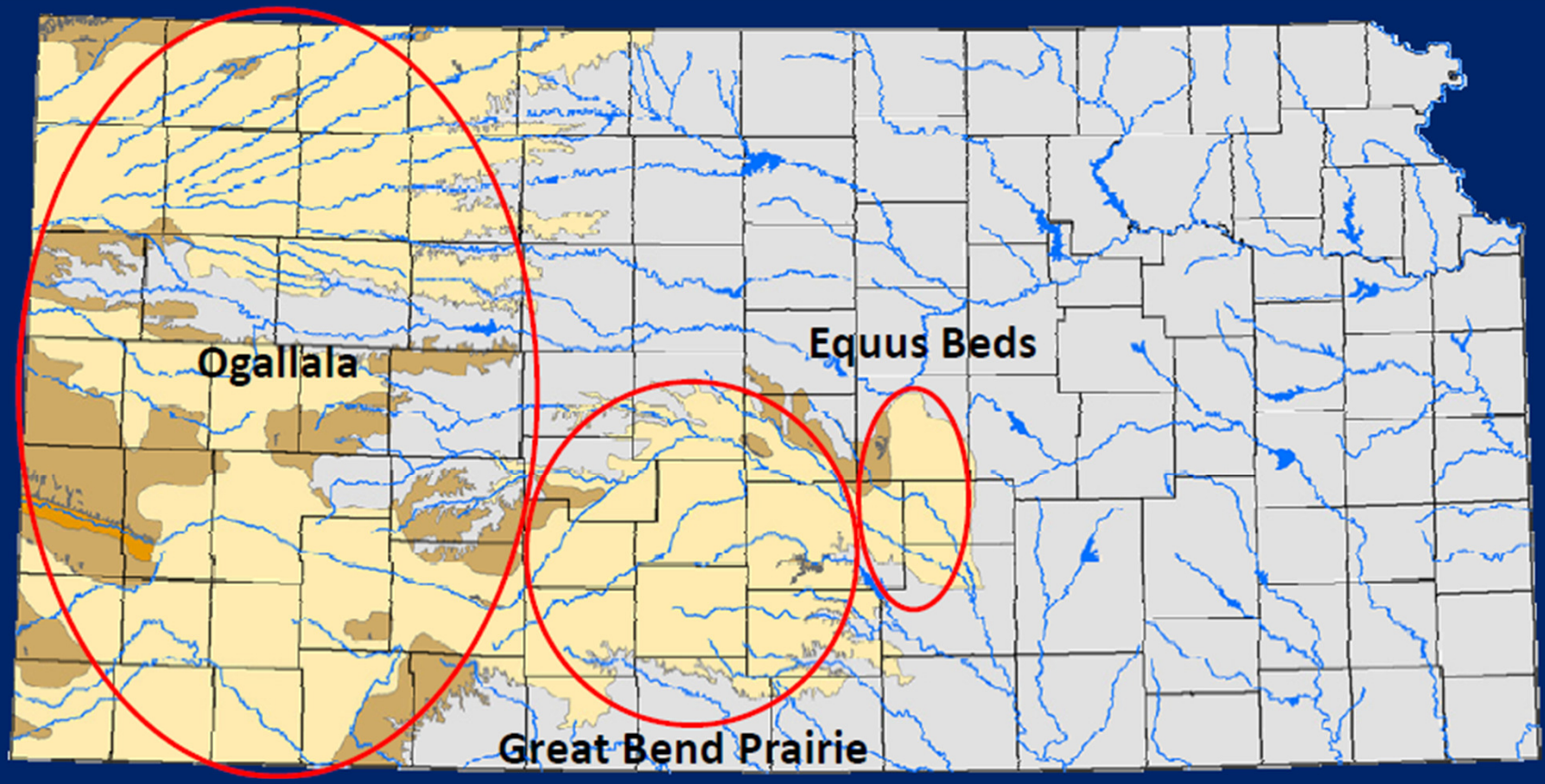
Addressing Kansas' Over-appropriation of the Ogallala Aquifer

David Barfield, Chief Engineer
Division of Water Resources
Kansas Department of Agriculture

AWSE, October 2011
Lawrence, Kansas

Kansas Department of Agriculture
Division of Water Resources

The Kansas High Plains Aquifer



In Kansas, The High Plains Aquifer is made up of several smaller sub-regional aquifers - the Ogallala, Great Bend Prairie and Equus Beds. On a national scale, many people and publications will refer to the High Plains aquifer as the Ogallala. In Kansas, we make a distinction.

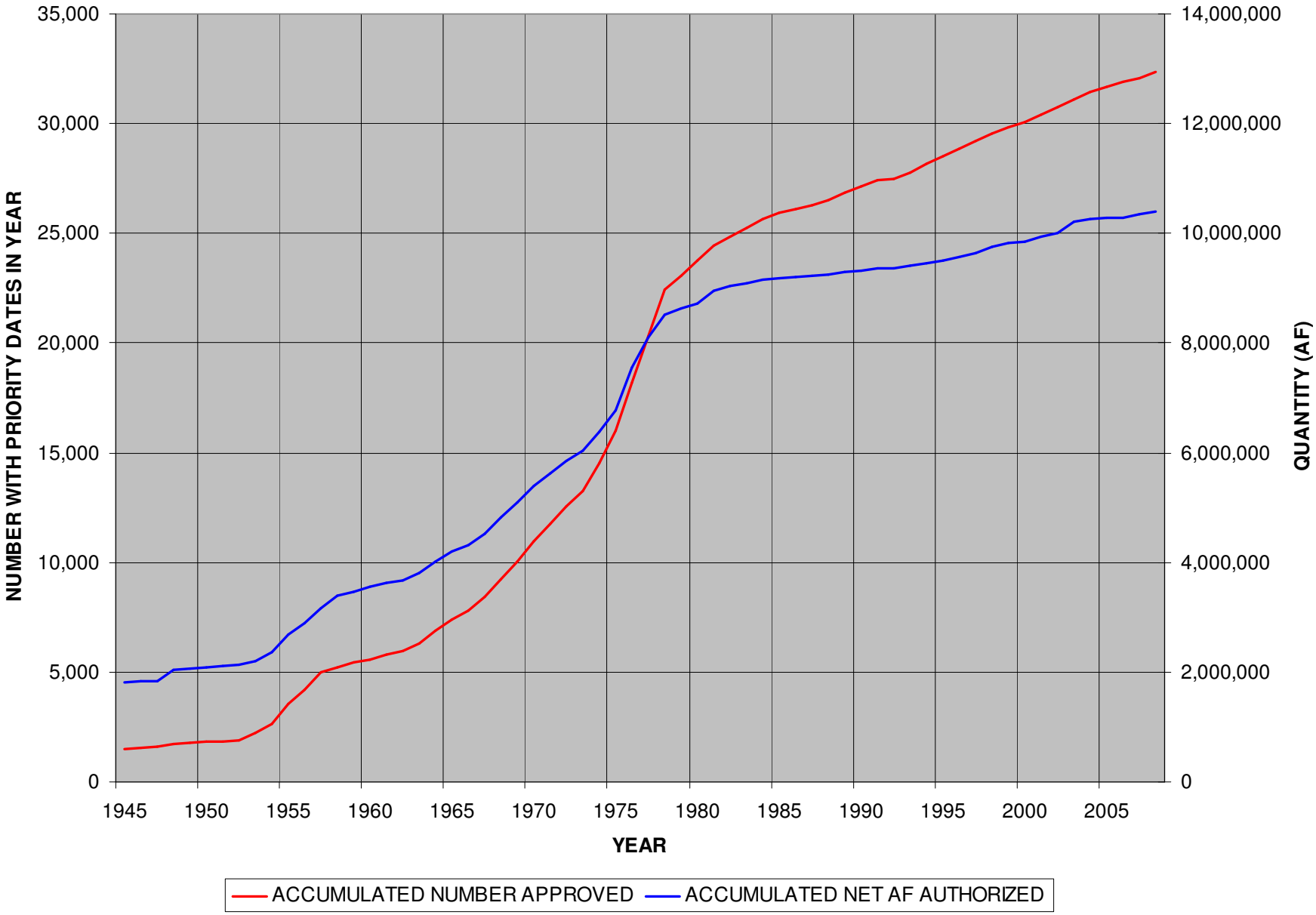
The Great Bend Prairie and Equus Beds aquifers are generally closer to the land surface (not as deep) and are more responsive to recharge. They are managed as sustainable systems. The Ogallala is generally deeper with less annual precipitation and has little natural recharge. Recharge estimates are in the 0.5 to 1 inch range annually.

Problem overview

- The Ogallala Aquifer of western Kansas
  - Significant remaining storage =approx. 100 MAF (although some not easily recoverable)
  - Limited recharge (1 MAF/year)
  - Appropriations = 5 MAF/year, Use= 3 MAF/year
    - Over-appropriation occurred prior to 1978 controls; knowledge of the problem.
  - Varying rates of water level declines, pumping rates
  - Varying remaining usable life – some areas done; many areas 25-50 yrs; some 100 yrs+

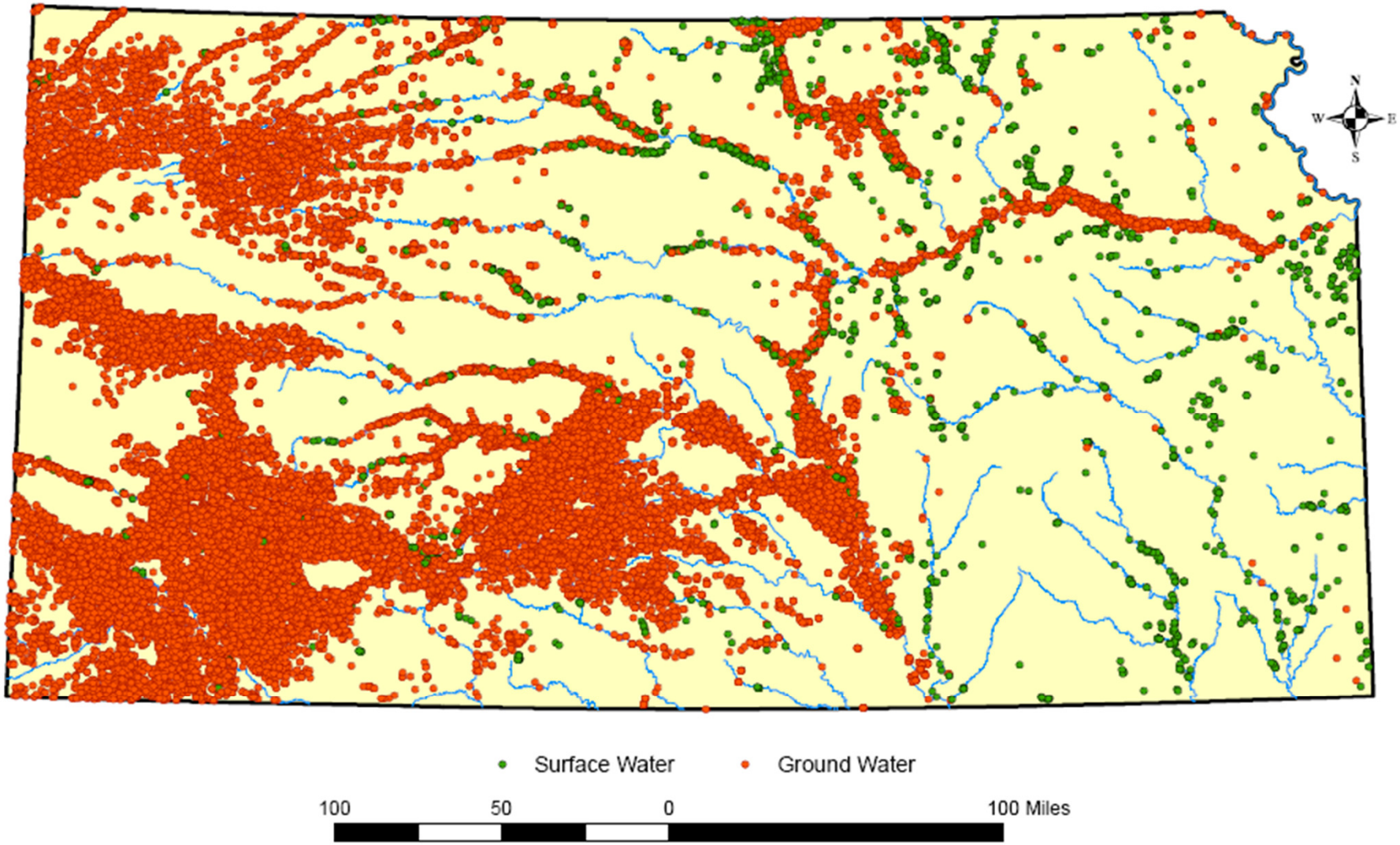
Kansas
Department of Agriculture
Division of Water Resources

