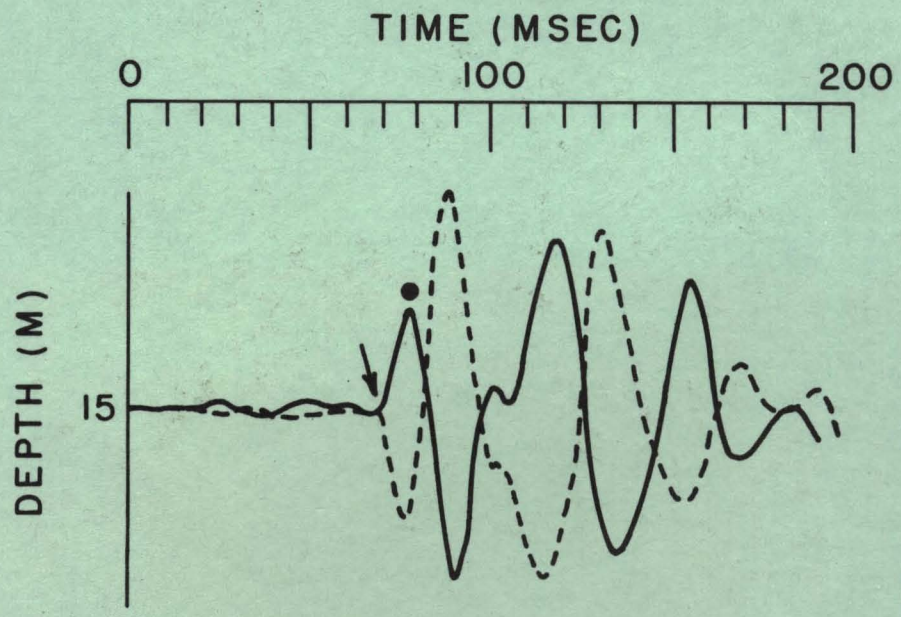
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

IN – SITU MEASUREMENTS OF SEISMIC VELOCITIES IN THE SAN FRANCISCO BAY REGION . . . PART II



OPEN-FILE REPORT 76-731

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature

Menlo Park, California

1976

This page intentionally left blank

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

National Center for Earthquake Research
345 Middlefield Road
Menlo Park, California 94025

IN-SITU MEASUREMENTS OF SEISMIC VELOCITIES IN THE SAN FRANCISCO BAY REGION...PART II

by

James F. Gibbs, Thomas E. Fumal, and Roger D. Borcherdt

Open-File Report 76-731

1976

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

CONTENTS

	PAGE
INTRODUCTION	1
SELECTION AND LOCATION OF SITES	2
DRILLING AND SAMPLING PROCEDURES	3
RECORDING PROCEDURES	3
REDUCTION OF GEOLOGIC DATA	5
Description of Samples	5
Geologic Log	6
Density Measurements	6
REDUCTION OF SEISMIC DATA	7
Identification of Shear Wave Onset	7
Travel Times and Average Velocities	8
Interval Velocities and Elastic Moduli	9
SUMMARY OF RESULTS	11
ACKNOWLEDGMENTS	12
REFERENCES	13
FIGURES	16
TABLES	20

INTRODUCTION

Seismic wave velocities (compressional and shear) are important parameters for determining the seismic response characteristics of various geologic units when subjected to strong earthquake ground shaking (Borcherdt, 1970; Joyner and Chen, 1975).

Seismic velocities of various units often show a strong correlation with the amounts of damage following large earthquakes and have been used as a basis for certain types of seismic zonation studies (Medvedev, 1965; Gibbs and others, 1975b).

Currently a program is in progress to measure seismic velocities in the San Francisco Bay region at an estimated 150 sites. At each site seismic travel times are measured in drill holes, normally at 2.5-m intervals to a depth of 30 m. Geologic logs are determined from drill hole cuttings, undisturbed samples, and penetrometer samples. The data provide a detailed comparison of geologic and seismic characteristics and provide parameters for estimating strong earthquake ground motions quantitatively at each of the sites (Joyner and Chen, 1975). A major emphasis of this program is to obtain a detailed comparison of geologic and seismic data on a regional scale for use in seismic zonation. The broad data base available in the San Francisco Bay region suggests using the area as a pilot area for the development of general techniques applicable to other areas.

Shear wave velocities in near-surface geologic materials are of especial interest for engineering seismology and seismic zonation studies, yet in general, they are difficult to measure because of contamination by compressional waves. A comparison of various in-situ techniques by Warrick (1974) establishes the reliability of the method utilizing a "horizontal traction" source for sites underlain by bay mud and alluvium. Gibbs, et al. (1975a) present data from 12 holes and establishes the reliability of the method for sites underlain

by a variety of different rock units and suggests the feasibility of making the measurements at a much larger number of sites. Data collected from the first 12 holes also provide an opportunity for developing a routine and efficient procedure for collection and reduction of the data.

Gibbs and others (1975b) report preliminary comparisons of the data with the amplification data recorded from nuclear explosions (Gibbs and Borcherdt, 1974), and the intensity data for the 1906 earthquake (Lawson, 1908). These comparisons show that correlations exist between the three data sets. Seismic data collected at additional sites should strengthen these correlations and provide significant new data from which ground motion predictions for seismic zonation can be made. This report presents the interpretation of the data collected from an additional 23 sites.

SELECTION AND LOCATION OF SITES

Several types of data are available in the San Francisco Bay region which are pertinent to the overall problem of estimating earthquake ground motions for seismic zonation. These are (1) distribution of intensity for the California earthquake of April 18, 1906, (2) ground motion amplifications recorded at 99 sites, and (3) detailed geologic mapping. Sites are selected on the basis of each of these data sets. The present locations of strong motion instrumentation are also considered. Once a site is selected, accessibility of the site is determined and formal permission is obtained from the property owners. A file of access data and sketch maps are being compiled for each site. The locations of the sites are presented on 7 1/2-minute map sheets (see figs 1-17).

DRILLING AND SAMPLING PROCEDURES

At each site selected, a hole 12.4 cm in diameter is drilled to a depth of 30 m using a "Failing 1500" truck-mounted drill and a rock bit with mud and water circulation. The boring is then cased with 7.6 cm diameter PVC plastic pipe and backfilled with drill cuttings and "pea" gravel. Casing insures accessibility of the hole and provided a secure clamping surface for the seismic probe.

Samples are taken in each of the holes at depths of approximately 3 m, 7.5 m, 30 m, and at boundaries defined by continuously monitoring the drill cuttings and the drill reaction. The type and number of samples taken at each site is determined by the type of material, the number of significant lithologic boundaries, and variations in weathering. For those holes which penetrate a single rock unit, material variations as a function of depth are due largely to weathering. For these holes the depths of 3, 7.5, and 30 m usually provided samples of deeply weathered, moderately weathered, and fresh rock. Additional samples are taken where unusually thick weathering zones are encountered. Cost and the need for a large number of holes distributed on a regional scale prohibited continuous sampling. In soils, standard penetration measurements are made and undisturbed samples are taken using a "Pitcher" core barrel and a "Shelby" thin tube liner. Undisturbed samples are also taken in soils with large amounts of hard rock fragments and in firm rock. Samples are obtained in hard rock using a core barrel with a diamond core bit.

RECORDING PROCEDURES

Compressional waves are generated at each site by the vertical impact of a sledge hammer on a steel plate. A signal produced by the opening of an impact switch attached to the hammer is recorded for determining origin time.

Shear waves are generated using the horizontal traction source introduced by Kobayashi (1959) and discussed by Warrick (1974). Briefly, the method consists of applying a horizontal impact to a large timber (244 x 30 x 18 cm). The timber is placed on a flattened soil surface and held firmly in place by the front wheels of a truck. A steel pipe extends through the timber and supports a 30 kg hammer to which is attached an impact switch. The specially constructed hammer rolls on bearings and moves a distance of 45 cm along the pipe before impacting the timber. The "horizontal traction" source generates a high proportion of S- to P-wave energy. The timber is impacted twice, once in each direction. The two impacts reverse the polarity of the S-waves but not the polarity of the smaller amounts of P-wave energy. Comparison of the two signals provides an important tool for identifying the onset of the S-wave.

The timber is offset 2.0 m from the hole and a three-component geophone package (natural frequency 14 Hz) is placed within 9 cm of its center. The signals recorded from the surface geophones are used to monitor the input signals and determine the origin time for the generated S-waves. The arrangement of timber, steel plate, and surface geophone package is illustrated in figure 18a.

The P-waves generated by a vertical impact on the steel plate and the S-waves generated by impacting the timber in both directions are recorded separately. This procedure is repeated for each 2.5 m interval (closer spacing is sometimes used to obtain a velocity in thin layers) in the drill hole.

The seismic probe used in the first 12 drill holes (Gibbs, et al., 1975a) consists of three sensors (one vertical and two horizontal) (Mark Product L-10, natural frequency 14 Hz). This package is not easily oriented from the surface so that one horizontal seismometer is inline and the other transverse.

This instrument was used only as a backup unit in the present study. The downhole instrument now being used is a three-component unit built by Oyo Corp., Tokyo, Japan. The new instrument package has a delinometer and an inflatable diaphragm which under most circumstances permits orientation from the surface. Proper orientation aides in identifying the onset of the S-wave.

The signals from the downhole and surface seismometers and the impact switches are recorded on photographic paper and magnetic tape in analog form. The velocity unit-impulse response of the recording system is essentially flat from 2 Hz to above 100 Hz. A detailed description of the recording instrumentation is presented by Warrick and others (1961). The recording oscillograph is modified for this project by adding 500 Hz galvanometers and increasing the paper speed to 46 cm/sec.

REDUCTION OF GEOLOGIC DATA

Description of Samples

Portions of each of the samples are examined and described in the laboratory. The terms used for the descriptions are summarized on figure 19. The sample descriptions are presented in the left-hand columns of figures 20-42.

The soil samples are described using the field techniques of the Soil Conservation Service and those specified for the Unified Soil Classification System. Descriptions include soil texture, color, amount, and size of coarse grains, plasticity, dry and wet consistency, and moisture condition. Texture refers to the relative proportions of clay, silt, and sand particles less than 2 mm in diameter. The dominant color of the soil and prominent mottles are determined from the Munsell soil color charts.

Descriptions of rock samples include rock name, weathering condition, color, grain size, hardness, and fracture spacing. Classifications of rock hardness and fracture spacing are those used by Ellen and others (1972) in

describing hillside materials in San Mateo County. The weathering classification is modified from that used by Aetron-Blume-Atkinson (1965) in describing Tertiary sedimentary rocks in the foothills of the Santa Cruz Mountains.

Geologic Log

Geologic logs are compiled for each hole using the field log and descriptions of the samples (figures 20-42). The field log is based on the reaction of the drill rig, a continuous record of drill cuttings, preliminary on-site inspection of samples, and inspection of nearby roadcuts and gullies.

Most information needed for describing relatively well-sorted soils and such properties of rock as lithology, color, and hardness are readily obtained from cuttings. Inspection of samples and nearby outcrops is also necessary to determine the nature of poorly sorted materials and to determine fracture spacing. Reaction of the drill rig is also useful in determining degree of fracturing as the rate of penetration in rock is highest for very closely fractured and crushed material and drilling roughness generally is at a maximum in closely to moderately fractured rock. In-situ consistency of soil is determined largely from standard penetration measurements and rate of drill penetration.

Density Measurements

Density measurements are required to calculate elastic moduli from measurements of seismic velocity. Densities are measured from most of the penetrometer, Pitcher tube, and diamond core samples (figs. 20-42). Densities are measured, where possible, by weighing a small piece of the sample and obtaining its volume by the mercury displacement method. A different method is used for very friable materials such as grus or poorly sorted materials which necessitated using a large sample. A slice is sawed from the Shelby tube containing the sample, its height and diameter measured, and the sample extruded for weighing.

For the mercury displacement method, measurements are made on three portions of a sample and the average reported.

While the accuracy of the density measurements is generally sufficient for calculation of elastic moduli, a number of the samples used to obtain densities do not completely represent the in-situ material. Materials that are sampled by penetration are compressed in sampling and several of these dried out before density measurements could be made. Densities of the hard rock samples are obtained using whole rock fragments from diamond core samples and are maximum densities. Depending on the amount and openness of fractures, these rock densities could be higher than in-situ densities by approximately 0.1-0.2 gm/cc.

REDUCTION OF SEISMIC DATA

Identification of Shear Wave Onset

To aid in the identification of the shear wave arrivals, the signals recorded in the drill hole from impacting the timber in opposite directions are superimposed and drafted on a common time base (figs. 43-65). The S-wave group is easily identified when displayed in this manner, by a 180° phase inversion. The onset of the S-wave is chosen as the start of the first inverted phase in the group. The interpretation proceeds from the bottom record, to the top using phase correlation at each recording depth. The onset of the S-wave arrival (arrows) and the first peak of the S-wave arrival (dots) are identified for each depth and for each site are indicated on figures 43-65.

It was not possible at every site to control the orientation of the down-hole seismometer package because of high viscosity drilling mud left in the hole; hence, the relative amounts of S-wave energy recorded on the two horizontal seismometers vary with depth. The S-wave arrival is generally

most easily identified on the horizontal seismogram with the largest amplitudes (e.g., see fig. 46). Comparison of the signals recorded on the horizontal sensors with that recorded on the vertical sensor shows that the S-wave energy generated by the horizontal traction source is at least twice as large as the P-wave energy.

On many of the horizontal seismograms some P-wave energy prior to the onset of the S-wave is apparent. Some P-wave energy is generated by the horizontal traction source and some probably results from conversion of S to P at seismic boundaries. In some cases the polarity of this P-wave energy is reversed and careful consideration of the entire record section is required to identify the S-arrival. Moreover, several locations (i.e. Fig. 44 at 10, 12.5, 15, and 17.5 m) show early arrivals which have characteristics of S-waves (phase reversal, frequency, etc.) but plot on the travel time graph between P- and S-wave velocity. These arrivals are thought to be waves which travel part of their path as faster P and convert to S at a seismic boundary. With rare exception, these arrivals cannot be phase correlated for more than a few depths and are readily identified when consideration is given to the entire record section. In general, the onset of the S-wave is easier to identify at sites underlain by the various types of soil than for sites underlain by the more consolidated rock units.

Travel Times and Average Velocities

To determine the travel time for the S-wave onset identified from the record sections (figs. 43-65), the following times are measured with respect to a 100 Hz time code signal recorded on the records:

1) $t_1 \equiv$ time of break in signal from impact switch
2) $t_2 \equiv$ onset time of S-wave arrival on inline uphole geophone
3) $t_3 \equiv$ onset time of identified S-wave arrival on downhole sensors

The time considered to be the origin time for the S-wave recorded on the downhole sensor is the onset time of the S-arrival on the uphole inline sensor. To reduce the uncertainties in determining this origin time, an average value (t_A) is determined for the set of values, $t_2 - t_1$, measured at each depth. The travel time for the first S-arrival is given by

$$t_s \equiv (t_3 - t_1) - t_A.$$

A corrected S-wave travel time (t_{s_c}), corresponding to the travel time for a vertical ray path, is computed from $t_{s_c} \equiv t_s + t_c$ where t_c corresponds to a timing correction (cosign of the angle of ray incidence) due to the distance the plank is offset from the center of the hole (usually 2.0 m). Average velocities from the surface are determined by dividing the corrected travel time by the corresponding depth. The travel time for the first S-peak is determined similarly. The origin corrections ($t_2 - t_1$), the travel times of the first S-arrival and the first S-peak (t_s), the corrected travel times for the first S-arrival and the first S-peak (t_{s_c}), and the average corresponding velocities computed at each site are presented in tables 1-23.

The travel times for the P-waves generated by a vertical impact on a steel plate are determined in the same way as for the S-waves, except that the origin time for the P-wave is given by the impact switch and no origin correction is necessary. The travel times, the corrected travel times, and the average velocities for the P-waves are also presented in tables 1-23.

Interval Velocities and Elastic Moduli

Calculation of interval velocities and elastic moduli requires determination of depth intervals over which the velocity is approximately constant within the uncertainty of the travel-time measurements. To determine these

depth intervals, the travel time data (tables 1-23) are plotted as a function of depth (figs. 66-88) and the geologic logs (figs. 20-42) are simplified (figs. 66-88). Depth intervals for velocity determinations are selected on the basis of distinct changes in slope of the travel time plots and evidence for lithologic boundaries. For those geologic materials with S-velocities greater than 350 m/sec, the intervals are required to contain at least four travel time measurements to avoid determining a velocity from a travel time differential due to large part to measurement error. For purposes of a generalized comparison between the different sites, the interval 10-30 m is selected for routine computation of velocity.

Velocities are calculated for each of the selected intervals (tables 24-46) from the slope of the linear regression line which best fits the travel time data in a least squares sense (Borcherdt and Healy, 1968, eqs. 3.1-3.5). The equation of the linear-regression line which best fits, in a least-squares sense, a sample of n pairs of time-depth coordinates $\{(x_1,t_1),\ldots,(x_n,t_n)\}$ is

$$t(x) = a + b\,(x - \bar{x})$$

where $$\bar{x} \equiv \frac{1}{n}\sum_{i=1}^{n} x_i \;,\quad a \equiv \frac{1}{n}\sum_{i=1}^{n} t_i \;,$$

the intercept is $$\text{INCPT} \equiv \frac{1}{n}\sum_{i=1}^{n} t_i - b\bar{x} \;,\quad \text{and}$$

the slope is $$b \equiv \sum_{i=1}^{n} w_i t_i$$

with $$w_i = (x_i - \bar{x})/D \quad \text{and} \quad D \equiv \sum_{k=1}^{n}(x_k - \bar{x})^2 \;.$$

The desired velocity (VEL) is given by $V = 1/b$. Assuming the standard statistical model (Borcherdt and Healy, 1968), the 68.3 confidence level, uncertainty interval (UNC INT) for the velocity is estimated by

$$\left(\frac{1}{b+S_b}, \frac{1}{b-S_b}\right) ,$$

where

$$S_b \equiv \frac{1}{(n-2)D} \sum_{i=1}^{n} (t_i - t(x_i))^2$$

is the standard error of the regression coefficient.

For these depth intervals with measurements of density (ρ), the shear modulus (SHEAR MOD, M) and bulk modulus (BULK MOD, K) is calculated (tables 24-46) using

$$M = \rho V_s^2$$

and

$$K = \rho V_p^2 - \frac{4}{3} M .$$

Poisson's ratio (σ) is calculated (tables 24-46) using

$$\sigma = \frac{\left(\frac{V_p}{V_s}\right)^2 - 2}{2\left(\frac{V_p}{V_s}\right)^2 - 2} .$$

SUMMARY OF RESULTS

Gibbs et. al., 1975a, presents data from 12 boreholes and establishes that reliable shear wave velocities can be measured in the bedrock units in the San Francisco Bay region. In this report seismic velocities (particularly S-wave velocities) together with geologic logs are reported for 23 new locations. The geologic units measured include a variety of Quaternary sediments ranging from older alluvium to bay mud.

The purpose of the study is to establish a data base for predicting ground motions for use in seismic zonation. This requires a large number of sites distributed throughout the region. The total number of sites measured to date is 35 with at least one measurement in every type of near surface material in the San Francisco Bay region.

ACKNOWLEDGMENTS

We wish to especially thank Kenneth R. Lajoie for many helpful discussions of the geology of the San Francisco Bay area and for his help in site selection. T. Leslie Youd has participated in many helpful discussions and provided laboratory personnel and equipment for density measurements. Edward F. Roth has been helpful in collecting the data in the field. We are deeply indebted to Richard E. Warrick, who pioneered the development of most of the S-wave apparatus and techniques used in this project.

REFERENCES

Aetron-Blume-Atkinson, 1965, Geologic site investigation for Stanford Linear Accelerator Center: Report No. ABA-88.

Borcherdt, R. D., 1970, Effects of local geology on ground motion near San Francisco Bay: Bull. Seism. Soc. Am., 60, 29-61.

Borcherdt, R. D., and Healy, J. H., 1968, A method for estimating the uncertainty of seismic velocities measured by refraction techniques: Bull. Seism. Soc. Am., 58, p. 1769-1790.

Brabb, E. E., 1970, Preliminary geologic map of the Central Santa Cruz Mountains, California: U.S. Geological Survey, Bay Region Environment and Resources Planning Study, Basis Data Contribution 6.

Brabb, E. E., and Pampeyan, E. H., 1972, Preliminary geologic map of San Mateo County, California: U.S. Geol. Survey Misc. Field Studies Map MF-328, scale 1:62,500.

Ellen, S. D., Wentworth, C. M., Brabb, E. E., and Pampeyan, E. H., 1972, Description of geologic units, San Mateo County, California: Accompanying U.S. Geol. Survey Miscellaneous Field Studies Map, MF-328.

Gibbs, James F., and Borcherdt, Roger D., 1974, Effects of local geology on ground motion in the San Francisco Bay region, California, a continued study: U.S. Geological Survey open-file report No. 74-222.

Gibbs, James F., Fumal, Thomas E., and Borcherdt, Roger D., 1975a, In-situ measurements of seismic velocities at twelve locations in the San Francisco Bay region: U.S. Geological Survey Open-file report 75-564.

Gibbs, J. F., Warrick, R. E., Fumal, T. E., Borcherdt, R. D., Lajoie, K. R., and Youd, T. L., 1975b, In-situ measurements of seismic velocities in the San Francisco Bay region: Abstract, Geol. Soc. Am., 71st Annual Meeting, Cordilleran Section, P406, Ca. State Univ., Los Angeles, California.

Helley, E. J., and Brabb, E. E., 1971, Geologic map of late Cenozoic deposits, Santa Clara County, California: U.S. Geol. Survey Misc. Field Studies Map MF-335.

Helley, E. J., Lajoie, K. R., and Burke, D. B., 1972, Geologic map of late Cenozoic deposits, Alameda County, California: U.S. Geol. Survey Misc. Field Studies Map MF-429.

Joyner, William B., and Chen, Albert T. F., 1975, Calculation of nonlinear ground response in earthquakes, Bull. Seism. Soc. Am., v. 65, p. 1315-1336.

Kobayaski, N., 1959, A method of determining the underground structure by means of SH waves: Zisin, ser. 2, v. 12, p. 19-24.

Lajoie, K. R., Helley, E. J., Nichols, D. R., and Burke, D. B., 1974, Geologic map of unconsolidated and moderately consolidated deposits of San Mateo County, California: U.S. Geol. Survey Misc. Field Studies Map MF-575.

Lawson, A. C. (Chairman), 1908, The California earthquake of April 18, 1906: Report of the State Earthquake Commission, Carnegie Inst. of Washington, Atlas Maps 21 and 22.

Medvedev, S. V., 1965, Engineering Seismology: National Technical Inf. Serivce, NTIS No. TT65-50011, 260 p.

Robinson, G. D., 1956, Geology of the Hayward quadrangle, California: U.S. Geol. Survey Geologic Quadrangle Map GQ-88.

Soil Survey Staff, 1951, Soil Survey Manual: U.S. Department of Agriculture Handbook 18.

Sowers, G. B., and Sowers, G. F., 1970, Introductory Soil Mechanics and Foundations: Macmillan, New York.

Terzaghi, K., and Peck, R. B., 1967, Soil Mechanics in Engineering Practice: John Wiley and Sons, New York.

U.S. Army Corps of Engineers, 1960, The unified soil classification system: Tech. Memorandum No. 3-357, Waterway Experiment Station, Vicksburg, Mississippi.

Warrick, R. E., 1974, Seismic investigation of a San Francisco Bay mud site: Seismol. Soc. America Bull., v. 64, p. 375-385.

Warrick, R. E., Hoover, D. B., Jackson, W. H., Pakiser, L. C., and Roller, J. C., 1961, The specification and testing of a seismic-refraction system for crustal studies: Geophysics, v. 26, p. 820-824.

FIGURES

		Page
Figures 1-17.	Portions of 7 1/2 minute quadrangle maps showing the location of each drill hole.	
Figure 1.	Site location 13; Alviso Raceway.	22
Figure 2.	Site locations 14, 22; Blackberry Farm and Stevens Creek Quarry.	23
Figure 3.	Site locations 15, 23;John Muir School and Cal State Hayward.	24
Figure 4.	Site locations 16, 17; Lowry Road and Hayward Sink.	25
Figure 5.	Site locations 18, 34; Parkway Towers and Morrison Canyon.	26
Figure 6.	Site location 19; Palo Alto Square.	27
Figure 7.	Site location 20; Mission Peak.	28
Figure 8.	Site location 21; Montgomery School.	29
Figure 9.	Site location 24; Miller School.	30
Figure 10.	Site location 25; Oliver's Salt Works.	31
Figure 11.	Site locations 26, 28; Corte Madera and Foothills Park.	32
Figure 12.	Site location 27; Mitchell Park.	33
Figure 13.	Site location 29; Sierra Morena.	34
Figure 14.	Site location 30; Pulgas Tunnel.	35
Figure 15.	Site location 31; Frenchmans Creek.	36
Figure 16.	Site location 32; Half Moon Bay Terrace.	37
Figure 17.	Site location 33, 35; Vista Grande and Lake Merced Country Club.	38
Figure 18 a.	Field setup showing shear wave generator, horizontal hammer, uphole geophone, and position of steel plate for P-wave generation.	39

Page

Figure 18 b. Cross section of borehole illustrating downhole geophone clamped into position and spacing of measurements------- 39

Figure 19. Explanation of the detailed geologic and drilling logs-- 40

Figures 20-42. Detailed geologic and drilling logs for each location.

Figure 20. Site No. 13; Alviso Raceway---------- 42

Figure 21. Site No. 14; Blackberry Farm---------- 43

Figure 22. Site No. 15; John Muir School---------- 44

Figure 23. Site No. 16; Lowry Road---------- 45

Figure 24. Site No. 17; Hayward Sink---------- 46

Figure 25. Site No. 18; Parkway Towers---------- 47

Figure 26. Site No. 19; Palo Alto Square---------- 48

Figure 27. Site No. 20; Mission Peak---------- 49

Figure 28. Site No. 21; Montgomery School---------- 50

Figure 29. Site No. 22; Stevens Creek Quarry---------- 51

Figure 30. Site No. 23; Cal State Hayward---------- 52

Figure 31. Site No. 24; Miller School---------- 53

Figure 32. Site No. 25; Oliver Salt Works---------- 54

Figure 33. Site No. 26; Corte Madera---------- 55

Figure 34. Site No. 27; Mitchell Park---------- 56

Figure 35. Site No. 28; Foothills Park---------- 57

Figure 36. Site No. 29; Sierra Morena---------- 58

Figure 37. Site No. 30; Pulgas Tunnel---------- 59

Figure 38. Site No. 31; Frenchman Creek---------- 60

Figure 39. Site No. 32; Half Moon Bay Terrace---------- 61

Figure 40. Site No. 33; Vista Grande---------- 62

Figure 41. Site No. 34; Morrison Canyon---------- 63

Page

Figure 42. Site No. 35; Lake Merced Country Club---------- 64

Figure 43-65. Record section showing the seismic data and the inverted phase obtained by reversing the direction of the source. The arrows represent the picks for the first S-wave and the dots the first S-Peak.

Figure 43. Site No. 13; Alviso Raceway---------- 65

Figure 44. Site No. 14; Blackberry Farm---------- 65

Figure 45. Site No. 15; John Muir School---------- 66

Figure 46. Site No. 16; Lowry Road---------- 66

Figure 47. Site No. 17; Hayward Sink---------- 67

Figure 48. Site No. 18; Parkway Towers---------- 67

Figure 49. Site No. 19; Palo Alto Square---------- 68

Figure 50. Site No. 20; Mission Peak---------- 68

Figure 51. Site No. 21; Montgomery School---------- 69

Figure 52. Site No. 22; Stevens Creek Quarry---------- 69

Figure 53. Site No. 23; Cal State Hayward---------- 70

Figure 54. Site No. 24; Miller School---------- 70

Figure 55. Site No. 25; Oliver Salt Works---------- 71

Figure 56. Site No. 26; Corte Madera---------- 71

Figure 57. Site No. 27; Mitchell Park---------- 72

Figure 58. Site No. 28; Foothills Park---------- 72

Figure 59. Site No. 29; Sierra Morena---------- 73

Figure 60. Site No. 30; Pulgas Tunnel---------- 73

Figure 61. Site No. 31; Frenchmans Creek---------- 74

Figure 62. Site No. 32; Half Moon Bay Terrace---------- 74

Figure 63. Site No. 33; Vista Grande---------- 75

		Page
Figure 64.	Site No. 34; Morrison Canyon----------	75
Figure 65.	Site No. 35; Lake Merced Country Club----------	76
Figure 66-88.	Travel time curves with simplified geologic logs. One P-wave and two S-wave picks are shown for each location. Velocities are in metres per second.	
Figure 66.	Site No. 13; Alviso Raceway----------	100
Figure 67.	Site No. 14; Blackberry Farm----------	101
Figure 68.	Site No. 15; John Muir School----------	102
Figure 69.	Site No. 16; Lowry Road----------	103
Figure 70.	Site No. 17; Hayward Sink----------	104
Figure 71.	Site No. 18; Parkway Towers----------	105
Figure 72.	Site No. 19; Palo Alto Square----------	106
Figure 73.	Site No. 20; Mission Peak----------	107
Figure 74.	Site No. 21; Montgomery School----------	108
Figure 75.	Site No. 22; Stevens Creek Quarry----------	109
Figure 76.	Site No. 23; Cal State Hayward----------	110
Figure 77.	Site No. 24; Miller School----------	111
Figure 78.	Site No. 25; Oliver Salt Works----------	112
Figure 79.	Site No. 26; Corte Madera----------	113
Figure 80.	Site No. 27; Mitchell Park----------	114
Figure 81.	Site No. 28; Foothills Park----------	115
Figure 82.	Site No. 29; Sierra Morena----------	116
Figure 83.	Site No. 30; Pulgas Tunnel----------	117
Figure 84.	Site No. 31; Frenchmans Creek----------	118
Figure 85.	Site No. 32; Half Moon Bay Terrace----------	119
Figure 86.	Site No. 33; Vista Grande----------	120
Figure 87.	Site No. 34; Morrison Canyon----------	121
Figure 88.	Site No. 35; Lake Merced Country Club----------	122

TABLES

Page

Tables 1-23. "Travel times and average velocities", are a summary of the times and corrections. Average velocity is calculated from the surface to each depth.

Tables 24-45. "Interval velocities and elastic moduli", are a summary of the calculations for seismic velocities and elastic moduli. At locations where a reasonably good density could not be determined, bulk and shear modulus are not reported.

Table 1, 24. Site No. 13; Alviso Raceway---------- 77, 123

Table 2, 25. Site No. 14; Blackberry Farm---------- 78, 124

Table 3, 26. Site No. 15; John Muir School---------- 79, 125

Table 4, 27. Site No. 16; Lowry Road---------- 80, 126

Table 5, 28. Site No. 17; Hayward Sink---------- 81, 127

Table 6, 29. Site No. 18; Parkway Towers---------- 82, 128

Table 7, 30. Site No. 19; Palo Alto Square---------- 83, 129

Table 8, 31. Site No. 20; Mission Peak---------- 84, 130

Table 9, 32. Site No. 21; Montgomery School---------- 85, 131

Table 10, 33. Site No. 22; Stevens Creek Quarry---------- 86, 132

Table 11, 34. Site No. 23; Cal State Hayward---------- 87, 133

Table 12, 35. Site No. 24; Miller School---------- 88, 134

Table 13, 36. Site No. 25; Oliver Salt Works---------- 89, 135

Table 14, 37. Site No. 26; Corte Madera---------- 90, 136

Table 15, 38. Site No. 27; Mitchell Park---------- 91, 137

Table 16, 39. Site No. 28; Foothills Park---------- 92, 138

Table 17, 40. Site No. 29; Sierra Morena ---------- 93, 139

Table 18, 41. Site No. 30; Pulgas Tunnel---------- 94, 140

Page

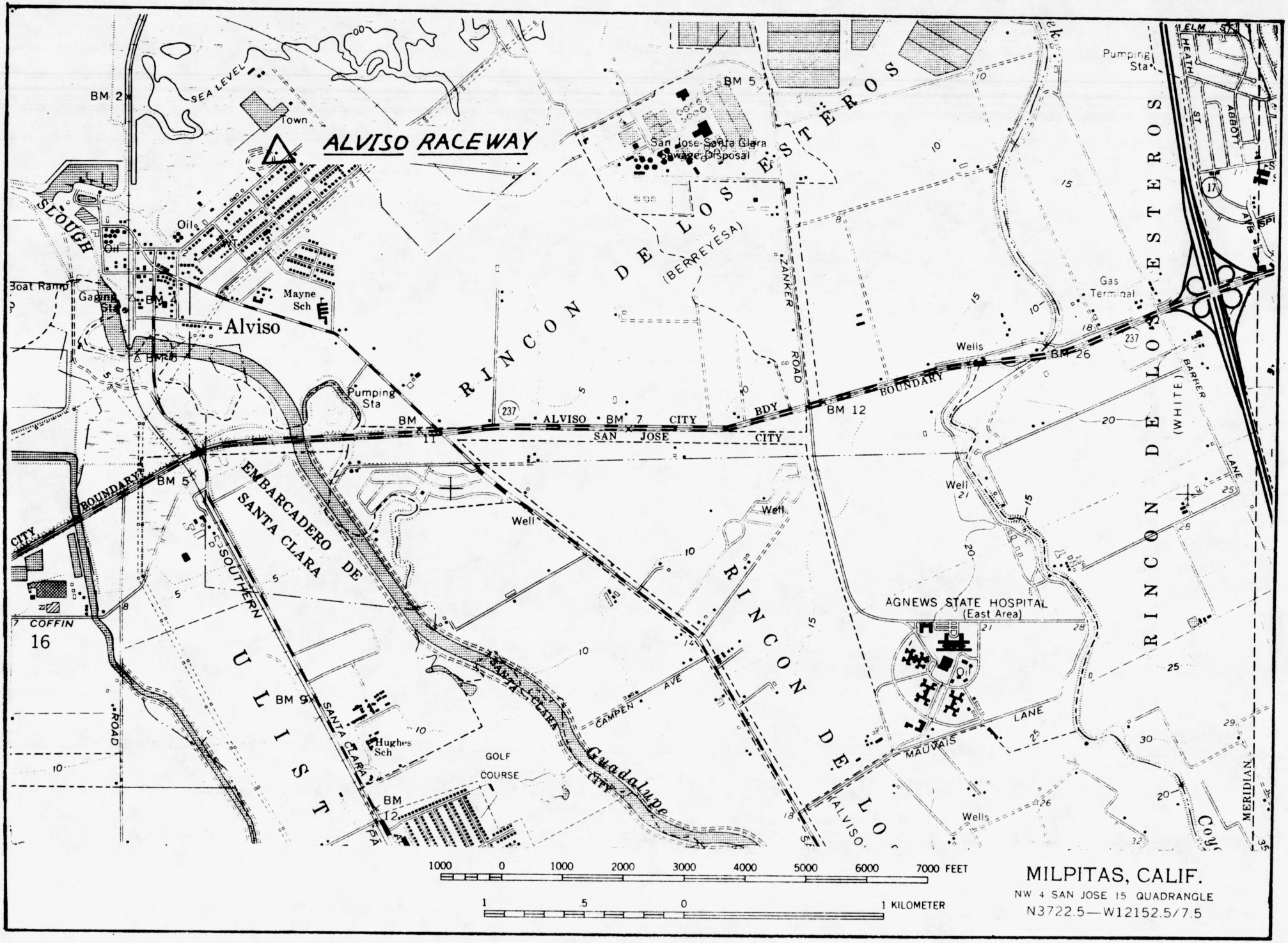
Table 19, 42. Site No. 31; Frenchmans Creek---------- 95, 141

Table 20, 43. Site No. 32; Half Moon Bay Terrace---------- 96, 142

Table 21, 44. Site No. 33; Vista Grande---------- 97, 143

Table 22, 45. Site No. 34; Morrison Canyon---------- 98, 144

Table 23, 46. Site No. 35; Lake Merced Country Club---------- 99, 145



MILPITAS, CALIF.

NW 4 SAN JOSE 15 QUADRANGLE

N3722.5—W12152.5/7.5

Fig. 1

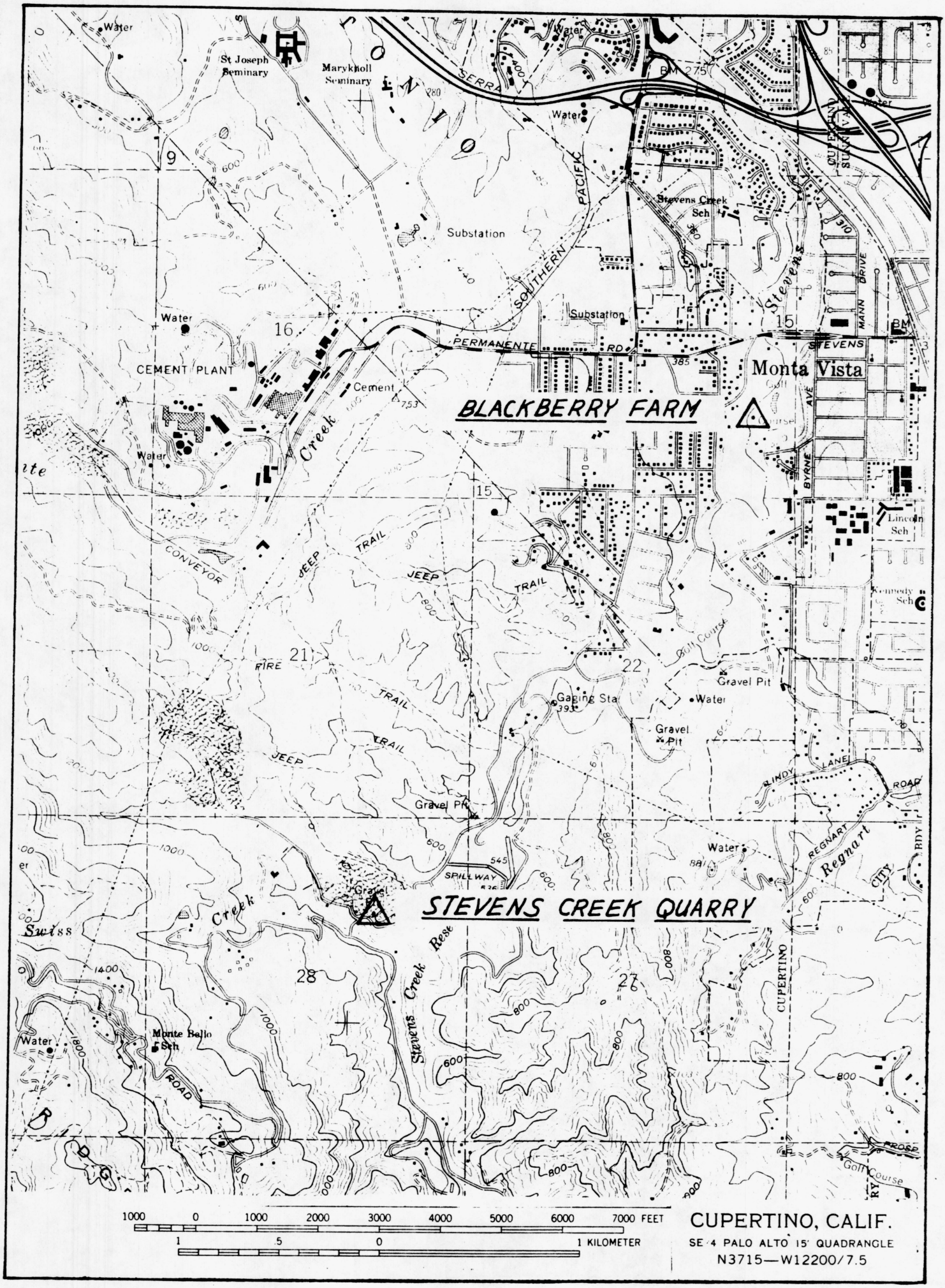

BLACKBERRY FARM
STEVENS CREEK QUARRY
Monta Vista
CEMENT PLANT
St Joseph Seminary
Marykholl Seminary
SERRA
SOUTHERN PACIFIC
PERMANENTE RD
STEVENS
MANN DRIVE
BYRNE AVE
CONVEYOR
JEEP TRAIL
FIRE TRAIL
Gravel Pit
Gaging Sta
Golf Course
LINDY LANE
REGNART ROAD
Regnart
CUPERTINO
Stevens Creek Sch
Lincoln Sch
Kennedy Sch
Monte Bello Sch
Stevens Creek
Swiss Creek
SPILLWAY
Substation
Water
Cement
Gravel
CUPERTINO, CALIF.
SE 4 PALO ALTO 15' QUADRANGLE
N3715—W12200/7.5
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

Fig. 2

JOHN MUIR SCHOOL
CAL STATE HAYWARD
HAYWARD
CALIFORNIA STATE COLLEGE HAYWARD
Hayward High Sch
All Saints Cemetery
Tennyson High Sch
Tyrrell School
Glassbrook School
Schafer Park School
Sorensen School
Sorensdale Park
St Clemente School
Bowman Sch
Harder Sch
Holy Sepulchre Cemetery
Highland School
Hillcrest Sch
Winton School
Alameda County Bldg
John Muir Sch
Southgate Sch
Eldridge
Burbank Sch
Kimball Sch
Stonebridge School
South Reservoir
Bayview School
Laurel School
Harris Sch
Markham School
Fairview Sch
East Ave Sch
Pine Tree Cemetery
Quarry
Pit
Water
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
HAYWARD, CALIF.
NE/4 HAYWARD 15' QUADRANGLE
N3737.5—W12200/7.5

