# GEOTECHNICAL PRE-DESIGN REPORT

## Donner Summit PUD

## Wastewater Treatment Plant Expansion

## Nevada County, California

**March 2011**

**Prepared for:**

**Donner Summit PUD**

**Prepared by:**

**BLACKBURN CONSULTING**

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Geotechnical • Construction Services • Forensics

March 15, 2011
BCI File No. 1856.2

Mr. Tom Skjelstad, General Manager
Donner Summit PUD
53823 Sherrit Lane
Soda Springs, CA 95728

Subject: **GEOTECHNICAL PRE-DESIGN REPORT**
Donner Summit PUD Wastewater Treatment Plant Expansion
Nevada County, California

Dear Mr. Skjelstad:

Blackburn Consulting (BCI) prepared this Pre-Design Report to provide preliminary design recommendations for the expansion of the wastewater treatment plant (WWTP). We incorporate comments made regarding our Draft Pre-Design Report dated January 6, 2011. We prepared this report in accordance with our original agreement dated August 31, 2010, and subsequent Change Order agreement dated October 20, 2010. We expect to Some additional geotechnical work may be required for final design, depending on final project layout, grade and loading conditions.

Please call if you have questions on this report or require additional information. We appreciate this opportunity to serve you.

Sincerely,

**BLACKBURN CONSULTING**

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Project Engineering Geologist

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**GEOTECHNICAL PRE-DESIGN REPORT**
Donner Summit PUD Wastewater Treatment Plant Expansion
Nevada County, California

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## INTRODUCTION

Blackburn Consulting (BCI) prepared this Geotechnical Pre-Design Report to provide preliminary geotechnical criteria for the proposed wastewater treatment plant (WWTP) expansion project. This study is based on a preliminary layout (emailed to BCI on 12/17/2010) of new facilities as prepared by Stantec. Additional geotechnical study may be required for final design depending on the final location, grades and loading conditions.

## SCOPE OF SERVICES

To prepare this report, BCI:

- Reviewed published geologic, soils, seismic and topographic mapping of the site.
- Attended a site review on August 31, 2010, with representatives from the DSPUD, USFS and Stantec.
- Reviewed and commented on initial site layouts prepared by Stantec.
- Excavated eight test pits and completed four seismic refraction profiles near the proposed improvements.
- Conducted laboratory testing on soil samples obtained from the test pits.
- Developed preliminary design recommendations for the proposed improvements.

## SITE AND PROJECT DESCRIPTION

The site is located near the community of Soda Springs in Nevada County, California. We show the project location on Figure 1.

The preliminary layout prepared by Stantec shows the proposed improvements located immediately north of the existing treatment plant. The new improvements include:

- Sludge thickening tank, mixing/aeration/thickening equipment and drying bed
- Membrane and equipment building
- Equalization storage tank
- Mixing pumps and blowers
- Headworks
- Access road across a ravine to the new storage tank

Site topography generally slopes to the northwest, toward the Yuba River. A northeast-trending ridge runs through the site and a parallel swale separates the ridge from the existing Operations Building.

We expect the new buildings will be concrete block or wood-frame with slab-on-grade floors. The storage tank is shown to be 700,000 gallon capacity, with diameter approximately 80 feet; height about 30 feet, at a pad elevation of about 6633 feet. Maximum fills are expected to be 10-15 ft, located at the northwest corner of the equipment building and where the access road crosses the ravine. Maximum cuts are expected to be about 6-8 ft, located at the southeast corner of the equipment building and near the center of the storage tank. We expect the tank will be established on a full-cut pad and the perimeter access road on minor fill.

Numerous large, granitic boulders, some exceeding 20 ft dimension and extending 20+ft above ground, are present across the site. The preliminary layout is intended to avoid the massive boulders; smaller boulders will be involved in project grading. We show photos of the site topographic features in Appendix C.

We show the site topography, rock outcrops greater than 10 feet in dimension, and proposed improvements on Figure 2.

## SITE GEOLOGY AND SEISMICITY

Published geologic mapping[1] shows the site to be underlain by Quaternary glacial deposits and Mesozoic granitic rock. Based on our observations, the earth materials appear to be predominately glacial deposits consisting of large granitic boulders embedded within a silty sand matrix. “Bedrock” was not apparent, as most of the boulders appear “detached” or “semi-detached”; however, some of the surface rock may represent the top of bedrock (i.e., continuous solid rock with depth). The northeast trending ridge through the site appears likely to represent a glacial moraine and not a bedrock ridge. We show the generalized site geology in Figure 3.

Soil mapping by the USDA[2] indicates a 4 to 5 foot soil cover comprised of well-drained, sandy loam with low shrink-swell potential (based on small quantities of clay soils). We show the mapped soil units in Figure 4.

The site is in an area with moderate historic seismicity. Toppozada[3] shows this area to have experienced only a few magnitude 5.0-5.4 earthquakes since 1869. More significant earthquakes have occurred further to the east, including earthquakes of magnitude 6.0 in 1948 and 1966 on the Dog Valley Fault, located approximately 20 miles east. Neither of these earthquakes is recorded as causing significant damage in the project vicinity.

The closest “active” fault (defined as surface displacement within Holocene time, generally the past 11,000 years) is the Dog Valley Fault. This fault is part of a zone of seismic activity which includes the Mohawk Valley, West Tahoe and Dollar Point Faults, each considered Late Quaternary or younger. We show the regional faults in Figure 5.

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[1] Saucedo, G.J. and Wagner, D.L., “Geologic Map of the Chico Quadrangle”, scale 1:250,000, California Division of Mines and Geology, 1992.
[2] USDA Web Soil Survey 2.0, Tahoe National Forest Area, California, 2009.
[3] Toppozada, et. al., “Epicenters of and Areas Damaged by M ≥ 5 California Earthquakes, 1800-1999”, California Division of Mines and Geology, Map Sheet 49, 2000.

## SUBSURFACE EXPLORATION

BCI observed and logged eight test pits at the approximate locations shown on Figure 2. Our excavation subcontractor used a Case 580K backhoe equipped with 18 inch wide digging bucket to excavate the pits. We include soil descriptions and other information pertaining to each test pit in Appendix A, and photos of each pit in Appendix C.

The test pits encountered mostly cobbles and boulders within a silty sand matrix. The backhoe was able to excavate to depths of about 3-6 feet before encountering refusal on large boulders. We estimate the cobble and boulder percentage at about 20-60% of the total volume with dimensions ranging from about 6-30 inches. The uppermost 6 inches is primarily silty sand with a large percentage of organics (pine needles and dark humus material).

## REFRACTION SEISMIC PROFILES

BCI performed four seismic refraction surveys (SR1 through SR4) at the approximate locations shown on Figure 2. Each seismic line consists of 5 shot points distributed along a collinear array of 12 geophones, with a multi-channel receiver (seismograph) located at one end of the array to collect the data. We placed geophones at 5-foot intervals along the array. We generated compressional wave energy (P-waves) at each shot point using multiple impacts with a 20-pound sledge hammer striking a steel plate placed on the ground surface. We used a *Geometrics Geode* seismograph to detect, digitize, and record the P-waves.

We analyzed the data using the computer program SeisImager by Geometrics, Inc. The seismic profiles are presented in Appendix A. The profiles show a general increase in velocity with depth, ranging from about 1,000 to 5,000 feet per second (fps). These velocities, extending to a depth of about 20 ft, suggest generally unconsolidated material consistent with glacial deposits. Bedrock velocities, typically in excess of 6,000 fps, were not recorded in any of the four profiles.

## GROUNDWATER

We did not observe free groundwater in the test pits during our field exploration in October 2010. We expect that groundwater may be seasonally present as perched water within low-lying areas (swales/drainages) during and shortly following periods of wet weather and snowmelt runoff.

## LABORATORY TESTS

We performed grain size analysis, maximum dry density, R-value, and direct shear tests on representative soil samples from the test pits, excluding cobbles and boulders and screened on 3-inch sieve. The grain size analyses show 16-31% fines (passing No. 200 mesh sieve), classed as "SM" per Unified Soil Classification System. The maximum dry density of these (screened) materials is 117 pcf at 13% optimum moisture. Direct shear tests on samples remolded to 95% relative compaction show soil cohesion of 364 psf and phi angle of 39°. We attach the complete laboratory test reports in Appendix B.

## GEOLOGIC HAZARDS

### Faulting

The Fault Activity Map of California and Adjacent Areas (Jennings, 1994)[4] does not identify Holocene and/or Late Quaternary age faults (displacement within the last 700,000 years) within or adjacent to the project. The project does not lie within or adjacent to an Alquist–Priolo Earthquake Fault Zone (Hart, 2007)[5]. On this basis, we consider the potential for ground rupture and/or fault creep hazard to be low for this site.

### Ground Shaking

The California Geological Survey (CGS)[6], indicates that for a seismic event with a 10 percent probability of exceedance in 50 years, expect a peak horizontal ground acceleration (PGA) on the order of 0.24g. We provide seismic design criteria in the Preliminary Recommendations section, below.

### Liquefaction

Liquefaction can occur when loose to medium dense, granular, saturated soils (generally within 50 feet of the surface) are subjected to ground shaking. The site is underlain by medium dense granular soils over granitic rock that is not generally susceptible to liquefaction. With proper grading and foundation preparation, we consider the potential for damaging liquefaction to be low.

### Landslides and Slope Stability

We did not observe any evidence of landslides or slope instability at the site. With proper site grading, we do not consider the proposed improvements to affect slope stability.

### Compressible Soil

The soils encountered in the upper 5 ft in the test pits have potential for compression under moderate structural loads. This can be mitigated by site grading and foundation design, described further in the Preliminary Recommendations section, below.

### Expansive Soil

Clay or clayey soils can expand when wetted and contract when dried. The surface soils at the site contain little clay; therefore, we consider the potential for damage due to expansive soils is low. Imported soils used for engineered fills on the site must have a low expansion potential.

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[4] Jennings, Charles W., 1994, Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruption, California Division of Mines and Geology.
[5] Hart, E.W., 2007 (Interim Revision), Fault-Rupture Hazard Zones in California", Special Publication 42, Califonia Geological Survey.
[6] California Geological Survey, Probabilistic Seismic Hazards Mapping Ground Motion Page (www.consrv.ca.gov)

## PRELIMINARY RECOMMENDATIONS

The following recommendations are based on the preliminary project layout and this initial study. BCI will provide further recommendations for final design of the specific project elements.

### Grading and Excavation

Strip and dispose of all surficial vegetation, tree roots, debris, and other deleterious materials (generally uppermost 6 inches). These materials are not suitable for use in engineered fill.

In general, we expect that excavations to a depth of about 10 ft can be completed with conventional heavy grading equipment (D10 or larger with rippers), provided the facilities are located to avoid the very large boulders/rock outcrops. Boulders and/or shallow rock in some areas may create excavation difficulties that require special handling and disposal. Depending on the final location of some facilities, minor blasting may be required to remove unavoidable large boulders/rock outcrops. Areas of deeper excavation and/or utility trenches may require special excavation techniques (such as chiseling, air tools or light charges) to facilitate excavation.

*Fill/Cut Slopes*

Place new fill on or against existing slopes by benching into native materials with discrete, stepped benches, one to two feet in height and width. Extend the benching (or overexcavate) laterally such that compacted fill extends a minimum of 5 feet beyond the building perimeter. If benching interferes with existing structures or utilities, BCI can approve modifications on a case-by-case basis.

Place fill in horizontal lifts with a maximum loose lift thickness of 8 inches, moisture condition to within 2% of optimum and compact to a minimum 90% relative compaction, per ASTM D 1557 test procedure. Construct fill slopes no steeper than 2:1. To achieve adequate compaction on the face of fill slopes, over-build the slopes and then cut back to the design grade. Track-walking is not an adequate method to compact the face of slopes.

We do not anticipate significant cut slopes for this project. Where necessary, construct cut slopes no steeper than 1.5:1 (horizontal to vertical).

*Structure Areas*

We recommend the following general steps in structure areas (buildings and tanks) to provide foundation support and mitigate detrimental settlement .

1. Overexcavate the soil/boulders within the proposed building/tank footprints to a depth of 3 feet below pad grade, and laterally to 5 ft beyond the building/tank limits. BCI must observe the base of the excavation for uniformity and suitability to determine if additional excavation is necessary.
2. Scarify the exposed soil to a depth of 8-inches, moisture condition to within 2% of optimum moisture and compact to at least 90% relative compaction based on current ASTM D 1557 test method. Inability to achieve the required compaction on the scarified materials may be used as a field criterion to identify areas requiring additional removal, moisture conditioning and/or compaction.

3. Backfill the overexcavated areas with acceptable fill meeting the following criteria:
    - Contain no visual concentration of organics, debris or deleterious materials,
    - Have a maximum particle size of 4-inches with at least 50% passing the No. 4 Sieve,
    - Expansion Index ≤ 25, per ASTM D4829.

The native, overexcavated soil (below the surface organic layer) may be used for backfill provided it is screened to exclude rock larger than 4 inches in greatest dimension.

**Foundations**

Conventional footing foundations are suitable for typical lightly to moderately loaded structures, conditioned on appropriate ground preparation (i.e., overexcavation and recompaction per above). Design perimeter footings a minimum 15 inches wide and, to mitigate frost heave, a minimum 24 inches deep into bearing material. Design isolated interior footings with minimum width of 3 feet and minimum depth of 24 inches. For preliminary design, use an allowable bearing capacity of 2,500 psf for footings placed per these recommendations, with one-third increase allowable for transient loads such as wind or seismic.

For the new storage tank, similar support to above is available for a concrete ringwall footing established within compacted fill placed per above. Design ring footing a minimum 15 inches wide and a minimum 24 inches deep into bearing material. If utilized, design interior column footing with minimum width of 3 ft and minimum depth of 24 inches into bearing material.

Lateral forces may be resisted by friction developed between the base of the footings and the underlying soil. Use a coefficient of friction to resist sliding of 0.35. Resistance to lateral loads may be provided by assuming a passive pressure based on an equivalent fluid weight of 300 pcf. In designing the structure to resist lateral loads, the upper 12 inches of soil should be ignored and the lateral resistance of the soil should be limited to 3,000 psf.

The anticipated superposed loads are not expected to result in significant settlement for either the proposed buildings or storage tank. For the above allowable bearing capacities, we estimate total settlement ≤ 1-inch and differential settlement ≤ ½-inch. This will be confirmed in final design based on total loads.

