Using GIS Tainted Glasses to Help Subdivide the Ogallala/High Plains Aquifer

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12th Annual GIS Day @ KU
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The High Plains Aquifer
The High Plains Aquifer in Kansas

Ogallala

Equus Beds

Great Bend Prairie
Accumulated Water Level Change, 1996 to 2012

Change in Feet
- Decline Over -70
- 60 to -70
- 50 to -60
- 40 to -50
- 30 to -40
- 20 to -30
- 15 to -20
- 10 to -15
- 5 to -10
- 0 to -5
- 0 to 5
- 5 to 10
- Increase Over 10

1996 to 1997
Water Management Activities, circa 2000

- Active discussions on the Ogallala Aquifer
  - Management and Technical Committees
  - Ogallala Two-Pool Concept

- Solomon Basin Advisory Committee Calls for Sustainability

- Governor Graves Call for Non-Depletion of Aquifers

- House Substitute for Senate Bill 287
  - Potential for Competing Water Needs for the Next 20 Years
  - Aquifer Resources and Transitions to Sustainability
    - KGS High Plains Aquifer Atlas

- Kansas Water Plan- Establish Aquifer Subunits across the Ogallala portion of the High Plains aquifer

- Apply Unique Management Plans
Kansas Water Plan directed the KGS to provide technical assistance to the western GMDs with aquifer subunits delineation.
Northwest Kansas GMD #4

Kansas Geological Survey
Kansas High Plains Aquifer Atlas

Predevelopment Saturated Thickness for the High Plains Aquifer in Kansas

Estimated Saturated Thickness (ft)
- Under 50
- 50 - 100
- 100 - 200
- 200 - 300
- Over 300

Change in Saturated Thickness for the High Plains Aquifer in Kansas, Predevelopment to 1997-99

Estimated Decrease in Saturated Thickness (ft)
- Increase
- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- Over 75

Estimated Usable Lifetime* for the High Plains Aquifer in Kansas

(* Usable lifetime is exhausted when saturated thickness is 30 feet or less)

Usable Years (from 1996)
- Already exhausted
- Not declining
- Under 25
- 25 - 50
- 50 - 100
- 100 - 250
- Over 250

Extent of the saturated portion of the aquifer Major streams

Values from interpolated surfaces are assigned to a PLSS section centers.
Northwest Kansas GMD #4 Subunit Criteria

Water Level Change

Water Usage
GMD #1 Municipal Buffer Zones
Western Kansas GMD #1 Subunit Criteria

Kansas Geological Survey
Western Kansas GMD #1 Subunit Criteria
Southwest Kansas GMD #3 Subunit Criteria

Water Use Density

Estimated Usable Lifetime

Biggest Hang-up: **Boundary Lines**
GMD #3 Subunit Wishlist

• Delineation of “Fuzzy” subunits

• Develop methodology to match ground-water extraction to some target volume

• Shared reductions by everyone (Vested water rights excluded)

• Honor water right priority dates (first in time, first in right)
  ◦ A little more to Senior rights
  ◦ A little less to Junior rights

• Focus on “Two-Mile” approach
The Geoff Bohling Solution……

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<td>Target (safe) yield:</td>
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<td>Target ratio of (% current FPDIV for most senior right) to (% current FPDIV for most junior right)</td>
<td>2</td>
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<td>Intercept of (%current FPDIV) vs. (Year-1964) line:</td>
<td>0.258129</td>
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<td>Slope of (%current FPDIV) vs. (Year-1964) line:</td>
<td>-0.01076</td>
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Current FPDIV | Year | (Year - 1964) | weight | FPDIV\*weight | % current new FPDIV |
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<td>835</td>
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<td>705</td>
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<td>0</td>
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<td>0.67</td>
<td>116.67</td>
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<td>135</td>
<td>1976</td>
<td>12</td>
<td>0.50</td>
<td>67.50</td>
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Weighted current yield: 2596.42
New total: 670.21

Example of Percent of Allocation based on Percent Reduction, Weighted Water Right Priority Year, and Water Right Allocations

Example graph showing percent allocation from 1964 to 1976 with specific years and allocation percentages.
Moving 2-Mile Circle Analysis

- Individual Water Rights will have different re-allocation amounts as relative priorities and budget targets change.
- 19753IRR39391 is part of 7 individual circle reviews.
- Percent of allocations ranges from 8.4% to 17.2%.
- Average of 11.9%.
GMD3’s 40/25 Rule

- Include budget allocation based on 40/25 Rule
  - 40% of storage used in 25 years
  - Involves other aquifer estimates
    - Annual Recharge
    - Saturated Thickness
    - Specific Yield
    - Time
  - Spatially Access Aquifer Parameters from the Section-Level Database
Average Percent of Current Authorized Quantity, by Point of Diverison, to Match 40/25 Volume
Southwest Kansas Groundwater Management District #3

40/25 Allocation Parameters
Water Rights Conditions as of 06/09/2003
Average Saturated Thickness 2003 to 2005
USGS Estimated Specific Yield (OFR 86-414)
USGS Estimated Recharge (WR17 87-4228)
Buffer Distance = 2 miles

Location Map

The Kansas Geological Survey compiled this map using data thought to be the most reliable information available. The Kansas Geological Survey does not guarantee the accuracy of data entered or calculations and disclaims any legal responsibility or liability for interpretations made from this map, or decisions based thereon.
Questions????

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