

Texas Water Development Board (TWDB) Groundwater Availability Modeling (GAM) Program

Jean Perez (Contract Manager)
Groundwater Availability Modeling Program
Texas Water Development Board



Disclaimer

Unless specifically noted, this presentation does not necessarily reflect official Board positions or decisions.

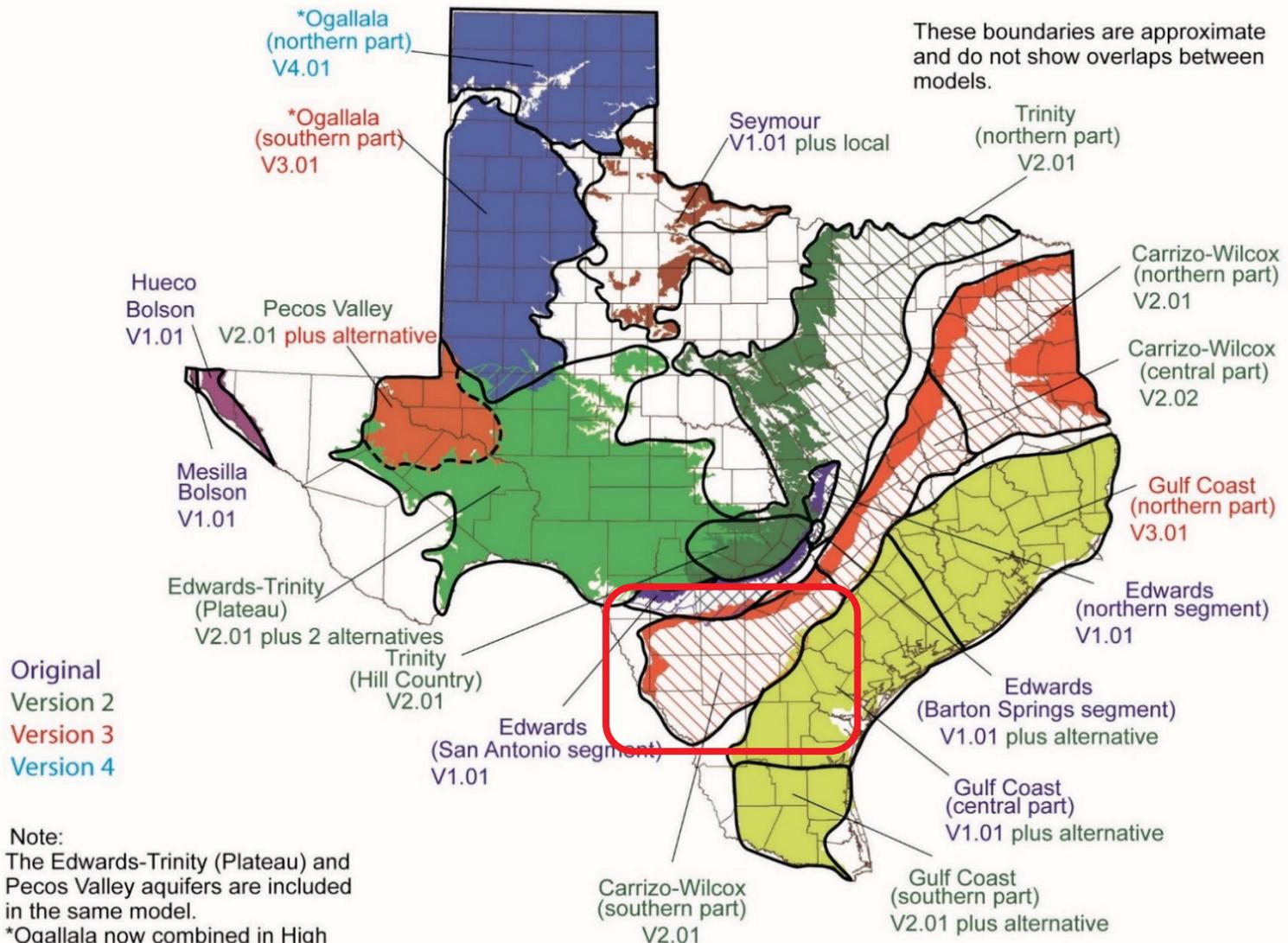
Agenda

- TWDB Staff Introduction
- GSI Presentation
 - Introduction of Project Team
 - Introduction of Project Objectives
 - Project Approach
 - Model Details
 - Schedules
 - Data Requests
 - Groundwater Well Locations and Construction Details
 - Historic Depth to Water Data
 - Geophysical Logs of Wells
 - Historic Groundwater Pumping Data
 - Deadline for submittal (negotiable)
 - Questions, Input, and Comments from Stakeholders

GAM Program

- **Aim:** Develop groundwater flow models for the major and minor aquifers of Texas.
- **Purpose:** Tools that can be used to aid in groundwater resources management by stakeholders.
- **Public process:** Stakeholder involvement during model development process.
- **Models:** Freely available, standardized, thoroughly documented. Reports available over the internet.
- **Living tools:** Periodically updated.

