

NeDNR Updates and Water Planning History

Lower Elkhorn NRD Director's Retreat
February 27, 2020

Jennifer J. Schellpeper
Water Planning Division Manager

NEBRASKA
Good Life. Great Water.
DEPT. OF NATURAL RESOURCES

NEBRASKA

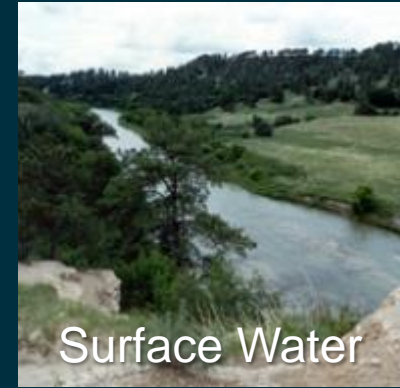
Good Life. Great Water.

DEPT. OF NATURAL RESOURCES

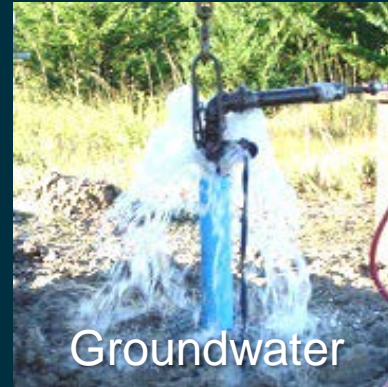
Providing the sound science and support for managing Nebraska's most precious resource



Water Planning and Integrated Management



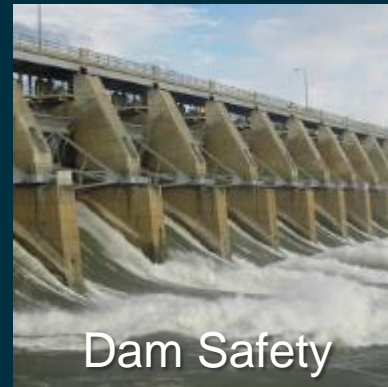
Surface Water



Groundwater



Floodplain Management



Dam Safety



Field Offices

NEBRASKA

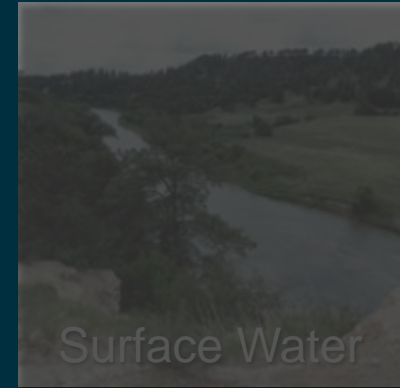
Good Life. Great Water.

DEPT. OF NATURAL RESOURCES

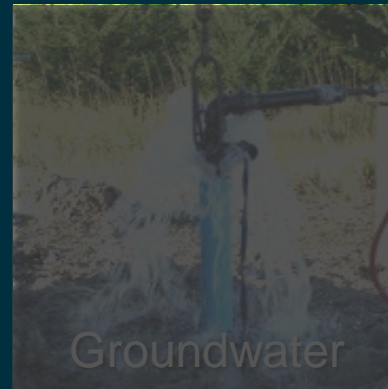
Providing the sound science and support for managing Nebraska's most precious resource



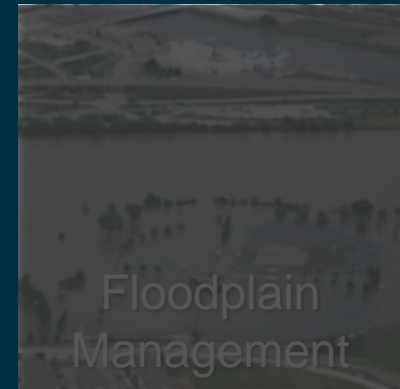
Water Planning and Integrated Management



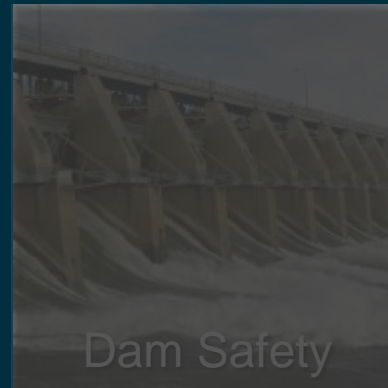
Surface Water



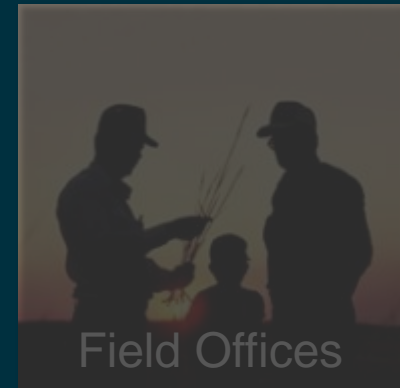
Groundwater



Floodplain Management



Dam Safety



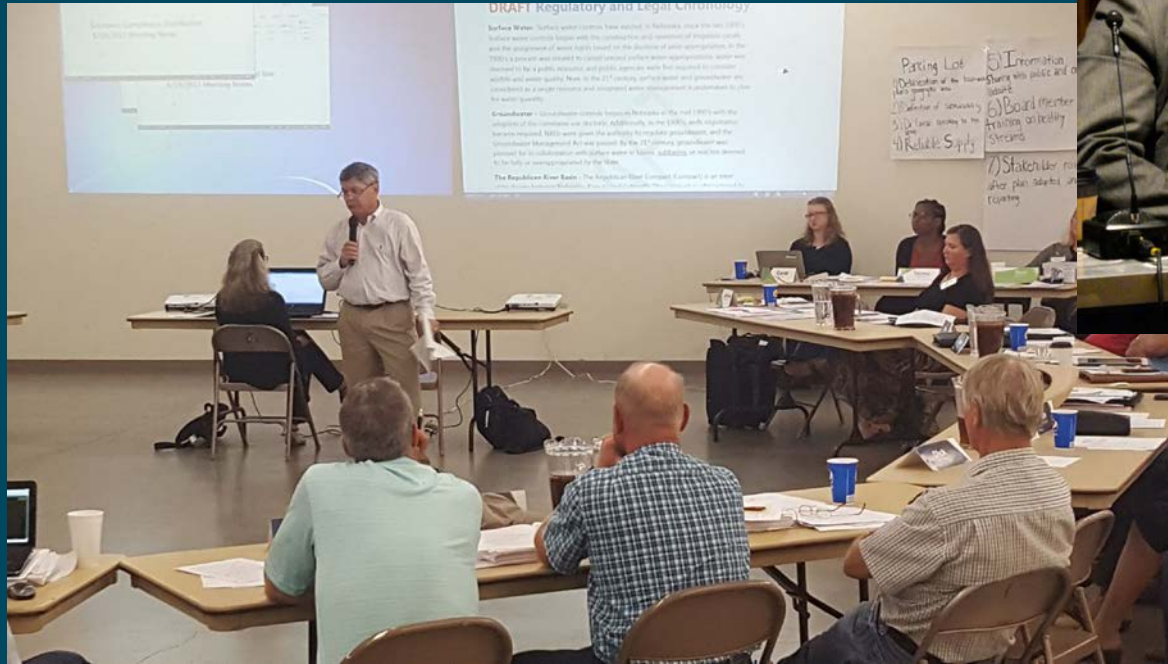
Field Offices

Overview

- Director Update
- Hydrologically Connected Groundwater and Surface Water
 - Background – Governance of Water
 - Current Water Planning Process
 - Science Foundation
 - Adaptive
 - Streamflow Depletions
- Groundwater Modeling Tools in Eastern Nebraska
- Concluding Thoughts



