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April 19, 2007

Ms. Kristen Andersen, Senior Planner
Tallahassee-Leon County Planning Department
300 S. Adams Street
Tallahassee, FL 32301

RE: Leon County Aquifer Vulnerability Assessment Progress Report #2: BC-06-21-06-53

Dear Ms. Andersen:

We are pleased to present you with the second progress report for the LAVA project detailing work we have completed during the second and third month of the project. An invoice for work completed to date is attached. GIS-compatible digital files representing deliverables due at this time are available for download at http://adgeo.net/lava.php. Please call if you have any questions.

Best regards,

Alex Wood, President
Advanced GeoSpatial Inc.

AW/aw

attachments

LEON COUNTY AQUIFER VULNERABILITY ASSESSMENT PROJECT
PROGRESS REPORT #2 – APRIL 19, 2007

As agreed upon between Leon County and Advanced GeoSpatial Inc., AGI will provide progress reports along with invoices and deliverables every month throughout the six-month project period. Each report is intended to detail the progress and metrics of the LAVA project. No report was submitted during the second month (March 19) because AGI discovered additional potentially usable data for use in development of model input. This second report details work completed between February 19 and April 19 per contract timeline. Work includes data development for the second and third months, and the second required project meeting. All deliverables are in ArcGIS file format and are posted at http://adgeo.net/lava.php for download.

Meetings

On April 12, 2007, AGI held the second advisory committee meeting at the City of Tallahassee Water Quality office. The following topics were discussed:

- Training Points Theme Development
    - Data Sources
    - Statistical Analysis
    - Nitrogen Fate and Source
- Presentation of Evidential Theme Development and TAC Feedback
    - Confinement - Overburden and Intermediate Confining Unit
        - Data Sources
        - Methodology
        - Surface Prediction/Validation
    - From Topography to Karst Features – Refinement Filters and Methods
    - Soil Hydraulic Conductivity
        - Lowest Reported Value
        - Sum of Weighted Average
    - Other Themes Considered
        - Soil Pedality (Structure)
        - Hydraulic Head Difference

A PowerPoint presentation and meeting agenda are available to view or download at http://adgeo.net/lava.php that cover the topics discussed at the meeting. The advisory committee provided feedback and suggestions on project direction.

Soil Hydraulic Conductivity and Soil Pedality Themes

Two parameters of soils are under evaluation for input into the LAVA model: *soil hydraulic conductivity*, which is the "amount of water that would move vertically through a unit area of saturated soil in unit time under unit hydraulic gradient" (USDA 2005); and *soil pedality*, which is analogous to soil structure defined as "the arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular" (Lin et al., 1999). Soil pedality is a combination of soil type, soil grade, and soil pedon size and is a relatively new concept used to estimate the hydrologic parameter of soil.

In 2006, the Leon County soils data was redesigned for the entire county. As a result, more detailed information is available for analysis for the LAVA project than during previous projects (e.g., Arthur et al., 2005). To determine the best representation of soil hydraulic conductivity and pedality in the aquifer vulnerability assessment, numerous data coverages were generated and are under evaluation for model input.

Multiple empirical values may be reported for any given soil column underlying a particular soil polygon, and multiple columns may be reported for each polygon. From this data, a number of datasets were generated to test in model sensitivity: for soil hydraulic conductivity one each representing average, minimum, and maximum hydraulic conductivity; and for soil pedality, one each representing average, minimum, and maximum pedality. These coverages are displayed below in Figures 1-6. This task is 100% complete.

Aquifer Confinement

Per the contract document, AGI was scheduled to deliver GIS files representing both the thickness of Intermediate Confining Unit (ICU) and the thickness of overburden on the Floridan Aquifer System (FAS) on March 19. Prior to the March 19 progress report deadline, AGI discovered additional potential well log data sources at the Northwest Florida Water Management District (NWFWMD) which existed in paper format only. AGI and the Client agreed that incorporation of this data could have significant benefit to the project, and as a result neither report nor invoice for this work was submitted on the March 19 while AGI converted this data into a usable GIS format. This work has since been completed and is detailed in this monthly progress report.

Results of past aquifer vulnerability projects have shown that aquifer confinement either in the form of overburden overlying the FAS, or the ICU is typically the most critical layer in determining aquifer vulnerability. Development of GIS files representing these units was approached by collecting as many data points as possible which contained information about the hydrostratigraphic surfaces to be modeled. Data sources included: the Florida Geological Survey well logs database, the Florida Aquifer Vulnerability Assessment project, the NWFWMD paper log data set, and the U.S. Geological Survey report (Open-File Report 88-86). Data points were analyzed for utility in the model and were eliminated if significant location or description errors could not be resolved.

The final point dataset is displayed in Figure 7 and was used to predict two hydrostratigraphic surfaces: the surface of the FAS (Figure 8) and the surface of the ICU (Figure 9). Ordinary kriging was selected as the surface prediction method because of its flexibility and data exploration options. A sensitivity analysis was completed to determine the best modeling protocol for creating surfaces. These surfaces were combined with Leon County LIDAR data to resolve areas where the prediction technique estimated surface elevation values above land surface. Resulting surfaces were then used to calculate thickness of the ICU (Figure 10) and thickness of sediment overlying the FAS (Figure 11). Model testing will reveal which of these two input themes will best represent aquifer confinement in the final model analysis; they will not both be included in the final model. This task is 100% complete.

