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**PREDICTING THE PROBABILITY OF GROUNDWATER CONTAMINATION IN THE EAGLE RIVER
WATERSHED VALLEY-FILL AQUIFER, NORTH-CENTRAL COLORADO, USING GROUNDWATER AGE
AND LOW-LEVEL VOLATILE ORGANIC COMPOUNDS**

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ABSTRACT: The Eagle River watershed valley-fill aquifer (ERWVFA) is located within Eagle County near the destination resort town of Vail, Colorado. The area has a fast growing permanent population, and the resort industry is rapidly expanding. As development continues, local organizations need tools to evaluate potential land-development effects on groundwater and surface- water resources so that informed land-use and water management decisions can be made. To support this effort, maps were constructed based upon statistical models that show the probability of groundwater contamination in the ERWVFA. Groundwater age-dating compounds were used to calibrate a groundwater probability model under the assumption that recently recharged groundwater has a greater predisposition to contamination than waters recharged many years earlier. Concentrations of volatile organic compounds (VOCs) determined with low-level laboratory methods were used to calibrate a second groundwater probability model because VOCs are common urban contaminants. The groundwater age-dating data indicated that most groundwater in the ERWVFA was recently recharged water (median recharge date is 1989) and had a high probability of contamination if anthropogenic compounds were released to the environment. VOCs were detected in all water samples at or above the low-level laboratory reporting limit concentrations, but VOC concentrations in all samples were at least one order of magnitude less than their USEPA Maximum Contaminant Level. Some of those VOCs can be naturally occurring at these extremely low concentrations. Low-level VOCs were analyzed from surface-water samples in undisturbed areas to determine naturally-occurring concentrations; total VOC concentrations above 28,000 picograms per liter were attributed to anthropogenic sources. Logistic regression statistical modeling techniques were used to develop two statistical models that predict the probability groundwater contamination. One model predicts the probability of unmixed young water (using chlorofluorocarbon-11 concentrations and tritium activities) and the second model predicts the probability of elevated VOC concentrations. Although the groundwater age dating indicates that most areas of the ERWVFA have a high probability of contamination, the probability maps help to show areas with the greatest probability of contamination if compounds of concern are released to the environment.

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