Director Update



Hydrologically Connected Ground and Surface Water

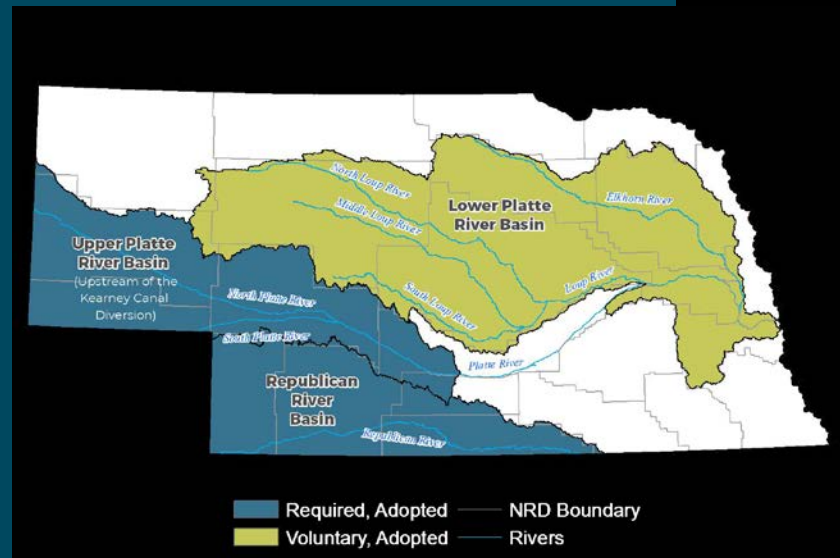
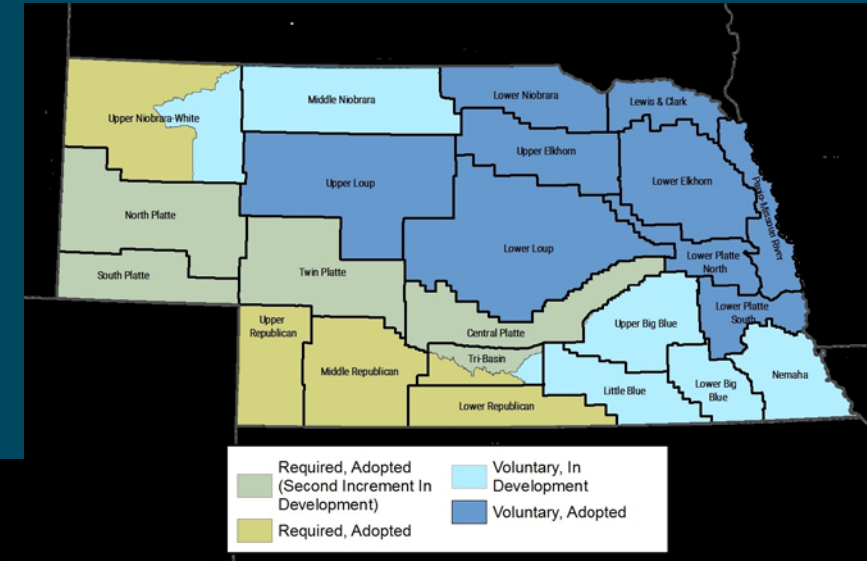
➤ Background – Governance of Water

