COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1953 No. 33

A PROVISIONAL ISOGONIC MAP OF AUSTRALIA AND NEW GUINEA SHOWING PREDICTED VALUES FOR THE EPOCH 1955·5

by

F.W. WOOD

and

I.B. EVERINGHAM

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1953 No. 33

A PROVISIONAL ISOGONIC MAP OF AUSTRALIA AND NEW GUINEA SHOWING PREDICTED VALUES FOR THE EPOCH 1955·5

by

F.W. WOOD

and

I.B. EVERINGHAM

C O N T E N T S

		Page
	ABSTRACT	(1)
1.	INTRODUCTION	1
2.	GENERAL PLAN OF REVISION	1
3.	DATA USED	1
4.	TREATMENT OF DATA - NORMAL VALUES ..	2
5.	SECULAR VARIATION - ISOPORS	3
6.	REVISION OF 1950.5 MAP TO 1952.5 ..	3
7.	EXTRAPOLATION TO 1955.5	4
8.	USE OF MAP	4
9.	REFERENCES	5

A B S T R A C T

A provisional isogonic map of Australia and New Guinea has been prepared showing predicted values of declination for the middle of 1955. Along with this map, an isoporic chart is given showing the expected annual rate of change of declination over the same area for the same epoch.

This rate of change (secular variation) can be taken as applying for all practical purposes from the beginning of 1953 to the end of 1957. It is expected that by that time a new map will have been prepared showing predicted values for 1960.5.

The main points to note about the present map, in comparison with that for 1950.5, are :-

(i) that the declination over Tasmania is from two-thirds to three-quarters of a degree greater (i.e. more easterly) than would have been expected from the 1950.5 map;

(ii) the annual rate of change of declination over the south-eastern part of Australia shows an increased positive (i.e. easterly) value;

(iii) the annual rate of change of declination over the north-western part of the mainland now shows a small negative (i.e. westerly) value instead of the small positive value shown in previous years.

(NOTE : Additional copies of the isogonic map for 1955.5 are available on request to the Chief Geophysicist, Bureau of Mineral Resources, 485 Bourke Street, Melbourne, C.1.)

A PROVISIONAL ISOGONIC MAP OF AUSTRALIA AND NEW GUINEA SHOWING PREDICTED VALUES FOR THE EPOCH 1955.5

1. INTRODUCTION

Numerous requests have been received from Commonwealth and State authorities for an isogonic map of Australia for the epoch 1955.5 covering the same area as that covered by the provisional map for the epoch 1950.5 (Holmes, 1951). The attached map has been prepared to meet these requests and to provide information to co-operating overseas organizations.

The map is based on the 1950.5 map which has been revised to include observations made during 1952. Full details of these observations have been published separately (Wood, 1953).

As in the case of the earlier map, the 1955.5 map shows only the smoothed isogonals (terrestrial lines) which are drawn without regard to local disturbances produced by magnetic rocks. Some areas in which such disturbances may be found are indicated on the map by stippling but there may be other areas similarly affected whose boundaries have not yet been determined.

2. GENERAL PLAN OF REVISION

As pointed out in Holmes' earlier report, an authoritative map cannot be produced until an extensive campaign of re-occupation of stations has been carried out over the whole area covered by the map. Late in 1951 a programme was drawn up by the Bureau for the re-occupation and/or establishment of upwards of 650 magnetic stations throughout Australia and its adjacent islands. This programme will take a few years to complete.

As part of the programme, Tasmania was completely re-surveyed in 1952 (Wood and Everingham, 1953). In the course of this survey, twenty-nine stations were occupied during March, April and May by F. W. Wood and J. A. Brooks. The results of these observations revealed errors of as much as three-quarters of a degree in the 1950.5 isogonic map for Tasmania. It was, therefore, decided to make a quick series of observations around the border of the Australian mainland to check the general pattern of the isogonic lines for the whole area of the present map. Twenty magnetic stations, many of them re-occupations, were included in this round-Australia survey which was carried out by J. A. Brooks and P. B. Tenni during July, August and September, 1952.

The reduction of the data and the preparation of the isogonic map showing predicted values for 1955.5 have been carried out by I. B. Everingham assisted by W. K. Bartlett.

3. DATA USED

The provisional isogonic map for 1950.5 provided the framework on which the 1955.5 map has been built up. The 1950.5 map was based on observations made at 450 stations throughout the area during the periods 1911-23, 1936-37 and 1944-45. It was, therefore, a complete and accurate presentation of all material available up to the date of its publication in 1951. From this

it followed that the simplest and most satisfactory method of preparing an isogonic map for 1955.5 was merely to adjust the positions of the isogonic lines of the 1950.5 map by the amount required to make them conform to the more recent evidence.

