Tri-Basin NRD
Groundwater Management
What does Tri-Basin do?
We plant trees and shrubs
We create and maintain wildlife habitat
We operate seven drainage improvement projects (IPAs)
We educate students and the public about natural resources conservation.
We provide cost-share to landowners for soil and water conservation practices.
We enforce state laws prohibiting human-caused erosion damage
We enforce state laws prohibiting excessive irrigation runoff
We protect groundwater
We protect it from contamination
We protect it from diminishment
We protect streamflows
We do all this with help from many partners
Tri-Basin NRD

• Vision statement (1996): “Tri-Basin NRD will work cooperatively with district residents to promote good stewardship of land and water resources.”

• Mission statement (1996): “Manage, conserve and protect the District’s land and water resources.”

• Groundwater reservoir life goal (1979, revised 1995): “All groundwater supplies within the Tri-Basin NRD will be used in a beneficial manner, efficiently managed and properly utilized to preserve the present quantity of this vital resource forever.”
1. Late Pliocene (~2,500,000 yrs. ago)

2. Early Pleistocene (~1,500,000 yrs. ago)

3. Illinoian (~200,000 yrs. ago)

4. Late Wisconsin (~30,000 yrs. ago)

Fig. 6- Evolution of the Platte River Valley over the Nebraska landscape from the Pliocene through present. Blue squares approximate area shown in Fig. 1. Image reproduced from Swinehart et. al. 1994.

http://snr.unl.edu/csd-esic/download/geologysoils/digitalgeologicmapscleaned/Fairfield/Fairfield_Supplement.pdf
Nebraska Groundwater Law

• Groundwater and surface water are owned by The People (the state)
• Landowners have the right to use groundwater for beneficial purposes on their own property
• Groundwater use is governed by correlative rights (all users share in a shortage) and regulated by NRDs
• Surface water use is governed by prior appropriation (first in time, first in right) and regulated by state Department of Natural Resources
Tri-Basin Natural Resources District
Aquifer Saturated Thickness

Represented Area

Saturated Thickness

- Observation Well
- Community
- Township

Saturated Thickness determined using 2012-2014 average Spring static water measure measurement.

This version is an initial draft.

Nolan Little
May 2016
Tri-Basin Natural Resources District
Groundwater Supplies in TBNRD

• 580,000 certified irrigated acres in TBNRD
• Over 5000 irrigation wells
• COHYST model runs by DNR estimate that annual groundwater pumping in TBNRD averages 343,000 acre-feet
2020 GW & SW (NeDNR 2020) Irrigable lands in TBNRD
Annual Actual Irrigated Acres –
TBNRD SW and GW land-use of 2020 from method 1
Groundwater Supplies in TBNRD

- Annual average natural recharge = 203,000 acre-feet
- CNPPID diversions for irrigation average 110,000 a-f/Yr. (about half of diverted water is consumed)
- Excess flow diversions average 7350 a-f/Yr.
Groundwater Supplies in TBNRD

• Net recharge = Natural recharge + Supp. Recharge – GW pumping

• $203,000 + 72,350 = 275,350$ a-f/Yr. (Total recharge)

• $275,350 – 343,000 = -67,650$ a-f/Yr. (Net recharge)

• These are very broad ESTIMATES of credits and debits (more detailed analysis is planned)
Tri-Basin Natural Resources District
Groundwater Quantity Management

- Gosper
- Phelps
- Kearney
- Republican Basin
- Little Blue Basin
- S-23 Elk Creek
- S-22 Union
- 5-13 Grant
- Heartwell

Legend:
- Designation: Phase II, Phase III
- River Basin: Republican, Little Blue, Platte
- Community:
- Highway
- County
- Township

Scale = 1:290,000

*The entire district is regulated under Phase I regulations.*
Groundwater Quality Management
Main TBNRD focus before 2003

- TBNRD established groundwater quality management area in 1989
- Groundwater quality management authority divided between state, NRDs
- NRDs responsible for non-point source contamination
- NDEQ responsible for point source contamination
Potential Point Source
Multiple Point Sources
Non-Point Sources
Nitrate-nitrogen

