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BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

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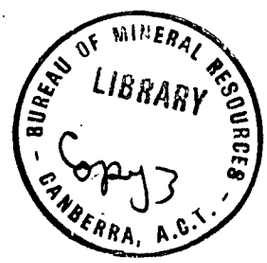

PRELIMINARY APPRAISAL OF THE PROSPECTS OF LOCATING SUPPLIES OF GROUNDWATER SUITABLE FOR KULGERA, NORTHERN TERRITORY, TOWN WATER SUPPLY.

by

D. Woolley

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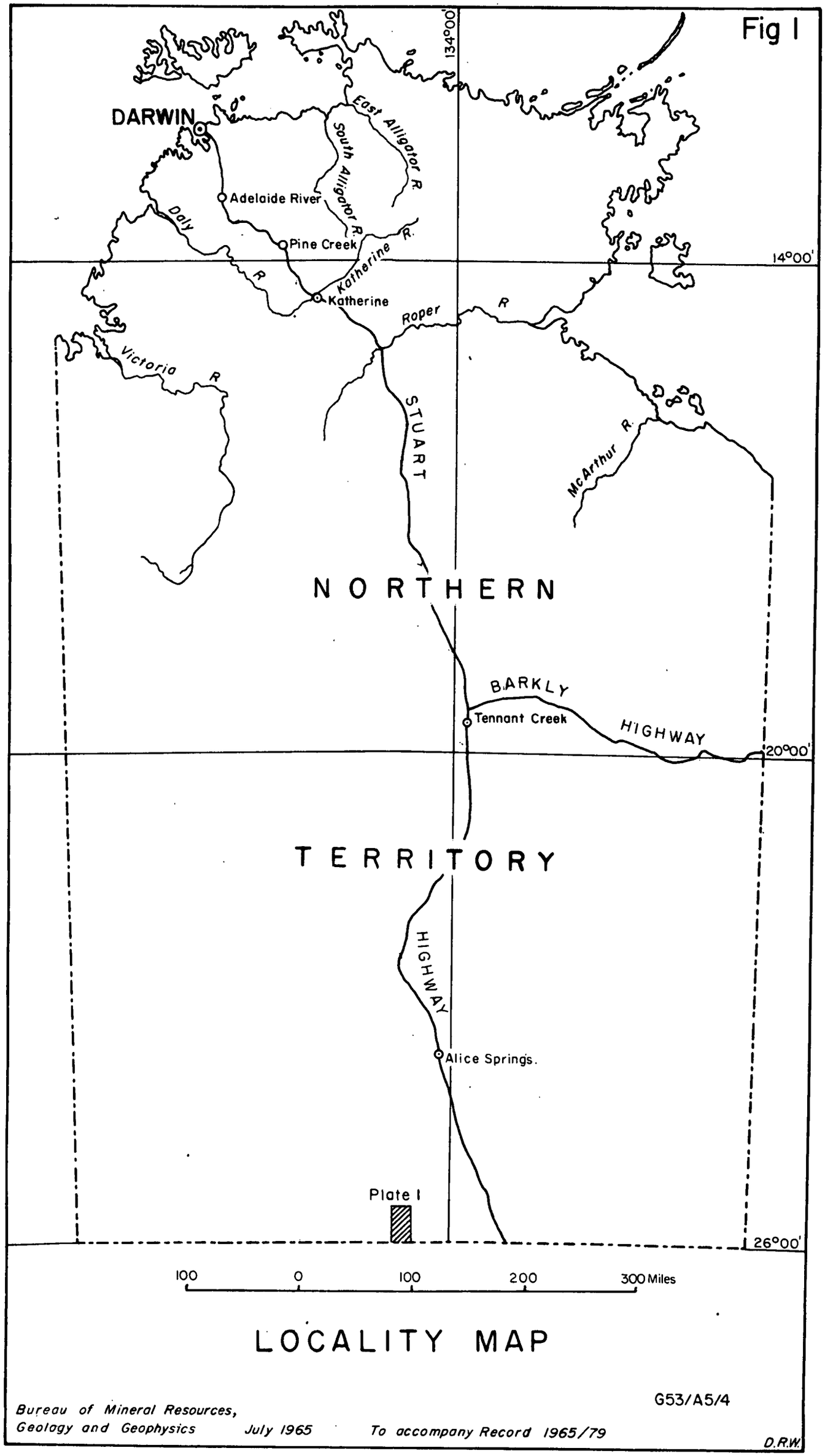


