Current Activities of the Texas Instream Flow Program

P. Dakus Geeslin

March 31, 2011

Texas Commission on Environmental Quality
Resource Protection Team

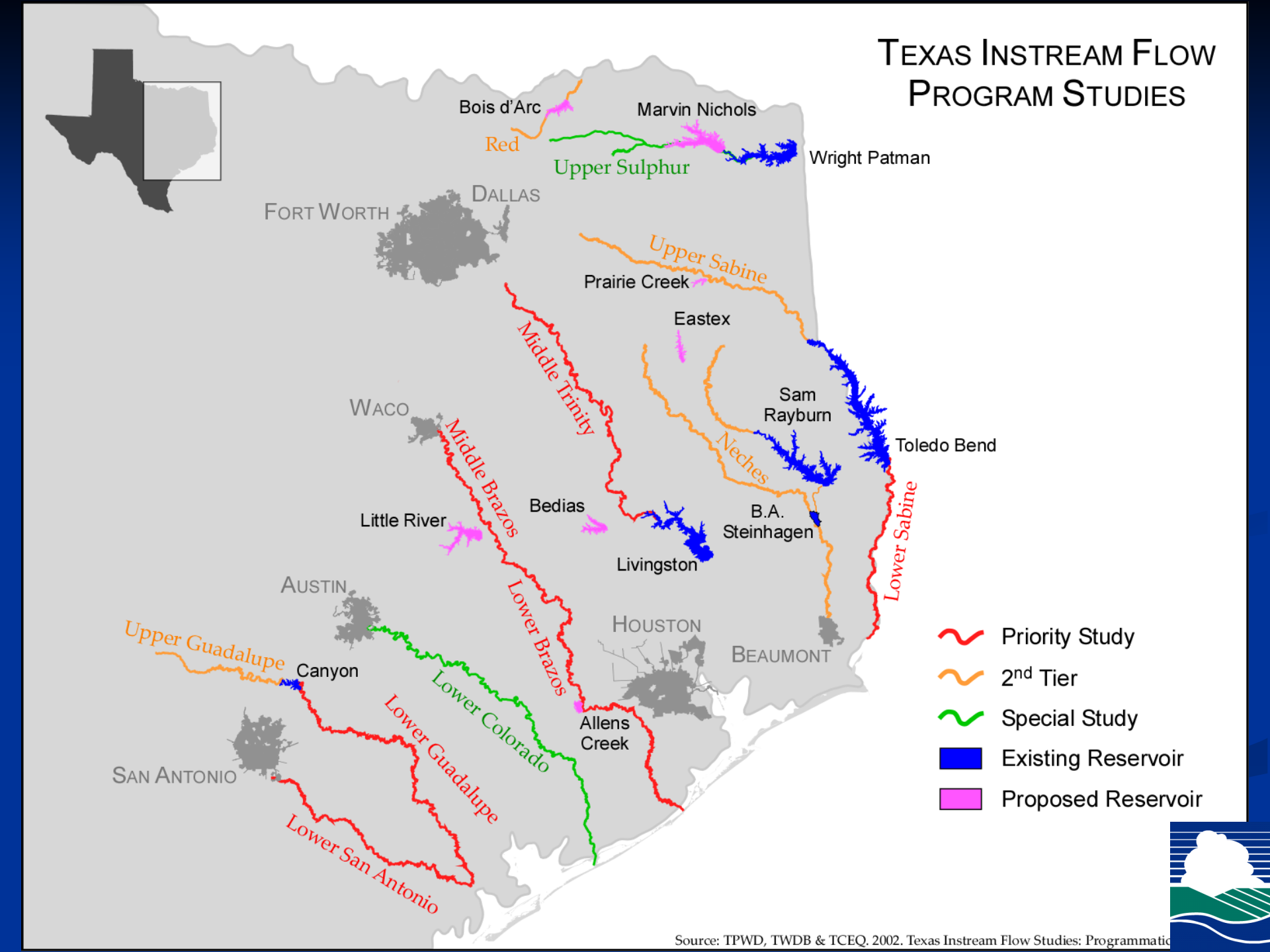
Senate Bill 2

The Texas Legislature directed

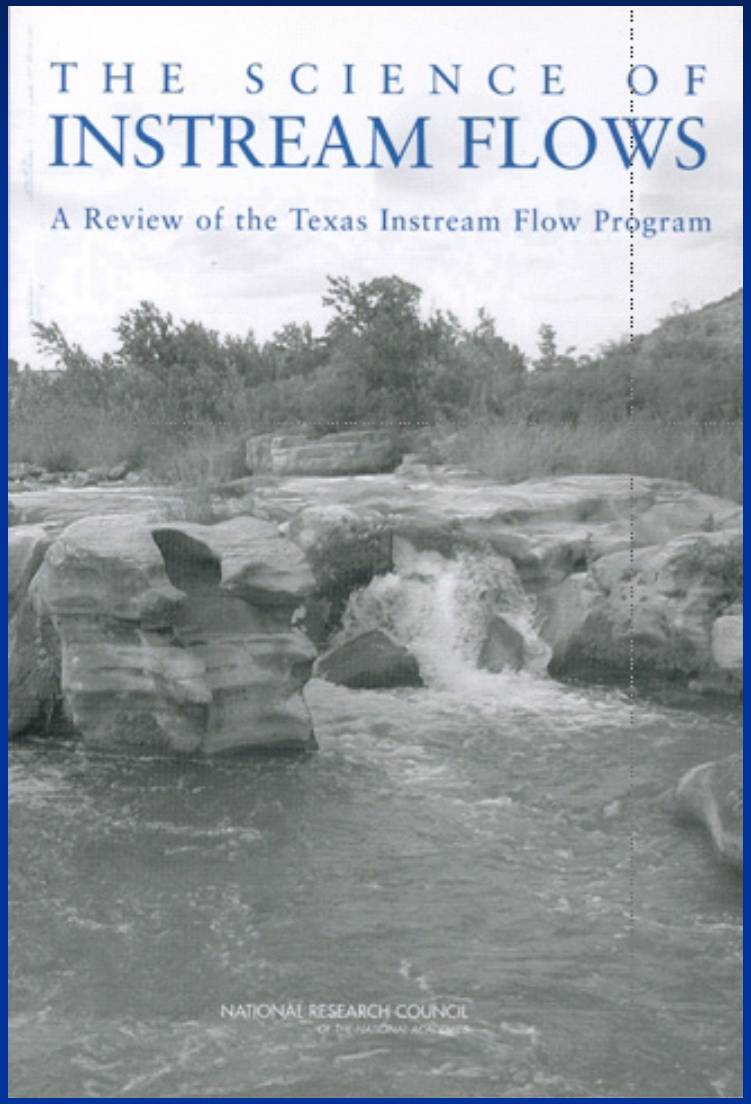
- Establish a data collection and evaluation program = Texas Instream Flow Program
- Determine flow regime necessary to support a sound ecological environment in Texas rivers and streams
- Complete priority studies by Dec 31,2016

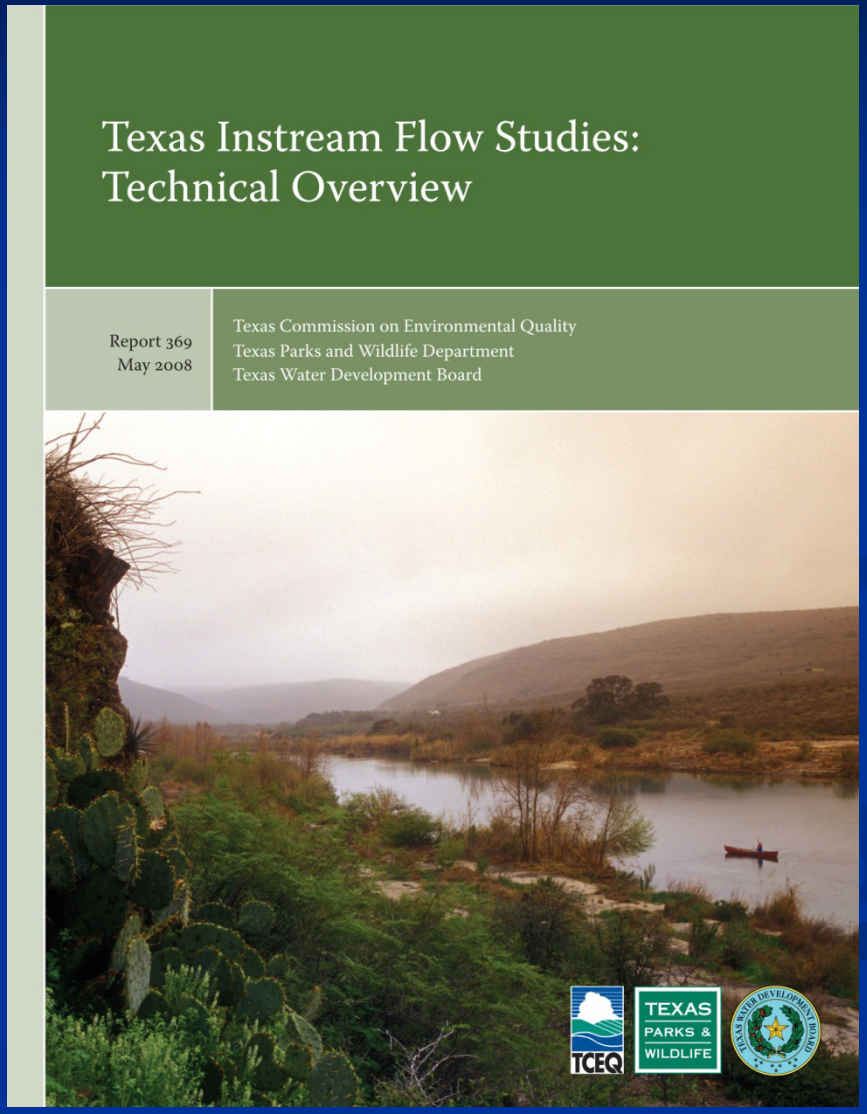
Program Purpose

For the first time state agencies and the public will collaborate on scientific studies to determine how much water should flow in rivers for a healthy environment.

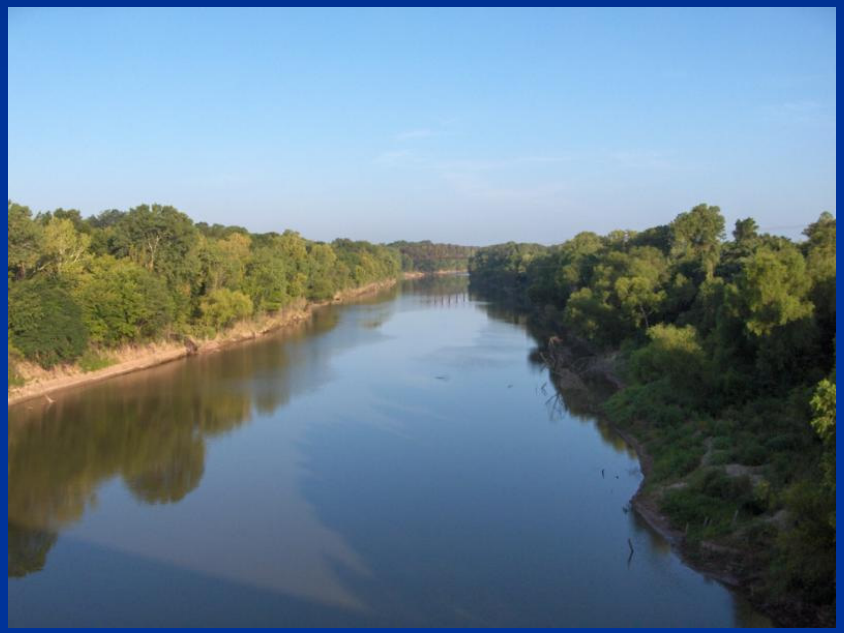

TEXAS INSTREAM FLOW PROGRAM STUDIES
Bois d'Arc
Red
Marvin Nichols
Upper Sulphur
Wright Patman
DALLAS
FORT WORTH
Upper Sabine
Prairie Creek
Eastex
Middle Trinity
Sam Rayburn
Toledo Bend
Neches
WACO
Middle Brazos
Bedias
Little River
B.A. Steinhagen
Lower Sabine
Livingston
AUSTIN
Lower Brazos
HOUSTON
BEAUMONT
Upper Guadalupe
Canyon
Lower Colorado
Lower Guadalupe
Allens Creek
SAN ANTONIO
Lower San Antonio
Priority Study
2nd Tier
Special Study
Existing Reservoir
Proposed Reservoir
Source: TPWD, TWDB & TCEQ. 2002. Texas Instream Flow Studies: Programmatic

Framework of the TIFP





Multidisciplinary Studies



- Physical Processes
  - channel processes, flushing flows, etc.
- Hydrology
- Biology
  - Instream aquatic assemblages
  - Riparian corridor
- Water Quality