- Nebraska Water Planning History

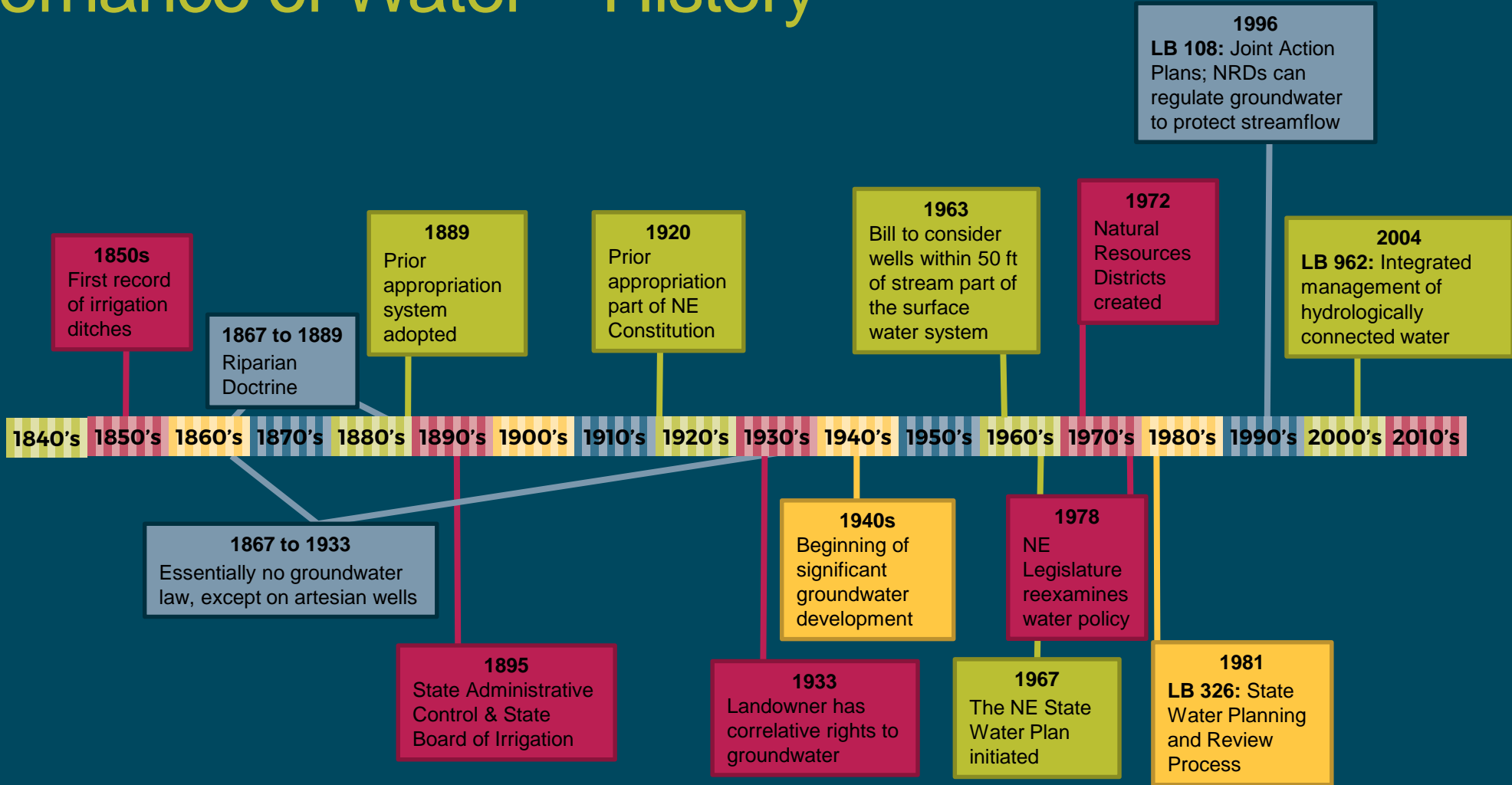
➤ Current Water Planning Process

- Science Foundation
- Adaptive

➤ Streamflow Depletions



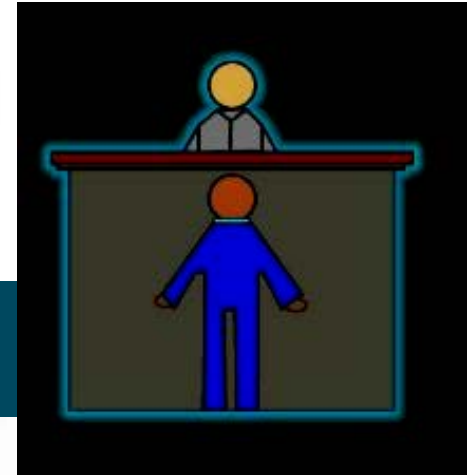
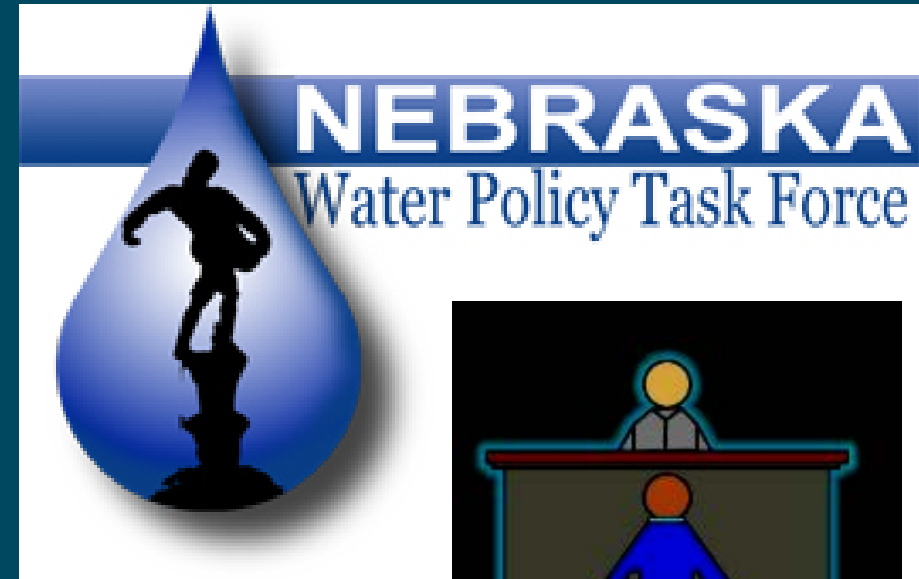
Governance of Water – History



Governance of Water – History

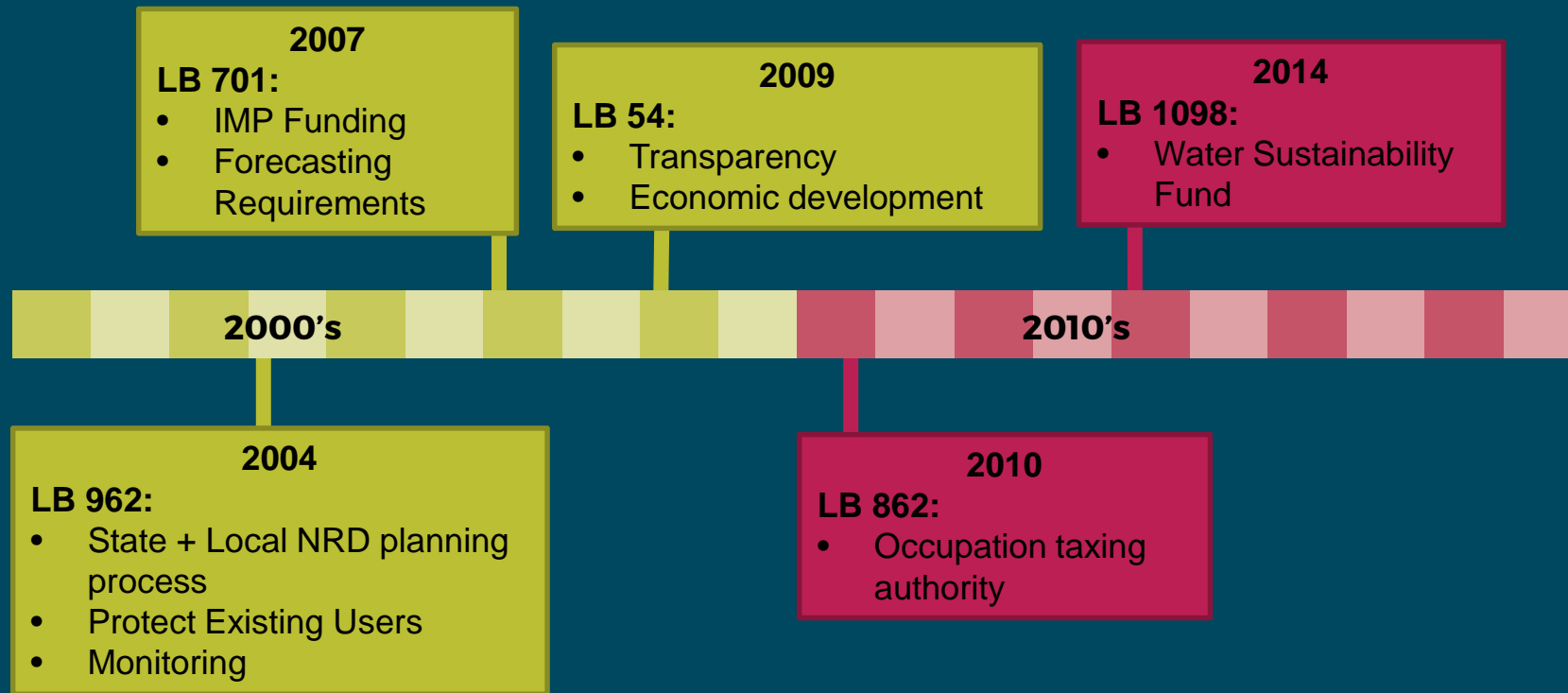
NE Water Policy Task Force

- Created in 2002 by the Nebraska Legislature
 - Consensus-based decision-making process
 - Evaluate law governing integrated water management
 - Inter- and intra- state lawsuits
- Developed LB962 (2004)
 - Recognized hydrologic connection of surface and groundwater
 - Established joint planning process (IMPs)
 - Goal: to sustain a balance between water use and water supply
 - Use best available science

