

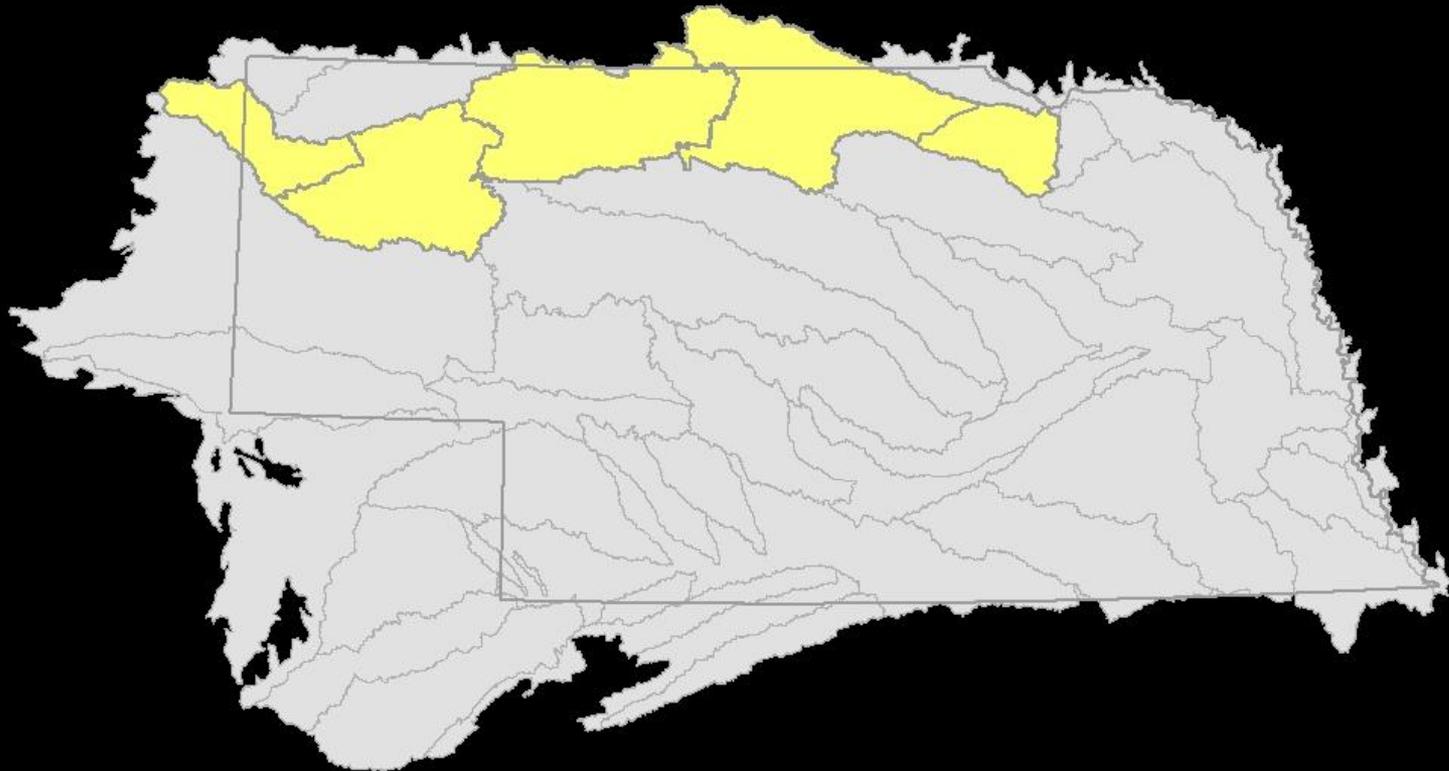
Niobrara River Basin INSIGHT Data and Analysis