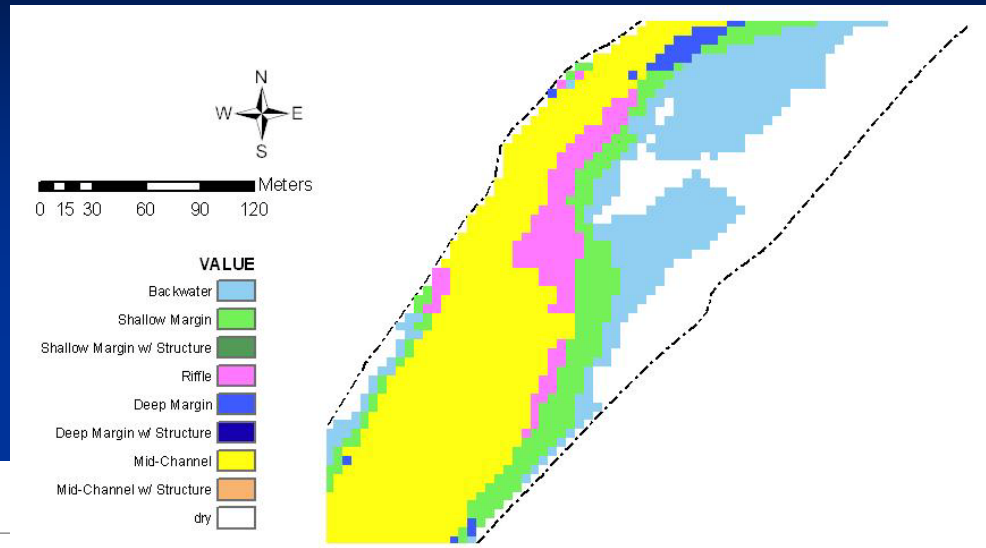
Physical Processes (Geomorphology)

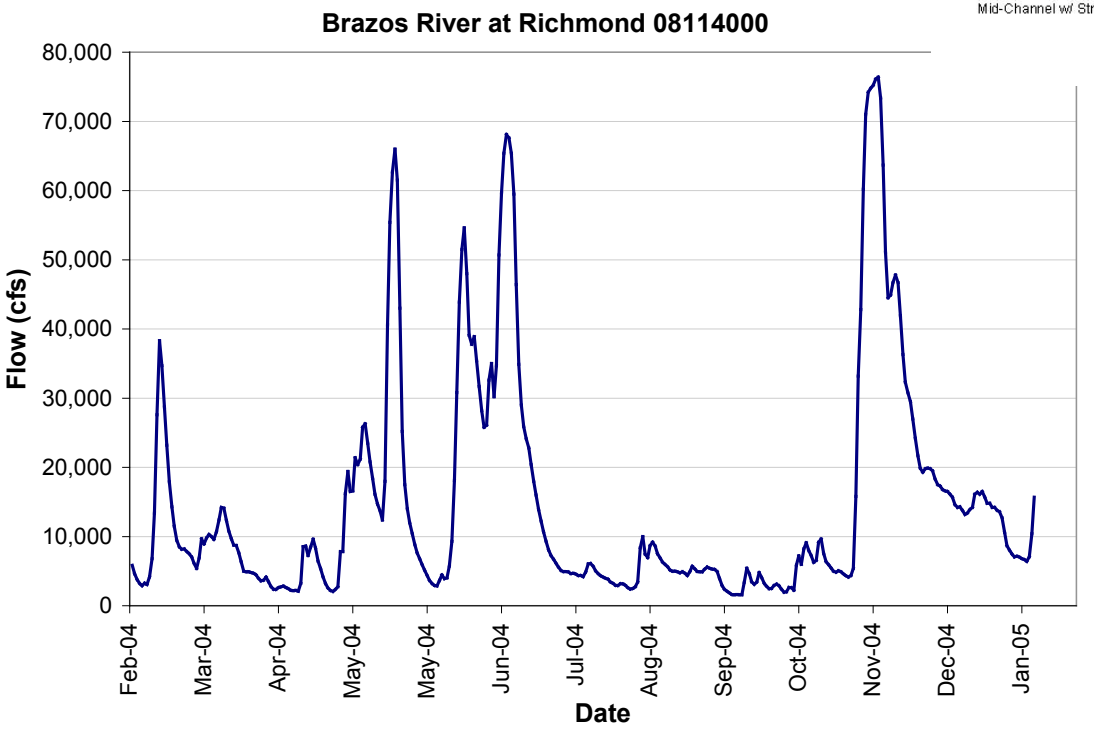
- Assess bed, banks and floodplains
- Examine active floodplains and channels
- Assess channel adjusting and overbank flow behavior
- Develop sediment budgets
- Identify habitat features

Evaluations

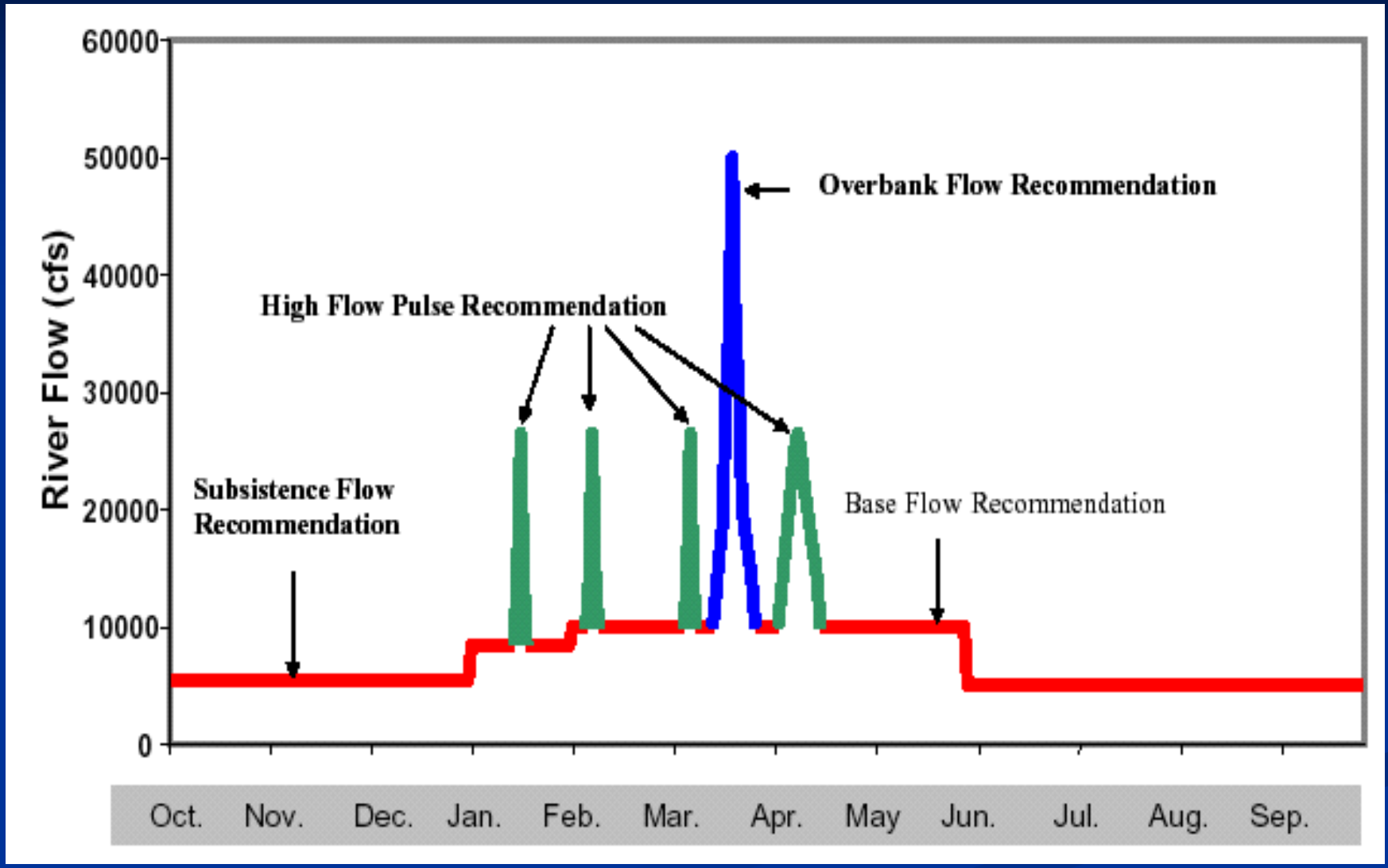
- Hydrology Hydraulics
- Physical Processes
- Water Quality
- Biology

Hydrology and Hydraulics





Environmental Flow Regime

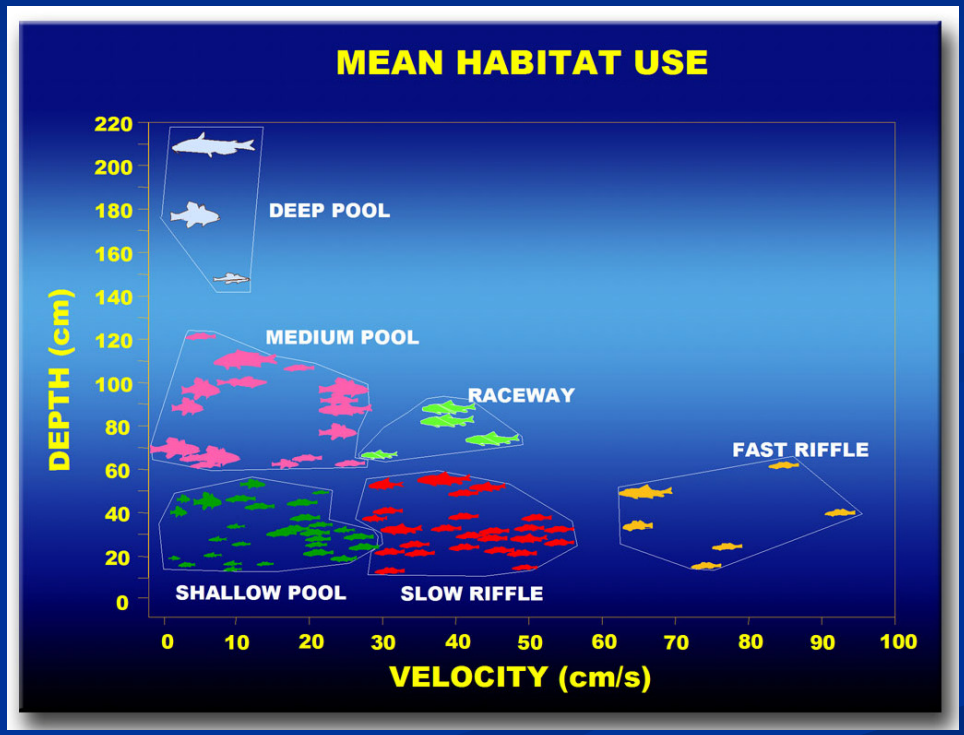


Evaluations

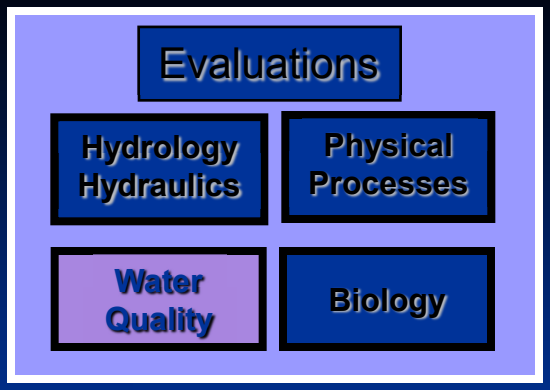
- Hydrology Hydraulics
- Physical Processes
- Water Quality
- **Biology**

Biology

Habitat Diversity



Biodiversity



Water Quality

Water Quality Indicators

Dissolved Oxygen, Temperature, Bacteria, Water Clarity, Salinity, Nutrients.

Technical Studies

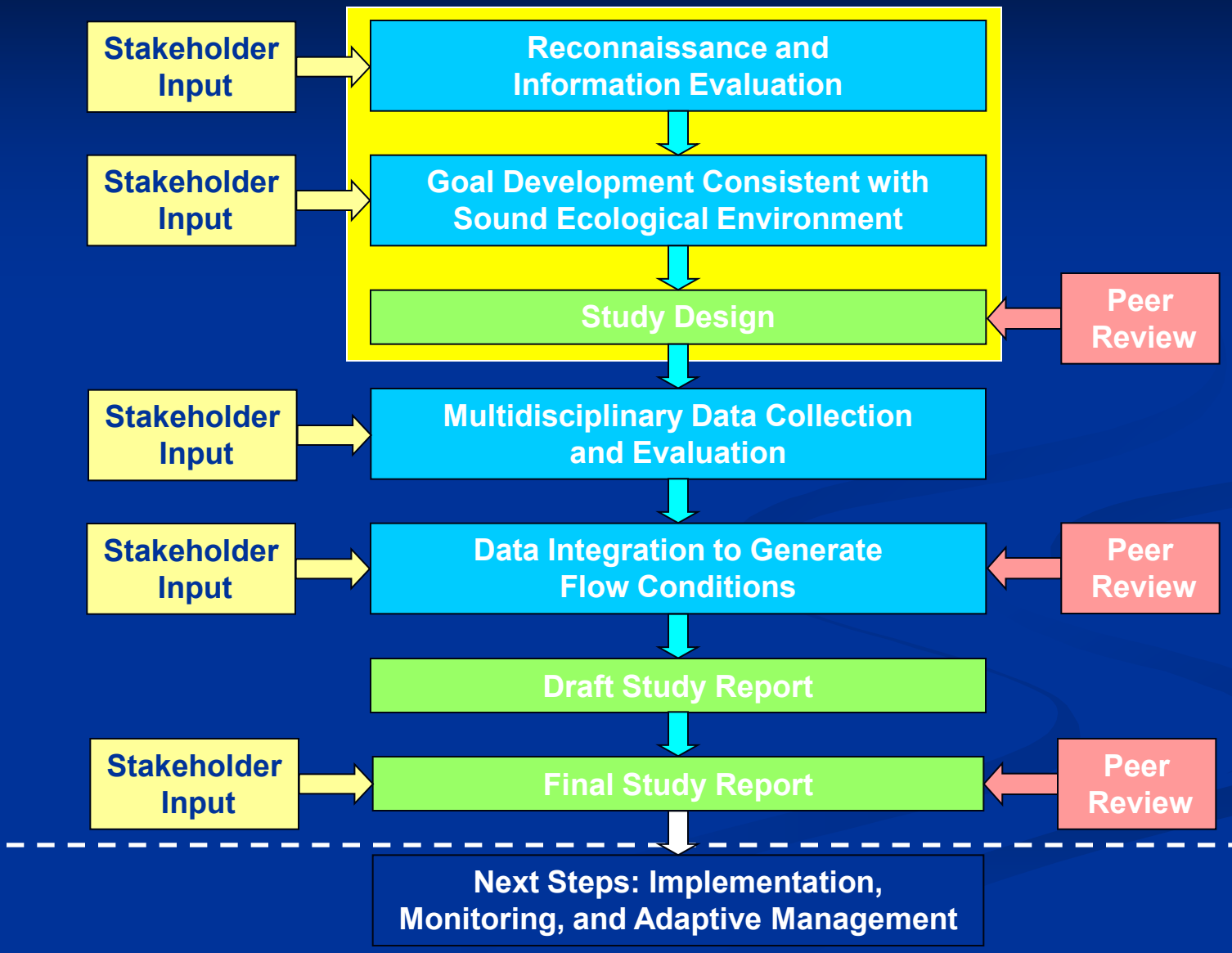
WQ Evaluation from existing programs – CRP, TPDES, TMDL

