

# GEOTECHNICAL INVESTIGATION

## I-80 PEQUOP SUMMIT ANIMAL OVERCROSSING ELKO COUNTY, NEVADA



STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
GEOTECHNICAL SECTION

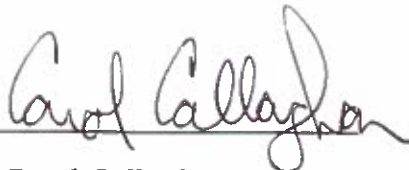
**GEOTECHNICAL INVESTIGATION REPORT**  
**I-80 PEQUOP SUMMIT ANIMAL OVERCROSSING**

August 31, 2015

EA #73606

ELKO COUNTY, NEVADA

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## **1.0 INTRODUCTION**

Presented herein is the Nevada Department of Transportation (NDOT) Geotechnical Investigation for the proposed wildlife overcrossing structures on I-80 EB and WB near Pequop Summit in Elko County, Nevada. A Preliminary Design Field Study (PDFS) held on November 13, 2014 identified the area under consideration as being in the vicinity of milepost 97, east of Pequop Summit and about 1/4 mile west of exit 376, Pequop. The project location is presented below in Appendix A.

The objective of this investigation is to determine general soil and groundwater conditions at the proposed project site. This report also provides geotechnical design recommendations for the construction of the structures proposed for this project. The scope of this report consists primarily of geotechnical exploration, analysis and recommendations for both design and construction. The investigation includes reviews of published geologic maps and preliminary design information, subsurface field exploration and soil sampling, laboratory testing, Refraction Microtremor Surveys (ReMi), and geotechnical engineering analysis. Results of our reviews field exploration and testing programs form the basis for the conclusions and recommendations presented in this report.

## **2.0 PROJECT DESCRIPTION**

The project site is located east of the city of Wells in Elko County in the Pequop Mountains. I-80 runs roughly east/west in the area of the proposed structures. Preliminary plans indicate prefabricated arch structures under consideration. Overcrossings are planned to be located in adjacent segments of a divided highway, EB and WB I-80 in existing road cuts in the vicinity of Elko MP 97. I-80 consists of five asphalt paved travel lanes with two eastbound travel lanes and three westbound travel lanes that includes a truck passing lane.

## **3.0 SITE CONDITIONS**

### **3.1 Surficial Geology**

According to available references (Geology of Elko County, Nevada, Bulletin 101; Nevada Bureau of Mines, and Geology, Robert R. Coats 1987), the project site is located within the Diamond Peak and Chainman Formation, which is part of the Carbonate and Detrital Sequences within and on the margin of the Orogenic Belt. Conglomerate, sandstone, shale and minor limestone make up this formation. The road cut in which the animal overcrossings are to be located is made up of these native rocks. Argillite, a clayey mudstone intermediary between shale and slate appears to be the primary rock type within the project area. Argillite is a slightly metamorphic or highly compacted sedimentary rock that, unlike shale, is bound by silica, but does not demonstrate the true slaty cleavage. The area of the proposed structures lies at an elevation of between about 6400 feet to 6500 feet and slopes fairly steeply downward to the south and less steeply downward to the east.

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- APPENDIX B: LABORATORY TEST DATA, SUMMARY OF RESULTS, PARTICLE SIZE DISTRIBUTION REPORTS
- APPENDIX C: GEOPHYSICAL LOCATION MAP, GEOPHYSICAL TEST DATA

## **4.0 SITE INVESTIGATION**

### **4.1 Drilling**

Site specific geotechnical information was gathered for the wildlife overcrossing. Subsurface information was gathered during November of 2014. The borings were drilled using a Deidrich D120, drill rig number 1627 equipped with an internal anvil automatic hammer utilizing hollow stem auger drilling methods. The NDOT engineer logged the subsurface conditions encountered during the field investigation. Soils were classified according to the United Soil Classification System (USCS) as described in the American Society of Testing and Materials (ASTM) D 2487. A brief key to the USCS is included in Appendix B on the Key to Boring Logs sheet. The borings were backfilled with cuttings and grouted upon completion.

Boring depths ranged from 15.2 to 25.3 feet. One boring was done on each shoulder in a staggered spacing in the area proposed for the structures. Augured samples of subgrade native and embankment fill soils were obtained from each boring. Driven samples were obtained using a Standard Penetration Test (SPT ASTM D 1586) split spoon sampler. Soil samples were obtained by driving the sampler 18 inches (unless otherwise noted) into the bottom of the boring using a 30-inch drop of an automatic hammer weight of 140 pounds. The blows per foot (Blow Count) are presented on the boring logs indicating the sampler drive resistance (N-Value), an indication of the apparent density of the site soils. Blow counts have not been corrected for rod length, hammer type, etc. Bulk samples were obtained by collecting auger spoils. The energy transfer from the automatic hammer into the drill rig string was calibrated at 74% for unit #1627. (SPT calibration was done by Gregg Drilling and Testing, Inc. in 2013.) Soils were classified according to the United Soil Classification System (USCS). Boring Logs and Line Sampling Data are included in Appendix A. A location map has been provided for these borings. Test Results from the borings are included in Appendix B.

Locations of the borings were obtained using handheld resource grade Global Positioning System (GPS). Elevations were obtained using survey methods from local survey markers. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

### **4.2 Geophysical Survey**

ReMi geophysical surveys were conducted by an NDOT Engineer along each of the four shoulders. ReMi data was obtained at each location using cables with 12 geophones spaced 20 feet apart. Broad ambient noise was used as a surface wave (S-wave) energy source and sledgehammer hits on an aluminum plate was used as a deep wave (P-wave) energy source. Data collected from the field was sent to Optim Software and Data Solutions for analysis. Locations of the geophysical surveys and the survey results are presented in Appendix C and discussed in the 'Discussion' section of this report.

## **5.0 LABORATORY TESTING**

Selected samples were tested at the NDOT headquarters laboratory facilities. Laboratory test results can be found in Appendix B.

The laboratory testing program consisted of:

- Natural Moisture Content (AASHTO T-265)
- Particle Size Gradations (AASHTO T-87 & T-27)
- Atterberg Limits (AASHTO T-89 & T-90)
- Resistance Value (R-Value, Nev. T-115)

## **6.0 DISCUSSION**

### **6.1 Site Geology and Subsurface Soil/Bedrock Conditions**

Native soils are generally classified as dense silty sands, frequently intermingled with clayey and gravelly sands. Below the roadbed subgrade, which appears to have been formed from processed native materials, native soils appear to be weak bedrock. It should be noted that the degree of weathering and the depth of bedrock varies across the project area. Refusal on bedrock was encountered on virtually every sample attempted even though drilling made good progress with little difficulty.

### **6.2 Soil Moisture and Groundwater Conditions**

Soils varied in moisture during sampling. All borings were dry near the surface and dry conditions continued to from 5 feet below the surface (PQ1) to full depth explored, 25 feet (PQ3). Drilling was accomplished in November without recent rainfall. Ground water was encountered in half of the borings drilled during the subsurface investigation for this structure. Groundwater depth when encountered varied from 8.5 to 12 feet below ground surface. However the groundwater elevation will fluctuate depending on the time of year and precipitation amounts. In addition, the bedrock may direct flows in unanticipated ways due to rock fissures.

## **7.0 GEOLOGIC HAZARDS**

### **7.1 Faulting and Site Seismicity**

No mapped faults trend through the project area. The nearest fault presented on the referenced geologic map is a north-south trending fault about 8 miles west of the wildlife crossing along the base of the western edge of the Pequop Range. Another small northwest-southeast trending fault lies at the base of the eastern edge of the Pequop Range and terminates about 5 miles south of the wildlife crossing.

### **7.2 Liquefaction**

Liquefaction is a nearly complete loss of soil shear strength that can occur during an earthquake as cyclic stresses generate excessive pore pressure between the soil grains and

the higher the ground acceleration or the longer the duration of shaking, the more likely liquefaction is to occur. This phenomenon is generally limited to unconsolidated sands (up to 35% non-plastic fines) lying below the ground water table. Due to the presence of shallow bedrock, the potential for liquefaction is negligible.

## **8.0 RECOMMENDATIONS**

### **8.1 Earthwork**

All excavation shall be performed in accordance with NDOT 2014 Standard Specifications for Road and Bridge Construction. All permanent embankment slopes should be constructed to lie at a maximum of 2:1 (horiz:vert) slope.

The contractor shall be responsible for all necessary shoring for any excavation and/or construction. All shoring must be in compliance with the Code of Federal Regulations 29 CFR part 1926. For excavations less than 20 feet deep, the roadbed subgrade should be considered OSHA Type C for temporary excavation purposes with an allowed OSHA maximum allowable slope of 1.5 H:1V. For stable native bedrock, the maximum allowable slope is 90 degrees (vertical). The contractor should monitor the existing paved roadway adjacent to excavations for deflection or damage to the structural section of the roadway.

*It should be noted that shallow bedrock is likely to be encountered during excavation activities.*

Variable site conditions always include the possibility of encountering very soft soils, boulders or other adverse conditions in native ground that were not identified in this investigation.

### **8.2 Foundations**

Shallow spread footings are recommended for the proposed structures. Provided that foundation grade soils are prepared in accordance with NDOT standards and specifications, spread footings for retaining walls placed within embankment fill can be designed for a factored bearing capacity of 4,000 pound per square foot (psf). Spread footings for the arch structures and retaining walls placed on native soil and/or bedrock can be designed for a factored bearing resistance of 10,000 psf (strength limit state). This bearing pressure may be increased by one third for total loading conditions, including wind and seismic forces. The weight of the foundation which extends below grade and backfill may be neglected when computing dead loads. The frost depth in the project area is three feet.

Lateral loads, such as wind or seismic, may be resisted by passive soil pressure and friction on the bottom of the footing. A friction factor of 0.40 may be utilized for sliding resistance at the base of the spread footing. Design values for passive equivalent fluid pressures is 300 psf per foot of depth. Both the passive pressure and sliding resistance can be assumed to act concurrently. In designing for passive pressure, the soil above the

footing should not be included unless confined by a concrete slab, or pavement. Design values are based on spread footings bearing on either native granular soils or structural fill, and backfilled with structural fill. The base of all excavations should be dry and free of loose materials at the time of concrete placement. Loose, wet, soft, frozen or disturbed soils encountered at the foundation subgrade should be removed to expose suitable soils and the resulting excavation shall be backfilled with compacted granular fill.

### **8.3 Mechanically Stabilized Earth Walls**

The in-place soil parameters for MSE walls are as follows:

Cohesion,  $c = 0$  psf

Soil Friction Angle ( $\phi$ ) =  $35^\circ$

Soil Unit Weight ( $\gamma_d$ ) = 125 pounds per cubic foot (pcf)

### **8.4 Settlement**

The estimated settlement of the structure abutments is less than 0.5 inches under the anticipated loading due to the type of construction to be performed founded on existing native bedrock. The removal of the embankment soil necessary for the construction of the existing interstate was greater than the planned surcharge loading on the native ground. Differential settlement between similarly loaded, adjacent footings are also estimated to be less than 0.5 inches provided they are founded on similar materials (e.g., all on engineered fill, native soil, or rock).

### **8.5 Seismic Design Parameters**

An Optim Software and Data Solutions representative performed interpretations of the data collected at each ReMi survey line using the most current SeisOpt ReMi software. The average shear wave velocity is presented by the 1-dimensional shear wave velocity profiles located in the Appendix. These plots depict variations in shear wave velocity profiles to a depth of 100 feet. The average shear wave velocity for the upper 100 feet of the soil profile ( $V_{s100'}$ ) is used to determine the Site Class Definitions as defined by Table 3.10.3.1-1 of AASHTO LRFD Bridge Design Specifications. The average shear wave velocity for the south shoulder of eastbound I-80 is 1798 feet per second (ft/s) and for the north shoulder of eastbound I-80 is 1680 (ft/s). The average shear wave velocity for the south shoulder of westbound I-80 is 2159 feet per second (ft/s) and for the north shoulder of westbound I-80 is 2123 (ft/s). These values, in conjunction with our field exploration, indicate the area is Site Class C (Soil Rock). Based on the NDOT Bridge Manual for Elko County, the Peak Ground Acceleration is 0.15g with a Short-Period Acceleration Coefficient ( $S_s$ ) of 0.40 and a Long-Period Spectral Acceleration Coefficient ( $S_d$ ) of 0.15.



## **9.0 REFERENCES**

Geology of Elko County, Nevada, Bulletin 101; Nevada Bureau of Mines, and Geology, Robert R. Coats, 1987.

Quaternary Faults in Nevada, Nevada Bureau of Mines and Geology, Craig M. De Polo, 2008

AASHTO LRFD Bridge Design Specifications, 5<sup>th</sup> Edition, 2010.

Standard Specifications for Road and Bridge Construction, State of Nevada Department of Transportation, 2014.