Jesse Bradley

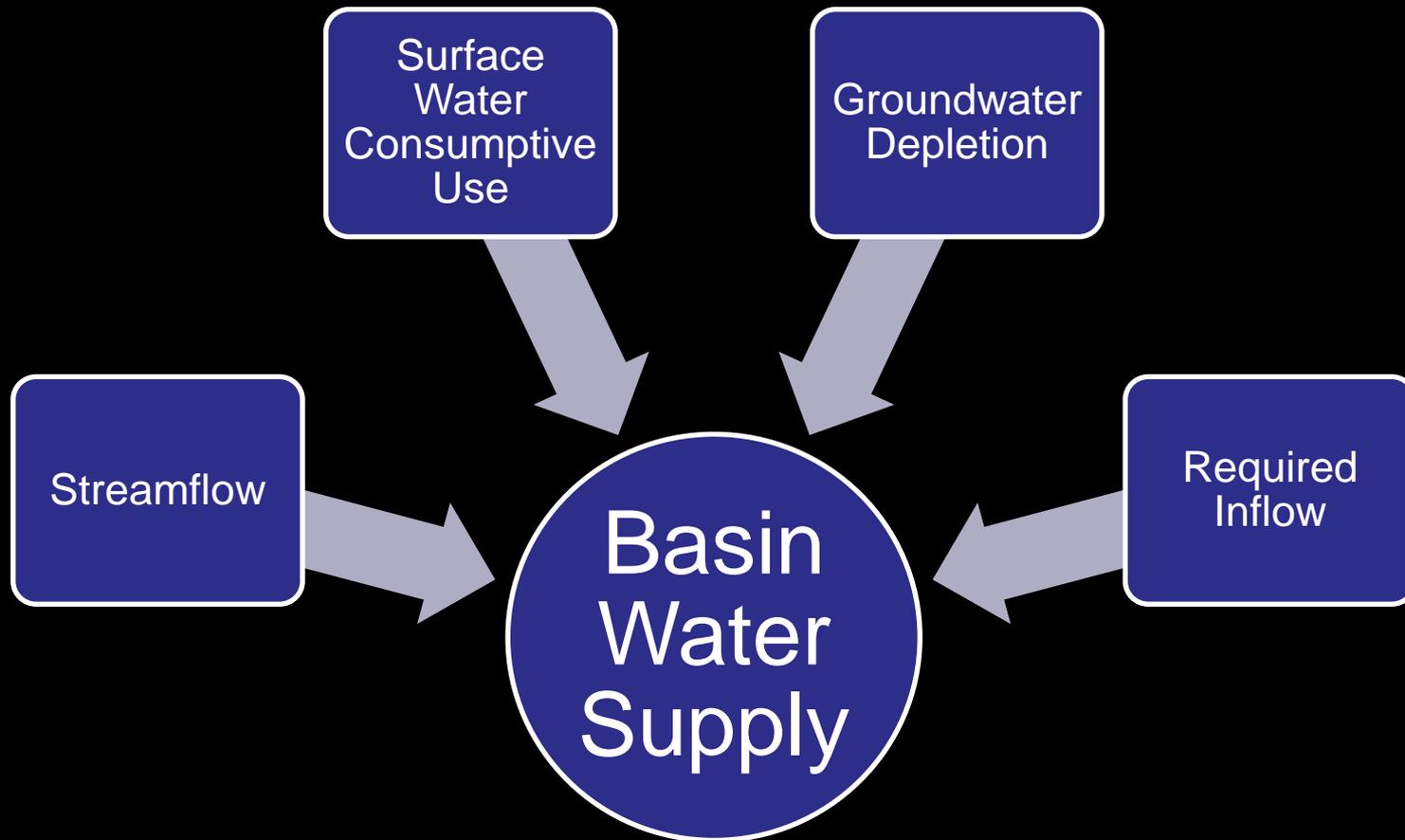
Nebraska Department of Natural Resources



INSIGHT Niobrara Subbasins



Components of Basin Water Supply (BWS)



