Comments to the Lower Colorado River Authority (LCRA) regarding revisions to the 2015 Water Management Plan for the Highland Lakes

Evaluation of RAINFALL/RUNOFF PATTERNS IN THE UPPER COLORADO RIVER BASIN ("Patterns")

This report[1] indicates that surface water regulations and management practices have allowed surface waters in the Colorado River watershed, intended as inflows to the Highland Lakes to be diverted to other uses by permits and by exemptions from permits. The magnitude of these diversions reduced the inflow volumes to the Highland Lakes below those necessary to adequately provide for firm and interruptible water supplies during the most recent period of extreme drought identified in the current planning process as June 2010 through May 2016. Groundwater permitting and other management practices have further exacerbated this situation by decreasing or reversing the hydrological flow from aquifers to the river and its tributaries.

Because the same regulations and practices are used in the lower basin below Longhorn Dam, it can expect similar results. This would make the implementation of the proposed new WMP extremely problematic. As such, these impacts should be reviewed and considered in the current revisions to the WMP.

Land management practices, including brush control, have not substantially increased stream flows because aquifers must recover before the benefits of brush removal can be realized as recovered baseflows. The details of brush control practices[2] are important because the deep roots of prairie grass are a key to getting rainwater back into the soil, thus recharging the aquifers so they can provide outflows to surface waters.

The "Patterns" report reveals gaps in information and deficiencies in regulatory processes used in permitting and regulating water rights that seem to have left inflows to the Highland Lakes inadequately protected. Some of these deficiencies are in the modeling tools (WAM's) used to predict the impact of surface water allocations and groundwater pumping on surface water baseflow, aquifer recharge and recovery, and --ultimately-- on inflows to the Highland Lakes and environmental flows in the lower basin and Matagorda Bay.

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[1] Kennedy Resource Company. August, 2017. EVALUATION OF RAINFALL/RUNOFF PATTERNS IN THE UPPER COLORADO RIVER BASIN, TWDB Contract # 1600012011. https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/1600012011_Kennedy.pdf

[2] Though outside the scope of the referenced study, an evaluation of the effects of "brush control" best practices--including replacement of grasses with native Texas prairie grasses -- might provide insights into adaptation of such practices to help restore ecological and hydrological functions. The groundwater-surface water connection is a hydrologic system that must be maintained in a "primed state" to effectively and efficiently pass water into the soil and thereby into the aquifer for outflow or alluvium for baseflow. Emphasizing this component in a brush control project is essential to restoring the hydrological system.

RELEVANCE TO LCRA WMP

To the extent that the same surface water laws and regulations, along with similar land management practices have been applied in the lower Colorado River basin, operational issues regarding the delivery of water from the Highland Lakes to reaches as far downstream as Wharton are likely less predictable by WAMS and other operational models. As LCRA's Operations Model relies on information available on surface waters (inflows, outflows, rainwater, evaporation, etc.) and not groundwater information, the model will likely be unreliable for predicting the amount of water that needs to be released to deliver the amount needed at the point of diversion. The shift in agriculture practices from dependence on surface water to a reliance on groundwater will make these predictions less accurate, because groundwater pumping amounts and timing are not generally available on a timely basis and the models may not be capable of using[3] such information.

Figure 1 below, taken from the Colorado County Groundwater Conservation District's Management Plan, is an example of the shift from using surface water to groundwater for irrigation in Colorado County just above Wharton. The impact of this shift is likely exacerbated in LCRA's Operations Model due to the extent of the Colorado River Alluvium shown in Figure 2. Groundwater pumping patterns in the Austin-Bastrop-La Grange-Columbus-Wharton reach of the Colorado River have changed significantly over the last decade and are expected to change even more dramatically in the decades to come. Because of the alluvium, there is likely a great deal of groundwater-surface water interaction in this reach of the river and the impacts of groundwater pumping on the river at any time are uncertain.

> ***SECTION 3.2 – Annual Groundwater Use[4]***
>
> *A significant portion of the economy of Colorado County can be attributed to agribusiness, most notably farming. The dominant crop type is rice which is heavily dependent upon irrigation. Colorado County and Wharton and Matagorda counties to the south are leading rice producers in the state and by far account for the most irrigation water use in Region K (Lower Colorado Regional Water Planning Group, 2010).*
>
> *The Lower Colorado River Authority (LCRA) provides the bulk of the irrigation water needed to farmers in Colorado County. Specifically, the water is diverted from the rivers to LCRA owned irrigation districts which consists of hundreds of miles of canals used to deliver the water to individual farmer's fields. In Colorado County, the LCRA owned and operated Garwood Irrigation District provides water to farmers on the west side of the Colorado River and the Lakeside*

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[3] The RiverWare software used for the Operations Model is able to calculate mass balances and therefore may be able to make use of such data.

