SAN ANTONIO RIVER AUTHORITY

Leaders in Watershed Solutions

Instream Flows in the San Antonio River Basin – From Science to Environmental flow Standards

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Keys to Success

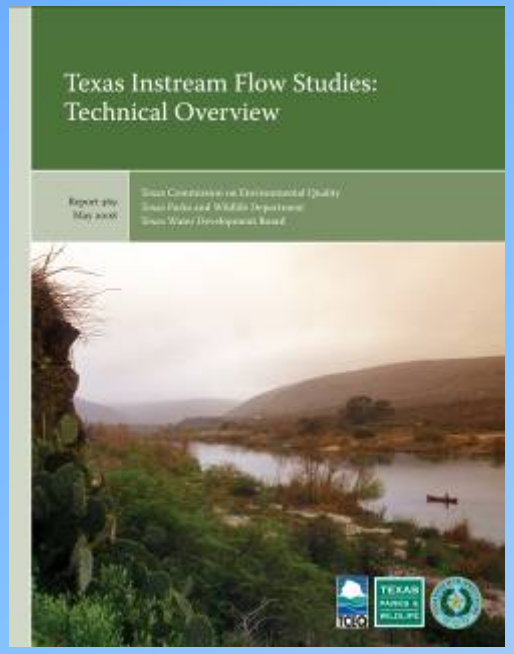
- Mandated Processes
- Science
- Compatible Schedules
- Stakeholder Participation

Mandated Processes

- Senate Bill 2 (2001) Texas Instream Flow Program
  - Directed TPWD, TCEQ and TWDB to complete instream flow studies on priority streams by 2016
- Senate Bill 3 (2007) Texas Environmental Flows Process
  - Established bay and basin stakeholder committees and expert science teams to develop instream flow and bay and estuary inflow recommendations for TCEQ to consider in establishing environmental flow standards for Texas rivers and bays (September 2009 for San Antonio Basin)

Science

SB 2 Texas Instream Flow Program (TIFP): Multidisciplinary approach



- Biology
  - Aquatic biology and ecology
  - Riparian ecology
- Hydrology & Hydraulics
- Physical Processes, Geomorphology
- Water Quality
- Connectivity

- People
  - Ecologists, Biologists, Engineers, Geomorphologists, Planners

Instream Flow Components (TIFP)

Subsistence flows	
Definition:	Infrequent, seasonal periods of low flow
Objectives:	Maintain water quality criteria
Base flows	
Definition:	Normal flow conditions between storm events
Objectives:	Ensure adequate habitat conditions, including variability, to support the natural biological community
High flow pulses	
Definition:	Short-duration, in-channel, high flow events following storm events
Objectives:	Maintain important physical habitat features
	Provide longitudinal connectivity along the river channel
Overbank flows	
Definition:	Infrequent, high flow events that exceed the normal channel
Objectives:	Maintain riparian areas
	Provide lateral connectivity between the river channel and active floodplain

Lower San Antonio River Instream Flow Study

San Antonio River

and Lower Cibolo Creek

Project Participants

EC

BW BIO-WEST, Inc.