BWS: Streamflow

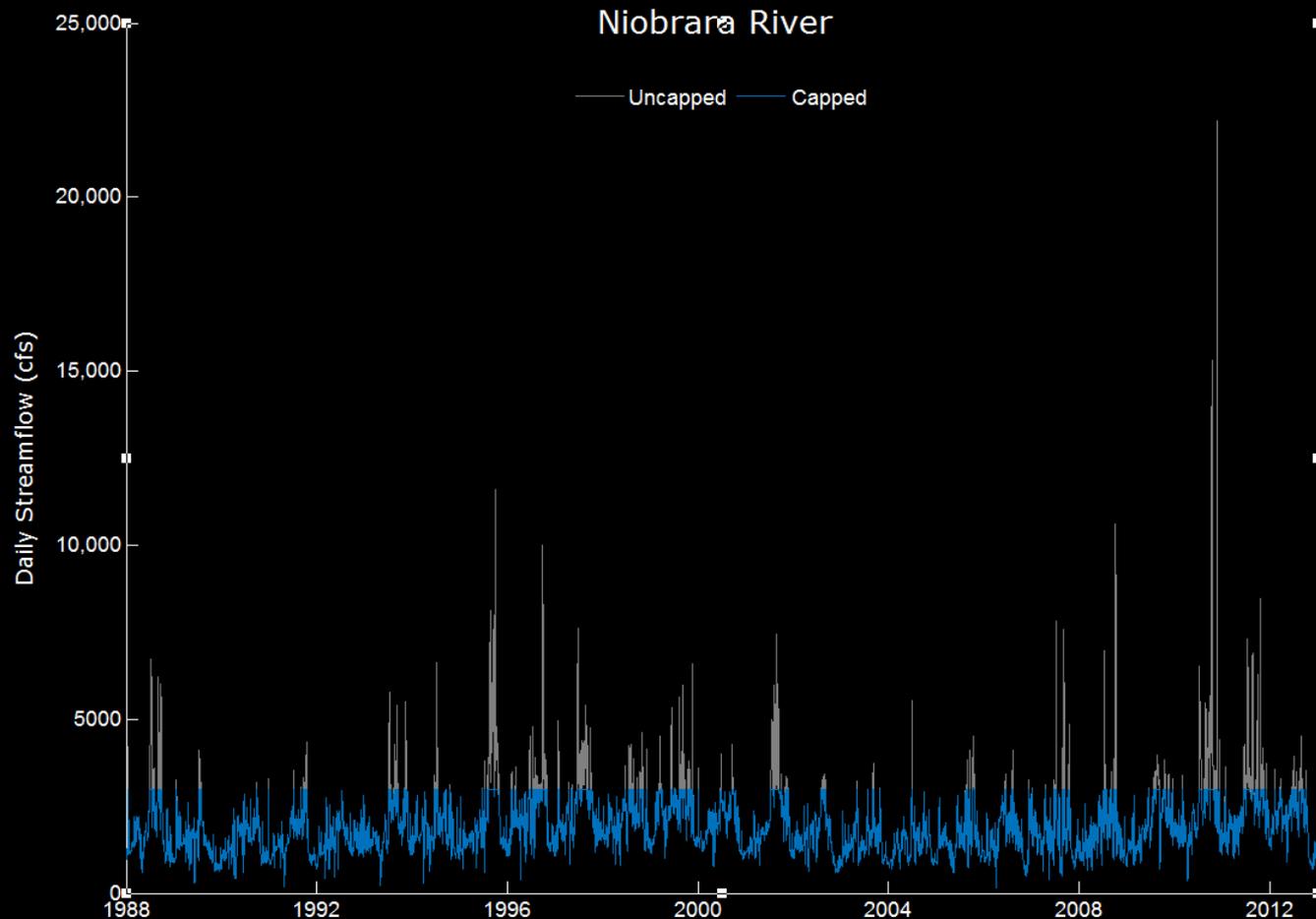
- Daily data from USGS gages in cfs
- Regression to fill major gaps in data
 - Gordon gage
- High flow events eliminated by capping at 5% exceedence level

Gage ID	Gage Name	INSIGHT Subbasin
6454500	Niobrara River above Box Butte Reservoir	Niobrara River Above Box Butte
6457500	Niobrara River near Gordon	Niobrara River Box Butte to Gordon
6461500	Niobrara River near Sparks, Nebr.	Niobrara River Gordon to Sparks
6465000	Niobrara River near Spencer, Nebr.	Niobrara River Sparks to Spencer
6465500	Niobrara River near Verdel, Nebr.	Niobrara River Spencer to Niobrara

BWS for Subbasins

- To avoid double counting, reach-gains used for subbasins with upstream subbasins
 - Box Butte to Gordon
 - Gordon to Sparks
 - Sparks to Spencer
 - Spencer to Niobrara
- Subtract upstream flow from downstream then cap
- Downstream Demands from upstream subbasins count as required inflows (discussed below)

Niobrara River: Capped Streamflow



BWS: Surface Water Consumptive Use

Type 1: Mirage Flats and Ainsworth canal systems

Canal Diversion, Direct Return, Field Delivery available in monthly reports from Reclamation

$$\text{SWCU} = \text{Net Diversion} - (\text{Field Delivery} * 65\%) = \text{CU}$$

