

April 20, 2012

The Honorable Troy Fraser, Co-Chair  
Environmental Flows Advisory Group  
P. O. Box 12068 – Capitol Station  
Austin, TX 78711

The Honorable Allan Ritter, Co-Chair  
Environmental Flows Advisory Group  
P. O. Box 2910  
Austin, TX 78768-2910

Dear Senator Fraser and Representative Ritter:

The Basin and Bay Expert Science Team (BBEST) for the Brazos River completed their environmental flow recommendation report on March 1, 2012. The report was submitted to the Environmental Flows Advisory Group (EFAG), the Texas Commission on Environmental Quality (TCEQ), and their Basin and Bay Area Stakeholder Committee.

The report is comprehensive and considers a wealth of scientific literature and data. The report clearly represents a substantial effort by the members of the science team to address their charge as stipulated in Senate Bill 3. The state can be proud we have so many dedicated scientists willing to participate in this program.

Attached are review comments prepared and adopted by the Texas Environmental Flows Science Advisory Committee (SAC) pursuant to Texas Water Code **Sec. 11.02362(q)**, as added by Senate Bill 3 in the 80<sup>th</sup> Texas Legislature, 2007. The statute calls for the SAC to provide input to the EFAG for its use in reviewing the BBEST environmental flow analyses and environmental flow regime recommendations. The attached review follows a modified framework adopted by the SAC in December 2010, and reflects the consensus opinion of the SAC members. Should the advisory group deem it appropriate to submit comments to the TCEQ as they undertake rulemaking for this basin, the SAC trusts that you will find the enclosed review helpful, and we stand ready to support your preparation of comments in any way you deem appropriate.

Sincerely,



Robert J. Huston  
SAC Chairman

CC: Hon. Dale Spurgin, Brazos River Basin and Bay Area Stakeholder Committee Chair  
Tom Gooch, Brazos River and Bay BBEST Chair  
Mark Vickery, Executive Director, Texas Commission on Environmental Quality

**To: Environmental Flows Advisory Group (EFAG)**  
**From: Texas Environmental Flows Science Advisory Committee (SAC)**  
**Date: April 20, 2012**  
**Re: Review comments on the Brazos River Basin and Bay Expert Science Team (BBEST)**  
**Environmental Flow Regime Recommendations Report dated March 1, 2012.**

## **Introduction**

The Brazos River Basin and Bay Expert Science Team (BBEST) submitted its environmental flow analyses and environmental flow regime recommendations to its Stakeholder Committee, the EFAG and the Texas Commission on Environmental Quality (TCEQ) on March 1, 2012. This was followed by a presentation to the SAC at its meeting on March 14, 2012. Texas Water Code **Sec. 11.02362 (q)**, as added by Senate Bill 3 in the 80<sup>th</sup> Texas Legislature, 2007 (SB 3), provides that “In accordance with the applicable schedule...the advisory group, with input from the science advisory committee, shall review the environmental flow analyses and environmental flow regime recommendations submitted by each basin and bay expert science team. If appropriate the advisory group shall submit comments on the analyses and recommendations to the commission for use by the commission in adopting rules under Section 11.1471. Comments must be submitted not later than six months after the date of receipt of the analyses and recommendations.” This memorandum represents the SAC’s input to the EFAG based on our review of the Brazos River BBEST report.

The SAC appreciates the quality of the work and the report provided by the Brazos BBEST. The analysis is comprehensive and considers a wealth of scientific literature and studies in the basin. The report is well prepared with excellent use of graphics.

## **SAC Review and Comments**

**1. Do the environmental flow analyses conducted by the BBEST appear to be based on a consideration of all reasonably available science, without regard to the need for water for other uses?**

**1.1. Has the BBEST identified and considered available literature and data? Were relevant scientific data and/or analyses discounted by the BBEST?**

The BBEST appears to have identified and considered all reasonably available literature and data, and did not ignore existing relevant data or analyses. The question of whether analyses were discounted by the BBEST is more complex. While “discounted” may not be the ideal word, the SAC does believe there might be analytical opportunities that were not employed. These are discussed in section 2.5 below.

