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Re: Texas Parks and Wildlife Department Staff Perspectives on the Brazos River Basin and Bay Expert Science Team Report and Recommendations

A statewide process for identifying and protecting environmental flows for Texas rivers and bay systems was passed in 2007 and is currently underway throughout most of the state. Senate Bill 3 (SB 3), Article 1 of the 70th Texas Legislature, outlines a collaborative process involving regional stakeholders and expert scientists with an interest in the water resources of the basin. One of the first steps in the SB 3 process was the appointment of a Brazos River Basin and Bay Expert Science Team (Brazos BBEST) who were tasked with developing science-based environmental flow regime recommendations for the basin and bay system by March 2012. The Brazos BBEST fulfilled their task and this memorandum summarizes Texas Parks and Wildlife Department (TPWD) staff comments on their report. SB 3 directed each BBEST to develop an environmental flow regime recommendation:

...through a collaborative process designed to achieve a consensus. In developing the analyses and recommendations, the science team must consider all reasonably available science, without regard to the need for the water for other uses, and the science team's recommendations must be based solely on the best science available.

The Brazos BBEST engaged resource agency staff and others throughout the process. TPWD assisted and supported the BBEST by conducting the modeling used to develop the environmental flow regimes and providing reports on fish and wildlife resources. The BBEST fostered participation by TPWD and others that resulted in the use of best available science to generate environmental flow regime recommendations that TPWD generally supports.

Having worked on numerous instream flow and freshwater inflow recommendations over many years, TPWD is familiar with the uncertainty embedded in such efforts, cognizant of the challenges faced by the BBEST, appreciative of the efforts expended by the members and grateful for the many opportunities to provide input throughout the process. The BBEST had

approximately twelve months to meet the SB 3 charge. The difficulty of the challenge cannot be overstated and the progress of the BBEST is commendable. The Brazos BBEST clearly learned and benefitted from the experiences of previous BBESTs and extended the state of the science in several respects such as the application of the Palmer Hydrologic Drought Index to define climatic conditions. That said, it is widely recognized that the science of environmental flows is complex along many dimensions, and the Brazos BBEST did not have the time, data, or budget to perform a definitive analysis.

This memorandum contains general comments regarding the Brazos BBEST report and the SB 3 charge to develop an environmental flow regime for the Brazos River and associated bay and estuary system. These comments are intended to assist the Environmental Flows Advisory Group, the Texas Commission on Environmental Quality, and the Brazos Basin and Bay Area Stakeholder Committee (Brazos BBASC) in reviewing the BBEST recommendations.

General Comments

TPWD commends the Brazos BBEST for its diligence and determination to address the requirements set forth by SB 3. In general, the BBEST followed guidance provided by the Texas Environmental Flows Science Advisory Committee (SAC) and addressed the requirements set forth by SB 3. The BBEST laid out a clear step by step approach to guide development of flow regime recommendations. The BBEST report consists of nine sections including recommendations for future work to be conducted within the context of adaptive management, however no comments are offered at this time on that section. Eight appendices thoroughly document the information used in the BBEST's evaluations.

Preamble

This section contains a thorough explanation of the SB 3 process and the BBEST charge and provides a refined summary of the BBEST findings. TPWD appreciates the efforts of the BBEST in Section 1.3 to define a sound ecological environment. The SAC definition of a sound ecological environment is adopted. Further, the "BBEST determined that a sound ecological environment within stream and river reaches of the Brazos Basin would be characterized by fish, macroinvertebrate (e.g., mussels, shrimp, crayfish), and riparian vegetation species assemblages that remain relatively intact compared to historical records." Because of a lack of robust information on macroinvertebrates and riparian vegetation, the BBEST used the integrity of fish assemblages as a gauge on the soundness of each river segment evaluated. For example, the fish assemblage integrity for the upper Brazos River is rated high, the middle Brazos River is low, and the lower Brazos River is rated moderate. Other information such as aquatic life use assessments is presented as well. Because explicit linkages to soundness (other than that "relatively intact" is characterized as sound) are not provided for moderate and low integrity ratings, the BBEST leaves room for interpretation in the report. Staff recommends that a clear definition linking integrity across the gradient of ecological soundness be generated as evaluations and discussions move forward.

The ecological soundness of the estuarine reaches of the Brazos River and San Bernard/Cedar Lakes system is not discussed.

