COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1966/118

GRAVITY TIE BETWEEN MELBOURNE AND TOOLANGI, VICTORIA 1965

by

J.R.H. van Son

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ILLUSTRATIONS

1. INTRODUCTION

As a result of the move of the Geophysical Branch of the Bureau of Mineral Resources (BMR) from Melbourne to Canberra, the premises occupied by the geophysical laboratory in Gordon Street, Footscray, were reallocated to another Government Department. These premises contain the site of the National Gravity Base Station (N.G.B.S.) in Australia and it is likely that access to this site may become difficult, if not impossible, in the future.

Before the premises were vacated, therefore, it was decided to make a gravity tie between N.G.B.S. and a site which could be regarded as 'permanently accessible' and which would also be suitable for pendulum measurements. A site (station 6491.0401) in the old Melbourne Observatory had already been strongly tied to N.G.B.S. and met most of the requirements for a suitable excentre (Shirley, in preparation). In addition, it was decided to make a gravity connection between N.G.B.S. and the BMR Seismic Observatory near Toolangi and, if possible, to locate a site suitable for pendulum work within the University of Melbourne.

Considerable time was spent in searching for the University site and achnowledgement is made to Mr. C. Kerr Grant of the Geology Department for his assistance in this regard. However, owing to a large building programme within the University, a suitable permanent site could not be found and a temporary gravity station was established in the University grounds.

Details of instrumentation and survey logistics are given in Plates 2 to 7.

2. FIELD PROCEDURE

The observations at each gravity station were made by the author using four gravity meters. The average time spent at each site was about 25 minutes.

Between N.G.B.S. Melbourne (station 5099.9901) and Toolangi Seismic Observatory (station 6592.0201) five gravity stations were established and are numbered 6592.0001 to 6592.0005. Gravity station 6592.0001 is located in the Melbourne University grounds. The gravity stations 6592.0002 to 6592.0004 were established to provide adequate drift control for the gravity meters.

Station 6592.0005 was used as an intermediate site for Worden 61 and Sharpe 145 because the range of these two gravity meters was not sufficient to cover the difference in gravity between stations 6592.0004 and 6592.0201. This intermediate station was not occupied by the La Coste and Romberg G20 and G101 gravity meters.

For the purpose of drift control, the stations were observed in the sequence 1, 2, 1, 2, 3, 2, 3, etc. Additional repeat runs were made with the two La Coste and Romberg meters over some intervals to check the consistency of reading of these two gravity meters in particular.

The four gravity meters were calibrated over the Melbourne calibration range during this survey.

3. SUMMARY OF RESULTS

The intervals measured are tabulated in Table 1. It is seen that there is good agreement between the results from all instruments. A value of -161.85 mgal is accepted for the interval Melbourne (N.G.B.S., station 5099.9901) - Toolangi (station 6592.0201)

4. REFERENCES

SHIRLEY, J.E. Gravity meter measurements in connection with the Western Pacific Calibration Line (Australian segment), 1965. Bur. Min. Resour. Aust. Rec. (in preparation)

TABLE 1

Intervals measured by gravity meter (in milligals)

Station	La Coste & Romberg G20	La Coste & Romberg G101	Worden 61	Sharpe 145	Accepted gravity value (mgal)
5099.9901 (N.G.B.S.)					979,979.0
	+0.83 (3.12.65)	+0.83 (3.12.65)	+0.78 (3.12.65)	+0.82 (3.12.65)	
6592.0001					979,979.82
	-23.06 (3.12.65) -23.08 (9.12.65)	-23.12 (3.12.65) -23.12 (9.12.65)	-23.08 (3.12.65)	-23.13 (3.12.65)	
6592.0002					979,956.72
	-11.31 (6.12.65) -11.32 (9.12.65)	-11.39 (6.12.65) -11.35 (9.12.65) -11.35 (10.12.65)	-11.29 (6.12.65)	-11.30 (6.12.65)	
6592.0003					979,945.39
	-17.79 (7.12.65) -17.76 (10.12.65)	-17.72 (7.12.65) -17.72 (10.12.65)	-17.69 (7.12.65)	-17.74 (7.12.65)	
6592.0004					979,927.65
			-64.93 (7.12.65)	-64.96 (7.12.65)	
6592.0005	-110.51 (7.12.65)	-110.51 (7.12.65)			979,862.70
			-45.54 (7.12.65)	-45.55 (7.12.65)	
6592.0201 (Toolangi)					979,817.15
	Σ(Av.) = -161.85	= -161.88	= -161.75	= -161.86	

∴ Accepted Interval, Melbourne (N.G.B.S., station 5099.9901) to Toolangi (station 6592.0201) = -161.85 mgal.

APPENDIX

Survey logistics

Organisation

Staff : Geophysicist J.R.H. van Son
Vehicles : One Ford Falcon Sedan, ZSA-817
Duration of Survey : 1st - 12th December 1965.
Data file (BMR Gravity Group): 6592

Instrumentation

Instruments used. The four gravity meters used on this survey were :

1. La Coste and Romberg G20. This instrument behaved satisfactorily. The 2.6 reading line was used. Slight changes in the inside meter temperature might indicate the presence of gas bubbles in the thermostat. This needs to be investigated.

