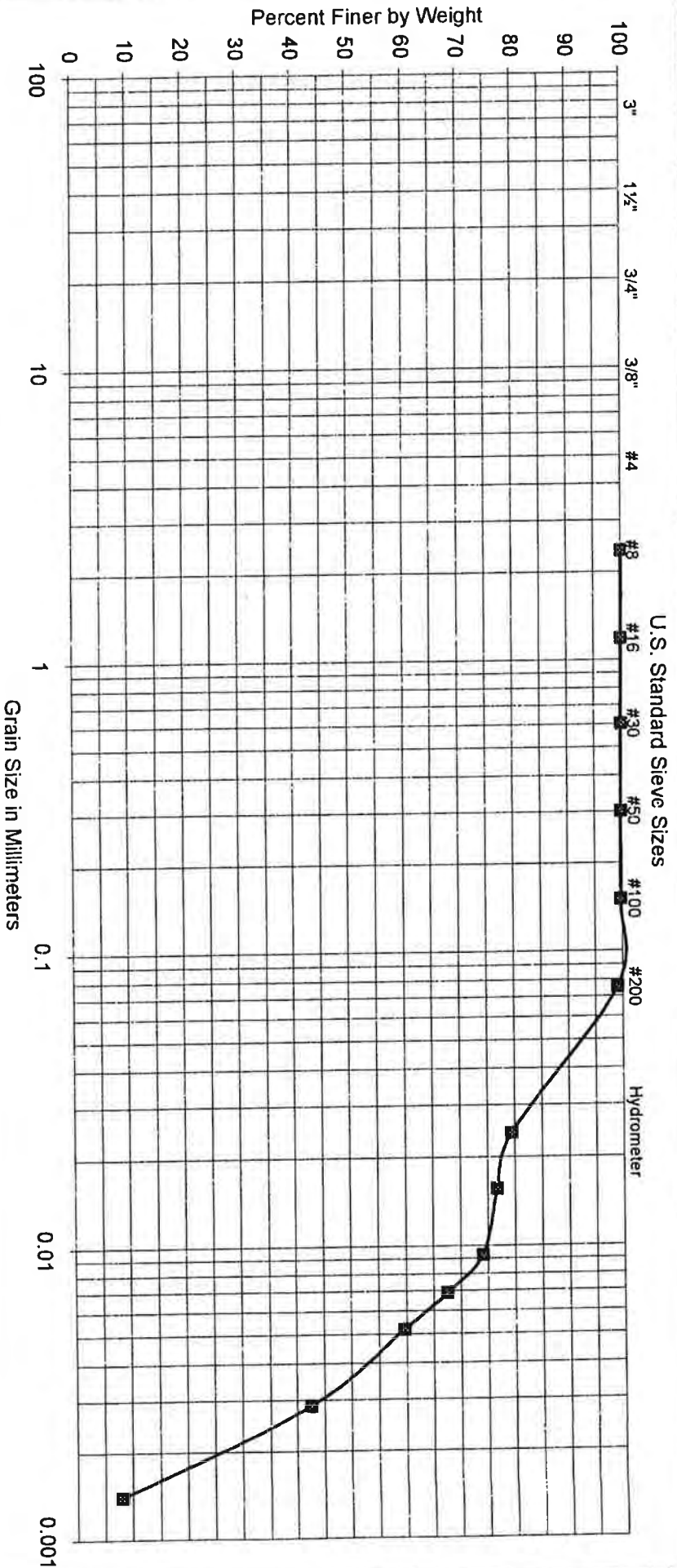
**UNIFIED SOIL CLASSIFICATION: ML**  
**DESCRIPTION: SILT WITH SAND**

**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.7**



|        |        |      |        |        |      |               |
|--------|--------|------|--------|--------|------|---------------|
| GRAVEL | COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|--------|--------|------|--------|--------|------|---------------|

**SAMPLE**  
 SAMPLE NUMBER: B-4  
 SAMPLE LOCATION: 34' - 36'

**UNIFIED SOIL CLASSIFICATION:** CH  
**DESCRIPTION:** FAT CLAY

**ATTERBERG LIMITS**  
 LIQUID LIMIT: 57  
 PLASTIC LIMIT: 23  
 PLASTICITY INDEX: 34

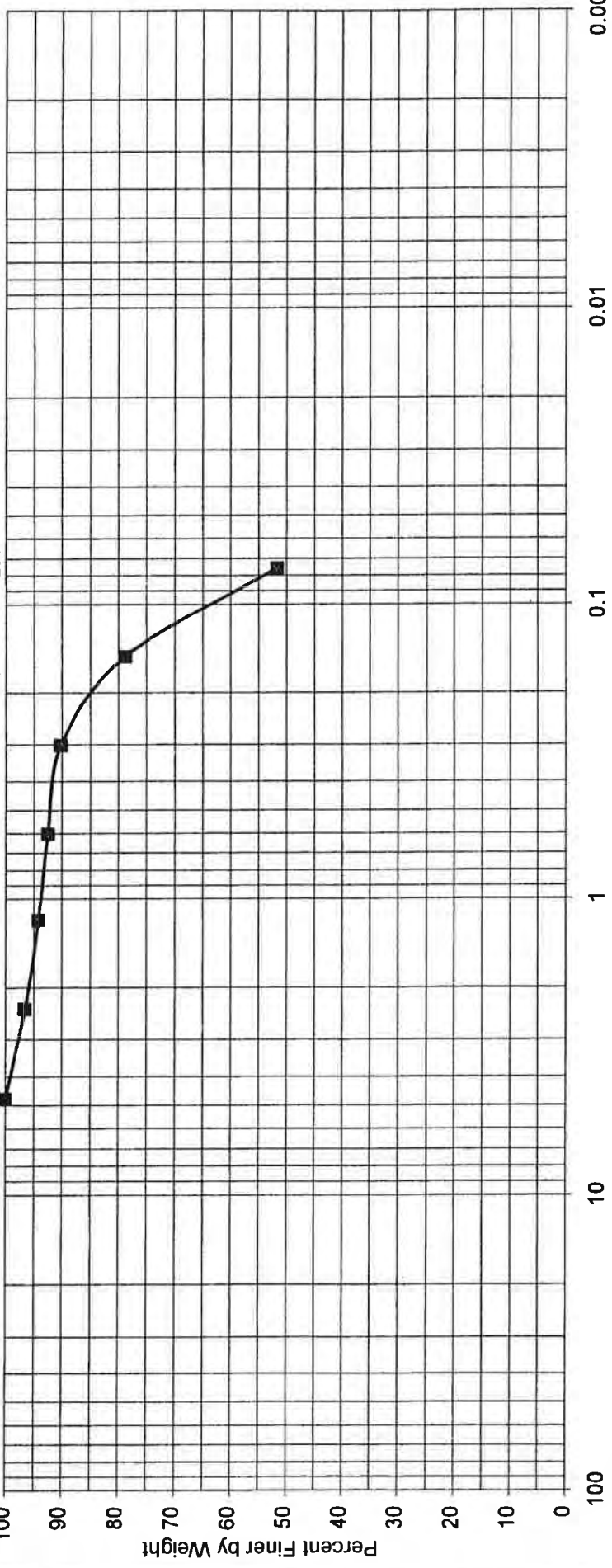


**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
 FIGURE C-1.8

U.S. Standard Sieve Sizes

3" 1 1/2" 3/4" 3/8" #4 #8 #16 #30 #50 #100 #200



|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| GRAVEL | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|--------|------|--------|--------|------|---------------|

**SAMPLE**  
 SAMPLE NUMBER: B-5  
 SAMPLE LOCATION: 5' - 7'

**UNIFIED SOIL CLASSIFICATION:** ML  
**DESCRIPTION:** SANDY SILT

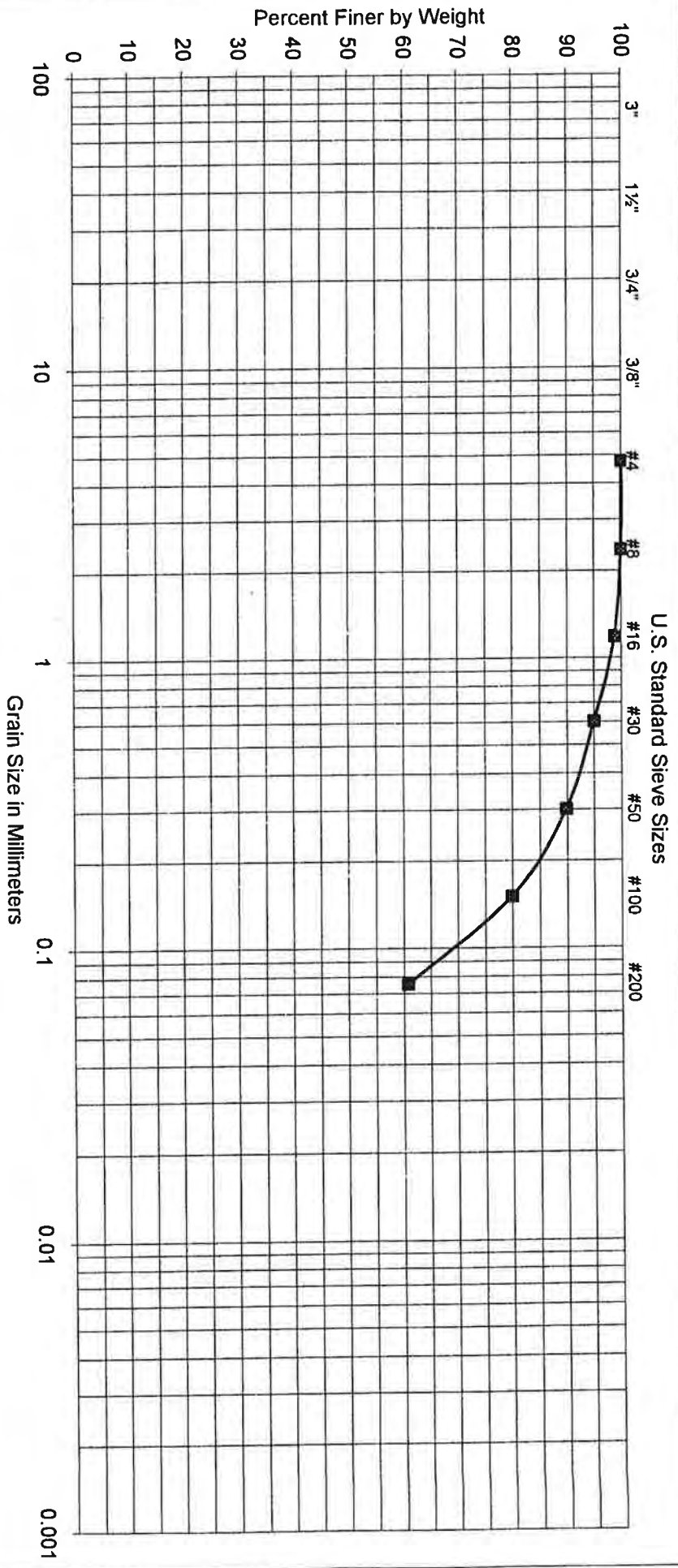
**ATTEBERG LIMITS**  
 LIQUID LIMIT: NP  
 PLASTIC LIMIT: NP  
 PLASTICITY INDEX: NP



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.9**





| COARSE           | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
|------------------|------|--------|--------|------|---------------|
| GRAVEL SAND SAND |      |        |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-6  
 SAMPLE LOCATION: 24' - 26'

**UNIFIED SOIL CLASSIFICATION:** ML  
**DESCRIPTION:** SANDY SILT

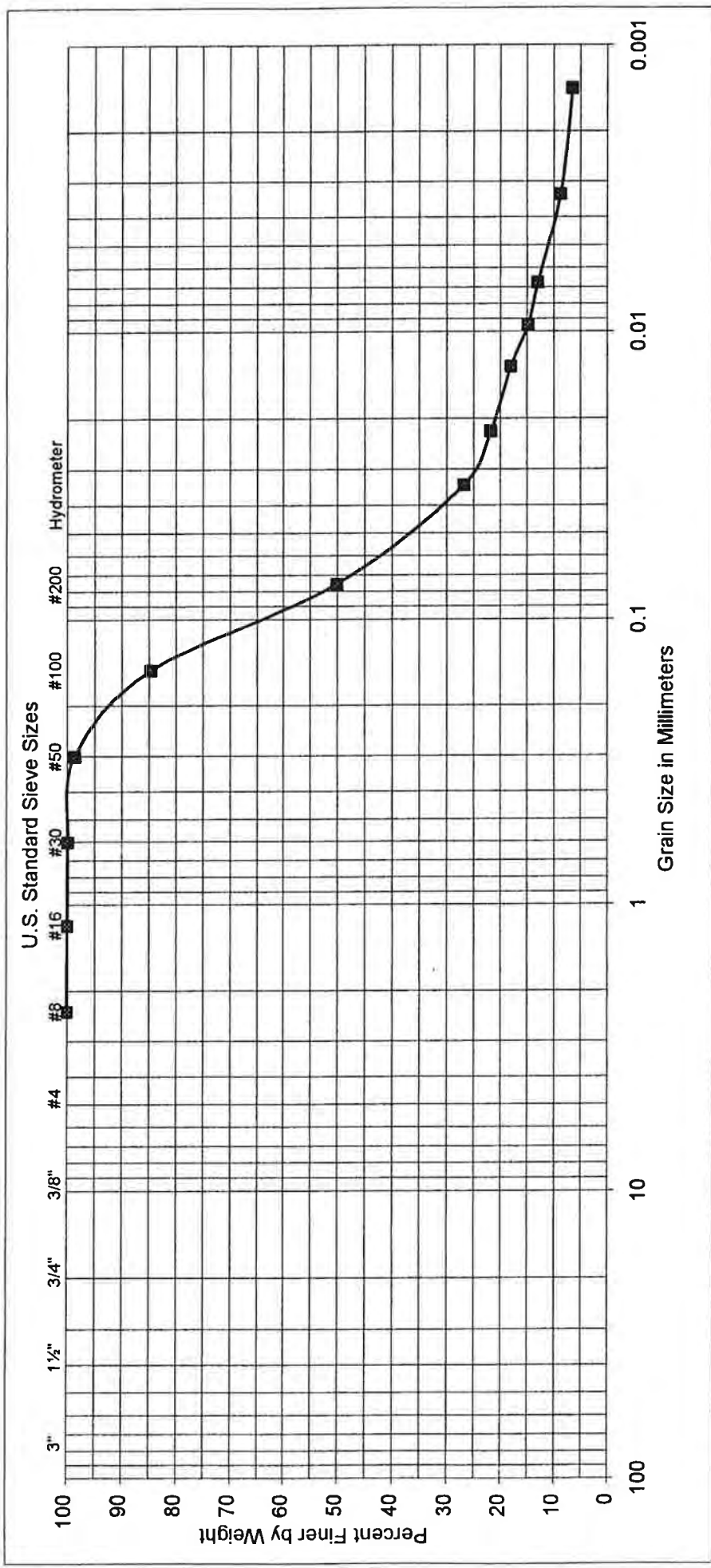
**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



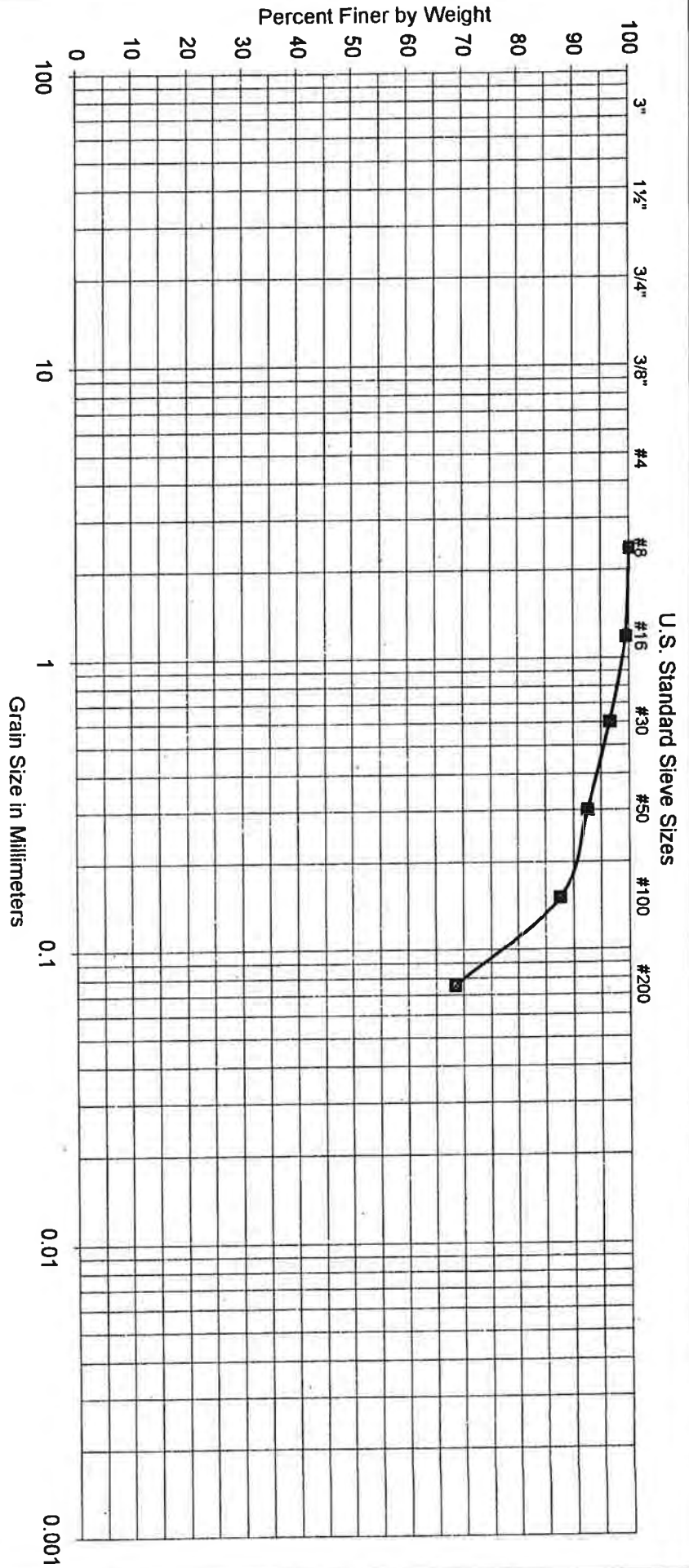
**Geotechnics Incorporated**

**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.10**



|  |              |                          |              |                  |
|--|--------------|--------------------------|--------------|------------------|
| COARSE<br>GRAVEL                       | FINE<br>SAND | COARSE<br>MEDIUM<br>SAND | FINE<br>SAND | SILT AND<br>CLAY |
| <b>SAMPLE</b>                          |              |                          |              |                  |
| SAMPLE NUMBER: B-7                     |              |                          |              |                  |
| SAMPLE LOCATION: 42' - 44'             |              |                          |              |                  |
| <b>UNIFIED SOIL CLASSIFICATION: SM</b> |              |                          |              |                  |
| <b>DESCRIPTION: SILTY SAND</b>         |              |                          |              |                  |
| <b>ATTEBERG LIMITS</b>                 |              |                          |              |                  |
| LIQUID LIMIT: NP                       |              |                          |              |                  |
| PLASTIC LIMIT: NP                      |              |                          |              |                  |
| PLASTICITY INDEX: NP                   |              |                          |              |                  |



| GRAVEL | SAND   | SILT AND CLAY |
|--------|--------|---------------|
| COARSE | COARSE |               |
| FINE   | MEDIUM |               |
|        | FINE   |               |

**SAMPLE**  
**SAMPLE NUMBER:** B-7  
**SAMPLE LOCATION:** 50' - 52'

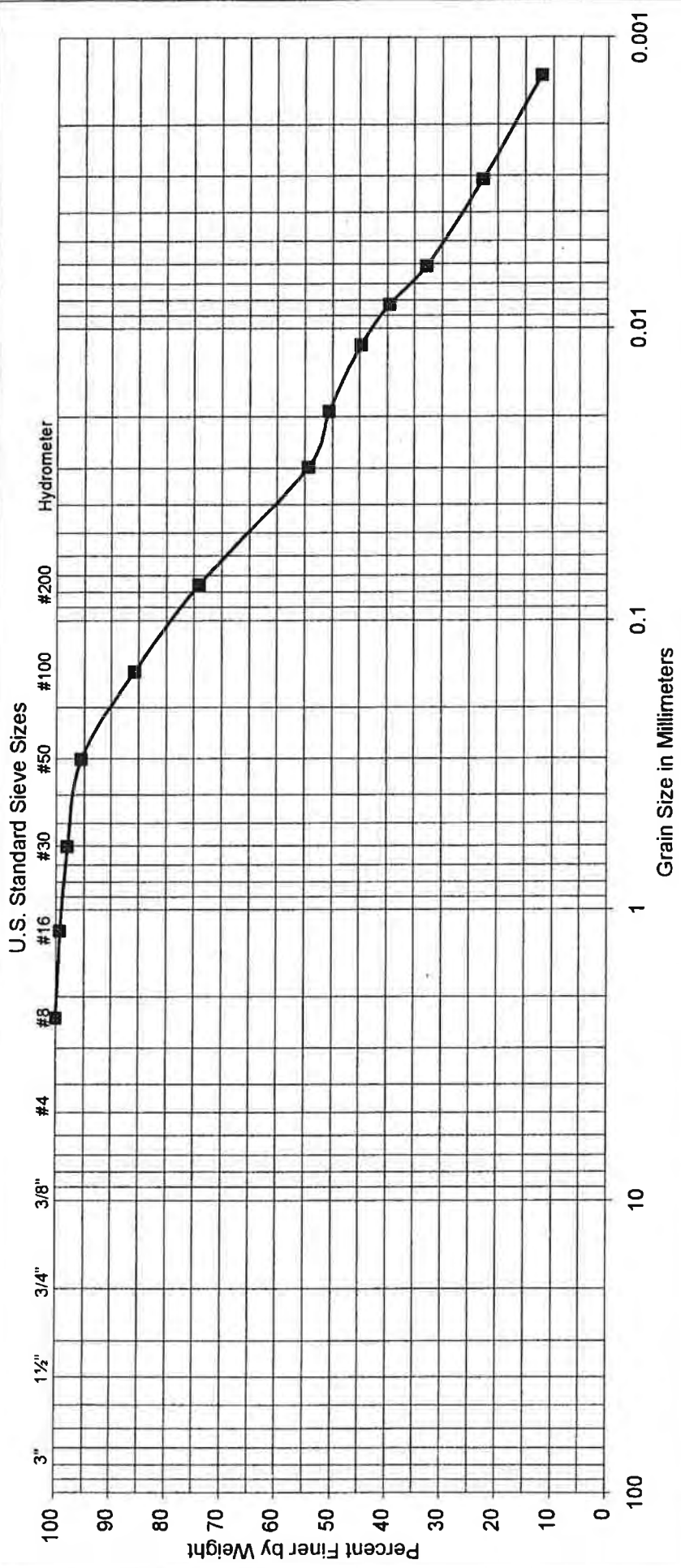
**UNIFIED SOIL CLASSIFICATION:** ML  
**DESCRIPTION:** SANDY SILT

**ATTERBERG LIMITS**  
**LIQUID LIMIT:**  
**PLASTIC LIMIT:**  
**PLASTICITY INDEX:**



**SOIL CLASSIFICATION**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-1.12**



|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: B-8  
 SAMPLE LOCATION: 7' - 9'

UNIFIED SOIL CLASSIFICATION: ML  
 DESCRIPTION: SANDY SILT

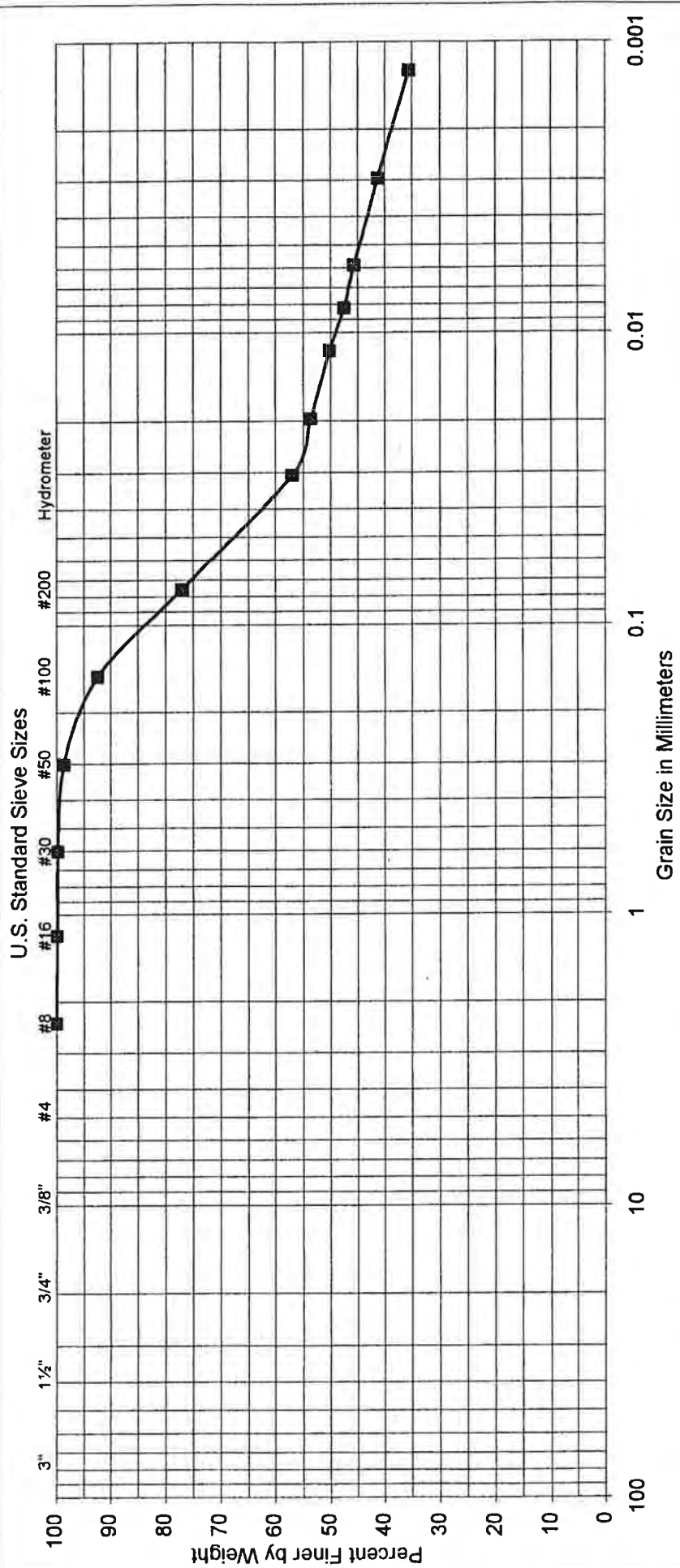
**ATTEBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**







|        |      |        |        |      |               |
|--------|------|--------|--------|------|---------------|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY |
| GRAVEL |      | SAND   |        |      |               |

**SAMPLE**  
 SAMPLE NUMBER: TP-22  
 SAMPLE LOCATION: 0' - 2'

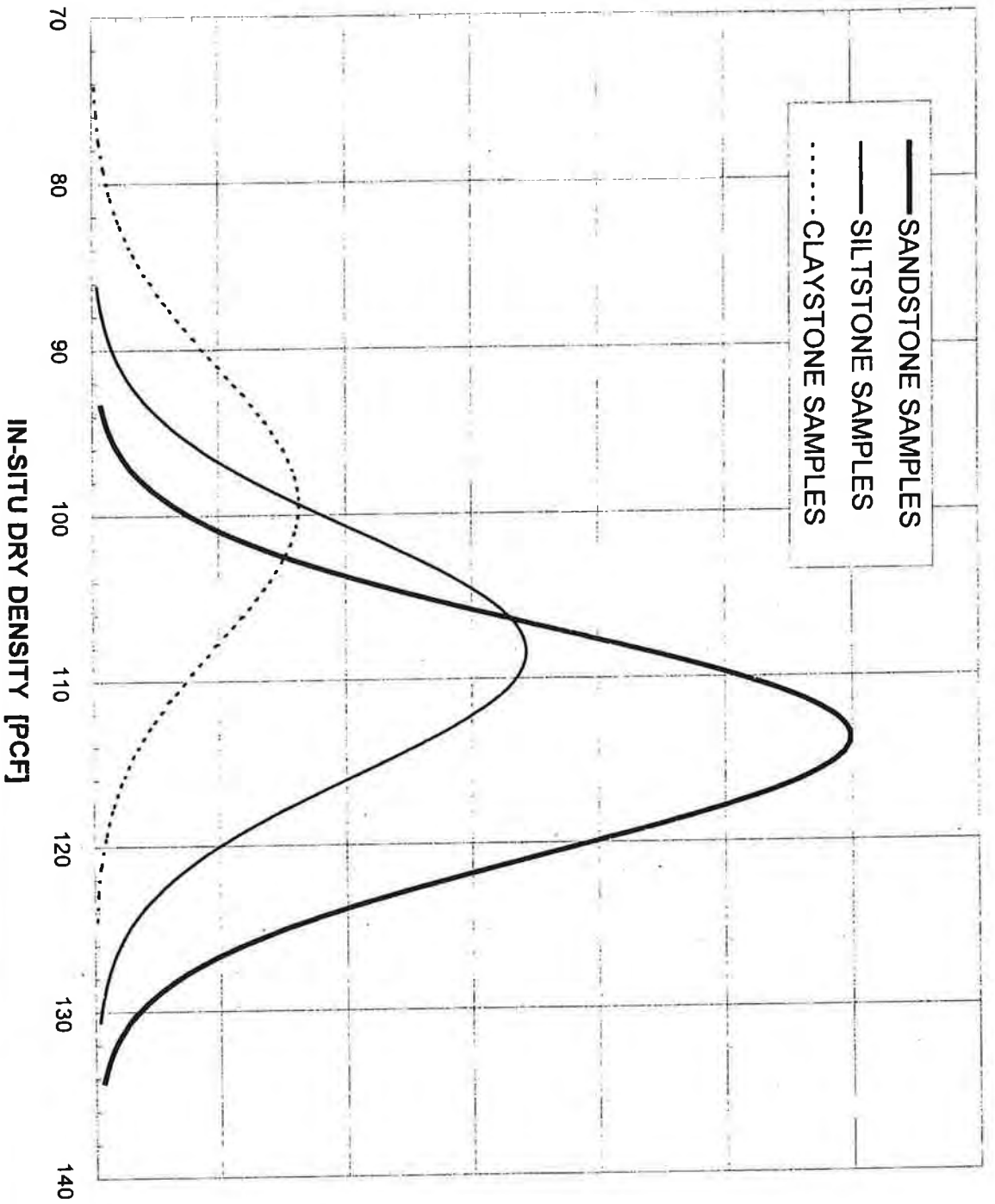
**UNIFIED SOIL CLASSIFICATION:** CL  
**DESCRIPTION:** LEAN CLAY WITH SAND

**ATTERBERG LIMITS**  
 LIQUID LIMIT:  
 PLASTIC LIMIT:  
 PLASTICITY INDEX:



**SOIL CLASSIFICATION**

PDF [%]



**SANDSTONE SAMPLES**

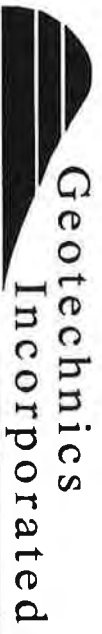
|             |     |
|-------------|-----|
| Population: | 101 |
| Average:    | 114 |
| Deviation:  | 7   |

**SILTSTONE SAMPLES**

|             |     |
|-------------|-----|
| Population: | 63  |
| Average:    | 108 |
| Deviation:  | 7   |

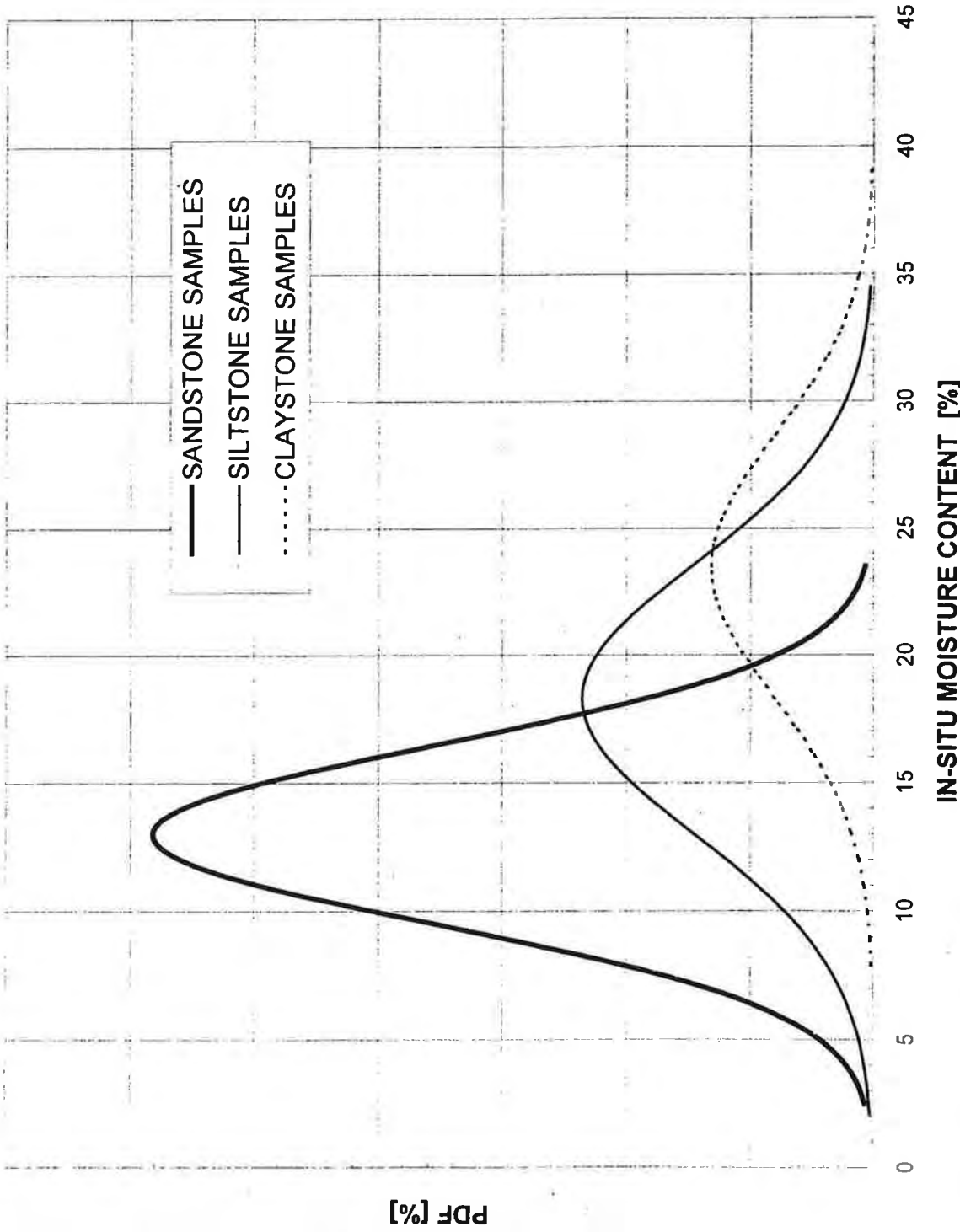
**CLAYSTONE SAMPLES**

|             |    |
|-------------|----|
| Population: | 34 |
| Average:    | 99 |
| Deviation:  | 8  |



**OTAY FORMATION DENSITY**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-2.1a**



**SANDSTONE SAMPLES**

|             |     |
|-------------|-----|
| Population: | 101 |
| Average:    | 13  |
| Deviation:  | 4   |

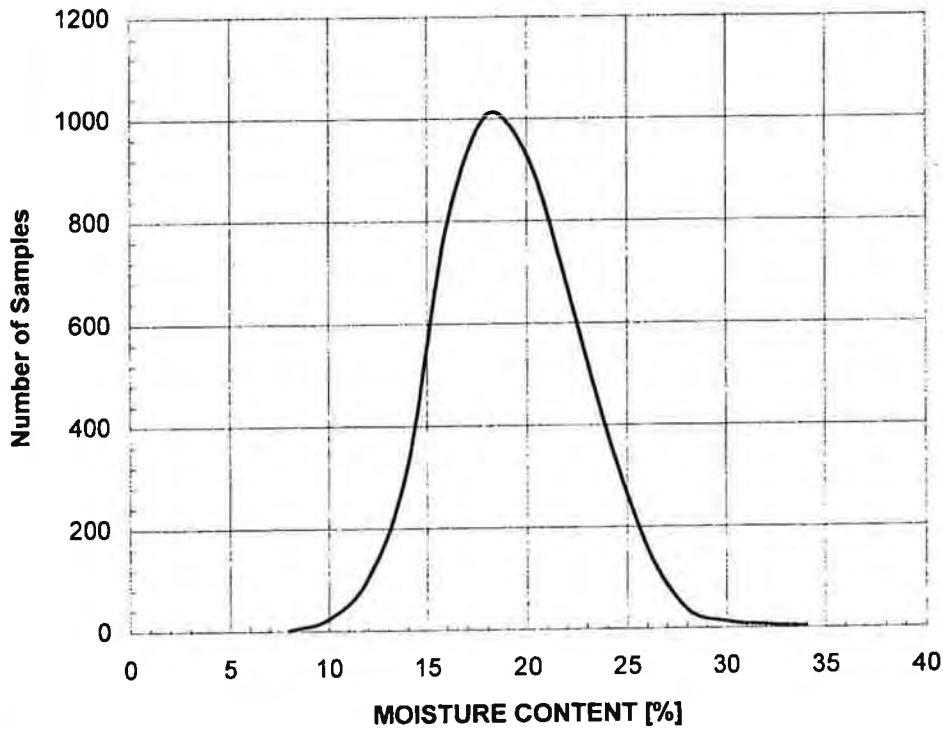
**SILTSTONE SAMPLES**

|             |    |
|-------------|----|
| Population: | 63 |
| Average:    | 18 |
| Deviation:  | 5  |

**CLAYSTONE SAMPLES**

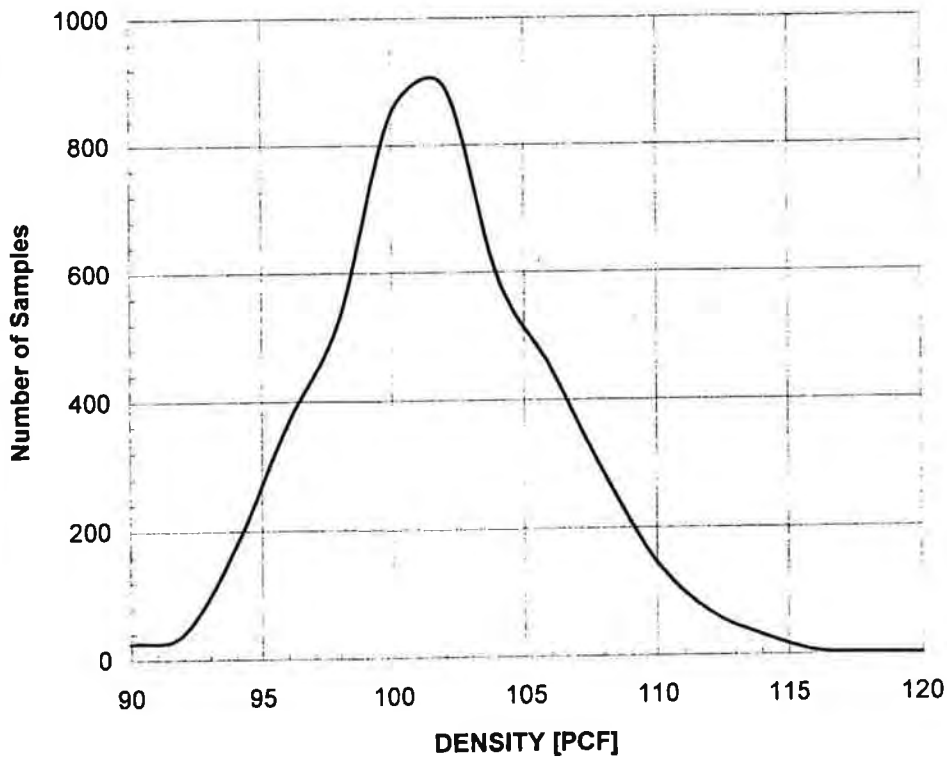
|             |    |
|-------------|----|
| Population: | 34 |
| Average:    | 24 |
| Deviation:  | 5  |





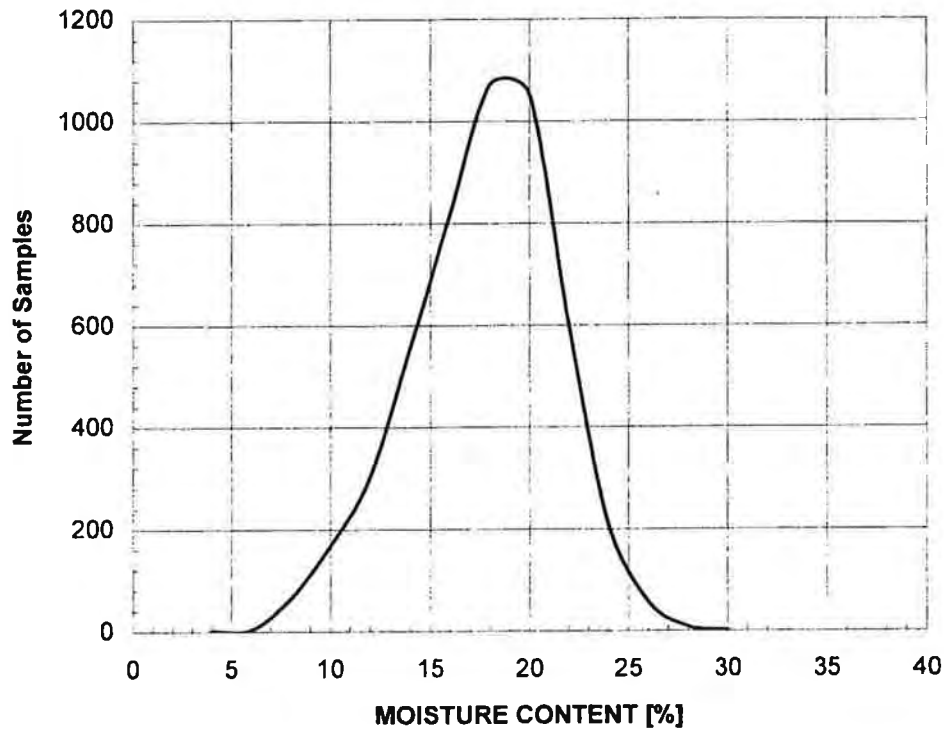
| Bin  | Frequency |
|------|-----------|
| 8    | 2         |
| 10   | 24        |
| 12   | 103       |
| 14   | 321       |
| 16   | 791       |
| 18   | 1007      |
| 20   | 929       |
| 22   | 672       |
| 24   | 388       |
| 26   | 161       |
| 28   | 38        |
| 30   | 13        |
| 32   | 6         |
| 34   | 3         |
| More | 0         |

|             |      |
|-------------|------|
| Population: | 4458 |
| Average:    | 18   |
| Deviation:  | 3    |



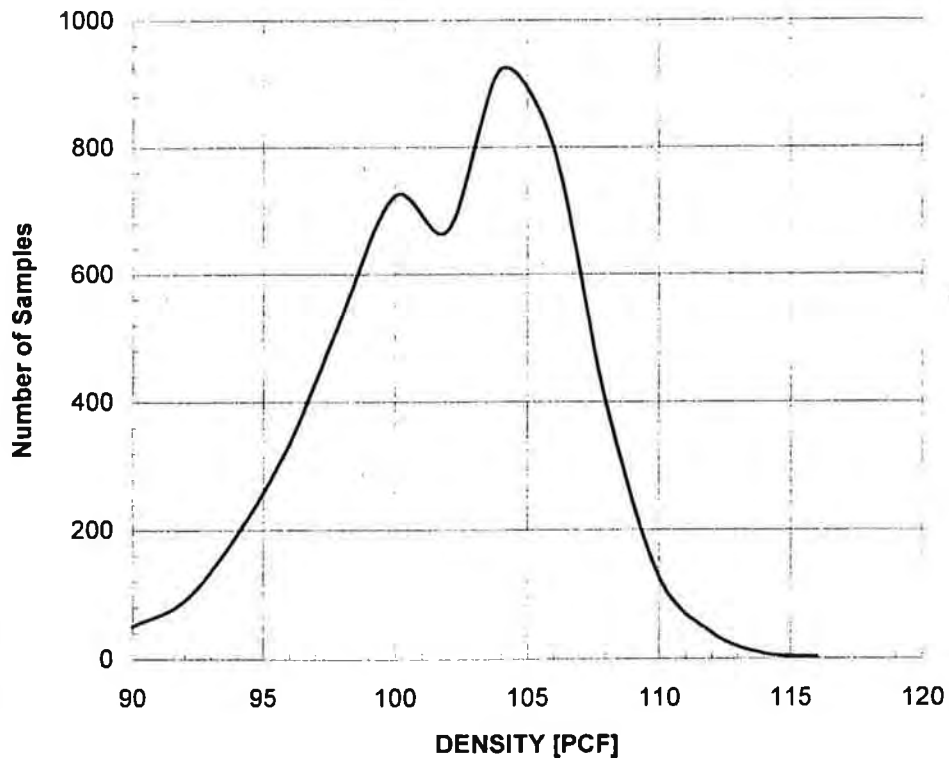
| Bin  | Frequency |
|------|-----------|
| 90   | 25        |
| 92   | 40        |
| 94   | 177       |
| 96   | 366       |
| 98   | 529       |
| 100  | 851       |
| 102  | 895       |
| 104  | 594       |
| 106  | 449       |
| 108  | 286       |
| 110  | 146       |
| 112  | 68        |
| 114  | 31        |
| 116  | 6         |
| 118  | 2         |
| 120  | 1         |
| More | 0         |

|             |      |
|-------------|------|
| Population: | 4464 |
| Average:    | 101  |
| Deviation:  | 4    |



| Bin  | Frequency |
|------|-----------|
| 4    | 1         |
| 6    | 3         |
| 8    | 64        |
| 10   | 168       |
| 12   | 302       |
| 14   | 556       |
| 16   | 817       |
| 18   | 1072      |
| 20   | 1053      |
| 22   | 601       |
| 24   | 213       |
| 26   | 58        |
| 28   | 9         |
| 30   | 2         |
| More | 0         |

|             |      |
|-------------|------|
| Population: | 4919 |
| Average:    | 17   |
| Deviation:  | 4    |



| Bin  | Frequency |
|------|-----------|
| 86   | 3         |
| 88   | 14        |
| 90   | 51        |
| 92   | 91        |
| 94   | 193       |
| 96   | 334       |
| 98   | 535       |
| 100  | 724       |
| 102  | 670       |
| 104  | 923       |
| 106  | 800       |
| 108  | 402       |
| 110  | 127       |
| 112  | 40        |
| 114  | 8         |
| 116  | 3         |
| More | 0         |

|             |      |
|-------------|------|
| Population: | 4919 |
| Average:    | 101  |
| Deviation:  | 5    |

**MAXIMUM DENSITY TEST RESULTS**  
(ASTM D1557)

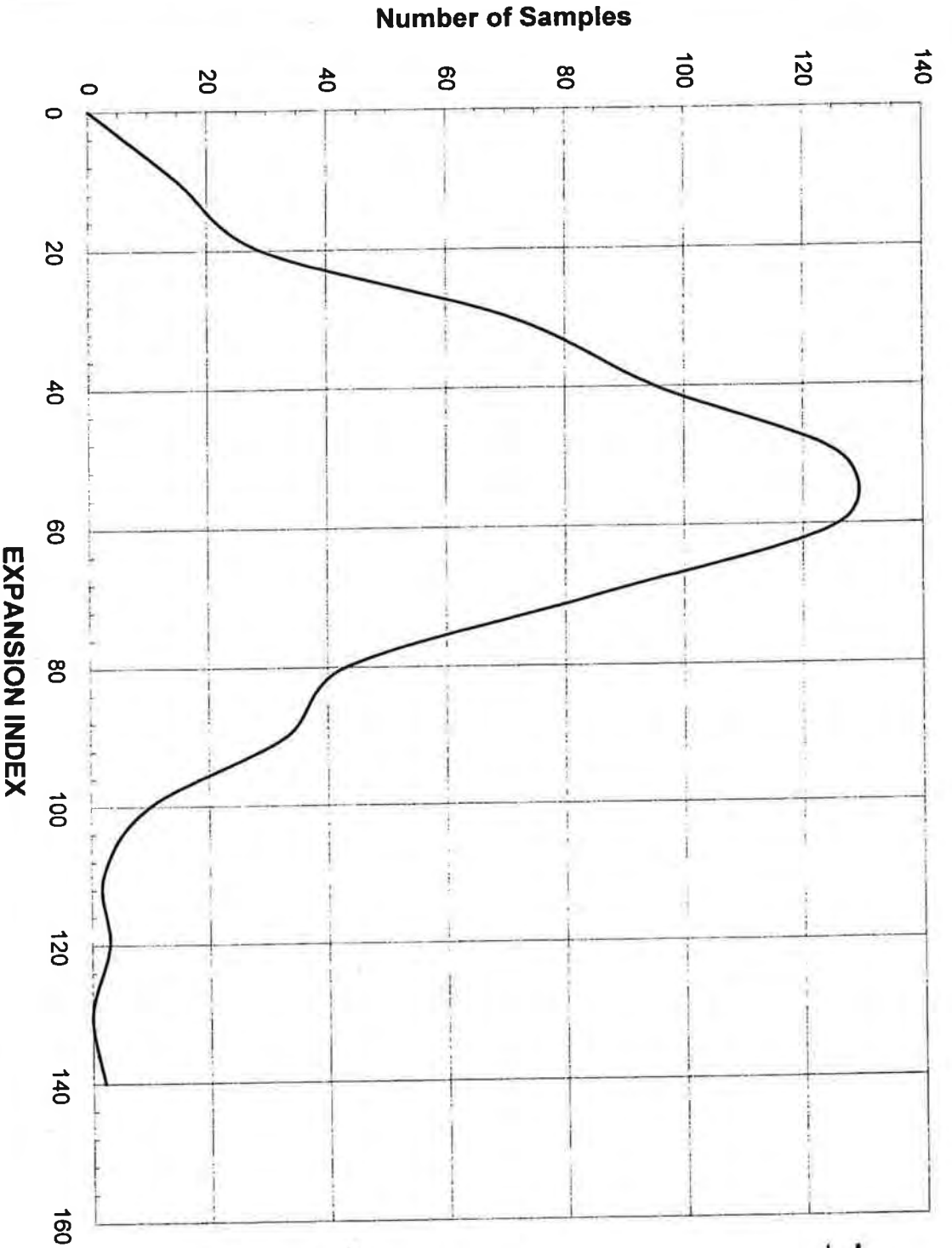
| <b>SAMPLE</b>   | <b>DESCRIPTION</b>                                  | <b>MAXIMUM DENSITY [PCF]</b> | <b>OPTIMUM MOISTURE [%]</b> |
|-----------------|---|------------------------------|-----------------------------|
| B-1 @ 10' - 12' | <u>Otay Formation</u> : Light gray sandy silt (ML). | 106½                         | 17½                         |
| B-5 @ 5' - 7'   | <u>Otay Formation</u> : Light gray sandy silt (ML). | 111                          | 15                          |

**EXPANSION INDEX TEST RESULTS  
(ASTM D4829)**

| <b>SAMPLE</b>   | <b>DESCRIPTION</b>                                      | <b>EXPANSION INDEX</b> |
|-----------------|---|------------------------|
| B-1 @ 10' - 12' | <u>Otay Formation</u> : Light gray sandy silt (ML).     | 53                     |
| B-2 @ 35' - 37' | <u>Otay Formation</u> : Brown fat clay (CH).            | 99                     |
| B-3 @ 39' - 41' | <u>Otay Formation</u> : Olive brown fat clay (CH).      | 69                     |
| B-4 @ 34' - 36' | <u>Otay Formation</u> : Light brown fat clay (CH).      | 74                     |
| B-6 @ 24' - 26' | <u>Otay Formation</u> : Light gray sandy silt (ML).     | 53                     |
| B-7 @ 42' - 44' | <u>Otay Formation</u> : Light gray silty sand (SM).     | 39                     |
| B-7 @ 50' - 52' | <u>Otay Formation</u> : Olive brown sandy silt (ML).    | 72                     |
| B-8 @ 7' - 9'   | <u>Otay Formation</u> : Olive brown sandy silt (ML).    | 44                     |
| TP-17 @ 4' - 6' | <u>Alluvium</u> : Dark brown sandy fat clay (CH).       | 99                     |
| TP-22 @ 0' - 2' | <u>Colluvium</u> : Dark brown lean clay with sand (CL). | 70                     |

**UBC TABLE NO. 18-1-B, CLASSIFICATION OF EXPANSIVE SOIL**

| <b>EXPANSION INDEX</b> | <b>POTENTIAL EXPANSION</b> |
|------------------------|----------------------------|
| 0-20                   | Very low                   |
| 21-50                  | Low                        |
| 51-90                  | Medium                     |
| 91-130                 | High                       |
| Above 130              | Very high                  |



| Bin  | Frequency |
|------|-----------|
| 0    | 0         |
| 10   | 15        |
| 20   | 29        |
| 30   | 71        |
| 40   | 95        |
| 50   | 126       |
| 60   | 126       |
| 70   | 85        |
| 80   | 43        |
| 90   | 33        |
| 100  | 10        |
| 110  | 2         |
| 120  | 3         |
| 130  | 0         |
| 140  | 2         |
| More | 0         |

|             |     |
|-------------|-----|
| Population: | 640 |
| Average:    | 50  |
| Deviation:  | 21  |



**EXPANSION INDEX DATA**  
(McMillin Olay Ranch, Village 1, 5 and 6)

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Document No. 03-0946

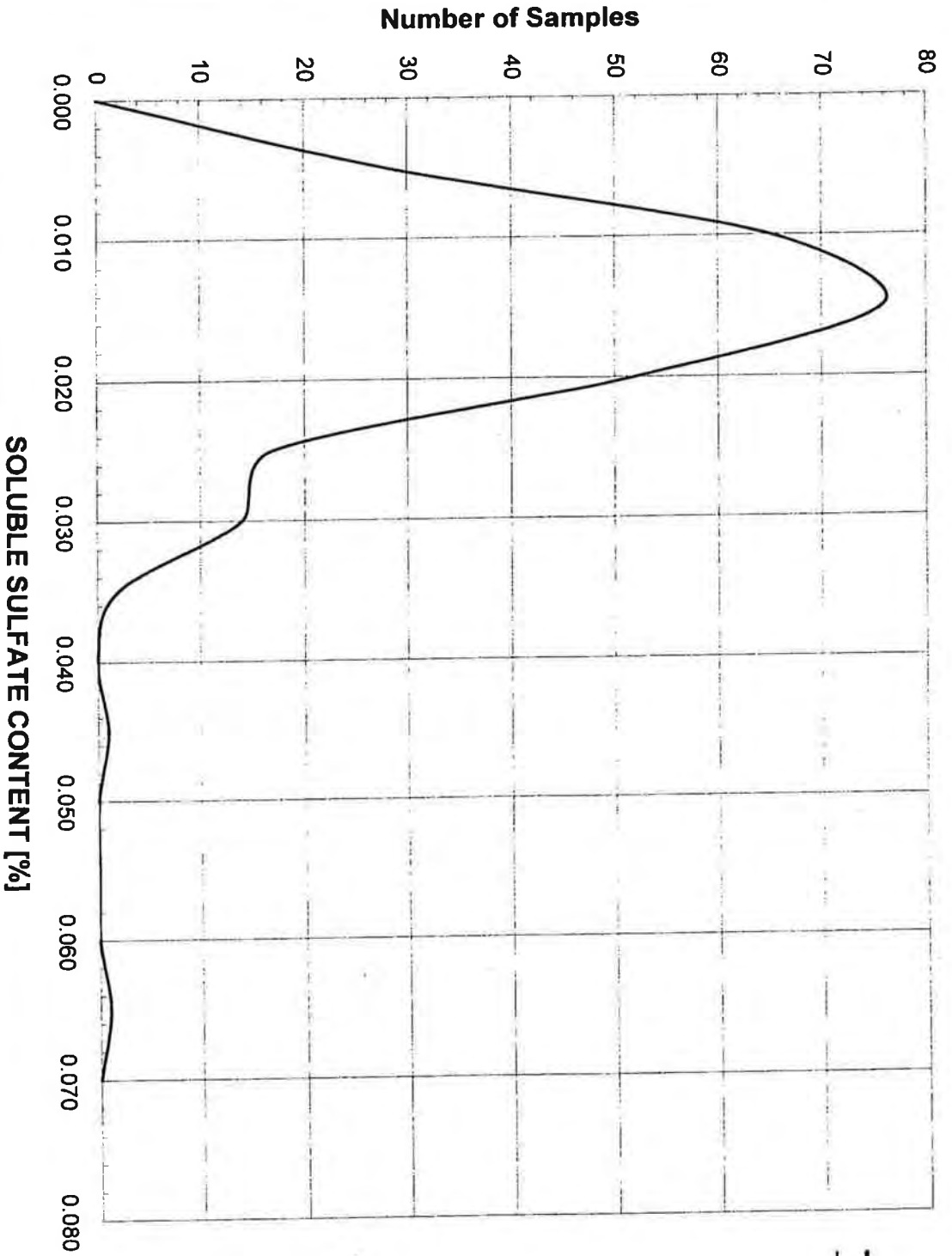
**FIGURE C-4.2**

**CHEMICAL TEST RESULTS**

| <b>SAMPLE</b>  | <b>pH</b> | <b>RESISTIVITY<br/>(OHM-CM)</b> | <b>SULFATE<br/>CONTENT [%]</b> | <b>CHLORIDE<br/>CONTENT [%]</b> |
|----------------|-----------|---------------------------------|--------------------------------|---------------------------------|
| B-2 @ 35'- 37' | 9.5       | 360                             | < 0.01                         | 0.03                            |
| B-3 @ 39'- 41' | 9.6       | 340                             | < 0.01                         | 0.05                            |
| B-4 @ 34'- 36' | 8.6       | 160                             | 0.05                           | 0.19                            |
| B-5 @ 5'- 7'   | 8.7       | 250                             | 0.01                           | 0.11                            |
| B-7 @ 50'- 52' | 9.9       | 550                             | < 0.01                         | 0.01                            |

**UBC TABLE NO. 19-A-4, REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE**

| <b>SULFATE CONTENT [%]</b> | <b>SULFATE EXPOSURE</b> | <b>CEMENT TYPE</b> |
|----------------------------|-------------------------|--------------------|
| 0.00-0.10                  | Negligible              | -                  |
| 0.10-0.20                  | Moderate                | II, IP(MS), IS(MS) |
| 0.20-2.00                  | Severe                  | V                  |
| Above 2.00                 | Very Severe             | V plus pozzolan    |



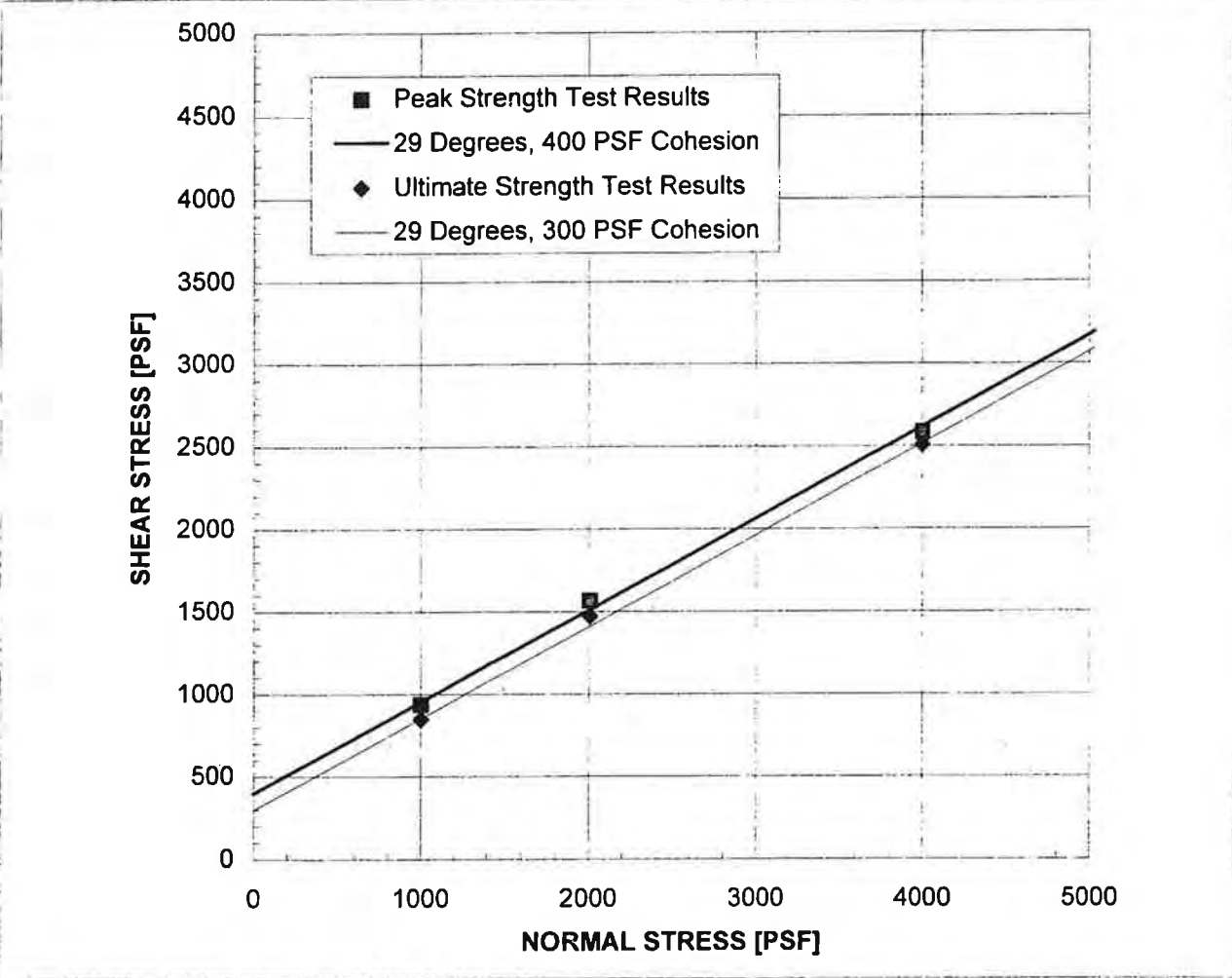
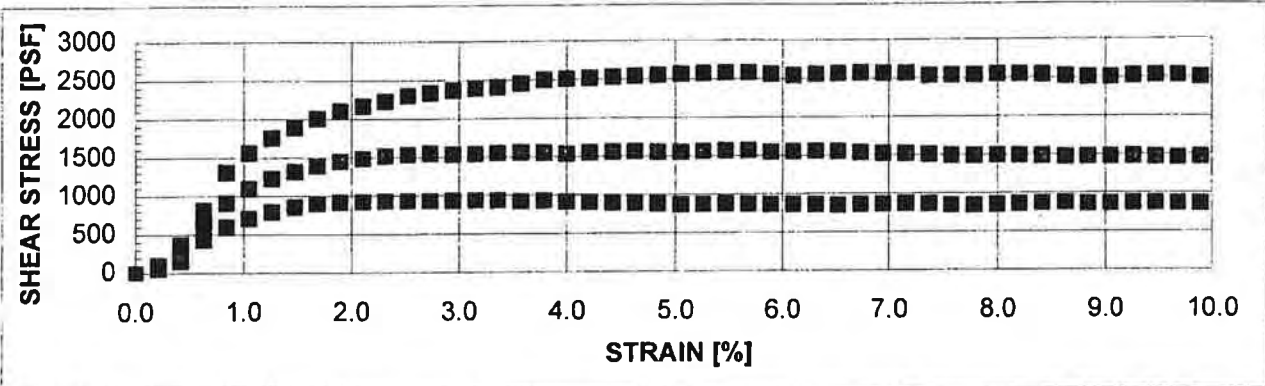
| Bin   | Frequency |
|-------|-----------|
| 0.000 | 0         |
| 0.005 | 28        |
| 0.010 | 65        |
| 0.015 | 76        |
| 0.020 | 52        |
| 0.025 | 17        |
| 0.030 | 14        |
| 0.035 | 2         |
| 0.040 | 0         |
| 0.045 | 1         |
| 0.050 | 0         |
| 0.055 | 0         |
| 0.060 | 0         |
| 0.065 | 1         |
| 0.070 | 0         |
| More  | 0         |

|             |       |
|-------------|-------|
| Population: | 430   |
| Average:    | 0.014 |
| Deviation:  | 0.008 |