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Water Brings Us Together

TCEQ

TEXAS PARKS & WILDLIFE

TEXAS WATER DEVELOPMENT BOARD

Instream Flows Study Sites

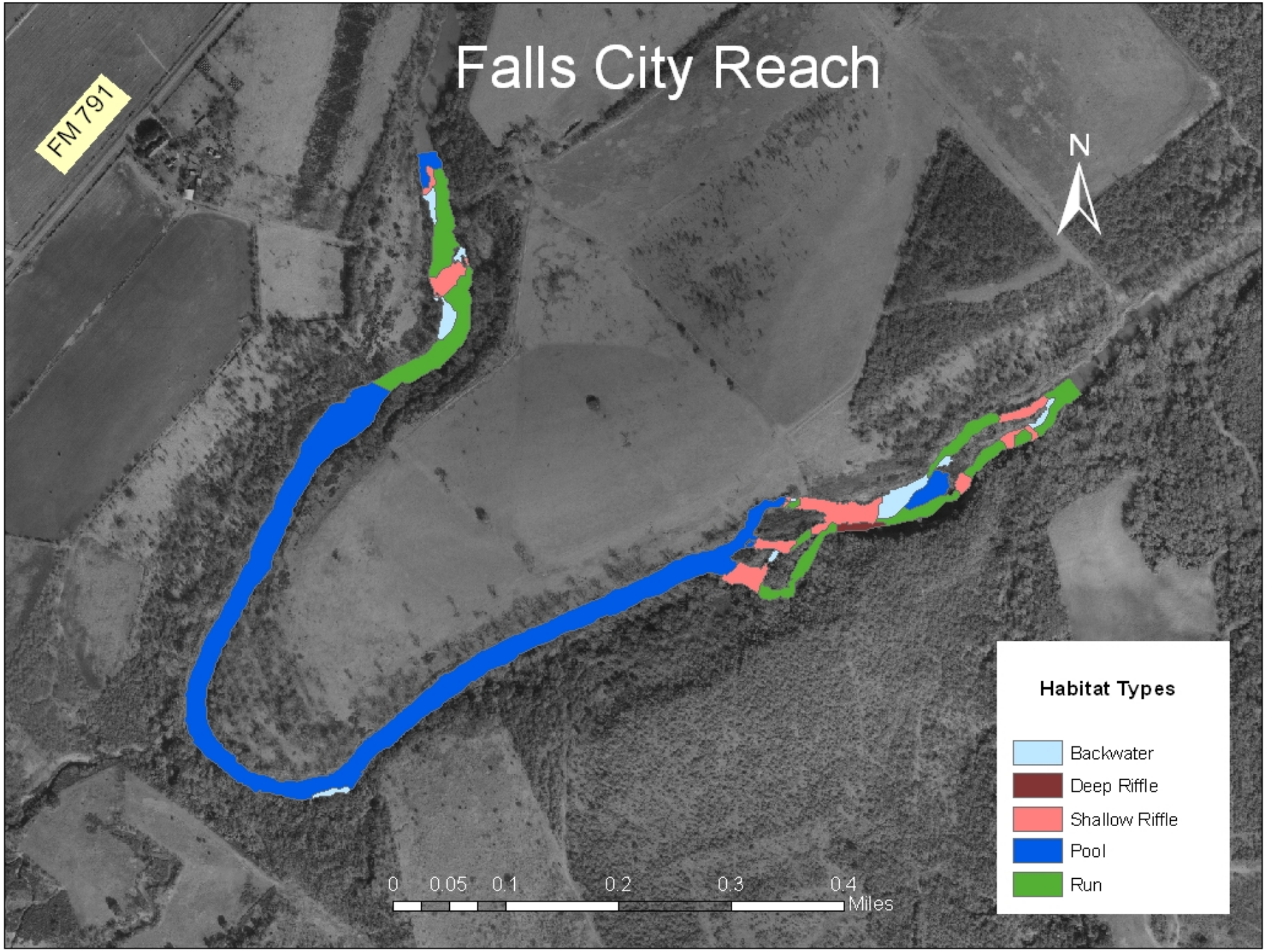
LSAR-TIFP Methodology

- **Aquatic Biology**
  - **Mesohabitat mapping, Fish habitat suitability, preliminary mussels evaluation**
- **Hydrology and Hydraulics**
  - **River 2D hydraulic models developed for each site**
- **Habitat Modeling**
  - **Linked hydraulic models with habitat models allowing analysis of Weighted Usable Area, Habitat time series, Habitat duration curves, and spatial evaluation using GIS**

LSAR-TIFP Methodology (cont.)

- **Riparian**
  - **Species and life stage data from each site; Hec-Ras model for floodplain inundation and linkage to transect data; tree-ring aging study by Baylor University**
- **Sediment Transport**
  - **UTSA sediment transport evaluation**
- **Water Quality**
  - **Comprehensive water quality modeling with emphasis on water temperature and dissolved oxygen**

Falls City Site


Falls City Reach
FM 791
N
Habitat Types
Backwater
Deep Riffle
Shallow Riffle
Pool
Run
0 0.05 0.1 0.2 0.3 0.4
Miles

Hydraulic Fieldwork

Aquatic Biology Fieldwork

Riparian Fieldwork

Sediment Fieldwork

Habitat Suitability Criteria Development

- Fish Sampling
  - 249 sites
  - 23,722 fishes
  - 15 families, 43 species

Data Reduction and Analysis

- Hydrologic Analysis
- Hydraulic Measurements
- Habitat and Substrate Mapping
- 2-D hydraulic models
- Habitat Suitability Criteria Development and habitat modeling
- Water Quality modeling
- Riparian Analysis
- Sediment transport modeling

(SB 3) Expert Science Team (BBEST) charge

- **Develop environmental flow analyses and a recommended environmental flow regime** for the river basin and bay system for which the team is established **through a collaborative process designed to achieve 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** [§ Sec. 11.02362(m)].

