GEOTECHNICAL
RECOMMENDATIONS REPORT

Napa-Sonoma Salt Marsh Restoration Pipeline

Napa and Sonoma Counties, CA

Prepared by:

BLACKBURN CONSULTING
11521 Blocker Drive, Suite 110
Auburn, CA 95603
(530) 887-1494

April 28, 2011

Prepared for:

Camp Dresser & McKee, Inc.

Auburn Office:
11521 Blocker Drive, Suite 110 ▪ Auburn, CA 95603
(530) 887-1494 ▪ Fax (530) 887-1495

blackburn consulting

Modesto Office: (209) 522-6273
West Sacramento Office: (916) 375-8706

Geotechnical ▪ Construction Services ▪ Forensics

File No. 2049.1
April 28, 2011

Mr. Michael Middleton, P.E.
CDM
2295 Gateway Oaks Drive, Suite 240
Sacramento, CA 95833

Subject: **Geotechnical Recommendations Report**
Napa-Sonoma Salt Marsh Restoration Pipeline
Sonoma and Napa Counties, California

Dear Mr. Middleton:

Blackburn Consulting (BCI) is pleased to submit this Geotechnical Recommendations Report for the Sonoma Valley County Sanitation District (SVCSD), Napa-Sonoma Salt Marsh Restoration Pipeline located in Napa and Sonoma Counties, California. BCI prepared this report in accordance with our August 6, 2010 agreement.

Please call us if you have questions or require additional information.

Sincerely,

BLACKBURN CONSULTING

Patrick F. Fischer, C.E.G.
Engineering Geologist, Principal

PROFESSIONAL GEOLOGIST
PATRICK F. FISCHER
No. 1739
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Tom Blackburn, P.E., G.E.
Geotechnical Engineer, President

REGISTERED PROFESSIONAL ENGINEER
THOMAS W. BLACKBURN
No. 2311
Exp. 6/30/12
GEOTECHNICAL
STATE OF CALIFORNIA

GEOTECHNICAL RECOMMENDATIONS REPORT

Napa-Sonoma Salt Marsh Restoration Pipeline

TABLE OF CONTENTS

LIST OF ABBREVIATIONS USED

AC	Asphaltic Concrete
AB	Aggregate Baserock
Af	Artificial Fill
Alf	Artificial Levee Fill
ASTM	American Society for Testing and Materials
BCI	Blackburn Consulting
bgs	Below the ground surface
CDM	Camp Dresser & McKee, Inc.
CRR	Cyclic Resistance Ratio
CSD	County Sanitation District
CSR	Cyclic Stress Ratio
CTM	California (Caltrans) Test Method
DWR	California Department of Water Resources
E’	Modulus of Soil Reaction
E'_b	Modulus of Soil Reaction (backfill)
E'_n	Modulus of Soil Reaction (undisturbed, native soil)
ft	Feet
FOS	Factor of Safety
GPS	Global Positioning System
I.D.	Inside Diameter
msl	Mean Sea Level
NAD	North American Datum
NSMWA	Napa-Sonoma Marshes Wildlife Area
NWPRA	Northwestern Pacific Railroad Authority
O.D.	Outside Diameter
Ph	Huichica Formation
Qha	Alluvium, undivided
Qhbm	Bay Mud
Qhc	Stream Channel Deposits
Qof	Older Alluvial Fan Deposits
r_d	Soil Flexibility Reduction
SCWA	Sonoma County Water Agency
SPT	Standard Penetration Test
SVCSD	Sonoma Valley County Sanitation District
USGS	United States Geological Survey
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

1.1 Purpose

Blackburn Consulting (BCI) prepared this draft Geotechnical Recommendations Report for the Sonoma Valley County Sanitation District's (SVCSD) Napa-Sonoma Salt Marsh Restoration Pipeline. This report presents geotechnical and geologic data for the project and provides recommendations for design and construction of the new pipeline.

BCI prepared this report for Camp Dresser & McKee, Inc. (CDM) to use during design and construction of the proposed improvements.

1.2 Scope of Services

To prepare this report, BCI:

- Discussed the proposed improvements with CDM personnel
- Reviewed published geologic mapping and geotechnical information available for the alignment
- Reviewed subsurface information provided by SVCSD for SVCSD reservoirs located adjacent to portions of the alignment
- Marked boring locations and notified Underground Service Alert
- Observed, logged, and sampled 36 borings to depths ranging from 10 to 50 feet below ground surface (bgs)
- Installed 4 groundwater observation wells along the alignment
- Performed laboratory tests on soil samples obtained from the exploratory borings
- Completed engineering analysis and calculations to develop conclusions and recommendations.

2 SITE AND PROJECT DESCRIPTION

2.1 Site Location and Description

The proposed pipeline project is located in an unincorporated area of Napa and Sonoma Counties. Figure 1 shows the general project location and Figure 2 shows a more detailed alignment location.

The pipeline begins north of the town of Schellville, in Sonoma County, at the SVCSD wastewater treatment plant (WWTP) near the intersection of 8th Street and Imperial Drive (approximate latitude 38.2511, longitude 122.4410). It then runs southeast, approximately 43,000 feet, into Napa County and terminates at Buchli Station Road (approximate latitude 38.2149, longitude 122.3319).

The alignment is located within the valley floor and low foothills of eastern Sonoma Valley. Topography along the alignment ranges from a low of approximately 5 feet above mean sea level (msl) at the northwestern portion to a high of approximately 100 feet along the southeastern

portion of the alignment. Topography is relatively flat, where crossing the valley floor, to moderately sloping. Figure 2 shows the overall topography in the area of the alignment.

Most of the pipeline alignment follows existing roadways and unimproved (dirt) roadways. A portion of the alignment is cross country (at Schell Creek). Major drainage crossings include Schell Creek/Slough at the west portion of the alignment and Huichica Creek at the eastern portion. The alignment crosses several other intermittent drainages and crosses Northwestern Pacific Railroad Authority (NWPRA) railroad embankment at two locations. Figure 2 shows major roadways, railroad, and drainages along the alignment.

2.2 Project Description

Project information provided by CDM indicates that the California Coastal Conservancy, U.S. Army Corps of Engineers, and California Department of Fish and Game are implementing a salinity reduction and habitat restoration project for the 9,460-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area. The Napa River Unit is located at the northeast edge of San Pablo Bay, adjacent to the Napa River. The purpose of the Napa River Salt Marsh Restoration Project is to restore habitat, including tidal habitat and managed ponds, and provide for better management of ponds in the Napa River Unit to support populations of fish and wildlife.

The restoration project includes the annual delivery of approximately 2,000 to 3,000 acre feet of tertiary recycled water from the SVCSD as an ongoing supply of non-saline water for restoration, and subsequent agricultural use. SVCSD will construct a pipeline (this project) to provide recycled water to ponds for habitat enhancement. The proposed facilities for the project include:

- Design and construction of new pipeline from the existing SVCSD WWTP to the existing SVCSD storage reservoirs located near the intersection of the NWPRA and Ramal Road, which includes approximately 3.5 miles of new 18-inch pipeline parallel to an existing 18-inch pipeline between the WWTP junction structure and the existing storage reservoirs.
- Approximately 4 miles of 18-inch to 24-inch pipeline from the reservoirs to the salt ponds at the east end of the project. From the reservoirs, approximately 0.25 miles of pipeline would be installed north along an access road to Ramal Road. The alignment would then extend 1.75 miles east along Ramal Road. At that point, the pipeline transverses Huichica Creek and runs east along an agricultural access road for approximately 1.25 miles to Buchli Station Road. The pipeline will then run south on Buchli Station Road for approximately 0.65 miles until it reaches the Huichica Creek entrance of the Napa-Sonoma Marshes Wildlife Area (NSMWA).

Typical cover over the pipe will be on the order of 3 to 5 feet. Trenchless installation methods may be used at Fremont Blvd (State Route 12/121), Schell Creek, drainage and railroad crossings, and Huichica Creek; otherwise, the pipeline will be an open cut installation. Figure 2 shows the approximate location of planned trenchless installations.

3 GEOLOGY

3.1 Regional Geology

The project region is located within the Coast Ranges Geomorphic Province. This province consists of northwest-trending mountain ranges and valleys. The ranges and valleys trend northwest, sub parallel to the San Andreas Fault. The Coast Ranges are composed of thick Mesozoic and Cenozoic sedimentary strata that dip to the east beneath the alluvium of the Great Valley; to the west is the Pacific Ocean. The northern and southern ranges are separated by a broad depression containing the San Francisco Bay, which formed due to east-west expansion (pull-apart) between the San Andreas Fault and the Hayward Fault systems. The northern Coast Ranges, where the project site is located, are dominated by irregular, knobby, landslide topography of the Franciscan Complex and the eastern border is characterized by strike-ridges and valleys in Upper Mesozoic strata. In several areas, Franciscan rocks are overlain by volcanic cones and flows of the Quien Sabe, Sonoma and Clear Lake volcanic fields.

3.2 Project Geology

A Geologic Map (after Wagner and Gutierrez, 2010)[1] of the area including the alignment is attached as Figure 3. This map shows the approximate pipeline alignment and underlying geology. The alignment is primarily underlain by three geologic units, which are:

- Bay Mud (Qhbm)
- Older Alluvial Fan Deposits (Qof)
- Huichica Formation (Ph)

Wagner and Gutierrez (2010) describe these units as follows:

- **Bay Mud (Qhbm; Holocene, less than 10,000 years old)** - Estuarine silt, clay, peat, and fine sand deposited at or near sea level in San Pablo Bay
- **Alluvial fan deposits (Qof; old, early to late Pleistocene age)** - Sand, gravel, silt, and clay, deeply dissected. Topography is moderately rolling with little or no original alluvial surfaces preserved
- **Huichica Formation (Ph; Pliocene age)** - Fluvial gravel, sand, silt, and clay. Sediments derived mostly from Sonoma Volcanics but coarse sand is rich in Franciscan pebbles and cobbles.

Other minor units encountered along the alignment include:

- **Artificial fill (af; Holocene, historic time)** – Constructed fills (road, embankment, etc.) that may be engineered and/or non-engineered. Locally includes artificial dam fill
- **Artificial levee fill (alf; Holocene, historic time)** - Constructed fills (levee) that may be engineered and/or non-engineered
- **Artificial fill placed over bay mud (afbm; Holocene, historic time)** - May be engineered and/or non-engineered

[1] Wagner , D.L., and Gutierrez, C.I., 2010, Geologic Map of the Napa, 30'x 60', Quadrangle, California, 1:100,000; California Geological Survey

- **Stream channel deposits (Qhc; late Holocene to modern <150 years)** - Deposits in active, natural stream channels. Consists of loose alluvial sand, gravel, and silt
- **Alluvial fan deposits (Qhf; Holocene age)** - Alluvial fan sediments deposited by streams emanating from the mountains as debris flows, hyper-concentrated mudflows, or braided stream flows. Sediments include sand, gravel, silt, and clay, that are moderately to poorly sorted, and moderately to poorly bedded
- **Alluvium, undivided (Qha; Holocene age)** - Alluvium deposited on fans, terraces, or in basins; composed of sand, gravel, silt, and clay that are poorly sorted
- **Alluvial fan deposits (Qpf; latest Pleistocene age)** - Sand, gravel, silt, and clay that is moderately to poorly sorted and bedded. Similar to Holocene fans (Qhf), but more dissected
- **Alluvial deposits (old), undivided (Qoa; early to late Pleistocene age)** - Alluvial fan, stream terrace, basin, and channel deposits

Within the area of the project alignment, expect sedimentary bedding to be relatively flat lying to gently sloping (several degrees) to the south-southwest.

3.2.1 Faulting

Review of the following maps shows no known faults mapped across or adjacent to the project alignment:

- Geologic Map of the Santa Rosa Quadrangle[2]
- Geologic Map of the Napa, 30'x 60', Quadrangle[3]
- Fault Activity Map of California and Adjacent Areas[4]

The project alignment is not within or adjacent to an Alquist–Priolo Earthquake Fault Zone (Bryant and Hart, 2007)[5]. We did not observe indications of faulting such as lineaments, scarps, springs, etc. along the project alignment during review of aerial photography and our field review.

Figure 4, Regional Fault Map, shows mapped faulting in the project region. The closest faults considered Holocene age (active) are the West Napa Fault located approximately 2.5 miles east of the eastern portion of the alignment, and the Rodgers Creek Fault located approximately 3.6 miles west of the western end of the alignment.

[2] Wagner, D.L., and Bortugno, E.J., 1982, Geologic Map of the Santa Rosa Quadrangle, 1:250,000; California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A
[3] Wagner , D.L., and Gutierrez, C.I., 2010, Geologic Map of the Napa, 30'x 60', Quadrangle, California, 1:100,000; California Geological Survey
[4] Jennings, Charles, 1994, Fault Activity Map of California and Adjacent Areas, 1:750,000; California Division of Mines and Geology, Geologic Data Map No. 6
[5] Bryant, W. A., and Hart, E.W., 2007 (Interim Revision), Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act With Index to Earthquake Fault Zone Maps; California Geological Survey, Special Publication 42

4 FIELDWORK AND LABORATORY TESTING

4.1 Exploratory Borings

BCI drilled and sampled 36 exploratory borings between September 30 and April 4, 2011. Boring depths range from 10 to 50 feet bgs. Completed borings are Borings B1, B2, and B4 through B37. Planned Boring B3 was not completed due to buried utility conflicts. BCI planned the general depth of the borings based on the proposed pipeline depth, anticipated soil conditions, and the location of existing utilities. Borings B6 through B9 are located several hundred feet south of the alignment to avoid existing SVCSD pipelines that could not be accurately located by SVCSD.

Sheets 1 through 16 in Appendix B show the boring locations. Appendix C contains a list of approximate boring locations and depths, boring logs, and profiles at most expected trenchless crossing locations. BCI located borings by handheld GPS and geographic features shown on the preliminary project mapping.

BCI's drilling subcontractors (Taber and Precision Drilling) drilled the borings using solid-stem auger (4-inch diameter), hollow-stem auger (8-inch diameter), and rotary wash techniques. Solid –stem or hollow-stem augers were used for drilling most borings (based on equipment availability). Rotary wash drilling was used when we anticipated a potential for loose or "running" sands in the deeper borings.

BCI obtained soil samples at various depth intervals using a 3.0-inch O.D. sampler (equipped with 2.4-inch diameter brass liners) or 2.0-inch O.D. Standard Penetration Test (SPT) sampler (1.4-inch I.D.). Samplers were driven with an automatic hammer (assumed energy efficiency of 75%), weighing 140-pounds and falling approximately 30 inches.

A BCI engineer logged the borings and used plastic caps to seal and label the 2.4-inch diameter, 6-inch long brass tubes retrieved from sampling. Bulk soil samples were retrieved from auger cuttings, placed in large cloth/plastic bags, and labeled for laboratory identification. The driller backfilled the borings with cement grout and/or soil cuttings upon completion and spread excess soil cuttings in adjacent fields or shoulder.

During the field exploration, BCI performed field strength testing with a pocket penetrometer on select cohesive and/or cemented soil samples. The results of field tests are noted on the boring logs (in Appendix C).

4.2 Laboratory Testing

In addition to the sampler penetration tests and pocket penetrometer field testing, BCI performed the following laboratory tests on representative soil samples from the exploratory borings:

- Moisture Content (ASTM D 2216) and Unit Weight (ASTM D 2937) for soil classification and in-place soil characteristics
- Plasticity Index (ASTM D 4318) for soil classification and correlations
- Sieve Analysis (ASTM D 422) for soil classification and correlations

- Direct Shear (ASTM D 3080) for soil strength
- Unconfined Compression (ASTM D 2166) for soil strength
- Maximum Dry Density (ASTM D 1557) for compaction characteristics
- Corrosivity Tests (Sulfate - CTM 417, Chloride – CTM 422, pH and Resistivity - CTM 643) to evaluate corrosion potential of soils.

Appendix D contains field and laboratory test summary sheets and laboratory test results. The boring logs in Appendix C show moisture-density test results.

5 SITE CONDITIONS

5.1 Subsurface Soil Conditions

Table 1 provides a summary of the general soil conditions observed along the alignment.

TABLE 1

General Soil Conditions along the Pipeline Alignment

General Location or Segment	Approximate Station No.* and Borings	Mapped Underlying Geology	General Subsurface Conditions
SVCSD WWTP to Schell Creek drainage	10+00 to 70+00 Borings B1 to B6	Alluvial Fan Deposits (old) and Artificial Fill (road)	Hard, lean clay and medium dense to dense clayey sand in the upper 13 to 16 feet, underlain by dense, silty sand and gravel. Some soft clay and sands and gravels (including road fill) in the upper 3 to 5 feet.
Schell Creek drainage	70+00 to 76+00 Boring B7 and B8	Bay Mud	Stiff to very stiff, lean to fat clay in the upper 8 feet, underlain by dense, granular soils (sand, silty sand, and gravel) to a depth of 13.5 to 16 feet. The granular soils are underlain by very stiff to hard, lean clay with some intervening, dense, clayey sands to depths in excess of 50 feet. Expect some soft to medium stiff clays in upper 3 to 5 feet.
Schell Creek Drainage to Railroad Alignment	76+00 to 96+00 Borings B9 and B10	Transitional from Bay Mud to Alluvial Fan Deposits (old)	Mixture of medium dense to dense sand to clayey sand, and hard, lean to fat clay, sandy clay, and silt.
Railroad Alignment	96+00 to 191+00 Borings B11 to B18 (see Taber Borings in Appendix A also)	Alluvial Fan Deposits	Very stiff to hard, lean clay and silt with sand and gravel to depths in excess of 25 feet. Some intervening, medium dense to dense, sand, silty sand, and gravels (typically at an approximate depth of 15-20 feet)
Railroad Alignment to Ramal Road	191+00 to 250+00 Borings B19 to B22 (see Taber Borings in Appendix A also)	Huichica Formation and Alluvial Fan Deposits	Very stiff to hard, lean clay and silt with sand to depths of 7.5 to 8.5 feet underlain by dense, clayey sand and gravel to depths in excess of 16 feet.

General Soil Conditions along the Pipeline Alignment			
General Location or Segment	**Approximate Station No.* and Borings**	**Mapped Underlying Geology**	**General Subsurface Conditions**
Ramal Road/Duhig Road to Huichica Creek	250+00 to 333+00 Borings B23 to B27	Huichica Formation and Alluvial Fan Deposits	Very stiff to hard, sandy, lean clay and silt to depths in excess of 16 feet.
Huichica Creek	333+00 to 344+00 Borings B28 and B29	Alluvial Deposits (old)	Very stiff to hard, clay, sandy clay and clay with sand to a depth of 37.5 feet. Some dense, clayey sand from 3 to 7.5 feet. Below 37.5 feet, dense sand and gravel with silt and clay.
Huichica Creek to Buchli Station Road and Railroad Alignment	344+00 to 428+00 Borings B30 to B36	Huichica Formation	Very stiff to hard, sandy, lean clay and silt to depths in excess of 16 feet. Some intervening, medium dense to dense, clayey sands.
Railroad Alignment to End of Project	428+00 to 433+88 Boring 37	Transition from Huichica Formation to Bay Mud	Medium stiff to stiff lean clay with gravel and fat clay to depths of up to 7 feet. Underlain by very stiff to hard lean clay.

* Estimated by BCI from preliminary plans provided by CDM (4/20/2011)

The description of soil conditions and stationing in Table 1 are generalized. Refer to the logs of the borings (in Appendix C) for further detail. Final boring logs are based on BCI's field logging, geologic mapping, and laboratory testing.

5.2 Groundwater

The U.S. Geological Survey (2006)[6] prepared groundwater elevation (hydraulic-head) maps that include the project area. Maps for Autumn (September or October) 1980 and Spring (March or April) 2003 indicate that groundwater can be expected near elevation 0.0 feet along the alignment west of the railroad and up to an elevation of approximately 10.0 feet east of the railroad. Fluctuations of several feet in groundwater elevation due to tidal, seasonal, irrigation, and pumping influences will occur. See the groundwater elevation maps in Appendix E.

Groundwater elevation data is available from the Department of Water Resources (www.water.ca.gov/groundwater/index.cfm) for two wells in the project vicinity. Figure 2 shows the approximate well locations. Summarized information for these wells follows:

- Well No. 04N05W02B001M – located north of Ramal Road at elevation 49.2 feet (Latitude: 38.2253, Longitude: -122.3775, NAD 27). Groundwater elevations recorded in 2008-2010 range from 5.4 feet to 13.9 feet (depth of over 35 feet).

[6] Farrar et al, 2006, Geohydrologic Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California; Scientific Investigations Report 2006-5092; United States Geological Survey in cooperation with Sonoma County Water Agency

- Well No. 05N05W30J003M – located approximately 2000 feet west of the north end of the alignment near Broadway (Highway 12) and at elevation 17.0 feet (Latitude: 38.2494, Longitude: -122.4472, NAD 27). The latest available groundwater elevations, recorded in 2000, range from -6.0 feet to 4.3 feet (depth of over 12 feet).

Table 2 summarizes groundwater level observations made during drilling by BCI at boring locations.

TABLE 2

Groundwater In Borings Summary[1]				
Boring No.	**Approximate Station**[2]	**Approximate Boring Elevation (ft)**	**Depth to Water (ft)**	**Approximate Water Elevation (ft)**
B1	19+50	18.0	18.0	0
B2	23+13	18.0	>16.5	<1.5
B4	37+50	16.0	>16.5	<-0.5
B5[3]	39+96	17.0	17.0	0.0
B6	56+72 (430 feet south)	12.0	16.0	-4.0
B7	69+24 (300 feet south)	8.0	9.0	-1.0
B8	70+06 (315 feet south)	8.0	9.0	-1.0
B9	77+00 (230 feet south)	6.0	15.0	-9.0
B10	91+06	7.5	12.0	-4.5
B11	99+74	8.5	>11.5	<-3.0
B12	116+42	9.5	9.0	0.5
B13	126+98	12.0	>11.5	<0.5
B14	135+90	14.5	>11.5	<3.0
B15	145+96	15.0	>11.5	<3.5
B16	157+08	13.0	>21.5	<-8.5
B17	171+90	13.5	15.0	-1.5
B18	188+56	12.5	12.0	0.5
B19	199+70	13.5	>16.5	<-3.0
B20	224+40	13.0	16.0	-3.0
B21[3]	233+42	12.5	15.0	-2.5
B22	248+28	30.0	>11.5	<18.5
B23	265+56	38.0	>16.5	<21.5

Groundwater In Borings Summary[1]				
Boring No.	**Approximate Station[2]**	**Approximate Boring Elevation (ft)**	**Depth to Water (ft)**	**Approximate Water Elevation (ft)**
B24	277+74	58.0	>11.5	<46.5
B25	292+90	47.0	>16.5	<30.5
B26	303+12	58.0	>11.5	<46.5
B27	313+04	50.0	>16.5	<33.5
B28[3]	334+45	20.0	8.5	11.5
B29	337+89	32.4	>21.5	<10.9
B30	342+82	41.5	>11.5	<30.0
B31	362+10	61.5	>16.5	<45.0
B32	375+50	83.0	>11.5	<71.5
B33	388+98	59.0	>16.5	<42.5
B34	400+98	48.5	>11.5	<37.0
B35	415+76	16.0	10.0	6.0
B36[3]	427+24	8.5	15.0	-6.5
B37	434+54	9.0	>16.5	<-7.5

[1] At time of drilling [2] Estimated by BCI from preliminary plans provided by CDM (4/20/2011)
[3] Converted to groundwater observation well; see Table 3 below for readings

BCI installed a groundwater observation wells at boring locations B5, B21, B28, and B36 and made the water level observations listed in Table 3:

TABLE 3

Observation Wells Groundwater Levels						
Boring No.	**Water Depth Below Surface/Elevation (feet)**					
	10/6/10	**11/2/10**	**11/30/10**	**3/23/11**	**4/4/11**	**4/23/11**
B5	---	---	---	3.0/14.0	---	5.0/12.0
B21	---	---	---	2.25/10.25	---	3.0/9.5
B28	14.5 /5.5	8.5 /11.5	8.2 /11.8	2.0/18.0	---	4.3/15.7
B36	---	---	---	---	15.0/-6.5	2.8/5.73

Based on groundwater observations, available groundwater mapping, and geologic conditions along the alignment, we summarize the general groundwater levels anticipated along the length of the alignment in Table 4.

TABLE 4

Summary of Anticipated Groundwater Occurrence	
Approximate Station*	**General Groundwater Condition**
10+00 to 55+00	Groundwater generally encountered at depths of 16 feet bgs or deeper. Expect groundwater near elevation 0.0 to 5.0 feet. Perched groundwater elevation could be higher near Schell Creek and other locations. The observation well at B5 (see Table 3) had water recorded at 3 to 5 feet below the surface (elevation 12 to 14 feet) during the winter, which may indicate temporarily perched groundwater since it is significantly higher than levels observed during drilling.
55+00 to 125+00	Groundwater generally encountered at depths of 9 feet bgs or deeper. Expect groundwater near elevation 0.0 feet (and likely higher adjacent to Schell Creek, particularly in winter/spring months).
125+00 to 235+00	Groundwater generally expected at depths greater than 11.5 feet bgs. Expect groundwater generally near elevation 0.0 feet. Shallower groundwater may occur adjacent to existing SVCSD reservoirs. Groundwater recorded in observation well B21 (see Table 3) at a depth of 2.25 to 3 feet (elevation 9.5 ft to 10.5 ft), which may be perched groundwater since it is significantly higher than levels observed during drilling.
235+00 to 329+00	Groundwater generally expected at depths greater than 16 feet bgs. Expect groundwater near elevation 5.0 to 10.0 based on USGS groundwater mapping. Some shallow seepage from adjacent reservoir (Station 235+00 to 239+00) could occur.
329+00 to 344+00	Groundwater encountered during drilling at a depth of approximately 8 feet bgs near Huichica Creek. Groundwater recorded in observation well B28 within 2 feet of the ground surface (elevation 18 ft) during winter rains, which may be perched groundwater. Expect typical groundwater near elevation 11.0 with higher conditions during peak creek flow and in the winter/spring.
344+00 to 406+00	Groundwater generally expected at depths greater than 16 feet bgs. Expect groundwater near elevation 10.0 to 15.0 feet based on USGS groundwater mapping.
406+00 to 422+00	Groundwater encountered at a depth of 10 feet bgs. Expect groundwater near elevation 6.0 feet.
422+00 to 433+88	Groundwater expected at typical depths of 5 to 10 feet bgs based on USGS groundwater mapping. Groundwater recorded in observation well B36 at a depth of 2.8 feet (elevation 5.7 ft) in the winter. Expect groundwater near elevation 0.0 to 6.0 feet.

*Estimated by BCI from preliminary plans provided by CDM (4/20/2011)

Relatively shallow, perched groundwater is likely to occur in localized areas along the alignment, particularly at and adjacent to drainages. Based on the location of natural drainages, shallow groundwater seepage could occur at the locations listed below (and other unidentified locations):

- Near Schell Creek
- Near Huichica Creek
- Stations 115+00 to 117+00
- Stations 157+00 to 158+00
- Stations 233+00 to 226+00
- Stations 264+50 to 267+00
- Stations 286+00 to 287+00
- Stations 293+00 to 296+00
- Stations 357+00 to 358+00

5.3 Existing Pavement Sections

We recorded existing pavement structural sections where borings were drilled in roadway pavement. Table 5 lists observed asphalt (AC) and baserock (AB) thicknesses.

TABLE 5

Measured Pavement Structural Sections at Boring Locations				
Boring No.	**Approximate Project Station ***	**Road Name**	**AC (inches)**	**AB (inches)**
B2	23+13	8th Street	4.0	3.0
B22	248+28	Ramal Road	4.0	4.0
B23	265+56	Ramal Road	4.0	5.0

*Estimated by BCI from preliminary plans provided by CDM (4/20/2011)

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 General Alignment Suitability

We did not observe areas of significant ground instability or unsuitable soil conditions along the alignment. The proposed alignment will be suitable for the planned pipeline when constructed in accordance with the project plans, industry standards, and our geotechnical recommendations. Significant geotechnical challenges for pipeline construction include the following:

- Presence of relatively shallow groundwater, particularly at drainage crossings that can require trench dewatering and create soft trench floor and sidewall conditions
- Excavation of fine grained soils that will be unsuitable for pipe zone backfill and may be difficult to compact when used as trench backfill, particularly when wet

- Presence of medium dense sands and gravels that may be within pipe depth for trenchless installations
- Soft surface soil conditions that may occur during the wet season, which will create difficult access to off-roadway locations and require prevention of mud tracking

6.2 Seismic Design

6.2.1 California Building Code Seismic Design Parameters

Based on the mapped geology and our subsurface exploration, the pipeline alignment is underlain by alluvial soils that generally consist of stiff to hard silt and clay, and medium dense to dense sand. Based on observed and anticipated soil conditions, a Site Class "D" (California Building Code, 2007) soil profile is applicable to the alignment.

Table 6 presents the California Building Code (CBC) design parameters for the project alignment. These values are based on BCI's review of design parameters at each end and midway along the alignment.

TABLE 6

Seismic Design Parameters (CBC 2007) For Site Class D	
S_s – Mapped Acceleration Parameter	1.50 g
S_1 – Mapped Acceleration Parameter	0.60 g
F_a – Site Coefficient	1.0
F_v – Site Coefficient	1.5
S_{MS} – MCE* Spectral Response Acceleration, Short Period	1.50
S_{M1} – MCE* Spectral Response Acceleration, 1-Second Period	0.90
S_{DS} – 5% Damped Design Spectral Response Acceleration, Short Period	1.00
S_{D1} – 5% Damped Design Spectral Response Acceleration, 1-Second	0.60

* Maximum Considered Earthquake

6.2.2 Liquefaction Analysis

Liquefaction can occur when loose to medium dense, granular, and certain soft, fine grained, saturated soils (generally within 50 feet of the surface) are subjected to ground shaking. Our subsurface investigation indicates that the alignment is primarily underlain by very stiff to hard, fine grained soils and dense granular soils that are not considered to be liquefiable. However, we did observe layers of medium dense, granular soils that may have potential for liquefaction, if saturated. Based on our review of the soil and groundwater conditions encountered in the exploratory borings completed by BCI, the soil layers listed in Table 7 have the potential for liquefaction and require analysis.

TABLE 7

Soil Layers with Potential for Liquefaction Observed in Borings			
Boring No.	**Depth - Top of Layer (ft)**	**Approx. Layer Thickness (ft)**	**Soil Type**
B7	23.5	4	Clayey Sand
B8	13.5	2.5	Poorly Graded Gravel
B8	33.5	4	Poorly Graded Sand with Silt
B8	37.5	6	Clayey Sand
B10	13.5	4	Poorly Graded Sand with Silt
B12	9.0	4.5	Silty Sand
B12	13.5	3	Poorly Graded Sand with Silt
B20	23.5	7	Well Graded Gravel with Clay and Sand
B21	13.0	3.5	Clayey Gravel with Sand

For the soil layers identified in Table 7, we completed a liquefaction evaluation based on the 1996 modifications of the "Simplified Procedure"[7]. The analysis predicts the factor of safety (FOS) against liquefaction from the ratio of Cyclic Resistance Ratio (CRR) to Cyclic Stress Ratio (CSR). Required variables include earthquake magnitude, peak horizontal ground acceleration, $(N1)_{60CS}$ (field N values corrected for sampler type, overburden, energy efficiency, hole diameter, and estimated fines content), r_d (soil flexibility reduction), and total and effective unit weights.

For liquefaction analysis, we use the following seismic parameters:

- Peak ground acceleration (PGA) of 0.4g, which is the Design Spectral Response for Short Period (S_{DS}) divided by 2.5 (CBC Section 1802.2.7)
- Modal (most likely event) earthquake magnitude of M7.0 for a PGA of 0.40g (based on USGS online, probabilistic ground motion analysis deaggregation, http://earthquake.usgs.gov/hazards/apps)
- Groundwater level at an elevation of 0.0 feet unless recorded at a higher elevation in our borings

Considering that the potential for ground settlement is the predominant liquefaction hazard along the alignment, a FOS of 1.2 against liquefaction is appropriate for evaluation of the triggering of liquefaction. Liquefaction can result in volumetric strain caused by excess pore pressures generated by the ground motions. The volumetric strain can result in ground settlement. We estimate the strain caused by liquefaction using the average corrected, clean sand blowcount ($(N1)_{60CS}$) and relationships developed by Tokimatsu and Seed (1987)[8].

[7] 1996 modifications of the "Simplified Procedure" by Seed and Idriss, 1971, published in the "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils" and, R.B., Seed, et al, 2003, Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework, Report No. EERC 2003-06

[8] Tokimatsu, K. and Seed, H.B. 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, 113(8)

Table 8 presents the layers evaluated, calculated FOS, and the estimated magnitude of potential settlement within the liquefiable layer.

TABLE 8

Liquefaction and Ground Settlement Analysis				
Boring No.	**Top of Layer Depth (ft)**	**Layer Thickness (ft)**	**FOS Against Liquefaction**	**Estimated Settlement***
B7	23.5	4	>1.2	0.0 inch
B8	13.5	2.5	0.9	0.4 inch
B8	33.5	4	0.7	0.7 inch
B8	37.5	6	>1.2	0.0 inch
B10	13.5	4	0.4	1.1 inch
B12	9.0	4.5	>1.2	0.0 inch
B12	13.5	3	0.4	1.0 inch
B20	23.5	7	0.5	1.5 inch
B21	13.0	3.5	>1.2	0.0 inch

* Settlement based on Tokimatsu, K. and Seed, H.B. 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, 113(8)

Based on the analysis summarized above, total settlement that can occur due to liquefaction ranges from 1.0 to 1.5 inches. Most of the potentially liquefiable layers are relatively thin (1.5 to 4 feet thick), have a thick cover of non-liquefiable soils (typically greater than 13 feet), and are confined by dense and/or very stiff to hard cohesive soils. Therefore, we expect settlement to manifest as large area settlement rather than ground cracking, boils, or significant ground distortion.

For estimation of potential differential settlement at pipe depth due to liquefaction, use ¾ths the maximum expected total settlement for design considerations. The differential settlement (approximately 1 inch) can be assumed to occur over a horizontal distance of 100 feet and along the alignment from Station 10+00 to 236+00 and 421+00 to 433+88.

6.3 Pipeline and Trench Design and Construction

6.3.1 Pipe Loading

Soil types within pipe depth (approximately 5 to 8 feet) are relatively consistent along the full length of the pipeline alignment. For consideration of trench backfill properties, we completed four compaction curves (ASTM D1557 test method). The curves indicate that compacted backfill that consists of native soils will have approximate moist unit weights that range from 120 to 124

pound per cubic foot (pcf) when compacted to a relative compaction of approximately 92%. For consideration in pipe loading, use a moist unit weight of 125 pcf for native soil backfill. Sand and aggregates that may be used for backfill typically have a compacted, moist unit weight that ranges from 125 pcf to 140 pcf, but this will depend on the actual sand/aggregate source. For buoyancy considerations, use a unit weight of 60 pcf for soils below design groundwater level.

For consideration of pipe loads in design of flexible and rigid pipe, the prism load method is often used as a conservative design and should be applicable to this project particularly when used with the USBR (1997) methods for determination of pipe deflection referenced below (consult pipe manufacturer recommendations). The formula is: $W_c = w\, B_c\, H_c$

Where:

W_c = Load on pipe (pounds/linear foot)
w = Unit weight of backfill material (pounds/cubic foot)
B_c = Outside diameter of pipe (feet)
H_c = Height of fill above the top of pipe (feet)

6.3.2 Soil Modulus

For pipe deflection estimates, use the modulus of soil reaction (E') values below in Table 9. These values are based on USBR, 1997, "Method for Prediction of Flexible Pipe Deflection", and native soil (silt and clay) backfill compacted to a minimum of 85% and 90% relative compaction (based on ASTM D1557 or California Test Method [CTM] 216) and in-place soil type/strength. We recommend a minimum 90% relative compaction for pipe embedment, however, consider an intermediate value (between the 85% and 90% value) of the soil modulus due to compaction difficulties/deficiencies that often occur adjacent to the pipe.

Table 9 provides E' values for native soil backfill (E'_b) used as pipe embedment (or pipe zone) materials and undisturbed (native) soil (primarily silt and clay) adjacent to the pipe trench (E'_n). We also provide a soil backfill value (avg) based on the average of the 85% and 90% compaction values for consideration of an intermediate value to use in design. We do not recommend use of silts and clays encountered along the alignment for pipe embedment. Granular soils are preferred embedment materials.

TABLE 9

Modulus of Soil Reaction (E')		
Approximate Station[1]	**E'_b (Native Backfill) psi**[2]	**E'_n (Native Soil) psi**[3]
10+00 to 77+00	400 and 1,500 (avg = 950)	3,000
77+00 to 400+00	400 and 1,500 (avg = 950)	5,000
400+00 to 433+88	400 and 1,500 (avg = 950)	3,000

[1] Stationing from preliminary plans provided by CDM
[2] At >85% to >90% Relative Compaction based on ASTM D1557 or CTM 216 (approx. 90% to 95% ASTM D698), USBR, 1997, Table 1
[3] After USBR, 1997, Table H-2. Note: E' values do not include a factor of safety

Granular import may be used for pipe zone backfill. For granular import, use E'_b equal to 2,000 psi when compacted to a minimum of 85% relative compaction (ASTM D 1557 or CTM 216) and 3,000 psi for compaction to a minimum of 90%. If necessary, a composite E' can be developed in accordance with the USBR (1997) method using both E'_b and E'_n values. Based on USBR guidelines, granular import must have less than 12% passing the No. 200 sieve (fines).

6.3.3 Design Groundwater Elevation

We did not observe groundwater within the anticipated trench depth (5 to 8 feet) over most of the project alignment; however, groundwater levels that are higher than observed can be expected due to tidal and seasonal effects, and irrigation (flooding and pumping). Assume a design groundwater elevation below typical trench depth (5 to 8 feet) with the exception of the following locations:

- **Crossing of Schell Creek at 8th Street (approximate Stations 20+00 to 25+00)** – assume a minimum design groundwater elevation near the normal high water level for Schell Creek
- **Stations 38+00 to 42+00** – assume a minimum design groundwater elevation of 12 feet (approximately 5 feet below the ground surface) based on groundwater observed in the observation well at Boring B5. Other boring/map data suggests groundwater is typically greater than 15 feet below the ground surface.
- **Stations 55+00 to 125+00** – assume a minimum design groundwater elevation of 2.0 feet (approximately 4 to 7 feet below the ground surface) based on groundwater observed and anticipated fluctuations
- **Crossing of Schell Creek (approximate Stations 67+50 to 69+00)** – assume a minimum design groundwater elevation near the normal high water level for Schell Creek
- **Stations 206+00 to 235+00** – assume a minimum design groundwater elevation of 15.0 feet (approximately 2.5 to 5 feet below the ground surface) based on presence of adjacent reservoirs and groundwater observed in the observation well
- **Crossing of Huichica Creek (approximate Stations 335+00 to 338+00)** – assume a minimum design groundwater elevation of 10 feet (approximately 7 feet below the adjacent ground surface) or near the normal high water level for Huichica Creek
- **Stations 421+00 to 433+88** - assume a minimum groundwater elevation of 6.0 feet (approximately 3 to 9 feet below the ground surface) based on observed and mapped groundwater elevations, and anticipated fluctuations

6.3.4 Soil Excavatability

Based on the mapped geologic conditions, subsurface conditions encountered in our borings, and exposed ground conditions (at minor road cuts), the soil underlying the alignment should be excavatable with conventional equipment (backhoe and moderate size excavator).

6.3.5 Trench Stability

The contractor should determine the proper construction technique for excavation, trench safety, and backfill operations. Most of the alignment is underlain by stiff to hard, cohesive soils. For project planning and design, anticipate temporary trench sloping and shoring in accordance with Type A soil requirements (Federal Register, 29 CFR, Part 1926, Subpart P; Occupational Safety and Health Standards – Excavations), which include sloping at a ¾:1 (H:V) gradient or flatter.

Portions of the alignment will be within and/or adjacent to areas of significant fill (primarily roadway embankment) and will require temporary sloping and shoring in accordance with Type B soils, which include sloping at a 1:1 gradient or flatter. These locations include the following Stations (other unidentified fills may be encountered):

- 233+40 to 235+50 (railroad and reservoir embankment)
- 263+50 to 270+00
- 285+74 to 287+64
- 292+36 to 296+20
- 309+00 to 311+00
- 313+50 to 315+90
- 331+46 to 334+00
- 401+08 to 402+28
- 433+30 to 433+88 (railroad embankment)

Excavations in submerged soils will need to be protected in accordance with Type C soil requirements. Based on anticipated depth to groundwater and the location of natural drainages, shallow groundwater seepage could occur at the locations listed below (and other unidentified locations):

- Near Schell Creek
- Stations 38+50 to 42+00
- Stations 54+50 to 125+00
- Stations 157+00 to 158+00
- Stations 207+00 to 226+00
- Stations 264+50 to 267+00
- Stations 286+00 to 287+20
- Stations 293+30 to 296+20
- Near Huichica Creek
- Stations 357+00 to 358+00
- Stations 421+30 to 433+88

All trenches must be sloped, shored, and/or shielded in accordance with current Cal OSHA requirements. The impact of traffic vibrations, actual soil conditions exposed in the open trenches, and other factors that may promote trench wall instability must be evaluated at the time

of construction and trench sloping/shoring adjusted accordingly. Surcharge loads such as trench spoils, equipment, etc. should not be placed adjacent to an open excavation (within a distance of ½ the height of the trench). ***The above is guideline information only.*** The contractor is responsible for site safety and final excavation and shoring design and construction based on actual excavation conditions encountered during construction.

6.3.6 Trench Dewatering

Relatively shallow, perched groundwater can occur in localized areas along the length of the alignment, particularly at and adjacent to drainages, creek beds, and reservoirs. For planning and design purposes, assume isolated sump pumping will be required for localized seepage into excavations with the exception of the following locations where more extensive dewatering (such as dewatering wells and/or additional sumps) may be required depending on final pipe depth and groundwater elevation at the time of excavation:

- Stations 54+50 to 125+00
- Crossings at Schell Creek
- Crossing at Huichica Creek
- Stations 421+30 to 433+88

6.3.7 Pipe Bedding and Pipe Zone Material

Support the pipe on a minimum of 4-inches of granular bedding and in accordance with the pipe manufacturer's recommendations. Although we do not anticipate soft, unsuitable pipe subgrade at any particular location, it can occur with the shallow groundwater conditions and fine grained soils; notify the project engineer and BCI for review and mitigation recommendations if encountered. To achieve a stable and non-yielding subgrade suitable for pipe placement and backfilling, typical mitigation may include replacement of unsuitable subgrade with ¾-inch minus crushed rock (minimum of 6 inches), enclosed in geotextile filtration fabric such as Mirafi 140N (or equivalent).

A granular pipe zone material may be used. Native soils will contain a significant amount of fines (passing #200 sieve) and will not be suitable for bedding or pipe zone backfill. For granular pipe zone backfill material, Sonoma County Water Agency (SCWA) specifies the following for pipe bedding material (which extends to 6 inches above the top of pipe):

Material Gradation

Sieve Size	Percent Passing by Weight
¾-inch	100
⅜-inch	80 -100
No. 4	30 - 80
No. 16	5 - 30
No 200	0 -5

Sand Equivalent = Minimum of 30, Maximum of 75
Durability = Minimum of 40

BCI considers the following materials to be suitable as alternative pipe zone (bedding) backfill material:

- Caltrans Class 1A Permeable Material
- Caltrans Class 2 Aggregate Baserock
- Controlled Low Strength Material (CLSM) or Controlled Density Fill (CDF) – see SCWA Standard Drawing No. 108

As previously discussed, a modulus of soil reaction (E') of 2,000 psi can be used for granular pipe zone backfill outlined above (or another approved granular material) if compacted to a minimum 85% relative compaction (ASTM D 1557 or CTM 216) or 3,000 psi at a minimum of 90% relative compaction.

6.3.8 Trench Backfill and Compaction

Trench backfill may consist of suitable on-site soils. Fill should be free of debris and concentrations of vegetation, and not contain rock larger than 3 inches in maximum dimension. High plasticity silts and clays (USCS classification – MH and CH) may be encountered along portions of the alignment and cause compaction difficulties. We recommend that these soils either be removed or the material be mixed with other suitable on-site material. These materials were primarily encountered as shallow soils adjacent to Schell Creek and at the east end of the alignment (see logs of Borings B7, B8, B36 and B37 in Appendix C).

If import fill is required for trench backfill, it should be graded and have material properties as follows:

- 95% to 100% passing the 3-inch sieve
- 20% to 50% passing the #200 sieve
- Plasticity Index not greater than 20
- Liquid Limit less than 35
- Expansion Index not greater than 20

Follow the pipe manufacturer's requirements for initial backfill to avoid damage to the pipe. To facilitate compaction in the pipe zone area (top of bedding up to 12 inches above pipe), use a trench width that provides a minimum clearance of 12 inches between the pipe and trench wall. If CLSM is used as pipe zone backfill, trench width can be reduced to a minimum clearance of 6 inches between the pipe and trench wall.

Moisture condition trench backfill to within 2% of optimum moisture content and compact to a minimum 90% relative compaction (based on ASTM D 1557 or CTM 216). For portions of the alignment outside of roadway/structural areas (such as agricultural areas or cross country locations), the upper 2 feet of fill can be compacted to between 85% and 90% relative compaction to allow for vegetative growth. Use a maximum compacted lift thickness of 8 inches unless field performance testing can demonstrate adequate compaction of thicker lifts. Jetting is not acceptable for compaction.

Test all trench backfill (bedding, pipe zone backfill, trench zone, etc.) at vertical increments of not more than 1 foot and at final grade or pavement subgrade. For horizontal testing frequency consider a frequency of at least one test for every 200 linear feet of pipe (both sides of pipe in pipe

zone). Complete at least one compaction curve (Proctor) for each material type, source location (for import), and as changes in native materials occur. Material changes include a change in material designation based on the Unified Soil Classification System. Testing frequency can be adjusted based on contractor performance, ease of compaction, and material variability.

Soil excavated during pipe installation can have moisture contents well over optimum, especially during the winter and spring months or if perched water is encountered. In this case, it will be necessary to dry back the soil to within 2% of optimum moisture content prior to use as backfill.

It is important to achieve compaction of pipe zone materials at the pipe haunches and spring line; compaction below the pipe spring line will be a difficult task for the contractor. We recommend a compaction demonstration section to test placement and compaction means and methods for each material type that will be used.

6.3.9 Backfill Requirements – County of Sonoma and Napa Right-Of-Way

Where the pipeline is located within County right-of-way follow the backfill requirements in the County of Sonoma, Department of Transportation and Public Works, Trench Backfill and Paving Details, Drawing No. 219 (see Appendix F) and County of Napa, Department of Public Works, Trench Backfill Typical Section (in Road and Street Standards) and/or other County approved backfill methods. Sonoma County requires a minimum of 90% relative compaction for trench backfill (Caltrans Structure Backfill) and Napa County requires a minimum of 95% relative compaction of trench backfill (Caltrans Structure Backfill or native soils) within 2.5 feet of the pavement surface. Test compact within County right-of-way in accordance with CTM 216.

6.3.10 Trench Backfill Settlement

If pipeline backfill is placed, compacted, observed, and tested as recommended above, we expect potential settlement at the surface to be less than ½-inch (0.25% to 0.50% of backfill depth) for the planned pipeline depths. Cross country pipeline locations, where a lower magnitude of specified backfill compaction may be used, may exhibit a greater degree of surface settlement. The magnitude of surface settlement will be affected by the degree and uniformity of backfill compaction; therefore, it is important that backfill methods are observed and compaction checked at frequent intervals where limiting potential settlement is important. This is especially critical where the pipeline crosses beneath roadways and other utilities.

6.3.11 Pipeline Thrust Blocks

We expect thrust blocks to be installed at depths greater than 3 feet. For design of thrust blocks, use a lateral bearing of 350 psf per foot of depth below the surface up to a maximum of 3,000 psf.

6.3.12 Groundwater Seepage Control

In order to minimize the flow of shallow groundwater along the pipeline and piping of soil materials, it may be desirable to limit the potential for flow of groundwater along the pipeline trench. For this purpose, consider trench plugs at a spacing of 200 to 300 feet where the trench gradient is 5% or steeper.

Plugs can consist of a relatively impermeable soil barrier, a minimum of 3 feet in width, such as compacted clayey silt or clay (classified as CH or MH) extended 12 inches into the surrounding native soil to a depth of 2 feet below finish grade or 2 feet above the pipe, whichever is less. Concrete thrust/anchor blocks could also be used to act as trench plugs. Plugs may also be recommended by the project engineer/geotechnical engineer at other locations during construction if significant groundwater seepage is encountered. If Controlled Low Strength Material (CLSM) is used for bedding and backfill, plugs are not necessary.

6.3.13 Soil Corrosivity

Select soil samples near the depth of the proposed pipeline were tested for corrosion characteristics (pH, resistivity, chlorides, and sulfates). We show the corrosion test results in Table 10 and in Appendix B.

TABLE 10

Laboratory Soil Corrosivity Results						
Boring Location	**Approximate Station**	**Sample No.**	**pH**	**Minimum Resistivity (ohm-cm)**	**Chloride (ppm)**	**Sulfate (ppm)**
B2	23+13	3	7.6	1,170	21	10
B4	37+50	3	8.1	1,860	26	7.4
B5	39+96	3	6.4	1,070	53	11
B7	69+24	4	7.4	260	1,700	310
B11	99+74	2	7.6	1,170	27	12
B17	171+90	3	8.6	1,040	110	92
B21	233+42	1	5.6	820	110	49
B29	337+89	2	6.2	500	270	17
B34	400+98	2	5.3	1,170	30	30
B37	434+54	1	7.4	674	---	---

Based on the laboratory test results, the site soil has a relatively neutral pH (with the exception of location B21 and B34 with a pH of 5.6 and 5.3), low resistivity, and low sulfate and chloride content (with the exception of high chloride content at location B7).

In general, our test results and the soil conditions (fine grained soils with shallow groundwater) suggest a moderate corrosion potential for steel along the alignment. The design engineer should consider the need for corrosion protection based on the type of pipe used and soil conditions indicated.

6.4 Trenchless Pipeline Crossings - Bore and Jack Locations

6.4.1 Proposed Bore and Jack Locations and Subsurface Conditions

Bore and Jack is a pipeline installation method that directly installs carrier pipe or casing simultaneously with the excavation. It is a multi-stage process that consists of a temporary horizontal jacking platform and a starting alignment track in an entrance pit at a desired elevation. The pipe is then jacked by manual control along the starting alignment track with

simultaneous excavation of the soil being accomplished by a rotating cutting head in the leading edge of the pipe annular space. The excavated soil is transported back to the entrance pit by augers rotating inside the pipe. This method typically provides limited tracking and steering and limited support of the excavation face.

Trenchless pipeline installation, likely bore and jack, is proposed at:

- Fremont Blvd (State Route 12/121) and Railroad; approximate Station 39+00
- Railroad crossing; approximate Station 234+00
- Railroad crossing; approximate Station 433+00

A trenchless, bore and jack installation is geotechnically feasible at these locations. Considering the generally very stiff to hard, medium dense to dense, and cohesive soil conditions within the expected installation depths, we expect the risk of ground running or settlement to be low if installations are completed using standard practice for bore and jack installations and control of any groundwater. The contractor is responsible for utilizing trenchless methods that do not cause settlement to the railroad embankment and that maintain the design horizontal and vertical pipe alignments and tolerances.

The observed soil conditions at these crossing locations are as follows and profiles at the locations are in Appendix C:

Fremont Blvd (State Route 12/121) and Railroad Crossing near Station 39+00
At the Fremont Blvd (State Route 12/121) and railroad crossing at approximate Station 39+00, Borings B4 and B5 generally encountered hard silt and clay and medium dense to dense clayey sand to a depth of 16.5 to 17 feet bgs (elevation 0.0 to -0.5 feet). In Boring B5, the silt/clay and sand is underlain by coarse to fine gravel with clay and sand to a depth of 21.5 feet bgs (elevation 4.5 feet). Groundwater was observed in Boring B5 at a depth of approximately 17 feet bgs (an elevation of approximately 0.0 feet) during drilling but later recorded in the groundwater observation well at up to 2 feet bgs (possibly perched groundwater).

Railroad Crossing Near Station 234+00
At the railroad crossing near Station 234+00, Boring B21 encountered very stiff to hard, sandy, lean clay to a depth of 8 feet, which is underlain by very dense, clayey gravel. Several feet of railroad embankment fill is present at and adjacent to the tracks. Groundwater was observed at a depth of approximately 15 feet bgs (an elevation of approximately -2.5 feet) during drilling but later recorded in the observation well at approximately 3 feet bgs.

Railroad Crossing Near Station 433+00
At the crossing near Station 433+00, Boring B37 encountered medium stiff to stiff, lean clay with gravel, and fat clay to a depth of 7 feet, which is underlain by hard, sandy, lean clay. No free groundwater was observed in the boring. Shallow groundwater is expected at this location but the clays may result in very slow seepage (or occlusion) and cause it to not be recorded in the boring.

6.4.2 Excavation and Shoring Design

Open excavations 5 feet or deeper (e.g., jacking and receiving pits) will require sloping and/or shoring in accordance with Cal OSHA requirements. Based on our subsurface exploration and laboratory testing, preliminary excavation and shoring design may be based on Type B soil to a depth of 15 feet (see Cal OSHA regulations). Cohesive soil conditions appear to be present at pit locations. For preliminary design of temporary shoring, use an equivalent fluid weight of 48 pcf (under dewatered conditions and no surcharge). The contractor is responsible for final excavation and shoring design and construction based on actual soil/excavation conditions encountered during construction. Shoring design must account for any surcharge loads from construction traffic, equipment, and stockpile of excavated soils.

6.4.3 Excavation Dewatering

We observed shallow groundwater (within several feet of the ground surface) at or near each of the crossing locations. If installation is completed in the late Summer or Fall months, the potential for extensive dewatering will be minimized and we expect sump pumps will be adequate for control of groundwater. More extensive dewatering (such as multiple sumps, sheet piles, etc.) may be necessary for installations completed during the winter or spring months. The contractor is responsible for dewatering design and construction.

6.4.4 Pit Bottom Support

Based on our subsurface exploration and anticipated conditions, the bottom of bore and jack pits (on the order of 10 to 15 feet below ground surface) will be founded in medium dense to dense sandy clay, clayey gravel, or hard clay. We expect pit floors to be stable. If unstable soil conditions are encountered or destabilized by the introduction of water combined with disturbance, overexcavate the base of the pit an additional 12 to 18 inches and replace with clean ¾-inch crushed rock. If necessary for added stabilization, use Mirafi 500x non-woven geotextile fabric (or equivalent approved by BCI) prior to placement of the crushed rock.

6.4.5 Pit Thrust Wall Design

For design of thrust walls at a depth of 4 feet or greater, use an ultimate passive earth pressure of 450 pounds per square foot, per foot of depth up to a maximum depth of 10 feet (triangular pressure distribution). This value should be reduced by an appropriate factor of safety and adjusted if necessary for actual soil conditions exposed.

For bore and jack methods, excessive adhesion between the pipe and cohesive soils expected at these crossings may affect pipe jacking and boring. This may necessitate over-cutting the bore, use of a high capacity jacking system, or a combination of the above.

6.4.6 Settlement Monitoring

Roadway and railroad will be sensitive to ground settlement that could occur during excavation and pipe installation. Although we expect the risk of ground settlement to be low based on the soil conditions, monitor crossing locations for settlement during construction. The contractor should provide a settlement monitoring plan for review and approval by the project engineer

prior to any excavation work. Establish monitoring points along the pipe centerline at intervals of at least 50 feet and approximately 10 feet from centerline on each side. Locate monitoring points to protect them from damage by construction operations, tampering, or other external influences. Monitor ground settlement of railroad centerline at track subbase. Monitor roadway at the pavement surface. Where recorded settlement is in excess of ¼-inch, the contractor should address and develop a settlement mitigation plan.

6.4.7 Pit Backfill

With the exception of high plasticity clays present at the railroad crossing near Station 433+50, on-site soil is suitable for pit backfill provided it is free of concentrations of organics and particles larger than 3 inches in maximum dimension. Condition backfill to within two percent of optimum moisture content and place backfill in loose lifts no greater than 8 inches thick. Compact the soil to a minimum of 90% relative compaction (per ASTM D 1557 or CTM 216).

6.5 Trenchless Pipeline Crossings – Directional Drilling Locations

6.5.1 Proposed Directional Drilling Locations and Subsurface Conditions

Horizontal directional drilling (HDD) uses a steerable soil drilling system to install the pipeline. In most cases, HDD is a two-stage process. Stage 1 involves drilling a pilot hole (typically 1 to 5 inches in diameter) along the proposed centerline. In stage 2, the pilot hole is enlarged to the desired diameter to accommodate the pipeline. The pilot hole is drilled with a surface-launched rig with an inclined carriage. After the drill head exits at the desired location, reaming devices are attached for the pullback operation. This stage involves enlarging the pilot hole to the desired diameter to accommodate the pipeline. The utility pipe is attached to the reamer, with a swivel to ensure that the rotation (torque) applied to the reamer is not transmitted to the utility. The reamer enlarges the bore hole to the required size and the utility is installed.

Trenchless pipeline installation, likely directional drilling, is proposed at:

- Schell Creek at 8th Street; approximate Station 22+00
- Schell Creek; approximate Station 68+50
- Drainage crossing; approximate Station 157+50
- Drainage crossing; approximate Station 225+00
- Huichica Creek; approximate Station 336+00

A trenchless installation is geotechnically feasible at these locations. Considering the generally very stiff to hard, dense, and cohesive soil conditions within the expected installation depths, we expect the risk of caving or ground settlement to be low if installations are completed using standard installation practice. The contractor is responsible for utilizing trenchless methods that do not cause settlement to roadway and railroad, avoids “frac-out” (expulsion of the drilling mud to the surface) into creeks/drainages, and that maintain the designed horizontal and vertical pipe alignments and tolerances.

The observed soil conditions at these crossing locations are as follows and profiles at the locations (with the exception of Station 68+50 due to length of the boring offset from the crossing) are in Appendix C:

Schell Creek Crossing on 8th Street Near Station 22+00
At the Schell Creek crossing on 8th Street; approximate Station 22+00, Borings B1 and B2 generally encountered very stiff to hard, sandy, lean clay to a depth of 13 to 16 feet bgs (elevation 2.5 to 5.5 feet), which is underlain by dense, silty sand and very dense, fine gravel with clay and sand to a depth of more than 18 feet. Boring B2 also had dense, sand with gravel in the upper 5 feet. Groundwater was observed in Boring B1 at a depth of approximately 18 feet bgs (an elevation of approximately -2.5 feet).

Schell Creek Crossing Near Station 68+50
At the Schell Creek crossing near Station 68+50, Borings B7 and B8 generally encountered a profile of very stiff to hard clay and sandy clay to a depth of 51.5 feet bgs (elevation -43.5 feet). There are some medium dense to dense, sands, silty sands, and gravel between depths of 8 to16 feet bgs (elevation 0.0 to -8.0 feet). Additionally, in Boring B7, medium dense to dense, clayey sand occurs at a depth of 23.5 to 27.5 feet bgs and, in Boring B8, medium dense to dense sand and clayey sand occurs at a depth of 33.5 to 43.5 feet bgs. Groundwater was observed in Borings B7 and B8 at a depth of approximately 9 feet bgs (an elevation of approximately -1.0 feet). Exploratory borings for this crossing are located several hundred feet south of the possible crossing location (due to avoidance of existing utilities with undefined locations in the area). Additional borings should be completed prior to construction to confirm soil conditions at the actual crossing location.

Drainage Crossing Near Station 157+50
At the drainage crossing near Station 157+50, Boring B16 generally encountered very stiff to hard silt and clay with sand to a depth of 21.5 feet bgs (elevation -8.5 feet). Some dense, clayey gravel occurs between depths 3.5 to 6 feet bgs (elevation 9.5 to 7.0 feet). We did not observe groundwater in Boring B16 but the contractor should expect some shallow groundwater.

Drainage Crossing Near Station 225+00
At the drainage crossing near Station 225+00, Boring B20 generally encountered very stiff to hard sandy clay to a depth of 7.5 feet bgs (elevation 5.5 feet). This is underlain to a depth of 23.5 feet bgs (elevation -10.5 feet) by very dense, clayey sand and gravel. Groundwater was observed in Boring B20 at a depth of 16 feet. Considering the location adjacent to the SVCSD reservoirs, the contractor should expect some groundwater shallower than 16 feet.

Huichica Creek Crossing Near Station 336+00
At the Huichica Creek Crossing near Station 336+00, Borings B28 and B29 generally encountered very stiff to hard, sandy clay and clay with sand to a depth of 22.5 feet bgs (elevation -2.5 feet). Boring B28 had a layer of dense, clayey sand at a depth of 3.5 to 7.5 feet. At a depth below 22.5 feet, in Boring B28, the clay is underlain by hard silt to a depth of 37.5 feet, which is underlain primarily by dense to very dense, sand and gravel to a depth of 51.5 feet. We observed groundwater in Boring B28 at approximately 8.2 feet bgs on 11/30/10 and 2 foot bgs on 3/23/2011 (after heavy rains).

6.5.2 Directional Drilling Recommendations

The soil conditions at all five possible crossing locations appear favorable for directional drilling installations. In general, the soils are fine grained and very stiff to hard. Groundwater is likely to be present within drilling depths at all locations. Gravels, that can create some drilling difficulties, are present but appear to be of limited thickness. Gravels of particular importance (coarse material with little fines and significant layer thickness) occur at the Fremont Blvd (State Route 12/121) and Railroad Crossing at a depth of 17 feet; some gravels may also be encountered at the crossing near Station 225+00 (see log of Boring B20) but there appears to be a significant amount of cohesive fines in the gravel. Other gravels can occur beyond the depth of exploratory drilling and between exploration locations.

At creek and drainage crossings, installations must be below anticipated scour depth and at sufficient depth to avoid "frac-out". Evaluation of scour depths is beyond our scope of work but the very stiff to hard cohesive soils will be resistant to erosion. For pipe depth/ "frac-out" considerations, we recommend a minimum pipe cover of 4 times the pipe diameter but this must be evaluated by the driller based on soil conditions, actual methods used, and fluid pressure.

6.6 Minor Structures (Valve Vaults, Access, etc)

Provided that the recommendations in this report are followed, minor structures (such as valve vaults, access ways, etc.) may be founded on concrete mat or strip footings, or a compacted granular base (minimum of 6 inches of Class 2 baserock) if appropriate. Embed the foundations a minimum of 24 inches below the ground surface and a minimum of 12 inches into firm native soil or compacted fill/backfill. Footings must be a minimum of 8 inches wide and sized not to exceed an allowable bearing capacity of 1,500 pounds per square foot (psf). The allowable bearing capacity may be increased by one-third if seismic and/or wind loads are included. If additional bearing capacity is required for specific minor structures, we can review and provide recommendations on a case-by-case basis.