2. La Coste and Romberg G101. This instrument, the latest acquisition of the BMR in the field of gravity meters, produced consistent results. Its reliability has still to be established. A slight 'heat-cycle' was detected, which needs to be remedied. This 'heat-cycle' which does not exceed 0.02 mgal, was not obvious during previous tests in the basement of the BMR building owing to vibrations in the building.

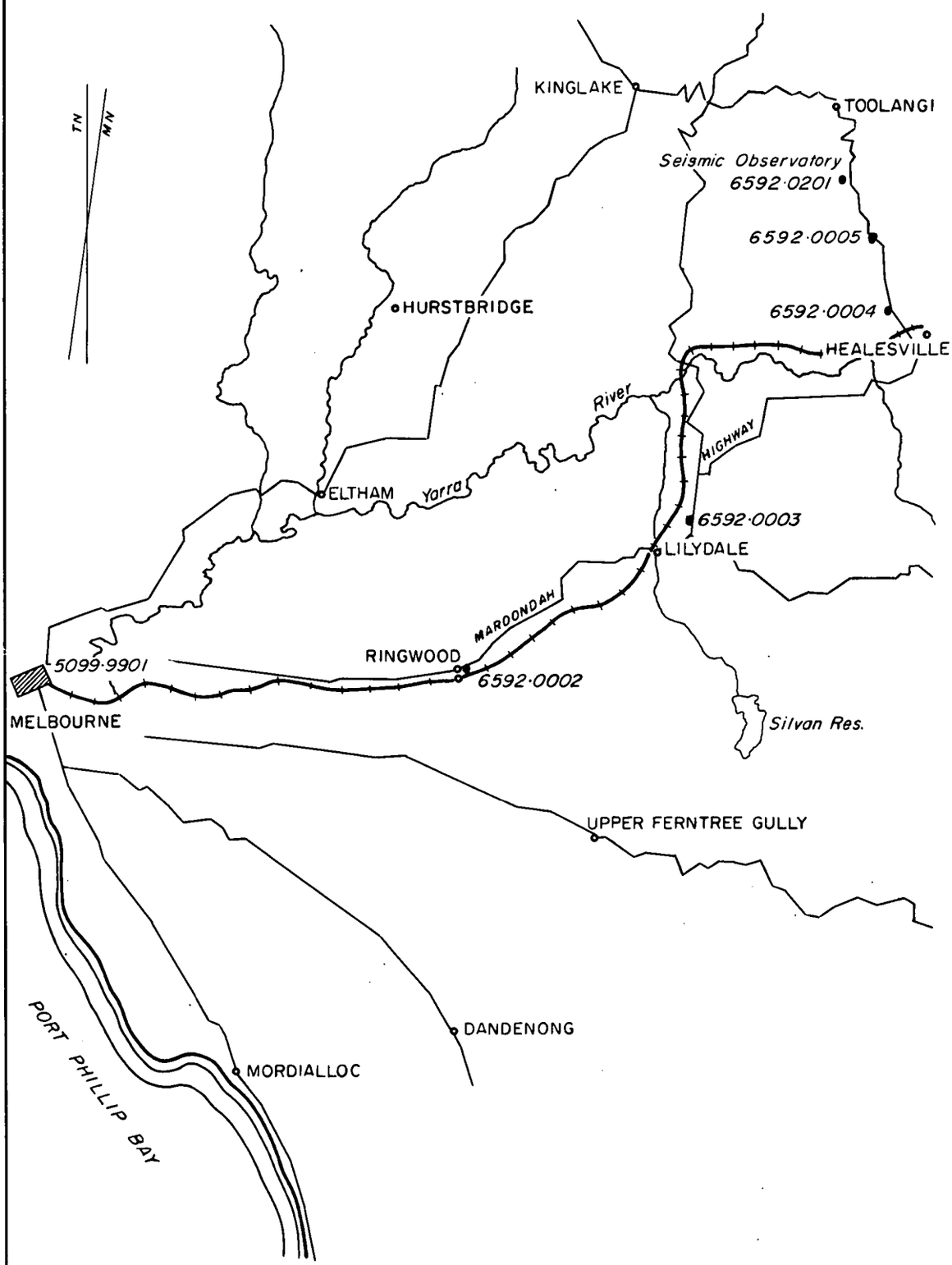
3. Worden 61. This instrument showed erratic drift during the calibration run over the Melbourne range. This erratic drift was most likely caused by an incorrect pressure inside the meter.

4. Canadian gravity meter, Sharpe 145. This gravity meter behaved satisfactorily.

Calibration factors. Observations with the Worden 61 and Sharpe 145 meters were calculated using the calibration factors obtained during the calibration runs on the 4th and 5th December. For Worden 61, the calibration factor is 0.09042 mgal per dial division, and for the Sharpe 145, it is 0.10655 mgal per dial division.

The La Coste gravity meters G20 and G101 were calibrated on the Melbourne calibration range on the above dates. The calibration factors so obtained agree to within 4 parts in 10,000 with the maker's values and, in common with other work carried out with La Coste instruments in Australia, the maker's values have been used in the reduction of the present data.

