

**DESCHUTES WATER PLANNING INITIATIVE
WATER SUPPLY GOALS AND OBJECTIVES**

**Deschutes River Conservancy
Deschutes Water Alliance**

Final Report

**Note: This report is meant to be a living document. This was the version presented at the
January 31, 2013 Workshop**

Water Supply Goals and Objectives - Final Report

Contents

1	Introduction	3
1.1	Background	3
1.2	Approach.....	5
1.2.1	Participation.....	5
1.2.2	Scope.....	6
1.2.3	Process	8
2	Irrigation	9
2.1	All Districts: Regulatory Compliance Challenges	10
2.2	Arnold Irrigation District	11
2.2.1	District Characterization	11
2.2.2	Challenges and Goals	13
2.3	Central Oregon Irrigation District	17
2.3.1	District Characterization	17
2.3.2	Challenges and Goals	20
2.4	North Unit Irrigation District.....	25
2.4.1	District Characterization	25
2.4.2	Challenges and Goals	28
2.5	Swalley Irrigation District.....	32
2.5.1	District Characterization	32
2.5.2	Challenges and Goals	33
2.6	Tumalo Irrigation District	36
2.6.1	District Characterization	36
2.6.2	Challenges and Goals	40
3	Municipalities	43
3.1	Challenges and Goals	43
3.1.1	Avion Water Company	45
3.1.2	City of Bend.....	45
3.1.3	Deschutes Valley Water District.....	46
3.1.4	City of La Pine.....	46
3.1.5	City of Redmond.....	47
4	Environment	48
4.1	Characterization.....	48
4.2	Challenges and Goals	48

1

2 INTRODUCTION

Water has long played a central role in the cultural and economic prosperity of the upper Deschutes Basin. From time immemorial, Native American tribes have relied on the river's abundant salmon runs for sustenance. Basin water supplies were developed extensively for agricultural use during late 19th century and have remained one of the central drivers of the regional economy for over one hundred years. More recently, the region has attracted new migrants, both full and part-time, that place a high value on a clean environment that can support high-quality recreational experiences. This population growth has had the consequence of increasing demand for reliable municipal water supplies. Together, these traditions and emerging forces are shaping a future water management paradigm that by necessity will look different from that of the past.

Fortunately, the residents of the basin have a long history of working together to meet water management challenges. This collaborative approach has resulted in truly unique achievements like a tribal water rights settlement that holds existing water right holders harmless, the creation of a groundwater mitigation program that allows municipal water use to expand while protecting river flows, and the historic reintroduction of anadromous fish to the upper basin as a component of a hydroelectric relicensing agreement. These examples of past collaboration are demonstrative of the basin's unique ability to come together and work constructively on matters of basinwide importance.

Most recently, the Deschutes Water Alliance (DWA) and the Deschutes River Conservancy (DRC) have continued collaboration on an effort to engage key basin stakeholders in a process to identify a range of unmet water management needs – including instream, agricultural and municipal needs – and to develop and analyze water management scenarios that can achieve some of those unmet needs. We are calling this effort the **Deschutes Water Planning Initiative** (the Initiative).

2.1 Background

The Initiative is a continuation of the DWA and the DRC's past work. In 2004, the DWA received a Water2025 grant from the Bureau of Reclamation to study the long-term water needs of the upper Deschutes Basin. That effort produced a series of peer reviewed studies that provide broad-scale analysis of current and future water needs across multiple sectors, including agriculture, municipal, and instream. The reports also explored mechanisms for reallocating existing water supplies to meet new and emerging water demands. They evaluated mechanisms like water banking, instream leasing, water conservation projects, and reservoir management. The Water2025 studies culminated in a three-day water summit in 2006 that included 160 stakeholders representing local, state and federal agencies, tribes, non-profits, irrigation districts

and private citizens with a stake in water management decisions. Based on the findings of the studies and input from stakeholders at the water summit, the DWA concluded that:

- Municipal water needs can be provided for as the urbanization process releases irrigation water at a rate that exceeds new supply needs;
- Reliability and delivery of agricultural water can be ensured through an aggressive program of major canal/lateral piping and lining;
- Costs of agricultural water and irrigation district finances can be secured through a collaborative Water Bank that acquires surplus water rights generated by land use change and growth and reallocates such rights to new groundwater and surface water users, as well as to ecosystem needs;
- Instream flow targets can be met through conservation, leasing, transfers and improved reservoir management;
- Up to 260,000 af of water supply will be needed to meet current and future water needs; and
- It will cost up to \$170 million to implement the scenarios analyzed by the DWA.

The value of this work is in its broad scale assessment of water supply and demand, and its conclusion that based on the volumes of water identified for reallocation, all needs can be met through a collaborative approach.

Since 2006, relatively large volumes of water have been reallocated using some of the mechanisms identified and evaluated in the study. For instance, the following volumes have been reallocated to date:

- Instream leasing: 30,000 af (annual)
- Water conservation: 40,000 af. (permanent)
- Transfers: 13,000 af (permanent)

Taken together, approximately 83,000 af have been reallocated to new uses - a substantial volume of water to produce in a relatively short amount of time. Also, since 2006 stakeholders have secured over \$35 million in state, federal, and hydro mitigation grants to implement water supply projects.

The planning work completed by the DWA in 2006 and the subsequent work by the DRC, cities and irrigation districts to begin meeting the basin needs that were identified has resulted in substantial progress towards meeting the basin's water needs. Based on this progress and the lessons learned, it is possible to make several general recommendations going forward:

- Development of water resource solutions should be done under a water management plan rather than a project-by-project approach.
- Long-term, multi-lateral agreements among stakeholders will be necessary to move beyond a project-by-project approach to water management;
- Future water management agreements must be flexible, voluntary, and capable of accommodating incremental progress towards goals; and

- Developing lower cost approaches should result in achieving basin goals more quickly.

