



# Oregon

Kate Brown, Governor

## Water Resources Department

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### MEMORANDUM

TO: Water Resources Commission

FROM: Kyle Gorman, South Central Region Manager  
Harmony Burreight, Planning Coordinator

SUBJECT: Agenda Item E, November 15, 2018  
Water Resources Commission Meeting

### Update on the Upper Deschutes Basin Study

#### I. Introduction

During this informational report, representatives from the Planning Team and Department staff will provide updates on the Bureau of Reclamation Upper Deschutes Basin Study.

#### II. Background

Bureau of Reclamation's WaterSMART Basin Studies are collaborative studies, cost-shared with non-Federal partners, to evaluate water supply and demand and help ensure reliable water supplies by identifying strategies to address imbalances in water supply and demand. Each study includes four key elements:

1. State-of-the-art projections of future supply and demand by river basin.
2. An analysis of how the basin's existing water and power operations and infrastructure will perform in the face of changing water realities.
3. Development of strategies to meet current and future water demands.
4. A trade-off analysis of strategies identified.

In 2014, a diverse group of stakeholders came together to form the Basin Study Work Group (BSWG) and to apply for and manage The Upper Deschutes Basin Study (Study). The \$1.5 million study is jointly funded by the Bureau of Reclamation (USBR) and the Department. Local partners leveraged the state and federal resources to obtain additional funds from private foundations and partners to support the Study.

The primary issue that the Upper Deschutes Basin Study aims to address are the low flow conditions in certain reaches of the Upper Deschutes River, while meeting current and future consumptive demands. During the winter-time, flows are low upstream of Bend as reservoirs fill, and during the summertime, flows are artificially high when these same reservoirs release water for delivery to downstream irrigation districts. Altered flows in the Upper Deschutes River have an impact on water quality, fish and wildlife habitat, as well as recreational opportunities. The Study area also includes the drainage area above Lake Billy Chinook, including the Crooked River, Whychus Creek, and Tumalo Creek watersheds and the Middle Deschutes reach of the Deschutes River. The Study complements other ongoing water-related work in the Basin.

The Basin Study has been an open and inclusive, consensus-based process that involves over 35 diverse partners, including cities, irrigation districts, conservation and recreation interests, community based organizations, tribes, and local, state, and federal agencies. A Plan of Study and Memorandum of Agreement guide the work of the BSWG. The Study aims to help balance water needs between farms, fish, and cities. Attachment 1 provides an overview of the Upper Deschutes Basin Study. Attachment 2 includes posters developed for a series of public events.

### **III. Department Involvement and Assistance**

This effort advances several recommended actions in the Integrated Water Resources Strategy, including Recommended Actions 5.A, 5.B, 9.A, 9.C, and 13.C.

#### Planning Partner/Assistance

The Department has been a key member of the BSWG since it was initiated in 2014. In 2016, the Department joined the Planning Team, which is a smaller group of partners that guide and support the process. The Department has also assisted with communication and outreach activities as capacity and resources have allowed.

#### Financial Assistance

Partners in the Deschutes Basin were successful at securing \$750,000 in grants from the Department through the Water Supply Development Fund (SB 839). Department funding was used to pay for facilitation services during development of the Plan of Study and Memorandum of Understanding, overall coordination of the collaborative process, coordination of technical work and products, development of technical memos, as well as communication and outreach activities. See Attachment 3 for a list of deliverables, including the authors and the cost.

#### Technical Assistance

All divisions in the Department provided significant technical assistance to the Study. In addition to reviewing all of the technical memos that were produced, staff participated in sub-group meetings and provided expertise on topics ranging from groundwater flow models to weather forecasting to storage.

Overall, Department staff contributed significant time as a planning partner and technical assistance provider. This is work that Department staff did on top of their regular workload since no additional staff resources were allocated to assist with the Basin Study. Basin Study partners were very appreciative of the time and expertise that the Department contributed.

### **IV. Outcomes**

The Upper Deschutes Basin Study has resulted in numerous outcomes that benefit the Basin as well as the Department. These outcomes include, but are not limited to:

- Development of a Riverware daily timestep water management model.
- Analysis of diverse water management/supply options using the Riverware model; including cost projections, impact on water supply scenarios, and opportunities and barriers.



- Diverse partners have built trust and enduring working relationships through the strong collaborative process.
- A more informed and engaged public as a result of extensive outreach by local partners, including the Deschutes River Conservancy, Deschutes Basin Board of Control, and Coalition for the Deschutes, among others.
- Coordination of information and tools between agency partners, most notably connecting a US Geological Survey groundwater model to the USBR models.
- Improved coordination between regional and Salem-based staff.
- Improved alignment between State and Federal planning programs and resources.

## V. Looking Ahead

The Study looks at a wide variety of water supply tools to balance instream and out-of-stream needs - all of which have associated opportunities and barriers. While the Study does not recommend any particular plan or project, it provides a wealth of information to help inform future water management in the Basin. Stakeholders within the Basin, including the Basin Study Working Group, are having conversations to determine how to maintain momentum and sustain collaboration once the Study concludes at the end of 2018. They are looking at examples of other basin studies and consulting leaders that have moved studies forward into planning and implementation.

One of the higher immediate priorities identified by several partners is resolution of the Habitat Conservation Plan (HCP) between the US Fish and Wildlife Services, National Marine Fisheries Service, the irrigation districts, and City of Prineville. The HCP addresses ESA related flow and reservoir operational targets that will need to be met in the future and set, in part, the water management paradigm that will need to be accounted for in future collaborative efforts to address the water issues facing the basin.

Most partners are interested in seeing the collaborative structure and process continue in some form. The Department will continue to provide support and assistance where possible to help the Basin understand and resolve its complex water issues.

