



NEBRASKA'S WATER MANAGEMENT RESOURCE

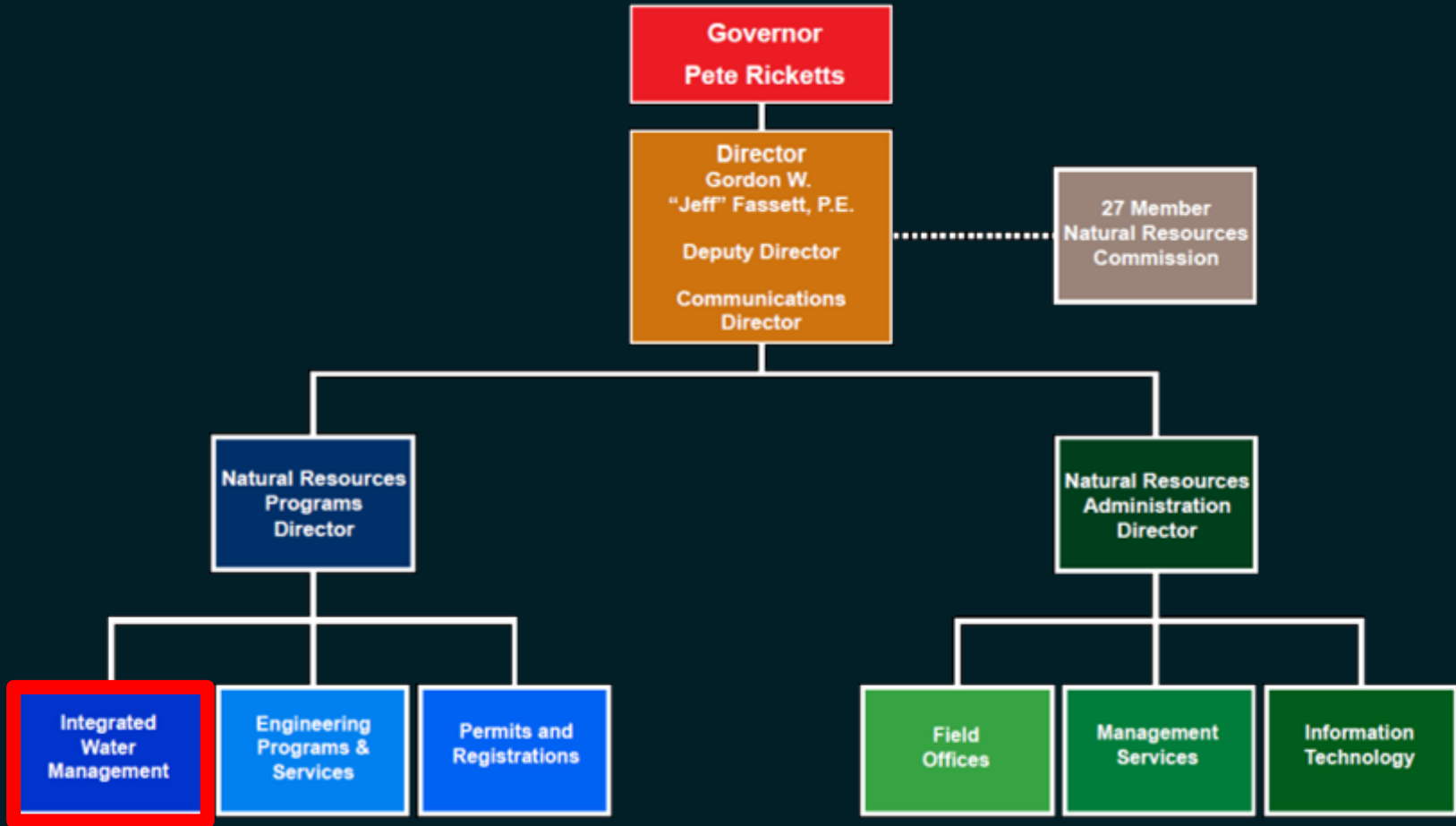
Providing the sound science and support for managing  
Nebraska's most precious resource.

## **WaterSMART and Conjunctive Water Management in the Niobrara River Basin**

Fall 2015 Niobrara Basin Compact Meeting  
Lincoln, Nebraska  
October 22<sup>nd</sup> , 2015

**Tim Freed, Sr., M.S.**  
Integrated Water Management Coordinator  
Nebraska Department of Natural Resources

# Nebraska Department of Natural Resources



# Integrated Water Management Division

## What we do:

Provide technical expertise, planning, and coordination

Develop models

Conduct studies

Help water managers

Collaborate with NRDs and other stakeholders

### To help better understand:

- Nebraska's water supplies and uses
- The effects of potential water management strategies

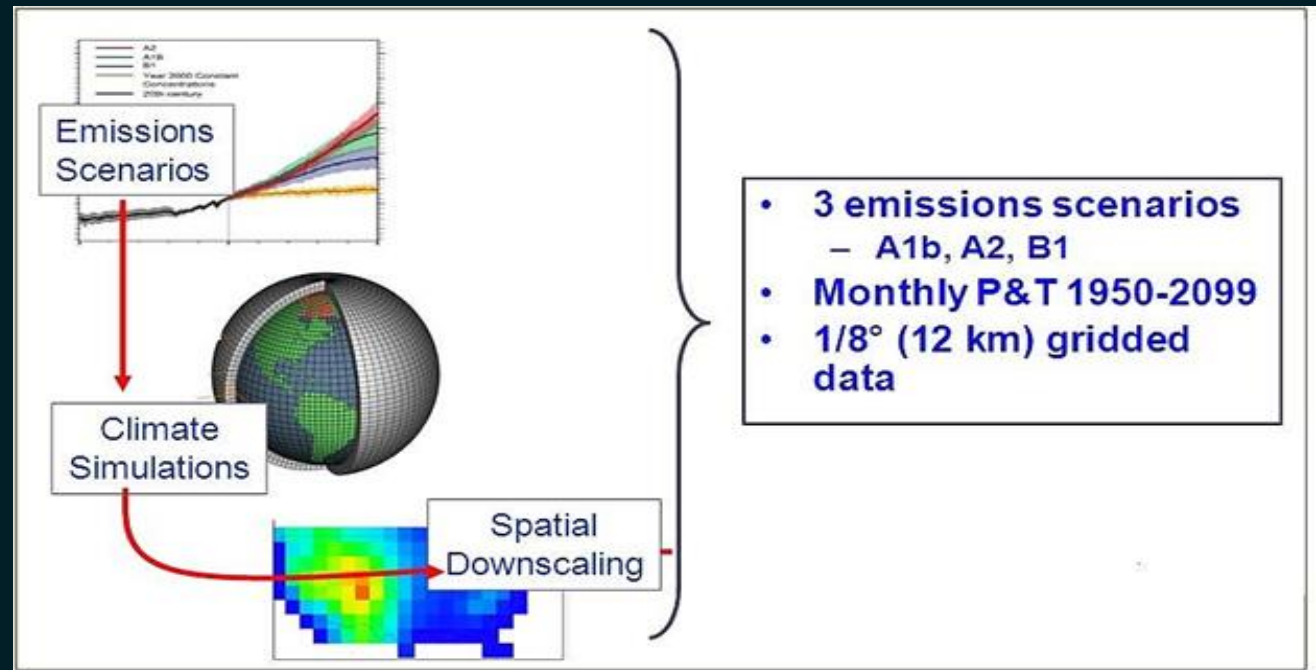
# Introduction and Background

- Niobrara River basin Study
  - a collaborative effort by the Nebraska Department of Natural Resources and the U.S. Bureau of Reclamation as a part of the WaterSMART program
  - evaluate the current and future water supply and demand to identify potential adaptation strategies to reduce any identified gaps