2.2 Approach

The goal of the Deschutes Water Planning Initiative is to engage partners in a process to develop a voluntary water management agreement that can be implemented to improve stream flows in the upper Deschutes basin while meeting the needs of agricultural and municipal interests. The core principles of the planning process are:

- The planning process will be inclusive, transparent, adaptive, and collaborative;
- It will be refined as necessary based on input from stakeholders;
- It acknowledges other external processes and will respond to and adapt to those processes as necessary and to maximize synergy amongst various efforts; and
- Progress towards this plan is expected to be incremental, allowing for continual monitoring and adaptation.

2.2.1 Participation

The Initiative is a collaboration between the DWA and the DRC. The DRC is a 501c(3) organization founded in 1996 and incorporated in Oregon. The DRC's mission is to restore stream flow and improve water quality in the Deschutes River and its tributaries. The DRC accomplishes its mission by using incentives and markets to encourage farmers, irrigation districts, cities and private water companies to engage in mutually beneficial, voluntary water management projects. The DRC's Board of Directors makes decisions based on consensus and is comprised of 30 members, representing every major public and private water-related interest in the Deschutes Basin. They include:

- Irrigated Agriculture (2)
- Environment (2)
- Confederated Tribes of Warm Springs (2)
- Portland General Electric
- US Department of Interior – Bureau of Reclamation
- US Department of Agriculture – Forest Service
- Oregon Department of Fish and Wildlife
- Oregon Water Resources Department
- Deschutes County
- Crook County
- Sherman/Wasco County
- Jefferson County
- Central Oregon Cities Organization
- Recreation/Tourism
- Livestock/Grazing
- Timber
- Land Development
- Private Business (10)

The DWA's mission is reflected in its three goals:

1. Secure and maintain stream flows and water quality in the Deschutes Basin for the benefit of fish, wildlife 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.

DWA voting members include:

- Confederated Tribes of Warm Springs
- Deschutes County
- Crook County
- Jefferson County
- Central Oregon Irrigation District
- North Unit Irrigation District
- Ochoco Irrigation District
- Three Sisters Irrigation District
- Tumalo Irrigation District
- Swalley Irrigation District
- Arnold Irrigation District
- Crook County Improvement District
- City of Bend
- City of Redmond
- City of Madras
- City of Sisters
- City of Culver
- City of La Pine
- Avion Water Company
- Deschutes Valley Water District
- DRC

Advisory members of the DWA include:

- Oregon Water Resources Commission
- Oregon Water Resources Department
- Oregon Department of Fish and Wildlife
- Oregon Department of Environmental Quality
- US Bureau of Reclamation

2.2.2 *Scope*

The geographic scope of the Initiative includes: 1) the stream reaches where flow will be improved, 2) several communities within the upper Basin that utilize surface water and/or groundwater from the mainstem aquifer, and 3) the lands served by the irrigation districts that store and divert water along those reaches.

Water Supply Goals and Objectives - Final Report

The Deschutes River begins at Little Lava Lake in the Cascades, runs from north to south to Crane Prairie Reservoir, east through Wickiup Reservoir, north through Bend to Lake Billy Chinook, and on for 120 miles to its mouth at the Columbia River. This Initiative focuses on the Deschutes River between Wickiup Reservoir and the Lake Billy Chinook. In addition to the Deschutes River, the Initiative includes Tumalo Creek, Crescent Creek from Crescent Lake Reservoir to its confluence with the Little Deschutes River and the Little Deschutes River from the Crescent Creek confluence to its confluence with the Deschutes River (Figure 1).

