DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 79/116

SHALLOW REFRACTION SURVEY IN THE VICINITY OF NARACOORTE ABATTOIR DISPOSAL LAGOONS.

GEOLOGICAL SURVEY

By

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D.M. No. 317/77

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PLANS

DEPARTMENT OF MINES AND ENERGY
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ABSTRACT

A shallow seismic refraction survey was carried out around the disposal lagoons at the Naracoorte Abattoir to determine the depth to the Gambier Limestone. This was found to occur at a depth of approximately 13 m over most of the area. Around the anaerobic lagoons it rises to within 6-7 m of the surface and may in fact occur at shallower depths beneath the lagoons.

INTRODUCTION

A shallow seismic refraction survey was carried out around the disposal lagoons of the Naracoorte Abattoir, located about 6 km east of Naracoorte (Figure 1). The purpose of the survey was to map the top of the buried Gambier Limestone in the vicinity of the lagoons. Drill hole information has indicated a sudden shallowing of the limestone surface beneath the anaerobic lagoons and it is believed that the Gambier Limestone aquifer could be polluted by the effluent if the lagoon excavations extend into it.

This work was carried out at the request of the Engineering Section of the S.A. Department of Mines and Energy in May, 1979.

METHOD

The seismic refraction method involves recording the times taken for energy to travel from an impulse source to an array of geophones. The times are then plotted against the geophone positions and the resultant "time-distance" curves analysed to obtain the seismic velocities and thicknesses of layers beneath the geophone spread.

The recording apparatus used on this survey consisted of an SIE PT 100 twenty four channel amplifier feeding an SIE ERC 6 electrostatic oscillograph.

Standard seismic refraction geophones were positioned 5 m apart in an in-line spread of 110 m total length. In adjacent spreads (e.g. 3 & 4, 4 & 5), geophone 1 was coincident with geophone 24 of the previous spread to ensure continuity of data.

The source consisted of gelignite charges located in drill holes 1-2 m deep. A correction was applied to arrival times to adjust the data to the surface datum. Shotpoints were located at the centre, at the ends and half a spread length (55 m) from each end of each spread.

To obtain information about the surface material it was necessary to carry out a series of weathering spreads at each shot point. For this purpose, a Bison Signal Enhancement hammer seismograph was used with readings being obtained every 2 m to a distance of 20 m.

Figure 2 shows the location of the seismic spreads around the lagoons.

INTERPRETATION AND RESULTS

The geological section, obtained from previously drilled observation bores, consists of topsoil, clay, Parilla Sand and Gambier Limestone. In two holes, a clay layer was observed between the Parilla Sand and Gambier Limestone.

The seismic results indicate the presence of two interfaces and these have been correlated with the upper surfaces of the Parilla Sand and Gambier Limestone. These two refractors were mapped using the reciprocal method described by Hawkins (1961). At the eastern ends of spreads 1 & 3, where the limestone surface was observed to shallow rapidly, the Generalised Reciprocal

Method (Palmer, 1974) was used to interpret the data (using an XY spacing of 15 m). As a result, the re-interpreted position of the limestone "cliff" has been shifted 5-10 m to the west. Because of the steep dip (greater than 15°) of this "cliff" there is some doubt as to its true location although the second interpretation (XY=15) is probably more accurate.

Seismic cross-sections are presented as Figures 3-7 and the velocities and depths to the two refractors are summarised below:

Layer	Average Velocity (m/s)	S. Dev.	Average Depth(m)	S. Dev.
Topsoil & clay	380	30	-	-
Parilla Sand	890	50	1.8	0.5
Gambier Limestone	2300	150	13.0*	1.6

*does not include data from spreads 1 and 3 where the limestone surface shallows rapidly.

Because the topsoil and clay probably have similar seismic velocities the boundary between these two materials was not observed. Similarly, the clay layer at the base of the Parilla Sand could not be detected. This clay layer, however, is believed to be present only in surface depressions of the limestone and hence its approximate extent could be determined (Figure 3).