Karst Features Theme

As indicated in the scope of work, Leon County is developing the evidential theme representing karst features in the study area. LIDAR data was processed to identify closed topographic depressions from the county's 20-ft LIDAR raster-format dataset. A number of filters and analytical processes were applied to this dataset to estimate which features best represent true karst features. Jay Johnson of Public Works is completing this task and may be contacted at 606-1529 or by email at JohnsonJa@leoncountyfl.gov. This task is 100% complete.

Other evidential themes under consideration

As mentioned above, coverages representing soil pedality have been developed for testing in the final model. Other themes evaluated for input include hydraulic head difference and aquifer recharge. The area's hydraulic head difference (FAS potentiometric surface – water table level) was initially considered as input for the model. Upon further consideration, this layer will not be implemented for two main reasons: (1) in a large part of the study area, there is a single aquifer system (FAS) and therefore no hydraulic head difference exists (i.e., equal to zero). The overwhelming number of raster cell values with zero values in these areas has the tendency to bias the statistical analysis for this layer, and (2) any dataset representing potentiometric levels/water table surface is merely a snapshot in time which will not reflect various seasonal fluctuations.

Research revealed that there is currently no recharge map available for the Leon County area and it is beyond scope of this project to develop an aquifer recharge map. Further, in other models, sensitivity analysis and preliminary modeling typically preclude the use of aquifer recharge maps in the weights of evidence analysis due to conditional independence issues.

Remaining tasks

The third and final advisory committee meeting is tentatively scheduled for June 14, 2007. Delivery of the next scheduled progress report, invoice, and deliverables is scheduled for May 19, 2007 and will detail results of preliminary modeling and sensitivity analysis. Overall, the project is on schedule and is scheduled to end on July 19, 2007. For reference, the task schedule as in the scope of work is included on the next page.

References

Arthur, J.D., Baker, A.E., Cichon, J.R., Wood, H.A.R., and Rudin, A., 2005, Florida Aquifer Vulnerability Assessment (FAVA): Contamination potential of Florida's principal aquifer systems: Report submitted to Division of Water Resource Management, Florida Department of Environmental Protection, 148 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, *in* Soil Sci. Soc. American Journal 63:948-954.

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/.

Table 1. Task schedule for the LAVA project.

Month 1: January 19 – February 19	***Percent Complete***	
Project Kickoff Meeting	100	
LAVA Scientific Advisory Committee Meeting #1	100	
LiDAR implementation and conversion	100	
Training Point Theme and Statistical Analyses	100	
Invoice amount	$	7,871
Month 2: February 19 – March 19		
Intermediate Aquifer System/Overburden Thickness Theme	100	
Invoice amount	$	9,850
Month 3: March 19 – April 19		
LAVA Scientific Advisory Committee Meeting #2	100	
Other Evidential Themes under Consideration and Testing	100	
Soil Permeability Theme	100	
Karst Features Theme (to be completed by Client)	100	
Invoice amount	$	7,963
Month 4: April 19 – May 19		
Preliminary Modeling/Sensitivity Analysis	100	
Invoice amount	$	12,428
Month 5: May 19 – June 19		
Final Modeling	100	
Board of County Commissioners Meeting		
Invoice amount	$	13,347
Month 6: June 19 – July 19		
Model Validation	100	
Map and Report Development	100	
LAVA Scientific Advisory Committee Meeting #3	100	
QA/QC of input data and model output	100	
Project Results Presentation and Meeting	100	
Training Session #1 and 2[1]	100	
Invoice amount	$	21,541
	$	73,000

