

# Review of the Departments New Methods for Assessing Water Supplies and Water Demands

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# Outline

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- Development of the new methods
- Concepts behind the methods
- Example of the methods
- INSIGHT

# Timeline

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- Platte Basin NRDs and Department initiate methodology study (2009)
- Release of Literature Review and Initial Recommendations (2010)
- Stakeholder Meetings and Initial Reports by Consultants (2011)
- Final Stakeholder Meetings Final Report (2013) <http://dnr.ne.gov/website/MainPage.aspx>

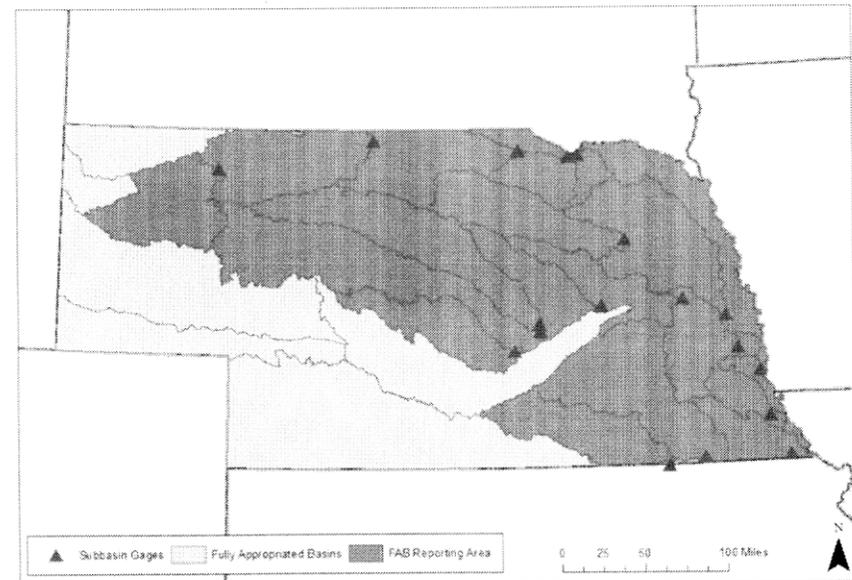
# Concepts

## ■ Basin Water Supplies

- Streamflow
- Groundwater Depletions
- Surface Water Consumption

## ■ Total Water Uses

- Groundwater Consumption
- Surface Water Consumption
- Water for Canal Deliveries
- Instream Flow Demands
- Hydropower Demands
- Downstream Water Demands

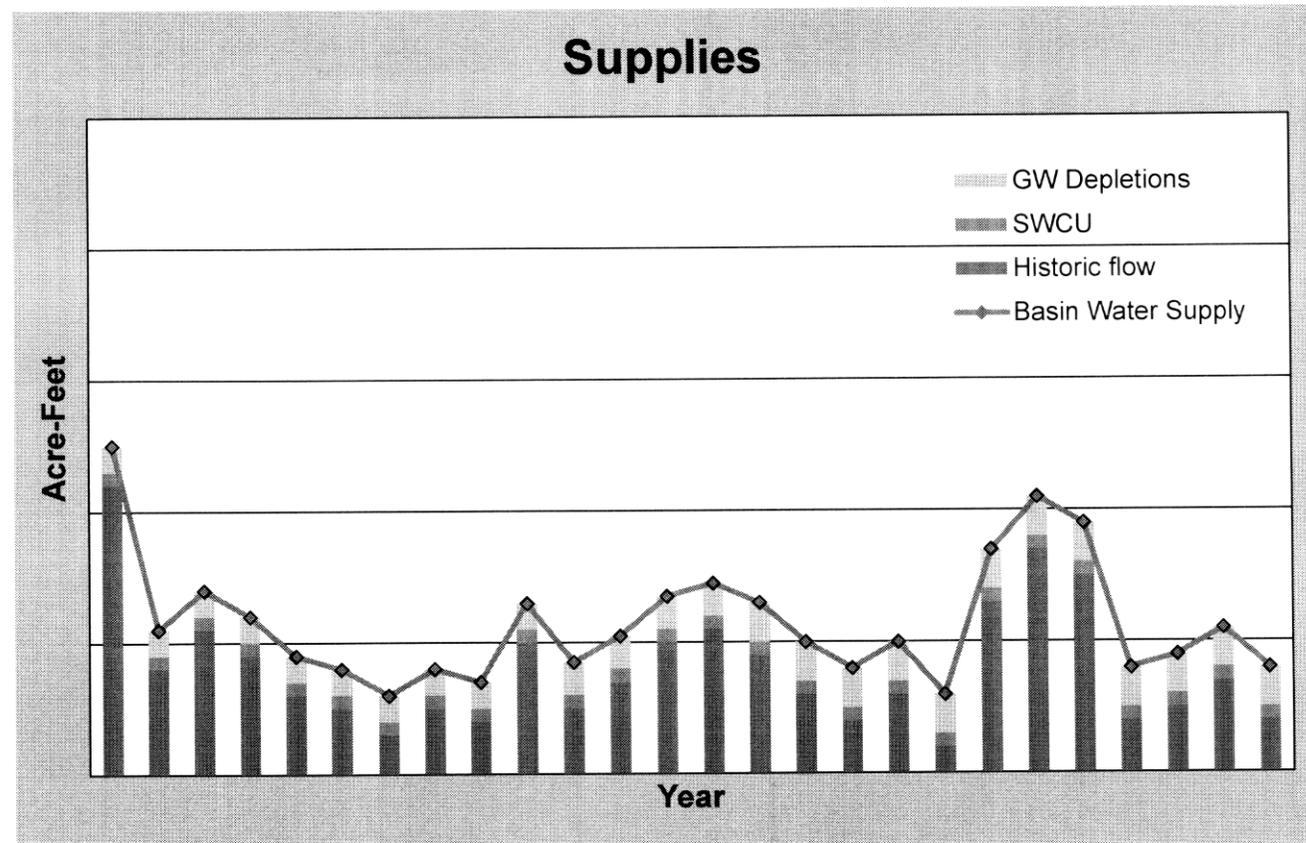


# Concepts

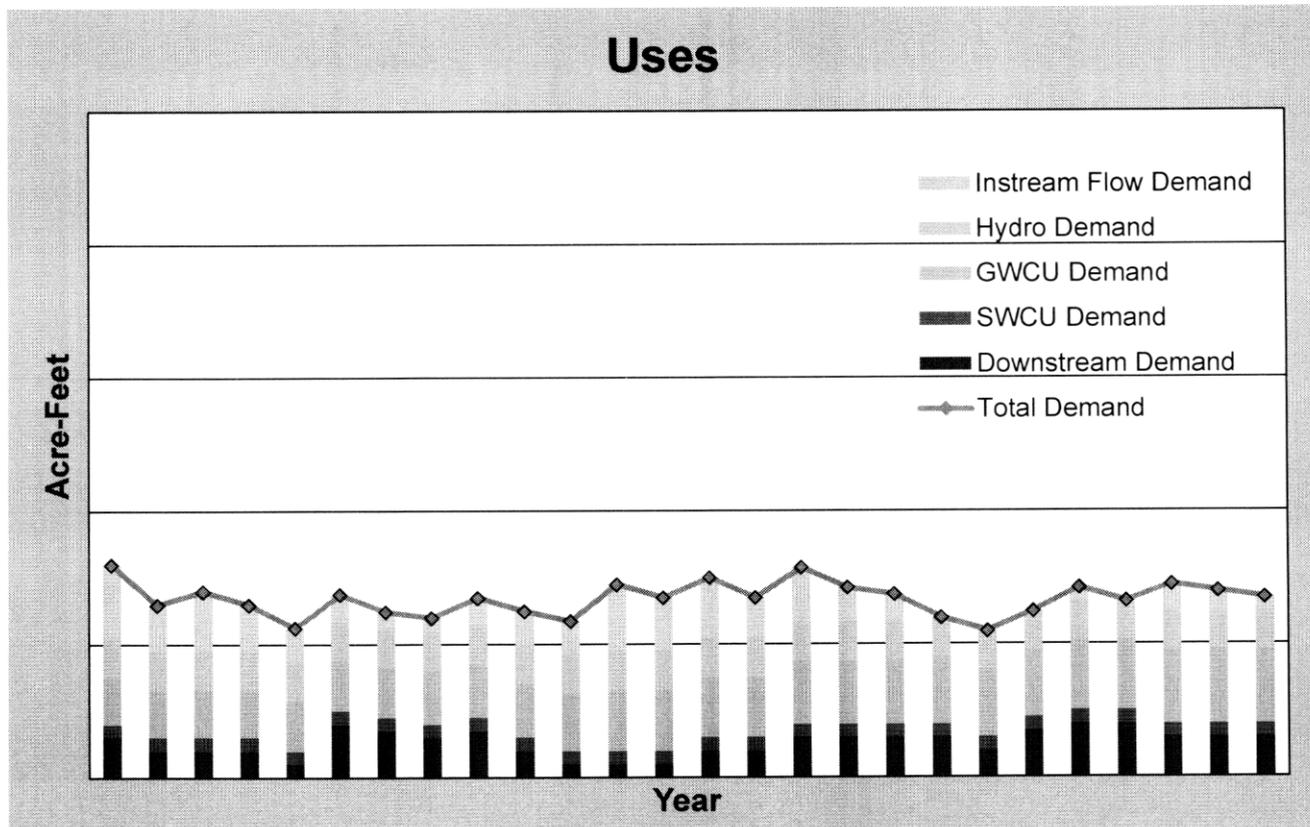
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- Representative Period
  - Statistical analysis of appropriate period
- June – August (peak demand)
- September – May (non-peak demand)
- Near-term and long-term