[4] Colorado County Groundwater Conservation District Management Plan, Section 3.2.

Irrigation District provides farmers on the east side. Both these irrigation districts extend southward into Wharton County.

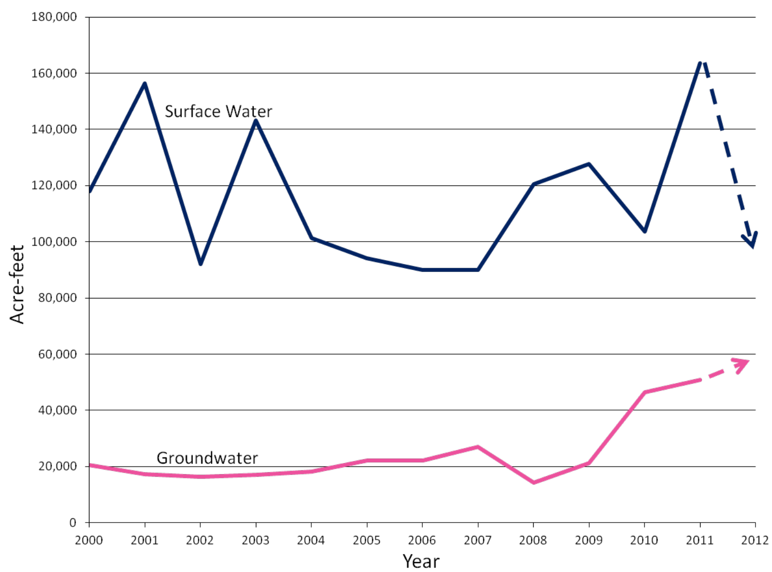


Figure 1. Usage of surface water (top line) and groundwater (bottom line) for irrigation in Colorado County from year 2000 though 2011. Dashed lines indicate projected trends beyond 2011. Modified from data provided in Appendix C1 (Allen, 2014; TWDB 2014).

Since 2000, irrigation usage has in part been a function of precipitation. In wet years such as in 2007, farmers require less water for irrigation whereas drier years, like 2001 and 2003, tend to require more (figure 5). Another related factor is the storage volume in the Highland Lake System located along the Colorado River northwest of Austin. Two of these lakes were built to act as reservoirs and their water levels rise and drop according to need and conditions.

In most dry years, if water was taken from the reservoir lakes, ensuing rains would replenish the lake levels. However, 2008 marked the beginning of a severe and sustained drought that has had a discernible impact on the region. As the drought persisted and inflows into the highland lakes were correspondingly reduced, the lake levels began to fall. Eventually, water storage reached a point where LCRA started restricting irrigation water to farmers downriver. In 2012, for the first time ever, farmers that used water through the irrigation districts were denied water from LCRA.

The restriction has persisted through the 2013 and 2014 seasons. Because of the senior water rights and due to the LCRA purchase contract, water has continued to be supplied to the Garwood Irrigation District during this time period.

As a result of the LCRA restrictions, surface water usage for 2012 though at least 2014 is projected to be substantially lower than in previous years (figure 5), reflecting only what was supplied to the Garwood Irrigation District. These restrictions have had an impact on groundwater usage. From 2000 through 2009, groundwater usage was relatively consistent. As the drought continued and farmers became increasingly aware that surface water was not guaranteed, more water wells were drilled and groundwater usage increased (figure 5) in order to compensate for the lack of surface water. The number of irrigation wells present in the Lakeside Irrigation District area in Colorado County has increased from seven (7) prior to 2012 to 26 as of mid 2014. This dramatic increase in high-rate wells has started to put a strain on the aquifer in the area south and east of Eagle Lake.

The amount of water use from other user groups pales in comparison to irrigation. The next largest user groups are mining and municipal. Water use from mining is due to the prolific gravel operations in the county. Owing to the relatively small population of Colorado County, municipal use is on the same scale. For a complete listing of water user group usage from year 2000 through 2011, see Appendix C1.