Fig 1
DARWIN
134°00'
East Alligator R.
South Alligator R.
Adelaide River
Daly R.
Pine Creek
Katherine R.
Katherine
14°00'
Roper R.
Victoria R.
STUART
McArthur R.
NORTHERN
BARKLY
Tennant Creek
HIGHWAY
20°00'
TERRITORY
HIGHWAY
Alice Springs.
Plate I
26°00'
100 0 100 200 300 Miles
LOCALITY MAP
G53/A5/4
Bureau of Mineral Resources,
Geology and Geophysics
July 1965
To accompany Record 1965/79
D.R.W.

SUMMARY.

There are two areas within 30 miles of Kulgera Township where there is a chance of obtaining groundwater supplies suitable for two water purposes. One of these is immediately east of the town, where aquifers may be present in Tertiary deposits. The other is ten miles to the north-north-east of the township, where the de Souza Sandstone may yield satisfactory supplies. A programme of drilling, totalling 2,500 feet, is recommended to test these areas, particularly with regard to the quality of any groundwater which may be present.

INTRODUCTION.

At the request of the District Engineer, Water Resources Branch of the N.T. Administration, this appraisal of the prospects of obtaining suitable supplies of groundwater for Kulgera Town Water Supply purposes has been prepared. Kulgera is on the main road south from Alice Springs, and 14 (road) miles north of the South Australian border (see Figure 1). The township of Kulgera consists of a store and a police station; Kulgera station homestead would also use a town supply. It is estimated that a supply of 4,000 gallons per hour (g.p.h.) is needed to meet present requirements. If a suitable supply can be located, the demand will probably rise rapidly. At present domestic supplies of water for the police station, the store and the station homestead are provided from a number of privately owned bores. The total supply available from these sources is barely adequate for minimum present requirements. Details of the bores are given in Table 3 below.

PREVIOUS INVESTIGATIONS.

Jones (1958) discussed the groundwater prospects in the immediate vicinity of Kulgera Township; he was concerned with the provision of a water supply for the Kulgera Police Station. Jones was pessimistic about the prospects of obtaining supplies of more than 200 - 400 g.p.h. in the immediate vicinity and was unable to suggest any suitable alternative site which would meet with Police Branch requirements. Four bores (Nos. 68, 69, 70 and 71 in Plate 2) were drilled as a result of his recommendations. Details of these bores are given in Table 3.

The Kulgera 1:250,000 sheet area was mapped by a field party from the Bureau of Mineral Resources in 1963 (Wells et al, 1964) Plate 1 has been adapted from the 1:250,000 geological map prepared by that party.

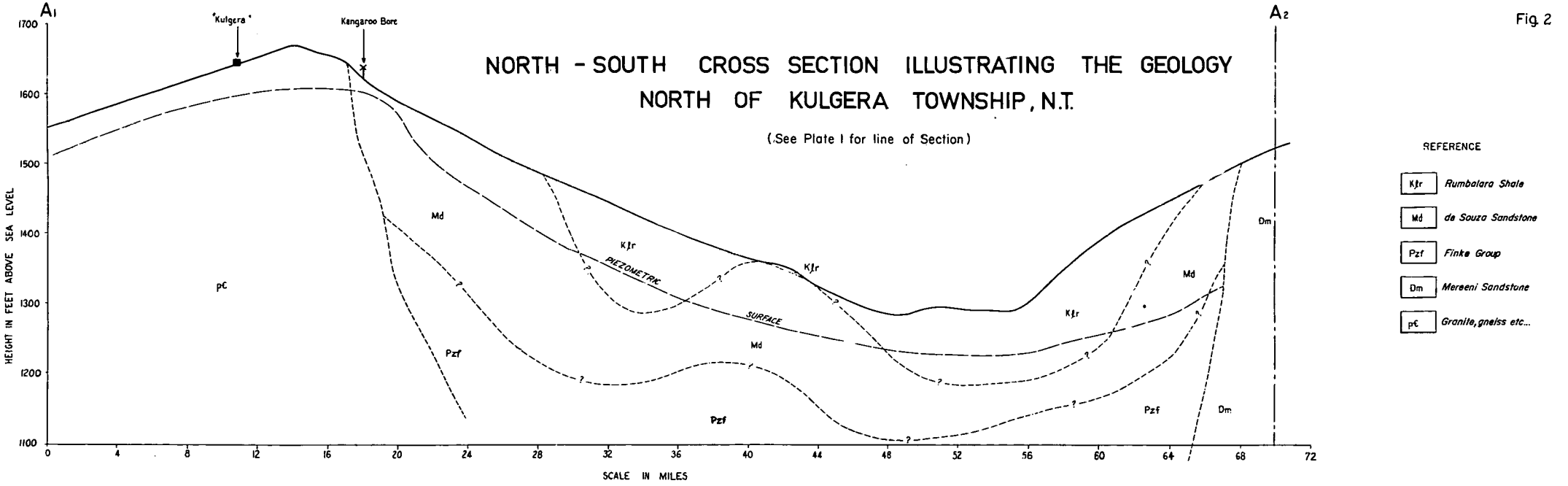
GEOLOGY.

