Section 3. – Underground Water

17. WATER SUPPLY AT CURRIE, KING ISLAND

by W. L. Matthews

Introduction

The absence of large permanent surface streams in the vicinity of Currie has forced the King Island Council to depend on an underground water supply for the township. The only stream in the area is Camp Creek which flows through the N part of the town but is reduced to isolated ponds during the summer. Rain water disappears into generally highly pervious dune sands which form an almost continuous belt of variable width along the W coast of the island.

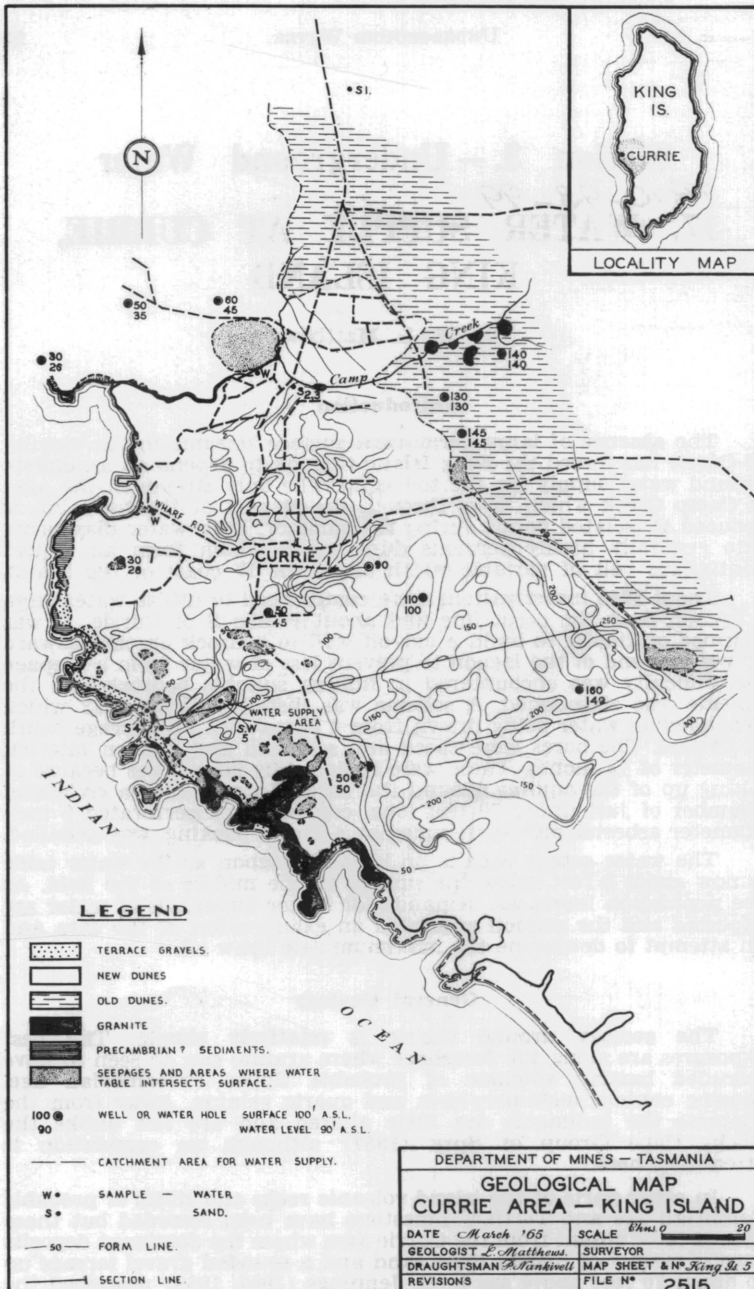
About 1940 investigations were commenced to utilize water from a lagoon near the coast line and about ½ mile S of Currie. It was planned originally to build a cut-off wall to bedrock on the seaward or western end of the lagoon to prevent loss of water from a seepage but difficulty was encountered in finding suitable bedrock and the scheme was abandoned. A scheme was installed about 1953 which depended on water being drawn from 4 bores with an average depth of 14 feet. The bores were cased and screened and had an internal diameter of 7½ inches. These were replaced by later bores because of silting up of the aquifer around the bores. Late in 1964 a collection chamber of just under 70 feet long, consisting of perforated 9 inch diameter asbestos pipe surrounded by a gravel packing, was installed.

The water supply area is no longer a lagoon as the water table is now about 5 feet below the surface in the middle of the field. As the population increases, demands for larger quantities of water are expected and the council requested an examination of the area and an attempt to determine the maximum safe draw off.

