UR1974-53

Results of drilling for water, Currie, King Island.

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A contracting company, Intairdril (Aust.) Pty Ltd has undertaken drilling in search of groundwater for the Currie Municipal Council. Ten holes were drilled, two of which examined prospects in the basement rocks (granite) while the remaining eight were drilled in superficial deposits (mainly sand dunes). In addition six short scout holes were drilled in the westernmost region of the area.

A short visit was made to King Island during the drilling programme when a pump test of a hole in basement rocks was undertaken. The scout holes were also drilled at this time.

Drilling records, as supplied to the Council by the contractors, are a poor representation of a drilling programme. Attempts to obtain detailed records (as required under the Underground Water Act, 1966) of the drilling while the plant was on King Island and after it left, failed. It is said that these more detailed records were lost with the drill when the Straitsman sank during her last voyage. Because of this, only limited conclusions can be made regarding the drilling.

RESULTS

The results are given in the order of drilling.

Area 1. Basement holes

Two holes 61 m apart were drilled in the middle of the racecourse; the first penetrated to 79.2 m with about 7.6 m of unconsolidated material on the surface, while the other was drilled to 91.4 m with 6.7 m of superficial surface material. Flow rates recorded by the driller were about 11 *l*/m for the first hole, and about 15 *l*/m for the second. Slotted casing was placed against the top 15 m of the first hole and a test of about four hours duration resulted in a water yield of about 5.5 *l*/m.

Area 2. Holes near Seismic Spread 7, 8 (fig. 1)

The first hole in this area was drilled to a depth of 15 m at a site about 300 m north-west of the seismic spreads and on top of a sand dune about 25 m above the surrounding land surface. The second hole was drilled in the valley about 200 m west of the spreads to a depth of about 9 m. Both holes were abandoned because of difficulty in keeping the holes open.

Area 3. Short scout holes

It was recommended in a previous report (Matthews and Cromer, 1973) that some investigations be made in the vicinity of Seismic Spreads 34 and 35 (fig. 1). Six exploration holes were drilled in the positions shown in Figure 2. All holes were drilled to basement except for Hole 6 which encountered mainly clay.

Hole No.	*Total Depth (m)*	*Water Table (m)*
1	8.2	2.1
2	5.2	3.0
3	6.1	∿2.0
4	7.9	∿3.7
5	8.2	∿4.3
6	5.2	

Differences in relief would account for the variation in depth to the water table as between Holes 1, 2, 4 and 5. Coarse carbonate sand occurs between the water table and basement. Plots of grain size are shown in Figure 2. The uniformity coefficient of the sand is low and the results as a whole give encouragement for further groundwater investigations in this area. The water table was encountered at 1.3 m in a hand auger hole drilled in December 1973 near Hole 1, suggesting a drop of about one metre in the water table in the two months from December to February.

Area 4. Holes 3 and 4

Hole 3 was sited near Seismic Spreads 7 and 8 (fig. 1). The first 15 m were reported as 'circulation drilled' (mud?), from 15 to 17.4 m 'with blades' in weathered granite, 18 m of casing was installed, 11 m of which was slotted. A pump test during a period of one hour resulted in a yield of 4 *l/m* on which the driller commented 'not indicative or conclusive of water available'.

The precise location of Hole 4 is unknown but it was probably drilled near the second hole, close to Spreads 7 and 8. The hole was drilled from 0-10.7 m with 'circulation' (mud?) and from 35-39 m with blades. Twelve metres of casing, of which 6.4 were slotted was installed and a one hour pump test with 'results as above' (meaning Hole 3).

