

Aquifer-Based Ground-Water Management

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WHAT IS THE ISSUE?

“The country cannot sustain even the current levels of ground-water use, never mind the projected increases in ground-water consumption in the next two decades. Our enormous expansion of ground-water pumping since the 1940’s...has caused a number of serious environmental problems.” (Such as rivers drying up, wells going dry, subsidence, loss of wetlands, springs, lakes)

**From “Water Follies” by Robert Glennon, 2002,
Island Press—page 32**

GROUND-WATER USE

- **Accounts for 98% of fresh water in the world**
- **GW USE (2000) (USGS)**
 - **25% (1.5 billion) of world population use GW**
 - **USA- 83.3 bgd (14 % increase from 1985)**
 - **140 million people (50%) in USA drink GW**
 - **PWS use increased 400 % between 1950 & 2000**
 - **GW use for irrigation increased from 24 % of total irrigation use in 1950 to 42 % in 2000**

Current Approach to GW Management

- **State governments**
 - **Withdrawal & use of ground-water administered by different agency than regulation / protection of ground-water quality**
 - **Within DEQs and Public Health Dept. –gw management related to protection of quality is commonly split among numerous programs**

Current Approach to GW Management

- **State governments**
 - i. SDWA programs focus on drinking water**
 - ii. CERCLA / RCRA programs focus on cleanups**
 - iii. Non-point source programs focus on ag chemicals in gw**
 - iv. Storm water management (CWA Sec??)**
 - v. Wetlands (CWA Sec 404)**

Current Approach to GW Management

➤ **Federal Gov'ts role in gw management**

- Derived from 16 different federal statutes
- Federal role primarily related to cleanup authorities under CERCLA / RCRA / drinking water protection
 - Not very active in ground-water management
- No national framework for monitoring or standards
- Poor transboundary cooperation – many aquifers span State boundaries

PROBLEMS RELATED TO CURRENT GW MANAGEMENT

- **Not aquifer based**
- **Fragmentation of management at Federal/State level**
- **Poor coordination between water supply and water quality management programs**
- **Inadequate recognition of GW/SW connections**
- **Rules/regulations not aimed at preventing aquifer mining**
- **Decline in resources and emphasis on GW protection, especially monitoring programs**

WHAT CAN BE DONE?

- **Need to refocus and strengthen ground-water protection / management efforts at State / Tribal level**
- **Better coordination between Federal; State /Tribal and local governments** (for example – GW quality may be impacted by land use in recharge area –which may be indifferent county or state)
- **Federal leadership**
- **Implement aquifer-based approach to ground-water management**

Aquifer-Based GW Management

- **Aquifers and aquifer systems are natural units of management for ground-water just as a stream, lake or watershed are natural units of management for surface water.**

Aquifer-Based GW Management

- Aquifers have mappable boundaries that are delineated based on:
 - Geologic features (formation boundaries)
 - Hydrologic features (flow system divides)
 - Water quality (quality related to aquifer mineralogy)
- Aquifers have hydrologic / hydraulic properties that are routinely assessed using standardized methods

