Modeling the Ship Creek ground-water table: comparing areas of low and high permeability, Anchorage Alaska

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This study determined the regional pattern of the unconfined aquifer's water table elevation within the northern portion of the Anchorage Bowl. Historically, the area's groundwater has been studied on a small scale, in piecemeal fashion to determine local conditions. To rectify this situation, a database of 609 wells was constructed from groundwater data from four different sources. This database was manipulated with a Geographic Information System, and then using the linear kriging interpolation method, a contour map was created documenting the water table elevation in 25-foot contour intervals.

The unconfined aquifer that conducts groundwater in the Anchorage Bowl does so in geologic materials with varying permeability. I hypothesized that areas of differing permeability would affect the uniformity of flow within the aquifer. A correlation between permeability values of the surficial geology and the spatial variability of groundwater elevations was examined. By quantitatively assessing the effects of permeability on elevation variability, it was shown that modeling in areas of low permeability would need a more substantial database by which to interpolate contours. Semivariograms were used to quantify spatial variability for areas of low and high permeability, and for low permeability materials, the variability in water-table elevations is no longer spatially correlated past 2,800 feet. For high permeable materials, variance remains spatially correlated until nearly 32,000 feet.

To show how this relationship would affect modeling efforts, the mean water-table slope was determined for areas representing high and low permeability, using two methods. Both methods determined that mean slopes for the two permeabilities were different by an order of magnitude, with the low permeable dataset having a steeper slope. This difference essentially implies that areas of an aquifer composed of materials with low permeability require about 10 times more data points to achieve the same precision as in high permeability areas.

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