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Groundwater Monitoring of Land Application with Manure, Biosolids, and other Organic Residuals

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Abstract Text:

Regulatory programs frequently require monitoring of first encountered (shallow-most) groundwater for purposes of determining whether an actual or potential, permitted or incidental waste discharge has had or will have a degrading effect on groundwater quality. Traditionally, these programs have focused on monitoring of incidental discharges from industrial sites. Increasingly, sources with an implied groundwater recharge are subject to monitoring requirements. These recharging sources include, for example, land application of municipal, food processing, or animal waste to irrigated cropland. Groundwater monitoring of a recharging source requires a different approach to groundwater monitoring than traditional (incidental source) monitoring programs. Furthermore, the shallow groundwater aquifer targeted for compliance monitoring commonly consists of highly heterogeneous unconsolidated alluvial, fluvial, lacustrine, glacial, or subaeolian sediments of late tertiary or quaternary age. Particularly in arid and semi-arid climates, groundwater is also frequently subject to significant seasonal and interannual groundwater level fluctuations that may exceed ten feet seasonally and several tens of feet within a three- to five-year period. We present a hydrodynamically rigorous approach to designing groundwater monitoring wells for recharging sources under conditions of aquifer heterogeneity and water level fluctuations and present the application of this concept to monitoring confined animal farming operations (CAFOs) with irrigated crops located on alluvial fans with highly fluctuating, deep groundwater table.

Impact Statement:

This project establishes an improved understanding of groundwater monitoring approaches on a dairy farm. While legally considered a point source, it is factually a nonpoint source or a collection of various nonpoint sources. Our improved groundwater monitoring design offers a better assessment of farming impacts on groundwater quality