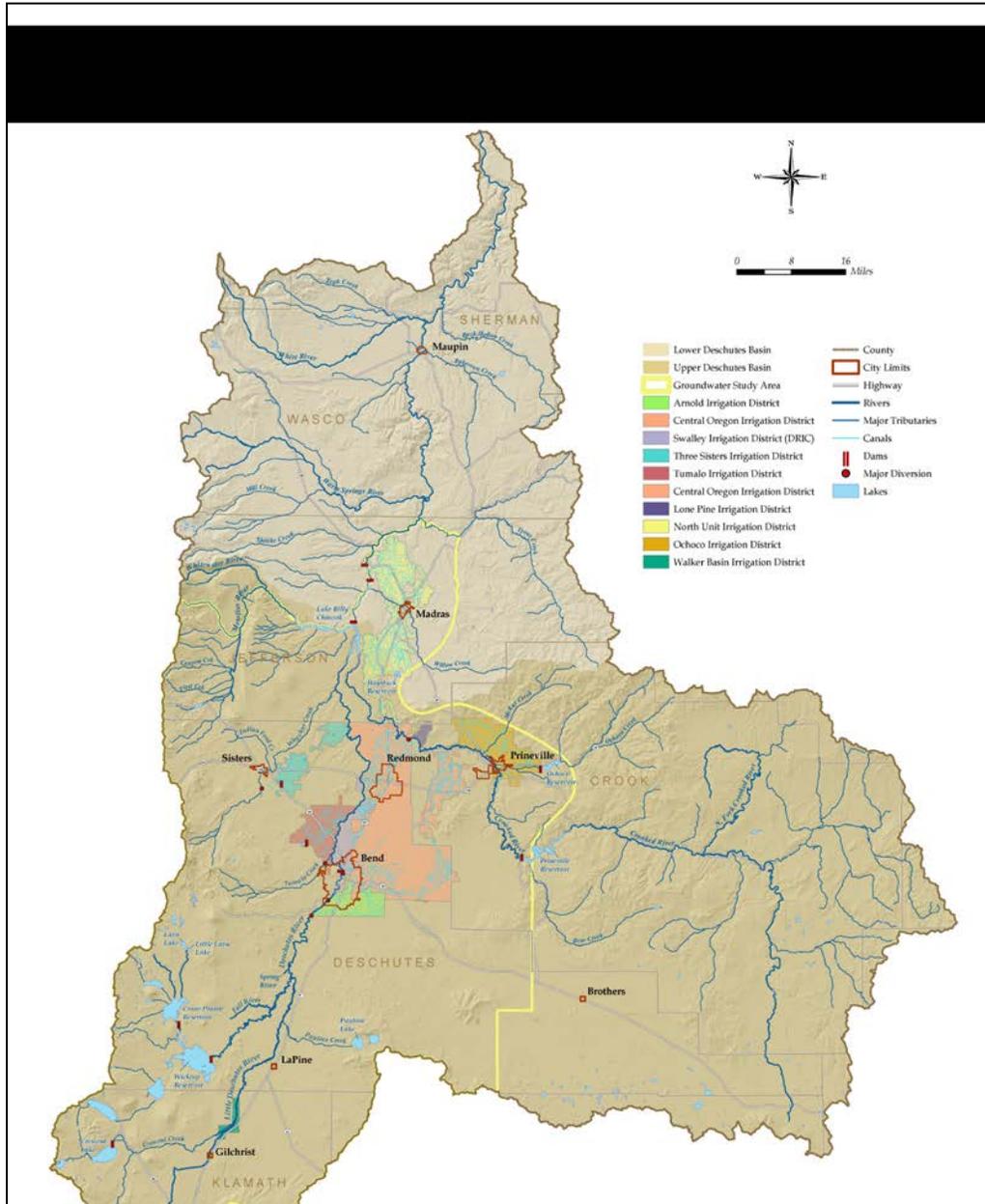


Figure 1. Deschutes Basin Map

Five irrigation districts store and divert along the upper Deschutes River and its tributaries. These districts include Arnold Irrigation District, Central Oregon Irrigation District, Lone Pine Irrigation District, North Unit Irrigation District, Swalley Irrigation District, and Tumalo Irrigation District. They include lands in Crook, Deschutes, and Jefferson Counties. This Initiative expands regional water planning efforts to include the needs of junior water users, particularly North Unit Irrigation District, who have not been closely involved in prior project planning and implementation. The planning process also includes the cities of Bend, Redmond and La Pine as well Avion Water Company and Deschutes Valley Water District.

2.2.3 *Process*

Phase I – Partnership Formation, Goals, Challenges, and Needs Assessment

The first phase of the Initiative is currently underway. The DRC Board formally voted to undertake the planning process at its March 2012 meeting. Shortly thereafter, DRC engaged the DWA in the discussion of a joint management agreement to guide implementation of the Initiative. An agreement was reached in May and the parties hired water resources planner David Newton to begin working with irrigation districts and municipal water providers to characterize their current water use and develop specific water management related goals. Concurrent with the district and municipal Goals, Challenges, and Needs Assessment effort, the DRC has convened a working group of instream interests to develop similar characterizations and goal statements specific to instream flow needs in the reaches encompassed by the planning effort. Once goals are developed, the DRC and DWA will host a stakeholder workshop that will give participants an opportunity to present their goals to the broader group. The workshop will be facilitated by a neutral third party and will conclude phase I of the Initiative's process.

Timeline: March 2012 – January 2013

Phase II – Identifying Water Supply Options and Develop Scenarios

The DRC and DWA will develop water supply options that are cost-effective and that respond to partner goals. Using the water supply needs and options, the DRC and DWA will prepare a series of preliminary water management scenarios that optimize water supply outcomes for participating organizations. Each scenario will be evaluated for its ability to produce water to meet a documented goal and its cost effectiveness in doing so. All stakeholders will be invited to participate in a workshop to evaluate and refine the preliminary scenarios. Based on participants' feedback, several scenarios will be selected for modeling.

Timeline: February 2013 – October 2013

Phase III – Optimize Water Management Scenarios

Once preferred alternatives are agreed upon by the partners, the DRC and DWA will use existing hydrologic models to evaluate the impacts of these scenarios. We will be modeling the surface water and groundwater impacts on the Deschutes River, irrigation district water reliability, and the potential for hydropower production. The Bureau of Reclamation, Oregon Water Resources Department, and other agencies are currently updating the Deschutes Basin surface and groundwater model as part of a collaborative process led by the Pacific Northwest National Laboratories. The DRC and DWA will not finance model development but expect to invest in modeling alternative water management scenarios once model development has been completed. The implementation plan will be refined and revised with partners as needed, based on modeling results.

A professionally facilitated workshop will be convened to consider modeling results and scenario refinements to optimize a water management scenario. Steps 1 through 5 of this phase will be repeated as necessary - an iterative process of scenario development, modeled impacts, and scenario optimization - until participants reach consensus on a water management scenario. The modeling results will be used to refine the scenarios and prepare a summary report on the modeled impacts.

Timeline: November 2013 – October 2014

Phase IV – Develop Water Management Agreement

The stakeholders will select a preferred water management scenario and enter into negotiations to develop an agreement to implement the scenario.

Timeline: November 2014 – March 2015

3 IRRIGATION

Understanding existing conditions and goal-setting by irrigation districts and other interests with a stake in the Deschutes River is fundamental to collaborative problem-solving for water resource issues in the upper Deschutes Basin. Arnold, Central Oregon, North Unit, Swalley, and Tumalo Irrigation Districts (collectively, the Districts) have joined communities, agencies, the DRC, and other DWA members in developing water resource solutions under the Initiative.

Goal-setting is a critical process tied to the important issues, concerns and challenges that stakeholders want to resolve. The first steps in goal-setting are to clarify the challenges facing each district, clearly define them, and develop achievable goals for responding to them. This process helped the Districts recognize their roles among other water suppliers in developing

water management solutions. It also helped the Districts to develop a clearer path for responding to their challenges.

The increasing focus on water resource management throughout the Pacific Northwest includes water quality, stream flow, fish and wildlife considerations. Water suppliers are concerned about their sources from two perspectives; one is a concern about the adequacy of quality and quantity for those they supply; the other is the potential implications of their diversions on fish, wildlife and overall health of watershed ecosystems.

3.1 All Districts: Regulatory Compliance Challenges

Arnold, Central Oregon, North Unit, Tumalo and Swalley Irrigation Districts (collectively, the Districts) recognize that activities under the Endangered Species Act (ESA) to protect, re-introduce or otherwise provide for listed species could affect the districts and their patrons. They also recognize that Clean Water Act (CWA) related actions to protect, improve or otherwise provide for water quality management could affect them. Finally, they recognize that provisions to respond to these activities require human resources, infrastructure and planning. These responses bring new financial challenges to annual operating budgets and revenue sources.

