
Water Quantity Trading & Banking: Concepts and Illustrations

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Groundwater Management Roles: Commonwealth and Users

What GW goal (limit on use & access)?

Who gets what and when?

What makes a “good” water management system?

- **Achieve resource management goals**
- **Cost effective investments**
- **Incentives for water efficiency & reliability**
- **Maximize value of the resource**
- **Minimize of 3rd party impacts**
- **Equitable**
- **Accommodate economic growth**

Types of Water Right Trading

Water Quantity Trading: Permanent or temporary transfers of water withdrawal “rights”.

Across geographic area

Between users

Water Banking: transferring legal claims on water over time (storage)

Temporal “trades”: ability to save “unused” water withdrawal “rights” for future use

Physical storage (Aquifer Storage and Recovery or ASR):
Establish legal claims on physical storage of water for future use

Water Right Systems in the U.S.

Prior Appropriation

Common law systems

Administrative Permit Systems (“Regulated Riparian”)

Conceptual Foundation for Water Quantity Trading Programs

- 1. Resource management goal & GW withdrawal cap consistent with goals**
- 2. Define and allocate limited number of claims (“rights”) of the GW resource**
- 3. System of Exchange**

Conceptual Foundations of Transferable water rights

Limited in supply (system “closed”)

Clearly defined

- Quantified (access, amount and duration)
- Not unlimited, conditional on other’s private/public uses

Monitored and Enforceable

Ownership interest secure

- Rules for changing terms/conditions clear in advance
- Duration of “rights” consistent with investment horizon

Transaction costs low as possible

Illustrations of Water Quantity Trading Programs

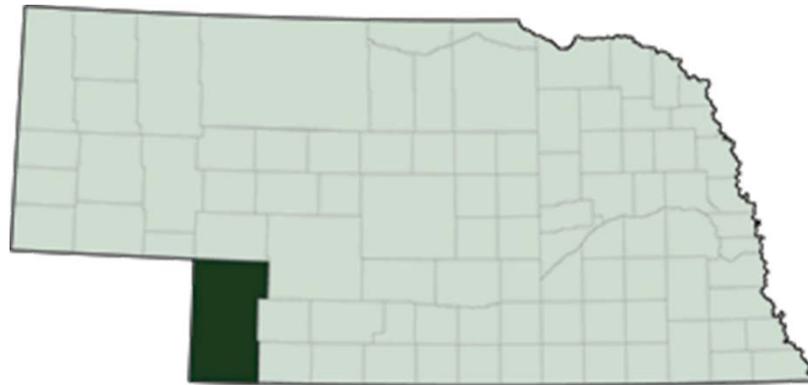
**Nebraska Upper Republican Natural
Resource District**

Texas Edwards Aquifer

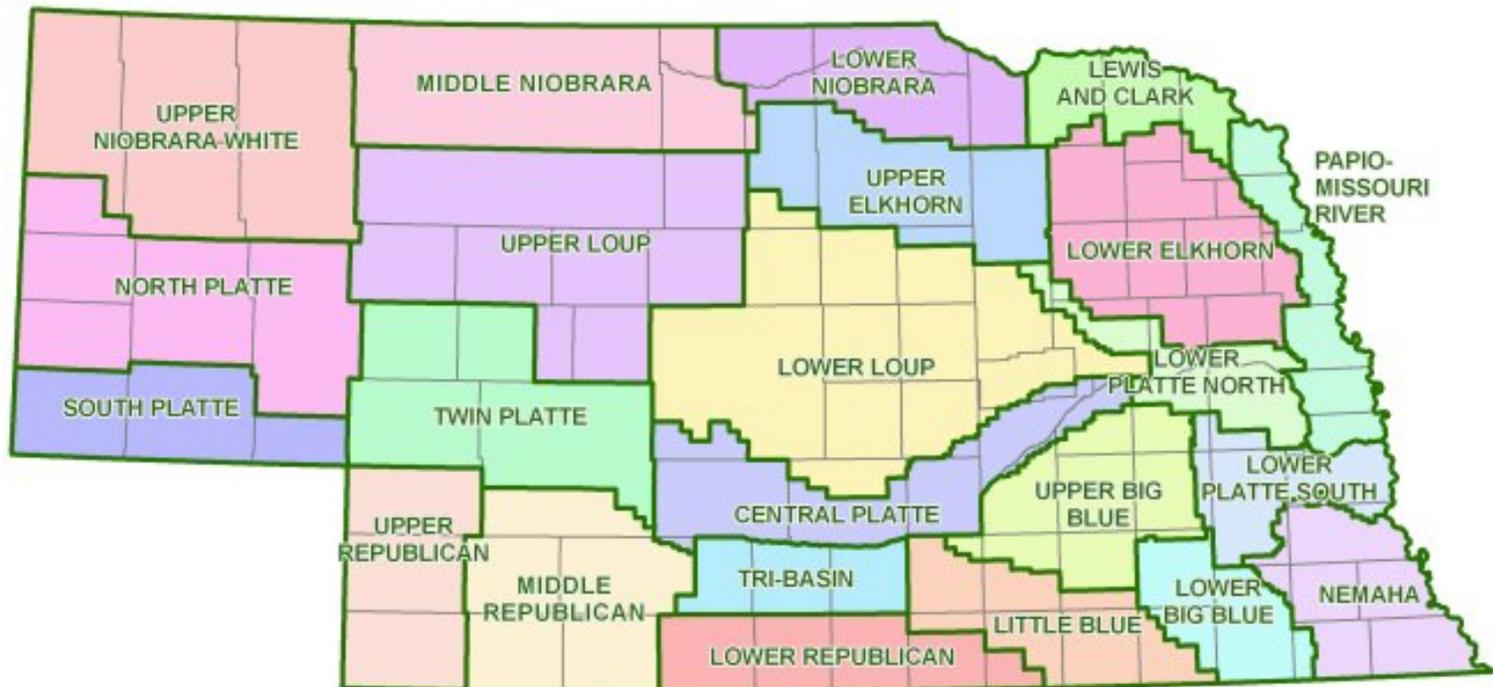
**North Carolina Central Coastal Plain
Capacity Use Area**