Instream Flow Analyses

Overall, TPWD supports the Brazos BBEST environmental flow recommendations. The Brazos BBEST followed guidance provided by the Science Advisory Committee (SAC) as well as the natural flow regime framework utilized by previous BBEST groups in developing their instream flow recommendations. The Brazos BBEST benefitted from a wealth of site-specific peer reviewed published literature of which it utilized to its full potential as well as relying on other information including data on historic flows, instream biology, water quality, sediment transport, and riparian ecology. TPWD commends the BBEST for adequately addressing the flow needs of such an expansive geographic area, and thoroughly assimilating the abundance of information that was available to them for this basin. The information is well documented in a series of technical appendices. The BBEST provides recommended flow regimes at 20 locations within the Brazos River and its tributaries, San Jacinto-Brazos Coastal and San Bernard River basins. BBEST flow regime recommendations include the following flow components: subsistence flow, three levels of base flows, five to seven levels of high flow pulses, and overbank events at each location. The recommended flow regimes offer the flow variability at each site needed to maintain important ecosystem functions.

Subsistence flow is the minimum streamflow needed during critical drought periods to maintain tolerable water quality conditions and provide minimal amounts of aquatic habitat for the survival of aquatic organisms (NRC 2005). BBEST recommended subsistence flows are based on the 95th percentile (Q95) of historic flows except where the Q95 resulted in a value less than 1 cfs. At these locations, a 1 cfs floor was established as the subsistence flow recommendation, and TPWD staff supports this approach. Although the 1 cfs subsistence flow recommendation at locations of prolonged very low or no flow periods (e.g. upper Brazos River Basin) may seem high compared to gage data, TPWD believes the recommendation is important for protecting the lowest flows at these sites allowing these areas to dry at more natural rates thereby maintaining frequencies of occurrence and duration of extreme low flow events from being exacerbated by new water development.

Base flow refers to the normal flow conditions found in a river in between storm events (high flow pulses). Base flows provide adequate habitat for the support of native aquatic communities and maintain groundwater levels to support riparian vegetation (NRC 2005). For the base flow recommendations, the Brazos BBEST relied on some site-specific studies conducted in the lower Brazos River but mostly upon qualitative information regarding the biota and their life history requirements. The Brazos BBEST, consistent with the work of previous BBESTs, quantified seasonal base flows as the 25th, 50th, and 75th percentile values of the base component derived from IHA/HEFR to represent central tendencies of base flows during low, medium, and high hydrological conditions for each season (p. 4-8). TPWD staff believes three levels of base flows are needed to provide adequate intra- and inter- annual flow variability which provides sufficient habitat diversity. An integral part of the BBEST base flow recommendations are the criteria for defining the low, medium, or high hydrologic condition. The BBEST recommends a method for establishing the appropriate hydrologic condition based on a monthly Palmer Hydrological Drought Index (PHDI) for specific sub-watersheds across ten climatic divisions of the Brazos and San Bernard Basins. TPWD staff believes such an innovative yet implementable approach is needed in the environmental flow (e-flow) recommendations in order for future TCEQ standards to be meaningful and flexible enough to be applied during variable climatic and hydrologic conditions often experienced across Texas. TPWD recommends the Brazos BBASC and TCEQ

adopt the same or a similar approach to establishing hydrologic conditions for variable base flow levels in their e-flow recommendations or proposed rules, respectively, in order to maintain sound aquatic and riparian habitats. Also, the BBEST's recommended base flow values should be further evaluated when additional information becomes available (e.g. Middle and Lower Brazos River SB2 Instream Flow Study) as part of future workplan activities.

The Brazos BBEST spent considerable effort evaluating the high flow pulse (HFP) component of the environmental flow regime. This BBEST benefited from an abundance of published literature regarding the HFPs in the Brazos to utilize in their e-flow recommendations. HFP recommendations that fully capture the ecological importance of a range of HFP frequencies, magnitudes, and durations have been one of the more difficult components for previous BBESTs to develop. The Brazos BBEST was able to consider high flow pulse requirements for fish spawning and recruitment, HFP effects on freshwater mussels, and ensuring that the recommended HFPs maintained critical connectivity with floodplain aquatic features (i.e. oxbow lakes) which are important nursery and feeding habitats for many of the aquatic species observed in the Brazos River Basin. TPWD supports the high flow pulse recommendations of the BBEST; the recommended HFPs for such a varied geographic and hydrographic area should be sufficient to maintain the ecological functions of high flow pulses.

