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NEBRASKA'S WATER MANAGEMENT RESOURCE

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

Integrated Water Management Modeling for Climate Variability Study in Niobrara River Basin

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Integrated Water Management Analyst
Nebraska Department of Natural Resources

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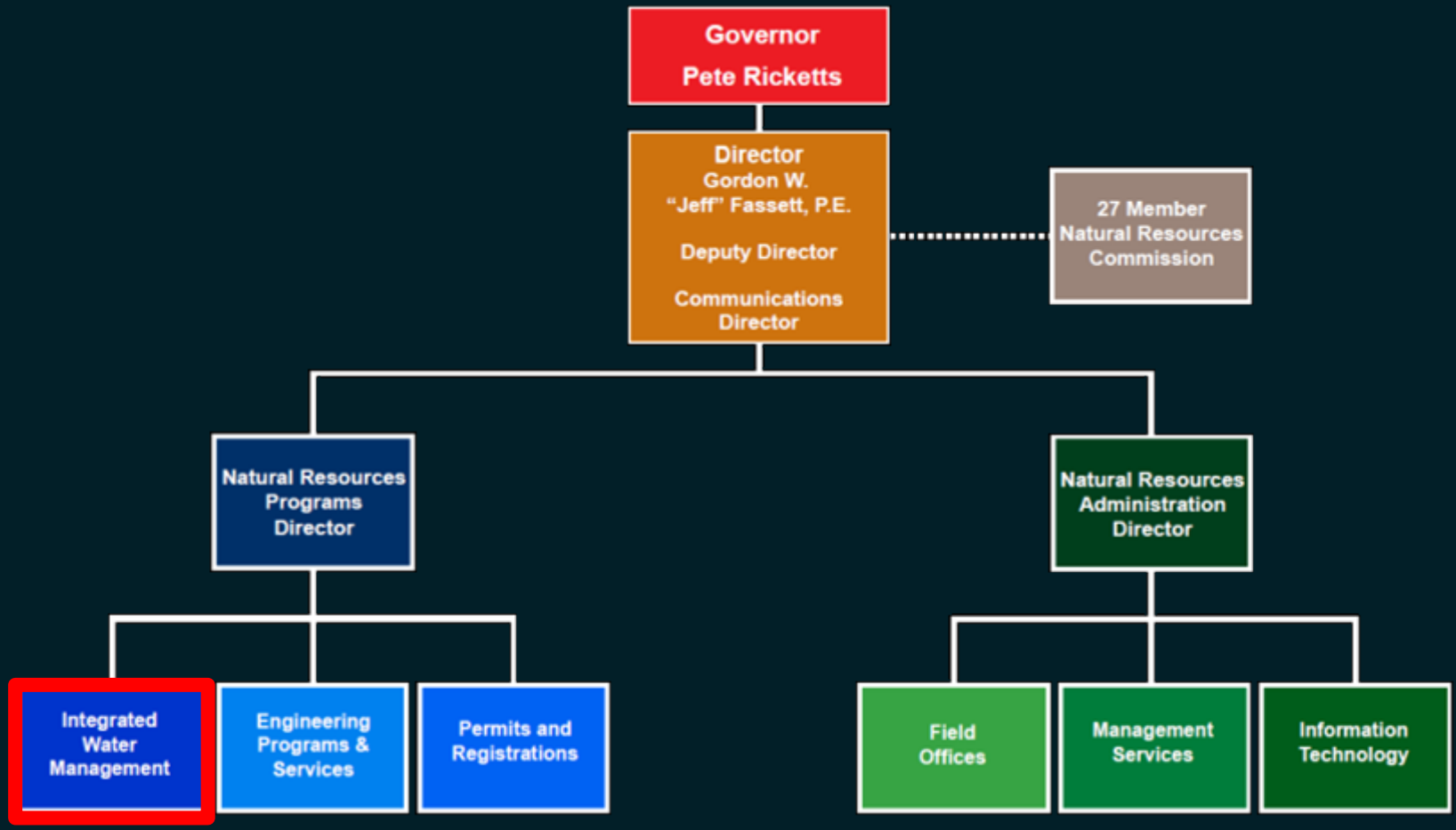

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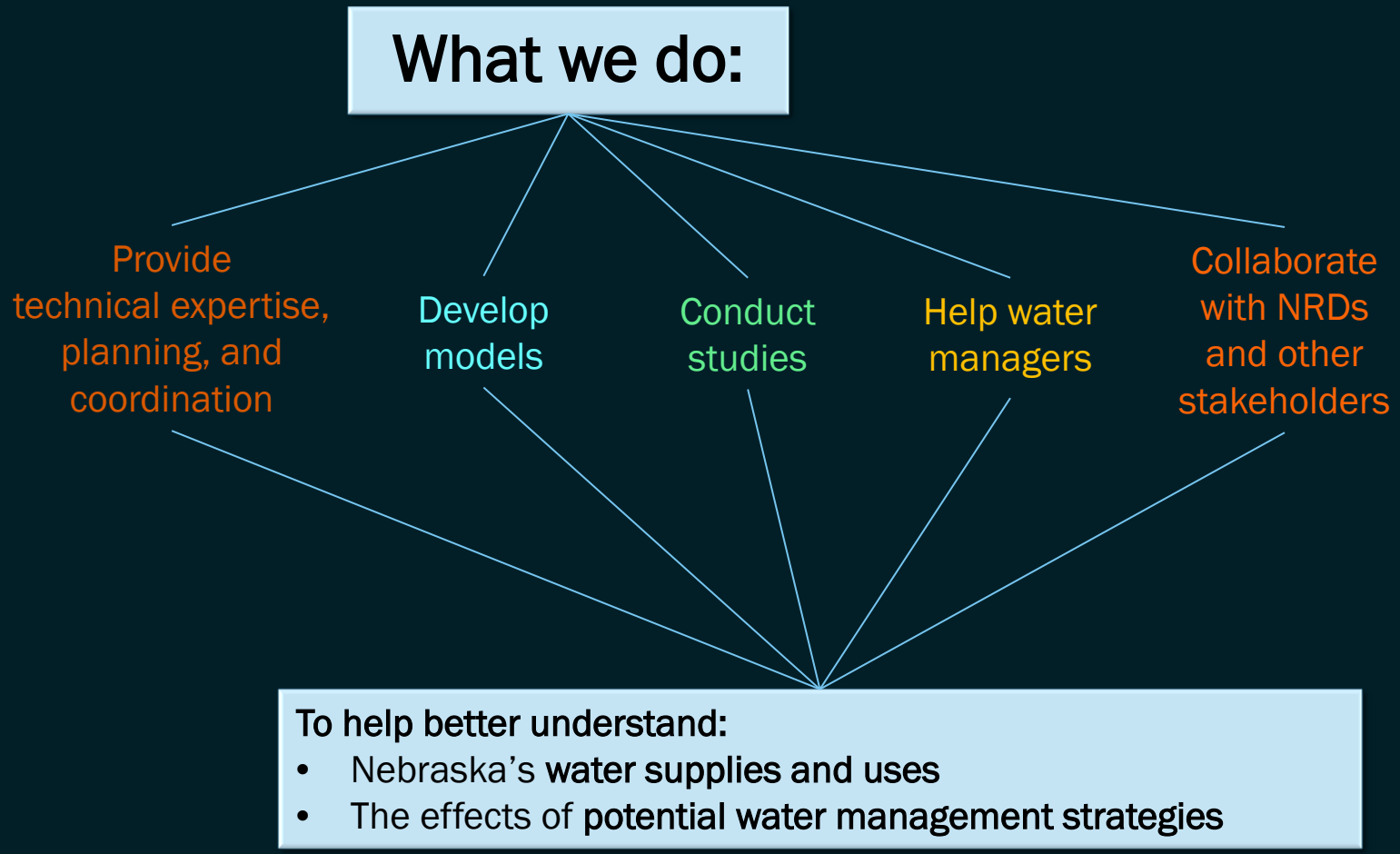
Integrated Water Management Division



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Introduction and Background

- Niobrara River basin Study

  - a collaborative effort by the Nebraska Department of Natural Resources and the U.S. Bureau of Reclamation

  - evaluate the current and future water supply and demand to identify potential adaptation strategies to reduce any identified gaps

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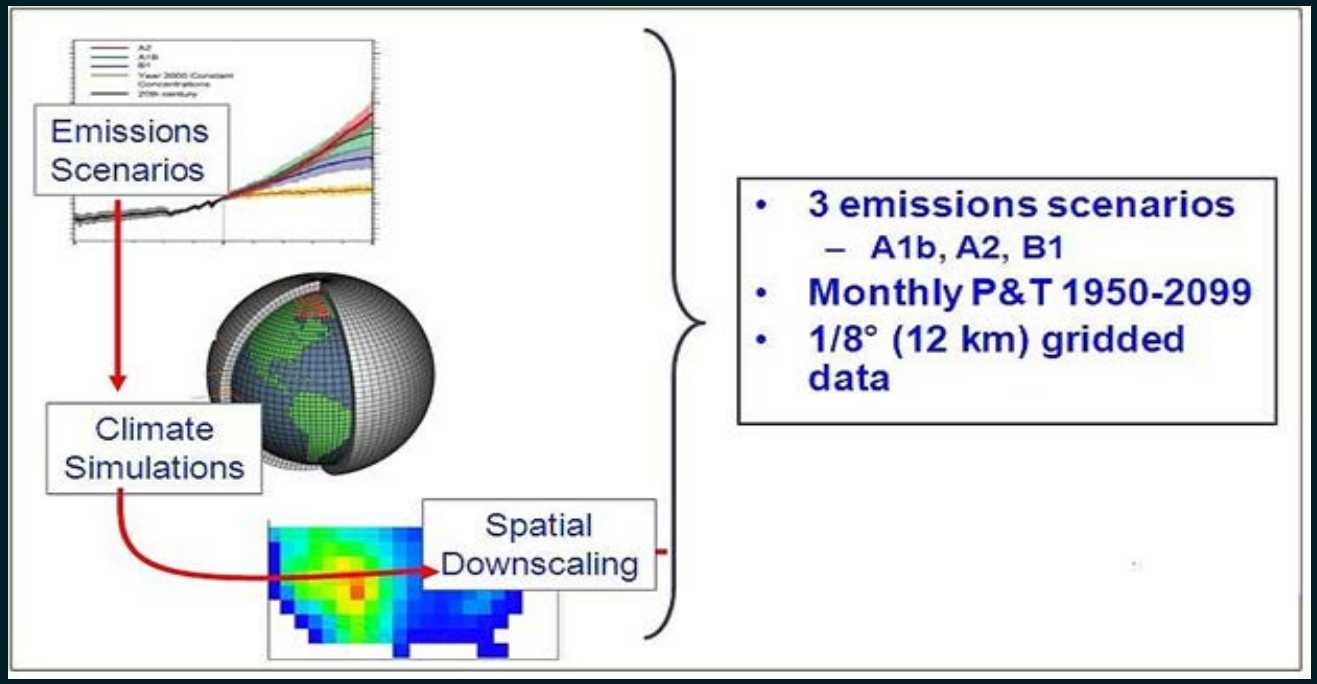
U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center | Nebraska-Kansas Office
Denver, Colorado | McCook, Nebraska

