

UR1974-32

Groundwater prospects, Greens Beach.

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The Beaconsfield Council requested an investigation into the groundwater prospects at Greens Beach [DQ790516] on the western side of the mouth of the Tamar River. The locality is a popular resort, and existing water supplies are unable to service the summer requirements of the caravan park.

Permanent residents at present obtain water from roof tanks, and from wells sunk in Tertiary gravels which underlie the more elevated land behind the beach. A small spring issuing from these deposits augments both the golf club and caravan park supplies. Water for toilet facilities in the park is also obtained from a shallow (3 m) concrete-lined well sunk in sand behind the beach.

GEOLOGY

Jurassic dolerite crops out at the extreme western end of the caravan park, and underlies most of West Head and Wentworth Hill. Tertiary basalt is exposed at low water at the eastern end of Greens Beach. Both rock types are covered by extensive deposits of Tertiary sand, gravel and clay which extend some kilometres inland. Quaternary beach sand overlies these older rocks and forms a curved strip approximately 0.5-1 km wide from Wentworth Hill to Port Dalrymple.

AUGERING

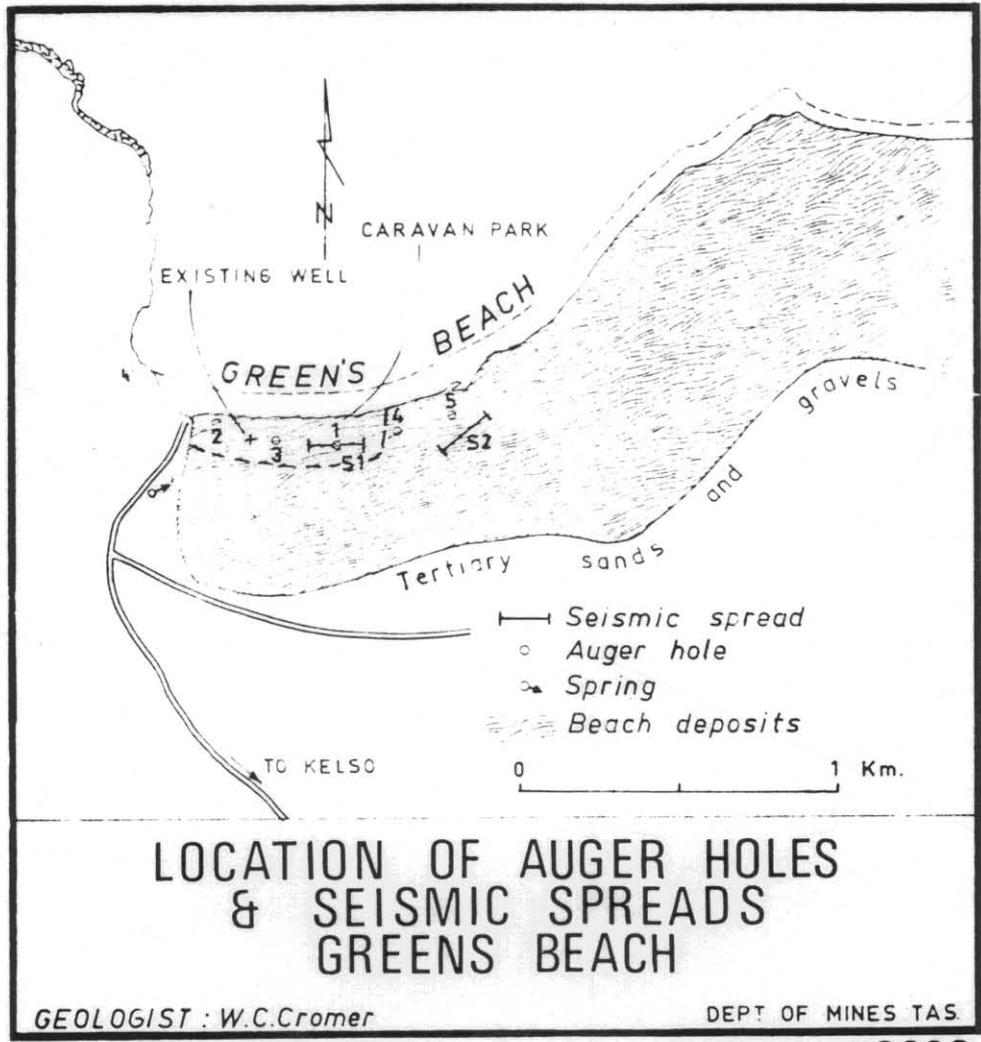
Five auger holes were drilled in the caravan park (fig. 1). Each penetrated a surface layer of grey sandy loam and then passed through medium- to fine-grained buff-coloured sand. The following details were recorded:

Table 1. WATER DEPTH AND QUALITIES

Auger Hole	Standing Water Level (m)	Water Quality (ppm T.D.S.)
1	2.1	320
2	1.6	490
3	2.3	500
4	2.4	250
5	2.3	220
Existing well	2.4	370
Spring (Tertiary gravels)	-	575

GEOPHYSICAL WORK

In an attempt to estimate basement depths, two seismic spreads were laid in the caravan park, parallel to Greens Beach (fig. 1). Geophone spacings of 8 m were employed. Results are summarised in Table 2.



