FINAL GEOTECHNICAL REPORT

Northside School Class 1 Bike Path Project
El Dorado County, California
EA 03-2E4800
03-ED-49-PM33.5/34.5, 03-ED-193-PM0.0/0.8

Prepared by:

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April 2013

Prepared for:

El Dorado County DOT
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Geotechnical ▪ Geo-Environmental ▪ Construction Services ▪ Forensics

BCI File No.: 1068.3
April 16, 2013

Mr. Chandra Ghimire, P.E.
El Dorado County DOT
2850 Fairlane Court
Placerville, CA 95667

Subject: **Final Geotechnical Report**
Northside School Class 1 Bike Path Project
EA 03-2E4800
03-ED-49-PM33.5/34.5, 03-ED-193-PM0.0/0.8
El Dorado County, California

Dear Mr. Ghimire:

Blackburn Consulting (BCI) prepared this Final Geotechnical Report for the proposed Class I Bike Path along Coloma Road (Hwy 49) and Georgetown Road (Hwy 193) in the unincorporated community of Cool.

Thank you for selecting BCI to provide these services. Please call if you have questions on this report or require additional information.

Sincerely,

BLACKBURN CONSULTING

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Exp. 3/31/15
CIVIL

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CERTIFIED ENGINEERING GEOLOGIST

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INTRODUCTION

Purpose

BCI prepared this Final Geotechnical Report for the proposed Class I Bike Path along Coloma Road (SR 49) and Georgetown Road (SR 193) in the unincorporated community of Cool. This report is based on project plans developed by the El Dorado County Department of Transportation (DOT), including Phase 1 plans for the SR193 segment (dated 8/23/11) and Phase 2 plans for the SR49 segment (dated 1/04/11).

BCI prepared a Preliminary Geotechnical Report for this project, dated June 12, 2008. This final report is modified to reflect the current plans and incorporates comments by Caltrans (Division of Engineering Services, 7/7/10, and Office of Special Funded Projects, 7/13/10 and 4/26/11).

Do not use or rely upon this report for different locations or improvements without the written consent of BCI.

Scope of Services

To prepare this report, BCI completed the following:

- Attended a site meeting with Richard Lee, El Dorado County DOT, in 2008, and a follow-up site review on May 2, 2012.
- Reviewed pertinent County documents, including existing arch culvert records and construction drawings.
- Reviewed published geologic/topographic mapping of the project alignment, including fault maps, soil surveys and Naturally Occurring Asbestos (NOA) mapping.
- Conducted generalized geologic mapping along the project alignment.
- Completed hand-augered borings and/or probes downstream from the Knickerbocker Creek arch culvert.
- Performed seismic refraction profiles near the proposed cut areas.
- Collected representative soil/rock samples from the creek crossing and new cut areas.
- Performed laboratory testing and analyses in support of the conclusions and recommendations contained herein.

SITE AND PROJECT DESCRIPTION

Site Location and Description

The site is located near the community of Cool in western El Dorado County. Site latitude is approximately 38.8871°N and longitude 121.0148°W. We show the project location on Figure 1. The bike path alignment parallels the existing roadway along moderately flat topography with surface elevations varying from about 1450 ft to 1530 ft. The existing road sections are in mostly low cut/fill (generally about 6 ft or less) with some cut sections to about 15 ft high. The existing cut slopes vary in gradient from about 2:1 to 1½:1 (Horizontal:Vertical), and have generally performed well, with the exception of some cut sloughing near SR 193 between Stations 26-28.

Project Description

The project includes about 9661 lineal feet of new bicycle path. Phase 1 includes about 4,416 lf of trail along the north side of SR 193 from SR 49 to the entrance of the Auburn Lake Trails development (Station 10+00 to 54+16). Phase 2 includes about 5,245 lf of trail along the west side of SR 49 from Northside School to the SR 49/193 intersection (Station 9+76 to 62+21).

The typical section for the new bike path is 8 ft wide with 2 ft to 4 ft shoulders. Construction will involve new cuts and fills to heights of about 10 ft or less and be within the existing Caltrans right-of-way (ROW). New cut/fill slopes are shown at 1½H:1V, or flatter.
The bicycle path will cross Knickerbocker Creek at SR 49 near Station 29+00. The highway crossing is a concrete arch culvert (Br. No. 25-0123) with 24 ft span supported on concrete bottom slab foundation. The County proposes to extend the culvert downstream (west) by about 8 ft to accommodate the bike lane.

GEOLOGIC SETTING

The project is located within the western Sierra Nevada foothills. Published geologic mapping shows the project alignment underlain by Jurassic-age meta-sedimentary, meta-volcanic and ultramafic rocks comprised of slate, quartzite and serpentine. These rocks occur within a northwest trending “mélange belt” between the Bear Mountains Fault Zone to the west and the Melones Fault Zone to the east. The regional structural features (rock bedding/foliation, faulting, etc) trends north-northwest and dip steeply. We show the regional geology and geologic features on Figure 2.

We observed rock consistent with the published mapping exposed along the project alignment. The rock is predominately slate and ultramafic rocks with variable degrees of weathering. Rock discontinuities (foliation/bedding) typically strike northwest and dip steeply to the east.
The ultramafic rock is mostly serpentine (serpentinite) and occurs extensively near the SR 49/193 intersection and east along SR 193. Both asbestiform (fibrous) and non-asbestiform (platy or blocky) mineral varieties can occur within these rocks. Churchill (2000) maps this area within “areas more likely to contain natural occurring asbestos”. We show this mapping on Figure 3.

SOIL MAPPING

Soil mapping by the USDA Natural Resources Conservation Service shows the majority of the project underlain by Auburn silt loam and Delpiedra rocky clay loam. These soil units are shallow (about 12-24 inches deep) and underlain by bedrock. They are characterized by greater than 70% fines, moderate permeability and low to moderate shrink-swell potential. We show the soils mapping on Figure 4, and local geologic features along the project alignment on Figure 5 (Sheets 1 through 4).

SITE SEISMICITY

The Bear Mountains Fault Zone is located approximately one mile west of the site. This fault is part of the Foothills Fault System, which has experienced reactivation along portions of this fault system. However, general evidence of Holocene activity (last 10,000 years) within most of the Bear Mountain Fault Zone is not generally indicated in the published literature. The project alignment is not within a designated Earthquake Fault Zone (EFZ) for fault rupture hazard.

Based on Probabilistic Seismic Hazards Mapping by the California Geologic Survey (www.consrv.ca.gov/cgs/), we obtain a peak ground acceleration (PGA) of 0.1g for ground motions with a 10% probability of being exceeded in 50 years.

SUBSURFACE CONDITIONS

BCI completed several hand-driven probes and/or hand auger borings downstream of the Knickerbocker Creek culvert. We encountered bedrock similar to that exposed in nearby cuts at shallow depth, generally within 1-2 ft of the channel bottom. In some areas, the bedrock is exposed within the channel bed. In the hand augered holes, we were able to penetrate about 8-15 inches into the weathered rock before encountering essential “refusal”.

Metamorphic rock is consistently exposed along the base of the road cuts. We obtained bulk samples at selected locations and along cut areas exposing serpentine. We show Knickerbocker Creek probe locations on Figure 6 and the bulk sample locations on Figure 5.

GROUNDWATER

We did not observe springs, seeps or free groundwater along the project alignment during our field work for this study (May 2008). Surface water in Knickerbocker Creek was about 1 ft deep. During the winter months, groundwater can perch at shallow depths above underlying rock units. Groundwater within the underlying rock is likely at significant depth and of limited yield (controlled primarily by rock discontinuities such as fracture and bedding planes). Seasonally, seepage can occur within shallow soil/rock during and for several months following the rainy season, particularly in low lying areas and drainages.

LABORATORY TESTING

We completed the following laboratory tests on representative soil/rock samples obtained for this study:

- Moisture/Density (CAL 216)
- Sieve Analysis (ASTM D422)
- Plasticity Index (ASTM D4318)
- Direct Shear (ASTM D3080)
- Sulfate/Chloride Content (CTM 417/422)
- pH and Minimum Resistivity (CTM 643)

Our testing indicates the native soils have 33-41% passing No. 200 sieve and Plasticity Index of 10-15 ("SM" per Unified Soil Classification System), with a Maximum Dry Density of 108 pcf at Optimum Moisture 16%. Direct shear tests on a sample remolded to 90% relative compaction show a soil friction angle of 36° and cohesion of 200 psf. Results of the corrosivity tests show soil pH of 6.2-7.4, sulfate content 3-9 ppm, chloride content 13-19 ppm, and minimum resistivity 1,820-3750 ohm-cm.

We attach the complete laboratory test results in Appendix A.

REFRACTION SEISMIC PROFILES

We completed two refraction seismic profiles at locations on Figure 5. Each refraction line consists of 5 shot points distributed along a collinear array of 12 geophones, with a multi-channel receiver (seismograph) located at one end of the array to collect the data. We placed the geophones at 10-foot intervals along the array. We then generated compressional wave energy (P-waves) at each shot point using multiple impacts with a 20-pound sledge hammer striking a steel plate on the ground surface. We used a Geometrics 12-channel seismograph to detect, digitize, and record the P-waves.

We analyzed the data using the computer program SeisImager by Geometrics, Inc. We present our interpreted seismic velocity/depth profiles on the Seismic Refraction Line Sheets in Appendix B.

The data show rock velocities less than about 7,000 feet per second (fps) within the upper 15-20 ft below ground surface, and increasing to greater than 10,000 fps below this depth. We interpret these velocities as slightly to moderately weathered metasedimentary rock within the upper 15-20 ft, transitioning to less weathered rock with depth.

CONCLUSIONS

Based on the data derived for this project, we conclude that the project is feasible with respect to geologic and geotechnical conditions. We did not observe evidence of geologic "fatal flaws", such as landsliding or fault rupture hazard that preclude design or construction. We consider the major geotechnical issues for this project as follows:

- Variable rock quality and hardness for design of new cuts and structure support
- Discontinuities within the rock (joints, fractures, etc) affecting cut stability
- Generation of rocky fill material

RECOMMENDATIONS

Project Grading

Cut Slopes

In general, we expect that new slopes cut at a gradient of 1.5H:1V will be generally stable. Flatter slopes (2H:1V) may be required in areas where slumps have occurred (such as SR 193 near Stations 26-28). The exposed rock may include discontinuities that dip adversely (i.e., obliquely out-of-slope) with respect to the roadway alignment, with the possibility for toppling or wedge type rock failures to occur along adversely dipping planes. A registered geologist should observe rock excavations to evaluate the potential need to flatten (or otherwise modify) rock slopes if adverse bedding or fracture conditions are exposed during construction.

Rock Excavation

- Based on the results of our seismic refraction survey, we present estimates of material rippability in Table 1.

Table 1: Material Rippability

Layer Velocity (fps)	Interpreted Material Type	Rippability
≤ 3,000	Fill, colluvium and decomposed to intensely weathered rock	Rippable with heavy-duty construction equipment
3,000 to 7,000	Intensely to moderately weathered rock, with local less weathered blocks	Rippable, with local resistant blocks that may require alternative excavation methods
≥ 7,000	Slightly weathered to fresh rock	Blasting or alternative excavation methods, with local blocks rippable along natural discontinuities

Fill Slopes

New fill slopes constructed at a gradient of 1.5H:1V, or flatter, will be generally suitable for fills to height less than about 10 ft. New embankment slopes and areas disrupted by grading are susceptible to erosion from surface runoff. Control overside runoff with curbs, dikes, crown-ditches, down-drains, etc. Vegetate finished slopes to reduce erosion potential.