General Geology

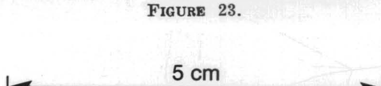
The geology around Currie is relatively simple. The best exposures are along the foreshore where granite can be seen to have intruded banded siltstone of probable Upper Precambrian age, causing contact metamorphism and quartz veining. Away from the contacts the sediments are little altered and are not unlike the Rocky Cape Group of Spry (1957) although no correlation is attempted here.

In other parts of the island volcanic rocks and tillite of probable Cambrian age and Tertiary limestone have been recorded but these appear to be absent from the Currie area where the dominant deposits consist mainly of Recent dune sand and a rounded gravel terrace up to about 10 feet above sea level. Jennings (1957, 1959) described the dunes fully and divided them into an Old and New Series. The dunes



N
KING IS.
CURRIE
LOCALITY MAP
Creek
Camp
WHARF RD.
CURRIE
WATER SUPPLY AREA
INDIAN
OCEAN
LEGEND
TERRACE GRAVELS.
NEW DUNES
OLD DUNES.
GRANITE
PRECAMBRIAN ? SEDIMENTS.
SEEPAGES AND AREAS WHERE WATER TABLE INTERSECTS SURFACE.
WELL OR WATER HOLE SURFACE 100' A.S.L. WATER LEVEL 90' A.S.L.
CATCHMENT AREA FOR WATER SUPPLY.
SAMPLE — WATER
SAND.
FORM LINE.
SECTION LINE.
DEPARTMENT OF MINES — TASMANIA
GEOLOGICAL MAP
CURRIE AREA — KING ISLAND
DATE March '65
SCALE Chns 0 20
GEOLOGIST L. Matthews.
SURVEYOR
DRAUGHTSMAN P. Nankivell
MAP SHEET & No King Is. 5
REVISIONS
FILE No 2515

FIGURE 23.



5 cm

of the "Old" Series in the Currie district generally consist of siliceous sand and are mostly stabilized by vegetation. They form low rounded hills and ridges and extend further inland than the "New" Series dunes which are characterized by sharp outlines and still recognizable blowouts. The New dunes are calcareous, being composed mainly of shell fragments. Pieces of wood, bone and carbonate concretions around formerly buried trees can be seen in some blowouts. Secondary carbonate deposition consists of an amorphous white, dense, earthy rock, probably almost impervious, tube-like deposits throughout the dunes, and a carbonate matrix which cements the sand grains and produces a fairly compact dune sandstone rock. Bedding is visible in some exposures and from measurements taken the wind direction during deposition was almost due W. Wind velocity varied as is indicated by varying grain size.

The carbonate content of the New dunes has been examined by Hughes (1957). It varies but in some areas it is quite high, e.g. a sample from Surprise Bay contained 91.3% carbonate, and a lime-cemented sample from Camp Creek near Currie contained 80% carbonate.

A gravel deposit up to about 10 feet above sea level occurs along the shore line, overlying the New dunes. The gravel is therefore a younger deposit and according to Jennings, represents a former sea level.

Hydrology

The water supply area is a hollow within the New dunes which Jennings (1957) regarded as a deflation zone where relatively impermeable basement is near the surface causing a lagoon to develop. Drilling in the area has shown sand overlying clay of variable thickness which in turn overlies basement rock. On the W end of the area, a trench has been dug at some time to drain the lagoon and fragments of rock indicate that the boundary between the granite and sedimentary rocks lies under the drain, with granite on the inland side.

Any attempt to estimate the reserves and safe draw-off at present is little more than a guess because of the very limited information available. To make anything like an accurate determination would require a contour plan of the basement and also of the water table as well as information regarding the grain size of the sediments present. These, together with measurement of porosity, permeability and percentage of rainfall that percolates into the sands would be some of the information required to come to any definite conclusion on the supply. However, the calculations in the following sections may give some idea of the conditions that apply.

The maximum catchment area which serves the water supply area has been determined by assuming that the main ridges of dunes, as well as forming the divides for surface water sheds, also have ridges in the water table beneath them where water runs in opposite directions. This is the usual form taken by a water table: its contours tend to have the same shape as the surface topography although the extremes of the land surface are not reflected in the water table. The inner margin of the new dunes rises an average of about 50 feet above the level of the old dunes further inland. It is expected that the water table will rise higher in the new dunes than in the old dunes, producing a divide in the water table where water runs in

