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BUREAU OF MINERAL
RESOURCES, GEOLOGY
AND GEOPHYSICS

Record 1972/24

SEISMIC REFRACTION SURVEY OF PROPOSED PIPE STORAGE AREA, MOLONGLO VALLEY INTERCEPTOR SEWER, ACT 1971

by

G.R. Pettifer

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SUMMARY

A seismic refraction investigation of a proposed concrete pipe storage area near Coppins Crossing revealed that in the higher parts of the site, low-velocity overburden of a rippable nature is present down to depths of at least 13 metres. In lower parts of the site, higher velocity overburden, probably representing weathered bedrock, and approaching the limit of rippability, occurs at depths of 2 to 3 metres over minor topographic rises.

1. INTRODUCTION

The plans for the proposed Molonglo Valley Interceptor Sewer to be constructed by the Department of Works include the construction of a suitable area for storage of precast concrete pipes. The area chosen by the Department of Works requires excavation to level the site adequately for pipe storage purposes. Some terracing may be required on the higher parts of the site, depending on the ease of excavation of the area. At the request of the Department of Works, the Bureau of Mineral Resources (BMR) conducted a seismic refraction survey over the proposed area to ascertain the degree of rippability of the overburden and the range of bedrock depths likely to be encountered during excavation.

A geophysical party, consisting of G.R. Pettifer (geophysicist), S. Hall (shooter) and two field hands, conducted the survey during November 1971.

2. GEOLOGY

The geology of the area has been compiled by Henderson (1970) and Strusz & Henderson (1971), and is shown in Plate 1. Scattered outcrops on the elevated areas of the site reveal a trough of tough fine-grained cherty tuff of the Silurian Deakin Volcanics which extends over the southern part of the survey area. The northern boundary of the trough is uncertain but may be inside the survey area. The northernmost outcrop within the site consists of a dark medium-grained dacitic crystal tuff of the Silurian Mount Painter Porphyry. The trough of cherty tuff lies within the Mount Painter Porphyry and is bounded to the southeast some 60 metres south of the survey area by a northeast-trending fault. This fault parallels, and is probably associated with, the major Winslade Fault Zone which occurs some 90 metres northwest of the area investigated. No faults were mapped in the survey area.

3. EQUIPMENT AND METHOD

BMR's standard 24-channel refraction seismograph (Dresser S.I.E. Co.) and 20-Hz geophones (Technical Instruments Co.) were used throughout the survey. Two intersecting traverses were investigated with a total of seven refraction spreads spaced along the traverse lines at intervals to give a general coverage of the proposed site. The location of the traverses is shown in Plate 1. Each spread consisted of 24 geophones

spaced at 3-metre intervals. Five shots were fired for each spread: one in the centre, two at 1 metre from each end of the spread and two, generally at 70 metres from each end of the spread.

The interpretation was carried out using the standard methods (Heiland, 1946). Depths to intermediate layers and bedrock were computed at each shot-point.

4. RESULTS

Plate 2 shows the seismic results along each traverse. In the survey area four main velocities were encountered. These velocities and their interpreted rock type are tabulated below.

Seismic velocity (m/s)	Rock type
300 - 700	Soil and clay
850 -1 500	Completely weathered bedrock
1 800-2 000	Weathered bedrock
4 100-5 700	Unweathered bedrock

The soil layer generally ranges in thickness from about 1.5 to 2.5 metres but appears to thicken in places (Traverse 1, Spread 1; Plate 2) to 8.5 metres. This layer should be easily ripped during excavation.

The underlying 850-1 500 m/s layer, representing completely weathered bedrock, was detected over most of the area; however, over two minor topographic highs in the lower parts of the site the layer is either not present or too thin to be detected by the seismic method. This limitation of the seismic method is discussed by Hawkins & Maggs (1961). Thus on Spread 3 of Traverse 1 and Spread 7 of Traverse 2 the 850-1 500 m/s layer may be present with a thickness as great as about 2 metres even though it was not recorded by the seismic method. The completely weathered bedrock should be rippable.

