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January 26, 2007

Ms. Gail L. Mowry, P.E.
Clean Water Engineer
Marion County Transportation Department
412 SE 25th Avenue
Ocala, FL 34471

RE: Marion County Aquifer Vulnerability Assessment, Progress Report #3

Dear Ms. Mowry:

We are pleased to present you with the third progress report for the MCAVA project detailing work we have completed during the previous seven-week project period. An invoice for work completed to date is also attached. Please call if you have any questions.

Best regards,

Alex Wood, President
Advanced GeoSpatial Inc.

AW/aw

attachments

MARION COUNTY AQUIFER VULNERABILITY ASSESSMENT PROJECT PROGRESS REPORT #3 – WEEK 21 (JANUARY 25-31)

As agreed upon between Marion County and Advanced GeoSpatial Inc., AGI will provide progress reports along with invoices at four intervals throughout the 27-week project period. Each report will be submitted to Marion County approximately every seven weeks, will detail the progress and metrics of the MCAVA project and accompany each invoice. This third report details the final 25% of the sensitivity/test modeling task, the weights of evidence modeling results and preliminary model validation.

Preliminary Sensitivity Analysis/Test Modeling

Karst features were analyzed and tested during the last seven week period. An additional, potentially usable data layer representing recharge from 1993 was also obtained and analyzed since the last progress report. This task is now 100% complete.

Karst features

As described in the previous report, closed topographic depressions were submitted to intensive shape and size analysis to extract what is known as an 'effective karst' layer. Two effective karst layers were analyzed for input into the model; one which was filtered using overburden on the Floridan Aquifer System, and another without application of this filter.

Karst features with the FAS overburden filter applied were tested for use in the model. The features were buffered into 25-ft zones to allow for a proximity analysis. Test modeling indicates that areas within 4,225 ft of a karst feature are more associated with the training points, and are associated with higher aquifer vulnerability. Conversely, areas greater than 4,225 ft from a karst feature are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 1.

Karst features with no FAS overburden filter applied were also tested for use in the model. The features were then buffered into 25 ft zones to allow for a proximity analysis as above. Test modeling indicates that areas within 1,375 ft of a karst feature are more associated with the training points, and are associated with higher aquifer vulnerability. Conversely, areas greater than 1,375 ft from a karst feature are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 2.

Aquifer Recharge

Recharge data for the c. 1993 layer was developed by SJRWMD for Marion County and published as "SJ93-5 Mapping Recharge to the Floridan Aquifer using Geographic Information Systems" (Boniol et al., 1993). Sensitivity analysis and test modeling for the 1993 recharge layer indicates that areas receiving 12 or more inches per year (in/yr) of recharge are more associated with training points, and therefore associated with higher aquifer vulnerability. Conversely, areas receiving less than 12 in/yr recharge are less associated with training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 3.

Final Modeling

Evidential themes representing soil permeability, aquifer recharge (both c. 1993 and 2002 datasets), thickness of Floridan Aquifer System overburden, thickness of the Intermediate Confining Unit, and two versions of effective karst features (as described above) were combined into models to develop various response themes for generation of a final model. This task is approximately 90% complete.

Aquifer recharge 2002 and c. 1993 data layers

Aquifer recharge data from 2002 was used in the vulnerability model with limited success. Two main factors have led to this layer's omission from further modeling. The primary disadvantage in using this layer is the coarseness of data compared to other evidential themes in the model. Another major factor contributing to the decision is an area of conflicting data in western Marion County. In this area, the Intermediate Confining Unit is represented by the southern edge of the Brooksville Ridge, a low permeability package of reworked Hawthorn Group sediments. The 2002 recharge layer contains a zone of lower recharge in this area, which is assumed to represent the sediments of the southern tip of the Ridge. However, the specific location of the polygon of lower recharge values conflicts with the location of the Ridge itself indicating that the polygon is potentially inaccurately located. This area of data conflict is highlighted in Figure 4 below.

The c. 1993 recharge evidential theme has yet to be included in the final modeling. This task represents the remaining 10% of effort to complete the final modeling phase.

Intermediate Confining Unit/Overburden on the Floridan Aquifer System

Models were developed using either the Intermediate Confining Unit or the overburden on the Floridan Aquifer System. Weights calculated for the Intermediate Confining Unit were stronger predictors of vulnerability (i.e., had higher absolute value) than weights calculated using overburden thickness. As a result, the Intermediate Confining Unit was chosen as the better controller of aquifer vulnerability because it shares the strongest association with training points.