### Attachments:

1. Basin Study Outreach Handout
2. Basin Study Outreach Posters
3. Table of Work Products

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## Basin Study Work Group Members

- Arnold Irrigation District
- Avion Water Company
- Bend Paddle Trail Alliance
- Central Oregon Cities Organization
- Central Oregon Flyfishers
- Central Oregon Irrigation District
- City of Bend
- City of La Pine
- City of Madras
- City of Prineville
- City of Redmond
- Coalition for the Deschutes
- Confederated Tribes of Warm Springs
- Crooked River Watershed Council
- Deschutes County
- Deschutes River Conservancy
- Deschutes Soil and Water Conservation District
- Deschutes Water Alliance
- Lone Pine Irrigation District
- Native Reintroduction Network
- Natural Resources Conservation Service
- North Unit Irrigation District
- Ochoco Irrigation District
- Oregon Department of Agriculture
- Oregon Dept. of Environmental Quality
- Oregon Water Resources Department
- Portland General Electric
- Swalley Irrigation District
- Three Sixers Irrigation District
- Trout Unlimited
- Tumalo Irrigation District
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- Upper Deschutes River Coalition
- Upper Deschutes Watershed Council
- Water for Life
- WaterWatch of Oregon

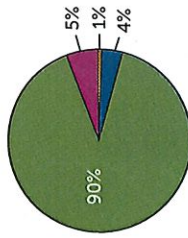
## Funding Sources

The Basin Study is funded by the Bureau of Reclamation's WatersSMART program and Oregon Water Resources Department. The Basin Study Work Group has received support from Oregon Water Resources Department, Lamb Foundation, Bella Vista Foundation, Collins Foundation, National Fish and Wildlife Foundation/Wells Fargo, Columbia Basin Water Transactions Program, Meyer Memorial Trust and Oregon Community Foundation.

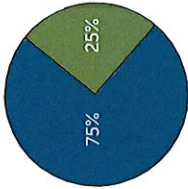
## Water Supply Goals

- 1 Secure and maintain stream flows and water quality in the Deschutes Basin for the benefit of fish, wild-life and people.
- 2 Secure and maintain a reliable and affordable supply of water to sustain agriculture.
- 3 Secure and maintain a safe, affordable and high quality water supply for urban communities.

BASIN WATER RIGHTS DISTRIBUTION	ESTIMATED SUPPLY SHORTFALLS
AS OF 2006 DESCHUTES WATER ALLIANCE STUDIES	2006 DESCHUTES WATER ALLIANCE STUDIES (TO 2025)



- Agricultural
- Municipal & Industrial
- Resorts
- Instream



- Agricultural, Municipal & Industrial & Resorts (combined)
- Rivers

## What comes after the Basin Study?

### Next Steps

- 1 Basin Study information will inform a long-term water management plan.
- 2 Raise political and financial support to implement plan.
- 3 **Implement!**

For more information about this study, visit the Bureau of Reclamation's website at: <http://www.usbr.gov/pn/studies/deschutes/> or email: [bor-pnr-ubbasinstudy@usbr.gov](mailto:bor-pnr-ubbasinstudy@usbr.gov)



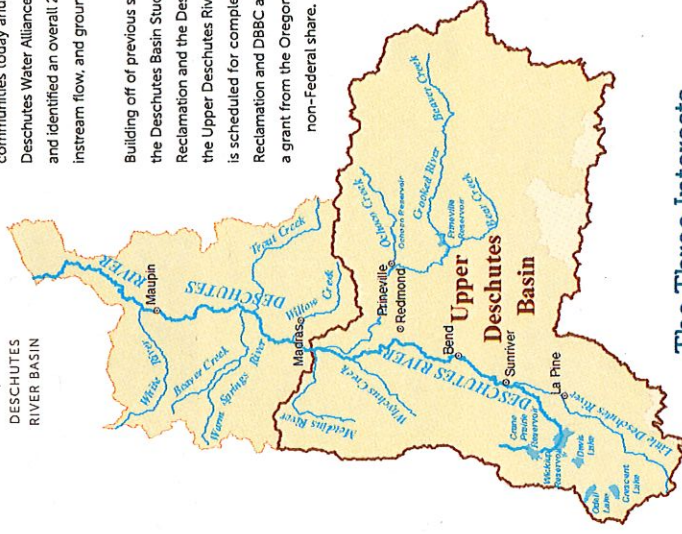
# THE UPPER DESCHUTES BASIN STUDY

## Water for agriculture, rivers & cities

LOCATOR MAP



DESCHUTES RIVER BASIN



## The Three Interests



FARMS

CITIES

RIVERS

## The Study's Objectives

- 1 BUILD UPON the solid foundation of prior studies to develop a comprehensive analysis of water supply and demand, integrating and updating the analyses to include new information that accounts for climate change.
- 2 ANALYZE how existing operations and infrastructure will perform under the projected future water supply conditions and demands.
- 3 IDENTIFY and evaluate options for addressing identified water imbalances and provide a common understanding of the interconnected effects of options that may move water between uses and users.
- 4 COMPLETE a tradeoff analysis to compare relative cost, benefits, and environmental impact of identified options. While the study will not propose any specific project, program, or plan, it will provide a basis for future water management in the basin.

In the Deschutes Basin, we are focused on meeting water needs for rivers and communities today and into the future. Previous studies conducted by the Deschutes Water Alliance assessed projected future water supplies and demands and identified an overall 230,000 acre-foot annual shortfall to meet agricultural, instream flow, and groundwater (municipal) needs.