PLATE 1



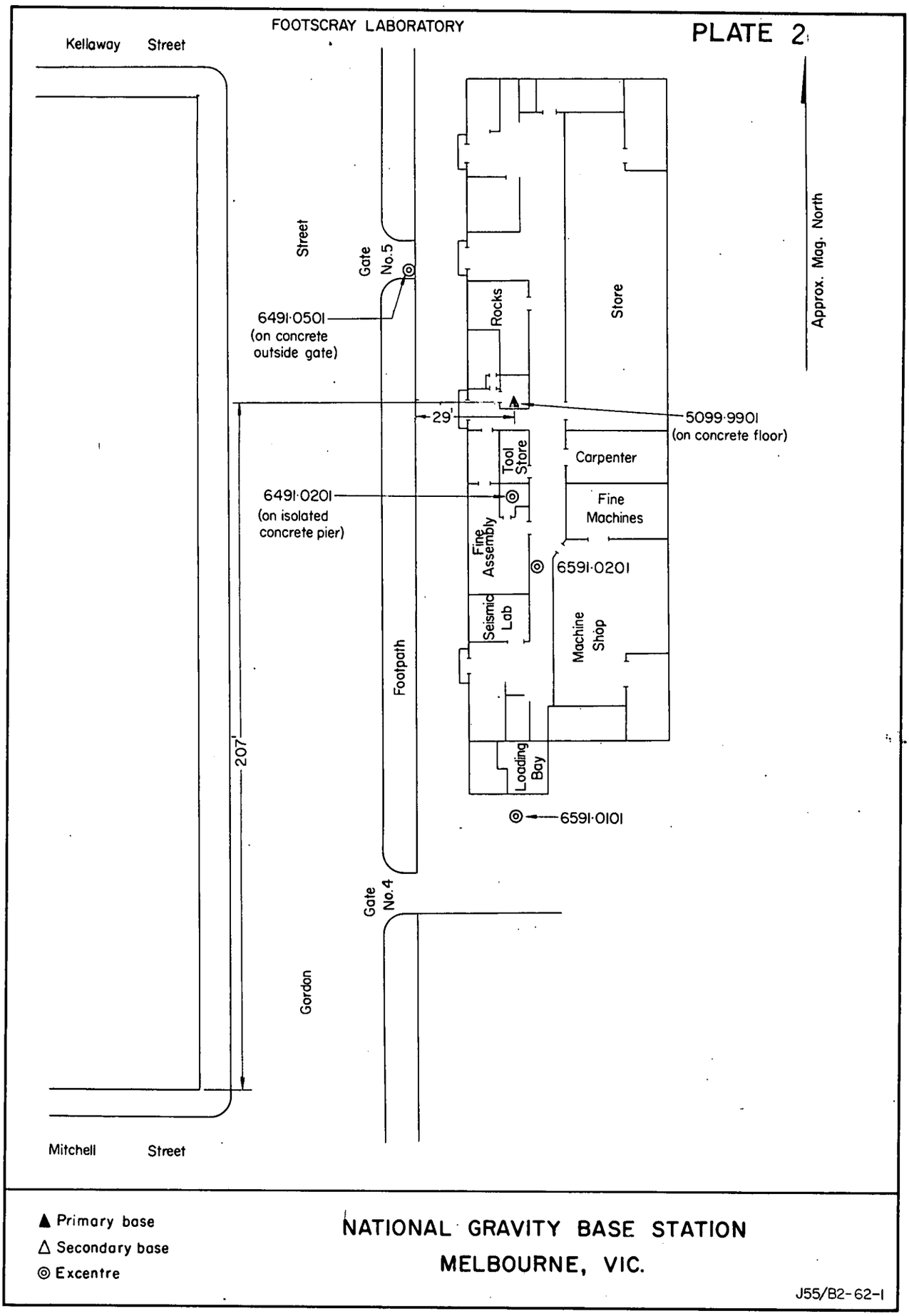
MELBOURNE – TOOLANGI GRAVITY TIE, 1965

LOCALITY MAP

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

J55/B2-93

TO ACCOMPANY RECORD No. 1966/118



▲ Primary base
△ Secondary base
◎ Excentre

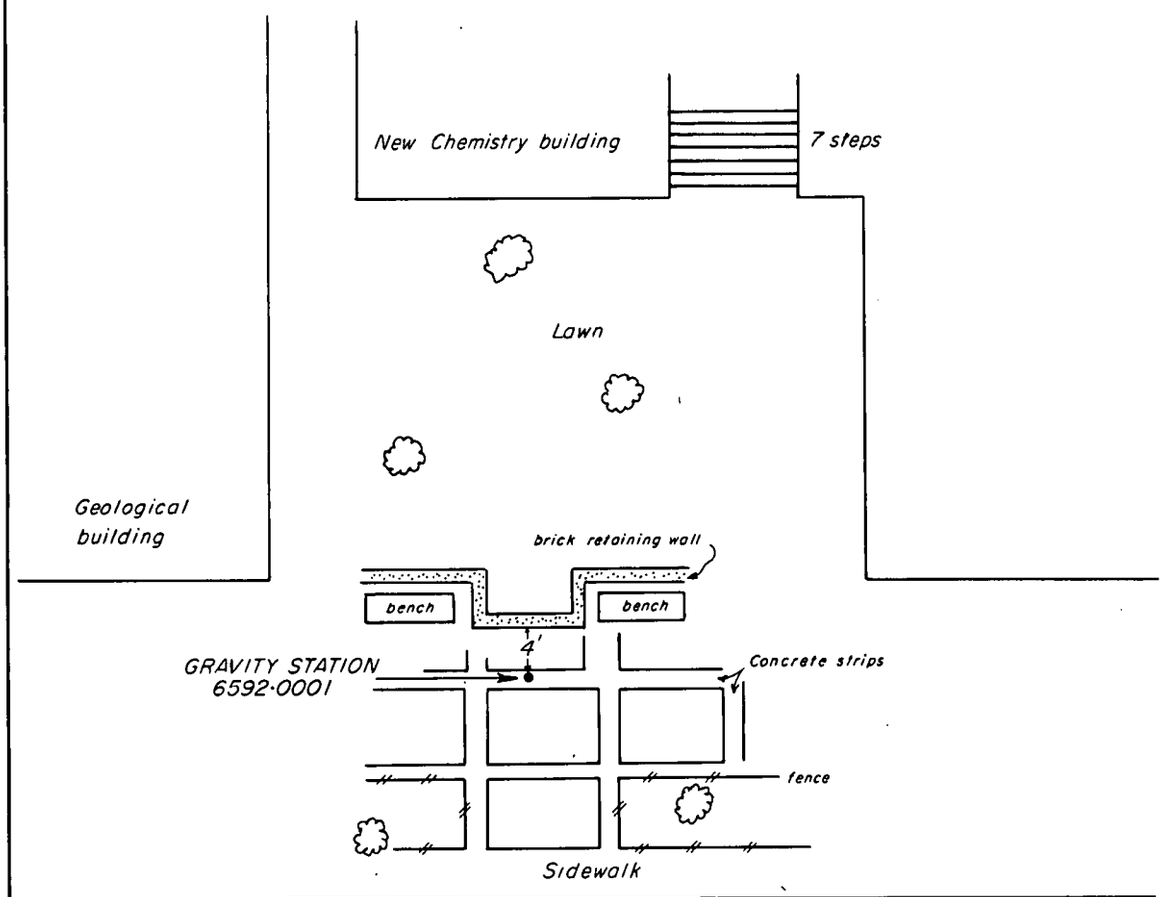
NATIONAL GRAVITY BASE STATION
MELBOURNE, VIC.

J55/B2-62-1

GRAVITY STATIONS
AUSTRALIAN NATIONAL GRAVITY NETWORK

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics
To accompany Record No. 1966/118

PLATE 3



MASSON ROAD

(on Melbourne University grounds)

Gravity station 6592·0001 on concrete strip approximately 4 ft from centre of retaining wall between the two seat benches in front of the lawn of the Inorganic Chemistry building.