Climate Variability Projection

- Intergovernmental Panel on Climate Change (IPCC)

  - Couples Model Intercomparison Project Phase 3 (CMIP3)

  - General Circulation Model (GCM) projections downscaling



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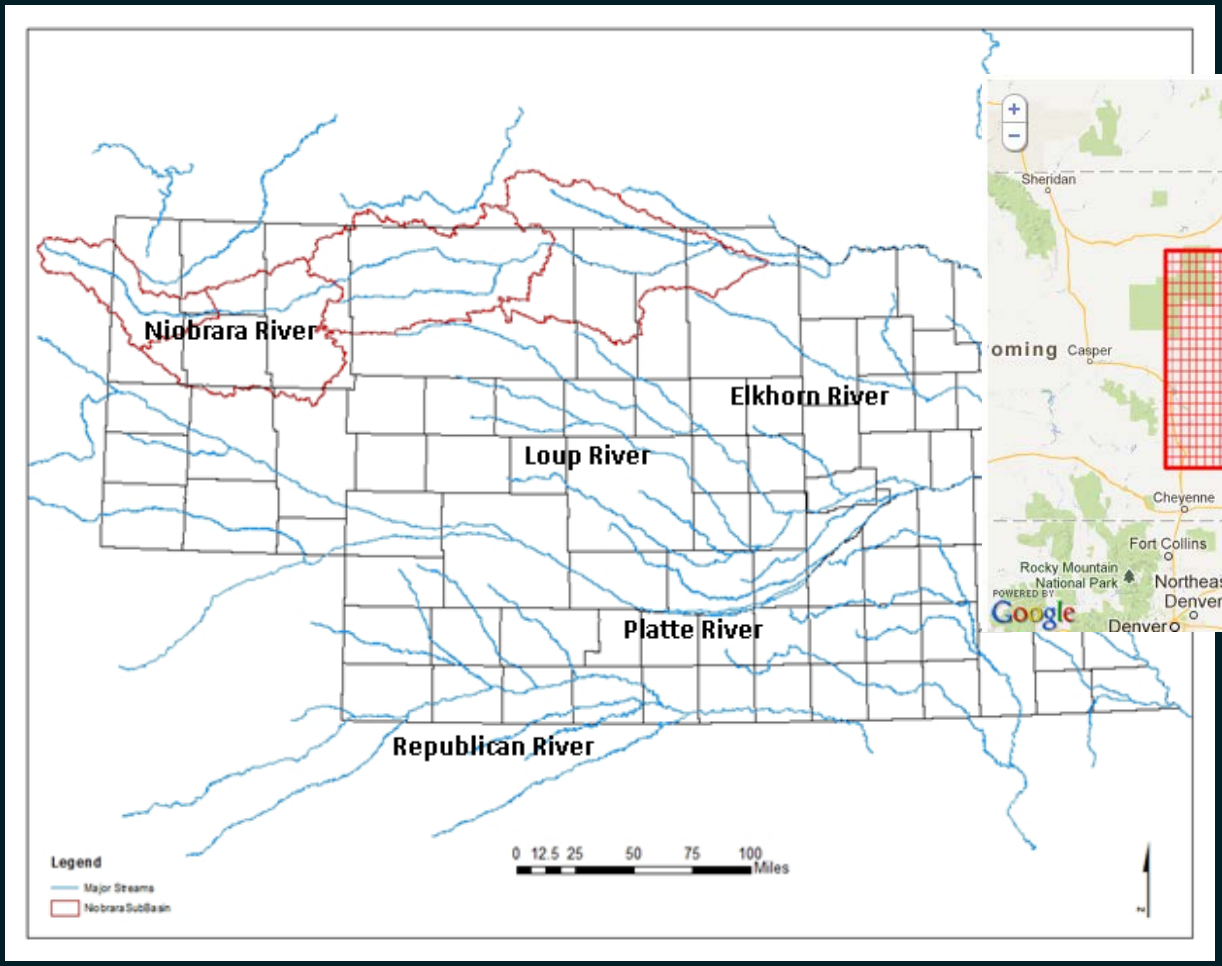
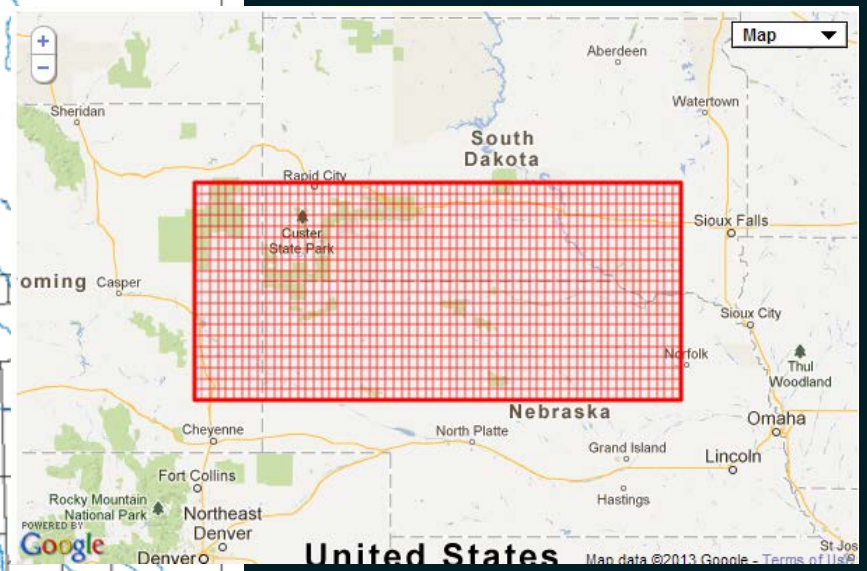
Climate Variability Projection





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Climate Variability Projection

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

2) Rank projections based on change between 2030-2059 and 1970-1999

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

Low	10th of P	90th of T	10th of P-ET
CT	50th of P	50th of T	50th of P-ET
High	90th of P	10th of T	90th of P-ET

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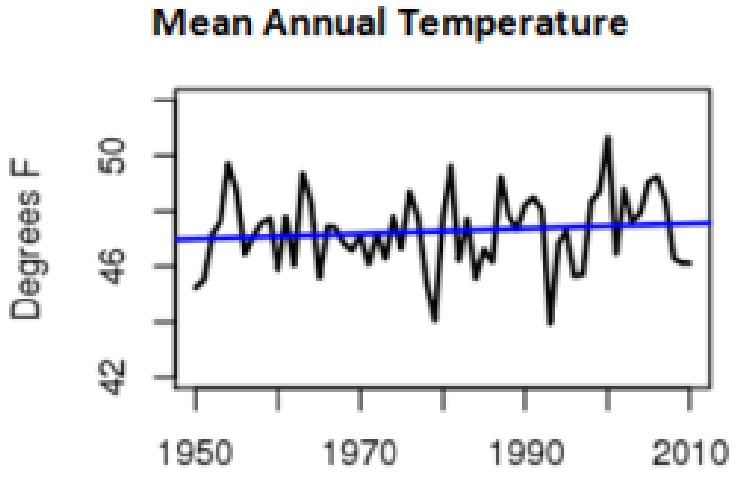
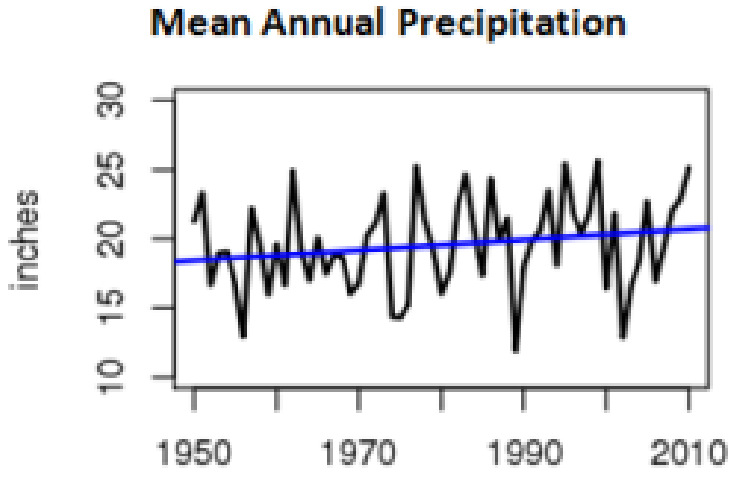
Historical Trends in Niobrara Basin





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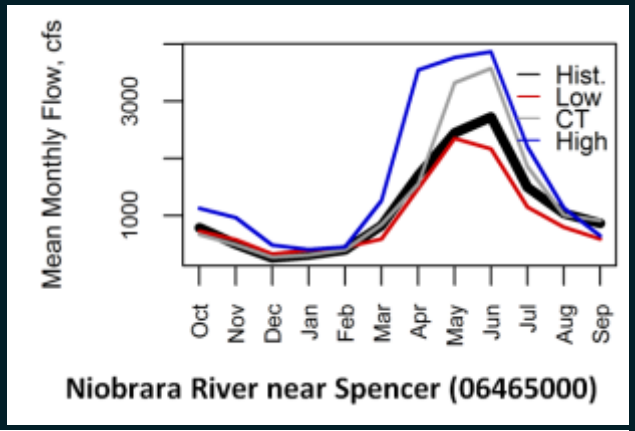
Climate Variability Projection

- Projection Analysis Results



		Low	Central Tendency	High
Mean Summer Temperature (June - August)	Select Projection	+2.9°C	+1.9°C	+1.2°C
	Based on 112 Projections	+3.3°C	+2.1°C	+.96°C
Mean Summer Precipitation (June - August)	Select Projection	-13%	+5.4%	+13%
	Based on 112 Projections	-15%	+4.7%	+17%

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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