Major Aquifers



Why Stakeholder Advisory Forums?

- Keep stakeholders updated about progress of the model
- Inform how the groundwater model can, should, and should not be used
- Provide stakeholders with the opportunity to provide input and data to assist with model development

Contact Information

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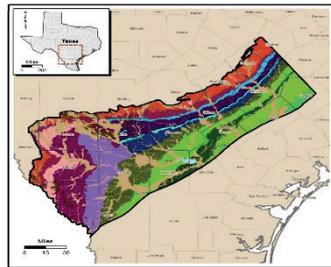
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www.twdb.texas.gov/groundwater/models/gam/czwx_s/czwx_s

UPDATE OF THE EXISTING GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF QUEEN CITY, SPARTA, AND CARRIZO-WILCOX AQUIFERS

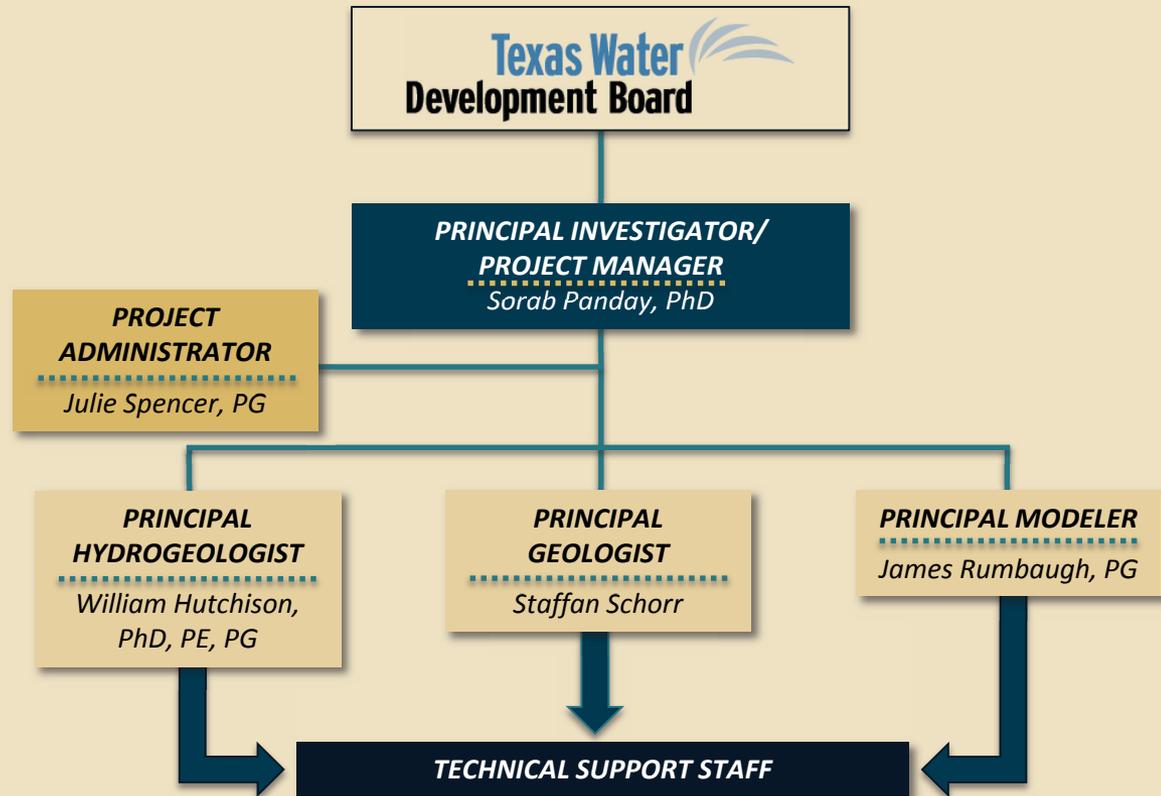


Stakeholder Advisory Forum

- **Opening by TWBD Contract Manager**
- **Introduction to Project Team**
- **Introduction to Project Objectives**
- **Project Approach**
 - **Model Details**
 - **Schedules**
- **Request for Data**
 - **Groundwater well locations and construction details**
 - **Historic depth to water data**
 - **Geophysical logs of wells**
 - **Historic groundwater pumping data**
 - **Submittal deadline**
- **Questions, Input, Comments from Stakeholders**

GSI ENVIRONMENTAL TEAM

- Julie Spencer
- Sorab Panday
- Jim Rumbaugh
- Bill Hutchison
- Staffan Schorr



TEAM BACKGROUND

- **Sorab Panday**
 - Primary author of MODFLOW-USG
 - Second Author on MODFLOW-NWT
- **Jim Rumbaugh**
 - Developer of Groundwater Vistas
 - Graphic User Interface to MODFLOW models
- **Bill Hutchison**
 - GMA 13 consultant
- **Staffan Schorr**
 - Expertise in developing regional conceptual models and 3-D geologic data for models
 - ArcGIS and Leapfrog Geo software