**SOLUBLE SULFATE DATA**  
 (McMillin Olay Ranch, Village 1, 5 and 6)

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-5.2**



**SAMPLE:** B-1 @ 10' -12'

**Fill:** Light gray sandy silt (ML).  
Remolded to ~90% Max. @ Optimum.

**PEAK**

|         |         |
|---------|---------|
| $\phi'$ | 29 °    |
| $C'$    | 400 PSF |

**ULTIMATE**

|         |         |
|---------|---------|
| $\phi'$ | 29 °    |
| $C'$    | 300 PSF |

**STRAIN RATE:** 0.0010 IN/MIN  
(Sample was consolidated and drained)

**IN-SITU**

|            |          |
|------------|----------|
| $\gamma_d$ | 95.6 PCF |
| $w_c$      | 17.9 %   |

**AS-TESTED**

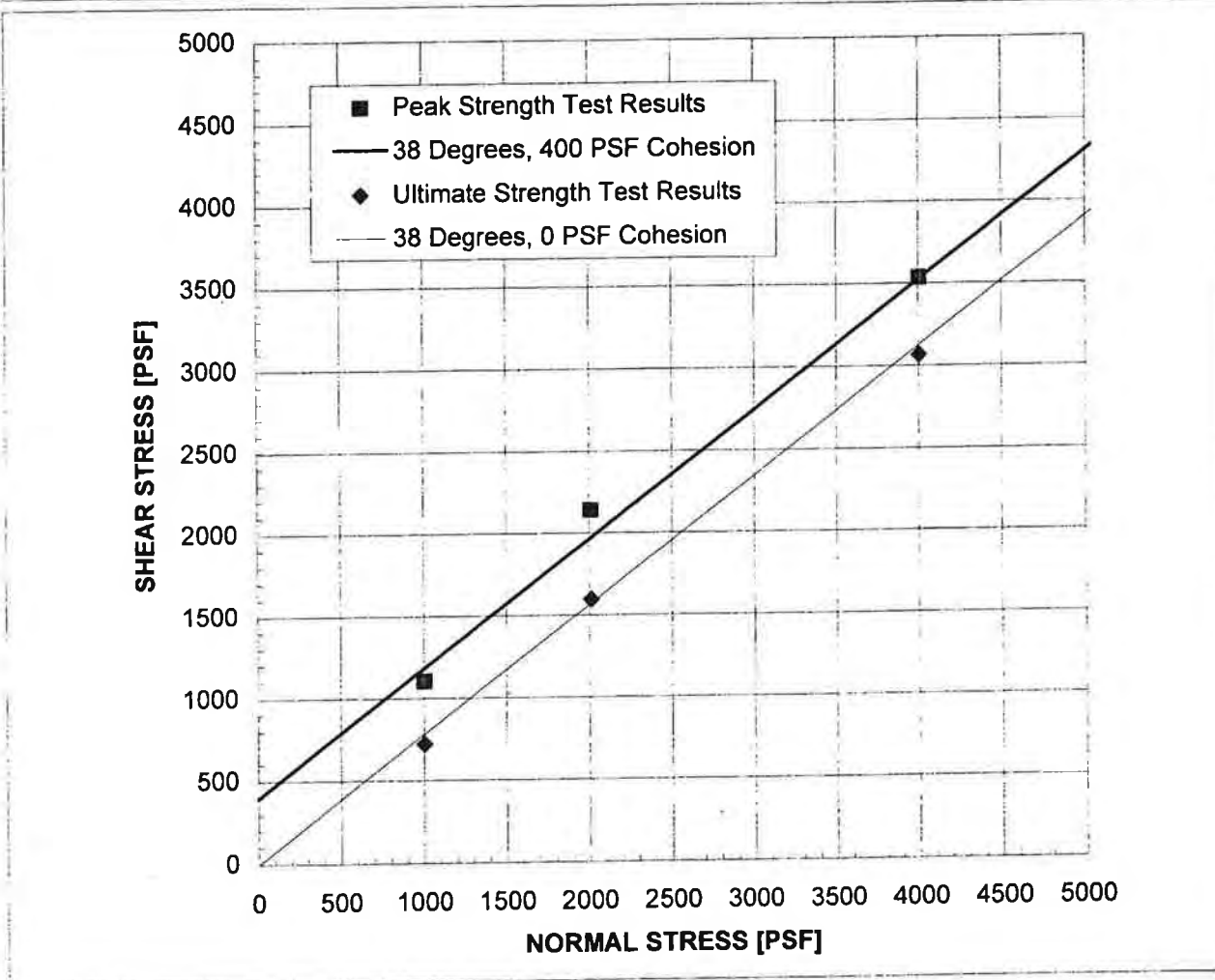
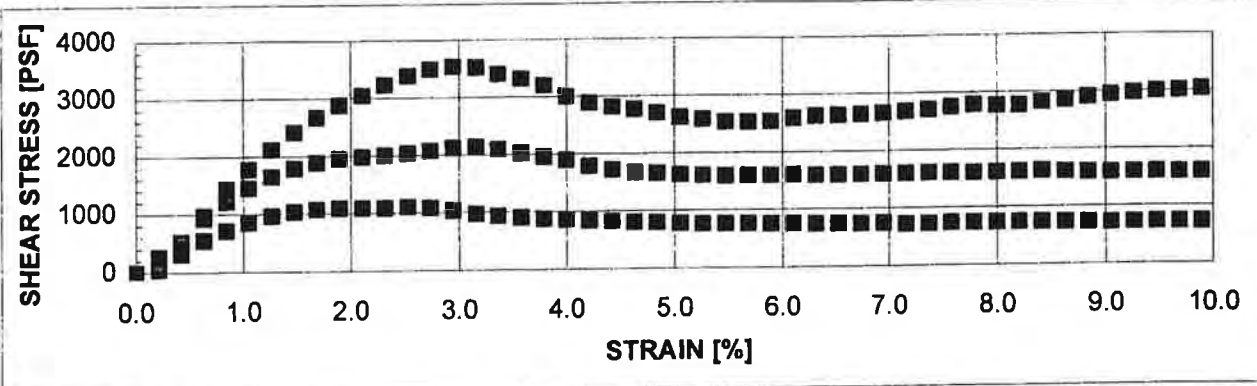
|            |          |
|------------|----------|
| $\gamma_d$ | 95.6 PCF |
| $w_c$      | 28.3 %   |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.1**





**SAMPLE:** B-1 @ 20' -21'

**OTAY FORMATION:** Light gray claystone with sand (CL).

**STRAIN RATE:** 0.0010 IN/MIN  
(Sample was consolidated and drained)

| PEAK    |         |
|---------|---------|
| $\phi'$ | 38 °    |
| $C'$    | 400 PSF |

| IN-SITU    |          |
|------------|----------|
| $\gamma_d$ | 96.6 PCF |
| $w_c$      | 26.4 %   |

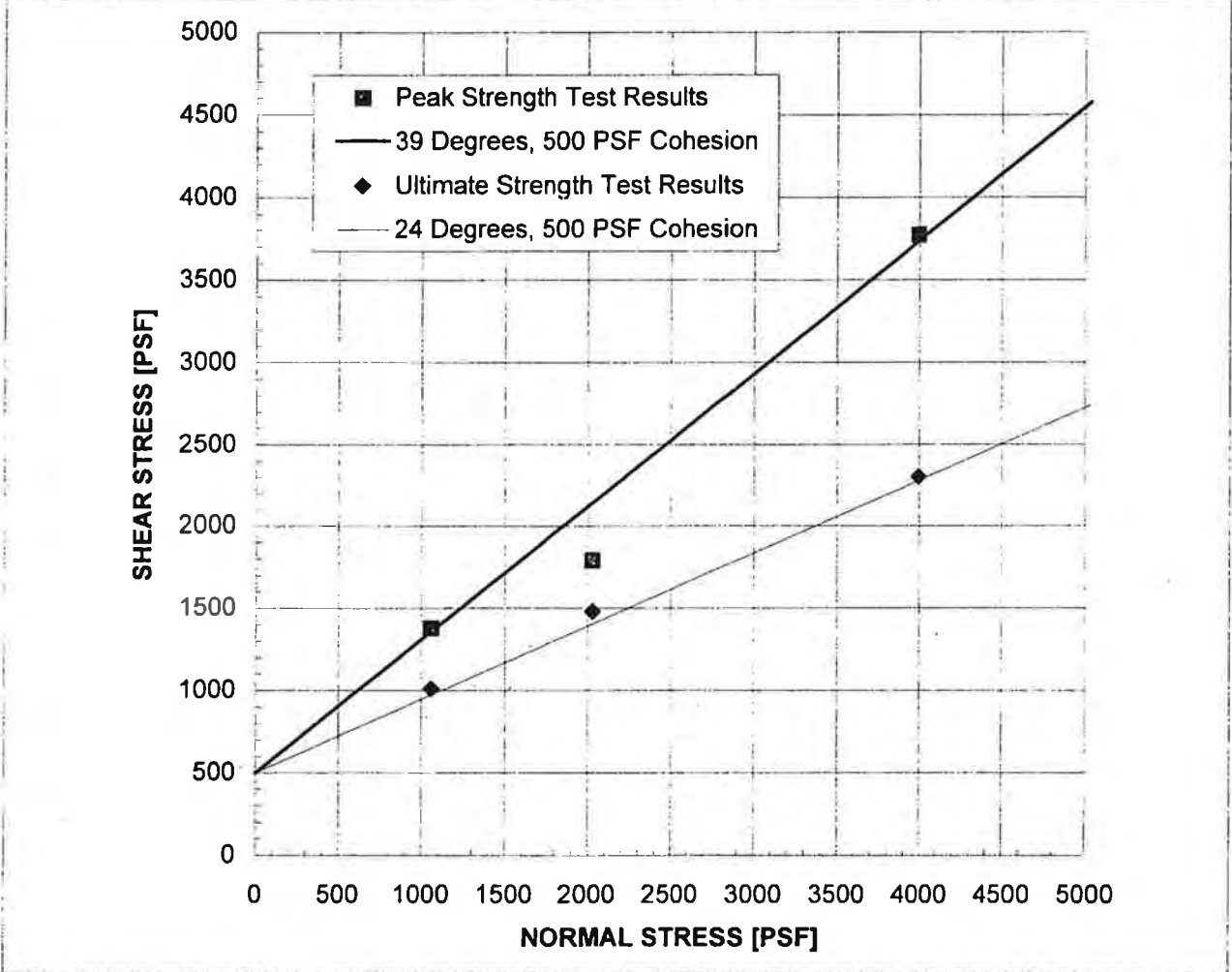
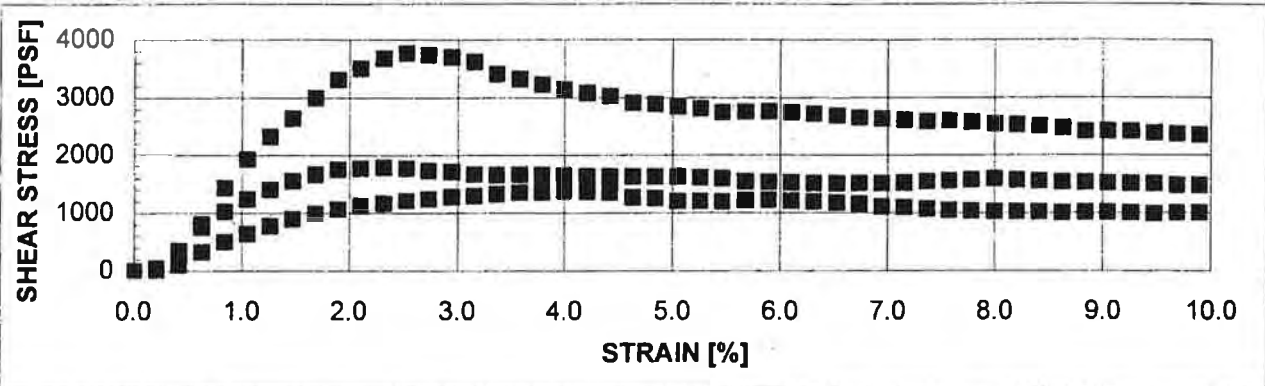
| ULTIMATE |
|----------|
| 38 °     |
| 0 PSF    |

| AS-TESTED |
|-----------|
| 96.6 PCF  |
| 27.5 %    |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.2**



**SAMPLE:** B-2 @ 30' -31'

**OTAY FORMATION:** Red brown claystone with sand (CL).

|         | PEAK    |
|---------|---------|
| $\phi'$ | 39 °    |
| C'      | 500 PSF |

|    | ULTIMATE |
|----|----------|
|    | 24 °     |
| C' | 500 PSF  |

**STRAIN RATE:** 0.0008 IN/MIN  
(Sample was consolidated and drained)

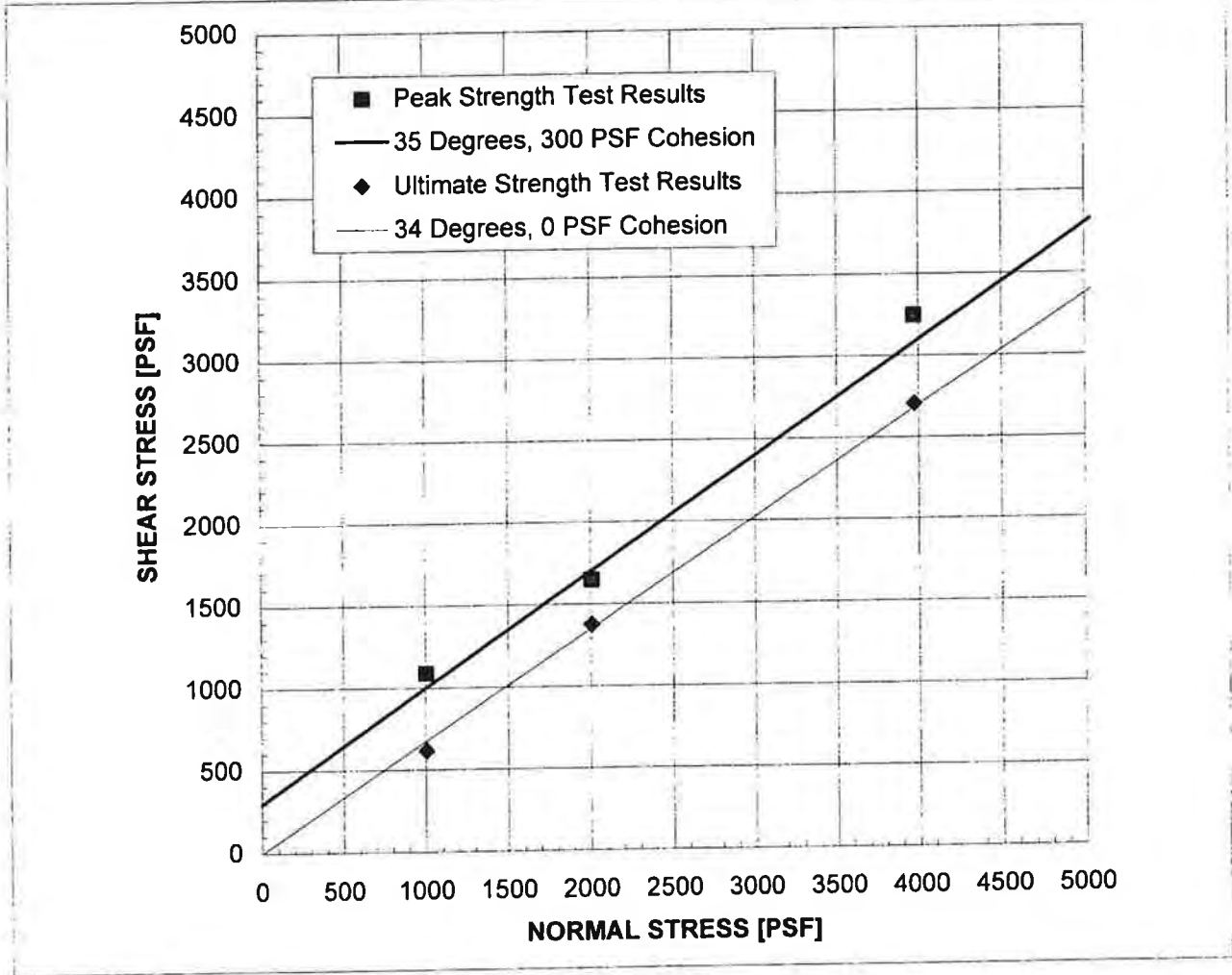
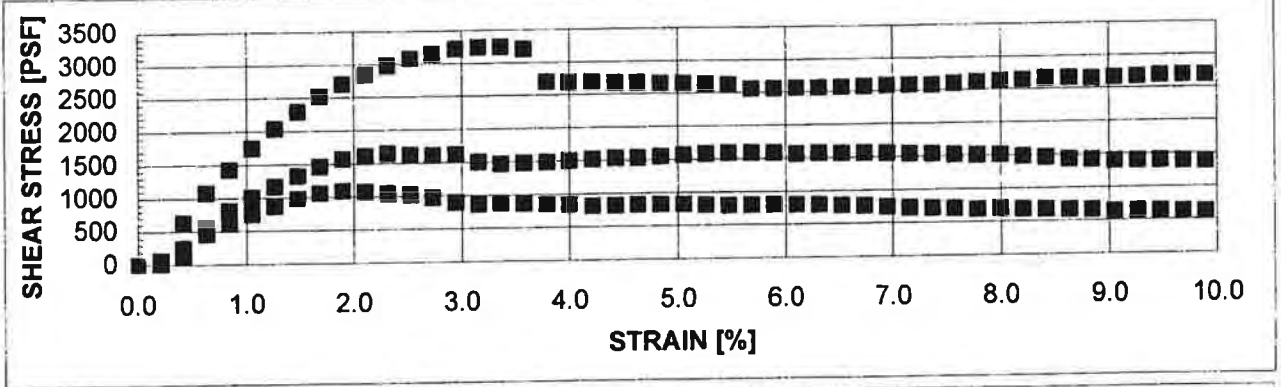
|                | IN-SITU  |
|----------------|----------|
| $\gamma_d$     | 98.9 PCF |
| w <sub>c</sub> | 21.9 %   |

|                | AS-TESTED |
|----------------|-----------|
| $\gamma_d$     | 98.9 PCF  |
| w <sub>c</sub> | 26.1 %    |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.3**



SAMPLE: B-4 @ 20' -21'

**OTAY FORMATION:** Light gray siltstone (ML).

STRAIN RATE: 0.0010 IN/MIN  
(Sample was consolidated and drained)

| PEAK    |         |
|---------|---------|
| $\phi'$ | 35 °    |
| $C'$    | 300 PSF |

| IN-SITU    |           |
|------------|-----------|
| $\gamma_d$ | 108.8 PCF |
| $w_c$      | 13.6 %    |

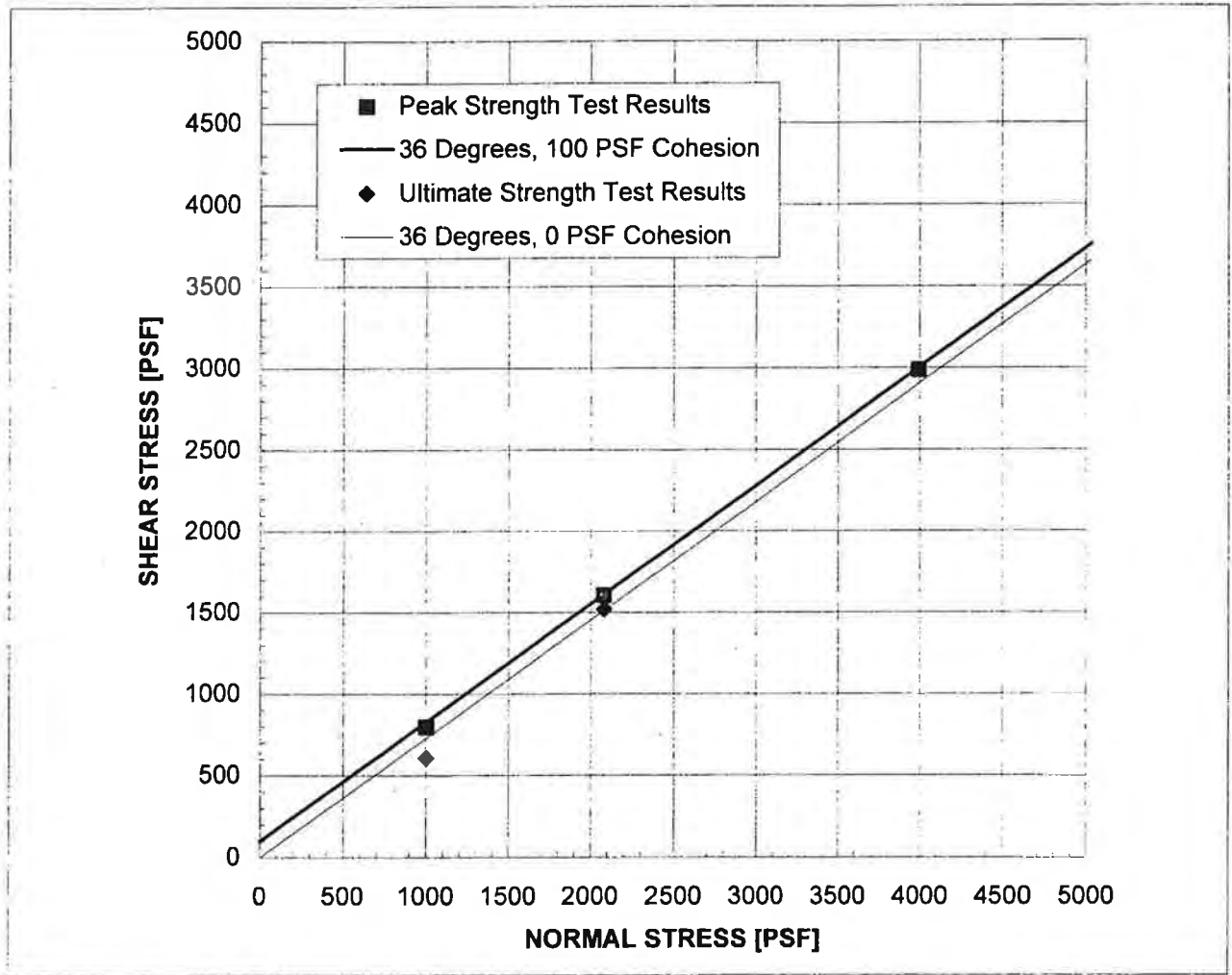
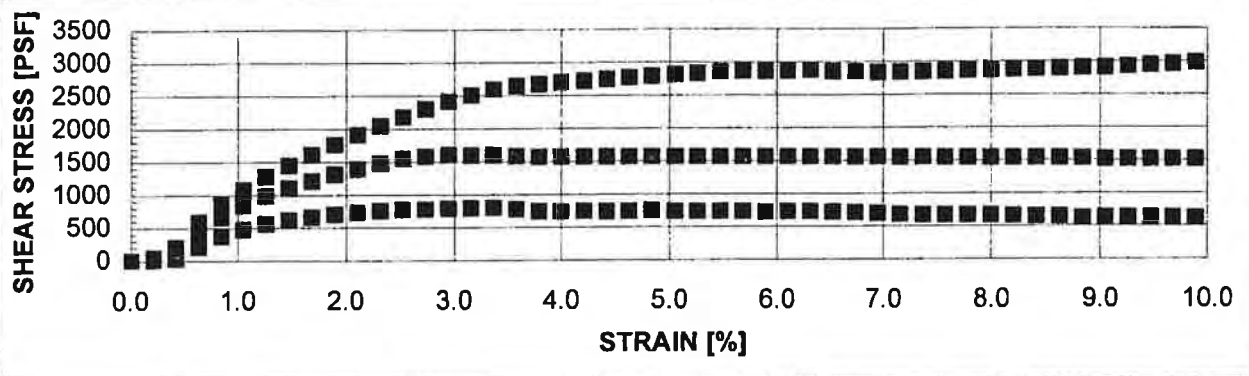
| ULTIMATE |       |
|----------|-------|
| $\phi'$  | 34 °  |
| $C'$     | 0 PSF |

| AS-TESTED  |           |
|------------|-----------|
| $\gamma_d$ | 108.8 PCF |
| $w_c$      | 20.3 %    |



**DIRECT SHEAR TEST RESULTS**

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Document No. 03-0946  
**FIGURE C-6.4**



**SAMPLE:** B-4 @ 30' -31'

**OTAY FORMATION:** Light gray siltstone with sand (ML).

|         | PEAK    |
|---------|---------|
| $\phi'$ | 36 °    |
| C'      | 100 PSF |

| ULTIMATE |
|----------|
| 36 °     |
| 0 PSF    |

**STRAIN RATE:** 0.0008 IN/MIN  
(Sample was consolidated and drained)

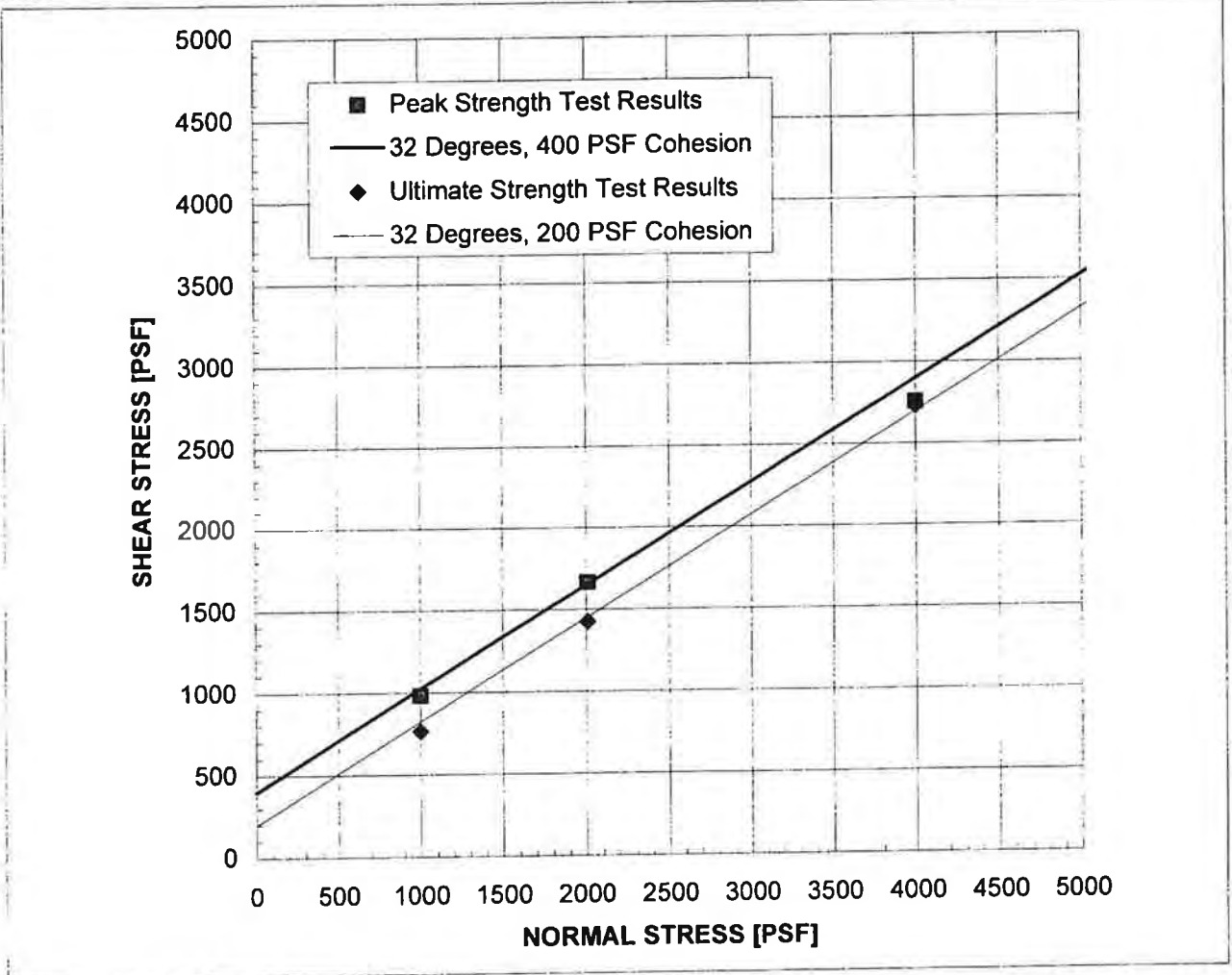
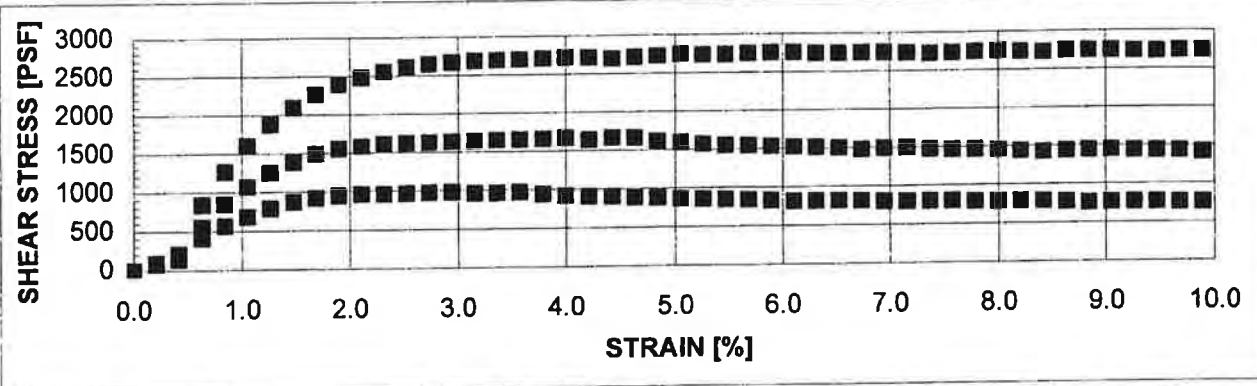
|                | IN-SITU   |
|----------------|-----------|
| $\gamma_d$     | 109.4 PCF |
| w <sub>c</sub> | 10.3 %    |

| AS-TESTED |
|-----------|
| 109.4 PCF |
| 20.0 %    |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.5**



**SAMPLE:** B-5 @ 5' -7'

**FILL:** Light gray sandy silt (ML).  
Remolded to ~90% Max. @ Optimum.

| PEAK    |         |
|---------|---------|
| $\phi'$ | 32 °    |
| $C'$    | 400 PSF |

| ULTIMATE |         |
|----------|---------|
|          | 32 °    |
|          | 200 PSF |

**STRAIN RATE:** 0.0010 IN/MIN  
(Sample was consolidated and drained)

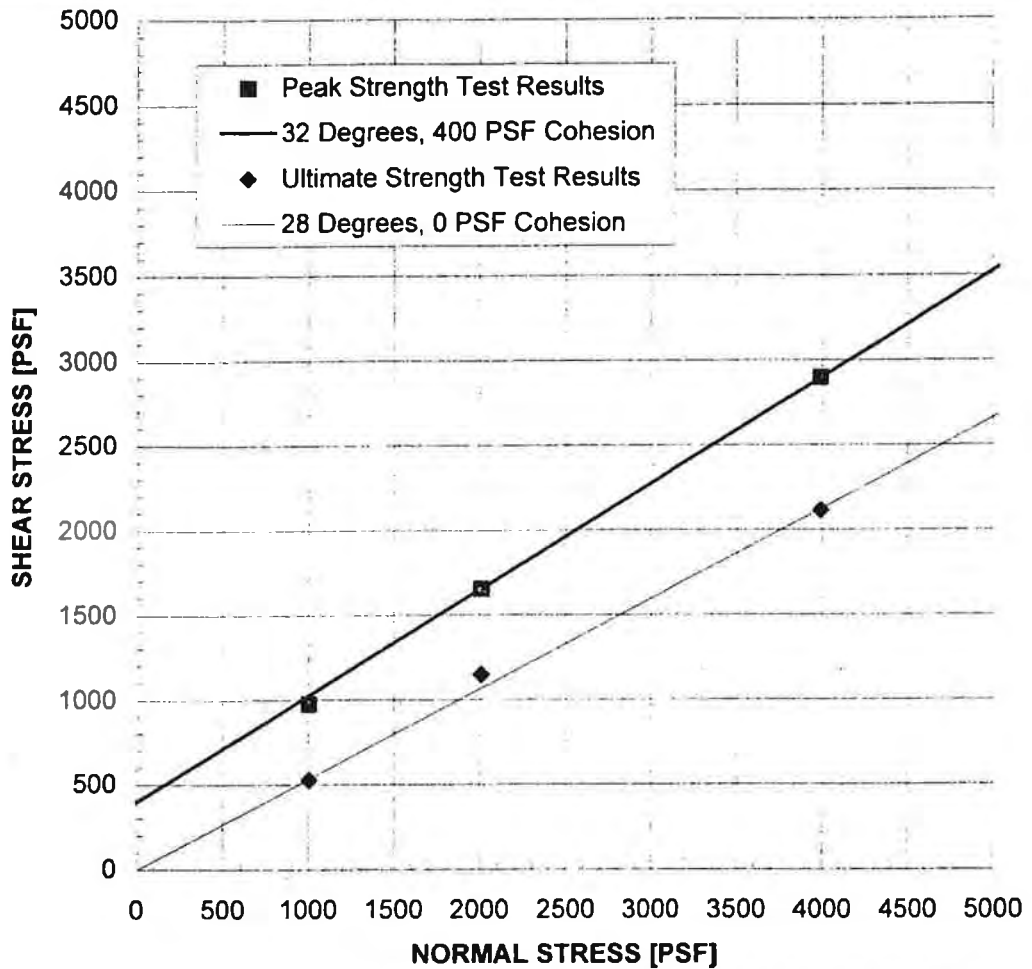
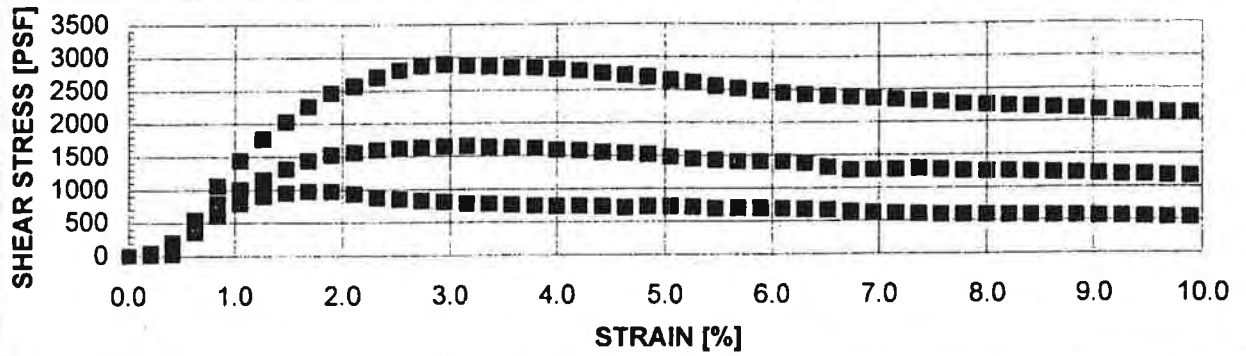
| IN-SITU    |          |
|------------|----------|
| $\gamma_d$ | 99.4 PCF |
| $w_c$      | 14.7 %   |

| AS-TESTED |          |
|-----------|----------|
|           | 99.4 PCF |
|           | 25.7 %   |



**DIRECT SHEAR TEST RESULTS**

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**FIGURE C-6.6**



SAMPLE: B-5 @ 30' - 31'

**OTAY FORMATION:** Light brown siltstone (ML).

**STRAIN RATE:** 0.0005 IN/MIN  
(Sample was consolidated and drained)

**PEAK**

|         |         |
|---------|---------|
| $\phi'$ | 32 °    |
| C'      | 400 PSF |

**IN-SITU**

|            |          |
|------------|----------|
| $\gamma_d$ | 88.0 PCF |
| $w_c$      | 33.3 %   |

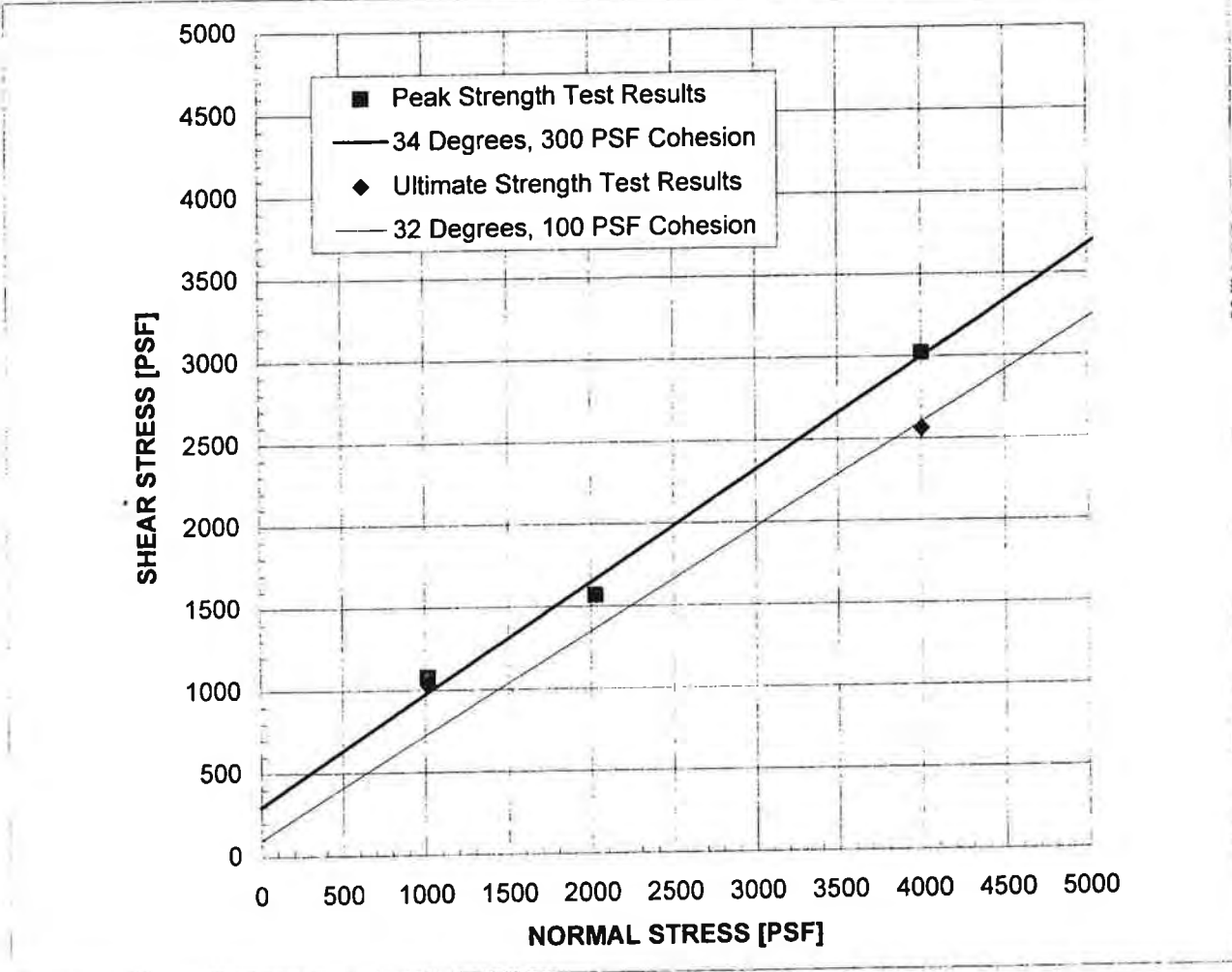
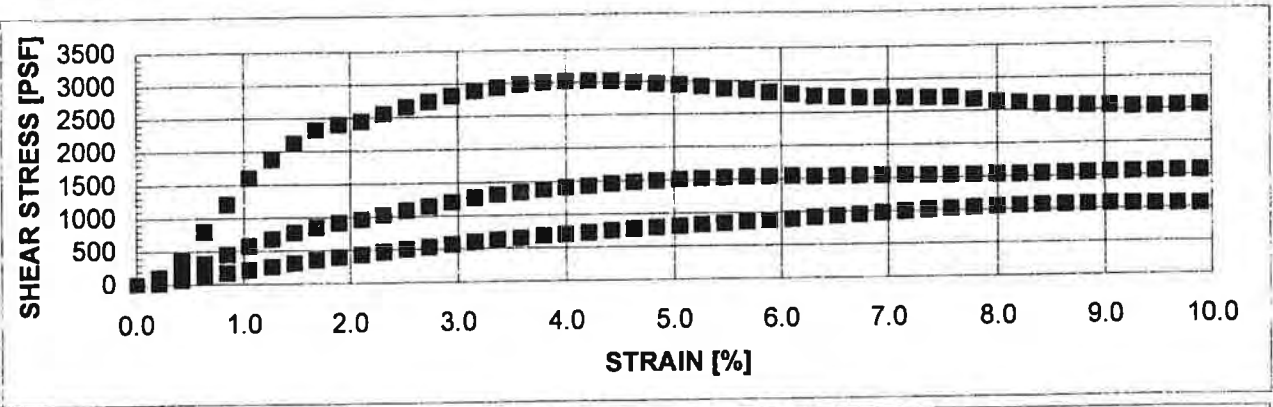
**ULTIMATE**

|         |       |
|---------|-------|
| $\phi'$ | 28 °  |
| C'      | 0 PSF |

**AS-TESTED**

|            |          |
|------------|----------|
| $\gamma_d$ | 88.0 PCF |
| $w_c$      | 33.9 %   |





SAMPLE: B-5 @ 80' - 81'

**OTAY FORMATION:** Light brown silty sandstone (SM).

**STRAIN RATE:** 0.0050 IN/MIN  
(Sample was consolidated and drained)

**PEAK**

|         |         |
|---------|---------|
| $\phi'$ | 34 °    |
| $C'$    | 300 PSF |

**IN-SITU**

|            |           |
|------------|-----------|
| $\gamma_d$ | 102.4 PCF |
| $w_c$      | 7.6 %     |

**ULTIMATE**

|  |         |
|--|---------|
|  | 32 °    |
|  | 100 PSF |

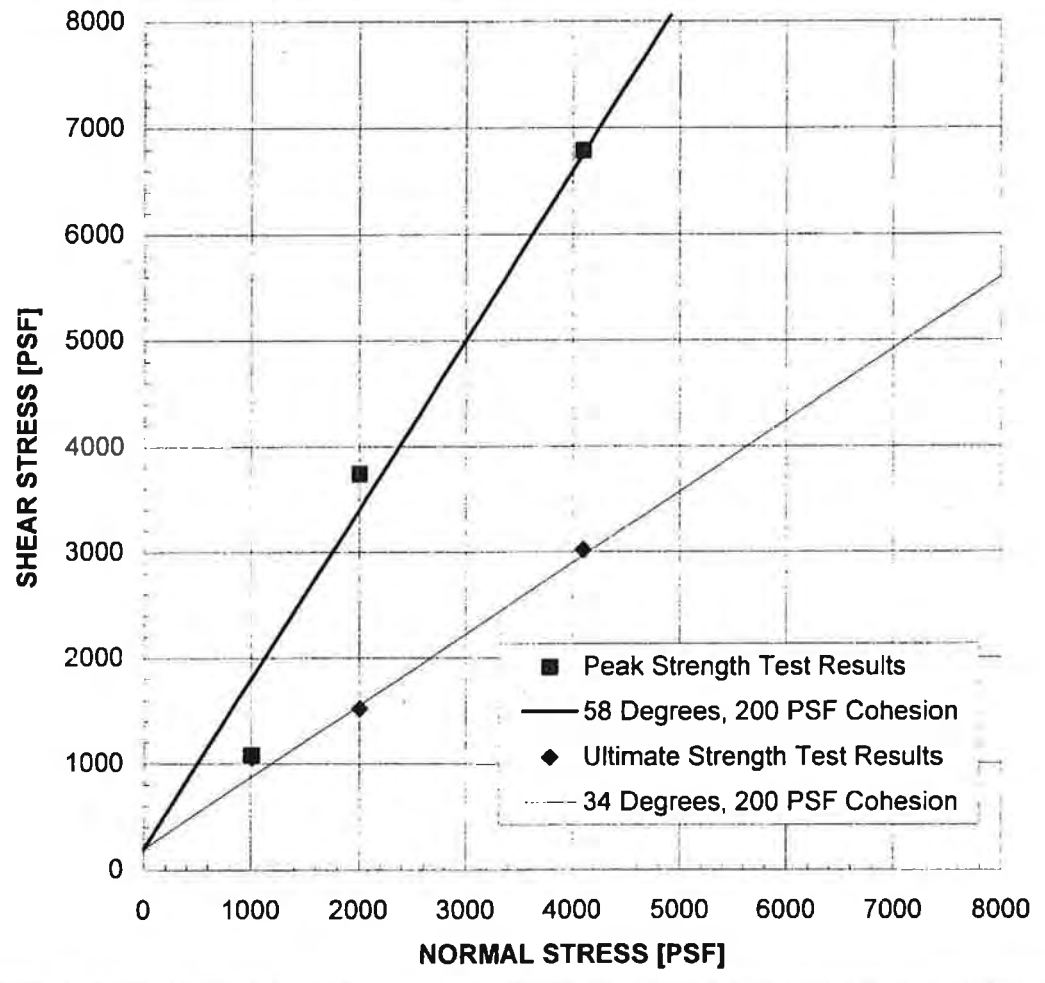
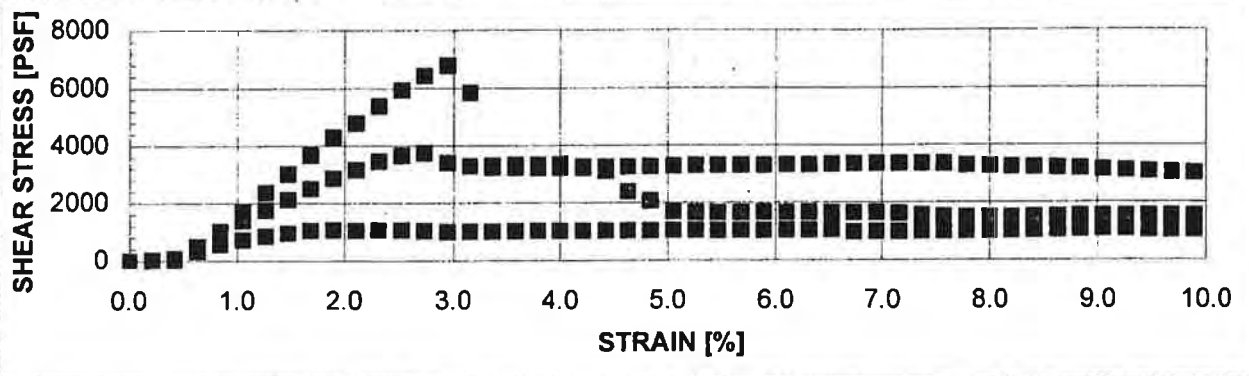
**AS-TESTED**

|  |           |
|--|-----------|
|  | 102.4 PCF |
|  | 23.9 %    |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.8**



**SAMPLE:** B-6 @ 20' - 21'

**OTAY FORMATION:** Light brown silty sandstone (SM). Cemented.

**STRAIN RATE:** 0.0050 IN/MIN  
(Sample was consolidated and drained)

|         | <b>PEAK</b> |
|---------|-------------|
| $\phi'$ | 58 °        |
| $C'$    | 200 PSF     |

|  | <b>ULTIMATE</b> |
|--|-----------------|
|  | 34 °            |
|  | 200 PSF         |

|            | <b>IN-SITU</b> |
|------------|----------------|
| $\gamma_d$ | 111.1 PCF      |
| $w_c$      | 17.2 %         |

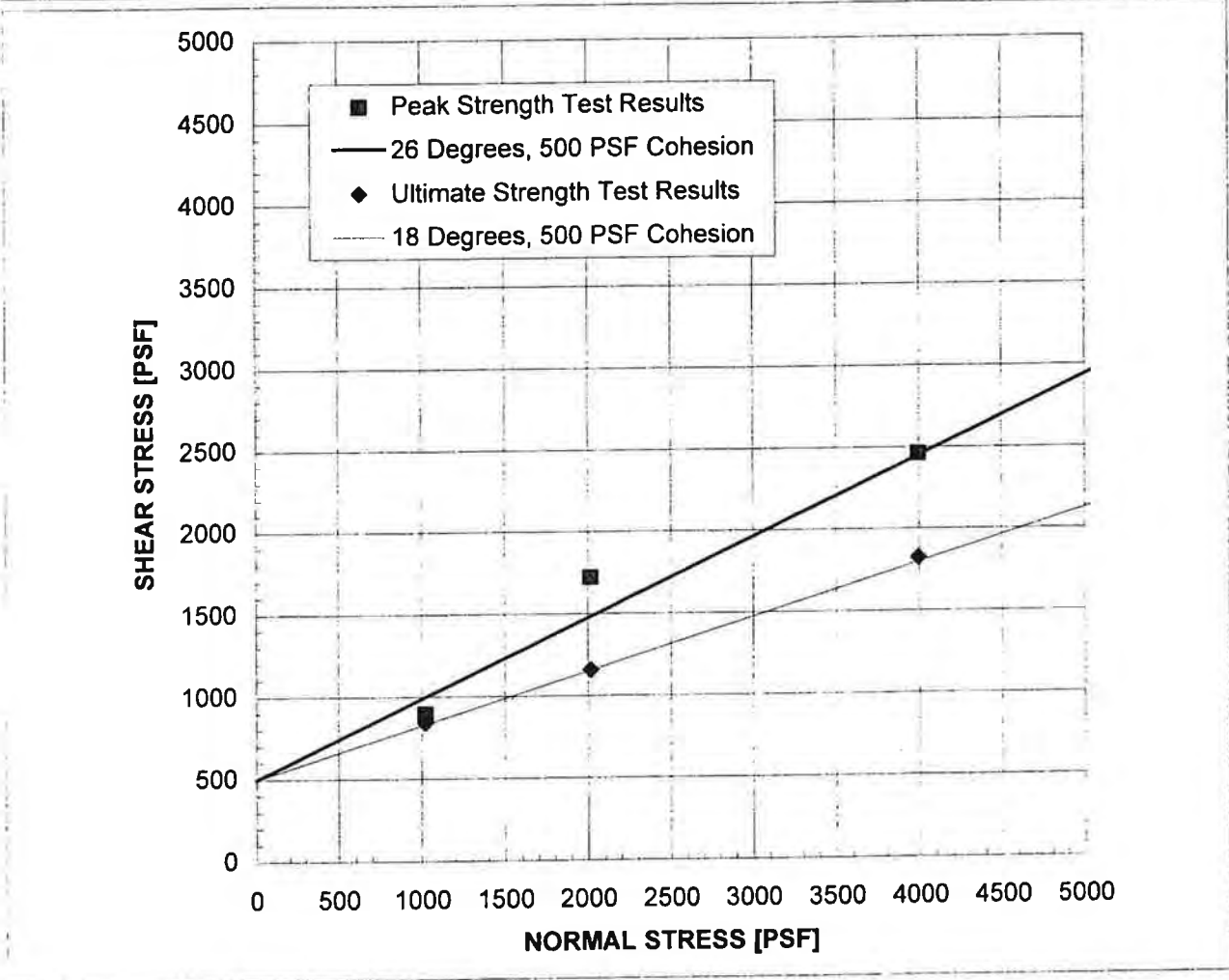
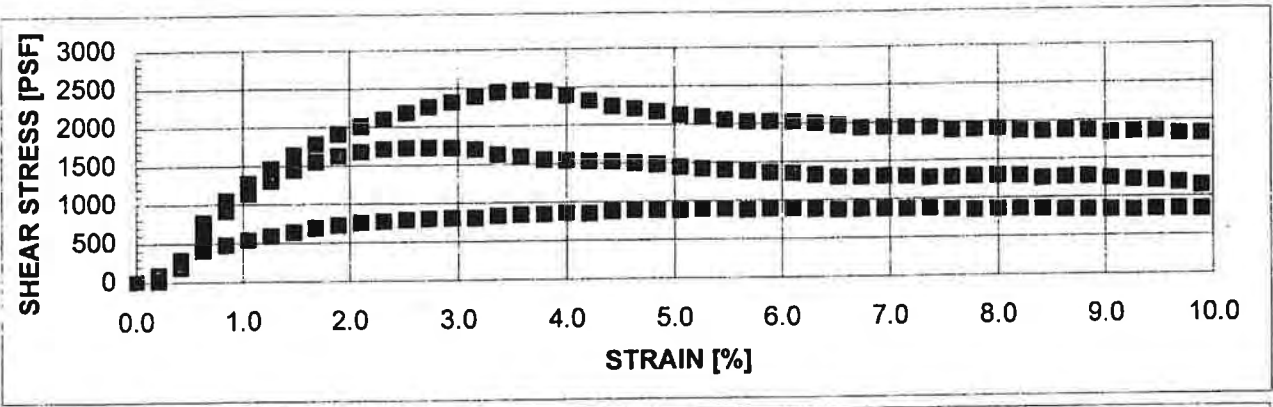
|  | <b>AS-TESTED</b> |
|--|------------------|
|  | 111.1 PCF        |
|  | 19.1 %           |



**DIRECT SHEAR TEST RESULTS**

Project No. 0367-014-00  
Document No. 03-0946  
**FIGURE C-6.9**



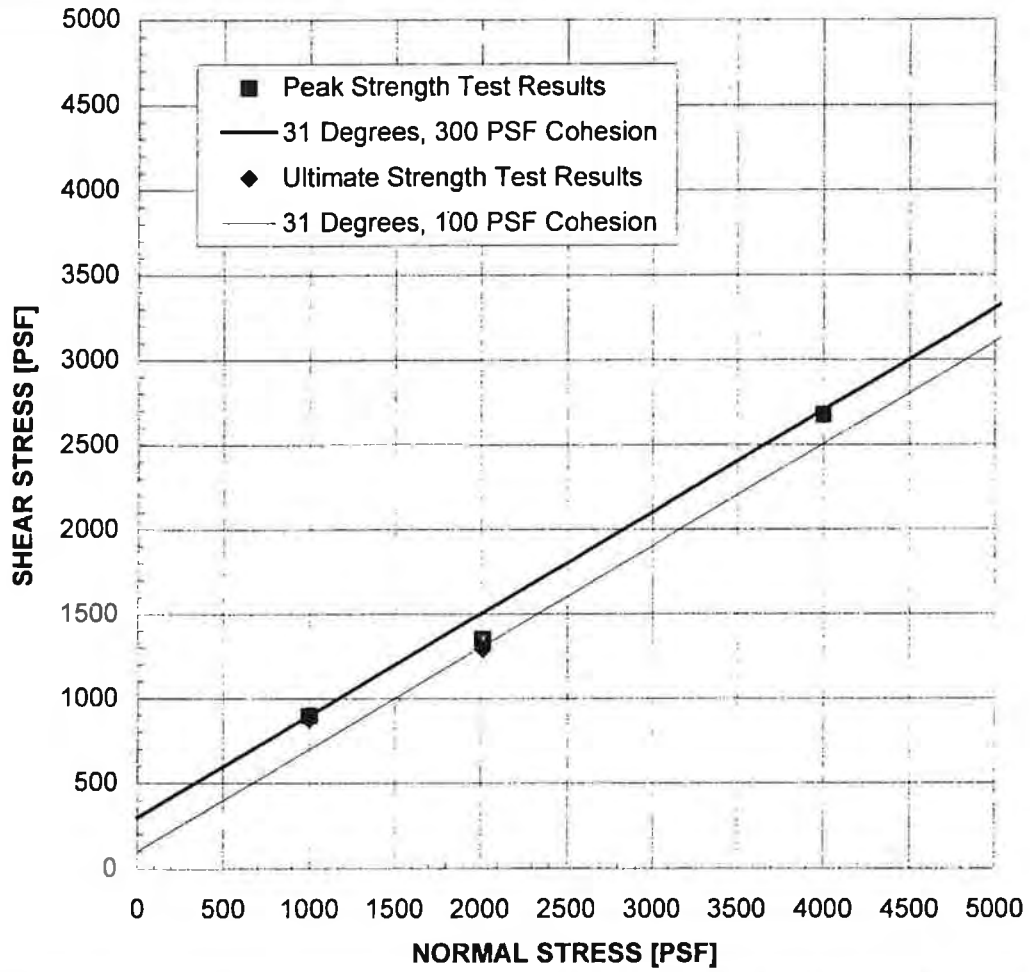
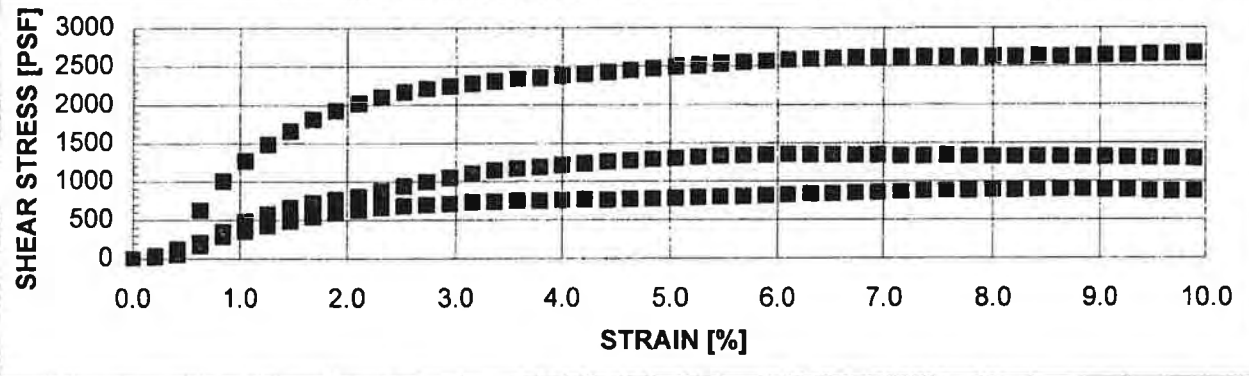


|  |                      |                  |
|--|----------------------|------------------|
| <b>SAMPLE:</b> B-7 @ 40' - 41'   | <b>PEAK</b>          | <b>ULTIMATE</b>  |
| <b>QTAY FORMATION:</b> Gray brown sandy siltstone (ML).                    | $\phi'$ 26°          | 18°              |
|  | $C'$ 500 PSF         | 500 PSF          |
| <b>STRAIN RATE:</b> 0.0005 IN/MIN<br>(Sample was consolidated and drained) | <b>IN-SITU</b>       | <b>AS-TESTED</b> |
|  | $\gamma_d$ 105.1 PCF | 105.1 PCF        |
|  | $w_c$ 21.1 %         | 22.3 %           |



**DIRECT SHEAR TEST RESULTS**

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 Document No. 03-0946  
**FIGURE C-6.10**



**SAMPLE:** B-7 @ 50' - 51'

**OTAY FORMATION:** Light brown silty sandstone (SM).

**PEAK**

$\phi'$  31°

$C'$  300 PSF

**ULTIMATE**

31°

100 PSF

**STRAIN RATE:** 0.0050 IN/MIN  
(Sample was consolidated and drained)

**IN-SITU**

$\gamma_d$  106.4 PCF

$w_c$  8.7 %

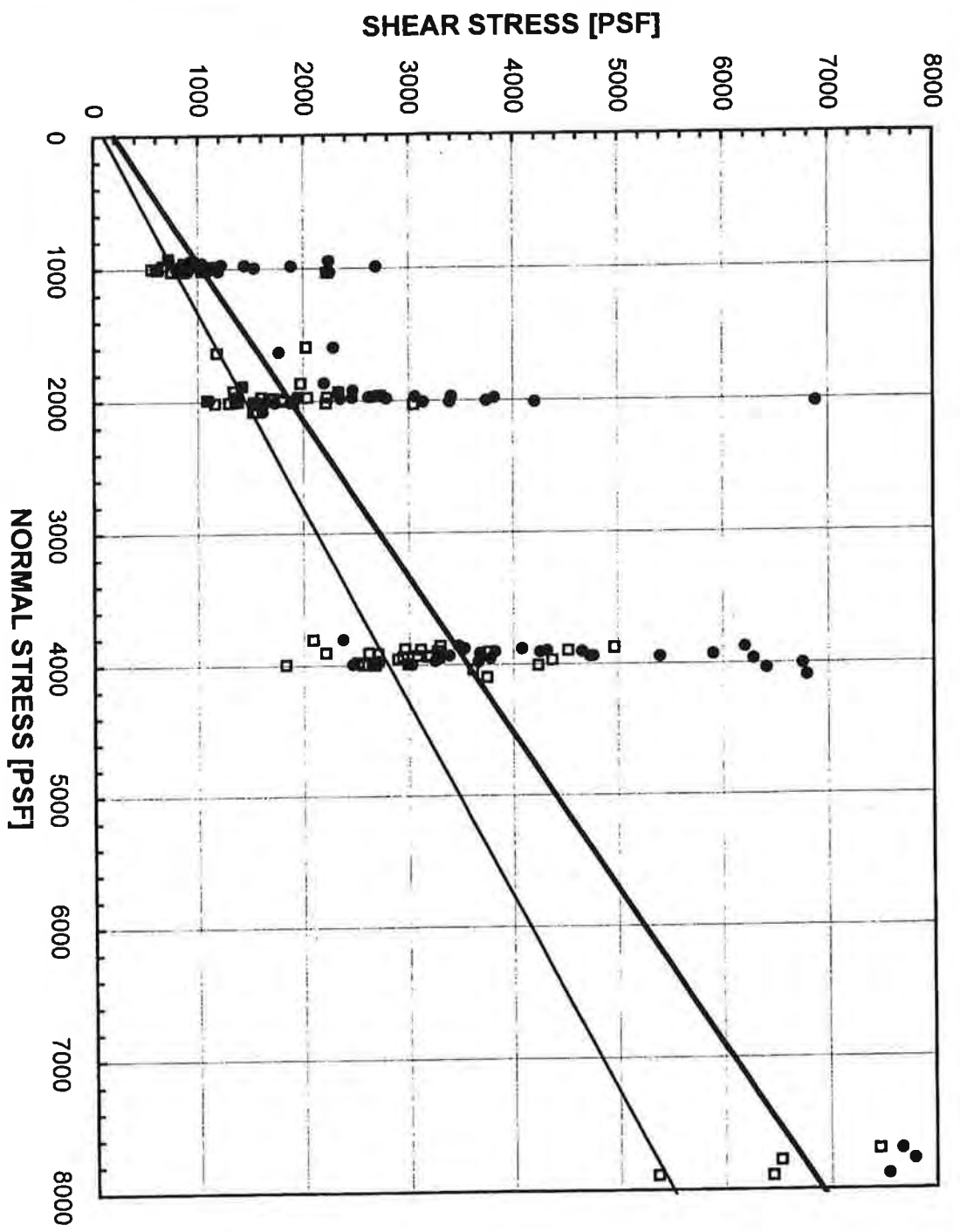
**AS-TESTED**

106.4 PCF

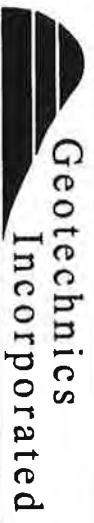
21.6 %



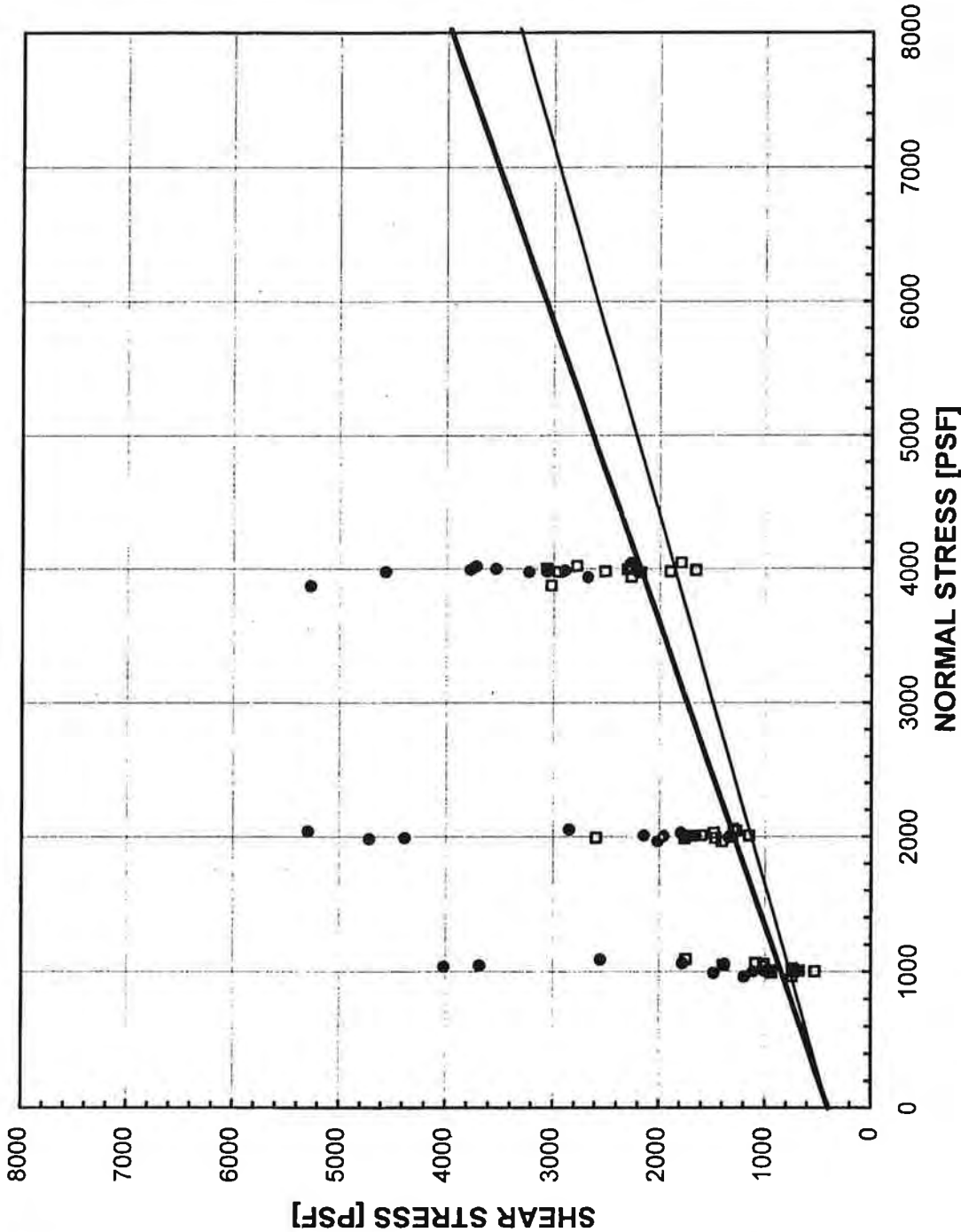
**DIRECT SHEAR TEST RESULTS**



**CLAY FORMATION (To):** A summary of direct shear tests from Villages 1, 5, 6, 7 & 12, including SP, SM, SC and ML materials.