6.7 Pavement Reconstruction and Temporary Access Roads

We assume existing pavement will be replaced to match the existing section and/or the County required minimum. Sonoma County requires a minimum Aggregate Baserock (AB) section of 18-inches for trench backfill/paving (Trench Backfill and Paving Details, Drawing No. 219). SCWA Standard Trench Details, Drawing No. 107 requires a minimum of 12 inches of Class 2 AB under pavement and road shoulder locations.

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 or CTM 216). Prior to placing asphalt, the subgrade and aggregate baserock should be stable under the weight of a loaded water truck.

Where temporary access roads will be constructed, remove organic materials from the surface, grade the access to a level condition, 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 (¾ inch) or Class 2 aggregate baserock on the prepared subgrade and compact with a smooth drum roller. If soil conditions are wet and/or pumping greater rock thickness, and possibly a fabric or geogrid underlayment, may be necessary for support of construction traffic.

6.8 General Erosion Control

The cohesive soils along the alignment will not have a high erosion potential but temporary erosion protection (hydroseed and mulch, or other) should be applied. Erosion control measures should be implemented during and after construction to minimize soil erosion. This can be accomplished during construction using the following methods:

- Avoid trenching and backfill operations around heavy rains whenever possible
- For temporary slopes, maintain the flattest possible gradient
- During the rainy season, cover exposed soil on sloping ground or drainage swales as soon as possible. Covers can consist of grass and/or mulch (straw, wood chips, manmade fibers, etc.)
- Minimize surface flow over areas disturbed by trenching. This can be accomplished by placing temporary earth berms at the top of sloped segments
- Control dust by sprinkling exposed soil with water or an approved dust palliative.
- Where space is available within public easement, construct debris basins to trap debris and silt prior to entering drainage channels.
- The potential for scour at creek/drainage crossings and determination of scour depths is beyond our scope of work. Pipe crossing depths should be adequate to avoid future scour.

Following construction, vegetate disturbed areas (planted with grasses or shrubs) and/or cover with a mulch or erosion control fabric to minimize soil erosion. Where the pipeline will be placed beneath drainage ditches or crossings, erosion control (fabric, rip-rap, etc.) must be included and based on estimated channel velocities.

Erosion mitigation features should be inspected periodically throughout the wet season for proper functioning and need for repair, modification, and/or replacement.

7 RISK MANAGEMENT

Our experience and that of our profession clearly indicates that the risks of costly design, construction, and maintenance problems can be significantly lowered by retaining the geotechnical engineer of record to provide additional services during design and construction.

For this project, we recommend that the project owner retain us to:

- Review and provide comments on the civil plans and specifications prior to construction.
- Monitor construction to check and document our report assumptions. At a minimum, BCI should observe trench excavations, approve trench backfill, test backfill compaction,

observe and test placement and compaction of fill for embankments and structures, and review foundation excavations.

- Update this report if design changes occur, 2 years or more lapses between this report and construction, and/or site conditions have changed.

If we are not retained to perform the above applicable services, we are not responsible for any other party's interpretation of our report, and subsequent addendums, letters, and discussions.

8 LIMITATIONS

BCI performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Where referenced, we used ASTM and CTM standards as a general (not strict) guideline only. Do not use or rely upon this report for different locations or improvements without the written consent of BCI. We do not warranty our services.

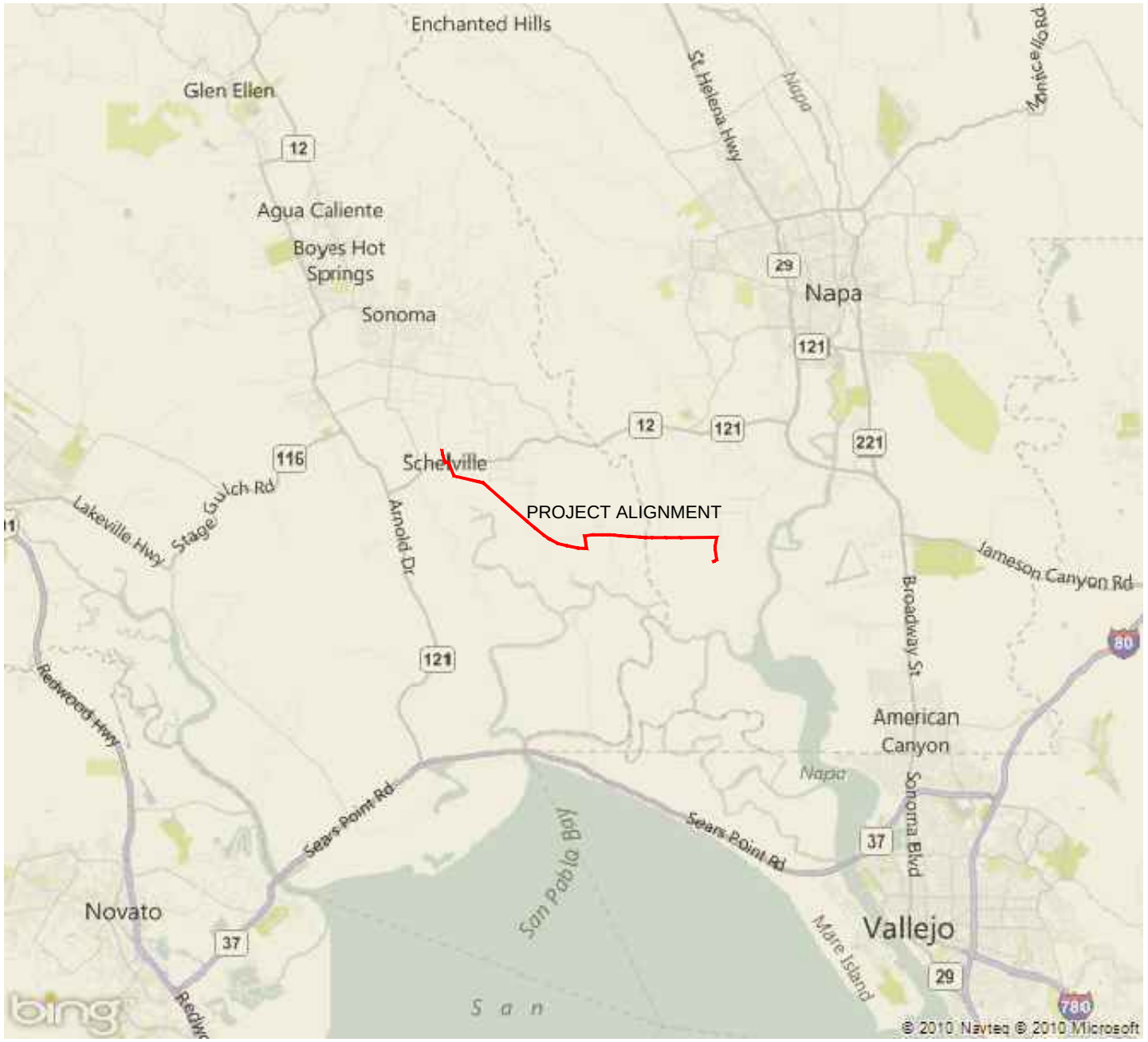
BCI based this report on the current site conditions. We assume the soil and groundwater conditions encountered in our explorations are representative of the subsurface conditions throughout the site. Conditions at locations other than our explorations could be different.

Logs of our explorations are presented in Appendix C. The lines designating the interface between soil types are approximate. The transition between material types may be abrupt or gradual and will vary laterally. Our recommendations are based on the final logs, which represents our interpretation of the field log and general knowledge of the site and geological conditions.

The groundwater elevations discussed in this report represent the groundwater elevation during the time of our subsurface exploration and at the exploration locations. The groundwater table may be lower or higher in the future and at other locations.

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.

FIGURES



N

NO SCALE

4/20/2011 2049.1 Figure 1 Vicinity Map.dwg

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

VICINITY MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Figure 1

PROJECT ALIGNMENT

SVCSD WWTP

Well 003M

B01 B02 B04 B05 B06 B07 B08 B09 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20 B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37

TB-11 TB-9 TB-12 TB-7,8 TB-1 P-2B PB-1A, 1B B-12 B-13 B-14 B-11 B-10

Trenchless Installation

SR 12/121

NWPRA Railroad Alignment

R-4 R-1 R-2

EXISTING SVCSD RESERVOIRS

Well 001M

NSMWA Entrance

N

LEGEND

- B01 - Approximate Boring Location
- Well 003M - Approximate Well Location (DWR Record-see report text)
- TB-1 - Approximate Taber Boring Location (Drilled 2000-see Appendix A)
- PB-2 - Approximate Taber Piezometer Location (Drilled 2000-see Appendix A)
- B-10 - Approximate Taber Boring Location (Drilled 1999-see Appendix A)

Source: MAPTECH Terrain Navigator Pro, v. 7.01, USGS topographic maps, 7.5 minute quadrangle, 1:24000, Sonoma and Napa, dated 1951, photorevised 1980 and Sears Point dated 1951, photorevised 1968, and Cutting Wharf, dated 1949, photorevised 1981.

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

SCALE: 1"=2400'

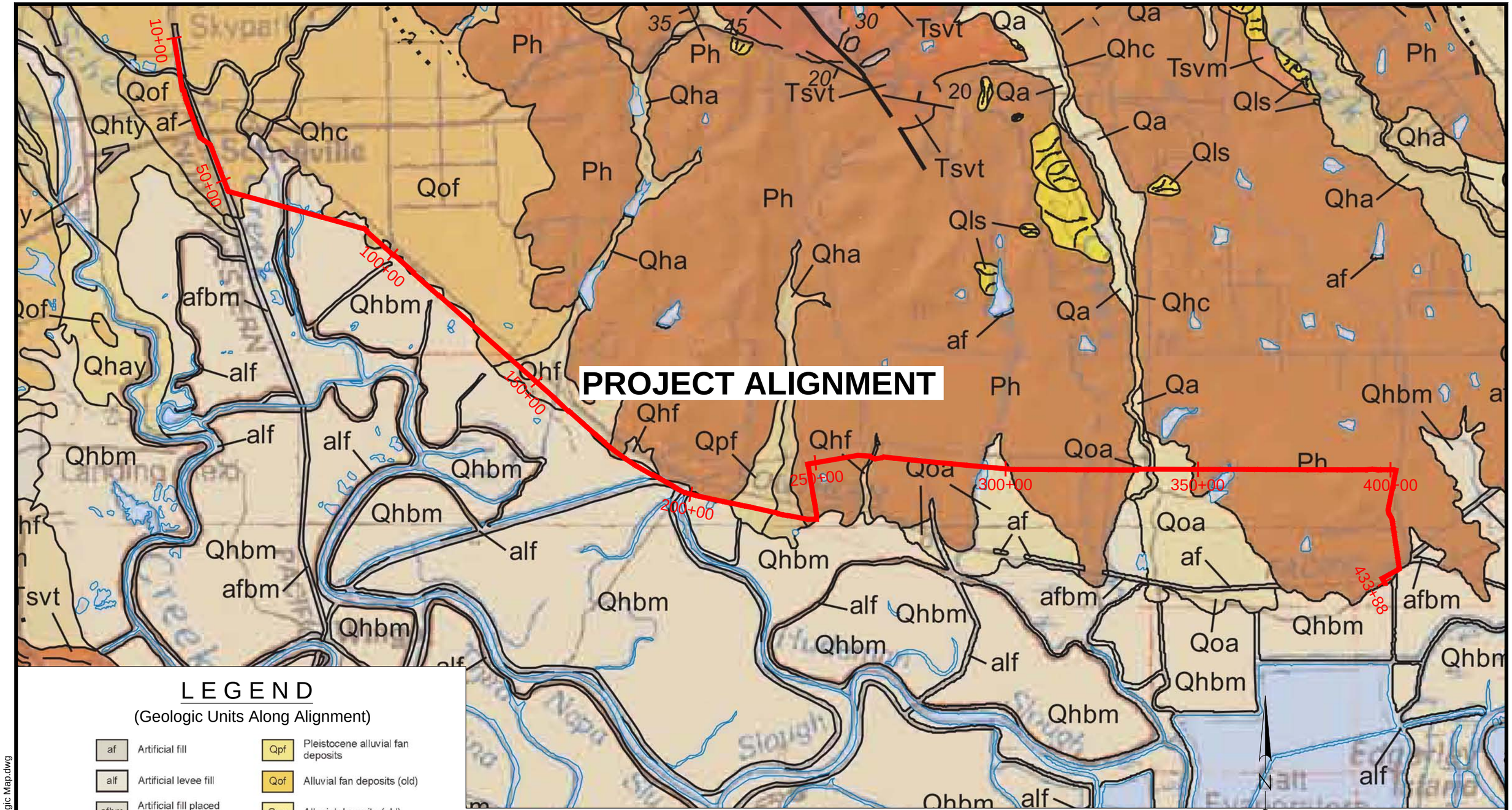
blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

SITE MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1
April 2011
Figure 2

4/28/2011 2049.1 Figure 2 Site Map.dwg



LEGEND

(Geologic Units Along Alignment)

af	Artificial fill	Qpf	Pleistocene alluvial fan deposits
alf	Artificial levee fill	Qof	Alluvial fan deposits (old)
afbm	Artificial fill placed over bay mud	Qoa	Alluvial deposits (old)
Qhc	Latest Holocene stream channel deposits	Qha	Holocene alluvium
Qhbm	Holocene estuarine deposits (bay mud)	Ph	Huichica Formation
Qhf	Holocene alluvial fan deposits		

Source: Preliminary Geologic Map of the Napa 30' x 60' Quadrangle, California. Compiled by David L. Wagner and Carlos I. Gutierrez, 2010, scale 1:100,000.

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

SCALE: 1"=2400'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

GEOLOGIC MAP

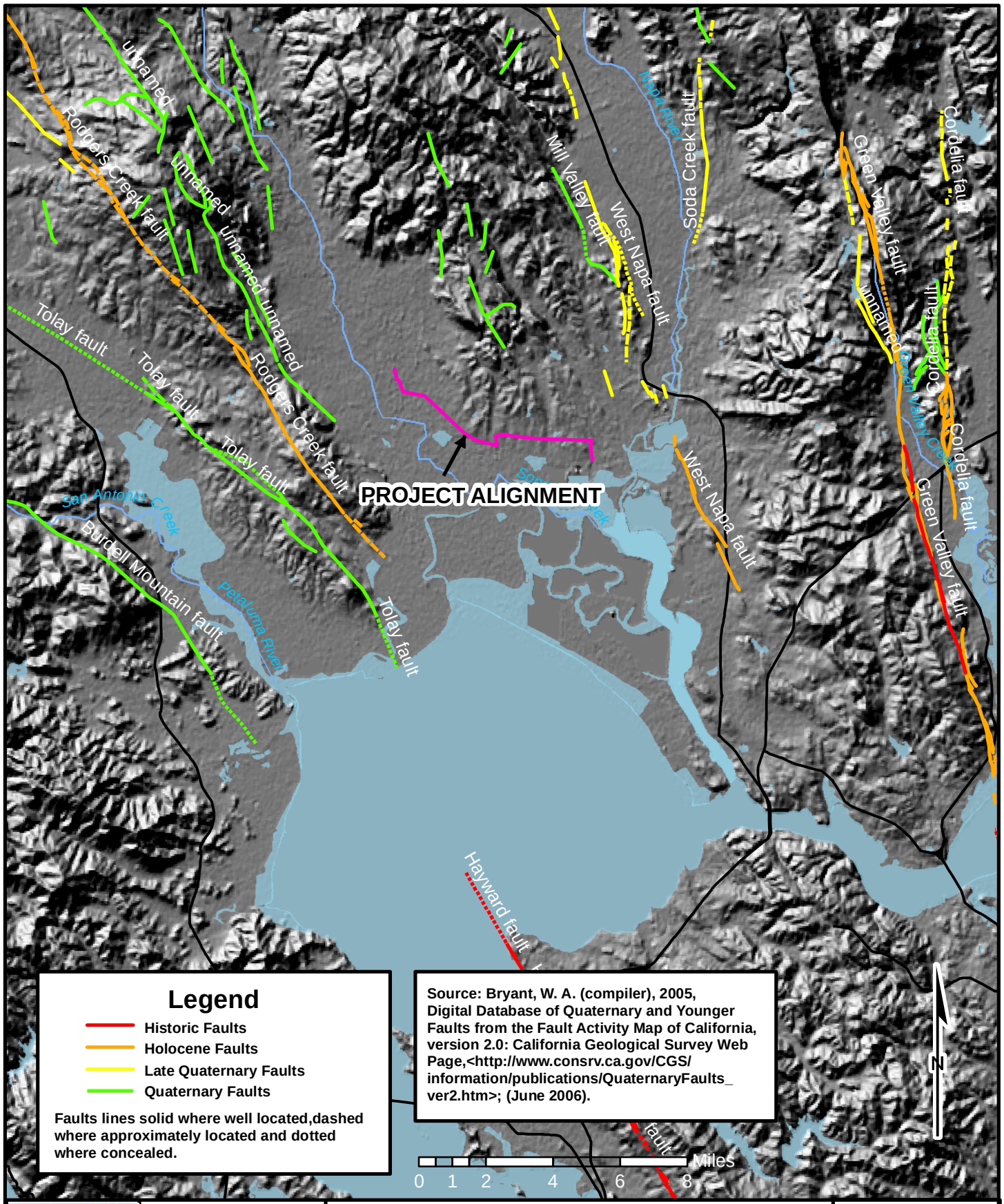
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Figure 3

4/20/2011 2049.1 Figure 3 Geologic Map.dwg



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).

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495-Fax
www.blackburnconsulting.com

REGIONAL FAULT MAP

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Figure 4

APPENDIX A

Existing Report Boring Logs

-Taber, 2000, Sonoma Valley CSD Reclamation Ponds R1 & R2

(Title Pages, Logs B-10 to B-14, and Location Map)

- Taber, 2000, Sonoma Valley CSD Effluent Reservoir R-4

(Title Pages, Logs P-1A/B, P-2B, B-1, B-7 to B-9, B-11, B-12, and Location Map)

SVCSD Reclamation
TW97/98-89

Taber
Since 1954

3911 West Capitol Avenue
West Sacramento, CA 95691-2116
(916) 371-1690
(707) 575-1568
Fax (916) 371-7265
www.taberconsultants.com

January 24, 2000

Sonoma Valley County Sanitation District
P.O. Box 11628
Santa Rosa, California 95406-1628

Attention: Kevin Berger

Subject: Geotechnical Evaluation 1P2/598/159
Sonoma Valley CSD Reclamation Ponds R1 & R2
Sonoma County, California

Transmitted herewith is our report of geotechnical study performed at the above site. This report summarizes all data developed for the R1 and R2 reservoirs, including data presented to date and data from "emergency" repairs in progress at R1, along with geotechnical analyses and conclusions for both reservoirs.

If you have any questions concerning this report or subsurface materials/ conditions at the site, please call. We appreciate this opportunity to be of service.

Very truly yours,
TABER CONSULTANTS

Thomas M. Skaug
CEG 1996

TMS/ns

Distribution: Client (3)
DSOD (3)

RECEIVED
JAN 26 2000
SONOMA COUNTY
WATER AGENCY

Taber Consultants
Engineers and Geologists

Bot 099542
70-49.06

Taber
Since 1954

GEOTECHNICAL EVALUATION
Sonoma Valley CSD Reclamation Ponds R1 And R2
Sonoma County, CA

Prepared for
Sonoma Valley County Sanitation District

1P1/598/159
38122-B4:N346:W046

January 2000

Taber
Since 1954

LIST OF ATTACHMENTS

List of Appendices (Bound Separately)

Taber
Since 1954
Taber Consultants
Engineers and Geologists
538 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7255
www.taberconsultants.com

TEST BORING LOG

1P1/598/159

TYPE: 4" Solid Auger to 20.5' then NX Rotary ELEVATION: Existing Ground Surface BORING No 10

DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS		SAMPLE No.	SAMPLE SIZE (inches)	BLOWS/FOOT 350 ft-lb	Moisture (%)	DRY DENSITY (lbs/cu. ft.)	OTHER TESTS	UNCONFINED COMPRESS STRENGTH (tsf)
0		CL	(Stiff) light brown very fine-coarse SANDY fine GRAVELLY CLAY to CLAY with fine SAND (fill)							
5		CL	(Hard and very stiff) very fine-coarse SANDY fine GRAVELLY CLAY to CLAY with SAND (fill)							
10		CL	(Stiff-soft) dark brown and gray CLAY with SAND							
15		CL	(Very stiff-stiff) light brown SILTY CLAY to CLAY						V V V	
20		GC	(Dense) brown CLAYEY very fine-coarse SANDY fine GRAVEL with coarse GRAVEL							
25		CL	Soft/loose brown very fine-medium SANDY CLAY/ CLAYEY SAND with trace fine GRAVEL	1	1.4	10	25	98		2.2
30		GP / GC	Compact brown CLAYEY fine GRAVELLY very fine-coarse SAND to CLAYEY SANDY GRAVEL	2	1.4	23				
35		SC	Loose brown CLAYEY very fine-coarse SAND with fine GRAVEL	3	1.4	10	31	91		0.8
40			No free groundwater encountered while augering. Boring grout backfilled 1-13-99.							

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: T.A.K. DATE: 1-13-99

Taber Consultants
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265
www.taberconsultants.com
Since 1954

TEST BORING LOG

1P1/598/159

TYPE: 4-Inch Solid Stem Auger

ELEVATION: Existing Ground Surface

BORING No 11

DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
0			(Stiff-very stiff) brown SANDY GRAVELLY CLAY to SILTY CLAY (fill)
5		CL	
10			
12			(Soft) dark brown CLAYEY SILT
15		ML	
			No free groundwater encountered. Boring grout backfilled 1-14-99.
20			
25			
30			
35			
40			

V

SAMPLE No. | SAMPLE SIZE (inches) | BLOWS/FOOT 350 ft-lb | Moisture (%) | DRY DENSITY (lbs/cu. ft.) | OTHER TESTS | UNCONFINED COMPRESS. STRENGTH (tsf)

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: T.A.K.

DATE: 1-14-99

1/99 1P1/598/159.dwg 1-1

Taber Consultants
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265
www.taberconsultants.com
Since 1954

TEST BORING LOG

1P1/598/159

TYPE: 4" Solid Auger to 20.0' then NX Rotary ELEVATION: Existing Ground Surface BORING No 12

UNCONFINED COMPRESS STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	BLOWS/FOOT 350 ft-lb	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
3.3		111	16	19	1.4	1			CL	Stiff brown very fine-coarse SANDY and GRAVELLY SILTY CLAY (fill)
2.8		112	17	19	1.4	2	5			
	G,A	108	15	24	2.5	3	10		ML	Semicompact dark gray very fine-fine SANDY SILT
	G	113	10	20	1.4	4			CL	(Stiff) dark gray SANDY fine GRAVELLY CLAY
		130	7	71	1.4	5	15		GP / GM	1-14-99 (Compact)-semicompact brown and gray SILTY and CLAYEY SANDY fine GRAVEL
		118	12	80	1.4	6	20		GC	Very dense-dense brown CLAYEY very fine-coarse SANDY fine GRAVEL
		116	20	42	1.4	7	25			
		120	14	15	1.4	8	30		ML	Stiff brown fine SANDY CLAYEY SILT with GRAVEL
				38	1.4	9			GC	Dense brown CLAYEY very fine-coarse SANDY fine GRAVEL
							35			Boring grout backfilled 1-14-99
							40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: T.A.K. DATE: 1-14-99

Taber Consultants
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265
www.taberconsultants.com
Since 1954

TEST BORING LOG

1P1/598/159

TYPE: 4" Solid Auger to 6.5ft. then NX Rotary ELEVATION: Existing Ground Surface BORING No 13

UNCONFINED COMPRESS. STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	BLOWS/FOOT 350 ft-lb	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
4.2		118	14	23	1.4	1	5		CL	Very stiff brown SANDY fine GRAVELLY CLAY (fill)
									ML	(Stiff) dark gray fine SANDY CLAYEY SILT
		118	12	19	1.4	2	10		GC	Semicompact brown CLAYEY and SILTY SANDY fine GRAVEL
1.1		107	21	21	1.4	3	15		CL	Very stiff brown fine SANDY SILTY CLAY
		110	18	26	1.4	4	20		GP / GC	Compact brown SANDY CLAYEY fine GRAVEL
2.1		111	19	28	1.4	5	25			
				35	1.4	6	30			
							35			No free groundwater encountered. Boring grout backfilled 1-15-99.
							40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: T.A.K. DATE: 1-14-99

Taber Consultants
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265
www.taberconsultants.com
Since 1954

TEST BORING LOG

1P1/598/159

TYPE: 4-Inch Solid Stem Auger

ELEVATION: Existing Ground Surface

BORING No 14

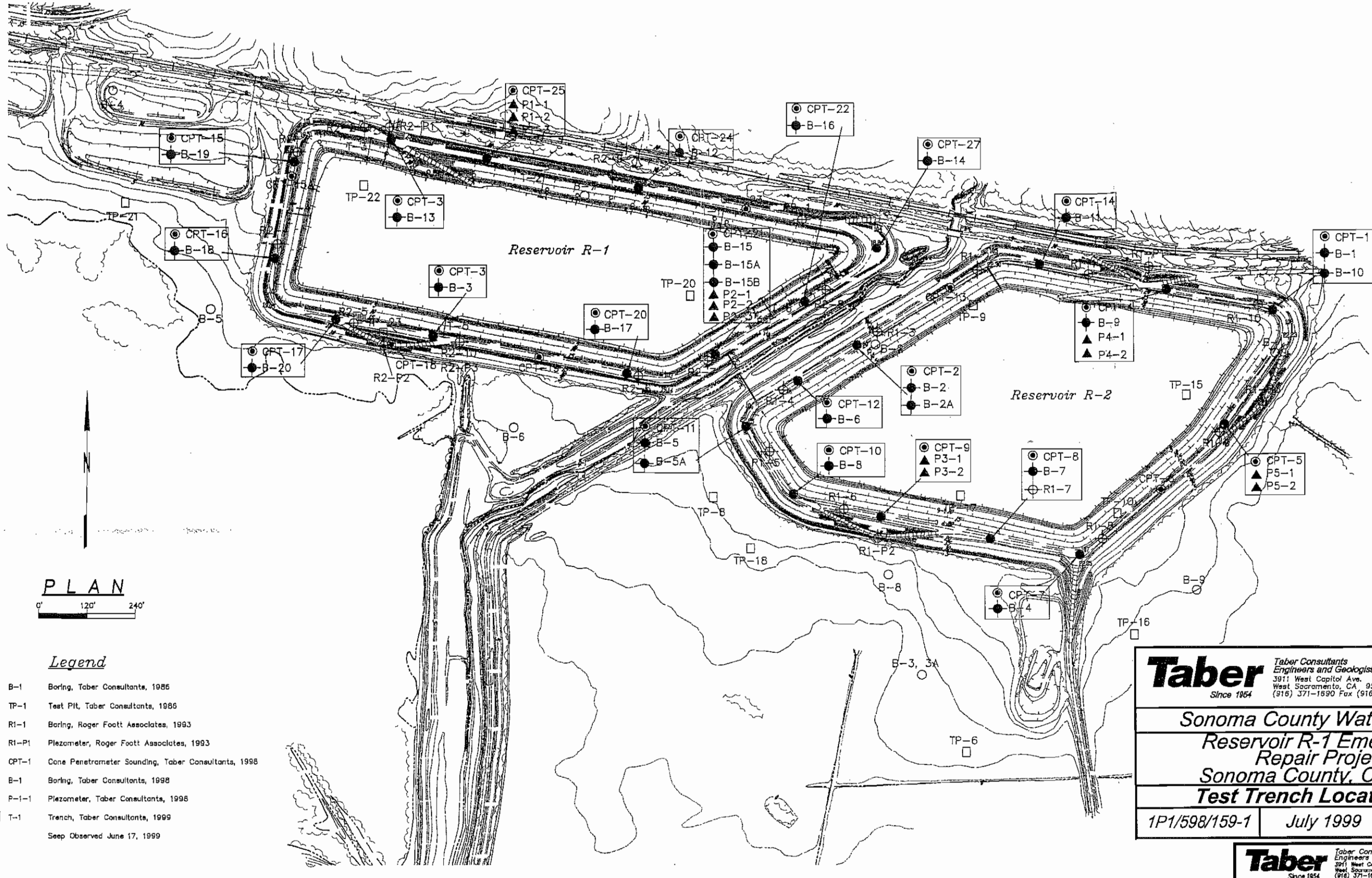
UNCONFIN COMPRES STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	BLOWS/FOOT 350 ft-lb	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
3.6		117	14	25	1.4	1	5		CL	Very stiff to stiff brown very fine-coarse SANDY CLAY with fine GRAVEL (fill)
1.2		113	15	12	1.4	2	10			
	V	113	18	19	2.5	3	15		CL	Stiff gray and brown fine SANDY SILTY CLAY
0.7		115	11	58	1.4	4	20		GC	Dense brown CLAYEY very fine-coarse SANDY fine GRAVEL
1.8		102	24	14	1.4	5	25		CL	Stiff light brown fine SANDY CLAY
							30			No free groundwater encountered. Boring grout backfilled 1-19-99.
							35			
							40			

1-19-99

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: T.A.K.

DATE: 1-15-99



Legend

○	B-1	Boring, Taber Consultants, 1986
□	TP-1	Test Pit, Taber Consultants, 1986
⊕	R1-1	Boring, Roger Foott Associates, 1993
⊕	R1-P1	Piezometer, Roger Foott Associates, 1993
◉	CPT-1	Cone Penetrometer Sounding, Taber Consultants, 1998
●	B-1	Boring, Taber Consultants, 1998
▲	P-1-1	Piezometer, Taber Consultants, 1998
⊢	T-1	Trench, Taber Consultants, 1999
⚲		Seep Observed June 17, 1999

Taber Since 1954

Taber Consultants
Engineers and Geologists
3911 West Capitol Ave.
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265

Sonoma County Water Agency

Reservoir R-1 Emergency Repair Project
Sonoma County, California

Test Trench Location Map

1P1/598/159-1	July 1999	Figure - 2

Taber Since 1954

Taber Consultants
Engineers and Geologists
3911 West Capitol Ave.
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265

Sonoma County Water Agency

Reservoirs R-1 & R-2
Sonoma County, California

Location of Field Tests

1P1/598/159	July 1999	Plate - 1

7.13.99 1P1598159_contour.dwg 1=1

40-03-08

Taber
Since 1954

3911 West Capitol Avenue
West Sacramento, CA 95691-2116
(916) 371-1690
(707) 575-1568
Fax (916) 371-7265
www.taberconsultants.com

June 28, 2000

Ms. Liz Ellis, P.E.
Green Valley Consulting Engineers
1400 N. Dutton Avenue, Suite 17
Santa Rosa, California 95401

Subject: Geotechnical Investigation 10-12-7426 1P2/599/96-3
Sonoma Valley CSD Effluent Reservoir R-4 38122-B4; 366N 080W
Sonoma County, California

Dear Ms. Ellis:

Attached hereto is our report of geotechnical investigation performed at the above site. One copy is being sent to John Hanson, design engineer for this project. Much of the data included herein has been previously forwarded to Mr. Hanson to expedite the design process.

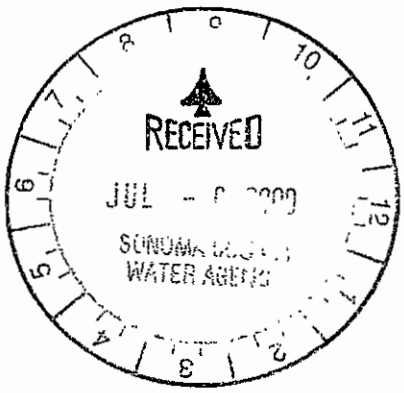
If you have any questions concerning this report or subsurface materials/ conditions at the site, please call. We appreciate this opportunity to be of service.

Very truly yours,
TABER CONSULTANTS

Thomas M. Skaug
Senior Geologist

TMS/ns

Distribution: Addressee (7)
John Hanson (1)



Taber
Since 1954

GEOTECHNICAL INVESTIGATION
Sonoma Valley CSD Effluent Reservoir R-4
Sonoma County, California

96-12-7 #26

Sonoma Valley CSD
Owner

1P2/599/96-3
38122-B4 N366:W082

June 2000

Taber
Since 1954

TABLE OF CONTENTS

Taber
Since 1954

LIST OF ATTACHMENTS

"General Conditions"
"Selected References"

Figure-1	Test Boring Logs (24 pages) "Boring Legend"
Figure-2	Laboratory Test Results (16 pages)
Figure-3	Location of Field Tests
Figure-4	Cross Section A – A′
Figure-5	Cross Section B – B′
Figure-6	Cross Section C – C′
Figure-7	Cross Section D – D′
Figure-8	Cross Section E – E′
Figure-9	Cross Section F – F′
Figure-10	Cross Section G – G′
Figure-11	Cross Section H – H′
Figure-12	Cross Section I – I′
Figure-13	Typical Section – Ground Preparation
Figure-14	Test Pit Logs
Figure-15	D698 Compaction Curves

LIST OF APPENDICES (Bound Separately)

Appendix A	"CPT/SPT Site Specific Correlation & Calibration Program"
Appendix B	"Data Transmittal / Proposed Sampling Memorandum"
Appendix C	"Preliminary Estimate of Construction Dewatering Requirements" "Hydrogeologic Assessment of the Ramal Road Reservoir Site" "R-4 Dewatering Calculations"
Appendix D	Triaxial Shear Test Reports (Sierra Testing Laboratory)
Appendix E	Log of Boring B-11, Taber Consultants, 1986
Appendix F	BACE Geotechnical: Logs of Borings 1 through 12 and Test Pits TP-1 through TP-7 Soil Classification Chart and Key to Test Data Physical Properties Criteria For Soil Classification Typical Piezometer Well Completion Detail
Appendix G	BACE Geotechnical Laboratory Results
Appendix H	CPT Logs
Appendix I	Liquefaction Calculation Printouts

Taber
Since 1954
Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

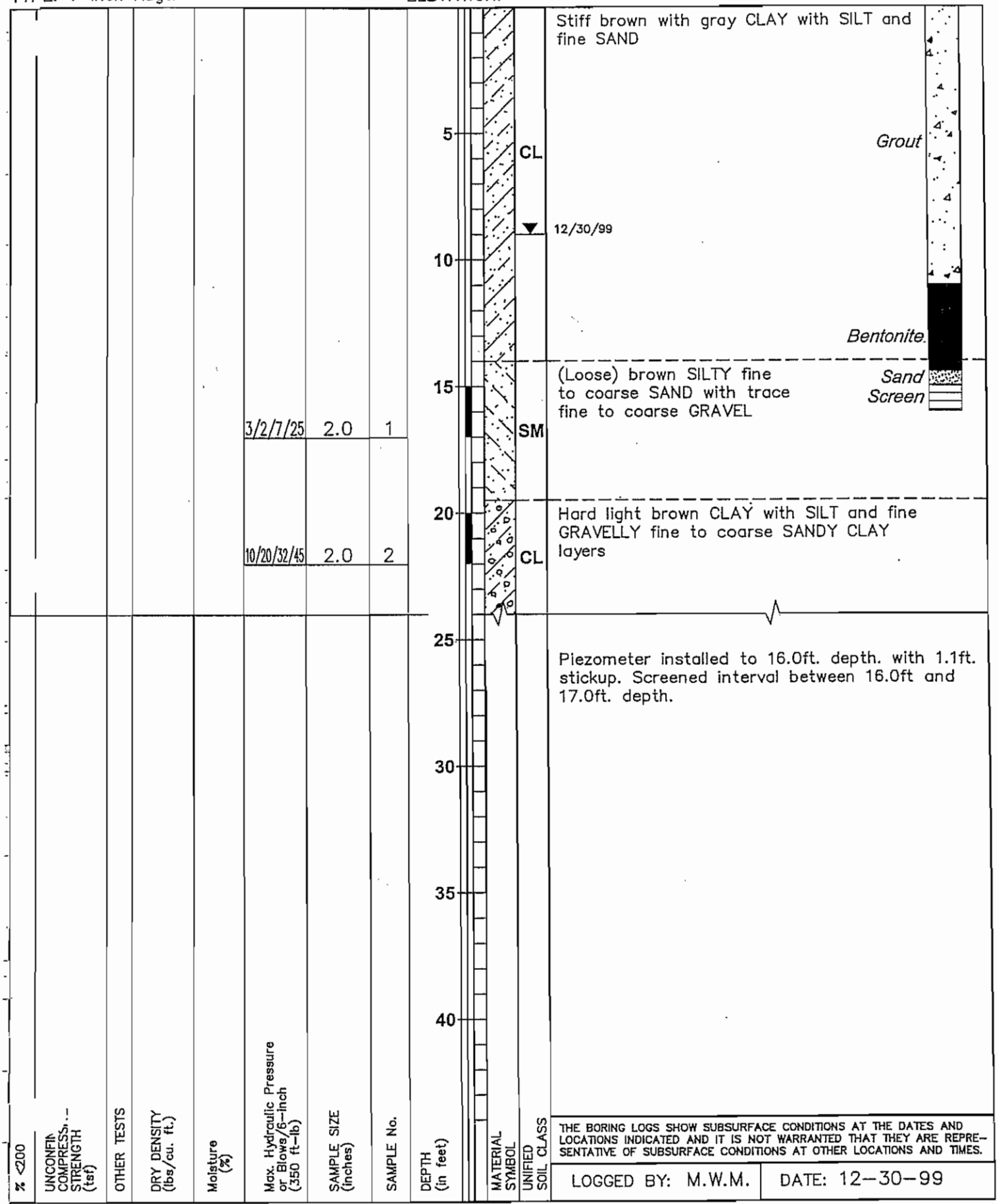
TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger

ELEVATION: 6.6

BORING No. P-1A



% <200	UNCONFIN COMPRESS... STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS
					3/2/7/25	2.0	1			
					10/20/32/45	2.0	2			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 12-30-99

Taber Since 1954

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

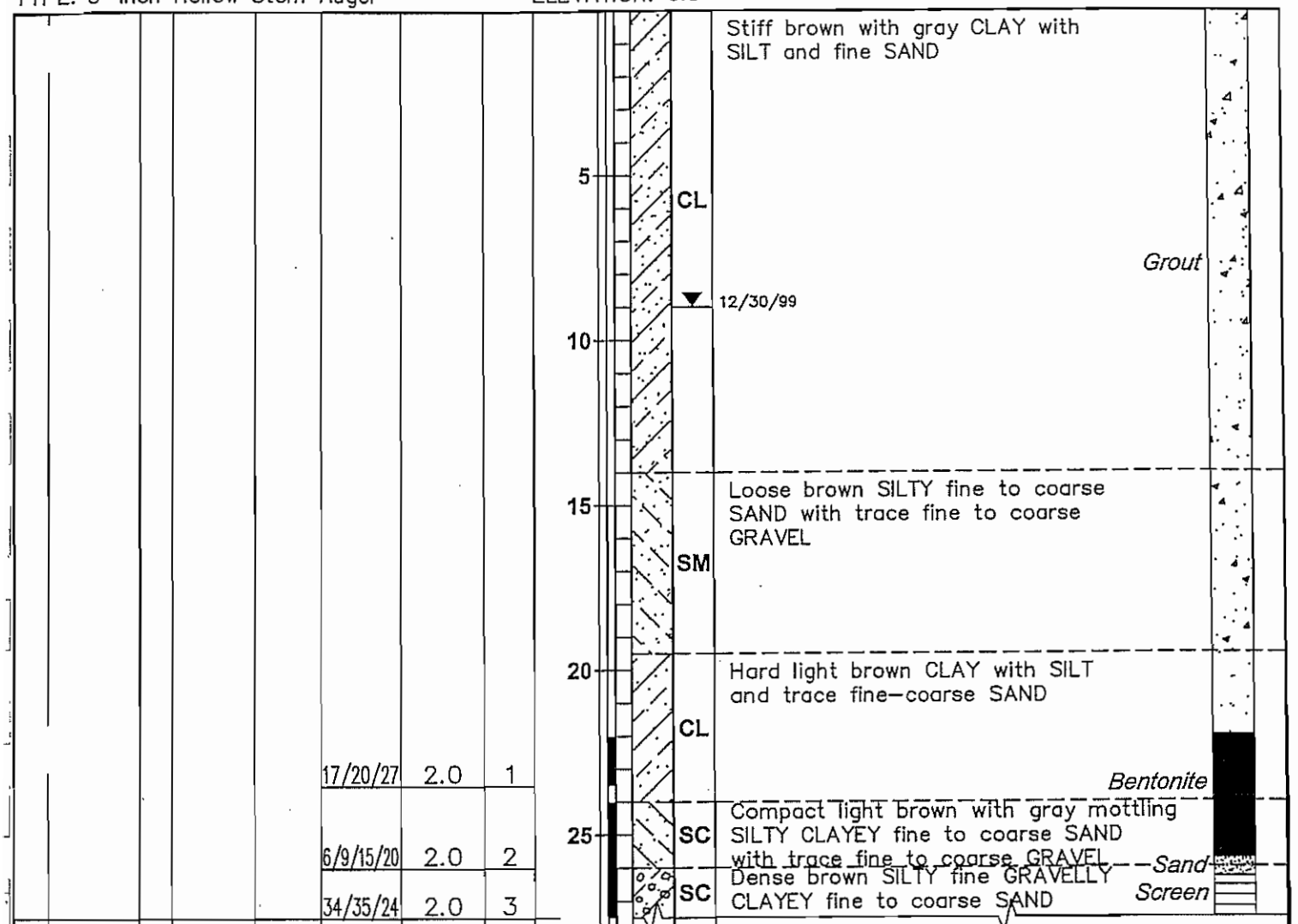
TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 6-inch Hollow Stem Auger

ELEVATION: 5.8

BORING No. P-1B



% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS
					17/20/27	2.0	1			
					6/9/15/20	2.0	2			
					34/35/24	2.0	3			

Piezometer installed to 27.5ft. depth. with 0.8ft. stickup. Screen interval between 26.3 and 27.5ft. depth.

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 12-30-99

03/13/00 1P259996-3b.dwg 1=1

Taber Since 1954

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger

ELEVATION: 14.2

BORING No. P-2B

% <200	UNCONFINED COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.
	4.8		112	18	4/8/10	1.4	1
	5.2		111	20	7/9/12	1.4	2
	0.8		90	20	11/13/22	1.4	3
17	0.9	G	103	15	16/25/32	1.4	4
	8.5		114	17	11/14/19	1.4	5
			105	13	10/14/16	1.4	6
29	0.3	G	102	11	16/84-0.9	1.4	7
26		G	95	13	9/17/21	1.4	8
37	1.5	G	113	17	7/7/6	1.4	9
	2.7		109	20	5/5/8	1.4	10

DEPTH (in feet) | MATERIAL SYMBOL | UNIFIED SOIL CLASS

DEPTH (in feet)	UNIFIED SOIL CLASS	
0	CL	(Stiff) dark brown fine SANDY SILTY CLAY with trace fine GRAVEL (fill)
		Stiff dark to light brown fine SANDY SILTY CLAY
5	CL	
		Grout
10		
	CL	(Stiff) light brown CLAY with SILT and trace fine SAND
		▼ 1/4/00
15	CL	Very stiff brown fine-coarse SANDY CLAY with SILT and fine GRAVEL and white to buff GRAVELLY SAND layers
20	SM	Dense light brown to white and dark brown SILTY fine GRAVELLY fine-coarse SAND with trace CLAY
25	CL	Very stiff orange brown SILTY fine-medium SANDY CLAY with trace fine GRAVEL
	CL	Very stiff orange brown fine GRAVELLY CLAY with fine to coarse SAND and SILT
30	SC	Very dense and dense light brown to brown fine GRAVELLY CLAYEY fine to coarse SAND with SILT and SILTY fine SAND layers
		▽ 1/4/00
35	SC	Semicompact orange brown fine GRAVELLY CLAYEY fine-coarse SAND with SILT and SILTY fine SAND layers
	CL	Stiff brown SILTY fine SANDY CLAY
40		*Bentonite*
		--CONTINUED--

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 1-4-00

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger

ELEVATION: 14.2

BORING No. P-2B cont.

% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
	3.6		116	17	7/10/12	1.4	11			CL	Stiff brown SILTY fine SANDY CLAY
49		G	106	18	16/17/15	1.4	12			GC / CL	Dense orange brown fine to coarse SANDY CLAYEY GRAVEL to GRAVELLY CLAY
	2.0		94	30	5/7/8	1.4	13	45		CL	Stiff light brown with black mottling CLAY with SILT and very fine SAND
								50			
								55			
								60			
								65			
								70			
								75			
								80			

Bentonite

Sand

Screen

Piezometer installed to 44.3ft. depth. with 0.5ft. stickup. Screened interval between 43.3ft. and 44.3ft. depth.

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 1-4-00

03/13/00 1P259996-3e.dwg 1=1

Taber Since 1954

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger to 5.0'/3-inch Rotary ELEVATION: 6.6± (per topo) **BORING No. 1**

% <200	UNCONFIN COMPRESS STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/ft. (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
	4.0	A	108	19	17	1.4	1			CL	Stiff brown CLAY to very fine-coarse SANDY CLAY
	2.6		105	20	21	1.4	2	5			
33	0.9	G	111	19	18	1.4	3			SC	Compact and semicompact brown interbedded CLAYEY and SILTY very fine-coarse GRAVELLY SAND and CLAYEY very fine-fine SAND
16	1.1	G	116	14	22	1.4	4	10			
12	2.1	G	126	11	44	1.4	5			GC	Dense brown CLAYEY very fine-coarse SANDY fine GRAVEL
	0.7		115	15	15	1.4	6	15			
	3.9	A	108	19	19	1.4	7			CL	Stiff brown CLAY
27	1.3	G,A	114	16	51	1.4	8	20		SC / GC	Dense brown CLAYEY very fine-coarse SANDY fine GRAVEL to 23.0ft. grading to brown GRAVELLY CLAYEY SAND
24	2.2	G	107	18	39	1.4	9				
22	2.2	G	110	16	65	1.4	10	25			
	1.5		110	15	38	1.4	11				
	5.9		114	17	27	1.4	12	30			Very stiff-stiff and locally soft SANDY CLAY locally with fine GRAVEL
	2.7	A	106	21	16	1.4	13			CL	
	2.6		103	21	11	1.4	14	35			
30	1.4	G,A	95	28	9	1.4	15				
								40		GC	Compact-semicompact brown CLAYEY very fine-coarse SANDY fine GRAVEL
											-- Boring Continues --

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: T.A.K. DATE: 7-8-99

04/24/00 1P259996-3aa.dwg 1=1

Taber Since 1954
Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger to 5.0'/3-inch Rotary ELEVATION: 6.6± (per topo)

BORING No. 1 cont.

% <200	UNCONFI COMPRESS... STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/ft. (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
					20	1.4	16				Compact-semicompact brown CLAYEY very fine-coarse SANDY fine GRAVEL
16	0.4	G	110	17	18	1.4	17	45		GC	
	2.0		106	21	10	1.4	18				Stiff brown CLAY
	1.6	A	103	23	10	1.4	19			CL	
								50			Boring dry during augering (depth to 5.0ft.)
											Boring grout backfilled 7-8-99
								55			
								60			
								65			
								70			
								75			
								80			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: T.A.K. DATE: 7-8-99

04/24/00 1P259996-3bb.dwg 1=1

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger/2.5-inch Rotary ELEVATION: 8.8 **BORING No. 7**

% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
								0		SC	(Compact) dark brown SILTY CLAYEY fine-coarse SAND with fine GRAVEL
										SC	(Semicompact) light brown SILTY CLAYEY fine-medium SAND
	6.0		114	17	11/12/15	1.4	1	5		CL	Very stiff light brown fine SANDY SILTY CLAY
					500psi	2.0	2	10			▽ 1/6/00
			122	12	26/33/37	2.5	3	15		SP / SM	Very dense/dense brown to dark gray SILTY fine to coarse GRAVELLY fine to coarse SAND with trace CLAY
	3.9		110	21	7/8/9	1.4	4			CL	Stiff light brown fine SANDY SILTY CLAY with SANDY CLAY with fine GRAVELLY layers
	2.0		119	15	1/5/9/8	1.4	5	20			
											Boring grout backfilled 1-6-00.
								25			
								30			
								35			
								40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. DATE: 1-6-00

03/13/00 1P259996-3m.dwg 1=1

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger/2.5-inch Rotary ELEVATION: 8.8 BORING No. 8

% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
		T	90	31	500psi	2.0	1			SC	(Compact) dark brown SILTY CLAYEY fine-coarse SAND with fine GRAVEL
										SC	(Semicompact) light brown SILTY CLAYEY fine-medium SAND
								5		CL	Very stiff light brown fine SANDY SILTY CLAY
								10			
28	1.0	G	100	25	3/6/8	1.4	2			SC	Semicompact brown SILTY CLAYEY fine-coarse SAND with GRAVEL
14	2.0	G	120	15	8/16/25	1.4	3	15		SP/SC	Dense brown fine to coarse GRAVELLY fine-coarse SAND with CLAY.
10		G	116	17	5/17/20	1.4	4			SW/SC	Dense dark brown fine-coarse SANDY fine to coarse GRAVEL with SILT and CLAY
	3.3		107	22	7/7/8/10	1.4	5	20		CL	Stiff light brown fine SANDY SILTY CLAY
											Boring grout backfilled 1-6-00.
								25			
								30			
								35			
								40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. DATE: 1-6-00

03/13/00 1P259996-3n.dwg 1=1

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 4-inch Auger/6-inch Hollow Stem Auger ELEVATION: 10.8

BORING No. 9

% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
										SC	(Compact) light brown SILTY CLAYEY fine GRAVELLY fine-coarse SAND (fill)
										CL	(Stiff) dark brown with black fine GRAVELLY SILTY fine to medium SANDY CLAY
	7.9		113	18	6/9/15	1.4	1	5		CL	Very stiff dark brown fine SANDY SILTY CLAY
	2.3		101	25	4/6/8	1.4	2	10		SC	Semicompact light brown SILTY CLAYEY fine-medium SAND
			92	27	4/4/6	2.5	3			SM	Loose light brown SILTY fine SAND with trace medium SAND
15		G	122	8	20/28/40	1.4	4	15		SM	Dense brown SILTY fine to coarse GRAVELLY fine-coarse SAND with CLAY
	5.2		110	20	5/8/11	1.4	5	20		CL	Stiff light brown with black streaks CLAY with SILT and trace fine SAND
	3.1		97	28	3/4/7/8	1.4	6	25			
					500psi	2.0	7	30			
					2/5/9	1.4	8				
								35			Hole collapsed to 8±ft. depth after pulling auger. Groundwater not measured. Boring grout backfilled 1-6-00.
								40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 1-6-00

03/13/00 1P259996-3a.dwg 1=1

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 6" Hollow Auger to 4'/2.5-inch Rotary ELEVATION: 11.2

BORING No. 11

% <200	UNCONFIN. COMPRESSIVE STRENGTH (tsf)	OTHER TESTS	DRY DENSITY (lbs/cu. ft.)	Moisture (%)	Max. Hydraulic Pressure or Blows/6-inch (350 ft-lb)	SAMPLE SIZE (inches)	SAMPLE No.	DEPTH (in feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS	
	8.7		113	22	10/14/18	1.4	1	5		SC	(Compact) dark brown CLAYEY SILTY fine to coarse SAND with fine GRAVEL
										CL	Very stiff light brown CLAY with SILT
	0.3		94	29	2/3/3/3	1.4	2	10		CL	Soft light brown fine SANDY CLAY with SILT
39		H	93	30	2/3/5	1.4	3			SM	Loose dark brown SILTY fine-medium SAND ▼ 1/7/00
17		G	109	21	6/5/10	1.4	4	15		SM / SC	Semicompact brown SILTY CLAYEY fine to medium SAND
23	2.8	G	115	18	7/9/9/11	1.4	5	20		CL	Stiff light brown CLAY with SILT
								25			Boring grout backfilled 1-7-00.
								30			
								35			
								40			

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. DATE: 1-7-00

03/13/00 1P259996-3q.dwg 1=1

Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
Since 1954

TEST BORING LOG

Job No. 1P2/599/96-3

TYPE: 6-inch Hollow Stem Auger

ELEVATION: 10.8

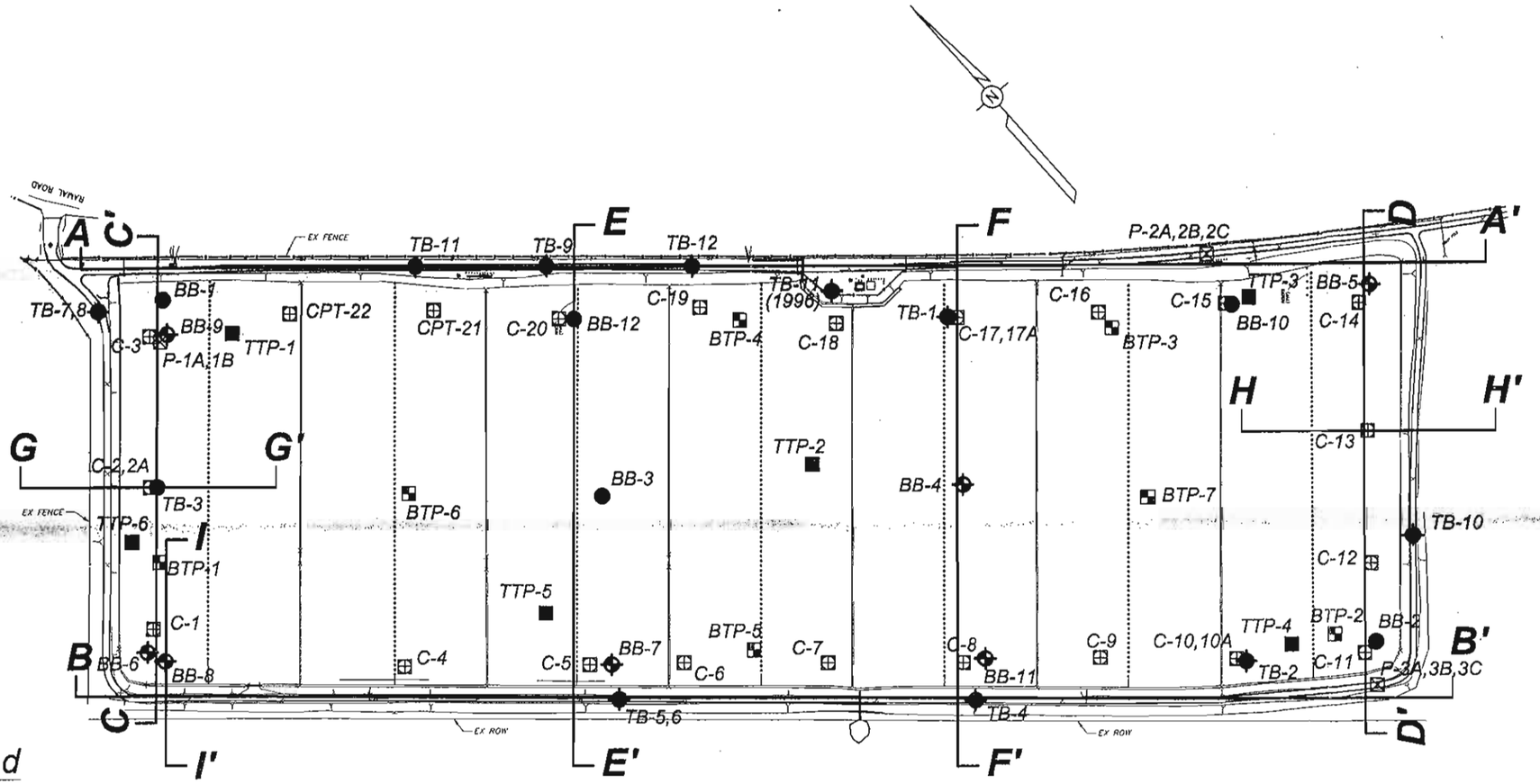
BORING No. 12

DEPTH (In feet)	MATERIAL SYMBOL	UNIFIED SOIL CLASS		SAMPLE No.	SAMPLE SIZE (inches)	Max. Hydraulic Pressure or Blows/6-Inch (350 ft-lb)	Moisture (%)	DRY DENSITY (lbs/cu. ft.)	OTHER TESTS	UNCONFINED COMPRESSIVE STRENGTH (tsf)	% <200
0		SC	(Compact) dark brown CLAYEY SILTY fine-coarse SAND with fine GRAVEL								
			(Very stiff) light brown CLAY with SILT								
5		CL									
10			▼ 1/7/00								
			(Semicompact) brown SILTY CLAYEY fine-coarse SAND with fine GRAVEL								
15		SC									
20											
			(Stiff) light brown CLAY with SILT								
25		CL									
			Semicompact brown SILTY CLAYEY fine-coarse SAND	1	2.0	5/6/10	22	105	T		
30		SC		2	1.4	4/6/7					
		CL	Stiff light brown CLAY with SILT								
35			Hole collapsed to 10±ft. depth after pulling auger out of hole. Boring grout backfilled 1-7-00.								
40											

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGED BY: M.W.M. | DATE: 1-7-00

03/13/00 1P259996-3r.dwg 1=1



Legend

- C-3 – Cone penetrometer test
- TB-1 – Taber boring
- P-2 – Taber piezometer
- TTP-2 – Taber test pit
- BB-1 – BACE boring
- BTP-3 – BACE test pit
- BB-3 – BACE boring with piezometer

PLAN

Scale 1" = 200'

Taber Since 1954
Taber Consultants
Engineers and Geologists
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
(916) 371-1690 Fax (916) 371-7265

Green Valley Consulting Engineers

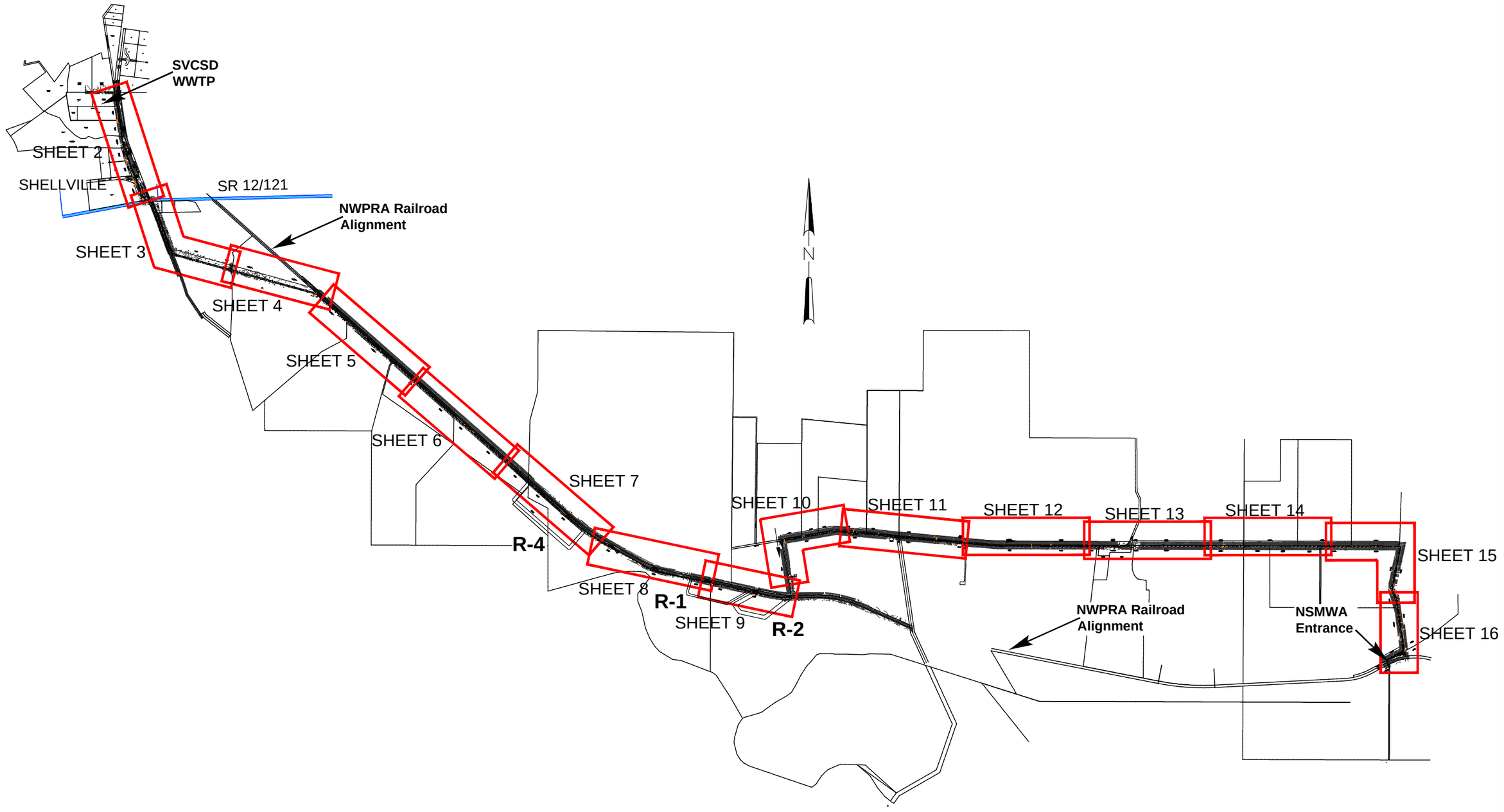
Sonoma Valley CSD
Effluent Reservoir R-4