The new data available for this purpose were :-

(a) continuous recordings at the Watheroo and Toolangi observatories; these provide both actual values of declination and an accurate measure of the annual rate of-change (secular variation) at these two key points;

(b) the new station observations made in Tasmania (29 stations) and around the border of the mainland (20 stations) in 1952, already referred to;

(c) sets of diurnal variation observations made over twelve-hour periods (0600 to 1800 hours) at four of these stations, namely, Hobart, Corinna and Gladstone (Tasmania), and Darwin (Northern Territory); these diurnal variation (d.v.) observations helped very greatly in correcting each station observation so that it represented a "normal" value, i.e., the value obtained after making allowance for short-period disturbances in the magnetic field at the time of observation; this correction is discussed below.

4. TREATMENT OF DATA - NORMAL VALUES

Each observed value of declination obtained at a given station at a certain local mean time (L.M.T.) was corrected by the addition of a known instrumental constant to give a value based on the international magnetic standard (I.M.S.). The resulting figure represents the absolute value of declination at the time and date of the observation. Each observation has a probable error of $\pm$ 0.5 minute of arc.

Further corrections had to be made for the diurnal and seasonal variations of declination and for small irregular disturbances. Depending upon the time of day, the observed value even on a quiet day may be equal to, greater than or less than the average value for the whole day. Therefore, an appropriate correction has to be applied for the effect of diurnal variation. Likewise, any irregular disturbance must be allowed for. The combined d.v. and disturbance correction was obtained for each observation by referring to the magnetogram recorded at the nearest observatory at the local mean time of the station observation and multiplying the departure from normal recorded there by an appropriate factor. This factor was obtained by comparing the diurnal variation observations, made in Tasmania and at Darwin, with the simultaneous magnetograph recordings at the Watheroo and Toolangi observatories. The factor obtained ranged from 0.7 at Darwin through 0.85 at Watheroo and 1.0 at Toolangi to 1.1 in Tasmania.

A correction for the seasonal variation of declination was obtained from observatory records at Toolangi and Watheroo. This variation is so small that it was assumed constant throughout the whole area embraced by the map.

The combined d.v., disturbance and seasonal correction was applied in such a way as to reduce the observed value at the station to the "normal" value at the middle of the month in which the observation was made. These "normal" values have a possible error not exceeding two minutes of arc.

5. SECULAR VARIATION - ISOPORS

There has not been a regular series of observations over the past five or ten years at any station except the two observatories. Therefore, the present value of secular variation is known accurately only at these two places and no charts showing lines of equal secular variation (isopors) are available. However, several of the stations occupied in the 1952 survey had been occupied in the 1944-45 survey and these gave fairly accurate values of secular variation. Some other stations, that had been occupied in the 1936-37 survey, were useful as checks on the trend of the isopors. The secular-variation stations used are :-

(a) Observatories -

Toolangi, Victoria.
Watheroo, Western Australia.

(b) Stations occupied in 1952 and on at least two other occasions since 1935 -

Belair, South Australia.
Carnarvon, Western Australia.
Cloncurry, Queensland.
Darwin, Northern Territory.
Port Hedland, Western Australia.
Tennant Creek, Northern Territory.

(c) Stations occupied in 1952 as well as in the 1944-45 survey -

Augusta, Western Australia.
Brisbane, Queensland.
Esperance, Western Australia.
Geraldton, Western Australia.
Mt. Yokine, Western Australia.
Broome, Western Australia.

(d) Stations occupied in 1952 and also in the 1936-37 survey -

Longford, Tasmania.
Sorell, Tasmania.

The values of secular variation at the time of the 1952 observations, as obtained from observations at the above stations, were used to produce an isoporic chart of Australia. With this chart it was possible to reduce all observations made in 1952 to the common epoch of 1952.5.

6. REVISION OF 1950.5 MAP TO 1952.5

Because of the marked difference between the isoporic chart obtained for 1952.5 and that used with the provisional 1950.5 isogonic map, it was decided to revise the 1950.5 map in two stages.

The first stage was to revise the map to 1952.5.

To do this, a determination was made of the amount by which the 1952.5 value, obtained at each station re-occupied during that year, differed from the value used for that station in drawing the 1950.5 map. These differences were then plotted on a map of Australia and from them contours were drawn to give the corrections that had to be applied at each point of the 1950.5 map to revise it to 1952.5.

7. EXTRAPOLATION TO 1955.5

The second stage was to predict the changes that will occur between 1952.5 and 1955.5. The change expected during this three-year period was obtained by extrapolating the secular variation curves for selected stations including the two observatories and all those stations at which two or more observations have been made in the past ten years.