The 1 800-2 000 m/s layer was detected only where the completely weathered layer is very thin or non-existent (Spreads 3 and 7). The seismic velocity of this layer suggests that it may have to be blasted. Over most of the two traverses investigated, particularly on the higher parts of the

site, the weathered bedrock is masked by the presence of the overlying completely weathered bedrock. Weathered bedrock may be present in thickness up to 6 metres over the site beneath completely weathered bedrock. In this case (6 m of weathered bedrock), the true depth to unweathered bedrock would be about 3 metres greater than that shown in Plate 2.

Bedrock occurs at depths ranging from 7 metres to greater than 20 metres. Bedrock highs appear to be associated with areas of surface outcrop.

The seismic results suggest that the overburden is more highly weathered in the higher parts of the site, and therefore suitable for excavation to depths of 13 metres (and in places to greater depths). The overburden velocity appears to increase over areas of surface outcrop and local topographic highs in the lower parts of the site, and here difficulty in ripping may be encountered.

The seismic results appear to be inconclusive in resolving the existence of the northern boundary of the trough of Deakin Volcanics along Traverse 1. Spread 6 crosses an outcrop of the Mount Painter Porphyry dacitic crystal tuff on the northern end of Traverse 2, and here the overburden appears to be rippable to a depth of 10 metres. The two volcanic tuffs found on the site appear to have similar bedrock velocities.

5. CONCLUSIONS

The results indicated that the higher parts of the site are rippable to depths of at least 13 metres. On the lower parts of the site the overburden velocity increases locally over minor topographic highs, and here difficulty with ripping the overburden could be expected. In the northern parts of the site Mount Painter Porphyry dacite tuff appears to be rippable to a depth of about 10 metres.

6. REFERENCES

CATERPILLAR TRACTOR COMPANY, 1966 - Handbook of ripping - a guide to greater profits (Third edition).