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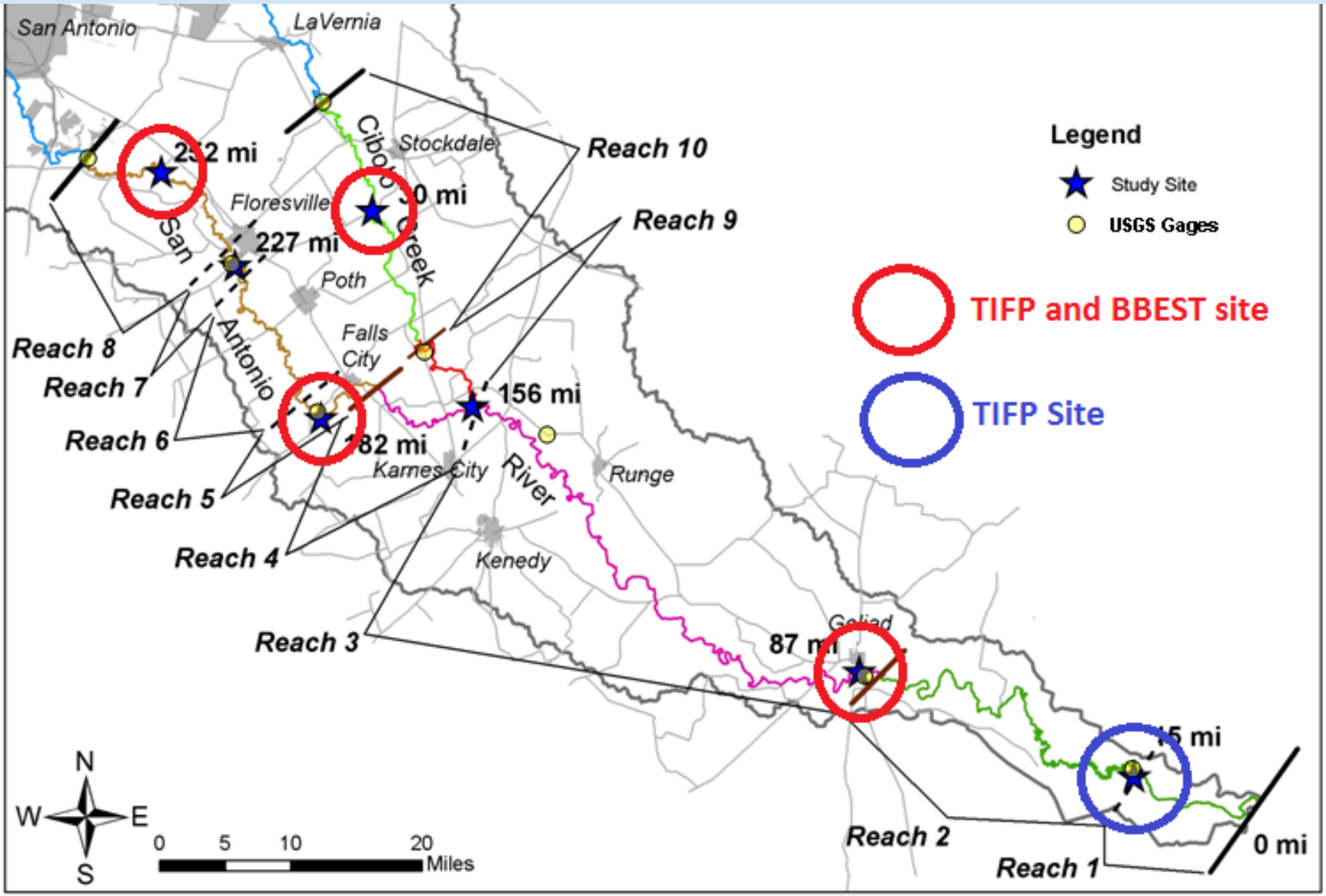
TIFP and BBEST Instream Flow Recommendation Sites