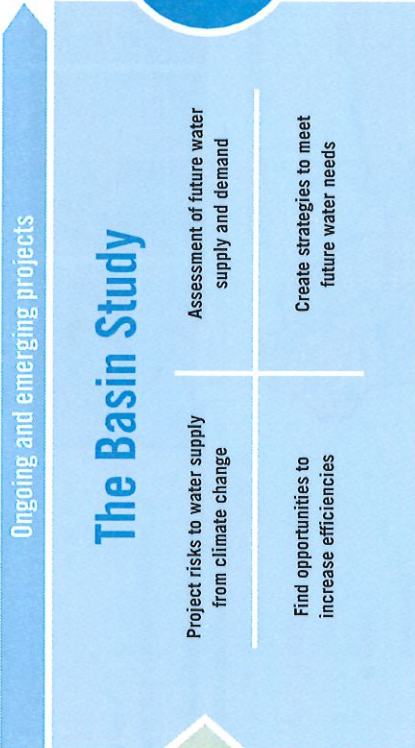
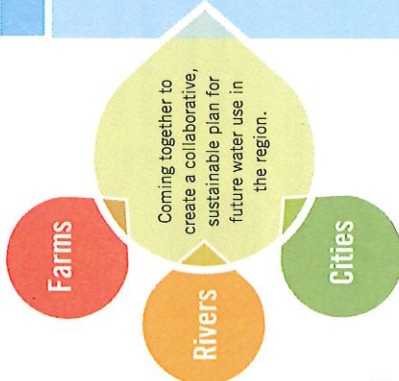
Building off of previous studies, the Bureau of Reclamation (Reclamation) and the Deschutes Basin Study Work Group (BSWG), through an agreement between Reclamation and the Deschutes Basin Board of Control (DBBC), will complete the Upper Deschutes River Basin Study. The Basin Study began in May 2015 and is scheduled for completion within 3 years at an estimated cost of \$1.5 million. Reclamation and DBBC are each responsible for 50 percent of the study costs; a grant from the Oregon Water Resources Department (OWRD) is funding the non-Federal share.

The Basin Study Work Group is a collaborative, consensus-based group with 38 representatives from irrigation, instream, and municipal interests, and from the Confederated Tribes of Warm Springs.

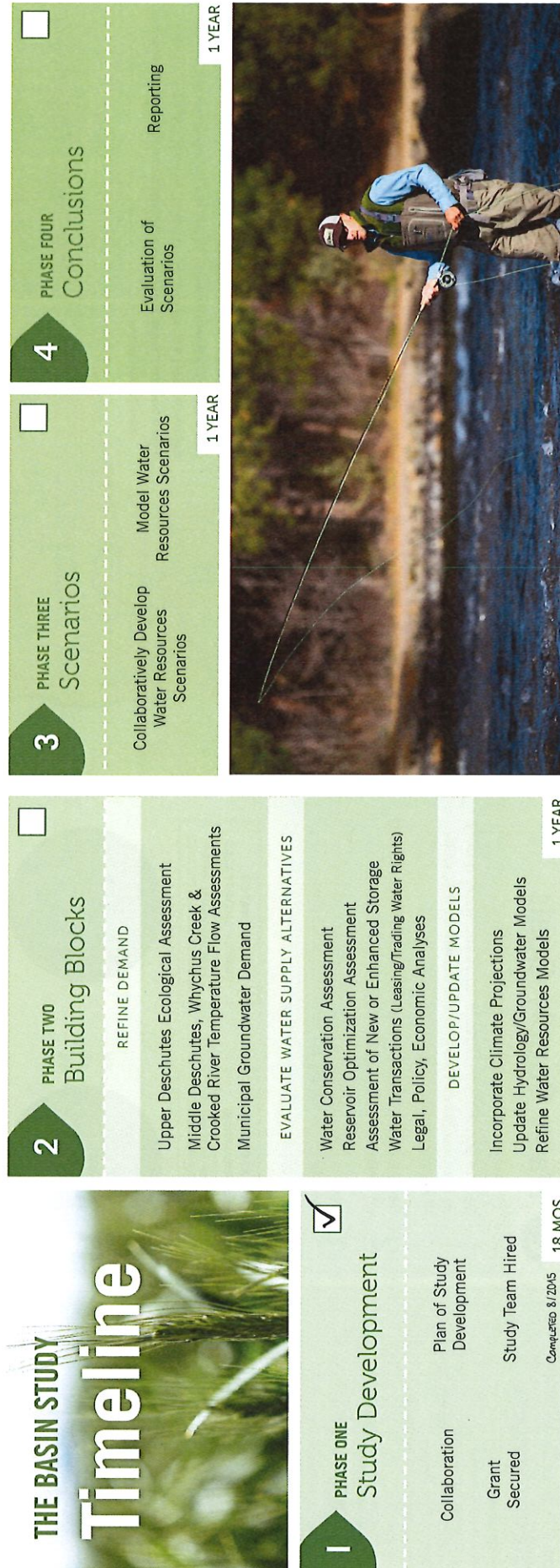


# THE UPPER DESCHUTES Basin Study

Planning for sustainable water for our farms, rivers and cities.