For slab-on-grade floors, and assuming grading as recommended above, place a minimum of 4 inches of washed, crushed, and compacted rock below the slab to provide uniform support. Grading for crushed rock beneath the floor slabs should meet 100% passing the ¾ inch sieve and less than 5% passing the No. 4 sieve. Exterior flatwork may be placed directly on the prepared subgrade with or without the use of rock underlayment, provided that the subgrade is free of debris, uniformly compacted and thoroughly wetted before placing concrete.

## Seismic Design Criteria

We classify the site in accordance with California Building Code (CBC, 2007) as Site Class C The Class Type is based on our site review, test pits, seismic refraction lines and mapped geologic conditions. We provide a summary of California Building Code design parameters in the Table 1 below.

**TABLE 1: Seismic Design Parameters (CBC 2007)**

| **Site Class** | **C** |
|---|---|
| $S_s$ – Mapped Acceleration Parameter | 1.097 g |
| $S_1$ – Mapped Acceleration Parameter | 0.371 g |
| $F_a$ – Site Coefficient | 1.0 |
| $F_v$ – Site Coefficient | 1.429 |
| $S_{MS}$ – MCE* Spectral Response Acceleration, Short Period | 1.097 g |
| $S_{M1}$ – MCE* Spectral Response Acceleration, 1-Second Period | 0.530 g |
| $S_{DS}$ – 5% Damped Design Spectral Response Acceleration, Short Period | 0.731 g |
| $S_{D1}$ – 5% Damped Design Spectral Response Acceleration, 1-Second | 0.354 g |

* Maximum Considered Earthquake

## Underground Utilities

In general, we expect typical trenching equipment (backhoe/excavator) can excavate the surface soils, alluvium, and glacial deposits for utility placement. Large boulders may require special excavation techniques (overexcavation, chiseling, air tools, etc.). Granitic rock may require blasting to facilitate utility excavation. Utility excavations will generate large cobble and boulder size material that will be unsuitable for trench backfill. We expect select (import) material will be necessary for trench backfill.

Common trench shoring and sloping techniques should be applicable. Dewatering may be required in trench excavations through the low portions of the site during early spring/summer months. For frost protection, consider utility depths of 3 feet or more.

## Pavement Sections

The results of the two R-value tests are 80 and 82. Owing to variations in the quality of the native soil we recommend a design R-value of 50 (consistent with Class 2-ASB) for new pavement structural sections. Table 2 presents the recommended pavement sections for Traffic Indices (TI) ranging from 5.0 to 7.5, with basement R-value of 50, in accordance with Caltrans Flexible Pavement Design Methods (Highway Design Manual, Chapter 600).

**TABLE 2: New Flexible Pavement Sections***
**(Basement R-value = 50)**

| Pavement Section | TI | | | |
|---|---|---|---|---|
| | **5.0** | **6.0** | **7.0** | **7.5** |
| HMA-A (ft) | 0.20 | 0.25 | 0.35 | 0.35 |
| AB (ft) | 0.35 | 0.35 | 0.35 | 0.45 |
| Full Depth AC (ft) | 0.35 | 0.45 | 0.55 | 0.60 |

*Calculated using CAL FP v. 1.1

Any import fill material should have a minimum R-value of 50 for use of these sections. We include the R-value results in Appendix B and pavement section calculations in Appendix D.

Subgrade should be free of material greater than 4-inches in diameter. For full depth asphalt sections subgrade should be free of material greater than 2-inches. Scarify subgrade to a depth of 6 inches and compact to a minimum of 95% relative compaction (based on ASTM D1557 test method).

Aggregate baserock (AB) should conform to Caltrans Class 2 requirements. Moisture condition and compact the AB to a minimum 95% relative compaction (based on ASTM D1557 test method). Prior to placing asphalt, the subgrade and aggregate baserock should be stable under the weight of a loaded water truck. Yielding or pumping subgrade, or the inability to achieve 95% relative compaction, can be used as a field criterion for supplemental stabilization measures, such as scarification and drying, subexcavation and replacement, or use of stabilization fabric or geogrid.

If needed, BCI and/or the project engineer should review soil conditions and approve mitigation methods prior to implementation.

Where temporary access roads will be constructed, grade the access to a level condition in accordance with the grading recommendations provided above, scarify the subgrade to a depth of 6 to 8 inches, moisture condition, and compact to a minimum of 90% relative compaction. Place a minimum of 4 inches of crushed rock (3/4 inch) or Class 2 aggregate baserock on the prepared subgrade and compact with a smooth drum roller.

## Erosion

Considering the predominately granular nature of the on-site soils, there is a relatively high potential for erosion. Work disturbing the surface soils and glacial deposits should anticipate potential erosion and include mitigation measures. Exposed rock areas will have low erosion potential.

**LIMITATIONS**

The recommendations provided in this report are for preliminary design of the facility layout as proposed by Stantec. BCI will prepare a design-level geotechnical report for the project once the project locations are confirmed and design details (grades, loads, etc) are established. Further subsurface investigation, testing and geotechnical evaluation may be required for final design.

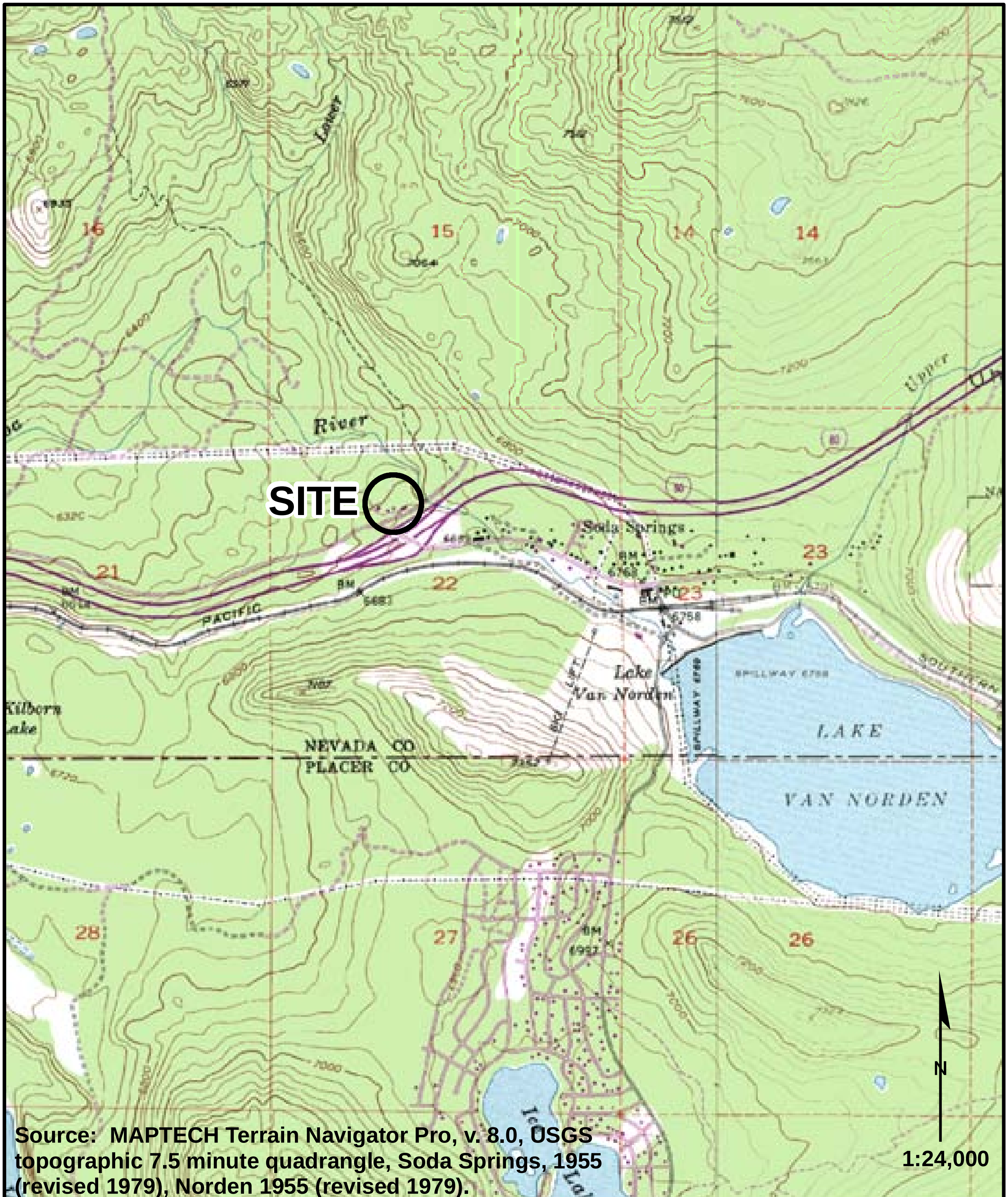
BCI performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. We do not warranty our services.

BCI based this report on the current site conditions. We assumed the soil, rock and ground water conditions are representative of the subsurface conditions on the site. Actual conditions between test pits and borings could be different.

Our scope did not include evaluation of on-site hazardous materials, soil corrosion potential, or flooding.

Modern design and construction are complex, with many regulatory sources/restrictions, involved parties, construction alternatives, etc. It is common to experience changes and delays. The owner should set aside a reasonable contingency fund based on complexities and cost estimates to cover changes and delays.

Logs of our test pits and borings are presented in Appendix A. The lines designating the interface between soil and rock types are approximate. The transition between soil/rock types may be abrupt or gradual. Our recommendations are based on the final logs, which represent our interpretation of the field logs and general knowledge of the site and geological conditions.




Source: MAPTECH Terrain Navigator Pro, v. 8.0, USGS topographic 7.5 minute quadrangle, Soda Springs, 1955 (revised 1979), Norden 1955 (revised 1979).

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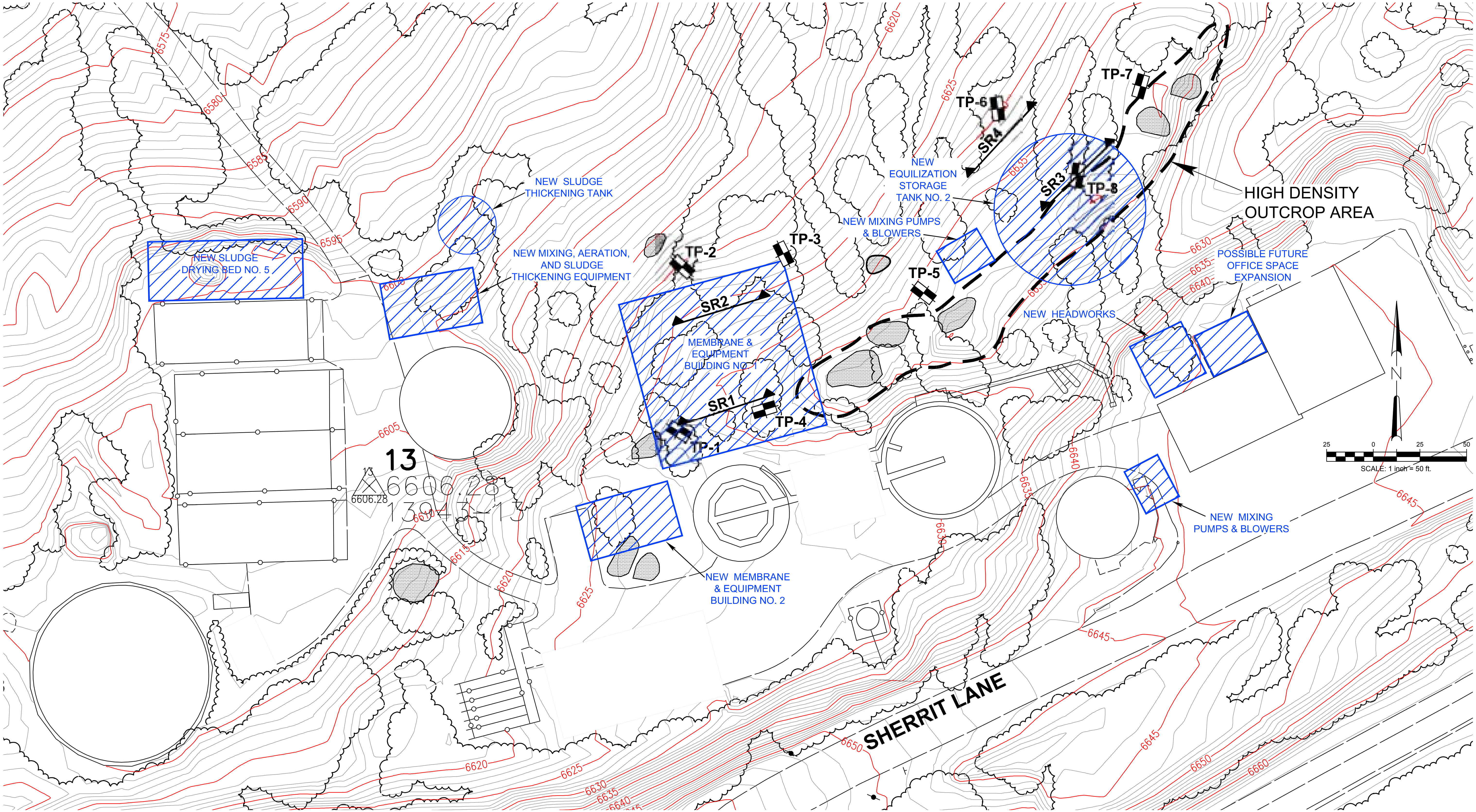
# VICINITY MAP