Type 3: ~20 smaller canals/pumpers

Canal Diversion records

$$\text{SWCU} = \text{Diversion} * 65\% = \text{CU}$$

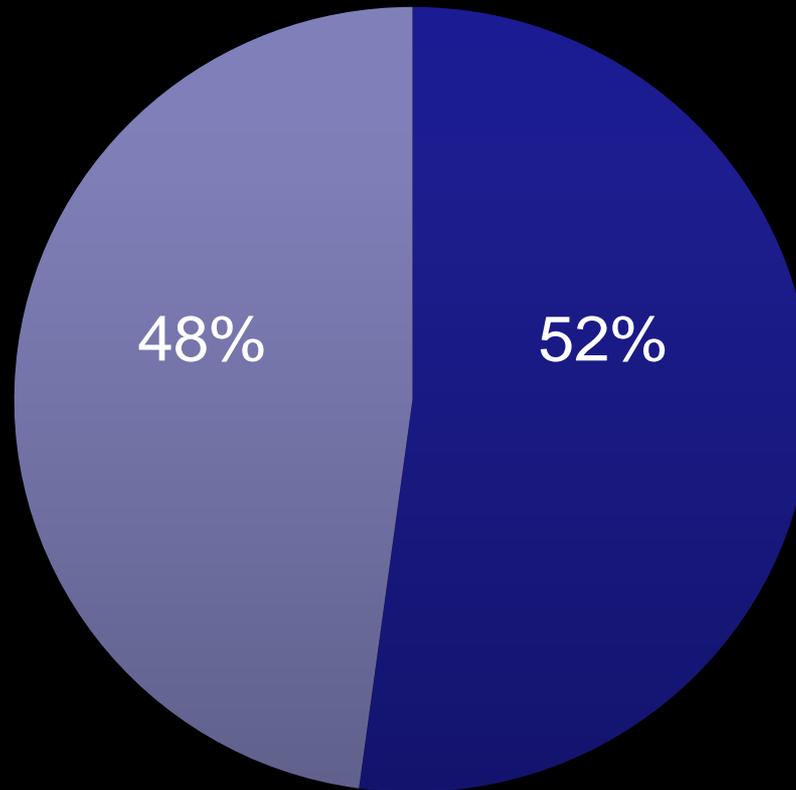
Type 4: Small pumpers/direct diverters

No direct diversion or use records

$$\text{SWCU} = \text{NIR} * \text{Acres} * \text{NASS Adjustment} = \text{CU}$$

Source of Surface Water Consumptive Use Data

Estimated - Small
Pumpers/Diverters,
based on acres



Measured - Type 1
and 3 Canals with
diversion records

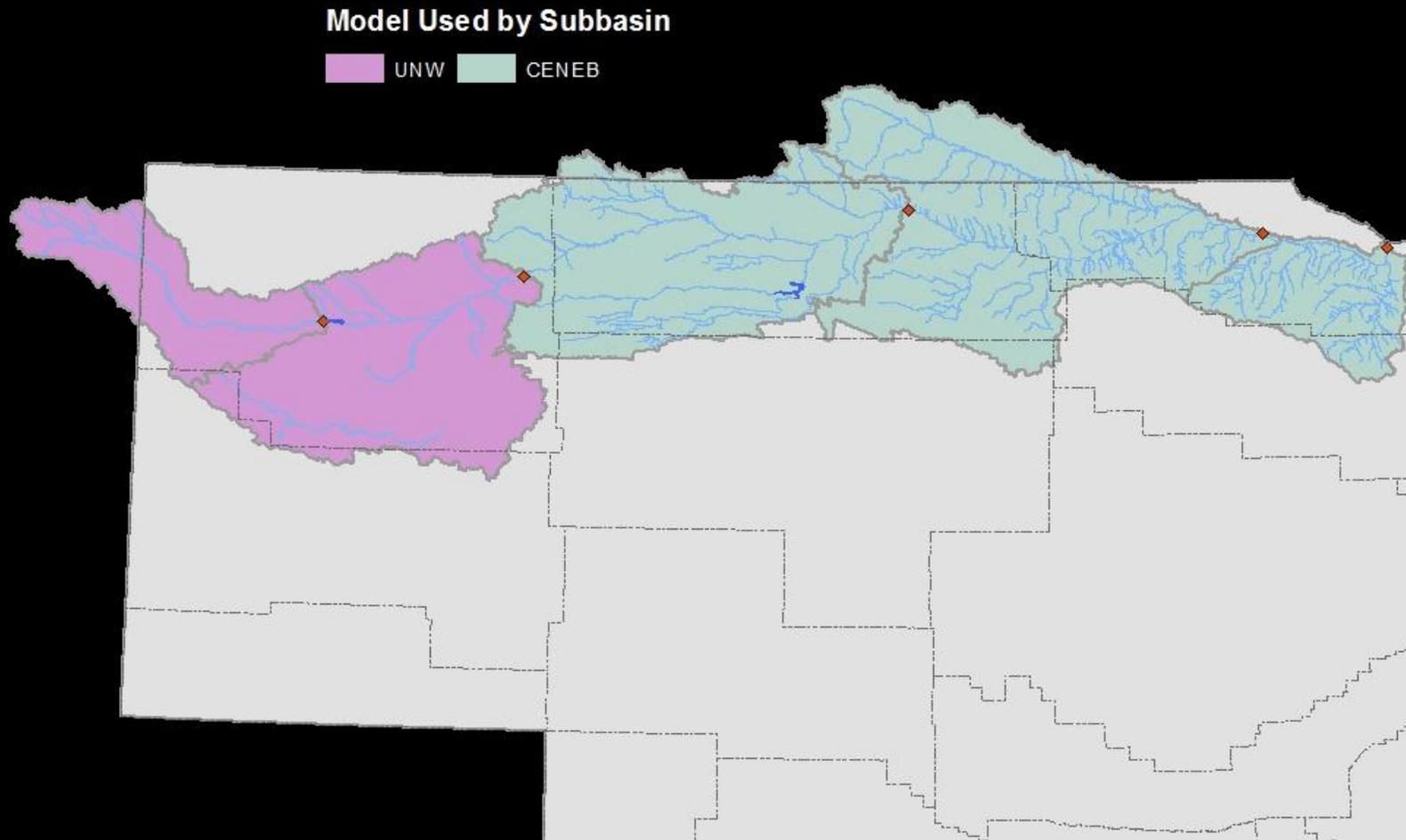
BWS: Surface Water Consumptive Use

- Reservoir Evaporation
 - Box Butte
 - Merritt

$$\text{SWCUE} = [(\text{Pan evaporation} * 0.7 * \text{surface area}) - (\text{precipitation} * \text{surface area})]$$