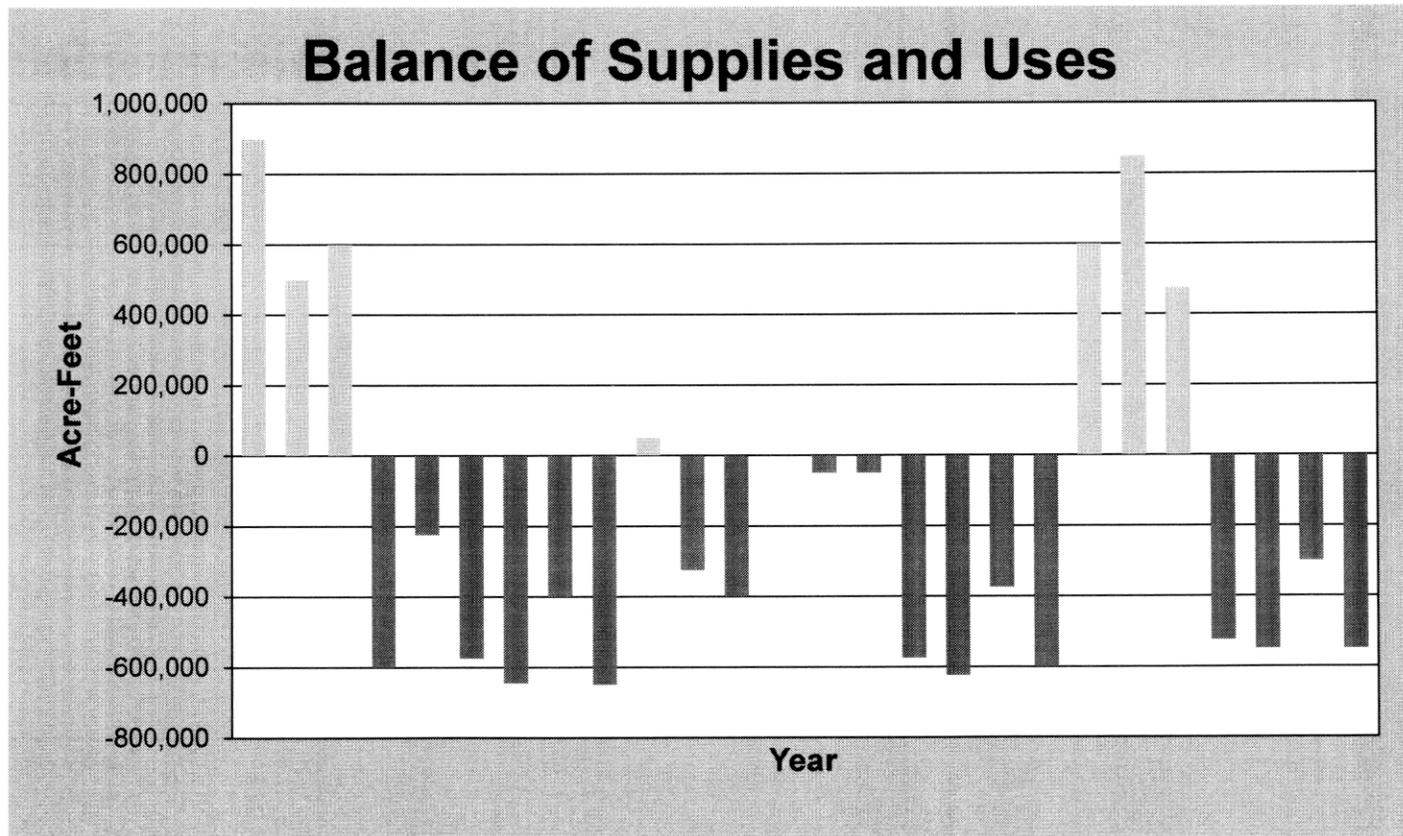
# Concepts



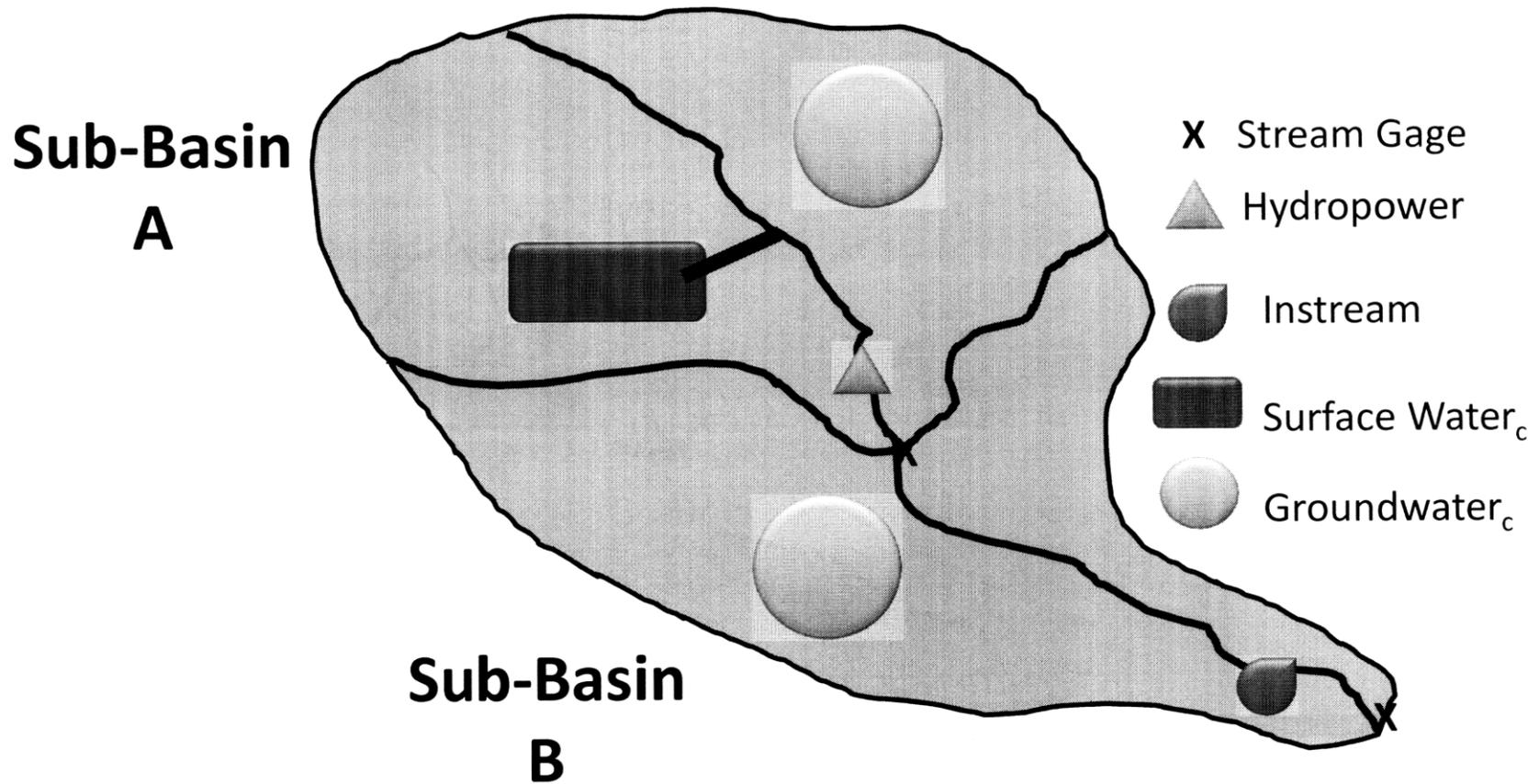
# Concepts



# Concepts



# Example



# Example

$$BWS = \text{Stream Gage} + \text{Surface Water}_C + \text{Groundwater}_D$$

## Sub-Basin A

Stream Gage = 400

Surface Water<sub>C</sub> = 100

Groundwater<sub>D</sub> = 300

**A Total BWS = 800**

Proportion of Total = 40%

## Entire Basin (A & B)

Stream Gage = 1300

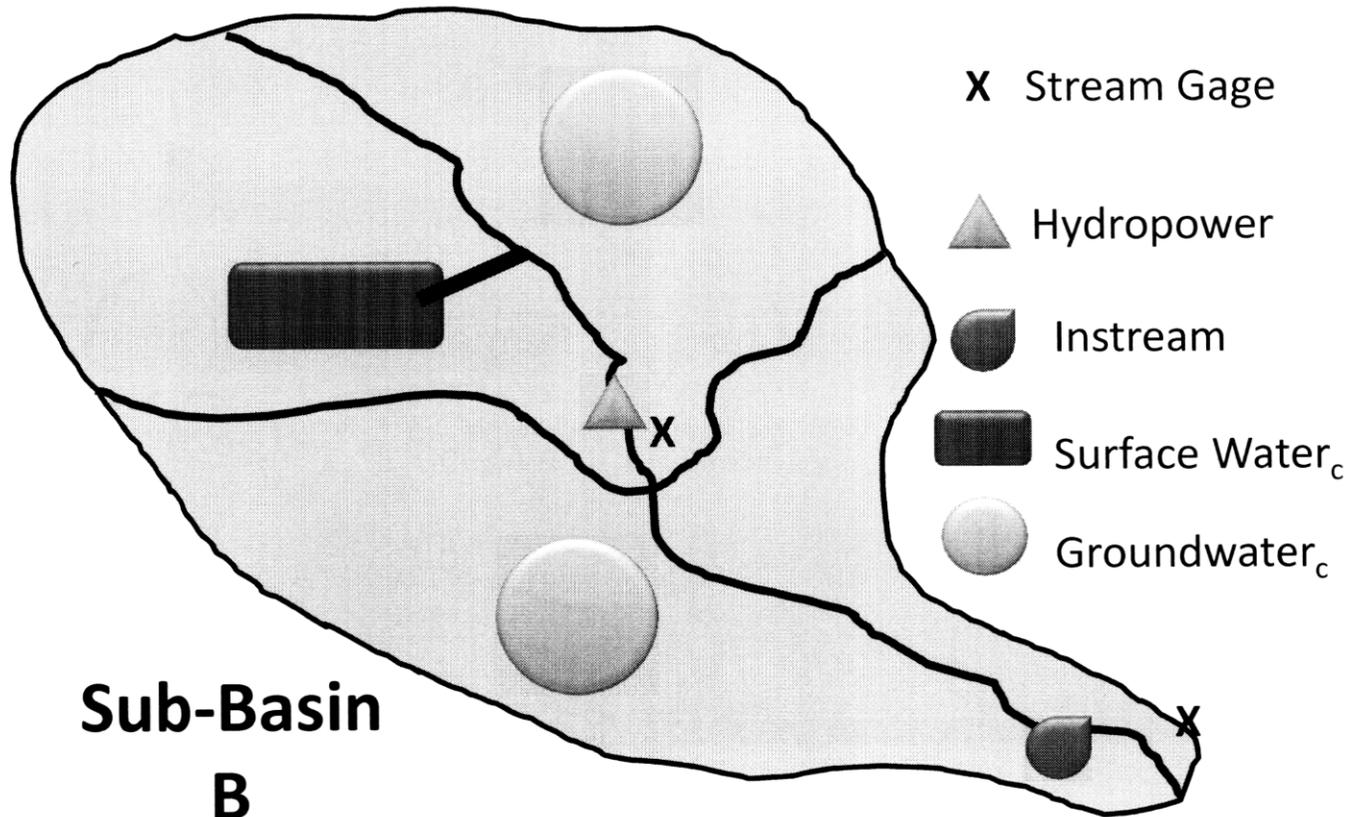
Surface Water<sub>C</sub> = 100

Groundwater<sub>D</sub> = 600

**B Total = 2000 (1200 exclusive to B)**

Proportion of Total = 60%

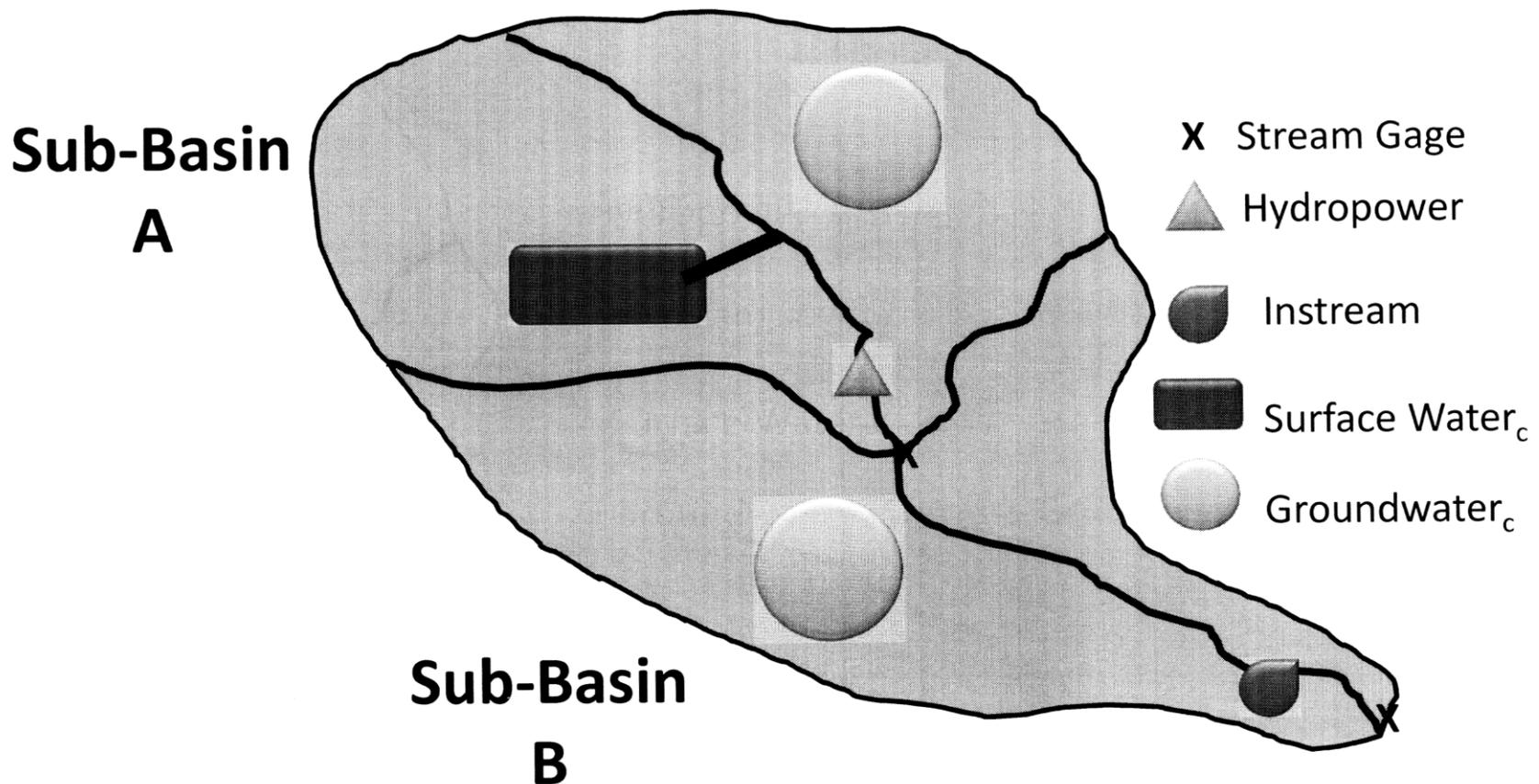
**Sub-Basin  
A**