### **1.2. Are the data sources and methods adequately documented?**

The referencing of data sources is excellent in the report, but some references were incomplete or missing in Appendix A. The description of the methods employed is also well done. As might be expected in the review of a complex process, questions can be raised regarding methods and choices made. However, the level of documentation was generally adequate.

### **1.3. To what extent has the BBEST considered factors extraneous to the ecosystem, especially societal constraints, such as other water needs?**

The BBEST kept constraints such as water needs separated from its analysis. They did use a Water Availability Model (WAM), but only for consideration of geomorphologic effects in Section 7.0 of the report.

While extraneous factors such as water needs were not considered explicitly, the BBEST has accepted existing reservoirs that are not part of the natural ecosystem and that potentially affect some aspects or dimensions of the Sound Ecological Environment (SEE) determination without explicitly stating the case for doing so. While accepting existing conditions is consistent with SB 3 and SAC guidance, there might have been opportunities to improve on the low fish integrity in certain reaches. This aspect is addressed in more depth in section 2.1 of these comments.

## **2. Did the BBEST perform an environmental flow analysis that resulted in a recommended environmental flow regime adequate to support a sound ecological environment and to maintain the productivity, extent and persistence of key aquatic habitats in and along the affected water bodies?**

The BBEST clearly performed an environmental flow analysis, following established hydrologic methods that produced a flow regime designed to support the existing ecological system throughout the basin. However, there is a question as to whether the existing system was determined to meet the definition of a SEE that is discussed below in section 2.1.

### **2.1. How is a sound environment defined and assessed for both riverine (lotic) and estuarine systems? What metrics of ecosystem health were used?**

The BBEST does not make an explicit assessment of SEE status, defined as a flow regime that

- *Sustains the full complement of native species in perpetuity;*
- *Sustains key habitat features required by these species;*
- *Retains key features of the natural flow regime required by these species to complete their life cycles; and*
- *Sustains key ecosystem processes and services, such as elemental cycling and the productivity of important plant, and animal populations*

Section 1.3 of the BBEST report explains procedures for SEE evaluation, but it primarily focuses on the “integrity” of fish communities. “Relatively intact” and “high integrity” are considered synonymous by the BBEST. Both terms mean that none of the native species have been eliminated from the reach, and the relative abundances of species have not been greatly altered. It further notes that high integrity is characterized by fish surveys producing the full complement of native species in relative abundances approximating those recorded in earlier studies or within un-impacted streams within the same zoogeographic region. Fish surveys revealing losses of native species, major changes in species relative-abundance patterns, or invasions by non-native species are defined as low integrity.

The report then evaluates each study reach using integrity of fish communities. Of the 12 reaches evaluated, only 4 (Upper Brazos, Salt Fork, Double Mountain Fork, and Navasota) received High integrity rankings. The Middle Brazos and Clear Fork received low integrity rankings. It is unclear at this point in the BBEST’s discussion whether or how “integrity” relates to SEE. If the community changes and low integrity rankings are associated with flow and the recommended flows are those that have been seen historically, that would not be a recommendation that would result in an improvement to the existing low integrity rankings in certain reaches... On the other hand, if the low integrity rankings are from stream fragmentation rather than flow, and the fragmentation is associated with existing permits and structures, then a flow regime designed to facilitate improvements in low fish integrity rankings would not seem appropriate

There almost no consideration of golden algae and its relationship to flow. The role of flows in protecting a SEE and in the prevention of these algae outbreaks is not well known, but an explicit statement regarding the decision not to consider these aspects of the natural flow regimes and the implications for SEE would seem appropriate, if for no other reason than to identify an area of uncertainty and need for future work. If the stakeholders determine that reducing golden algae is one of their goals, they should be able to understand whether or how the issue was addressed by the BBEST.