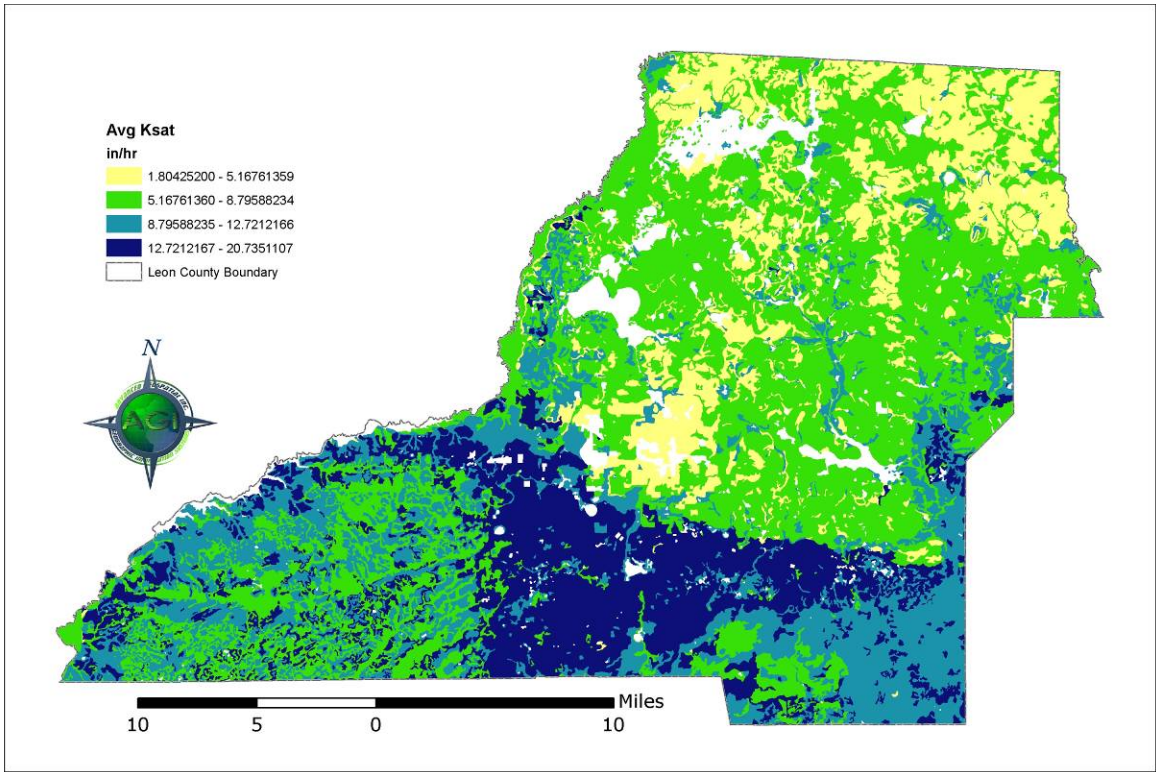

Figure 1. Average hydraulic conductivity values of sum of harmonic weighted averages for each soil polygon.

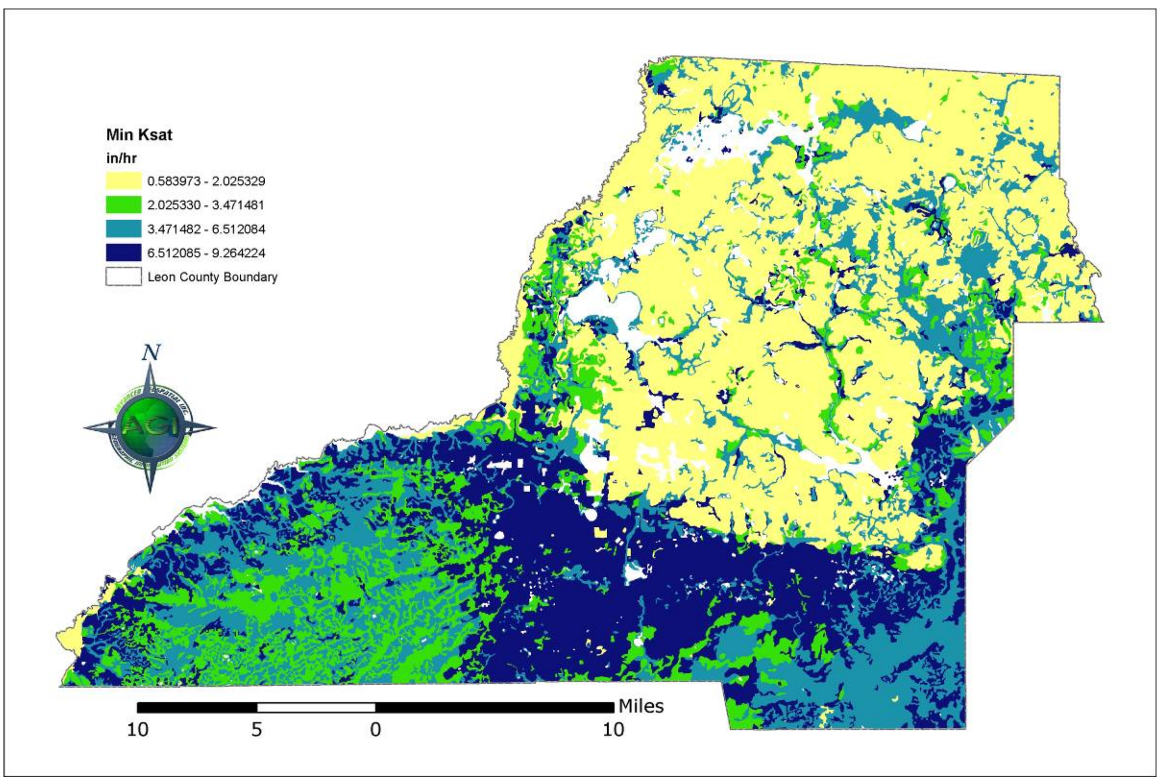

Figure 2. Minimum hydraulic conductivity values of sum of harmonic weighted averages for each soil polygon.