**DIRECT SHEAR TEST SUMMARY**



**QTAY FORMATION (IQ):** A summary of direct shear tests from Villages 1, 5, 6, 7 & 12, including MH, CL, and CH materials.

| GEOLOGIC NAME | SAMPLE ID | USCS | DESCRIPTION | ULTIMATE VALUES     |                | PEAK VALUES         |                |
|---------------|-----------|------|-------------|---------------------|----------------|---------------------|----------------|
|               |           |      |             | FRICITION ANGLE [°] | COHESION [PSF] | FRICITION ANGLE [°] | COHESION [PSF] |

**TEST RESULTS**

|                     |                 |    |   |    |     |    |     |
|---------------------|-----------------|----|---|----|-----|----|-----|
| FILL                | B-1 @ 10' - 12' | ML | Light gray sandy silt (ML). Remolded to ~90% Max. | 29 | 300 | 29 | 400 |
| OTAY FORMATION (To) | B-1 @ 20' - 21' | CL | Light gray claystone with sand (CL).              | 38 | 0   | 38 | 400 |
| OTAY FORMATION (To) | B-2 @ 30' - 31' | CL | Red brown claystone with sand (CL).               | 24 | 500 | 39 | 500 |
| OTAY FORMATION (To) | B-4 @ 20' - 21' | ML | Light gray siltstone (ML).                        | 34 | 0   | 35 | 300 |
| OTAY FORMATION (To) | B-4 @ 30' - 31' | ML | Light gray siltstone with sand (ML).              | 36 | 0   | 36 | 100 |
| FILL                | B-5 @ 5' - 7'   | ML | Light gray sandy silt (ML). Remolded to ~90% Max. | 32 | 200 | 32 | 400 |
| OTAY FORMATION (To) | B-5 @ 30' - 31' | CH | Brown fat claystone (CH).                         | 28 | 0   | 32 | 400 |
| OTAY FORMATION (To) | B-5 @ 80' - 81' | SM | Light brown silty sandstone (SM).                 | 32 | 100 | 34 | 300 |
| OTAY FORMATION (To) | B-6 @ 20' - 21' | SM | Light brown silty sandstone (SM). Cemented.       | 34 | 200 | 58 | 200 |
| OTAY FORMATION (To) | B-7 @ 40' - 41' | ML | Gray brown sandy siltstone (ML).                  | 18 | 500 | 26 | 500 |
| OTAY FORMATION (To) | B-7 @ 50' - 51' | SM | Light brown silty sandstone (SM).                 | 31 | 100 | 31 | 300 |

**DESIGN VALUES**

|                     |           |    |  |    |     |
|---------------------|-----------|----|--|----|-----|
| OTAY FORMATION (To) | SANDSTONE | SM | Interbedded sandstone and siltstone (SP, SM, SC and ML). | 34 | 100 |
| OTAY FORMATION (To) | CLAYSTONE | CL | Interbedded siltstone and claystone (MH, CL, and CH).    | 20 | 400 |
| OTAY FORMATION (To) | BENTONITE | CH | Sheared bentonitic claystone. residual strength.         | 8* | 0*  |
| BUTTRESS FILL       | SAND      | SM | Remolded mixture of sands and silts (SM, SC and ML).     | 32 | 200 |

\* Residual values



**SHEAR STRENGTH SUMMARY**

Project No. 0367-014-00

Document No. 03-0946

FIGURE C-6.14

**SAMPLE NO.:** B-2

**SAMPLE DATE:** 9/30/03

**SAMPLE LOCATION:** 35' - 35'

**TEST DATE:** 10/20/03

**SAMPLE DESCRIPTION:** Light grayish brown fat clay (CH)

### LABORATORY TEST DATA

| TEST SPECIMEN                      | 1      | 2      | 3      | 4 | 5 |         |
|------------------------------------|--------|--------|--------|---|---|---------|
| A COMPACTOR PRESSURE               | 130    | 105    | 80     |   |   | [PSI]   |
| B INITIAL MOISTURE                 | 8.1    | 8.1    | 8.1    |   |   | [%]     |
| C BATCH SOIL WEIGHT                | 940    | 920    | 900    |   |   | [G]     |
| D WATER ADDED                      | 130    | 142    | 155    |   |   | [ML]    |
| E WATER ADDED (D*(100+B)/C)        | 15.0   | 16.7   | 18.6   |   |   | [%]     |
| F COMPACTION MOISTURE (B+E)        | 23.1   | 24.8   | 26.7   |   |   | [%]     |
| G MOLD WEIGHT                      | 2115.0 | 2110.5 | 2113.9 |   |   | [G]     |
| H TOTAL BRIQUETTE WEIGHT           | 3174.9 | 3161.3 | 3157.4 |   |   | [G]     |
| I NET BRIQUETTE WEIGHT (H-G)       | 1059.9 | 1050.8 | 1043.5 |   |   | [G]     |
| J BRIQUETTE HEIGHT                 | 2.65   | 2.65   | 2.65   |   |   | [IN]    |
| K DRY DENSITY (30.3*I/((100+F)*J)) | 98.5   | 96.3   | 94.2   |   |   | [PCF]   |
| L EXUDATION LOAD                   | 7030   | 4510   | 2100   |   |   | [LB]    |
| M EXUDATION PRESSURE (L/12.54)     | 561    | 360    | 167    |   |   | [PSI]   |
| N STABILOMETER AT 1000 LBS         | 40     | 61     | 64     |   |   | [PSI]   |
| O STABILOMETER AT 2000 LBS         | 101    | 134    | 140    |   |   | [PSI]   |
| P DISPLACEMENT FOR 100 PSI         | 3.85   | 4.36   | 4.44   |   |   | [Turns] |
| Q R VALUE BY STABILOMETER          | 28     | 10     | 7      |   |   |         |
| R CORRECTED R-VALUE (See Fig. 14)  | 31     | 10     | 7      |   |   |         |
| S EXPANSION DIAL READING           | 0.0099 | 0.0052 | 0.0025 |   |   | [IN]    |
| T EXPANSION PRESSURE (S*43,300)    | 429    | 225    | 108    |   |   | [PSF]   |
| U COVER BY STABILOMETER            | 0.77   | 1.01   | 1.04   |   |   | [FT]    |
| V COVER BY EXPANSION               | 3.30   | 1.73   | 0.83   |   |   | [FT]    |

|                             |      |
|-----------------------------|------|
| TRAFFIC INDEX:              | 5.0  |
| GRAVEL FACTOR:              | 1.43 |
| UNIT WEIGHT OF COVER [PCF]: | 130  |
| R-VALUE BY EXUDATION:       | 8    |
| R-VALUE BY EXPANSION:       | 7    |
| R-VALUE AT EQUILIBRIUM:     | 7    |

\*Note: Gravel factor estimated from pavement section using CTM 301, Section C, Part b.



### R-VALUE TEST RESULTS

Project No. 0367-014-00

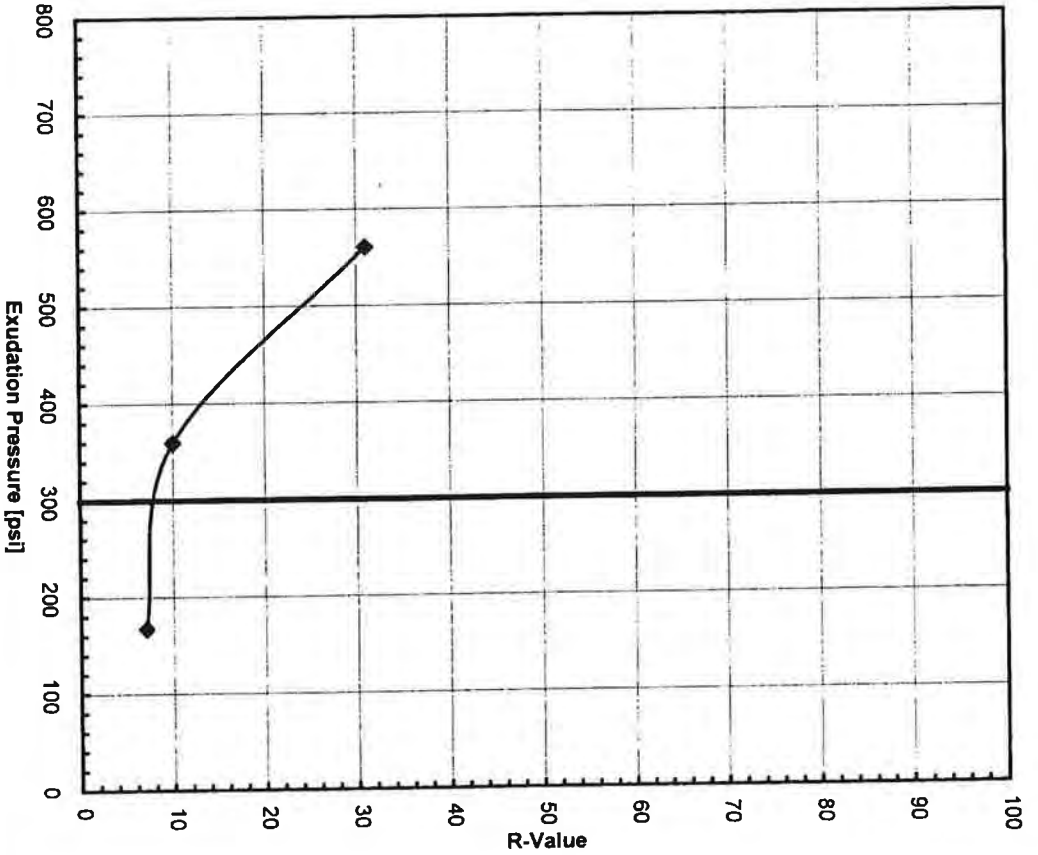
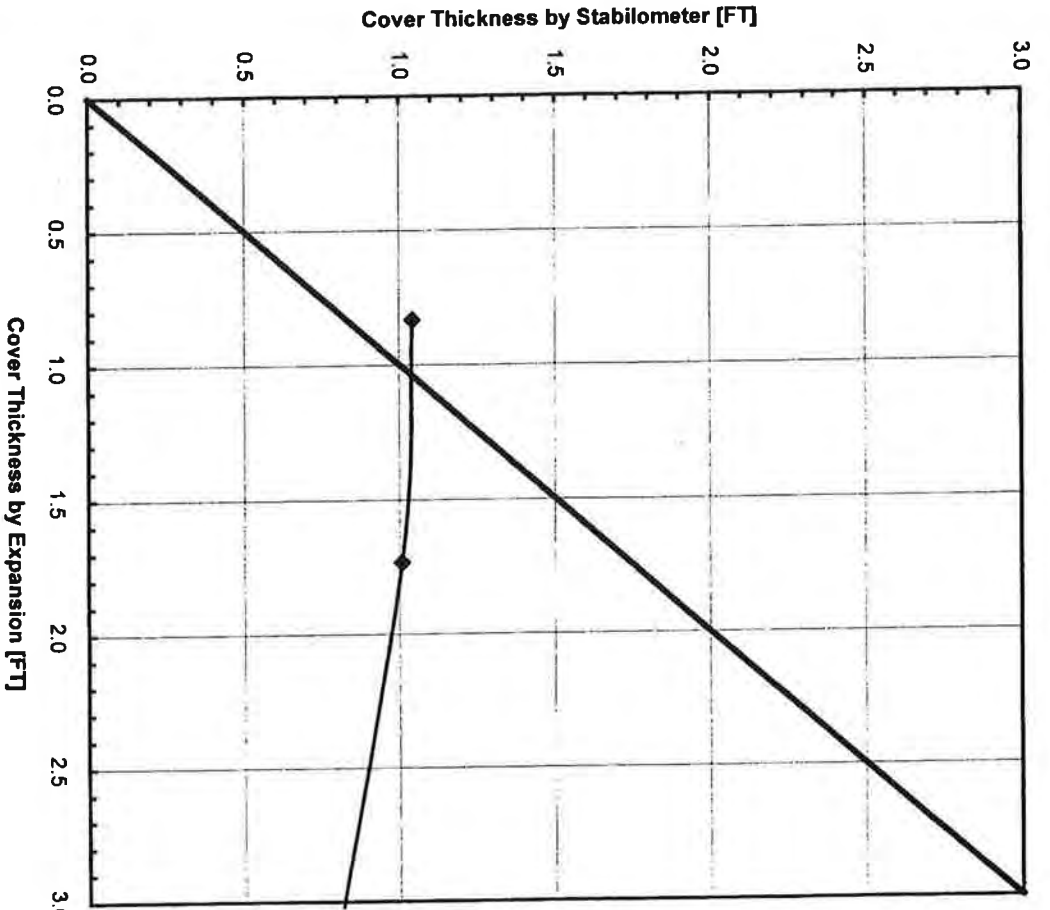
Document No. 03-0946

**FIGURE C-7.1a**

Sample: B-2, 35' - 35'

R-Value at Equilibrium:

7



COVER AND EXUDATION CHARTS

Project No. 0367-014-00  
Document No. 03-0946  
FIGURE C-7.1b

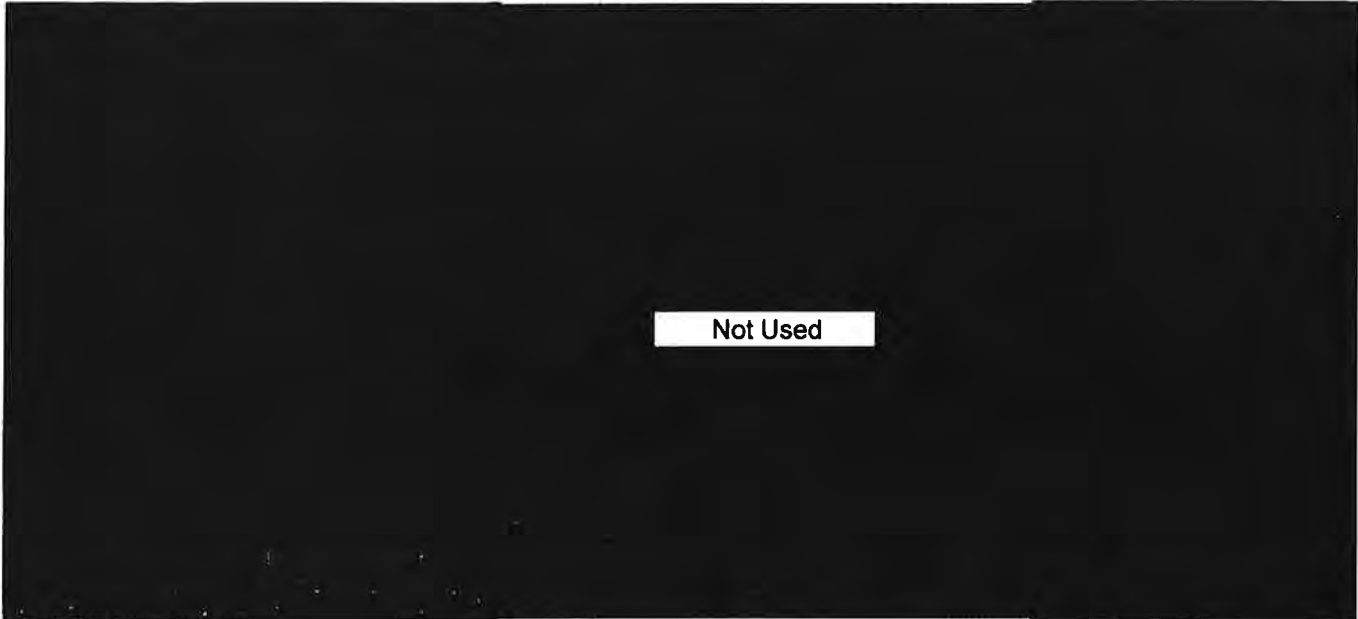


**PAVEMENT CALCULATION SHEET**

*(Based On CalTrans Topic 608.4)*

**Entered Values:**

|                 |           |
|-----------------|-----------|
| Traffic Index:  | 5.0       |
| R-Value (S.G.): | 7         |
| R-Value (A.B.): | 78        |
| R-Value (A.S.): | 50        |
| Safety Factor:  | 0.2       |
| Gf (A.C.):      | 2.54 [ft] |
| Gf (A.B.):      | 1.1 [ft]  |
| Gf (A.S.):      | 1.0 [ft]  |



Not Used

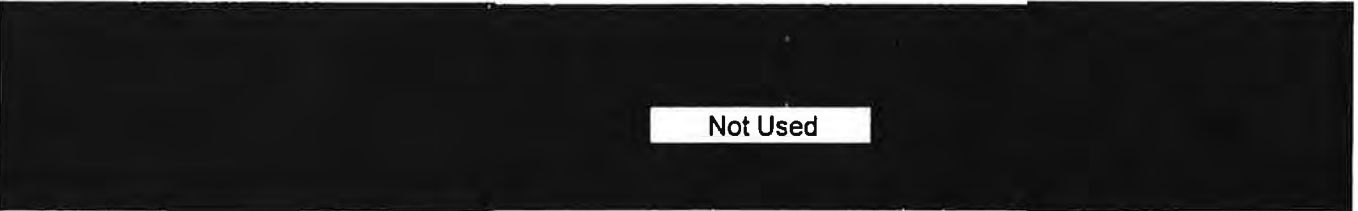
| <b>WITHOUT SUBBASE Calculations:</b> |             |
|--------------------------------------|-------------|
| GE (Total):                          | 1.49 [ft]   |
| GE (A.C.):                           | 0.35 [ft]   |
| GE (A.C.) + S.F.:                    | 0.55 [ft]   |
| T (A.C.):                            | 0.22 [ft]   |
| T (A.C.): (Rounded 0.05              | 0.20 [ft]   |
| GE (A.C.): (Actual)                  | 0.64 [ft]   |
| GE ( A.B.):                          | 0.85 [ft]   |
| T (A.B.):                            | 0.77 [ft] = |
| GE (A.B.): (Actual)                  | 0.92 [ft]   |
| GE (Act. Tot):                       | 1.55        |

2.4 [in]

9.3 [in]

|      |
|------|
| Ave  |
| Gf   |
| 1.43 |

| <b>RECOMMENDED PAVEMENT SECTION (WITHOUT SUBBASE)</b> |
|---|
| Use   |
| <b>3</b>  |
| inches asphalt concrete over                          |
| <b>10</b>   |
| inches of aggregate base                              |



Not Used



**PAVEMENT SECTION DESIGN**

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-7.1c**



**SAMPLE NO.:** B-3  
**SAMPLE LOCATION:** 39' - 41'  
**SAMPLE DESCRIPTION:** Olive brown sandy silt (ML)

**SAMPLE DATE:** 9/30/03  
**TEST DATE:** 10/21/03

### LABORATORY TEST DATA

| TEST SPECIMEN                      | 1      | 2      | 3      | 4 | 5 |         |
|------------------------------------|--------|--------|--------|---|---|---------|
| A COMPACTOR PRESSURE               | 60     | 100    | 130    |   |   | [PSI]   |
| B INITIAL MOISTURE                 | 9.4    | 9.4    | 9.4    |   |   | [%]     |
| C BATCH SOIL WEIGHT                | 915    | 915    | 915    |   |   | [G]     |
| D WATER ADDED                      | 130    | 115    | 102    |   |   | [ML]    |
| E WATER ADDED (D*(100+B)/C)        | 15.5   | 13.7   | 12.2   |   |   | [%]     |
| F COMPACTION MOISTURE (B+E)        | 24.9   | 23.1   | 21.6   |   |   | [%]     |
| G MOLD WEIGHT                      | 2009.6 | 2020.0 | 2009.2 |   |   | [G]     |
| H TOTAL BRIQUETTE WEIGHT           | 3046.7 | 3043.7 | 3019.9 |   |   | [G]     |
| I NET BRIQUETTE WEIGHT (H-G)       | 1037.1 | 1023.7 | 1010.7 |   |   | [G]     |
| J BRIQUETTE HEIGHT                 | 2.60   | 2.54   | 2.44   |   |   | [IN]    |
| K DRY DENSITY (30.3*I/((100+F)*J)) | 96.7   | 99.2   | 103.2  |   |   | [PCF]   |
| L EXUDATION LOAD                   | 1980   | 3430   | 6790   |   |   | [LB]    |
| M EXUDATION PRESSURE (L/12.54)     | 158    | 274    | 541    |   |   | [PSI]   |
| N STABILOMETER AT 1000 LBS         | 58     | 42     | 30     |   |   | [PSI]   |
| O STABILOMETER AT 2000 LBS         | 129    | 106    | 65     |   |   | [PSI]   |
| P DISPLACEMENT FOR 100 PSI         | 4.80   | 4.32   | 4.14   |   |   | [Turns] |
| Q R VALUE BY STABILOMETER          | 11     | 23     | 47     |   |   |         |
| R CORRECTED R-VALUE (See Fig. 14)  | 12     | 23     | 45     |   |   |         |
| S EXPANSION DIAL READING           | 0.0016 | 0.0026 | 0.0061 |   |   | [IN]    |
| T EXPANSION PRESSURE (S*43,300)    | 69     | 113    | 264    |   |   | [PSF]   |
| U COVER BY STABILOMETER            | 0.92   | 0.81   | 0.58   |   |   | [FT]    |
| V COVER BY EXPANSION               | 0.53   | 0.87   | 2.03   |   |   | [FT]    |

|                             |      |
|-----------------------------|------|
| TRAFFIC INDEX:              | 5.0  |
| GRAVEL FACTOR:              | 1.53 |
| UNIT WEIGHT OF COVER [PCF]: | 130  |
| R-VALUE BY EXUDATION:       | 25   |
| R-VALUE BY EXPANSION:       | 20   |
| R-VALUE AT EQUILIBRIUM:     | 20   |

\*Note: Gravel factor estimated from pavement section using CTM 301, Section C, Part b.

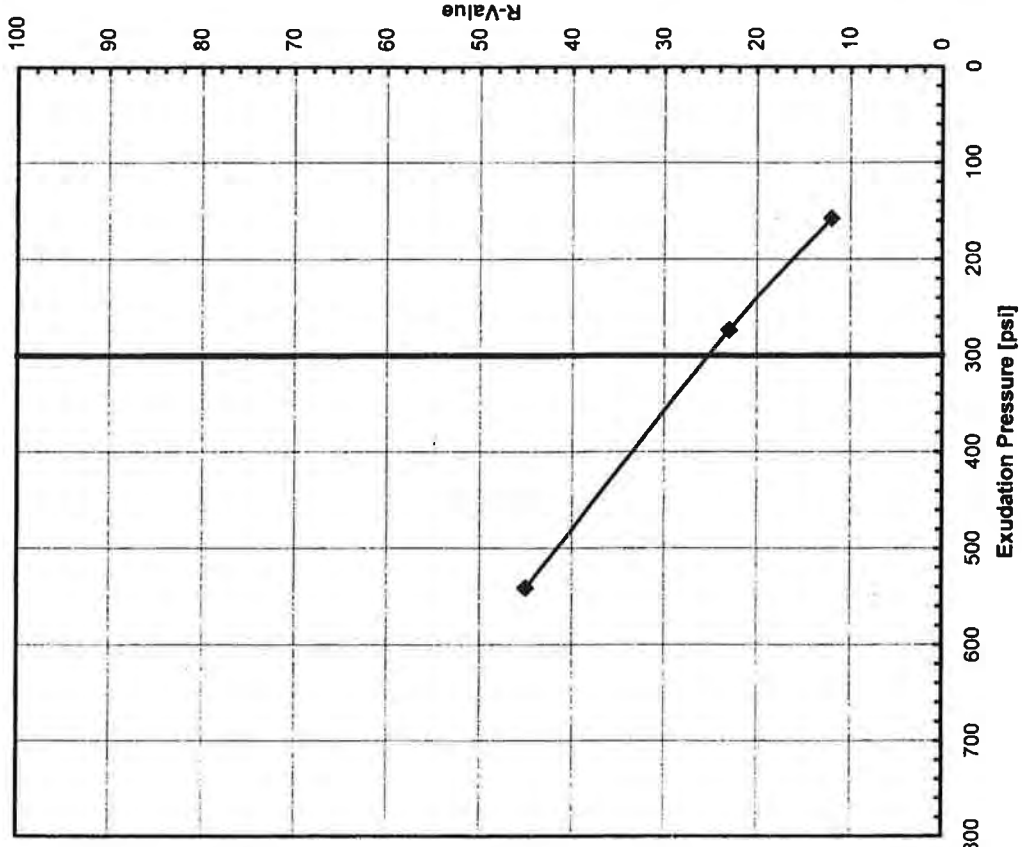
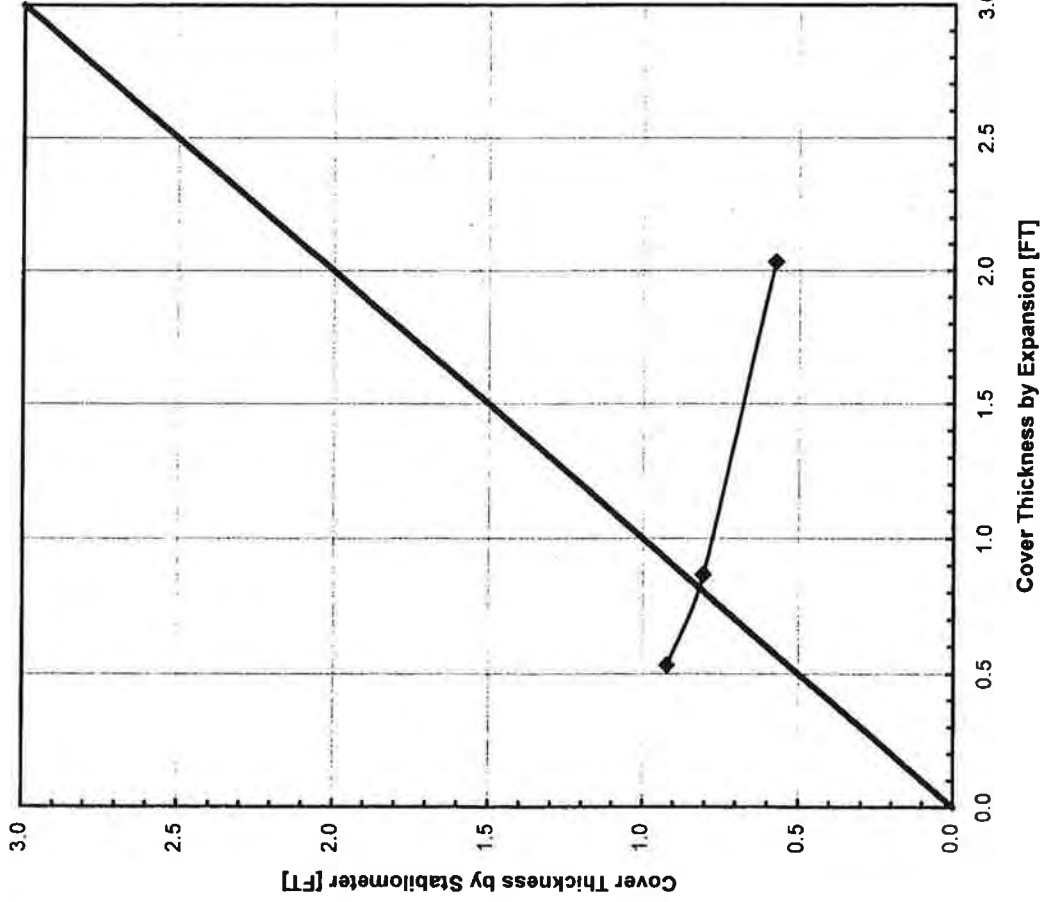


### R-VALUE TEST RESULTS

Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-7.2a**

Sample: B-3, 39' - 41'

R-Value at Equilibrium:

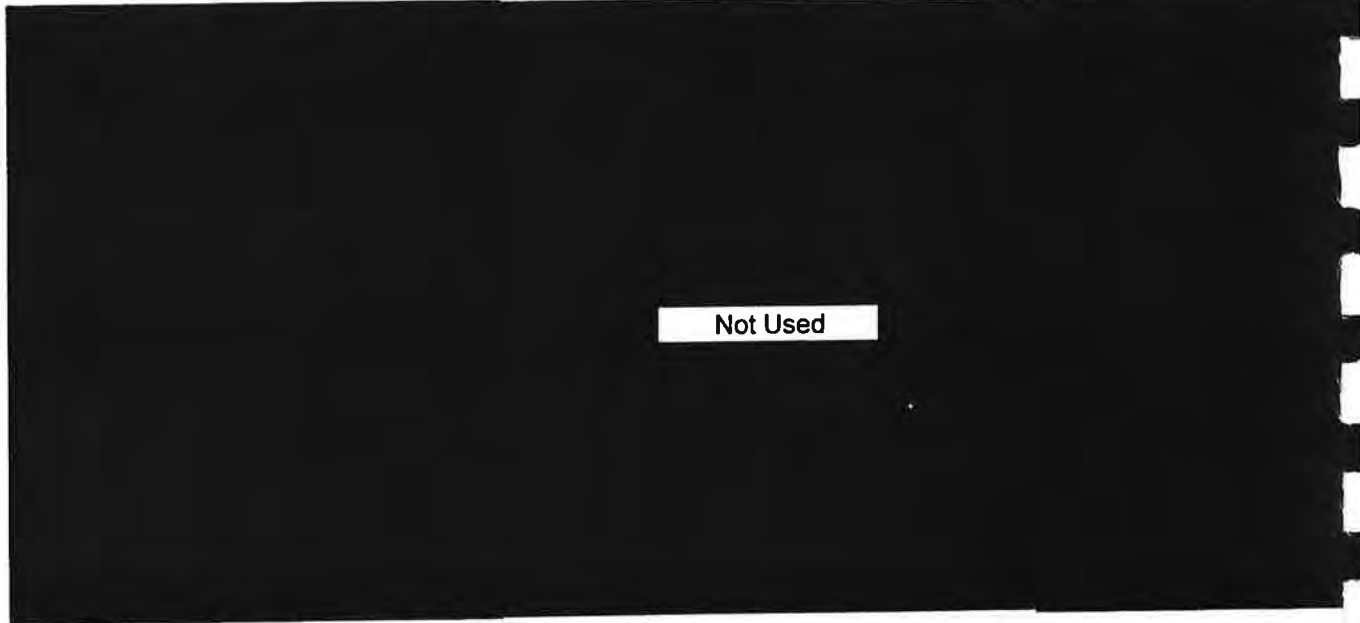


# PAVEMENT CALCULATION SHEET

(Based On CalTrans Topic 608.4)

## Entered Values:

|                 |           |
|-----------------|-----------|
| Traffic Index:  | 5.0       |
| R-Value (S.G.): | 20        |
| R-Value (A.B.): | 78        |
| R-Value (A.S.): | 50        |
| Safety Factor:  | 0.2       |
| Gf (A.C.):      | 2.54 [ft] |
| Gf (A.B.):      | 1.1 [ft]  |
| Gf (A.S.):      | 1.0 [ft]  |



| WITHOUT SUBBASE Calculations: |             |
|-------------------------------|-------------|
| GE (Total):                   | 1.29 [ft]   |
| GE (A.C.):                    | 0.35 [ft]   |
| GE (A.C.) + S.F.:             | 0.55 [ft]   |
| T (A.C.):                     | 0.22 [ft]   |
| T (A.C.): (Rounded 0.05       | 0.20 [ft]   |
| GE (A.C.): (Actual)           | 0.64 [ft]   |
| GE (A.B.):                    | 0.65 [ft]   |
| T (A.B.):                     | 0.59 [ft] = |
| GE (A.B.): (Actual)           | 0.64 [ft]   |
| GE (Act. Tot):                | 1.28        |

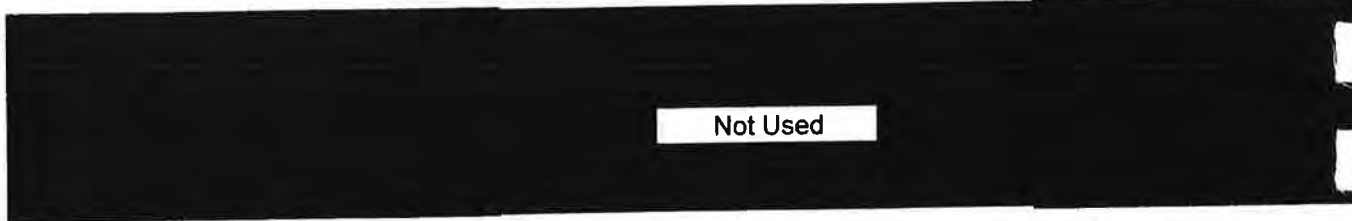
2.4 [in]

7.1 [in]

|      |
|------|
| Ave  |
| Gf   |
| 1.53 |

## RECOMMENDED PAVEMENT SECTION (WITHOUT SUBBASE)

Use  
3  
inches asphalt concrete  
over  
7  
inches of aggregate base



SAMPLE NO.: B-4

SAMPLE DATE: 9/30/03

SAMPLE LOCATION: 34' - 36'

TEST DATE: 10/20/03

SAMPLE DESCRIPTION: Light gray brown silt (ML)

### LABORATORY TEST DATA

| TEST SPECIMEN                      | 1      | 2      | 3      | 4 | 5 |         |
|------------------------------------|--------|--------|--------|---|---|---------|
| A COMPACTOR PRESSURE               | 130    | 100    | 175    |   |   | [PSI]   |
| B INITIAL MOISTURE                 | 11.8   | 11.8   | 11.8   |   |   | [%]     |
| C BATCH SOIL WEIGHT                | 900    | 890    | 890    |   |   | [G]     |
| D WATER ADDED                      | 90     | 112    | 81     |   |   | [ML]    |
| E WATER ADDED (D*(100+B)/C)        | 11.2   | 14.1   | 10.2   |   |   | [%]     |
| F COMPACTION MOISTURE (B+E)        | 23.0   | 25.9   | 22.0   |   |   | [%]     |
| G MOLD WEIGHT                      | 2013.4 | 2009.0 | 2019.4 |   |   | [G]     |
| H TOTAL BRIQUETTE WEIGHT           | 2997.0 | 2999.7 | 2985.5 |   |   | [G]     |
| I NET BRIQUETTE WEIGHT (H-G)       | 983.6  | 990.7  | 966.1  |   |   | [G]     |
| J BRIQUETTE HEIGHT                 | 2.42   | 2.49   | 2.35   |   |   | [IN]    |
| K DRY DENSITY (30.3*I/((100+F)*J)) | 100.1  | 95.8   | 102.1  |   |   | [PCF]   |
| L EXUDATION LOAD                   | 4130   | 2450   | 6020   |   |   | [LB]    |
| M EXUDATION PRESSURE (L/12.54)     | 329    | 195    | 480    |   |   | [PSI]   |
| N STABILOMETER AT 1000 LBS         | 40     | 47     | 31     |   |   | [PSI]   |
| O STABILOMETER AT 2000 LBS         | 98     | 116    | 80     |   |   | [PSI]   |
| P DISPLACEMENT FOR 100 PSI         | 4.20   | 4.36   | 3.89   |   |   | [Turns] |
| Q R VALUE BY STABILOMETER          | 27     | 18     | 39     |   |   |         |
| R CORRECTED R-VALUE (See Fig. 14)  | 26     | 18     | 35     |   |   |         |
| S EXPANSION DIAL READING           | 0.0089 | 0.0024 | 0.0117 |   |   | [IN]    |
| T EXPANSION PRESSURE (S*43,300)    | 385    | 104    | 507    |   |   | [PSF]   |
| U COVER BY STABILOMETER            | 0.79   | 0.88   | 0.70   |   |   | [FT]    |
| V COVER BY EXPANSION               | 2.97   | 0.80   | 3.90   |   |   | [FT]    |

|                             |      |
|-----------------------------|------|
| TRAFFIC INDEX:              | 5.0  |
| GRAVEL FACTOR:              | 1.49 |
| UNIT WEIGHT OF COVER [PCF]: | 130  |
| R-VALUE BY EXUDATION:       | 24   |
| R-VALUE BY EXPANSION:       | 16   |
| R-VALUE AT EQUILIBRIUM:     | 16   |

\*Note: Gravel factor estimated from pavement section using CTM 301, Section C, Part b.

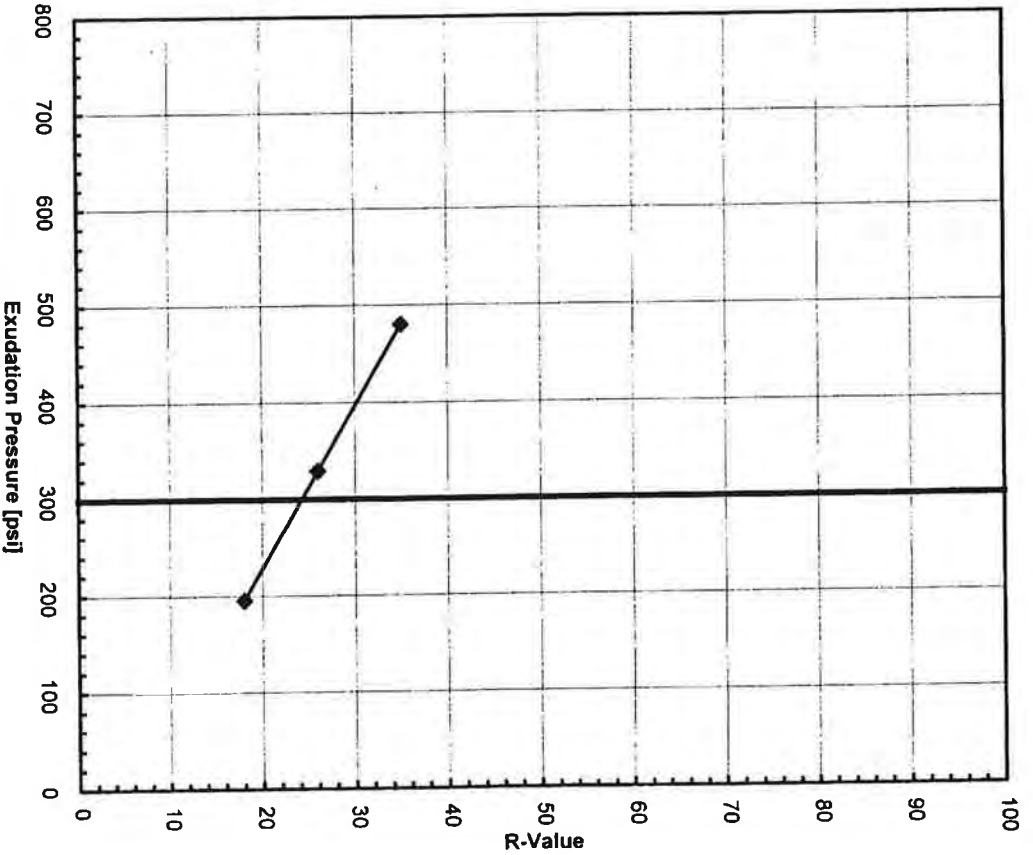
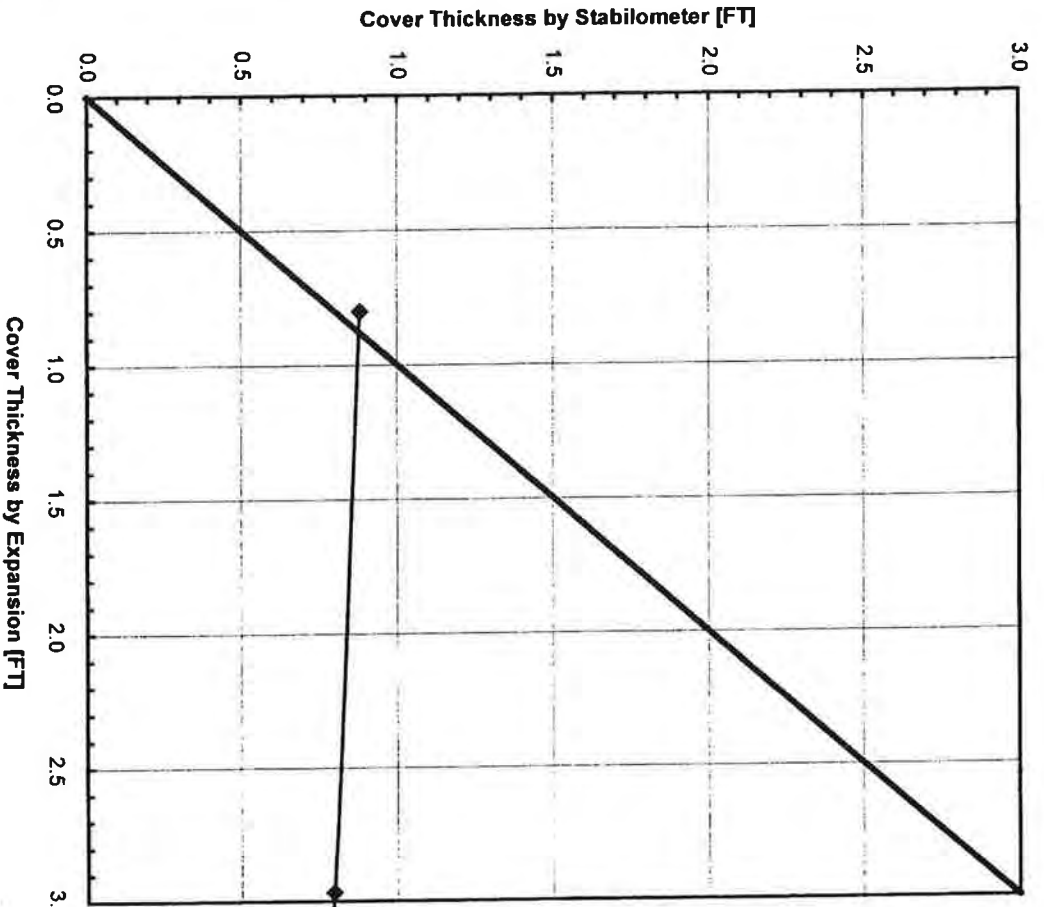


### R-VALUE TEST RESULTS

Project No. 0367-014-00

Document No. 03-0946

FIGURE C-7.3a



COVER AND EXUDATION CHARTS

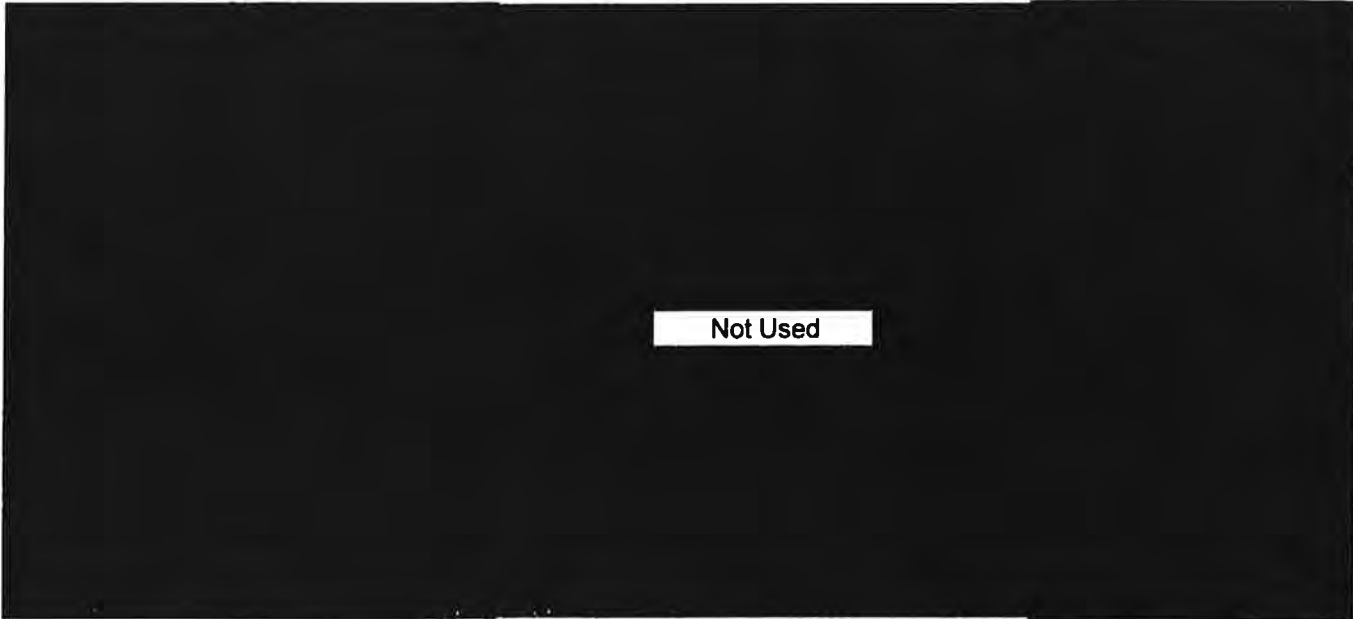
Project No. 0367-014-00  
Document No. 03-0946  
FIGURE C-7.3b

**PAVEMENT CALCULATION SHEET**

*(Based On CalTrans Topic 608.4)*

**Entered Values:**

|                 |           |
|-----------------|-----------|
| Traffic Index:  | 5.0       |
| R-Value (S.G.): | 16        |
| R-Value (A.B.): | 78        |
| R-Value (A.S.): | 50        |
| Safety Factor:  | 0.2       |
| Gf (A.C.):      | 2.54 [ft] |
| Gf (A.B.):      | 1.1 [ft]  |
| Gf (A.S.):      | 1.0 [ft]  |



Not Used

| <b>WITHOUT SUBBASE Calculations:</b> |             |
|--------------------------------------|-------------|
| GE (Total):                          | 1.34 [ft]   |
| GE (A.C.):                           | 0.35 [ft]   |
| GE (A.C.) + S.F.:                    | 0.55 [ft]   |
| T (A.C.):                            | 0.22 [ft]   |
| T (A.C.): (Rounded 0.05              | 0.20 [ft]   |
| GE (A.C.): (Actual)                  | 0.64 [ft]   |
| GE (A.B.):                           | 0.71 [ft]   |
| T (A.B.):                            | 0.64 [ft] = |
| GE (A.B.): (Actual)                  | 0.73 [ft]   |
| GE (Act. Tot):                       | 1.37        |

2.4 [in]

7.7 [in]

|      |
|------|
| Ave  |
| Gf   |
| 1.49 |

| <b>RECOMMENDED PAVEMENT SECTION (WITHOUT SUBBASE)</b> |
|---|
| Use   |
| <b>3</b>  |
| inches asphalt concrete over                          |
| <b>8</b>  |
| inches of aggregate base                              |



Not Used



**PAVEMENT SECTION DESIGN**

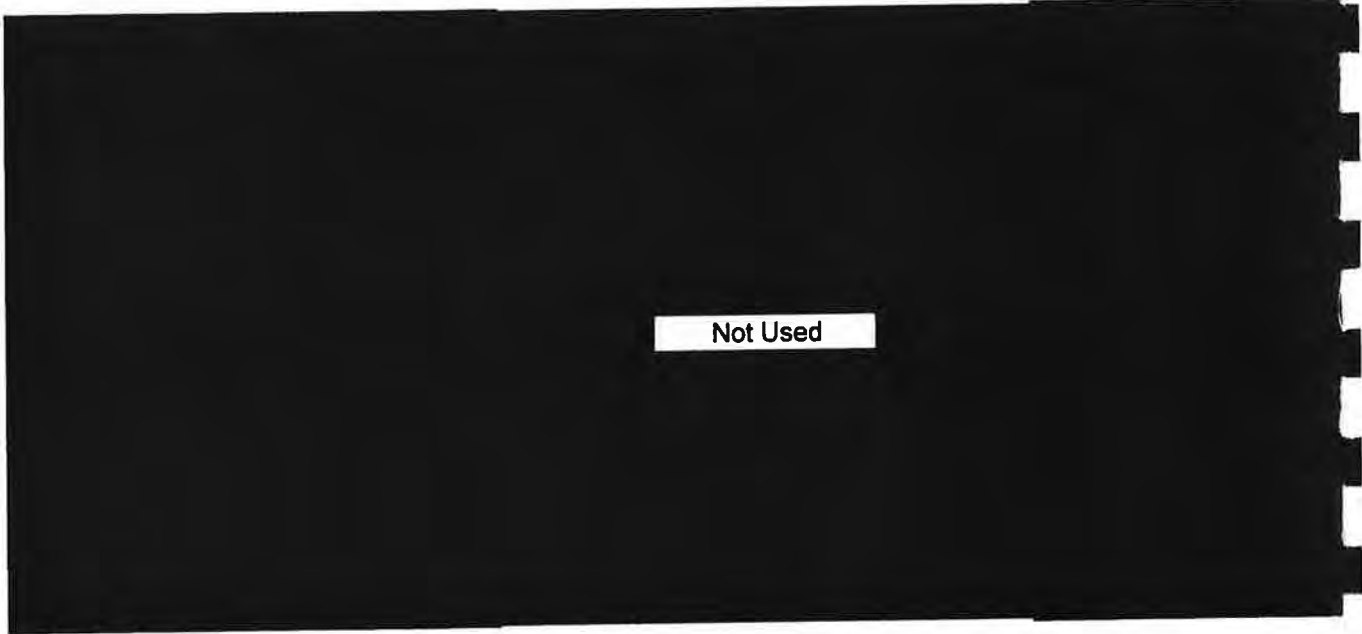
Project No. 0367-014-00  
 Document No. 03-0946  
**FIGURE C-7.3c**

**PAVEMENT CALCULATION SHEET**

*(Based On CalTrans Topic 608.4)*

**Entered Values:**

|                 |           |
|-----------------|-----------|
| Traffic Index:  | 5.0       |
| R-Value (S.G.): | 32        |
| R-Value (A.B.): | 78        |
| R-Value (A.S.): | 50        |
| Safety Factor:  | 0.2       |
| Gf (A.C.):      | 2.54 [ft] |
| Gf (A.B.):      | 1.1 [ft]  |
| Gf (A.S.):      | 1.0 [ft]  |



Not Used

**WITHOUT SUBBASE**

**Calculations:**

|                         |             |
|-------------------------|-------------|
| GE (Total):             | 1.08 [ft]   |
| GE (A.C.):              | 0.35 [ft]   |
| GE (A.C.) + S.F.:       | 0.55 [ft]   |
| T (A.C.):               | 0.22 [ft]   |
| T (A.C.): (Rounded 0.05 | 0.20 [ft]   |
| GE (A.C.): (Actual)     | 0.64 [ft]   |
| GE (A.B.):              | 0.45 [ft]   |
| T (A.B.):               | 0.41 [ft] = |
| GE (A.B.): (Actual)     | 0.46 [ft]   |
| GE (Act. Tot):          | 1.09        |

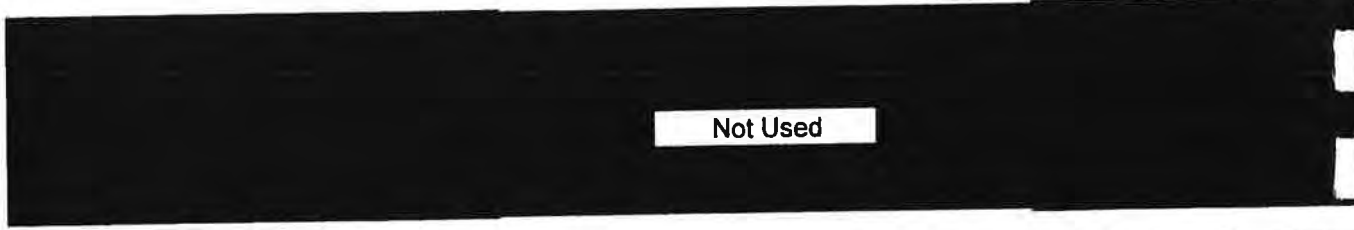
2.4 [in]

4.9 [in]

|      |
|------|
| Ave  |
| Gf   |
| 1.64 |

**RECOMMENDED PAVEMENT SECTION (WITHOUT SUBBASE)**

Use  
3  
inches asphalt concrete  
over  
5  
inches of aggregate base



Not Used

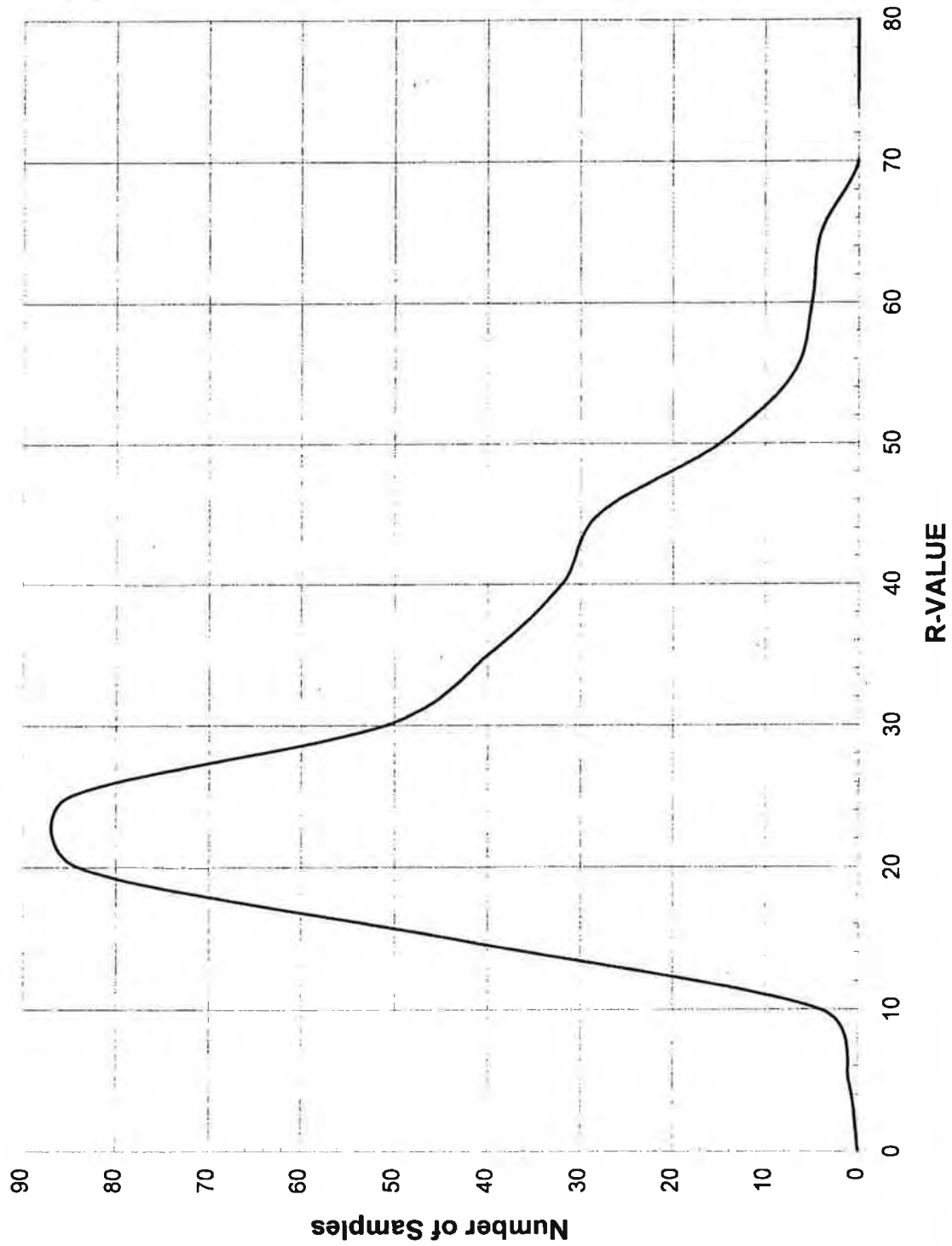


**PAVEMENT SECTION DESIGN**

Project No. 0367-014-C

Document No. 03-094b

**FIGURE C-7.4a**



| Bin  | Frequency |
|------|-----------|
| 0    | 0         |
| 5    | 1         |
| 10   | 4         |
| 15   | 44        |
| 20   | 84        |
| 25   | 85        |
| 30   | 51        |
| 35   | 40        |
| 40   | 32        |
| 45   | 28        |
| 50   | 15        |
| 55   | 7         |
| 60   | 5         |
| 65   | 4         |
| 70   | 0         |
| 75   | 0         |
| 80   | 0         |
| More | 0         |

|             |     |
|-------------|-----|
| Population: | 400 |
| Average:    | 27  |
| Deviation:  | 12  |



**Geotechnics  
Incorporated**

**R-VALUE DATA**

(McMillin Otay Ranch, Village 1, 5 and 6)



SAMPLE NO.: B-7

SAMPLE DATE: 9/30/03

SAMPLE LOCATION: 42' - 44'

TEST DATE: 10/21/03

SAMPLE DESCRIPTION: Light gray silty sand (SM)

LABORATORY TEST DATA

| TEST SPECIMEN                      | 1      | 2      | 3      | 4 | 5 |         |
|------------------------------------|--------|--------|--------|---|---|---------|
| A COMPACTOR PRESSURE               | 130    | 150    | 200    |   |   | [PSI]   |
| B INITIAL MOISTURE                 | 5.6    | 5.6    | 5.6    |   |   | [%]     |
| C BATCH SOIL WEIGHT                | 965    | 950    | 940    |   |   | [G]     |
| D WATER ADDED                      | 125    | 114    | 100    |   |   | [ML]    |
| E WATER ADDED (D*(100+B)/C)        | 13.7   | 12.7   | 11.2   |   |   | [%]     |
| F COMPACTION MOISTURE (B+E)        | 19.3   | 18.3   | 16.8   |   |   | [%]     |
| G MOLD WEIGHT                      | 2110.5 | 2115.0 | 2113.9 |   |   | [G]     |
| H TOTAL BRIQUETTE WEIGHT           | 3191.8 | 3170.5 | 3145.6 |   |   | [G]     |
| I NET BRIQUETTE WEIGHT (H-G)       | 1081.3 | 1055.5 | 1031.7 |   |   | [G]     |
| J BRIQUETTE HEIGHT                 | 2.64   | 2.55   | 2.50   |   |   | [IN]    |
| K DRY DENSITY (30.3*I/((100+F)*J)) | 104.0  | 106.0  | 107.0  |   |   | [PCF]   |
| L EXUDATION LOAD                   | 2590   | 3330   | 8720   |   |   | [LB]    |
| M EXUDATION PRESSURE (L/12.54)     | 207    | 266    | 695    |   |   | [PSI]   |
| N STABILOMETER AT 1000 LBS         | 32     | 29     | 21     |   |   | [PSI]   |
| O STABILOMETER AT 2000 LBS         | 66     | 59     | 42     |   |   | [PSI]   |
| P DISPLACEMENT FOR 100 PSI         | 6.14   | 5.49   | 5.16   |   |   | [Turns] |
| Q R VALUE BY STABILOMETER          | 37     | 44     | 58     |   |   |         |
| R CORRECTED R-VALUE (See Fig. 14)  | 40     | 44     | 58     |   |   |         |
| S EXPANSION DIAL READING           | 0.0021 | 0.0025 | 0.0069 |   |   | [IN]    |
| T EXPANSION PRESSURE (S*43,300)    | 91     | 108    | 299    |   |   | [PSF]   |
| U COVER BY STABILOMETER            | 0.59   | 0.55   | 0.41   |   |   | [FT]    |
| V COVER BY EXPANSION               | 0.70   | 0.83   | 2.30   |   |   | [FT]    |

TRAFFIC INDEX:  
 GRAVEL FACTOR:  
 UNIT WEIGHT OF COVER [PCF]:  
 R-VALUE BY EXUDATION:  
 R-VALUE BY EXPANSION:  
 R-VALUE AT EQUILIBRIUM:

|      |
|------|
| 5.0  |
| 1.64 |
| 130  |
| 45   |
| 32   |
| 32   |

\*Note: Gravel factor estimated from pavement section using CTM 301, Section C, Part b.