We do not anticipate a need for subdrainage at the base of new fill slopes. However, actual conditions exposed during construction may require subdrainage in specific portions of fill slopes, such as local spring areas.

Knickerbocker Creek Culvert

Foundation support is available within the rock unit to extend the arch culvert footing downstream by about 8 ft. We recommend the base of footings be established at least 2 ft into the rock unit, as identified by a BCI representative upon excavation. Footings of minimum 3 ft width can be assigned an allowable bearing capacity of at least 5 ksf, net at groundline. Higher bearing pressures are available with increased rock penetration and/or positive field review by this office.

We expect rock excavation can be achieved with air tools without blasting. Rock blasting would likely disrupt/degrade integrity of the surrounding rock and should be avoided. If the rock surface is variable along the footing line, plain concrete can be used to level the contact between the footing and rock, as needed.

Use a coefficient of friction to resist sliding of 0.40 between the footing and weathered rock. Passive pressures in the rock unit can be based on an equivalent fluid weight of 500 pcf below a depth of one foot. For additional security against sliding (if necessary), or if hard rock precludes reasonable rock excavation, dowels can be used to establish a positive connection between the footing and rock (e.g., staggered row of #8 bars grouted in drilled holes extending 5±ft into rock). For tension loads, use an ultimate bond strength of 20 psi between the rock (weathered shale) and grout.

Pour footing concrete neat, without forming, against trimmed, intact bearing material in clean and dry excavations. Assuming dry season (low flow) construction, we expect de-watering can be achieved by diking and/or diverting surface water, with sump pumping.

Soil Corrosivity

The laboratory test results indicate a “non-corrosive” soils environment as defined by the September 2003 Caltrans “Corrosion Guidelines” publication. Therefore, we do not expect special corrosion considerations will be required with respect to concrete/steel design associated with the culvert extension or other project elements.

Naturally Occurring Asbestos

El Dorado County (Environmental Management Division) is conducting NOA testing and assessment independent of this report. We recommend observation of rock types exposed during construction for the potential presence of asbestos material. In areas of exposed NOA, comply with the applicable provisions of Section 19 of the 2010 Caltrans Standard Specifications and Section 14-11 of the 2010 Standard Special Provisions. In addition, prepare a worker health and safety program in accordance with all regulatory requirements, including CAL OSHA.

CONSTRUCTION SUPPORT

BCI expects to provide the following services during construction:

- Conduct field reviews of project grading to identify the presence of Naturally Occurring Asbestos materials and confirm stability of project cut slopes
- Verify foundation bearing conditions at Knickerbocker Creek culvert and wingwall extensions
- Review base of fill foundations for sub-drainage elements, if necessary
- Perform R-value testing for SR49 paving, if necessary
- Submit Field Reports of observations and test results
- Update this report if design changes occur or site conditions change.

LIMITATIONS

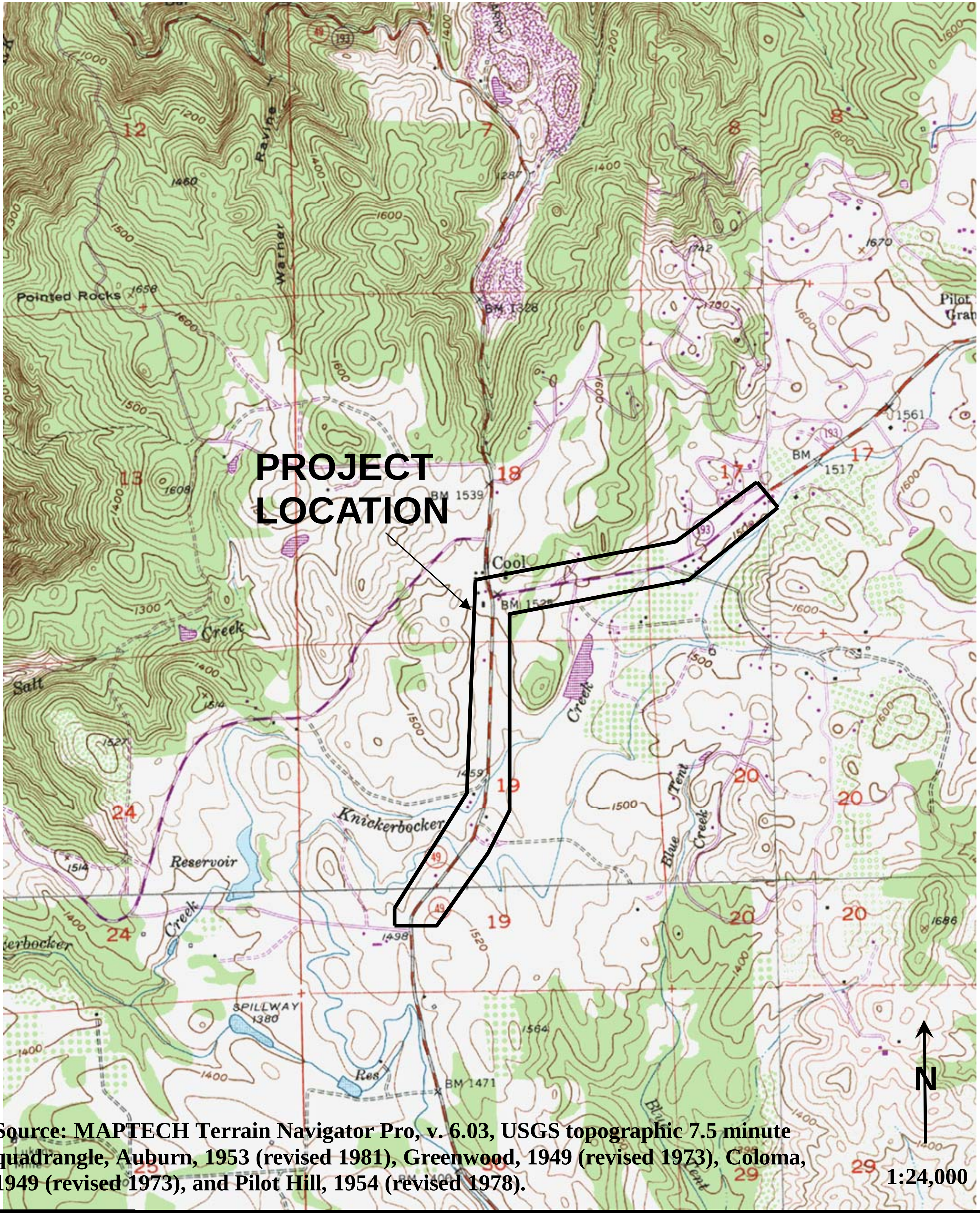
BCI performed these services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Our scope of work did not include evaluation of on-site hazardous materials or flooding.

Modern design and construction is 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.

REFERENCES

- Busch, Lawrence L., 2001, *Mineral Land Classification of El Dorado County, California*, California Geologic Survey, Open-File Report 2000-03.
- California Department of Water Resources, 2007, *Historical Groundwater Levels From Well Data*, DWR website: http://wdl.water.ca.gov/gw/map/index.cfm.
- Caltrans Standard Specifications, May 2006, California Department of Transportation, Publication Distribution Unit.
- Churchill, Ronald K., et al., 2000, *Areas More Likely to Contain Natural Occurrences of Asbestos in Western El Dorado County, California*, California Geologic Survey, Open-File Report 2000-002.
- Corrosion Guidelines, Version 1.0, September 2003, California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch.
- Wagner, D. L., et al, 1981, *Geologic Map of the Sacramento Quadrangle*, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 1A.

Figures



Source: MAPTECH Terrain Navigator Pro, v. 6.03, USGS topographic 7.5 minute quadrangle, Auburn, 1953 (revised 1981), Greenwood, 1949 (revised 1973), Coloma, 1949 (revised 1973), and Pilot Hill, 1954 (revised 1978).

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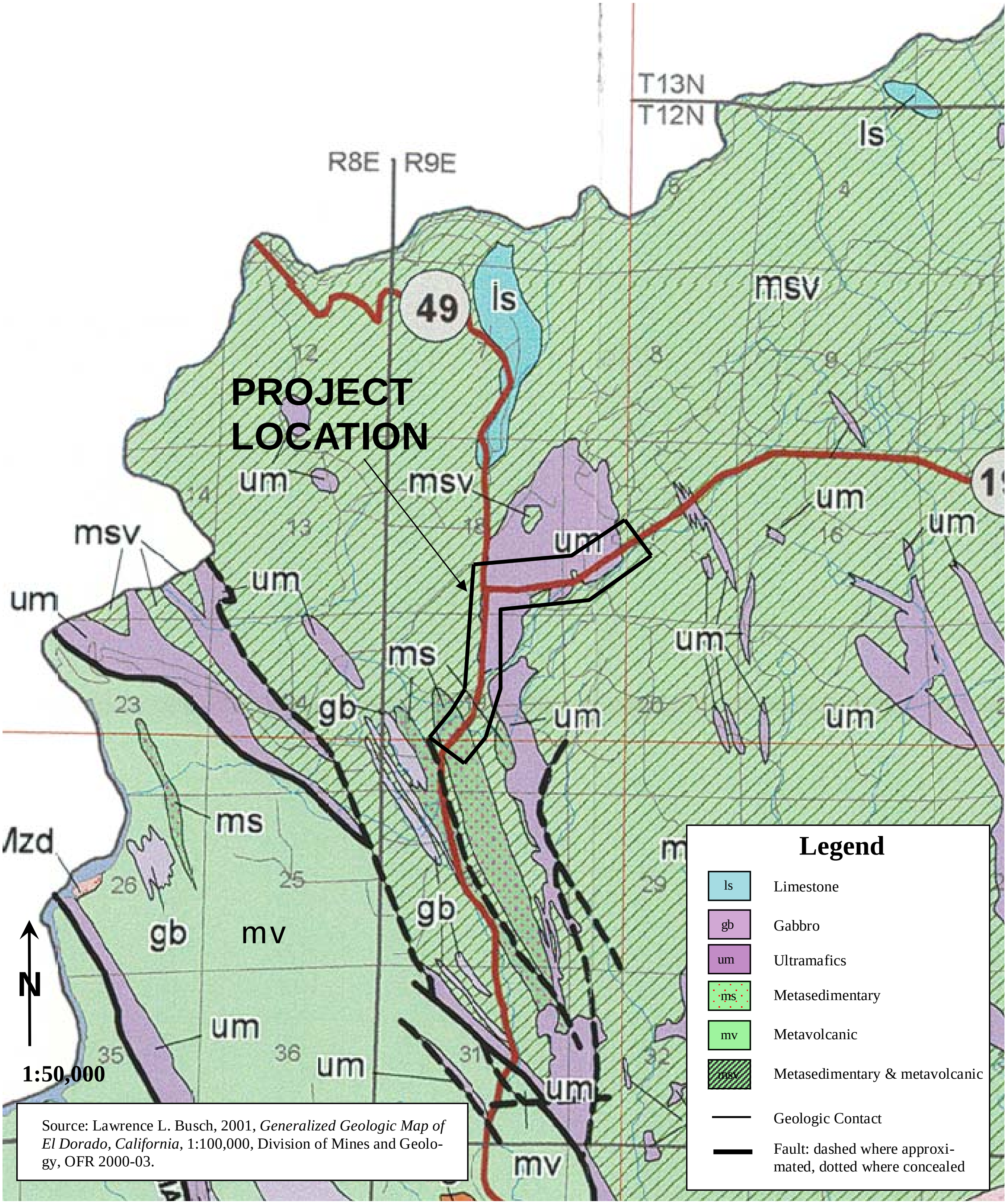
VICINITY MAP
Northside School Bike Path
El Dorado County, CA

Job No. 1068.3

May 2012

Figure 1



Source: Lawrence L. Busch, 2001, *Generalized Geologic Map of El Dorado, California*, 1:100,000, Division of Mines and Geology, OFR 2000-03.