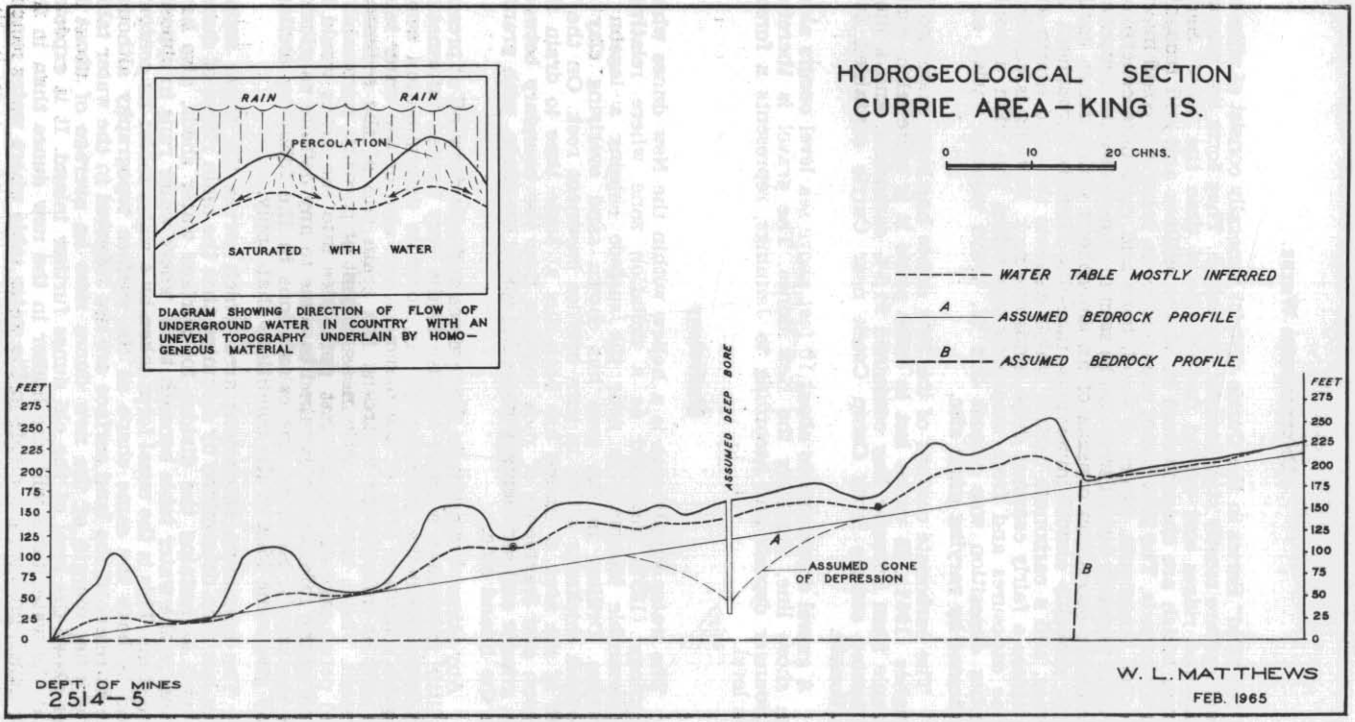

HYDROGEOLOGICAL SECTION
CURRIE AREA – KING IS.
0 10 20 CHNS.
WATER TABLE MOSTLY INFERRED
A ASSUMED BEDROCK PROFILE
B ASSUMED BEDROCK PROFILE
RAIN
RAIN
PERCOLATION
SATURATED WITH WATER
DIAGRAM SHOWING DIRECTION OF FLOW OF UNDERGROUND WATER IN COUNTRY WITH AN UNEVEN TOPOGRAPHY UNDERLAIN BY HOMO–GENEOUS MATERIAL
FEET
275
250
225
200
175
150
125
100
75
50
25
0
ASSUMED DEEP BORE
A
ASSUMED CONE OF DEPRESSION
B
DEPT. OF MINES
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FIGURE 24.

opposite directions. This is the probable reason for the series of lagoons along the boundary of the old and new dunes. Similarly the N and S boundaries of the catchment area have been determined by putting them along the main topographic ridges.

This catchment area, as determined above, not only serves the water supply area but also a number of seepages along the foreshore, part of the water for a soakage for watering the greens of the golf course and a number of areas where the water table intersects the surface allowing some evaporation to take place. The catchment area marked on the plan occupies about 400 acres. With a mean annual rainfall of about 36 inches, approximately 3.2 x 10^8 gallons of water would fall on this area per year. Assuming 50% of this is lost through transpiration of plants and evaporation (an average figure for sand dunes from the literature) and 50% of the remainder is lost through other seepages, the quantity reaching the water tables to serve the water supply area would be 8 x 10^7 gallons per year. From a report by the consultant engineers to the council, the estimated requirements during the summer of 1962-63 were 210,000 gallons per day and in 10 years 300,000 gallons per day are estimated. From the above figures the replenishing rate could therefore be about the same as the draw off or a bit less.