A SAC concern is that the Brazos River BBEST report does not explicitly address SEE status. It can be inferred from the recommendations that the BBEST concluded the ecological condition was sufficiently sound to support the existing fish assemblage, given the level of changes that have occurred. This is consistent with SAC guidance, including the Biological Overlay dated August 31, 2009. It is recognized that essentially all river basins in Texas have seen substantial alternations. Several previous BBEST efforts have concluded that while flows were not entirely natural, and effects on native species had occurred, they still constituted a SEE. However, that

clarity of statement, and a description of any linkage between SEE and fish community integrity are lacking in the Brazos BBEST report.

On the estuary side of the report, the Brazos BBEST chose to use the same approach as the Sabine-Neches BBEST, which relied on hydrology-based methods rather than a salinity-zone approach. The Brazos BBEST essentially (but not explicitly) concluded that a SEE exists in the Brazos and San Bernard estuarine systems, and that a regime of inflows that supported the river would be supportive of the estuaries. This is justified based on the fact that the Brazos and San Bernard estuaries are riverine-estuary rather than a bay-estuary, and that data for a more comprehensive analysis were not available.

**2.2. How were locations selected for environmental flow analysis? Are these shown to be representative of and adequate to protect the basin? Was the process and rationale for selection adequately described? Were environmental flow regimes recommended for each selected site? Was a procedure presented by which the flow regime at other locations could be estimated?**

The location of flow recommendation stations seems logical and sufficient, emphasizing availability of a long-term flow record. There are good sub-basin descriptions. The estuarine portion was well described even though relatively little data were available.

There was no procedure presented by which the flow regime could be extrapolated. Instead, the BBEST recommended that TCEQ develop such a procedure.

**2.3. How were the historical flow periods defined and evaluated? How was a particular period selected as the basis for determining the flow regime?**

The SAC understands that there was an assessment of the alterations in flow over time at each gauge, and that at the end of that assessment the entire period-of-record was used at each gauge.

This has led to the period-of-record extending to as long as 111 years for some segments, while only 39 years for some others. There is little analysis or discussion in the BBEST report pertaining to what, if any, effects using these widely ranging periods-of-record may have on the recommended flow regimes.

**2.4. Was a sound ecological environment determined to exist at each selected site during the selected period? If not, were the underlying causes and/or modifications needed identified?**

As discussed under section 2.1, while a sound ecological environment was not explicitly determined to exist at every station, the analysis was performed with an implicit determination

that the fish community was in an acceptable condition given existing system modifications. Some areas have been impacted strongly enough to have extirpated fish species and modified the remaining communities. Generally, reservoir development causing flow alterations and habitat fragmentation was blamed. While basing the flow recommendation upon historically altered flow data will likely not guarantee that fluvial specialist species will receive flows they need, the BBEST did conclude that the existing fish community would be protected.

For the estuarine areas the data are limited, and there appears to have been no explicit finding of a SEE under current conditions. Absent such a finding, the SAC infers that the BBEST did believe a SEE currently exists and based their recommended environmental flow regime recommendations on a conventional hydrologic analysis of the existing flows.

**2.5 Was a functional relationship between flow regimes and ecological health developed? Or, were proxy or intermediate variables used? Are assumptions underlying the methodology clearly stated? To what extent were overlay considerations (sediment transport, water quality, nutrients, etc.) addressed?**

Despite the absence of local data to allow development of site-specific mathematical relations, a qualitative functional relationship between flows and ecological health was clearly understood by the BBEST and discussed in the report. They employed established and SAC-recommended methods for historical hydrologic analyses. There is a lack of clarity over how sound the BBEST believed the existing ecological environment to be. Assuming there was an implicit finding of a SEE, where information was available functional relations were evaluated to confirm the appropriateness of HEFR results.

