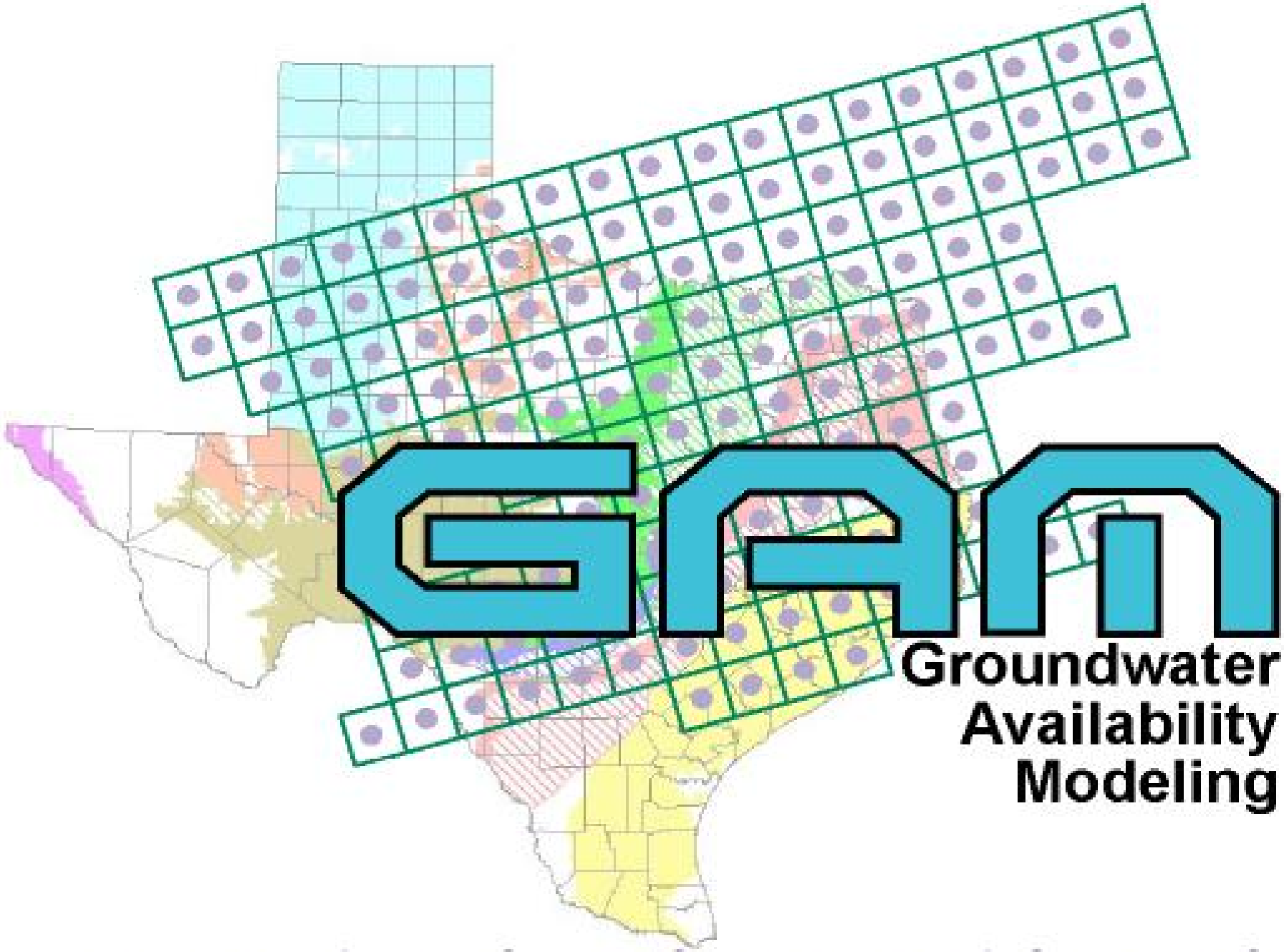

texas water development board

Agenda for Stakeholder Advisory Forum (SAF) Meeting No. 1 July 12, 2006

- Overview of GAM program and status
- Edwards Trinity (High Plains) GAM project team
- Basic concepts of groundwater flow in the aquifer and groundwater flow modeling
- Project approach
- Project schedule

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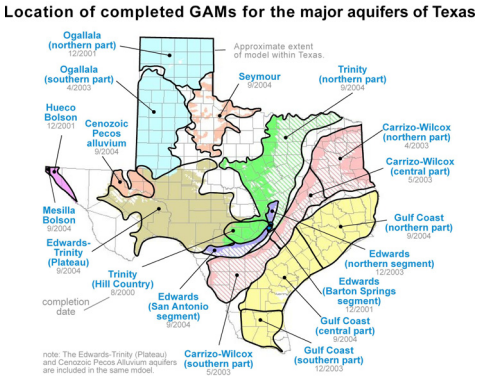
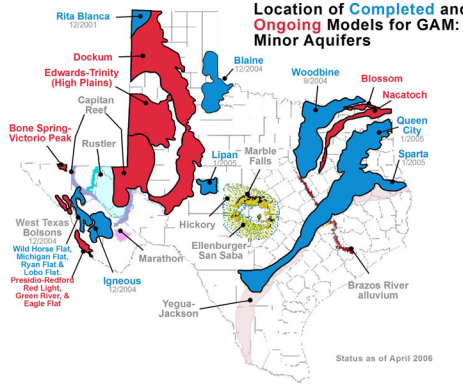
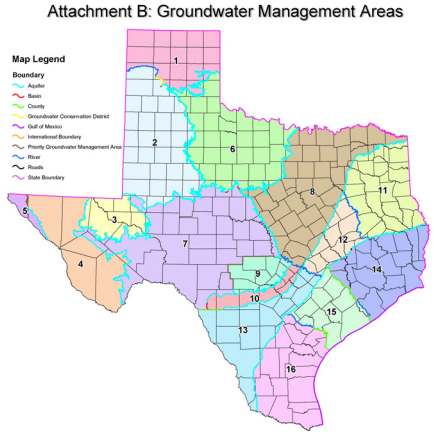
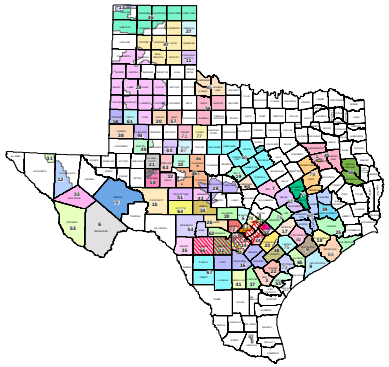
Groundwater Availability Modeling