Kulgera is situated on high country underlain by Precambrian igneous and metamorphic rocks. This basement complex is overlain to the north and east by Palaeozoic sandstone and shale of the Finke Group and by the de Souza Sandstone, of Mesozoic age. The de Souza Sandstone is overlain by the Rumbalara Shale, of Cretaceous age. Various deposits assigned to the Tertiary occur in the area, and large tracts of country are covered by Quaternary deposits (Plate 1 and Figure 2).

Fig. 2

NORTH - SOUTH CROSS SECTION ILLUSTRATING THE GEOLOGY NORTH OF KULGERA TOWNSHIP, N.T.

(See Plate I for line of Section)



President Geologists' Office, Alice Springs, N.T., May 1964. G53/5-3A

Bureau of Mineral Resources, Geology and Geophysics

To accompany Record 1965/79

G53/A5/2

(a) Precambrian. The basement complex consists essentially of granite and gneissic granite. These rocks have been intruded by dolerite dykes and by numerous quartz veins. A shallow (less than 100 feet) weathering profile is present in some areas.

(b) Finke Group. (Undifferentiated Palaeozoic) Very few outcrops of the Finke Group occur in the area (Plate 1). In the type area at Horseshoe Bend the group consists, in descending order, of the following formations, defined by Wells et al (op cit):

Idracowra Sandstone
Horseshoe Bend Shale
Langra Sandstone
Polly Conglomerate

The Horseshoe Bend Shale is a laminated chocolate brown and pale green biotitic mudstone or siltstone. The Langra Sandstone is divided into an upper and a lower sandstone by a shale unit, the lithology of which is identical with the Horseshoe Bend Shale, which overlies the Langra Shale. The Polly Conglomerate is probably only a local development, and shale similar to the Horseshoe Bend Shale probably occupies the same stratigraphic position except near old (pre Finke Group) elevated areas. Sandstones within the group are variable in lithology, but most are fine to medium grained quartz sandstone with slight to moderate amounts of clayey matrix. They are generally white, cream or brown in surface outcrops. The maximum exposed thickness of the Finke Group is 1,500 feet.

(c) de Souza Sandstone. This unit consists of friable, clean, white, medium-grained, cross-bedded, quartz sandstone which is pebbly in part. It unconformably overlies both Precambrian basement rocks and Finke Group rocks in the area of Plate 1. In other areas, to the east of Plate 1, it also overlies rocks of Permian age. It is overlain in turn by the Cretaceous Rumbalara Shale. Wells, et al, consider it to be probably Jurassic. It is probably the equivalent of one of the main sandstone aquifers of the Great Artesian Basin.

(d) Rumbalara Shale. This unit is a fossiliferous black shale where fresh, but it weathers to grey, white, brown and red, and contains thin lenses or beds of sandstone near the base. It is generally regarded as unconformably overlying the de Souza Sandstone (Opik and Sullivan, 1951), but the boundary may be gradational in some areas. Its age, established by fossil evidence, is Lower Cretaceous.

(e) Tertiary deposits. Various outcrops of siltstone, limestone and sandstone have been assigned a Tertiary age. Several bores have penetrated sediments which are correlated on lithological grounds with fossiliferous Tertiary sediments near Alice Springs. The extent of the deposits is not known, because they are generally obscured by Quaternary deposits. A small shallow basin, whose maximum known depth is 100 feet, occurs at Kulgera township. Bore samples

indicate that the sediment is yellow, grey and brown sandy clay. (e.g. bores 68, 69, 70, and 71, Table 3).

