TR20_252_282

31. Groundwater investigations, Flinders Island.

W.L. Matthews

The Flinders Council has requested advice on groundwater prospects at various centres on the island. These include the Whitemark area where it is hoped to augment the town supply, Lady Barron, Emita, North East River, Trousers Point and Palana. Several investigations have previously been made of the groundwater conditions. These include reports by Nye (1931) on water prospects at a property called 'Wingaroo', at the butter factory south of Whitemark and on Mr Cooper's property at Emita. Carey (1945) reported on a proposed supply for the Whitemark State School, Keid (1949) examined groundwater supplies on Flinders and Cape Barren Islands and Hughes (1959) reported on a water supply for the hospital at Whitemark. During the development of soldier settlement properties on the island, the Land Settlement Division of the Agricultural Bank drilled a number of holes, the results of which are used wherever possible.

No comprehensive geological mapping has yet been undertaken on Flinders Island. The geology of the entire island is the subject of a report by Blake (1947), and Sutherland and Kershaw (1971) described the Cainozoic geology and produced a map of all the rock units and their distribution. Everard (1950) described the limestone occurrences at several of the areas examined and produced detailed geological maps of these areas. Groves (1973) described granitic rocks on the island and Jack (1966) reported on the tin deposits. Early geological observations were made by Strzelecki (1845), Gould (1872), Johnston (1879) and Waterhouse (1917). As the present survey was of limited duration, little additional geological information was obtained.

The term 'coffee rock' is used often in this report and is a local name to describe a silt, sand or grit which has a brown, carbonaceous organic matrix and forms a fairly compact material. It is not unlike spent compacted coffee grounds in appearance and the water obtained in areas where it occurs is not unlike percolated coffee.

Seismic surveys were conducted and designed to determine the order of thickness of the Cainozoic sediments overlying bedrock. These sediments contain much of the water that is expected to be obtained. The seismic surveys do not accurately indicate the position of the water table. Where test holes have been dug near seismic spreads, the water table is shallower than that indicated by seismic interpretations. Closer geophone spacing would have shown more accurately the position of the water table.

WHITEMARK AREA

The present water supply for Whitemark is obtained from Pats River to the north of the township. A weir has been built across the river in an area where granite crops out. The storage behind the weir is small and during dry periods when the volume of water flowing in the river is small, restrictions have to be placed on Whitemark users. The water from the catchment of the weir is pumped to a reservoir dug into a hill to the south, and then gravitates to the town some 2 km further south. The quality of the water is quite good except for a slight brown colouration. As well as looking at groundwater conditions, the council is also investigating a dam site upstream from the present scheme where a much larger volume of water could be stored.

Relief

Whitemark is situated on a coastal plain which extends from Trousers Point to north of Pats River. It ranges in width from about 500 m at Loccota to about 3 km just west of Ranga. To the south of Whitemark the plain rises to about 15 m above sea level before the landsurface rises sharply to ridges and peaks of basement rocks. East of Whitemark the margin of the plain is marked by a steep low ridge which trends in a north-west direction, and east of this ridge the landsurface forms an undulating plateau area 1-2 km in width. The relief becomes steep and rugged further east and the north-west trending ridge is less prominent near Ranga before continuing to the Strzelecki Peaks. To the north it appears to end at Pats River. Trousers Point is a small residual erosional high on the coast.

Several streams flow across the plain, their catchments lying mainly in the higher country east of the plain. The largest such stream is Pats River to the north, but the streams coming from the Strzelecki Peaks area have a considerable flow. Along the coast between Trousers Point and Double Corner there is a narrow strip up to about 300 m in width of largely stabilised sand dunes.

General geology

The distribution of rocks as represented on Figure 93 is mainly the result of previous surveys. The oldest rocks around Whitemark (and also the oldest known on the island) are quartzite and slate beds which have been correlated (*e.g.* Blake, 1947) with the Mathinna Beds of north-eastern Tasmania. They crop out at isolated localities near Whitemark. At Double Corner, north of the township, they appear on the foreshore and along the west side of the ridge forming the margin of the plain. There is a narrow strip of these rocks south of Whitemark. Hughes (1959) on the basis of bore hole information, regarded these rocks as underlying the Cainozoic sediments of the coastal plain.

Granitic rocks of probable Devonian age intrude the quartzite and slate beds, and Groves (1973) identified several types of granite in the vicinity, most of which are coarse-grained and porphyritic. The ridge to the east of Whitemark (the western edge of which Everard (1950) suggests is a fault scarp), Strzelecki Peaks and the higher country to the east of the plateau largely consist of these rocks. The granite is locally intruded by basic dykes which appear to be narrow.

Tertiary basalt up to 15 m in thickness underlies the plateau to the east of the NW-trending ridge (Blake, 1947). The basalt is deeply weathered and outcrops are rare. Blake (1947) and Sutherland and Kershaw (1971) regarded the basalt as fissure intrusions or associated with the fault system of the area. Blake recorded gravel, sand and clay underlying the basalt. Basalt was also struck in a bore at the hotel at Whitemark (Hughes, 1959), so it may occur at depth under the coastal plain at other locations.

The coastal plain is underlain mainly by Cainozoic sediments made up largely of limestone, quartz grit, sand and clay. Sutherland regarded most of the limestone around Whitemark as aeolian in origin. The grit and sand beds appear to be locally cemented and partly consolidated. Just south of Whitemark near Test Hole 3 (fig. 93), areas of greybilly occur near the surface. The depth and nature of these sediments on the coastal plain is largely unknown except for a few shallow test holes dug during the present survey and from sketchy details of previous drilling.

The narrow strip of sand dunes along the coastline are largely siliceous in composition (Sutherland and Kershaw, 1971).

Table 1. TOTAL DISSOLVED SOLIDS CONTENT OF WATERS IN THE WHITEMARK-TROUSERS POINT AREA

Sample Point No.	Depth *(m)*	Water level *(m)*	T.D.S. *(ppm)*	Remarks
1.	4.3	1.2	600	Gavin: clear water, capacity ~40 *l*/min.
2.	3.1	1.2	1120	Gavin: clear water, capacity >40 *l*/min.
3.	2.4	0.9	800	Barratt: water a little brown, good well.
4.			1350	Waterhole.
5.	4.3	1.5	300	T.D. Blundstone: clear water.
6.			1000	Gavin: waterhole.
7.	8.2	4.3	440	T.D. Blundstone: clear water.
8.	8.5	4.6	450	T.D. Blundstone: clear water.
9.	3.7	0.6	500	T.D. Blundstone: clear water.
10.	5.0	1.5	500	T.D. Blundstone: clear water.
11.	12+	9.8	520	Water slightly brown.
12.	17.7	14.3	420	Clear water.
13.	14.9	12.5		Well not being used, sample not tested.
14.	5.6	4.9	440	Clear water.
15.			1330	Creek water running at 40-75 *l*/min.
16.			2000	Dam water.
17.	2.4	0.0	700	Clear water.
18.	7.3	1.2	350	Clear water.
19.	2.7	1.2	900	Elwood: clear water.
20.	2.4	0.6	2200	T.D. Blundstone: fairly clear water.
21.	4.3	2.1	700	T.D. Blundstone: clear water.
22.	3.4	0.8	430	Walker: clear water, supply poor in summer.
23.			1350	PMG bore: used on garden.
24.			5100	Stream water running over solid granite.
25.	4.0	2.7	680	T.D. Blundstone: clear water.
26.	3.1	1.2	1360	T.D. Blundstone: clear water.
27.	3.1+	0.6	1350	Elwood: bore, clear water.
28.				Boyes: bore, closed.
29.			220	Pats River water, slight brown colour.
30.			500	Walker: bore (hole not open) clear water.
31.	4.3	1.8	420	B.P. Service Station: 9000 litres just pumped, clear water.
32.			360	Creek water above basalt.
33.			4300	Creek water below basalt.
34.			13600	Lagoon just behind beach, Trousers Point.
35.	2.7	0.9	400	Clear water.
36.	2.1	0.9	360	Slightly coloured water.
37.	4.6	2.4	440	Clear water.
38.			110	Stream, slightly brown water 1500-3000 *l*/min?
39.			370	Windmill on water hole.
40.	0.6	0.0	320	Water running over, shallow well in seepage on granite, clear water.

Table 1. (continued)

Sample Point No.	Depth *(m)*	Water level *(m)*	TDS *(ppm)*	Remarks
41.	1.0	0.0	320	Clear water.
42.	3.4	1.2	500	Happy Valley: clear water.
43.	3.4	1.2	430	Happy Valley: clear water.
44.	3.1	1.2	600	Happy Valley: clear water.
45.	3.4	1.8	680	Happy Valley: clear water.
46.	4.9	1.5	450	Clear water.
47.	4.3	2.3	500	T.D. Blundstone: clear water.
48.			300	Dam which supplies large area on farm.
49.	18.3			Bore, 40 *l*/min, not used, slots in casing closed.
50.	3.2	1.8	480	Clear water.
51.	5.5	3.4	1800	Clear water.
52.			1500	Creek water.
53.	11.0		300	Boyes: bore, closed, yielded 30 *l*/min.
54.				Bore, position approximate, casing 1 m above ground.

General hydrology

All the rock units near Whitemark have some groundwater potential. The Mathinna Beds of north-eastern Tasmania which are similar to the quartzite and slate beds around Whitemark have been drilled and found to contain appreciable quantities of groundwater. The water is stored in joints and other fractures and yields of up to 230 *l*/min are usually obtained. Granite has been drilled in some areas with varying success. Again the occurrence of water is dependent upon the existence of open joints and fractures within the granite. Granite tends to have fairly widely spaced joints unless it has been fractured by faulting. Fractured zones would be difficult to locate and the granite probably has the least groundwater potential of any rock unit around Whitemark.

Tertiary basalt is known to be a reliable supplier of water in many parts of Tasmania, but the area of basalt for storage of water around Whitemark is small. The quality of any water found in the basalt is also likely to be poor. The Cainozoic sediments (limestone, sand, grit and clay) which underlie much of the area around Whitemark supply most of the water at present obtained from wells. Sand and grit beds, if sufficiently thick are likely to extend appreciable distances laterally and could yield large quantities of water. Sand dunes are also capable of supplying large quantities of water, but around Whitemark there is only a narrow strip of dunes along the coast and although they almost certainly contain water, their storage area may not be large enough to supply the water required for Whitemark. The only well which penetrates the dunes (Well No. 51, fig. 93), and Bore No. 23 (fig. 93) which probably intersects material under the dunes, both yield rather poor quality water.