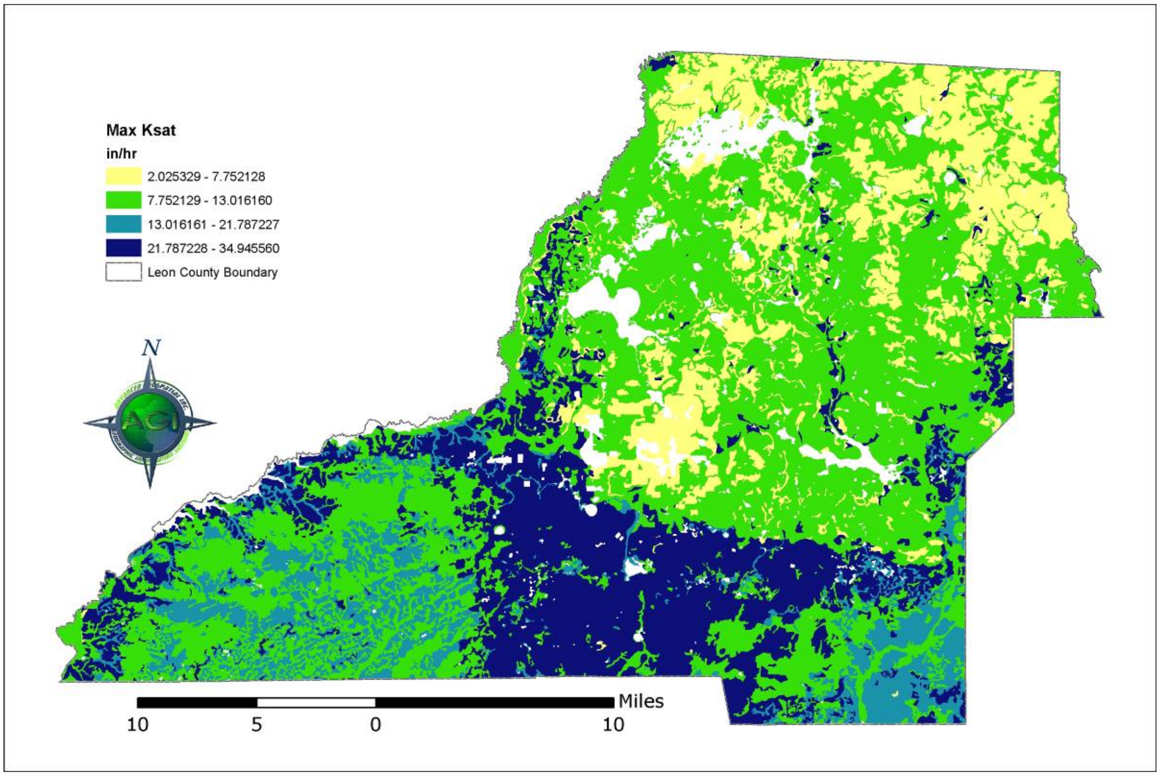

Figure 3. Maximum hydraulic conductivity values of sum of harmonic weighted averages for each soil polygon.

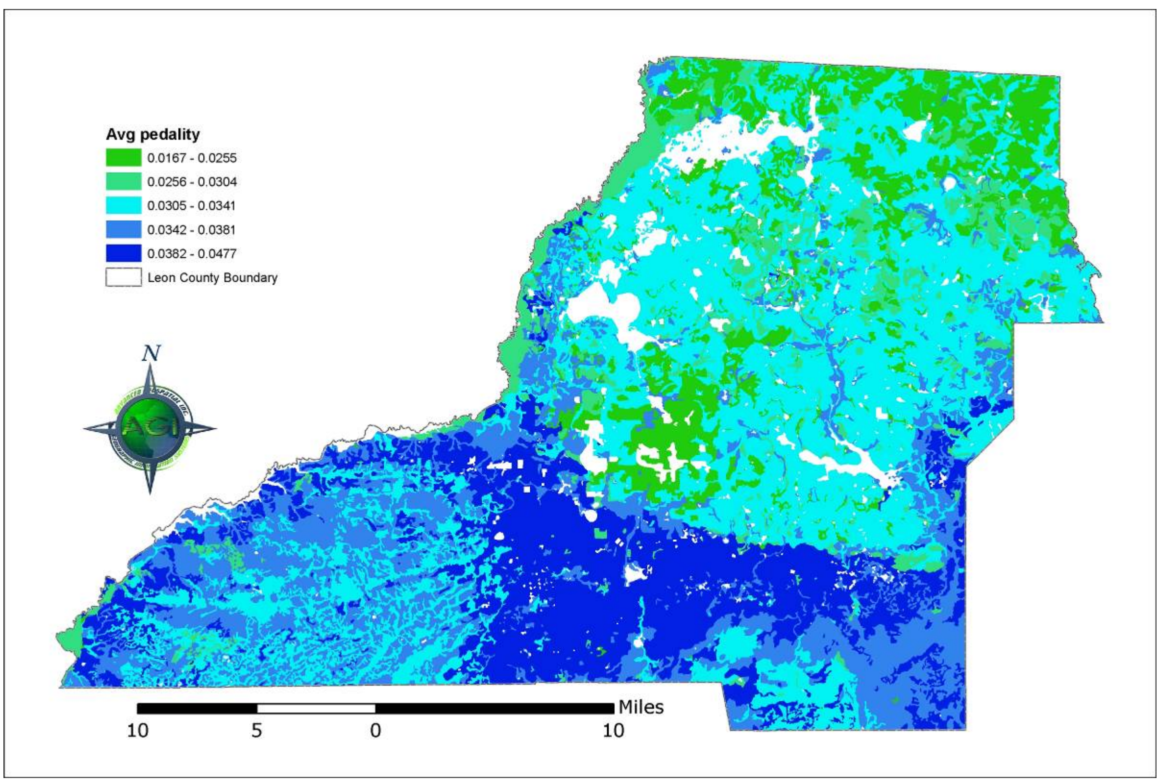

Figure 4. Average soil pedality values (unitless) of sum of harmonic weighted averages for each soil polygon.