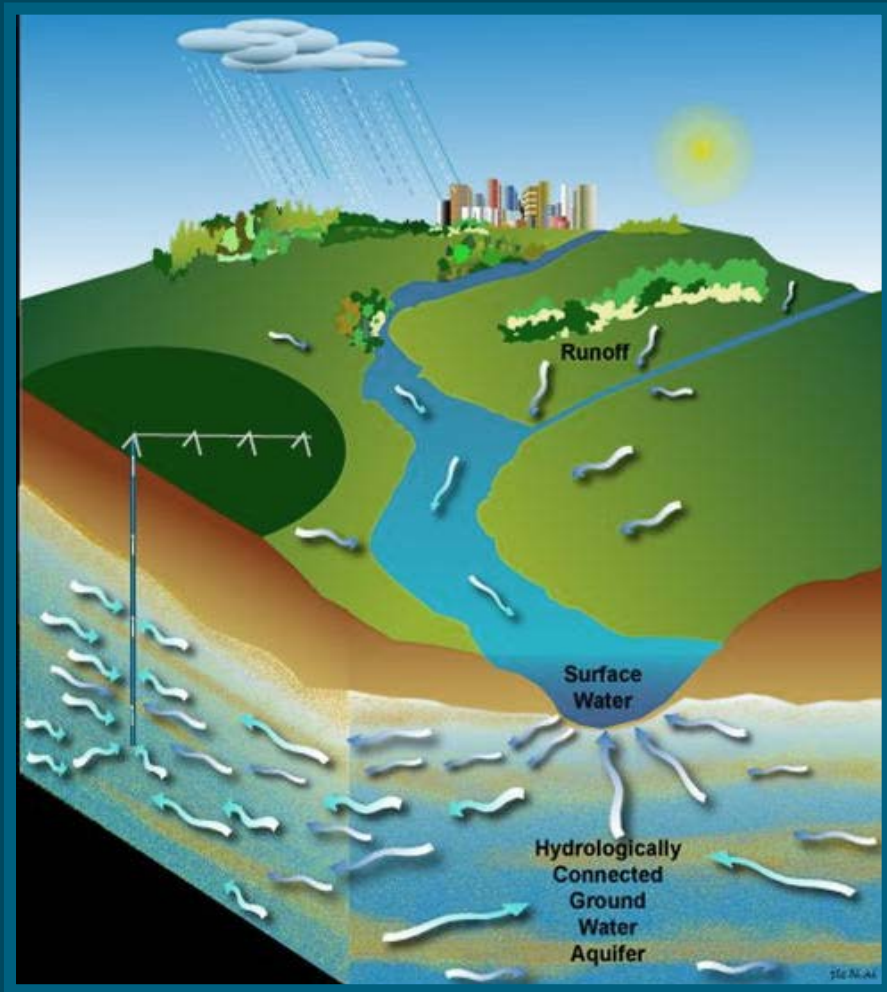


Governance of Water – History

Additional Tools



Governance of Water – Integrated Management Summary



Surface Water

- Regulated by NeDNR
- Prior appropriations
- First in time is first in right



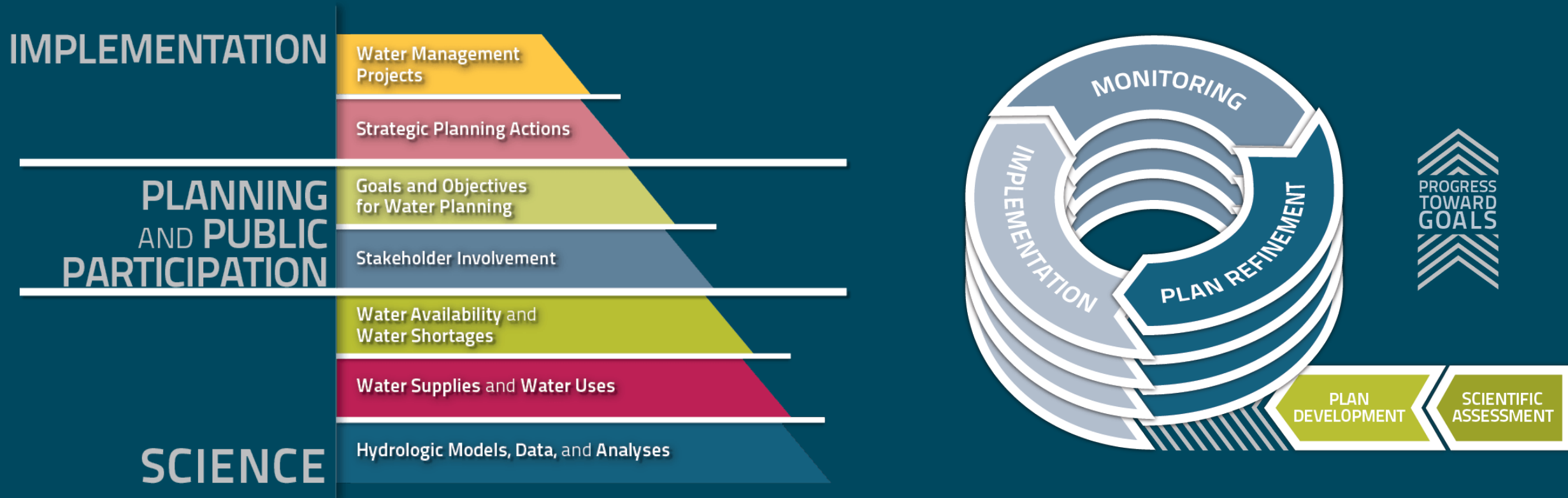
Groundwater

- Regulated by NRDs
- Correlative rights
- Share and share alike

Current Process – adaptive management

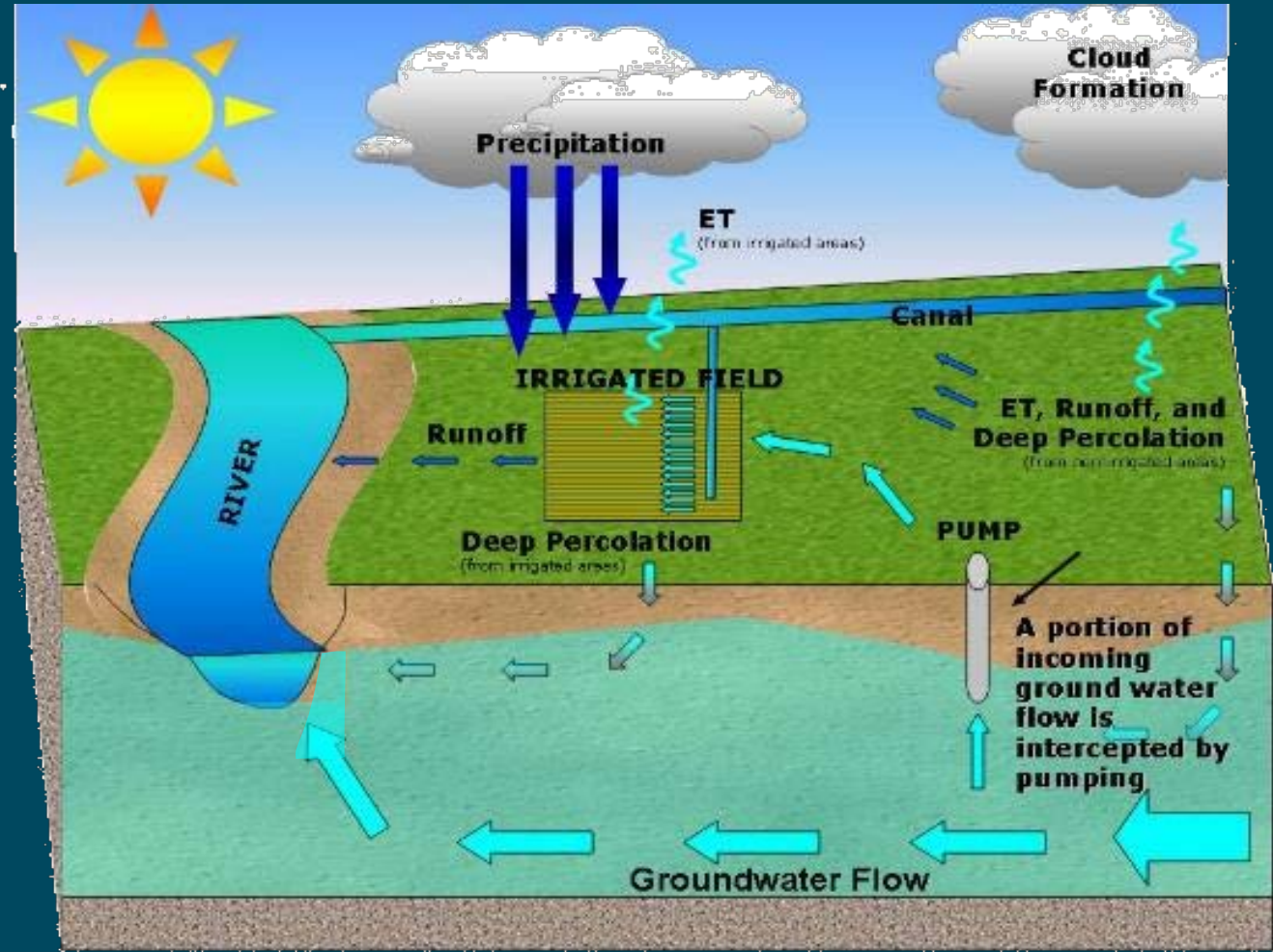
➤ General Goals

- Protect existing uses from negative impacts of new uses
- Meet interstate compliance obligation
- Ensure long-term balance of water supplies and uses
 - Protect economic viability
