Environmental Flows Recommendations Report

Final Submission to the Environmental Flows Advisory Group, Rio Grande Basin and Bay Area Stakeholders Committee, and Texas Commission on Environmental Quality

Upper Rio Grande Basin and Bay Expert Science Team

July 2012

Upper Rio Grande BBEST

- The Upper Rio Grande BBEST study area includes the Rio Grande basin upstream of Amistad Reservoir and below Presidio, including the Pecos and Devils river basins.

Upper Rio Grande BBEST Membership

- Kevin Urbanczyk — Chair
- Zhuping Sheng — Vice-Chair, Pecos River Subcommittee
- Jeff Bennett — Rio Grande Subcommittee
- David Dean — Rio Grande Subcommittee
- Gary Bryant — Pecos River Subcommittee
- Ryan Smith — Devils River Subcommittee

SB3 Terminology

- *"**Environmental flow analysis**" means the application of a scientifically derived process for predicting the response of an ecosystem to changes in instream flows or freshwater inflows.*
- *"**Environmental flow regime**" means a schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be 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.*

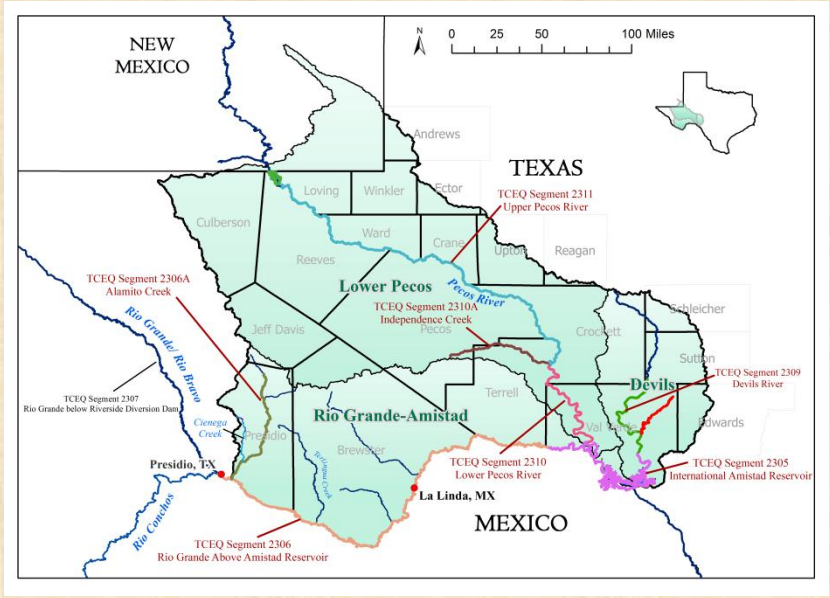
Sound Ecological Environment

- A sound ecological environment is one that:
  - sustains the full complement of the current suite of native species in perpetuity, or at least support the reintroduction of extirpated species,
  - 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