Locally, actions are underway to protect and improve water quality in upper Deschutes Basin streams. The Oregon Department of Environmental Quality (ODEQ) is establishing Total Maximum Daily Loads (TMDLs) for the Crooked River, Deschutes River, Tumalo Creek, and Whychus Creek. Federally listed steelhead have been re-introduced into the lower Crooked River, McKay Creek, and Whychus Creek. These events reflect the influence of the Clean Water Act (CWA) and the Endangered Species Act (ESA) and the need for water suppliers and other water resource interests to participate in collaborative programs that respond to both their needs and the needs for protecting health of watersheds, fish and wildlife

The Districts recognize the importance of these events and related regulatory activities and their connectivity to the waters affected by the events. Accordingly, they choose to acknowledge these present and potential future activities and manage the potential impacts of the activities by responding to them. For example, the Arnold, Central Oregon, North Unit, Ochoco, Tumalo and Swalley Irrigation Districts and the City of Prineville are working with the National Oceanic and Atmospheric Administration and the U.S. Fish and Wildlife Service to jointly develop a Habitat Conservation Plan (HCP). The HCP objective is to obtain an incidental take permit for potential loss of a re-introduced steelhead due to water withdrawals or discharges.

The HCP and ODEQ's TMDL processes may ultimately require the Districts and the City of Prineville to address water quantity, water quality and instream habitat needs. The Districts recognize this potential responsibility, are concerned about its potential future implications, and recognize their role in responding to it. Their response, however, brings significant costs for the professional and legal counsel required to develop and implement the Districts' roles in ways that also protect their patrons and their economic and operational viability.

3.2 Arnold Irrigation District

3.2.1 District Characterization

Arnold Irrigation District (AID) provides irrigation water to patrons south and southeast of the City of Bend. As described below, AID provides these patrons with both live flow from the Deschutes River and stored water from Crane Prairie Reservoir. The district delivers this water to 647 accounts across 4,384 acres. AID is relatively urbanized, and approximately 600 acres fell within Urban Growth Boundaries or Urban Reserve Areas as of 2006. Correspondingly, the district has a relatively small average account size of 6.78 acres that reflects its exurban character.

AID provided full year diversion data for 1999 through 2011, including stock runs and direct from river diversions, for this evaluation. The district diverted an average of 32,131 af, or 7.33 af/ac during that period (Figure 2). They delivered an estimated 21,894 af, or 4.99 af/ac, to farms each year based on district records for 1999-2011. On average, crops used an estimated 11,604 based on estimated on-farm efficiencies of 53% (Table 1, Figure 3).

During some years, AID relies on both live flow from the Deschutes River and storage from Crane Prairie Reservoir. The district’s history of storage use shows that its storage use varies each year, with AID using no stored water over half of the years evaluated but relying on storage to provide up to 25% of its supply during drought years. The district diverted an average of 3,918 af of stored water during the years when the district used stored water between 1992 and 2011,. It used a maximum of 6,238 af in 1994.

Table 1. Arnold Irrigation District Characterization, 1992 – 2011.

Approximate Total Acres	4,384
Primary Water Sources	Deschutes River; 1905
Supplemental Water Sources	Crane Prairie storage (2nd 10,500 AF + 1/5 storage above 35,000 AF)
Storage Use	Highly variable
Diversions	32,131 af; 7.33 af/ac
Deliveries (estimated)	21,894 af; 4.99 af/ac
Crop Water Use (estimated)	11,669 af; 2.66 af/ac

Note: volumes and duties represent full year annual medians.

AID follows a typical approach to district assessments. The district charges patrons a \$455.78 account fee plus an additional \$84.87 per acre. The district does not operate any hydropower facilities to subsidize its operations but is evaluating a potential hydropower site in the district.

