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1986/65. A water bore on the recreation park at Dodges Ferry

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Abstract

A bore drilled to 60 m depth at the recreation park at Dodges Ferry penetrated Quaternary sediments overlying Triassic sandstone and shale. Water was struck at several levels below about 38 m and a total water output of some 136 litres per minute was measured during the drilling process. A pump test over an eight-hour period at 80 l/min indicated that the bore should yield this quantity of water over extended periods. Because the shoreline is fairly close, salt water intrusion is a possibility if the bore is pumped continuously for long periods. Pumping periods of four to eight hours at this rate are suggested. The water remained a little cloudy during the test but this may clear with use. The iron content is high enough to stain porcelain if not removed. The water should be suitable for septic tanks, as a fire fighting supply, for watering lawns on well-drained soils, and for shrubs with some salt tolerance. It would not be suitable to water salt-sensitive plants or as a drinking supply.

INTRODUCTION

The Department of Education requested that a water bore be drilled on the recreation park at Dodges Ferry [EN509556], a possible site for a school. Bores at nearby locations have been successful in obtaining water but quality is variable, although it is useable for a number of purposes.

RESULTS OF DRILLING

The drilling process tends to reconstitute the rock being penetrated so that there is sometimes some difficulty in interpreting the actual *in situ* material (see log). This applies particularly to unconsolidated sediments and weathered rock. The borehole extended through Quaternary sediments consisting of sand, sandy clay, and clay at the surface, and sandstone and shale of Triassic age at lower levels. There are definite Triassic shale fragments at 22.5 m and rock of this age extends to the bottom of the hole. Deeply weathered Triassic rocks may be present from about 7.5 m to 22.5 m, with the shallower material being Quaternary in age.

Water was struck at about 38 m from the surface and the flow rate increased at intervals to about 57 m, when an approximate total output of some 136 litres per minute (1800 gallons per hour) was measured. The rock type in this interval is dominantly sandstone, although thin shale bands may occur interbedded with the sandstone.

The hole has been cased with 125 mm diameter PVC casing to 60 m, the lower portion being slotted to allow the water to enter the bore. Because of collapse of unconsolidated material during the drilling, the top portion of the hole was cased with 200 mm steel casing. As this was being withdrawn (after installation of the PVC casing), fine quartz gravel was placed around the outside of the PVC. Insufficient quartz gravel to fill the whole space between the 200 mm and 125 mm casing was not readily available and crushed blue metal was used for the top portion.

Log of borehole

Samples were collected at intervals of 2.5 m during the drilling process and a description of these materials is as follows:-

Depth (m)	Description
0 - 2.5	Grey, even-grained, fine sand.
2.5 - 5.0	Brown clayey sand.
5.0 - 7.5	Grey-brown sand.
7.5 - 10.0	Grey-brown clayey sand.
10.0 - 17.5	Grey sandy clay.
17.5 - 20.0	Grey and brown sandy clay, becoming more clayey.
20.0 - 22.5	Sandy clay.
22.5 - 25.0	Shale fragments.
25.0 - 27.5	Sandy clay.
27.5 - 30.0	Mainly clay, brown and grey.
30.0 - 32.5	Clay and sandy clay.
32.5 - 37.5	Shale fragments and sandy clay.
37.5 - 45.0	Sandstone fragments.
45.0 - 47.5	Sand, some shale fragments.
47.5 - 52.5	Mainly sand and sandstone fragments.
52.5 - 60.0	Mainly grey sand.

PUMP TEST

A pump test was conducted over a period of eight hours with an output of 80 litres per minute (1060 gallons per hour). The measurements of drawdown with time can be seen on the accompanying figures. In the later stages of the test the graph flattens and forms a straight line, while in the first ten minutes there is an irregularity where the water level rose instead of falling. This can only be explained by a reduction in the output rate over this period or a series of false water level measurements. An earlier aborted test has been plotted and this does not show this irregularity and is more likely to represent the actual shape of the drawdown curve for that output.

The final drawdown of 29.65 m below the surface indicates a considerable safety margin because of the possible drawdown to 60 m (or 57 m where the final water-bearing horizon was encountered). Projection of this line to 100 000 minutes or about 70 days, a procedure sometimes used to determine long term yield, indicates a drawdown of 33.4 m after this period.

