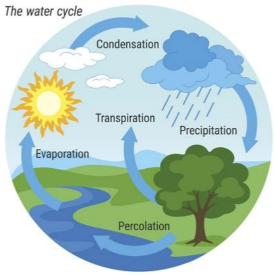
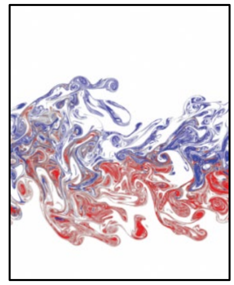
Boase Seminar Series in Hydrology and Water Resources Engineering

Department of Civil, Environmental and Architectural Engineering



Balancing Technology & Investigations to Drive Remedial Success

Dr. Scott Potter, Ph.D. P.E

Sr. Vice President, Chief Hydrogeologist

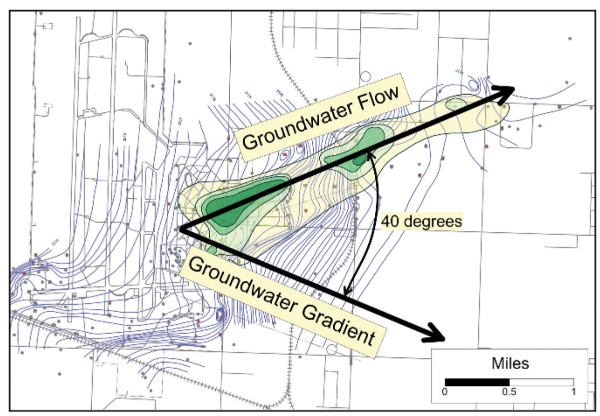
Arcadis, Newton, PA

Wednesday, April 5, 2023 | 11:15 AM | ECCE 1B41 &

Zoom: https://cuboulder.zoom.us/j/98861379124

Abstract:

A realistic conceptualization of plume movement in aquifers recognizes that most groundwater flow and contaminant mass flux occur through a relatively small percentage of the overall aquifer volume. This process is driven by permeability contrasts between soils and hydraulic gradients. While groundwater flow does occur in less permeable materials, it typically represents only a small proportion of the total groundwater flux. Aquifer structure influences solute transport by facilitating fast initial breakthrough due to “flow-focusing” and advection in the highly permeable materials, with long-term persistence of the plume due to diffusive exchange and slow advection from zones with lower permeability. The integration of groundwater flux with mass flux is the foundation of the Three-Compartment Model (3-C Model) (Potter et al., 2015; Suthersan et al., 2016; Horst et al., 2017). The 3-C Model combines the concept of hydrostratigraphic flux – groundwater concentration and hydraulic conductivity data obtained through high-resolution site characterization (HRSC) – with groundwater flow dynamics. While the details of integrating these data results in a continuous distribution of mass flux, the 3-C Model establishes a new conceptual site model (CSM) that divides the aquifer into three ‘compartments’ based on order-of-magnitude contrasts in groundwater flux. These three divisions enhance and refine the standard advection-diffusion model to better reflect the variable processes of groundwater flow and transport where *Compartment 1* represents the advection zone (e.g., sands and gravels), *Compartment 2* is a transitional zone with slow advection and contaminant storage (e.g., sands mixed with silts and clays), and *Compartment 3* is primarily a storage zone (e.g., silts and clays). Between each compartment, groundwater and contaminants are exchanged via changes in soil structure and diffusion. This new flow and transport CSM has led to the development of better strategies to both flush contaminants from aquifers and deliver reagents for in situ treatment. *Dynamic Groundwater Recirculation (DGR™)*, which is a remedial strategy that exploits this new thinking to more efficiently restore sites, has been effectively applied at dozens of sites since 2006. The data collected from these projects, along with data gathered using high resolution site characterization (HRSC) methods, are the underpinnings of the 3-C Model describing the emergent behavior of DGR™ and the underlying science termed chaotic advection. The challenge is how to incorporate ambient and engineered dynamic behaviors into the design.



Speaker Bio: Scott Potter is a Senior Vice President with Arcadis in Yardley, Pennsylvania. He is the Chief Hydrogeologist for Arcadis, US and is co-author of *Remediation Hydraulics* (CRC Press 2008) with Fred Payne and Joseph Quinnan. He has 33 years of professional experience developing site-wide remedial strategies, groundwater flow and contaminant transport modeling, surface water flow and transport modeling, and quantitative analysis of hydrogeologic systems. He has directed quantitative studies at chemical facilities, petroleum refineries, solid and hazardous waste facilities, manufactured gas plants, manufacturing facilities, power generation and distribution facilities, well fields, and mines to assess conditions and develop remediation strategies. He is currently active in the development of the *3-Compartment* model to assess mass flux and improved methods to combine uncertainty with system optimization.