TIFP and **BBEST** Recommendations Development

- **BBEST** – Historical Hydrology driven - *Biology used as an overlay.*
  - Subsistence – HEFR
  - Base-Flows – HEFR
  - Pulses and Overbank flows – HEFR
  - Hydrologic time period used
    - Pre-1970
      - Elmendorf, Falls City, and Goliad
    - Full Period of Record
      - Cibolo Creek

TIFP and BBEST Recommendations Development

- **TIFP** – Biological Data driven with site-specific data and modeling – *Hydrology used only as an overlay.*
  - Subsistence - Water Quality modeling linked to biological response
  - Base-flows: Habitat modeling linked to biological response
  - Pulse and Overbank flow: Riparian evaluation for indicator species driven by hydraulic modeling, tree-ring study, and species life history requirements

Compatible Schedules

- SB2 Texas Instream Flow Program – 2016
  - Schedule accelerated with the help of financial and technical assistance from San Antonio River Authority
  - Interim Report issued August 2011
- SB3 Environmental Flows Process
  - Original deadline for San Antonio Basin – September 2009
  - Deadline moved to September 2011

Stakeholder Participation

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SB2 – Lower San Antonio Subbasin Stakeholders Goal

"a naturally functioning and sustainable ecosystem that supports a balance of ecological benefits and economic, recreational, and educational uses".

(SB 3) Stakeholders' (BBASC) charge

- Each basin and bay area **stakeholders committee shall review the environmental flow analyses and environmental flow regime recommendations** submitted by the committee's basin and bay expert science team **and shall consider them in conjunction with other factors, including the present and future needs for water for other uses related to water supply planning** in the pertinent river basin and bay system. [§ Sec. 11.02362 (o)]

BBEST Recommendations

Table 6.1-15. – Environmental Flow Regime Recommendation, San Antonio River at Goliad

Overbank Flows	Qp: 23,600 cfs with Average Frequency 1 per 5 years Regressed Volume is 273,000 Duration Bound is 69											
	Qp: 10,600 cfs with Average Frequency 1 per 2 years Regressed Volume is 107,000 Duration Bound is 45											
	Qp: 7,680 cfs with Average Frequency 1 per year Regressed Volume is 73,500 Duration Bound is 38											
High Flow Pulses	Qp: 1,520 cfs with Average Frequency 1 per season Regressed Volume is 12,800 Duration Bound is 19			Qp: 3,540 cfs with Average Frequency 1 per season Regressed Volume is 30,000 Duration Bound is 24			Qp: 1,640 cfs with Average Frequency 1 per season Regressed Volume is 11,200 Duration Bound is 16			Qp: 2,320 cfs with Average Frequency 1 per season Regressed Volume is 17,600 Duration Bound is 19		
	Qp: 550 cfs with Average Frequency 2 per season Regressed Volume is 3,940 Duration Bound is 11			Qp: 1,570 cfs with Average Frequency 2 per season Regressed Volume is 11,300 Duration Bound is 16			Qp: 750 cfs with Average Frequency 2 per season Regressed Volume is 4,450 Duration Bound is 10			Qp: 780 cfs with Average Frequency 2 per season Regressed Volume is 5,070 Duration Bound is 11		
Base Flows (cfs)	290			280			220			270		
	200			180			150			200		
	140			130			120			130		
Subsistence Flows (cfs)	76			60			54			66		
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Winter			**Spring**			**Summer**			**Fall**		

Notes:

1. Period of Record used : 1/1/1940 to 12/31/1969.
2. Volumes are in acre-feet and durations are in days.

TIFP Interim Recommendations

GOLIAD

Overbank Flow

Magnitude = 14,000 cfs
Frequency = 1 event
Duration = 2 days

Key Indicators:
Riparian: Inundates approx. 90% of hardwood forest community
Sediment transport: Channel maintenance