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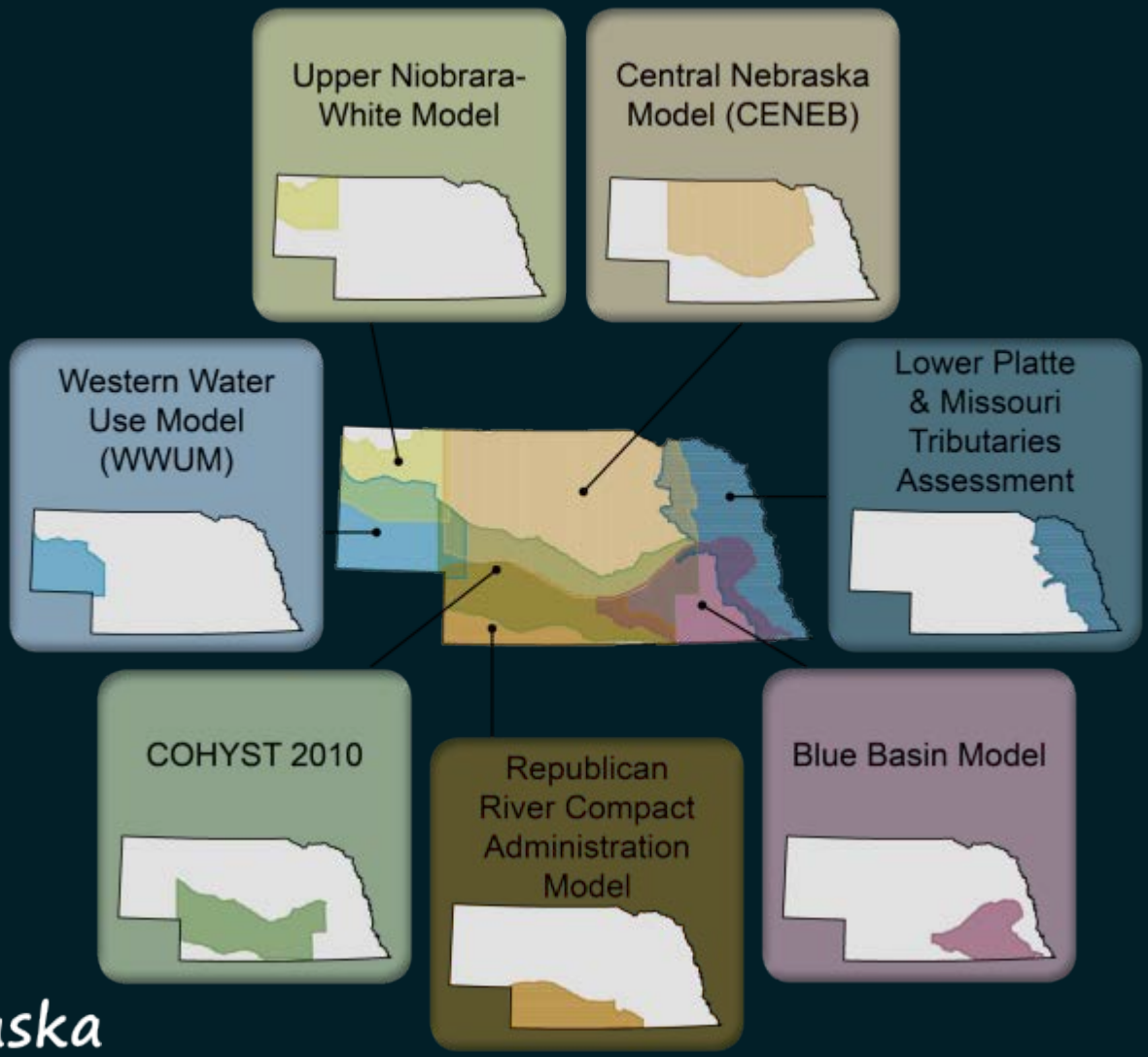
Integrated Water Management Modeling



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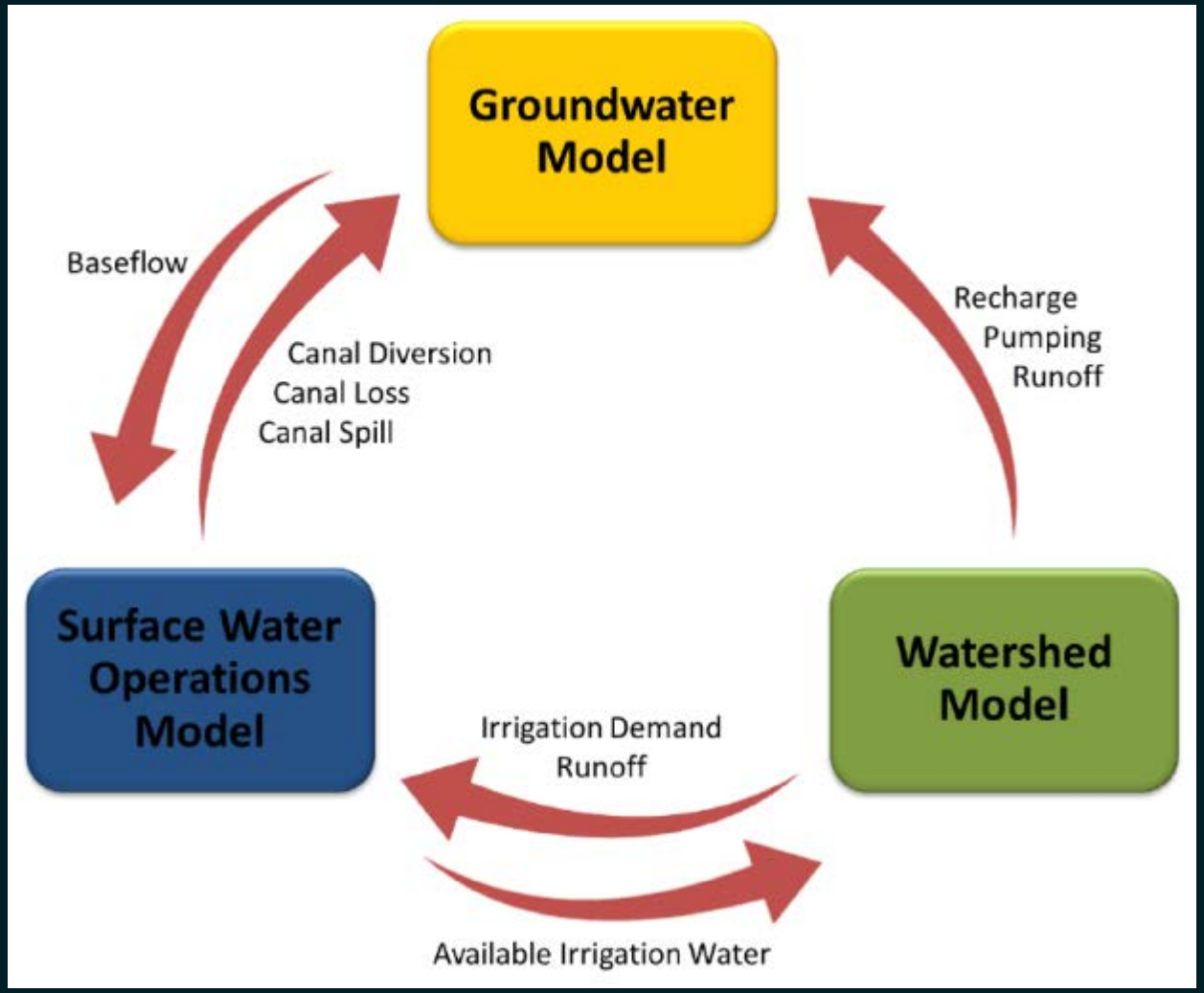
Framework for IWM Modeling



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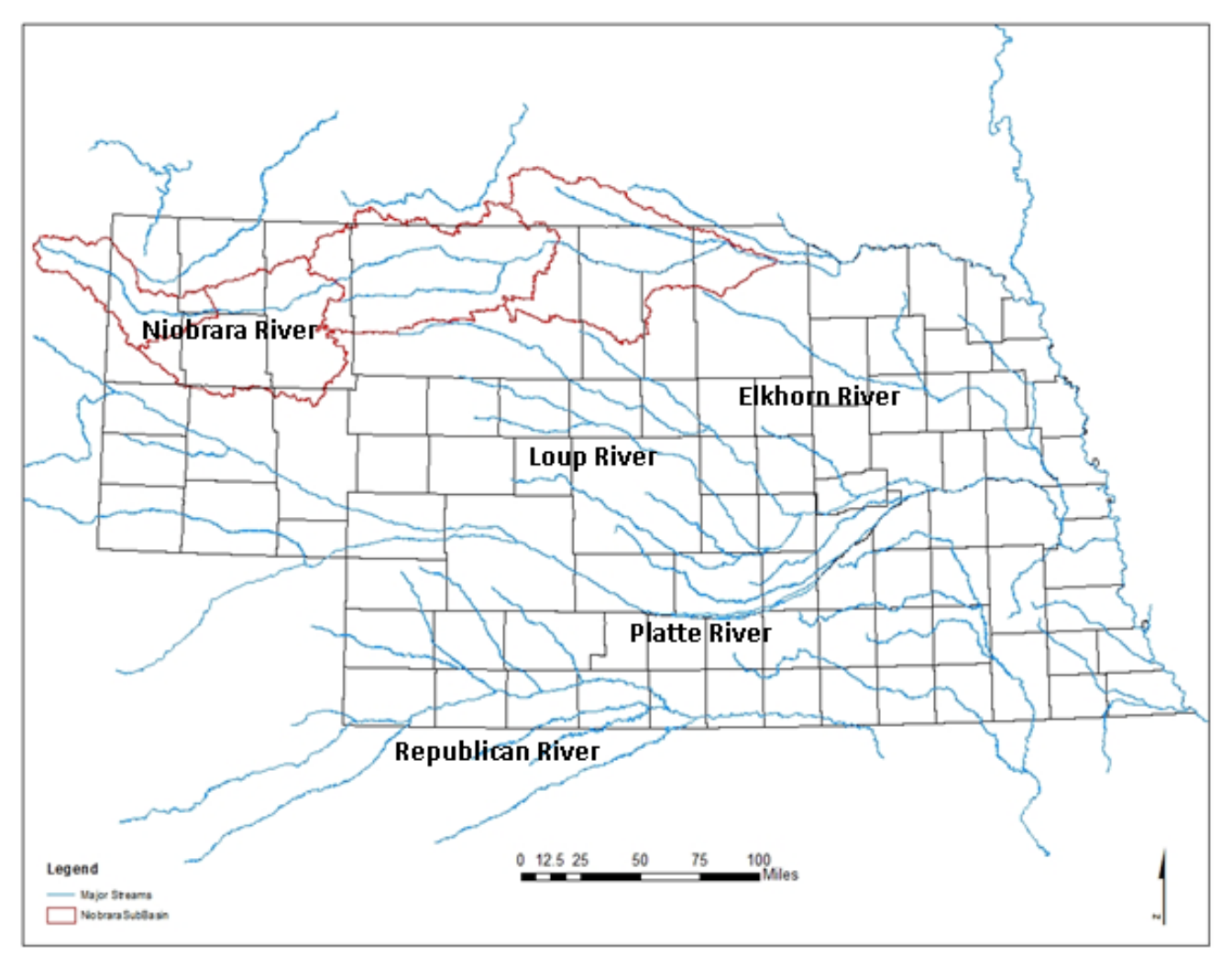
Framework for IWM Modeling