BWS: Groundwater Depletion

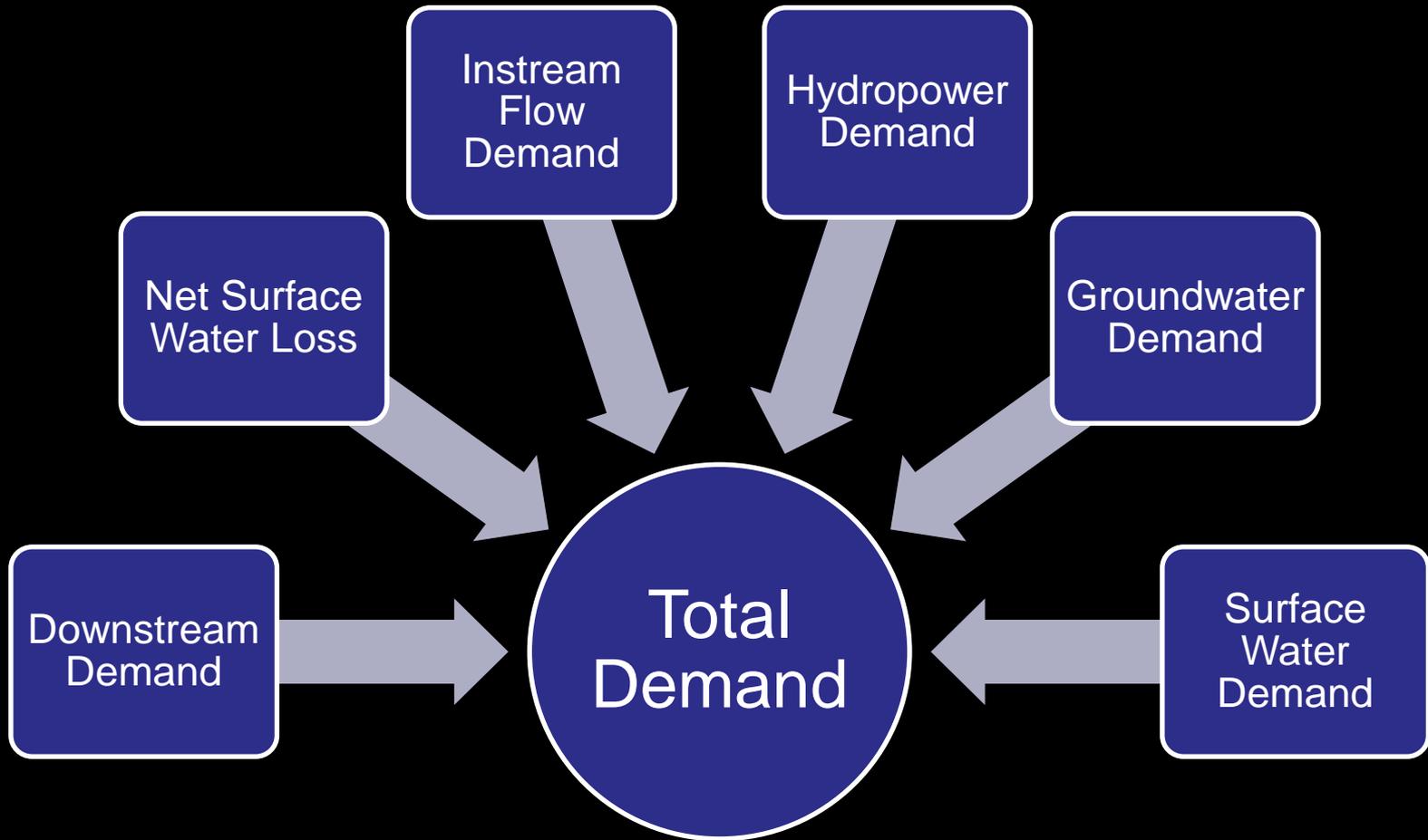
- Based on groundwater model results



BWS: Required Inflow

- Based on downstream demands assigned to upstream basins
- Those demands are generally proportioned based on the percentage of BWS from each subbasin