Water Supply Goals and Objectives - Final Report

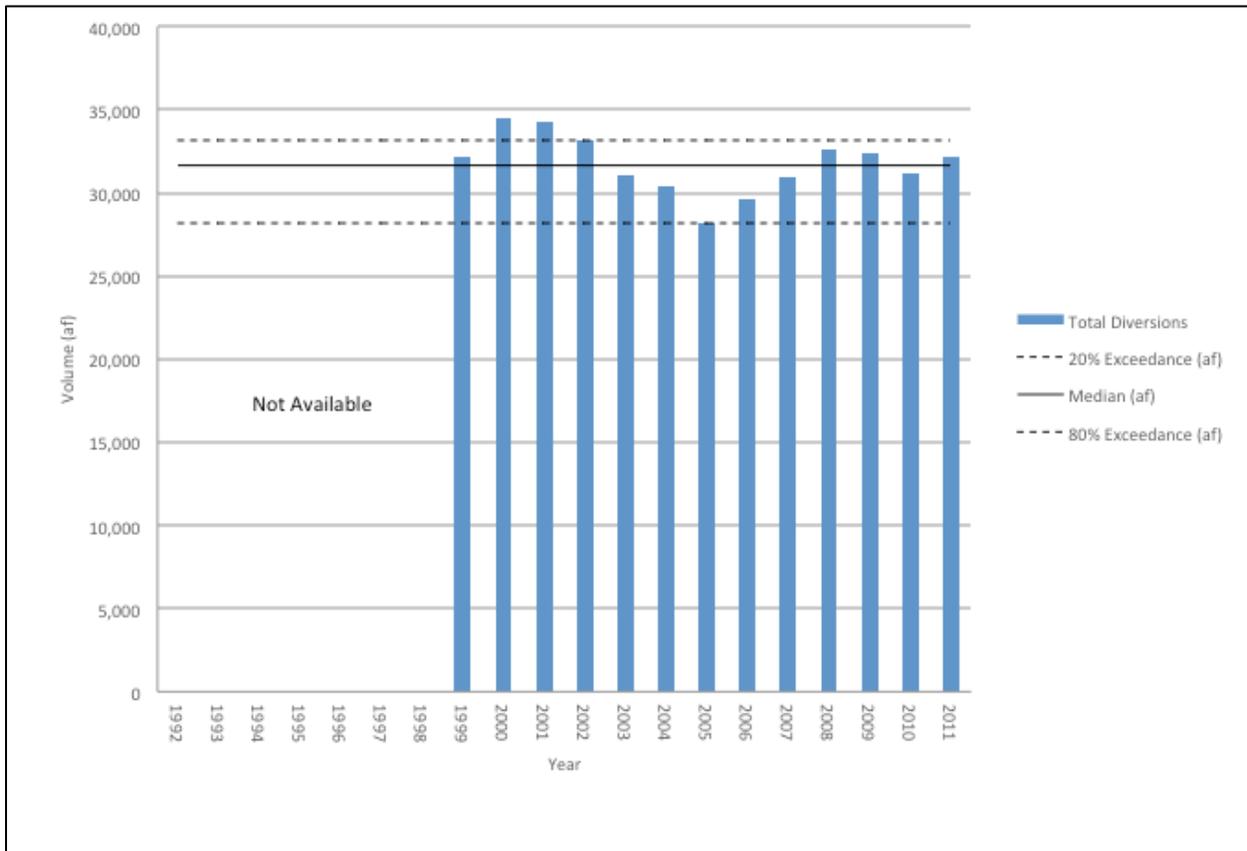


Figure 2. Arnold Irrigation District's diversions varied from 22,306 af to 34,503 af between 1999 and 2011.

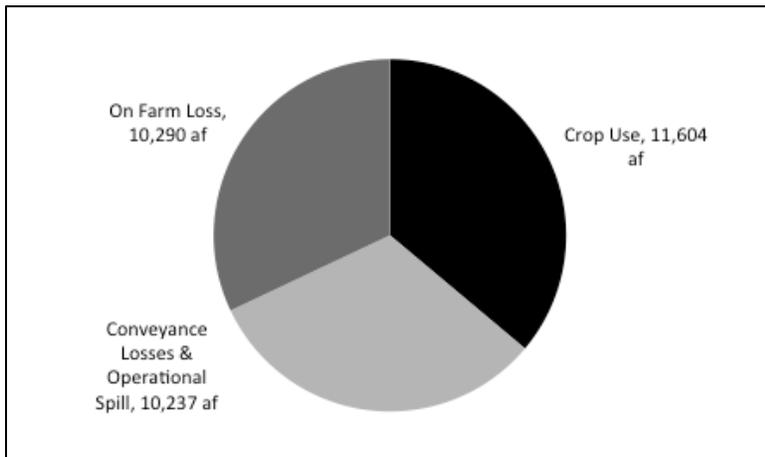


Figure 3. Conveyance losses, operational spill, and on-farm losses provide opportunities for efficiency improvements in Arnold Irrigation District.

3.2.2 *Challenges and Goals*

Challenges facing AID were clarified to provide a basis for setting meaningful goals for the district. This process helped the district to recognize its role among other water suppliers in developing water management solutions and helped it develop a clearer path for responding to its challenges. AID challenges and goals are described herein.

Water Supply Challenges

As described above, AID depends primarily on live flow in the Deschutes River for its water supply. AID generally has sufficient water supply under average water supply conditions. Concerns of high importance to the AID are supply reliability during drought conditions and the unintended consequences of conservation projects and water transactions by other water suppliers on districts with junior water rights.

AID has a supplemental water right for up to 13,500 af of storage in Crane Prairie Reservoir that it relies on during dry years. The actual volume of storage available to the district is function of the total volume in Crane Prairie and the fractional allocation of this volume between AID, Central Oregon Irrigation District, and Lone Pine Irrigation District. The maximum storage that begins the storage report for the year is the volume when both Wickiup and Crane Prairie Reservoirs are together at their maximum. This date is usually around the second week in April but it can vary from late March to early May. The volume of water in Crane Prairie Reservoir at this time is the baseline for fractional allocations of stored water for the three districts. After this date, water losses through reservoir seepage and evaporation reduce the total water volume. Reservoir seepage ranges between 15 and 20 percent. As the total volume is reduced, the fractional volumes allocated to the three districts are also reduced. The actual storage volume available to AID is usually less than its maximum storage right of 13,500 af. This situation is one component of AID's concern about supply reliability during drought conditions.

The supplemental storage provides supply when water availability under AID's primary right (live flow) is insufficient for demand. Live flow decreases during drought conditions, requiring AID to shift to storage for supply. If the district must depend on storage for its full deliveries, the maximum volume of 13,500 af, if available, would last approximately 59 days at AID's maximum diversion rate of 95 cfs. OWRD reduces the total storage released from Crane Prairie and Wickiup Reservoir available to districts at Bend based on losses in the Deschutes River. OWRD reduces storage amounts by a fixed rate of 12.5% between Crane Prairie and Benham Falls and again reduced based on measured losses, generally 7%, between Benham Falls and Bend. In order for AID to achieve its present diversion rate of 95 cfs, the rate of storage release from Crane Prairie must be about 117 cfs. This rate is charged against the total available storage for AID (and other districts relying on storage), resulting in 58 days of net supply. In most cases, the gross volume of storage available to AID is less than 13,500 af, indicating duration of storage supply for less than 58 days during a drought and full dependency on storage.

Generally, the net volume of storage available to AID is a relatively small percentage of its total annual diversion volume. The district relies primarily on live flow for supply. This reliance concerns AID relative to its supply during drought conditions. The district ran out of water during the 1994 irrigation season, leaving a lasting memory of drought impacts. This event led to significant improvements by AID to conserve water through water management and control provisions and reduce its risk of supply shortage in such events.

History of past drought experience remains the basis for AID's concern about supply reliability during drought conditions. The district has significantly improved its water management and control program and has reduced its average annual diversions accordingly. These improvements have reduced AID's risk of inadequate drought supply since its reduced diversion requirement means the district needs less live flow to meet its delivery needs. This also suggests it is more likely that AID's supply needs can be met with live flow only, allowing it to leave more water in storage as a hedge against dry years. However, AID is concerned that conservation projects by other districts with senior water rights and related water transfers are offsetting its reductions in risk. For example, planning work relative to shifting part of NUID's supply from the Crooked River to the Deschutes River raises concern about impacts to Wickiup storage, which could then impact AID. Potential for impacts on AID by projects implemented by other Districts is a second component of AID's concern about supply reliability during drought conditions.