R-VALUE TEST RESULTS

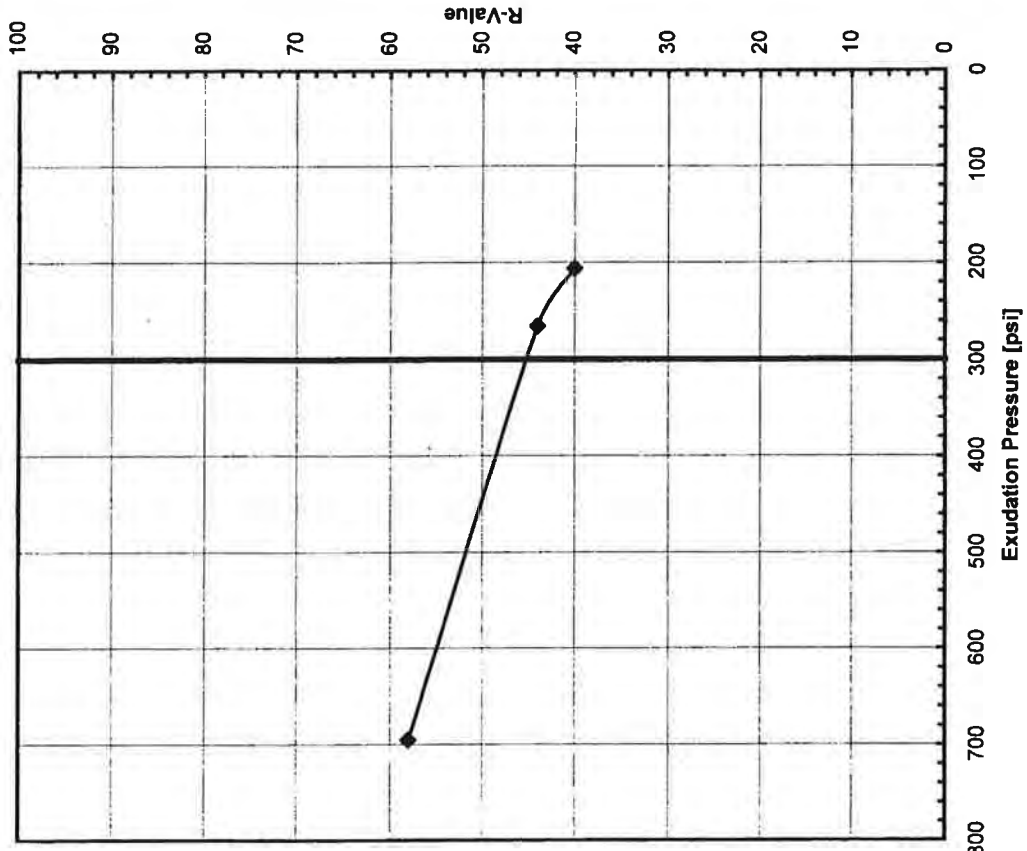
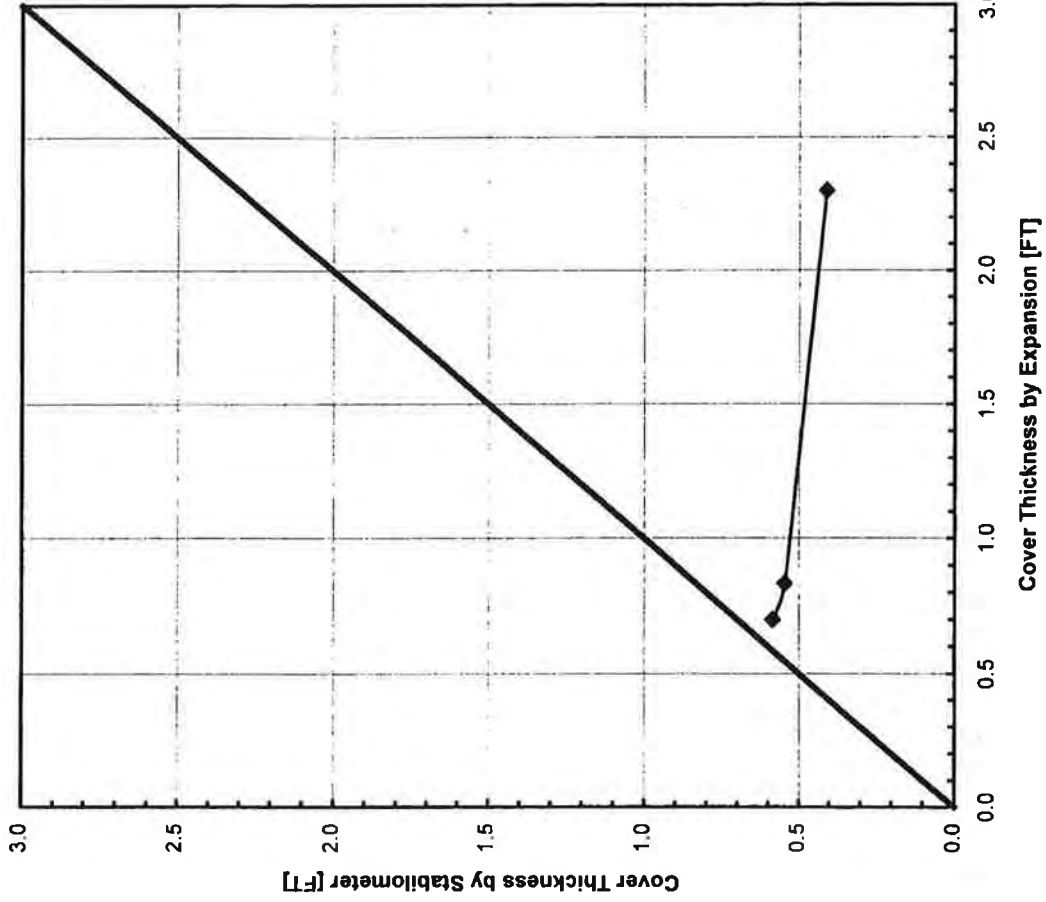
Project No. 0367-014-00

Document No. 03-0946

FIGURE C-7.4a

Sample: B-7, 42' - 44'

R-Value at Equilibrium:



**APPENDIX D**

**STANDARD GUIDELINES FOR GRADING PRACTICES**

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## 1.0 GENERAL

- 1.1 Representatives of Geotechnics Incorporated should be present on-site during grading operations in order to make observations and perform tests so that professional opinions can be developed. The opinion will address whether grading has proceeded in accordance with the Geotechnical Consultant's recommendations and applicable project specifications; if the site soil and geologic conditions are as anticipated in the preliminary investigation; and if additional recommendations are warranted by any unexpected site conditions. Services do not include supervision or direction of the actual work of the contractor, his employees or agents.
- 1.2 The guidelines contained herein and the standard details attached hereto represent this firm's standard recommendations for grading and other associated operations on construction projects. These guidelines should be considered a portion of the report to which they are appended.
- 1.3 All figures attached hereto shall be considered as part of these guidelines.
- 1.4 The Contractor should not vary from these guidelines without prior recommendation by Geotechnics Incorporated and the approval of the Client or his authorized representative.
- 1.5 These Standard Grading Guidelines and Standard Details may be modified and/or superseded by recommendations contained in the text of the geotechnical report and/or subsequent reports. Where a conflict may appear to exist, the recommendations of the body of the geotechnical reports will supersede those of the standard guidelines.
- 1.6 If disputes arise out of the interpretation of these grading guidelines or standard details, Geotechnics Incorporated should determine the appropriate interpretation.

## 2.0 DEFINITION OF TERMS

- 2.1 ALLUVIUM -- Detrital deposits resulting from flow of water, including sediments deposited in river beds, canyons, flood plains, lakes, fans at the foot of slopes and estuaries.
- 2.2 AS-GRADED -- The surface and subsurface conditions at completion of grading.
- 2.3 BACKCUT -- A temporary construction slope or excavation at the rear of buttresses, stabilization fills or retaining walls.

- 
- 2.4 **BACKDRAIN** -- Generally a perforated pipe and surrounding filter or similar drainage system placed behind earth retaining structures, buttresses, and stabilization fills.
- 2.5 **BEDROCK** -- A relatively undisturbed consolidated sedimentary or igneous formational deposit, exposed either at the surface or beneath superficial deposits of soil.
- 2.6 **BENCH** -- A relatively level step with a near vertical rise excavated into sloping ground on which fill is to be placed. See also "Terrace".
- 2.7 **BORROW (Import)** -- Any fill material hauled to the project site from off-site areas.
- 2.8 **BUTTRESS FILL** -- A fill mass, the configuration of which is designed by engineering calculations to enhance the stability of slopes, where deep-seated failure is of concern. A buttress is generally specified by minimum key width and depth, and by maximum steepness of the backcut angle. Fill materials with specified characteristics may be recommended for the buttress construction. A buttress may contain a back-drain system.
- 2.9 **CIVIL ENGINEER** -- The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topographic conditions.
- 2.10 **COLLUVIUM** -- Generally poorly consolidated deposits usually located near the base of slopes, and brought there primarily by gravity through slope creep (also see Slope Wash).
- 2.11 **COMPACTION** -- Is the densification of a fill material by mechanical means.
- 2.12 **CONTRACTOR** -- A person or company under contract or otherwise retained by the Client to perform demolition, earthwork, or other site improvements.
- 2.13 **DEBRIS** -- All products of clearing, grubbing, demolition, and soil material unsuitable for reuse as compacted fill and/or any other material so designated by the Geotechnical Consultant.
- 2.14 **ENGINEERING GEOLOGIST** -- A Geologist holding a valid certificate of registration in the specialty of Engineering Geology.

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- 2.15 ENGINEERED FILL -- A fill of which the Geotechnical Consultant or his representative, during grading, has made sufficient tests and observations to enable him to conclude that the fill has been placed in substantial compliance with the recommendations of the Geotechnical Consultant and the governing agency requirements. This generally requires that the consultants representative be present on a continuous basis when fill is placed.
- 2.16 EROSION -- The wearing away of the ground surface as a result of the movement of wind, water, and/or ice.
- 2.17 EXCAVATION -- The mechanical removal of earth materials.
- 2.18 EXISTING GRADE -- The ground surface configuration prior to new grading.
- 2.19 FILL -- Any soil, rock, soil-rock blends or other similar materials placed by man.
- 2.20 FINISH GRADE -- The ground surface configuration at which time the surface elevations conform to the approved plan.
- 2.21 GEOFABRIC -- Any engineering textile utilized in geotechnical applications including subgrade stabilization, back-drains, subdrains, and earth reinforcement.
- 2.22 GEOLOGIST -- A representative of the Geotechnical Consultant educated and trained in the field of geology.
- 2.23 GEOTECHNICAL CONSULTANT -- The Geotechnical Engineering and Engineering Geology consulting firm retained to provide technical services for the project. For the purpose of these guidelines, observations by the Geotechnical Consultant include observations by the Geotechnical Engineer, Engineering Geologist and those performed by persons employed by and responsible to the Geotechnical Consultant.
- 2.24 GEOTECHNICAL ENGINEER -- A licensed Civil Engineer who applies scientific methods, engineering principles and professional experience to the acquisition, interpretation and use of knowledge of soil and bedrock materials for the evaluation of engineering problems. Geotechnical Engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology and related sciences.
- 2.25 GRADING -- Any operation consisting of excavation, filling or combinations thereof, and associated operations.

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- 2.26 **LANDSLIDE DEBRIS** -- Soil or bedrock materials that has been transported within the landslide mass.
- 2.27 **MAXIMUM DENSITY** -- Standard laboratory test for maximum dry unit weight. Unless otherwise specified, the maximum dry unit weight shall be determined in accordance with ASTM D1557.
- 2.28 **OPTIMUM MOISTURE** -- Test moisture content at the maximum density, determined in accordance with ASTM D1557.
- 2.29 **RELATIVE COMPACTION** -- The degree of compaction of a fill material, given as the in-place dry unit weight as a percentage of the maximum density.
- 2.30 **ROUGH GRADE** -- The ground surface configuration where the surface elevations approximately conform to the approved grading plan.
- 2.31 **SITE** -- The particular parcel of land where grading is being performed, as defined by the grading plan.
- 2.32 **SLOPE** -- A natural or constructed inclined ground surface, the steepness of which is generally specified as a ratio of horizontal:vertical (e.g., 2:1).
- 2.33 **SLOPE WASH** -- Soil and/or rock material that has been transported down a slope by mass wasting assisted by surface runoff water (also see Colluvium).
- 2.34 **SOIL** -- Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof, that is not cemented and typically unconsolidated.
- 2.35 **SOIL ENGINEER** -- Licensed Civil Engineer experienced in soil mechanics (also see Geotechnical Engineer).
- 2.36 **STABILIZATION FILL** -- A fill mass, the configuration of which is typically related to slope height and is specified by the standards of practice for enhancing the stability of slopes which may be subject to excessive creep, erosion, or surficial instability. A stabilization fill is normally specified by minimum key width and depth, and by maximum steepness of the backcut angle. A stabilization fill may or may not have a back-drain system specified. Similar to a buttress fill, however the term buttress fill is generally reserved for fills used to stabilize deep-seated instabilities.
- 2.37 **SUBDRAIN** -- Generally a perforated pipe surrounded with a gravel or geofabric filter, or similar drainage system placed beneath a fill in the alignment of canyons or former drainage channels. May include synthetic composite drain-panel systems.

- 2.38 SLOUGH -- Loose, un-compacted fill material generated during grading operations.
- 2.39 TAILINGS -- Non-engineered fill which accumulates on or adjacent to equipment haul-roads, as the result of spillage during transport.
- 2.40 TERRACE -- Relatively level step constructed in the face of a graded slope surface for drainage control and maintenance purposes.
- 2.41 TOPSOIL -- The upper weathered zone of soil which is usually darker in color, soft or loose, and often contains vegetation debris.
- 2.42 WINDROW -- A horizontal row of large rock buried within engineered fill in accordance with guidelines set forth by the Geotechnical Consultant.

### **3.0 SITE PREPARATION**

- 3.1 Clearing and grubbing should consist of the removal of vegetation such as brush, grass, wood, stumps, trees, roots to trees, and otherwise deleterious materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.
- 3.2 Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and other man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or re-routing pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of Geotechnics Incorporated at the time of demolition.
- 3.3 Debris generated during clearing, grubbing and/or demolition operations should be removed from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of Geotechnics.

### **4.0 SITE PROTECTION**

- 4.1 The Contractor should be responsible for the stability of all temporary excavations. Recommendations by Geotechnics Incorporated pertaining to temporary excavations (e.g., backcuts) are guidelines and should be evaluated by the contractor. Recommendations by Geotechnics Incorporated should not be considered to preclude more restrictive requirements by the regulating agencies.



- 4.2 Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site.
- 4.3 During periods of rainfall, Geotechnics Incorporated should be kept informed by the Contractor as to the nature of remedial or preventative work being performed (e.g., pumping, placement of sandbags or plastic sheeting, temporary de-silting basins, other labor, grading, etc.).
- 4.4 Following periods of rainfall, the Contractor should contact Geotechnics Incorporated and arrange a review of the site in order to visually assess rain related damage. Geotechnics Incorporated may also recommend excavations and testing in order to aid in their assessments.
- 4.5 Rain related damage should be considered to include, but may not be limited to, erosion, silting, saturation, erosion of underground utility backfill, structural distress and other adverse conditions identified by Geotechnics Incorporated. Soil adversely affected should be classified as unsuitable materials and should be subject to over-excavation and replacement with compacted fill or other remedial grading as recommended by Geotechnics Incorporated.

## 5.0 EXCAVATIONS

### 5.1 UNSUITABLE MATERIALS

- 5.1.1 Materials which are unsuitable should be excavated under observation and recommendations of Geotechnics Incorporated. Unsuitable materials include, but may not be limited to, dry, loose, soft, wet, compressible natural soils and fractured, weathered, soft bedrock, and non-engineered or otherwise deleterious fill material.
- 5.1.2 Material identified by Geotechnics Incorporated as unsatisfactory due to its moisture conditions should be over-excavated, watered or dried, as needed, and thoroughly mixed to a uniform near optimum moisture condition (as per guidelines reference 7.2.1) prior to placement as compacted fill.

### 5.2 CUT SLOPES

- 5.2.1 If cut slope excavations expose loose, cohesionless, significantly fractured or otherwise unsuitable material, over-excavation and replacement of the unsuitable materials with a compacted stabilization fill may be recommended

by Geotechnics Incorporated. Unless otherwise specified by Geotechnics Incorporated, stabilization fill construction should conform to the requirements of the Standard Details.

- 5.2.2 A Geotechnics Incorporated representative should observe cut slopes during excavation. Geotechnics Incorporated should be notified by the contractor prior to beginning slope excavations.
- 5.2.3 If, during the course of grading, adverse or potentially adverse geotechnical conditions are encountered which were not anticipated in the geotechnical investigation report, Geotechnics Incorporated should evaluate and make recommendations to address these problems.

## **6.0 COMPACTED FILL**

All fill materials should be compacted to at least 90 percent of maximum density (ASTM D1557) unless otherwise recommended by Geotechnics Incorporated.

### **6.1 PLACEMENT**

- 6.1.1 Prior to placement of compacted fill, the Contractor should request a review by Geotechnics Incorporated of the exposed ground surface. Unless otherwise recommended, the exposed ground surface should then be scarified watered or dried as needed, thoroughly mixed to achieve over optimum moisture conditions, then compacted to a minimum of 90 percent of the maximum density.
- 6.1.2 Compacted fill should be placed in thin horizontal lifts. Each lift should be watered or dried as needed, mixed to achieve over optimum moisture conditions then compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.
- 6.1.3 When placing fill in horizontal lifts on areas sloping steeper than 5:1 (horizontal:vertical), horizontal benches should be excavated into the slope area. Benching should be sufficient to expose natural ground, bedrock or engineered compacted fill. No compacted fill should be placed in an area subsequent to keying and benching until the area has been reviewed by Geotechnics Incorporated. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement fill. An adjacent thick lift of fill generated by the benching should be avoided.

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Typical keying and benching details have been included within the accompanying Standard Details.

- 6.1.4 Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described.
- 6.1.5 Fill should be tested for compliance with the recommended relative compaction and moisture conditions. Density testing frequency should be adequate for Geotechnics Incorporated to provide professional opinions regarding fill compaction and adherence to recommendations. Fill found not to be in conformance with the grading recommendations should be removed or otherwise treated as recommended by Geotechnics Incorporated.
- 6.1.6 The Contractor should assist Geotechnics Incorporated representative by digging test pits for evaluation and/or for testing fill compaction.
- 6.1.7 As recommended by Geotechnics Incorporated, the Contractor may need to remove or stop grading equipment within the area being tested if personnel safety is considered to be a problem.

## 6.2 MOISTURE

- 6.2.1 Optimum moisture will vary with material type and will typically be determined by ASTM D1557. Unless otherwise recommended by Geotechnics Incorporated, fill should be mixed to achieve uniform soil moisture in excess of optimum moisture.
- 6.2.2 Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface of previously compacted fill should be processed by scarification, watered or dried as needed, thoroughly mixed to over optimum moisture conditions, then compacted to at least 90 percent relative compaction. Where wet, dry, or other unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be over-excavated.
- 6.2.3 Following a period of flooding, rainfall or over-watering by other means, no additional fill should be placed until evaluation and recommendations have been made by Geotechnics Incorporated, and remedial grading performed as described under Section 5.6 herein.

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### 6.3 FILL MATERIAL

- 6.3.1 Excavated on-site materials which are considered suitable to Geotechnics Incorporated may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement.
- 6.3.2 Where import fill materials are required for use on-site, Geotechnics Incorporated should be notified in advance of importing, to evaluate and/or sample and test materials from proposed borrow sites. No import fill materials should be delivered for use on-site without prior evaluation by Geotechnics Incorporated.
- 6.3.3 Rocks 12 inches in maximum dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of the rock is avoided. The amount of rock should not exceed 40 percent by dry weight retained on the 3/4-inch sieve, size.
- 6.3.4 Where rocks or similar irreducible materials of greater than 12 inches but less than four feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the accompanying Standard Details is recommended. Rocks greater than four feet should be broken down or disposed of off-site. Rocks up to four feet maximum dimension should be placed below the upper 10 feet of any fill and should not be closer than 20-feet to any slope face. These recommendations could vary as locations of underground utility improvements dictate. Where practical, oversized material should not be placed below areas where structures or deep utilities are proposed. Oversized material should be placed in windrows on a compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so that successive strata of oversized material are not in the same vertical plane, in accordance with the attached Standard Details.
- 6.3.5 It may be possible to dispose of individual larger rock as field conditions dictate, as recommended by Geotechnics Incorporated at the time of placement.
- 6.3.6 The construction of a "rock fill" consisting primarily of rock fragments up to two feet in maximum dimension with little soil material may be feasible. Such material is typically generated on sites where extensive blasting is required. Recommendations for construction of rock fills should be provided by Geotechnics Incorporated on a site-specific basis.

- 6.3.7 During grading operations, placing and mixing materials from the cut and/or borrow areas may result in soil mixtures which possess unanticipated engineering properties. Testing may be required of samples obtained directly from the fill areas in order to determine conformance with the specifications. Processing of these additional samples may take two or more working days, and require that the contractor alter their operation.
- 6.3.8 Any fill placed in areas not previously observed and evaluated by Geotechnics Incorporated will require removal and re-compaction. Determination of over-excavations should be made upon review of field conditions by Geotechnics Incorporated.

#### 6.4 FILL SLOPES

- 6.4.1 Fill slopes should be compacted in accordance with these grading guidelines and specific report recommendations. Two methods of slope compaction are typically utilized in mass grading, lateral over-building and cutting back to grade, and mechanical compaction to grade (i.e. sheepsfoot roller back-rolling). Constraints such as height of slope, fill soil type, access, property lines, and available equipment will influence the method of slope construction and compaction. Geotechnics Incorporated should be notified by the contractor what method will be employed prior to slope construction.

Over-building should be accomplished with horizontal fill lifts (reference Section 6), and compaction equipment working as close to the edge as practical. The amount of lateral over-building will vary as field conditions dictate. Compaction testing of slope faces will be required, and reconstruction of the slope may be recommended if testing does not meet project specifications.

Mechanical compaction of the slope to grade during construction should utilize two types of compactive effort. First, horizontal fill lifts should be compacted during fill placement. The equipment should provide compactive effort to the outer edge of the fill slope. Sloughing of fill soils should not be permitted to drift down the slope. Secondly, at intervals not exceeding four feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be back-rolled with a sheepsfoot-type roller, or other equipment that can be shown to compact the slope face to the specified compaction. Moisture conditions of the fill slope soils should be maintained above optimum throughout the compaction process. Generally upon slope completion, the entire slope should be compacted utilizing typical methods, (i.e. sheepsfoot rolling, bulldozer tracking, or rolling with rubber-

tired heavy equipment). Final slope compaction should be performed without grade stakes on the slope face.

- 6.4.2 Where placement of fill above a natural slope or above a cut slope is proposed, the fill slope configuration as presented in the accompanying Standard Details should be utilized.
- 6.4.3 For pad areas above fill slopes, positive drainage should be established away from the top-of-slope, as designed by the project civil engineer.

## 6.5 TRENCH BACKFILL

- 6.5.1 Utility trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 90 percent of maximum density (ASTM D1557).
- 6.5.2 Within slab areas, but outside the influence of foundations, trenches up to one foot wide and two feet deep may be backfilled with sand (S.E. > 30) and consolidated by jetting, or by mechanical means.
- 6.5.3 If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the Contractor may elect to use clean, granular material, (S.E. > 30) in the pipe zone and one foot above the top of pipe. This material should be thoroughly jetted in place. Other methods of utility trench compaction may also be appropriate, upon review of Geotechnics Incorporated at the time of construction.
- 6.5.4 In cases where clean granular materials are proposed for use in lieu of native materials or where jetting is proposed, the procedures should be considered subject to review by Geotechnics Incorporated.
- 6.5.5 Gravel bedding or backfill is not recommended in trenches exceeding 20 percent gradient because of the potential for piping. Bedding materials should consist of clean sand with backfill as recommended by Geotechnics Incorporated based on specific site conditions and available materials.

## 7.0 DRAINAGE

- 7.1 Canyon and fill buttresses or slope stabilization subdrain systems recommended by Geotechnics Incorporated should be installed in accordance with the specifications of the accompanying Standard Details.

- 7.2 All subdrain outlets should be connected to a permanent structure such as a storm drain, or outletted to the surface. Surface or daylight outlets should be constructed using a concrete headwall in accordance with the Standard Details. All subdrain outlets should be surveyed by the project civil engineer.
  
- 7.3 Subdrains temporarily terminated should be surveyed at each end by the project civil engineer for future relocation and connection.

**GEOTECHNICAL MAP FOR OTAY RANCH  
VILLAGE 7 – PLATE 1**

**This exhibit is on file at the City of Chula Vista, Planning  
Department located at 276 Fourth Avenue,  
Chula Vista, CA 91910**



**REMEDIAL GRADING PLAN FOR OTAY RANCH  
VILLAGE 7 – PLATE 2**

**This exhibit is on file at the City of Chula Vista, Planning  
Department located at 276 Fourth Avenue,  
Chula Vista, CA 91910**

**APPENDIX F-2**

**GEOTECHNICAL INVESTIGATION OTAY RANCH  
VILLAGE 7, R-2, AND VILLAGE 4 COMMUNITY  
PARK**

# **GEOTECHNICAL INVESTIGATION**

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## **OTAY RANCH VILLAGE 7, R-2 AND VILLAGE 4 COMMUNITY PARK CHULA VISTA, CALIFORNIA**



**GEOCON**  
INCORPORATED

GEOTECHNICAL  
CONSULTANTS

PREPARED FOR

**THE OTAY RANCH COMPANY  
SAN DIEGO, CALIFORNIA**

**MAY 5, 2004**



Project No. 06862-52-03  
May 5, 2004

The Otay Ranch Company  
610 West Ash Street, Suite 1500  
San Diego, California 92101

Attention: Ms. Ranie Hunter

Subject: OTAY RANCH VILLAGE 7, R-2 AND VILLAGE 4 COMMUNITY PARK  
CHULA VISTA, CALIFORNIA  
GEOTECHNICAL INVESTIGATION


Dear Ms. Hunter:

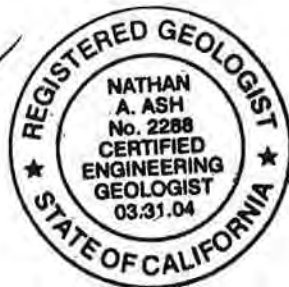
In accordance with your request, we have performed a geotechnical investigation for the subject project. The accompanying report presents the findings of our study and our recommendations relative to the geotechnical aspects of developing the property as presently proposed. Based on the results of our investigation, it is our opinion that the site can be developed as planned, provided the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

  
Nathan A. Ash  
CEG 2288



NAA:SW:JH:bjl

(14/del) Addressee  
(2/del) Hunsaker & Associates  
Attention: Mr. Lex Williman

  
Shawn Weedon  
RCE 61803



  
John Hoobs  
CEG 1524



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### LIMITATIONS AND UNIFORMITY OF CONDITIONS

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#### FIELD INVESTIGATION

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County of San Diego Department of Environmental Health Geotechnical Boring Waiver

### APPENDIX B

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### APPENDIX C

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Computer Output from *SLOPEW5*

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# GEOTECHNICAL INVESTIGATION

## 1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed Otay Ranch Village 7, R-2 site and Otay Ranch Village 4 Community Park site located in Chula Vista, California. The purpose of the investigation was to evaluate subsurface soil and geologic conditions at the sites and, based on conditions encountered, provide recommendations pertaining to the geotechnical aspects of developing the property. We understand the Village 7, R-2 site will be developed for residential building pads and The Village 4 site will be developed as a sheet-graded pad for a community park.

The field investigation included a site reconnaissance, review of aerial photographs and geologic maps, and the excavation of 11 exploratory borings and 25 exploratory trenches. We performed the boring and trenching operations concurrently with the investigation for Otay Ranch Village 2, and the boring and trench numbering is not consecutive. A detailed discussion of the field investigation and logs of the exploratory borings and trenches are presented in Appendix A. Laboratory tests were performed on soil samples obtained from the borings and trenches to evaluate pertinent physical properties. Appendix B presents a summary of the laboratory test results.

We reviewed the following reports and plans as part of the geotechnical investigation:

- *Geotechnical Investigation, Otay Ranch Village 6, R-2 Site, Chula Vista, California*, prepared by Geocon Incorporated, dated April 8, 2002 (Project No. 06667-52-01).
- *Preliminary Geotechnical Investigation, Otay Ranch Village 2, Chula Vista, California*, prepared by Geocon Incorporated, dated August 18, 2003 (Project No. 06862-52-02).
- *Lotting Study, Otay Ranch, Village 7, City of Chula Vista, California*, prepared by Hunsaker & Associates, dated April 5, 2004.

## 2. SITE AND PROJECT DESCRIPTION

The Otay Ranch Village 7, R-2 and Village 4 Community Park site encompasses approximately 40 acres of undeveloped land located in Chula Vista, California. The site is bounded on the north by the proposed Birch Road, on the west by the proposed La Media Road, and on the south by the United States Government Air Traffic Control Vortac Site. The approximate locations of Village 7, R-2 and Village 4 Community Park are shown on the *Vicinity Map*, Figure 1. The Village 4 Community Park site is a roughly triangular-shaped parcel located across Wolf Canyon from the Village 2 site and south of the Village 7, R-2 site. Village 4 Community Park is bounded by Wolf Canyon on the west, proposed La Media Road on the east, Otay Ranch Village 7, R-2 on the north, and undeveloped farmland on the south.

In general, the topography of the property consists of previously cultivated land featuring rounded ridges separated by several gently to moderately sloping canyons. Drainage flows to the south and west towards the proposed La Media Road and to the south and east toward Wolf Canyon. Elevations range from approximately 585 feet above Mean Sea Level (MSL) to approximately 375 feet MSL. Vegetation consists of planted and native grasses and shrubs.

A steel-pipe water trunk line crosses the property in a roughly north-south direction from Wolf Canyon to the southeastern corner of the Village 4 Community Park site. The trunk line was installed by cut-and-cover methods beneath Wolf Canyon and extends through approximately 1,500 feet of tunnel across the eastern one-third of the Village 4 Community park site. The location of the trunk line is presented on the *Geologic Map*. The pipeline enters the Village 4 Community Park site through a tunnel portal located at elevation 388 feet MSL on the slope along the western margin of the park site. Grading is not planned in the vicinity of the tunnel portal.

Future development of the Village 7, R-2 site will include the construction of residential villages consisting of single-family homes with associated roads, underground utilities, and landscaping. Cut slopes up to approximately 40 feet and fill slopes of up to approximately 85 feet in height are proposed, with maximum slope inclinations of 2:1 (horizontal:vertical). A large drainage basin will be constructed along the southern edge of the site. Improvements to the Village 4 Community Park site will include the construction of a gently southeast-sloping, sheet-graded pad with cut slopes up to approximately 75 feet high and fill slopes up to approximately 65 feet high along the margins of the site.

La Media Road will extend along the western margin of Village 7, R-2 and will be constructed with an approximately 85-foot-high fill slope extending across the Wolf Canyon drainage. South of Wolf Canyon, La Media Road continues into the east side of Otay Ranch Village 4 Community Park site. Cut slopes up to approximately 75 feet high will be constructed along the east side of La Media Road on the eastern edge of Village 4 Community Park and along the west side of the road alignment west of the Village 7, R-2 property.

The above locations and descriptions are based on a site reconnaissance and review of the referenced plans. If final development plans differ significantly from those described herein, Geocon Incorporated should be contacted for review and possible revisions to this report.

### **3. SOIL AND GEOLOGIC CONDITIONS**

#### **3.1 General**

Three geologic formations and three surficial soil types were encountered during our investigation. Formational deposits included the Tertiary-age Otay Formation and San Diego Formation, and



Quaternary-age Terrace Deposits. The surficial units consisted of alluvium, colluvium and topsoil. The formational and surficial units are discussed below in order of increasing age. The approximate lateral extent of the formational and surficial soils is presented on the *Geologic Map*, Figures 2, 3 and 4, and on the *Geologic Cross Sections*, Figures 5 and 6.

### **3.2 Topsoil (Unmapped)**

Topsoil is present as a thin veneer overlying formational soils across the site. The topsoil has an average thickness of approximately 3 feet and is characterized as soft to stiff, dry to damp, dark brown, sandy clay to clayey sand. The clayey portion of the topsoil is typically expansive or collapsible. Removal of the topsoil will be necessary in areas to support fill or structures. Due to the relatively thin thickness, topsoil is not shown on the *Geologic Map* (Figures 2, 3 and 4).

### **3.3 Alluvium (Qal)**

Alluvial soils are stream-deposited materials found in the canyon drainages and generally vary in depth dependent upon the size of the canyon. The alluvium consists of firm to stiff, dry to moist, light to dark brown, sandy clay and loose to medium dense, damp to moist, silty to clayey sand. The thickness of alluvium encountered in the exploratory trenches ranged from approximately 10 feet to more than 20 feet. Alluvial deposits are likely deeper than 20 feet in the bottom of Wolf Canyon. Due to the relatively unconsolidated nature of the alluvial deposits, remedial grading will be necessary in areas to receive fill or structures.

### **3.4 Colluvium (Unmapped)**

Colluvium derived from formational soils at higher elevations is present on the side slopes of canyons and the upper portions of the canyon drainages. The colluvium consists of stiff to hard, dry to moist, light to dark brown, sandy clay and loose to medium dense, clayey to silty sand. The thickness of colluvium encountered in the exploratory excavations ranged from approximately 2 to 5 feet. Removal and compaction of colluvium is required in areas that will support fill or structures. Due to the relatively thin thickness and discontinuity of the deposits, colluvium is not shown on the *Geologic Map* (Figures 2, 3 and 4).

### **3.5 Terrace Deposits (Qt)**

Quaternary-age Terrace Deposits unconformably overlie the San Diego Formation above an elevation of approximately 515 feet MSL in the northern and eastern areas of the Village 7, R-2 site and the northeastern portion of the Village 4 Community Park site. Sediments generally associated with this formation consist of cobble-gravel-sand mixtures with locally cemented zones and sandy to clayey siltstones. The granular soils of the Terrace Deposits typically exhibit adequate shear strength and low expansive potential in either an undisturbed or properly compacted condition.

### **3.6 San Diego Formation (Tsd)**

The Tertiary-age (Pliocene) San Diego Formation overlies the Otay Formation and typically consists of massively bedded, well-sorted, fine-grained sandstones with some cemented gravel lenses. Above an approximate elevation of 470 feet MSL, this unit is composed of light gray, silty, fine-grained sandstones with “rip up” clasts of clay. Cohesionless, friable sand lenses can also occur and may require remedial grading measures if encountered in proposed cut slopes or at finish-pad grade during grading operations. In general, the sediments of the San Diego Formation exhibit adequate shear strength and “very low” to “medium” expansion characteristics in either an undisturbed or properly compacted condition. Oversize material may be generated in this unit during grading procedures because of matrix cementation.

### **3.7 Otay Formation (To)**

The Tertiary-age (possibly Oligocene) Otay Formation underlies the site either exposed near the surface or underlying the younger geologic formations and surficial soils at depth. The Otay Formation consists of dense, silty, fine- to coarse-grained sandstone and siltstone with discontinuous interbeds of highly expansive bentonitic claystone. The coarser-grained portions of the Otay Formation typically have a “very low” to “low” expansion potential and adequate shear strength. The silt and clay portions of the formation can exhibit a “medium” to “high” expansion potential.

A relatively continuous bentonite claystone bed up to approximately 5 feet thick was encountered during the investigation at the Village 4 Community Park site in borings B-45 through B-48 and B-50 at elevations ranging from 438 to 444 feet MSL. A discontinuous bentonitic claystone bed up to 3 feet thick was encountered at the Village 7, R-2 site in boring B-51 and in trench T-22 at an elevation of approximately 444 feet MSL. The bentonitic claystone bed was not encountered in the other excavations and likely pinches out between exposures. Bentonitic claystone typically possesses a “very high” expansion potential and will require special considerations with respect to placement as fill, undercutting of pad and street subgrade, and slope stability. The possibility of encountering thicker beds and bentonite claystone during mass grading operations in areas not explored during this investigation exists. If encountered, beds of bentonite claystone in cut slopes and keyway excavations should be evaluated individually.

## **4. GEOLOGIC STRUCTURE**

Bedding attitudes observed within formational materials encountered during the investigation are nearly horizontal. The regional dip of sedimentary units in the eastern Chula Vista area is generally 1 to 5 degrees toward the southwest. The granular portions of the formational units are typically massive with bedding not discernible. This is also true within massive claystone and siltstone interbeds of the Otay Formation. High-angle contacts between formational units are not uncommon,

however, it is our opinion that adverse geologic structure does not present a significant geologic hazard to the proposed development of the site.

## 5. GROUNDWATER

Groundwater was not encountered in any of the exploratory excavations of this investigation or from any of the previous geotechnical investigations performed and is not anticipated to adversely impact the development of the property. It is not uncommon for groundwater seepage conditions to develop where none previously existed due to the permeability characteristics of the geologic units encountered on site. During the rainy season, perched water conditions are likely to develop within the drainage areas that may require special consideration during grading operations. Groundwater elevations are dependent on seasonal precipitation, irrigation and land use, among other factors, and vary as a result.

## 6. GEOLOGIC HAZARDS

### 6.1 Faulting and Seismicity

A review of geologic literature indicates that there are no known active or potentially active faults at the site. The Rose Canyon Fault Zone, located approximately 11 miles northwest of the site, is the closest known active fault. An active fault is defined by the California Geologic Survey (CGS), as a fault showing evidence for activity roughly within the last 11,000 years. The CGS has included portions of the Rose Canyon Fault Zone within a State of California Earthquake Fault Zone. This site is not located within such a zone. The "potentially active" La Nacion Fault is located approximately three miles west of the site and should not impact the proposed development.

### 6.2 Seismicity – Deterministic Analysis

Earthquakes that might occur on the Rose Canyon Fault or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The computer program *EQFAULT* (Blake, 1998) was utilized to approximate the distance of known faults to the site. Within a search radius of 50 miles from the site, six known active faults were identified. The results of the seismicity analyses indicate that the Rose Canyon Fault is the dominant source of potential ground motion at the site. Earthquakes on the Rose Canyon Fault having a maximum credible magnitude of 7.2 are considered to be representative of the potential for seismic ground shaking within the property. The "maximum credible earthquake" is defined as the maximum earthquake that appears capable of occurring under the presently known tectonic framework (California Division of Mines and Geology Notes, Number 43). The estimated maximum credible ground acceleration expected at the site was calculated to be approximately 0.28g, using the Sadigh *et al.* (1997), attenuation relationship. The earthquake events and site accelerations for the faults considered most likely to subject the site to ground shaking are presented on the following table. The

seismic risk at the site is not considered significantly greater than that of the surrounding developments or the Chula Vista area in general.

**TABLE 6.1  
DETERMINISTIC SITE PARAMETERS FOR SELECTED ACTIVE FAULTS**

| Fault Name                   | Distance From Site (miles) | Maximum Credible Magnitude | Maximum Credible Site Accelerations (g) |
|------------------------------|----------------------------|----------------------------|---|
| Rose Canyon                  | 11                         | 7.2                        | 0.28                                    |
| Coronado Bank                | 19                         | 7.4                        | 0.20                                    |
| Elsinore-Julian              | 41                         | 7.1                        | 0.05                                    |
| Newport-Inglewood (Offshore) | 45                         | 7.1                        | 0.05                                    |
| Elsinore-Coyote Mountain     | 43                         | 6.8                        | 0.04                                    |
| Earthquake Valley            | 44                         | 6.5                        | 0.02                                    |

In the event of a major earthquake along any of the above-referenced faults or other faults in the southern California region, the site could be subjected to moderate to severe ground shaking. With respect to seismic shaking, the site is considered comparable to others in the general vicinity. While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. We recommend that the seismic design of the structures be performed in accordance with the Uniform Building Code (UBC) guidelines currently adopted by the City of Chula Vista.

### **6.3 Liquefaction**

Liquefaction typically occurs when a site is subjected to strong seismic shaking, on-site soils are cohesionless with less than 20 percent fines, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from the earthquake-generated ground accelerations. The potential for liquefaction is considered to be very low due to the dense formational units encountered and the absence of a permanent groundwater table in the upper 50 feet.

### **6.4 Landsliding**

Based on a review of referenced background geologic data, field observation of the site, and our subsurface evaluation, no landslides or landslide deposits have been mapped or observed at the site. It is the opinion of Geocon Incorporated that the potential for landsliding adversely affecting the proposed improvements is very low, provided the recommendations of this report are followed.

## 7. SLOPE STABILITY ANALYSES

### 7.1 Proposed Graded Slopes

The proposed slope configurations, as depicted on the referenced plans, were evaluated to determine both surficial and global stability based on the current geologic information. The potential for relatively thick continuous bentonitic claystone layers as well as thin, discontinuous bentonitic claystone layers is likely. Overall, the proposed cut and fill slopes can be constructed as planned; however, due to the discontinuous nature of the bentonite layers, predicting or locating isolated layers is difficult. Buttress fills will be required during grading operations. Slope stability analyses are presented in Appendix C.

## 8. CONCLUSIONS AND RECOMMENDATIONS

### 8.1 General

- 8.1.1 No soil or geologic conditions were encountered that would preclude the development of the property as presently planned, provided the recommendations of this report are followed.
- 8.1.2 The surficial soils consisting of topsoil, colluvium and alluvium are not considered suitable for the support of fill or structural loads in their present condition and will require remedial grading in the form of removal, moisture conditioning as necessary, and compaction. Terrace Deposits and formational materials of the San Diego and Otay Formations are suitable for the support of structures and compacted fill.
- 8.1.3 No landslides, active or potentially active faults were encountered at the site during our geologic reconnaissance, subsurface investigation, or review of background materials.
- 8.1.4 A portion of the cut slopes composed of Terrace Deposits and formational materials, as well as slopes composed of properly compacted fill, should be grossly stable at inclinations of 2:1 (horizontal:vertical) or less. Potentially unstable cut slopes exposing bentonite clay layers and out-of-slope bedding are discussed herein and should be evaluated during grading operations.
- 8.1.5 The presence of relatively thick layers of bentonitic clays will require special consideration with respect to placement as fill, undercutting of pad and street subgrade, and buttress slope stability. Sections 8.4.8 and 8.4.9 outline recommendations for the placement of bentonitic clays.
- 8.1.6 Grading plans indicate that the Village 4 Community Park site will be constructed to a sheet-graded condition. Preparation of an update report will be required prior to fine grading of the site once grading plans are available.

### 8.2 Soil and Excavation Characteristics

- 8.2.1 Based on the results of the field investigation and our experience in the general area, it is anticipated that the surficial soils and formational materials can generally be excavated with moderate to heavy effort using conventional heavy-duty excavation equipment. Cemented zones may be encountered at random locations in the formational deposits, however, the extent is expected to be localized. Difficult ripping conditions and the generation of oversize material should be anticipated within these cemented zones.

- 8.2.2 It is estimated that a majority of the on-site materials possess a “very low” to “medium” expansion potential (expansion index of 90 or less) as defined by Uniform Building Code (UBC) Table 18-I-B. The expansion potential of the bentonite claystone and surficial soils ranges from “high” to “very high.” Due to the wide range of expansion potential typically exhibited by soils in this area, it is recommended that the expansion potential be evaluated for the building pads once final grade is achieved.
- 8.2.3 Laboratory testing performed on selected samples obtained during our subsurface investigation indicates that the soils tested contained negligible percentages of water-soluble sulfate. Further laboratory testing should be performed on soils that are exposed at finish grade to determine the percentage of water-soluble sulfate present. Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, it is recommended that further evaluation by a corrosion engineer be performed if improvements are planned that are susceptible to corrosion.

### **8.3 Slope Stability Analyses**

- 8.3.1 Slope stability analyses were performed using a two-dimensional computer program *SLOPEW5* created by Geo-Slope International Ltd. Rotational-mode analyses were performed using Bishop’s Simplified procedure and block-mode analyses was performed using the Janbu’s method. Output of the computer program including the calculated factor of safety and the failure surface is shown in Appendix C.
- 8.3.2 Shear strength parameters for the existing geologic features were determined from laboratory direct shear and residual shear tests on samples obtained during our field investigation and on samples obtained from other investigations in the area in accordance with ASTM D 3080-03. Direct shear tests were performed on samples of the Terrace Deposits, Otay Formation, and San Diego Formation. Residual shear tests were performed on samples of the bentonitic claystone encountered in the Otay Formation. The geologic units encountered and the shear strength properties used in the analyses are presented in Appendix C.
- 8.3.3 Various cross sections were selected to perform the slope stability analyses. Appendix C provides a description of the cross sections, their corresponding factor of safety, and the condition of the slope stability analyses. A factor of safety of 1.5 for static conditions is currently required by the City of Chula Vista for graded slopes.
- 8.3.4 The presence of weak bentonitic clay layers will require the construction of buttresses on several proposed cut slopes. In general, the affected cut slopes are located along the

southerly margins of the property. The location and proposed maximum width of the buttress fills are shown on the *Geologic Map* (Figures 2, 3 and 4)

- 8.3.5 Surficial slope stability calculations were performed for a 2:1 (horizontal:vertical) fill slope. The calculated factor of safety is greater than the required minimum factor of safety of 1.5. Plants with variable root depth should be planted as soon as possible once the fill slopes have been constructed. Surficial slope stability calculations are presented in Appendix C.

## **8.4 Grading**

- 8.4.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D and the City of Chula Vista Grading Ordinance. Where the recommendations of Appendix D conflict with this section, the recommendations of this section should take precedence.
- 8.4.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.
- 8.4.3 Site preparation should begin with the removal of all deleterious material, debris and vegetation. The depth of removal should be such that material exposed in cut areas or soils to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.
- 8.4.4 All topsoil, colluvium and alluvium exposed at grade within the site boundary should be removed to expose firm formational soil. Prior to any fill soils being placed, the existing ground surface should be scarified, moisture conditioned as necessary, and compacted to a depth of at least 12 inches.
- 8.4.5 The site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content, as determined in accordance with ASTM Test Procedure D 1557-00. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.



- 8.4.6 To reduce the potential for differential settlement of the compacted fill soils, it is recommended that the cut portion of residential building pads with cut-fill transitions be undercut at least 3 feet and replaced with properly compacted fill soils.
- 8.4.7 The upper 3 feet of all building pads (cut or fill) should be composed of properly compacted or undisturbed formational soil with a "very low" to "medium" expansion potential (EI of 90 or less). Fill soils with an Expansion Index above 90 should be placed at least 3 feet below finish grade. In addition, formational soils with an expansion index greater than 90 should be undercut at least 3 feet below finish-pad grade and replaced with soil with soil possessing a "very low" to "medium" expansion potential. Cobbles or concretions greater than 1 foot in maximum dimension should not be placed within 10 feet of finish grade or 3 feet of the deepest utility. Cobbles and concretions greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade.
- 8.4.8 Bentonitic claystone layers that occur within 5 feet of finish grade should be removed and replaced with properly compacted fill soil having a "very low" to "medium" expansion potential (Expansion Index of 90 or less). The undercut within the building pads should be sloped at least 2 percent toward the adjacent street.
- 8.4.9 Bentonitic claystone layers encountered during the normal excavation or undercutting of building pads, streets or slopes should be mixed with granular materials in a ratio of at least two parts sand to one part bentonite clay and compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture. The mixed bentonite clay should be placed at least 5 feet below finish grade and at least 15 feet from the face of a fill slope.
- 8.4.10 Slope stability analysis utilizing drained direct shear strength parameters based on our experience with similar soil types in nearby areas and laboratory test results indicates that the proposed fill slopes, constructed of on-site materials, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions. Cut slopes that are not impacted by bentonitic clay layers were also found to possess a calculated factor of safety in excess of 1.5 for a deep-seated failure condition. However, several of the proposed slopes will require buttressing to obtain a factor of safety of at least 1.5. These slopes are shown on the *Geologic Map* (Figures 2, 3 and 4) and should be graded with buttresses varying from 15 to 55 feet wide. The design buttress width is shown on the *Geologic Map*.
- 8.4.11 The *Typical Stability Fill Detail* presented on Figure 7 should be used for design and construction of slope buttresses, where required. The backcut for the buttress should

commence at least 10 feet from the top of the proposed finish-graded slope and should extend at least 3 feet below adjacent pad grade or below the bentonite layer, to a maximum depth of 15 feet below finish-pad grade.

- 8.4.12 We recommend all cut slope excavations including buttresses and shear keys be observed during grading to check that soil and geologic conditions do not differ significantly from those anticipated. During the construction of buttresses, there is a risk that the temporary backcut slopes will become unstable. This risk can be reduced by grading the buttress fill in short segments and/or flattening the inclination of the temporary slope.
- 8.4.13 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of 90 or less than 90 or at least 35 percent sand-size particles should be acceptable as "granular" fill. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength. The use of cohesionless soils in the outer portion of fill slopes should be avoided. Fill slopes should be overbuilt 2 feet and cut back or be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content to the face of the finished sloped.
- 8.4.14 All slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

## **8.5 Subdrains**

- 8.5.1 The geologic units encountered on the site have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to groundwater seepage. The locations of proposed subdrains are presented on the *Geologic Map*, Figures 2, 3 and 4. The use of canyon subdrains will be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Figure 8 depicts a typical canyon subdrain detail.
- 8.5.2 Prior to outletting, the final 20-foot segment of subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/perforated interface, a seepage cutoff wall should be constructed on the downslope side of the junction in accordance with Figure 9. Subdrains that discharge into a natural drainage course

or open space area should be provided with a permanent headwall structure in accordance with Figure 10.

8.5.3 The final grading plans should show the location of all proposed subdrains. Upon completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map depicting the existing conditions. The final outlet and connection locations should be determined during grading. Subdrains that will be extended on adjacent projects can be placed on formational material and a vertical riser should be placed at the end of the subdrain.

## 8.6 Seismic Design Criteria

8.6.1 Table 8.6 summarizes seismic design parameters obtained from the Uniform Building Code (UBC) Table 16-J for two different Soil Profile Types,  $S_c$  and  $S_D$ , which are prevalent on this project. A summary of the Soil Profile Type for each lot should be provided in the final report of grading. The corresponding parameters listed on Table 8.6 should be used for seismic design. The values listed are for the Rose Canyon Fault, which is identified as a Type B fault and is more dominant than the nearest Type A fault due to its proximity to the site. The Rose Canyon Fault is located approximately 11 miles northwest of the site.

**TABLE 8.6  
SEISMIC DESIGN PARAMETERS**

| Parameter                  | Soil Profile Type (UBC Table 16-J) |       | UBC Reference |
|----------------------------|------------------------------------|-------|---------------|
|                            | $S_c$                              | $S_D$ |               |
| Seismic Zone Factor        | 0.40                               | 0.40  | Table 16-I    |
| Seismic Coefficient, $C_a$ | 0.40                               | 0.44  | Table 16-Q    |
| Seismic Coefficient, $C_v$ | 0.56                               | 0.64  | Table 16-R    |
| Near-Source Factor, $N_a$  | 1.0                                | 1.0   | Table 16-S    |
| Near Source Factor, $N_v$  | 1.0                                | 1.0   | Table 16-T    |
| Seismic Source             | B                                  | B     | Table 16-U    |

8.6.2 Conformance to the above criteria for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive

## 8.7 Foundations

8.7.1 The following foundation recommendations are for one- or two-story residential structures and are separated into categories dependent on the thickness and geometry of the underlying fill soils as well as the Expansion Index of the prevailing subgrade soils of a particular building pad (or lot). The recommended minimum foundation and interior concrete slab design criteria for each category is presented on Table 8.7.1.

**TABLE 8.7.1  
FOUNDATION RECOMMENDATIONS BY CATEGORY**

| Foundation Category | Minimum Footing Depth (inches) | Continuous Footing Reinforcement     | Interior Slab Reinforcement                        |
|---------------------|--------------------------------|--------------------------------------|--|
| I                   | 12                             | Two No. 4 bars, one top, one bottom  | 6 x 6 - 10/10 welded wire mesh at slab mid-point   |
| II                  | 18                             | Four No. 4 bars, two top, two bottom | No. 3 bars at 24 inches on center, both directions |
| III                 | 24                             | Four No. 5 bars, two top, two bottom | No. 3 bars at 18 inches on center, both directions |

### CATEGORY CRITERIA

Category I: Maximum fill thickness is less than 20 feet and expansion index is 50 or less.

Category II: Maximum fill thickness is less than 50 feet, expansion index is 90 or less, or variation in fill thickness is greater than or equal to 10 feet and is less than 20 feet.

Category III: Fill thickness is greater than or equal to 50 feet, variation in fill thickness is greater than or equal to 20 feet, or Expansion Index exceeds 90 and is 130 or less.

### Notes:

1. All footings should have a minimum width of 12 inches.
2. Footing depth is measured from lowest adjacent subgrade.
3. All interior living area concrete slabs should be at least four inches thick for Categories I and II, and 5 inches thick for Category III.
4. All interior concrete slabs should be underlain by at least 4 inches (3 inches for Category III) of clean sand or crushed rock.
5. All slabs expected to receive moisture-sensitive floor coverings or used to store moisture-sensitive materials should be underlain by a vapor inhibitor covered with at least 2 inches of the clean sand recommended in No. 4 above.

8.7.2 Foundations for Category I, II or III may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient loads such as wind or seismic forces.

- 8.7.3 The use of isolated footings which are located beyond the perimeter of the building and support structural elements connected to the building is not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.
- 8.7.4 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. In addition, consideration should be given to connecting patio slabs that exceed 5 feet in width to the building foundation to reduce the potential for future separation to occur.
- 8.7.5 No special subgrade presaturation is deemed necessary prior to placing concrete, however, the exposed foundation and slab subgrade soils should be moisture conditioned as necessary to maintain a moist condition, as would be expected in any such concrete placement.
- 8.7.6 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal:vertical), special foundations and/or design considerations are recommended due to the tendency for lateral soil movement to occur.
- For slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.
  - Where the height of the fill slope exceeds 20 feet, the minimum horizontal distance should be increased to  $H/3$  (where  $H$  equals the vertical distance from the top of the slope to the toe) but need not exceed 40 feet. For composite (fill over cut) slopes,  $H$  equals the vertical distance from the top of the slope to the bottom of the fill portion of the slope. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.
  - For cut slopes in dense formational materials or fill slopes inclined at 3:1 (horizontal:vertical) or flatter, the bottom outside edge of building footings should be at least 7 feet horizontally inside the face of the slope, regardless of slope height.
  - Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, it is recommended that the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements that are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures that would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

8.7.7 As an alternative to the foundation recommendations for each category, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (UBC Section 1816). Although this procedure was developed for expansive soils, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented on the following table for the particular foundation category designated.

**TABLE 8.7.7  
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS**

| Post-Tensioning Institute (PTI)<br>Design Parameters | Foundation Category |             |             |
|--|---------------------|-------------|-------------|
|  | I                   | II          | III         |
| 1. Thornthwaite Index                                | -20                 | -20         | -20         |
| 2. Clay Type—Montmorillonite                         | Yes                 | Yes         | Yes         |
| 3. Clay Portion (Maximum)                            | 30%                 | 50%         | 70%         |
| 4. Depth to Constant Soil Suction                    | 7.0 ft.             | 7.0 ft.     | 7.0 ft.     |
| 5. Soil Suction                                      | 3.6 ft.             | 3.6 ft.     | 3.6 ft.     |
| 6. Moisture Velocity                                 | 0.7 in./mo.         | 0.7 in./mo. | 0.7 in./mo. |
| 7. Edge Lift Moisture Variation Distance             | 2.6 ft.             | 2.6 ft.     | 2.6 ft.     |
| 8. Edge Lift   | 0.41 in.            | 0.78 in.    | 1.15 in.    |
| 9. Center Lift Moisture Variation Distance           | 5.3 ft.             | 5.3 ft.     | 5.3 ft.     |
| 10. Center Lift                                      | 2.12 in.            | 3.21 in.    | 4.74 in.    |

8.7.8 The UBC Section 1816 uses interior stiffener beams in its structural design procedures. If the structural engineer proposes a post-tensioned foundation design method other than UBC Section 1816, it is recommended that interior stiffener beams be used for Foundation Categories II and III. The depth of the perimeter foundation should be at least 12 inches for Foundation Category I. Where the Expansion Index for a particular building pad exceeds 50 but is less than 91, the perimeter footing depth should be at least 18 inches; and where it exceeds 90 but is less than 130, the perimeter footing depth should be at least 24 inches.

Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.7.9 If post-tensioned foundation systems are used, they should be designed to resist the amount of edge lift indicated on Table 8.7.7. Our experience indicates that, unless reinforcing steel is placed at the bottom of perimeter footings and interior stiffener beams, post-tensioned slabs may be susceptible to excessive edge lift, regardless of underlying soil conditions. Current PTI design procedures primarily address the potential for center lift of slabs but, because of the placement of the reinforcing tendons in the top of the slab, the resulting stress eccentricity after tensioning reduces the ability of the system to mitigate edge lift. As a minimum, we recommend at least two No. 4 steel reinforcing bars at the bottom of the perimeter footings and stiffener beams.

8.7.10 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soils (if present), differential settlement of deep fills, or fills of varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and the placement of crack-control joints at periodic intervals, particularly where re-entrant slab corners occur.

## **8.8 Retaining Walls and Lateral Loads**

8.8.1 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 40 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal:vertical), an active soil pressure of 55 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index of 90 or less. For those lots with finish-grade soils having an Expansion Index greater than 90 and/or where backfill materials do not conform to the above criteria, Geocon Incorporated should be consulted for additional recommendations.

8.8.2 Unrestrained walls are those that are allowed to rotate more than  $0.001H$  (where  $H$  equals the height of the retaining wall portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, an additional uniform pressure of  $7H$  psf should be added to the above active soil pressure.

- 8.8.3 All retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely impact the property adjacent to the base of the wall. A typical *Retaining Wall Drainage Detail* is presented on Figure 11. The above recommendations assume a properly compacted granular (Expansion Index of 90 or less) backfill material with no hydrostatic forces or imposed surcharge load. If conditions different than those described are anticipated, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.
- 8.8.4 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within 3 feet below the base of the wall has an Expansion Index of less than 90. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated.
- 8.8.5 For resistance to lateral loads, an allowable passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed natural soils. The allowable passive pressure assumes a horizontal surface extending away from the base of the wall at least 5 feet or three times the height of the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance. An allowable friction coefficient of 0.35 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the allowable passive earth pressure when determining resistance to lateral loads.
- 8.8.6 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 8 feet. In the event that walls higher than 8 feet or other types of walls (such as crib-type walls) are planned, Geocon Incorporated should be consulted for additional recommendations.

## **8.9 Drainage and Maintenance**

- 8.9.1 Establishing proper drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Positive measures should be taken to properly finish-grade the building pads after the structures and other improvements are in place so that the drainage water from the lots and adjacent properties are directed off the lots and to



the street away from foundations and the top of the slopes. Experience has shown that even with these provisions, a shallow groundwater or subsurface water condition can develop in areas where no such water conditions existed prior to the site development; this is particularly true where a substantial increase in surface water infiltration results from an increase in landscape irrigation.

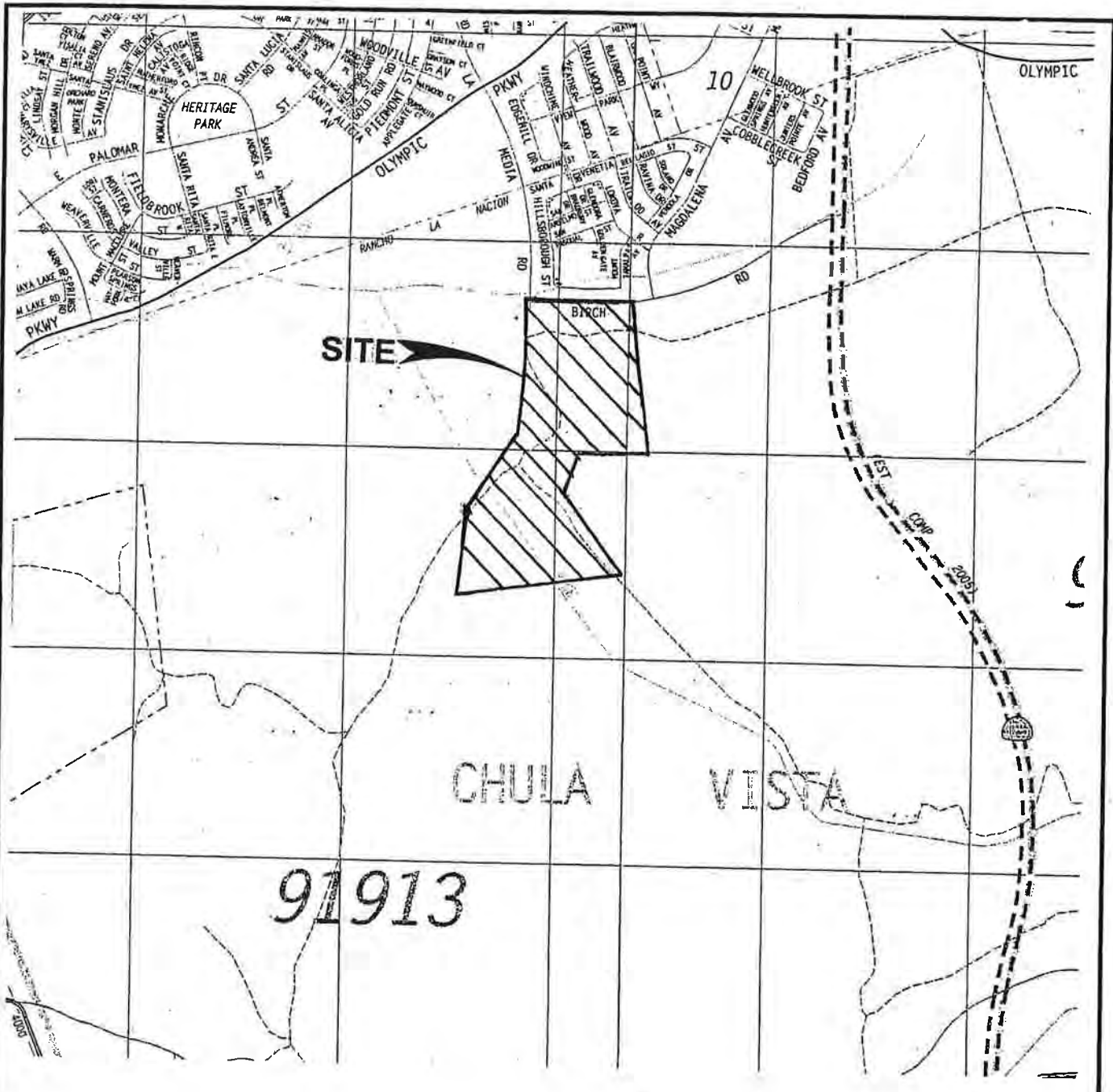
- 8.9.2 All underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks for early detection of water infiltration and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for a prolonged period of time.
  
- 8.9.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that drains be installed to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

#### **8.10 Grading and Foundation Plan Review**

- 8.10.1 Geocon Incorporated should review the grading and foundation plans prior to finalization to verify their compliance with the recommendations of this report and determine the need for additional comments, recommendations and/or analysis.

## LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.
2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.
3. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



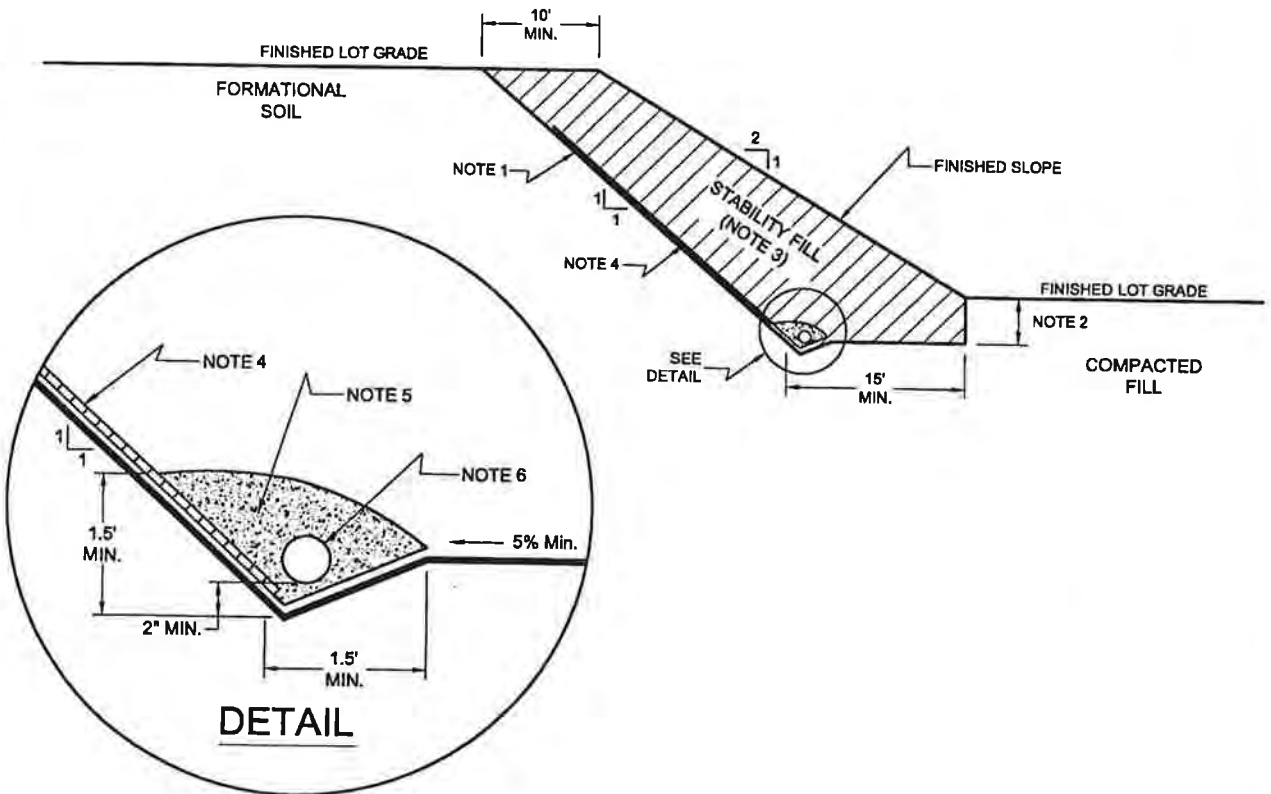
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|  |                             |        |
|--|-----------------------------|--------|
| <b>VICINITY MAP</b>  |                             |        |
| OTAY RANCH VILLAGE 7, R - 2<br>AND VILLAGE 4 COMMUNITY PARK<br>CHULA VISTA, CALIFORNIA |                             |        |
| DATE 05-05-2004  | PROJECT NO. 06862 - 52 - 03 | FIG. 1 |



**NOTES:**

- 1.....EXCAVATE BACKCUT AT 1:1 INCLINATION
- 2.....BASE OF STABILITY FILL TO BE 3 FEET BELOW PAD GRADE, OR BOTTOM OF BENTONITE LAYER OR A MAXIMUM OF 15 FEET BELOW PAD GRADE SLOPING A MINIMUM 5 % INTO SLOPE
- 3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL WITH MINIMUM SHEAR STRENGTH OF  $\phi = 28^\circ$ ,  $C=250$  psf
- 4.....WHERE SEEPAGE IS ENCOUNTERED IN BACKCUT OR SLOPE HEIGHT EXCEEDS 15 FEET, CHIMNEY DRAINS ARE RECOMMENDED. CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN 5000 OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE
- 5.....FILTER MATERIAL TO BE 1-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC.
- 6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET

**TYPICAL STABILITY FILL DETAIL**

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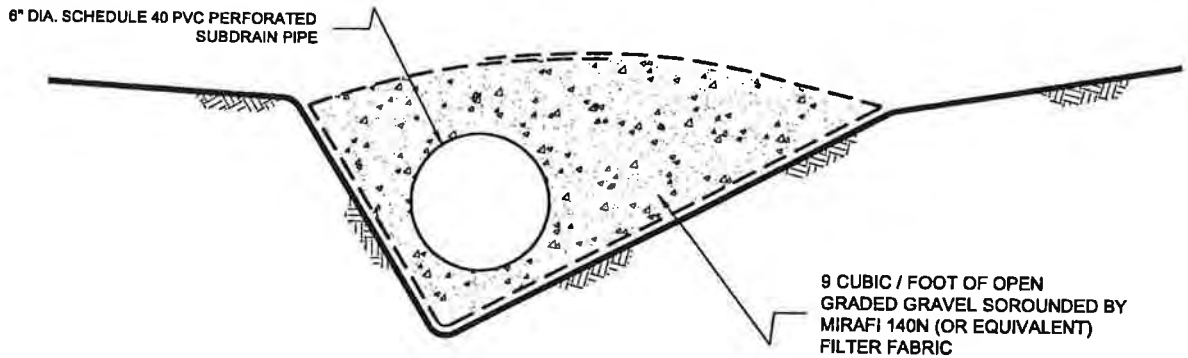
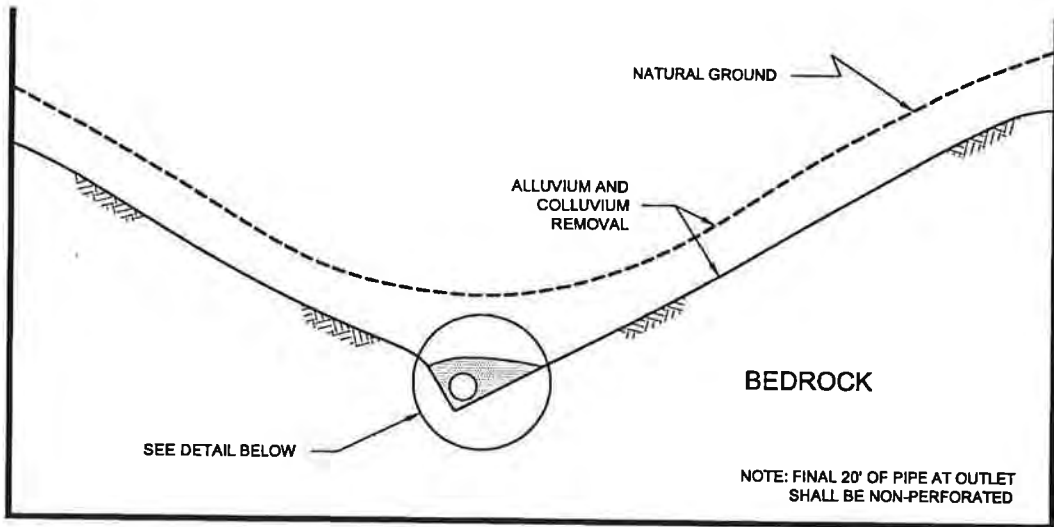
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FIG. 7



NO SCALE

TYPICAL CANYON SUBDRAIN DETAIL

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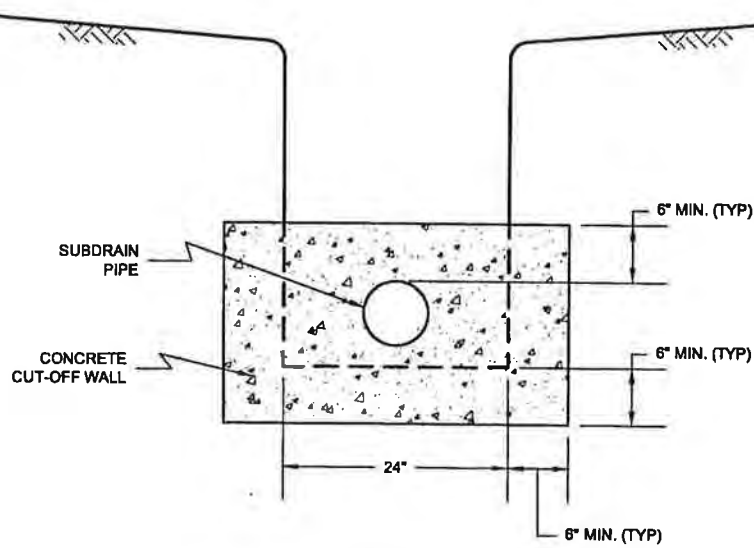
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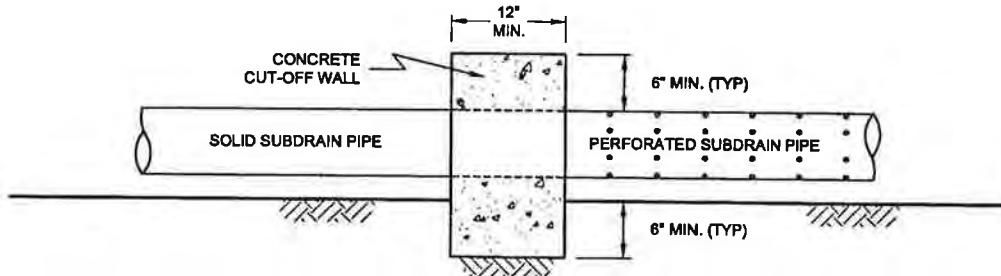
FIG. 8

FRONT VIEW



NO SCALE

SIDE VIEW



NO SCALE

RECOMMENDED SUBDRAIN CUT-OFF WALL

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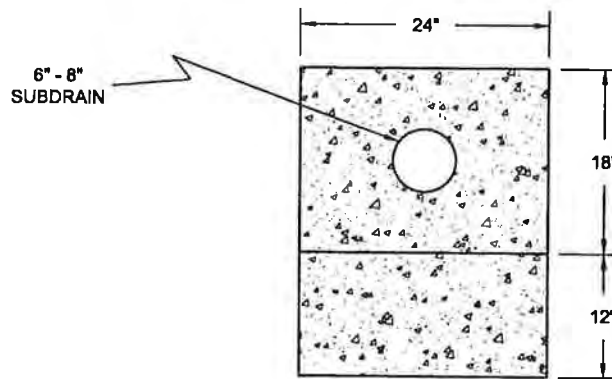
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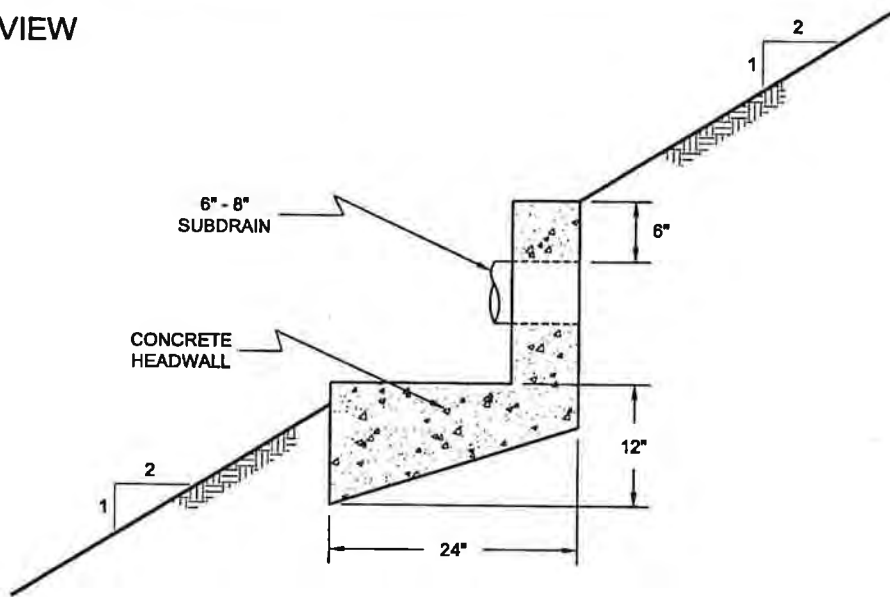
FIG. 9

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

SUBDRAIN OUTLET HEADWALL DETAIL

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CHULA VISTA, CALIFORNIA

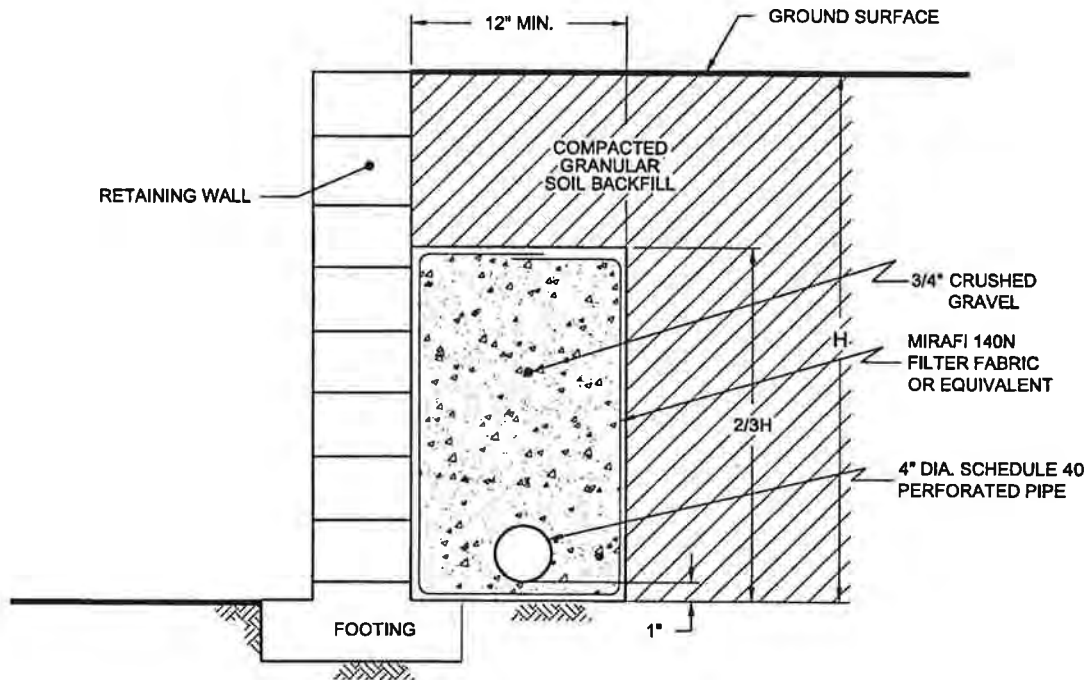
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FIG. 10



**NOTES:**

- 1.....PREFABRICATED DRAINAGE PANELS SUCH AS MIRADRAIN 6000 OR EQUIVALENT MAYBE USED IN LIEU OF PLACING GRAVEL
- 2.....DRAIN SHOULD BE UNIFORMLY SLOPED AT 0.5 % OR GREATER TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

**RETAINING WALL DRAINAGE DETAIL**

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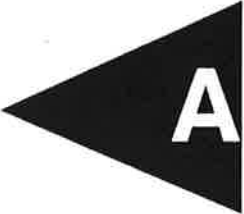
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FIG. 11



APPENDIX



## APPENDIX A

### FIELD INVESTIGATION

The field investigation was performed on September 12, 18, 19 and 24, 2003; January 14 and 15, 2004; and February 2, 2004; and consisted of a geologic reconnaissance and the excavation of 11 exploratory borings and 25 exploratory trenches. The approximate locations of the excavations are shown on the *Geologic Map*, Figures 2, 3, and 4. The locations of the exploratory borings were surveyed by the project civil engineer, and the exploratory trenches were located in the field using a compass and tape measure. The exploratory borings were excavated to a maximum depth of approximately 66 feet with a truck-mounted drill rig with a 30-inch-diameter bucket-auger. The exploratory trenches were excavated to a maximum depth of approximately 21 feet with a JD 555 tracked backhoe with a 24-inch-wide bucket. As drilling and trenching proceeded, the soil and geologic conditions encountered were logged and sampled.

Samples were obtained during our large-diameter boring excavations using a Modified California sampler. The sampler is composed of steel and is driven to obtain relatively undisturbed soil samples. The Modified California sampler has an inside diameter of 2.5 inches and an outside diameter of 3 inches. Up to 18 rings are placed inside the sampler that are 2.4 inches in diameter and 1 inch in height. The samplers were driven 12 inches into the bottom of the excavations with the use of a telescoping Kelly bar. The weight of the Kelly bar (4,500 lbs. maximum) drives the sampler and varies with depth. The height of drop is usually 18 inches. Blow counts are recorded for every 12 inches the sampler is driven. The penetration resistance values shown on the boring logs are shown in terms of blows per foot. These values are not to be taken as N-values and adjustments have not been applied. Ring samples at appropriate intervals were retained in moisture-tight containers and transported to the laboratory for testing. The type of sample is noted on the exploratory boring logs. Elevations shown on the boring logs were determined from either a topographic map or by using a benchmark. Each excavation was backfilled, unless otherwise noted.

The soil conditions encountered in the excavations were visually examined, classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for *Description and Identification of Soils* (Visual-Manual Procedure D 2488-00). Logs of the exploratory borings are presented on Figures A-1 through A-11 and exploratory trenches are presented on Figures A-12 through A-36. The borings and trenches for Otay Ranch Village 7, R-2 and Village 4 Community Park were excavated concurrently with our exploratory program for Otay Ranch Village 2, and, to avoid confusion, the boring and trench numbers reflect the Village 2 numbering system. The logs depict the general soil and geologic conditions encountered and the depth at which samples were obtained.

A Waiver for Geotechnical Boring was issued for the exploratory excavations by the County of San Diego Department of Environmental Health and is shown after the figures in this appendix.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | BORING B 44  |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|-----------|-------------|--------------|--|--|-------------------------|-------------------------|
|                      |               |           |             | ELEV. (MSL.) | DATE COMPLETED   |  |                         |                         |
|                      |               |           |             |              | ELEV. (MSL.) <u>432</u> DATE COMPLETED <u>09-12-2003</u>   |  |                         |                         |
|                      |               |           |             |              | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>   |  |                         |                         |
| MATERIAL DESCRIPTION |               |           |             |              |  |  |                         |                         |
| 0                    |               |           |             |              | <b>TOPSOIL</b><br>Loose to very stiff, damp, dark brown, fine to medium, Sandy CLAY; porous, thin roots, small pods of carbonate, trace gravel   |  |                         |                         |
| 2                    |               |           |             | CL           |  |  |                         |                         |
| 4                    |               |           |             |              | <b>OTAY FORMATION</b><br>Medium dense, damp, light brown, Silty, fine- to coarse-grained SANDSTONE, ("GRITSTONE"); carbonate mineralization and moderately weathered in upper 2 feet of unit, some gravel-sized clasts, overall very massive and intact, becomes dense at 6 feet |  |                         |                         |
| 6                    | B44-1         |           |             | SM           |  | 4/12"                                    |                         |                         |
| 8                    |               |           |             |              | Grades to dense, damp, yellowish brown, fine- to medium-grained, Sandy SILTSTONE   |  |                         |                         |
| 10                   | B44-2         |           |             | ML           |  | 8/7"                                     |                         |                         |
| 12                   |               |           |             |              | Grades to very dense, damp, Silty, fine- to medium-grained SANDSTONE; moderately cemented, some coarse sand to fine gravel-sized clasts, massive and tight, friable  |  |                         |                         |
| 14                   |               |           |             |              | -Becomes fine- to coarse-grained and gravelly  |  |                         |                         |
| 16                   | B44-3         |           |             |              |  | 6/7"                                     |                         |                         |
| 18                   |               |           |             |              |  |  |                         |                         |
| 20                   | B44-4         |           |             | SM           |  | 8/8"                                     |                         |                         |
| 22                   |               |           |             |              | -Grades very Silty and fine- to medium-grained   |  |                         |                         |
| 24                   |               |           |             |              |  |  |                         |                         |
| 26                   | B44-5         |           |             |              |  | 8/8"                                     |                         |                         |
| 28                   |               |           |             |              | -Fine- to coarse-grained and gravelly  |  |                         |                         |

Figure A-1,  
Log of Boring B 44, Page 1 of 3

06862-52-03.GPJ

| SAMPLE SYMBOLS                      |                             |                          |                               |                          |                                |
|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
| <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 44</b>  |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|-----------------------------|---------------|-----------|-------------|-------------------------|---|----------------------------------|--|-------------------------|---------------------|
|                             |               |           |             |                         | ELEV. (MSL.) <u>432</u>   | DATE COMPLETED <u>09-12-2003</u> |  |                         |                     |
|                             |               |           |             |                         | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>  |                                  |  |                         |                     |
| <b>MATERIAL DESCRIPTION</b> |               |           |             |                         |   |                                  |  |                         |                     |
| 30                          | B44-6         |           |             |                         |   |                                  | 12/8"                                    |                         |                     |
| 32                          |               |           |             |                         | -Fine- to medium-grained, locally strongly cemented, overall very massive and uniform   |                                  |  |                         |                     |
| 34                          |               |           |             |                         |   |                                  |  |                         |                     |
| 36                          | B44-7         |           |             |                         |   |                                  | 15/10"                                   |                         |                     |
| 38                          |               |           |             |                         |   |                                  |  |                         |                     |
| 40                          | B44-8         |           |             | SM                      | -Grades fine- to coarse-grained and gravelly, yellowish brown   |                                  | 10/8"                                    |                         |                     |
| 42                          |               |           |             |                         |   |                                  |  |                         |                     |
| 44                          |               |           |             |                         | -Fine- to medium-grained, strongly cemented, grayish brown  |                                  |  |                         |                     |
| 46                          |               |           |             |                         |   |                                  |  |                         |                     |
| 48                          |               |           |             |                         |   |                                  |  |                         |                     |
| 50                          | B44-9         |           |             |                         |   |                                  | 8/12"                                    |                         |                     |
| 52                          |               |           |             |                         | -Dense, damp, light reddish to yellowish brown, very Silty, fine- to medium-grained SANDSTONE with local interbeds of brown, Clayey, hard SILTSTONE                                     |                                  |  |                         |                     |
| 54                          |               |           |             |                         |   |                                  |  |                         |                     |
| 56                          |               |           |             | ML                      | Hard, damp, grayish to olive brown, Sandy, Clayey SILTSTONE   |                                  |  |                         |                     |
| 58                          |               |           |             | SC                      | Very dense, damp, reddish brown, Silty and bentonitic, Clayey SANDSTONE; fine- to coarse-grained with some fine- to coarse gravel sized clasts, overall massive and moderately cemented |                                  |  |                         |                     |

**Figure A-1,  
Log of Boring B 44, Page 2 of 3**

06862-52-03 GI

| SAMPLE SYMBOLS              |                                |
|-----------------------------|--------------------------------|
| ... SAMPLING UNSUCCESSFUL   | ... STANDARD PENETRATION TEST  |
| ... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE               |
|                             | ... DRIVE SAMPLE (UNDISTURBED) |
|                             | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET   | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | BORING B 44                   |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---|---------------|-----------|-------------|-------------------------------|---|--|-------------------------|-------------------------|
|   |               |           |             | ELEV. (MSL.) <u>432</u>       | DATE COMPLETED <u>09-12-2003</u>  |  |                         |                         |
|   |               |           |             | EQUIPMENT                     |   |  |                         |                         |
|   |               |           |             | 30-INCH DIAMETER BUCKET AUGER |   |  |                         |                         |
| MATERIAL DESCRIPTION  |               |           |             |                               |   |  |                         |                         |
| 60  | B44-10        |           |             | SC                            |   | 15/12"                                   |                         |                         |
| 62  |               |           |             |                               |   |  |                         |                         |
| 64  |               |           |             |                               |   |  |                         |                         |
| 66  | B44-11        |           |             | SM                            | Very dense, damp, yellowish brown, Silty, fine- to coarse-grained SANDSTONE with some gravel-to small cobble sized clasts | 15/10"                                   |                         |                         |
| BORING TERMINATED AT 66 FEET<br>No groundwater<br>Backfilled with alternating layers of bentonite and soil cuttings |               |           |             |                               |   |  |                         |                         |

Figure A-1,  
Log of Boring B 44, Page 3 of 3

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|                |  |                             |  |                               |  |                                |
|----------------|--|-----------------------------|--|-------------------------------|--|--------------------------------|
| SAMPLE SYMBOLS |  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|                |  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | BORING B 45  |                               | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>(%) |
|----------------------|---------------|-----------|-------------|-------------------------|--|-------------------------------|--|-------------------------|-----------------|
|                      |               |           |             |                         | ELEV. (MSL.)   | DATE COMPLETED                |  |                         |                 |
|                      |               |           |             |                         | ELEV. (MSL.)   | 504                           | DATE COMPLETED                           | 09-12-2003              |                 |
|                      |               |           |             |                         | EQUIPMENT  | 30-INCH DIAMETER BUCKET AUGER |  |                         |                 |
| MATERIAL DESCRIPTION |               |           |             |                         |  |                               |  |                         |                 |
| 0                    |               |           |             | CI                      | <b>TOPSOIL</b><br>Loose to stiff, damp, dark brown, Sandy CLAY; porous, roots  |                               |  |                         |                 |
| 2                    |               |           |             | SM                      | <b>SAN DIEGO FORMATION</b><br>Dense, damp, light gray, Silty, fine-grained SANDSTONE; micaceous, weathered with carbonate mineralization in upper 3 feet of unit, some tight fractures                             |                               |  |                         |                 |
| 4                    | B45-1         |           |             |                         | 6/10"  |                               |  |                         |                 |
| 6                    |               |           |             | ML                      | 18-inch thick bed of dark grayish brown, hard, Clayey SILTSTONE; some tight carbonate-filled fractures   |                               |  |                         |                 |
| 8                    | B45-2         |           |             |                         | 6/8"   |                               |  |                         |                 |
| 10                   |               |           |             | SM                      | Dense, damp, gray, Silty, fine-grained SANDSTONE; massive and micaceous  |                               |  |                         |                 |
| 12                   |               |           |             |                         |  |                               |  |                         |                 |
| 14                   |               |           |             | ML                      | Bed of Clayey SILTSTONE  |                               |  |                         |                 |
| 16                   | B45-3         |           |             |                         | 6/12"  |                               |  |                         |                 |
| 18                   |               |           |             | SM                      | -Becomes dense, damp, grayish brown, fine-grained, Sandy SILTSTONE   |                               |  |                         |                 |
| 20                   | B45-4         |           |             |                         | 6/12"  |                               |  |                         |                 |
| 22                   |               |           |             | SM                      | -3-inch thick concretionary bed, continuous around hole (N57W/4SW)   |                               |  |                         |                 |
| 24                   | B45-5         |           |             |                         | 5/12"  |                               |  |                         |                 |
| 26                   |               |           |             |                         | Becomes dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; moderately to strongly cemented locally, trace clasts of claystone, overall massive and somewhat graded, little distinguishable bedding |                               |  |                         |                 |
| 28                   |               |           |             |                         | -Claystone clasts along contact  |                               |  |                         |                 |

Figure A-2,  
Log of Boring B 45, Page 1 of 3

06862-52-03.GI

| SAMPLE SYMBOLS  |                                |
|---|--------------------------------|
|    | ... SAMPLING UNSUCCESSFUL      |
|    | ... STANDARD PENETRATION TEST  |
|    | ... DISTURBED OR BAG SAMPLE    |
|    | ... CHUNK SAMPLE               |
|  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | BORING B 45  |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|-----------|-------------|--------------|---|--|-------------------------|-------------------------|
|                     |               |           |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                         |
|                     |               |           |             |              | ELEV. (MSL.) <u>504</u> DATE COMPLETED <u>09-12-2003</u>  |  |                         |                         |
|                     |               |           |             |              | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>  |  |                         |                         |
|                     |               |           |             |              | <b>MATERIAL DESCRIPTION</b>   |  |                         |                         |
| 30                  | B45-6         |           |             | SM           | Very dense, damp, grayish brown, Silty, very fine- grained SANDSTONE; massive and tight, moderately cemented                    | 8/10"                                    |                         |                         |
| 32                  |               |           |             |              |   |  |                         |                         |
| 34                  |               |           |             |              |   |  |                         |                         |
| 36                  | B45-7         |           |             |              |   | 12/12"                                   |                         |                         |
| 38                  |               |           |             |              |   |  |                         |                         |
| 40                  | B45-8         |           |             | SM           | <b>OTAY FORMATION</b><br>Very dense, damp, grayish brown, Silty, fine- to medium-grained SANDSTONE; massive                     | 10/12"                                   |                         |                         |
| 42                  |               |           |             |              |   |  |                         |                         |
| 44                  |               |           |             | ML           | -6-inch thick, strongly cemented concretionary bed<br>Becomes dense, damp, brown, very fine-grained, Sandy and Clayey SILTSTONE |  |                         |                         |
| 46                  | B45-9         |           |             | SM           | Very dense, damp, Silty, fine- to medium-grained SANDSTONE; massive and friable   | 10/12"                                   |                         |                         |
| 48                  |               |           |             |              |   |  |                         |                         |
| 50                  | B45-10        |           |             |              | -Bentonite rip-up clasts  | 10/12"                                   |                         |                         |
| 52                  |               |           |             |              |   |  |                         |                         |
| 54                  |               |           |             |              | -Becomes fine-grained, moderately cemented  |  |                         |                         |
| 56                  | B45-11        |           |             |              |   | 15/12"                                   |                         |                         |
| 58                  |               |           |             |              |   |  |                         |                         |

Figure A-2,  
Log of Boring B 45, Page 2 of 3

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|                |                             |                               |                                |
|----------------|-----------------------------|-------------------------------|--------------------------------|
| SAMPLE SYMBOLS | ... SAMPLING UNSUCCESSFUL   | ... STANDARD PENETRATION TEST | ... DRIVE SAMPLE (UNDISTURBED) |
|                | ... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE              | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.





| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY   | GROUNDWATER | SOIL CLASS (USCS) | <b>BORING B 45</b>  |                                  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE (%) |
|----------------------|------------|---|-------------|-------------------|---|----------------------------------|------------------------------------|----------------------|--------------|
|                      |            |   |             |                   | ELEV. (MSL.) <u>504</u>   | DATE COMPLETED <u>09-12-2003</u> |                                    |                      |              |
|                      |            |   |             |                   | EQUIPMENT   |                                  |                                    |                      |              |
|                      |            |   |             |                   | 30-INCH DIAMETER BUCKET AUGER   |                                  |                                    |                      |              |
| MATERIAL DESCRIPTION |            |   |             |                   |   |                                  |                                    |                      |              |
| 60                   | B45-12     |  |             | CH                | Hard, damp to moist, gray to olive gray and pink to white beds of bentonite CLAYSTONE; overall well-bedded with few fractures, some minor seepage through fractured in bentonite at 63 feet |                                  | 8/12"                              |                      |              |
| 62                   |            |   |             |                   |   |                                  |                                    |                      |              |
| 64                   | B45-13     |  |             | ML-SM             | Very dense, damp, Sandy SILTSTONE to Silty SANDSTONE; massive, becomes strongly cemented, very difficult drilling, ("GRITSTONE"), grayish brown   |                                  | 20/8"                              |                      |              |
|                      |            |   |             |                   | BORING TERMINATED AT 65.7 FEET<br>No groundwater<br>Backfilled with alternating layers of bentonite and soil cuttings   |                                  |                                    |                      |              |

Figure A-2,  
Log of Boring B 45, Page 3 of 3

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| SAMPLE SYMBOLS  |                             |   |                               |   |                                |
|---|-----------------------------|---|-------------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | BORING B 46   |   | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE CONTENT (%) |
|----------------------|------------|-----------|-------------|---|---|------------------------------------|----------------------|----------------------|
|                      |            |           |             | ELEV. (MSL.)  | DATE COMPLETED  |                                    |                      |                      |
|                      |            |           |             | ELEV. (MSL.)  | 453   | DATE COMPLETED                     | 09-16-2003           |                      |
|                      |            |           |             | EQUIPMENT   | 30-INCH DIAMETER BUCKET AUGER   |                                    |                      |                      |
| MATERIAL DESCRIPTION |            |           |             |   |   |                                    |                      |                      |
| 0                    |            |           |             | CL  | TOPSOIL<br>Loose to stiff, damp, grayish brown, fine to medium, Sandy CLAY; porous, thin roots  |                                    |                      |                      |
| 2                    |            |           |             | ML  | OTAY FORMATION<br>Hard, damp, dark brown, Clayey SILTSTONE; fractured and moderately weathered, carbonate mineralization<br><br>-Becomes very fine-grained, Sandy   | 4/12"                              | 120.2                | 10.3                 |
| 4                    | B46-1      |           |             |   |   |                                    |                      |                      |
| 6                    |            |           |             | SM  | Medium dense, moist, light gray, Silty, fine-grained SANDSTONE; massive, some mica flakes<br><br>-Becomes dense   | 4/12"                              |                      |                      |
| 8                    | B46-2      |           |             |   |   |                                    |                      |                      |
| 10                   |            |           |             | CH  | -Contact (N54E/8NW)<br>Hard, damp, gray to olive, white and pink, bentonite CLAYSTONE; locally highly fractured, overall well-bedded, no evidence of offset or displacement, manganese oxide mineralization | 7/12"                              |                      |                      |
| 12                   | B46-3      |           |             |   |   |                                    |                      |                      |
| 14                   |            |           |             | SM  | Very dense, damp, light grayish brown, Silty, fine to medium SANDSTONE; massive and intact<br><br>-Becomes fine- to coarse-grained and gravelly; moderately cemented  | 7/7"                               | 126.4                | 10.4                 |
| 16                   | B46-4      |           |             |   |   |                                    |                      |                      |
| 18                   |            |           |             |   |   |                                    |                      |                      |
| 20                   |            |           |             |   | -Increase in degree of cementation  |                                    |                      |                      |
| 22                   | B46-5      |           |             |   |   |                                    |                      |                      |
| 24                   |            |           |             |   |   |                                    |                      |                      |
| 26                   |            |           |             | BORING TERMINATED AT 30.5 FEET<br>No groundwater<br>Backfilled with alternating layers of bentonite and soil cuttings |   |                                    |                      |                      |
| 28                   |            |           |             |   |   | 10/6"                              |                      |                      |
| 30                   |            |           |             |   |   |                                    |                      |                      |

Figure A-3, Log of Boring B 46, Page 1 of 1

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| SAMPLE SYMBOLS  |                             |   |                               |   |                                |
|---|-----------------------------|---|-------------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 47</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |      |
|-----------------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|---------------------|------|
|                             |               |           |             |                         | ELEV. (MSL.) <u>447</u>  | DATE COMPLETED <u>09-16-2003</u> |  |                         |                     |      |
|                             |               |           |             |                         | EQUIPMENT _____  |                                  |  |                         |                     |      |
| <b>MATERIAL DESCRIPTION</b> |               |           |             |                         |  |                                  |  |                         |                     |      |
| 0                           |               |           |             | SC                      | <b>TOPSOIL</b><br>Loose to stiff, damp, fine to medium, Sandy CLAY; porous, thin roots   |                                  |  |                         |                     |      |
| 2                           |               |           |             | SM                      | <b>OTAY FORMATION</b><br>Medium dense to dense, damp, light grayish brown to gray, Silty, fine - grained SANDSTONE; moderately weathered with some carbonate - filled fractures in upper 4 feet<br><br>- Becomes increasingly dense and less fractured; thin SILTSTONE interbeds                   |                                  |  |                         |                     |      |
| 4                           | B 47-1        |           |             |                         |  |                                  |  |                         |                     |      |
| 6                           |               |           |             |                         |  |                                  |  | 5/12"                   |                     |      |
| 8                           |               |           |             | CH                      | Very stiff to hard, damp, olive gray to pink and white, bentonite CLAYSTONE; generally well - bedded, locally highly fractured to shattered<br>- Approximately 6-inch thick interbed of light gray Clayey SILTSTONE within bentonite beds, some carbonate mineralization<br><br>Contact (N38W/25W) |                                  |  |                         |                     |      |
| 10                          | B 47-2        |           |             |                         |  |                                  |  | 6/12"                   | 120.2               | 11.1 |
| 12                          |               |           |             | SM                      | Becomes very dense, damp, grayish brown, Silty fine to coarse - grained Silty SANDSTONE ("GRITSTONE"); some fine gravel sized clasts, massive and intact   |                                  |  |                         |                     |      |
| 14                          | B 47-3        |           |             |                         |  |                                  |  |                         |                     |      |
| 16                          |               |           |             |                         |  |                                  |  | 9/12"                   |                     |      |
| 18                          |               |           |             |                         |  |                                  |  |                         |                     |      |
| 20                          | B 47-4        |           |             |                         |  |                                  |  |                         |                     |      |
| 22                          |               |           |             |                         |  |                                  |  |                         |                     |      |
| 24                          |               |           |             |                         |  |                                  |  |                         |                     |      |
|                             |               |           |             |                         | BORING TERMINATED AT 25 FEET<br>No groundwater<br>Backfilled with layers of bentonite and cuttings   |                                  |  |                         |                     |      |

**Figure A-4,**  
**Log of Boring B 47, Page 1 of 1**

06862-52-02.GF

| SAMPLE SYMBOLS |                                |
|----------------|--------------------------------|
|                | ... SAMPLING UNSUCCESSFUL      |
|                | ... DISTURBED OR BAG SAMPLE    |
|                | ... STANDARD PENETRATION TEST  |
|                | ... CHUNK SAMPLE               |
|                | ... DRIVE SAMPLE (UNDISTURBED) |
|                | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET               | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | <b>BORING B 48</b>   |                                  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE CONTENT (%) |
|-----------------------------|------------|-----------|-------------|-------------------|--|----------------------------------|------------------------------------|----------------------|----------------------|
|                             |            |           |             |                   | ELEV. (MSL.) <u>478</u>  | DATE COMPLETED <u>09-17-2003</u> |                                    |                      |                      |
|                             |            |           |             |                   | EQUIPMENT _____  |                                  |                                    |                      |                      |
| <b>MATERIAL DESCRIPTION</b> |            |           |             |                   |  |                                  |                                    |                      |                      |
| 0                           |            |           |             | CL                | <b>TOPSOIL</b><br>Loose to medium dense, damp, dark brown, Clayey, fine to medium SAND; porous, thin roots, some carbonate mineralization  |                                  |                                    |                      |                      |
| 2                           |            |           |             |                   |  |                                  |                                    |                      |                      |
| 4                           |            |           |             | SM                | <b>SAN DIEGO FORMATION</b><br>Medium dense to dense, damp, light gray, Silty, fine - grained SANDSTONE; some weathering and carbonate mineralization in upper 2 feet of unit, locally highly micaceous |                                  |                                    |                      |                      |
| 6                           | B 48-1     |           |             |                   | Dense to very stiff, damp, brownish gray to grayish brown, Clayey to very fine - grained Sandy SILTSTONE   | 4/12"                            | 109.2                              | 15.2                 |                      |
| 8                           |            |           |             | ML                | - At 7.5 feet thin interbed of reddish brown CLAYSTONE<br>- Becomes dense Sandy SILTSTONE at 8 feet  |                                  |                                    |                      |                      |
| 10                          | B 48-2     |           |             |                   | - Grades to Silty CLAYSTONE; olive to reddish brown at 11 feet   | 5/12"                            |                                    |                      |                      |
| 12                          |            |           |             |                   |  |                                  |                                    |                      |                      |
| 14                          |            |           |             |                   | <b>OTAY FORMATION</b><br>Dense, damp, grayish brown, Silty, fine - grained SANDSTONE; massive and intact, moderately cemented  |                                  |                                    |                      |                      |
| 16                          | B 48-3     |           |             |                   | - Thin Clayey SILTSTONE interbed<br>- Sandstone becomes very fine - grained and gray in color  | 6/12"                            |                                    |                      |                      |
| 18                          |            |           |             |                   |  |                                  |                                    |                      |                      |
| 20                          | B 48-4     |           |             | SM                | - Interbed of hard, gray brown, Clayey SILTSTONE at 19.5 feet  | 5/12"                            | 113.2                              | 14.9                 |                      |
| 22                          |            |           |             |                   | - Becomes dense, light gray to nearly white, Silty, fine to medium SANDSTONE; massive, some coarse san - sized grains, overall weakly cemented   |                                  |                                    |                      |                      |
| 24                          |            |           |             |                   |  |                                  |                                    |                      |                      |
| 26                          | B 48-5     |           |             |                   |  | 6/12"                            |                                    |                      |                      |
| 28                          |            |           |             |                   | - Tight, high angle, brown clay - filled fracture to 1/8-inch thick at 28 feet   |                                  |                                    |                      |                      |

**Figure A-5,  
Log of Boring B 48, Page 1 of 2**

06862-52-02.GPJ

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             | ... DRIVE SAMPLE (UNDISTURBED)  |
|   |                             | ... CHUNK SAMPLE  |
|   |                             | ... WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 48</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|-------------------------|
|                     |               |           |             |                         | ELEV. (MSL.) <u>478</u>  | DATE COMPLETED <u>09-17-2003</u> |  |                         |                         |
|                     |               |           |             |                         | <b>MATERIAL DESCRIPTION</b>  |                                  |  |                         |                         |
| 30                  | B 48-6        |           |             | SM                      | - 3-inch thick, continuous bed of strongly cemented SANDSTONE at 33.5 feet   |                                  | 8/12"                                    |                         |                         |
| 32                  |               |           |             |                         |  |                                  |  |                         |                         |
| 34                  |               |           |             |                         |  |                                  |  |                         |                         |
| 36                  | B 48-7        |           |             |                         | - Becomes very Silty and grayish brown, some hard claystone pods and thick interbeds   |                                  | 10/12"                                   | 124.0                   | 10                      |
| 38                  |               |           |             |                         | - Contact slightly undulating but nearly horizontal  |                                  |  |                         |                         |
| 40                  | B 48-8        |           |             | CH                      | Hard, damp, olive to brownish gray and white to pink interbeds of bentonite CLAYSTONE; locally highly fractured, overall tight and well - bedded |                                  | 7/12"                                    |                         |                         |
| 42                  |               |           |             |                         | - Distinct and continuous bed of white bentonite   |                                  |  |                         |                         |
| 44                  |               |           |             |                         | Becomes very dense, damp, yellowish to light grayish brown, Silty, fine to medium - grained SANDSTONE ("GRITSTONE"); massive and intact          |                                  |  |                         |                         |
| 46                  | B 48-9        |           |             | SM                      |  |                                  | 12/6"                                    |                         |                         |
| 48                  |               |           |             |                         | - Fine to coarse - grained and gravelly  |                                  |  |                         |                         |
| 50                  | B 48-10       |           |             |                         |  |                                  | 10/6"                                    | 128.3                   | 7.2                     |
|                     |               |           |             |                         | BORING TERMINATED AT 50.5 FEET<br>No groundwater<br>Backfilled with layers of bentonite and cuttings   |                                  |  |                         |                         |

Figure A-5,  
Log of Boring B 48, Page 2 of 2

06862-52-02.C

|                |                             |                               |                                |
|----------------|-----------------------------|-------------------------------|--------------------------------|
| SAMPLE SYMBOLS | ... SAMPLING UNSUCCESSFUL   | ... STANDARD PENETRATION TEST | ... DRIVE SAMPLE (UNDISTURBED) |
|                | ... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE              | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 49</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|-------------------------|
|                      |               |           |             |                         | ELEV. (MSL.) <u>424</u>  | DATE COMPLETED <u>09-17-2003</u> |  |                         |                         |
|                      |               |           |             |                         | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>   |                                  |  |                         |                         |
| MATERIAL DESCRIPTION |               |           |             |                         |  |                                  |  |                         |                         |
| 0                    |               |           |             | SC                      | <b>TOPSOIL</b><br>Loose, damp, dark brown, Clayey, fine to medium SAND; thin roots, porous, some carbonate mineralization  |                                  |  |                         |                         |
| 2                    |               |           |             |                         | <b>OTAY FORMATION</b><br>Dense, damp, light brown, Silty fine to coarse-grained SANDSTONE; some gravel-sized clasts, slightly weathered in upper tow feet of unit with some carbonate mineralization ("GRITSTONE") |                                  |  |                         |                         |
| 4                    |               |           |             |                         |  |                                  |  |                         |                         |
| 6                    | B49-1         |           |             |                         | -Fine to medium-grained  |                                  | 4/12"                                    |                         |                         |
| 8                    |               |           |             |                         |  |                                  |  |                         |                         |
| 10                   | B49-2         |           |             |                         | -Massive and very dense, slightly graded, fine to coarse-grained, moderately to locally strongly cemented  |                                  | 8/12"                                    |                         |                         |
| 12                   |               |           |             |                         |  |                                  |  |                         |                         |
| 14                   |               |           |             | SM                      |  |                                  |  |                         |                         |
| 16                   | B49-3         |           |             |                         |  |                                  | 5/8"                                     | 126.1                   | 7.2                     |
| 18                   |               |           |             |                         |  |                                  |  |                         |                         |
| 20                   |               |           |             |                         |  |                                  |  |                         |                         |
| 22                   |               |           |             |                         |  |                                  |  |                         |                         |
| 24                   |               |           |             |                         | -Bed of strongly cemented sandstone, approx. 12-inches thick   |                                  |  |                         |                         |
| 26                   | B49-4         |           |             |                         | -Dense, fine to coarse-grained and gravelly, slightly clayey   |                                  | 6/12"                                    | 123.1                   | 8.9                     |
| 28                   |               |           |             |                         |  |                                  |  |                         |                         |
| 30                   | B49-5         |           |             |                         |  |                                  | 10/10"                                   |                         |                         |
|                      |               |           |             |                         | BORING TERMINATED AT 31 FEET<br>No groundwater<br>Backfilled with alternating layers of bentonite and soil cuttings  |                                  |  |                         |                         |

Figure A-6,  
Log of Boring B 49, Page 1 of 1

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| SAMPLE SYMBOLS  |                                |   |
|---|--------------------------------|---|
|    | ... SAMPLING UNSUCCESSFUL      |    |
|    | ... DISTURBED OR BAG SAMPLE    |    |
|  | ... DRIVE SAMPLE (UNDISTURBED) |  |
|    | ... CHUNK SAMPLE               |   |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | BORING B 50  |                | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE (%) |
|----------------------|------------|-----------|-------------|-------------------|--|----------------|------------------------------------|----------------------|--------------|
|                      |            |           |             |                   | ELEV. (MSL.)   | DATE COMPLETED |                                    |                      |              |
|                      |            |           |             |                   | ELEV. (MSL.)   | 488            | DATE COMPLETED                     | 09-18-2003           |              |
|                      |            |           |             |                   | EQUIPMENT  |                |                                    |                      |              |
| MATERIAL DESCRIPTION |            |           |             |                   |  |                |                                    |                      |              |
| 0                    |            |           |             |                   | <b>COLLUVIUM</b>   |                |                                    |                      |              |
| 2                    |            |           |             | CL                | Loose to very stiff, damp to moist, dark brown to grayish brown, fine to medium - grained, Sandy CLAY; some pieces of wood, crude layering |                |                                    |                      |              |
| 4                    |            |           |             |                   |  |                |                                    |                      |              |
| 6                    | B 50-1     |           |             | SM                | <b>SAN DIEGO FORMATION</b><br>Medium dense to dense, damp, gray, Silty fine - grained SANDSTONE; highly micaceous                          |                | 3/12"                              |                      |              |
| 8                    |            |           |             | ML                | Grades to dense, damp, brownish gray, Clayey, fine - grained Sandy SILTSTONE; some tight carbonate filled fractures                        |                |                                    |                      |              |
| 10                   |            |           |             |                   | Becomes dense, very fine - grained SANDSTONE; massive, micaceous, some local reddish brown banding   |                |                                    |                      |              |
| 12                   |            |           |             |                   |  |                |                                    |                      |              |
| 14                   |            |           |             | SP                |  |                |                                    |                      |              |
| 16                   | B 50-2     |           |             |                   |  |                | 7/10"                              | 117.4                | 12.2         |
| 18                   |            |           |             |                   |  |                |                                    |                      |              |
| 20                   |            |           |             |                   |  |                |                                    |                      |              |
| 22                   |            |           |             |                   | <b>OTAY FORMATION</b>  |                |                                    |                      |              |
| 24                   |            |           |             |                   | Dense, damp, fine to medium grained SANDSTONE; light gray, weakly cemented, massive, some coarse - grained clasts                          |                |                                    |                      |              |
| 26                   | B 50-3     |           |             | SP                |  |                | 6/12"                              |                      |              |
| 28                   |            |           |             |                   |  |                |                                    |                      |              |
|                      |            |           |             |                   | - 4-inch thick, continuous, grayish brown, bed of fine to coarse - grained   |                |                                    |                      |              |

Figure A-7,  
Log of Boring B 50, Page 1 of 2

06862-52-02.G

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             | ... STANDARD PENETRATION TEST   |
|   |                             | ... DRIVE SAMPLE (UNDISTURBED)  |
|   |                             | ... CHUNK SAMPLE  |
|   |                             | ... WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | BORING B 50  |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|-----------|-------------|--|--|--|-------------------------|-------------------------|
|                     |               |           |             | ELEV. (MSL.) <u>488</u>  | DATE COMPLETED <u>09-18-2003</u>   |  |                         |                         |
|                     |               |           |             | EQUIPMENT  |  |  |                         |                         |
|                     |               |           |             | MATERIAL DESCRIPTION   |  |  |                         |                         |
| 30                  |               |           |             |  | sandstone at 29 feet   |  |                         |                         |
| 32                  |               |           |             |  |  |  |                         |                         |
| 34                  |               |           |             |  |  |  |                         |                         |
| 36                  |               |           |             | SP   | - Some fragments of brown CLAYSTONE<br>- 9-inch thick bed of strongly cemented SANDSTONE; light gray to nearly white in color, continuous around hole at 35 feet   |  |                         |                         |
| 38                  |               |           |             |  | - Becomes very dense, olive brown to brownish gray, Silty, very fine - grained SANDSTONE; massive, moderately cemented at 37.5 feet  |  |                         |                         |
| 40                  | B 50-4        |           |             |  |  | 15/12"                                   |                         |                         |
| 42                  |               |           |             |  |  |  |                         |                         |
| 44                  |               |           |             | CH   | Becomes hard, damp, light gray to pink to white, bentonite CLAYSTONE; well bedded and slightly fractured to crushed and sheared upper 3-inches, <u>roughly horizontal bedding dipping gently toward west</u> | 15/12"                                   | 121.1                   | 11.4                    |
| 46                  | B 50-5        |           |             |  | Very dense, damp, grayish to yellowish brown, Silty fine to medium - grained SANDSTONE ("GRITSTONE"); moderately cemented, massive   |  |                         |                         |
| 48                  |               |           |             | SM   |  |  |                         |                         |
| 50                  |               |           |             |  |  |  |                         |                         |
| 52                  |               |           |             |  | - Grades fine to coarse - grained and gravelly   |  |                         |                         |
| 54                  |               |           |             |  |  |  |                         |                         |
|                     |               |           |             | BORING TERMINATED AT 55 FEET<br>No groundwater<br>Backfilled with layers of bentonite and cuttings |  |  |                         |                         |

Figure A-7,  
Log of Boring B 50, Page 2 of 2

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|                |                                     |                             |                          |                               |                          |                                |
|----------------|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| SAMPLE SYMBOLS | <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
|                | <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |








NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 51</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>NTEN |
|-----------------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|------------------|
|                             |               |           |             |                         | ELEV. (MSL.) <u>488</u>  | DATE COMPLETED <u>09-18-2003</u> |  |                         |                  |
|                             |               |           |             |                         | EQUIPMENT _____  |                                  |  |                         |                  |
| <b>MATERIAL DESCRIPTION</b> |               |           |             |                         |  |                                  |  |                         |                  |
| 0                           |               |           |             |                         | <b>TOPSOIL</b><br>Loose, damp, dark brown, Clayey, fine to medium SAND   |                                  |  |                         |                  |
| 2                           |               |           |             | SM                      | <b>SAN DIEGO FORMATION</b><br>Dense, damp, gray to brownish gray, Silty, fine grained SANDSTONE;<br>fractured and weathered with carbonate mineralization in upper 3 feet of unit        |                                  |  |                         |                  |
| 4                           |               |           |             |                         | - Decrease in weathering, highly micaceous   |                                  |  |                         |                  |
| 6                           | B 51-1        |           |             | ML                      | Dense, damp, grayish brown, Clayey, fine - grained Sandy SILTSTONE   |                                  | 4/12"                                    |                         |                  |
| 8                           |               |           |             |                         | Grades to dense, damp, light gray, Silty, fine to medium - grained SANDSTONE; micaceous, local reddish brown to dark gray banding discontinuous around hole, massive and weakly cemented |                                  |  |                         |                  |
| 10                          | B 51-2        |           |             | SM                      | - Tight clay - filled, subvertical fracture showing no evidence of offset  |                                  | 6/12"                                    | 115.2                   | 12               |
| 12                          |               |           |             |                         | Bed of hard, damp, brown, Clayey, fine 0 grained Sandy SILTSTONE; approximately 18-inches thick (N79E/6NW)   |                                  | 7/12"                                    | 112.7                   | 13.5             |
| 14                          | B 51-3        |           |             | ML                      | Becomes dense, damp, light gray, Silty, fine to medium - grained SANDSTONE; massive and moderately cemented, some fragments of claystone and mica flakes                                 |                                  |  |                         |                  |
| 16                          |               |           |             |                         | - Thin interbeds of reddish to olive brown, somewhat bentonitic CLAYSTONE; with gray fine to medium - grained SANDSTONE at 22 feet   |                                  |  |                         |                  |
| 18                          |               |           |             |                         | <b>OTAY FORMATION</b><br>Very dense, damp, gray brown, Silty, fine - grained SANDSTONE;<br>moderately cemented, massive at 4 feet  |                                  | 8/10"                                    |                         |                  |
| 20                          | B 51-4        |           |             | SM                      | - Becomes light gray to nearly white and fine to medium grained, weakly to moderately cemented at 28 feet  |                                  |  |                         |                  |
| 22                          |               |           |             |                         |  |                                  |  |                         |                  |
| 24                          |               |           |             |                         |  |                                  |  |                         |                  |
| 26                          | B 51-5        |           |             |                         |  |                                  | 8/12"                                    | 124.5                   | 10.1             |
| 28                          |               |           |             |                         |  |                                  |  |                         |                  |

**Figure A-8,  
Log of Boring B 51, Page 1 of 2**

06862-52-02.GF

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             |  |
|   |                             |  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET   | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | BORING B 51                                    |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---|---------------|-----------|-------------|--|---|--|-------------------------|-------------------------|
|   |               |           |             | ELEV. (MSL.) <u>488</u>                        | DATE COMPLETED <u>09-18-2003</u>  |  |                         |                         |
|   |               |           |             | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u> |   |  |                         |                         |
| MATERIAL DESCRIPTION  |               |           |             |  |   |  |                         |                         |
| 30  | B51-6         |           |             | SM   |   | 10/8"                                    |                         |                         |
| 32  |               |           |             |  |   |  |                         |                         |
| 34  |               |           |             |  |   |  |                         |                         |
| 36  | B51-7         |           |             | ML   | <i>-Becomes fine to coarse - grained and graded at 34.5 feet</i><br>18-inch thick bed of hard, reddish brown, Clayey SILTSTONE  | 8/12"                                    |                         |                         |
| 38  |               |           |             |  | Very dense, damp, light brown, Silty, fine - grained SANDSTONE; massive and moderately to strongly cemented   |  |                         |                         |
| 40  | B51-8         |           |             | SM   |   | 10/8"                                    | 120.9                   | 12.5                    |
| 42  |               |           |             |  |   |  |                         |                         |
| 44  |               |           |             |  |   |  |                         |                         |
| 46  |               |           |             | CH   | Hard, damp, olive to grayish brown and pink to white, bentonite CLAYSTONE; overall well - bedded and moderately to locally highly fractured, beds nearly horizontal orientation, dip slightly to the west |  |                         |                         |
| 48  |               |           |             |  |   |  |                         |                         |
| 50  | B51-9         |           |             | SM   | Very dense, damp, light brown to grayish brown, Silty, fine to coarse - grained SANDSTONE ("GRITSTONE"); massive and moderately to strongly cemented, trace gravel - sized clasts                         | 15/8"                                    |                         |                         |
| 52  |               |           |             |  |   |  |                         |                         |
| 54  |               |           |             |  |   |  |                         |                         |
| BORING TERMINATED AT 55 FEET<br>No groundwater<br>Backfilled with alternating layers of soil cuttings and bentonite |               |           |             |  |   |  |                         |                         |

Figure A-8,  
Log of Boring B 51, Page 2 of 2

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| SAMPLE SYMBOLS |                             |  |                               |
|----------------|-----------------------------|--|-------------------------------|
|                | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |
|                | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |
|                |                             |  | ... WATER TABLE OR SEEPAGE    |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | <b>BORING B 52</b>  |                                  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE (WTE) |
|----------------------|------------|-----------|-------------|-------------------|---|----------------------------------|------------------------------------|----------------------|----------------|
|                      |            |           |             |                   | ELEV. (MSL.) <u>524</u>   | DATE COMPLETED <u>09-19-2003</u> |                                    |                      |                |
|                      |            |           |             |                   | EQUIPMENT   |                                  |                                    |                      |                |
|                      |            |           |             |                   | 30-INCH DIAMETER BUCKET AUGER   |                                  |                                    |                      |                |
| MATERIAL DESCRIPTION |            |           |             |                   |   |                                  |                                    |                      |                |
| 0                    |            |           |             |                   |   |                                  |                                    |                      |                |
| 2                    |            |           |             | CL                | <b>TOPSOIL</b><br>Very stiff, damp, dark brown, fine to medium - grained, Sandy CLAY; porous, thin roots, some carbonate mineralization and krotovina   |                                  |                                    |                      |                |
| 4                    |            |           |             |                   |   |                                  |                                    |                      |                |
| 6                    | B52-1      |           |             | ML-SM             | <b>TERRACE DEPOSITS</b><br>Medium dense, damp, reddish to grayish brown, Silty, fine - grained SANDSTONE; interbedded with very light brown to nearly white, damp, loose to medium dense, highly carbonaceous SILTSTONE; locally powdery with trace concretions | 3/12"                            | 68.4                               | 20                   |                |
| 8                    | B52-2      |           |             |                   |   |                                  |                                    |                      |                |
| 10                   | B52-3      |           |             | ML                | <b>SAN DIEGO FORMATION</b><br>Dense, damp, light grayish brown, fine - grained, Sandy SILTSTONE; massive  | 6/10"                            |                                    |                      |                |
| 12                   |            |           |             |                   |   |                                  |                                    |                      |                |
| 14                   |            |           |             |                   |   |                                  |                                    |                      |                |
| 16                   | B52-4      |           |             | SM                | Grades to light brown, Silty, fine - grained SANDSTONE; micaceous, moderately cemented at 14 feet   | 7/10"                            | 113.0                              | 13.0                 |                |
| 18                   |            |           |             |                   |   |                                  |                                    |                      |                |
| 20                   | B52-5      |           |             |                   | -Interbed of dark brown, Sandy SILTSTONE at 20 feet<br>-Very dense, damp, light gray, Silty, fine - grained SANDSTONE; massive and micaceous, moderately cemented, some clasts of dark brown claystone  | 8/8"                             |                                    |                      |                |
| 22                   |            |           |             |                   |   |                                  |                                    |                      |                |
| 24                   | B52-6      |           |             | ML                | Very stiff to hard, damp, dark brown, fine - grained, Sandy, Clayey SILTSTONE; some carbonate concretions   | 8/12"                            |                                    |                      |                |
| 26                   | B52-7      |           |             |                   |   |                                  |                                    |                      |                |
| 28                   |            |           |             | SM                | Grades to very dense, damp, brownish gray, Silty, very fine - grained SANDSTONE; massive and micaceous  |                                  |                                    |                      |                |

Figure A-9,  
Log of Boring B 52, Page 1 of 2

06862-52-03.G

| SAMPLE SYMBOLS  |                             |   |                                |
|---|-----------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |    | ... STANDARD PENETRATION TEST  |
|  | ... DISTURBED OR BAG SAMPLE |    | ... CHUNK SAMPLE               |
|   |                             |  | ... DRIVE SAMPLE (UNDISTURBED) |
|   |                             |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 52</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |  |  |
|----------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|-------------------------|--|--|
|                      |               |           |             |                         | ELEV. (MSL.) <u>524</u>  | DATE COMPLETED <u>09-19-2003</u> |  |                         |                         |  |  |
|                      |               |           |             |                         | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>   |                                  |  |                         |                         |  |  |
| MATERIAL DESCRIPTION |               |           |             |                         |  |                                  |  |                         |                         |  |  |
| 30                   | B52-8         |           |             | SM                      | -Interbed of dark brown, Clayey SILTSTONE; approx. 2.5 feet thick<br>-12-inch thick, interbed of Clayey, fine, Sandy SILTSTONE |                                  | 10/10"                                   | 123.8                   | 10.7                    |  |  |
| 32                   |               |           |             |                         |  |                                  |  |                         |                         |  |  |
| 34                   |               |           |             |                         |  |                                  |  |                         |                         |  |  |
| 36                   | B52-9         |           |             |                         |  |                                  | 10/10"                                   |                         |                         |  |  |
| 38                   |               |           |             |                         |  |                                  |  |                         |                         |  |  |
| 40                   | B52-10        |           |             |                         |  |                                  | 10/10"                                   |                         |                         |  |  |
|                      |               |           |             |                         | BORING TERMINATED AT 41 FEET<br>No groundwater<br>Backfilled with alternating layers of soil cuttings and bentonite            |                                  |  |                         |                         |  |  |

**Figure A-9,  
Log of Boring B 52, Page 2 of 2**

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|                       |                             |                               |                                |
|-----------------------|-----------------------------|-------------------------------|--------------------------------|
| <b>SAMPLE SYMBOLS</b> | ... SAMPLING UNSUCCESSFUL   | ... STANDARD PENETRATION TEST | ... DRIVE SAMPLE (UNDISTURBED) |
|                       | ... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE              | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>BORING B 53</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>(%) |
|-----------------------------|---------------|-----------|-------------|-------------------------|--|----------------------------------|--|-------------------------|-----------------|
|                             |               |           |             |                         | ELEV. (MSL.) <u>547</u>  | DATE COMPLETED <u>09-19-2003</u> |  |                         |                 |
|                             |               |           |             |                         | EQUIPMENT <u>30-INCH DIAMETER BUCKET AUGER</u>   |                                  |  |                         |                 |
| <b>MATERIAL DESCRIPTION</b> |               |           |             |                         |  |                                  |  |                         |                 |
| 0                           |               |           |             |                         | <b>TOPSOIL</b>   |                                  |  |                         |                 |
| 2                           |               |           |             | CL                      | Loose to stiff, damp, dark brown, fine to medium, Sandy CLAY; porous, thin roots, some carbonate mineralization  |                                  |  |                         |                 |
| 4                           |               |           |             | ML                      | <b>TERRACE DEPOSITS</b><br>Medium dense, damp, light brown, fine - grained, Sandy SILTSTONE; highly weathered and fractured in upper 2 feet of unit, abundant carbonate mineralization |                                  |  |                         |                 |
| 6                           | B53-1         |           |             |                         | Dense, decrease in weathering, grades to very fine - grained, Silty SANDSTONE; locally interbedded with Clayey SILTSTONE; some siliceous concretions, local carbonate stringers        |                                  | 6/12"                                    |                         |                 |
| 10                          | B53-2         |           |             | SM                      | -Discontinuous well cemented concretionary zones 2 to 3-inch thick, light gray to nearly white at 11 feet  |                                  | 6/12"                                    | 113.4                   | 14.6            |
| 16                          | B53-3         |           |             |                         | -Beds of dark grayish to reddish brown, fine, Sandy and Clayey SILTSTONE at 14 feet  |                                  | 5/12"                                    |                         |                 |
| 16                          |               |           |             |                         | -Grades to moderately cemented, light brown, fine - grained SANDSTONE at 16 feet   |                                  |  |                         |                 |
| 20                          | B53-4         |           |             |                         | -Continuous, 4-inch thick, strongly cemented bed at 19 feet  |                                  |  |                         |                 |
| 20                          |               |           |             |                         | -Becomes reddish to brownish gray, fine to medium - grained SANDSTONE; weakly cemented at 19.5 feet  |                                  | 7/12"                                    |                         |                 |
| 22                          |               |           |             |                         | Grades to very stiff to hard, damp, dark olive gray, Clayey to fine Sandy SILTSTONE  |                                  |  |                         |                 |
| 26                          | B53-5         |           |             | ML                      | -Approx. 6-inch thick bed of very stiff, reddish to olive brown, CLAYSTONE; interbedded with Sandy SILTSTONE   |                                  | 2/12"                                    | 85.8                    | 31.8            |

