Salinization of Deep Produciton Wells in the Western San Joaquin Valley: Risk Analysis, Uncertainty, and Data Needs

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Executive Summary

On the Westside of the San Joaquin Valley, highly saline shallow groundwater is estimated to migrate downward at rates between 0.5 and 1 foot per year, depending on surface water supplies and groundwater management strategies. Based on these estimates, it will take between 200 and 600 years for the highly saline groundwater to reach production wells located in the lower semi-confined and confined aquifers. However, vertically extensive interconnected coarse-textured bodies, leakage inside wells and boreholes, or locally strong vertical hydraulic gradients may lead to much earlier contamination of individual deep production wells. Existing regional models are not designed to quantify the risk for such early arrival. The San Joaquin Valley Drainage Implementation Program (SJVDIP) has outlined the need to study the potential for groundwater quality degradation due to the effects of alternative groundwater management practices of which increased deep well pumping is one of them.

The objective of the proposed work is to quantify the risk of contamination of wells located in the lower semi-confined aquifer and in the confined aquifer below the Corcoran clay as a function of well location, sub-area geology, and groundwater management practices. We will consider individual sub-areas of the original study area (Fig. 1, not shown here) equal in size to approximately that of a township-range (i.e. ~36 square miles). During the initial 2-year funding period, efforts have concentrated on the collection of relevant geological data, geostatistical analysis of this data, and the development of a general groundwater flow and transport model used to simulate the movement of salt particles in a heterogeneous aquifer environment representative of the project area. The main objective of the proposed work is to use the available data and these modeling tools to quantify the risk for well contamination, expressed as the probability that an individual well within a sub-area at a given depth becomes contaminated after 25, 50 or 100 years. These results can then be used in cost-benefit analysis of groundwater management alternatives and to improve existing groundwater monitoring programs. We propose to perform a sensitivity analysis to evaluate the effects of the assumptions invoked in the development and parameterization of the geostatistical, groundwater flow, and salt transport models on the results of the risk analysis. Based on the sensitivity analysis, confidence intervals can be developed for the risk analysis. With this information, it will be possible to provide specific recommendations for future data collection, monitoring, and improved aquifer characterization. The implementation of these recommendations are meant to improve the reliability of the risk analysis. These benefits are consistent with the recommendations of the SJVDIP and the University of California Salinity/Drainage Program Groundwater Management Technical Committee (April 1999).