



Memorandum

TO: TAC

DATE: September 10, 1999

FROM: Dave Dilks
Penelope Moskus

PROJECT: ALCOVY

COPIES:

SUBJECT: Alcovy Watershed Protection Project Model Selection

SUMMARY

Watershed modeling is an integral portion of the Alcovy Watershed Protection Project. The overall goal of the watershed modeling is to develop a tool that can define acceptable land use and/or best management practices that will result in attainment of water quality objectives. This tool must meet the needs of both the TAC and the Georgia DNR/EPD. The project team interviewed the TAC at the August 19, 1999 meeting to more explicitly define their management objectives for the modeling, as a critical step of model selection. The purpose of this memorandum is to outline the modeling objectives discussed at the meeting and to provide a model recommendation.

The BASINS/NPSM model is recommended as the framework that best meets the objectives of the TAC. This is the most detailed of the models under consideration, and provides the potential for the greatest long-term accuracy. It must be recognized that this model contains more complexity than can be adequately supported by the existing monitoring effort. The full benefits from selecting this model will be seen after six years of additional data collection and additional model calibration efforts. If the resources to support the long-term application of BASINS/NPSM are not available, application of the simpler GWLF model will provide equally reliable answers over the course of this study at a lesser cost.

The remainder of this memorandum describes the objectives for the modeling stated at the August 19 meeting, and discusses the model recommendation.

MODEL OBJECTIVES

The Project Team interviewed the TAC at the August 19 meeting regarding many factors that can influence model selection. These consisted of:

- Consistency with Other Local Applications
- Stakeholder Approval
- User Interface
- Groundwater Quality
- Constituents
- Spatial and Temporal Resolution
- Reliability

This section lists the specific questions that were asked and summarizes the response of the TAC.

Consistency with Other Local Applications – How important is it to select the same watershed modeling approach that is being applied in the majority of adjacent watersheds? The TAC believes that consistency is important. The RDC is not currently running models for other watersheds. There is agreement within the TAC that the Northeast Georgia RDC will be the entity that runs the model. The RDC will also be responsible for maintaining the model after this project is complete. There is a desire to have some consistency across the models supported by the RDC. However, recognizing that different watersheds will have different resources available, the RDC also needs the flexibility to support a range of model complexities (including limited or no modeling). There is some desirability to have consistency with the model application already developed for the Gwinnett County portion of the watershed, but this desire should not be viewed as the primary determinant of model selection.

Stakeholder Approval – What stakeholders will be required to approve the selected model? TAC will make the final selection of the model with input from EPD, based upon recommendations from the project team. Input for model selection will not be solicited from others.

User Interface – How important is it that the selected model contain a user-friendly interface that will allow the TAC to perform additional scenarios without consultant assistance after project completion? A user-friendly interface (with user friendly inputs and outputs) that will allow the TAC to perform additional scenarios without consultant assistance after project completion is an important model feature.

Groundwater Quality – Is the capability to simulate changes in groundwater quality important? The capability of the model to simulate changes in groundwater quality is not an important enough model feature to invest additional resources in its development.

Constituents – What are the water quality constituents of concern? At a minimum, the model must be capable of predicting the concentration of those constituents that have been listed as impairing water quality in the watershed. The model should also be able to provide predictions for other parameters that are of concern to the TAC such as metals, nutrients, sediment and Gwinnett County MS4 constituents.

Spatial and Temporal Resolution – What is the required spatial detail of model predictions and what are the required time scales? For the river, a one-dimensional (1-D) model that can make predictions on the scale of hundreds of feet is sufficient for this study. A 1-D model will predict changes in concentration along the length of the river, but will not consider lateral or vertical variations in water quality. For the reservoirs (Beaverdam Creek and Cornish Creek Reservoirs), an empirical model that assumes complete mixing is sufficient for this study. Only the Alcovy arm of Lake Jackson will be simulated. Continuous simulation with a daily time step will be used to estimate watershed loads.

Reliability - How reliable should the model be? The TAC expressed a desire to focus on the model with the greatest long-term accuracy as opposed to the model that provides the most "bang for the buck" at the end of the study.

MODEL RECOMMENDATION

This section describes the ability of two models (GWLF and BASINS/NPSM) to meet the objectives stated above. Although only two models are presented, it is important to know that these models were selected from the suite of models reviewed in the EPA Compendium of Watershed-Scale Models for TMDL Development (EPA, 1992). LTI based the selection of these two models on prior experience with these models, performance of these models, their ability to meet the model objectives outlined in this memorandum, and their acceptability to EPD.

GWLF

GWLF is a model with a moderate level of complexity which has been approved by EPD and which performed well when compared to measured data. A modified version of GWLF has been used previously in the Lake Lanier watershed and is currently being used within Cherokee County, Georgia. Other moderate level models considered include NPSMAP, P8-UCM, SIMPTM, Auto-QI, AGNPS, and SLAMM. These models were not selected for a variety of reasons, including, but not limited to an inability to simulate point sources (SIMPTM, Auto-QI), inability to simulate urban land uses (AGNPS), inability to simulate rural land uses (P8-UCM, SIMPTM, Auto-QI), inability to simulate sediment (NPSMAP, P8-UCM), and non-continuous simulation (P8-UCM, AGNPS).

GWLF is capable of meeting the great majority of the objectives described above, and will provide as much or better accuracy than BASINS/NPSM if applied only with the data to be collected during this study. It can be applied using a level of effort less than currently allotted in the existing budget. Its primary limitation is that its level of accuracy can not be greatly improved in response to additional future monitoring, giving it a lower potential future accuracy than the more complex BASINS/NPSM model.

BASINS/NPSM

BASINS/NPSM is a model with a high level of complexity, based upon the well-accepted HSPF watershed model. BASINS/NPSM is currently being used within Georgia (Fulton County, Gwinnett County and elsewhere). This model has been approved by EPD and has also performed well when applied with sufficient monitoring data. Other complex-level models considered include: STORM, ANSWERS, DR3M, SWRRBWQ, and SWMM. These models were not selected for a variety of reasons, including, but not limited to an inability to simulate point sources (ANSWERS), inability or low ability to simulate urban land uses (ANSWERS, SWRRBWQ), inability or low ability to simulate rural land uses (STORM, DR3M, SWMM), and non-continuous simulation (ANSWERS).

BASINS/NPSM is also capable of meeting the great majority of the objectives described above. The strongest factor favoring the use of BASINS/NPSM is the potential for future accuracy much greater than the GWLF model. This improved accuracy can be achieved only in response to a long term (i.e., at least six years) monitoring effort and additional calibration effort. It must be recognized that BASINS/NPSM contains more complexity than can be adequately supported by the existing monitoring effort. If the resources are not available to support this long-term effort, BASIN/NPSM will provide accuracy similar to or slightly less than GWLF at a higher overall cost (although still consistent with the model budget).

RECOMMENDATION

LTI recommends using the BASINS/NPSM model for modeling the Alcovy River study area. Both BASINS/NPSM and GWLF are capable of meeting the majority of the management objectives. BASINS/NPSM is selected primarily because it provides the potential for greatest long-term accuracy. The full benefits from selecting this model will be seen only after six years of additional data collection and additional model calibration efforts. If the resources to support the long-term application of BASINS/NPSM are not available, application of the simpler GWLF model is recommended as it will provide equally reliable answers over the course of this study at a lesser cost.

REFERENCES

EPA, 1992. Compendium of Watershed-Scale Models for TMDL Development. EPA 841-R-94-002.