5 cm

Figure 1.

Table 2. SEISMIC RESULTS

Layer	Layer Velocity (m/s)	Layer Thickness (m)	Interpretation
<i>Spread 1</i>			
1	375-470	3	Dry-damp sand.
2	1590-1620	c. 24	Saturated sand, and possibly clay and gravel.
3	3500-6000	-	Basement, probably weathered-fresh dolerite.
<i>Spread 2</i>			
1	330-340	4	Dry-damp sand.
2	1600	c. 25	Saturated sand, and possibly clay and gravel.
3	3500-6000	-	Basement, probably weathered-fresh dolerite.

The seismic results indicate that a substantial thickness of saturated sand (possibly with clay and gravel) is present beneath the caravan park.

DISCUSSION AND RECOMMENDATIONS

Large quantities of water appear to be present in the beach sand underlying the caravan park. The water is of good quality and is suitable for toilet and shower usage. It is suitable for drinking purposes provided that a test for bacterial content is satisfactory. The water may be extracted by either or both of the following methods.

Wells. A concrete-lined well, 3 m deep and 1.3 m in diameter is at present being used in the park. It is pumped intermittently during the day at a rate of 12 l/min for a total drawdown of 0.15 m. It is not properly developed and is inefficient. At least double the yield can be expected if it is excavated to at least another metre below the water-table.

A number of similar wells excavated in the park would provide ample water supplies. They should be spaced so that during pumping their areas of influence do not overlap to any great degree. Most concrete-lined wells depend mainly on bottom entry of water, and yields will be considerably increased if 'no-fines' concrete or permeable epoxy-resin bonded gravel walls are used. Preferably, the wells should be excavated to at least one metre below the summer water table level, connected to a single central pump, and when in use pumped at low uniform rates.

Spear Bores. Galvanised iron spear bores (fig. 2), which are in effect small diameter wells, can economically supply large quantities of water under favourable conditions. Such conditions exist at Greens Beach. A spear consists of a single small-diameter pipe (generally about 50 mm) to which is attached an appropriate screen at the lower end. It is jettied or rammed into unconsolidated sediments to the required depth, and connected to a small suction pump. A single spear efficiently used is capable of supplying up to 20 l/min of water, but yields are considerably increased by using multiple spears arranged in any one of several patterns (circular patterns are most efficient, and linear arrangements least efficient) and connected to a central suction pump (fig. 3). Spacings of 8-15 m are recommended between spears. The screen on the spear must be placed deep enough in the

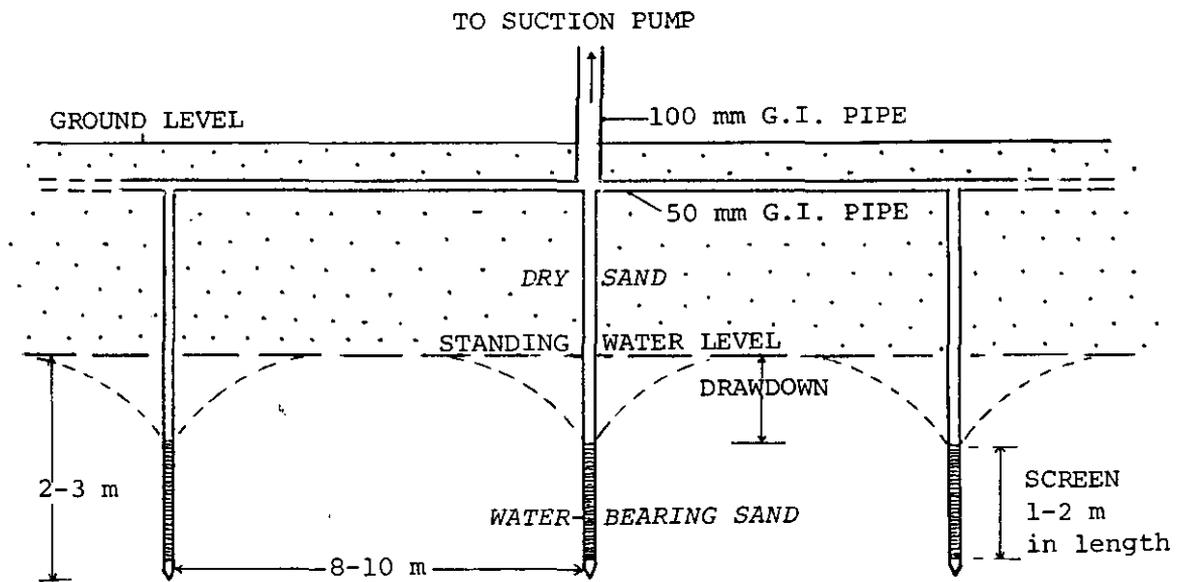


Figure 2. Diagrammatic small-scale spear-bore system for sand aquifers.