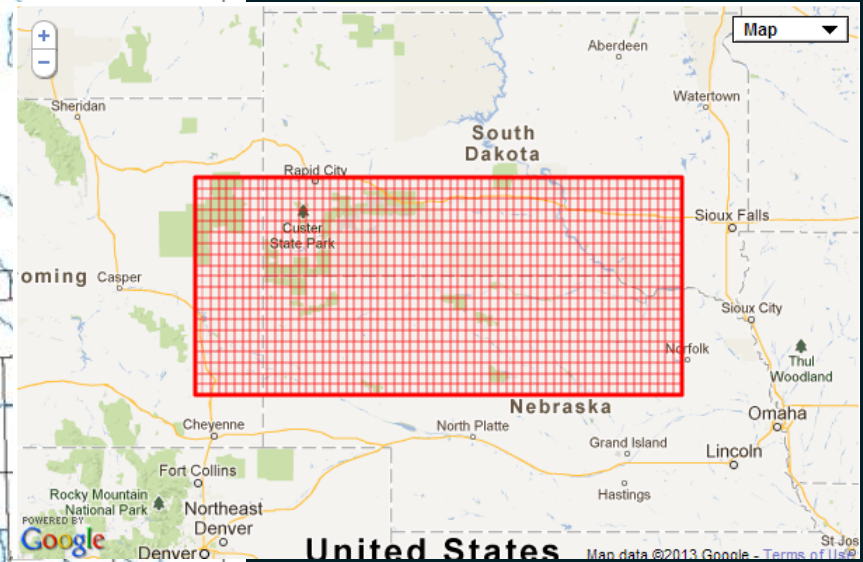
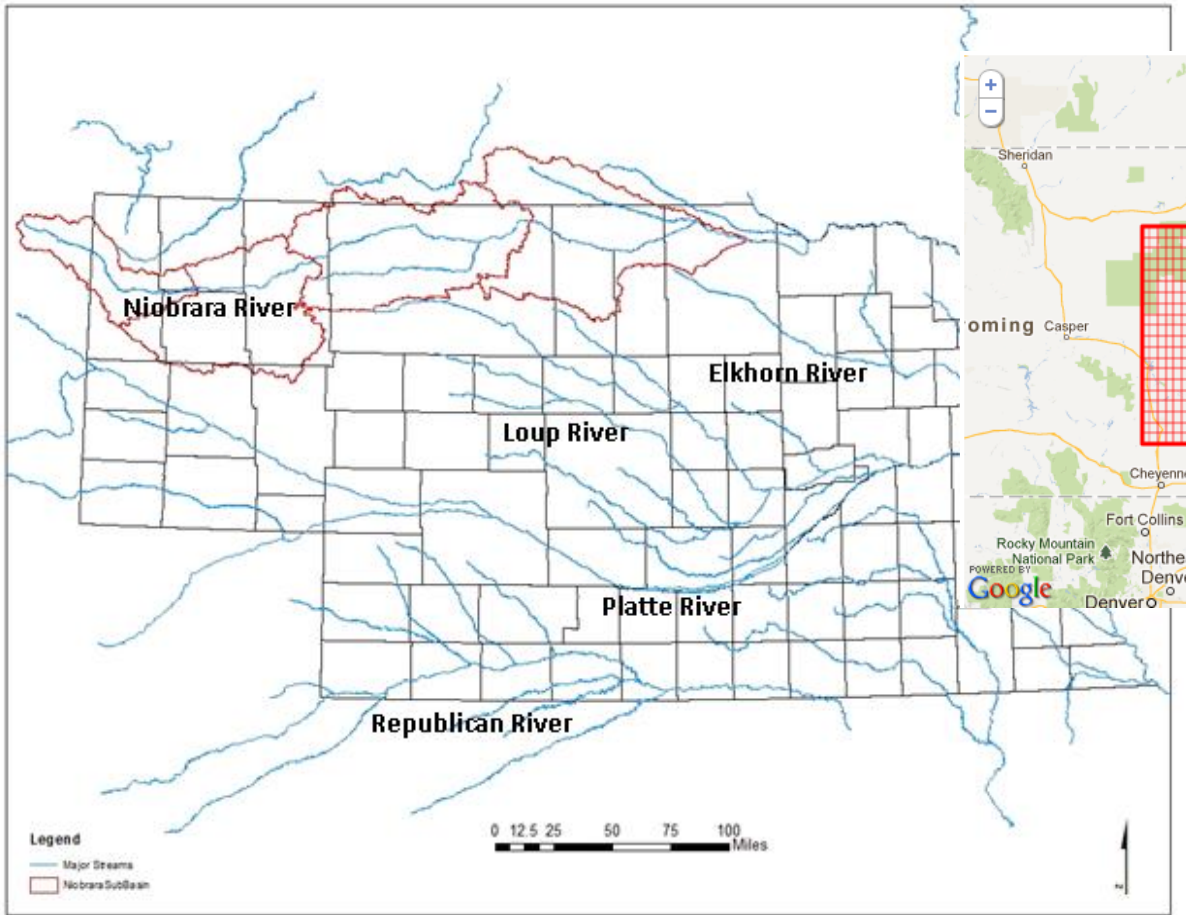


# Climate Variability Projection

- Intergovernmental Panel on Climate Change (IPCC)
  - General Circulation Model (GCM) projections downscaling



# Climate Variability Projection



# Climate Variability Projection

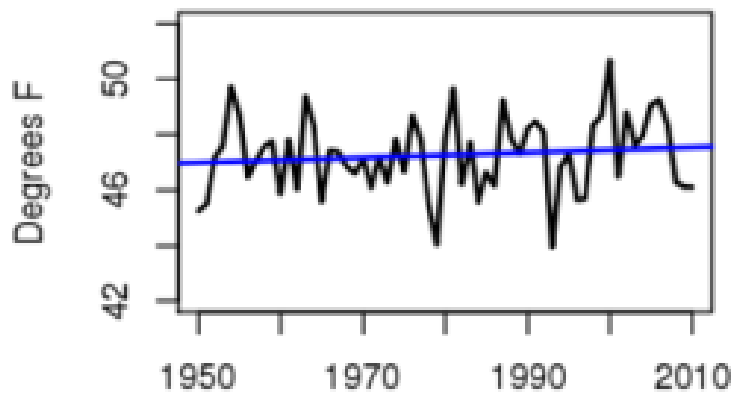
1) Start from 112 archived CMIP3 climate & hydrology projections, including P, T, RO, ET

2) Select projections that represent projected ranges in P, T, P-ET

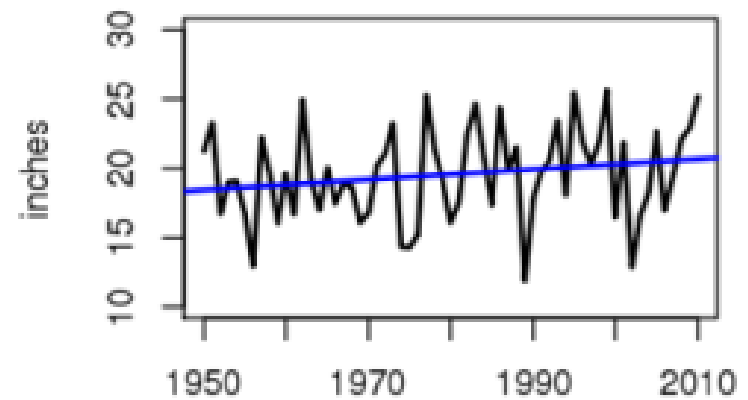
Low	10 <sup>th</sup> of P	90 <sup>th</sup> of T	10 <sup>th</sup> of P-ET
CT	50 <sup>th</sup> of P	50 <sup>th</sup> of T	50 <sup>th</sup> of P-ET
High	90 <sup>th</sup> of P	10 <sup>th</sup> of T	90 <sup>th</sup> of P-ET

# Historical Trends in Niobrara Basin

Mean Annual Temperature



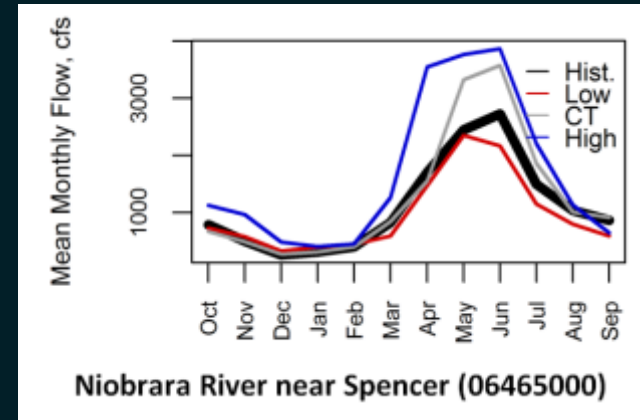
Mean Annual Precipitation





# Climate Variability Projection

- Projection Analysis Results

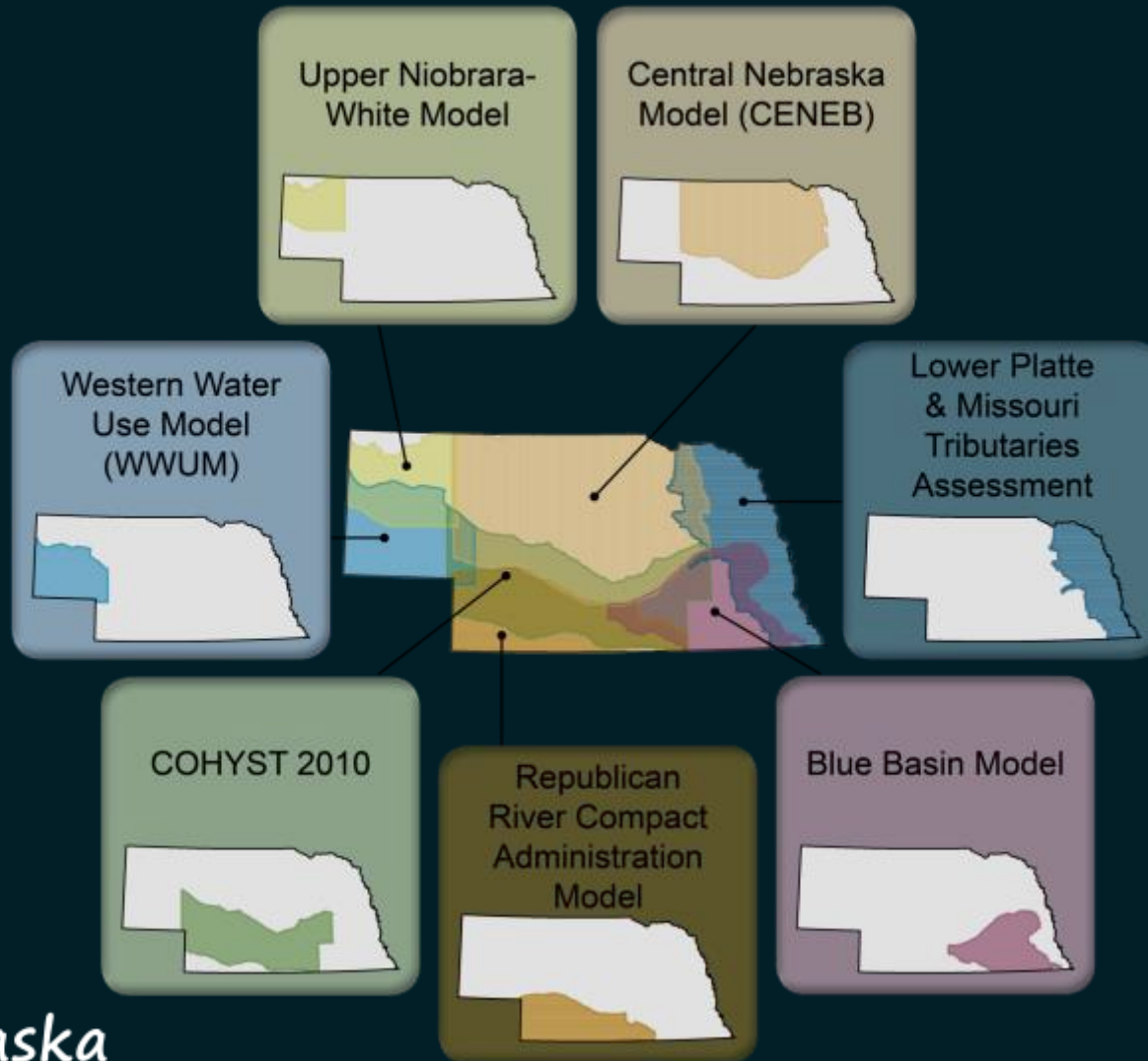


		Low	Central Tendency	High
Mean Summer Temperature (June - August)	Select Projection Based on 112 Projections	+2.9°C	+1.9°C	+1.2°C
		+3.3°C	+2.1°C	+0.96°C
Mean Summer Precipitation (June - August)	Select Projection Based on 112 Projections	-13%	+5.4%	+13%
		-15%	+4.7%	+17%

