DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept. Bk. No. 79/57

MINTABIE OPAL FIELD AND MARLA

Groundwater Resources

GEOLOGICAL SURVEY

By

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DEPARTMENT OF MINES - SOUTH AUSTRALIA

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DEPARTMENT OF MINES AND ENERGY
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PART I: MINTABIE OPAL FIELD

INTRODUCTION

With increasing population at Mintabie there will be a greater demand for water to the point where existing sources become inadequate. At present water supplies are obtained from three wells in the vicinity of opal fields. These include Apamurra, Sailor and Larry Wells all of which are used for the watering of cattle.

In early 1979 a water well was drilled in the mine area and reports indicated that it was of relatively low salinity and high yielding. However, a bore about 5 metres away was found to be very low yielding. Some miners are using water from exploration drill holes which are mainly drilled by a Callweld plant, with a diameter of about 1 metre.

Streams in the area flow only on rare occasions and surface water can be disregarded as a potential source of permanent supplies.

This report summaries the known position regarding groundwater and recommendations are made for further investigation and testing.

CLIMATE

The area is part of the arid zone with an average annual rainfall of less than 150 mm per year. There are however, extreme variations, from almost zero to possibly 500 mm per year, occurring at rare intervals e.g. 1974. In common with much of the northern part of the State most rain falls during the summer months.

Evaporation in the area is very high, probably rising to

3000 mm per year so that the occurrence of surface water is a rare event. Pools in the streams would persist for only a few days after rain.

PHYSIOGRAPHY

The workings at Mintabie (Fig. 2) lie mainly along the top of a low, north west trending excarpment, rising to 20-25 metres above the lower country to the north east. On the escarpment the land surface is relatively flat in the form of a plateau but with prominent sand dunes trending E-N-E at intervals of ½-3/4 km.

Numerous ephemeral streams trending north easterly have eroded the scarp into a series of headlands particularly in the vicinity of the airstrip. These streams terminate in clay-pans 3 km north of the workings.

GEOLOGY

The Mintabie Beds, apparently of Upper Devonian age outcrop along the escarpment and dip south westerly at approximately 5^{o} (Fig. 3). The rocks are described as greyish brown arkosic sandstones and feldspathic siltstone. These grade upward into a white kaolinitc sandstone in which the opal horizon is located.

Beneath the sandstones a black pyritic shale has been intersected in one bore but its extent is unknown. The underlying Blue Hills Sandstone has not been intersected at the opal field but is believed to be the aquifer at Apamurra and Sailor Wells.

In outcrop the rocks appear to be moderately jointed but beneath the plateau jointing is probably restricted. At the opal horizon both joints and interstitial porosity are filled with opaline material. Quaternary unconsolidated sand dunes occur on the plateau, rising 5-10 metres above the general level.

HYDROGEOLOGY

On the plateau the standing water level occurs at 15-20 m below the surface, for aquifers occurring above and below the opalised zone.

Groundwater occurring above the opalised zone is apparently unconfined and with a salinity of up to 3500 mg/l. Yields are very low probably ranging from 0.05 to 0.2 kilolitres per day. This water is used by a few miners for domestic purposes. It appears to be a perched water above the almost impermeable opalised zone. Water intake from this aquifer into some mines has apparently decreased indicating that partial dewatering has occurred.

An aquifer beneath the opalised zone has been reached by two bores at a depth of approximately 30 metres. The aquifer which is described as a brown quartzite, is confined with a standing water level approximately 15 metres below the surface. The yield available from these two bores, approximately 5 m apart, is considerably different. One yielded 10 kl.day and the second is reported to have been airlifted at 1000 kl/day for a 3 hour period. Later information indicates that this pumping rate is probably exaggerated and could not be maintained.

Salinity of the deeper aquifer at this locality was 1125 mg/l on 7th February 1979 but a sample pumped from the bore on 14th March 1979 had a salinity of 2600 mg/l, when tested in the field. Salinity is apparently variable and appears to be affected by pumping. In early April salinity had decreased to approximately 1250 mg/l.

