Accurate determination of water table depths using ground-penetrating radar.

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Water table elevations are used to determine ground water flow directions in geotechnical and contaminant site investigations. Sparsely distributed monitoring wells often provide the water level measurements used to construct water table contour maps. The use of ground-penetrating radar to improve interwell interpolations through such techniques as cokriging is being investigated. The water table is often associated with a strong radar reflection which cuts across other events from the subsurface. The effectiveness of using GPR in interwell interpolation is dependent on the precision to which correlations with the water table can be developed. As GPR is sensitive to changes in water content rather than pressure changes, the reflection associated with the water table actually occurs at the top of the capillary fringe. The size and variability of the capillary fringe affects the correlation between the reflection from the top of the capillary fringe and the water table. This correlation is also reduced by errors in radar velocity, surface elevations and measured water table elevations.

Fixed offset profiles and common midpoint (CMP) gathers were collected at an aggregate extraction site on the Red Deer River, Alberta, Canada. The radar profiles were positioned near existing monitoring wells, and water levels were routinely measured during GPR data acquisition. Velocity control was provided by common midpoint gathers. Processed GPR profiles were then used to determine the depth to the top of the capillary fringe. Analysis of the precision with which ground-penetrating radar interpretations can be correlated with measured water levels will be presented.

(1998) Geo-triad '98: Abstracts: Plenary, Oral, Posters, Core Workshop