Donner Summit PUD
Placer County, California

File No. 1856.2

March 2011

Figure 1




## LEGEND

TP-1 Approximate Test Pit Location

SR1 Seismic Line Location

Major Rock Outcrops exceeding 10 ft. in dimension

Proposed Structure Locations

3/10/2011 1856.2 Figure 2 Site Plan.dwg

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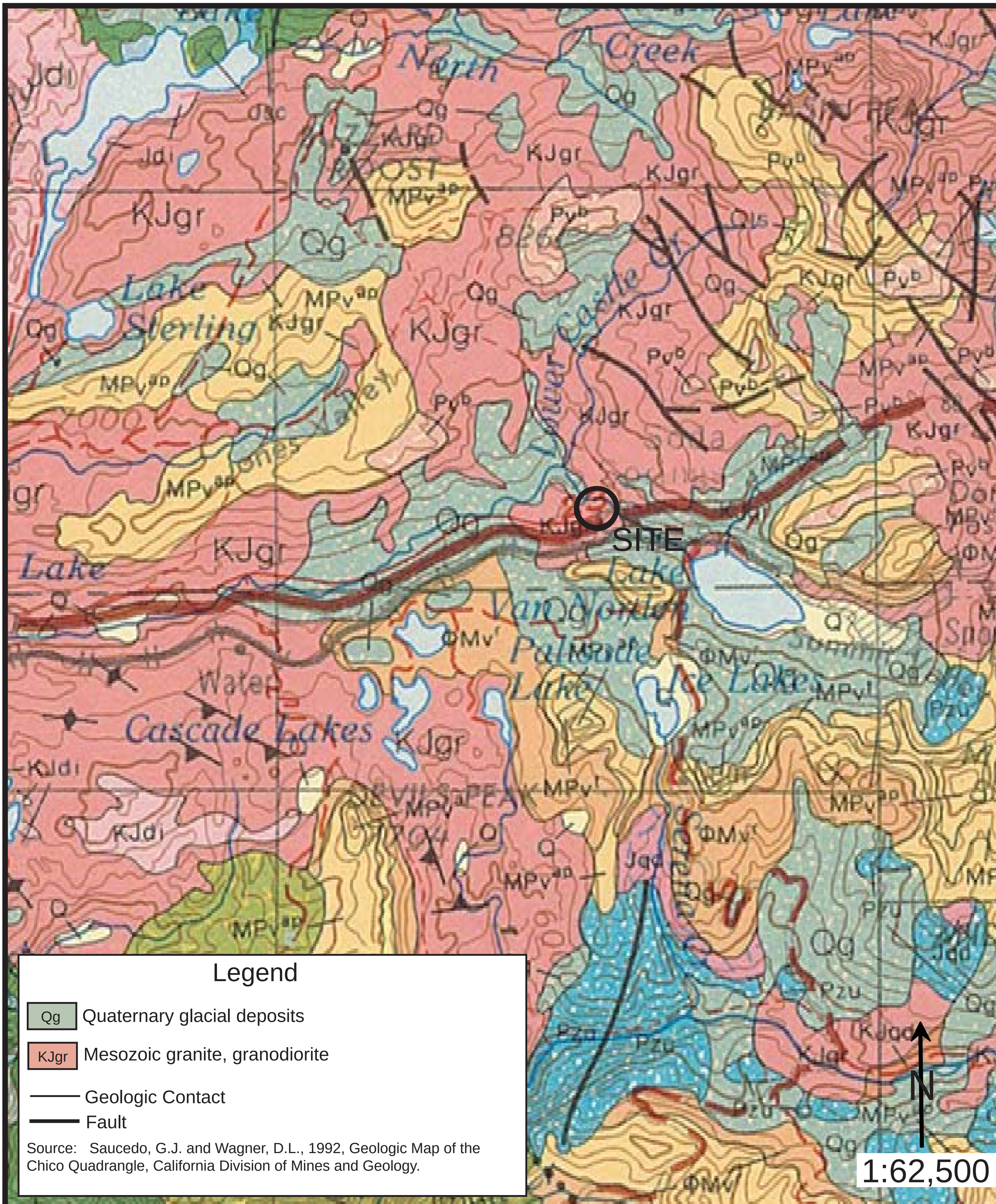
# SITE MAP

Donner Summit PUD WWTP Expansion
Nevada County, California

File No. 1856.2

March 2011

Figure 2

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# REGIONAL GEOLOGIC MAP

Donner Summit PUD
Nevada County, California

File No. 1856.2

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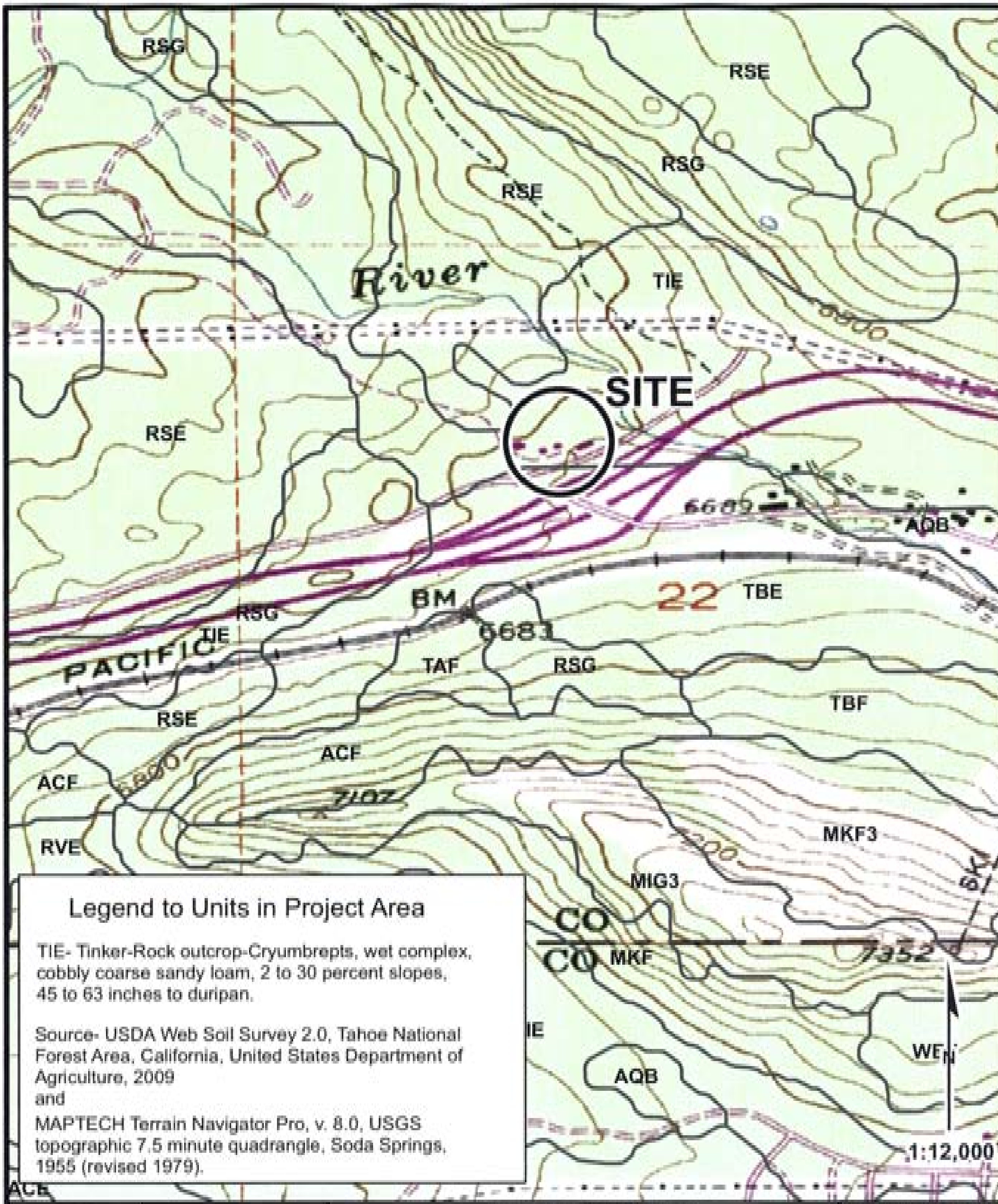
Figure 3

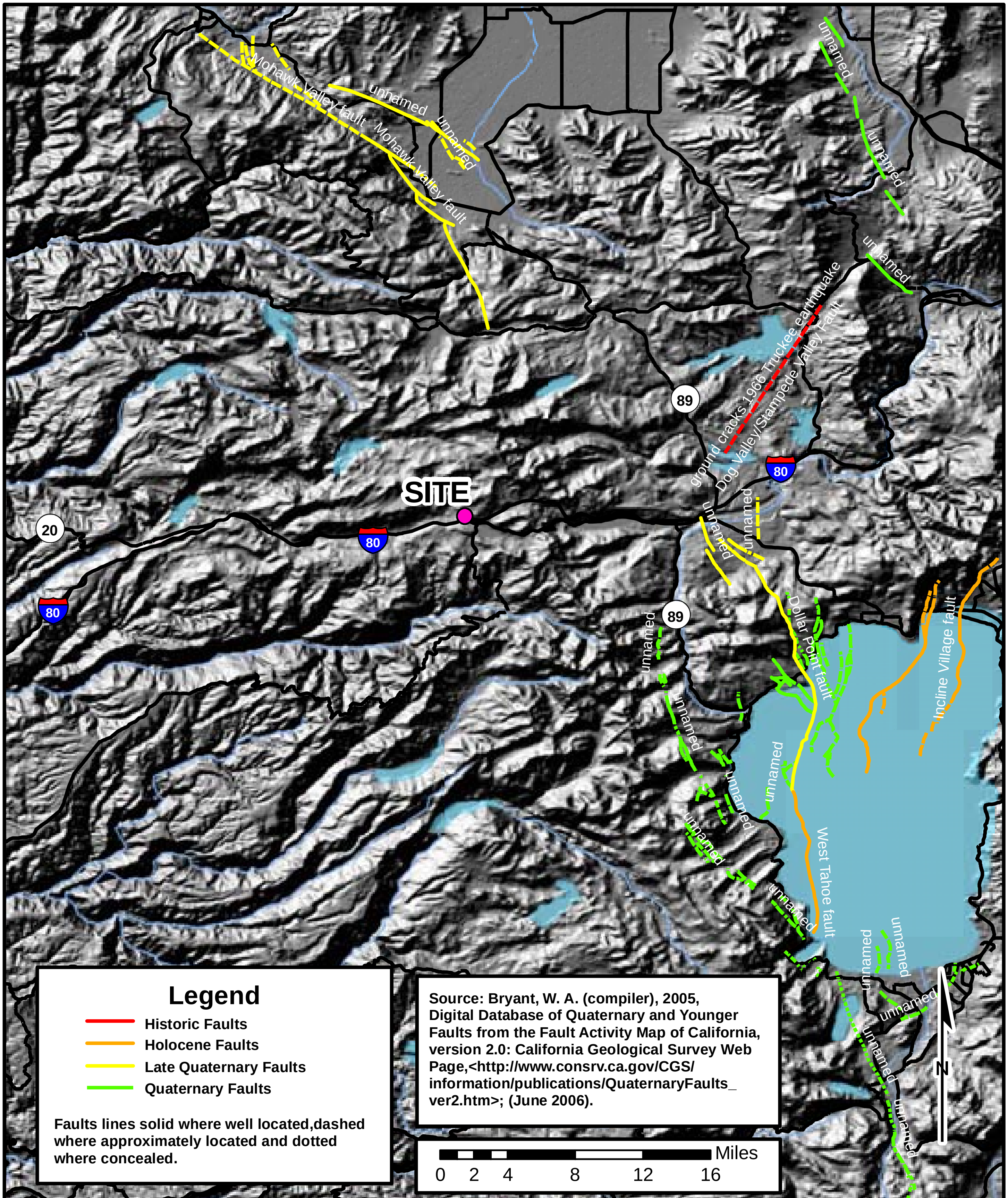



Legend to Units in Project Area

TIE- Tinker-Rock outcrop-Cryumbrepts, wet complex, cobbly coarse sandy loam, 2 to 30 percent slopes, 45 to 63 inches to duripan.

Source- USDA Web Soil Survey 2.0, Tahoe National Forest Area, California, United States Department of Agriculture, 2009
and
MAPTECH Terrain Navigator Pro, v. 8.0, USGS topographic 7.5 minute quadrangle, Soda Springs, 1955 (revised 1979).

| | | | |
|---|---|---|---|
| blackburn consulting | 11521 Blocker Drive, Ste 110<br>Auburn, CA 95603<br>Phone: (530) 887-1494<br>Fax: (530) 887-1495-Fax<br>www.blackburnconsulting.com | **SOILS MAP**<br>Donner Summit PUD<br>Nevada County, California | File No. 1856.2<br>March 2011<br>Figure 4 |




## Legend

- Historic Faults
- Holocene Faults
- Late Quaternary Faults
- Quaternary Faults

**Faults lines solid where well located,dashed where approximately located and dotted where concealed.**

**Source: Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: California Geological Survey Web Page,<http://www.consrv.ca.gov/CGS/information/publications/QuaternaryFaults_ver2.htm>; (June 2006).**

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# REGIONAL FAULT MAP

Donner Summit PUD
Nevada County, California

**File No. 1856.2**

**March 2011**

**Figure 5**

Test Pits Logs

Legends to Logs

Seismic Refraction Profiles

# LOG OF TEST PIT TP1

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6628.8 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), olive brown, moist, approximately 40-50% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive brown, (medium dense), moist, approximately 60% cobbles and Boulders 6-30" in diameter. | | 1 | | | | PA, R |
| 5 | | | | | | | | |
| | | Essential excavation refusal at 6 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

# LOG OF TEST PIT TP2

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6620.7 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive gray, (medium dense), moist, approximately 40% cobbles and Boulders 6-24" in diameter. | | | | | | |
| 5 | | Essential excavation refusal at 4.5 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

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Donner Summit PUD WWTP Expansion
Soda Springs, CA
1856.2

# LOG OF TEST PIT TP3

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6622.6 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive gray, (medium dense), moist, approximately 20% cobbles and Boulders 6-30" in diameter. | | 1 | | | | PA, DS, CP |
| 5 | | | | | | | | |
| | | Essential excavation refusal at 5.5 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

# LOG OF TEST PIT TP4

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6631.5 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive gray, (medium dense), moist, approximately 50% cobbles and Boulders 6-30" in diameter. | | | | | | |
| 5 | | | | | | | | |
| | | Essential excavation refusal at 5 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |



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Donner Summit PUD WWTP Expansion
Soda Springs, CA
1856.2

# LOG OF TEST PIT TP5

Date Excavated: 10/27/10 | Logged by: RCP | Depth to Water (ft): None

Equipment: CASE 580K | Surface Elevation(ft): ~6635.5 | Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive brown, (medium dense), moist, approximately 30% cobbles and Boulders 6-18" in diameter. | | | | | | |
| 5 | | Essential excavation refusal at 3.25 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

# LOG OF TEST PIT TP6

Date Excavated: 10/27/10 | Logged by: RCP | Depth to Water (ft): None

Equipment: CASE 580K | Surface Elevation(ft): ~6629.7 | Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| 5 | | Cobbles and Boulders with Silty Sand matrix, GM, olive brown, (medium dense), moist, approximately 40% cobbles and Boulders 6-24" in diameter. | | | | | | |
| | | Essential excavation refusal at 5.5 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

