COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1967/101

TIDBINBILLA TRACKING STATION SEISMIC REFRACTION SURVEY,

AUSTRALIAN CAPITAL TERRITORY 1967

by

P.E. MANN and E.J. POLAK

RECORD No. 1967/101

TIDBINBILLA TRACKING STATION SEISMIC REFRACTION SURVEY,

AUSTRALIAN CAPITAL TERRITORY 1967

by

P.E. MANN and E.J. POLAK

CONTENTS

ILLUSTRATIONS

SUMMARY

A short seismic refraction survey to determine the depth to bedrock was done for the erection of another dish antenna at the Tidbinbilla tracking station, A.C.T. The bedrock is Silurian granite, has a seismic velocity of 11,400 to 16,000ft/s and is deeper than any excavation required for the station.

1. INTRODUCTION

The Commonwealth Department of Works is preparing plans for the extension of the National Aeronautical Space Administration deep space tracking station at Tidbinbilla, Australian Capital Territory. The extension will consist of a new larger-diameter dish antenna with a control room underneath.

The Geological Branch of the Bureau of Mineral Resources, Geology and Geophysics is carrying out a geological investigation for the project and the Commonwealth Department of Works is testing the area by auger drilling.

A seismic test was made by the Geophysical Branch of the BMR to determine the depth to the fresh rock at several possible positions for the dish. The main consideration was to find a place where the overburden is thick enough for the excavation for the cellar not to reach the bedrock. The test was carried out on May 16th and 17th by P.E. Mann and E.J. Polak, geophysicists, assisted by D. Tarlinton, field-hand

2. GEOLOGY

The general geology of the area is given by Snelling (1957).

The Tidbinbilla tracking station is located on the alluvial flats of Paddy's River. The alluvium is probably of considerable thickness. The bedrock underlying the alluvium and on the slopes of the hills consists of Shannon Flats Granodiorite of Upper Silurian age.

3. METHODS AND EQUIPMENT

The seismic method of exploration depends on the contrast in the velocity of elastic waves through different rock formations and on the discontinuities between these formations. Details of the method have been given by Heiland (1946). In the field work and calculations the method of differences was used (Heiland 1946, p. 548).

Five main traverses were shot to determine the bedrock profile and in addition short weathering spreads were shot to determine the velocity and thickness of the overburden layers at several points on the main traverse.

The seismic recording equipment used in the test was an SIE 24-channel refraction seismograph with TIC geophones of natural frequency 20 c/s

4. RESULTS

Plate 1 shows the arrangement of the geophysical traverses and Plate 2 gives the results of the interpretation of the geophysical work.

Depth to bedrock

The results of the seismic survey were interpreted as a five-layer structure.

Top-layer. This thin layer, in which the seismic velocity is about 1000 ft/s, is interpreted as soil.

2nd layer. This layer, in which the velocity is about 1700 ft/s, is interpreted as loose alluvium. This bed exists only at the floor of the valley, namely on traverses A to C.

3rd layer. This is interpreted as more compacted alluvium and/or completely decomposed granite above the water table. Seismic velocities in this bed range between 3800 and 4500 ft/s.

4th layer. This layer is interpreted as weathered bedrock. The velocities of 6150 to 7500 ft/s indicate that the rock is jointed and highly weathered.

5th layer. This is interpreted as bedrock; the seismic velocity ranges from 11,400 to 16,000 ft/s.

The depth to the bedrock was calculated using the velocities found in the upper layers obtained from the weathering spreads with 10-ft geophone spacing. The profile of the bedrock below the traverses is shown in Plate 2. The depth to the bedrock ranges between 48 ft at station B20 to 272 ft at station D11. It is everwhere deeper than the proposed excavations.