CONCLUSIONS AND RECOMMENDATIONS

The Gambier Limestone occurs at a fairly uniform depth of approximately 13 m over most of the area surveyed. Only beneath the anaerobic lagoons does an appreciable shallowing occur and the limestone rises to within 6-7 m of the surface. The presence of the Parilla Sand between the effluent and Gambier Limestone probably prevents the contents of the lagoons from entering the aquifer.

The presence of a large limestone boulder (believed to have been removed from the lagoon excavations) and the intersection

of limestone at 1.5 m in borehole JES 51 suggest that the limestone may, in fact, be shallower beneath the lagoons. This may be tested by two further refraction spreads, one along the eastern edge of the anaerobic lagoons and the second along the mound between the two lagoons.

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REFERENCES

Hawkins, L.V., 1961. "The reciprocal method of routine shallow refraction investigations" Geophysics, 26, 806-819.

Palmer, D., 1974. "An application of the time section in shallow seismic refraction studies" M.Sc. Thesis, University of Sydney.

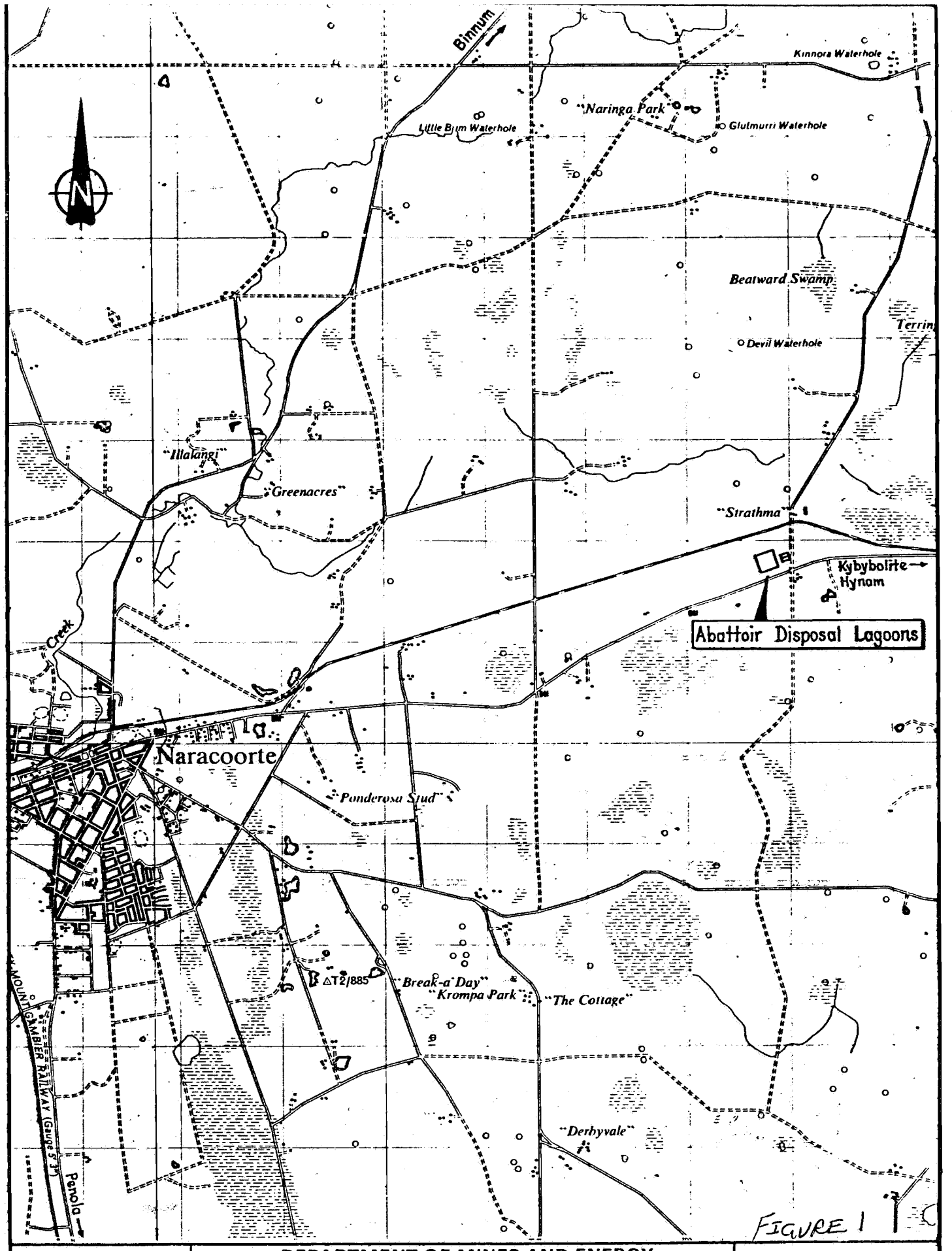


FIGURE 1

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1:50000
COMPILED: M. Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE: 10th AUG. 1979
DRN: TE / CKD:	LOCALITY PLAN	PLAN NUMBER S 14206

