Case Study

Schlumberger WATER SERVICES

About Schlumberger Water Services

We offer innovative groundwater solutions through professional expertise to meet the advancing technological requirements of today's professionals.

Schlumberger Water Services specializes in assessing, developing, and managing groundwater resources using some of the finest, advanced and cost-effective technologies available today.

Whether you're looking for field-scale data collection, data management, modeling, or resource decision-making solutions, our teams of specialists are here to help you address all your groundwater projects safely and efficiently.

Applied Technologies:

- Mini-Diver
- Micro-Diver
- Baro-Diver
- Cera-Diver
- CTD-Diver
- Pocket-Diver
- LoggerDataManager

Monitoring Groundwater Resources for Municipalities

Guelph, Ontario, Canada

Groundwater monitoring using Diver dataloggers in the City of Guelph, Ontario, Canada

Highlights:

- Deployment of automated data acquisition sensors to support water supply studies
- Determining effectiveness of automated sensors versus manual and frequent data collection
- Utilizing sensors to correct and compensate for changes to climatic conditions
- Applying 3D visualization software for displaying and mapping water elevations

Background

The City of Guelph is located in south western Ontario, Canada with a growing population of over 110,000. Currently, Guelph relies one hundred percent on groundwater as their source of water supply. In April of 2006, the City of Guelph Waterworks Department was approached to participate in a pilot study developed by Schlumberger Water Services. The study was intended to evaluate the effectiveness of Diver* dataloggers and to quantify the benefit of electronic data collection solutions for environmental monitoring. Twenty Diver dataloggers were deployed, the majority being installed in and around the Arkell Spring Grounds. A Baro-Diver*, designed to measure barometric pressure, was deployed in the center of the monitoring network allowing for the successful compensation of all Diver dataloggers within a twenty kilometer radius. A Mini-Diver* was deployed to collect long-term linear measurements, and a Micro-Diver* was installed in wells that measured less than one inch in diameter. Finally, a CTD-Diver* and Cera-Diver* were deployed in areas where downhole concentrations posed a possible risk to compromising the stainless steel housing of non-ceramic dataloggers (i.e. salinity, acidity etc.). In addition to the more robust housing, the CTD-Diver also logged temperature, pressure and electrical conductivity.

The Arkell Spring Grounds supplies up to 60 percent of the water for the City of Guelph and encompasses an area of approximately 280 hectares. Groundwater monitoring in this area has typically been completed through manual readings; however the fragile nature of the area has led to increased environmental monitoring requirements for mandatory compliance reporting, as well as qualitative and quantitative forecasting models.

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Case Study: Monitoring Water Resources for Municipalities

The primary data types collected during this pilot program were water level, temperature and barometric pressure. Equipment used for data acquisition included a laptop computer, an optical reading unit, a pocket PC, Pocket-Diver* and LoggerDataManager* software. The collected data was electronically captured and then compensated with barometric measurements for analysis at a later date with HydroGeo Analyst* software.

Challenges

In the past the City of Guelph gathered information from wells via manual measurements. Challenges associated with this method include:

- finding cost-effective methods for obtaining groundwater measurements
- compensating for barometric changes
- obtaining accurate field measurements
- recording seasonal variations in water levels due to rain events and pumping
- maintaining data accuracy during user input
- managing volumes of water level data
- transferring data to a QA/QC system

Solution

Field trials were conducted over several months and changes of season. This was a valuable part of the study as it allowed the equipment and the method of deployment to be evaluated for extreme conditions. The data collected at each site were obtained over multi-hour intervals, at minimal cost, and were quickly and accurately transferred into other software applications.

Water levels, groundwater temperatures and barometric pressures were recorded using the appropriate Divers. The data were transferred to a computer using the LoggerDataManager software. The barometric pressure data were used to adjust the water level data and the complete set of raw and compensated data were displayed in the resulting graphs.

Results

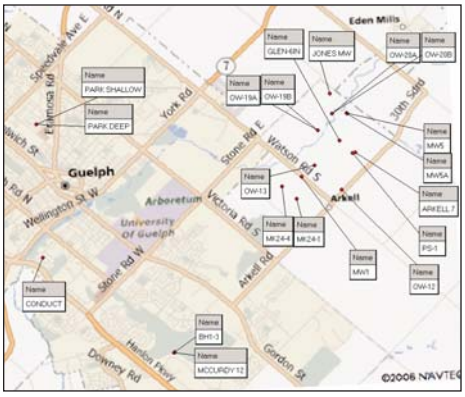
Deployment of the Diver dataloggers to the optimum monitoring locations presented some challenges due to the variation in subsurface lithology and proximity to pumping wells. Each Diver was positioned at a depth that corresponded to the seasonal variations of the aquifer with expected drawdown and drought conditions taken into consideration.

Significant resource time was spent on this segment of the pilot test. However, the results obtained by allocating the time to complete this setup properly were well worth the increased effort for the frequency of data captured by the Diver dataloggers.

Overall the cost and time per unit was significantly less with the use of Diver dataloggers. This allowed for a better understanding of aquifer performance during the pilot test than would be provided by manual readings alone, such as rapid aquifer responses to transient events. Data collected also had the benefit of reduced inefficiencies due to mechanical measurement issues, operator error and transcription errors.

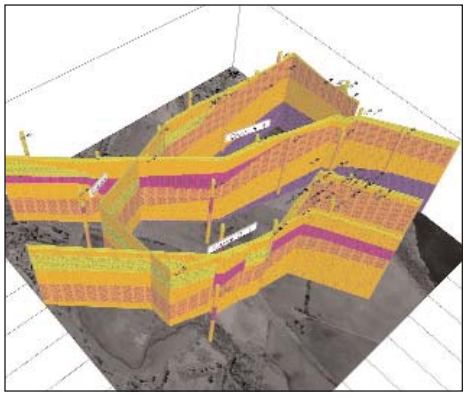
By applying the barometric pressure compensation to the raw electronic data using the LoggerDataManager software, a more meaningful, extensive and accurate set of observations were obtained.

Given the current mandatory compliance requirements found in Certificates of Approval, Permits to Take Water, and Environmental Assessments, the addition of this technology to the hydrogeologist's toolbox will prove to be highly effective and beneficial.



Map of the City of Guelph's pilot project


Programming Diver Dataloggers for continuous monitoring using hand-held PC


3D visualization using HydroGeo Analyst

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