Extended deployment of WQ Data Sondes

Use of existing WQ models in use by TCEQ

Development of Statewide Water Quality modeling approach

Steps in TIFP Studies



Study Design

- Summary of available data and reconnaissance surveys
- Conceptual model of river systems
- Goals, objectives and indicators for the study
- Proposed study sites, methods and tools
- Public participation process
- Peer Review Process (USGS)

Study Design

Instream Flow Study of the Middle and Lower Brazos River

Draft Study Design

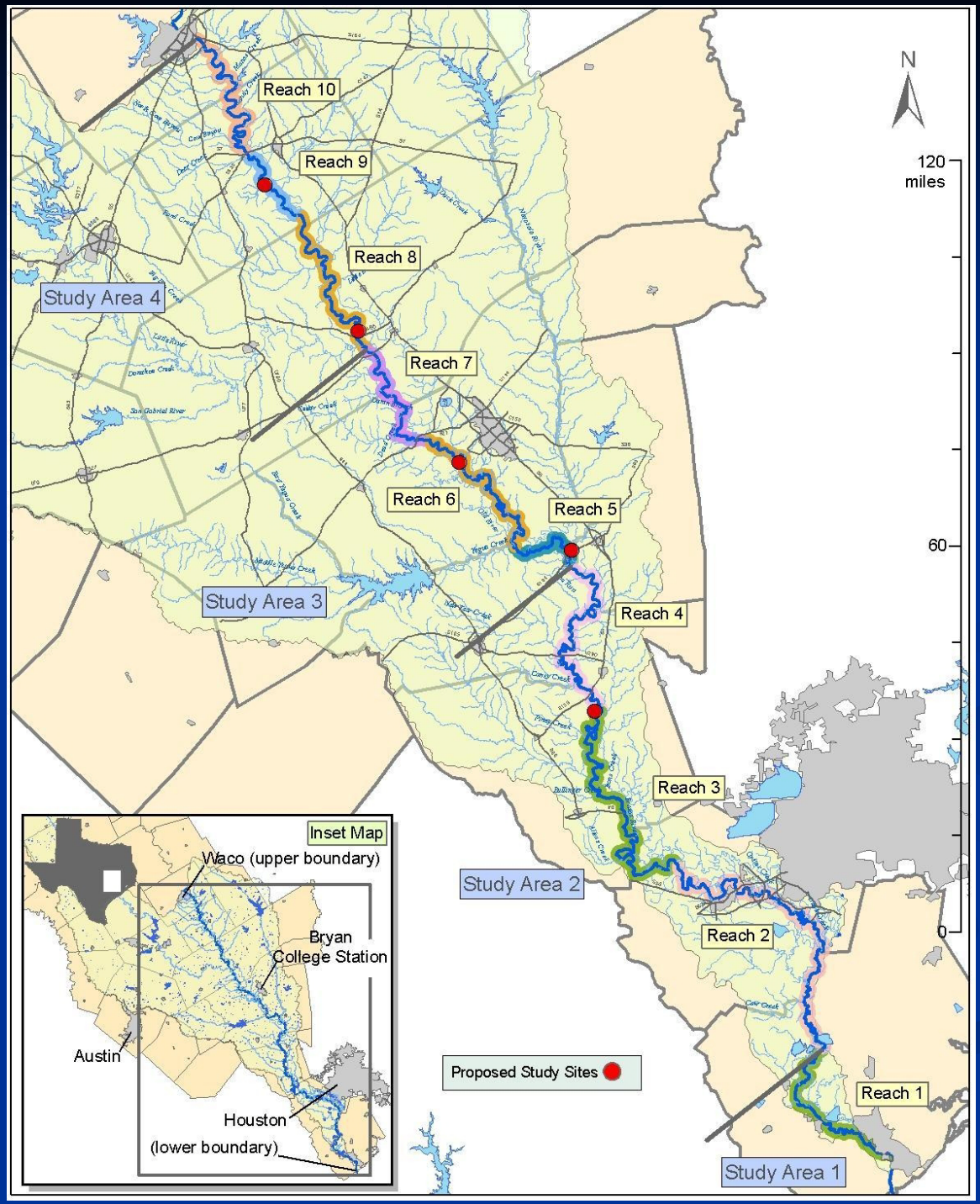
Prepared for

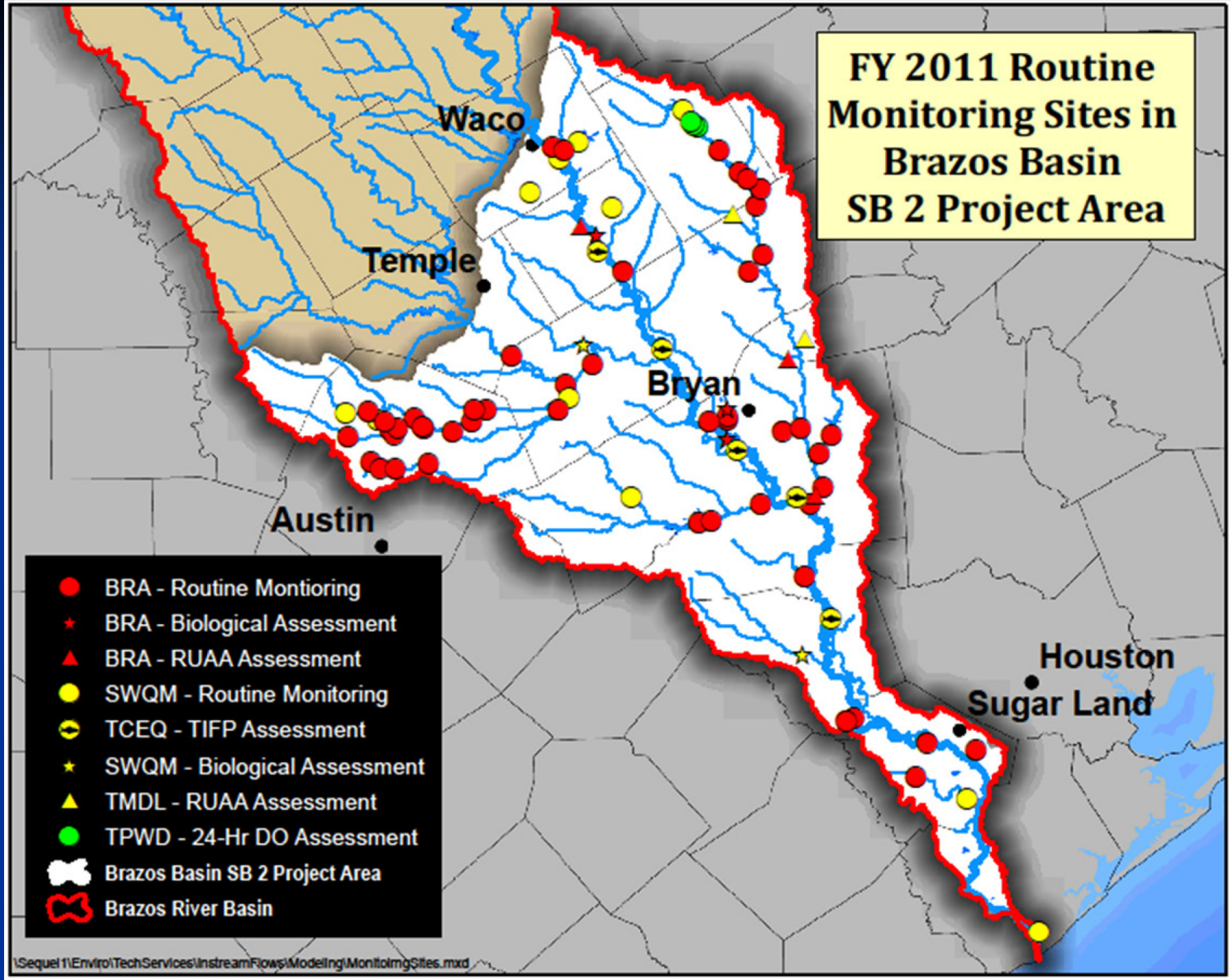
Middle and Lower Brazos River Sub-Basin Study Design Workgroup

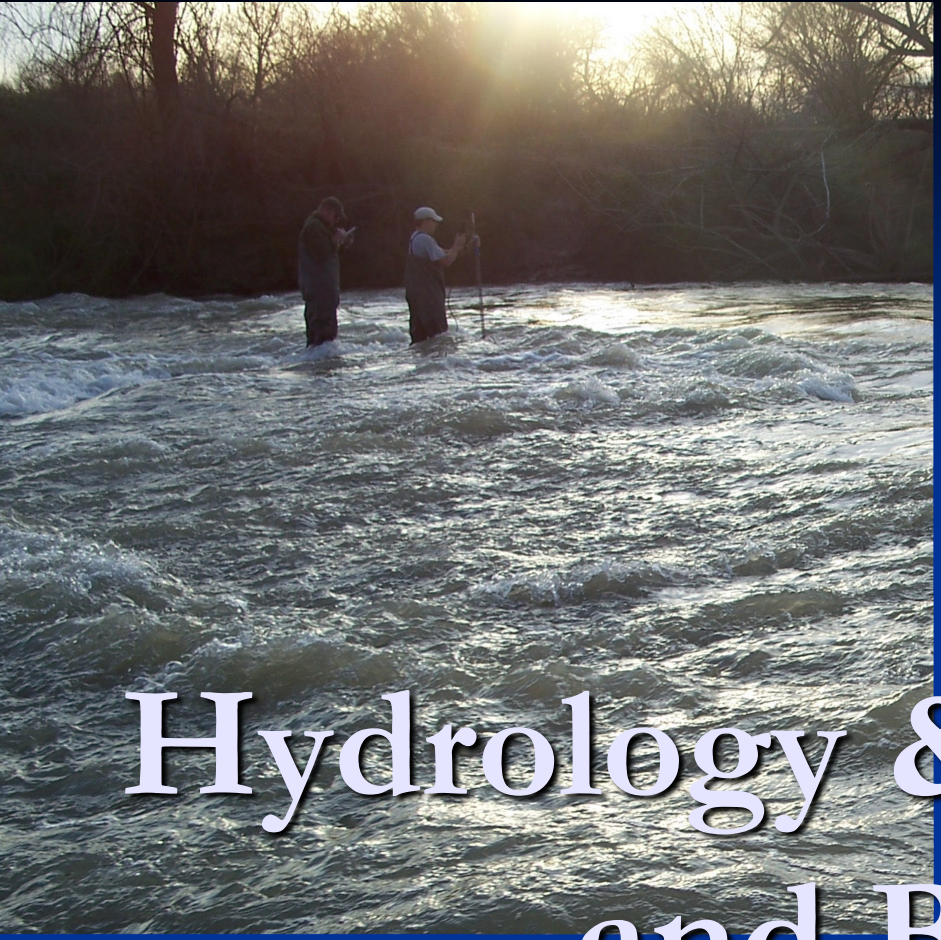
Prepared by

TEXAS INSTREAM FLOW PROGRAM AND BRAZOS RIVER AUTHORITY

MARCH 2010


N
120
miles
60
0
Reach 10
Reach 9
Reach 8
Reach 7
Reach 6
Reach 5
Reach 4
Reach 3
Reach 2
Reach 1
Study Area 4
Study Area 3
Study Area 2
Study Area 1
Proposed Study Sites
Inset Map
Waco (upper boundary)
Bryan
College Station
Austin
Houston
(lower boundary)


FY 2011 Routine Monitoring Sites in Brazos Basin SB 2 Project Area
Waco
Temple
Bryan
Austin
Houston
Sugar Land
BRA - Routine Montioring
BRA - Biological Assessment
BRA - RUAA Assessment
SWQM - Routine Monitoring
TCEQ - TIFP Assessment
SWQM - Biological Assessment
TMDL - RUAA Assessment
TPWD - 24-Hr DO Assessment
Brazos Basin SB 2 Project Area
Brazos River Basin
\Sequel1\Enviro\TechServices\InstreamFlows\Modeling\MonitoringSites.mxd



Hydrology & Hydraulics and Biology for Habitat Modeling

Hydrology
Gage Location and 7Q2 values

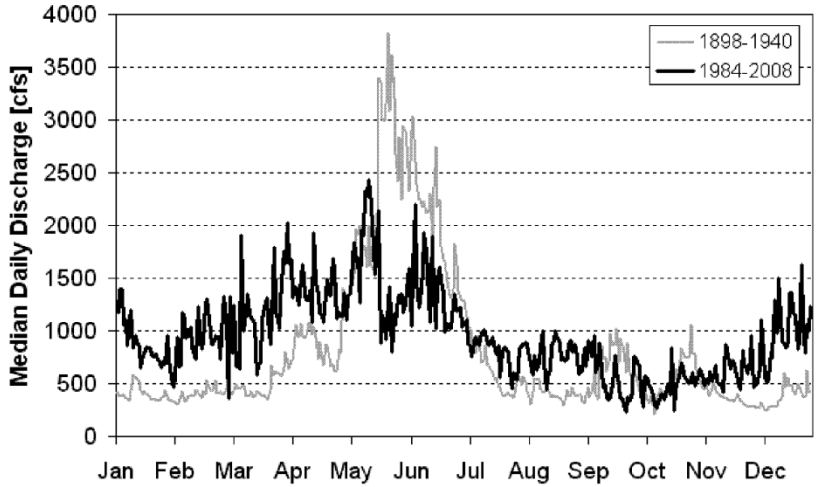


Figure 2. Median of daily streamflow values for USGS gage 08096500, Brazos River at Waco.