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# LOG OF TEST PIT TP7

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6639.5 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive gray, (medium dense), moist, approximately 40% cobbles and Boulders 6-36" in diameter. | | | | | | |
| 5 | | Essential excavation refusal at 3 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

# LOG OF TEST PIT TP8

Date Excavated: 10/27/10 Logged by: RCP Depth to Water (ft): None

Equipment: CASE 580K Surface Elevation(ft): ~6638.3 Time of Reading:

| DEPTH (feet) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE | SAMPLE NUMBER | HAND PEN. (tsf) | MOISTURE (%) | DRY UNIT WT. (pcf) | LAB TESTS |
|---|---|---|---|---|---|---|---|---|
| | | Silty Sand, SM, (loose), dark brown, moist, approximately 40-50% organics. | | | | | | |
| | | Silty Sand, SM, (medium dense), olive gray, moist. | | | | | | |
| | | Cobbles and Boulders with Silty Sand matrix, GM, olive brown, (medium dense), moist, approximately 30% cobbles and Boulders 6-18" in diameter. | | 1 | | | | PA, R |
| 5 | | | | | | | | |
| | | Essential excavation refusal at 5.5 feet.<br>No groundwater encountered.<br>Backfilled with native material on 10/27/2010. | | | | | | |

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# UNIFIED SOIL CLASSIFICATION (ASTM D 2487-06)

| MATERIAL TYPES | CRITERIA FOR ASSIGNING SOIL GROUP NAMES | | | GRAPHIC SYMBOL | GROUP SYMBOL | SOIL GROUP NAMES |
|---|---|---|---|---|---|---|
| **COARSE-GRAINED SOILS** >50% RETAINED ON NO. 200 SIEVE | **GRAVELS** >50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS <5% FINES | Cu $\geq$ 4 AND 1 $\leq$ Cc $\leq$ 3 | | **GW** | WELL-GRADED GRAVEL |
| | | | Cu < 4 AND/OR 1 > Cc > 3 | | **GP** | POORLY-GRADED GRAVEL |
| | | GRAVELS WITH FINES >12% FINES | FINES CLASSIFY AS ML OR MH | | **GM** | SILTY GRAVEL |
| | | | FINES CLASSIFY AS CL OR CH | | **GC** | CLAYEY GRAVEL |
| | **SANDS** <50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN SANDS <5% FINES | Cu $\geq$ 6 AND 1 $\leq$ Cc $\leq$ 3 | | **SW** | WELL-GRADED SAND |
| | | | Cu < 6 AND/OR 1 > Cc > 3 | | **SP** | POORLY-GRADED SAND |
| | | SANDS WITH FINES >12% FINES | FINES CLASSIFY AS ML OR MH | | **SM** | SILTY SAND |
| | | | FINES CLASSIFY AS CL OR CH | | **SC** | CLAYEY SAND |
| **FINE-GRAINED SOILS** >50% PASSING NO. 200 SIEVE | **SILTS AND CLAYS** LIQUID LIMIT <50 | INORGANIC | PI>7 AND PLOTS ON OR ABOVE "A" LINE | | **CL** | LEAN CLAY |
| | | | PI>4 AND PLOTS BELOW "A" LINE | | **ML** | SILT |
| | | ORGANIC | LL (oven dried)<0.75/LL (not dried) | | **OL** | ORGANIC CLAY OR SILT |
| | **SILTS AND CLAYS** LIQUID LIMIT >50 | INORGANIC | PI PLOTS ON OR ABOVE "A" LINE | | **CH** | FAT CLAY |
| | | | PI PLOTS BELOW "A" LINE | | **MH** | ELASTIC SILT |
| | | ORGANIC | LL (oven dried)<0.75/LL (not dried) | | **OH** | ORGANIC CLAY OR SILT |
| **HIGHLY ORGANIC SOILS** | | PRIMARILY ORGANIC MATTER, DARK COLOR, ORGANIC ODOR | | | **PT** | PEAT |

NOTE: $Cu = D_{60}/D_{10}$

$Cc = (D_{30})^2 / D_{10} \times D_{60}$

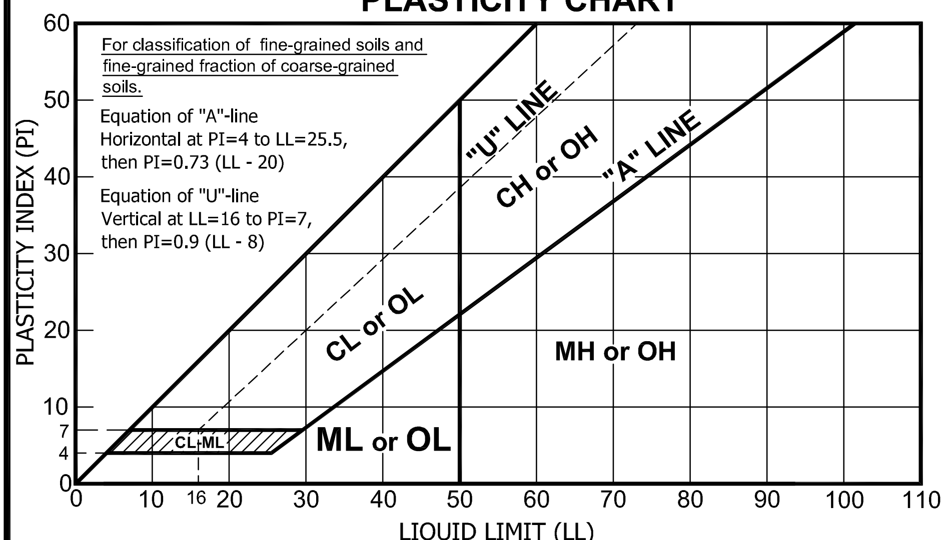
## BLOW COUNT

The number of blows of a 140-lb. hammer falling 30-inches required to drive the sampler the last 12-inches of an 18-inch drive. The notation 50/4 indicates 4-inches of penetration achieved in 50 blows.

## SAMPLE TYPES

- Auger or backhoe cuttings
- Modified California
- Shelby tube
- Rock core
- Standard Penetration (SPT)

## PLASTICITY CHART




## ADDITIONAL TESTS

| | |
|---|---|
| C | - Consolidation |
| CP | - Compaction Curve |
| CR | - Corrosivity Testing |
| CU | - Consolidated Undrained Triaxial |
| DS | - Direct Shear |
| EI | - Expansion Index |
| P | - Permeability |
| PA | - Partical Size Analysis |
| PI | - Plasticity Index |
| PP | - Pocket Penetrometer |
| R | - R-Value |
| SE | - Sand Equivalent |
| SG | - Specific Gravity |
| SL | - Shrinkage Limit |
| SW | - Swell Potential |
| TV | - Pocket Torvane Shear Test |
| UC | - Unconfined Compression |
| UU | - Unconsolidated Undrained Triaxial |

## GROUND WATER LEVELS

- Later water level after drilling
- Water level at time of drilling

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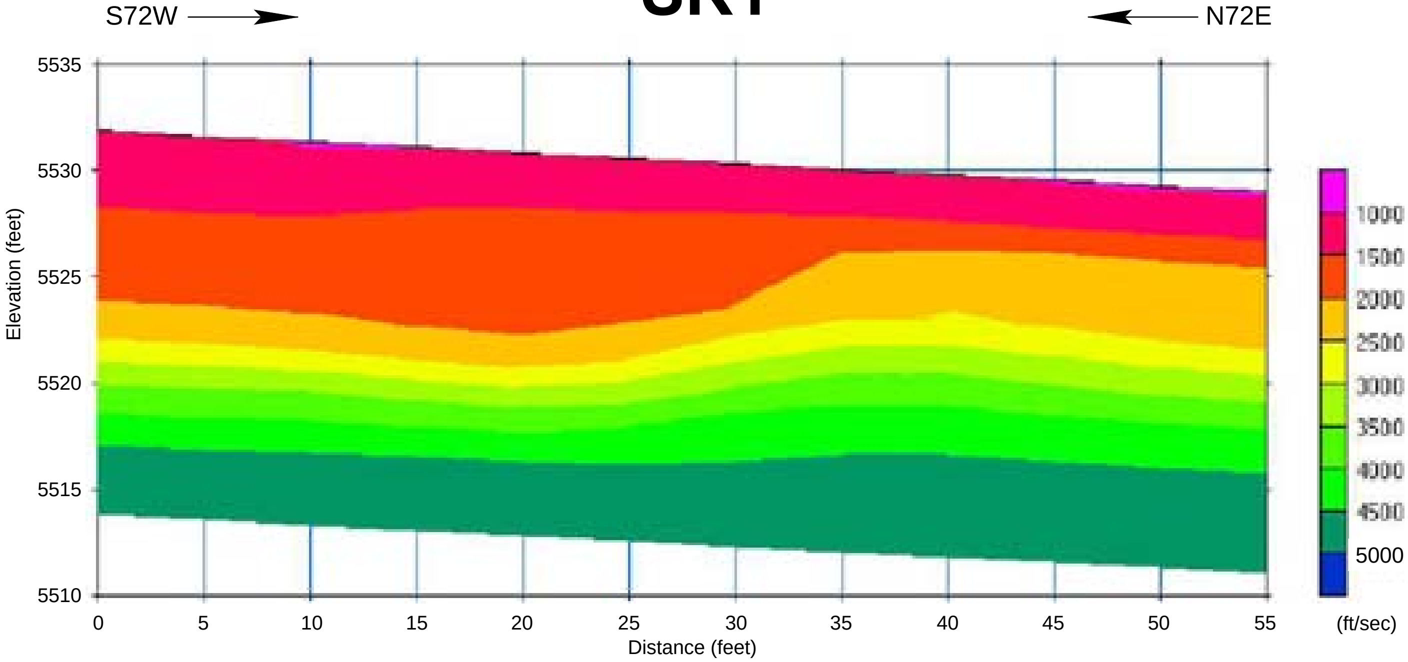
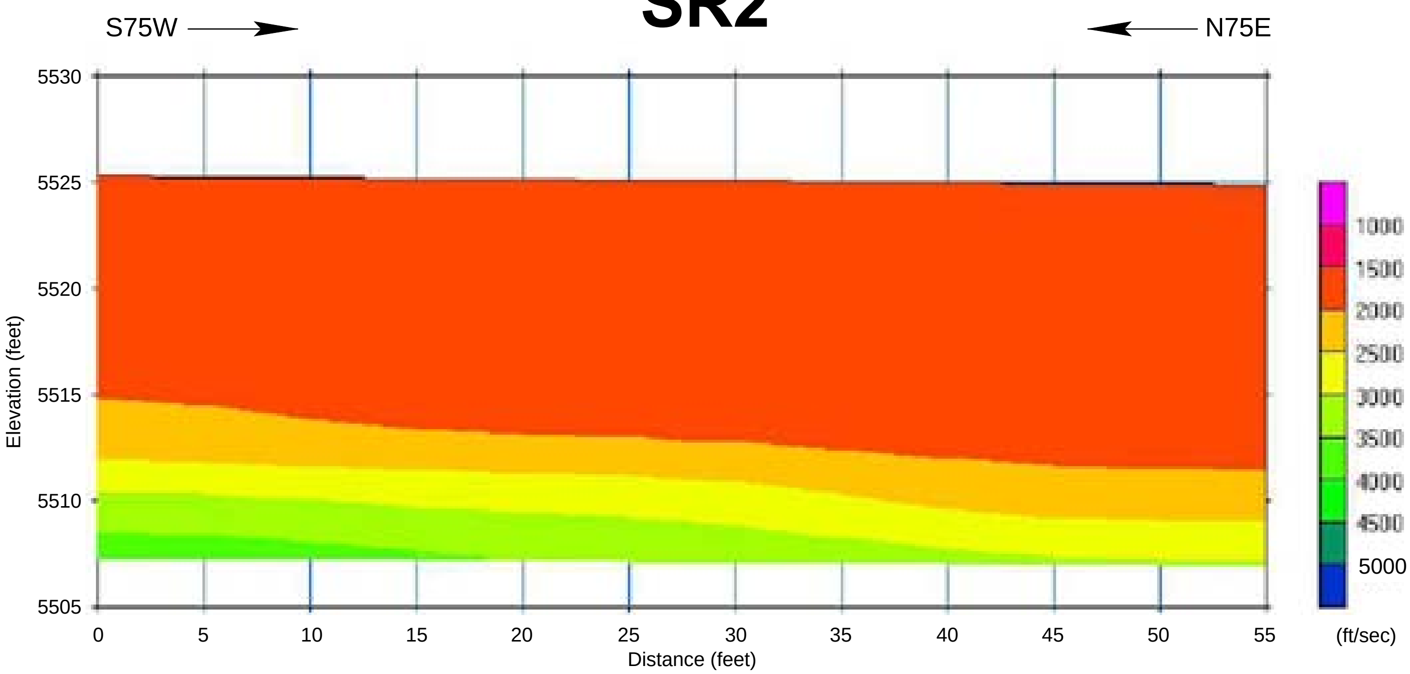
# BORING LOG / TEST PIT LEGEND AND SOIL DESCRIPTIONS