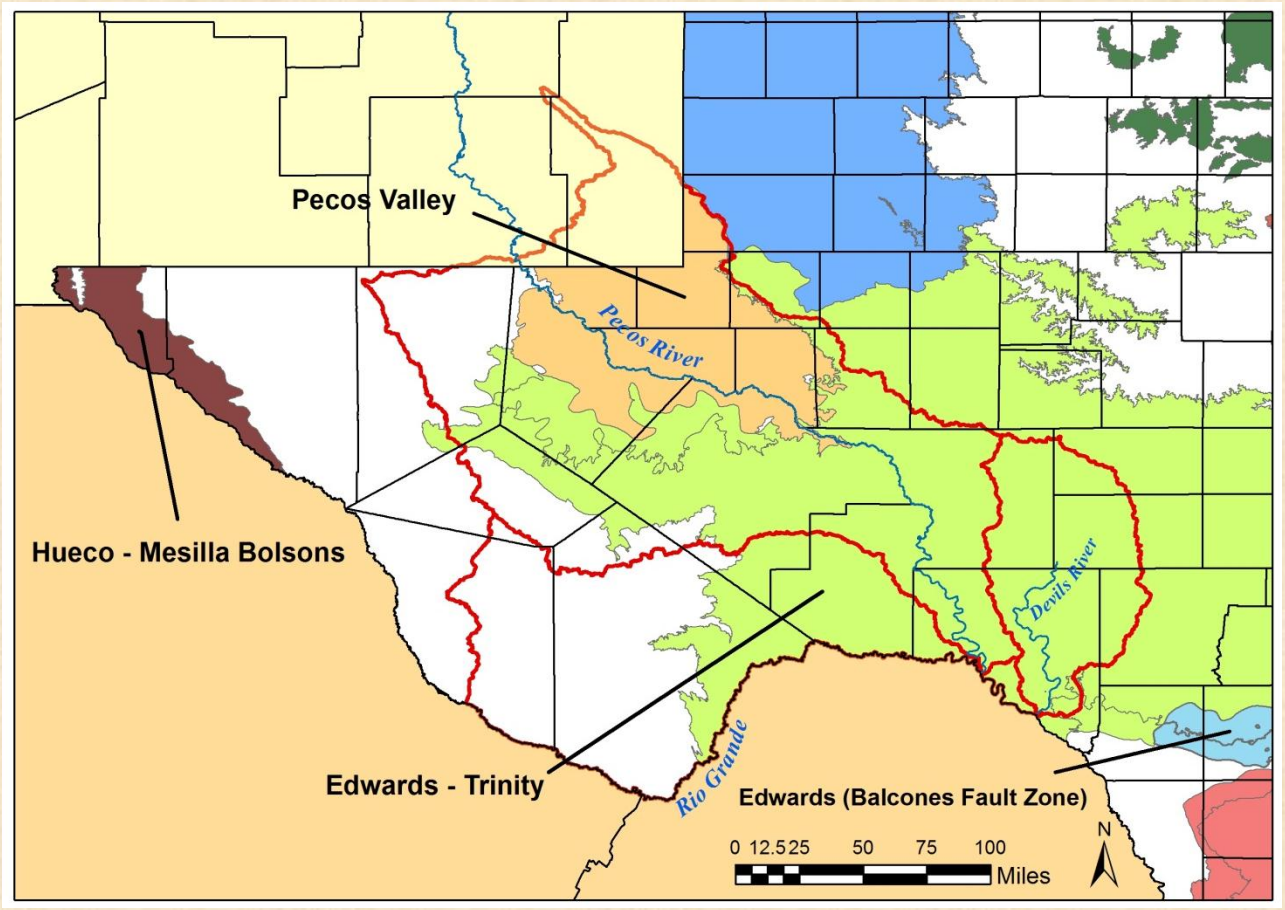
Sound Ecological Environment

- The Upper Rio Grande BBEST feels that the water bodies of our assigned area are “sound” with two large exceptions:

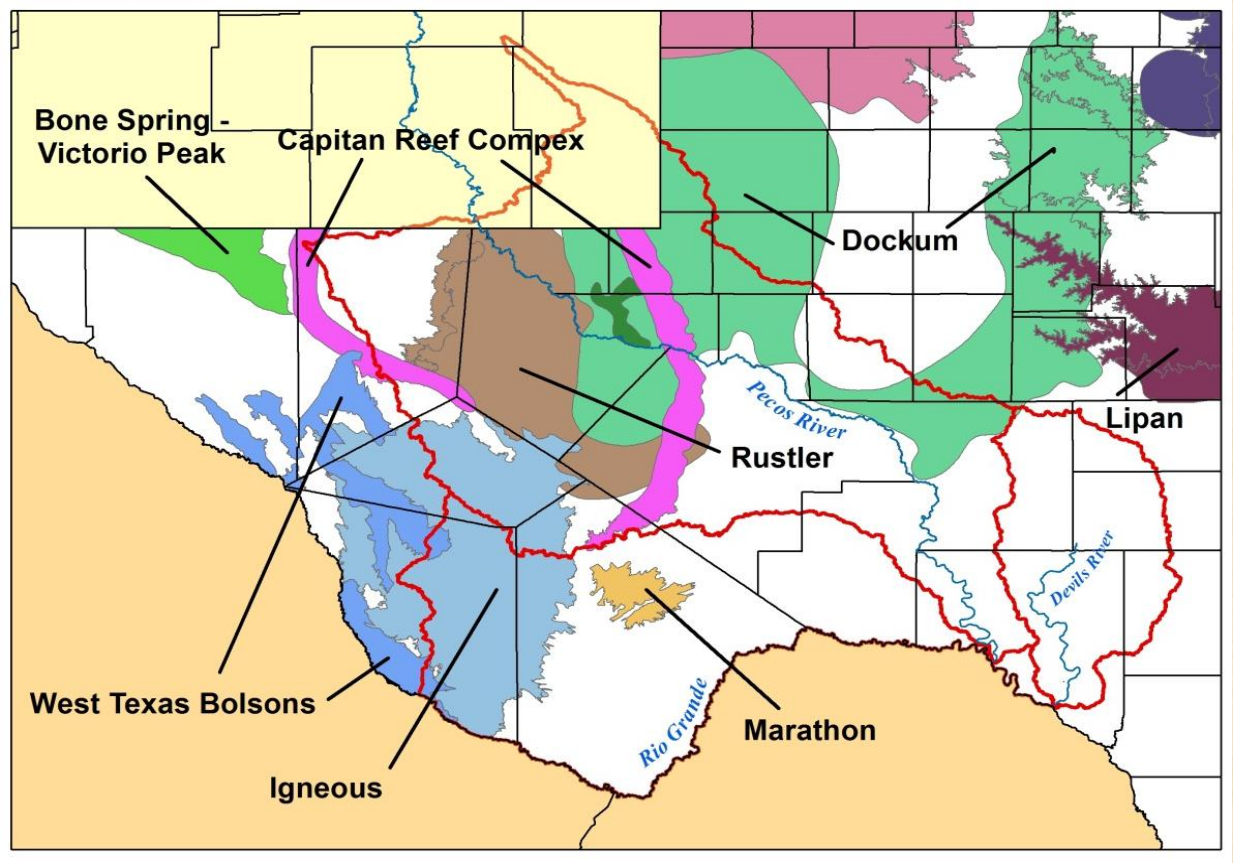
1) The Pecos River from the New Mexico state line to the confluence with Independence Creek (TCEQ segment 2311) and
2) The Rio Grande upstream of La Linda, Coahuila Mexico (the “Parks reach”).



Major Aquifers



Minor Aquifers



General Flow Components

Component	Hydrology	Geomorphology	Biology	Water Quality
No-Flow Periods	Flow ceases between perennial pools	Encroachment of vegetation	Generally stressful for fish communities	Temperatures rise and oxygen levels decrease. These condition sometimes cause fish kills
Subsistence Flows	Infrequent low flows	Increased deposition of fine and organic particles, encroachment of vegetation	Provide restricted aquatic habitat limit connectivity	Elevate temperature and constituent concentrations Maintain adequate levels of dissolved oxygen
Base Flows	Average flow condition, including variability	Maintain soil moisture and ground water table Maintain a diversity of habitats, Exports or transports sediment?	Provide suitable aquatic habitat, Provide connectivity along channel corridor	Provide suitable in-channel water quality
High Flow Pulses	In channel short duration, high flows	Deposit sediment, development of inset flood plains; Prevent encroachment of riparian vegetation	Serve as recruitment events for organisms; Provide connectivity to near-channel water bodies	Restore in-channel water quality after prolonged low flow periods. Episodic in nature and associated with fish kills (anecdotal, no real investigation of this yet)
Overbank flows	Infrequent high flows that exceed the channel	Provide lateral channel movement and floodplain maintenance; Recharge floodplain water table; form new habitats; flush organic material into channel; Deposit nutrients in floodplain	Provide new life phase cues for organisms; Maintain diversity of riparian vegetation; Provide conditions for seedling development; Provide connectivity to floodplain	Restore water quality in floodplain water bodies
Channel Maintenance	For most streams, channel maintenance occurs mostly during pulse and overbank flows	Long-term maintenance of existing channel morphology	Maintains foundation for physical habitat features instream	Water quality condition like those during pulse overbank flows