LOCATION OF FIELD TESTS

1P2/599/96-3	April 2000	Figure - 3

APPENDIX B

Boring Location Map, BCI 2011; Sheets 1 through 16



SCALE: 1"=2400'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP INDEX

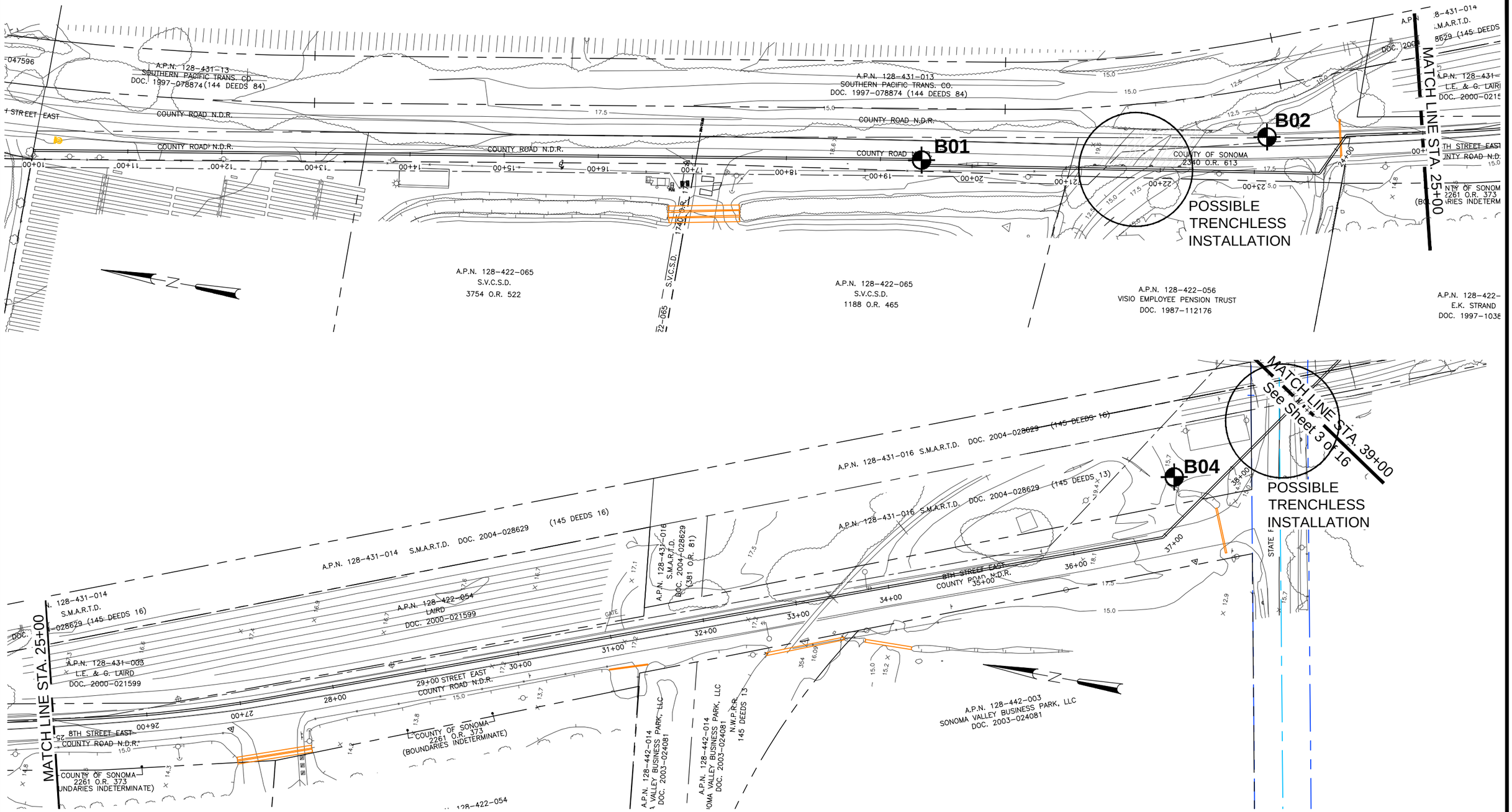
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 1 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 Approximate Boring Location

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

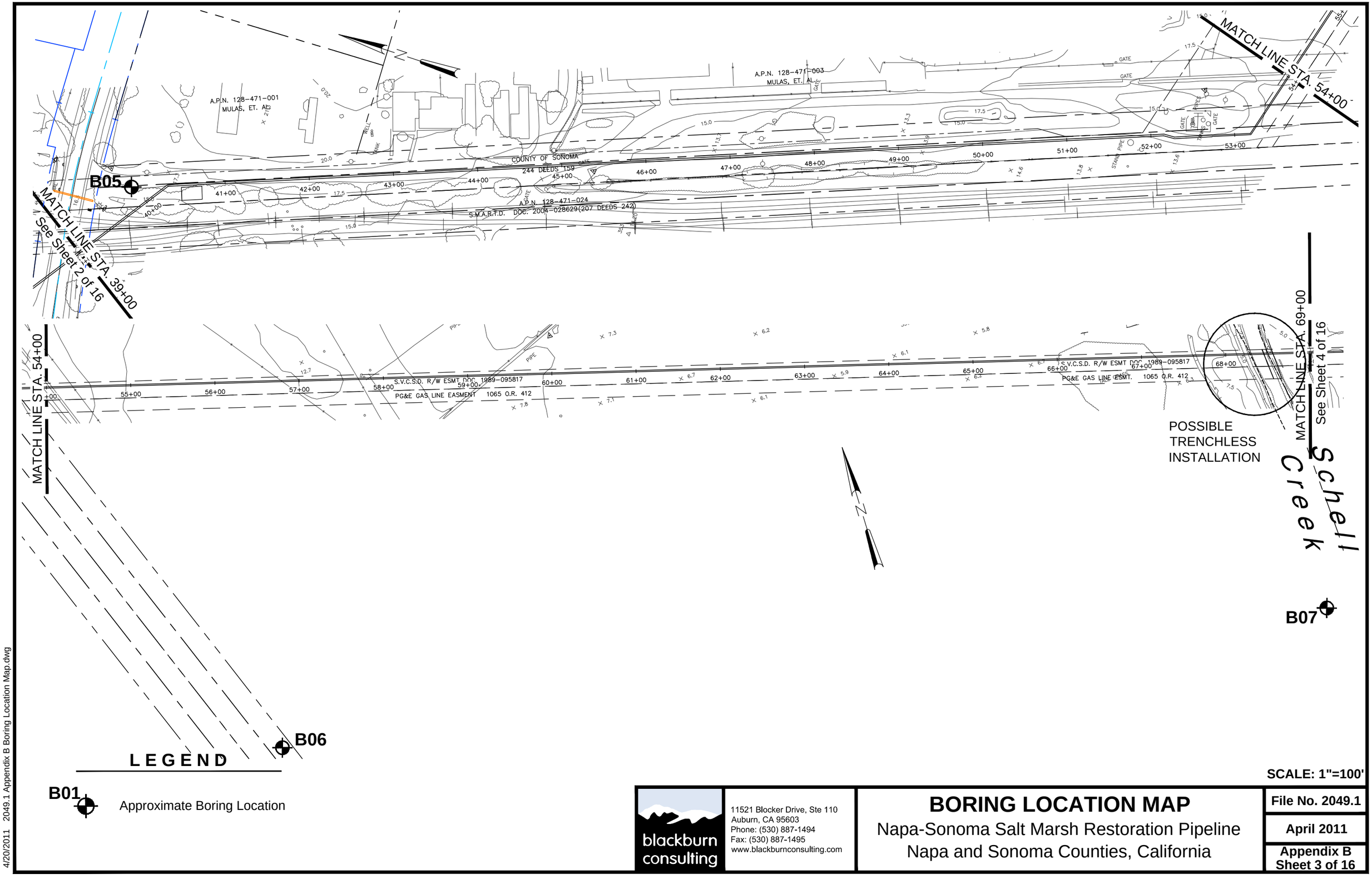
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 2 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

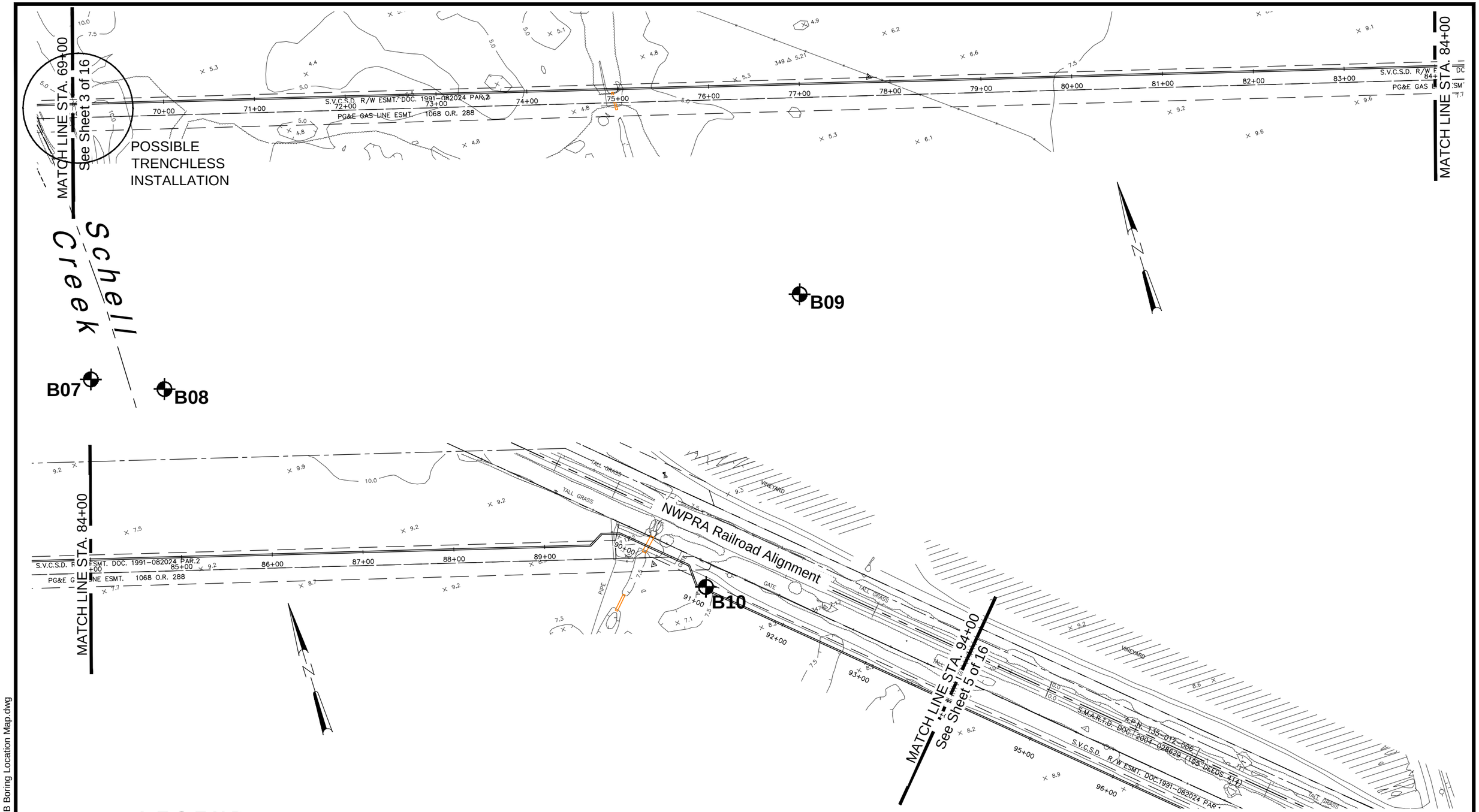
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 3 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

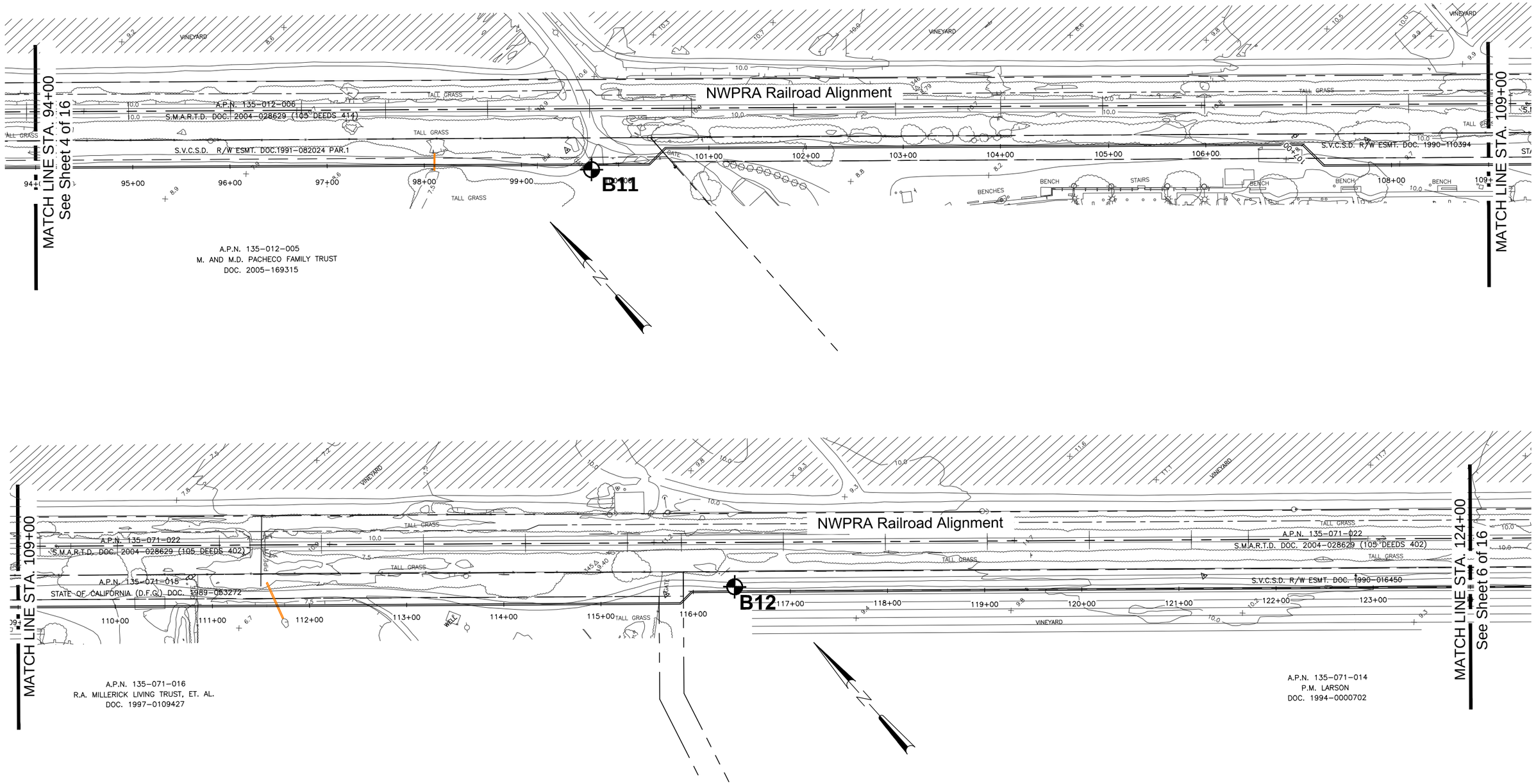
blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1
April 2011
Appendix B
Sheet 4 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

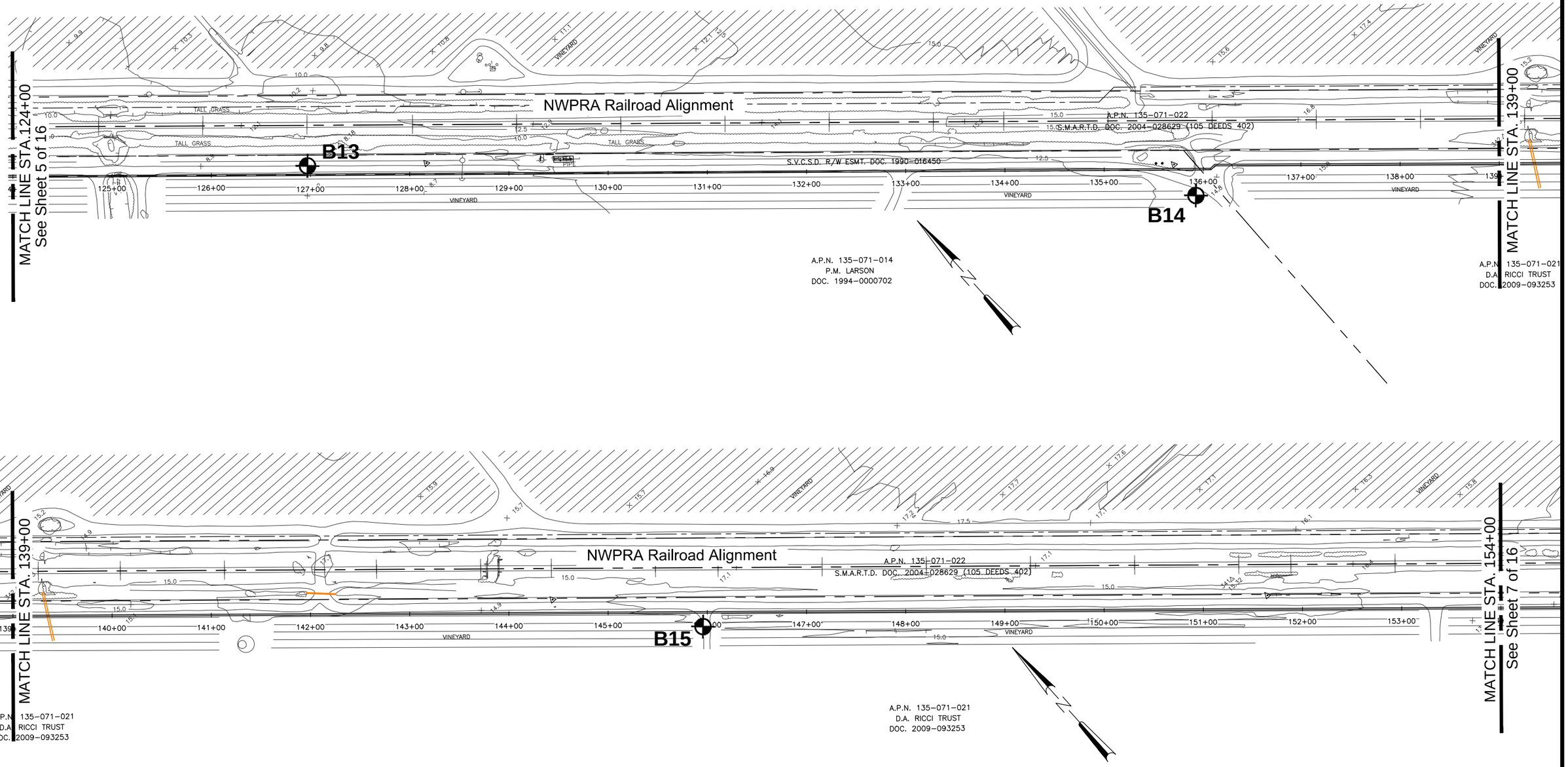
blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1
April 2011
Appendix B
Sheet 5 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

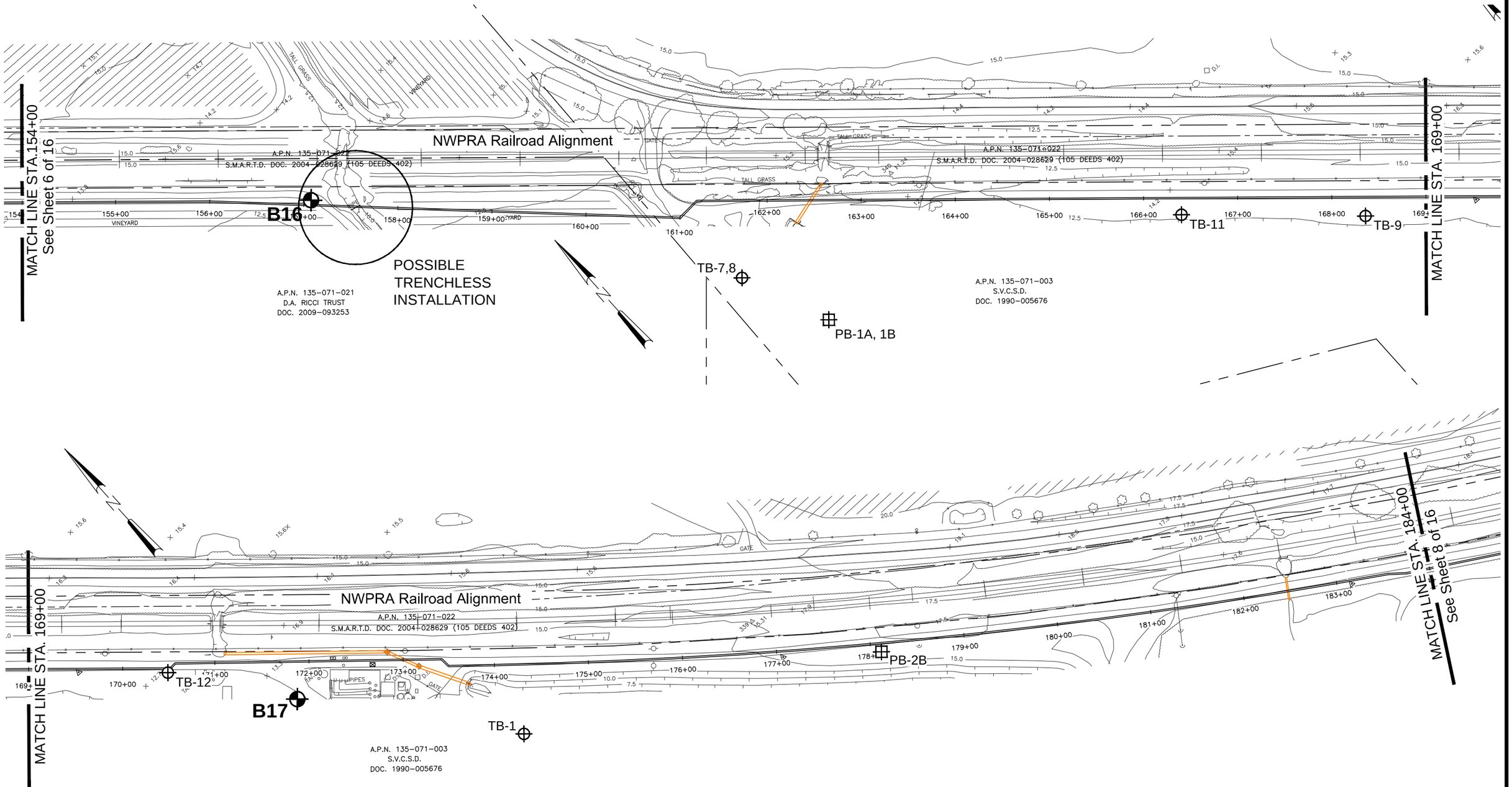
blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1
April 2011
Appendix B
Sheet 6 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

TB-1 — Approximate Taber Boring Location (Drilled 2000-see Appendix A)

PB-2 — Approximate Taber Piezometer Location (Drilled 2000-see Appendix A)

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

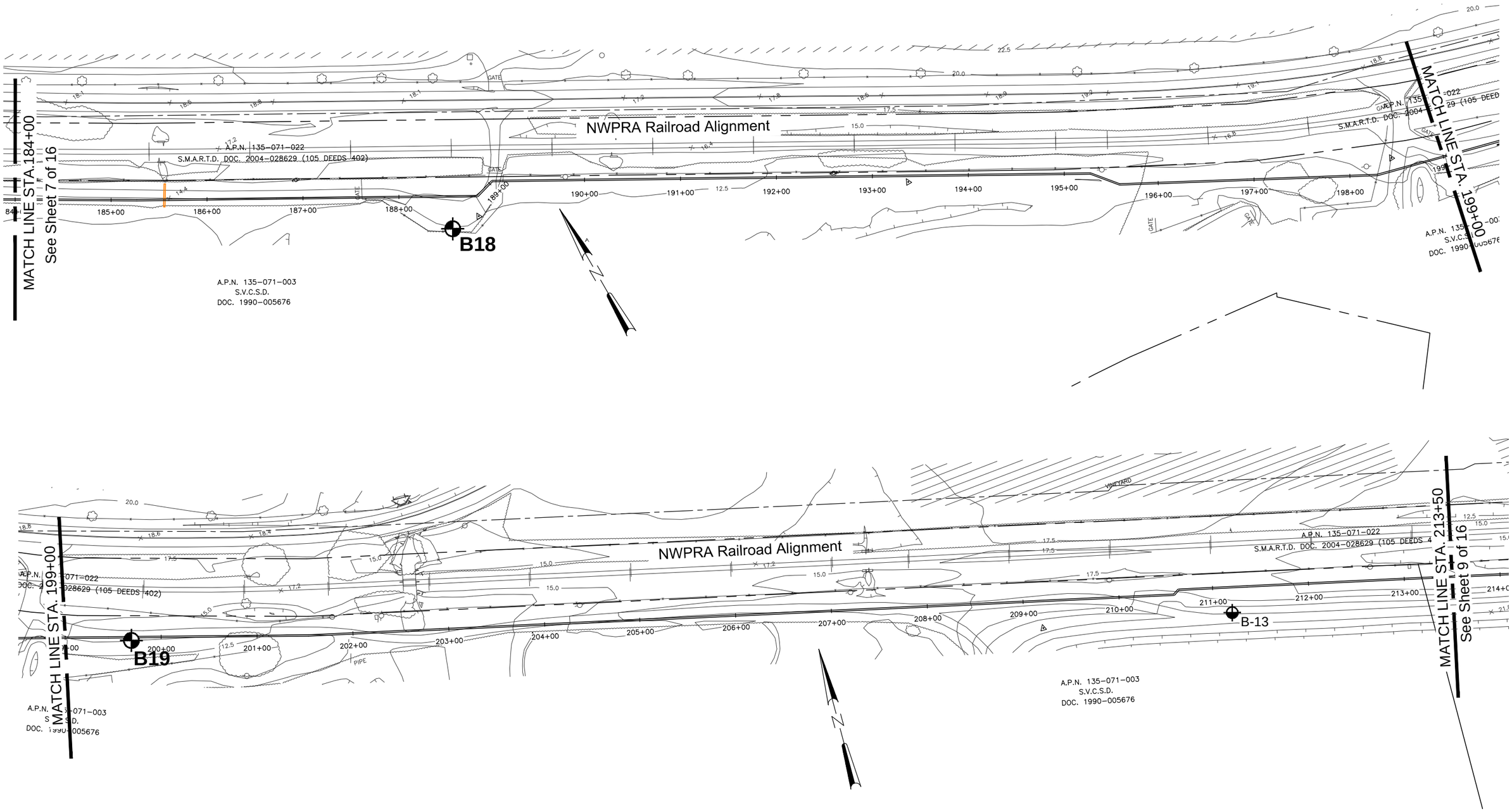
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 7 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

B-10 - Approximate Taber Boring Location (Drilled 1999-see Appendix A)

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

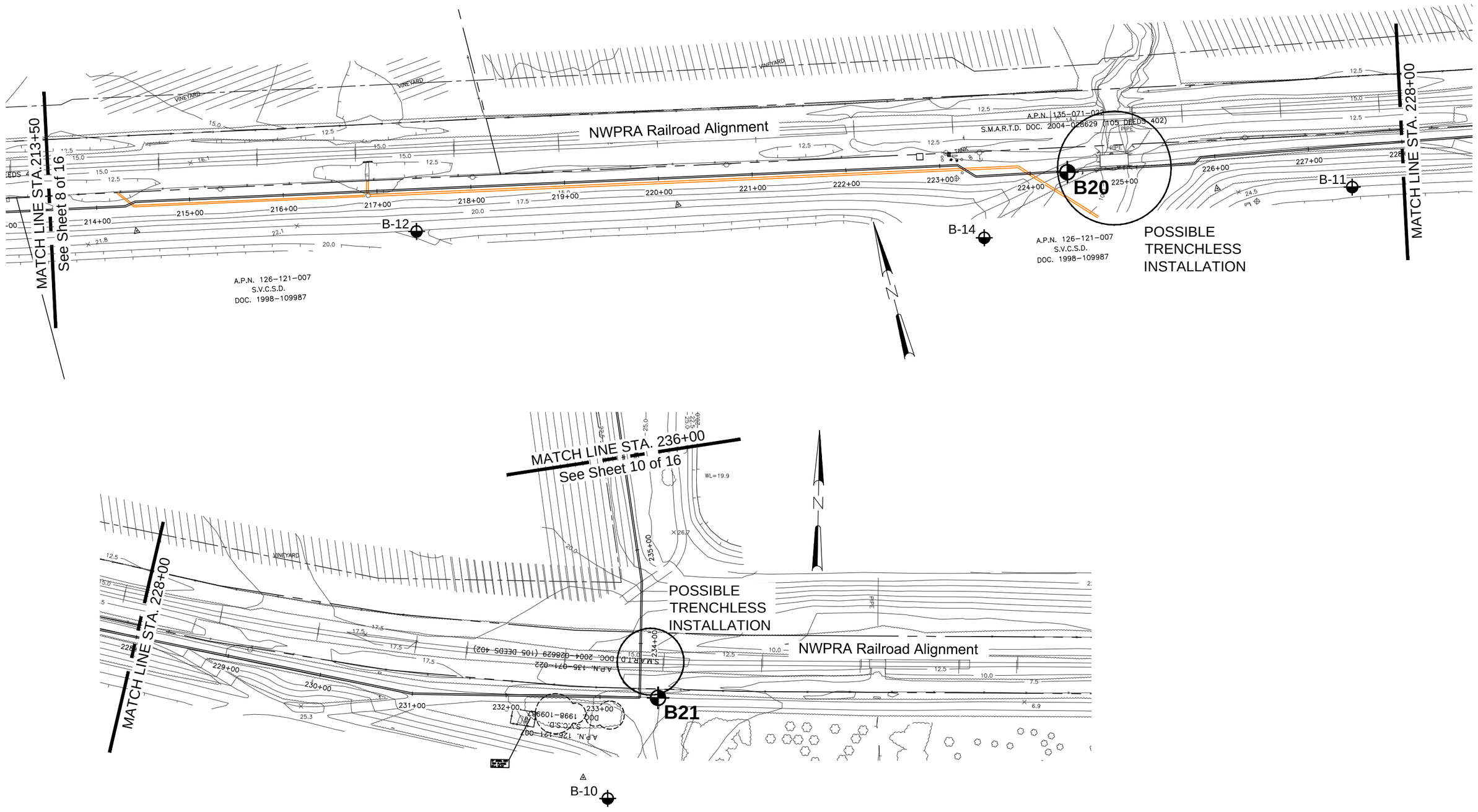
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 8 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 Approximate Boring Location

B-10 - Approximate Taber Boring Location (Drilled 1999-see Appendix A)

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

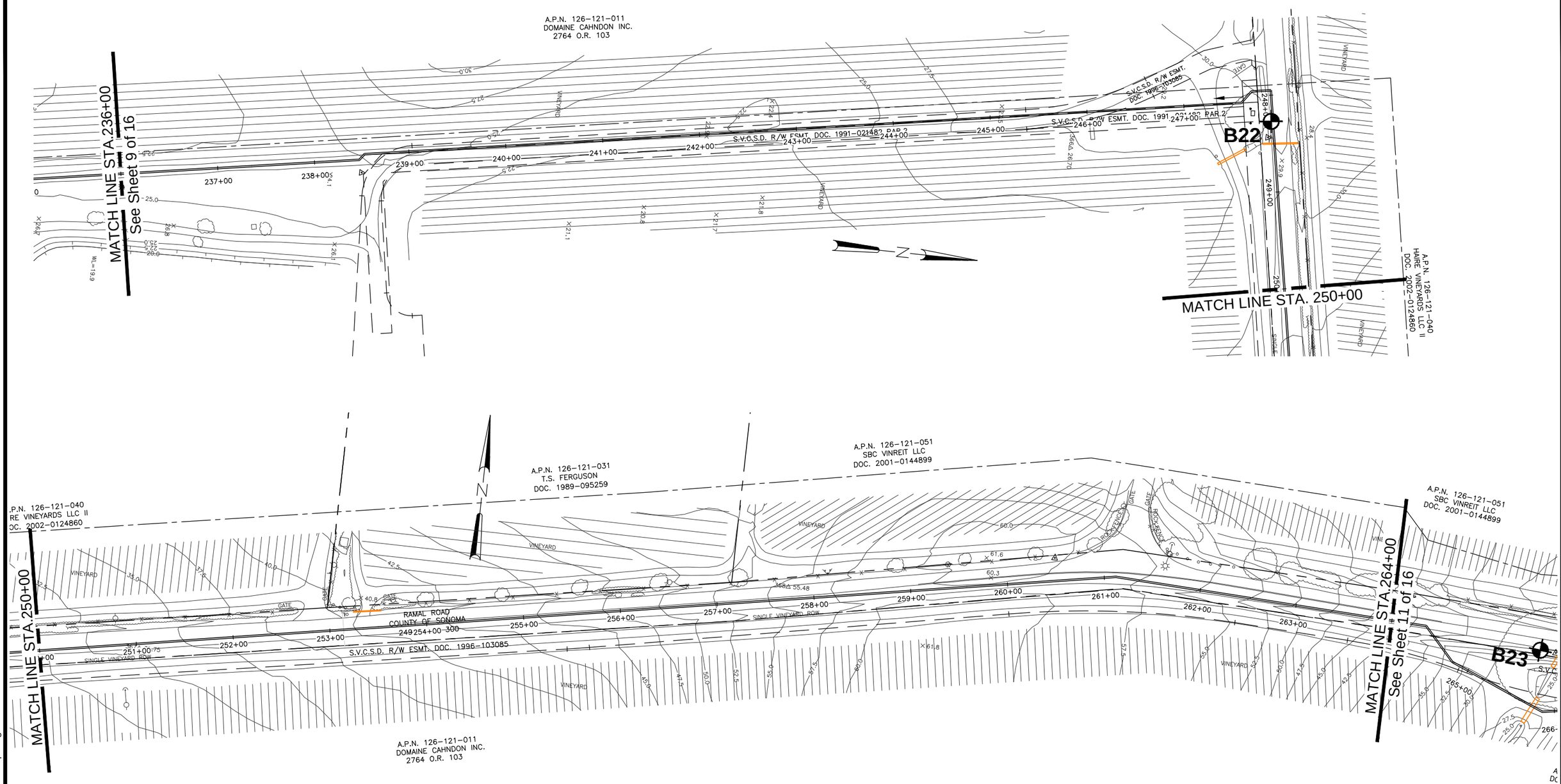
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B Sheet 9 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

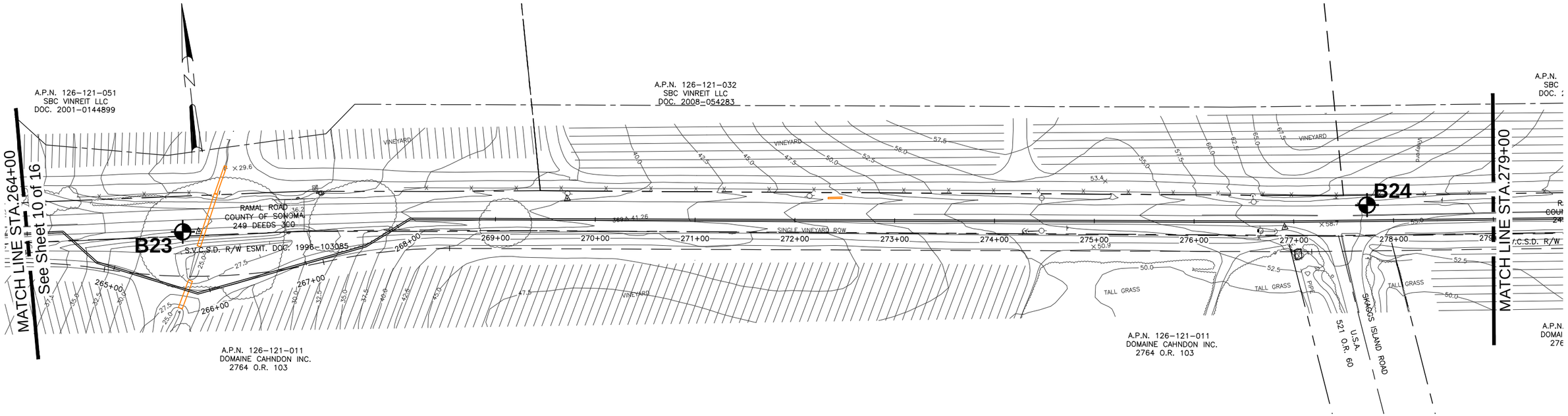
BORING LOCATION MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 10 of 16



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

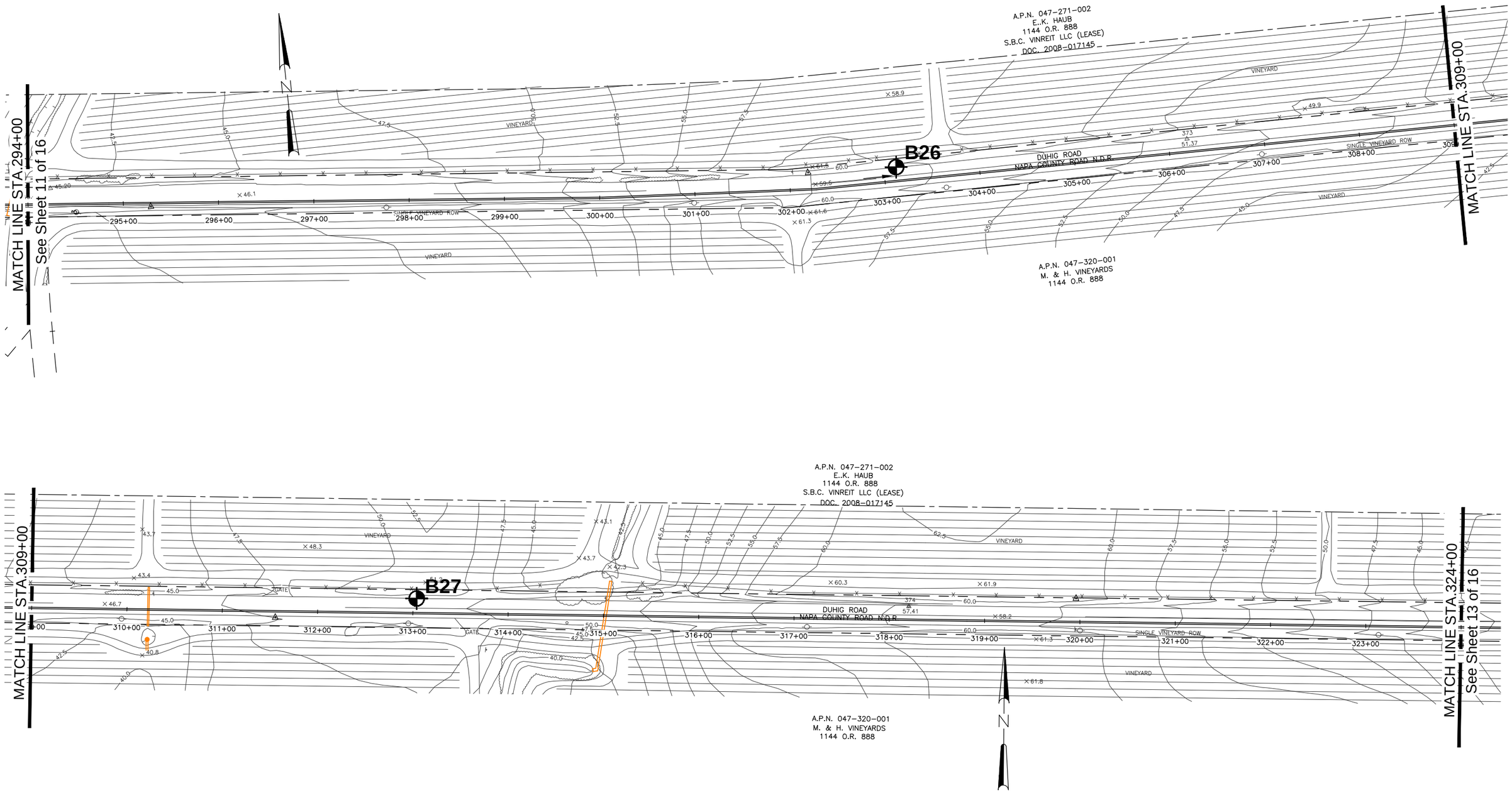
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 11 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 ⊕ Approximate Boring Location

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

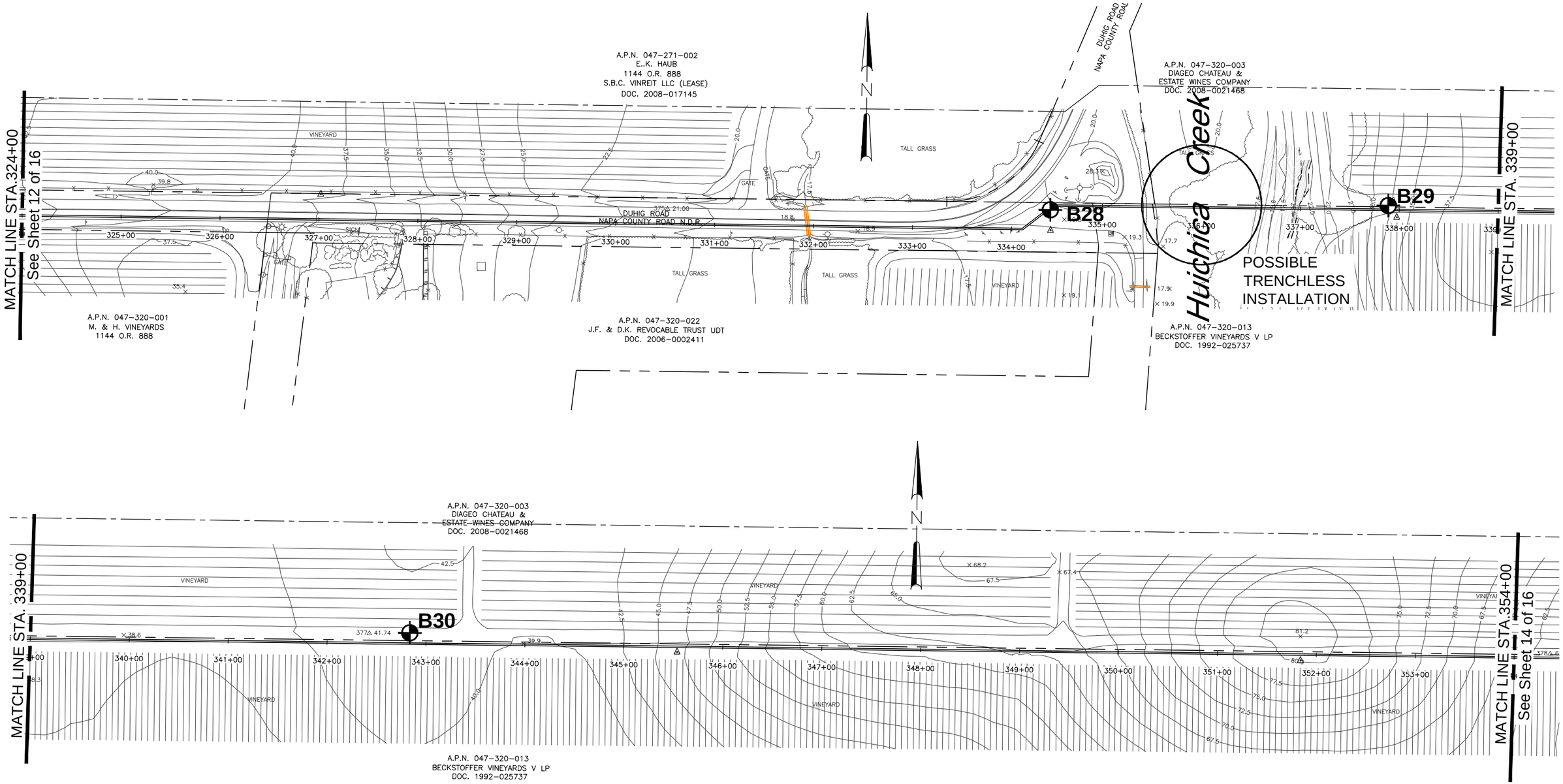
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 12 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

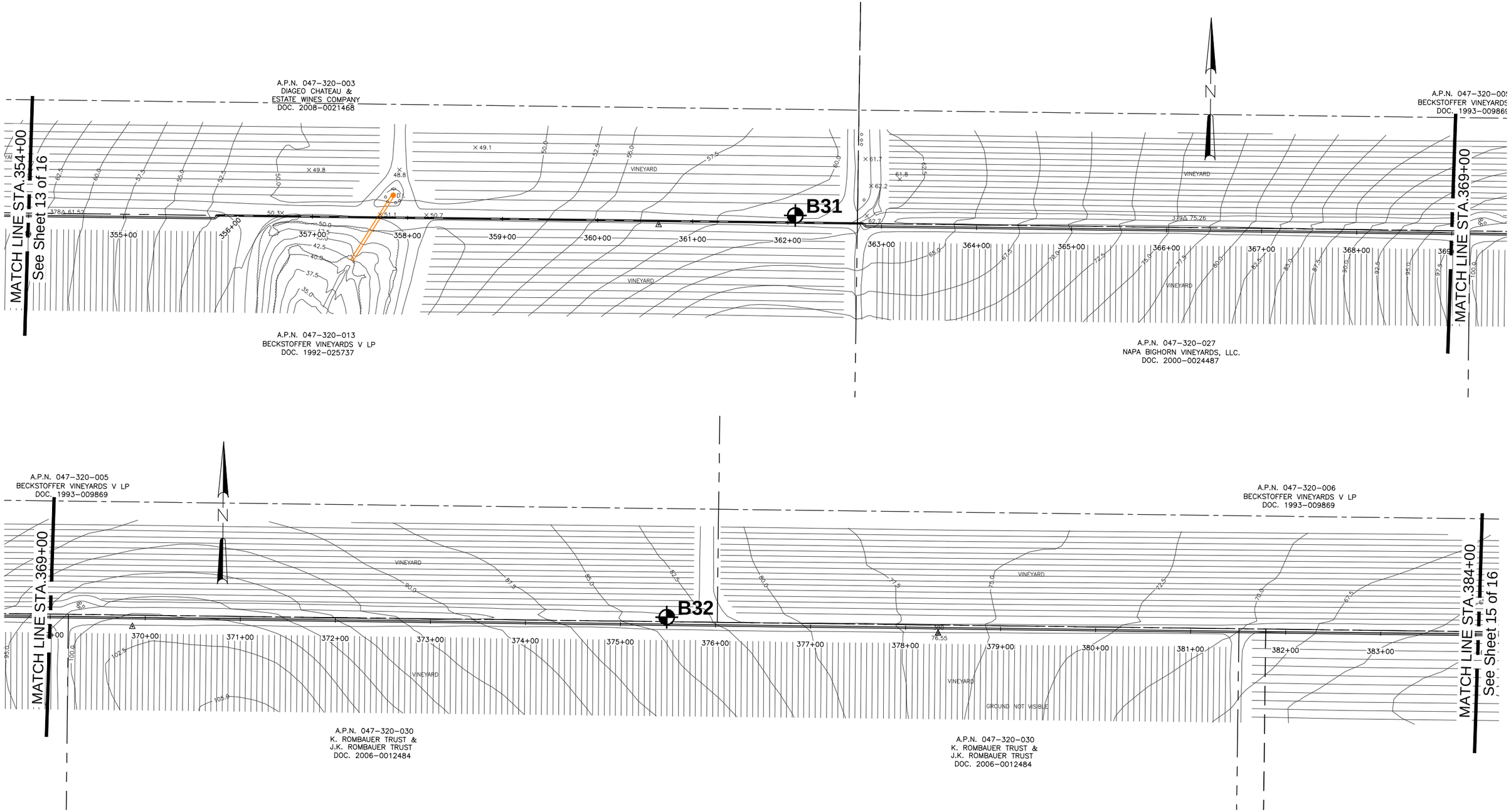
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B
Sheet 13 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

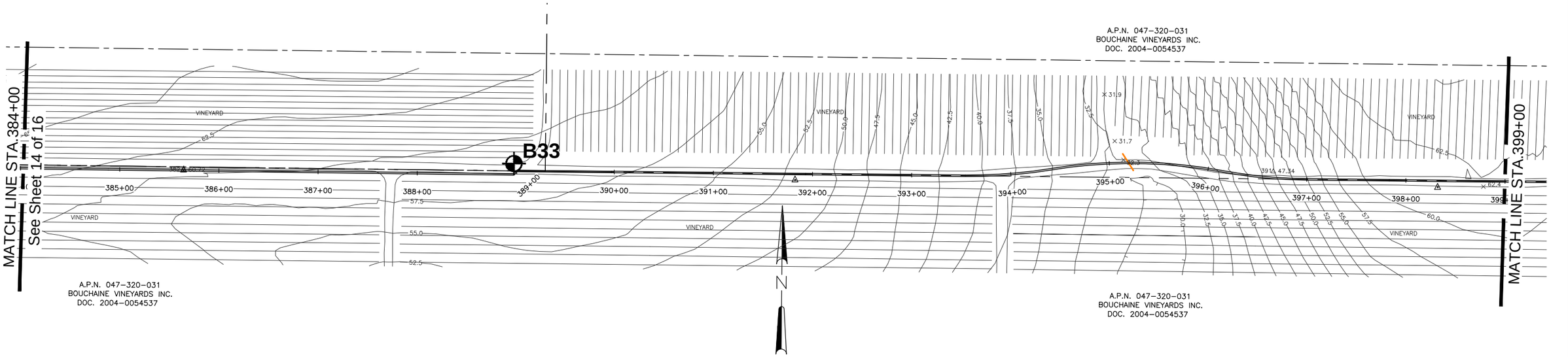
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

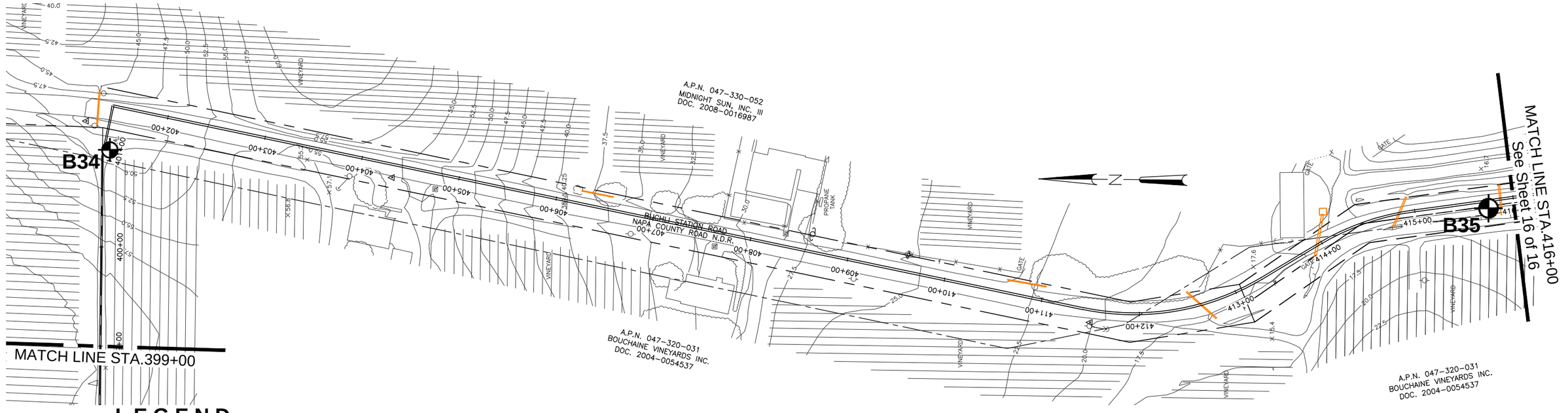
File No. 2049.1

April 2011

Appendix B
Sheet 14 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg





LEGEND

B01 Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

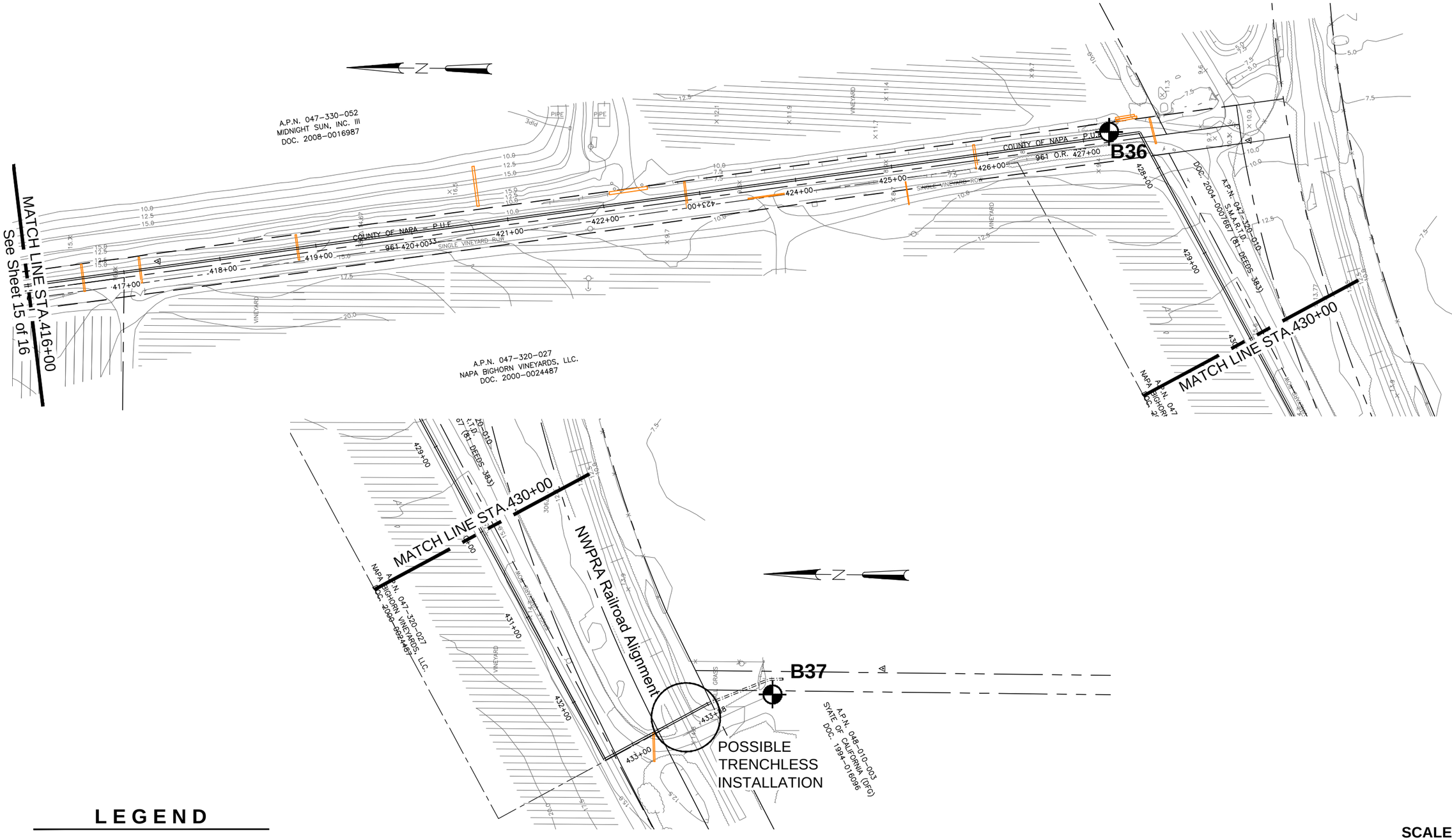
Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix B Sheet 15 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg



LEGEND

B01 — Approximate Boring Location

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

Napa-Sonoma Salt Marsh Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1
April 2011
Appendix B
Sheet 16 of 16

4/20/2011 2049.1 Appendix B Boring Location Map.dwg

APPENDIX C

BCI Exploration Location Summary Table

Boring Logs (BCI 2010); B1, B2, and B4 through B37

Legend of Boring Logs

Trenchless Crossing Profiles (Stations 22+00, 39+00, 157+50, 225+00, 234+00, 336+00, 443+00)

Well Construction Detail – B5, B21, B28, and B36

BCI EXPLORATION LOCATION SUMMARY				
Boring No.	**General Location**	**Approximate Station Number[1]**	**Approx. Elevation (ft)[1]**	**Boring Depth (ft)**
B1	8th Street	19+50	18.0	18.0
B2	8th Street	23+13	18.0	16.5
B3	Not drilled - utility conflicts	---	---	---
B4	8th Street and Fremont Drive	37+50	16.0	16.5
B5	8th Street and Fremont Drive	39+96	17.0	21.5
B6	Access South of Fremont Dr.	56+72 (430 feet south of alignment)	12.0	16.5
B7	Schell Creek	69+24 (300 feet south of alignment)	8.0	51.5
B8	Schell Creek	70+06 (315 feet south of alignment)	8.0	51.5
B9	Schell Creek to Railroad	77+00 (230 feet south of alignment)	6.0	26.5
B10	Railroad alignment	91+06	7.5	21.5
B11	Railroad alignment	99+74	8.5	11.5
B12	Railroad alignment	116+42	9.5	16.5
B13	Railroad alignment	126+98	12.0	11.5
B14	Railroad alignment	135+90	14.5	11.5
B15	Railroad alignment	145+96	15.0	11.5
B16	Railroad alignment	157+08	13.0	21.5
B17	Railroad alignment/Ramal Rd	171+90	13.5	26.5
B18	Railroad alignment/Ramal Rd	188+56	12.5	21.5
B19	Railroad alignment/Ramal Rd	199+70	13.5	16.5
B20	Railroad alignment/Ramal Rd	224+40	13.0	31.5
B21	Railroad alignment/Ramal Rd	233+42	12.5	16.5
B22	Ramal Road	248+28	30.0	11.5
B23	Ramal Road	265+56	38.0	16.5
B24	Ramal Road	277+74	58.0	11.5
B25	Ramal Road	292+90	47.0	16.5

BCI EXPLORATION LOCATION SUMMARY				
Boring No.	**General Location**	**Approximate Station Number**[1]	**Approx. Elevation (ft)**[1]	**Boring Depth (ft)**
B26	Ramal Road	303+12	58.0	11.5
B27	Ramal Road	313+04	50.0	16.5
B28	Ramal Road at Huichica Creek	334+45	20.0	51.5
B29	East side of Huichica Creek	337+89	32.4	21.5
B30	Vineyard Road	342+82	41.5	11.5
B31	Vineyard Road	362+10	61.5	16.5
B32	Vineyard Road	375+50	83.0	11.5
B33	Vineyard Road	388+98	59.0	16.5
B34	Buchli Station Road	400+98	48.5	11.5
B35	Buchli Station Road	415+76	16.0	16.5
B36	Buchli Station Road	427+24	8.5	18.0
B37	NSMWA Parking Lot	434+54	9.0	16.5

[1]Estimated by BCI from preliminary plans provided by CDM (4/20/2011)

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-3-10**	**3-22-11**	**38° 15' 2.43" / -122° 26' 27.14"**	**B01**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision and Taber			**5.00' Lt Sta 19+50**	**18.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon, SPT (1.4")			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**18.0 ft**	**38.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); soft; black; moist; little medium to fine SAND; mostly fines.												
	1				1										
16.00	2				2	3 3 3	6					PP - .5			
	3		SANDY lean CLAY (CL); hard; dark gray; dry; some medium to fine SAND; mostly fines.							25	92				
14.00	4														
	5				3	5 9 33	42			39	79	PP - >4.5			
12.00	6														
	7		Lean CLAY with SAND (CL); hard; dark brown; dry; little medium to fine SAND; mostly fines.												
10.00	8														
	9														
8.00	10				4	7 18 29	47			24	100	PP - >4.5			
	11														
6.00	12														
	13														
4.00	14														
	15				5	3 4 6	10					PP - 2.5			
2.00	16		SILTY SAND (SM); dense; brown; wet; mostly medium to fine SAND; some fines.												
	17				6	7 14 20	34								
0.00	18														
	19														
	20														

(continued)

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B01**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 2**		

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	20		Well-graded SAND with SILT and GRAVEL (SW-SM); dense; dark brown; wet; some coarse to fine GRAVEL; mostly coarse to medium SAND; few fines.		7	7 13 30	43			15	118	PP - >4.5			
	21														
-4.00	22														
	23		Lean CLAY with SAND (CL); hard; dark brown; wet; little fine SAND; mostly fines.												
-6.00	24														
	25				8	9 18 23	41			32	94	PP - >4.5			
-8.00	26		SILTY SAND with GRAVEL (SM); dense; greenish gray; wet; little coarse to fine GRAVEL; mostly coarse to fine SAND; little fines.												
	27														
-10.00	28														
	29														
-12.00	30				9	16 16 16	32			22	108	PP - >4.5			
	31		Lean CLAY with SAND (CL); stiff to very stiff; greenish gray; wet; little fine SAND; mostly fines.												
-14.00	32														
	33														
-16.00	34														
	35				10	3 5 11	16			21	108	PP - 1.75			
-18.00	36														
	37		Poorly graded GRAVEL with CLAY and SAND (GP-GC); medium dense to dense; greenish gray; wet; mostly coarse to fine GRAVEL; little coarse to fine SAND; little fines.		11	5 12 16	28								
-20.00	38		Bottom of borehole at 38.0 ft bgs												
	39														
-22.00	40														
	41														
-24.00	42														
	43														
	44														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B01**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 14' 59.24" / -122° 26' 26.02"**	**B02**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**37.00' Lt Sta 23+13**	**18.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING
grout				**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 4" AC over 3" AB.												
	1		Well-graded SAND with GRAVEL (SW); dense; dark brown; dry; little fine GRAVEL; mostly coarse to fine SAND.												
16.00	2				1	43 22 22	44								
	3														
14.00	4														
	5				2	3 7 10	17					PP - 2.2			
12.00	6		Lean CLAY (CL); stiff to very stiff; black; moist; mostly fines.							28	91				
	7														
10.00	8														
	9														
8.00	10				3	6 9 10	19					PP - 4.0			
	11		SANDY lean CLAY (CL); very stiff; dark brown; dry; some medium to fine SAND; mostly fines.												
6.00	12														
	13		Poorly graded GRAVEL with CLAY and SAND (GP-GC); very dense; dark brown; moist; mostly fine GRAVEL; little medium to fine SAND; few fines.												
4.00	14														
	15				4	13 25 32	57								
2.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
0.00	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B02**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-3-10**	**11-3-10**	**38° 14' 46.63" / -122° 26' 19.78"**	**B04**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**37.00' Lt Sta 37+50**	**16.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout				**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); hard; dark brown; moist; little medium to fine SAND; mostly fines.												
	1														
14.00	2				1	22 15 14	29			14	106	PP - >4.5			
	3														
12.00	4		Poorly graded SAND with SILT (SP-SM); dense; brown; moist; mostly coarse to fine SAND; little fines.												
	5				2	16 50/6"	50/6			19	102	PP - >4.5			
10.00	6		SILT with SAND (ML); hard; brown; moist; few fine SAND; mostly fines.												
	7		CLAYEY SAND (SC); medium dense; brown; moist; mostly medium SAND; some fines.												
8.00	8														
	9														
6.00	10				3	5 7 9	16			33	90				
	11														
4.00	12														
	13														
2.00	14														
	15				4	6 7 7	14					PP - 0.75			
0.00	16		Bottom of borehole at 16.5 ft bgs												
	17														
-2.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B04**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-3-10**	**11-3-10**	**38° 14' 44.91" / -122° 26' 17.29"**	**B05**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**25.00' Lt Sta 39+96**	**17.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**17.0 ft**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded GRAVEL with CLAY and SAND (GP-GC); loose to medium dense; grayish brown; moist; mostly fine GRAVEL; few medium to fine SAND; few fines.												
	1				1										
15.00	2		CLAYEY SAND (SC); medium dense; dark brown; moist; some medium to fine SAND; some fines.		2	23	11					PP - 2			
	3					5									
			SILT (ML); hard; brown; moist; mostly fines.			6				17	94				
13.00	4														
	5														
			SANDY lean CLAY (CL); hard; brown; moist; mostly SAND.		3	3	10					PP - >4.5			
11.00	6					4									
						6				29	92				
	7														
9.00	8														
	9		SANDY SILT (ML); very stiff to hard; brown; moist; some medium to fine SAND; mostly fines.												
7.00	10				4	6	31					PP - 3.5			
	11					13									
						18				27	94				
5.00	12														
	13		CLAYEY SAND (SC); medium dense; brown; moist; mostly medium SAND; some fines.												
3.00	14														
	15				5	3	11								
						3									
1.00	16					8				31	92				
	17		Well-graded SAND with SILT and GRAVEL (SW-SM); dense; reddish brown; wet; some coarse to fine GRAVEL; some coarse to fine SAND; few fines.												
-1.00	18														
	19														
-3.00	20				6	6	37								
	21					20									
						17				23	104				
	22		Bottom of borehole at 21.5 ft bgs												

