PACIFIC BENTONITE LTD.

REPORT ON

SEISMIC REFRACTION INVESTIGATION

BENTONITE RESERVES EVALUATION

HAT CREEK, BRITISH COLUMBIA

by

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October, 1996

Project No. FGI-316

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ILLUSTRATIONS

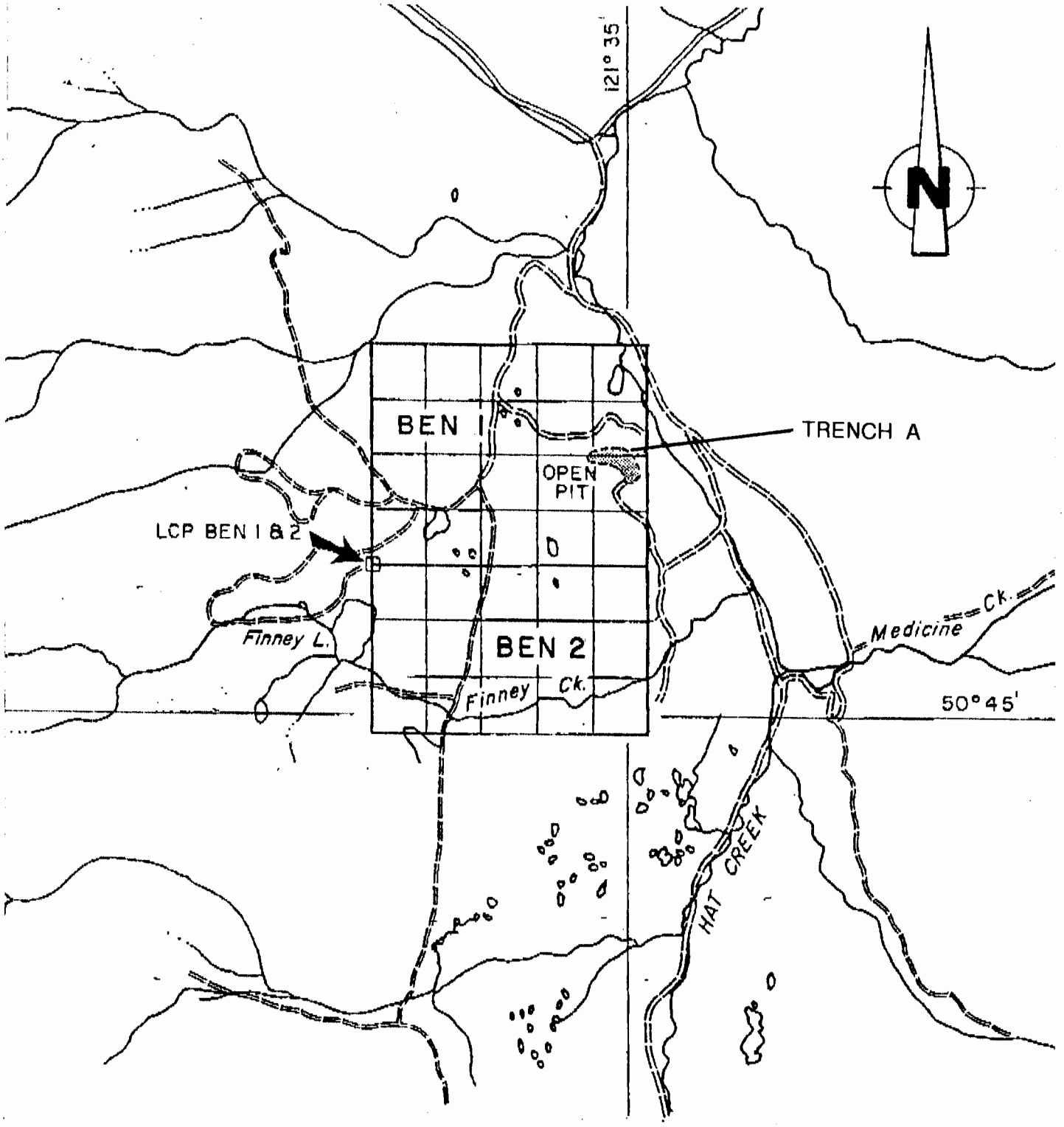
1. INTRODUCTION

In the period October 25 and 26, 1996, Frontier Geosciences Inc. carried out a detailed seismic refraction investigation for Pacific Bentonite Ltd. at their bentonite clay deposit at Hat Creek, B.C. The purpose of the seismic refraction investigation was to determine subsurface conditions for thicknesses of bentonite and to explore for zones or layers of more competent, lithified bentonite at depth.