 - Social and Environmental Health
 - Safety and Welfare of the Basin



Streamflow Depletions – Water Budget

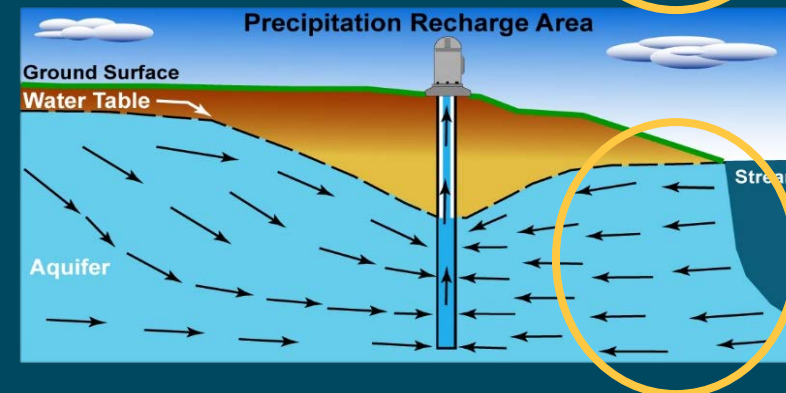
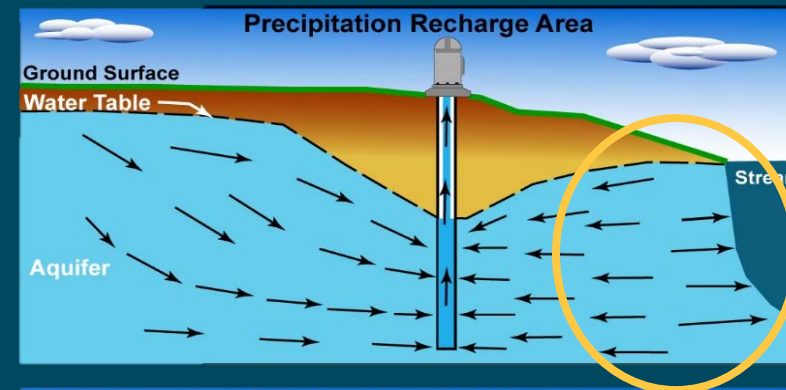
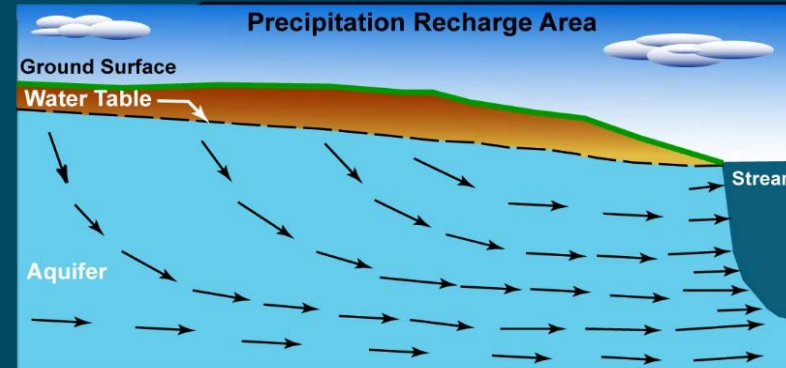
- Typical elements of ground and surface water budgets



Streamflow Depletions

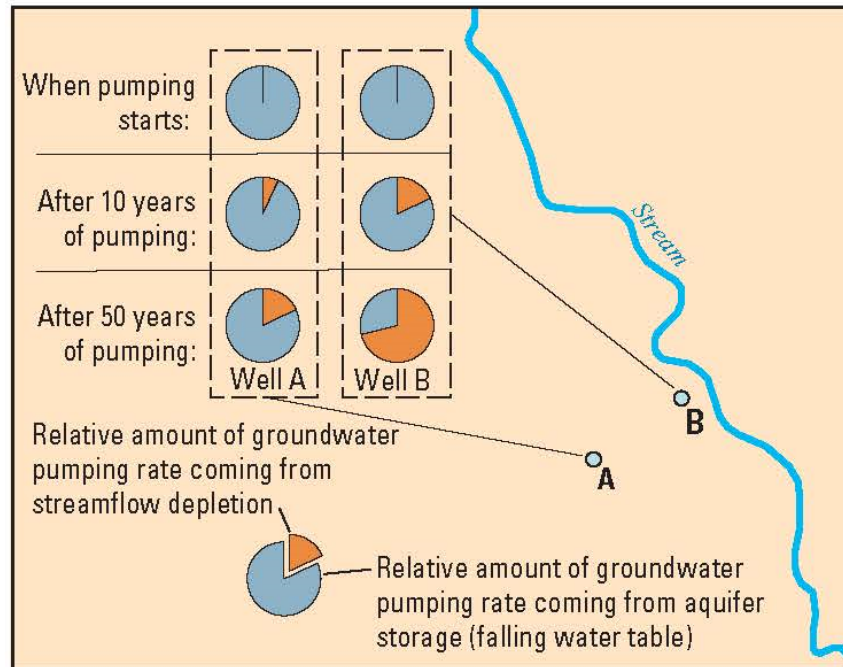
- When pumping occurs in areas where groundwater and surface water are hydrologically connected, surface water is **depleted** either through
 - Interception of groundwater that would have gone to streamflow,
 - or
 - Water moving from the stream into the groundwater system.