Period of Record

Sub-Basin	Site Name	Period of Record
Rio Grande	Alamito Creek	1/1/1932 to 12/31/2009
Rio Grande	Rio Grande below Rio Conchos near Presidio	1/1/1901 to 2/28/1914 and 3/1/1931 to 12/31/1967
Rio Grande	Terlingua Creek	1/1/1932 to 12/31/2009
Rio Grande	Rio Grande at Johnson's Ranch	1/1/1936 to 12/31/1967
Rio Grande	Rio Grande at Foster's Weir	1/1/1962 to 12/31/2009
Pecos River	Pecos River near Orla	1/1/1938 to 12/31/2009
Pecos River	Pecos River near Pecos	1/1/1902 to 12/31/1935
Pecos River	Pecos River near Girvin	1/1/1939 to 12/31/2011
Pecos River	Independence Creek near Sheffield	1/1/1975 to 6/30/1985 and 7/1/2000 to 12/31/2009
Pecos River	Pecos River near Langtry	1/1/1967 to 12/31/2010
Devils River	Devils River near Juno	1/1/1936 to 2/28/1949 and 3/1/1931 to 12/31/1972
Devils River	Devils River at Pafford's Crossing	1/1/1960 to 12/31/2009

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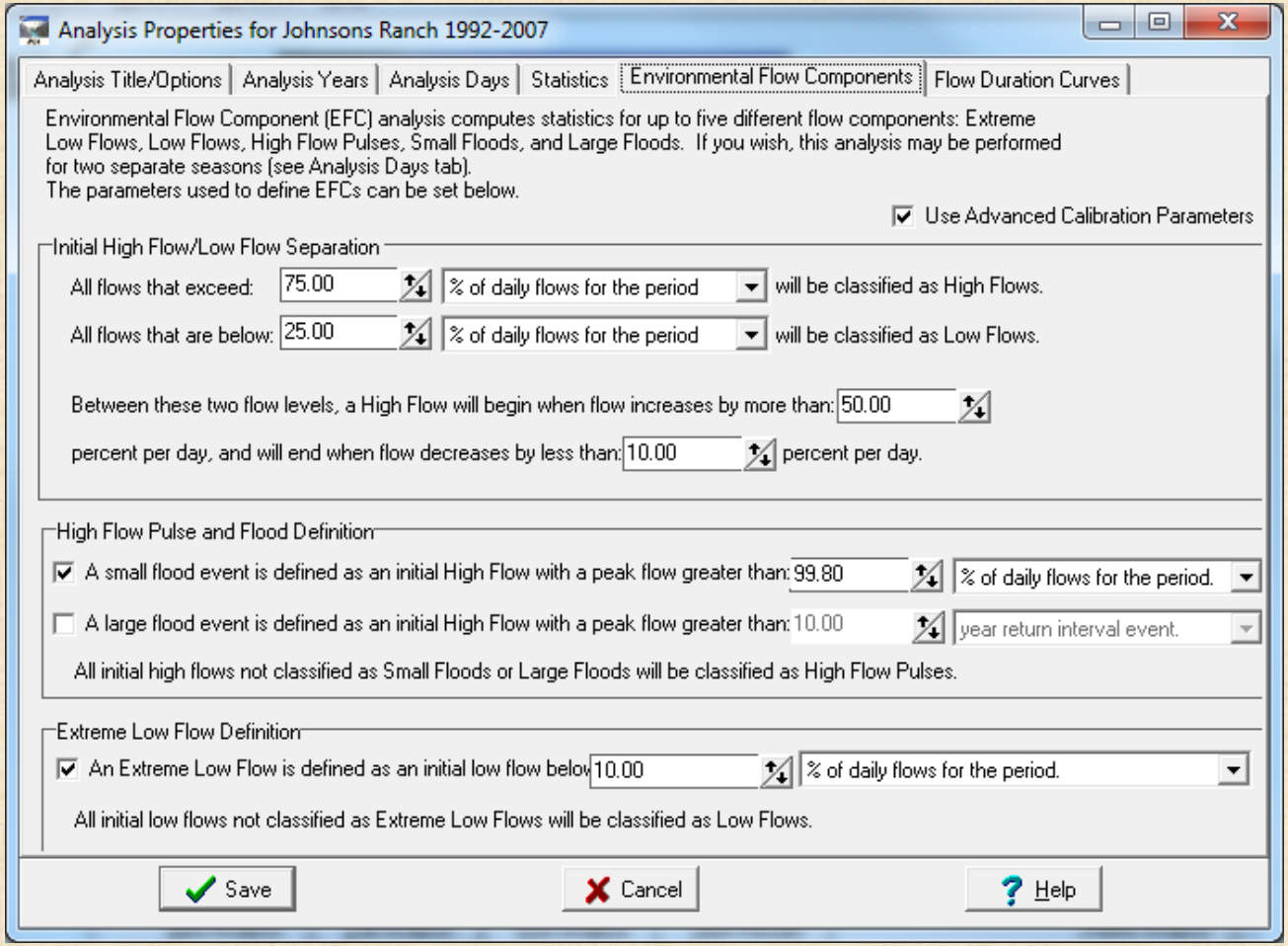
Analysis Properties for Johnsons Ranch 1992-2007
Analysis Title/Options
Analysis Years
Analysis Days
Statistics
Environmental Flow Components
Flow Duration Curves
Environmental Flow Component (EFC) analysis computes statistics for up to five different flow components: Extreme Low Flows, Low Flows, High Flow Pulses, Small Floods, and Large Floods. If you wish, this analysis may be performed for two separate seasons (see Analysis Days tab).
The parameters used to define EFCs can be set below.
Use Advanced Calibration Parameters
Initial High Flow/Low Flow Separation
All flows that exceed: 75.00 % of daily flows for the period will be classified as High Flows.
All flows that are below: 25.00 % of daily flows for the period will be classified as Low Flows.
Between these two flow levels, a High Flow will begin when flow increases by more than: 50.00
percent per day, and will end when flow decreases by less than: 10.00 percent per day.
High Flow Pulse and Flood Definition
A small flood event is defined as an initial High Flow with a peak flow greater than: 99.80 % of daily flows for the period.
A large flood event is defined as an initial High Flow with a peak flow greater than: 10.00 year return interval event.
All initial high flows not classified as Small Floods or Large Floods will be classified as High Flow Pulses.
Extreme Low Flow Definition
An Extreme Low Flow is defined as an initial low flow below 10.00 % of daily flows for the period.
All initial low flows not classified as Extreme Low Flows will be classified as Low Flows.
Save
Cancel
Help