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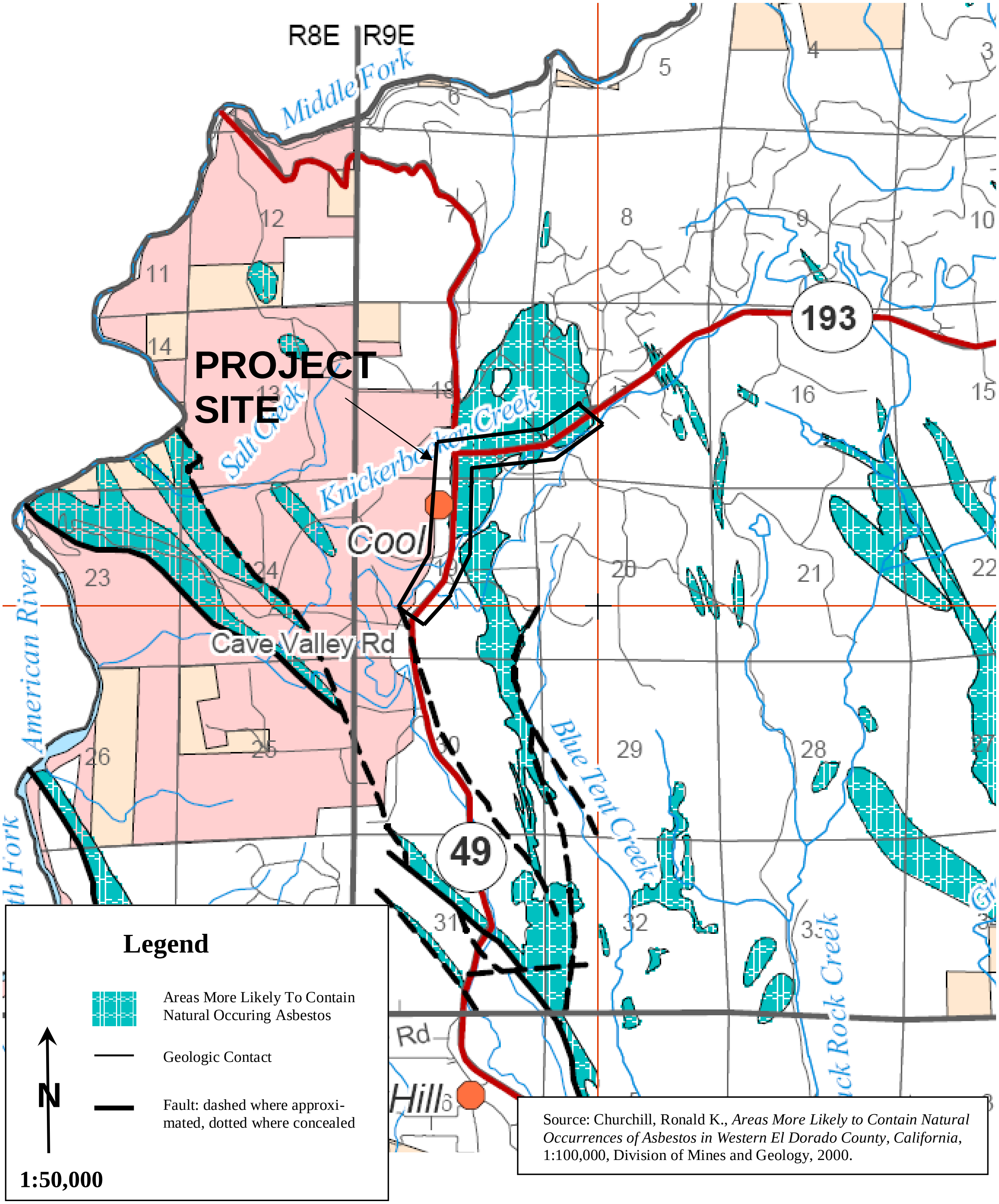
REGIONAL GEOLOGIC MAP
Northside School Bike Path
El Dorado County, CA

Job No. 1068.3

May 2012

Figure 2



Source: Churchill, Ronald K., *Areas More Likely to Contain Natural Occurrences of Asbestos in Western El Dorado County, California*, 1:100,000, Division of Mines and Geology, 2000.

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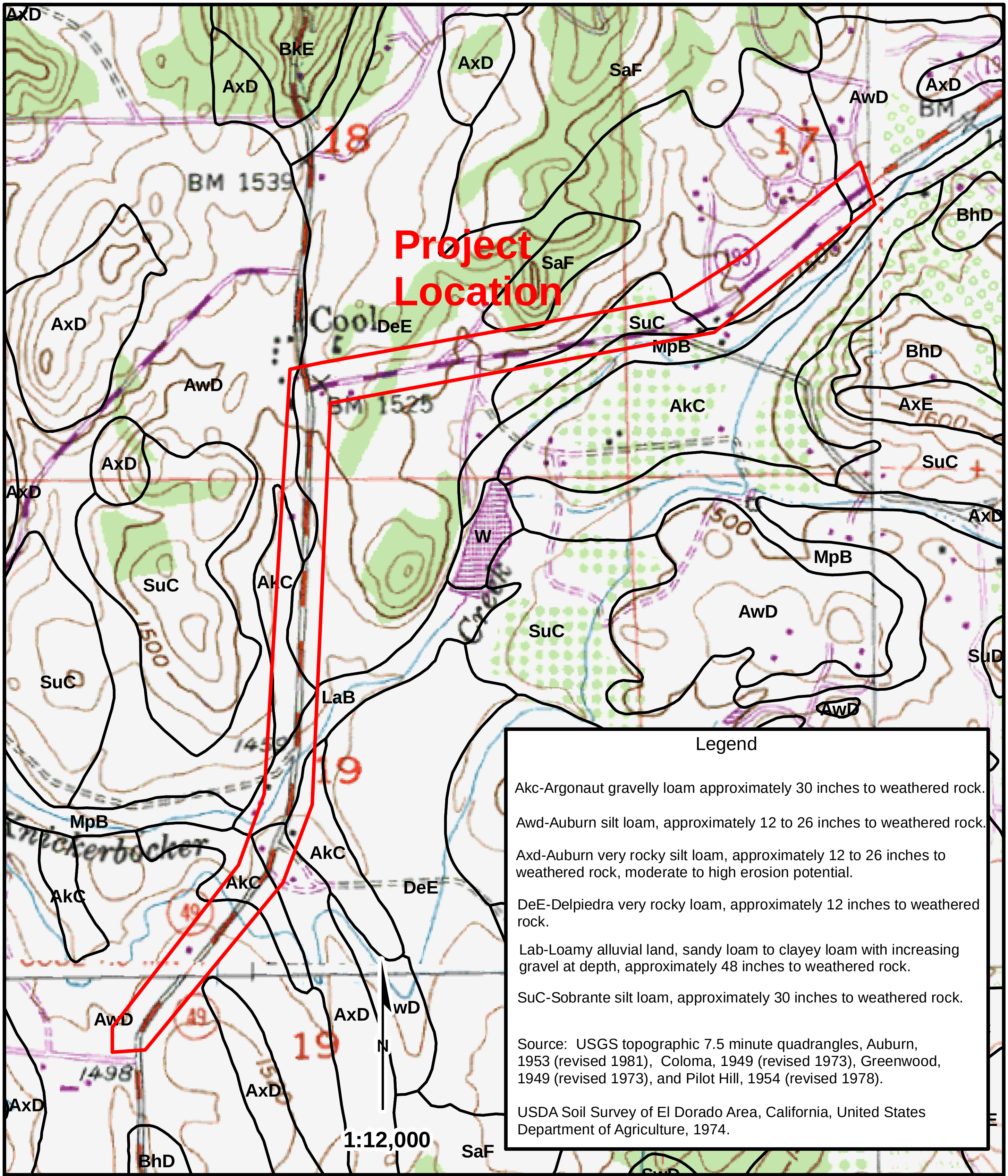
Areas of Potential Naturally Occurring Asbestos

Northside School Bike Path
El Dorado County, CA

Job No. 1068.3

May 2012

Figure 3



Legend

Akc-Argonaut gravelly loam approximately 30 inches to weathered rock.

Awd-Auburn silt loam, approximately 12 to 26 inches to weathered rock.

Axd-Auburn very rocky silt loam, approximately 12 to 26 inches to weathered rock, moderate to high erosion potential.

DeE-Delpiedra very rocky loam, approximately 12 inches to weathered rock.

Lab-Loamy alluvial land, sandy loam to clayey loam with increasing gravel at depth, approximately 48 inches to weathered rock.

SuC-Sobrante silt loam, approximately 30 inches to weathered rock.

Source: USGS topographic 7.5 minute quadrangles, Auburn, 1953 (revised 1981), Coloma, 1949 (revised 1973), Greenwood, 1949 (revised 1973), and Pilot Hill, 1954 (revised 1978).

USDA Soil Survey of El Dorado Area, California, United States Department of Agriculture, 1974.

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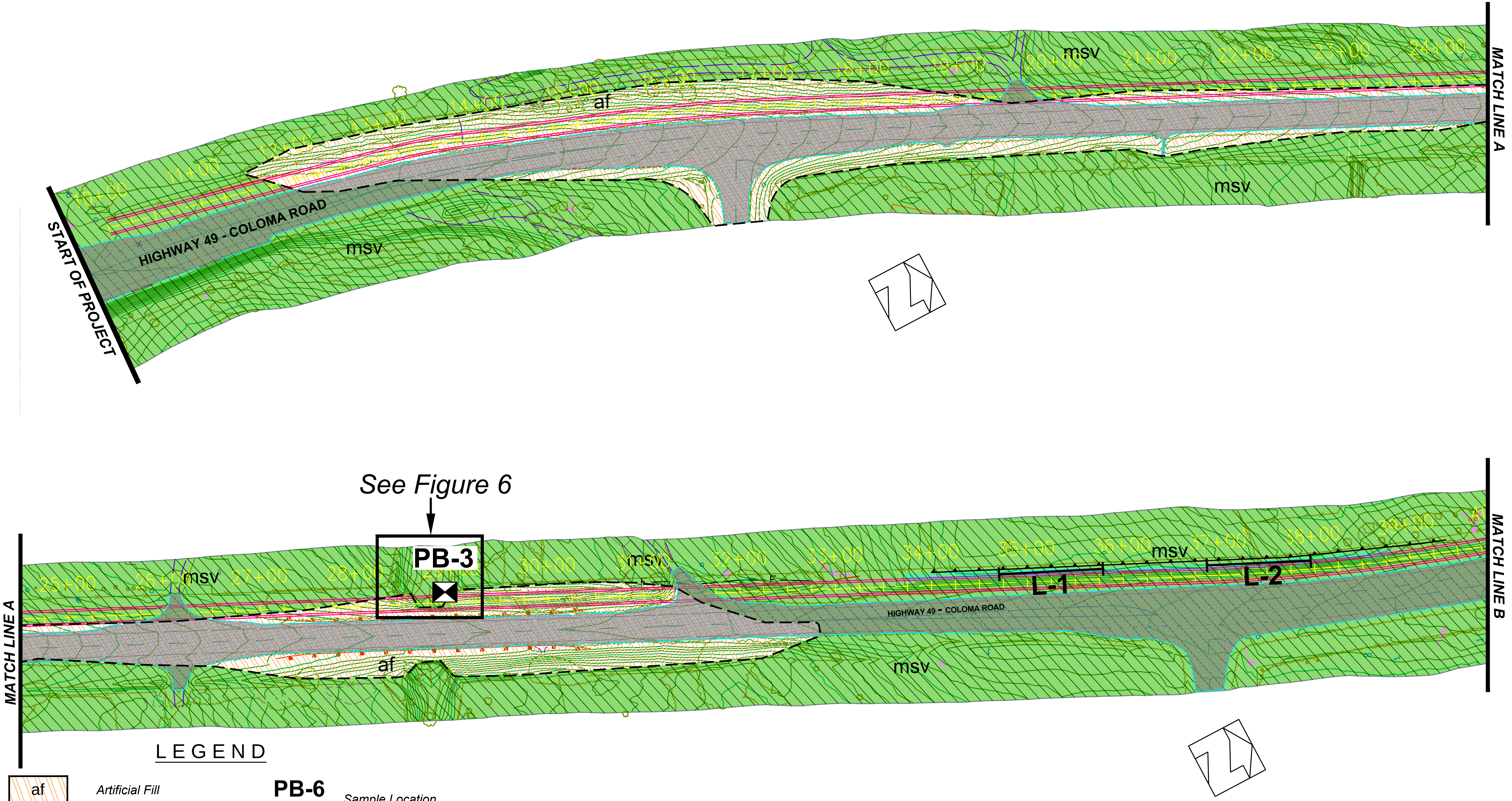
SOIL SURVEY MAP

