Can the Ogallala Aquifer Sustain Long Term Ground Water Production?

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TOPICS

• High Plains (Ogallala) Aquifer
• Design of Efficient, High Capacity Wells
• Water Conservation
• Future Ground Water Development
High Plains Aquifer (Ogallala)

- Largest Aquifer in U.S.
- 111.8 million acres (175,000 mi²)
- Some development in 1930s & 1940s
- Increase from 2.1M irrigated acres in 1949 to 13.7M acres in 1980
- 15.5 M acres in 2005
* Ogallala wells typically produce between 200-500 gpm, some 1000+ gpm; some <50 gpm

* Generally good quality water (TDS<1000 mg/l)

* Aquifer is being ‘mined’ by intense use
Water level changes, 1950-2011

Source: McGuire, 2012
Saturated Thickness changes, 1950-2011

Source: McGuire, 2011
Decrease in Saturation Means

- Existing wells lose production
- Increased pumping costs with depth
- Less water available for new wells
- New wells must be deeper (if possible)
- Water quality degrades (increased salinity)
- Abandoned farms
- Increased regulations
Ogallala Aquifer

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Well Drilling
Types of Wells

- Domestic
- Municipal
- Commercial
- Irrigation
Types of screen

- Torch cut
- Plasma cut
- Saw cut (PVC)
- Mill slot
- Wire wrapped
- Louvered

Photo from johnsonscreens.com
Well Development

- Removes drilling fluid from filter pack and formation (increases production)
- Removes fines from filter pack, properly grades filter pack and formation for long term sand-free production

Photo from Driscoll, 1986
Why is Well Efficiency Important?

BENEFITS OF HIGH WELL EFFICIENCY

* Energy cost savings
* An efficient, sand-free well will save a farmer significant money on energy costs to produce the water and the well and pump lifetime will be extended significantly.

PUMPS FAIL

* When you need it the most.....
* During the hottest time of the irrigation season.....
* When the pump contractor is servicing a municipal well for a bigger client.....
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Water Conservation

Average daily parlor discharge (gal)

Water conservation in milking parlors, A Tale of 3 Dairies
Water Conservation
Consequences of Water Waste

- Decreased aquifer life
- Decreased pump life
- Decreased well life
- Increased cost of well replacement (deeper wells, deeper pump setting, more HP required)
- Increased energy costs
- Increased water rights acquisition cost
- Green water lagoons must be larger
- More green water to manage
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Ogallala Options – Moving Forward

- Conservation
  - Change to less water intensive crops
  - Utilize water saving technologies (center pivots, sub-surface drip, soil moisture monitoring, etc.)
  - Eliminate water waste in barns
- Ogallala has recovered in areas of CRP lands
- Ogallala Initiative – NRCS paying farmers not to pump
- Explore deeper aquifer options
Dockum Aquifer (AKA Santa Rosa)

- Encompasses 96,000 mi²
- Underlies Ogallala aquifer, separated by low permeability shales (redbeds)
- Variable thickness (0 to >2000 ft thick)
- Variable yield (<40 to >2000 gpm)
- Variable water quality (<500 to >10,000 mg/L TDS)

Map from Bradley and Kalaswad (2003)
Dockum Aquifer (cont.)

- Relatively few wells
- Even fewer wells with good data (at least in public record)
- Some Municipal wells in TX (Hereford, Tulia, Happy)
- Recharge is limited (isotope data suggest 20,000 to 30,000 year old water)
Prospecting for low TDS water
Higher drilling, completion and production costs
Reduce risk by drilling slim hole
  * Geophysics
  * Lithology
  * Zone testing for water quality
Production may not warrant large diameter casing (>12 in casing)
Minimum $250,000 for production well
Where Do We Go From Here?

- Continue Ogallala production but manage pumping to prolong aquifer life
- High efficiency, smaller diameter wells specifically designed to a declining Ogallala water table can reduce local drawdown and require less energy to pump ground water
- Conservation is most effective way to reduce water use/cost
- Budget $$$ to prospect in Dockum
- Blend Ogallala and Dockum water to meet production and water quality needs
Questions/Discussion

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