Area 5

The location of area 5 is not known with certainty but it is assumed that the two holes were drilled in the area of the scout holes previously described. They are numbered 3 and 1 but it is unlikely they are in the same area as Scout Holes 3 and 1. Hole 3 of Area 5, was drilled to 7.6 m with the final 3.7 m being drilled with the hammer drill (which probably indicates that hard basement rocks were encountered) and 1.5 m of casing was installed. Scout Hole 3 struck basement at 6.1 m and would have required that amount of casing to keep the hole open. Hole 1 of Area 5 struck basement at 5.5 m whereas Scout Hole 1 struck basement at 8.2 m. No water was recorded from either of the two holes drilled in Area 5. The different locations can be explained by the fact that different drillers drilled the two sets of holes and the locations were probably not passed on.

Area 6

This area is situated in the swamp near Camp Creek in the northern part of Currie. Hole 1 has 10 m of unconsolidated material and it was hammer drilled from 10-18.3 m (probably in bedrock). Water was struck at 1.8 m from the surface and 10.4 m of slotted casing was installed in the hole.

Hole 2 was sited 15.2 m from Hole 1 and contained 8.8 m of unconsolidated material, and from 8.8-19.8 m, the hole was hammer drilled (basement rocks?). Water was struck at 2.7 m on drilling and 8.8 m of slotted casing was installed in the hole. Pump tests arranged by the Council's Consulting Engineer have been conducted on these holes and the results are discussed below.

DISCUSSION OF RESULTS

The holes on the racecourse indicated that joints in the granite are closed and only contain small quantities of water. One hole in this area would have been sufficient to show this and a more distant location could have been selected for investigation rather than the drilling of a further hole some 60 m away from the first.

The remainder of the holes were drilled mainly into superficial deposits made up largely of sand dune material. The attempts at drilling in this material indicated that the contractors were either inexperienced in developing water bores in these conditions or did not have adequate equipment for such development. Several attempts were made by drilling with air circulation but it is impossible to keep the hole open below the water table using this method, so that casing can be installed. It is believed that mud may have been used for this purpose in one or two attempts (Holes 3 and 4, Area 4) but as recorded in the drillers report, only one hour was spent in doing a flow test on the wells. With the kind of drilling rig being operated, the use of mud during the drilling process is probably the only practical method of keeping the hole open. However a considerable time should be spent in removing the mud from the sides of the hole, once the casing is installed, using surging and detergent washing, before a pump test would yield any significant results. Apart from the quick scout holes, the other holes drilled west of the racecourse cannot be used as a guide to the water prospects of the dunes in this area. The scout holes indicated the possibility of reasonable quantities of water being present and this is supported by the occurrence of strong seepages coming from the dunes along the coastline further to the west.

Camp Creek area

The two holes drilled in the swamp area near Camp Creek encountered reasonable quantities of water. The holes were probably kept open during drilling by circulation of the naturally occurring near-surface clay which was quite possibly easily removed during a pumping period. Pump tests on these holes were conducted over periods of one hour, 24 hours and 72 hours at rates ranging from 100-270 *l*/m.

There is no indication of aquifer thickness from the driller's information but the maximum possible thickness at Hole 1 is about 8 m (water was struck at 1.8 m and basement rocks at about 10 m) and for Hole 2 about 6m. There is some clay in this section however, as evidenced by the hand drilling done in December 1973 and also from samples obtained from a nearby back-hoe hole dug by the Consulting Engineers. The Council's Consulting Engineer had cuttings from each hole collected from the area around the bores for sizing analysis. The graphs of the sieve analyses are shown in Figure 3. Considering the high uniformity coefficient, it seems unlikely that these samples are representative of material from which water can be pumped at greater than 150 *l*/m and it is probable the material from the aquifer has been contaminated with finer material.

The water level rises to about one metre below the surface and water was struck at 1-2 m below this, so that the water is confined to some extent. Assuming the aquifer is confined, values of transmissibility and storage coefficient have been calculated for the various pump tests performed. However most of the assumptions of conditions for the Theiss equation to hold, are unfulfilled. For example, it is unlikely that the aquifer is of uniform thickness and of infinite areal extent. In addition drawdown measurements are very irregular and it is difficult to draw a definite straight line through the plotted points. Values of transmissivity for the various tests performed, range from 2.8-20.8 m^2/day and the corresponding storage coefficient ranges from 2.2×10^{-3}-4.6×10^{-2}.