## THE BASIN STUDY Timeline





## Basin Study Deliverables – DRAFT

Topic	Document	Information Provided	Author	Cost
Basin Study DRAFT	<a href="#">1. DRAFT Upper Deschutes River Basin Study</a>	Report that summarizes the results of the Basin Study, describes potential water management options/tools, and lays out potential next steps.	Bureau of Reclamation	
Hydrology and Water Supply	<a href="#">2. TM - Analysis of Regulated River Flow in the Upper Deschutes Basin using Varying In-Stream and Out-of-Stream Conditions</a>	Describes modeling studies of river flows, incorporating ranges of hydrologic conditions based on recorded data, current water udage patterns and water rights, and hypothetical water management scenarios; identifies estimated shortages in water supplies for assumed conditions.	Bureau of Reclamation	
Climate Change	<a href="#">3. TM - Development of Future Projected Climate Adjusted Flows</a>	Presents climate change models used to project potential future variability in precipitation and temperature; discusses applications relative to Basin Study objectives.	Bureau of Reclamation	
Instream Ecological Needs	<a href="#">4. TM - Oregon Spotted Frog and Deschutes Redband Trout Habitat Modeling and Riparian Analysis at Two Sites on the Upper Deschutes River</a>	Instream flow study at two sites on the Upper Deschutes River below Wickiup Reservoir; evaluates relationships between streamflow and both instream and adjacent riparian wetland habitats.	River Design Group	
Stream Temperature	<a href="#">5. TM - Prineville Reservoir and Crooked River Temperature Model</a>	Development of a temperature model of Prineville Reservoir and the Crooked River; explores the effects of potential water management approaches on water temperatures.	Portland State University	
	6. TM - Whychus Creek and Middle Deschutes River Temperature Assessments	Assessment of relationships between stream temperature, streamflow and air temperature at three sites (Whychus Creek, Middle Deschutes River, and Tumalo Creek); regression analyses used to assess potential predictors of stream temperatures.	Upper Deschutes Watershed Council	
Irrigation District Infrastructure and Water Use	7. TM - Literature Reviews (individual documents) for Arnold, Central Oregon, Lone Pine, North Unit, Ochoco, Swalley, Three Sisters, and Tumalo Irrigation Districts	Compilations of available data on irrigation systems including supply, storage, distribution, water use, and water conservation.	Anderson Perry	
Water Conservation Tools (Irrigation)	<a href="#">8. TM - Water Conservation Assessment</a>	High-level summary estimates of water conservation potential and associated costs for the eight irrigation districts in the study area; addresses piping district-owned canals, piping private laterals, and on-farm conservation.	Summit Conservation Strategies	
Market-Based Tools	<a href="#">9. TM - Market-Based Approaches as a Water Supply Alternative (LPE Task 7)</a>	Evaluates the potential for market-based approaches as water supply options; addresses price incentives to promote efficient water use and reallocation of	Summit Conservation Strategies	



Topic	Document	Information Provided	Author	Cost
		existing supply relative to potential water management objectives.		
Enhanced/New Storage	<a href="#">10. TM - Assessment of Potential Enhancements or New Storage Opportunities</a>	Provides information about potential approaches, additional storage volumes, and costs for new water storage opportunities; helps inform evaluations of storage options as a possible element of future water management strategies.	Bureau of Reclamation	
Legal & Policy Factors	<a href="#">11. TM - Water Right Assessment (Task 1A)</a>	Summary of existing information on water rights and water use (irrigation, municipal, quasi-municipal and instream) in the Upper Deschutes basin.	GSI Water Solutions	
	<a href="#">12. TM - Water Right, Legal and Policy Opportunities and Impediments for Stored Water (Task 2, Part 2)</a>	Evaluates potential water right opportunities for managing reservoirs to increase streamflow in the Upper Deschutes outside of irrigation season and to establish mitigation credits (note: Task 2, Part 1 was not implemented per BSWG decision as additional information became available).	GSI Water Solutions	
	<a href="#">13. TM - Water Right, Legal and Policy Opportunities and Impediments Associated with Options for Water Movement (Task 4)</a>	Explores potential ways to move water rights and/or water supply to meet various needs.	GSI Water Solutions	
	<a href="#">14. TM - Water Right Opportunities and Impediments for New or Expanded Reservoir Storage (Task 5)</a>	Identifies opportunities and impediments for new or expanded water storage from a water rights/legal perspective.	GSI Water Solutions	
	<a href="#">15. TM - Supply and Demand of Deschutes Groundwater Deschutes Basin Groundwater Mitigation Credits (Task 6)</a>	Evaluates the projected supply of, and demand for, mitigation credits for allowing new uses of groundwater.	GSI Water Solutions	
	<a href="#">16. TM - Whychus Creek Water Right, Legal and Policy Opportunities and Impediments (Task 3)</a>	Considers potential groundwater-surface water exchanges and below ground storage opportunities in the Whychus Creek basin.	GSI Water Solutions	
Hydrologic Forecasting Improvements	<a href="#">17. TM - Current Hydrologic Forecasting, Potential Improvements, and Next Steps</a>	Evaluation of opportunities for improvements in hydrologic forecasting approaches that could enhance water management operations in the Upper Deschutes and Crooked River basins.	Watershed Professionals Network	
	<a href="#">18. TM - Upper Crooked River Basin SNOTEL</a>	Evaluates potential opportunities for improving hydrologic forecasting that could enhance water management operations; explores possible sites for additional snow telemetry stations in the	Bureau of Reclamation	

Topic	Document	Information Provided	Author	Cost
		Upper Crooked River basin.		
Improved Gaging of Diversions	<a href="#">19. TM - Crooked River Diversion Gaging</a>	Evaluates potential opportunities for improving water management by installing additional gaging on Crooked River diversions below Prineville Reservoir.	Bureau of Reclamation	
Potential Storage Enhancement through Flood Control Operations	<a href="#">20. TM - Prineville Reservoir Operating Rule Curve</a>	Evaluates the potential for enhancing storage at Prineville Reservoir via modifications to the rule curve guiding flood control operations.	Bureau of Reclamation	
Multi-Criteria Evaluations	<a href="#">21. TM - Multi-Criteria Evaluation of Alternatives and Scenarios</a>	Summarizes criteria developed by the BSWG for evaluation of potential water resource management tools; evaluates potential water management tools and hypothetical scenarios relative to the identified criteria.	Summit Conservation Strategies	
Technical Sufficiency Review	Technical Memorandum: Summary of Technical Sufficiency Reviews, Upper Deschutes River Basin Study ( <i>in process</i> )	Provides comments received from technical reviewers on Basin Study technical documentation; includes descriptions of how comments are addressed in the Basin Study report.	Bureau of Reclamation	
Basin Study Work Group	Basin Study Work Group Charter	Defines the purpose, structure, and processes for the Basin Study Work Group (BSWG) as agreed to by the BSWG Steering Committee.	Bureau of Reclamation	
Basin Study Administration	Memorandum of Agreement: Deschutes Basin Board of Control and Reclamation	Establishes the terms guiding performance of the Basin Study and the associated cost-share responsibilities between the Deschutes Basin Board of Control (acting as the fiscal agent for the BSWG) and Reclamation.	Bureau of Reclamation	
Study Scope, Schedule & Budget	Plan of Study	Sets forth the planned scope, schedule & budget for the Basin Study; tasks to be addressed within the fixed budget were evaluated and agreed upon by the BSWG	Bureau of Reclamation	