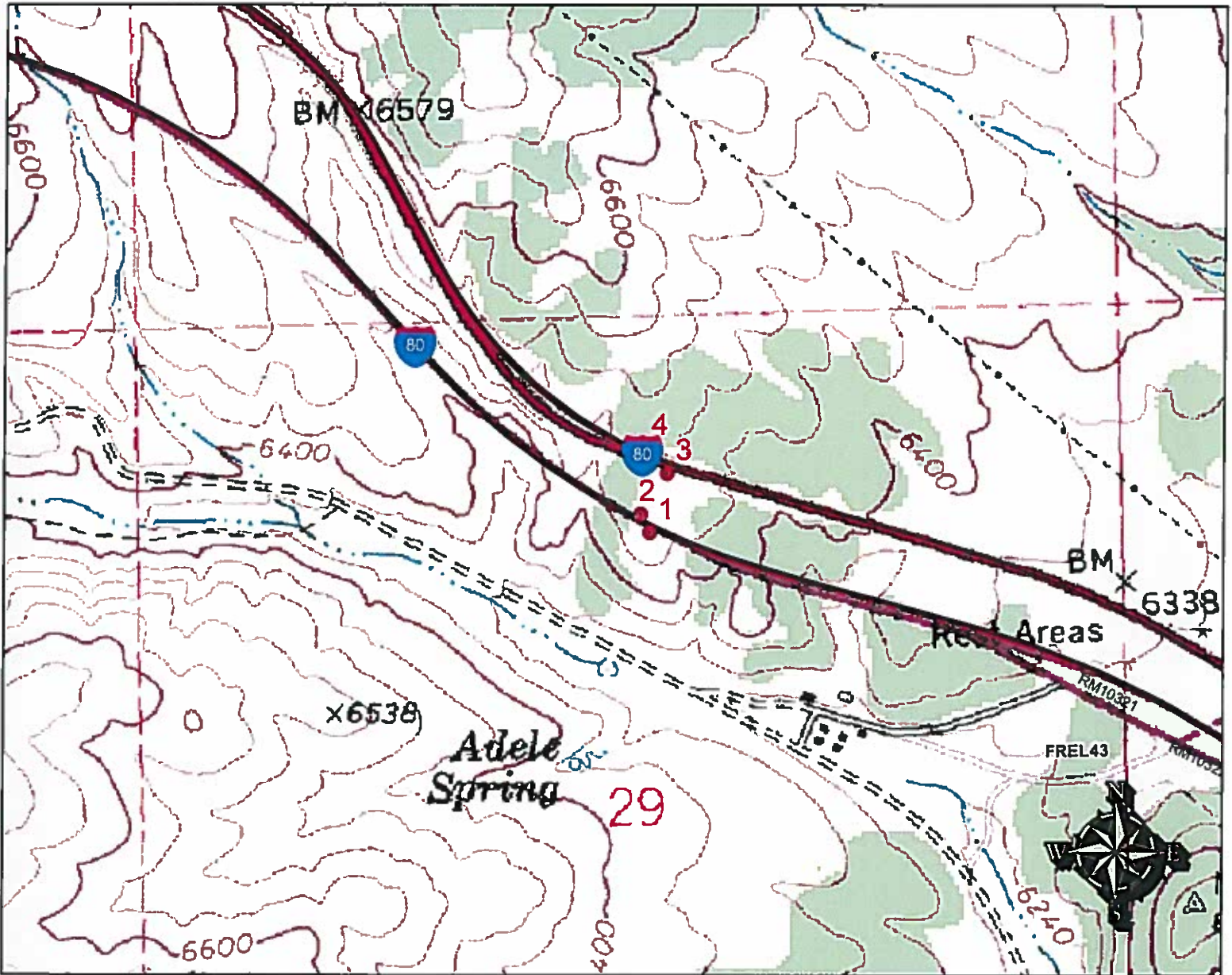
# Appendix A

Location Maps

Exploration Log Key

Exploration Log Sheets

# I-80 @ PEQUOP - ANIMAL CROSSING



## Legend

● TEST HOLES



1 inch = 824 feet

## State Maintained Roads SYSTEM

-  IR - Interstate
-  SR - State Route
-  US - US Route

## Image

### RGB

-  Red: Band\_1
-  Green: Band\_2
-  Blue: Band\_3

THIS MAP IS FOR DISPLAY PURPOSES ONLY.  
 MAP COMPILED WITH DATA FROM THE  
 TRIMBLE GEO XT HANDHELD GPS UNIT.  
 THE DATA IS NOT SURVEY GRADE.  
 NOT ALL FEATURES PORTRAYED DUE TO  
 SCALE.



# I-80 @ PEQUOP - ANIMAL CROSSING



1 inch = 500 feet

## Legend

- TEST HOLES

## State Maintained Roads

### SYSTEM

- IR - Interstate
- SR - State Route
- US - US Route

THIS MAP IS FOR DISPLAY PURPOSES ONLY.  
MAP COMPILED WITH DATA FROM THE  
TRIMBLE GEO XT HANDHELD GPS UNIT.  
THE DATA IS NOT SURVEY GRADE.  
NOT ALL FEATURES PORTRAYED DUE TO  
SCALE.



## KEY TO EXPLORATION LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
	.002 mm	#200	#40	#10	#4	¾ inch	3 inch	12 inch

USCS GROUP	TYPICAL SOIL DESCRIPTION
GW	Well graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat and other highly organic soils

### MOISTURE CONDITION CRITERIA

Description	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp, no visible free water.
Wet	Visible free water, usually below groundwater table.

### SOIL CEMENTATION CRITERIA

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Won't break or crumble w/finger pressure



Groundwater Elevation Symbols

STANDARD PENETRATION CLASSIFICATION*			
GRANULAR SOIL		CLAYEY SOIL	
BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
0 - 4	VERY LOOSE	0 - 1	VERY SOFT
5 - 10	LOOSE	2 - 4	SOFT
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF
31 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
		OVER 60	VERY HARD

\*Standard Penetration Test (N) 140 lb hammer  
30 inch free fall on 2 inch O.D. x 1.4 inch I.D. sampler.

Field Blow counts on California Modified Sampler (NCMS) can be converted to NSPT field by:  
 $(NCMS \text{ field}) \times (0.62) = NSPT \text{ field}$

Blow counts from Automatic Hammer can be converted to Standard SPT N<sub>60</sub> by:  
 Rig #1627:  $(NSPT \text{ field}) \times (1.2) = N_{60}$   
 Rig #1082:  $(NSPT \text{ field}) \times (1.45) = N_{60}$

### TEST ABBREVIATIONS

CD CONSOLIDATED DRAINED	OC ORGANIC CONTENT
CH CHEMICAL (CORROSIVENESS)	C CONSOLIDATION
CM COMPACTION	PI PLASTICITY INDEX
CU CONSOLIDATED UNDRAINED	RQD ROCK QUALITY DESIGNATION
D DISPERSIVE SOILS	RV R-VALUE
DS DIRECT SHEAR	S SIEVE ANALYSIS
E EXPANSIVE SOIL	SL SHRINKAGE LIMIT
G SPECIFIC GRAVITY	U UNCONFINED COMPRESSION
H HYDROMETER	UU UNCONSOLIDATED UNDRAINED
HC HYDRO-COLLAPSE	UW UNIT WEIGHT
K PERMEABILITY	W MOISTURE CONTENT

### SAMPLER NOTATION

CMS CALIF. MODIFIED SAMPLER <sup>1</sup>
CPT CONE PENETRATION TEST
CS CONTINUOUS SAMPLER <sup>2</sup>
PB PITCHER BARREL
RC ROCK CORE <sup>3</sup>
SH SHELBY TUBE <sup>4</sup>
SPT STANDARD PENETRATION TEST
TP TEST PIT

- 1- I.D.= 2.421 inch
- 2- I.D.=3.228 inch with tube; 3.50 inch w/o tube
- 3- NXB I.D.= 1.875 inch
- 4- I.D.= 2.875 inch

SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL/ROCK COLOR CHARTS.

EXAMPLE: [7.5 YR 5/3] BROWN

Revised August 2010

# NEVADA

DEPARTMENT OF  
TRANSPORTATION



GEOTECHNICAL  
ENGINEERING

START DATE 11/4/14

END DATE 11/4/14

JOB DESCRIPTION Pequop Animal Overcrossing Summit

LOCATION I-80 Elko County

BORING PQ1

E.A. # 73606-1

GROUND ELEV. 6420.90 (ft)

HAMMER DROP SYSTEM safety

## EXPLORATION LOG

SHEET 1 OF 1

STATION OE 107+33

OFFSET 30 R

ENGINEER Callaghan

EQUIPMENT Dietrich D-120

OPERATOR Altamirano

DRILLING METHOD auger

BACKFILLED Yes DATE 11/5/14

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
11/4/14	8.50	6412.4

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT			LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot	Percent Recov'd				
								SM	dry orangy brown silty coarse sand mixed with pavement millings	10' off EOP 100lb downpressure drilling not hard despite inability to sample effectively with spt
	5.00									
6415.9	5.25	A	SPT	refusal	refusal	67		ML	4.50 5.00 moist orangy brown silt moist orangy brown silty gravelly coarse sand	bulk samples taken every five feet
	7.00									
	7.33	B	SPT	refusal	refusal	50		SM		
	9.00									
	9.25	C	SPT	refusal	refusal	67			9.00 wet brown clayey sand	
6410.9	10									
	11.00									
	11.33	D	SPT	refusal	refusal	133				
	13.00									
	13.99	E	SPT	refusal	refusal	0		SC		
6405.9	15.00									
	15.99	F	SPT	refusal	refusal	0			15.17	
6400.9	20									
6395.9	25									

NV\_DOT\_PEQUOP\_EAST\_ANIMAL\_OVERCROSSING.GPJ NV\_DOT\_GDT\_3/31/15



GEOTECHNICAL  
ENGINEERING

EXPLORATION LOG

START DATE 11/4/14

END DATE 11/4/14

JOB DESCRIPTION Pequop Animal Overcrossing Summit

LOCATION I-80 Elko County

BORING PQ2

E.A. # 73606-1

GROUND ELEV. 6418.30 (ft)

HAMMER DROP SYSTEM safety

STATION OE 106+43

OFFSET 28 L

ENGINEER Callaghan

EQUIPMENT Dietrich D-120

OPERATOR Altamirano

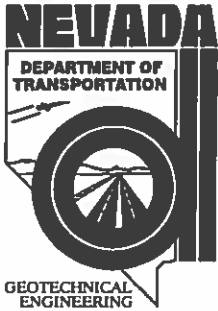
DRILLING METHOD auger

BACKFILLED Yes DATE 11/5/14

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
	dry	0.0

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT			LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot	Percent Recov'd				
6413.3	5.00	A	SPT	refusal	refusal	33		SM	dry grey silty gravelly sand	appears to be grinding soft bedrock not hard drilling
	5.23			refusal	refusal					
	7.00	B	SPT	refusal	refusal	0				
	7.19			refusal	refusal					
6408.3	9.00	C	SPT	refusal	refusal	50		SM	dry grey silty sandy gravel	
	9.33			refusal	refusal					
	11.00	D	SPT	refusal	refusal	50				
	11.33			refusal	refusal					
6403.3	13.00	E	SPT	31	refusal	73		GP GM	dry grey silty sandy gravel	
	13.92			refusal	refusal					
	15.00	F	SPT	48	refusal	100				
	15.67			refusal	refusal					
6398.3	18.00	G	SPT	21	68	116		SC SM	moist orangy brown silty clayey sand	
	20.00			30						
	20.00			38						
	20.00									
6393.3	25.00	H	SPT	refusal	refusal	300			25.33	
	25.33			refusal	refusal					

NV\_DOT\_PEQIOP\_EAST\_ANIMAL\_OVERCROSSING.GPJ NV\_DOT\_GDT 8/31/15



**START DATE** 11/5/14  
**END DATE** 11/5/14  
**JOB DESCRIPTION** Pequop Animal Overcrossing Summit  
**LOCATION** I-80 Elko County  
**BORING** PQ3  
**E.A. #** 73606-1  
**GROUND ELEV.** 6452.50 (ft)  
**HAMMER DROP SYSTEM** safety

**EXPLORATION LOG**

**STATION** OW 110+48  
**OFFSET** 36 R  
**ENGINEER** Callaghan  
**EQUIPMENT** Dietrich D-120  
**OPERATOR** Altamirano  
**DRILLING METHOD** auger  
**BACKFILLED** Yes **DATE** 11/5/14

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
	dry	0.0

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT			LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot	Percent Recov'd				
6447.5	5.00	A	SPT	refusal	refusal	80		SC SM	dry orange and gray silty clayey sand	not hard drilling bulk samples every five feet
	5.42									
6442.5	7.99	B	SPT	refusal	refusal	100		CL	dry gray sandy lean clay	
	9.00									
6437.5	9.92	C	SPT	19 refusal	refusal	100		SC SM	moist orangy brown silty clayey sand	
	11.00									
6432.5	11.42	D	SPT	refusal	refusal	100		SC SM	dry gray silty clayey sand	
	13.00									
6427.5	14.33	E	SPT	11 43 refusal	refusal	106		SC SM	dry gray silty clayey sand	
	15.00									
6422.5	15.33	F	SPT	refusal	refusal	50		SC SM	dry gray silty clayey sand	
	17.00									
6417.5	17.00	G	SPT	refusal	refusal	0		SC SM	dry gray silty clayey sand	
	18.00									
6412.5	18.00	H	SPT	refusal	refusal	0		SC SM	dry gray silty clayey sand	
	20									
6407.5	21.99	I	SPT	refusal	refusal	0		SC SM	dry gray silty clayey sand	
	23.00									
6402.5	23.00	J	SPT	refusal	refusal	0		SC SM	dry gray silty clayey sand	
	25.00									
6427.5	25.00	K	SPT	refusal	refusal	0		SC SM	dry gray silty clayey sand	

NV\_DOT\_PEQUOP\_EAST\_ANIMAL\_OVERCROSSING.GPJ NV\_DOT\_GDT\_4/2/15





**START DATE** 11/5/14  
**END DATE** 11/5/14  
**JOB DESCRIPTION** Pequop Animal Overcrossing Summit  
**LOCATION** I-80 Elko County  
**BORING** PQ4  
**E.A. #** 73606-1  
**GROUND ELEV.** 6464.20 (ft)  
**HAMMER DROP SYSTEM** safety

**EXPLORATION LOG**

**STATION** OW 108+76  
**OFFSET** 48 L  
**ENGINEER** Callaghan  
**EQUIPMENT** Dietrich D-120  
**OPERATOR** Altamirano  
**DRILLING METHOD** auger  
**BACKFILLED** Yes **DATE** 11/5/14

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
11/5/14	12.00	6452.2

GEOTECHNICAL ENGINEERING

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT			LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot	Percent Recov'd				
6459.2	5.00							SC SM	dry gray orange silty clayey sand	not hard drilling bulk samples taken every five feet
	5.67	A	SPT	42	refusal	150				
	7.00									
	7.42	B	SPT	refusal	refusal	140				
6454.2	9.00							SC SM	dry flaky gray silty clayey sand with gravel	
	9.50	C	SPT	refusal	refusal	50				
	11.00									
	11.33	D	SPT	refusal	refusal	50				
6449.2	13.00							SC SM	wet orangy brown silty clayey sand with gravel	
	13.00	E	SPT	refusal	refusal	0				
	15.00									
	15.77	F	SPT	refusal	refusal	0				
6444.2	17.00							SC SM	wet black silty clayey sand	
	17.00	G	SPT	refusal	refusal	0				
	18.00									
	18.00	H	SPT	refusal	refusal	0				
6439.2	22.00							SC SM		
	22.25	I	SPT	refusal	refusal	133				
6439.2	25.00	J	SPT	refusal	refusal	0				

## Appendix B

Laboratory Test Data  
Summary of Results  
Particle Size Distribution Reports

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-192-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OE~107+33 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): \_\_\_\_\_ Lt. \_\_\_\_\_ Rt. 35'  
 Sample No.: PQ1-A County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--	Auger Cuttings	4--
	6--		6--
	8--		8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	100
3/4"	95
1/2"	84
3/8"	78
No. 4	63
No. 10	48
No. 16	41
No. 40	32
No. 50	30
No. 100	27
No. 200	24

Liquid Limit 20  
 Plastic Index 6  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 8  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-1-b

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-193-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OE~107+33 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): \_\_\_\_\_ Lt. \_\_\_\_\_ Rt. 35'  
 Sample No.: PQI-B County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--	Auger Cuttings	8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	96
3/8"	91
No. 4	76
No. 10	57
No. 16	47
No. 40	35
No. 50	32
No. 100	28
No. 200	26