Extrapolation of the 72 hour test curve to a time of 100 000 minutes suggests that the drawdown after this longer period would be about 8.2 m from the surface when the pumping rate is about 100 *l*/m. Irregularity of drawdown figures makes a confident projection impossible but with a possible drawdown of about 10 m from the surface, there is some safety margin.

Yields could probably be increased by installation of screens or gravel packing around casing with very narrow closely spaced slots (or a screen). Well development by surging could improve yields further, particularly if the samples sized are representative of the aquifer. There is a large proportion of fine material which, if removed, would increase the average size of the aquifer particles around the bore.

Chemical analyses of water samples collected during the 72 hour test are as follows.

	After 4 hours pumping mg/l	*After 7 hours pumping mg/l*
pH	6.8	6.9
CO_3	Nil	Nil
HCO_3	295	295
Cl	285	290
SO_4	37	
Ca	39	42
Mg	34	34
Fe	1.3	1.3
Al	<0.1	<0.1
K	14	12
Na	180	180
T.D.S.	770	770
T.S.S. (inc. turbidity)	20	32
Permanent hardness	Nil	5
Temporary hardness	240	240
Alkalinity	240	240
Colour	>70	>70
Turbidity	20	20

The total dissolved solids (T.D.S.) content compares favourably with that of the present town supply but the Na and Cl content is considerably higher. Preliminary tests indicate a high bacterial content, some of which is derived from sewerage.

CONCLUSIONS

In the one area where the basement rocks were tested, namely the racecourse, only small quantities of water were obtained.

The area of dunes west of the racecourse was not satisfactorily tested. This may have been due to lack of experience of the contractors to develop water resources in sand dunes or a lack of equipment on King Island or a combination of both factors. These inadequacies may have been partly or wholly overcome by much closer supervision of the drilling operations. The potential of this area is still unknown but prospects still appear good from the results of the scout holes and because of the occurrence of strong seepages along the foreshore.

The swamp on the side of Camp Creek shows some promise as a water supplier. The dissolved solids content of the water compares favourably with the present water supply, although some preliminary measurements of bacteria show some contamination from sewerage. Increased yields could probably be obtained by installation of screened or gravel packed bores (slotted casing or screen) and surging to remove the finer material in the aquifer.

The information supplied by the contracting company to the Council is of very restricted value. Drillers involved in groundwater investigations

should be able to supply a lithologic log, the depth at which water was struck, standing water level and other relevant information. Very little of this information can be extracted from the data supplied by the drillers to the Council.

REFERENCE

MATTHEWS, W.L.; CROMER, W.C. 1973. Groundwater investigations at Currie, King Island. *Unpubl.Rep.Dep.Mines Tasm.* 1973/94.

[18 July 1974]