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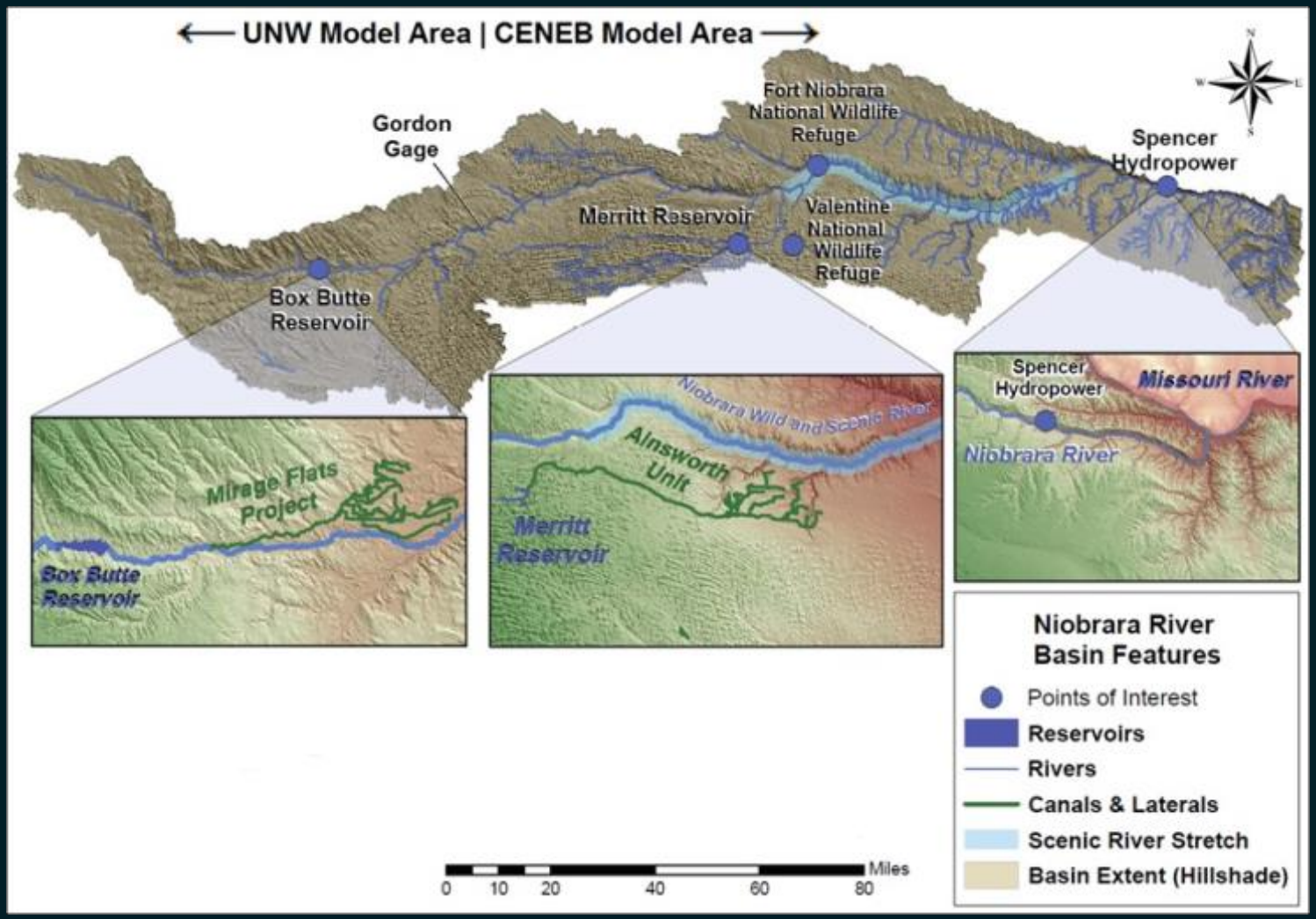
Framework for IWM Modeling



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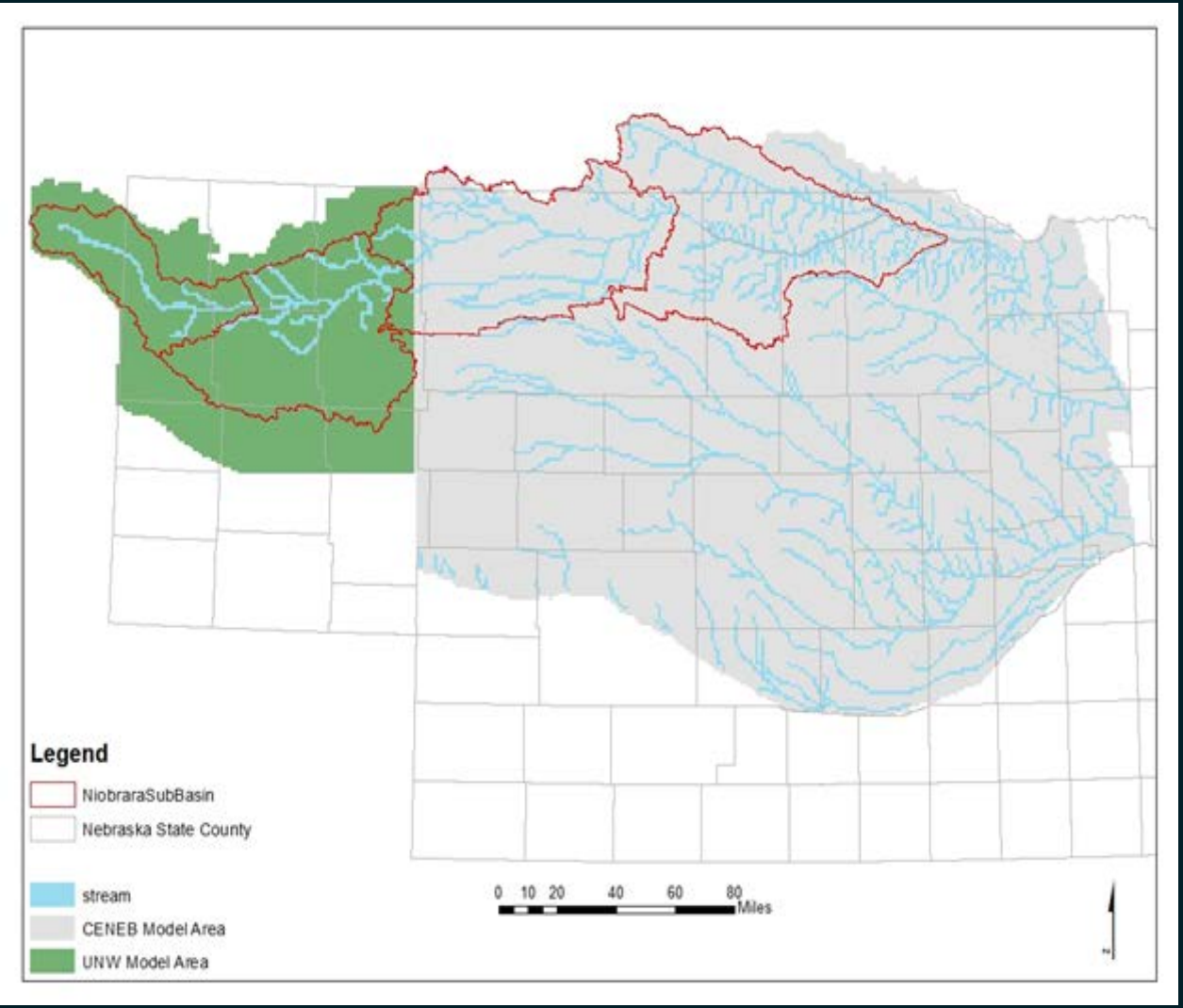
Application of IWM Modeling



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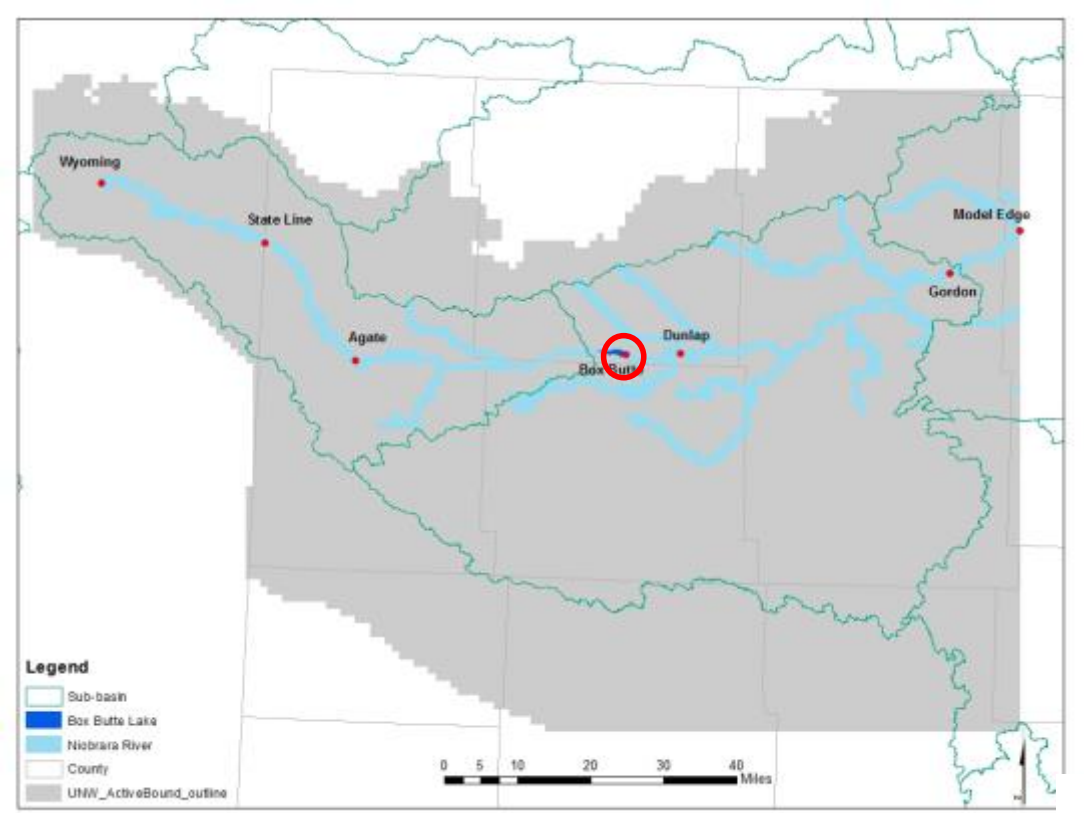
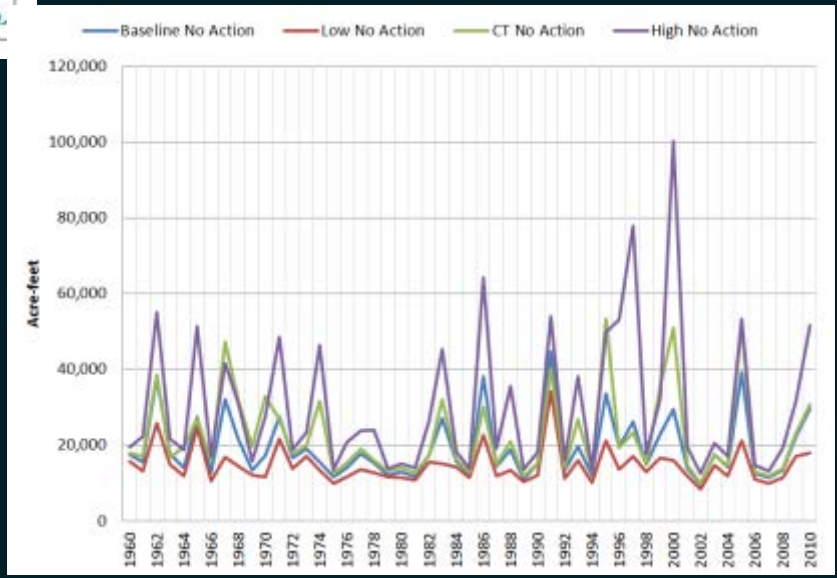


