Florida Department of Health
Onsite Nitrogen Reduction Strategies Study

Contract CORCL

Task D.5
Draft QAPP Recommendation for Process Forward Meeting
July 13, 2010
11:00 a.m.
Teleconference

MINUTES

Attendees:	Kathryn Lowe	CSM
	Dr. John McCray	CSM
	Damann Anderson	Hazen and Sawyer
	Elke Ursin	FDOH
	Dr. Eberhard Roeder	FDOH
	Gerald Briggs	FDOH

I. Draft Task D QAPP

The Task D Draft QAPP (Task D.4) was the focus of the call, with the objective of going through comments on the draft QAPP from FDOH and the RRAC. These comments on the draft QAPP and the response from the project team are summarized below. These revisions will be incorporated into the Final Task D QAPP (Task D.6).

II. Response to Comments

Section 1.0

1.) Page 1-1. Please review the document and consistently use "ground-water" or "groundwater" throughout.

Response: The text has been double checked for consistent use of "groundwater". Note, groundwater now only occurs as hyphenated (ground-water) for a line break.

2.) Page 1-1. General Comments from Scott Johnson. I am new to the TRAP Committee, so some of my comments may have been addressed in earlier work efforts, especially since the Nitrogen Reduction Strategy Study is a set of investigations and studies that have been ongoing for some time. While I understand the primary purpose of the QAPP is to detail the actions the contractor will take to maintain the study quality, it would be helpful to discuss in some

detail how the "sponsor", Florida Department of Health, will be included in various reviews of the many proposed activities over the five year period. I would hope a Quality Assurance Plan might briefly address timely input and reviews by the sponsor, Florida stakeholders, other review agencies, etc., that will ultimately help ensure the quality of the study (as well as the practicality, appropriateness, ease of use, etc., of the final product).

Response: Reviews are specified in the contract between the sponsor (FDOH) and the prime contractor (Hazen and Sawyer). However, a general note has been added as suggested at the end of Section 1 and in Section 2.1.

The sensitivity portion of the QAPP (Section 2.1.2) identifies groundwater velocity as a key variable. Would site slope in the area of the OWS be a potential input parameter to correlate to the model? I'm thinking ahead to model inputs that could be reasonably provided for a specific site and that are understood by technicians, Environmental Health employees and engineers.

Response: Good comment. To have confidence that the simple tools developed are accurate and representative of observed field conditions requires that we first describe the physical and chemical mechanisms. Previous work has shown the importance of groundwater velocity for enabling unique model solutions (McCray and Heatwole, 2006). Once specific site data is available, other parameters such as topography, can be evaluated for their impact on model output. Ideally, Task D will identify those parameters that are easily measured that can be used as simple surrogates by practitioners. Slope can be a factor for mounding on the groundwater table, however; for the models described here, slope is not a fundamental variable. It often mimics the hydraulic gradient for an unperturbed unconfined aquifer, but use of slope as a surrogate would be appropriate only for a first-order approximation. An OWS or other surface features (storm water features, pavement) can significantly alter the natural hydraulic gradient in the aquifer. The text has been revised to highlight the importance of simple surrogate parameters (now Section 2.1.1.2, last sentence in section).

3.) Page 1-2, Section 1.2, 2nd paragraph. Clarify – Why is "…the ability to produce output concentrations and a reasonable plume shape, and to provide information on mass flux at a downstream boundary" considered "conditions that are important in Florida". It seems these are output issues or results of modeling and are not worded as input variables or existing elements, like the other conditions sited in the sentence.

Response: This paragraph is specific to the overall project goals and the sentence questioned was intended to provide a summary of the types of model outputs that will be provided. The text has been clarified to note that the model will provide outputs for evaluation of these different conditions. In addition, the goal of determining the load per OWDTS for land planning purposes and/or for use in large-scale models has been added.

4.) Page 1-2, Section 1.2, 2nd paragraph. The literature review made excellent points about the need to identify the goals of the modeling project. This product is pretty complex and would need correspondingly a lot of input parameters. It might be useful to: a) identify the stepping stones along the way (in case funding is discontinued), and b) clarify with RRAC just what they want and preferences for different alternatives or limitations ("reasonable plume shape?") (e.g. should this be a module for a common watershed model; is this a stand-alone conceptual tool)
Response: Agreed. Not sure if this is best handled by the QAPP due to the dynamic nature of funding as well model development and evaluation... No change has been made to the text.

5.) Page 1-3, Section 1.3. I changed this to three to match the contract.

Response: Reference is now to "phases" rather than "years".