Magnitude = 11,500 cfs
Frequency = 1 event
Duration = 2 days

Key Indicators:
Riparian: Inundates approx. 65% of hardwood forest community
Sediment transport: Channel maintenance

High Flow Pulses

Magnitude = 8,000 cfs
Frequency = 2 events
Duration = 2-3 days

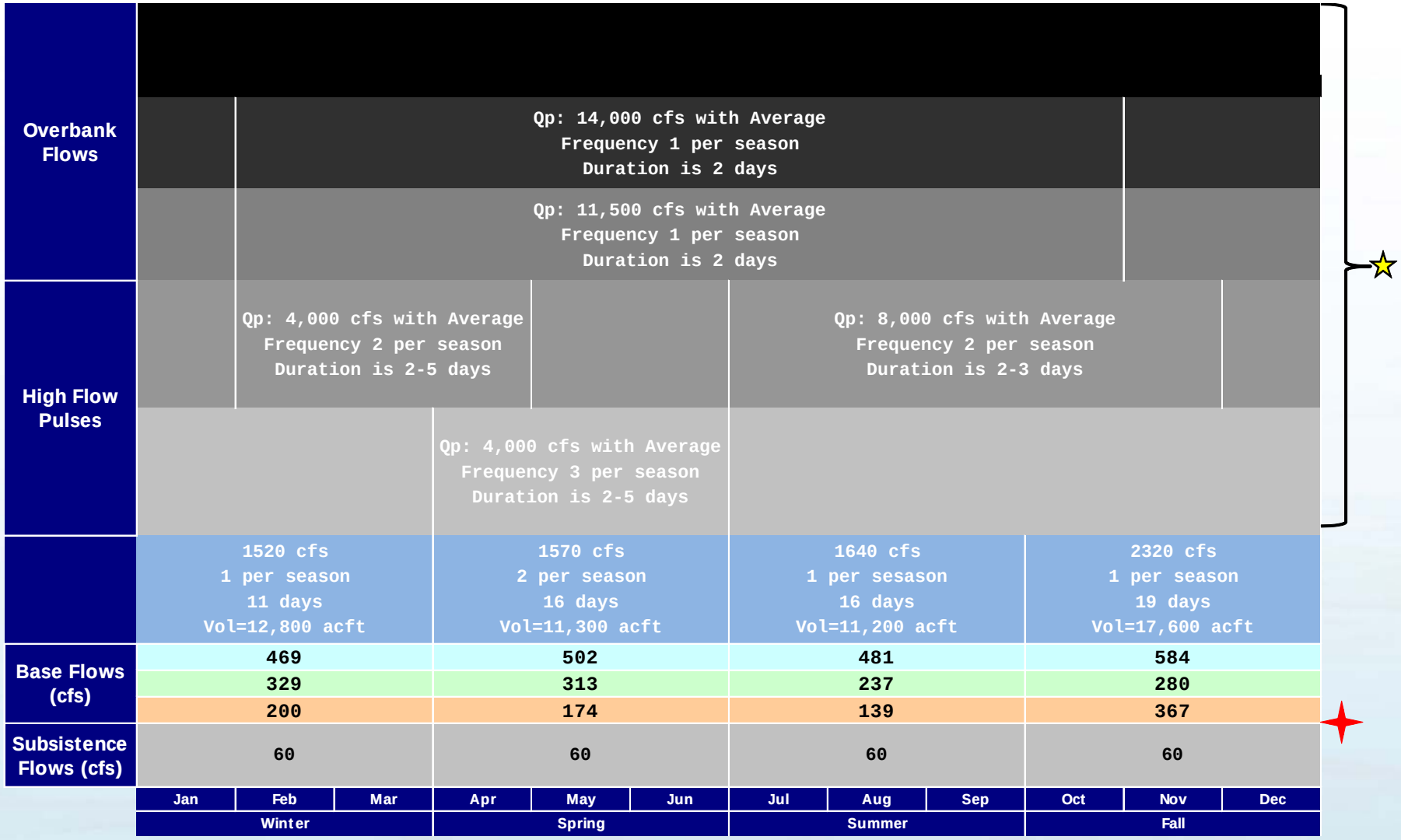
Key Indicators:
Riparian: Green Ash / Box Elder