Total Flow



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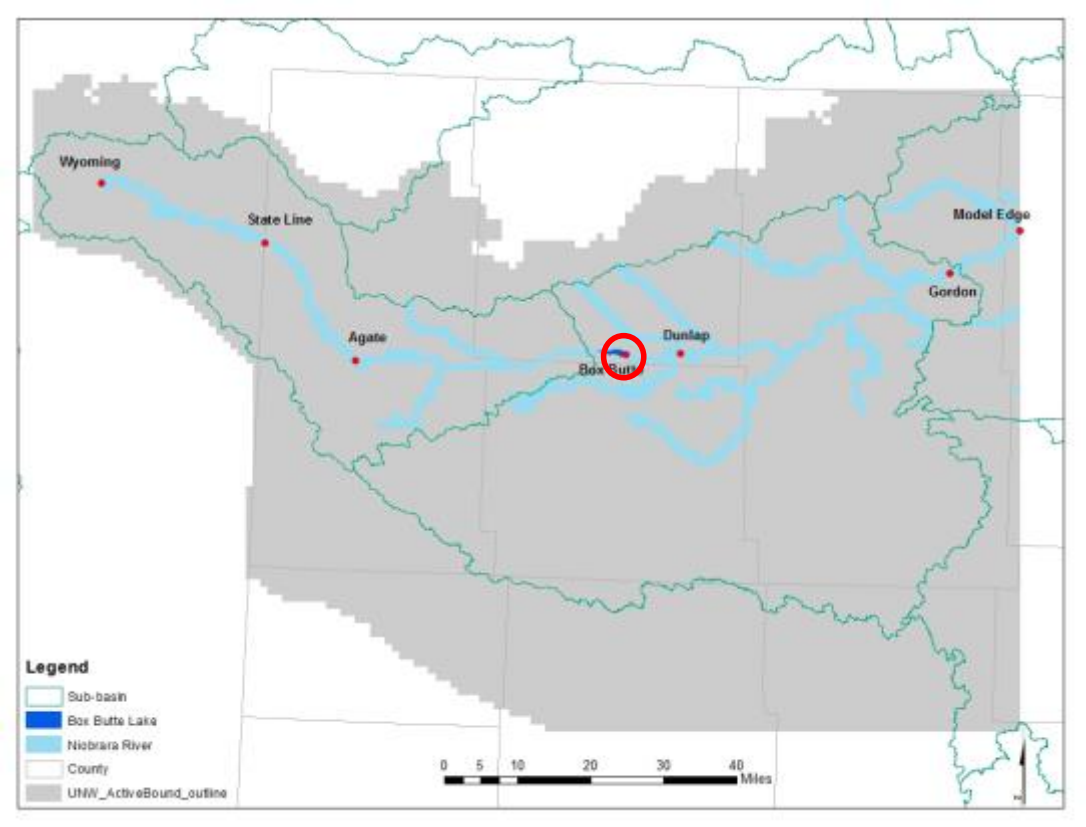
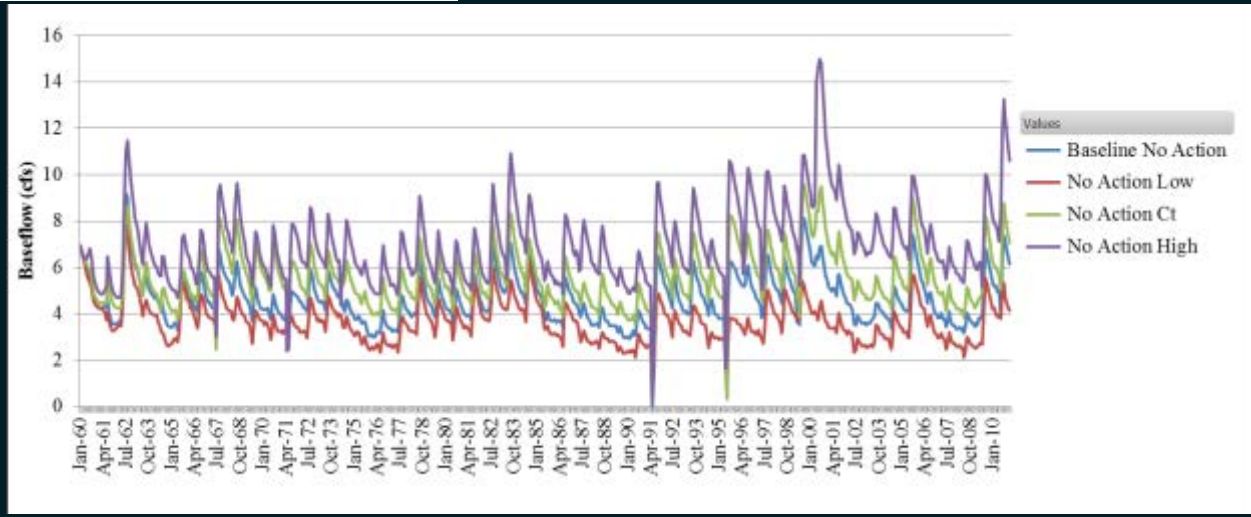


Baseflow



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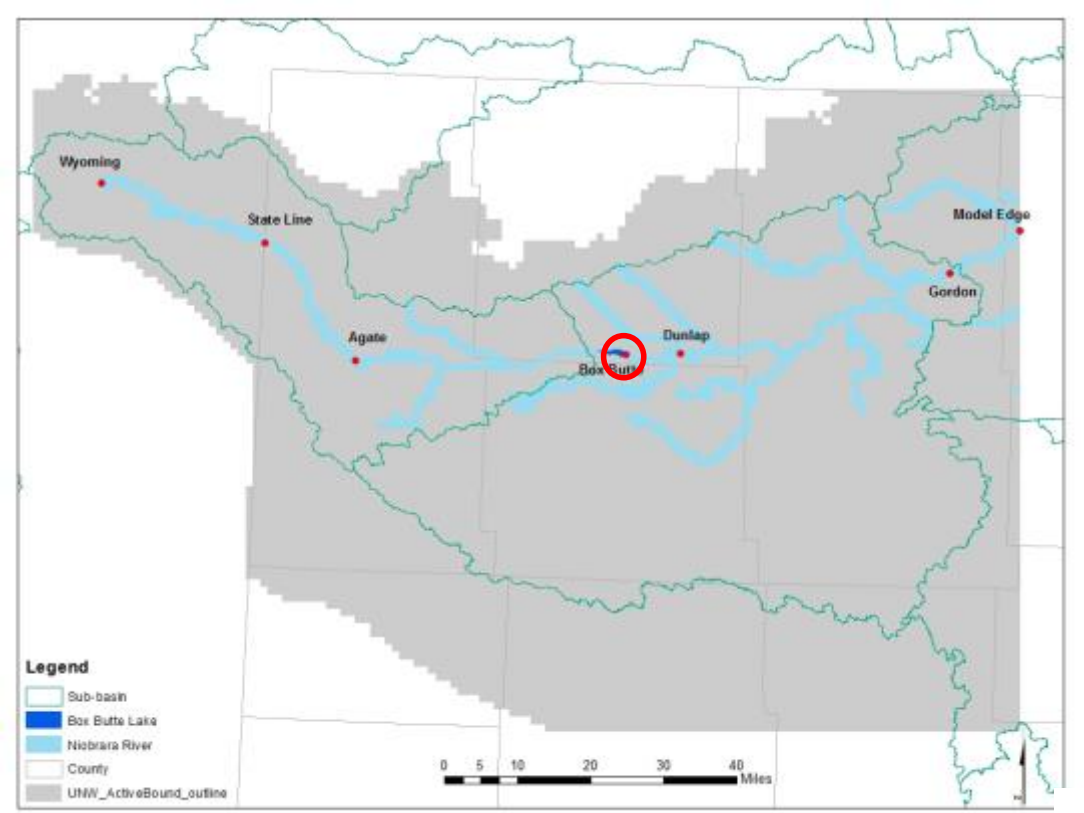
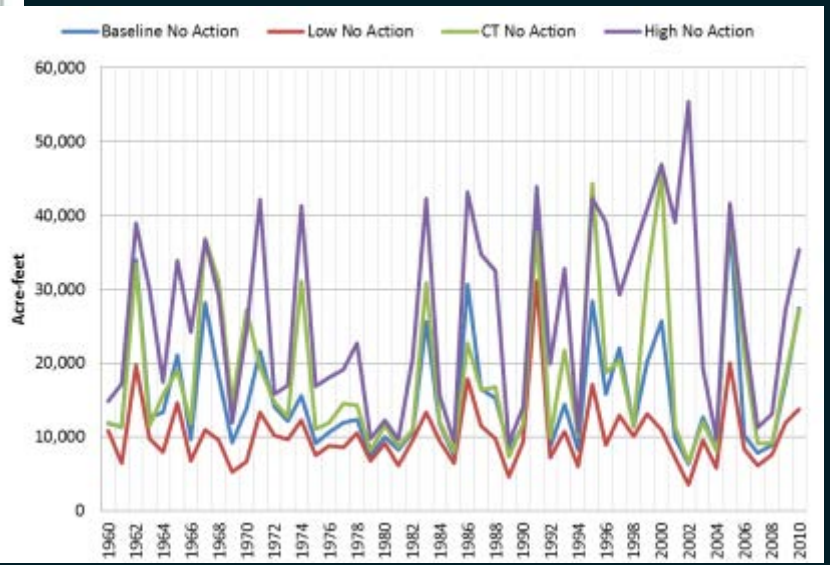