Liquid Limit 20  
 Plastic Index 6  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 53  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-2-4(0)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-194-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OE~107+33 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): \_\_\_\_\_ Lt. \_\_\_\_\_ Rt. 35'  
 Sample No.: PQ1-C County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--		8--
	10--		10--
	12--	Auger Cuttings	12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	93
No. 4	78
No. 10	57
No. 16	46
No. 40	33
No. 50	30
No. 100	27
No. 200	25

Liquid Limit 20  
 Plastic Index 6  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 66  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-1-b

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## SUMMARY OF RESULTS N.D.O.T. GEOTECHNICAL SECTION

EAI/Cont # 73606

Job Description Pequop Animal Overcrossing

Boring No. PQ-1

Elevation (ft) 6420.9

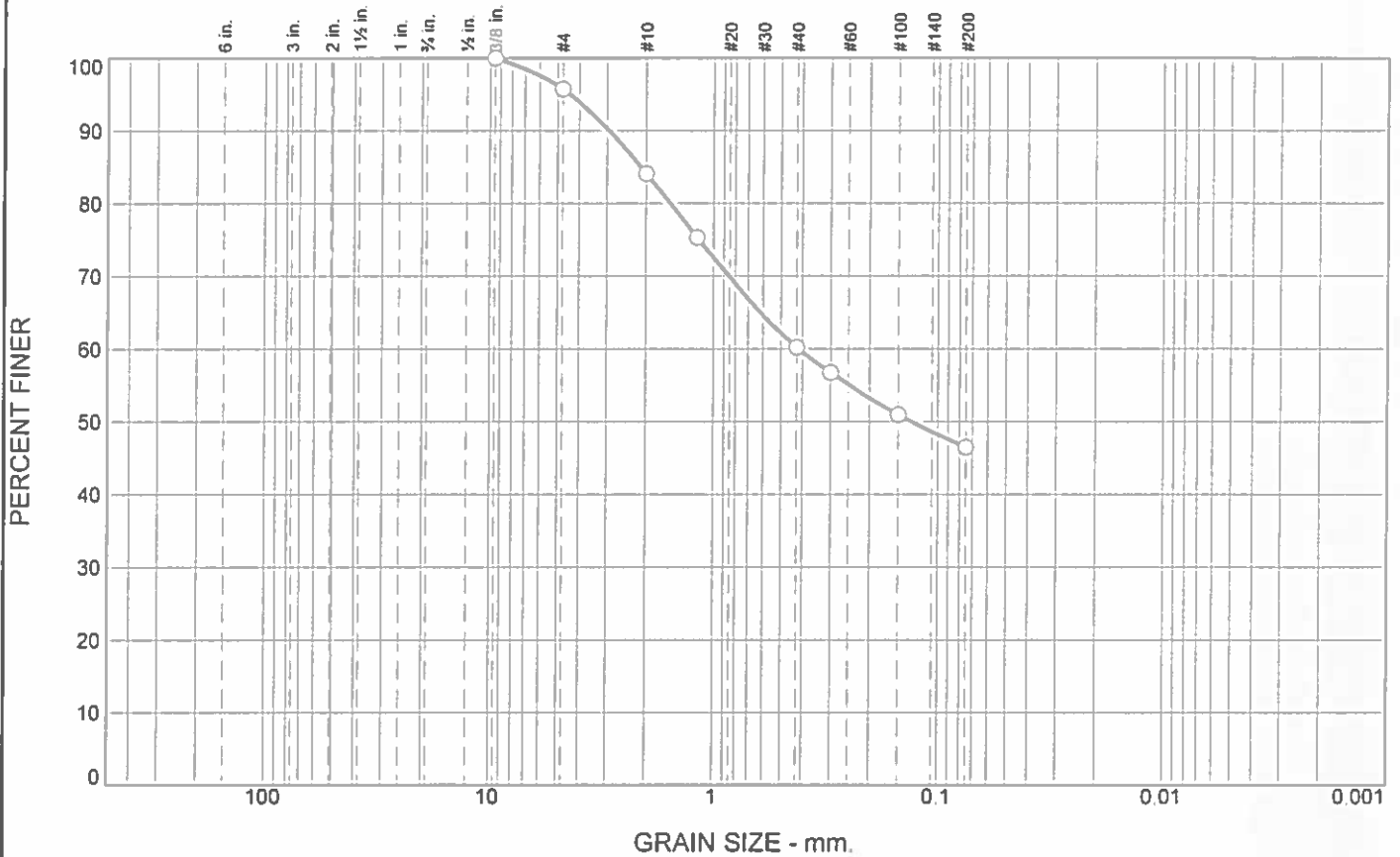
Station "OE" 107+33, 30' Rt.

Date 1/12/2015

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLER TYPE	N BLOWS per ft.	SOIL GROUP	W% %	DRY UW pct	% PASS #200	LL %	PL %	PI %	TEST TYPE	STRENGTH TEST				COMMENTS
												$\phi$ deg.	C psi	$\phi$ deg.	C psi	
D	11.0 - 11.3	SPT		SC	11.5		46.5	23	14	9						

CMS = California Modified Sampler 2.42" ID  
 SPT = Standard Penetration 1.38" ID  
 CS = Continuous Sample 3.23" ID  
 RC = Rock Core  
 PB = Pitcher Barrel  
 CSS = Calif. Split Spoon 2.42" ID  
 CPT = Cone Penetration Test  
 TP = Test Pit  
 P = Pushed, not driven  
 R = Refusal  
 Sh = Shelby Tube 2 8/7" ID  
 U = Unconfined Compressive  
 UU = Unconsolidated Undrained  
 CD = Consolidated Drained  
 CU = Consolidated Undrained  
 DS = Direct Shear  
 $\phi$  = Friction  
 C = Cohesion  
 N = No. of blows per ft., sampler  
 N = Field SPT       $N = (N_{100})^{(0.62)}$   
 H = Hydrometer  
 S = Sieve  
 G = Specific Gravity  
 PI = Plasticity Index  
 LL = Liquid Limit  
 PL = Plastic Limit  
 NP = Non-Plastic  
 OC = Consolidation  
 Ch = Chemical  
 RV = R - Value  
 MD = Moisture Density  
 CM = Compaction  
 E = Swell/Pressure on Expansive Soils  
 SL = Shrinkage Limit  
 UW = Unit Weight  
 W = Moisture Content  
 K = Permeability  
 O = Organic Content  
 D = Dispersive  
 ROD = Rock Quality Designation  
 X = X-Ray Diffraction  
 HCpot = Hydro-Collapse Potential  
 \* = Average of subsamples

# Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	4.3	49.2	46.5		SC	A-4(1)	14	23

SIEVE inches size	PERCENT FINER	
	○	
3/8"	100.0	
<del>GRAIN SIZE</del>		
D <sub>60</sub>	0.4171	
D <sub>30</sub>		
D <sub>10</sub>		
<del>COEFFICIENTS</del>		
C <sub>c</sub>		
C <sub>u</sub>		

SIEVE number size	PERCENT FINER	
	○	
#4	95.7	
#10	84.1	
#16	75.3	
#40	60.2	
#50	56.7	
#100	51.0	
#200	46.5	

Material Description  
○ clayey sand

REMARKS:  
○

○ Source of Sample: PQ-1      Depth: 11.0 - 11.3'      Sample Number: D

**NEVADA  
DEPARTMENT OF  
TRANSPORTATION**

Client: C. Callaghan  
Project: Pequop Animal Overcrossing  
Project No.: 73606

Figure

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-195-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station OE~106+43 Route I-80  
RIGSBY, DRAGOO Location from CL (ft) Lt. 28' Rt. \_\_\_\_\_  
 Sample No.: PQ2-A County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--	Auger Cuttings	4--
	6--		6--
	8--		8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	93
3/8"	85
No. 4	69
No. 10	50
No. 16	41
No. 40	29
No. 50	27
No. 100	23
No. 200	21

Liquid Limit 18  
 Plastic Index 5  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 6  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
           Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-1-b

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-196-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OE~106+43 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): Lt. 28' Rt. \_\_\_\_\_  
 Sample No.: PQ2-B County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--	Auger Cuttings	8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	95
3/8"	90
No. 4	77
No. 10	56
No. 16	47
No. 40	35
No. 50	33
No. 100	29
No. 200	26

Liquid Limit	<u>18</u>
Plastic Index	<u>6</u>
Specific Gravity	_____
Resistance Value	<u>6</u>
Cover Thickness	Stabilometer _____ Expansion Pressure _____
Sand Equivalent	_____
Natural Moisture, %	_____
Resistivity	_____
pH Factor	_____
AASHTO Classification	<u>A-2-4(0)</u>

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-197-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station OE~106+43 Route I-80  
RIGSBY, DRAGOO Location from CL (ft) Lt. 28' Rt. \_\_\_\_\_  
 Sample No.: PQ2-C County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--		8--
	10--		10--
	12--		12--
	14--	Auger Cuttings	14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	95
3/8"	90
No. 4	74
No. 10	59
No. 16	51
No. 40	41
No. 50	39
No. 100	34
No. 200	31

Liquid Limit 19  
 Plastic Index 6  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 12  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-2-4(0)

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**SUMMARY OF RESULTS  
N.D.O.T. GEOTECHNICAL SECTION**

EAJCont # 73606

Job Description Pequop Animal Overcrossing

Boring No. PQ-2

Elevation (ft) 6418.3

Station "OE" 106+43, 28' lt.

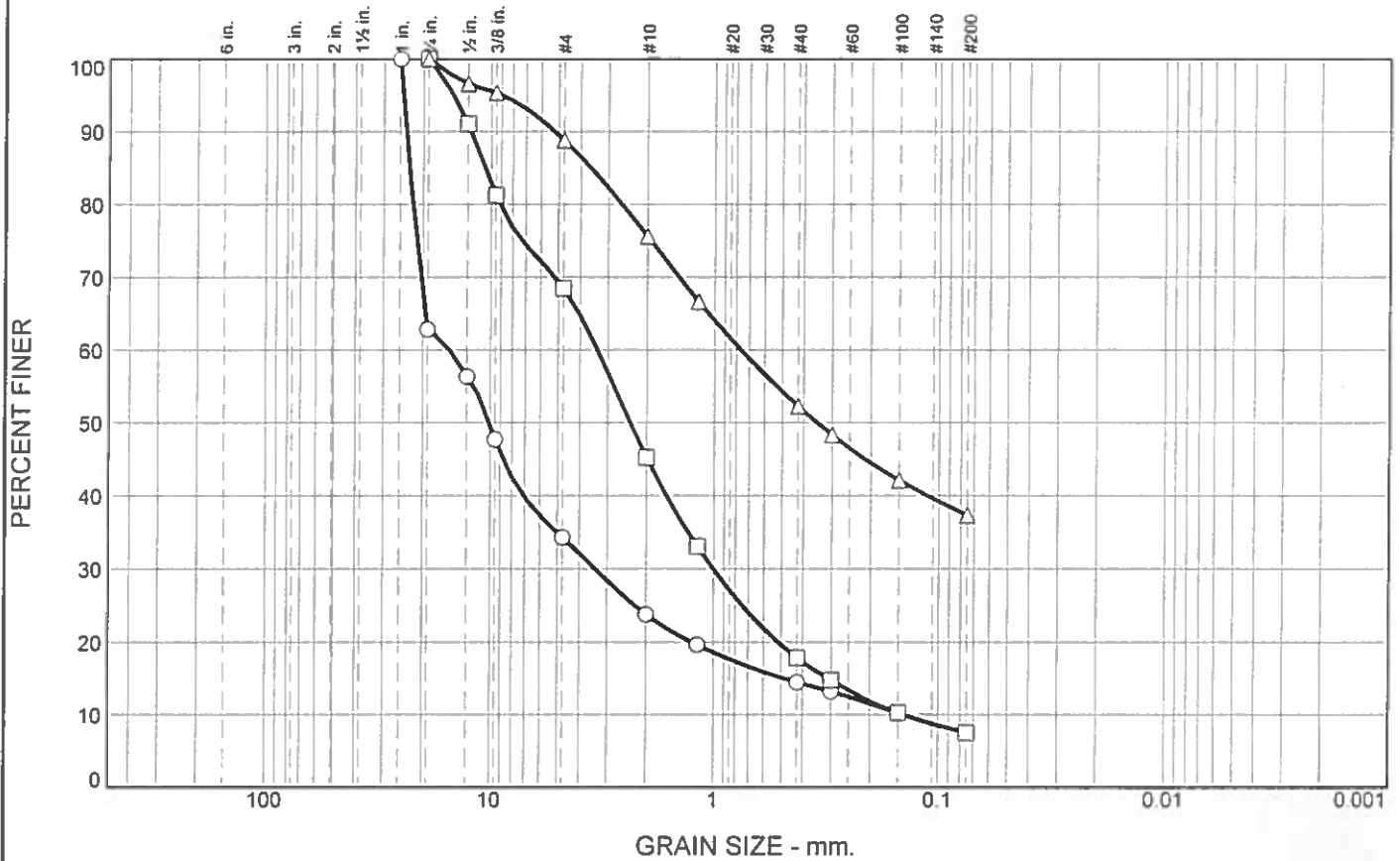
Date 1/12/2015

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	TEST TYPE	STRENGTH TEST				COMMENTS
												Φ deg.	C psi	Peak	Residual	
E	13.0 - 13.7	SPT		GP-GM	2.4		7.5	19	17	2						
F	15.0 - 15.7	SPT		SW-SM	1.6		7.5	15	NP	NP						
G	20.0 - 20.7	SPT		SC-SM	7.7		37.3	19	13	6						

CMS = California Modified Sampler 2.42" ID  
 SPT = Standard Penetration 1.38" ID  
 CS = Continuous Sample 3.23" ID  
 RC = Rock Core  
 PB = Pitcher Barrel  
 CSS = Calif. Split Spoon 2.42" ID  
 CPT = Cone Penetration Test  
 TP = Test Pit  
 P = Pushed, not driven  
 R = Refusal  
 Sh = Shelby Tube 2.87" ID  
 U = Unconfined Compressive  
 UU = Unconsolidated Undrained  
 CD = Consolidated Drained  
 CU = Consolidated Undrained  
 DS = Direct Shear  
 φ = Friction  
 C = Cohesion  
 N = No. of blows per ft., sampler  
 N = Field SPT      N = (N<sub>min</sub>)(0.62)  
 \* = Average of subsamples

H = Hydrometer  
 S = Sieve  
 G = Specific Gravity  
 PI = Plasticity Index  
 LL = Liquid Limit  
 PL = Plastic Limit  
 NP = Non-Plastic  
 OC = Consolidation  
 Ch = Chemical  
 RV = R - Value  
 MD = Moisture Density  
 CM = Compaction  
 E = Swell/Pressure on Expansive Soils  
 SL = Shrinkage Limit  
 UW = Unit Weight  
 W = Moisture Content  
 K = Permeability  
 O = Organic Content  
 D = Dispersive  
 RQD = Rock Quality Designation  
 X = X-Ray Diffraction  
 HCpot = Hydro-Collapse Potential

# Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	65.7	26.8		7.5	GP-GM	A-1-a	17	19
□	0.0	31.5	61.0		7.5	SW-SM	A-1-a	NP	15
△	0.0	11.2	51.5		37.3	SC-SM	A-4(0)	13	19

SIEVE inches size	PERCENT FINER		
	○	□	△
1"	100.0		
3/4"	62.9	100.0	100.0
1/2"	56.4	91.1	96.6
3/8"	47.7	81.3	95.3
GRAIN SIZE			
D <sub>60</sub>	15.1551	3.3387	0.7647
D <sub>30</sub>	3.3850	1.0031	
D <sub>10</sub>	0.1417	0.1425	
COEFFICIENTS			
C <sub>c</sub>	5.33	2.12	
C <sub>u</sub>	106.92	23.44	

SIEVE number size	PERCENT FINER		
	○	□	△
#4	34.3	68.5	88.8
#10	23.8	45.2	75.6
#16	19.6	33.1	66.7
#40	14.5	17.9	52.3
#50	13.2	14.8	48.3
#100	10.2	10.3	42.1
#200	7.5	7.5	37.3

Material Description	
○	poorly graded gravel with silt and sand
□	well-graded sand with silt and gravel
△	silty, clayey sand

REMARKS:	
○	
□	
△	

○ Source of Sample: PQ-2      Depth: 13.0 - 13.7'      Sample Number: E  
 □ Source of Sample: PQ-2      Depth: 15.0 - 15.7'      Sample Number: F  
 △ Source of Sample: PQ-2      Depth: 20.0 - 20.7'      Sample Number: G

**NEVADA  
DEPARTMENT OF  
TRANSPORTATION**

Client: C. Callaghan  
 Project: Pequop Animal Overcrossing  
 Project No.: 73606

Figure

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-198-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OW~110+48 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): \_\_\_\_\_ Lt. \_\_\_\_\_ Rt. 36'  
 Sample No.: PQ3-A County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0
	2--		2--
	4--	Auger Cuttings	4--
	6--		6--
	8--		8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	95
No. 4	82
No. 10	62
No. 16	54
No. 40	44
No. 50	42
No. 100	38
No. 200	34

Liquid Limit 21  
 Plastic Index 7  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 11  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-2-4(0)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-199-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station OW~110+48 Route I-80  
RIGSBY, DRAGOO Location from CL (ft) Lt. \_\_\_\_\_ Rt. 36'  
 Sample No.: PQ3-B County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--	Auger Cuttings	8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	96
No. 4	86
No. 10	71
No. 16	61
No. 40	47
No. 50	44
No. 100	39
No. 200	35

Liquid Limit 20  
 Plastic Index 6  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 17  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-2-4(0)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-200-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OW~110+48 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): \_\_\_\_\_ Lt. \_\_\_\_\_ Rt. 36'  
 Sample No.: PQ3-C County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--		8--
	10--		10--
	12--	Auger Cuttings	12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	97
No. 4	85
No. 10	68
No. 16	61
No. 40	52
No. 50	50
No. 100	47
No. 200	44

Liquid Limit 22  
 Plastic Index 8  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 22  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-4(0)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**SUMMARY OF RESULTS  
N.D.O.T. GEOTECHNICAL SECTION**

EA/Cont # 73606

Job Description Pequop Animal Overcrossing

Boring No. PQ-3

Elevation (ft) 6452.5

Station "OW" 110+48, 36' Rt. Date 1/12/2015

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLER TYPE	N BLOWS per ft.	SOIL GROUP	W% pcf	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST			COMMENTS
											TEST TYPE	Φ deg	C psi	
A	5.0 - 5.3	SPT		SC-SM	4.7		27.0	21	15	6				
C	9.0 - 9.9	SPT		CL	8.8		53.9	25	14	11				
D	11.0 - 11.4	SPT		SC-SM	4.7		30.4	18	14	4				
E	13.0 - 14.4	SPT		SC-SM	10.6		44.9	21	15	6				

CMS = California Modified Sampler 2.42" ID  
 SPT = Standard Penetration 1.38" ID  
 CS = Continuous Sample 3.23" ID  
 RC = Rock Core  
 PB = Pitcher Barrel  
 CSS = Calif. Split Spoon 2.42" ID  
 CPT = Cone Penetration Test  
 TP = Test Pit  
 P = Pushed, not driven  
 R = Refusal  
 Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive  
 UU = Unconsolidated Undrained  
 CD = Consolidated Drained  
 CU = Consolidated Undrained  
 DS = Direct Shear  
 Φ = Friction  
 C = Cohesion  
 N = No. of blows per ft., sampler  
 N = Field SPT      N = (N<sub>60</sub>)/0.62

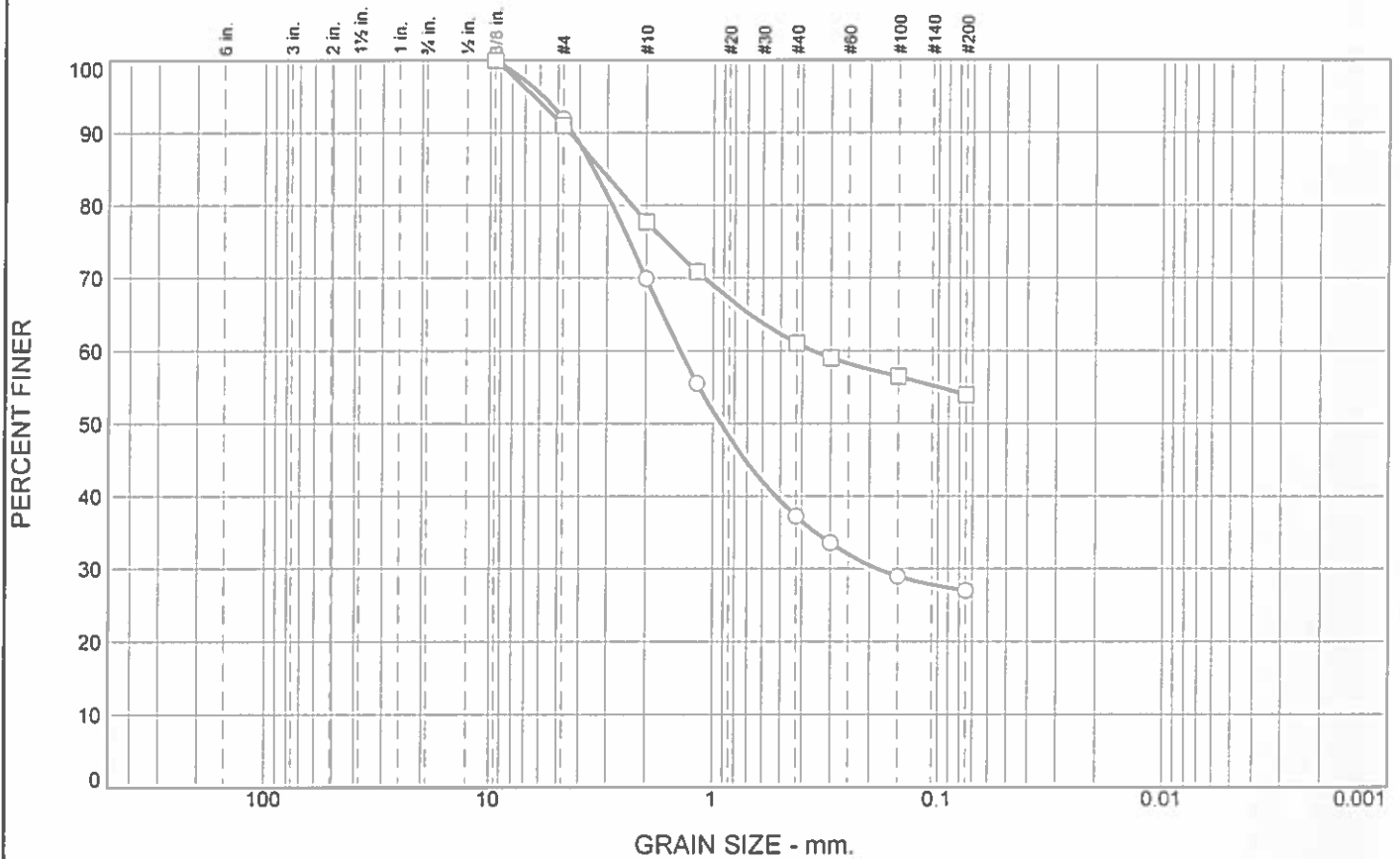
H = Hydrometer  
 S = Sieve  
 G = Specific Gravity  
 PI = Plasticity Index  
 LL = Liquid Limit  
 PL = Plastic Limit  
 NP = Non-Plastic  
 OC = Consolidation  
 Ch = Chemical  
 RV = R - Value  
 MD = Moisture Density

CM = Compaction  
 E = Swell/Pressure on Expansive Soils  
 SL = Shrinkage Limit  
 UW = Unit Weight  
 W = Moisture Content  
 K = Permeability  
 O = Organic Content  
 D = Dispersive  
 ROD = Rock Quality Designation  
 X = X-Ray Defraction  
 HCpot = Hydro-Collapse Potential

\* = Average of subsamples



# Particle Size Distribution Report

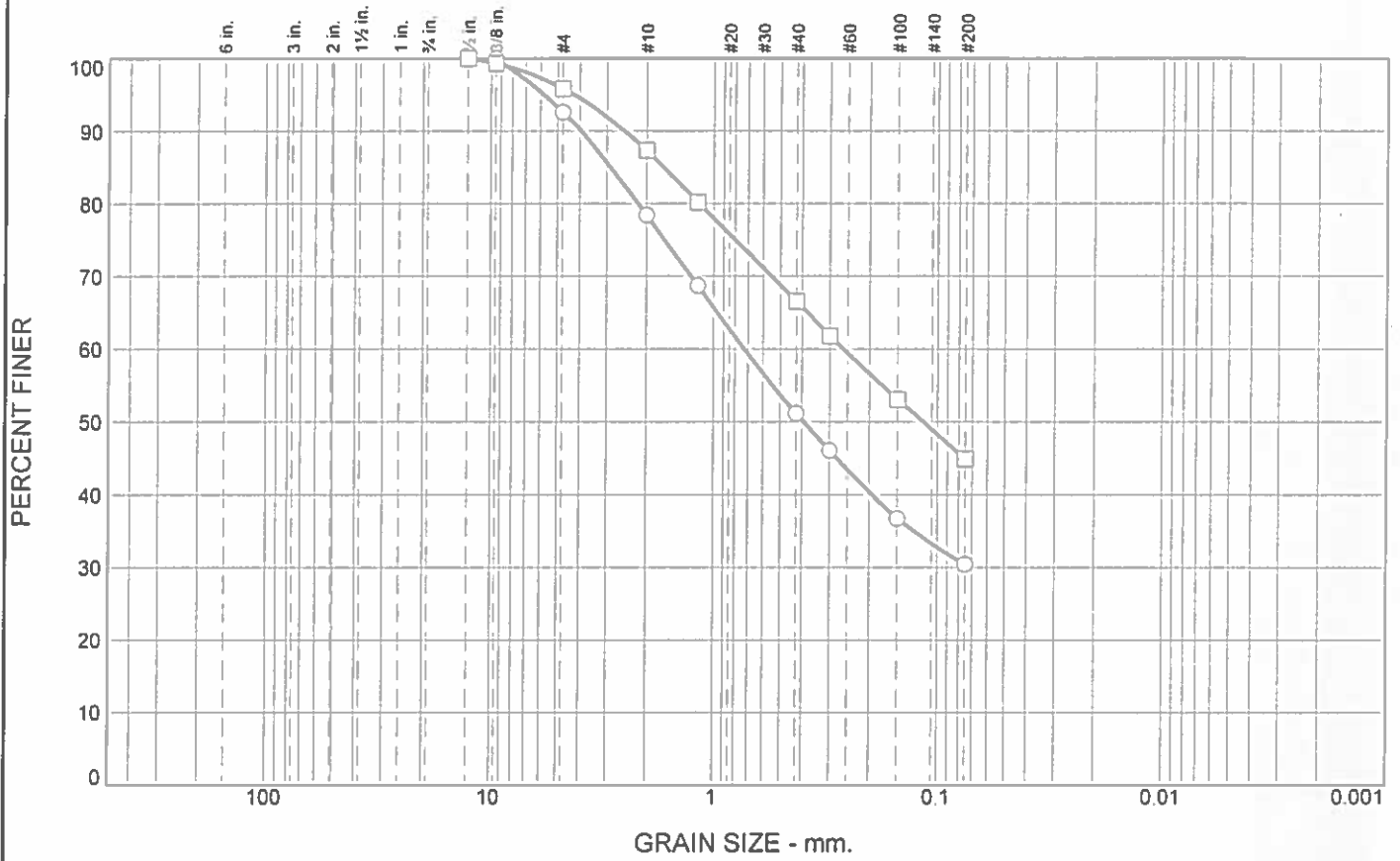


	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	8.1	64.9	27.0		SC-SM	A-2-4(0)	15	21
□	0.0	9.0	37.1	53.9		CL	A-6(3)	14	25

SIEVE inches size	PERCENT FINER		SIEVE number size	PERCENT FINER		Material Description
	○	□		○	□	
3/8"	100.0	100.0	#4	91.9	91.0	<input type="radio"/> silty, clayey sand  <input type="checkbox"/> sandy lean clay
			#10	69.9	77.7	
			#16	55.6	70.9	
			#40	37.3	61.0	
			#50	33.6	59.0	
			#100	29.0	56.5	
			#200	27.0	53.9	
GRAIN SIZE						REMARKS:
D <sub>60</sub>	1.4031	0.3611				
D <sub>30</sub>	0.1847					
D <sub>10</sub>						
COEFFICIENTS						
C <sub>c</sub>						
C <sub>u</sub>						

○ Source of Sample: PQ-3      Depth: 5.0 - 5.3'      Sample Number: A  
 □ Source of Sample: PQ-3      Depth: 9.0 - 9.9'      Sample Number: C

# Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	7.4	62.2	30.4		SC-SM	A-2-4(0)	14	18
□	0.0	4.2	50.9	44.9		SC-SM	A-4(0)	15	21

SIEVE inches size	PERCENT FINER	
	○	□
1/2"	100.0	100.0
3/8"	100.0	99.3
GRAIN SIZE		
D <sub>60</sub>	0.7278	0.2620
D <sub>30</sub>		
D <sub>10</sub>		
COEFFICIENTS		
C <sub>c</sub>		
C <sub>u</sub>		

SIEVE number size	PERCENT FINER	
	○	□
#4	92.6	95.8
#10	78.4	87.3
#16	68.7	80.2
#40	51.2	66.6
#50	46.1	61.8
#100	36.8	53.1
#200	30.4	44.9