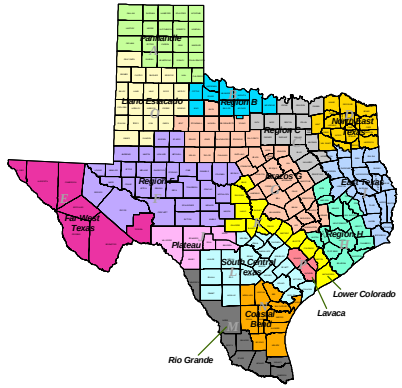




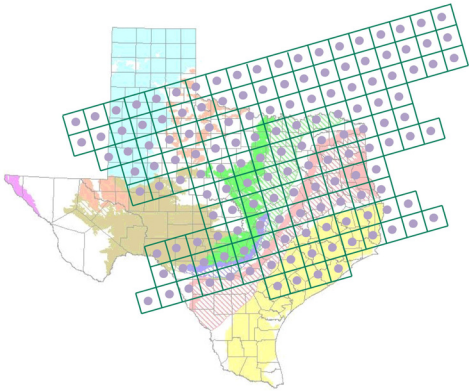


Contract Manager
Richard M. Smith





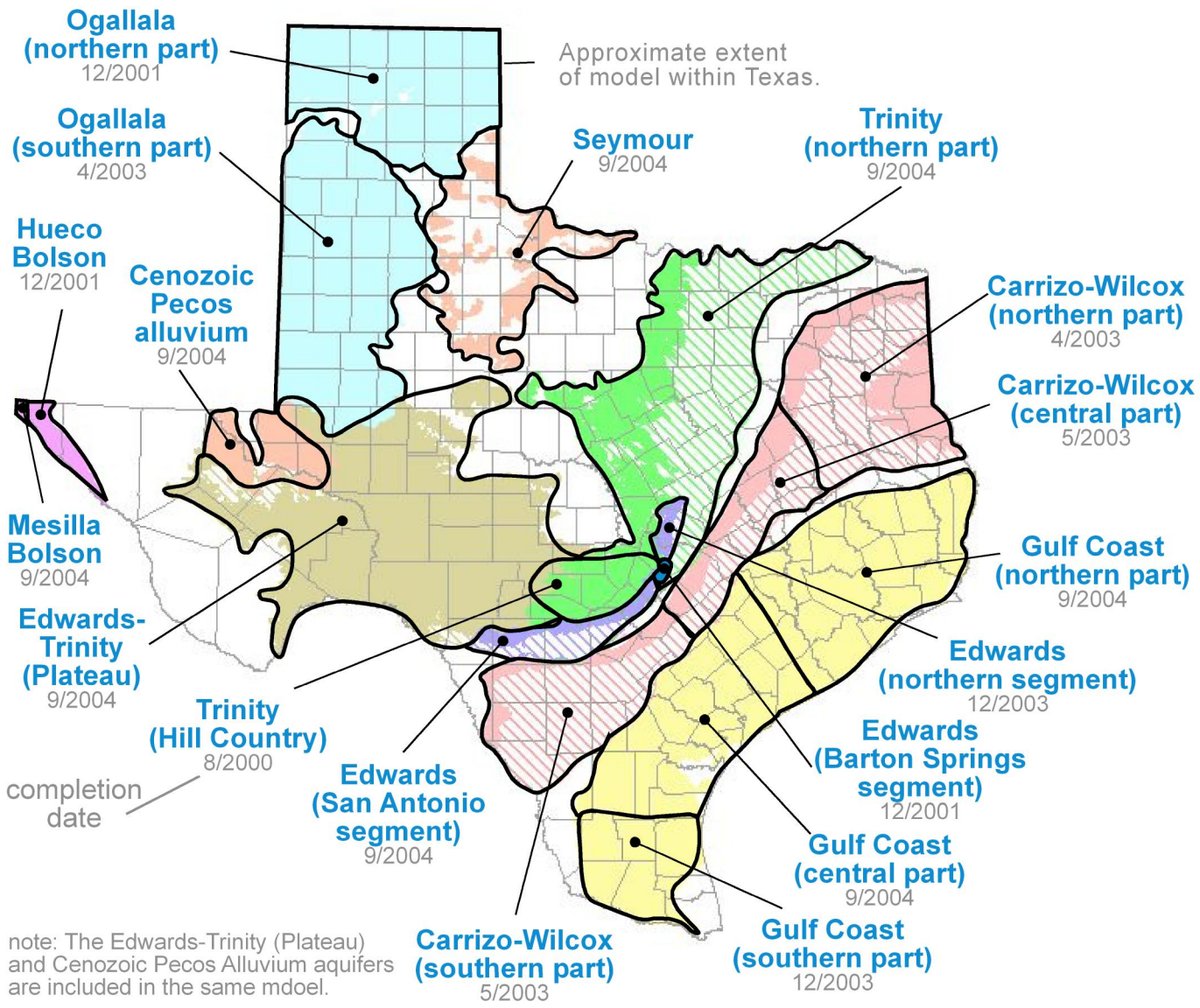
Texas Water Development Board

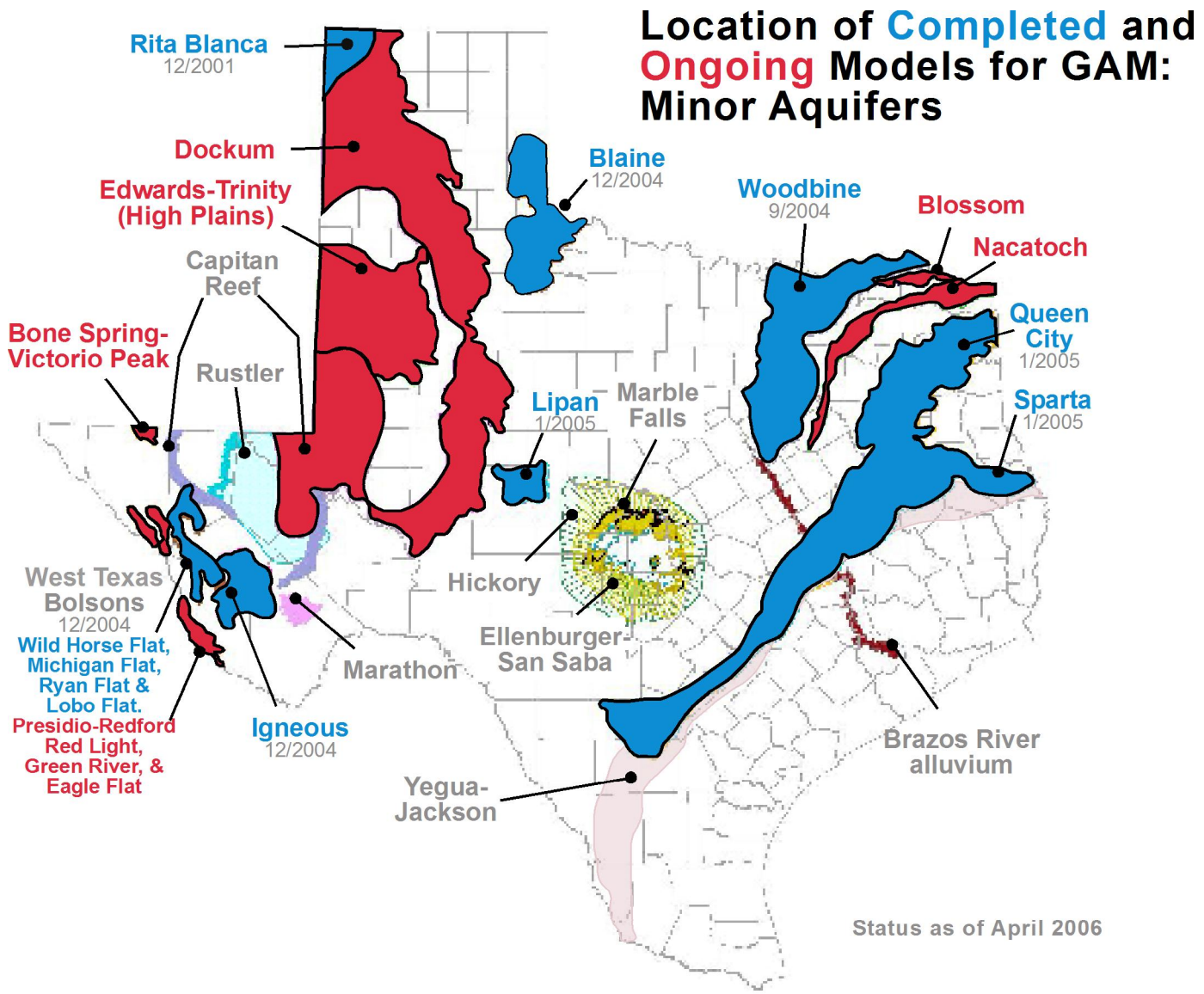


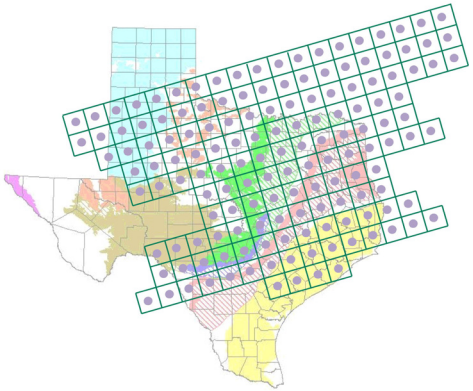
GAM

- Purpose: to develop tools that can be used to help GCDs, RWPGs, and others assess groundwater availability.
- Public process: you get to see how the model is put together.
- Freely available: standardized, thoroughly documented, and available over the internet.
- Living tools: periodically updated.

Location of completed GAMs for the major aquifers of Texas

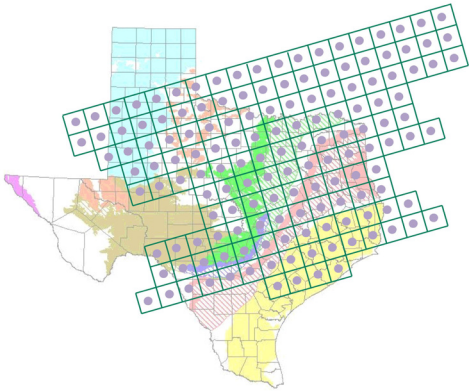



Location of Completed and Ongoing Models for GAM: Minor Aquifers
Rita Blanca
12/2001
Dockum
Edwards-Trinity (High Plains)
Capitan Reef
Bone Spring-Victorio Peak
Rustler
Blaine
12/2004
Lipan
1/2005
Marble Falls
Woodbine
9/2004
Blossom
Nacatoch
Queen City
1/2005
Sparta
1/2005
Hickory
Ellenburger-San Saba
West Texas Bolsons
12/2004
Wild Horse Flat, Michigan Flat, Ryan Flat & Lobo Flat.
Presidio-Redford
Red Light, Green River, & Eagle Flat
Marathon
Igneous
12/2004
Yegua-Jackson
Brazos River alluvium
Status as of April 2006



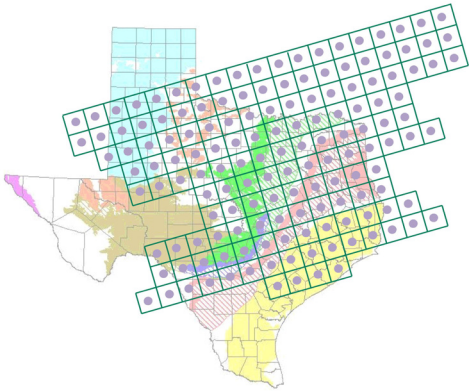
What is groundwater availability or MAG?

- Managed available groundwater (MAG)…the amount of groundwater available for use.
- The State does not directly decide how much groundwater is available for use: GCDs will through GMA process
- A GAM is a tool that can be used to assess groundwater availability once GCDs and GMAs decide on the desired future condition of the aquifer.



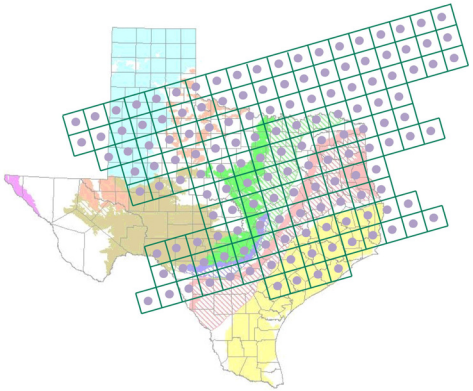
Do we have to use GAM?

- Water Code & TWDB rules require that GCDs use GAM information, if available, for their management plans.
- TWDB rules require that RWPGs use managed available groundwater estimates, if developed in time for the planning cycle



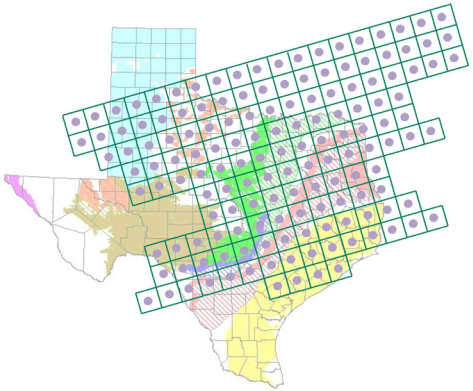
How do we use GAM?

- The model
  - predict water levels and flows in response to pumping and drought
  - effects of well fields
- Data in the model
  - water in storage
  - recharge estimates
  - hydraulic properties
- GCDs and RWPGs can request runs



Living tools

- GCDs, RWPGs, TWDB, and others collect new information on aquifer.
- This information can enhance the current GAMs.
- TWDB plans to update GAMs every five years with new information.
- Please share information and ideas with TWDB on aquifers and GAMs.