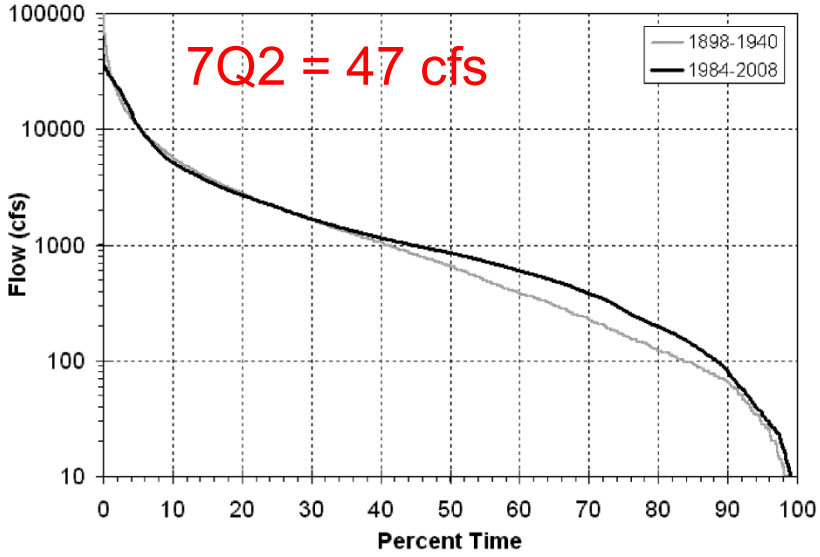


Figure 3. Flow duration curves for daily average flow at USGS gage 08096500, Brazos River at Waco.

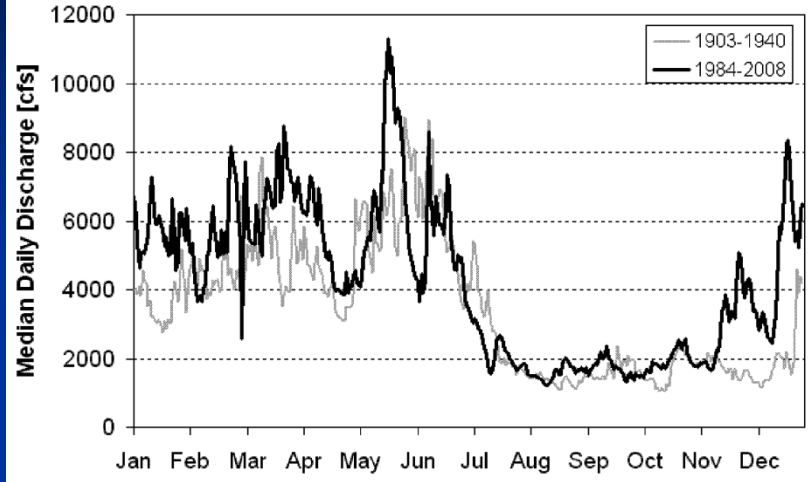


Figure 4. Median of daily streamflow values for USGS gage 0811400, Brazos River at Richmond.

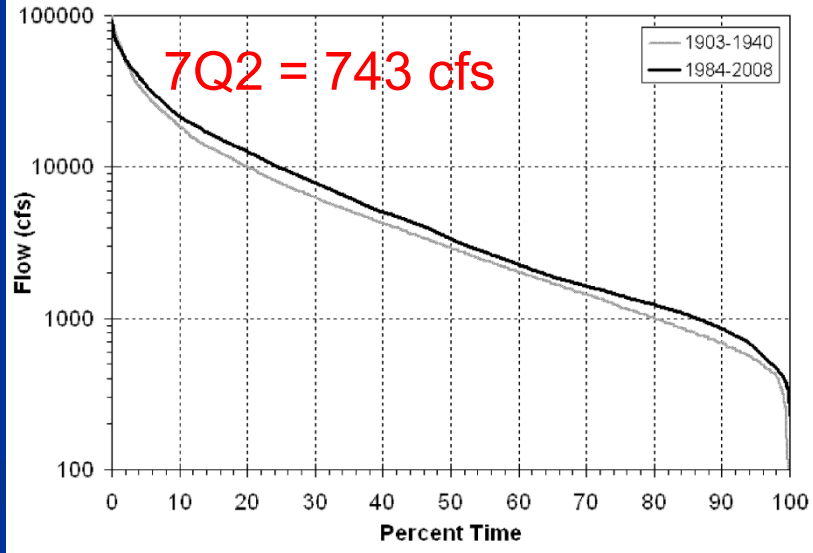


Figure 5. Flow duration curves for daily average flow at USGS gage 0811400, Brazos River at Richmond.

What Flows to Sample?

Station	High BF (35-50%)	Medium BF (15-35%)	Low BF (5-15%)
Waco	400-800 cfs	135-400 cfs	35-135 cfs
Highbank	650-975	275-650	100-275
Bryan	1025-1475	550-1025	275-550
Hempstead	1550-2500	850-1550	450-850
Richmond	1700-2900	900-1700	500-900

H&H Topics

- Elevation reference points - Benchmarks
- Hydraulic model calibration/validation
- 2D habitat modeling
- 1D overbanking/riparian modeling

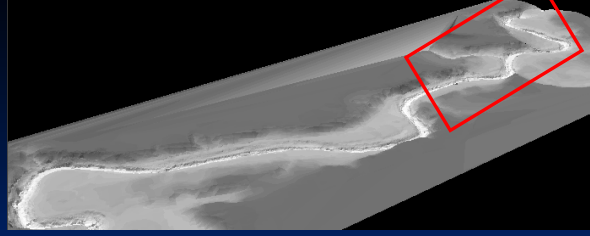
Surveying
Water surface elevation (WSE)

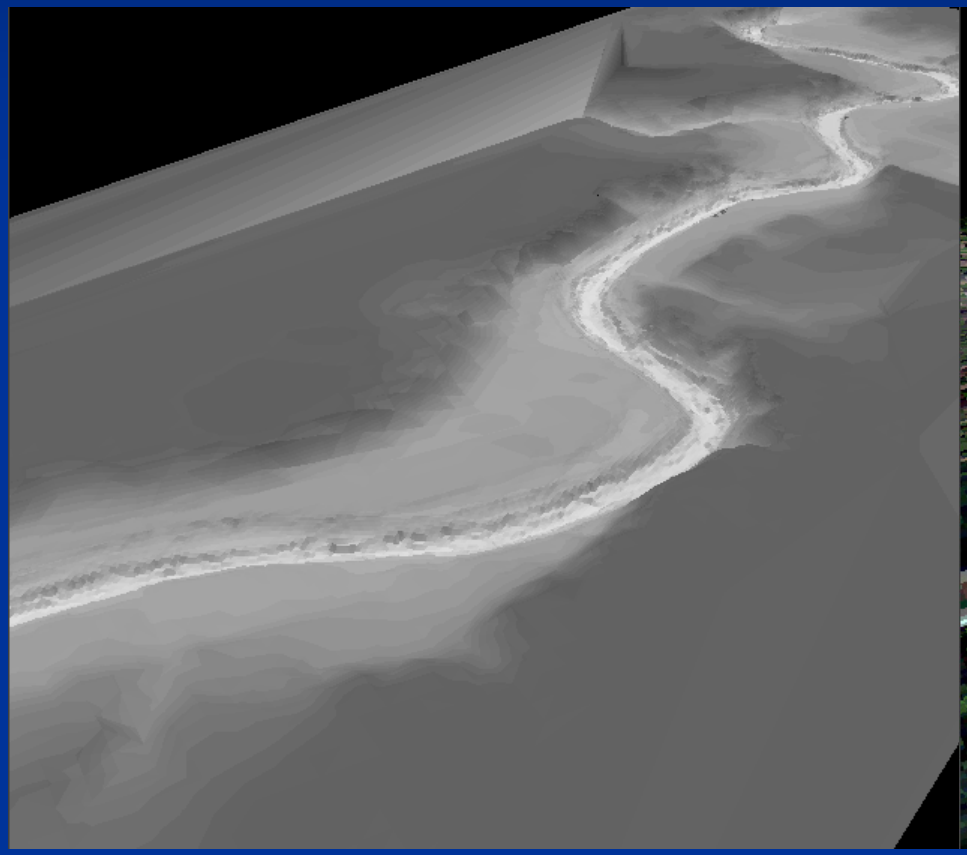
Surveying
Water surface elevation (WSE)

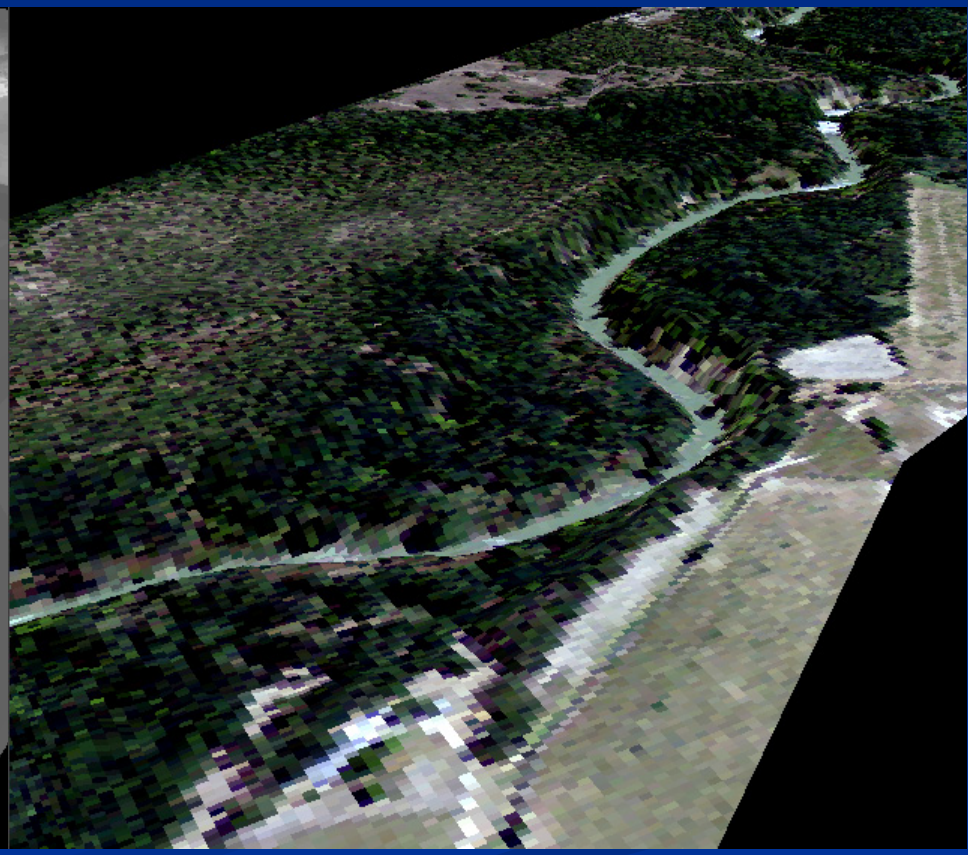
Bathymetry

- Echosounder
  - Boat mounted:
    - RTKGPS + echosounder
- RTKGPS
  - Roving unit on range pole
    - point measurements
- Total station
- Laser

