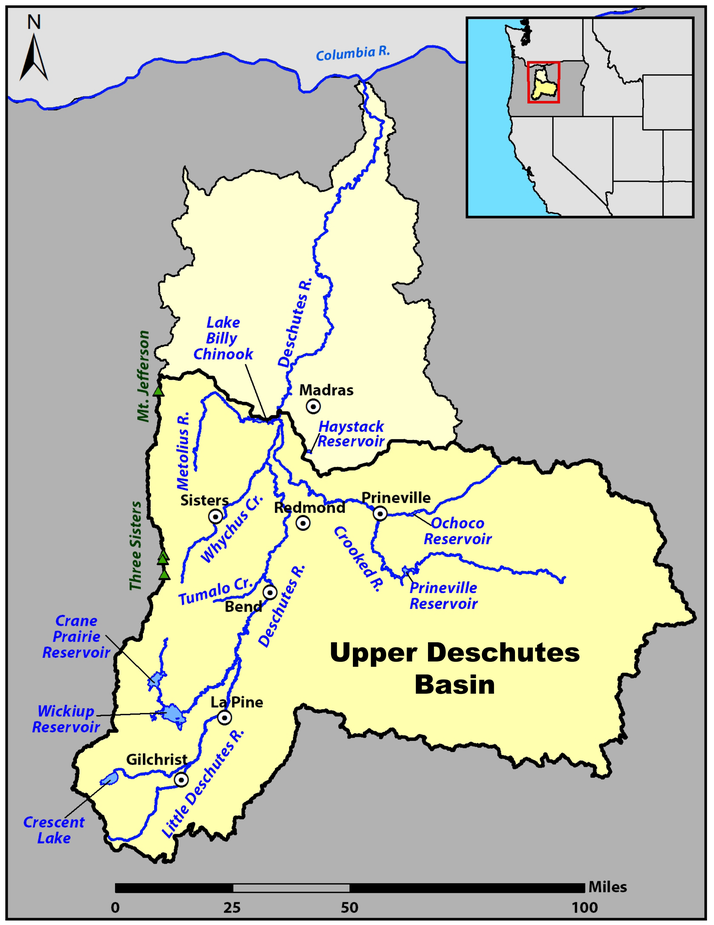
# Upper Deschutes Basin Study: Purpose & Overview

THE UPPER DESCHUTES BASIN STUDY
Water for agriculture, rivers & cities

**The Upper Deschutes Basin Study is a $1.5M three year study, funded by Bureau of Reclamation & Oregon Water Resources Dept.**

**The Study is co-managed by Bureau of Reclamation and the Basin Study Work Group**

**The Study builds off of 20 years of work by stakeholders in the Basin.**




## Objectives—The Study is intended to:

- Evaluate and quantify current and future water supply and demand
- Develop and analyze potential tools that could be considered for addressing identified imbalances in supply and demand
- Evaluate potential water management tools in terms of effectiveness, cost, environmental impact, risk, stakeholder response, and other factors

## What the Basin Study is NOT:

- Implementation Plan
  — *The Study will not propose or recommend any particular action*
- Habitat Conservation Plan
- Watershed Plans

## Study Take-Aways:

- We have a good set of water supply tools: all have opportunities and barriers
- Shortages associated with meeting instream and out of stream needs are significant
- To address shortages, we will need to consider all the available tools
  —*Beyond the Study, a strategic approach to combining tools could benefit any future implementation*

**Basin Study Work Group**

Central Oregon Irrigation District
North Unit Irrigation District
Arnold Irrigation District
Swalley Irrigation District
Lone Pine Irrigation District
Tumalo Irrigation District
Ochoco Irrigation District
Three Sisters Irrigation District
City of Bend
Avion
City of Madras
City of Redmond
City of LaPine
City of Prineville
USDA Forest Service
Department of Environmental Quality
US Fish and Wildlife Service
Confederated Tribes of Warm Springs
Deschutes County
Coalition for the Deschutes
Crooked River Watershed Council
Upper Deschutes Watershed Council
Sunriver Anglers
Central Oregon Flyfishers
Deschutes River Conservancy
Trout Unlimited
Native Reintroduction Network
Bureau of Reclamation
Oregon Water Resources Department
Oregon Land and Water Alliance
Oregon Department of Agriculture
Deschutes Soil and Water Conservation District
Portland General Electric
WaterWatch
Deschutes Water Alliance
Bend Paddle Trail Alliance

# Water Supply in the Upper Deschutes Basin

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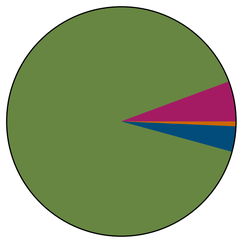
## Water Supply Goals—Secure and Maintain:

- Streamflows and water quality for the benefit of fish, wildlife and people
- A reliable and affordable water supply to sustain agriculture
- A safe, affordable and high quality water supply for urban communities