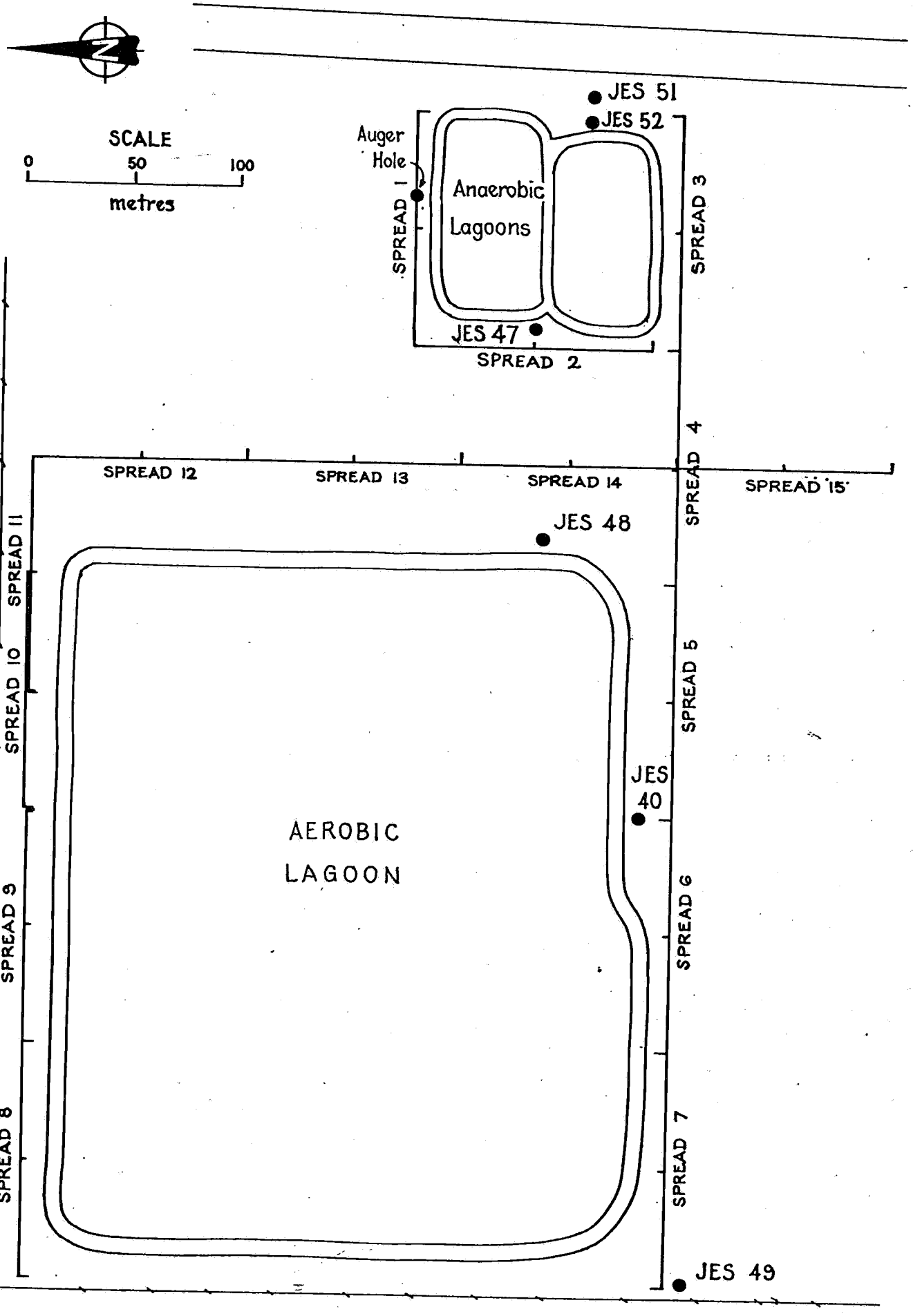


FIGURE 2

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1:2500
COMPILED: M. Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE: 13th AUG. 1979
DRN TE / CKD:	LOCATIONS OF SEISMIC TRAVERSES AROUND DISPOSAL LAGOONS	PLAN NUMBER S 14207