Karst Features

This layer was used as input into the aquifer vulnerability model in two versions: one in which thickness of overburden separating features from the FAS were filtered, and one in which thickness overburden was not used as a filter. Input of the latter data layer produced more defensible results (i.e., conditional independence value of 0.91, which is within an acceptable range of 1.00±0.15 – for further reference on conditional independence, please access the FAVA report from FDEP's website).

Response Theme

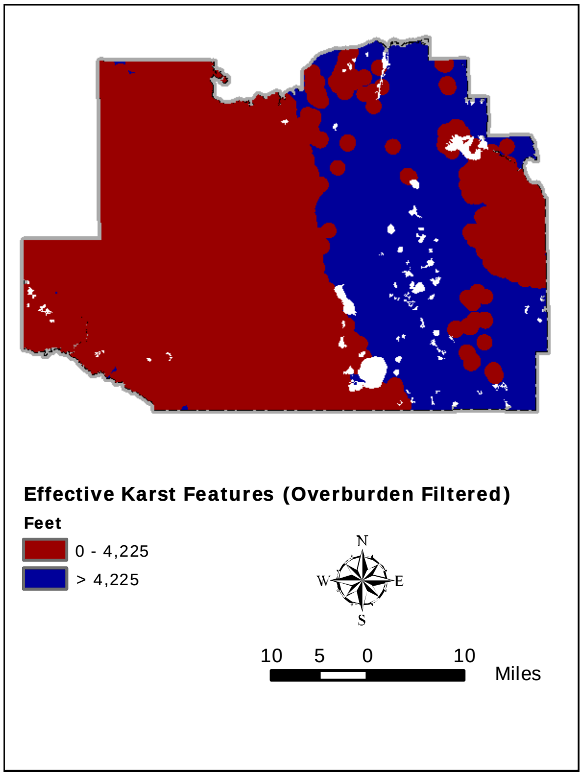
Results of the modeling phase have allowed statistical determination of the most appropriate inputs for generation of final vulnerability response themes, or model output. Combining evidential themes representing soil permeability, Intermediate Confining Unit thickness, and effective karst features (not filtered by overburden) using the weights of evidence technique results in generation of a response theme, or relative aquifer vulnerability map across the study area (Figure 5). It should be noted that though the final modeling phase is 90% complete, the response theme displayed below should be considered 'draft' form until the model validation has been completed and the final project report is complete.

Model Validation

Model validation was initiated to test the strength and confidence of the final MCAVA model results. Validation completed to date includes development of a supplementary training point dataset based on dissolved nitrogen (Figure 6) and comparison of dissolved oxygen well data against posterior probability values (model output) shown in Figure 7. The dissolved nitrogen dataset will be used to complete a separate response theme for comparison of the primary response theme. This phase is approximately 20% complete.

Overall, the MCAVA project is on schedule. The final report will serve as fourth progress report and is due on March 15, 2007, at project termination. The final report will be submitted in draft form to the TAC for review and comment during the final TAC meeting, on February 27, 2007.

1.



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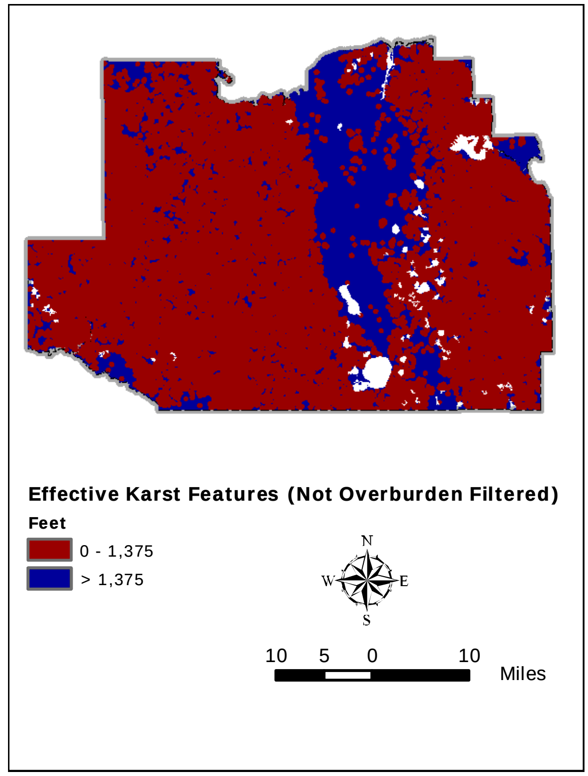