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B05**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-6-10**	**10-6-10**	**38° 14' 28.24" / -122° 26' 8.82"**	**B06**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**430.00' Rt Sta 56+72**	**12.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**16.0 ft**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded GRAVEL with CLAY and SAND (GP-GC); very dense; grayish brown; dry; mostly coarse GRAVEL; little medium SAND; few fines.												
10.00	2				1	14 30 27	57			11	111				
8.00	4		SANDY lean CLAY with GRAVEL (CL); stiff; reddish brown; moist; little coarse to fine GRAVEL; some coarse to fine SAND; mostly fines.												
6.00	6				2	7 12 21	33			14	110	PP - 1.5			
4.00	8		SANDY SILT (ML); hard; brown; moist; some fine SAND; mostly fines.												
2.00	10				3	10 18 31	49					PP - >4.5			
0.00	12														
-2.00	14		Lean CLAY with SAND (CL); stiff; brown; moist; some medium to fine SAND; mostly fines.												
-4.00	16				4	5 7 13	20					PP - 1.5			
	16.5		Bottom of borehole at 16.5 ft bgs												
-6.00	18														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B06**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-6-10**	**10-6-10**	**38° 14' 26.44" / -122° 25' 53.47"**	**B07**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**300.00' Rt Sta 69+24**	**8.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**9.0 ft**	**51.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean to fat CLAY with SAND (CL/CH); very stiff; black; moist; little medium to fine SAND; mostly fines.												
	1				1										
6.00	2				2	4 5 6	11			22	89	PP - 3.7			
	3														
4.00	4														
	5				3	2 8 15	23			23	104	PP - >4.5			
2.00	6		SANDY lean CLAY (CL); hard; brown; moist; some medium SAND; mostly fines.												
	7														
0.00	8		Well-graded SAND with CLAY (SW-SC); dense; dark brown; wet; mostly coarse to fine SAND; little fines.												
	9														
-2.00	10				4	10 16 22	38								
	11														
-4.00	12														
	13														
-6.00	14		SANDY lean CLAY (CL); very stiff; brown; wet; some medium to fine SAND; mostly fines.												
	15				5	12 42 29	71			28	96	PP - >4.5			
-8.00	16														
	17														
-10.00	18														
	19														
-12.00	20				6	5 9 11	20			33	91	PP - 3.2			
	21														
-14.00	22														
	23														
-16.00	24		CLAYEY SAND (SC); medium dense to dense; brown; wet; mostly medium to fine SAND; some fines.												
	25														

(continued)

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B07**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 2**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	25		CLAYEY SAND (SC) *(continued)*.		7	9 14 17	31								
-18.00	26														
	27														
-20.00	28		SANDY lean CLAY (CL); very stiff; brown; wet; little medium to fine SAND; mostly fines.												
	29														
-22.00	30				8	7 11 17	28					PP - 4.0			
	31														
-24.00	32														
	33														
-26.00	34														
	35				9	7 10 13	23					PP - 3.2			
-28.00	36		Fat CLAY (CH); very stiff; bluish gray; wet; trace medium SAND; mostly fines.												
	37														
-30.00	38														
	39														
-32.00	40				10	6 9 10	19					PP - 2.5			
	41														
-34.00	42														
	43														
-36.00	44		Fat CLAY with SAND (CH); stiff; black; wet; little medium to fine SAND; mostly fines.												
	45				11	6 19 15	34					PP - 1.7			
-38.00	46														
	47														
-40.00	48		Fat CLAY with SAND (CH); hard; bluish gray; wet; little medium to fine SAND; mostly fines.												
	49														
-42.00	50				12	11 23 31	54					PP - >4.5			
	51														
-44.00	52		Bottom of borehole at 51.5 ft bgs												
-46.00	53														
	54														
	55														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B07**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-5-10**	**10-5-10**	**38° 14' 26.09" / -122° 25' 51.95"**	**B08**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**315.00' Rt Sta 70+06**	**8.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**9.0 ft**	**51.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean to fat CLAY with SAND (CL/CH); stiff; black; moist; little medium SAND; mostly fines.												
6.00	2				1	3 2 6	8			16	113	PP - 1.75			
4.00	4														
	5				2	2 3 9	12	0							
2.00	6														
	7														
0.00	8		SILTY SAND with GRAVEL (SM); dense; brown; wet; little fine GRAVEL; mostly coarse to fine SAND; some fines.												
	9		▽												
-2.00	10				3	14 14 32	46								
	11														
-4.00	12														
	13														
-6.00	14		Poorly graded GRAVEL (GP); medium dense; grayish brown; wet; mostly coarse GRAVEL.												
	15				4	5 10 14	24			29	95	PP - >4.5			
-8.00	16		Lean CLAY with SAND (CL); very stiff to hard; brown; wet; little medium to fine SAND; mostly fines.												
	17														
-10.00	18														
	19														
-12.00	20				5	8 11 12	23			33	89	PP - 2.25			
	21														
-14.00	22														
	23														
-16.00	24														
	25														

(continued)

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B08**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 2**		

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	25		Lean CLAY with SAND (CL)*(continued)*.		6	10 16 20	36					PP - >4.5			
-18.00	26														
	27														
-20.00	28		SANDY lean CLAY (CL); very stiff to hard; brown; wet; some fine SAND; mostly fines.												
	29														
-22.00	30				7	8 10 12	22								
	31														
-24.00	32														
	33														
-26.00	34		Poorly graded SAND with SILT (SP-SM); medium dense; dark brown; wet; mostly medium to fine SAND; little fines.												
	35				8	10 11 15	26								
-28.00	36														
	37														
-30.00	38		CLAYEY SAND (SC); dense; brown; wet; mostly fine SAND; some fines.												
	39														
-32.00	40				9	8 14 22	36								
	41														
-34.00	42														
	43														
-36.00	44		SANDY lean CLAY (CL); hard; grayish brown; wet; some fine SAND; mostly fines.												
	45				10	18 29 31	60					PP - >4.5			
-38.00	46														
	47														
-40.00	48														
	49														
-42.00	50				11	16 21 35	56					PP - >4.5			
	51														
-44.00	52		Bottom of borehole at 51.5 ft bgs												
	53														
-46.00	54														
	55														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B08**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-6-10**	**10-6-10**	**38° 14' 24.27" / -122° 25' 40.14"**	**B09**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**230.00' Rt Sta 77+00**	**6.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**15.0 ft**	**26.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND (SC); medium dense; brown; dry; mostly medium to fine SAND; some fines.												
	1														
4.00	2				1	9	23					PP -			
	3					11				17	96	>4.5			
						12									
2.00	4														
	5				2	9	36					PP -			
0.00	6					18						>4.5			
						18				16	112				
	7		CLAYEY GRAVEL with SAND (GC); dense; dark brown; dry; mostly coarse to fine GRAVEL; few medium SAND; some fines.												
-2.00	8		Lean to fat CLAY with SAND (CL/CH); very stiff; brown; dry; little fine SAND; mostly fines.												
	9														
-4.00	10				3	5	22					PP - 2.5			
	11					10				28	94				
						12									
-6.00	12														
	13														
-8.00	14														
	15				4	5	24					PP - 2.5			
-10.00	16					10									
						14									
	17														
-12.00	18		SANDY lean CLAY (CL); hard; brown; moist; some medium to fine SAND; mostly fines.												
	19														
	20														

(continued)

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B09**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 2**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	20		SANDY lean CLAY (CL)*(continued)*.		5	10 15 20	35					PP - >4.5			
	21														
-16.00	22														
	23														
-18.00	24		SILT (ML); hard; brown; moist; trace SAND; mostly fines.												
	25				6	10 18 27	45					PP - >4.5			
-20.00	26														
	27		Bottom of borehole at 26.5 ft bgs												
-22.00	28														
	29														
-24.00	30														
	31														
-26.00	32														
	33														
-28.00	34														
	35														
-30.00	36														
	37														
-32.00	38														
	39														
-34.00	40														
	41														
-36.00	42														
	43														
	44														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B09**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 14' 22.8" / -122° 25' 26.09"**	**B10**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**2.00' Lt Sta 91+06**	**7.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**12.0 ft**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND (SC); very dense; brown; dry; mostly medium to fine SAND; some fines.												
	1				1										
5.50	2				2	5 21 50/3"	71/9					PP - >4.5			
	3									14	114				
3.50	4		Poorly graded SAND with SILT (SP-SM); dense; dark brown; moist; mostly medium to fine SAND; some fines.												
	5				3	15 18 31	49					PP - >4.5			
1.50	6									20	104				
	7														
-0.50	8		Lean CLAY with SAND (CL); hard; dark brown; moist; few medium to fine SAND; mostly fines.												
	9														
-2.50	10				4	10 17 23	40			28	95	PP - >4.5			
	11														
-4.50	12		▽												
	13														
-6.50	14		Poorly graded SAND with SILT (SP-SM); medium dense; dark brown; wet; mostly medium to fine SAND; some fines.												
	15				5	4 5 5	10								
-8.50	16														
	17														
-10.50	18		Well-graded SAND with SILT and GRAVEL (SW-SM); very dense; dark brown; wet; few fine GRAVEL; mostly coarse to fine SAND; few fines.												
	19														
-12.50	20				6	6 25 27	52								
	21														
	22		Bottom of borehole at 21.5 ft bgs												

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B10**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 14' 17.02" / -122° 25' 18.01"**	**B11**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**6.00' Rt Sta 99+74**	**8.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); medium dense; brown; dry; mostly medium to fine SAND; some fines.												
	1														
6.50	2				1	5	14					PP - 3.5			
	3					5				9	105				
						9									
4.50	4		SANDY lean CLAY with GRAVEL (CL); hard; light gray; moist; few fine GRAVEL; little medium to fine SAND; mostly fines.												
	5				2	5	25					PP - >4.5			
2.50	6					10									
						15									
	7														
0.50	8														
	9														
-1.50	10				3	15	79					PP - >4.5			
	11					47				12	122				
						32									
-3.50	12		Bottom of borehole at 11.5 ft bgs												
	13														
-5.50	14														
	15														
-7.50	16														
	17														
-9.50	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B11**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 14' 6.35" / -122° 25' 2.4"**	**B12**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**6.00' Lt Sta 116+42**	**9.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**9.0 ft**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); hard; light brown; dry; few medium to fine SAND; mostly fines.												
	1				1										
7.50	2				2	8 10 15	25			14	115	PP - >4.5			
	3														
5.50	4		SILT (ML); hard; light brown; dry to moist.												
	5				3	7 15 24	39			28	95	PP - >4.5			
3.50	6														
	7		SILTY SAND (SM); medium dense; brown; moist to wet; mostly medium to fine SAND; some fines.												
1.50	8														
	9														
-0.50	10				4	8 13 14	27			26	98	PP - >4.5			
	11														
-2.50	12														
	13														
-4.50	14		Poorly graded SAND with SILT (SP-SM); loose to medium dense; brown; wet; mostly medium to fine SAND; some fines.												
	15				5	3 4 3	7								
-6.50	16														
	17		Bottom of borehole at 16.5 ft bgs												
-8.50	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B12**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 13' 59.45" / -122° 24' 52.37"**	**B13**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**10.00' Lt Sta 126+98**	**12.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); hard; brown; dry; few medium to fine SAND; mostly fines.												
	1														
10.00	2		SILT (ML); stiff to very stiff; brown; dry; trace medium to fine SAND; mostly fines.		1	5 7 11	18					PP - 2.25			
	3		Lean CLAY with SAND (CL); brown; dry; little medium to fine SAND; mostly fines.							16	98				
8.00	4														
	5				2	4 13 22	35					PP - >4.5			
6.00	6														
	7		SILT with SAND (ML); very stiff; brown; moist; few medium to fine SAND; mostly fines.												
4.00	8														
	9														
2.00	10				3	5 7 10	17					PP - 2.0			
	11														
0.00	12		Bottom of borehole at 11.5 ft bgs												
	13														
-2.00	14														
	15														
-4.00	16														
	17														
-6.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B13**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 1**		

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 13' 53.46" / -122° 24' 44.14"**	**B14**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**28.00' Rt Sta 135+90**	**14.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); hard; light yellowish brown; dry; some medium to fine SAND; mostly fines.												
	1				1										
12.50	2				2	14 20 50	70					PP - >4.5			
	3														
10.50	4		Lean CLAY with SAND (CL); hard; brown; dry; few medium to fine SAND; mostly fines.												
	5				3	7 15 29	44					PP - >4.5			
8.50	6														
	7														
6.50	8														
	9														
4.50	10				4	7 14 21	35					PP - >4.5			
	11														
2.50	12		Bottom of borehole at 11.5 ft bgs												
	13														
0.50	14														
	15														
-1.50	16														
	17														
-3.50	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B14**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 13' 46.97" / -122° 24' 34.55"**	**B15**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**14.00' Rt Sta 145+96**	**15.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); hard; dark brown; dry; mostly fines.												
	1														
13.00	2				1	5 7 11	18			16	99	PP - >4.5			
	3														
11.00	4		SILT (ML); very stiff; light brown; dry; mostly fines.												
	5				2	4 5 7	12					PP - 2.0			
9.00	6														
	7														
7.00	8		Poorly graded GRAVEL with SAND (GP); dense; reddish brown; dry; mostly coarse to fine GRAVEL; little medium to fine SAND.												
	9														
5.00	10				3	12 19 16	35					PP - 3.0			
	11														
3.00	12		SILT (ML); very stiff; light brown; moist; mostly fines. Bottom of borehole at 11.5 ft bgs												
	13														
1.00	14														
	15														
-1.00	16														
	17														
-3.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B15**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**9-30-10**	**9-30-10**	**38° 13' 39.55" / -122° 24' 23.98"**	**B16**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**5.00' Lt Sta 157+08**	**13.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); hard; very dark brown; dry; few medium to fine SAND; mostly fines.												
	1														
11.00	2				1	6 8 10	18					PP - >4.5			
	3		Becomes silty.							9	92				
9.00	4		CLAYEY GRAVEL with SAND (GC); dense; light brown; moist; mostly coarse to fine GRAVEL; few medium to fine SAND; some fines.												
	5				2	8 17 24	41					PP - >4.5			
7.00	6		SILT with SAND (ML); very stiff; little medium to fine SAND; mostly fines.												
	7														
5.00	8														
	9														
3.00	10				3	11 11 10	21					PP - 3.75			
	11									17	113				
1.00	12														
	13														
-1.00	14														
	15				4	7 11 13	24					PP - 3.5			
-3.00	16														
	17														
-5.00	18														
	19														
-7.00	20				5	8 11 16	27					PP - 4.5			
	21														
	22		Bottom of borehole at 21.5 ft bgs												

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B16**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-1-10**	**10-1-10**	**38° 13' 30.08" / -122° 24' 10.73"**	**B17**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**38.00' Rt Sta 171+90**	**13.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**15.0 ft**	**26.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		GRAVELLY lean CLAY with SAND (CL); hard; dark brown; dry; some coarse to fine GRAVEL; little medium to fine SAND; mostly fines.												
	1				1										
11.50	2				2	7 16	33					PP - >4.5			
	3					17				10	116				
9.50	4		Lean CLAY (CL); stiff; dark brown; moist; mostly fines.												
	5				3	4 7	18					PP - 2.0			
7.50	6					11									
	7														
5.50	8		Lean CLAY with SAND (CL); hard; brown; moist; little medium to fine SAND; mostly fines.												
	9														
3.50	10				4	6 11	27					PP - >4.5			
	11					16				21	107				
1.50	12														
	13														
-0.50	14		CLAYEY SAND with GRAVEL (SC); very dense; dark brown; wet; few coarse to fine GRAVEL; mostly fine SAND; little fines.												
	15				5	10 14	60								
-2.50	16					46									
	17														
-4.50	18		Lean CLAY with SAND (CL); very stiff; brown; wet; little medium to fine SAND; mostly fines.												
	19														
	20														

(continued)

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B17**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 2**		

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	20		Lean CLAY with SAND (CL)*(continued)*.		6	7 10 13	23					PP - 3.75			
	21														
-8.50	22														
	23														
-10.50	24		SANDY lean CLAY (CL); hard; brown; wet; some fine SAND; mostly fines.												
	25				7	9 20 23	43					PP - >4.5			
-12.50	26														
	27		Bottom of borehole at 26.5 ft bgs												
-14.50	28														
	29														
-16.50	30														
	31														
-18.50	32														
	33														
-20.50	34														
	35														
-22.50	36														
	37														
-24.50	38														
	39														
-26.50	40														
	41														
-28.50	42														
	43														
	44														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B17**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-1-10**	**10-1-10**	**38° 13' 20.51" / -122° 23' 53.36"**	**B18**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**35.00' Rt Sta 188+56**	**12.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**12.0 ft**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); hard; dark brown; dry; some fine SAND; mostly fines.												
10.50	2				1	9 13 9	22			8	100	PP - 4.5			
8.50	4		Lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines.												
	5				2	6 11 19	30			23	99	PP - 3.75			
6.50	6														
4.50	8														
2.50	10				3	7 6 13	19					PP - 3.75			
0.50	12														
-1.50	14		SANDY lean CLAY (CL); very stiff; yellowish brown; wet; some fine SAND; mostly fines.												
	15				4	7 7 9	16					PP - 2.5			
-3.50	16														
	17		SANDY lean CLAY with GRAVEL (CL); hard; yellowish brown; wet; few coarse to fine GRAVEL; some medium to fine SAND; mostly fines.												
-5.50	18														
	19														
-7.50	20				5	21 35 50/5"	85/11					PP - >4.5			
	21														
	22		Bottom of borehole at 21.5 ft bgs												

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B18**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-1-10**	**10-1-10**	**38° 13' 15.8" / -122° 23' 40.84"**	**B19**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**4.00' Rt Sta 199+70**	**13.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); dark brown; moist; some medium to fine SAND; mostly fines.												
	1				1										
11.50	2				2	5	11					PP -			
	3					5				24	100	1.75			
			Lean CLAY (CL); medium stiff to stiff; light gray; moist; mostly fines.			6									
9.50	4														
	5		CLAYEY SAND with GRAVEL (SC); loose to medium dense; reddish brown; moist; few fine GRAVEL; mostly fine SAND; some fines.		3	5	11					PP - 3.0			
7.50	6					6				16	109				
			SANDY lean CLAY (CL); very stiff; dark gray; moist; some medium to fine SAND; mostly fines.			5									
5.50	8														
	9		CLAYEY GRAVEL with SAND (GC); very dense; light brown; moist; unknown, could be rock..												
3.50	10				4	16	85/11								
	11					35									
1.50	12					50/5"									
	13														
-0.50	14														
	15				5	30	50/6								
-2.50	16					50/6"									
			Bottom of borehole at 16.5 ft bgs												
	17														
-4.50	18														
	19														
	20														

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B19**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-1-10**	**10-1-10**	**38° 13' 10.58" / -122° 23' 10.84"**	**B20**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**1.00' Rt Sta 224+40**	**13.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon, SPT (1.4")			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**16.0 ft**	**31.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); hard; black; moist; some fine SAND; mostly fines.												
	1														
11.00	2				1	6 8 6	14			14	91	PP - >4.5			
	3														
9.00	4														
	5				2	5 6 12	18	0							
7.00	6		SANDY lean CLAY (CL); very stiff; light gray; moist; some fine SAND; mostly fines.												
	7				3	5 8 13	21			17	114	PP - 2.75			
5.00	8		CLAYEY SAND with GRAVEL (SC); very dense; brown; wet; little fine GRAVEL; mostly medium to fine SAND; some fines.												
	9														
3.00	10				4	11 50/5"	50/5								
	11														
1.00	12														
	13														
-1.00	14		CLAYEY GRAVEL with SAND (GC); very dense; reddish brown; wet; could have some rock, unknown.												
	15				5	11 24 37	61								
-3.00	16														
	17														
-5.00	18														
	19														
	20														

(continued)

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B20**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 2**		

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	20		CLAYEY GRAVEL with SAND (GC)*(continued)*.		6	18 21 27	48								
	21														
-9.00	22														
	23														
-11.00	24		Well-graded GRAVEL with CLAY and SAND (GW-GC); medium dense; dark brown; wet; mostly coarse to fine GRAVEL; little medium to fine SAND; little fines; no samples from this layer.												
	25				7	4 7 10	17	0							
-13.00	26														
	27		Blowcount of 6 likely no good due to sample disturbance.		8	1 2 4	6	0							
-15.00	28														
	29														
-17.00	30				9	7 7 8	15								
	31		Lean CLAY with SAND (CL); soft to medium stiff; yellowish brown; wet; little medium to fine SAND; mostly fines.												
-19.00	32		Bottom of borehole at 31.5 ft bgs												
	33														
-21.00	34														
	35														
-23.00	36														
	37														
-25.00	38														
	39														
-27.00	40														
	41														
-29.00	42														
	43														
	44														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B20**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 9.54" / -122° 22' 59.02"**	**B21**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**19.50' Rt Sta 233+42**	**12.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**15.0 ft**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); hard; grayish brown; moist; few fine GRAVEL; little medium to fine SAND; mostly fines.												
	1				1										
10.50	2				2	8 8 12	20			19	108	PP - >4.5			
	3														
8.50	4														
	5				3	9 15 30	45			26	92	PP - 3.0			
6.50	6		SANDY lean CLAY with GRAVEL (CL); very stiff; yellowish brown; moist; few coarse to fine GRAVEL; some medium to fine SAND; mostly fines; weak to moderate cementation.												
	7														
4.50	8		CLAYEY GRAVEL with SAND (GC); very dense; dark brown; moist; mostly coarse to fine GRAVEL; few medium to fine SAND; some fines.												
	9														
2.50	10				4	25 44 50/5"	94/11								
	11														
0.50	12														
	13														
-1.50	14														
	15				5	12 11 13	24								
-3.50	16														
	17		Bottom of borehole at 16.5 ft bgs												
-5.50	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B21**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 23.67" / -122° 23' 2.27"**	**B22**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**0.00' Rt Sta 248+28**	**30.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 4" AC over 4" AB.												
	1		SILT with SAND (ML); hard; dark brown; moist; little coarse to fine SAND; mostly fines.												
28.00	2				1	14 16 14	30					PP - >4.5			
	3														
26.00	4														
	5				2	9 20 31	51			19	96	PP - >4.5			
24.00	6		SANDY SILT (ML); hard; yellowish brown; dry; some medium to fine SAND; mostly fines.												
	7														
22.00	8		CLAYEY GRAVEL with SAND (GC); very dense; grayish brown; dry; mostly coarse to fine GRAVEL; little medium to fine SAND; some fines.												
	9														
20.00	10				3	16 30 31	61					PP - >4.5			
	11														
18.00	12		Bottom of borehole at 11.5 ft bgs												
	13														
16.00	14														
	15														
14.00	16														
	17														
12.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B22**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 25.71" / -122° 22' 40.84"**	**B23**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**54.00' Lt Sta 265+56**	**38.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT 4" AC over 5" AB.												
	1		SANDY lean CLAY (CL); hard; brown; dry; little fine SAND; mostly fines; Road embankment fill..												
36.00	2				1										
					2	9 10 10	20			17	92	PP - >4.5			
	3														
34.00	4														
	5		SILT with SAND (ML); very stiff; light brown; dry; little fine SAND; mostly fines.		3	5 7 9	16			16	96	PP - 3.6			
32.00	6														
	7														
30.00	8		SANDY lean CLAY (CL); hard; black; moist; some medium to fine SAND; mostly fines.												
	9														
28.00	10				4	5 9 10	19			12	93	PP - 4.2			
	11		Some silt layers.												
26.00	12														
	13		Lean CLAY (CL); very stiff; light brown; moist; mostly fines.												
24.00	14														
	15				5	5 9 13	22			26	95	PP - 2.6			
22.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
20.00	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B23**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 24.77" / -122° 22' 25.78"**	**B24**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**14.00' Lt Sta 277+74**	**58.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		GRAVELLY lean CLAY with SAND (CL); very stiff; brown; moist; some coarse to fine GRAVEL; little medium to fine SAND; mostly fines; Road embankment fill?.												
56.00	2		SANDY SILT (ML); hard; yellowish brown; dry; some medium to fine SAND; mostly fines.		1	7 8 11	19					PP - 3.2			
54.00	4		SANDY lean CLAY with GRAVEL (CL); hard; yellowish brown; dry; little fine GRAVEL; some medium to fine SAND; mostly fines.												
	5				2	10 24 30	54					PP - >4.5			
52.00	6														
	7														
50.00	8														
	9														
48.00	10		SILTY SAND (SM); dense to very dense; yellowish brown; dry; mostly medium to fine SAND; some fines.		3	6 17 28	45					PP - >4.5			
	11														
46.00	12		Bottom of borehole at 11.5 ft bgs												
	13														
44.00	14														
	15														
42.00	16														
	17														
40.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B24**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 23.54" / -122° 22' 7.93"**	**B25**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**20.00' Lt Sta 292+90**	**47.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		GRAVELLY lean CLAY with SAND (CL); hard; dark brown; moist; some coarse to fine GRAVEL; few medium to fine SAND; mostly fines; Upper 1 to 2 feet is road embankment fill..												
	1				1										
45.00	2				2	4 11 30	41					PP - >4.5			
	3		SANDY SILT (ML); hard; yellowish brown; dry; some coarse to fine SAND; mostly fines; moderate to strong cementation.							22	102				
43.00	4														
	5				3	8 17 28	45					PP - >4.5			
41.00	6									27	97				
	7														
39.00	8														
	9														
37.00	10				4	5 12 16	28					PP - >4.5			
	11									26	93				
35.00	12														
	13		SILT with SAND (ML); hard; yellowish brown; dry; some coarse to fine SAND; mostly fines.												
33.00	14														
	15				5	6 15 18	33					PP - >4.5			
31.00	16									23	106				
	17		Bottom of borehole at 16.5 ft bgs												
29.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B25**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 22.69" / -122° 21' 54.51"**	**B26**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**15.00' Lt Sta 303+12**	**58.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); hard; light brown; moist; mostly fines.												
	1														
56.00	2				1	4	17					PP -			
	3					6						>4.5			
						11									
			SILT with SAND (ML); very stiff; reddish brown; moist; few medium to fine SAND; mostly fines.												
54.00	4														
	5				2	13	38					PP - 2.5			
52.00	6					16									
						22									
	7		SILT (ML); hard; light brown; moist; mostly fines.												
50.00	8														
	9														
48.00	10				3	8	30					PP -			
	11					13				24	99	>4.5			
						17									
46.00	12		Bottom of borehole at 11.5 ft bgs												
	13														
44.00	14														
	15														
42.00	16														
	17														
40.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B26**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 1**		

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**11-2-10**	**11-2-10**	**38° 13' 22.73" / -122° 21' 41.93"**	**B27**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Precision			**15.00' Lt Sta 313+04**	**50.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SILT with SAND (ML); very stiff; yellowish brown; dry; few fine SAND; mostly fines.												
	1				1										
48.00	2				2	7 11 22	33					PP - 2.6			
	3		SANDY lean CLAY (CL); hard; reddish brown; dry; little medium to fine SAND; mostly fines.							21	100				
46.00	4														
	5				3	10 20 30	50					PP - >4.5			
44.00	6									18	108				
	7		Lean CLAY with SAND (CL); hard; yellowish brown; dry; little medium to fine SAND; mostly fines.												
42.00	8														
	9														
40.00	10				4	11 23 30	53					PP - >4.5			
	11									20	105				
38.00	12														
	13		SANDY SILT (ML); stiff; light brown; dry; some fine SAND; mostly fines.												
36.00	14														
	15				5	8 14 21	35			19	103	PP - 1.5			
34.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
32.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B27**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-5-10**	**10-5-10**	**38° 13' 22.74" / -122° 21' 14.96"**	**B28**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**2.00' Rt Sta 334+45**	**20.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**16.0 ft**	**14.5 ft on 10-6-10**	**51.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); very stiff; light brown; moist; little medium to fine SAND; mostly fines.												
18.00	2				1	6 11 19	30					PP - 2.5			
	3														
16.00	4		CLAYEY SAND with GRAVEL (SC); dense; dark brown; moist; some fine GRAVEL; mostly medium to fine SAND; little fines.												
	5				2	8 15 25	40								
14.00	6									12	103				
	7														
12.00	8		Lean CLAY with SAND (CL); hard; reddish brown; moist; little fine SAND; mostly fines.												
	9														
10.00	10				3	10 16 21	37					PP - >4.5			
	11									24	100				
8.00	12														
	13														
6.00	14														
	15		Fat CLAY (CH); hard; reddish brown; moist; mostly fines.		4	5 6 15	21					PP - >4.5			
4.00	16									27	94				
	17														
2.00	18														
	19														
0.00	20				5	10 15 31	46					PP - >4.5			
	21														
-2.00	22														
	23		SILT (ML); hard; reddish brown; moist; mostly fines.												
-4.00	24														
	25														

(continued)

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B28**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 2**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	25		SILT (ML) *(continued)*.		6	9 15 20	35					PP - >4.5			
-6.00	26														
	27														
-8.00	28		SANDY SILT (ML); hard; reddish brown; moist; some fine SAND; mostly fines.												
	29														
-10.00	30				7	10 19 30	49					PP - >4.5			
	31														
-12.00	32														
	33														
-14.00	34														
	35				8	8 12 15	27					PP - >4.5			
-16.00	36														
	37														
-18.00	38		Poorly graded SAND with SILT (SP-SM); dense; dark brown; wet; mostly medium to fine SAND; little fines.												
	39														
-20.00	40				9	8 16 25	41					PP - 4.5			
	41		SANDY SILT (ML); hard; reddish brown; moist; some fine SAND; mostly fines.												
-22.00	42		Poorly graded SAND with SILT (SP-SM); dense; dark brown; wet; mostly medium to fine SAND; little fines.												
	43														
-24.00	44		Well-graded SAND with CLAY and GRAVEL (SW-SC); very dense; dark brown; wet; little coarse to fine GRAVEL; mostly coarse to fine SAND; few fines.												
	45				10	12 20 34	54								
-26.00	46														
	47														
-28.00	48		Poorly graded GRAVEL with SAND (GP); dense; dark brown; wet; mostly fine GRAVEL; little medium to fine SAND.												
	49														
-30.00	50				11	8 14 29	43								
	51														
-32.00	52		Well-graded SAND with GRAVEL (SW); dense; dark brown; wet; little fine GRAVEL; mostly coarse to fine SAND.												
	53		Bottom of borehole at 51.5 ft bgs												
-34.00	54														
	55														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME **Napa-Sonoma Pipeline**		FILE NO. **2049.1**	HOLE ID **B28**
COUNTY **SON**	ROUTE	POSTMILE	
CLIENT **Camp Dresser & McKee**			
PREPARED BY **DPC**	CHECKED BY **PFF**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 22.78" / -122° 21' 10.44"**	**B29**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**4.00' Lt Sta 337+89**	**32.4 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); very stiff; brown; moist; little medium to fine SAND; mostly fines.												
	1														
30.40	2				1	3 9 14	23					PP - 3.0			
	3									21	98				
28.40	4		SANDY lean CLAY (CL); hard; light brown; dry; mostly medium to fine SAND; mostly fines.												
	5				2	23 30 43	73					PP - >4.5			
26.40	6														
	7														
24.40	8														
	9														
22.40	10				3	9 20 28	48					PP - >4.5			
	11									19	103				
20.40	12														
	13														
18.40	14		Lean CLAY with SAND (CL); hard; light reddish brown; dry; little medium to fine SAND; mostly fines.												
	15				4	9 16 31	47					PP - >4.5			
16.40	16									25	100				
	17														
14.40	18														
	19														
12.40	20				5	7 15 18	33								
	21														
	22		Bottom of borehole at 21.5 ft bgs												

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B29**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 22.92" / -122° 20' 56.91"**	**B30**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**10.00' Lt Sta 342+82**	**41.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with SAND (CL); stiff to very stiff; brown; moist; little medium to fine SAND; mostly fines.												
39.50	2				1	4 6 8	14			24	94	PP - 2.0			
37.50	4		Poorly graded GRAVEL with CLAY and SAND (GP-GC); very dense; reddish brown; dry; mostly coarse to fine GRAVEL; little medium to fine SAND; few fines.		2	19 50/6"	50/6								
35.50	6														
33.50	8														
31.50	10				3	11 24 25	49			15	113	PP - >4.5			
29.50	12		Bottom of borehole at 11.5 ft bgs												
27.50	14														
25.50	16														
23.50	18														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B30**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 22.91" / -122° 20' 40.38"**	**B31**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**10.00' Lt Sta 362+10**	**61.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); very stiff; dark brown; dry; some fine SAND; mostly fines.												
	1														
59.50	2				1										
	3				2	7 6 8	14								
57.50	4		SILT with SAND (ML); hard; yellowish brown; dry; some fine SAND; mostly fines.												
	5				3	5 13 22	35					PP - >4.5			
55.50	6														
	7														
53.50	8														
	9														
51.50	10				4	17 36 42	78					PP - >4.5			
	11														
49.50	12														
	13														
47.50	14		CLAYEY SAND with GRAVEL (SC); dense; dark reddish brown; moist; few coarse to fine GRAVEL; mostly medium to fine SAND; little fines.												
	15				5	15 21 28	49								
45.50	16														
	17		Bottom of borehole at 16.5 ft bgs												
43.50	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B31**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 22.85" / -122° 20' 23.67"**	**B32**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**8.00' Lt Sta 375+50**	**83.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILTY CLAY (CL-ML); very stiff; dark brown; moist; some medium to fine SAND; mostly fines.												
	1														
81.00	2				1	5 4 8	12					PP - 3.2			
	3		SANDY SILTY CLAY (CL-ML); hard; yellowish brown; dry; some medium to fine SAND; mostly fines.												
79.00	4														
	5				2	7 17 23	40			23	100	PP - >4.5			
77.00	6														
	7														
75.00	8														
	9														
73.00	10		Becomes more clayey.		3	6 14 18	32					PP - >4.5			
	11														
71.00	12		Bottom of borehole at 11.5 ft bgs												
	13														
69.00	14														
	15														
67.00	16														
	17														
65.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B32**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 1**		

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-6-10**	**10-6-10**	**38° 13' 22.89" / -122° 20' 6.94"**	**B33**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**10.00' Lt Sta 388+98**	**59.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); hard; dark reddish brown; moist; some fine SAND; mostly fines.												
	1				1										
57.00	2				2	4 5 12	17			13	116	PP - >4.5			
	3														
55.00	4		CLAYEY SAND with GRAVEL (SC); medium dense; dark reddish brown; moist; few fine GRAVEL; some coarse to fine SAND; some fines.												
	5				3	6 7 9	16			17	106				
53.00	6														
	7														
51.00	8		SANDY lean CLAY (CL); hard; yellowish brown; dry; some medium to fine SAND; mostly fines.												
	9														
49.00	10				4	12 15 25	40			20	109				
	11														
47.00	12														
	13														
45.00	14		Lean CLAY with SAND (CL); hard; yellowish brown; dry; little medium to fine SAND; mostly fines.												
	15				5	8 13 22	35					PP - >4.5			
43.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
41.00	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B33**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 22.72" / -122° 19' 51.71"**	**B34**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**6.00' Rt Sta 400+98**	**48.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
cuttings			**None observed**	**11.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); hard; dark brown; moist; few coarse to fine GRAVEL; some medium to fine SAND; mostly fines.												
	1														
46.50	2				1	3 4 11	15			14	108	PP - 4.5			
	3														
44.50	4														
	5				2	3 6 8	14					PP - 1.25			
42.50	6		SILT (ML); stiff to very stiff; yellowish brown; moist; mostly fines.												
	7														
40.50	8														
	9														
38.50	10				3	5 9 16	25			26	95	PP - 3.75			
	11														
36.50	12		Bottom of borehole at 11.5 ft bgs												
	13														
34.50	14														
	15														
32.50	16														
	17														
30.50	18														
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME			FILE NO.	HOLE ID
Napa-Sonoma Pipeline			**2049.1**	**B34**
COUNTY	ROUTE	POSTMILE		
SON				
CLIENT				
Camp Dresser & McKee				
PREPARED BY	CHECKED BY	SHEET		
DPC	**PFF**	**1 of 1**		

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**10-4-10**	**10-4-10**	**38° 13' 9.17" / -122° 19' 52.37"**	**B35**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**7.00' Rt Sta 415+76**	**16.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**10.0 ft**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); stiff; dark brown; moist; little medium to fine SAND; mostly fines.												
	1				1										
14.00	2				2	4 4 5	9			17	106	PP - 1.5			
	3														
12.00	4		Lean CLAY with GRAVEL (CL); very stiff; grayish brown; moist; few coarse to fine GRAVEL; mostly fines.												
	5														
					3	5 11 15	26			15	110	PP - 3.5			
10.00	6														
	7														
8.00	8		SILT (ML); hard; light gray; moist.												
	9														
6.00	10				4	10 22 32	54			25	101	PP - >4.5			
	11														
4.00	12														
	13														
2.00	14		SANDY SILT (ML); hard; light gray; moist; some medium to fine SAND; mostly fines.												
	15				5	8 17 30	47					PP - >4.5			
0.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
-2.00	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B35**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**4-4-11**	**4-4-11**	**38° 12' 57.64" / -122° 19' 49.94"**	**B36**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**10.00' Lt Sta 427+24**	**8.5 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**8"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**15.0 ft**	**18.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); stiff; dark brown; moist; few fine GRAVEL; some fine SAND; mostly fines.												
	1				1										
6.50	2		CLAYEY SAND with GRAVEL (SC); medium dense to dense; reddish brown; moist; little coarse to fine GRAVEL; mostly coarse to fine SAND; some fines.		2	3 4 8	12			23	93	PP - 2.0			
4.50	4														
	5				3	12 17 25	42			19	106	PP - >4.5			
2.50	6														
	7		SANDY lean to fat CLAY (CL/CH); stiff to very stiff; brown; moist; little fine SAND; mostly fines.												
0.50	8														
	9														
-1.50	10				4	9 14 14	28			28	97	PP - 3.0			
	11														
-3.50	12														
	13														
-5.50	14														
	15				5	4 5 8	13					PP - 1.5			
-7.50	16														
	17				6	2 4 5	9					PP - 1.5			
-9.50	18		Bottom of borehole at 18.0 ft bgs												
	19														
	20														

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B36**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
DPC	**3-22-11**	**3-22-11**	**38° 12' 53.26" / -122° 19' 54.55"**	**B37**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**16.00' Rt Sta 434+54**	**9.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4"**
SAMPLER TYPE(S) AND SIZE(S) (ID)			HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, 2.5" Split Spoon			**Automatic, 140lb, 30 in.**	**~75%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
grout			**None observed**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Strength (PP-tsf/UC-psi)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with GRAVEL (CL); medium stiff; brown; moist; little coarse to fine GRAVEL; mostly fines.												
	1				1										
7.00	2				2	3 4 6	10					PP - 0.7			
	3		Fat CLAY (CH); medium stiff to stiff; brown; moist; mostly fines.							26	98				
5.00	4														
	5				3	5 6 8	14					PP - 1.0			
3.00	6									32	88				
	7		SANDY lean CLAY (CL); hard; olive brown; moist; some medium to fine SAND; mostly fines.												
1.00	8														
	9														
-1.00	10				4	7 12 16	28					PP - >4.5			
	11									23	103				
-3.00	12														
	13														
-5.00	14														
	15				5	7 12 17	29			27	102	PP - >4.5			
-7.00	16														
	17		Bottom of borehole at 16.5 ft bgs												
-9.00	18														
	19														
	20														

BCI BORING LOG 2049.1.GPJ BCI 2010 LOG.GLB 4/26/11

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

PROJECT NAME		FILE NO.	HOLE ID
Napa-Sonoma Pipeline		**2049.1**	**B37**
COUNTY	ROUTE	POSTMILE	
SON			
CLIENT			
Camp Dresser & McKee			
PREPARED BY	CHECKED BY	SHEET	
DPC	**PFF**	**1 of 1**	

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- 2.5" Split Spoon Sampler
- 2" Split Spoon Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

blackburn consulting

Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

BORING RECORD LEGEND

COUNTY	ROUTE	POSTMILE
Sonoma		

PROJECT OR BRIDGE NAME: **Napa-Sonoma Pipeline**

PREPARED BY	DATE	SHEET
DPC	**4/28/2011**	**1 of 2**

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

blackburn consulting

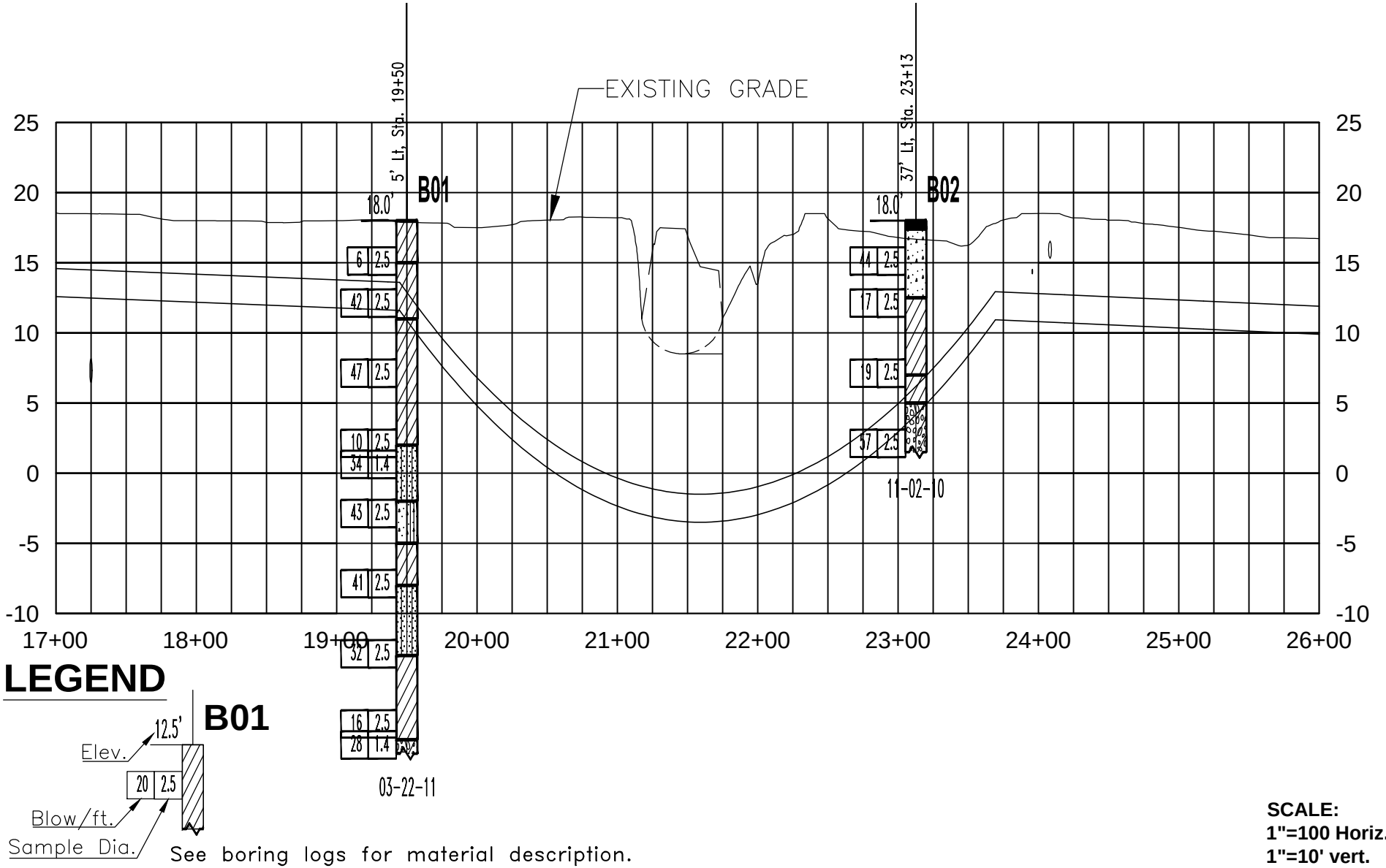
Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495

BORING RECORD LEGEND

COUNTY	ROUTE	POSTMILE
Sonoma		

PROJECT OR BRIDGE NAME: **Napa-Sonoma Pipeline**

PREPARED BY	DATE	SHEET
DPC	**4/28/2011**	**2 of 2**



LEGEND

See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

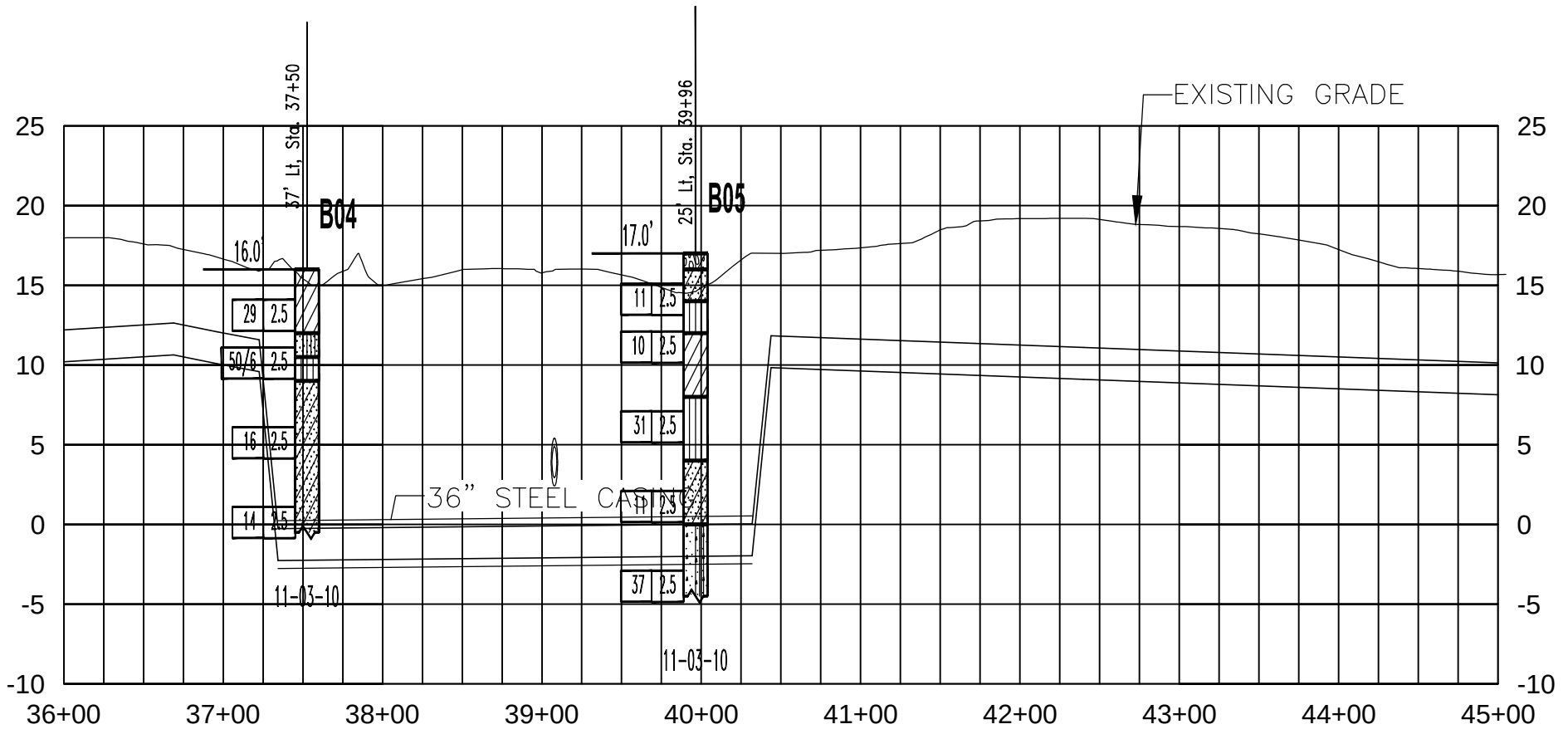
PROFILE AT STA 22+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

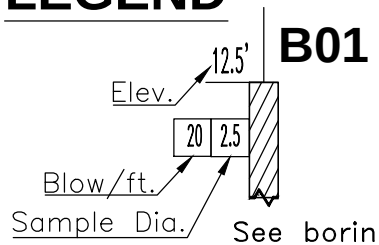
File No. 2049.1

April 2011

Appendix C



LEGEND



See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

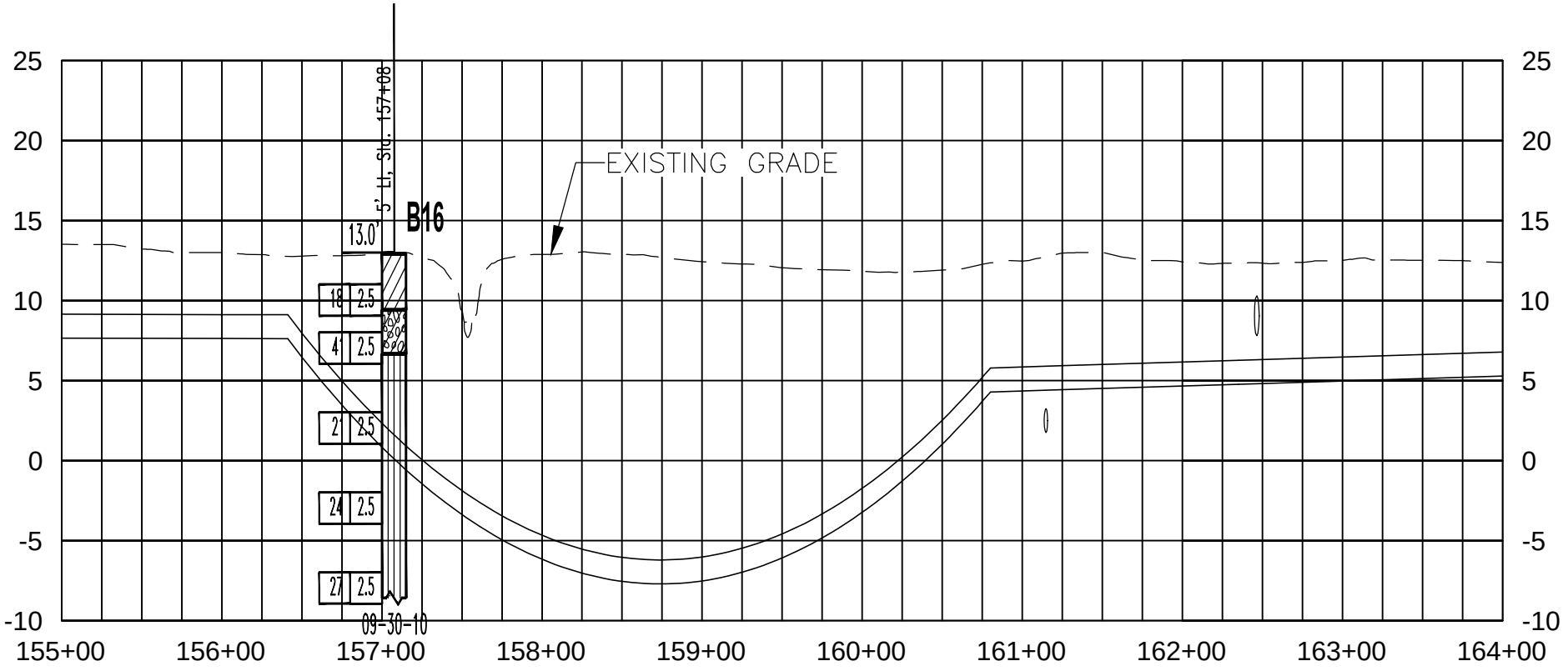
PROFILE AT STA 39+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

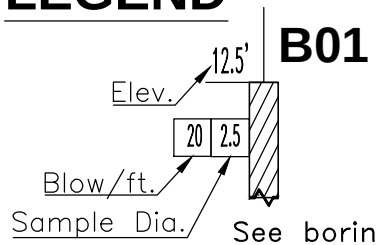
File No. 2049.1

April 2011

Appendix C



LEGEND



See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

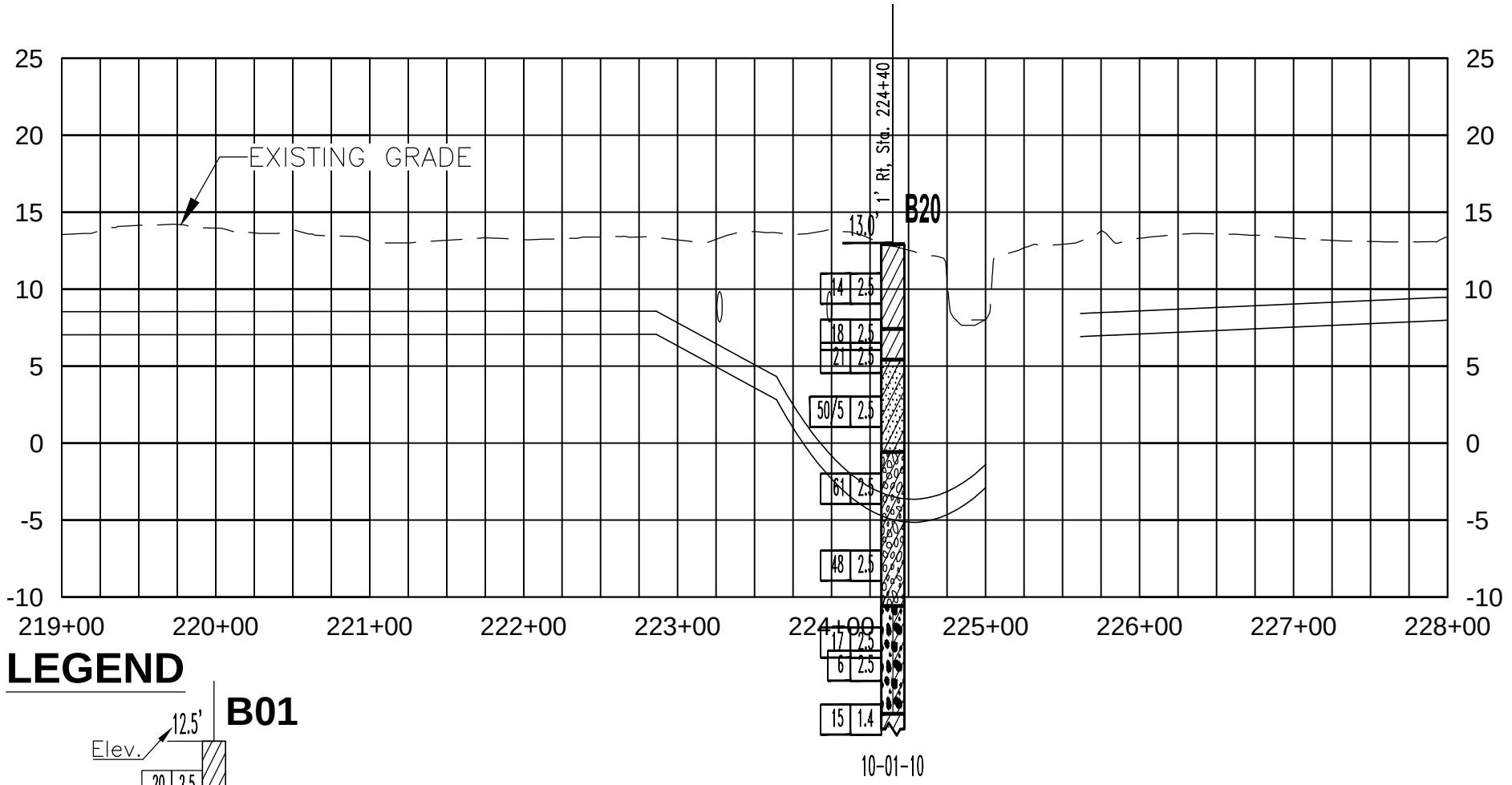
PROFILE AT STA 157+50

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix C



LEGEND

See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

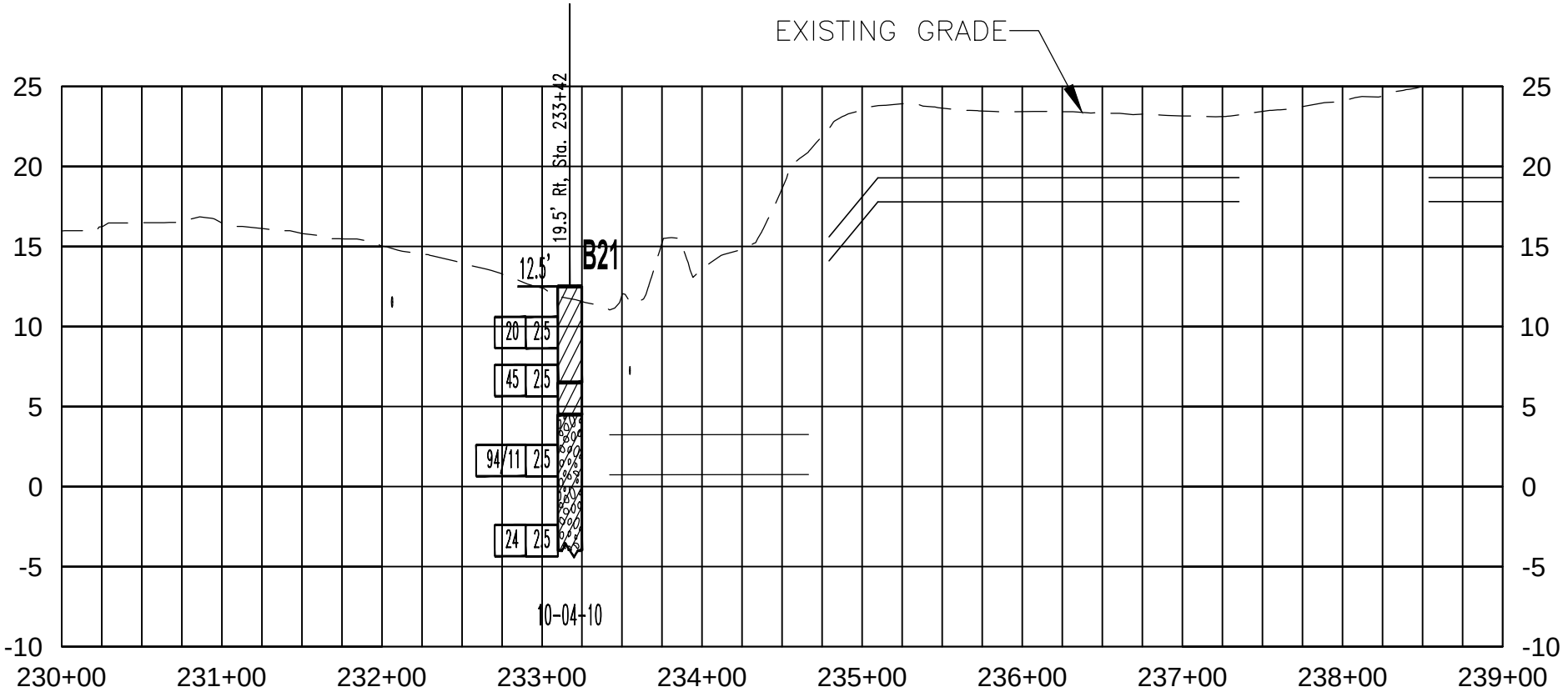
PROFILE AT STA 225+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

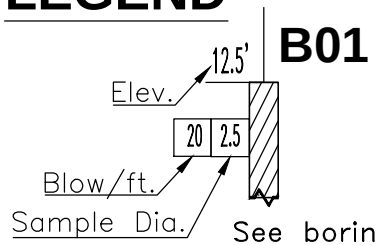
File No. 2049.1

April 2011

Appendix C



LEGEND



See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

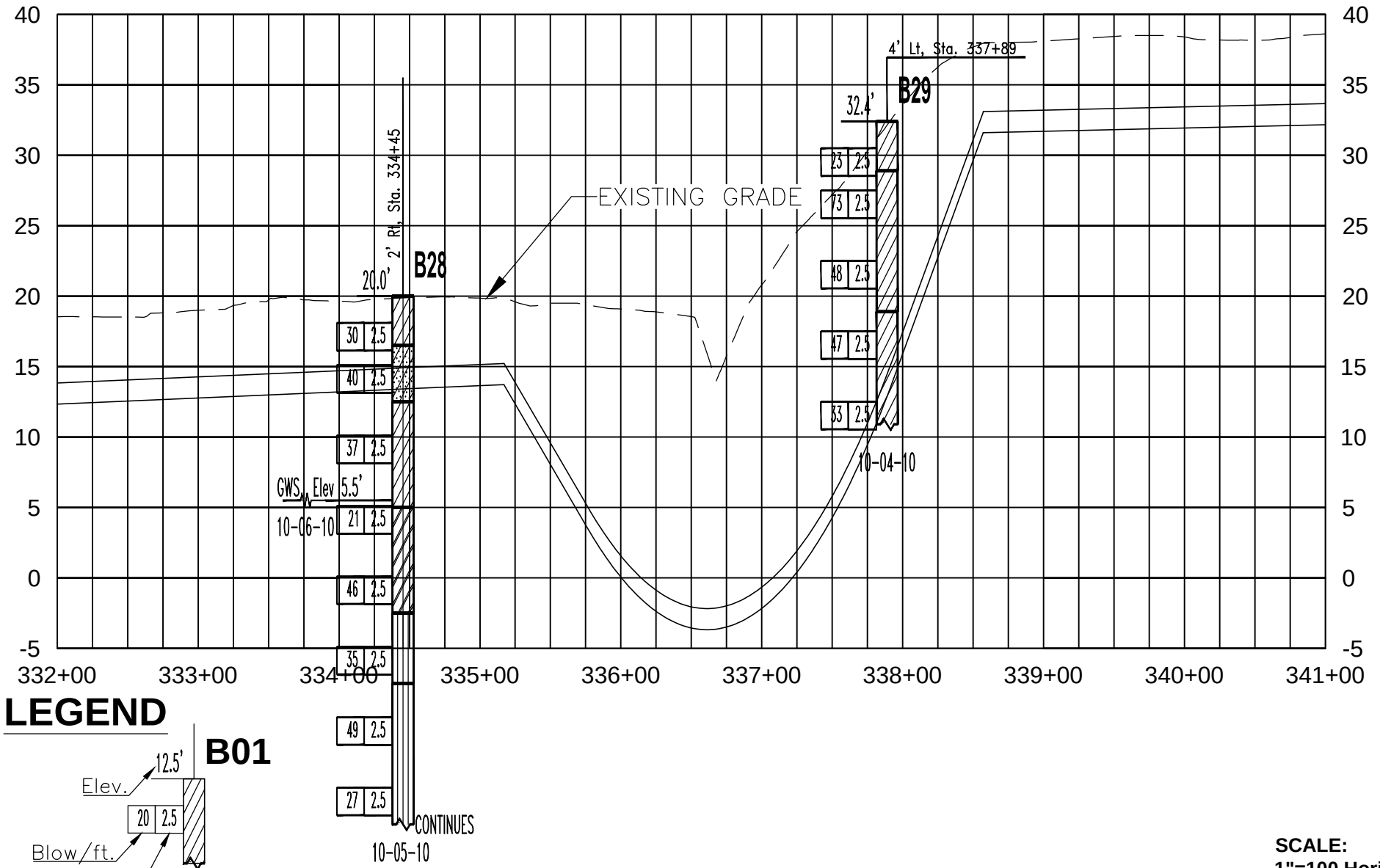
PROFILE AT STA 234+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix C



LEGEND

See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

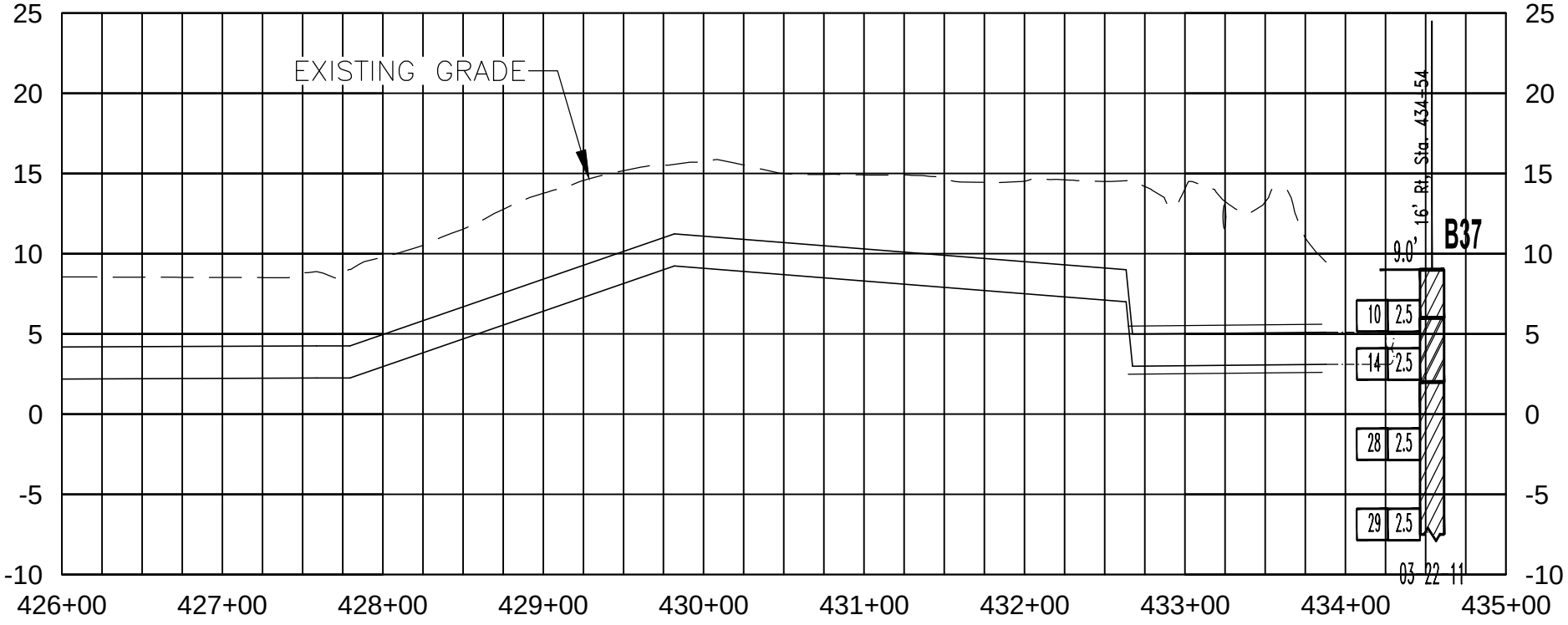
PROFILE AT STA 336+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

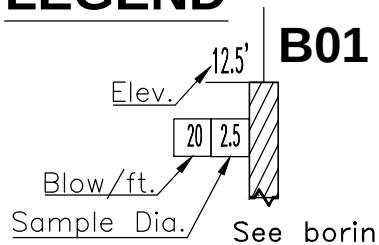
File No. 2049.1

April 2011

Appendix C



LEGEND



See boring logs for material description.