Fig. 3

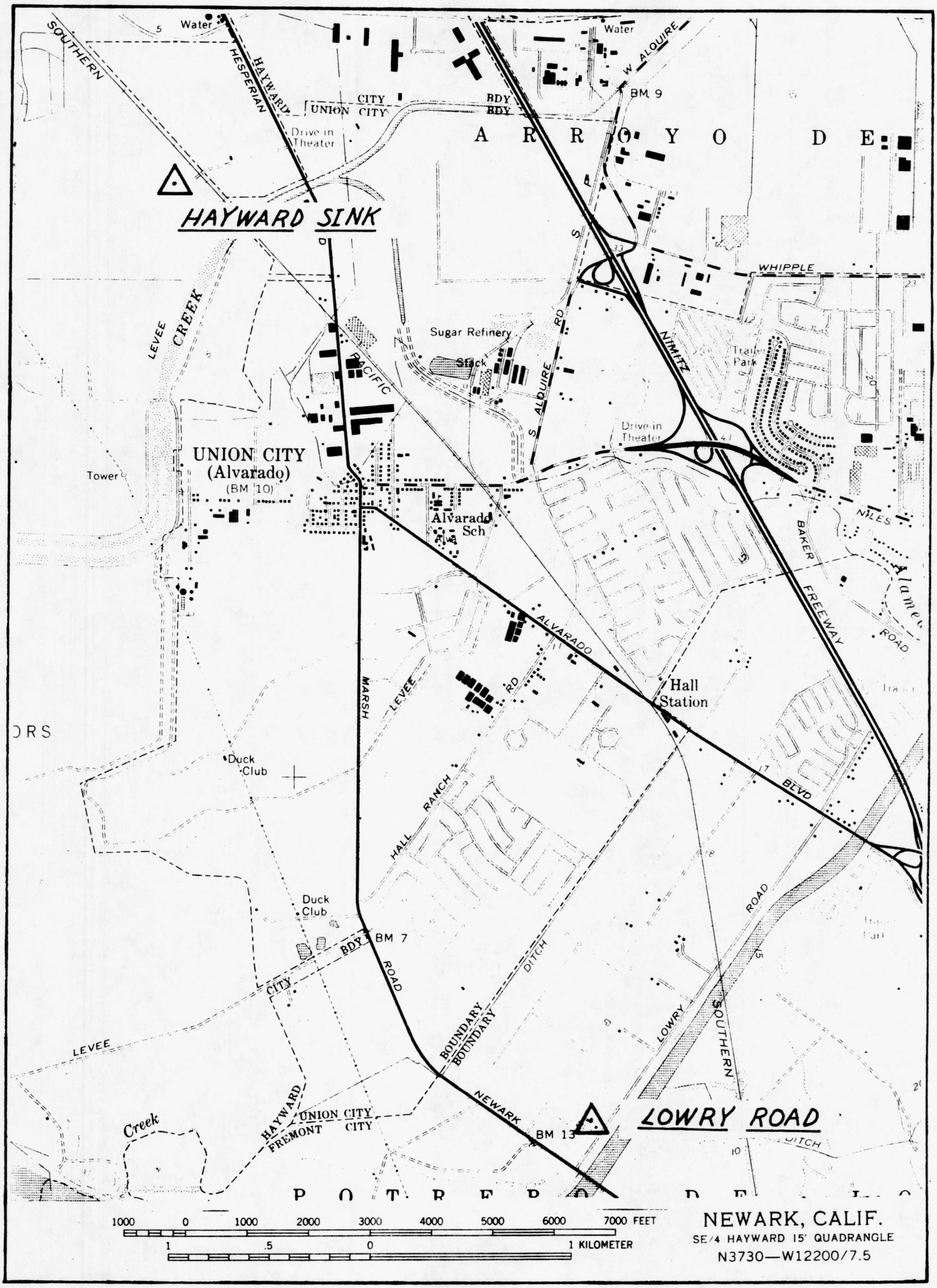
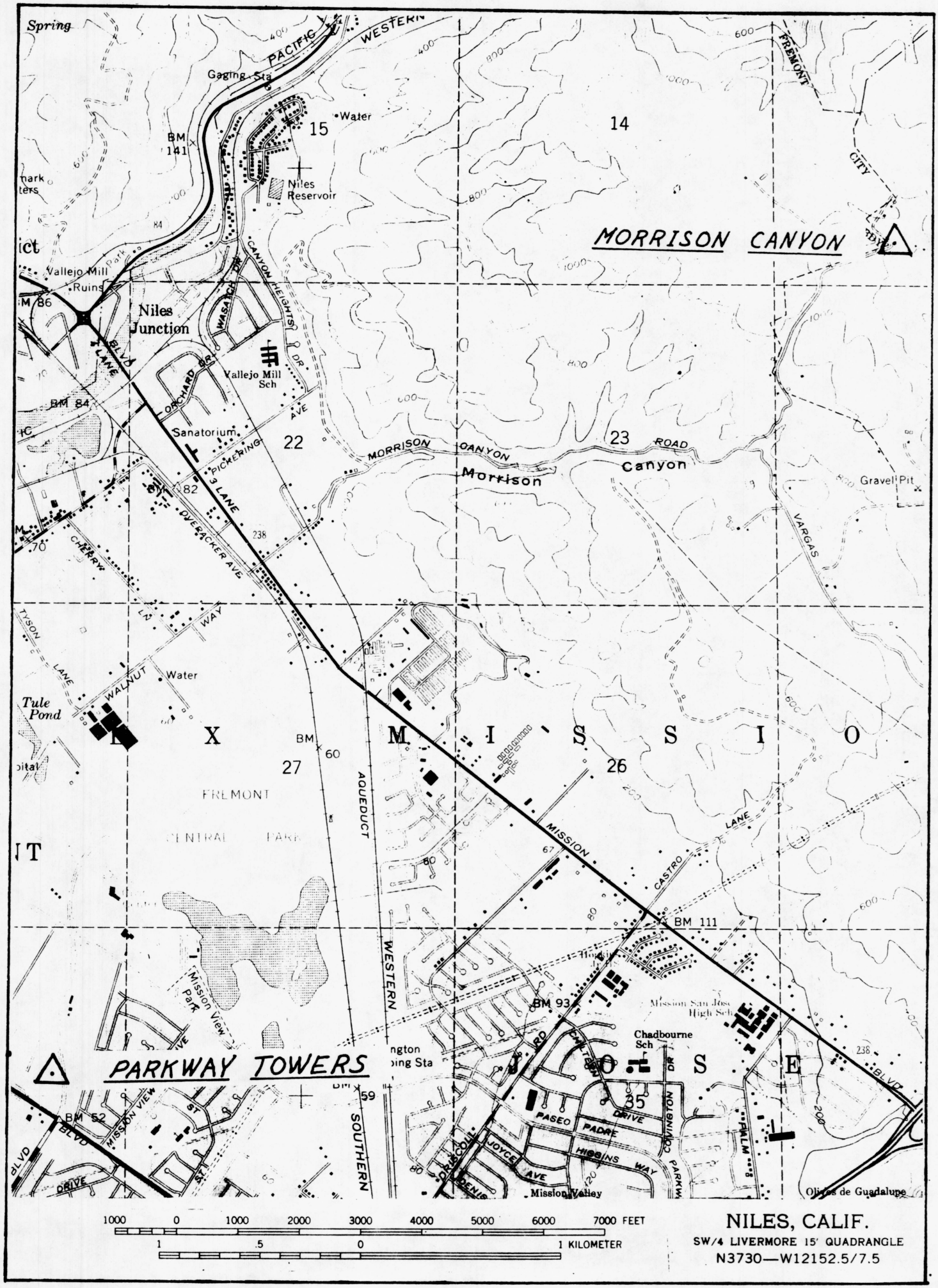
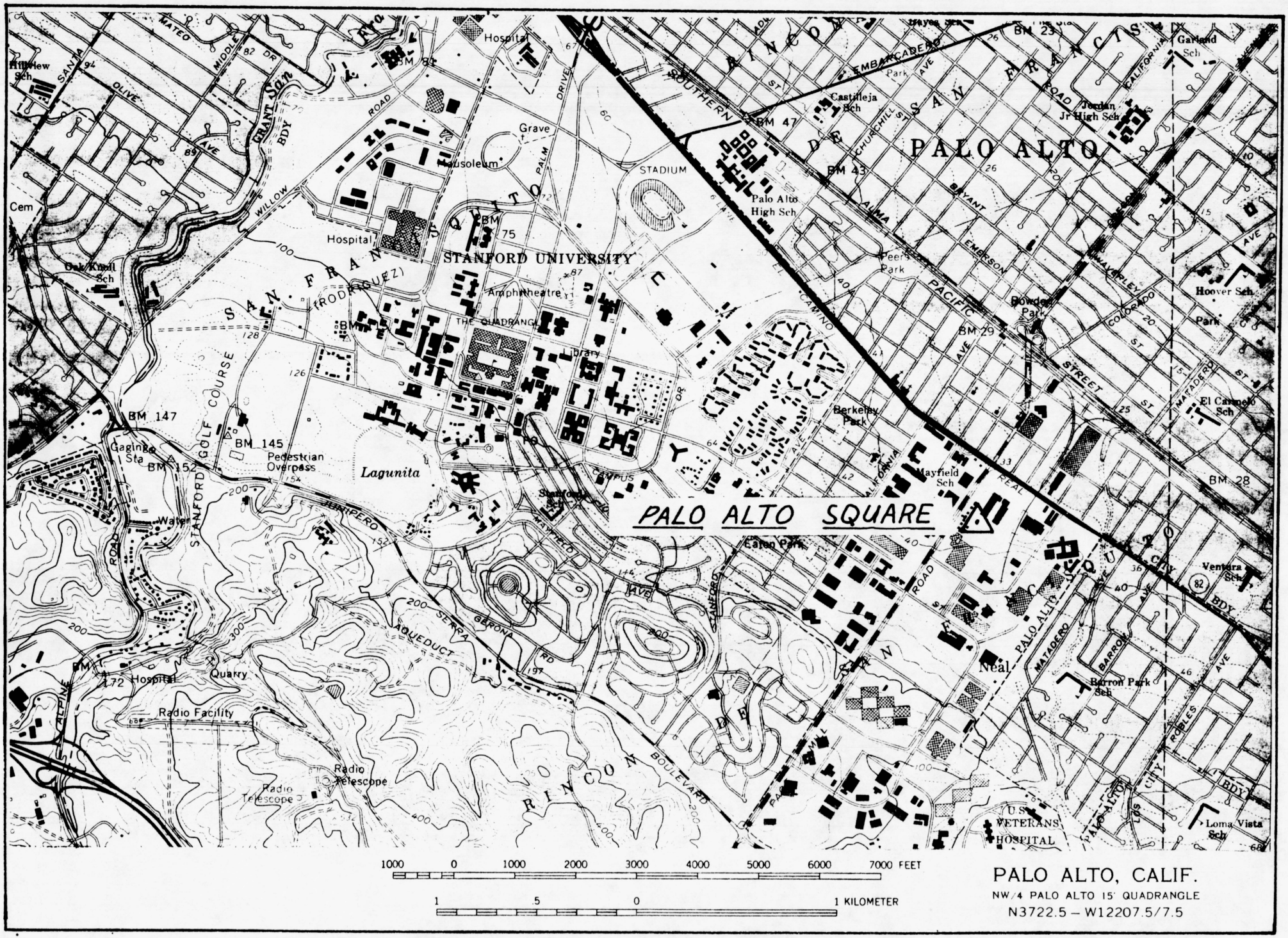

HAYWARD SINK
LOWRY ROAD
UNION CITY
(Alvarado)
(BM 10)
Sugar Refinery
Stack
Drive in Theater
Alvarado Sch
Hall Station
Duck Club
Duck Club
BM 9
BM 7
BM 13
Water
Water
Tower
Creek
SOUTHERN PACIFIC
HESPERIAN
HAYWARD
CITY UNION CITY
BDY
BDY
W ALQUIRE
S ALQUIRE RD
WHIPPLE
NIMITZ FREEWAY
BAKER
NILES
ALVARADO
ALVARADO RD
MARSH
LEVEE
LEVEE
CREEK
HALL RANCH
BLVD
ROAD
DITCH
BOUNDARY
BOUNDARY
CITY
BDY
ROAD
LOWRY
SOUTHERN
PACIFIC
DITCH
NEWARK
HAYWARD
FREMONT
UNION CITY
CITY
LEVEE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
NEWARK, CALIF.
SE/4 HAYWARD 15' QUADRANGLE
N3730—W12200/7.5

Fig. 4



NILES, CALIF.
SW/4 LIVERMORE 15' QUADRANGLE
N3730—W12152.5/7.5

Fig. 6



PALO ALTO, CALIF.

NW/4 PALO ALTO 15' QUADRANGLE

N3722.5 — W12207.5/7.5

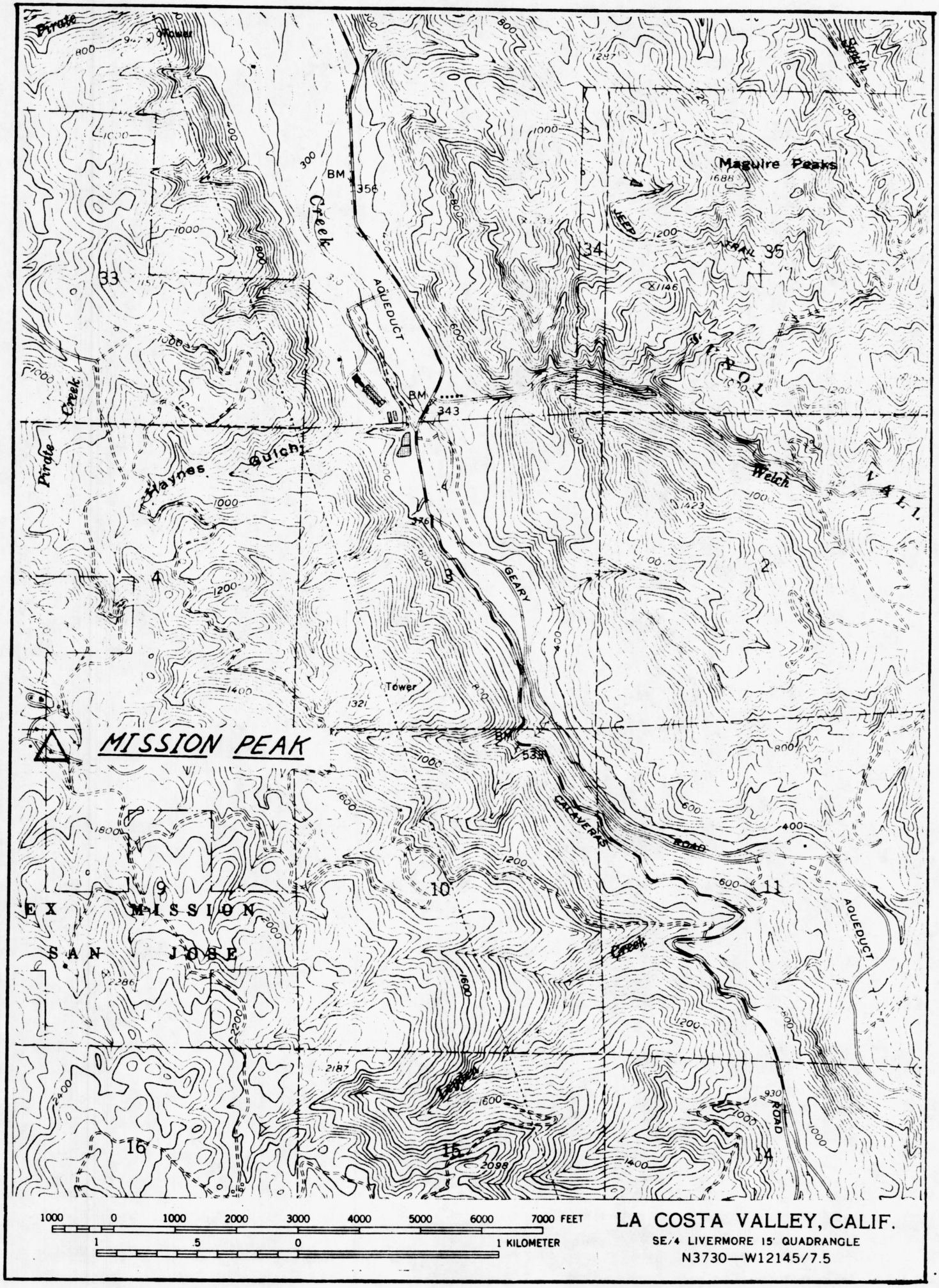

Pirate
Tower
Maguire Peaks
1688
BM
356
Creek
AQUEDUCT
JEEP
TRAIL
1146
33
34
35
BM
343
Pirate Creek
Haynes Gulch
Welch
376
GEARY
1423
2
4
Tower
1321
MISSION PEAK
BM
533
CALAVERAS
ROAD
9
10
11
EX MISSION SAN JOSE
2286
Creek
2187
930
ROAD
16
15
2098
14
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
LA COSTA VALLEY, CALIF.
SE/4 LIVERMORE 15' QUADRANGLE
N3730—W12145/7.5

Fig. 7

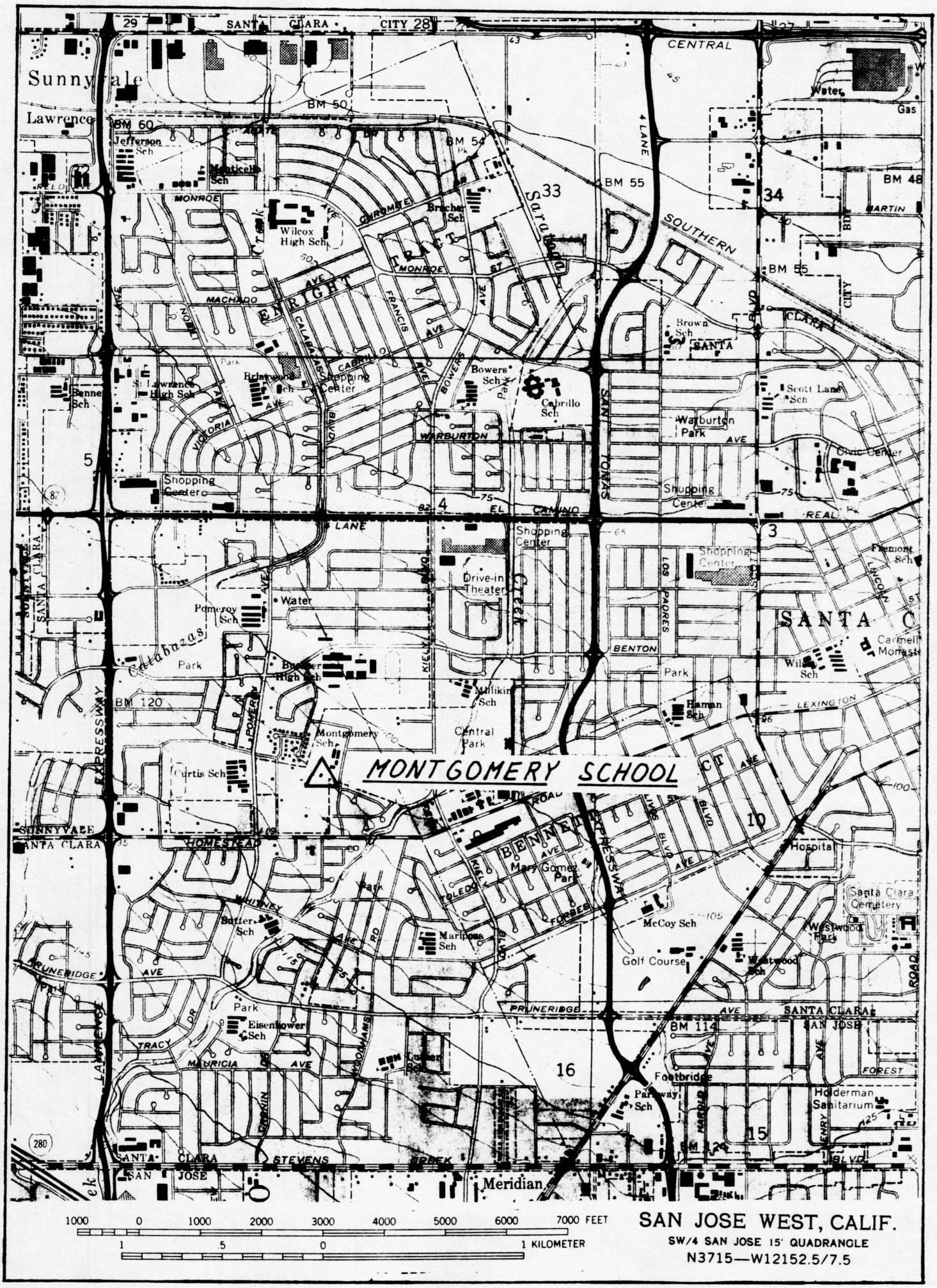

MONTGOMERY SCHOOL
SAN JOSE WEST, CALIF.
SW/4 SAN JOSE 15' QUADRANGLE
N3715—W12152.5/7.5
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
Sunnyvale
Lawrence
SANTA CLARA
CITY
Jefferson Sch
Monticello Sch
Wilcox High Sch
Bracher Sch
Saratoga Creek
ENRIGHT
MONROE
MACHADO
FRANCIS AVE
BOWERS AVE
Bowers Sch
Cabrillo Sch
Brown Sch
SANTA CLARA
Scott Lane Sch
Warburton Park
Civic Center
Shopping Center
EL CAMINO REAL
SAN TOMAS
SOUTHERN PACIFIC
Water
Gas
BM 48
BM 50
BM 54
BM 55
BM 60
BM 120
BM 114
Bennett Sch
St. Lawrence High Sch
Briarwood Sch
Cabrillo Shopping Center
VICTORIA AVE
WARBURTON
Pomeroy Sch
Water
Drive-in Theater
Calabazas Creek
Calabazas Park
Bracher High Sch
Millikin Sch
Central Park
Harman Sch
BENTON Park
LOS PADRES
Fremont Sch
Carmelite Monastery
Wilcox Sch
LEXINGTON
Montgomery Sch
Curtis Sch
SUNNYVALE
HOMESTEAD
BENNETT
Mary Gomez Park
Hospital
Santa Clara Cemetery
Westwood Park
Westwood Sch
McCoy Sch
Golf Course
Sutter Sch
Mariposa Sch
Park
Eisenhower Sch
PRUNERIDGE AVE
TRACY DR
MAURICIA AVE
LAWRENCE EXPRESSWAY
SANTA CLARA
SAN JOSE
STEVENS CREEK
Footbridge
Parkway Sch
Holderman Sanitarium
FOREST AVE
HARKINS
HENRY BLVD
Meridian
1
2
3
4
5
9
10
15
16
29
33
34

Fig. 8

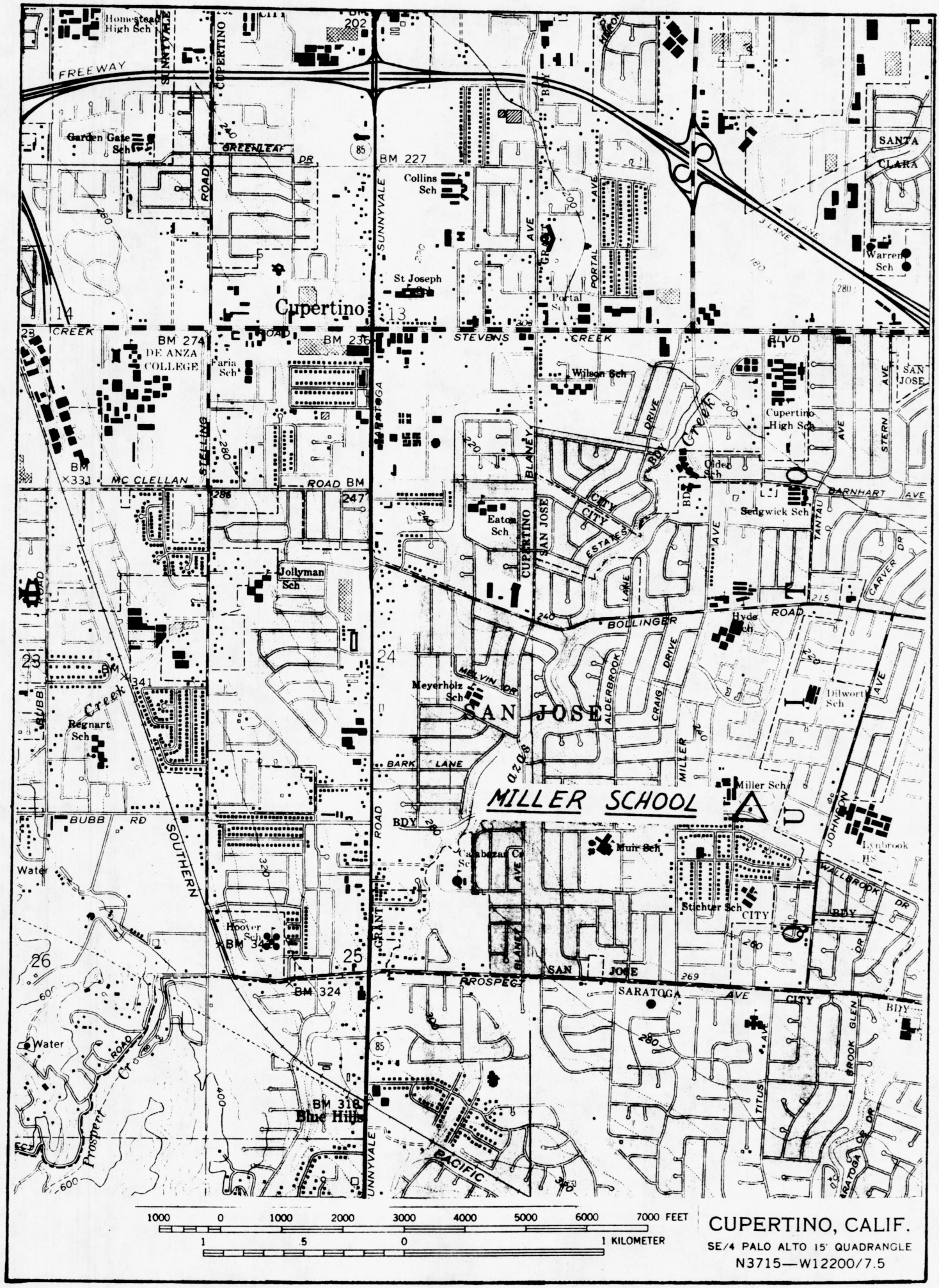

MILLER SCHOOL
SAN JOSE
Cupertino
SARATOGA AVE
STEVENS CREEK BLVD
BOLLINGER ROAD
PROSPECT
BARNHART AVE
MC CLELLAN ROAD
BUBB RD
Homestead High Sch
Garden Gate Sch
Collins Sch
St Joseph
Portal Sch
Warren Sch
Wilson Sch
Cupertino High Sch
Eaton Sch
Sedgwick Sch
Jollyman Sch
Meyerholz Sch
Regnart Sch
Hoover Sch
Miller Sch
Muir Sch
Stichter Sch
Dilworth Sch
Hyde Sch
Faria Sch
DE ANZA COLLEGE
Blue Hills
BM 227
BM 236
BM 247
BM 274
BM 324
BM 341
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CUPERTINO, CALIF.
SE/4 PALO ALTO 15' QUADRANGLE
N3715—W12200/7.5

Fig. 9

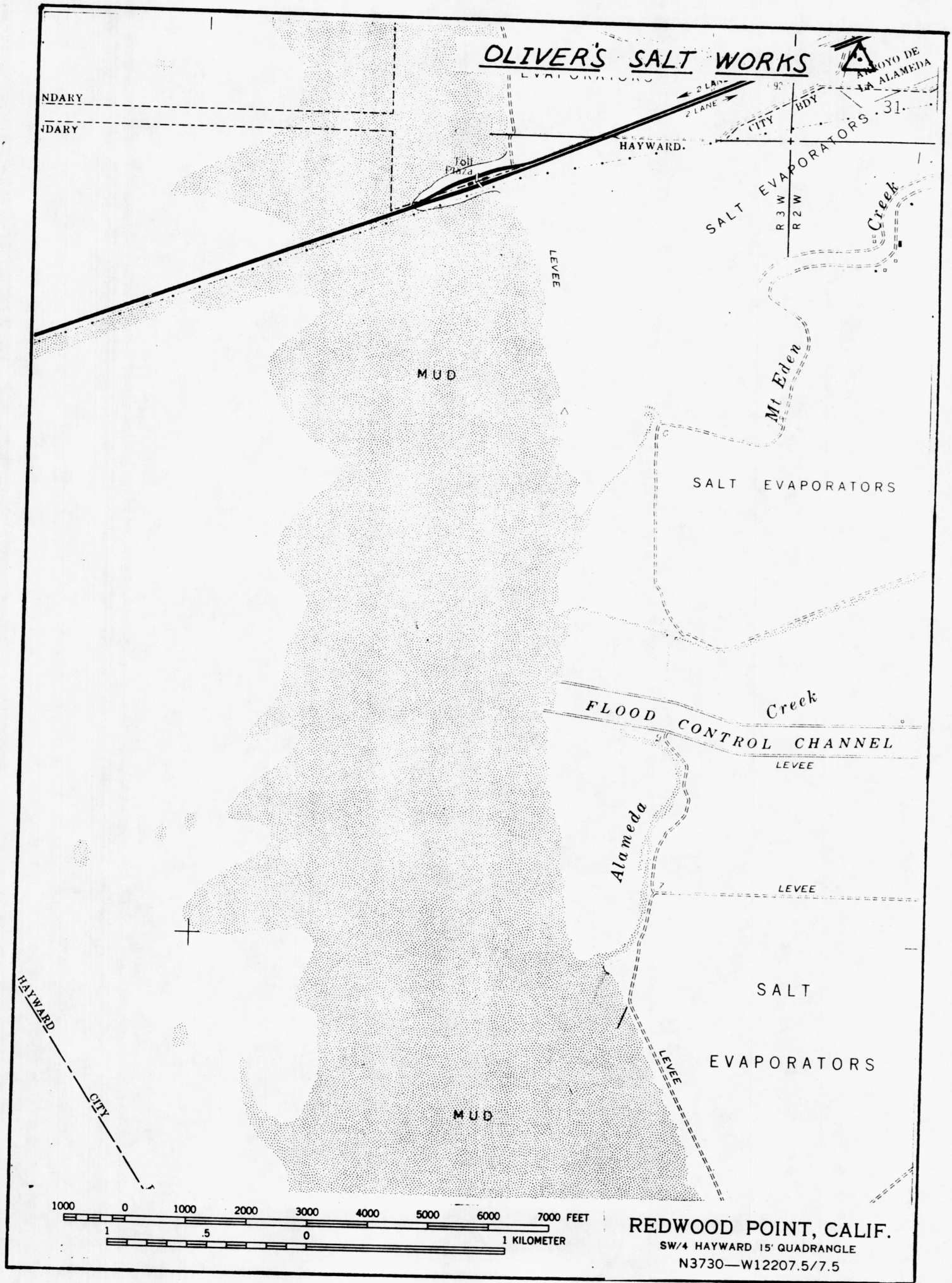
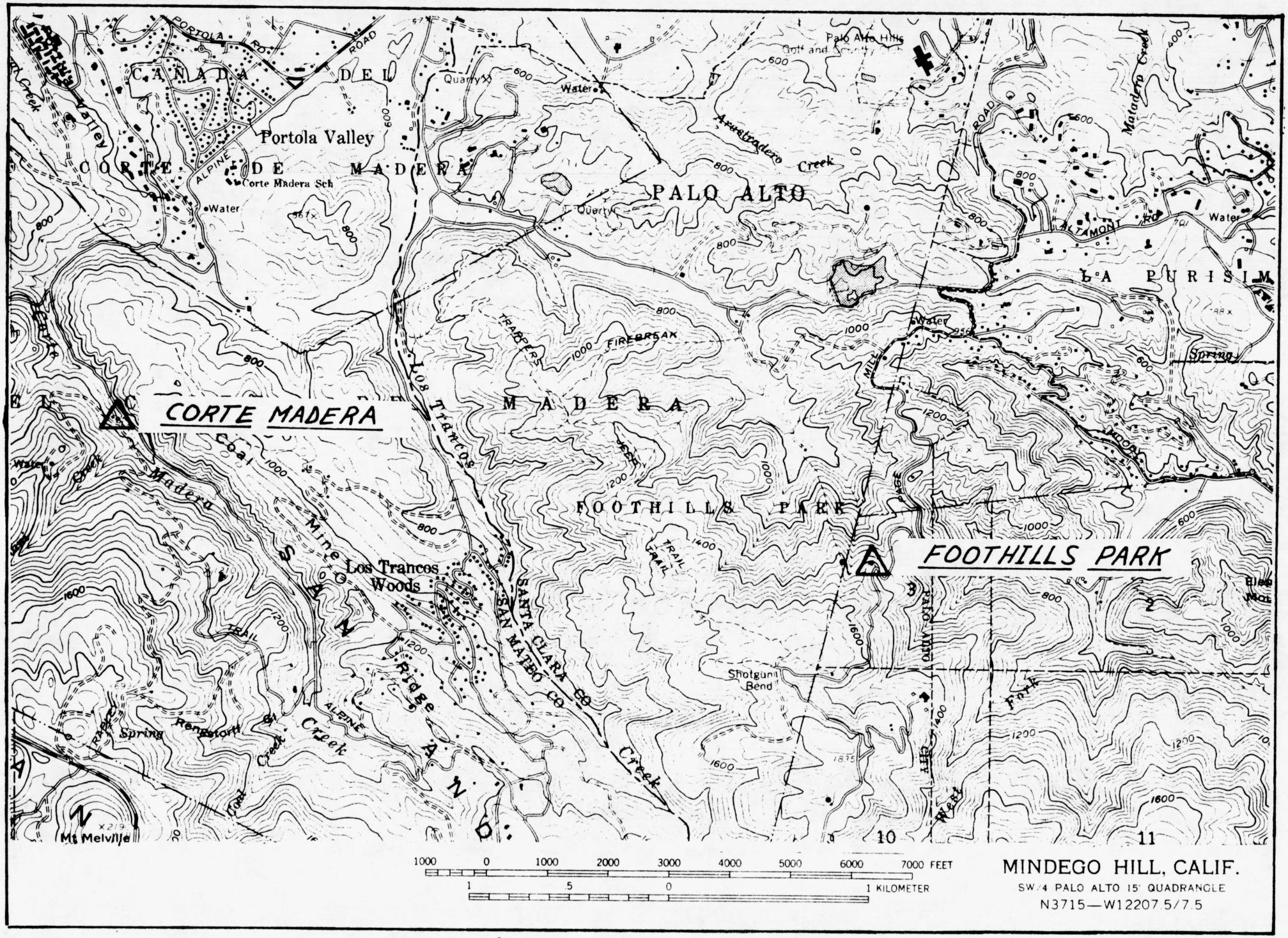

OLIVER'S SALT WORKS
EVAPORATORS
NDARY
NDARY
2 LANE
2 LANE
CITY BDY
HAYWARD.
31
Toll Plaza
SALT EVAPORATORS
R 3 W
R 2 W
Creek
LEVEE
MUD
Mt Eden
SALT EVAPORATORS
FLOOD CONTROL CHANNEL
Creek
LEVEE
Alameda
LEVEE
SALT
EVAPORATORS
LEVEE
HAYWARD
CITY
MUD
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
REDWOOD POINT, CALIF.
SW/4 HAYWARD 15' QUADRANGLE
N3730—W12207.5/7.5

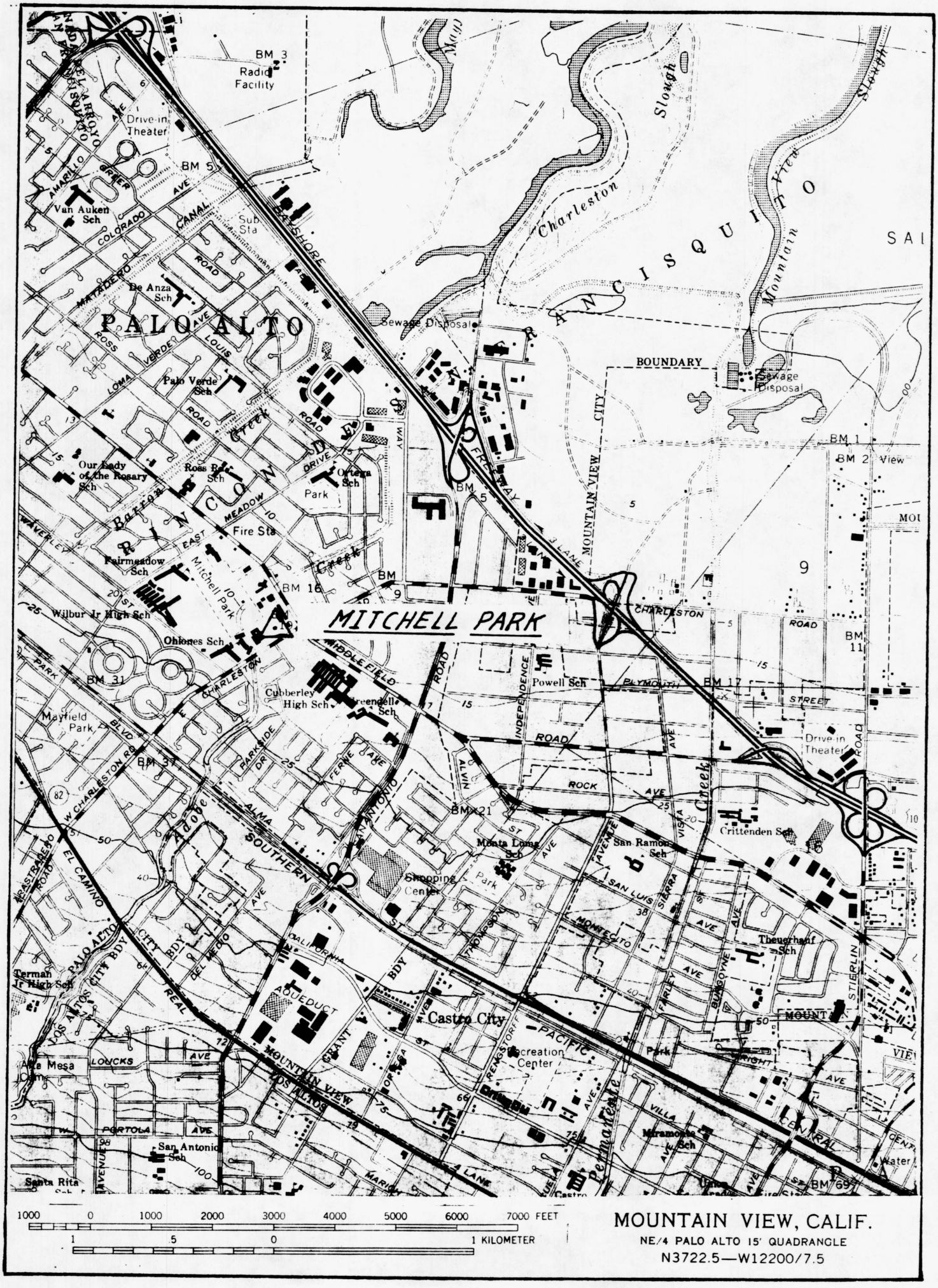
Fig. 10



MINDEGO HILL, CALIF.

SW/4 PALO ALTO 15' QUADRANGLE

N3715—W12207.5/7.5

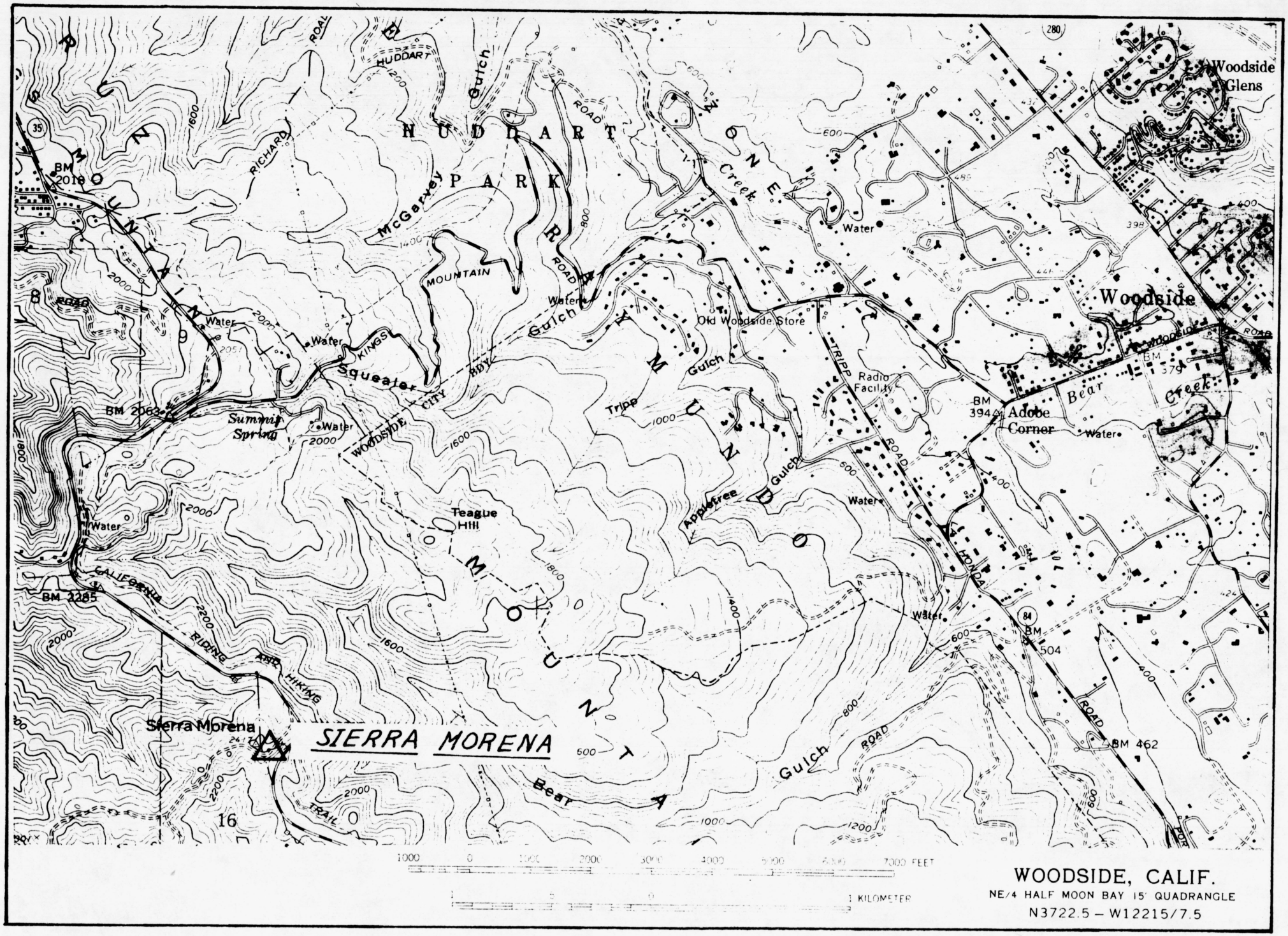


MOUNTAIN VIEW, CALIF.

NE/4 PALO ALTO 15' QUADRANGLE

N3722.5—W12200/7.5

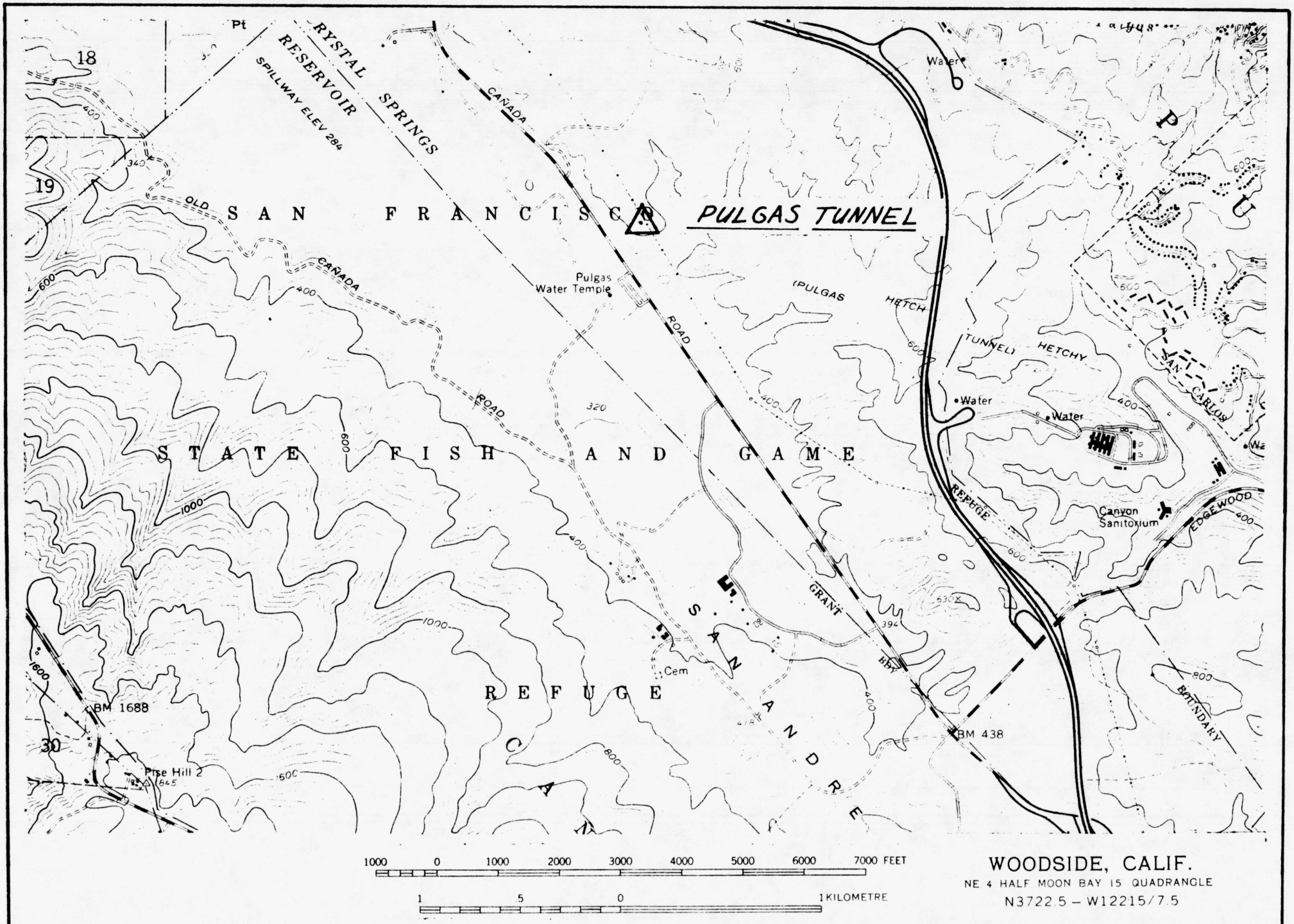
Fig. 12



WOODSIDE, CALIF.