Northside School Bike Path
El Dorado County, California

Job No. 1068.3

May 2012

Figure 4



LEGEND

af	*Artificial Fill*
msv	*Metasedimentary & Metavolcanic Rock*
um	*Ultramafic Rocks*
— —	*Approximate Geologic Contact*
PB-6 ⊠	*Sample Location*
L-2	*Seismic Refraction Line*

Source: Topography and alignment by El Dorado County Department of Transportation, received February 2008.

SCALE: 1" = 100'

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SITE PLAN

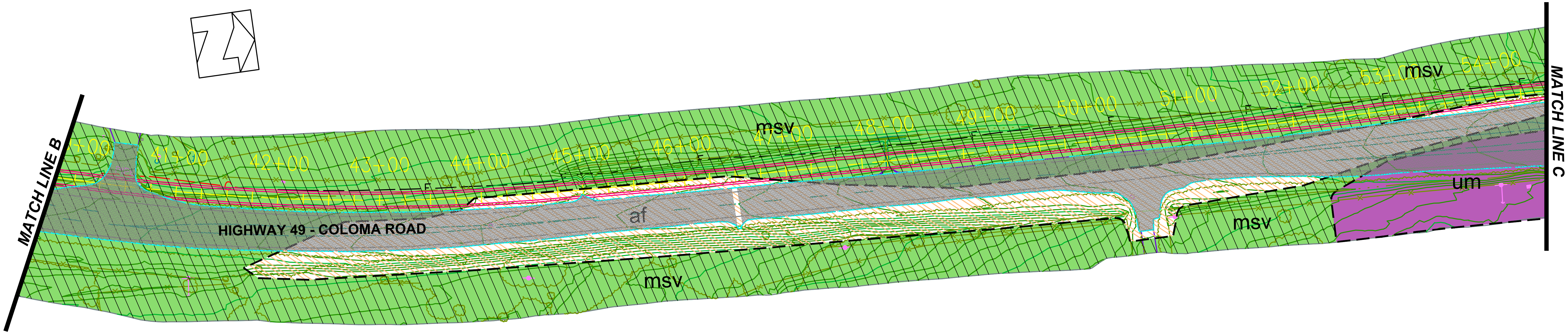
Northside School Bike Path
El Dorado County, California

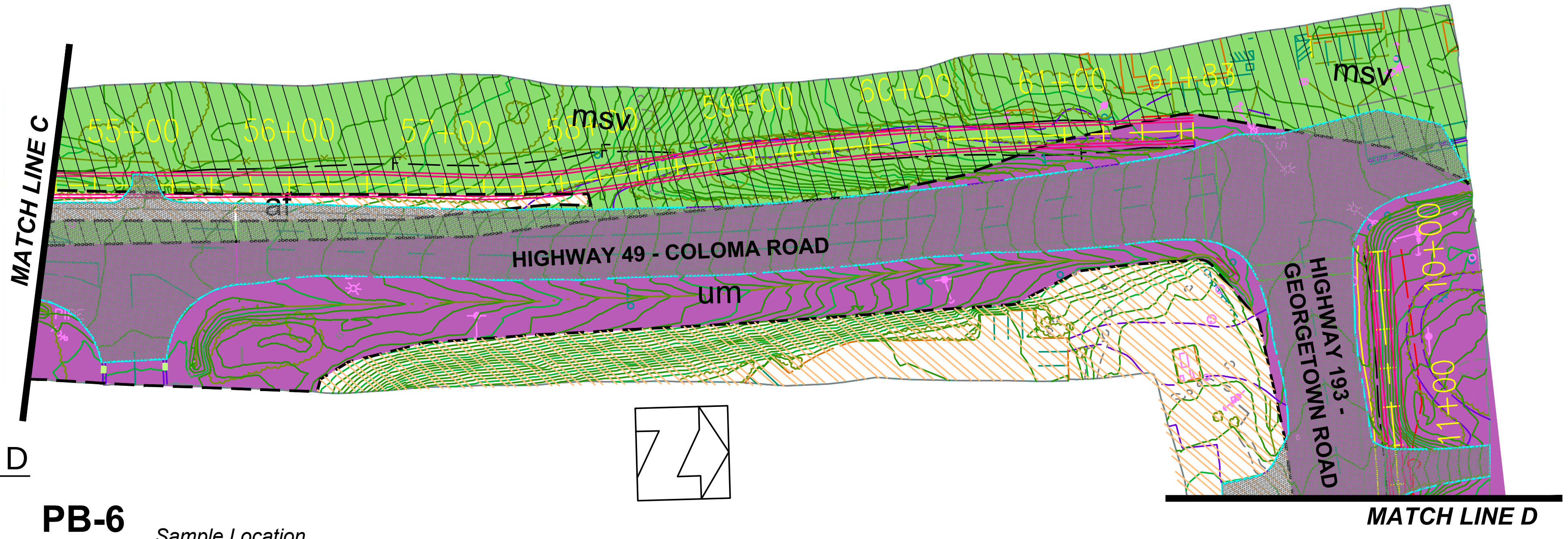
File No. 1068.3

May 2012

Figure 5
Page 1 of 4

5/7/2012 – 1068.2 Northside School Bike Path Figure 5.dwg





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SCALE: 1" = 100'

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SITE PLAN

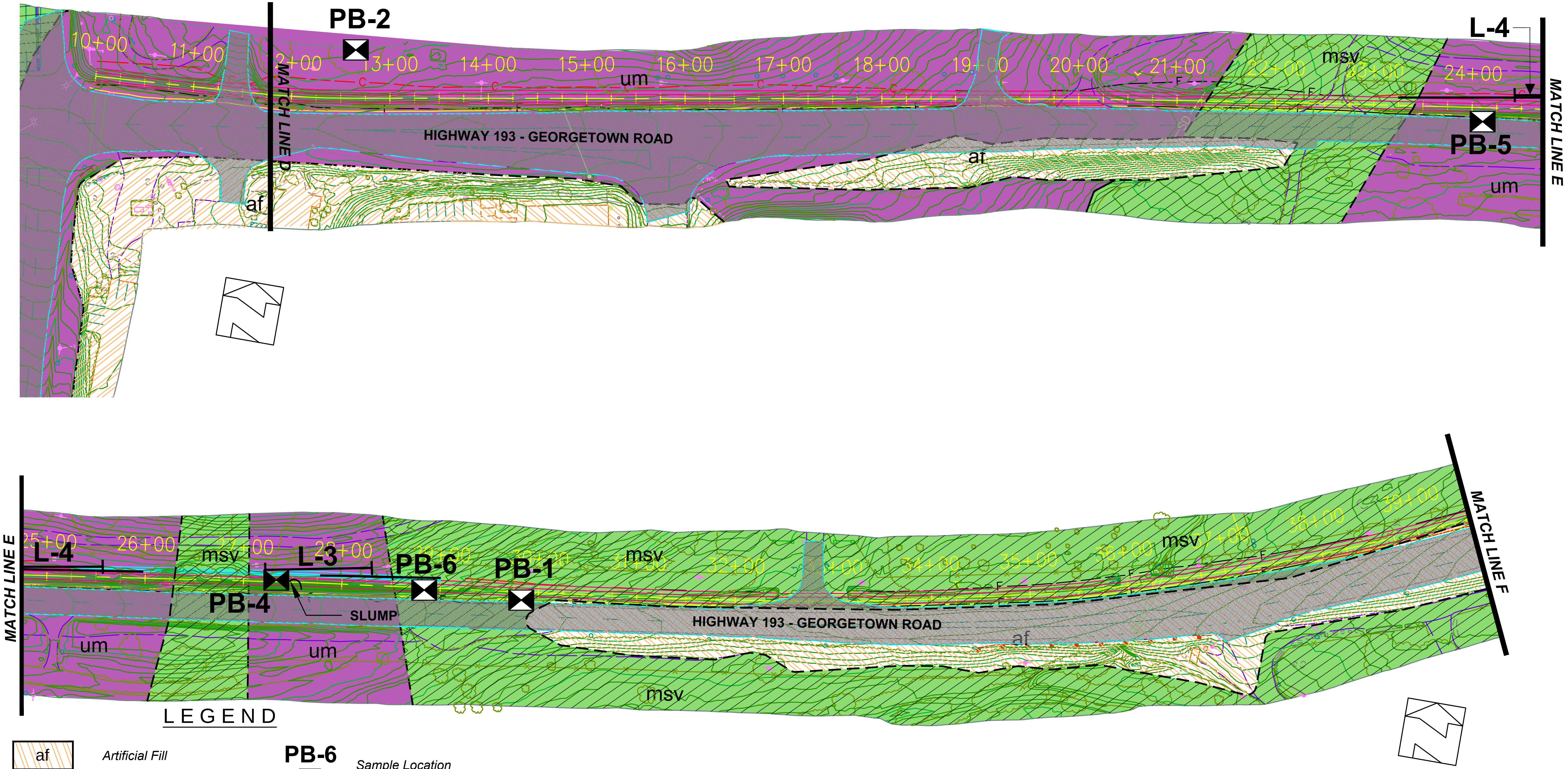
Northside School Bike Path
El Dorado County, California

File No. 1068.3

May 2012

Figure 5
Page 2 of 4

5/7/2012 -- 1068.2 Northside School Bike Path Figure 5.dwg



LEGEND

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um	*Ultramafic Rocks*
— —	*Approximate Geologic Contact*
PB-6 ⊠	*Sample Location*
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Source: Topography and alignment by El Dorado County Department of Transportation, received February 2008.