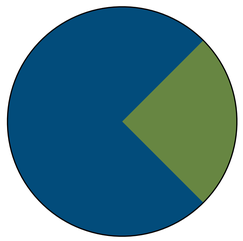
**BASIN WATER RIGHTS DISTRIBUTION**

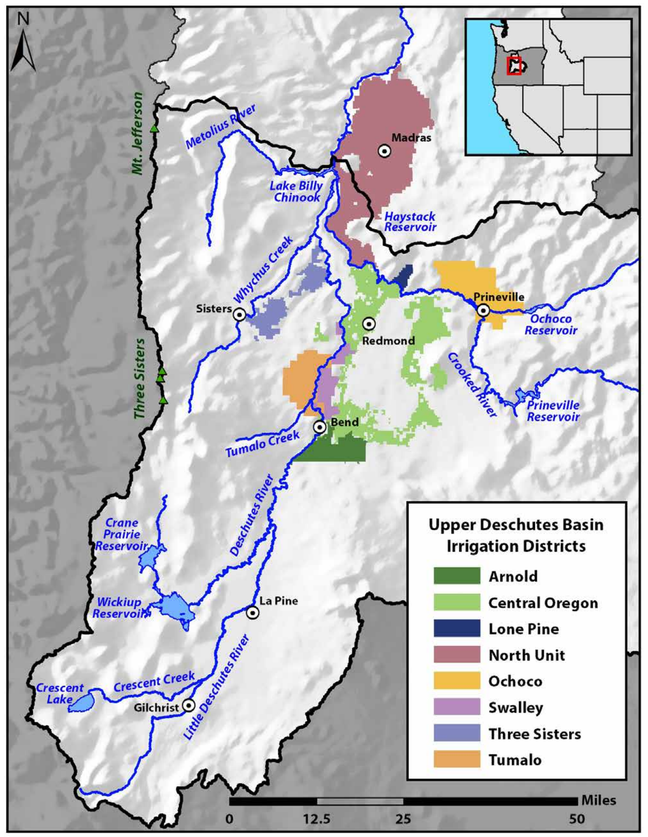
As of 2006 Deschutes Water Alliance Studies




**ESTIMATED SUPPLY SHORTFALLS**

2006 Deschutes Water Alliance Studies (to 2025)




## The Need for Integrated Solutions:

- 8 irrigation districts
- 5 reservoirs
- Low and altered streamflows
- Cities and private water suppliers
- A finite supply of water

## Total Annual Inflows to the Basin

- 860,000 to 2.3 million AF

## Instream Demand

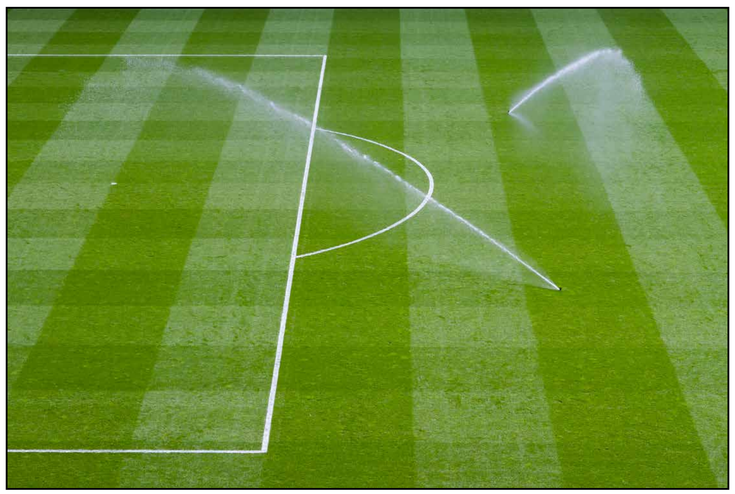
- Median shortages associated with meeting instream water rights and existing irrigation demands are approximately 130,000 AF. Shortages range up to 300,000 AF in dry years.
- To meet higher flows that may contribute to broader ecological benefits in some reaches, median shortages are approximately 200,000 AF, ranging up to 400,000 AF in dry years.

## Irrigation Demand

- Average annual surface water diversion for major irrigation districts is 724,000 AF
- Goal to maintain existing water supply reliability
- More challenging for "junior" irrigation districts

## Municipal Demand

- Current annual diversion (mostly groundwater): 40,000 AF
- Projected 50-year demand will require 16,000 AF of water dedicated instream for groundwater mitigation



# Water Supply Options: Water Conservation

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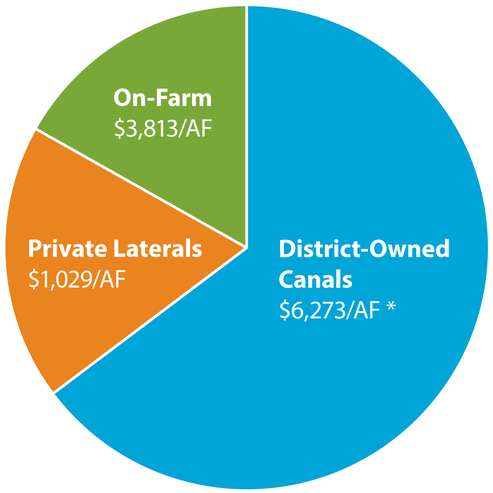
**The Water Conservation Assessment analyzed actions that increase efficiency of irrigation water delivery and use through modernizing irrigation infrastructure.**

## Tools assessed include:

- Piping district canals
- Piping privately-owned laterals
- On-farm infrastructure upgrades (e.g., flood to sprinkler irrigation)




**Potential Total Water Conservation: 200,000 AF; $986M**


Piping canals in Three Sisters Irrigation District

* Opportunities and costs varied widely between and within districts ($1,000-$20,000/AF)

## Benefits

- Upgrading infrastructure improves irrigation district and on-farm management and operations
- The same amount of acres can be irrigated with less water
- Piping canals and laterals increases opportunities for other tools like water marketing

