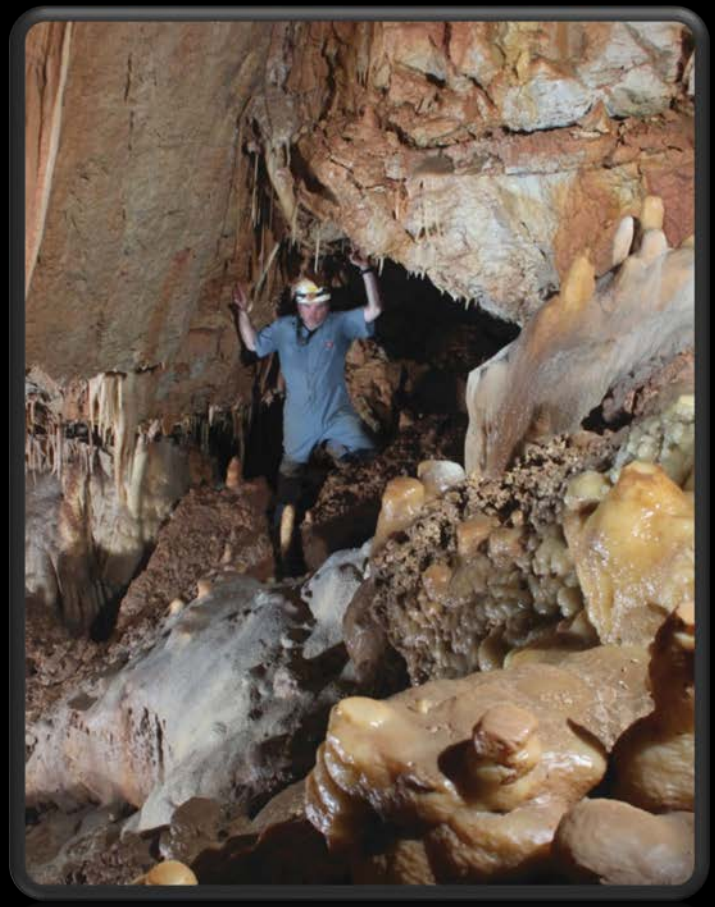
The Science Program Strategic Focus, Progress to Date, and Program Status

Technical Briefing for the
Edwards Aquifer Authority
Board of Directors
November 12, 2014

Presentation Overview

- Strategic Planning 2014 – 2017
- Development of the Conceptual Model over 15-years
- Interformational Flow and the Data Collection Toolbox
- Modeling and the Iterative Process



Strategic Planning 2014-2017

Short Term Goals

- Fill open positions with well qualified candidates as soon as possible.
- Refine the process for tracking and reporting project metrics.
- Increase collaboration (across AMT) for maintaining project workload and timely completion.

Strategic Planning 2014-2017

Focus Areas and Long Term Goals

Three areas of focus: IFF, Models, Data Management

- Complete project milestones for IFF and present to board annually.
- Accomplish model completion, evaluation and implementation (FeFlow, MODFLOW, and HSPF) and provide updates as needed.
- Refine the Data Management process to better accommodate expanding data streams while improving data QA/QC, archival, retrieval, and availability.

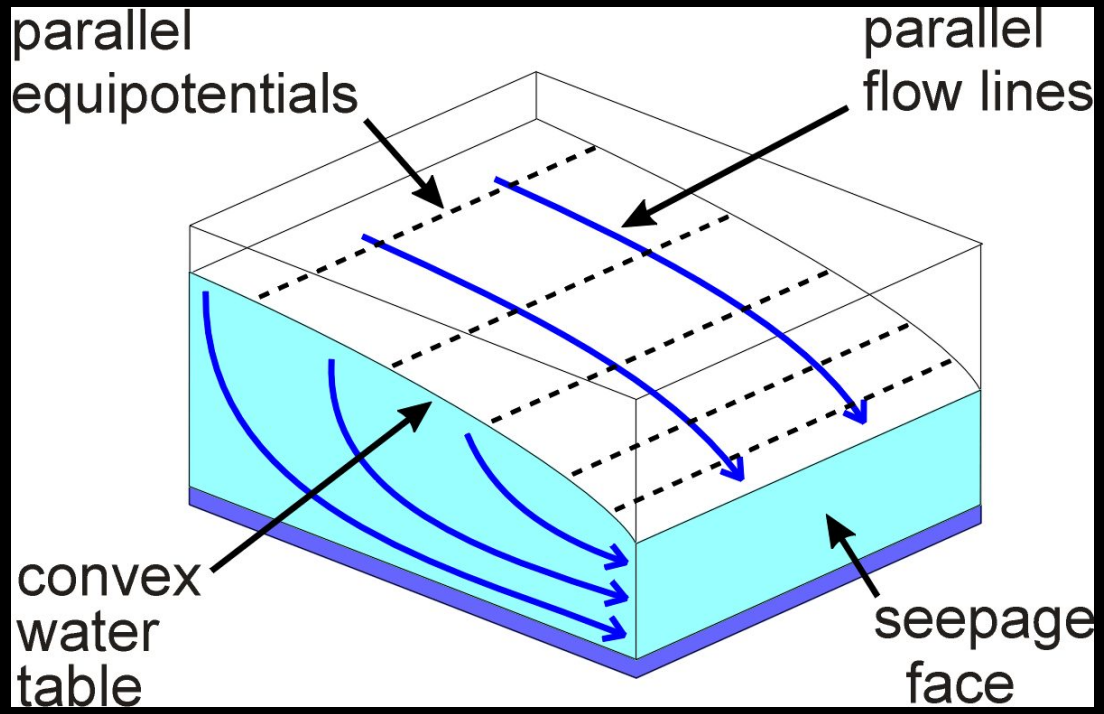
Development of the Conceptual Model of the Aquifer

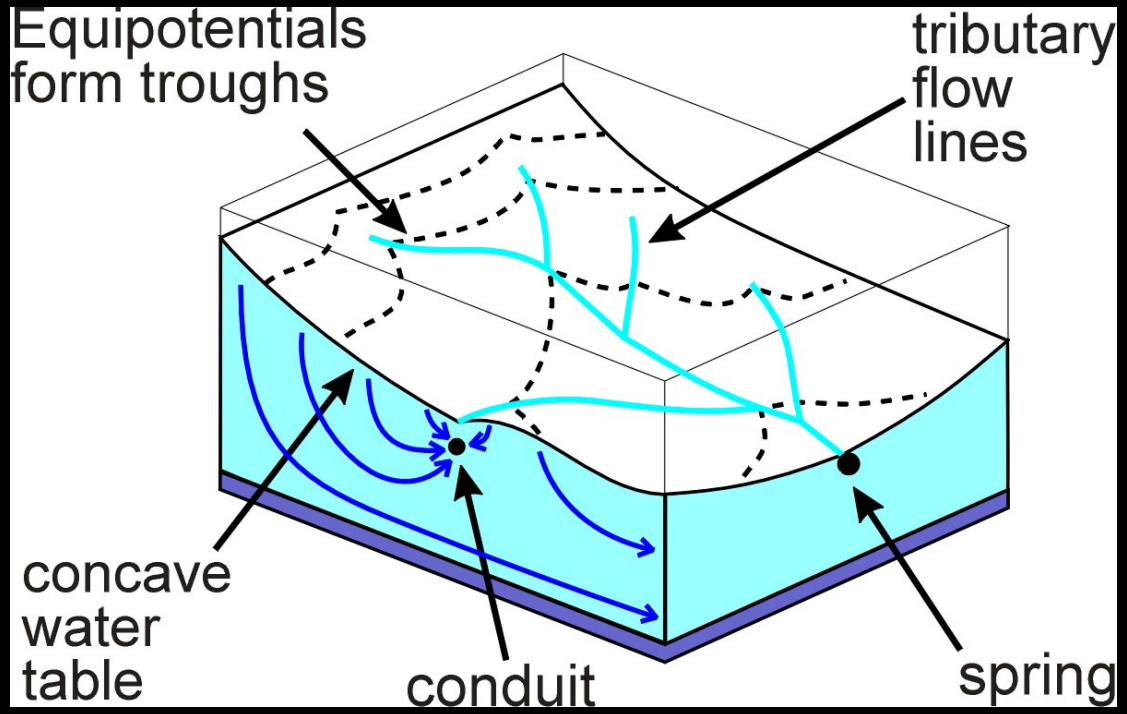
Geary Schindel

Director and CTO Aquifer Science

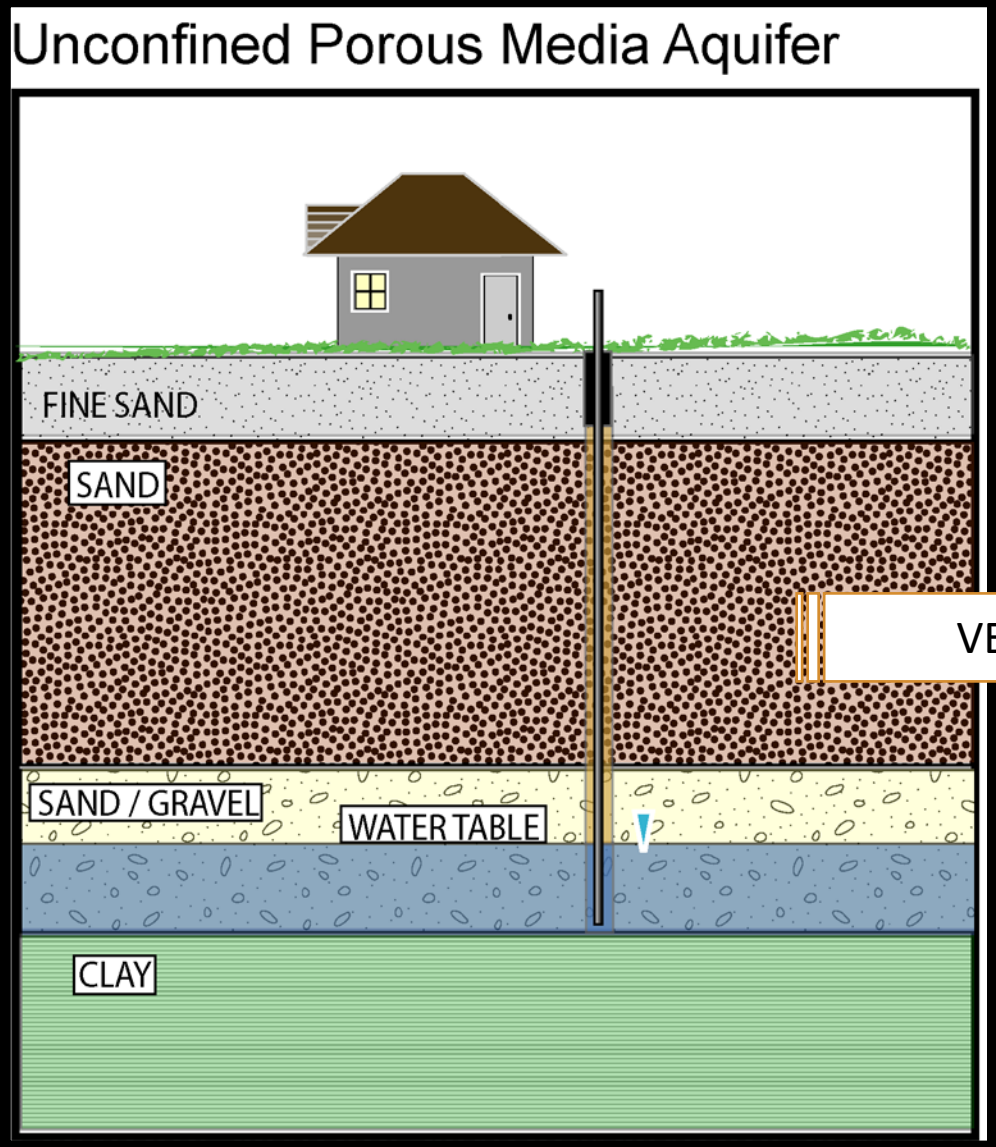
Development of the Conceptual Model

- Pre-1999 – Aquifer was treated as a porous media aquifer
- Post-2000 – Aquifer is treated as a conduit dominated aquifer

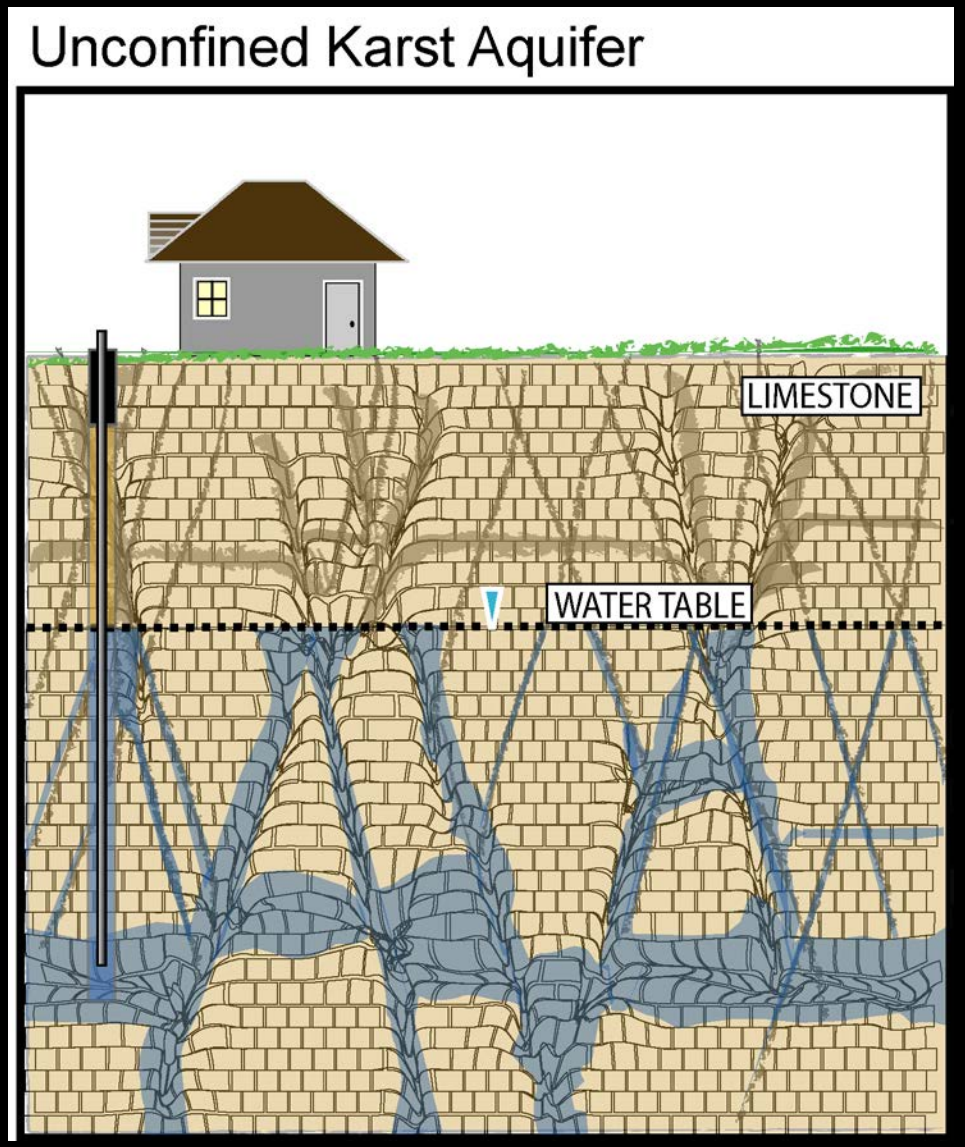




Development of the Conceptual Model



VERSUS



Transition to Conduit Dominated Conceptual Model

- Commitment of the board to develop in-house science expertise
- Commitment to Research Programs
  - OTS (2000-2004)
  - ASRPP (2005 – Present)
- Data Collection Programs
  - Water quality monitoring
  - Water level monitoring
  - Synoptic water level
  - Tracer testing
  - Geophysics