The investigation consisted of three parallel lines in a box cut excavated by British Columbia Hydro in their exploration of the coal reserves at Hat Creek. The box cut designated trench "A," is located above the valley floor, at the west side of the property. A Site Plan at 1:50,000 scale is presented in Figure 1.

The box cut is symmetrical, strikes east-west and is approximately 200 m in length. The cut was excavated into bentonite and soft coal measures in a coal burn zone. To the west, there is a steeply dipping contact between coal and the bentonite which forms the majority of the exposures to the east.

The seismic lines were placed to straddle the contact between the coal and bentonite. Seismic line 1 was located at the bottom of the cut with lines 2 and 3 located approximately 20 m above line 1, at the sides of the cut.



Scale 1:50 000

Metres 1000 0 1000 2000 3000

PACIFIC BENTONITE LTD. HAT CREEK AREA
SEISMIC REFRACTION SURVEY
SITE PLAN
FRONTIER GEOSCIENCES INC.
OCTOBER, 1996 | | FIG. 1

2. THE SEISMIC REFRACTION SURVEY METHOD

2.1 Equipment

The seismic refraction investigation was carried out using a Geometrics, ES-1225, 12 channel, signal enhancement seismograph, and Mark Products Ltd. 14 Hz geophones. One 82.5 metre, multicored cables was utilized for seismic line coverage on the seismic lines. Geophone spacings along the seismic cable were maintained at 7.5 m throughout the survey. An 8 gauge seismic shotgun of proprietary design, firing blank, black powder loads, was utilized as the energy source in the survey.

2.2 Survey Procedure

For each spread, the seismic cable was laid out in a straight line and the geophones implanted. Five separate shotholes were excavated by hand auger and then occupied by the seismic shotgun: one at either end of the 12 channel set-up, one at the mid-point along the cable, and one off each end of the line to ensure adequate coverage of the basal layer. Shots were fired individually and arrival times for each geophone were automatically recorded in the seismograph. The recorded data was initially stored in the seismograph and subsequently printed onto electro-sensitive recording film.

Data recorded during field surveying operations were generally of excellent quality. Throughout the survey, notes were recorded regarding seismic line positions in relation to the geological features of the area. Detailed survey information was not recorded in the survey.

3. SEISMIC REFRACTION ANALYSIS

3.1 Interpretation

Interpreted geological conditions at the box cut indicate thin to moderately thick bentonite covering a higher velocity basal layer. In general, the velocity contrasts between refractive layers was more than adequate for interpretation. Interpreted boundaries between layers with different velocities are indicated by continuous lines in the sections. The basal layer in the bentonite areas is interpreted as a slightly denser, more lithified horizon.

3.2 Interpretive Method

The seismic data from the investigation was analyzed using the method of differences technique. The method of differences utilizes the travel times for sound waves that arrive at a specific geophone from shots detonated to either side of the geophone. Using the "total time" (travel times from shot point to shot point), the vertical travel time of the sound waves between the refractor surfaces and the geophone at the ground surface was computed. This time was then multiplied by the velocity of each overburden layer to obtain the overburden thickness below each geophone station.

3.3 Limitations

The depths to subsurface boundaries derived from seismic refraction surveys are generally accepted as accurate to within fifteen percent of the true depths to the boundaries. In some cases, unusual geological conditions may produce false or misleading seismic arrivals with the result that computed depths to subsurface refractors may be less accurate. These conditions may be caused by a "hidden layer" situation or by a velocity inversion. The first condition is caused by the inability to detect the existence of layers because of insufficient velocity contrasts or layer thicknesses. A velocity inversion exists when an underlying layer has a lower velocity than the layer directly above it.

The results are interpretive in nature and are considered to be a reasonably accurate presentation of existing subsurface conditions within the limitations of the seismic refraction method.

4. GEOPHYSICAL RESULTS

4.1 General

The results of the seismic refraction interpretations for the three lines carried out at the box cut are shown at 1:500 scale in Figure 2 in the Appendix. The elevations of each line are approximate with elevations of the box cut taken from B.C. Hydro, 1:20,000 scale mapping of the area.

4.2 Discussion

Seismic line 1 was positioned to straddle the contact between the coal and the bentonite. Geophones 7 through 12 of spread no. 1 were placed over the coal, and the higher velocity in the coal is apparent in the 1975 m/s basal velocity. This basal velocity layer is overlain by 2 to 3 metres of loose coal and surface alluvium. To the east, the basal velocity drops off in the bentonite area to 1670 m/s and 1830 m/s. These velocities are likely indicative of slightly denser, more lithified bentonite than the materials exposed at the surface. The soft bentonite evident in the cut is likely consistent with the 750 m/s velocity indicated as the second layer in the sections. Further to the east on seismic line 1, the basal layer velocity drops to 1050 m/s which is believed indicative of relatively soft bentonite.