Kansas Water Right Development

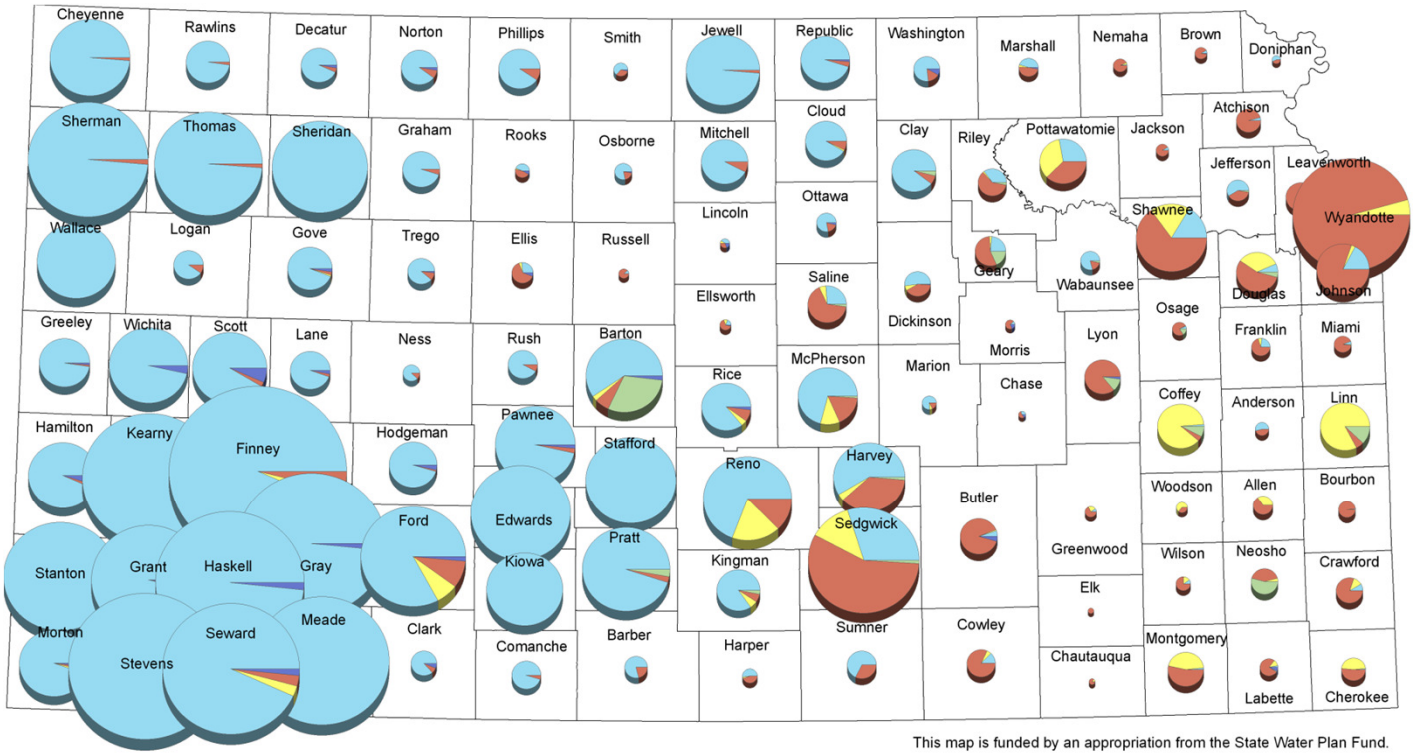


Kansas

Irrigation Points of Diversion



Reported Water Use by Type of Use for Kansas Counties



This map is funded by an appropriation from the State Water Plan Fund.

Disclaimer: Features on this map represent conditions as of the date of the map and are subject to change. The user is referred to specific polices, regulations and/or orders of the Chief Engineer.

Percentages of 1.5% or less do not show up in the pie charts.

This map is intended for planning purposes only.

Pratt: 70,221 AF
McPherson: 32,240 AF
Lane: 14,386 AF

Use Made of Water

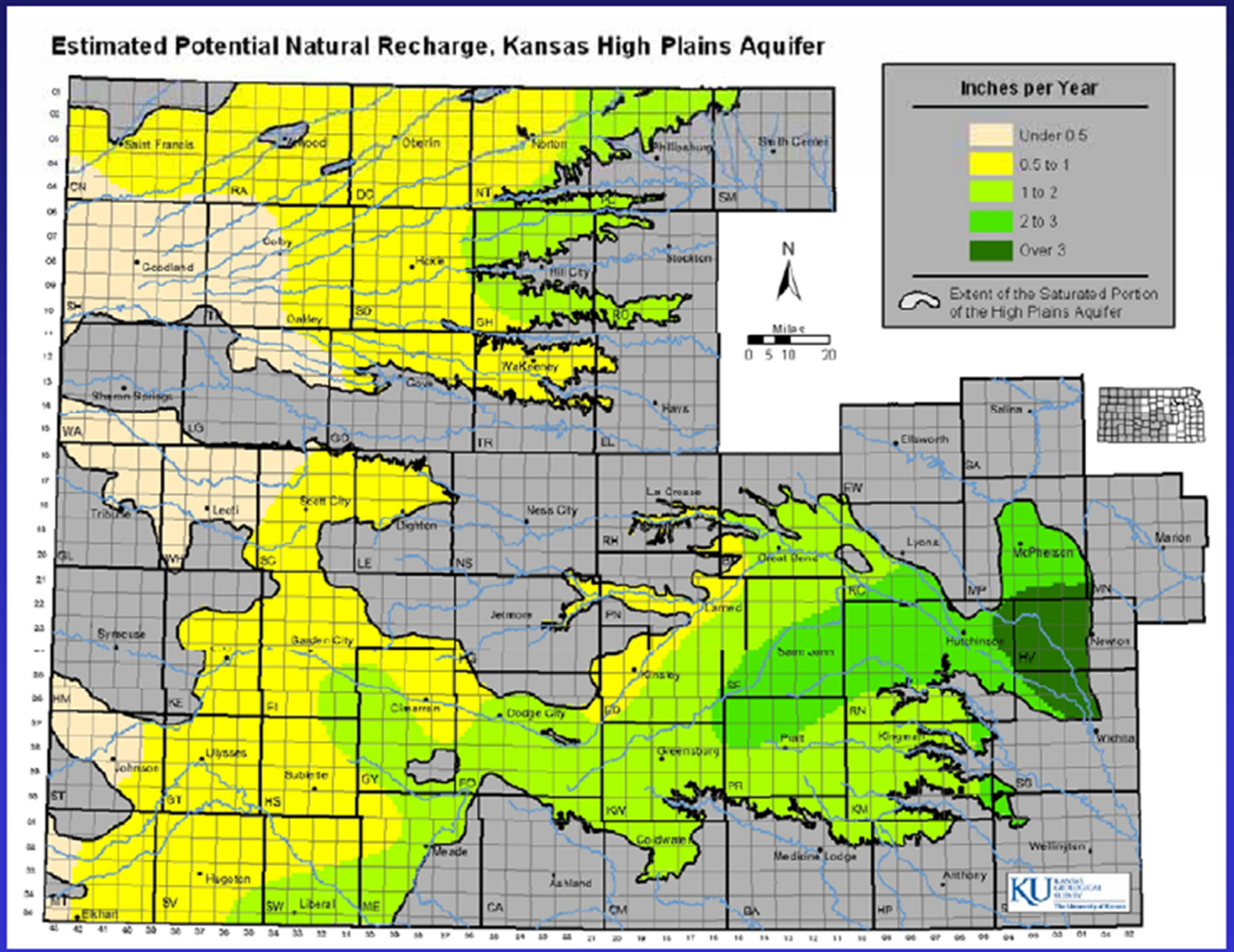
Irrigation
Municipal
Stockwater
Industrial
Recreation