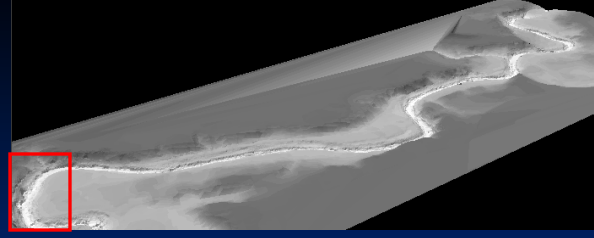
Digital Terrain Model

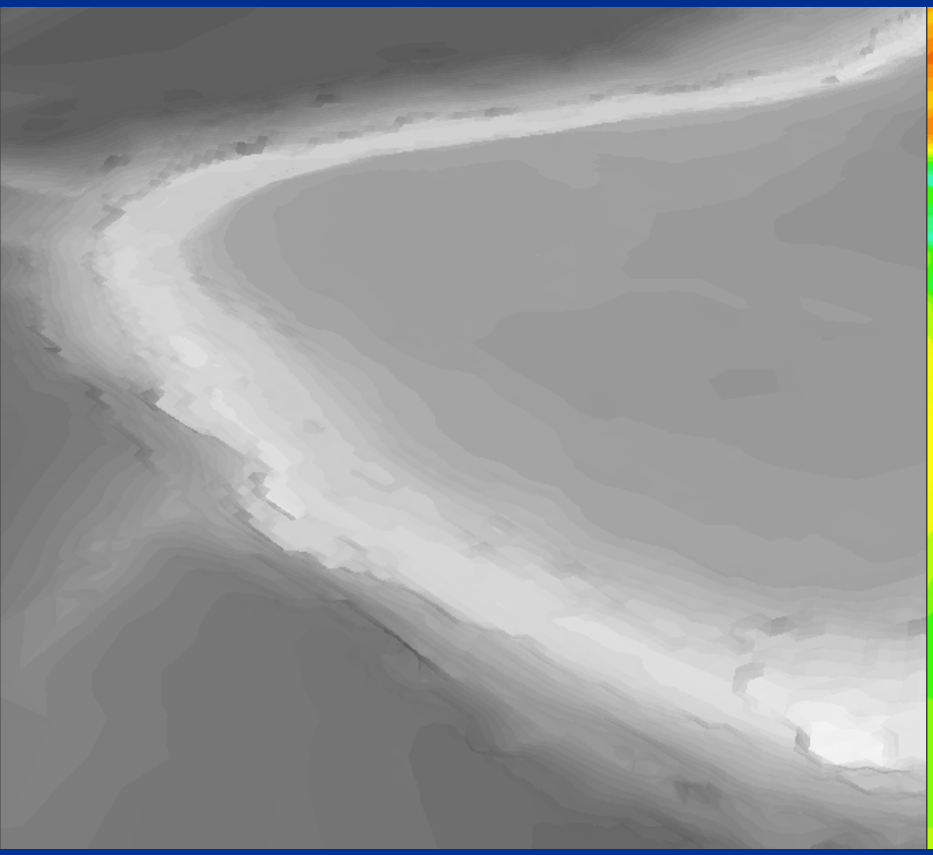


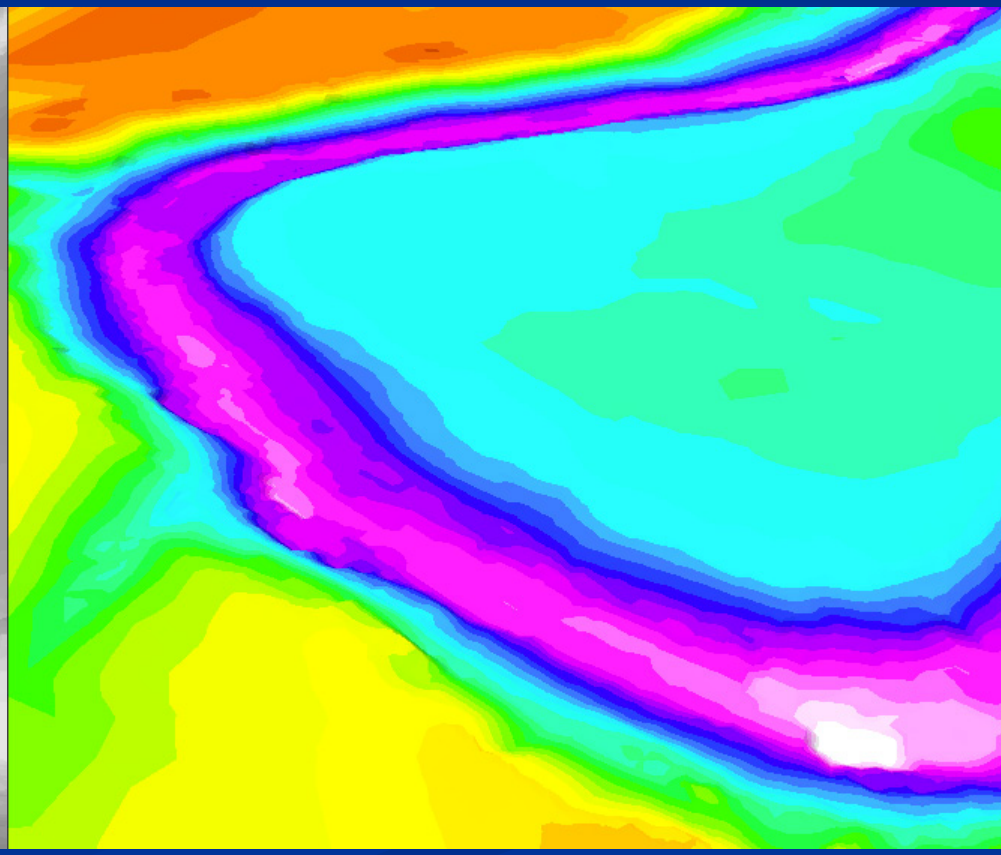




Digital Terrain Model

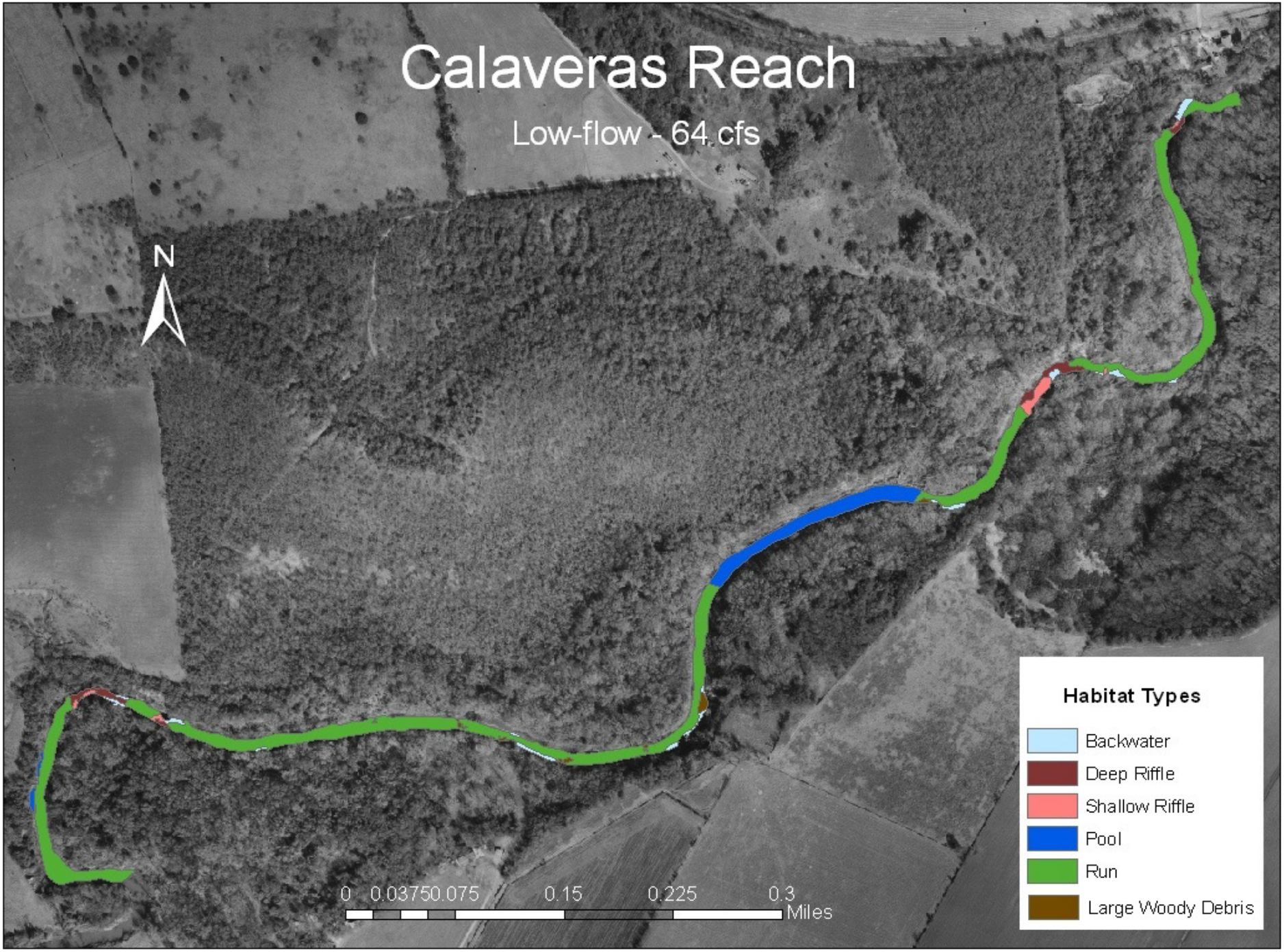


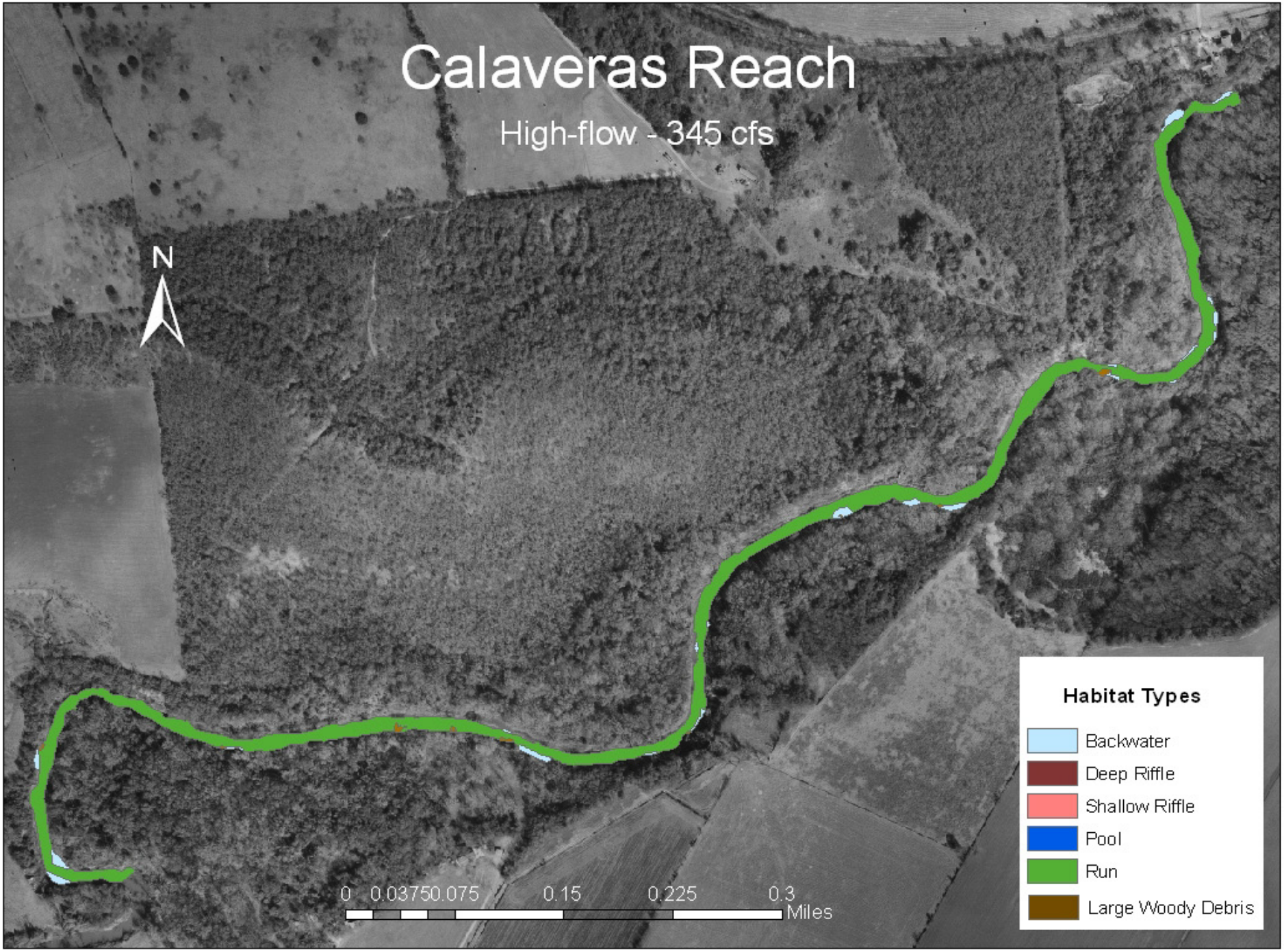




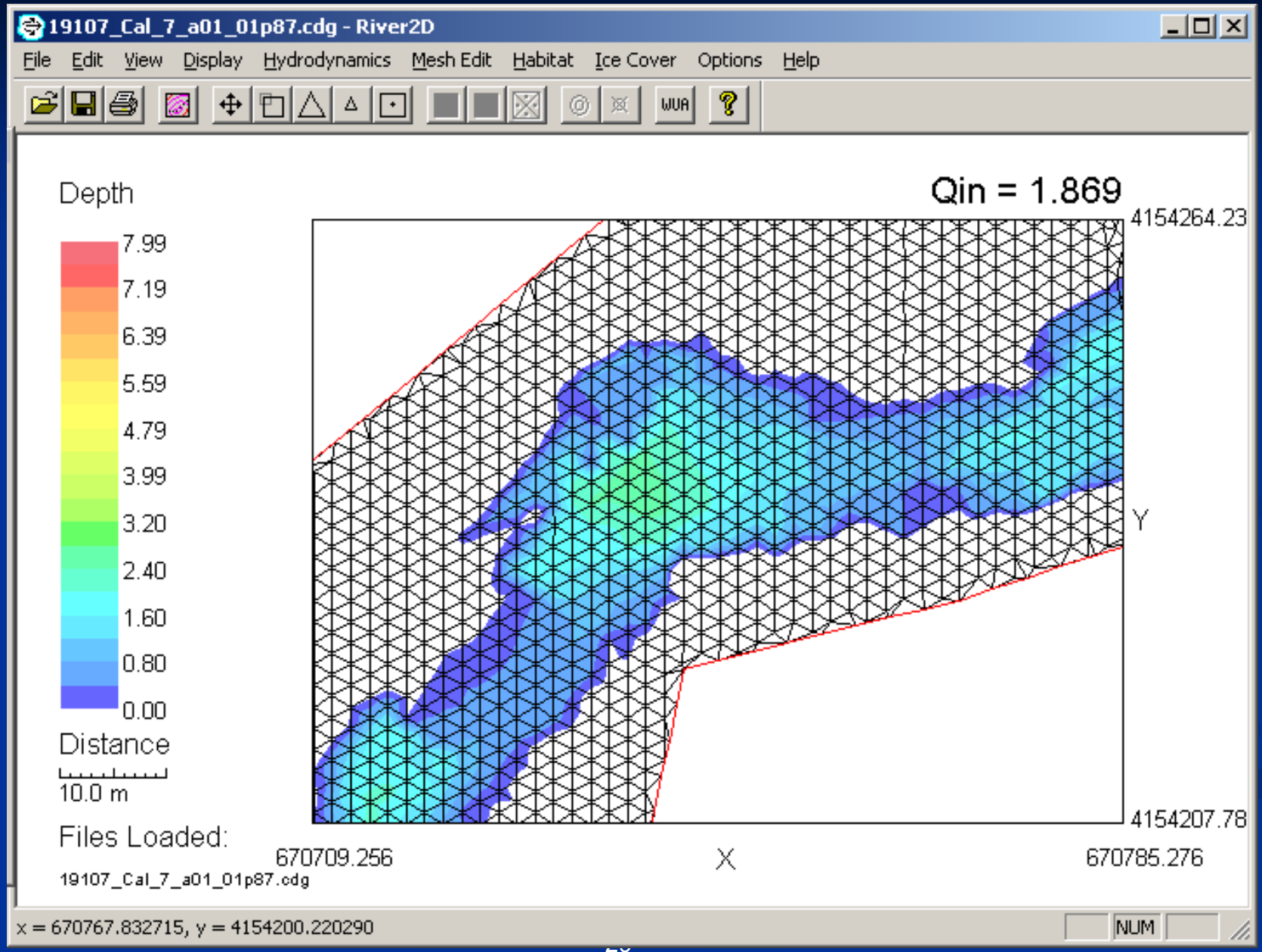
Habitat and Substrate Mapping

- Mesohabitat mapping
  - Runs, riffles, pools, backwater
- Substrate mapping
  - Clay, silt, sand, cobble, rubble, boulder, bedrock
- Large woody debris

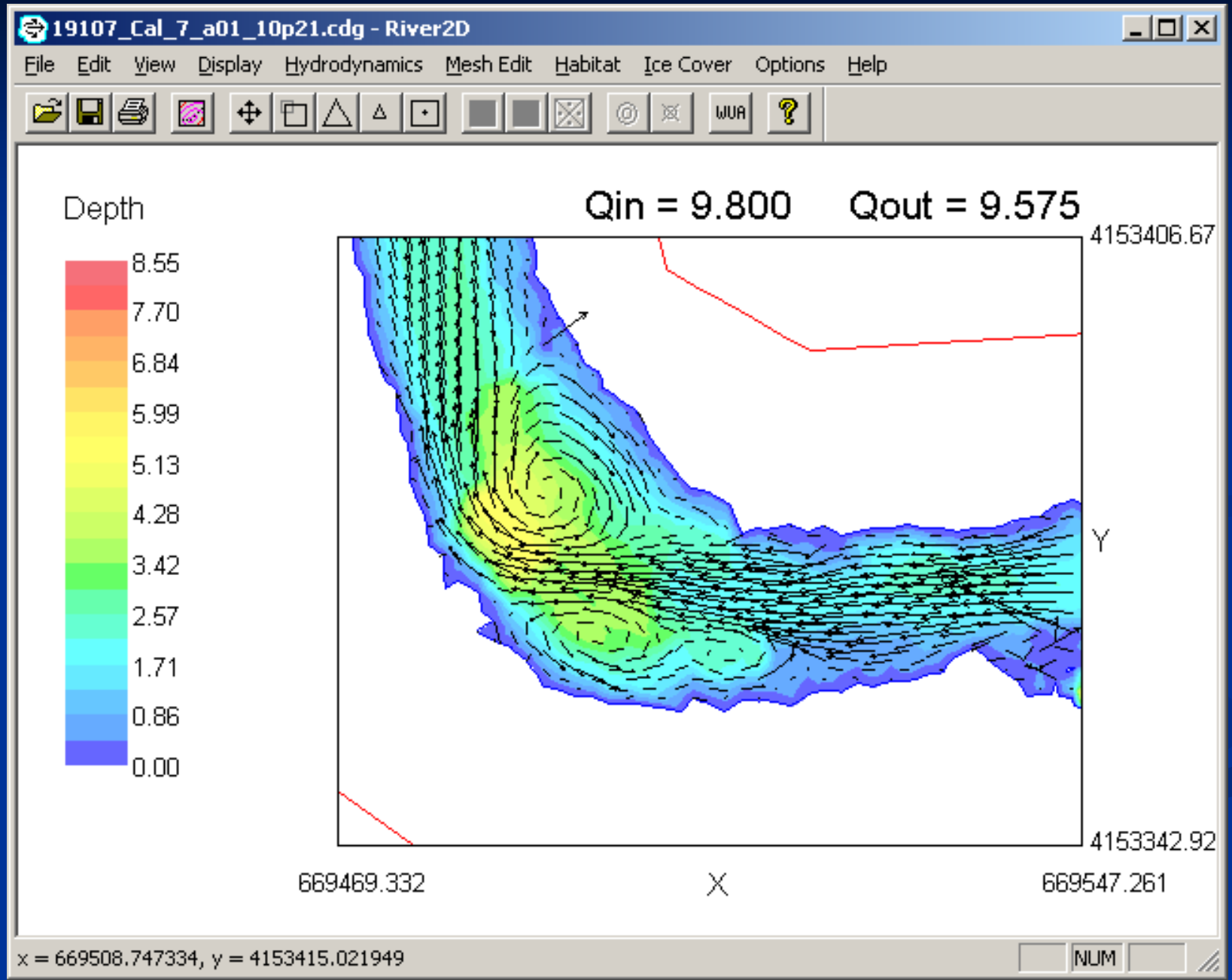

Calaveras Reach
Low-flow - 64 cfs
N
0 0.03750.075 0.15 0.225 0.3
Miles
Habitat Types
Backwater
Deep Riffle
Shallow Riffle
Pool
Run
Large Woody Debris


Calaveras Reach
High-flow - 345 cfs
N
