Thesis Proposal: Tuesday, Nov. 12 | 2 p.m. | 1122 Rood Hall

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Presentation Title: An Analysis of Maximum Displacement Pneumatic Slug Tests for the Characterization of Aquifer Parameters – Guidelines for an Alternative Field Procedure

Abstract: Accurate determination of aquifer characteristics, specifically the spatial distribution of hydraulic conductivity (K), is essential for understanding the movement of ground water and contaminants within aquifers. Over the past decade, pneumatic slug approaches have become increasingly popular as an alternative to physical slugs. Pneumatic slug testing involves either injecting compressed air or nitrogen gas to lower the water column in the well (positive displacement) or creating a vacuum in the well to increase the position of the water column in the well (negative displacement). Pneumatic slugs typically allow for significantly greater initial displacements than physical slugs with maximum displacements limited by either: (1) the distance from the top of the well above the top of the water column in the well for negative displacement slugs, or (2) the distance from the top of the water column to the top of the well screen for positive displacement wells. Perturbations from maximum displacement slugs sample significantly greater aquifer volumes, and should yield more representative hydraulic values than physical slugs. A comparative analysis of aquifer properties obtained from large displacement pneumatic slugs and smaller physical slugs with a maximum displacement of 0.6 m was performed at two field sites: the WMU Asylum Lake well field, situated in an unconfined, well-sorted glacial outwash aquifer; and at a PFAS contaminated site in Muskegon, MI where a series of shallow, intermediate, and deep wells are situated in a heterogeneous downward fining sequence. Pumping tests conducted at Asylum Lake provide a rare opportunity for direct comparisons of hydraulic properties obtained from pumping and slug tests, including storage parameters obtained from larger displacement multiwell pneumatic tests. Preliminary results show expected consistency in K estimates from the pneumatic tests with similar initial positive and negative displacements. Values of K obtained from pneumatic slugs tend to be within an order of magnitude of aquifer test estimates in the Asylum Lake wellfield, with higher K estimates generated by the smaller displacement slugs. Smaller pneumatic slugs with displacements similar to a physical slug yielded higher K estimates, presumably because perturbations for these tests only sample the annular region of the well and are not representative of the aquifer.