0 37.5 75 150 Miles

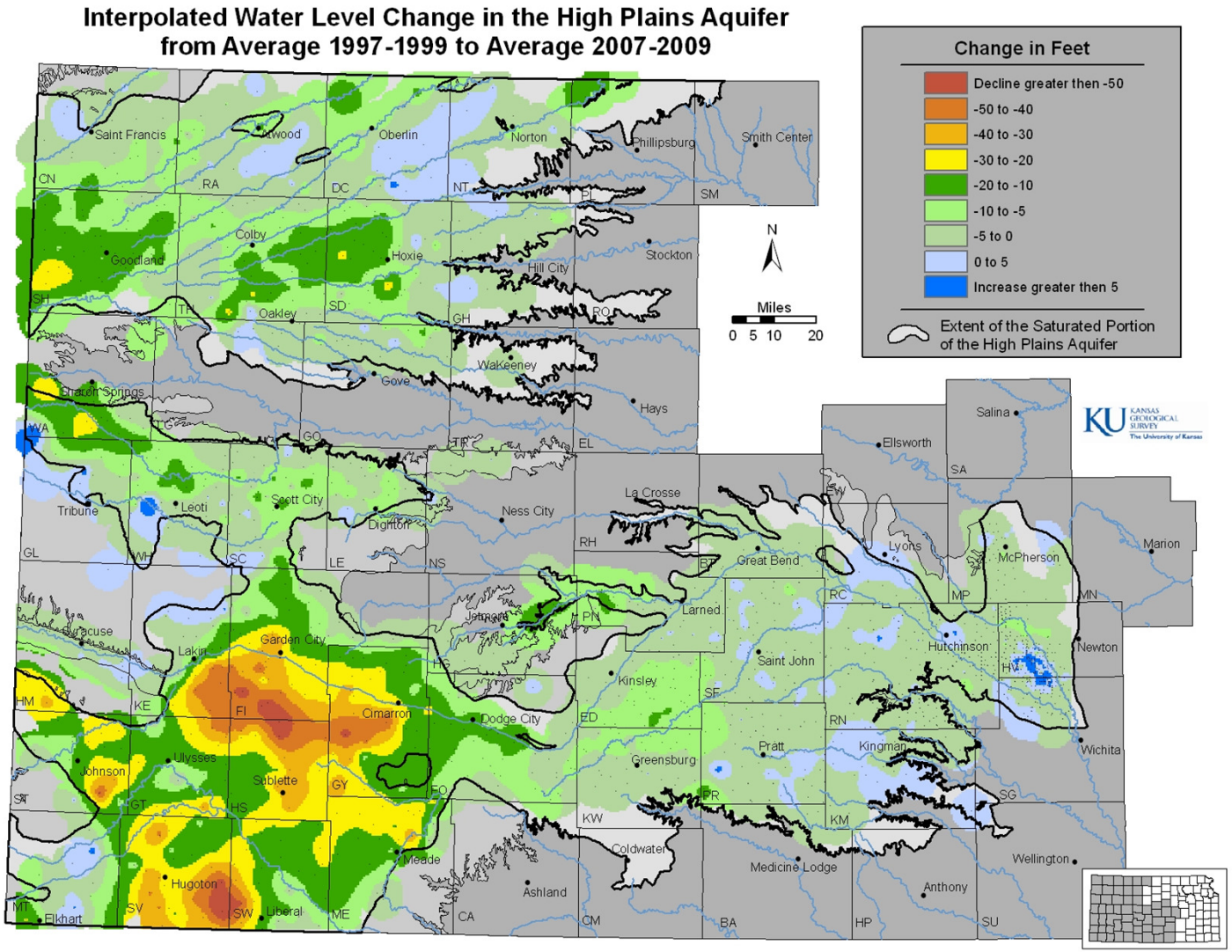
Kansas Department of Agriculture
Division of Water Resources
Water Use Unit
March 3, 2009

Kansas
Department of Agriculture
Division of Water Resources

Estimated Annual Recharge

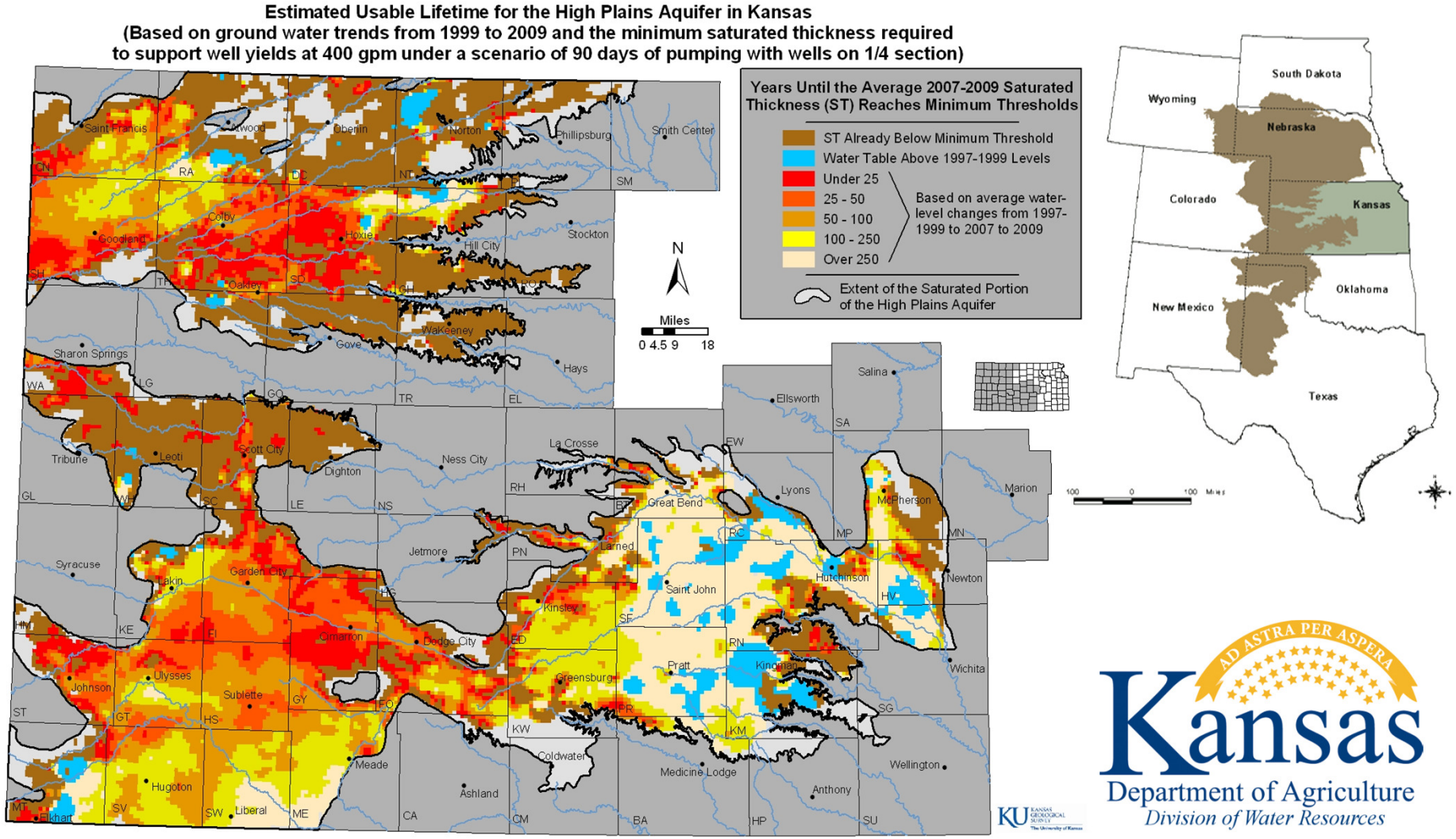


Withdrawals exceeding recharge results in groundwater declines



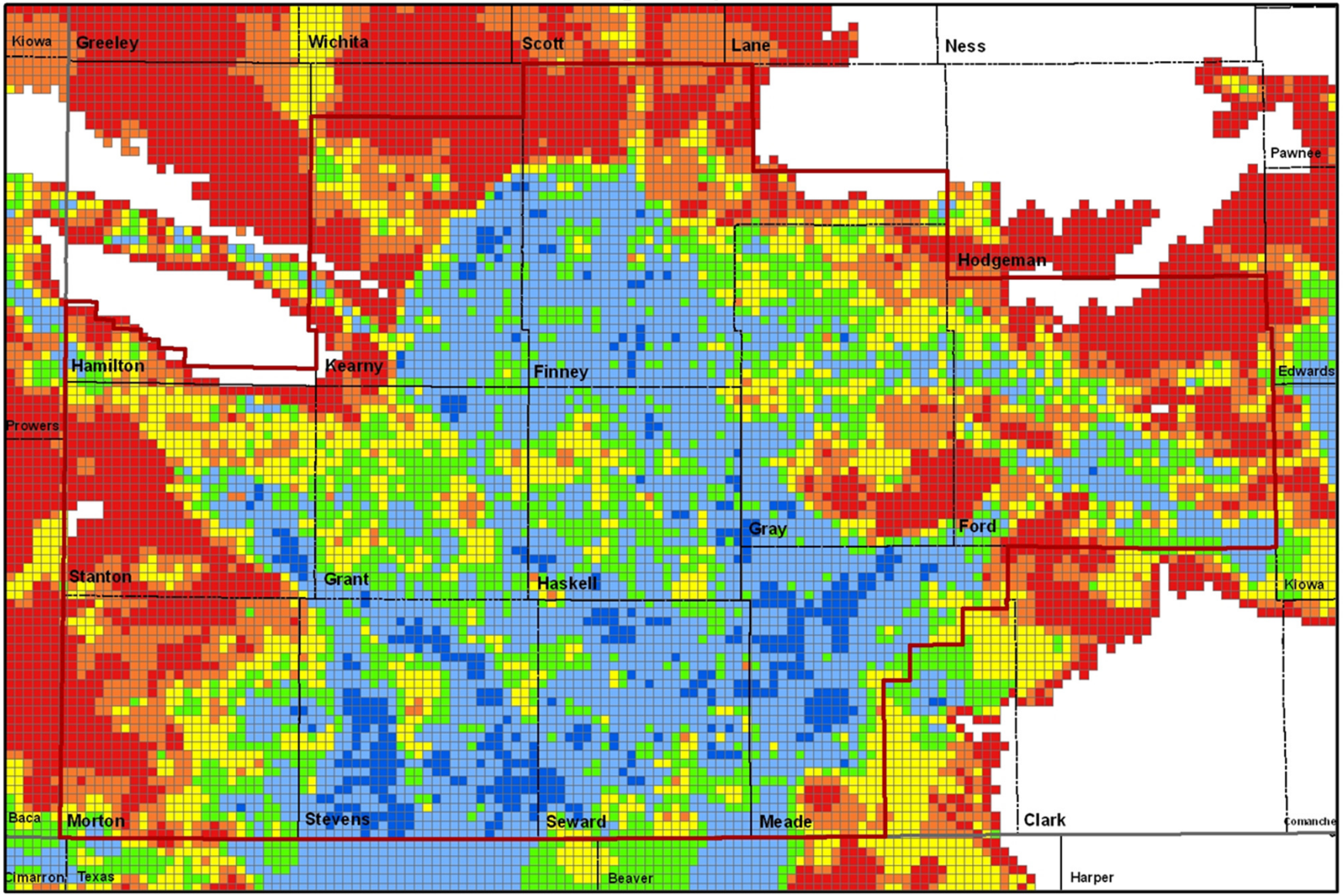
Kansas
Department of Agriculture
Division of Water Resources