0 0.03750.075 0.15 0.225 0.3
Miles
Habitat Types
Backwater
Deep Riffle
Shallow Riffle
Pool
Run
Large Woody Debris

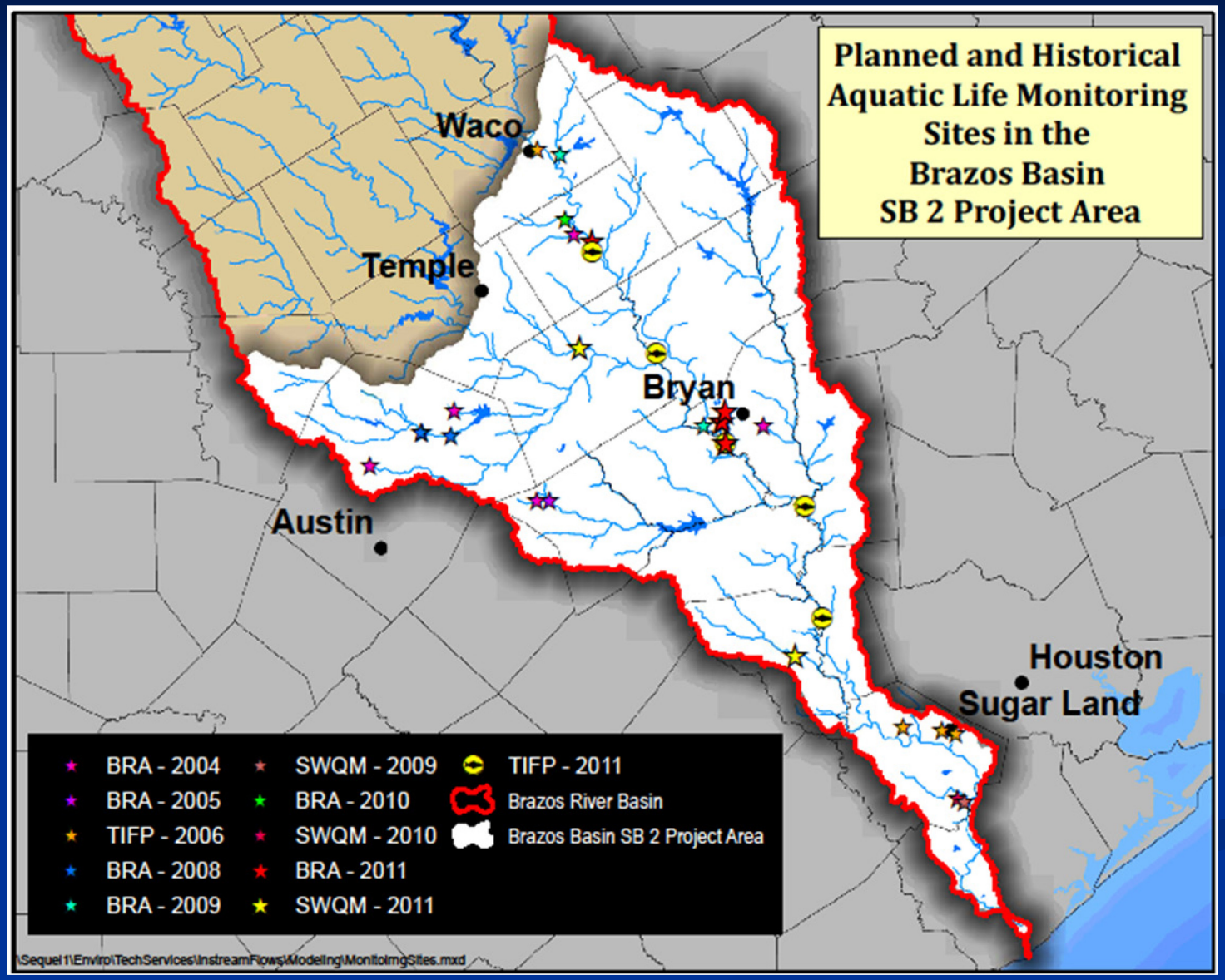
River2D model



River2D model



Biological Sampling Events

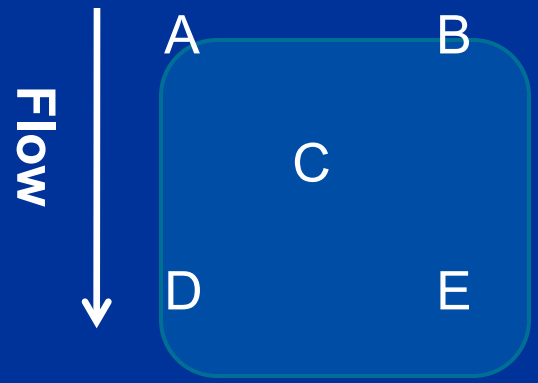


Habitat Suitability Criteria (HSC) Development

- Overlay habitat and substrate maps
- Randomly pick sites within each habitat/substrate category
- Sample with appropriate gear
  - Seines
  - Boat electrofishing
  - Barge-style electrofishing

Mesohabitat Characterization

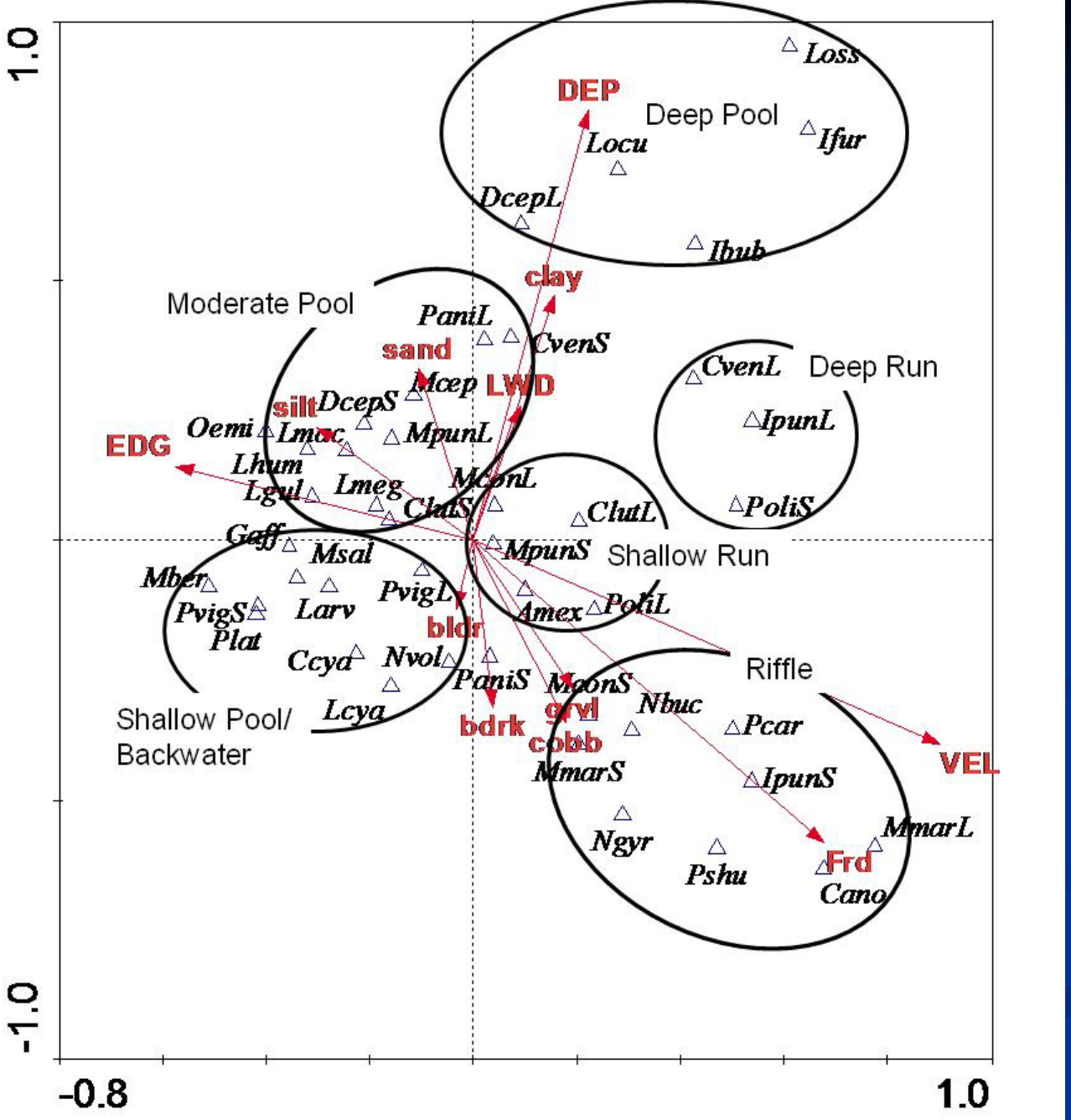
- Record habitat type
- Take depth, velocity, substrate, and GPS waypoint at 5 locations
- Note coverage of LWD, aquatic veg, undercut bank, etc.