6.) Page 1-3, Section 1.3, 3rd bullet. What averaging area does this refer to? Is this explained later? What are the vertical depth assumptions?

Response: The bullet list in Section 3 was intended as a quick list to summarize the broad scope within Task D. However, the list was confusing and not easily followed related to the structure of the Task D subtasks. The list has been revised to better describe the overall approach and a figure added. The detailed wording (spatially averaged) was removed with additional detail provided in Section 2.1.1.1.

7.) Page 1-3, Section 1.3, 5th and 6th bullets. These two steps need to be incorporated into step 3, too, so that the simple soil tool reliability is established. It may be a terminology question: does development include?-Conceptual model development, -Mathematical model coding implementation, -Code Verification (mathematically correct), -model application check, -Model Calibration/sensitivity analysis, -Model Validation/verification. Above you said, it included performance evaluation, i.e. at least calibration

Response: Good comment. The bullet list was confusing and did not clearly outline the Task D structure. The list has been revised to highlight 5 general activities (literature review, plan preparation, model development, performance evaluation, and decision support) and a figure added. Development includes the conceptual model, coding and initial verification of the code. Model performance evaluation includes the calibration, validation, and sensitivity analysis.

8.) Page 1-3, Section 1.3, 7th bullet. Does this refer to calibration or to the development of a generalized tool with lookup tables etc.?

Response: The bullet list has been revised to better outline Task D activities. The previous 7th bullet was not clear but referred to calibration.

9.) Page 1-3, Section 1.3, 9th bullet. Does this refer to soil or groundwater models.

Response: The bullet list has been revised to better outline Task D activities. The previous 9th bullet was not clear but referred to general decision support required to use the simple tools developed in Task D (yes, soil and groundwater modules).

10.) Page 1-4, 2nd paragraph. It seems providing guidance on input parameters will be key to making this useful.

Response: Agreed. Hopefully the development of the decision support framework is now more clearly presented.

11.) Clarify whether you mean by the end of our fiscal year (June 30) or the calendar year (Dec 31).

Response: This paragraph has been moved up to the first paragraph in Section 1.3 and now refers to phase of funding rather than years.

Section 2.0

12.) Page 2-1, Section 2, 1st sentence. Clarify that this refers to items 1-6 (better 7) of the list in section 1.0. Need some language on how we will proceed later.

Response: Reference back to Section 1.3, which lists all the tasks and the phase when it will be completed, is provided. In addition, the general approach for tasks completed during future phases has been added. Additional detail will be provided for future tasks as needed when the scope becomes clear (i.e., scope depends on previous project outcomes and funding so definitive detailed description is not possible at this time). To address this issue, the "observational approach" will be used which includes basing future tasks on information learned from previous tasks and obtaining appropriate consensus on changes to the agreed upon approach. Section 2.3, Contingency Measures, has been added to clarify this approach.

13.) Page 2-1, Section 2, 3rd paragraph, 1st sentence. Why is "…the ability to produce output concentrations and a reasonable plume shape, and to provide information on mass flux at a downstream boundary" considered "conditions that are important in Florida". It seems these are output issues or results of modeling and are not worded as input variables or existing elements, like the other conditions sited in the sentence.

Response: This paragraph has been deleted as it was repetitive of Section 1. The paragraph was revised to clarify. See response to comment #3 above.

14.) Page 2-1, Section 2.1.1. General Comment from Bill Melton. Task 2.1.1 seems to negate the whole project. Should we have concentrated more on how we could measure the results? It seems at this point that any results will be suspect, simply because there is no universally accepted measurement system.

Response: Note, this is now Section 2.1.1.1. The opening sentence has been revised to note that the first modeling task, rather than the main goal, is to develop a simple tool. In addition, the description is intended to support the need for a reasonable soil-treatment module prior to groundwater transport. Specifically, we know that treatment occurs in the vadose-zone and without consideration of that treatment, the groundwater estimates are artificially high. Rather than negating the whole project, this task will improve the model predictions and reduce the uncertainty in evaluating expected performance. Finally, this project is unique in that it encompasses both the data collection (Task C) as well as the model development to ensure the "right" data is collected. Additional task description has been added to Section 2 to clarify how all the subtasks for the entire multi-phase project will be completed to meet project goals.

15.) Page 2-2, 2nd paragraph, 2nd sentence. Does this refer to Otis' 2007 report for the Wekiva Study Area?

Response: Yes. The reference has been corrected to Otis 2007.

16.) Page 2-2, 2nd paragraph, last sentence. Need some evaluation and calibration on these two approaches (classification and 1-d model). e.g. Otis aimed his classification of reductions to be somewhat conservative (on the low side). One way may be to do a side by side comparison (classification/models) with data for specific sites.