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- **November 5, 2018**
 - **TWDB Published Request for Statement of Qualifications**
- **December 20, 2018**
 - **Due date for Statement of Qualifications**
- **February 22, 2019**
 - **TWDB Awarded Project to GSI Environmental team**
- **May 17, 2019**
 - **Contract signed by TWDB**
- **June 13, 2019**
 - **Kick-off Meeting with TWDB and GSI Environmental Team**

- **Current GAM used in development of desired future conditions**
 - Proposed on April 27, 2016
 - Adopted as final on November 21, 2016
- **During DFC development**
 - Model calibration period was extended to 2011 to provide a new baseline for DFC drawdown calculations (Tech Memo 17-01)
- **Outcrop area DFCs were set independent of model**
 - Tech Memo 16-08 describes limitations of current GAM
 - Continued pumping of 2011 rates through 2070 (Scenario 15) results in depletion of outcrop area storage below 80 percent

POTENTIAL ISSUES

- **Model code**
 - **MODFLOW-96**
- **Steeply dipping aquifers**
 - **Transition from outcrop to subcrop areas**
- **Parameter assignment**
 - **Storativity/Specific Yield**
- **Calibration did not explicitly consider outcrop vs downdip matches**
 - **Because downdip wells outnumbered outcrop wells, a poor fit in the outcrop area would be numerically less significant**

TWDB REQUIREMENTS/OBJECTIVES

- Upgrade existing GAM to MODFLOW-USG or MODFLOW6 code
- Hydrostratigraphic framework must be evaluated and improved by analyzing well logs and/or geophysical logs
- Representation of groundwater-surface water interactions must be improved by using refined grid cells along rivers and major streams
- Groundwater data must be updated since the last update in 2005
- Calibration period (minimum) must be from 1980 to 2015
 - Could be past 2015, depending on data availability

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THREE ELEMENTS OF A GOOD MODEL

- **Good conceptual model**
 - Code selection based on elements of conceptual model
- **Good calibration statistics**
- **Can be used for intended purpose**

GOOD CONCEPTUAL MODEL

- **Hydrogeologic framework**
 - Well logs, geophysical logs
- **Aquifer parameters**
 - Outcrop area
 - Dwindip area
- **Recharge and evapotranspiration**
- **Groundwater pumping and surface water diversions**
- **Streams, springs, and reservoirs**