Over-Appropriation:
Ogallala-High Plains aquifer is being dewatered



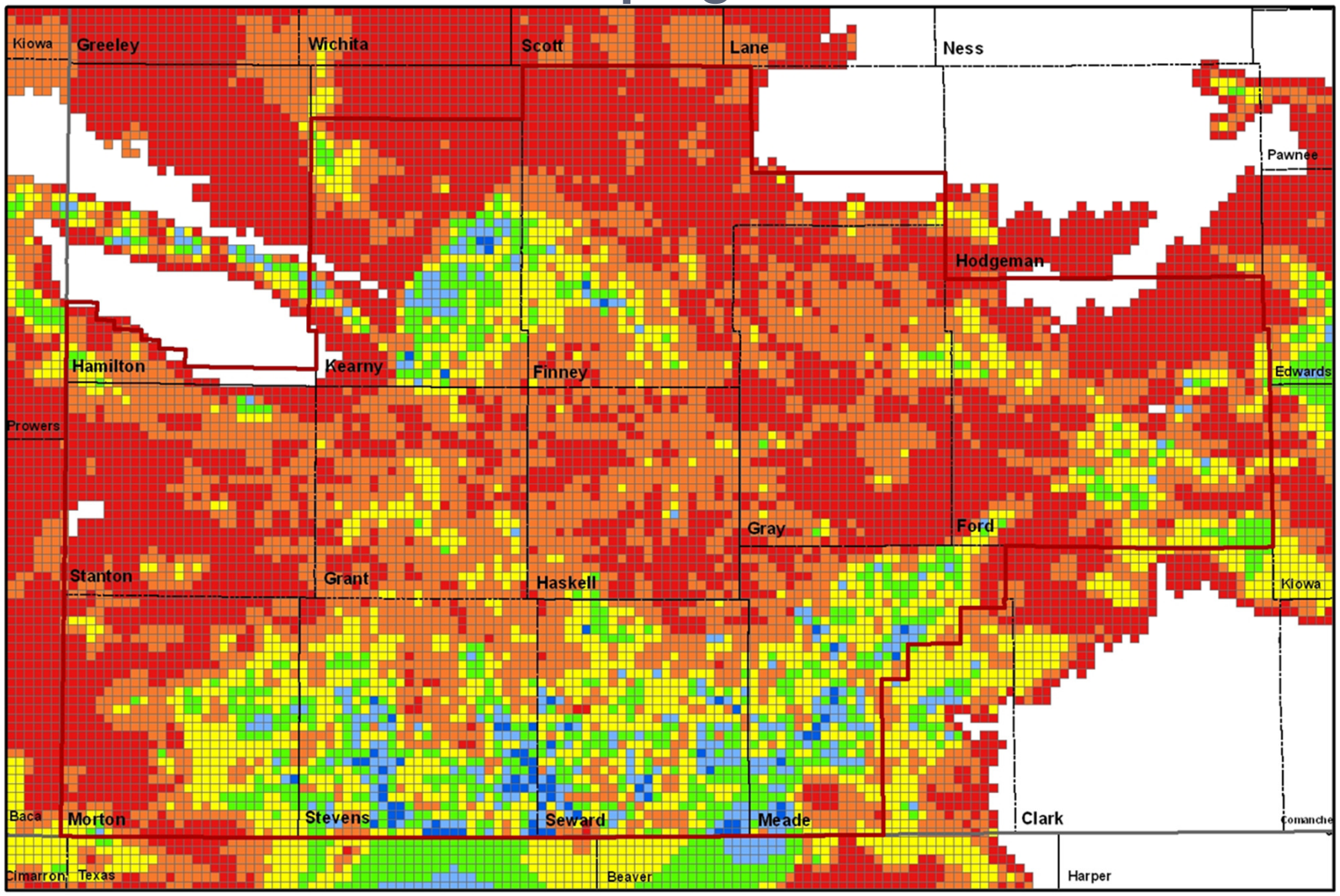
Kansas Department of Agriculture
Division of Water Resources

Practical Pumping Rates – 2008



KGS, 2011

Practical Pumping Rates – 2068



KGS, 2011

Today's challenge

- A storage depletion decision. How fast do we want to use it?
- How to manage?

Kansas
Department of Agriculture
Division of Water Resources

Kansas regulatory framework for groundwater management

- Hybrid of state control/local input
  - State control oversight (1945, 1978) under the Kansas Water Appropriation Act which regulates groundwater and surface water in a single priority system
    - Yet, over-appropriation happened
  - GMDs created to provide local input/leadership
    - Slowed/stopped development
    - Metering/study
    - Voluntary, incentive based reductions
  - Yes, over-appropriation unaddressed

Kansas Department of Agriculture
Division of Water Resources

KWAA Adaptations

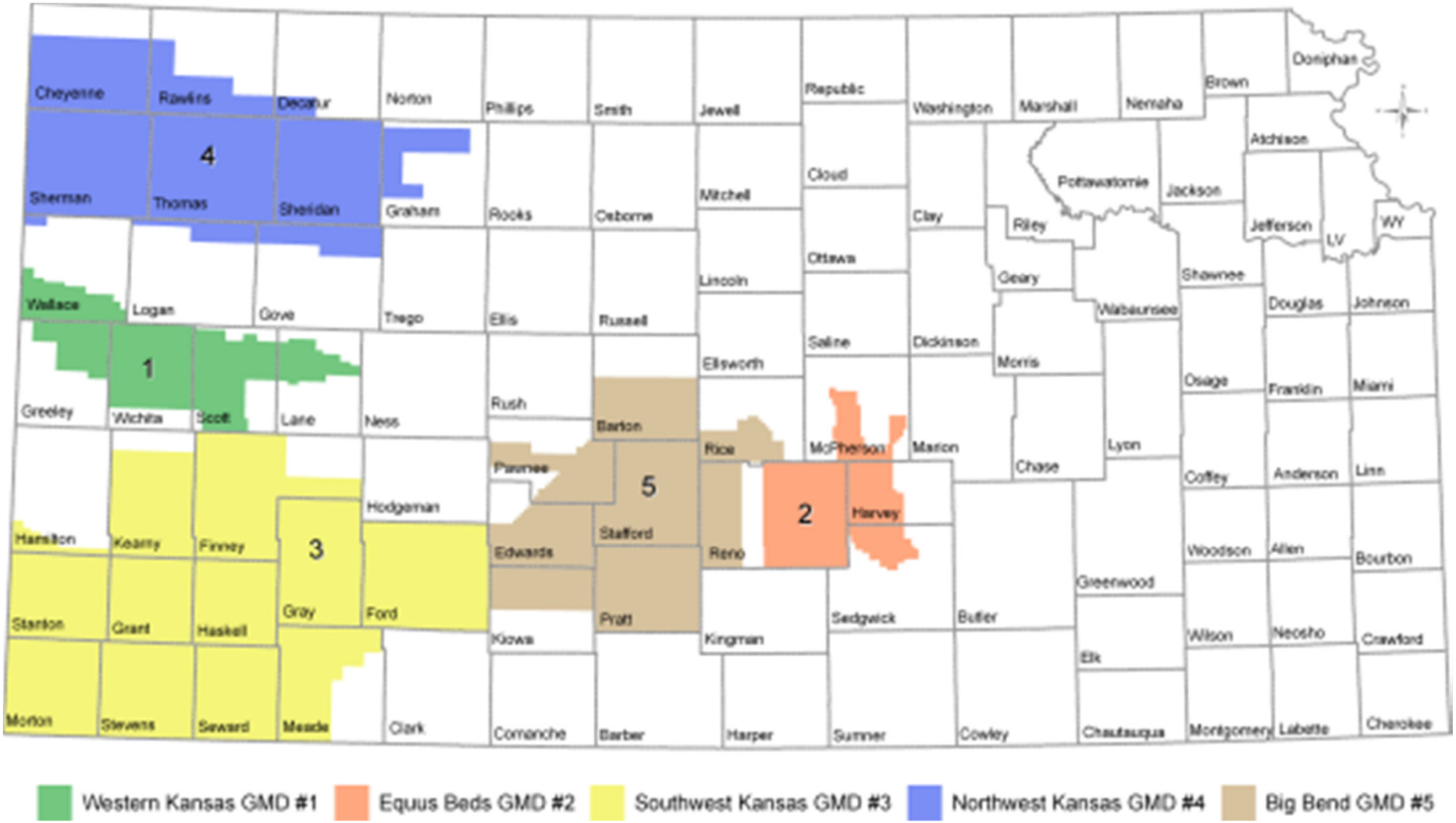
Year	Updates to Water Laws
1973	Groundwater Management District Act
1978	KWAA amended to require water rights for all non-domestic uses
1978	GMD Act amended, IGUCA provision added
Early 1980s	Significant new restrictions for new water rights (closing areas, using safe yield to guide development)
1984	Minimum desirable streamflows established
1989	Water use reporting improved via penalties for failure to report
2000	Significant new KWAA regulations

Groundwater Management District Act

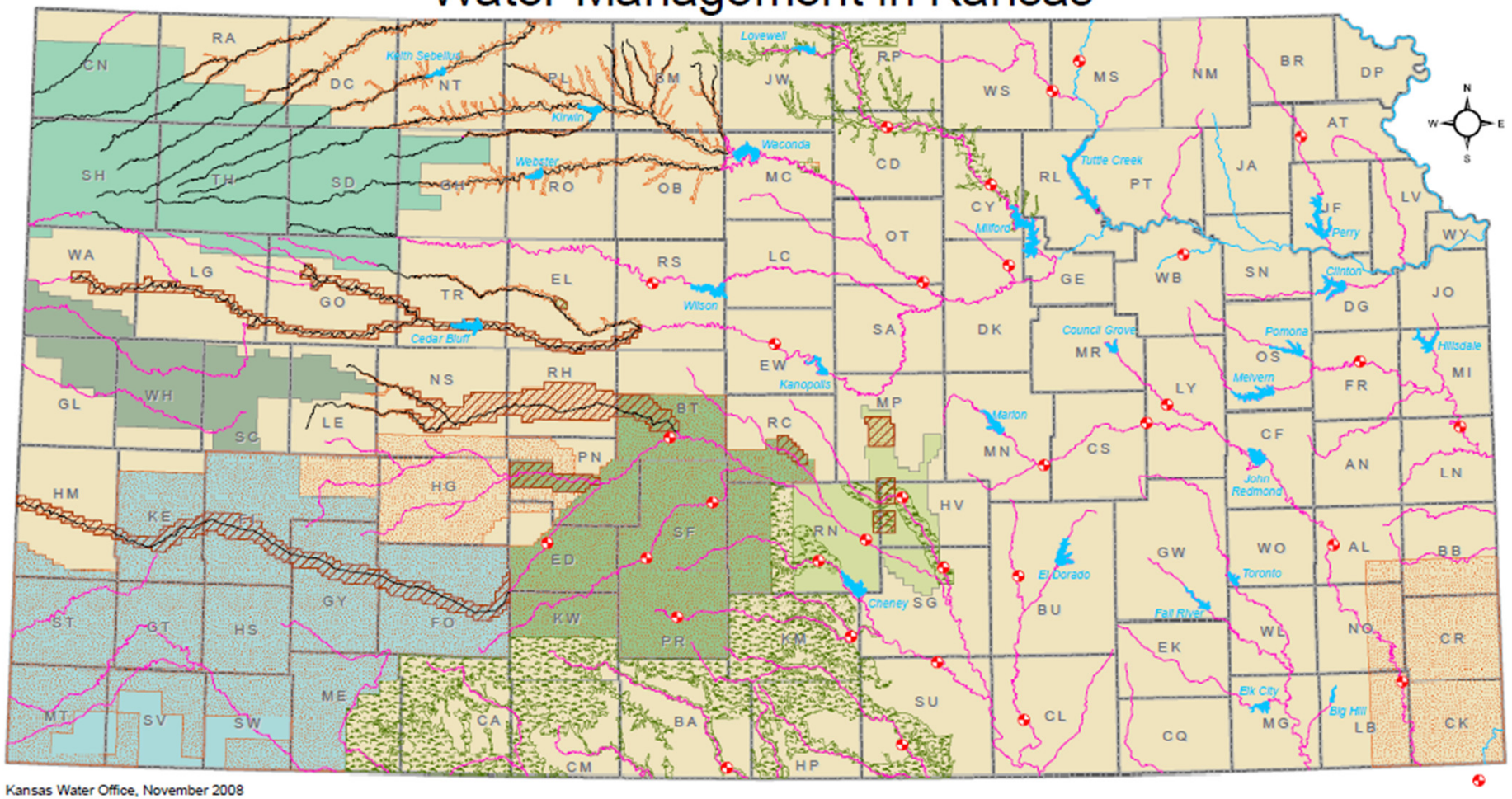
- Allows local people to help determine destiny – within state laws and policies
- Water users and landowners vote
  - Board elected, local funding
- Must adopt Management Program, subject to Chief Engineer's approval
- May recommend regulations and IGUCAs to the Chief Engineer
- Permit approval/regulatory authority remains with Chief Engineer