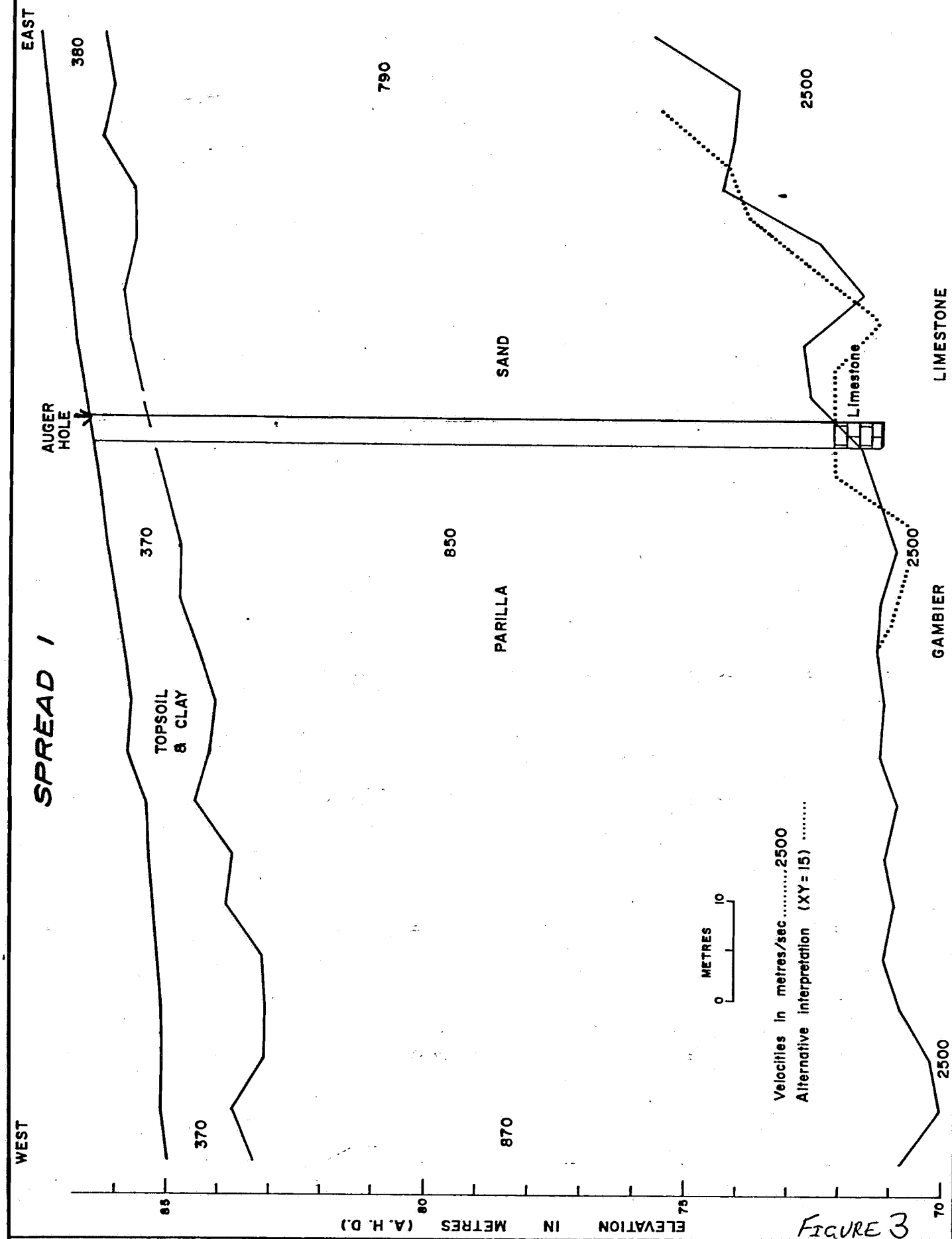


FIGURE 3

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1:500 (horiz)
COMPILED: M. Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE 13th AUG 1979
DRN: TE CKD:	SEISMIC CROSS-SECTION SPREAD 1	PLAN NUMBER S 14208