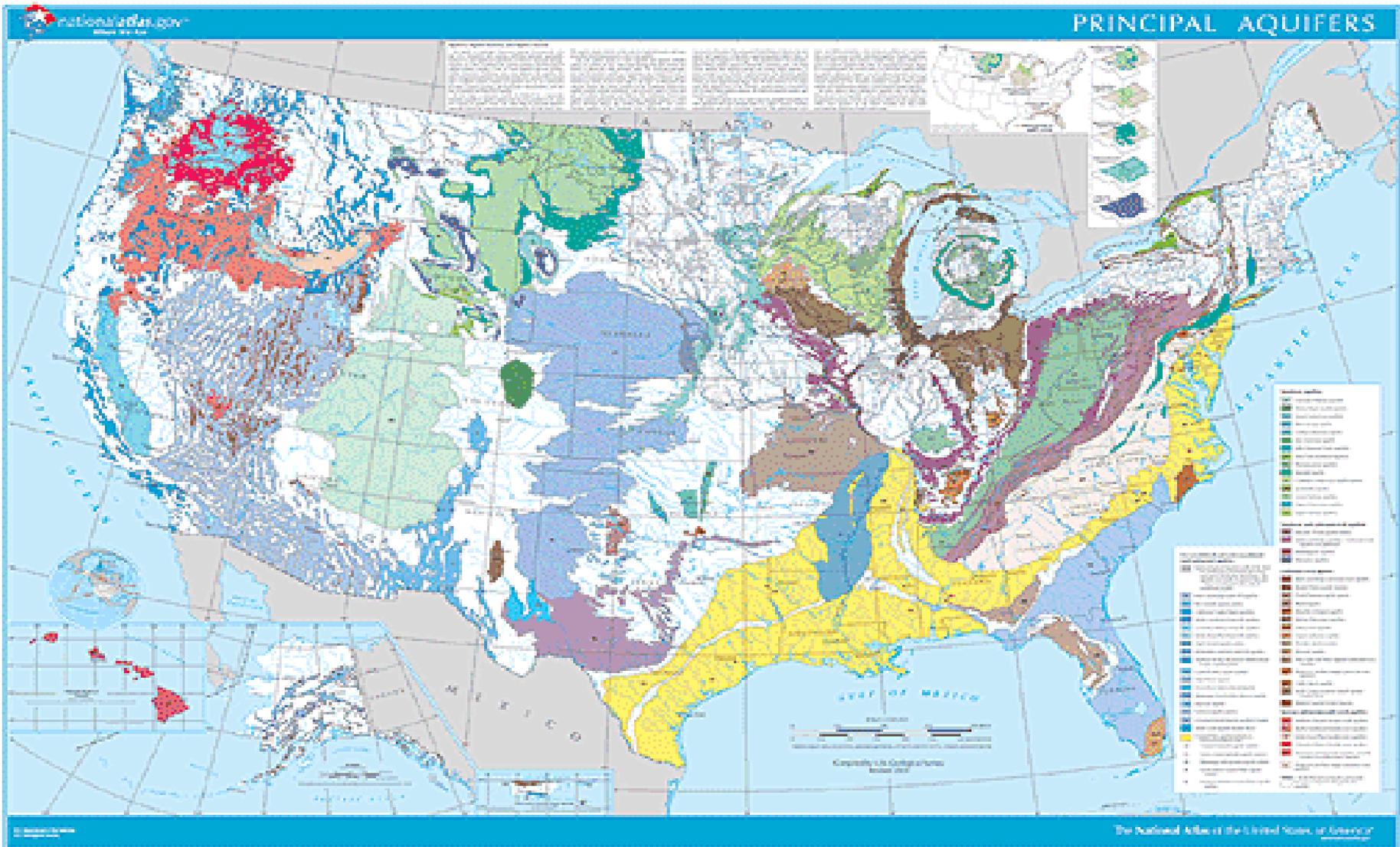
Aquifer-Zones

- **Sub-divisions of aquifers with differing hydrologic conditions**
 - **Recharge /discharge areas**
 - **Confined vs unconfined**
 - **Gaining / losing reaches of streams**

Aquifer-Based GW Management

- **USGS & State have mapped and assessed hundreds of aquifers and aquifer systems in the US**

USGS Circular 1279 – Estimated Withdrawals from Principal Aquifers in the United States



Principal Aquifers in the United States (USGS)

Aquifer-Based GW Management

- Data / information needs
 - A map of the aquifer or aquifer system which depicts the aerial extent and describes the lithology
 - **Delineation of recharge and discharge areas**
 - Sound understanding of the hydrology of the aquifer (confined vs. unconfined, hydraulic properties, interaction w/ surface waters, ecological importance)
 - **Real time tracking of water levels and water quality**
 - Information on location and annual yield of ground-water supply wells
 - **Data on chemistry of the ground water in different parts of the aquifer, including areas of known contamination**

Aquifer-Based GW Management

- **Management goals**
 - Allowable annual withdrawals should be based on *sustaining* the use of the aquifer for future beneficial uses including ecological needs
 - Effective integration of ground-water quality and ground-water quantity / supply management
 - Full cost pricing should be applied to ground-water development and use- use asset management concepts – *an aquifer is an asset!*

Aquifer-Based GW Management

- **Management goals**
 - **Differential / adaptive management**
 - Example - recharge areas need to be managed differently than recharge areas
 - Will need to adapt management of climate change conditions
 - Acknowledge uncertainty in model results
 - **Need to plan for large increase in GW use required to produce energy from new sources (ethanol, nuclear)**

Aquifer-Based GW Management

- **Management goals**
 - **Need to improve methodologies for estimating recharge and discharge from aquifers**
 - **Need to improve technologies for artificially recharging aquifers**
 - **Need to better understand / manage ground water dependent ecosystems**

How to implement?

- **Need to refocus and strengthen State /Tribal GW protection & management programs**
- **Need a paradigm change in Federal agencies (EPA, USGS)
– GW protection /management is NOT just a State /local responsibility**
- **Need to recognize ground water in Clean Water Act**
- **Need to focus on the resource!**

Thank you!

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The Alps above Innsbruck

