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1984/61. Preliminary report on the feasibility of using groundwater as a supplementary water supply at the Kingston Golf Club

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Abstract

Seven auger holes were drilled to assess the feasibility of using groundwater as a supplementary water supply at the Kingston Golf Club. This drilling tested an area of 0.75 km², underlain by an average of 7 m of sand. A seven-hour pump test was undertaken on the aquifer, with rapid recovery of water levels. Water quality was good, and pump testing showed no decline in water quality from salt water intrusion. The installation of two spear bores, with provision for water level monitoring, is recommended.

INTRODUCTION

This is an interim report on the groundwater investigation undertaken by Department of Mines staff at the Kingston Golf Club. The Club wishes to use groundwater as a supplementary supply to their existing surface and reticulated sources. The original geological and drilling investigation was undertaken by A.T. Moon and completed by B.E. Cox, who then tested the aquifer. Unfortunately, time and staff shortage has not permitted the calculation of aquifer properties, the computer modelling of the aquifer for long term pumping, and the writing of a final report. However these results will not greatly alter the conclusions and recommendations of this interim report.

LOCATION OF AQUIFER

An aquifer is a rock formation in which groundwater can be stored and extracted in significant quantities by a well, bore or a spring. The eastern section of the Kingston golf course, encircled by the large meander of Browns River, is underlain by a dune and beach sand aquifer. The area tested by drilling to date covers 0.75 square kilometres. Seven holes have been auger-drilled to an average depth of seven metres, at which depth the aquifer base is sealed by organic silt and clay. The coastal sand forming this shallow aquifer is fine and fine-medium grained, with some shell material and pebbles. The exploratory drilling on 4 June 1984 showed the water table to be two metres below the ground surface at that time.

The exploration drilling programme showed that even after a prolonged drought the water saturated layer of sand was five metres thick beneath an area of 0.75 km² which, with further exploration drilling, may be found to be as much as 1.5 km². Conductivity tests in each hole showed the groundwater to be of a good quality. Moon recommended to the Golf Club that some limited aquifer testing be undertaken. Two pump tests were carried out; one for testing the yield of the aquifer and the other to see if any salt intrusion into the aquifer was likely to occur from Browns River.

AQUIFER TESTS

Hole 4 was used as a pump test bore with two observation holes being drilled three metres and fifteen metres west of the pump bore. In the pump test bore a stainless steel screen was jetted to the base of the