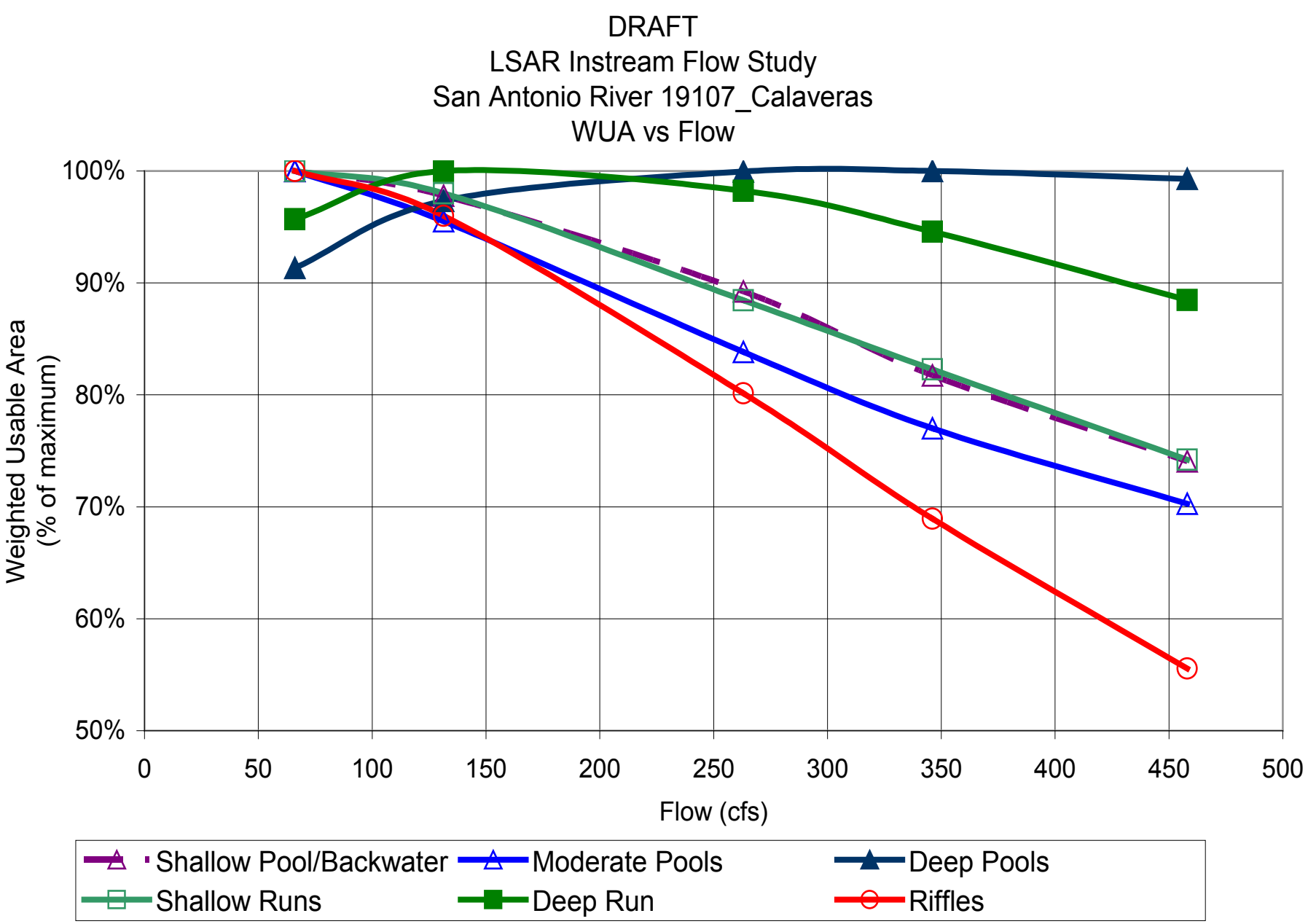
Data Analysis

- Examine habitat use of various life-stages
- Develop habitat guilds using Canonical Correspondence Analysis (CCA)
- Establish Habitat Suitability Criteria (HSC) for each guild
  - Depth
  - Velocity
  - Substrate

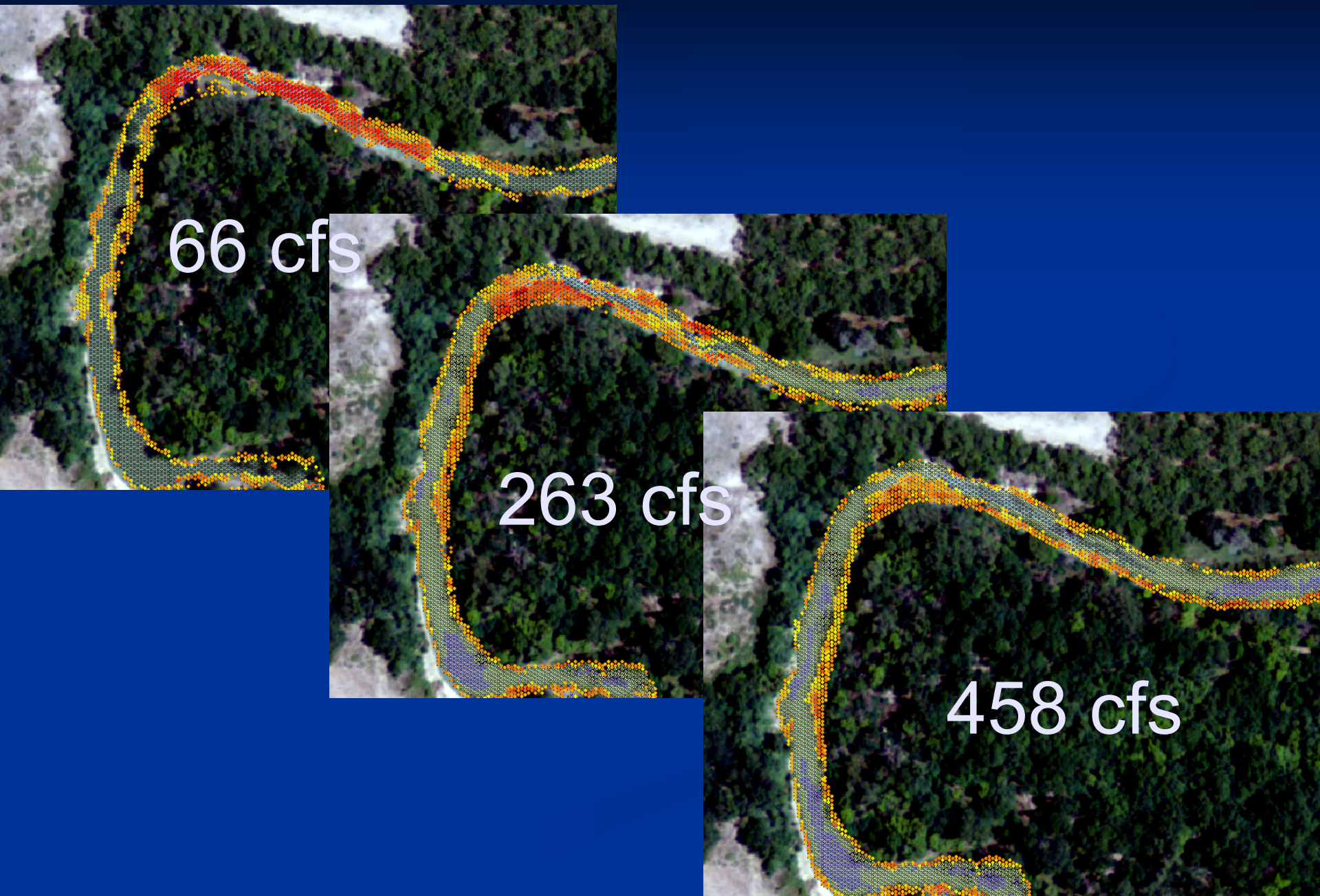
CCA


1.0
-1.0
-0.8
1.0
Deep Pool
Moderate Pool
Deep Run
Shallow Run
Riffle
Shallow Pool/
Backwater
DEP
clay
sand
silt
LWD
EDG
VEL
bldr
bdrk
grvl
cobb
Frd
Loss
Locu
Ifur
DcepL
Ibub
PaniL
CvenS
Mcep
DcepS
Oemi
Lmac
MpunL
Lhum
Lgul
Lmeg
MconL
ClutS
CvenL
IpunL
PoliS
ClutL
Gaff
Msal
MpunS
Mber
PvigL
PvigS
Larv
Plat
Amex
PoliL
Ccya
Nvol
PaniS
MconS
Lcya
Nbuc
Pcar
MmarS
IpunS
Ngyr
Pshu
MmarL
Cano

Habitat Modeling Results



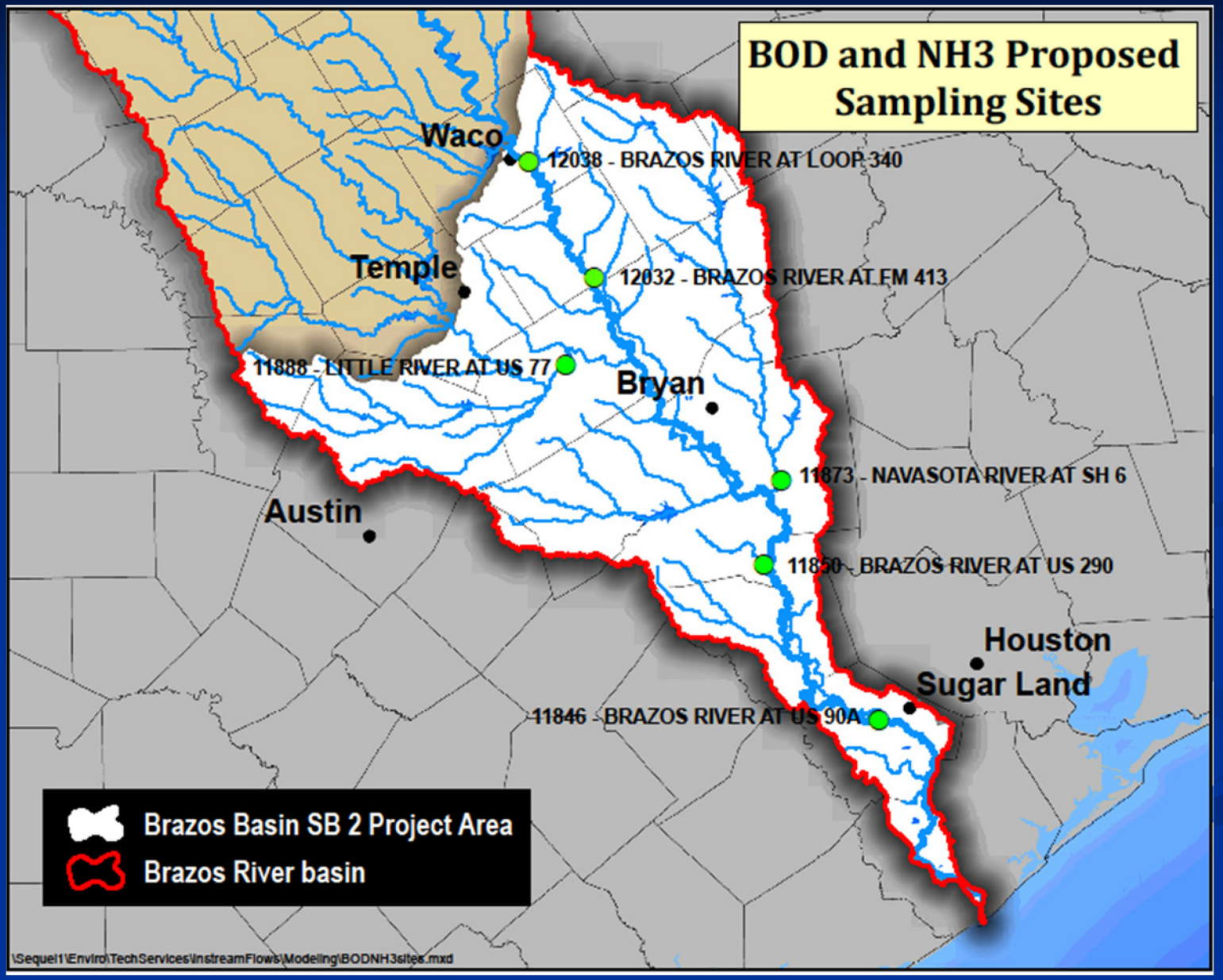
Calaveras – Riffle Habitat Guild



Water Quality

- Approach outlined in Study Design
  - Summarize Available Information
  - Assess Current Conditions
    - Current Flow
    - Water Quality Data
  - Identify Water Quality Goals, Objectives, and Identify Needs
  - Conduct Studies and Apply Models if needed
  - Integration into Flow Recommendations