Character of the overburden

The seismic velocities show that there is a marked difference between the overburden on the floor and the sides of the valley. The velocities on traverses A, B, and C are lower than those on traverses D and E. According to experience by the Caterpillar Tractor Co., using a Caterpillar D9 with hydraulic No. 9 ripper (Caterpillar, 1961), material with seismic velocities greater than 5000 ft/s cannot be ripped. Hence, if the excavations reach the fourth layer, which has velocities in the range 6000 to 7500 ft/s, blasting would probably be required. This layer ranges in depth from 20 ft on traverses A, B, and C to 70 ft on traverses D and E.

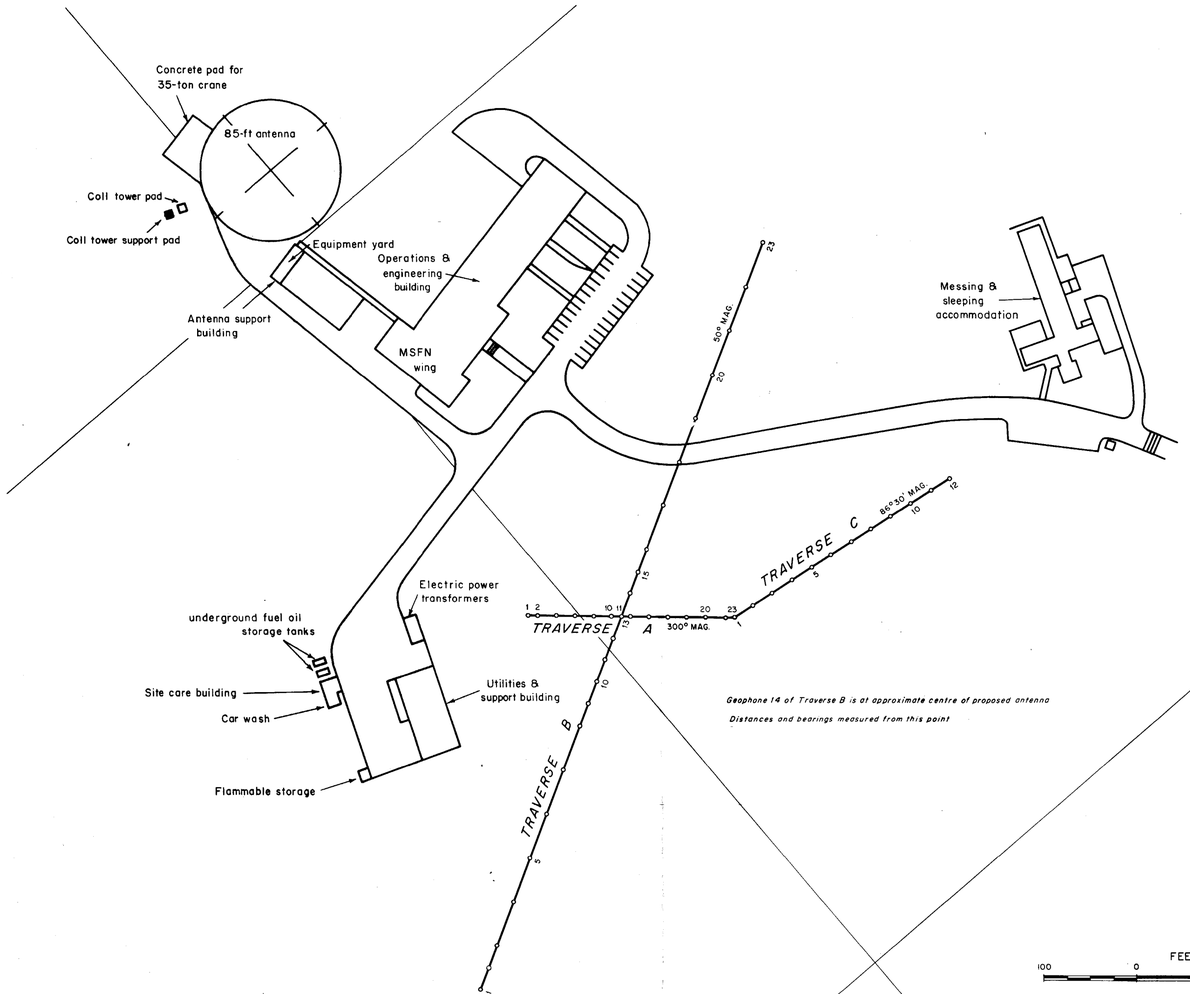
5. CONCLUSIONS

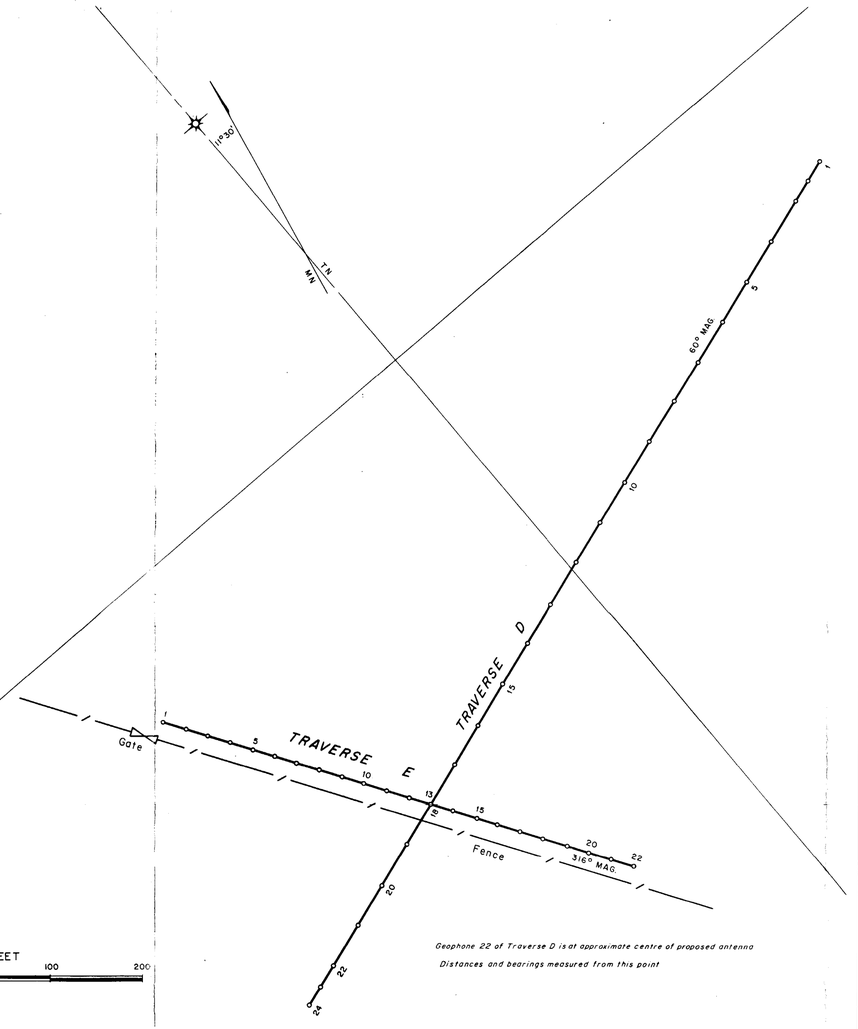
The depth to bedrock (determined as rock with seismic velocity of more than 11,400 ft/s) is deeper than the required excavation for the cellar of the dish. However, it may be necessary to select an area where the layer immediately above bedrock is also deeper than the proposed excavation.