This water is known as a **depletion to streamflow**. Streamflow depletions also occur from direct stream pumping.

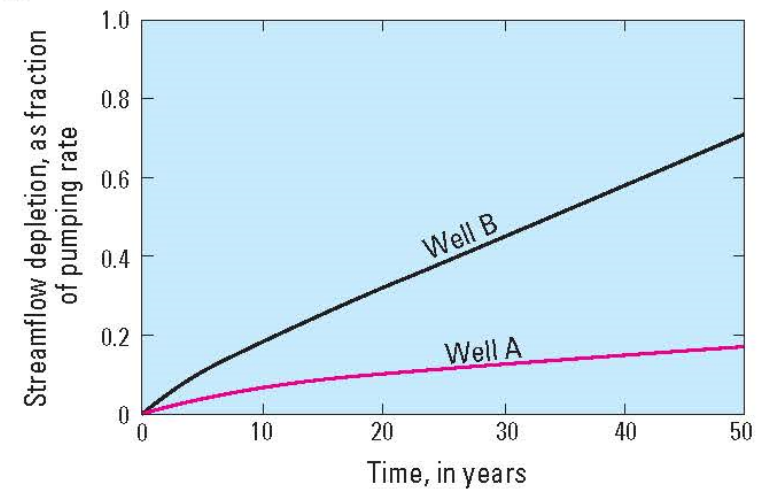


Streamflow Depletions

A



B

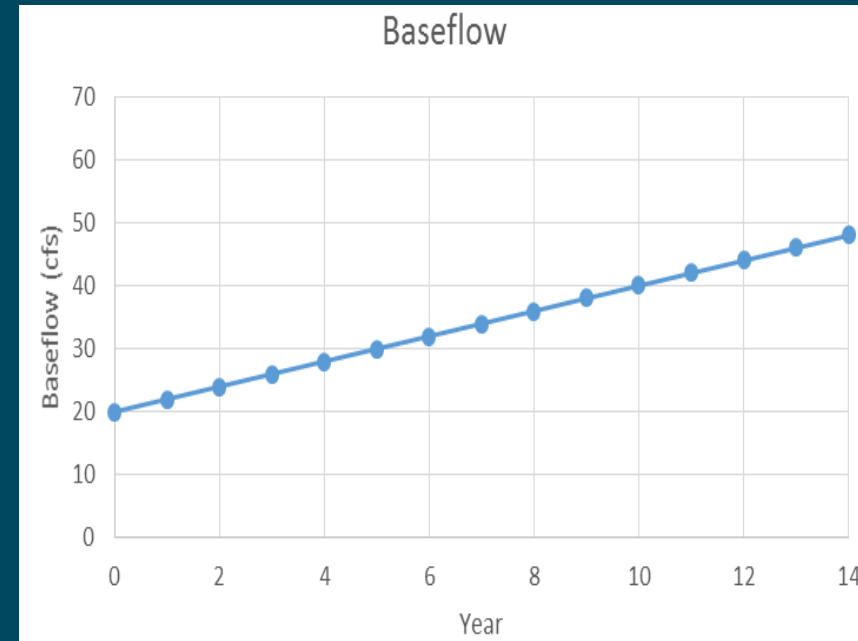
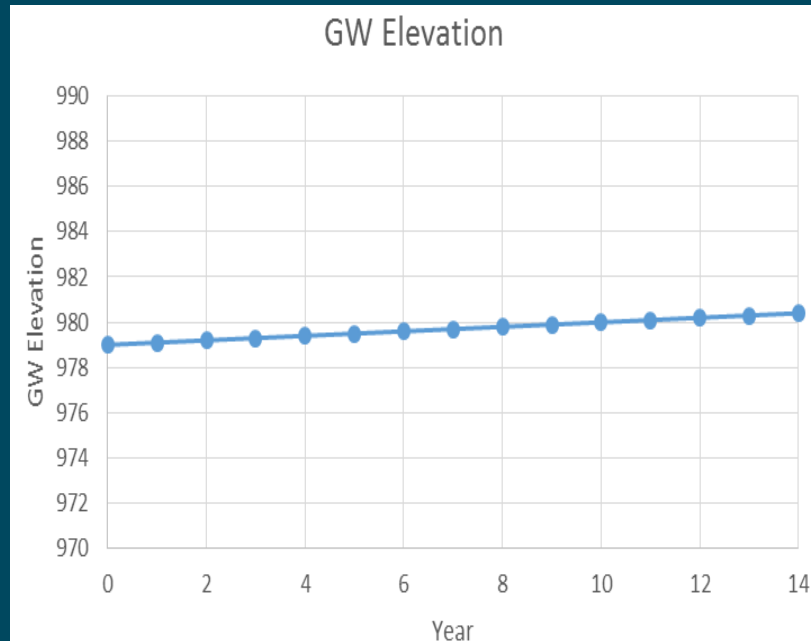


Streamflow Depletions

- Factors that affect timing, rates, and locations of streamflow depletion:
 - Geology and hydraulic properties of aquifer
 - Transmissivity
 - Specific Yield
 - Aquifer size/volume
 - Geometry of the surface water streams
 - Well location (vertical and horizontal distance from streams)
 - Pumping rates and operational characteristic

Streamflow Depletions - Example

Example of Observed Groundwater Elevation and Baseflow Trends



Question for discussion: Are there depletions occurring due to groundwater pumping in this area?

Streamflow Depletions - ANSWER...

➤ We don't know for sure.