**Material Description**

○ silty, clayey sand

□ silty, clayey sand

**REMARKS:**

○

□

○ Source of Sample: PQ-3      Depth: 11.0 - 11.4'      Sample Number: D

□ Source of Sample: PQ-3      Depth: 13.0 - 14.4'      Sample Number: E

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: SI4-06, RV-201-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OW~108+76 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): Lt. 48' Rt. \_\_\_\_\_  
 Sample No.: PQ4-A County: ELKO

Sample Type:  RV  Sub  Chem  DC  Other   
 Vegetation: None  Trees  Shrubs   
 Brushy  Grassy   
 Cut Section  Fill Section   
 Taken Through Oil  Taken on Shoulder   
 Gravel Depth (in) \_\_\_\_\_ Oil Depth (in) \_\_\_\_\_  
 Remarks: \_\_\_\_\_  
 Submitted By: \_\_\_\_\_  
 Title: \_\_\_\_\_

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--	Auger Cuttings	4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	100
3/4"	96
1/2"	87
3/8"	76
No. 4	63
No. 10	51
No. 16	46
No. 40	38
No. 50	36
No. 100	32
No. 200	29

Liquid Limit 23  
 Plastic Index 10  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 18  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-2-4(0)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-202-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OW~108+76 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): Lt. 48' Rt. \_\_\_\_\_  
 Sample No.: PQ4-B County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--	Auger Cuttings	8--
	10--		10--
	12--		12--
	14--		14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
No. 4	92
No. 10	78
No. 16	69
No. 40	57
No. 50	54
No. 100	51
No. 200	49

Liquid Limit 23  
 Plastic Index 8  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 13  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-4(1)

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# LINE SAMPLING DATA

Date Reported: 12/5/14  
 Lab No.: S14-06, RV-203-14  
 E.A.: 73606 Job Description: PEQUOP ANIMAL CROSSING I-80  
 Date Rec'd: 11/10/14  
 Samplers: ALTAMIRANO, Station: OW~108+76 Route: I-80  
RIGSBY, DRAGOO Location from CL (ft): Lt. 48' Rt. \_\_\_\_\_  
 Sample No.: PQ4-C County: ELKO

Sample Type	Depth (ft)	Boring Description	PSI
RV <input checked="" type="checkbox"/> Sub <input type="checkbox"/> Chem <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> Vegetation: None <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Brushy <input type="checkbox"/> Grassy <input type="checkbox"/> Cut Section <input checked="" type="checkbox"/> Fill Section <input type="checkbox"/> Taken Through Oil <input type="checkbox"/> Taken on Shoulder <input type="checkbox"/> Gravel Depth (in) _____ Oil Depth (in) _____ Remarks: _____ Submitted By: _____ Title: _____	0--		0--
	2--		2--
	4--		4--
	6--		6--
	8--		8--
	10--		10--
	12--		12--
	14--	Auger Cuttings	14--
	16--		16--
	18--		18--
	20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	97
No. 4	90
No. 10	76
No. 16	68
No. 40	57
No. 50	53
No. 100	47
No. 200	43

Liquid Limit 23  
 Plastic Index 10  
 Specific Gravity \_\_\_\_\_  
 Resistance Value 22  
 Cover Stabilometer Expansion Pressure \_\_\_\_\_  
 Thickness \_\_\_\_\_  
 Sand Equivalent \_\_\_\_\_  
 Natural Moisture, % \_\_\_\_\_  
 Resistivity \_\_\_\_\_  
 pH Factor \_\_\_\_\_  
 AASHTO Classification A-4(1)

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**SUMMARY OF RESULTS  
N.D.O.T. GEOTECHNICAL SECTION**

EA/Cont # 73606

Job Description Pequop Animal Overcrossing

Boring No. PQ-4

Elevation (ft) 6463.0

Station "OW" 108+76, 48' Lt. Date 1/12/2015

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLER TYPE	N BLOWS per ft.	SOIL GROUP	W% WATER	DRY UW pcf	% PASS #200	LL %	PL %	PI %	TEST TYPE	STRENGTH TEST				COMMENTS
												φ deg.	C psi	φ deg.	C psi	
												Peak	Residual			
A	5.0 - 6.0	SPT		SC-SM	5.5		38.2	20	14	6						
B	7.0 - 7.6	SPT		SC-SM	2.2		28.9	22	15	7						

CMS = California Modified Sampler 2.42" ID  
 SPT = Standard Penetration 1.38" ID  
 CS = Continuous Sample 3.23" ID  
 RC = Rock Core  
 PB = Pitcher Barrel  
 CSS = Calif. Split Spoon 2.42" ID  
 CPT = Cone Penetration Test  
 TP = Test Pit  
 P = Pushed, not driven  
 R = Refusal  
 Sh = Shelby Tube 2.87" ID

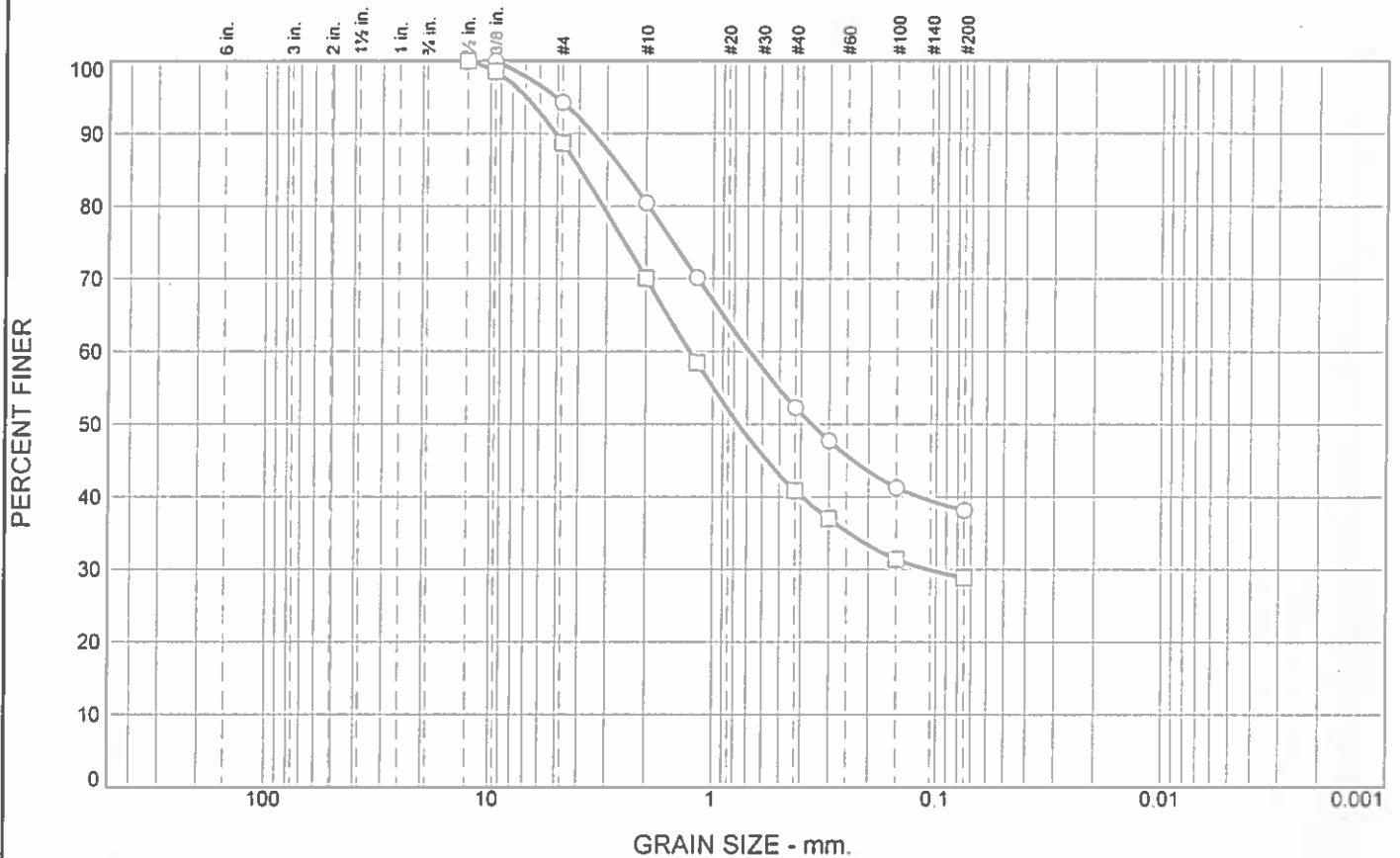
U = Unconfined Compressive  
 UU = Unconsolidated Undrained  
 CD = Consolidated Drained  
 CU = Consolidated Undrained  
 DS = Direct Shear  
 φ = Friction  
 C = Cohesion  
 N = No. of blows per ft., sampler  
 N = Field SPT      N = (N<sub>max</sub>)<sup>1/0.62</sup>

H = Hydrometer  
 S = Sieve  
 G = Specific Gravity  
 PI = Plasticity Index  
 LL = Liquid Limit  
 PL = Plastic Limit  
 NP = Non-Plastic  
 OC = Consolidation  
 CH = Chemical  
 RV = R - Value  
 MD = Moisture Density

CM = Compaction  
 E = Swell/Pressure on Expansive Soils  
 SL = Shrinkage Limit  
 UW = Unit Weight  
 W = Moisture Content  
 K = Permeability  
 O = Organic Content  
 D = Dispersive  
 ROD = Rock Quality Designation  
 X = X-Ray Diffraction  
 HCpot = Hydro-Collapse Potential

\* = Average of subsamples

# Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	5.7	56.1	38.2		SC-SM	A-4(0)	14	20
□	0.0	11.3	59.8	28.9		SC-SM	A-2-4(0)	15	22

SIEVE inches size	PERCENT FINER	
	○	□
1/2"	100.0	100.0
3/8"	100.0	98.5
GRAIN SIZE		
D <sub>60</sub>	0.6857	1.2696
D <sub>30</sub>		0.1091
D <sub>10</sub>		
COEFFICIENTS		
C <sub>c</sub>		
C <sub>u</sub>		

SIEVE number size	PERCENT FINER	
	○	□
#4	94.3	88.7
#10	80.4	70.0
#16	70.2	58.5
#40	52.3	40.9
#50	47.7	37.0
#100	41.3	31.4
#200	38.2	28.9

**Material Description**  
 silty, clayey sand  
 silty, clayey sand

**REMARKS:**

○ Source of Sample: PQ-4      Depth: 5.0 - 6.0'      Sample Number: A  
 □ Source of Sample: PQ-4      Depth: 7.0 - 7.6'      Sample Number: B

**NEVADA  
DEPARTMENT OF  
TRANSPORTATION**

Client: C. Callaghan  
 Project: Pequop Animal Overcrossing  
 Project No.: 73606

Figure

## Appendix C

### Geophysical Testing Location Map Geophysical Test Data



# I-80 @ PEQUOP - ANIMAL CROSSING




1 inch = 83 feet

## Legend

 TEST HOLES WITH REMI LINES

## State Maintained Roads

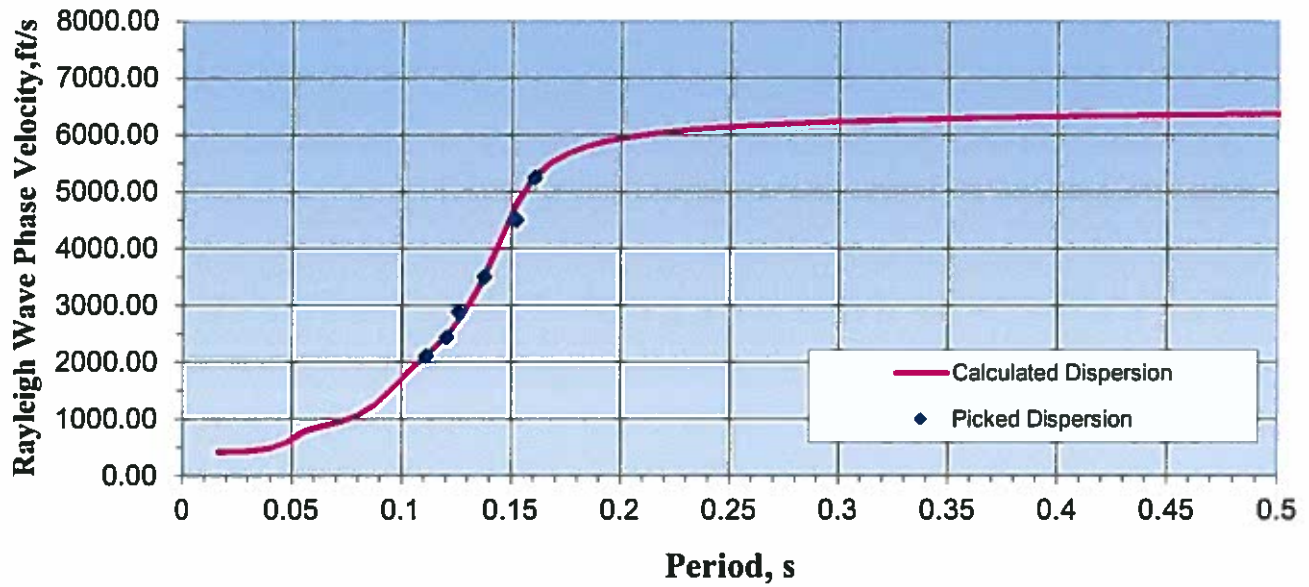
### SYSTEM

-  IR - Interstate
-  SR - State Route
-  US - US Route

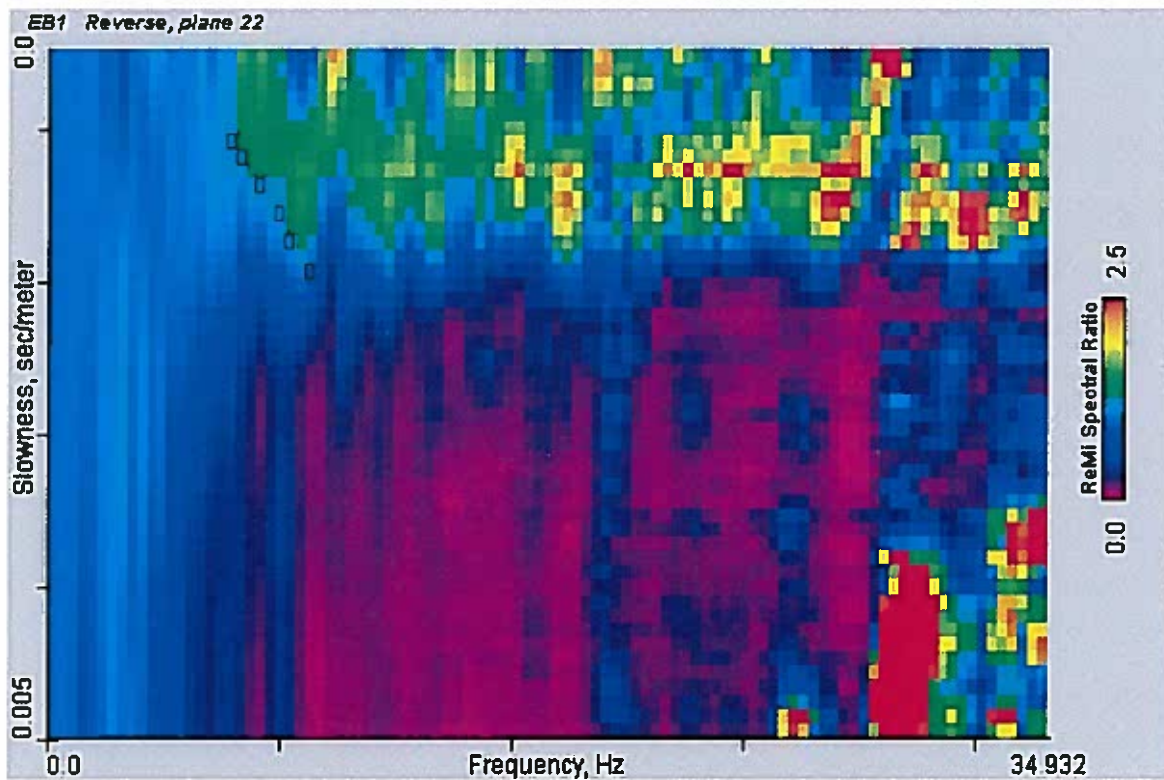
THIS MAP IS FOR DISPLAY PURPOSES ONLY.  
 MAP COMPILED WITH DATA FROM THE  
 TRIMBLE GEO XT HANDHELD GPS UNIT.  
 THE DATA IS NOT SURVEY GRADE.  
 NOT ALL FEATURES PORTRAYED DUE TO  
 SCALE.