Recharge to the upper unconfined aquifer is believed to occur from downward percolation of local rainfall. The underlying confined aquifer is probably recharged from ephemeral streams along the escarpment. However, annual

recharge is probably very small and the low salinity water of the deeper aquifer may be mainly "fossil".

Beneath the plains north east of the escarpment salinity of the groundwater increases markedly. At the foot of the scarp a bore to 17 metres is reported to yield 2 kl/day, the salinity being 2400 mg/l. Local recharge probably accounts for this relatively low salinity as another bore 3/4 km east near the claypan has a salinity of approximately 7000 mg/l.

Pollution Potential

Groundwater of the upper unconfined aquifer is likely to become polluted because of the large number of open Calweld drill holes which penetrate it. Some of these holes are being used for disposal of rubbish and domestic wastes.

There is less possibility that the deeper aquifer will become polluted by this practice in the short term, but it could become a problem if allowed to continue. The lower aquifer near Peg M7 contained water with 130 mg/l of nitrate when tested in February. This is believed to be due to natural causes, but the water should not be consumed by children under 5 years of age.

Future Investigations

It is considered that the following steps should be taken:-

(1) Pump test of water well, located 42 metres on a bearing of 123^{o} from Peg M7. (Fig. 2), to determine yield-drawdown characteristics, aquifer parameters and predictions of long term yield. This is to be a 3 stage test and a 24 hours constant discharge test, for which approval has been given.

(2) It would be preferable for a production bore to be located outside the mining area and it is suggested that the

area to be reserved from the Mining Act in the vicinity of the airstrip should be tested. This would involve drilling to approximely 40 metres, to be followed by a pump test, if yield and salinity are satisfactory.

(3) If Mintabie Beds are not satisfactory for a permanent water supply the Blue Hills Sandstone should be investigated. The Ammaroodina Creek cuts through this sandstone at localities 9 km north and 6 km north east of Mintabie. Recharge at these sites is expected to be good.

PART II: MARLA

INTRODUCTION

Marla is considered to be the general area extending east from Marla Bore along the present Stuart Highway to Marla Road House. The latter is in an area where a future settlement may be located.

In any proposals for establishing a town, water will be one of the first requirements. Because of the general lack of surface water in the area, groundwater appears to offer the only possibility for a permanent supply. Testing of groundwater in the area is encouraging, although yields are relatively low, sufficient for only a small population.

CLIMATE

The climate is similar to that at Mintabie but rainfall is expected to be even lower because of the flat nature of the landscape. Average annual rainfall is less than 150 mm; however, extreme annual variations could be expected.

PHYSIOGRAPHY

Land surface of the area is almost flat without sand dunes or streams. Several small clay pans occur lying 1/3-1/2 metre below the general level. To the west and north west deeply dissected hills occur, a prominent local high

point being Mt. Byilkaoora.

GEOLOGY

Sediments in the area consist of a thin Quaternary cover over Mesozoic and Palaeozoic rocks.

The Quaternary sediments consist mainly of sand and red clay, partly wind deposited with a thickness of 2-3 metres.

The underlying clays, with a thickness of 15-20 metres are Bulldog Shale, forming part of Mesozoic sedimentation in the Great Artesian Basin. Marla is in a marginal area of the basin where the underlying Cadna-Owie Formation is not expected to be more than 20 metres in thickness.

Slates, probably of Ordvician age occur beneath the Mesozoic sediments.

HYDROGEOLOGY

Groundwater occurring in the Cadna-Owie formation in the Marla area is of relatively low salinity, ranging from less than 200 to 1200 mg/l. The low salinity is because of proximity to a recharge zone, located in the higher ground near Mt. Byilkaoora. The aquifer, which is overlain by Bulldog Shale, appears to be partly confined with water rising a few metres above the depth at which it is intersected.

Pump tests and air lift methods have indicated that yields of 60-130 kilolitres per day could be expected. Drawdown after continuous pumping for 30 days should not exceed 10 metres.

Pollution of the aquifer could become a problem if wastes are not properly treated and prevented from direct entry to the aquifer.

