Florida Aquifer Vulnerability Assessment Phase II
Levy County, Floridan Aquifer System

Michael Sole, Secretary

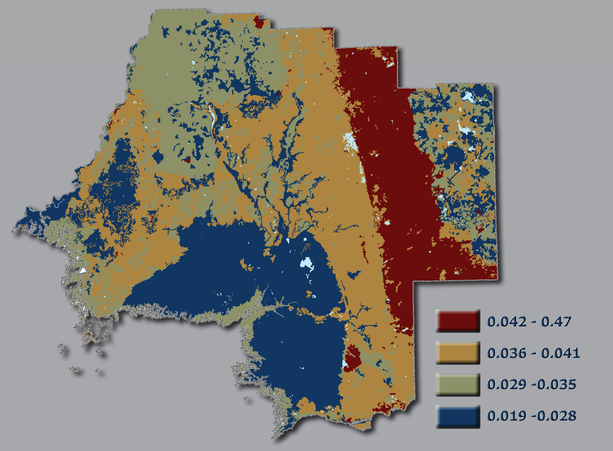
Jonathan Arthur
State Geologist and Director

INTRODUCTION

The Floridan aquifer system is the most important and prolific source of fresh water in Levy County. Groundwater use from the Floridan aquifer system in Levy County is an estimated 57 million gallons of water per day for public supply, agriculture and other uses. In addition to this amount, there are over 6,257 self-supply wells in the county tapping the Floridan aquifer system providing fresh water to homeowners (SWFWMD; 2006, 2003 (Revised), and 2004). Levy County's 34,450 residents (U.S. Census Bureau, 2000) rely almost exclusively on the Floridan aquifer system for their fresh water needs.

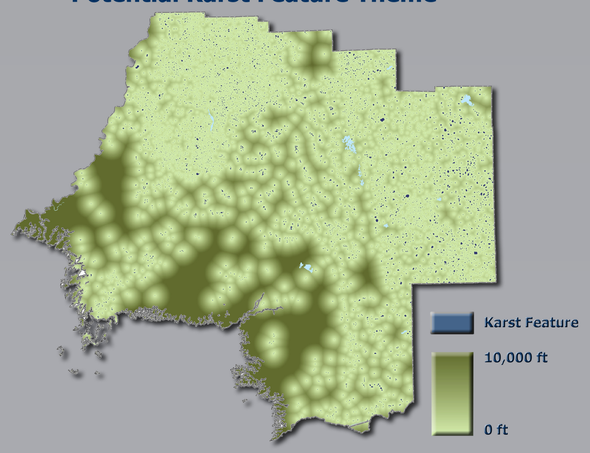
Identifying areas of Levy County where the Floridan aquifer system is more vulnerable to contamination from activities at land surface is a critical component of a comprehensive groundwater management program. Protection of the Floridan aquifer system is an important measure to take in helping ensure viable, fresh water is available from the Floridan aquifer system for continued future use in the Levy County study area. Aquifer vulnerability modeling allows for a pro-active approach to protection of aquifer systems, which can save significant time and increase the value of protection efforts. Maps of three types of data were used to determine aquifer vulnerability in Levy County; soil pedality, karst features and recharge potential. Maps explaining these data are displayed below.

Soil Pedality Theme



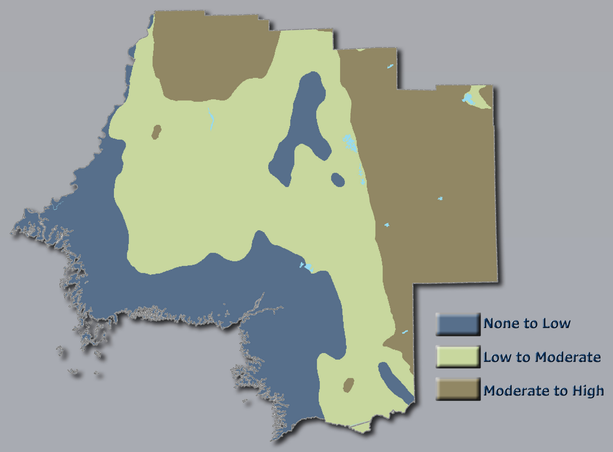
Soil pedality is a relatively new concept used to estimate how water moves through soil (Lin et al. 1999). The rate that water moves through soil is a critical component of any aquifer vulnerability analysis, as soil is an aquifer system's first line of defense against potential contamination. Soil pedality values, which are calculated based on soil type, soil grade, and soil structure, are unitless, and higher values correspond to higher flow rates and therefore higher aquifer vulnerability. In 2006, Levy County soils data were redesigned for the study area by the Natural Resources Conservation Service. As a result, more detailed information is available for soils analysis for the LCAVA project than during previous projects.

Potential Karst Feature Theme



Karst features, or sinkholes and depressions, can provide preferential pathways for movement of surface water into the underlying Floridan aquifer system and increase an area's aquifer vulnerability where present. The closer an area is to a karst feature, the more vulnerable it may be considered. Karst features tend to be generally circular in nature (in contrast to non-karstic depressional features which may not be circular) and can be identified and extracted from a digital elevation model based on this characteristic. These resulting potential karst features can be buffered into zones as shown here to allow for a relative distance analysis.