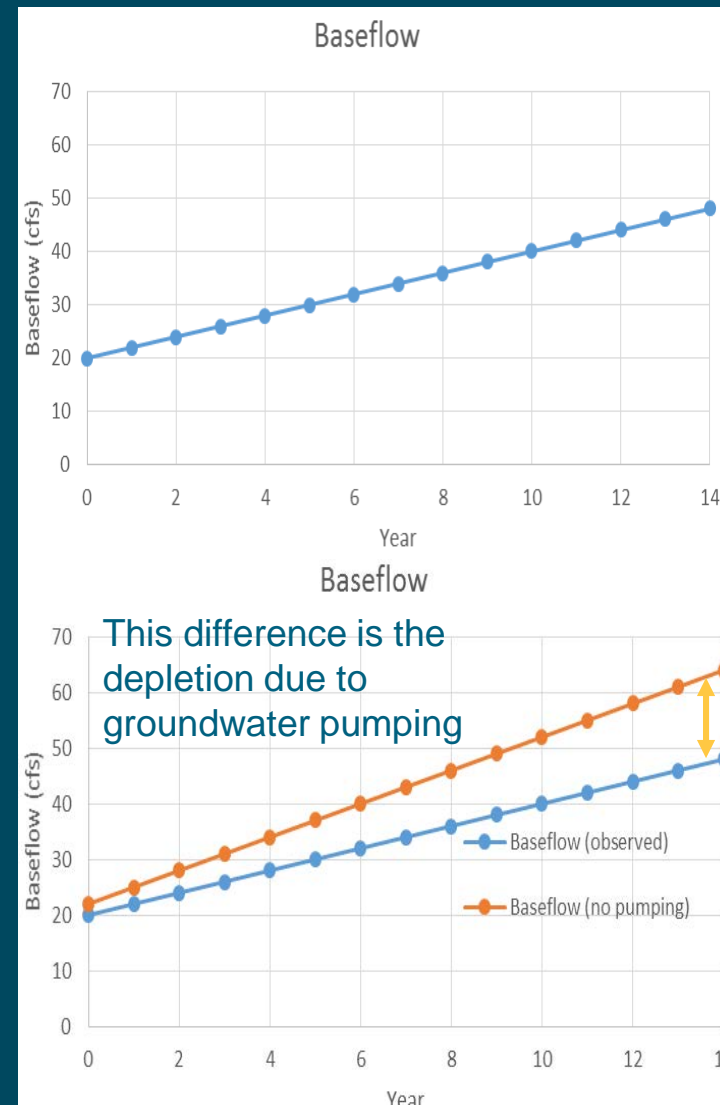
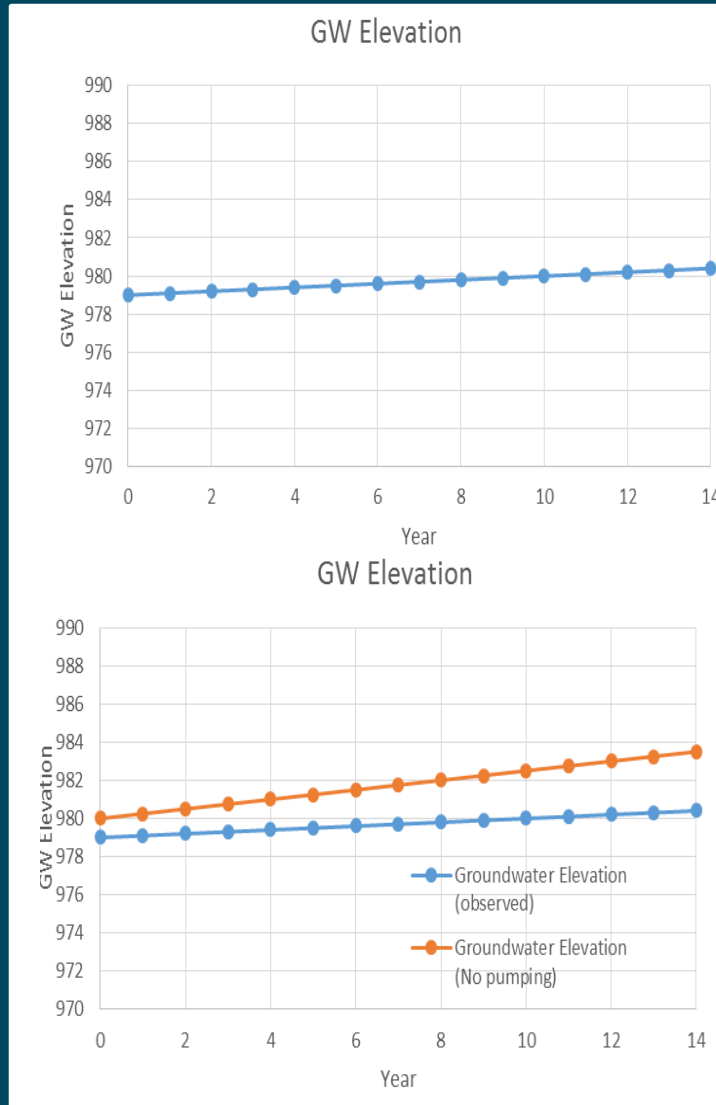
Why?

- We don't know what conditions would have been without groundwater pumping occurring. *This is what we use modeling tools for!*

How?

- To estimate conditions without the effects of pumping, a model is used to simulate two identical hydrologic scenarios – one with groundwater pumping occurring, and one without groundwater pumping occurring.

The Estimated Effects of Groundwater Pumping Can be Determined



Streamflow Depletions – Lower Platte Basin

- Current estimates of streamflow depletion are calculated based upon an analytical mathematical model using Conservation and Survey Division **publication** (Conservation and Survey Division. 2005. *Mapping of Aquifer Properties-Transmissivity and Specific Yield-for Selected River Basins in Central and Eastern Nebraska*. Lincoln)
- New work is being performed to use a numerical mathematical model to estimate Streamflow Depletions (MODFLOW)

Lower Platte Stream Depletion Modeling

➤ Numerical Modeling

○ Spatial representation of data

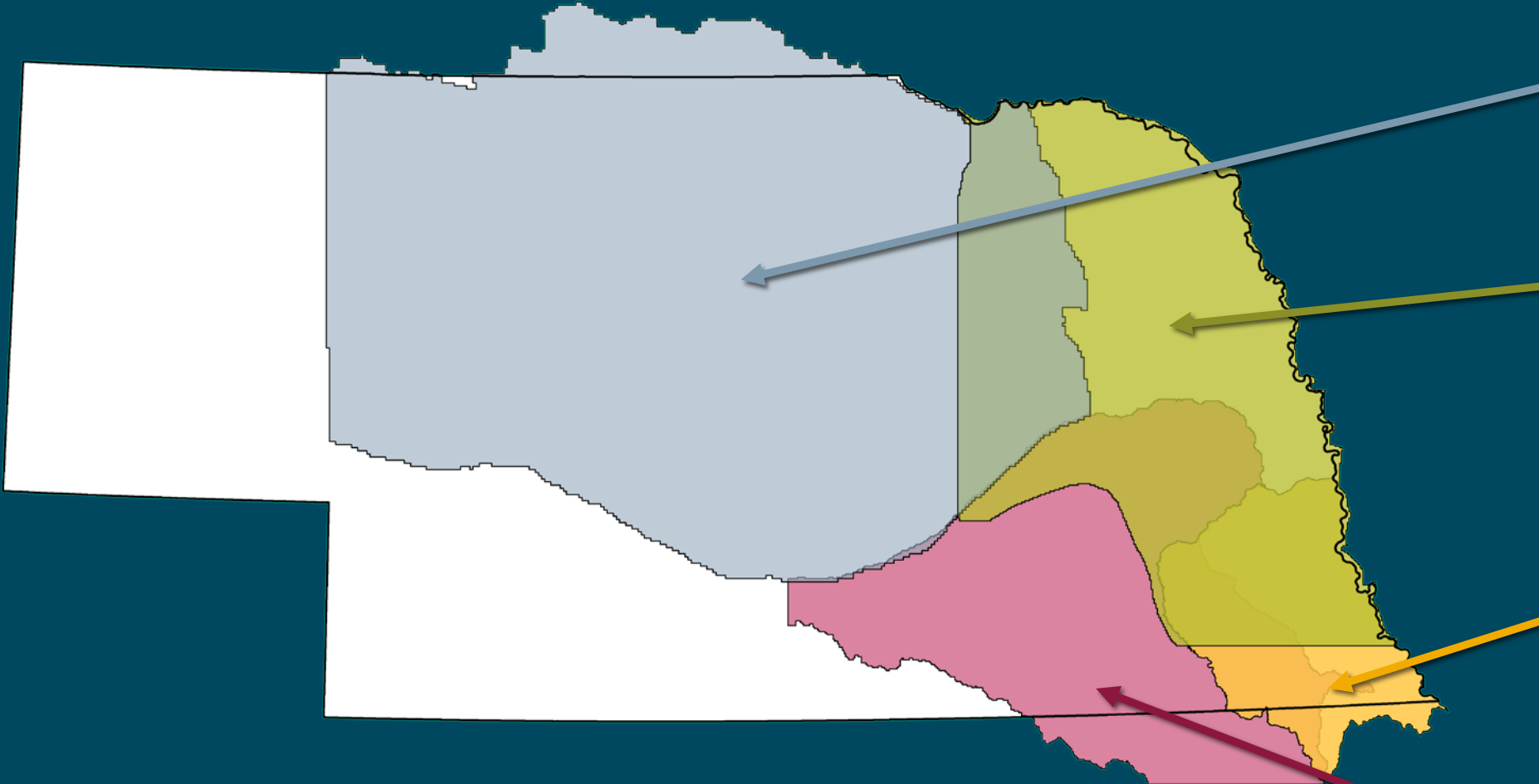
- Geology
- Irrigated acres
- Crop type

○ Changes through time

○ Accounting of water budgets across the region

- Supplies: streams, precipitation recharge, irrigation recharge, aquifer storage
- Demands: crop water use, wetland/open water, streams, aquifer storage