Participating in the GAM process

- SAF meetings
  - hear about progress on the model
  - comment on model assumptions
  - offer information (timing is important!)
- Report review
  - at end of project
- Contact TWDB
  - contract manager

Comments:

Contract Manager

richard.smith@twdb.state.tx.us

(512) 936-0877

www.twdb.state.tx.us/gam

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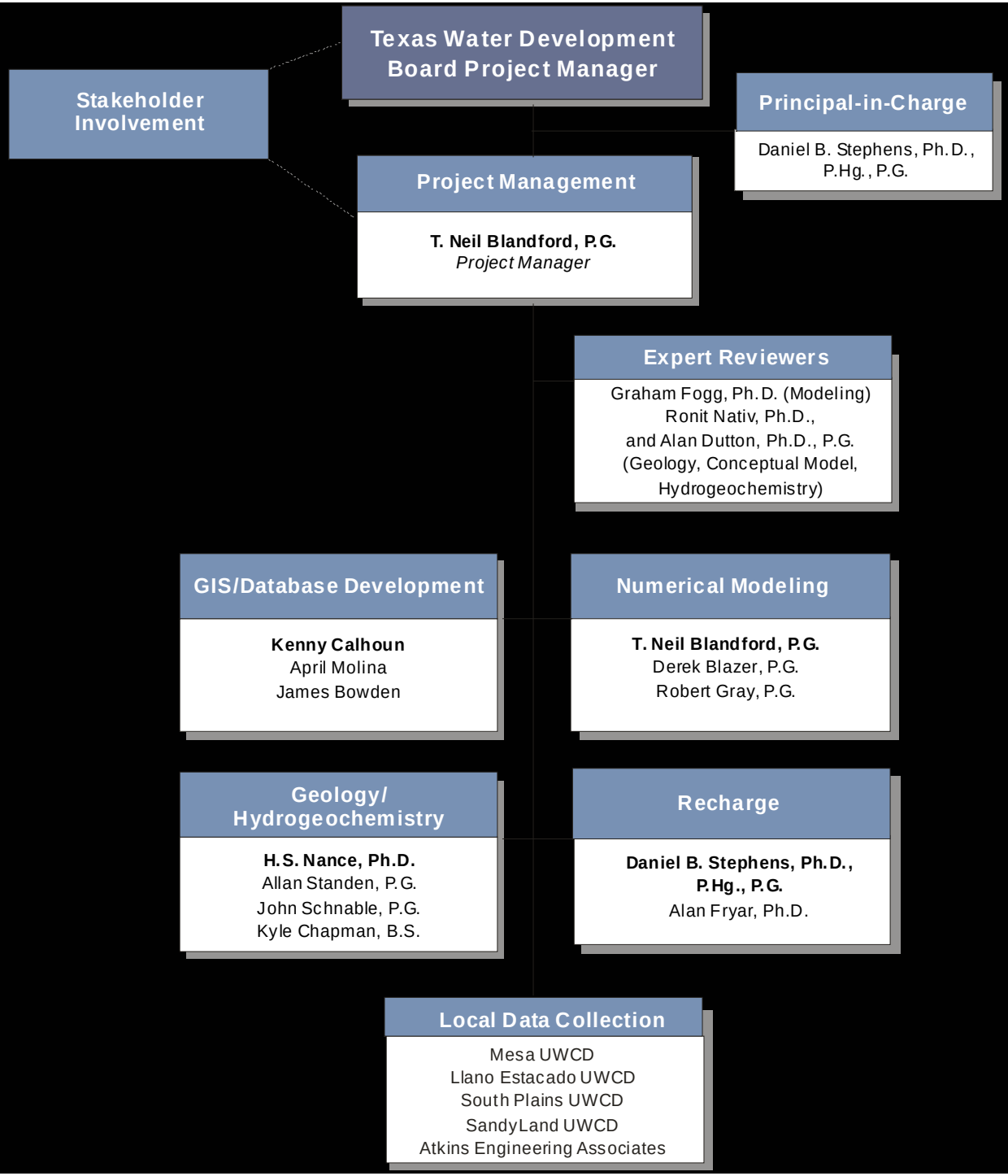
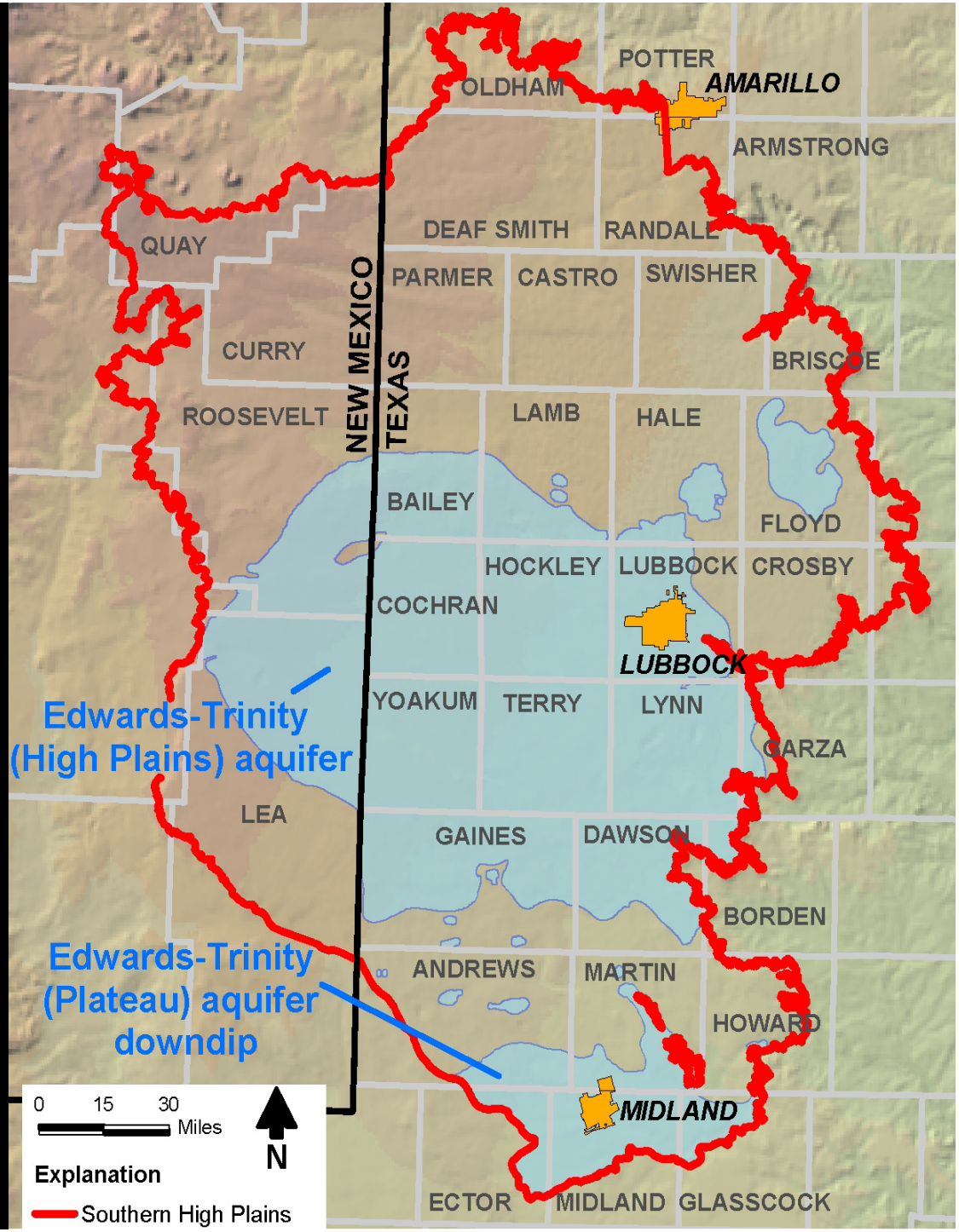
Project Team



Note: Names in bold are Task Leaders

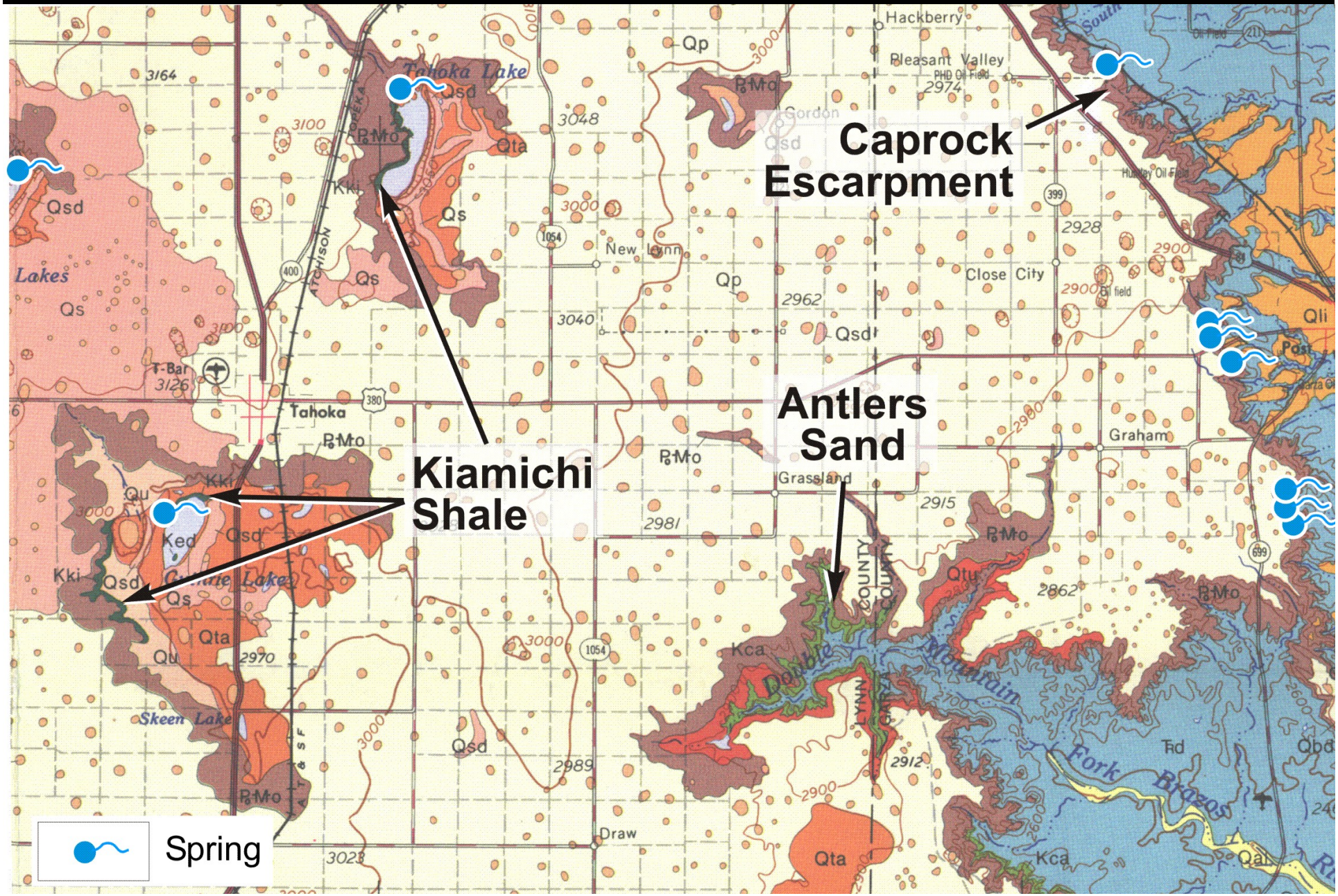
Edwards Trinity (High Plains) Aquifer



Lower Cretaceous Geologic Units Nomenclature and Equivalent Hydrostratigraphic Units

