Combined Method of Aspect Ratio and Passive Flux Meter Data to Determine More Accurate Groundwater Velocities

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Background/Objectives. Design and application of permeable reactive barriers have very specific design assumptions/needs. One of the most critical variables to successful implementation is identifying accurate groundwater velocity. A key factor is determining the flux rate of contaminants through a permeable reactive zone driven by groundwater velocity. Thus, poor estimations of groundwater velocities lead to significant variances. These variances greatly impact remedial outcomes. This learning lab will address the concept of groundwater velocity estimates in general and an innovative approach to obtaining a more accurate estimate of groundwater flow velocity using a combined method employing a plume aspect ratio and groundwater velocity obtained using passive flux meters.

In this learning lab we will present data that demonstrate a strong correlation between a low-resolution analysis method referred to as a plume aspect ratio (plume length ÷ plume width) and a high-resolution numerical result using passive flux meters. This discussion will include early analysis demonstrating significant differences between the traditionally derived groundwater velocities using field measured hydraulic conductivity and gradient versus the combined methods (plume aspect ratio and passive flux meter).

The objective of this work is to provide the industry with an additional predictive tool that can be used to help calibrate and reality-check traditional groundwater velocity estimates. Estimated groundwater velocities are currently used in most permeable reactive zone designs and contaminant transport models.

Approach/Activities. This evaluation combines two separate methods to arrive at a site-specific groundwater velocity. This method is based on a combination of low-resolution analysis (aspect ratio) and high-resolution passive flux meter data. The passive flux meter data presented will be based on the evaluation of over eight sites. Because of the excellent correlation between these two methods it appears that these two separate lines of evidence support the underlying estimated groundwater velocity.

Results/Lessons Learned. Early evidence supports the concept that a significant variance exists between groundwater velocity derived from traditional estimates of hydraulic conductivity, effective porosity and the resulting velocities. Using the combined methods of plume aspect ratio analysis with passive flux meter velocities an exponential curve was built. The resulting curve generated is an accurate way to validate traditional groundwater velocity estimates. The use of the resulting groundwater velocities will ultimately improve overall design accuracy.