(f) Quaternary deposits. These are mainly windblown sand, soil, and alluvium associated with the major water courses. Maximum thickness of the alluvium is not known, but is probably less than 50 feet.

STRUCTURE.

The Mesozoic sediments occur in a broad shallow syncline (Figure 2) which has an east-trending axis. There is some evidence for an anticlinal flexure, with an east-trending axis through No. 1 Sisters Dam, on the southern limb of the syncline. These structures probably reflect similar structures in the underlying Finke Group sediments.

HYDROLOGY.

(a) Availability of Groundwater

(i) Precambrian. Groundwater has been obtained from granite in the area, but supplies are nearly always less than 300 g.p.h. The quality of the water from the granite aquifers is good, and the total dissolved solids (t.d.s.) content is generally less than 1,500 p.p.m. (parts per million.) Small supplies of groundwater have also been obtained from metamorphic rocks in the area in a few localities, but the quality is poor; the t.d.s. content ranges up to 7,000 p.p.m. (Table 1). A notable exception is Calamity No. 1 Bore, which yielded a supply of 4,000 g.p.h. in 1946, of water having approximately 700 p. p. m. salinity. The present supply is not known. Calamity No. 2 Bore, 100 yards to the south-west, is 40 feet deeper, but has a supply of only 3000 g. p. h. The Calamity Bores are 10½ miles south-east of Kulgera homestead.

It is concluded, on the basis of results of previous drilling (summarised on Table 1), that an adequate supply of groundwater suitable for use as a town water supply cannot be expected from aquifers within the basement rocks.

(ii) Finke Group sediments. The Langra Sandstone contains highly saline water; the t.d.s. content of water in the lower sandstone unit is generally more than 10,000 p.p.m., and in the upper sandstone the water has 7,000-9,000 p.p.m. The Horseshoe Bend Shale is not a prospective aquifer in the Kulgera area. The Idracowra Sandstone may provide an aquifer, if it occurs.

(iii) de Souza Sandstone. This formation is correlated with the main aquifer of the Great Artesian Basin. It is a reliable aquifer in the Northern Territory wherever it occurs below the piezometric surface. In the area to the north of Kulgera, several bores have penetrated the unit. The results of those for which reliable logs are available, are summarised in Table 2. Other bores in the area probably derive their supplies from

the same aquifer but too little information is available to be certain. One of these is Kangaroo Bore (G53/5-11) eight miles northeast of Kulgera, which is 100 feet deep and initially had a supply of more than 2,700 g. p. h. of water having 1,088 p.p.m. salinity. The supply had fallen to 300 g.p.h. in 1957, and was increased to more than 800 g.p.h. by the use of gelignite. The hole finished on hard drilling, but no information is available about the strata penetrated. It is suspected that this hole penetrated the basal part of the de Souza Sandstone, and that the good quality water is due to its proximity to a recharge source.

Several small creeks flow north in the vicinity of Kangaroo Bore and flood out in areas of outcrop of de Souza Sandstone before reaching Little Kalamurta Creek (Plate 1). These outcrop areas are regarded as an area of recharge to the de Souza Sandstone, and therefore an area in which good quality water may be obtainable from the formation.

(iv) Rumbalara Shale. Small to large supplies, which are generally highly saline, can be obtained from this unit. The salinity ranges from 7,000 p.p.m. to 30,000 p.p.m.; the high salt content is probably due in part to the low permeability of the formation. A further reason is the occurrence of salt lakes on the outcrop areas west of Erldunda Homestead. Many of the dud salty bores on Erldunda appear to have been terminated in the Rumbalara Shale (Plate 1). The unit is clearly not a prospective groundwater source for Kulgera.

(v) Tertiary deposits. Of these, the deposits of immediate interest are those which occur within the township of Kulgera, and in the area immediately to the south of the town. Drilling in the township area has established (Table 3) that:

(a) The deposits assigned to the Tertiary are at least 100 feet thick.

(b) The top 100 feet do not contain significant aquifers. The largest known supply, of 150-200 g.p.h., was obtained from Police Bore No. 4, which has decreased to less than 80 g.p.h.

(c) Very small supplies, of less than 100 g.p.h., have been obtained from the unconformity between underlying granite and Tertiary sediments.

(d) The maximum thickness of the sediments in the township area is not known. Contours drawn on the surface of the Precambrian rocks (Plate2) indicate that the sediments occupy a basin elongated approximately in a north-north-westerly direction, and that the greatest depth of sediments occurs to the east or north-east of the No. 4. Police Station Bore.