Kansas
Department of Agriculture
Division of Water Resources

Kansas Groundwater Management Districts



Water Management in Kansas



Kansas Water Office, November 2008

Minimum Desirable Streamflow Gage

Intensive Groundwater Use Control Area (IGUCA) or Special Water Quality Use Area (SWQUA)

Groundwater Management District

- Western Kansas GMD #1
- Equus Beds GMD #2
- Southwest Kansas GMD #3
- Northwest Kansas GMD #4
- Big Bend GMD #5

Closed or Restricted Area*

- Closed Stream
- Restricted Stream
- Unrestricted Stream
- Closed
- Special Restrictions

* See Regulation for details

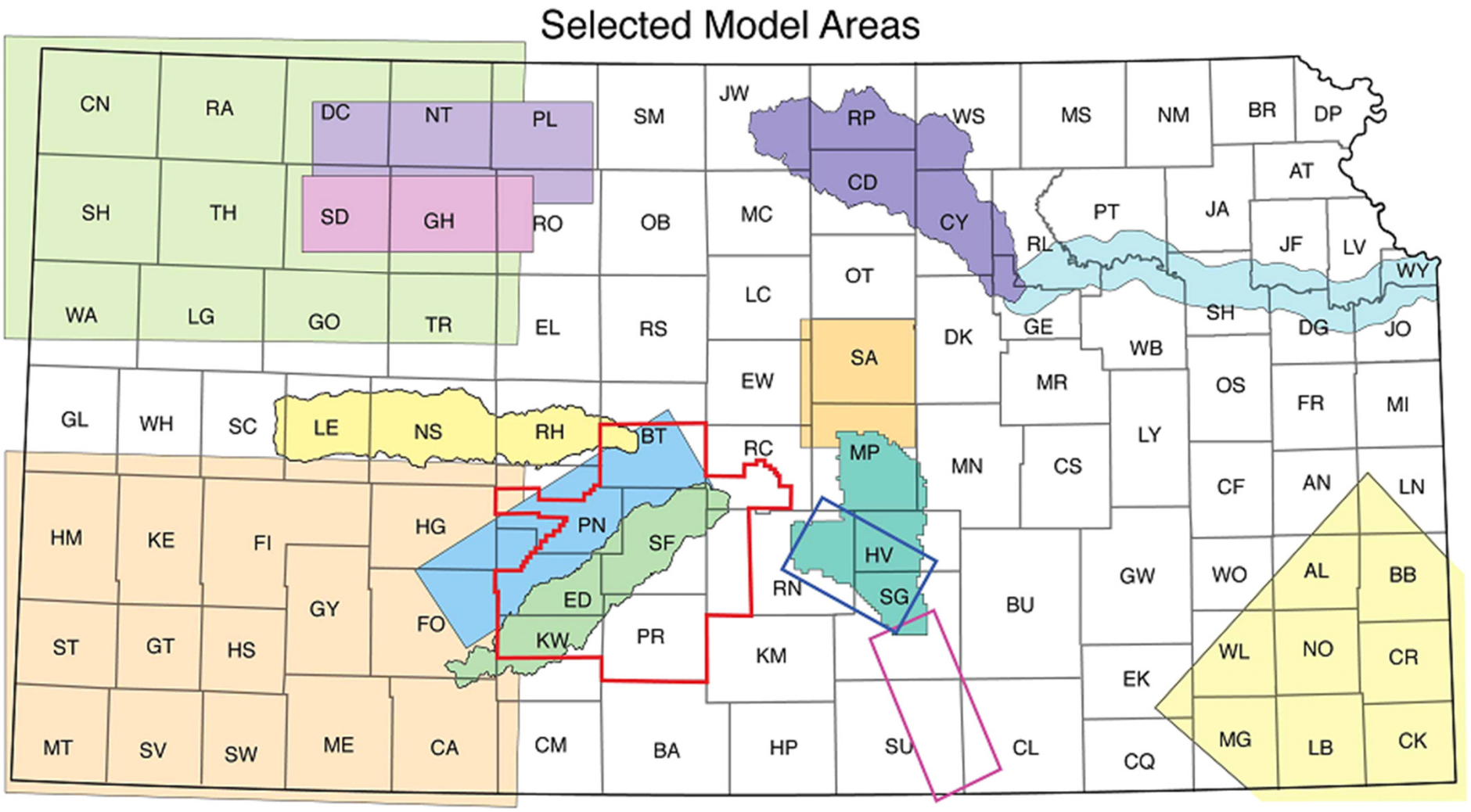
Source:
Kansas Department of Agriculture

More study

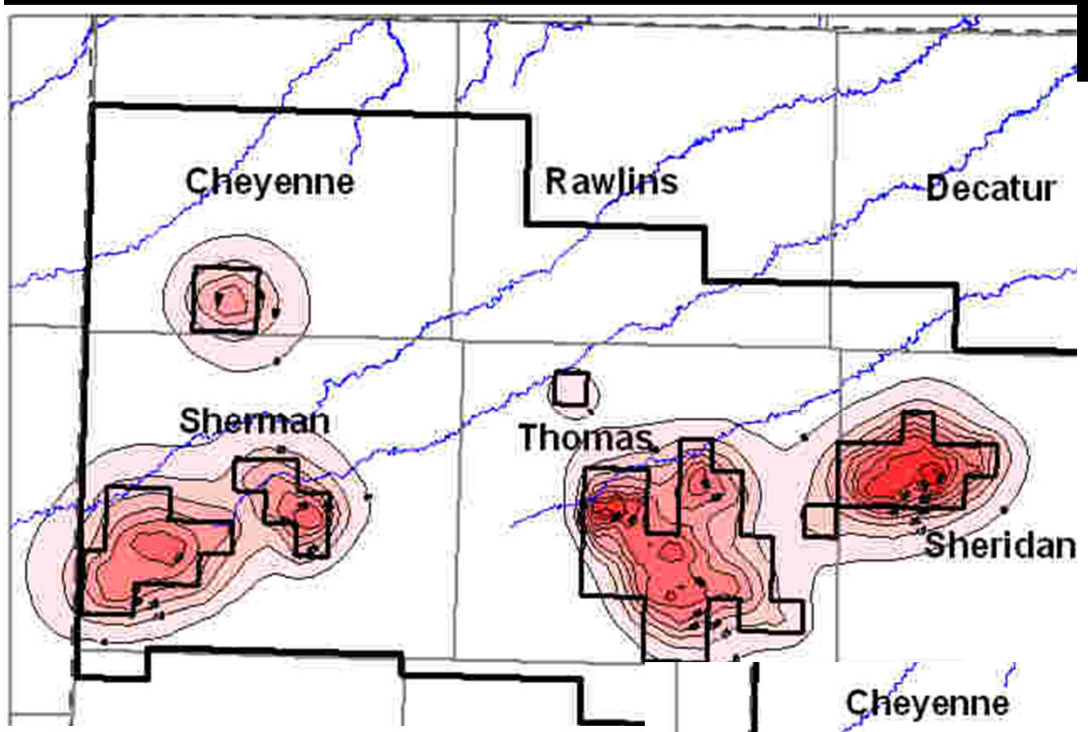
- Significant investment in building groundwater model
- Economic modeling to determine ways to reduce negative impact of reductions

Kansas
Department of Agriculture
Division of Water Resources

Use of groundwater models to assess future

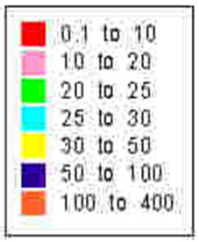


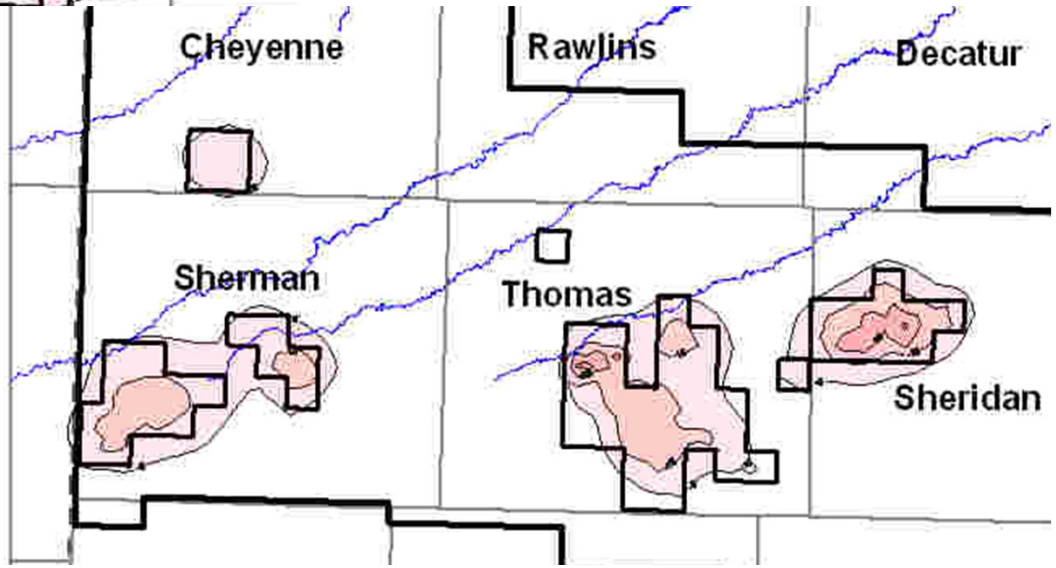
Exploring management options at subunit level