CONCLUSIONS

MINTABIE

Groundwater occurs in the Mintabie Beds as a perched aquifer of relatively high salinity above the opal horizon and in

a deeper aquifer of lower salinity. Pollution or salinity increase may prevent long term use of groundwater in the mine area, although the water bore near Peg M7 may be adequate for the present population. Other sources will probably be necessary in future as the population increases and additional testing in Mintabie Beds and Blue Hills Sandstone is proposed.

MARLA

The Cadna-Owie Formation is the main aquifer of the area and is capable of yielding up to 130 kilolitres per day. Salinity is relatively low, from less than 200 to approximately 1200 mg/l. Disposal of wastes will need to be carefully controlled to prevent pollution of the aquifer.

At both Mintabie and Marla the nitrate level of the groundwater is known to be high, in the range 120-130 mg/l. This is well above the maximum recommended by the World Health Organisation (45 mg/l). Water with the nitrate level indicated should not be consumed by children under 5 years.

RECOMMENDATIONS

MINTABIE

Following the pump test of the bore near Peg M7 the results will be appraised but additional drilling and testing in Mintabie Beds in the vicinity of the airstrip is recommended. Maximum depth of a bore at this locality is expected to be 40 metres. Drilling should be followed by a 3 stage pump test and 24 hour constant discharge test if initial results indicate yield and salinity are satisfactory.

In the long term groundwater resources of the Mintabie Beds may not be adequate in quality and quantity. Accordingly, it is recommended that the next step should be investigation of groundwater in the Blue Hills Sandstone. Two bore sites together with observation bores are proposed on Ammaroodina Creek, 6 km and 9 km north east and north of Mintabie, respectively.

Maximum depth at each site is estimated to be to 70 metres. and drilling and development should be followed by pump tests which should include a step drawdown and constant discharge.

MARLA

The drilling and testing of two bores is recommended. Total depth should not exceed 40 metres and the bores could be drilled where convenient. However, they should be spaced at least 300 metres to reduce the effects of mutual interference, if both are pumping at the same time.

To obtain information on storage coefficient observation bores are required and it may be possible to use existing bores drilled for A.N.R. for this purpose.

Step drawdown tests of 3 stages and a 24 hour constant discharge test should be conducted at both sites.