# Example

Near Term Demand =  $\boxed{\text{Groundwater}_D}$  + Surface Water<sub>C</sub> + Hydropower + Instream + Downstream Demand

Long Term Demand =  $\boxed{\text{Groundwater}_C}$  + Surface Water<sub>C</sub> + Hydropower + Instream + Downstream Demand



# Example

## Uses in Sub-Basin A

Groundwater<sub>c</sub> = 500

Surface Water<sub>c</sub> = 100

Hydropower = 300

Total Demands in A = 900

Mainstem Consumptive Demand=160

Downstream Non-Consumptive=200

Downstream Demand = 160+200-300=60

**A Total = 500 + 100 + 300 + 60 = 960**

## Uses in Sub-Basin B (not inclusive of A)

Groundwater<sub>c</sub> = 400 (mainstem) 200 (tributary)

Surface Water<sub>c</sub> = 0

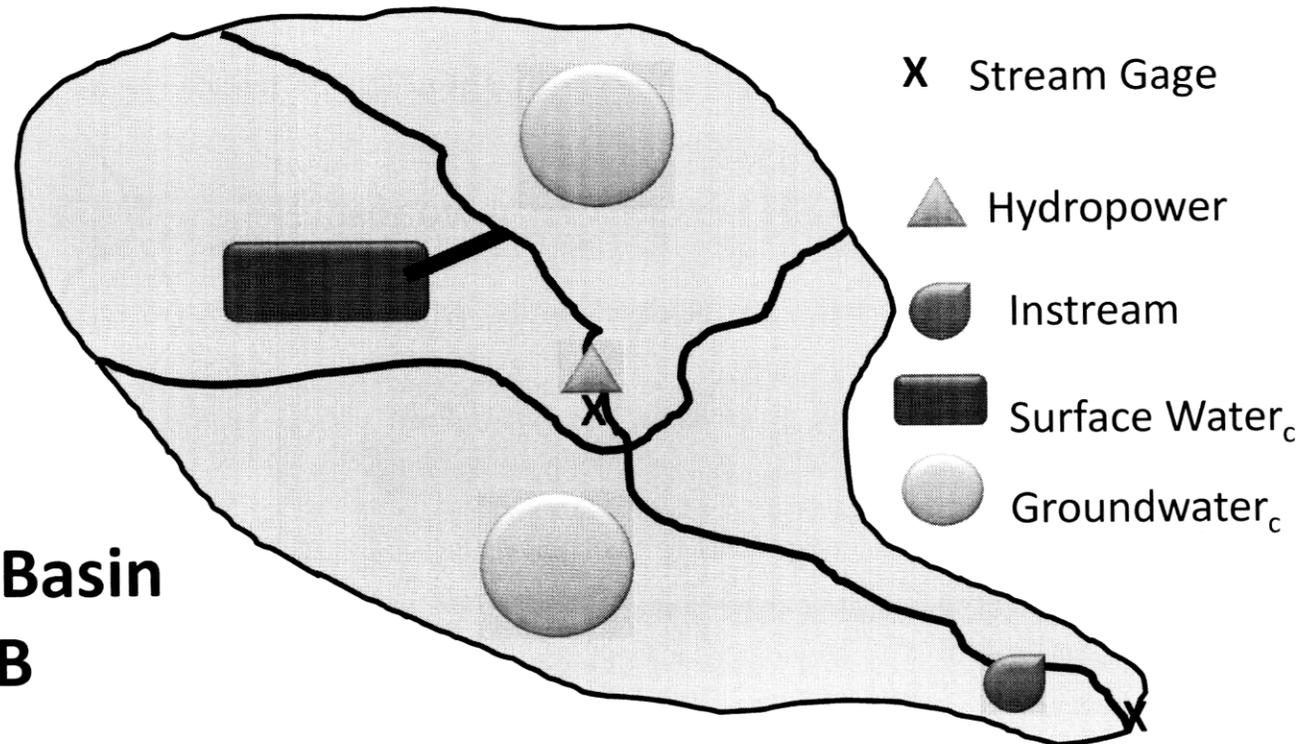
Instream = 500 (mainstem)