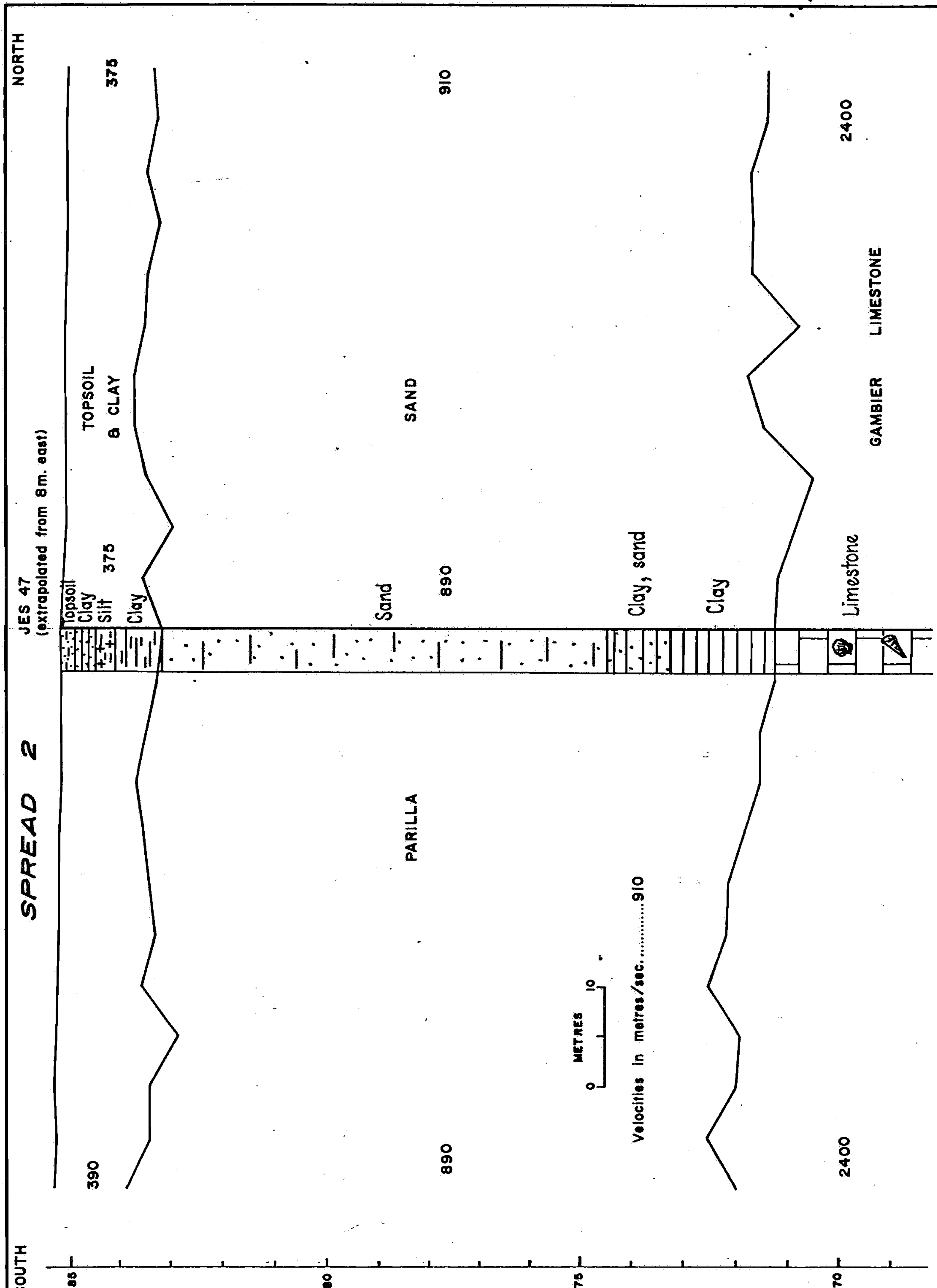
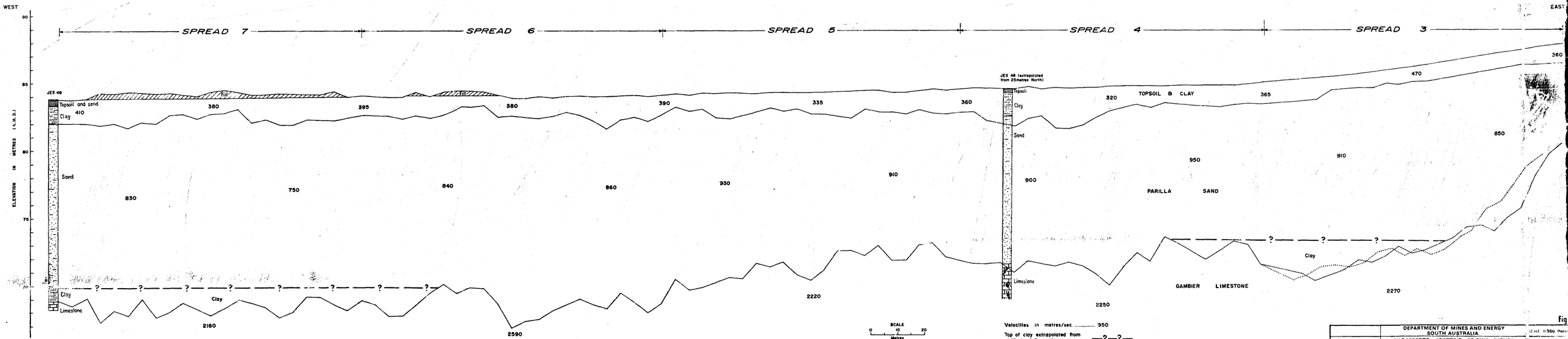