Well and stream survey

The large number of windmills on wells in the Whitemark area indicates that there is abundant groundwater in the district. The positions of many of these wells together with a few bores and bulldozed water holes are shown on Figure 93 and the observations made appear in Table 1. The results of this survey and previous surveys have not indicated any lack of water, but the quality is not as good as might be desired. The total dissolved solids of each sample of water was measured with a salinity meter which only provides an approximate measurement. It is to be expected that much of the water around Whitemark and in other parts of the island would have a fairly high bicarbonate content due to the widespread occurrence of limestone, and in the case of Whitemark, the presence of basalt nearby. The instrument used in measuring salinity is calibrated for waters containing a high proportion of chloride, and this would largely account for the variations between the measurements of total dissolved solids using the salinity meter and chemical analyses. The values presented on the map are all salinity meter readings and chemical analyses are shown in Table 2.

Most samples tested were in the range of 300-700 ppm dissolved solids. Water of this quality is, in most cases, suitable for many purposes although hardness could detract from its usefulness for some domestic purposes, for example hot water services. Bulldozed water holes generally have a greater range of values, but the concentration of the dissolved solids by evaporation may explain this. Hughes (1959) noted that around Whitemark the groundwater salinity is relatively high and the present survey confirmed this, although salinities were not found to be as high as reported then.

It is significant that salinities of some of the creek waters are also high and this is probably one of the causes of high salinities in some parts

Table 2. CHEMICAL ANALYSES

Item	1	2	3	4	5	6	7	8	9	10	11	12	13
pH	5.0	5.1	8.2	8.3	8.3	7.6	8	8.3	8.3	5.6	7.9	7.0	7.4
							parts per million						
CO_3	-	-	-	8	8	-	-	4	10	-	-	-	-
HCO_3	9	11	470	450	550	490	405	415	585	17	490	575	550
Cl	120	80	620	680	275	260	200	210	355	305	3400	355	355
SO_4	11	20	68	150	77	70	88	67	100	<5	540	5	84
SiO_2	<10	<10	2	2	8	2	2	2	2	2	8	4	6
Ca	7	12	80	90	65	50	70	70	65	8	410	55	105
Mg	10	10	55	55	30	30	30	25	30	20	230	30	30
Fe	2	2	<0.1	<0.1	<0.1	4	<0.1	<0.1	<0.1	2	<0.1	<0.3	<0.1
Al	1	1	<0.2	<0.2	<0.2	8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K	4	5	25	25	10	65	10	11	15	8	13	20	20
Na	70	50	490	600	400	290	230	220	420	160	1000*	340	340
Total dissolved solids	460	600	1550	1730	1050	1060	810	810	1250	620	7760	1140	1180
Hardness ($CaCO_3$)	60	70	425	450	285	245	300	280	280	100	1970	260	385
Permanent	53	60	40	65	-	-	-	-	-	85	1570	-	-
Temporary	7	10	385	385	285	245	300	280	280	15	400	260	385
Alkalinity (as $CaCO_3$)	7	9	385	385	450	400	330	345	500	14	400	470	450

1. Test hole No. 2, Lady Barron
2. Test hole No. 1, Lady Barron
3. Pratts River, Palana - Sample Point 4
4. Well, Palana - Sample Point 2
5. Test hole No. 3, Whitemark - end of test
6. Test hole No. 2, Whitemark
7. Well at butter factory, Whitemark, start of test
8. Well at butter factory, Whitemark, end of test
9. Test hole No. 3, Whitemark - start of test
10. Creek water, Whitemark - Sample Point 32
11. Creek water, Whitemark - Sample Point 33
12. Test hole No. 1, Whitemark
13. Test hole No. 5, Whitemark.

*Reported as one gram per litre.

of the coastal plain. These creeks flow across the plain and seepage through the stream beds adds to the groundwater supply. At the time of the visits of Hughes (1959) and Keid (1949), the groundwater supplies were probably more extensively used than they are at present due to the absence of a town supply. This greater use would have lowered the water table and encouraged greater infiltration of poor quality water from the creeks into the aquifers supplying wells and bores.

It is of interest to note that Nye (1931*c*) collected samples of water from the butter factory well which had a total dissolved solids content of between 1300-1400 ppm, Keid's sample in 1949 was 1093 ppm, Hughes in 1958 noted 1007 ppm and from the present survey 810 ppm has been recorded.

The salinity of water from three creeks and Pats River was measured. Two of the streams had high salinity water and one creek and Pats River had low salinity water. Hughes suggested that the high salinity water might be a result of clearing of the land in the catchments of the streams. It had been shown in Western Australia that clearing of land resulted in a rise in water tables as the effects of transpiration by the trees were removed. The water table thus comes into contact with new material and begins to leach out additional salts. An alternative to this theory is that the high salinity is associated with the streams flowing across areas of weathered basalt. The catchment areas of Pats River and the other low salinity creek at Loccota have very little or no basalt, whereas the streams with a high salinity have at least part of their catchments passing through basalt country.

The stream running through the school grounds at Whitemark was tested near the school, and most of the stream bed above this locality is in or near basalt country. The stream to the south of Whitemark was tested at a number of places. Where this stream runs across part-cleared country underlain by granite and granite derived soil to the east of the basalt, the salinity is very low. Within the area of basalt and just to the west, the salinity is much higher with about a ten-fold increase. This is apparently due to extra water being supplied by springs coming from the basalt areas. The water becomes diluted further downstream by a tributary with lower salinity water and by further spring water.

Highly saline water has been noted to be associated with weathered basalt areas around Campbell Town, Tasmania and also in Western Victoria (Venables, 1970). Water quality in basalt throughout Tasmania is usually very good, particularly where the rainfall is moderate to high. Higher salinities may be due to local variations in composition or the precipitation of soluble salts from solutions associated with the volcanism which have not previously been leached and are now in the process of being remobilised. Salts in inclusions in the basalt may also be released by weathering.

Test drilling and pump testing

In an attempt to locate areas for the development of an additional water supply, sand screens were jetted down and the holes were pump tested for a short period. An existing well at the butter factory which had previously been suggested as a possible supply was also pumped.

The positions of the test holes are shown on Figure 93. The first two areas investigated were both in the vicinity of the butter factory.

Test Hole 1. This hole was jetted to about 2 m, at which depth a layer that was impenetrable with the equipment was struck. It may have been 'coffee rock' or a cemented sand. The material above was a brown-stained sand with some grit horizons.

The water table was struck at about one metre below the surface. The hole was pumped for approximately one hour at a rate of about 20 *l*/min, this being the maximum flow rate. At the beginning of pumping the water was dark brown but cleared to a pale yellow colour at the end of pumping. Salinity meter measurements indicated 870 ppm of dissolved solids.

Test Hole 2. A spear bore was jetted down near the butter factory well. The water table was struck at about 1.5 m and the hole was extended about one metre below the water table before hard material, probably 'coffee rock' was struck. A pump test was undertaken but the yield was low (about 6 *l*/min). A chemical analysis of the water is shown in Table 2.

Test Hole 3. This hole was sited nearer to Whitemark and penetrated clean coarse sands for about 3.5 m. The sand was cemented in some zones and proved difficult to penetrate with the jet. About 100 m to the south-west of the hole, greybilly-like rock occurs near the surface and was impossible to drill through. The hole was pumped for three hours at about 26 *l*/min and showed no signs of being over pumped. The water was very faintly yellow coloured and a salinity meter test indicated 800 ppm of dissolved solids. A larger pump was used and this delivered water at about 73 *l*/min for a period of approximately two hours. There was little effect on the water table level. A chemical analysis is given in Table 2.

Test Hole 4. This hole was sited to the north-east of Whitemark, near the foothills of the NW-trending ridge. It was dug with a post hole digger. From the surface to 1.2 m clay and sandy clay was encountered and from 1.2-1.5 m, stiff greyish blue clay with travertine nodules. Further drilling was prevented because of the hardness of this material.

Test Hole 5. This hole was drilled in the vicinity of a known successful bore with good quality water (Sample Point No. 30, fig. 93). The following material was encountered.

Depth (m)	*Description*
0-0.9	Clay and sandy clay.
0.9-1.2	Limonite-cemented grit.
1.2-4.6	Coarse, clean quartz sand.

The hole could have been jetted to a greater depth as the sand bed continues to deeper levels. A pump test lasting three hours at a rate of 76 *l*/min was carried out. During this period, the water table maintained a level of about one metre below the surface. A salinity test indicated about 800 ppm of dissolved solids and a chemical analysis is shown in Table 2.

Pump test on well

A pump test was undertaken on a well at the butter factory (fig. 93). This well or the area around it has been suggested at various times as a possible source of water for Whitemark.

The well was pumped at about 120 *l*/min for two hours and recovery was measured for two and a half hours. A time/drawdown plot is shown on Figure 94. The drawdown plot is not quite a straight line, but if a straight line is drawn through the last four points of this curve (the most favourable line) then the drawdown would reach the bottom of the well after 100 000 minutes or about 70 days. Although not all the conditions as required by the Theis formula for the calculations of transmissivity are met, an approximate guide can be obtained from these curves. The calculated value from the recovery curve being about twice as much as from the drawdown curve.