Assigned as Downstream Demand to Sub-basin A =160

**B Total = 400 + 200 + 500 – 360 = 740**

**Sub-  
Basin  
A**

**Sub-Basin  
B**



# Example

## Sub-basin A

BWS = 800

Total Long-term Demand = 1060

Balance = - 260

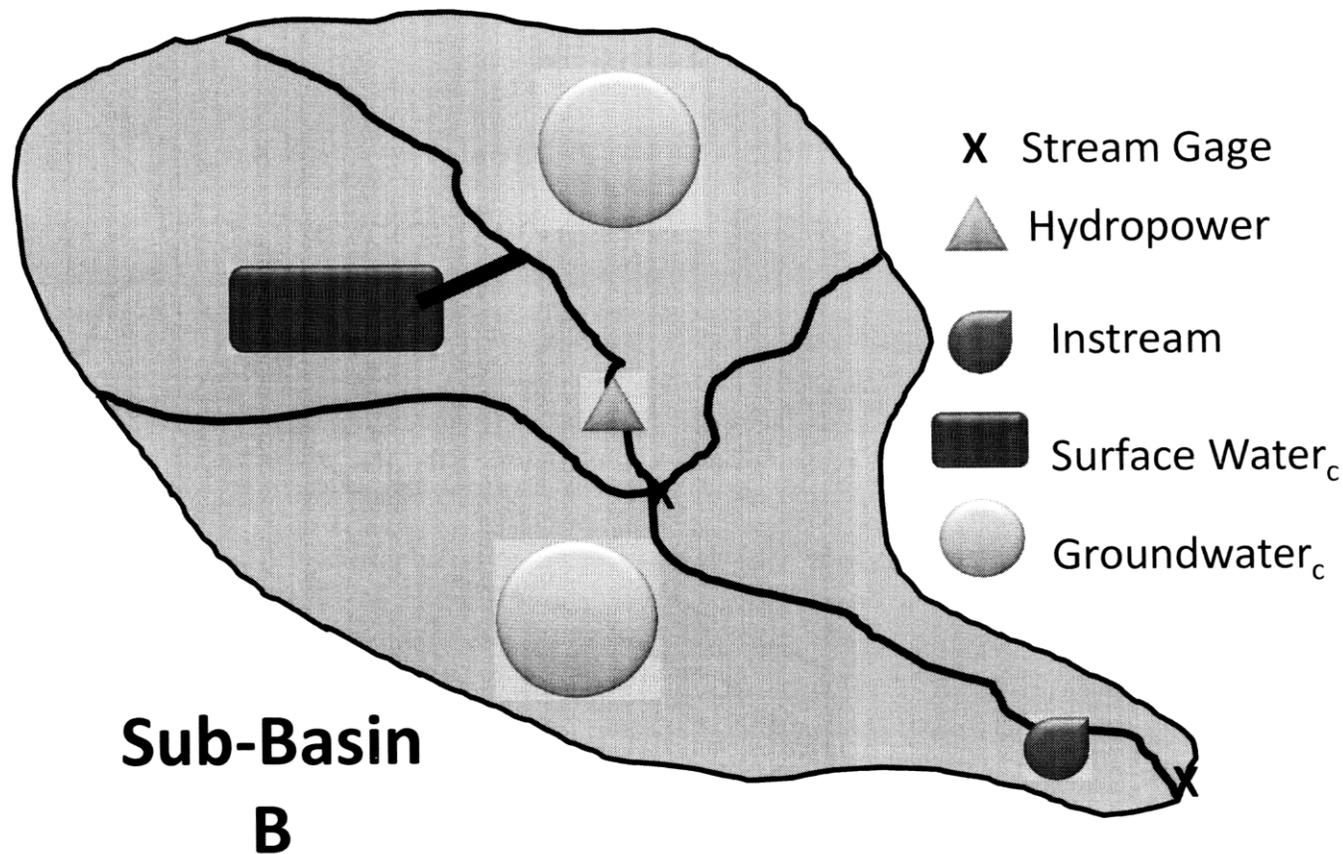
## Sub-basin B

BWS = 1200

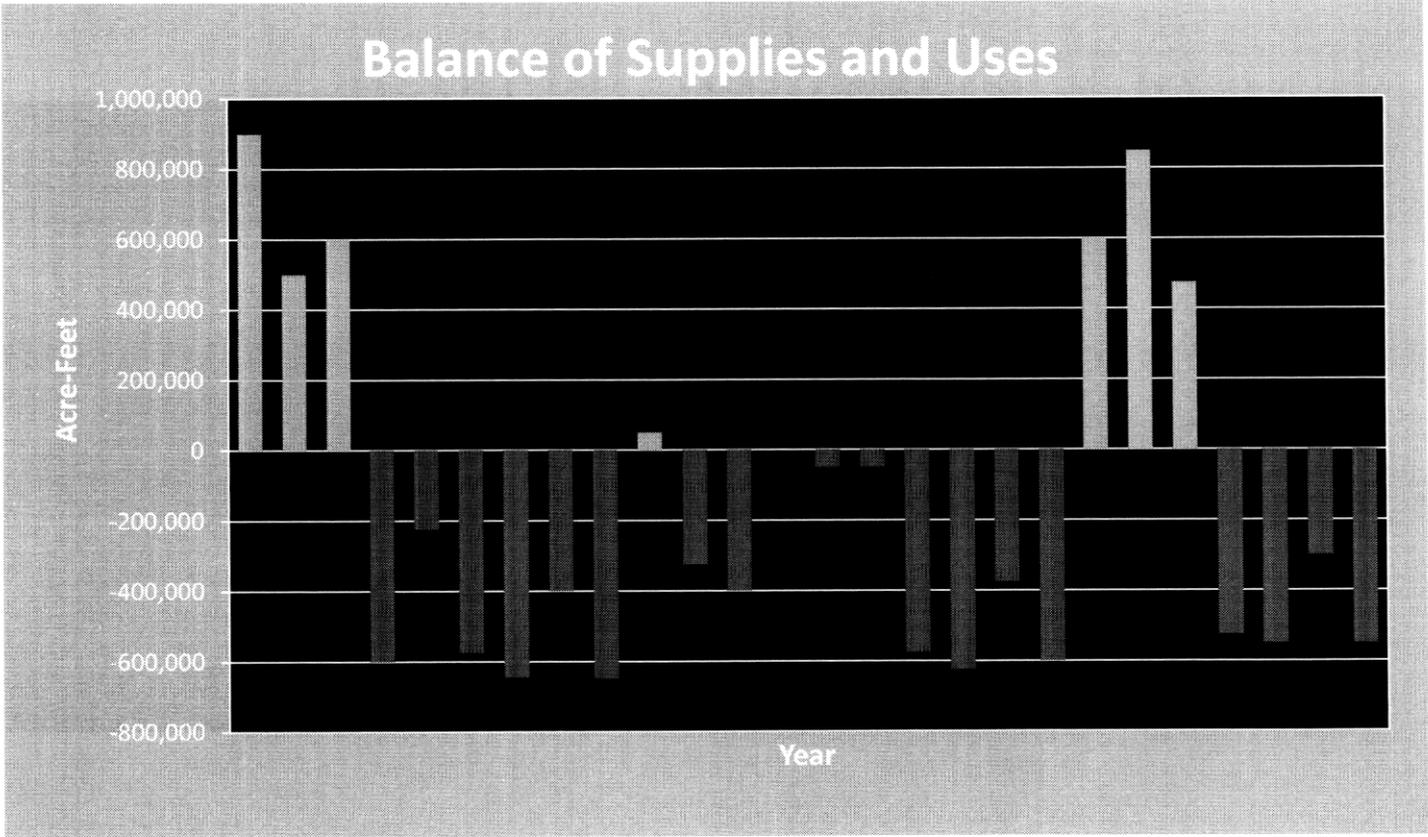
Total Long-term Demand = 640

Balance = + 560

Sub-Basin  
A



# Concepts



# INSIGHT Charts and Graphs on Website

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- Information will be displayed on the INSIGHT Website by the following categories:
  - Statewide
    - Big Picture
    - Supply
    - Demand
    - Nature & Extent of Use
  - Basin/Sub-Basin
    - Big Picture
    - Supply
    - Demand
    - Nature & Extent of Use
    - Balance

# INSIGHT Website Example for Statewide Presentation of Data

## INSIGHT

An Integrated Network of Scientific Information & GeoHydrologic Tools

HOME
ABOUT
STREAM FLOW
MODELING DATA

### Getting Started with INSIGHT

Use this page to get started using the INSIGHT data and information.

Begin by exploring chart information for the state of Nebraska on the tab area below. If you'd rather learn more about one of the state's basins, use your mouse to hover over the map to the right and click on the basin you want to learn more about.

Note that the map has some ground-out areas. These areas, including the White Hat Plate, Lodgepole Creek, and Republican basins have limited data and are currently not available. Keep in mind that state totals do not include the data from these basins. Be sure to check back later for updates which may include this information.

Finally, if you prefer to use the name of the basin in a format that is different from the format used in the map, you can click on the basin name in the dropdown menu to the right.

SELECT BASIN ▼

- Big Blue
- Elkhorn
- Little Blue
- Loup
- Lower Platte
- Missouri Tributaries
- Nemaha
- Niobrara
- Republican
- White Hat Plate

Supply
Demand
Nature & Extent of Use

Chart: Precipitation Volume and Rate
Season: Annual

### Water Supply

The water supply for the state of Nebraska is composed of several different sources. For example, precipitation is one of the sources of Nebraska's water supply.

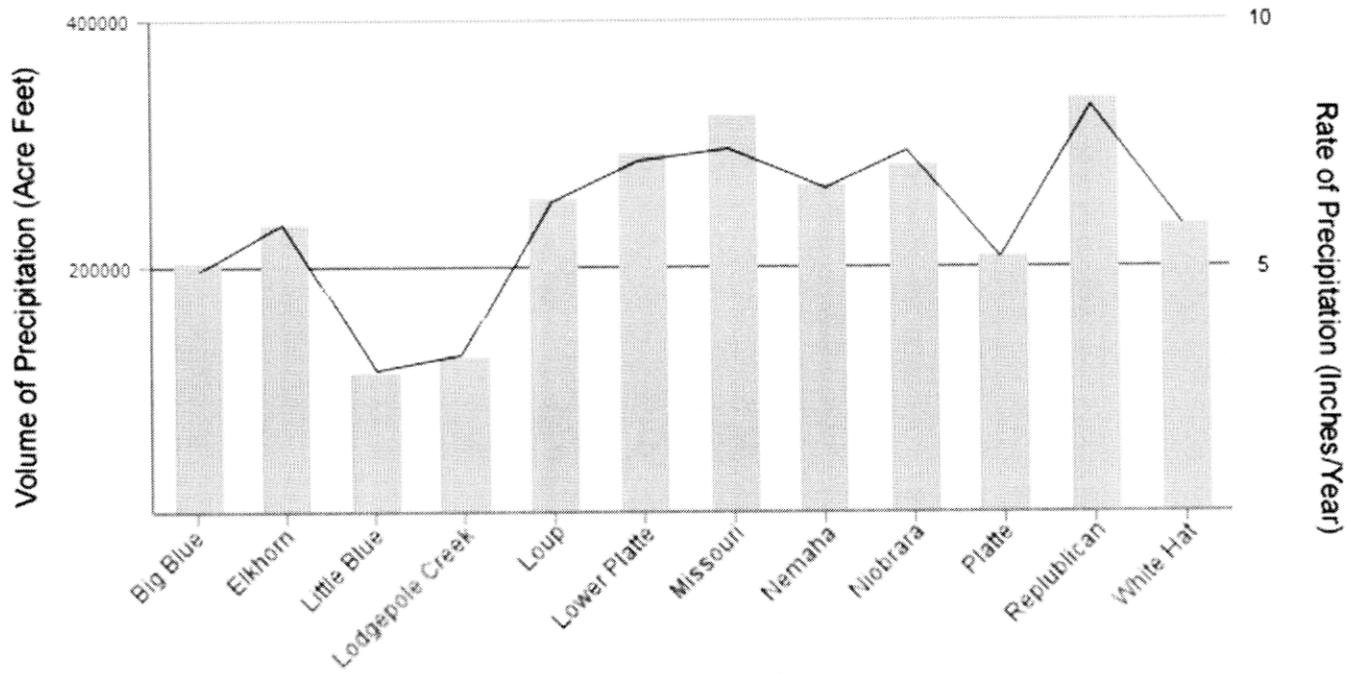
However, other sources include the water that already exists in the rivers that originate in the neighboring states of Wyoming, Colorado and Kansas.