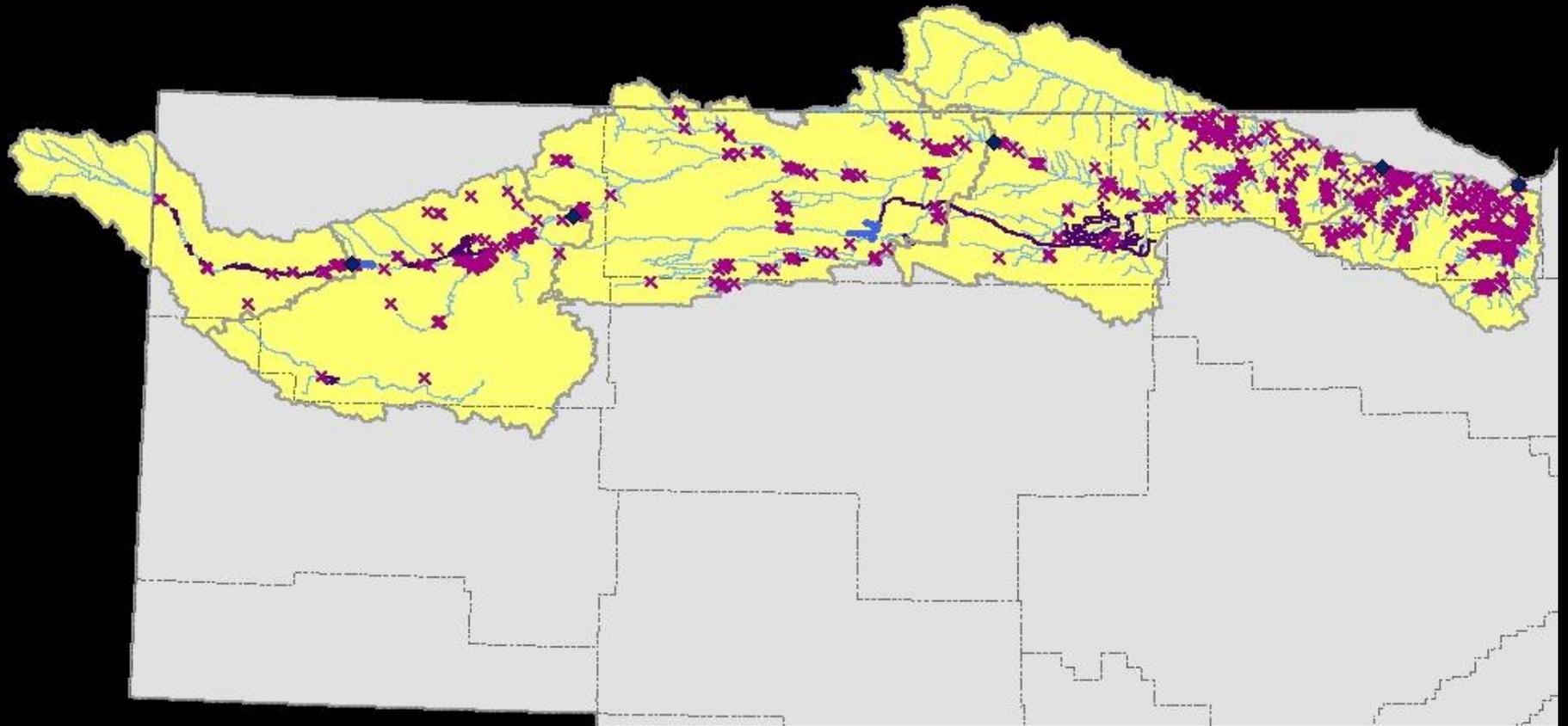
Total Demand (TD)



TD: Surface Water Demand

- Same as surface water consumptive use except when under water administration
- No water administration adjustments applied in the Niobrara Basin