Significant supplies of groundwater have been obtained from Tertiary deposits in other parts of Central Australia, and possibly suitable aquifers may be present in the Tertiary sediments to the east of the No. 4 Police Station Bore. The quality of the small quantities of water already obtained from these sediments at Kulgera is satisfactory for human consumption in most cases, but the high flouride content of water from some bores (e.g. Police No.4)

makes the water marginal for human use; the total dissolved solids content ranges from 1,000 to 1,500 p.p.m. Any deeper aquifers within the Tertiary sequence may contain groundwater which is not suitable for human consumption.

(vi) Quaternary deposits. None of the bores for which reliable logs are available has obtained water from the Quaternary deposits. It is presumed that the strata are generally above the piezometric surface in the Kulgera area.

CONCLUSIONS.

The following points summarize the groundwater potential of the rock units which occur within a 20-mile radius of Kulgera Township.

(a) Neither the Precambrian basement rocks nor the Quaternary deposits can be expected to yield groundwater supplies suitable for town water supply purposes.

(b) Sediments of the Finke Group may produce adequate supplies, but too little is known of their occurence in the Kulgera area at present to allow a confident prediction. (Groundwater obtained from them may not be suitable for human use.).

(c) The Rumbalara Shale contains saline water.

(d) The Tertiary deposits in the immediate vicinity of the township may produce moderate supplies from the area east of the No. 4 Police Station Bore. This possibility depends on the presence of aquifers within the Tertiary sequence at depths greater than 100 feet below ground level. The quality of any water present may not be satisfactory for human consumption.

(e) The de Souza Sandstone has the best prospects, and a supply of several thousand gallons per hour (not necessarily from one bore) should be attainable. It may be possible to locate an area in which recharge conditions are such that the water is suitable for human consumption. Any groundwater withdrawal points designed to exploit the de Souza Sandstone would be at least 10 miles from the existing township.

RECOMMENDATIONS.

Two areas warrant further investigation; the following drilling programmes would enable a more precise assessment to be made.

1. Within Kulgera Township. A series of holes should be drilled to bedrock at 300-feet intervals along a line starting at the Police Station No. 4 Bore and extending in an east-north-easterly direction for at least a quarter of a mile. The holes would show:-
   (a) The maximum thickness of the Tertiary sediments in the basin.
   (b) Whether any significant aquifers are present in the deeper parts of the sequence.
   (c) The quality of groundwater.

The total footage involved in this programme is approximately 1,000 feet (five holes to an average depth of 200 feet).

2. Kangaroo Bore area. A series of holes is recommended in this area along a line extending north from Kangaroo Bore. The holes should be at one mile spacing and at least 300 feet deep. They would test the de Souza Sandstone, particularly with regard to water quality. Four holes should be sufficient initially; the total footage involved would be 1,200-1,500 foot, depending on the total depths of individual holes.

On the basis of the available information test drilling in other areas cannot be recommended.

REFERENCES

JONES, N.O. 1958 — Groundwater prospects, Kulgera Police Station, N.T. Resident Geologist's Office, North. Terr. Admin. (Unpubl.Rep).

ÖPIK, A.A. & SULLIVAN, C.J., 1951 — Ochre deposits, Rumbalara, N.T. Bur. Min. Res. Aust. Bull. 8.

WELLS, A., STEWART, A. & SKWARKO.S., 1964 — The Geology of the south-eastern part of the Amadeus Basin. Bur. Min. Res. Aust. (Rec. 1964/35)

TABLE 1.

Bores drilled in granitic and metamorphic rocks. (Locations shown on Plate 1).