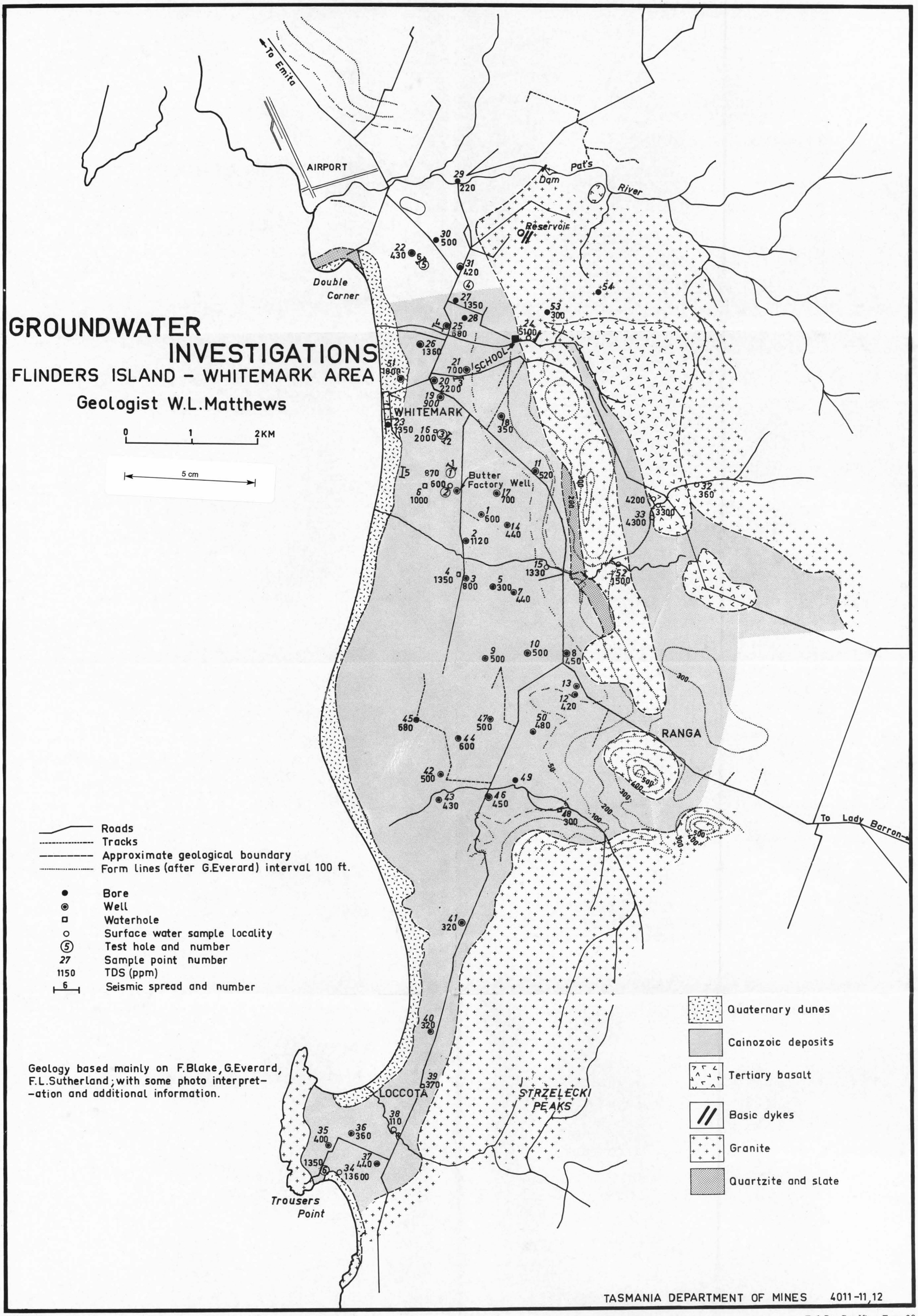

FIGURE 93

TR80_252_282

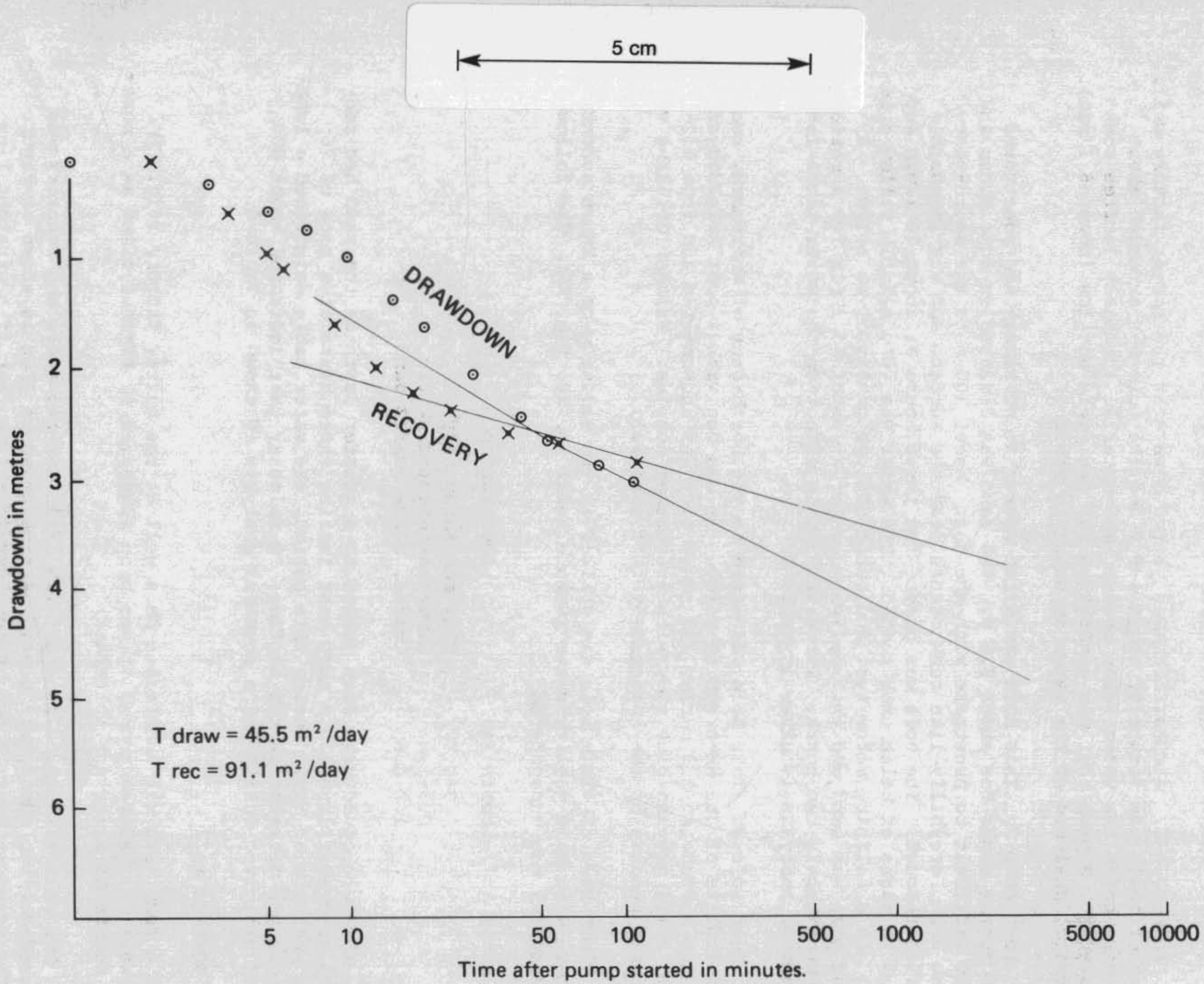

Figure 94. *Time/drawdown plot, Whitemark Butter Factory bore.*

Although a longer pump test would be required to determine the rate at which the well could maintain a supply, it is likely that it would be of the order of 120 *l*/min. A greater quantity of water could probably be obtained if the well was deepened, but as with most wells it is difficult to deepen once a considerable amount of water has been secured. Two water analyses were made; one on a sample before pumping commenced and one towards the end of pumping.

Nye (1931*c*) recorded that the butter factory drew about 10 *l*/min from a well 2.4 m deep, and that this did not represent the capacity of the well although there was some drawdown. This is apparently the well near the one tested which is about 3.5 m deep.

From the results of Test Holes 3 and 5 and the well at the butter factory, it appears that large quantities of water could be obtained from under the plain on which Whitemark is situated. The presence of coarse sand in the two spear bores allowed large quantities of water to be pumped, and in both holes the output was probably only a small proportion of the possible output. The quantities being pumped were at the maximum capacity of the pump. In addition it is likely that in each case the sand extends to greater depths than that penetrated. A limiting factor might be the quality of the water which is a little higher in dissolved solids than that recommended for small towns. It is of interest to note however, that all of the hardness in the water from Test Holes 3 and 5 and from the well at the butter factory is temporary (removable) hardness.

Seismic surveys

Six seismic spreads were fired in the positions shown on Figure 95. Each had a geophone spacing of 7.6 m and was fired on each end at a similar distance from the first geophone. An extension shot was fired on the end of Spread 1. The seismic work was undertaken to determine the depths of unconsolidated material under the plain. Most, and perhaps all of the spreads failed to probe deep enough to reach basement rock.

The results of the seismic spreads are summarised on Table 3 and interpreted sections are shown on Figure 95. The lower velocities of 365-560 m/s probably represent soil and fairly uncompacted and unsaturated material. The material with a velocity of about 1650-1900 m/s is probably saturated sediments with some areas of consolidation or it may be 'coffee rock'. Another possibility is that it is weathered basement rock which may also exhibit seismic velocities in this range. It is not unweathered basement rock as unweathered slate and quartzite would be expected to exhibit velocities at least at high as 3050 m/s and granite probably at least 4500 m/s. Using this information, it can be calculated that unweathered basement rocks are not likely to occur at depths of less than about 30 m below the surface.

The extension shot on Spread 1 with the first geophone at an interval of 53 m exhibited the same velocity as the shorter spread. Using a similar calculation as above, it is unlikely that unweathered basement occurs at shallower depths than about 40 m in the vicinity of Spread 1. The last two geophones on the extension shot suggested a slightly greater velocity (2590 m/s) which if reliable would almost certainly represent basement that was slightly weathered. It is unwise to place too much emphasis on a velocity indicated by only two geophones on the end of the spread however, as near surface irregularities could produce the same effect.

Table 3. RESULTS OF SEISMIC SPREADS

Spreads	Layer 1		Layer 2		Layer 3	
	V_0	Thickness (*m*)	V_1	Thickness (*m*)	V_2	Depth to V_1/V_2 interface (*m*)
Whitemark						
1	380	3.7-4.6	1890			
2	560	3.0-4.0	1645			
3	460	3.4-4.3	1705			
4	365	3.0-4.0	1675			
5	425	3.0-4.6	1890			
6	460	3.0-4.3	1905			
Lady Barron						
1	335	4.3-5.5	1630			
2	535	2.4-4.0	2010	17.7-20.7	3200	21.3-24.4
Palana						
	490	2.1-3.7	1370	16.8-19.8	5180	20.1-22.3
North East River						
1	335	2.7-4.6	610	6.1-10.7	1585	9.8-13.7
2	395	3.4-4.6	1705			
3	365	3.4-4.3	1615			
4	305	3.7-4.0	1660			