Aquifer Research Initiatives

- Knippa Gap Flowpath Study
- Nueces River Hydrology
- Interformational Flow Study
- Borehole Hydrophysics
- Regional Tracer Testing
- Remote Sensing Evapotranspiration Data
- Bacterial Source Tracking
- Passive (Sentinel) Well Sampling
- Pharmaceuticals and Personal Care Products

Aquifer Research Initiatives

- Blanco River Gains and Losses Study
- Leona Formation Study
- Uvalde-Kinney County Groundwater Study
- Cibolo Creek Study

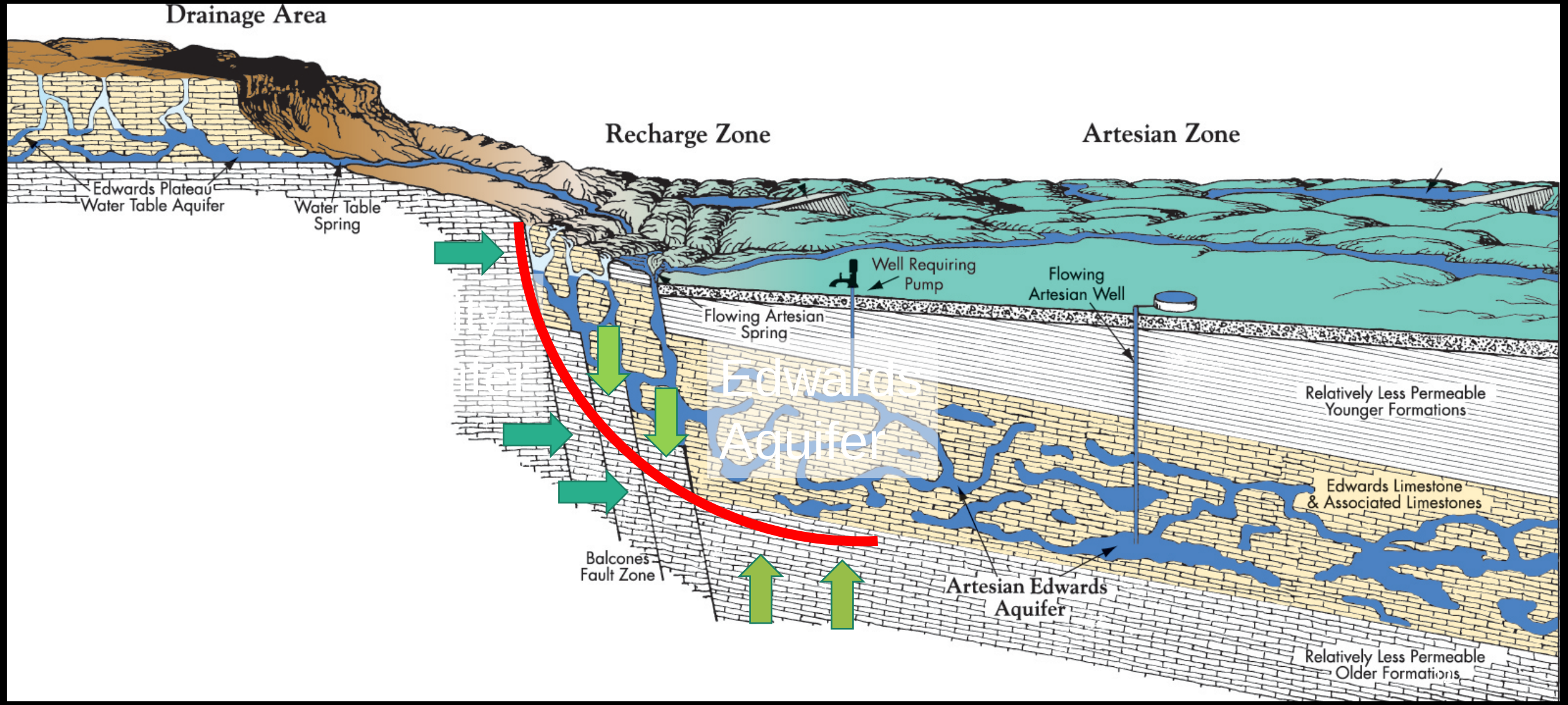
Investigating the Edwards – Trinity Aquifer Interface:

Quantifying Interformational Flow (IFF)

Dr. Marcus Gary

Data Collection Supervisor

Current hypothesis separates the two aquifers



What is an aquifer?

- a consolidated or unconsolidated geologic unit (material, stratum, or formation) or set of connected units that yields water of suitable quality to wells or springs in economically usable amounts.

What is a geologic formation?

- A mappable body of rock identified by lithic characteristics and stratigraphic position; a mappable body of igneous or metamorphic rock.

geologic formation ≠ aquifer

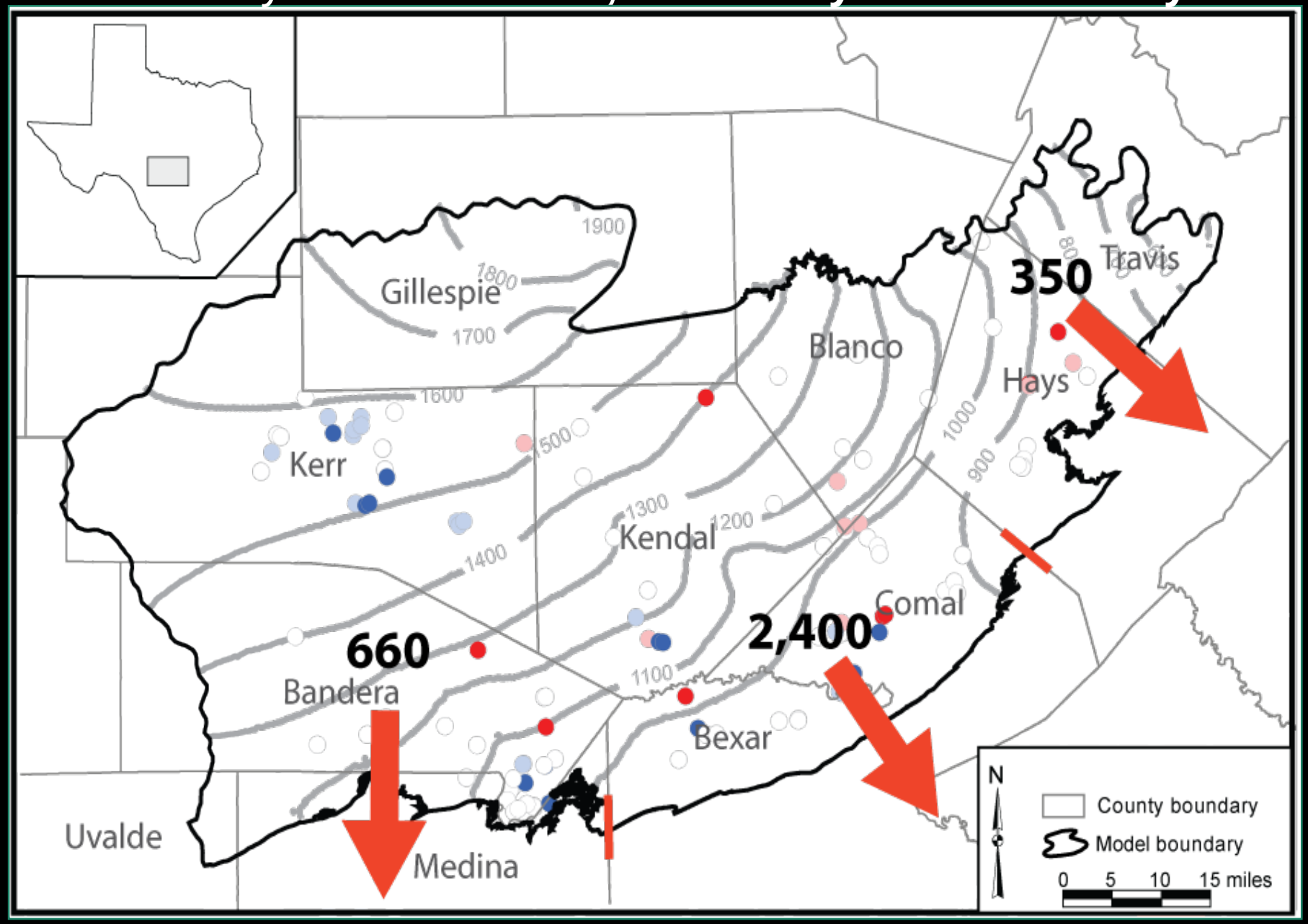
WHY IS IT IMPORTANT TO UNDERSTAND INTERFORMATIONAL FLOW?

- **Improves ability to quantify total recharge to both aquifers.**
- **Aids in reducing uncertainty of water balance equations.**
- **Helps define lateral hydrogeologic properties of both aquifers.**

PREVIOUS ESTIMATES OF FLOW FROM THE TRINITY INTO THE EDWARDS

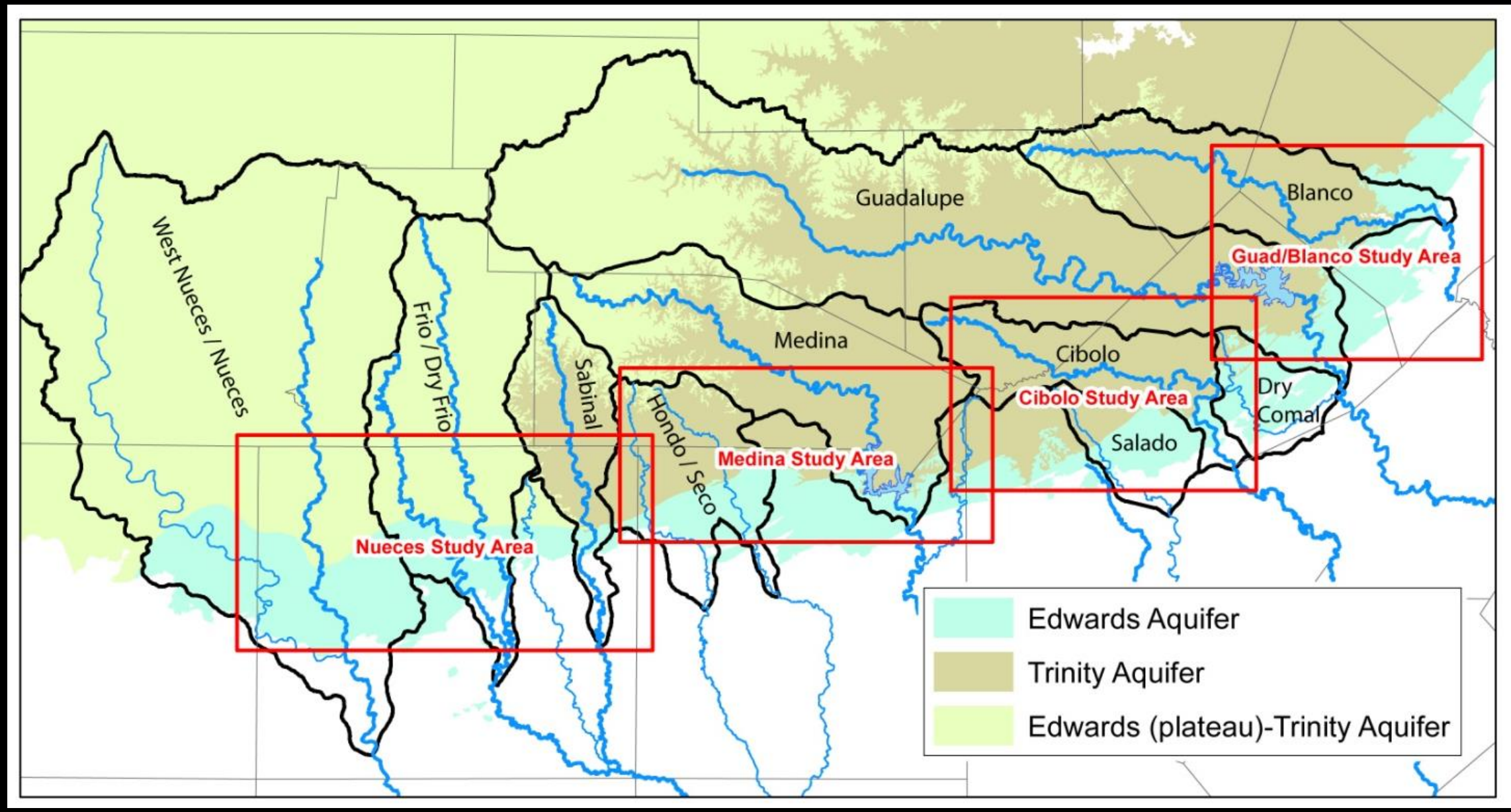
- **Lowry, 1955 – 53,800 ac-ft/yr**
  (Cibolo Creek Basin only)
- **Bader, 1993 – 107,000 ac-ft/yr**
  (Cibolo Creek Basin only)
- **Kuniansky and Holligan, 1994 – 360,000 ac-ft/yr**
- **LBG-Guyton and Associates, 1995 – 5,000 ac-ft/yr**
  (Did not include Cibolo Creek)
- **Lindgren et al., 2005 (USGS MODFLOW) – 40,298 ac-ft/yr**
- **Jones et al., 2011 (TWDB GAM) – 110,600 ac-ft/yr**