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FIGS. 1-3

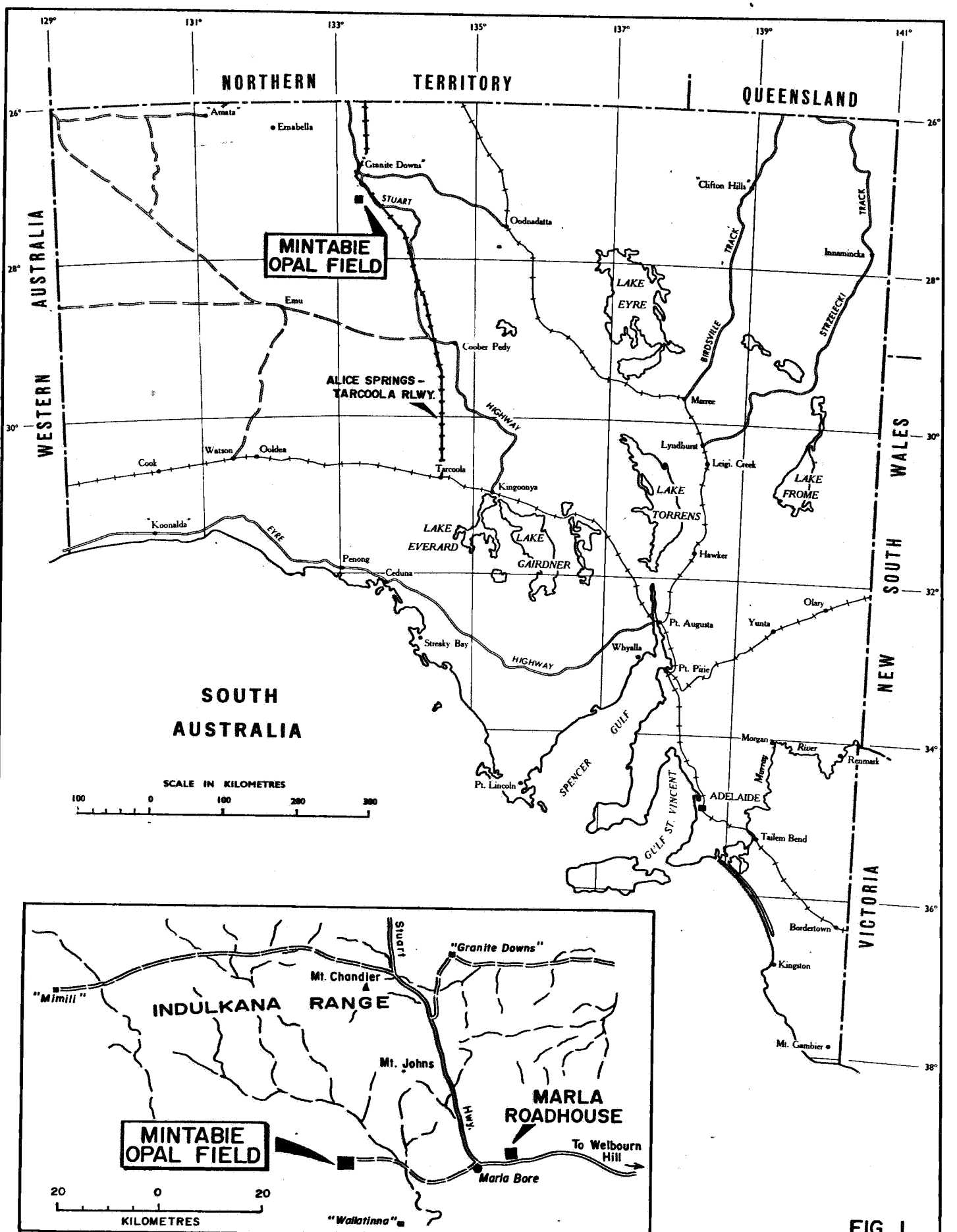


FIG. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Compiled R C Shepherd	MINTABIE OPAL FIELD AND MARLA LOCALITY PLAN	Date: APRIL 1979
Drn M.R. Ckd.		Drg. No. S 14034

P F No 5585C 9942

CLAYPAN

MINTABIE DAM

CLAYPAN

S.A.D.M.E. CAMP ■

Airstrip

1 ● PROPOSED SITE FOR WATER WELL

PLATEAU

Workings

• Round Hill

" HOTEL" ■

To Marla Bore (approx. 40 kms.)