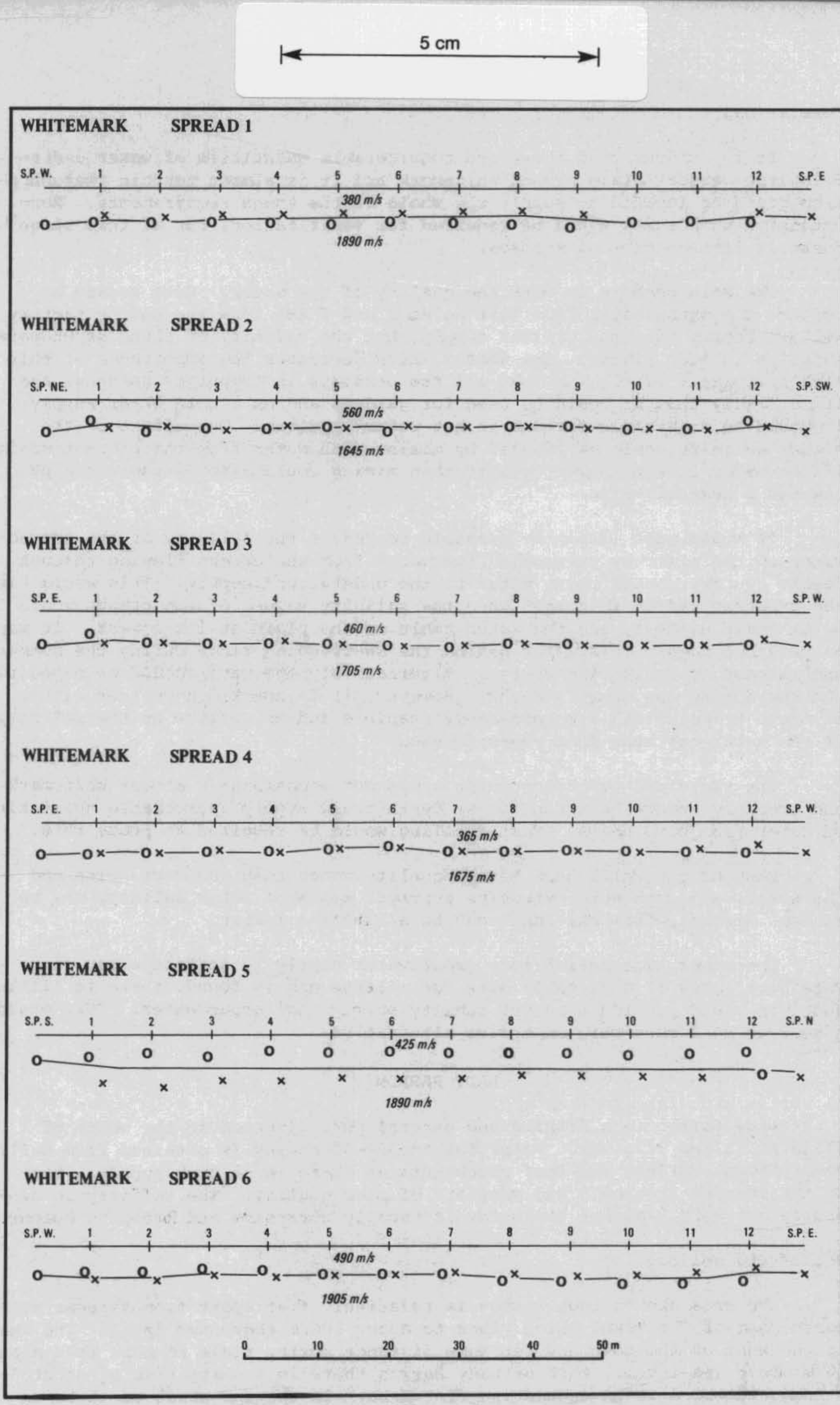

Figure 95. *Seismic sections, Whitemark.*

Conclusions

It is evident that there are considerable quantities of water underlying the coastal plain around Whitemark and it is almost certain that supplies could be located to supply the whole of the towns requirements. More extensive pump tests would be required for verification, but at this stage there is little doubt of success.

The main concern is with the quality of the water. With regard to colour, the groundwater from Test Holes 3 and 5 and from the butter factory well is better than the present supply, but the salinity of these groundwater supplies is much higher. One factor which decreases the importance of this high salinity a little, is that all the hardness is temporary hardness and it is likely that it could be used for gardens and as a cold water supply. It would be unsuitable for use in hot water services. The effect of the higher salinity could be reduced by mixing with water from the present scheme. If the water in Pats River is acid then mixing would also increase the pH towards a neutral value.

It would most likely be possible to reduce the salinity of the groundwater on the plain by preventing the water from the creeks flowing through basalt country contributing water to the underground supply. This would have the greatest effect in summer when the salinity values of the creeks would be at their highest, and the water table on the plain at its lowest. It may be possible to dam this water behind the NW-trending ridge during the summer and release it during the winter. Alternatively the water could be piped to the sea during the summer months. However, it is not known whether either of these propositions are completely feasible and any effect on the salinity of the water may take some years to show.

The slate and quartzite which crops out occasionally around Whitemark and probably underlies the plain at depth could supply appreciable quantities of water from bore holes. Test drilling would be required to prove this.

Many of the wells show better quality water than the test holes and the bores, and with more extensive surveys, zones of lower salinity may be found. Distance from Whitemark may be a limiting factor.

The other alternative to a groundwater supply is surface water (*e.g.* Pats River) and if a suitable site for a large dam is found, there is little doubt it would provide a better quality supply than groundwater. This would appear to be a much more expensive alternative.

LADY BARRON

Lady Barron is a fishing and general port situated in the south of Flinders Island (fig.96). Water for the 20-30 houses is obtained from wells, water holes, springs and roof catchments as there is no town supply. Most of the sources are small and many are of poor quality. The salinity is generally not very high but the water is usually corrosive and brown in colour.

Relief and geology

The area around Lady Barron is relatively flat apart from Vinegar Hill north-east of the town, which rises to about 100 m above sea level. The land to the west of the town and for some distance north, rises no more than about 10 m above sea level. East of Lady Barron there is a sharp rise of about 5-8 m from the shore to an undulating flat area. In the low areas of these undulations lagoons have formed, the largest near Lady Barron being Scotts Lagoon.

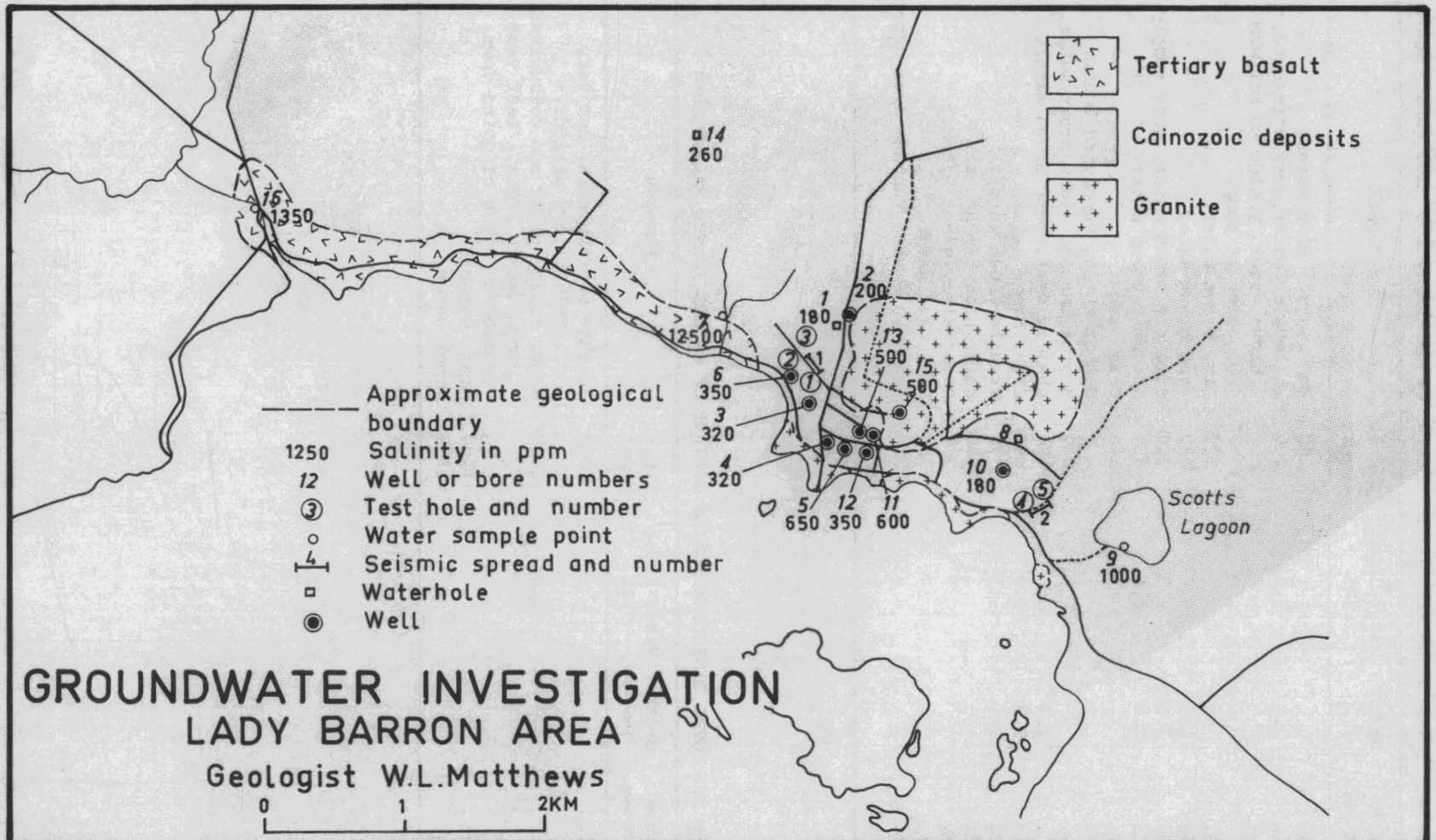
Tertiary basalt
Cainozoic deposits
Granite
Approximate geological boundary
1250 Salinity in ppm
12 Well or bore numbers
Test hole and number
Water sample point
Seismic spread and number
Waterhole
Well
GROUNDWATER INVESTIGATION
LADY BARRON AREA
Geologist W.L.Matthews
0 1 2KM
Scotts Lagoon
14 260
16 1350
7 12500
1 180
2 200
13 500
15 500
6 350
3 320
4 320
5 650
12 350
11 600
10 180
9 1000

Figure 96.

Table 4. TOTAL DISSOLVED SOLIDS CONTENT OF WATERS IN THE LADY BARRON AREA

Sample Point No.	Depth *(m)*	Water level *(m)*	T.D.S. *(ppm)*	Remarks
1.			180	Holloway: brown water.
2.	2.9	1.2	200	Holloway: water very corrasive, brown water, yields to maximum capacity at pump.
3.			320	Dam, brown water.
4.	1.5	0.0	320	Very brown water.
5.	3.7	2.7	650	Slightly brown water, good supply.
6.	2.6	0.6	350	Slightly brown water.
7.			12500	Creek water.
8.				Dam on spring supplying house.
9.			1000	Scotts Lagoon, light brown water.
10.	1.2	0.6	180	Shallow well, very brown water.
11.	2.7	0.9	600	Light brown water.
12.	3.1	1.5	350	Treacle-brown water.
13.			500	Water hole 5 m across.
14.			260	Dam, fairly clear water.
15.			500	Dam, dark water.
16.			1350	Samphire River, running over outcrop of basalt.

Table 5. TOTAL DISSOLVED SOLIDS CONTENT OF WATERS IN THE PALANA AREA

Sample Point No.	Depth *(m)*	Water level *(m)*	T.D.S. *(ppm)*	Remarks
1.			1900	Seepage on foreshore, not very reliable in dry periods.
2.	4.7	3.5	1500	Water fairly clear and colourless, pumped at 20 *l*/min. Last year showed no signs of going down.
3.			1400	Creek water.
4.			1250	Creek water.

Granitic rocks occur on Vinegar Hill and at intervals along the foreshore near the township. Groves (1973) classified these exposures as medium-to coarse-grained biotite-muscovite granite/adamellite. Tertiary basalt occurs west of the jetty and continues along the shoreline to at least Samphire River with only occasional outcrops. Along the shore east of the town, the cliffs are partly of granite and partly of 'coffee rock'. This same material occurs west of the town as evidenced by the sediments struck in test holes. The undulations east of the town are sandy and are probably stabilised dunes. Sand and granite debris covers large parts of the slopes of Vinegar Hill and the flat to the west of the town. To the north of Vinegar Hill a limestone deposit has been worked for agricultural purposes (Everard, 1950). Apart from this area there appears to be little limestone around Lady Barron.