A second map, similar to that described in paragraph (6) above, was then prepared by plotting the expected differences between the 1952.5 and 1955.5 values and drawing contours over the whole area of the map.

The contour values shown on these two maps were then combined to form a third map which showed the total difference between the values assumed for the 1950.5 map and those predicted for the epoch 1955.5. This third map showed directly the amount by which the terrestrial lines of the 1950.5 map had to be moved to put them in the positions predicted for 1955.5. The result is the attached isogonic map.

8. USE OF THE MAP

Because of the control made possible by the 1952 observations, it is considered that the 1955.5 isogonic map will prove more reliable than the 1950.5 map even though it involves predictions. These predictions are controlled only by observations at the observatories and stations listed in paragraph (5) above. From the distribution of these control points it will be seen that the areas in which unexpected changes might occur are :-

(a) Eastern New South Wales and the adjacent ocean areas, in which no observations were made in 1952 and in which secular variation is apparently high;

(b) Papua and New Guinea, where, however, the secular variation is small and only small changes are expected.

The isoporic chart inset into the main isogonic map shows expected annual rates of change of declination centred on 1955.5.

These values may, however, be used without appreciable error over the five-year period from the beginning of 1953 to the end of 1957. It is expected that, by that time, a provisional isogonic map for 1960.5 will be available.

9. REFERENCES

Holmes, W. M. (1951) -

A Provisional Isogonic Map of Australia and New Guinea for the Epoch 1950.5, B.M.R.G.G., Records 1951 No.44.

Wood, F. W. (1953) -

Summary of Absolute Magnetic Regional Observations made in Australia in 1952, B.M.R.G.G., Records 1953 No.35.

Wood, F. W. and Everingham, I. B. (1953) -

Isogonic Map of Tasmania at the Epoch 1952.5, B.M.R.G.G., Records 1953 No.34.

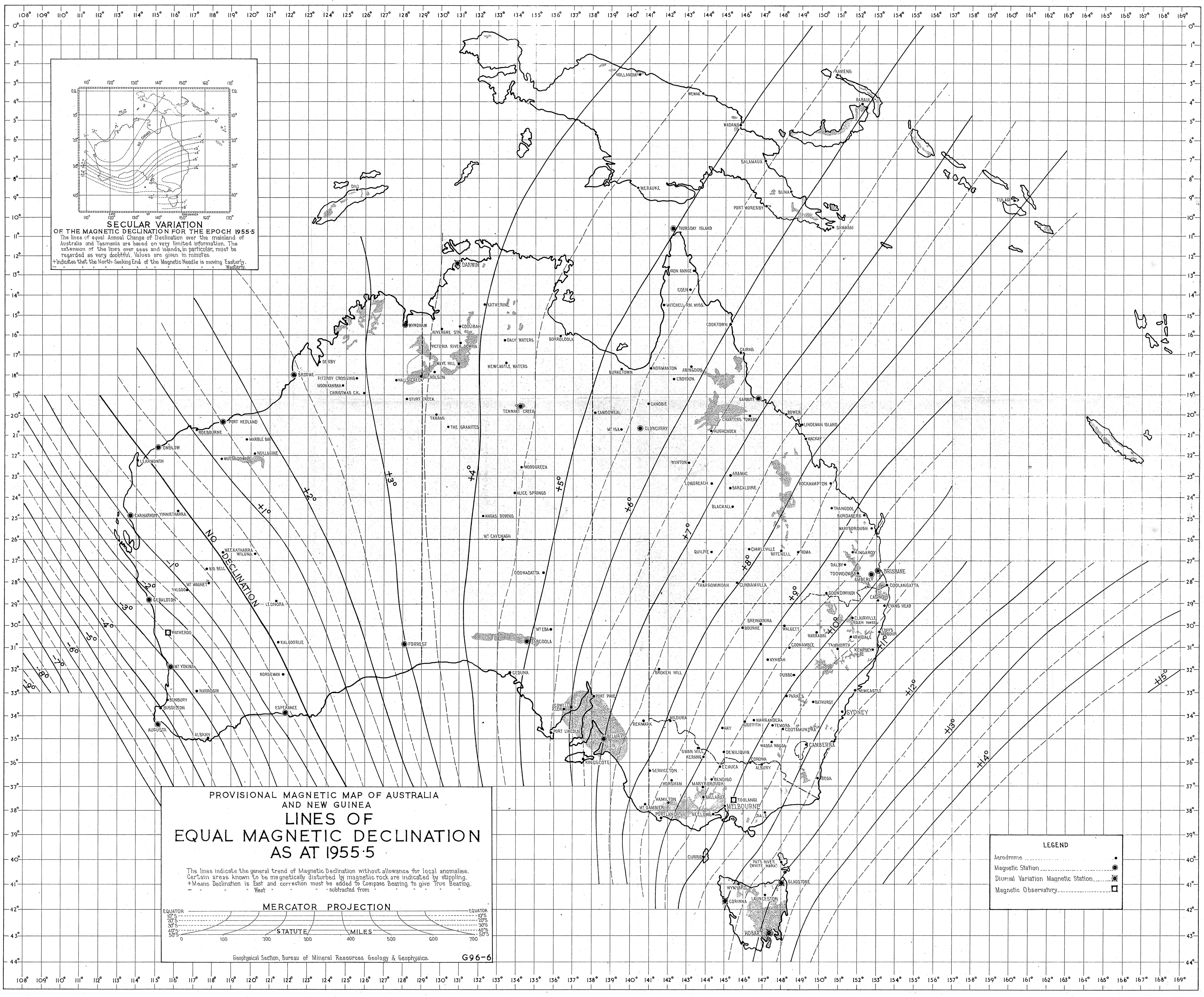
F. Wood.