Groundwater Modeling Tools in Eastern Nebraska



Central Nebraska
(CENEB) Model



Lower Platte &
Missouri Tributaries
Model



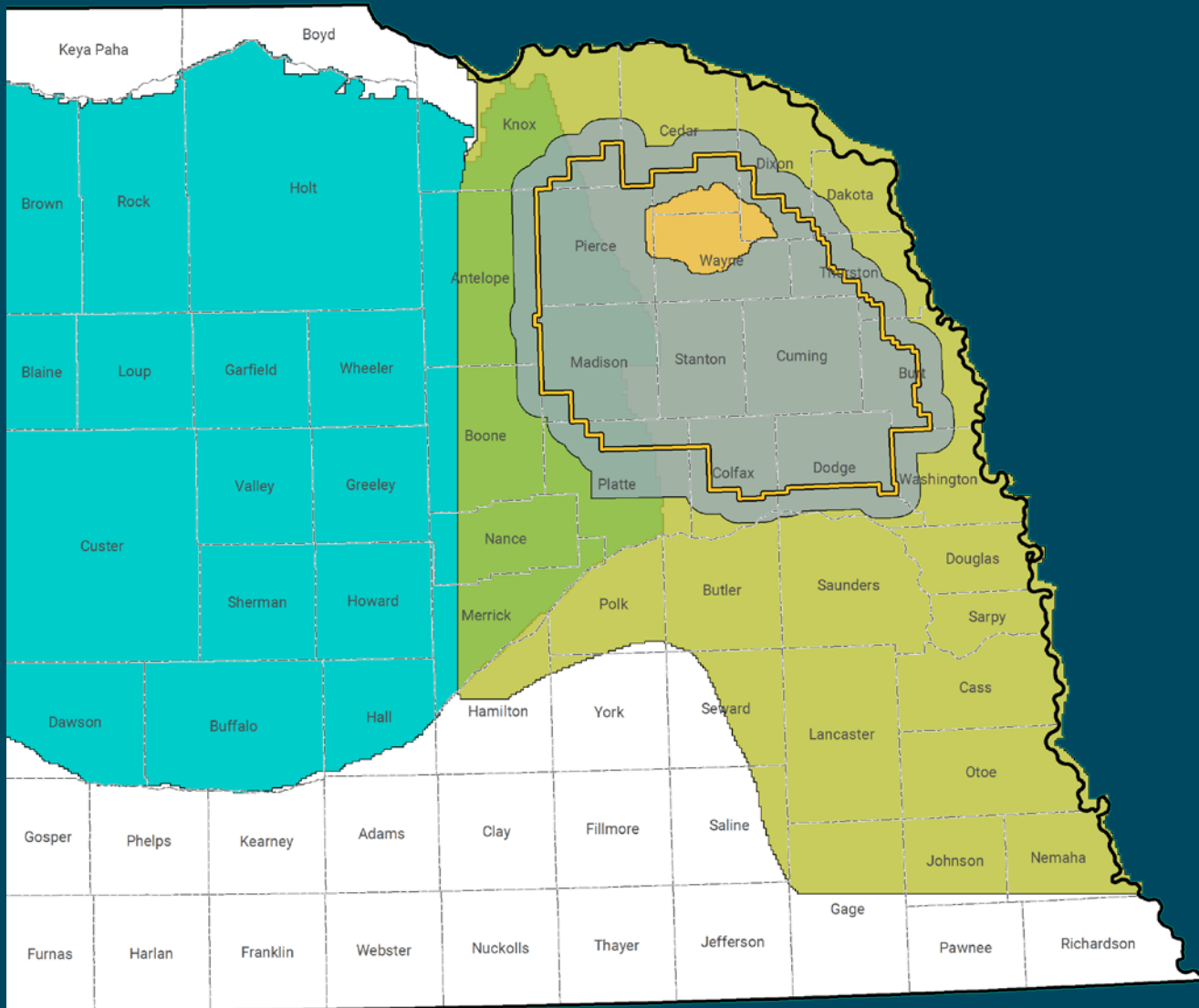
Lower Platte &
Missouri Tributaries
Nemaha Model








Blue Basin Model



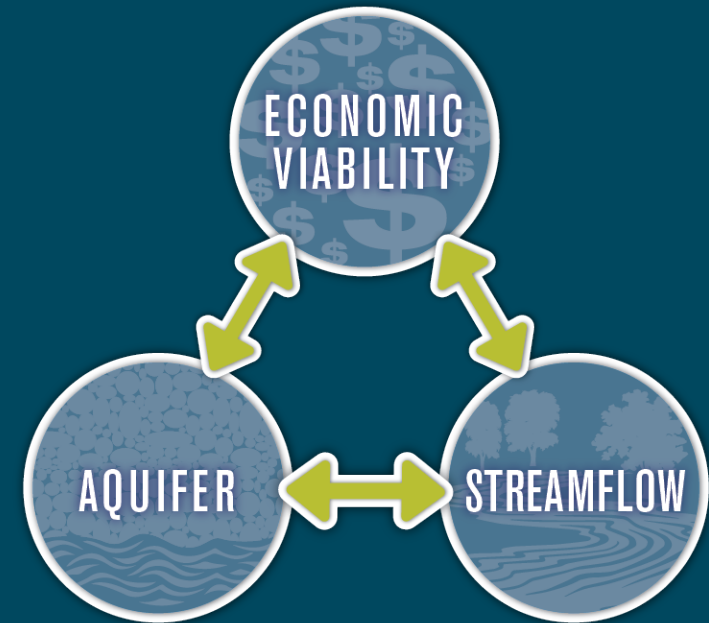
Models in the LENRD



-  Lower Elkhorn NRD (LENRD) Boundary
-  LENRD- Pilot Study Model Area
-  LENRD- District Wide Model Area
-  Lower Platte Missouri Tributaries Model
-  ELM Phase-3

Concluding Thoughts

- Challenge: improve best available science for the estimation of streamflow depletions from groundwater use
- Planning Toolbox – adaptive management
 - Improve data
 - Collect new data
 - Develop new models and analysis tools
 - Focus on overarching plan goals
- Communication & Collaboration



NEBRASKA

Good Life. Great Water.

DEPT. OF NATURAL RESOURCES

THANK YOU

Jennifer J. Schellpeper

Water Planning Division Manager

jennifer.schellpeper@nebraska.gov

dnr.nebraska.gov  