Acre-feet/year per linear mile of contact between the Trinity-Edwards = **110,000 ac.ft./year from Trinity**



Slide courtesy of Ian Jones, TWDB

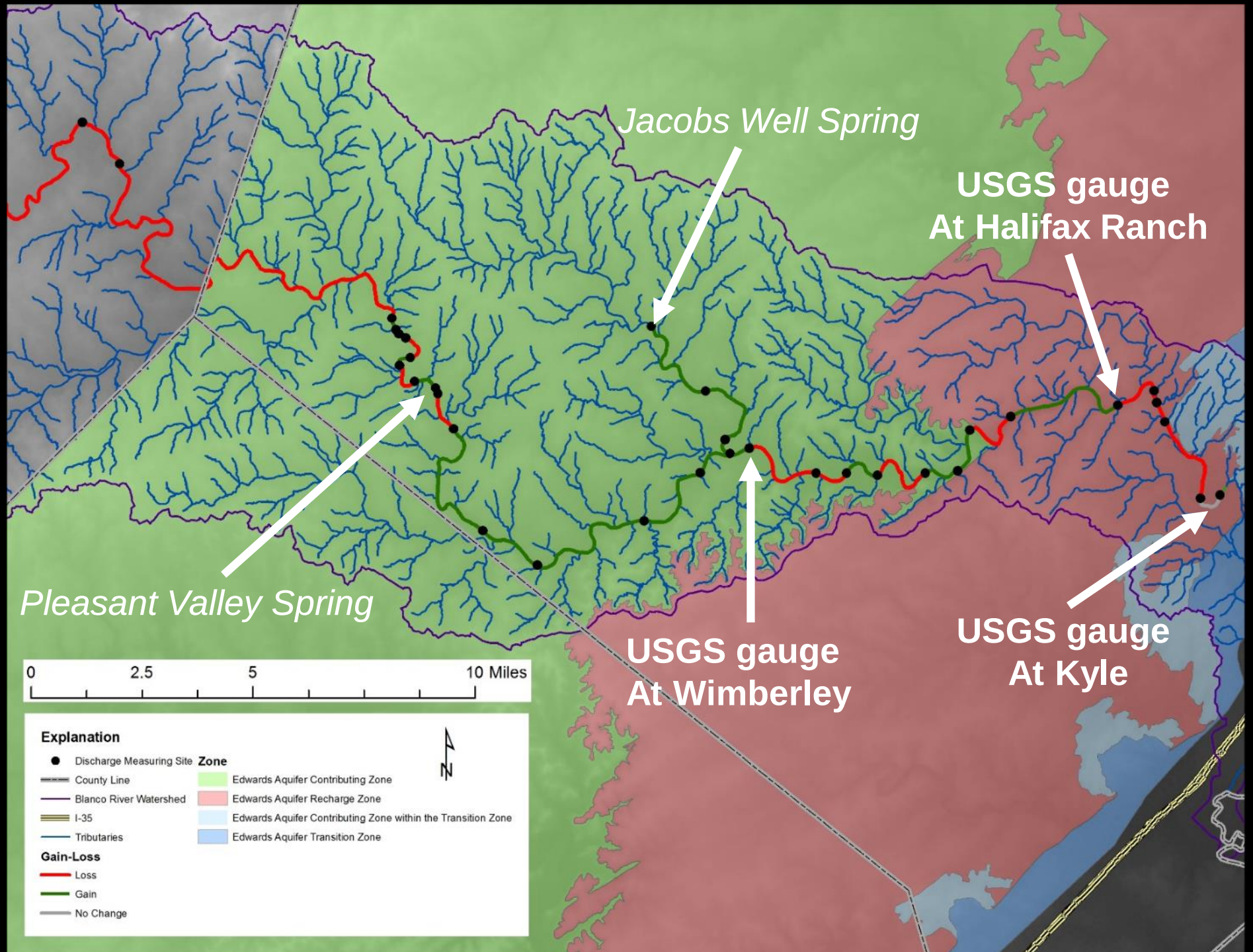
Interformational Flow Study Areas



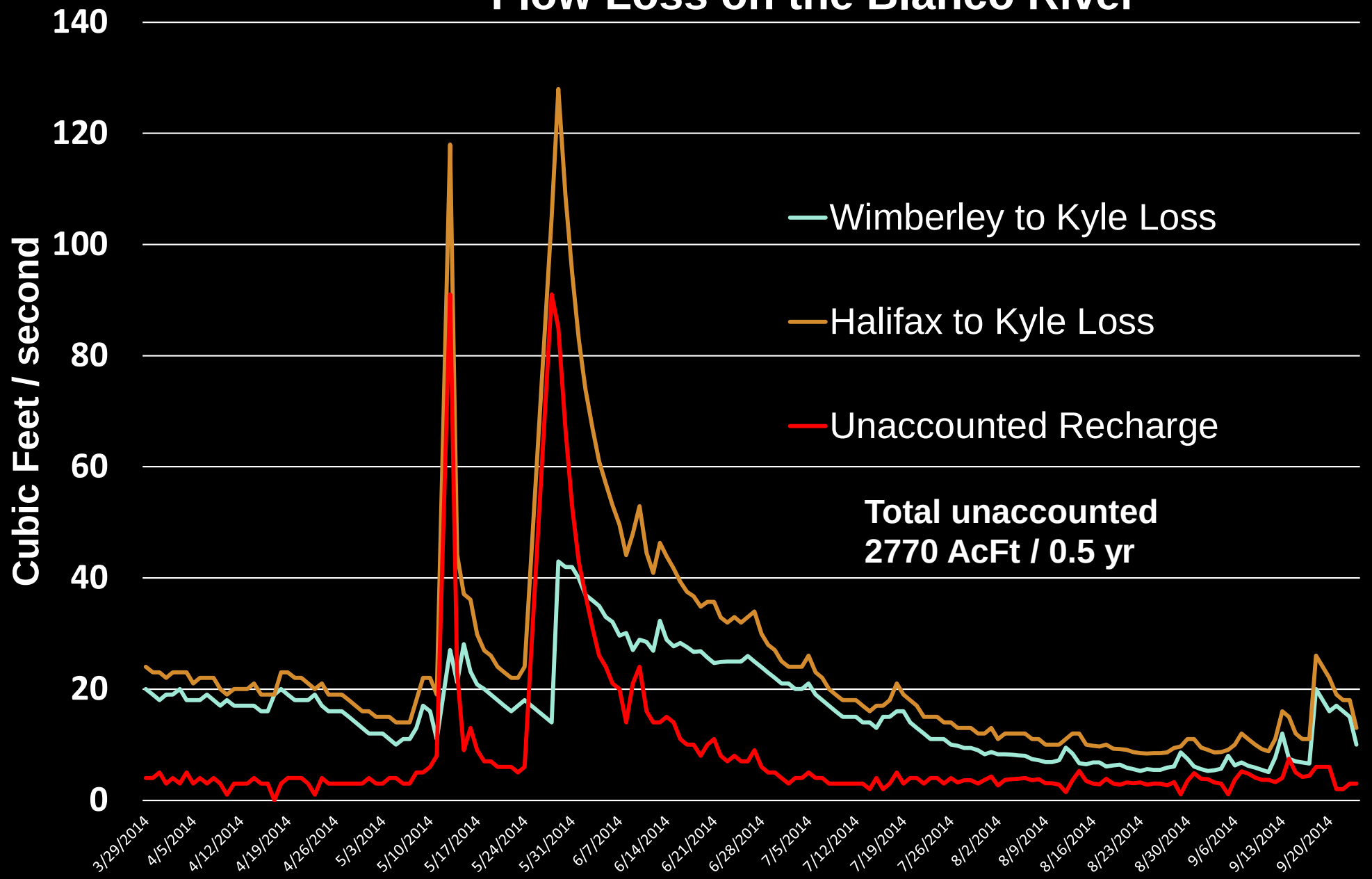
Blanco/Guadalupe Study Area Progress

(working collaboratively with BSEACD)

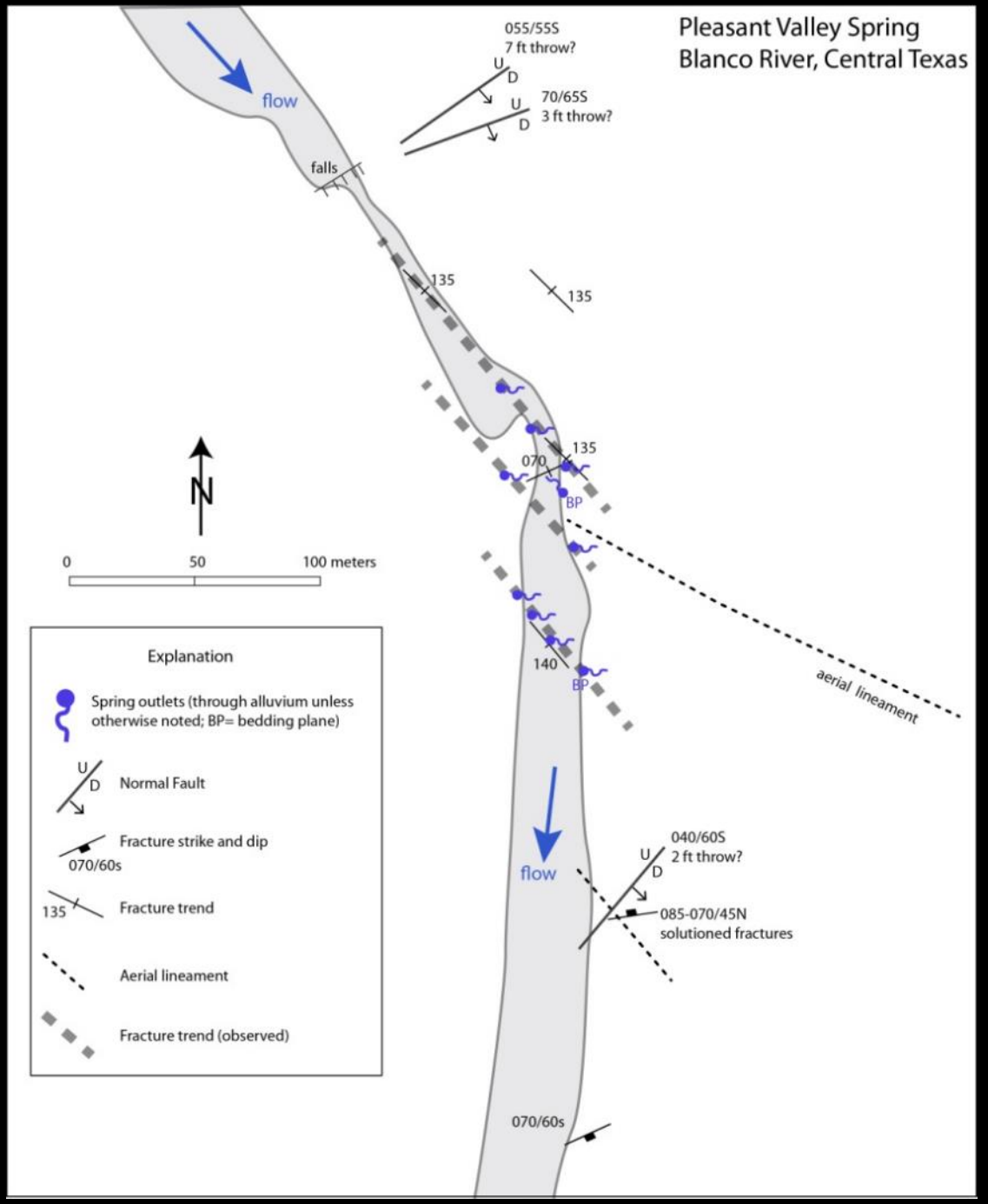
- Synoptic gain/loss study of the Blanco River.
- Characterization of Major Trinity springs.
- Localized potentiometric surface mapping.


Jacobs Well Spring
USGS gauge
At Halifax Ranch
Pleasant Valley Spring
USGS gauge
At Wimberley
USGS gauge
At Kyle
0
2.5
5
10 Miles
Explanation
Discharge Measuring Site
County Line
Blanco River Watershed
I-35
Tributaries
Gain-Loss
Loss
Gain
No Change
Zone
Edwards Aquifer Contributing Zone
Edwards Aquifer Recharge Zone
Edwards Aquifer Contributing Zone within the Transition Zone
Edwards Aquifer Transition Zone
N