• Primary groundwater contaminant
• Sources are commercial fertilizer, manure
• 10 parts per million (ppm) is USEPA drinking water limit
• Primarily affects small children ("Blue Baby Syndrome") and people with compromised immune symptoms
Other contaminants

- Herbicides and insecticides are potential contaminants
- Atrazine has been detected in a few samples
- Repeated testing in TBNRD has NEVER produced results higher than 3 parts per billion (ppb)
- Isolated detections of other industrial chemicals (Carbon Tetrachloride)
Three Management Phases

• Phase One (entire district)= No Nitrogen fertilizer for spring-planted crops before March 1 on sandy soils (Nov. 1 on all other soils)
• Free domestic well sampling for nitrates, bacteria
• If groundwater Nitrate levels in any township average higher than 9ppm for four years, then Phase Two
Phase Two

- Phase one controls continue
- Mandatory certification class every four years
- Mandatory deep soil sampling
- Mandatory irrigation water sampling
- Mandatory annual crop reports
- Unless nitrates decline more than one ppm in 15 years, Phase Two townships advance to Phase Three
Phase Three

• No nitrogen fertilizer application > 60Lbs. Per acre before March 1 on any soils

• Fertilizer must be split-applied if a crop requires more than 80 Lbs. actual N
Tri-Basin Natural Resources District
Groundwater Quality Management

Represented area shown in red

Phase I: Average sampled N < 9.0 PPM.

Phase II: Average sampled N > 9.0 PPM. Producers are required to: obtain nitrogen management certification; sample soil & water; and submit crop reports. Application of nitrogen is prohibited September 1 - November 1. *

Phase III: Average sampled N > 9.0 PPM for 15 years. All producers requirements remain the same as Phase II. Application of nitrogen is prohibited September 1 - March 1. *

*For more details, groundwater management rules can be found at www.tribasin.org.
Tri-Basin Natural Resources District

2022 Average Sampled Nitrate Level by Township

Nitrate Level: 0.0 - 5.0, 5.1 - 10.0, 10.1 - 15.0, 15.1 - 20.0, 20.1 - 25.0, 25.1 - 30.0

Phase Area:
- Phase II
- Phase III

Represented Area

Nolan Little
March 2022
Tri-Basin Natural Resources District

Natural Resources District
Chemigation and Fertigation

[Diagram showing a system for anti-pollution protection with labeled components: Irrigation Pumping Plant, Vacuum Relief Valve and Inspection Port, Chemical Injection Line Check Valve, Electric Motor and Chemical Pump, Chemical Tank, Calibration Tube, Suction Line Strainer, Electrally Interlocked Control Panels, Automatic Low Pressure Drain (Discharge 20 ft. from well)]
Integrated Water Management
Integrated water resources management

- Managing groundwater to protect streamflows.
- Required by state law (LB 962-2004)
- Also required to help Nebraska meet requirements of interstate agreements (e.g., Republican River Compact)
Integrated water resources management (continued)

- Regulation is based on meeting requirements of joint integrated management plans (IMPs) in Platte and Republican basins.
TBNRD regulatory actions to protect streamflows

- All groundwater-irrigated acres must be certified.
- Transfers of certified irrigated acres are regulated.
- Transfers of certified irrigated acres are pro-rated if the destination field has higher rate of stream depletion than originating field.
- Increases in water use for large commercial and industrial uses are also regulated and must be offset.
- TBNRD agrees to offset depletions to streamflows resulting from groundwater pumping as part of our IMPs.
TBNRD Platte Basin IMP requirements

- TBNRD includes both overappropriated and fully appropriated portions of Platte basin.
- TBNRD IMP streamflow depletion reduction requirements to return to 1997 levels of depletions:
  - **OA Basin** (W of US Hwy. 183) 1775 a-f/Yr. by 2020
  - **FA Basin** (E of US Hwy. 183) 1760 a-f/Yr. by 2020
  - Total offset requirement= 3535 a-f/Yr. by 2020
TBNRD Republican Basin
IMP Requirements

