UR1974_81

Groundwater potential, R.L. Badcock's property, Forth.

W.L. Matthews

Mr. Badcock requested advice on the prospects of groundwater occurring on his properties in quantities large enough for use in irrigation, or at least to top up surface dams that are used for this purpose at present. He owns three areas of land at Forth (fig. 1). The properties are situated to the east of the Forth River.

RELIEF AND GEOLOGY

The land surface is undulating due to the dissection of the basalt plateau that occurs in this area. Slopes from this plateau to the valley of the Forth River and towards the shoreline to the north are steep enough to have developed landslips, some of which are active at present while others are dormant.

The geology of the area was mapped by Burns (1963) and a slightly simplified version of his map is shown on Figure 1. Folded Precambrian rocks made up of quartzite, garnet schist and amphibolite occupy an arcuate region in the southern part of the map area. Burns interprets this as being part of a southerly pitching anticlinal system. Before the extrusion of the Tertiary basalt, the land surface was uneven and valleys had formed; many of those near the coast descended in a northerly direction. One of these valleys appears to have been situated to the east of the Forth River and possibly formed near, or along the axis of one of the folds in the older rocks. When the basalt was extruded these valleys were filled with lava. There may have been alluvial deposits on their floors which would also be covered by the basalt. Around the Forth River and along the shoreline are alluvium and beach deposits which include gravel beds.

HYDROLOGY

Tertiary basalt is regarded as a good source of groundwater in many localities throughout the State and supplies could probably be obtained on all the properties. The potential of the Precambrian rocks as a groundwater source, is unknown, although it is expected that the garnet schist would have a low porosity. There might be zones within the quartzite that are fractured and which would probably contain water but such zones may be difficult to locate. Until more information is available on the potential of the Precambrian rocks as a water source it would be best to concentrate on the basalt. In any case, it is mainly the basalt soils that are being used in agriculture in the area.

The present irrigation system depends on dams built at intervals along most of the valleys and the water supplying these dams is derived from springs which come out of the basalt *i.e.* from the ground water storage. A bore put down in the vicinity of these springs will collect some of the water that feeds the springs that fill the dams. If both dams and bores are to be used to supply water for irrigation then the bores should be sited to have the least effect on the supplies to the dams.

Unsuccessful bores in basalt are unlikely. Successful bores encounter water which can be pumped at rates of at least 15 *l*/m, and rates of up to 1500 *l*/m have been occasionally recorded. The rate at which water can be pumped depends to some extent on the depth that is penetrated below the water table but mainly on the closeness of the jointing, degree of vesicularity and weathering. The water is stored in joints, fractures and vesicles and the rate at which water can flow through the rock is controlled by the degree to which these are interconnected. Another factor which must be considered is the volume and, or, area of rock in which water can be stored. The properties of the rock might be such that it allows water to flow freely through it but if there is only a small area of rock in which it is stored, a bore pumped at a high rate could deplete the supplies.

In general the water table is struck at shallower depths in low-lying country than on the tops of hills so that drilling costs are usually lower for sites drilled in valleys. In addition, both surface and underground drainage is usually directed towards these areas so they are often the best sites to select in basalt country. There are also much wider variations in the level of the water table from winter to summer in hill sites than in valley sites.

Three bores are known to have been drilled in the area and their approximate positions are shown on the plan. Hole 1 [DQ387381] was drilled on a hill and struck basalt and Precambrian rocks. From the driller's log, the depth to the contact is uncertain but it is probably either 44.2 m or 54.9 m. Water was struck at 54.9 m and the hole delivered 15 *l*/m. Hole 2 [DQ384381], 30.5 m below Hole 1 struck weathered basalt and basalt for the whole of its depth of 25.6 m and was pumped at a rate of 273 *l*/m. Hole 3 [DQ381404], drilled in 1970, struck 'basalt and hard clay bands', (driller's log) was 36.6 m deep and yielded 227 *l*/m. The quality of the water from these bores has not been tested but in most areas where basalt is drilled, the quality is good.

Prospects on the northern property

There are prospects of obtaining supplies of groundwater at virtually any point on this property but some areas appear more favourable, from surface observations. The area around point A [DQ388411] is one of these. It has extensive areas of basalt around it, and is low-lying. If basement rocks are at a considerable depth surrounding this area then a high yielding bore (dependent on the jointing, etc.), could influence the groundwater over a wide area, particularly to the east. A high yielding bore would also probably affect the supplies to dams up the creek from this site but it would also catch some of the water that passes by them.

It is proposed to build a house on the hill in the south-east corner of this block and water will be required for the house. Although most points in this part of the property could be expected to yield enough water for a house, the area around point B [DQ387400] is topographically more favourable than most other areas. If a high yielding bore were obtained in this area, it could be some safeguard against washouts of the dams below. On the other hand, if a high yielding bore in this area was pumped continuously over long periods, then the supply to the dams would be affected.

Prospects on the middle property

Dams have been extensively developed in all the valleys on this property. Because of the presence of Precambrian rocks in the low-lying parts in this area, probably the most favourable sites, from surface observation, are on top of the hill above the house [DQ392390]. Here, the distance to any surface exposures of Precambrian rocks is greater than at other points. However if it was possible to install a high yielding bore at this point, it could seriously affect the supplies to the dams on either side of the ridge.