BORE No,	NAME	TOTAL DEPTH	AQUIFER	SUPPLY	SALINITY(IN PARTS PER MILLION = P.P.M.)		
G53/5-8	Dud		Granite?	Nil			
G53/5-9	Dud		Granite?	Nil	T.D.S.	SULPHATE	FLUORIDE
G53/5-14	Lyndock Well	75'?	Gneiss	Small			
G53/5-16	Homestead Well (Mt. Cavanagh)		Granite	100 g.p.h.	842	97	2.2
G53/5-17	Calamity No.2	143'	Granite	300 g.p.h.		42	1.0
G53/5-18	Calamity No.1	105'	Metamorphic rock	4,000 g.p.h.	692		
G53/5-20	Engine Well	20'	Granite	Dry			
G53/5-21	Mill Well	52'	Granite	17,000/day 1936 7,000/day 1939	1582	205	1.7
G53/5-22	Dud	74'	Gneiss	Small			
G53/5-23	Dud	175'	Granite	Drilling supply			
G53/5-24	Ironwood No.2	67'	Metamorphic weathered	1,400 g.p.h.			
G53/5-25	Ironwood No.1	75'	Weathered metamorphic	1,400 g.p.h.	1083	111	1.2
G53/5-29	Greenwoods	111'	Granite	50 g.p.h.	1393	169	2.6
G53/5-62	Greenwoods No.2	105'	Metamorphic rock	60 g.p.h.	6587	1170	2.4
G53/5-67	Dud	100'	Schist	Nil			
G53/5-68	No.1 Try Police Station	180'	Weathered granite	110 g.p.h.	1236	154	1.8
G53/5-72	Homestead Bore (Victory Downs)	85'	Granite	300 g.p.h.			
G53/5-77	Greenwood No.3	175'	Schist	Ca 100 g.p.h.			
G53/5-125	Dud	121'	Granite	Seepage	Good		
G53/5-150	Dud	158'	Granite	V.small	?		
G53/5-126	Dud	127'	Granite	Nil			
G53/5-166	Kulgera Store 1964/1	120'	Granite	50 g.p.h.	1356	161	3.0
G53/5-167	Kulgera Store 1964/2	140'	Granite	50 g.p.h.	1338	159	3.0

TABLE 2.

Bores drilled in probable de Souza Sandstone north of Kulgera (Locations shown on Plate 1)

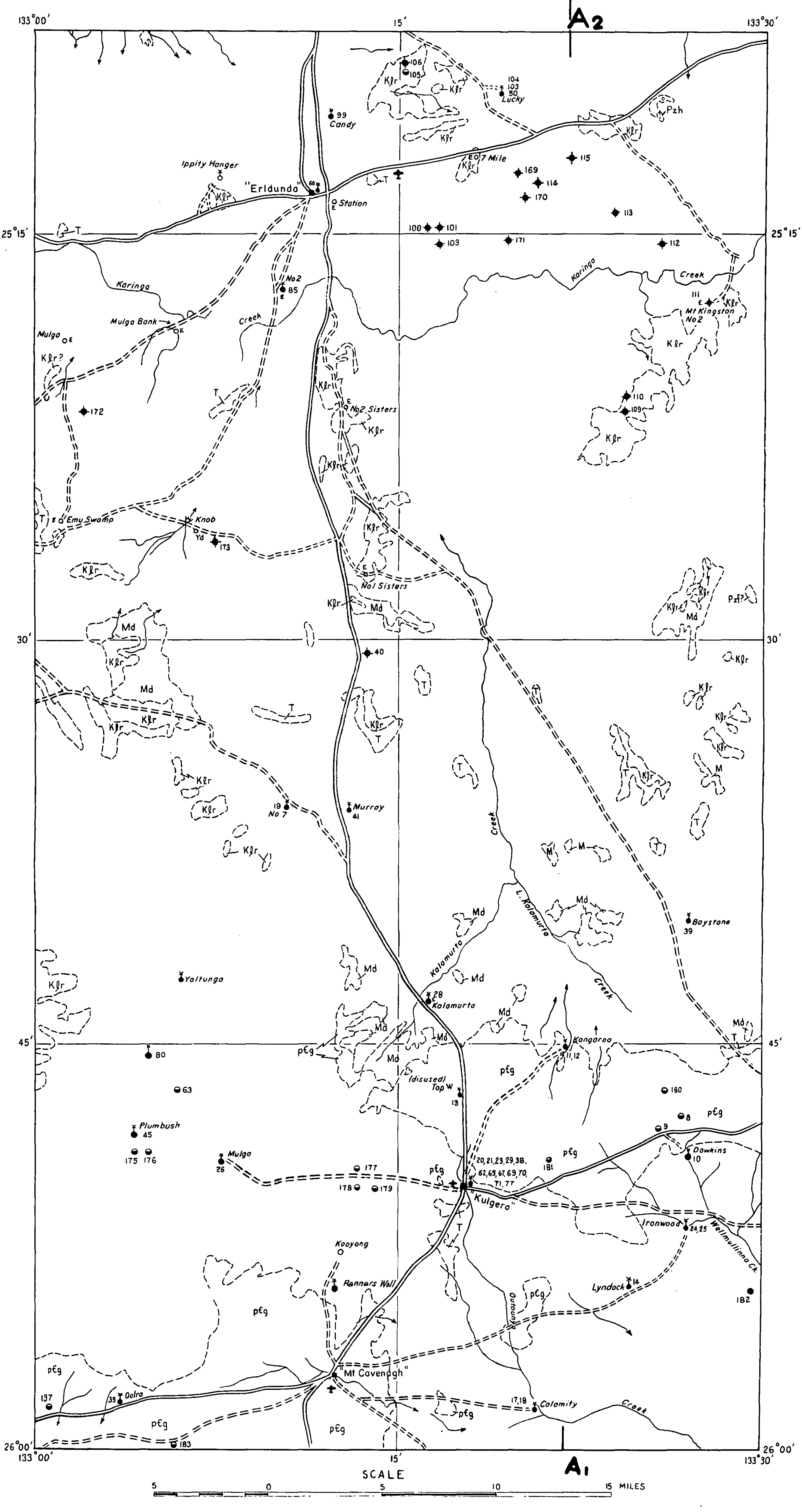
G53/5-19	No.7 Goyder Stock Route	208'	1800 g.p.h.	2322	386	1.3
G53/5-39	Baystone	212'	800 g.p.h.	7013	1220	2.6
G53/5-41	Murry	200'	1500 g.p.h.	2541	362	0.4