Recharge Potential Theme



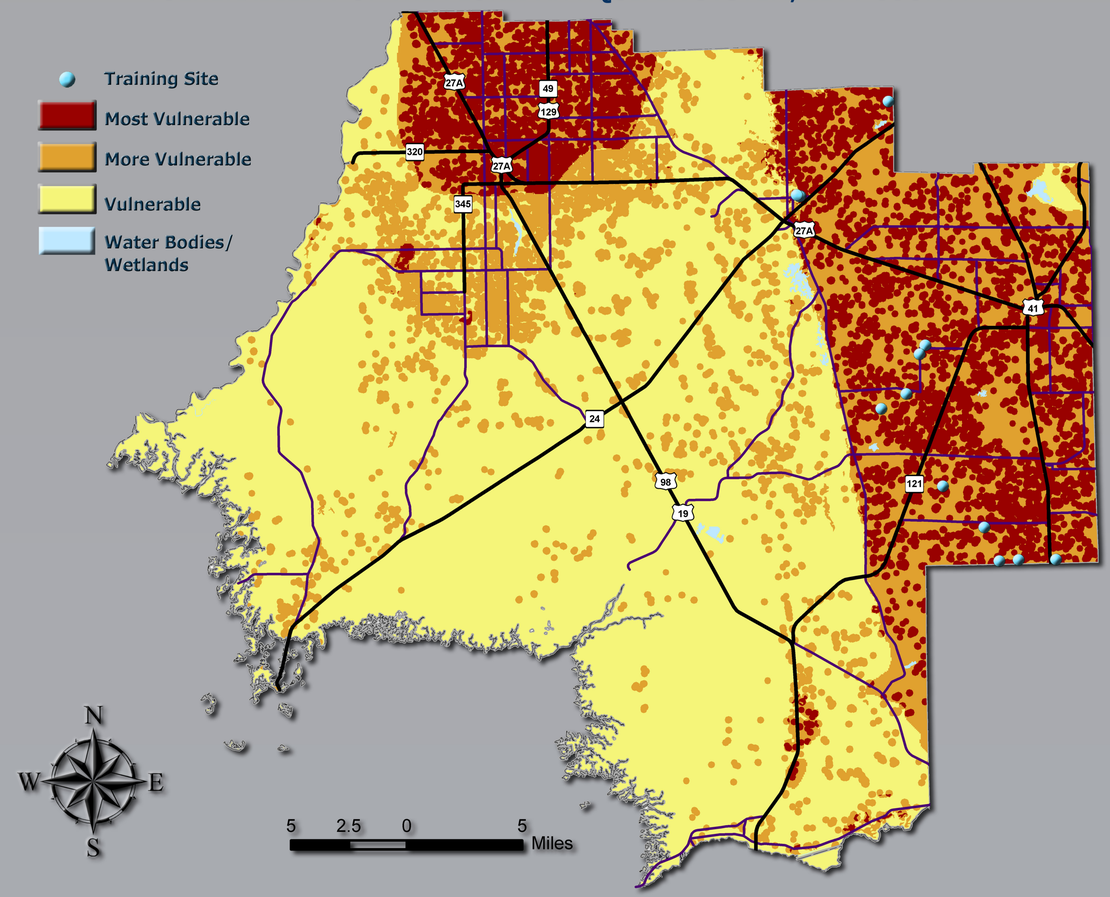
In Copeland et al. (1991), the area of the Brooksville Ridge in central Florida is defined as having higher recharge potential than adjacent areas. The Brooksville Ridge is chiefly composed of undifferentiated Hawthorn Group sediments which are poorly to moderately consolidated clayey sands and silty clays (Scott et al., 2001). In the study area, these sediments are estimated to exceed 100 feet in thickness. In other areas of Florida, Hawthorn Group sediments forming the Intermediate Confining Unit normally provide an effective confining or semi-confining unit for the underlying FAS. In Levy County, however, these sediments are generally highly weathered, leaky, thin and intensely breached by karst features. These factors combine to increase the recharge potential to the FAS in the study area where these sediments are present. Where recharge potential is high, aquifer vulnerability is increased.

APPROACH TO MODEL DEVELOPMENT

The primary purpose of the Levy County Aquifer Vulnerability Assessment, or LCAVA, is to provide a science-based, water-resource management tool that can be used to help minimize adverse impacts on groundwater quality, including focused protection of sensitive areas such as springsheds and groundwater recharge areas. The modeling process used for the LCAVA project is "weights of evidence," and is based in a geographic information system (GIS). The approach used in the project is a modification of the technique used in Phase I of the Florida Aquifer Vulnerability Assessment project (Arthur et al., 2007). One of the main benefits of applying this technique to the LCAVA project is that it is data-driven, rather than expert-driven, and model output is dependent upon a training site dataset, which produces a self-validated model output. For LCAVA, training sites are groundwater wells with water quality indicative of a good connection between the aquifer and land surface, or simply, aquifer vulnerability.