Response: Additional description on model performance evaluation has been added (see also new Section 2.1.2).

17.) Page 2-2, 3rd paragraph, first sentence. This section needs some modification. At the current rate of progress task C data will be available long after the soil model is completed. There needs to be some assurance of the validity of the soil model before it becomes the input into the next model. Once more data become available, a later task could do a post-audit.

Response: Additional task description (and a figure to illustrate the interative steps) has been added to Section 2 to clarify how all the subtasks for the entire multi-phase project will be completed to meet project goals. Specific to this comment, Section 2.1.3 has been added to describe model performance evaluation. In addition, model development (including the soil-treatment module) will be completed in three iterative steps increasing in complexity as data for development and calibration becomes available. Each step includes calibration and performance evaluation utilizing the appropriate data set (e.g., 1: existing data

that may or may not be complete, 2: Task C obtained data, and 3: multiple OSTDS input data).

18.) Page 2-2, Section 2.1.1, 1st paragraph, 3rd sentence. "…. including fertilizer loads and groundwater recharge".

Response: Text has been revised as suggested.

19.) Page 2-3, 1st paragraph, 1st sentence. Can this model both TKN and nitrate at the same time? Would the plumes be superimposed? Can there be nitrification in the plume? (Seminole site). This assumes that variability in water table elevation is unimportant relative to temporal variability in nitrogen inputs. How will this work for seasonal water table changes (e.g. Damann's work on the surfactant study site, where varying water tables resulted in very different speciation of nitrogen inputs)

Response: The model as described can simulate one first-order conversion. So, it can simulate the conversion of nitrate to nitrogen gas. It could also simulate the conversion of ammonium to nitrate, but this would not be as useful. Other models exist that can simulate chain degradation (e.g., organic N to ammonium to nitrate to nitrogen gas), but these models are not set up to handle some of the other important attributes thought to be important for this project (e.g., temporally varying concentration input due seasonal precipitation). It may be possible to develop more sophisticated tools that are still user friendly, but this cannot be commented on in more detail until the development is underway. It is important to realize that at some level of sophistication the model is not longer a "site-general user-friendly" tool, and that if more complexity is required, then a consulting from with expertise in using existing numerical models with the desired complexity must be employed on a case-by-case basis. No change has been made to the text.

20.) Page 2-3, 1st paragraph, 6th sentence. If the first order reaction requires a supply of carbon or low redox from outside the plume, the shallowing of the plume could be explained. In the Seminole case, convergent flow lines could be another reason, so this might be not the best case to test the limitations of the first order approach.

Response: The first order denitrification reaction requires both low oxygen and carbon. If these conditions are not met from the outside, the result would be ammonium plumes that are deeper than nitrate. Data can be used to test this, however; what drives the redox conditions is very complex and poorly described at this time. Most contaminant plumes that originate from the surface exhibit the behavior described, thus the micro-stratification that usually exists in unconfined sedimentary aquifers is often used as the explanation. No change has been made to the text.

21.) Page 2-6, Figure 2-4 Caption. This is already a good example for a need to discuss the "spatially averaging" part. GW concentration at the source vary quite a bit.

Response: The spatial averaging generally refers to the OWS source to the ground water table. That is, a footprint on the surface of some simplified shape will deliver some averaged mass of nitrogen to the aquifer, which will serve as the source term for the aquifer contaminant transport model. The plume shown in this figure is the aquifer plume. Even the simplest models we propose are designed to provide information on concentration in x, y, z, and time. Note, an illustration has been added (Figure 2-1) to clarify "spatial averaging".

22.) Page 2-8, 3rd paragraph. It appears that this work is largely done. So, what will be done for this project, and what will be the deliverables (such as the Java model…..)?

Response: This paragraph describes what we know with regards to HPS model sensitivity based on prior work. The work by Heatwole was not in a format that can be "turned over" to a user. In addition, this was an MS thesis project, and a more rigorous sensitivity analysis should be conducted using a range of values typical for Florida aquifers. The sensitivity analysis for the Heatwole study was conducted for a limited range of model-input parameters relevant to a specific aquifer in Colorado. Specific to the FOSNR project, the aquifer model will need to be developed, appropriate input parameters will be defined specific to Florida groundwater conditions, and a sensitivity analysis completed. The results from this FOSNR project may indeed match the Colorado study, but it might not. In addition, Task C was structured based on this understanding of parameter sensitivity such that data we know the model will be sensitive to and is rarely collected (e.g., groundwater velocity) will be obtained.