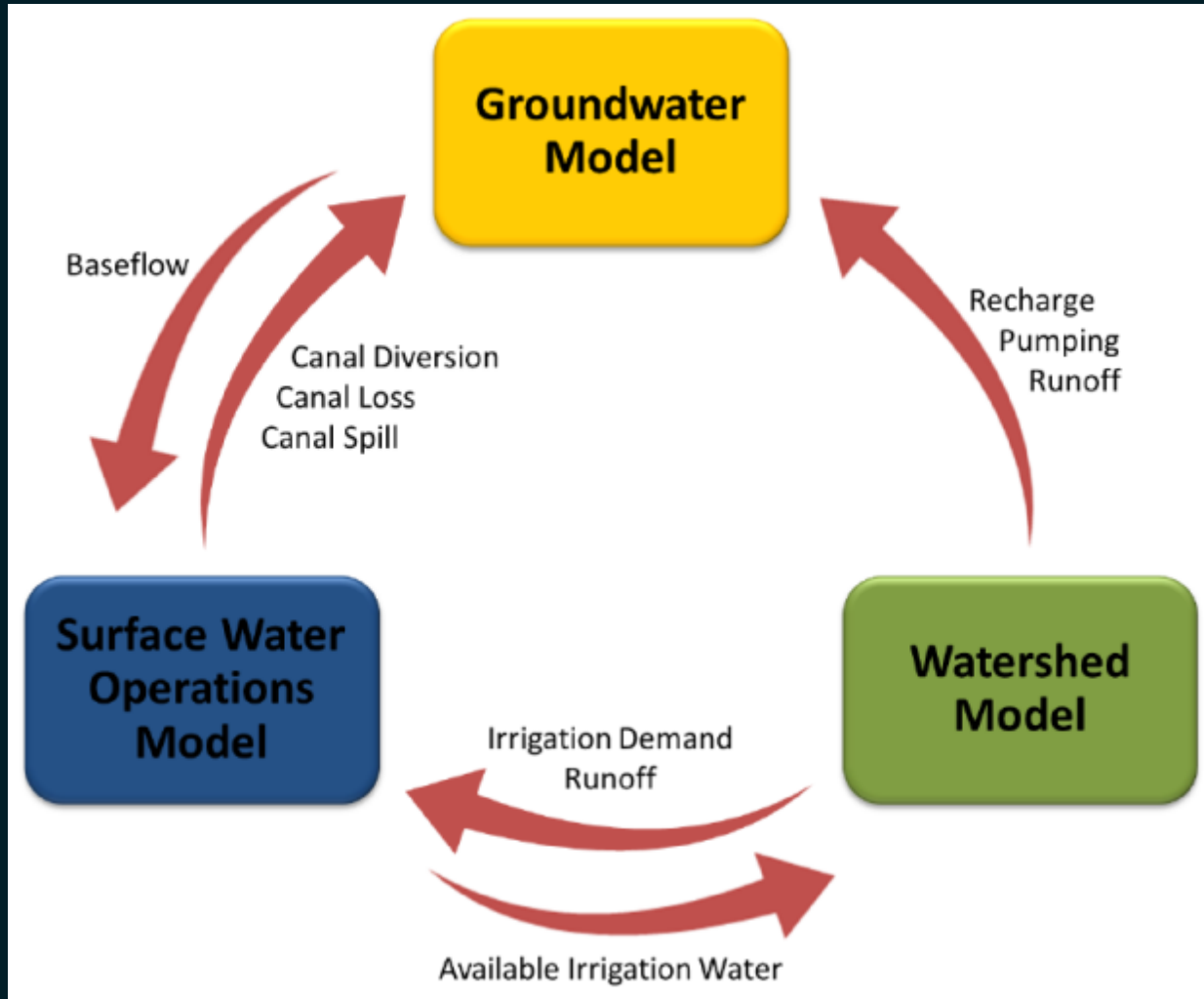
# Integrated Water Management Modeling

- Change in one hydrological component may affect the other components of the system
- Integrated Water Management (IWM) Model for better understanding of
  - interaction between surface water and groundwater systems
  - response of different hydrological components to stress
- Integrated Water Management (IWM) Model for
  - evaluation of basin water supply and use
  - effective management of water resources