• TBNRD needs to maintain positive balance between imported water and depletions to streamflows

• TBNRD maintains this balance in three ways:
  - Maintain GW levels at or above 1981-85 levels
  - Regulate irrigated crop production
  - Augment streamflows
Mound Credit and Streamflow Depletions at the TBNRD Southern Boundary - Variable Scenario

The graph shows the annual acre-feet from 2007 to 2033 for Mound Credit and Streamflow Depletions. The X-axis represents the years from 2007 to 2033, while the Y-axis represents acre-feet ranging from 0 to 14,000. The graph includes lines for Mound Credit (blue) and Depletions (orange), with projected values indicated by dotted lines for the years 2023 to 2033.
Streamflow augmentation vs. Regulation

- Augmentation can be accomplished directly or indirectly.
- Direct augmentation=pumping water into a stream or releasing water from a reservoir.
- Indirect augmentation=diverting water into canals and reservoirs and allowing it to seep into the ground.
What are alternatives to augmentation?

• Pay farmers not to irrigate
  ▪ Needed reductions can be achieved by acquiring easements
  ▪ Easements can be acquired from willing sellers or by eminent domain (using condemnation enables targeting areas of greatest benefit)
  ▪ NRD would need to retire irrigation on at least 50,000 acres in Platte basin and 10,000 acres in Rep. Basin
  ▪ Cost=at least $4000/ acre, $24 million total
Tri-Basin depletion offset projects
CNPPID High Flow Diversions

• TBNRD works with CNPPID to divert high Platte flows into canals, Elwood reservoir.
• Over 107,800 acre-feet diverted since first diversions in 2006.
• Over 80,800 creditable a-f at NRD cost of $12-$22 per a-f (DNR pays half cost).
• Diversions into Elwood Reservoir and E-65 Canal benefit both Platte and Republican Basins.
Elwood Reservoir
Wetland Recharge Project
North Dry Creek Streamflow Augmentation Project
North Dry Creek Streamflow Augmentation Project

- TBNRD developed first streamflow augmentation well project in Nebraska.
- Located on North Dry Creek (Platte Trib. Near Kearney).
- First well completed in 2011, second well in 2014.
- DNR paid 50% of construction cost.
- $11-15 per creditable a-f cost, depending on volume pumped.
Current plan is to drill two pumping wells which will be located along Turkey Creek in Gosper County.

Each well will be accompanied by at least one observation well.

First observation well was drilled spring 2015

First production well was drilled winter (2015-16).
Holen Augmentation Well

- A second production well is planned when needed.
- Expected pumping rate is 1200 gpm per well.
- Expected Max. output is 1000 acre-feet per well per year.
- Pumped water will be replaced by recharge into Elwood reservoir and E-65 canal.
- Most pumping will occur during spring and fall.
- NRD will assist with maintaining Turkey Creek in immediate vicinity of wells.
Platte-Republican Diversion

• Originally conceived by former State Sen. Mark Christensen (2006)
• High Platte flows in 2015 led to evaluation of potential diversion sites
• Now a cooperative project of Tri-Basin NRD, Lower Republican NRD and Central NE Public Power and Irrigation District
Platte-Republican Diversion Project Feasibility Study

• Available on the Tri-Basin NRD website at:

www.tribasinnrd.org
Feasibility Study Results

- Diversion rates of 40 cfs and 100 cfs analyzed
- Estimate of up to 11,000 acre-feet of divertable high flows in average year
- Use of pipe versus check dams in upper end analyzed
- Overall cost estimate (2017) = $1.4-$1.8 million
- Cost per acre-foot= $32-$81/a-f
- Overall cost-benefit ratio= at least 3.4:1
Next Steps

• Jointly apply for water right with CNPPID (ongoing)
• Final design, cost estimate
• Secure permanent easements from landowners
• Construct diversion
• Construct pipeline and check dams to minimize erosion
Questions?