GEOLOGIC FRAMEWORK UPDATES

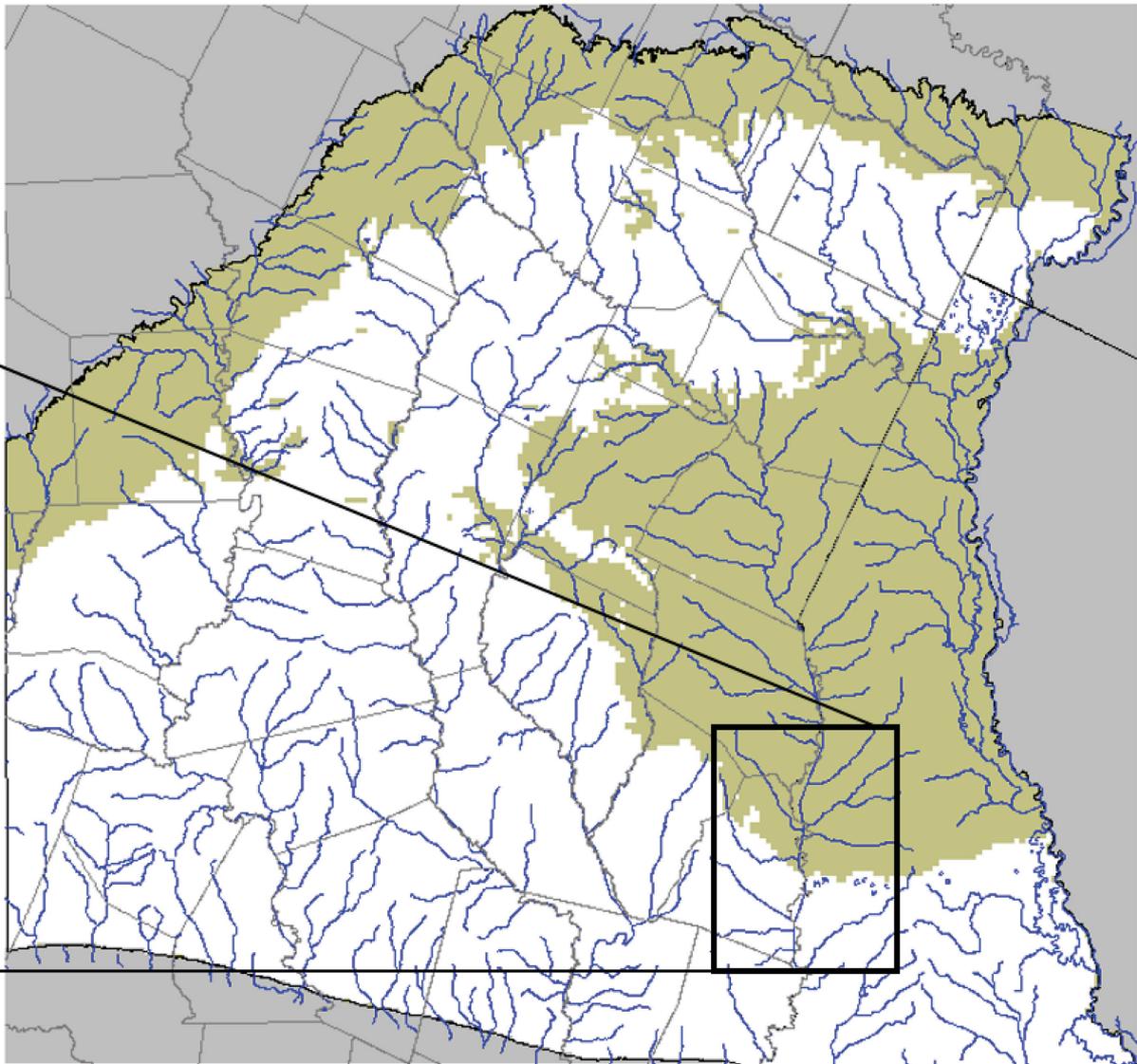
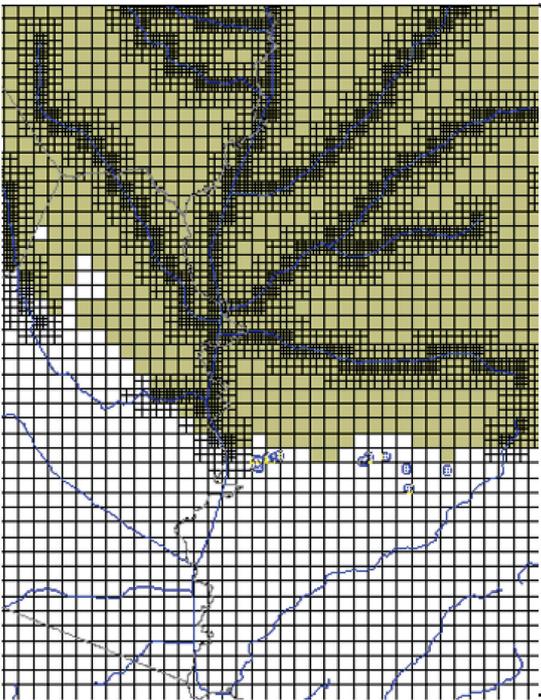
- **Aquifer framework will be:**
 - **Based on lithostratigraphic information**
 - **Compatible with lithostratigraphic work done by the TWDB BRACS team for aquifers of the Upper Coastal Plains in Central Texas, in northern portion of study area**

MODEL CODE UPDATE: MODFLOW 6

- **Variable grid in areas of interest (i.e. smaller cell size where needed)**
- **No more “dry cells”**
- **Efficient solvers**
- **Currently being used for Northern Carrizo-Wilcox GAM update (GMA 11)**
 - **Example of Oct-Tree Grid in new model**