Arizona Water Bank

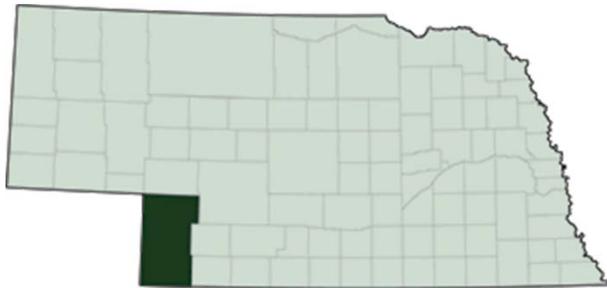
Nebraska Upper Republican Natural Resource District (NRD) Groundwater Management Program



Nebraska Natural Resource Districts



URNRD Groundwater Management Challenges



- Vast majority of groundwater used for irrigation
- Persistent declines in GW aquifer levels
- Declining flows in Republican River and tribs.



URNRD Groundwater Aquifer Limits

Well drilling moratorium imposed since mid-1990s.

URNRD limits to GW use

- GW allocation per well = # certified irrigated acres X per acre allocation (ex: 13 acre inches)
- 5 year allocation (65 ac inches total) set by URNRD
- 5 year allocations declining over time (22 to current 13 ac inches).
- Proportional sharing of the total allowable use.



URNRD GW Trading Provisions

1. Pooling

Grouping well allocation for single user

2. Allocation trading

Transfer all or portion of water allocation permanently between users

3. Banking

Farmers can bank unused allocation for future years & future allocation periods

4. New industrial wells required to “offset”.

Reduce use in same geographic area



URNRD GW Allocation Trading cont.