Hydrology

The results of a survey of wells and other water occurrences is shown on Table 4. The main features of the water supplies are the generally poor colour of the water and, as shown by the chemical analyses (table 2), the low pH or high acidity. The salinity of most of the water tested is fairly low. The only reasonably clear water was obtained from a water hole about 2 km north-west of the town. Some seepages occur on the bench in the eastern part of the town.

The broad flats that occur in the area suggest that water should be obtainable provided they are underlain by sand and, or, gravel beds. Two shallow holes (Test Holes 1 and 2) were jetted down on the west side of Vinegar Hill. Both encountered coarse sand near the surface in which the water table was struck but on deepening the hole, 'coffee rock' was met which gave a brown colouration to the water and eventually prevented further drilling. Test Holes 1 and 2 were sunk to one and two metres below the water table respectively. Each hole was pumped but gave a little less than 8 *l*/min. A chemical analysis of water from each of these holes indicated a fairly low total dissolved solids content and a low pH. A further hole (Test Hole 3) was similarly drilled down to the water table through coarse sand.

Attempts to drill Test Holes 4 and 5 east of the town and behind the seepages proved unsuccessful. The first hole collapsed due to the dryness of the sand and the second which was jetted, struck 'coffee rock' at about one metre from the surface and which proved too hard to penetrate.

Seismic spreads

Two spreads were fired (fig.97) to determine the thickness of the Cainozoic sediments underlying the flat areas at the positions shown on Figure 96. Each spread had a geophone spacing of 7.6 m. Spread 1 revealed about 4.3-5.5 m of soil and fairly unconsolidated material (V_0 = 335 m/s) occurring at the surface underlain by material with a seismic velocity of 1630 m/s. This probably represents saturated and perhaps slightly consolidated Cainozoic sediments ('coffee rock') or possibly weathered basalt. Unweathered granite or basalt is unlikely to occur any closer than about 40 m from the surface. Under Spread 2, 2.4-4 m of soil and generally unconsolidated material (V_0 = 535 m/s) was indicated at the surface. This is underlain by material with a seismic velocity of 2010 m/s which is also probably compacted sediments or possibly weathered granite. Unweathered granite is not expected to occur at depths shallower than about 40-45 m.

It is apparent from the seismic spreads that a considerable thickness of Cainozoic sediments (or weathered rock) occurs to the east of, and west of Vinegar Hill. There is a good chance of obtaining water supplies from

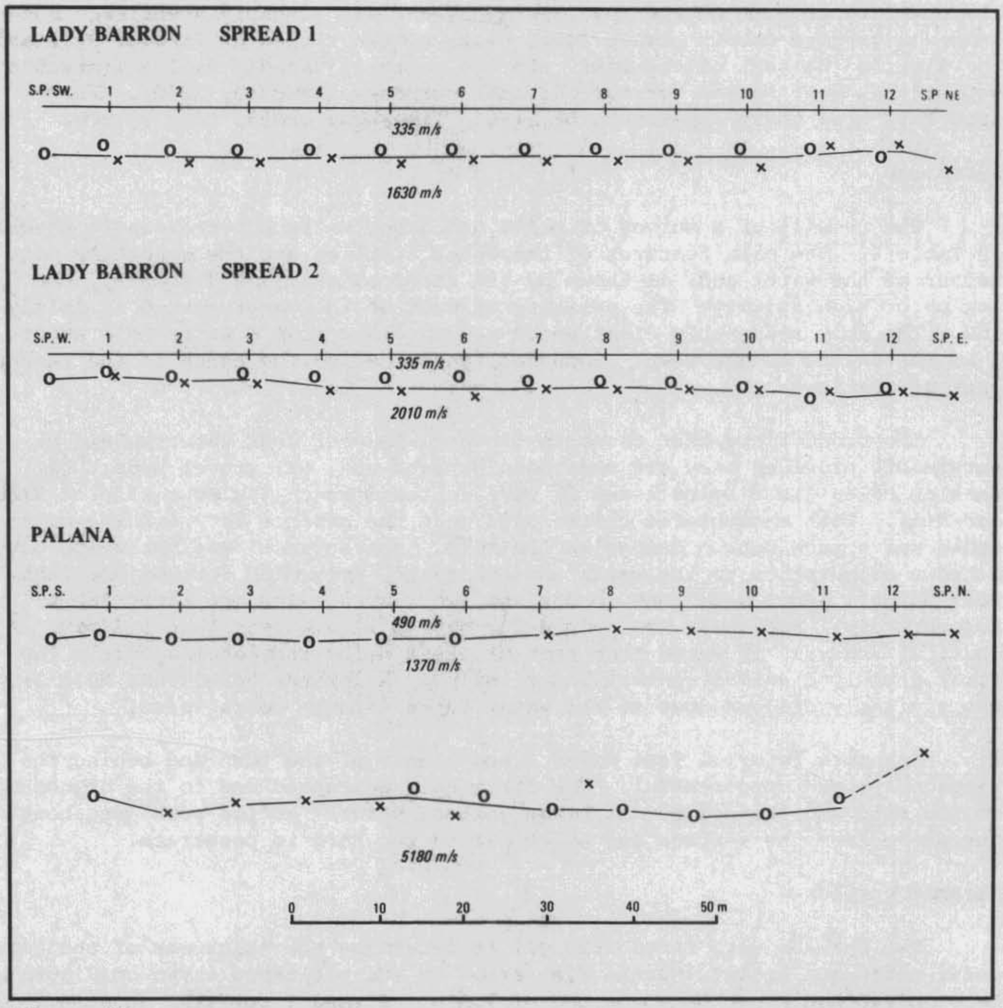

Figure 97. *Seismic sections, Lady Barron and Palana.*

these sediments, but test drilling would be required for confirmation.

Conclusions

There are several possibilities for a water supply that could be investigated. The present supplies to individual households do not indicate that any could be extended to supply the whole town as most are centred on runoff and springs from Vinegar Hill or roof catchments.

Scotts Lagoon is a possible source and almost certainly has an adequate volume for supplies, but salinity is fairly high and colour is poor.

Water probably occurs under the extensive flats in the area, but test drilling would be required to prove it. Areas on either side of Vinegar Hill could be investigated and localities of at least 0.5-1 km from the shoreline should be selected due to possible sea water contamination after heavy pumping.

The largest stream in the area, Samphire River, has a strong flow but salinity is fairly high near the mouth of the stream. It is probable that only the larger demands of an industry would warrant obtaining a supply from the mountain headwaters where the quality is likely to improve.

PALANA

A small settlement at Palana of about six houses requires a permanent supply of water. At present residents depend on tank water. During the 1939-1945 war, an air force establishment in the area is reputed to have been supplied from a well (Well 2, fig. 98). The settlement is on the eastern side of Bligh Point and about 750 m north of the mouth of Pratts River.

Relief and geology

Around Palana the land surface is undulating and slopes mainly towards Pratts River. From just west of the mouth of Pratts River to Bligh Point there is a high, steep-sided ridge. On the western and northern side of the ridge there is a narrow flat area along the shoreline. The settlement is also situated on a narrow, relatively flat area some 15 m above sea level with steep slopes to the shoreline. The ridge rises some 100 m above this area.

Granitic rocks occur on most of the high part of the ridge and around the foreshore of Bligh Point. Further outcrops occur along the foreshore towards North East River. Groves (1973) classified the foreshore granite as porphyritic biotite granite/adamellite. It is grey in colour and has dykes of microgranite associated with it. The undulating area around Palana is mainly underlain by Cainozoic limestone which occurs over a vertical range of about 120 m (Everard, 1950). Sand dunes up to approximately one kilometre in width occur east of Pratts River towards North East River. Another belt of dunes of about the same width are present on the coast towards Killiecrankie Bay. Other flat areas and valleys are underlain by Cainozoic material probably consisting mainly of sand, clay and granite debris.

Hydrology

There appear to be three possible means of obtaining water.

(1) From a spring near the settlement.
(2) From the well used by the Air Force.
(3) Water from Pratts River.

5 cm

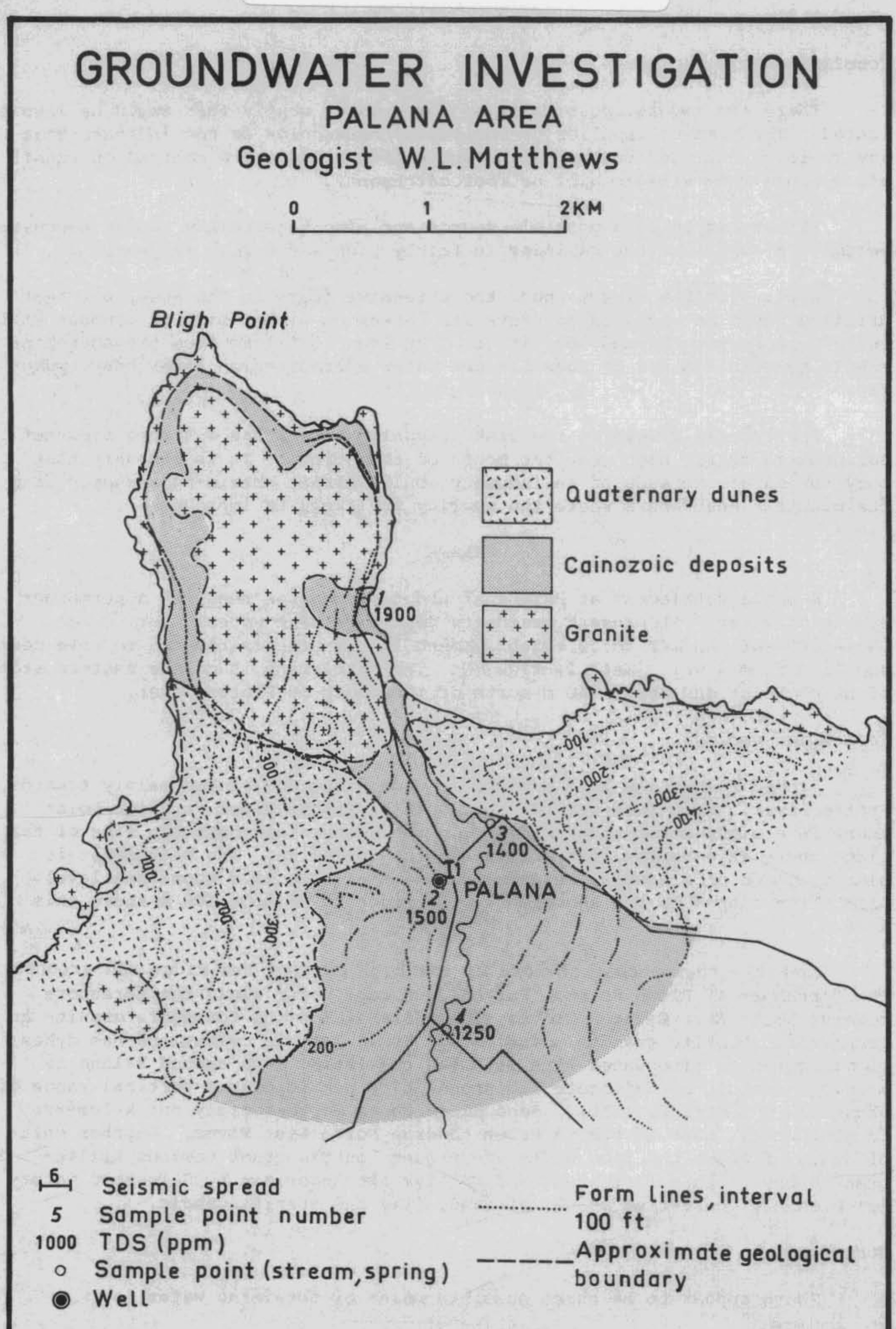

Figure 98.

