

### 1.3 Sound Ecological Environment

SB 3 defines an environmental flow regime as:

“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.”

According to SAC guidance (SAC 2009a), a sound ecological environment is one 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.

There are many definitions of sound environment. All definitions involve subjective interpretation of both language and intent. In the context of the BBEST's analysis, an acceptably sound ecological environment is one in which the flow regime maintains the important physical, chemical, and biological characteristics of a water body as well as the native species dependent on these characteristics. An environment which is not considered ecologically sound, is one in which human modifications of the flow regime have resulted in the reduction or loss of important physical, chemical, or biological ecosystem features and significant reductions in native species abundance or that promotes the establishment of invasive species.

The flow regimes developed by the BBEST are intended to support an acceptably sound ecological environment including important physical, chemical, and biological characteristics that presently exist or have existed before. The flow regimes described by the BBEST are not intended to produce pristine conditions that may have existed before human development. Nor are they intended to produce ecological conditions that have never occurred before in that water body. The BBEST agrees that sound ecological environment for a water body will depend on its geographic location within the watershed and its historical conditions.

Streams in the Nueces River basin have changed in a variety of ways for during the past 100 years. Causes of those changes have been natural and man-made. Precipitation patterns have caused extended drought periods at times and high flow periods during other times. Manmade changes include construction of reservoirs, water diversions, wastewater and irrigation return flows, groundwater development, land use and management practices, increased impervious cover, and livestock grazing, and brush proliferation. Man-made changes have also included introduction of invasive species like common carp, Asian clam, and giant cane (Arundo) salt cedar. Although effects of these changes on aquatic ecosystems vary between water bodies, it is reasonable to say all water bodies selected for analysis by the BBEST have been modified to some degree by man's human activities.

The BBEST reached consensus on the above definition of “sound ecological environment” as well as the BBEST reached consensus on the descriptions of the soundness of the current riverine, riparian, and estuarine environments focused on in this report. The BBEST also reached consensus on the components (i.e., subsistence, base, pulse, and overbank flows) of the environmental flow regimes that will maintain a sound ecological environment in these basins.

**Comment [s1]:** 1.1 don't believe that tamarisk is present in significant quantity in the Nueces River Basin. NRA's 2010 guide to riparian vegetation does not include it and the following USGS map doesn't either [Tamarisk Identification and Mapping Using Remotely Sensed Data](#) . Are there other invasives that we should identify?

### 1.3.1 Sound Ecological Environments – Streams

Compared Relative to Texas streams east of the Nueces River basin, relatively little analysis of ecological health of Nueces basin streams has been conducted.

#### Edwards Plateau Streams

Edwards Plateau streams for which environmental flow regimes are described include the West Nueces River at Brackettville, Nueces River at Laguna, Frio River at Concan, upper Sabinal River, Hondo Creek, and Seco Creek. These streams are characterized by spring flows, clear water, and relatively few point source wastewater discharges and water diversions (no major upstream reservoirs). Water quality assessments indicate oxygen levels, pH, chlorides, and sulfates are typically adequate for a healthy aquatic community. However the 2011 draft water quality assessment for the Frio River in the reach including Concan indicated the river was not supporting the designated criteria for fish and benthic macroinvertebrate communities. Based on review of available biological, physical, and chemical data, the Edwards Plateau streams maintain acceptable sound environments.

#### Desert Streams

Desert streams for which environmental flow regimes are described include the Nueces River sites at Uvalde, ~~at~~ Cotulla, ~~at~~ Tilden, ~~at~~ Three Rivers, and ~~at~~ Mathis. On the Frio River, sites included the Dry Frio at Reagan Wells and Frio River at Tilden. Environmental flow regimes were also described for the Atascosa River, lower Sabinal River, and San Miguel Creek. A unique stream is the Leona River below Uvalde where an environmental flow regime was developed for springs flowing into the river. In contrast to the Edwards Plateau streams, desert streams are more turbid and a greater proportion experience extended periods of no flow than do Edwards Plateau streams.

Flow regimes for the Nueces River at Mathis and at Three Rivers are greatly influenced by upstream reservoir operations/releases. These two sites experience flow regimes that differ substantially from the natural flow variability typical of streams which are not downstream of major reservoirs operated for water supply. Pulse flows are reduced in magnitude, frequency, and duration when compared to a stream with natural flow variability. The Atascosa River and the reach of the Nueces River near Tilden were both assessed in TCEQ's 303d listing as not supporting the designated criteria for fish and macroinvertebrate communities. Despite these exceptions Excluding the Nueces River at Mathis, the Nueces River at Three Rivers, Nueces River near Tilden, and the Atascosa River and at this time, the remaining desert stream sites maintain acceptable sound environments at this time. The arid conditions these streams are exposed to may increase their vulnerability to changes in flow regime.