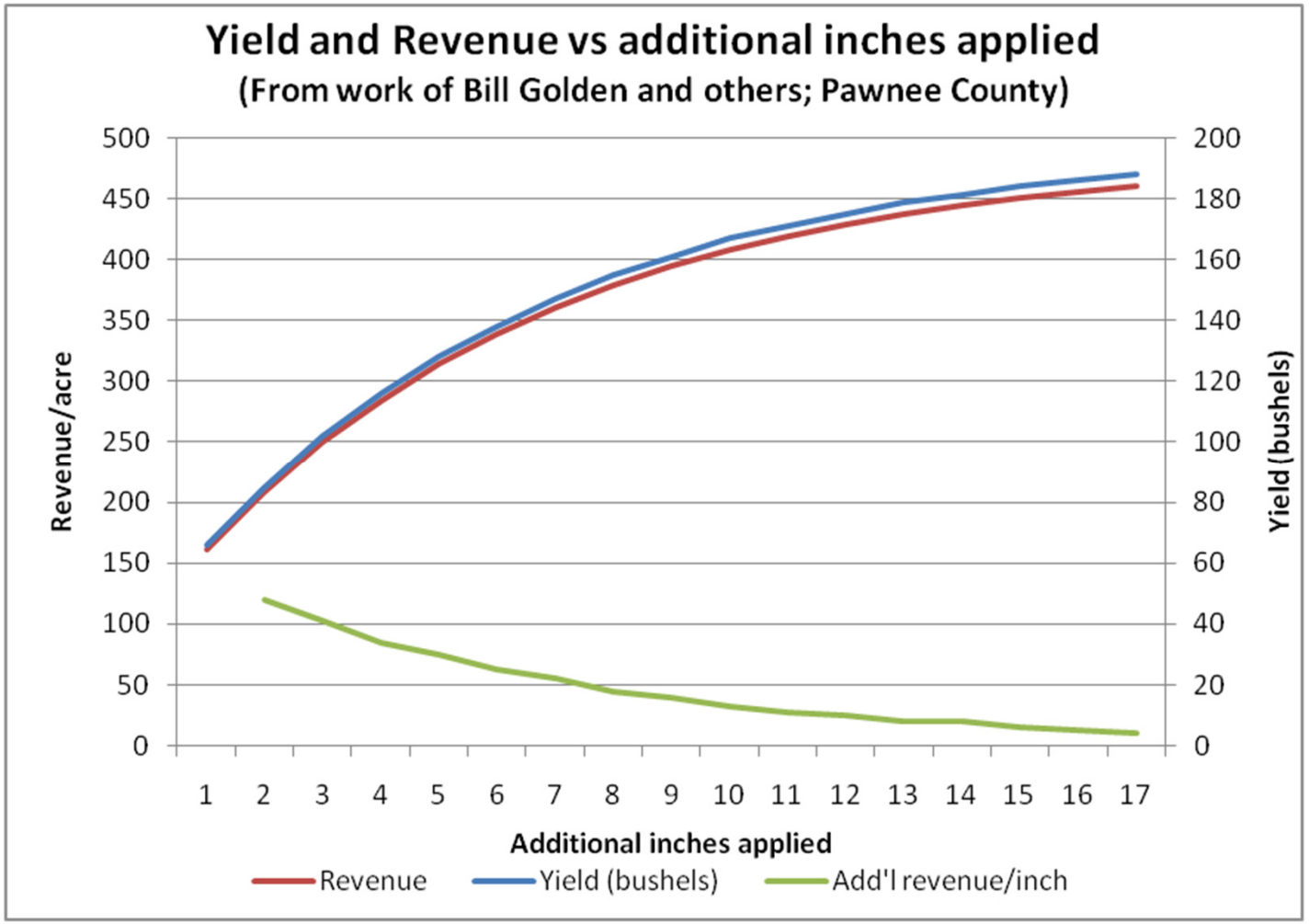
Future water level rises with no pumping in target areas

Future water level rises with 30% reduction in target areas





Economic studies: Law of Diminishing Returns



Kansas Department of Agriculture
Division of Water Resources

Will Increased Water-Use Efficiency Conserve Water?

- No – If well capacity is a limiting factor, increasing water-use efficiency increases the average value of water and producers will find a use for the 'saved' water. (This may also apply to other technologies such as drought resistant corn)

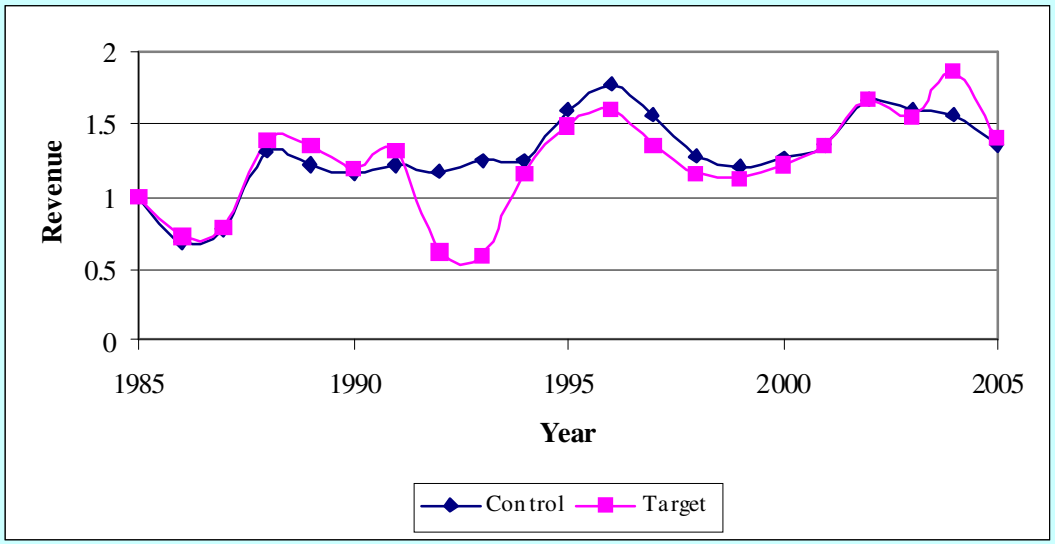
- If you define conservation as an absolute reduction in groundwater use – then additional regulation will be required.

Kansas
Department of Agriculture
Division of Water Resources

Water use regulation's input on regional economies?

- Evidence from the Walnut Creek case study
  - We may be over estimating the direct impacts
  - We may be over estimating the employment impacts
  - Producers develop and implement strategies to diminish the direct impacts

Figure 5. Time Series Comparison of the Indexed Values of Irrigated Crop Revenue



Kansas Department of Agriculture
Division of Water Resources

How to Reduce Economic Impacts?

- Water use restrictions are preferable to water right retirement (set a volumetric restriction and let the producer decide how to use it)
- Give as much advance notice as possible or phase in restrictions
- Allow trading or re-constituting of water rights
- Allow multi-year allocations
- Combine regulation with incentives (as an example modify CREP to allow partial retirement of the water right)

Kansas
Department of Agriculture
Division of Water Resources

Options to move forward

- Passive management
- Management by crisis
- Management by local policy
- Management by state policy
- Does management have to be the same everywhere?

Kansas
Department of Agriculture
Division of Water Resources

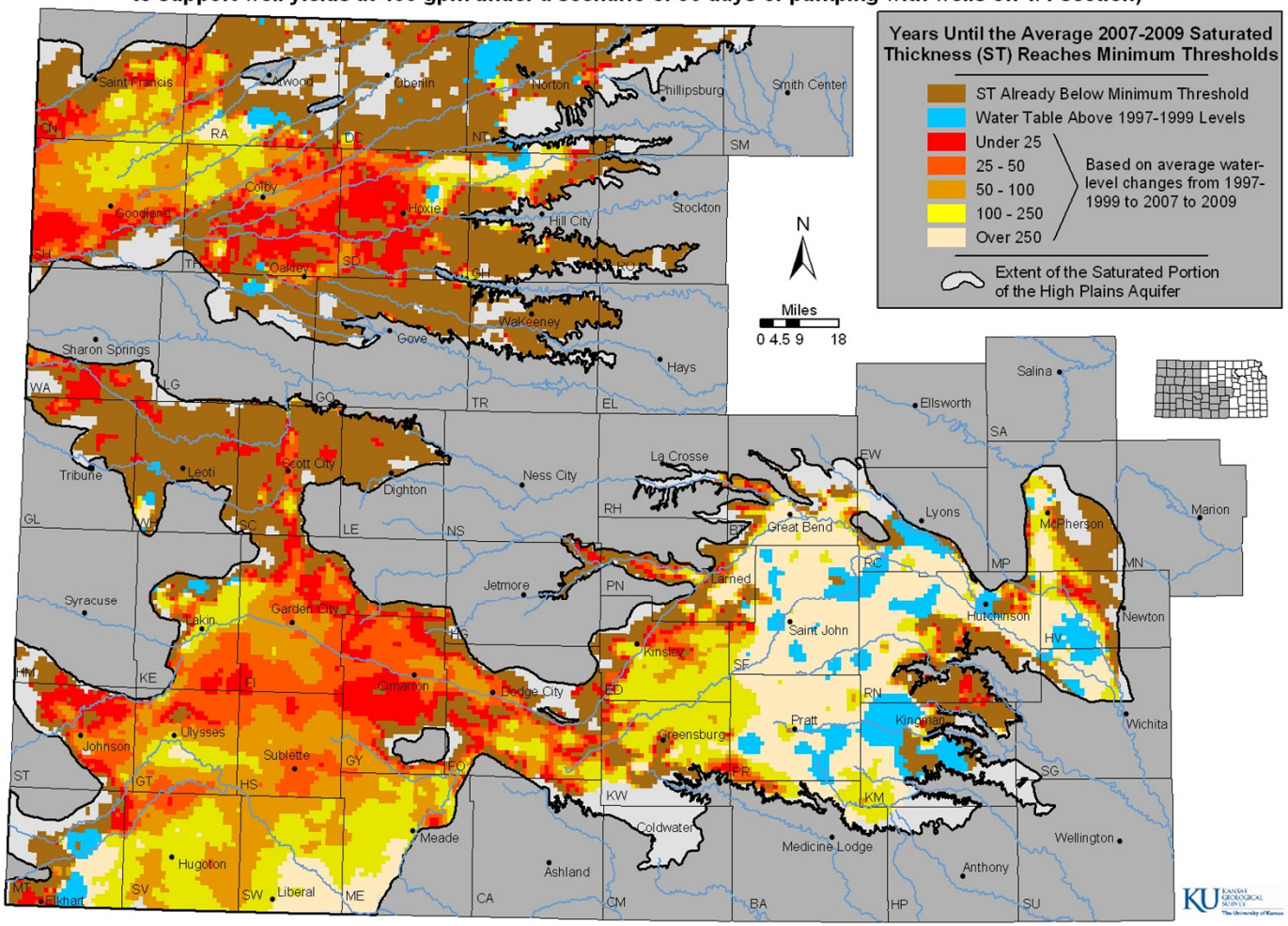
Passive management

- What controls use?
  - Water right limitations
  - Resource limitations (declining rates)
  - Movement to higher valued uses
- Requires senior water right holders accepting declines
- Limits future high valued uses when water runs out.
- GMD 1

Kansas Department of Agriculture
Division of Water Resources

Over-Appropriation:
Ogallala-High Plains aquifer is being dewatered

Estimated Usable Lifetime for the High Plains Aquifer in Kansas
(Based on ground water trends from 1999 to 2009 and the minimum saturated thickness required to support well yields at 400 gpm under a scenario of 90 days of pumping with wells on 1/4 section)



KU Kansas Geological Survey

Kansas Department of Agriculture
Division of Water Resources

Management by crisis – where will impairment complaints in groundwater systems take us?