System	Series	Group	Formation		Hydrogeologic Unit
			Edwards - Trinity (High Plains)	Edwards - Trinity (Plateau)	
Quaternary	Pleistocene to recent		Blackwater Draw	Alluvium	Ogallala or High Plains aquifer - includes uppermost permeable sediments of Washita Group
Tertiary	Late Miocene to Pliocene		Ogallala	Ogallala	----------?----------
Early (Lower) Cretaceous	Comanche	Washita	Duck Creek	Boracho or Ft. Lancaster	Confining units (primarily shale) Edwards Aquifer - Comanche Pea
		Fredericks-burg	Kiamichi		
			Edwards	------?------	and Walnut formations contain shale interbeds
			Comanche Peak	Finlay or Fort Terrett	
			Walnut		
		Trinity	Antlers Sand	Antlers Sand and Basal Cretaceous Sand	Trinity Aquifer
Triassic		Dockum	Chinle or Cooper Canyon	Upper	Confining Unit

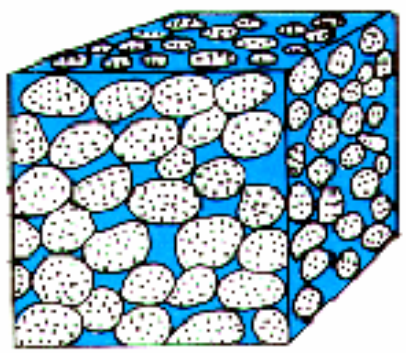
Geologic Map of Central Lynn County

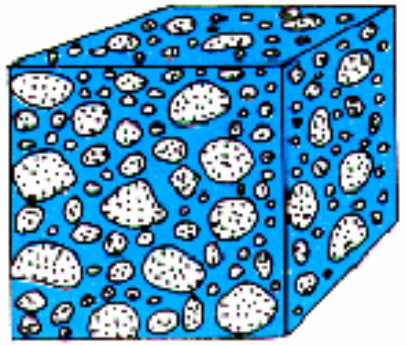


Groundwater Occurrence

Primary Openings

(Ogallala)



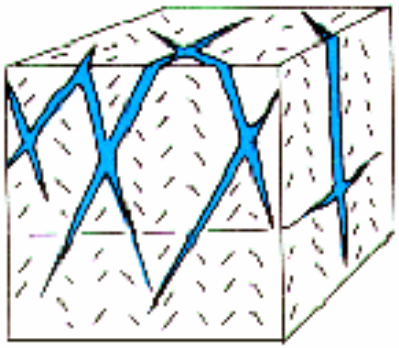


ND

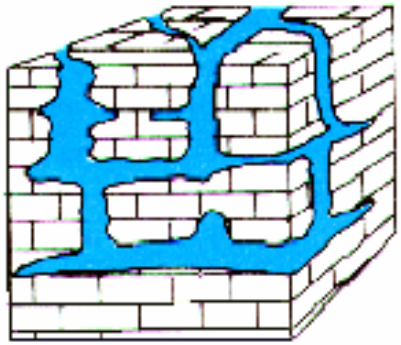
Secondary Openings

Edwards-Trinity (HP)

SECONDARY OPENINGS



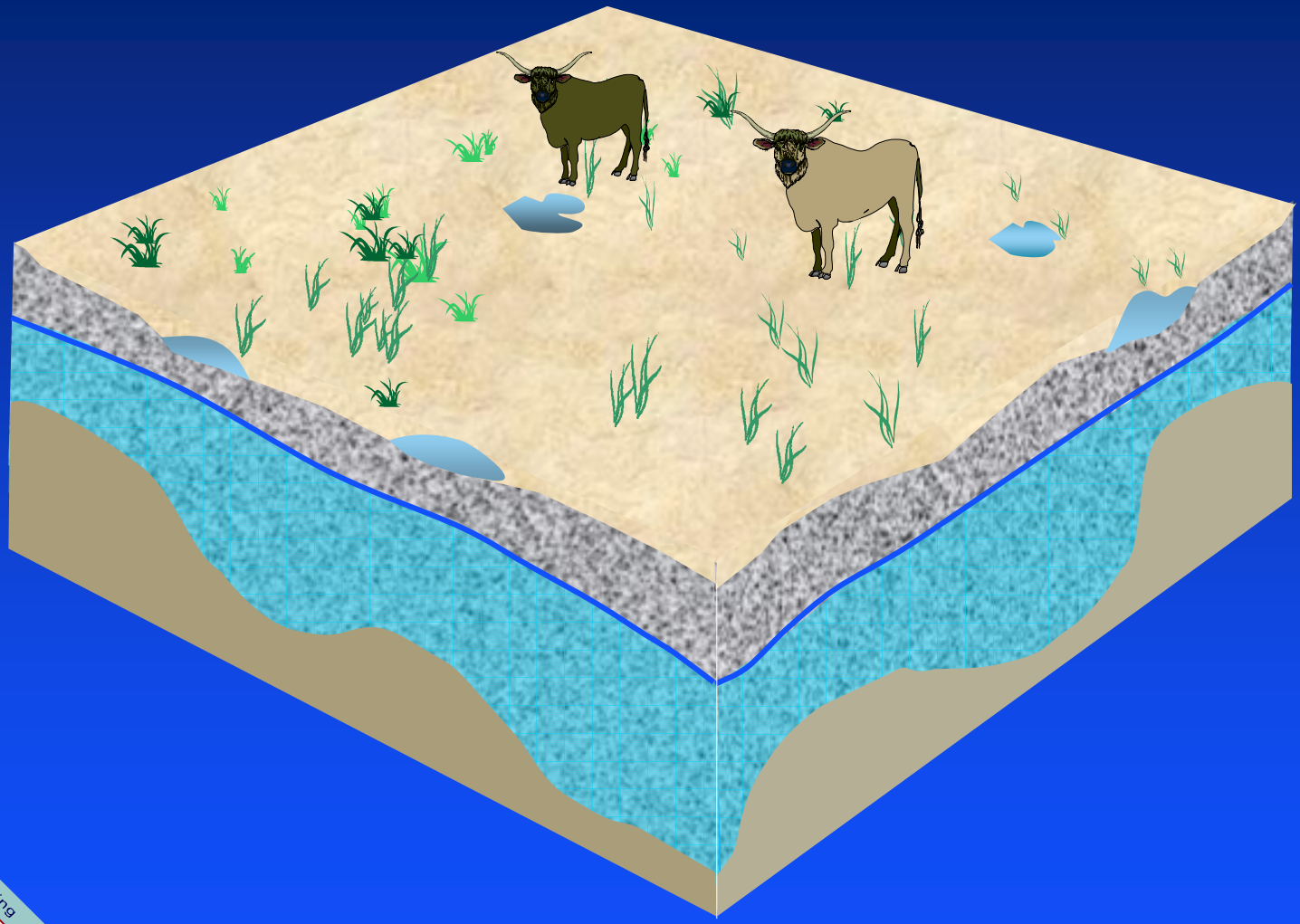
FRACTURES IN GRANITE



CAVERNS IN LIMESTONE

Source - Heath (1983)

Pre-1940



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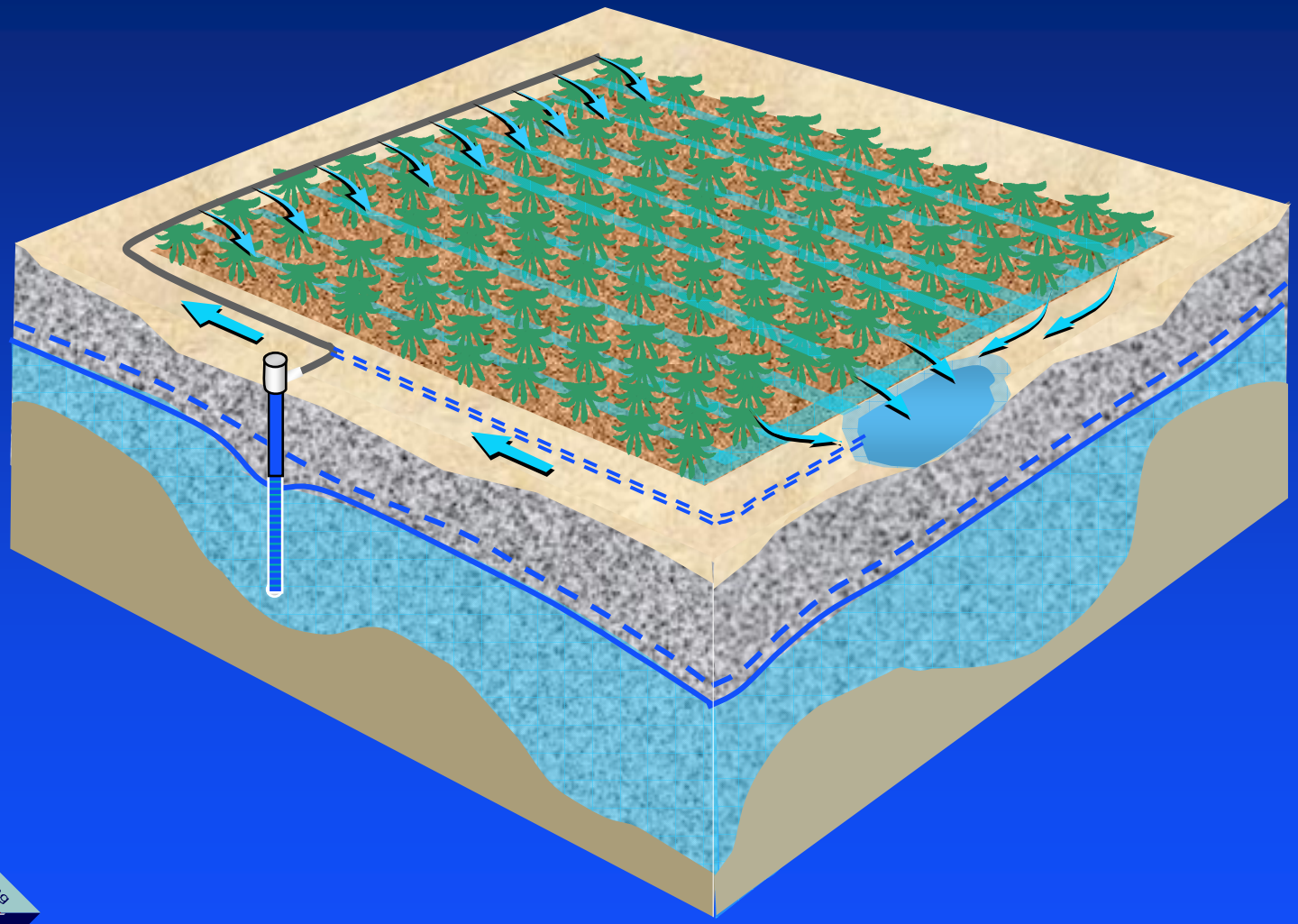
Early Irrigated Agriculture (1940s-1970s)