In addition, water exists under ground (called *groundwater*) in aquifers. To access groundwater, consumers of that water use wells and pumps.

Also, Nebraska accumulates and manages a supply of surface water, in reservoirs, which allows for a continuous supply to be available throughout the year.

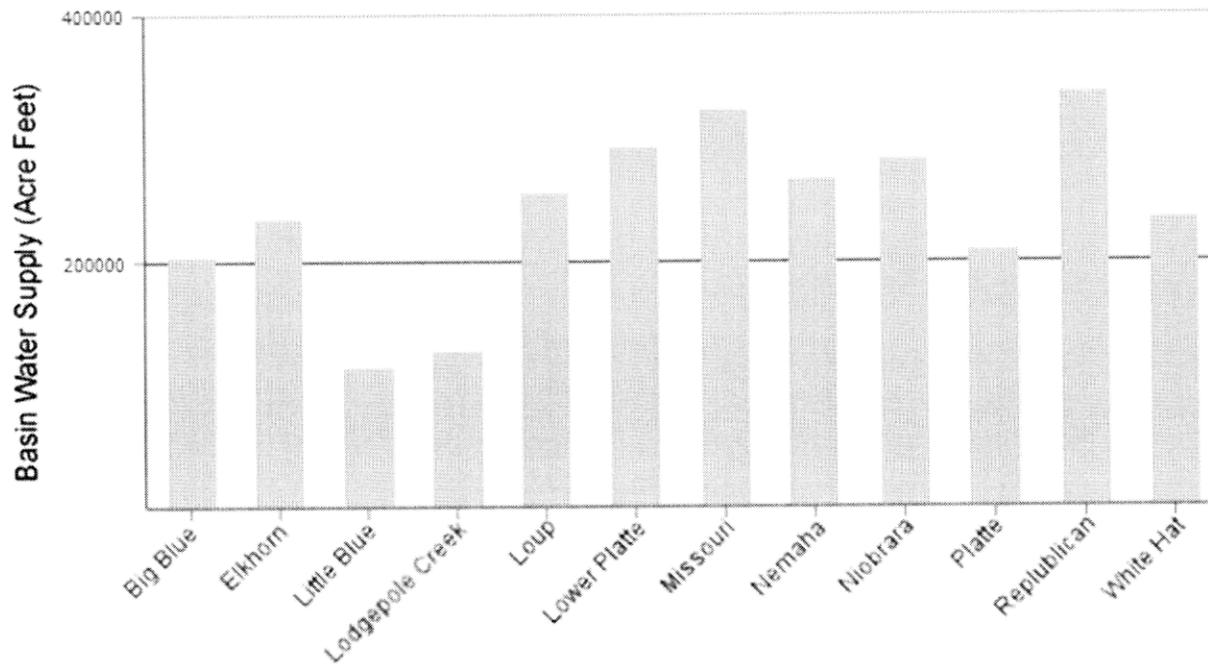
# Statewide: Supply

## Precipitation Rates and Volumes by Basin



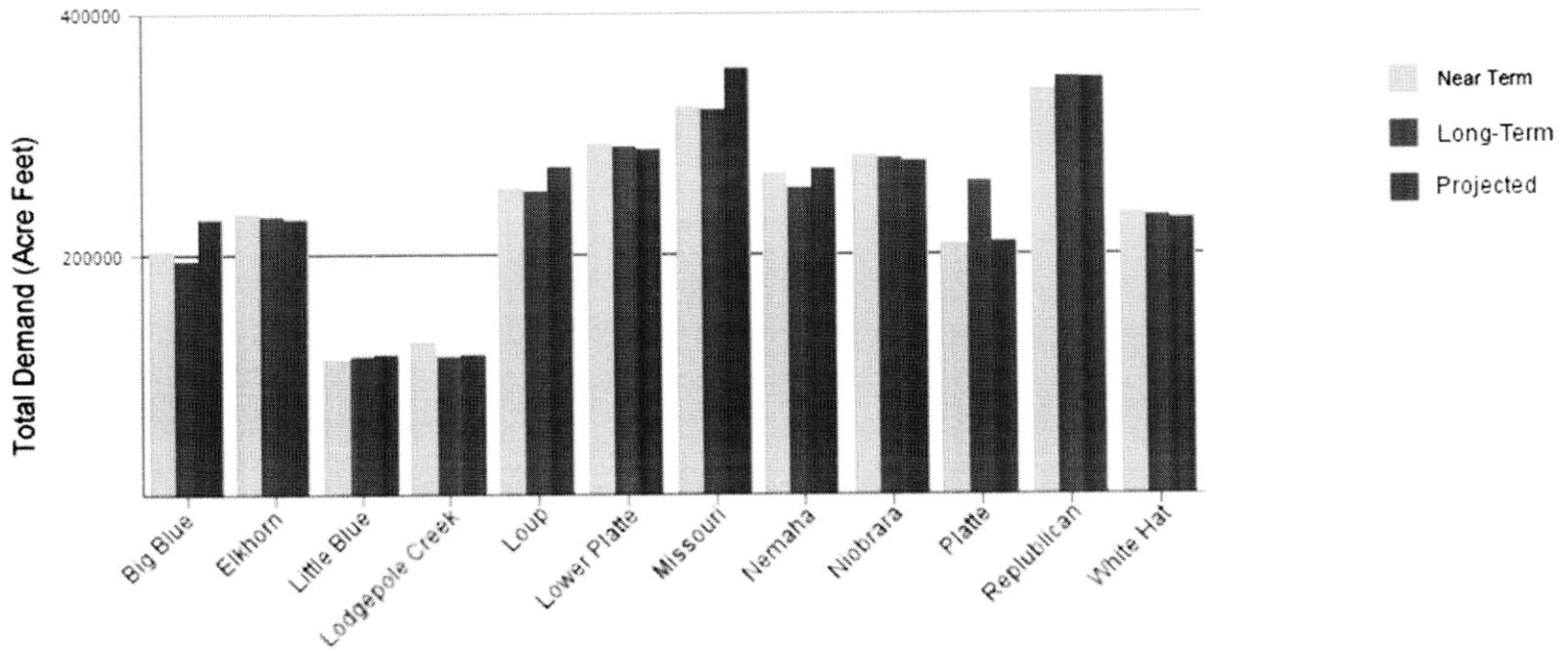
# Statewide: Supply

## Average Basin Water Supply



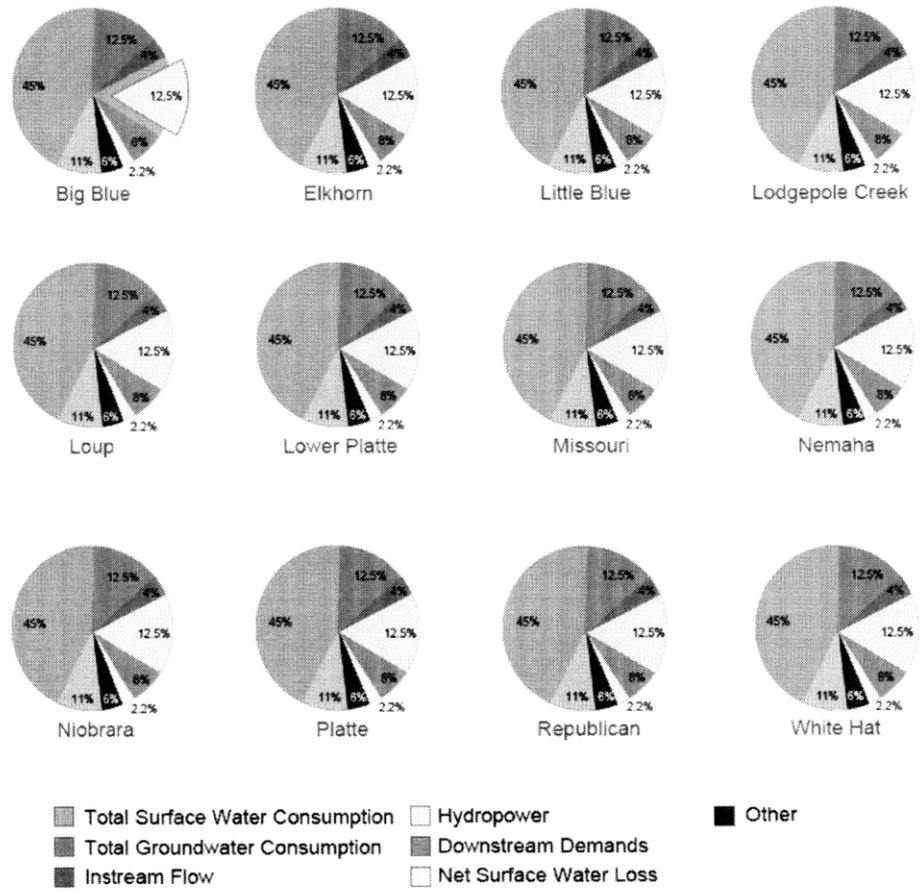
# Statewide: Demand

## Average Total Demand



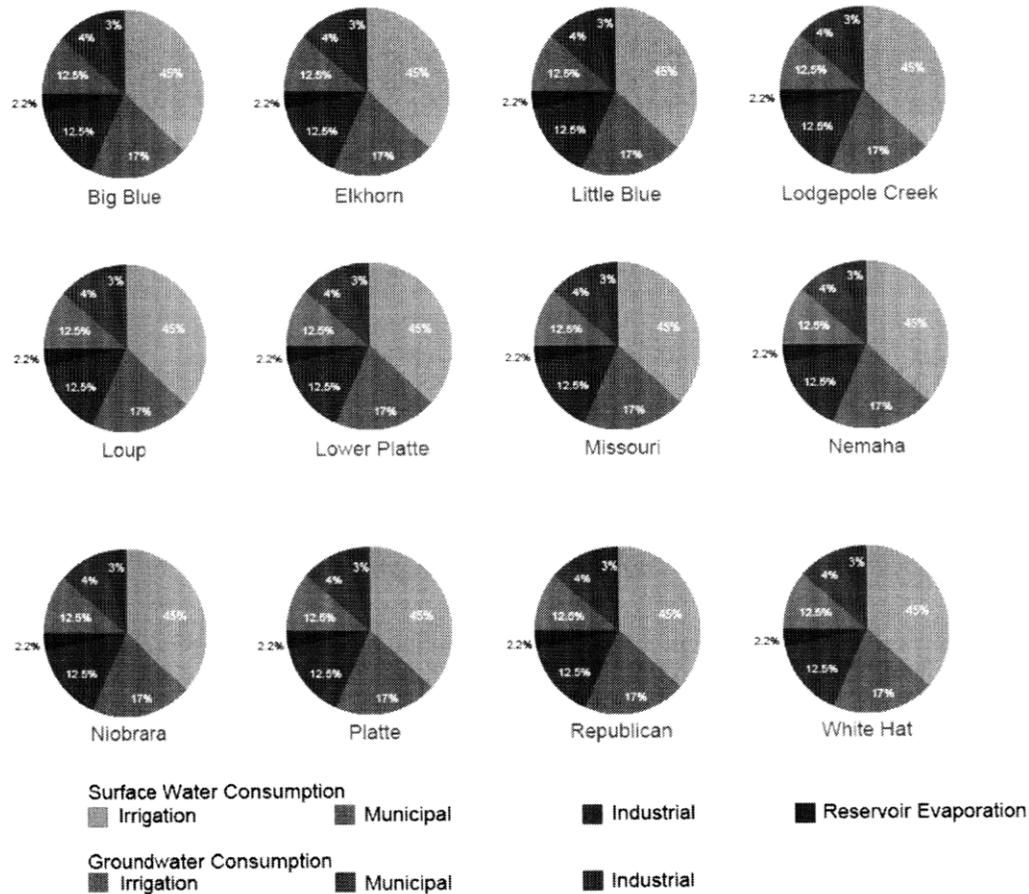
# Statewide: Nature & Extent of Use

## Average Long-Term Total Demand by Basin by Category



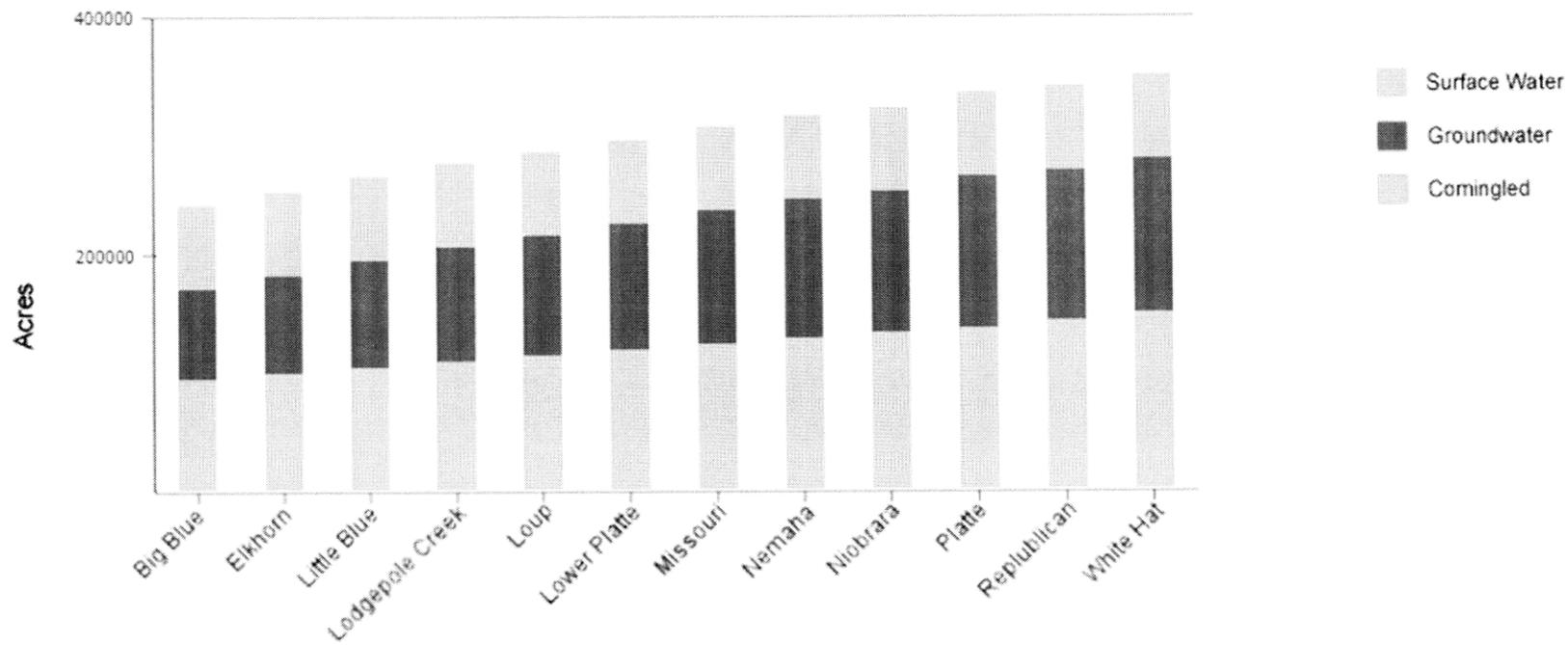
# Statewide: Nature & Extent of Use

## Average Long-Term Surface Water Consumption and Groundwater Consumption by Basin by Category



# Statewide: Nature & Extent of Use

## Irrigated Acres by Basin



# INSIGHT Website Example for Basin/Sub-Basin Presentation of Data

## INSIGHT

An Integrated Network of Scientific Information & Geo-Hydrologic Tools



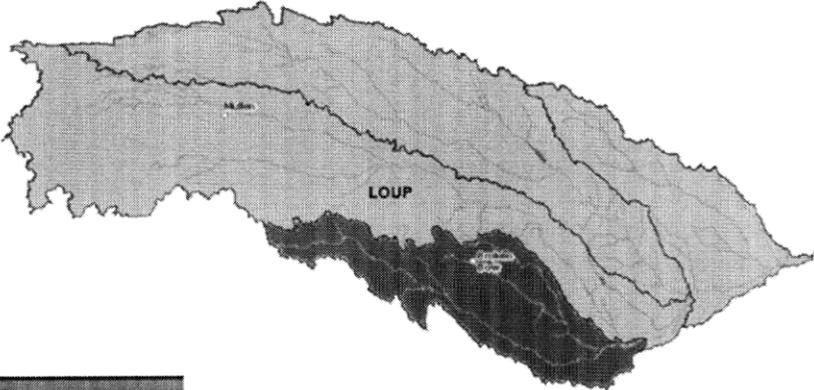
HOME
ABOUT
STREAM FLOW
MODELING DATA

### Explore the Loup Basin

Use this page to get started using the INSIGHT data and information.

Begin by exploring chart information for the Loup basin on the map area below. If you'd rather learn more about one of the Loup's sub-basins, use your mouse to hover over the map to the right and click on the sub-basin you want to learn more about.