SCALE:
1"=100 Horiz.
1"=10' vert.

blackburn consulting

11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

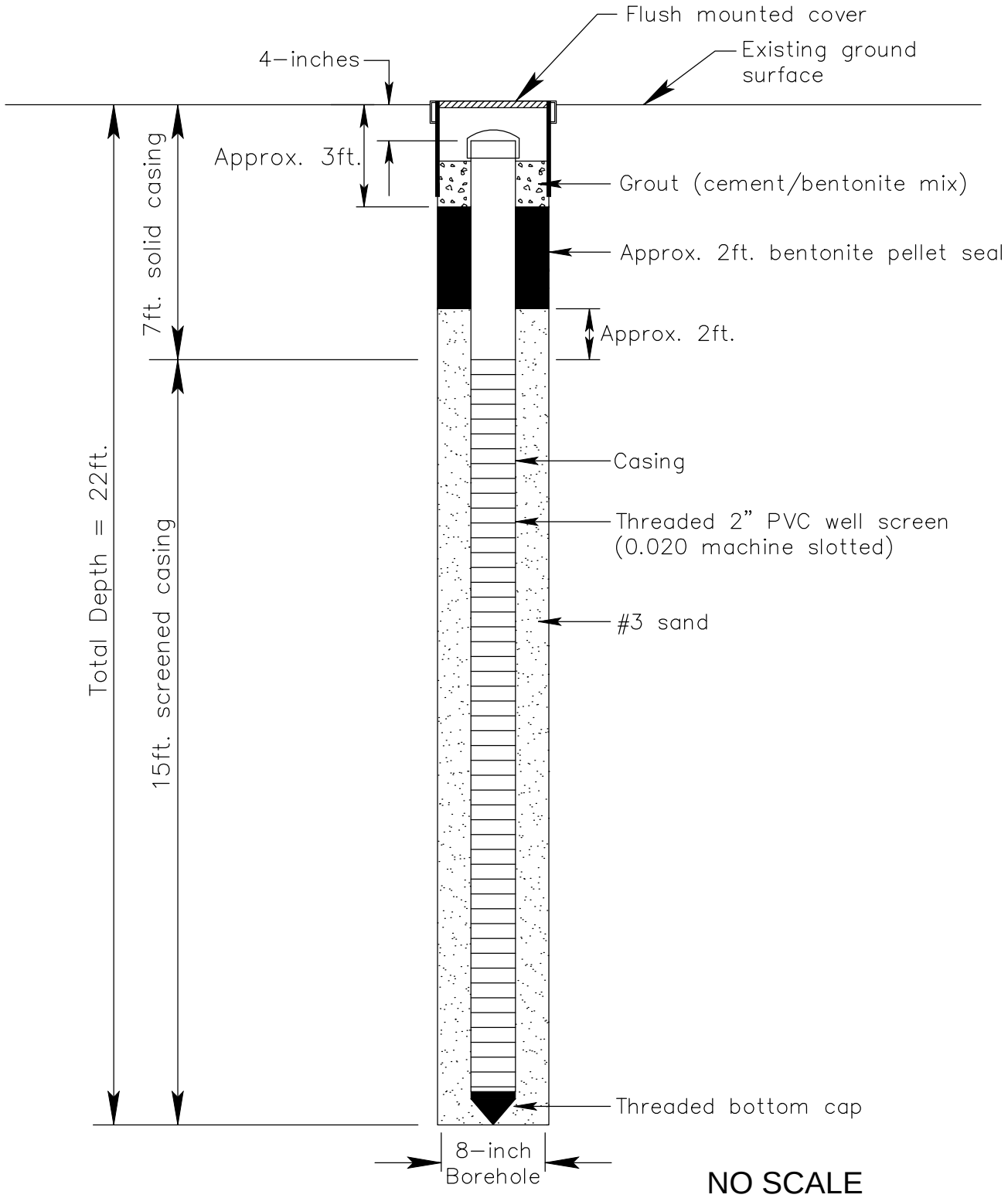
PROFILE AT STA 433+00

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

Appendix C



blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

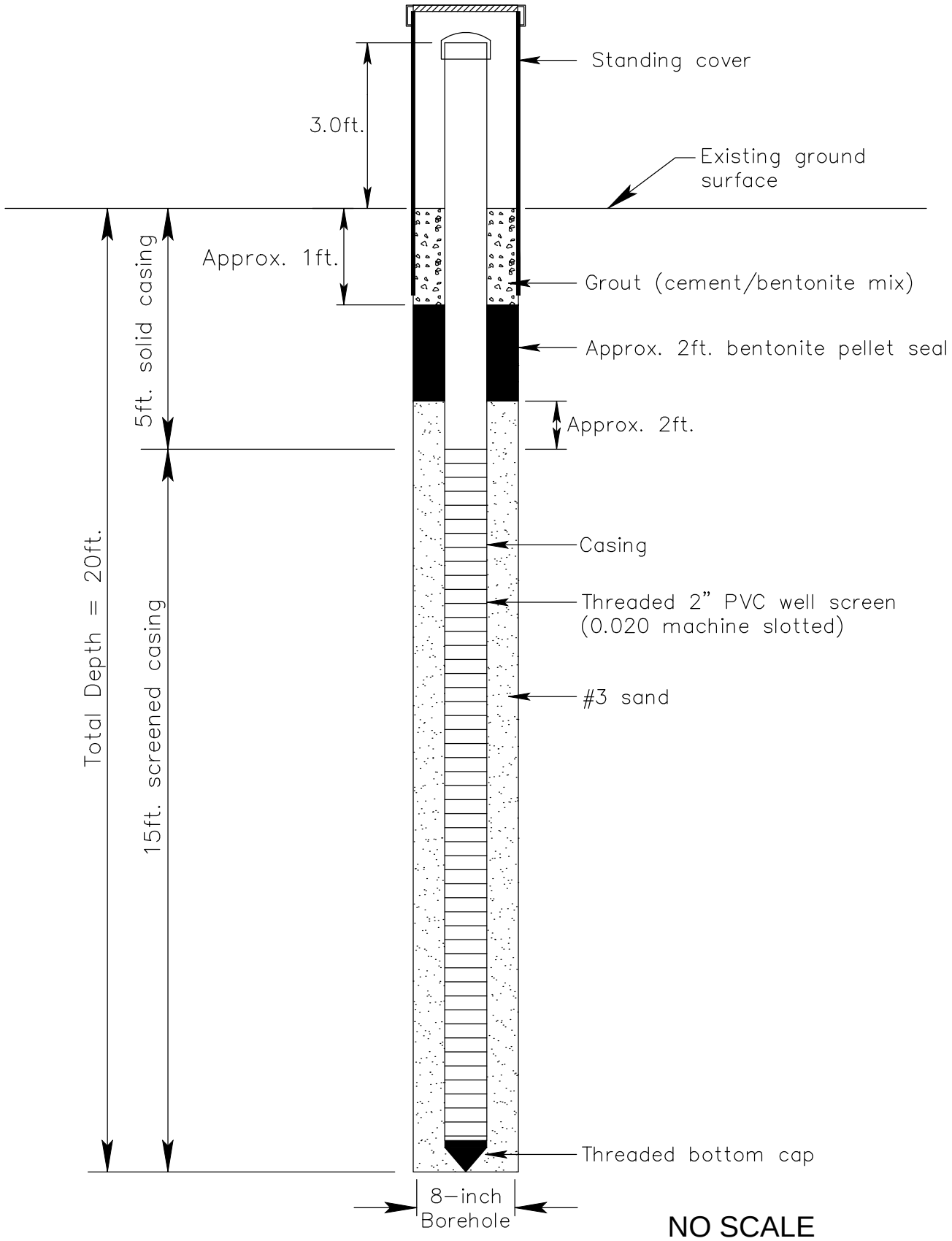
WELL B05 DETAIL

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

4/25/2011 2049.1 MW Schematic.dwg



blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

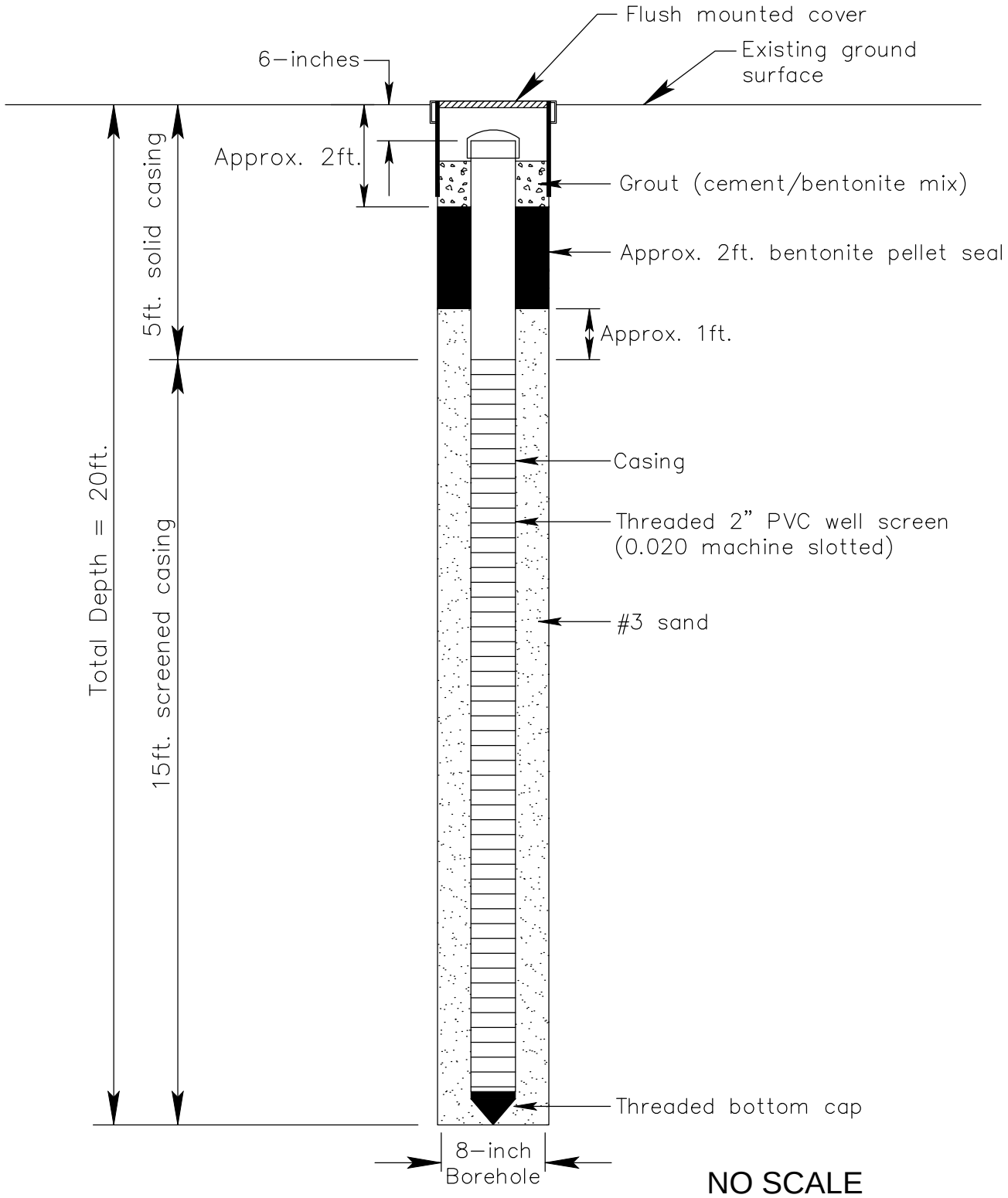
WELL B21 DETAIL

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

4/25/2011 2049.1 MW Schematic.dwg



blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

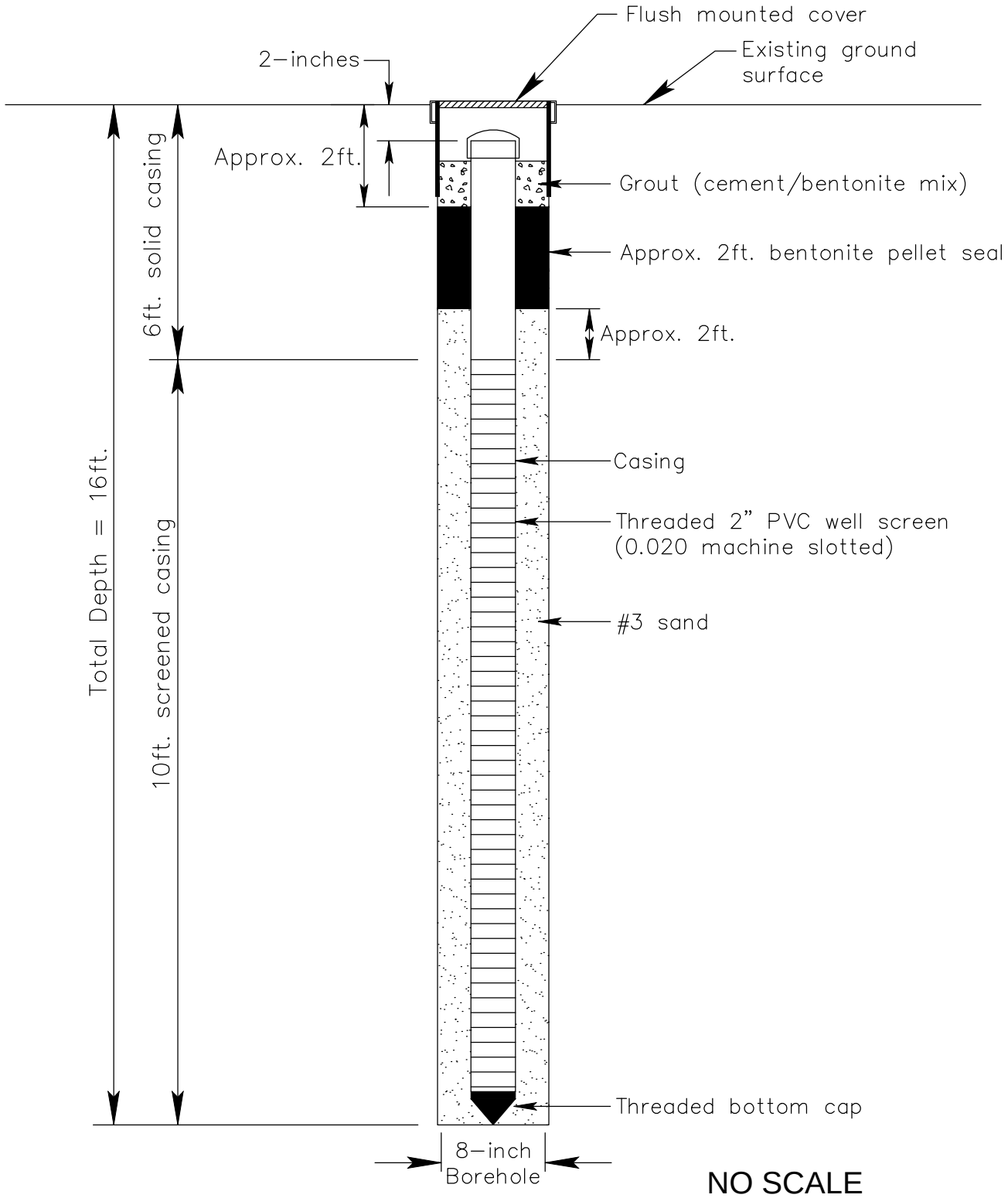
WELL B28 DETAIL

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

4/25/2011 2049.1 MW Schematic.dwg



blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

WELL B36 DETAIL

Napa-Sonoma Salt Marsh
Restoration Pipeline
Napa and Sonoma Counties, California

File No. 2049.1

April 2011

4/25/2011 2049.1 MW Schematic.dwg

APPENDIX D

Field and Laboratory Testing Summary (Sheets 1-5)

Laboratory Test Results

Field and Laboratory Testing Summary

Exploration I.D.	Sample No.	Depth (feet)	Sample Type	USCS Classification	N Value	Moisture Content (%)	Dry Density, γ_{dry} (pcf)	Percent Retained #4	Percent Passing #200	LL	P I	Friction Angle, ϕ	Cohesion, psf, C	Pocket Penetrom. (tsf)	Unconf. Compression (tsf)	D1557 Max Dry Density, (pcf)/Opt. Moist (%)	Corrosivity			
																	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
B1	1	1.5-3.0	Bulk	CL																
B1	2	2.0-3.5	2.5 ID SS	CL	6	24.7	92							0.5						
B1	3	5.0-6.5	2.5 ID SS	CL	42	39.2	79							>4.5						
B1	4	10-11.5	2.5 ID SS	CL	47	24.3	100							>4.5	1.4					
B1	5	15.0-16.5	2.5 ID SS	CL	10									2.5						
B1	6	16.5-18.0	SPT	SM	34			13.0	15.9											
B1	7	20.0-21.5	2.5 ID SS	SW-SM	43	15	118	29.4	7.9					>4.5						
B1	8	25.0-26.5	2.5 ID SS	CL/SM	41	31.8	94							>4.5						
B1	9	30.0-31.5	2.5 ID SS	SM/CL	32	22.1	108	19.6	13.8					>4.5						
B1	10	35.0-36.5	2.5 ID SS	CL	16	20.5	108			38	18			1.8						
B1	11	36.5-38.0	SPT	CL/GP-GC	28															
B2	1	2.0-3.5	2.5 ID SS	SW	44															
B2	2	5.0-6.5	2.5 ID SS	CL	17	27.6	91							2.2	1.5					
B2	3	10-11.5	2.5 ID SS	CL	19									4.0			7.6	1170	21.0	10.0
B2	4	15.0-16.5	2.5 ID SS	GP-GC	57				6.6											
B4	1	2.0-3.5	2.5 ID SS	CL	29	14.1	106							>4.5						
B4	2	5.0-5.5	2.5 ID SS	SP-SM/ML	50/6	19.2	102							>4.5						
B4	3	10-11.5	2.5 ID SS	SC	16	33.1	90					27	543				8.1	1860	26.0	7.4
B4	4	15.0-16.5	2.5 ID SS	SC	14									0.8						
B5	1	1.5-3.0	Bulk	CL																
B5	2	2.0-3.5	2.5 ID SS	CL/ML	11	16.9	94							2.0						
B5	3	5.0-6.5	2.5 ID SS	CL	10	28.7	92							>4.5			6.4	1070	53.0	11.0
B5	4	10-11.5	2.5 ID SS	ML	31	26.9	94					32	400	3.5						
B5	5	15.0-16.5	2.5 ID SS	SC	11	30.9	92							2.0						
B5	6	20.0-21.5	2.5 ID SS	GW-GC	37	23.3	104	45.0	8.0											
B6	1	2.0-3.5	2.5 ID SS	GP-GC	57	10.6	111							>4.5						
B6	2	5.0-6.5	2.5 ID SS	CL	33	14.1	110							1.5						
B6	3	10-11.5	2.5 ID SS	ML	49									>4.5						
B6	4	15.0-16.5	2.5 ID SS	CL	20									1.5						
B7	1	1.5-4.5	Bulk	CL/CH						41	25									
B7	2	2.0-3.5	2.5 ID SS	CL/CH	11	22.4	89							3.7						
B7	3	5.0-6.5	2.5 ID SS	CL	23	22.5	104							>4.5						
B7	4	10.0-11.5	2.5 ID SS	SW-SC	38												7.4	260	1700.0	310.0
B7	5	15.0-16.5	2.5 ID SS	CL	71	28.4	96							>4.5	4.4					
B7	6	20.0-21.5	2.5 ID SS	CL	20	33.1	91							3.2						
B7	7	25.0-26.5	2.5 ID SS	SC	31															
B7	8	30.0-31.5	2.5 ID SS	CL	28									4.0						
B7	9	35.0-36.5	2.5 ID SS	CH	23									3.2						
B7	10	40.0-41.5	2.5 ID SS	CH	19									2.5						
B7	11	45.0-46.5	2.5 ID SS	CH	34									1.7						
B7	12	50.0-51.5	2.5 ID SS	CH	54									>4.5						
B8	1	2.0-3.5	2.5 ID SS	CL/CH	8	16.3	113							1.8	1.2					
B8	2	5.0-6.5	2.5 ID SS	CL/CH	12															

Field and Laboratory Testing Summary

Exploration I.D.	Sample No.	Depth (feet)	Sample Type	USCS Classification	N Value	Moisture Content (%)	Dry Density, γ_{dry} (pcf)	Percent Retained #4	Percent Passing #200	LL	P I	Friction Angle, ϕ	Cohesion, psf, C	Pocket Penetrom. (tsf)	Unconf. Compression (tsf)	D1557 Max Dry Density, (pcf)/Opt. Moist (%)	Corrosivity			
																	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
B8	3	10.0-11.5	2.5 ID SS	SM	46				33.7											
B8	4	15.0-16.5	2.5 ID SS	GP/CL	24	28.9	95							>4.5						
B8	5	20.0-21.5	2.5 ID SS	CL	23	32.6	89							2.3	1.1					
B8	6	25.0-26.5	2.5 ID SS	CL	36									>4.5						
B8	7	30.0-31.5	2.5 ID SS	CL	22				53.8	38	17									
B8	8	35.0-36.5	2.5 ID SS	SP-SM	26				10.7											
B8	9	40.0-41.5	2.5 ID SS	SC	36															
B8	10	45.0-46.5	2.5 ID SS	CL	60									>4.5						
B8	11	50.0-51.5	2.5 ID SS	CL	56									>4.5						
B9	1	2.0-3.5	2.5 ID SS	SC	23	16.7	96							>4.5						
B9	2	5.0-6.5	2.5 ID SS	SC	36	16.2	112							>4.5						
B9	3	10.0-11.5	2.5 ID SS	CL/CH	22	27.8	94							2.5						
B9	4	15.0-16.5	2.5 ID SS	CL/CH	24									2.5						
B9	5	20.0-21.5	2.5 ID SS	CL	35									>4.5						
B9	6	25.0-26.5	2.5 ID SS	ML	45									>4.5						
B10	1	1.0-3.0	Bulk	SC																
B10	2	2.0-3.25	2.5 ID SS	SC	71/9	14	114							>4.5						
B10	3	5.0-6.5	2.5 ID SS	SP-SM	49	20.1	104							>4.5						
B10	4	10.0-11.5	2.5 ID SS	CL	40	27.8	95							>4.5						
B10	5	15.0-16.5	2.5 ID SS	SP-SM	10															
B10	6	20.0-21.5	2.5 ID SS	SW-SM	52															
B11	1	2.0-3.5	2.5 ID SS	SM	14	8.9	105							3.5						
B11	2	5.0-6.5	2.5 ID SS	CL	25									>4.5			7.6	1170	27	12
B11	3	10.0-11.5	2.5 ID SS	CL	79	11.7	122							>4.5						
B12	1	1.5-4.5	Bulk	CL & ML																
B12	2	2.0-3.5	2.5 ID SS	CL	25	14.4	115							>4.5						
B12	3	5.0-6.5	2.5 ID SS	ML	39	28.3	95							>4.5						
B12	4	10.0-11.5	2.5 ID SS	SM	27	26.3	98							>4.5						
B12	5	15.0-16.5	2.5 ID SS	SP-SM	7															
B13	1	2.0-3.5	2.5 ID SS	ML & CL	18	16.1	98							2.3						
B13	2	5.0-6.5	2.5 ID SS	CL	35					33	22			>4.5						
B13	3	10.0-11.5	2.5 ID SS	ML	17									2.0						
B14	1	1.5-4.5	Bulk	ML & CL																
B14	2	2.0-3.5	2.5 ID SS	ML	70									>4.5						
B14	3	5.0-6.5	2.5 ID SS	CL	44									>4.5						
B14	4	10.0-11.5	2.5 ID SS	CL	35									>4.5						
B15	1	2.0-3.5	2.5 ID SS	CL	18	16.2	99			43	27			>4.5						
B15	2	5.0-6.5	2.5 ID SS	ML	12									2.0						
B15	3	10.0-11.5	2.5 ID SS	GP	35									3.0						
B16	1	2.0-3.5	2.5 ID SS	CL	18	8.5	92							>4.5	0.0					
B16	2	5.0-6.5	2.5 ID SS	GC	41									>4.5						
B16	3	10.0-11.5	2.5 ID SS	ML	21	16.7	113							3.8						
B16	4	15.0-16.5	2.5 ID SS	ML	24									3.5						

Field and Laboratory Testing Summary

Exploration I.D.	Sample No.	Depth (feet)	Sample Type	USCS Classification	N Value	Moisture Content (%)	Dry Density, γ_{dry} (pcf)	Percent Retained #4	Percent Passing #200	LL	P I	Friction Angle, ϕ	Cohesion, psf, C	Pocket Penetrom. (tsf)	Unconf. Compression (tsf)	D1557 Max Dry Density, (pcf)/Opt. Moist (%)	Corrosivity			
																	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
B16	5	20.0-21.5	2.5 ID SS	ML	27									4.5						
B17	1	1.5-3.0	Bulk	CL																
B17	2	2.0-3.5	2.5 ID SS	CL	33	10	116							>4.5						
B17	3	5.0-6.5	2.5 ID SS	CL	18									2.0			8.6	1040	110	92
B17	4	10.0-11.5	2.5 ID SS	CL	27	20.7	107							>4.5						
B17	5	15.0-16.5	2.5 ID SS	SC	60															
B17	6	20.0-21.5	2.5 ID SS	CL	23									3.8						
B17	7	25.0-26.5	2.5 ID SS	CL	43									>4.5						
B18	1	2.0-3.5	2.5 ID SS	CL	22	7.7	100							4.5						
B18	2	5.0-6.5	2.5 ID SS	CL	30	22.5	99							3.8	2.2					
B18	3	10.0-11.5	2.5 ID SS	CL	19									3.8						
B18	4	15.0-16.5	2.5 ID SS	CL	16									2.5						
B18	5	20.0-21.5	2.5 ID SS	CL	85/11									>4.5						
B19	1	1.5-3.0	Bulk	CL																
B19	2	2.0-3.5	2.5 ID SS	CL	11	23.6	100							1.8						
B19	3	5.0-6.5	2.5 ID SS	SC	11	16.1	109							3.0						
B19	4	10.0-11.5	2.5 ID SS	GC	85/11															
B19	5	15.0-16.5	2.5 ID SS	GC	50/6															
B20	1	2.0-3.5	2.5 ID SS	CL	14	13.7	91			25	8			>4.5						
B20	2	5.0-6.5	2.5 ID SS	CL	18															
B20	3	6.5-8.0	2.5 ID SS	CL/SC	21	16.6	114							2.8						
B20	4	10.0-11.5	2.5 ID SS	SC	50/5															
B20	5	15.0-16.5	2.5 ID SS	GC	61															
B20	6	20.0-21.5	2.5 ID SS	GC	48															
B20	7	25.0-26.5	2.5 ID SS	GW-GC	17															
B20	8	26.5-28.0	2.5 ID SS	GW-GC	6															
B20	9	30.0-31.5	SPT	CL	15															
B21	1	1.5-4.5	Bulk	CL													5.6	820	110	49
B21	2	2.0-3.5	2.5 ID SS	CL	20	18.7	108							>4.5						
B21	3	5.0-6.5	2.5 ID SS	CL	45	25.5	92							3.0						
B21	4	10.0-11.5	2.5 ID SS	GC	94/11															
B21	5	15.0-16.5	2.5 ID SS	GC	24															
B22	1	2.0-3.5	2.5 ID SS	CL	30									>4.5						
B22	2	5.0-6.5	2.5 ID SS	CL	51	19.2	96							>4.5	3.6					
B22	3	10.0-11.5	2.5 ID SS	GC	61				12.1					>4.5						
B23	1	1.5-4.5	Bulk	CL																
B23	2	2.0-3.5	2.5 ID SS	CL	20	17.2	92							>4.5						
B23	3	5.0-6.5	2.5 ID SS	ML	16	15.7	96							3.6						
B23	4	10.0-11.5	2.5 ID SS	CL	19	12.3	93							4.2						
B23	5	15.0-16.5	2.5 ID SS	CL	22	25.7	95							2.6						
B24	1	2.0-3.5	2.5 ID SS	ML	19									3.2						
B24	2	5.0-6.5	2.5 ID SS	CL	54			0.0	97.6	45	20			>4.5						
B24	3	10.0-11.5	2.5 ID SS	SM	45			13.6	26.0					>4.5						

Field and Laboratory Testing Summary

Exploration I.D.	Sample No.	Depth (feet)	Sample Type	USCS Classification	N Value	Moisture Content (%)	Dry Density, γ_{dry} (pcf)	Percent Retained #4	Percent Passing #200	LL	P I	Friction Angle, ϕ	Cohesion, psf, C	Pocket Penetrom. (tsf)	Unconf. Compression (tsf)	D1557 Max Dry Density, (pcf)/Opt. Moist (%)	Corrosivity			
																	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
B25	1	1.5-4.5	Bulk	CL&ML																
B25	2	2.0-3.5	2.5 ID SS	CL&ML	41	22.4	102							>4.5						
B25	3	5.0-6.5	2.5 ID SS	ML	45	26.9	97							>4.5						
B25	4	10.0-11.5	2.5 ID SS	ML	28	26.1	93							>4.5						
B25	5	15.0-16.5	2.5 ID SS	ML	33	22.7	106							>4.5						
B26	1	2.0-3.5	2.5 ID SS	CH	17			0.0	87.9	63	42			>4.5						
B26	2	5.0-6.5	2.5 ID SS	ML	38			0.0	98.2	40	11			2.5						
B26	3	10.0-11.5	2.5 ID SS	ML	30	23.7	99							>4.5	2.3					
B27	1	1.5-4.5	Bulk	CL/ML																
B27	2	2.0-3.5	2.5 ID SS	CL/ML	33	20.7	100							2.6						
B27	3	5.0-6.5	2.5 ID SS	CL	50	18.1	108							>4.5						
B27	4	10.0-11.5	2.5 ID SS	CL	53	19.6	105							>4.5						
B27	5	15.0-16.5	2.5 ID SS	ML	35	19.2	103							1.5						
B28	1	2.0-3.5	2.5 ID SS	CL	30									2.5						
B28	2	5.0-6.5	2.5 ID SS	SC	40	12.3	103		15.5											
B28	3	10.0-11.5	2.5 ID SS	CL	37	23.8	100							>4.5	3.0					
B28	4	15.0-16.5	2.5 ID SS	CH	21	27.3	94			53	31			>4.5						
B28	5	20.0-21.5	2.5 ID SS	CL	46									>4.5						
B28	6	25.0-26.5	2.5 ID SS	ML	35									>4.5						
B28	7	30.0-31.5	2.5 ID SS	ML	49									>4.5						
B28	8	35.0-36.5	2.5 ID SS	ML	27									>4.5						
B28	9	40.0-41.5	2.5 ID SS	ML	41									4.5						
B28	10	45.0-46.5	2.5 ID SS	SW-SC	54															
B28	11	50.0-51.5	2.5 ID SS	GP	43															
B29	1	2.0-3.5	2.5 ID SS	CL	23	20.7	98							3.0						
B29	2	5.0-6.5	2.5 ID SS	CL	73									>4.5			6.2	500	270	17
B29	3	10.0-11.5	2.5 ID SS	CL	48	18.7	103			48	26			>4.5	2.5					
B29	4	15.0-16.5	2.5 ID SS	CL	47	24.6	100							>4.5						
B29	5	20.0-21.5	2.5 ID SS	CL	33															
B30	1	2.0-3.5	2.5 ID SS	CL	14	23.9	94							2.0						
B30	2	5.0-6.5	2.5 ID SS	GP-GC	50/6															
B30	3	10.0-11.5	2.5 ID SS	GP-GC	49	14.9	113							>4.5						
B31	1	1.5-4.5	Bulk	CL																
B31	2	2.0-3.5	2.5 ID SS	CL	14															
B31	3	5.0-6.5	2.5 ID SS	ML	35									>4.5						
B31	4	10.0-11.5	2.5 ID SS	ML	78									>4.5						
B31	5	15.0-16.5	2.5 ID SS	SC	49															
B32	1	2.0-3.5	2.5 ID SS	CL-ML	12			8.2	63.8	24	7			3.2						
B32	2	5.0-6.5	2.5 ID SS	CL-ML	40	22.5	100		84.6					>4.5	1.4					
B32	3	10.0-11.5	MC	CL-ML	32			0.0	96.8					>4.5						
B33	1	1.5-4.5	Bulk	CL & SC																
B33	2	2.0-3.5	2.5 ID SS	CL	17	13.4	116							>4.5						
B33	3	5.0-6.5	2.5 ID SS	SC	16	17	106													

Field and Laboratory Testing Summary

Exploration I.D.	Sample No.	Depth (feet)	Sample Type	USCS Classification	N Value	Moisture Content (%)	Dry Density, γ_{dry} (pcf)	Percent Retained #4	Percent Passing #200	LL	P I	Friction Angle, ϕ	Cohesion, psf, C	Pocket Penetrom. (tsf)	Unconf. Compression (tsf)	D1557 Max Dry Density, (pcf)/Opt. Moist (%)	Corrosivity			
																	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
B33	4	10.0-11.5	2.5 ID SS	CL	40	19.5	109													
B33	5	15.0-16.5	2.5 ID SS	CL	35									>4.5						
B34	1	2.0-3.5	2.5 ID SS	CL	15	13.7	108			40	27			4.5						
B34	2	5.0-6.5	2.5 ID SS	CL & ML	14									1.3			5.3	1170	30	30
B34	3	10.0-11.5	2.5 ID SS	CL	25	26	95							3.8						
B35	1	1.5-4.5	Bulk	CL																
B35	2	2.0-3.5	2.5 ID SS	CL	9	16.9	106							1.5						
B35	3	5.0-6.5	2.5 ID SS	CL	26	15.3	110							3.5	1.4					
B35	4	10.0-11.5	2.5 ID SS	ML	54	24.6	101							>4.5						
B35	5	15.0-16.5	2.5 ID SS	ML	47									>4.5						
B36	1	1.0-2.0	Bulk	CL																
B36	2	2.0-3.5	2.5 ID SS	SC	12	23.4	93							2.0						
B36	3	5.0-6.5	2.5 ID SS	SC	42	18.7	106	21.0	33.7					>4.5						
B36	4	10.0-11.5	2.5 ID SS	CL/CH	28	27.5	97			59	36			3.0						
B36	5	15.0-16.5	2.5 ID SS	CL/CH	13									1.5						
B36	6	16.5-18.0	SPT	CL/CH	9									1.5						
B37	1	1.0-5.0	Bulk	CL & CH													7.4	674		
B37	2	2.0-3.5	2.5 ID SS	CL & CH	10	25.6	98							0.7						
B37	3	5.0-6.5	2.5 ID SS	CH	14	32.2	88			66	46			1.0	1.2					
B37	4	10.0-11.5	2.5 ID SS	CL	28	22.5	103							>4.5	2.9					
B37	5	15.0-16.5	2.5 ID SS	CL	29	27.1	102							>4.5						
B1&B5	1	1.5-3.0	Bulk	CL & SC				14.1	49.6	29	10					121.7/11.0				
B12&B14	1	1.5-4.5	Bulk	CL & ML						35	21					120.2/11.7				
B25&B27	1	1.5-4.5	Bulk	CL & ML				4.0								115.5/13.3				
B31&B35	1	1.5-4.5	Bulk	CL				10.4	63.5	42	25					120.5/12.4				

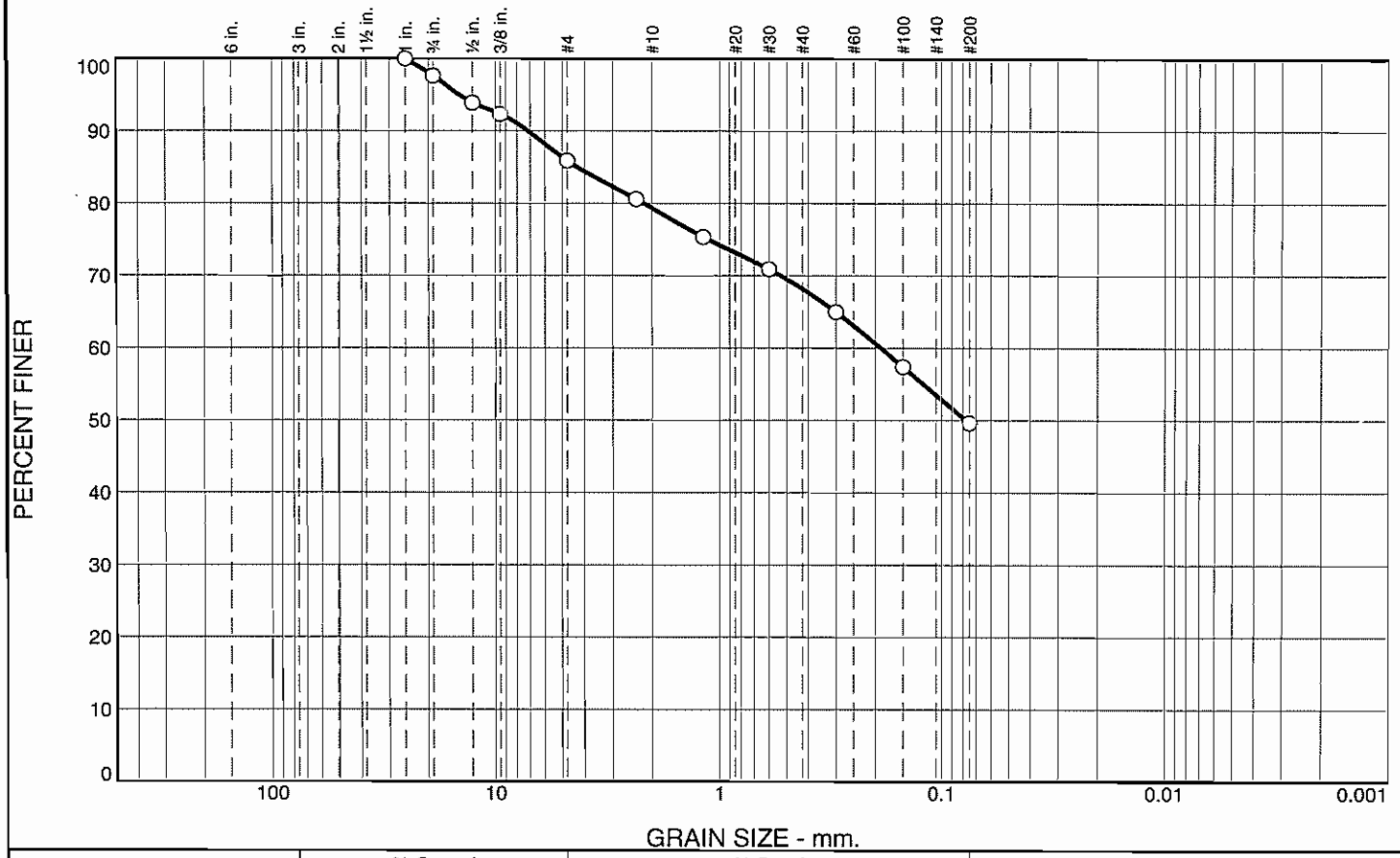
Project: Napa-Sonoma Pipeline
Project No.: 2049.1
Date: November 2010

blackburn consulting

Test Results - #200 Sieve Wash (ASTM D1140)

Sample No.	Approximate Depth (ft)	Percent Passing #200 Sieve	Material Description
B2-4B	15.5-16.0	6.6	Poorly Graded Gravel with Clay and Sand
B8-3C	11.0-11.5	33.7	Silty Sand with Gravel
B8-7C	31.0-31.5	53.8	Sandy lean Clay
B8-8C	36.0-36.5	10.7	Poorly Graded Sand with Silt
B22-3B	10.5-11.0	12.1	Clayey Gravel
B28-2C	6.0-6.5	15.5	Clayey Sand with Gravel
B32-2C	6.0-6.5	84.6	Silty Clay with Sand

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.4	11.7	6.6	11.1	18.6	49.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0"	100.0		
3/4"	97.6		
1/2"	93.9		
3/8"	92.4		
#4	85.9		
#8	80.6		
#16	75.3		
#30	70.9		
#50	65.0		
#100	57.4		
#200	49.6		

* (no specification provided)

Material Description

Dark Brown Clayey SAND

Atterberg Limits

PL= 19 LL= 29 PI= 10

Coefficients

D_{90}= 7.1367 D_{85}= 4.3006 D_{60}= 0.1882
D_{50}= 0.0775 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(2)

Remarks

Sample Number: B1-1 & B5-1 Combined **Depth:** 1.5'-3.0'

Date: 11-17-2010

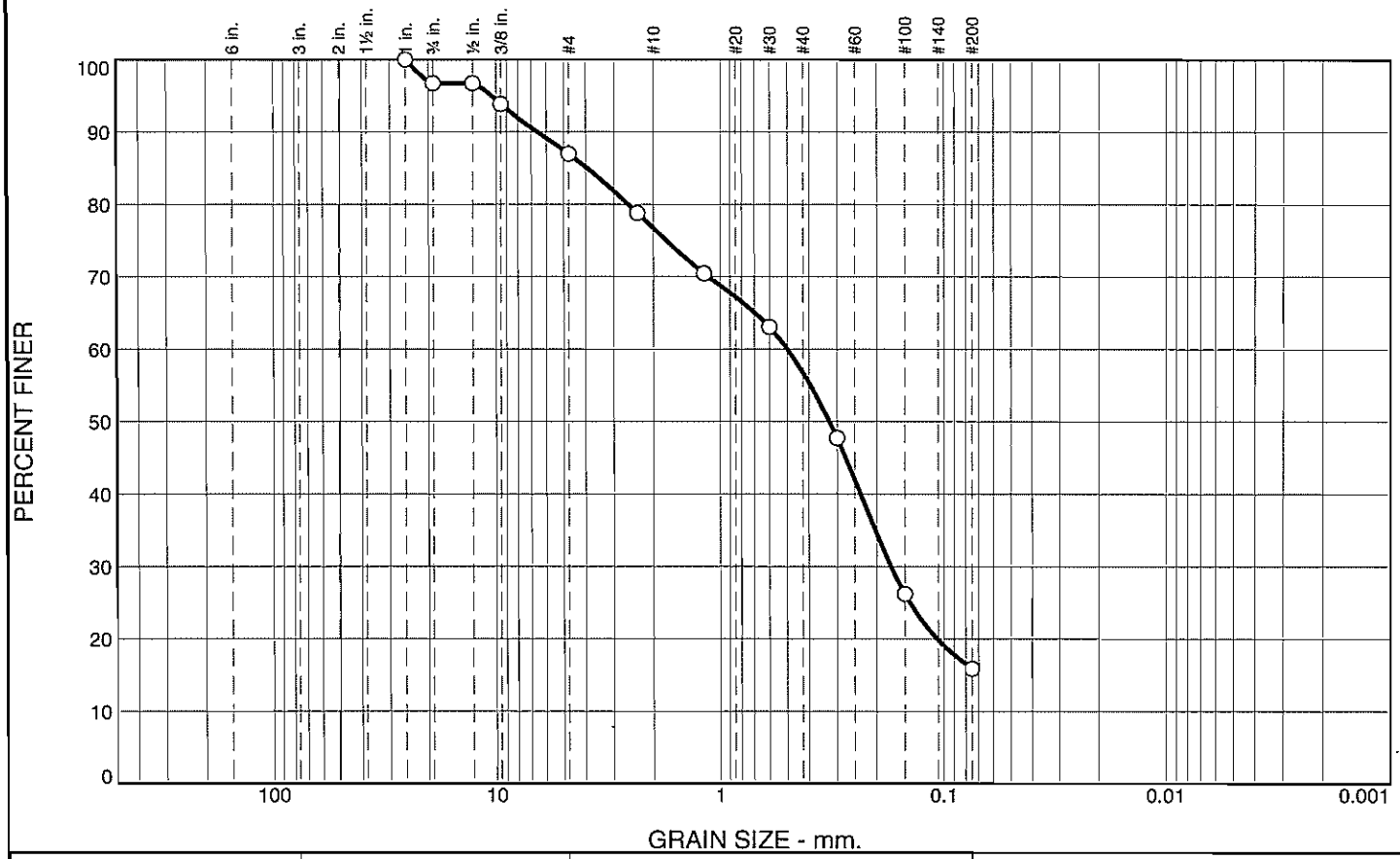
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.3	9.7	10.3	19.9	40.9	15.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.7		
1/2"	96.7		
3/8"	93.8		
#4	87.0		
#8	78.8		
#16	70.4		
#30	63.0		
#50	47.7		
#100	26.2		
#200	15.9		

* (no specification provided)

Material Description

Brown Silty SAND

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 6.5707 D_{85}= 3.9434 D_{60}= 0.4991
D_{50}= 0.3244 D_{30}= 0.1727 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample Number: B1-6 **Depth:** 16.5'-18.0'

Date: 11-11-2010

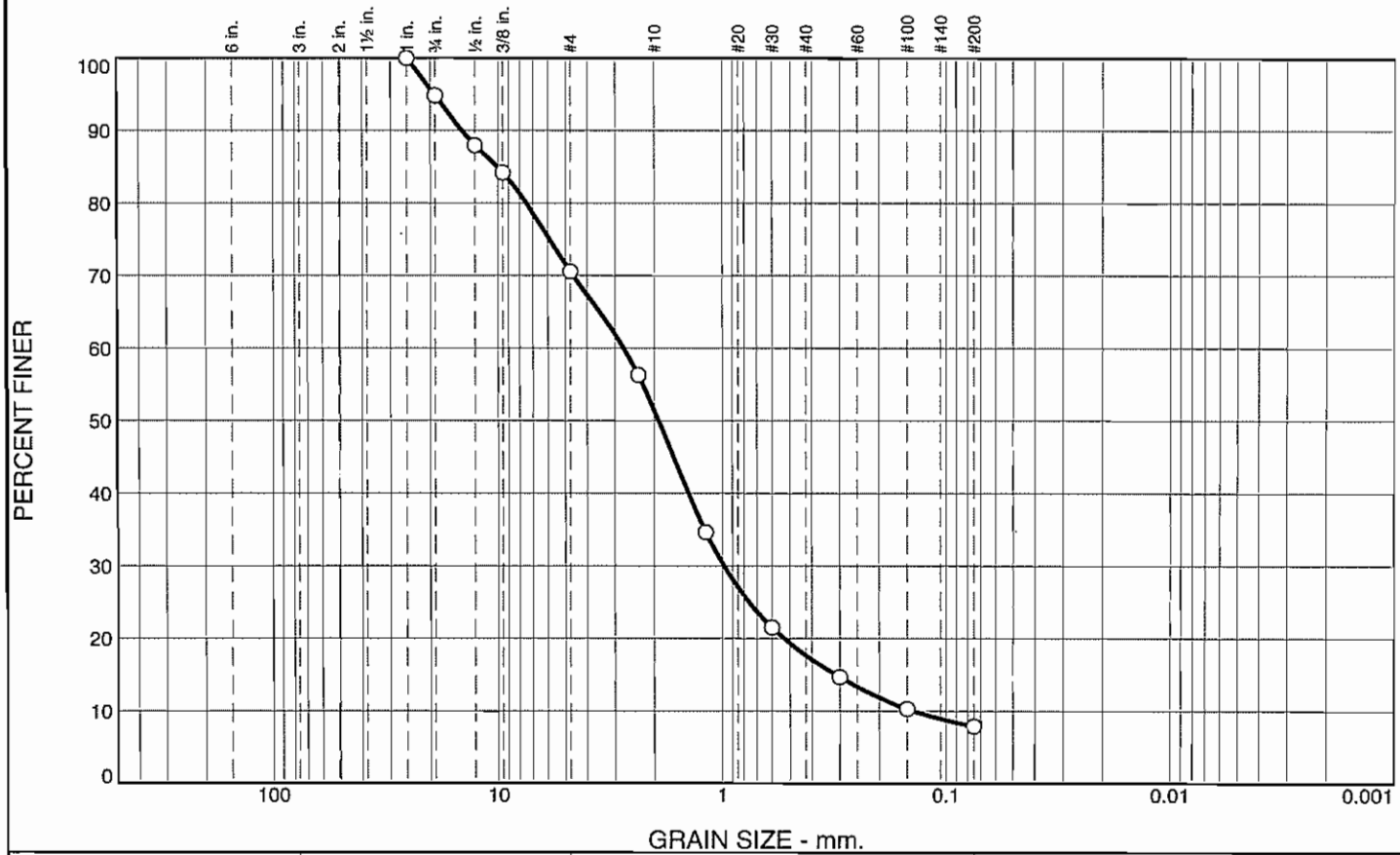
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.2	24.2	19.2	33.8	9.7	7.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0"	100.0		
3/4"	94.8		
1/2"	88.0		
3/8"	84.2		
#4	70.6		
#8	56.3		
#16	34.6		
#30	21.5		
#50	14.7		
#100	10.3		
#200	7.9		

* (no specification provided)

Material Description

Olive brown well graded SAND with Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.5068 D_{85}= 10.0769 D_{60}= 2.7456
D_{50}= 1.9119 D_{30}= 0.9825 D_{15}= 0.3126
D_{10}= 0.1411 C_u= 19.46 C_c= 2.49

Classification

USCS= SW-SM AASHTO=

Remarks

Sample Number: B1-7C **Depth:** 21.0'-21.5'

Date: 4-7-2010

Blackburn Consulting

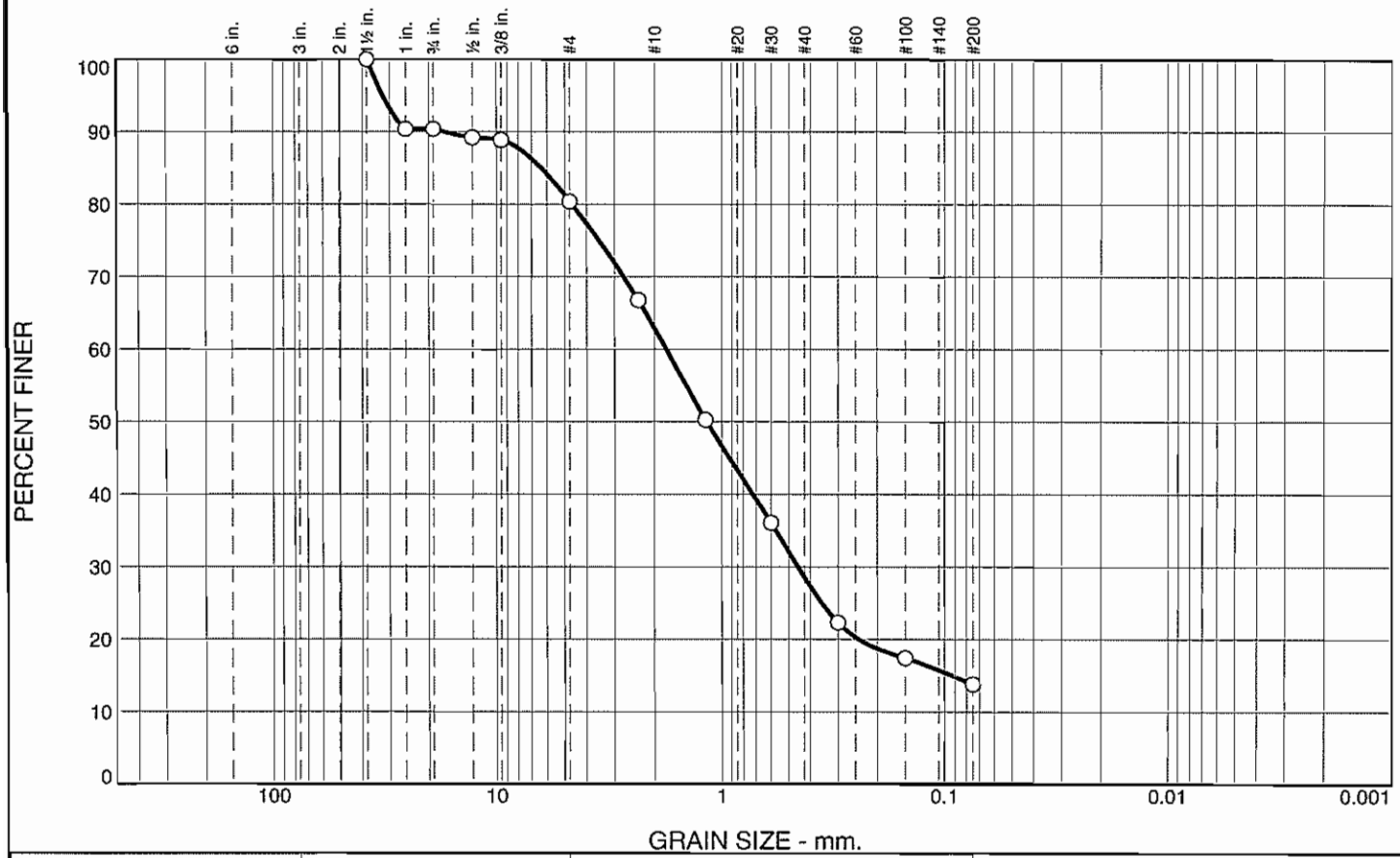
Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline

Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.6	10.0	17.5	34.3	14.8	13.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1.0"	90.4		
3/4"	90.4		
1/2"	89.2		
3/8"	88.9		
#4	80.4		
#8	66.8		
#16	50.3		
#30	36.1		
#50	22.3		
#100	17.4		
#200	13.8		

* (no specification provided)

Material Description

Brown Silty SAND with Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.1942 D_{85}= 6.3281 D_{60}= 1.7720
D_{50}= 1.1651 D_{30}= 0.4548 D_{15}= 0.0927
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: B1-9B **Depth:** 30.5'-31.0'

Date:

Blackburn Consulting

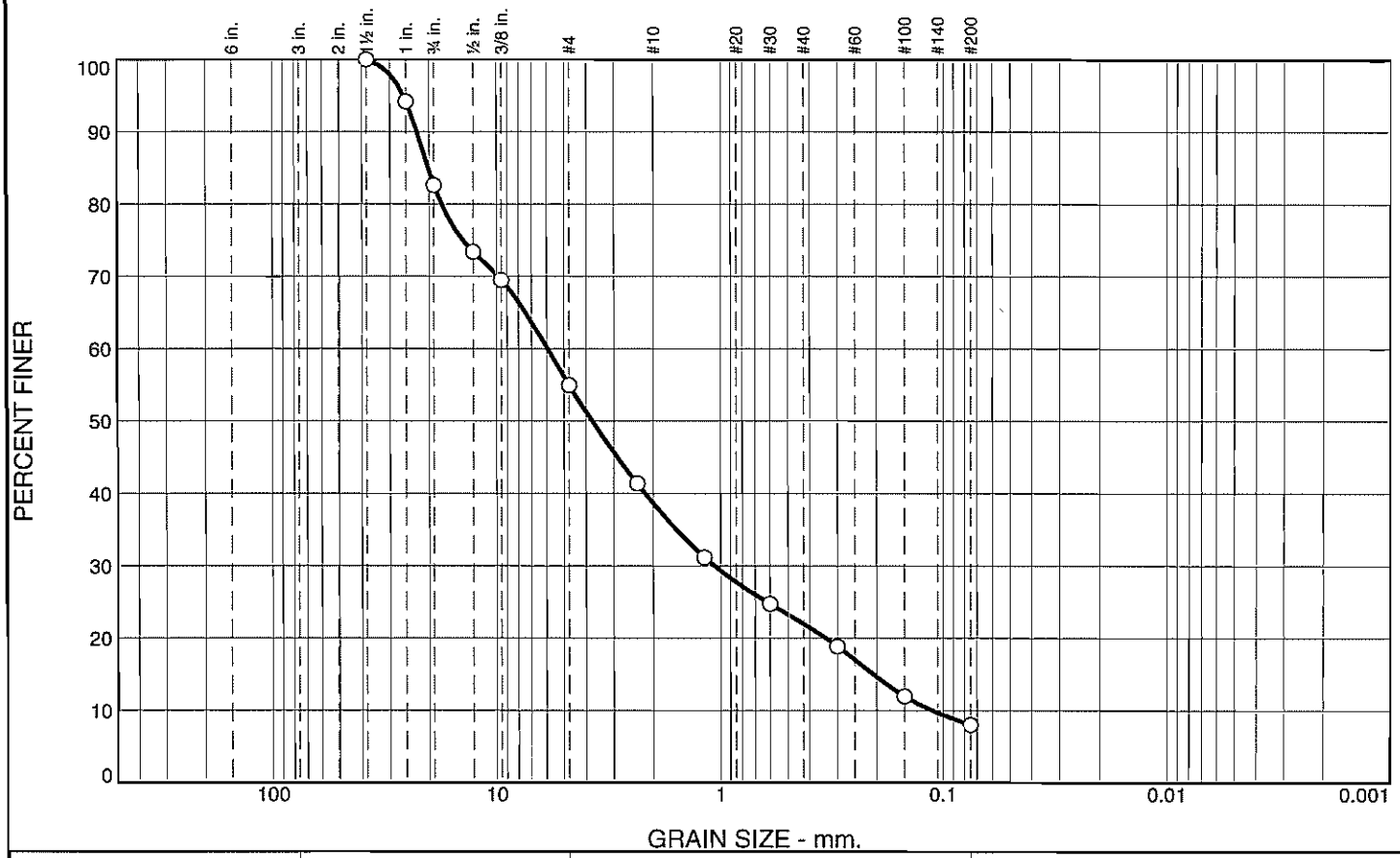
Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline

Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.4	27.6	16.4	16.7	13.9	8.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1.0"	94.2		
3/4"	82.6		
1/2"	73.4		
3/8"	69.5		
#4	55.0		
#8	41.4		
#16	31.2		
#30	24.7		
#50	18.9		
#100	12.0		
#200	8.0		

* (no specification provided)

Material Description

Brown well-graded SAND with Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.7394 D_{85}= 20.2232 D_{60}= 5.9290
D_{50}= 3.7540 D_{30}= 1.0665 D_{15}= 0.2064
D_{10}= 0.1125 C_u= 52.71 C_c= 1.71

Classification

USCS= SW-SM AASHTO=

Remarks

Sample Number: B5-6C **Depth:** 20.0'