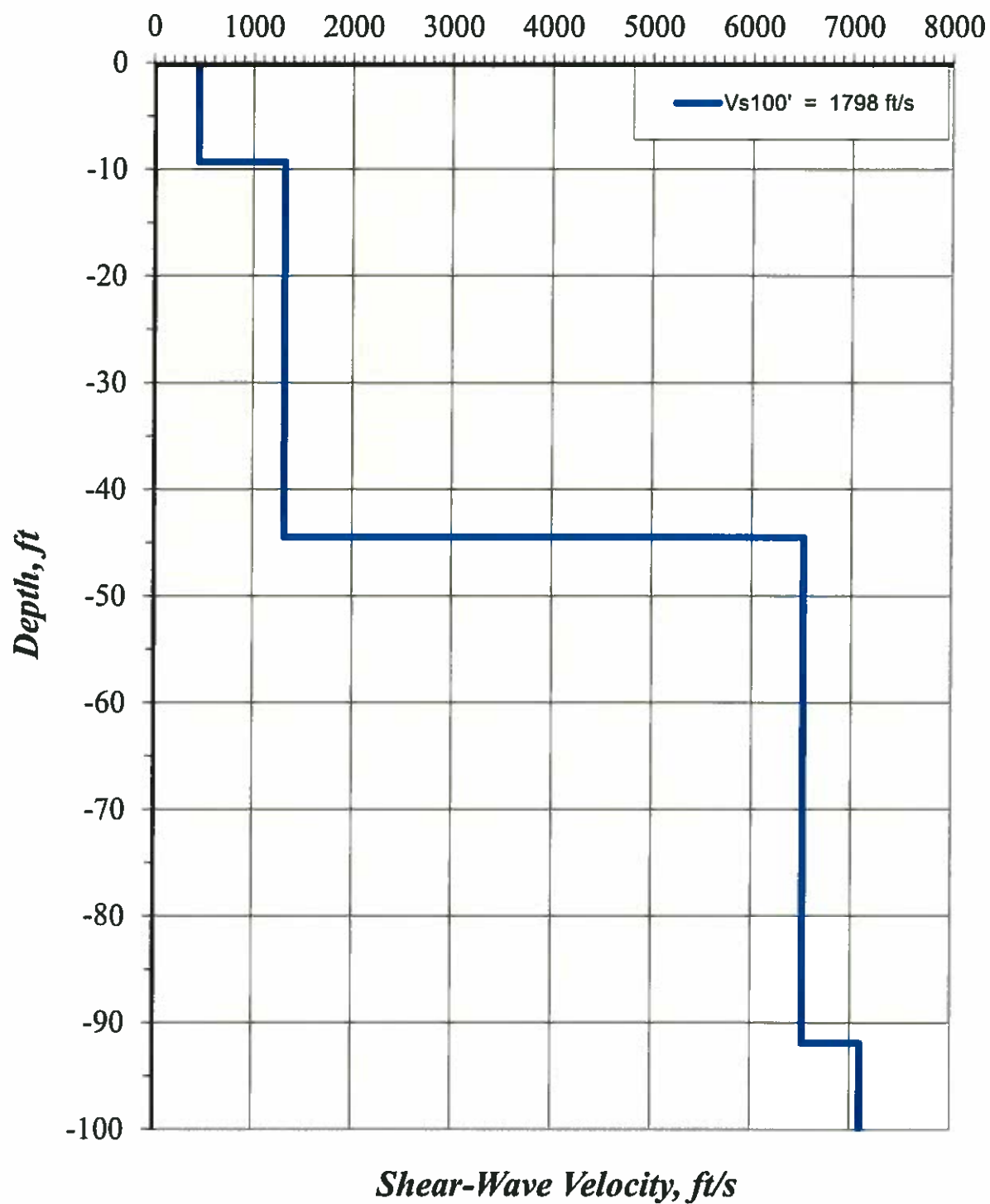
***EB1: Supportive Illustration***  
**Dispersion Curve Showing Picks and Fit**



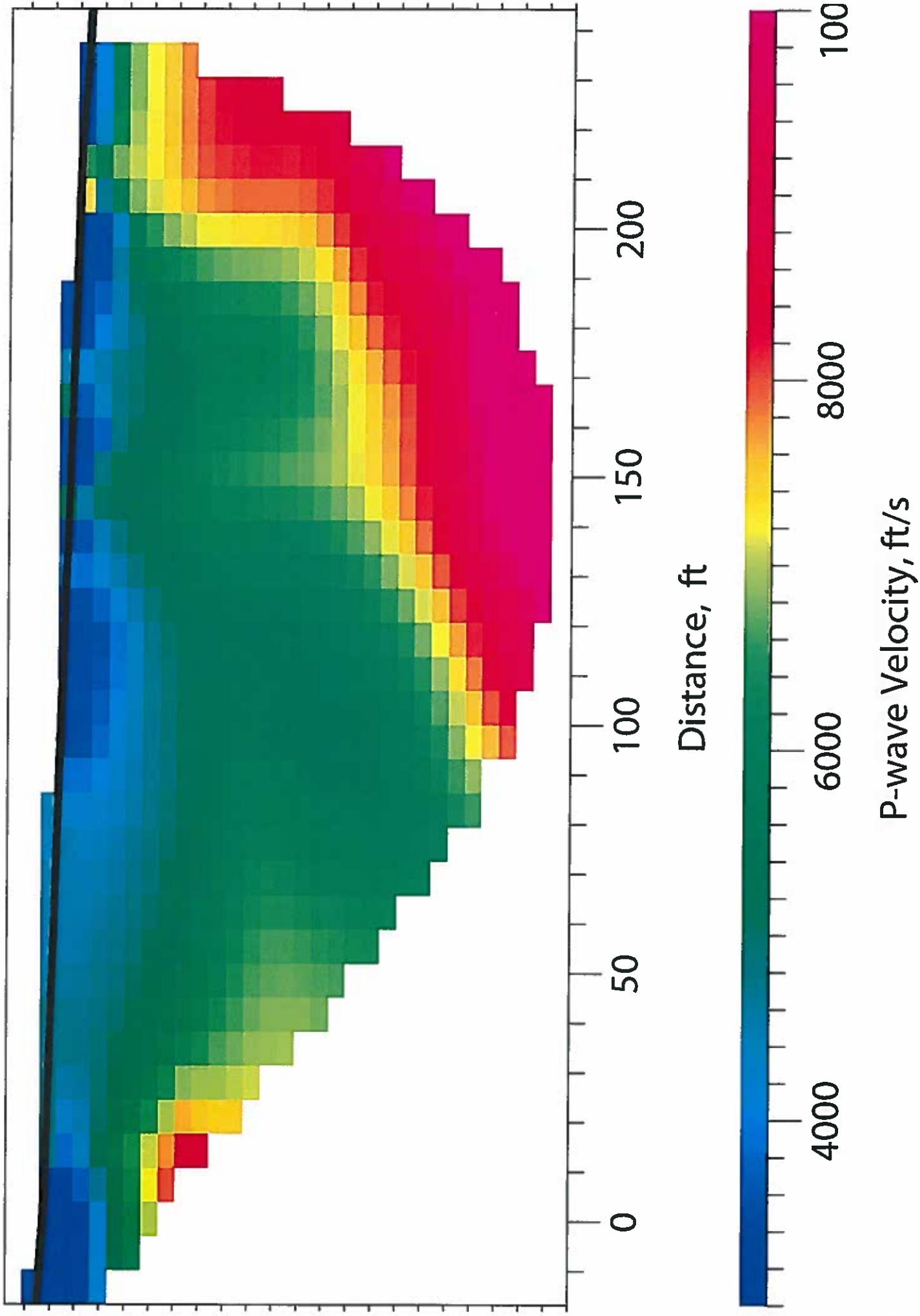
**p-f Image with Dispersion Modeling Picks**