Flow Loss on the Blanco River



Pleasant Valley Spring



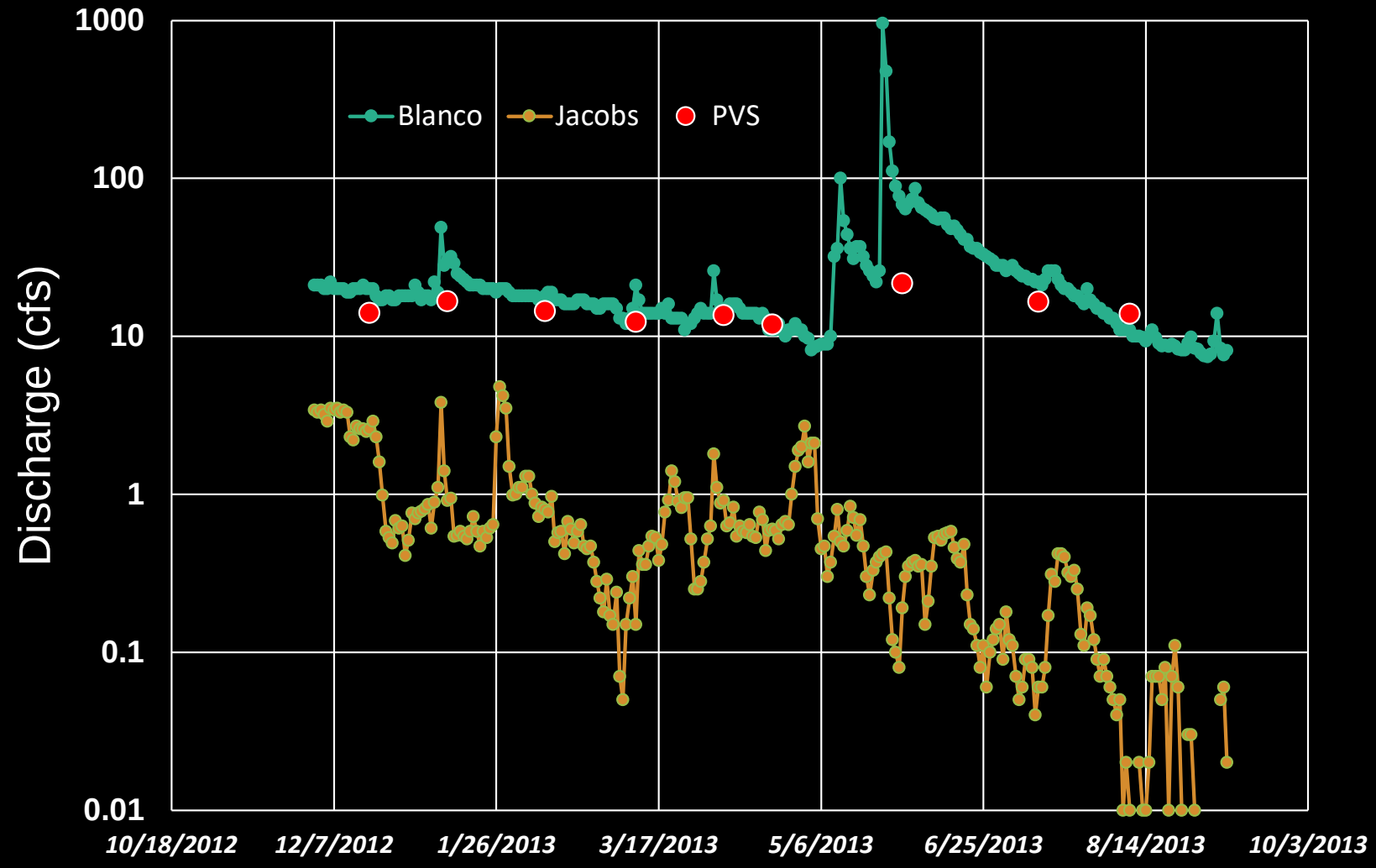
Comparison of Flow:

Blanco River at Wimberley

Jacobs Well Spring

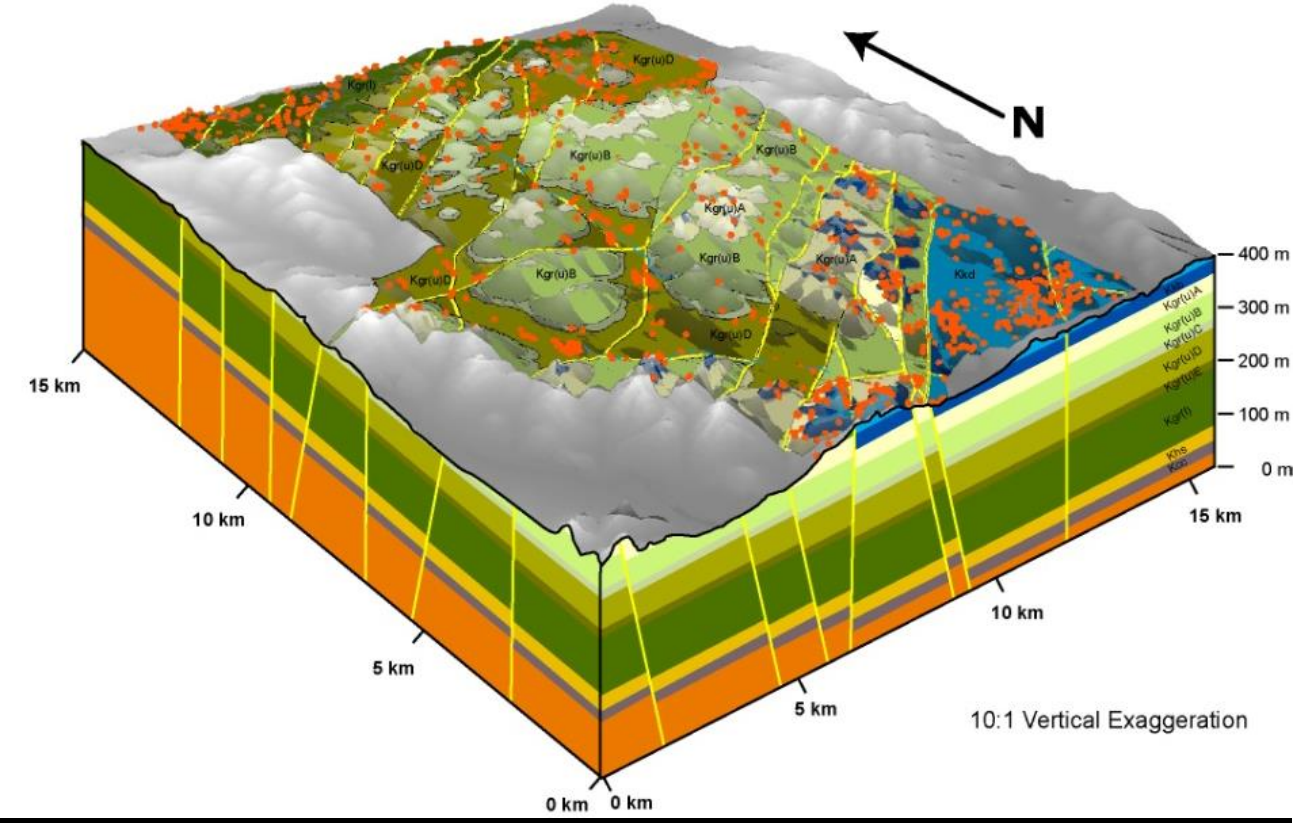
Pleasant Valley Spring

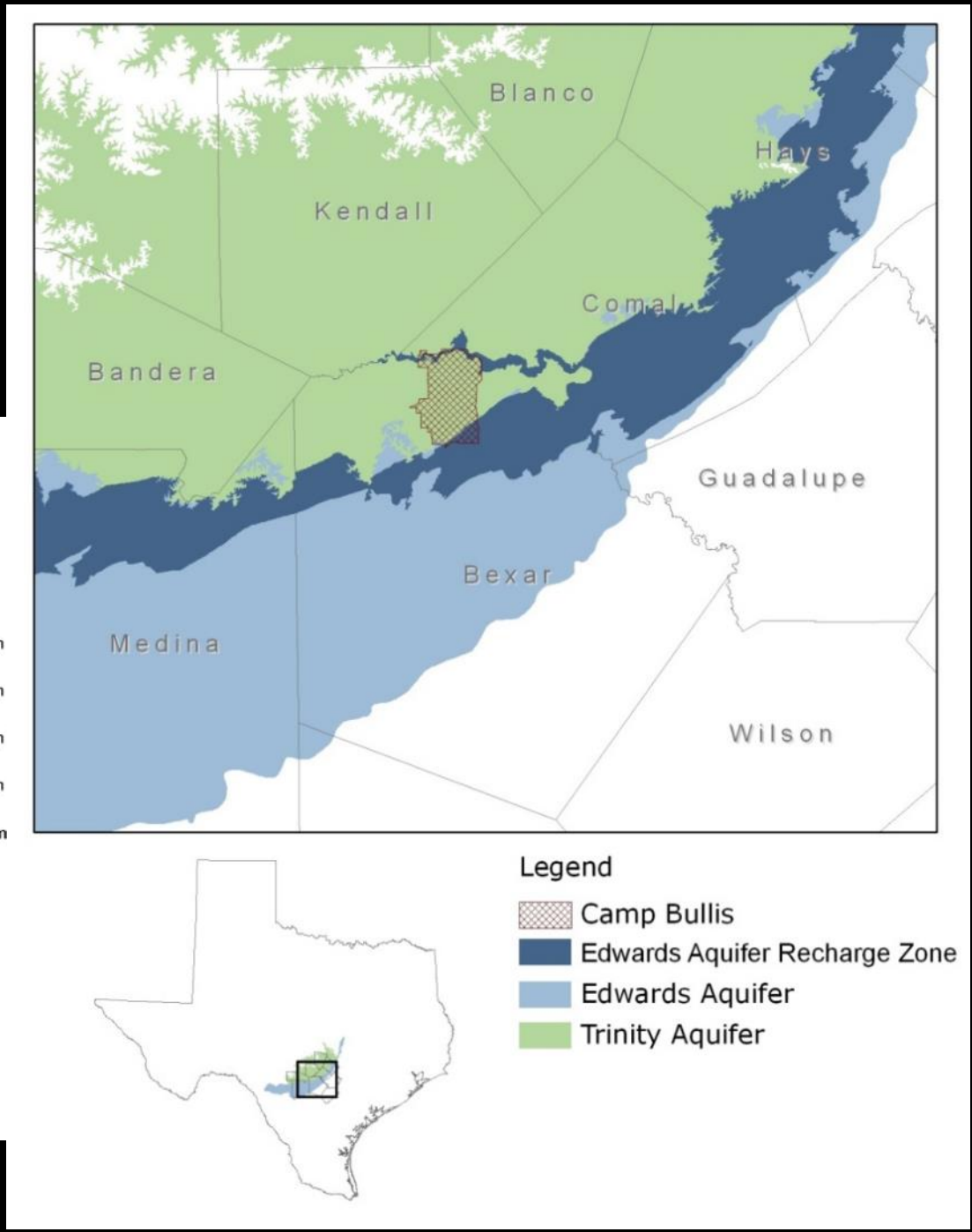
Pleasant Valley Spring was completely undocumented one year ago.