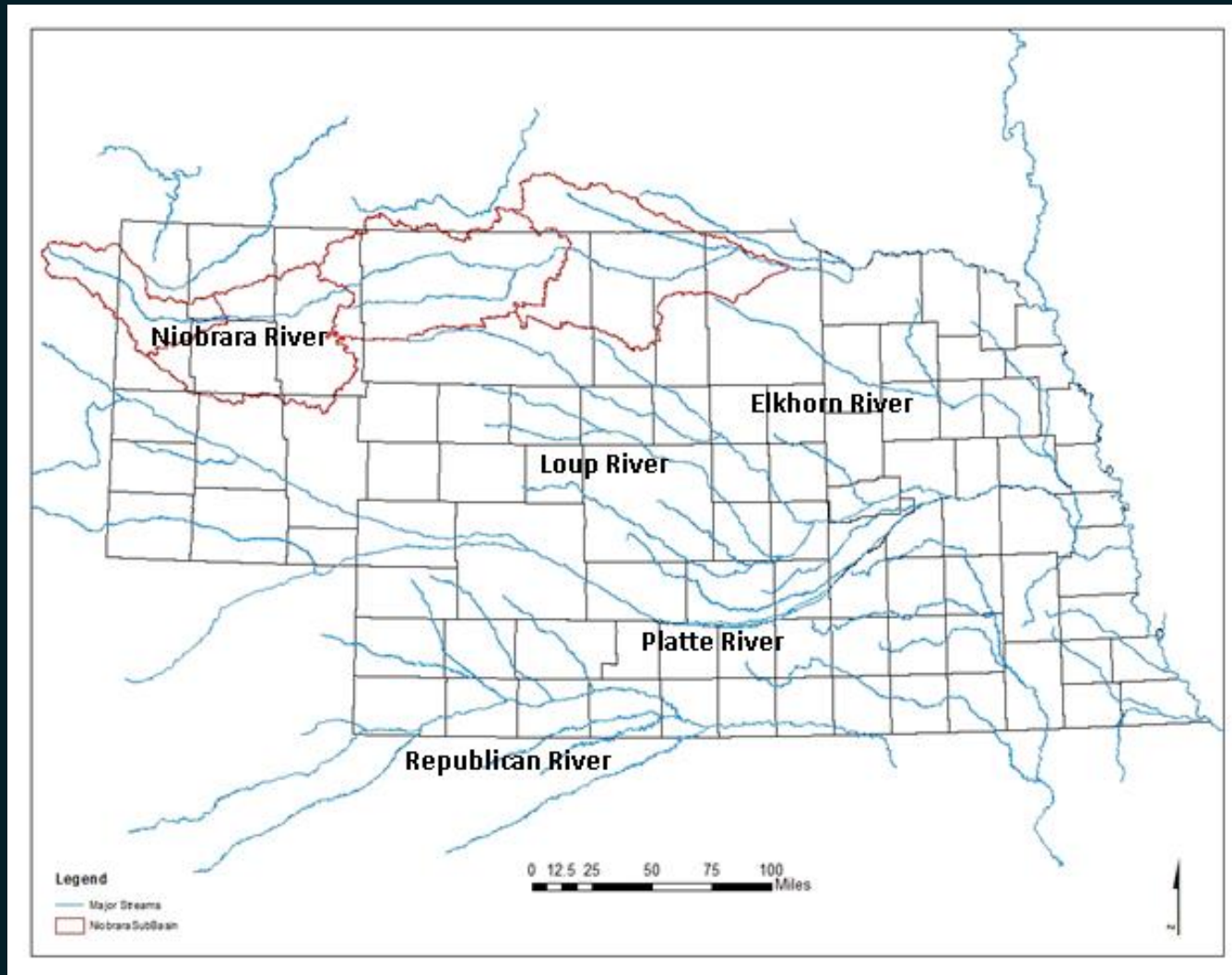
# Integrated Water Management Modeling



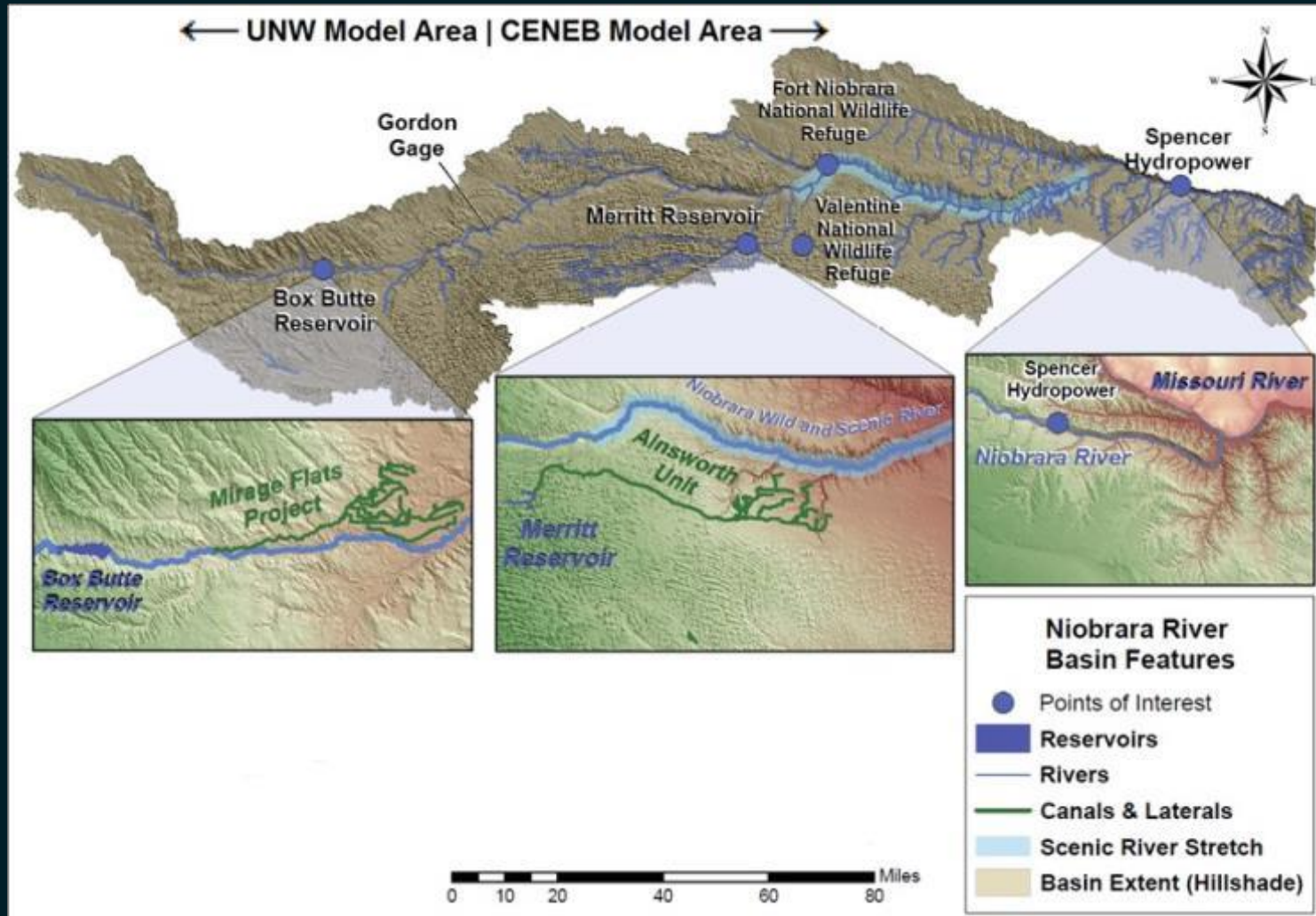
# Framework for IWM Modeling



# Framework for IWM Modeling

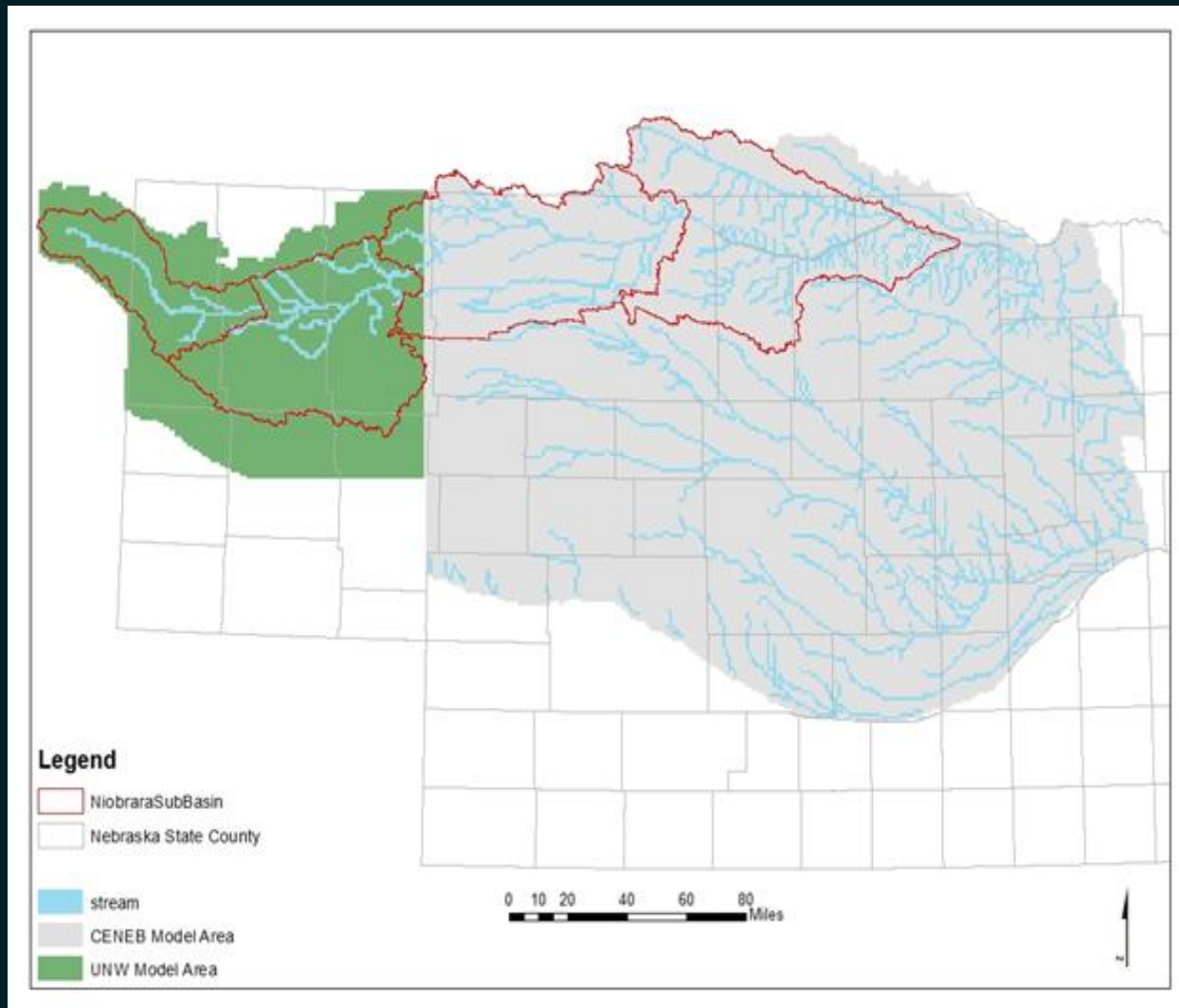


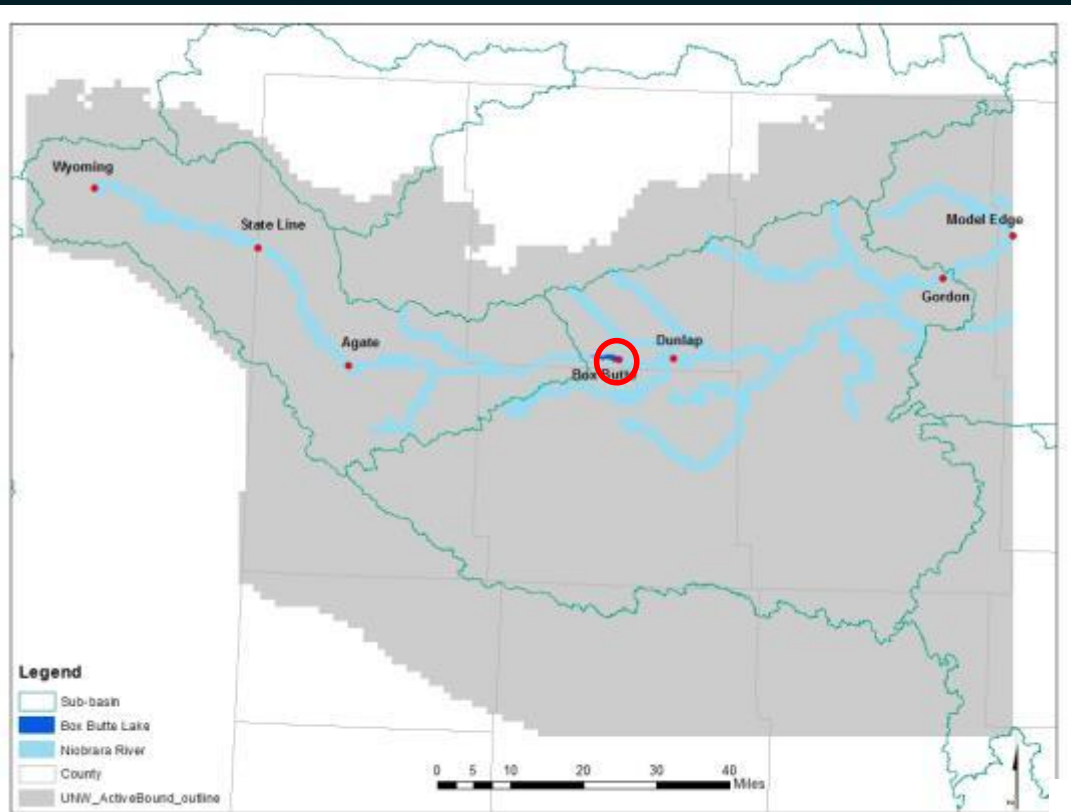