Model generation is accomplished by associating training site locations with data layers representing natural conditions which control aquifer vulnerability. Data layers used for the LCAVA project are described on the lower left side of this poster and include karst features, soil pedality, and recharge potential. The model helps determine which areas of each data layer share a greater association with aquifer vulnerability based on the location of the training sites, and then combine them in a map as shown here. The model results are an estimate of the natural vulnerability of the aquifer system; land use types and human activities are not used as input. The LCAVA model output map indicates that the areas of highest vulnerability are associated with dense karst-feature distribution, higher soil pedality values and areas having a higher recharge potential.

VULNERABILITY OF THE FLORIDAN AQUIFER SYSTEM, LEVY COUNTY



REFERENCES

Arthur, J.D., Wood, H.A.R., Baker, A.E., Cichon, J.R., and Raines, G.L., 2007, Development and Implementation of a Bayesian-based Aquifer Vulnerability Assessment in Florida: Natural Resources Research Journal, v.16, no.2, p93-107.

Copeland, R., Scott, T.M., Lloyd, J.M., 1991, Florida's Ground Water Quality Monitoring Program: Hydrogeological Framework: Florida Geological Survey Special Publication No. 32, 97 p.

Lin, H.S., McInnes, K.J., Wilding, L.P., and Hallmark, C.T., 1999, Effect of Soil Morphology on Hydraulic Properties: I. Quantification of Soil Morphology, Soil Science Society of America Journal, v. 63, p. 948-954.

Scott, T.M., Campbell, K.M., Rupert, F.R., Arthur, J.D., Missimer, T.M., Lloyd, J.M., Yon, J.W., Duncan, J.G., 2001, Geologic Map of the State of Florida: Florida Geological Survey Map Series 146, Scale 1:750,000, 1 sheet.

Southwest Florida Water Management District, 2006, 2003 (Revised) and 2004 Estimated Water Use Reports: Southwest Florida Water Management District, 471 p.

United States Census Bureau: American Factfinder State and County Quick Facts, 14-Feb-2007, 13:08 EST: http://factfinder.census.gov/. Source: U.S. Census Bureau, Census 2000, Census 1990. United States Department of Agriculture, Natural Resources Conservation Service, 2005, National Soil Survey Handbook, title 430-VI. [Online] Available: http://soils.usda.gov/technical/handbook/.

Qualifications:
Phase II of the Florida Aquifer Vulnerability Assessment project, which includes preparation of this poster, was funded in part by a Section 106 Water Pollution Control Program grant from the U.S. Environmental Protection Agency (US EPA) through a contract with the Florida Department of Environmental Protection/Florida Geological Survey (FDEP/FGS). The total cost of Phase II of the FAVA project was $234,899, of which 11% was provided by the US EPA. The FAVA maps were developed by the FDEP/FGS or its contractor to carry out agency responsibilities related to management, protection, and responsible development of Florida's natural resources. Although efforts have been made to make the information in these maps accurate and useful, the FDEP/FGS assumes no responsibility for errors in the information and does not guarantee that the data are free from errors or inaccuracies. Similarly FDEP/FGS assumes no responsibility for the consequences of inappropriate uses or interpretations of the data on these maps. As such, these maps are distributed on an "as is" basis and the user assumes all risk as to their quality, the results obtained from their use, and the performance of the data. FDEP/FGS further makes no warranties, either expressed or implied as to any other matter whatsoever, including, without limitation, the condition of the product, or its suitability for any particular purpose. The burden for determining suitability for use lies entirely with the user. In no event shall the FDEP/FGS or its employees have any liability whatsoever for payment of any consequential, incidental, indirect, special, or tort damages of any kind, including, but not limited to, any loss of profits arising out of use of or reliance on the maps or support by FDEP/FGS. FDEP/FGS bears no responsibility to inform users of any changes made to this data. Anyone using this data is advised that resolution implied by the data may far exceed actual accuracy and precision. Comments on this data are invited and FDEP/FGS would appreciate that documented errors be brought to the attention of FDEP/FGS staff. Because part of this data was developed and collected with U.S. Government and/or State of Florida funding, no proprietary rights may be attached to it in whole or in part, nor may it be sold to the U.S. Government or the Florida State Government as part of any procurement of products or services.

This poster is developed as part of Florida Aquifer Vulnerability Assessment (FAVA) Phase II for the Florida Department of Environmental Protection/Florida Geological Survey per FDEP/FGS Contract No. RM059. Version 1.5: July 10, 2008. The vulnerability map accompanies "The Levy County Aquifer Vulnerability Assessment Report" prepared by Alan E. Baker, P.G. 2324, Alex R. Wood, and James R. Cichon of Advanced GeoSpatial Inc.;
FAVA Phase II project managers are Allan Stodghill, P.G. (FDEP), Division of Water Resource Mangement and Rick Copelenad, Ph.D., P.G., FDEP/FGS.