Reservoir Release



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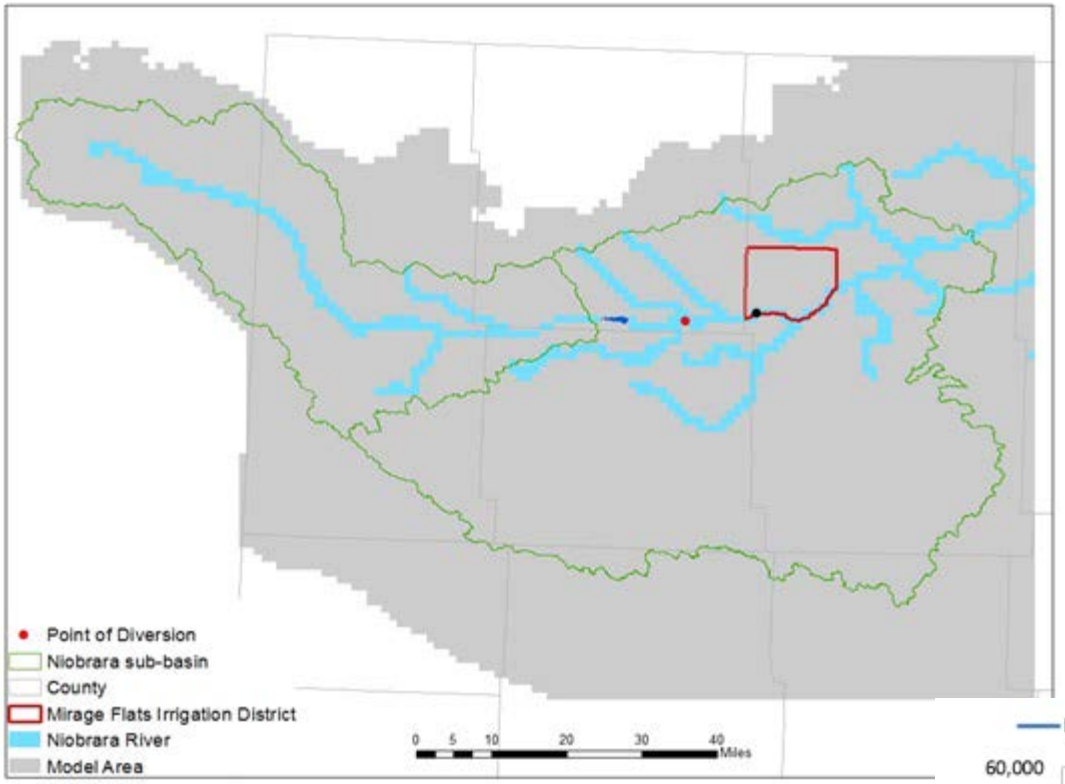
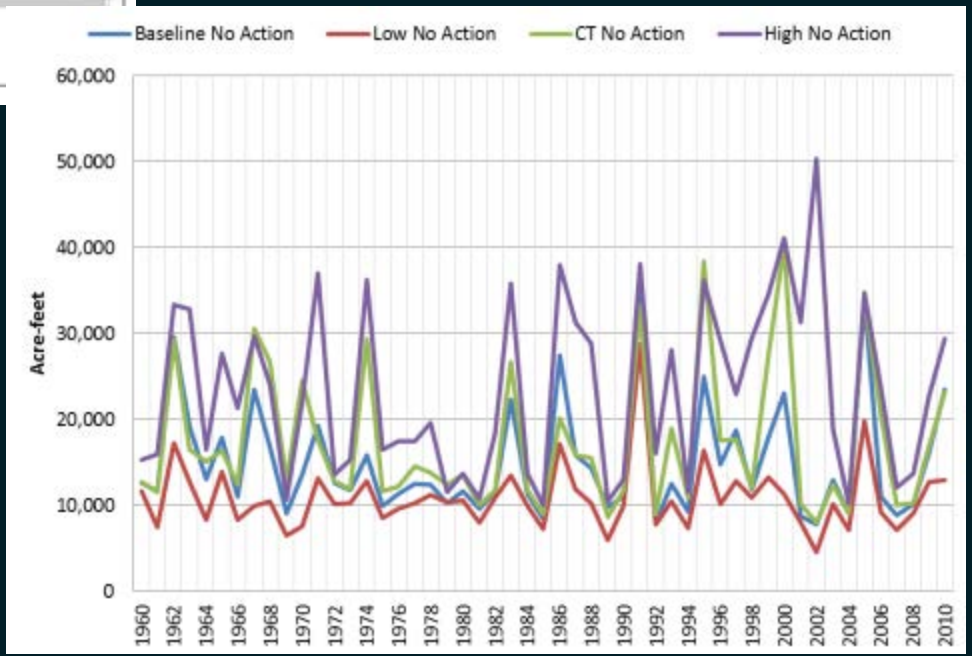


Surface water Diversion



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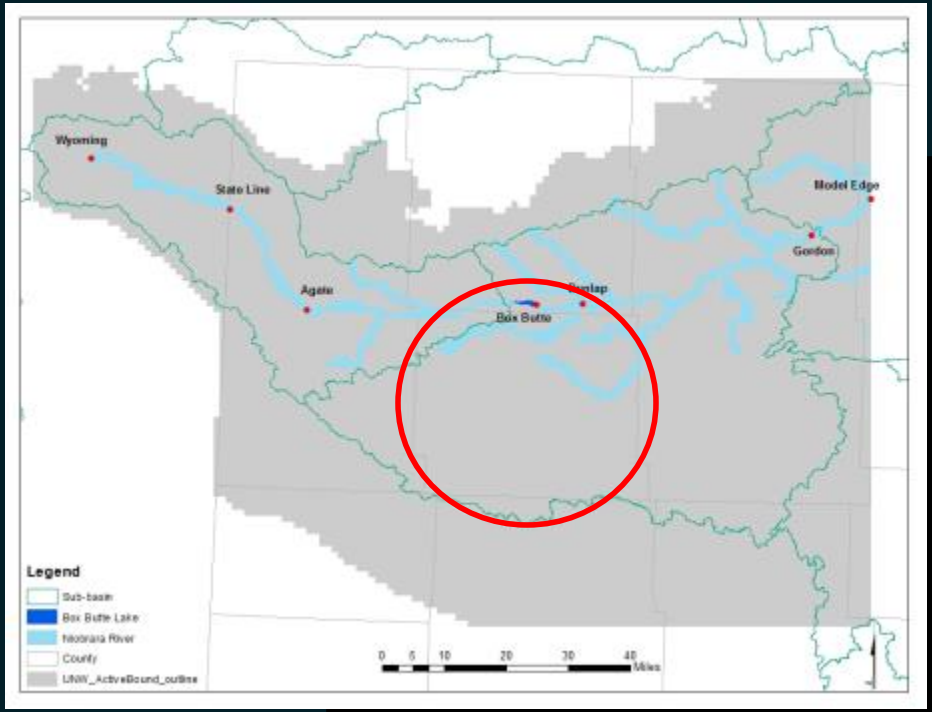

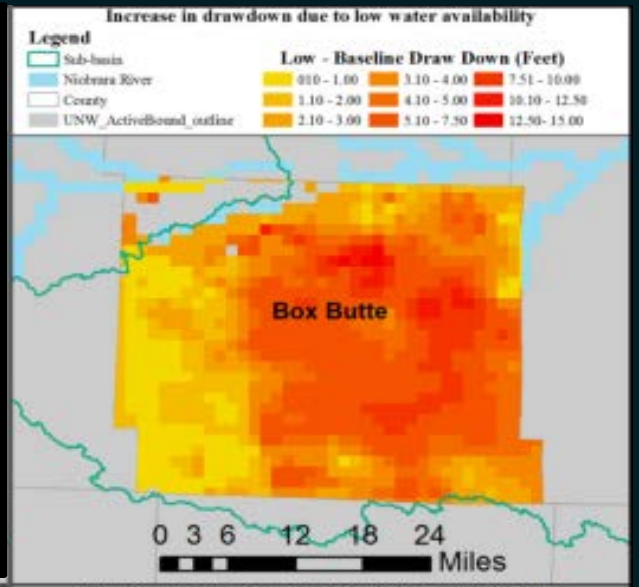

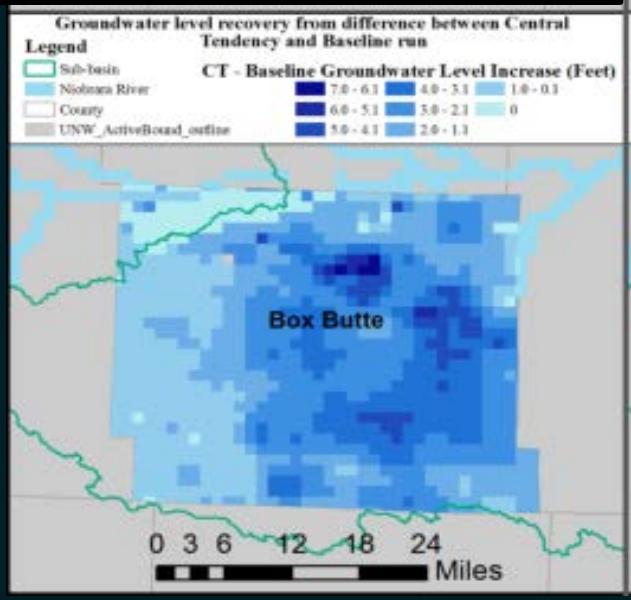

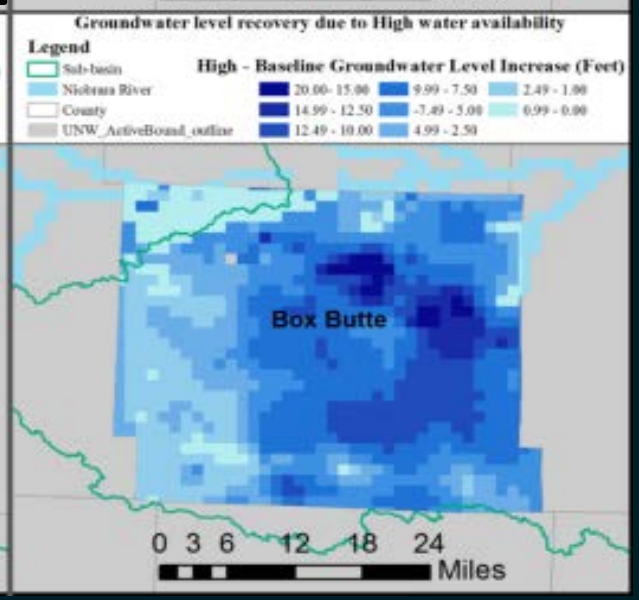

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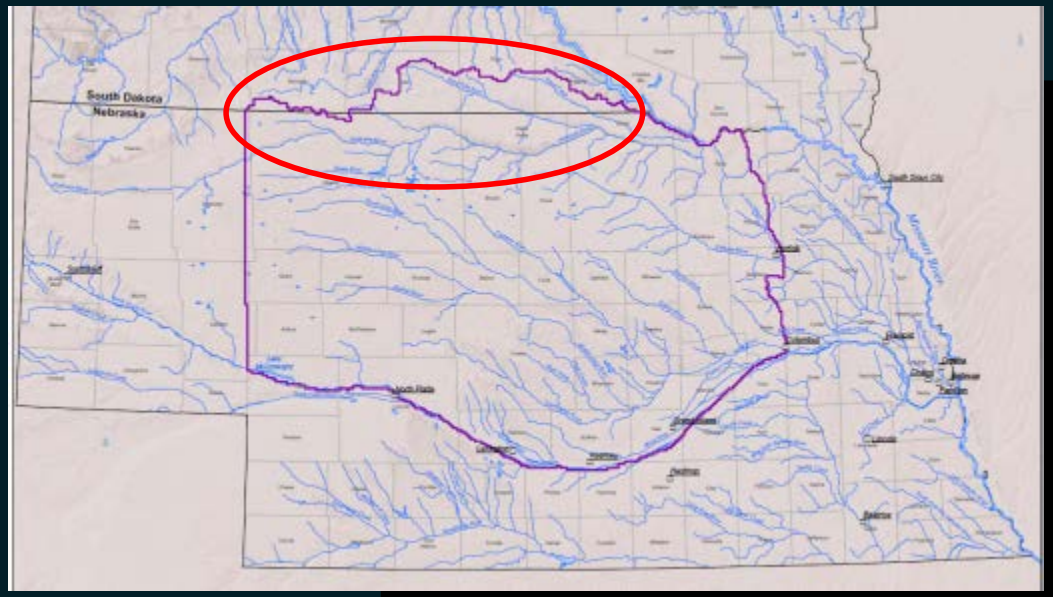