The Brazos BBEST evaluated the relationship between flow and sediment transport at two locations: Brazos River at Seymour and Brazos River at Richmond. The analyses focused on sediment transport under various scenarios (water development projects) with the implementation of their environmental flow recommendations. The BBEST analyses of the sediment transport at these locations indicate that the river channel is undergoing modest geomorphic change. TPWD encourages the BBEST to work with the Brazos BBASC to understand the importance of geomorphic processes to the ecological health of the system and assist the BBASC in determining appropriate high flow pulse recommendations for the stakeholder report. Further evaluation of high flow pulses is a topic that could also be addressed in the Brazos BBASC work plan.

Freshwater Inflow Analyses

TPWD agrees with the BBEST findings that the Brazos and San Bernard estuarine ecosystem and associated marshes support important nurseries and essential habitat for certain aquatic species and wildlife, and also that it currently has productive recreational and commercial fisheries.

The Brazos BBEST concluded that the Brazos and San Bernard River system has been extensively modified, and that it is highly unlikely the estuarine ecosystem can return to its historical or natural state. For this reason and also due to the lack of data, the BBEST concluded that the instream flow regime recommendations will provide sufficient inflows to support a sound environment at the mouths of both rivers. In the course of reaching this conclusion the BBEST conducted a literature review, considered SAC guidance, calculated and compared sediment transport capacity for different inflow scenarios, and evaluated statistical correlations between modeled estuarine inflows and gaged river flows. Citing a lack of extensive data, the BBEST settled on a hydrology-based approach to characterize historical inflow patterns to the estuaries. TPWD would like to clarify that although routine fishery-independent data are not currently being collected in the estuarine reach of the Brazos estuarine systems there is a

growing fishery independent database for the San Bernard/Cedar Lakes system. Regarding the assumption that the recommended instream flow regime would satisfy the needs of the estuary, it is not clear if the role played by the saltwater barrier on the San Bernard was considered. A similar structure is also recommended in the 2011 Region H Water Plan for the Brazos River. As proposed, the saltwater barrier has the potential to prevent subsistence and low base flows from reaching the estuarine system. The structure could negatively affect nekton and estuarine habitat by limiting the freshwater input to the San Bernard estuary and thus increasing salinities during low flow conditions. In addition, the saltwater barrier will impeded the movement of organisms to upstream freshwater environments.

The BBEST also evaluated sediment concerns in the basin by evaluating sediment transport capacity for alternative instream flow scenarios. Sediment transport capacity was calculated using daily mean flow data and sediment rating curves, and then converting the result into a mean annual sediment yield by summing the daily values and dividing by the number of years in the period of analysis (1940-1997). The report clearly explains that the sediment analyses are not an accurate estimate of sediment load and are suitable only for comparison between alternative scenarios. In general it is difficult to translate the results from this type of analysis into an effect on the ecosystem since a net increase in sediment does not always translate into positive effects on the ecosystem. Similar to a flow regime, it is critical to consider the timing, quantity, quality, and rate at which it flows into the estuary and accumulates on the fringing marshes. TPWD encourages the BBEST to work with the Brazos BBASC to understand the importance of maintaining sediment loads to the estuarine portion of the Brazos and the San Bernard Rivers. Changes in the morphology of the river could result in substantial coastal erosion and reduced productivity of the estuary, negatively affecting the “soundness” of the estuary.

While TPWD agrees that it is unlikely that all water in excess of the environmental flow recommendation will be stored or diverted, it is not impossible. Future water availability scenarios predict an increase in the amount of water consumptively used, more dependence on return flows to meet human demands and a resulting decrease in the amount of water returned to streams, and development of water supply strategies such as scalping operations that will need high diversion rates and large storage to be successful. In addition, existing water rights will not be subject to SB 3 environmental flow requirements thus making environmental flows junior in priority and subject to depletion during critical low flow periods.

Concluding Comments

Overall, the Brazos BBEST members met their charge and provided a suite of environmental flow regime recommendations which appear to be adequate to support a sound ecological environment. TPWD plans to remain involved with the important work of SB 3 and is looking forward to providing technical assistance and guidance to the expert science team and stakeholders when requested. Since the work of the BBEST does not end with the publication of a BBEST report, TPWD is also looking forward to assisting the BBEST and the BBASC with the development of a focused and prioritized Adaptive Management Work Plan that is intended to address knowledge gaps and issues raised in the BBEST report.

Thank you for the opportunity to share these comments with you.