2007 Taste of Research Summer Scholarship Program

Managed Aquifer Recharge in the Botany Aquifer

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Research Theme: Energy, Resources and the Environment

Introduction

The Botany aquifer is the only significant aquifer in the Sydney region. UNSW extracts bore water from the aquifer for use in irrigation, toilet flushing, cooling towers and heat exchangers. In 2006, a Managed Aquifer Recharge (MAR) scheme was set up at UNSW to counter-balance increased abstraction of groundwater. Balancing extraction with recharge is important to protect the aquifer, ensure water supplies are available over the long term and to prevent consolidation and settlement of the ground surface.

A 1ML percolation pit was constructed under the village green. The pit will collect 160ML of stormwater per year and return it to groundwater, replacing 80% of the bore water extracted and used on campus.

Aims This project aimed to resolve some of the uncertainties surrounding the potential for future MAR schemes in the Botany region. Specific aims included:

- To review groundwater monitoring infrastructure at UNSW;
- To install a new monitoring bore with multi-level piezometers to allow groundwater analysis at different depths; and
- To approximate the relationship between rainfall and groundwater levels.

Investigation Techniques

- Preliminary assessment of existing bore infrastructure;
- Drilling of new bore and piezometer installation;
- Groundwater logging and data analysis; and
- Groundwater sampling for chemical analysis.

Groundwater bores at UNSW

6 monitoring bores: 2 with loggers installed to record groundwater level, temperature and barometric pressure
3 production bores: Supplying up to 400ML/day to campus
New monitoring bore: A 50mm bore was constructed in January 2007 at the Village Green. A data logger was installed in addition to a multi-level piezometer, which allows comparative chemical analysis of the groundwater at different depths. A stratigraphic analysis was also carried out on the sediments above and below the watertable.

Photos: Installing the percolation tank under the Village Green at UNSW and drilling rig installing multi-level monitoring piezometers.

Recharge rates

The groundwater level at a bore adjacent to the swimming pool at the UNSW campus was monitored over a period of 6 months and compared to rainfall levels over the same period. The watertable was located about 5-6 m below ground surface. It was found that rainfall events over 10-20 mm/day caused groundwater levels to increase by up to 1.5 m.

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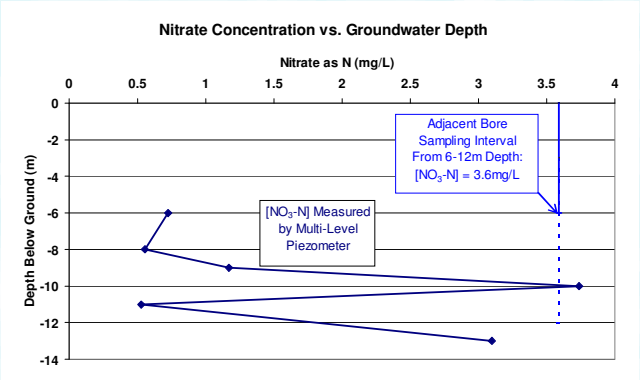
Groundwater chemistry

Groundwater was found to be suitable for irrigation, and, with the exception of low pH and elevated nitrate levels, the groundwater met drinking water guidelines (ANZECC 1992). Since no pathogens such as Coliforms were detected, high nitrate concentrations may be associated with fertiliser usage.

	Drinking Water	Irrigation	UNSW Groundwater
pH	6.5-8.5	-	**6.02**
TDS mg/L)	<1000	-	186
Nitrate (mg/L)	<7.3	-	**9**
Iron (mg/L)	0.3	0.2	<0.05
Chloride (mg/L)	<250	<700	43.1
Coliforms (cfu/100ml)	1	-	0

The value of using multi-level piezometers for sampling is evident from differing chemical analyses at varying depths within the aquifer (as shown in Figure below).



Conclusions and Further Investigations

The relationship between rainfall and groundwater levels is complicated and dependent on localised rainfall events, threshold rainfall, and antecedent (lead-up) rainfall rates. It is however clear that groundwater levels during the current period of drought are lower than those during previous years in which there were was average rainfall.

Chemical analysis confirmed the groundwater in the aquifer below UNSW to be of very high quality. The groundwater is suitable for irrigation and, with minimal treatment, for use as drinking water.

Maintenance of existing groundwater infrastructure is crucial to the success of future investigations and research into groundwater supply, quality and usage. Ongoing rainfall monitoring at UNSW is recommended, as data will be useful for investigations into aquifer recharge rates.

References

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