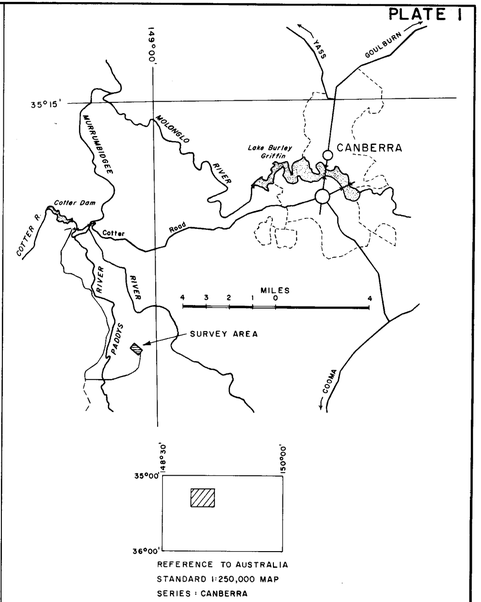
6. REFERENCES

CATERPILLAR	1961	Model MD1. Engineering Seismograph Geophysical Specialties Co. Minneapolis, Minnesota.
HEILAND, C.A.	1946	GEOPHYSICAL PROSPECTING. Prentic Hall, New York.
SNELLING, N.J.	1957	The geology and petrology of the Murrumbidgee Bathylith and its relation to the Palaeozoic igneous activity of the Tasman Geosyncline. Thesis, Australian National University. June 1957 (unpublished).

PLATE I







REFERENCE TO AUSTRALIA STANDARD 1:250,000 MAP SERIES : CANBERRA

TIDBINBILLA TRACKING STATION, ACT, 1967
LOCALITY MAP SHOWING TRAVERSES

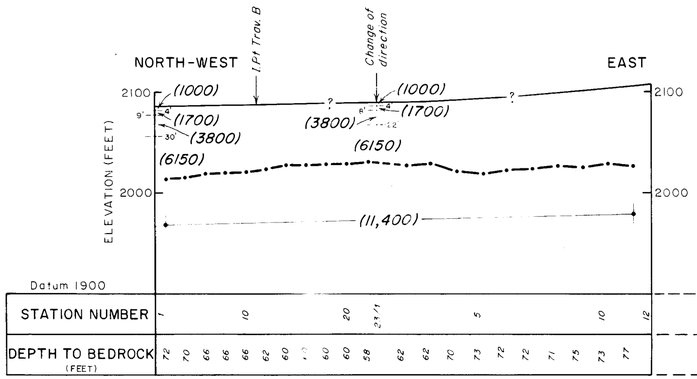
BASED ON PLAN DSS 42

TO ACCOMPANY RECORD No. 1967/101

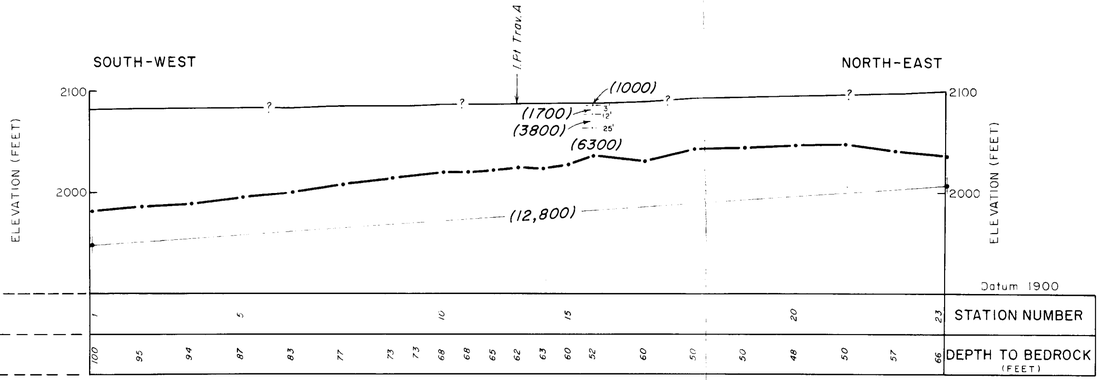
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS 155/B5-47