12/17/2009 Boring Test Pit Legend with Graphics.dwg

# SR1




# SR2




3/10/2011 1856.2 Appendix A Seismic Profiles.dwg

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## SEISMIC PROFILES

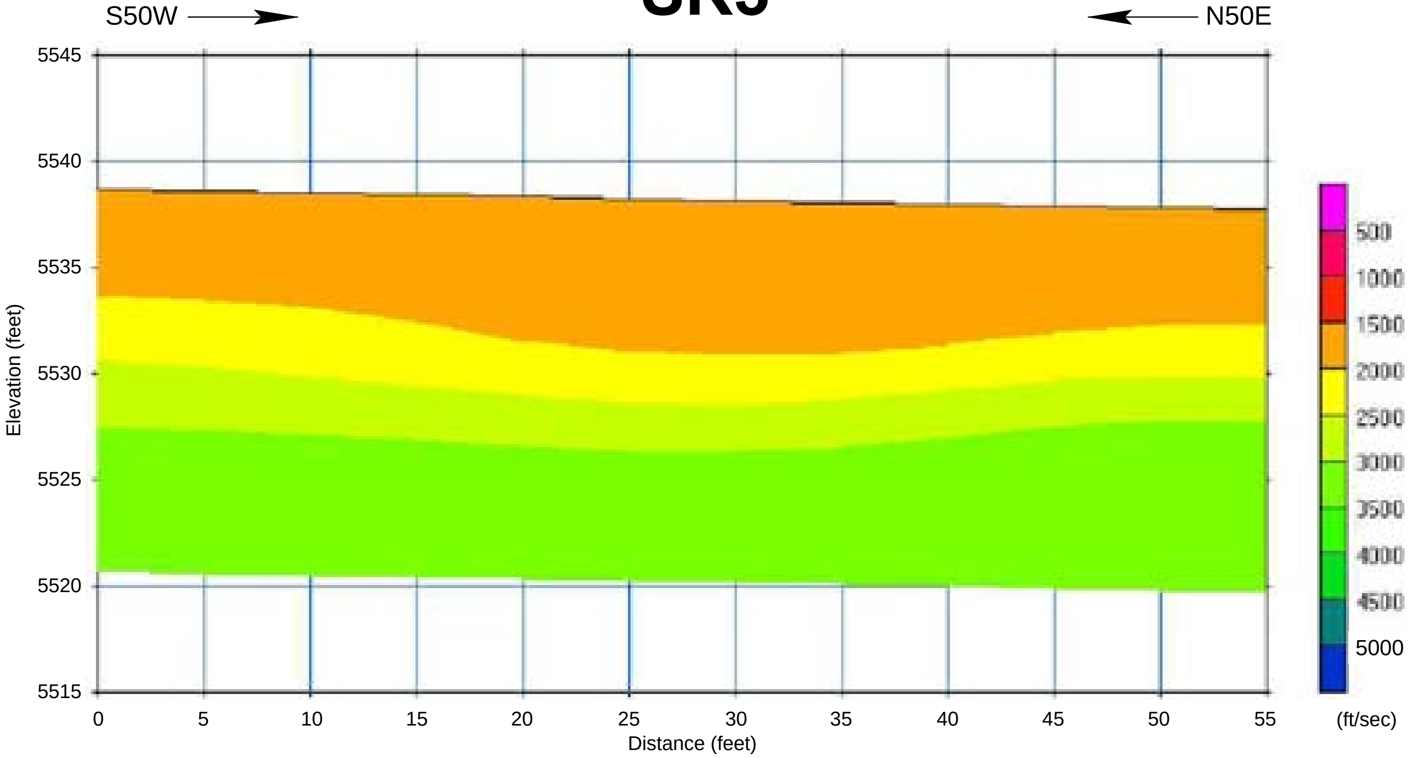
Donner Summit PUD
WWTP Expansion
Nevada County, California

**File No. 1856.2**

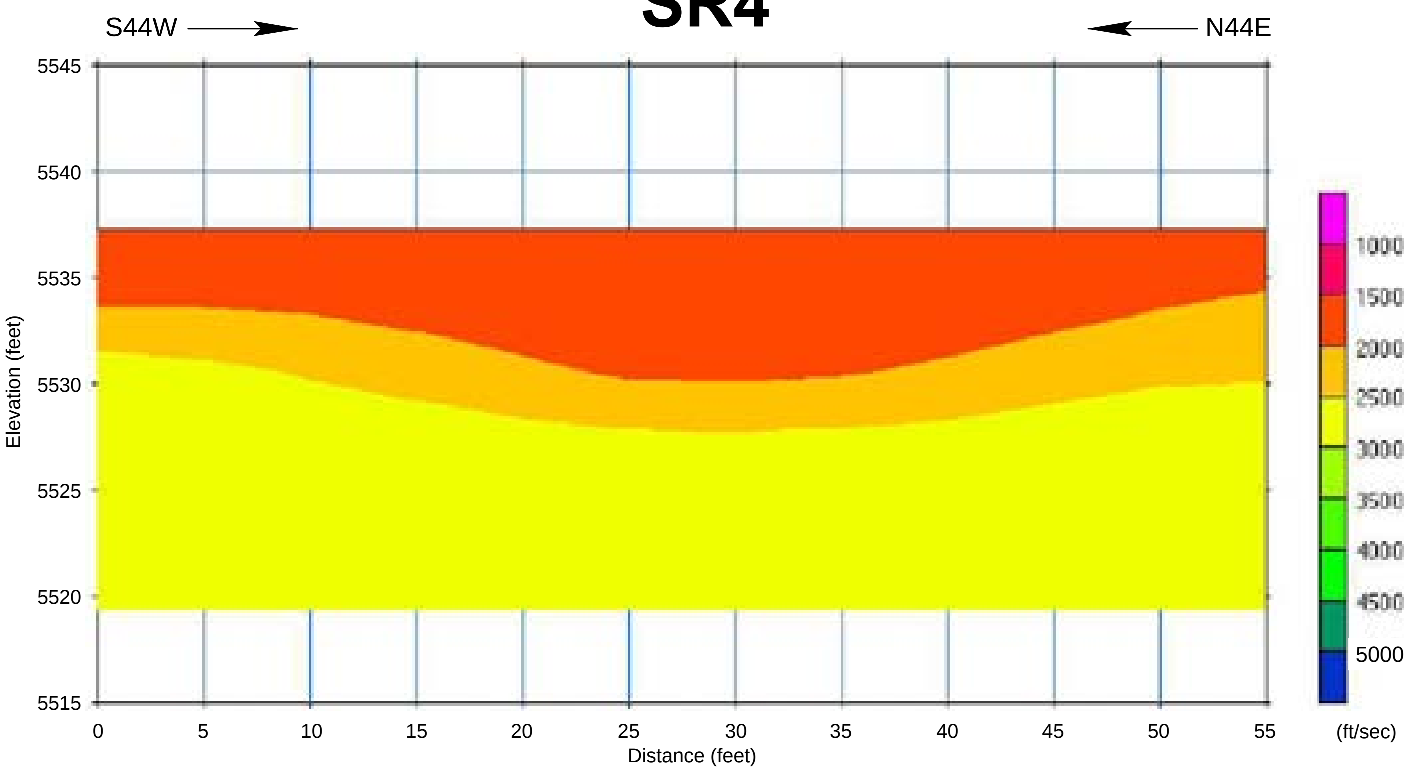
**March 2011**

**Appendix A**

# SR3




# SR4





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## SEISMIC PROFILES

Donner Summit PUD
WWTP Expansion
Nevada County, California

**File No. 1856.2**

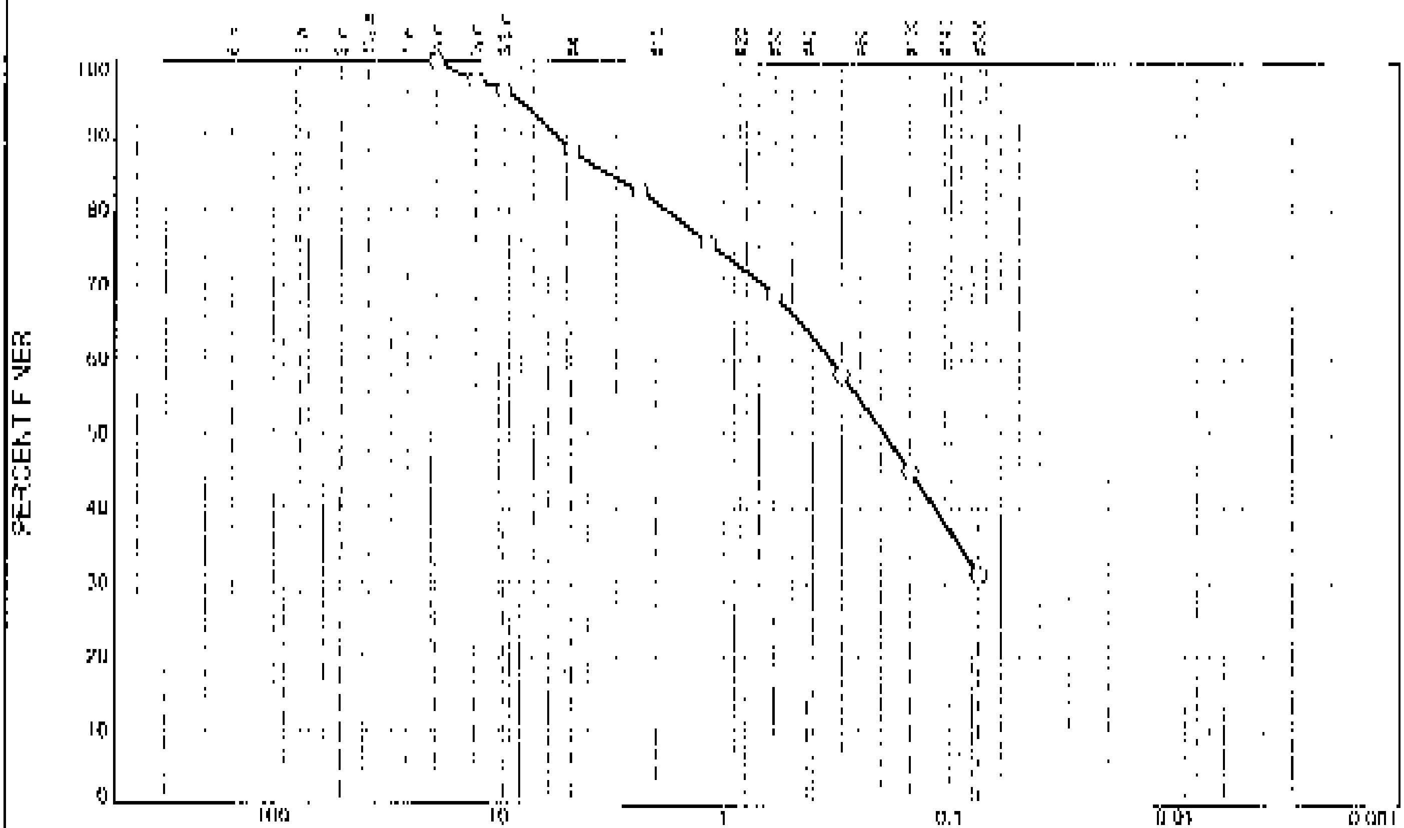
**March 2011**

**Appendix A**

3/10/2011 1856.2 Appendix A Seismic Profiles.dwg

# Laboratory Test Results

# Particle Size Distribution Report



GRAIN SIZE - mm

| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 11.9 | 7.0 | 17.3 | 32.7 | 31.1 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 3/4" | 100.0 | | |
| 1/2" | 97.5 | | |
| 3/8" | 96.1 | | |
| #4 | 88.1 | | |
| #8 | 82.5 | | |
| #16 | 75.7 | | |
| #30 | 68.7 | | |
| #50 | 58.0 | | |
| #100 | 45.0 | | |
| #200 | 31.1 | | |

* (no specification provided)

**Material Description**

Dark Yellowish Brown Silty SAND

**Atterberg Limits**

PL= LL= PI=

**Coefficients**

$D_{90}$= 5.3660 $D_{85}$= 3.3130 $D_{60}$= 0.3364
$D_{50}$= 0.1943 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= AASHTO=

**Remarks**

collected sample excludes material greater than 3" (cobbles)

**Sample Number:** TP1-1 **Depth:** 2.0'-6.0'

**Date:** 11-22-2010

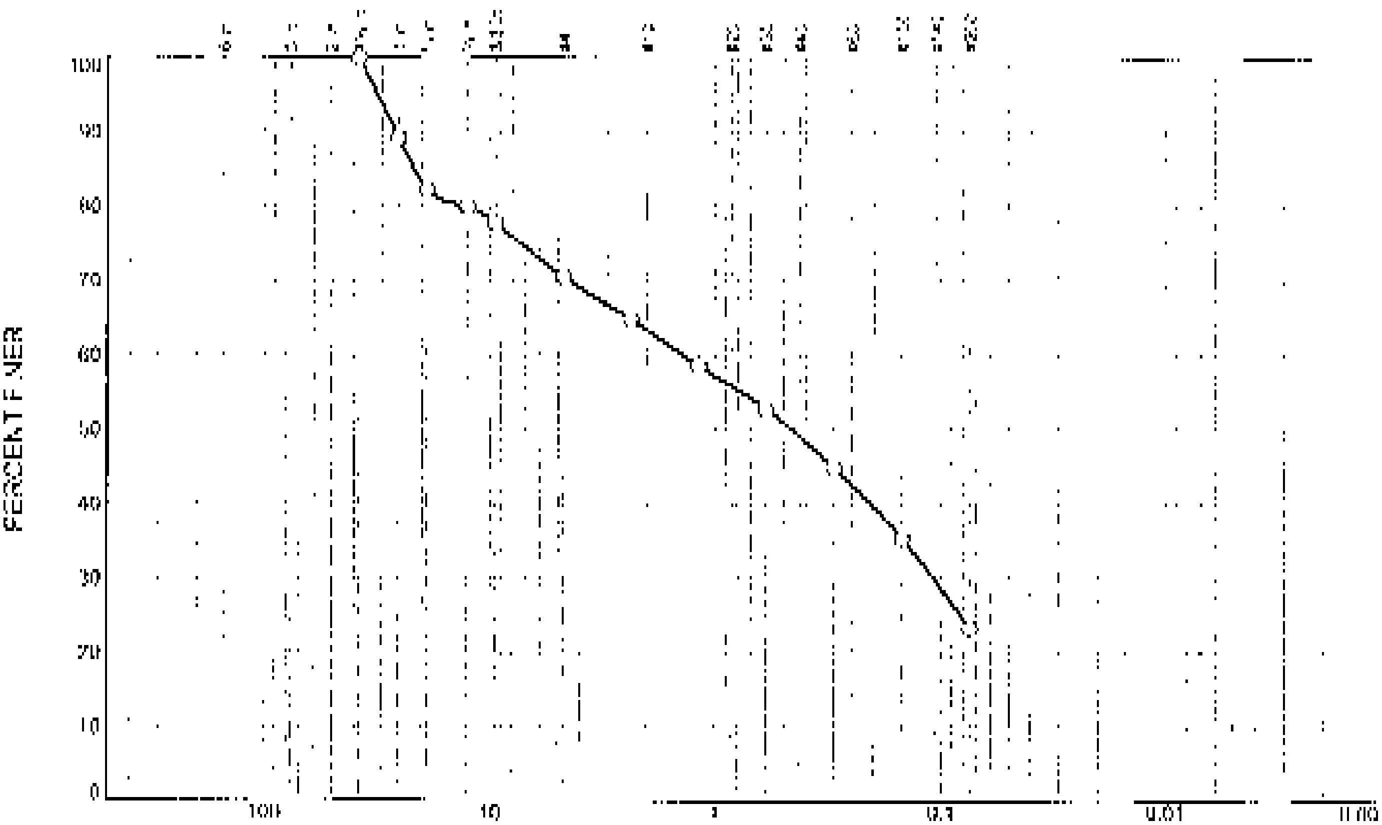
**Blackburn Consulting**

**Auburn, CA**

**Client:** Donner Summit PUD
**Project:** Donner Summit PUD WWTP Expansion
**Project No:** 1856.2 **Figure**

**Tested By:** KLC **Checked By:** KLC

# Particle Size Distribution Report




| % +3" | % Gravel Coarse | % Gravel Fine | % Sand Coarse | % Sand Medium | % Sand Fine | % Fines Silt | % Fines Clay |
|---|---|---|---|---|---|---|---|
| 0.0 | 17.8 | 11.7 | 7.1 | 14.3 | 25.8 | 23.3 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5" | 100.0 | | |
| 1.0" | 89.1 | | |
| 3/4" | 82.7 | | |
| 1/2" | 80.0 | | |
| 3/8" | 77.7 | | |
| #4 | 70.5 | | |
| #8 | 64.8 | | |
| #16 | 58.6 | | |
| #30 | 52.8 | | |
| #50 | 44.9 | | |
| #100 | 35.4 | | |
| #200 | 23.3 | | |