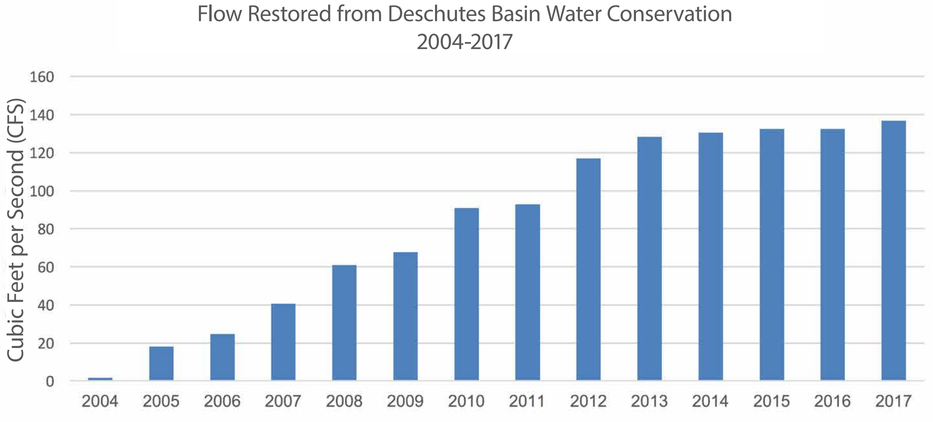
## Challenges

- Piping district canals is expensive
- Potential opposition to district canal piping
- Efficiency upgrades on privately-owned laterals and on-farm requires action by multiple private parties involving additional costs


Irrigated agriculture

**Important Note:** **The Study will not recommend, propose, or endorse any particular action. It will assess the general potential for water conservation as a possible element for consideration during future water resource planning by stakeholders.**

## A Proven Tool for Restoring Flows in the Deschutes


## Overview of Tools

| Water Supply Tool | Supply (AF) | Total Cost | Avg $/AF |
|---|---|---|---|
| **Water Conservation Infrastructure** | **200,000** | **$986 M** | **$4,930** |
| Market-Based Incentives | 164,000 | $65 M | $398 |
| Storage | 40,000 | $200 M | $5,000 |

# Water Supply Options: Market-Based Approaches

**Market-Based Approaches use price incentives to promote efficient water use and reallocation of supply.**

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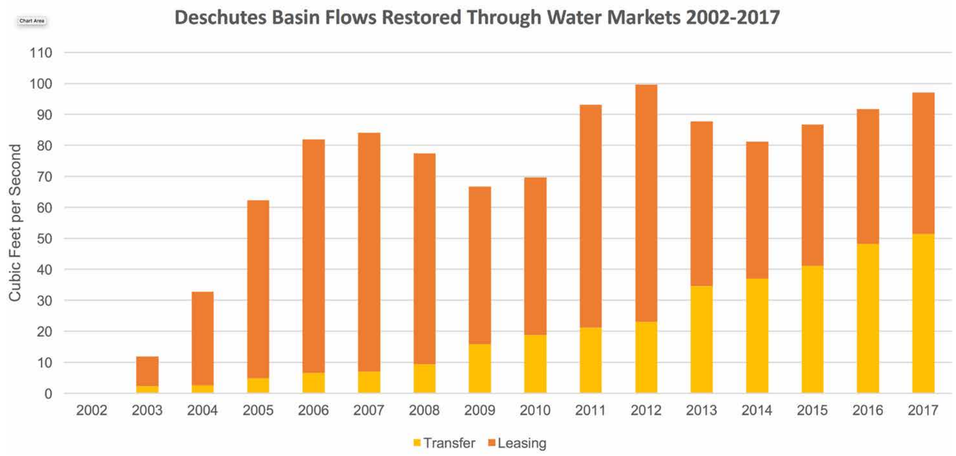
## A Proven Tool for Restoring Flows in the Deschutes


Water markets have contributed significantly to restored streamflows in the Middle Deschutes River below Bend.




**Tools assessed include:**

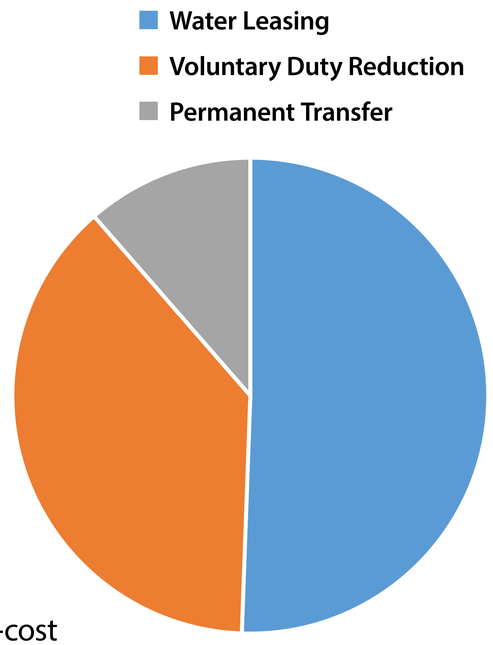
- Temporary lease of water rights: fallowing acres on an annual basis
- Voluntary duty reduction: incentives to reduce water use per acre
- Permanent sale of water rights: moving irrigation water rights permanently off acres

Water supply generated can move from farm to farm, or farm to river

**Scale and Cost of Opportunity**

Approximately 164,000 acre-feet may be available through market-based approaches (Total $65 M, average $398/AF)

The study identified a range of prices at which some water users are willing to lease/sell water. Generally, price increases as the volume of water needed increases.