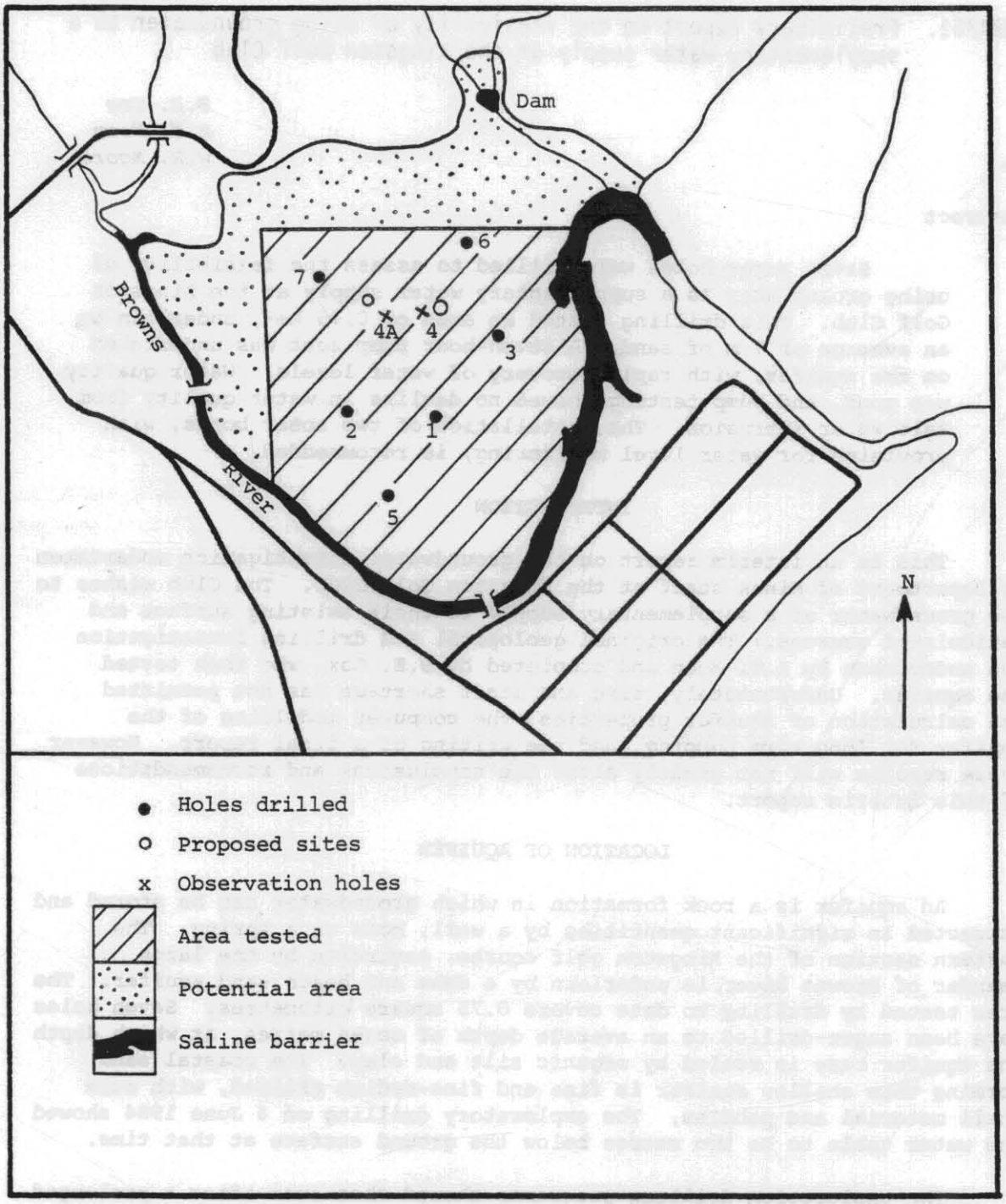

Figure 1. *Shallow sand aquifer, Kingston Golf Club*

aquifer. This screen was No. 10 size (*i.e.* with mesh size of 10 μm) 1.8 m long and 50 mm in diameter. The pump bore was gravel packed. The two observation bores used 600 mm x 50 mm No. 10 stainless steel screens.

The bore was pumped for seven hours with a pumping rate of 0.5 *l*/sec, which was gradually increased to the last hour when the pumping rate was 1.1 *l*/sec. The water level in the pump bore appeared to stabilise with the water level falling only 1 mm in the last hour. During the seven hours of pumping the water level of the pumped bore fell by 2.75 m, at the three metre observation hole by 1.11 m and at the 15 m observation hole by 0.52 m. Recovery in all three holes was rapid.

SALT WATER INTRUSION

Browns River is tidal and is reported to be saline up to the Channel Highway bridge. As this river encircles the aquifer area on three sides it acts as a saline barrier. Under the influence of prolonged long term overpumping, salt water intrusion from this saline barrier into the aquifer is considered a possibility.

In order to try and estimate if any salt water intrusion is likely to occur, Hole 5, the nearest to the river, was pumped at 0.2 *l*/sec for five hours, with water quality being monitored using a conductivity meter. No decline of the water quality through salt water intrusion was recorded. With a reasonable recharge and intermittent and seasonal pumping rates rapid salt water intrusion appears unlikely.

Such short term pumping is only an indicator and when the anticipated life expectancy of a spear bore pumping system is considered to be 15-20 years, permanent monitoring of water quality for salt water intrusion is considered essential for this project.

WATER QUALITY

The chemical analyses of the four water samples collected at the beginning and end of the two pump tests showed the water to be of good quality, with a total dissolved salt content between 660-700 milligrams per litre. No problems are foreseen using such good quality water for irrigation purposes on the golf course, provided that the quality is maintained over the years.

CONCLUSIONS

(1) From the results of preliminary drilling and testing, the shallow sand aquifer would appear to have a good water supply potential and be more than adequate for a supplementary groundwater supply using small diameter spear bores.

(2) Such a system should start with only a small scheme of two or three spear bores, which will allow the monitoring of water levels over a summer pumping season. The water levels should not only be measured during summer but also in winter and other non-pumping periods to enable an estimate of recharge occurring during winter rains and when other sources are being used for irrigation.

(3) Little is known of the recharge from existing irrigation and winter rains, and before the full potential of any sand aquifer is known some accurate measurement of recharge is critical. Recharge can only be estimated from long term records of the amount of water put on

the actual aquifer area during the summer as well as the amount of rainfall that reaches the aquifer. These figures, as well as the monitoring of the water table fluctuations in the observation holes, are required continuously over a longer period of time than is possible by aquifer testing. Only when these figures become available can the full potential of the aquifer become known. The groundwater could then be more fully utilised if required.

(4) If the monitoring part of the scheme is ignored, as has happened already at other golf courses in the Hobart area, overpumping of the aquifer is inevitable with the associated problems of falling water table, decline in bore yields, and possible increase in salinity of the groundwater.

RECOMMENDATIONS

(1) A first stage scheme with two permanent pump spear bores should be installed. One of these bores could be the existing Hole 4, and a second pump bore could be installed 40 m to the west of Hole 4.

The spears should be 1.8 m long and 50 mm in diameter with a No. 10 mesh size (10 µm) and be gravel packed. These two bores should be pumped at 0.7-0.9 *l*/sec into a pipeline to the existing dam. Overpumping is not so likely to occur when the water is pumped into a dam, rather than when the spears are directly connected to the irrigation sprinklers.

(2) A common pump with a water meter should be installed for both spears and lifting water to the dam.

(3) A system of seven observation and monitoring bores, comprising one metre long 50 mm diameter stainless steel spears, should be installed below the water table. The position of these to be in a circle around the pump bores, yet close enough to monitor any movement of salt water from the saline barrier of Browns Rivulet.

(4) These monitoring bores should have water level measuring floats installed.

(5) The measuring of water table fluctuations, pumping rates, and rainfall be recorded weekly by the ground staff and checked regularly by Department of Mines staff. Experience has shown that the monitoring should be left to the curator and his staff rather than any golf course grounds committee, whose members change over time. As the curator is using the system and it is his responsibility, it is to his advantage to keep accurate monitoring records.

(6) A water quality sample should be taken at the beginning and end of each pumping season and tested for chemical analysis.

(7) After 12-18 months pumping and monitoring, consideration should be given to maintaining or increasing the recommended pumping rate. Any future expansion of the existing spear bore array should be considered.

[20 September 1984]