(F. W. Wood)
Geophysicist.

I. B. Everingham

(I. B. Everingham)
Geophysicist.

Melbourne,
February, 1953.


PROVISIONAL MAGNETIC MAP OF AUSTRALIA
AND NEW GUINEA
LINES OF
EQUAL MAGNETIC DECLINATION
AS AT 1955·5
The lines indicate the general trend of Magnetic Declination without allowance for local anomalies.
Certain areas known to be magnetically disturbed by magnetic rock are indicated by stippling.
+Means Declination is East and correction must be added to Compass Bearing to give True Bearing.
– " " " West " " " subtracted from " " " " " "
MERCATOR PROJECTION
EQUATOR
10°S
20°S
30°S
40°S
50°S
STATUTE MILES
0
100
200
300
400
500
600
700
Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.
G96-6
SECULAR VARIATION
OF THE MAGNETIC DECLINATION FOR THE EPOCH 1955·5
The lines of equal Annual Change of Declination over the mainland of Australia and Tasmania are based on very limited information. The extension of the lines over seas and islands, in particular, must be regarded as very doubtful. Values are given in minutes
+Indicates that the North-Seeking End of the Magnetic Needle is moving Easterly.
– " " " " " " " " " " " " Westerly.
EAST OF GREENWICH
LEGEND
Aerodrome
Magnetic Station
Diurnal Variation Magnetic Station
Magnetic Observatory
NO DECLINATION
+1°
+2°
+3°
+4°
+5°
+6°
+7°
+8°
+9°
+10°
+11°
+12°
+13°
+14°
+15°
–1°
–2°
–3°
–4°
–5°
–6°
–7°
–8°
–9°
HOLLANDIA
WEWAK
MADANG
KAVIENG
RABAUL
SALAMAUA
MERAUKE
BUNA
PORT MORESBY
SAMARAI
DILI
THURSDAY ISLAND
DARWIN
IRON RANGE
COEN
MITCHELL RIV. MISS.
COOKTOWN
CAIRNS
KATHERINE
WYNDHAM
DALY WATERS
BORROLOOLA
DERBY
BROOME
FITZROY CROSSING
NEWCASTLE WATERS
BURKETOWN
NORMANTON
CROYDON
TENNANT CREEK
CAMOOWEAL
CLONCURRY
CHARTERS TOWERS
BOWEN
MACKAY
PORT HEDLAND
ROEBOURNE
ONSLOW
MARBLE BAR
NULLAGINE
WINTON
LONGREACH
ALICE SPRINGS
ROCKHAMPTON
CARNARVON
BUNDABERG
MARYBOROUGH
CHARLEVILLE
ROMA
BRISBANE
TOOWOOMBA
MEEKATHARRA
WILUNA
OODNADATTA
GERALDTON
LEONORA
WATHEROO
KALGOORLIE
FORREST
TARCOOLA
BOURKE
NORSEMAN
CEDUNA
BROKEN HILL
DUBBO
NEWCASTLE
SYDNEY
ESPERANCE
PORT PIRIE
PORT LINCOLN
RENMARK
MILDURA
CANBERRA
BUNBURY
BUSSELTON
AUGUSTA
ALBANY
KINGSCOTE
MT GAMBIER
HAMILTON
BALLARAT
MELBOURNE
TOOLANGI
GEELONG
PORTLAND
BEGA
CURRIE
WYNYARD
LAUNCESTON
HOBART