Additional restrictions in special use areas

All pooling, transfers, and offsets subject to spatial limitations

Pooling and carry-forward allowed by rule

URNRD individually reviews and approves allocation transfers



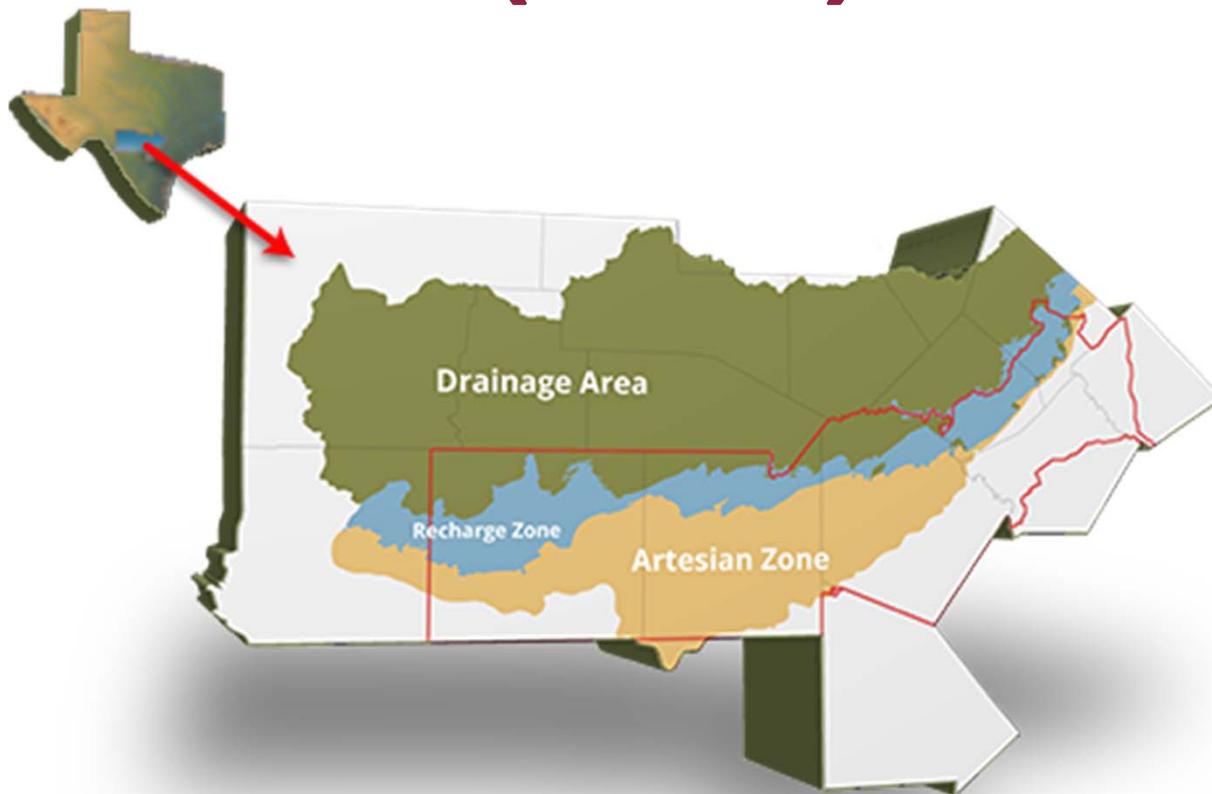
URNRD GW Allocation Trading Outcomes

Users broadly supportive of GW limits & allocations (GW rules installed by elected body)

Farmers make extensive use of pooling & banking

Limited allocation transfers

Edwards Aquifer Authority (Texas)



Edwards Aquifer Authority (EAA)



- Endangered Species Act legal action triggered by diminished spring flows
- Texas legislature created EAA in 1993.
- Legislation sets cap on overall GW withdrawals (currently 572,000 ac ft/yr)