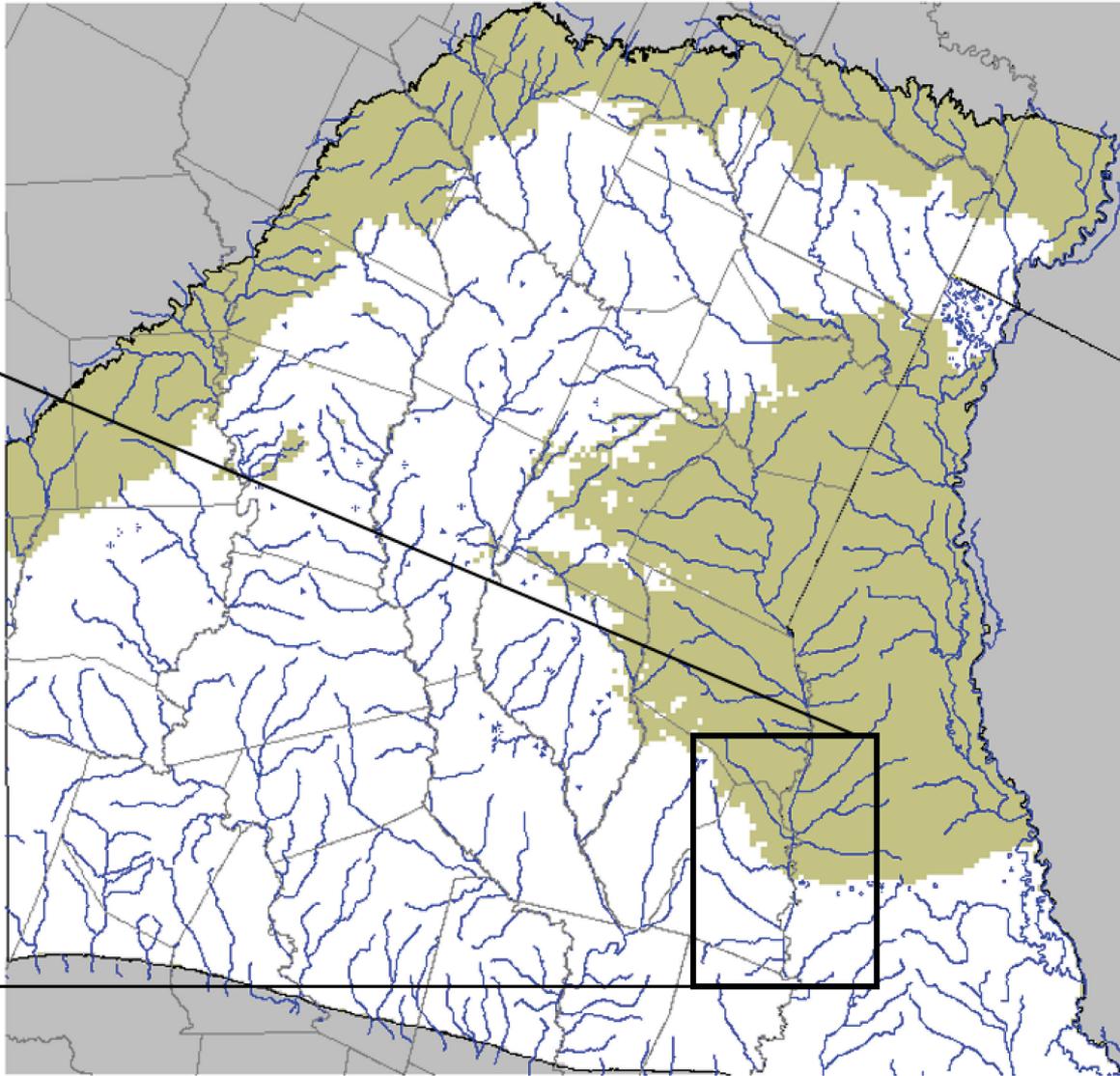
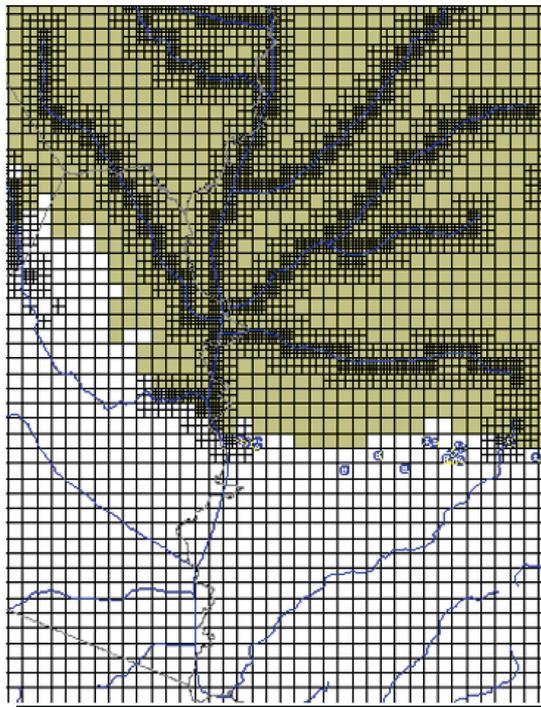
GRID LAYER 5