# Framework for IWM Modeling



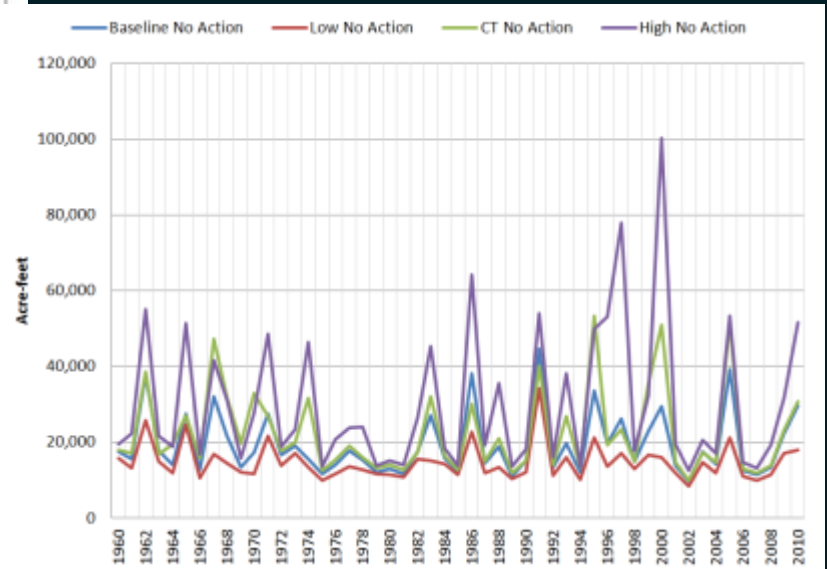


# Application of IWM Modeling

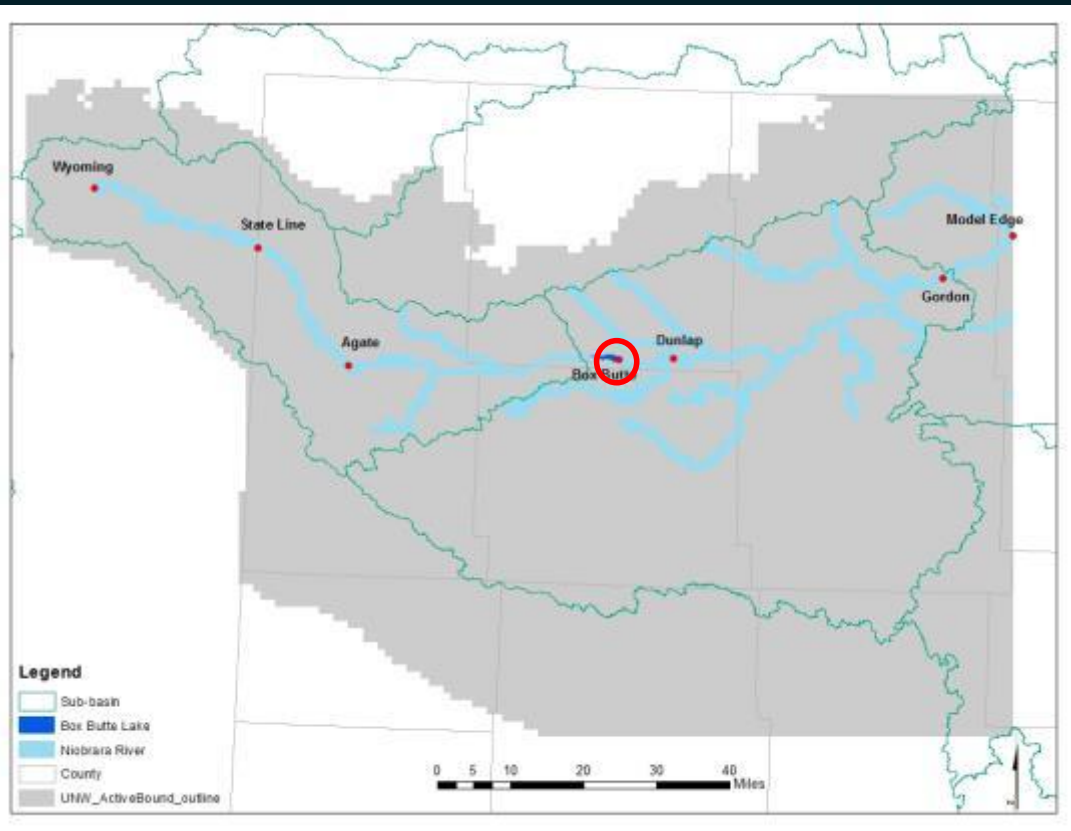




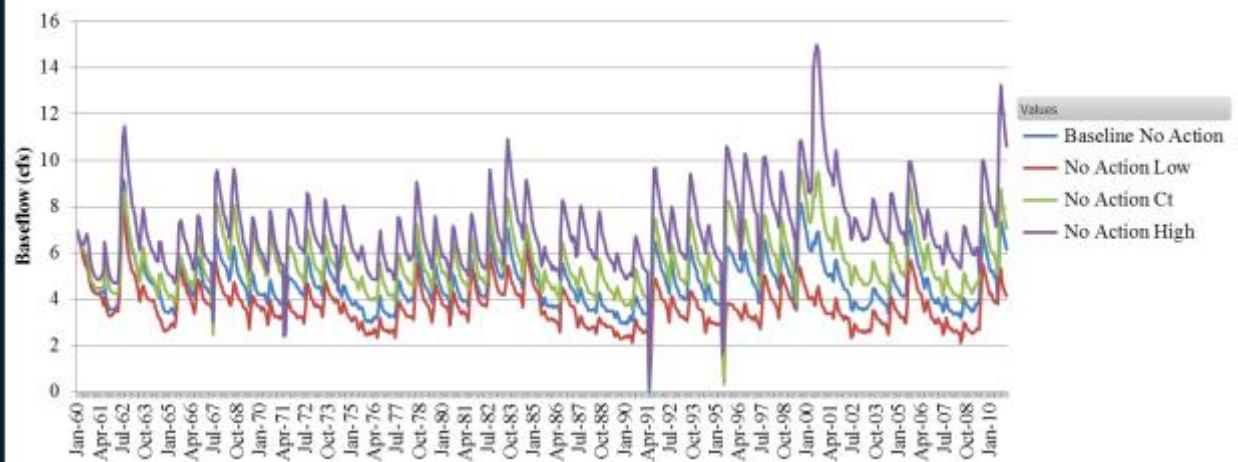
## Total Flow

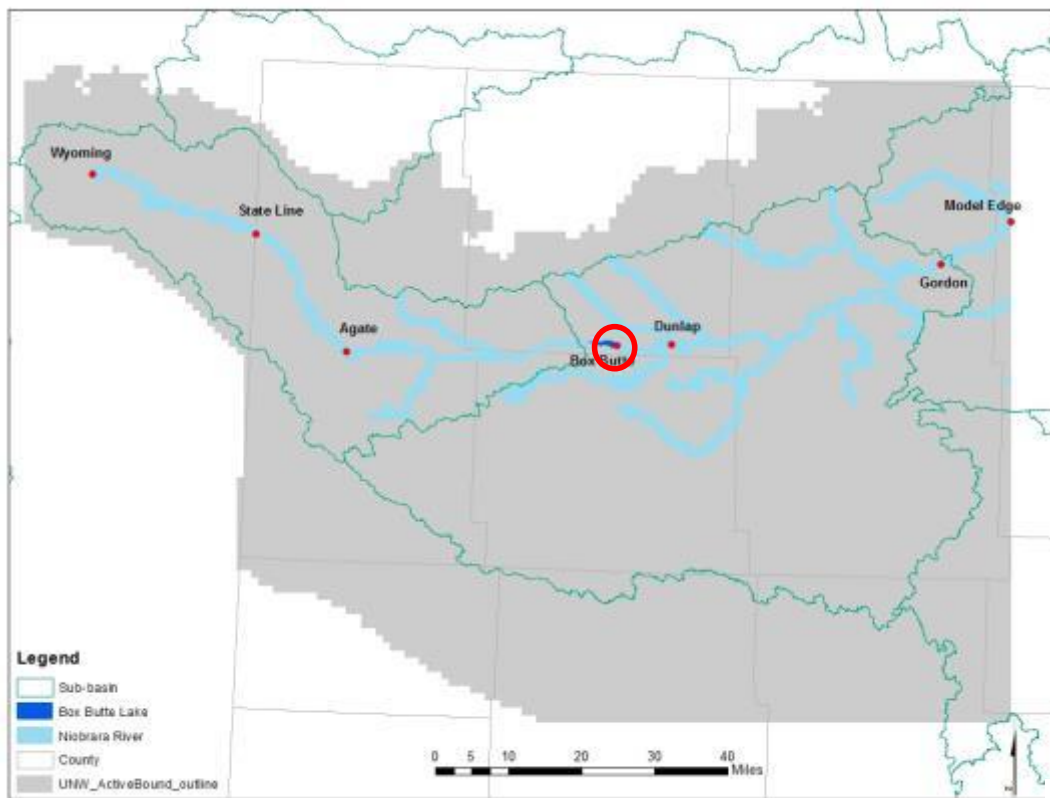




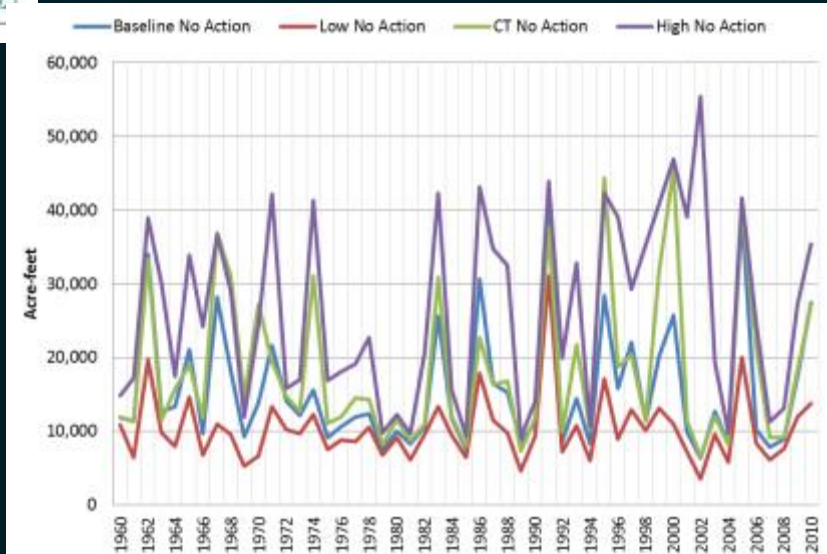