SCALE: 1" = 100'

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SITE PLAN

Northside School Bike Path
El Dorado County, California

File No. 1068.3

May 2012

Figure 5
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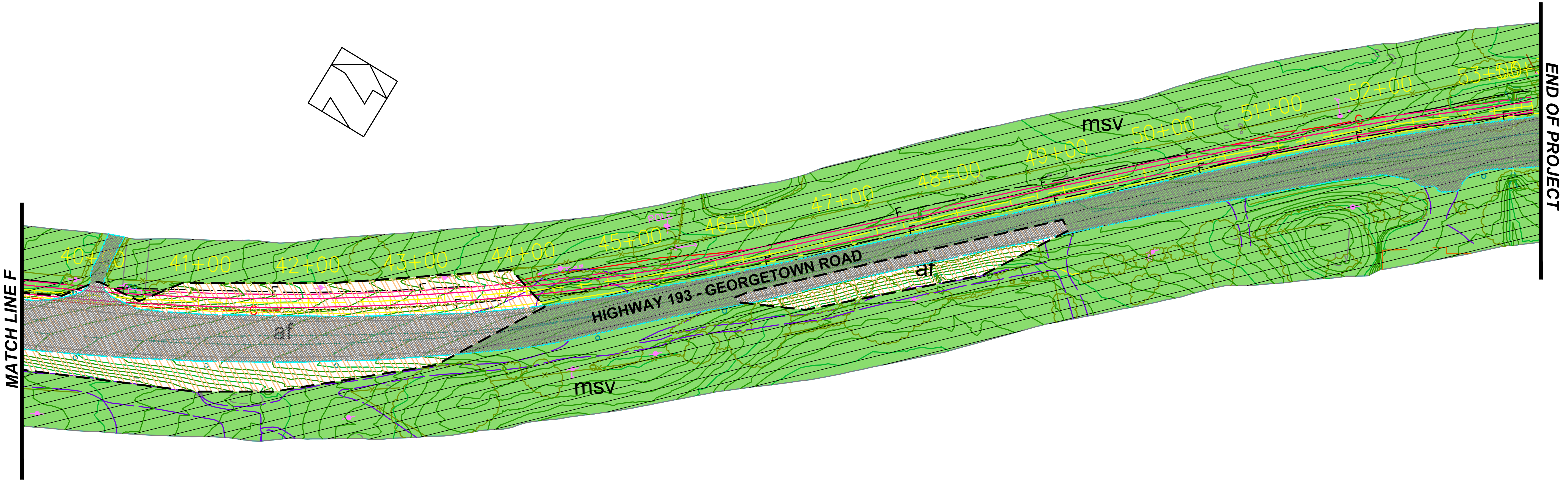
5/7/2012 – 1068.2 Northside School Bike Path Figure 5.dwg



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Source: Topography and alignment by El Dorado County Department of Transportation, received February 2008.

SCALE: 1" = 100'

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SITE PLAN
Northside School Bike Path
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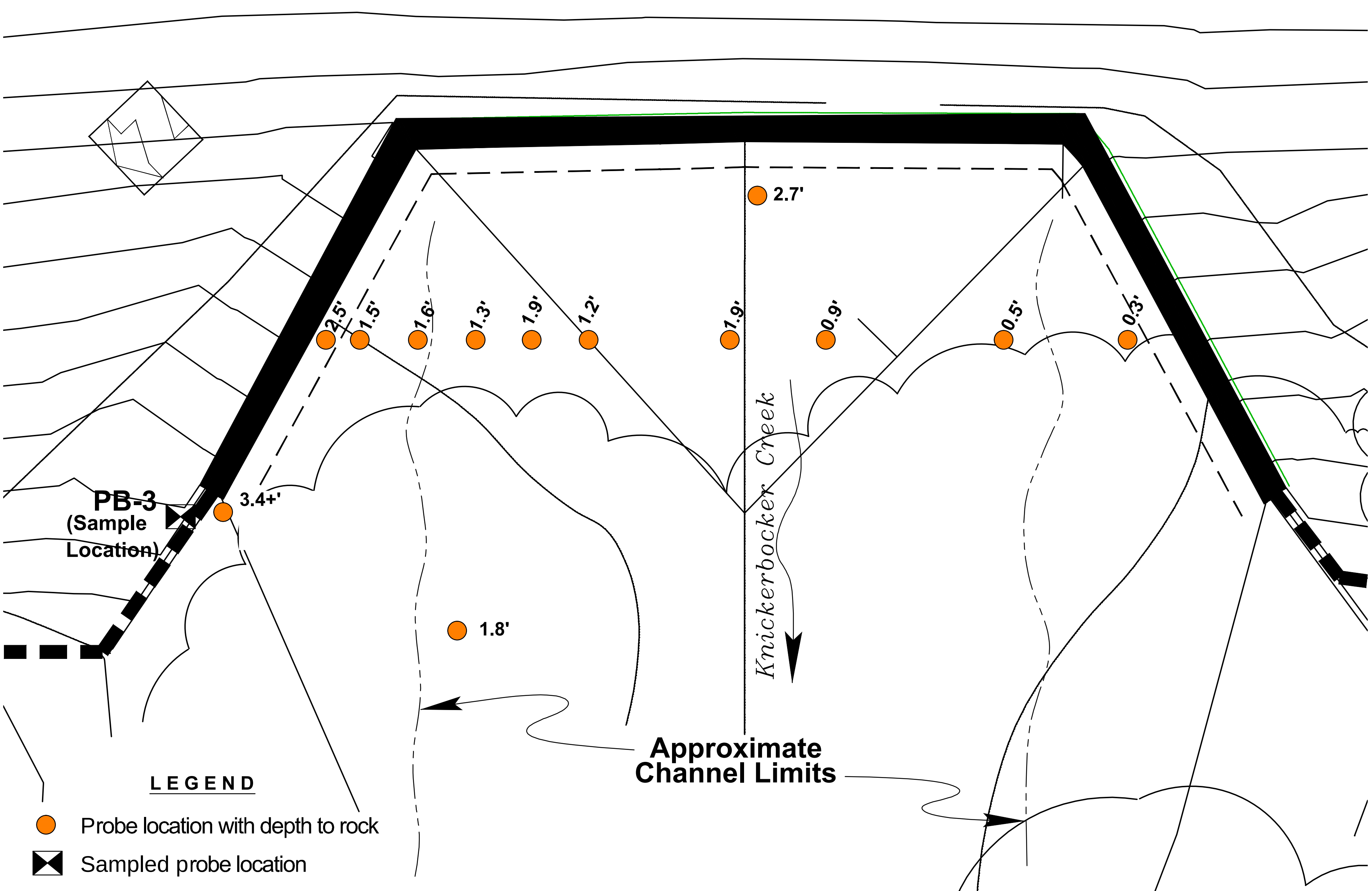
May 2012

Figure 5
Page 4 of 4

5/7/2012 – 1068.2 Northside School Bike Path Figure 5.dwg



NOTE: Water depth in creek approximately 1 ft (elev. 1448 ±) , May 2008.

SCALE: 1" = 5'

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KNICKERBOCKER CREEK CULVERT

Northside School Bike Path
Bridge No. 25-0123
El Dorado County, California

File No. 1068.3

May 2012

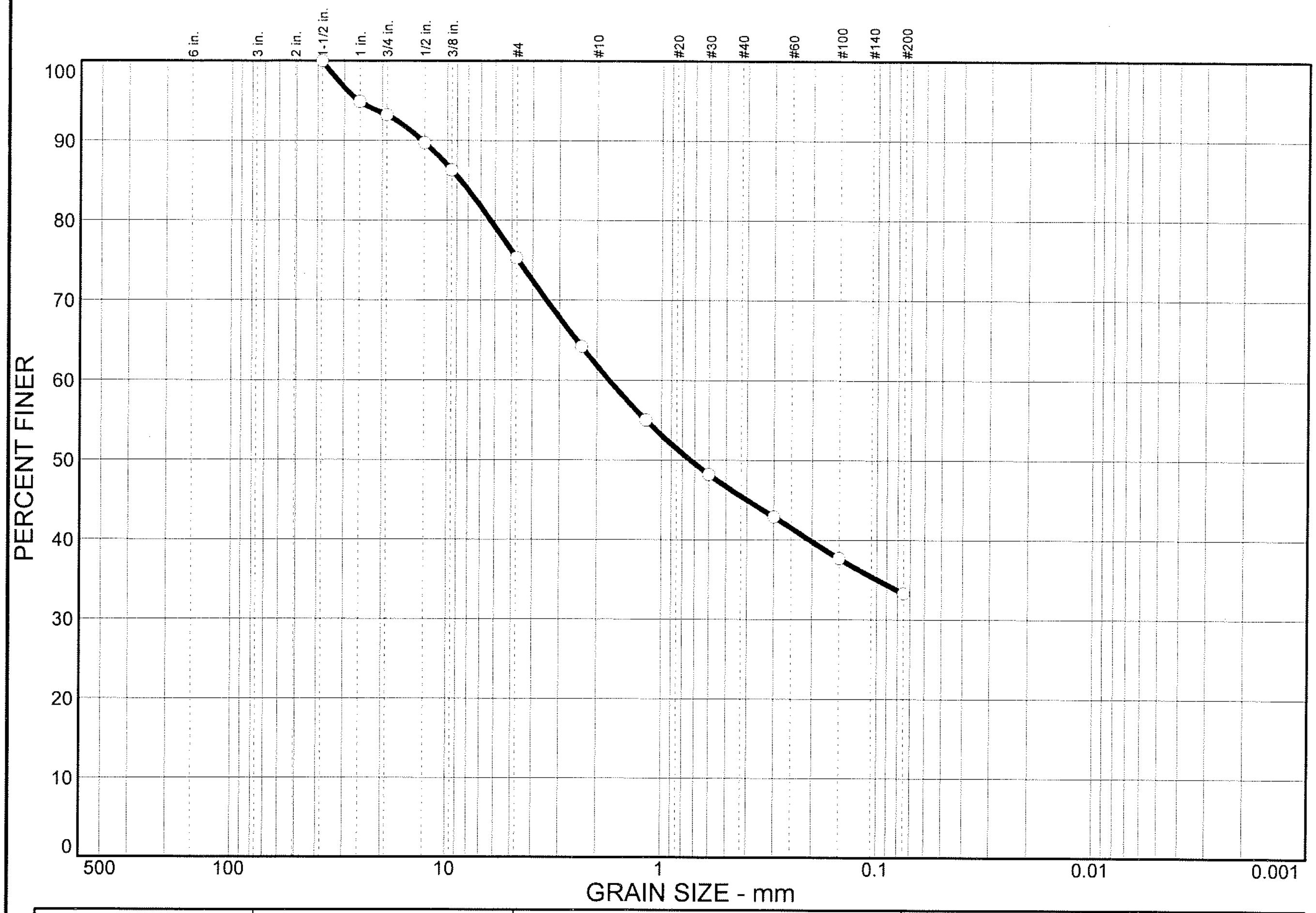
Figure 6

5/9/2012 - 1068.2 Northside School Bike Path Figure 6.dwg

APPENDIX A

Laboratory Test Results

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	24.7	42.0	33.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2 in.	100.0		
1 in.	94.9		
3/4 in.	93.2		
1/2 in.	89.7		
3/8 in.	86.3		
#4	75.3		
#8	64.2		
#16	55.0		
#30	48.2		
#50	42.9		
#100	37.7		
#200	33.3		

* (no specification provided)

Material Description

Dark Yellowish Brown Silty SAND with GRAVEL AND Organics

Atterberg Limits

PL= 30 LL= 45 PI= 15

Coefficients

D_{85}= 8.67 D_{60}= 1.75 D_{50}= 0.734
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