Water Quality Sampling Events

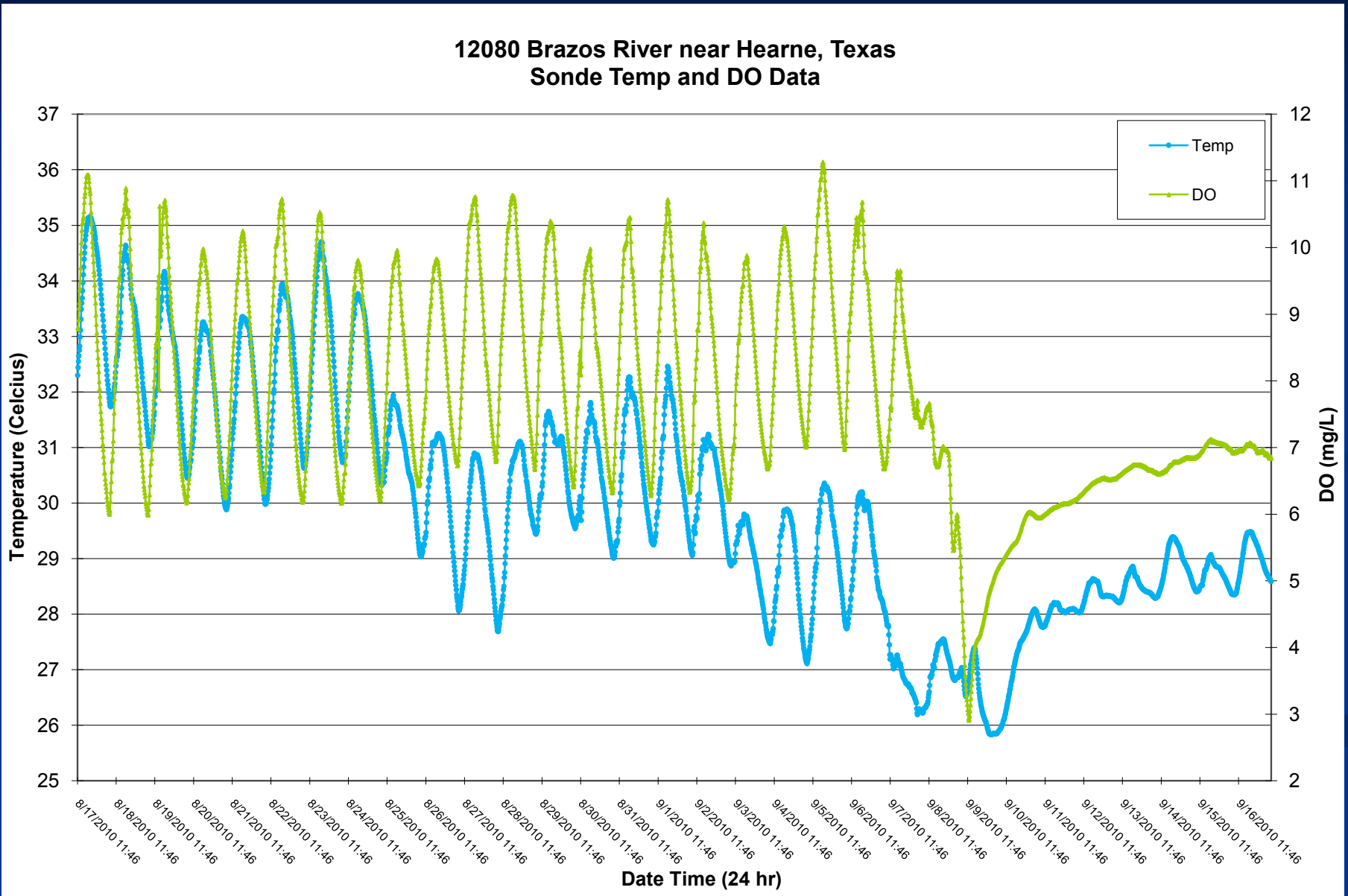


Summary of Available Information

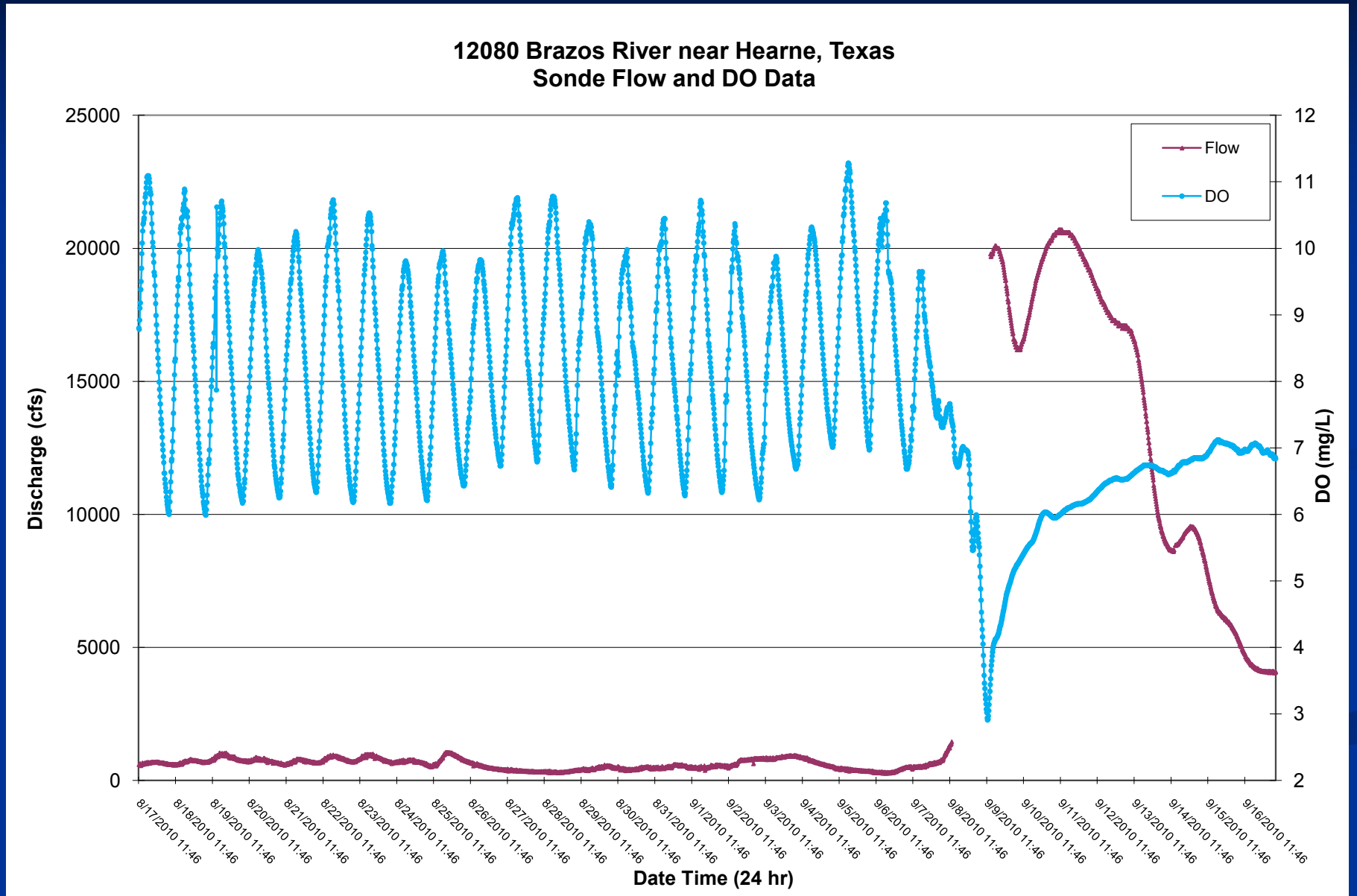
- Clean Rivers Program – BRA/TCEQ Historical Water Quality Trends
- Other Sources of WQ Data
  - SWQM Stations
  - USGS
  - TCEQ – UAAs, RWAs, TMDL Implementation

Note: All needs of TIFP WQ analysis are NOT addressed by existing programs.

Sonde Long-term Water Quality



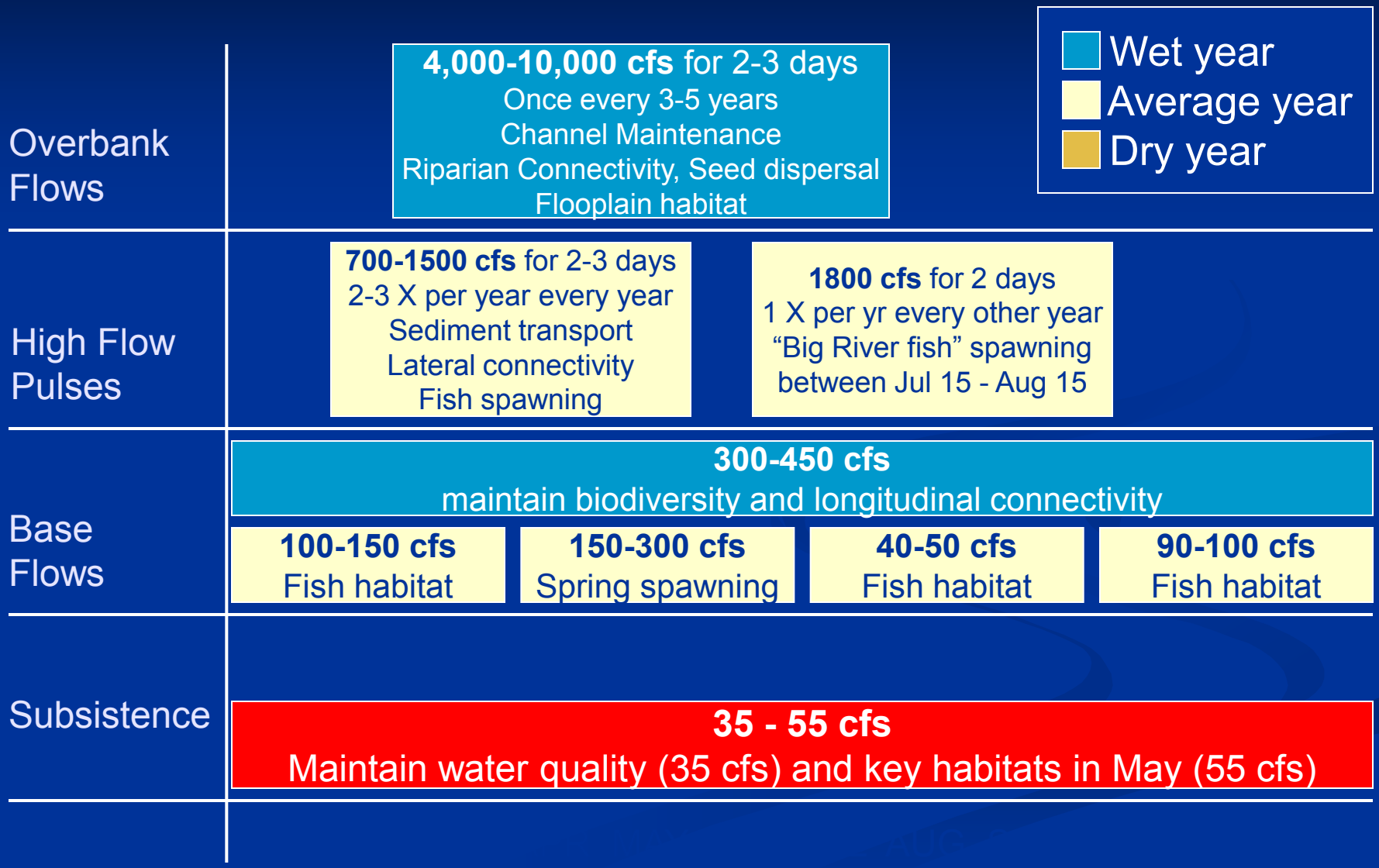
Sonde Long-term Water Quality and Flow



Additional Study Efforts

- TCEQ/BRA Water Quality Study
- TWDB Research and Planning Contracts
  - TAMU Fish Habitat Utilization
  - TSU UAV Flyover

Integration of Flow Components



Instream Flow Program Results

- An essential database for conservation of fish and wildlife resources in Texas
- Considered in the State's water rights permitting process, and
- Incorporated into future regional and state water plans

Linking SB2 and SB3

- SB3 Objective: develop recommendations to protect instream flows and freshwater inflows" (TWC § 11.0235 d-6).
- BBEST utilize "best available science" to generate flow recommendations to meet the needs of the environment (TWC § 11.02362 m). SB2 studies currently underway in the Middle and Lower Brazos River Basin may be considered "best science available."
- BBEST recommendations are then considered "in conjunction with other factors, including the present and future needs for water for other uses related to water supply planning," by BBASC (TWC §11.02362 o).
- TCEQ considers recommendations of both the expert science team and area stakeholder committee, human and other competing water needs, and other factors (TWC §11.1471 b).
- Adaptive Mgmt component requires flow recommendations to be reviewed at a minimum every 10 years by BBEST/BBASC (TWC §11.02362 p).

Information

Texas Instream Flow Program Website

www.twdb.state.tx.us/Instreamflows/

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Questions???