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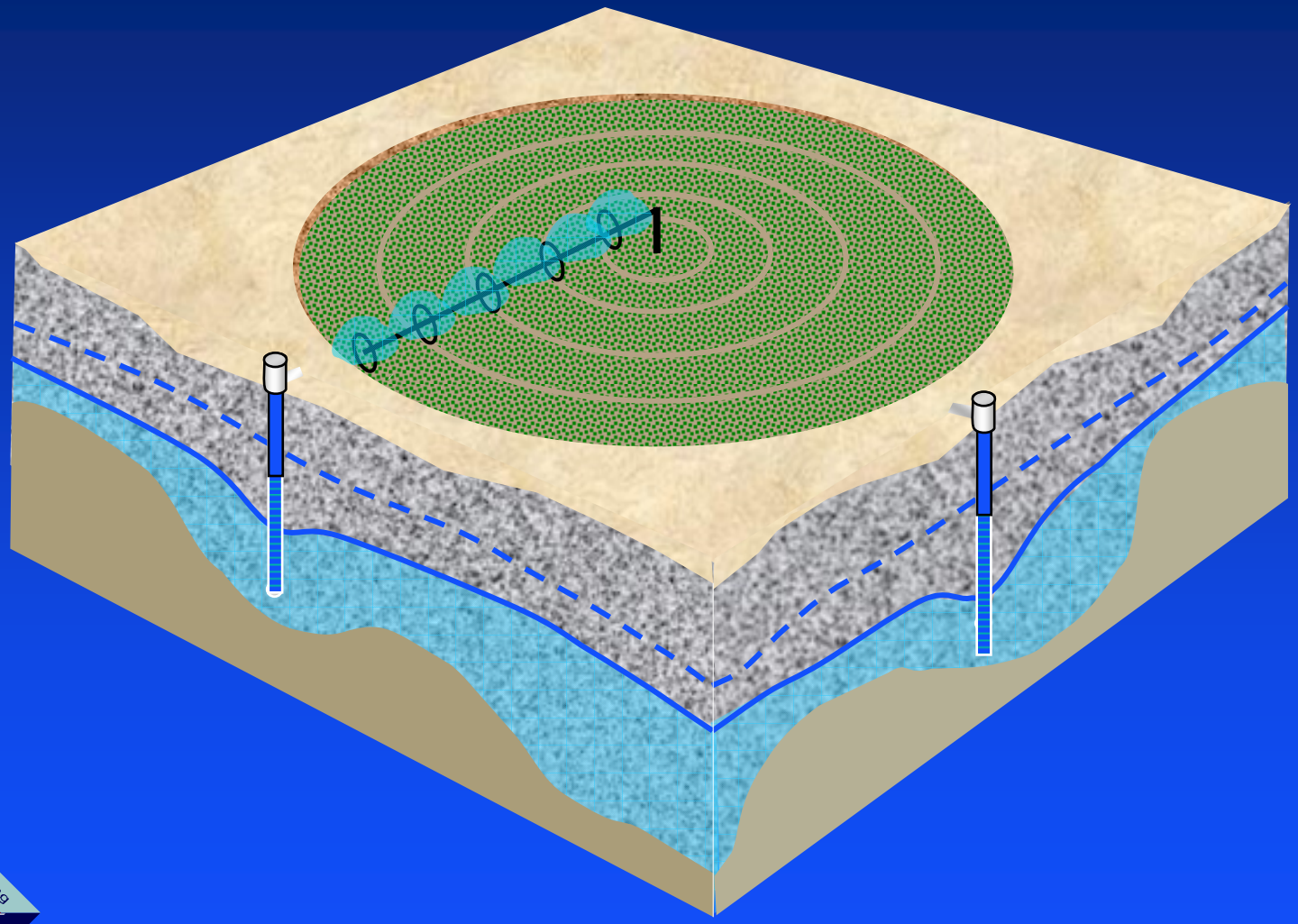
Recent Developments (1980s - 1990s)



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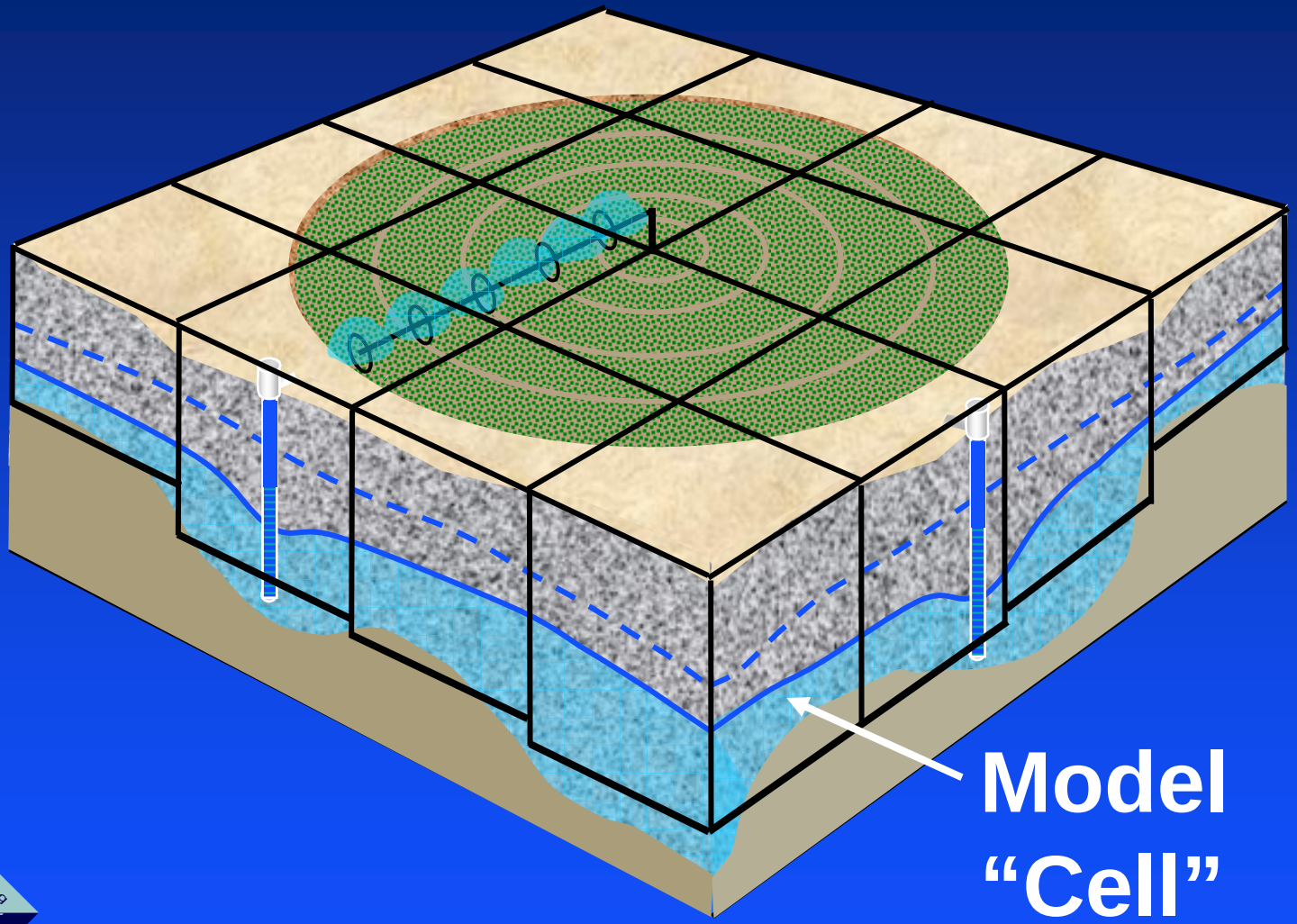
Groundwater Flow Modeling



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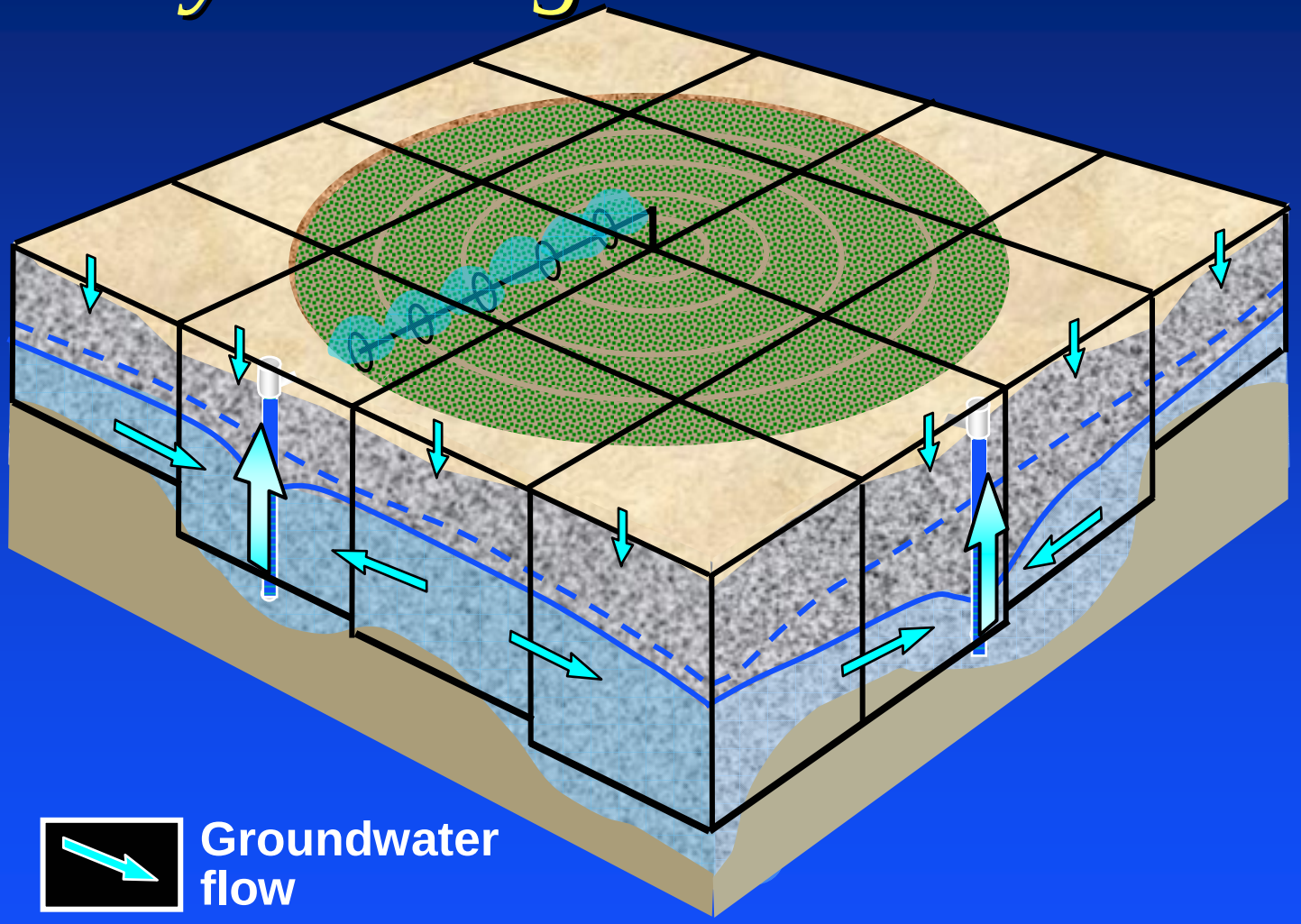
Cells "Communicate" - Each Cell is Affected by its Neighbor