NE/4 HALF MOON BAY 15' QUADRANGLE

N3722.5 — W12215/7.5

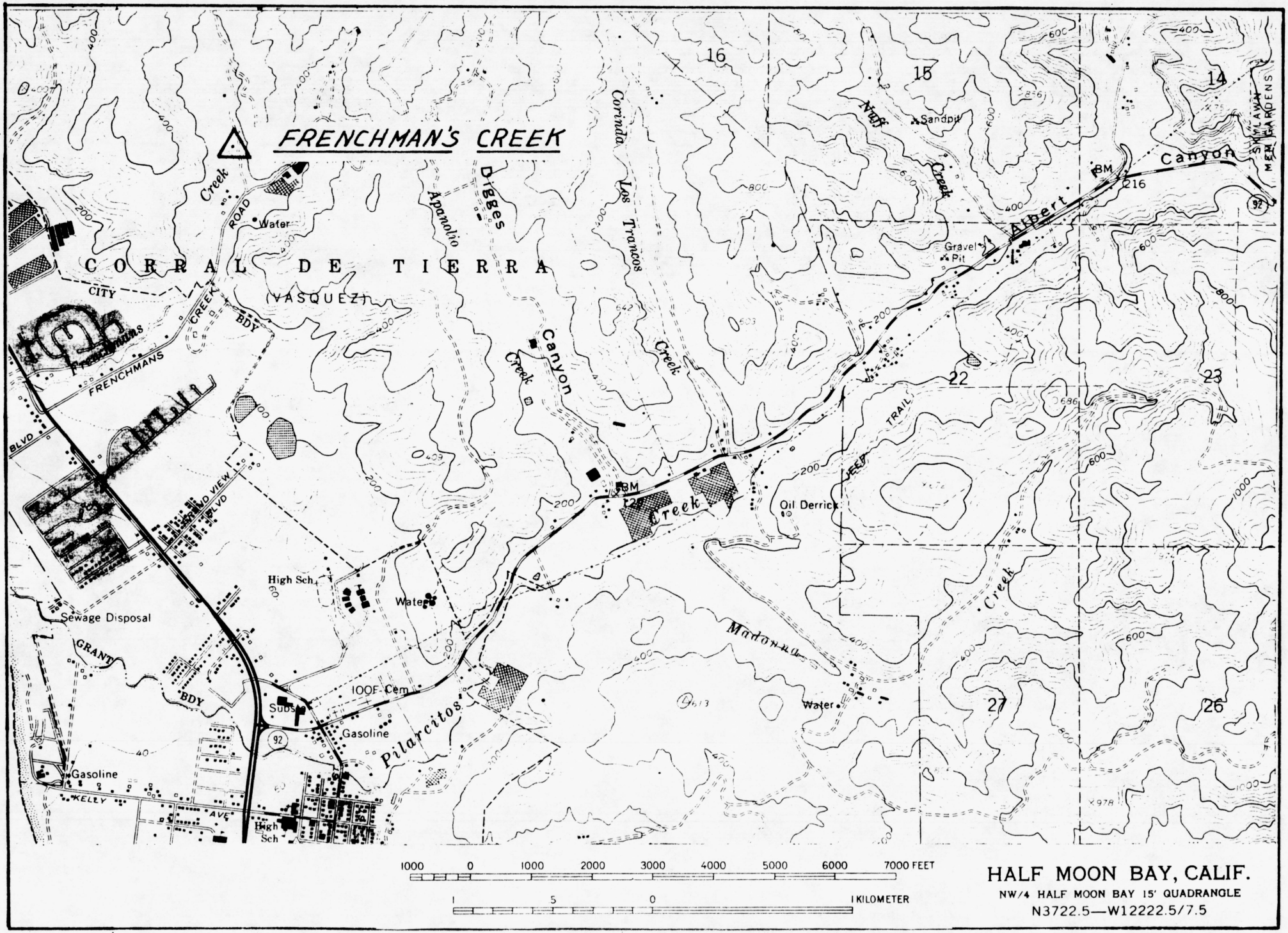


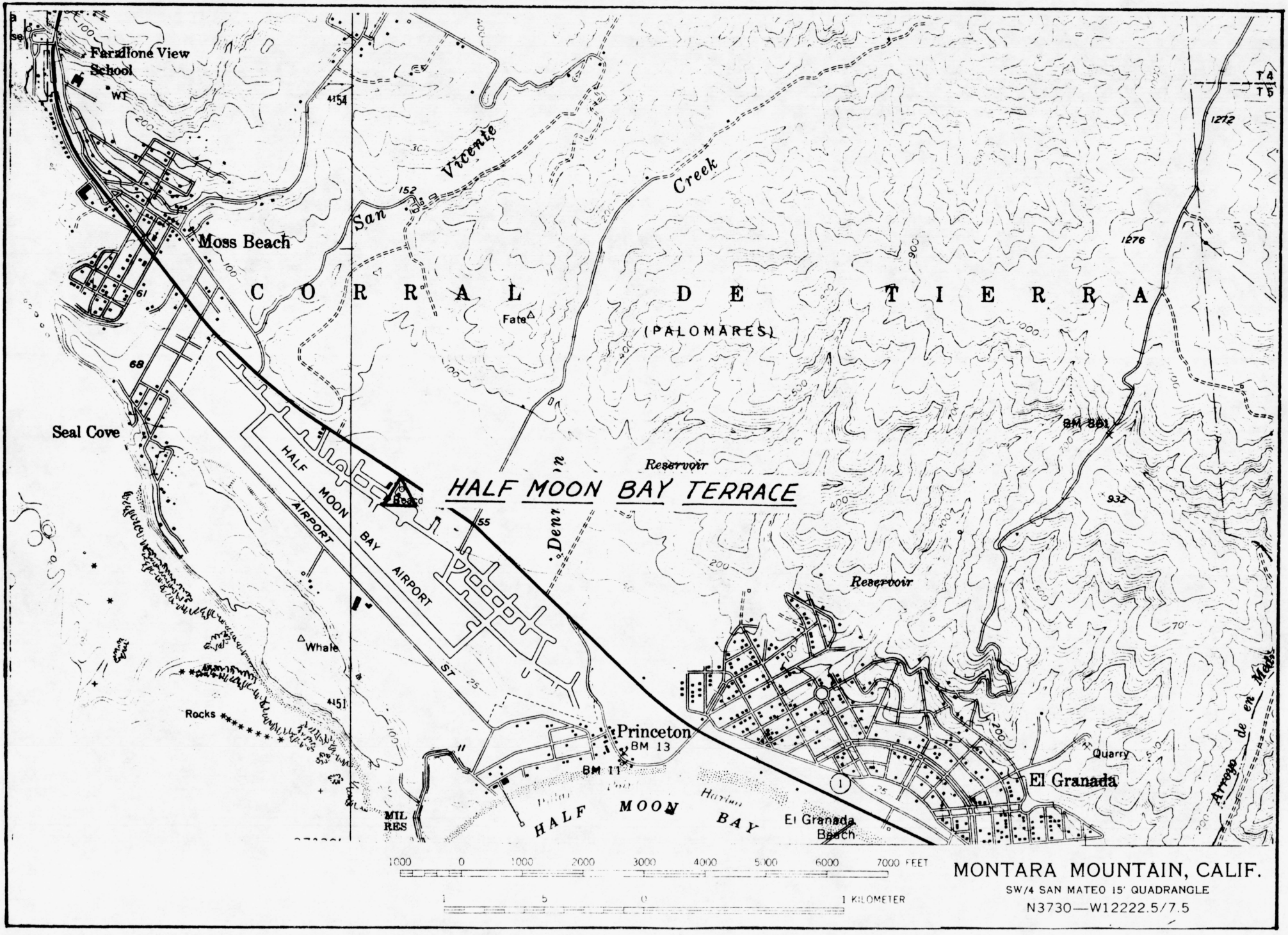
WOODSIDE, CALIF.

NE 4 HALF MOON BAY 15 QUADRANGLE

N3722.5 — W12215/7.5

Fig. 14


FRENCHMAN'S CREEK
CORRAL DE TIERRA
(VASQUEZ)
Frenchmans Creek
Frenchmans
Creek Road
Water
Apanolio
Digges
Corinda Los Trancos Creek
Canyon Creek
Sandpit
Gravel Pit
Albert
Canyon
BM 216
Oil Derrick
BM 128
Creek
Madrone
Pilarcitos Creek
Trail
Jeep
City Bdy
Frenchmans Blvd
Grand View Blvd
High Sch
Water
Sewage Disposal
Grant
Bdy
IOOF Cem
Subs
Gasoline
Kelly Ave
High Sch
16
15
14
22
23
27
26
92
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
HALF MOON BAY, CALIF.
NW/4 HALF MOON BAY 15' QUADRANGLE
N3722.5—W12222.5/7.5


Farallone View School
WT
Moss Beach
San Vicente Creek
C O R R A L D E T I E R R A
(PALOMARES)
Fate
Seal Cove
HALF MOON BAY AIRPORT
HALF MOON BAY TERRACE
Reservoir
Reservoir
Whale
Rocks
Princeton
BM 13
BM 11
HALF MOON BAY
El Granada Beach
El Granada
Quarry
Arroyo de en Medio
BM 881
MIL RES
T 4
T 5
1272
1276
932
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
MONTARA MOUNTAIN, CALIF.
SW/4 SAN MATEO 15' QUADRANGLE
N3730—W12222.5/7.5

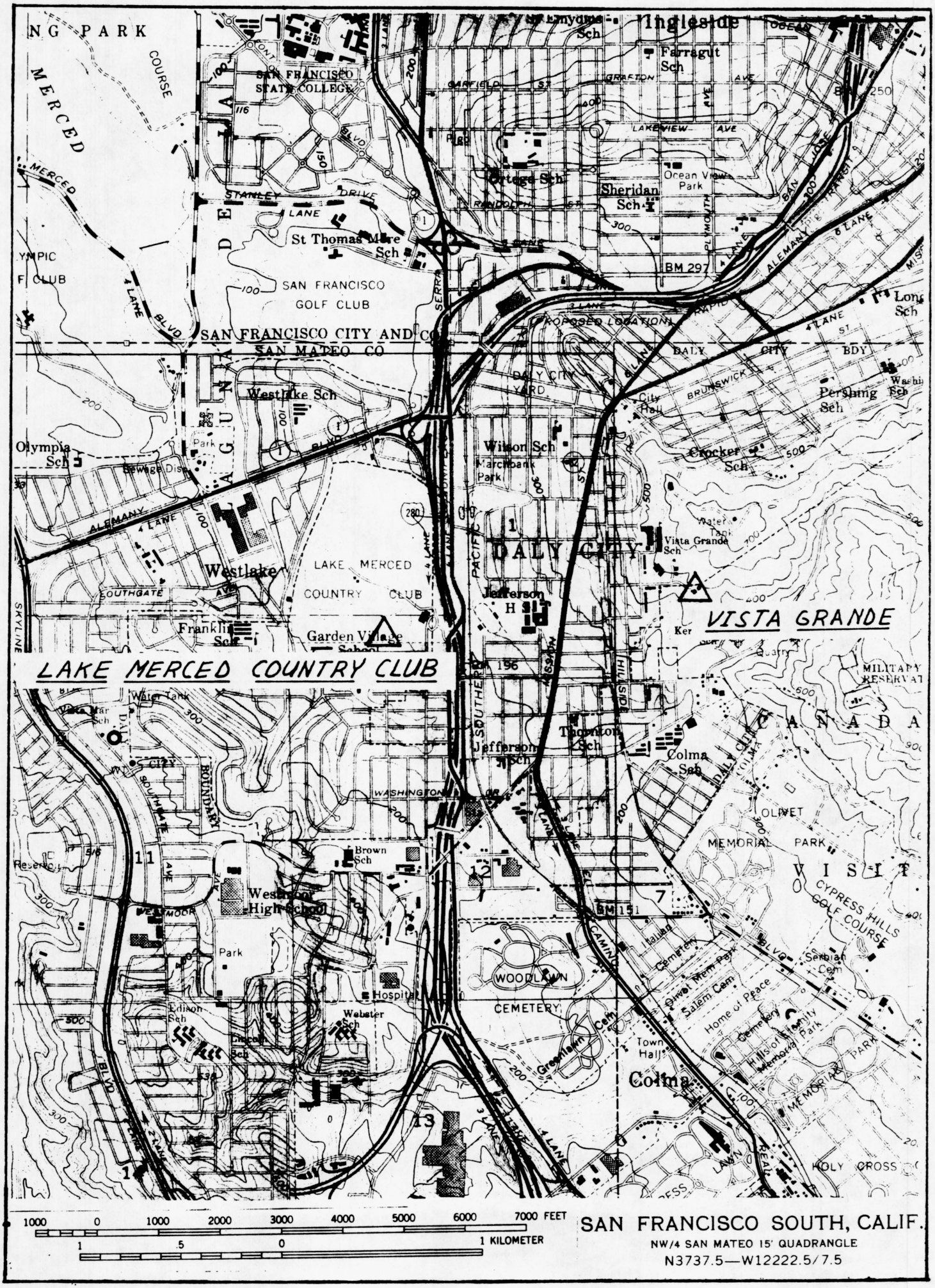
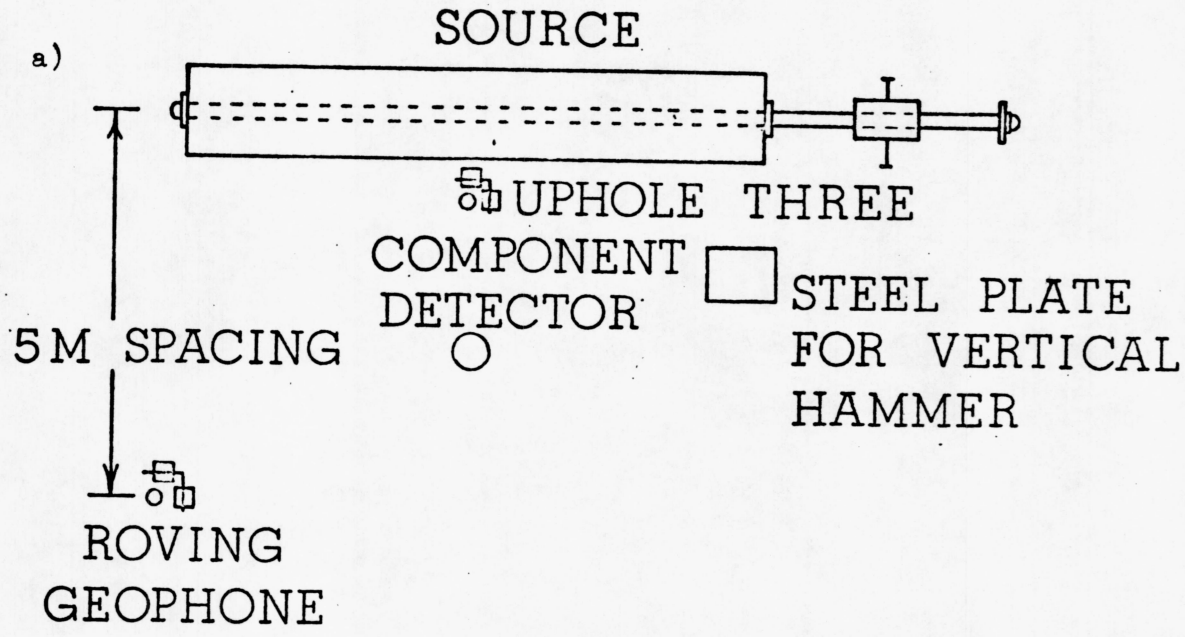

LAKE MERCED COUNTRY CLUB
VISTA GRANDE
SAN FRANCISCO STATE COLLEGE
SAN FRANCISCO GOLF CLUB
SAN FRANCISCO CITY AND CO
SAN MATEO CO
LAKE MERCED COUNTRY CLUB
DALY CITY
Ingleside
Westlake
Westlake High School
Colma
CANADA
Farragut Sch
Ortega Sch
Sheridan Sch
St Thomas More Sch
Westlake Sch
Olympia Sch
Wilson Sch
Crocker Sch
Pershing Sch
Vista Grande Sch
Jefferson H
Garden Village School
Franklin Sch
Brown Sch
Thornton Sch
Jefferson Sch
Colma Sch
Webster Sch
Edison Sch
Lincoln Sch
Ocean View Park
Marchbank Park
Park
Hospital
City Hall
Town Hall
WOODLAWN CEMETERY
Greenlawn Cem
Salem Cem
Home of Peace Cemetery
Hills of Eternity Memorial Park
Serbian Cem
Holy Cross Cemetery
OLIVET MEMORIAL PARK
CYPRESS HILLS GOLF COURSE
MILITARY RESERVATION
Water Tank
Sewage Disp
Quarry
BM 297
BM 151
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
SAN FRANCISCO SOUTH, CALIF.
NW/4 SAN MATEO 15' QUADRANGLE
N3737.5—W12222.5/7.5

Fig. 17


a)
SOURCE
UPHOLE THREE COMPONENT DETECTOR
STEEL PLATE FOR VERTICAL HAMMER
5M SPACING
ROVING GEOPHONE

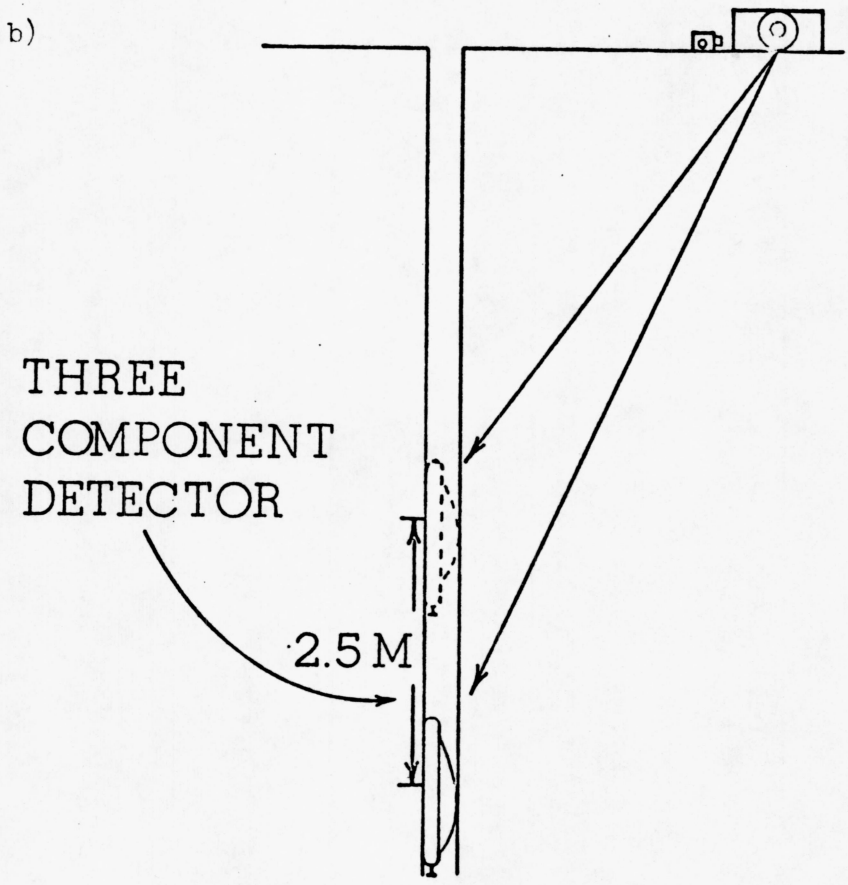

b)
THREE COMPONENT DETECTOR
2.5M

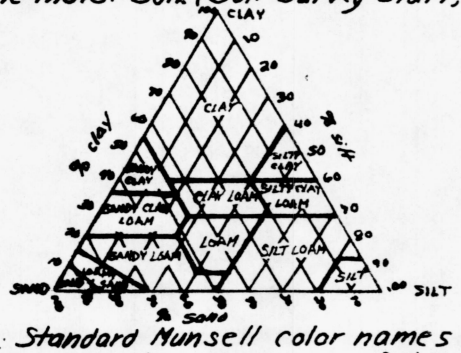
Fig. 18

ELEVATION:	LOCATION : LAT. LONG.	HOLE NO: Brabb (1970)
DATE :	7½' QUAD	SITE : Brabb and Pampeyan (1972)
		GEOLOGIC MAP UNIT: Helley and Brabb (1971) Helley et. al. (1972) Lajoie et. al. (1974) Robinson (1956)

SAMPLE DESCRIPTION	DRILLING	BLOWS/Ft.	SAMPLING
DRILLING:			
Auger	▨		
Rotary-wash (mud drilling fluid)	▽		
Drilling rate (min./ft.)	2		
SAMPLING:			
Standard penetration sample taken inside a 1⅜" I.D. split spoon driven 18" into the soil by a 140 lb. weight falling 30" at the top of the drill rod.			▤
Blow count for last 12" or, if penetration <12", for depth driven as noted.		36 88/11	
California penetration sample taken inside a 2" I.D. split spoon driven into the soil by 425 lb. slip jars falling inside the boring.			Ca
Shelby sample taken inside a 3" I.D. thin-walled tube mounted on end of drill rod and pushed into soil by drill rig.			S
Pitcher undisturbed sample taken inside a 3" I.D. Shelby tube mounted in a Pitcher core barrel.			P
Rock core sample taken inside a NX (2⅛") size core barrel with a diamond bit.			RC
DENSITY: Results of laboratory tests			

DESCRIPTION:

Texture: the relative proportions of clay, silt, and sand below 2 mm. Proportions of larger particles are indicated by modifiers of textural class names. Determination is made in the field mainly by feeling the moist soil. (Soil Survey Staff, 1951)



Color: Standard Munsell color names are given for the dominant color of the moist soil and for prominent mottles.

Plasticity: estimated from the strength of air dried sample and toughness of thread formed when soil is rolled at the plastic limit. (Sowers and Sowers, 1970)

plasticity	dry strength	field test
non plastic	v. low	falls apart easily
slightly	slight	easily crushed
medium	medium	friable with difficulty
highly	high	cannot crush with fingers

Relative density of sand and consistency of clay is correlated with penetration resistance: (Terzaghi and Peck, 1948)

blows/ft.	relative density	blows/ft.	consistency
0-4	v. loose	<2	v. soft
4-10	loose	2-4	soft
10-30	medium	4-8	medium
30-50	dense	8-15	stiff
>50	v. dense	15-30	v. stiff
		>30	hard

CL, MH, etc.: Unified Soil Classification Group Symbol (U.S. Army Corps of Engineers, 1960)

Rock hardness: response to hand and geologic hammer: (Ellen et. al., 1972)

hard - hammer bounces off with solid sound

firm - hammer dents with thud, pick point dents or penetrates slightly

soft - pick point penetrates

friable material can be crumbled into individual grains by hand.

ELEVATION:	LOCATION: LAT. LONG.	HOLE NO:
DATE:	7½' QUAD	SITE: GEOLOGIC MAP UNIT:

SAMPLE DESCRIPTION				DESCRIPTION

Fracture spacing: (Ellen et. al., 1972)

cm	in	fracture spacing
0-1	0-½	v. close
1-5	½-2	close
5-30	2-12	moderate
30-100	12-36	wide
>100	>36	v. wide

Weathering: (Aetron-Blume-Atkinson, 1965)

Fresh: no visible signs of weathering

Slight: no visible decomposition of minerals, slight discoloration

Moderate: Slight decomposition of minerals and disintegration of rock, moderate discoloration

Deep: moderate decomposition of minerals, extensive disintegration of rock, deep and thorough discoloration

Decomposed: extensive decomposition of minerals and complete disintegration of rock but original structure is preserved

ALTITUDE: 2'	LOCATION: Lat. 37° 25' 55" Long. 121° 58' 06" QUADRANGLE: MILPITAS, CALIF. 7 1/2'	HOLE No. 13 SITE: ALVISO RACEWAY GEOLOGIC MAP UNIT: Qhbm HOLOCENE BAY MUD
DATE: 4-8-75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
							SURFACE: Sandy gravel and cobbles (fill)
						0	
							SILTY CLAY, dark brownish gray with gray streaks, some fine gravel (CL)
							SILT LOAM, yellowish brown, grading to: FINE SANDY LOAM, grayish brown
CLAY LOAM, dark yellowish brown, medium plasticity, high dry strength, medium toughness, moist, very stiff (CL)		1.89	19				CLAY LOAM, dark yellowish brown, medium plasticity, moist, very stiff (CL)
						5	
							SILT LOAM, mottled light gray and brown, some very coarse sand and fine gravel
CLAY, mottled dark gray and yellowish brown, medium plasticity, high dry strength, medium toughness, moist, very stiff. (CL)		1.86	19				CLAY, yellowish brown with gray mottles, some dark brown, very coarse sand, medium plasticity, moist, very stiff (CL)
						10	grades to: CLAY, gray with yellowish brown mottles. (CL)
							SAND and GRAVEL, dark gray, mostly very coarse sand and fine gravel (GP)
						15	
CLAY, olive brown, medium plasticity, medium dry strength, medium toughness, contains some small carbonate concretions, moist, hard. (CL)		1.95	37				CLAY, olive brown, medium plasticity calcareous, moist, hard. (CL)
						20	
							SAND, fine to medium grained
							SILTY CLAY LOAM, olive, low plasticity
						25	grading to: SILT LOAM, olive brown, low plasticity moist, hard. (ML)
SILT LOAM, olive brown, low plasticity, low dry strength low toughness, weakly calcareous, moist, hard. (ML)		1.93	51				
						30	

COMMENTS: Fig. 20	LOGGED BY: T. FUMAL

ALTITUDE: 310'	LOCATION: Lat. 37°19'06" Long. 122°03'38"	HOLE No. 14
DATE: 4-11-75	QUADRANGLE: CUPERTINO, CALIF.	SITE: BLACKBERRY FARM
		GEOLOGIC MAP UNIT: Qyf HOLOCENE ALLUVIAL FAN DEPOSITS

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	VERY FINE SANDY LOAM, dark brown, dry loose
GRAVELLY SAND, dark gray and dark brown, 40% is 10-30 mm, mostly angular to subrounded, sandstone and shale, wet, very dense. (SW)			66			5	GRAVELLY SAND and SANDY GRAVEL dark gray and dark brown, angular to subrounded (SW-GW)
							COBBLES
SANDY LOAM, dark yellowish brown, low plasticity, moist, very dense. (SC)			48/3'			10	SANDY LOAM, and SANDY CLAY LOAM, dark yellowish brown, low plasticity, moist, very dense (SC-CL)
							grading to: SANDY LOAM, brown, gravelly (SP)
						15	
							SANDY GRAVEL, dark yellowish brown, 20-30% sand, gravel mostly <35mm substantial 35-60 mm, dark gray shale, olive brown sand stone, pale brown
						20	coarse sandstone. (GP)
							SANDY LOAM, brown, gravelly (SP)
						25	
							SANDY GRAVEL, dark yellowish brown, 50% is 5-10 mm. (GP)
						30	

COMMENTS:

LOGGED BY: T. FUMAL

Fig. 21

ALTITUDE: 70′ **DATE:** 3/26/75	**LOCATION:** Lat. 37° 39' 23" Long. 122° 05' 02" **QUADRANGLE:** 7 1/2′ HAYWARD, CALIFORNIA	**HOLE No.** 15 **SITE:** JOHN MUIR SCHOOL **GEOLOGIC MAP UNIT:** Qof LATE PLEISTOCENE ALLUVIUM

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	SILTY CLAY, very dark grayish brown with black mottles, very stiff (CL)
VERY FINE SANDY CLAY LOAM, brown, medium plasticity, medium dry strength, medium toughness, slightly moist, very stiff (CL)		1.98	25			5	VERY FINE SANDY CLAY LOAM, brown, medium plasticity, slightly moist, very stiff (CL)
CLAY LOAM, dark yellowish brown, contains 10% dark brown, very coarse sand grains; medium plasticity, medium dry strength, medium toughness, moist, hard. (CL)		1.99	47			10	CLAY LOAM, dark yellowish brown, contains <10% dark brown, very coarse sand, medium plasticity, moist, hard (CL)
							VERY FINE SANDY CLAY LOAM, dark brown, stiffer (CL)
						15	SAND, very coarse
						20	FINE SANDY CLAY LOAM, mottled brown and olive with some fine black mottles
						25	SILTY CLAY, brown, hard (CL)
							grading to bluish gray
VERY FINE SANDY LOAM, brown, low plasticity medium dry strength, low toughness, moderately quick, moist, hard. (SM)		1.90	69			30	VERY FINE SANDY LOAM, brown, low plasticity, moist, hard (SM)

COMMENTS:
Fig. 22

LOGGED BY: T. FUMAL

ALTITUDE: 10'	LOCATION: Lat. 37° 34' 05" Long. 122° 03' 59" QUADRANGLE: NEWARK, CALIFORNIA	HOLE No. 16 SITE: LOWRY ROAD GEOLOGIC MAP UNIT: Qyf HOLOCENE ALLUVIAL FAN DEPOSITS
DATE: 3/31/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	VERY FINE SANDY LOAM, dark brown grading to: SANDY CLAY LOAM, dark brown.
SAND, grayish brown, well-sorted medium to fine grained, non-plastic, quick, loose, (SP)			11				SAND, grayish brown, well-sorted, grades from fine to coarse, loose (SM)
						5	SILTY CLAY, mottled light gray and strong brown, contains some dark brown very coarse sand. Very stiff SILTY CLAY, dark greenish gray, stiff with some thin beds of softer silt, grading to:
CLAY, grayish green, with common fine mottles of light olive brown, medium plasticity, medium dry strength, high toughness, many white calcareous stringers, moist, hard (CL)		2.02	38			10	CLAY, grayish green with light olive brown mottles, medium plasticity, calcareous, moist, hard. (CL)
							SILT LOAM, olive grading to: SILTY CLAY, olive grading to: SILTY CLAY LOAM, yellowish brown with 10-15% dark brown, coarse sand medium plasticity. (CL)
						15	
SILT LOAM, dark yellowish brown, low plasticity, low dry strength, low toughness quick, weakly calcareous, moist, very stiff (ML)		1.93	24				SILT LOAM, dark yellowish brown, low plasticity, weakly calcareous, moist, very stiff. (ML)
						20	
						25	
							grading to:
SILT LOAM, olive with common fine strong brown mottles, low plasticity, low dry strength, low toughness, moderately quick, calcareous moist, hard. (ML)		1.84	43				SILT LOAM, olive and gray with strong brown mottles, weakly calcareous, moist, hard. (ML)
						30	

COMMENTS:

Fig. 23

LOGGED BY: T. FUMAL

ALTITUDE: 3'	LOCATION: Lat. 37° 36' 36" Long. 122° 05' 24" QUADRANGLE: 7 1/2' NEWARK, CALIF.	HOLE No. 17 SITE: HAYWARD SINK GEOLOGIC MAP UNIT: Qb HOLOCENE INTERFLUVIAL BASIN DEPOSITS
DATE: 3/28/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
CLAY, very dark gray, high plasticity, high dry strength high toughness, wet, soft. (CH)				S		0	CLAY, very dark gray, high plasticity, wet (CH). Has brown mottles and roots above water table.
GRAVELLY SAND, 50% very fine to coarse sand; gravel is mostly < 5 mm, with 10-15% 5-10 mm up to 25 mm. (SW)		1.95	75			5	SILTY CLAY, olive gray, low plasticity contains some very fine sand and brown mottles near base.
							GRAVELLY SAND, very dense (SW)
						10	SILT LOAM, pale brown mottled gray and brown
						15	SAND and GRAVEL, rounded to sub-rounded, black siltstone, brown ss. red chert and brown laminated shale. Wood fragments
SILT LOAM, olive with common medium mottles of yellowish brown; low plasticity, medium dry strength, low toughness, moist, very stiff (ML-CL)		1.87	26			20	SILT LOAM, olive with common, medium mottles of yellowish brown, low plasticity, moist, very stiff (ML-CL)
						25	SILTY CLAY, olive, medium plasticity calcareous, hard (CL) silt loam
SILTY CLAY, Olive, medium plasticity, medium dry strength, medium toughness, moist, hard, contains small irregular carbonate concretions. (CL)		1.91	49			30	

COMMENTS:

LOGGED BY: T. FUMAL

Fig. 24

ALTITUDE: 52' DATE: 4/1/75	LOCATION: Lat. 37° 32' 34" Long. 121° 58' 20" QUADRANGLE: NILES, CALIFORNIA	HOLE No. 18 SITE: PARKWAY TOWERS GEOLOGIC Qyf HOLOCENE MAP UNIT: ALLUVIAL FAN DEPOSITS

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	
							VERY FINE SANDY LOAM, brown grading to olive brown, low plasticity, slightly moist. (ML)
VERY FINE SANDY LOAM, Brown, low plasticity, slight dry strength, quick, low toughness, slightly moist, loose. (ML)	1.70		8			5	
	.5						
	1						
VERY FINE SANDY LOAM, olive brown, low plasticity, slight dry strength, quick, low toughness, slightly moist, medium dense (ML)	1.72		32			10	
	.8						
	2						COARSE SAND and GRAVEL, substantial is 20-30 mm, mostly dark olive gray, fine to medium grained hard sandstone and siltstone, some dark brown hard shale, quartz and red chert. (GW)
	2.0					15	
	1.5					20	
	2						VERY FINE SANDY LOAM, brown, low plasticity. (ML)
	2					25	COARSE SAND and GRAVEL (GW)
						30	

COMMENTS: Water loss was very rapid from 12.4 - 20m

LOGGED BY: T. FUMAL

Fig. 25

ALTITUDE: 37'	LOCATION: Lat. 37° 25' 14" Long. 122° 08' 30" QUADRANGLE: 7 1/2' PALO ALTO, CALIFORNIA	HOLE No. 19 SITE: PALO ALTO SQUARE GEOLOGIC MAP UNIT: Qof LATE PLEISTOCENE ALLUVIUM
DATE: 4/18/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	SILTY CLAY, dark gray. (CH)
SANDY CLAY, dark yellowish brown, sand is mostly sub-angular to subrounded up to coarse size, medium plasticity, high dry strength, medium toughness, slightly moist, hard. (CL)		2.03	68 / 6"			5	SANDY CLAY, dark yellowish brown, sand is mostly fine with some up to coarse size, medium plasticity, slightly moist, hard. (CL)
							SANDY GRAVEL, mostly subangular to sub-rounded gravel of brown fine ss., black siltstone, brown shale and pale brown coarse sandstone. (GM)
							SANDY CLAY, brown (CL)
						10	
SANDY CLAY LOAM, olive gray, sand is mostly fine with some up to coarse size, medium plasticity, high dry strength medium toughness, wet, very stiff (CL)		1.82	32				SANDY CLAY LOAM, olive gray, sand is mostly fine with some up to coarse size, medium plasticity, wet, very stiff (CL)
						15	
						20	
							SILTY SAND, with some fine gravel (SM)
							SILTY CLAY, olive brown, medium plasticity (CL)
						25	
							SANDY CLAY LOAM, bluish gray. (CL)
							grading to: SANDY LOAM, very dense
						30	
No sample recovered.			69 / 6"				

COMMENTS: Fig. 26	48	LOGGED BY: T. FUMAL

ALTITUDE: 1640'	LOCATION: Lat. 37° 31' 12" Long. 121° 52' 23" QUADRANGLE: 7 1/2' LA COSTA VALLEY, CALIF.	HOLE No. 20 SITE: MISSION PEAK GEOLOGIC MAP UNIT: BRIONES SANDSTONE
DATE: 4/3/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	FINE SANDY LOAM, olive brown moist. (SW)
SANDSTONE deeply weathered, mostly very close to close fracture; fragments are quite firm to hard, with moderate to thick strong brown clay coatings; 40-50% is sand and clay; moist.		2.31		P		5	SANDSTONE, deeply to moderately weathered, mostly very close to close fracture; fragments quite firm with moderate to thick clay coatings, 40-50%. Sand and clay matrix, includes lenses of moderately fractured rock.
							harder
						10	harder
						15	SANDSTONE, olive brown fine grained slightly weathered to fresh, quite firm, moderate to wide fracture.
						20	
						25	
						30	

COMMENTS: Slower drilling began at 14.5 m. A small amount of sample was cut at 30 m. but the sample tube fell off. Fig. 27

LOGGED BY: T. FUMAL

ALTITUDE: 110'	LOCATION: Lat. 37° 20' 27" Long. 121° 58' 58" QUADRANGLE: 7 1/2' SAN JOSE WEST, CALIF.	HOLE No. 21 SITE: MONTGOMERY SCHOOL GEOLOGIC MAP UNIT: Qyfo HOLOCENE FLUVIAL DEPOSITS
DATE: 4/9/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	CLAY LOAM, dark brown, low plasticity grading to: SANDY CLAY LOAM, 10-20% gravel to 10 mm.
GRAVELLY SAND, grayish brown, poorly sorted, 40% fine gravel to 10 mm, angular to subrounded, very dense (SP)			86 101				GRAVELLY SAND, Grayish brown, very dense (SP)
						5	SANDY CLAY LOAM, olive brown with mottles of stony brown
							GRAVELLY SAND, dark gray and dark yellowish brown, mostly <5 mm. (SP)
SANDY CLAY, dark brown grading to grayish brown, low plasticity, stiff (CL)			13			10	SANDY CLAY, dark brown grading to greenish gray, low plasticity, stiff (CC) Includes some thin lenses of silty sand.
							SANDY GRAVEL, Grayish brown
						15	
CLAY LOAM, olive, low plasticity, medium dry strength, low toughness, some rounded gravel of dark gray fine ss and pale brown coarse ss, moist, very stiff. (CL)	2.5 1.92 2.5 1.5 .7		30				FINE SANDY LOAM grading to: CLAY LOAM, olive, low plasticity, some gravel, moist, very stiff (CL)
						20	FINE SANDY LOAM, bluish gray mottled gray and olive grading to FINE SAND, olive grading to: GRAVELLY SAND
LOAM, olive with mottles of light gray, low plasticity, calcareous (ML) grading to: SANDY LOAM, light gray, low plasticity, strongly calcareous (SM)	1.80		95			25 30	LOAM and SANDY LOAM, olive, low plasticity, calcareous. (NL) grading to: SANDY LOAM, light gray, low plasticity moist, calcareous, hard (SM)

COMMENTS:
Fig. 28

LOGGED BY: T. FUMAL

ALTITUDE: 600'	LOCATION: Lat. 37° 17' 48" Long. 122° 04' 54" QUADRANGLE: 7 1/2 CUPERTINO, CALIFORNIA	HOLE No. 22 SITE: STEVENS CREEK QUARRY GEOLOGIC MAP UNIT: SANTA CLARA FM.
DATE: 4/14/75		

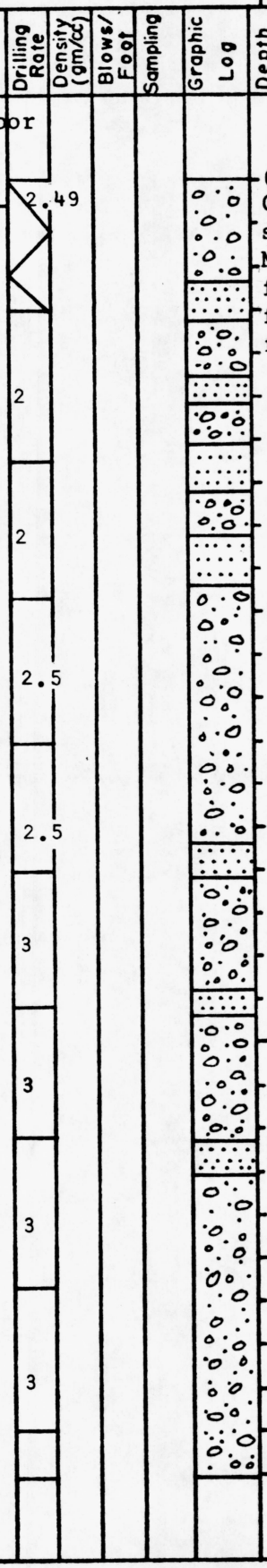
SAMPLE DESCRIPTION

Site is located on quarry floor about 5 m from cut face exposing 15-20 m of Santa Clara Fm. Material in cut is interbedded conglomerate and very fine sandstone:

CONGLOMERATE, dark greenish gray, poorly sorted, 50-90% gravel, mostly <3", substantial 3-6" save up to 1 ½', angular to well-rounded, hard, lithology is mostly graywacke, some greenstone and chert. Most is cemented and calcareous, some is friable.

SANDSTONE, ranges from well-sorted very fine sandstone to poorly sorted gravelly, clayey fine sandstone; dark gray to dark brown; fracture is very close to moderate, mostly 3" - 1'; firm.

SANDSTONE makes up about 30% of cut in beds up to 3' mostly 1-2'. Gravel beds are up to 15' thick as bedding in gravel is 5-15'.



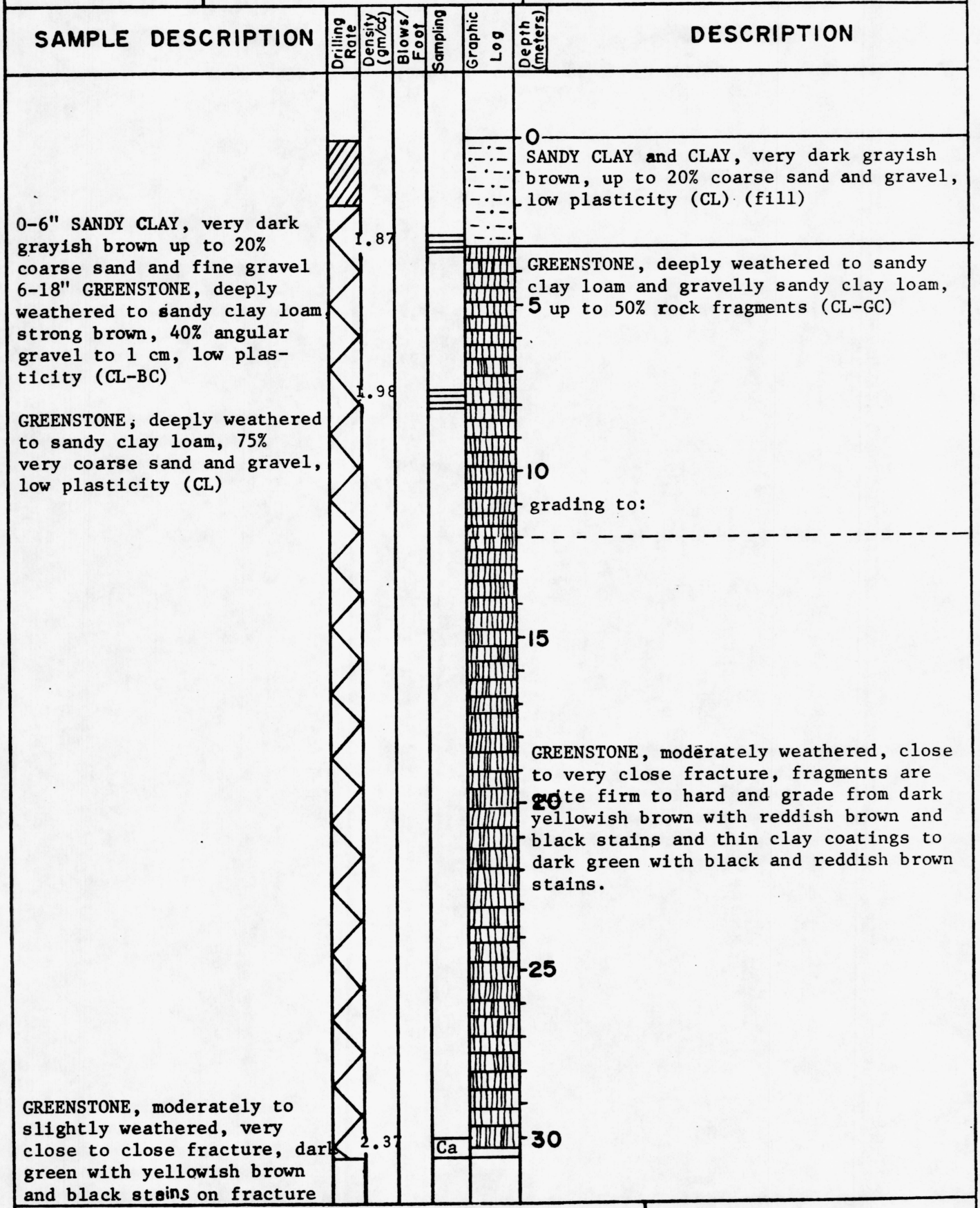
DESCRIPTION

CONGLOMERATE, dark greenish gray, poorly sorted, 50-90% gravel mostly graywacke. Most is cemented and calcareous, some is friable. Includes beds of SANDSTONE, fine grained dark gray to dark brown, firm, very close to moderate fracture.

COMMENTS: STEVENS CREEK facies of Santa Clara Fm.