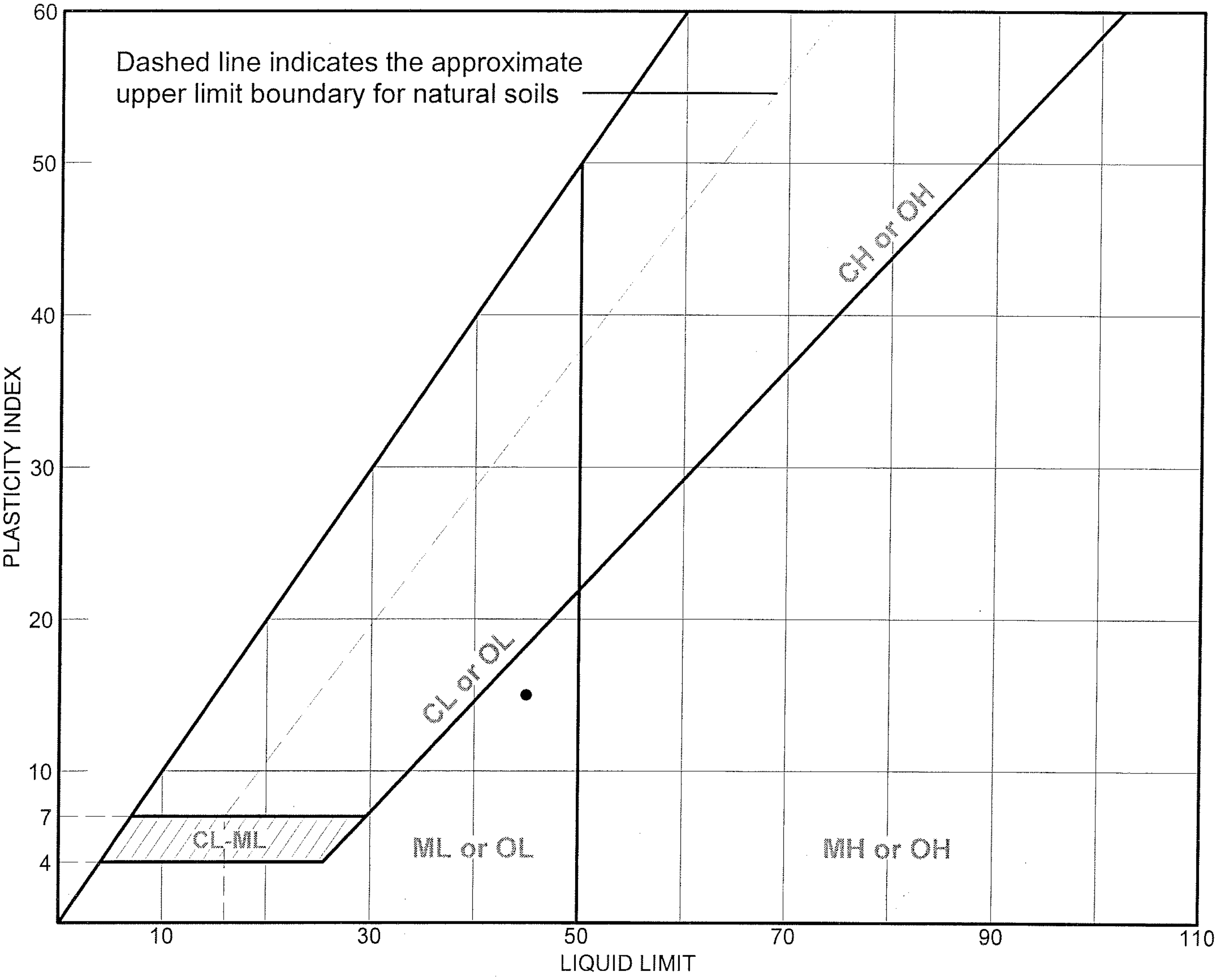
Remarks

Sample No.: PB-3 **Source of Sample:** **Date:** 5-12-08
Location: **Elev./Depth:**

Blackburn Consulting
Auburn, California

Client: El Dorado County
Project: Northside Bike Investigation
Project No: 1068.2 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT

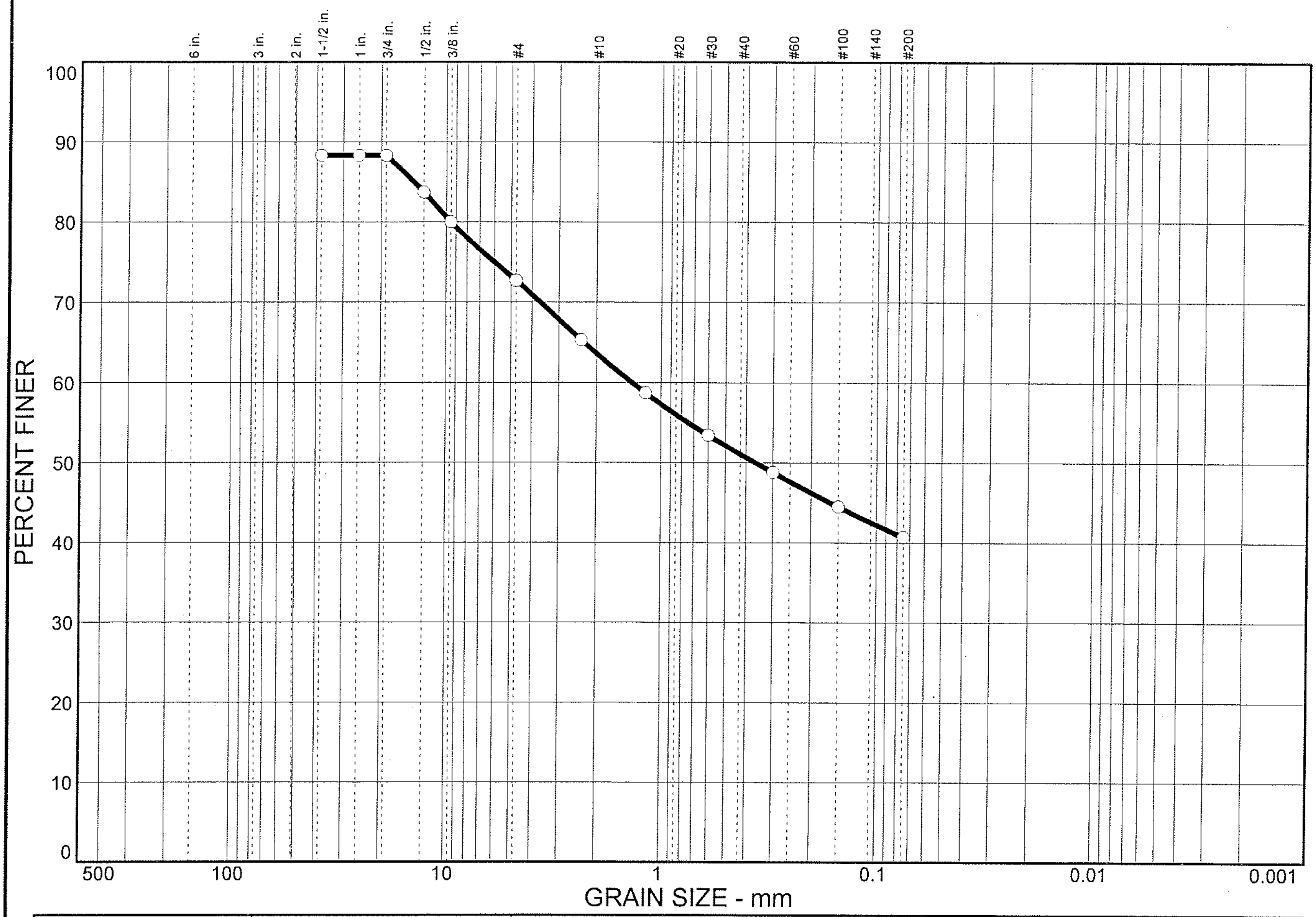


SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		PB-3			30	45	15	SM

LIQUID AND PLASTIC LIMITS TEST REPORT **Blackburn Consulting** **Auburn, California**	**Client:** El Dorado County **Project:** Northside Bike Investigation **Project No.:** 1068.2 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		32.0	40.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2 in.	88.3		
1 in.	88.3		
3/4 in.	88.3		
1/2 in.	83.7		
3/8 in.	80.0		
#4	72.7		
#8	65.3		
#16	58.7		
#30	53.4		
#50	48.8		
#100	44.5		
#200	40.7		

* (no specification provided)

Material Description

Light Brown Silty sand with Sandstone

Atterberg Limits

PL= 29 LL= 39 PI= 10

Coefficients

D_{85}= 14.1 D_{60}= 1.37 D_{50}= 0.362

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample No.: PB-6 **Source of Sample:** **Date:** 5-12-08

Location: **Elev./Depth:**

Blackburn Consulting

Auburn, California

Client: El Dorado County

Project: Northside Bike Investigation

Project No: 1068.2 **Figure**

Relative Compaction
C.T.M. 216

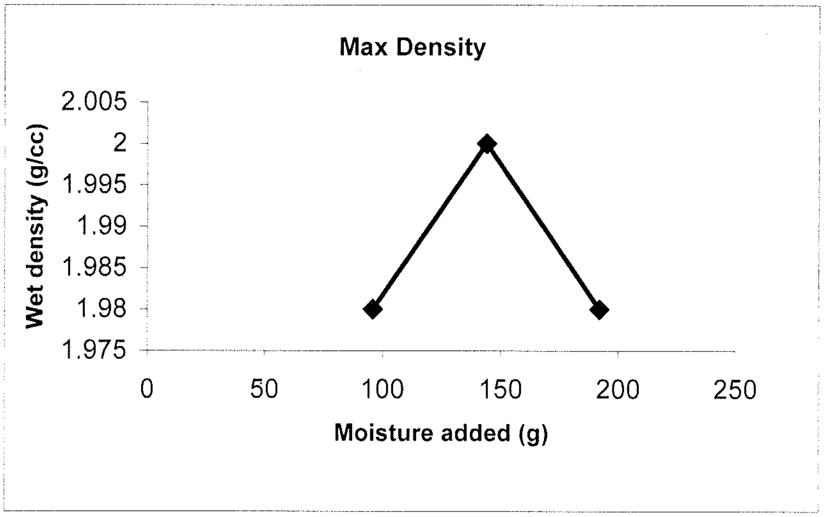
Project Name:	EL DORADO BIKE PATH	**Date:**	5/16/08
Project No:	1068.2	**Tested by:**	KC / EH
Boring/Sample No.:	PB-6	**Depth:**	
Sample Description:	Light Brown Silty Sand with Sandstone		

IMPACT TEST DATA				
Initial Wet Weight of Sample (g)	**2400**			
Specimen Number	1	2	3	4
Water Adjustment (g)	96	144	192	
Tamper Reading	11.5	11.4	11.5	
Wet Density (g/cc)	1.98	2.00	1.98	

SAND VOLUME DATA	
Initial Sand wt (g)	
Residue wt (g)	
Sand used	
Cone Correction (g)	
Sand in hole (g)	
Sand Density (g/cc)	
Volume of Hole	
Wet Density (g/cc)	

Rock Correction

Total Sample (g)	
+3/4" in Air (g)	
+3/4" in Water (g)	
+3/4" Volume (cc)	
% +3/4"	
% -3/4"	
Density +3/4" (g/cc)	
% +3/4"/ Den. +3/4"	
% -3/4" / Den. -3/4"	
SUM	
Adj. density (g/cc)	**2.00**