**Benefits**

- The study suggests that water is available now at relatively low-cost
- Temporary tools are flexible and can be scaled in dry years

**Challenges**

- District operational issues ("carry water") associated with leasing/transferring larger quantities of water may limit this tool's viability in certain places.
- Districts would need to develop new policies and programs to optimize these options
- Costs may increase due to the need to coordinate with multiple private parties

**Important Note:** **The Study will not recommend, propose, or endorse any particular action. It will assess the general potential for market-based approaches to generate water supply for possible consideration during future water resource planning by stakeholders.**

## Overview of Tools

| Water Supply Tool | Supply (AF) | Total Cost | Avg $/AF |
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# Water Supply Options: Potential Enhanced/New Storage

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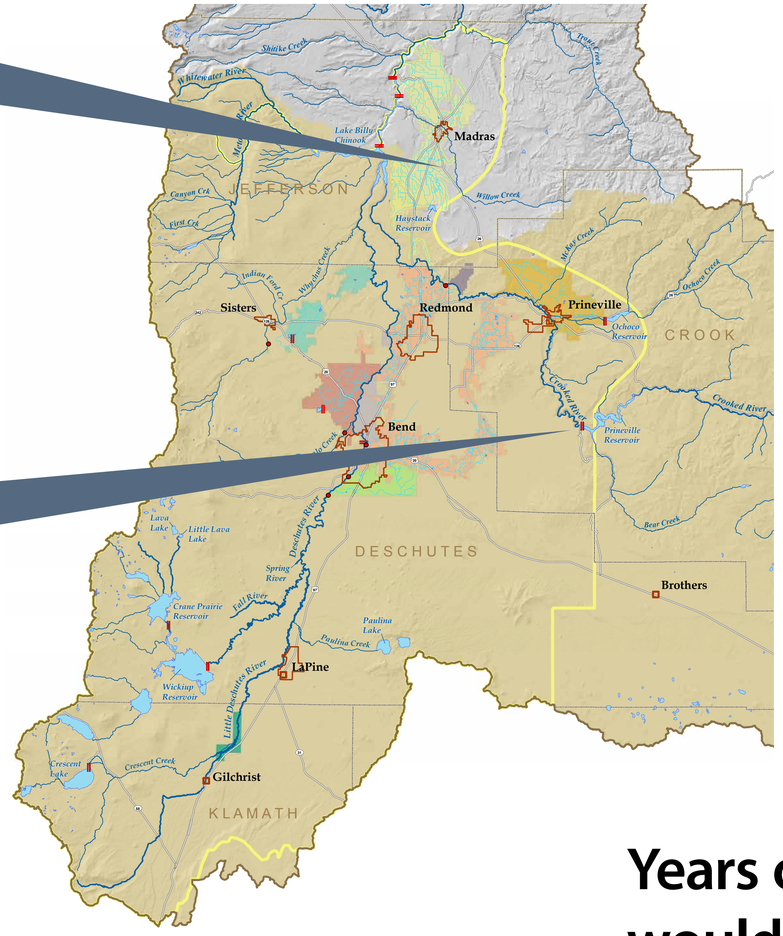
**Why Storage?** It may be possible to improve streamflows by relocating existing storage and/or adding water storage capacity to provide flexibility in water operations.

## Upper Deschutes River

- A possible future concept could relocate existing storage in Wickiup Reservoir to potential off- channel storage sites closer to North Unit Irrigation District (NUID).
- Could use NUID Main Canal to send water to new or expanded off-channel storage facilities.
- Potential storage from 5,000 to 70,000 AF
- Construction costs could exceed $100-300M

## Crooked River

- Potential to recover 4,500 AF of storage space in Prineville Reservoir that has been lost to sedimentation
- Construction costs could exceed $1M





Arthur R. Bowman Dam & Prineville Reservoir

## Challenges

- Land acquisition
- Environmental impacts
- Site-specific conditions
- Permitting
- Existing utilities and infrastructure
- Historic properties
- Cost
- Fish passage
- Dam safety considerations
- Other issues

**Years of investigation and studies would be needed before any particular project could be advanced**

**Important Note:** The Study will not recommend, propose, or endorse any particular action. It will assess the general storage potential for possible consideration during future water resource planning by stakeholders. Any storage concept will have high costs and significant challenges; thus, storage should be considered to be a potential longer-term tool.

### Overview of Tools

| Water Supply Tool | Supply (AF) | Total Cost | Avg $/AF |
|---|---|---|---|
| Water Conservation Infrastructure | 200,000 | $986 M | $4,930 |
| Market-Based Incentives | 164,000 | $65 M | $398 |
| **Storage** | **40,000** | **$200 M** | **$5,000** |

# Modeling Tools, Scenarios & Preliminary Results

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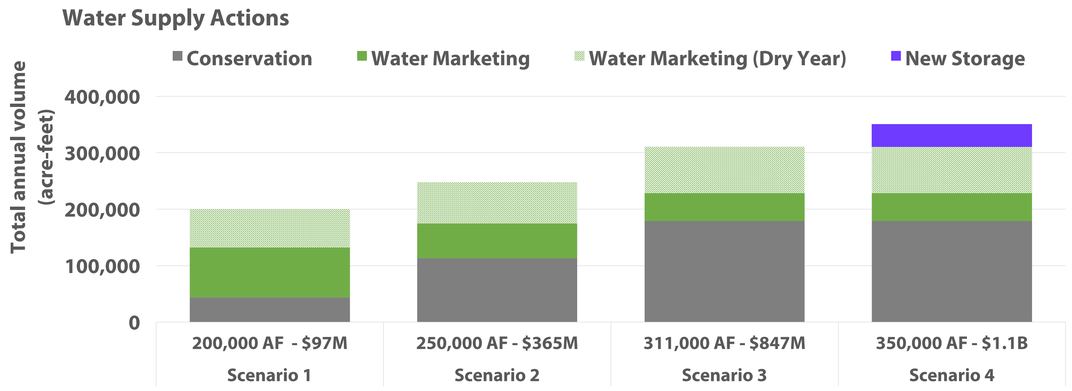
## Upper Deschutes Basin Study: Modeling