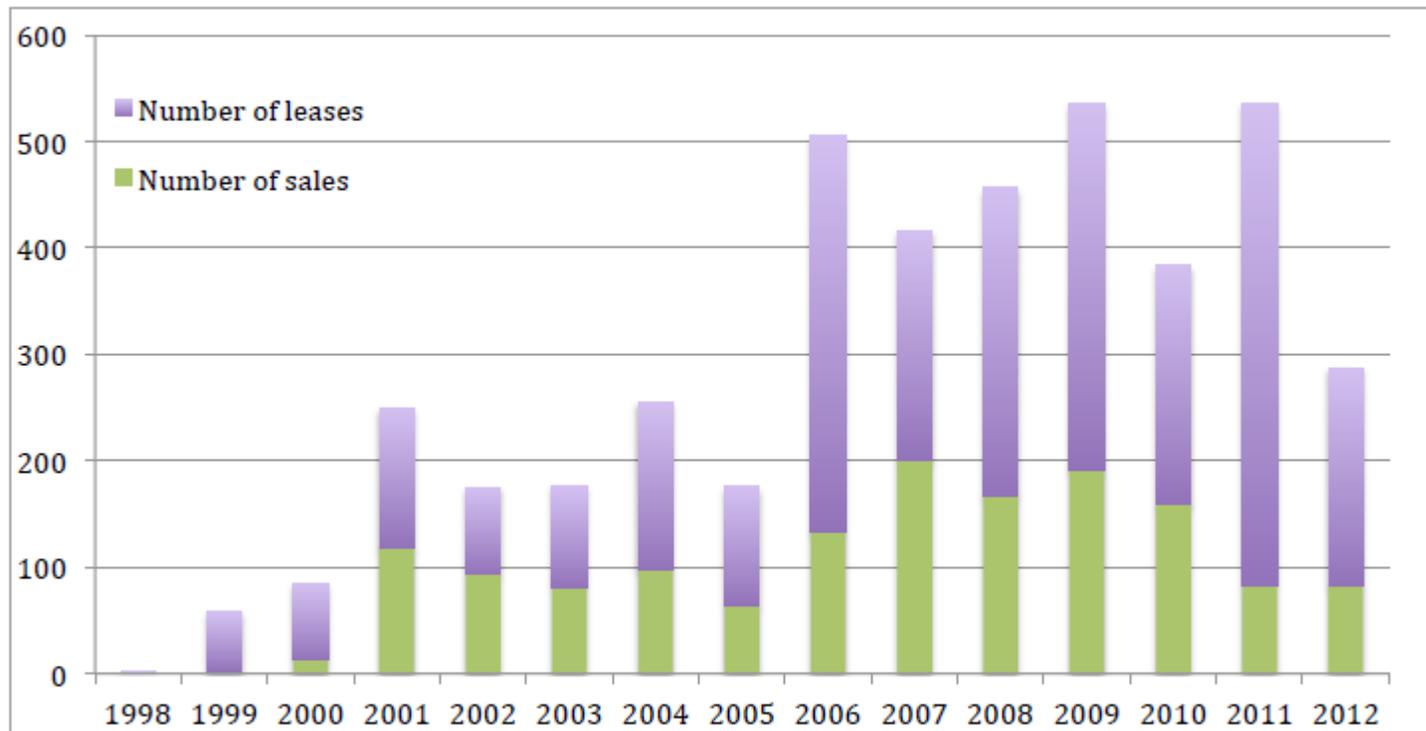


Edwards Aquifer Authority (EAA)

- EAA issues “permanent” withdrawal permits (initial allocation based on historical use)
- Proportional sharing if aggregate withdrawals change.
- Transfer of permit ownership and leases authorized
- Restrictions on transfers:
 - Transfers must be within EAA
 - Irrigation right holders cannot transfer more than 50% of rights for nonagricultural uses
- ASR authorized and used

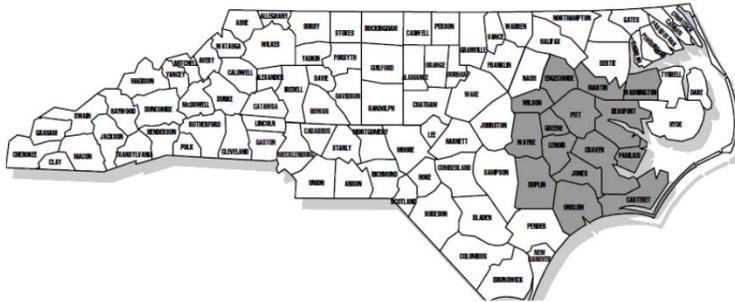
Edwards Aquifer Authority Outcomes

Number of Edward Aquifer Water Transfers



Source: Suggs, 2013

CCPCUA GW Management Challenge



- Coastal Cretaceous aquifers high quality water (same VA coastal aquifers)
- Low recharge relative to withdrawals
- Salt water intrusion, dewatering (permanent loss of storage), land subsidence