The spring on the shoreline just below the settlement (Sample Point 1, fig.98) is the nearest source. The spring is situated at the base of a steep shallow valley extending towards the top of the ridge. The valley is underlain by superficial material probably mainly made up of sand and granite debris with a steep seaward sloping contact with the underlying granite. Most of the water supplying the spring is likely to be stored in this superficial material. There is a fairly small catchment and storage area behind the spring and due to the steepness of the country, it is expected that this would drain after extended dry periods, which is in fact reported to happen by local residents. There is another such valley in the northern area of Bligh Point but the same situation is likely to be present. A sample of water from the spring near the settlement had a total dissolved solids content of 1900 ppm which is too high for domestic use for extended periods, but may be useful as a source for emergency supplies.

The well used during the war (Sample Point 2, fig. 98) although about 1.5 km from the settlement area, is a possible source of supply if piping the water is not too expensive. The output of the well is unknown but the owner of the property on which it is situated pumped approximately 20 *l*/min from the well in 1974 with little effect on the water level. The water is clear but as can be seen from the chemical analysis (table 2) the water has 1730 ppm of dissolved solids which again is high. However, it could be used as a supply other than that for drinking water and hot water services. If it is further considered for use as a supply, then it should be pump tested over a period of about two days to check yield and drawdown.

The possibilities of deepening the well should be examined if yields prove insufficient. A seismic spread undertaken along the road and near the well suggests that the well may be deepened with little difficulty as it is now only 4.7 m deep. The seismic results are shown in Figure 97. Material with a thickness of 2.1-3.7 m (water level 3.5 m, V_0 = 490 m/s), represents loose soil and unconsolidated and fairly dry material. The underlying material (V_1 = 1370 m/s) is interpreted as containing water and probably extends to 20.1-22.3 m below the surface and is 16.8-19.8 m in thickness.

This is underlain by material which is almost certainly relatively unweathered granite (V_2 = 5180 m/s).

The flow of water in Pratts River is reported to fluctuate although there was a strong flow at the time it was examined. The salinity was measured at the site of two road bridges. As the river approaches the sea the salinity increases, a 200 ppm increase being recorded between the two sites. A sample for chemical analysis from the more southerly bridge (table 2) indicates a lower salinity than the well.

Conclusions

The seepage near the settlement, although not much more saline than the other sources investigated, is likely to be unreliable during extended very dry periods.

The well is a possible source, but pump tests should be undertaken before the purchase of a pump. It is likely that greater quantities could be obtained by deepening the well.

Pratts River is also a possibility and from the quality tests, the dissolved solids content decreases upstream.

EMITA

Emita is an agricultural district and a resort and tourist area situated on the west coast of Flinders Island approximately 17 km north of Whitemark. Settlement Point to the west of Emita has several small popular beaches on its northern side. As with many areas on Flinders Island, surface water is scarce or remote in the areas where it is required and the council has requested advice on water prospects in the beach areas and also in the agricultural region of Emita.

Relief and geology

The land surface around Emita is relatively uneven and a hill to the south-west of the township rises some 180 m above sea level. The main agricultural areas are undulating and there are only relatively small areas of flat land in the district. The beaches are usually fringed by low cliffs bordering narrow areas of flat land. There are occasional surface streams in the area, with two creeks on the southern side of Settlement Point entering Sawyers Bay and another on the northern side entering the southern end of Marshall Bay being the most important.

Geologically the area consists of granitic rocks and Cainozoic deposits. The granite, where examined by Groves (1973) is a porphyritic biotite granite/adamellite and occurs on much of the higher ground and around the coastline. It contains xenoliths and fairly large zones of aplitic dykes. Limestone, cemented sand and silt can be seen to overlie the granite along the coastline in the vicinity of the beaches. Just east of the jetty at Settlement Point very compact lime-rich dunes, dipping at about 30°E, overlie the granite. Throughout the area where granite is not exposed, sand, granite debris and limestone occur at the surface. North of Emita, there are large areas of limestone. Along the coast behind Marshall Bay, sand dunes ranging up to one kilometre in width, extend along the whole length of the bay.

Hydrology

The main inspections were made in the beach areas with only a brief examination undertaken in the central part of Emita. The area is very sparsely settled for the installation of any reticulated supply, but observations were made on water prospects in the area.

A survey of wells and other water supplies is shown in Table 6 and the points where samples were collected are indicated on Figure 99. Salinity in most of the samples tested was high and unsuitable for long term domestic use. The two best supplies are from a well (Well 1, fig.99) and a bore (Bore 6, fig. 99). The well was reported to yield 40 *l*/min. The bore, drilled near a successful well not far from the shoreline, was extended too deep and when pumped the fresh water/salt water interface rose to contaminate the supply including the well water. However at present, the quality is reasonably good.

There are three main beach areas which require water supplies, the largest beach is situated near the jetty at Settlement Point with the two smaller beaches to the east. There are no obvious or significant seepages coming onto the main beach and near surface water just behind the beach in a lagoon is fairly saline (Sample Point 5, fig. 99). However, better quality water may possibly be obtained at depth as evaporation would concentrate the salt in the lagoon. The well and bore mentioned above indicate that good supplies do occur in the area and are likely to be present at many localities behind the beach. It may also be possible to use the supplies that are developed by arrangement with the owners, or to install a well or bore another hole in a more convenient area. Care should be taken not to pump large

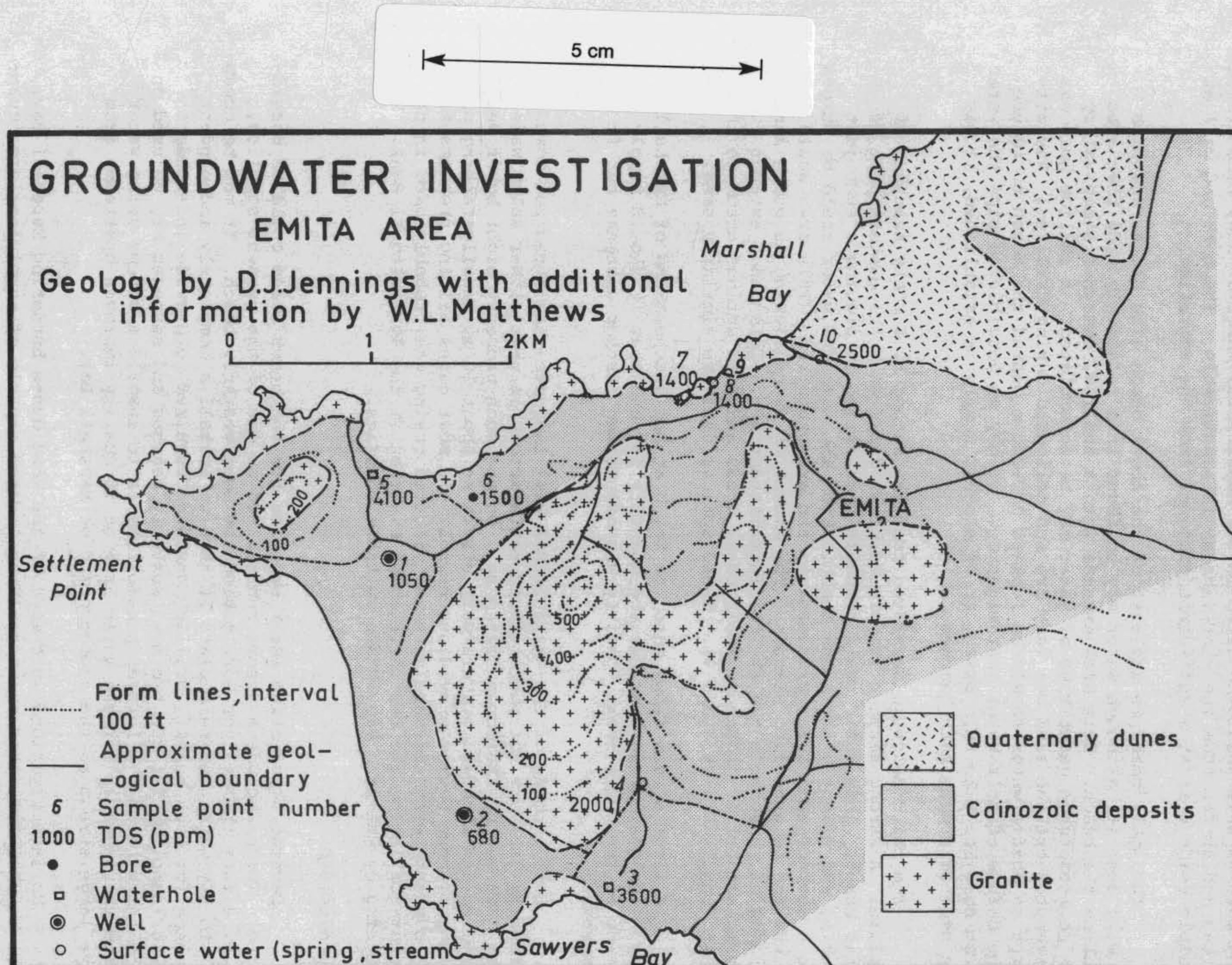
5 cm
GROUNDWATER INVESTIGATION
EMITA AREA
Geology by D.J.Jennings with additional information by W.L.Matthews
0
1
2KM
Marshall Bay
Settlement Point
EMITA
Sawyers Bay
Form lines, interval 100 ft
Approximate geol--ogical boundary
6 Sample point number
1000 TDS (ppm)
Bore
Waterhole
Well
Surface water (spring, stream)
Quaternary dunes
Cainozoic deposits
Granite

Figure 99.

quantities of water from depths below sea level if the hole is sited near the shoreline. Such a precaution should avoid salt water contamination. Any bore or well should be sited in the superficial material away from granite areas and as far from the shoreline as is practicable. The bore and well at Sample Point 6 is at a sufficient distance from the shoreline.