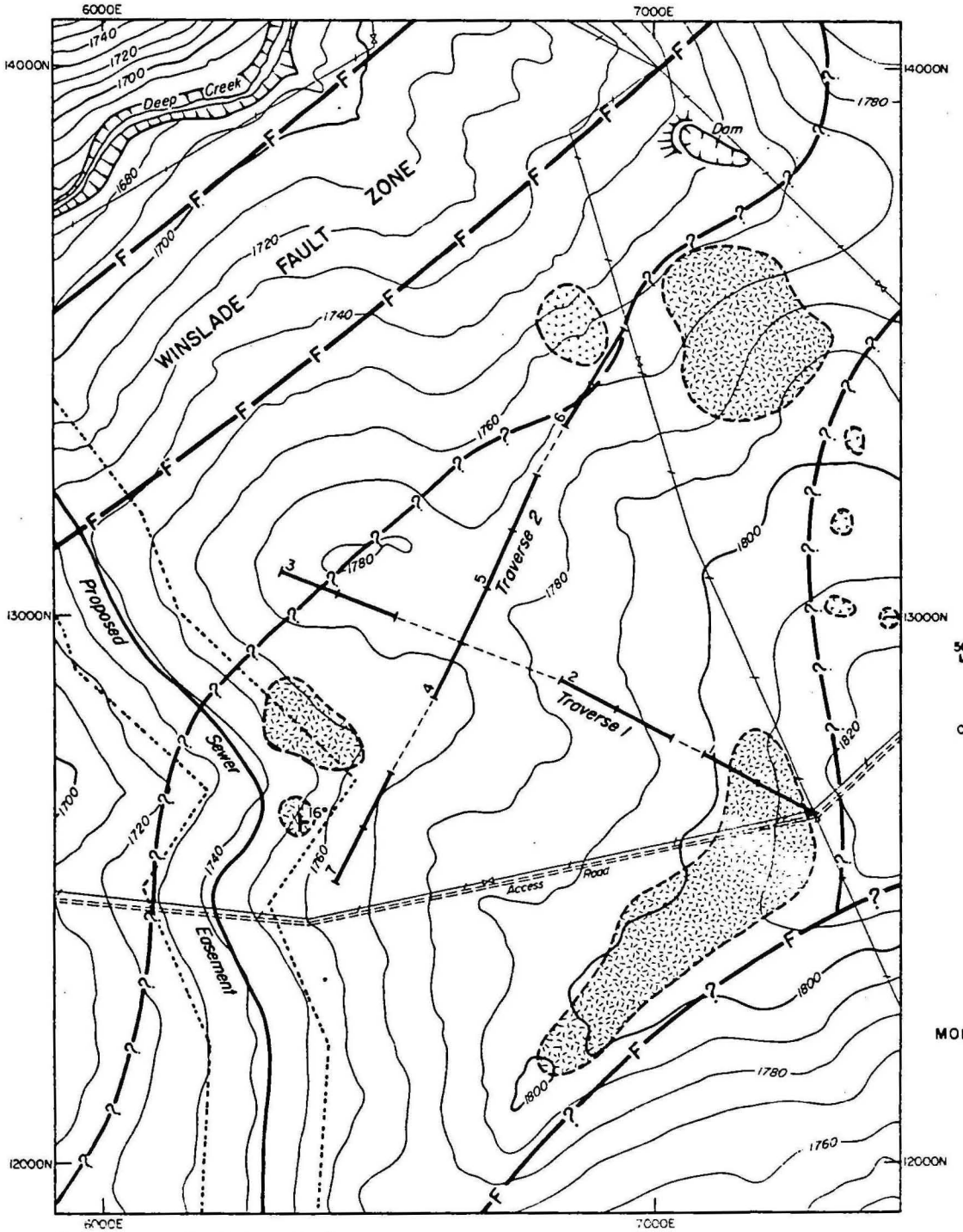
HAWKINS, L.V., and MAGGS, D., 1961 - Nomograms for determining maximum errors and limiting conditions in a seismic refraction survey with a blind zone problem. Geophys. Prospecting 9(4), 526-532.

HEILAND, C.A., 1946 - GEOPHYSICAL EXPLORATION. New York, Prentice-Hall Inc.

HENDERSON, G.A.M., 1970 - North Molonglo Outfall Sewer, A.C.T.. Geological report on detailed investigation, 1969. Bur. Miner. Resour. Aust. Rec. 1970/61 (unpubl.).

STRUSZ, D.L., & HENDERSON, G.A.M., 1971 - Canberra City A.C.T. 1:50,000 Geological Map and Explanatory Notes.

PLATE 1



GRID NORTH
MAGNETIC NORTH

LEGEND

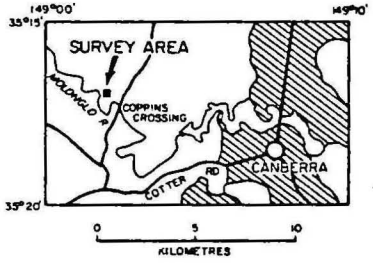
GEOLOGY (after Henderson G.A.M. 1970)

- Deakin Volcanics, cherty tuff
- Mt Painter Porphyry dacite tuff
- 16° Dip and strike
- F Fault
- ? Inferred geological boundary
- Geological boundary of outcrop
- 5 Spread and number
- Fence and gate