Prospects on the southern property

The eastern part of this property is underlain by basalt. The most topographically attractive site is in the area of point D [DQ381379] where the land is fairly flat and much of the surrounding land slopes towards it and a bore in this area should draw water from the widest possible area of saturated basalt rock provided there are no unpredictable great variations in the subsurface topography of the Precambrian rocks. A resistivity probe was undertaken in this area for comparison with one next to the successful bore about 0.4 km to the north-east. This successful bore appears to have encountered weathered basalt for most of its depth and the standing water level is 10.7 m below the surface. The probes plot in an almost identical manner to a depth of about 7 m and then diverge a little. The probe near Badcock's property has a lower resistivity for the remainder of its depth. It is possible either that the basalt is more deeply weathered than in the area where the hole was drilled *i.e.* has a greater clay content or it is possible that Precambrian schist underlies the basalt at about this depth. In either case there are reasonable prospects of obtaining water because point D is about 11 m below the successful hole which is on the side of a slope and the water table should be struck at a shallower depth.

CONCLUSIONS

Prospects for obtaining water in bores on all properties are good but in each case, if high yielding supplies are obtained, sustained pumping at these high rates will probably affect supplies to nearby dams. The overall effect would be to increase the total water as the bores would obtain some water not available to the dams and the dams would collect water that would not arrive to be pumped from the bores.

Sites are suggested for the three properties but it seems likely that a high yielding bore in the middle property could seriously affect some of the supplies to dams in the area.

The rate at which water can be pumped from the bores will be determined by the degree of jointing, vesicularity and weathering of the basalt, and the depth of saturated rock encountered in the bores. The storage volume that the bores can draw on will be determined by the shape of the upper surface of the Precambrian rocks underlying the basalt.

REFERENCE

BURNS, K.L. 1963. Geological atlas 1 mile series. Zone 7 Sheet 29 (8115N). Devonport. *Department of Mines, Tasmania.*

[5 December 1974]

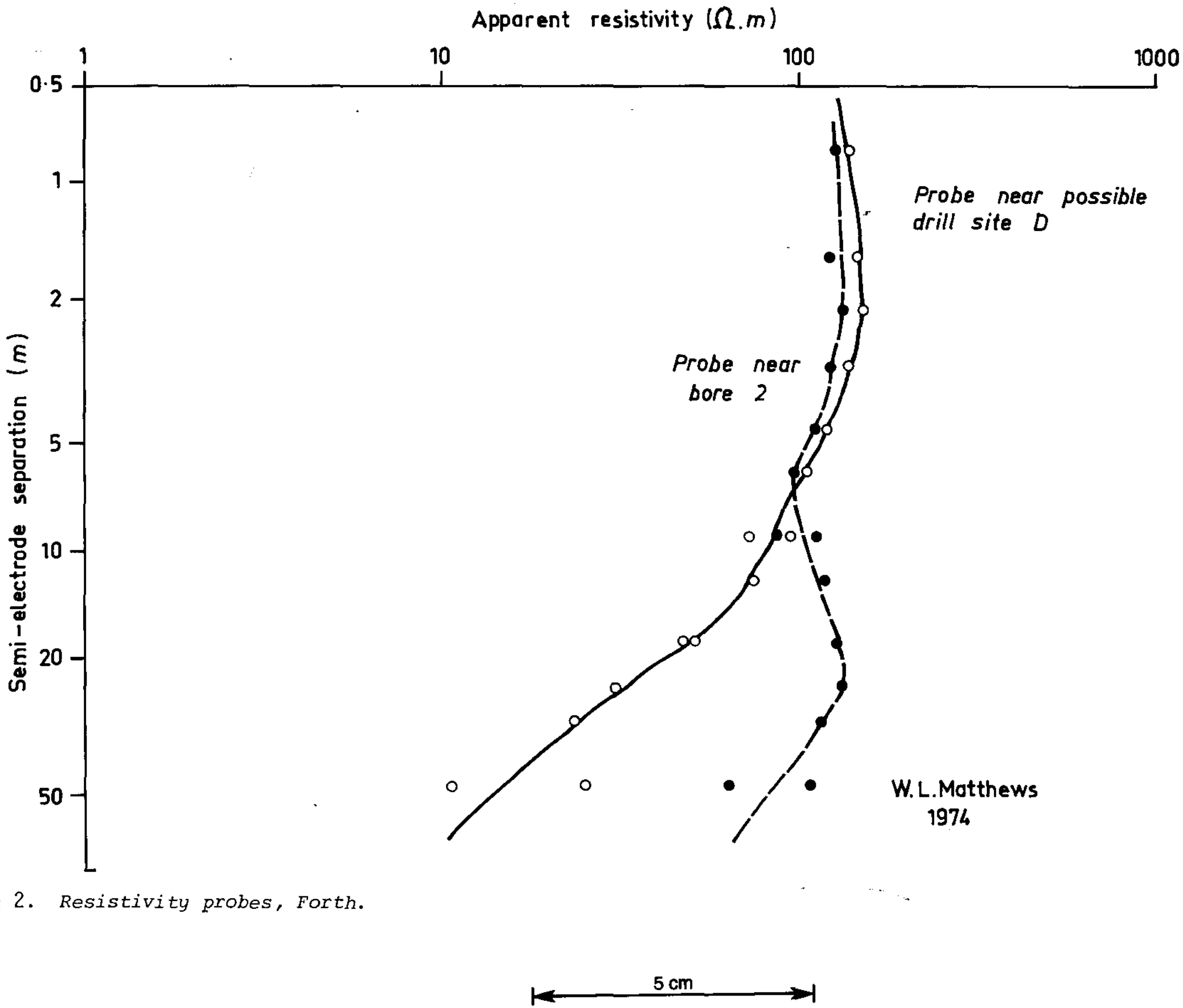

Figure 2. *Resistivity probes, Forth.*

4/4