COLORADO RIVER ALLUVIUM[5]

The Colorado River of Texas stretches from its headwaters in the Trans-Pecos region to the Gulf of Mexico. After passing through the Edwards Plateau where it has eroded canyons in Cretaceous age limestone, which are now impounded by the Highland Lakes chain, the Colorado River flowed through the Balcones Escarpment near Austin. At this point the ancestral river encountered a gently sloping area with low stream gradients, and the river deposited its sediment load in broad floodplain and terrace deposits. Continuing through the Blackland Prairie, the Colorado River eroded the soft Eocene age sediments as it meandered within a restricted floodplain.

Multiple older terrace deposits were isolated as the river continued to erode. Younger alluvial deposits were laid down in the newer, more narrow floodplain. These deposits consisted of rounded sand, pebbles and cobbles of quartz. chert and other minerals which were more resistant to chemical weathering than the granite and limestone from which they were derived.

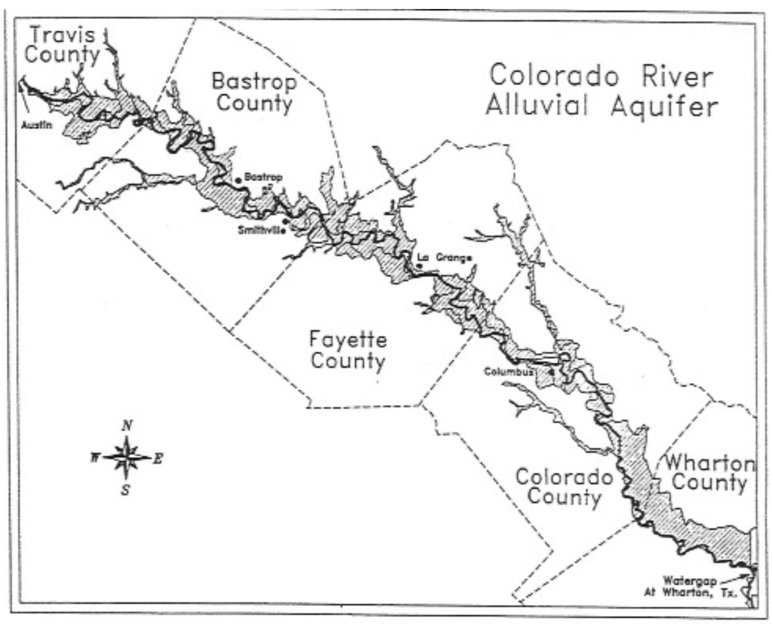


Figure 1. Extent of the Colorado River Alluvium, south-central Texas (after Barnes, 1974).

[5] Geoffrey P. Saunders. Lower Colorado River Authority. Qualification of the Colorado River Alluvium as a Minor Aquifer in Texas TRANSACTIONSOF THE GULF COASTASSOCIATIONOF GEOLOGICAL SOCIETIES VOLUMEXLVI, 1996 363.)

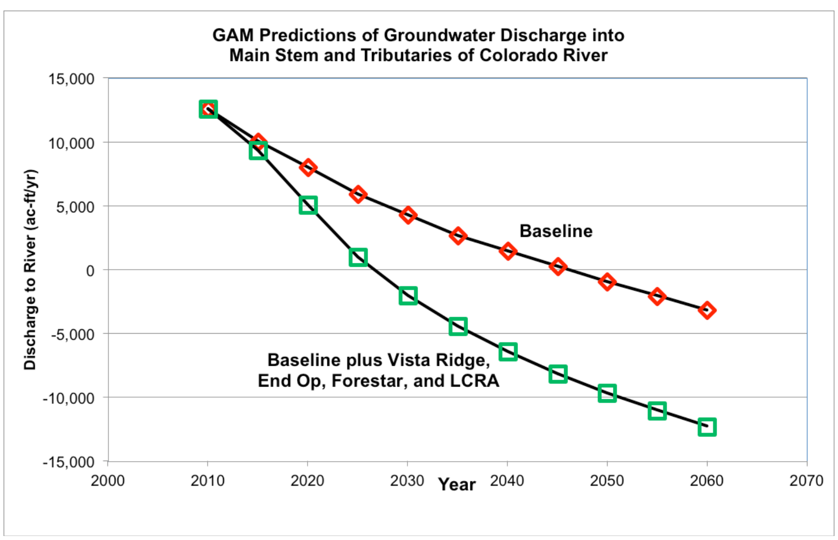
Figure 2. Extent of the Colorado River Alluvium, south-central Texas (after Barnes, 1974)