If you prefer to see the name of the basins in a list, click on the down arrow located to the right of the SELECT BASIN area to see a menu of basin names. Clicking on one of these basin names has the same effect as clicking on the basin in the map.



Basin Overview
Supply
Demand
Nature & Extent of Use
Balance

### At a Glance

Basin:	LOUP		
Area (square miles):	1,234,567		
Population:			
Current Supply Sources:	sources		
Current Water Demand:	1,293,871 acre-feet/year (19% of state total)		
Largest Demand Sector:	largest sector (63% of regional total)		
Projected Demand:	1,293,872 acre-feet/year		
Growth (1999-2010):	1 acre-feet/year		

### Average Demand by Sector

	Surface Water		Groundwater	
Irrigation	825,541	18%	825,541	18%
Municipal	465,156	22%	465,156	22%
Industry	45,565	4%	45,565	4%
Hydroelectric	344,504	16%	344,504	16%
Instream Flow	1,445,565	50%	1,445,565	50%

The Loup Basin is located in central Nebraska, and is entirely contained within the state. The Loup Basin, with an area of approximately 14,200 square miles, has more area in Nebraska than any other basin.

At its farthest western extent, the Loup Basin boundary is about halfway between Alliance, Nebraska, and Hyannis, Nebraska, in Sheridan and Garden Counties. The Loup River headwaters are about seven miles northwest of Hyannis, Nebraska. The basin is defined as draining to the confluence of the Loup River and Beaver Creek, about 25 miles upstream from Columbus, Nebraska. The Loup River extends beyond the basin boundary to its junction with the Platte River at Columbus, Nebraska.