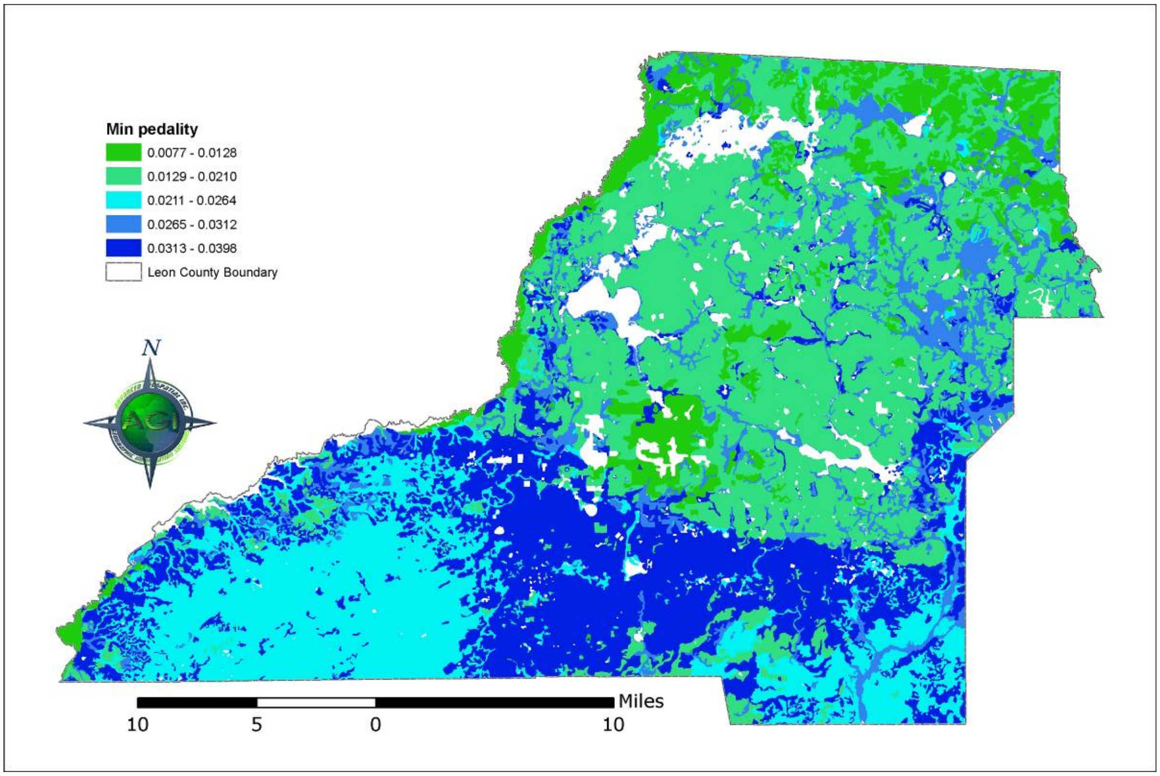

Figure 5. Minimum soil pedality values (unitless) of sum of harmonic weighted averages for each soil polygon.

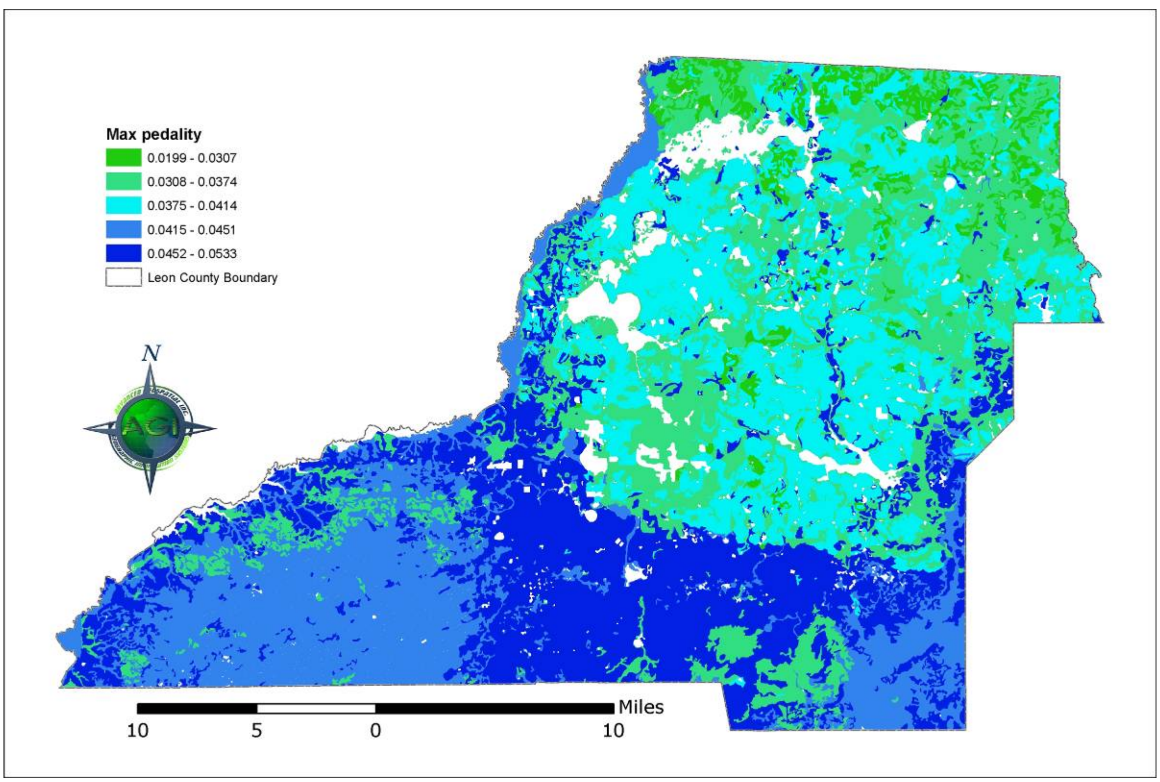

Figure 6. Maximum soil pedality values (unitless) of sum of harmonic weighted averages for each soil polygon.

