

GEOL-304 Assignment 3 - March 9th, 2011

(Total marks 40)

This assignment is due by Wednesday March 30th

- 1) Over the next 50 years Vancouver Island is almost certain to see (a) a significant increase in population, (b) more buildings and roads (c) higher average temperatures (d) lower snowfall amounts and (e) higher sea levels. How might these various changes affect our drinking water supply, and what should we do about it? (10 points)
- 2) Explain the process of base-exchange softening in an aquifer like the Nanaimo Gp. and describe its effects on the water chemistry. (10 points)
- 3) When we did the slug tests at the landfill we measured the recovery rates using the down-hole tape and also using Graeme's transducers. We worked with the tape data in class to estimate permeability. For this question I'd like you to work with the transducer data, which is in the file: "assignment3-q3-xls", and again use the Hvorslev method to estimate the permeability. In case you don't have the book, the formula is:

$$K = (r^2 \ln(L_e/R)) / (2L_e t_{37})$$

where K = permeability (cms/), r and R are the radii of the casing and the screen (in this case 2.5 cm), L_e is the length of the screened interval (300 cm), and t_{37} is the time (seconds) taken to recover to 37% of the standing water level.

In order to estimate t_{37} you'll need to determine the head difference between the start of the test (just after the slug was dropped in) and the end. You can do that using the graph. t_{37} is the time when the level has dropped to 37% of this distance. (10 points)

- 4) The DRASTIC model that has been used to evaluate aquifers on Vancouver Island uses seven different characteristics to determine the relative vulnerability of different areas to aquifer contamination. Some of the important ones are:

Depth to the water table (where >50 m is considered "deep" and <10 m is considered "shallow"),

Recharge (where rainfall amounts of 500 mm/y or more are considered "high" and amounts of 100 mm/y or less are considered "low"),

Conductivity (where values of 10^{-6} cm/s or lower are considered "low", and 10^{-3} cm/s or higher are considered "high").

How would you rate the vulnerability of the Nanaimo Gp. aquifer at the RDN landfill in Cedar based on these 3 parameters? (I'm looking for generalizations, not numbers.) Explain your answer. (10 points)