Plate I

GEOLOGICAL MAP OF THE

KULGERA - ERLDUNDA AREA, N. T.

(Adapted from B.M.R. 1:250,000 Sheet SG53-5)



REFERENCE

T	Tertiary: sand, clay, siltstone
Kℓr	Cretaceous: Rumbalara Shale
Md	Mesozoic: de Souza Sandstone
Pzf	Palaeozoic: Finke Group
pЄg	Precambrian. Granite

- 26 Bore equipped, with reference number
- Bore, salt
- Bore, small supply
- Bore, small supply, salt
- Bore, dry
- O E Earth tank

- Geological boundary, position approx.
- Vehicle track
- Main road

G53/A5/1

Bureau of Mineral Resources, Geology and Geophysics

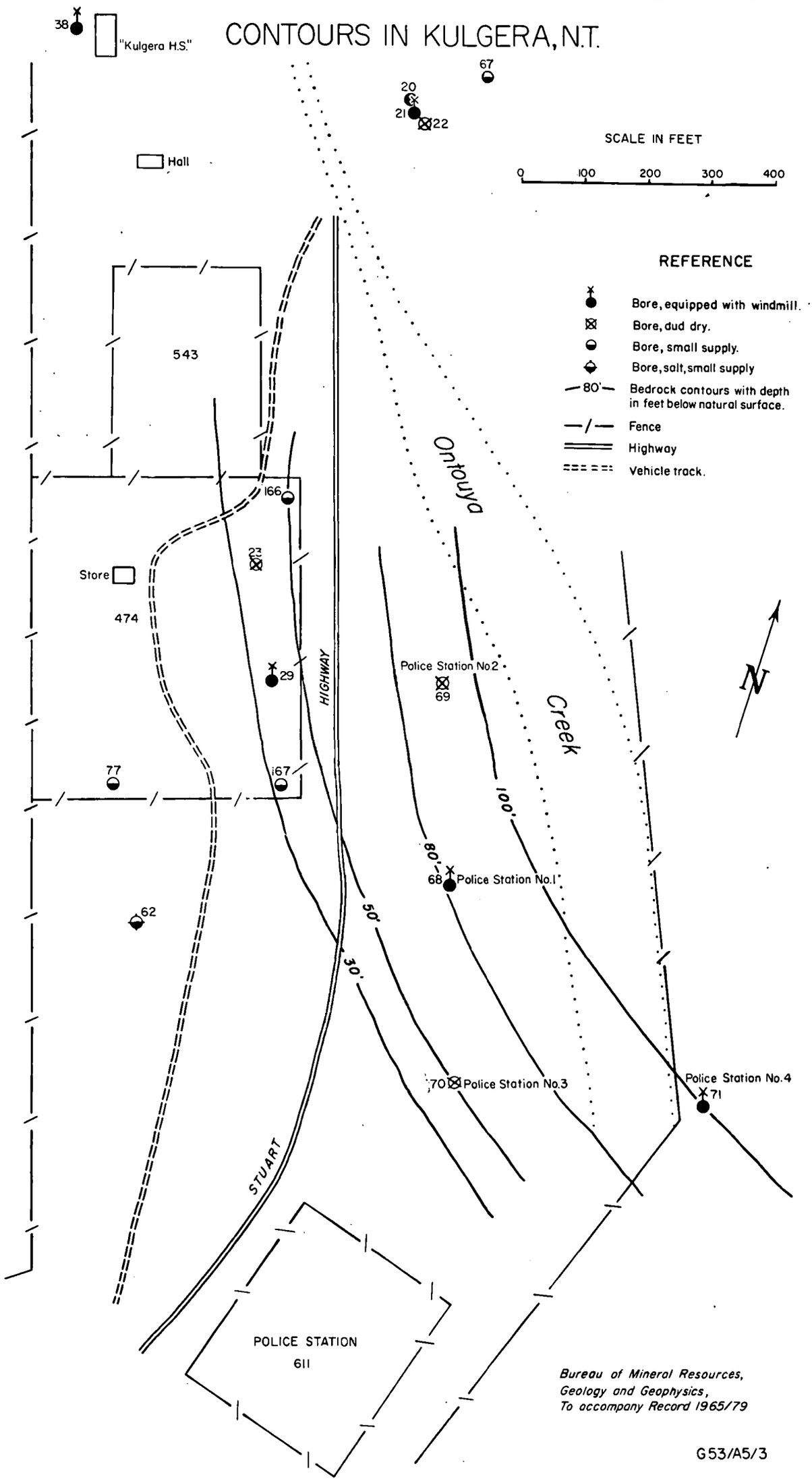
To accompany Record 1965/79

G53/5-1A

Resident Geologists' Office, Alice Springs, N.T. May, 1964

PLATE 2

MAP SHOWING LOCATION OF BORES AND BEDROCK CONTOURS IN KULGERA, N.T.



Bureau of Mineral Resources, Geology and Geophysics, To accompany Record 1965/79

G53/A5/3

D.R.W.

TABLE 3.

Bores drilled within Kulgera Township (for locations see Plate 2).

BORE No.	NAME	TOTAL DEPTH	STRATA PENETRATED	SUPPLY	DEPTH WATER STRUCK	SALINITY(IN PARTS PER MILLION-P.P.M		
						T.D.S.	SULPHATE	FLUORIDE
G53/5-20	Engine Well	20'	?		?			