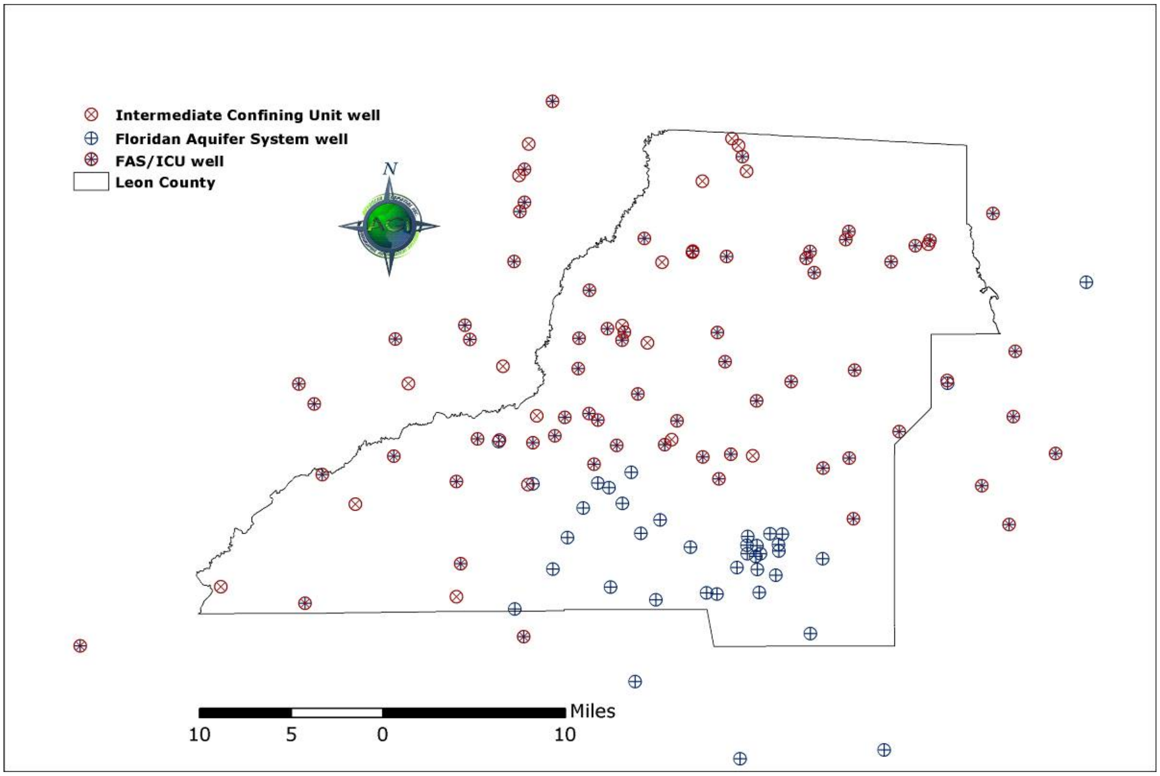

Figure 7. Location of data points (boreholes, cuttings samples, and well logs) used to characterize hydrostratigraphic surfaces and ultimately thickness of aquifer confinement.