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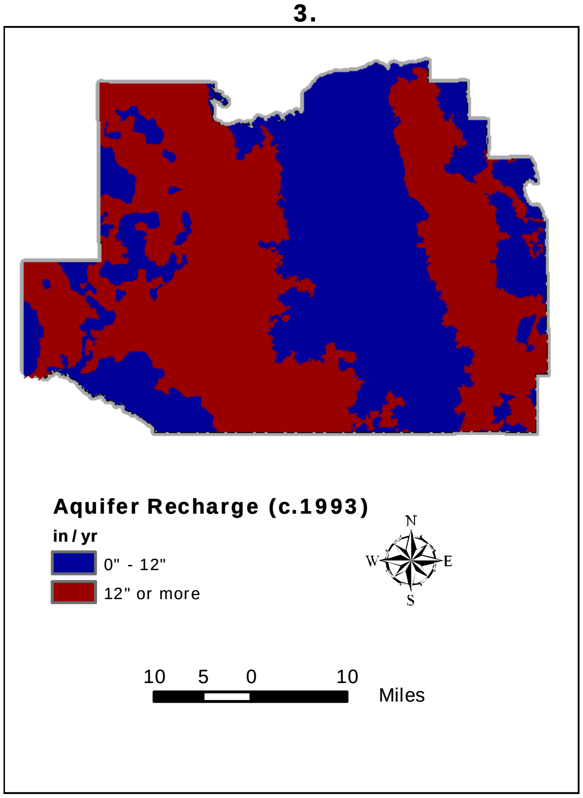

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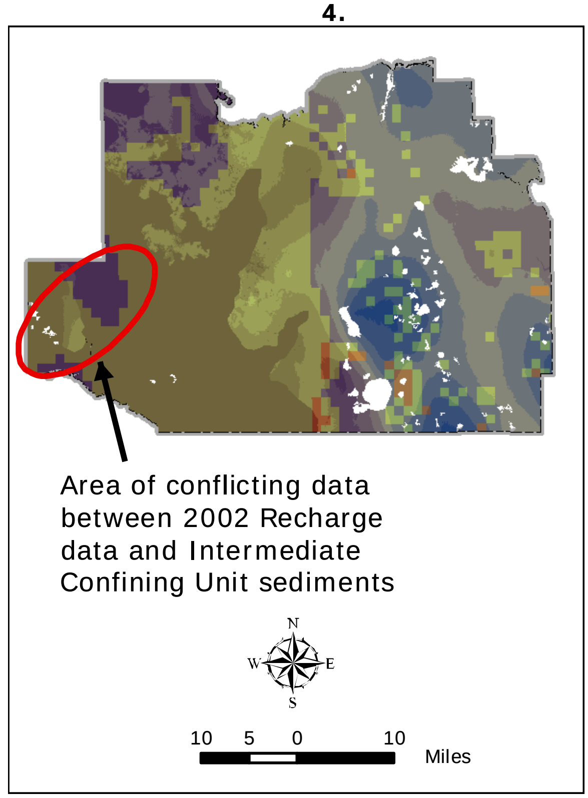
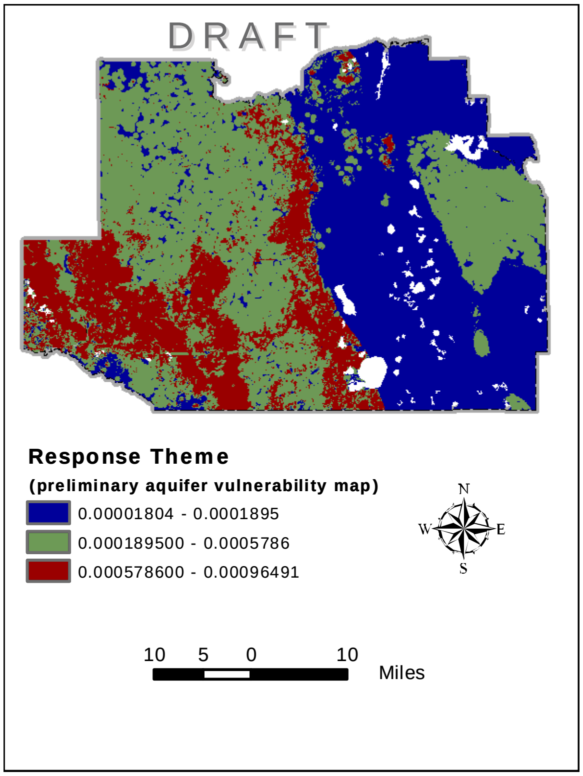


Figure 1. Generalized karst evidential theme (overburden filtered). | Figure 2. Generalized karst evidential theme (not filtered). | Figure 3. Generalized aquifer recharge (c. 1993 data) evidential theme. | Figure 4. Resulting from data coarseness and conflicting area in western Marion, recharge (2002) layer was omitted.