LOGGED BY: T. FUMAL

ALTITUDE: 440' DATE: 3/27/75	LOCATION: Lat. 37° 39 ' 25" Long. 122° 03' 37" QUADRANGLE: HAYWARD, CALIFORNIA	HOLE No. 23 SITE: CAL STATE HAYWARD GEOLOGIC MAP UNIT: FRANCISCAN GREENSTONE



COMMENTS: Fig. 30	LOGGED BY: T. FUMAL

ALTITUDE: 235'	**LOCATION:** Lat. 37° 18' 05" Long. 122° 00' 36"	**HOLE No.** 24
DATE: 4/10/75	**QUADRANGLE:** 7 1/2' CUPERTINO, CALIF.	**SITE:** MILLER SCHOOL
		GEOLOGIC MAP UNIT: Qof LATE PLEISTOCENE ALLUVIUM

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	
	1.5					5	CLAY LOAM, dark brown, gravelly grading to: SANDY LOAM, brown, gravelly grading to: COARSE SAND and GRAVEL, dark brown and yellowish brown (GW) COBBLES
LOAMY SAND, dark yellowish brown, poorly sorted, mostly medium to fine size, sub-rounded to subangular, non-plastic, very dense, wet. (SM-SW)	2.5	1.78	96/6"			10	SANDY LOAM, yellowish brown grading to: SAND and LOAMY SAND grading to: SANDY GRAVEL
	1.5					15	SANDY LOAM, yellowish brown, with some very coarse sand and fine gravel grading to: SILT LOAM, brown (ML)
GRAVELLY SAND, olive brown, poorly sorted, 30% gravel up to 35 mm, mostly pale brown coarse sandstone; some cobbles of hard sandstone and soft, deeply weathered sandstone (?) (SW)	2	2.25				20	GRAVELLY SAND, olive brown, poorly sorted, up to 30% gravel of pale brown coarse sandstone, moist (SW)
	2.5						
	1.7					25	FINE SANDY LOAM, brown grading to: SAND and GRAVEL
	4.5						SANDY CLAY LOAM and LOAM, strong brown, low plasticity, some very coarse sand and gravel, moist, hard (CL)
SANDY CLAY LOAM and LOAM, strong brown, low plasticity medium dry strength, low toughness, some very coarse sand and fine gravel subrounded to subangular moist, hard. (CL)	1.95	115				30	

COMMENTS: Hard loam at 26.4 m strongly resembled Santa Clara Fm. encountered at Mary Knoll site. Fig. 31

LOGGED BY: T. FUMAL

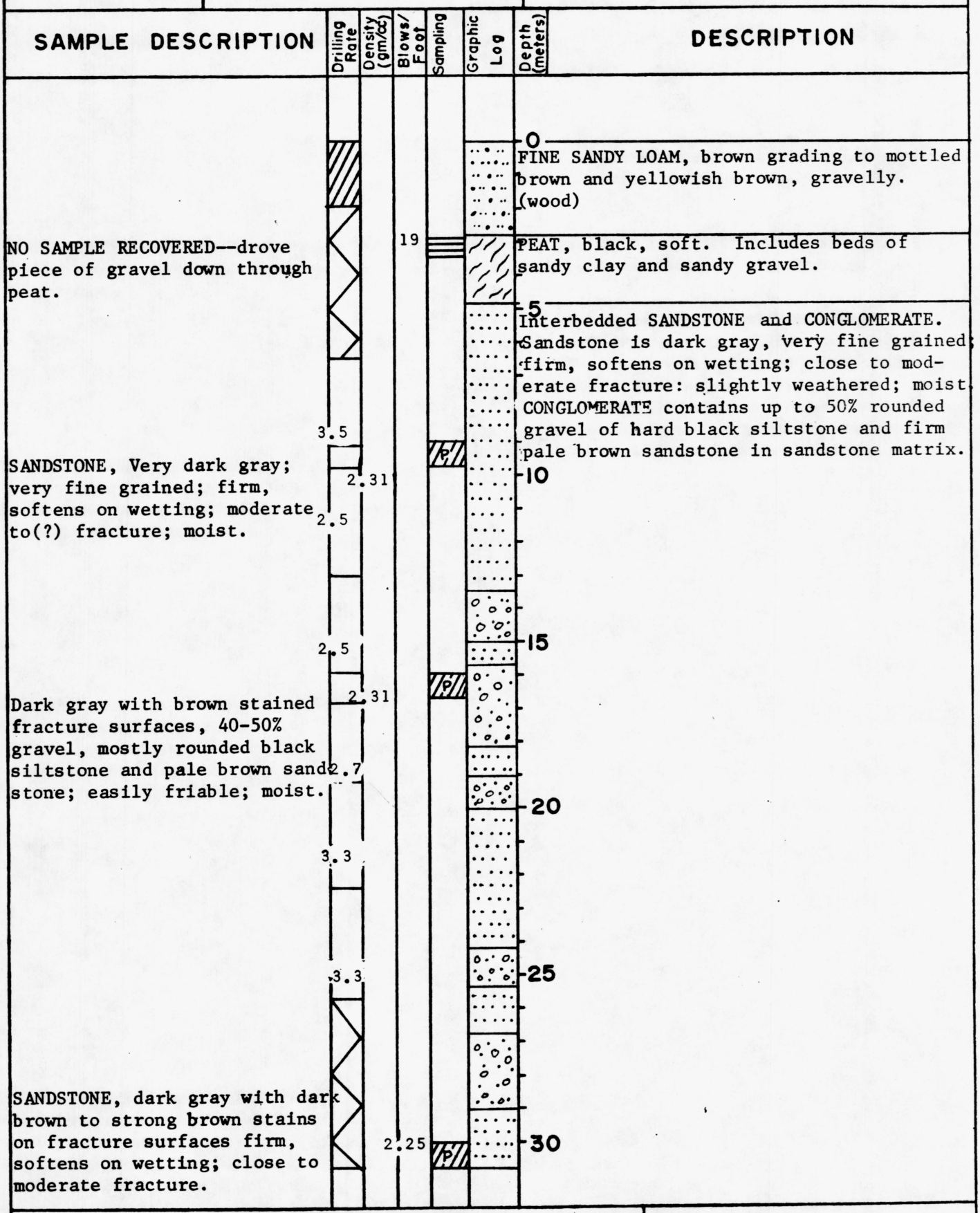
ALTITUDE: 2'	LOCATION: Lat. 37° 37' 26" Long. 122° 07' 47" QUADRANGLE: 7 1/2' REDWOOD PT., CALIF	HOLE No. 25 SITE: OLIVER'S SALT WORKS GEOLOGIC MAP UNIT: Qhbm HOLOCENE BAY MUD
DATE: 5/1/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/ Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	
							CLAY, black with 30% very fine sand grading to: FINE SANDY LOAM, grayish brown
CLAY, grayish brown, high plasticity, high dry strength, high toughness, some calcareous concretions, moist, hard (CH)	1.94		33				CLAY, grayish brown, high plasticity calcareous, moist, hard. (CH)
	1.8					5	grading to: FINE SANDY CLAY, low plasticity (CL)
	1.6						SAND, dark brown, dark gray, grades from medium to very coarse sand with fine gravel and shell fragments
						10	
0-8" SILTY CLAY LOAM, grayish brown low plasticity, medium dry strength low toughness, moist (CL)	2						SILTY CLAY LOAM, grayish brown, low plasticity, moist. (CL)
	2.13		58				SAND, grades from very fine to very coarse
8-18" VERY FINE SAND, well-sorted, non-plastic dense (SP)	2						VERY FINE SANDY LOAM, grayish brown (SM) Includes beds of fine sand.
						15	
	2						
	1.5					20	
	2						CLAY LOAM, grayish brown, low plasticity contains thin lenses of fine to coarse sand. (CL)
	2.5					25	
	2					30	CLAY, bluish gray with fine strong brown mottles, low plasticity, hard (CL)

COMMENTS: Hole was drilled to 41.6 m but casing was stopped at 21.2 m.

LOGGED BY: T. FUMAL

ALTITUDE: 790'	**LOCATION:** Lat. 37° 21' 33" Long. 122° 13' 01"	**HOLE No.** 26
DATE: 4/16/75	**QUADRANGLE:** 7 1/2' MINDEGO HILL, CALIFORNIA	**SITE:** CORTE MADERA
		GEOLOGIC MAP UNIT: SANTA CLARA FM.



COMMENTS: Corte Madera facies of Santa Clara Fm. site is on stream terrace ≈ 5 m above stream.

LOGGED BY: T. FUMAL

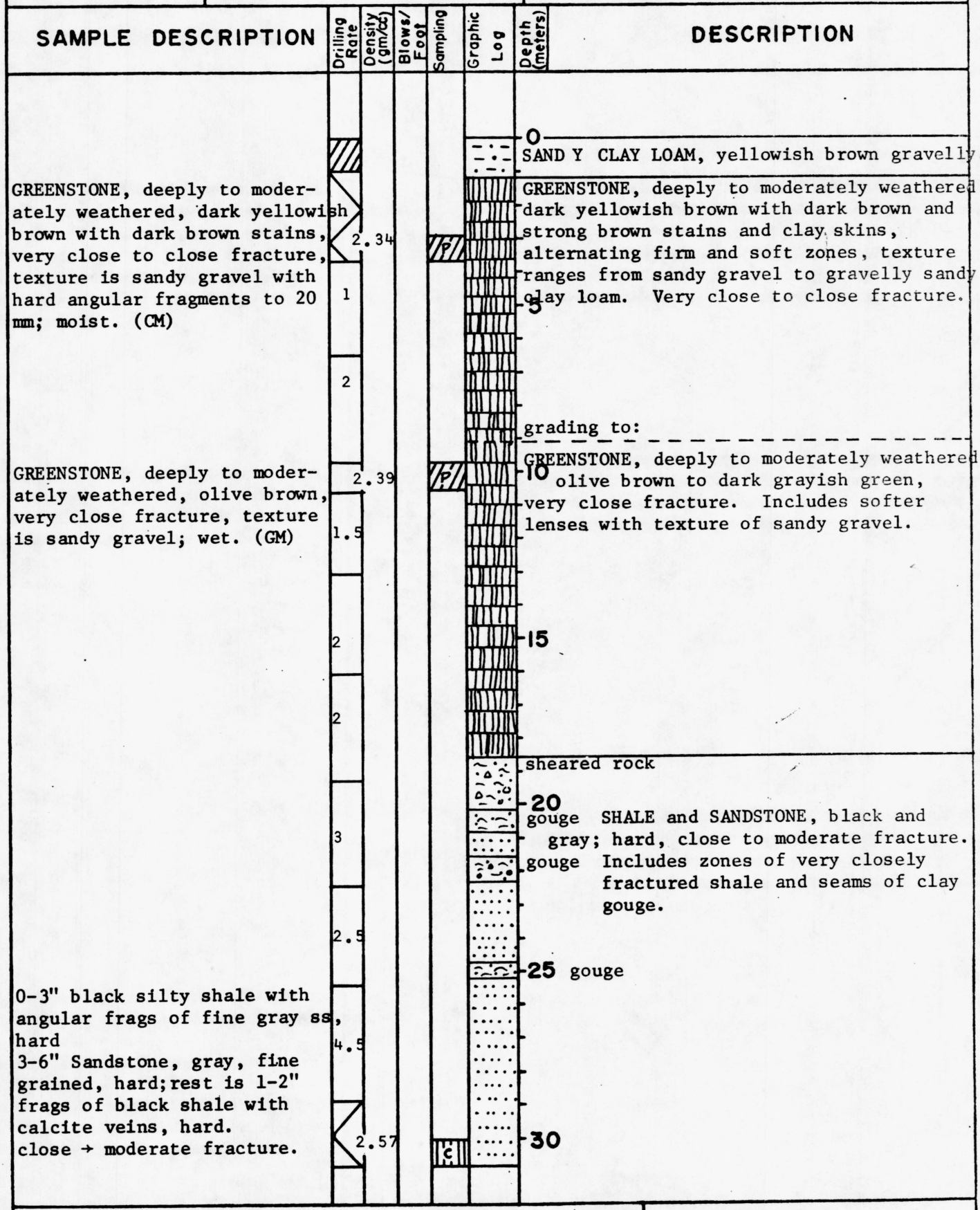
Fig. 33

ALTITUDE: 19'	LOCATION: Lat. 37° 25' 11" Long. 122° 06' 36" QUADRANGLE: 7 1/2' MOUNTAIN VIEW, CALIF.	HOLE No. 27 SITE: MITCHELL PARK GEOLOGIC MAP UNIT: Qyfo HOLOCENE FLUVIAL DEPOSITS
DATE: 7/17/75		

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	
							CLAY, dark gray, medium plasticity, calcareous (CL) mottled gray and grayish brown
FINE SANDY LOAM, olive brown, low plasticity, medium dry strength, low toughness, moist, medium dense, calcareous, (SM) grading to: VERY GRAVELLY SANDY LOAM with up to 50% fine gravel, dense (GM)	1.80		47				SANDY LOAM, olive brown (SM) grading to: GRAVELLY SANDY LOAM
						5	CLAY LOAM, olive, with up to 30% fine sand grading grayish green.
							SAND and GRAVEL
SANDY CLAY, olive gray, 20-30% coarse sand and fine gravel to 4 mm, low plasticity, medium dry strength low toughness, moist, hard, calcareous (CL) grading to: SANDY CLAY with <5% coarse sand, strongly calcareous.	2.09		97			10	SANDY CLAY, olive gray, up to 30% coarse sand and gravel; low plasticity ~~calcareous, hard. (CL)~~
	1						FINE SANDY LOAM, grading to:
	1.5						SAND grading to: SAND AND GRAVEL, gray, reddish and yellowish brown; mostly 2-7 mm, rounded to subangular.
	1.5					15	
							SILTY CLAY, olive gray, medium plasticity, moist, calcareous, hard (CL)
SILTY CLAY, olive gray, medium plasticity, high dry strength, medium toughness, moist, calcareous, hard (CL)	1.91		58				
	1.5					20	
							grading to: FINE SANDY LOAM, olive gray
	1					25	
	2						CLAY, gray, some dark brown, coarse sand stiffer. (CL)
SANDY CLAY LOAM, dark grayish brown, low plasticity, sand is up to medium size, some gravel to 20 mm; calcareous (CL)							SANDY CLAY LOAM, dark grayish brown, low plasticity, some gravel to 20 mm, calcareous (CL)
						30	

COMMENTS: Fig. 34	LOGGED BY: T. FUMAL

ALTITUDE: 1400'	**LOCATION:** Lat. 37° 21' 02" Long. 122° 10' 28"	**HOLE No.** 28
DATE: 4/15/75	**QUADRANGLE:** 7 1/2' MINDEGO HILL, CALIFORNIA	**SITE:** FOOTHILLS PARK
		GEOLOGIC MAP UNIT: FRANCISCAN GREENSTONE



COMMENTS:

Fig. 35

LOGGED BY: T. FUMAL

ALTITUDE: 2400'	LOCATION: 37° 24' 37" Lat.	HOLE No. 29
DATE: 4/25/75	Long. 122° 18' 25"	SITE: SIERRA MORENA
	QUADRANGLE: 7 1/2 WOODSIDE, CALIFORNIA	GEOLOGIC MAP UNIT: LAMBERT SHALE

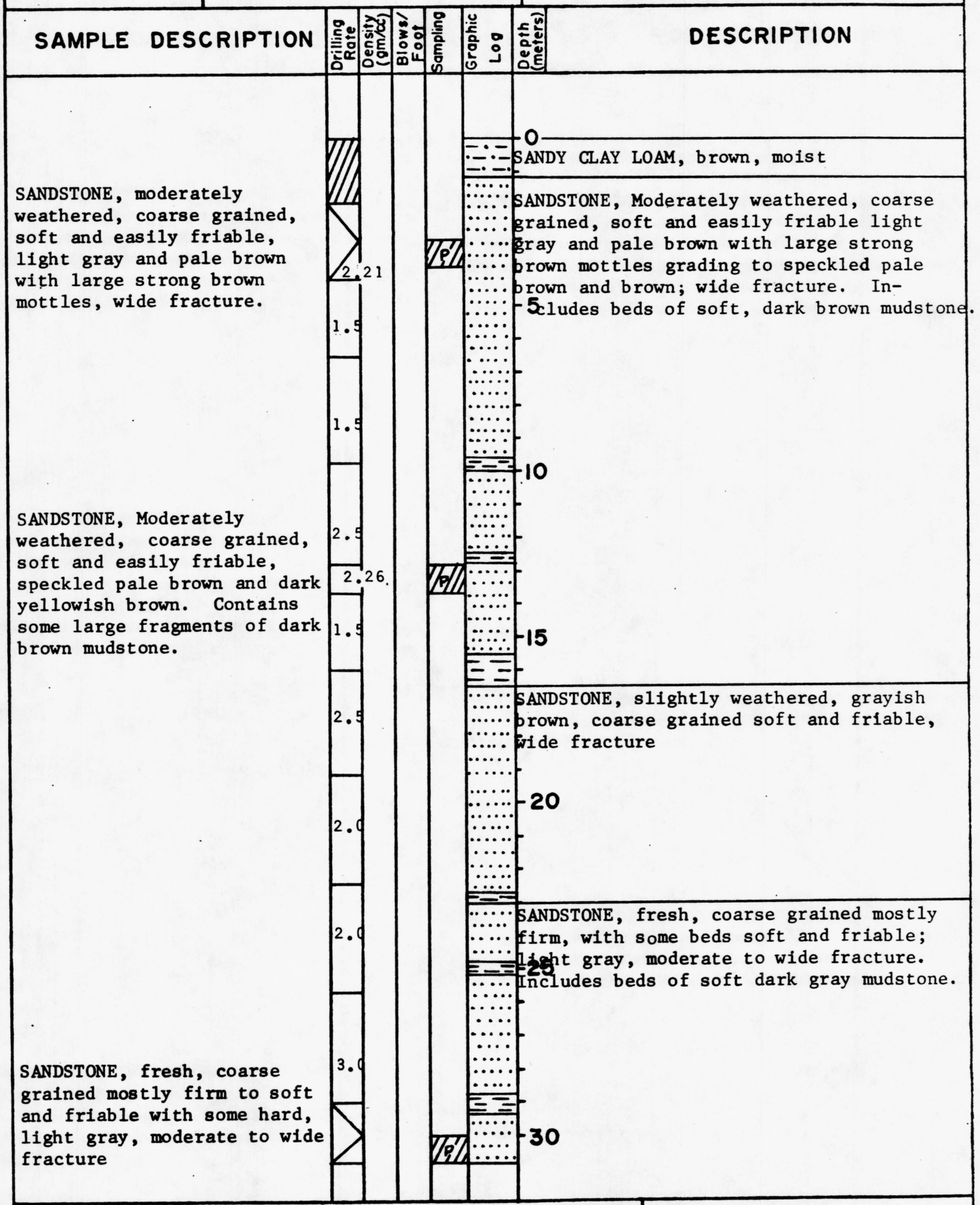
SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	MUDSTONE, slightly weathered, black to very dark grayish brown with dark brown to strong brown discoloration on fracture surfaces; close to very close fracture; friable to gravelly sand with firm angular fragments to 25 mm; moist.
MUDSTONE, slightly weathered, friable to gravelly sand with firm angular fragments to 25 mm, black to very dark grayish brown with dark brown to strong brown discoloration on fracture surfaces. Close to very close fracture, moist.		2.14		P		5	
							MUDSTONE, fresh, black, firm to hard, close to very close fracture, moist.
MUDSTONE, black, fresh, firm, close to very close fracture. 30% < 5 mm.		2.08		P		10	
						15	
						20	
						25	
MUDSTONE, black, fresh, firm, hard to firm, close to very close fracture 50% < 10 mm, up to 40 mm angular fragments.		2.17		P		30	

COMMENTS: Site is located on dirt road bed. Soil and weathered rock had been cut away.

LOGGED BY: T. FUMAL

Fig. 36

ALTITUDE: 440'	LOCATION: Lat. 37° 29' 11" Long. 122° 18' 52" QUADRANGLE: 7 1/2' WOODSIDE, CALIF.	HOLE No. 30 SITE: PULGAS TUNNEL GEOLOGIC MAP UNIT: BUTANO (?) SANDSTONE
DATE: 4/21/75		



COMMENTS: Fig. 37	LOGGED BY: T. FUMAL

ALTITUDE: 140'	**LOCATION:** Lat. 37° 29' 38" Long. 122° 26' 02"	**HOLE No.** 31
DATE: 4/24/75	**QUADRANGLE:** 7 1/2 HALF MOON BAY, CALIF	**SITE:** FRENCHMAN'S CREEK
		GEOLOGIC MAP UNIT: Qyf COARSE-GRAINED YOUNGER ALLUVIUM

SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	
SANDY LOAM, brown 15-20% very coarse sand and fine gravel, granitic, micaceous, low plasticity, medium dry strength, low toughness, moist, dense (SM)	1	1.82	48				COARSE SANDY CLAY LOAM, dark brown 20% coarse sand, low plasticity grading to: SANDY LOAM, 10-20% very coarse sand granitic, micaceous, low plasticity dense (SM) Includes beds of GRAVELLY COARSE SAND, angular to subangular, white, very pale brown and dark red, no mica.
	1.5					5	
	1.5						
SANDY LOAM, dark brown, 10% very coarse sand, micaceous, low plasticity, medium dry strength, low toughness, moist, very dense (SM)	1.8	1.88				10	
QUARTZ DIORITE GRUS, deeply weathered, mottled white, very pale brown, and yellowish brown, soft and easily friable to very coarse sand and sandy clay loam, wet.	1.5	2.25		R		15	QUARTZ DIORITE GRUS, deeply weathered, soft and easily friable to very coarse sand and sandy clay loam; mottled white, very pale brown and yellowish brown.
	2					20	QUARTZ DIORITE GRUS, Moderately weathered, most is easily friable to gravelly coarse sand, some is hard with very close to moderate fracture.
	3.5						
	6					25	QUARTZ DIORITE, fresh, hard, moderate fracture, gray and black
QUARTZ DIORITE, hard, 40-50 % ferromagnesian minerals, mostly altered to chlorite, plagioclase strongly sausseritized. 0-9" fractured at 4-5", 9-16" fractured 1-3' or smaller.	5.5	2.52		C		30	QUARTZ DIORITE, hard, strong alteration of ferromagnesian minerals and plagioclase, close to moderate fracture, mottled dark green and white.

COMMENTS: Site is on stream terrace approximately 10 m above present stream. Fig. 38 60

LOGGED BY: T. FUMAL

ALTITUDE: 50'	LOCATION: Lat. 37° 30' 56" Long. 122° 29' 50" QUADRANGLE: 7 1/2' MONTARA MTN., CALIF.	HOLE No. 32 SITE: HALF MOON BAY TERRACE GEOLOGIC MAP UNIT: Qof COARSE-GRAINED OLDER ALLUVIUM
DATE: 4/23/75		

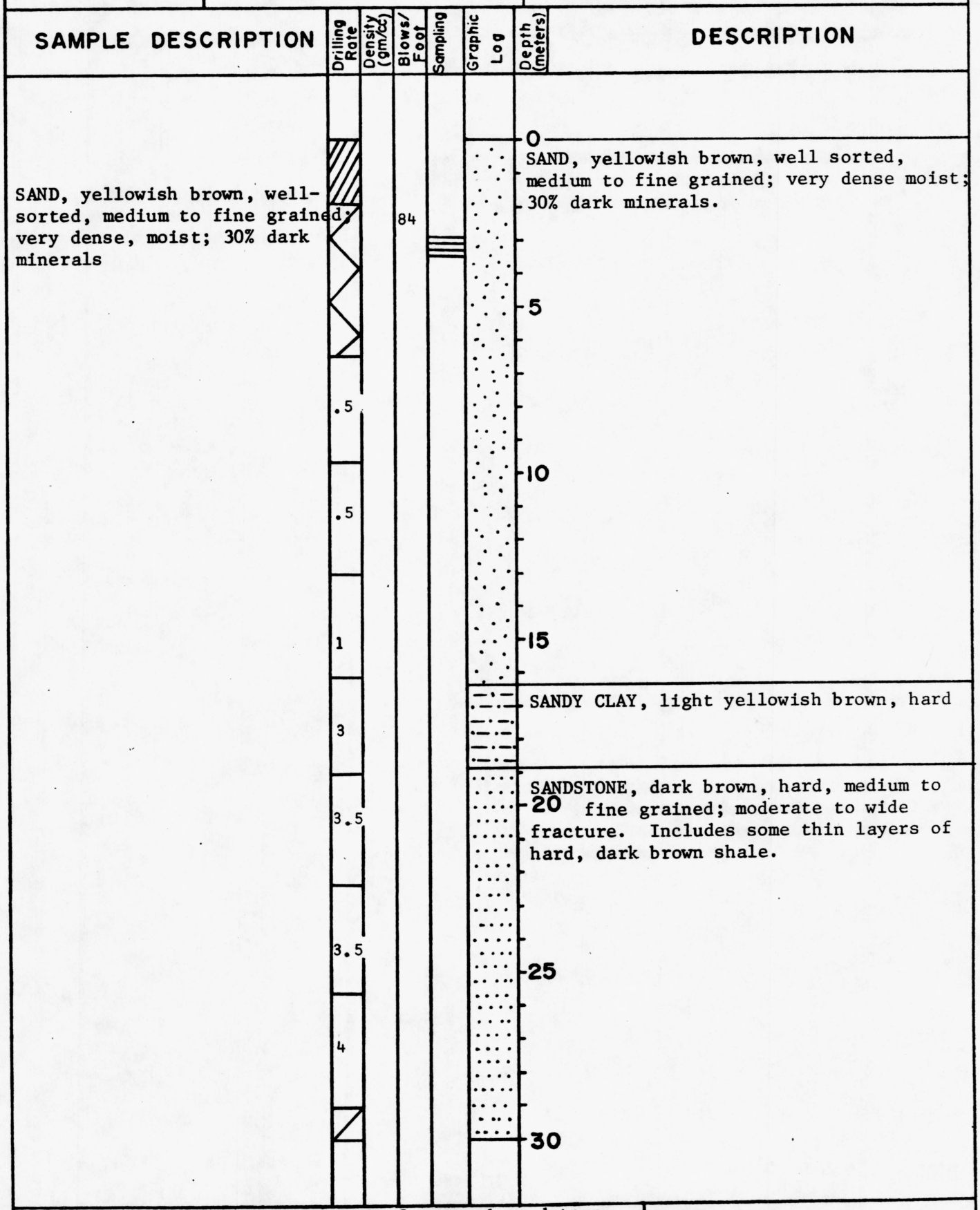
SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
						0	CLAY LOAM, very dark brown with many fine white mottles (soft feldspar) grading to:
SANDY CLAY LOAM, grayish brown with common, large, strong brown mottles; 15-20% very coarse sand, medium plasticity high dry strength, medium toughness, moist, very stiff (CL)	1	1.84	24				SANDY CLAY LOAM, grayish brown with strong brown mottles (CL) medium plasticity, moist
	.5					5	SANDY LOAM grading to: SAND and GRAVEL, white to reddish brown angular to subangular, granitic
CLAY LOAM, yellowish brown, and SANDY LOAM, brown, 15-20% very coarse sand	1	1.92	83/10"			10	SAND, strong brown to brown, poorly sorted mostly medium to very coarse, granitic, wet. Contains thin beds of sandy loam, clay loam, and green, micaceous silt loam. (SW)
	.5					15	
SAND, dark grayish brown, poorly sorted, mostly medium to coarse size, granitic non-plastic, very dense. (SW)	.5		80/4"			20	SAND, dark grayish brown, poorly sorted, mostly medium to coarse size with some thin beds of fine sand; granitic, non-plastic, wet, very dense (SW)
	1.2					25	SAND, fine, black
	2.5					30	SANDSTONE, very fine grained, silty dark olive gray, soft, wet. Contains some thin, cemented layers and beds of shell fragments.
SANDSTONE, Very fine grained, silty, dark olive gray, soft, wet			60/1½"				

COMMENTS:

Fig. 39

LOGGED BY: T. FUMAL

ALTITUDE: 500' **DATE:** 4/30/75	**LOCATION:** Lat. 37° 41' 50" Long. 122° 27' 22" **QUADRANGLE:** 7 1/2' SAN FRANCISCO SOUTH, CALIF	**HOLE No.** 33 **SITE:** VISTA GRANDE **GEOLOGIC MAP UNIT:** COLMA/FRANCISCAN SS



COMMENTS: Rapid water loss in fractured sandstone from 18.9 m to about 25 m.

LOGGED BY: T. FUMAL

Fig. 40

ALTITUDE: 995 DATE: 4/2/75	LOCATION: Lat. 37° 34' 48" Long. 121° 55' 29" QUADRANGLE: 7 1/2' NILES, CALIF.	HOLE No. 34 SITE: MORRISON CANYON GEOLOGIC MAP UNIT: CLAREMONT SHALE

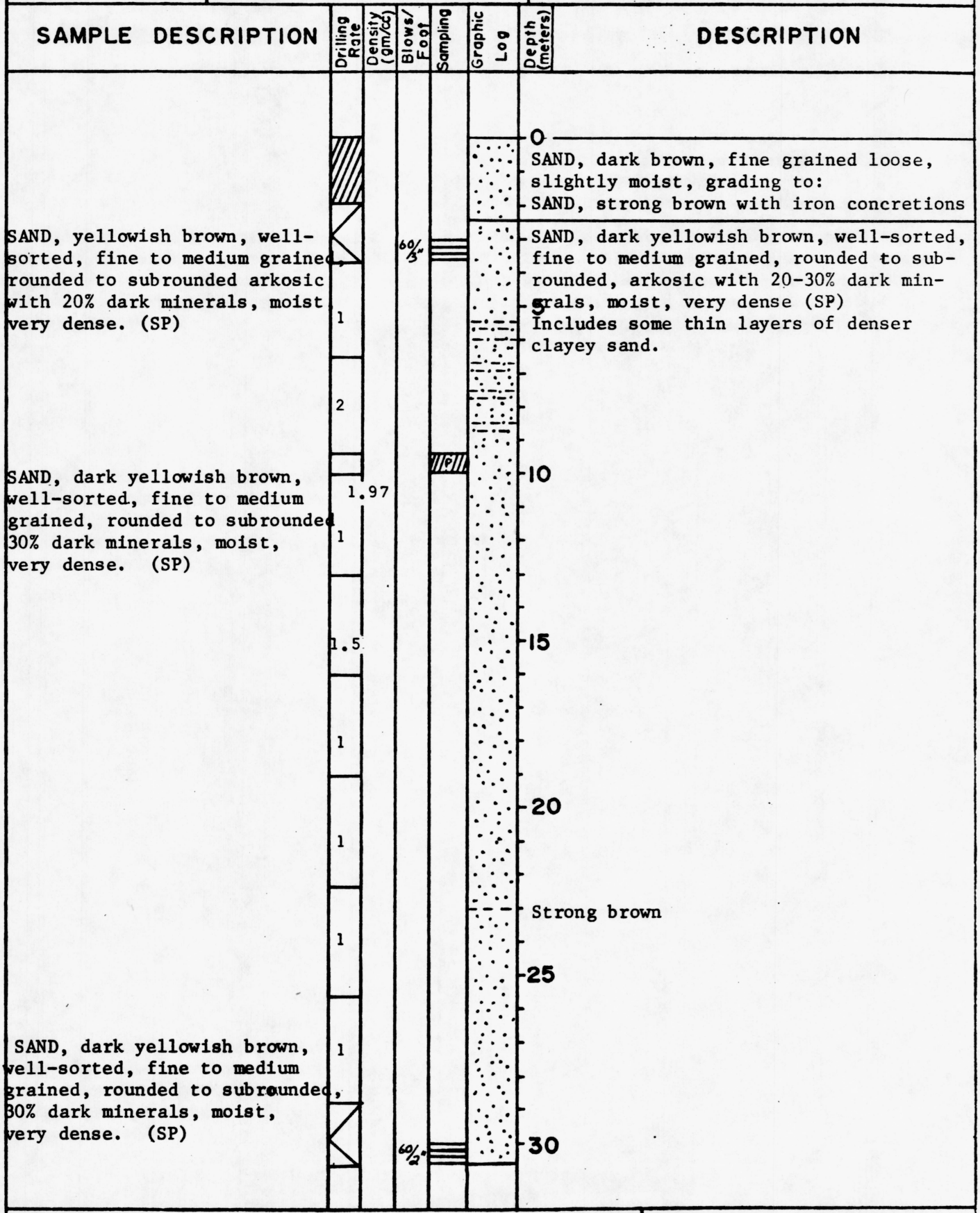
SAMPLE DESCRIPTION	Drilling Rate	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
							SURFACE -Littered with angular frags of hard, laminated, siliceous shale
						0	
CLAY LOAM and SANDY CLAY LOAM grayish brown, poorly sorted, up to 30% very coarse, angular sand and 10% angular gravel of hard, brown siliceous shale; high dry strength and plasticity; moist, very stiff.		1.92	25				CLAY LOAM, mottled gray and strong brown, very stiff, moist.
							CLAY LOAM, grayish brown, very stiff some shale frags. grading to: SHALY CLAY LOAM, gray 60-70% shale frags.
						5	
	2						SHALE, very dark brown, firm to hard, very closely fractured, slightly weathered (strong brown stains on fracture surfaces) to fresh.
						10	
	3						SANDSTONE, very dark brown, very fine grained, soft.
SANDSTONE, very dark brown, very fine grained, quite firm, softens on wetting to very fine loamy sand, moderate to close fracture, moist.	4.5	2.20					SANDSTONE, very dark brown, very fine grained, quite firm, softens on wetting, fracture. Spacing is predominantly moderate to wide.
	5					15	
	5					20	
	4					25	
	4						
SANDSTONE, very dark brown, very fine grained, quite firm, softens on wetting to very fine loamy sand; 20" of sample has 1 calcite-healed fracture at 13" which dips 60°, moist.		2.19				30	

COMMENTS:

LOGGED BY: T. FUMAL

Fig. 41

ALTITUDE: 165 **DATE:** 4/28/75	**LOCATION:** Lat. 37° 41' 42" Long. 122° 28' 24" **QUADRANGLE:** 7 1/2' SAN FRANCISCO SOUTH, CALIF.	**HOLE No.** 35 **SITE:** LAKE MERCED COUNTRY CLUB **GEOLOGIC MAP UNIT:** COLMA FORMATION



COMMENTS:
Fig. 42

LOGGED BY: T. FUMAL

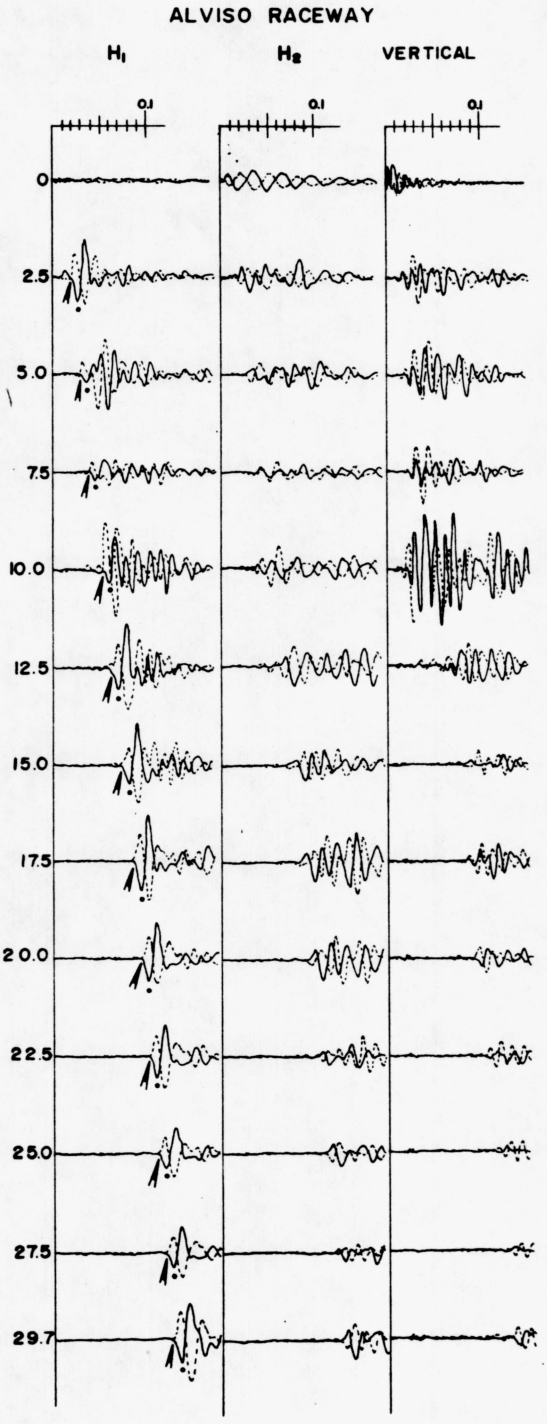

ALVISO RACEWAY
H1
H2
VERTICAL
0.1
0.1
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.7

Fig. 43

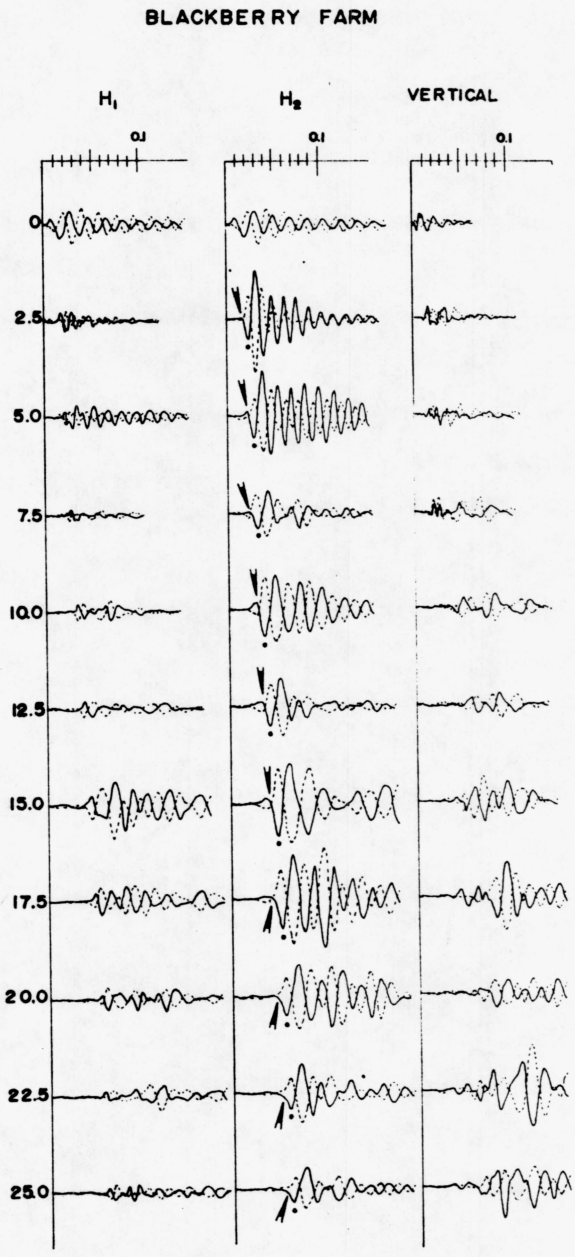

BLACKBERRY FARM
H1
H2
VERTICAL
0.1
0.1
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0

Fig. 44

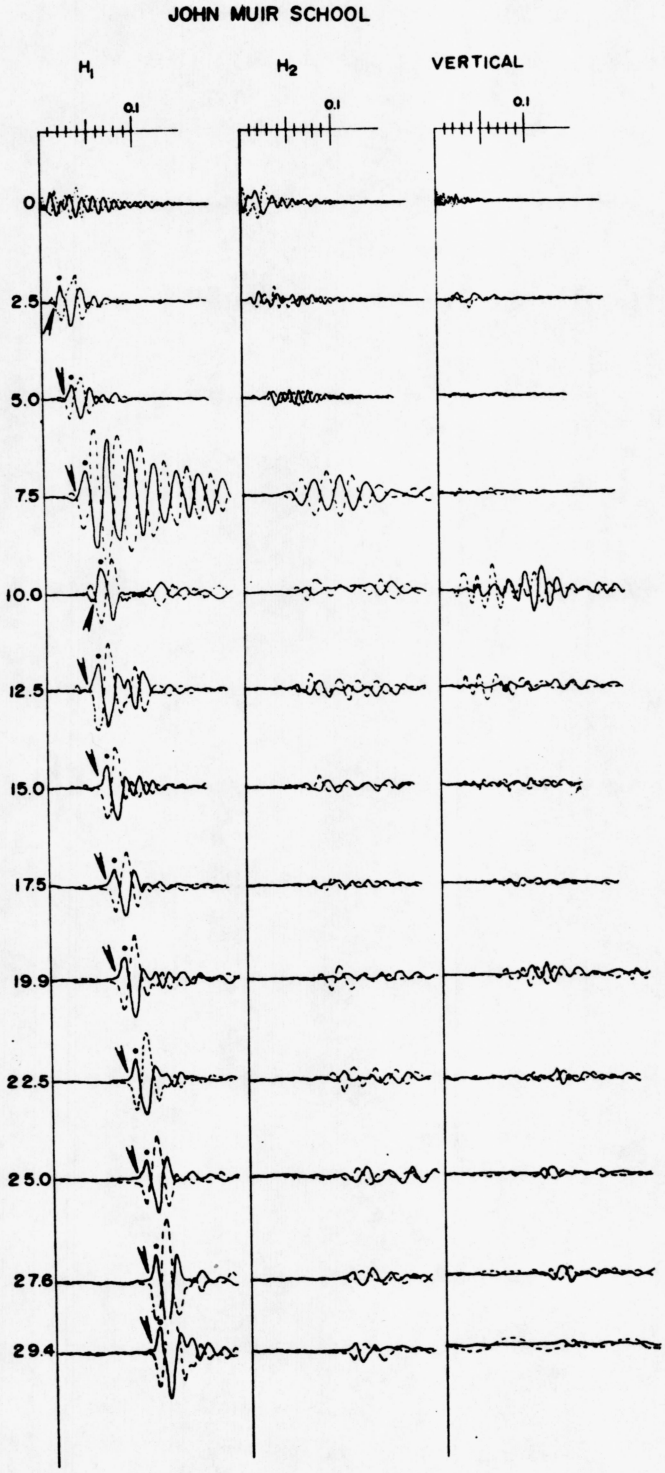

JOHN MUIR SCHOOL
H1
H2
VERTICAL
0.1
0.1
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
19.9
22.5
25.0
27.6
29.4

Fig. 45

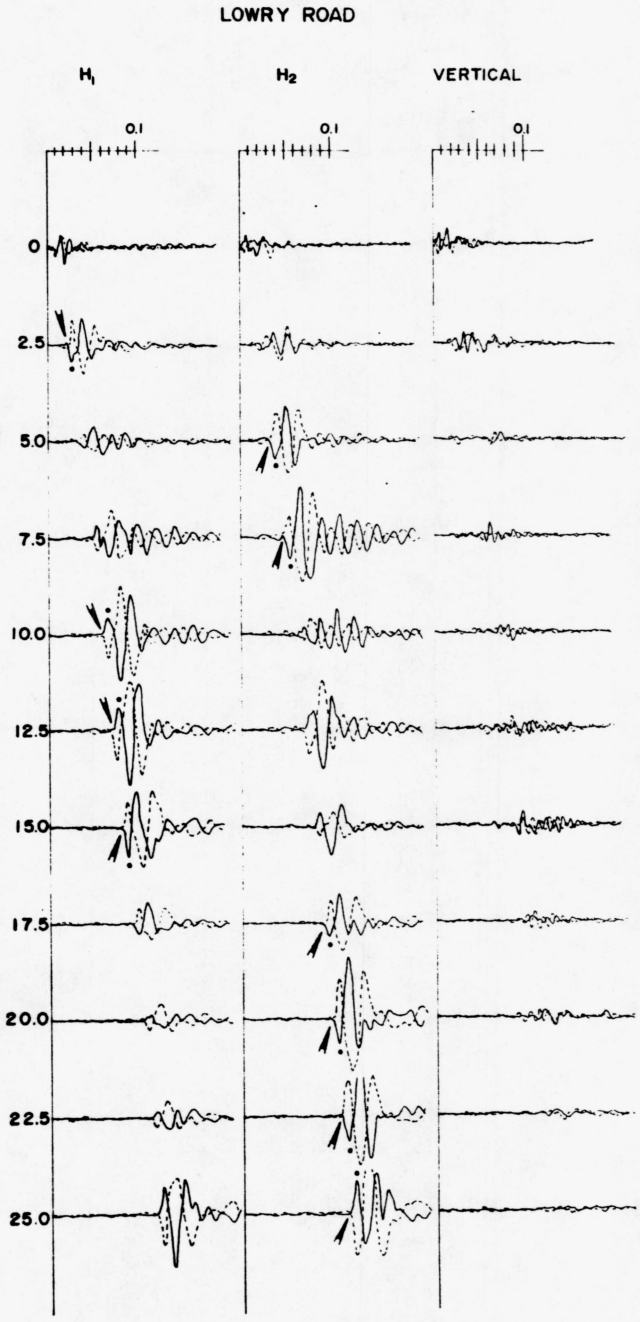

LOWRY ROAD
H1
H2
VERTICAL
0.1
0.1
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0