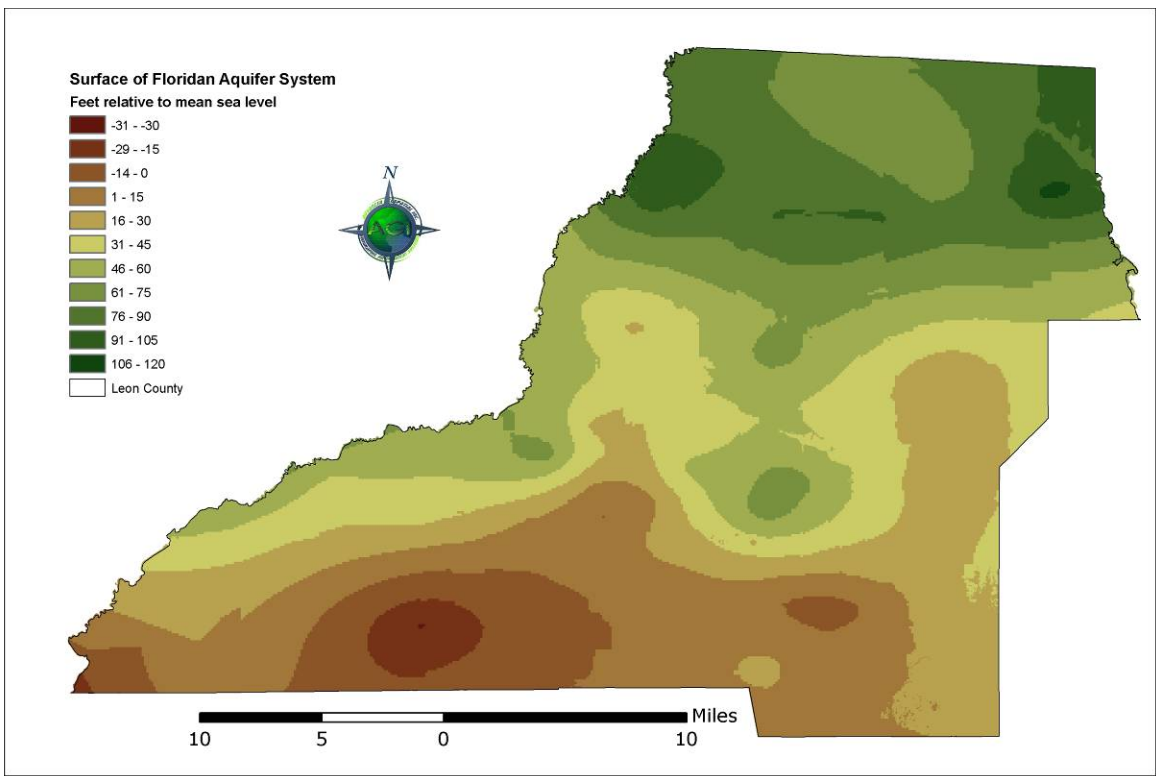

Figure 8. Surface of the Floridan Aquifer System in feet relative to mean sea level predicted using Ordinary Kriging.

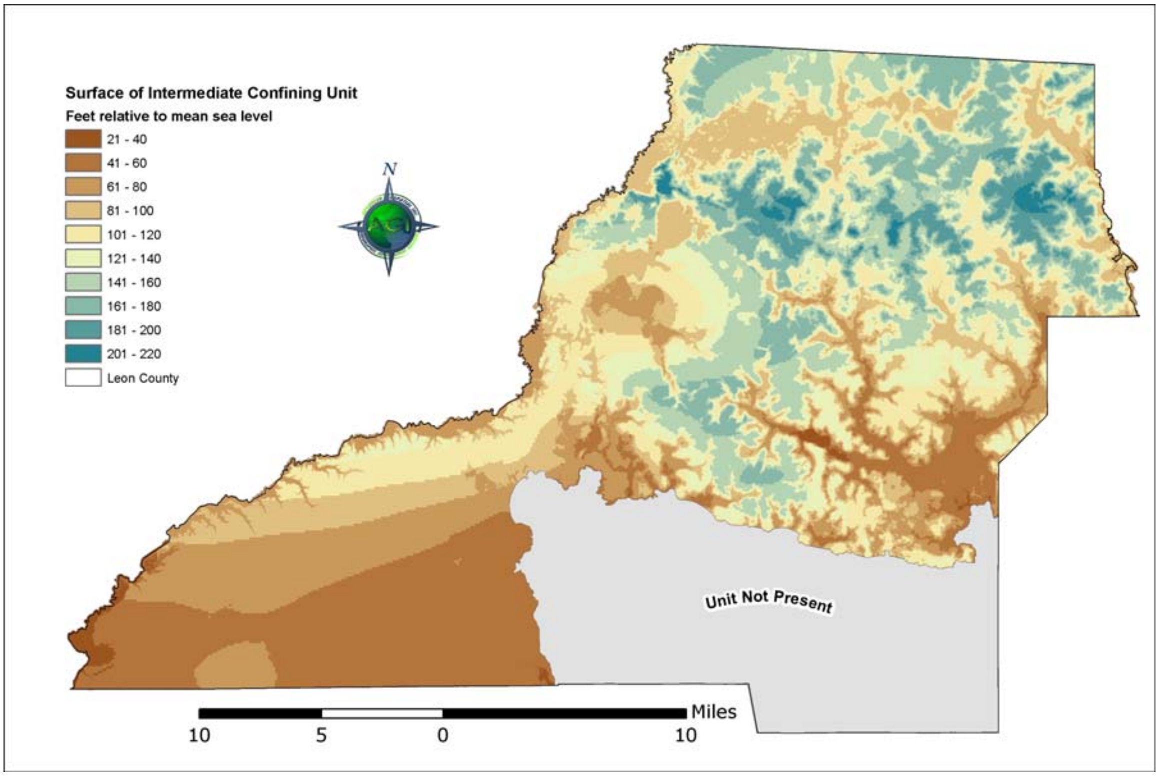

Figure 9. Surface of the Intermediate Confining Unit in feet relative to mean sea level predicted using Ordinary Kriging.

