Pitfalls in Ground Water Planning

Dr. Todd Halihan
Oklahoma State University
School of Geology
In more honest times, scientists used observations to test the accuracy of models. Today, models are used to discredit observations.

-Dr. Malcolm Ross-
Stratigraphy of Ideas – Adapted from E.O. Wilson

- Interesting – relationship may exist
- Suggestive – relationship seems to exist
- Persuasive – relationship exists enough to fight about it
- Compelling – relationship exists to strong critic, acknowledges scientific defeat
- Obvious – nobody fights against idea, because we always have known it to be true
Instinct – “deeply filled or permeated”

What is this a picture of?
- glass ?
- water ?
- ice ?
- air ?

The very essence of instinct is that it's followed independently of reason.

Charles Darwin

http://www.greatervernonwater.ca/
Were our water management strategies DEVELOPED FROM DATA and REASON?

Or did they EVOLVE from available technology and instincts?
Poor Water Instincts

1. Surface water is foundation for supply
2. Ground water is limited
3. Should spend <$25M on ground water evaluation
4. Most water is stored at surface
5. Most water leaves basins through rivers
6. Systems are at steady state
7. Cannot “make” water with policy
“Pore” Water Instincts

1. Ground water is foundation for supply
2. Ground water is best storage solution
3. Should spend >$10M on ground water evaluation
4. Most water stored in the subsurface
5. Most water leaves through evapotranspiration
6. Systems are NOT at steady state
7. Can “make” water with policy
Fundamental Goal of Water Management

If we can accommodate instincts and preconceptions…

- **Store** as much water as possible as efficiently as possible – while having zero or negative **Basin Water Use**
Where to store drinking water?

Surface Water – 0.12 M km$^3$ - $1B/km^3$

Ground Water
8 M km$^3$
$0.0001B/km^3$
Storage of water at the surface
Storage of water at the surface

700,000,000,000 liters of water evaporated each year
Storage of water at the surface

Intended Use? – Banking Fee?
Storage of water at the surface

In Oklahoma, evaporation from man-made lakes could supply water to ~20 million people.

Would cost over ½ Billion to produce with desal plant.
Difference between a reservoir and an evaporation basin?
Lake Optima, OK
Water Supply, Recreation, Flood Control

- 12 years to complete
- $25 million
- 15200 ft long (2.88mi)
- 618,500 acre feet

Is this water storage?
What is the total cost?
Water “Use” and Stream Flow

- Water is converted to another form when it is “used”. Water is not “lost” or “burned”

- Stream flow is only a spring discharge from either a point source or a line source
Where is the water used?

Rain

ET

Runoff
to ocean
How to “make” water

1. Increase the amount of rain
2. Turn off rivers
3. Decrease the amount of evapotranspiration
How to “make” water?

The Water Budget Paradox

World Desalination Capabilities

- Denver Cloud Seeding

ADDED DEPOSITS

Amistad
Mead
Powell

Ogallala Irrigation ET

1% of US Evapotranspiration

LOST WITHDRAWALS
How to “make” water?

Decrease the amount of evapotranspiration

- No coordinated effort
- Reduced by 3.6% will “make” all the water the US uses
- 3.6% = 20x entire world’s desalination capabilities
How do you reduce ET?

1. Make water use important for crop prices
2. Manage other basin vegetation
3. Store Water Underground
   - Why is it against our instincts to store water underground?
   - Why don’t we calculate the amount of water we can “make” to determine our project budgets?
How to “make” water profitably

1. Modify water policy to limit Basin Use
2. Modify water policy to encourage making water
3. Modify water laws to align with data, not instincts
4. Invest in water projects that further goals
Balance the budget with policy incentives

1. Paid to recharge vs evaporate
2. Modify crops to reduce ET
3. Power Generation
Add to Oklahoma’s Strengths

- Huge intellectual capital in the state for subsurface and agricultural technologies
- Methods and Policy Framework needed Worldwide
- Oklahoma is a leader in Energy Production - can use same skills to lead in Water Production
Questions????