50 0 50 100 150 METRES

100 0 100 200 300 400 FEET

CO-ORDINATES IN FEET ORIGIN AT STROMLO TRIG STATION
TOPOGRAPHIC CONTOUR INTERVAL 10 FEET



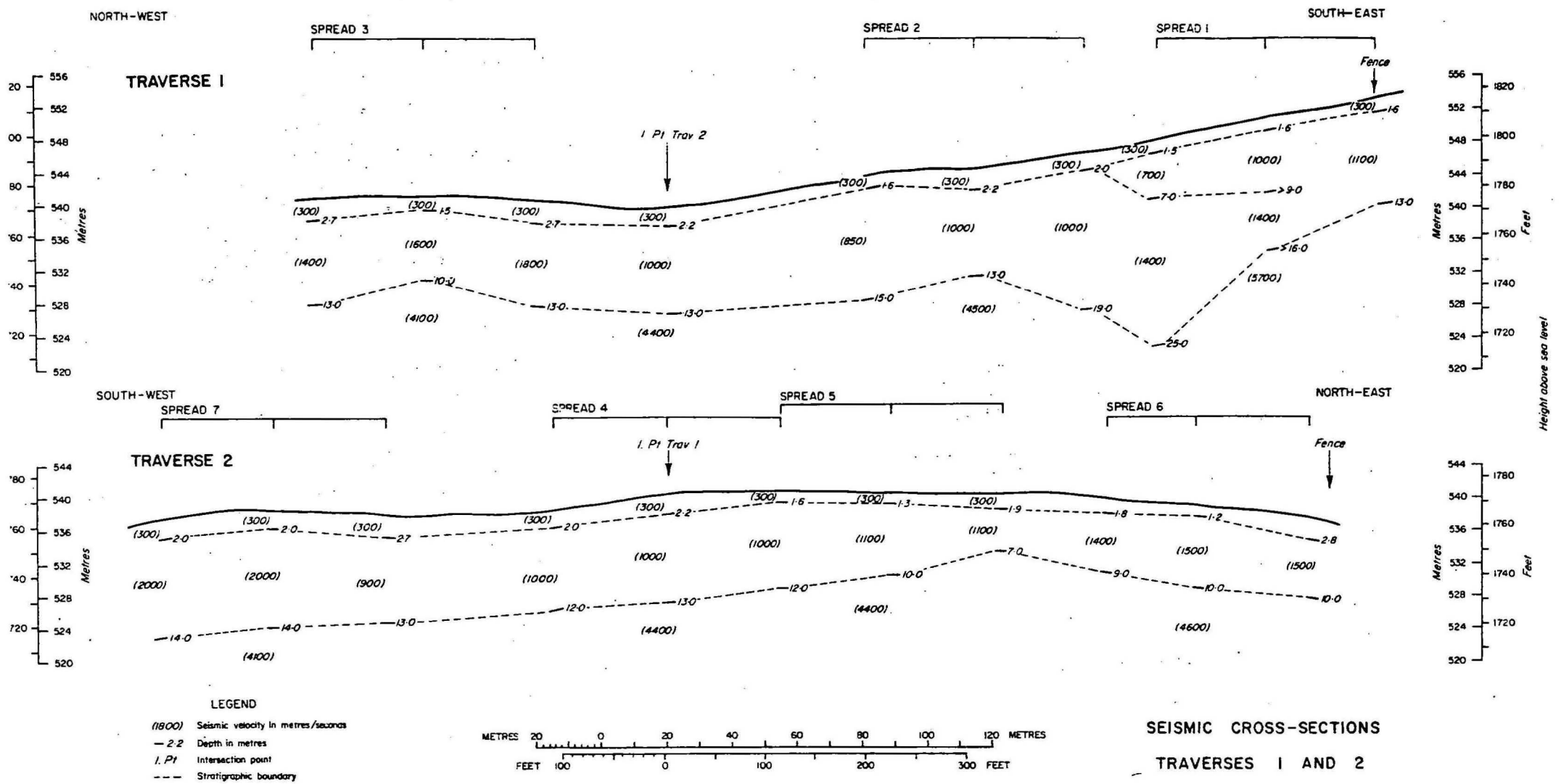
PIPE STORAGE AREA
MOLONGLO VALLEY INTERCEPTOR SEWER
1971

LOCALITY MAP AND
LOCATION OF TRAVERSES

To accompany Record No. 1972/24

155/85-130

Pipe Storage Area, Molonglo Valley 1971



SEISMIC CROSS-SECTIONS

TRAVERSES 1 AND 2