The Colorado River Alluvial Aquifer is a laterally continuous, hydraulically interconnected series of alluvial and terrace deposits. These deposits are mapped in Travis. Bastrop, Fayette, Colorado and Wharton counties (Barnes. 1974). At a point near the town of Wharton, the Colorado River passes through a "watergap" where it has eroded a narrow valley through underlying formations, effectively dividing the deposits of the Colorado River from the Gulf Coast Aquifer (Fig. 1).

The total area of mapped alluvial deposits is 14,500 acres (5,870 hectares).The alluvium is variable in width and depth, but it is found at all points along the Colorado River between Austin and Wharton. The alluvium is up to 4 miles in width. mostly depending on the resistance to erosion of underlying formations. Depth of the alluvium is not well defined at all locations, but is described as being between 20 to 40 feet (6 to 12 m) deep (Rodda et al., 1969).The isopach thickness of the alluvium has been mapped in the Austin area; average thickness is about 30 feet (9 m), ranging from less than 10 feet (3 m) to about 60 feet (18 m) (Gamer and Young, 1976).

GROUNDWATER MODEL PREDICTS REVERSAL OF COLORADO RIVER GAIN/LOSS STATUS

The current groundwater availability model (GAM) predicts[6] that groundwater pumping in the Simsboro Aquifer will affect the Colorado River and its tributaries by decreasing the amount of groundwater that currently go into the river (Figure 3). The model predicts that during the fifty-year planning period both baseline and permitted pumping will cause the river segments in the Utley-Bastrop-Smithville reach to reverse from being primarily a "gaining" stream to become a "losing" stream. This reversal will have a significant impact on environmental flows during dry and extraordinary drought periods, especially if LCRA requests emergency exemptions for interruptible water from the Highland Lakes into the lower basin as was the case during the last drought.



[6] Rice, George. March 22, 2016. Effects of Vista Ridge Pumping and Additional Pumping by End Op, Forestar, and LCRA on Groundwater and Surface Water in the LPGCD and POSGCD. Report: http://www.environmental-stewardship.org/wp-content/uploads/2016/04/EffectsOfPumping_BaselinePlus_VREndOpForestarLCRA-1.pdf

Figure 3. Effects of Vista Ridge, End Op, Forestar, and LCRA Power Plant Pumping on Groundwater and Surface Water in the Lost Pines GCD and Post Oak Savannah GCD

The improved GMA-12 GAM includes a groundwater-surface water package that permits the model to better predict the impacts of groundwater pumping on surface waters at both a regional and local level. An earlier report[7] to the Colorado-Lavaca BBASC provides additional details regarding the groundwater-surface water package. The model is currently available for reviewed and should be released for use by the groundwater districts in the near future. The "improved" model will provide a better quantitative estimate of the magnitude and timing of the impact of baseline and permitted pumping on the Colorado River and should be used to confirm the predictions of the old model. LCRA should use the new model to inform the WAM in association with these Highland Lakes water management plan revisions.

ES REQUEST 1: Environmental Stewardship requests that the LCRA use the improved GMA-12 GAM to better estimate the impacts of groundwater pumping in the Simsboro Aquifer on the Colorado River and it tributaries in the Austin-Bastrop-Smithville reach to inform the current water management planning process on the potential impacts of such pumping on the overall Highland Lakes system.

EXAMPLE OF HYDROLOGICAL IMPACT OF THE LAST DROUGHT ON THE COLORADO RIVER AT BASTROP GAGE.

Groundwater is a critical component of subsistence and critical flow regimes at the Bastrop gage on the Colorado River. ES' slide presentation[8] to the GMA-12 on June 27, 2014 demonstrates the importance of Carrizo-Wilcox groundwater outflow in the Utley to Bastrop segment of the river. Critical flow is 120 cfs (in old study) and subsistence flows vary by month in the Environmental Flow Standards (EFS) adopted for the river at this gage. Saunders (2006 and 2009) and Deeds et al (2006) place current and historic outflows at between 30 and 50 cfs. Both report indicate that the river may already be losing water to the Simsboro aquifer (Saunders: -9 cfs; Deeds: -4,347 afy) in the Austin-Bastrop segment of the River.