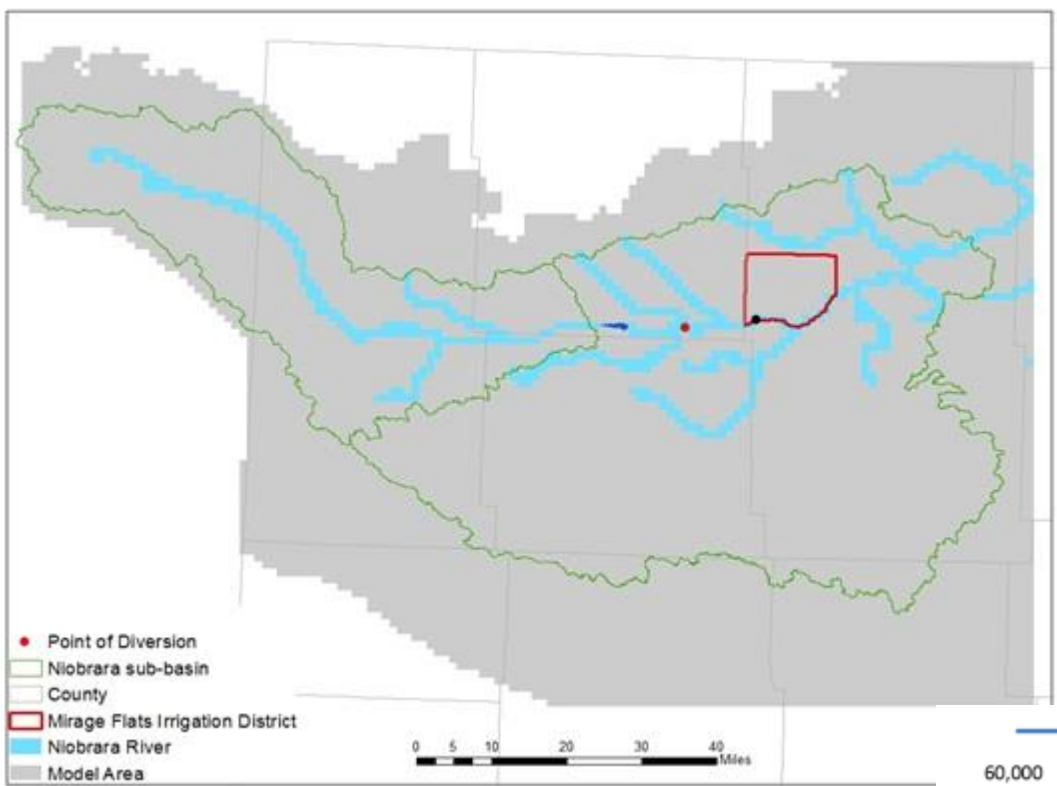
## Baseflow



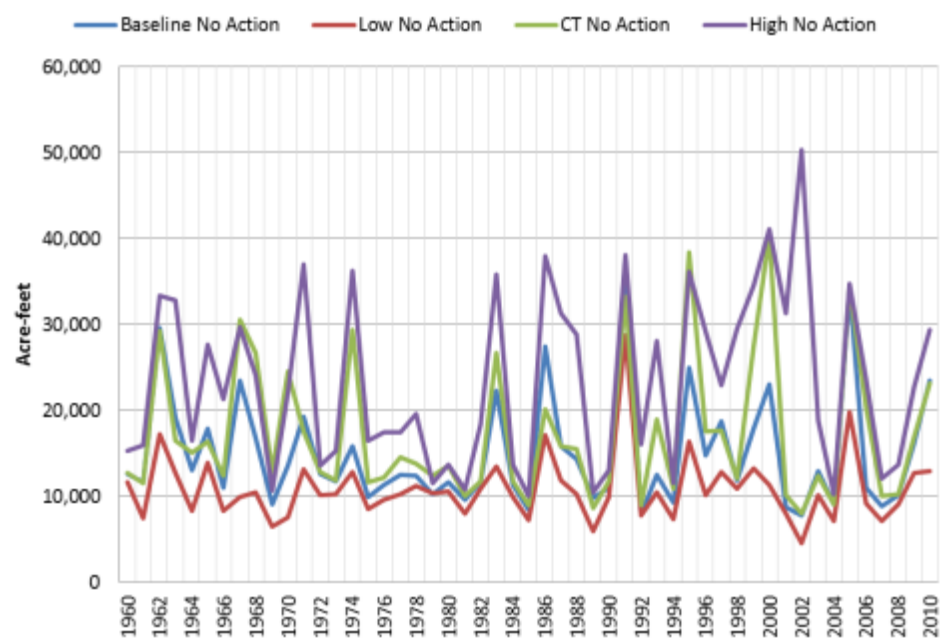


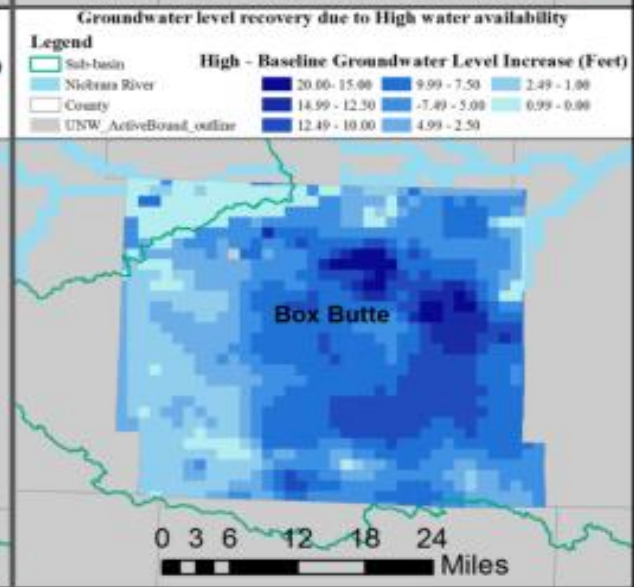
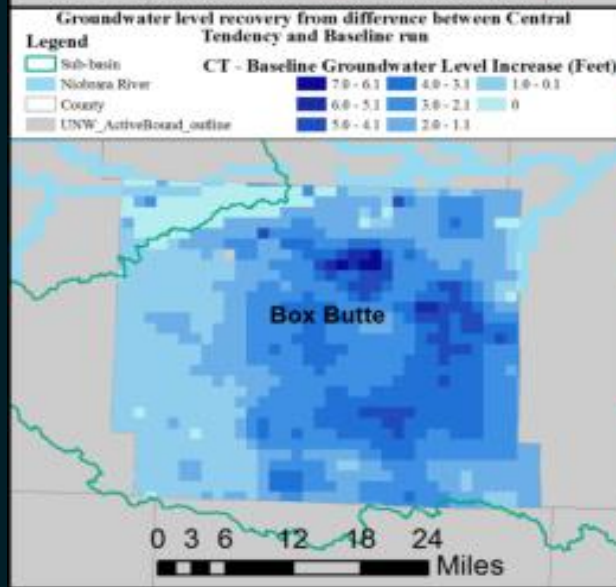
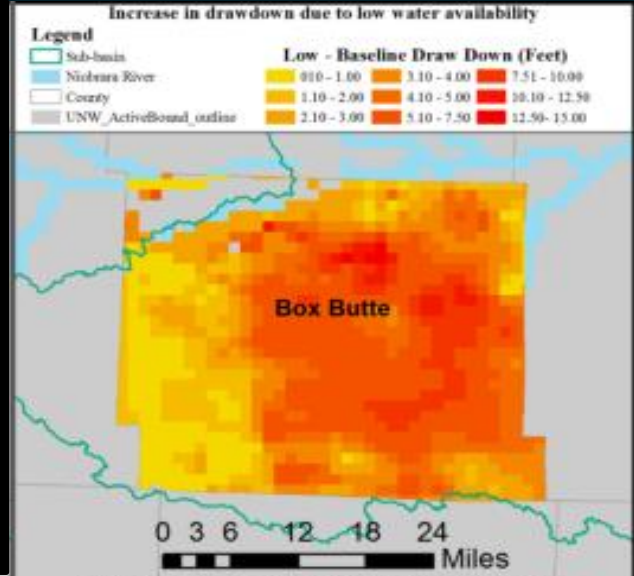
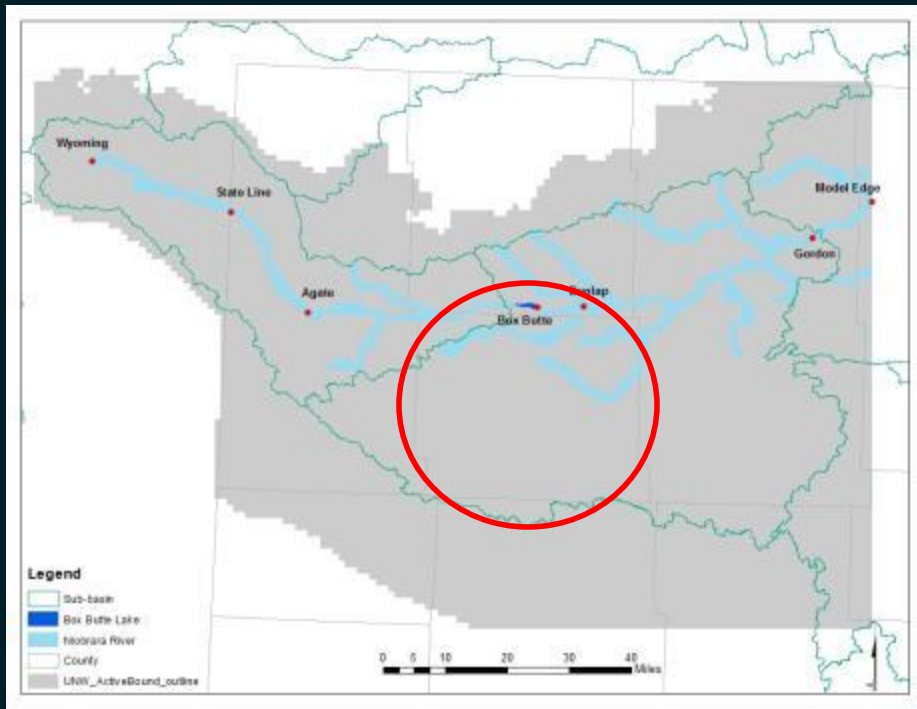
## Reservoir Release