Fig. 46

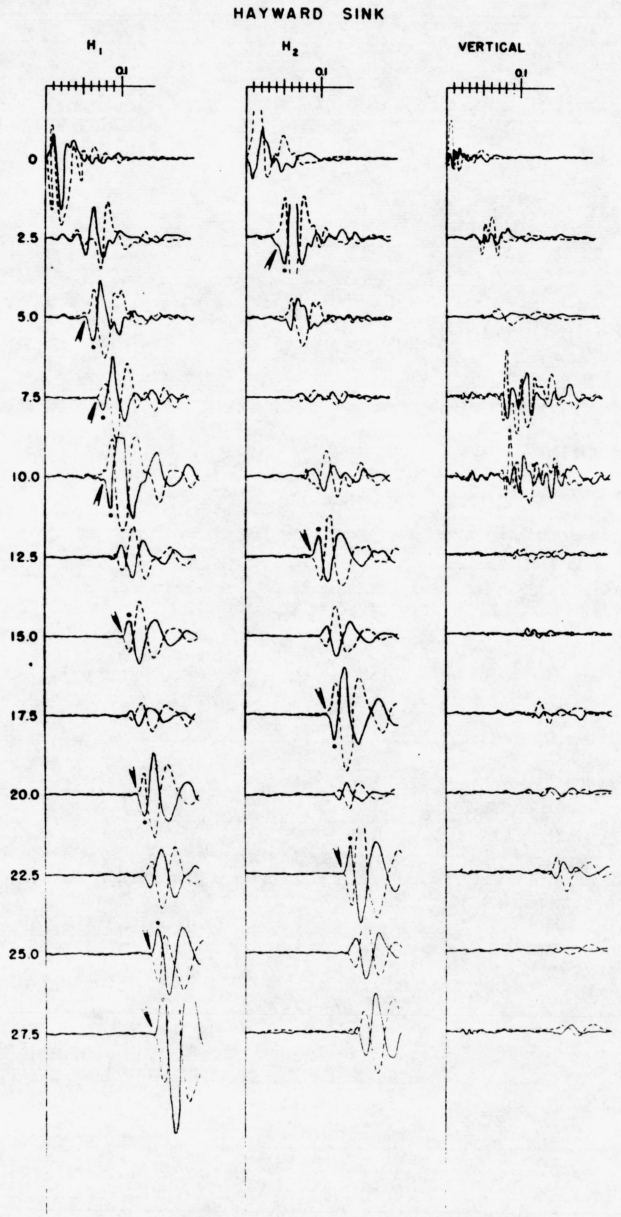

HAYWARD SINK
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5

Fig. 47

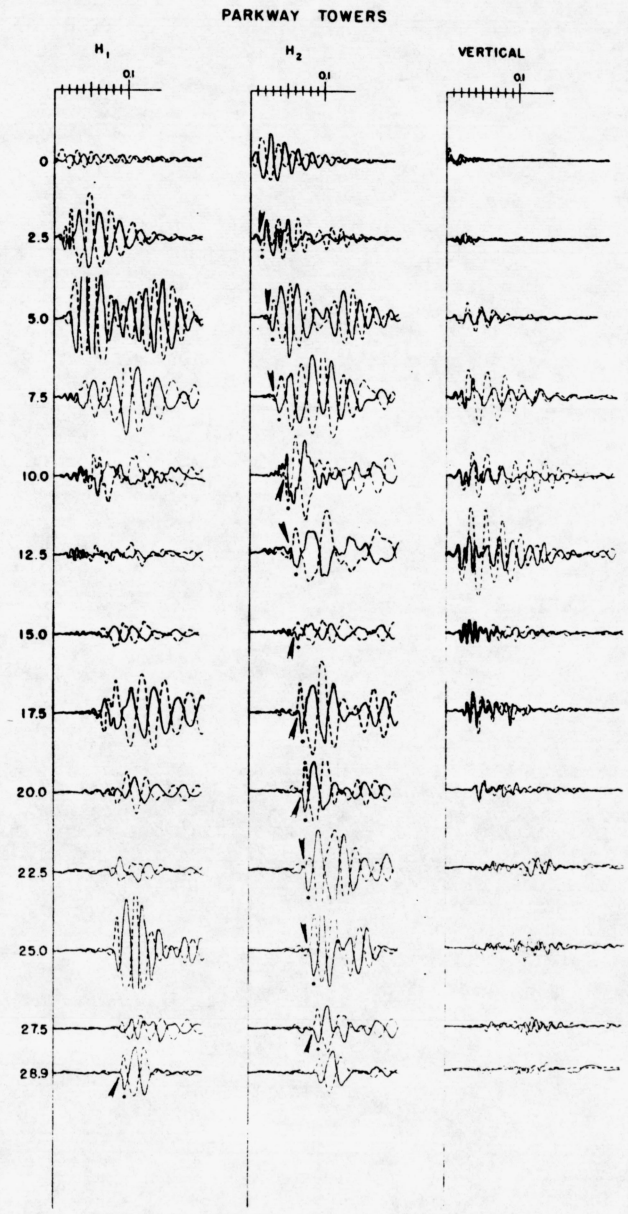

PARKWAY TOWERS
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
28.9

Fig. 48

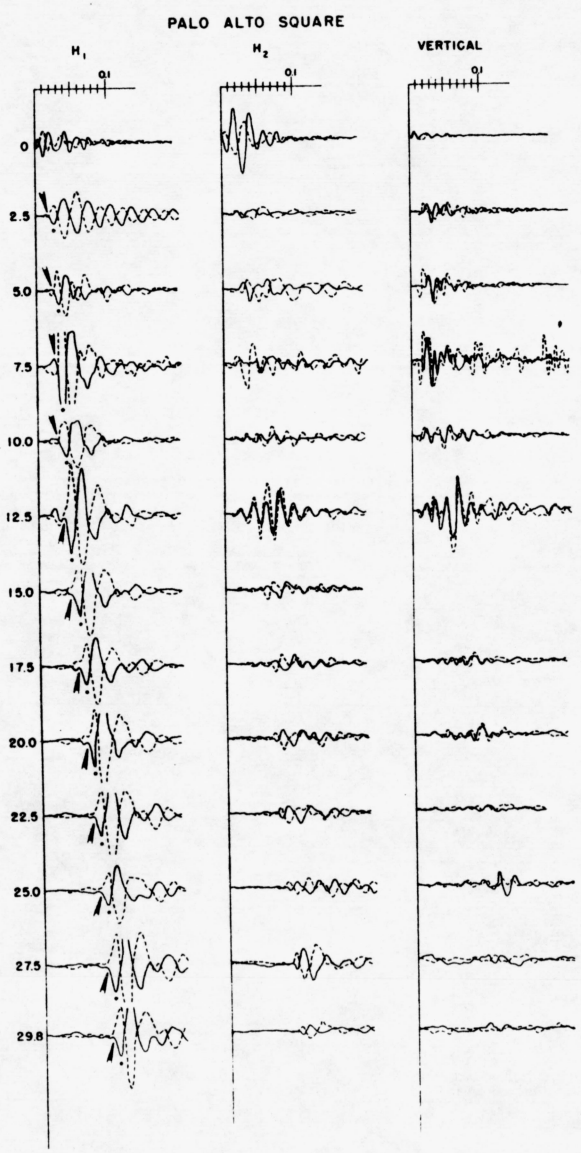

PALO ALTO SQUARE
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.8

Fig. 49

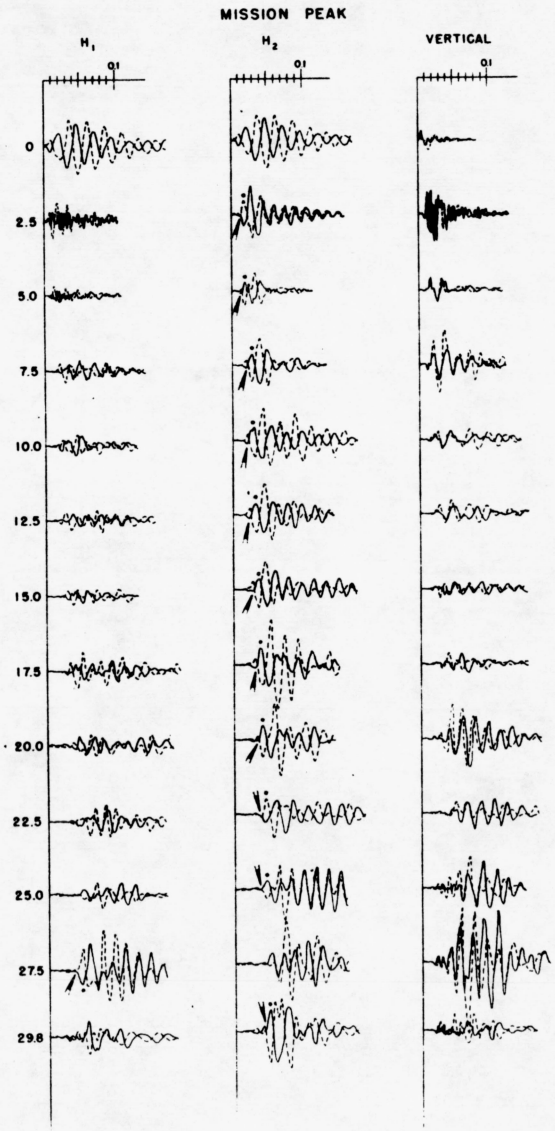

MISSION PEAK
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.8

Fig. 50

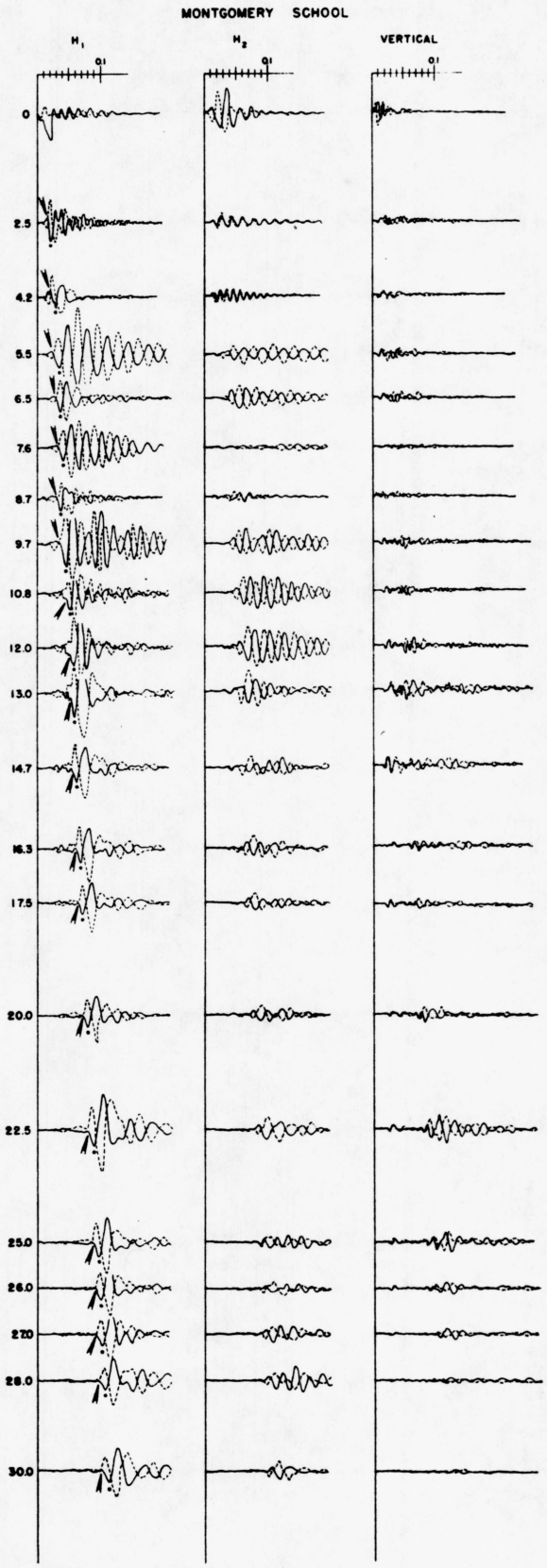

MONTGOMERY SCHOOL
H1
H2
VERTICAL
0.1
0
2.5
4.2
5.5
6.5
7.6
8.7
9.7
10.8
12.0
13.0
14.7
16.3
17.5
20.0
22.5
25.0
26.0
27.0
28.0
30.0

Fig. 51

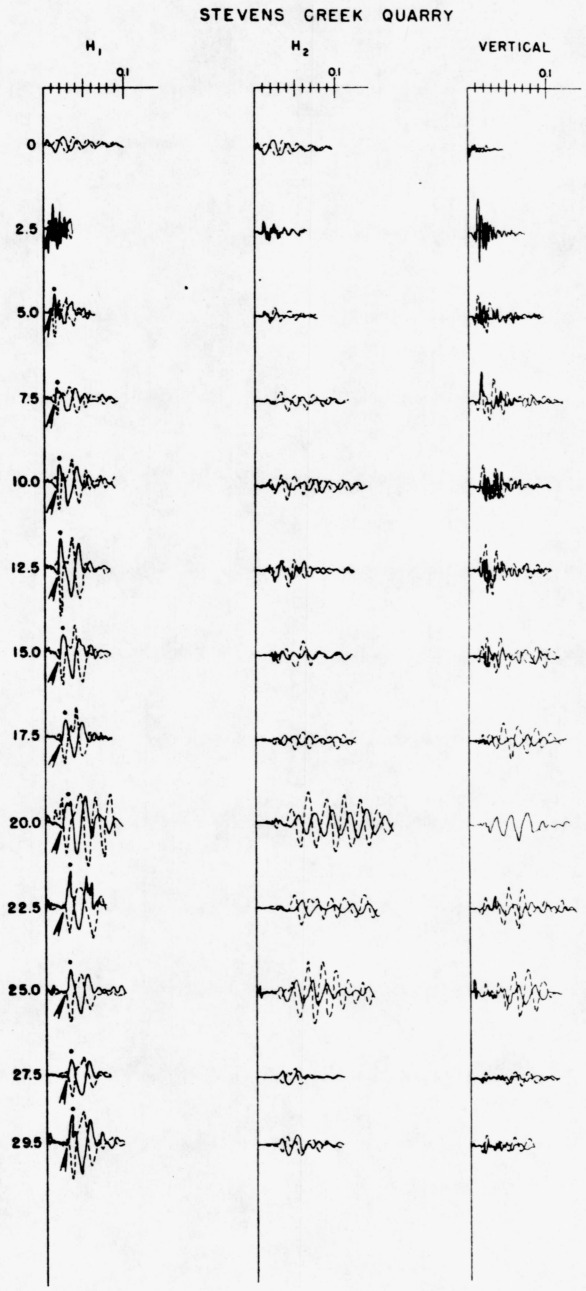

STEVENS CREEK QUARRY
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.5

Fig. 52

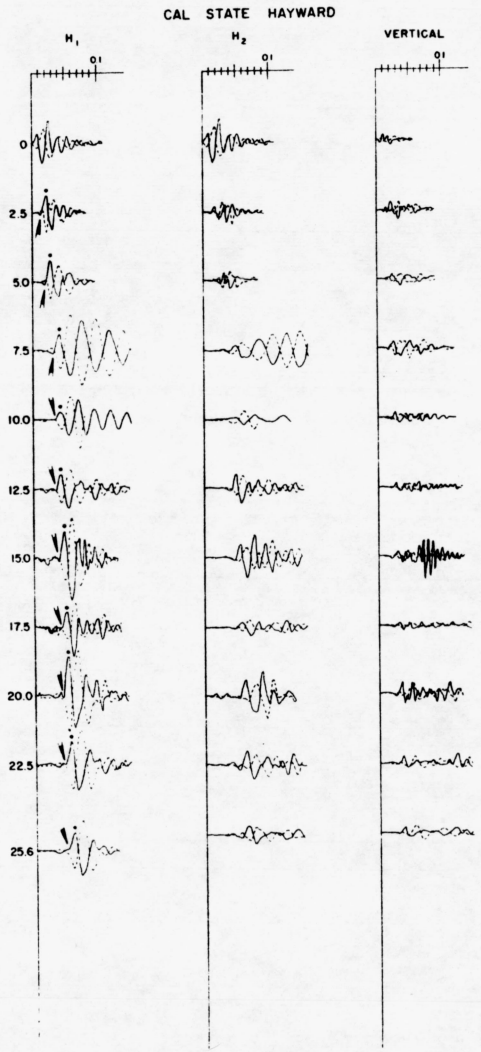

CAL STATE HAYWARD
H1
H2
VERTICAL
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.6

Fig. 53

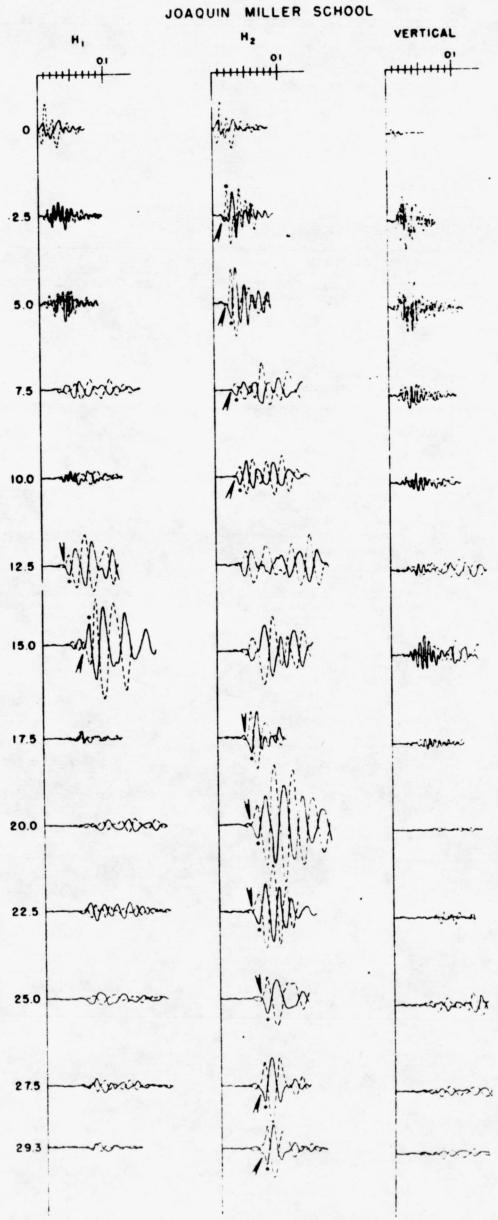

JOAQUIN MILLER SCHOOL
H1
H2
VERTICAL
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.3

Fig. 54

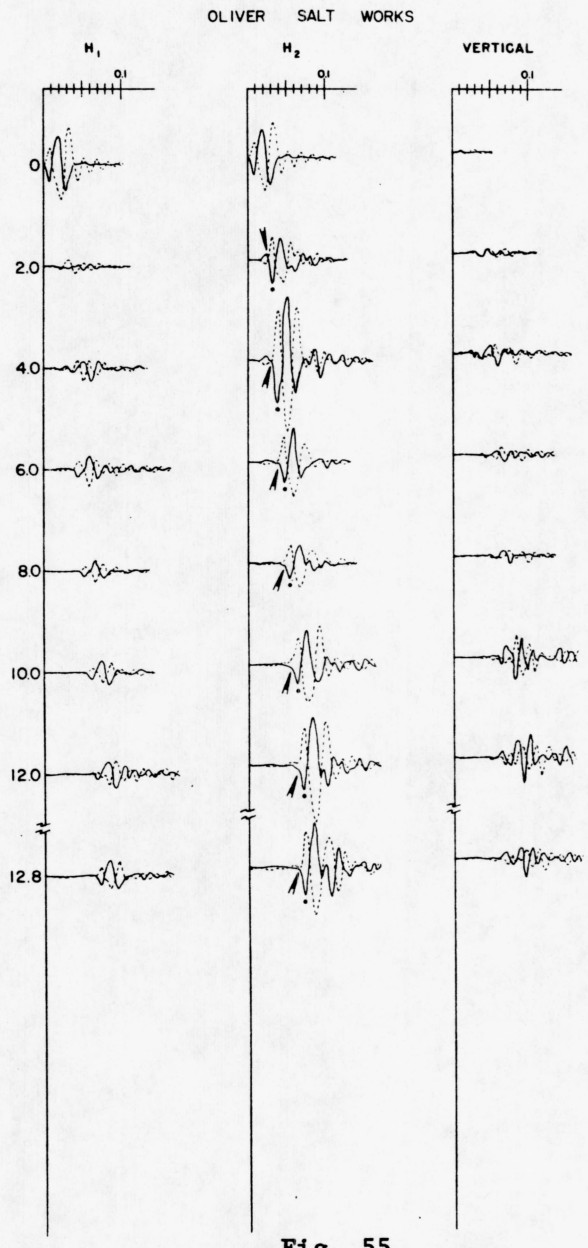

OLIVER SALT WORKS
H1
H2
VERTICAL
0.1
0
2.0
4.0
6.0
8.0
10.0
12.0
12.8

Fig. 55

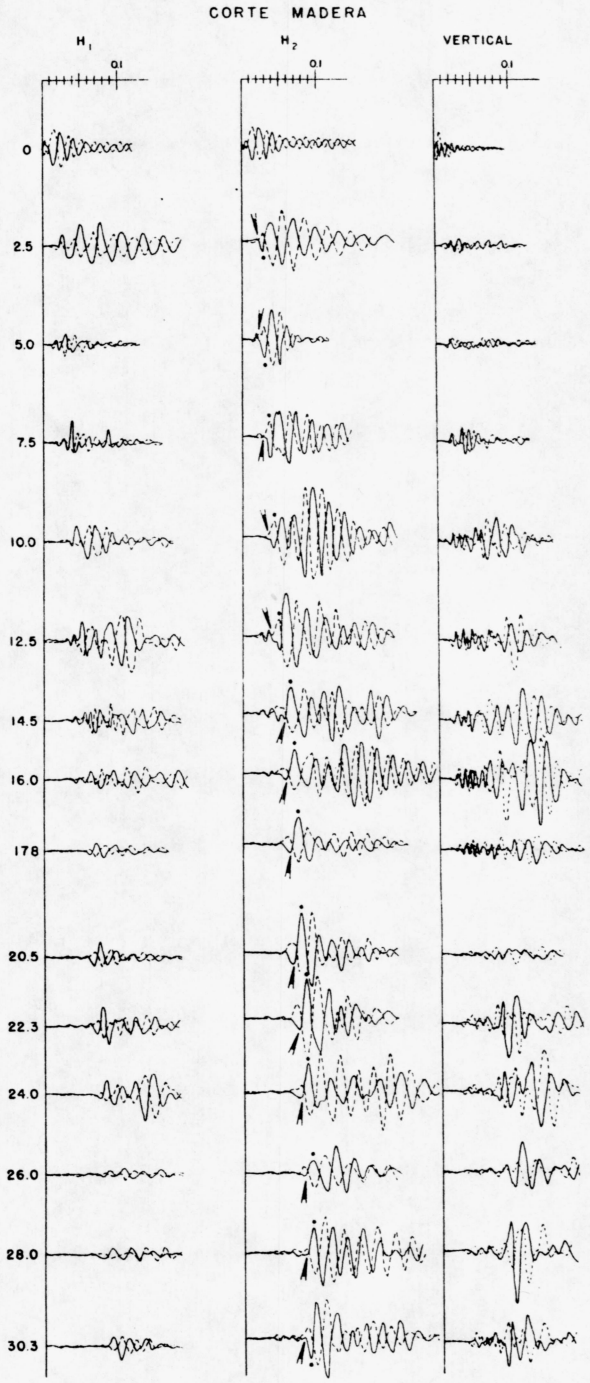

CORTE MADERA
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
14.5
16.0
17.8
20.5
22.3
24.0
26.0
28.0
30.3

Fig. 56

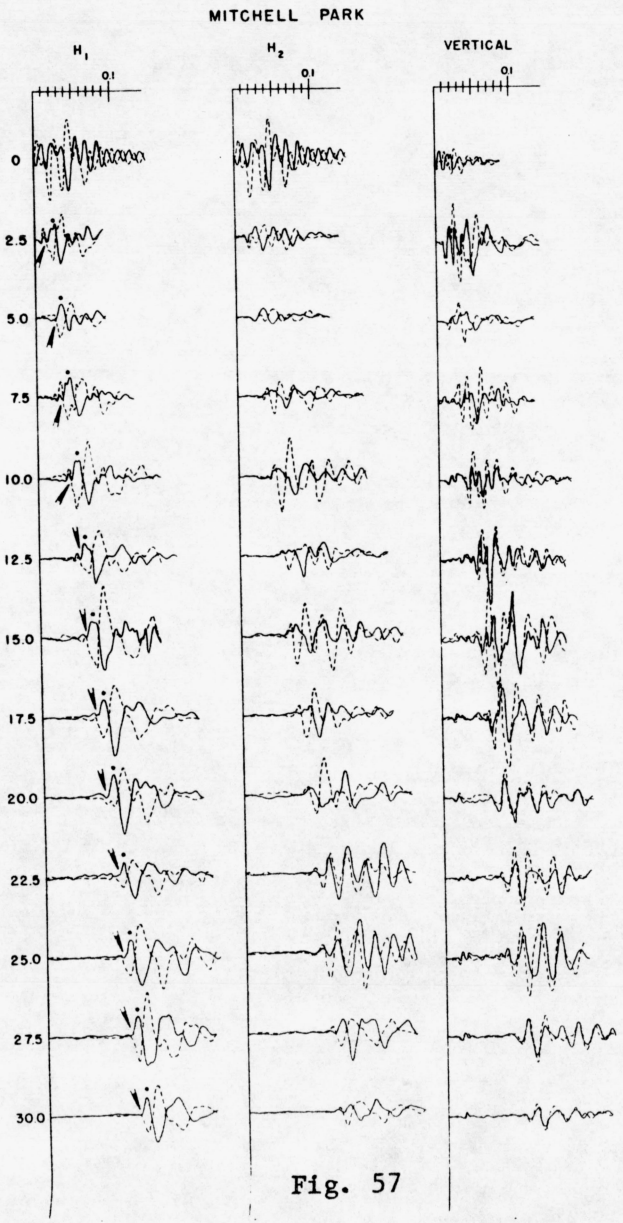

MITCHELL PARK
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0

Fig. 57

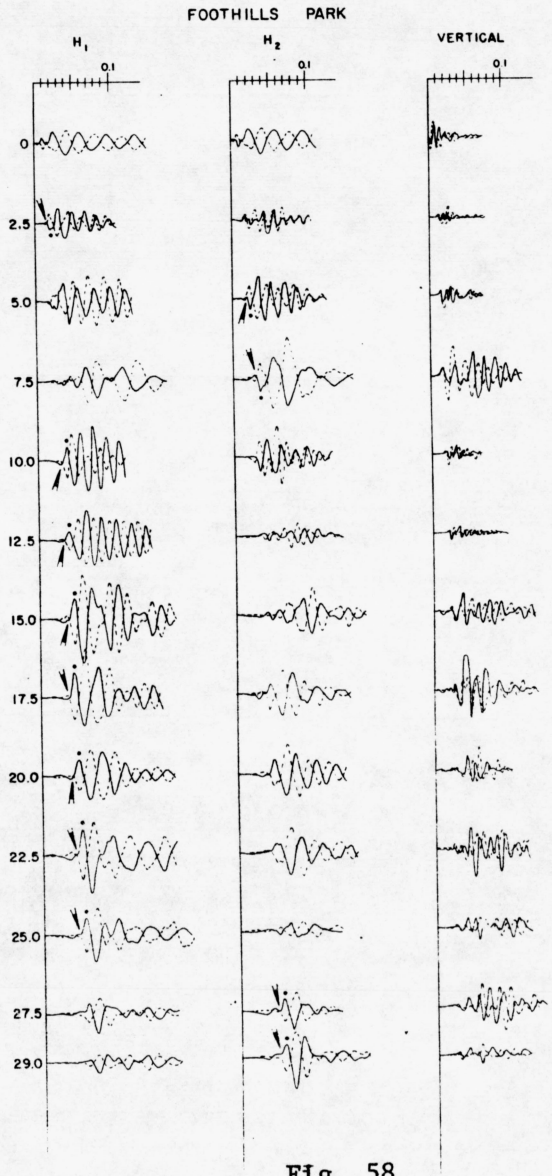

FOOTHILLS PARK
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.0

Fig. 58

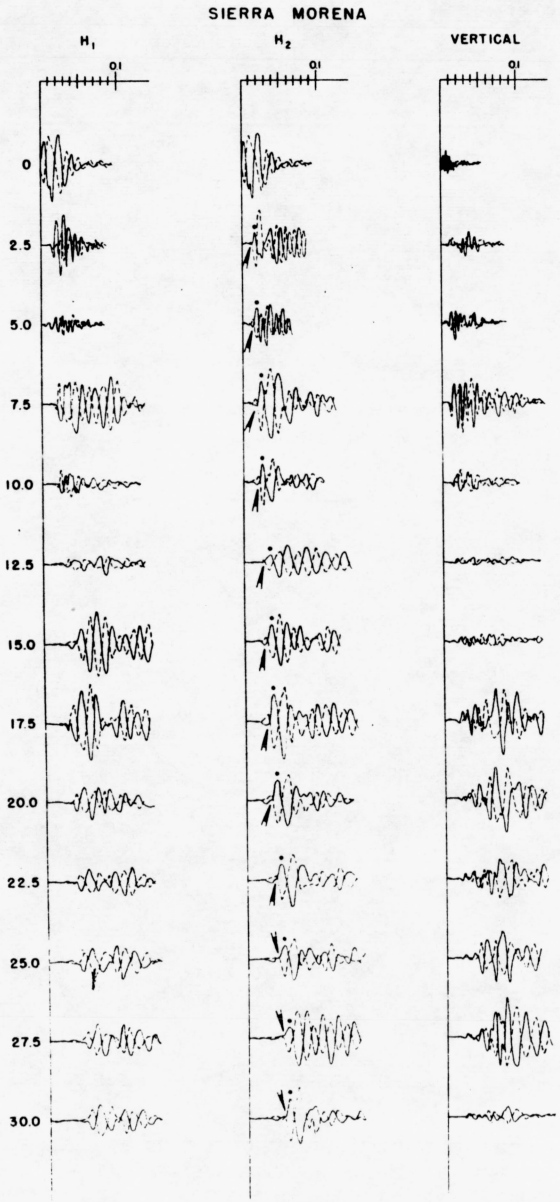

SIERRA MORENA
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0

Fig. 59

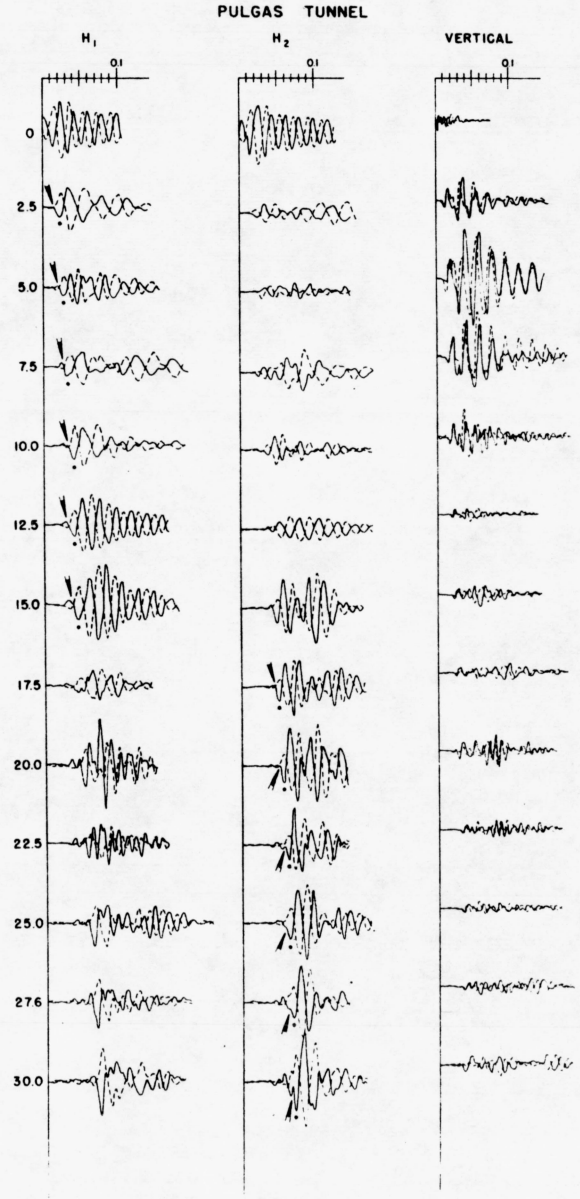

PULGAS TUNNEL
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.6
30.0

Fig. 60

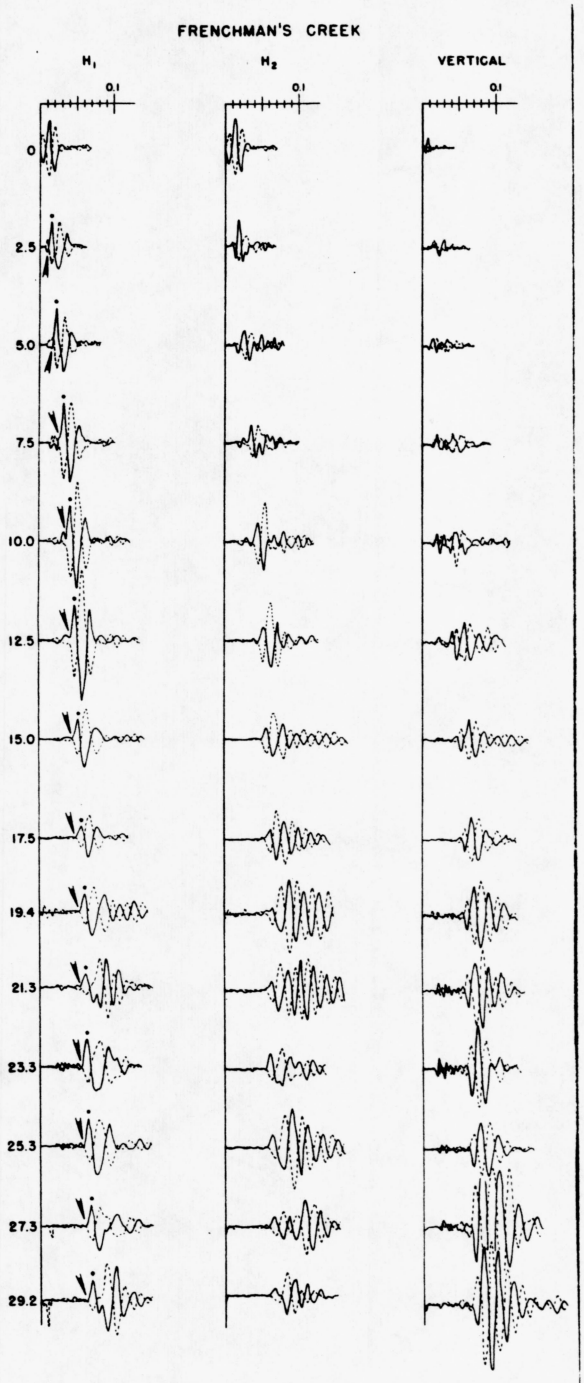

FRENCHMAN'S CREEK
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
19.4
21.3
23.3
25.3
27.3
29.2

Fig. 61

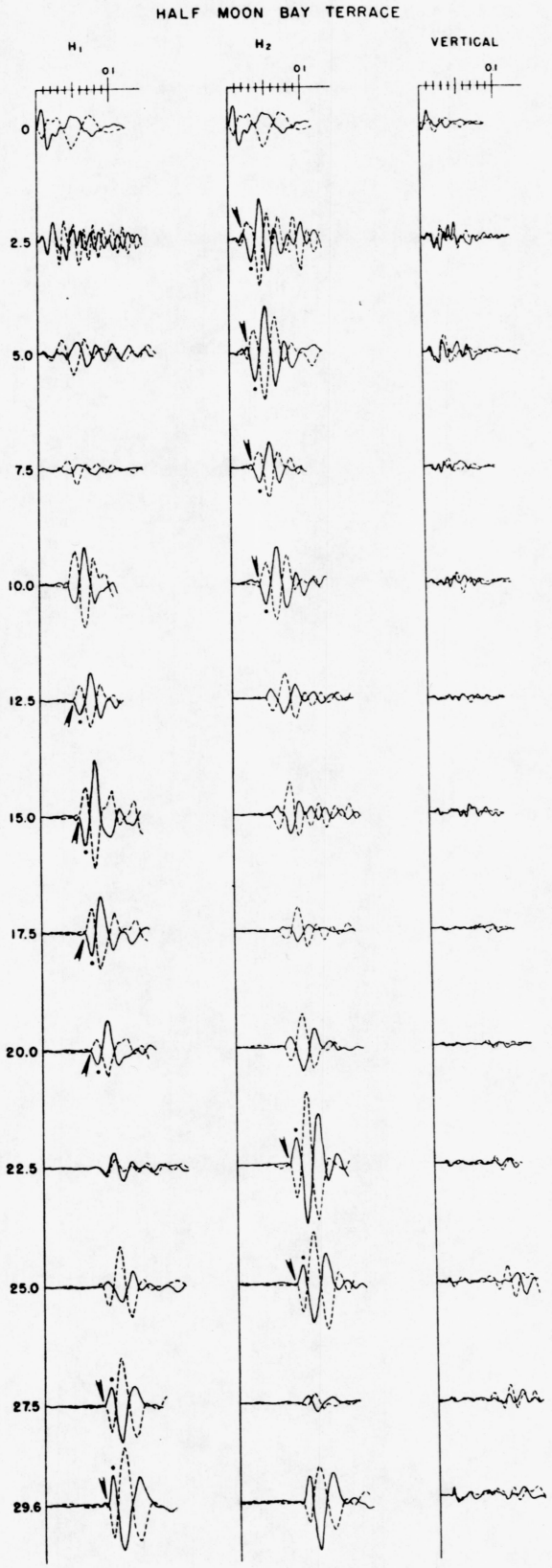

HALF MOON BAY TERRACE
H1
H2
VERTICAL
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.6

Fig. 62

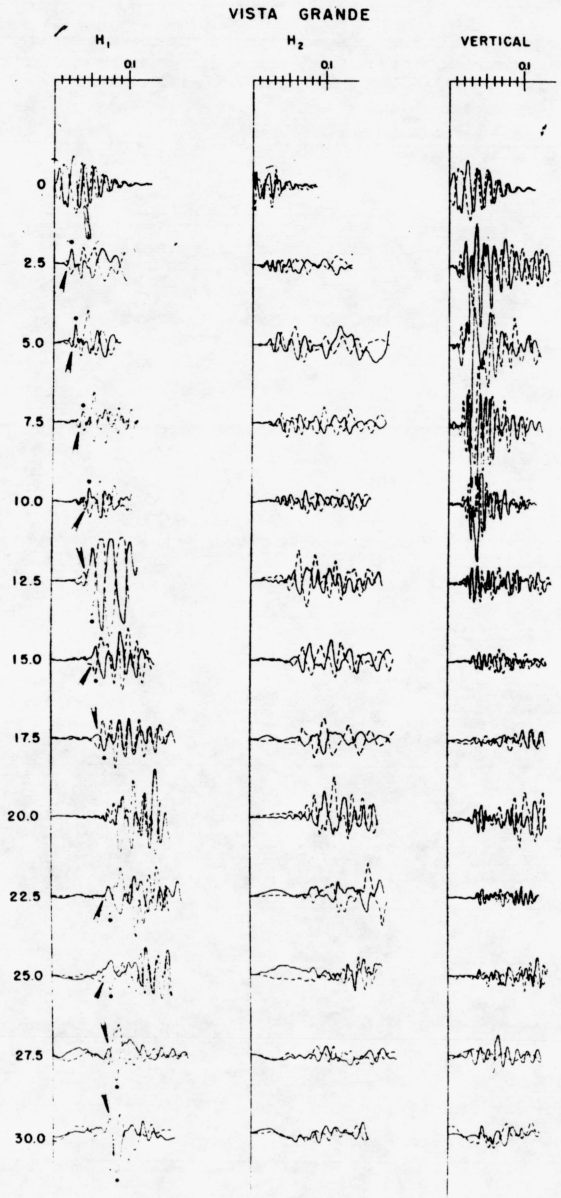

VISTA GRANDE
H1
H2
VERTICAL
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0

Fig. 63

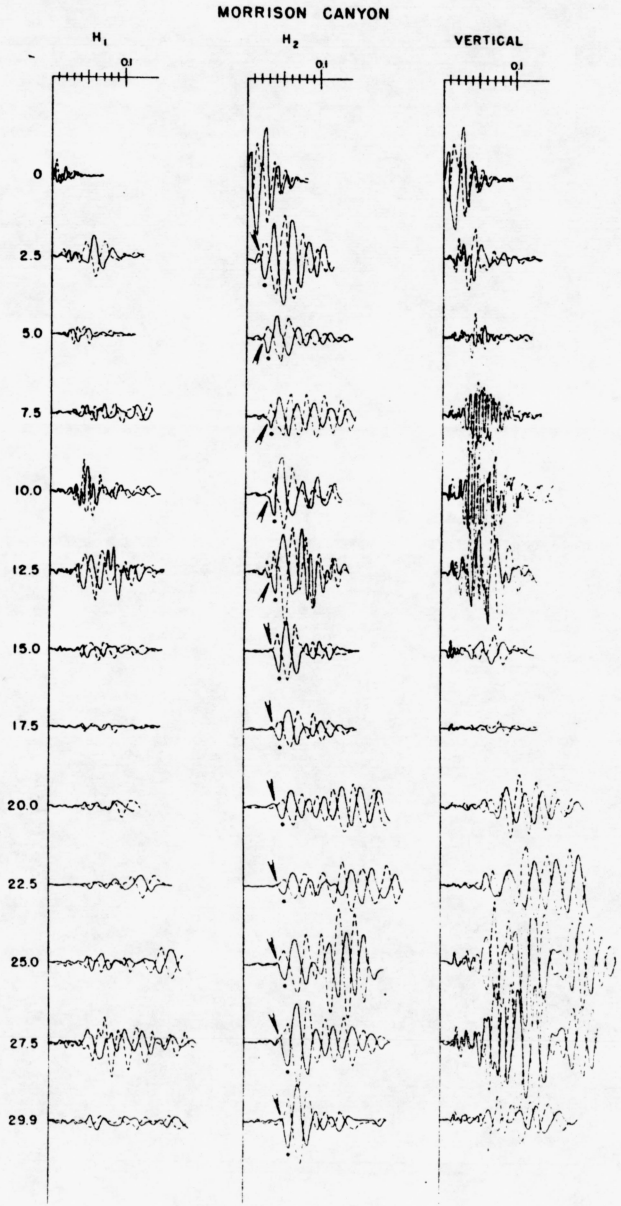

MORRISON CANYON
H1
H2
VERTICAL
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.9

Fig. 64

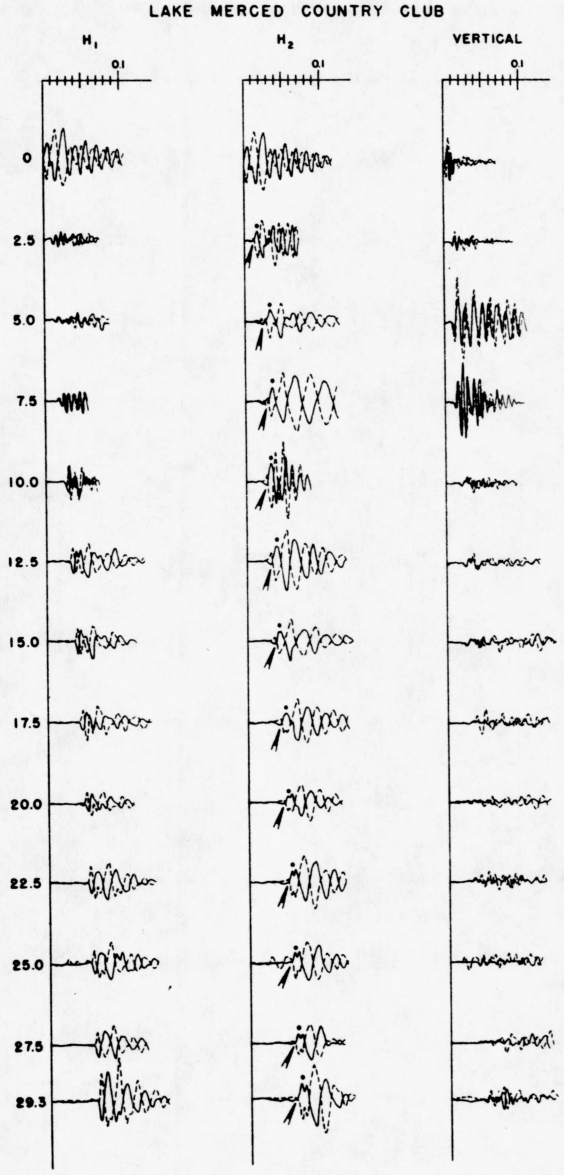

LAKE MERCED COUNTRY CLUB
H1
H2
VERTICAL
0.1
0.1
0.1
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
29.3

Fig. 65

TABLE 1

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 13 ALVISO RACEWAY DATE LOGGED 7-2-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.018	0.014	180
5.0	0.003	0.028	0.026	194
7.5	0.002	0.036	0.035	217
10.0	0.002	0.052	0.051	197
12.5	0.002	0.065	0.064	195
15.0	0.002	0.074	0.073	205
17.5	0.003	0.085	0.084	207
20.0	0.002	0.092	0.091	219
22.5	0.002	0.101	0.100	224
25.0	0.002	0.111	0.110	226
27.5	0.002	0.119	0.118	232
29.7	0.003	0.127	0.126	234

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.023	0.018	0.007	0.005	457
5.0	0.032	0.029	0.007	0.006	759
7.5	0.041	0.039	0.009	0.009	852
10.0	0.058	0.057	0.010	0.010	1020
12.5	0.069	0.068	0.012	0.012	1050
15.0	0.080	0.079	0.013	0.013	1160
17.5	0.092	0.091	0.014	0.014	1250
20.0	0.099	0.098	0.015	0.015	1340
22.5	0.108	0.107	0.016	0.016	1410
25.0	0.117	0.116	0.017	0.017	1480
27.5	0.125	0.124	0.019	0.019	1450
29.7	0.133	0.132	0.021	0.021	1420

(M) = metres

(S) = seconds

CORR = corrected

(M/S) = metres per second

AVE VEL = average velocity

TABLE 2

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 14 BLACKBERRY FARM DATE LOGGED 7-7-75
PLANK DIST= 1.8 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.003

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.003	0.017	0.014	181
5.0	0.003	0.021	0.020	253
7.5	0.003	0.024	0.023	321
10.0	0.003	0.030	0.030	338
12.5	0.003	0.036	0.036	350
15.0	0.003	0.042	0.042	359
17.5	0.003	0.049	0.049	359
20.0	0.003	0.052	0.052	386
22.5	0.003	0.056	0.056	403
25.0	0.003	0.059	0.059	424

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.022	0.018	0.012	0.009	266
5.0	0.028	0.026	0.014	0.013	384
7.5	0.031	0.030	0.014	0.014	554
10.0	0.038	0.037	0.016	0.016	637
12.5	0.044	0.044	0.018	0.018	703
15.0	0.050	0.050	0.019	0.019	796
17.5	0.055	0.055	0.021	0.021	838
20.0	0.058	0.058	0.022	0.022	913
22.5	0.062	0.062	0.023	0.023	982
25.0	0.065	0.065	0.024	0.024	1040