5.



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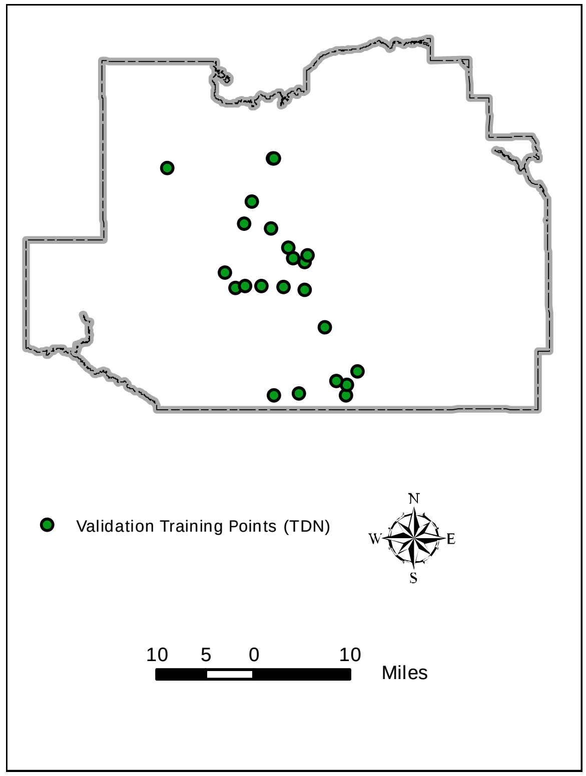

Figure 5. Relative aquifer vulnerability model results based on dissolved oxygen concentrations. | Figure 6. Location of training points for dissolved nitrogen to be used for validation of model results.

7.

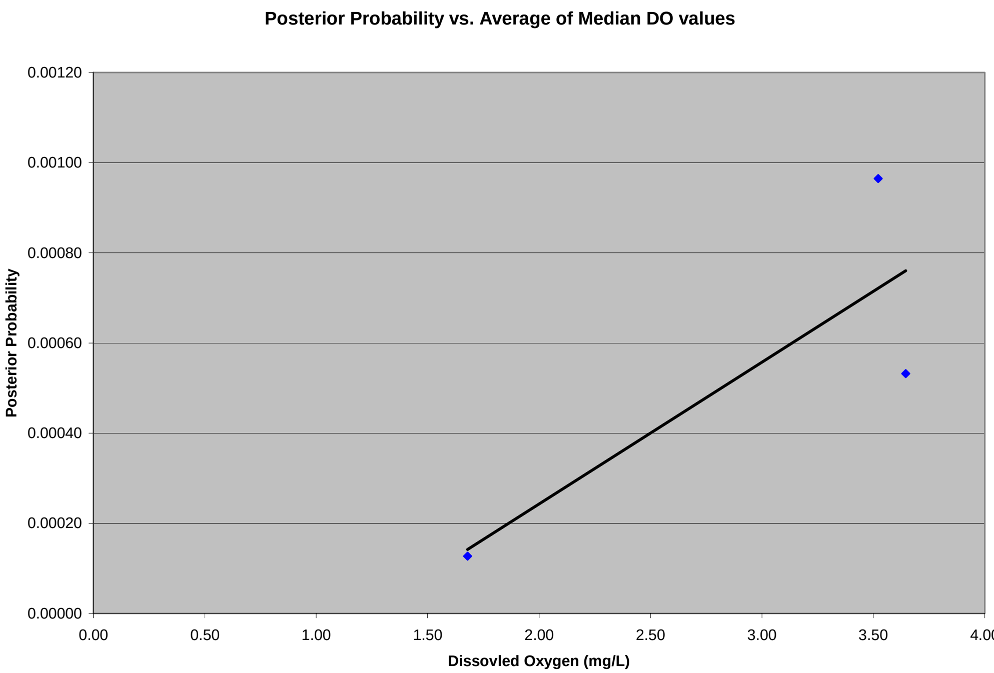

Figure 7. Comparison of training point values to posterior probability values of the response theme.