This is unlikely to be a very reliable prediction but again indicated a large safety margin, when pumping at this rate. The accuracy of this projection depends on the permeability of the rock around the bore being uniform over an extensive area. This is unlikely to be the case because variations in the degree of fracturing in the sandstone are probable and lateral variations in clay content in the sandstone will also have a bearing on the permeability. However the prospects of maintaining this yield (80 l/min) for a long period are extremely good. In fact it is likely that almost double this yield could be pumped.

WATER QUALITY

Samples of water were collected at intervals during the test and chemical analyses were performed at the Department of Mines Launceston Laboratory. Only small variations in salinity occurred over the period of the test and

it should be noted that an increase with time did not occur. The dissolved solids are composed dominantly of sodium chloride, although calcium and magnesium bicarbonate and sulphate make up a significant proportion. The salt composition is similar to that in water from nearby bores.

Time	0.5 hours	2 hours	5 hours	8 hours
pH	6.6	6.6	6.6	6.7
Conductivity ($\mu\text{S}/\text{cm}$)	3600	3550	3600	3550
<i>Item</i>				
CO_3^{2-}	Nil	Nil	Nil	Nil
HCO_3^-	250	250	250	250
Cl	1090	1090	1070	1060
SO_4^{2-}	100	100	100	98
Ca	66	65	62	62
Mg	110	105	100	100
Fe	0.6	0.6	0.3	0.6
Al	<0.2	<0.2	<0.2	<0.2
K	22	21	21	20
Na	640	610	590	600
TDS	2430	2270	2340	2270
Permanent Hardness	410	390	360	360
Temporary Hardness	210	210	200	210
Alkalinity	210	210	200	210

Two factors regarding the water may require special attention. Throughout the test the water remained cloudy. This was due mainly to a small amount of clay, and perhaps colloidal material, coming with the water. After a period this may decrease and clear water may eventually be produced. In the event that it does not clear, it could be necessary to consider installing a settling tank and taking clear water from the top of this to another tank. The iron content (Fe) is a little high and staining of porcelain is a possibility. Aeration of the water and settlement of the precipitated iron compounds before use may be necessary if these effects are considered important.

Although the total salt content is relatively high, the water should be useful for a number of purposes. It should be suitable for septic tanks and as a fire fighting supply. There is unlikely to be much effect on grass growth, particularly on well-drained sandy soils, as higher salinity water from bores is being used on gardens in the area without apparent adverse effect. Salt-sensitive plants (e.g. roses) are likely to be affected by the water. The salt content is above acceptable limits for a drinking supply and it is unlikely to be suitable for long term use in hot water services. There is likely to be some corrosion of metals so that plastic fittings and pipes are advisable wherever possible and storage should be in concrete rather than galvanised tanks.

CONCLUSIONS AND RECOMMENDATIONS

The bore, as installed, should be capable of supplying the required volume of water for a school. Although the pump test (at 80 l/min) indicated the bore could be pumped for long periods without the water level being drawn down to the bottom of the bore, extended continuous pumping periods should be avoided. The shoreline is quite close and if the water level in the bore is drawn down below sea level for long periods, salt water intrusion is a definite possibility. The bore should be pumped for relatively short periods only (perhaps four to eight hours maximum if the

output is 80 l/min) and allowed to recover for at least a similar period before pumping again. If a higher yielding pump is installed the time of pumping should be reduced accordingly. The drawdown after eight hours pumping at 136 l/min is likely to be to 45 to 50 m below the surface and salt water intrusion becomes more likely.

A little sand may be produced with the water from time to time and a helical rotor pump is probably best suited to these conditions. There are several manufacturers of this kind of pump.

The effect of salt in water on plants can be reduced by using particular methods of application. During hot days evaporation (and consequent concentration of the salt in water) can be quite high, especially when a sprinkler system is used, so that the cooler parts of the day are favoured for watering. There is less evaporation when the water is applied by flood irrigation and the effects of salt in water are reduced by use of a drip system. It is not often possible to effectively flood-irrigate lawns, so that the cooler parts of the day are suggested for watering, if a sprinkler system is used.

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