# Upper Deschutes Basin Study: Purpose & Overview



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:

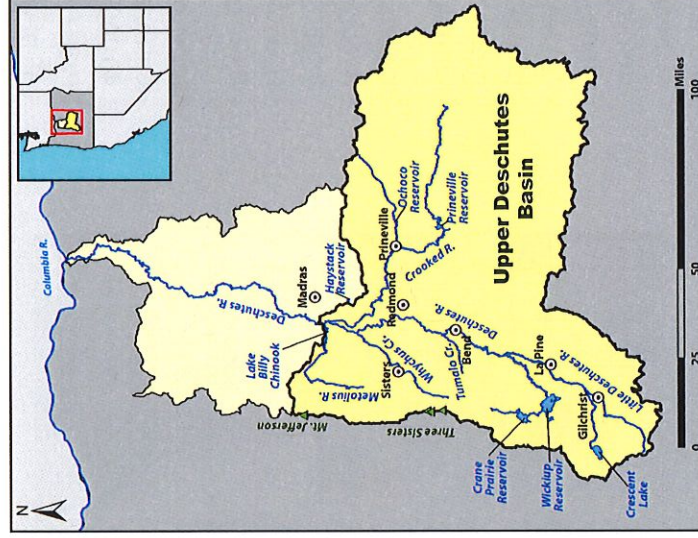
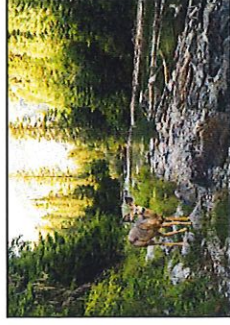
- Evaluate and quantify current and future water supply and demand
- Develop and analyze potential tools that could be considered for addressing identified imbalances in supply and demand
- Evaluate potential water management tools in terms of effectiveness, cost, environmental impact, risk, stakeholder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



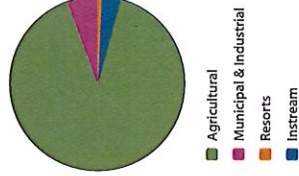
# Water Supply in the Upper Deschutes Basin



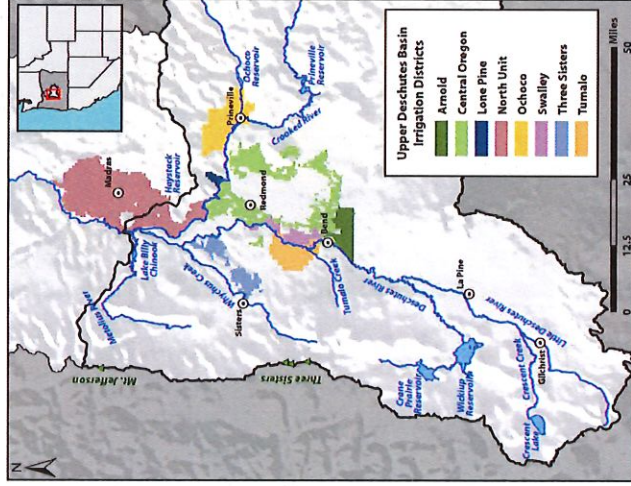
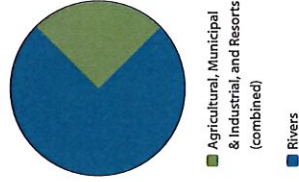
## Water Supply Goals—Secure and Maintain:

- 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 (to 2025)

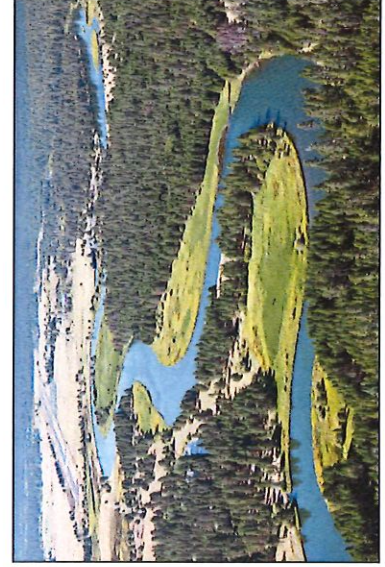


**ESTIMATED SUPPLY SHORTFALLS**  
2006 Deschutes Water Alliance Studies (to 2025)



## 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

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

\* 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

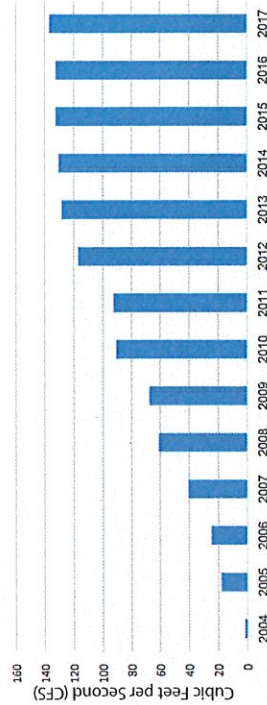
## Important Note:

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

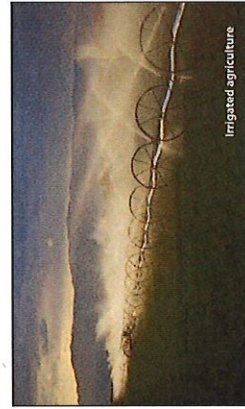


Flow Restored from Deschutes Basin Water Conservation  
2004-2017



## Overview of Tools

Water Supply Tool	Supply (AF)	Total Cost	Avg \$/AF
<b>Water Conservation Infrastructure</b>	<b>200,000</b>	<b>\$986 M</b>	<b>\$4,930</b>
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.