**Figure A-10,  
Log of Boring B 53, Page 1 of 2**

06862-52-03.GP

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             | ... STANDARD PENETRATION TEST   |
|   |                             | ... DRIVE SAMPLE (UNDISTURBED)  |
|   |                             |    |
|   |                             | ... CHUNK SAMPLE  |
|   |                             |  |
|   |                             | ... WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | BORING B 53  |  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE CONTENT (%) |
|----------------------|------------|-----------|-------------|-------------------|--|--|------------------------------------|----------------------|----------------------|
|                      |            |           |             |                   | ELEV. (MSL.)   | DATE COMPLETED   |                                    |                      |                      |
|                      |            |           |             |                   | ELEV. (MSL.)   | 547  | DATE COMPLETED                     | 09-19-2003           |                      |
|                      |            |           |             |                   | EQUIPMENT  | 30-INCH DIAMETER BUCKET AUGER  |                                    |                      |                      |
| MATERIAL DESCRIPTION |            |           |             |                   |  |  |                                    |                      |                      |
| 30                   | B53-6      |           |             |                   | SAN DIEGO FORMATION<br>Medium dense, damp, light brown, fine - grained, Sandy SILTSTONE; highly weathered and fractured in upper 2 feet of unit, abundant carbonate mineralization |  | 10/10"                             |                      |                      |
| 32                   |            |           |             |                   |  |  |                                    |                      |                      |
| 34                   |            |           |             |                   |  |  |                                    |                      |                      |
| 36                   | B53-7      |           |             | SM                |  | -Becomes light brown and locally light reddish brown in color, very tight  | 10/8"                              |                      |                      |
| 38                   |            |           |             |                   |  |  |                                    |                      |                      |
| 40                   | B53-8      |           |             |                   |  |  |                                    |                      |                      |
| 42                   |            |           |             |                   |  | -6-inch thick bed of strongly cemented SANDSTONE at 41 feet<br>Very hard, damp, grayish brown, fine - grained, Sandy SILTSTONE to fine - grained SANDSTONE; highly micaceous | 10/10"                             | 111.1                | 16.5                 |
| 44                   |            |           |             | ML-SM             |  |  |                                    |                      |                      |
| 46                   | B53-9      |           |             |                   |  | -Becomes strongly cemented, very fine - grained SANDSTONE at 46 feet   | 10/10"                             |                      |                      |
| 48                   |            |           |             |                   |  | -Thin, continuous, reddish brown banding   |                                    |                      |                      |
| 50                   | B53-10     |           |             | ML                |  | Grades to very dense, very fine -grained, Sandy SILTSTONE  | 10/10"                             |                      |                      |
| 52                   |            |           |             |                   |  |  |                                    |                      |                      |
| 54                   | B53-11     |           | SM          |                   | Very dense, damp, yellowish to grayish brown, Silty, fine - grained SANDSTONE; moderately cemented, massive  | 15/8"  |                                    |                      |                      |
| 56                   |            |           |             |                   | BORING TERMINATED AT 56 FEET<br>No groundwater<br>Backfilled with alternating layers of soil cuttings and bentonite  |  |                                    |                      |                      |

Figure A-10,  
Log of Boring B 53, Page 2 of 2

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| SAMPLE SYMBOLS |                             |  |
|----------------|-----------------------------|--|
|                | ... SAMPLING UNSUCCESSFUL   |  |
|                | ... DISTURBED OR BAG SAMPLE |  |
|                |                             |  |
|                |                             |  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



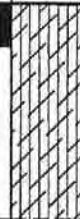
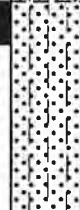
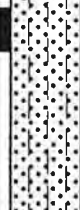
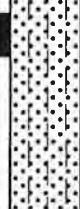

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | <b>BORING B 60</b>   |  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE (%) |  |
|----------------------|------------|-----------|-------------|-------------------|--|--|------------------------------------|----------------------|--------------|--|
|                      |            |           |             |                   | ELEV. (MSL.)   | DATE COMPLETED   |                                    |                      |              |  |
|                      |            |           |             |                   | ELEV. (MSL.)   | 538  | DATE COMPLETED                     | 09-24-2003           |              |  |
|                      |            |           |             |                   | EQUIPMENT  | 30-INCH DIAMETER BUCKET AUGER  |                                    |                      |              |  |
| MATERIAL DESCRIPTION |            |           |             |                   |  |  |                                    |                      |              |  |
| 0                    |            |           |             | SC                | <b>TOPSOIL</b><br>Loose, damp, dark brown, Clayey, fine to medium SAND; porous, roots  |  |                                    |                      |              |  |
| 2                    |            |           |             | SM                | <b>TERRACE DEPOSITS</b><br>Medium dense, damp, grayish to light reddish brown, Silty, fine - grained SANDSTONE; highly fractured and weathered, carbonate mineralization, some krotovina, locally loose in upper 3 feet  |  |                                    |                      |              |  |
| 4                    |            |           |             |                   |  |  |                                    |                      |              |  |
| 6                    | B60-1      |           |             |                   | -Becomes interbedded with thin beds of Clayey to Sandy SILTSTONE, isolated, thin concretionary beds at 5.5 feet  | 4/12"  | 104.6                              | 19.                  |              |  |
| 8                    |            |           |             | ML                | Grades to dense, damp, grayish brown, fine - grained, Sandy SILTSTONE; some interbeds of olive to reddish brown, Silty CLAYSTONE, some fracturing, overall moderately indurated and tight  |  |                                    |                      |              |  |
| 10                   | B60-2      |           |             |                   |  |  | 3/12"                              |                      |              |  |
| 12                   |            |           |             |                   |  |  |                                    |                      |              |  |
| 14                   |            |           |             | ML                | -Discontinuous 3 to 6-inch thick, very hard, concretionary bed at 14.5 feet  |  |                                    |                      |              |  |
| 16                   | B60-3      |           |             |                   |  |  | 3/12"                              |                      |              |  |
| 18                   |            |           |             | ML                | -Distinct jointing (N10E/81E) (N80W/80S), perpendicular sets   |  |                                    |                      |              |  |
| 20                   | B60-4      |           |             |                   |  | -Interbed of reddish to olive brown claystone                              |                                    |                      |              |  |
| 22                   |            |           |             |                   |  |  | 2/12"                              | 87.1                 | 32.0         |  |
| 24                   |            |           |             | ML                | 2-inch thick (N15E/6NW) claystone bed  |  |                                    |                      |              |  |
| 26                   | B60-5      |           |             |                   |  | -Distinct, continuous bed of light reddish brown to peach, Silty SANDSTONE |                                    |                      |              |  |
| 28                   |            |           |             |                   | <b>SAN DIEGO FORMATION</b><br>Very dense, damp, gray brown, Clayey, very fine - grained Sandy SILTSTONE<br>-Grades to very dense, damp, gray to light reddish brown, very fine - grained, Silty SANDSTONE; massive and friable, micaceous, moderately cemented | 8/12"  |                                    |                      |              |  |

Figure A-11,  
Log of Boring B 60, Page 1 of 2

06862-52-03.GF

| SAMPLE SYMBOLS                      |                             |                          |                               |                          |                                |
|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
| <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET   | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | BORING B 60  |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---|---------------|---|-------------|--------------|---|--|-------------------------|-------------------------|
|   |               |   |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                         |
|   |               |   |             |              | <b>538</b>  | <b>09-24-2003</b>                        |                         |                         |
|   |               |   |             |              | <b>EQUIPMENT 30-INCH DIAMETER BUCKET AUGER</b>  |  |                         |                         |
| <b>MATERIAL DESCRIPTION</b>   |               |   |             |              |   |  |                         |                         |
| 30  | B60-6         |    |             | ML           | Hard, damp, olive gray to reddish brown, Clayey SILTSTONE; thin interbeds of Silty CLAYSTONE, moderately indurated  | 7/12"                                    |                         |                         |
| 32  |               |   |             |              |   |  |                         |                         |
| 34  |               |   |             |              |   |  |                         |                         |
| 36  | B60-7         |    |             | SM           | Grades to very dense, damp, light gray, Silty, very fine - grained SANDSTONE; massive, micaceous, moderately cemented<br><br>-Becomes yellowish brown with reddish brown banding, locally strongly cemented | 12/10"                                   | 117.4                   | 12.3                    |
| 38  |               |   |             |              |   |  |                         |                         |
| 40  | B60-8         |   |             |              |   |  |                         |                         |
| 42  |               |   |             |              |   |  |                         |                         |
| 44  |               |   |             |              | -Approx. 8-inch thick bed of olive gray, Clayey SILTSTONE at 43.5 feet  |  |                         |                         |
| 46  | B60-9         |  |             |              | -Very dense, light brown, Silty, fine - grained SANDSTONE; poorly developed, light reddish brown banding  | 15/10"                                   |                         |                         |
| 48  |               |   |             |              |   |  |                         |                         |
| 50  | B60-10        |  |             |              |   | 12/10"                                   | 121.4                   | 11.2                    |
| BORING TERMINATED AT 51 FEET<br>No groundwater<br>Backfilled with alternating layers of soil cuttings and bentonite |               |   |             |              |   |  |                         |                         |

**Figure A-11,  
Log of Boring B 60, Page 2 of 2**

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| SAMPLE SYMBOLS  |  |
|---|--|
|  ... SAMPLING UNSUCCESSFUL   |  ... STANDARD PENETRATION TEST    |
|  ... DISTURBED OR BAG SAMPLE |  ... DRIVE SAMPLE (UNDISTURBED) |
|  ... CHUNK SAMPLE            |  ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.





| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | TRENCH T 133            |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|-----------------------------|---------------|---|-------------|-------------------------|--|--|-------------------------|---------------------|
|                             |               |   |             | SOIL<br>CLASS<br>(USCS) | ELEV. (MSL.) <u>460</u> DATE COMPLETED <u>09-12-2003</u>   |  |                         |                     |
|                             |               |   |             |                         | EQUIPMENT <u>JD 450 C TRACKHOE</u>   |  |                         |                     |
|                             |               |   |             |                         | MATERIAL DESCRIPTION   |  |                         |                     |
| 0                           | T133-1        |  |             | CL                      | <b>COLLUVIUM</b><br>Stiff to hard, dry, dark yellowish-brown, CLAY; roots, cracking  |  |                         |                     |
| 2                           |               |   |             |                         |  |  |                         |                     |
| 4                           |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Medium dense, dry, yellowish-gray, Silty SAND; soil carbonate pockets up to 4-inch diameter in upper 1 foot |  |                         |                     |
| 6                           |               |   |             |                         |  |  |                         |                     |
| TRENCH TERMINATED AT 7 FEET |               |   |             |                         |  |  |                         |                     |

Figure A-12,  
Log of Trench T 133, Page 1 of 1

06862-52-03.G

|                |   |   |  |
|----------------|---|---|--|
| SAMPLE SYMBOLS |  ... SAMPLING UNSUCCESSFUL   |  ... STANDARD PENETRATION TEST |  ... DRIVE SAMPLE (UNDISTURBED) |
|                |  ... DISTURBED OR BAG SAMPLE |  ... CHUNK SAMPLE              |  ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY         | GROUNDWATER | TRENCH T 134 |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|-------------------|-------------|--------------|---|--|-------------------------|-------------------------|
|                     |               |                   |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                         |
|                     |               |                   |             |              | 414   | 09-12-2003                               |                         |                         |
|                     |               |                   |             |              | EQUIPMENT JD 450 C TRACKHOE   |  |                         |                         |
| 0                   |               |                   |             |              | MATERIAL DESCRIPTION  |  |                         |                         |
| 2                   |               | [Hatched pattern] |             | CL           | <b>COLLUVIUM</b><br>Stiff, damp, dusky yellowish-brown, CLAY; roots, cracking                       |  |                         |                         |
| 6                   |               |                   |             | CL           | <b>ALLUVIUM</b><br>Stiff, damp, very pale orange to grayish-orange, CLAY with Sand; highly porous   |  |                         |                         |
| 8                   |               | [Hatched pattern] |             | SC           | <b>OTAY FORMATION</b><br>Dense, moist, mottled Clayey SAND; upper 1 foot weathered and mainly white |  |                         |                         |
|                     |               |                   |             |              | TRENCH TERMINATED AT 9 FEET   |  |                         |                         |

Figure A-13,  
Log of Trench T 134, Page 1 of 1

06862-52-03 GPJ

| SAMPLE SYMBOLS                      |                                |                          |
|-------------------------------------|--------------------------------|--------------------------|
| <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL      | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE    | <input type="checkbox"/> |
| <input type="checkbox"/>            | ... STANDARD PENETRATION TEST  | <input type="checkbox"/> |
| <input type="checkbox"/>            | ... CHUNK SAMPLE               | <input type="checkbox"/> |
| <input type="checkbox"/>            | ... DRIVE SAMPLE (UNDISTURBED) | <input type="checkbox"/> |
| <input type="checkbox"/>            | ... WATER TABLE OR SEEPAGE     |                          |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH IN FEET        | SAMPLE NO. | LITHOLOGY | GROUNDWATER | SOIL CLASS (USCS) | TRENCH T 135   |                  | PENETRATION RESISTANCE (BLOWS/FT.) | DRY DENSITY (P.C.F.) | MOISTURE (%) |
|----------------------|------------|-----------|-------------|-------------------|--|------------------|------------------------------------|----------------------|--------------|
|                      |            |           |             |                   | ELEV. (MSL.)   | DATE COMPLETED   |                                    |                      |              |
|                      |            |           |             |                   | ELEV. (MSL.)   | 518              | DATE COMPLETED                     | 01-15-2004           |              |
|                      |            |           |             |                   | EQUIPMENT  | JD - 310 BACKHOE |                                    |                      |              |
| MATERIAL DESCRIPTION |            |           |             |                   |  |                  |                                    |                      |              |
| 0                    | T135-1     |           |             | CL                | <b>TOPSOIL</b><br>Stiff, damp, dark brown, very fine, Sandy CLAY   |                  |                                    |                      |              |
| 2                    |            |           |             | ML                | <b>TERRACE DEPOSITS</b><br>Stiff, humid, light tan, very fine, Sandy SILT; with claystone clasts, krotovina    |                  |                                    |                      |              |
| 4                    |            |           |             | SM                | Stiff, humid, buff, Silty, very fine, SAND   |                  |                                    |                      |              |
| 6                    |            |           |             | SC                | <b>SAN DIEGO FORMATION</b><br>Very dense, damp, gray, Clayey, very fine SANDSTONE; some concretions, some mica |                  |                                    |                      |              |
| 8                    |            |           |             |                   | TRENCH TERMINATED AT 8 FEET<br>Backfilled on 01-15-2004  |                  |                                    |                      |              |

Figure A-14,  
Log of Trench T 135, Page 1 of 1

06862-52-03.G

|                |                             |                               |                                |
|----------------|-----------------------------|-------------------------------|--------------------------------|
| SAMPLE SYMBOLS | ... SAMPLING UNSUCCESSFUL   | ... STANDARD PENETRATION TEST | ... DRIVE SAMPLE (UNDISTURBED) |
|                | ... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE              | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 136  |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|-----------|-------------|-------------------------|---|------------------|--|-------------------------|-------------------------|
|                     |               |           |             |                         | ELEV. (MSL.)  | DATE COMPLETED   |  |                         |                         |
|                     |               |           |             |                         | ELEV. (MSL.)  | 500              | DATE COMPLETED                           | 01-14-2004              |                         |
|                     |               |           |             |                         | EQUIPMENT   | JD - 310 BACKHOE |  |                         |                         |
| 0                   |               |           |             |                         | MATERIAL DESCRIPTION  |                  |  |                         |                         |
|                     |               |           |             | SM                      | <b>TOPSOIL</b><br>Loose, dry to humid, brown, Silty, very fine SAND; some clay, burrows   |                  |  |                         |                         |
| 2                   |               |           |             | SM                      | <b>SAN DIEGO FORMATION</b><br>Medium dense to dense, humid, light gray, Silty, very fine SAND; abundant rip - up clasts of more indurated material, burrows |                  |  |                         |                         |
| 4                   |               |           |             | SM                      | Dense to very dense, humid to moist, gray, Silty, very fine SANDSTONE;<br>slightly indurated, abundant mica   |                  |  |                         |                         |
| 6                   |               |           |             |                         | TRENCH TERMINATED AT 6 FEET<br>Backfilled on 01-14-2004   |                  |  |                         |                         |

Figure A-15,  
Log of Trench T 136, Page 1 of 1

06862-52-03.GPJ

|                |                                     |                             |                          |                               |                          |                                |
|----------------|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| SAMPLE SYMBOLS | <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
|                | <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

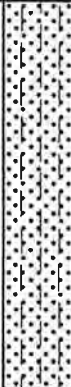







| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 137  |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>% (WET) |
|----------------------|---------------|---|-------------|-------------------------|---|------------------|--|-------------------------|---------------------|
|                      |               |   |             |                         | ELEV. (MSL.)  | DATE COMPLETED   |  |                         |                     |
|                      |               |   |             |                         | ELEV. (MSL.)  | 450              | DATE COMPLETED                           | 01-14-2004              |                     |
|                      |               |   |             |                         | EQUIPMENT   | JD - 310 BACKHOE |  |                         |                     |
| MATERIAL DESCRIPTION |               |   |             |                         |   |                  |  |                         |                     |
| 0                    |               |  |             | SM                      | OTAY FORMATION<br>Dense to very dense, damp, light tan, Silty, very fine SANDSTONE; abundant mica |                  |  |                         |                     |
| 2                    |               |   |             |                         |   |                  |  |                         |                     |
| 4                    |               |   |             |                         |   |                  |  |                         |                     |
| 6                    |               |  |             | ML-CL                   | Very stiff to hard, light brown, Clayey SILTSTONE to Silty CLAYSTONE                              |                  |  |                         |                     |
| 8                    |               |   |             |                         |   |                  |  |                         |                     |
|                      |               |   |             |                         | TRENCH TERMINATED AT 8 FEET<br>Backfilled on 01-14-2004   |                  |  |                         |                     |

Figure A-16,  
Log of Trench T 137, Page 1 of 1

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| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             |  |
|   |                             |  |
|   |                             |  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 138 |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|-----------|-------------|-------------------------|--------------|--|--|-------------------------|-------------------------|
|                      |               |           |             |                         | ELEV. (MSL.) | DATE COMPLETED   |  |                         |                         |
|                      |               |           |             |                         | ELEV. (MSL.) | 420  | DATE COMPLETED                           | 01-14-2004              |                         |
|                      |               |           |             |                         | EQUIPMENT    | JD - 310 BACKHOE   |  |                         |                         |
| MATERIAL DESCRIPTION |               |           |             |                         |              |  |  |                         |                         |
| 0                    |               |           |             |                         | SM           | <b>TOPSOIL</b><br>Loose to medium dense, humid to damp, brown, Silty, very fine to medium SAND   |  |                         |                         |
| 2                    |               |           |             |                         |              |  |  |                         |                         |
| 4                    |               |           |             |                         | ML           | <b>OTAY FORMATION</b><br>Firm, damp, light olive, Clayey SILTSTONE, with fine sand; abundant stringers of tan silt, some small concretions |  |                         |                         |
| 4                    |               |           |             |                         | SM           | Very dense, damp, tan, Silty, fine to very coarse SANDSTONE; some well rounded pebbles to 3/8"; trace fat clay                             |  |                         |                         |
| 6                    |               |           |             |                         |              | TRENCH TERMINATED AT 6 FEET<br>Backfilled on 01-14-2004  |  |                         |                         |

Figure A-17,  
Log of Trench T 138, Page 1 of 1

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| SAMPLE SYMBOLS           |                                |                          |
|--------------------------|--------------------------------|--------------------------|
| <input type="checkbox"/> | ... SAMPLING UNSUCCESSFUL      | <input type="checkbox"/> |
| <input type="checkbox"/> | ... STANDARD PENETRATION TEST  | <input type="checkbox"/> |
| <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) | <input type="checkbox"/> |
| <input type="checkbox"/> | ... DISTURBED OR BAG SAMPLE    | <input type="checkbox"/> |
| <input type="checkbox"/> | ... CHUNK SAMPLE               | <input type="checkbox"/> |
| <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |                          |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET                                      | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | TRENCH T 139 |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>(%) |
|--|---------------|-----------|-------------|--------------|---|--|-------------------------|-----------------|
|  |               |           |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                 |
|  |               |           |             |              | 410   | 01-14-2004                               |                         |                 |
|  |               |           |             |              | EQUIPMENT JD - 310 BACKHOE  |  |                         |                 |
| MATERIAL DESCRIPTION                                     |               |           |             |              |   |  |                         |                 |
| 0  |               |           |             |              | ALLUVIUM<br>Loose to medium dense, damp to moist, reddish brown, Silty, fine to medium SAND                 |  |                         |                 |
| 2  | T139-1        |           |             |              |   |  |                         |                 |
| 4  | T139-2        |           |             |              |   |  |                         |                 |
| 6  |               |           |             | SM           |   |  |                         |                 |
| 8  |               |           |             |              |   |  |                         |                 |
| 10   |               |           |             |              |   |  |                         |                 |
| 12   |               |           |             |              |   |  |                         |                 |
| 14   | T139-3        |           |             | CL/SC        | Stiff, damp to moist, dark brown, Sandy CLAY to Clayey SAND; with pebbles, fractures into irregular pods    |  |                         |                 |
| 16   | T139-4        |           |             | SM           | OTAY FORMATION<br>Dense, moist, light brown, Silty, fine to medium SANDSTONE; with clay and pebbles to 3/8" |  |                         |                 |
| TRENCH TERMINATED AT 16 FEET<br>Backfilled on 01-14-2004 |               |           |             |              |   |  |                         |                 |

Figure A-18,  
Log of Trench T 139, Page 1 of 1

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| SAMPLE SYMBOLS |                               |                                |
|----------------|-------------------------------|--------------------------------|
|                | ... SAMPLING UNSUCCESSFUL     |                                |
|                | ... DISTURBED OR BAG SAMPLE   |                                |
|                | ... STANDARD PENETRATION TEST |                                |
|                | ... CHUNK SAMPLE              |                                |
|                |                               | ... DRIVE SAMPLE (UNDISTURBED) |
|                |                               | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.









| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 140  |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|---------------------|---------------|---|-------------|-------------------------|---|------------------|--|-------------------------|-------------------------|
|                     |               |   |             |                         | ELEV. (MSL.)  | DATE COMPLETED   |  |                         |                         |
|                     |               |   |             |                         | ELEV. (MSL.)  | 410              | DATE COMPLETED                           | 01-14-2004              |                         |
|                     |               |   |             |                         | EQUIPMENT   | JD - 310 BACKHOE |  |                         |                         |
| 0                   |               |   |             |                         | MATERIAL DESCRIPTION  |                  |  |                         |                         |
| 2                   | T140-1        |    |             | SM                      | <b>ALLUVIUM</b><br>Loose to medium dense, damp to moist, reddish brown, Silty, fine to medium SAND                  |                  |  |                         |                         |
| 4                   |               |   |             | SM                      |   |                  |  |                         |                         |
| 6                   |               |   |             | SM                      |   |                  |  |                         |                         |
| 8                   |               |   |             | SM                      |   |                  |  |                         |                         |
| 10                  |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Dense, moist, light brown, Silty, fine to coarse SANDSTONE; trace clay and pebbles to 3/8" |                  |  |                         |                         |
|                     |               |   |             |                         | TRENCH TERMINATED AT 11 FEET<br>Backfilled on 01-14-2004  |                  |  |                         |                         |

Figure A-19,  
Log of Trench T 140, Page 1 of 1

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| SAMPLE SYMBOLS  |                             |   |                                |
|---|-----------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |    | ... STANDARD PENETRATION TEST  |
|  | ... DISTURBED OR BAG SAMPLE |    | ... CHUNK SAMPLE               |
|   |                             |  | ... DRIVE SAMPLE (UNDISTURBED) |
|   |                             |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 141  |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|---------------------|---------------|-----------|-------------|-------------------------|---|------------------|--|-------------------------|---------------------|
|                     |               |           |             |                         | ELEV. (MSL.)  | DATE COMPLETED   |  |                         |                     |
|                     |               |           |             |                         | ELEV. (MSL.)  | 424              | DATE COMPLETED                           | 01-15-2004              |                     |
|                     |               |           |             |                         | EQUIPMENT   | JD - 310 BACKHOE |  |                         |                     |
| 0                   |               |           |             |                         | MATERIAL DESCRIPTION  |                  |  |                         |                     |
| 2                   |               | [Pattern] |             | SM                      | <b>OTAY FORMATION</b><br>Very dense, humid, light gray, Silty, very fine to very coarse SANDSTONE;<br>some pebbles to 3/8" subrounded to subangular, trace gravel to 1" subrounded<br>to subangular |                  |  |                         |                     |
|                     |               |           |             |                         | TRENCH TERMINATED AT 3 FEET<br>Backfilled on 01-15-2004   |                  |  |                         |                     |

Figure A-20,  
Log of Trench T 141, Page 1 of 1

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|                |   |  |   |
|----------------|---|--|---|
| SAMPLE SYMBOLS | <input type="checkbox"/> ... SAMPLING UNSUCCESSFUL              | <input type="checkbox"/> ... STANDARD PENETRATION TEST | <input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED) |
|                | <input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> ... CHUNK SAMPLE              | <input type="checkbox"/> ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

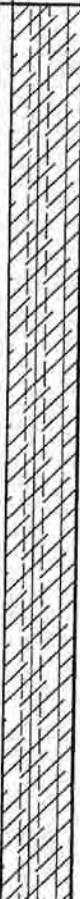
| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY  | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 142   |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |  |  |  |  |  |  |  |
|---------------------|---------------|--|-------------|-------------------------|--|------------------|--|-------------------------|-------------------------|--|--|--|--|--|--|--|
|                     |               |  |             |                         | ELEV. (MSL.)   | DATE COMPLETED   |  |                         |                         |  |  |  |  |  |  |  |
|                     |               |  |             |                         | ELEV. (MSL.)   | 400              | DATE COMPLETED                           | 01-15-2004              |                         |  |  |  |  |  |  |  |
|                     |               |  |             |                         | EQUIPMENT  | JD - 310 BACKHOE |  |                         |                         |  |  |  |  |  |  |  |
| 0                   |               |  |             |                         | MATERIAL DESCRIPTION   |                  |  |                         |                         |  |  |  |  |  |  |  |
| 2                   |               |  |             | ML-CL                   | <b>ALLUVIUM</b><br>Stiff, humid to moist, dark brown with white stringers, Silty CLAY to Clayey SILT; vigorous reaction to HCL |                  |  |                         |                         |  |  |  |  |  |  |  |
| 4                   |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
| 6                   |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
| 8                   |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
| 10                  |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
| 12                  |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
| 14                  |               |  |             |                         |  |                  |  |                         |                         |  |  |  |  |  |  |  |
|                     |               |  |             |                         |  |                  |  |                         |                         |  |  | TRENCH TERMINATED AT 14 FEET<br>Backfilled on 01-15-2004 |  |  |  |  |

Figure A-21,  
Log of Trench T 142, Page 1 of 1

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| SAMPLE SYMBOLS  |                             |   |                               |   |                                |
|---|-----------------------------|---|-------------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.








| DEPTH<br>IN<br>FEET                                      | SAMPLE<br>NO | LITHOLOGY   | GROUNDWATER | TRENCH T 143 |   |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|--|--------------|---|-------------|--------------|---|------------------|--|-------------------------|---------------------|
|  |              |   |             | ELEV. (MSL.) | DATE COMPLETED  | EQUIPMENT        |  |                         |                     |
|  |              |   |             | 380          | 01-15-2004  | JD - 310 BACKHOE |  |                         |                     |
| MATERIAL DESCRIPTION                                     |              |   |             |              |   |                  |  |                         |                     |
| 0  |              |   |             |              |   |                  |  |                         |                     |
| 2  |              |   |             |              |   |                  |  |                         |                     |
| 4  | T143-1       |  |             |              |   |                  |  |                         |                     |
| 6  |              |   |             |              |   |                  |  |                         |                     |
| 8  |              |   |             | CL           |   |                  |  |                         |                     |
| 10   |              |   |             |              |   |                  |  |                         |                     |
| 12   |              |   |             |              |   |                  |  |                         |                     |
| 14   |              |   |             |              |   |                  |  |                         |                     |
| 16   |              |   |             |              |   |                  |  |                         |                     |
| 18   |              |   |             | SM           | Dense, moist, light brown, Silty, very fine SAND; some clay, trace pebbles to 3/8", laminated |                  |  |                         |                     |
| TRENCH TERMINATED AT 18 FEET<br>Backfilled on 01-15-2004 |              |   |             |              |   |                  |  |                         |                     |

Figure A-22,  
Log of Trench T 143, Page 1 of 1

06862-52-03.G

| SAMPLE SYMBOLS  |                             |   |                               |   |                                |
|---|-----------------------------|---|-------------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 144  |                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|-----------|-------------|-------------------------|---|------------------|--|-------------------------|-------------------------|
|                      |               |           |             |                         | ELEV. (MSL.)  | DATE COMPLETED   |  |                         |                         |
|                      |               |           |             |                         | ELEV. (MSL.)  | 434              | DATE COMPLETED                           | 01-15-2004              |                         |
|                      |               |           |             |                         | EQUIPMENT   | JD - 310 BACKHOE |  |                         |                         |
| MATERIAL DESCRIPTION |               |           |             |                         |   |                  |  |                         |                         |
| 0                    |               |           |             | SM                      | <b>COLLUVIUM</b><br>Loose, dry, light tan, Silty, very fine SAND; highly fractured  |                  |  |                         |                         |
| 2                    |               |           |             | SM-SW                   | <b>OTAY FORMATION</b><br>Very dense, humid to damp, light tan, Silty, very fine to very coarse SANDSTONE; some pebbles, trace fine gravel |                  |  |                         |                         |
| 4                    |               |           |             |                         |   |                  |  |                         |                         |
| 6                    |               |           |             |                         |   |                  |  |                         |                         |
| 8                    |               |           |             |                         |   |                  |  |                         |                         |
| 10                   |               |           |             |                         | TRENCH TERMINATED AT 10 FEET<br>Backfilled on 01-15-2004  |                  |  |                         |                         |

Figure A-23,  
Log of Trench T 144, Page 1 of 1

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| SAMPLE SYMBOLS  | ...   |   |   |   |   |
|---|---|---|---|---|---|
|   |  | SAMPLING UNSUCCESSFUL   |  | STANDARD PENETRATION TEST   |  |
|  | DISTURBED OR BAG SAMPLE   |  | CHUNK SAMPLE  |  | WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 145   |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>NTEN |  |  |  |
|----------------------|--------------|-----------|-------------|-------------------------|--|--------------------------------|--|-------------------------|------------------|--|--|--|
|                      |              |           |             |                         | ELEV. (MSL.)   | DATE COMPLETED                 |  |                         |                  |  |  |  |
|                      |              |           |             |                         | ELEV. (MSL.)   | 364                            | DATE COMPLETED                           | 02-02-2004              |                  |  |  |  |
|                      |              |           |             |                         | EQUIPMENT  | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                  |  |  |  |
| MATERIAL DESCRIPTION |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 0                    |              |           |             | SM-SC                   | <p><b>ALLUVIUM</b><br/>Loose to medium dense, damp to moist, olive brown, Silty and Clayey fine to coarse SAND with scattered gravel; porous; thin layering; local carbonate pods.</p> <p style="text-align: center;">-Becomes more sandy</p> <p style="text-align: center;">EXCAVATION TERMINATED AT 17 FEET<br/>Backfilled on 02-02-2004</p> |                                |  |                         |                  |  |  |  |
| 2                    |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 4                    |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 6                    |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 8                    |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 10                   |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 12                   |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 14                   |              |           |             |                         |  |                                |  |                         |                  |  |  |  |
| 16                   |              |           |             |                         |  |                                |  |                         |                  |  |  |  |

Figure A-24,  
Log of Trench T 145, Page 1 of 1

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| SAMPLE SYMBOLS                      |                             |                          |                               |                          |                                |
|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
| <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>TRENCH T 146</b>   |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |  |  |  |  |  |  |
|--|---------------|-----------|-------------|-------------------------|---|--------------------------------|--|-------------------------|-------------------------|--|--|--|--|--|--|
|  |               |           |             |                         | ELEV. (MSL.)  | DATE COMPLETED                 |  |                         |                         |  |  |  |  |  |  |
|  |               |           |             |                         | ELEV. (MSL.)  | 368                            | DATE COMPLETED                           | 02-02-2004              |                         |  |  |  |  |  |  |
|  |               |           |             |                         | EQUIPMENT   | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                         |  |  |  |  |  |  |
| MATERIAL DESCRIPTION   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 0  |               |           |             |                         | <p><b>ALLUVIUM</b><br/>Loose to medium dense, light olive brown to brown, Silty to Clayey, fine to coarse SAND with scattered gravel, porous; thin layering in upper 4 feet</p> <p>-Some pods of very stiff clay; carbonate mineralization</p> <p>Medium dense, moist, yellowish brown, fine to coarse SAND with little silt; some fine gravels</p> |                                |  |                         |                         |  |  |  |  |  |  |
| 2  |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 4  |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 6  |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 8  |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 10   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 12   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 14   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 16   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 18   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 20   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| 22   |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |
| EXCAVATION TERMINATED AT 23 FEET<br>No groundwater<br>Backfilled on 02-02-2004 |               |           |             |                         |   |                                |  |                         |                         |  |  |  |  |  |  |

Figure A-25,  
Log of Trench T 146, Page 1 of 1

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|                |  |                             |  |                               |  |                                |
|----------------|--|-----------------------------|--|-------------------------------|--|--------------------------------|
| SAMPLE SYMBOLS |  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|                |  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | TRENCH T 147            |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|----------------------|---------------|---|-------------|-------------------------|---|--|-------------------------|---------------------|
|                      |               |   |             | SOIL<br>CLASS<br>(USCS) | ELEV. (MSL.) <u>410</u> DATE COMPLETED <u>02-02-2004</u><br>EQUIPMENT <u>JD - 450 TRACK-MOUNTED BACKHOE</u>   |  |                         |                     |
| MATERIAL DESCRIPTION |               |   |             |                         |   |  |                         |                     |
| 0                    |               |  |             | ML                      | <b>TOPSOIL</b><br>Loose to medium dense, damp to moist, Clayey fine to medium Sandy SILT;<br>carbonate pods; porous with rootlets   |  |                         |                     |
| 2                    |               |   |             |                         |   |  |                         |                     |
| 4                    |               |   |             |                         |   |  |                         |                     |
| 6                    |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Light gray to light yellowish brown, medium dense to dense, damp, Silty,<br>fine-to coarse-grained SANDSTONE "gritstone"; weathered in upper 6-inches<br>with carbonate mineralization |  |                         |                     |
|                      |               |   |             |                         |   |  |                         |                     |
|                      |               |   |             |                         | EXCAVATION TERMINATED AT 7 FEET<br>No groundwater<br>Backfilled on 02-02-2004   |  |                         |                     |

Figure A-26,  
Log of Trench T 147, Page 1 of 1

06862-52-03.G

|                |   |   |  |
|----------------|---|---|--|
| SAMPLE SYMBOLS |  ... SAMPLING UNSUCCESSFUL   |  ... STANDARD PENETRATION TEST |  ... DRIVE SAMPLE (UNDISTURBED) |
|                |  ... DISTURBED OR BAG SAMPLE |  ... CHUNK SAMPLE              |  ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.


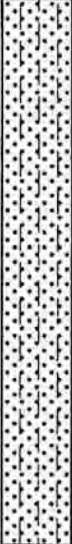
| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY  | GROUNDWATER | TRENCH T 148 |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%)   |  |  |
|----------------------|---------------|--|-------------|--------------|--|--|-------------------------|---|--|--|
|                      |               |  |             | ELEV. (MSL.) | DATE COMPLETED   |  |                         |   |  |  |
|                      |               |  |             |              | ELEV. (MSL.) <u>450</u> DATE COMPLETED <u>02-02-2004</u>   |  |                         |   |  |  |
|                      |               |  |             |              | EQUIPMENT <u>JD - 450 TRACK-MOUNTED BACKHOE</u>  |  |                         |   |  |  |
| MATERIAL DESCRIPTION |               |  |             |              |  |  |                         |   |  |  |
| 0                    |               |   |             | SC-CL        | <b>TOPSOIL</b><br>Soft to loose, damp, to moist, Clayey SAND to Sandy CLAY; dark grayish brown; porous with roots  |  |                         |   |  |  |
| 2                    |               |  |             |              |  |  |                         |   |  |  |
| 4                    |               |  |             | SM           | <b>OTAY FORMATION</b><br>Medium dense to dense, damp to moist, light gray to nearly white, Silty, fine-to medium-grained SANDSTONE; some micas; strongly weathered in upper 2 feet of unit |  |                         |   |  |  |
| 6                    |               |  |             |              |  |  |                         |   |  |  |
| 8                    |               |  |             |              |  |  |                         |   |  |  |
| 10                   |               |  |             |              |  |  |                         | -Becomes yellowish to light olive brown, fine-grained, very dense, moderately fractured; some bentonite rip-up clasts |  |  |
| 12                   |               |  |             |              | EXCAVATION TERMINATED AT 12 FEET   |  |                         |   |  |  |

Figure A-27,  
Log of Trench T 148, Page 1 of 1

06862-52-03.GPJ

|                |   |   |  |
|----------------|---|---|--|
| SAMPLE SYMBOLS |  ... SAMPLING UNSUCCESSFUL   |  ... STANDARD PENETRATION TEST |  ... DRIVE SAMPLE (UNDISTURBED) |
|                |  ... DISTURBED OR BAG SAMPLE |  ... CHUNK SAMPLE              |  ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES




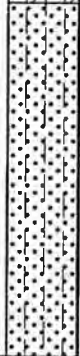
| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 149   |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|---------------------|---------------|-----------|-------------|-------------------------|--|--------------------------------|--|-------------------------|---------------------|
|                     |               |           |             |                         | ELEV. (MSL.)   | DATE COMPLETED                 |  |                         |                     |
|                     |               |           |             |                         | ELEV. (MSL.)   | 443                            | DATE COMPLETED                           | 02-02-2004              |                     |
|                     |               |           |             |                         | EQUIPMENT  | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                     |
| 0                   |               |           |             |                         | MATERIAL DESCRIPTION   |                                |  |                         |                     |
| 0                   |               |           |             |                         | <b>TOPSOIL</b><br>Loose to stiff, damp, dark grayish brown, Clayey SAND to Sandy CLAY  |                                |  |                         |                     |
| 2                   |               |           |             | SC-CL                   |  |                                |  |                         |                     |
| 4                   |               |           |             |                         | <b>OTAY FORMATION</b><br>Dense, damp, light olive brown, Silty, fine-to medium-grained SANDSTONE;<br>thin SILTSTONE interbeds; local bentonite claystone rip-up clasts |                                |  |                         |                     |
| 6                   |               |           |             | SM-ML                   |  |                                |  |                         |                     |
| 8                   |               |           |             |                         |  |                                |  |                         |                     |
| 10                  |               |           |             |                         | -Becomes fine-to coarse-grained "gritstone"  |                                |  |                         |                     |
|                     |               |           |             |                         | EXCAVATION TERMINATED AT 11 FEET<br>No groundwater<br>Backfilled on 02-02-2004   |                                |  |                         |                     |

Figure A-28,  
Log of Trench T 149, Page 1 of 1

06862-52-03 GF



|                |                                     |                             |                          |                               |                          |                                |
|----------------|-------------------------------------|-----------------------------|--------------------------|-------------------------------|--------------------------|--------------------------------|
| SAMPLE SYMBOLS | <input type="checkbox"/>            | ... SAMPLING UNSUCCESSFUL   | <input type="checkbox"/> | ... STANDARD PENETRATION TEST | <input type="checkbox"/> | ... DRIVE SAMPLE (UNDISTURBED) |
|                | <input checked="" type="checkbox"/> | ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> | ... CHUNK SAMPLE              | <input type="checkbox"/> | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>TRENCH T 150</b>   |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|---|-------------|-------------------------|---|----------------------------------|--|-------------------------|-------------------------|
|                      |               |   |             |                         | ELEV. (MSL.) <u>432</u>   | DATE COMPLETED <u>02-02-2004</u> |  |                         |                         |
|                      |               |   |             |                         | EQUIPMENT   |                                  |  |                         |                         |
|                      |               |   |             |                         | JD - 450 TRACK-MOUNTED BACKHOE  |                                  |  |                         |                         |
| MATERIAL DESCRIPTION |               |   |             |                         |   |                                  |  |                         |                         |
| 0                    |               |   |             |                         | <b>TOPSOIL</b><br>Loose to stiff, damp, dark brown, Clayey to Silty, fine to medium SAND  |                                  |  |                         |                         |
| 2                    |               |  |             | SM-SC                   |   |                                  |  |                         |                         |
| 4                    |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Dense to very dense, damp, yellowish to light olive brown, Silty, fine-to coarse-grained SANDSTONE "gritstone" |                                  |  |                         |                         |
| 6                    |               |   |             |                         |   |                                  |  |                         |                         |
| 8                    |               |   |             |                         | EXCAVATION TERMINATED AT 8 FEET<br>No groundwater<br>Backfilled on 02-02-2004   |                                  |  |                         |                         |
|                      |               |   |             |                         |   |                                  |  |                         |                         |

**Figure A-29,**  
**Log of Trench T 150, Page 1 of 1**

06862-52-03.GPJ

| SAMPLE SYMBOLS  |                             |   |                               |   |                                |
|---|-----------------------------|---|-------------------------------|---|--------------------------------|
|  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.









| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 151  |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|---------------------|---------------|---|-------------|-------------------------|---|--------------------------------|--|-------------------------|---------------------|
|                     |               |   |             |                         | ELEV. (MSL.)  | DATE COMPLETED                 |  |                         |                     |
|                     |               |   |             |                         | ELEV. (MSL.)  | 428                            | DATE COMPLETED                           | 02-02-2004              |                     |
|                     |               |   |             |                         | EQUIPMENT   | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                     |
| 0                   |               |   |             |                         | MATERIAL DESCRIPTION  |                                |  |                         |                     |
| 2                   |               |  |             | SM-ML                   | <b>COLLUVIUM</b><br>Loose, damp, grayish brown, Silty and Clayey, fine to medium SAND to Sandy SILT; some roots and gravel  |                                |  |                         |                     |
| 4                   |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Loose to dense, damp, light grayish brown, Silty, fine-to medium-grained SANDSTONE; highly weathered and creep-affected in upper 2 feet of unit; becomes increasingly dense with depth |                                |  |                         |                     |
| 6                   |               |   |             |                         | EXCAVATION TERMINATED AT 6 FEET<br>No groundwater<br>Backfilled on 02-02-2004   |                                |  |                         |                     |

Figure A-30,  
Log of Trench T 151, Page 1 of 1

06862-52-03.G

|                |   |                             |   |                               |   |                                |
|----------------|---|-----------------------------|---|-------------------------------|---|--------------------------------|
| SAMPLE SYMBOLS |  | ... SAMPLING UNSUCCESSFUL   |  | ... STANDARD PENETRATION TEST |  | ... DRIVE SAMPLE (UNDISTURBED) |
|                |  | ... DISTURBED OR BAG SAMPLE |  | ... CHUNK SAMPLE              |  | ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES


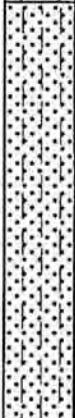
| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | TRENCH T 152 |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|---|-------------|--------------|---|--|-------------------------|-------------------------|
|                      |               |   |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                         |
|                      |               |   |             |              | 462   | 02-02-2004                               |                         |                         |
|                      |               |   |             |              | EQUIPMENT JD - 450 TRACK-MOUNTED BACKHOE  |  |                         |                         |
| MATERIAL DESCRIPTION |               |   |             |              |   |  |                         |                         |
| 0                    |               |  |             | SC           | TOPSOIL<br>Loose, damp, grayish brown, Clayey, fine SAND  |  |                         |                         |
| 2                    |               |  |             | SM           | OTAY FORMATION<br>Dense, damp, gray to light grayish brown, Silty, fine-to medium-grained SANDSTONE |  |                         |                         |
| 4                    |               |   |             |              |   |  |                         |                         |
| 6                    |               |   |             |              |   |  |                         |                         |
| 8                    |               |   |             |              | EXCAVATION TERMINATED AT 8 FEET<br>No groundwater<br>Backfilled on 02-02-2004                       |  |                         |                         |

Figure A-31,  
Log of Trench T 152, Page 1 of 1

06862-52-03.GPJ

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             | ... STANDARD PENETRATION TEST   |
|   |                             |  |
|   |                             | ... DRIVE SAMPLE (UNDISTURBED)  |
|   |                             |  |
|   |                             | ... CHUNK SAMPLE  |
|   |                             | ... WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.





| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | TRENCH T 153 |  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>VTEN |
|---------------------|---------------|-----------|-------------|--------------|--|--|-------------------------|------------------|
|                     |               |           |             | ELEV. (MSL.) | DATE COMPLETED   |  |                         |                  |
|                     |               |           |             |              | ELEV. (MSL.) <u>440</u> DATE COMPLETED <u>02-02-2004</u>   |  |                         |                  |
|                     |               |           |             |              | EQUIPMENT <u>JD - 450 TRACK-MOUNTED BACKHOE</u>  |  |                         |                  |
|                     |               |           |             |              | MATERIAL DESCRIPTION   |  |                         |                  |
| 0                   |               |           |             |              | <b>TOPSOIL</b><br>Loose to medium dense, damp, brown, Silty, fine to medium SAND   |  |                         |                  |
| 2                   |               |           |             | SM           |  |  |                         |                  |
| 4                   |               |           |             |              | <b>OTAY FORMATION</b><br>Dense, damp, gray to yellowish brown, Silty, fine-to medium-grained SANDSTONE; some claystone rip-up clasts |  |                         |                  |
| 6                   |               |           |             | SM           |  |  |                         |                  |
|                     |               |           |             |              | EXCAVATION TERMINATED AT 6.5 FEET<br>No groundwater<br>Backfilled on 02-02-2004  |  |                         |                  |

Figure A-32,  
Log of Trench T 153, Page 1 of 1

06862-52-03.C

|                |   |  |  |
|----------------|---|--|--|
| SAMPLE SYMBOLS | <input type="checkbox"/> ... SAMPLING UNSUCCESSFUL              | <input type="checkbox"/> ... STANDARD PENETRATION TEST | <input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)        |
|                | <input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE | <input checked="" type="checkbox"/> ... CHUNK SAMPLE   | <input checked="" type="checkbox"/> ... WATER TABLE OR SEEPAGE |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET         | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | <b>TRENCH T 154</b>  |                                  | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|-----------------------------|---------------|---|-------------|-------------------------|--|----------------------------------|--|-------------------------|-------------------------|
|                             |               |   |             |                         | ELEV. (MSL.) <u>540</u>  | DATE COMPLETED <u>02-02-2004</u> |  |                         |                         |
|                             |               |   |             |                         | EQUIPMENT <u>JD - 450 TRACK-MOUNTED BACKHOE</u>  |                                  |  |                         |                         |
| <b>MATERIAL DESCRIPTION</b> |               |   |             |                         |  |                                  |  |                         |                         |
| 0                           |               |  |             | SC                      | <b>TOPSOIL</b><br>Loose, damp, grayish brown, Clayey, fine to medium SAND with some gravel   |                                  |  |                         |                         |
| 2                           |               |  |             | SM                      | <b>TERRACE DEPOSITS</b><br>Medium dense, damp, grayish brown, Silty fine-grained SANDSTONE with SILTSTONE interbeds; highly fractured; abundant carbonate mineralization |                                  |  |                         |                         |
| 4                           |               |  |             | ML                      | Hard, damp, olive gray to reddish brown, Clayey and fine-grained Sandy SILTSTONE   |                                  |  |                         |                         |
| 6                           |               |  |             |                         |  |                                  |  |                         |                         |
|                             |               |   |             |                         | TRENCH TERMINATED AT 7.5 FEET<br>No groundwater<br>Backfilled on 02-02-2004  |                                  |  |                         |                         |

**Figure A-33,  
Log of Trench T 154, Page 1 of 1**

06862-52-03.GPJ

| SAMPLE SYMBOLS  | ...   |   |   |   |   |
|---|---|---|---|---|---|
|   |  | SAMPLING UNSUCCESSFUL   |  | STANDARD PENETRATION TEST   |  |
|  | DISTURBED OR BAG SAMPLE   |  | CHUNK SAMPLE  |  | WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

| DEPTH<br>IN<br>FEET | SAMPLE<br>NO. | LITHOLOGY | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 155   |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT |
|---------------------|---------------|-----------|-------------|-------------------------|--|--------------------------------|--|-------------------------|---------------------|
|                     |               |           |             |                         | ELEV. (MSL.)   | DATE COMPLETED                 |  |                         |                     |
|                     |               |           |             |                         | ELEV. (MSL.)   | 440                            | DATE COMPLETED                           | 02-02-2004              |                     |
|                     |               |           |             |                         | EQUIPMENT  | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                     |
| 0                   |               |           |             |                         | MATERIAL DESCRIPTION   |                                |  |                         |                     |
|                     |               |           |             | SM                      | <b>TOPSOIL</b><br>Loose, dense, Silty, fine to medium SAND   |                                |  |                         |                     |
| 2                   |               |           |             |                         | <b>OTAY FORMATION</b><br>Medium dense to dense, damp, light gray, Silty, fine-to medium-grained SANDSTONE, weathered and fractured in upper 2 feet of unit |                                |  |                         |                     |
| 4                   |               |           |             | SM                      |  |                                |  |                         |                     |
| 6                   |               |           |             |                         | EXCAVATION TERMINATED AT 6 FEET  |                                |  |                         |                     |

Figure A-34,  
Log of Trench T 155, Page 1 of 1

06862-52-03.GF

| SAMPLE SYMBOLS | <input type="checkbox"/> ... SAMPLING UNSUCCESSFUL              | <input type="checkbox"/> ... STANDARD PENETRATION TEST | <input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED) |
|----------------|---|--|---|
|                | <input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> ... CHUNK SAMPLE              | <input type="checkbox"/> ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.





| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | TRENCH T 156 |   | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>CONTENT (%) |
|----------------------|---------------|---|-------------|--------------|---|--|-------------------------|-------------------------|
|                      |               |   |             | ELEV. (MSL.) | DATE COMPLETED  |  |                         |                         |
|                      |               |   |             |              | 442   | 02-02-2004                               |                         |                         |
|                      |               |   |             |              | EQUIPMENT JD - 450 TRACK-MOUNTED BACKHOE  |  |                         |                         |
| MATERIAL DESCRIPTION |               |   |             |              |   |  |                         |                         |
| 0                    |               |  |             | SC           | TOPSOIL<br>Loose, damp, grayish brown, Clayey, fine to medium SAND                      |  |                         |                         |
| 2                    |               |  |             | SM           | OTAY FORMATION<br>Medium dense, damp, light gray, Silty, fine-grained SANDSTONE         |  |                         |                         |
|                      |               |  |             | CH           | Stiff, moist, olive gray to pink and white bentonite CLAYSTONE; weathered and fractured |  |                         |                         |
| 4                    |               |  |             | SM           | Dense, damp, light olive gray, Silty, fine-to coarse-grained SANDSTONE "gritstone"      |  |                         |                         |
| 6                    |               |   |             |              | EXCAVATION TERMINATED AT 6 FEET<br>No groundwater<br>Backfilled on 02-02-2004           |  |                         |                         |

Figure A-35,  
Log of Trench T 156, Page 1 of 1

06862-52-03.GPJ

| SAMPLE SYMBOLS  |                             |   |
|---|-----------------------------|---|
|  | ... SAMPLING UNSUCCESSFUL   |    |
|  | ... DISTURBED OR BAG SAMPLE |    |
|   |                             |  |
|   |                             | ... STANDARD PENETRATION TEST   |
|   |                             |  |
|   |                             | ... DRIVE SAMPLE (UNDISTURBED)  |
|   |                             |  |
|   |                             | ... CHUNK SAMPLE  |
|   |                             | ... WATER TABLE OR SEEPAGE  |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.




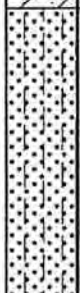
| DEPTH<br>IN<br>FEET  | SAMPLE<br>NO. | LITHOLOGY   | GROUNDWATER | SOIL<br>CLASS<br>(USCS) | TRENCH T 157   |                                | PENETRATION<br>RESISTANCE<br>(BLOWS/FT.) | DRY DENSITY<br>(P.C.F.) | MOISTURE<br>(%) |
|----------------------|---------------|---|-------------|-------------------------|--|--------------------------------|--|-------------------------|-----------------|
|                      |               |   |             |                         | ELEV. (MSL.)   | DATE COMPLETED                 |  |                         |                 |
|                      |               |   |             |                         | ELEV. (MSL.)   | 422                            | DATE COMPLETED                           | 02-02-2004              |                 |
|                      |               |   |             |                         | EQUIPMENT  | JD - 450 TRACK-MOUNTED BACKHOE |  |                         |                 |
| MATERIAL DESCRIPTION |               |   |             |                         |  |                                |  |                         |                 |
| 0                    |               |  |             | SC                      | <b>TOPSOIL</b><br>Loose, damp, grayish brown, Clayey, fine to medium SAND  |                                |  |                         |                 |
| 2                    |               |  |             | SM                      | <b>OTAY FORMATION</b><br>Dense, damp, gray to light olive brown, Silty, fine-to medium-grained SANDSTONE; moderately weathered with carbonate mineralization in upper foot of unit |                                |  |                         |                 |
| 4                    |               |   |             |                         |  |                                |  |                         |                 |
| 6                    |               |   |             |                         | EXCAVATION TERMINATED AT 6 FEET<br>No groundwater<br>Backfilled on 02-02-2004  |                                |  |                         |                 |

Figure A-36,  
Log of Trench T 157, Page 1 of 1

06862-52-03.C

|                |   |  |   |
|----------------|---|--|---|
| SAMPLE SYMBOLS | <input type="checkbox"/> ... SAMPLING UNSUCCESSFUL              | <input type="checkbox"/> ... STANDARD PENETRATION TEST | <input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED) |
|                | <input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE | <input type="checkbox"/> ... CHUNK SAMPLE              | <input type="checkbox"/> ... WATER TABLE OR SEEPAGE     |

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



# County of San Diego

DEPARTMENT OF ENVIRONMENTAL HEALTH  
LAND AND WATER QUALITY DIVISION

P.O. BOX 129261, SAN DIEGO, CA 92112-9261  
(619) 338-2222 FAX (619) 338-2377; 2315  
1-800-253-9833

GARY W. ERBECK  
DIRECTOR

RICHARD HAAS  
ASSISTANT DIRECTOR

## WAIVER FOR GEOTECHNICAL BORING(S)

DATE: August 11, 2003

TO: Shawn Weedon  
Geocon, Inc.  
6960 Flanders Dr.  
San Diego, CA 92121

RE: Otay Ranch Village 2  
ADDRESS: South of Olympic Pky, between Taber Dr. and La Media Rd  
Chula Vista, CA

A.P.N.(S): 644-030-07, -10, -11, -14, -15, -18, -19; 644-060-10, -13

Monitoring Well/Site Assessment and Mitigation Program (SAM) staff have reviewed County records currently available regarding County permitted hazardous materials establishments and SAM unauthorized releases sites. Please be aware that it is possible there are several water supply wells located in this area.

**Based on this limited review, and your signed waiver statement, a waiver for a geotechnical-boring permit is granted.**

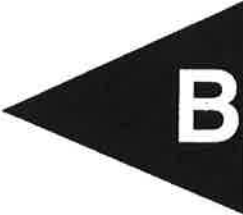
The following conditions apply:

1. **As specified in the Department of Water Resources Bulletin 74-81 and 74-90**
  - a. All borings must be properly destroyed. Borings must be sealed from the bottom of the boring to ground surface with an approved sealing material.
  - Or Backfill proposal for large diameter boring approved as proposed.
2. Drill cuttings must be properly handled and disposed to be in compliance with Stormwater Best Management Practices of the local jurisdiction.

Please note that there may be sites with contaminated soil and/or groundwater for which SAM has no information. All responsibilities, obligations and liabilities under state and local laws still apply to the proposed drilling. If new information becomes available indicating that substances have been found or are planned to be used at the site, you agree to notify SAM of this change for further evaluation.

  
Marisue Crystal, Environmental Health Technician  
Site Assessment and Mitigation Program (SAM)  
Monitoring Wells - (619) 338-2339

APPENDIX



B

## APPENDIX B

### LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were analyzed for maximum dry density and optimum moisture content, expansion potential, water-soluble sulfate, and shear strength characteristics. The results of the laboratory tests are presented on Tables B-I through B-IV.

**TABLE B-I  
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY  
AND OPTIMUM MOISTURE CONTENT TEST RESULTS  
ASTM D 1557-02**

| <b>Sample No.</b> | <b>Description</b>  | <b>Maximum Dry Density (pcf)</b> | <b>Optimum Moisture Content (% dry wt.)</b> |
|-------------------|---|----------------------------------|---|
| T139-1            | Dark grayish brown, Silty, fine to coarse SAND, with trace clay | 113.9                            | 14.7  |
| T143-1            | Very dark grayish brown, Sandy CLAY, with trace gravel          | 120.1                            | 13.5  |

**TABLE B-II  
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS  
ASTM D 3080-03**

| Sample No. | Dry Density<br>(pcf) | Moisture Content<br>(%) |         | Unit<br>Cohesion<br>(psf) | Angle of Shear<br>Resistance (degrees) |
|------------|----------------------|-------------------------|---------|---------------------------|--|
|            |                      | Initial                 | At Test |                           |  |
| B8-7**     | 69.4                 | 53.7                    | 60.8    | 0                         | 12                                     |
| B11-2      | 110.4                | 13.3                    | 19.5    | 1270                      | 40                                     |
| B13-2      | 114.4                | 12.7                    | 18.1    | 880                       | 38                                     |
| B15-1      | 108.4                | 5.4                     | 18.7    | 180                       | 46                                     |
| B22-5**    | 71.2                 | 54.3                    | 58.7    | 160                       | 13                                     |
| B23-2      | 111.2                | 9.4                     | 19.6    | 340                       | 34                                     |
| B26.6**    | 78.2                 | 41.6                    | 43.9    | 350                       | 10                                     |
| B36-3*     | 93.8                 | 21.6                    | 27.1    | 700                       | 34                                     |
| B38-3**    | 104.3                | 15.5                    | 34.6    | 270                       | 16                                     |
| B40-1      | 117.9                | 9.7                     | 15.0    | 1100                      | 39                                     |
| B40-6**    | 70.5                 | 50.5                    | 55.6    | 150                       | 9                                      |
| B42-3      | 104.5                | 17.8                    | 25.3    | 850                       | 43                                     |
| B43-2      | 103.4                | 23.3                    | 26.7    | 1400                      | 39                                     |
| B51-3      | 112.7                | 14.2                    | 19.3    | 746                       | 44                                     |
| B52-1      | 68.4                 | 21.8                    | 46.7    | 403                       | 31                                     |
| T4-1*      | 97.2                 | 16.3                    | 26.9    | 720                       | 37                                     |
| T9-1*      | 90.2                 | 23.2                    | 30.6    | 810                       | 32                                     |

\* Sample remolded to approximately 90 percent of maximum dry density at near optimum moisture content.

\*\* Residual Shear Test Results

**TABLE B-III**  
**SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS**  
**ASTM D 4829-95**

| Sample No. | Moisture Content |                | Dry Density (pcf) | Expansion Index | Classification |
|------------|------------------|----------------|-------------------|-----------------|----------------|
|            | Before Test (%)  | After Test (%) |                   |                 |                |
| T139-1     | 15.1             | 29.6           | 93.2              | 48              | Low            |
| T143-1     | 14.4             | 27.2           | 94.2              | 34              | Low            |

**TABLE B-IV**  
**SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS**  
**CALIFORNIA TEST NO. 417**

| Sample No. | Water Soluble Sulfate Content (percent) | Exposure   |
|------------|---|------------|
| T139-1     | 0.008                                   | Negligible |
| T143-1     | 0.002                                   | Negligible |

# APPENDIX



C

## APPENDIX C

### SLOPE STABILITY ANALYSES

Slope stability analyses were performed using a two-dimensional computer program *SLOPEW5* created by Geo-Slope International Ltd. Rotational-mode analyses were performed using Bishop's Simplified procedure and block-mode analyses was performed using the Janbu's method. Output of the computer program, including the calculated factor of safety and the failure surface, is presented herein.

Shear strength parameters for the existing geologic features were determined from laboratory direct shear and residual shear tests on samples obtained during our field investigation and on samples obtained from other investigations in the area in accordance with ASTM D 3080-03. Direct shear tests were performed on samples of the Terrace Deposits, Otay Formation, and San Diego Formation. Residual shear tests were performed on samples of the bentonitic claystone encountered in the Otay Formation. The geologic units encountered and the shear strength properties used in the analyses is presented on Table C-I.

**TABLE C-I  
SUMMARY OF SOIL PROPERTIES USED FOR SLOPE STABILITY ANALYSES**

| Geologic Unit                    | Density (pcf) | Cohesion (psf) | Friction Angle (degrees) |
|----------------------------------|---------------|----------------|--------------------------|
| Compacted Fill (Qcf)             | 130           | 300            | 28                       |
| Terrace Deposits (Qt)            | 130           | 325            | 33                       |
| Otay Formation (To)              | 130           | 325            | 33                       |
| Otay Formation – Bentonite (Tob) | 130           | 50             | 10                       |
| San Diego Formation (Tsd)        | 130           | 325            | 33                       |

We selected cross sections prepared during the investigation (Figures 5 and 6) to perform the slope stability analyses. Table C-II provides a description of the cross-sections, their corresponding factor of safety, file name, and the condition of the slope stability analyses. A factor of safety of 1.5 for all static slopes is currently required by the City of Chula Vista to build structures above or below a slope.



**TABLE C-II  
SUMMARY OF SLOPE STABILITY ANALYSES**

| <b>Cross-Section</b> | <b>Factor of Safety</b> | <b>File Name</b> | <b>Condition of Slope Stability Analyses</b>  |
|----------------------|-------------------------|------------------|---|
| A-A'                 | 2.21                    | AAStaticCir      | Minimum Rotational-mode Factor of Safety  |
| A-A'                 | 1.58                    | AAStaticBlk      | Minimum Block-mode Factor of Safety   |
| C-C'                 | 2.28                    | CCStaticCir      | Minimum Rotational-mode Factor of Safety for Proposed Cut Slope                                       |
| E-E'                 | 4.56                    | EEStaticCir      | Minimum Rotational-mode Factor of Safety for South Slope  |
| E-E'                 | 2.30                    | EEStaticBlk      | Minimum Block-mode Factor of Safety for South Slope   |
| E-E'                 | 2.97                    | EEStaticCirLft   | Minimum Rotational-mode Factor of Safety for North Slope  |
| E-E'                 | 2.59                    | EEStaticBlkLft   | Minimum Block-mode Factor of Safety for the North Slope   |
| G-G'                 | 1.65                    | GGStaticCir      | Minimum Rotational-mode Factor of Safety  |
| G-G'                 | 1.18                    | GGStaticBlk      | Minimum Block-mode Factor of Safety   |
| G-G'                 | 1.53                    | GGStaticBlkFS15  | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 30-Foot Buttress                    |
| H-H'                 | 2.17                    | HHStaticCir      | Minimum Rotational-mode Factor of Safety  |
| H-H'                 | 1.44                    | HHStaticBlk      | Minimum Block-mode Factor of Safety   |
| H-H'                 | 1.53                    | HHStaticBlkFS15  | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 15-Foot Buttress                    |
| I-I'                 | 2.12                    | IISStaticCir     | Minimum Rotational-mode Factor of Safety for the East Slope   |
| I-I'                 | 1.33                    | IISStaticBlk     | Minimum Block-mode Factor of Safety for the East Slope  |
| I-I'                 | 1.50                    | IISStaticFS15    | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 50-Foot Buttress for the East Slope |
| I-I'                 | 2.51                    | IISStaticCirLft  | Minimum Rotational-mode Factor of Safety for the West Slope   |
| I-I'                 | 1.55                    | IISStaticBlkLft  | Minimum Block-mode Factor of Safety for the West Slope  |
| J-J'                 | 3.49                    | JJStaticCir      | Minimum Rotational-mode Factor of Safety  |
| J-J'                 | 1.86                    | JJStaticBlk      | Minimum Block-mode Factor of Safety   |
| K-K'                 | 2.25                    | KKStaticCir      | Minimum Rotational-mode Factor of Safety  |

**TABLE C-II (Continued)  
SUMMARY OF SLOPE STABILITY ANALYSES**

| <b>Cross-Section</b> | <b>Factor of Safety</b> | <b>File Name</b>  | <b>Condition of Slope Stability Analyses</b>  |
|----------------------|-------------------------|-------------------|---|
| K-K'                 | 1.44                    | KKStaticBlk       | Minimum Block-mode Factor of Safety   |
| K-K'                 | 1.53                    | KKStaticBlkFS15   | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 20-Foot Buttress                    |
| L-L'                 | 1.86                    | LLStaticCir       | Minimum Rotational-mode Factor of Safety  |
| L-L'                 | 1.23                    | LLStaticBlk       | Minimum Block-mode Factor of Safety   |
| L-L'                 | 1.50                    | LLStaticBlkFS15   | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 55-Foot Buttress                    |
| N-N'                 | 2.23                    | NNStaticCirLft    | Minimum Rotational-mode Factor of Safety for the West Slope   |
| N-N'                 | 1.53                    | NNStaticBlkLft    | Minimum Block-mode Factor of Safety for the West Slope  |
| N-N'                 | 1.62                    | NNStaticCirRt     | Minimum Rotational-mode Factor of Safety for the East Slope   |
| N-N'                 | 1.13                    | NNStaticBlkRt     | Minimum Block-mode Factor of Safety for the East Slope  |
| N-N'                 | 1.58                    | NNStaticBlkRtFS15 | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 50-Foot Buttress for the East Slope |
| P-P'                 | 1.84                    | PPStaticCir       | Minimum Rotational-mode Factor of Safety  |
| P-P'                 | 1.40                    | PPStaticBlk       | Minimum Block-mode Factor of Safety   |
| P-P'                 | 1.75                    | PPStaticBlkFS15   | Block-mode Analysis with a Factor of Safety of at least 1.5 and a 15-Foot Buttress                    |

The presence of weak bentonitic clay layers will require the use of slope buttresses or stabilization fills on several proposed cut slopes. In general, the affected cut slopes are located along the southerly margins of the property.