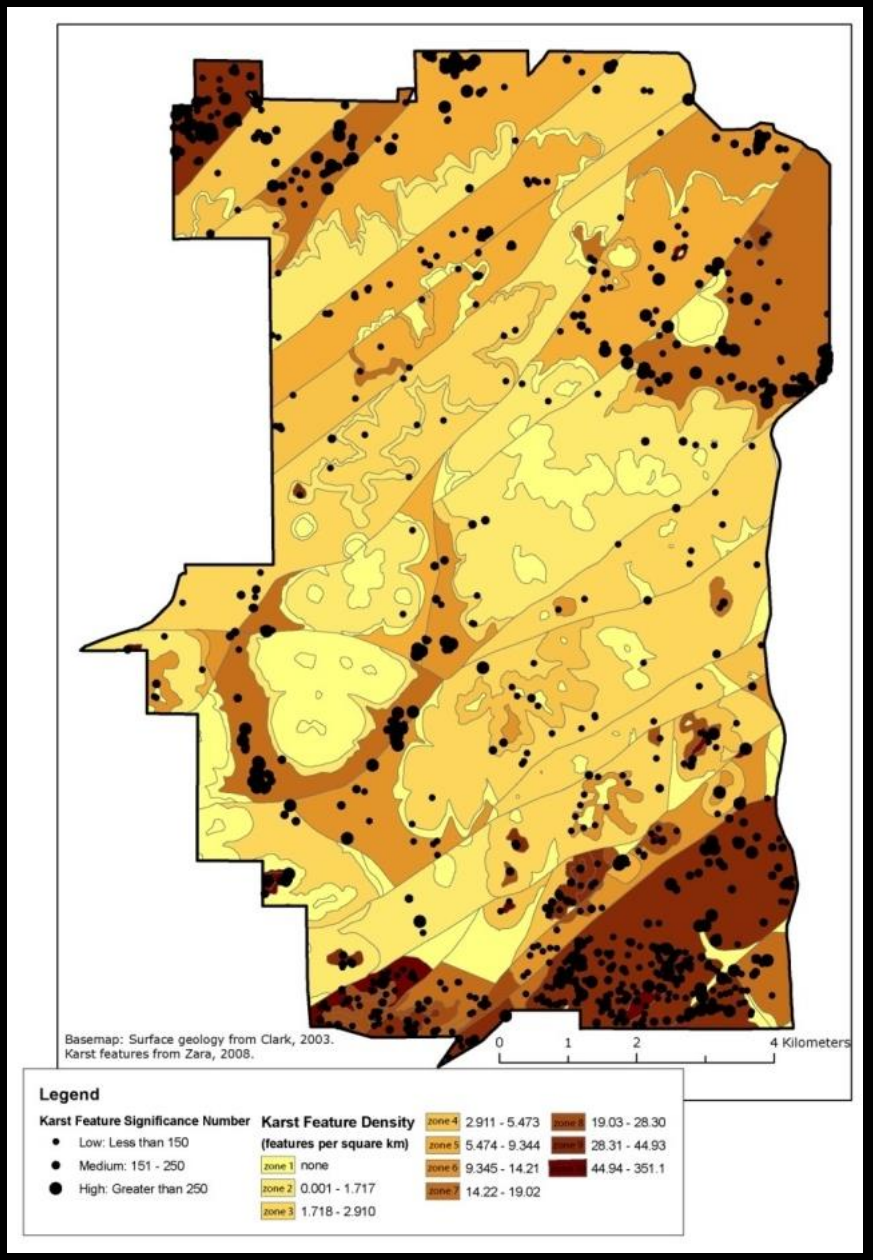
Cibolo Study Area Progress

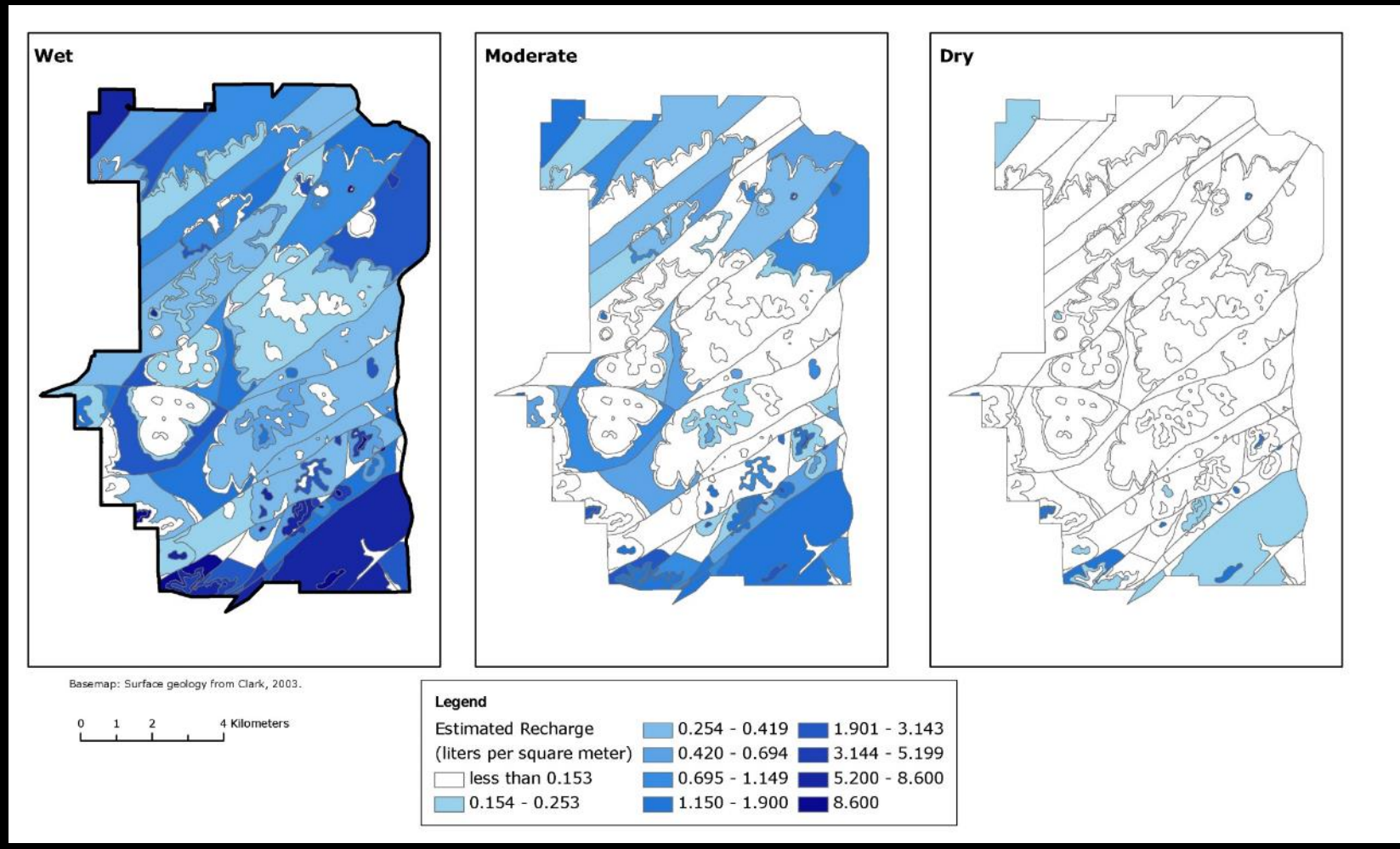
- Camp Bullis Integrated Recharge Study
- Natural Bridge Caverns Area Research





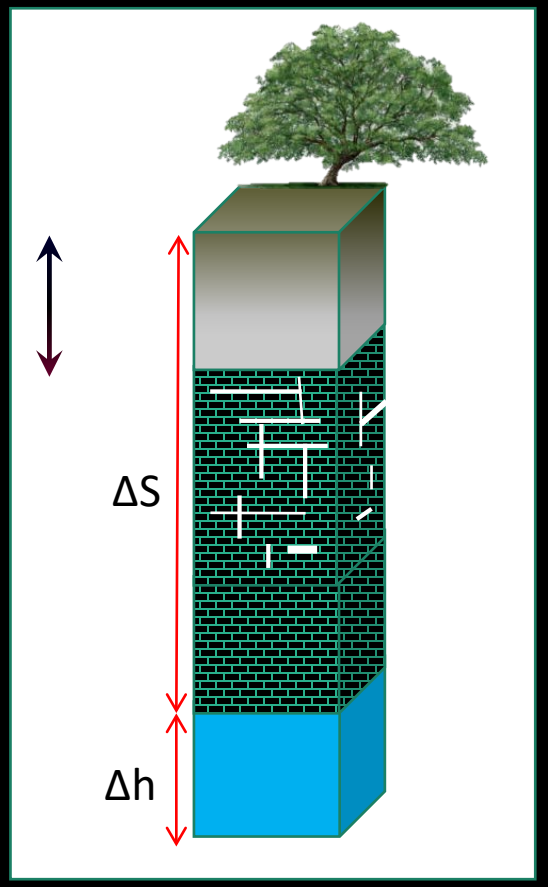
Spatial and Temporal Recharge Variability Related to Groundwater Interconnection of the Edwards and Trinity Aquifers: Camp Bullis, Bexar and Comal Counties, Texas



