Draft Report: Field Studies and Updates to the Central Carrizo-Wilcox,Queen City, and Sparta GAM to Improve the Quantification of Surface Water-Groundwater Interaction in the Colorado River Basin

Reviewed by
Steve Box, Executive Director
Environmental Stewardship

TWDB Contract # 1548301856
TWDB/BBASC Comments to Final Report

REQUIRED CHANGES

General Draft Final Report Comments:

When taken together, the Draft Report and the technical improvements to the GMA-12 GAM that it describes make an important advance in understanding and managing the surface water-groundwater interaction between the Colorado River and the Carrizo-Wilcox Aquifer Group.

By reviewing the historical studies, by incorporating the science (data) into the GAM, and by updating the model to include local and intermediate level groundwater flow systems, the tools will soon be in place to predict the groundwater and surface water interactions in this segment of the Colorado River Basin. Hopefully these tools, along with future field studies to enable monitoring, will be used to establish the scientific basis to inform the policy and management decisions that will guide adaptive management of these important natural systems while balancing the need for development of these water resources against the need to conserve these waters for future generations.

We want to take this opportunity to thank the Texas Water Development Board and the Texas Legislature for providing the funding and contract management support necessary to make these considerable improvements to the GMA-12 GAM. We look forward to participating as a stakeholder in the final phases of calibrating and installing the improved GAM into practice.

Specific Draft Final Report Comments:

ES 1: Section 3.1, paragraph 1: The sentence should include recognition that environmental flow water is considered a component of interruptible supply and therefore subject to curtailment during certain hydrological conditions. Revise the sentence: " Lakes Buchanan and Travis are operated as a system to supply interruptible water supplies for agriculture and environmental flows when available, and firm water supplies for municipal and industrial use."

> Note to Myron: It has been a long time since I reviewed the LCRA Water Management Plan. Does the current plan still include environmental water as a component of interruptible water supplies?

ES 2: Section 3.3, paragraph 1: A sentence or two should be added to complete the history and recognize that attempts have been made to get the Colorado River Alluvium designated as a minor aquifer. To be technically correct, Figure 3-7 *does not* include the Colorado River Alluvium as a minor aquifer since it has not been designated as a minor aquifer. Rather, the surficial alluvium and terrace deposits have been superimposed to characterize the alluvium. Saunders (1996) described the qualifications for the aquifer to be designated as a minor aquifer and Region K Water Planning Group considered, but did not designate it as a minor aquifer.

> Saunders, Geoffrey P. 1996. Qualification of the Colorado River Alluvium as a Minor Aquifer in Texas. TRANSACTIONSOF THE GULF COASTASSOCIATIONOF GEOLOGICAL SOCIETIES VOLUMEXLVI, 1996 363. Lower Colorado River Authority, Austin, TX 78767.
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> **Abstract:** The Colorado River Alluvium has characteristics which qualify it for designation as a minor aquifer by the Texas Water Development Board, although the TWDB has not yet made such a designation. Without recognition as a significant water supply in the state, this resource is vulnerable to pollution and diminution. Major and minor aquifers in Texas were redefined by the TWDB as an update to the Texas Water Plan in 1990. The Brazos River Alluvium was separated from other Quaternary deposits .and designated as a minor aquifer because of its importance as a water supply for irrigation use. No other alluvial aquifers have been recognized as significant water supplies in Texas. The Colorado River Alluvium stretches for 200 miles (322 km) from Austin to Wharton, Texas. Water-bearing formations farther downstream are grouped into the Gulf Coast Aquifer. Water in the alluvial aquifer is in direct contact with the Colorado River and has similar water quality characteristics as the river, which is now considered exceptional for aquatic life. .Since some communities use the alluvial aquifer for municipal water supply, it is important that groundwater be of high quality.
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> The Brazos River Alluvial Aquifer has been found to be highly vulnerable to pollution. Using the same assessment criteria, the Colorado River Alluvial Aquifer would also be deemed to be vulnerable to pollution.

ES 5: Section 4.1.3, last sentence page 31: To be technically accurate, the last sentence should be revised to denote that Figure 4-9 shows the estimated base-flow index for outcrops of major and minor aquifers and for the Colorado River Alluvium in the Colorado River Basin as determined by TWDB (2016). Revise the sentence: "Figure 4-9 shows the estimated base-flow index for outcrops of major and minor aquifers and the Colorado River Alluvium in the Colorado River Basin as determined by TWDB (2016)."