Some porosity measurements of the typical sands were made with the following results:

Sample No	1	2	3	4	5
Porosity %	39.1	39.7	39.5	34.9	33.7

The positions of these samples are shown on the plan. No 1 is a siliceous sand from the Old dunes and the others are from the calcareous New aunes.

Little is known about the thickness of the dunes and the shape of the basment underneath the Old dunes but if it is assumed the basement rises gradually from sea level as shown in the section, and if the water table, based on some well information and water holes, is shaped as shown, a figure can be calculated for the water stored. Taking the porosity as 36% and specific retention of 12% (a figure quoted in the literature for sand) the volume of water available would be about 6.2 x 10^8 gallons. On the other hand if the basement extends to sea level to the Old dune-New dune boundary and then steepens sharply, as shown in the alternative section, about 2.9 x 10^9 gallons would be available. It is probable the correct value lies somewhere between these two extremes, though it is unlikely that all the water stored could be pumped from the present supply area because of probable irregularities in the basement which would prevent entire drainage. The surface of the dunes is also very irregular with deep areas of internal drainage and it is expected many small reversals of drainage in the water table would retard overall flow.

If these figures are approximately correct, it would seem that the rainfall gain each year would keep pace with the draw off and for dry seasons an adequate storage would be available. However, a close watch should be kept on water table levels to see that there are no long term falls.

OTHER AREAS FOR ADDITIONAL WATER SUPPLY

Along the coastline are a number of seepages from the dunes, some of which could be developed in a similar manner to the present scheme. Possibly the largest seepage in the vicinity of Currie is a zone on the N side of Camp Creek mouth but the topography is unfavourable. A seepage on Wharf Road and a swamp area on Camp Creek are the most favourable areas. Samples of water were taken from these areas together with a sample from the town supply and analysed for dissolved solids. Comparison is made with a previous analysis of the town water.

	Town Supply 1952 (Avery & Anderson Analysts)	Town Supply 1964	Wharf Rd. Dec. 1964	Camp Creek Dec. 1964
T.D.S.	761	657.6	936.6	767.6
Ca	99.7	100	104.9	91.5
Mg	23.3	21.2	34.1	27.1
Na	95.1	100.7	188	144
Cl	182	172.5	250	239
SO_4	26.1	29.6	51	32.4
CO_3	295.5 (HCO_3)	169.1	243	169.3
NO_3	31.4	N.D.	N.D.	N.D.
Fe_2O_3 & Al_2O_3	2.0	0.8	1.6	4.0
SiO_2	6.1	11.2	14.8	12.8
pH	7.9	7.4	7.7	7.8
$CaSO_4$	9	41.9	72.2	45.9
$CaCO_3$		219.3	209.3	195
$CaHCO_3$	393	....	....	....
$MgCO_3$	....	52.7	118.3	73.5
$MgSO_4$	25	....	....	....
$MgCl_2$	71	23.5	....	23.1
Na_2CO_3			58.7	....
NaCl	212	255.4	412	365.5
Total Hardness	345	338.4	402.6	340.3
Temporary	279	281.9	349.6	282.2
Permanent	59	56.5	53	58.1

Quality of these waters as far as dissolved solids are concerned is similar except for the Wharf Road sample which has slightly greater hardness and a greater concentration of sodium chloride.

For any scheme that might be planned for these areas, it is suggested that a collection chamber be used rather than a system of bores because of the small thickness of water-saturated sediments. The present water scheme and these other areas depend on the water arriving at the collection points with little aid of drawdown. Test holes dug around existing bores while pumping showed no drawdown at 15 feet away. If a sufficient thickness of sand saturated with water were to occur in a position as shown in Figure 24, a large drawdown could be obtained. In this case pumping could affect a wide area and prevent some of the water losses through seepages from the catchment area.

CONCLUSIONS AND RECOMMENDATIONS

(1) The data available are insufficient to make a firm assessment of the potential yield from the aquifer.

(2) Estimates of the probable recharge characteristics indicate that the anticipated draw off is about the same order as the recharge.

(3) The same assumptions indicate that the groundwater reserves are probably adequate to carry over a 2 or 3 year dry period.

(4) Since the indications are that recharge and draw off are possibly about the same order it is highly desirable to initiate a programme of regular measurement of the water table level as soon as possible. This could be carried out at some of the existing bore holes.

(5) The existing supply would be inadequate to meet a sudden increase in water useage combined with a few dry years. It is therefore desirable to commence preliminary investigations in other areas and to take steps to prevent possible contamination in such areas as may be required for future development.

(6) The opinion of the Health Department should be sought as to the possible effect of pollution of the groundwater from the cemetery.

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