## 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

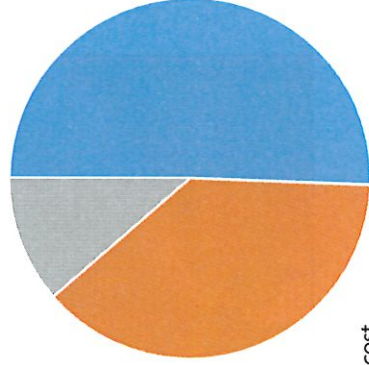
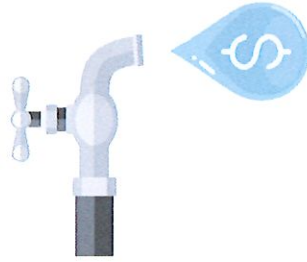
Water supply generated can move from farm to farm, or farm to river

## Scale and Cost of Opportunity

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

- Water Leasing
- Voluntary Duty Reduction
- Permanent Transfer

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

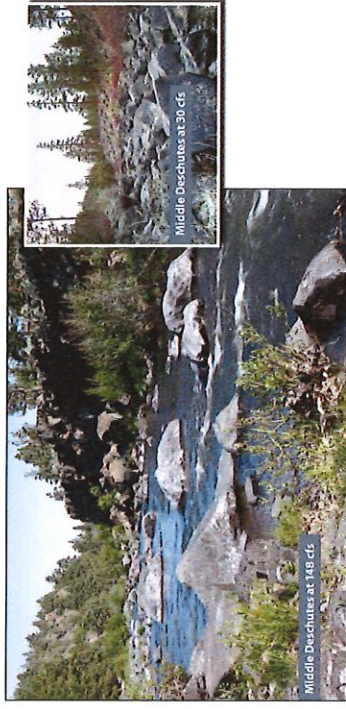
## Challenges

- 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

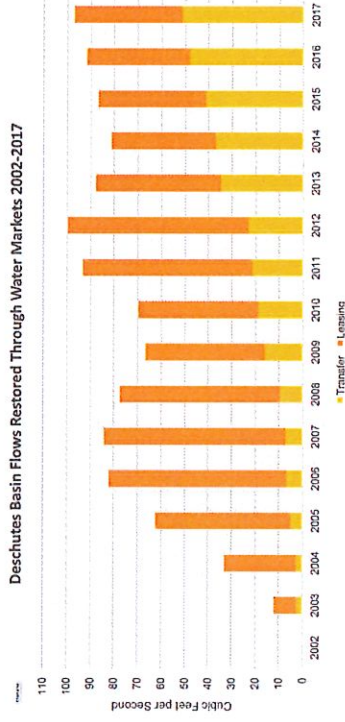
## Important Note:

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.

## A Proven Tool for Restoring Flows in the Deschutes



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



## Overview of Tools

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



# Water Supply Options: Potential Enhanced/New Storage

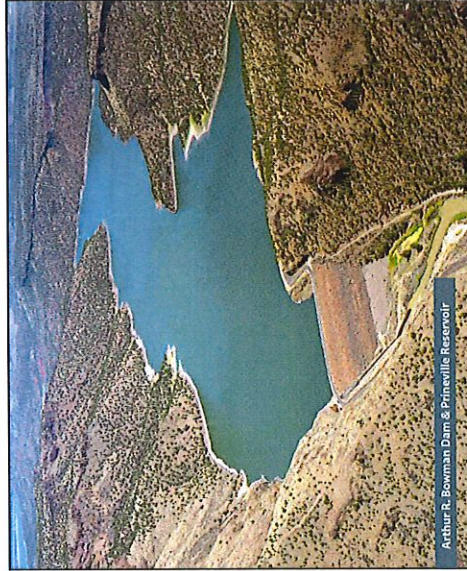
**Why Storage?** It may be possible to improve streamflows by relocating existing storage and/or adding water storage capacity to provide flexibility in water operations.

## Upper Deschutes River

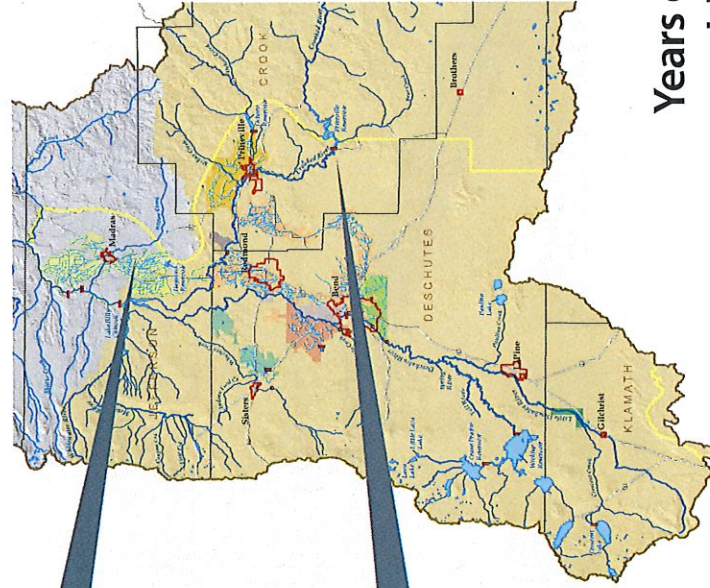
- A possible future concept could relocate existing storage in Wickiup Reservoir to potential off-channel storage sites closer to North Unit Irrigation District (NUID).
- Could use NUID Main Canal to send water to new or expanded off-channel storage facilities.
- Potential storage from 5,000 to 70,000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

