3-D Colour Schemes for Complex Glacial Aquifer/Aquitard Systems

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The Waterloo Moraine, which provides about 80% of the drinking water for the Regional Municipality of Waterloo, is a complex glacial system composed of highly intermingled material including gravel, sand, silt, clay, and bedrock. Over the last 10 years, we have conducted detailed studies of the Moraine in order to define the groundwater flow system and delineate the well capture zones that the Regional Municipality uses as a basis for designating wellhead protection areas (Martin and Frind, 1998; Frind et al, 2002). From our experience with this highly complex system, distinct units that can be unambiguously classified as either aquifers or aquitards are difficult to identify.

To adequately describe this complexity in three dimensions, we have developed a conceptual model that divides the Moraine into a number of layers (eight in this case). Each of these layers is nominally classified as "aquifer" or "aquitard", where an "aquifer" will contain mostly sand and gravel, but also some clay or silt, and an "aquitard" will contain mostly silt and clay, but also some sand and gravel. Each layer is represented in terms of continuous distributions of hydraulic conductivity K (m/s), translated into a continuous colour ramp as follows:

Material	K (m/s)	Colour range
Gravel	$10^{0} – 10^{-3}$	red – orange
Sand	$10^{-3} – 10^{-6}$	Orange – yellow
Silt	$10^{-6} – 10^{-9}$	Yellow – green
Clay	$10^{-9} – 10^{-12}$	green – blue

This system allows a gradual transition over the entire range of materials for each layer, using the full range of colours. Fissuring can be represented by superimposing a grid-like pattern onto the background colour. By showing the colour map for each layer, the complete 3-D system can be represented. This approach easily facilitates the realistic representation of complex glacial systems, such as the Waterloo Moraine, in the context of groundwater studies.

References

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