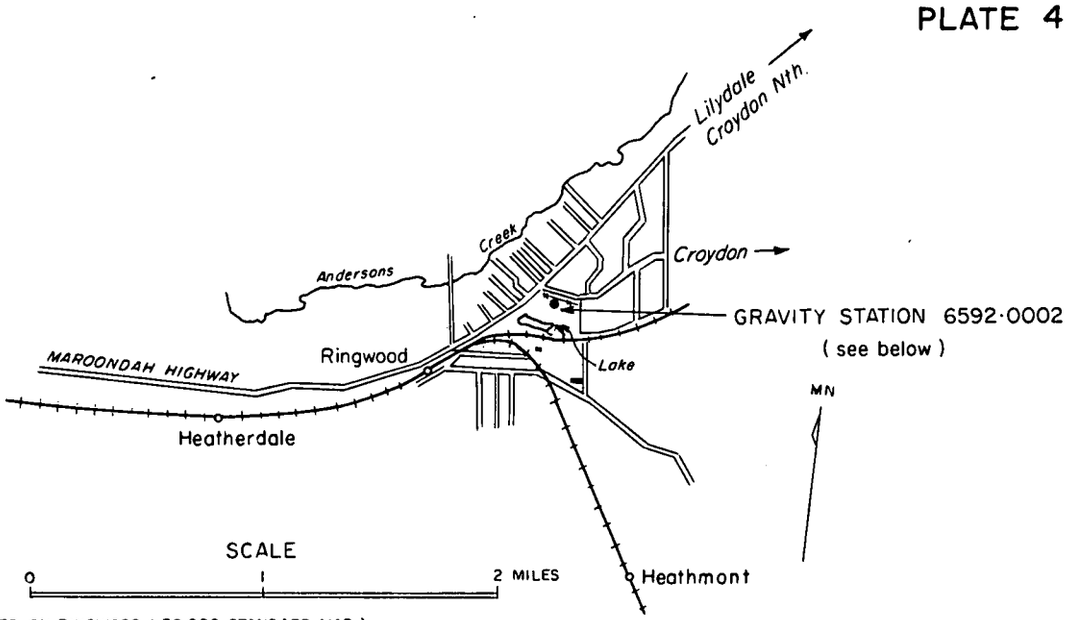
GRAVITY STATION 6592·0001

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

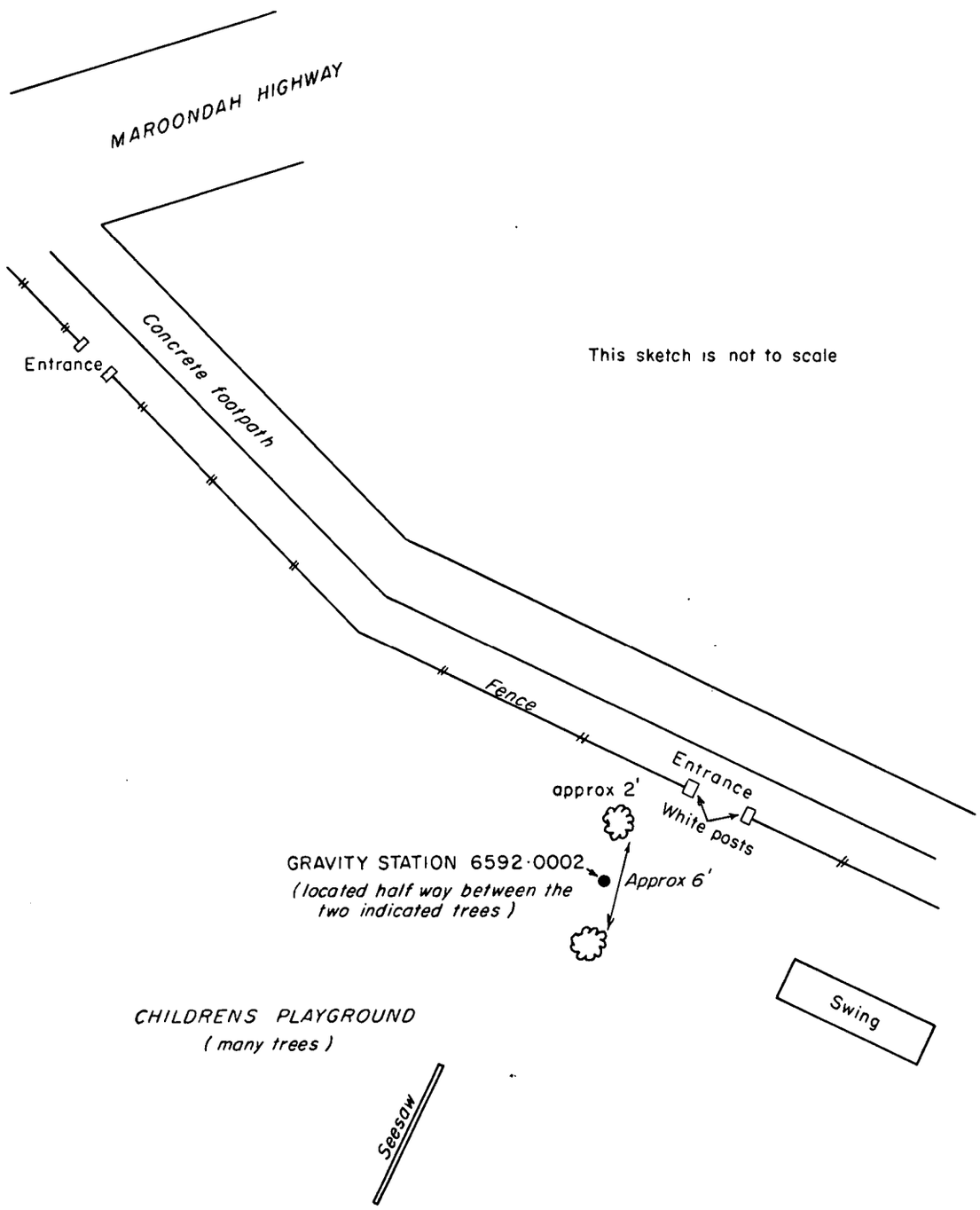
J55/B2-94

TO ACCOMPANY RECORD No. 1966/118

PLATE 4



(BASED ON RINGWOOD 1:50,000 STANDARD MAP)



