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A SPATIAL AND STATISTICAL ASSESSMENT OF THE VULNERABILITY OF TEXAS GROUNDWATER TO NITRATE CONTAMINATION

by

Thomas Anders Evans, B.S.M.E., M.S.E.

and

David R. Maidment, Ph.D.

Principal Investigator

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CENTER FOR RESEARCH IN WATER RESOURCES

Bureau of Engineering Research .The University of Texas at Austin

J.J.Pickle Research Campus . Austin, TX 78712-4497

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ABSTACT

Nitrate concentrations in approximately 46,000 water samples from Texas wells are analyzed using spatial and statistical representations on a grid of 7.5' quadrangles. In each quadrangle containing at least 12 measurements, the probabilities of exceeding four threshold concentrations probabilities of exceeding four concentration thresholds of nitrate (0.1, 1.0, 5.0, and 10.0 mg/l nitrate as nitrogen) are estimated as the ratio of observed exceedences to the total number of measurements. An alternative probability analysis using the lognormal distribution yields exceedence probabilities that show some systematic difference from those computed directly from the data.

Five representative aquifers were chosen for additional analysis. Nitrate exceedence probabilities are relatively uniform within aquifers, but differ significantly from one aquifer to another. The exceedence probability for the 1 mg/l threshold was selected as best representing vulnerability to nitrate contamination. The five aquifers, ranked from lowest to highest vulnerability by this criterion are: Carrizo-Wilcox, Edwards (Balcones Fault Zone), Hueco-Mesilla Bolson, Ogallala, and Seymour. Evidence suggests that nitrate levels are increasing across the state, and in the Ogallala in particular, but such trends are not consistent across aquifers.

Linear regression was used to assess the relationship between nitrate exceedence probabilities potential indicator parameters. The dominant parameter is the aquifer from which the sample is drawn. Setting this aside, the only consistently significant indicator is average annual rainfall: groundwater is more likely to be contaminated in regions where rainfall is low than in regions

where rainfall is hi gh. No significant relation between the spatial patterns of nitrate contamination and the sale of nitrogen fertilizers was found.

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