Date: 3-31-2011

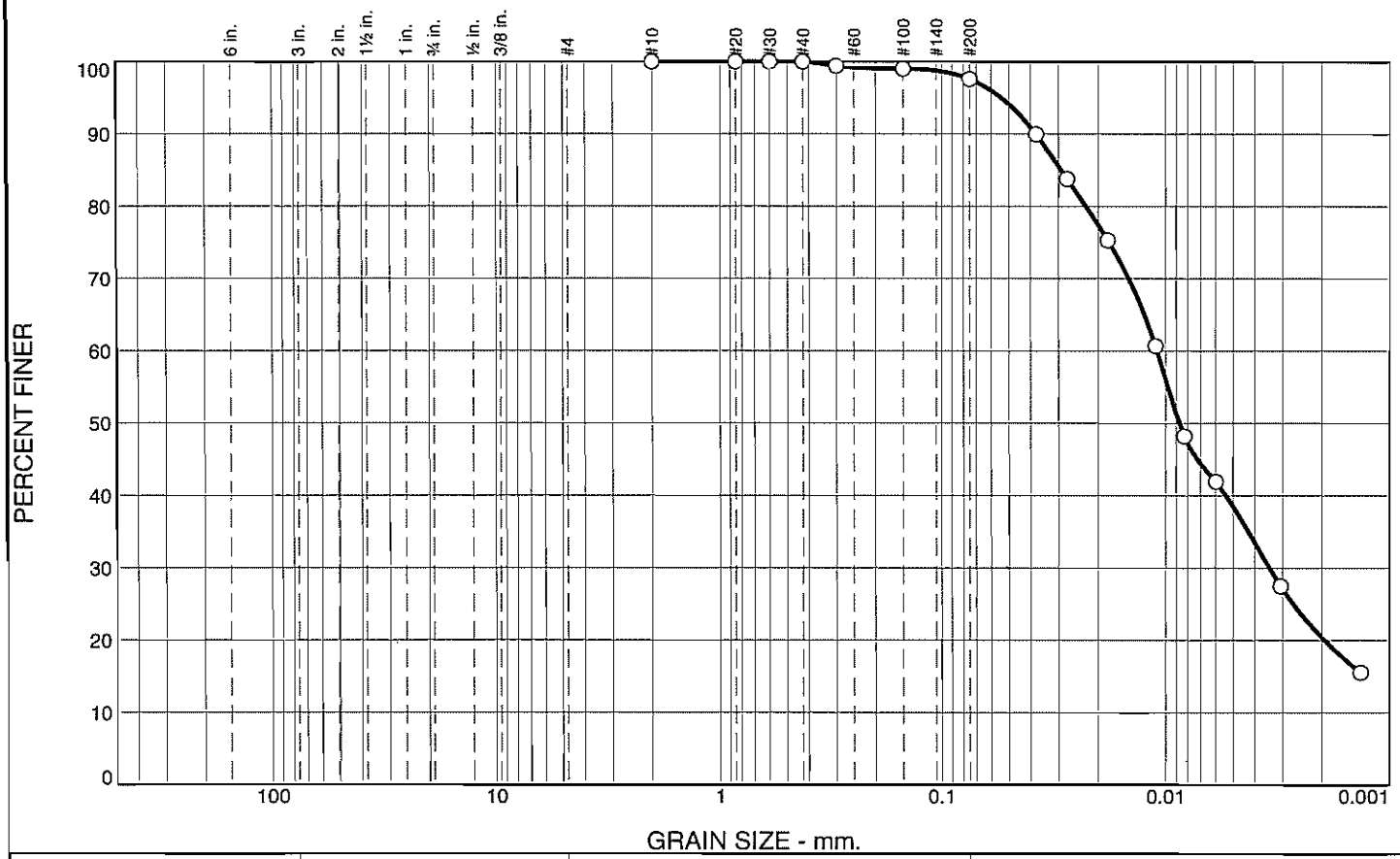
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	2.4	59.0	38.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#30	100.0		
#40	100.0		
#50	99.4		
#100	99.0		
#200	97.6		

* (no specification provided)

Material Description

Yellowish Brown Lean CLAY

Atterberg Limits

PL= 25 LL= 45 PI= 20

Coefficients

D_{90}= 0.0379 D_{85}= 0.0293 D_{60}= 0.0110
D_{50}= 0.0087 D_{30}= 0.0034 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(22)

Remarks

Sample Number: B24-2B **Depth:** 5.5'-6.0'

Date: 11-15-2010

Blackburn Consulting

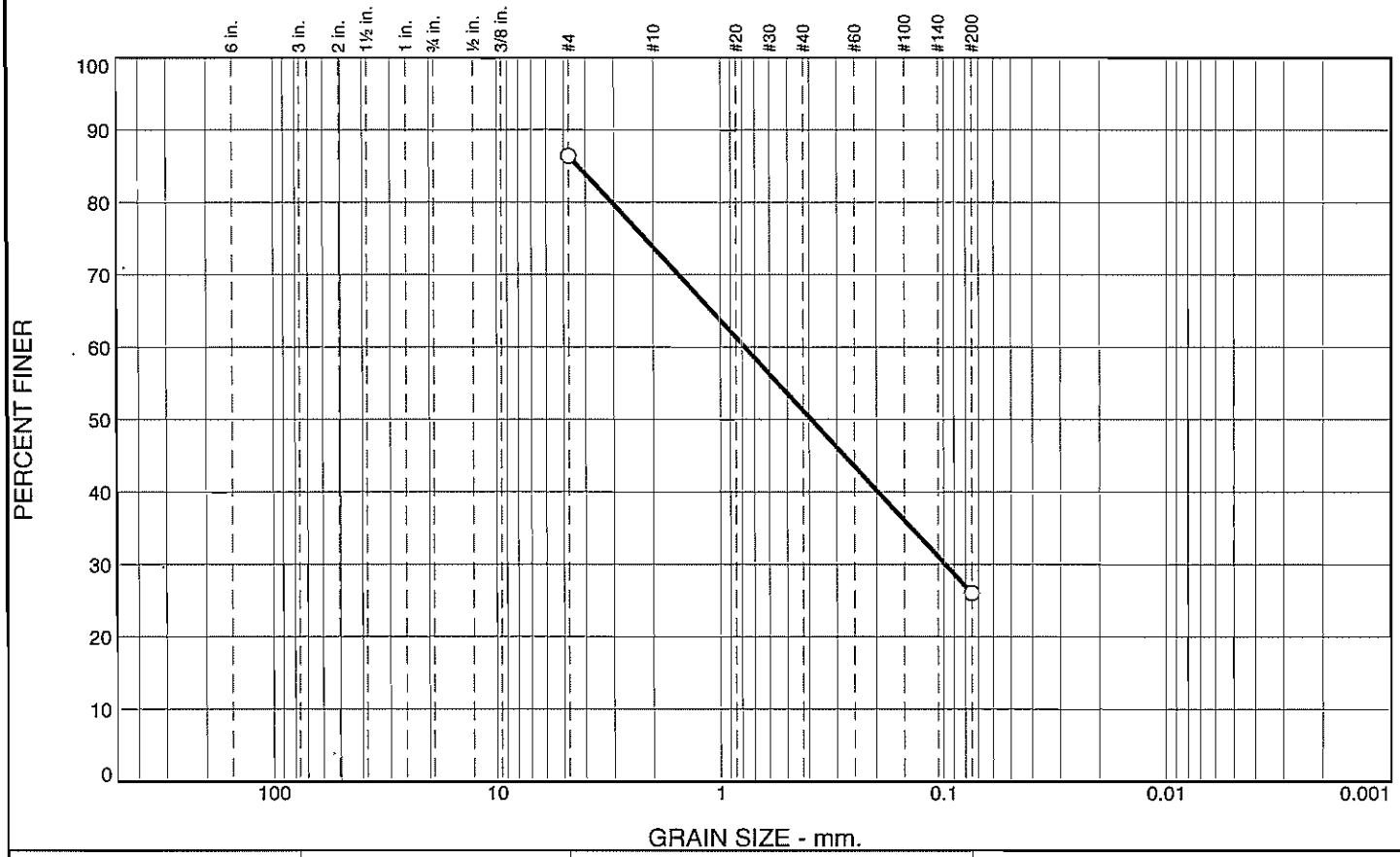
Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline

Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.6	22.5	25.3	26.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	86.4		
#200	26.0		

* (no specification provided)

Material Description

Yellowish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= 4.3196 D_{60}= 0.7752
D_{50}= 0.3900 D_{30}= 0.0987 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample Number: B24-3B **Depth:** 10.5'-11.0'

Date: 11-11-2010

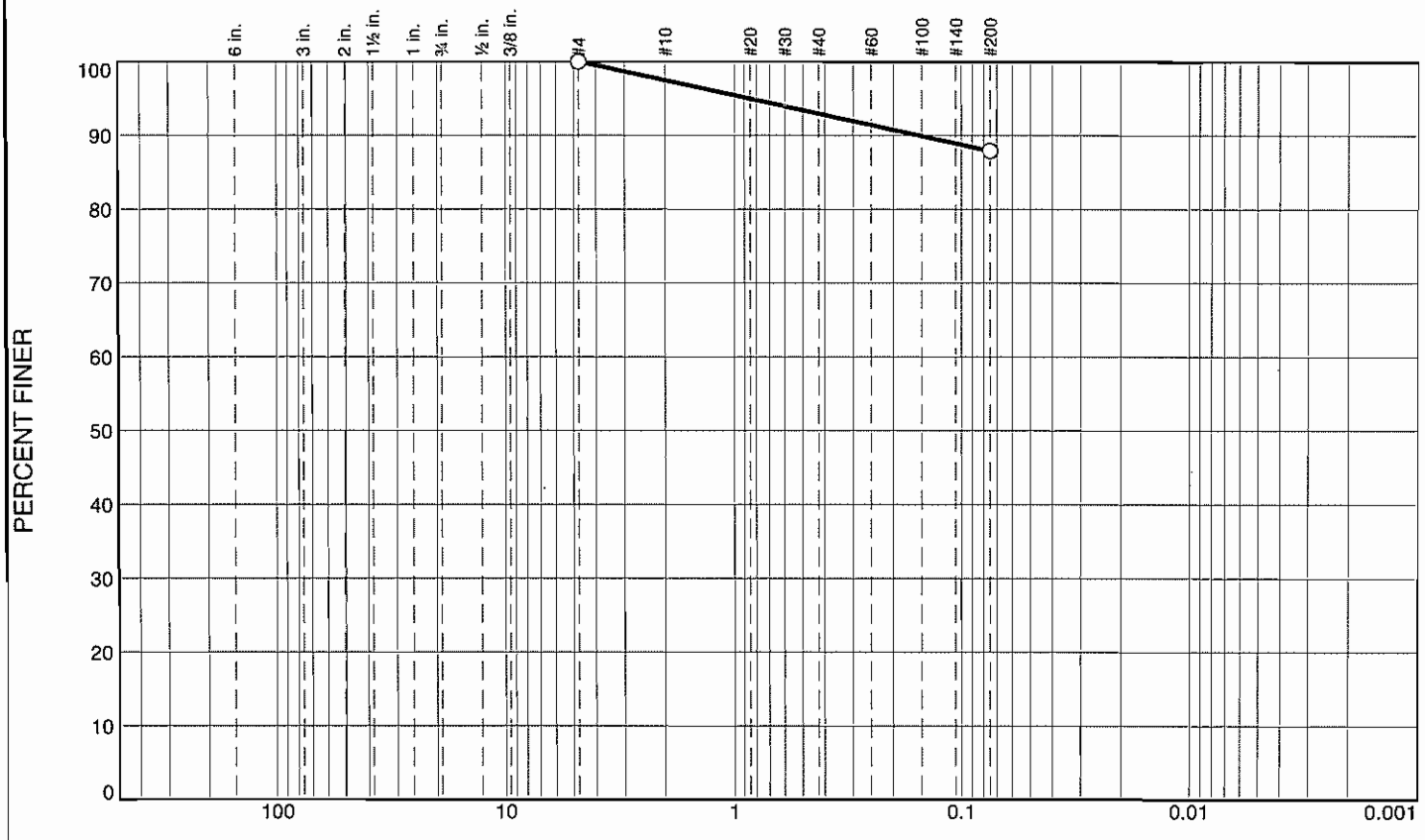
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.5	4.5	5.1	87.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#200	87.9		

* (no specification provided)

Material Description

Dark Yellowish Brown Fat CLAY

Atterberg Limits

PL= 21 LL= 63 PI= 42

Coefficients

D_{90}= 0.1539 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(40)

Remarks

Sample Number: B26-1B **Depth:** 2.5'-3.0'

Date: 11-11-2010

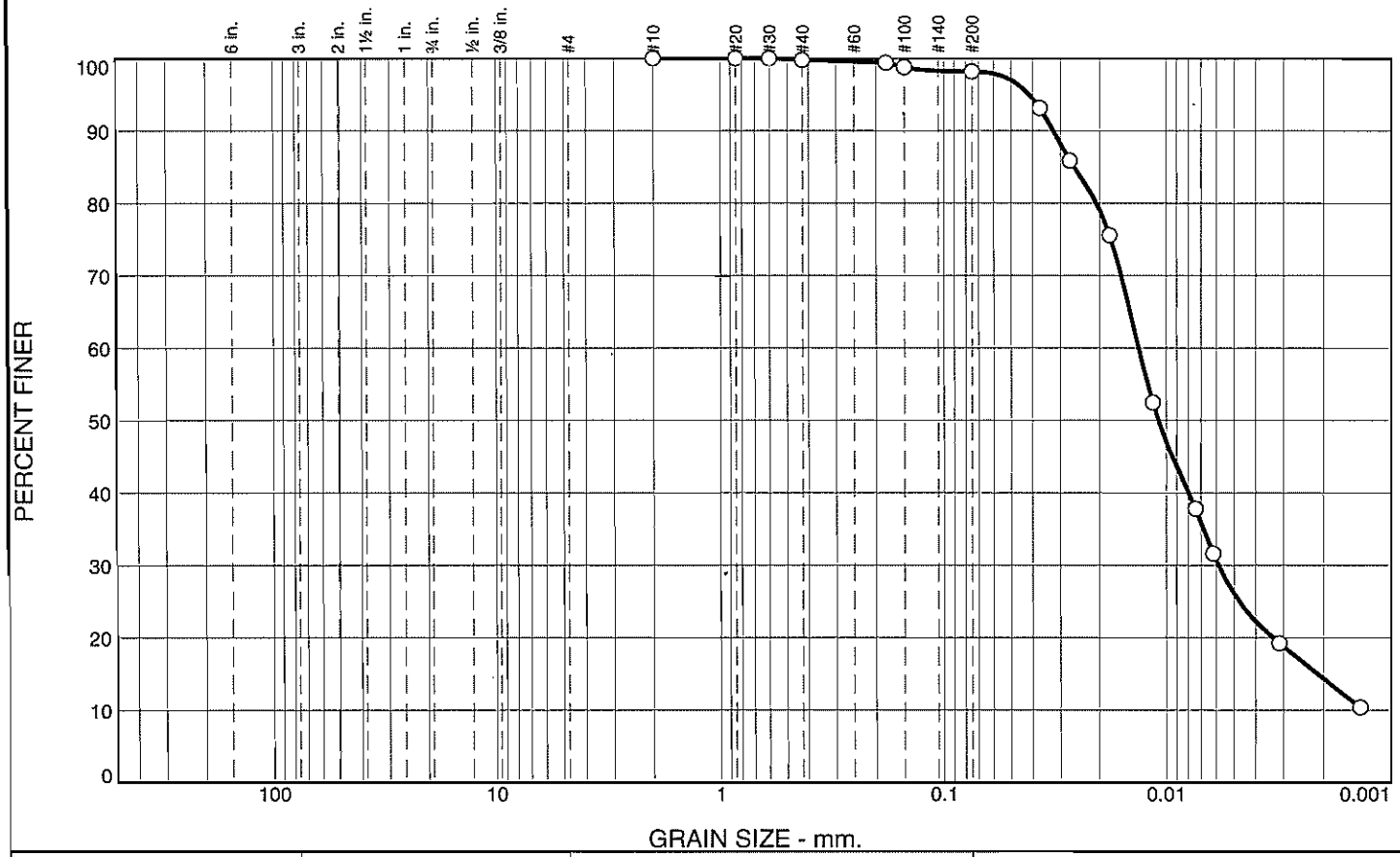
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	1.6	72.1	26.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.8		
#80	99.4		
#100	98.8		
#200	98.2		

* (no specification provided)

Material Description

Yellowish Brown SILT

Atterberg Limits

PL= 29 LL= 40 PI= 11

Coefficients

D_{90}= 0.0324 D_{85}= 0.0261 D_{60}= 0.0133
D_{50}= 0.0108 D_{30}= 0.0059 D_{15}= 0.0021
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-6(13)

Remarks

Sample Number: B26-2B **Depth:** 5.5'-6.0'

Date: 11-15-2010

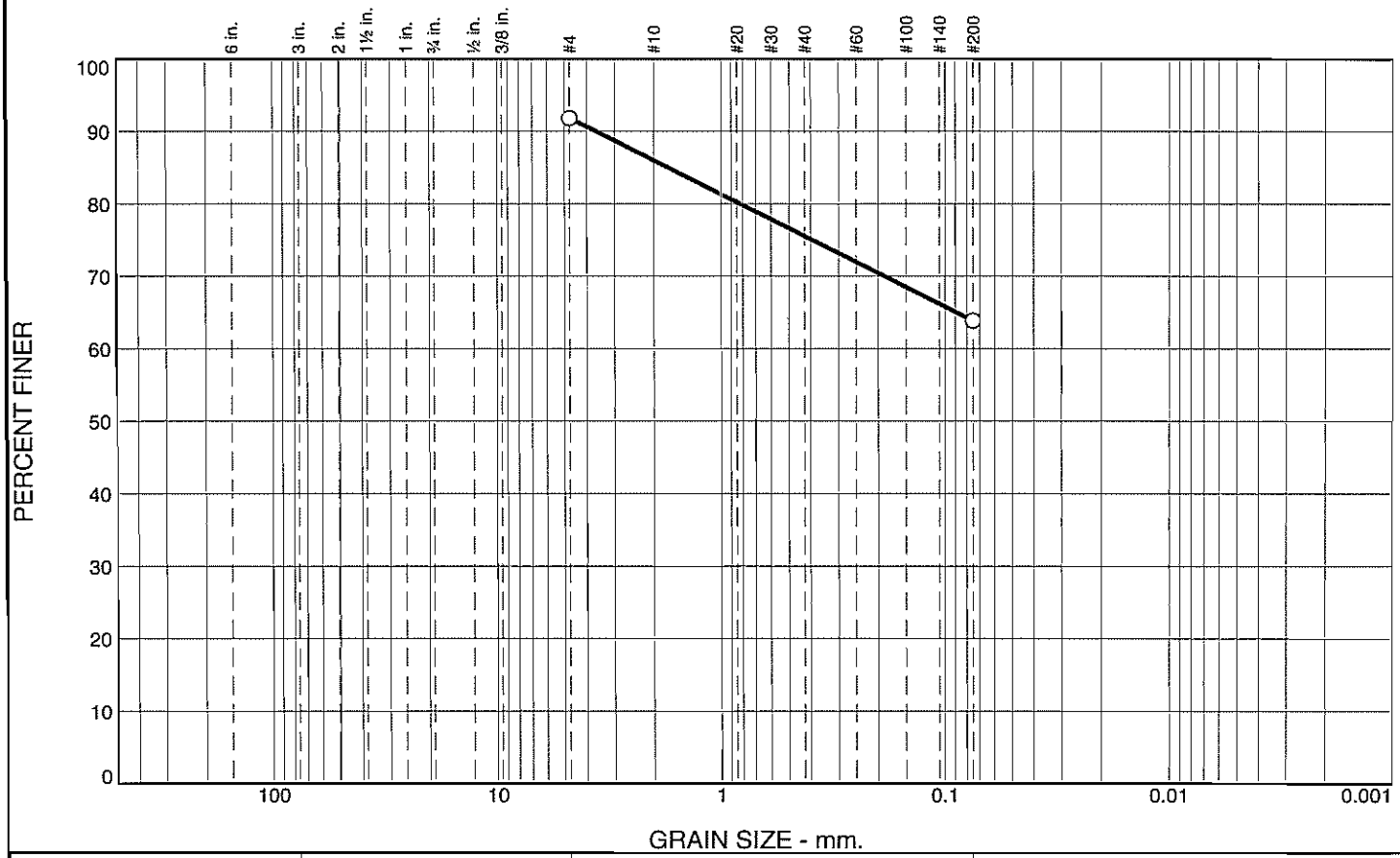
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			5.8	10.5	11.7	63.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	91.8		
#200	63.8		

* (no specification provided)

Material Description

Very Dark Gray Sandy Silty CLAY

Atterberg Limits

PL= 17 LL= 24 PI= 7

Coefficients

D_{90}= 3.6249 D_{85}= 1.7269 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(2)

Remarks

Sample Number: B32-1B **Depth:** 2.5'-3.0'

Date: 11-11-2010

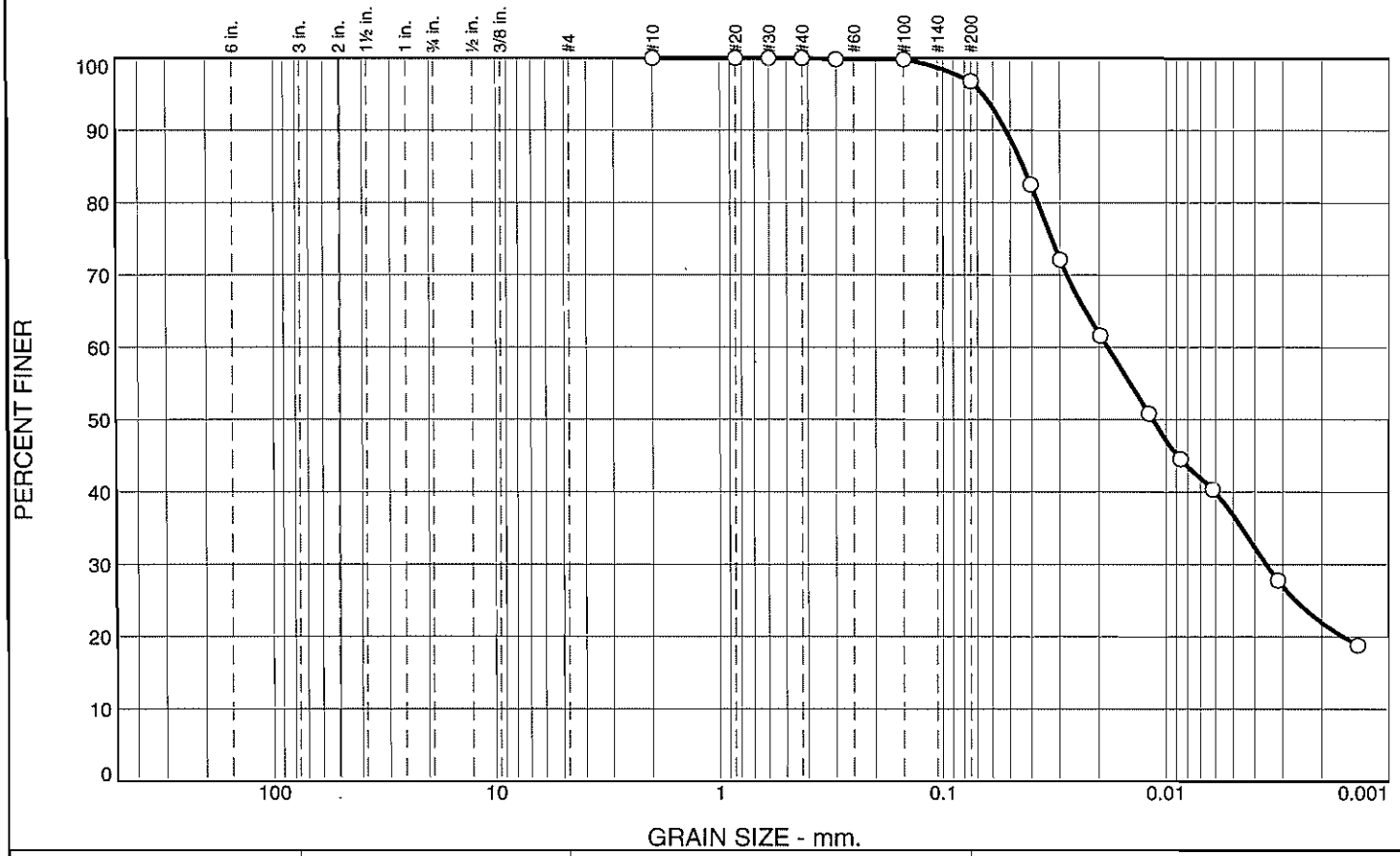
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	3.2	60.0	36.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#30	100.0		
#40	100.0		
#50	99.8		
#100	99.8		
#200	96.8		

* (no specification provided)

Material Description

Yellowish Brown SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0523 D_{85}= 0.0437 D_{60}= 0.0183
D_{50}= 0.0115 D_{30}= 0.0036 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Sample Number: B32-3B **Depth:** 10.5'-11.0'

Date: 11-15-2010

Blackburn Consulting

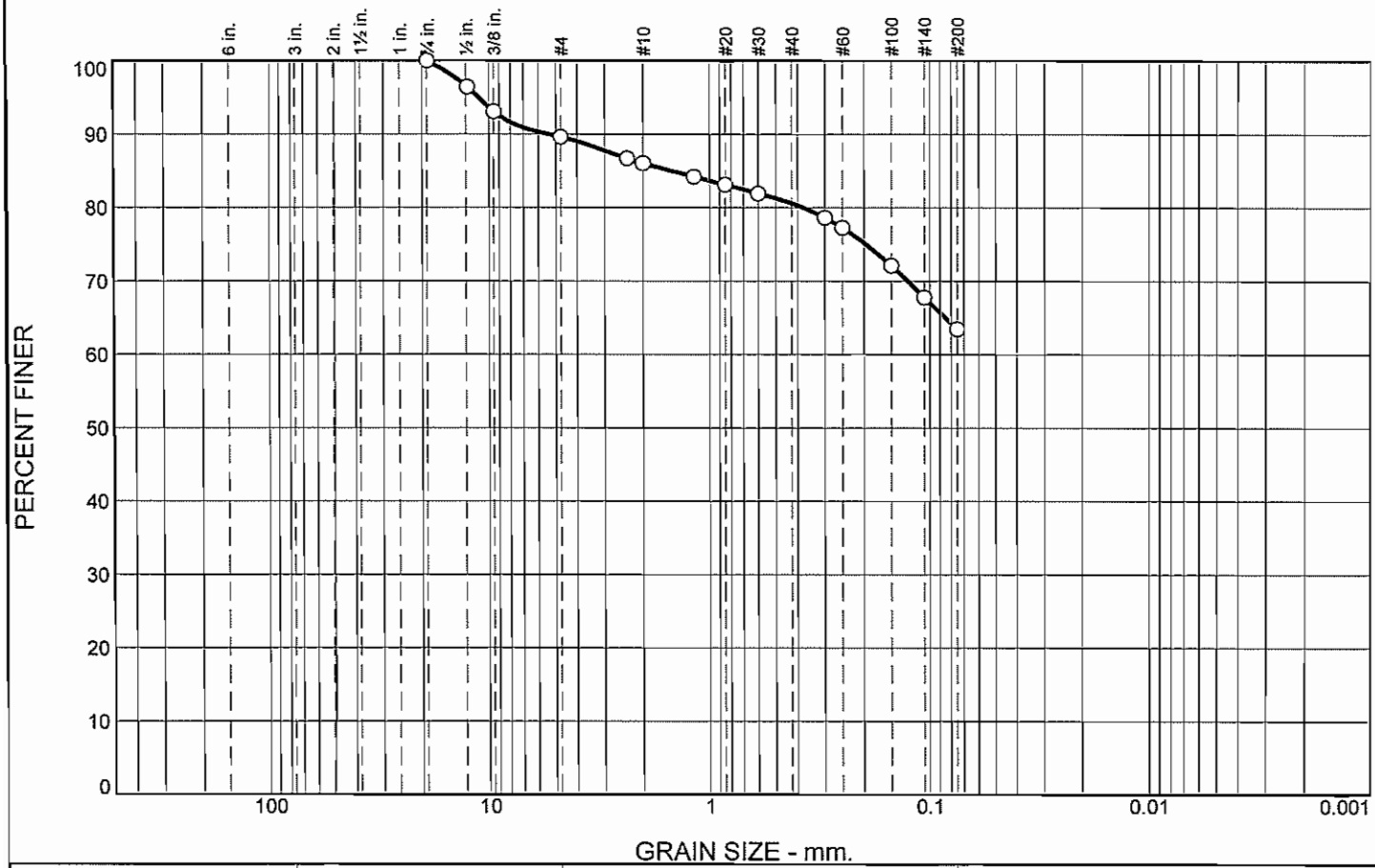
Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline

Project No: 2049.1 **Figure**

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

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.4	3.6	5.4	17.1	63.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.4		
3/8"	93.1		
#4	89.6		
#8	86.7		
#10	86.0		
#16	84.2		
#20	83.1		
#30	81.9		
#50	78.6		
#60	77.2		
#100	72.1		
#140	67.8		
#200	63.5		

* (no specification provided)

Soil Description

Fat CLAY and SILTY CLAY with SAND, trace GRAVEL, dark grayish brown and very dark gray

Atterberg Limits

PL= 17 LL= 42 PI= 25

Coefficients

D_{90}= 5.4170 D_{85}= 1.4996 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(13)

Remarks

Source of Sample: Composite B31 & B35 **Depth:** 1.5-4.5'
Sample Number: 1 **Date:** 10/26/10

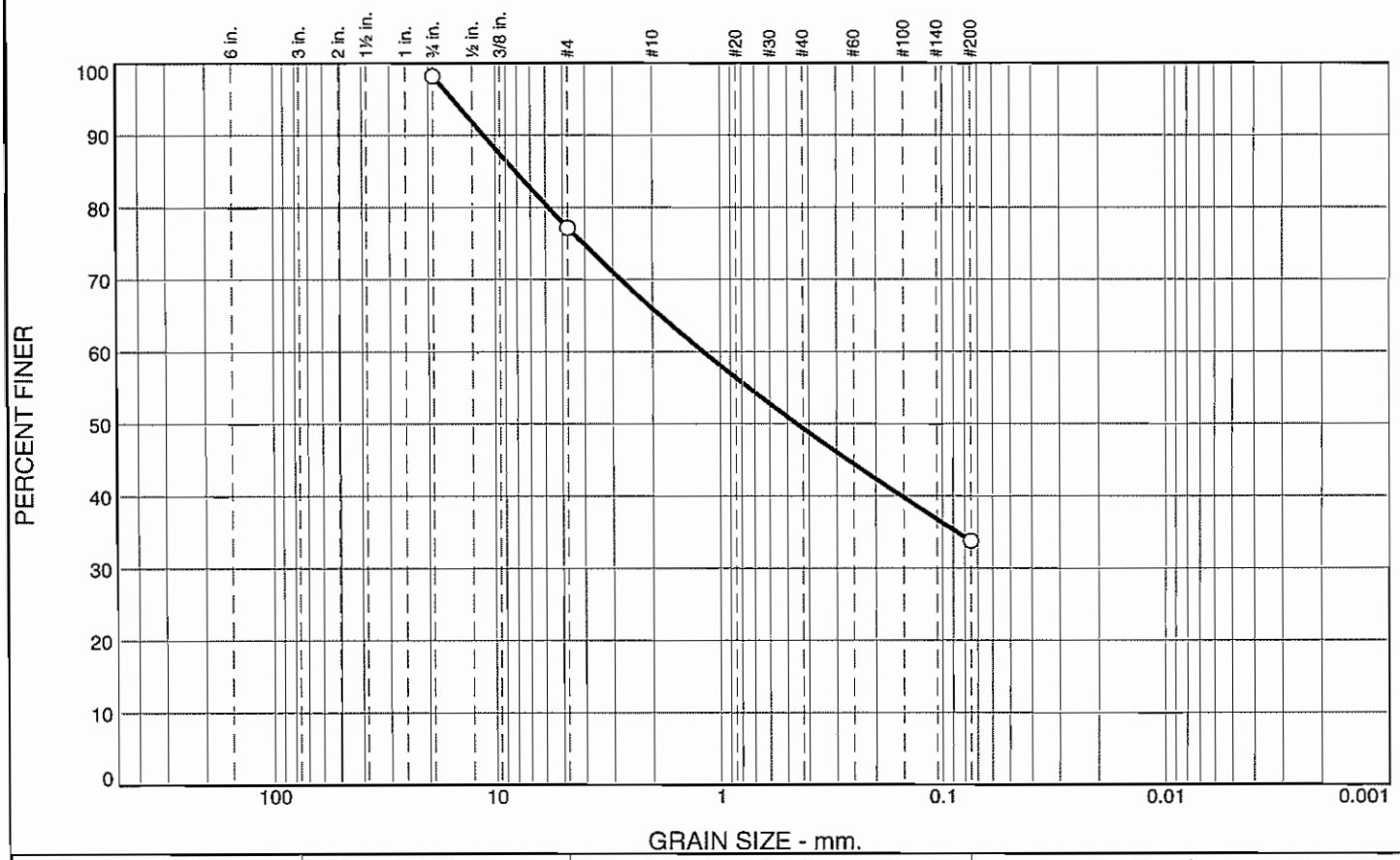
Blackburn Consulting

W. Sacramento, CA

Client: CDM
Project: Napa-Sonoma Pipeline

Project No: 2049.1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		21.0	11.2	16.6	15.7	33.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	98.2		
#4	77.2		
#200	33.7		

* (no specification provided)

Material Description

Dark Yellow Clayey SAND with Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.2785 D_{85}= 8.1333 D_{60}= 1.1918
D_{50}= 0.4526 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Sample Number: B36-3C **Depth:** 6.0'-6.5'

Date: 4-18-2011

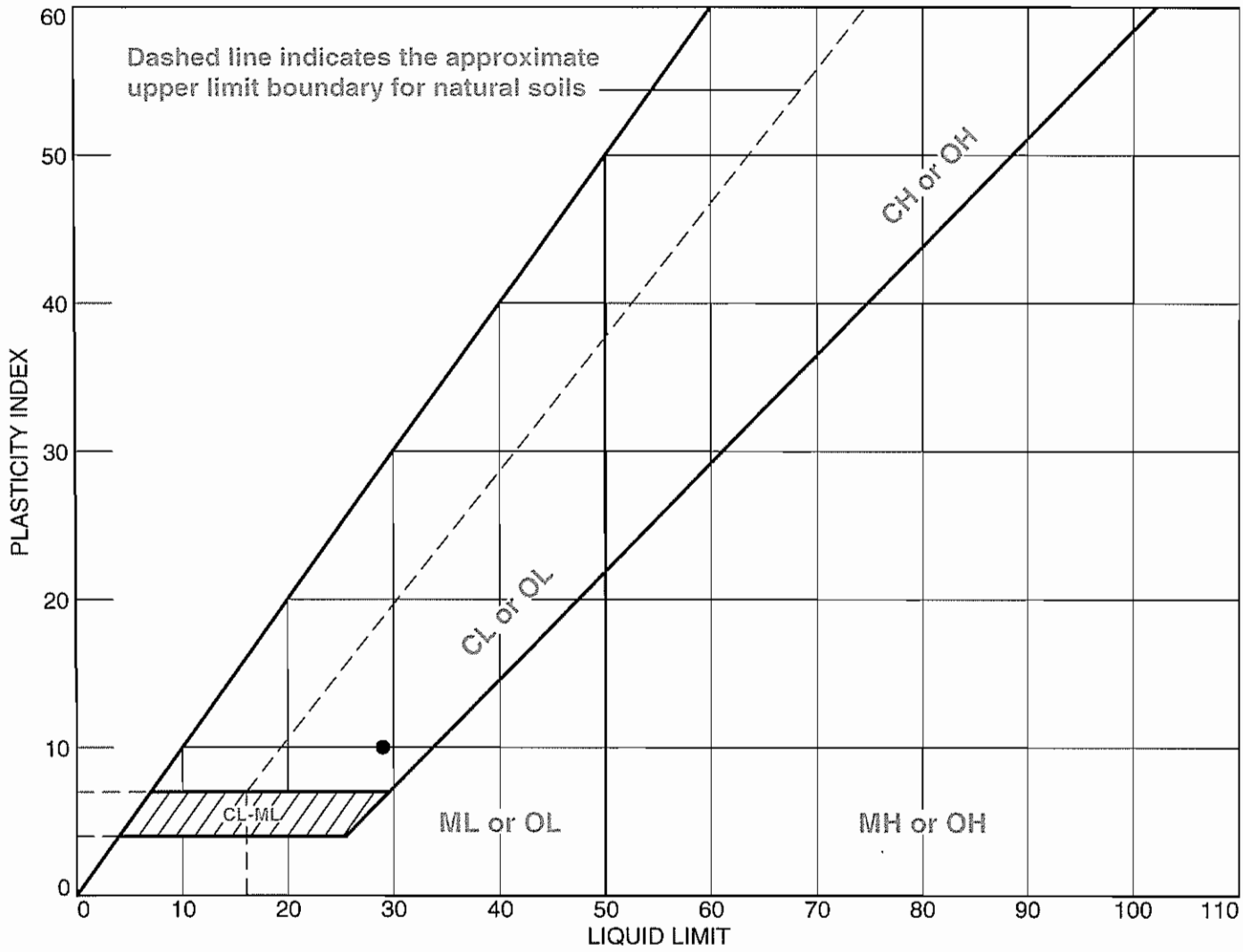
Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No: 2049.1 **Figure**

Tested By: KC **Checked By:** KC

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		B1-1 & B5-1 Combined	1.5'-3.0'		19	29	10	SC

Blackburn Consulting

Auburn, CA

Client: CDM

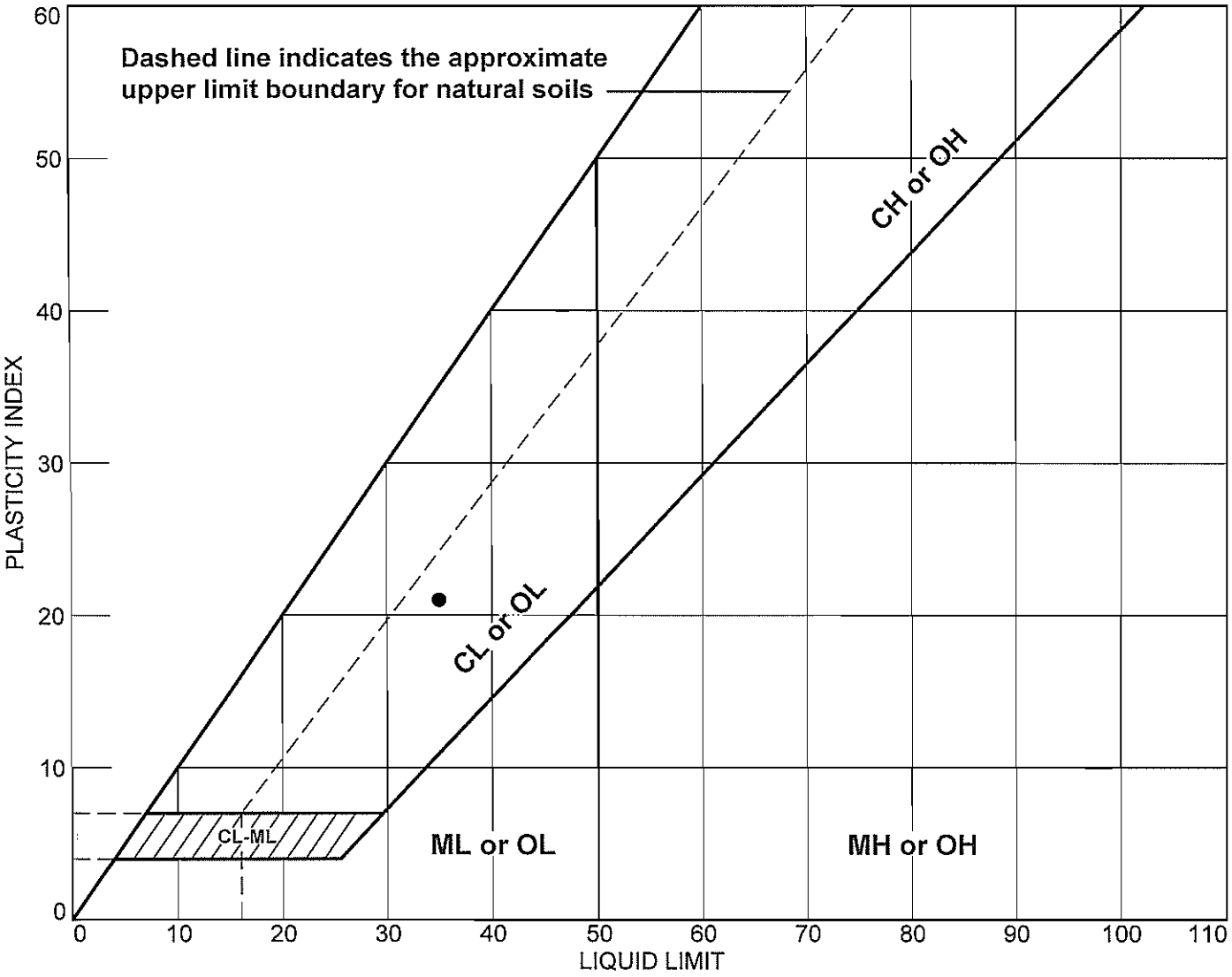
Project: Napa - Sonoma Pipeline

Project No.: 2049.1

Figure

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

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Composite B12 & B14	1	1.5-4.5'		14	35	21	CL

Blackburn Consulting

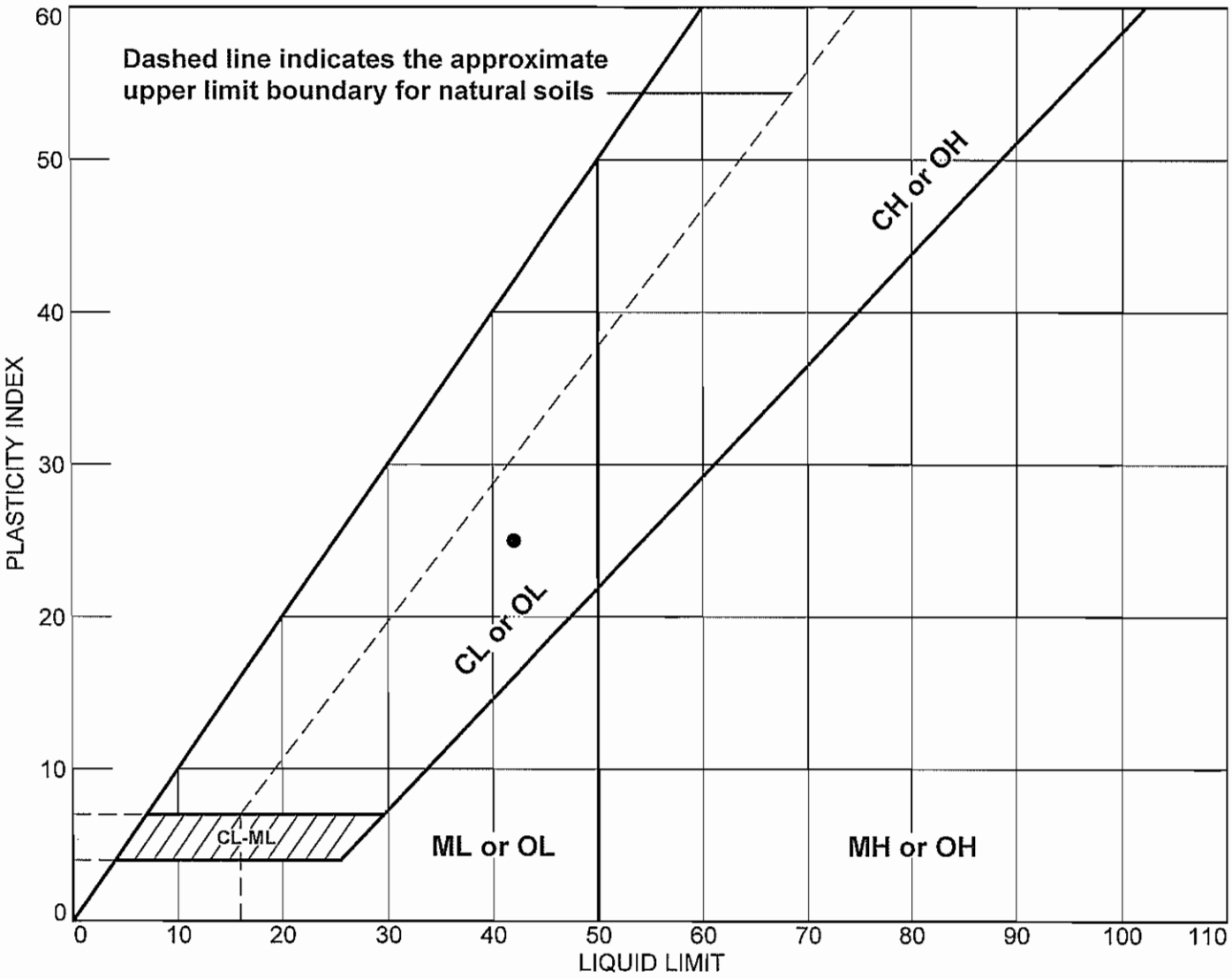
W. Sacramento, CA

Client: CDM

Project: Napa-Sonoma Pipeline

Project No.: 2049.1

LIQUID AND PLASTIC LIMITS TEST REPORT



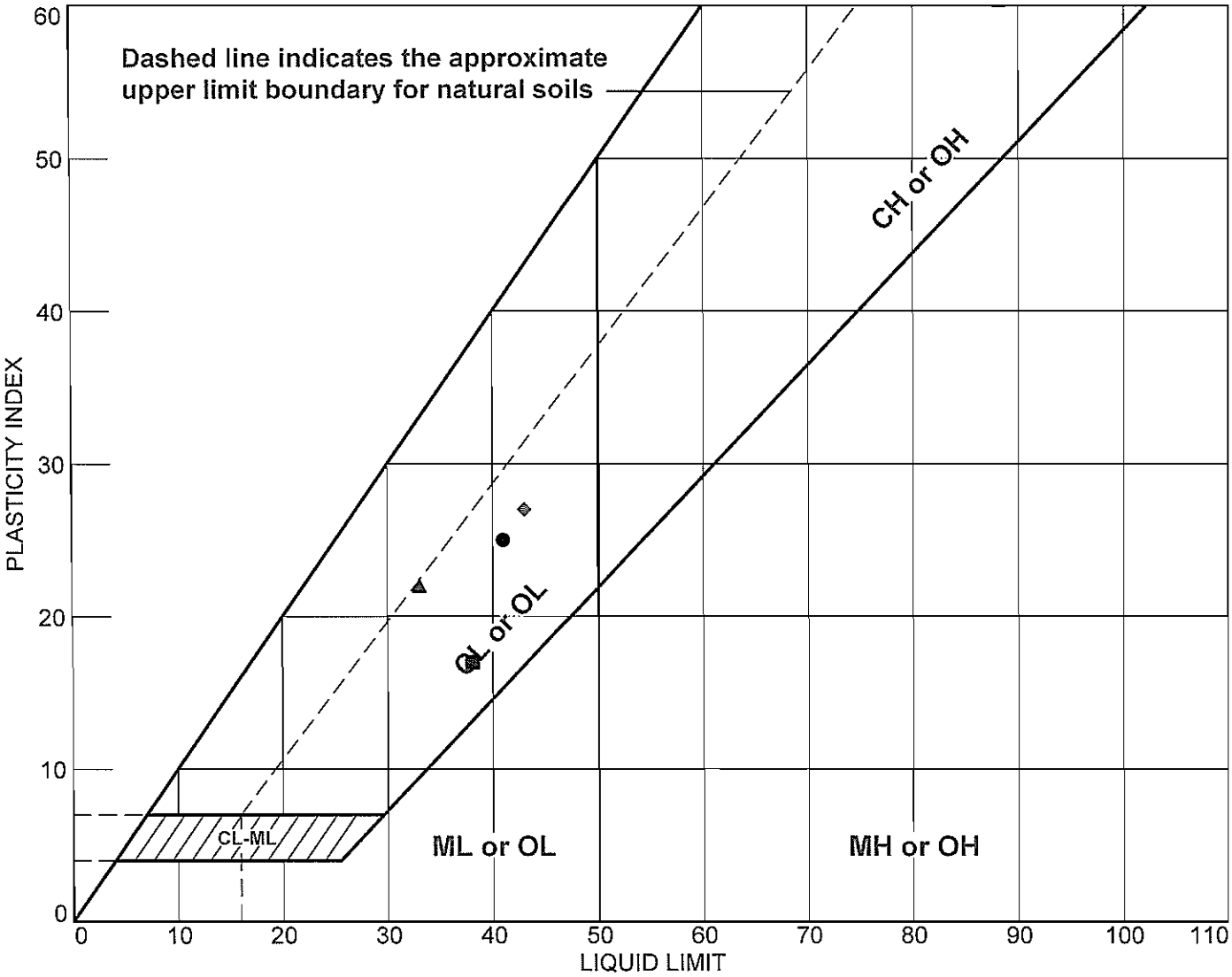
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Composite B31 & B35	1	1.5-4.5'		17	42	25	CL

Blackburn Consulting

W. Sacramento, CA

Client: CDM
Project: Napa-Sonoma Pipeline
Project No.: 2049.1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-7	1	1.5-4.5'		16	41	25	CL
■	B-8	7c	31.0-31.5'		21	38	17	CL
▲	B-13	2c	6.0-6.5'		11	33	22	CL
◆	B-15	1c	3.0-3.5'		16	43	27	CL

Blackburn Consulting

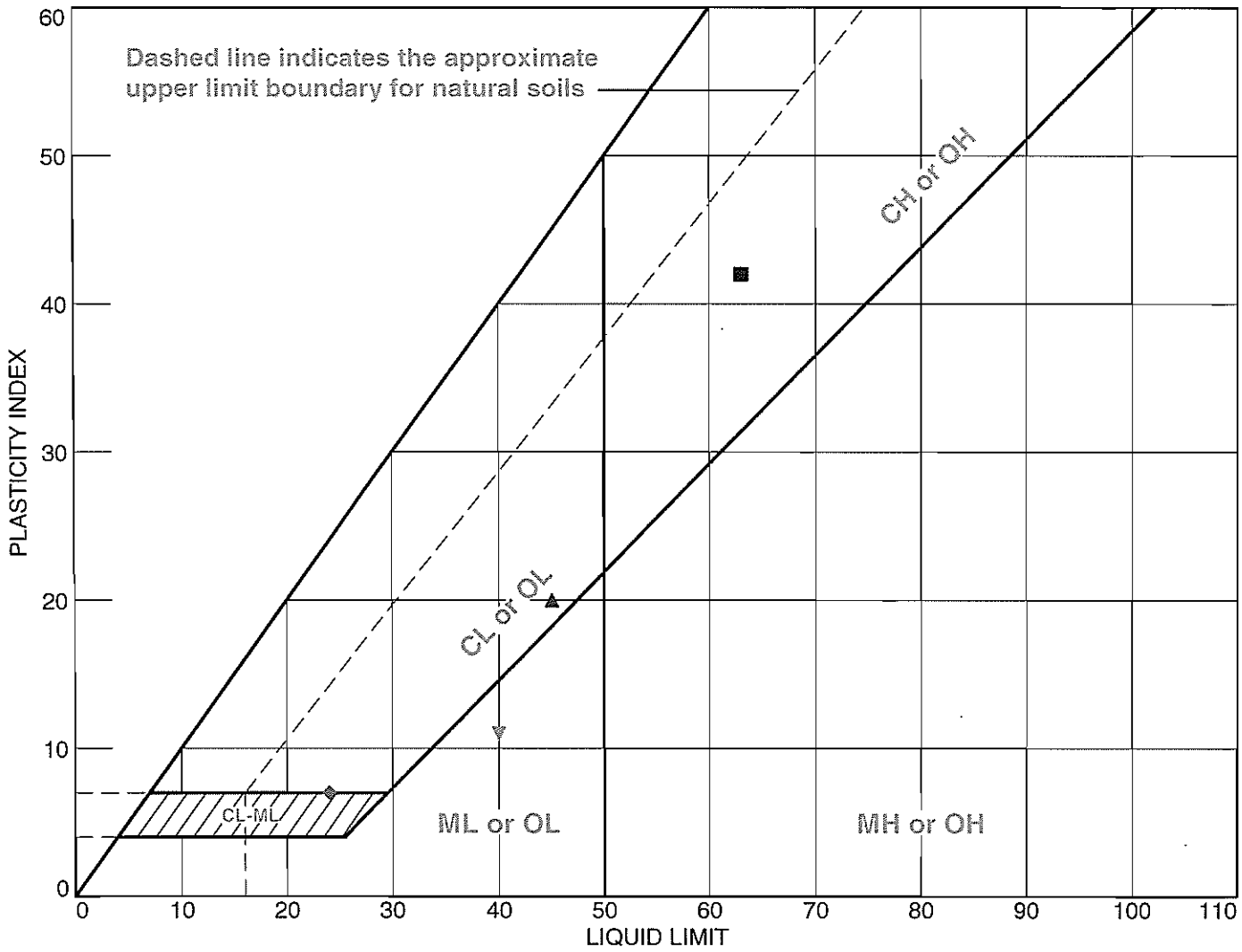
W. Sacramento, CA

Client: CDM

Project: Napa-Sonoma Pipeline

Project No.: 2049.1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		B1-6	16.5'-18.0'		NP	NV	NP	SM
■		B26-1B	2.5'-3.0'		21	63	42	CH
▲		B24-2B	5.5'-6.0'		25	45	20	CL
◆		B32-1B	2.5'-3.0'		17	24	7	CL-ML
▼		B26-2B	5.5'-6.0'		29	40	11	ML

Blackburn Consulting

Auburn, CA

Client: CDM

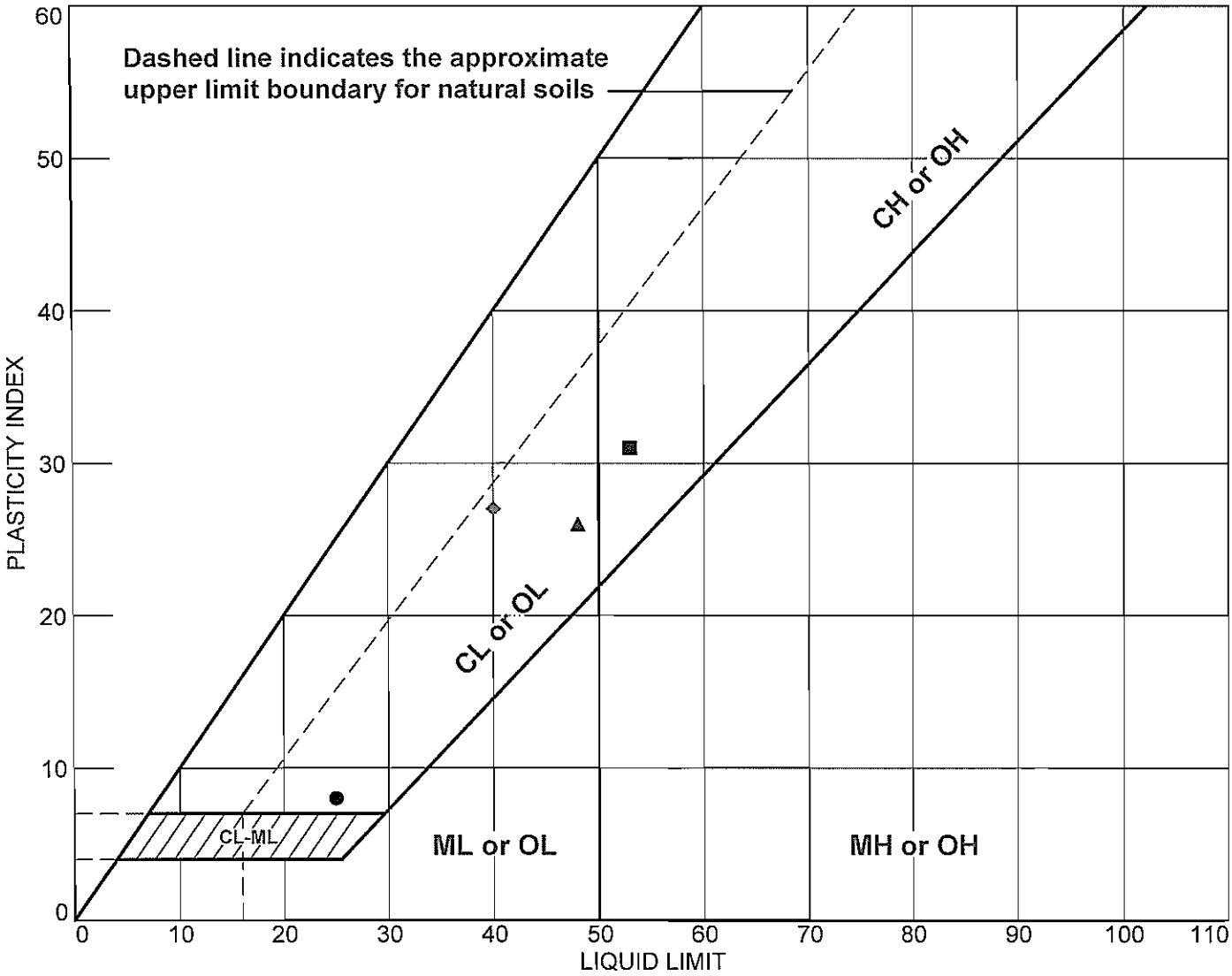
Project: Napa - Sonoma Pipeline

Project No.: 2049.1

Figure

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

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-20	1c	3.0-3.5'		17	25	8	CL
■	B-28	4c	16.0-16.5'		22	53	31	CH
▲	B-29	3c	11.0-11.5'		22	48	26	CL
◆	B-34	1c	3.0-3.5'		13	40	27	CL

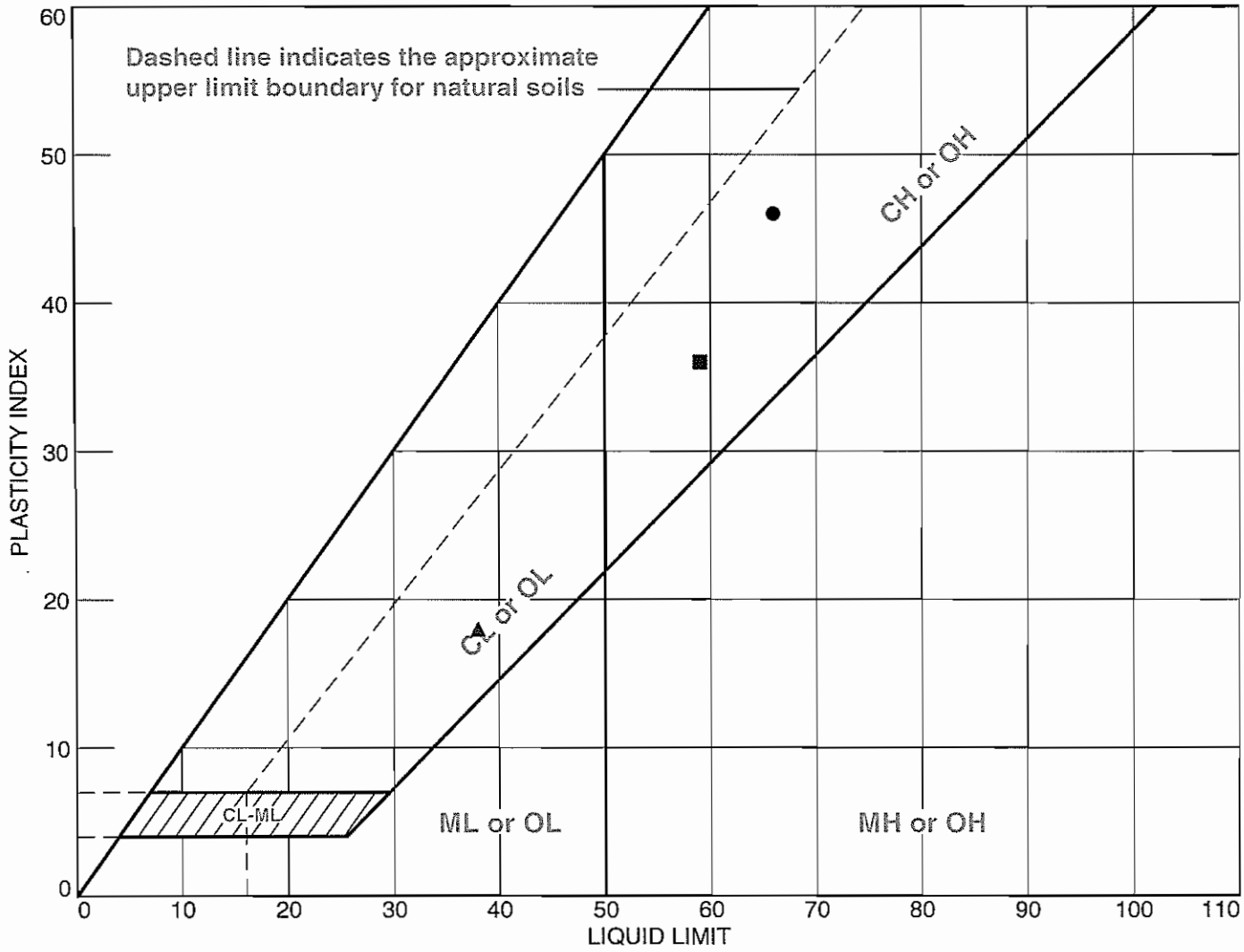
Blackburn Consulting

W. Sacramento, CA

Client: CDM
Project: Napa-Sonoma Pipeline

Project No.: 2049.1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		B37-3B	5.5'-6.0'		20	66	46	CH
■		B36-4B	10.5'-11.0'		23	59	36	CH
▲		B1-10B	35.5-36.0		20	38	18	CL

Blackburn Consulting

Auburn, CA

Client: CDM
Project: Napa - Sonoma Pipeline
Project No.: 2049.1
Figure

Tested By: ○ KLC □ KLC △ BWM **Checked By:** KLC

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipline
Project Number: 2049.1
Sample: B1-4b Depth: 10.5-11.0'
Sample Description: SILT/CLAY (ML/CL), dark yellowish brown, slightly cemented
Date: 4/9/2011
Tested By: MDR

Original Sample Length	5.481
Original Diameter (in)	2.407
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.55

Test Results

Axial Strain at Max. Load	2.0%
Average cross-sectional area (in^2)	4.64
Deflection at Max. Load (in)	0.110
Maximum Load (lbs)	87
Strain at Failure (%)	0.60
Compressive Strength (tsf)	**1.35**

Moisture Density

Tube and Sample (g)	783.02
Tube (g)	0.00
Sample Weight (g)	783.02
Tare Number	D6
Tare Weight (g)	169.31
Wet Weight (g)	600.43
Dry Weight (g)	522.80
Dry Weight (g)	353.49
Water Weight (g)	77.63
Percent Moisture (%)*	22.0
Wet Density (pcf)	119.6
Dry Density (pcf)	98.1