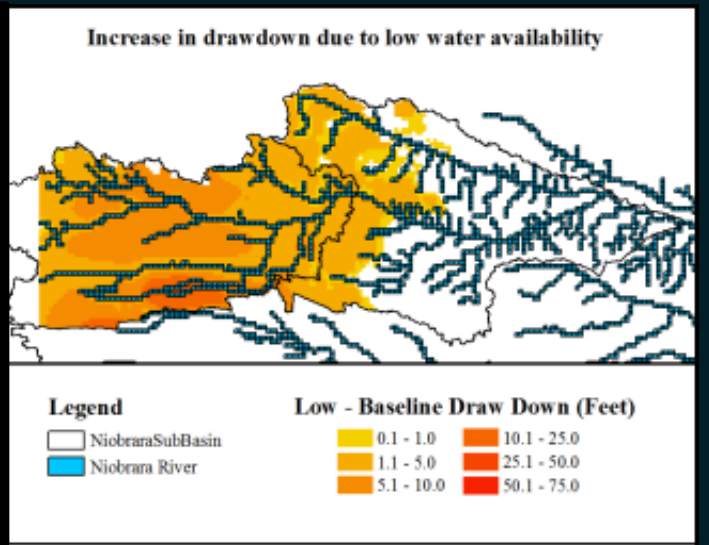

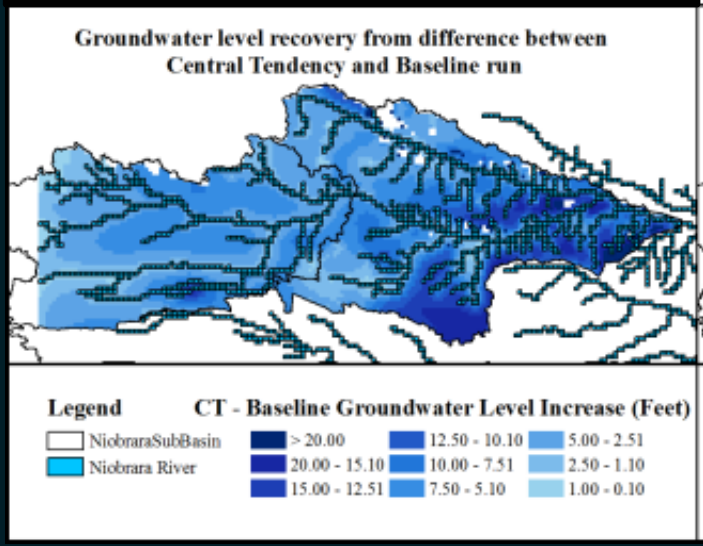

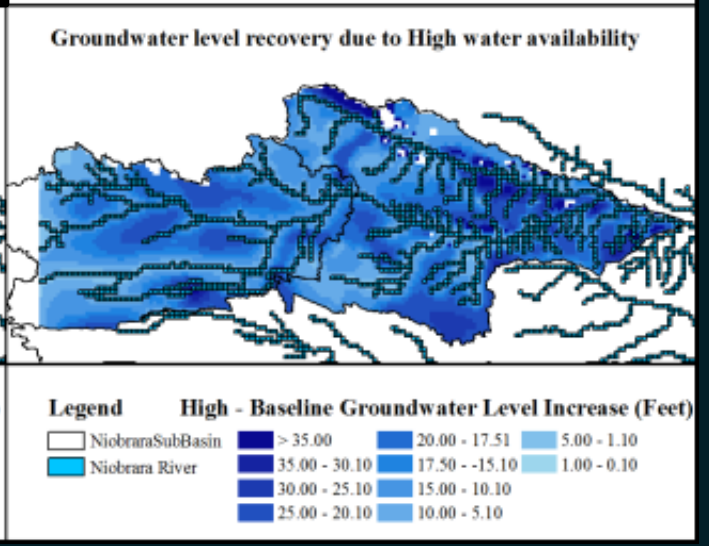

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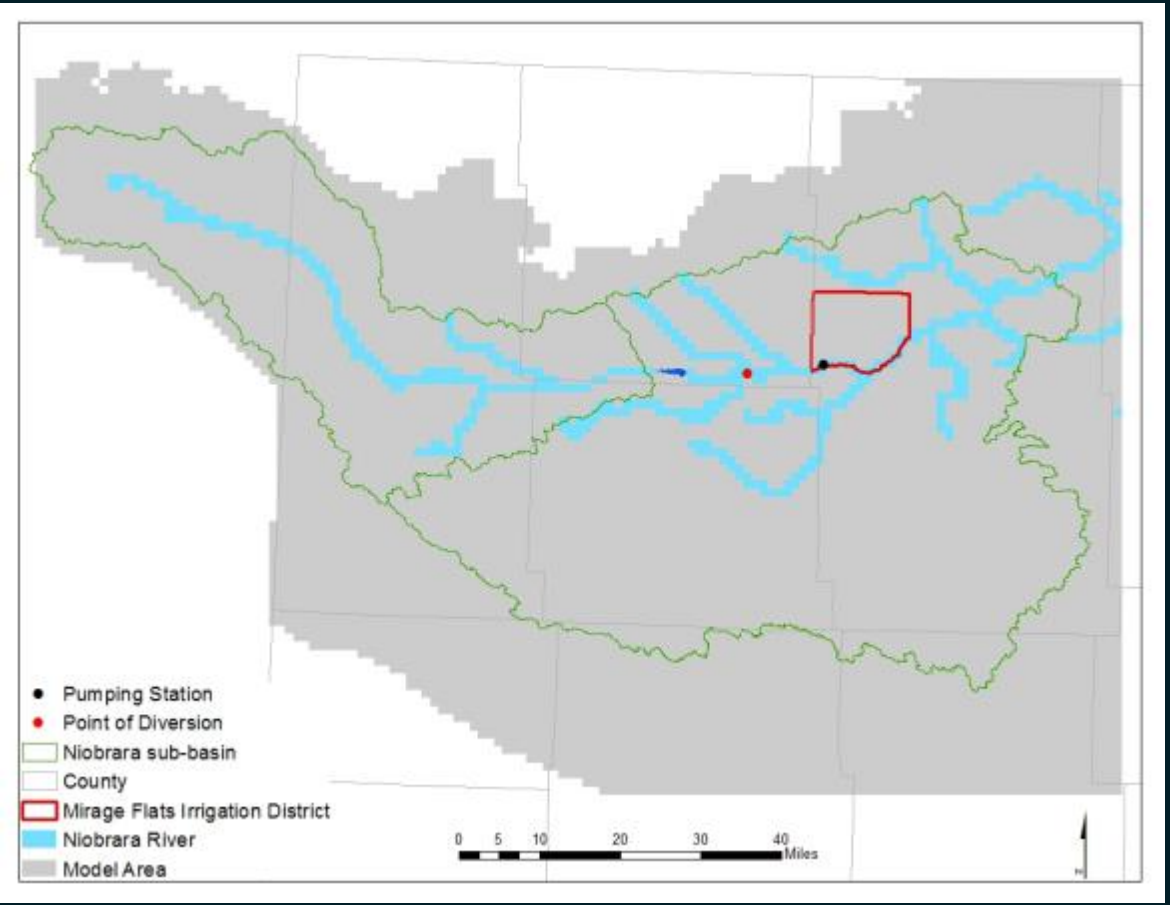
Alternative water Management Scenario

- Mirage Flats Pumping Station Scenario (Alt1)



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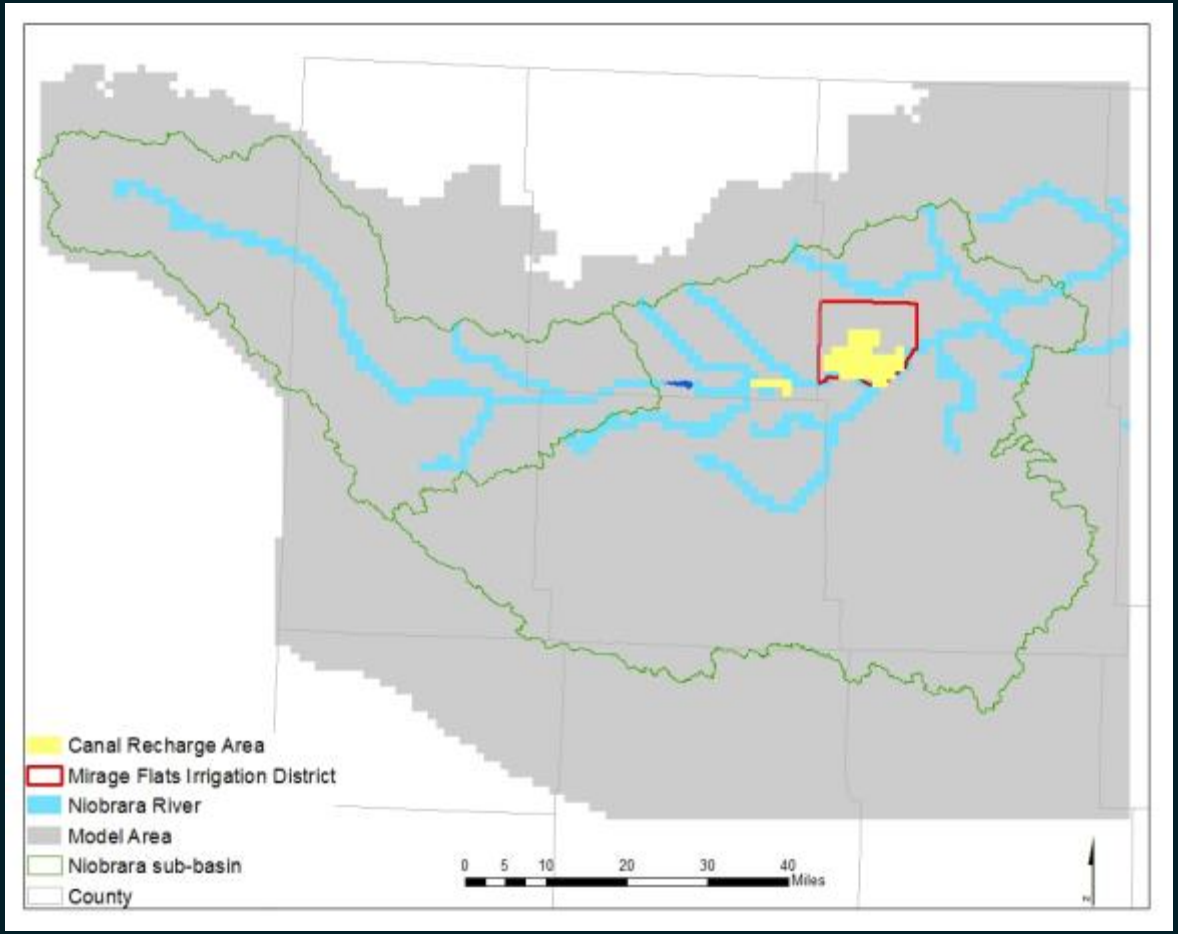
Alternative water Management Scenario