Portions of the conserved water resulting from past conservation projects by other districts with senior rights have been transferred to stream flow and are protected under instream water rights. AID respects the right of the districts to implement conservation projects and contribute water to instream flow; however, it is concerned about unintended consequences. Before the conservation projects, districts would work with a "block" of water, within which their diversions could fluctuate, leaving part of this "block" of senior water instream. This undiverted instream water could be used by junior districts. This water also provided some cushion and flexibility to junior districts in responding to their own needs.

After the conservation projects, the "block" of water is partitioned into two parts. One part is for the district's use and the other part is instream. Each part is enclosed within a distinct, well-defined regulatory boundary. The result is loss of that cushion and associated flexibility to junior districts in responding to their needs.

AID is concerned that, as this process continues, the district will be pushed more and more toward dependency on its supplemental storage in Crane Prairie. Add flow releases in connection with potential ESA and/or CWA actions, probability of reservoir filling in a given year could decrease, bringing additional threat to AID supply reliability. Increased dependency on storage increases AID's risk of inadequate supply during drought conditions. AID is concerned that the benefits of risk reduction measures it has already taken are being eroded by conservation projects and other water transactions by other districts without consideration of the "whole"

Financial Challenges

AID depends on annual assessments for its operating revenues. The district presently has no other revenue source. Over approximately the last five years, AID's annual legal costs have roughly doubled to about \$20,000 for general day-to-day operating issues in today's environment and regulatory compliance needs. The district has increased assessment rates over time and has limited opportunities with this revenue source to generate capital it could use for infrastructure improvements and piping projects for water conservation. The 50 percent match requirement for grant funding to do piping conservation projects is prohibitive for AID. Limited finances are also critical to AID in upgrading its creosote-treated, wood-framed flume extending from the districts diversion on the Deschutes River over approximately 1.5 miles of its main canal. The last work on the flume was in the 1950s. AID is concerned that the structure is at or near its design life and is at risk of fire. District finance limitations preclude AID from addressing this critical issue, including provisions for the Wild and Scenic River designation of the area in which the flume is located.

Concerns relative to water supply, finance and regulatory compliance issues were considered by AID in its efforts to resolve them. These considerations lead to identification of goals that AID desires to achieve in response to these concerns. The resulting AID goals are presented below (Table 2).

Water Supply Goals and Objectives - Final Report

Table 2. Arnold Irrigation District Goals.

	Water Supply Reliability	Finance	Regulatory Compliance
Problem	Awareness of 1994 drought impacts underscore AID water supply concerns and its focus on live flow supply to conserve storage and increase end-of-season carry-over storage for next season. Conservation and transactions by other districts (with senior water rights) threaten AID supply and exacerbate its supply reliability concerns and that of districts with junior right holders during drought. The 1.5 mile long wood structured flume at the diversion dates to 1950s and needs upgrade/replacement to maintain water delivery capability.	Revenues are from patrons only, are limited, and restrict implementation of infrastructure upgrades and piping projects to conserve water and respond to supply reliability concerns. Grant funding match requirements (50%) are prohibitive to funding opportunities for conservation projects. Conservation reduces diversion volume which increases degree to which supply can be met with live flows, decreasing dependency on storage. Assessment increases have been made, but are not solution to upgrade needs and increasing operating costs.	The HCP and TMDL processes may require AID to address water quality, quantity, and instream habitat needs.
Goal	Increase reliability of water supply in drought years and capability to deliver water through the flume structure.	Increase annual revenues.	Account for potential regulatory activities and manage potential adverse impacts on AID operations.
Objectives	<ol style="list-style-type: none"> 1. Avoid deterioration of supply reliability through narrowly-scoped conservation projects and related water transactions by others in the upper Basin. 2. Improve reliability of the flume to convey water supply from the diversion to the canal distribution system. 	Develop additional revenue source(s) to relieve patrons of sole revenue burden and to support infrastructure upgrades and conservation projects, and to maintain pace with increasing operating costs.	Respond to potential water quality, quantity and instream habitat needs through collaborative programs with other Districts.
Proposed Actions	<ol style="list-style-type: none"> 1. Restore 1,000 af of supply by: <ol style="list-style-type: none"> a. In concert with other Districts, formulate and implement a plan that prevents deterioration of AID (and other districts') supply reliability through impacts of conservation & water transactions in the upper Basin. b. In concert with other Districts, develop & implement plan that considers integrated system functions (storage, river flows, Districts) and allocates conserved water according to needs of Districts, municipalities and stream flows. 2. Upgrade the flume to current design and performance standards. 	Develop and implement hydropower energy generation.	<ol style="list-style-type: none"> 1. Account for conservation completed by AID relative to contribution toward regulatory compliance needs; 2. Participate in collaborative upper Basin water management and allocation planning relative to water needs of agriculture, urban suppliers and stream flows.

3.3 Central Oregon Irrigation District

3.3.1 District Characterization

Central Oregon Irrigation District (COID) provides water to serves 3,598 accounts across approximately 44,784 acres. Patrons irrigate the majority of these acres, 67%, with sprinklers and the remainder, 33%, by flooding. While the district does retain some larger scale production agriculture, the district’s average parcel size of 12.12 acres reflects a shift towards smaller scale and amenity farms in portions of the district.

COID diverts an average of 304,195 af, or 6.79 af per acre, through its Pilot Butte and Central Oregon Canals each year. The district delivers an estimated average of 164,265 af, or 3.67 af per acre, each year based on estimated conveyance efficiencies (Table 3). Estimated annual crop water use averages 96,095 af (Figure 4). The district typically diverts most of this water under its 1900 water right (Figure 5).

COID diversions vary each year. The range of variability between COID’s minimum and maximum diversions is approximately 50,000 af (Figure 5), or 17% of its average demand. On average, the district supplies approximately 1,269 af from storage (Figure 6).

Table 3. Central Oregon Irrigation District Characterization, 1992 – 2011.