GRAVITY STATION 6592·0002

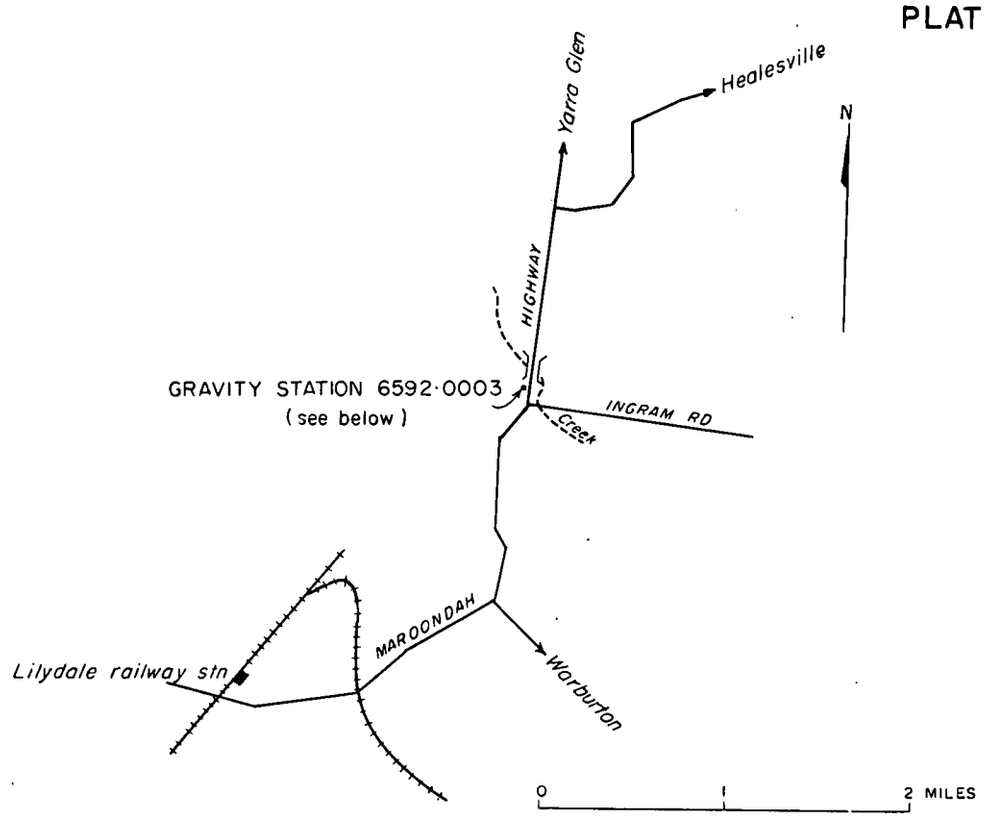
LAKE

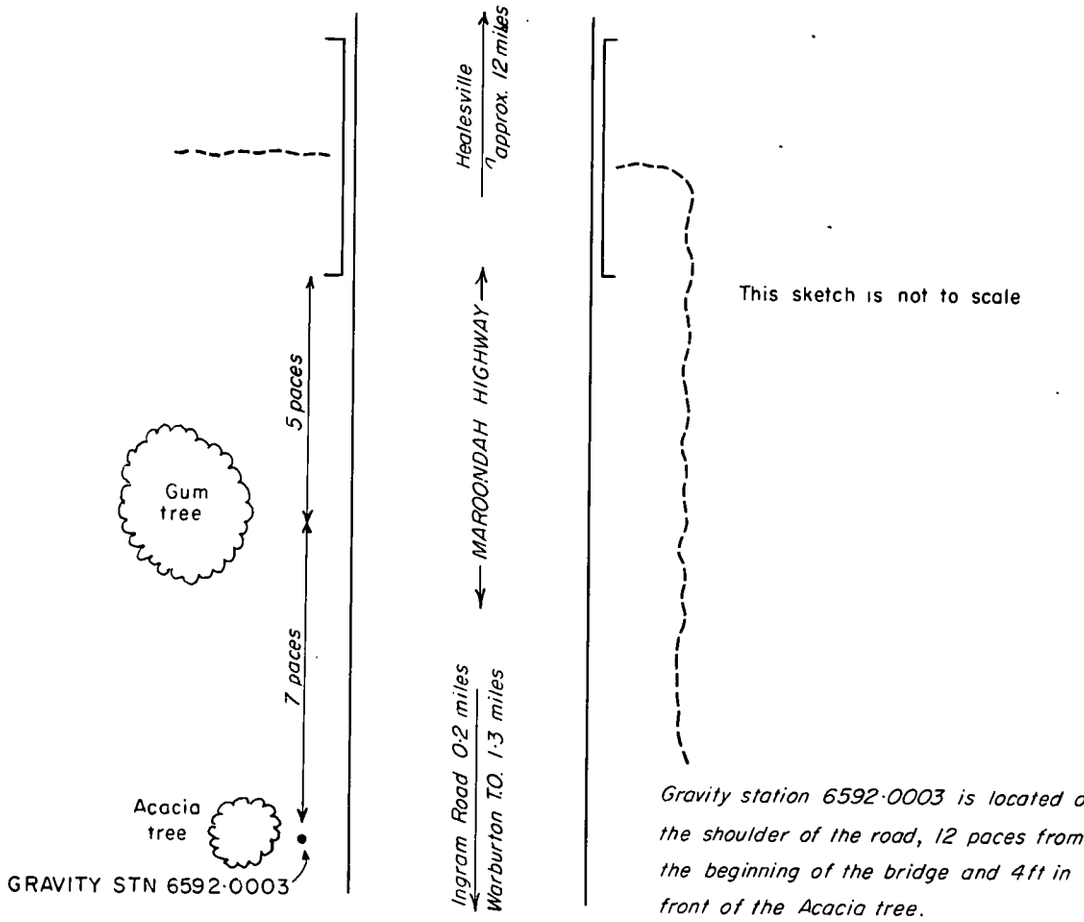
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