TRAVERSE A

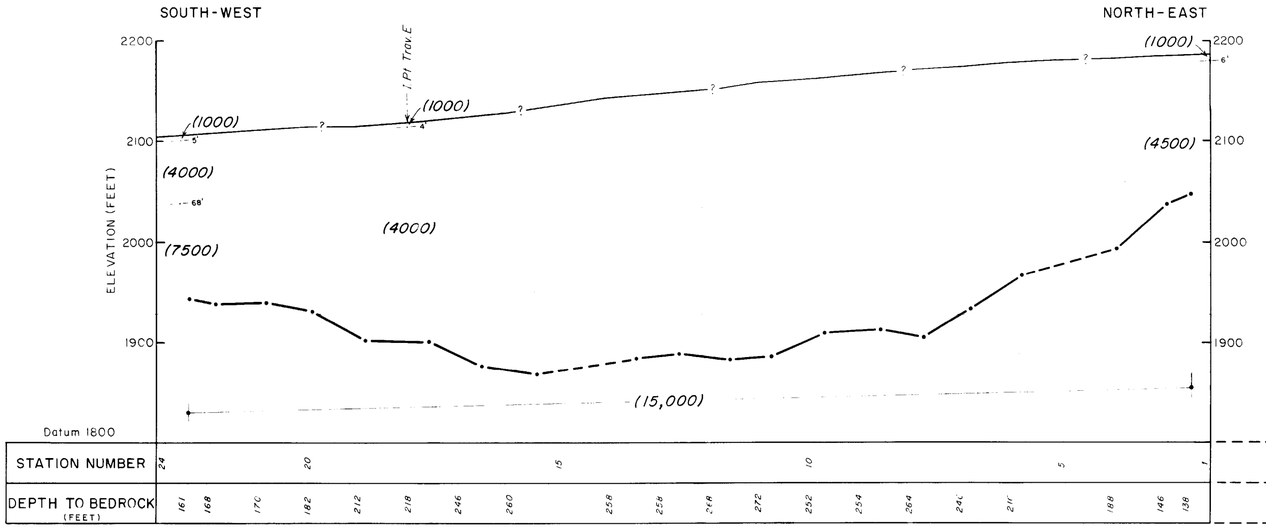
TRAVERSE C



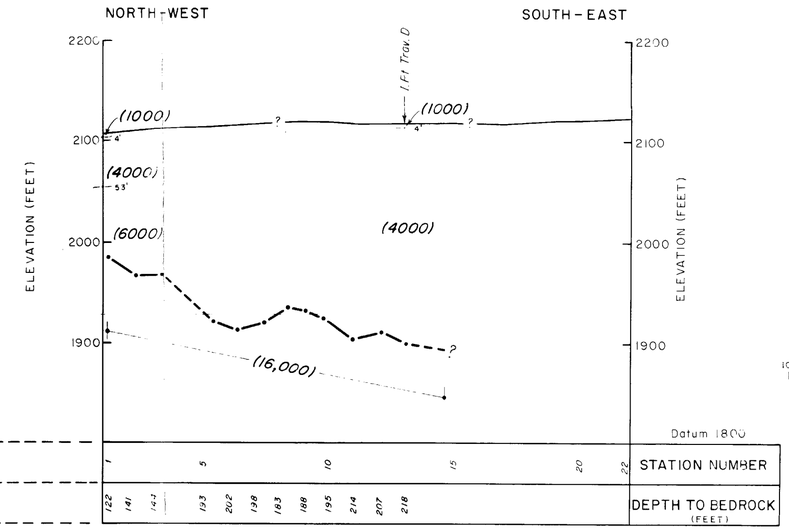
TRAVERSE B



TRAVERSE D



TRAVERSE E



LEGEND

- Unweathered bedrock boundary
- (1700) Seismic velocity (ft/s) in formation
- 4' Depth to formation with different seismic velocity
- I.Pt Traverse intersection point
- ?—? Approximate surface profile

SEISMIC CROSS-SECTIONS

(FEET)
100 0 100 200 300
(Horizontal and vertical)

TO ACCOMPANY RECORD No 1967/101