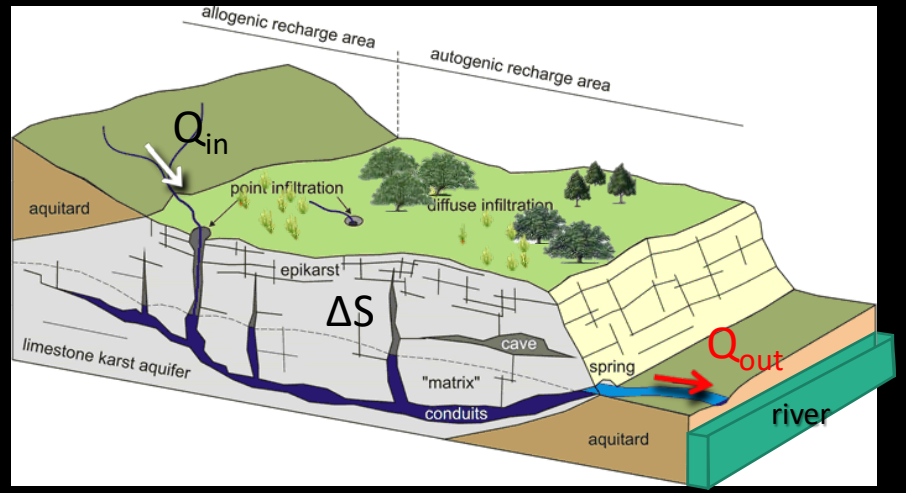


Integrate Processes from Local to Regional Scale

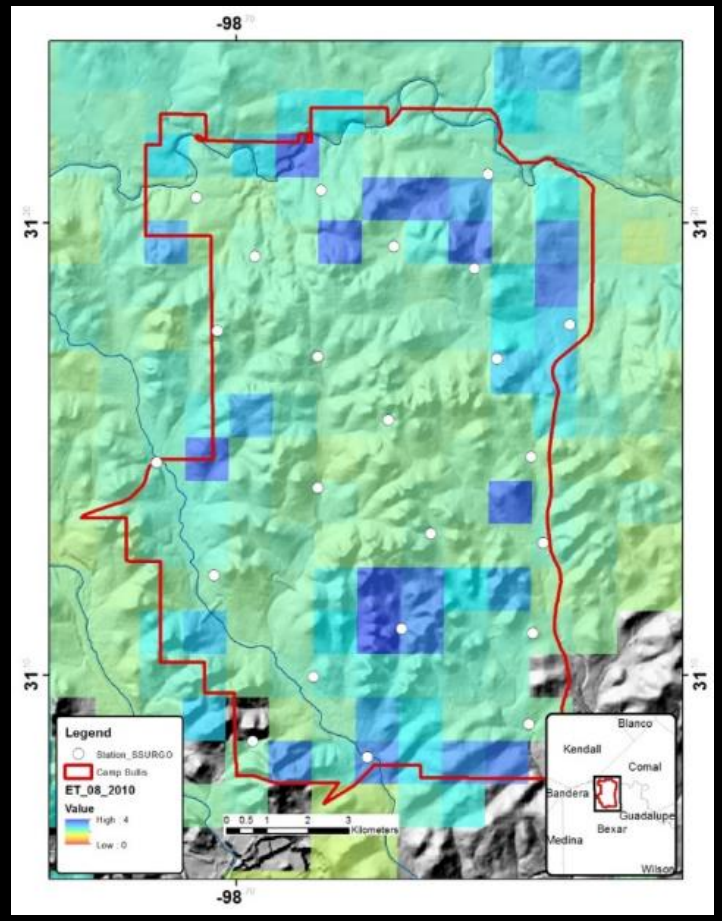
POINT:
Met data
1D Model
In situ data



FIELD/PLOT:
Eddy Covariance
Shallow Geophysics
Drip rates
Stream/GW



CAMP BULLIS:
ET MODIS (1km)
ET Landsat (30m



Aquifer Data & Maps

MAPS

J-17 DATA

J-27 DATA

HISTORICAL DATA

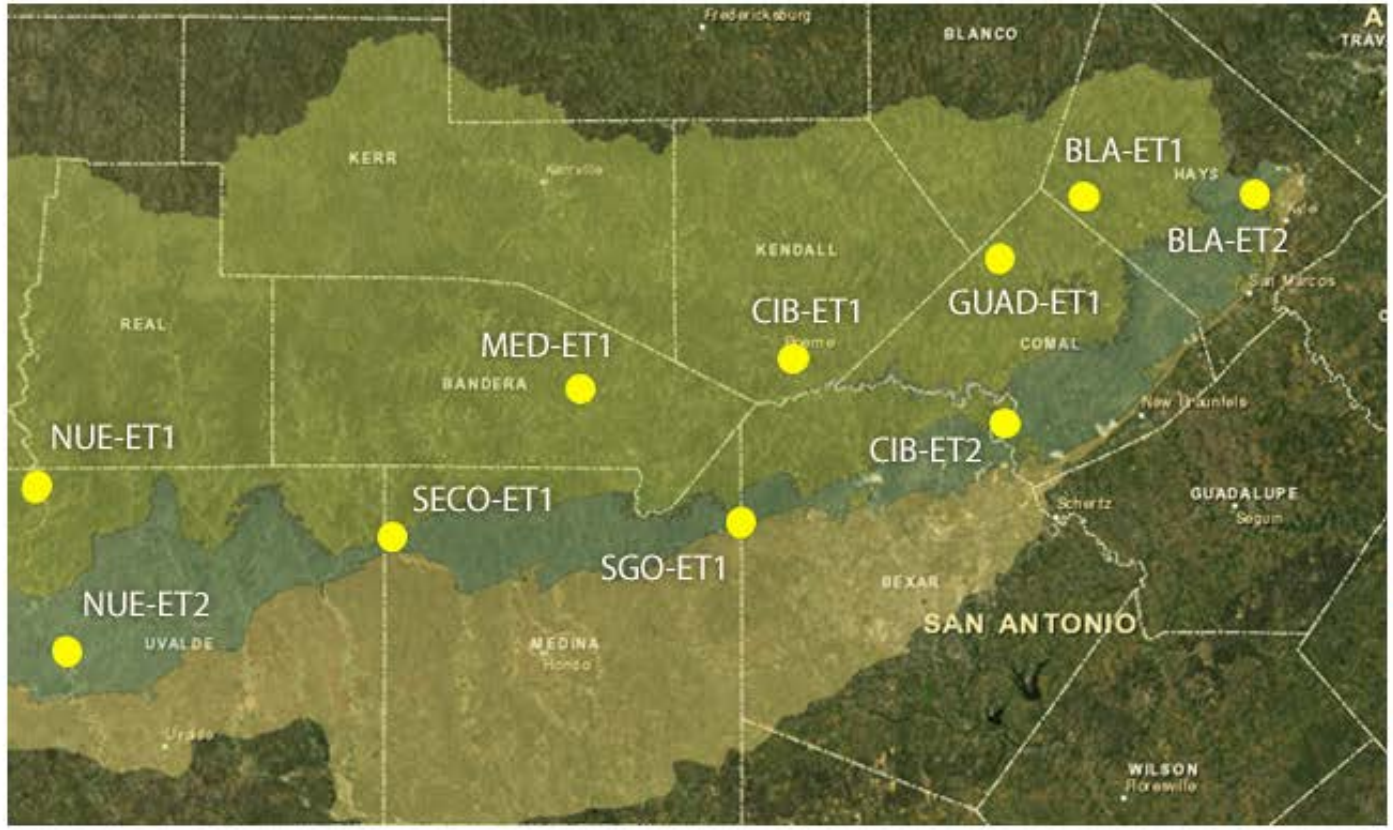
Historic Data Downloads

WEATHER STATIONS

WATER QUALITY MONITORS

DOWNLOAD WIDGET

Weather Stations



GROUNDWATER PERMIT HOLDERS

WELL OWNERS

EDUCATORS

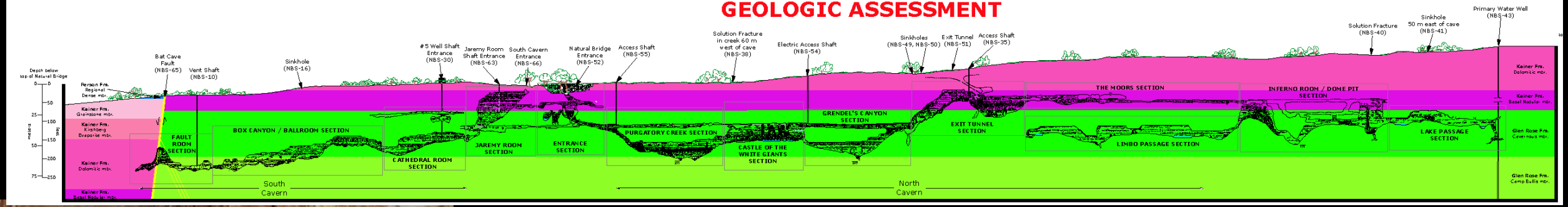
COMMUNITY

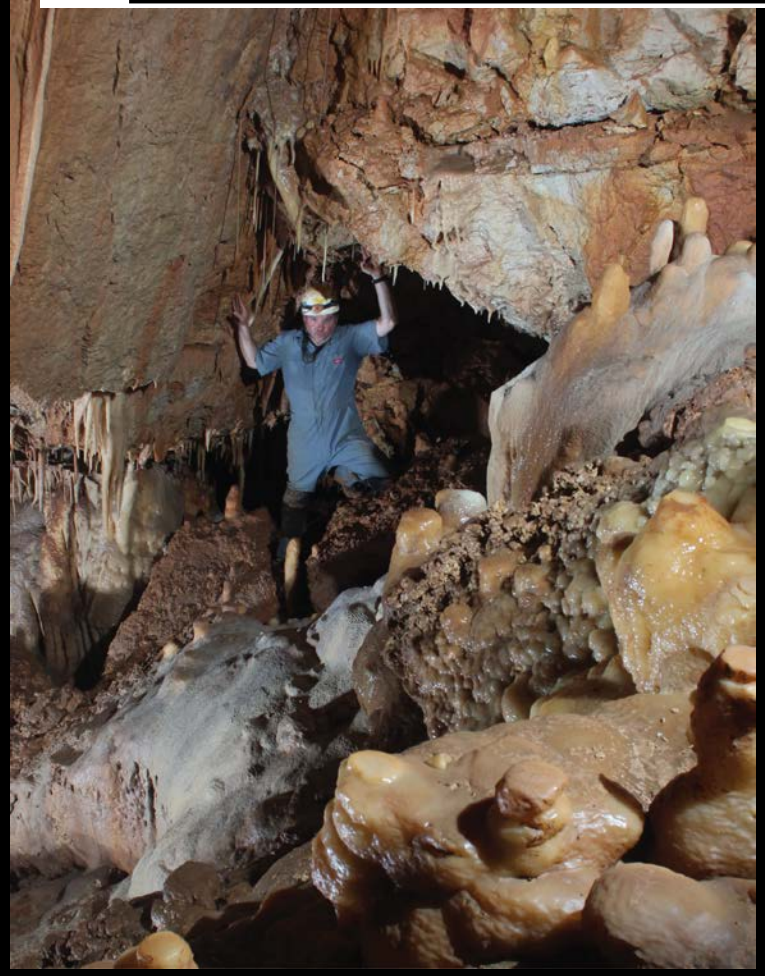
CRITICAL PERIOD TOOLS

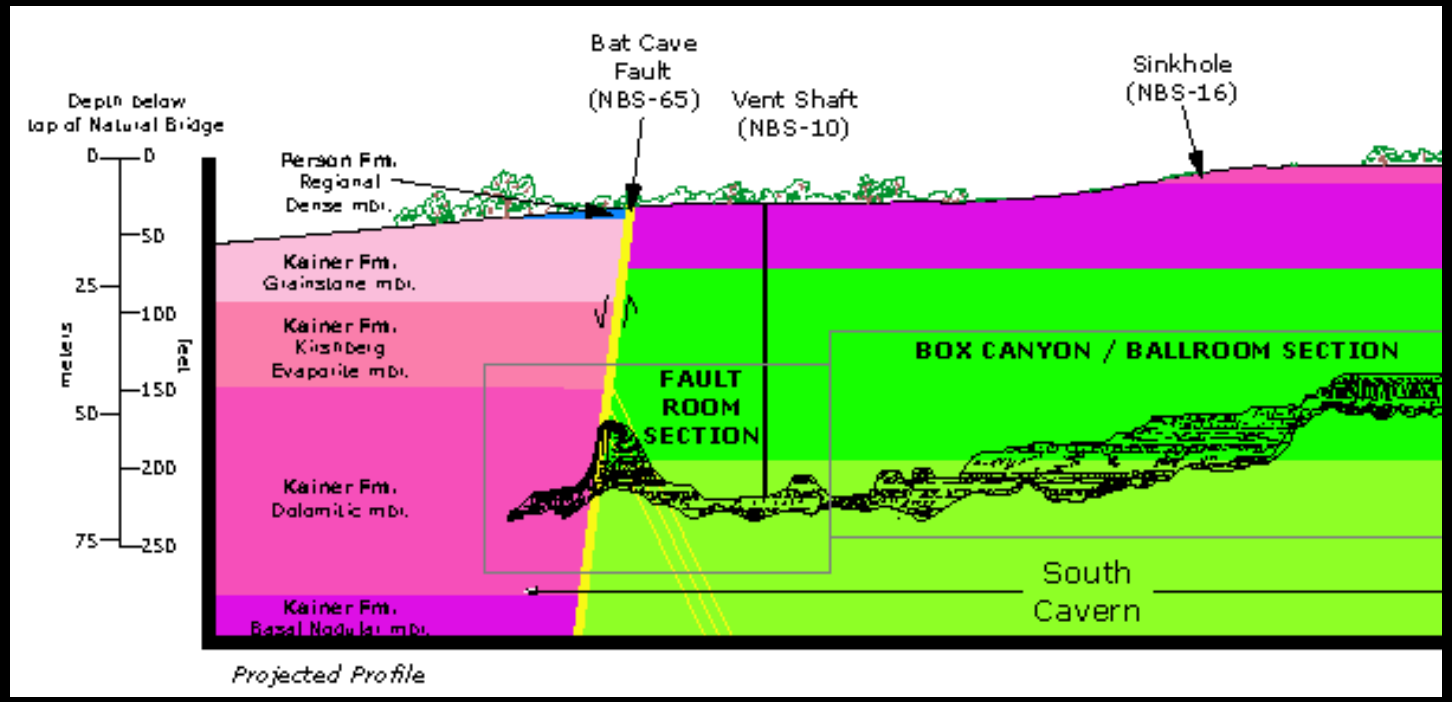
AQUIFER CONDITIONS

NATURAL BRIDGE CAVERNS

GEOLOGIC ASSESSMENT

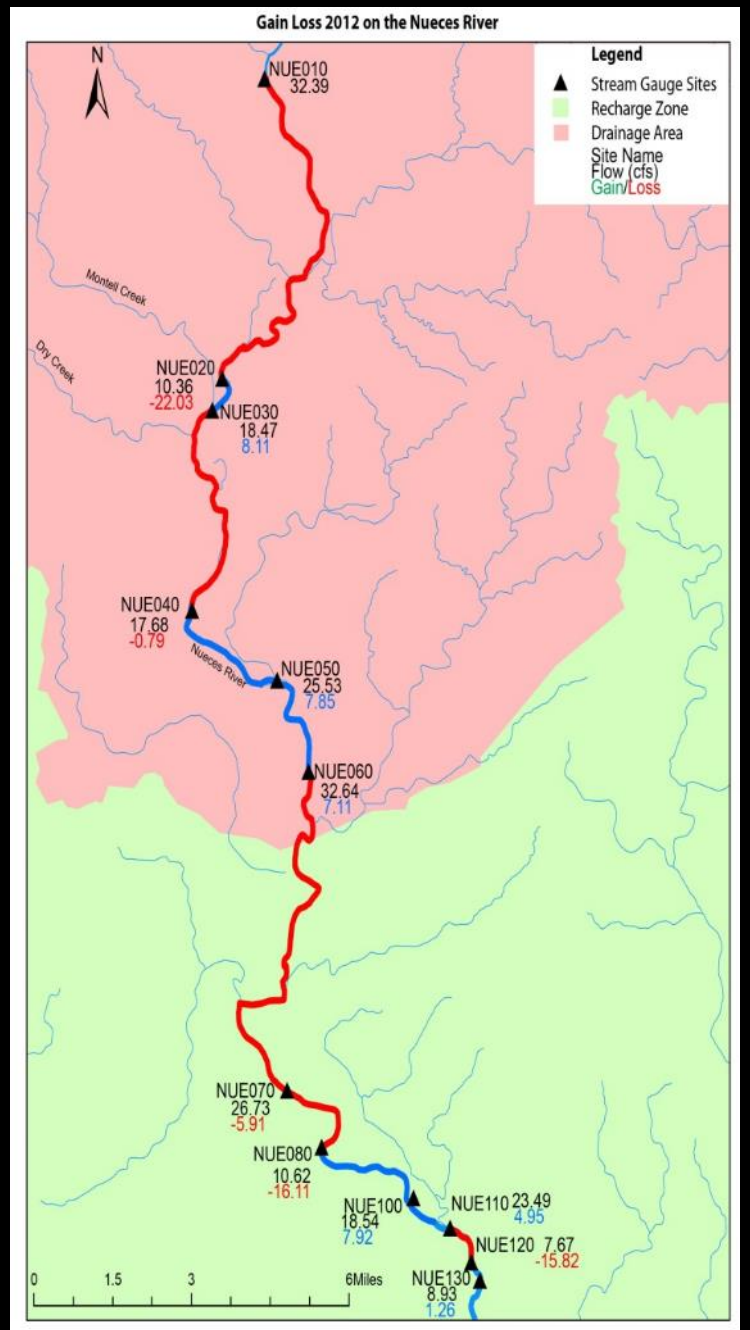


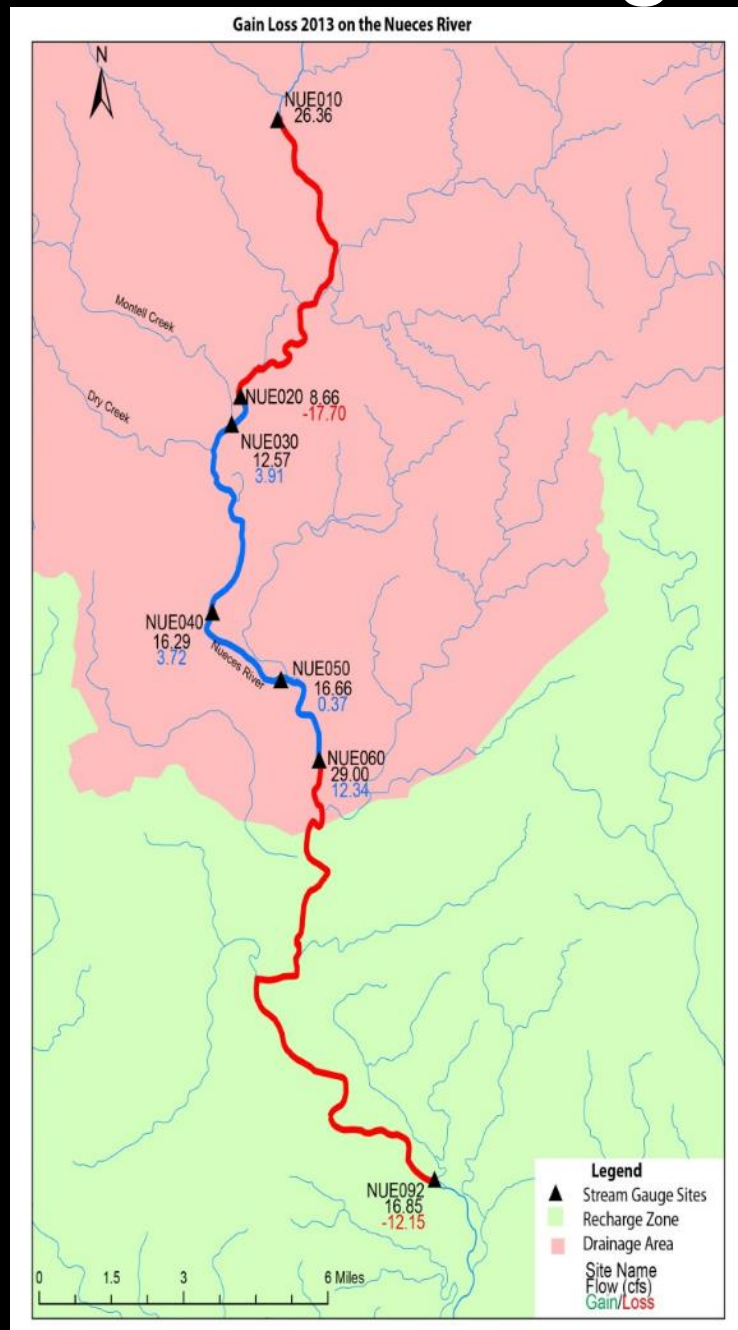


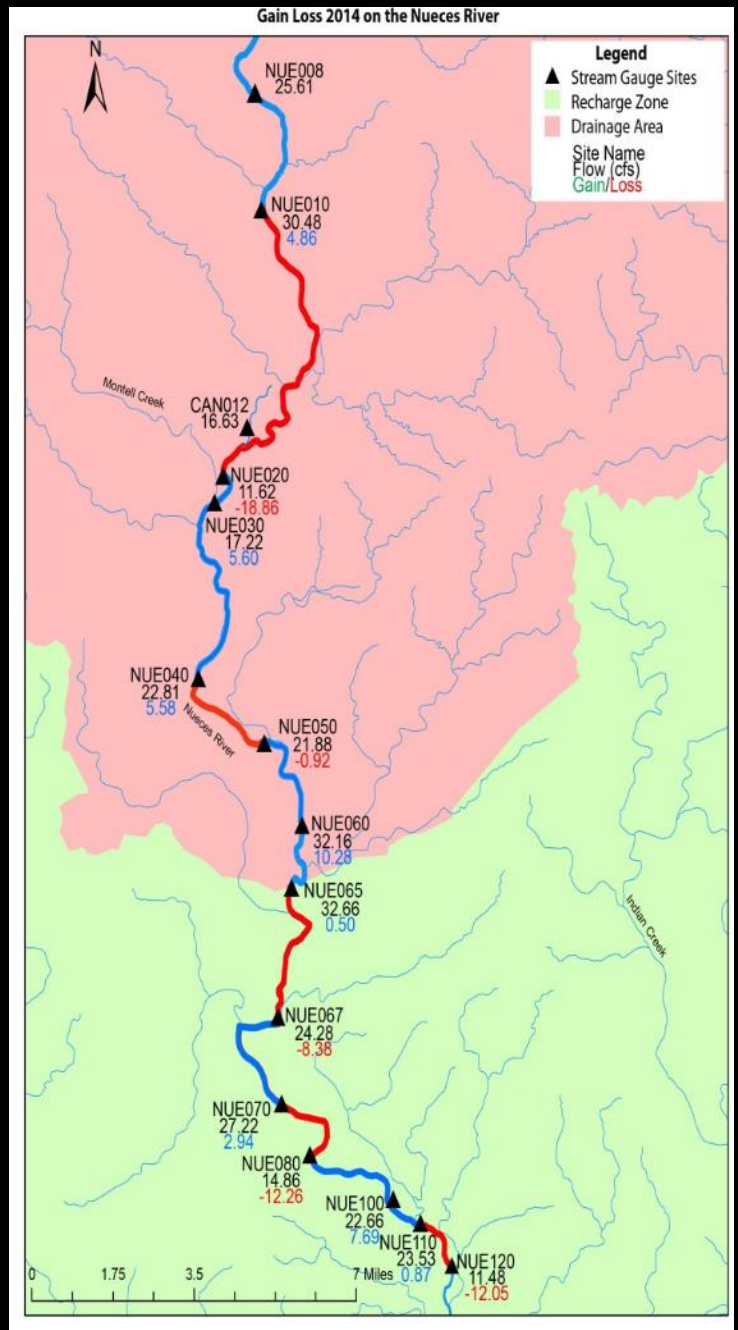


Projected Profile

Gain/Loss Studies along Nueces River







COLLABORATIVE EFFORT

working with neighboring agencies and entities

- Trinity Glen Rose Groundwater Conservation District
- Barton Springs Edwards Aquifer Conservation District
- Nueces River Authority
- The University of Texas at Austin
- Hays Trinity Groundwater District
- U.S. Geological Survey
- Camp Bullis – Joint Base San Antonio
- Texas Parks and Wildlife
- Natural Bridge Caverns
- Cibolo Nature Center
- Bandera County River Authority and Groundwater District
- Southwest Research Institute