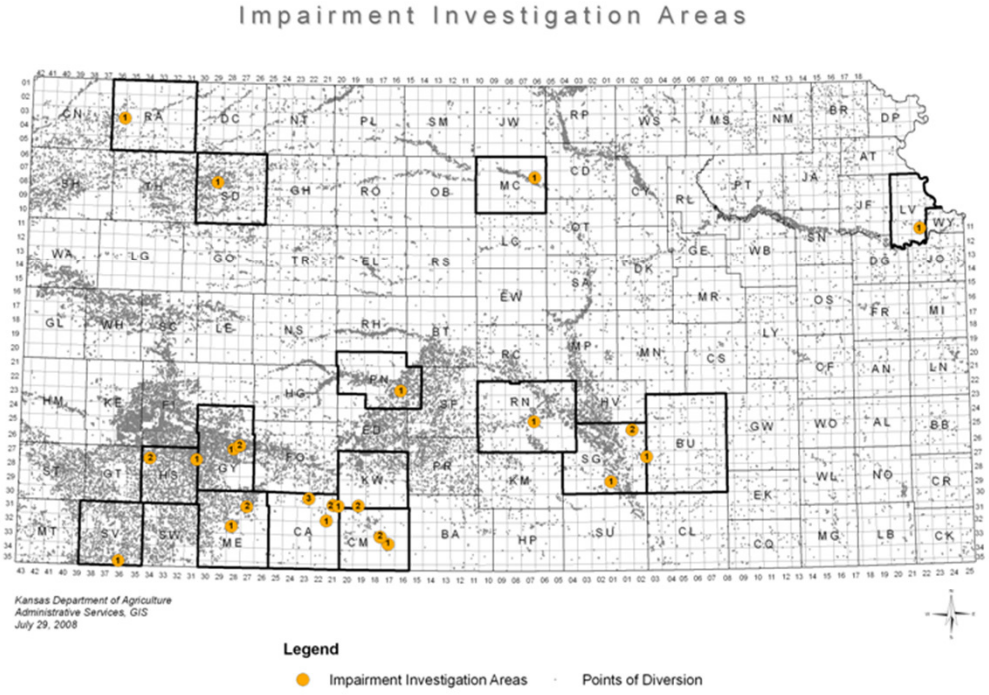
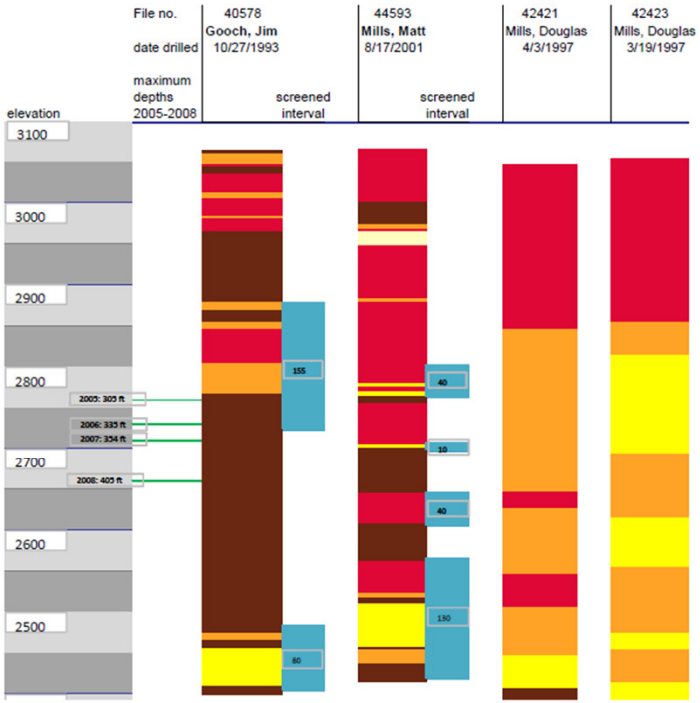


Figure 1. Lithologic profile of irrigation wells.

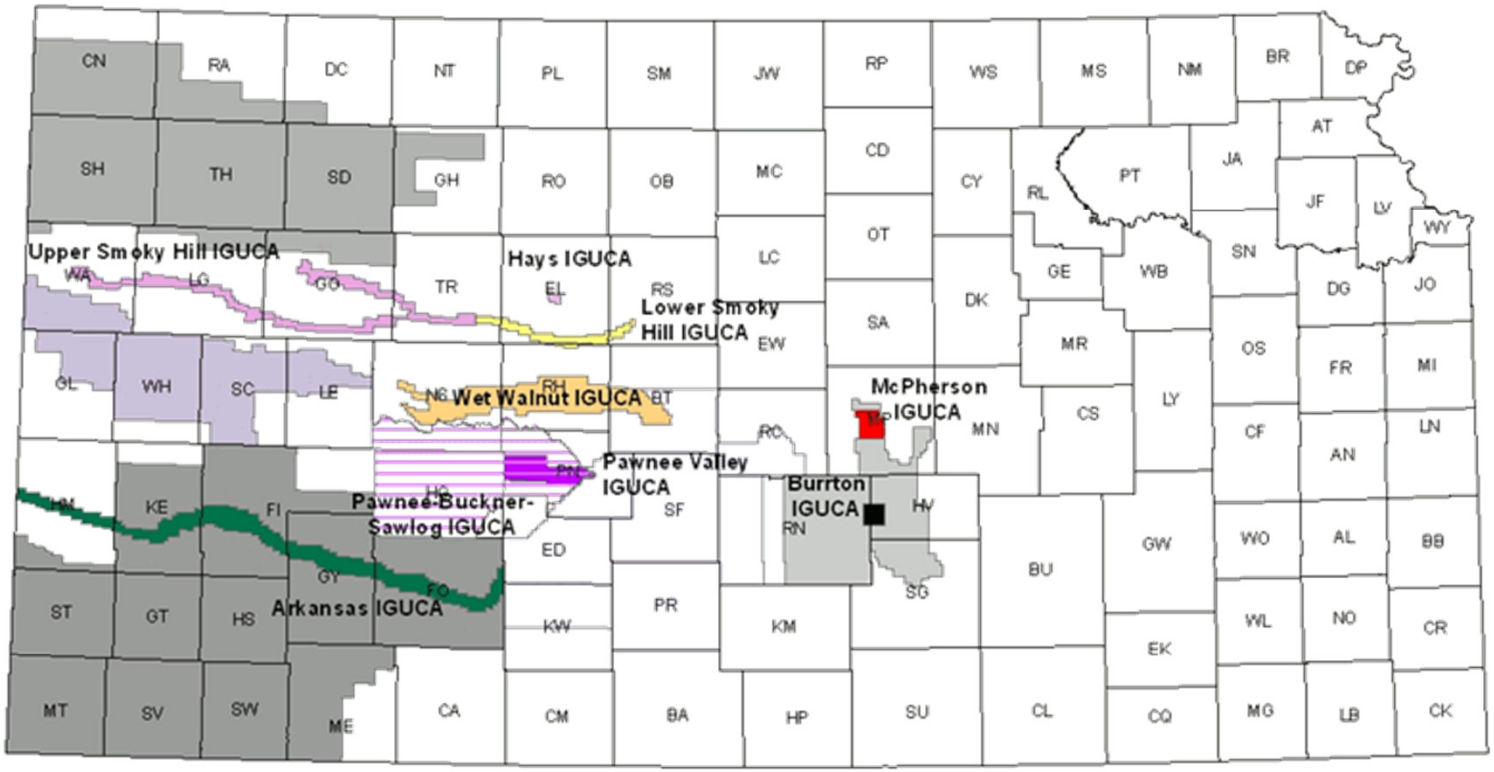


Intensive Groundwater Use Control Areas (IGUCAs) – the unused tool in the Ogallala

- Water management tool that works in conjunction with the Kansas Water Appropriation Act
- Provides alternatives to strict administration of water rights by priority
- Allows for flexible solutions
- Formal public hearings are held
- Chief engineer can amend an IGUCA in the public interest

Kansas
Department of Agriculture
Division of Water Resources

Intensive Groundwater Use Control Areas in Kansas



GMD

- Western Kansas GMD #1
- Equus Beds GMD #2
- Southwest Kansas GMD #3
- Northwest Kansas GMD #4
- Big Bend GMD #5

IGUCA

- Arkansas IGUCA
- Burrton IGUCA
- Hays IGUCA
- Lower Smoky Hill IGUCA
- McPherson IGUCA
- Pawnee Valley IGUCA
- Pawnee-Buckner-Sawlog IGUCA
- Upper Smoky Hill IGUCA
- Wet Walnut IGUCA

N

Kansas Department of Agriculture
Division of Water Resources
October 18, 2007

0 25 50 100 Miles

Management by local policy

- Why IGUCAs unused in Ogallala?
  - Once initiated, GMD looses control of the process.
- How to encourage local initiatives?
  - New legislative option: Local Enhanced Management Areas (LEMAs)
    - CE decides whether or not to adopt a specific plan recommended by the GMD
- Options being discussed
  - 5-year allocations in high priority area
  - District-wide allocation of the supply

Kansas Department of Agriculture
Division of Water Resources

Management by state policy

- If local management continues to be unable to substantively address:
  - CE initiate IGUCAs
  - CE identify problem areas, call for GMD action. If no action, initiate IGUCA
  - Create more restrictive definitions of "reasonable use" and/or "waste of water" in high decline area.
  - Other?