- Mirage Flats Canal Recharge (Alt2)



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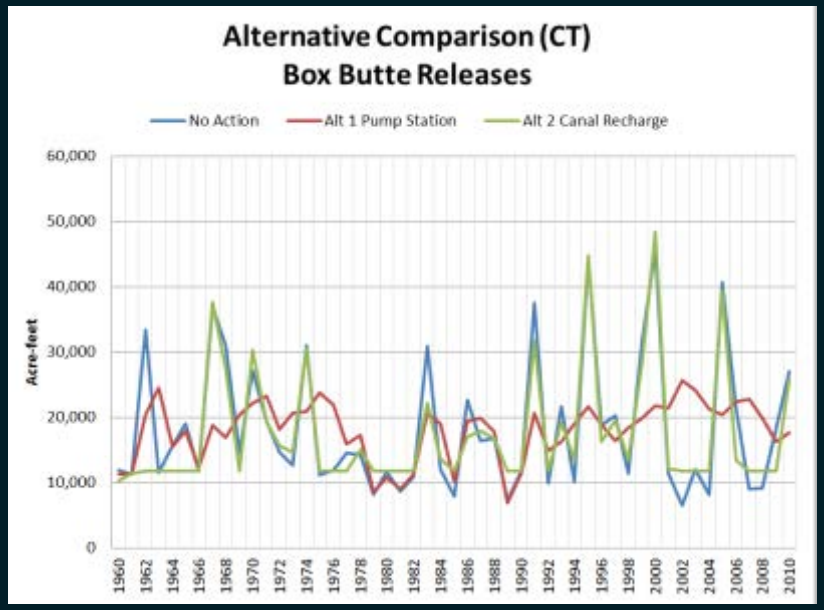
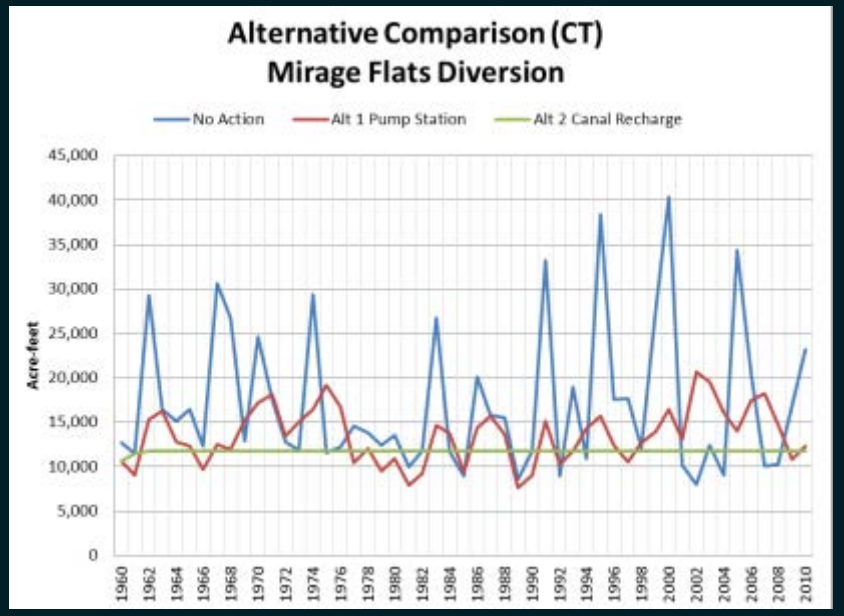
Alternative water Management Scenario

- Alternative water management scenario comparison





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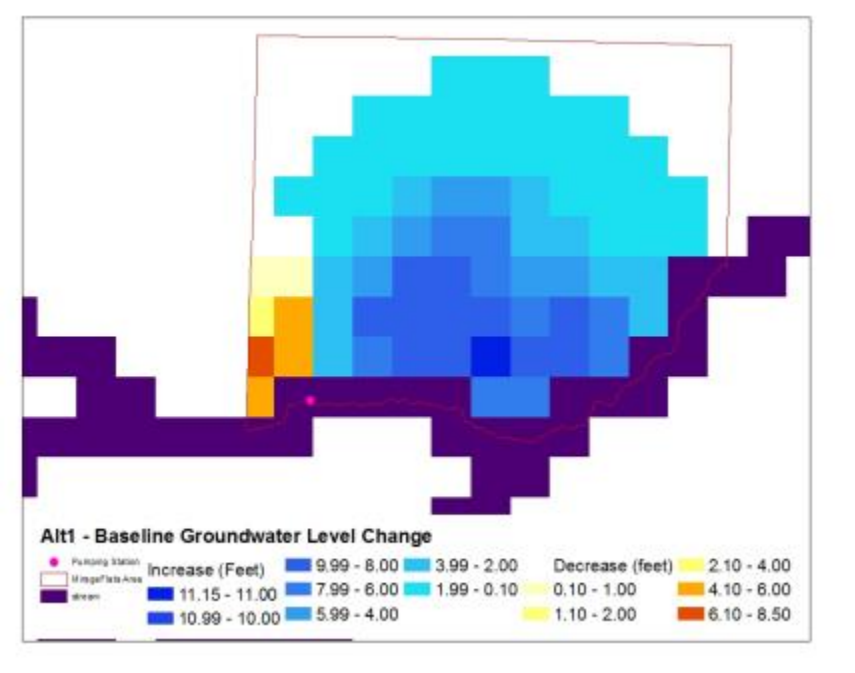
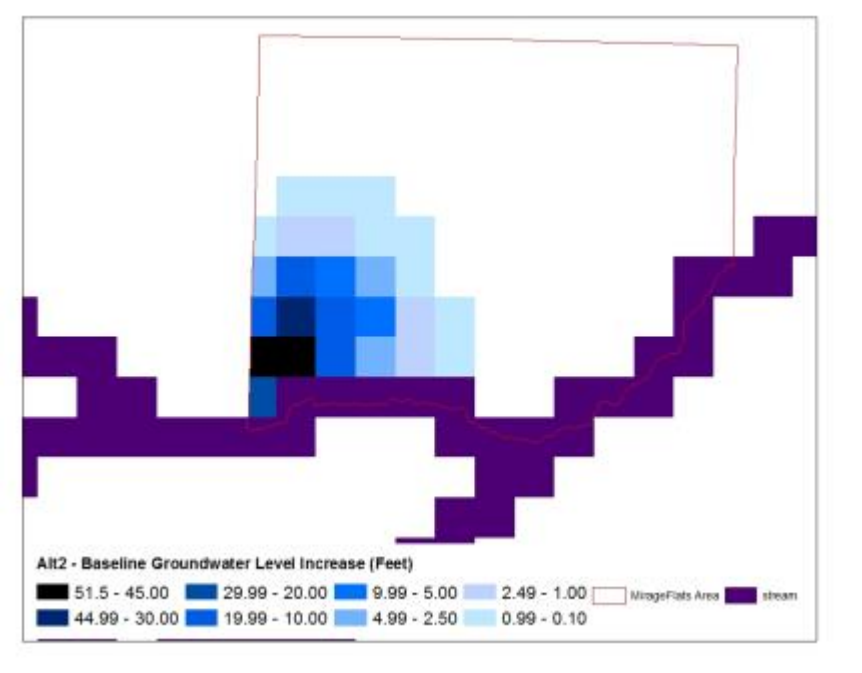
Alternative water Management Scenario

- Alternative water management scenario comparison





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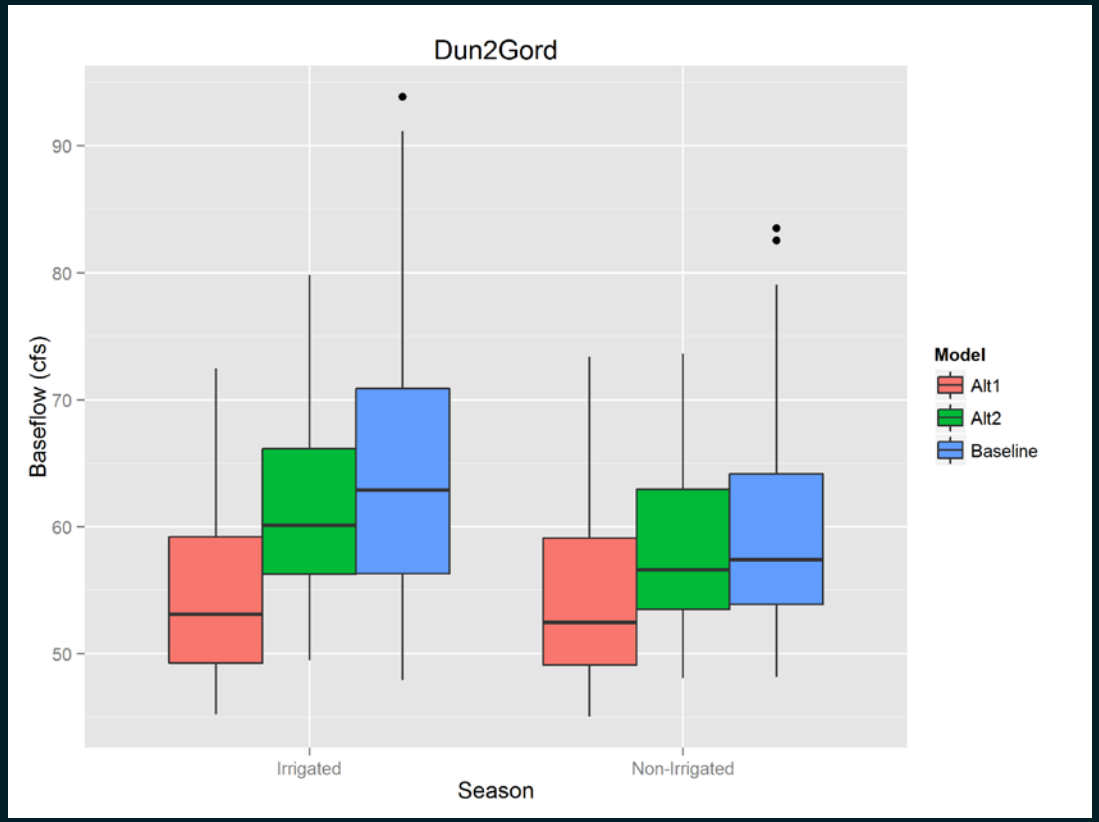
Alternative water Management Scenario

- Alternative water management scenario comparison



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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

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NEBRASKA'S WATER MANAGEMENT RESOURCE

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

THANK YOU

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