ES 7: Section 5.4, page 59-60, dot points 2 & 3: It would be helpful to have a figure that depicts the relationship of the thickness of the alluvium at the River's center and at 700 feet on either side of center. The description fails to make clear what this relationship looks like spatially. This is an important description of the boundaries of the alluvium and therefore important in understanding how the model works in relationship to the actual river.

ES 8: Section 6.1, page 74, paragraph 2: It seems there is some missing text in the sentence "If the size of a model cell .....represented by a single model cell".

ES 9: Section 7, pages 83-89: The tense of this section should be changed from "will" to "would/should be" so as not to confuse future readers into believing that these field studies are in fact expected to occur. INTERA should recognize that such studies must go out for competitive bids. As such, the section should be written more as a scope of work rather than a response to an RFQ.

ES 10: Section 7.3, dot 2: Typo "from bank storage OR from the aquifer ...".

ES 11: Section 7.3, new dot 4: Suggest adding a new dot point that raises the following question: During persistent drought or extreme drought, is groundwater quantity sufficient to maintain critical/subsistence instream flows to get the river/stream through the drought in an ecologically sound condition.

ES 12: Section 7.3.1 last paragraph, page 85: Word missing: The simple approach will use a spreadsheet and the advanced approach will use the groundwater model.

ES 13: Section 7.3.4 last paragraph: What do Figures 7-5 through 7-8 reveal. It may be apparent to the author but it would be helpful for one set of the figures to be explained in more detail. For example which of the figures indicate a gaining/losing segment? What is the implication of the trend line? What is the implication of the change for Bastrop from 2012 - 2015?

ES 14: Section 7.2, page 83, First Sentence: Are thee other sites in the middle or upper basin that would be suitable candidates for such field studies?

The following comments were provided by George Rice on July 18, 2017, and are incorporated as Environmental Stewardship's comments 15-19:

ES 15: Section 2.1, page 4: Typo in Equation 2-1. Head difference (h_s- h_a) should be in numerator .

ES 16: Section 2.1, page 4: First paragraph in section 2.2 reads:

> *The rise of floodwater not only maintains losing segments of a river, but also can make gaining sections become losing ones, inducing flow from the river into the stream resulting in groundwater recharge.(Emphasis added).*
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> Should read "… inducing flow from the river into the *aquifer* resulting in groundwater recharge."

ES 17: Section 4.1.2, page 23: There is a problem with the signs in Equation 4-2.

Equation 4-2: $Q_{net} = Q_{up}+Q_t+Q_r-Q_{down}-Q_w-Q_e$

The text states that positive values of Q_{net} represent gaining stream reaches and negative values represent losing reaches. However, assuming a gaining reach where:

Q_{up} = 100 cfs

Q_{down} = 200 cfs

All other values = 0 cfs

Then:

Q_{net} = 100 cfs - 200 cfs = -100 cfs

Thus, a gaining segment results in a negative, not a positive value.

ES 19: Section 7.4, page 89: The text states that data will be collected for at least two years. This is good, but long-term data collection is needed. It may be beyond the scope of the studies described in this document, but a plan for long-term data collection should be developed.

Figures and Tables Comments:

ES 3: Figure 3-6, page 16: The insert box should be re-positioned to better match the study area and more clearly identify the Alluvium and Terrace Deposits associated with the Colorado River Alluvium.

ES 4: Figure 3-7, page 17: The insert box should be repositioned over Bastrop, Lee and Fayette counties to better match the study area and the outcrops associated with the Colorado River Alluvium.

ES 6: Figure 4-9, page 47: To be technically accurate, the title of the figure should be modified to denote that the estimated base-flow index (BFI) includes the Colorado River Alluvium as well as major and minor aquifers in the Colorado River Basin. (See also ES 5). Revise the caption: "Estimated base-flow index (BFI) for outcrops of major and minor aquifers and the Colorado River Alluvium in the Colorado River Basin as determined by TWDB (2016) using base-flow index values and hydrologic landscape regions from Wolock (2003a,b; 2004).

ES 18: Section 7.2, page 84: Table 7.1 indicates that locating a study area in the outcrop of the Carrizo Wilcox Aquifer is relatively unimportant. However, the effect that pumping the Carrizo Wilcox will have of stream flows is a major question. Therefore, it is very important that the study be located in an area where the Carrizo Wilcox Aquifer is known to discharge to a stream.