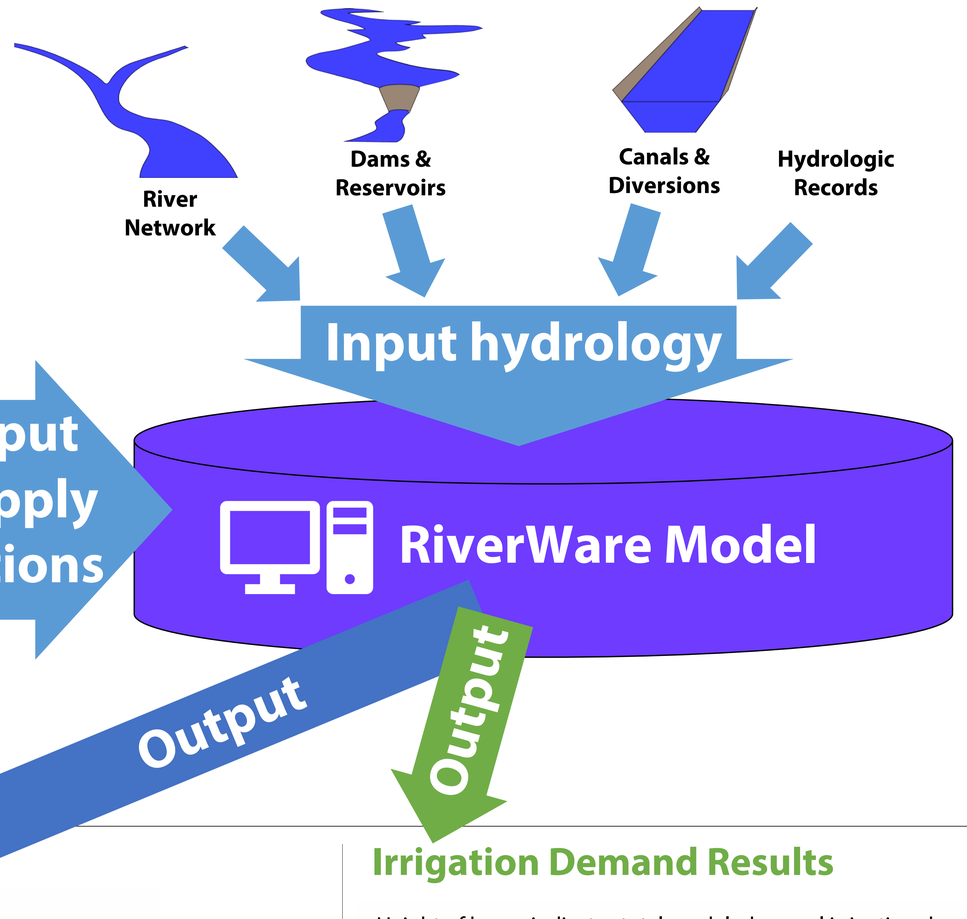
### What is a model?

Models combine many features of a river system such as reservoir operations, water rights, and diversions. They allow us to test different conditions in the river and explore potential impacts. These tests are called scenarios.

### Basin Study Model Scenarios

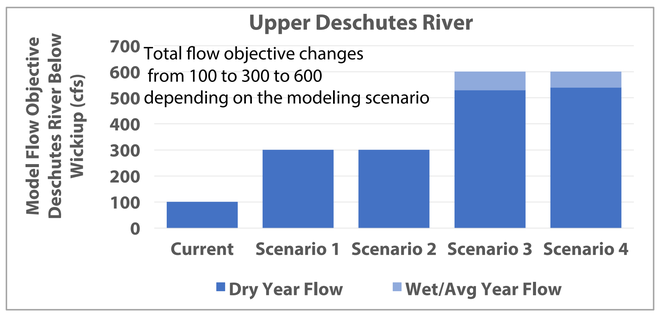
- Modeling looked at four hypothetical water management scenarios modifying in-stream and irrigation demand
- Irrigation demands adjusted using water supply actions: conservation, water marketing, and new storage