The small beach to the east of the above beach also has no seepages coming onto it, although water may be found in a relatively wide flat area behind the beach. This area extends into a shallow, somewhat steep valley where reasonable quantities of water may be accumulated. A shallow hole was attempted but the sand was very dry and collapsed during drilling. Any attempt to obtain water should be located 100-200 m behind the beach to reduce the chance of salt water contamination. It may be possible to pipe the water from Bore No. 6 to this beach, or if another supply is established, it may be used to supply both beaches.

The third beach is separated from the second by a rocky headland of aplite. A strong seepage (Sample Point 7) flows onto the eastern part of this beach. This water could probably be utilised by digging a sump just behind and slightly above the beach. From the sump the water could be pumped to a storage tank and reticulated to the area required. This area would include the neighbouring beaches. The amount of water flowing is quite large and is of reasonable quality for intermittent use. This beach extends further east but is broken by small rocky areas and more springs occur to the east (Sample Points 8 and 9). These springs could be similarly used.

A large stream flows onto the beach at the southern end of Marshall Bay. The quality is poor but the quantity is such that it should supply the needs of the whole area. Quality was not tested further upstream but it may improve.

Bore records of the Agricultural Bank indicate that bores put down for property use were not particularly satisfactory in that either salty water was obtained or the bores silted up. On one such property eight bores were drilled and although gravels were struck at about 10 m, usually resting on granite, none having proved successful. In most cases silting problems may be overcome with suitable screens. Slotted casing was probably used in the bores drilled by the Land Settlement Division of the Agricultural Bank. Prospecting by drilling may locate suitable supplies.

Conclusions

Several alternative water supplies for the beach areas could be considered. These include a scheme centralised on one of the present supplies, *i.e.* either the well or bore behind the most westerly beach. It may be cheaper to buy water and reticulate it than to install a completely independent scheme for each beach. Drilling would be required to provide independent water supplies for the two most westerly beaches and seepages may be used on the third beach. A further possibility is to install a scheme using water from the seepages for the whole area or if quality improves upstream, from the large stream on the southern end of Marshall Bay.

No investigations were made of the sand dunes bordering Marshall Bay, but it is likely that areas could be located capable of supplying large quantities of water.

Test boring and a thorough investigation of existing wells and bores would be required in the rural part of Emita to establish the presence of large supplies of water.

Table 6. TOTAL DISSOLVED SOLIDS CONTENT OF WATERS IN THE EMITA AREA

Sample Point No.	Depth *(m)*	Water level *(m)*	T.D.S. *(ppm)*	Remarks
1.	10.1	9.1	1050	Clear water, pumped all day at times, 40 *l*/min.
2.	3.1	0.6	680	Clear water.
3.			3600	Water hole.
4.			2000	Creek water.
5.			4100	Lagoon, dries up in dry summer.
6.	7.6+?	3.1	1500	Bore hole near old well (collapsed).
7.			1400	Spring on beach clear water 40-80 *l*/min.
8.			1400	Springs (3) on beach, about 16 *l*/min each.
9.				Small spring.
10.			2500	Stream, 400-800 *l*/min.

Table 7. TOTAL DISSOLVED SOLIDS CONTENT OF WATERS IN THE NORTH EAST RIVER AREA

Sample Point No.	Depth *(m)*	Water level *(m)*	T.D.S. *(ppm)*	Remarks
1.			1150	Small seepage on steep slope.
2.			500	Small seepage near top of slope.
3.			2000	Dam water, brown colour.

The survey of wells, bores and spring water suggests that good quality water will be difficult to find.

NORTH EAST RIVER

North East River is situated in the north-eastern corner of Flinders Island and is an important tourist and holiday area. There is only one semi-permanent resident in the area and this lack of permanency is due to the diminished supplies of water during dry periods. The holiday areas are along the western side of the estuary of the Arthur River, the outer side of the estuary consisting of a spit with tidal water entering the estuary through a very narrow channel to the north.

There are two roads into the area, a southern and more recent access route and an older northern road. A road along the western side of the estuary connects these two roads and extends to north of the river mouth.

Relief and geology

Much of the area is undulating to steep with flat areas along the western side of the estuary where the camping grounds are situated. These relatively flat areas range up to about 750 m in width with a small cliff about 3-5 m in height descending to sea level. To the west the land surface rises abruptly to a level of about 100 m above sea level. The high country to the south of North Point forms a small amphitheatre-like feature around the flat.

Granitic rocks underlie most of the higher ground and around the coastline on either side of North Point. Groves (1973) classified the exposures as porphyritic biotite granite/adamellite with abundant xenoliths. Pegmatite zones occur within the granite. West of North Point a band of sand dunes up to one kilometre in width extend towards Killiecrankie Bay. The spit east of the estuary is underlain by sand, and although largely stabilised now, it has in the past been remobilised by wind. The remainder of the area, including the flat, is underlain by Quaternary and Tertiary sediments. At the surface, sand is the dominant lithology and at least some of it is wind blown. Along the foreshore, the low cliffs consist of sand and silt with a dark brown, carbonaceous organic matrix ('coffee rock'). Plastic clay occurs locally on the flat area. Everard (1950) recorded scattered small areas of limestone between Quoin Hill and the Arthur River. They occur over a vertical range of 150 m (Hughes 1959). Nye (1931*a*) reported that a bore drilled at 'Wingaroo' to about 24 m struck sand, clay and limestone to about 7 m and then alternating sand, coarse sand and limestone to the final depth. The lower part of the section is regarded as Late Tertiary in age (Sutherland and Kershaw, 1971). Similar material may possibly underlie the flat areas at North East River.

Hydrology

The area is noted for its lack of surface water. The sole resident in the area depends, apart from tank water, on a small spring (Sample Point No. 1, fig.100 on the side of a very steep slope. During very dry years, this spring dries up, but in an average year yields about one hundred litres of water per day. Another spring (Sample Point 2) on a westward facing slope gives a similar quantity of water but gravitates towards the sea rather than towards the house. About one kilometre south-west of the house a bulldozed hole contains only a small amount of water. Approximately 100 m south-west of the house a seepage occurs which could be usefully developed. Small seepages of brown water occur along the foreshore.

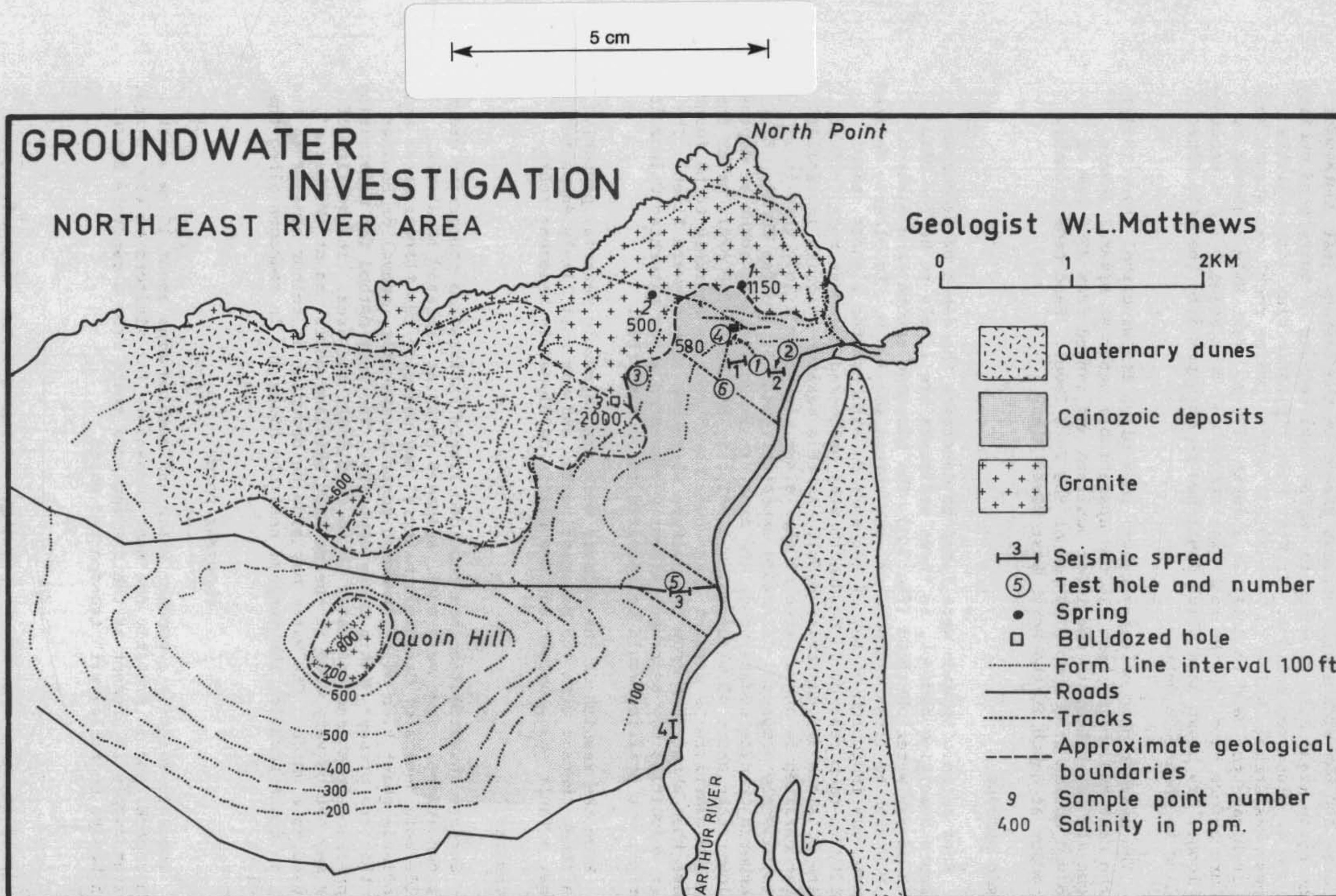
5 cm
GROUNDWATER INVESTIGATION
NORTH EAST RIVER AREA
North Point
Geologist W.L.Matthews
0 1 2KM
Quaternary dunes
Cainozoic deposits
Granite
Seismic spread
Test hole and number
Spring
Bulldozed hole
Form line interval 100 ft
Roads
Tracks
Approximate geological boundaries
Sample point number
Salinity in ppm.
Quoin Hill
ARTHUR RIVER
1150
500
580
2000
600
800
700
500
400
300
200
100

Figure 100.

Some shallow drilling was attempted at the various localities shown on Figure 100 but with little success except in the seepage just south-west of the house (Test Hole 4) where the water obtained was of quite good quality (540 ppm of dissolved solids). In Test Hole 1 plastic clay with a little dampness was struck, while in Test Hole 2 moist 'coffee rock' was struck before it became too hard to drill at a depth of 2 m. Test Hole 3 showed no moisture before hard 'coffee rock' was struck and Test Holes 5 and 6 encountered loose, dry brown sand which continued to collapse into the hole after drilling to about one metre.