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

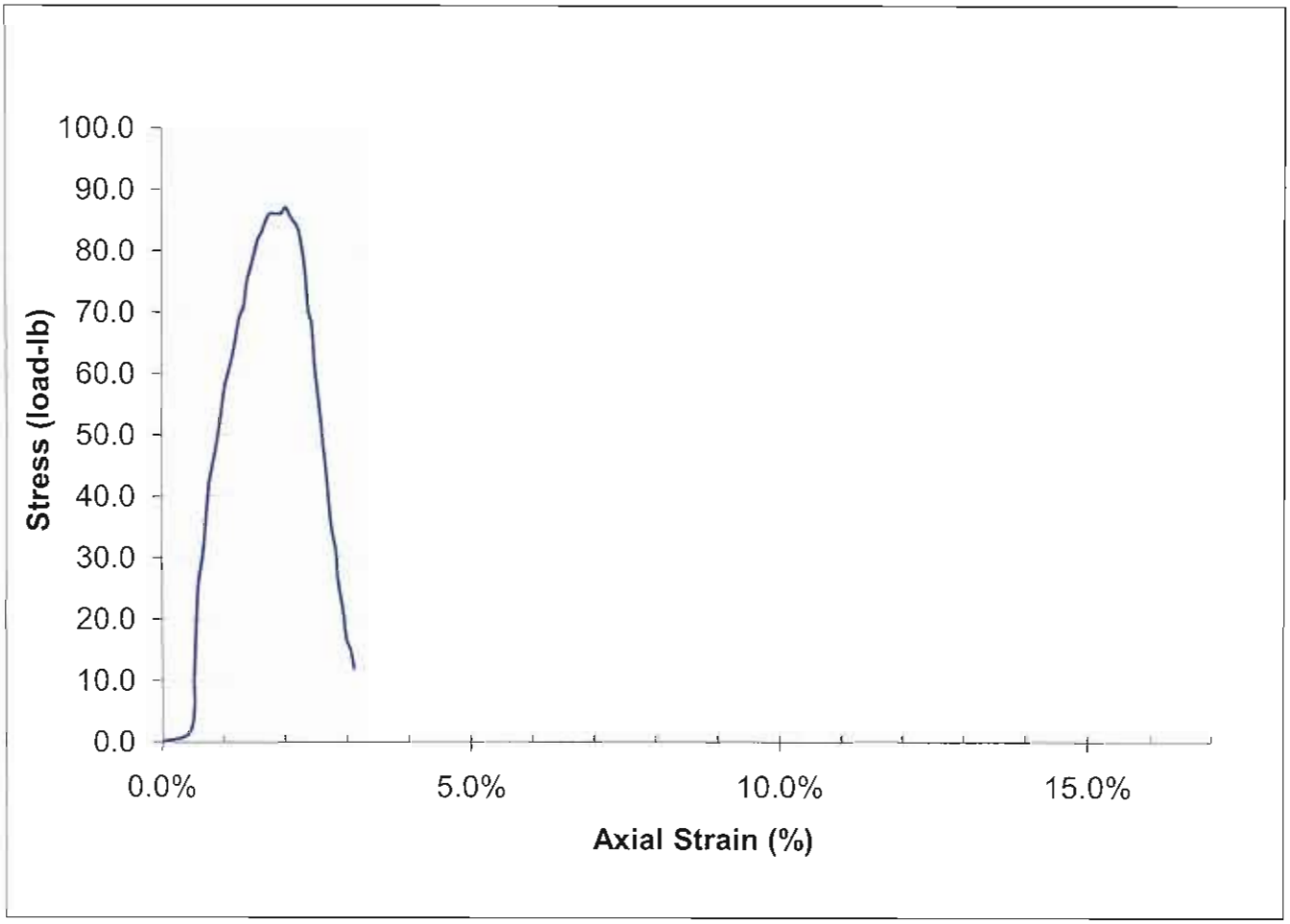
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.026	2	0.079	77	0.133	68		
0.029	12	0.083	80	0.136	60		
0.032	25	0.086	82	0.140	54		
0.036	30	0.089	83	0.143	48		
0.039	36	0.093	85	0.146	43		
0.042	42	0.096	86	0.150	35		
0.046	46	0.099	86	0.154	31		
0.049	49	0.103	86	0.156	26		
0.053	54	0.106	86	0.160	22		
0.056	58	0.110	87	0.163	17		
0.059	60	0.113	86	0.167	15		
0.063	63	0.116	85	0.170	12		
0.066	66	0.120	84				
0.069	69	0.123	82				
0.073	71	0.127	77				
0.076	75	0.130	70				

Project
Napa-Sonoma Pipline
Project Number
2049.1
Sample Number
B1-4b
Material Description
SILT/CLAY (ML/CL), dark yellowish brown, slightly cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	119.6
Dry Density (pcf)	98.1
% Moisture	22.0

Unconfined Compressive Strength (tsf)	1.35

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B2-2c Depth: 6.0-6.5'
Sample Description: Lean CLAY, black
Date: 11/13/2010
Tested By: MDR

Original Sample Length	4.990
Original Diameter (in)	2.392
Height-to-Diameter Ratio	2.1 : 1
Sample Area (in^2)	4.49

Test Results

Axial Strain at Max. Load	5.7%
Average cross-sectional area (in^2)	4.76
Deflection at Max. Load (in)	0.283
Maximum Load (lbs)	102
Strain at Failure (%)	1.41
Compressive Strength (tsf)	**1.54**

Moisture Density

Tube and Sample (g)	681.20
Tube (g)	0.00
Sample Weight (g)	681.20
Tare Number	O
Tare Weight (g)	232.60
Wet Weight (g)	587.60
Dry Weight (g)	510.90
Dry Weight (g)	278.30
Water Weight (g)	76.70
Percent Moisture (%)*	27.6
Wet Density (pcf)	115.7
Dry Density (pcf)	90.7

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

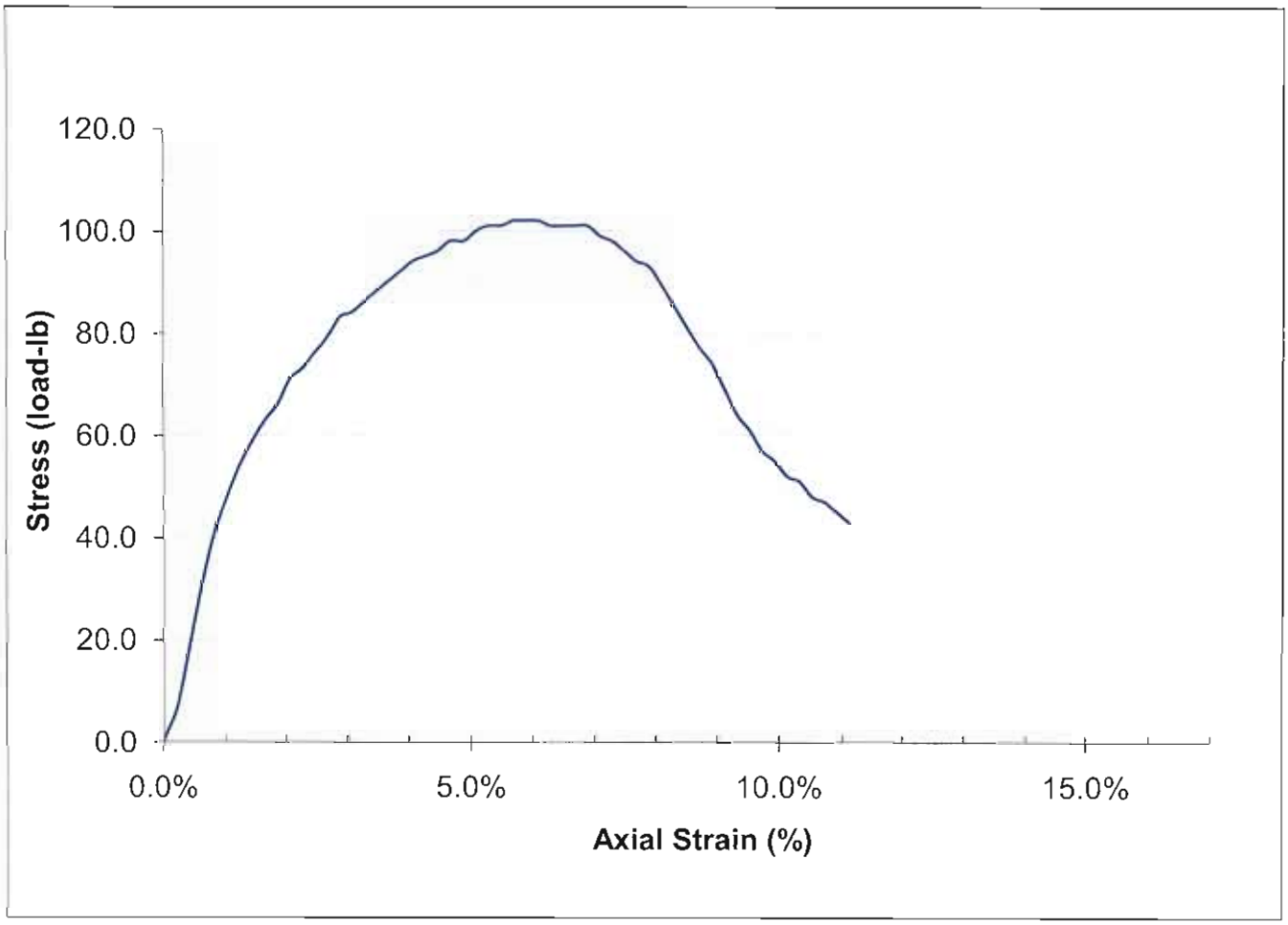
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.001	1	0.162	86	0.323	101	0.484	57
0.011	7	0.172	88	0.333	101	0.494	55
0.021	19	0.182	90	0.343	101	0.504	52
0.031	31	0.192	92	0.353	99	0.514	51
0.041	41	0.202	94	0.363	98	0.524	48
0.051	48	0.212	95	0.373	96	0.534	47
0.061	54	0.222	96	0.383	94	0.544	45
0.072	59	0.232	98	0.393	93	0.554	43
0.082	63	0.243	98	0.404	89	0.564	43
0.092	66	0.253	100	0.414	85	0.575	41
0.102	71	0.263	101	0.424	81	0.585	39
0.112	73	0.273	101	0.434	77	0.595	38
0.122	76	0.283	102	0.444	74	0.605	37
0.132	79	0.293	102	0.454	69	0.608	37
0.142	83	0.303	102	0.464	64		
0.152	84	0.313	101	0.474	61		

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B2-2c
Material Description
Lean CLAY, black
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	115.7
Dry Density (pcf)	90.7
% Moisture	27.6

Unconfined Compressive Strength (tsf)	1.54

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipline
Project Number: 2049.1
Sample: B7-5c Depth: 16.0-16.5'
Sample Description: Lean CLAY, brown, partially cemented
Date: 10/30/2010
Tested By: MDR

Original Sample Length	6.012
Original Diameter (in)	2.396
Height-to-Diameter Ratio	2.5 : 1
Sample Area (in^2)	4.51

Test Results

Axial Strain at Max. Load	5.3%
Average cross-sectional area (in^2)	4.76
Deflection at Max. Load (in)	0.321
Maximum Load (lbs)	292
Strain at Failure (%)	1.93
Compressive Strength (tsf)	**4.41**

Moisture Density

Tube and Sample (g)	873.00
Tube (g)	0.00
Sample Weight (g)	873.00
Tare Number	O
Tare Weight (g)	232.60
Wet Weight (g)	716.30
Dry Weight (g)	609.20
Dry Weight (g)	376.60
Water Weight (g)	107.10
Percent Moisture (%)*	28.4
Wet Density (pcf)	122.7
Dry Density (pcf)	95.5

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

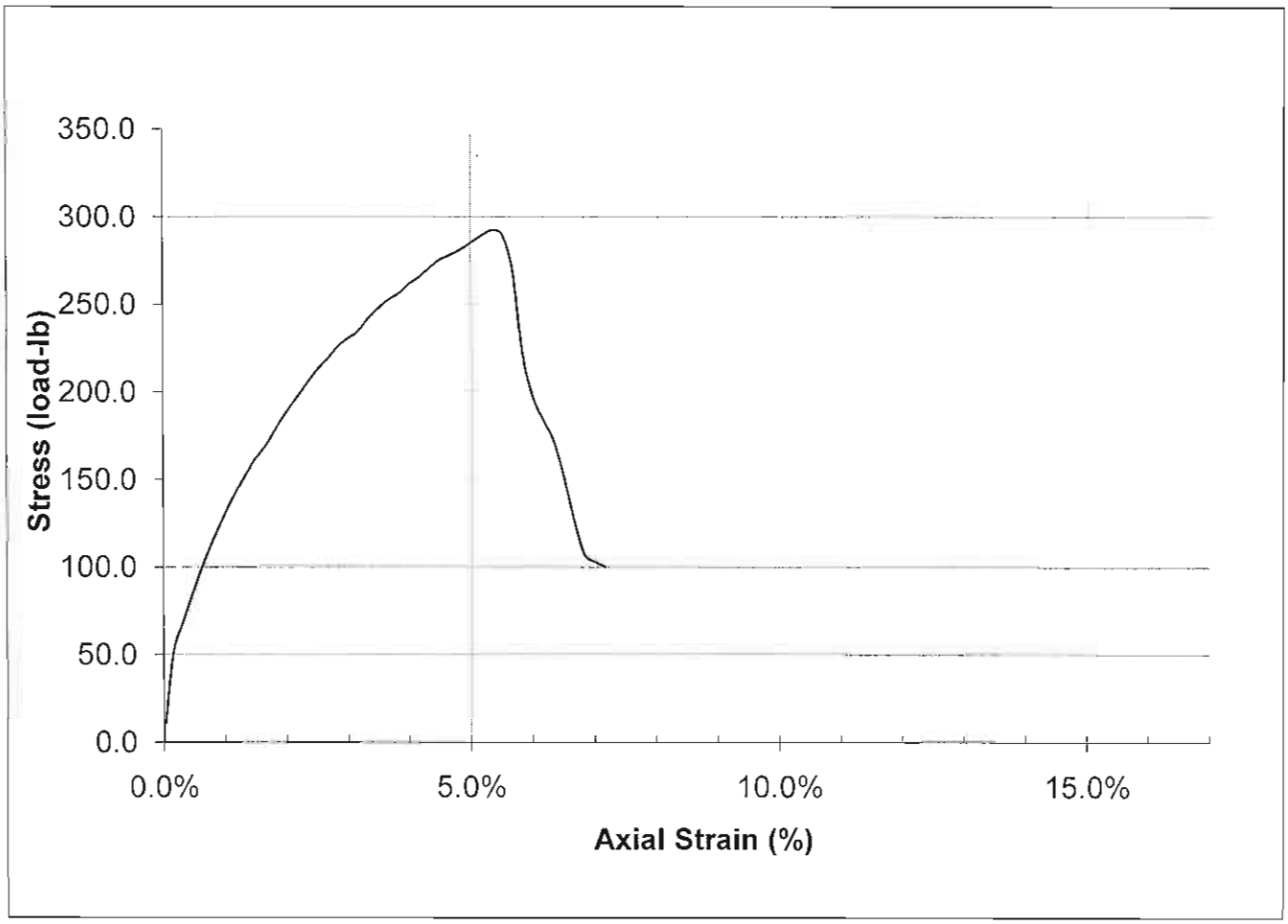
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
	2	0.160	218	0.321	292		
0.009	50	0.170	225	0.331	290		
0.019	69	0.180	230	0.341	270		
0.029	86	0.190	234	0.351	222		
0.039	102	0.200	241	0.361	197		
0.049	116	0.210	247	0.371	184		
0.059	129	0.220	252	0.381	172		
0.069	141	0.231	256	0.391	152		
0.079	151	0.240	261	0.401	127		
0.089	161	0.250	265	0.411	107		
0.101	170	0.260	270	0.421	103		
0.110	179	0.270	275	0.431	100		
0.120	188	0.281	278	0.442	98		
0.130	196	0.291	281	0.452	94		
0.140	204	0.301	285	0.462	92		
0.150	212	0.311	289	0.471	91		

Project
Napa-Sonoma Pipline
Project Number
2049.1
Sample Number
B7-5c
Material Description
Lean CLAY, brown, partially cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	122.7
Dry Density (pcf)	95.5
% Moisture	28.4

Unconfined Compressive Strength (tsf)	4.41

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B8-1c Depth: 3.0-3.5'
Sample Description: SANDY CLAY, very dark brown & brown, with fine-medium GRAVEL and rootlets
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.537
Original Diameter (in)	2.404
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.54

Test Results

Axial Strain at Max. Load	5.9%
Average cross-sectional area (in^2)	4.82
Deflection at Max. Load (in)	0.324
Maximum Load (lbs)	80
Strain at Failure (%)	1.79
Compressive Strength (tsf)	**1.19**

Moisture Density

Tube and Sample (g)	869.60
Tube (g)	0.00
Sample Weight (g)	869.60
Tare Number	F7
Tare Weight (g)	179.50
Wet Weight (g)	653.70
Dry Weight (g)	587.10
Dry Weight (g)	407.60
Water Weight (g)	66.60
Percent Moisture (%)*	16.3
Wet Density (pcf)	131.8
Dry Density (pcf)	113.3

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

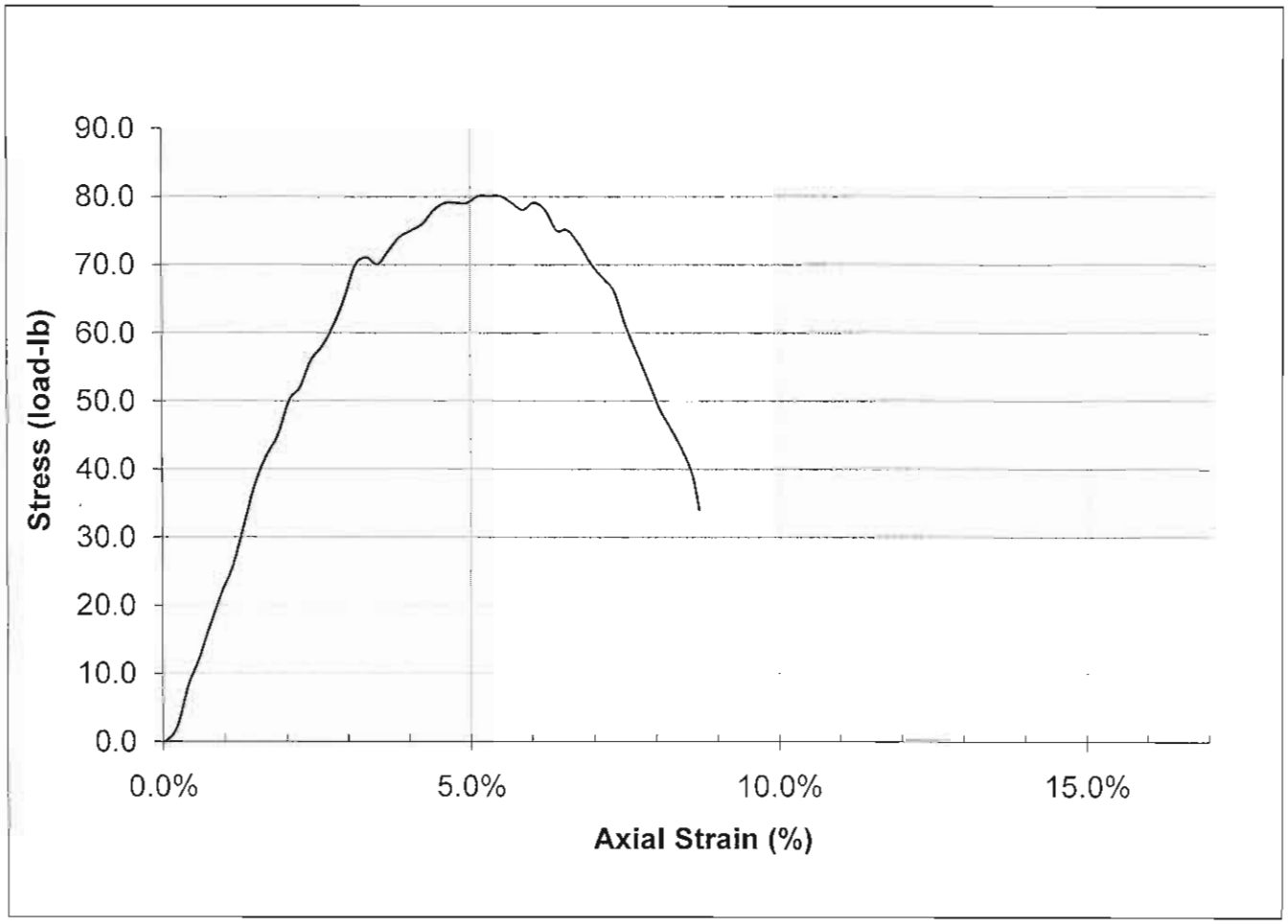
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.002	2	0.163	70	0.324	79	0.481	34
0.012	8	0.173	71	0.334	78		
0.022	12	0.183	70	0.344	75		
0.032	17	0.193	72	0.354	75		
0.042	22	0.203	74	0.364	73		
0.053	26	0.213	75	0.374	70		
0.063	32	0.224	76	0.385	68		
0.073	38	0.234	78	0.395	66		
0.083	42	0.244	79	0.405	61		
0.093	45	0.254	79	0.415	57		
0.103	50	0.264	79	0.425	53		
0.113	52	0.274	80	0.435	49		
0.123	56	0.284	80	0.445	46		
0.133	58	0.294	80	0.455	43		
0.143	61	0.304	79	0.465	39		
0.153	65	0.314	78	0.475	34		

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B8-1c
Material Description
SANDY CLAY, very dark brown & brown, with fine-medium GRAVEL and rootlets
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	131.8
Dry Density (pcf)	113.3
% Moisture	16.3

Unconfined Compressive Strength (tsf)	1.19

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B8-5c Depth: 21.0-21.5'
Sample Description: CLAYEY SILT (SILTY CLAY), brown/orange brown mottled
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.673
Original Diameter (in)	2.406
Height-to-Diameter Ratio	2.4 : 1
Sample Area (in^2)	4.55

Test Results

Axial Strain at Max. Load	6.7%
Average cross-sectional area (in^2)	4.87
Deflection at Max. Load (in)	0.381
Maximum Load (lbs)	72
Strain at Failure (%)	2.16
Compressive Strength (tsf)	**1.06**

Moisture Density

Tube and Sample (g)	801.50
Tube (g)	0.00
Sample Weight (g)	801.50
Tare Number	F8
Tare Weight (g)	167.70
Wet Weight (g)	527.50
Dry Weight (g)	439.10
Dry Weight (g)	271.40
Water Weight (g)	88.40
Percent Moisture (%)*	32.6
Wet Density (pcf)	118.4
Dry Density (pcf)	89.3

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

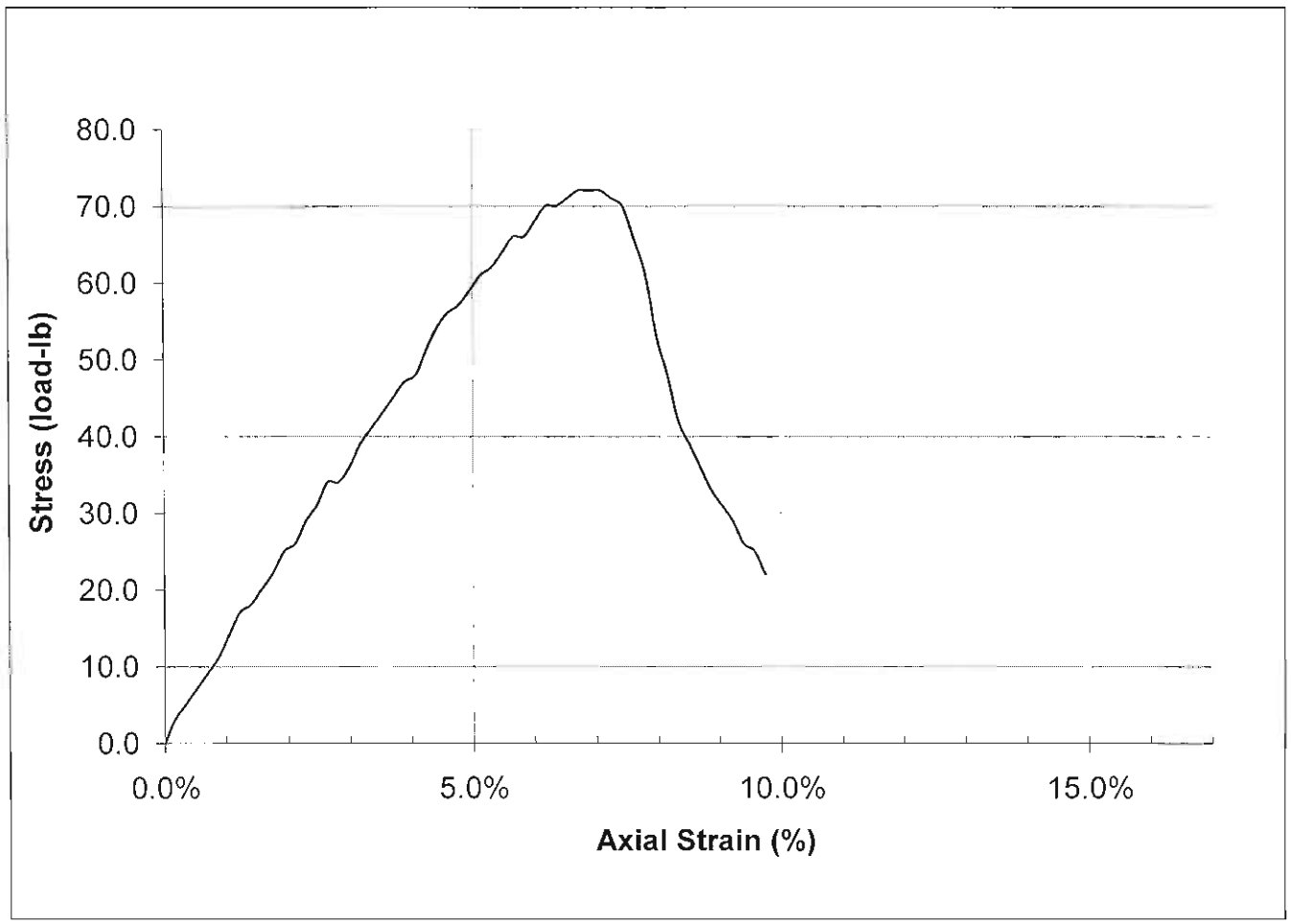
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
	2	0.160	34	0.321	66	0.482	39
0.009	3	0.170	36	0.331	66	0.492	36
0.019	5	0.180	39	0.341	68	0.502	33
0.029	7	0.190	41	0.351	70	0.512	31
0.039	9	0.200	43	0.361	70	0.522	29
0.049	11	0.210	45	0.371	71	0.532	26
0.059	14	0.220	47	0.381	72	0.542	25
0.069	17	0.231	48	0.391	72	0.552	22
0.079	18	0.240	51	0.401	72	0.562	20
0.089	20	0.250	54	0.411	71	0.569	18
0.099	22	0.260	56	0.421	70		
0.110	25	0.270	57	0.431	66		
0.120	26	0.281	59	0.442	61		
0.130	29	0.291	61	0.452	53		
0.140	31	0.301	62	0.462	48		
0.150	34	0.311	64	0.472	42		

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B8-5c
Material Description
CLAYEY SILT (SILTY CLAY), brown/orange brown mottled
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	118.4
Dry Density (pcf)	89.3
% Moisture	32.6

Unconfined Compressive Strength (tsf)	1.06

Unconfined Compression Test
ASTM D 2166-06

blackburn consulting

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B16-1c   Depth: 3.0-3.5'
Sample Description: SILT with SAND, dark grayish brown
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.463
Original Diameter (in)	2.376
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.43

Test Results

Axial Strain at Max. Load	0.0%
Average cross-sectional area (in^2)	4.43
Deflection at Max. Load (in)	0.000
Maximum Load (lbs)	0
Strain at Failure (%)	0.00
Compressive Strength (tsf)	**0.00**

Moisture Density

Tube and Sample (g)	1028.60
Tube (g)	392.10
Sample Weight (g)	636.50
Tare Number	F9
Tare Weight (g)	186.10
Wet Weight (g)	548.90
Dry Weight (g)	520.40
Dry Weight (g)	334.30
Water Weight (g)	28.50
Percent Moisture (%)*	8.5
Wet Density (pcf)	100.1
Dry Density (pcf)	92.2

Remarks:

* % moisture taken after test.

Sample fell apart during extraction

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B18-2c Depth: 6.0-6.5'
Sample Description: Lean CLAY with SAND, yellowish brown & brownish yellow, slightly cemented
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.540
Original Diameter (in)	2.397
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.51

Test Results

Axial Strain at Max. Load	3.9%
Average cross-sectional area (in^2)	4.70
Deflection at Max. Load (in)	0.218
Maximum Load (lbs)	143
Strain at Failure (%)	1.21
Compressive Strength (tsf)	**2.19**

Moisture Density

Tube and Sample (g)	798.00
Tube (g)	0.00
Sample Weight (g)	798.00
Tare Number	G1
Tare Weight (g)	191.30
Wet Weight (g)	622.40
Dry Weight (g)	543.20
Dry Weight (g)	351.90
Water Weight (g)	79.20
Percent Moisture (%)*	22.5
Wet Density (pcf)	121.6
Dry Density (pcf)	99.3

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

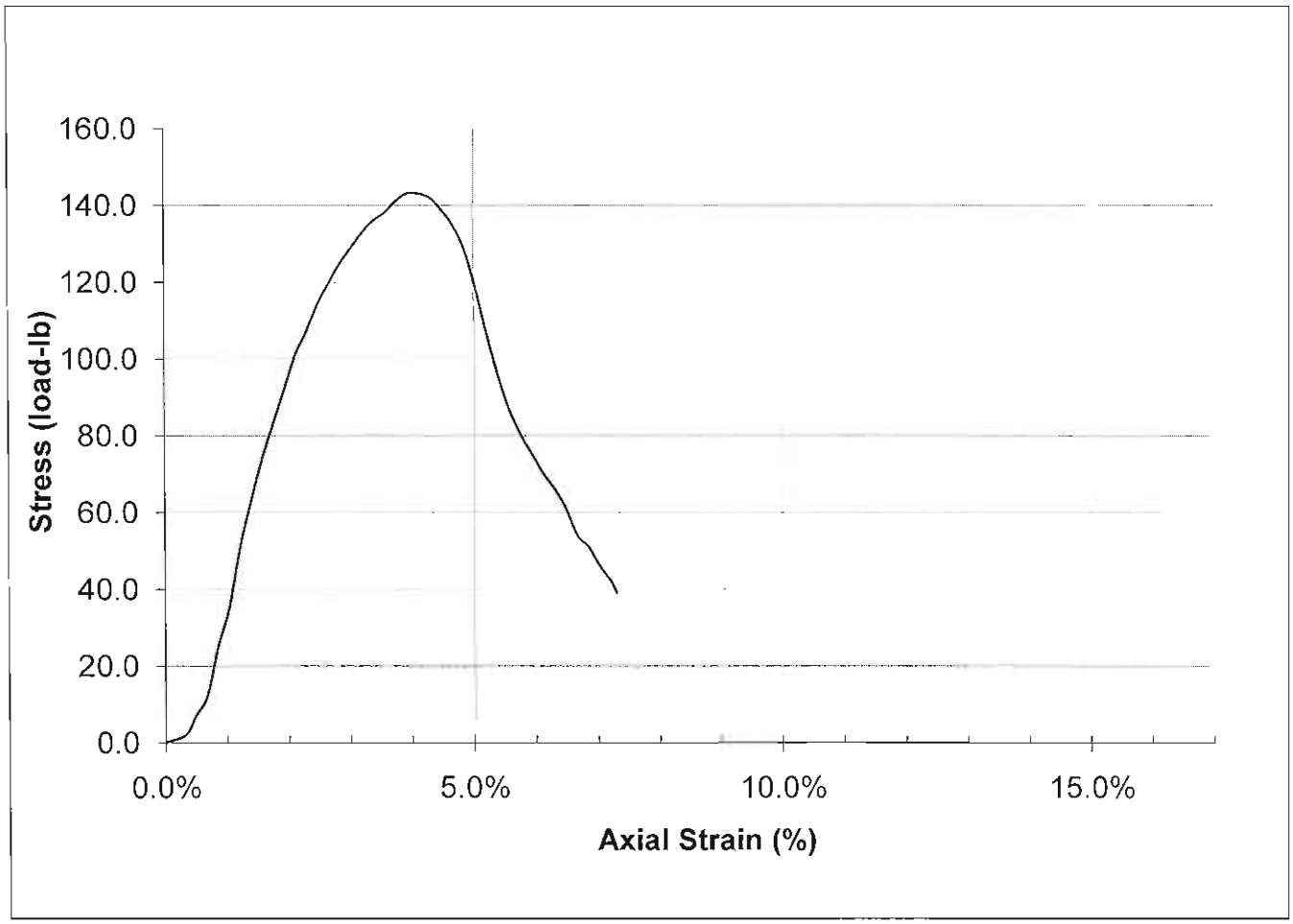
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.018	2	0.178	133	0.339	70		
0.027	7	0.188	136	0.349	66		
0.037	12	0.198	138	0.359	61		
0.047	25	0.208	141	0.369	54		
0.057	35	0.218	143	0.379	51		
0.067	51	0.228	143	0.389	46		
0.077	63	0.238	142	0.399	42		
0.087	74	0.248	139	0.404	39		
0.097	83	0.258	135				
0.107	92	0.268	129				
0.117	101	0.278	119				
0.127	107	0.288	107				
0.137	114	0.298	96				
0.148	120	0.308	87				
0.158	125	0.319	80				
0.168	129	0.329	75				

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B18-2c
Material Description
Lean CLAY with SAND, yellowish brown & brownish yellow, slightly cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	121.6
Dry Density (pcf)	99.3
% Moisture	22.5

Unconfined Compressive Strength (tsf)	2.19

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B22-2c Depth: 6.0-6.5'
Sample Description: SANDY SILT, pale brown, very fine-fine SAND, slightly cemented
Date: 11/13/2010
Tested By: MDR

Original Sample Length	5.300
Original Diameter (in)	2.420
Height-to-Diameter Ratio	2.2 : 1
Sample Area (in^2)	4.60

Test Results

Axial Strain at Max. Load	4.2%
Average cross-sectional area (in^2)	4.80
Deflection at Max. Load (in)	0.222
Maximum Load (lbs)	240
Strain at Failure (%)	1.18
Compressive Strength (tsf)	**3.60**

Moisture Density

Tube and Sample (g)	913.80
Tube (g)	178.40
Sample Weight (g)	735.40
Tare Number	N
Tare Weight (g)	238.80
Wet Weight (g)	660.10
Dry Weight (g)	592.10
Dry Weight (g)	353.30
Water Weight (g)	68.00
Percent Moisture (%)*	19.2
Wet Density (pcf)	114.9
Dry Density (pcf)	96.4

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

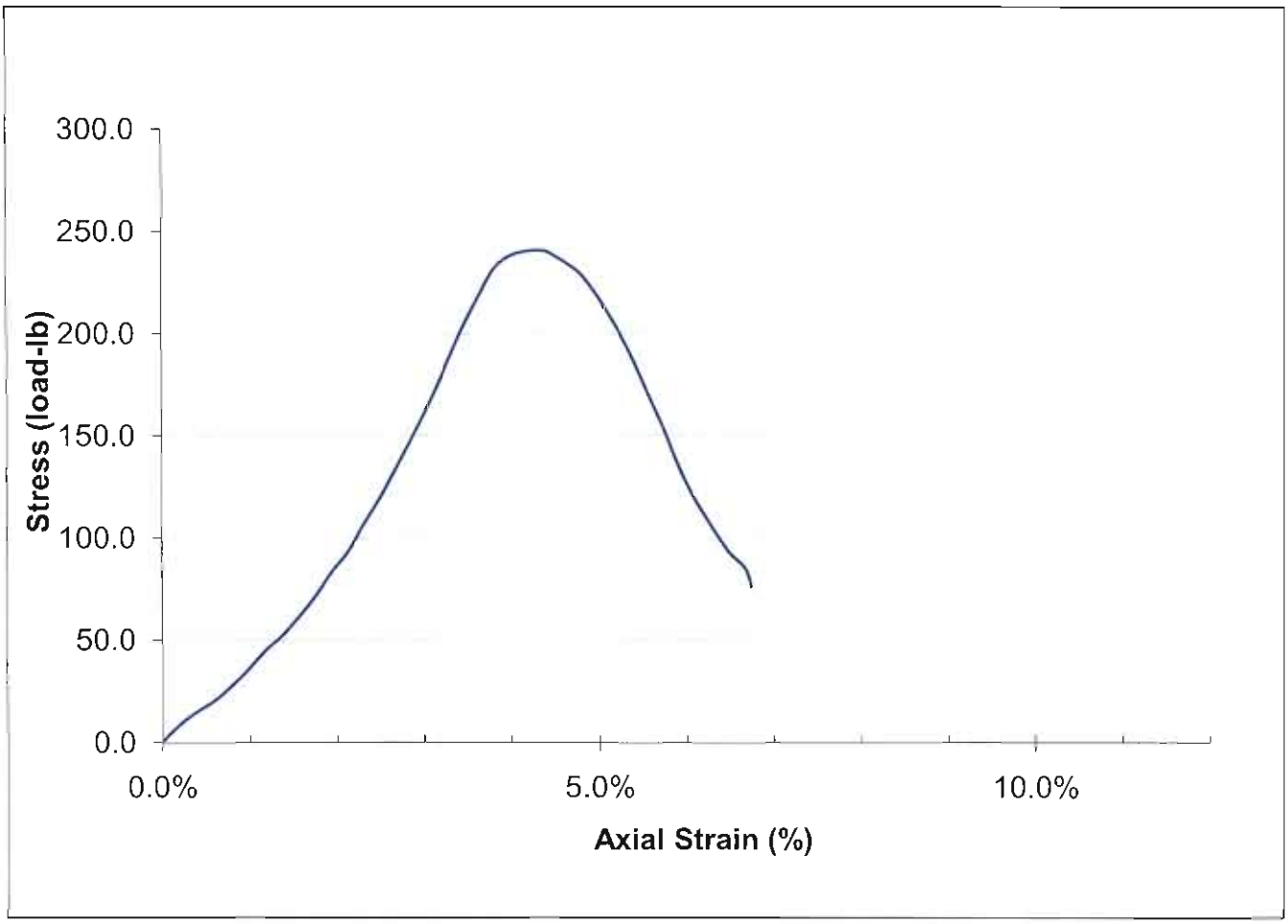
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.001	1	0.162	166	0.323	118		
0.011	9	0.172	184	0.333	105		
0.021	15	0.182	202	0.343	93		
0.031	20	0.192	218	0.353	85		
0.041	27	0.202	232	0.357	76		
0.051	35	0.212	238				
0.061	44	0.222	240				
0.072	52	0.232	240				
0.082	61	0.243	235				
0.092	71	0.253	229				
0.102	83	0.263	218				
0.112	93	0.273	205				
0.122	107	0.283	190				
0.132	120	0.293	172				
0.142	135	0.303	154				
0.152	150	0.313	134				

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B22-2c
Material Description
SANDY SILT, pale brown, very fine-fine SAND, slightly cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	114.9
Dry Density (pcf)	96.4
% Moisture	19.2

Unconfined Compressive Strength (tsf)	3.60

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B26-3c Depth: 11.0-11.5'
Sample Description: Lean CLAY with SAND, light yellowish brown and strong brown, mottled
Date: 11/13/2010
Tested By: MDR

Original Sample Length	5.970
Original Diameter (in)	2.425
Height-to-Diameter Ratio	2.5 : 1
Sample Area (in^2)	4.62

Test Results

Axial Strain at Max. Load	1.9%
Average cross-sectional area (in^2)	4.71
Deflection at Max. Load (in)	0.111
Maximum Load (lbs)	148
Strain at Failure (%)	0.66
Compressive Strength (tsf)	**2.26**

Moisture Density

Tube and Sample (g)	888.70
Tube (g)	0.00
Sample Weight (g)	888.70
Tare Number	P
Tare Weight (g)	238.40
Wet Weight (g)	813.30
Dry Weight (g)	703.10
Dry Weight (g)	464.70
Water Weight (g)	110.20
Percent Moisture (%)*	23.7
Wet Density (pcf)	122.8
Dry Density (pcf)	99.2

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

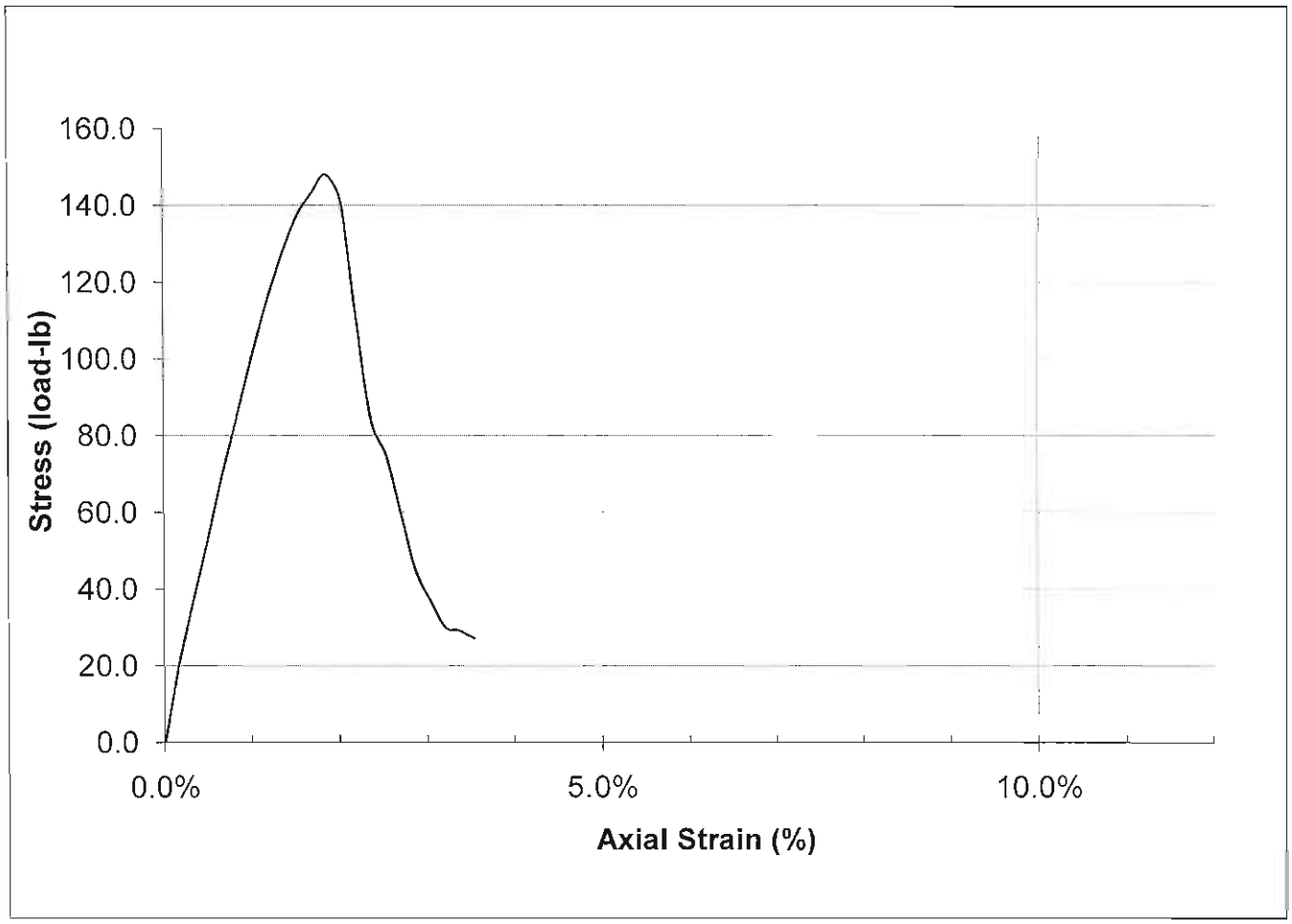
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.001	1	0.161	60				
0.010	20	0.171	45				
0.020	37	0.181	37				
0.030	53	0.191	30				
0.040	70	0.201	29				
0.050	85	0.211	27				
0.060	100						
0.070	114						
0.080	126						
0.091	137						
0.101	143						
0.111	148						
0.121	141						
0.131	111						
0.141	84						
0.151	75						

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B26-3c
Material Description
Lean CLAY with SAND, light yellowish brown and strong brown, mottled
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	122.8
Dry Density (pcf)	99.2
% Moisture	23.7

Unconfined Compressive Strength (tsf)	2.26

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B28-3c Depth: 11.0-11.5
Sample Description: SILTY CLAY, yellowish brown and olive brown, slightly cemented
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.485
Original Diameter (in)	2.398
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.52

Test Results

Axial Strain at Max. Load	5.5%
Average cross-sectional area (in^2)	4.78
Deflection at Max. Load (in)	0.303
Maximum Load (lbs)	200
Strain at Failure (%)	1.66
Compressive Strength (tsf)	**3.01**

Moisture Density

Tube and Sample (g)	802.50
Tube (g)	0.00
Sample Weight (g)	802.50
Tare Number	G2
Tare Weight (g)	179.40
Wet Weight (g)	581.50
Dry Weight (g)	504.10
Dry Weight (g)	324.70
Water Weight (g)	77.40
Percent Moisture (%)*	23.8
Wet Density (pcf)	123.4
Dry Density (pcf)	99.7

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

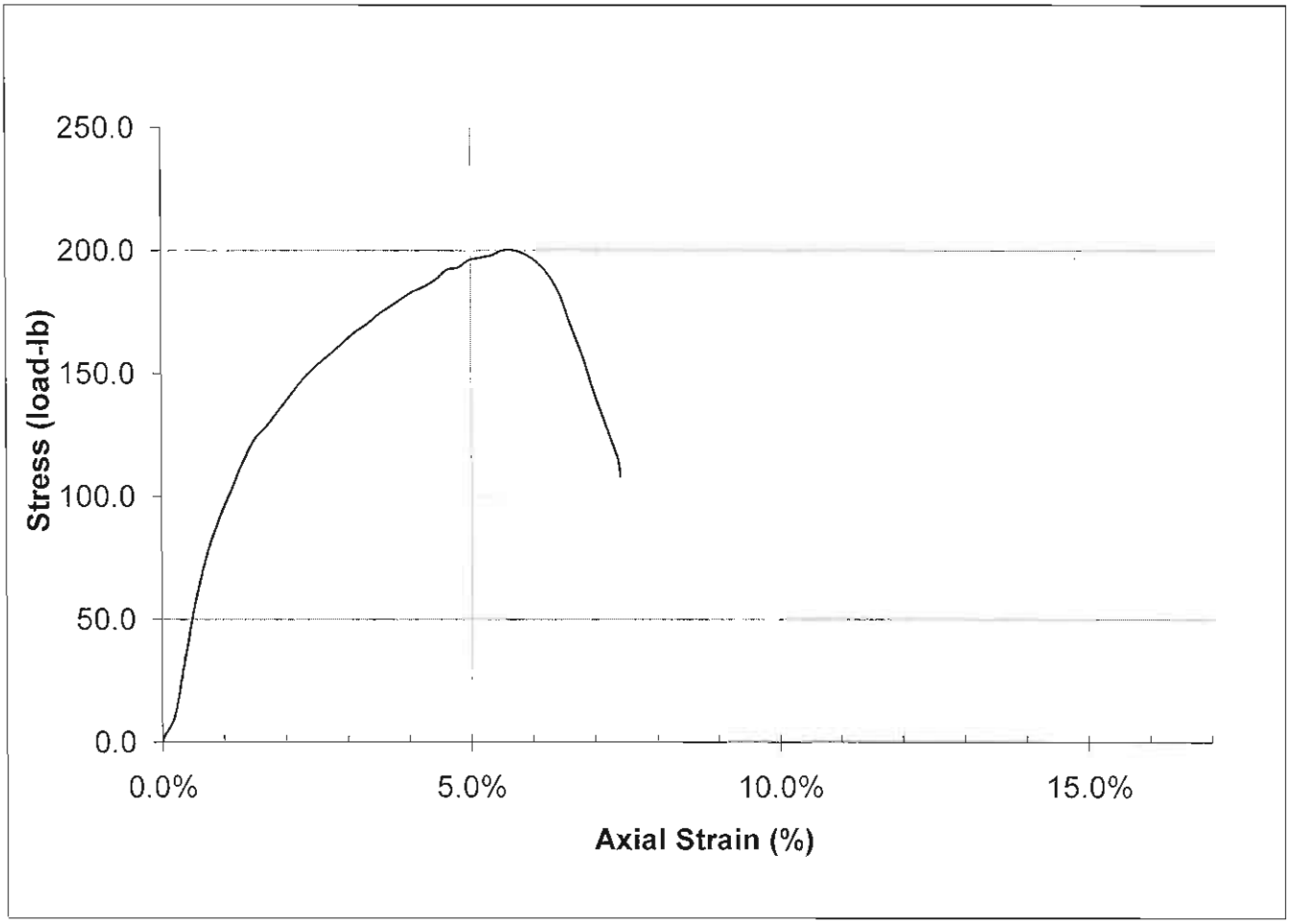
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.001	2	0.162	163	0.324	198		
0.011	11	0.172	167	0.333	195		
0.021	36	0.182	170	0.343	190		
0.031	60	0.192	174	0.353	182		
0.041	78	0.202	177	0.363	169		
0.051	91	0.212	180	0.373	157		
0.061	102	0.222	183	0.383	142		
0.072	114	0.232	185	0.393	129		
0.082	123	0.243	188	0.404	115		
0.092	128	0.253	192	0.406	108		
0.102	134	0.263	193				
0.112	140	0.273	196				
0.122	146	0.283	197				
0.132	151	0.293	198				
0.142	155	0.303	200				
0.152	159	0.313	200				

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B28-3c
Material Description
SILTY CLAY, yellowish brown and olive brown, slightly cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	123.4
Dry Density (pcf)	99.7
% Moisture	23.8

Unconfined Compressive Strength (tsf)	3.01

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipline
Project Number: 2049.1
Sample: B29-3c Depth: 11.0-11.5
Sample Description: Olive and orange brown SILT (slightly cemented)
Date: 10/29/2010
Tested By: MDR

Original Sample Length	5.676
Original Diameter (in)	2.406
Height-to-Diameter Ratio	2.4 : 1
Sample Area (in^2)	4.55

Test Results

Axial Strain at Max. Load	3.2%
Average cross-sectional area (in^2)	4.70
Deflection at Max. Load (in)	0.182
Maximum Load (lbs)	161
Strain at Failure (%)	1.03
Compressive Strength (tsf)	**2.47**

Moisture Density

Tube and Sample (g)	824.40
Tube (g)	0.00
Sample Weight (g)	824.40
Tare Number	E5
Tare Weight (g)	177.10
Wet Weight (g)	616.80
Dry Weight (g)	547.40
Dry Weight (g)	370.30
Water Weight (g)	69.40
Percent Moisture (%)*	18.7
Wet Density (pcf)	121.7
Dry Density (pcf)	102.5

Compression Tests

Dial reading @ 0 lb	0.000

Rate of Strain=0.056in/min

Remarks:

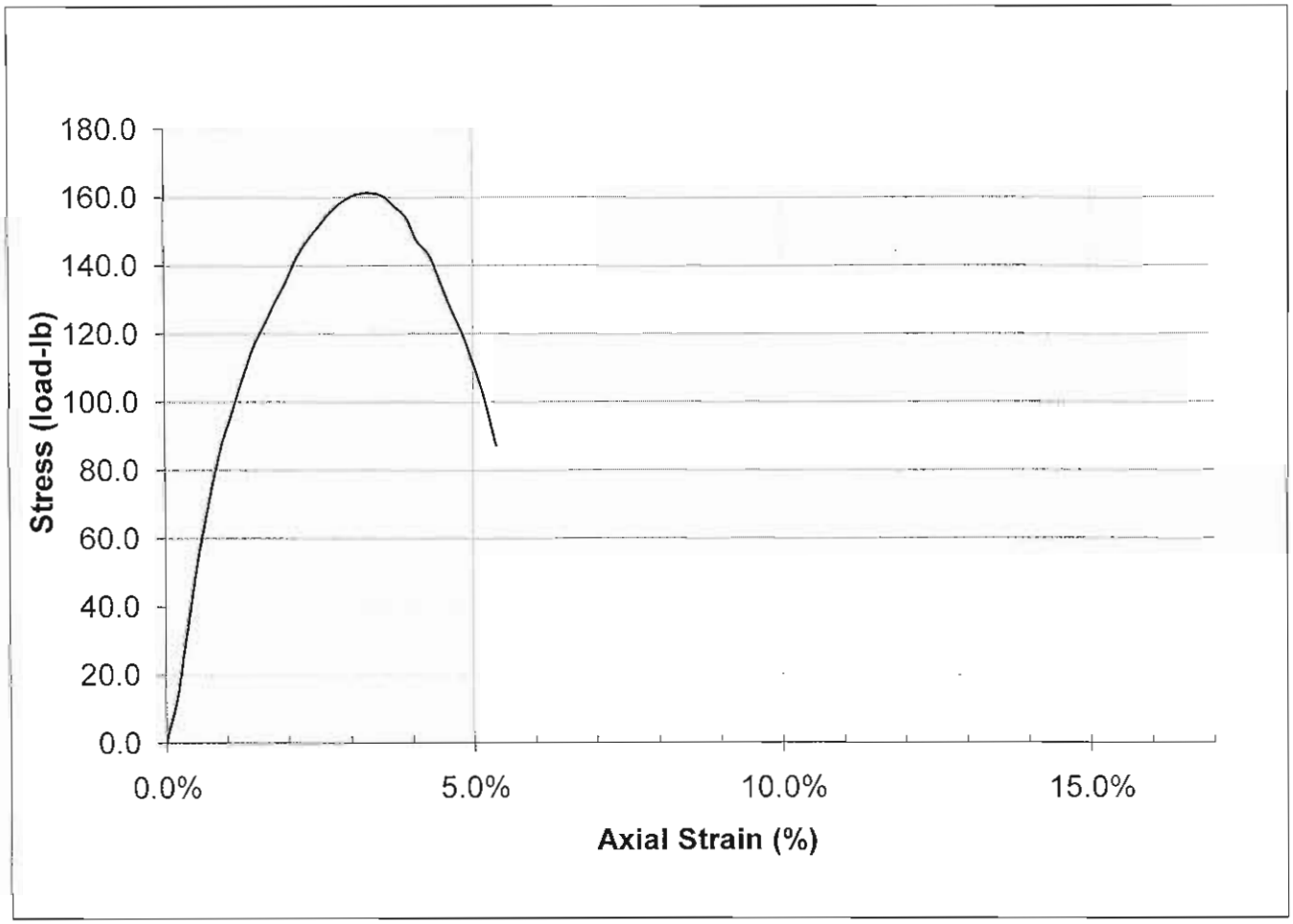
* % moisture taken after test.