At least three sets of biological data presented in the BBEST report appear to have been available for establishing flow recommendations based directly on biological to flow relationships. These include 1) the species-specific flow recommendation (227 cfs) provided by Durham and Wilde (2009), 2) the oxbow connectivity work conducted in the basin, and 3) the Duke (2011) riparian assessment. In each instance, it appears these data could have been considered to directly set recommendations based on biology to flow relationships and then other parts of the flow-regime supplemented based on historical hydrology. An additional approach would have been to use this site-specific biological data to parameterize HEFR prior to any analysis. While it is unclear if direct relationships were considered or if any parameterization of HEFR was done, a post-HEFR analysis was performed and a determination was made that HEFR generated flows would achieve environmental flow components necessary for a sound ecological environment. No modifications were proposed based on this site-specific data.

The sediment analysis was complete and it addressed realistic projects and flow changes. The scenario with full implementation of environmental flows (infinite infrastructure) indicated a major reduction of sediment transport. Consistent with other basins, the infinite infrastructure scenario was not considered to be realistic. The evaluations performed by the Brazos BBEST for two possible projects are considered to be useful and realistic. Also, the recommendation for evaluation of changes in sediment transport and stream habitat with any new reservoir project is considered to be appropriate. Functional relationships based upon riparian considerations were not possible to develop because of data limitations. Nutrient supplies to the very small estuary were not considered, and no significant relation between flow and water quality was found in the water quality analysis.

## **2.6. Was a sound ecological environment demonstrated to be achieved at each selected site under conditions of the recommended flow regime?**

The historical hydrologic analysis was conducted with a comprehensive and consistent application of established and SAC-recommended methods to define essential environmental flows based on the existing flow records. Assuming that the existing flow regime provides a SEE (inferred but not explicitly stated), then the recommended regime should provide a SEE.

There are several positive environmental aspects of the recommended environmental flow regimes. One is the use of the 1 cfs minimum for subsistence flows at locations where zero flow is common. This insures that a new permit could not further reduce flows at the lower end of the range. Another positive feature is the use of the Palmer Hydrologic Drought Index (PHDI) values to define hydrologic conditions. A 25<sup>th</sup> and 75<sup>th</sup> percentile PHDI value was calculated for each watershed using the entire available period of record (1895-present) to indicate which periods were dry (Palmer Index < 25<sup>th</sup> percentile), wet (> 75<sup>th</sup> percentile), or in average conditions where the Index is between the two percentile values. The SAC agrees that this procedure may constitute a viable alternative over using reservoir levels or stream flows to determine the hydrologic condition applicable to base flow recommendations because it is independent of man-made flow alterations.

## **2.7 Is uncertainty in the analyses described or quantified? Where models were employed, was the extent of validation and associated predictive errors described and quantified?**

There was no attempt to address uncertainty in the recommended flow regimes. However, there was a substantial recognition and discussion of uncertainty in the sediment transport modeling analysis, pages 7-13 and 7-14, particularly with regards sediment transport rating curves. Uncertainty in the flow regime is discussed in Section 8 (Adaptive management).

## **2.8 Additional Comments**

The SAC appreciates the efforts made both in formulating an initial draft of a Work Plan for adaptive management (Section 8) and in identifying issues related to environmental flows that are likely to arise in the basin.

There is a sentence on page 4-18 that is incorrect: “Hence, it never flooded to create a bay. As a result the Brazos River lacks a well developed estuary.” There is indeed a well-developed estuary here. Earlier in this paragraph they correctly state “The Brazos River would be classified as having a *river-mouth estuary* or *riverine estuary*” so the correct statement would have been: “Hence, it never flooded to create a bay. As a result the Brazos River lacks a well developed bay system.”

The photos that accompanied the flow recommendations in Section 4.0 are excellent. This is a very powerful approach to help communicate the environmental flow recommendations to stakeholders.

The image shown as Fig. 5.1 (pg 5-37) is problematic. It appears to show a nearshore band of turbid water, which in fact results from an attempt to superpose the nearshore image with a stock image of Gulf of Mexico water. This nearshore band could be misinterpreted. Another image is available (shown below), taken the day before by TGLO, which shows the same sediment transport features but lacks the photographic image processing artifact.



Freeport, TX

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Imagery Date: 2/15/2010

28°54'43.85" N 95°21'31.72" W elev 4 ft

Eye alt 12.12 mi