Key Indicators: Riparian - Sycamore
Magnitude = 4,000 cfs
Frequency = 2 events
Duration = 2-5 days

Magnitude = 4,000 cfs
Frequency = 3 events
Duration = 2-5 days
Key Indicators: Riparian - Black Willow

BASE FLOWS (cfs) - Aquatic Habitat protection (intra- and interannual variability)											Key Indicators: Aquatic Habitat, Water Quality	
Base Wet	475	460	471	470	538	498	503	434	507	531	579	535
Base Average	325	340	323	305	326	308	248	212	252	272	287	282
Base Dry	200	203	197	178	190	154	121	111	186	155	169	176
SUBSISTENCE FLOWS (cfs) - Water quality protection and maintainence of limited aquatic habitat										Key Indicators: Water Quality, Aquatic Habitat		
Subsistence	80	80	80	80	80	80	80	80	80	80	80	80
MONTH	January	February	March	April	May	June	July	August	September	October	November	December

San Antonio River at Goliad (BBASC)



Flow Levels
High (75th %ile)
Medium (50th %ile)
Low (25th %ile)
Subsistence

☆ Concept 1 on Pulses @ 20% Ratio

✦ 50% Rule for Diversions between Dry Base and Subsistence Flow

San Antonio River at Goliad

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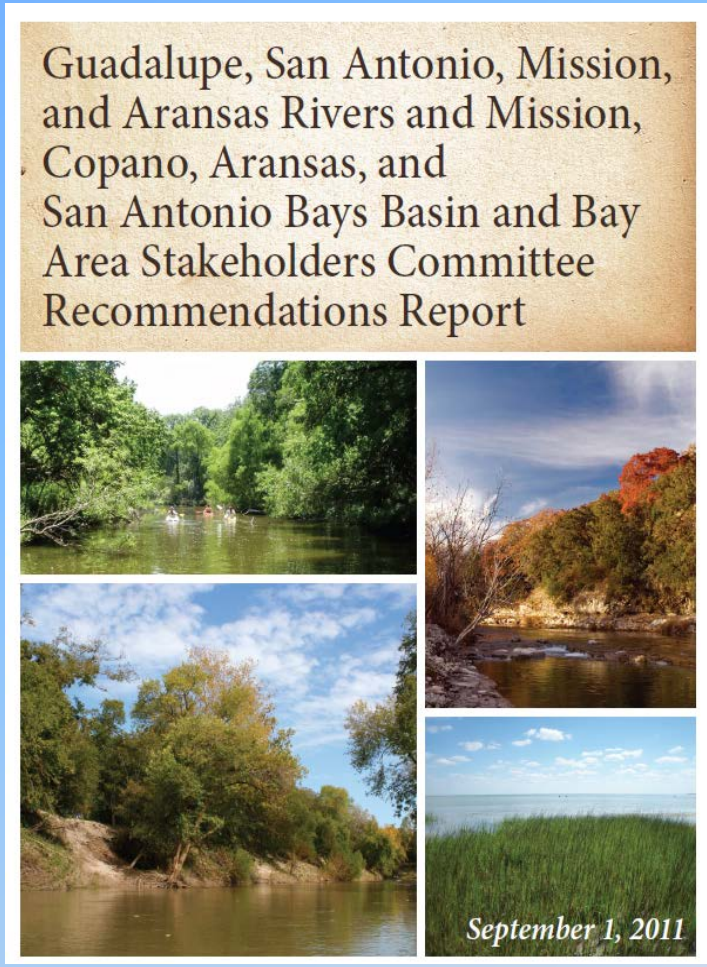
Environmental Flows



Environmental Flow Standards

- TCEQ considered BBEST and BBASC recommendation reports
- TCEQ adopted environmental flow standards for the San Antonio River on August 8, 2012
- The adopted standards reflected the TIFP recommendations for the San Antonio River with few exceptions

Questions

http://www.sara-tx.org/public_resources/library.php#water_quality_reports

Guadalupe, San Antonio, Mission, and Aransas Rivers and Mission, Copano, Aransas, and San Antonio Bays Basin and Bay Stakeholder Committee and Expert Science Team - Texas Commission on Environmental Quality - www.tceq.texas.gov

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