TABLE 3

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 15 JOHN MUIR SCHOOL DATE LOGGED 7-8-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.015	0.012	213
5.0	0.004	0.024	0.022	224
7.5	0.004	0.034	0.033	228
10.0	0.004	0.044	0.043	231
12.5	0.004	0.048	0.047	253
15.0	0.004	0.057	0.056	265
17.5	0.004	0.066	0.066	256
19.9	0.004	0.073	0.073	273
22.5	0.004	0.084	0.084	258
25.0	0.004	0.093	0.093	269
27.6	0.004	0.102	0.102	271
29.4	0.004	0.105	0.106	277

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.021	0.016	0.010	0.008	320
5.0	0.030	0.028	0.014	0.013	384
7.5	0.044	0.043	0.017	0.016	456
10.0	0.049	0.048	0.019	0.019	536
12.5	0.055	0.054	0.022	0.022	575
15.0	0.064	0.063	0.024	0.024	530
17.5	0.072	0.072	0.026	0.026	677
19.9	0.081	0.081	0.029	0.029	539
22.5	0.091	0.091	0.031	0.031	728
25.0	0.100	0.100	0.033	0.033	759
27.6	0.109	0.109	0.034	0.034	813
29.4	0.113	0.113	0.035	0.035	841

TABLE 4

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 16 LOWRY ROAD DATE LOGGED 7-9-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.022	0.017	145
5.0	0.002	0.035	0.032	153
7.5	0.002	0.049	0.047	158
10.0	0.002	0.061	0.060	167
12.5	0.002	0.070	0.069	180
15.0	0.002	0.081	0.080	186
17.5	0.002	0.091	0.090	193
20.0	0.002	0.100	0.100	200
22.5	0.002	0.110	0.110	205
25.0	0.002	0.118	0.118	212

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.027	0.021	0.012	0.009	256
5.0	0.040	0.037	0.017	0.016	316
7.5	0.054	0.052	0.019	0.018	408
10.0	0.066	0.065	0.020	0.020	509
12.5	0.076	0.075	0.022	0.022	575
15.0	0.087	0.086	0.023	0.023	557
17.5	0.098	0.097	0.025	0.025	704
20.0	0.107	0.106	0.026	0.026	773
22.5	0.117	0.117	0.027	0.027	835
25.0	0.125	0.125	0.028	0.028	895

TABLE 5

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 17 HAYWARD SINK DATE LOGGED 7-28-75
PLANK DIST= 2.0 PLATE DIST= 2.2 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.044	0.034	72
5.0	0.003	0.053	0.049	101
7.5	0.004	0.067	0.065	115
10.0	0.004	0.078	0.077	130
12.5	0.004	0.090	0.089	140
15.0	0.004	0.102	0.101	148
17.5	0.004	0.110	0.109	159
20.0	0.004	0.120	0.119	167
22.5	0.004	0.130	0.130	173
25.0	0.004	0.138	0.138	181
27.5	0.004	0.145	0.145	190

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.052	0.041	0.012	0.009	277
5.0	0.061	0.057	0.012	0.011	455
7.5	0.075	0.073	0.013	0.012	501
10.0	0.087	0.085	0.014	0.014	731
12.5	0.099	0.098	0.015	0.015	846
15.0	0.111	0.110	0.017	0.017	891
17.5	0.119	0.118	0.018	0.018	979
20.0	0.130	0.129	0.019	0.019	1060
22.5	0.139	0.139	0.021	0.021	1080
25.0	0.148	0.148	0.022	0.022	1140
27.5	0.156	0.156	0.023	0.023	1200

TABLE 6

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 18 PARKWAY TOWERS DATE LOGGED 7-29-75
PLANK DIST= 2.0 PLATE DIST= 2.4 AVE ORIGIN CORR= 0.007

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.007	0.014	0.011	228
5.0	0.007	0.025	0.023	215
7.5	0.007	0.034	0.033	228
10.0	0.007	0.044	0.043	231
12.5	0.007	0.055	0.054	230
15.0	0.007	0.061	0.060	248
17.5	0.007	0.065	0.065	270
20.0	0.007	0.071	0.071	233
22.5	0.007	0.077	0.077	293
25.0	0.007	0.083	0.083	302
27.5	0.007	0.090	0.090	306
28.9	0.007	0.093	0.093	311

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.025	0.020	0.012	0.009	288
5.0	0.034	0.032	0.013	0.012	426
7.5	0.041	0.040	0.016	0.015	492
10.0	0.049	0.048	0.018	0.018	571
12.5	0.062	0.061	0.020	0.020	536
15.0	0.066	0.065	0.023	0.023	660
17.5	0.070	0.070	0.025	0.025	706
20.0	0.076	0.076	0.029	0.029	594
22.5	0.083	0.083	0.044	0.044	514
25.0	0.089	0.089	0.046	0.046	545
27.5	0.095	0.095	0.047	0.047	587
28.9	0.098	0.098	0.048	0.048	604

TABLE 7

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 19 PALO ALTO SQUARE DATE LOGGED 8-1-75
PLANK DIST= 2.0 PLATE DIST= 2.1 AVE ORIGIN CORR= 0.010

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.010	0.015	0.012	214
5.0	0.010	0.019	0.018	284
7.5	0.011	0.026	0.025	299
10.0	0.010	0.033	0.032	309
12.5	0.010	0.043	0.042	294
15.0	0.010	0.049	0.048	309
17.5	0.010	0.060	0.060	293
20.0	0.010	0.070	0.070	287
22.5	0.010	0.078	0.078	289
25.0	0.010	0.087	0.087	288
27.5	0.010	0.093	0.093	296
29.8	0.010	0.101	0.101	295

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.025	0.019	0.011	0.008	296
5.0	0.028	0.026	0.013	0.012	417
7.5	0.035	0.034	0.016	0.015	486
10.0	0.043	0.042	0.018	0.018	567
12.5	0.051	0.050	0.020	0.020	633
15.0	0.060	0.059	0.022	0.022	688
17.5	0.069	0.068	0.025	0.025	705
20.0	0.079	0.079	0.026	0.026	773
22.5	0.087	0.087	0.027	0.027	836
25.0	0.096	0.096	0.029	0.029	855
27.5	0.103	0.103	0.030	0.030	919
29.8	0.110	0.110	0.031	0.031	953

TABLE 8

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 20 MISSION PEAK DATE LOGGED 8-5-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.012	0.009	268
5.0	0.002	0.014	0.013	386
7.5	0.002	0.015	0.014	520
10.0	0.002	0.019	0.019	539
12.5	0.002	0.023	0.023	552
15.0	0.002	0.027	0.027	562
17.5	0.002	0.030	0.030	588
20.0	0.003	0.034	0.034	592
22.5	0.002	0.036	0.036	628
25.0	0.002	0.037	0.037	679
27.5	0.002	0.039	0.039	708
29.8	0.002	0.041	0.041	729

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.017	0.013	0.009	0.007	355
5.0	0.018	0.017	0.010	0.009	538
7.5	0.019	0.018	0.012	0.012	646
10.0	0.026	0.025	0.012	0.012	849
12.5	0.030	0.030	0.013	0.013	973
15.0	0.034	0.034	0.014	0.014	1080
17.5	0.036	0.036	0.015	0.015	1170
20.0	0.040	0.040	0.016	0.016	1260
22.5	0.042	0.042	0.017	0.017	1330
25.0	0.045	0.045	0.018	0.018	1390
27.5	0.047	0.047	0.018	0.018	1530
29.8	0.049	0.049	0.019	0.019	1570

TABLE 9

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 21 MONTGOMERY SCHOOL DATE LOGGED 8-6-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.017	0.013	135
4.2	0.003	0.020	0.018	230
5.5	0.004	0.026	0.025	223
6.5	0.004	0.028	0.027	241
7.6	0.004	0.032	0.031	244
8.7	0.004	0.035	0.034	253
9.7	0.004	0.041	0.040	240
10.8	0.004	0.046	0.045	237
12.0	0.004	0.051	0.050	237
13.0	0.004	0.052	0.052	252
14.7	0.005	0.057	0.057	259
16.3	0.004	0.062	0.062	264
17.5	0.004	0.065	0.065	270
20.0	0.004	0.073	0.073	274
22.5	0.004	0.081	0.081	278
25.0	0.004	0.088	0.088	284
26.0	0.003	0.091	0.091	286
27.0	0.004	0.093	0.093	290
28.0	0.003	0.096	0.096	291
30.0	0.003	0.100	0.100	300

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.023	0.018	0.011	0.009	291
4.2	0.025	0.023	0.012	0.011	387
5.5	0.036	0.034	0.013	0.012	450
6.5	0.037	0.036	0.014	0.013	485
7.6	0.041	0.040	0.015	0.015	523
8.7	0.042	0.041	0.016	0.016	557
9.7	0.048	0.047	0.018	0.018	550
10.8	0.052	0.051	0.019	0.019	578
12.0	0.057	0.056	0.020	0.020	608
13.0	0.058	0.057	0.020	0.020	657
14.7	0.063	0.063	0.022	0.022	674
16.3	0.068	0.068	0.023	0.023	714
17.5	0.071	0.071	0.025	0.025	704
20.0	0.080	0.080	0.027	0.027	744
22.5	0.088	0.088	0.028	0.028	806
25.0	0.095	0.095	0.029	0.029	854
26.0	0.098	0.098	0.030	0.030	869
27.0	0.100	0.100	0.030	0.030	902
28.0	0.103	0.103	0.031	0.031	905
30.0	0.107	0.107	0.032	0.032	939

TABLE 10

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 22 STEVENS CREEK QUARRY DATE LOGGED 8-7-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.006	0.005	533
5.0	0.002	0.008	0.007	673
7.5	0.002	0.011	0.011	705
10.0	0.002	0.013	0.013	784
12.5	0.002	0.015	0.015	843
15.0	0.002	0.017	0.017	890
17.5	0.002	0.019	0.019	927
20.0	0.002	0.022	0.022	913
22.5	0.002	0.025	0.025	903
25.0	0.002	0.026	0.026	954
27.5	0.002	0.029	0.029	950
29.5	0.002	0.030	0.030	985

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.010	0.008	0.005	0.004	640
5.0	0.012	0.011	0.006	0.006	897
7.5	0.015	0.014	0.006	0.006	1290
10.0	0.018	0.018	0.007	0.007	1450
12.5	0.020	0.020	0.008	0.008	1580
15.0	0.022	0.022	0.009	0.009	1680
17.5	0.025	0.025	0.009	0.009	1950
20.0	0.027	0.027	0.010	0.010	2010
22.5	0.030	0.030	0.011	0.011	2050
25.0	0.031	0.031	0.012	0.012	2090
27.5	0.034	0.034	0.013	0.013	2120
29.5	0.035	0.035	0.013	0.013	2270

TABLE 11

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 23 CAL STATE HAYWARD DATE LOGGED 8-19-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.018	0.014	177
5.0	0.004	0.021	0.019	256
7.5	0.004	0.031	0.030	250
10.0	0.004	0.034	0.033	299
12.5	0.004	0.035	0.035	361
15.0	0.004	0.040	0.040	378
17.5	0.004	0.044	0.044	400
20.0	0.004	0.045	0.045	446
22.5	0.004	0.048	0.048	470
25.6	0.004	0.052	0.052	493

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.021	0.016	0.010	0.008	320
5.0	0.026	0.024	0.013	0.012	414
7.5	0.039	0.038	0.015	0.014	517
10.0	0.041	0.040	0.017	0.017	599
12.5	0.042	0.041	0.019	0.019	555
15.0	0.046	0.046	0.020	0.020	756
17.5	0.050	0.050	0.023	0.023	755
20.0	0.052	0.052	0.024	0.024	837
22.5	0.056	0.056	0.026	0.026	858
25.6	0.059	0.059	0.028	0.028	917

TABLE 12

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 24 MILLER SCHOOL DATE LOGGED 8-20-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.015	0.012	214
5.0	0.004	0.020	0.018	270
7.5	0.005	0.025	0.024	311
10.0	0.005	0.031	0.030	329
12.5	0.004	0.034	0.033	373
15.0	0.004	0.040	0.040	379
17.5	0.004	0.045	0.045	392
20.0	0.004	0.051	0.051	394
22.5	0.004	0.053	0.053	426
25.0	0.004	0.060	0.060	418
27.5	0.004	0.061	0.061	452
29.3	0.003	0.065	0.065	452

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.020	0.016	0.009	0.007	355
5.0	0.025	0.023	0.011	0.010	489
7.5	0.032	0.031	0.014	0.014	554
10.0	0.038	0.037	0.015	0.015	579
12.5	0.042	0.041	0.018	0.018	703
15.0	0.048	0.047	0.019	0.019	735
17.5	0.050	0.050	0.025	0.025	704
20.0	0.058	0.058	0.028	0.028	717
22.5	0.060	0.060	0.031	0.031	729
25.0	0.072	0.072	0.034	0.034	737
27.5	0.067	0.067	0.036	0.036	755
29.3	0.070	0.070	0.038	0.038	772

TABLE 13

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 25 OLIVER SALT WORKS DATE LOGGED 8-21-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.003

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.0	0.003	0.022	0.016	128
4.0	0.003	0.031	0.028	144
6.0	0.003	0.039	0.037	162
8.0	0.003	0.048	0.047	171
10.0	0.003	0.057	0.056	178
12.0	0.003	0.065	0.064	187
12.8	0.003	0.067	0.066	193

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.0	0.030	0.021	0.009	0.006	314
4.0	0.038	0.034	0.011	0.010	406
6.0	0.046	0.044	0.013	0.012	486
8.0	0.054	0.052	0.014	0.014	589
10.0	0.064	0.063	0.015	0.015	679
12.0	0.071	0.070	0.016	0.016	760
12.8	0.074	0.073	0.017	0.017	762

TABLE 14

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 26 CORTE MADERA DATE LOGGED 8-22-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.019	0.014	173
5.0	0.005	0.022	0.020	250
7.5	0.004	0.028	0.027	282
10.0	0.004	0.037	0.036	279
12.5	0.005	0.042	0.041	305
14.5	0.004	0.043	0.042	344
16.0	0.004	0.046	0.045	354
17.8	0.005	0.052	0.051	347
20.5	0.005	0.057	0.056	364
22.3	0.005	0.063	0.063	352
24.0	0.004	0.071	0.071	336
26.0	0.004	0.072	0.072	359
28.0	0.005	0.077	0.077	362
30.3	0.005	0.079	0.079	381

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.030	0.023	0.016	0.012	200
5.0	0.032	0.029	0.016	0.015	336
7.5	0.038	0.036	0.017	0.016	456
10.0	0.046	0.045	0.019	0.019	536
12.5	0.051	0.050	0.021	0.021	602
14.5	0.052	0.051	0.023	0.023	636
16.0	0.056	0.055	0.023	0.023	701
17.8	0.063	0.063	0.025	0.025	716
20.5	0.067	0.067	0.027	0.027	762
22.3	0.073	0.073	0.028	0.028	799
24.0	0.078	0.078	0.029	0.029	830
26.0	0.080	0.080	0.030	0.030	859
28.0	0.084	0.084	0.031	0.031	905
30.3	0.086	0.086	0.035	0.035	867

TABLE 15

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 27 MITCHELL PARK DATE LOGGED 8-25-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.018	0.014	177
5.0	0.002	0.027	0.025	199
7.5	0.002	0.036	0.035	215
10.0	0.002	0.045	0.044	226
12.5	0.002	0.055	0.054	230
15.0	0.002	0.062	0.061	244
17.5	0.002	0.074	0.074	238
20.0	0.002	0.085	0.085	236
22.5	0.002	0.096	0.096	235
25.0	0.002	0.104	0.104	241
27.5	0.002	0.112	0.112	246
30.0	0.002	0.121	0.121	248

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.028	0.022	0.009	0.007	355
5.0	0.036	0.033	0.010	0.009	538
7.5	0.046	0.044	0.011	0.011	705
10.0	0.055	0.054	0.013	0.013	784
12.5	0.067	0.066	0.014	0.014	904
15.0	0.074	0.073	0.016	0.016	945
17.5	0.084	0.083	0.017	0.017	1040
20.0	0.094	0.094	0.019	0.019	1060
22.5	0.105	0.105	0.020	0.020	1130
25.0	0.113	0.113	0.022	0.022	1140
27.5	0.121	0.121	0.023	0.023	1200
30.0	0.130	0.130	0.025	0.025	1200

TABLE 16

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 28 FOOTHILLS PARK DATE LOGGED 8-26-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.012	0.010	263
4.9	0.001	0.017	0.016	308
7.5	0.002	0.024	0.023	321
10.0	0.002	0.028	0.028	362
12.5	0.002	0.032	0.032	393
15.0	0.002	0.035	0.035	430
17.5	0.002	0.038	0.038	461
20.0	0.002	0.041	0.041	488
22.5	0.002	0.044	0.044	511
25.0	0.002	0.048	0.048	520
27.5	0.001	0.051	0.051	538
29.0	0.002	0.052	0.052	557

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.016	0.013	0.010	0.008	320
4.9	0.022	0.021	0.011	0.010	481
7.5	0.028	0.027	0.015	0.014	517
10.0	0.037	0.036	0.018	0.018	566
12.5	0.039	0.039	0.020	0.020	632
15.0	0.045	0.045	0.022	0.022	687
17.5	0.043	0.043	0.022	0.022	800
20.0	0.047	0.047	0.023	0.023	873
22.5	0.050	0.050	0.024	0.024	941
25.0	0.054	0.054	0.025	0.025	1000
27.5	0.058	0.058	0.026	0.026	1060
29.0	0.060	0.060	0.027	0.027	1030

TABLE 17

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 29 SIERRA MORENA DATE LOGGED 8-27-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.013	0.010	246
5.0	0.002	0.015	0.014	359
7.5	0.002	0.020	0.019	388
10.0	0.002	0.022	0.022	463
12.5	0.002	0.029	0.029	436
15.0	0.002	0.030	0.030	504
17.5	0.002	0.032	0.032	550
20.0	0.002	0.034	0.034	591
22.5	0.002	0.038	0.038	594
25.0	0.002	0.041	0.041	611
27.5	0.002	0.047	0.047	586
30.0	0.002	0.049	0.049	513

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.018	0.014	0.008	0.006	400
5.0	0.020	0.019	0.009	0.008	598
7.5	0.025	0.024	0.011	0.011	705
10.0	0.027	0.026	0.013	0.013	784
12.5	0.035	0.035	0.015	0.015	843
15.0	0.038	0.038	0.016	0.016	945
17.5	0.039	0.039	0.017	0.017	1040
20.0	0.041	0.041	0.019	0.019	1060
22.5	0.045	0.045	0.020	0.020	1130
25.0	0.048	0.048	0.021	0.021	1190
27.5	0.054	0.054	0.022	0.022	1250
30.0	0.056	0.056	0.023	0.023	1310

TABLE 18

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 30 PULGAS TUNNEL DATE LOGGED 8-28-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.003	0.016	0.012	202
5.0	0.002	0.020	0.018	271
7.5	0.002	0.025	0.024	312
10.0	0.002	0.031	0.030	330
12.5	0.002	0.037	0.036	343
15.0	0.002	0.042	0.041	351
17.5	0.002	0.047	0.047	376
20.0	0.003	0.052	0.052	387
22.5	0.002	0.058	0.058	390
25.0	0.002	0.060	0.060	419
27.6	0.002	0.065	0.065	425
30.0	0.002	0.069	0.069	436

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.024	0.019	0.009	0.007	355
5.0	0.027	0.025	0.012	0.011	448
7.5	0.032	0.031	0.013	0.013	597
10.0	0.038	0.037	0.015	0.015	679
12.5	0.044	0.043	0.020	0.020	532
15.0	0.049	0.048	0.022	0.022	597
17.5	0.053	0.052	0.026	0.026	677
20.0	0.058	0.058	0.029	0.029	593
22.5	0.063	0.063	0.031	0.031	728
25.0	0.065	0.065	0.032	0.032	733
27.6	0.070	0.070	0.033	0.033	838
30.0	0.073	0.073	0.034	0.034	884

TABLE 19

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 31 FRENCHMANS CREEK DATE LOGGED 8-29-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.011	0.009	291
5.0	0.002	0.018	0.017	299
7.5	0.002	0.028	0.027	277
10.0	0.002	0.037	0.036	275
12.5	0.002	0.043	0.042	294
15.0	0.002	0.047	0.047	321
17.5	0.002	0.051	0.051	345
19.4	0.002	0.054	0.054	351
21.3	0.002	0.056	0.056	382
23.3	0.002	0.057	0.057	410
25.3	0.002	0.058	0.058	437
27.3	0.002	0.062	0.062	441
29.2	0.002	0.063	0.063	464

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.017	0.013	0.007	0.005	457
5.0	0.024	0.022	0.009	0.008	598
7.5	0.033	0.032	0.012	0.012	545
10.0	0.042	0.041	0.014	0.014	728
12.5	0.050	0.049	0.015	0.015	843
15.0	0.054	0.054	0.016	0.016	945
17.5	0.058	0.058	0.017	0.017	1040
19.4	0.061	0.061	0.018	0.018	1030
21.3	0.063	0.063	0.019	0.019	1130
23.3	0.064	0.064	0.019	0.019	1230
25.3	0.065	0.065	0.020	0.020	1270
27.3	0.069	0.069	0.020	0.020	1370
29.2	0.071	0.071	0.021	0.021	1390

TABLE 20

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 32 HALFMOON BAY TERRACE DATE LOGGED 9-3-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.009

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.008	0.019	0.015	167
5.0	0.008	0.022	0.021	242
7.5	0.009	0.030	0.029	257
10.0	0.009	0.036	0.035	231
12.5	0.009	0.045	0.045	280
15.0	0.009	0.052	0.052	290
17.5	0.009	0.059	0.059	297
20.0	0.009	0.066	0.066	303
22.5	0.009	0.073	0.073	308
25.0	0.009	0.079	0.079	316
27.5	0.009	0.083	0.083	331
29.6	0.009	0.085	0.086	344

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.029	0.023	0.009	0.007	355
5.0	0.033	0.031	0.010	0.009	538
7.5	0.040	0.039	0.011	0.011	705
10.0	0.047	0.046	0.012	0.012	849
12.5	0.055	0.054	0.014	0.014	904
15.0	0.061	0.061	0.015	0.015	1010
17.5	0.069	0.069	0.017	0.017	1040
20.0	0.076	0.076	0.018	0.018	1120
22.5	0.082	0.082	0.020	0.020	1130
25.0	0.088	0.088	0.021	0.021	1190
27.5	0.092	0.092	0.023	0.023	1200
29.6	0.094	0.094	0.024	0.024	1240

TABLE 21

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 33 VISTA GRANDE DATE LOGGED 9-4-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.003

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.003	0.017	0.013	188
5.0	0.003	0.025	0.023	215
7.5	0.003	0.034	0.033	228
10.0	0.003	0.044	0.043	231
12.5	0.003	0.050	0.049	253
15.0	0.003	0.055	0.055	275
17.5	0.003	0.060	0.060	293
22.5	0.003	0.073	0.073	309
25.0	0.003	0.075	0.075	334
27.5	0.003	0.077	0.077	358
30.0	0.003	0.079	0.079	380

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.024	0.019	0.010	0.008	320
5.0	0.030	0.028	0.012	0.011	448
7.5	0.040	0.039	0.014	0.014	554
10.0	0.050	0.049	0.017	0.017	599
12.5	0.055	0.054	0.021	0.021	602
15.0	0.060	0.059	0.023	0.023	657
17.5	0.065	0.065	0.024	0.024	733
22.5	0.079	0.079	0.038	0.038	594
25.0	0.081	0.081	0.039	0.039	643
27.5	0.087	0.087	0.040	0.040	689
30.0	0.089	0.089	0.040	0.040	751

TABLE 22

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 34 MORRISON CANYON DATE LOGGED 9-5-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.003

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.003	0.018	0.014	177
5.0	0.003	0.026	0.024	207
7.5	0.003	0.031	0.030	250
10.0	0.003	0.034	0.033	299
12.5	0.003	0.039	0.039	324
15.0	0.003	0.041	0.041	359
17.5	0.003	0.042	0.042	419
20.0	0.003	0.045	0.045	446
22.5	0.003	0.047	0.047	480
25.0	0.003	0.049	0.049	511
27.5	0.003	0.052	0.052	530
29.9	0.003	0.054	0.054	554

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.024	0.019	0.008	0.006	400
5.0	0.031	0.029	0.008	0.007	673
7.5	0.036	0.035	0.009	0.009	852
10.0	0.041	0.040	0.010	0.010	1020
12.5	0.045	0.044	0.012	0.012	1050
15.0	0.048	0.048	0.012	0.012	1250
17.5	0.050	0.050	0.013	0.013	1350
20.0	0.053	0.053	0.014	0.014	1440
22.5	0.055	0.055	0.014	0.014	1610
25.0	0.057	0.057	0.015	0.015	1570
27.5	0.060	0.060	0.016	0.016	1720
29.9	0.062	0.062	0.017	0.017	1760

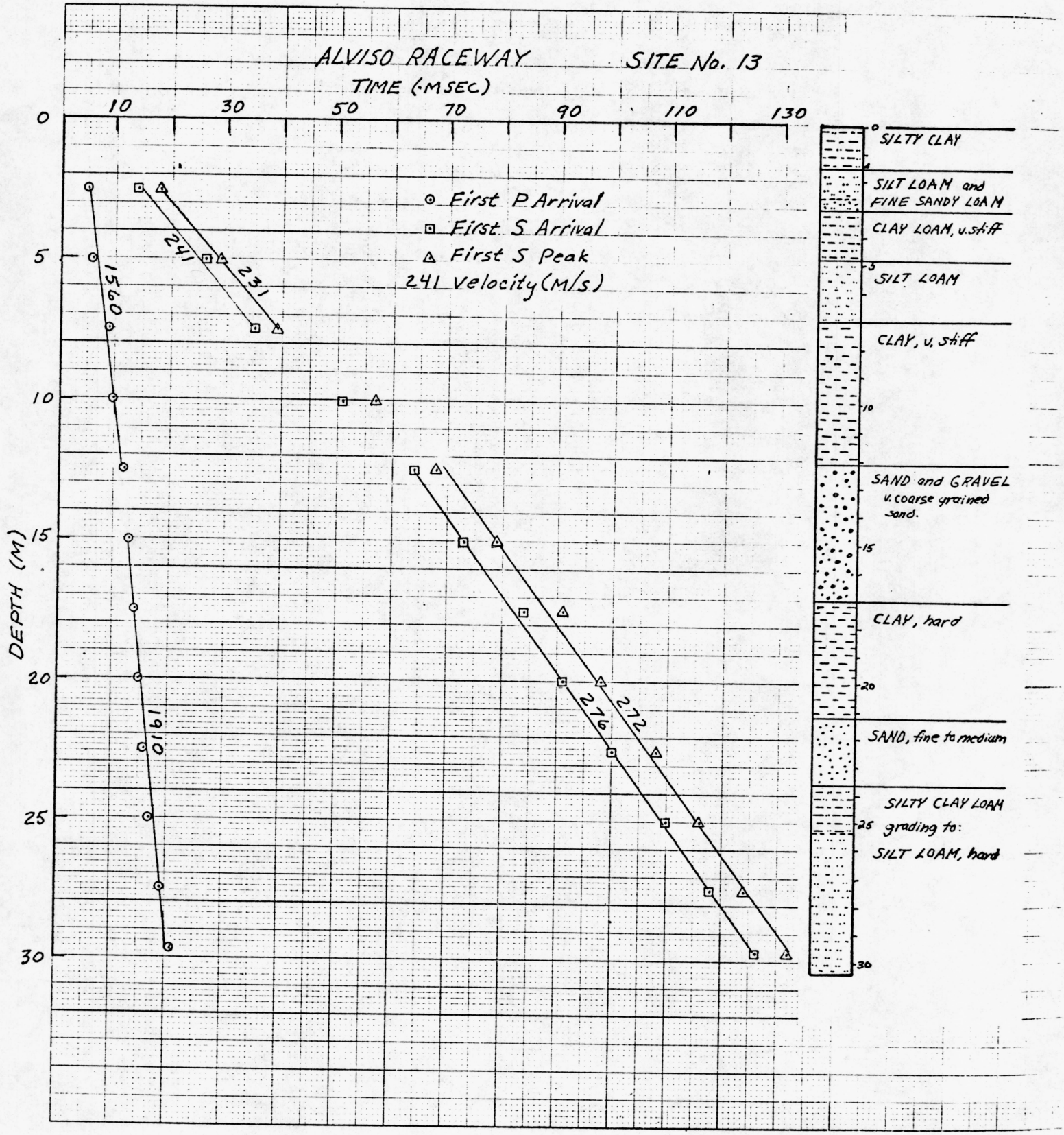
TABLE 23

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 35 LAKE MERCED COUNTRY CLUB DATE LOGGED 9-8-75
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.002

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.002	0.013	0.010	246
5.0	0.002	0.019	0.018	283
7.5	0.002	0.027	0.026	287
10.0	0.002	0.030	0.029	339
12.5	0.002	0.034	0.034	372
15.0	0.002	0.039	0.039	388
17.5	0.002	0.043	0.043	409
20.0	0.002	0.048	0.048	418
22.5	0.002	0.052	0.052	434
24.9	0.002	0.055	0.056	446
27.5	0.002	0.061	0.061	452
29.3	0.002	0.064	0.064	458

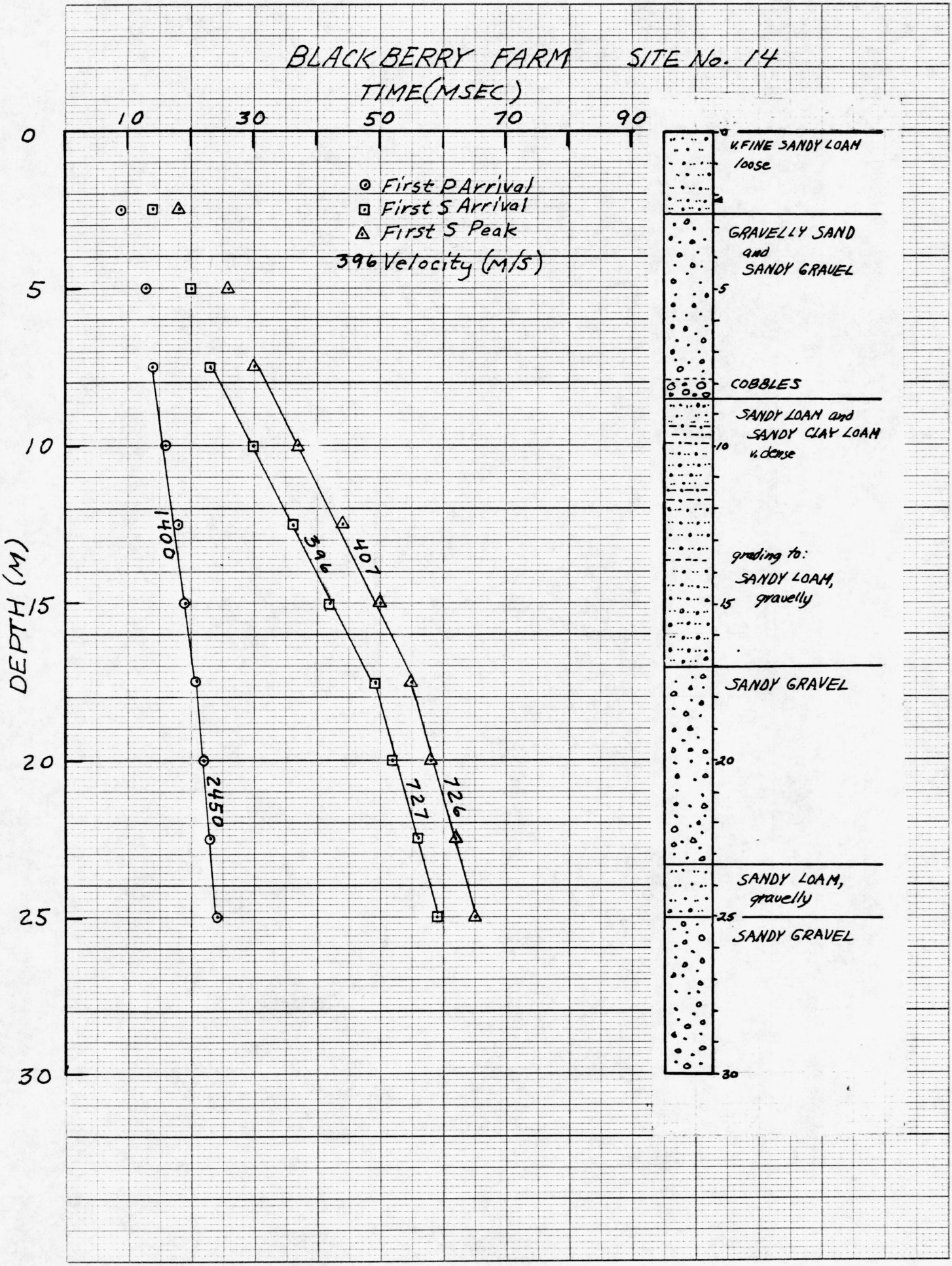
DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.018	0.014	0.009	0.007	355
5.0	0.025	0.023	0.011	0.010	489
7.5	0.030	0.029	0.014	0.014	554
10.0	0.035	0.034	0.020	0.020	509
12.5	0.039	0.039	0.023	0.023	550
15.0	0.043	0.043	0.025	0.025	595
17.5	0.048	0.048	0.026	0.026	677
20.0	0.052	0.052	0.028	0.028	717
22.5	0.056	0.056	0.030	0.030	752
24.9	0.060	0.060	0.032	0.032	780
27.5	0.065	0.065	0.034	0.034	810
29.3	0.068	0.068	0.035	0.035	839



46 1240

K•E 20 X 20 TO THE INCH • 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 66



46 1240

20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 67

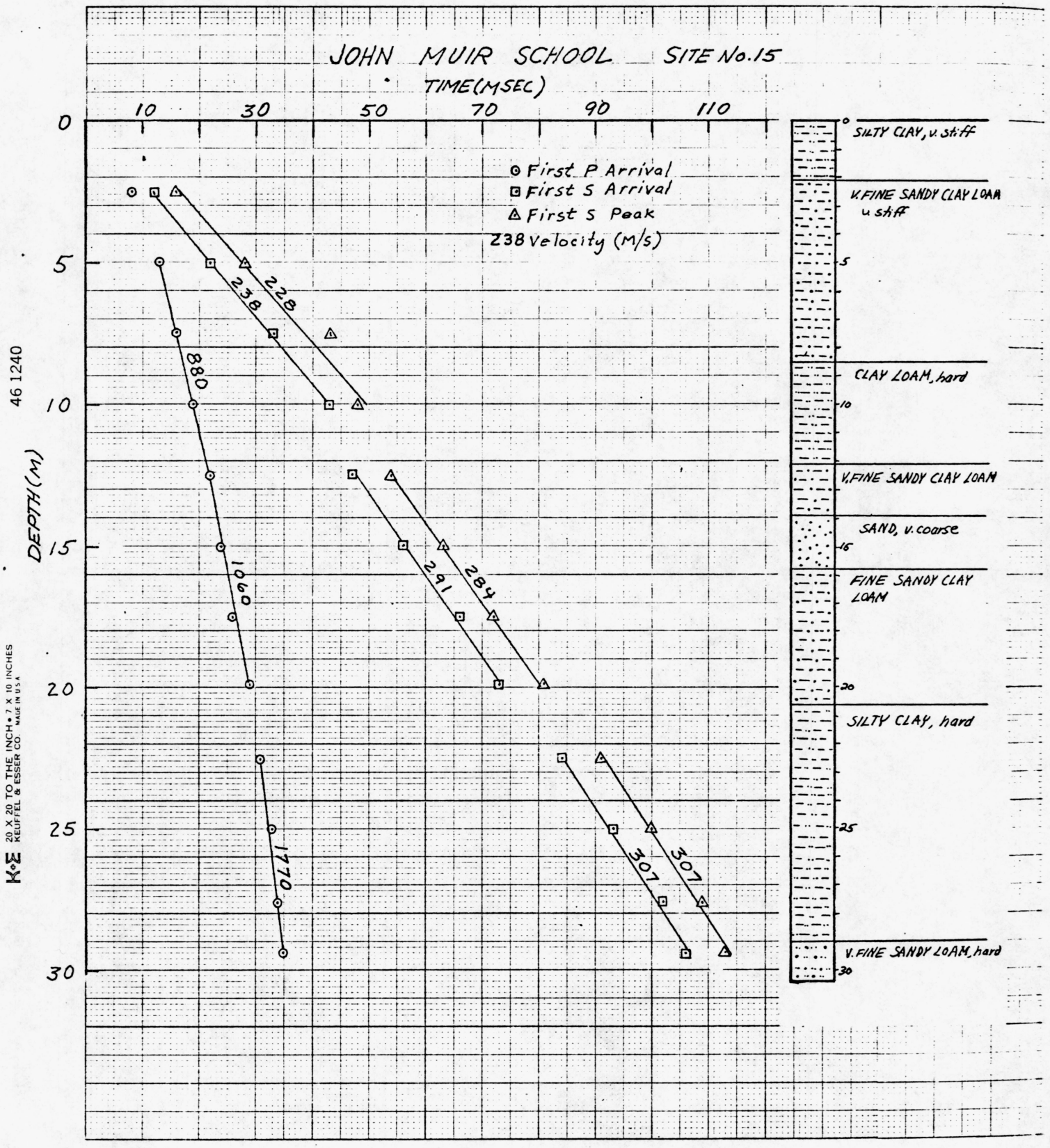
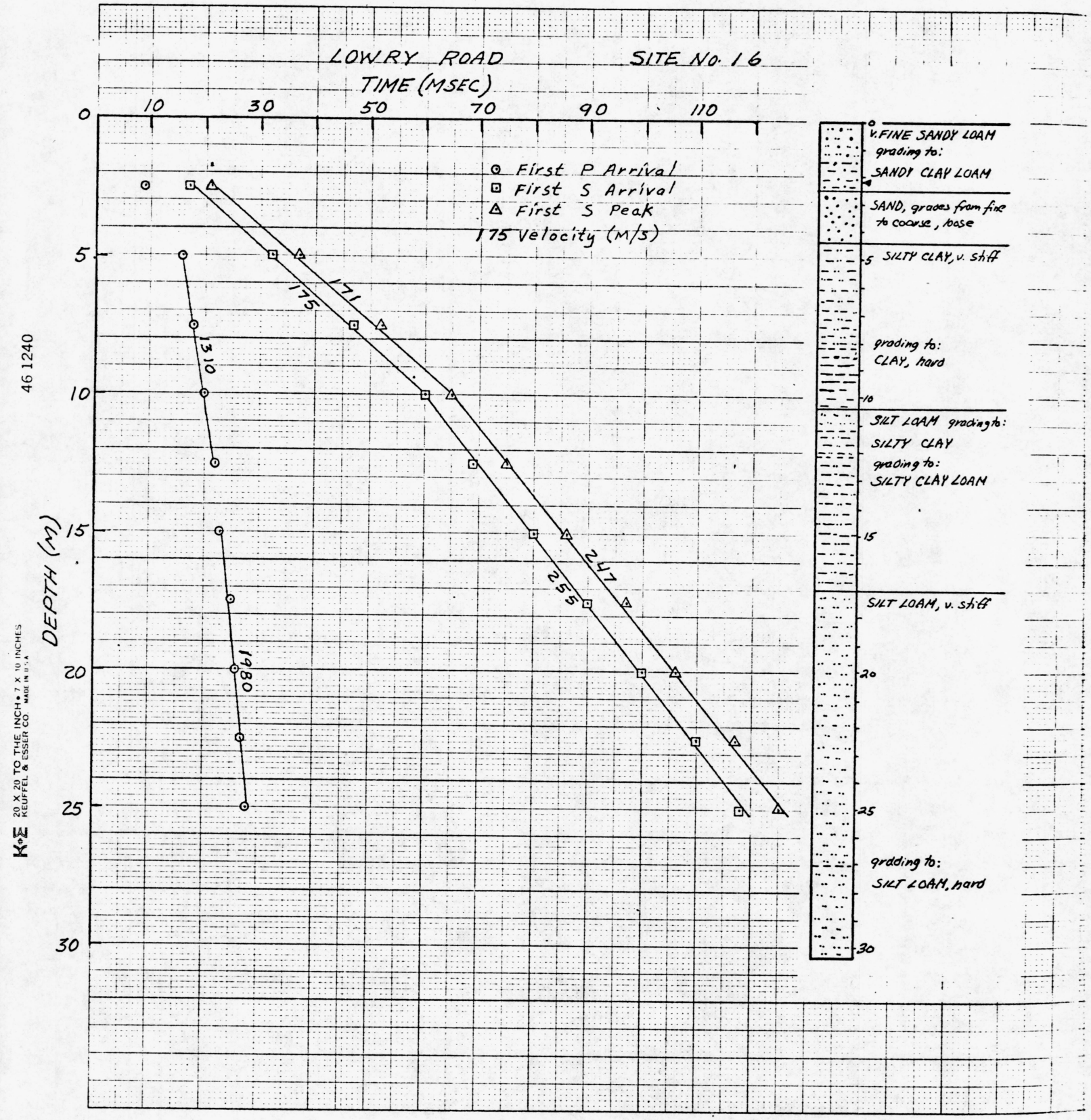

JOHN MUIR SCHOOL SITE No.15
TIME(MSEC)
10
30
50
70
90
110
0
5
10
15
20
25
30
DEPTH(M)
First P Arrival
First S Arrival
First S Peak
238 Velocity (M/s)
228
238
880
1060
1770
284
291
307
307
SILTY CLAY, v. stiff
V. FINE SANDY CLAY LOAM u. stiff
CLAY LOAM, hard
V. FINE SANDY CLAY LOAM
SAND, v. coarse
FINE SANDY CLAY LOAM
SILTY CLAY, hard
V. FINE SANDY LOAM, hard
46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 68



46 1240

K+E 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 69

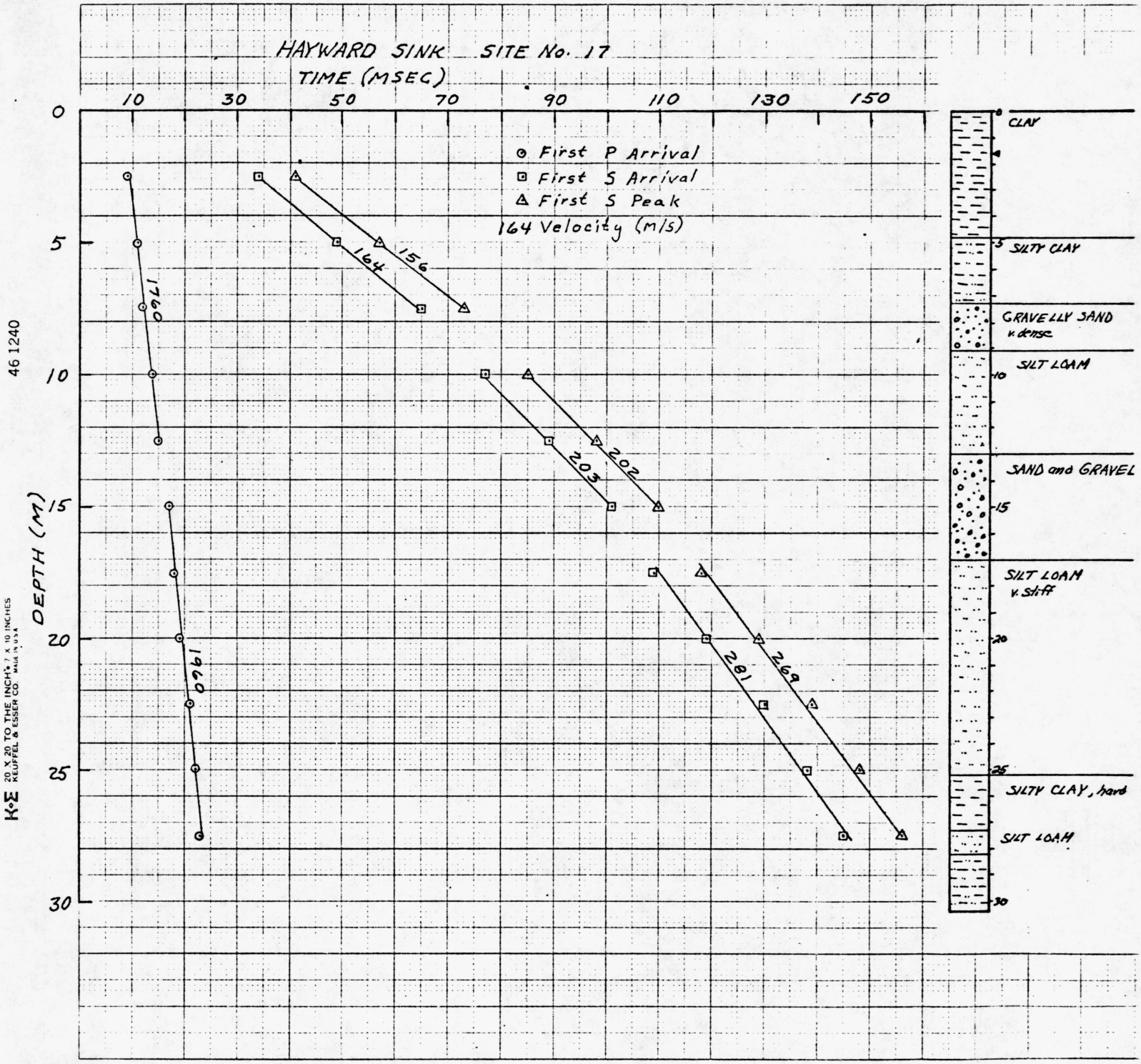

HAYWARD SINK SITE No. 17
TIME (MSEC)
10
30
50
70
90
110
130
150
0
5
10
15
20
25
30
DEPTH (M)
First P Arrival
First S Arrival
First S Peak
164 Velocity (m/s)
1760
164
156
202
203
1960
281
269
CLAY
SILTY CLAY
GRAVELLY SAND
v. dense
SILT LOAM
SAND and GRAVEL
SILT LOAM
v. stiff
SILTY CLAY, hard
SILT LOAM
46 1240
KE 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 70