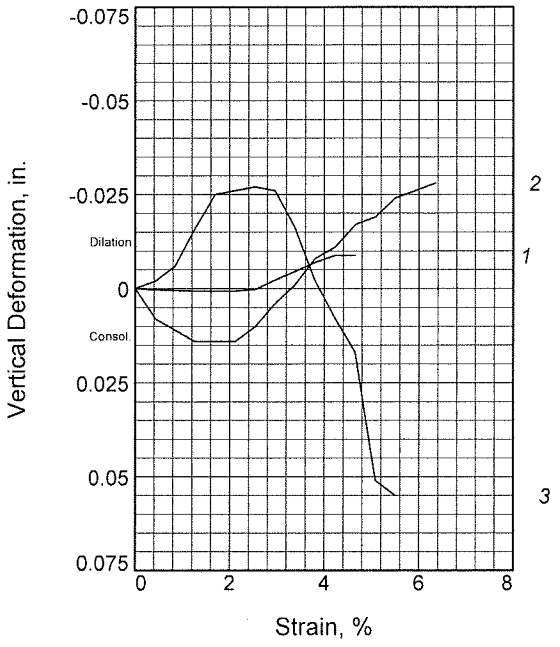
MOISTURE ADJUSTMENT FOR AGGREGATE BASE PAY QUANTITY			
Inplace Wet		Test Spec Wet	
Inplace dry		Test Spec Dry	
Inplace Water		Test Spec Water	
Inplace % Water		Test Spec % Water	

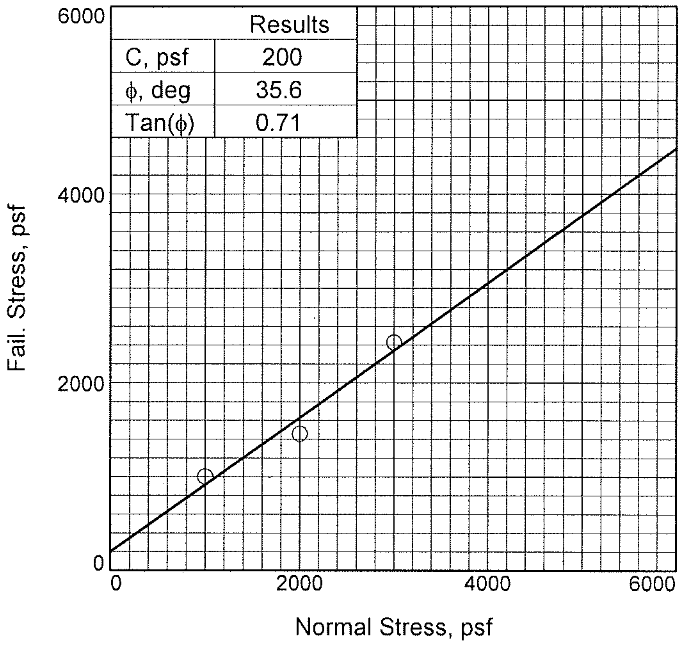
Dry Density Calculation			
Tare #	Y	**Max Wet Density (g/cc)**	**2.00**
Tare wt (g)	154.7	**Max Dry Density (g/cc)**	**1.72**
Tare + wet (g)	520.7	**Max Wet Density (pcf)**	**124.9**
Tare + dry (g)	469.7	**Max Dry Density (pcf)**	**107.5**
% Moisture	**16.2%**		

%+3/4 Adjustment	
20	1.00
21-25	0.99
26-30	0.98
31-35	0.97
36-40	0.96
41-45	0.95
46-50	0.94

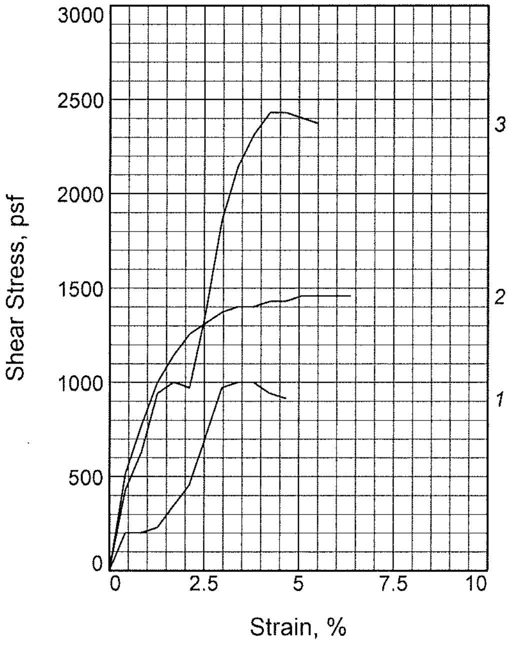
Remarks: Material screened on #4 sieve for Direct Shear

Blackburn Consulting





	Results
C, psf	200
ϕ, deg	35.6
Tan(ϕ)	0.71



Sample No.		1	2	3
Initial	Water Content, %	16.4	16.4	16.5
	Dry Density, pcf	112.5	102.9	103.7
	Saturation, %	89.2	69.3	71.0
	Void Ratio	0.4977	0.6374	0.6257
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.94	0.94	0.94
At Test	Water Content, %	18.3	22.3	22.1
	Dry Density, pcf	112.9	105.2	105.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4936	0.6021	0.5961
	Diameter, in.	2.36	2.36	2.36
	Height, in.	0.94	0.92	0.93
Normal Stress, psf		1000	2000	3000
Fail. Stress, psf		1001	1458	2430
Strain, %		3.4	5.1	4.2
Ult. Stress, psf				
Strain, %				
Strain rate, %/min.		0.15	0.15	0.15

Sample Type: Remolded

Description: Light Brown Silty sand with Sandstone

LL= 39 **PL=** 29 **PI=** 10

Assumed Specific Gravity= 2.70

Remarks: material screened on #4 sieve and remolded to 90% of CTM - 216

Figure ________

Client: El Dorado County

Project: Northside Bike Investigation

Sample Number: PB-6

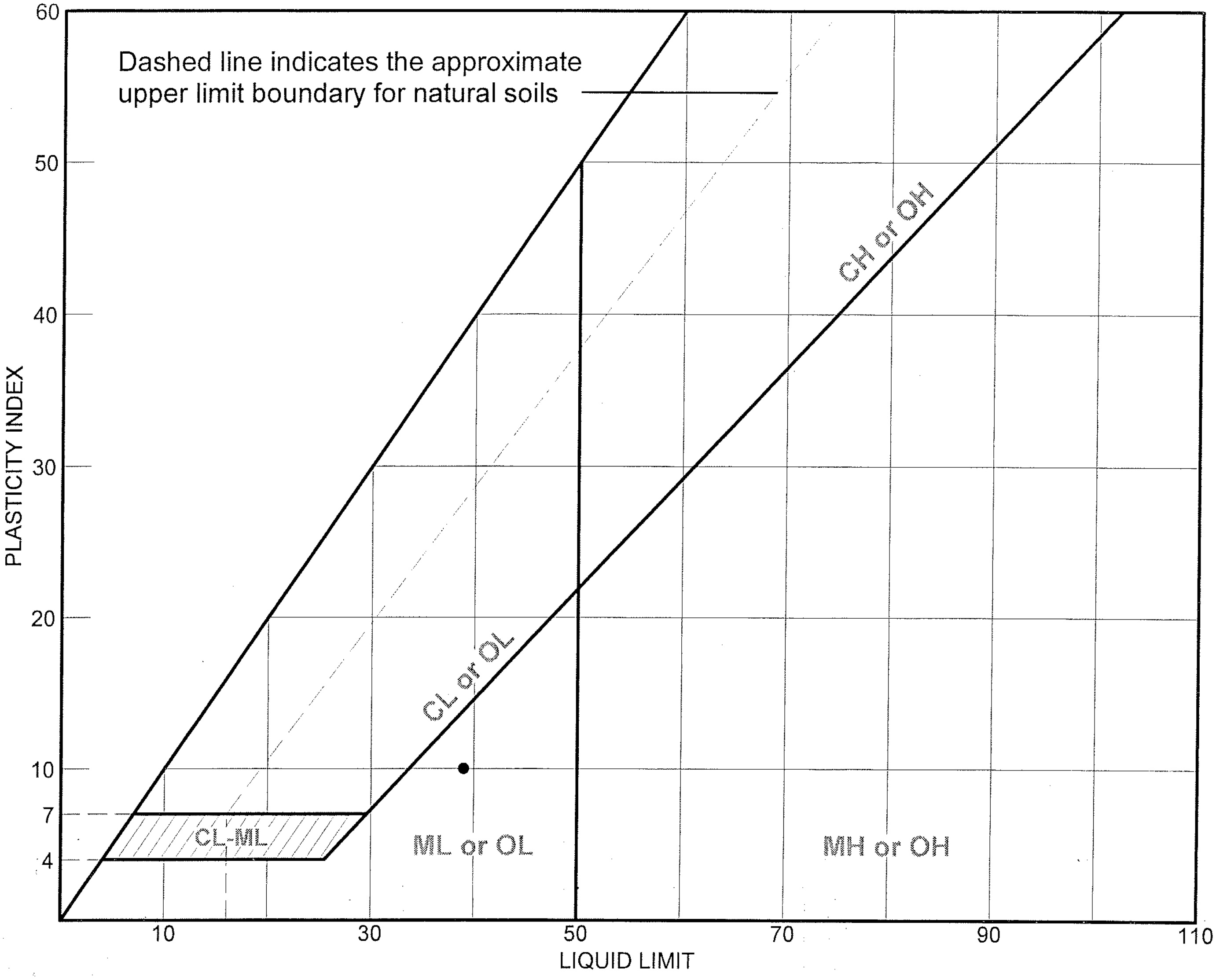
Proj. No.: 1068.2 **Date Sampled:** 5-12-08

DIRECT SHEAR TEST REPORT

Blackburn Consulting

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

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		PB-6			29	39	10	SM

LIQUID AND PLASTIC LIMITS TEST REPORT

Blackburn Consulting

Auburn, California

Client: El Dorado County

Project: Northside Bike Investigation

Project No.: 1068.2

Figure

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 05/21/2008
Date Submitted 05/14/2008

To: Ken Colburn
Blackburn Consulting Laboratory
11521 Blocker Dr. Ste. 110
Auburn, CA 95603

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : NORTHSIDE BIKE INVES Site ID : PB3.
Your purchase order number is 1068.2.
Thank you for your business.

* For future reference to this analysis please use SUN # 53242-106603.

EVALUATION FOR SOIL CORROSION

Soil pH	7.38	
Minimum Resistivity	1.82 ohm-cm (x1000)	
Chloride	19.1 ppm	00.00191 %
Sulfate	8.8 ppm	00.00088 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 05/21/2008
Date Submitted 05/14/2008

To: Ken Colburn
Blackburn Consulting Laboratory
11521 Blocker Dr. Ste. 110
Auburn, CA 95603

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : NORTHSIDE BIKE INVES Site ID : PB6.
Your purchase order number is 1068.2.
Thank you for your business.

* For future reference to this analysis please use SUN # 53242-106604.