The nearest deep drilling known took place at 'Wingaroo' (Nye, 1931*a*) and the sand and shelly beds yielded appreciable water at several levels. The quality was better in the lower aquifers and ranged from 3900 ppm of dissolved solids at 6 m to 1796 ppm at the 24 m level. Sand beds probably also occur at depth in the North East River area.

Seismic spreads

Four seismic spreads were fired to determine the depth of Cainozoic sediments overlying bedrock, as these sediments are likely to be the main source of any water obtained (fig. 101). The geophone spacing and distance from the shot to first geophone of each spread was 7.6 m. No clearly defined basement was indicated on any of the spreads although the highest seismic velocity in each case could be due to very weathered basement rock (either granite or slate and quartzite beds). As this maximum velocity is similar to that obtained in other parts of the island, it seems likely that it is due to slightly compacted Cainozoic deposits, possibly 'coffee rock'. If unweathered granite occurs under the area, it is unlikely to occur at depths shallower than about 45 m (assuming a velocity of about 4500 m/s), or if the slate and quartzite is present then unweathered rock is unlikely to be found at less than about 30 m from the surface where the spreads were fired. The higher velocities may represent slightly compacted water saturated Cainozoic material, but drilling would be required to confirm this.

From the results of the seismic work the Cainozoic material probably has a steep contact with the basement rocks, and was most likely deposited against a fault scarp or ancient sea cliffs developed in basement rocks.

Conclusions

Surface investigation has provided little information concerning groundwater conditions. Some very small seepages occur at isolated locations. Considerable depths of Cainozoic material may underlie the flatter areas and appreciable quantities of water would occur in any grit, gravel or boulder beds that are present within these deposits. The only method for determining the presence or absence of water is to test drill the area. The quality of water may not be very good if the nearest existing bores, as at 'Wingaroo', are used as a guide. The water may also be brownish in colour similar to the water in the waterhole, the seepage near the house and in seepages along the shoreline.

TROUSERS POINT

Trousers Point is a popular beach and camping area about 10 km south of Whitemark, and is probably the most accessible for visitors to the Island. No water supply is present at the camping area apart from a concrete barrel which has to be filled with transported water.

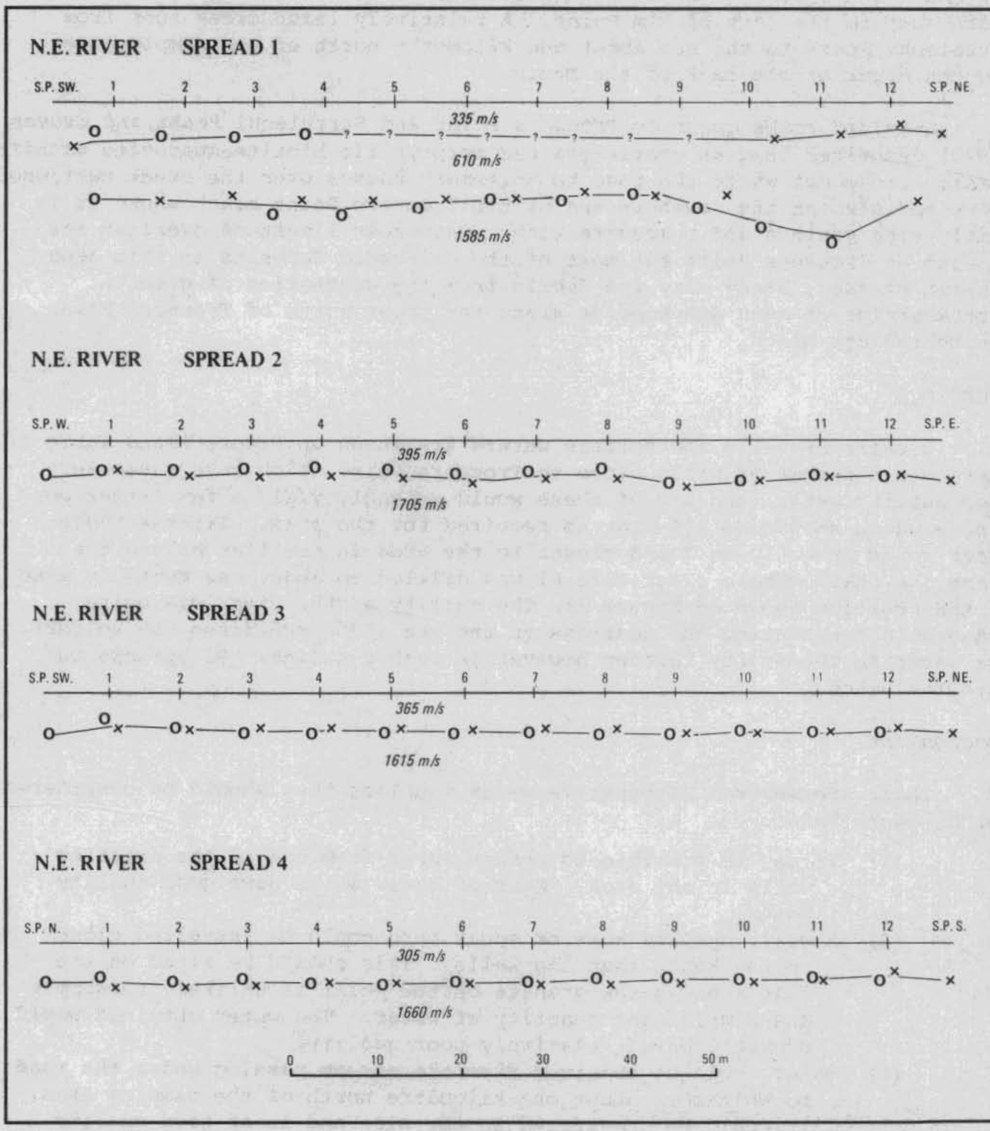

Figure 101. *Seismic sections, North East River.*

5 cm

Relief and geology

Trousers Point is a monadnock separated from Strzelecki Peaks by a narrow flat which forms part of the flat area extending to the north of Whitemark and rising to about 20 m above sea level. The flat ends at the beach just to the east of Elm Point. A relatively large creek runs from Strzelecki Peaks to the sea about one kilometre north of the camping area. Lagoons occur at the back of the beach.

Granitic rocks occur on Trousers Point and Strzelecki Peaks, and Groves (1973) described them as coarse-grained porphyritic biotite-muscovite granite. Granite crops out where the road to Whitemark passes over the creek mentioned above and also on the southern end of the Trousers Point beach where it is fairly fine-grained and muscovite rich. Cainozoic limestone overlies the granite at Trousers Point but most of the Cainozoic deposits in this area consist of sand, sandy clay and debris from the weathering of granite. Narrow strips of sand dunes occur along the coast north of Trousers Point and behind the beach.

Hydrology

Details of wells and surface waters are shown on Figure 93 and Table 1. There are a number of wells close to Trousers Point which have reasonably good quality water, and any of these would probably yield a few litres per minute which should be all that is required for the area. Alternatively, water could probably be found closer to the area in the flat behind the beach. A shallow hole (Test Hole 6) was drilled to about one metre in sand in the position shown on Figure 93. The quality of the water was quite reasonable considering the nearness to the sea (1350 ppm dissolved solids). The water in the nearby lagoons however is rather saline. No springs run onto the beach.

Conclusions

There are several alternative water supplies that should be considered for Trousers Point.

(1) It may be possible to obtain water from one of the existing wells in the area. Most of these wells have good quality water.

(2) A well, shallow bore or spear bore could be installed closer to the beach than the wells. This should be sited on the flat area as the granite on the point is unlikely to supply any significant quantity of water. The water obtained would probably be of relatively poor quality.

(3) Water could be obtained from the stream passing under the road to Whitemark about one kilometre north of the camping area. It could be gravitated to the site and is of good quality.

GENERAL CONCLUSIONS

In most parts of Flinders Island, particularly the areas underlain by Cainozoic sediments, groundwater is plentiful. Rainfall statistics supplied by the Bureau of Meteorology (table 8) indicate that withdrawal rates could be high and the supply should be maintained.

Quality of the groundwater is variable but at many locations it is only fair and has restricted uses. In areas where the water comes into contact with basalt or areas where limestone is common, the water is alkaline with a pH value ranging from 7 to >8 and the total dissolved solids content is relatively high. In areas where the water is in contact with granite or granite

Table 8. RAINFALL STATISTICS (Values are in millimetres)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Pats River (1942-1974)													
1974	33	16	33	130	149	33	195	69	80	46	79	49	912
Mean	41	51	48	62	89	73	90	80	60	70	57	60	781
Whitemark P.O. (1962-1974)													
1974	36	15	34	155	133	25	201	74	61	44	-	-	
Mean	42	56	39	73	101	65	83	86	66	51	56	67	785
Locotta (1928-1946)													
Mean	54	55	74	92	49	75	67	63	58	82	73	51	793
Lady Barron (1912-1974)													
1974	34	17	41	138	113	28	193	88	70	37	73	67	899
Mean	40	44	58	65	75	82	83	80	65	68	52	54	766
Emita (1915-1974)													
1973	25	88	78	141	80	77	28	84	67	47	64	51	830
1974	33	16	28	137	175	29	177	78	81	-	-	44	
Mean	41	45	63	63	52	71	67	63	57	61	51	47	681
Palana (The Hermitage)													
1974	35	13	34	102	135	23	189	82	69	38	97	26	843
Mean	44	47	56	62	75	79	73	73	58	67	57	53	744
'Wingaroo'													
1974	35	6	33	98	150	21	187	87	72	50	98	33	870
Mean	43	45	54	63	78	77	79	77	60	70	55	53	754

debris, or where there is an apparent lack of limestone, the pH value lies between 5 and 6 (acidic) and the total dissolved solids content is also relatively low (*e.g.* chemical analyses 1, 2 and 10, table 2).

The record of water bores on Flinders Island is not good. Many were drilled by the Land Settlement Division of the Agricultural Bank, but few are in operation now. Good quantities of water were obtained on drilling. Most were drilled on the Furneaux Estate on the eastern part of the island and the remaining few around Emita and Whitemark. They were usually drilled to a depth of 10-15 m with clay and sand near the surface and gravel beds towards the bottom. Silting and probably corrosion have proved troublesome. The silting problems were probably caused by the use of slotted casing to keep out fine sand. With screens of a suitable size or gravel packing around slotted casing, silting problems should be overcome in most cases. Corrosion could be prevented largely by the use of stainless steel screens or plastic casing and plastic delivery pipes.

Although most water bores were successful, test drilling should be undertaken to determine depths to aquifers, water quality and yield during the investigation of any area. There are some areas such as parts of the plains around Whitemark where this may be done cheaply by jetting screens down, but where compacted sediments occur, a drill would be required.

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