The higher velocity zone at depth on seismic line 1 is reflected in the 1720 m/s zone on line 2 and the 1920 m/s / 1700 m/s zone on line 3. These zones are bounded by lower basal layer velocities indicative of weaker, less dense materials.

The overburden is generally thicker on seismic lines 2 and 3 which is consistent with those traverses being located at or close to, original ground level. The looser, softer materials were apparently removed in the deeper, excavated area of seismic line 1.

The higher velocity zones in the basal refractor that are to the east and believed to be in the bentonite area, are interpreted as more competent than the surficial exposures. The velocity magnitudes are low however, in comparison to sedimentary bedrock velocities. These higher velocity zones extend for 50 m or more in the basement and could encompass smaller zones of higher density rock that went undetected in the survey.

For: Frontier Geosciences Inc.

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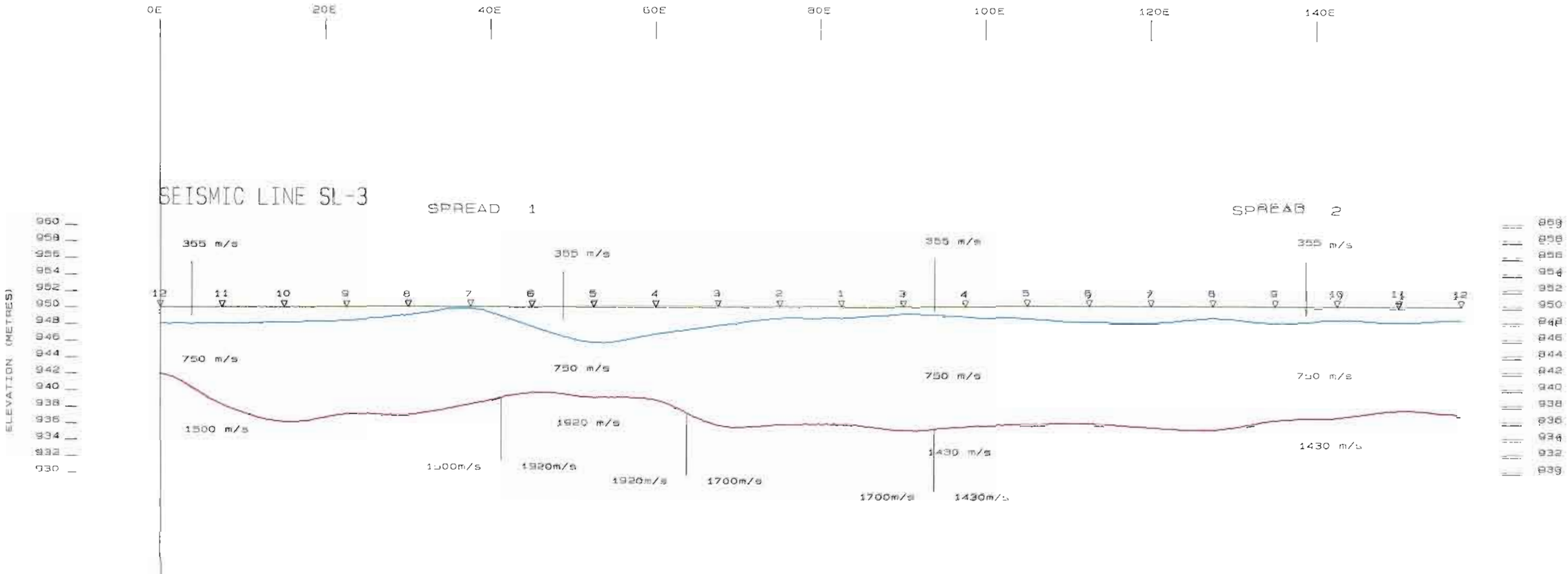
5. STATEMENT OF COST