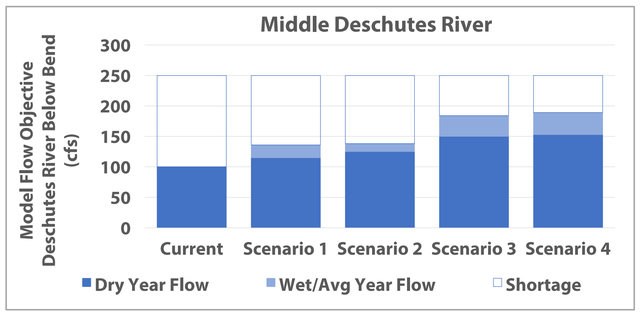


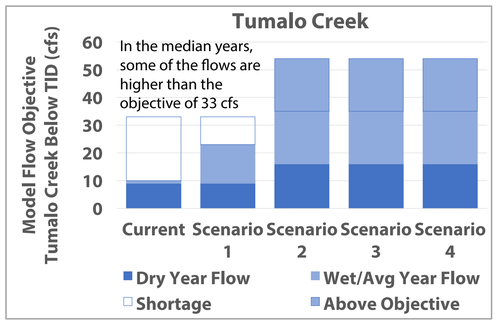



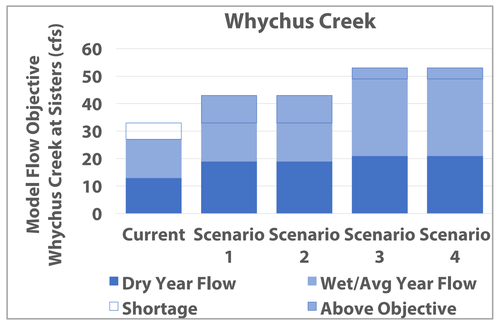

## Model River Flow Objective Results

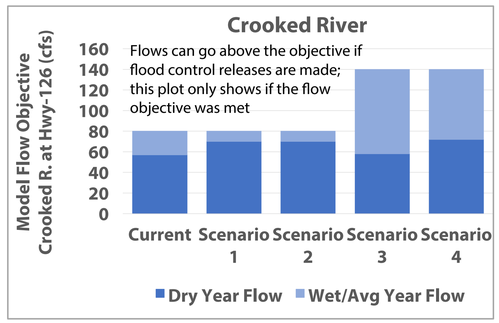
- Bar heights indicate model flows and flow objectives for critical time periods
- Hollow boxes indicate that the flows did not reach the model objective during the critical time period (shortage)
- Outlined boxes indicate flows in the river reach exceeded model objectives



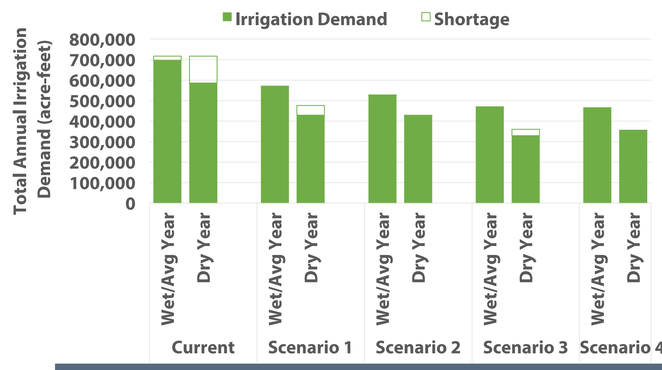




## Irrigation Demand Results

- Height of boxes indicates total modeled annual irrigation demand
- Modeled demand larger in wet and average years than dry years
- Hollow boxes indicate water delivery did not meet modeled demand (shortage)




**Important Note:**
The four hypothetical water management scenarios were framed solely for modeling purposes to help evaluate various water management tools. Thus, the scenarios may not be realistic, implementable, advisable, or desired, and should not be viewed as recommendations, endorsements, or plans.

# Instream Flow Studies

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**The Basin Study generated information on flow-habitat and flow-temperature relationships in various reaches to help understand potential benefits of different flow levels.**

## Upper Deschutes Habitat Modeling

- The Upper Deschutes River, 60 miles between Wickiup Reservoir and the City of Bend, is managed to store and deliver irrigation water.
- Water storage and release results in large fluctuations between low winter flows and high summer flows, causing loss of vegetation and available habitat.

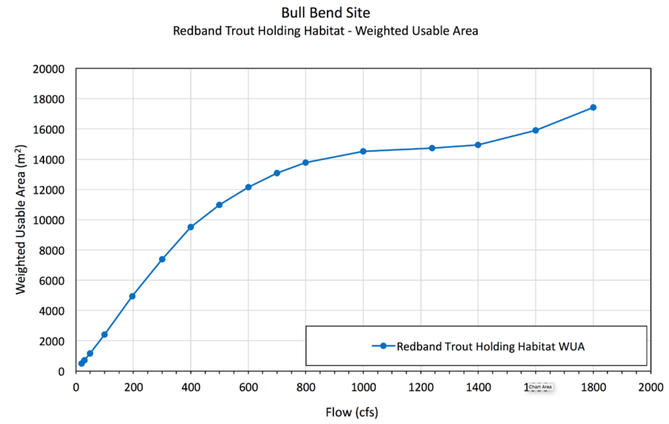
### Study Objectives

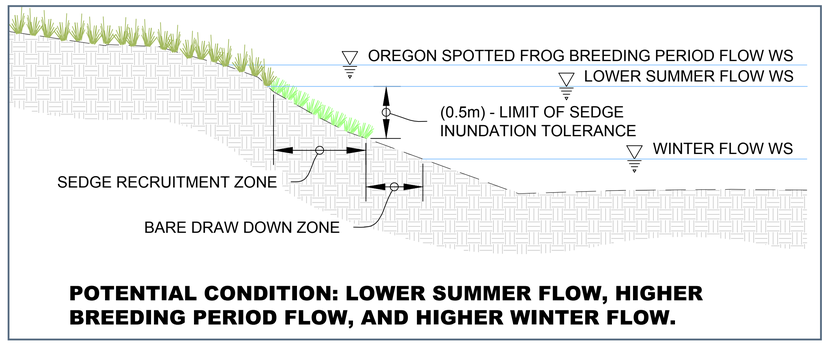
- How do Oregon spotted frog and Deschutes redband trout habitats change with changes in flow?
- How does flow affect wetland and riparian habitat?
- The study assessed two sites along the Deschutes River (Bull Bend and Dead Slough-approximately 1 mile each).

### Study Takeaways

- Redband trout habitat at the studied sites increases with increased winter flows. Rate of habitat increase varies with flows.
- Lower summer flows and higher winter flows tend to benefit recruitment of riparian vegetation and Oregon spotted frog habitat.

**Important Notes**: The study assessed two sites; results cannot necessarily be extrapolated for the whole river reach. The study was based on limited habitat information for Oregon spotted frog.