COLLABORATIVE EFFORT

Formation of Edwards/Trinity Water Research Interest Group

- Organizations from previous slide; and,
- Medina County Groundwater Conservation District
- Uvalde County Underground Water Conservations District
- Kinney County Groundwater Conservation District
- Cow Creek Groundwater Conservation District
- Hill Country Underground Water Conservation District
- GMA-10
- GMA-9
- Other stakeholder groups

2015 GOALS FOR INTERFORMATIONAL FLOW PROJECT

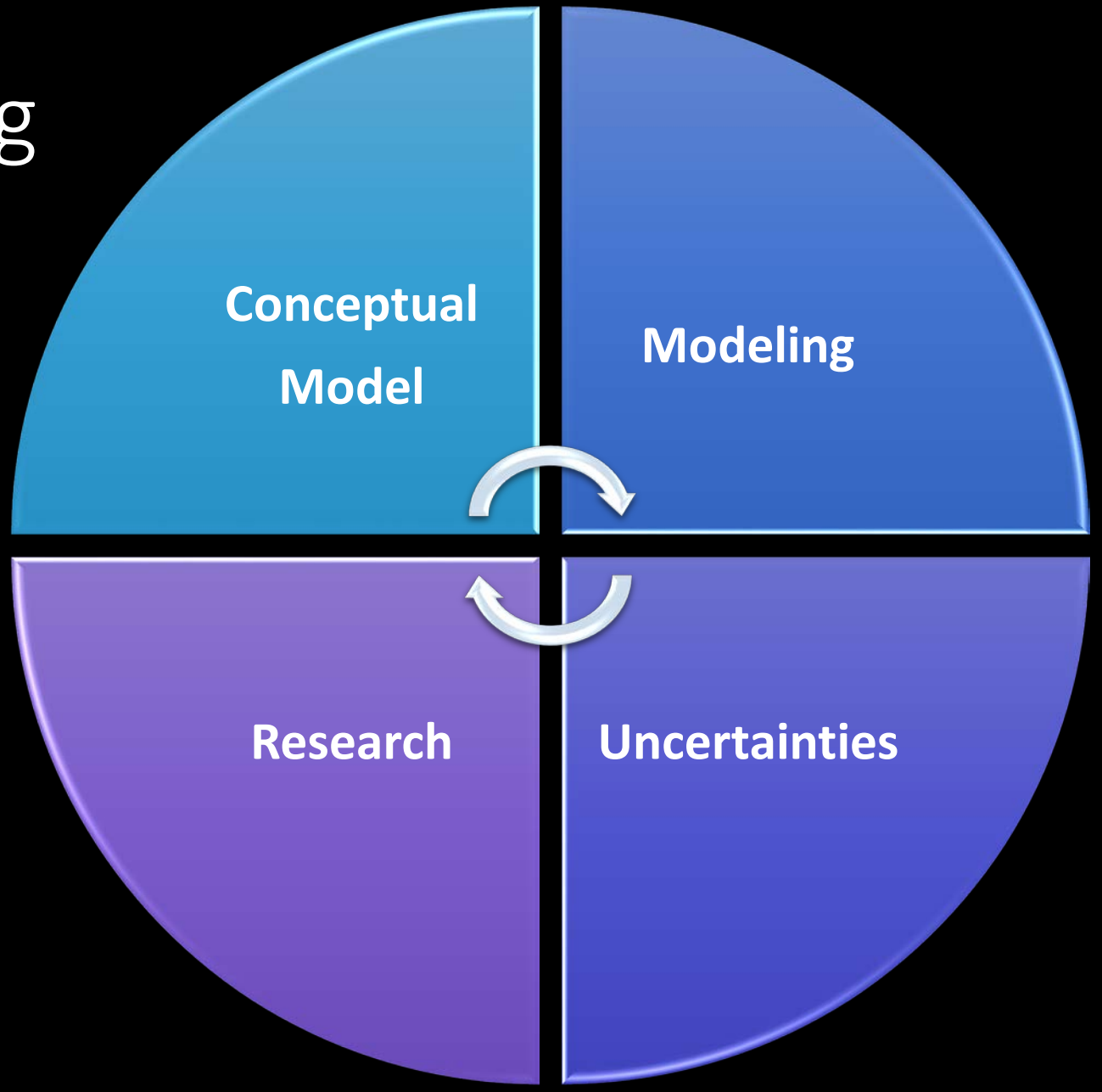
- Expand surface water flow monitoring network
- Conduct multiple region-wide gain/loss flow studies
- Compile groundwater level data in Trinity-Edwards transects
- Initiate geochemical analysis study
- Begin 3-year recharge study at Camp Bullis
- Evaluate possible locations for test wells to test vertical connection from Edwards to Trinity
- Publish topic-specific papers related to IFF

Modeling and the Iterative Process

James Winterle
Director of
Modeling and Data Management

Groundwater Modeling

- Modeling is an iterative process
- It makes use of the extensive data collection conceptual model development from Aquifer Science
- Represents a compilation of knowledge
- Can identify key uncertainties where more knowledge is needed
- Can also help identify what is not important
- Feedback to aquifer research programs

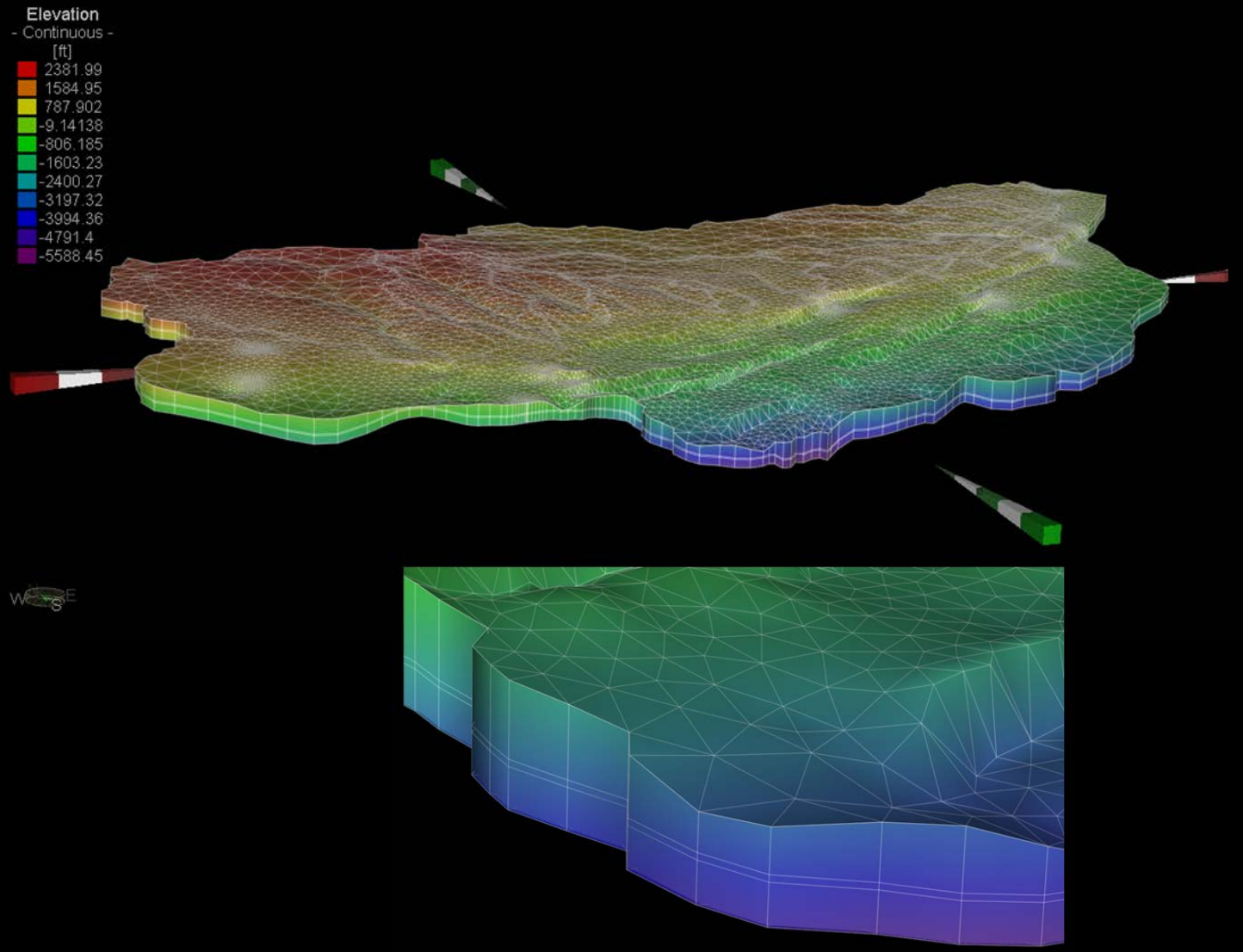


Current Modeling Activities

- New Finite Element Model
- MODFLOW Model Updates
- HSPF Watershed Models
- Other Models (e.g., statistical forecasting)

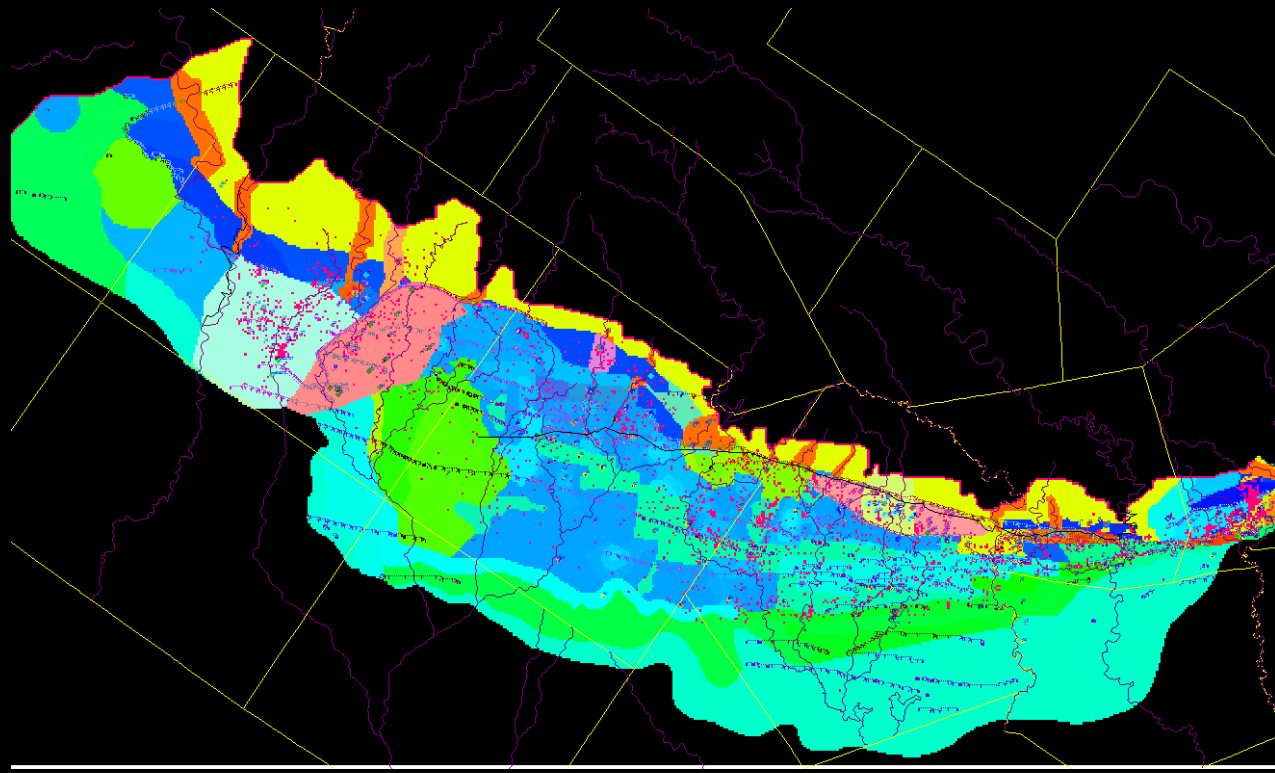
Finite-Element (FEFLOW) Model

- 3-layer finite-element grid
- Includes entire contributing zone
- Model calibration nearly complete
- Will present to Groundwater Model Review panel on Dec. 3
- Model and draft report due by Dec. 31



MODFLOW Model Updates

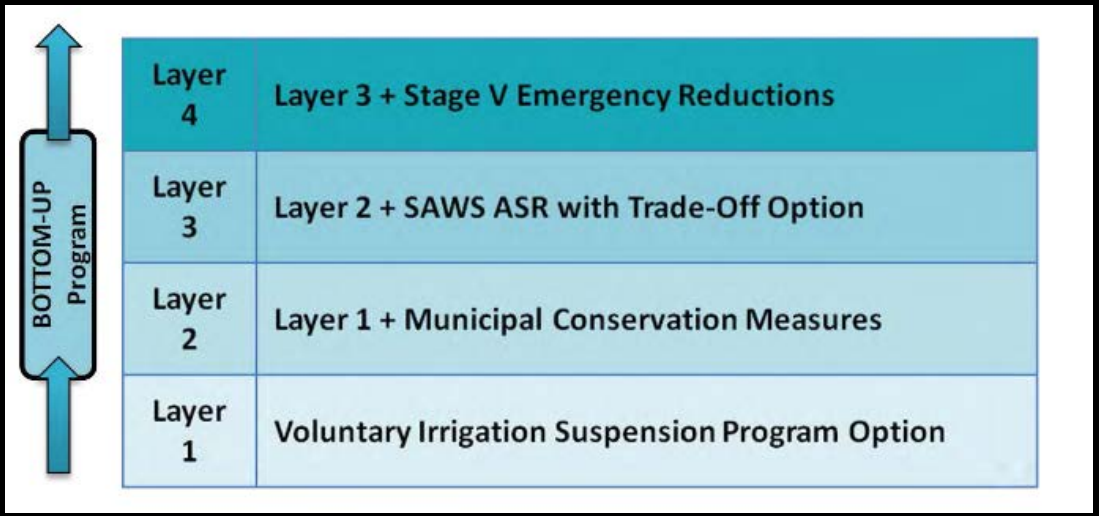
- Calibration nearly complete
- Better representation of pumping locations
- More observation targets for calibration
- Revised locations of conduits and barriers
- Revised representation of subsurface inflows and outflows



MODFLOW model hydraulic conductivity zones (preliminary)