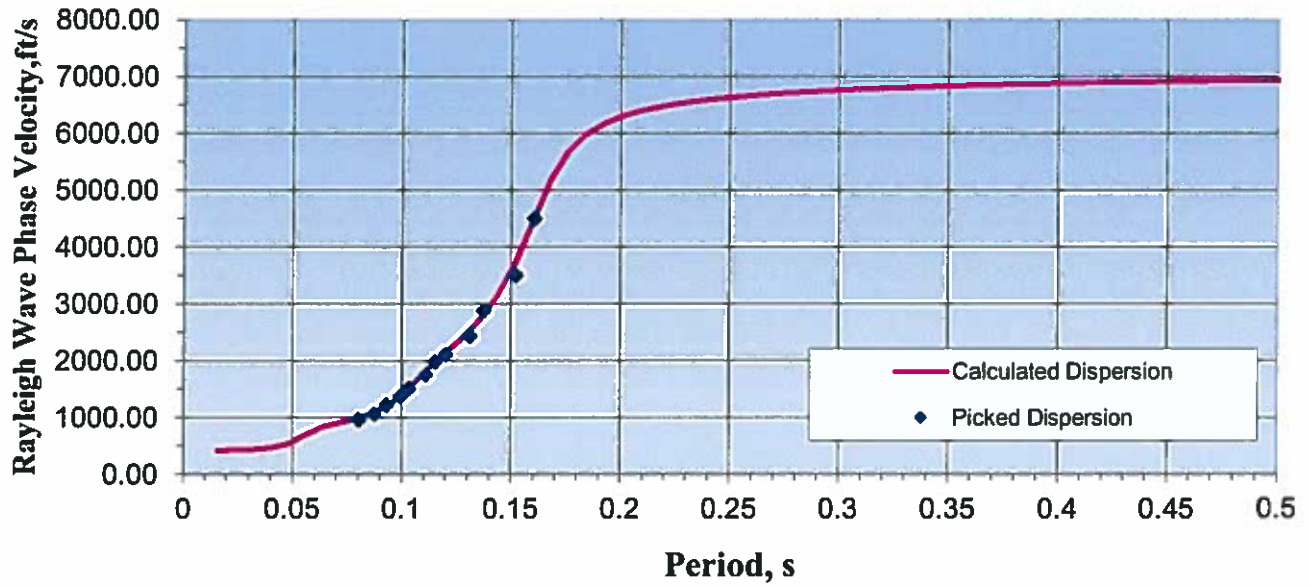
***EB1: Vs Model***



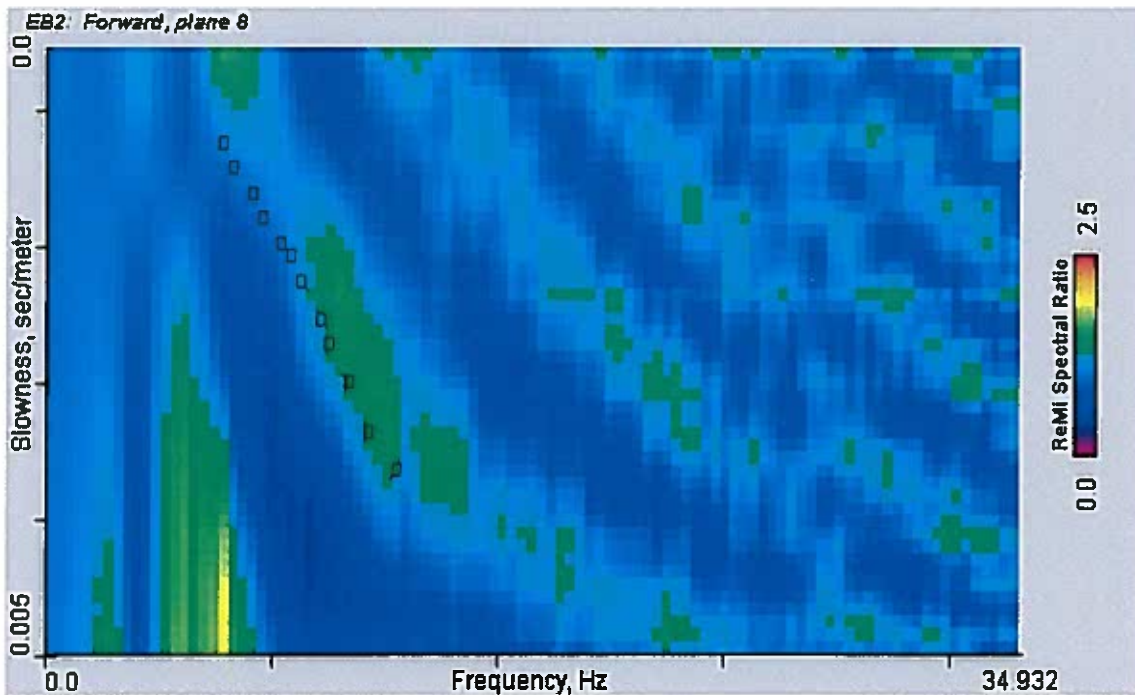
# EB1: Velocity Model



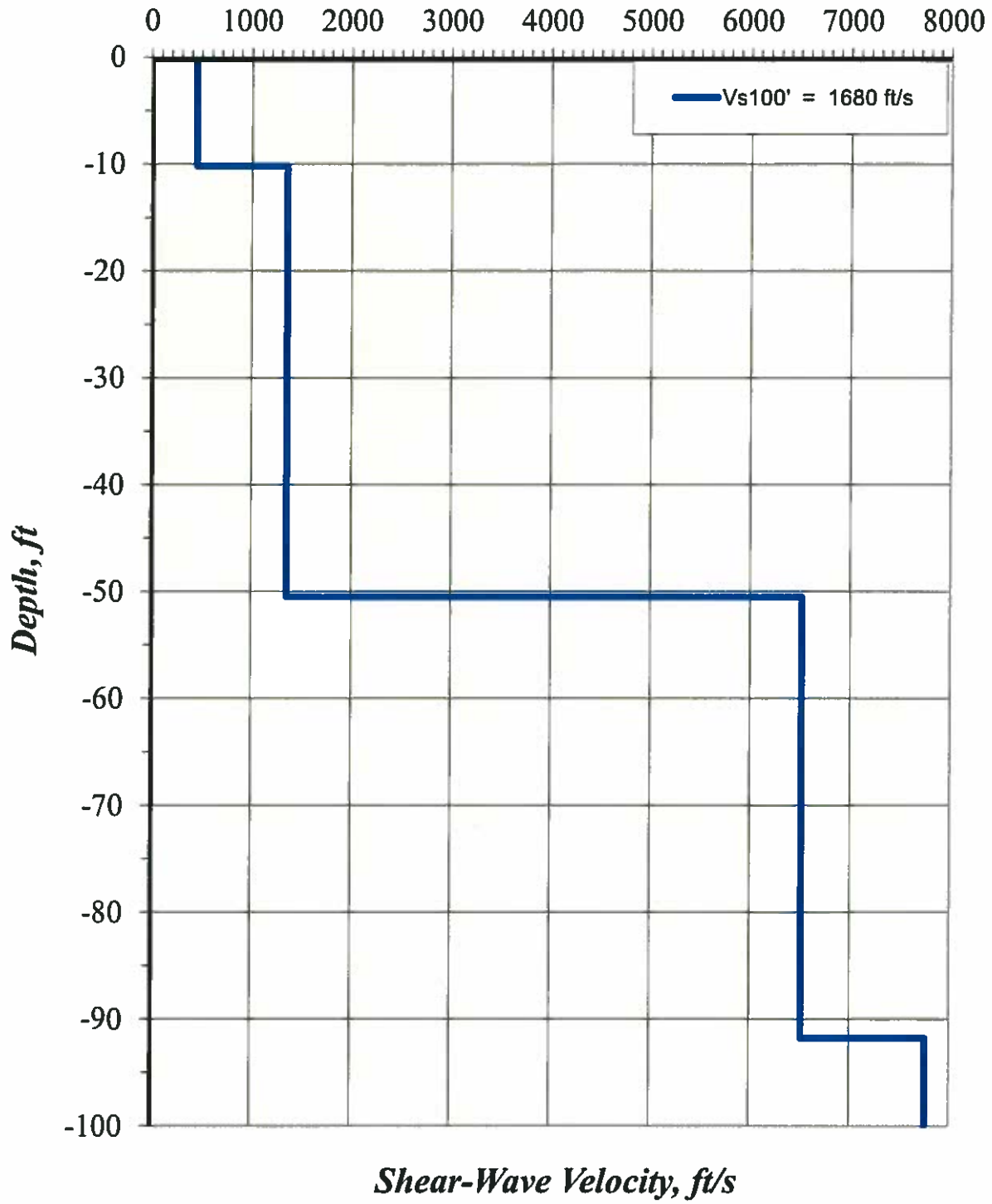
***EB2: Supportive Illustration***  
**Dispersion Curve Showing Picks and Fit**



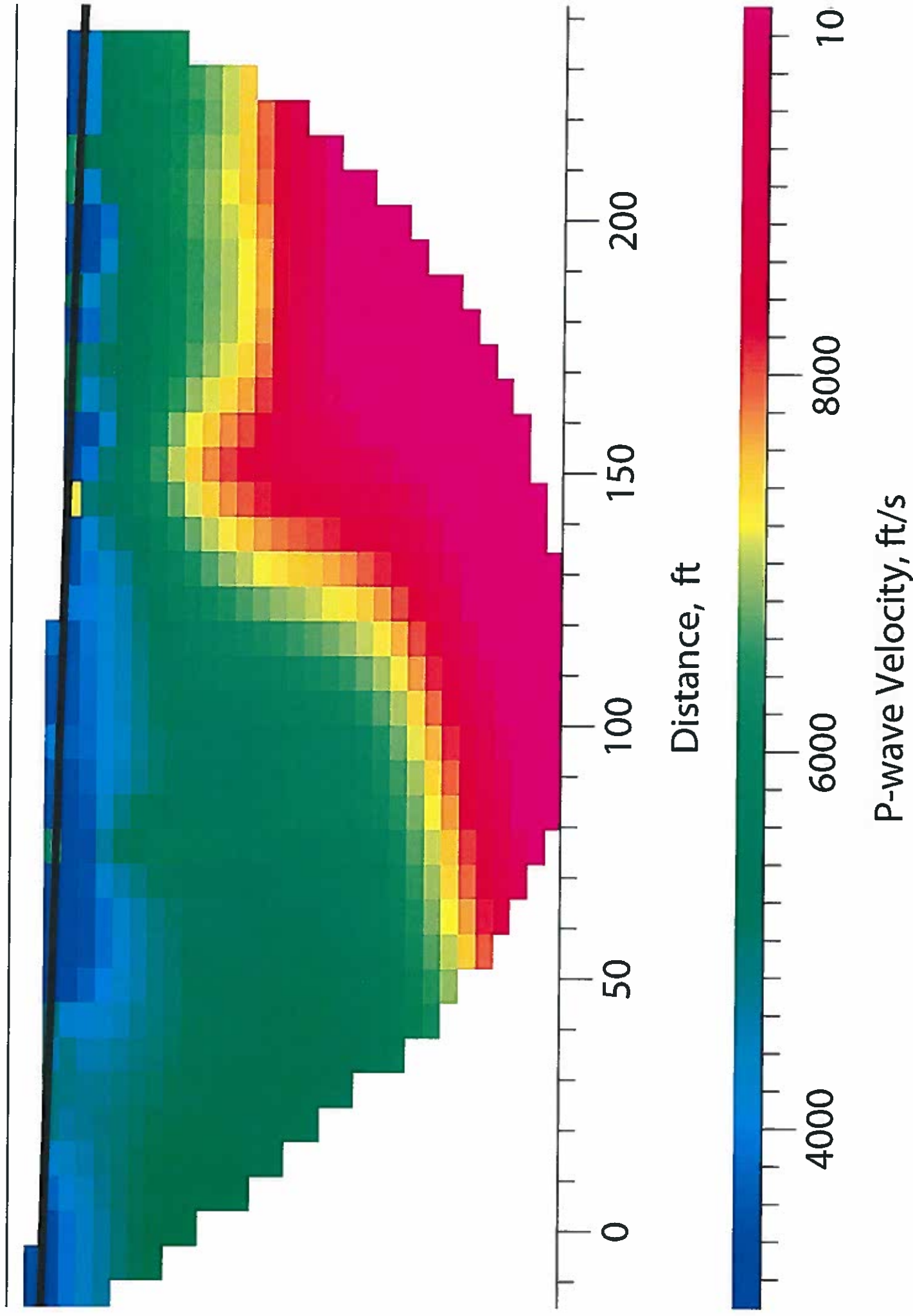
**p-f Image with Dispersion Modeling Picks**



