

## **PERTEMUAN PERSATUAN** **Meetings of the Society**

### **Ceramah Teknik (Technical Talk)**

#### **Groundwater protection in Kelantan**

SAIM SURATMAN

#### **Laporan (Report)**

Dr. Saim Suratman gave the above talk on Monday, 3rd November 1997 at the Department of Geology, University of Malaya. He is attached to the Geological Survey Malaysia and recently obtained his Ph.D. from University of Newcastle-upon-Tyne. His talk, which is based on his Ph.D. research proved very interesting and attracted a crowd of about 55.

#### **Abstrak (Abstract)**

The North Kelantan River Basin is underlain by flat lying Quaternary alluvium which ranges in thickness from a few metres inland to more than 200 m at the coast. The alluvium contains two different aquifer systems, known as the shallow aquifer (which is quite thin and mostly unconfined), and the deep aquifer (which is mainly confined with thickness usually more than 15 m). The shallow aquifer is the most important aquifer system for the public water supply systems of the area and contributes a remarkable 90% of the total drinking water demand. These two main aquifer systems are hydraulically interconnected being separated only by semi-permeable silt.

A comprehensive study on the groundwater systems in the North Kelantan River Basin was carried out using groundwater models and Geographical Information Systems (GIS). Through the modelling and GIS, considerable advances in the understanding of the aquifer systems in relation to hydrogeochemical properties, groundwater contamination, groundwater flow, wellhead protection area (WHPA) delineation and groundwater vulnerability mapping have been realised.

A groundwater flow model for North Kelantan was constructed using a three-dimensional regional groundwater flow code (MODFLOW), together with the particle-tracking program (MODPATH) to calculate the pathlines and time-of-travel (TOT). The results of the modelling works were integrated into GIS using ARC/INFO and ArcView. The GIS also supported storage, analysis, querying, browsing and display of various geographical data available for the study area. This allowed visualisation and better understanding of the aquifer systems, aiding plans to protect the groundwater from further deterioration in quality.

The groundwater in North Kelantan is naturally rich in iron which exceeds the raw water quality limits. Contamination by nitrate and ammonium is quite apparent, resulting from various human activities in the urban and agriculturally active areas.

The 50-day, 1-year, 10-year and 20-year TOT zones for source protection have been adopted in the interests of protecting the groundwater from contamination, and vulnerability mapping using the new RUSTICS method (modified from DRASTIC) was carried out to map the areas vulnerable to pollution.

The project demonstrates the feasibility and desirability of integrating source protection zone delineation with regional groundwater vulnerability mapping by integrating groundwater models with GIS. The benefits of adopting generic vulnerability mapping technique to local land use circumstances are also clearly shown.

G.H. Teh