Approximate Total Acres	44,784 ac
Primary Water Sources	Deschutes River; 1900, 1907, 1913 plus power rights
Supplemental Water Sources	Crane Prairie (9,000 af balance after Arnold & Lone Pine Irrigation Districts plus 4/5 of 1st 15,000 af surplus storage above 30,000 af)
Storage Use	1,269 af; 0.03 af/ac
Diversions	304,195 af; 6.79 af/ac
Deliveries (estimated)	164,265 af; 3.67 af/ac
Crop Water Use (estimated)	96,095 af; 2.15 af/ac

Note: volumes and duties represent annual medians.

COID diverted a minimum of 270,499 af in 2005 (Figure 6). The district only used 923 af feet of storage during that year (Figure 6), slightly less than its average storage use, even though more storage was available. The district leased approximately 11,555 af instream during that year, within the existing range of annual leasing for the district, suggesting that leasing did not lead to lower than average water diversions. This data suggests that COID had access to additional water during this year but did not divert it. The district’s low year diversion was adequate to meet its needs under conditions experienced in 2005.

Annual diversions include net diversions from COID’s Central Oregon and Pilot Butte Canals less spills to North Unit Irrigation District and deliveries to the Lone Pine Canal. This evaluation estimated spills to North Unit Irrigation District for 1992-2006 and deliveries to the Lone Pine Canal for 1992-2002 based on the respective median annual volumes of the remaining years. Storage data came from the Oregon Water Resources Department.

Water Supply Goals and Objectives - Final Report

COID charges a \$300 account fee plus a \$23/acre assessment. The district delivers water based on a “point-in-time” basis where they deliver a set amount of water to each parcel at a set time each day. They do not adjust the amount of water based on the daily demands of that parcel. Two hydropower plants, one on the Central Oregon Canal and one on the Pilot Butte Canal, subsidize district operations. The district maintains 28 telemetry-enabled gauges to monitor canal and lateral flow and has a long-term goal of installing SCADA controls throughout its system. COID passes water through the Pilot Butte Canal to Lone Pine and spills water through the K Lateral to North Unit Irrigation District.

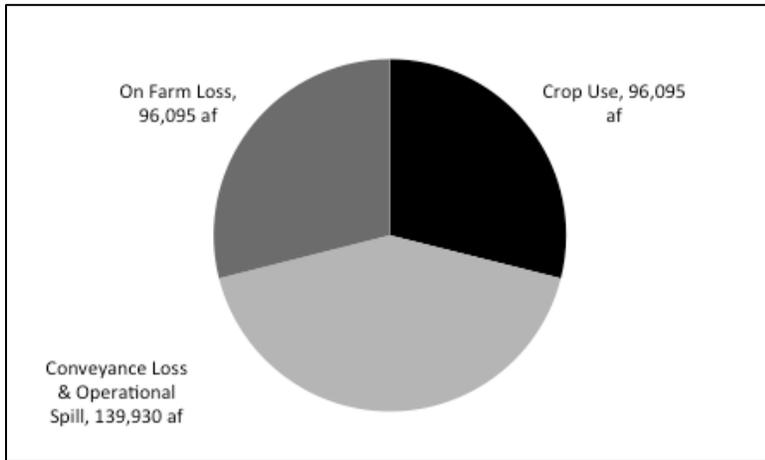


Figure 4. Conveyance losses, operational spills, and on-farm losses provide opportunities for efficiency improvements in Central Oregon Irrigation District.