Groundwater flow

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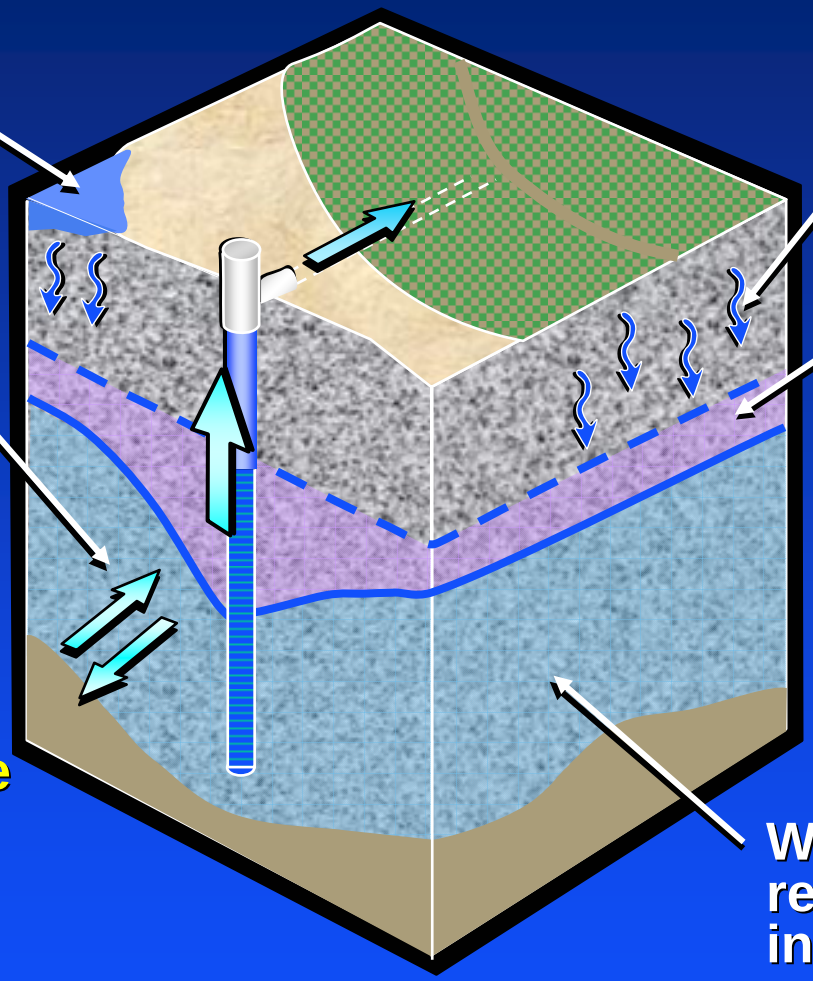
Major Influences in the Life of a Cell



Natural recharge

Irrigation return flow

Water removed from storage

Exchange of water with neighboring cells

- Permeability
- Storage value
- Thickness

Water remaining in storage

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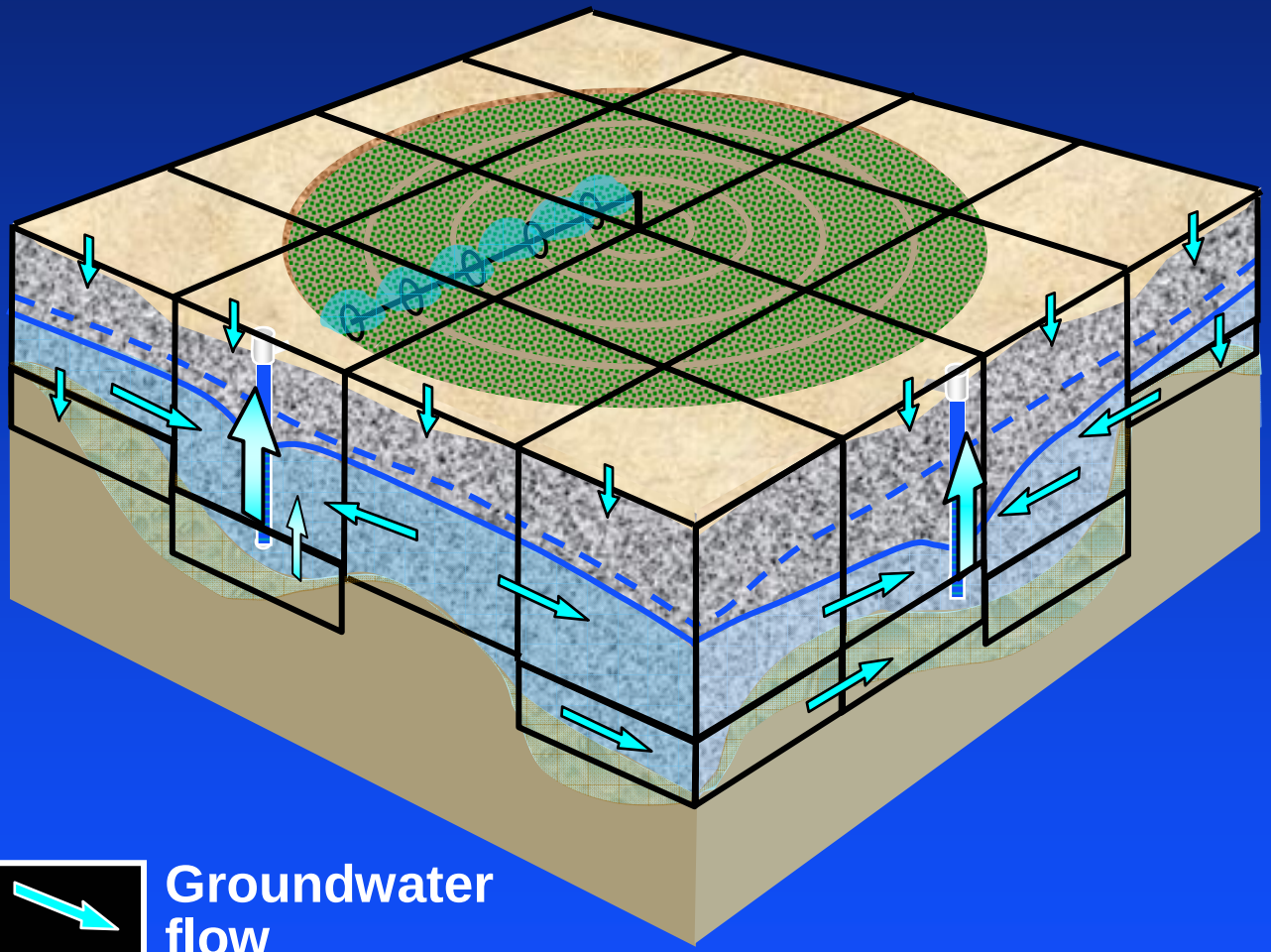
To add aquifers, we add additional layer(s) of cells ....



Groundwater flow

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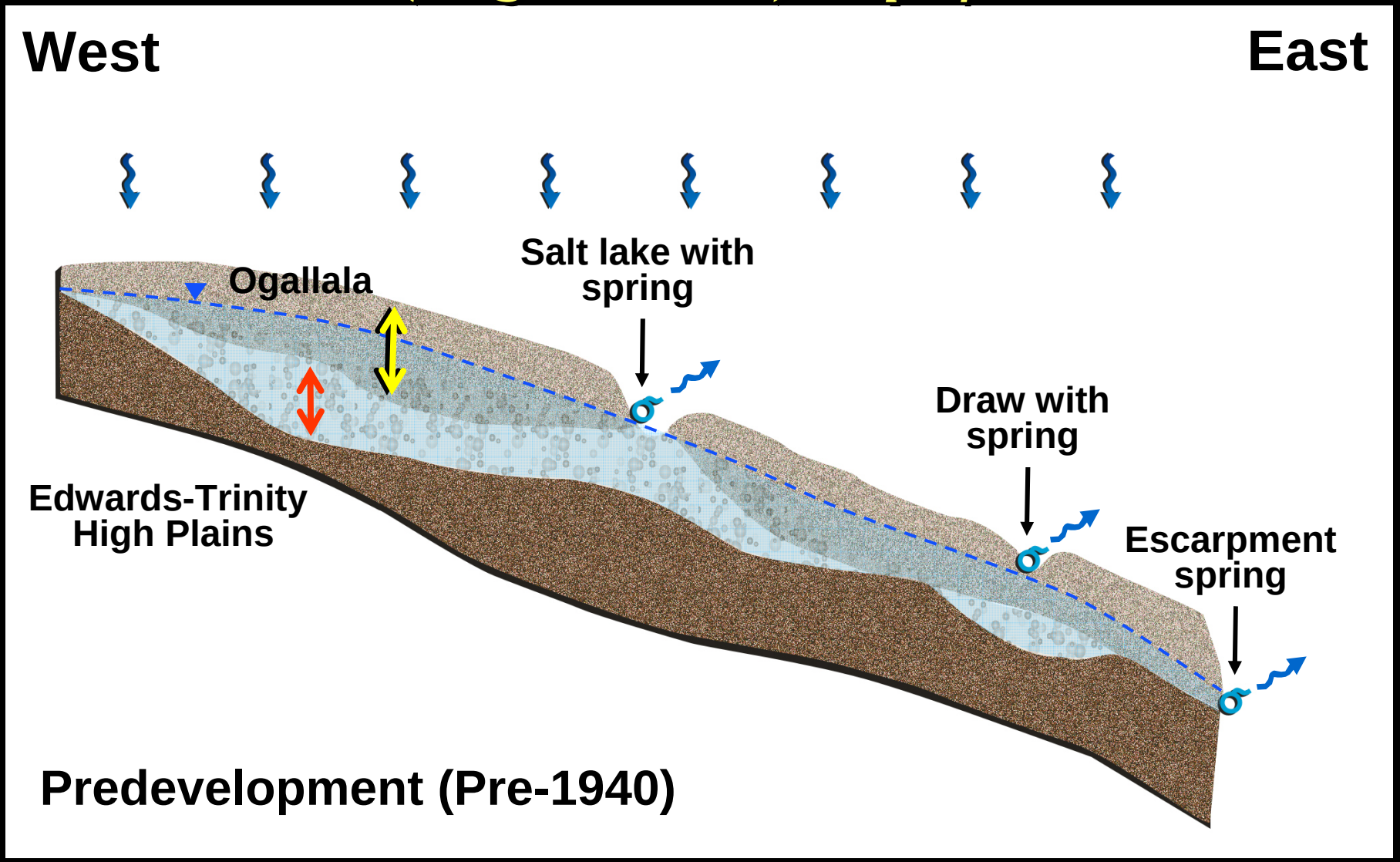
Conceptual Model of Groundwater Flow Southern Ogallala and Edwards-Trinity (High Plains) Aquifer