The critical/subsistence environmental flow standard at the Austin gage is 49 cfs and is subject to emergency curtailment. Otherwise, the flow in the river during drought conditions is primarily from City of Austin return flows, and perhaps City of Pflugerville (via Wilbarger Creek) return flows. A significant reduction in groundwater outflows due to pumping could shift this segment of the river from a minor losing segment (estimated at -9 cfs) to a major losing segment if Simsboro pumping were to significantly reduce outflow and/or increase surface water inflows to the aquifer in this segment of the river.

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[7] Young, Steven et al. August 2017. Final 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.
Report: http://www.twdb.texas.gov/groundwater/models/gam/czwx_c/Final_BBASC_083117.pdf

[8] Environmental Stewardship. June 27, 2014. GMA-12 DFC GW-SW Considerations Power Point Presentation to GMA-12. http://www.environmental-stewardship.org/wp-content/uploads/2016/04/GMA-12Meeting27June14FINAL.pptx.pdf

Deeds also reports that the Colorado River gains 160,000 ac-ft/yr between Austin and Bay City which agrees with Saunders' (2006) report of 217 cfs total gains (157,100 ac-ft/yr) an essential contribution to Matagorda Bay during drought conditions. Critical Freshwater inflows to Matagorda Bay during drought conditions is set by TCEQ at 14,260 ac-ft/month.

Figure 4 is a hydrograph of the three year drought period from January 2011 through December 2013 when the region experienced some of the most severe drought conditions in decades. The distinguishing feature of this figure is that in-stream flows benefitted from the irrigation releases for down-stream rice farming during the spring, summer, and early fall of 2011. Irrigation water was curtailed during the 2012 and 2013 irrigation seasons. Note, however, that there was very little flow from rainfall during the 2011 period. Lacking irrigation flows, flow in the river for the summer and fall would likely have dropped into the 120 cfs critical environmental flow range during that period.

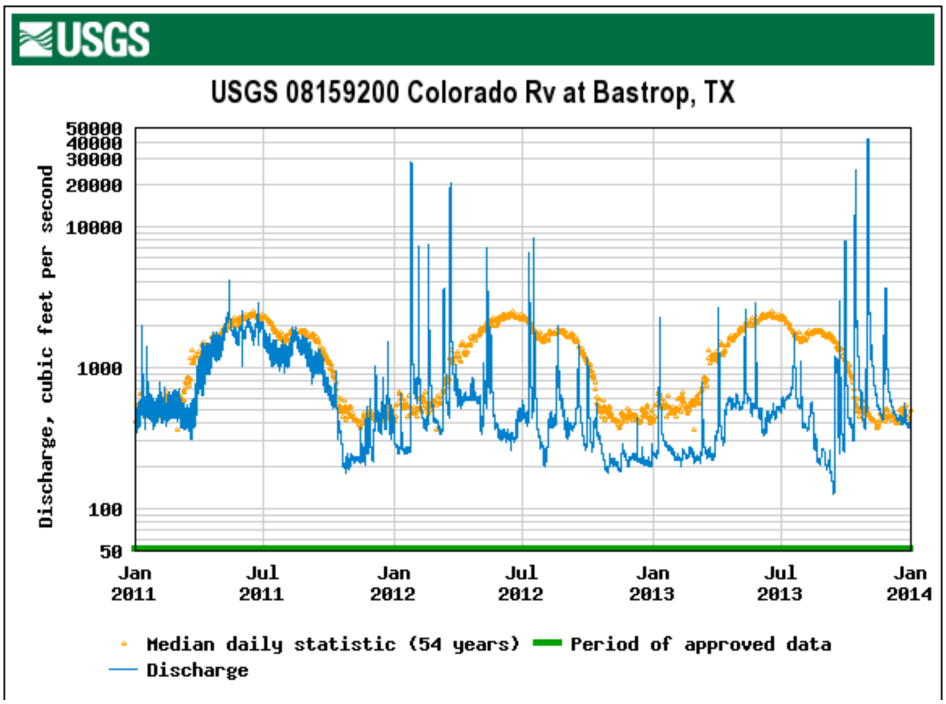

Figure 4. Colorado River at Bastrop gage during drought period Jan.2011 - Dec.2013

Figure 5 is a hydrograph of the month of September, 2013 when the flow was trending toward the critical in-stream flow minimum. Fortunately, the region received significant rainfall starting in mid-September and river flow rebounded.