Grid
Layer 5



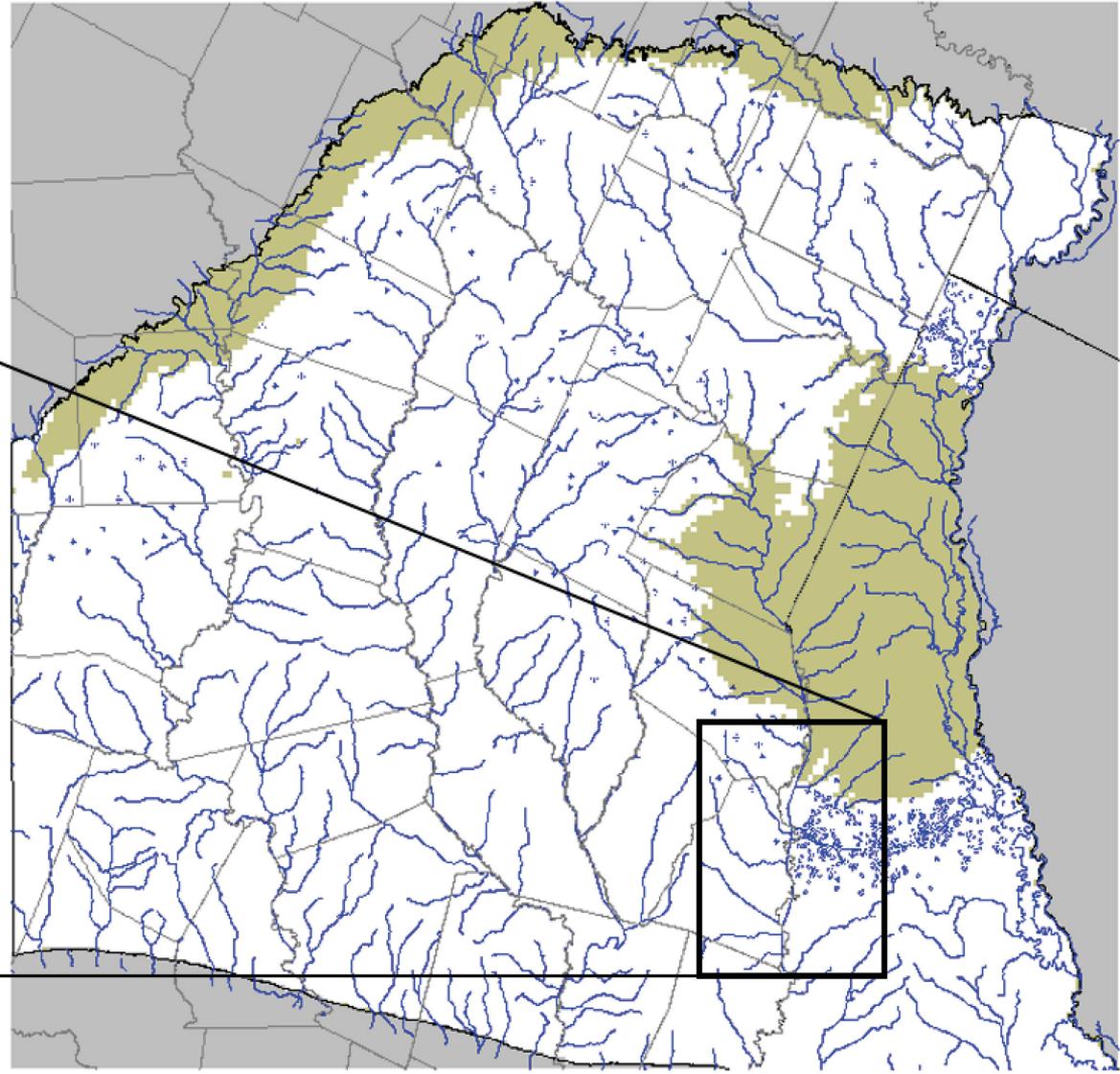
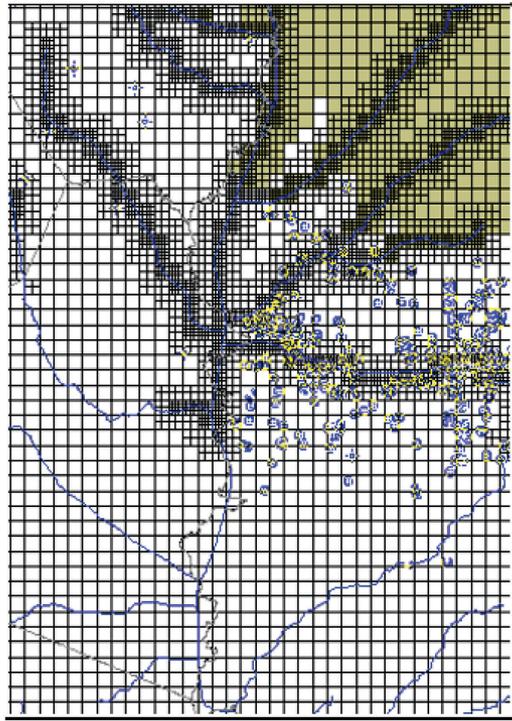
GRID LAYER 6