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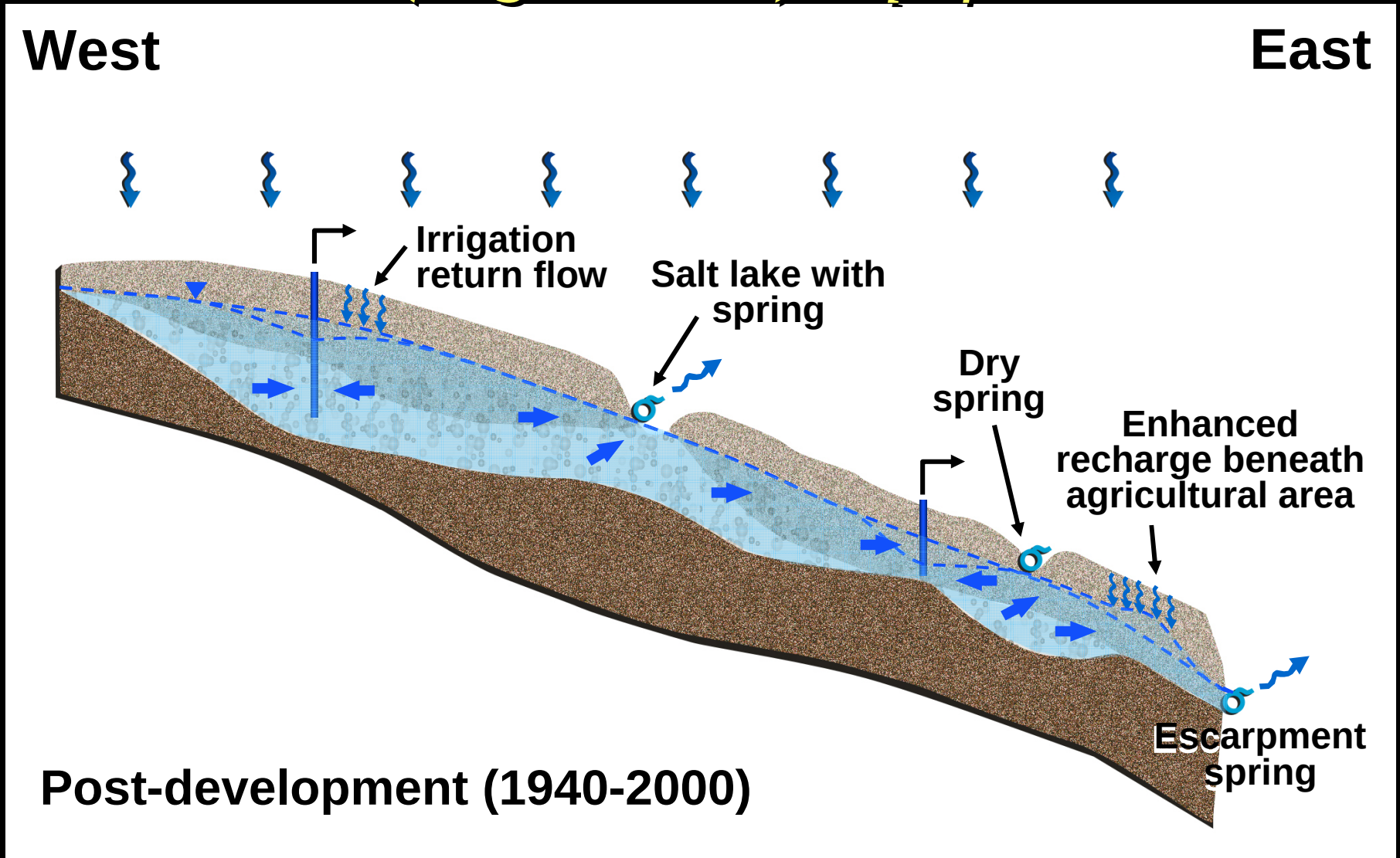

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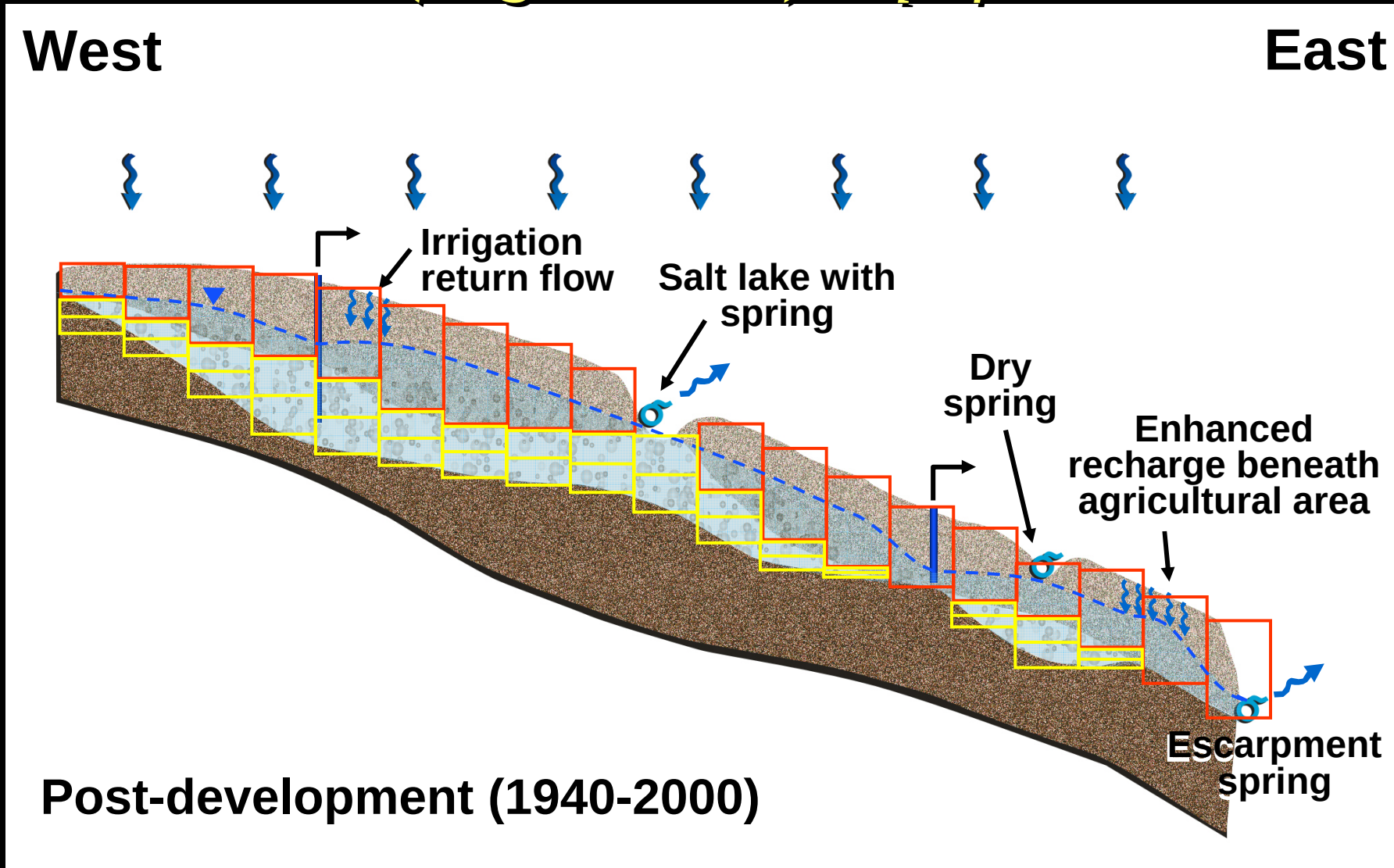

Approach to Model Layers

- Layer 1 - Ogallala and permeable portions of the Cretaceous section in direct hydraulic communication
- Layer 2 - Low-permeability portions of the Duck Creek and Kiamichi Formation
- Layer 3 - Edwards, Comanche Peak and Walnut Formations
- Layer 4 - Antlers Sand