## 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
<b>Storage</b>	<b>40,000</b>	<b>\$200 M</b>	<b>\$5,000</b>

**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.



# Modeling Tools, Scenarios & Preliminary Results

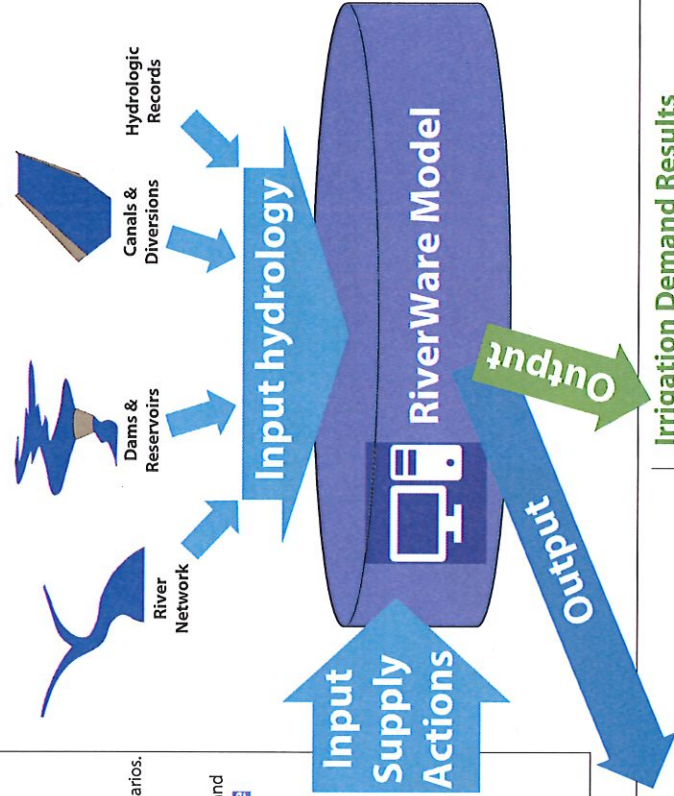
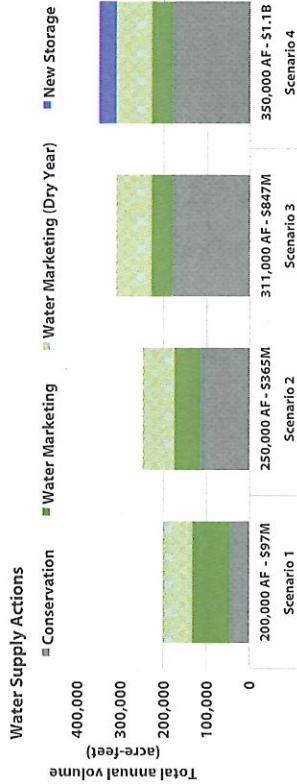
## Upper Deschutes Basin Study: Modeling

### 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.

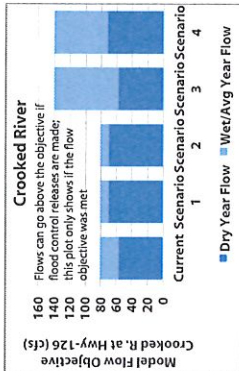
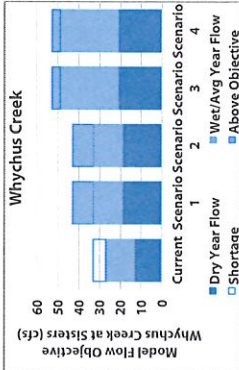
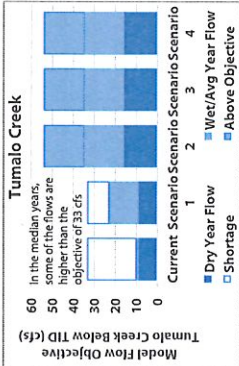
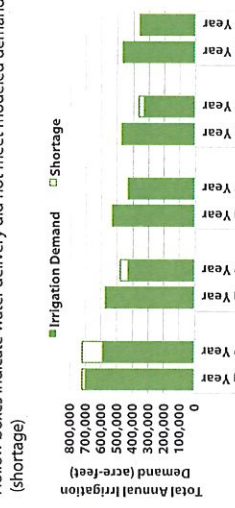
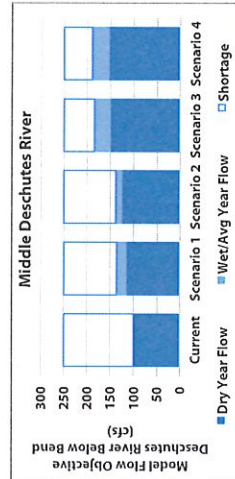
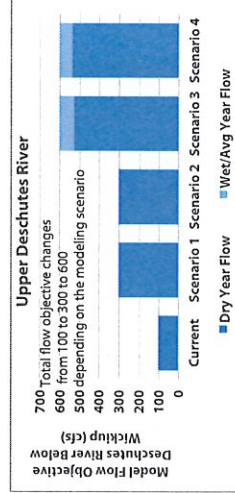
### Basin Study Model Scenarios