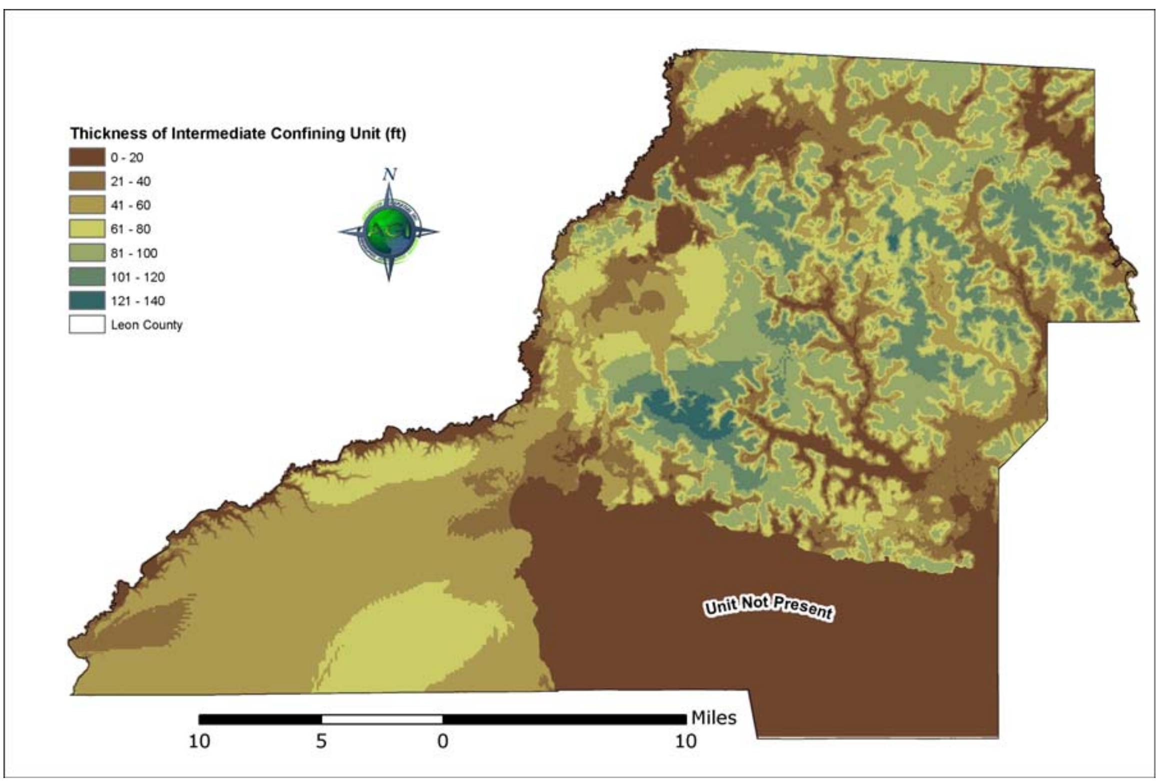

Figure 10. Thickness of the Intermediate Confining Unit in feet calculated by subtracting surface of ICU from surface of FAS.

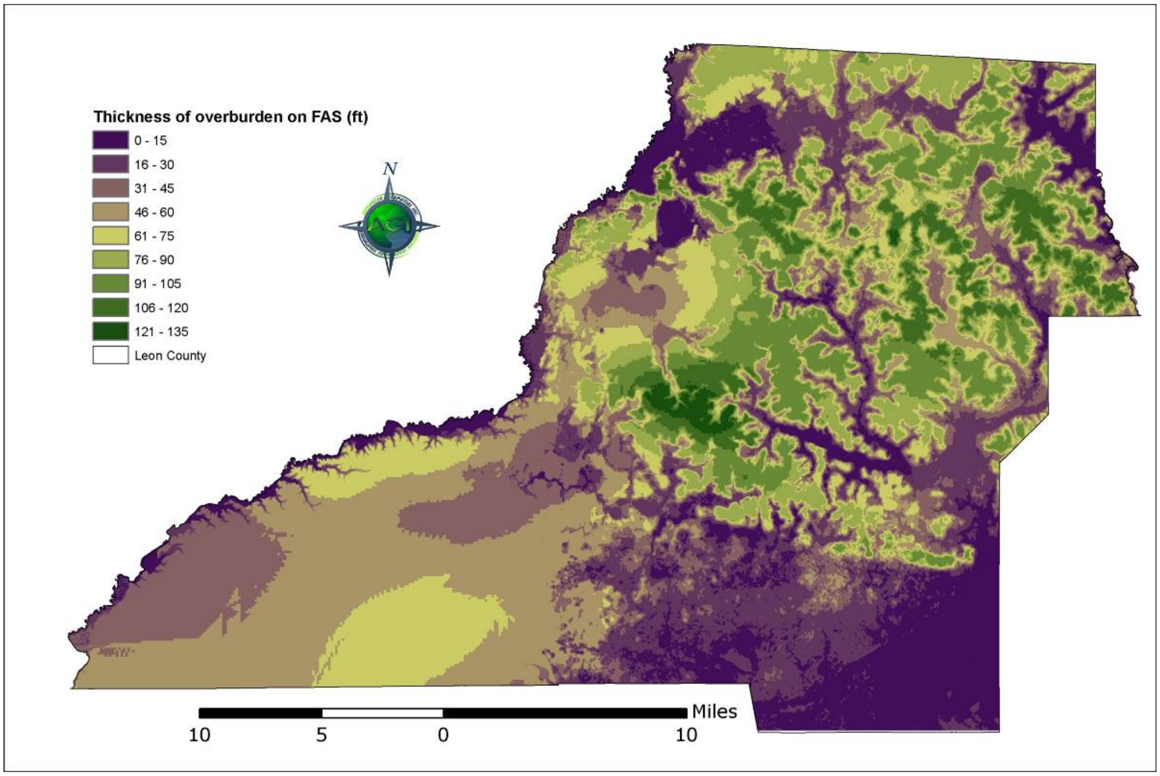

Figure 11. Thickness of overburden overlying the FAS in feet calculated by subtracting digital elevation data (LIDAR) from the surface of FAS.