#### Coastal Streams

Two small coastal streams, Oso Creek and San Fernando Creek, were assessed. Both of these streams have relatively small watersheds in an arid region. Perennial flows in these streams appear to be maintained by point source wastewater discharges. Portions of the watersheds have been substantially modified by agricultural development and, in the case of Oso Creek, by recent urban development. In both cases, information suggests these streams were probably intermittent prior to human development. Because these streams provide aquatic habitat more persistently than they did before in

**Comment [djh2]:** Is this general statement supported by the previous indication about water quality at Concan?

portions of their reaches, they are considered to maintain an acceptable sound environment in relation to their flow regimes.

**Comment [djh3]:** Perhaps we need to clarify this statement. Increased flow may negatively affect native species adapted for intermittent conditions by shifting the environmental factors that provide cues for reproduction, alter the strength of species interactions, and be more amenable to the establishment of non-native species.

Segment 2104: Nueces River from the confluence with the Frio River upstream to Holland Dam. 303d listing impaired fish and benthic macroinvertebrate communities from the downstream end up to Dragon Creek confluence

**Comment [s5]:** I suggest moving highlighted text to Section 3.4.

Segment 2106: Nueces River/Lower Frio River from Choke Canyon dam downstream to 100 yards upstream of US59 in Live Oak County. 303d listing as impaired because of elevated total dissolved solids.

Segment 2107: Atascosa River from the confluence with the Frio River upstream to the confluence of the West Prong and North Prong of the Atascosa. 303d listing

- impaired fish and benthic macroinvertebrate communities from Borrego Creek confluence upstream to confluence with Palo Alto Creek.
- elevated bacteria levels from the confluence with the Frio upstream to the confluence with Galvan Creek
- depressed oxygen from the confluence with Borrego Creek upstream to Galvan Creek

Segment 2108: San Miguel Creek. 303d listing for elevated bacteria

Segment 2109: Leona River from confluence with Frio River upstream to US83 near Uvalde. 303d listing for elevated bacteria

Segment 2113: Upper Frio River from 100 meter upstream of US90 upstream to the confluence of the West and East Frio rivers. 303d listing impaired fish and benthic macroinvertebrate communities

Segment 2117: Frio River from 2.6 miles downstream of US16 upstream to 100 meters upstream of US90. 303d listing for elevated bacteria from the confluence of Esperanza Creek upstream to the confluence with Ruiz Creek

TCEQ Water Quality Segment, Water Body Name	Aquatic Life Use Designation	Chlorides	Sulfates	Total Dissolved Solids	Dissolved Oxygen	pH
2102, Nueces below Mathis	High	250	250	500	5.0	6.5-9.0
2104, Nueces at Tilden	High	700	300	1,500	5.0	6.5-9.0
2105, Nueces at Cotulla	High	200	200	900	5.0	6.5-9.0
2106, Nueces at Three Rivers	High	285	145	735	5.0	6.5-9.0
2107, Atascosa River	High	600	500	1,500	5.0	6.5-9.0
2108, San Miguel Creek	High	700	700	2,000	5.0	6.5-9.0

**Comment [djh4]:** I suggest adding a column that summarizes the above statements for these segments (i.e. Frio at Concan is listed as Exceptional according to aquatic life use designation, but also has a 303d listing as impaired). Without putting these side by side I wonder if it will lead to confusion or incorrect interpretations.

2109, Leona River	High	650	500	2,000	5.0	6.5-9.0
2105, Nueces at Uvalde	High	200	200	900	5.0	6.5-9.0
2112, Nueces at Laguna	High	50	50	400	5.0	6.5-9.0
2117, Frio at Tilden	High	620	380	1,700	5.0	6.5-9.0
2117, Frio at Derby	High	620	380	1,700	5.0	6.5-9.0
2113, Frio at Concan	Exceptional	50	50	400	6.0	6.5-9.0
2110, Sabinal below Edwards outcrop	High	200	100	700	5.0	6.5-9.0
2111, Sabinal above Edwards outcrop	High	50	75	500	5.0	6.5-9.0
2114, Hondo Creek	High	50	100	400	5.0	6.5-9.0
2115, Seco Creek	High	50	70	400	5.0	6.5-9.0
West Nueces at Brackettville	High				5.0	
Dry Frio at Reagan	High				5.0	
Oso Creek	High				5.0	
San Fernando Creek	High				5.0	

#### Literature Cited

Texas Commission on Environmental Quality. 2010. Chapter 307 – Texas Surface Water Quality Standards. Adopted June 30, 2010.  
[http://www.tceq.texas.gov/assets/public/permitting/waterquality/standards/docs/TSWQS2010\\_rule.pdf](http://www.tceq.texas.gov/assets/public/permitting/waterquality/standards/docs/TSWQS2010_rule.pdf)

Texas Commission on Environmental Quality. 2011. Draft 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d). <http://www.tceq.texas.gov/waterquality/assessment/10twqi/10twqi>

Science Advisory Committee, Recommendation to the Governor's Environmental Flows Advisory Committee. August, 2006.