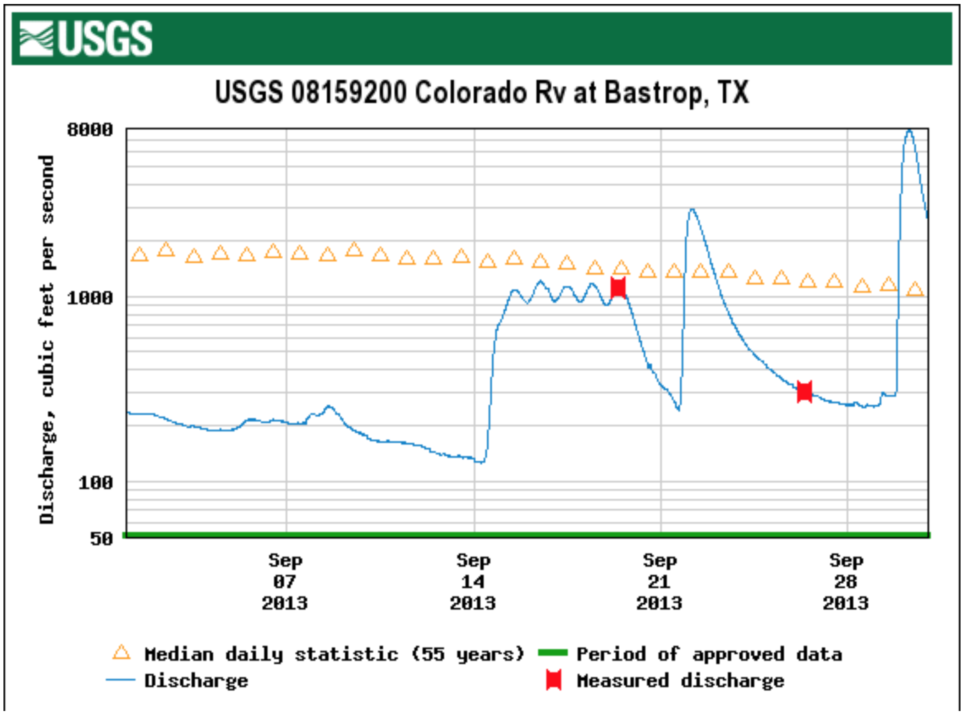

Figure 5. Colorado River at Bastrop gage during drought period Oct. 2012- Sept. 2013

A hydrograph separation on the three year period represented in Figure 4, with irrigation releases removed, would likely reveal a very good estimate of actual groundwater outflows to the river from the Carrizo-Wilcox Aquifer group. During this period the bank storage for the river had likely been exhausted and the river was relying on the minimum flows passing through the Austin gage at Longhorn Dam, City of Austin return flows, and groundwater base flows. Environmental Stewardship attempted to fund a USGS gain-loss study from Utley bridge to Matagorda Bay during that period to provide current period groundwater outflow estimates for purposes of calibrating GAM and WAM models.

ES REQUEST 2: Environmental Stewardship requests that the LCRA prepare the hydrographic separation as described above for the period January 2011 through December 2013 for the Bastrop and Wilbarger gages of the Colorado River to gain insights on the quantity of groundwater that was being contributed to river flow for this extraordinary drought period.

QUESTIONS

In the context of the LCRA WMP, the report raises the following questions that are relevant to revisions to the 2015 plan:

1. To what extent, in the modeling tools (WAM) or other management practices, is LCRA considering and using the information from the rainfall/runoff report to adapt its management practices to better predict and improve inflows to the Highland Lake system? Solving the inflow problem is a critical function to improving management of the river and Highland Lakes system.

2. To what extent is the LCRA using its Operations Model or other tools to measure and predict the quantity of groundwater outflows to surface waters available to satisfy environmental flows (especially subsistent flows during extraordinary drought)? Could the Operations Model (RiverWare) take data from a Surface Water-Ground Water monitoring system that interfaces with the improved GMA-12 GAM? Would this improve the predictive function of the model for delivering water down-river to users and to meet environmental needs?

   Are groundwater outflows in "gaining" stream segments, and surface water losses in "losing" stream segments accounted for and considered in decisions to release stored water from the Highland Lakes or to allow storable water to pass through the system? Are there policy questions/decisions that need to be considered or adapted in making such decisions?