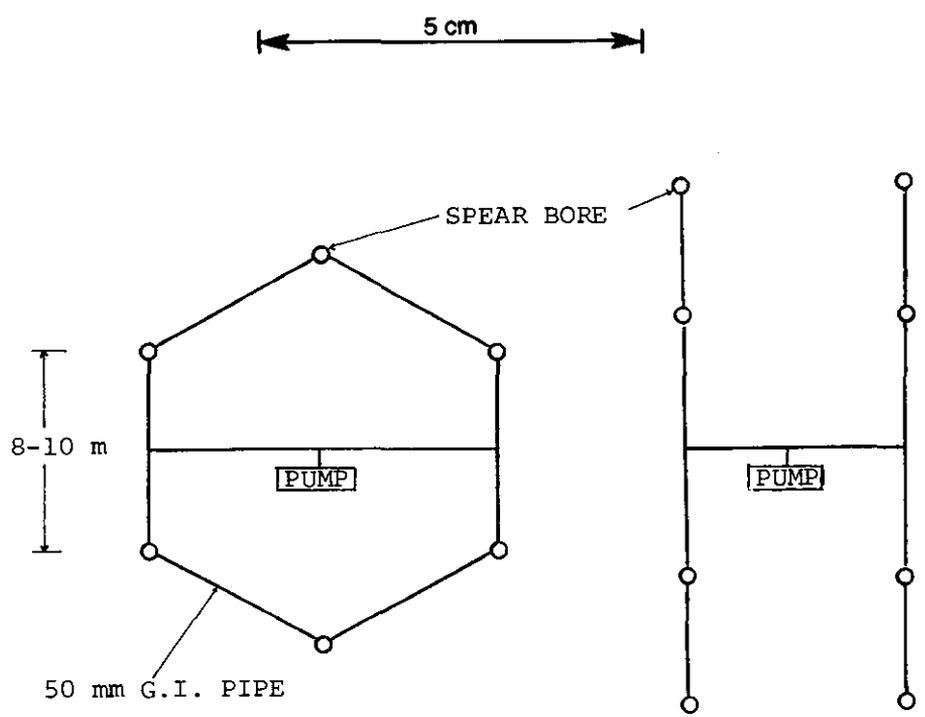


Figure 3. Possible arrangements for spear-bore systems.

aquifer (about 2-3 m below the water table) so that its top is below the suction limit of the pump. This avoids pumping air and so breaking suction.

An appropriate screen opening, which is determined by the grain size distribution of the sand, is necessary to ensure efficient operation. During the initial development of the system, pumping should remove up to 50% of the sand in the immediate vicinity of the screen. This creates a natural gravel pack around it, and increases yield. Sand samples from each of the five augered holes in the caravan park were analysed for grain size distribution (Table 3). Each sample was collected from the level of the water table.

Table 3. GRAIN SIZE ANALYSES, GREENS BEACH

Sieve opening (mm)	PERCENTAGE OF SAND RETAINED				
	Hole 1	Hole 2	Hole 3	Hole 4	Hole 5
1.00	0.1	0.7	0.1		
0.70	0.1	1.8	0.3	0.1	
0.50	0.6	4.5	0.9	0.7	0.1
0.30	2.6	9.7	4.3	9.7	2.2
0.25	2.6	5.5	3.7	9.2	2.3
0.18	13.7	14.4	12.3	22.8	11.2
0.13	75.1	55.7	69.3	53.5	79.0
0.075	5.0	7.5	8.9	3.8	5.0
0.045	0.1	0.1	0.1	0.1	0.1
<0.045	0.1	0.1	0.1	0.1	0.1
	100.0	100.0	100.0	100.0	100.0

Graphical representation of the above data enables appropriate screen sizes to be selected. The analysed sand is very well sorted, and screen openings will be critical since most of the sand lies within a very restricted size range. An opening of 0.150 mm (0.006 in, or Johnson well screen No. 6) will allow approximately 50% of the sand to pass through the screen during pumping. Most of this sand will collect inside the spear and should be removed by hand pumping. Surging the spear with a plunger also assists in development.

Spears, screens and pumps are available from Mono Pumps (Hobart).

[17 April 1974]