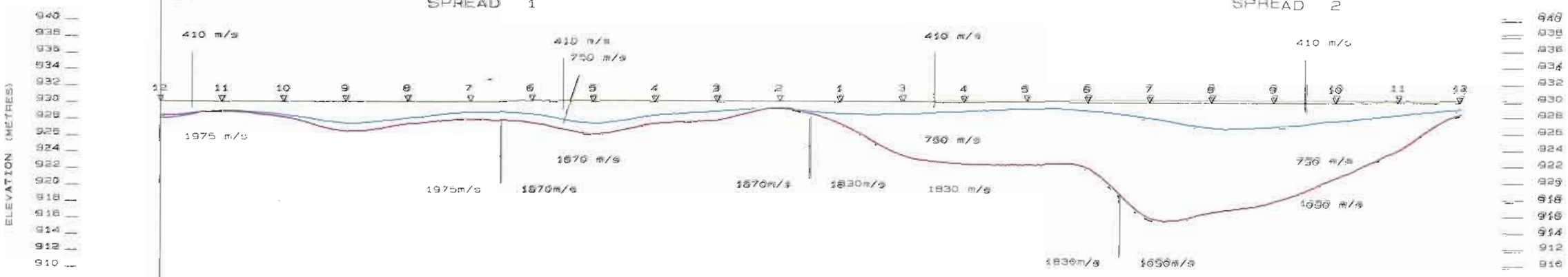
Frontier Geosciences Inc:

Item	Days	Unit Cost	Total Cost
Senior Geophysicist-Field	3	$520.00	$1560.00
Senior Geophysicist-Interpretation/Report	3.5	$520.00	$1820.00
Geophysical Technician-Field	3	$280.00	$840.00
Geophysical Technician-Office	1.5	$280.00	$420.00
Seismic Refraction System	3	$260.00	$780.00
Consummables	-	$175.00	$175.00
Mobilization/Demobilization	-	$458.00	$458.00
Board and Lodging	-	$132.00	$132.00
Data Processing and Reporting	-	$265.00	$265.00
		Total	**$6450.00**

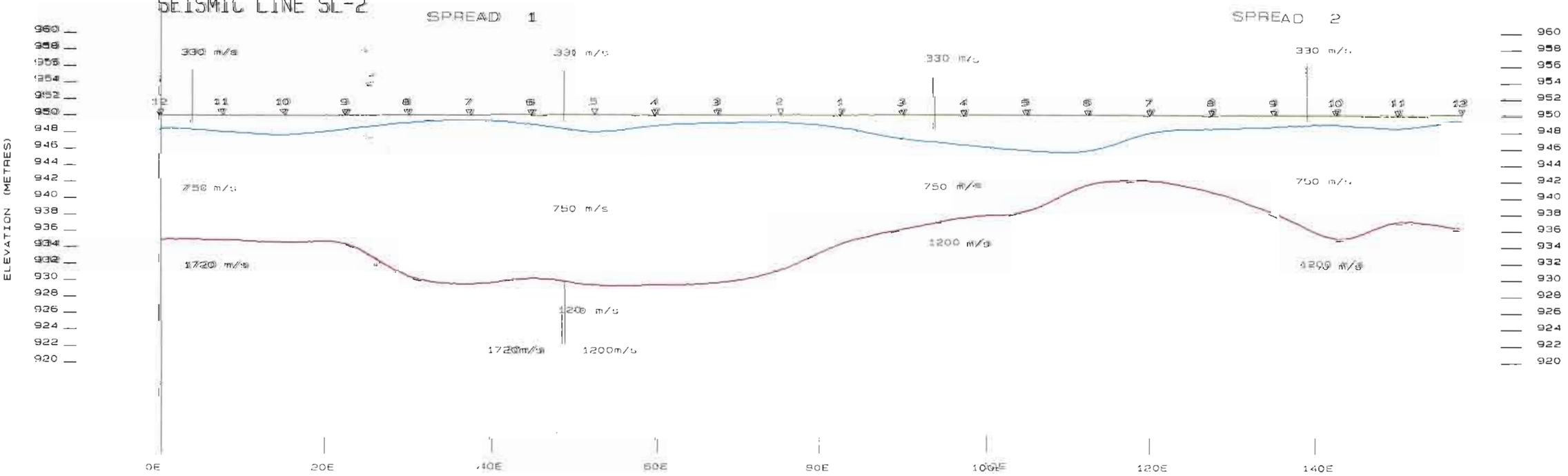
SEISMIC LINE SL-3



SEISMIC LINE SL-1



SEISMIC LINE SL-2



NOTES:
VERTICAL SCALE: 1:500
HORIZONTAL SCALE: 1:500
INSTRUMENT: GEOMETRICS ES-1225

PACIFIC BENTONITE LIMITED
HAT CREEK AREA

SEISMIC REFRACTION SURVEY

INTERPRETED DEPTH SECTIONS
SL-1 SL-2 AND SL-3

FRONTIER GEOSCIENCES INC.

DATE: OCTOBER 1996 | FIG. 2