Surficial slope stability calculations were performed for a 2:1 (horizontal:vertical) fill slope. The calculated factor of safety is greater than the required minimum factor of safety of 1.5. Plants with variable root depth should be planted as soon as possible once the fill slopes have been constructed. Surficial slope stability calculations are presented in Appendix C.

ASSUMED CONDITIONS:

|                            |            |                       |                            |
|----------------------------|------------|-----------------------|----------------------------|
| Slope Height               | H          | =                     | Infinite                   |
| Depth of Saturation        | Z          | =                     | 3 feet                     |
| Slope Inclination          | 2:1        | (Horizontal:Vertical) |                            |
| Slope Angle                | i          | =                     | 26.6 degrees               |
| Unit Weight of Water       | $\gamma_w$ | =                     | 62.4 pounds per cubic foot |
| Total Unit Weight of Soil  | $\gamma_t$ | =                     | 130 pounds per cubic foot  |
| Angle of Internal Friction | $\phi$     | =                     | 28 degrees                 |
| Apparent Cohesion          | C          | =                     | 300 pounds per square foot |

Slope saturated to vertical depth Z below slope face.  
Seepage forces parallel to slope face

ANALYSIS:

$$FS = \frac{C + (\gamma_t - \gamma_w)Z \cos^2 i \tan \phi}{\gamma_t Z \sin i \cos i} = 2.4$$

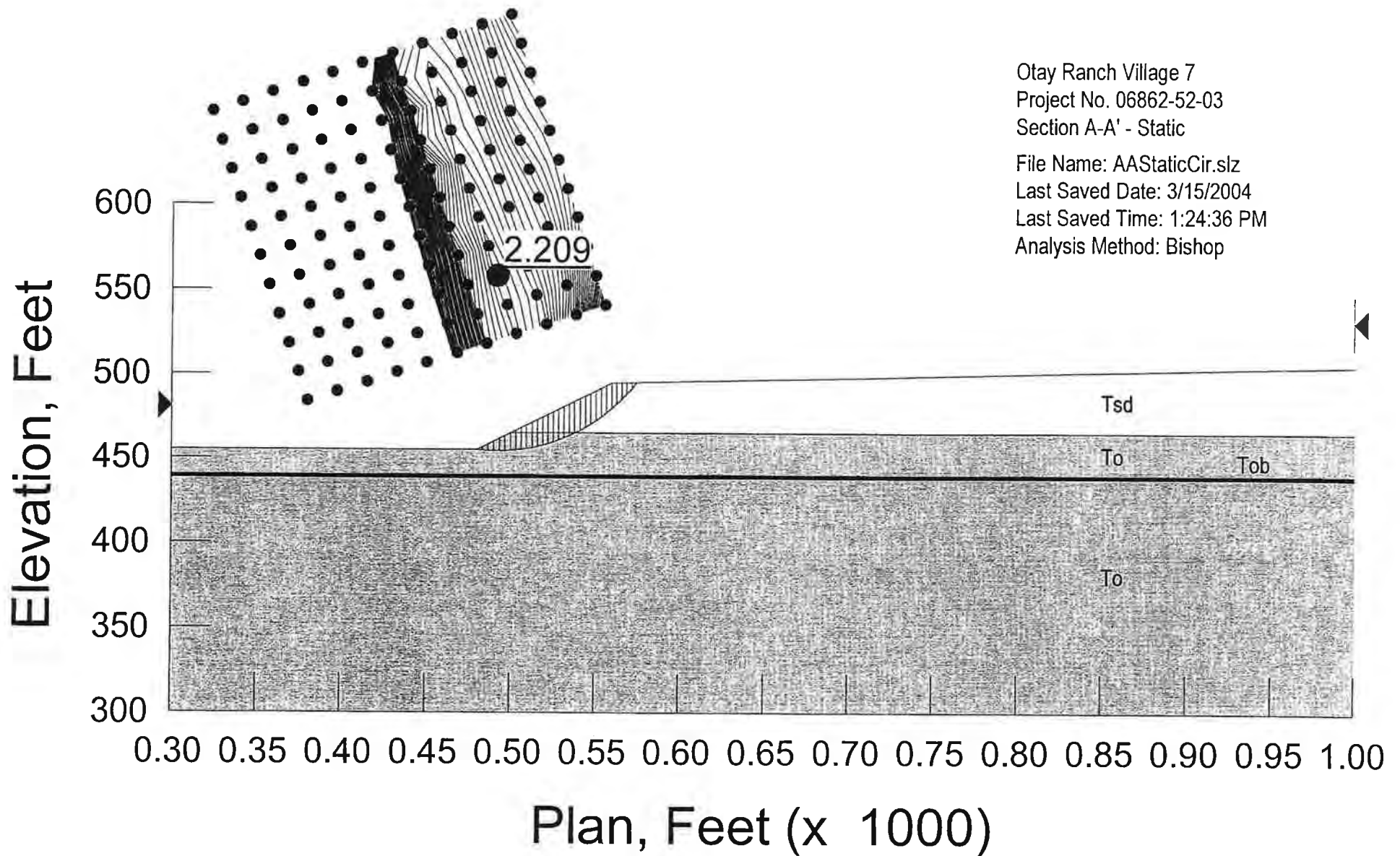
REFERENCES:

- (1) Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62.
- (2) Skempton, A. W., and F. A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81.

**SURFICIAL SLOPE STABILITY ANALYSIS**

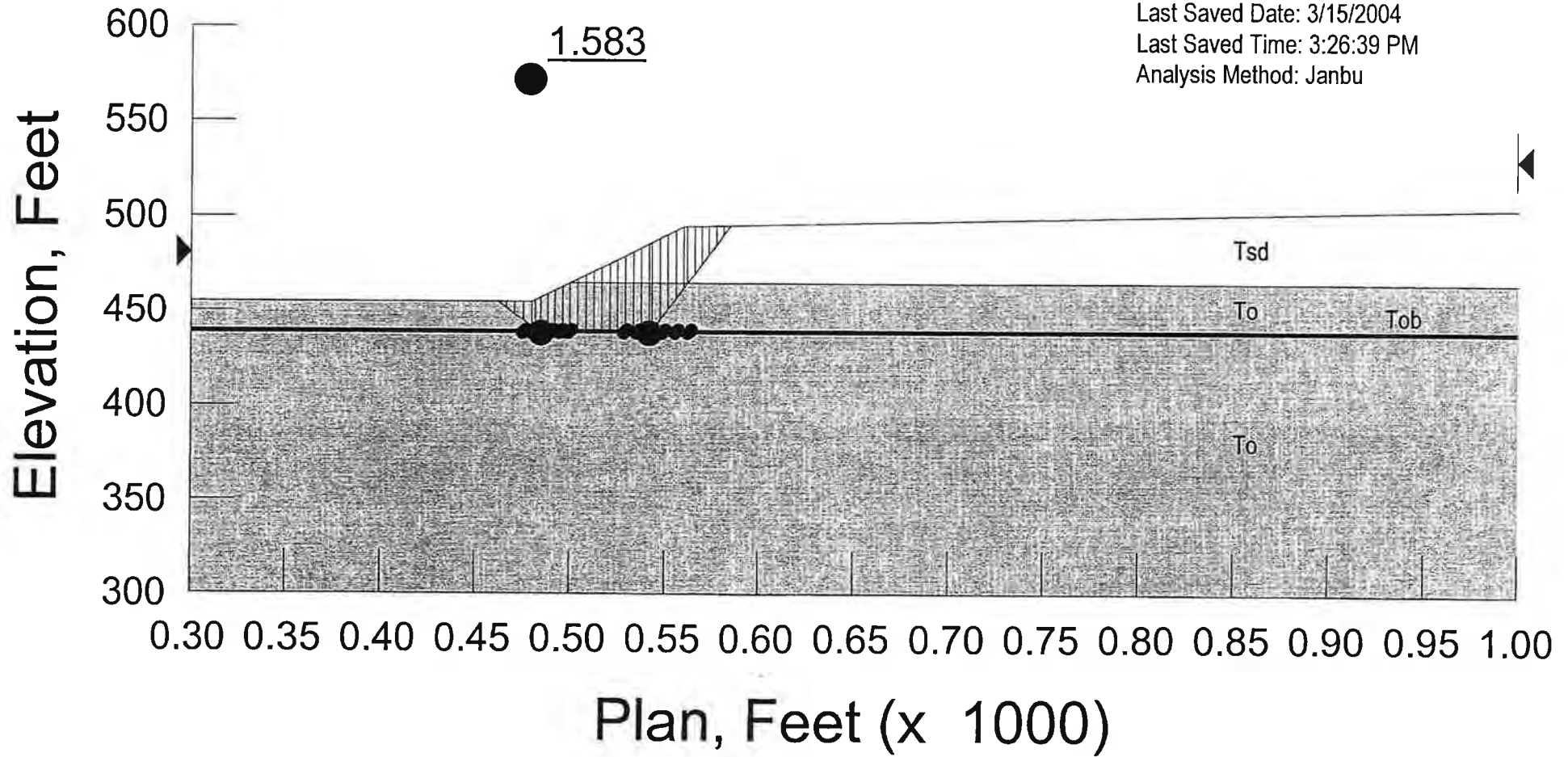
**OTAY RANCH VILLAGE 7, R-2  
AND VILLAGE 4 COMMUNITY PARK  
CHULA VISTA, CALIFORNIA**

FIGURE C-1

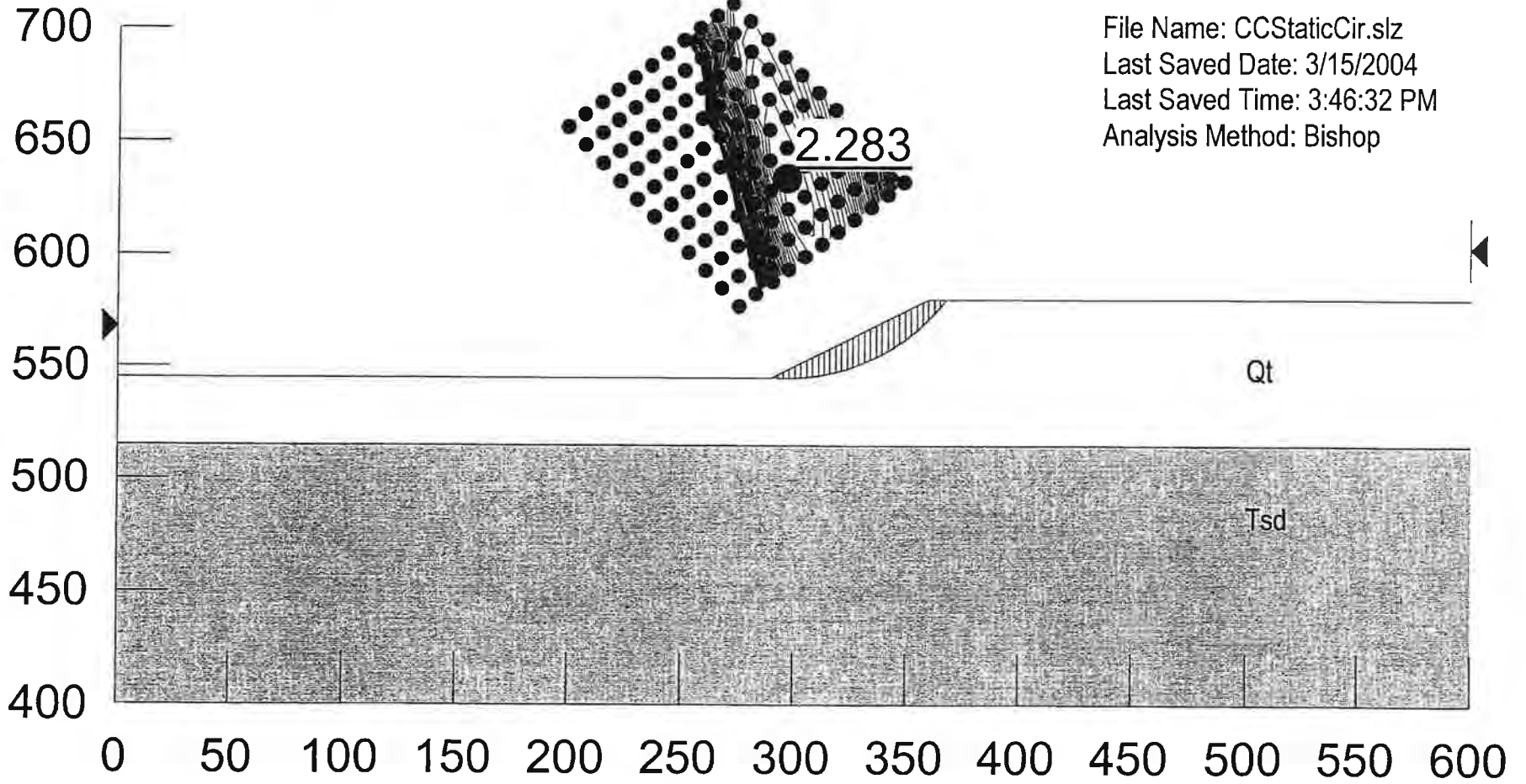


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Section A-A' - Static  
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Analysis Method: Bishop

Otay Ranch Village 7  
Project No. 06862-52-03  
Section A-A' - Static  
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Analysis Method: Janbu



Elevation, Feet

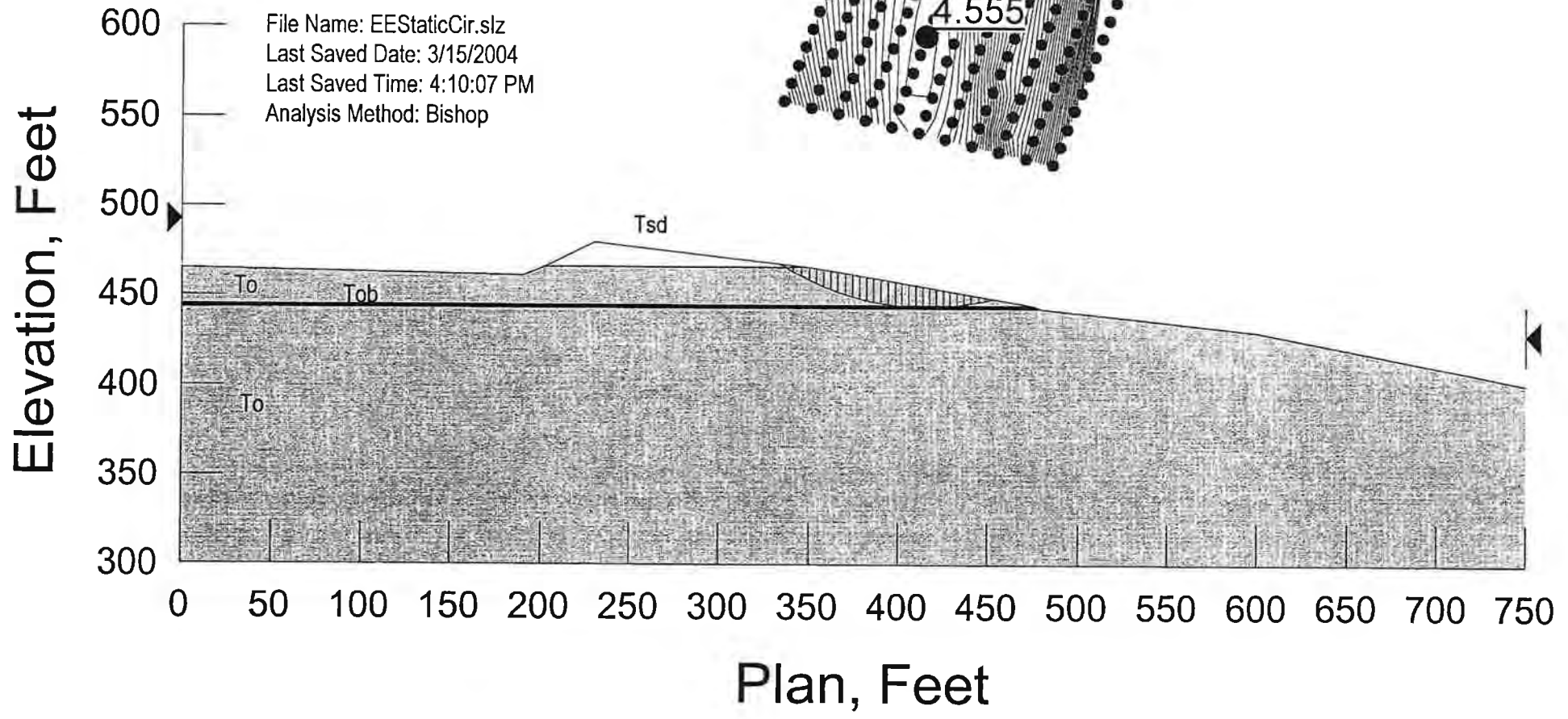


Plan, Feet

Otay Ranch Village 7  
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Section C-C' - Static  
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Analysis Method: Bishop

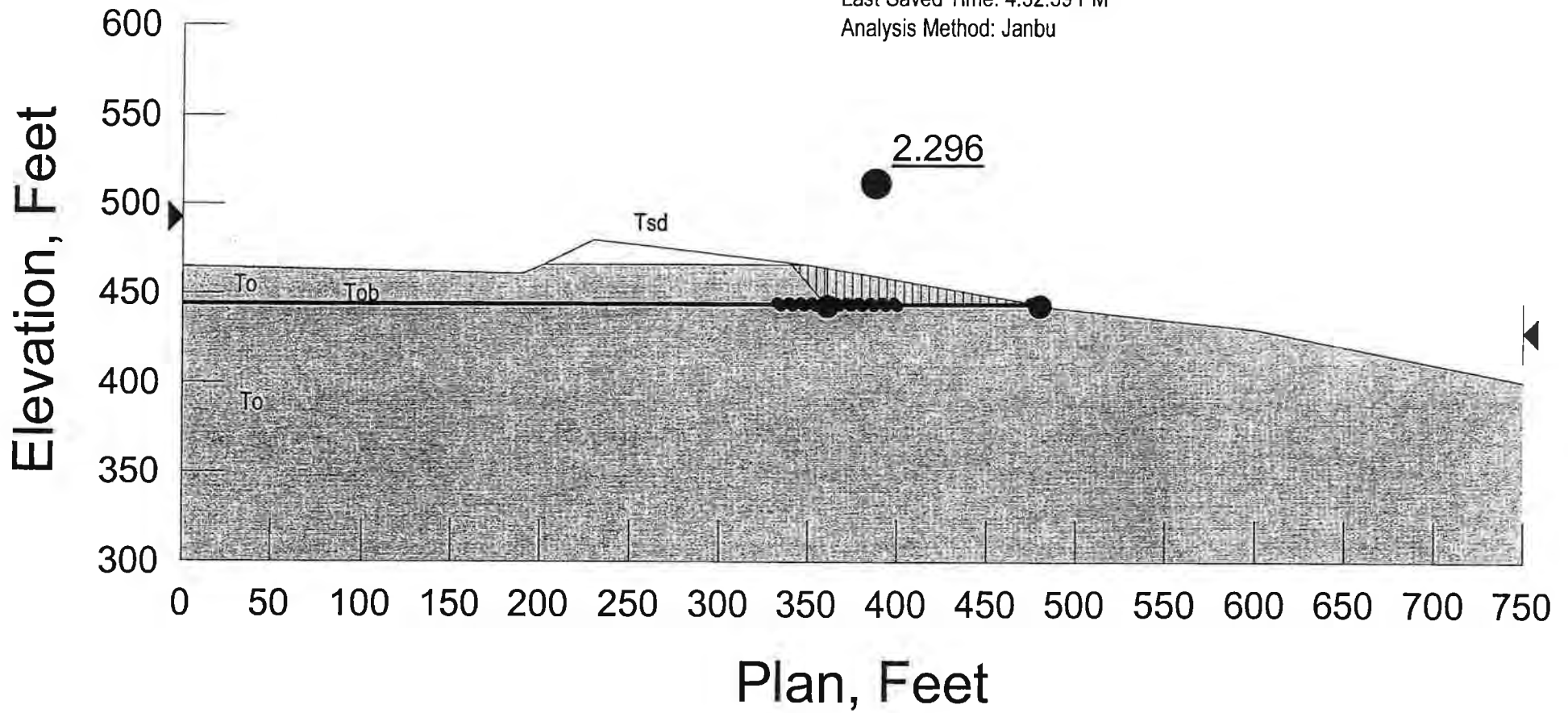
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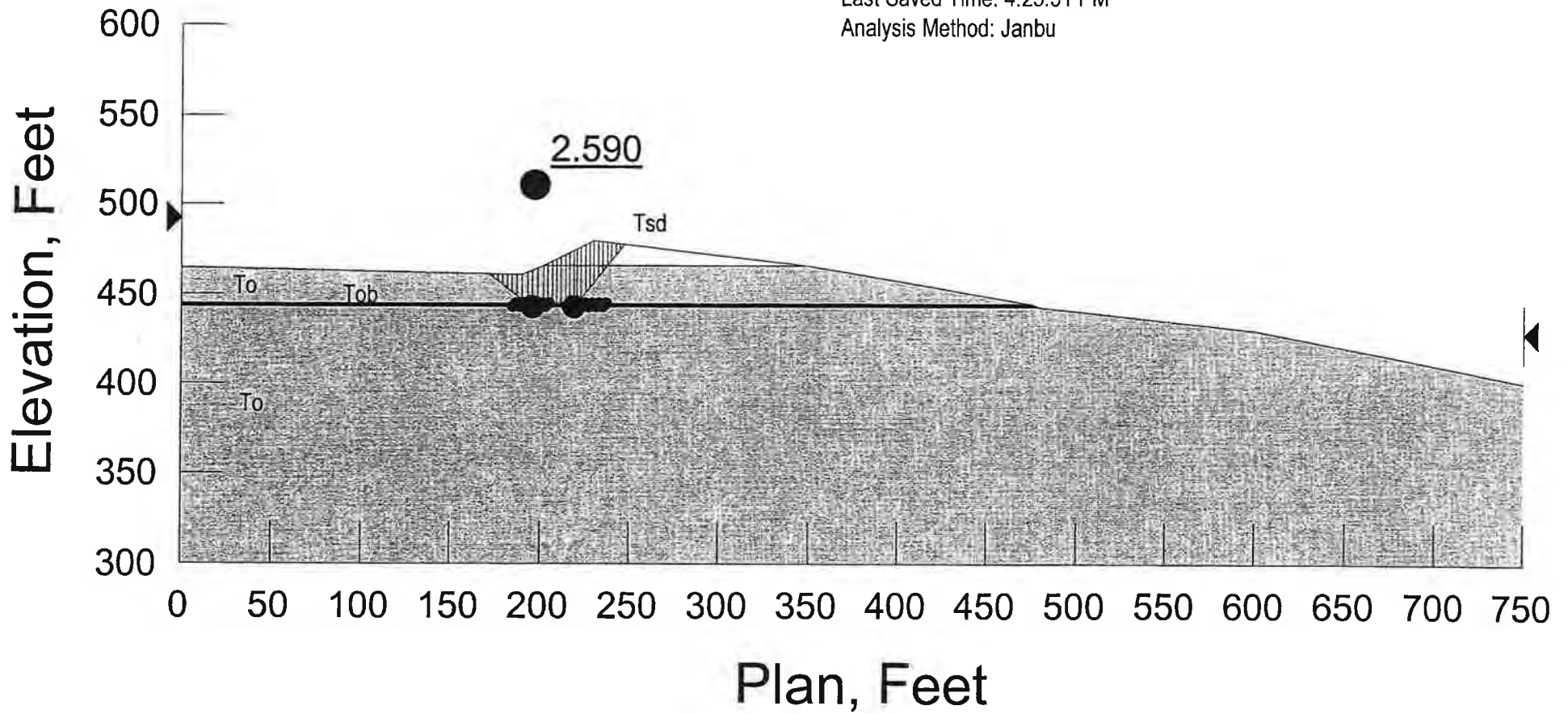
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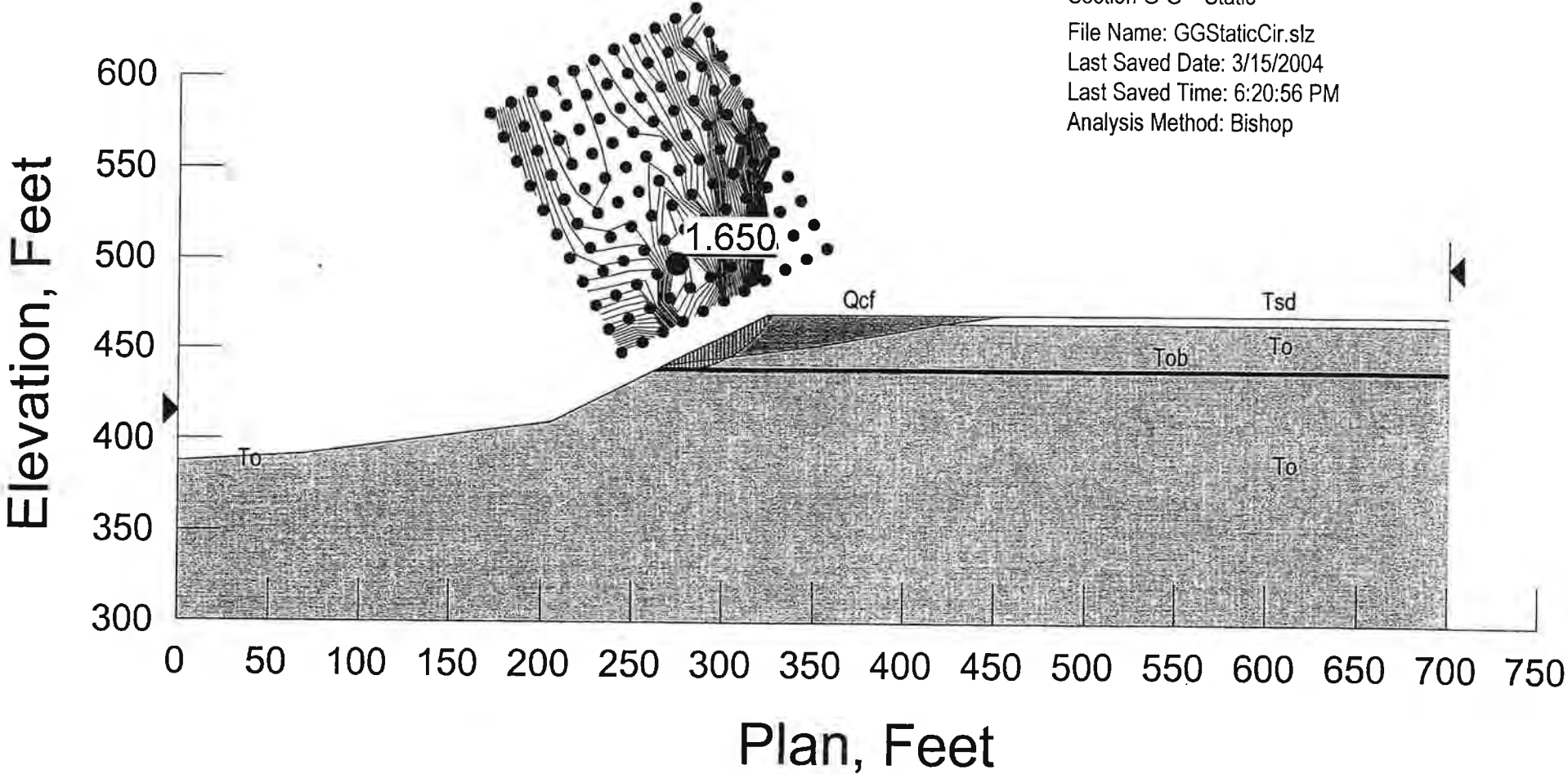




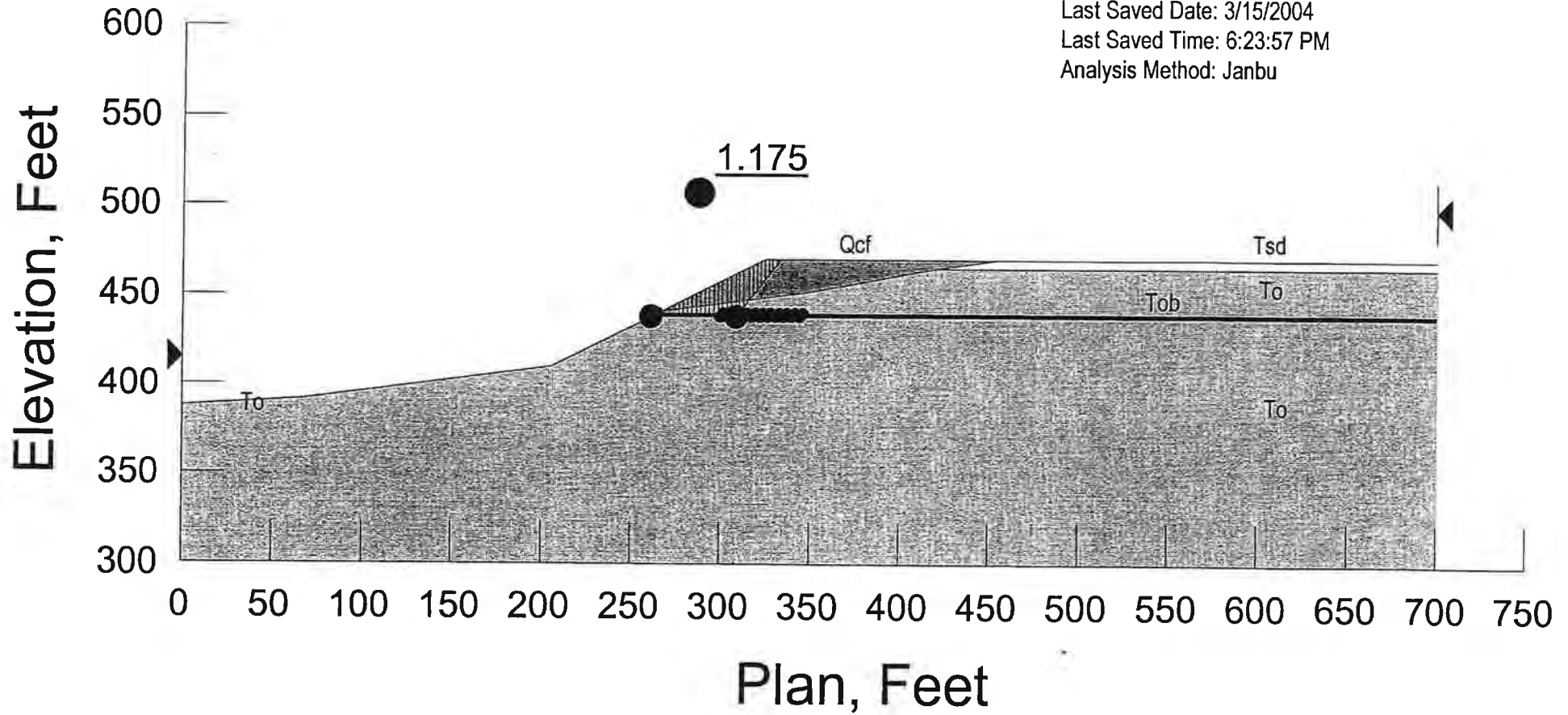
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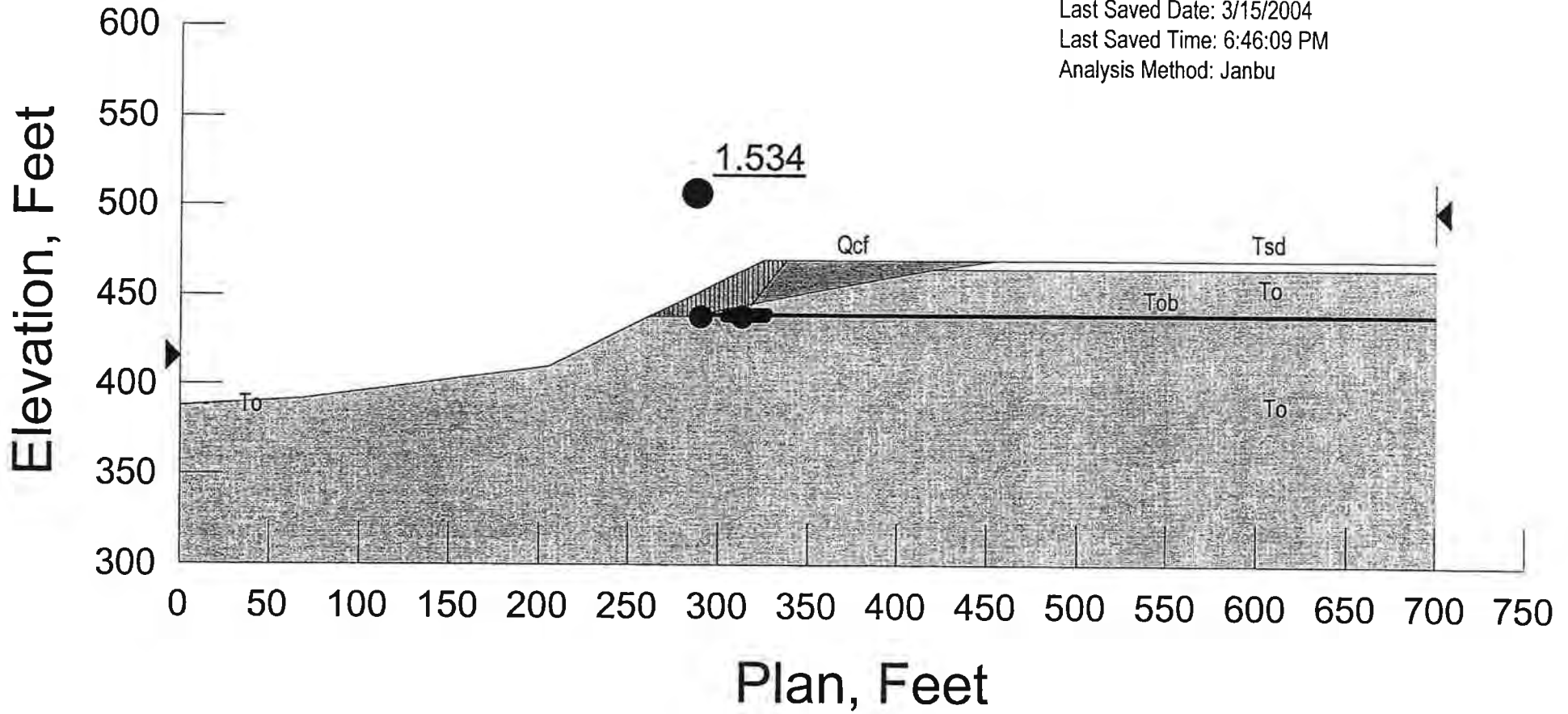
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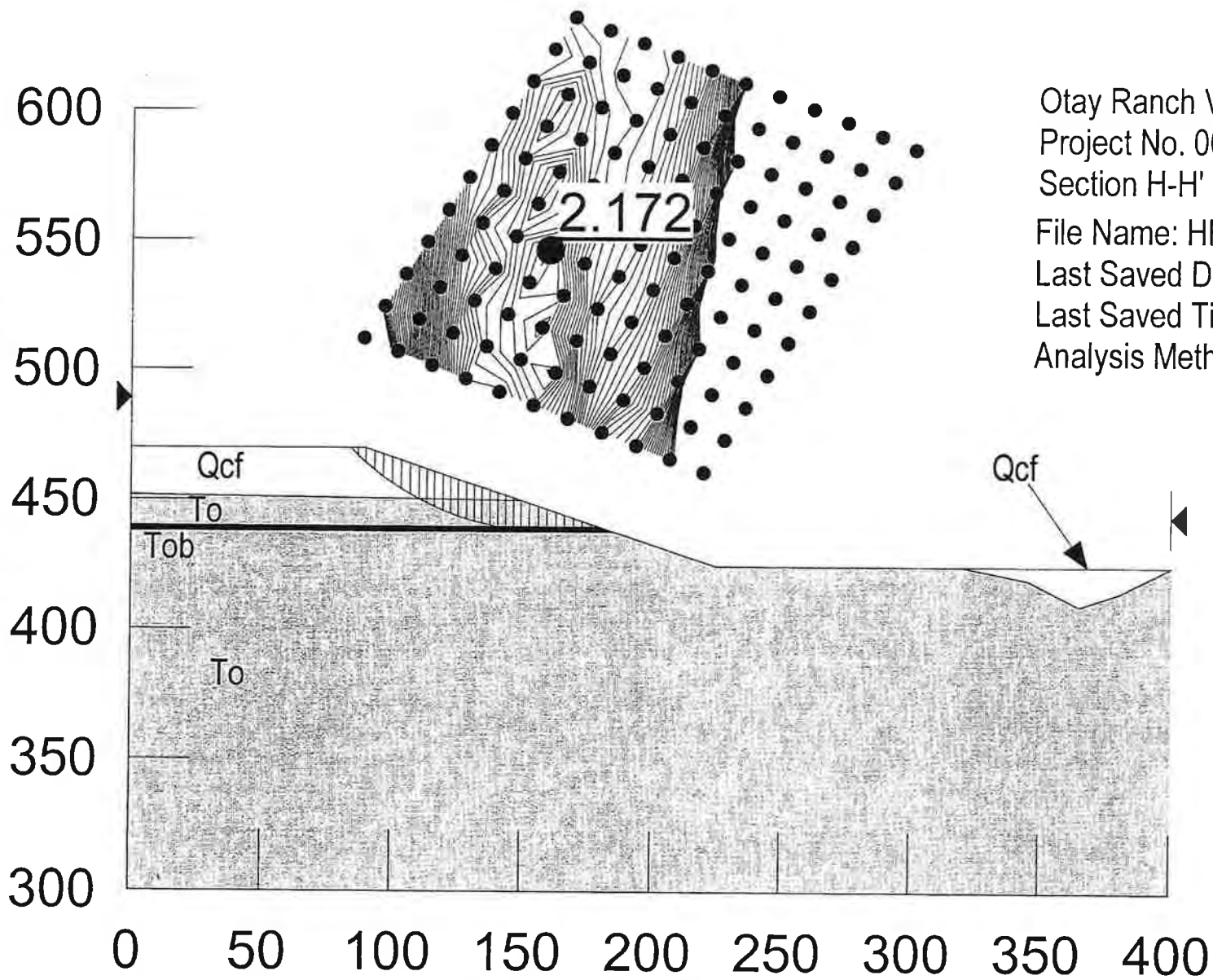
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Section G-G' - Static  
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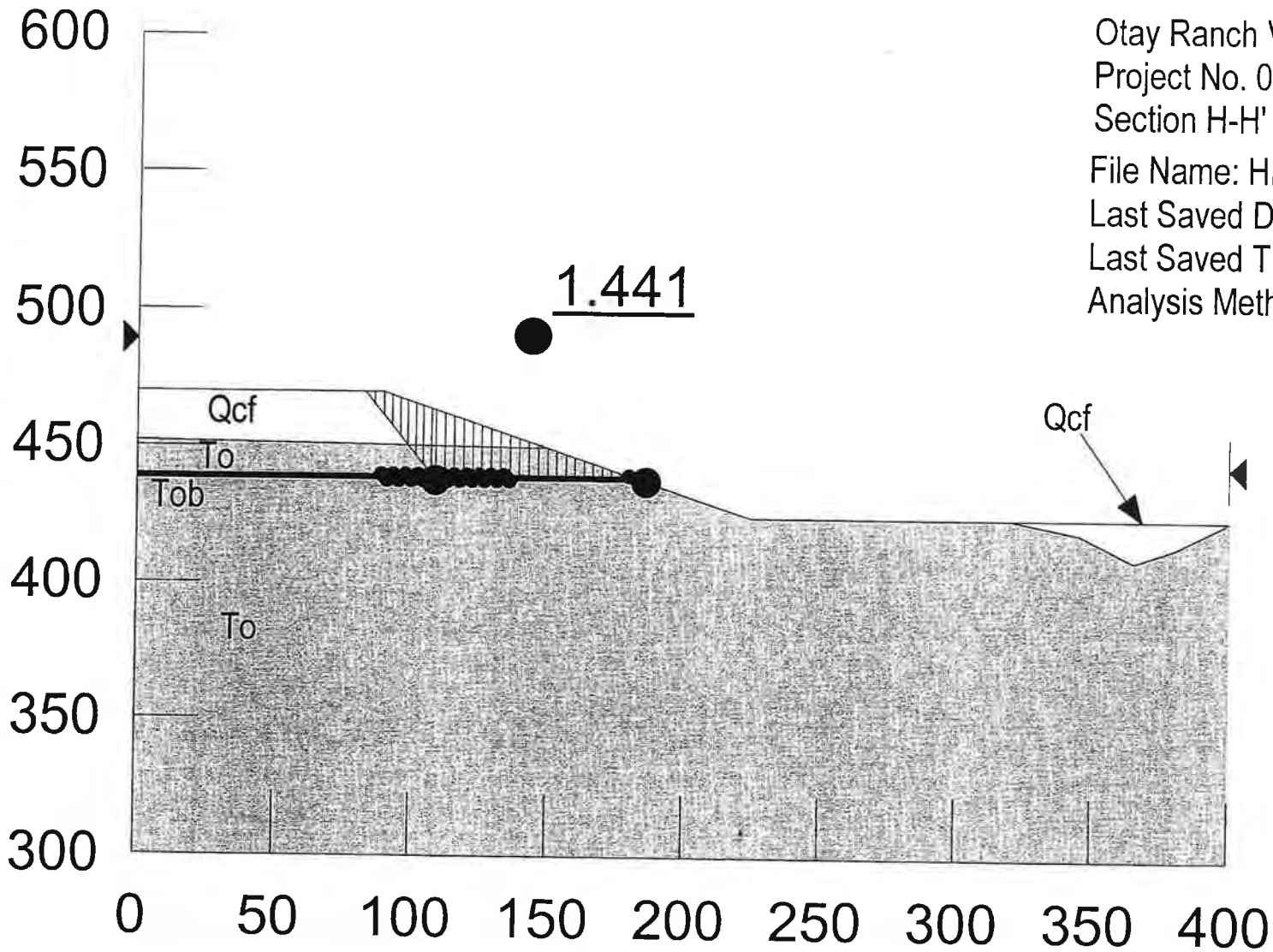
Elevation, Feet



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Analysis Method: Bishop

Plan, Feet

Elevation, Feet

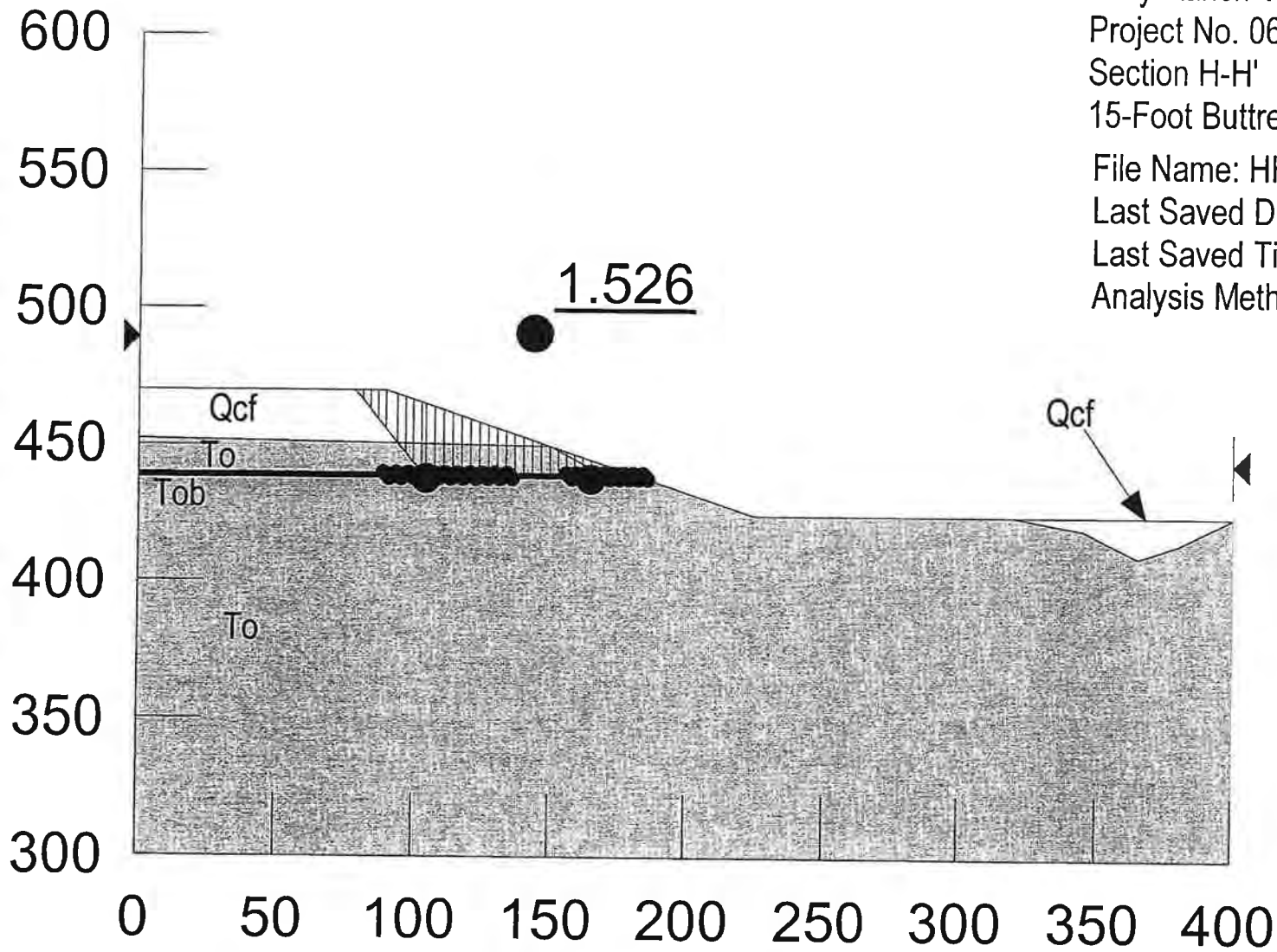


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Plan, Feet



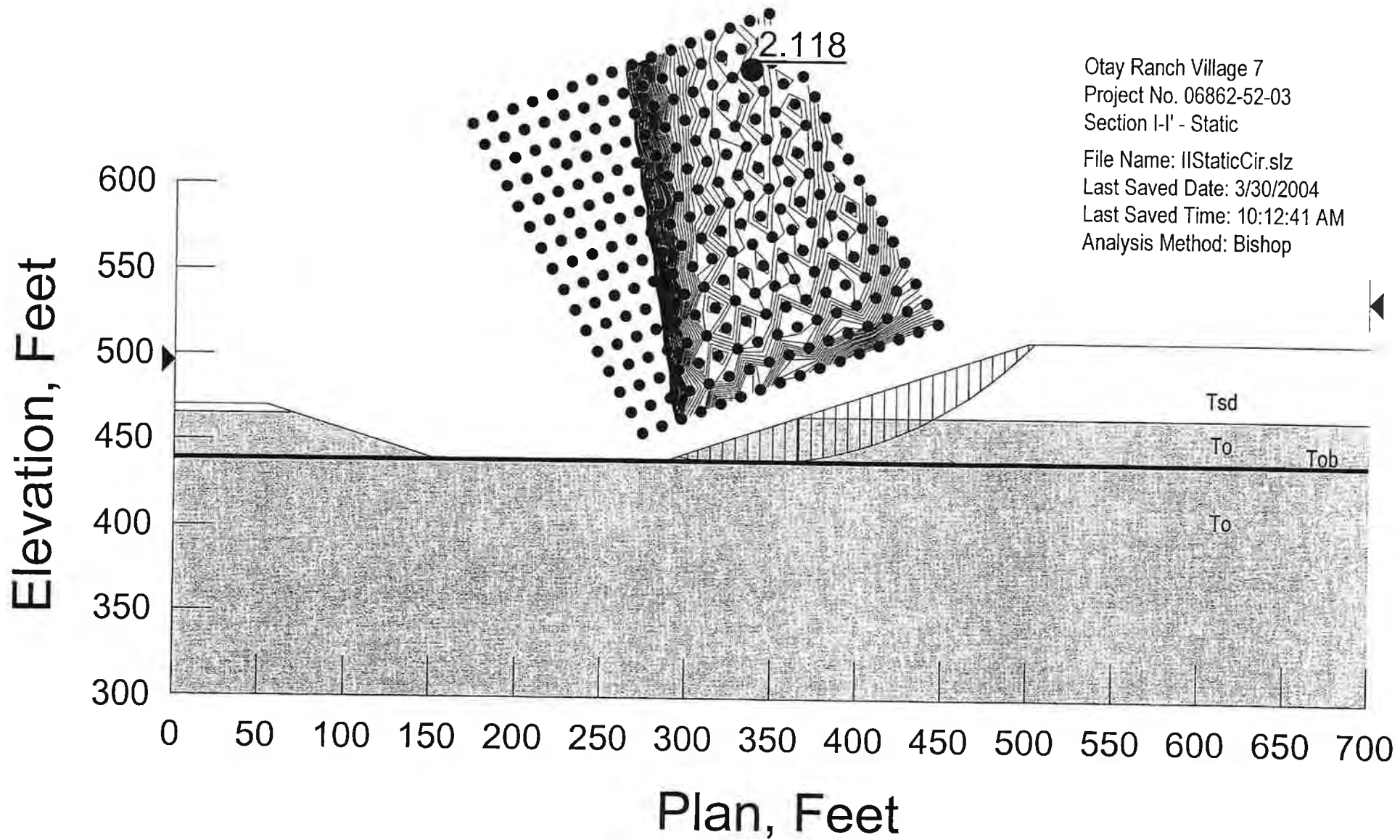
Elevation, Feet



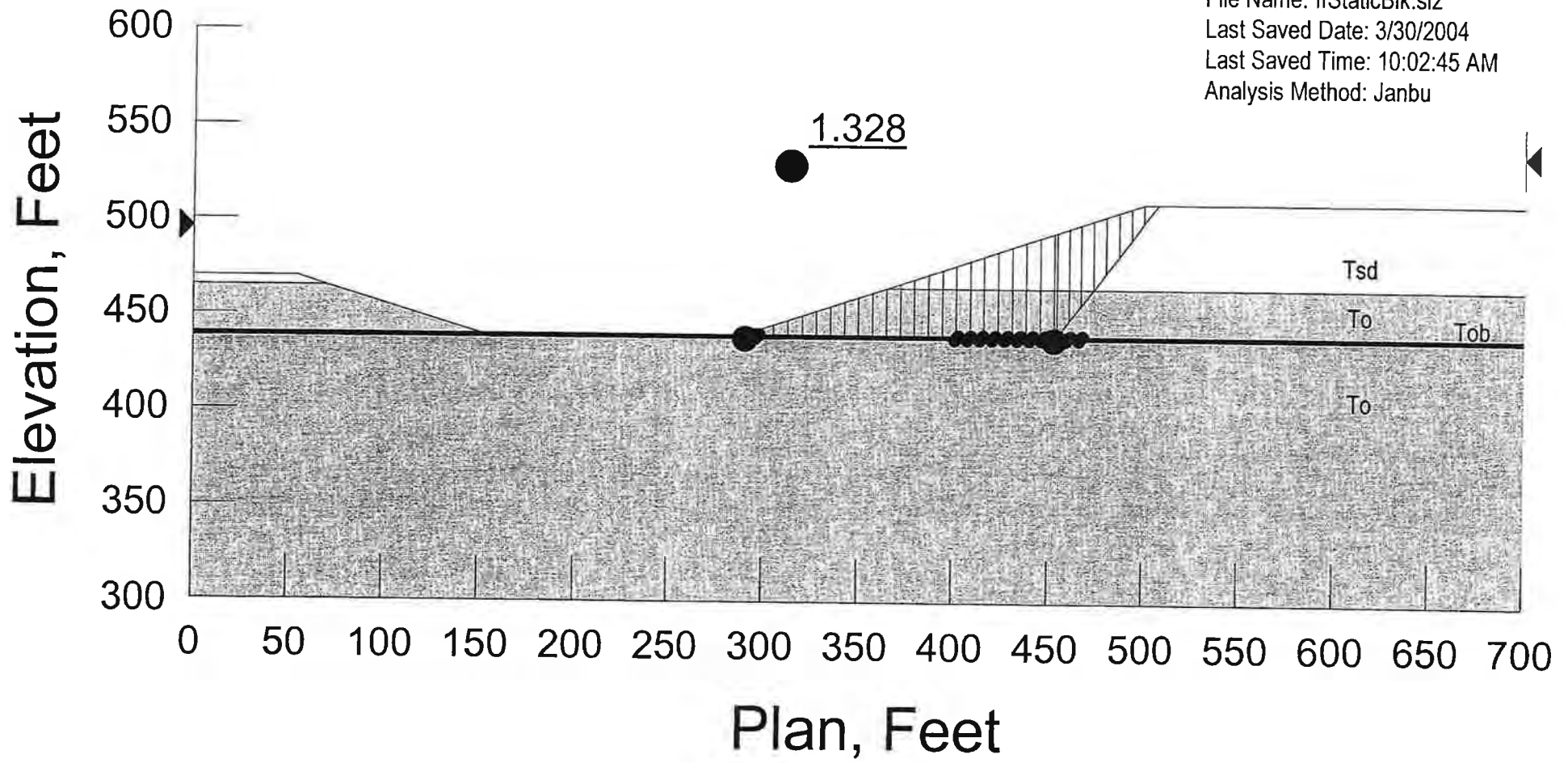
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Section H-H'  
15-Foot Buttress  
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Analysis Method: Janbu

Plan, Feet



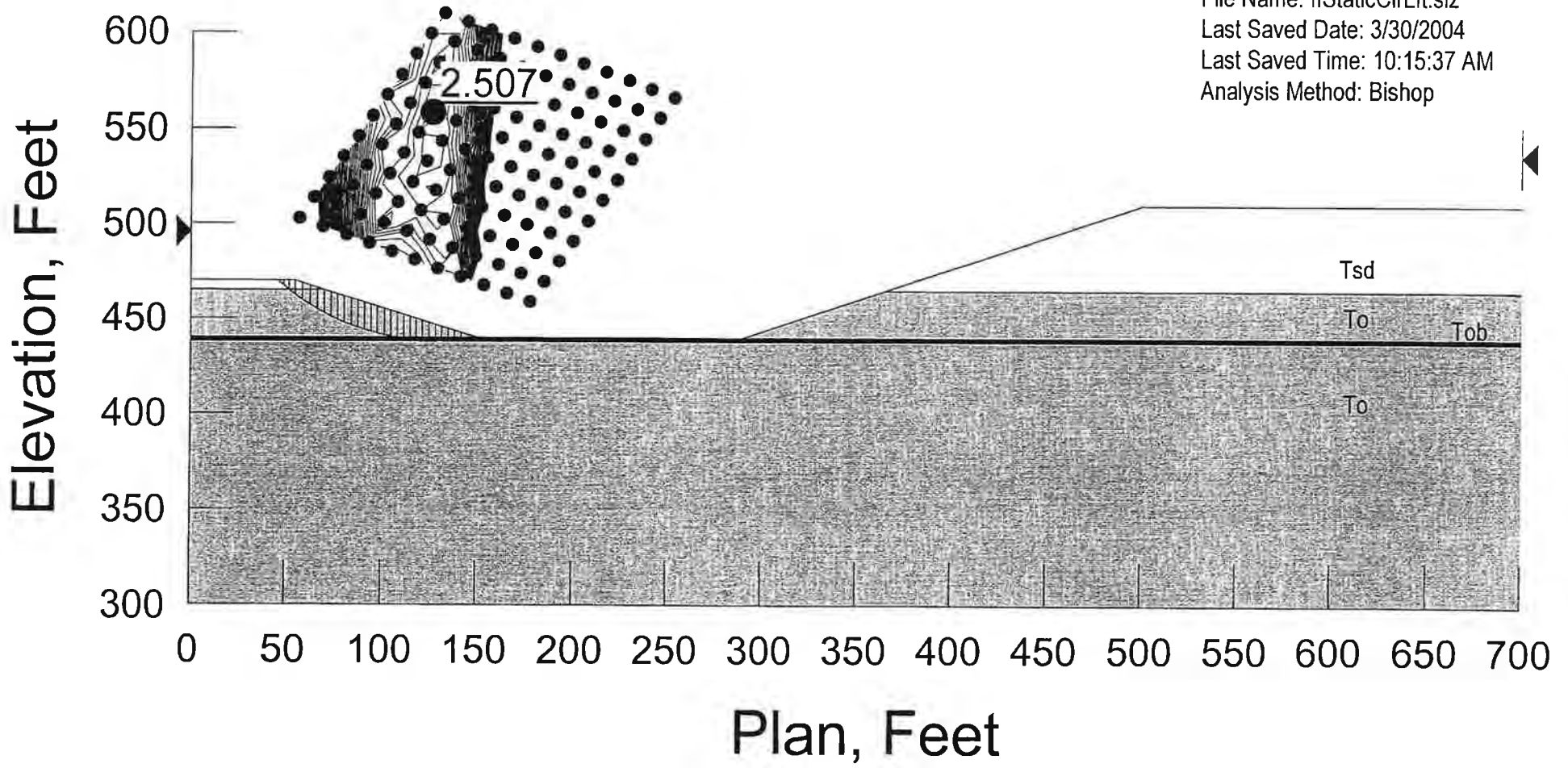


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Section I-I' - Static  
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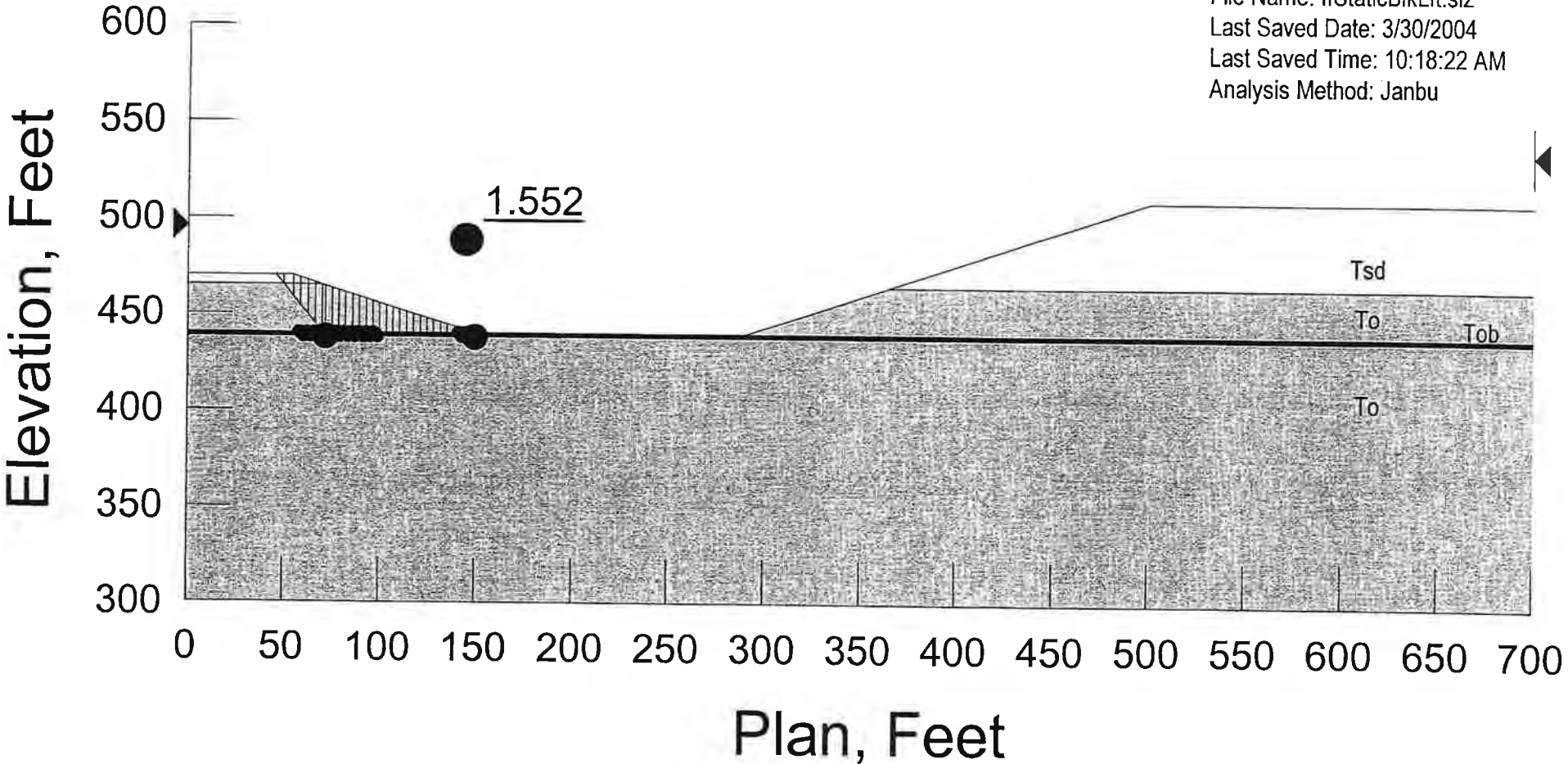