* (no specification provided)

**Material Description**

Dark Yellowish Brown Silty SAND with Gravel

**Atterberg Limits**

PL = LL = PI=

**Coefficients**

$D_{90}$= 26.2385 $D_{85}$= 21.7944 $D_{60}$= 1.3817
$D_{50}$= 0.4583 $D_{30}$= 0.1086 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS = AASHTO=

**Remarks**

collected sample excludes material greater than 3" (cobbles)

**Sample Number:** TP3-1 **Depth:** 2.0-5.5'

**Date:** 11-22-2010

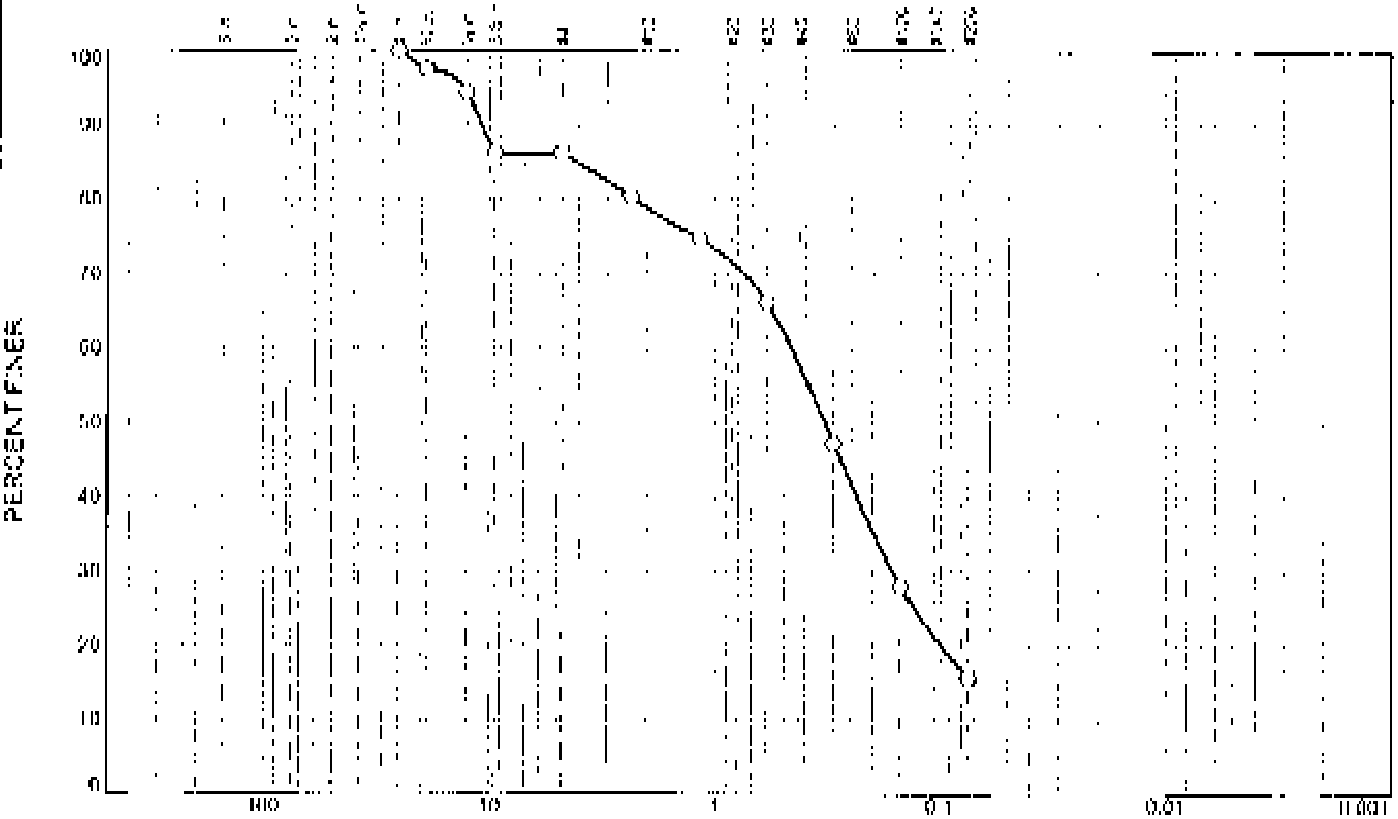
**Blackburn Consulting**

**Auburn, CA**

**Client:** Donner Summit PUD
**Project:** Donner Summit PUD WWTP Expansion
**Project No:** 1856.2 **Figure**

Tested By: KLC Checked By: KLC

# Particle Size Distribution Report




| % +3" | % Gravel Coarse | % Gravel Fine | % Sand Coarse | % Sand Medium | % Sand Fine | % Fines Silt | % Fines Clay |
|---|---|---|---|---|---|---|---|
| 0.0 | 2.4 | 11.4 | 7.4 | 21.1 | 42.0 | 15.7 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.0" | 100.0 | | |
| 3/4" | 97.6 | | |
| 1/2" | 94.5 | | |
| 3/8" | 86.2 | | |
| #4 | 86.2 | | |
| #8 | 80.5 | | |
| #16 | 74.7 | | |
| #30 | 66.1 | | |
| #50 | 47.1 | | |
| #100 | 28.0 | | |
| #200 | 15.7 | | |

* (no specification provided)

**Material Description**
Dark Yellowish Brown Silty SAND

**Atterberg Limits**
PL= LL= PI=

**Coefficients**
$D_{90}$= 10.8784 $D_{85}$= 4.0820 $D_{60}$= 0.4630
$D_{50}$= 0.3280 $D_{30}$= 0.1632 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**
USCS= AASHTO=

**Remarks**
collected sample excludes material greater than 1" (cobbles)

**Sample Number:** TP8-1 **Depth:** 3.0-5.5'

**Date:** 11-22-2010

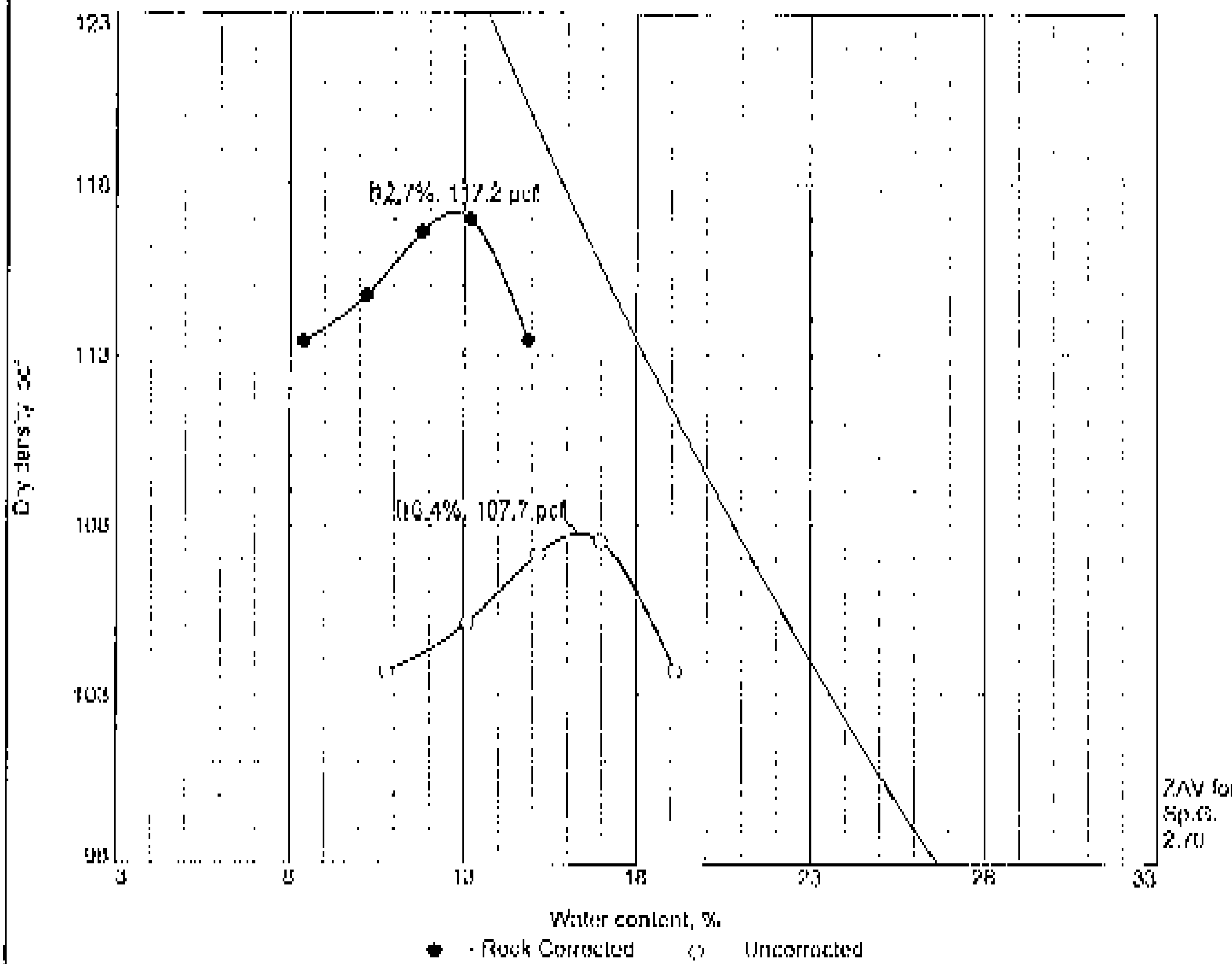
**Blackburn Consulting**

**Auburn, CA**

**Client:** Donner Summit PUD
**Project:** Donner Summit PUD WWTP Expansion
**Project No:** 1856.2 **Figure**

**Tested By:** KLC **Checked By:** KLC

# COMPACTION TEST REPORT




Test specification: ASTM D 1557-07 Method B Modified
ASTM D 4718-87 Oversize Corr. Applied to Each Test Point

| Elev/ Depth | Classification USCS | Classification AASHTO | Nat. Moist. | Sp.G. | LL | PI | % > 3/8 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| 2.0'-5.5' | | | | 2.70 | | | 22.5 | 23.3 |

| ROCK CORRECTED TEST RESULTS | UNCORRECTED | MATERIAL DESCRIPTION |
|---|---|---|
| Maximum dry density = 117.2 pcf | 107.7 pcf | Dark Yellowish Brown Silty SAND with Gravel |
| Optimum moisture = 12.7 % | 16.4 % | |

**Project No.** 1856.2 **Client:** Donner Summit PUD
**Project:** Donner Summit PUD WWTP Expansion

○ **Depth:** 2.0'-5.5' **Sample Number:** TP3-1

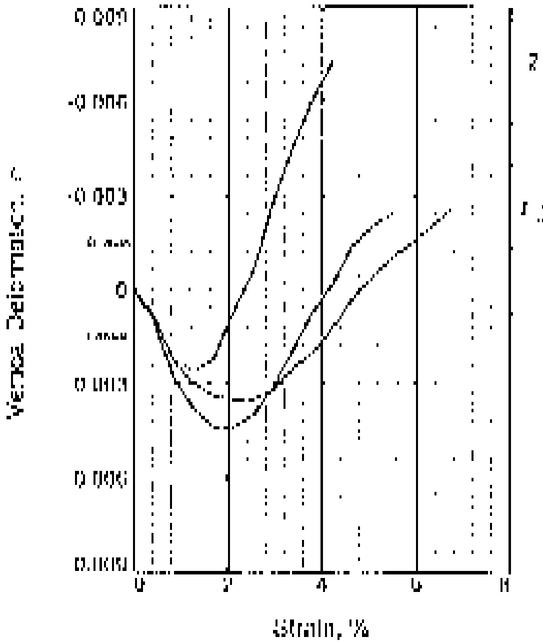
**Remarks:**
uncorrected value based on material passing 3/8" sieve. (collected sample excludes material greater than 3" (cobbles))