3. In what ways and to what extent is the LCRA taking active measures to manage and protect groundwater inflows from being diminished through groundwater pumping of aquifers that intersect and influence the Colorado River and tributaries?

4. In what ways and to what extent is the LCRA taking active measures to protect historic interactions between groundwater, the Colorado River and its tributaries from unreasonable impacts resulting from groundwater pumping?

APPENDIX A

Specific Draft Final Report Comments and Author's Reply:

ES 2: Section 3.3, page 30: The assumption here seems to be that stream flow in relation to rainfall is a function of runoff and does not consider the hydrologic connection between rainfall, vegetation, aquifers and groundwater outflows to rivers and streams (baseflows). To what extent are stream flow gains and losses to and from groundwater aquifers considered in WAM data and analyses?

Author's Reply: WAM simulated results were not analyzed to assess historical rainfall/runoff relationships in the upper basin because the WAM model simulates a hypothetical condition, as prescribed by the user, not the historical condition. However, streamflow gains and losses are effectively considered in the overall WAM process in two ways. First, the extent that historical streamflow gains and losses actually occurred are captured in the naturalized flows, the hydrologic input to the WAM model, because the naturalized flows are based on observed flows that reflect all historical gains and losses. Second, for most of the upper Colorado Basin, the WAM has channel losses associated with stream reaches between primary control points and these loss factors are applied to changes in flow due to water rights activities that are simulated in the WAM.

ES 14, Section 3.5, page 37: Bringing groundwater management into the overall water management practices in the upper basin might be an important aspect of future adaptive management of these natural systems and associated resources. Groundwater trends seem to vary throughout the study area. Groundwater management practices used by Groundwater Conservation Districts (instilled in their Management Plans) and by Groundwater Management Areas in developing their Desired Future Conditions might be diminishing groundwater outflows to rivers, streams, and springs, thus impacting baseflows.

a) It would be useful to review the GMA, DFCs, and GCD Management Plans to determine which are protective of surface water and spring flow and which are not. Groundwater availability models (GAMs) vary considerably in their ability to model and confidently (quantitatively) predict outflows to surface waters and springs.

Author's Reply: Agree with comment. With regard to recommendation in item (a), review of the ground water districts' desired future condition information is beyond this project's scope of work and budget.

ES 21: Section 4.6, page 48: This scenario demonstrates the importance of the hydrologic connection between rainfall, the importance of woody vegetation returning water to the soil, aquifer recovery, and improved groundwater outflow (baseflow) to surface waters. All of these are components of hydrologic recovery. Was there a native prairie grass recovery component that went along with the woody plants?

Author's Reply: This comment is not clear, but it appears to ask whether the particular document summarized in this section describes a native prairie grass recovery component along with the increase in woody plants in the North Concho watershed

during the period after 1960. Additional review of this document indicates that it does attribute "greater vegetation cover – both woody and herbaceous plants" to the hydrologic recovery but does not describe whether there was a deliberate replanting of native prairie grass or not. The text included in the draft report is considered to be sufficient.

ES 24: Section 5.2.3,page 53: Were these groundwater declines incorporated into WAM data? Would it have raised a flag that surface water availability was being significantly impacted?

Author's Reply: The review of Groundwater Management Area's planning information, including their Desired Future Condition, is beyond this project's scope of work and budget.

ES 25: Section 5.3.1, page 54: The following publications referenced in INTERA's Draft Report on GAM Improvements may provide some insight into the groundwater-surface water interactions in the upper basin and how they may have impacted runoff during some portion of the study period. These studies should be reviewed and included in the report if appropriate. INTERA may be able to provide other references and insights regarding aquifer conditions and outflows to surface waters.

Slade, R.M., Jr., and Buszka, P.M., 1994, Characteristics of streams and aquifers and processes affecting the salinity of water in the upper Colorado River Basin, Texas: USGS, Water Resource Investigations Report 94-4036.
See Section 4.3.1, page 34 in GAM Improvements Draft Report

Slade, R.M., Jr., Bentley, J.T., and Michaud D., 2002. Results of Streamflow Gain-Loss Studies in Texas, With Emphasis on Gains From and Losses to Major and Minor Aquifers, Texas, 2000, U.S. Geological Survey - Open-File Report 02-068.
See Figure 4-2 and 4-3 in GAM Improvements Draft Report