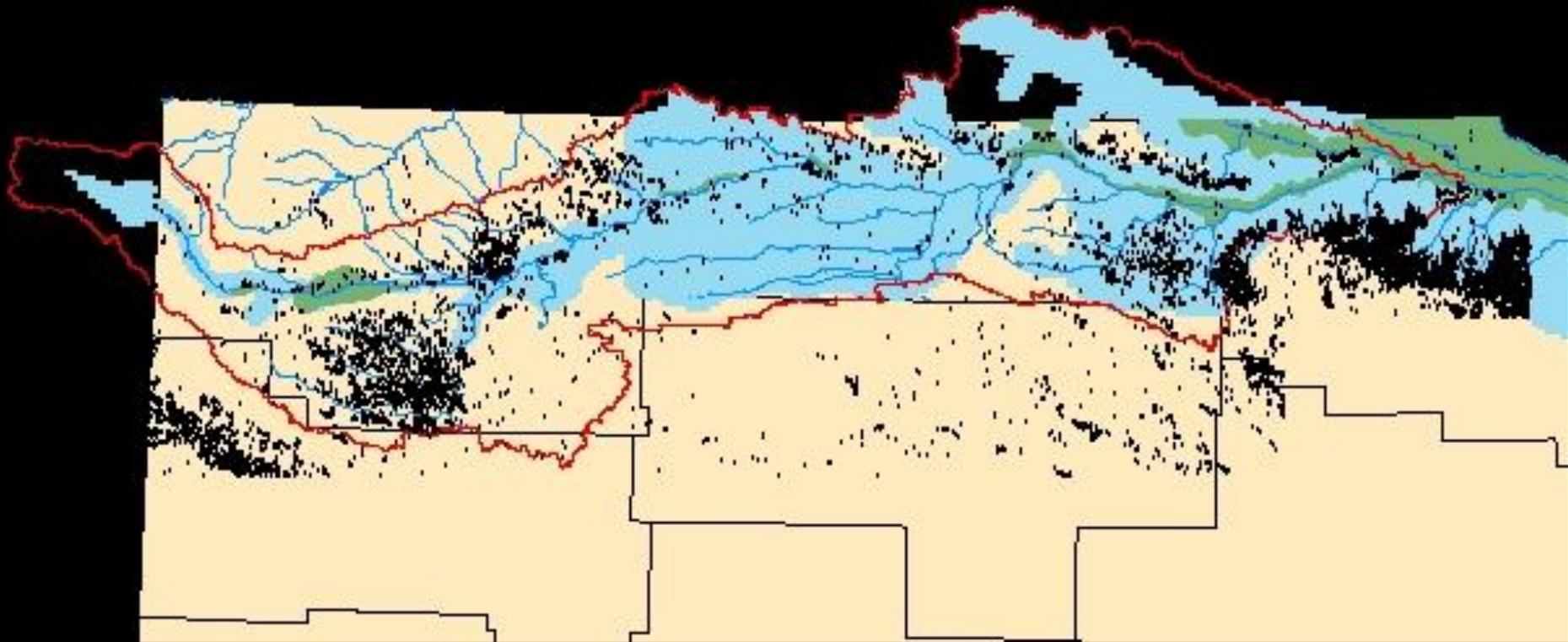
TD: Surface Water Demand



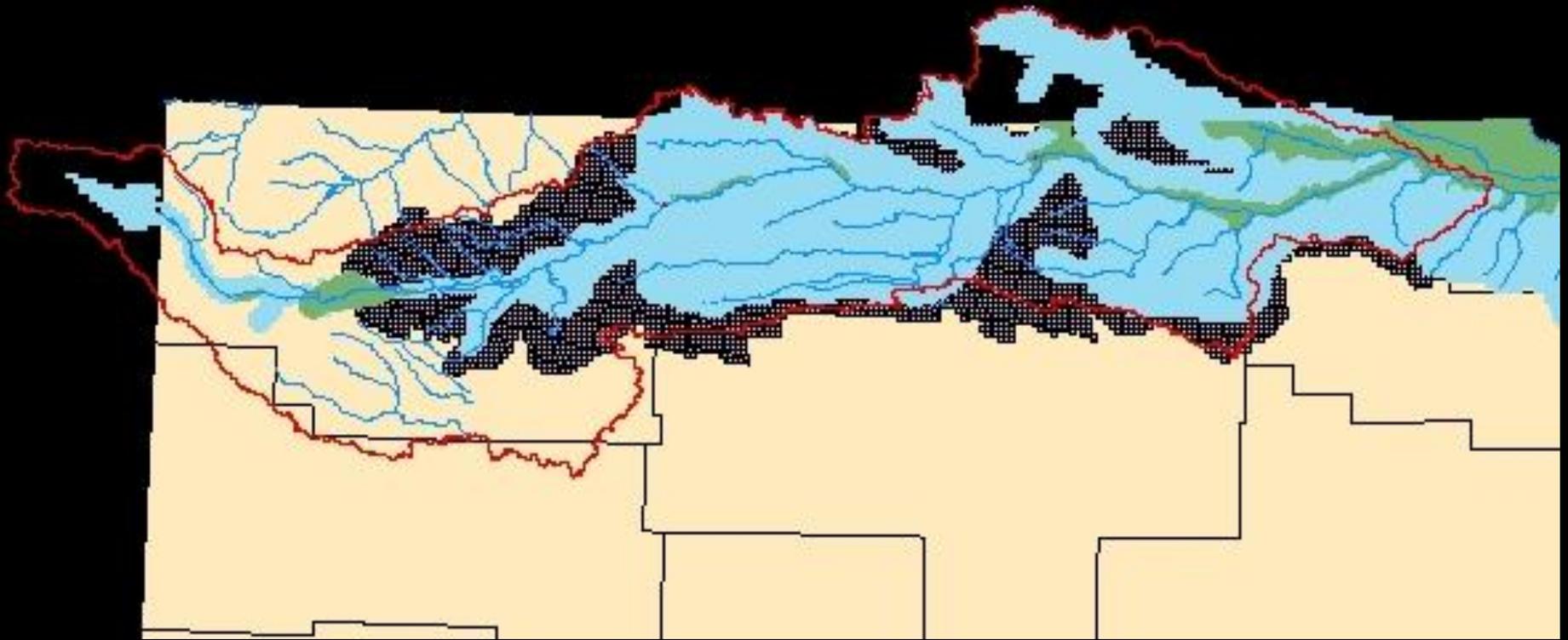
TD: Groundwater Demand

- For **Near-Term**, modeled groundwater depletions were used (same as used for BWS)
- For **Long-Term**, estimated groundwater consumption within the 10/50 area was used
 - Irrigation
 - Municipal
 - Industrial