Kansas
Department of Agriculture
Division of Water Resources

Governor's Ogallala Initiatives

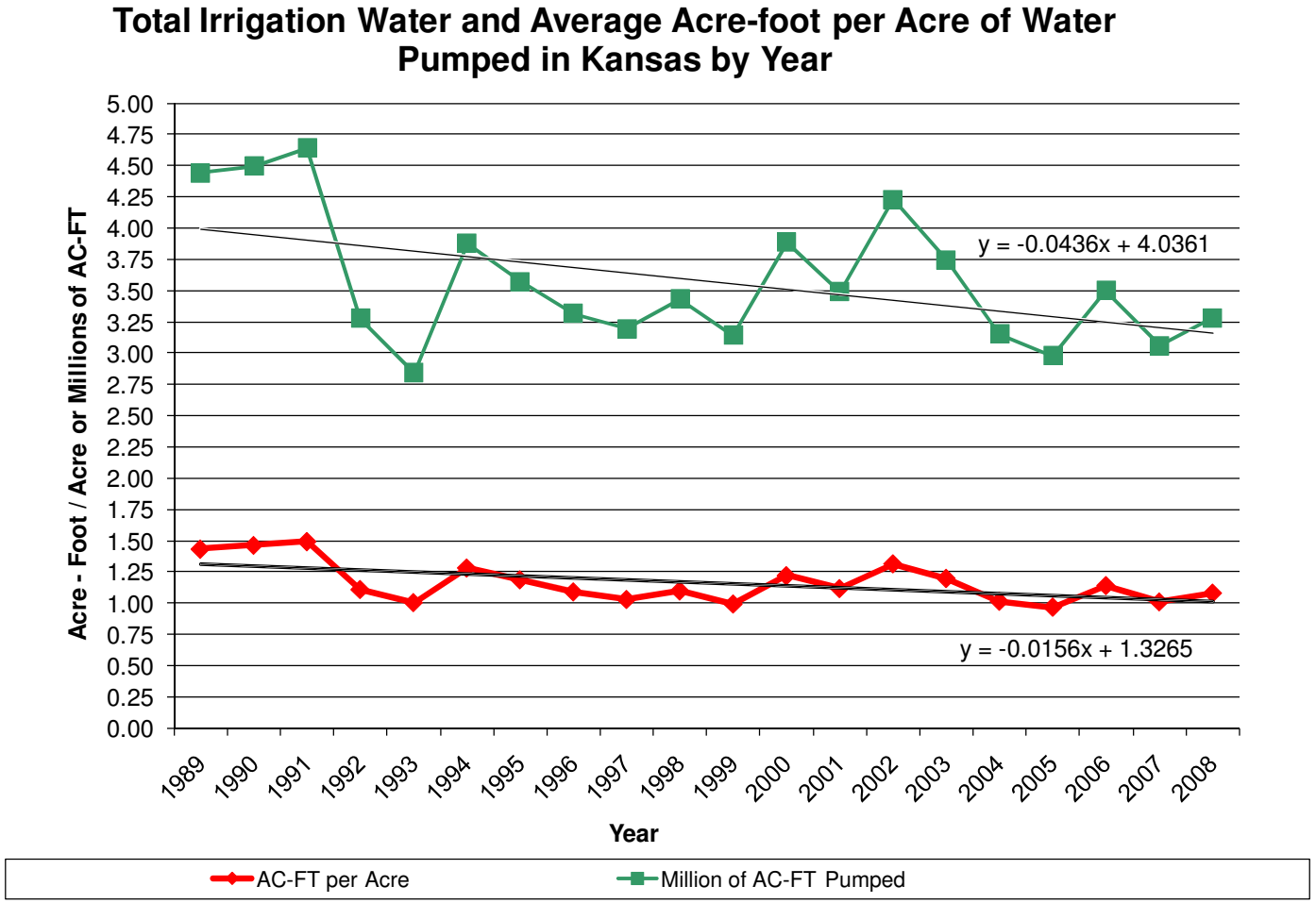
- Ogallala Summit in Colby in July, 300+ attend
- Ogallala Aquifer Advisory Committee established to follow-up
- First issues to be addressed(2012 Legislative session):
  - Review whether the KWAA's "use it or lose it" provision should be changed
  - LEMAs'

Kansas
Department of Agriculture
Division of Water Resources

Questions

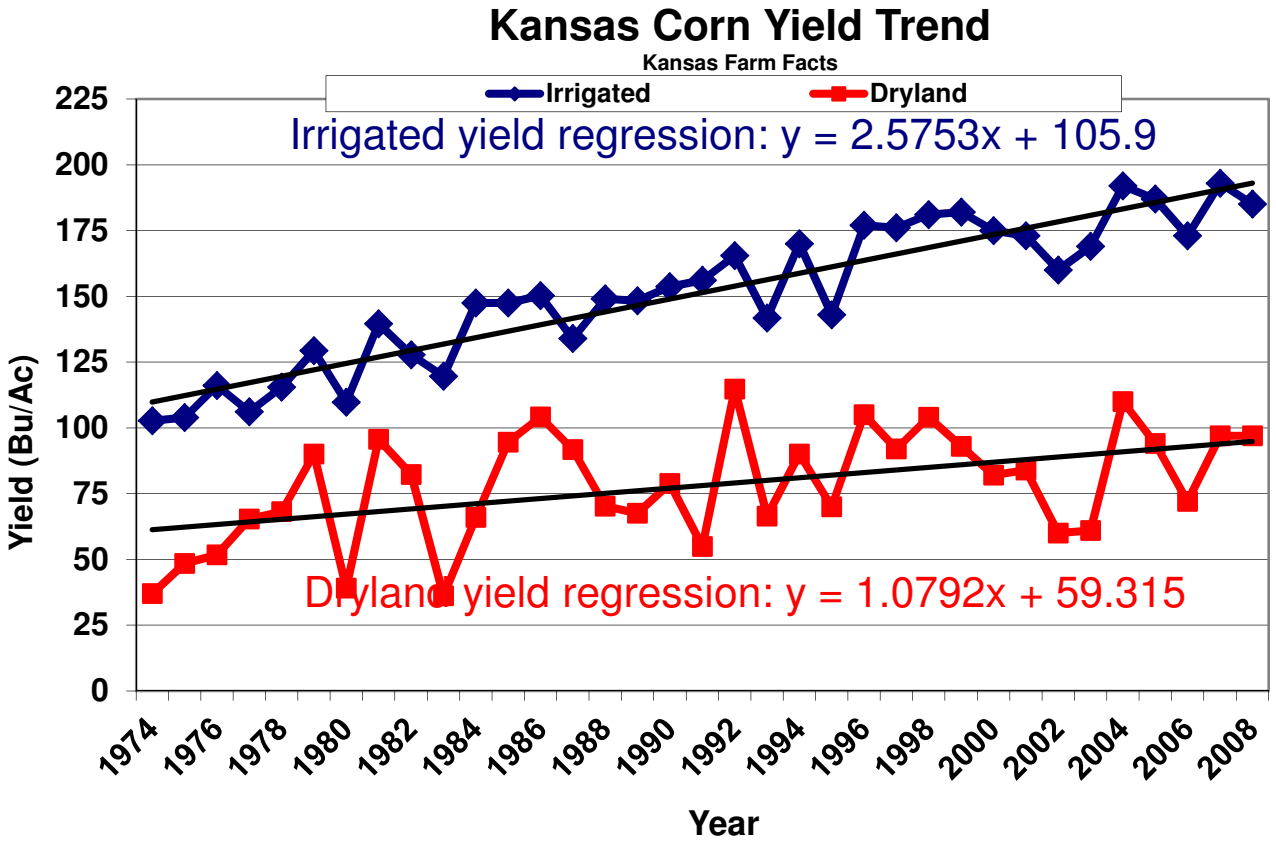
Kansas
Department of Agriculture
Division of Water Resources

There is a trend towards less reported irrigation pumping



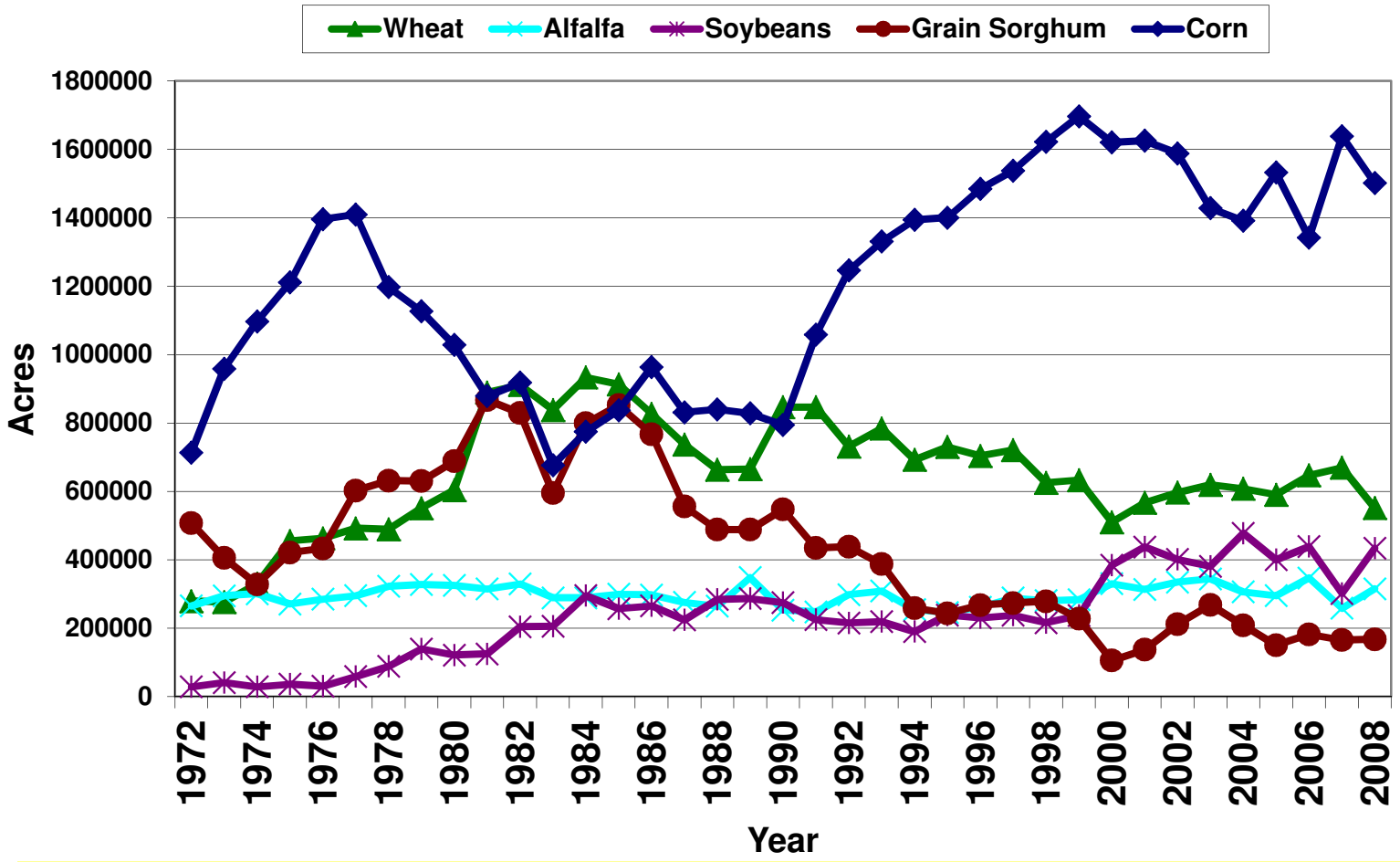
Kansas Department of Agriculture
Division of Water Resources

Irrigated yields are increasing 2.4 times faster than dryland and have much less variability



Kansas Department of Agriculture
Division of Water Resources

Major Kansas Irrigated Crop Acreage- 1972 to 2008



Corn is by far the primary irrigated crop in Kansas