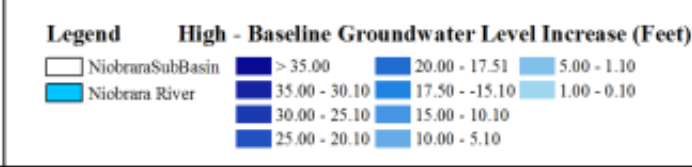
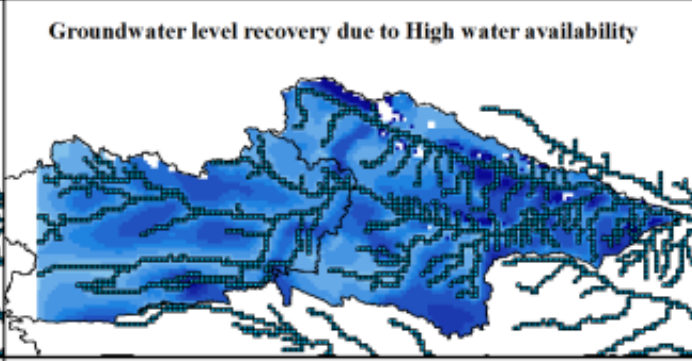
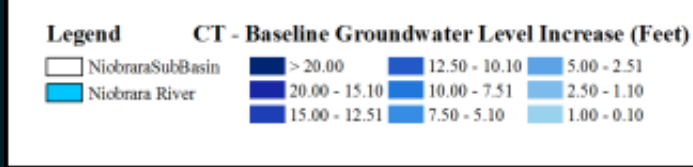
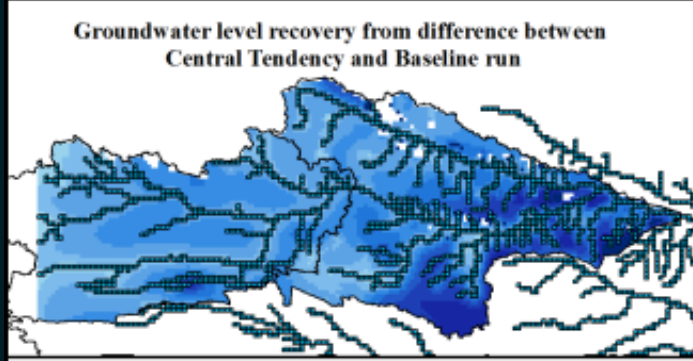
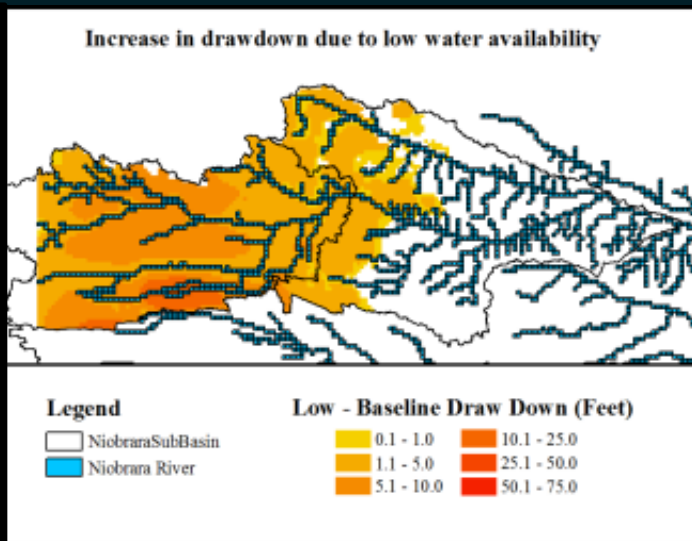
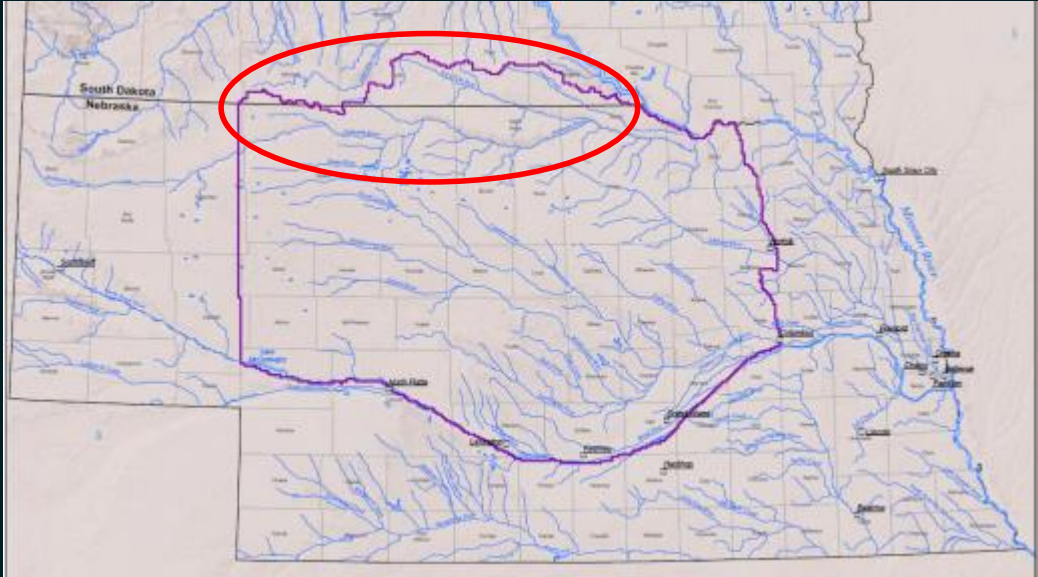