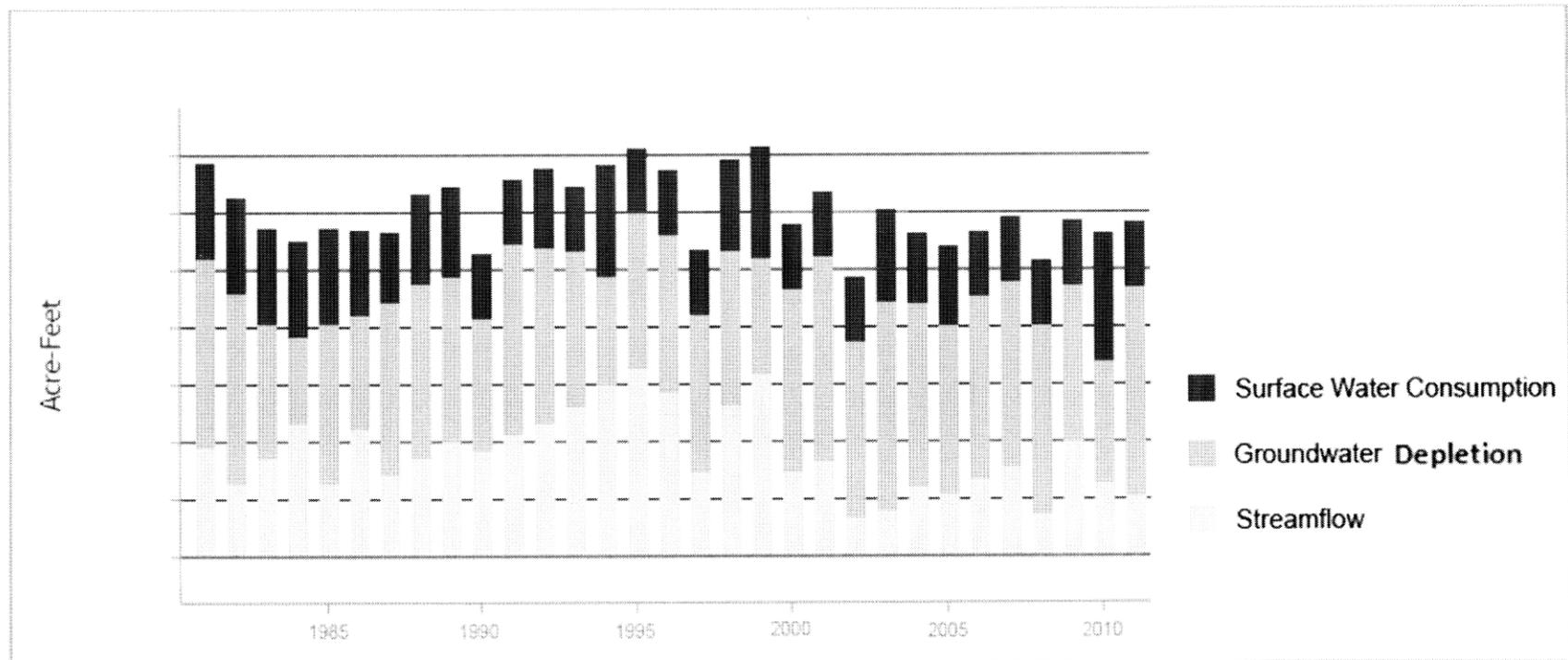
According to the 2010 U.S. Census, the largest city in the basin is Broken Bow, with a population of about 3,600. In descending order, the next largest cities include St. Paul (2,300), Ord (2,100), Ravenna (1,400), and Fullerton (1,300).

The topography of more than half of the upstream end of the Loup Basin consists of sand hills, which are sand dunes stabilized in place by a grass cover. The downstream portion of the basin consists mostly of dissected plains, with small areas of upland plains. The upland plains are land that is flat to gently rolling and dissected plains are where streams have cut into former plains creating hilly land with steep slopes and sharp ridge crests, along with remnants of the plains on the hilltops. There are several valleys in the Loup Basin, which are the flat-lying areas along the Loup River and its major tributaries.

The primary aquifer in the Loup Basin is the Ogallala Formation, which consists of poorly sorted, generally unconsolidated clay, silt, sand, and gravel. The Ogallala Formation is part of a vast system of