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Overbank Flows	Qp: 2,469 ft³/s with Average Frequency 1 per 5 years Regressed Volume is 9,996 Regressed Duration is 6											
High Flow Pulses	Qp: 1,459 ft³/s with Average Frequency 1 per 2 years Regressed Volume is 5,763 Regressed Duration is 6											
	Qp: 915 ft³/s with Average Frequency 1 per year Regressed Volume is 3,535 Regressed Duration is 5											
	Qp: 2 ft³/s with Average Frequency 1 per 2 seasons Volume is 1,448 Duration is 4				Qp: 484 ft³/s with Average Frequency 1 per 2 seasons Volume is 1,448 Duration is 4				Qp: 1,250 ft³/s with Average Frequency 1 per 2 seasons Volume is 5,175 Duration is 6			
					Qp: 226 ft³/s with Average Frequency 1 per season Volume is 648 Duration is 4				Qp: 675 ft³/s with Average Frequency 1 per season Volume is 2,700 Duration is 6			
Base Flows (ft³/s)	1.8(49.5%)				1.8(36.9%)				1.8(49.4%)			
	1.4(67.5%)				1.4(47.4%)				1.4(58.5%)			
	1.1(85.1%)				1.1(69.5%)				1.1(74.9%)			
Subsistence Flows (ft³/s)	0.71(97.8%)				0.71(87.0%)				0.71(87.8%)			
	Nov	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
	Winter				**Spring**				**Monsoon**			

Rio Grande