

MEMORANDUM

To: Implementing Committee

From: Robert L. Gulley

Date: September 3, 2012

RE: Ecological Modeling

EAA provided \$25,000 of Zero-Year funding for a meeting to provide a recommendation to the Implementing Committee regarding the appropriate approach to develop an ecological model. A memorandum describing the meeting is attached as Attachment 1. The cost of the meeting was \$7,373.74.

The Expert Panel recommended that prior to determining whether an integrative complex model is appropriate and, if so or what integrative model would be best suited, the Implementing Committee should have knowledgeable scientists identify key questions that the model will be expected to answer. For each question, the scientists should identify the state of knowledge and the models that have been or need to be developed. They should, for each of the key questions, then articulate the possible range of answers, the prioritized steps that need to be taken to improve the answers, and what is expected to be gained in predictive capability as more and more complexity to the models.

Ed Oborny and Thom Hardy agreed with the recommendation and that, because of the work in developing the HCP, the requirements of the recommendation could be satisfied relatively quickly.

If the Implementing Committee wishes to accept the Panel's recommendation, I suggest that the Implementing Committee authorize the use of the remaining Zero-Year funding (\$17,626.26) to retain Ed Oborny and Thom Hardy to conduct the analysis required by Recommendation #1. They would be required to submit a report to the Implementing Committee before December 13, 2012. The Report would specify any work required that could not be completed. A copy of the Panel's recommendation draft report will be submitted to the Science Committee for review and comment by November 16, 2012 to allow time for the comments to be considered by Ed and Thom.

A scope of work for the Ecological Modeling Work Plan would then be prepared. The scope of work would include completing the work in Recommendation #1. The expert panel would be given the report and asked to consider what modifications they would suggest to Recommendations 2 through 4. The budget for the Work Plan would be limited to no more than \$150,000 for 2013.

MEMORANDUM

To: Implementing Committee
From: Robert L. Gulley
Date: August 29, 2012
Re: Ecological Modeling Meeting

A two-day meeting regarding ecological modeling was held at the Edwards Aquifer Authority on August 28-29, 2012. The purpose of the meeting was to receive input from a panel of experts regarding the best model or methodology to use to develop a decision-making tool to evaluate the available data regarding the effectiveness of the HCP. The expert panel consisted of:

George Ward, University of Texas at Austin
Bill Grant, Texas A&M University
Anthony Starfield, Retired, formerly from the University of Minnesota
Terry McLendon, Texas Tech University
Mac McKee, Utah State University

Ed Oborny (BIO-WEST) and Thom Hardy (Texas State) also participated on the panel. Also in attendance at the meeting were:

Jose Hidalgo	Marcus Gary
Melani Howard	Kevin Connally
Nathan Pence	John Waugh
Chris Abernathy	Steve Bereyso
Jenna Cantwell	Ken Diehl
Robert L. Gulley	Chad Norris
Geary Schindel	Doyle Mosier
Jim Winterlie	Steve Raabe
Franziska Giger	

To begin the meeting, Robert Gulley gave an overview of the HCP, the role of adaptive management in the HCP implementation process and the role that was envisioned for ecological modeling. Gulley emphasized the need to have a model that was capable of contributing to the decision-making process between year 3 and 5 of the HCP implementation process. Ed Oborny and Thom Hardy participated in the discussion providing background information regarding the available data from the EARIP process. Afterwards, three panel members gave presentations on specific examples of ecological models. Terry McLendon gave a presentation on the EDYS

model; Bill Grant gave a presentation with examples of different types of ecological models; Mac McKee gave a presentation on data-driven modeling. The powerpoints used in these presentations are posted in the ecological modeling section of the EAHCP website.

The presentations were followed by approximately eight hours of discussion regarding the best approach to ecological modeling for the EAHCP. At the conclusion of these discussions, the expert panel made the following recommendations:

1. Use Simple Models to Identify Knowledge Gaps and Understand Existing Data.

Begin the process by identifying a finite number of key questions to be answered. For each question identify the state of knowledge and identify models that have been or may need to be developed. Analyze how those models have been used to guide the next step in the direction of answering the questions. Recommendation #1 will be satisfied when, for each of the key questions, you can articulate the possible range of answers (at this stage), the prioritized steps that need to be taken to improve the answers, and what you can expect to gain in predictive capability, as you add more and more complexity to the models.

2. Comprehensive Data Management and Computation Framework

In parallel with the first step, decide if a comprehensive data management and computation framework is necessary by evaluating prototypes (simple models) and assessing data holdings. Such a framework would have the capabilities to handle the mathematics of solving coupled models, and to transfer data and model results among the components. Capability for versatile and cogent graphical output will be helpful in communicating with stakeholders.

3. Data Mining

As part of the initial step, formulate specific questions and have existing data reevaluated to determine if the answers can be identified from existing data. Such a reevaluation may involve approaches such as those discussed by Dr. McKee.

4. Integrative Complex Ecological Model

When sufficient information is obtained through Recommendation #1 regarding the efficacy of the prototypes (simple models), decide if an integrative complex ecological model or series of linked simple models would be useful. If the former, formulate a list of necessary attributes such a model must have to employ in reviewing available software.

The expert panelists were in agreement with respect to the first three recommendations. Terry McLendon believed that selecting an integrative ecological model (such as EDYS) should be done very soon. He argued that existing aquatic data is sufficient to make such a model useful now. He believes that eventually you need a synthesis model, and we cannot wait a long time to do that and still stay on schedule.

Ed Oborny and Thom Hardy agreed that much the work done to date has been valuable but that there are open issues that would benefit from the panel's Recommendation #1. Others on the expert panel acknowledged that they are not in a position to know how much work has been done, but that the more that had been done would shorten the time needed for the first step. There was a general consensus among these individuals that the process itself was important and that a formal process could avoid potentially fatal problems with the model from arising later. They also thought the process would help answer the question of whether the solution lay in a large integrative model or linked smaller models.