Grid
Layer 6



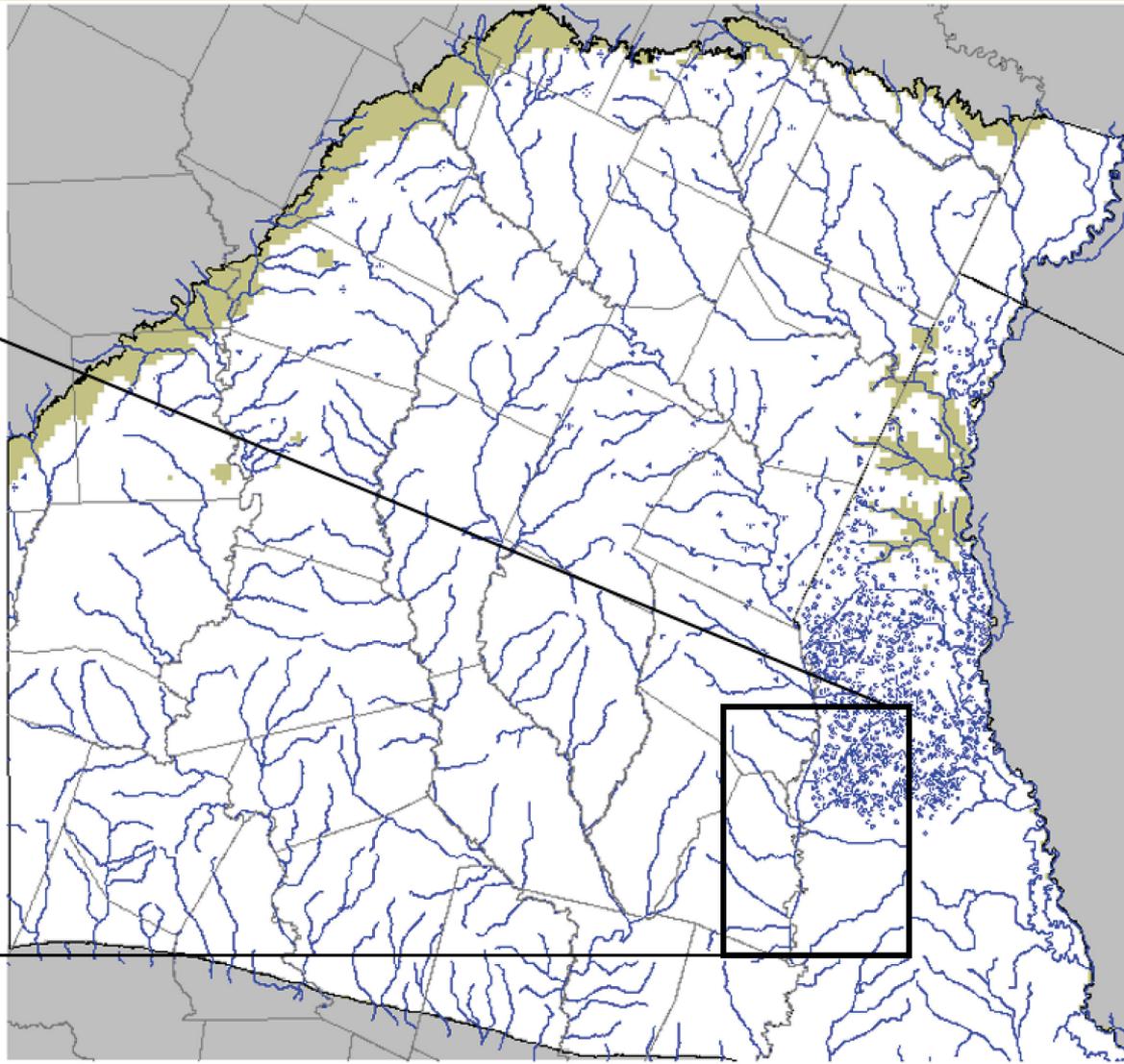
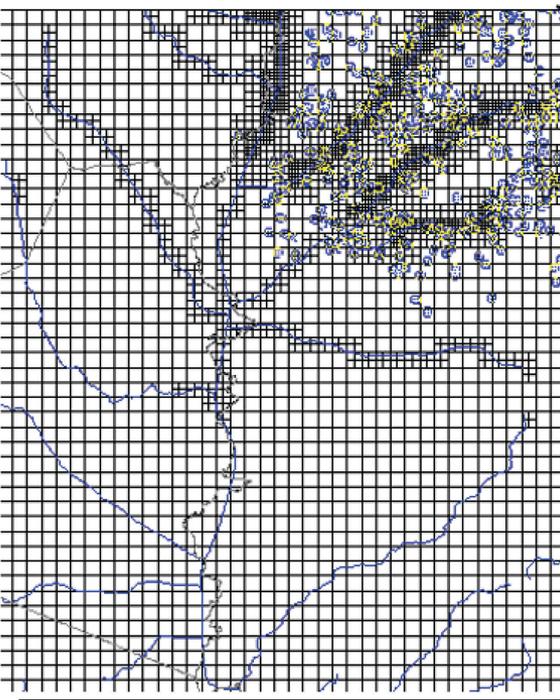
GRID LAYER 7