J55/B2-95

TO ACCOMPANY RECORD No. 1966/118

PLATE 5





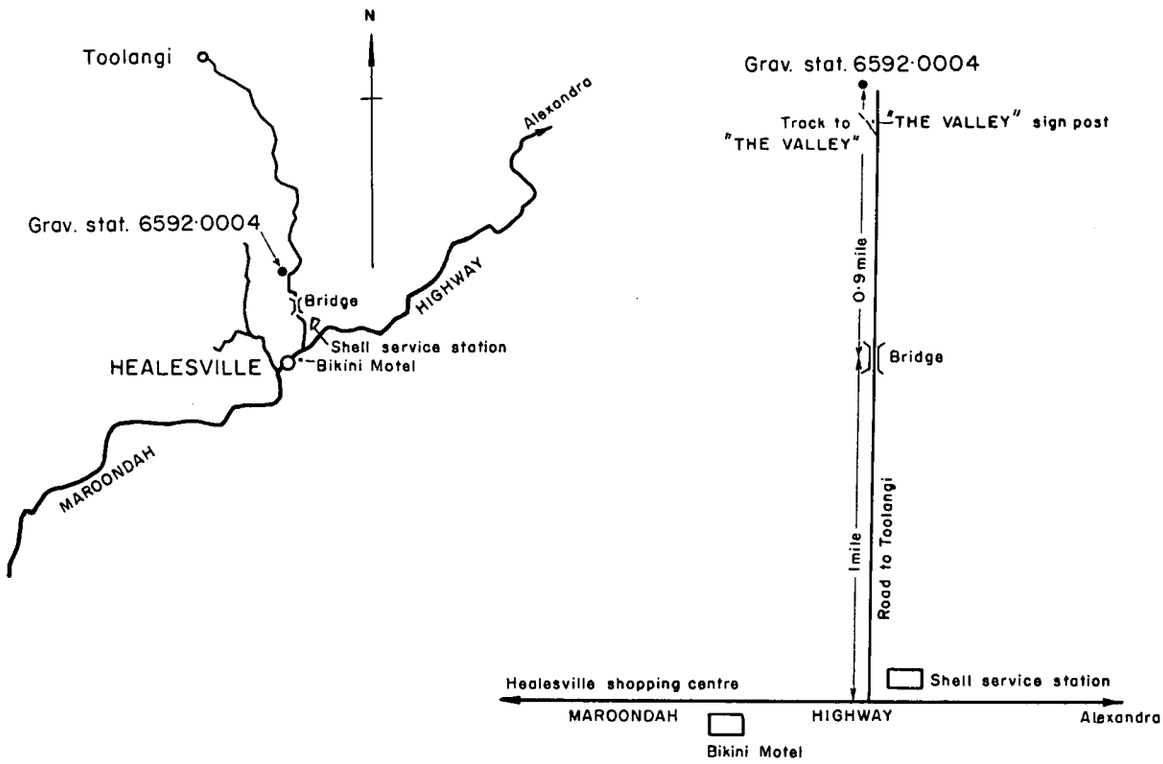
Gravity station 6592·0003 is located on the shoulder of the road, 12 paces from the beginning of the bridge and 4ft in front of the Acacia tree.