Example of Model Use in Support of HCP

"Bottom-Up" Analysis (HDR, 2011)



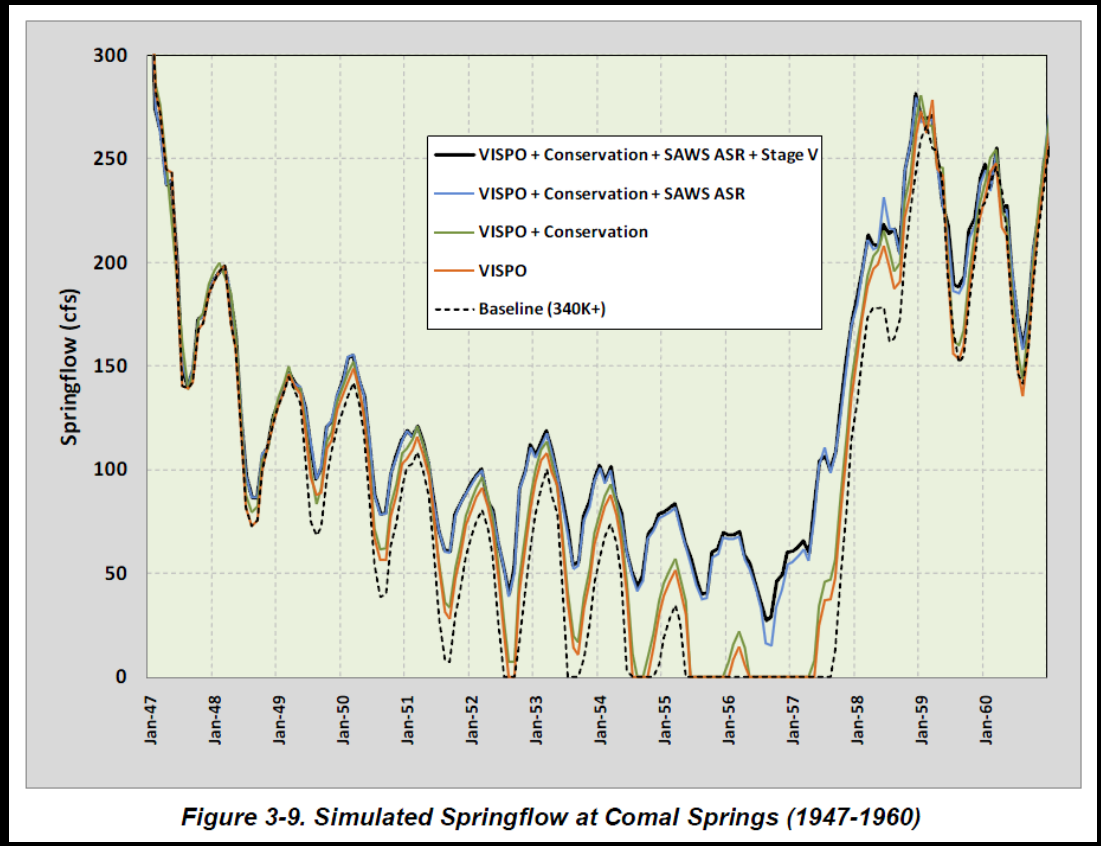
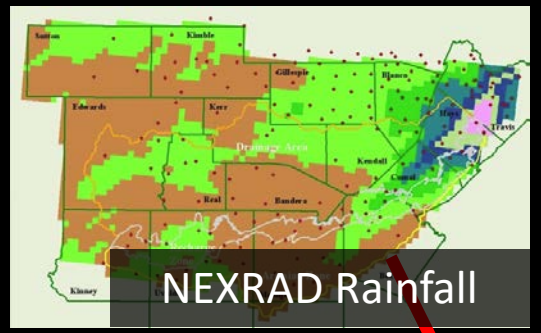


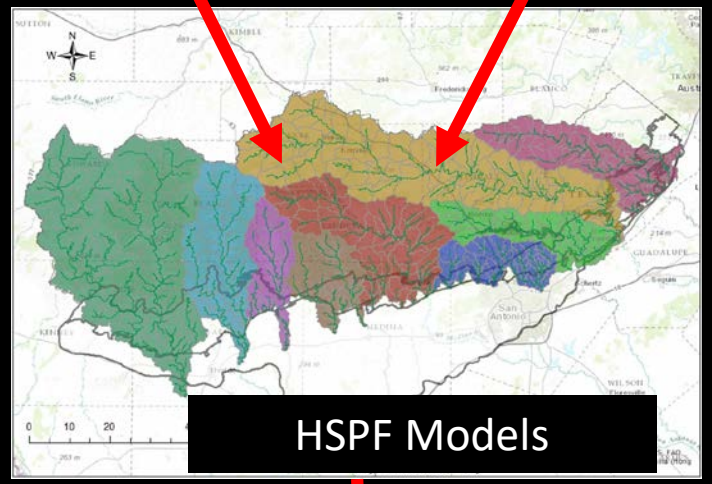
Figure 3-9. Simulated Springflow at Comal Springs (1947-1960)

HSPF Watershed Models

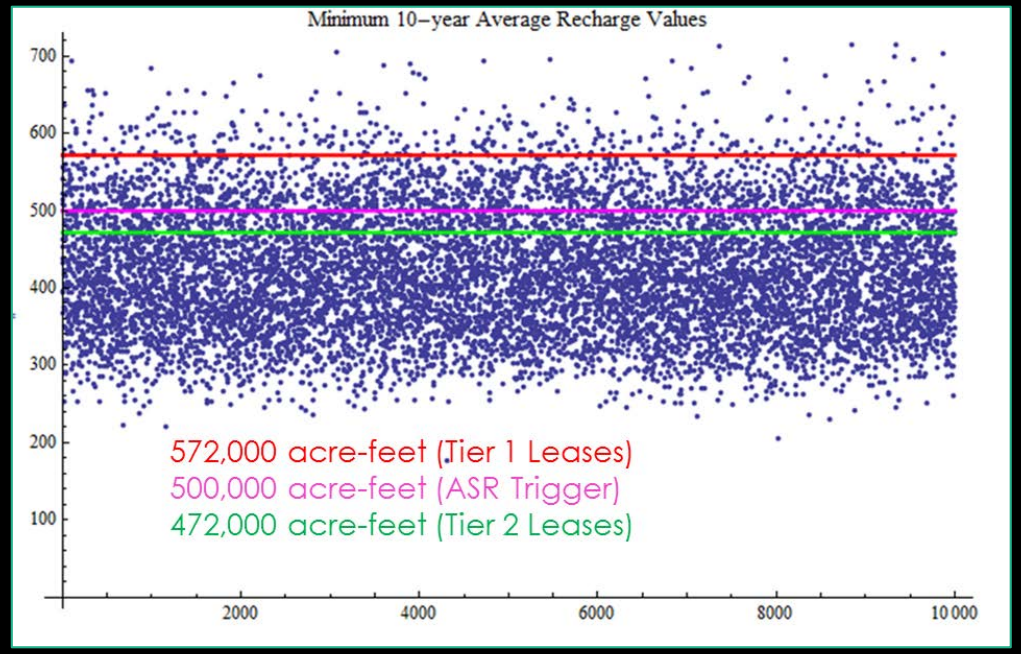
- Used as an alternative way to obtain recharge estimates
- Watershed Models are now integrated with NEXRAD rainfall data
- Can obtain recharge estimate within one month of actual rainfall
- Future work will evaluate ways to integrate data from the EAA evaporation station network

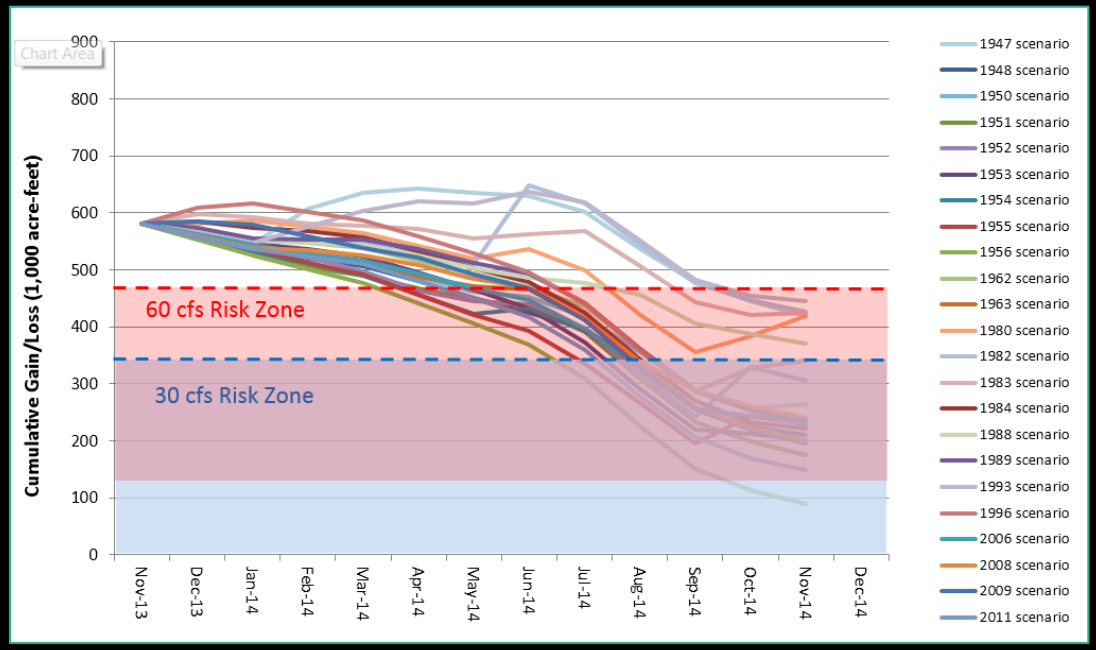


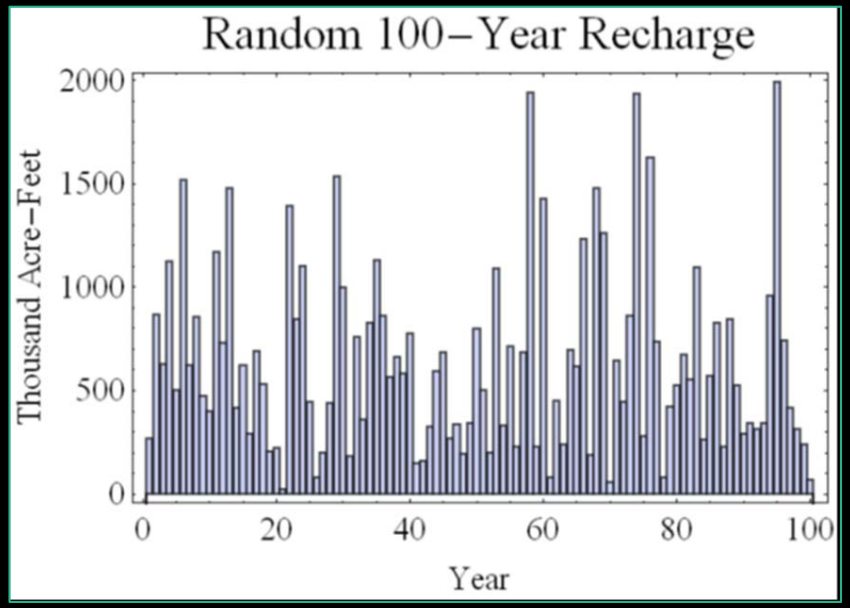
ET Network Data



Monthly Recharge Estimate

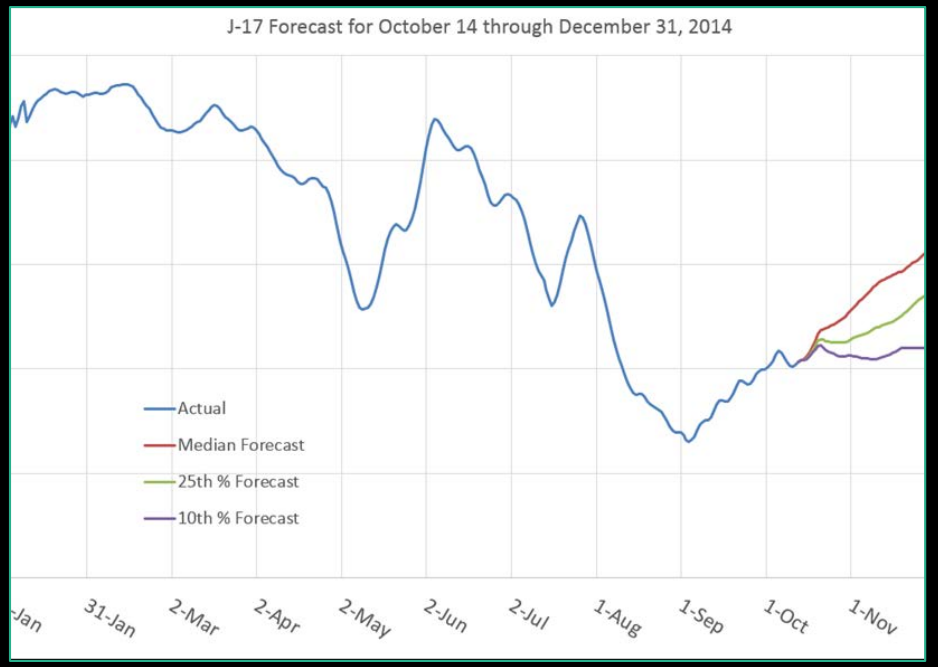






Other Models

Good data permits good statistical models for forecasting



2015 GOALS FOR
Modeling and Data Management

- Initiate the evaluation process for new model(s)
- Refine the data management process
- Refine the water level monitoring network to facilitate modeling needs

Science Teams

- **Aquifer Science**
  - Geary Schindel (Director/CTO)
  - Steve Johnson (Manager)
  - Marcus Geary PhD, (Supervisor)
  - Gizelle Luevano (Coordinator)
  - Matt Schwarz (EST)
  - Anastacio Moncada (EST)
  - Chanda Burgoon (EST)
  - **Vacant** (EST)

- **Data Management & Modeling**
  - Jim Winterle(Director)
  - Al Liu (Sr. Modeler)
  - Rob Esquilin (Sr. Hydrogeologist)
  - Ned Troshanov (Data Analyst)
  - **Vacant** (Data Mgmt. Supervisor)
  - Robin Tremallo (Coordinator)
  - David Gregory (Sr. EST)
  - Ron Gloyd (EST)