G53/5-21	Mill Well	52'	Granite	300 g.p.h.		1582	205	1.7
G53/5-22	Dud	74'	?	Ca 50 g.p.h.	?			
G53/5-23	Dud	175'	Granite	Ca 50 g.p.h.	60'			
G53/5-29	Greenwood No.1	111'	Granite	50 g.p.h.	?	1393	169	2.6
G53/5-38	Kulgera Homestead		?	?		2106	289	2.8
G53/5-62	Greenwood No.2	105'	0-25' Quaternary 25-90?' Schist 90-105' Granite	300 g.p.h.	40, 64-66, 83-91	6587	1170	2.4
G53/5-67	Kulgera H.S. Dud	100'	Granite	Nil				
G53/5-68	No.1 Police Station	180'	0-20 Quaternary 20-80 Tertiary 80-170 Granite	120 g.p.h.	80'	1292	144	1.1
G63/5-69	Police No.2	100'	0-20 Quaternary 20-95 Tertiary 95-100 Granite	Less than 50 g.p.h.	95'	1305	150	1.5
G53/5-70	Police No.3	95'	0-5 Quaternary 5-50 Tertiary 50-65 Schist 65-95 Granite	80 g.p.h.	40'	1403	145	2.1
G53/5-71	Police No.4	155'	0-10 Quaternary 10-100 Tertiary 100-155 Granite	180 g.p.h.	40'	1278	150	2.2
G53/5-77	Greenwood No.3	175'	Schist	Ca 200 g.p.h.	40', 100'	2071	263	1.2
G53/5-166	Store 64/1	120'	0-20 Quaternary 20-50 Tertiary 50-120 Granite	Soakage 50 g.p.h.	90' 120'	1356	161	3.0
G53/5-167	Store 64/2	140'	0-30 Quaternary 30-140 Granite	50 g.p.h.	90', 100', 130'	1338	159	3.0