## Surface water Diversion



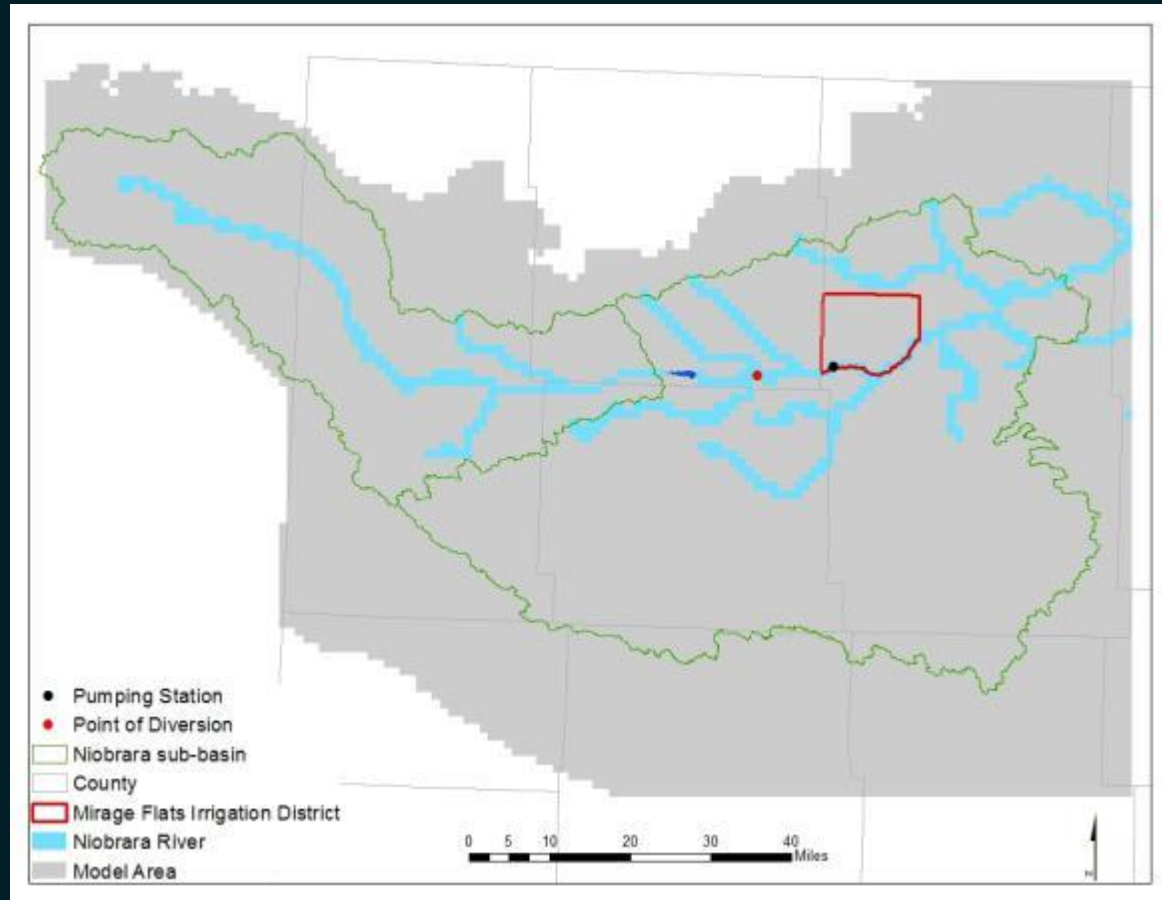






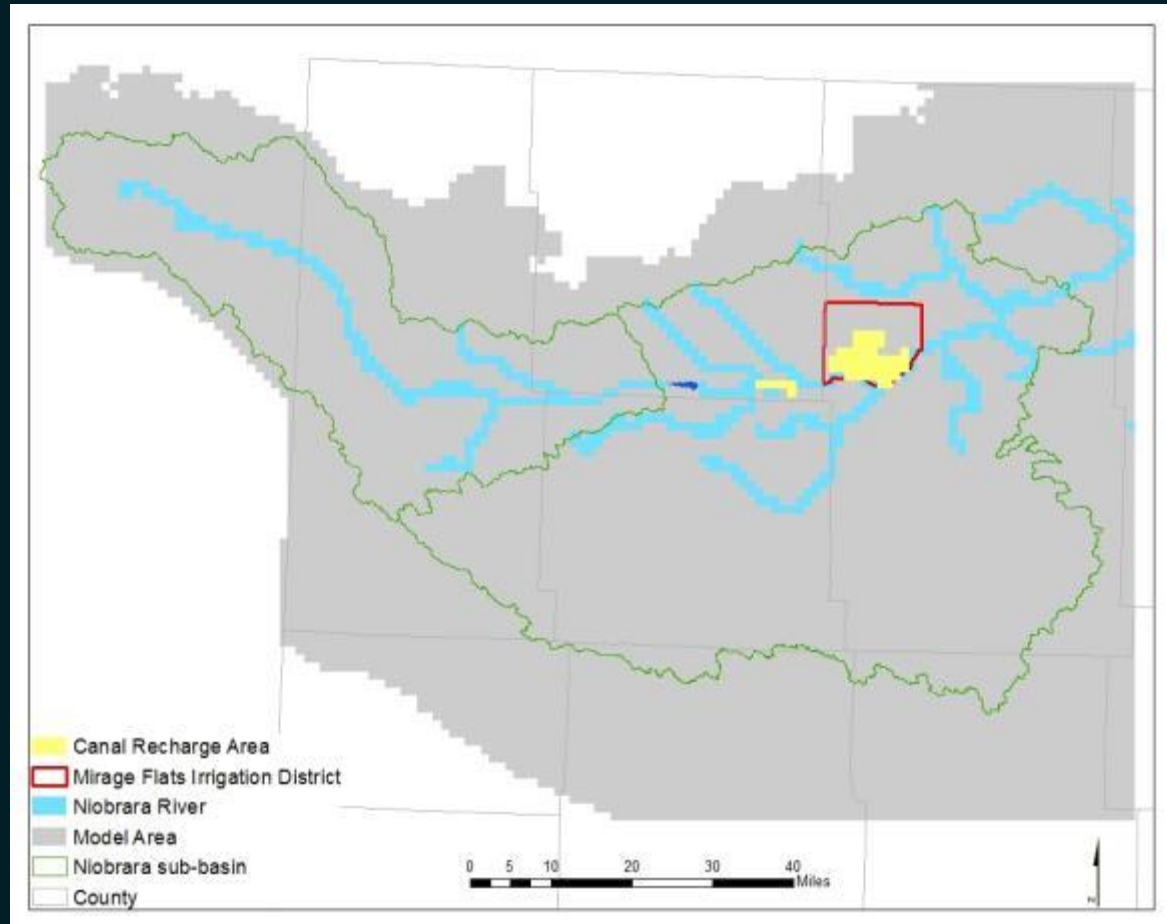
# Alternative water Management Scenario

- Mirage Flats Pumping Station Scenario (Alt1)



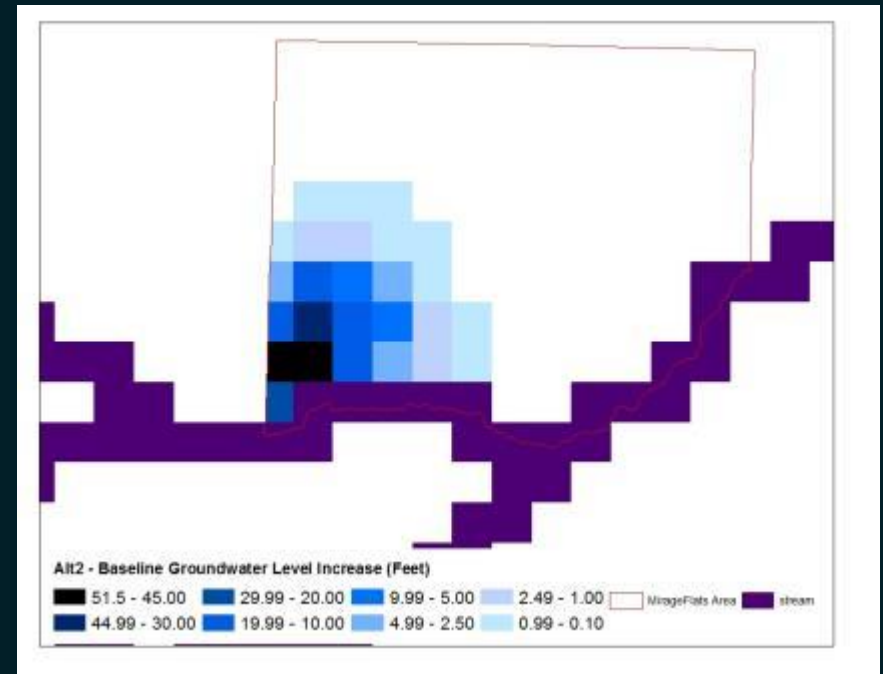
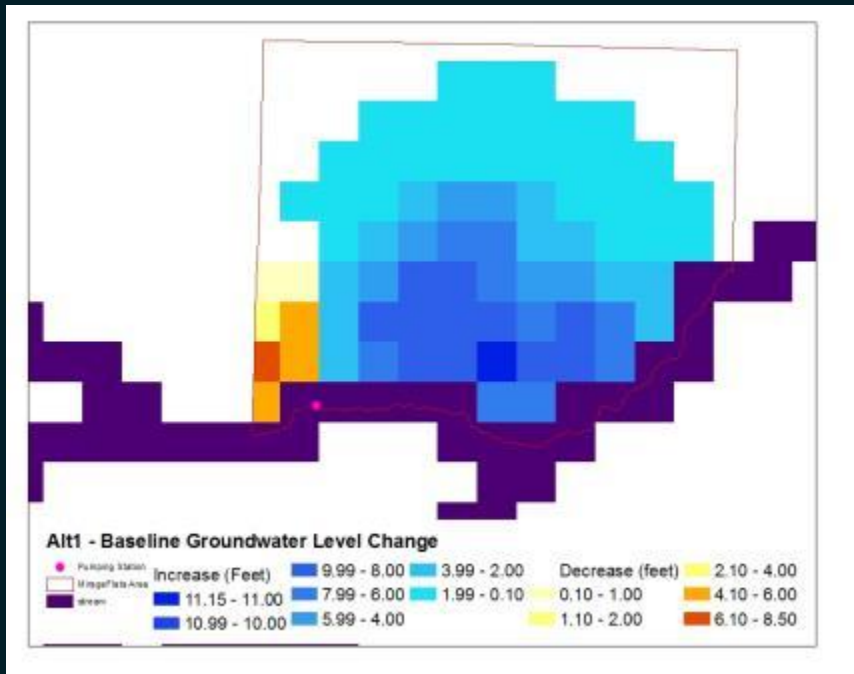
# Alternative water Management Scenario

- Mirage Flats Canal Recharge (Alt2)



# Alternative water Management Scenario

- Alternative water management scenario comparison





# Summary

- Projections of GCM used to analyze the condition of future water availability of Niobrara basin
- Better understanding of the response of hydrological components to future climate projections with integrated water management model
- Application of Integrated water management model is necessary for adaptation and effective management of water resources to changing environment



# Nebraska

## Department of Natural Resources

NEBRASKA'S WATER MANAGEMENT RESOURCE

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

### THANK YOU

**Tim Freed, Sr., M.S.**

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