LOCALITY MAP

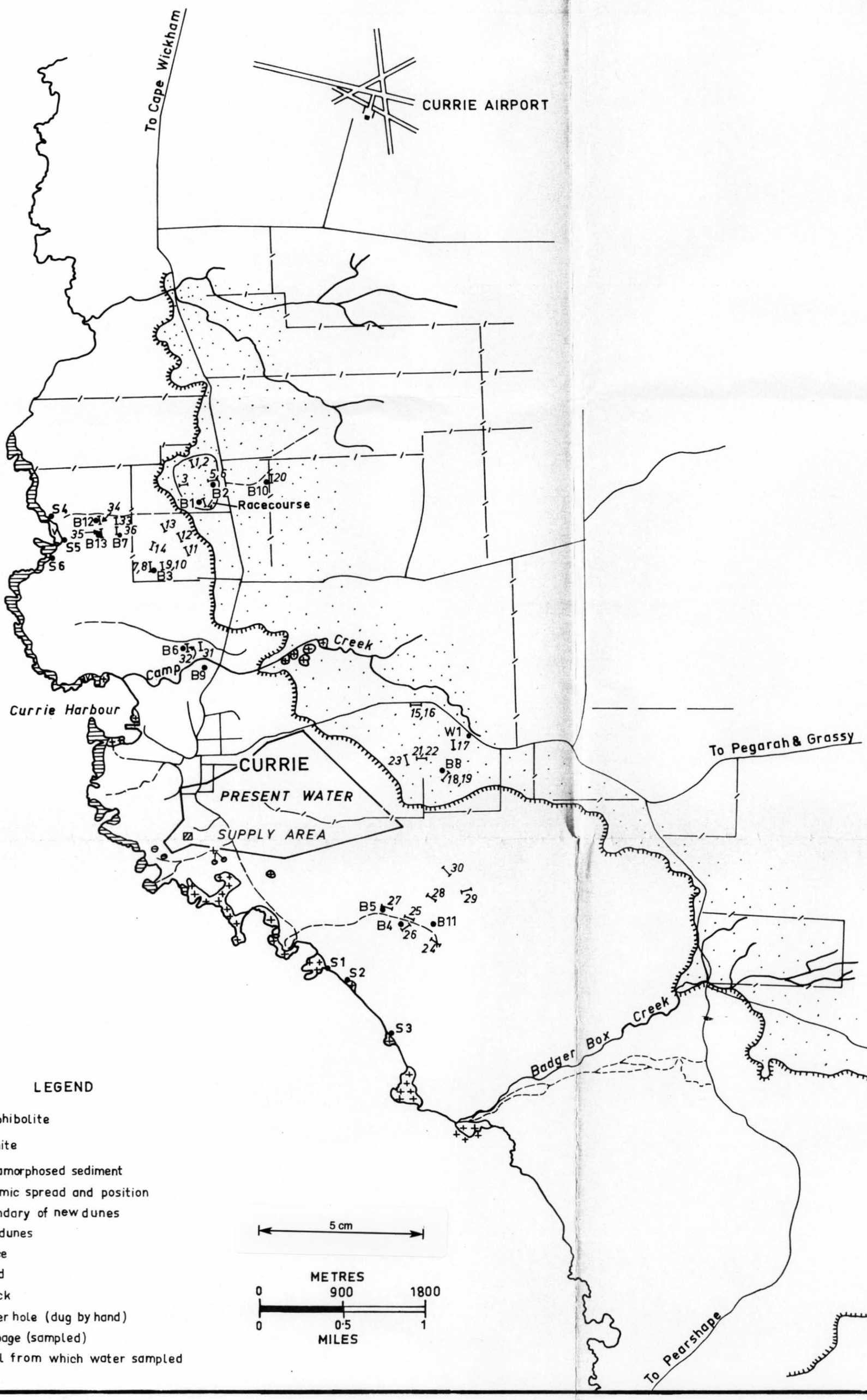
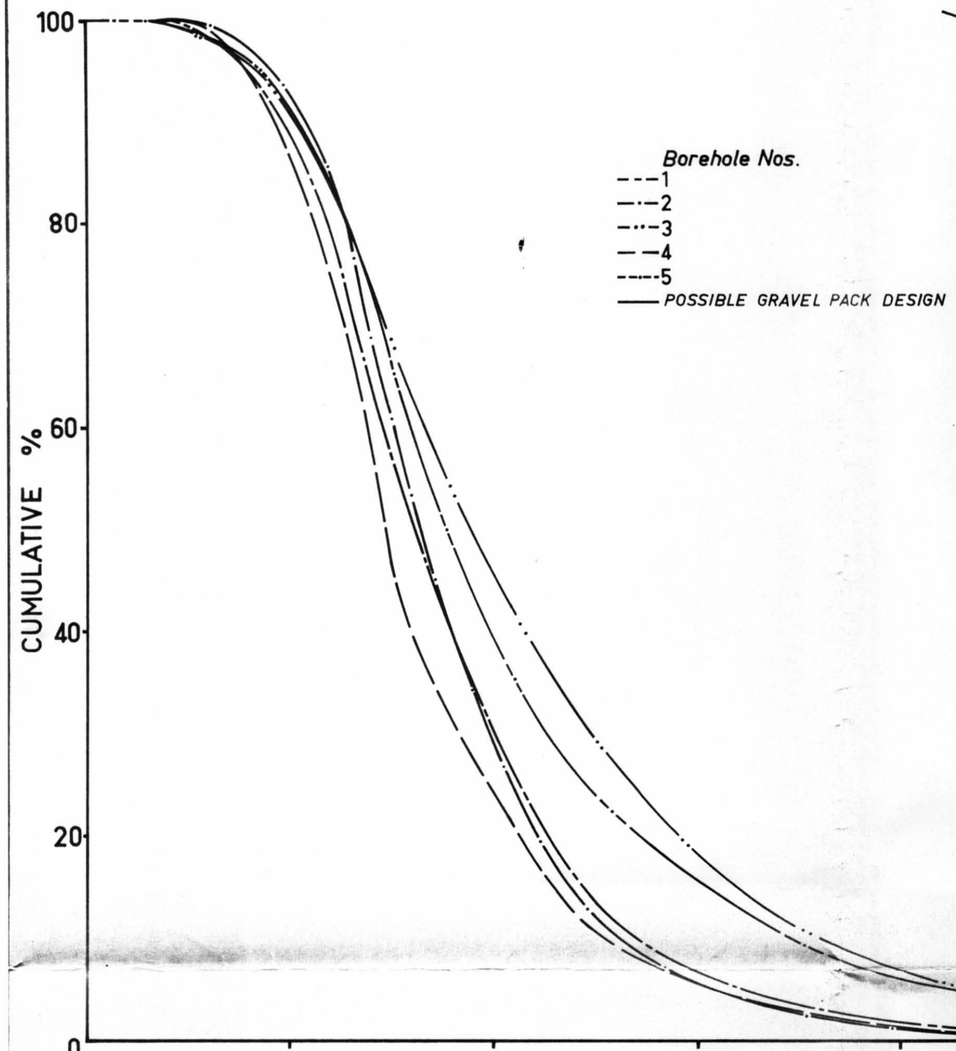