EVALUATION FOR SOIL CORROSION

Soil pH	6.17		
Minimum Resistivity	3.75	ohm-cm (x1000)	
Chloride	13.3 ppm	00.00133	%
Sulfate	3.1 ppm	00.00031	%

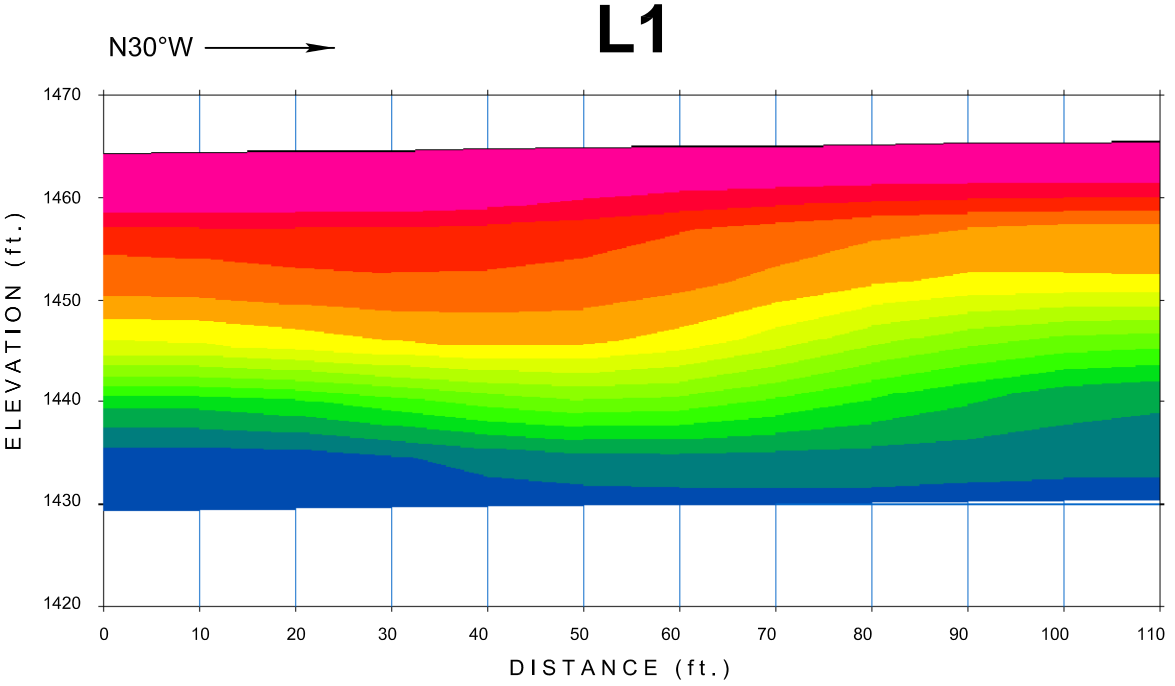
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX B

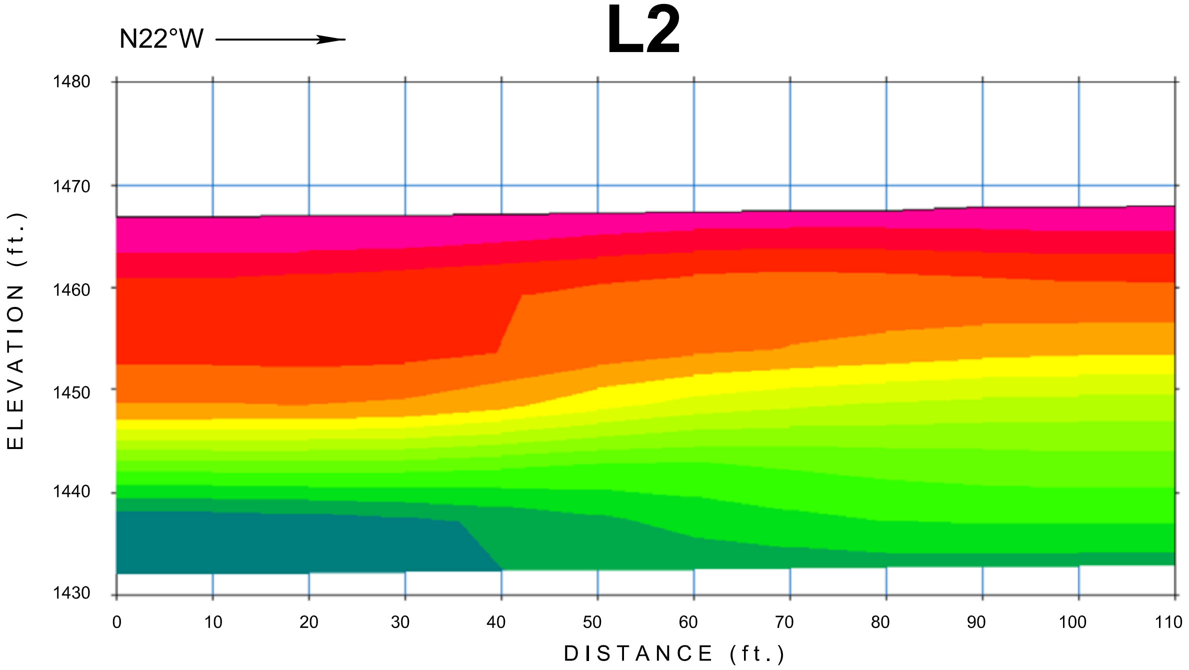
Seismic Refraction Lines

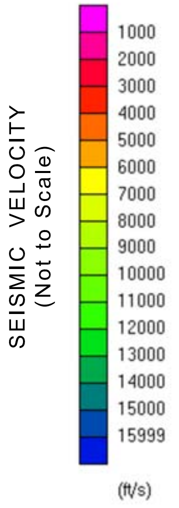
Appendix B

L1



L2





Scale: 1" = 20'

6/5/2008 - Y:\Projects\1068.3 Northside Bike Supplemental\Final Report\1068.2 Northside School Bike Path Appendix B.dwg

blackburn consulting

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

SEISMIC REFRACTION LINES

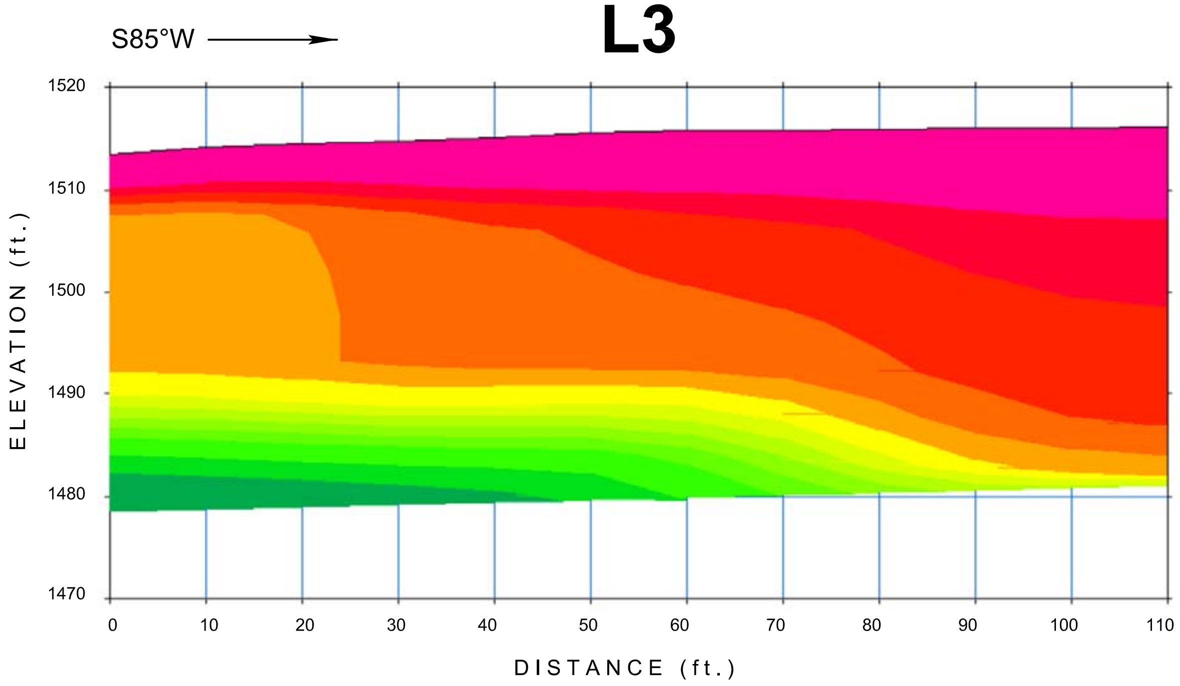
Northside Bike Path Project
El Dorado County, California

File No. 1068.3

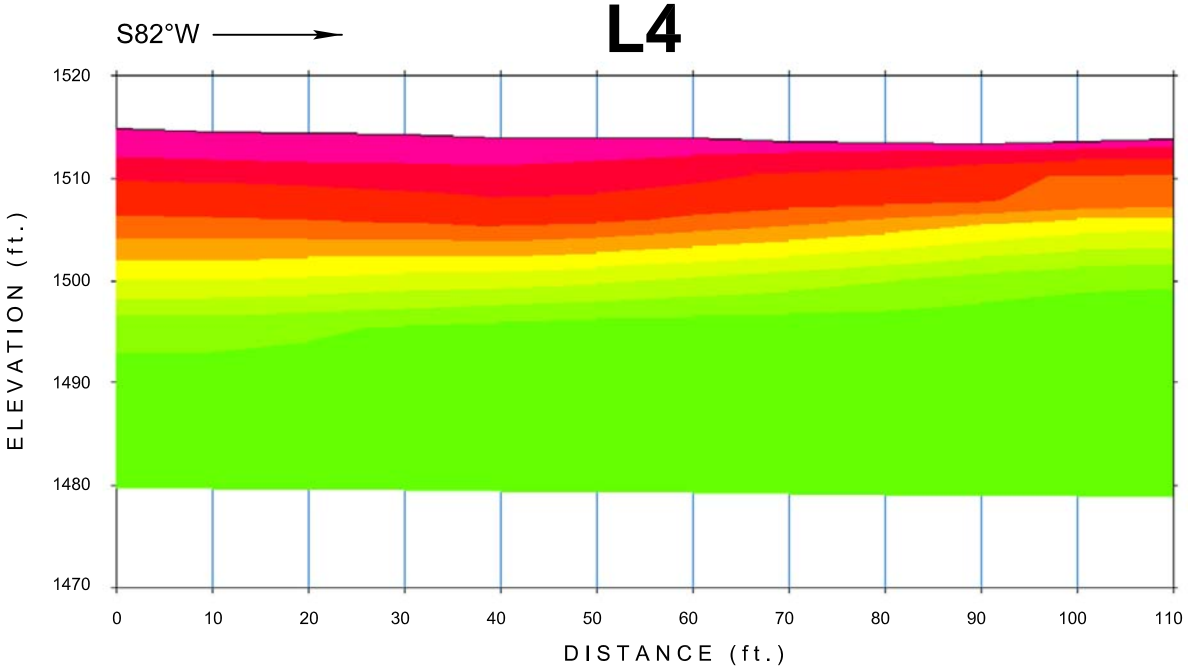
May 2012

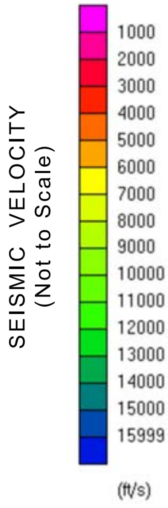
Appendix B

L3



L4





Scale: 1" = 20'

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SEISMIC REFRACTION LINES

Northside Bike Path Project
El Dorado County, California

File No. 1068.3

May 2012

Appendix B

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