**Review of Instream Flow Study of Lower San Antonio River and Lower Cibolo Creek, Draft Study Design**

**Reviewer 1**

Overall this is an impressive, attempt to deal with a broad mandate. There are some key shortcomings, however. The objectives are not defined clearly enough to determine whether they are being met. The different parts of the study are not always well integrated. The central feature of the project is a generic 2D hydraulic model that is not sufficiently linked to biological questions. The proposed sampling strategy for riparian vegetation will not make it possible to relate the occurrence of riparian species or communities to flow.

**General Comments**

Page 6. The explanation of the increase in discharge since 1970 is unconvincing. Amounts in different units are difficult to compare. How does the change in total annual discharge compare to the change in total annual pumpage from the Edwards Aquifer? Prepare graphs showing the time trend in total annual streamflow, total annual groundwater withdrawal in the watershed, total annual discharge from the wastewater treatment plant in San Antonio, and total annual precipitation. This would show how much of the increase in discharge in the river is due to groundwater pumping and/or sewage discharge.

Page 29, section 2.2.2, Biology Objectives. The biological objective is vague: "to determine and maintain flows necessary to support key aquatic habitats and native species and biological communities known to occur in the river and riparian zones". At what level do we want to maintain these features? Do we want them to function at current levels, pre-industrial levels, or at some other benchmark? The following section, Physical Processes, has the same problem. Is the goal to maintain current channel dimensions within a certain range? Is the goal to allow all processes to occur naturally? Indicators are supposed to help determine whether goals are being met, but these goals are too vague to work in that way. The other goals have the same problem.

Page 33. Considerable work with stakeholders has been done to identify key animal species to serve as indicators. The same has not been done for riparian vegetation, however. No indicator riparian species are identified, and no distinction is made between native and invasive riparian species. Is maintaining overall diversity and richness really the only concern with respect to riparian plants? How about the total area or linear thickness of riparian vegetation?

Table 10 (Water Quality Indicators) does not include suspended sediment. This can be a major problem for fish and mussels. For example, darters, one of the target fish groups, spawn in gravel, and the golden orb mussel is a filter feeder that can be killed by excessive sedimentation. Total annual suspended sediment yield could also be an indicator of effects of watershed management, and impacts animals as well as channel

geometry. Also missing are any indicators related to toxic compounds (e.g. heavy metals, pharmaceuticals from treated sewage, etc.) that might endanger humans or wildlife and are generally problems downstream of the sewage outfalls of major cities.

P. 63. One of the goals for overbank flows is to maintain riparian vegetation. In order to quantify the needed overbank flows it will be necessary to know the hydraulic position occupied by the desirable riparian species, but it does not appear that this will be possible using the data collected. The 2D hydraulic model will not extend up to the flood plain. A 1D hydraulic model will be available, but it is unclear whether the resolution will be sufficient to determine the inundating discharge of a surface occupied by a given plant. Two sets of plant data will be collected. Extent and distribution of riparian communities will be assessed using the TPWD/NatureServe Vegetation Classification System database. This database will not provide information about the locations of individual plants, and it is unclear whether the mapped plant-community polygons will be small enough to relate to local hydraulic position as determined from the 1D hydraulic model. The 50-m transects perpendicular to the channel will provide information about individual species, but will be much too large to have a uniform inundation frequency. Thus it is unlikely to be possible to relate riparian vegetation to hydraulic position. If more precise positional information were desired about vegetation, this could be acquired by subdividing the 50-m plots into 1-m subplots and measuring elevation of each subplot relative to some hydraulic reference (e.g. Auble et al. 2005). It is unclear, though, whether the 1D hydraulic model would provide precise enough hydraulic information to relate to such data.

The proposed study is limited by lack of information on the threats to the target species. More specifically, the proposed fish and mussel habitat studies are generic in that they are not guided by knowledge or hypotheses about processes or life stages that are most important to prevent decline. The fish surveys will tell us where some of the different life stages are, but they will not necessarily tell us which of those life stages is most vulnerable or why. Brief biological descriptions of a few species are provided, but these do not include information about the important threats. Such information can be acquired from biologists and should be assembled before the modeling exercise begins (e.g. Bovee et al. 2008). Where information is scarce for a species (e.g. for golden orb mussel) it may be possible to take advantage of what is known about close relatives. For example, some Texas fish spend a critical part of their life cycle on the flood plain. The proposed modeling effort will not be able to address this vulnerability because the 2-D model does not extend up to the flood plain. Threats to unionid mussels include overharvesting, excessive siltation, channel dredging, and decline of the fish species serving as glochidial hosts. Can the data collection effort be tailored to address any of these issues? Darters spawn in gravels, and therefore eggs may be especially susceptible to siltation. Can we include assessment of spawning gravels and flushing flows necessary to keep them clean?

