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MEMORANDUM

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FROM L.V. Pitts RESOURCES DEPT. 3 February 1984

TO Distribution TORONTO

NO. ..... FILE NO. MER 7936-0 SUBJECT Presentation and Use of Hydraulic Conductivity Data

A number of projects recently have required that "average" hydraulic conductivity values be calculated for specific hydrogeologic units from hydraulic conductivity data obtained in the field.

Freeze and Cherry (1979) report that natural heterogeneity in a geological formation will cause hydraulic conductivity to vary from 1 to 2 orders of magnitude, and that the probability density function for hydraulic conductivity is log normal. This implies that if one plots the log value of hydraulic conductivity versus frequency of occurrence one would get a normal distribution curve. The importance of this in selecting the "measure of central tendency" is that the arithmetic mean is inappropriate for describing the "average" value of hydraulic conductivity. Since we rarely have enough data to support the use of the mode (most frequently occurring value), we are left with the median (determined by arranging the values in order of magnitude and selecting the middle value). Another measure of central tendency that we might use is the geometric mean, which is defined by the following equation:

$$\text{G.M. } (y) = \text{antilog } \frac{1}{n} \sum_{i=1}^{n} \log y_i$$

If you are doing the calculations using a computer you could use the equivalent formula:

$$\text{G.M. } (y) = \sqrt[n]{\prod_{i=1}^{n} y_i}$$

It should be noted that you cannot use the term standard deviation (S.D.) as is to express variability in a log normal distribution. You can, however, express variability in your sample data by the following:

- 68% of the samples will lie in the range of "antilog [log G.M. - S.D. (of log data)]" to "antilog [log G.M. + S.D. (of log data)]"
- or 95% of the samples will lie in the range of "antilog [log G.M. - 2 x S.D.(of log data)]" to "antilog [log G.M. + 2 x S.D. (of log data)]".

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