Grid
Layer 7



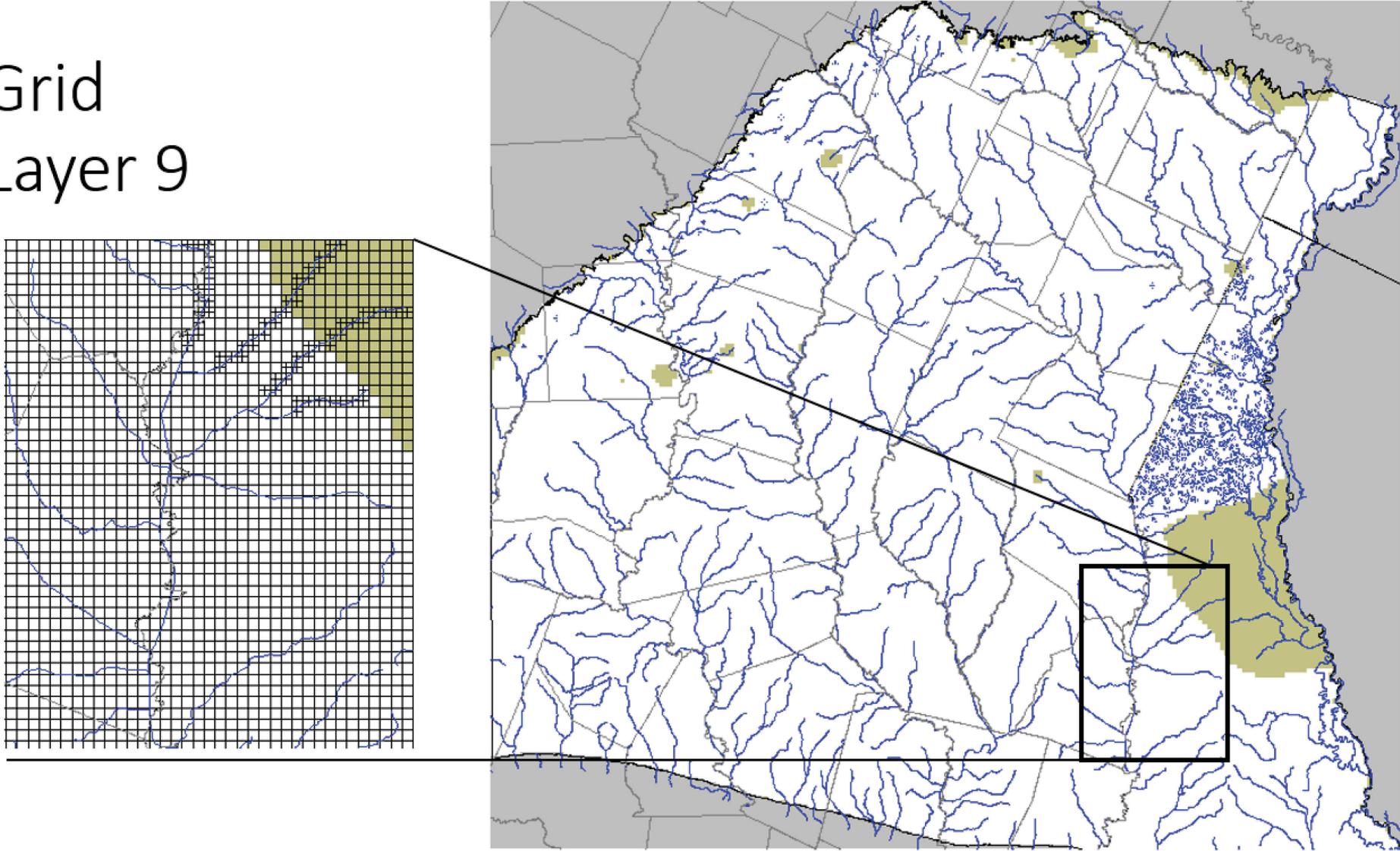
GRID LAYER 8

Grid
Layer 8



GRID LAYER 9

Grid
Layer 9



- **Comparison of actual data with model simulated data (e.g. groundwater elevations)**
- **Current GAM did not distinguish between outcrop and downdip wells**
 - **Dominance of downdip wells**
 - **Poor outcrop calibration was effectively masked in the statistics**
- **Update will calculate calibration statistics for outcrop and downdip wells separately**
 - **Enhanced by data from new outcrop monitoring wells now being constructed**

CAN BE USED FOR INTENDED PURPOSE



- **Current GAM developed prior to HB 1763 (Joint Planning)**
- **Efforts to use current GAM in DFC development in 2010 and 2016 identified areas where GAM could be improved**
- **Updated GAM will be tested with current DFCs to assure it can be used for DFC development (i.e. simulation through 2070)**

PROJECT SCHEDULE

- **Interim Framework Deadline**
 - January 31, 2020
- **Interim Draft Conceptual Model Deadline**
 - November 30, 2020
- **Interim Draft Model Design Deadline**
 - June 30, 2021
- **Calibrated Model Deadline**
 - January 31, 2022
- **Final Report Deadline**
 - June 30, 2022

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REQUEST FOR DATA

- **Well borehole geophysical logs and lithologic logs**
- **Information for wells**
 - **Locations and construction**
 - **Lithologic logs, geophysical logs**
 - **Pumping, water levels, water quality**
- **Information for surface water network**
 - **River and stream flows**
 - **Locations and construction of main canals, drains**
 - **Diversions, water quality**

DATA REQUESTS: *SUBMITTAL DEADLINES*



- **Geophysical logs and lithologic logs**
 - *Immediate priority for keeping on contract schedule*
 - **By September 30, 2019**
- **Well information, water levels, pumping, surface water, water quality data**
 - **By January 2020**

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QUESTIONS AND DISCUSSION

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