Attention must be paid to integrating the different study components. For example, shade from riparian trees decreases light, reducing unwanted algal growth. Woody debris is important habitat for some fish. The project will be studying fish habitat, riparian vegetation, and woody debris, but it is not clear whether these studies will be carried out

at appropriate scales to be integrated effectively. Measurements of local riparian vegetation and woody debris must be integrated into fish microhabitat assessment, and must be related to the broader-scale studies of riparian vegetation and woody debris.

**Detailed Comments**

Page 2, 3rd line from bottom, replace "interchangeable" with "interchangeably".

Table 2. It is not possible to determine the location of these gages from the information provided. A figure showing location is necessary. These locations could be added to Figure 1. The Table should also show the number of complete years of record for each gage.

Figure 4. What is the change in total annual precipitation since 1970. The difference on the graph appears small.

Page 15. What might have caused the recent major mortality of the Texas endemic golden orb mussel, as indicated by shell piles?

Page 15, second to last paragraph. This is what Baker proposed for Texas streams. What evidence is there that this is true for the San Antonio? Why not show the record of peak instantaneous annual discharge to see whether there is a history of major floods on this particular river?

Page 16, line 6. The sentence "The high mobility of log jams are attributed to these events considering high stream power caused by narrow incised banks" is unclear (also "are" should be "is").

What is the importance of log jams in this system? Fish habitat? Structure to reduce erosion? What is the historic condition?

Section 1.2, Assessment of current conditions makes general statements about how wide a strip of riparian vegetation remains in urban and rural areas, but nothing about species, reproduction, or ecological function.

Page 16. The last paragraph in section 11.3 (beginning "Cawthon and Curran….") should be moved to directly after the second paragraph of the section (beginning "Baker…").

p. 24, second to last paragraph says "The banks of the lower Cibolo Creek are steep and undercut." Is that the natural condition or an indicator of some problem. Has there been recent incision?

Page 30. Physical Processes. The Physical Processes component is the only one of the 5 components whose objective does not tie back to the Basin Goal. Consider replacing the first sentence with "The geomorphological objective is to determine flows necessary to

maintain fluvial processes essential for meeting the basin goal. Positive and negative effects of channel migration, woody-debris dynamics and overbank flooding will be evalutated."

Page 30, 5 lines from bottom, replace "paired" with "pared".

Table 7. The natural vs current distinction is useful, but please give the justification for choosing the last 20-25 years as current.

Throughout. Both "overbank" and "overbanking" are used. "Overbank" is usually preferred.

Table 9 (Physical Processes). It might be useful to add degree of channel incision (i.e. elevation of the channel bed in certain locations. The introduction suggested that incision is a potential problem in some places.

Figure 11. The key includes a pink for Edwards Plateau that does not occur on the map. Shouldn't this part of the key be deleted?

Figure 11. The study area is divided into 5 Study Segments, one of which, Segment LCC1, is superfluous. This smallest of segments is not important enough to merit any Reach-Specific Activities (see page 45). Why not lump this segment with Segment LCC2, keeping Reach 9 and Reach 10 as separate Reaches?

P. 50, Section "High flow pulse and overbank assessment" Third line, "indictors" should be "indicators".

P. 56. More information on the number of riparian transects per study site is necessary. The statement "…the number of transects run will be determined by the size of the Study Site selected" is vague.

P. 55-57. Riparian habitat - baseline surveys and evaluation. The ninth line of the first paragraph states that age-class distributions of riparian vegetation will be assessed. Age classes are, indeed, important for linking riparian vegetation to flow, but the detailed methods make it clear that no age measurements will be made. Therefore, replace "age class" with "size class".

**References**

Auble, G.T., M.L. Scott, and J.M. Friedman. 2005. Use of individualistic streamflow-vegetation relations along the Fremont River, Utah, USA to assess impacts of flow alteration on wetland riparian areas. Wetlands 25:143-154.

Bovee, K.D., Waddle, T.J., Talbert, C. Hatten, J.R., and Batt, T.R., 2008, Development and Application of a Decision Support System for Water Management Investigations in

the Upper Yakima River, Washington: U.S. Geological Survey Open-File Report 2008-1251, 289 p.