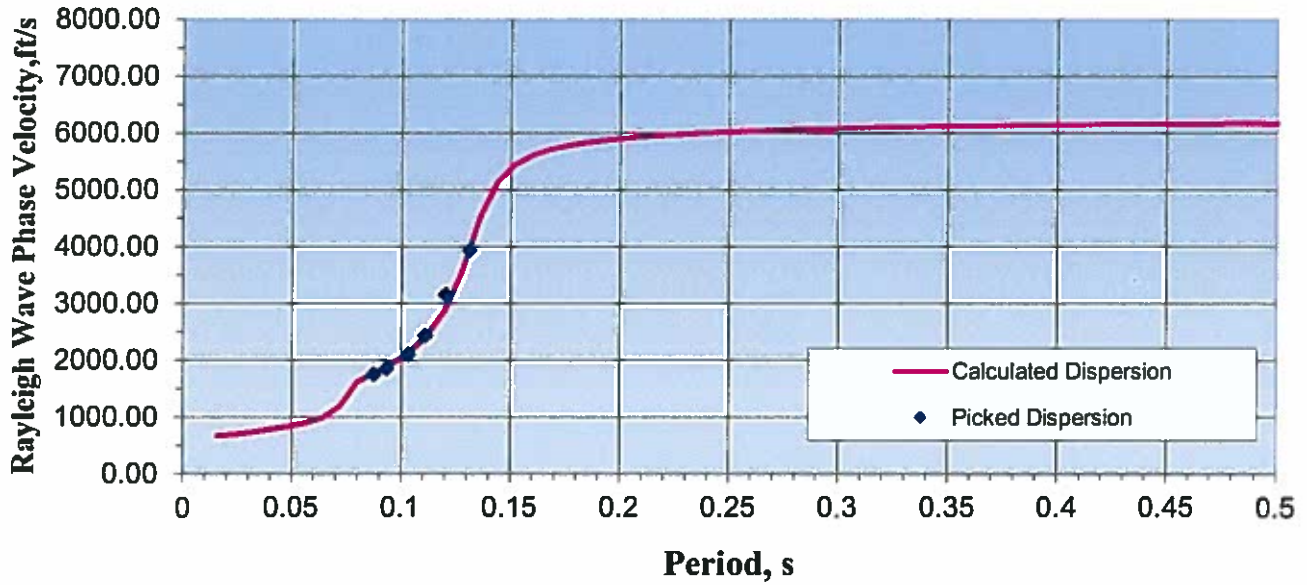
***EB2: Vs Model***



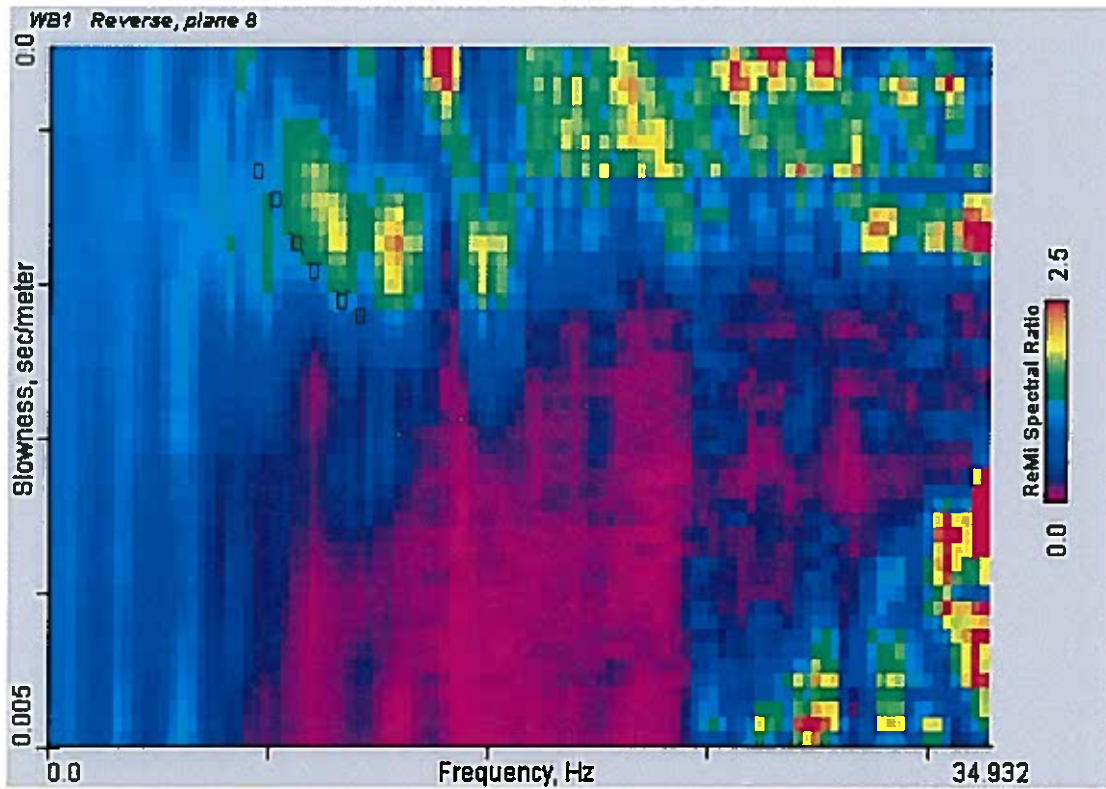
# EB2: Velocity Model



***WB1: Supportive Illustration***  
**Dispersion Curve Showing Picks and Fit**

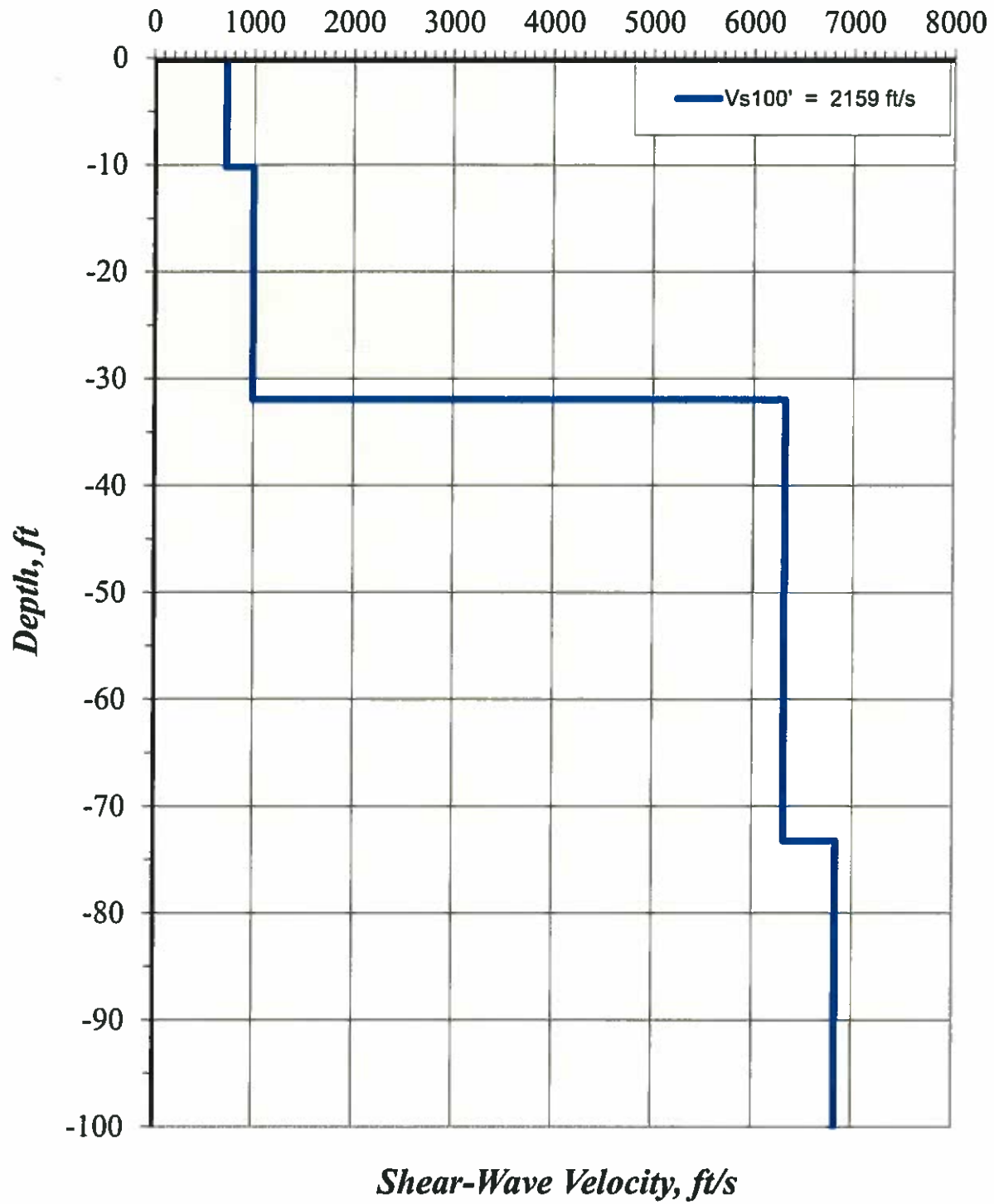


**p-f Image with Dispersion Modeling Picks**

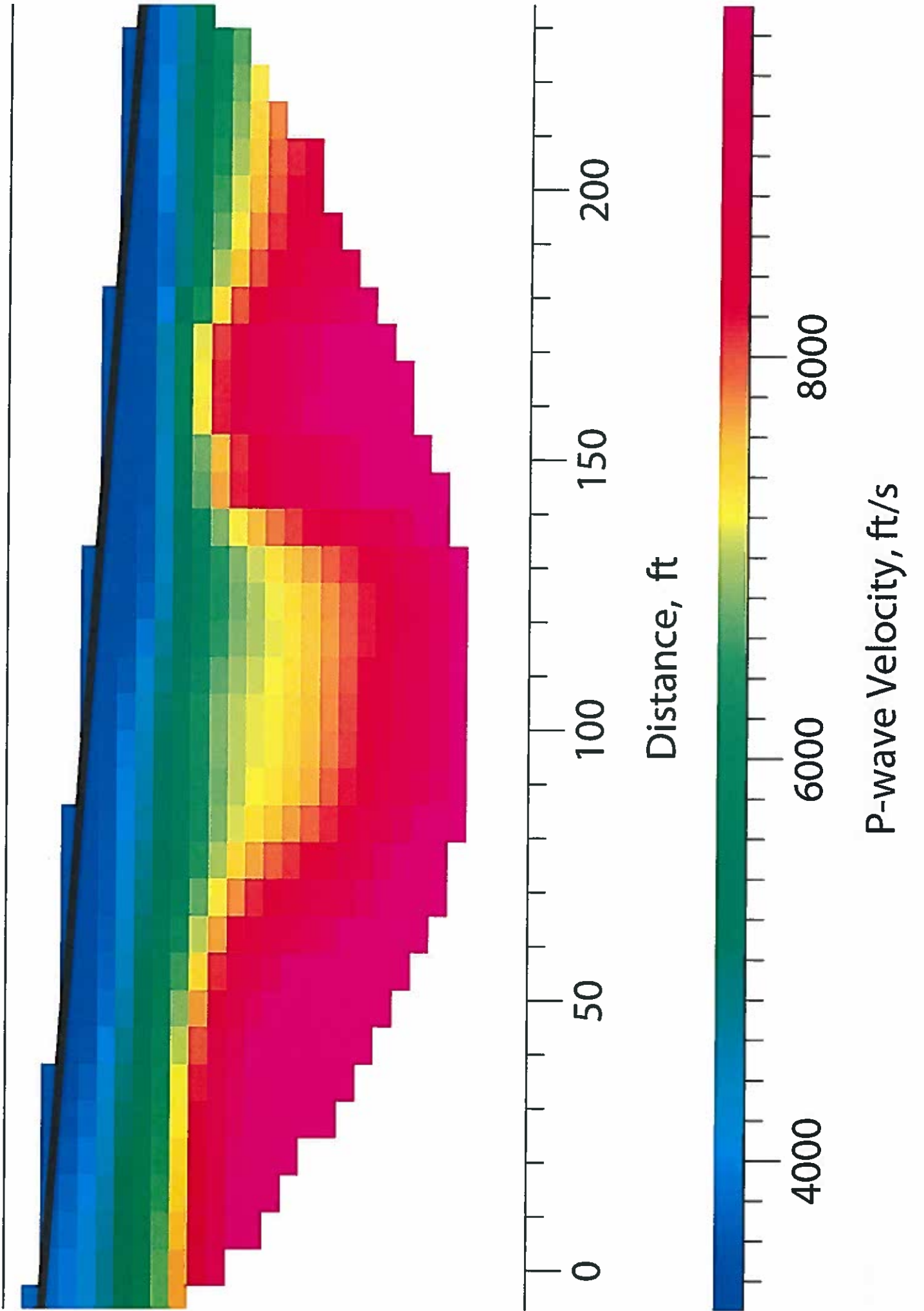




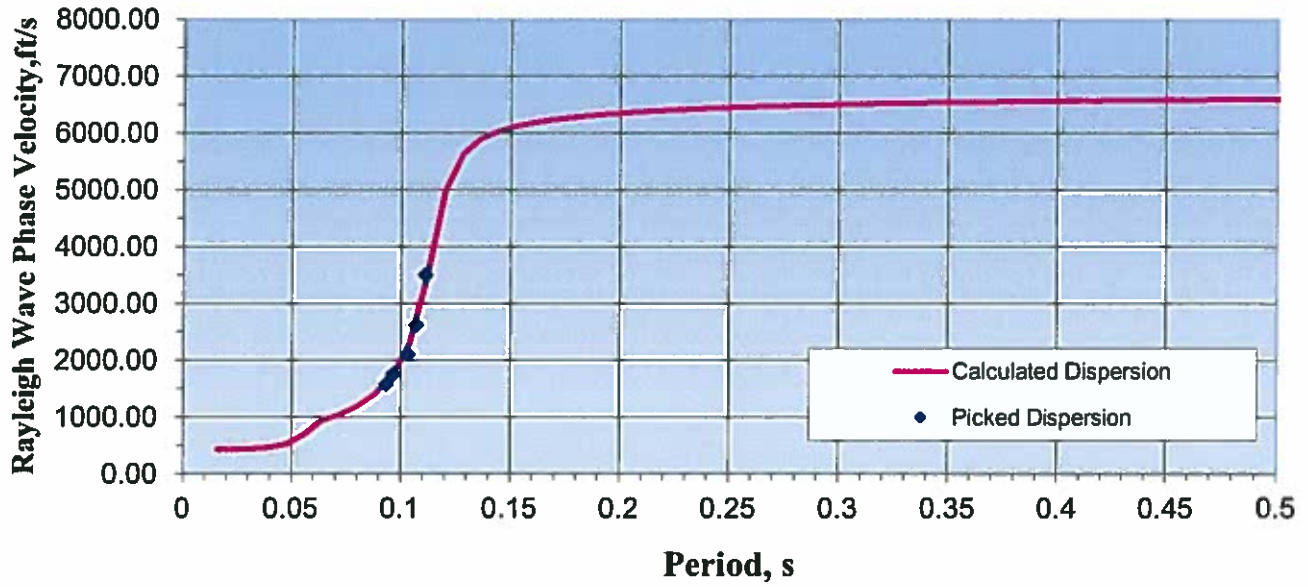
*WB1: Vs Model*



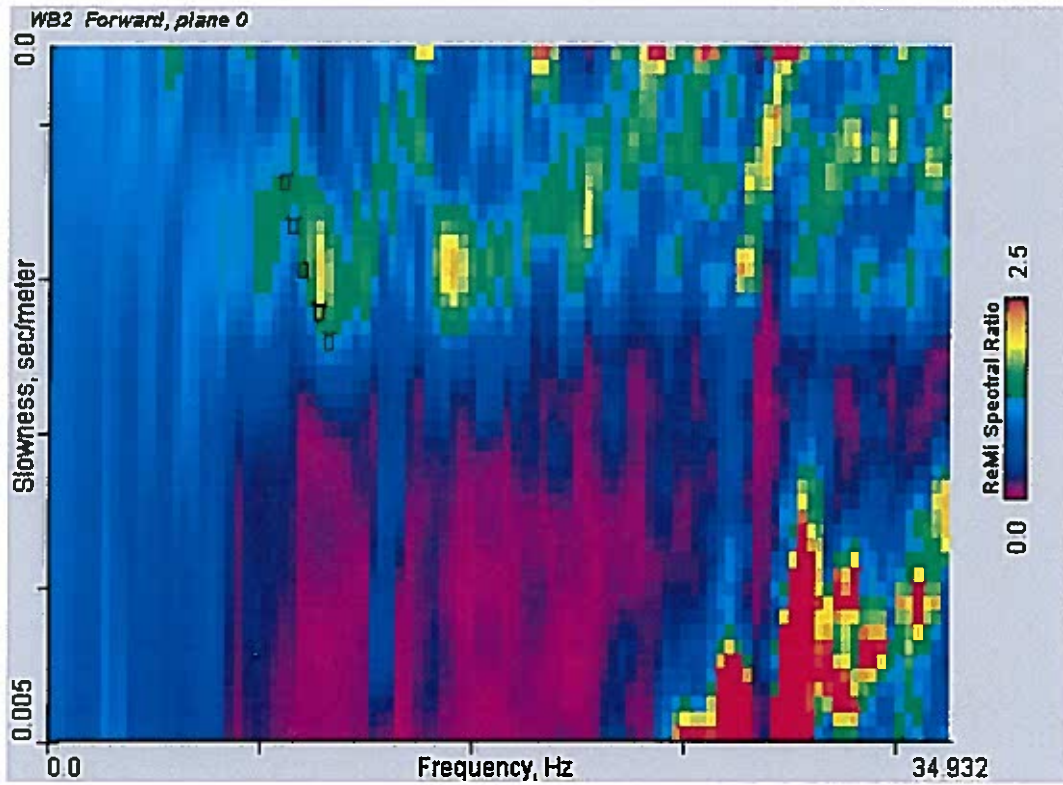
# WB1: Velocity Model



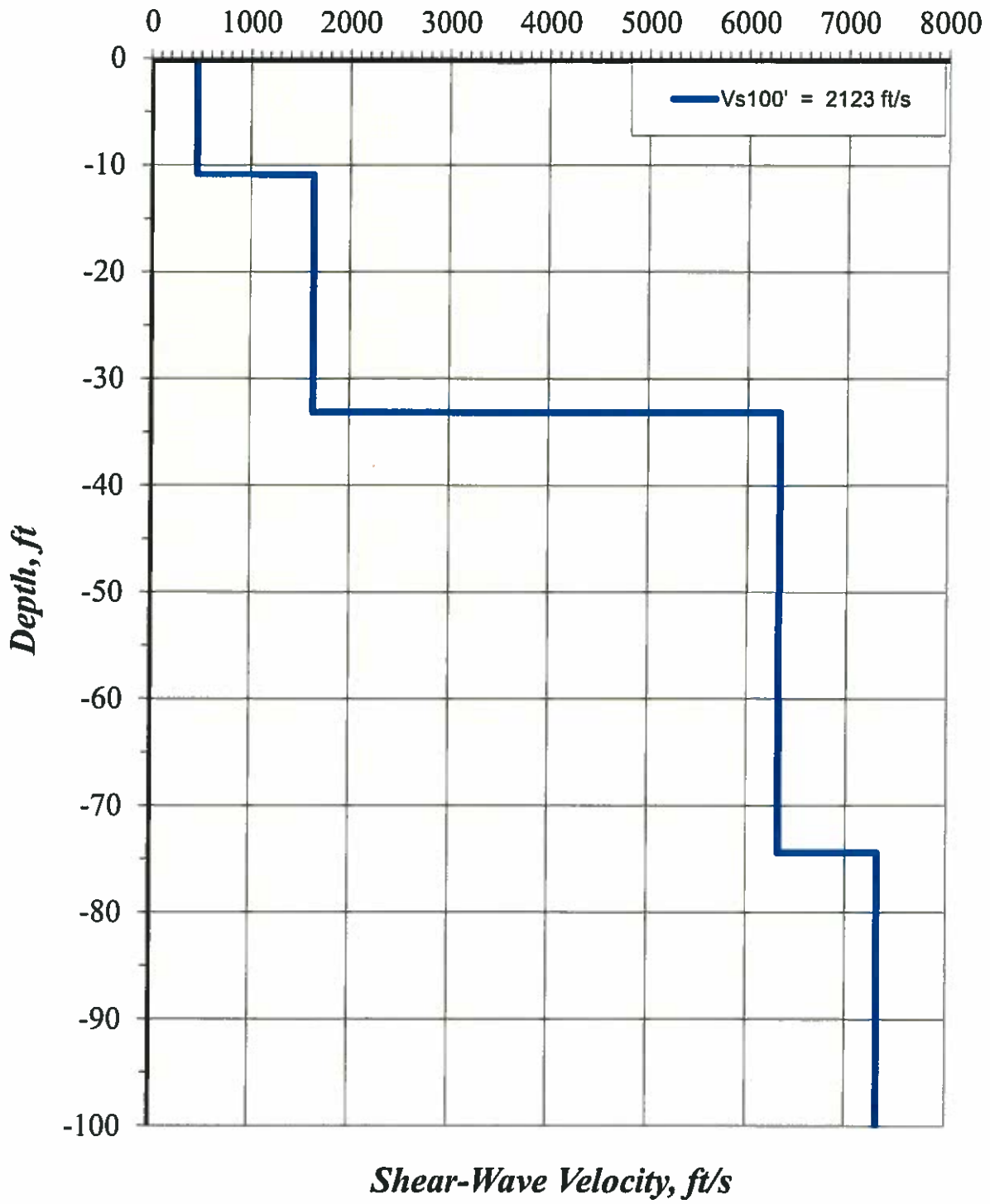
***WB2: Supportive Illustration***  
**Dispersion Curve Showing Picks and Fit**



**p-f Image with Dispersion Modeling Picks**



***WB2: Vs Model***



# WB2: Velocity Model