WELL TO BE PUMP TESTED

High dump

Workings

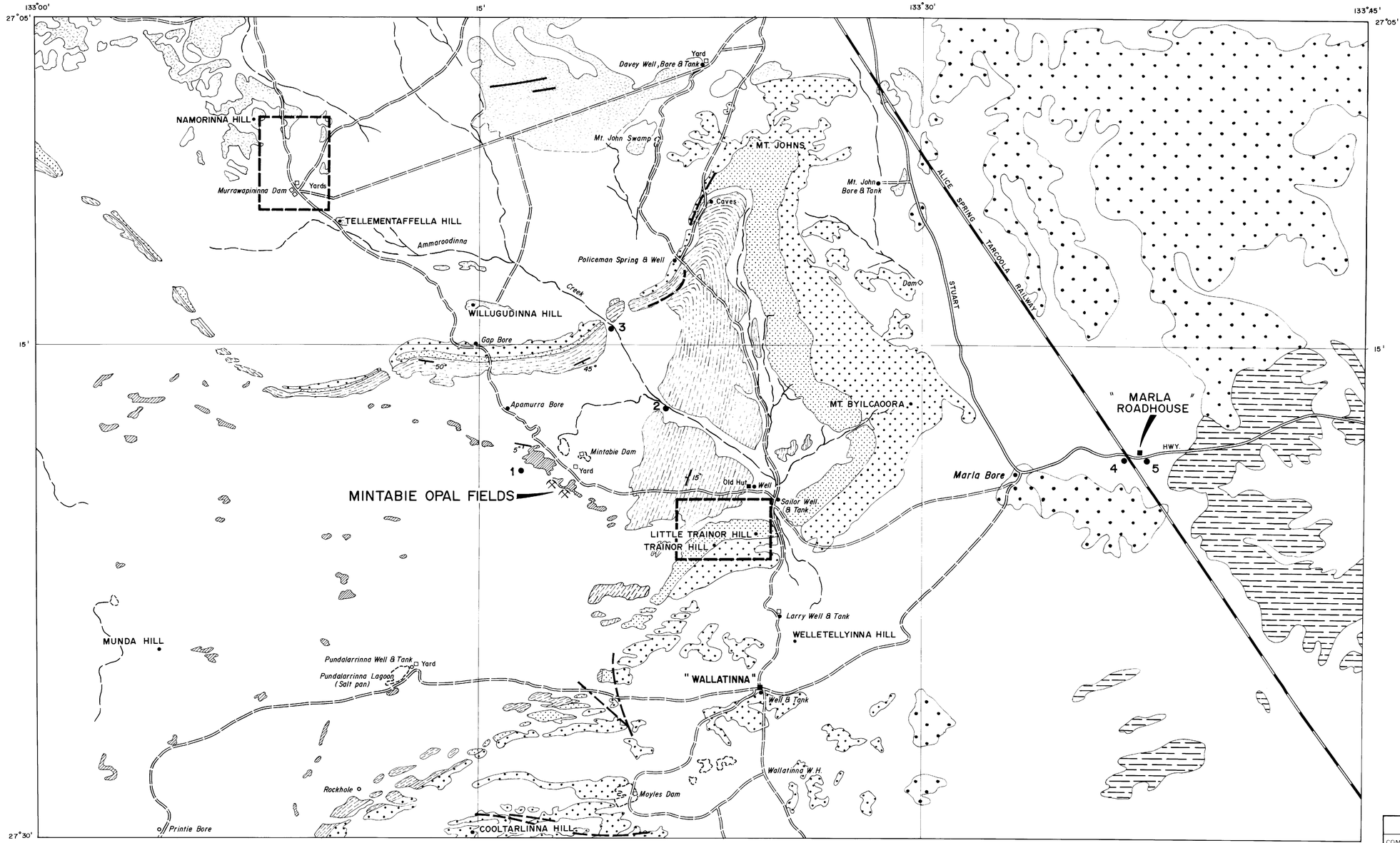
500 400 300 200 100 0 500 1000

METRES

FIG. 2

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1 : 10,000
COMPILED R. G. S.	MINTABIE OPAL FIELD	DATE APRIL 1979
DRN M. R. CKD	LOCATION OF TEST WELL & PROPOSED WATER WELL	PLAN NUMBER 79 - 338

/351/



LEGEND

CAINOZOIC

Alluvial sands and clays with limestone and sand dunes

MESOZOIC

BULLDOG SHALE - Dark grey, carbonaceous and silty

CADNA-OWIE FORMATION - Fine to medium grained feldspathic sandstone.

PALAEOZOIC

MINTABIE BEDS - White to greyish brown feldspathic sandstone.

BLUE HILLS SANDSTONE - Red brown medium grained kaolinitic.

MT. CHANDLER SANDSTONE - Sandstone, feldspathic.

CAMBRIAN - Sandstone, conglomerate, shale, siltstone

PROTEROZOIC

ADELAIDEAN - Sedimentary rocks and volcanics.

• 4 Proposed water well sites.

Fault

Aboriginal nucleus areas.

15° Bedding

5 0 5 10
KILOMETRES

FIG. 3

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1 : 126,720
COMPILED R.G.S.	MINTABIE OPAL FIELD AND MARLA GENERALISED GEOLOGICAL PLAN SHOWING PROPOSED DRILLING SITES	DATE APRIL 1979
DRN M.R. CKD		PLAN NUMBER 79 - 339

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