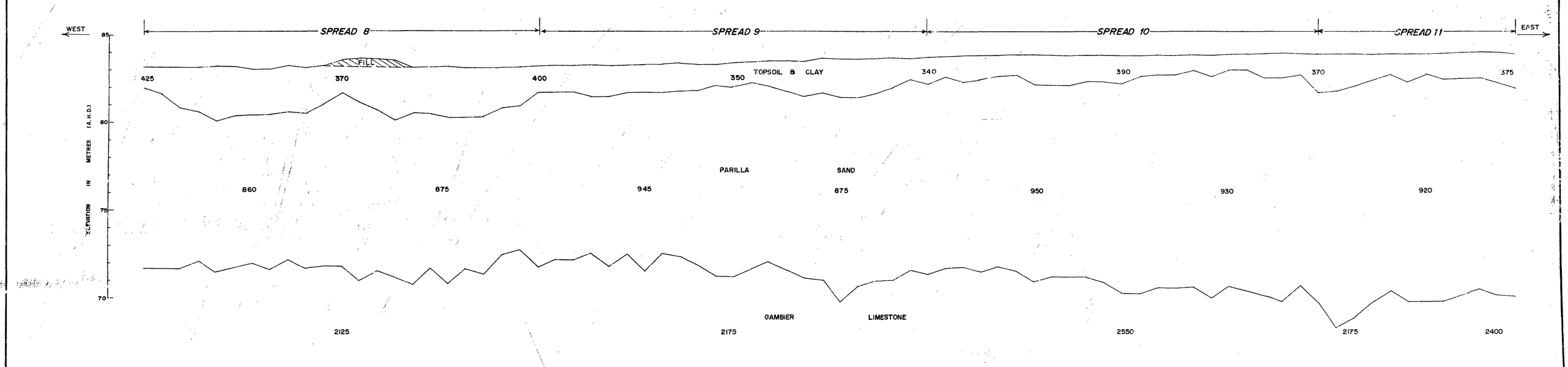