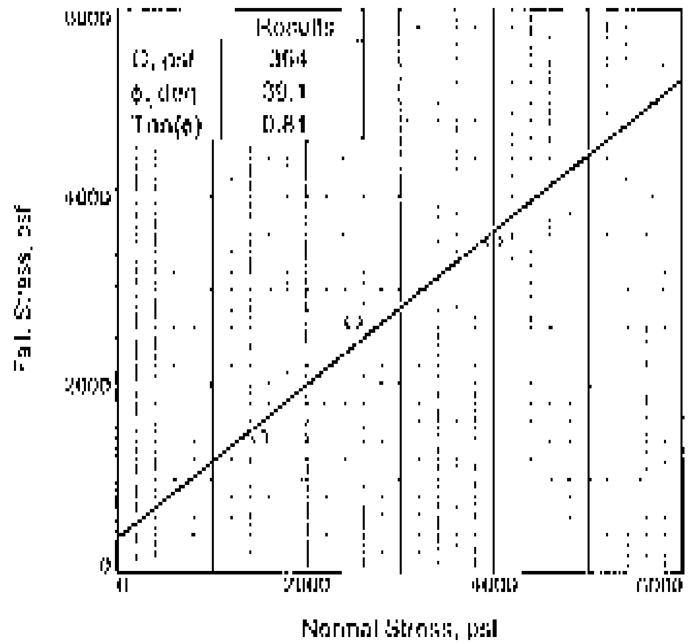
**Blackburn Consulting**

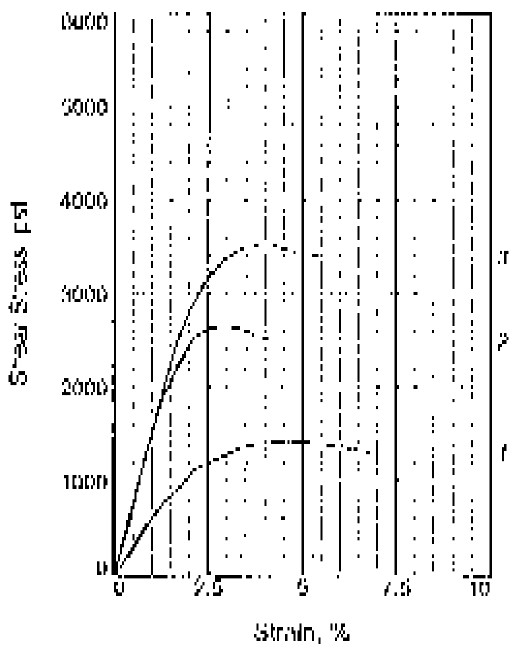
**Auburn, CA**

**Figure**

**Tested By:** KLC **Checked By:** KLC




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, % | 17.4 | 16.9 | 16.8 |
| | Dry Density, pcf | 101.6 | 102.1 | 102.1 |
| | Saturation, % | 71.2 | 70.3 | 69.5 |
| | Void Ratio | 0.6595 | 0.6505 | 0.6505 |
| | Diameter, in. | 2.36 | 2.36 | 2.36 |
| | Height, in. | 0.94 | 0.94 | 0.94 |
| At Test | Water Content, % | 23.1 | 22.7 | 21.4 |
| | Dry Density, pcf | 103.9 | 104.5 | 106.9 |
| | Saturation, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6226 | 0.6126 | 0.5763 |
| | Diameter, in. | 2.36 | 2.36 | 2.36 |
| | Height, in. | 0.92 | 0.92 | 0.90 |
| Normal Stress, psf | | 1300 | 2500 | 4000 |
| Fail. Stress, psf | | 1430 | 2659 | 3517 |
| Strain, % | | 4.2 | 3.0 | 3.8 |
| Ult. Stress, psf | | | | |
| Strain, % | | | | |
| Strain rate, in./min. | | 0.20 | 0.20 | 0.20 |

**Sample Type:** Remolded

**Description:** Dark Yellowish Brown Silty SAND with Gravel

**Assumed Specific Gravity=** 2.70

**Remarks:** Remolded to 95% of 107.7 pcf near 16.4% moisture. (material screened through #4 sieve for Direct Shear)

**Figure**

**Client:** Donner Summit PUD

**Project:** Donner Summit PUD WWTP Expansion

**Sample Number:** TP3-1 **Depth:** 2.0'-5.3'

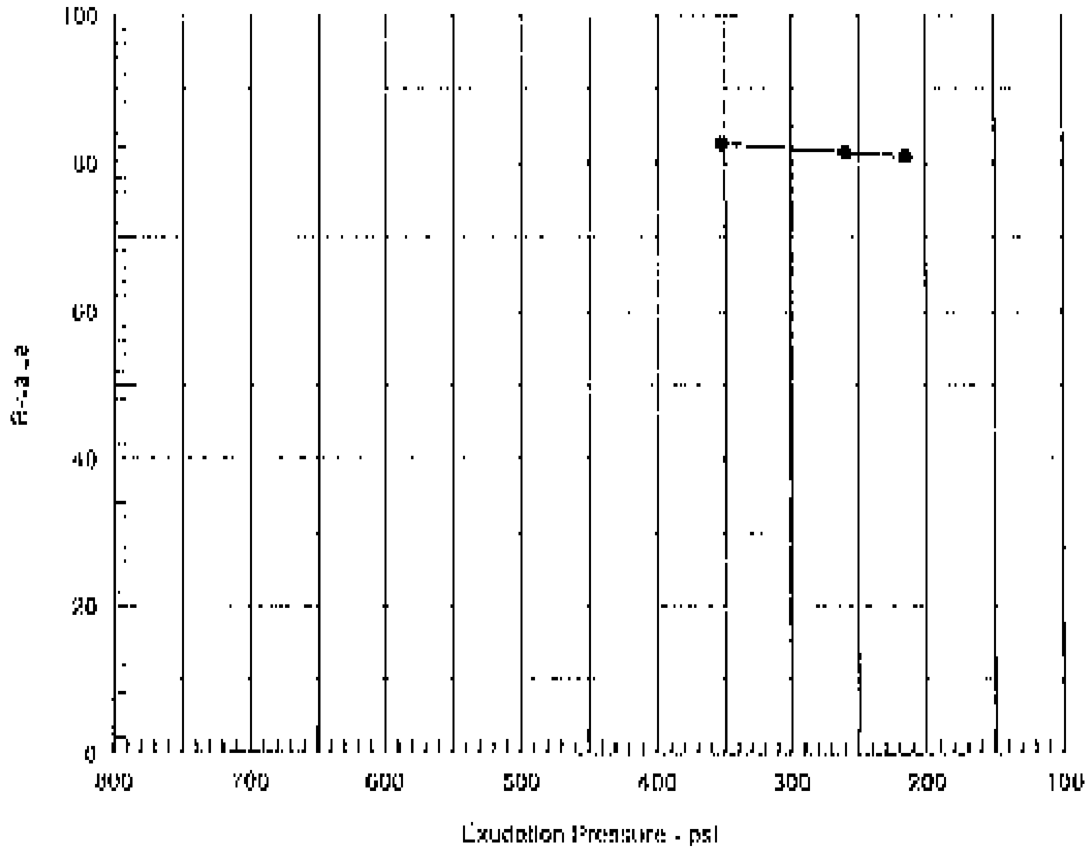
**Proj. No.:** 1856.2 **Date Sampled:** 11-22-2010

DIRECT SHEAR TEST REPORT

Blackburn Consulting

**Tested By:** KLC **Checked By:** KLC

# R-VALUE TEST REPORT




Resistance R-Value and Expansion Pressure - Cal Test 301

| No. | Compact. Pressure psi | Density pcf | Moist. % | Expansion Pressure psf | Horizontal Press. psi @ 160 psi | Sample Height In. | Exud. Pressure psi | R Value | R Value Corr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 350 | 114.3 | 5.8 | 92 | 18 | 2.49 | 353 | 83 | 83 |
| 2 | 350 | 114.8 | 8.0 | 70 | 20 | 2.48 | 259 | 81 | 81 |
| 3 | 350 | 115.2 | 9.1 | 52 | 22 | 2.48 | 215 | 81 | 81 |

**Test Results**

R-value at 300 psi exudation pressure = 82

**Material Description**

Poorly-graded SAND with SILT and GRAVEL, light olive brown

Project No.: 1856.2

Project: Donner Summit PUD Expansion

Source of Sample: TP-1 Depth: 2.0-6.0'

Sample Number: 1

Date: 3/2/2011

Tested by: MDR

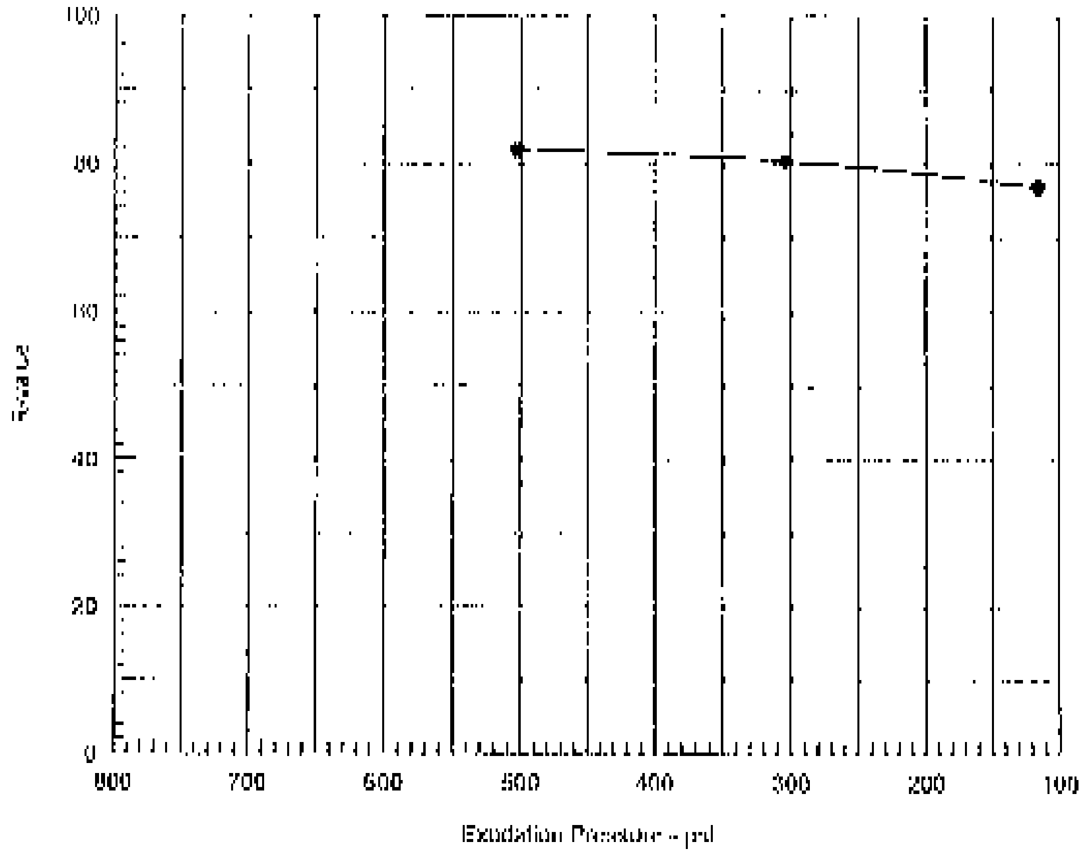
Checked by: RBL

Remarks:
18.9% retained on No. 4 sieve, sample batched.

R-VALUE TEST REPORT

**Blackburn Consulting**

# R-VALUE TEST REPORT




Resistance R-Value and Expansion Pressure - Cal Test 301

| No. | Compact. Pressure psi | Density pcf | Moist. % | Expansion Pressure psf | Horizontal Press. psi @ 160 psi | Sample Height In. | Exud. Pressure psi | R Value | R Value Corr. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 350 | 114.6 | 12.1 | 22 | 18 | 2.48 | 503 | 82 | 82 |
| 2 | 350 | 114.1 | 12.3 | 17 | 20 | 2.50 | 304 | 80 | 80 |
| 3 | 350 | 114.0 | 12.5 | 9 | 23 | 2.50 | 115 | 77 | 77 |

**Test Results**

R-value at 300 psi exudation pressure = 80

**Material Description**

Poorly-graded SAND with SILT and GRAVEL, dark yellowish brown

**Project No.:** 1856.2

**Project:** Donner Summit PUD Expansion

**Source of Sample:** TP-8 **Depth:** 3.0-5.5'

**Sample Number:** 1

**Date:** 3/2/2011

**Tested by:** MDR

**Checked by:** RBL

**Remarks:**
17.5% retained on No.4 sieve, sample batched.

R-VALUE TEST REPORT

**Blackburn Consulting**

Test Pit Photos

Site Photos

**Test Pit Photos**

TP1

TP1

TP2

TP2

**Test Pit Photos**

TP3


TP3

TP4


TP4

**Test Pit Photos**

TP5

TP5

TP6

TP6

**Test Pit Photos**

TP7


TP7

TP8


TP8

## Site Photos

Looking from proposed equalization tank to existing facilities.

The area of the proposed advanced treatment plant building.

Looking across northeast trending gully towards site of proposed equalization tank.

## Site Photos

The area of the proposed advanced treatment plant building.

Looking at the area of the proposed equalization tank.

# Pavement Section Calculations

CALFP Ver 1.1

Unit System : E

Title: Donner Summit PHD
Traffic Index (TI) 08.0
R Value of Subgrade (Native Soil) = 50
Required GE: 0000.80 ft

Base Type AB Class 2

Base Gravel Factor 0001.10
Base R Value 0078.00
0.0032*TI*(100-R VALUE) 0000.35 ft
Base MAX. depth 0002.00 ft
Base MIN. depth 0000.35 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.54 | 00.25 | 00.15 | 02.54 | 00.38 |
| 00.20 | 02.54 | 00.51 | 00.25 | 02.54 | 00.64 |
| 00.30 | 02.54 | 00.76 | 00.35 | 02.54 | 00.89 |
| 00.40 | 02.54 | 01.02 | 00.45 | 02.54 | 01.14 |
| 00.50 | 02.54 | 01.27 | 00.55 | 02.56 | 01.41 |
| 00.60 | 02.64 | 01.58 | 00.65 | 02.71 | 01.76 |

HMA Safety Factor (GE) 0000.20 ft
HMA Ultimate Depth 0000.65 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over design.
Note: Negative Safety Factor in Base

| HMA ft | TPB ft | T Base ft | B Base ft | Subbase ft | Res GE ft | Cost $/y^2 | HMA GF |
|---|---|---|---|---|---|---|---|
| 00.20 | 00.00 | 00.35 | 00.00 | 00.00 | 00.09 | 0000.00 | 02.54 |
| 00.25 | 00.00 | 00.35 | 00.00 | 00.00 | 00.22 | 0000.00 | 02.54 |
| 00.30 | 00.00 | 00.35 | 00.00 | 00.00 | 00.35 | 0000.00 | 02.54 |
| 00.35 | 00.00 | 00.35 | 00.00 | 00.00 | 00.47 | 0000.00 | 02.54 |
| 00.40 | 00.00 | 00.35 | 00.00 | 00.00 | 00.60 | 0000.00 | 02.54 |

***** FINISH *****

CALFP Ver. 1.1

Unit System : E

Title: Dumosa Summit PED
Traffic Index (TI) = 06.0
R-Value of Subgrade (Native Soil) = 50
Required GE = 0000.96 ft