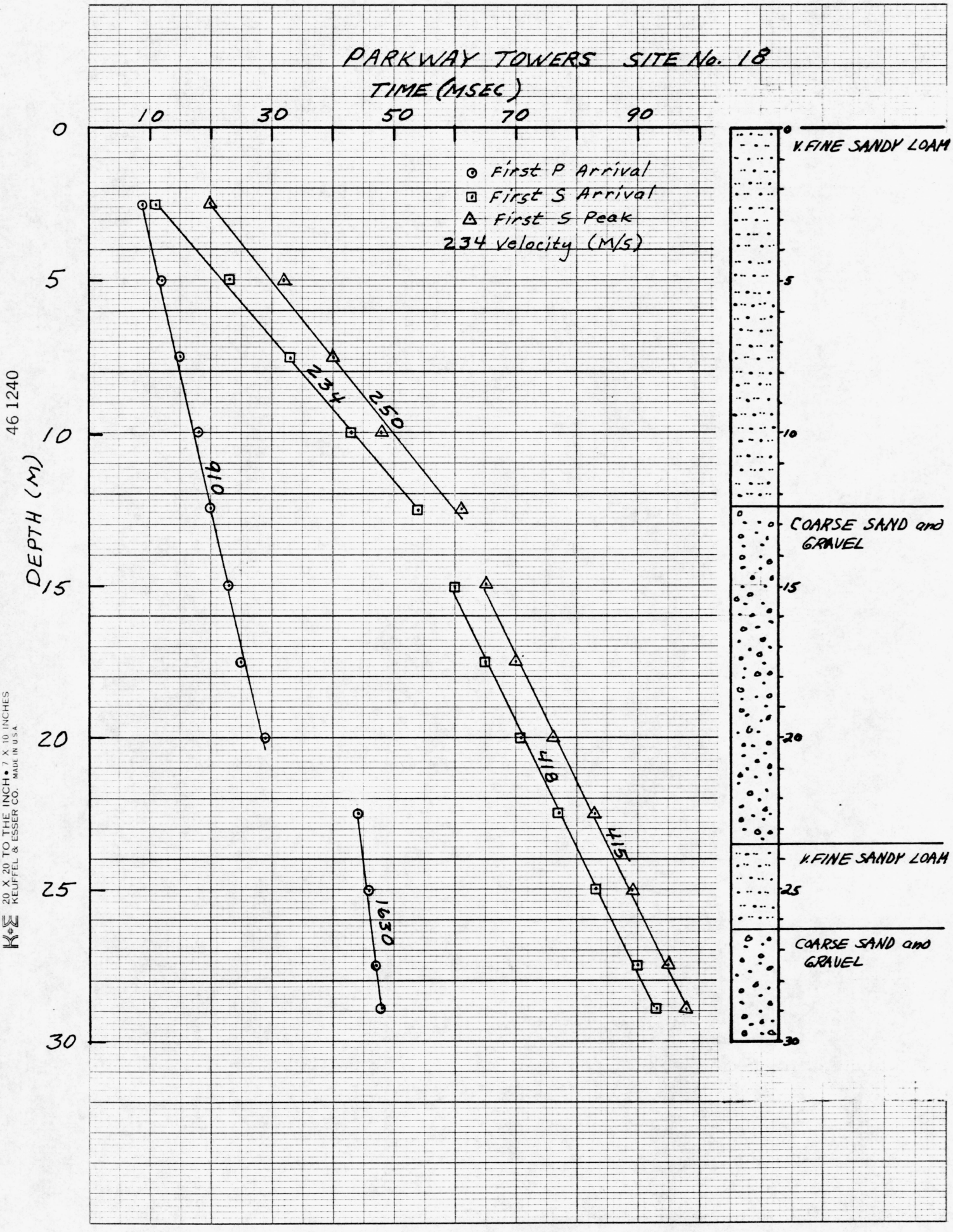

PARKWAY TOWERS SITE No. 18
TIME (MSEC)
10
30
50
70
90
0
5
10
15
20
25
30
DEPTH (M)
First P Arrival
First S Arrival
First S Peak
234 Velocity (M/S)
234
250
910
418
415
1630
V. FINE SANDY LOAM
COARSE SAND and GRAVEL
V. FINE SANDY LOAM
COARSE SAND and GRAVEL

Fig. 71

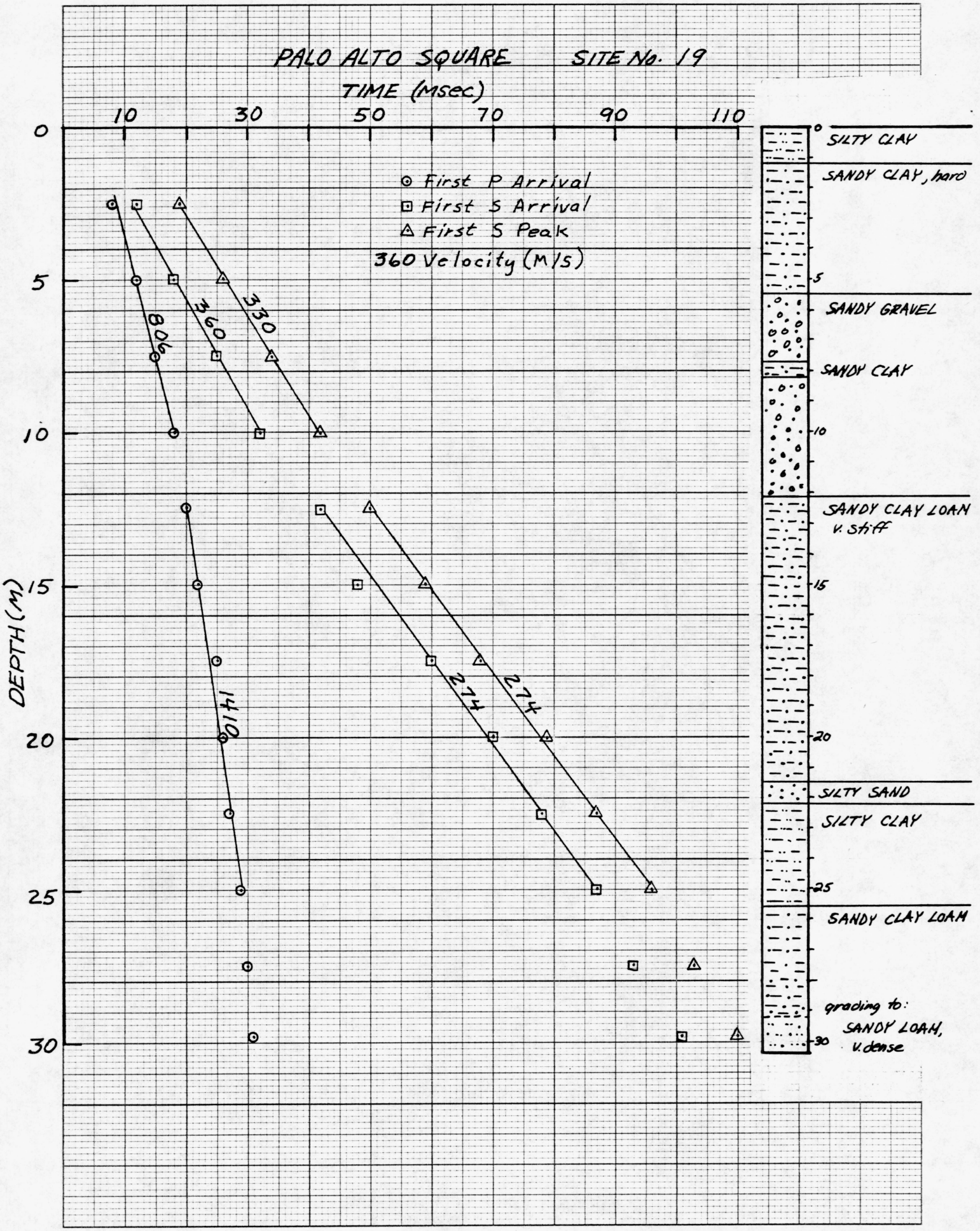

PALO ALTO SQUARE SITE No. 19
TIME (msec)
10
30
50
70
90
110
0
5
10
15
20
25
30
DEPTH (m)
First P Arrival
First S Arrival
First S Peak
360 Velocity (M/S)
806
360
330
1414
274
274
SILTY CLAY
SANDY CLAY, hard
SANDY GRAVEL
SANDY CLAY
SANDY CLAY LOAM
v. stiff
SILTY SAND
SILTY CLAY
SANDY CLAY LOAM
grading to:
SANDY LOAM,
v. dense

Fig. 72

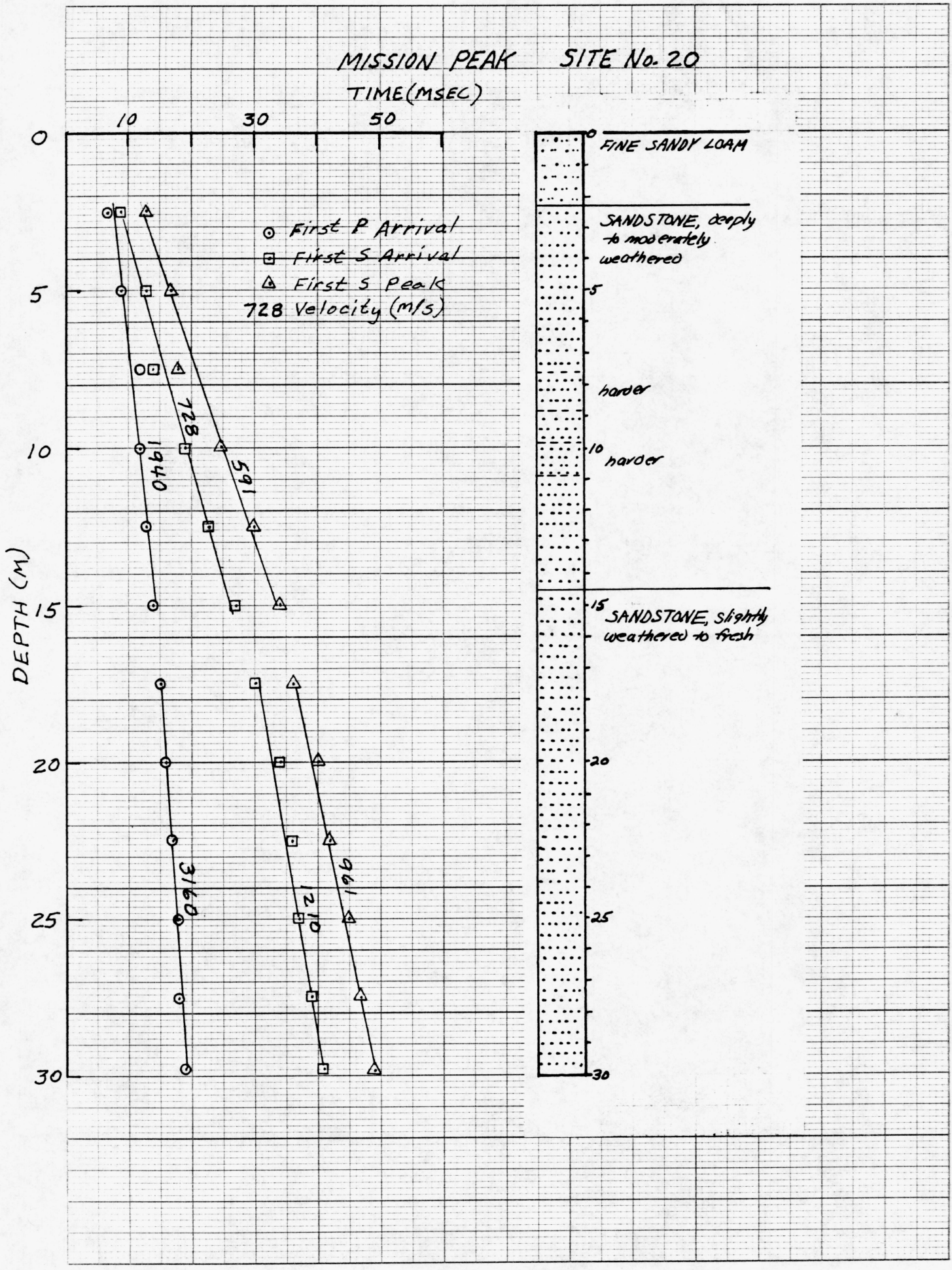

MISSION PEAK SITE No. 20
TIME (MSEC)
10
30
50
0
5
10
15
20
25
30
DEPTH (M)
First P Arrival
First S Arrival
First S Peak
728 Velocity (m/s)
1940
728
591
3160
1210
961
FINE SANDY LOAM
SANDSTONE, deeply to moderately weathered
harder
harder
SANDSTONE, slightly weathered to fresh
0
5
10
15
20
25
30
46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 73

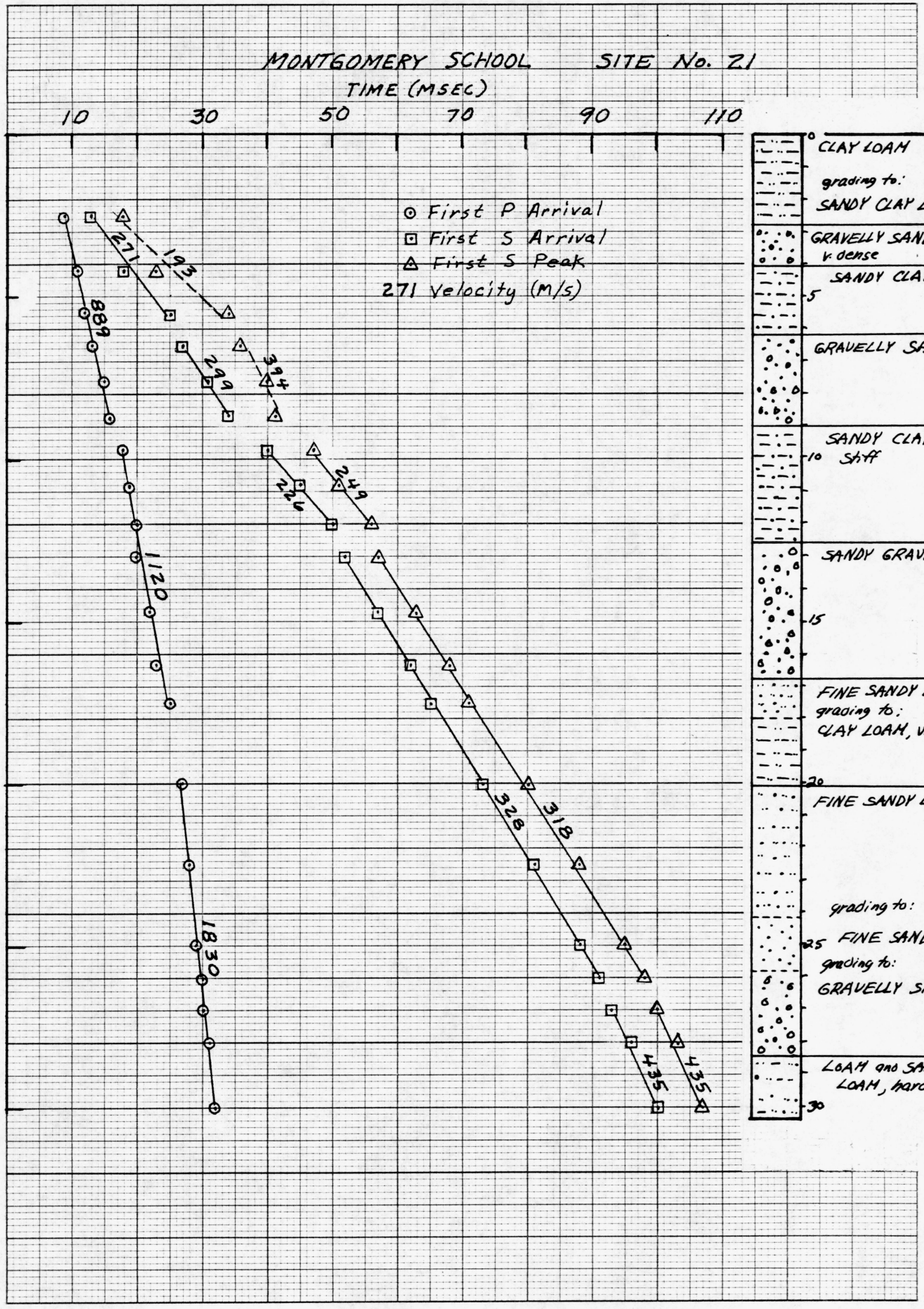
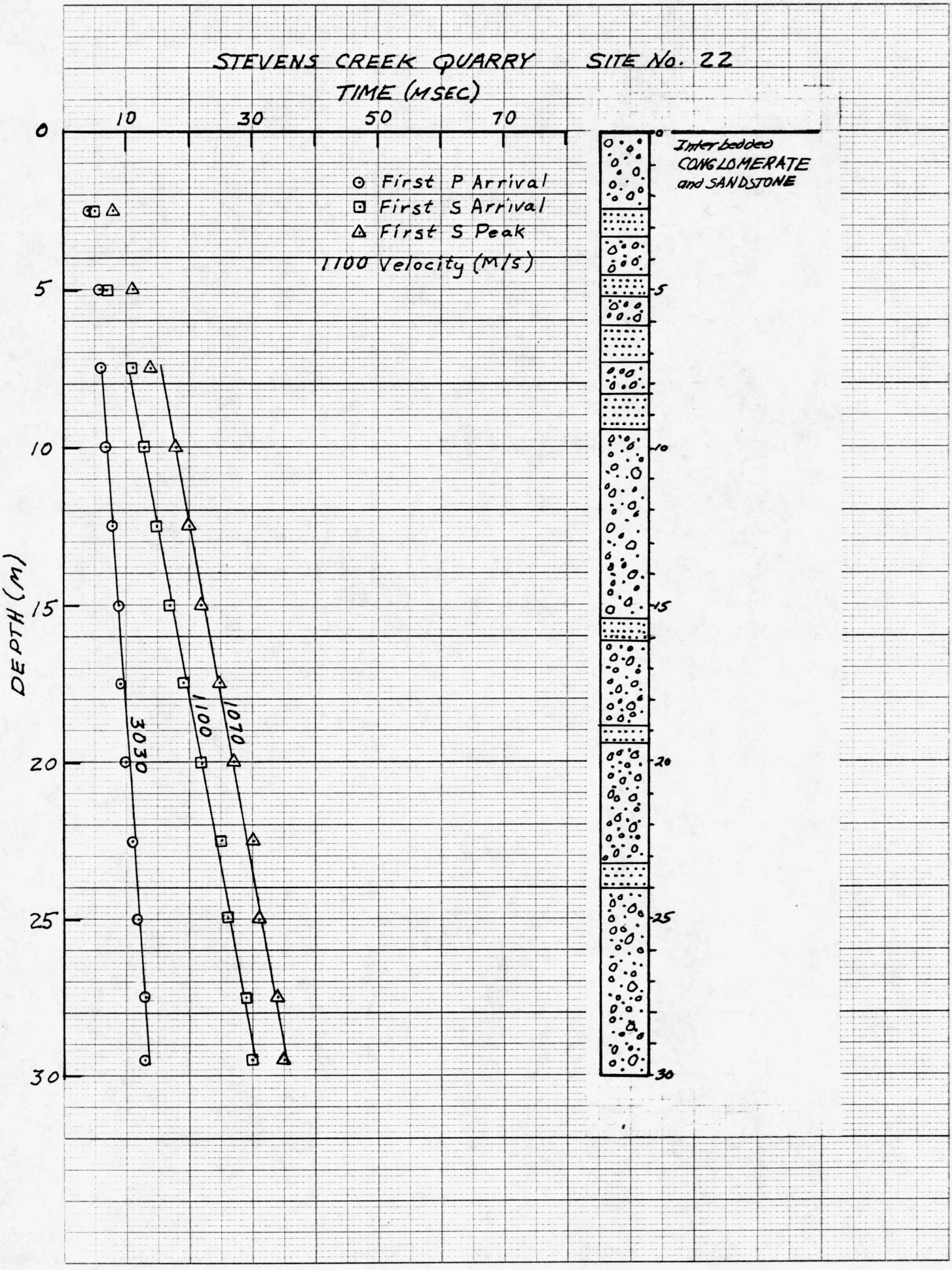
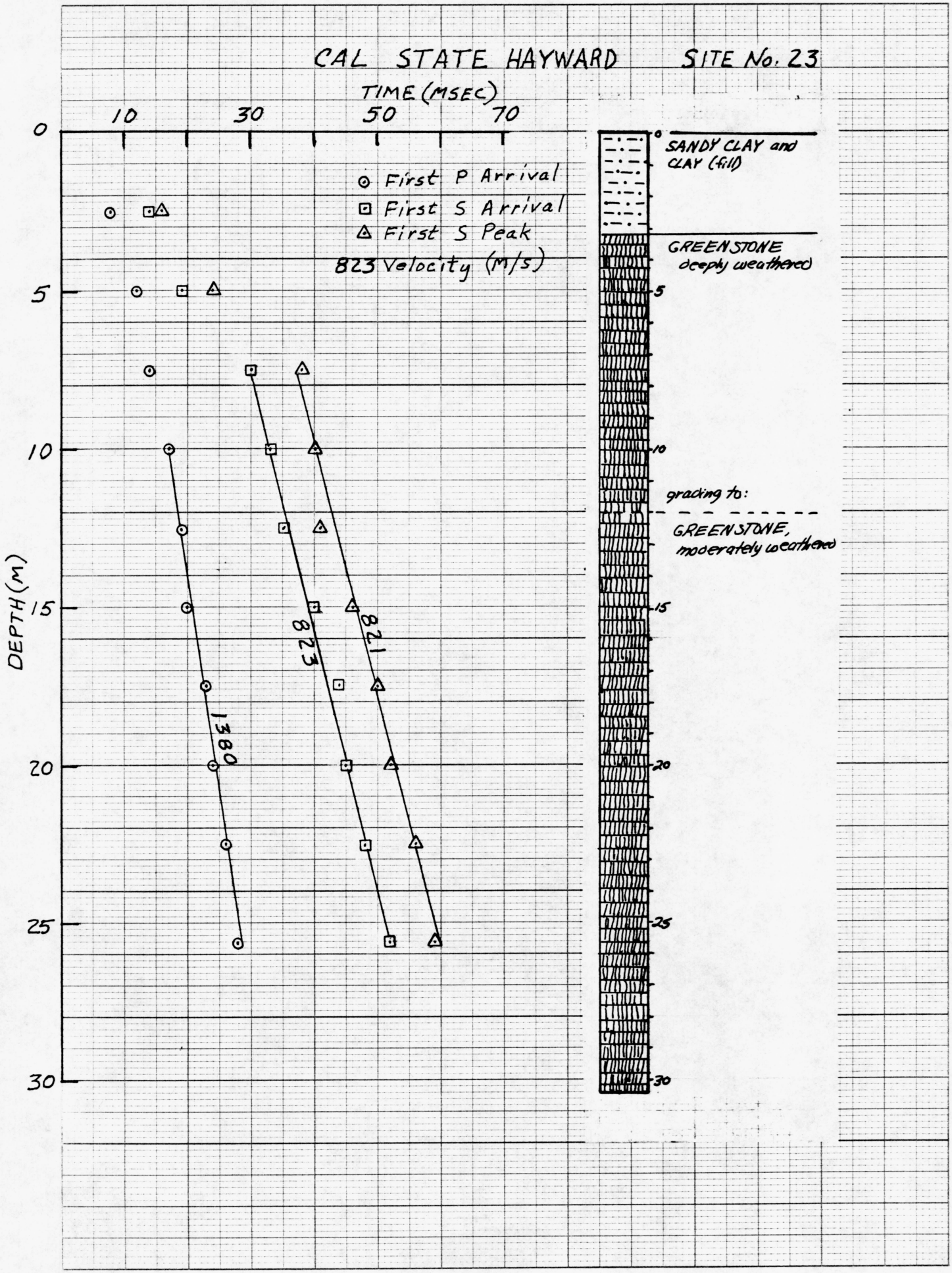

MONTGOMERY SCHOOL SITE No. 21
TIME (MSEC)
10
30
50
70
90
110
DEPTH(M)
0
5
10
15
20
25
30
First P Arrival
First S Arrival
First S Peak
271 Velocity (M/s)
271
193
889
299
394
226
249
1120
328
318
1830
435
435
CLAY LOAM
grading to:
SANDY CLAY LOAM
GRAVELLY SAND
v. dense
SANDY CLAY LOAM
GRAVELLY SAND
SANDY CLAY
Stiff
SANDY GRAVEL
FINE SANDY LOAM
grading to:
CLAY LOAM, v. stiff
FINE SANDY LOAM
grading to:
FINE SAND
grading to:
GRAVELLY SAND
LOAM and SANDY
LOAM, hard

Fig. 74



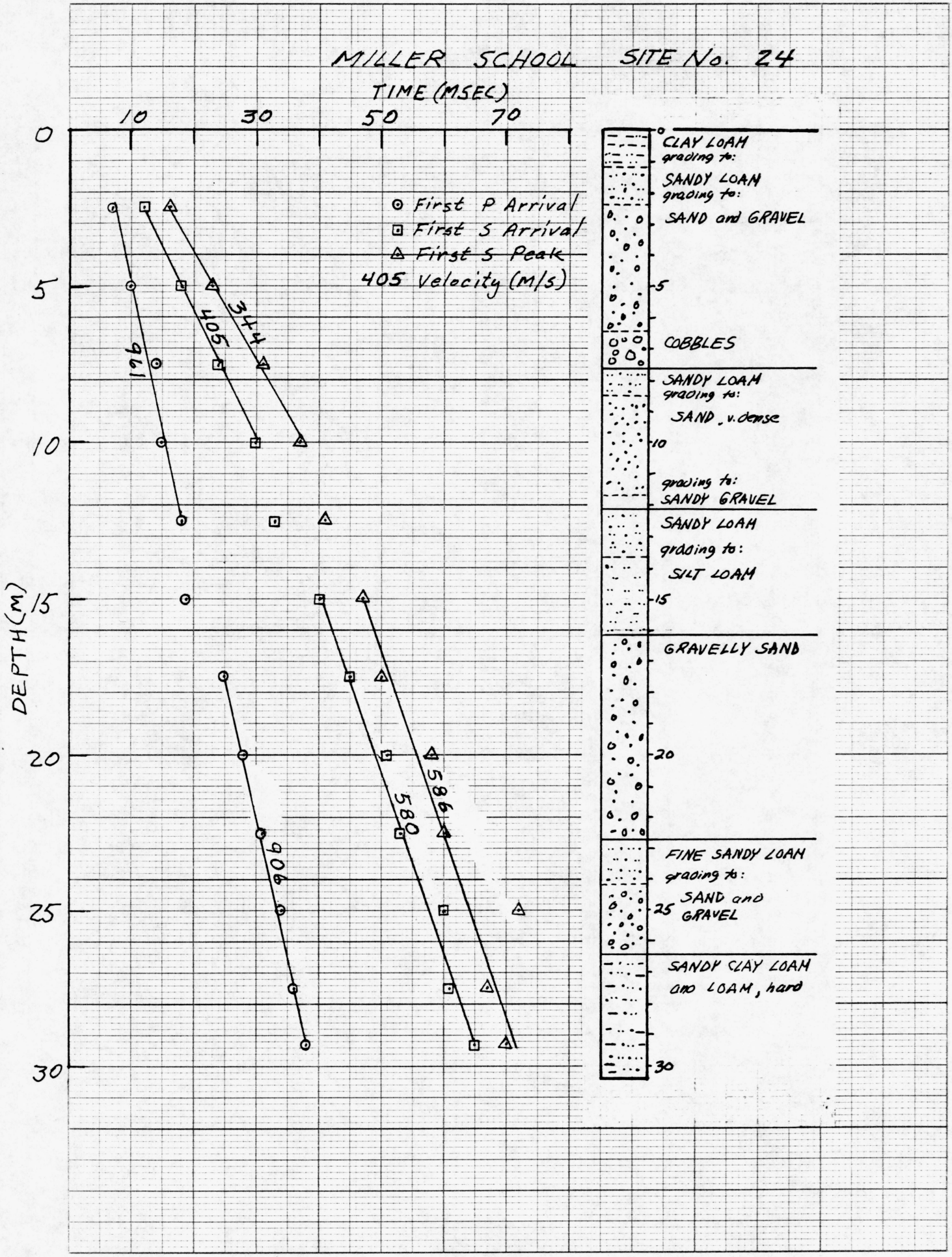
46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 75



46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

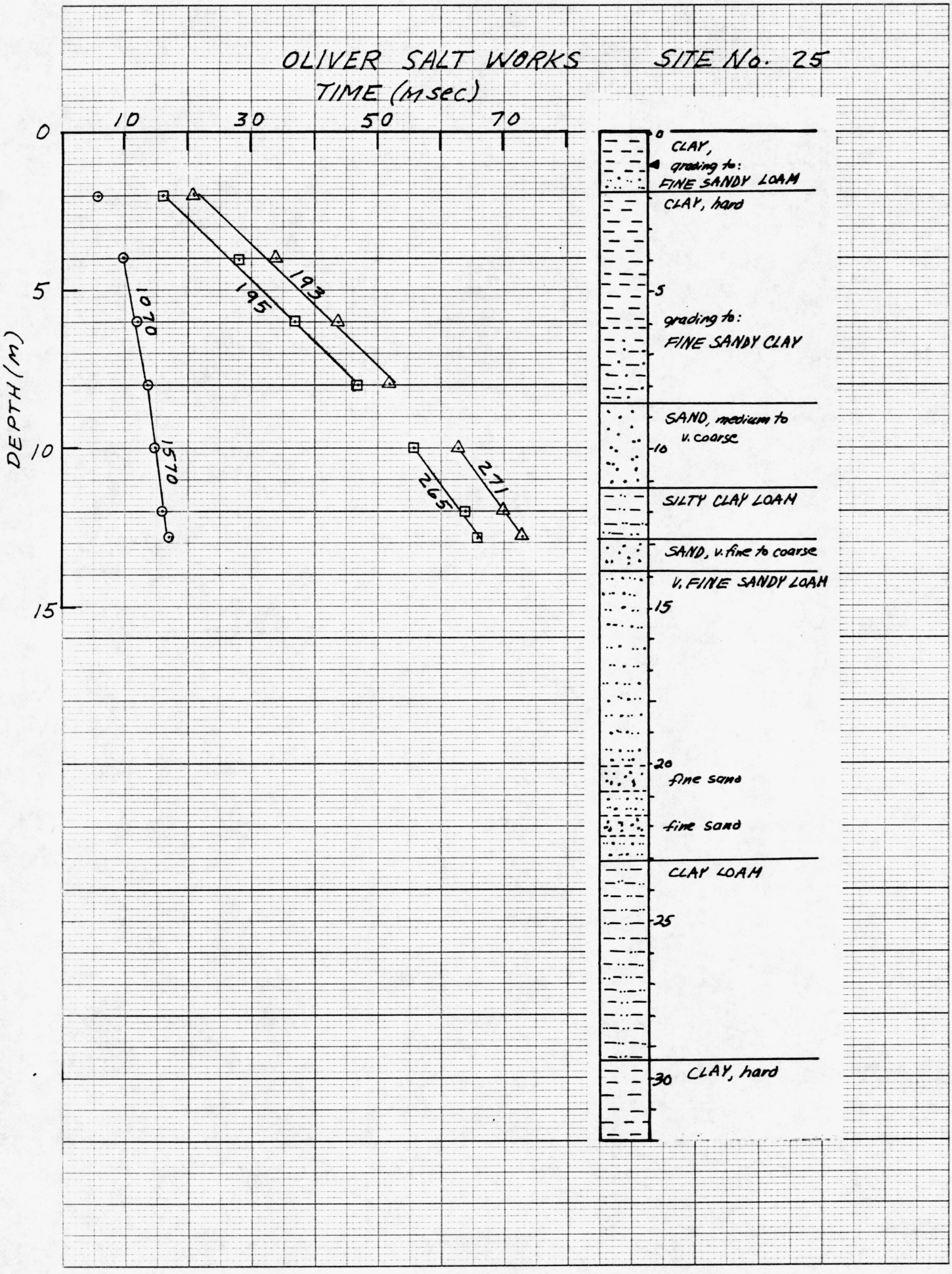
Fig. 76



46 1240

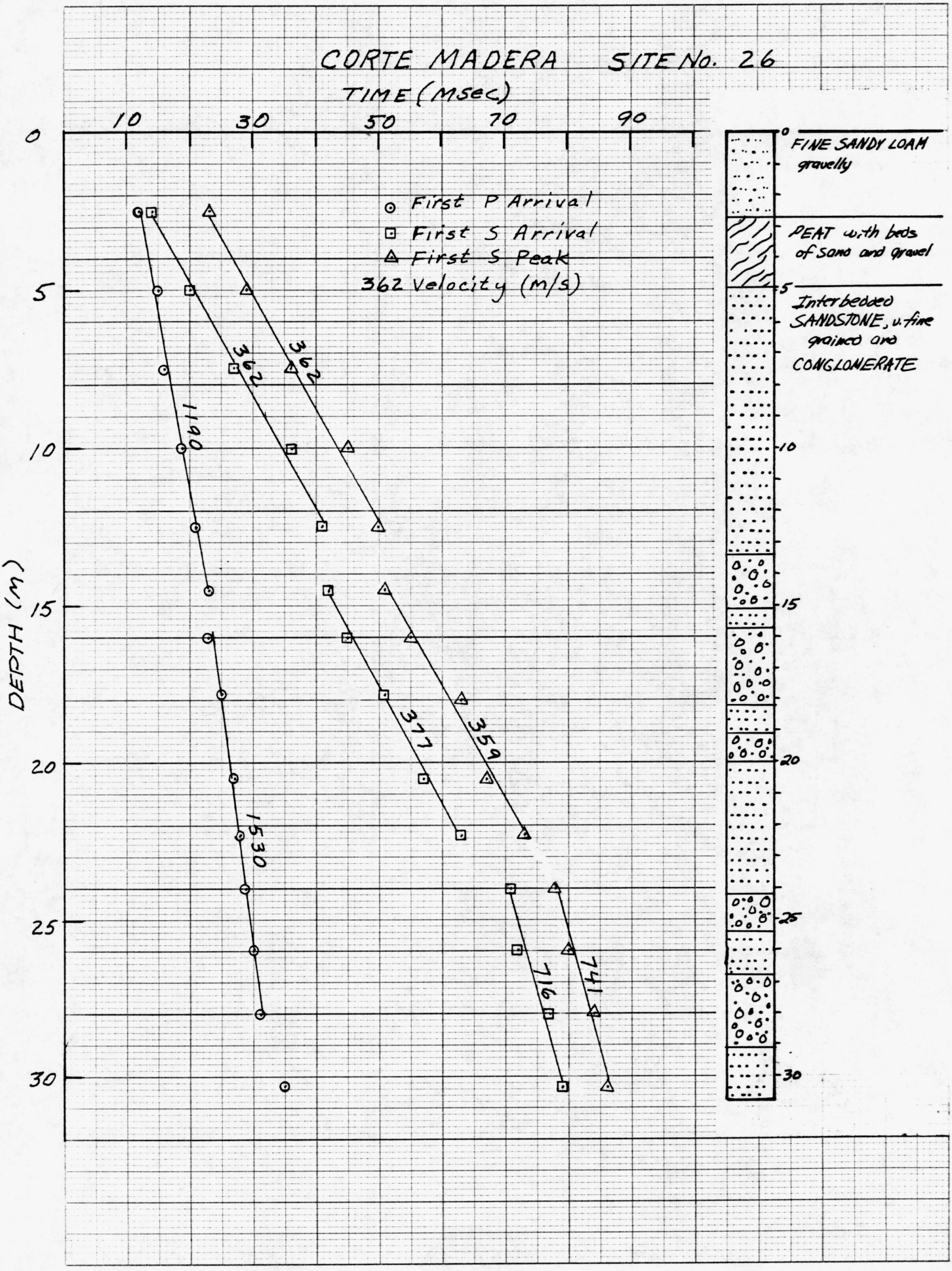
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 77



46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 78



46 1240

20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 79

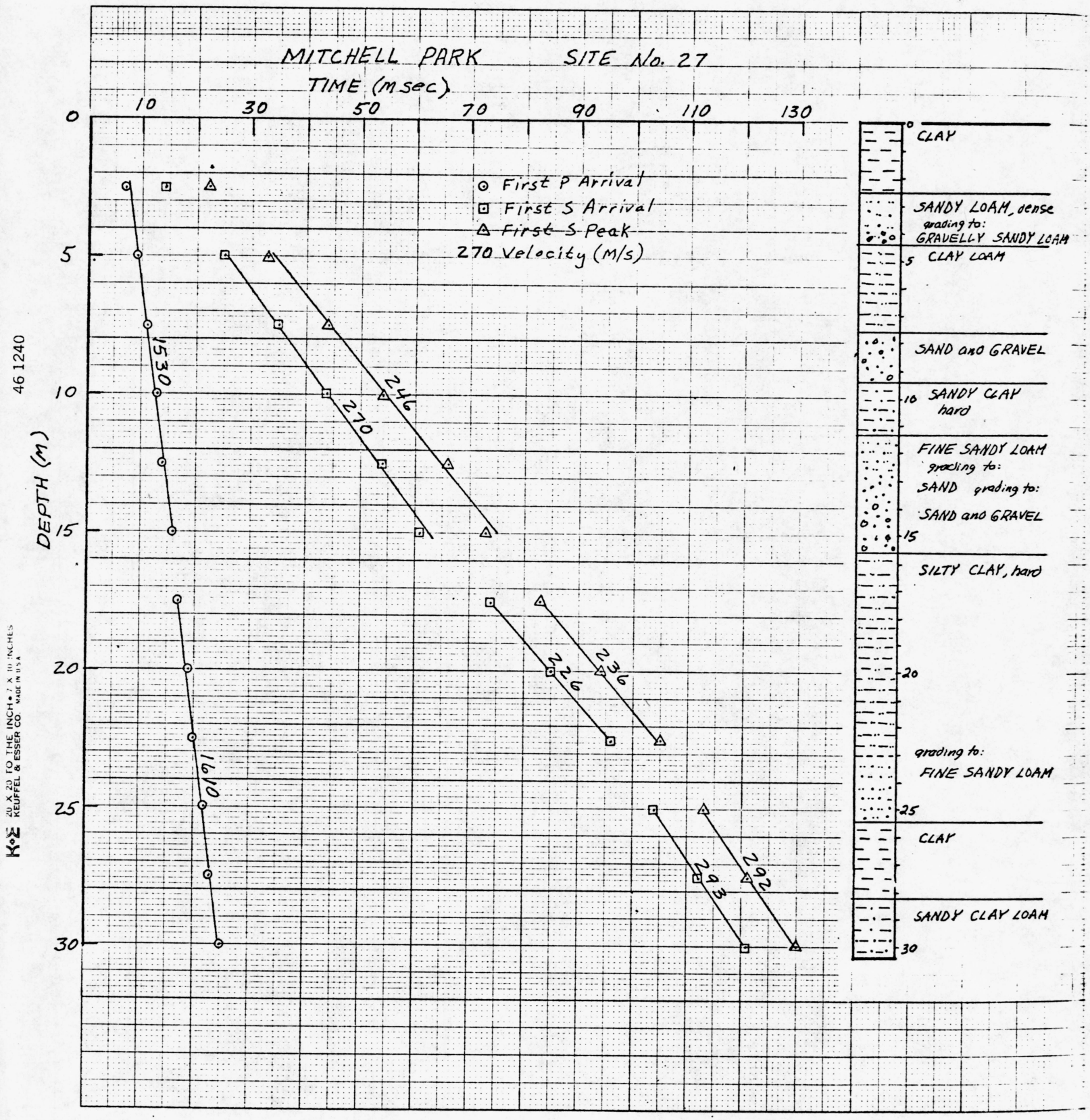
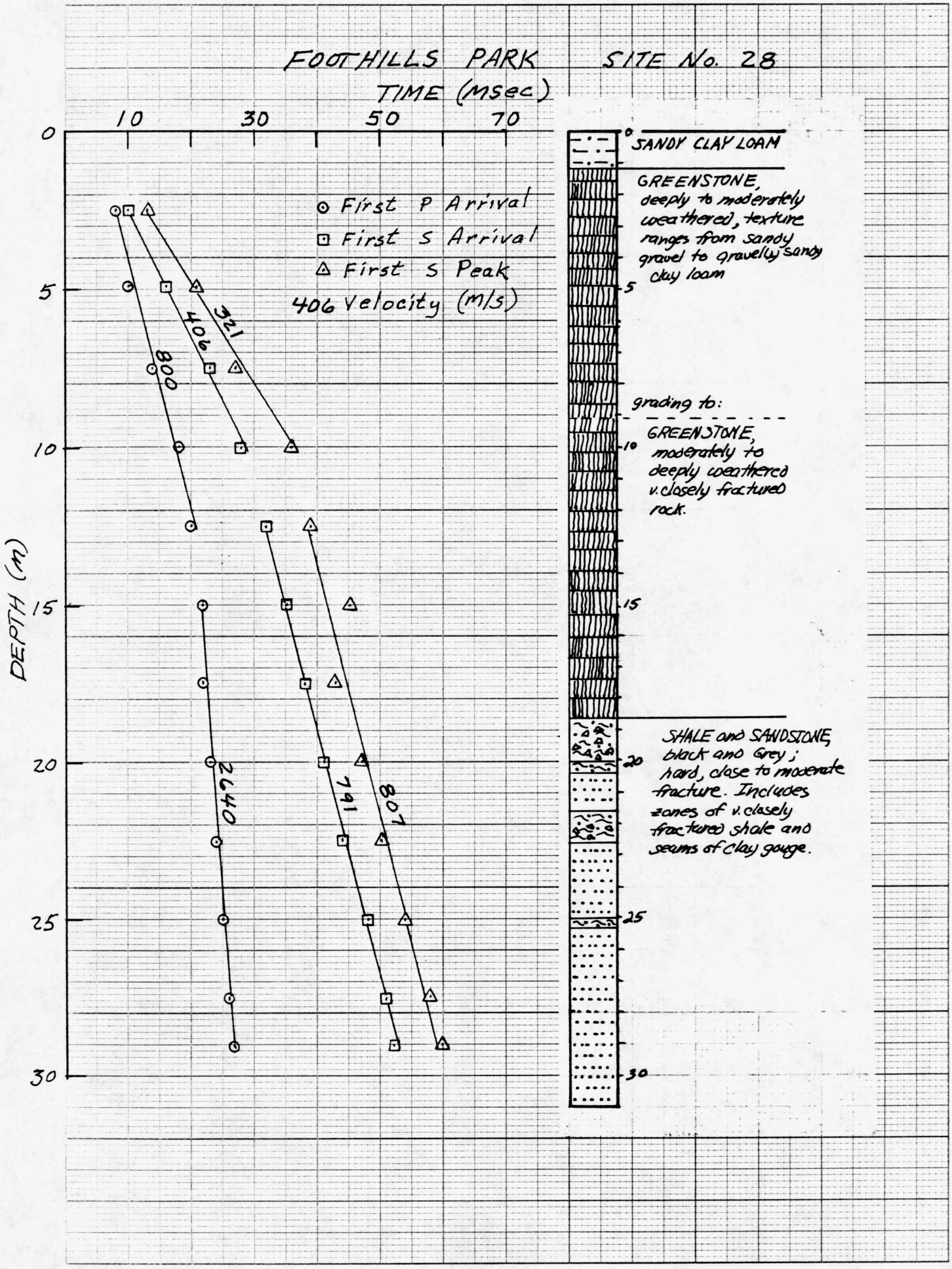

MITCHELL PARK SITE No. 27
TIME (msec)
10
30
50
70
90
110
130
0
5
10
15
20
25
30
DEPTH (M)
First P Arrival
First S Arrival
First S Peak
270 Velocity (M/s)
1530
270
246
1610
226
236
293
292
CLAY
SANDY LOAM, dense grading to: GRAVELLY SANDY LOAM
CLAY LOAM
SAND and GRAVEL
SANDY CLAY hard
FINE SANDY LOAM grading to: SAND grading to: SAND and GRAVEL
SILTY CLAY, hard
grading to: FINE SANDY LOAM
CLAY
SANDY CLAY LOAM

Fig. 80



46 1240

20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO MADE IN U.S.A.