FIG 1.

SIEVE ANALYSES - SAND SAMPLES NORTH OF CURRIE



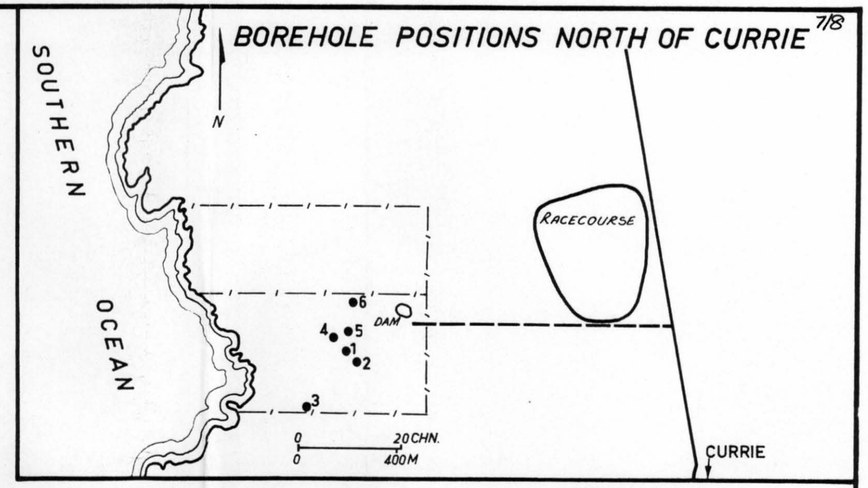


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FIG 2.