Base Type = AB Class 2

Base Gravel Factor = 0001.10
Base R-Value = 0078.00
0.0032*TI*(100-R VALUE) = 0000.42 ft
Base MAX. depth = 0002.00 ft
Base MIN. depth = 0000.35 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.31 | 00.23 | 00.15 | 02.31 | 00.35 |
| 00.20 | 02.31 | 00.46 | 00.25 | 02.31 | 00.58 |
| 00.30 | 02.31 | 00.69 | 00.35 | 02.31 | 00.81 |
| 00.40 | 02.31 | 00.92 | 00.45 | 02.31 | 01.04 |
| 00.50 | 02.31 | 01.16 | 00.55 | 02.34 | 01.29 |
| 00.60 | 02.41 | 01.45 | 00.65 | 02.48 | 01.61 |
| 00.70 | 02.54 | 01.78 | 00.75 | 02.60 | 01.95 |
| 00.80 | 02.65 | 02.12 | 00.85 | 02.71 | 02.30 |

HMA Safety Factor (GE) = 0000.20 ft
HMA Ultimate Depth = 0000.80 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over-design
Note: Negative Safety Factor in Base

| HMA ft | CTB ft | T Base ft | P Base ft | Subbase ft | Res GE ft | Cost $/y^2 | HMA-GF |
|---|---|---|---|---|---|---|---|
| 00.25 | 00.00 | 00.35 | 00.00 | 00.00 | 00.00 | 0000.00 | 02.31 |
| 00.30 | 00.00 | 00.35 | 00.00 | 00.00 | 00.12 | 0000.00 | 02.31 |
| 00.35 | 00.00 | 00.35 | 00.00 | 00.00 | 00.23 | 0000.00 | 02.31 |
| 00.40 | 00.00 | 00.35 | 00.00 | 00.00 | 00.35 | 0000.00 | 02.31 |
| 00.45 | 00.00 | 00.35 | 00.00 | 00.00 | 00.46 | 0000.00 | 02.31 |
| 00.50 | 00.00 | 00.35 | 00.00 | 00.00 | 00.58 | 0000.00 | 02.31 |

***** FINISH *****

CALFP Ver 1.1

Unit System E

Title: Donner Summit PUD
Traffic Index (TI) = 07.0
R Value of Subgrade (Native Soil) 50
Required GE = 0001.12 ft

Base Type AB-Class 2

Base Gravel Factor = 0001.10
Base R.Value = 0078.00
0.0032*TI*(100-R.VALUE) = 0000.49 ft
Base MAX. depth 0002.00 ft
Base MIN. depth 0000.35 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.14 | 00.21 | 00.15 | 02.14 | 00.32 |
| 00.20 | 02.14 | 00.43 | 00.25 | 02.14 | 00.54 |
| 00.30 | 02.14 | 00.64 | 00.35 | 02.14 | 00.75 |
| 00.40 | 02.14 | 00.86 | 00.45 | 02.14 | 00.96 |
| 00.50 | 02.14 | 01.07 | 00.55 | 02.17 | 01.19 |
| 00.60 | 02.23 | 01.34 | 00.65 | 02.29 | 01.49 |
| 00.70 | 02.35 | 01.65 | 00.75 | 02.40 | 01.80 |
| 00.80 | 02.46 | 01.97 | 00.85 | 02.51 | 02.14 |
| 00.90 | 02.55 | 02.30 | 00.95 | 02.60 | 02.47 |

HMA Safety Factor (GF) = 0000.20 ft
HMA Ultimate Depth = 0000.95 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) 0000.20 ft

Note: Positive Residual GE indicates over design.
Note: Negative Safety Factor in Base

| HMA ft | TPB ft | T-Base ft | B-Base ft | Subbase ft | Res-GE ft | Cost $/y^2 | HMA GF |
|---|---|---|---|---|---|---|---|
| 00.35 | 00.00 | 00.35 | 00.00 | 00.00 | 00.01 | 0000.00 | 02.14 |
| 00.40 | 00.00 | 00.35 | 00.00 | 00.00 | 00.12 | 0000.00 | 02.14 |
| 00.45 | 00.00 | 00.35 | 00.00 | 00.00 | 00.23 | 0000.00 | 02.14 |
| 00.50 | 00.00 | 00.35 | 00.00 | 00.00 | 00.34 | 0000.00 | 02.14 |
| 00.55 | 00.00 | 00.35 | 00.00 | 00.00 | 00.46 | 0000.00 | 02.17 |
| 00.60 | 00.00 | 00.35 | 00.00 | 00.00 | 00.60 | 0000.00 | 02.23 |

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: Donner Summit PUD
Traffic Index (TI) = 07.5
R-Value of Subgrade (Native Soil) = 50
Required GE = 0001.20 ft

Base Type = AB Class 2

Base Gravel Factor = 0001.10
Base R-Value = 0078.00
0.0032*TI*(100-R.VALUE) = 0000.53 ft
Base MAX. depth = 0002.00 ft
Base MIN. depth = 0000.35 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.07 | 00.21 | 00.15 | 02.07 | 00.31 |
| 00.20 | 02.07 | 00.41 | 00.25 | 02.07 | 00.52 |
| 00.30 | 02.07 | 00.62 | 00.35 | 02.07 | 00.72 |
| 00.40 | 02.07 | 00.83 | 00.45 | 02.07 | 00.93 |
| 00.50 | 02.07 | 01.04 | 00.55 | 02.09 | 01.15 |
| 00.60 | 02.16 | 01.30 | 00.65 | 02.21 | 01.44 |
| 00.70 | 02.27 | 01.59 | 00.75 | 02.32 | 01.74 |
| 00.80 | 02.37 | 01.90 | 00.85 | 02.42 | 02.06 |
| 00.90 | 02.47 | 02.22 | 00.95 | 02.51 | 02.38 |
| 01.00 | 02.56 | 02.56 | 01.05 | 02.60 | 02.73 |

HMA Safety Factor (GE) = 0000.20 ft
HMA Ultimate Depth = 0001.00 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over design.
Note: Negative Safety Factor in Base

| HMA ft | TPB ft | T-Base ft | B-Base ft | Subbase ft | Res-GE ft | Cost $/yd^2 | HMA GF |
|---|---|---|---|---|---|---|---|
| 00.35 | 00.00 | 00.45 | 00.00 | 00.00 | 00.02 | 0000.00 | 02.07 |
| 00.40 | 00.00 | 00.35 | 00.00 | 00.00 | 00.01 | 0000.00 | 02.07 |
| 00.45 | 00.00 | 00.35 | 00.00 | 00.00 | 00.12 | 0000.00 | 02.07 |
| 00.50 | 00.00 | 00.35 | 00.00 | 00.00 | 00.22 | 0000.00 | 02.07 |
| 00.55 | 00.00 | 00.35 | 00.00 | 00.00 | 00.33 | 0000.00 | 02.09 |
| 00.60 | 00.00 | 00.35 | 00.00 | 00.00 | 00.48 | 0000.00 | 02.16 |
| 00.65 | 00.00 | 00.35 | 00.00 | 00.00 | 00.62 | 0000.00 | 02.21 |

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title : Donner Summit PUD
Traffic Index (TI) = 05.0
R Value of Subgrade (Native Soil) = 50
Required GE = 0000.80 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.54 | 00.25 | 00.15 | 02.54 | 00.38 |
| 00.20 | 02.54 | 00.51 | 00.25 | 02.54 | 00.64 |
| 00.30 | 02.54 | 00.76 | 00.35 | 02.54 | 00.89 |
| 00.40 | 02.54 | 01.02 | 00.45 | 02.54 | 01.14 |
| 00.50 | 02.54 | 01.27 | 00.55 | 02.56 | 01.41 |
| 00.60 | 02.64 | 01.58 | 00.65 | 02.71 | 01.76 |

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0000.65 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over design.
Note: Negative Safety Factor in Native Soil

| HMA ft | TPB ft | T-Base ft | D-Base ft | Subbase ft | Res-GE ft | Cost $/y^2 | HMA GF |
|---|---|---|---|---|---|---|---|
| 00.35 | 00.00 | 00.00 | 00.00 | 00.00 | 00.09 | 0000.00 | 02.54 |
| 00.40 | 00.00 | 00.00 | 00.00 | 00.00 | 00.22 | 0000.00 | 02.54 |
| 00.45 | 00.00 | 00.00 | 00.00 | 00.00 | 00.34 | 0000.00 | 02.54 |
| 00.50 | 00.00 | 00.00 | 00.00 | 00.00 | 00.47 | 0000.00 | 02.54 |
| 00.55 | 00.00 | 00.00 | 00.00 | 00.00 | 00.61 | 0000.00 | 02.56 |

Note: This design requires a safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table.

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: Denver Summit PUD
Traffic Index (TI) = 06.0
R-Value of Subgrade (Native Soil) = 50
Required GE = 0000.96 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.31 | 00.23 | 00.15 | 02.31 | 00.35 |
| 00.20 | 02.31 | 00.46 | 00.25 | 02.31 | 00.58 |
| 00.30 | 02.31 | 00.69 | 00.35 | 02.31 | 00.81 |
| 00.40 | 02.31 | 00.92 | 00.45 | 02.31 | 01.04 |
| 00.50 | 02.31 | 01.16 | 00.55 | 02.34 | 01.29 |
| 00.60 | 02.41 | 01.45 | 00.65 | 02.48 | 01.61 |
| 00.70 | 02.54 | 01.78 | 00.75 | 02.60 | 01.95 |
| 00.80 | 02.65 | 02.12 | 00.85 | 02.71 | 02.30 |

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth 0000.80 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) 0000.30 ft

Note: Positive Residual GE indicates over design
Note: Negative Safety Factor to Native Soil

| HMA ft | LCB ft | T Base ft | U Base ft | Subbase ft | Res GE ft | Cost $/y^2 | HMA-GF |
|---|---|---|---|---|---|---|---|
| 00.45 | 00.00 | 00.00 | 00.00 | 00.00 | 00.08 | 0000.00 | 02.31 |
| 00.50 | 00.00 | 00.00 | 00.00 | 00.00 | 00.20 | 0000.00 | 02.31 |
| 00.55 | 00.00 | 00.00 | 00.00 | 00.00 | 00.33 | 0000.00 | 02.34 |
| 00.60 | 00.00 | 00.00 | 00.00 | 00.00 | 00.49 | 0000.00 | 02.41 |
| 00.65 | 00.00 | 00.00 | 00.00 | 00.00 | 00.65 | 0000.00 | 02.48 |

Note: This design requires a safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res GE' column. Such a design is generally shown in the first row of the above table.

***** END *****

CALFP Ver 1.1

Unit System = E

7 Title: Donner Summit PUD
Traffic Index (TI) = 07.0
R-Value of Subgrade (Native Soil) = 50
Required GE = 0001.12 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.14 | 00.21 | 00.15 | 02.14 | 00.32 |
| 00.20 | 02.14 | 00.43 | 00.25 | 02.14 | 00.54 |
| 00.30 | 02.14 | 00.64 | 00.35 | 02.14 | 00.75 |
| 00.40 | 02.14 | 00.86 | 00.45 | 02.14 | 00.96 |
| 00.50 | 02.14 | 01.07 | 00.55 | 02.17 | 01.19 |
| 00.60 | 02.23 | 01.34 | 00.65 | 02.29 | 01.49 |
| 00.70 | 02.35 | 01.65 | 00.75 | 02.40 | 01.80 |
| 00.80 | 02.46 | 01.97 | 00.85 | 02.51 | 02.13 |
| 00.90 | 02.55 | 02.30 | 00.95 | 02.60 | 02.47 |

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0000.95 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design
Note: Negative Safety Factor in Native Soil

| HMA ft | TPB ft | T-Base ft | B-Base ft | Subbase ft | Res-GE ft | Cost $/y^2 | HMA-GF |
|---|---|---|---|---|---|---|---|
| 00.55 | 00.00 | 00.00 | 00.00 | 00.00 | 00.07 | 0000.00 | 02.17 |
| 00.60 | 00.00 | 00.00 | 00.00 | 00.00 | 00.22 | 0000.00 | 02.23 |
| 00.65 | 00.00 | 00.00 | 00.00 | 00.00 | 00.37 | 0000.00 | 02.29 |
| 00.70 | 00.00 | 00.00 | 00.00 | 00.00 | 00.53 | 0000.00 | 02.35 |

Note: This design requires a Safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res-GE' column. Such a design is generally shown in the first row of the above table

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: Denver Summit PUD
Traffic Index (TI) = 07.5
R Value of Subgrade (Native Soil) = 50
Required GE = 0001.20 ft

| Depth (ft) | GF | GE (ft) | Depth (ft) | GF | GE (ft) |
|---|---|---|---|---|---|
| 00.10 | 02.07 | 00.21 | 00.15 | 02.07 | 00.31 |
| 00.20 | 02.07 | 00.41 | 00.25 | 02.07 | 00.52 |
| 00.30 | 02.07 | 00.62 | 00.35 | 02.07 | 00.72 |
| 00.40 | 02.07 | 00.83 | 00.45 | 02.07 | 00.93 |
| 00.50 | 02.07 | 01.04 | 00.55 | 02.09 | 01.15 |
| 00.60 | 02.16 | 01.30 | 00.65 | 02.21 | 01.44 |
| 00.70 | 02.27 | 01.59 | 00.75 | 02.32 | 01.74 |
| 00.80 | 02.37 | 01.90 | 00.85 | 02.42 | 02.06 |
| 00.90 | 02.47 | 02.22 | 00.95 | 02.51 | 02.38 |
| 01.00 | 02.56 | 02.56 | 01.05 | 02.60 | 02.73 |

HMA Safety Factor (GE) = 0000.10 ft
HMA Ultimate Depth = 0001.00 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (selected) = 0000.30 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Native Soil

| HMA ft | TPB ft | T Base ft | B Base ft | Subbase ft | Res GE ft | Cost $/ft^2 | HMA-GF |
|---|---|---|---|---|---|---|---|
| 00.60 | 00.00 | 00.00 | 00.00 | 00.00 | 00.10 | 0000.00 | 02.16 |
| 00.65 | 00.00 | 00.00 | 00.00 | 00.00 | 00.24 | 0000.00 | 02.21 |
| 00.70 | 00.00 | 00.00 | 00.00 | 00.00 | 00.39 | 0000.00 | 02.27 |
| 00.75 | 00.00 | 00.00 | 00.00 | 00.00 | 00.54 | 0000.00 | 02.32 |

Note: This design requires a Safety Factor for GE. This requires that a design be selected that has a value as close as possible to 0.1 in the 'Res GE' column. Such a design is generally shown as the first row of the above table.

***** FINISH *****