TD: Groundwater Demand



TD: Groundwater Demand



TD: Hydropower Demand

- Calculated by adding streamflow and groundwater depletions and then capping at permitted amount

$\text{Min}(\text{daily } Q + \text{GW depl.}, \text{daily permitted amount})$

TD: Instream Flow Demand

- Only considered for permitted instream flow rights
- None on the mainstem of the Niobrara
- Long Pine Creek instream flows represented by non-consumptive demand for hydropower

TD: Net Surface Water Loss

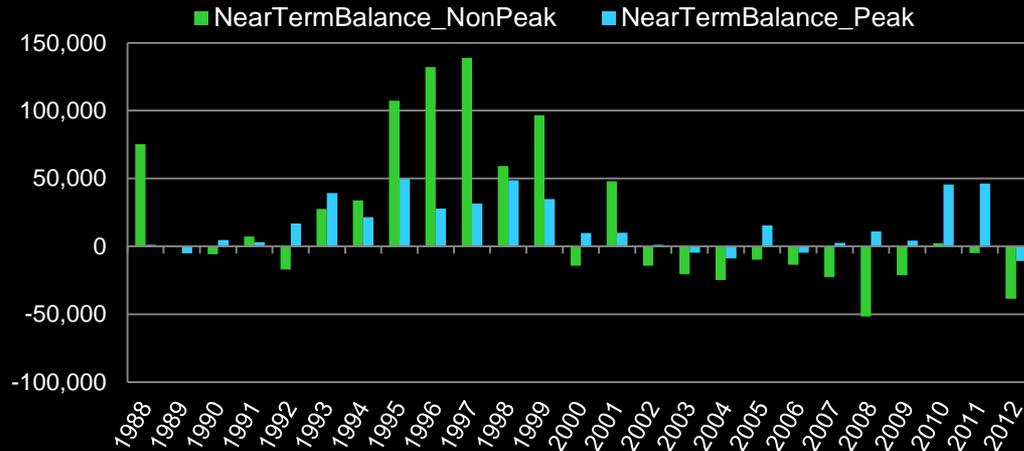
- Intended to account for water to convey surface water consumptive use
- Only included for larger irrigation districts and canals (Mirage Flats and Ainsworth)
- Calculated as the difference between diversion and CU

TD: Downstream Demand

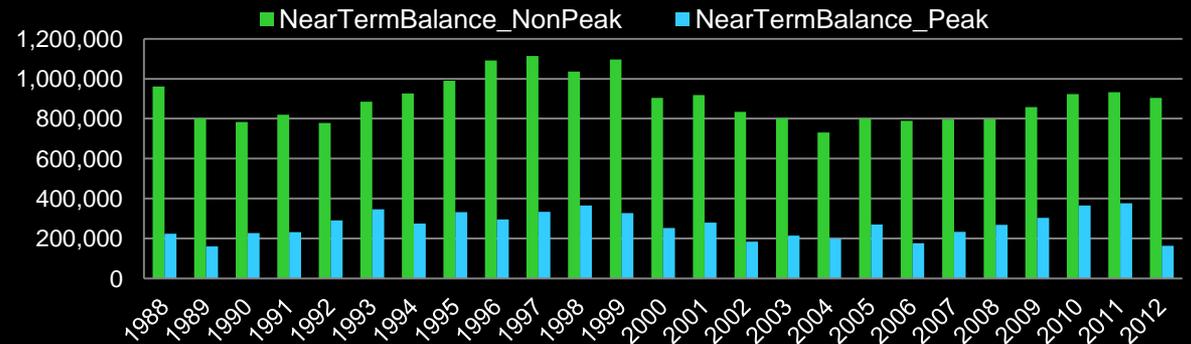
- For Niobrara, only applicable at the subbasin level
- Based on downstream mainstem demands
- Proportioned based on contribution of each subbasin BWS to the total subbasin for consumptive uses
- Hydropower proportioned based on percentage of depletion from each subbasin
- <http://www.dnr.nebraska.gov/Media/IWM/Statewide/INSIGHTMethodsCurrentVersion.pdf>

Going Further into the Data

Niobrara River Sparks to Spencer – with Non-Consumptive Demands



Niobrara River Sparks to Spencer - No Non-Consumptive Demands





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