**Upper Deschutes River: low and high flows**

## Flow Temperature Assessments: Middle Deschutes, Tumalo Creek, Whychus Creek and lower Crooked River

- High summer temperatures are a limiting factor in some reaches in the Deschutes Basin.
- A variety of models were developed to capture relationships between streamflow, water temperature, air temperature and, in the case of the Crooked River, reservoir levels.
- These models can be used to explore the impacts of water management strategies on water temperatures.
- Generally, higher streamflows help toward temperature standards associated with fish needs.

# Additional Study Elements

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**Additional Snow Telemetry (SNOTEL) Stations**

Upper Crooked River Basin currently has three SNOTEL sites. Adding more sites could improve runoff forecasts and make water operations more efficient.

**Gaging at Diversions**

Additional measurement (gaging) of diversions from Crooked River below Prineville Reservoir could help water managers achieve more efficient operations.

**Potential Forecasting Improvements**

Options for improving hydrologic forecasts include: aerial snow observations, modeling approaches, and refinement of existing forecasting techniques.

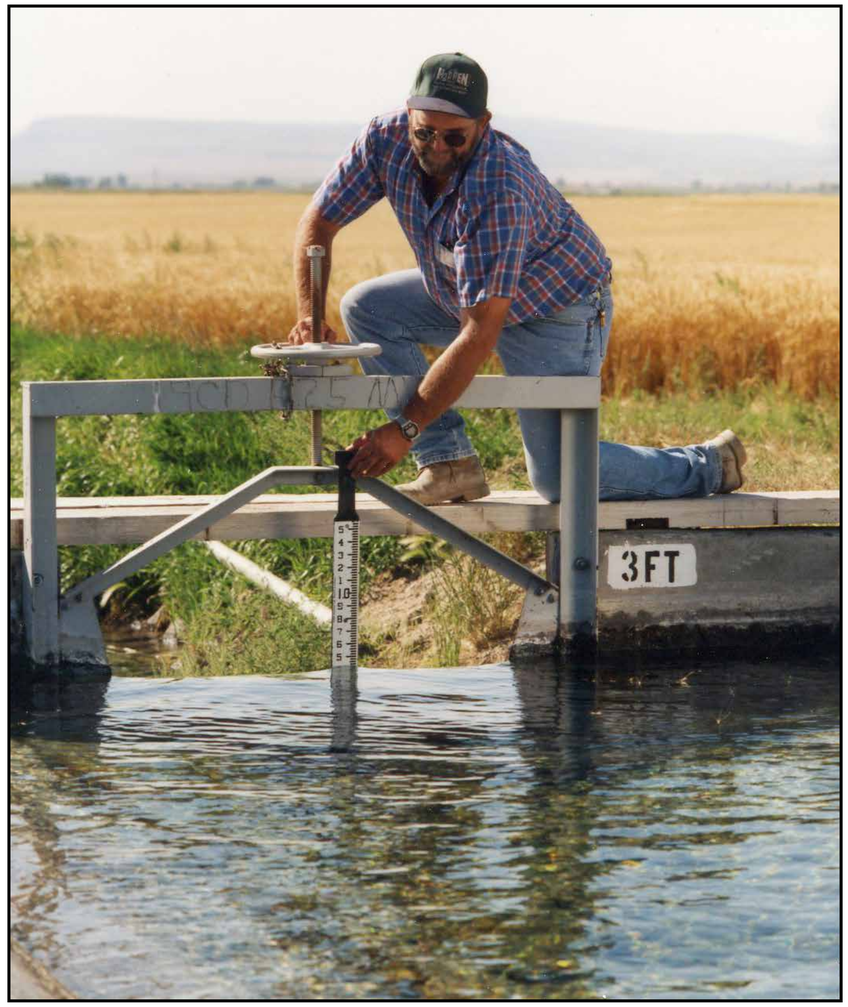
**Groundwater/Surface Water Switches and Aquifer Recharge**

Opportunities to use temporary groundwater-surface water exchanges and below ground storage concepts could provide additional flow to Whychus Creek in dry years.

**Legal, Policy and Economic Issues**

The study evaluated water rights, legal and policy opportunities and impediments associated with:

- Using stored water for instream flow protection and groundwater mitigation
- Different options for moving water between farms and rivers:
  - Transfers
  - Leases
  - Conserved water allocations
  - Exchanges
  - Water management agreements
- Potential new or expanded reservoir storage