North Carolina CCPCUA GW Management Goals

Established regulatory rules in 2001

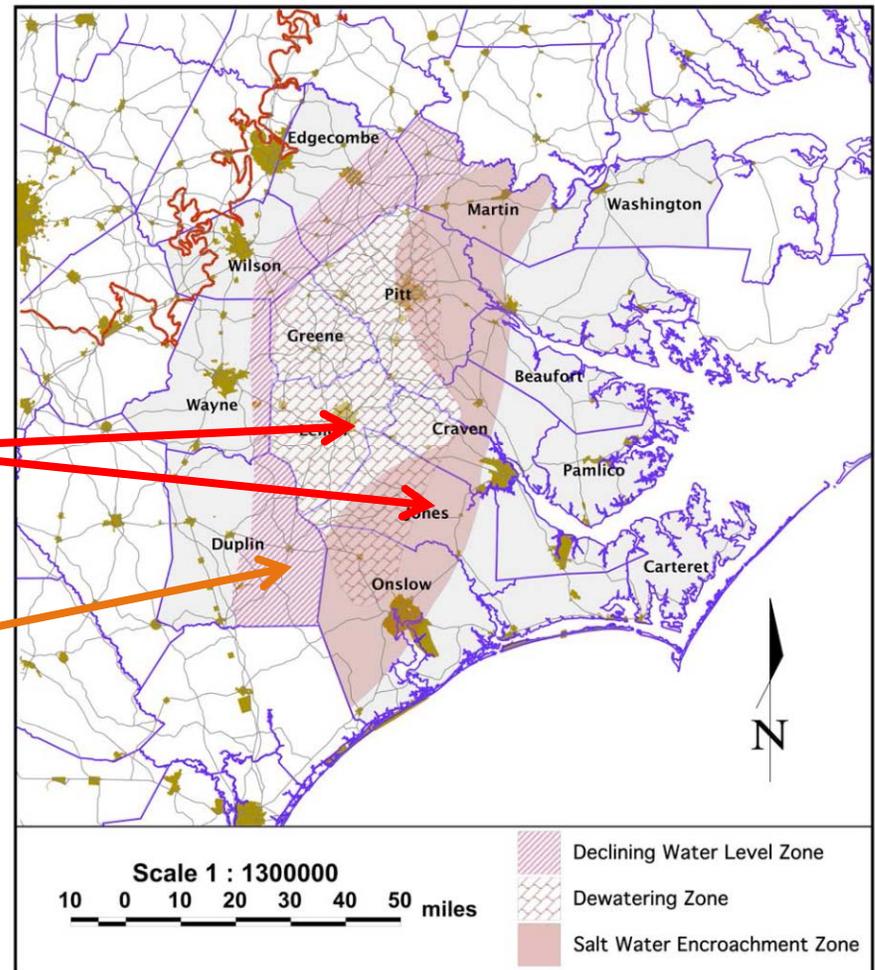
The rules establish:

75% reductions dewatering & saltwater intrusion zones, and

30% reductions in declining zones

from “approved base rate” (historical pumping) by 2018.

CCPCUA Cretaceous Aquifer Zones





Role of CCPCUA Trading Options

Trading mechanisms used as a mechanism to facilitate and ease the transition to alternative water sources.



CCPCUA Trading Options

- Cretaceous Aquifer Bank Account
Permittees allowed to bank reductions in GW use below approved use levels (during 16 yr phase in)
- Permit transfers
Permittees may sell or transfer portions of permitted GW withdrawals
- Physical GW Banking (ASR):
new water can be stored via ASR at 1:1 rate (1 gallon in, 1 gallon out)



CCPCUA Outcomes

- *A priori* reduction schedule assisted planning efforts
- Substantial water infrastructure investments (storage, distribution, treatment)



CCPCUA Outcomes

- Cretaceous Aquifer Bank Account
 - Banked over 37 billion gallons for future use.
 - Less than half of permittees set up a bank
- Permit transfers
 - Limited number, short in duration (2-3 yrs).
 - Transfers between existing users
- Physical GW Banking:
 - Greenville ASR project

Arizona Water Banking





Arizona Water Banking

- Arizona Department of Water Resources (ADWR) issues water storage & recharge permits
- Storage occurs in designated GW “Active Management Areas (AMA)
- Arizona Water Banking Authority (AWBA)
 - Arizona receives Colorado River water through the Central Arizona Project (CAP). AWBA created to store and deliver surplus CAP water for a number of purposes (costs paid for by pumping fees)



Arizona Water Banking

Direct Recharge

(Underground storage facility or USF) via infiltration basins or direct injection



Indirect Recharge (Groundwater Savings Facility or GSF). GW irrigators use surface water instead of GW



Arizona Water Banking

ADWR certifies long-term storage credits.

Credit is given for water that reaches the aquifer (3-5% delivery loss) minus a 5% “cut to the aquifer”

Credits can be used to recover water anytime (subject to permit conditions) and can be traded.

Water recovery must occur in same AMA where recharge occurred

Themes and Observations

Groundwater Management Goals, Caps, and Initial Allocation

Required & Potentially Quite
Contentious

Aquifer goals and caps for VA?

Initial Allocation Options

Duration and Security of GW Withdrawal Rights

Certainty in use and duration &
Need to match long term investment decisions

Case illustrations define withdrawal “rights” in
statute or rule

Designs to address public need for adaptive
management & right security

Trading Themes

Water withdrawal permits trading between users often “thin”

Most active programs involve ag to municipal/industrial uses

Geographic limits on trade

Virginia Issue: Access to GW for new users
(opportunities for “buying in”; equity concerns)

Trading Themes

Water banking popular

Create water saving incentives

Facilitate use of subsurface storage

Organizational umbrellas & rule structures to
reduce transaction costs