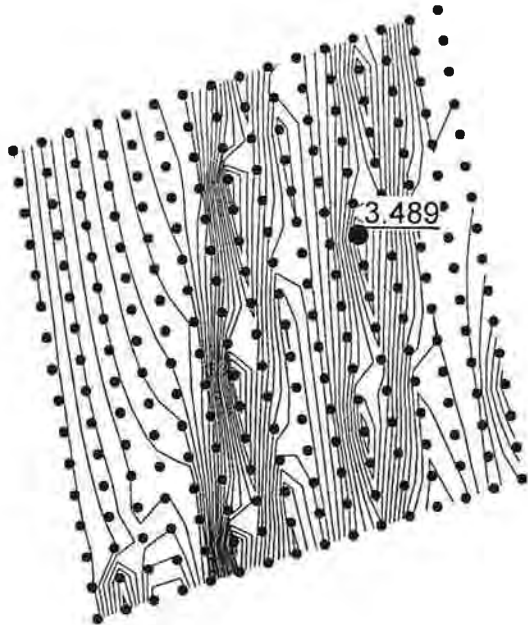
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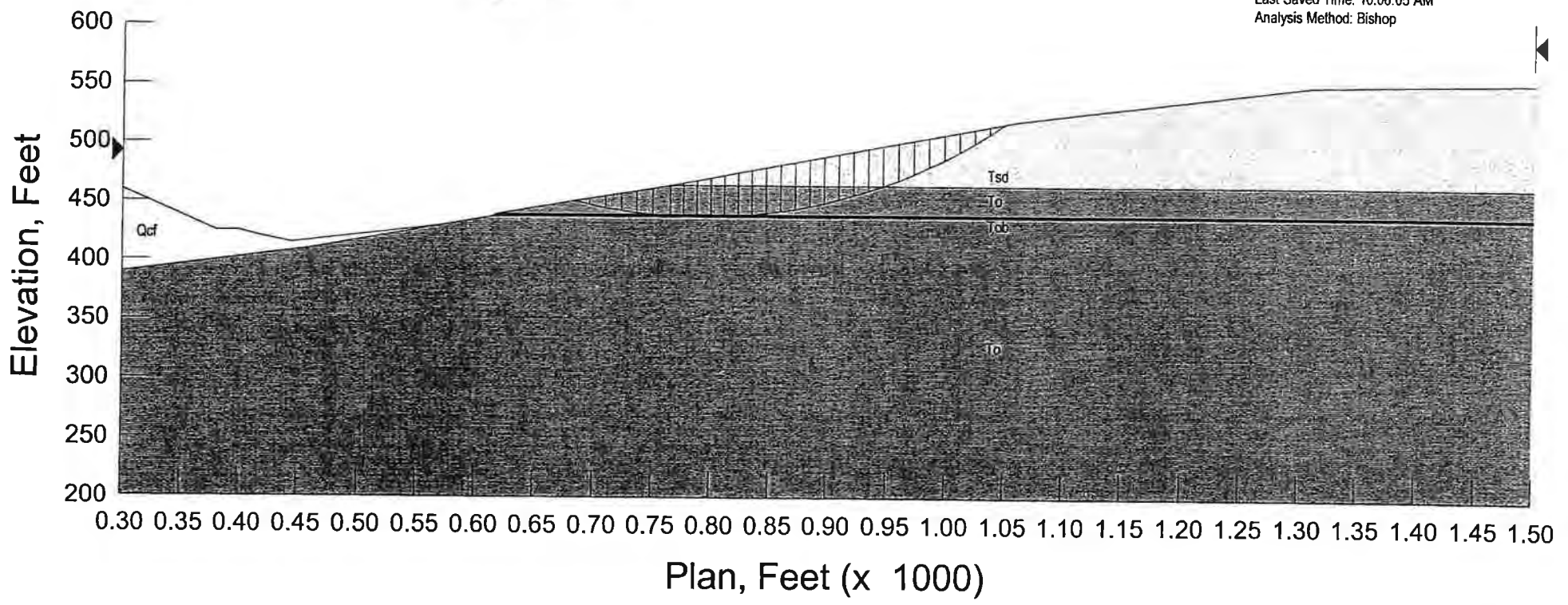
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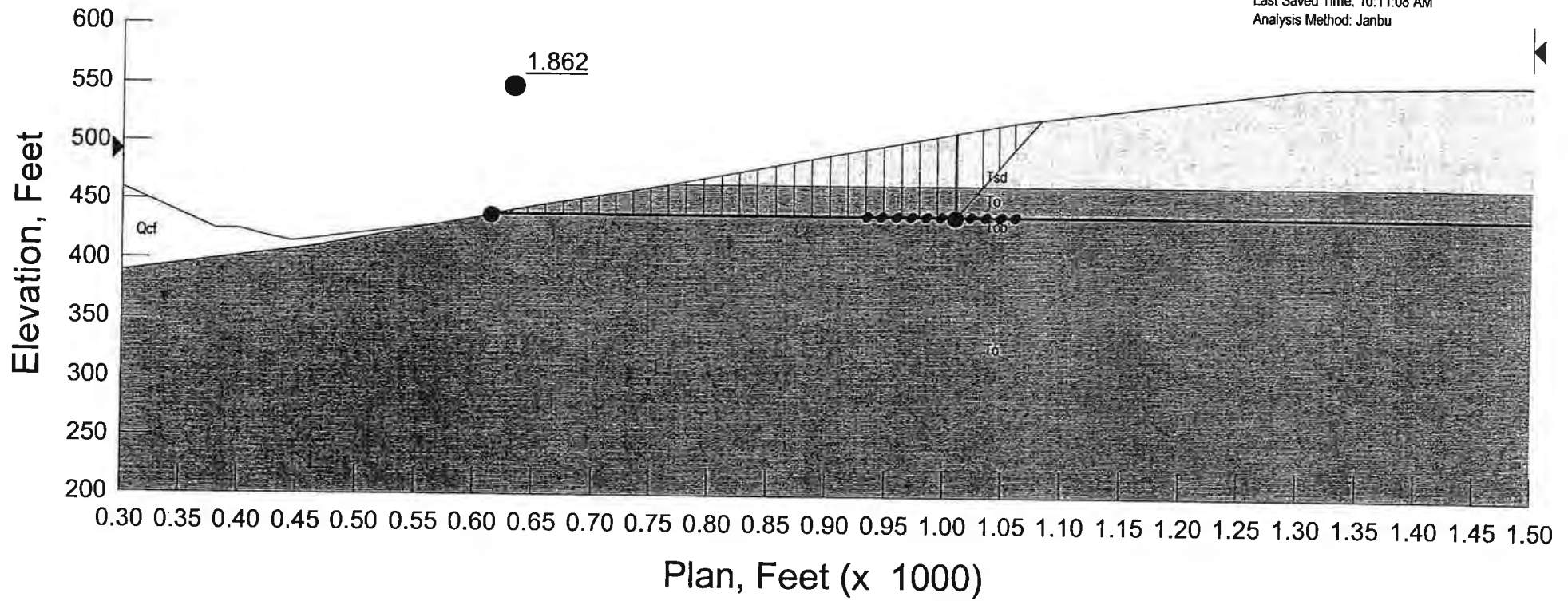


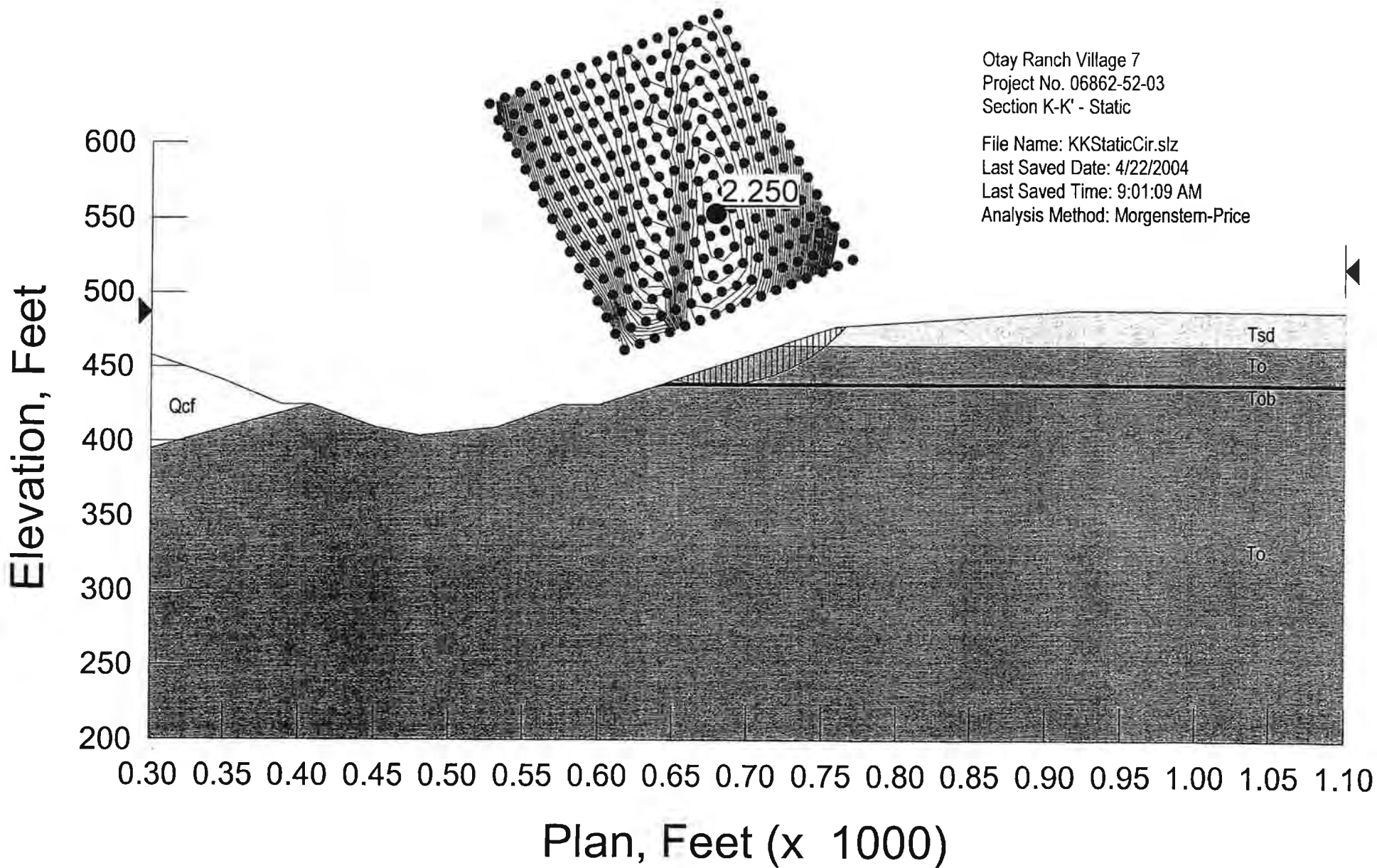


Otay Ranch Village 7  
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 Section J-J' - Static  
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 Last Saved Time: 10:06:05 AM  
 Analysis Method: Bishop



Otay Ranch Village 7  
Project No. 06862-52-03  
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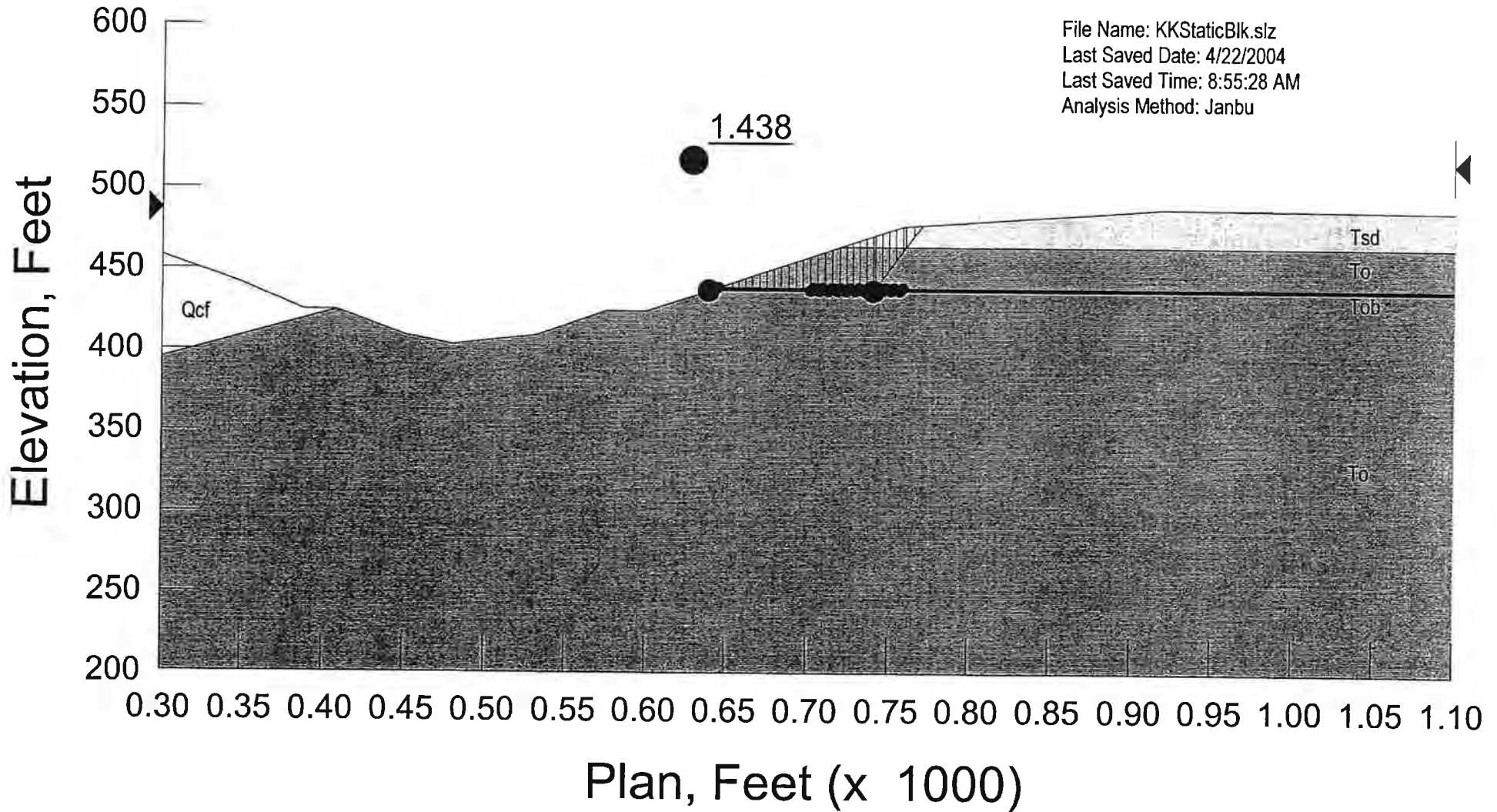






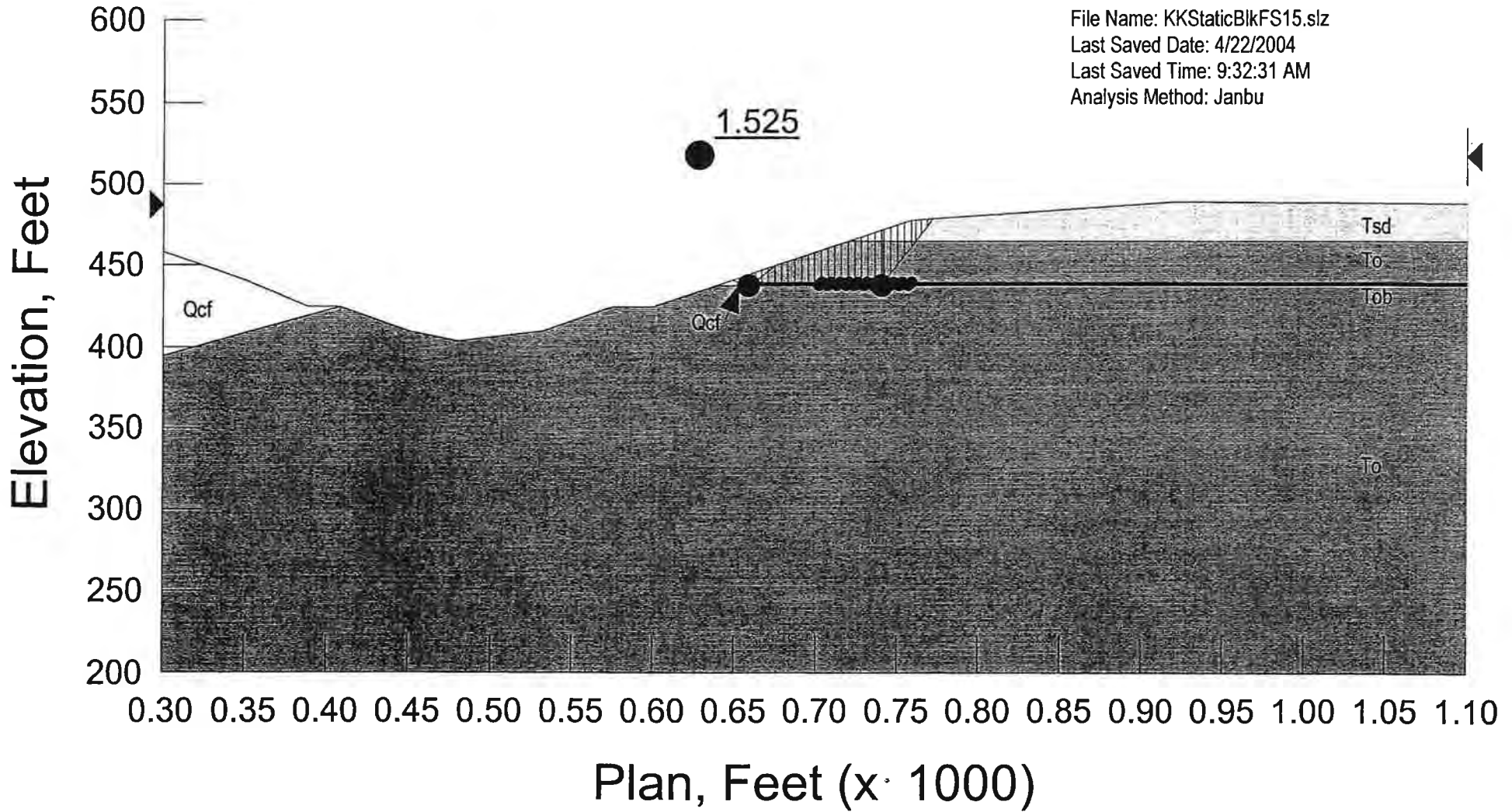
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Section K-K' - Static

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Analysis Method: Janbu



Otay Ranch Village 7  
Project No. 06862-52-03  
Section K-K' - Static  
20-Foot Buttruss

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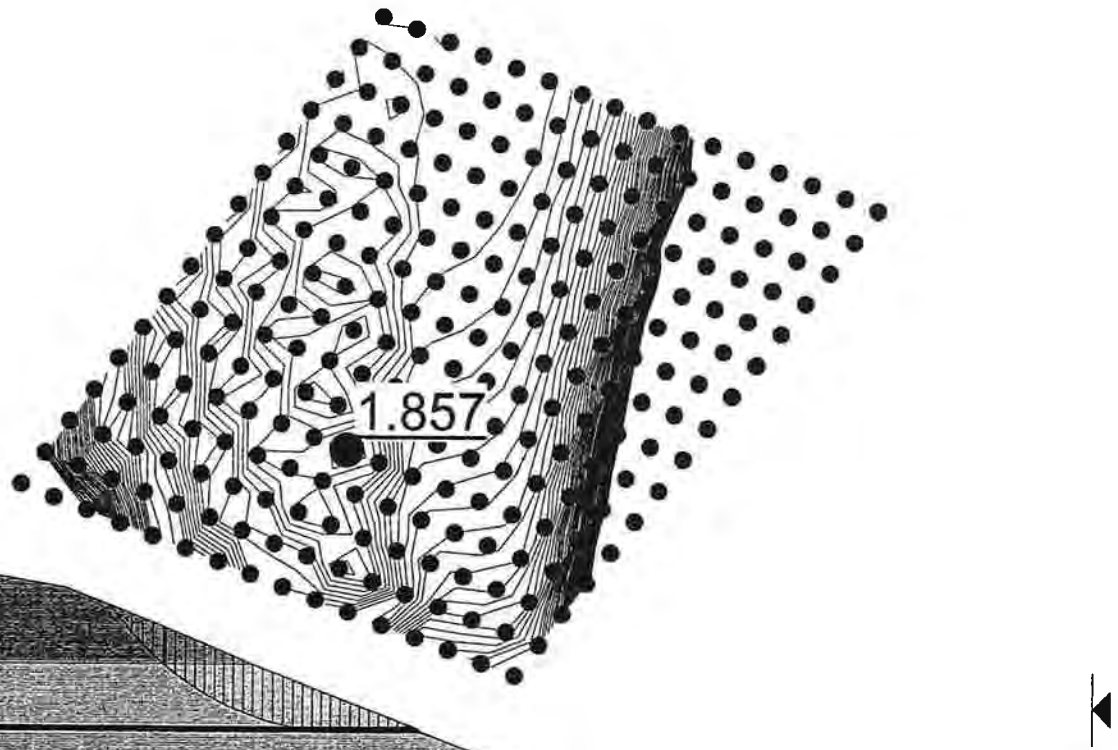
Elevation, Feet

600  
550  
500  
450  
400  
350  
300

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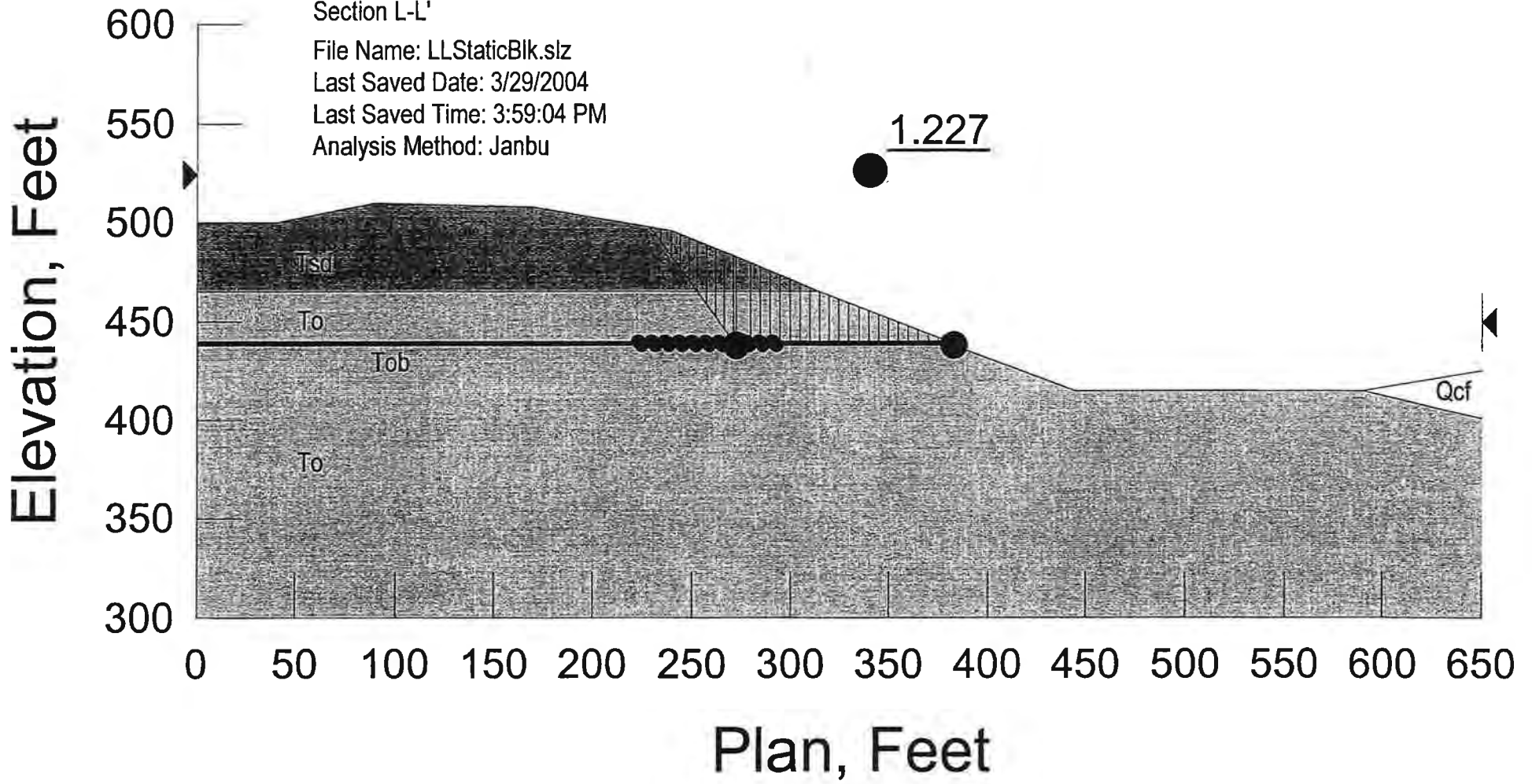
Plan, Feet

Otay Ranch Village 7  
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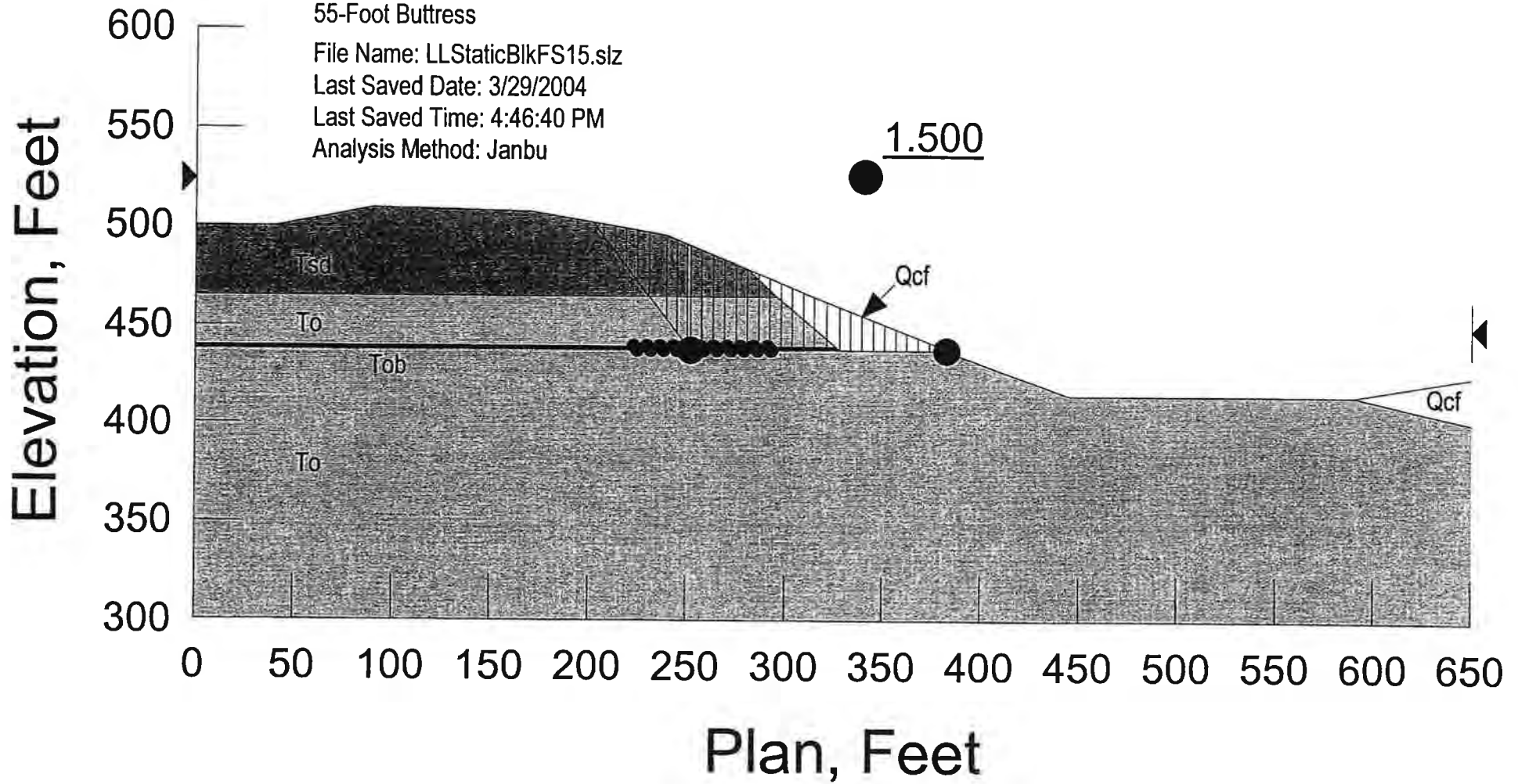


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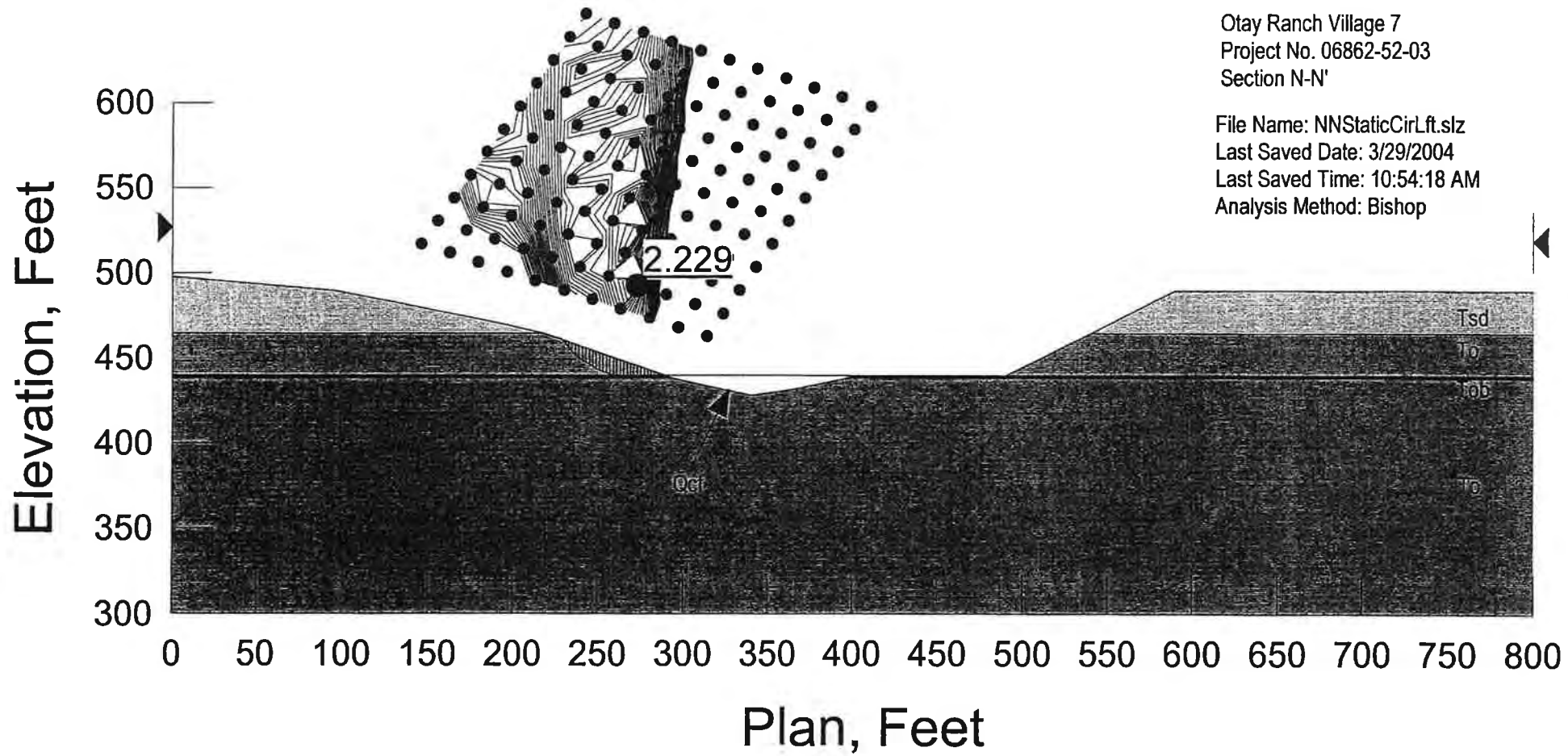
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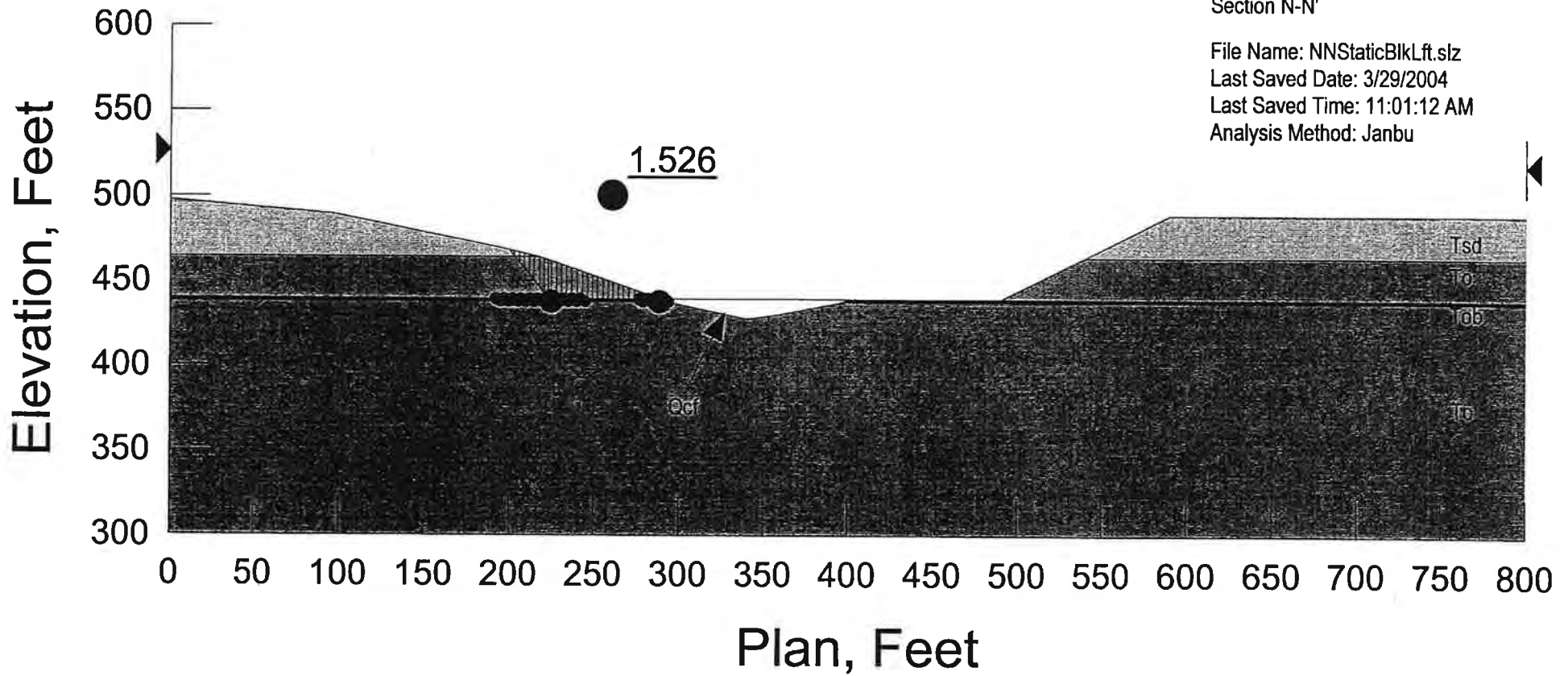






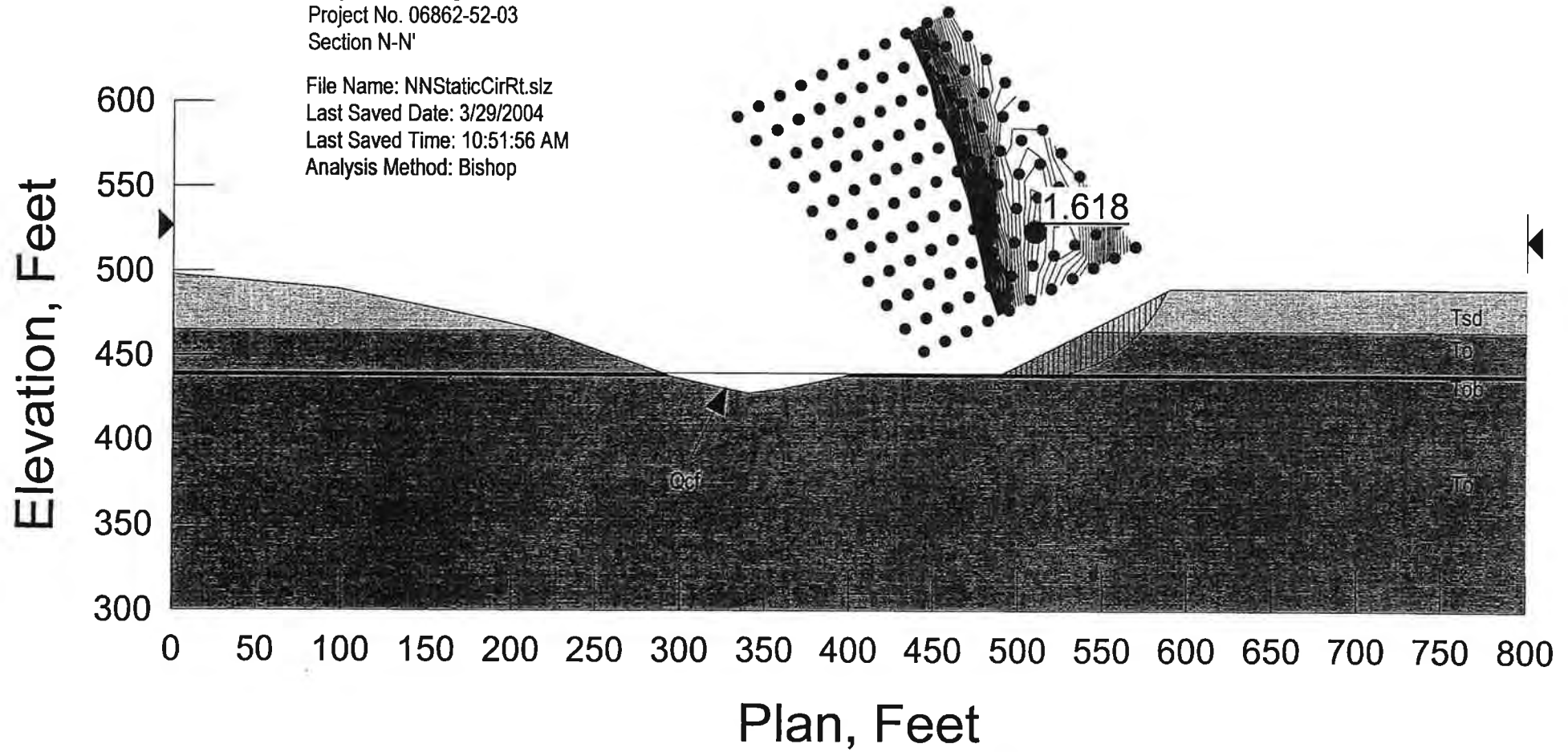
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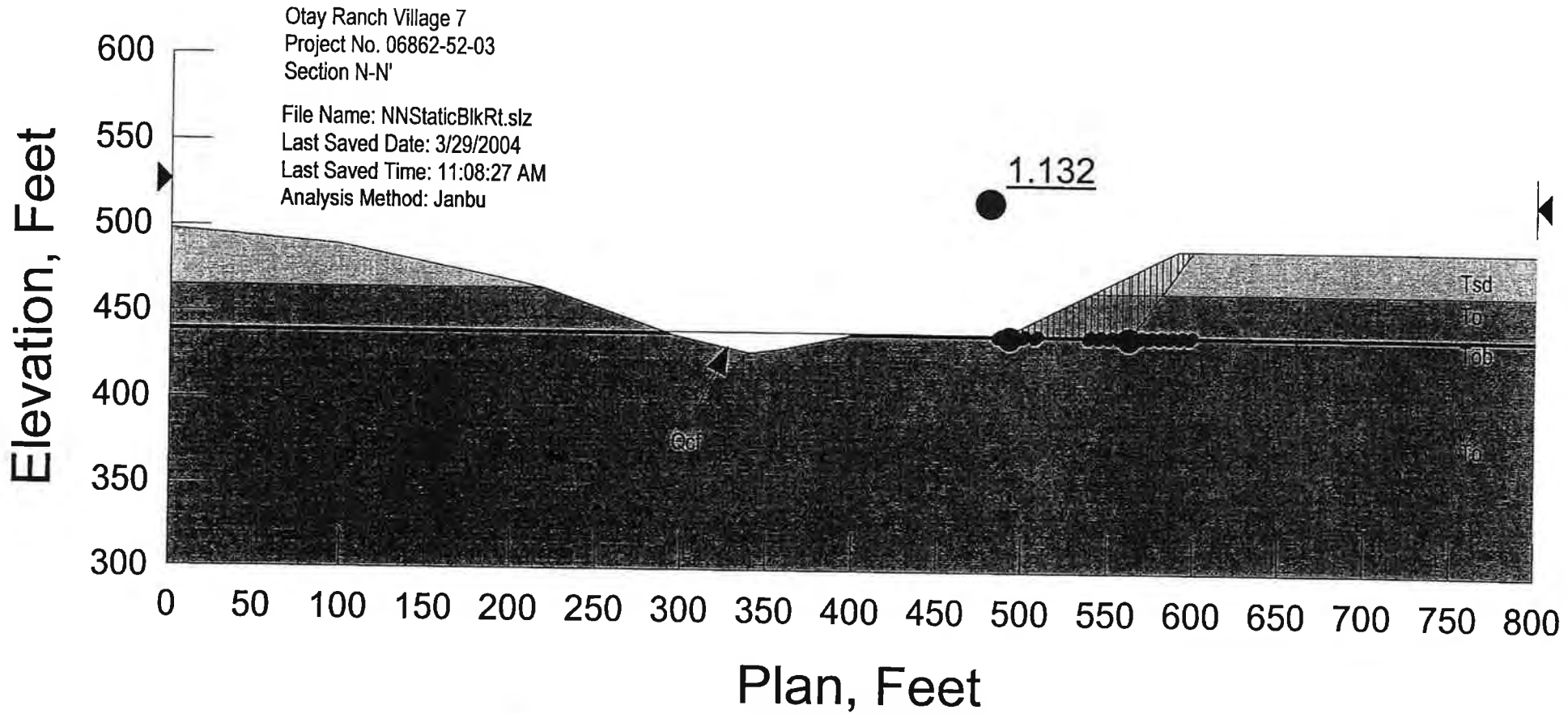


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Section N-N'

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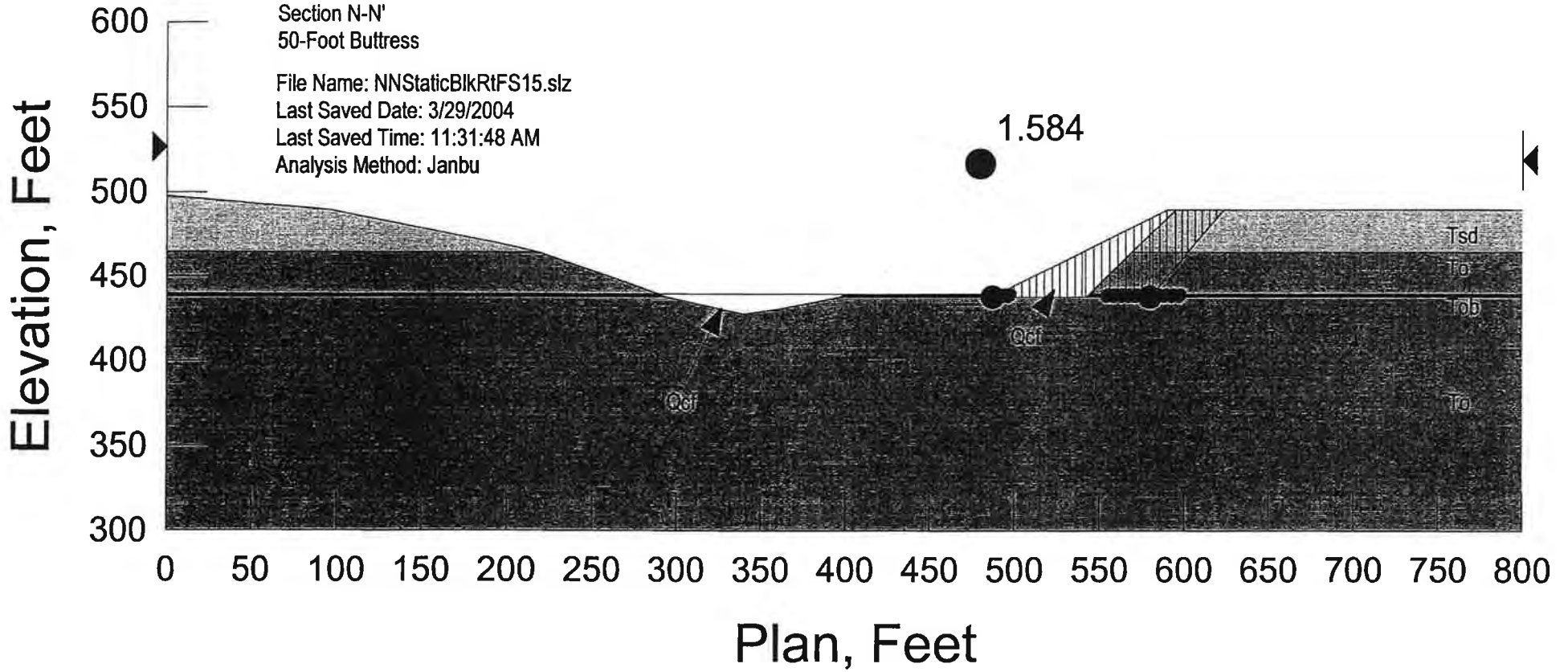






Otay Ranch Village 7  
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Section N-N'  
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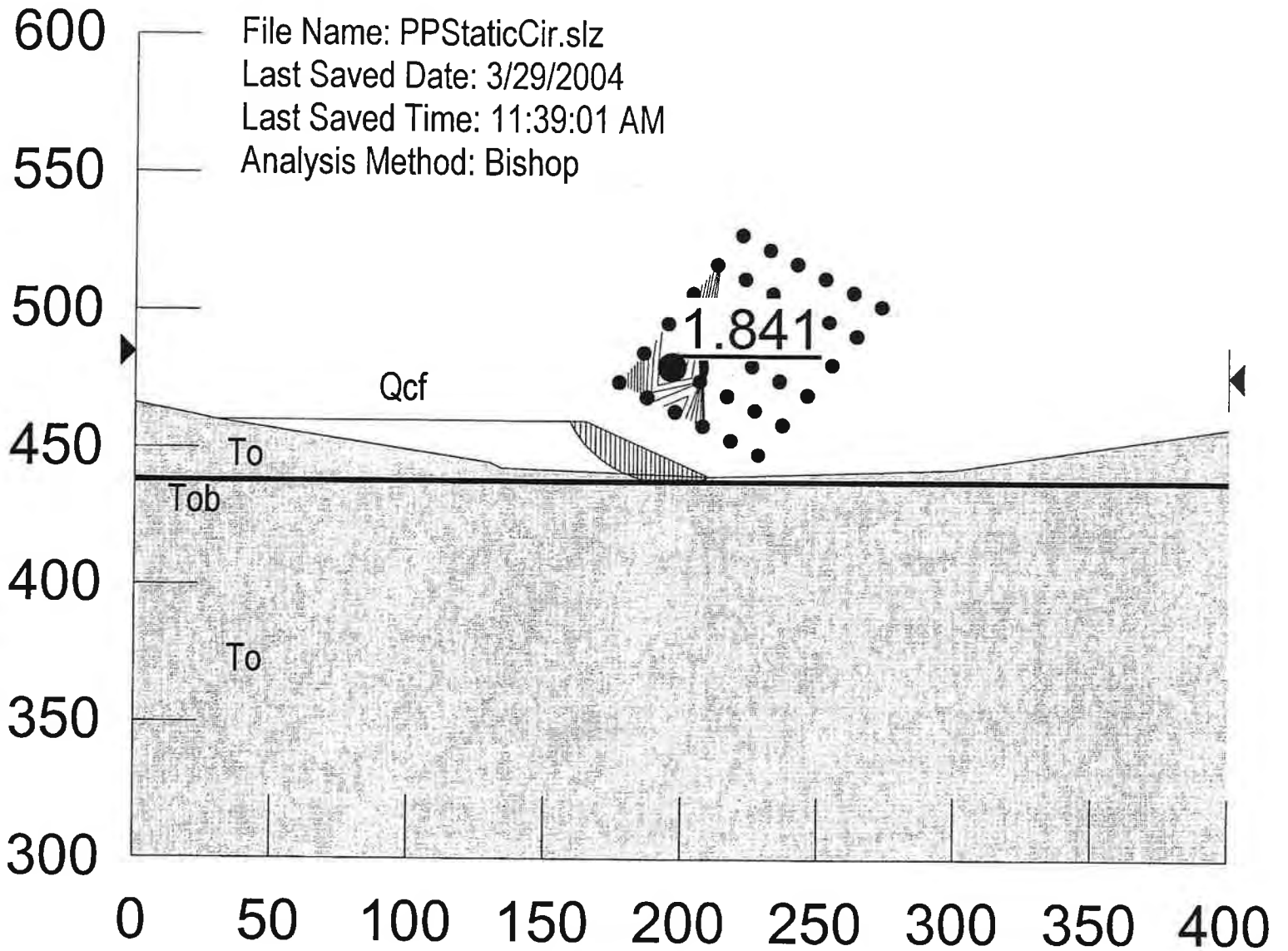
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Section P-P'

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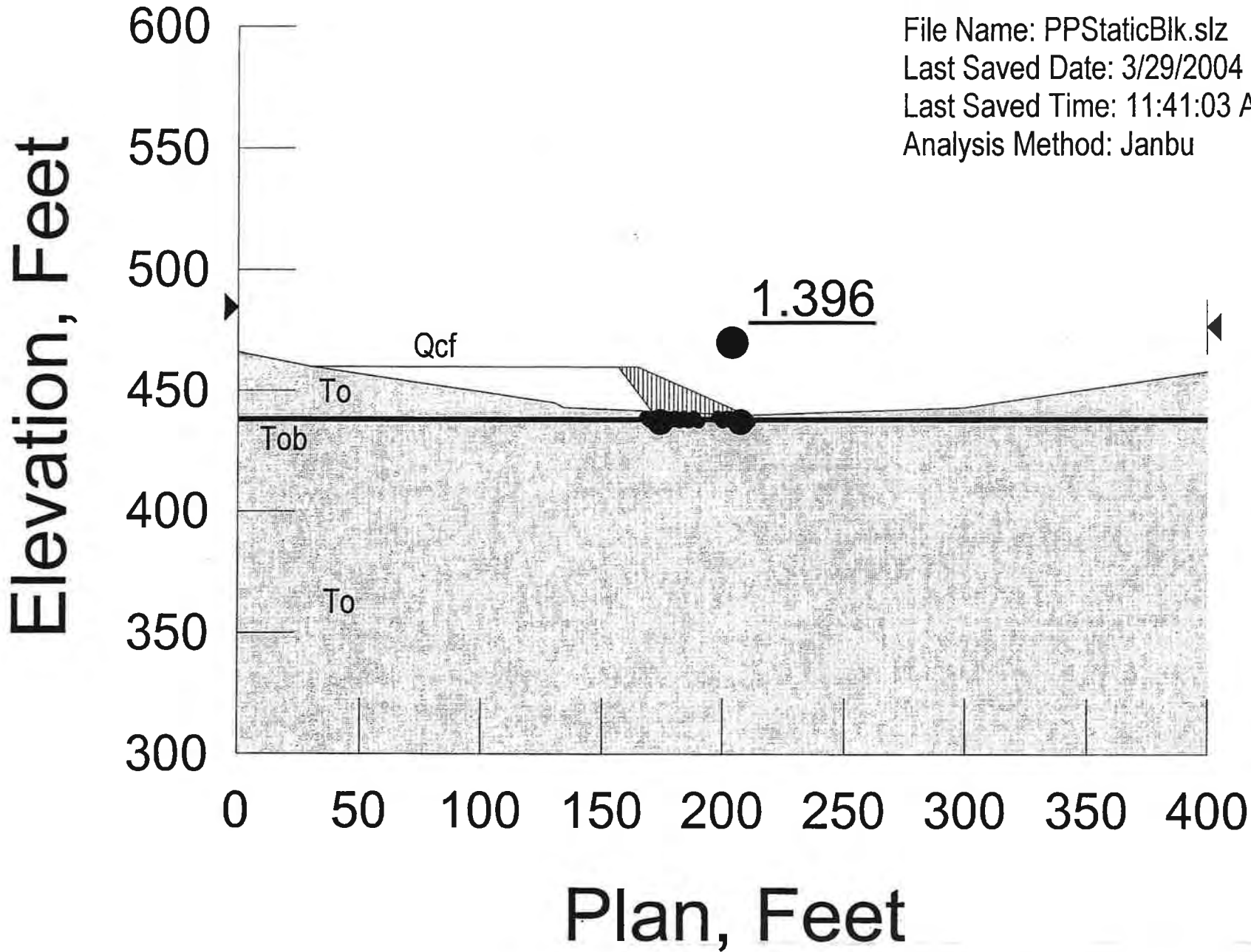
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Plan, Feet

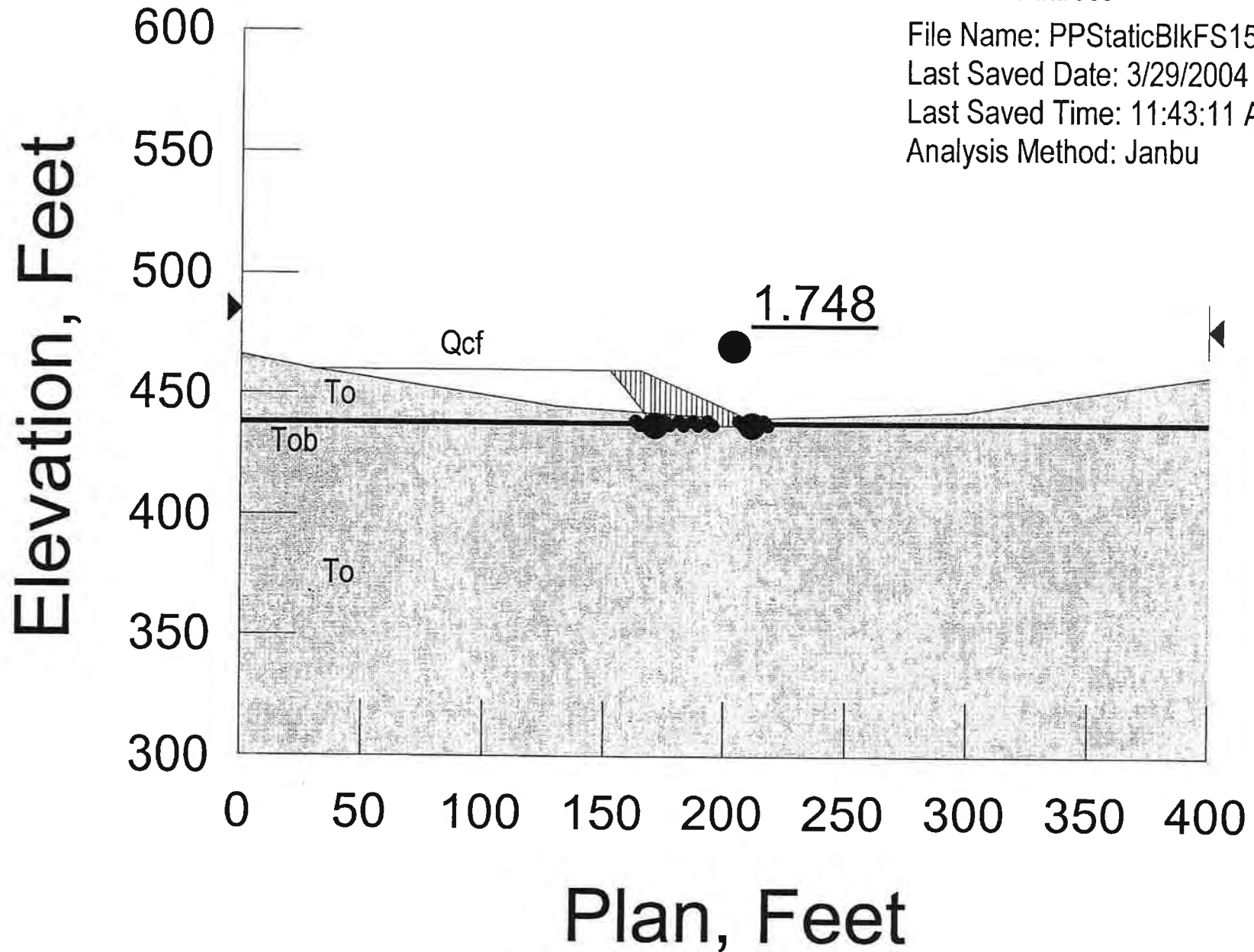
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Section P-P'

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Otay Ranch Village 7  
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Section P-P'  
15-Foot Buttress

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APPENDIX

D

**APPENDIX D**

**RECOMMENDED GRADING SPECIFICATIONS**

**FOR**

**OTAY RANCH VILLAGE 7, R-2  
AND VILLAGE 4 COMMUNITY PARK  
CHULA VISTA, CALIFORNIA**

**PROJECT NO. 06862-52-03**

## RECOMMENDED GRADING SPECIFICATIONS

### 1. GENERAL

- 1.1. These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon Incorporated. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.
- 1.2. Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. It will be necessary that the Consultant provide adequate testing and observation services so that he may determine that, in his opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep him apprised of work schedules and changes so that personnel may be scheduled accordingly.
- 1.3. It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, adverse weather, and so forth, result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that construction be stopped until the unacceptable conditions are corrected.

### 2. DEFINITIONS

- 2.1. **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.
- 2.2. **Contractor** shall refer to the Contractor performing the site grading work.
- 2.3. **Civil Engineer or Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.



- 2.4. **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.
- 2.5. **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.
- 2.6. **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.
- 2.7. **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

### 3. MATERIALS

- 3.1. Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.
  - 3.1.1. **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than 3/4 inch in size.
  - 3.1.2. **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.
  - 3.1.3. **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than 3/4 inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

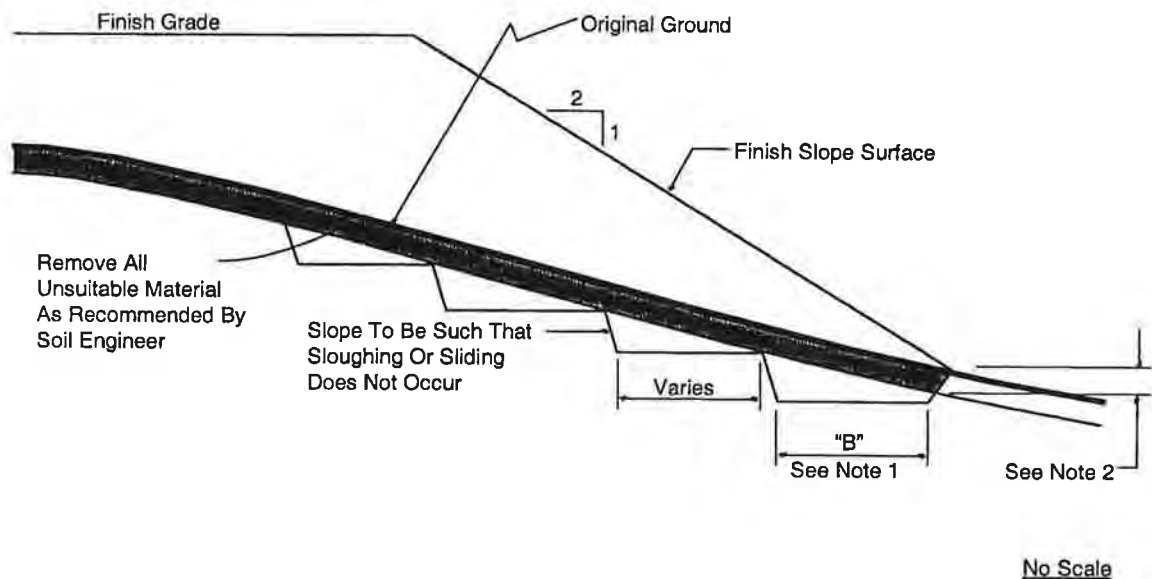
- 3.2. Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.
- 3.3. Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.
- 3.4. The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized, provided it is acceptable to the governing agency, Owner and Consultant.
- 3.5. Representative samples of soil materials to be used for fill shall be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.
- 3.6. During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

#### **4. CLEARING AND PREPARING AREAS TO BE FILLED**

- 4.1. Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1-1/2 inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

- 4.2. Any asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility. Concrete fragments which are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.
- 4.3. After clearing and grubbing of organic matter or other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction shall be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.
- 4.4. Where the slope ratio of the original ground is steeper than 6:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

#### TYPICAL BENCHING DETAIL



#### DETAIL NOTES:

- (1) Key width "B" should be a minimum of 10 feet wide, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.
- (2) The outside of the bottom key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

- 4.5. After areas to receive fill have been cleared, plowed or scarified, the surface should be disced or bladed by the Contractor until it is uniform and free from large clods. The area should then be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6.0 of these specifications.

## 5. COMPACTION EQUIPMENT

- 5.1. Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.
- 5.2. Compaction of *rock* fills shall be performed in accordance with Section 6.3.

## 6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

- 6.1. *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:
- 6.1.1. *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.
- 6.1.2. In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D1557-00.
- 6.1.3. When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.
- 6.1.4. When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

- 6.1.5. After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D1557-00. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.
- 6.1.6. Soils having an Expansion Index of greater than 50 may be used in fills if placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.
- 6.1.7. Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.
- 6.1.8. As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.
- 6.2. *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:
  - 6.2.1. Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.
  - 6.2.2. Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

- 6.2.3. For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.
- 6.2.4. For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.
- 6.2.5. Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.
- 6.2.6. All rock placement, fill placement and flooding of approved granular soil in the windrows must be continuously observed by the Consultant or his representative.
- 6.3. *Rock* fills, as defined in Section 3.1.3., shall be placed by the Contractor in accordance with the following recommendations:
- 6.3.1. The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent, maximum slope of 5 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.
- 6.3.2. *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be

utilized. The number of passes to be made will be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

- 6.3.3. Plate bearing tests, in accordance with ASTM D1196-93, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the number of passes of the compaction equipment to be performed. If performed, a minimum of three plate bearing tests shall be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.
- 6.3.4. A representative of the Consultant shall be present during *rock* fill operations to verify that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading. In general, at least one test should be performed for each approximately 5,000 to 10,000 cubic yards of *rock* fill placed.
- 6.3.5. Test pits shall be excavated by the Contractor so that the Consultant can state that, in his opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.
- 6.3.6. To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7. All *rock* fill placement shall be continuously observed during placement by representatives of the Consultant.

## 7. OBSERVATION AND TESTING

- 7.1. The Consultant shall be the Owners representative to observe and perform tests during clearing, grubbing, filling and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill shall be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test shall be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.
- 7.2. The Consultant shall perform random field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion as to whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.
- 7.3. During placement of *rock* fill, the Consultant shall verify that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant shall request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. If performed, plate bearing tests will be performed randomly on the surface of the most-recently placed lift. Plate bearing tests will be performed to provide a basis for expressing an opinion as to whether the *rock* fill is adequately seated. The maximum deflection in the *rock* fill determined in Section 6.3.3 shall be less than the maximum deflection of the properly compacted *soil* fill. When any of the above criteria indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.
- 7.4. A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.



- 7.5. The Consultant shall observe the placement of subdrains, to verify that the drainage devices have been placed and constructed in substantial conformance with project specifications.
- 7.6. Testing procedures shall conform to the following Standards as appropriate:

**7.6.1. Soil and Soil-Rock Fills:**

- 7.6.1.1. Field Density Test, ASTM D1556-00, *Density of Soil In-Place By the Sand-Cone Method.*
- 7.6.1.2. Field Density Test, Nuclear Method, ASTM D2922-96, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*
- 7.6.1.3. Laboratory Compaction Test, ASTM D1557-00, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*
- 7.6.1.4. Expansion Index Test, ASTM D4829-95, *Expansion Index Test.*

**7.6.2. Rock Fills**

- 7.6.2.1. Field Plate Bearing Test, ASTM D1196-93 (Reapproved 1997) *Standard Method for Nonreparative Static Plate Load Tests of Soils and Flexible Pavement Components, For Use in Evaluation and Design of Airport and Highway Pavements.*

**8. PROTECTION OF WORK**

- 8.1. During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.
- 8.2. After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

## 9. CERTIFICATIONS AND FINAL REPORTS

- 9.1. Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.
  
- 9.2. The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

## LIST OF REFERENCES

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- Farrand, G. T. (Editor), 1977. *Geology of Southwestern San Diego County, California and Northwestern Baja, California*. Imperial Beach Quadrangle: San Diego Association of Geologists.
- Kennedy, M. P. and S. S. Tan, 1977. *Geology of National City, Imperial Beach and Otay Mesa Quadrangles, Southern San Diego Metropolitan Area, California*: California Division of Mines and Geology, Map Sheet 29, 1:24,000.
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- U.S. Department of Agriculture, 1953. *Aerial Stereoscopic Photographs AXN-9M-167 and -168*.
- Sadigh, *et al.*, 1997, *Attenuation relationships for Shallow Crustal Earthquakes Based on California Strong Motion Data*, Seismological Research Letters, Vol. 68, No. 1, January/February, pp. 180-189.

**OVERSIZED EXHIBIT**  
**“GEOLOGIC MAP OTAY RANCH VILLAGE 7, R-2**  
**AND VILLAGE 4 COMMUNITY PARK FIGURE 2”**

**This exhibit is on file at the City of Chula Vista, Planning  
Department located at 276 Fourth Avenue,  
Chula Vista, CA 91910**

**OVERSIZED EXHIBIT  
“GEOLOGIC MAP OTAY RANCH VILLAGE 7, R-2  
AND VILLAGE 4 COMMUNITY PARK FIGURE 4”**

**This exhibit is on file at the City of Chula Vista, Planning  
Department located at 276 Fourth Avenue,  
Chula Vista, CA 91910**