Fig. 81

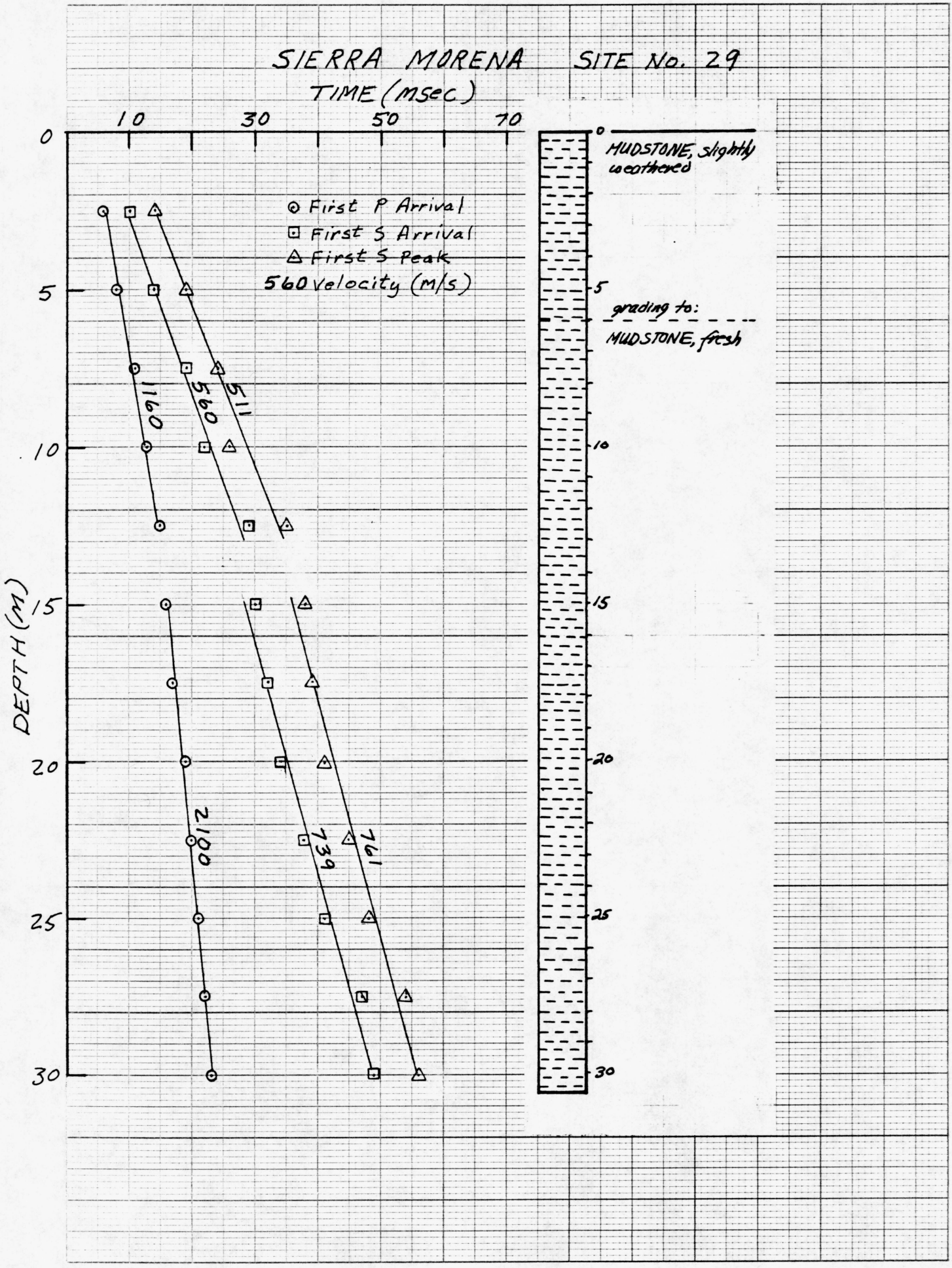
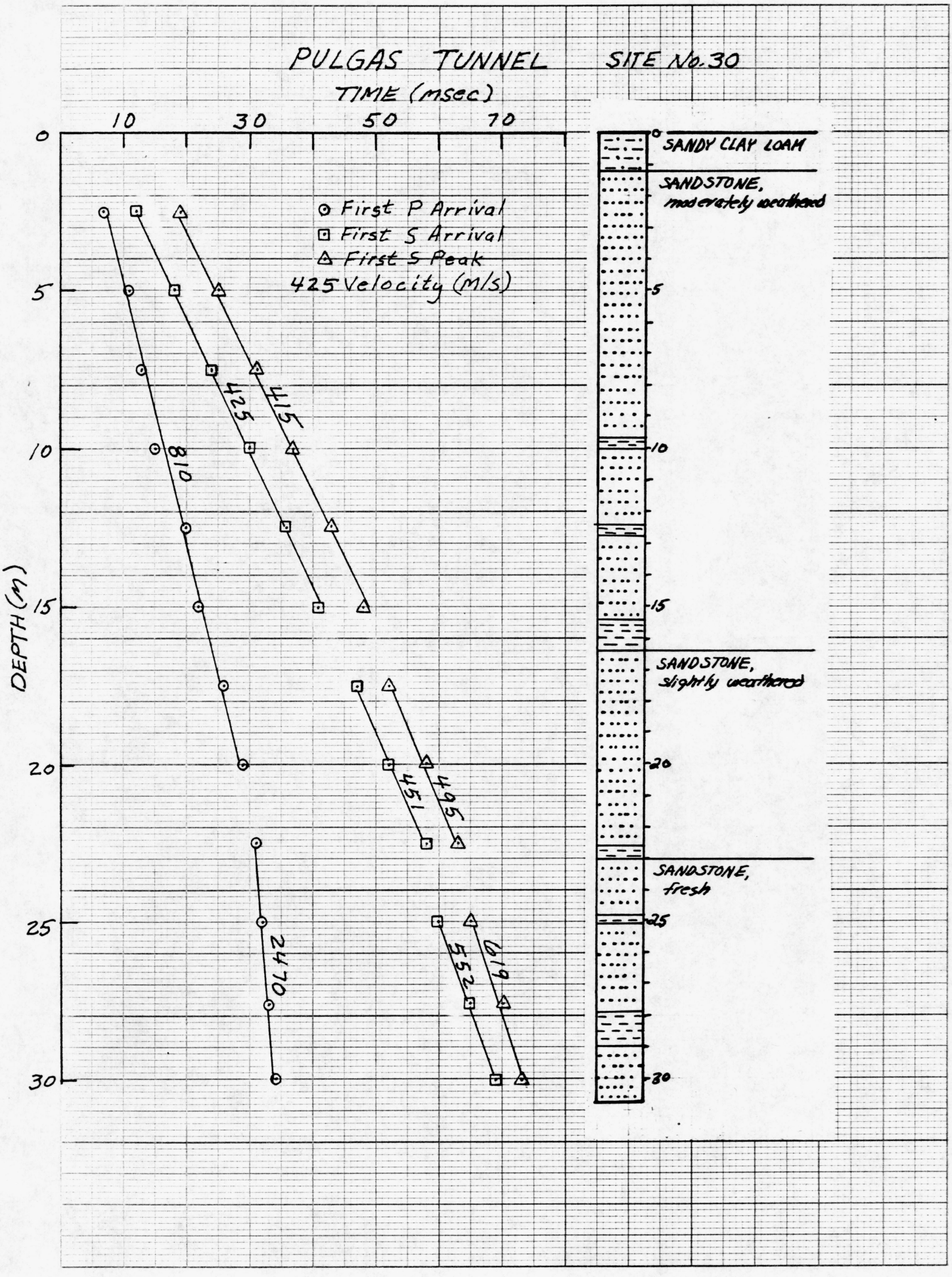
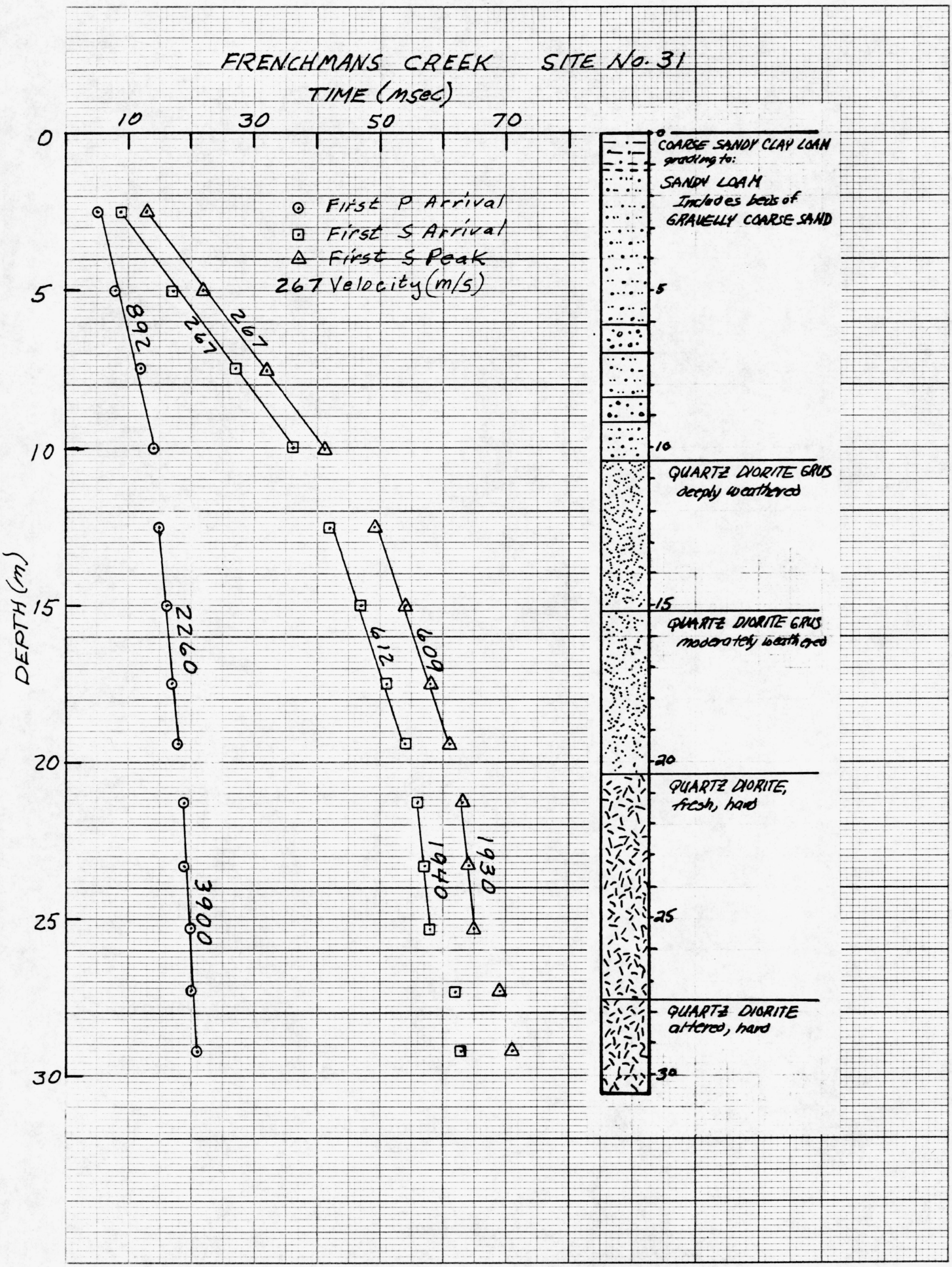

SIERRA MORENA SITE No. 29
TIME (MSEC)
10
30
50
70
0
5
10
15
20
25
30
DEPTH (M)
First P Arrival
First S Arrival
First S Peak
560 Velocity (M/S)
1160
560
511
2100
739
761
MUDSTONE, slightly weathered
grading to:
MUDSTONE, fresh
46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 82



46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 83



46 1240

20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 84

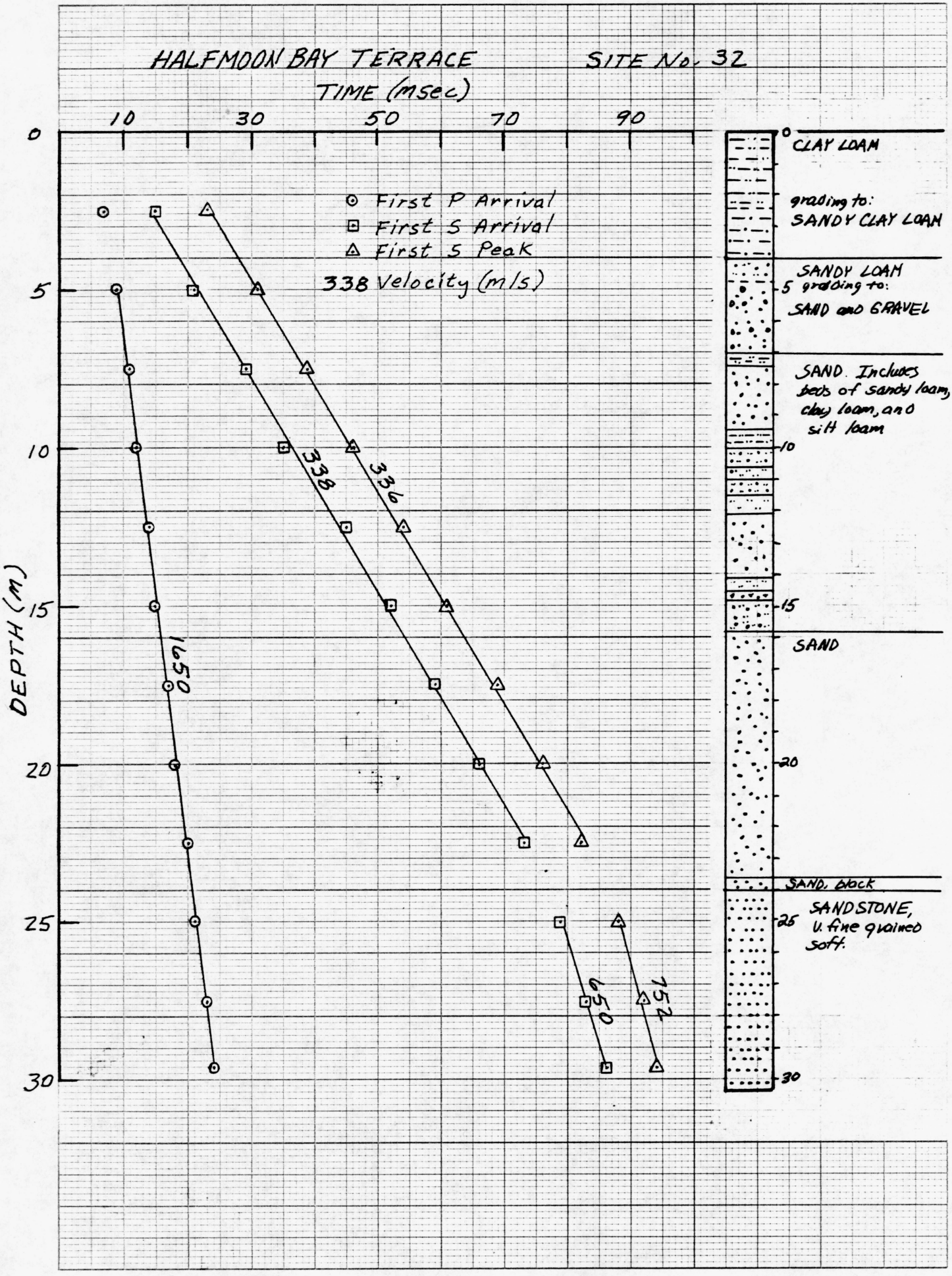
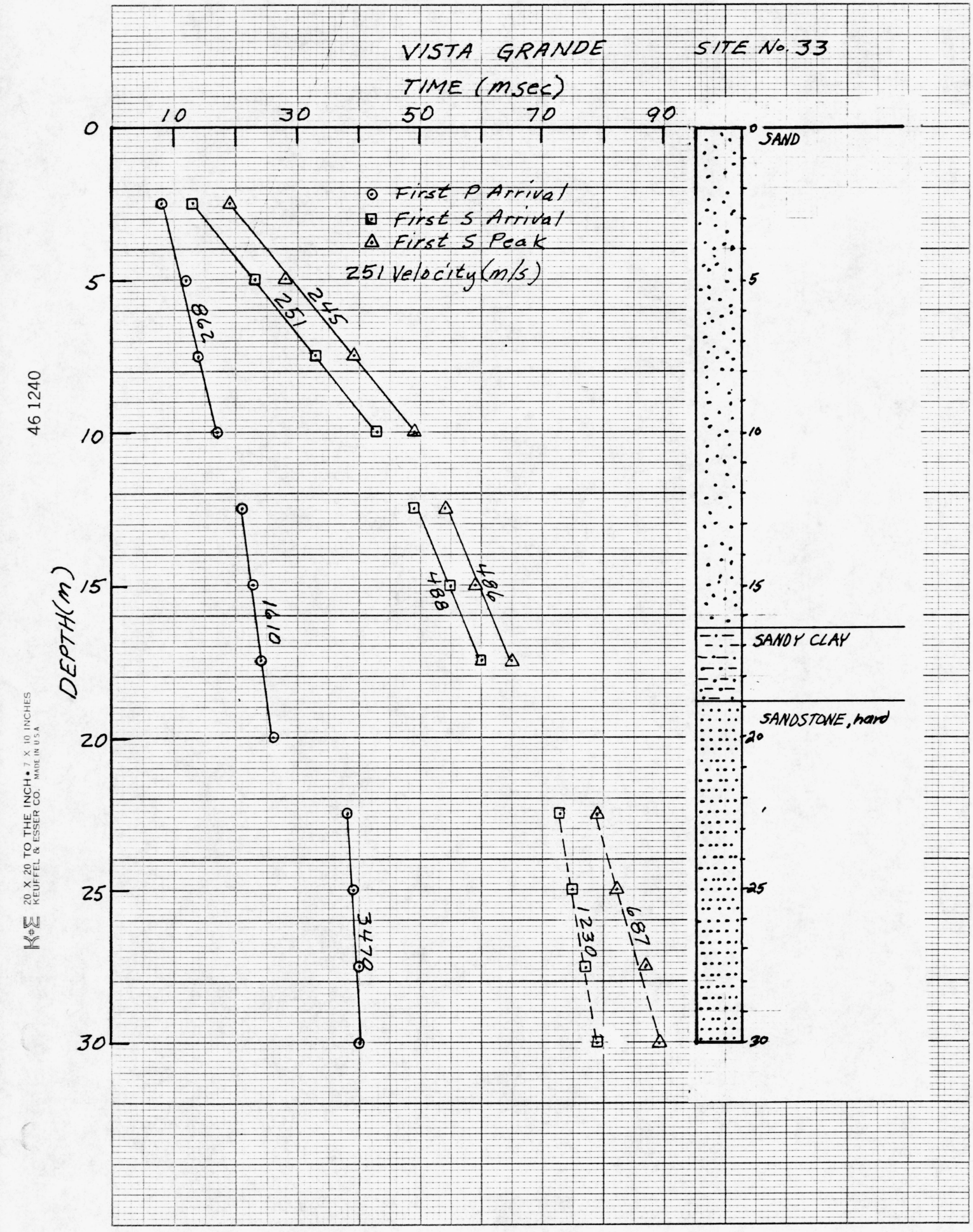
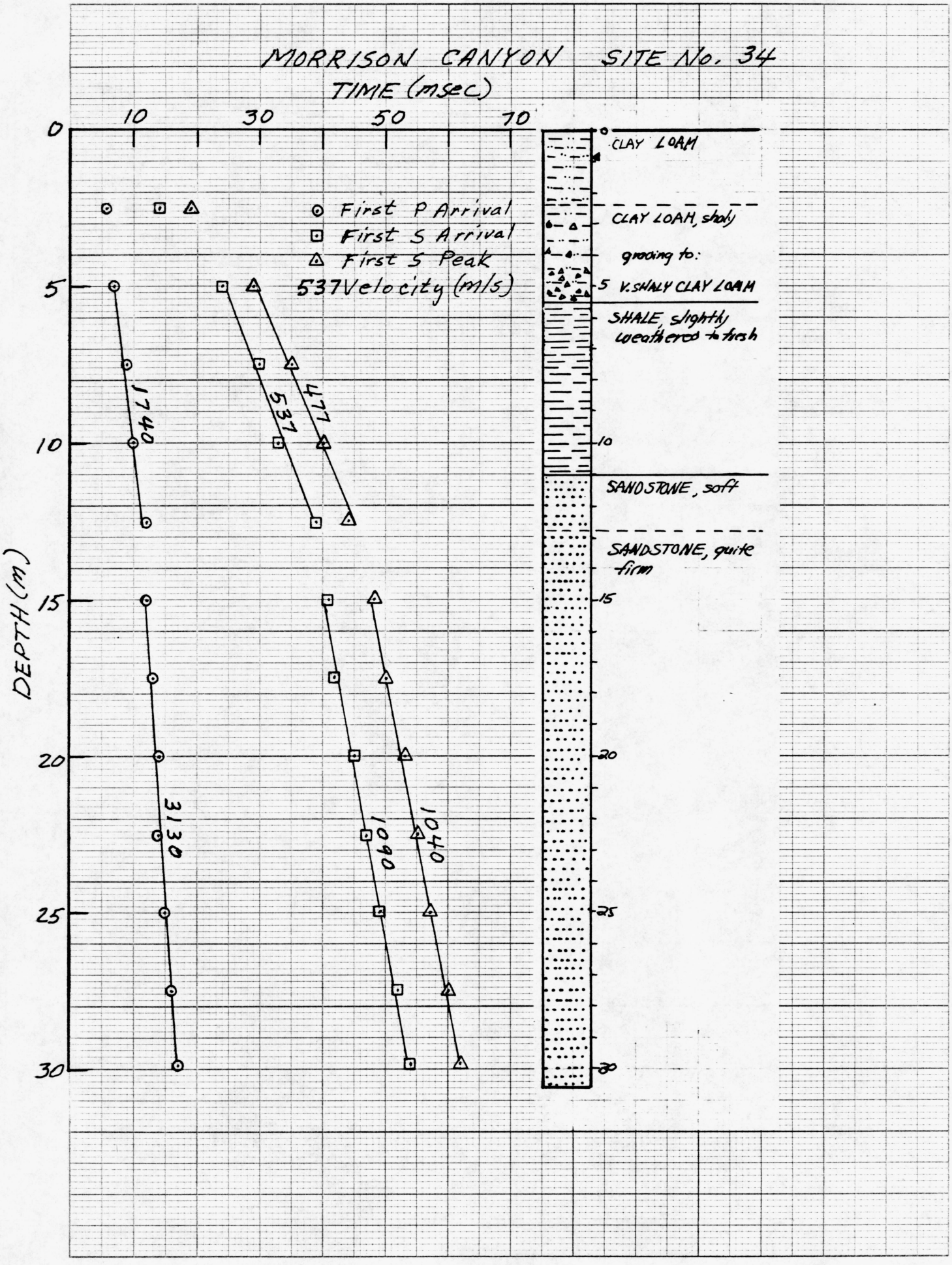

HALFMOON BAY TERRACE
SITE No. 32
TIME (msec)
10
30
50
70
90
0
5
10
15
20
25
30
DEPTH (m)
First P Arrival
First S Arrival
First S Peak
338 Velocity (m/s)
1650
338
336
650
752
CLAY LOAM
grading to:
SANDY CLAY LOAM
SANDY LOAM
grading to:
SAND and GRAVEL
SAND. Includes beds of sandy loam, clay loam, and silt loam
SAND
SAND, block
SANDSTONE, v. fine grained soft.

Fig. 85



46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

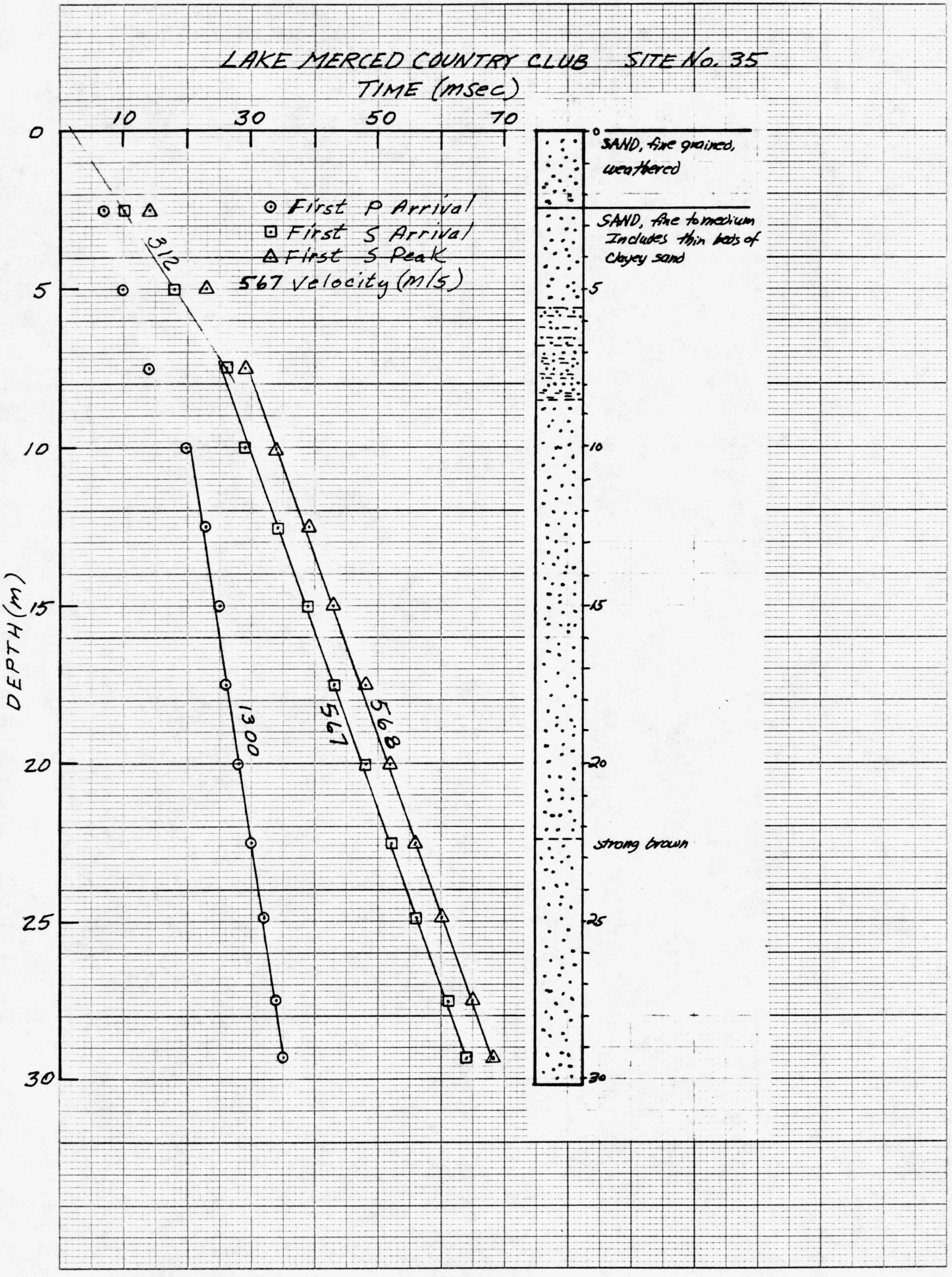
Fig. 86



46 1240

20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 87



46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Fig. 88

TABLE 24

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 13 ALVISO RACEWAY

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.004	241	(222, 264)
12.5-29.7	8	0.019	276	(272, 280)
10.0-29.7	9	0.016	267	(261, 273)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.007	231	(220, 243)
0.024	272	(265, 279)
0.021	263	(257, 271)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.004	1560	(1460,1660)
15.0-29.7	7	0.005	1910	(1760,2080)
10.0-29.7	9	0.005	1960	(1860,2070)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
241	2.5- 7.5	1560	2.5-12.5	6.4	1.88	1100	44000	0.488
276	12.5-29.7	1910	15.0-29.7	24.3	1.94	1480	68700	0.489
267	10.0-29.7	1960	10.0-29.7	24.3	1.94	1380	72700	0.491

INT = interval

NO MEAS = number of measurements

INCPT = intercept

VEL = velocity

UNC = uncertainty

M = metres

S = seconds

M/S = metres per second

MOD = modulus

G/CC = grams per cubic centimeter

TABLE 25

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 14 BLACKBERRY FARM

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-17.5	5	0.004	396	(390, 403)
17.5-25.0	4	0.025	727	(699, 758)
10.0-25.0	7	0.011	505	(473, 542)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.012	407	(393, 422)
0.031	726	(698, 757)
0.021	551	(518, 588)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-17.5	5	0.008	1400	(1320,1490)
17.5-25.0	4	0.014	2450	(2450,2460)
10.0-25.0	7	0.011	1840	(1740,1960)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	(G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
396	7.5-17.5	1400	7.5-17.5					0.457
727	17.5-25.0	2450	17.5-25.0					0.452
505	10.0-25.0	1840	10.0-25.0					0.459

TABLE 26

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 15 JOHN MUIR SCHOOL

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.001	238	(237, 239)
12.5-19.9	4	0.005	291	(281, 301)
22.5-29.4	4	0.011	307	(290, 327)
10.0-29.4	9	0.006	293	(286, 300)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.006	228	(204, 258)
0.010	284	(278, 289)
0.018	307	(289, 327)
0.012	287	(283, 292)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-12.5	4	0.008	880	(834, 932)
12.5-19.9	4	0.010	1060	(978,1140)
22.5-29.4	4	0.018	1770	(1600,1980)
10.0-29.4	9	0.011	1180	(1130,1240)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
238	2.5-10.0	880	5.0-12.5	9.7	1.99	1130	13900	0.450
291	12.5-19.9	1060	12.5-19.9					0.459
307	22.5-29.4	1770	22.5-29.4	29.4	1.90	1800	57000	0.484
293	10.0-29.4	1180	10.0-29.4	29.4	1.90	1630	24400	0.467

TABLE 27

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 16 LOWRY ROAD

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.004	175	(169, 181)
10.0-25.0	7	0.021	255	(251, 260)
10.0-25.0	7	0.021	255	(251, 260)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.007	171	(164, 178)
0.025	247	(242, 252)
0.025	247	(242, 252)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-12.5	4	0.012	1310	(1200,1440)
12.5-25.0	6	0.016	1980	(1860,2110)
10.0-25.0	7	0.015	1830	(1720,1940)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
175	2.5-10.0	1310	5.0-12.5	9.2	2.02	619	33900	0.491
255	10.0-25.0	1980	12.5-25.0	24.4	1.88	1230	71900	0.491
255	10.0-25.0	1830	10.0-25.0	24.4	1.88	1230	61100	0.490

TABLE 28

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 17 HAYWARD SINK

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.019	164	(162, 166)	0.025	156	(156, 157)
10.0-15.0	3	0.027	203	(202, 203)	0.036	202	(201, 203)
17.5-27.5	5	0.048	281	(269, 294)	0.054	269	(260, 278)
10.0-27.5	8	0.041	257	(249, 266)	0.048	253	(244, 257)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.008	1760	(1640,1890)
15.0-27.5	6	0.009	1960	(1860,2070)
10.0-27.5	8	0.008	1850	(1780,1910)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
164	2.5- 7.5	1760	2.5-12.5	3.0	1.91	516	58400	0.496
203	10.0-15.0	1960	15.0-27.5					0.495
281	17.5-27.5	1956	15.0-27.5	25.1	1.91	1510	71100	0.489
257	10.0-27.5	1850	10.0-27.5	25.1	1.91	1270	63400	0.490

TABLE 29

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 18 PARKWAY TOWERS

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.001	234	(229, 239)
15.0-28.9	7	0.023	418	(408, 430)
10.0-28.9	9	0.021	402	(389, 416)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.010	250	(237, 264)
0.028	415	(405, 425)
0.027	405	(388, 423)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-20.0	8	0.006	910	(883, 938)
21.0-28.9	4	0.030	1630	(1490,1810)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
234	2.5-12.5	910	2.5-20.0	6.4	1.71	938	12900	0.464
418	15.0-28.9	1630	21.0-28.9					0.465
402	10.0-28.9	1630	21.0-28.9					0.453

TABLE 30

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 19 PALO ALTO SQUARE

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.0-10.0	4	0.004	360	(348, 373)
12.5-25.0	6	-.004	274	(266, 283)
10.0-29.8	9	-.002	287	(281, 293)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.011	330	(317, 344)
0.005	274	(271, 278)
0.008	287	(283, 292)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.006	806	(751, 870)
12.5-25.0	6	0.011	1410	(1290,1540)
10.0-29.8	9	0.012	1490	(1410,1580)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
360	2.0-10.0	806	2.5-10.0	3.0	2.03	2640	9690	0.375
274	12.5-25.0	1410	12.5-25.0	15.5	1.82	1370	34200	0.480
287	10.0-29.8	1490	10.0-29.8	15.5	1.82	1500	38400	0.481

TABLE 31

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 20 MISSION PEAK

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-15.0	6	0.005	728	(686, 776)	0.008	591	(549, 640)
17.5-29.8	6	0.016	1210	(1100,1330)	0.018	961	(909,1020)
10.0-29.8	9	0.010	909	(848, 979)	0.015	858	(823, 896)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-15.0	6	0.007	1940	(1700,2260)
17.5-29.8	6	0.010	3160	(2880,3500)
10.0-29.8	9	0.008	2750	(2620,2880)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
728	2.5-15.0	1940	2.5-15.0	3.0	2.31	12300	70700	0.418
1210	17.5-29.8	3160	17.5-29.8					0.415
909	10.0-29.8	2750	10.0-29.8					0.439

TABLE 32

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 21 MONTGOMERY SCHOOL

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 5.5	3	0.004	271	(234, 323)
6.5- 8.7	3	0.005	299	(277, 325)
9.7-12.0	3	-.002	226	(221, 232)
13.0-26.0	8	0.012	328	(326, 331)
27.0-30.0	3	0.031	435	(393, 487)
10.0-30.0	13	0.014	344	(339, 348)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.004	193	(146, 286)
0.020	394	(301, 573)
0.008	249	(240, 258)
0.016	318	(314, 321)
0.038	435	(392, 487)
0.019	335	(330, 340)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	6	0.006	889	(866, 914)
2.5- 8.7	6	0.006	889	(866, 914)
9.7-20.0	8	0.009	1120	(1060,1180)
22.5-30.0	6	0.015	1830	(1700,1980)
10.0-30.0	13	0.012	1430	(1370,1490)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
271	2.5- 5.5	889	2.5-10.0					0.449
299	6.5- 8.7	889	2.5- 8.7					0.436
226	9.7-12.0	1120	9.7-20.0					0.479
328	13.0-26.0	1118	9.7-20.0	18.6	1.92	2080	21200	0.453
435	27.0-30.0	1830	22.5-30.0	30.0	1.80	3410	55600	0.470
344	10.0-30.0	1430	10.0-30.0	18.6	1.92	2270	36200	0.469
344	10.0-30.0	1430	10.0-30.0	30.0	1.80	2130	33900	0.469

TABLE 33

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 22 STEVENS CREEK QUARRY

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-29.5	10	0.004	1100	(1080,1130)
10.0-29.5	9	0.003	1090	(1060,1130)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.008	1070	(1050,1100)
0.009	1100	(1070,1130)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-29.5	10	0.004	3030	(2910,3150)
10.0-29.5	9	0.004	3100	(2950,3260)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
1100	7.5-29.5	3030	7.5-29.5	12.0	2.49	30300	188000	0.423
1090	10.0-29.5	3100	10.0-29.5	12.0	2.49	29800	199000	0.429

TABLE 34

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 23 CAL STATE HAYWARD

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-25.6	8	0.021	823	(785, 864)
10.0-25.6	7	0.021	824	(774, 880)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.028	821	(789, 856)
0.027	793	(758, 830)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
10.0-25.6	7	0.010	1380	(1330,1440)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
823	7.5-25.6	1380	10.0-25.6	7.6	1.98	13400	19800	0.224
824	10.0-25.6	1380	10.0-25.6					0.223

TABLE 35

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 24 MILLER SCHOOL

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.006	405	(395, 417)
15.0-29.3	7	0.015	580	(546, 618)
10.0-29.3	9	0.012	548	(527, 571)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.009	344	(334, 355)
0.022	586	(502, 704)
0.020	554	(507, 610)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.005	961	(891,1040)
17.5-29.3	6	0.006	906	(878, 936)
10.0-29.3	9	0.002	801	(769, 837)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
405	2.5-10.0	961	2.5-12.5	9.8	1.78	2930	12600	0.392
580	15.0-29.3	906	17.5-29.3	24.0	2.10	7070	7840	0.153

TABLE 36

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 25 OLIVER SALT WORKS

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.0- 8.0	4	0.006	195 (186, 204)
10.0-12.8	3	0.018	265 (244, 291)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.012	193 (182, 207)
0.026	271 (267, 274)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
4.0- 8.0	3	0.006	1070 (896,1320)
8.0-12.8	4	0.008	1570 (1420,1770)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
195	2.0- 8.0	1070	4.0- 8.0	3.0	1.94	741	21200	0.483
265	10.0-12.8	1570	8.0-12.8	12.0	2.13	1500	50700	0.485

TABLE 37

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 26 CORTE MADERA

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5-12.5	5	0.007	362	(344, 382)	0.016	362	(349, 375)
14.5-22.3	5	0.003	377	(354, 404)	0.011	359	(330, 395)
24.0-30.3	4	0.037	716	(606, 875)	0.046	741	(666, 835)
10.0-30.3	11	0.010	422	(403, 444)	0.021	446	(427, 467)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-14.5	6	0.010	1190	(1160,1230)
16.0-28.0	7	0.013	1530	(1440,1630)
10.0-30.3	11	0.012	1370	(1310,1440)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
362	2.5-12.5	1190	2.5-14.5	9.7	2.31	3040	28900	0.449
377	14.5-22.3	1530	16.0-28.0	16.1	2.31	3300	49500	0.467
716	24.0-30.3	1527	16.0-28.0	30.0	2.25	11500	37100	0.359
422	10.0-30.3	1370	10.0-30.3	16.1	2.31	4130	38000	0.448
422	10.0-30.3	1370	10.0-30.3	30.0	2.25	4020	37000	0.448

TABLE 38

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 27 MITCHELL PARK

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-15.0	5	0.007	270	(262, 279)	0.014	246	(236, 256)
17.5-22.5	3	-.004	226	(226, 226)	0.009	236	(230, 243)
25.0-30.0	3	0.018	293	(283, 303)	0.027	292	(283, 303)
10.0-30.0	9	0.005	256	(251, 261)	0.018	264	(260, 259)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-15.0	5	0.006	1530	(1450,1610)
17.5-30.0	6	0.006	1610	(1540,1680)
10.0-30.0	9	0.006	1640	(1610,1680)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
270	5.0-15.0	1530	5.0-15.0	9.8	2.07	1520	46400	0.484
226	17.5-22.5	1610	17.5-30.0	18.3	1.91	977	48100	0.490
293	25.0-30.0	1610	17.5-30.0					0.483
256	10.0-30.0	1640	10.0-30.0	18.3	1.91	1260	49900	0.488

TABLE 39

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 28 FOOTHILLS PARK

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.004	406	(378, 437)
12.5-29.0	8	0.016	791	(776, 806)
10.0-29.0	9	0.015	776	(762, 790)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.005	321	(306, 337)
0.023	807	(743, 883)
0.024	822	(770, 882)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.005	800	(754, 852)
15.0-29.0	7	0.016	2640	(2450,2860)
10.0-29.0	9	0.014	2280	(2140,2450)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
406	2.5-10.0	800	2.5-12.5	6.4	2.36	3890	9920	0.327
791	12.5-29.0	2640	15.0-29.0	28.0	2.57	16100	157000	0.450
776	10.0-29.0	2280	10.0-29.0	28.0	2.57	15500	113000	0.435

TABLE 40

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 29 SIERRA MORENA

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.005	560	(517, 611)
15.0-30.0	7	0.008	739	(691, 794)
10.0-30.0	9	0.010	779	(733, 832)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.009	511	(468, 561)
0.016	761	(702, 831)
0.015	742	(695, 797)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.004	1160	(1150,1170)
15.0-30.0	7	0.009	2100	(1990,2210)
10.0-30.0	9	0.008	1990	(1910,2070)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
560	2.5-12.5	1160	2.5-12.5	6.4	2.11	6630	19600	0.348
739	15.0-30.0	2100	15.0-30.0	30.0	2.17	11900	79500	0.429
779	10.0-30.0	1990	10.0-30.0	30.0	2.17	13200	68300	0.409

TABLE 41

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 30 PULGAS TUNNEL

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-15.0	6	0.007	425	(420, 431)
17.5-22.5	3	0.008	451	(429, 475)
25.0-30.0	3	0.015	552	(530, 576)
10.0-30.0	9	0.013	525	(509, 542)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.013	415	(409, 421)
0.017	495	(495, 495)
0.025	619	(553, 704)
0.021	569	(549, 593)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-20.0	8	0.004	810	(776, 847)
22.5-30.0	4	0.022	2470	(2450,2500)
10.0-30.0	9	0.008	1060	(966,1180)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
425	2.5-15.0	810	2.5-20.0	7.9	2.24	4060	9310	0.310
451	17.5-22.5	810	2.5-20.0					0.275
552	25.0-30.0	2470	22.5-30.0	29.0	2.05	6260	117000	0.474
525	10.0-30.0	1060	10.0-30.0	29.0	2.05	5660	15600	0.338

TABLE 42

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 31 FRENCHMANS CREEK

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	-.001	267 (259, 276)
12.5-19.4	4	0.022	612 (610, 615)
21.3-25.3	3	0.045	1940 (1930,1940)
10.0-29.2	10	0.026	761 (712, 818)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.004	267 (265, 270)
0.029	609 (607, 612)
0.052	1930 (1920,1930)
0.031	716 (663, 777)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.003	892 (844, 945)
12.5-19.4	4	0.009	2260 (2170,2350)
21.3-29.2	5	0.013	3900 (3250,4870)
10.0-29.2	10	0.010	2690 (2560,2840)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
267	2.5-10.0	892	2.5-10.0	6.4	1.85	1320	13000	0.451
612	12.5-19.4	2260	12.5-19.4	12.8	2.12	7960	97500	0.460
1940	21.3-25.3	3900	21.3-29.2					0.336
761	10.0-29.2	2690	10.0-29.2	12.8	2.12	12300	137000	0.456
761	10.0-29.2	2690	10.0-29.2	29.2	2.52	14600	163000	0.456

TABLE 43

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 32 HALFMOON BAY TERRACE

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-22.5	9	0.007	338	(334, 343)
25.0-29.6	3	0.041	650	(630, 672)
10.0-29.6	9	0.012	384	(369, 401)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.015	336	(332, 341)
0.055	752	(560, 875)
0.024	399	(382, 418)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-29.6	11	0.006	1650	(1630,1680)
10.0-29.6	9	0.006	1630	(1590,1660)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
338	2.5-22.5	1650	5.0-29.6	6.4	1.88	2160	48400	0.478
650	25.0-29.6	1650	5.0-29.6					0.408
384	10.0-29.6	1630	10.0-29.6					0.470

TABLE 44

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 33 VISTA GRANDE

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.003	251	(249, 254)
12.5-20.0	3	0.024	488	(486, 489)
22.5-30.0	4	0.054	1230	(1230,1230)
10.0-30.0	8	0.027	538	(502, 579)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.008	245	(240, 252)
0.029	486	(485, 488)
0.046	687	(595, 813)
0.029	479	(459, 499)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.005	862	(827, 901)
12.5-20.0	3	0.013	1610	(1350,1980)
22.5-30.0	4	0.032	3470	(2800,4580)
10.0-30.0	8	0.004	762	(688, 855)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
251	2.5-10.0	862	2.5-10.0					0.453
488	12.5-20.0	1610	12.5-20.0					0.449
1230	22.5-30.0	3470	22.5-30.0	26.0	2.30	34600	231000	0.429
538	10.0-30.0	762	10.0-30.0	26.0	2.30	6670	4500	0.004

TABLE 45

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 34 MORRISON CANYON

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-12.5	4	0.015	537	(503, 576)	0.019	477	(452, 504)
15.0-29.9	7	0.026	1090	(1050,1130)	0.033	1040	(1010,1060)
10.0-29.9	9	0.025	1040	(994,1090)	0.031	956	(923, 991)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-12.5	4	0.004	1740	(1580,1930)
15.0-29.9	7	0.007	3130	(2920,3360)
10.0-29.9	9	0.007	3110	(2920,3330)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
537	5.0-12.5	1740	5.0-12.5					0.447
1090	15.0-29.9	3130	15.0-29.9	23.2	2.20	26100	180000	0.431
1040	10.0-29.9	3110	10.0-29.9	23.2	2.20	23800	181000	0.437

TABLE 46

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 35 LAKE MERCED COUNTRY CLUB

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
7.5-29.3	10	0.012	567	(561, 572)	0.016	568	(563, 573)
10.0-29.3	9	0.012	558	(554, 563)	0.017	575	(570, 579)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
10.0-29.3	9	0.013	1300	(1260,1340)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
567	7.5-29.3	1300	10.0-29.3	10.1	1.97	6330	24800	0.382
558	10.0-29.3	1298	10.0-29.3	10.1	1.97	6160	25000	0.386