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.001	2	0.162	158				
0.011	15	0.172	160				
0.021	36	0.182	161				
0.031	56	0.192	161				
0.041	72	0.202	160				
0.051	86	0.212	157				
0.061	96	0.222	154				
0.072	107	0.232	147				
0.082	116	0.243	143				
0.093	123	0.253	135				
0.102	129	0.263	127				
0.112	135	0.273	120				
0.122	142	0.283	111				
0.132	147	0.293	101				
0.142	151	0.303	88				
0.152	155	0.304	87				

Project
Napa-Sonoma Pipline
Project Number
2049.1
Sample Number
B29-3c
Material Description
Olive and orange brown SILT (slightly cemented)
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	121.7
Dry Density (pcf)	102.5
% Moisture	18.7

Unconfined Compressive Strength (tsf)	2.47

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B32-2c Depth: 6.0-6.5'
Sample Description: SILTY CLAY with SAND, yellowish brown and light brownish gray
Date: 11/13/2010
Tested By: MDR

Original Sample Length	5.480
Original Diameter (in)	2.384
Height-to-Diameter Ratio	2.3 : 1
Sample Area (in^2)	4.46

Test Results

Axial Strain at Max. Load	1.6%
Average cross-sectional area (in^2)	4.54
Deflection at Max. Load (in)	0.089
Maximum Load (lbs)	89
Strain at Failure (%)	0.49
Compressive Strength (tsf)	**1.41**

Moisture Density

Tube and Sample (g)	789.90
Tube (g)	0.00
Sample Weight (g)	789.90
Tare Number	Q
Tare Weight (g)	240.70
Wet Weight (g)	692.90
Dry Weight (g)	609.80
Dry Weight (g)	369.10
Water Weight (g)	83.10
Percent Moisture (%)*	22.5
Wet Density (pcf)	123.0
Dry Density (pcf)	100.4

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

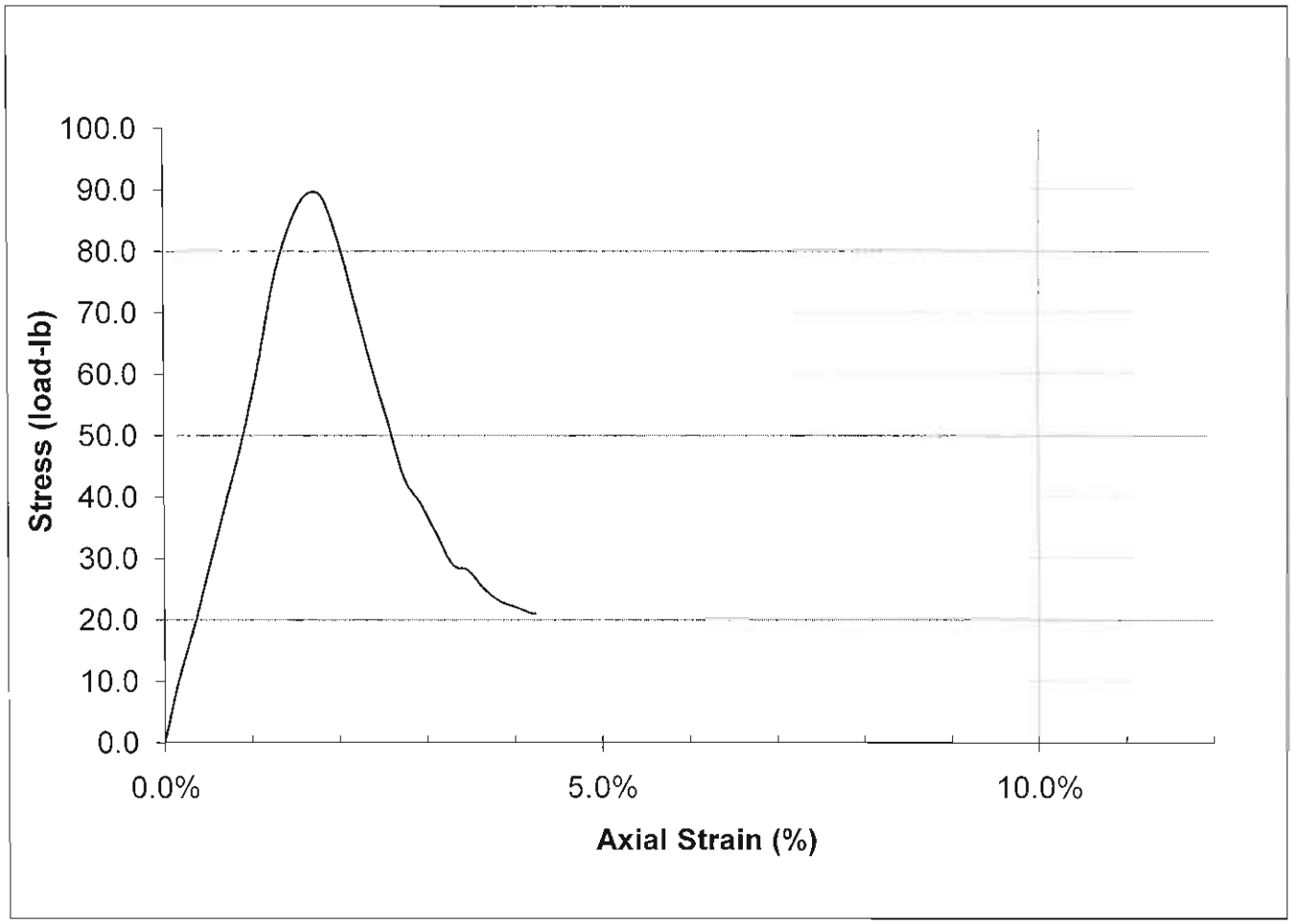
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.000	2	0.160	39				
0.009	10	0.170	34				
0.019	19	0.180	29				
0.029	29	0.190	28				
0.039	39	0.200	25				
0.049	49	0.210	23				
0.059	61	0.220	22				
0.069	75	0.230	21				
0.079	84	0.232	21				
0.089	89						
0.099	89						
0.110	81						
0.120	71						
0.130	61						
0.140	52						
0.150	43						

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B32-2c
Material Description
SILTY CLAY with SAND, yellowish brown and light brownish gray
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	123.0
Dry Density (pcf)	100.4
% Moisture	22.5

Unconfined Compressive Strength (tsf)	1.41

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipeline
Project Number: 2049.1
Sample: B35-3c Depth: 6.0-6.5'
Sample Description: Lean CLAY with SAND, dark yellowish brown, some fine GRAVEL
Date: 10/31/2010
Tested By: MDR

Original Sample Length	5.960
Original Diameter (in)	2.396
Height-to-Diameter Ratio	2.5 : 1
Sample Area (in^2)	4.51

Test Results

Axial Strain at Max. Load	4.6%
Average cross-sectional area (in^2)	4.73
Deflection at Max. Load (in)	0.274
Maximum Load (lbs)	91
Strain at Failure (%)	1.63
Compressive Strength (tsf)	**1.39**

Moisture Density

Tube and Sample (g)	895.10
Tube (g)	0.00
Sample Weight (g)	895.10
Tare Number	G3
Tare Weight (g)	186.00
Wet Weight (g)	622.80
Dry Weight (g)	564.80
Dry Weight (g)	378.80
Water Weight (g)	58.00
Percent Moisture (%)*	15.3
Wet Density (pcf)	126.9
Dry Density (pcf)	110.0

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

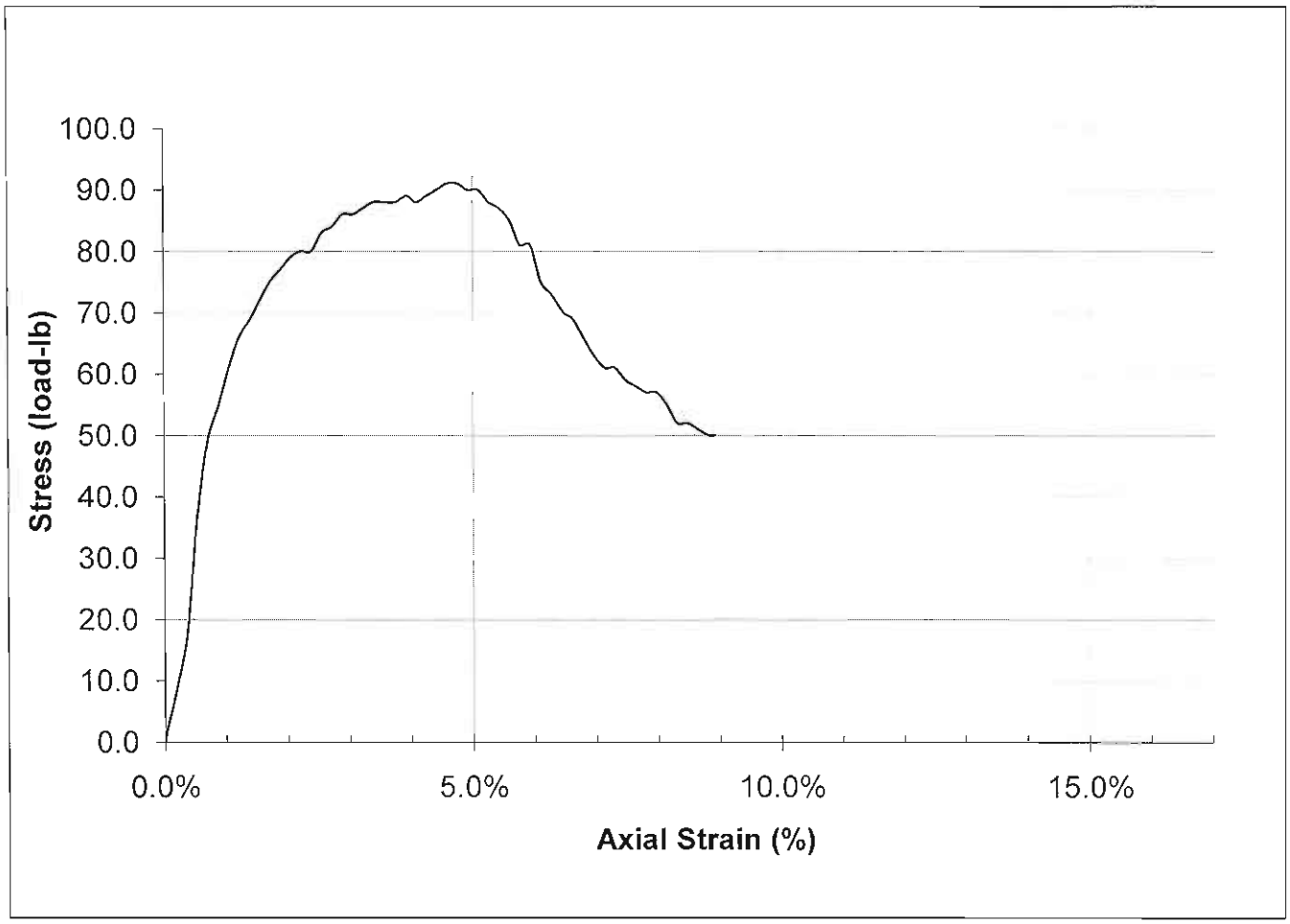
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.002	2	0.163	84	0.324	87	0.485	55
0.012	9	0.173	86	0.334	85	0.495	52
0.022	18	0.183	86	0.344	81	0.505	52
0.032	37	0.193	87	0.354	81	0.515	51
0.042	49	0.203	88	0.364	75	0.525	50
0.053	55	0.213	88	0.374	73	0.531	50
0.063	61	0.224	88	0.386	70		
0.073	66	0.235	89	0.395	69		
0.084	69	0.244	88	0.405	66		
0.093	72	0.254	89	0.415	63		
0.103	75	0.264	90	0.425	61		
0.113	77	0.274	91	0.435	61		
0.123	79	0.284	91	0.445	59		
0.133	80	0.294	90	0.455	58		
0.143	80	0.304	90	0.465	57		
0.153	83	0.314	88	0.475	57		

Project
Napa-Sonoma Pipeline
Project Number
2049.1
Sample Number
B35-3c
Material Description
Lean CLAY with SAND, dark yellowish brown, some fine GRAVEL
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	126.9
Dry Density (pcf)	110.0
% Moisture	15.3

Unconfined Compressive Strength (tsf)	1.39

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipline
Project Number: 2049.1
Sample: B37-3c Depth: 6.0-6.5'
Sample Description: Fat CLAY (CH), pale olive, slightly cemented
Date: 4/9/2011
Tested By: MDR

Original Sample Length	5.985
Original Diameter (in)	2.403
Height-to-Diameter Ratio	2.5 : 1
Sample Area (in^2)	4.54

Test Results

Axial Strain at Max. Load	2.9%
Average cross-sectional area (in^2)	4.67
Deflection at Max. Load (in)	0.173
Maximum Load (lbs)	77
Strain at Failure (%)	1.04
Compressive Strength (tsf)	**1.19**

Moisture Density

Tube and Sample (g)	828.99
Tube (g)	0.00
Sample Weight (g)	828.99
Tare Number	J7
Tare Weight (g)	190.11
Wet Weight (g)	701.04
Dry Weight (g)	576.62
Dry Weight (g)	386.51
Water Weight (g)	124.42
Percent Moisture (%)*	32.2
Wet Density (pcf)	116.3
Dry Density (pcf)	88.0

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

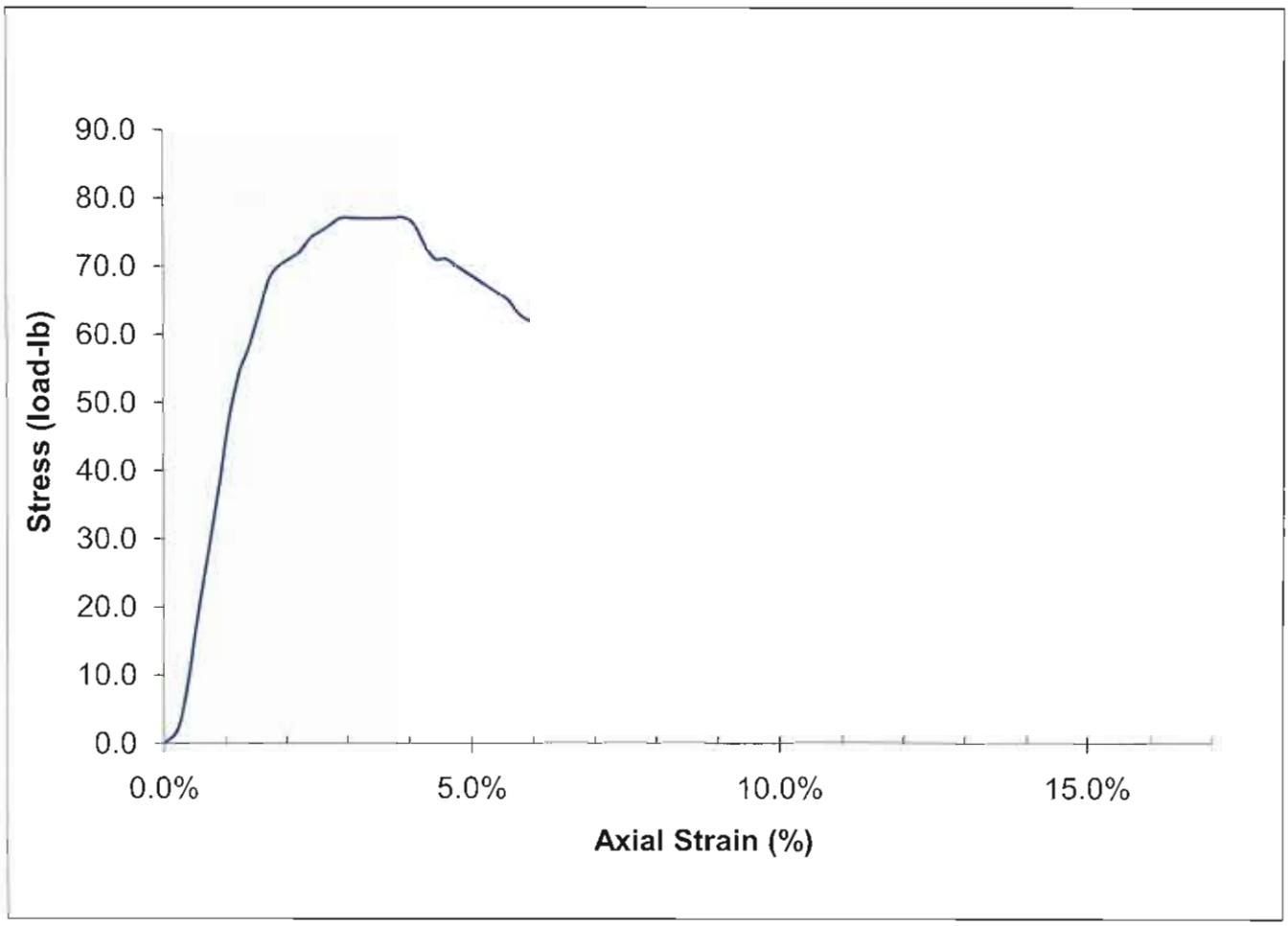
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.013	2	0.173	77	0.334	65		
0.022	8	0.183	77	0.344	63		
0.032	18	0.193	77	0.354	62		
0.042	27	0.203	77	0.364	63		
0.053	37	0.213	77	0.370	63		
0.063	47	0.224	77				
0.073	54	0.234	77				
0.083	58	0.244	76				
0.093	63	0.254	73				
0.103	68	0.264	71				
0.113	70	0.274	71				
0.123	71	0.284	70				
0.133	72	0.294	69				
0.143	74	0.304	68				
0.153	75	0.314	67				
0.163	76	0.324	66				

Project
Napa-Sonoma Pipline
Project Number
2049.1
Sample Number
B37-3c
Material Description
Fat CLAY (CH), pale olive, slightly cemented
Tested By
MDR

ASTM D 2166-06



Wet Density (pcf)	116.3
Dry Density (pcf)	88.0
% Moisture	32.2

Unconfined Compressive Strength (tsf)	1.19

Unconfined Compression Test
ASTM D 2166-06

Project Name: Napa-Sonoma Pipline
Project Number: 2049.1
Sample: B37-4c Depth: 11.0-11.5'
Sample Description: Lean CLAY with SAND (CL), pale olive and olive, slightly cemented
Date: 4/9/2011
Tested By: MDR

Original Sample Length	5.911
Original Diameter (in)	2.416
Height-to-Diameter Ratio	2.4 : 1
Sample Area (in^2)	4.58

Test Results

Axial Strain at Max. Load	7.7%
Average cross-sectional area (in^2)	4.97
Deflection at Max. Load (in)	0.457
Maximum Load (lbs)	199
Strain at Failure (%)	2.70
Compressive Strength (tsf)	**2.88**

Moisture Density

Tube and Sample (g)	897.14
Tube (g)	0.00
Sample Weight (g)	897.14
Tare Number	G1
Tare Weight (g)	191.36
Wet Weight (g)	649.12
Dry Weight (g)	565.14
Dry Weight (g)	373.78
Water Weight (g)	83.98
Percent Moisture (%)*	22.5
Wet Density (pcf)	126.1
Dry Density (pcf)	103.0

Remarks:

* % moisture taken after test.

Compression Tests

Dial reading @ 0 lb	0.000

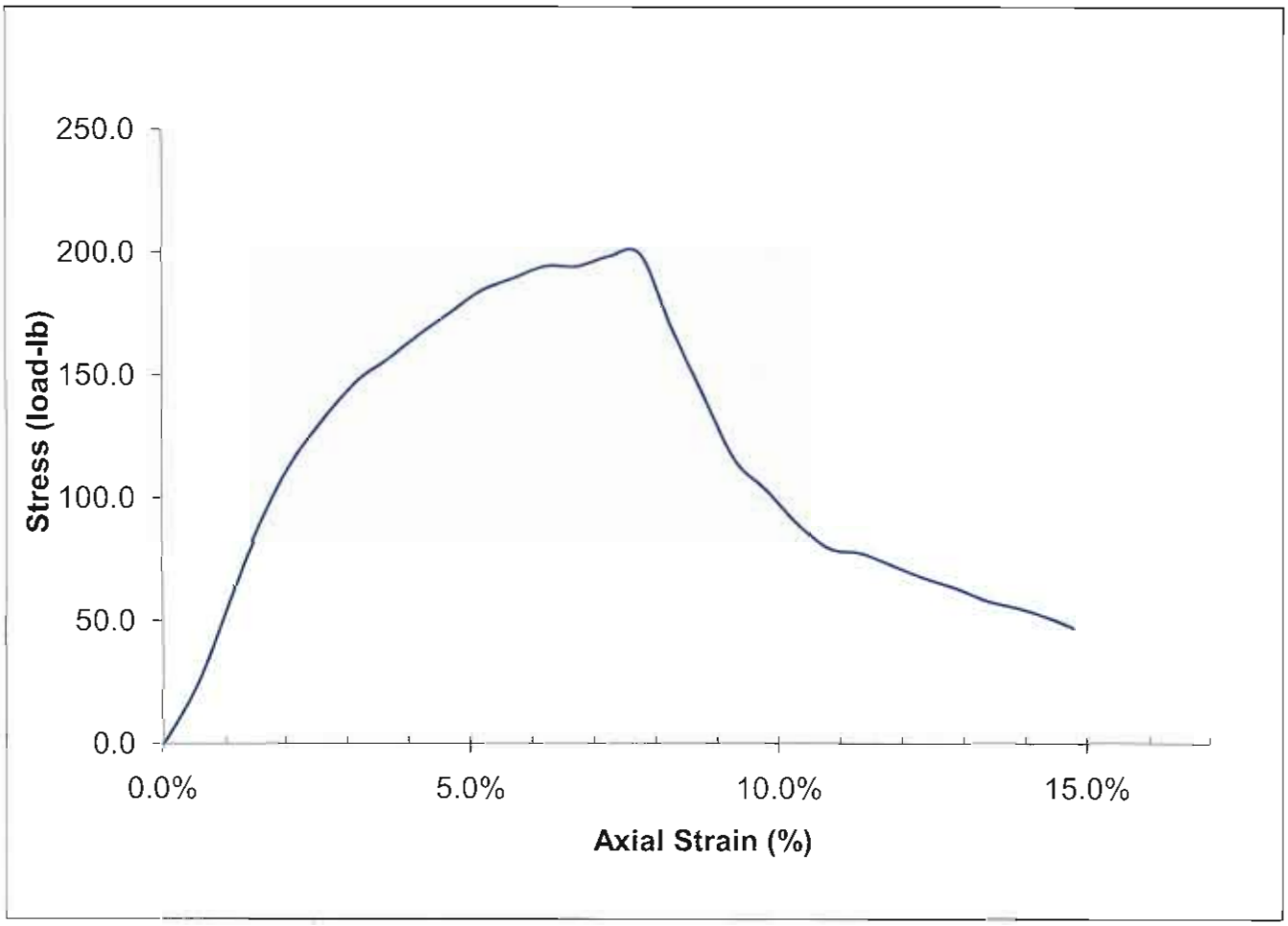
Rate of Strain=0.056in/min

Unconfined Compression Test Readings

Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb	Dial Reading	Lb
0.004	2	0.487	169				
0.035	26	0.518	141				
0.065	60	0.548	115				
0.095	91	0.578	103				
0.125	115	0.608	89				
0.155	132	0.638	79				
0.186	147	0.668	77				
0.216	156	0.699	72				
0.246	166	0.729	67				
0.276	175	0.759	63				
0.306	184	0.789	58				
0.336	189	0.819	55				
0.367	194	0.849	51				
0.397	194	0.872	47				
0.427	198						
0.457	199						

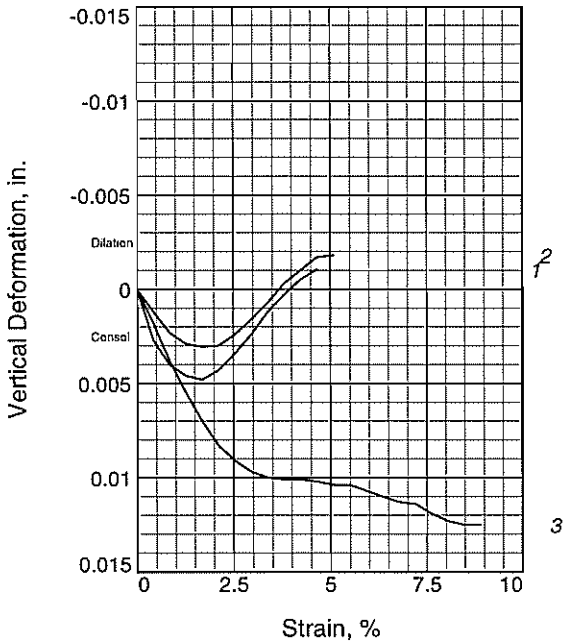
Project
Napa-Sonoma Pipline
Project Number
2049.1
Sample Number
B37-4c
Material Description
Lean CLAY with SAND (CL), pale olive and olive, slightly cemented
Tested By
MDR

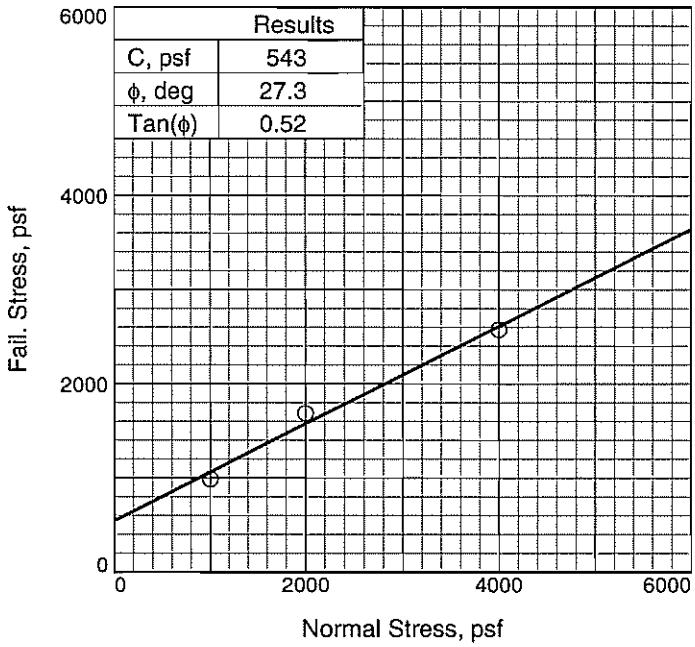
ASTM D 2166-06

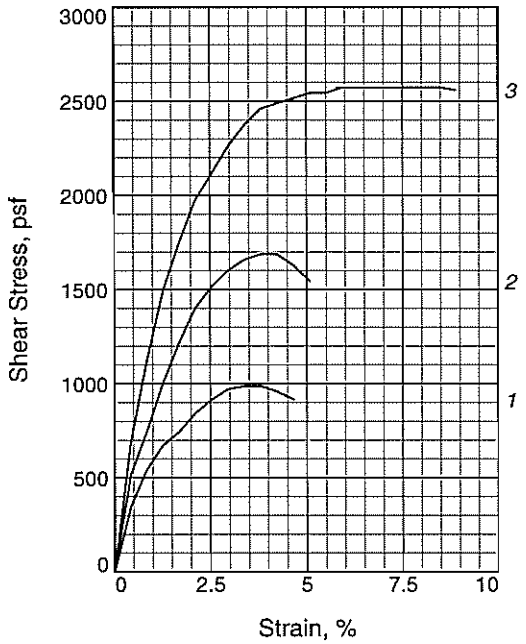


Wet Density (pcf)	126.1
Dry Density (pcf)	103.0
% Moisture	22.5

Unconfined Compressive Strength (tsf)	2.88







Sample No.		1	2	3
Initial	Water Content, %	32.0	34.5	34.3
	Dry Density, pcf	89.9	86.9	87.0
	Saturation, %	98.8	99.0	98.8
	Void Ratio	0.8752	0.9400	0.9369
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.94	0.94	0.94
At Test	Water Content, %	31.2	33.0	28.8
	Dry Density, pcf	91.4	89.1	94.9
	Saturation, %	99.7	100.0	100.0
	Void Ratio	0.8451	0.8918	0.7769
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.93	0.92	0.87
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		986	1687	2573
Strain, %		3.4	3.8	5.9
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.10	0.10	0.10

Sample Type: undisturbed
Description: Olive Brown Clayey SAND

Assumed Specific Gravity= 2.70
Remarks:

Figure _____

Client: CDM

Project: Napa - Sonoma Pipeline

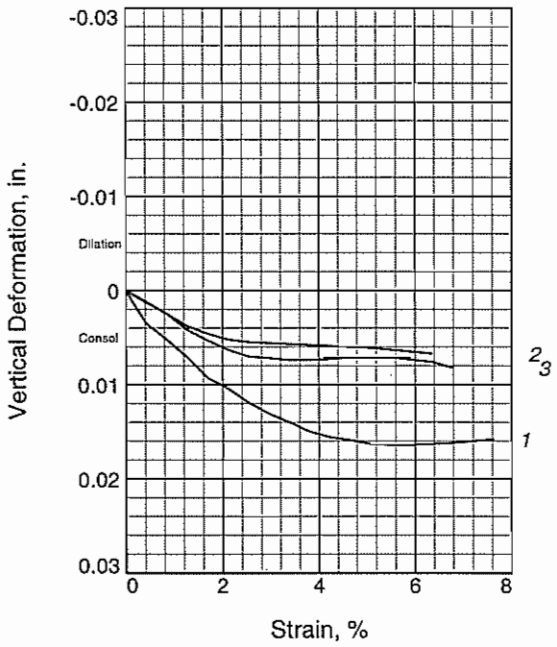
Sample Number: B4-3C **Depth:** 11.0'-11.5'

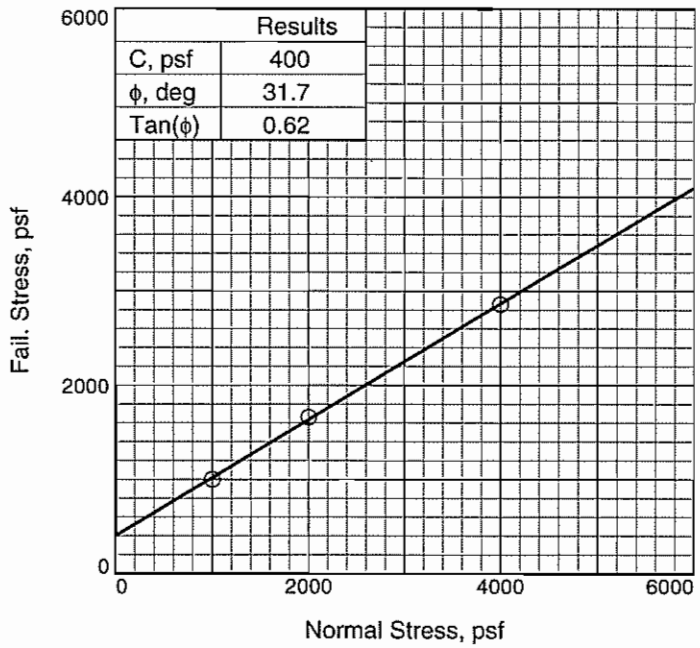
Proj. No.: 2049.1 **Date Sampled:**

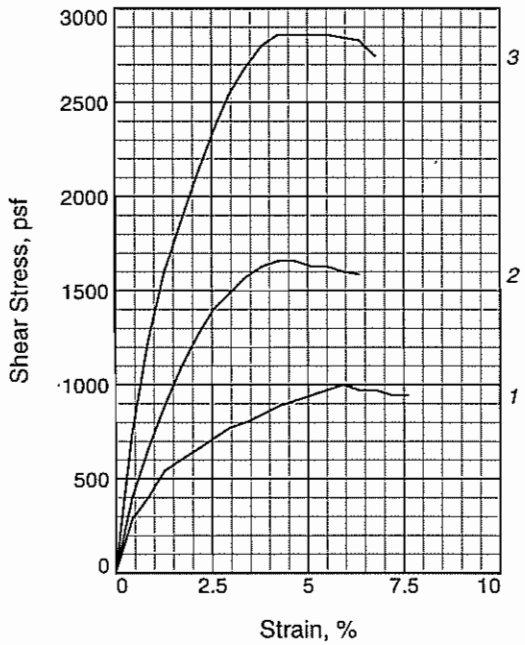
DIRECT SHEAR TEST REPORT

Blackburn Consulting

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







Sample No.		1	2	3
Initial	Water Content, %	27.4	26.3	27.1
	Dry Density, pcf	88.2	94.5	92.8
	Saturation, %	81.3	90.5	89.6
	Void Ratio	0.9104	0.7839	0.8157
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.94	0.94	0.94
At Test	Water Content, %	30.0	26.5	25.0
	Dry Density, pcf	91.5	98.2	100.7
	Saturation, %	96.2	99.9	100.0
	Void Ratio	0.8431	0.7162	0.6741
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.91	0.91	0.87
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		1001	1658	2859
Strain, %		5.9	4.2	4.2
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.09	0.09	0.09

Sample Type: undisturbed
Description: Dark Yellowish Brown Sandy SILT

Assumed Specific Gravity= 2.70
Remarks:

Figure _____

Client: CDM

Project: Napa - Sonoma Pipeline

Sample Number: B5-4C **Depth:** 11.0'-11.5'

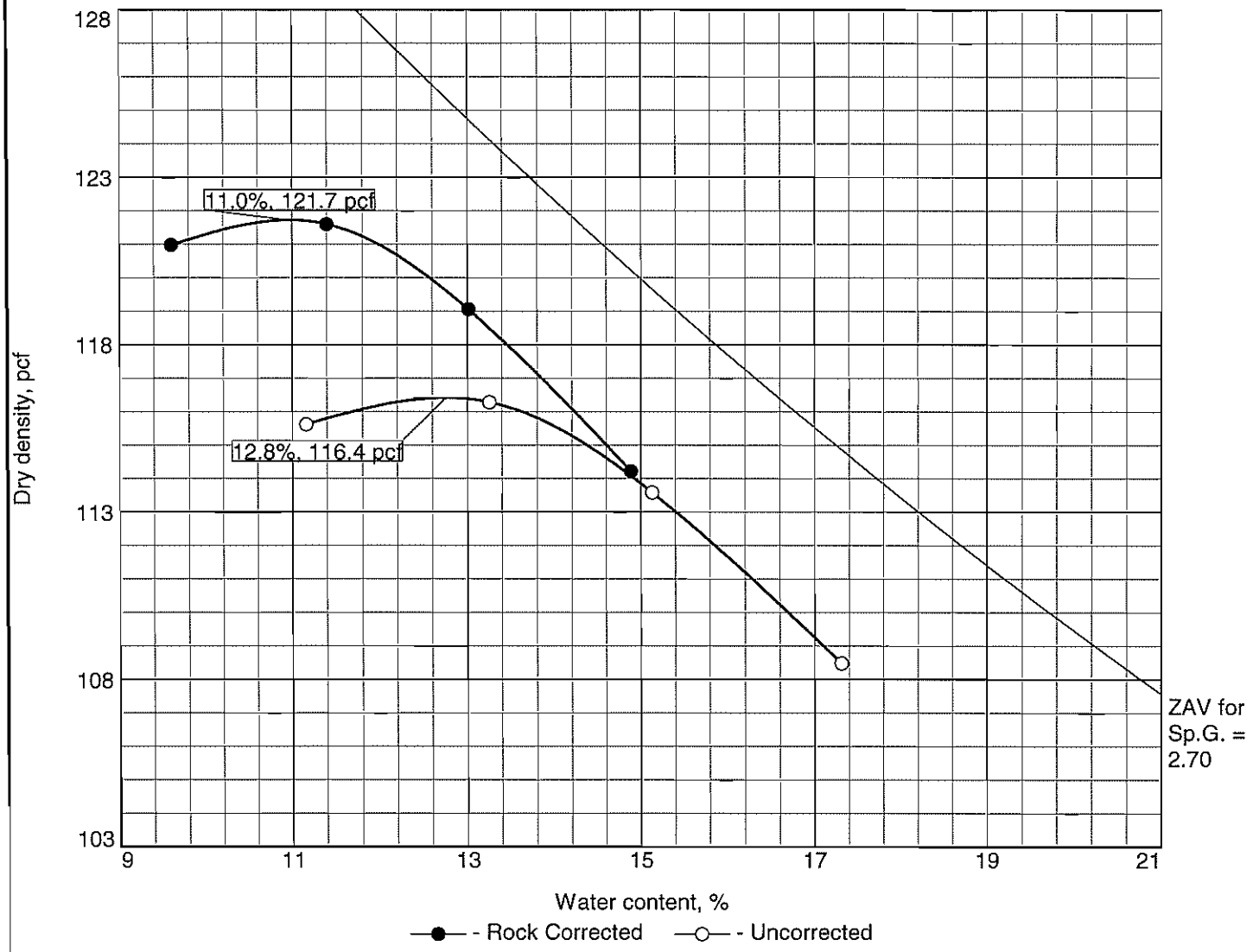
Proj. No.: 2049.1 **Date Sampled:**

DIRECT SHEAR TEST REPORT

Blackburn Consulting

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

COMPACTION TEST REPORT



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

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1.5'-3.0'	SC	A-4(2)		2.70	29	10	14.1	49.6

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 121.7 pcf	116.4 pcf	Dark Brown Clayey SAND
Optimum moisture = 11.0 %	12.8 %	

Project No. 2049.1 **Client:** CDM
Project: Napa - Sonoma Pipeline

○ **Depth:** 1.5'-3.0' **Sample Number:** B1-1 & B5-1 Combined

Blackburn Consulting

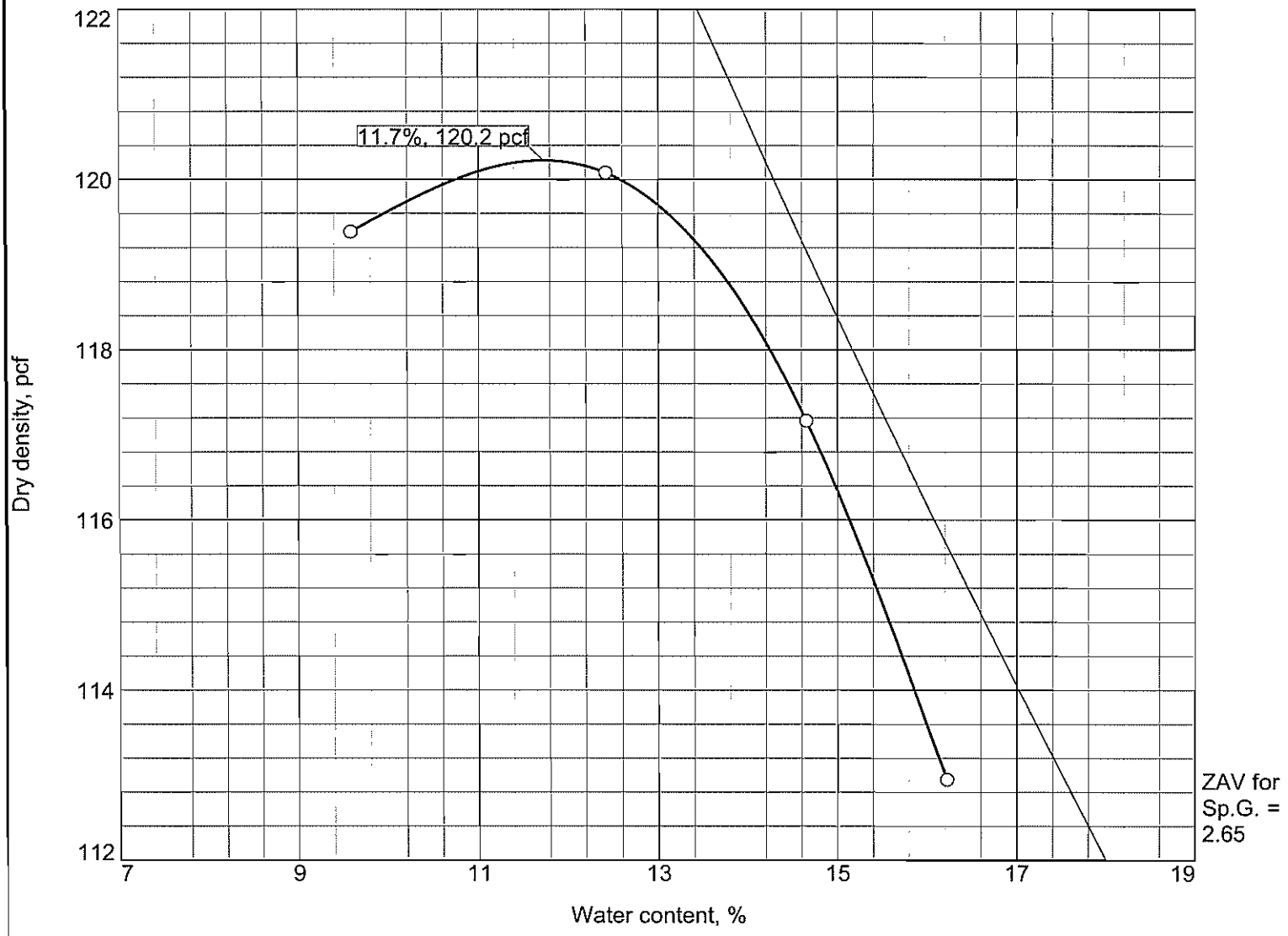
Auburn, CA

Remarks:

Figure

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

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method B Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1.5-4.5'	CL			2.65	35	21	0.1	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.2 pcf Optimum moisture = 11.7 %	Lean CLAY, dark grayish brown/pale brown

Project No. 2049.1 **Client:** CDM

Project: Napa-Sonoma Pipeline

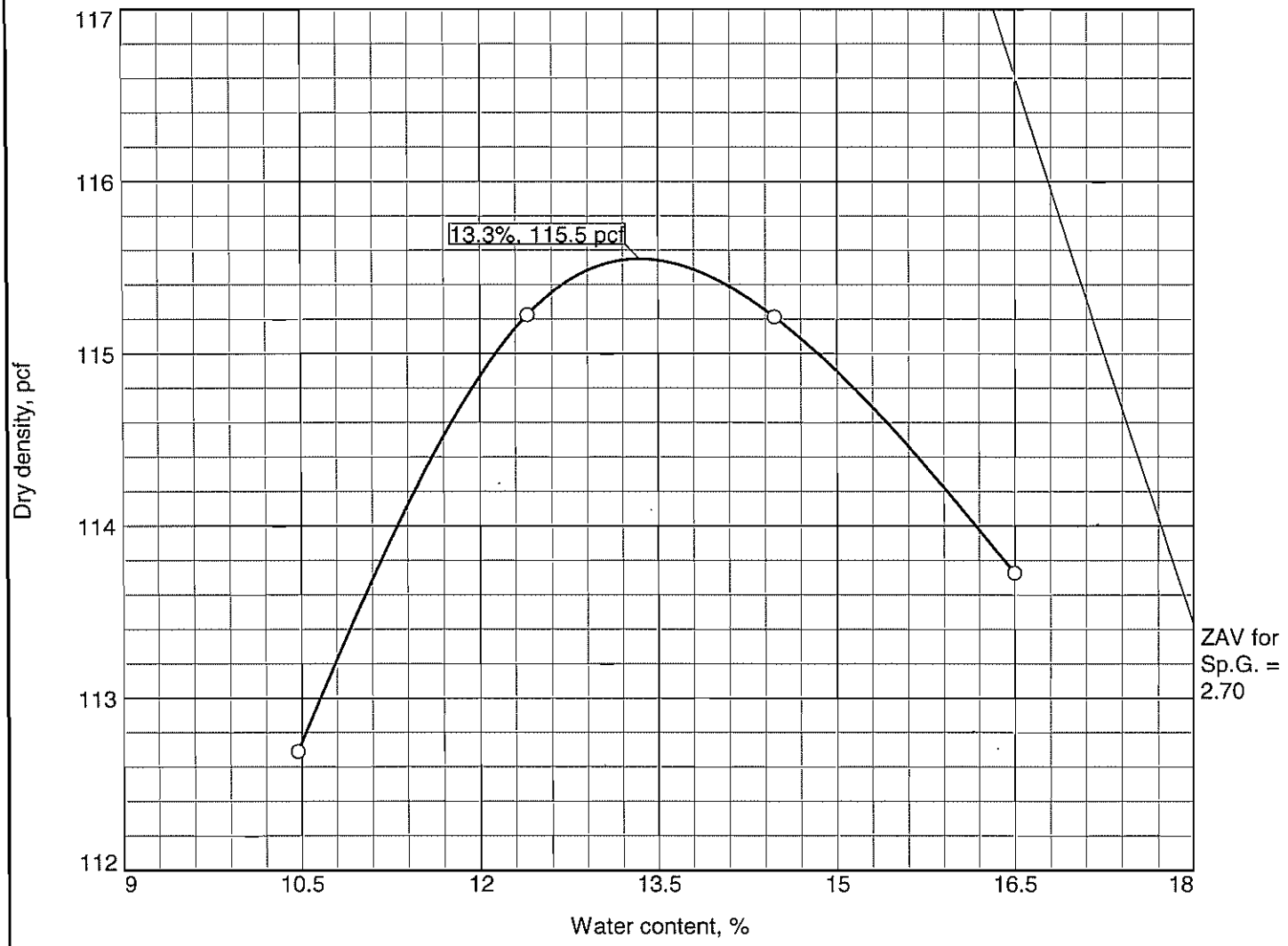
○ **Sample Source:** Composite B12 & B14 **Depth:** 1.5-4.5' **Sample No.:** 1

Blackburn Consulting

W. Sacramento, CA

Remarks:

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1.5'-4.5'				2.70			4.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.5 pcf Optimum moisture = 13.3 %	Yellowish Brown Lean CLAY

Project No. 2049.1 **Client:** CDM
Project: Napa - Sonoma Pipeline

○ **Depth:** 1.5'-4.5' **Sample Number:** B25-1 & B27-1

Blackburn Consulting

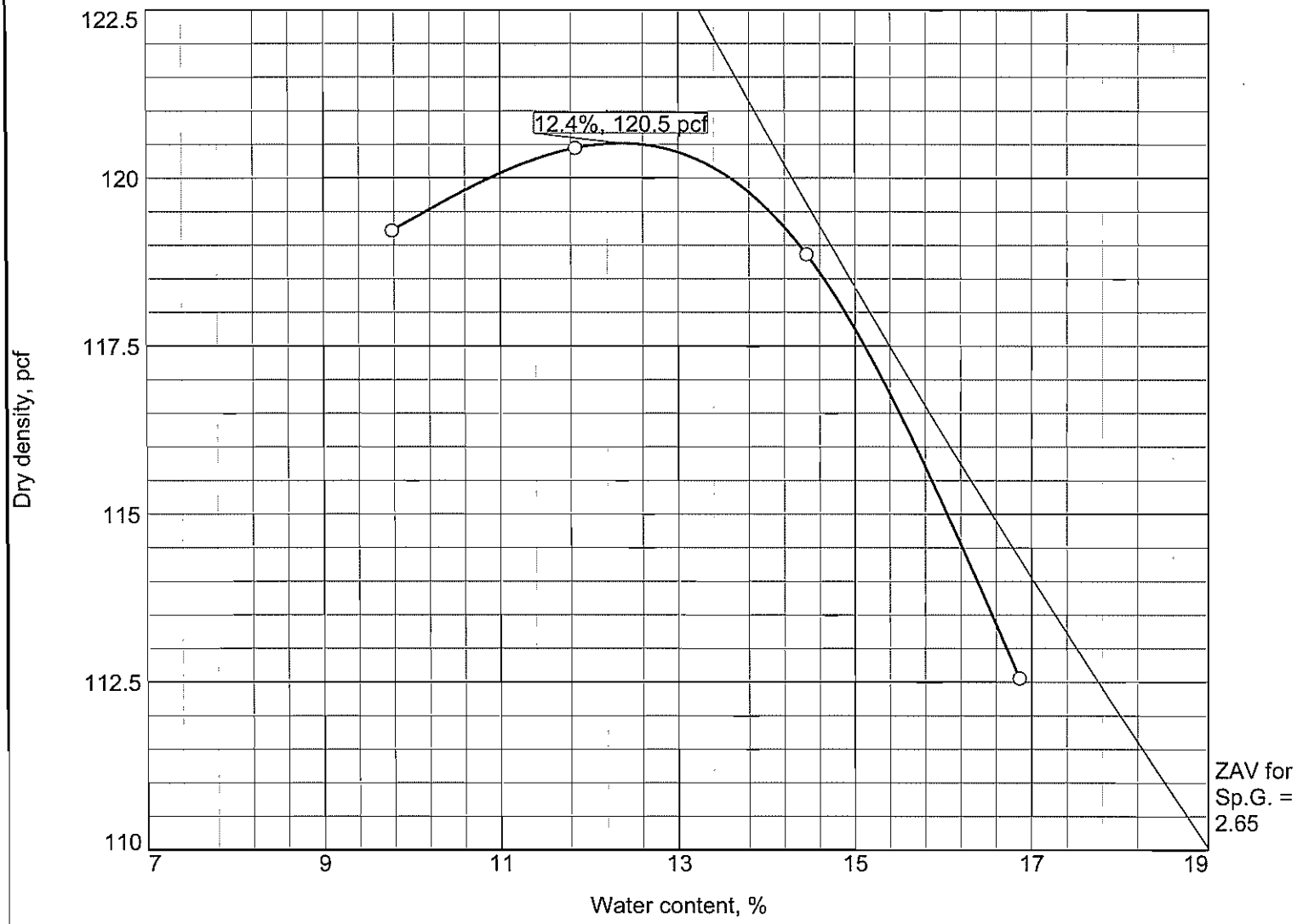
Auburn, CA

Remarks:

Figure

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

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method B Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1.5-4.5'	CL	A-7-6(13)		2.65	42	25	6.9	63.5

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.5 pcf Optimum moisture = 12.4 %	Fat CLAY and SILTY CLAY with SAND, trace GRAVEL, dark grayish brown and very dark gray

Project No. 2049.1 **Client:** CDM

Project: Napa-Sonoma Pipeline

○ **Sample Source:** Composite B31 & B35 **Depth:** 1.5-4.5' **Sample No.:** 1

Blackburn Consulting

W. Sacramento, CA

Remarks:

BSK Associates
Engineers & Laboratories

567 West Shaw Avenue Suite B
Fresno CA 93704
P 559.497.2880
F 559.497.2886
www.bskassociates.com

VIA US MAIL

November 10, 2010

BSK Job G1008510F
BSK SAMPLE ID: F10-628

Mr. Mark Robertson
Blackburn Consulting
2491 Boatman Avenue
West Sacramento, CA 95691

SUBJECT: Laboratory Testing Results
PO 10071 – Napa-Sonoma Pipeline
Sample Date: Various (9/30 through 10/06/10)

Dear Mr. Robertson:

BSK has performed testing on six (6) samples shipped to our laboratory. Testing was performed in accordance with Caltrans Test Methods and consisted of Minimum Resistivity and pH (Caltrans Test Method 643), Sulfate Content (Caltrans Test Method 417), and Chloride Content (Caltrans Test Method 422). The results are tabulated below and the test reports are enclosed.

Sample ID	Minimum Resistivity, Ohm-cm @ 15.5°C	pH	Sulfate, mg/kg	Chloride, mg/kg
Composite: B7-4B & B7-4C	260	7.4 @ 22.6°C	310	1700
Composite: B11-2B & B11-2C	1,170	7.6 @ 22.8°C	12	27
Composite: B17-3B & B17-3C	1,040	8.6 @ 22.7°C	92	110
Bulk: B21-1	820	5.6 @ 22.6°C	49	110
Composite: B29-2B & B29-2C	500	6.2 @ 22.6°C	17	270
Composite: B34-2B & B34-2C	1,170	5.3 @ 22.7°C	30	30

BSK appreciates the opportunity to be of service to Blackburn Consulting and looks forward to being of service to you in the future. Please call with any questions you may have @ 559-497-2870.

Respectfully,
BSK Associates

Nathan M. Shwiyhat, P.E.
Project Engineer

Enclosures: Minimum Resistivity Test Reports
Analytical Results

Distribution: Client (1 original, 1 E-Copy)
Mr. Mike Robertson, Blackburn Consulting (1 E-Copy)
BSK File

BSK Associates
Engineers & Laboratories

567 West Shaw Avenue Suite B
Fresno CA 93704
P 559.497.2880
F 559.497.2886
www.bskassociates.com

VIA US MAIL

November 18, 2010

BSK Job G1008510F
BSK SAMPLE ID: F10-628
Sample Receipt Date: 11/10/10

Mr. Ken Colburn
Blackburn Consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603

SUBJECT: Laboratory Testing Results
PO 10078 – Napa-Sonoma Pipeline
Sample Date: Various (11/2 through 11/03/10)

Dear Mr. Colburn:

BSK has performed testing on three (3) samples shipped to our laboratory. Testing was performed in accordance with Caltrans Test Methods and consisted of Minimum Resistivity and pH (Caltrans Test Method 643), Sulfate Content (Caltrans Test Method 417), and Chloride Content (Caltrans Test Method 422). The results are tabulated below and the test reports are enclosed.

Sample ID	Minimum Resistivity, Ohm-cm @ 15.5°C	pH	Sulfate, mg/kg	Chloride, mg/kg
B2-3C @ 11.0' – 11.5'	1,170	7.6 @ 19.6°C	10	21
B4-3B @ 10.5' – 11.0'	1,860	8.1 @ 19.6°C	7.4	26
B5-3B @ 5.5' – 6.0'	1,070	6.4 @ 19.6°C	11	53

BSK appreciates the opportunity to be of service to Blackburn Consulting and looks forward to being of service to you in the future. Please call with any questions you may have @ 559-497-2870.

Respectfully,
BSK Associates

Nathan M. Shwiyhat, P.E.
Project Engineer

Enclosures: Minimum Resistivity Test Reports
Analytical Results

Distribution: Client (1 original, 1 E-Copy)
BSK File

11521 Blocker Drive, Suite 110
Auburn, CA 95603

blackburn consulting

(530) 887-1494
fax: (530) 887-1495

Minimum Resistivity and pH Test Results

File No.: 2049.1
Date: 4/13/2011

Project Name: Napa Sonoma Pipeline

Sample ID	Minimum Resistivity, Ohm-cm @ 15.5° C	pH
B37-1	674	7.36 @ 20.6° C

Minimum Resistivity and pH performed based on Caltrans Test Method 643

APPENDIX E

Groundwater Elevation Maps

Sonoma Valley, USGS (2006), 1980 and 2003 water levels

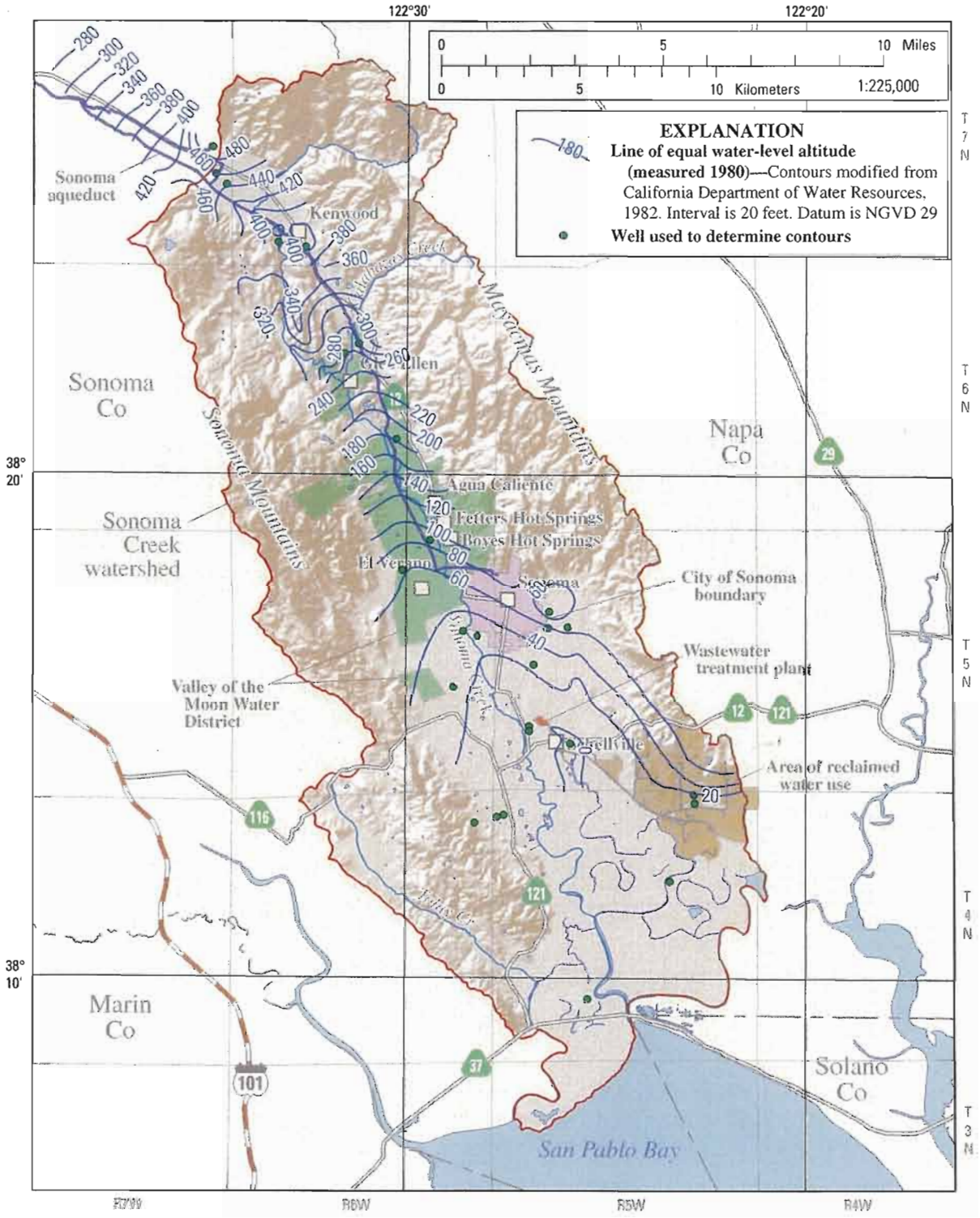
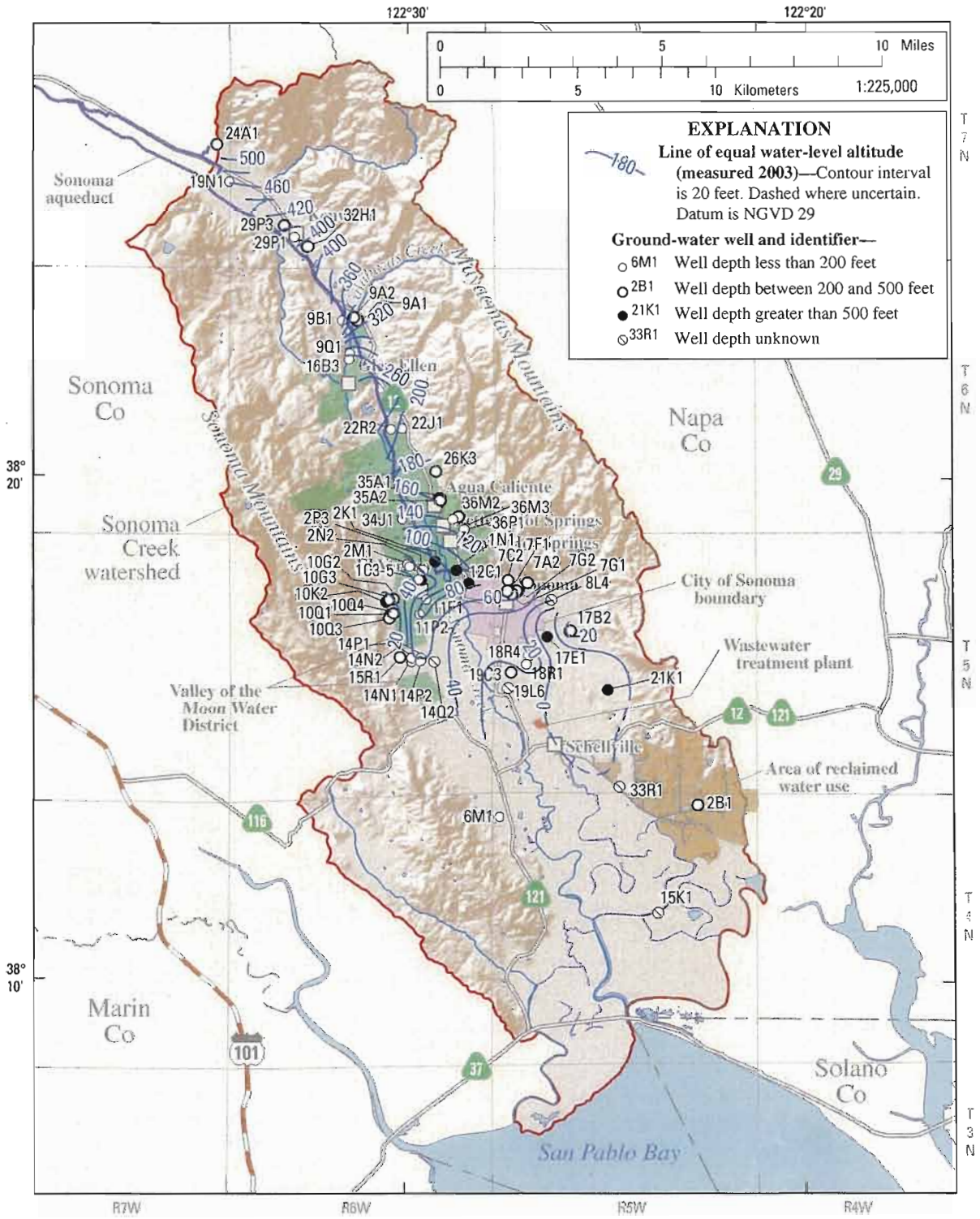


Figure 17. Autumn 1980 water levels in Sonoma Valley, Sonoma County, California.



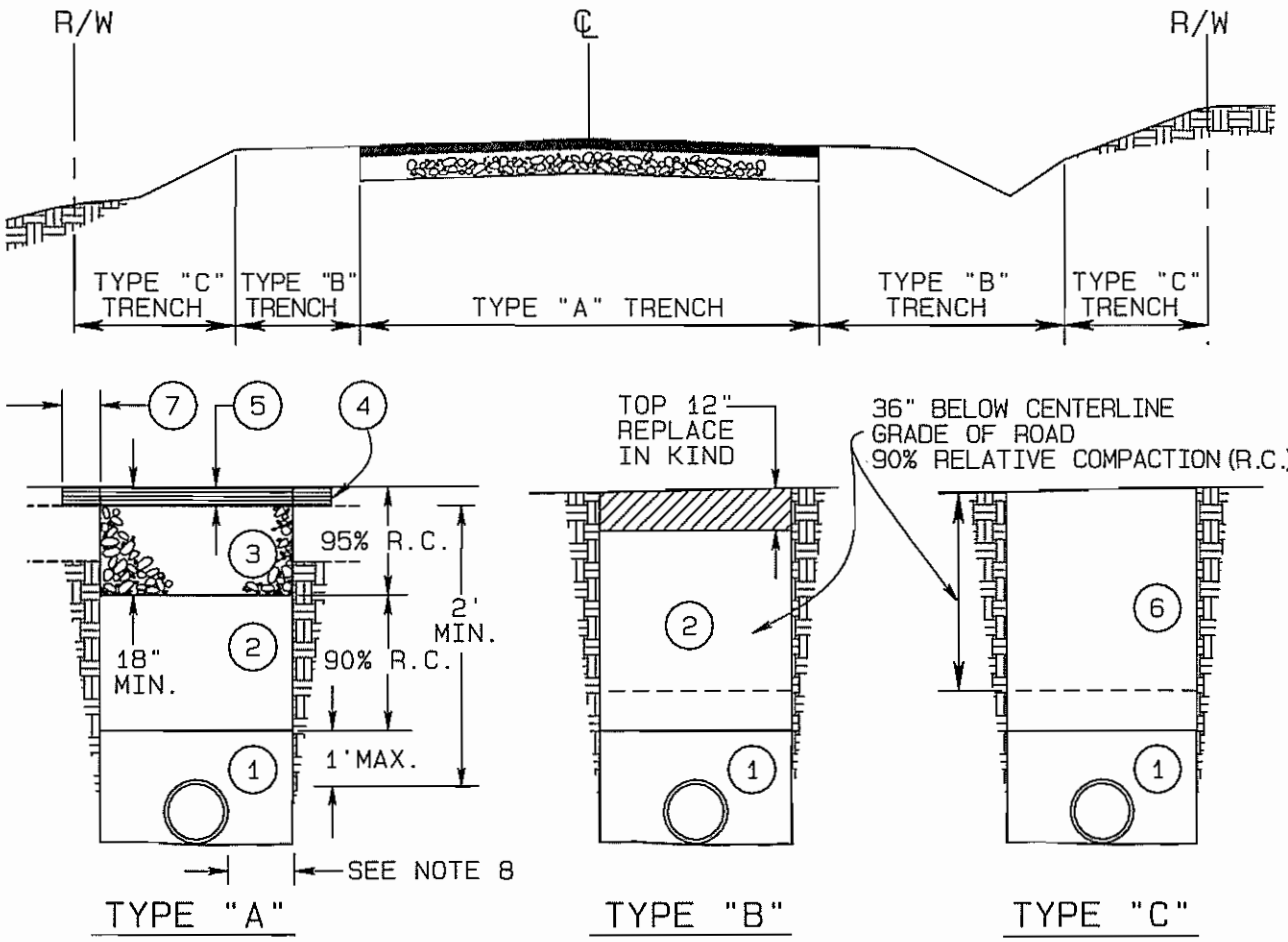
Base from U.S. Geological Survey digital data, 1:250,000, 2003. State Plane Projection, Fipzone 402
Shaded relief base from 1:250,000 scale Digital Elevation Model: sun illumination from northwest at 30 degrees above horizon

Figure 18. Spring 2003 water levels in Sonoma Valley, Sonoma County, California.

APPENDIX F

County of Sonoma, Department of Transportation and Public Works, Trench Backfill and Paving Details, Drawing No. 219

County of Napa, Department of Public Works, Trench Backfill Typical Section



NOTES:

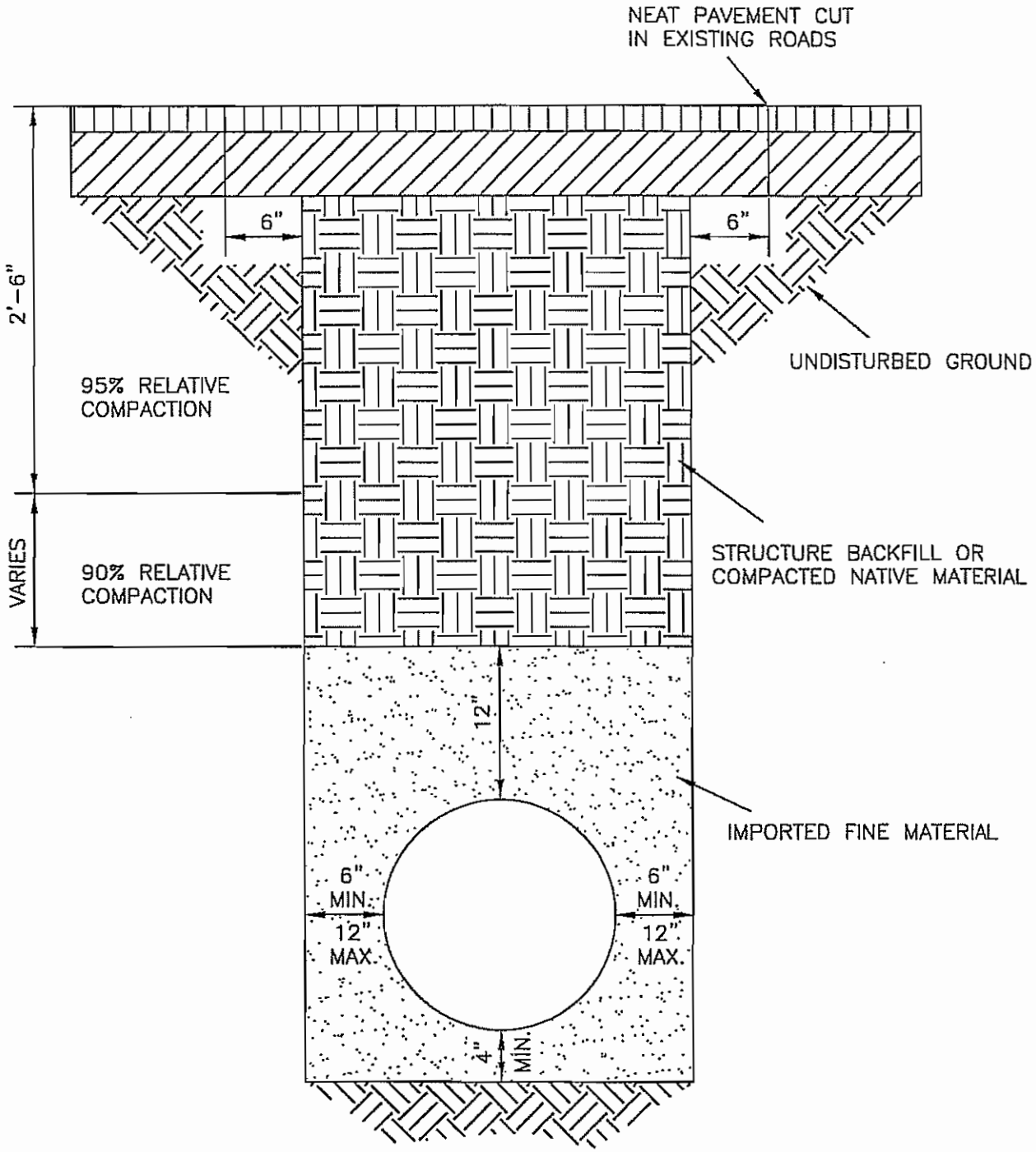
1. BEDDING REQUIREMENTS AS REQUIRED BY AGENCY INSPECTING PIPE. STORM DRAIN BEDDING PER STATE STANDARD PLANS AND SECTION 19 OF THE STATE STANDARD SPECIFICATIONS.
2. STRUCTURE BACKFILL MATERIAL PER SECTION 19 OF THE STATE STANDARD SPECIFICATIONS. PEA GRAVEL SHALL NOT BE USED FOR STRUCTURE BACKFILL.
3. CLASS 2 AGGREGATE BASE MATERIAL. THICKNESS SHALL BE EQUAL TO THE THICKNESS OF THE EXISTING ROAD BASE, BUT IN NO CASE SHALL THE THICKNESS BE LESS THAN 18".
4. TACK COAT S.S. 1 EMULSIFIED ASPHALT.
5. TRENCH SHALL BE PAVED WITH ASPHALT CONCRETE WHOSE THICKNESS IS EQUAL TO THE THICKNESS OF THE EXISTING ROAD SURFACE, BUT IN NO CASE SHALL THICKNESS BE LESS THAN 3".
6. REPLACE WITH NATIVE MATERIAL RELATIVE COMPACTED TO 90%.
7. ROADWAY PAVEMENT SHALL BE SAW CUT AND REMOVED FOR 6" EACH SIDE OF TRENCH.
8. STORM DRAIN:
   TWO (2) FEET; SIDE CLEARANCE MAY BE REDUCED TO A MINIMUM OF 6" WHEN A SLURRY CEMENT BACKFILL IS USED.

   UTILITIES:
   PIPE DIAMETER 18" OR LESS: 6" MIN. TO 9" MAX., PLUS ALLOWANCE FOR TRENCH SHORING.
   PIPE DIAMETER GREATER THAN 18": 9" MIN. TO 12" MAX., PLUS ALLOWANCE FOR TRENCH SHORING.
9. ANY CONCRETE ROADWAY REMOVED DURING EXCAVATION SHALL BE REPLACED IN KIND AND THICKNESS.

COUNTY OF SONOMA
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

TRENCH BACKFILL AND PAVING DETAILS

DATE: MAY 2004 REVISED: JUNE 2010	SCALE: NONE	DRAWING NO. 219



NOT TO SCALE

COUNTY OF NAPA
DEPT. OF PUBLIC WORKS

TRENCH BACKFILL
TYPICAL SECTION

COUNTY ENGINEER RCE 17995

DATE: JANUARY 1999