Wolock, D.M., 2003b, Hydrologic landscape regions of the United States raster digital data U.S. Geological Survey Open-File Report 03-145 and digital data set (available at http://water.usgs.gov/lookup/getspatial?hlrus).
See Figure 4-9 in GMA Improvements Draft Report

Wolock, D.M., and others, 2003a, Flow characteristics at the US Geological Survey steamgages in conterminous United States: US Geological Survey Open-File Report 03-146, Data accessed February 2016, Available from: (available at http://water.usgs.gov/lookup/getspatial?qsitesdd).
See Figure 4-7, 4-8 and 4-9 in GMA Improvements Draft Report

Wolock, D.M., and others, 2004, Delineation and Evaluation of Hydrologic-Landscape Regions in the United States Using Geographic Information System Tools and Multivariate Statistical Analysis: Environmental Management, Volume 34, Supplement 1, pp. 71-88.
See Figure 4-9 in GMA Improvements Draft Report

Author's Reply: As a result of this comment, each of the references stated above was reviewed. For various reasons, the text of the report was not changed in response to these documents/data sources.

LCRA Water Management Plan Update Process: Participant comments through Aug. 31, 2018, and LCRA responses

Comments from Environmental Stewardship:

[*Comments abbreviated*].

1. Environmental Stewardship requests that the LCRA use the improved GMA-12 GAM to better estimate the impacts of groundwater pumping in the Simsboro Aquifer on the Colorado River and it tributaries in the Austin-Bastrop-Smithville reach to inform the current water management planning process on the potential impacts of such pumping on the overall Highland Lakes system.

> ***LCRA's response****: Interactions between groundwater and surface water are outside the scope of the WM Prevision.*

2. Environmental Stewardship requests that the LCRA prepare the hydrographic separation as described above for the period January 2011 through December 2013 for the Bastrop and Wilbarger gages of the Colorado River to gain insights on the quantity of groundwater that was being contributed to river flow for this extraordinary drought period.

> ***LCRA's response****: Determining the amount of groundwater that may have contributed to base flows in the Colorado River is outside the scope of the WMP revision. Environmental Stewardship may wish to review the naturalized flows for the Colorado River, which include numerous dry periods over the period of record, including recent drought years.*

3. To what extent, in the modeling tools (WAM) or other management practices, is LCRA considering and using the information from the rainfall/runoff report to adapt its management practices to better predict and improve inflows to the Highland Lake system? Solving the inflow problem is a critical function to improving management of the river and Highland Lakes system.

> ***LCRA's response****: This WMP revision uses a hydrologic period of record of 1940-2016. That period includes the years studied in the rainfall/runoff report, including the recent drought years, which included low inflows. The WM Prevision will include curtailment curves for providing interruptible stored water to agricultural customers and levels of environmental flow criteria that allow LCRA to meet the demands of its firm water customers while maintaining a minimum combined storage in lakes Buchanan and Travis of at least 600,000 acre-feet through a repeat of period of record.*

4. To what extent is the LCRA using its Operations Model or other tools to measure and predict the quantity of groundwater outflows to surface waters available to satisfy environmental flows (especially subsistent flows during extraordinary drought)? Could the Operations Model (RiverWare) take data from a Surface Water-Ground Water monitoring system that interfaces with the improved GMA-12 GAM? Would this improve the predictive function ofthe model for delivering water down-river to users and to meet environmental needs?

> ***LCRA's response****: Groundwater-surface water interaction is outside the scope of the WMP revision.*

5. Are groundwater outflows in "gaining" stream segments, and surface water losses in "losing" stream segments accounted for and considered in decisions to release stored water from the Highland Lakes or to allow storable water to pass through the system? Are there policy questions/decisions that need to be considered or adapted in making such decisions?

> ***LCRA's response****: Groundwater-surface water interaction is outside the scope of the WMP revision.*

6. In what ways and to what extent is the LCRA taking active measures to manage and protect groundwater inflows from being diminished through groundwater pumping of aquifers that intersect and influence the Colorado River and tributaries?

> ***LCRA's response****: Groundwater-surface water interaction is outside the scope of the WMP revision.*

7. In what ways and to what extent is the LCRA taking active measures to protect historic interactions between groundwater, the Colorado River and its tributaries from unreasonable impacts resulting from groundwater pumping?

> ***LCRA's response****: Groundwater-surface water interaction is outside the scope of the WMP revision.*