- 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



**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

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

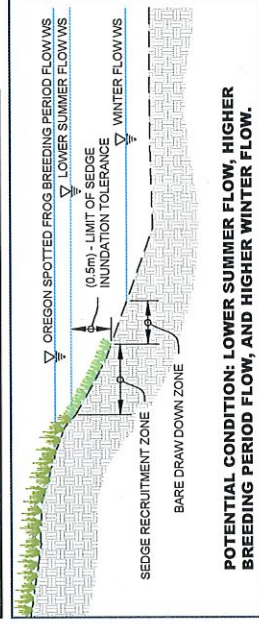
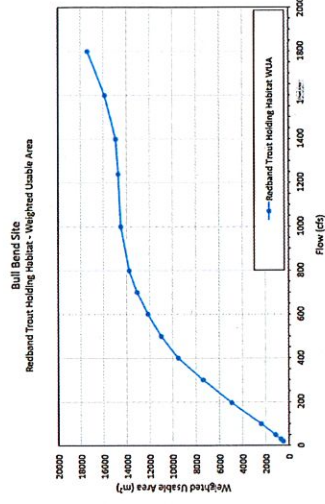
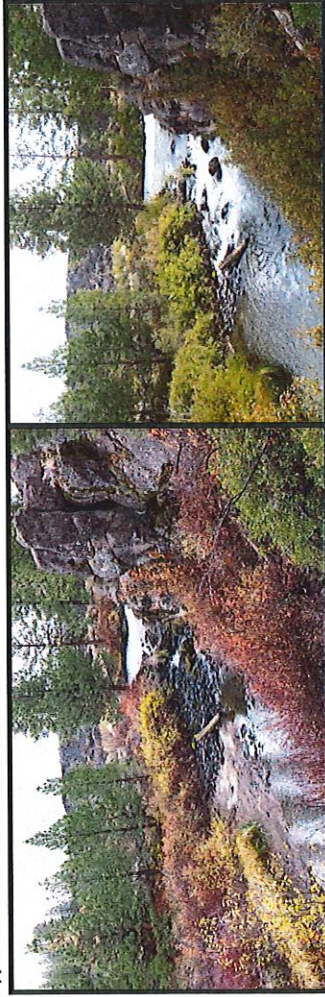
- How do Oregon spotted frog and Deschutes redband trout habitats change with changes in flow?
- How does flow affect wetland and riparian habitat?
- The study assessed two sites along the Deschutes River (Bull Bend and Dead Slough-approximately 1 mile each).

### 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



### 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

## Overview

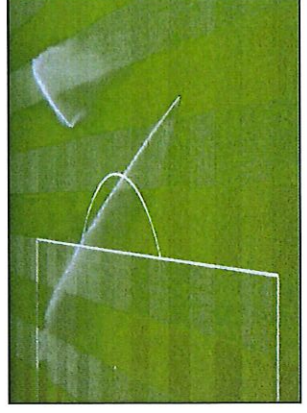
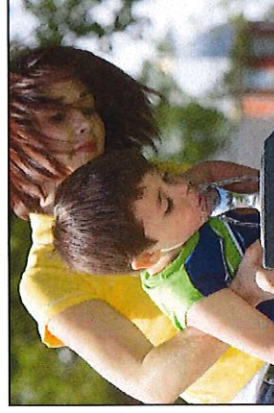
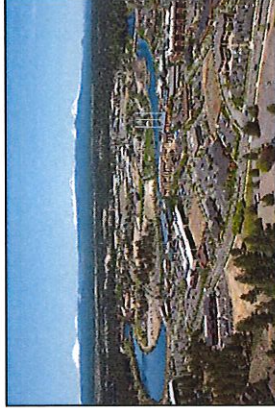
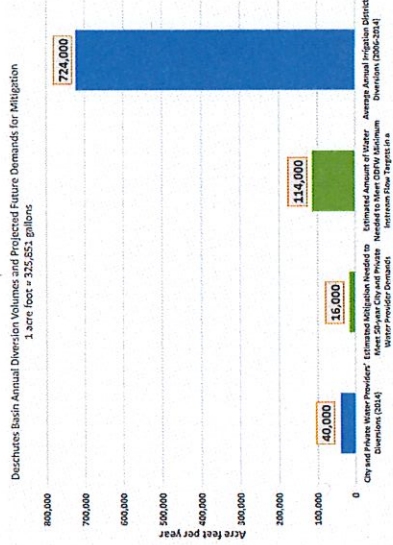
- Deschutes Basin surface waters are fully allocated and generally not available to meet future water supply needs.
- Most groundwater use in the basin requires a water right from Oregon Water Resources Department and must provide mitigation:
- Mitigation is required because groundwater pumping affects 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

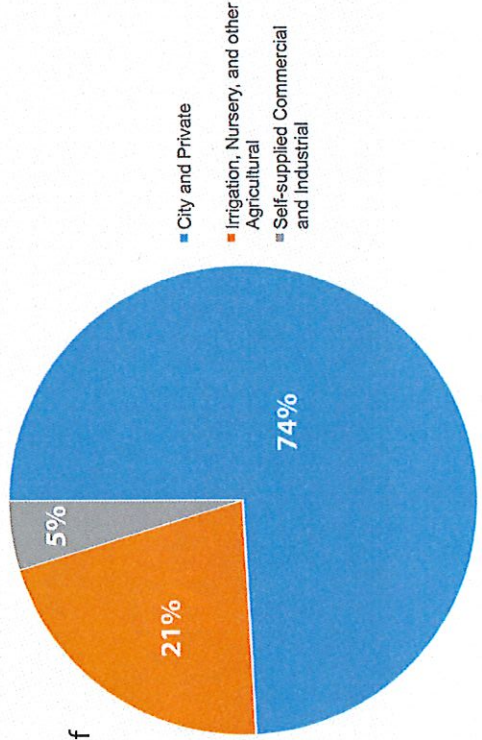
- Most city and private water providers rely on groundwater.
- The Study estimated city and private water provider diversions of approx. 40,000 AF annually.
- Meeting ALL the 50-year projected groundwater demands will require approximately 21,000 AF of mitigation (water dedicated instream) annually.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



Projected 50-year Demand for Mitigation  
Approximately 21,000 Acre Feet







# BALANCING THE DESCHUTES

## WATER FOR THE RIVER AND FARMS



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.

< Upper Deschutes >

BEND Middle Deschutes >

REDMOND

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.

CULVER

Lone Billy Channel

NORTH UNIT IRRIGATION DISTRICT NUID

MADRAS



## 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, Turriolo and Lone Pine.

## CONSERVATION TOOLS



### TRANSFERRING\*

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



### SHARING

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



### 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.



### RESERVOIR MGMT\*

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



### LEASING\*

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

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