FIGURE 4

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1:500 (horiz)
COMPILED: M. Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE: 13th AUG. 1979
DRN: T E CKD:	SEISMIC CROSS-SECTION SPREAD 2	PLAN NUMBER S 14209


WEST
EAST
SPREAD 7
SPREAD 6
SPREAD 5
SPREAD 4
SPREAD 3
ELEVATION IN METRES (A.H.D.)
90
85
80
75
JES 49
Topsoil and sand.
Clay
Sand
Clay
Limestone
Fill
410
380
395
380
390
335
360
830
750
840
860
930
910
2160
2590
2220
JES 48 (extrapolated from 25metres North)
Topsoil
Clay
Sand
Limestone
320
TOPSOIL & CLAY
365
470
360
850
950
910
900
PARILLA SAND
Clay
GAMBIER LIMESTONE
2250
2270
SCALE
0 10 20
Metres
Velocities in metres/sec 950
Top of clay extrapolated from drillhole information
Alternative interpretation (XY = 15) .....
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA
COMPILED M. Micenko
NARACOORTE ABATTOIR SEISMIC SURVEY
DRN. TE CKD
SEISMIC CROSS-SECTION SPREADS 3,4,5,6,7
SCALE 1:500 (Horiz
DATE 17th AUG 19
PLAN NUMBER
79-596

Fig



Velocities in metres/sec 2175

SCALE
0 10 20
Metres

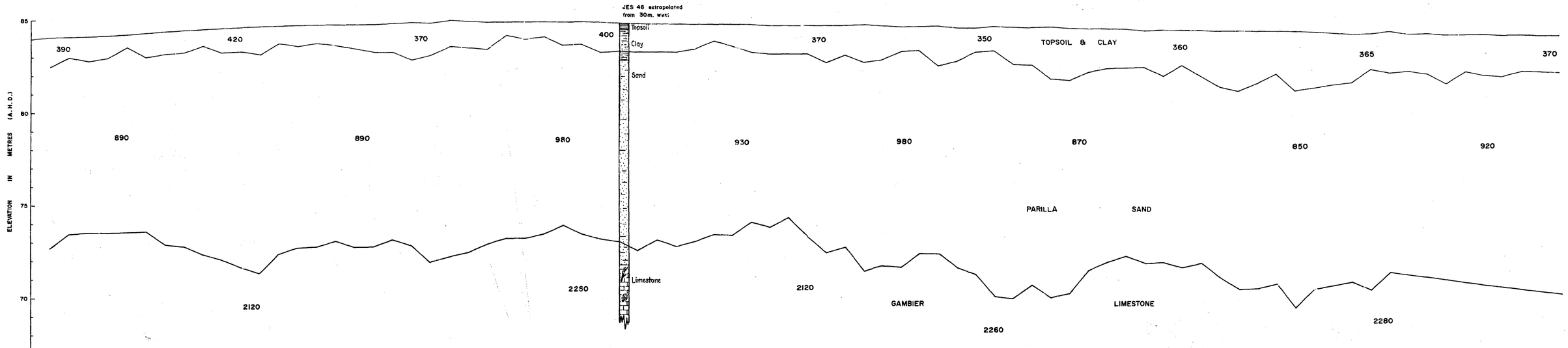
Fig. 6

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1:500 (horiz
COMPILED M.Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE AUGUST 1979
DRN S.R CKD		PLAN NUMBER 79-59
	SEISMIC CROSS-SECTION SPREADS 8,9,10,11	

SOUTH

NORTH

SPREAD 15 — SPREAD 14 — SPREAD 13 — SPREAD 12



Velocities in metres/sec. 2260

SCALE
0 10 20
Metres

Fig. 7

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1:500 (horiz.
COMPILED M Micenko	NARACOORTE ABATTOIR SEISMIC SURVEY	DATE 16th AUG. 1979
DRN TE CKD	SEISMIC CROSS-SECTION SPREADS 12, 13, 14, 15	PLAN NUMBER 79-598