23.) Page 2-8, 3rd paragraph, 3rd sentence. Revise the sentence so it is one, complete thought.

Response: Text has been revised as suggested.

24.) Page 2-8, Section 2.1.3. General Comment from Eb. Was this not already done as task D3? What problem did you find with the St Johns site that it is not listed here? As we wait, additional data sets are being developed at UCF and on the St Johns River. Perhaps have some language with criteria for selection (e.g. how many points in x,y,z,t?).

Response: No specific problem has been identified with the St Johns site. However, this comment highlights the importance of the observational approach. Rather than selecting a data set before model development, available data sets must continue to be monitored such that the best data is used for calibration. Unfortunately suggesting the number of data points and type can not be

meaningfully done at this time. Rather how a successful calibration is determined is described in Section 2.2, Performance Assessment and the text has been revised to note that model-performance evaluation will be done with the best available data.

25.) Page 2-8, Section 2.1.3, 1st paragraph, 4th sentence. Need to reconsider or develop a time-line to make this workable?

Response: Additional task description has been added to Section 2 to clarify how all the subtasks for the entire multi-phase project will be completed to meet project goals. Most importantly, model development will be completed in three iterative steps increasing in complexity as data for development and calibration becomes available. Each step includes calibration and performance evaluation utilizing the appropriate data set (e.g., 1: existing data that may or may not be complete, 2: Task C obtained data, and 3: multiple OSTDS input data). In this approach, tools are developed based on the best available data to quantify mechanisms responsible for treatment and transport. The complementary decision support framework will provide guidance to the user for appropriate model selection based on the question being asked as well as when numerical modeling and/or additional data collection is required.

26.) Page 2-8. Primary Candidate Studies bullet list. Can you make it clear how these studies equate to sites?

Response: The bullet list heading have been revised to clarify that the studies are for Task D performance evaluation rather than Task C sites.

27.) Page 2-9, Section 2.1.4, 1st sentence. It seems useful to have a similar caliber of performance evaluation for the soil treatment component.

Response: Agreed, and this is the intent. The text has been revised to clarify model performance evaluation (e.g., calibration, validation, uncertainty analysis) compared to measures that deem the performance evaluation successful (e.g., unique solution, RMSE, etc.).

28.) Page 2-9, Section 2.1.4, 2nd sentence. Could you develop some criteria to give a qualitative grading?

Response: Good comment. We will develop qualitative criteria as the model development and calibration is initiated. FDOH and the RRAC will have a say in how accurate they want the model to be as well as which conditions are most important (e.g., plume length). We also plan to develop a matrix to demonstrate which criteria are appropriate for different desired model outputs (e.g., simple mass-balance vs. spatial ammonium, nitrogen, and redox conditions in the aquifer). The model to be used/developed also depends on the desired criteria.

The models we produce would fall somewhere in the middle between the simplest models and the most complex. No change has been made to the text.

29.) Page 2-9, Section 2.1.4, 2nd paragraph, last sentence. This does not make sense to me.

Response: Text has been revised to clarify.

30.) Page 2-9, last paragraph. Spell out NMB and RSR acronyms now rather than later.

Response: Text has been revised as suggested.

31.) Page 2-10, Section 2.2, 1st sentence. It will be neat to see all these evaluations, but how will you explain all of these (and which one is best) to us the RRAC and the intended user.

Response: If a model is to be used, then some level of understanding of how model fit is evaluated is a necessary criterion. These are not difficult to implement in a spreadsheet, once model output and calibrating data are obtained. In general, not one method is universally accepted as the best one, so the prudent approach is to try several different methods and choose the model that is overall the best. The point is that all methods have advantages and disadvantages, so by using more methods a disadvantage does not wreck the results. In addition, performance evaluation must be done at different levels to satisfy the different levels of users. The mathematical measures require statistical understanding which may or may/not be understood by all users and in the end. The text has been revised to clarify the purpose of performance assessment.

Section 3.0

32.) Page 3-3, 1st sentence after bullets. I see this language throughout and am wondering if we should be more specific? Put in FDOH instead of sponsor?

Response: Text has been revised as suggested.

33.) Page 3-3, Section 3.8. I see this language throughout and am wondering if we should be more specific? Put in FDOH instead of sponsor?

Response: Text has been revised as suggested.

References

34.) General edits and typo corrections.

Response: All edits and typo corrections have been made as suggested.

III. Summary and Recommendations

Based on the discussion from this conference call, the Task D QAPP will be revised to reflect a re-organization of the Task D effort. This will then form the basis for a contract amendment for Task D, if deemed necessary by FDOH and the project team.