CAMP CREEK AREA

UNIFORMITY COEFFICIENT HOLE 1 4·9
HOLE 2 4·7

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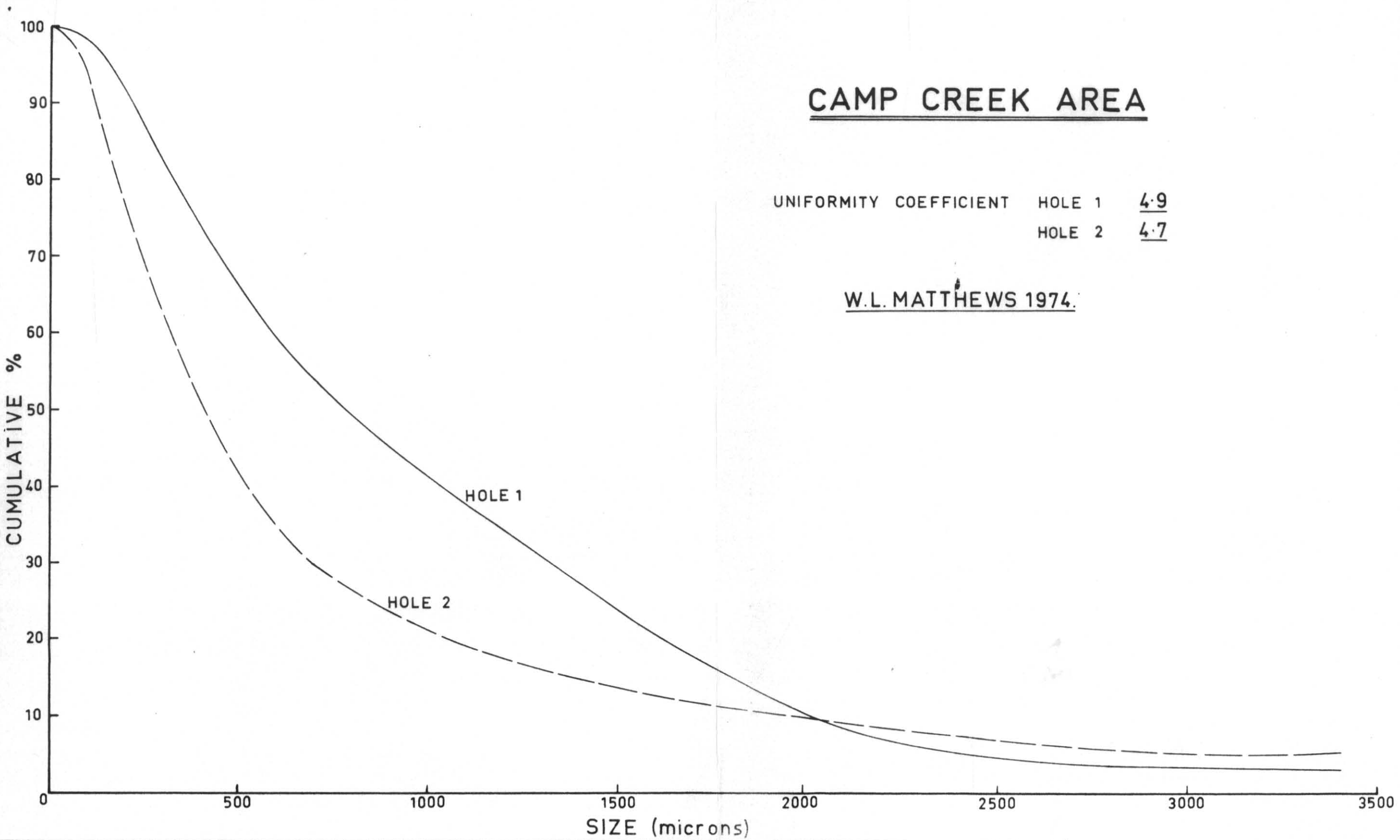

FIG 3

5 cm