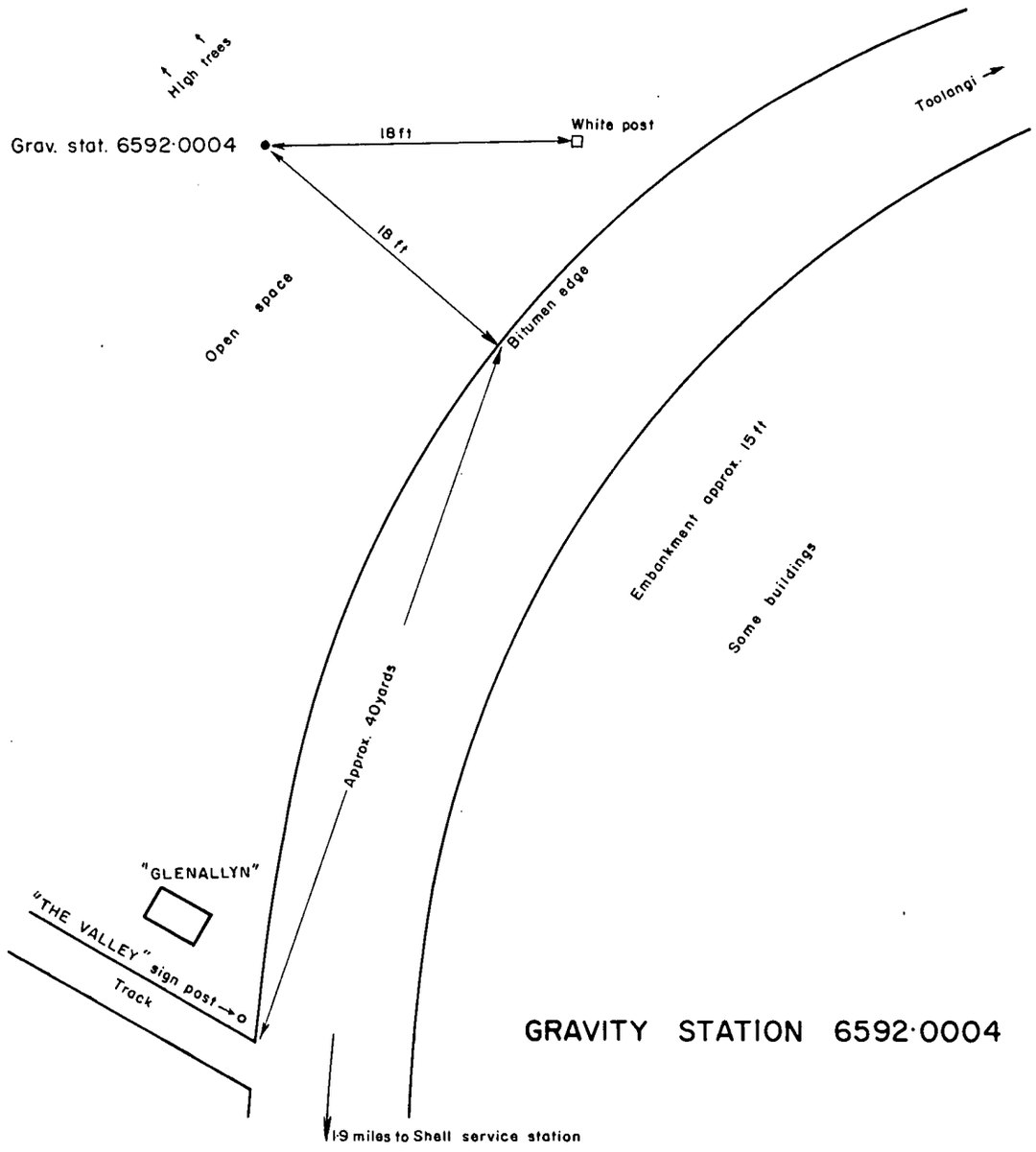
GRAVITY STATION 6592·0003

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

J55/B2-96

TO ACCOMPANY RECORD No. 1966/118





GRAVITY STATION 6592·0004

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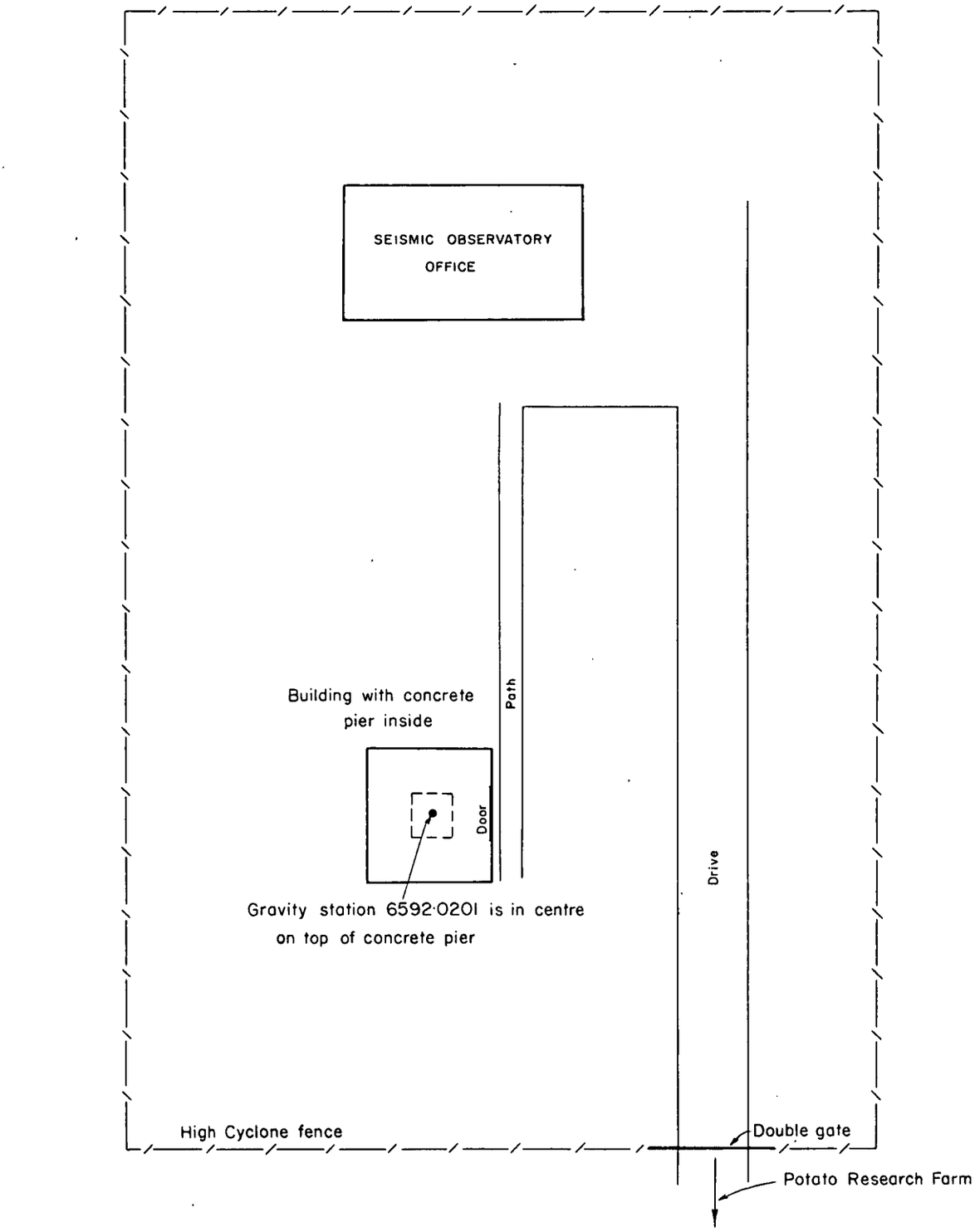
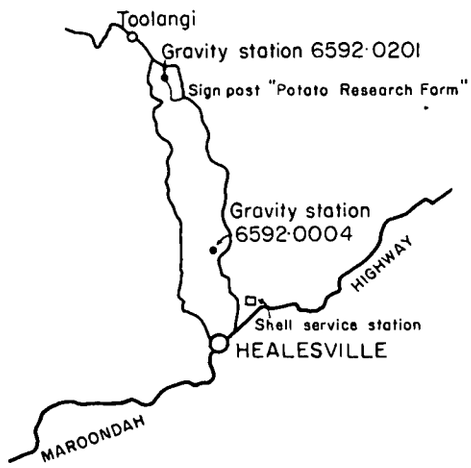
To accompany Record No. 1966/118





GRAVITY STATION 6592·0201
SEISMIC OBSERVATORY
NEAR TOOLANGI, VIC.

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. J 55/82-98

To accompany Record No. 1966/118