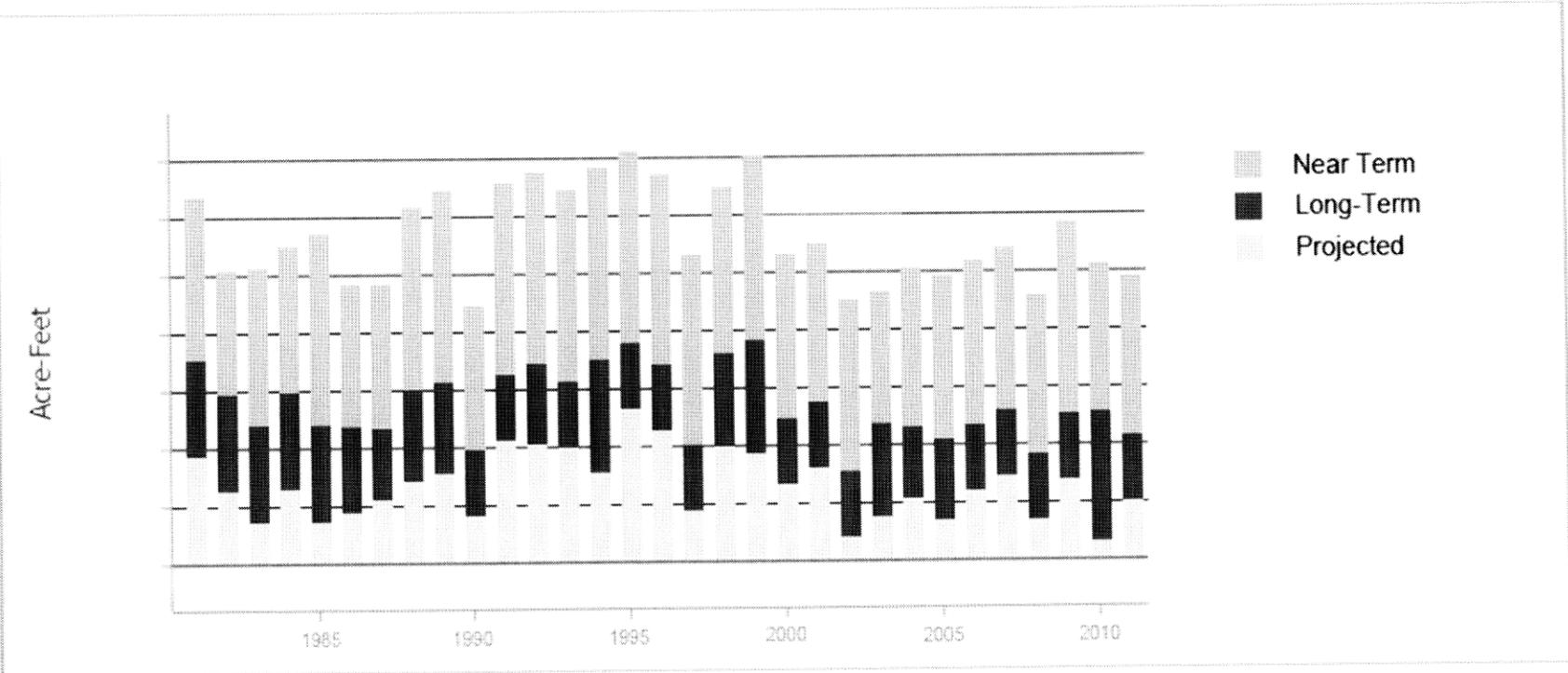
# Basin/Sub-Basin: Supply

## Basin Water Supply



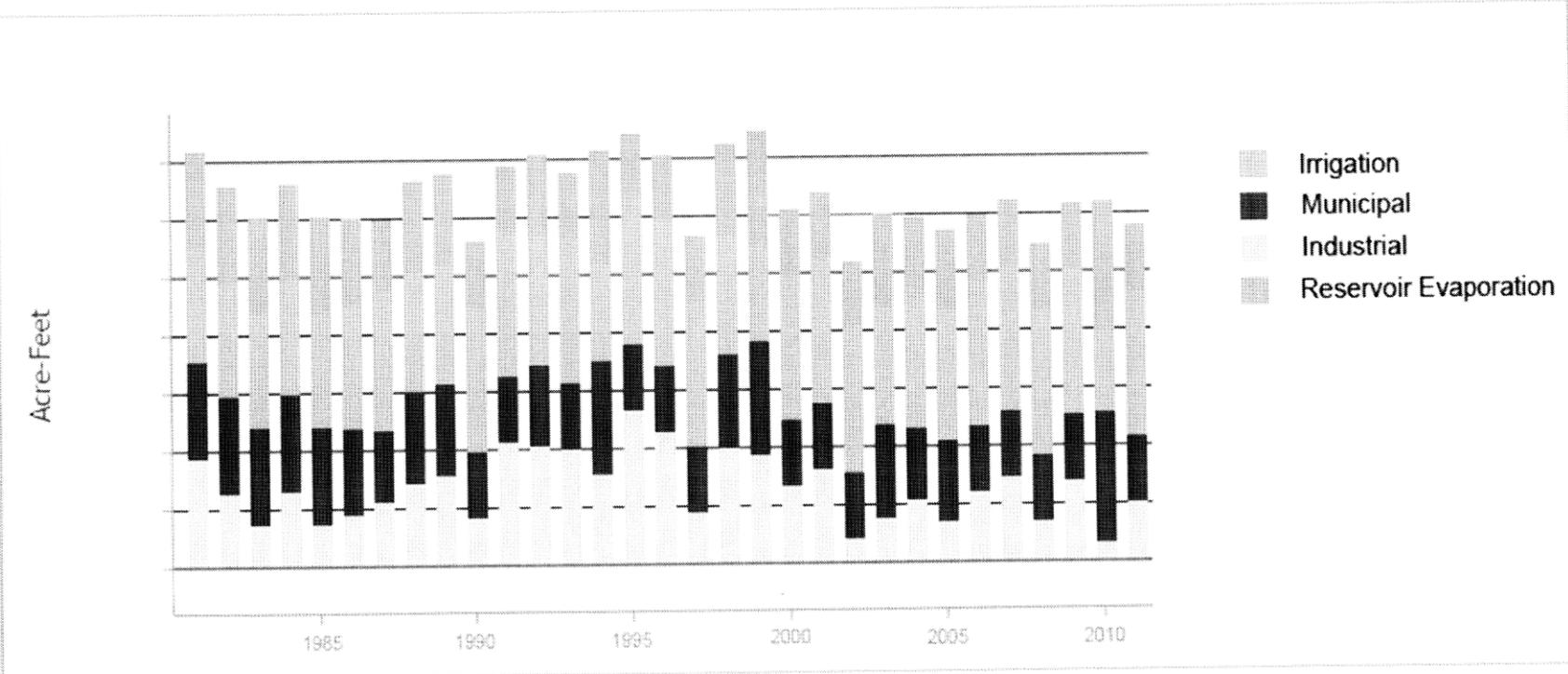
# Basin/Sub-Basin: Demand

## Total Demand



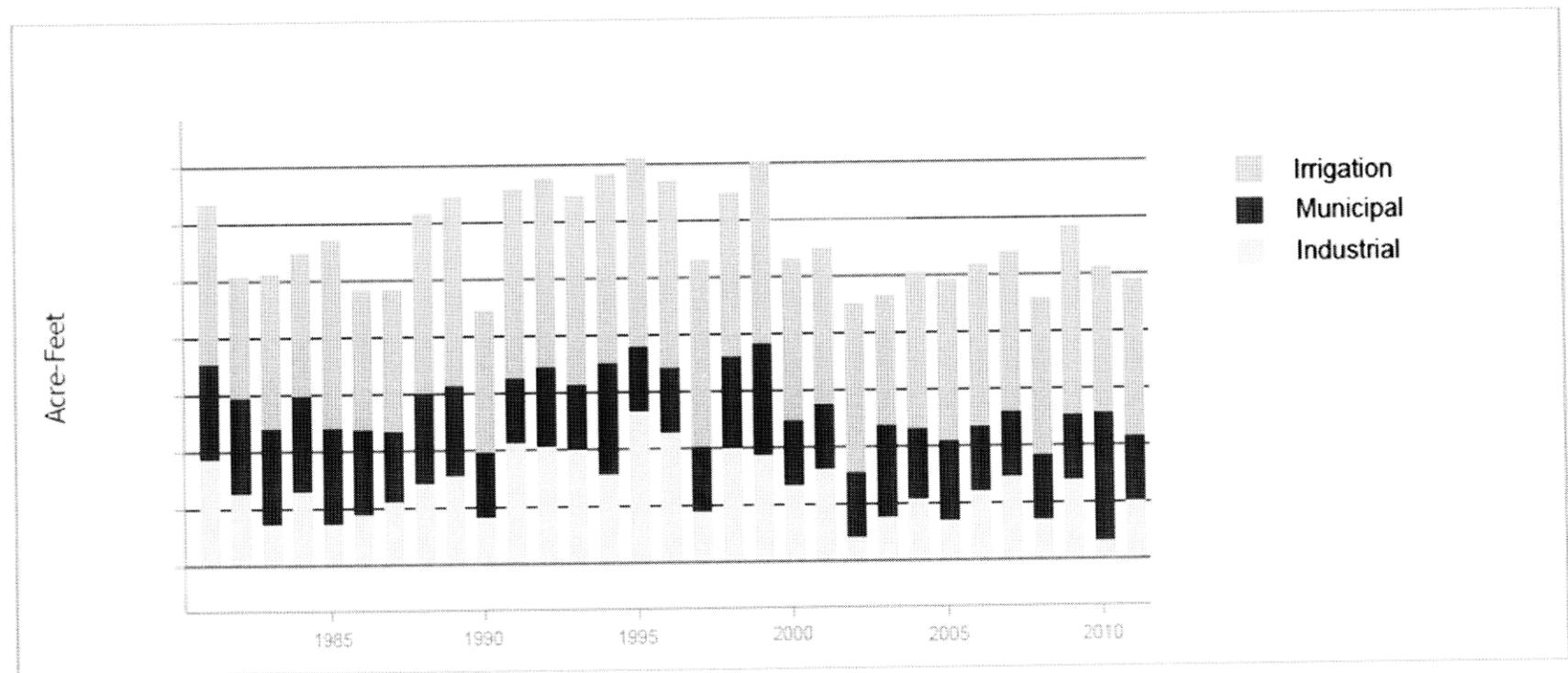
# Basin/Sub-Basin: Demand

## Total Surface Water Consumption



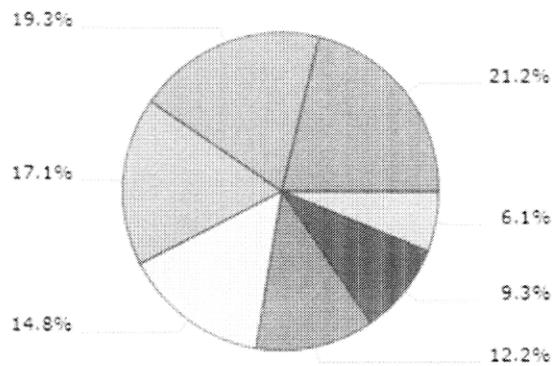
# Basin/Sub-Basin: Demand

## Total Groundwater Consumption

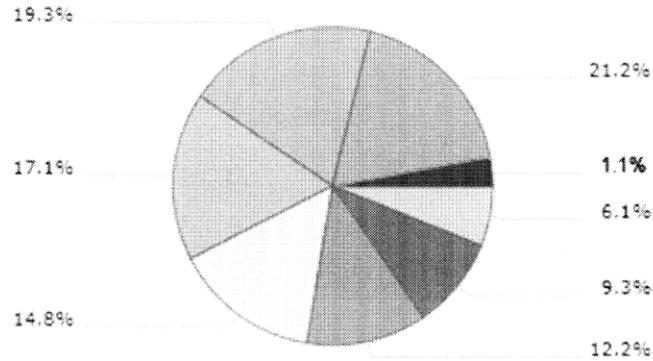


# Basin/Sub-Basin: Nature & Extent of Use

## Long-Term Average Total Demand by Sector



September - May

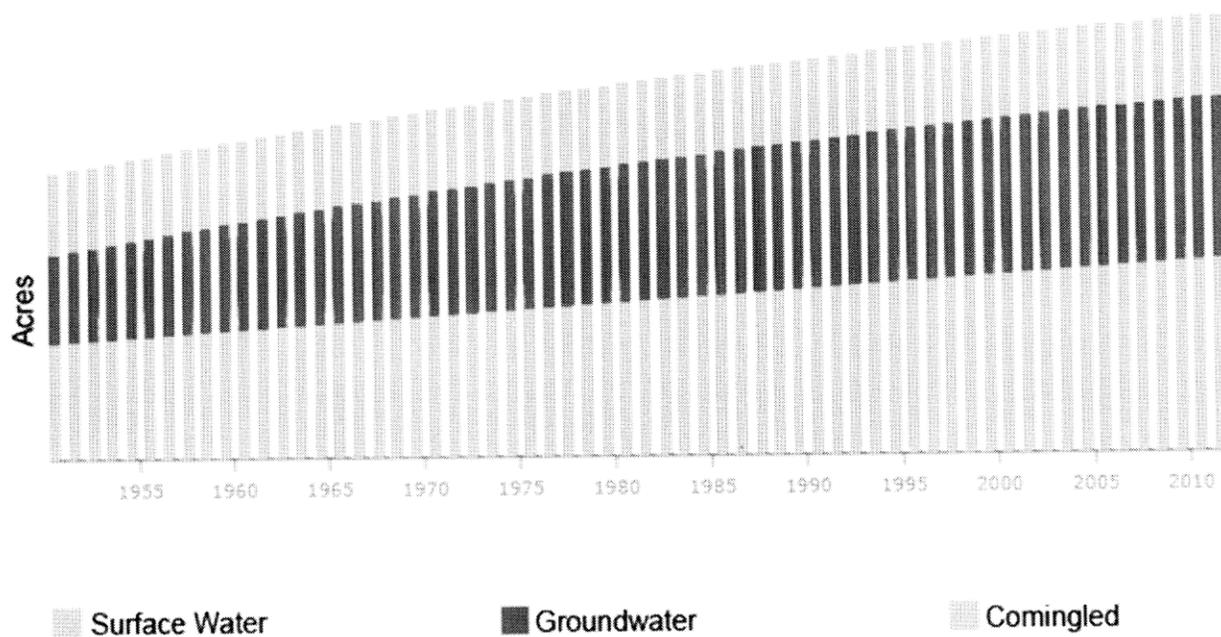


June - August

- Total Surface Water Consumption
- Total Groundwater Consumption
- ▒ Instream Flow
- Hydropower
- ▒ Downstream Demands
- ▒ Net Surface Water Loss

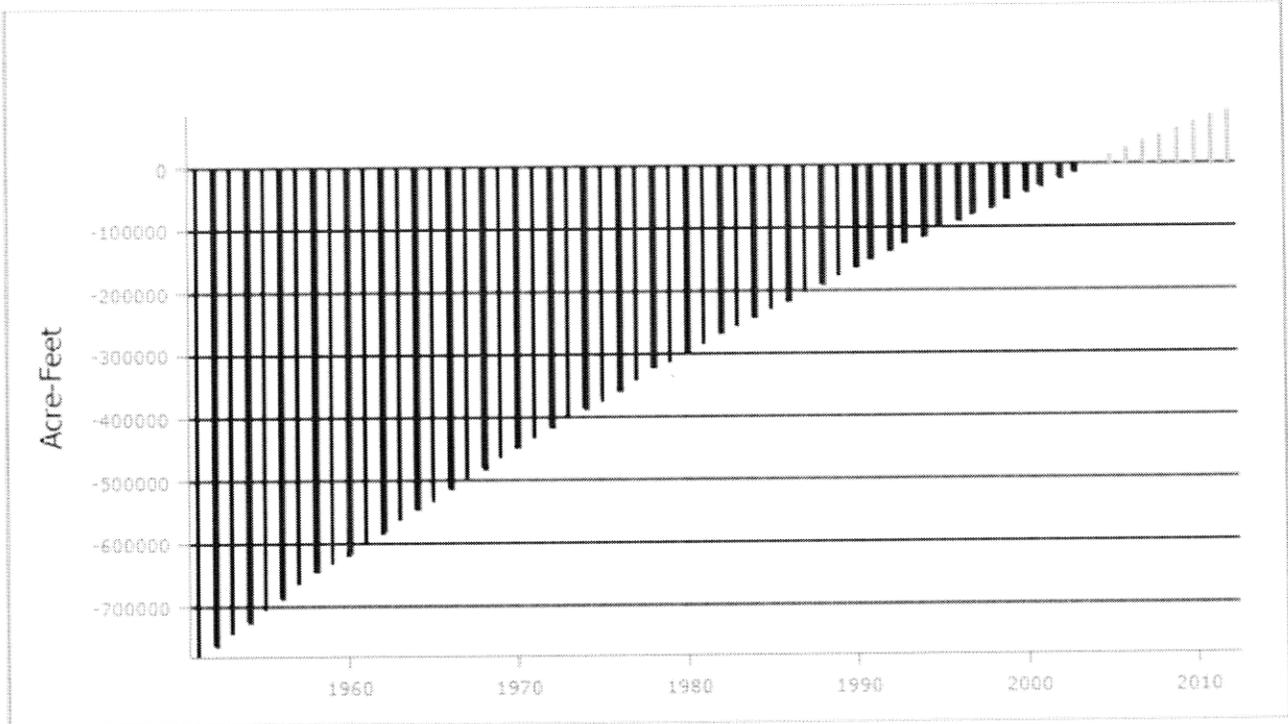
# Basin/Sub-Basin: Nature & Extent of Use

## Irrigated Acres



# Basin/Sub-Basin: Balance

Long-Term\* Balance of Water Supplies and Total Demands



# Summary

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- Methods and tools developed support unique setting with each basin, sub-basin, or reach
- New methods provide comprehensive assessment of hydrologically connected water supplies and demands on those supplies
- INSIGHT provides for a single location to access the data, tools, and results

Thank you

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Questions?