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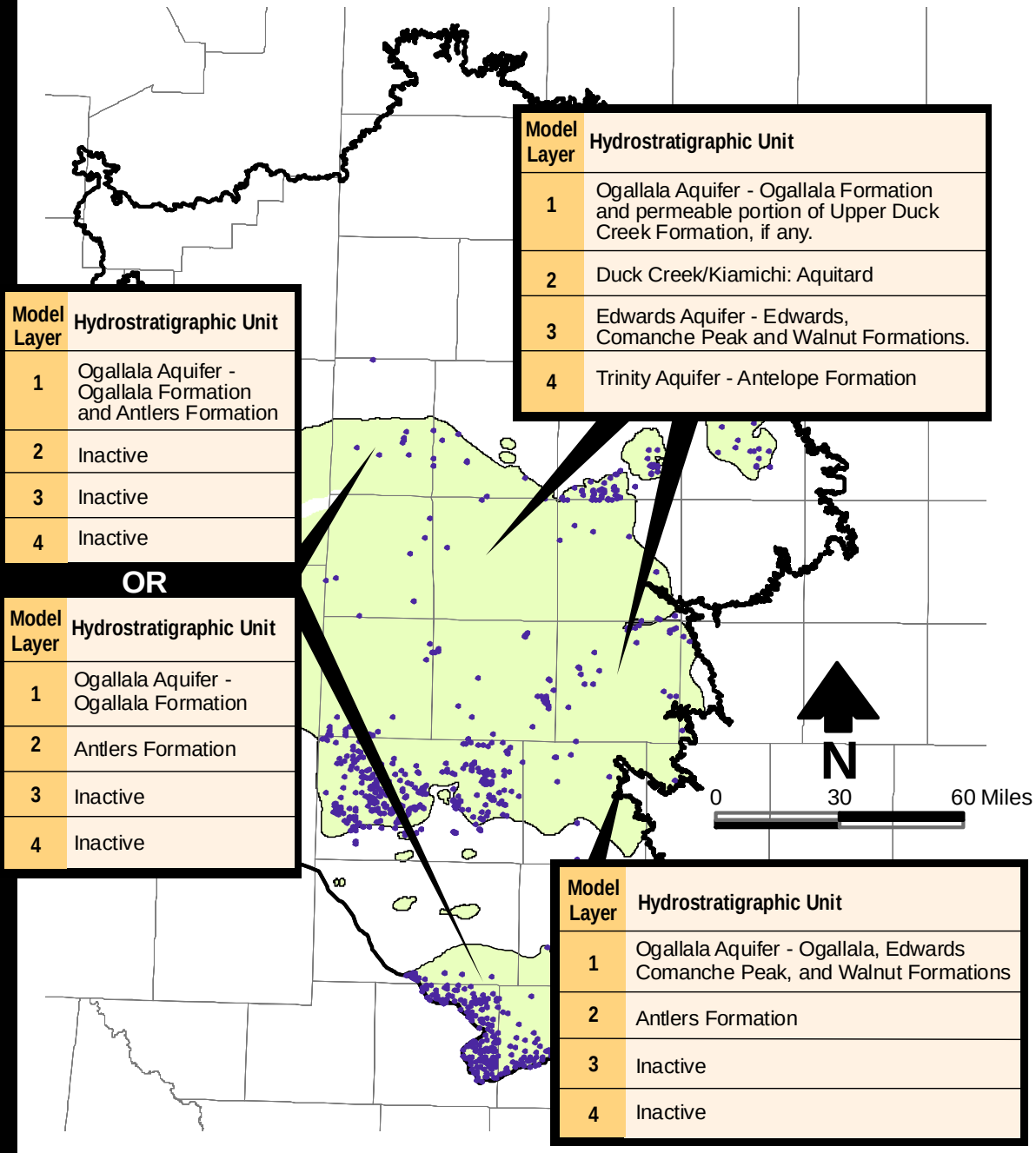
Model Layering and Edwards Trinity Wells in TWDB Database



Approach to Geologic Characterization

- Begin with existing cross sections (e.g. Fallin, 1989 and HPUWCD No. 1 for Lynn County)
- Add mapped geologic outcrops
- Implement the following in sequence
  - Geophysical logs from oil and gas wells (~ 10 per county)
  - Drillers' logs from the Texas observation wells system
  - Driller's logs submitted electronically to the state
  - TCEQ surface casing information
  - GCD well log information not previously provided by team members

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Approach to Hydraulic Properties and Recharge

- Hydraulic properties will be correlated with depositional environments if possible
- Nature of formation will be considered (e.g. fractured rock will have a lower specific yield than porous material)
- Groundwater recharge will be estimated from the modeling - most recharge would have to pass through the Ogallala

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Approach to Model Calibration

- Begin date - 1930
- Contract - focus on 1980 through 2002 for transient calibration; we will focus on entire time period
- Implement enhancements made to the Southern Ogallala GAM for Hockley and Lubbock Counties (need approval of TWDB)
- Will need to consider calibration in the Ogallala as well as the Edwards-Trinity (High Plains) aquifer

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Some Thoughts About this Aquifer...

- The Edwards Trinity (High Plains) aquifer is not another Ogallala
- Yields can be substantial in some areas, but high yields are not likely to be widespread

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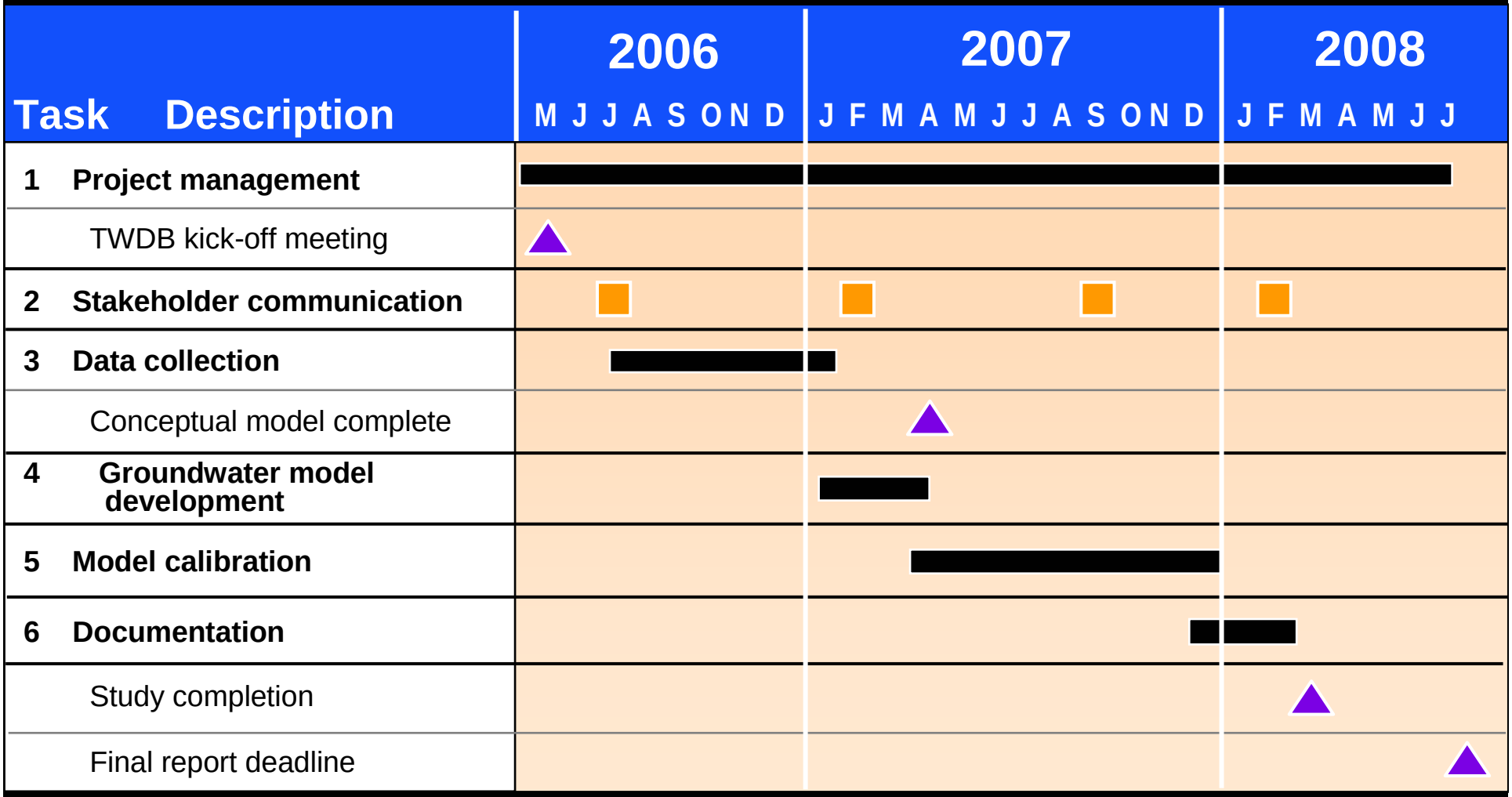
Project Schedule



Fine Print

- The model will be a regional scale tool, and will be most applicable at that scale. The model will have limited utility for local analyses, such as individual well locations, farms and well fields
- Model utility may be constrained by historical aquifer conditions used during the calibration process. Effects caused by future changes in aquifer stresses must be considered carefully.

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Remember to ask for help here....

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Edwards-Trinity (High Plains) GAM
First Stakeholder Advisory Forum
Held July 12, 2006 in Lubbock, Texas

Stakeholder Attendees	
Name	**Affiliation**
James P. Mitchell	HPUG Dist #1
Marisue Potts	Land owner
Cleon Namken	USDA-NRCS
Judy Reeves	
Jason Coleman	SPUWCD
Don McReynolds	HPUWCD #1
Herb Grubb	HDR Ener.
Mike McGregor	Llano Estacado UWCD
Kevin Hopson	DBS&A
Jim Conkwright	HPUWCD #1
Harvey Everheart	Mesa UWCD
Neil Blandford	DBS&A
H.P. Brown, Jr	Region O
Ken Carver	Permian Basin UWCD
Richard Smith	TWDB
Alan Stanton	DBS&A

Summary of Questions/Responses from the Edwards-Trinity (High Plains) GAM SAF No. 1 High Plains Underground Water Conservation District No. 1 Lubbock, Texas July 12, 2006

Questions directed to Richard Smith (TWDB Project Manger)

How many GAM runs have been requested of the TWDB?
Over 100

Is the two years for upcoming regional work part of the five year planning cycle?
Yes

Do the groundwater districts have less than two years to get Desired Future Conditions to be part of the next RWPG plan?
Yes, however, the deadline may be extended from 9/1/07 to 12/1/07.

Questions directed to Neil Blandford (DBS&A Project Manager)

What is the time step for the GAM?
The stress periods are 1 year, and every stress period will probably be divided into at least 5 time steps.

Where does the aquitard fit in?
It will be discussed later in the presentation, but low permeability units in the Cetaceous such as the Kiamichi will be included as an aquitard layer

What are the purple dots in the figure?
They are wells available in the TWDB database that are listed as Edwards-Trinity High Plains wells.

Are the Ogallala-Antlers hydraulically connected when in one layer?
Separation into layers will be formation specific if delineation can be determined from well logs.

What are the water quality characteristics of the Edwards-Trinity High Plains aquifer?
What are the chloride concentrations like?
The water quality may not be as good as that in the Ogallala, but we still need to look at available data, so I can not really say at this point.

Are the driller's logs that will be used in the study available to anyone?
Yes, logs and associated information used during the study will be available at TWDB website.

Will all information used be available after the GAM is completed?
Yes, all geo-data will be available at TWDB website.

How much confidence is there in the TWDB's delineated extent of the Edwards-Trinity High Plains aquifer?
We believe it is pretty accurate and we will use the delineated extent, unless information collected during the project indicates that it should be different.