# Meeting Future Groundwater Needs
## Municipal • Industrial • Commercial • Irrigation

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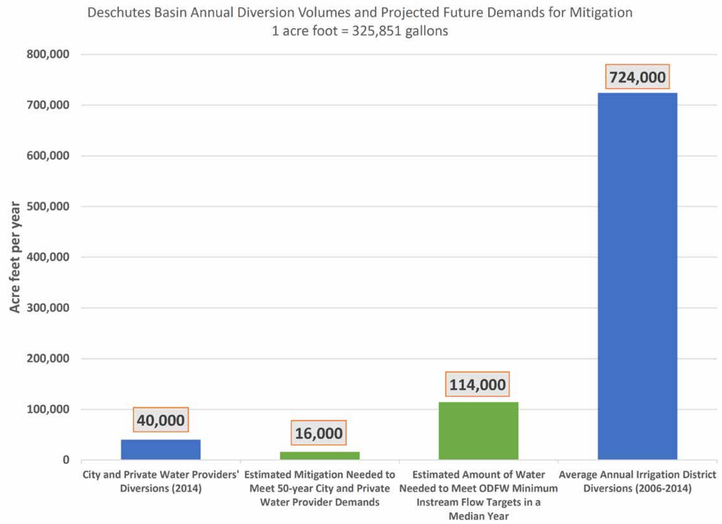
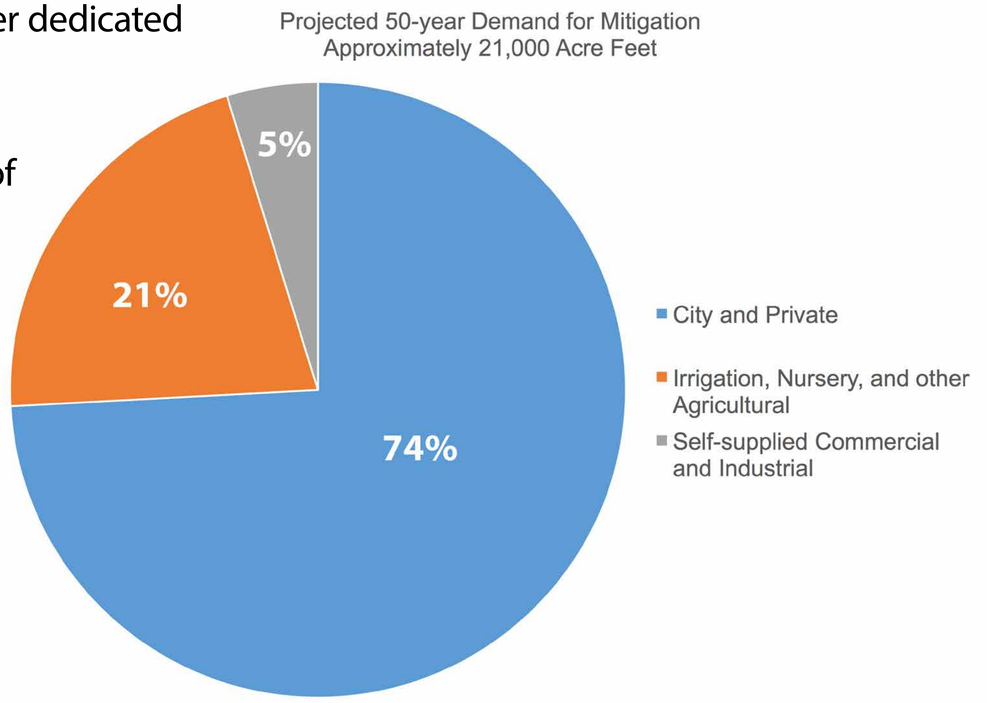
### Overview

- Deschutes Basin surface waters are fully allocated and generally not available to meet future water supply needs.
- Most groundwater use in the basin requires a water right from Oregon Water Resources Department and must provide mitigation:
  - Mitigation is required because groundwater pumping affects surface water flows.
  - Mitigation is generally provided by dedicating water instream to offset groundwater pumping impacts.
  - Majority of projected mitigation demand is for municipal, commercial and industrial water use provided by public (city) and private water providers.




### Current and Future City and Private Water Provider Use

- Most city and private water providers rely on groundwater.
- The Study estimated city and private water provider diversions of approx. 40,000 AF annually.
- Meeting ALL the 50-year projected groundwater demands will require approximately 21,000 AF of mitigation (water dedicated instream) annually.
- Meeting 50-year city and private water providers projected demands will require approx. 16,000 AF of mitigation (water dedicated instream) annually.




### Meeting Future Groundwater Needs

- Mitigation for future groundwater needs is one of three foundational goals for the Basin Study, along with improving streamflow and improving irrigation water supply security and efficiency.
- The Study will evaluate how well various water supply tools and water management scenarios could establish the requirements to meet groundwater mitigation needs.

# BALANCING THE DESCHUTES

## WATER FOR THE RIVER AND FARMS

Crane Prairie Reservoir

Wickiup Reservoir

LA PINE

< Upper Deschutes

BEND

Middle Deschutes >

REDMOND

CULVER

Lake Billy Chinook

MADRAS

NORTH UNIT IRRIGATION DISTRICT NUID

CENTRAL OREGON IRRIGATION DISTRICT COID

USING A VARIETY OF TOOLS, irrigation districts with senior water rights, like COID, can conserve water to help districts with junior water rights, like NUID, thus allowing additional water to stay in the Deschutes River.

## Restoring the Upper DESCHUTES RIVER

Every fall, streamflows in the Upper Deschutes River are reduced to a small fraction of their natural flows to store water in Wickiup and Crane Prairie Reservoirs for the next irrigation season. The low winter flows strand migrating fish in pools and threaten wildlife habitat.

Central Oregon Irrigation District's conservation measures will generate a more reliable water supply for North Unit Irrigation District. North Unit Irrigation District will then be able to make water available from their storage in Wickiup Reservoir to increase winter flows in the Upper Deschutes River.

## CONSERVATION TOOLS

### TRANSFERRING*

Permanent transfers of water rights off the land generate improved water supply for farmers, cities, and the river.

### LEASING*

Temporary transfers (usually one year) of water off the land generate improved water supply for famers, cities, and the river.

### PIPING

Piping COID's outdated canals, that leak up to 50% of their water in transmission, allows commercial farmers and the Deschutes River to capture an abundance of water.

### SHARING

Water agreements between districts facilitate water conservation measures and improve reliability.

### RESERVOIR MGMT*

Better allocation of stored water addresses district water supply and streamflow needs.

* These tools can be used for mitigation to ensure that municipal water needs are met.

## Taking care of FARMERS

The amount of water that is saved through COID piping and other conservation measures is shared with NUID and other junior water right holders to ensure that farmers have the water they need, even in dry years.

Though this infographic focuses on COID and NUID, there are four other irrigation districts in the region employing conservation measures that will help balance the Deschutes: Arnold, Swalley, Tumalo and Lone Pine.