Water Supply Goals and Objectives - Final Report

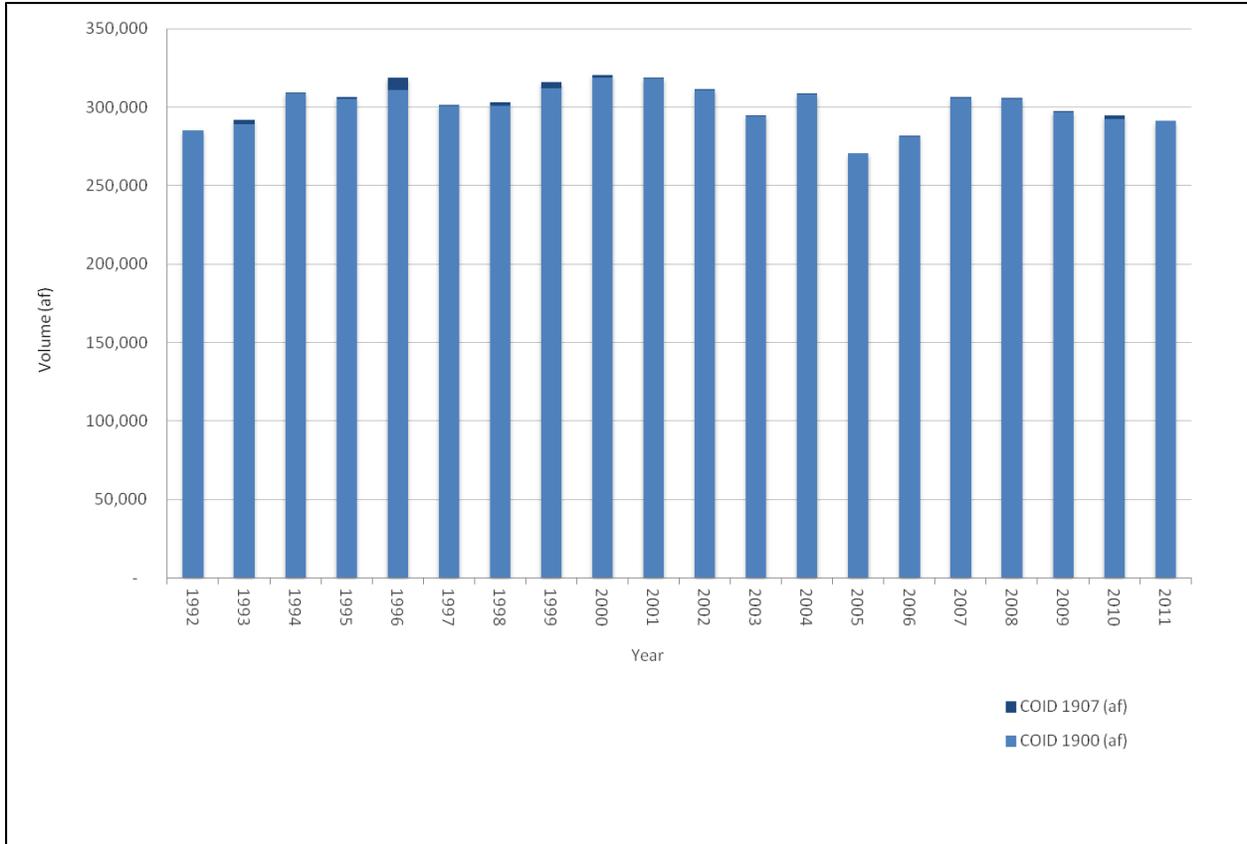


Figure 5. Central Oregon Irrigation District’s primarily diverted water under its 1900 water right between 1992 and 2011. The district diverted an estimated maximum of 2% of its water under its 1907 right in 1996. This evaluation does not include the impacts of annual water leasing. Including the impacts of annual water leasing would slightly increase the proportion of water that the district diverted under its 1907 water right.

Water Supply Goals and Objectives - Final Report

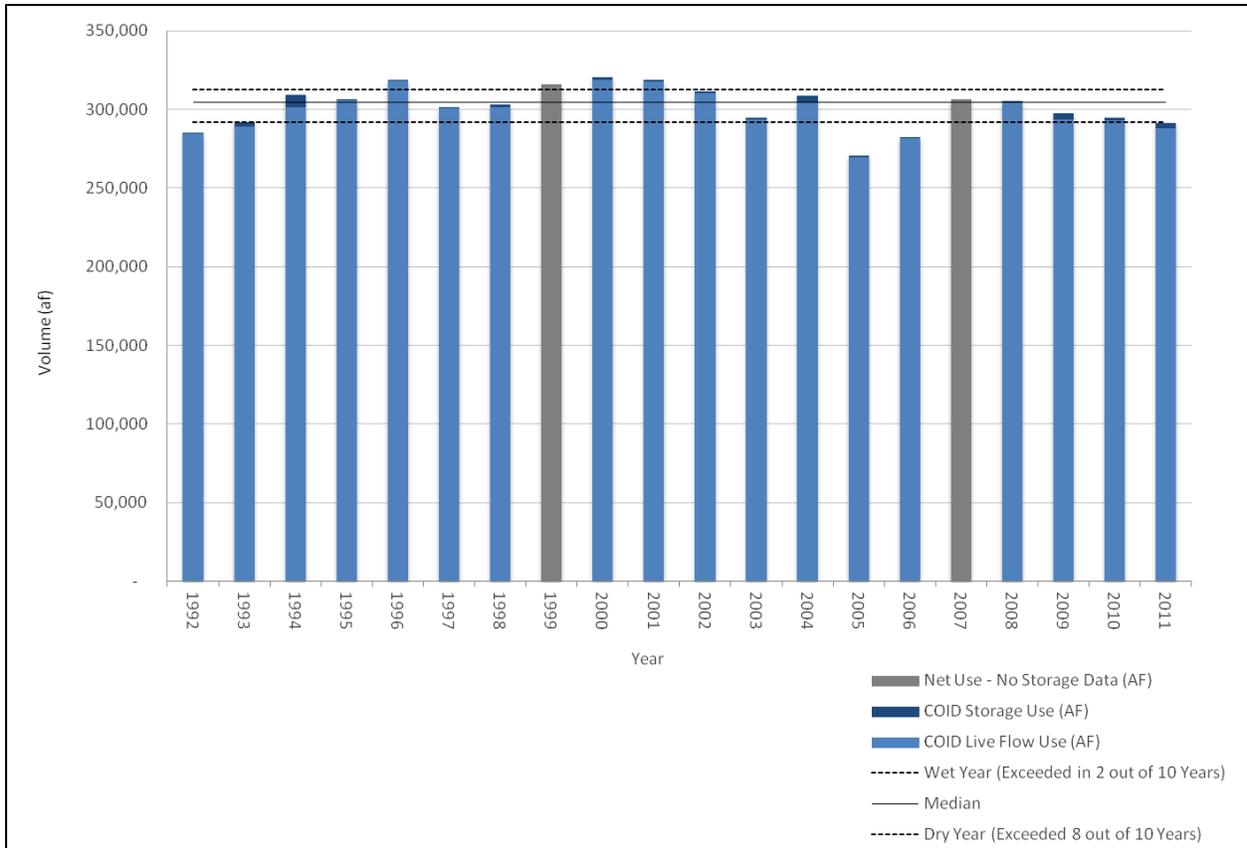


Figure 6. Central Oregon Irrigation District’s diversions fluctuated between 270,499 af and 320,564 af from 1992 through 2011. The district diverted over 291,677 af during low diversion years. The district diverted 304,195 af during an average year. The district diverted over 312,366 af during high diversion years. Live flow from the Deschutes River provided close to 100% of the Central Oregon Irrigation District’s water supply during this period. The district used a maximum of 7,935 af of stored water during 1994, representing 1% of its total diversions during that year.

3.3.2 Challenges and Goals

COID depends on the Deschutes River to supply approximately 45,000 acres of irrigated land in the Bend, Redmond and Powell Butte areas. Challenges facing COID were clarified to provide a basis for setting meaningful goals for the district. This process helped the district to recognize its role among other water suppliers in developing water management solutions and helped it to develop a clear path for responding to its challenges. COID identified four principal categories of problem categories that provide a framework for district goal-setting and related management actions. These problems are summarized herein.

Financial Challenges

Major demographic changes have occurred in the upper Deschutes Basin, beginning in the 1970s and accelerating in the 1990s to the present time. Rapid population growth led to rapid land development and associated increases in water supply demands both within and outside of urban growth boundaries.

COID supplies water to irrigated lands within the Urban Growth Boundaries (UGBs) of Bend and Redmond. Rapid population growth and related land development have urbanized irrigated lands supplied by COID. Urbanization in the UGB and in the Urban Reserve Areas (URAs) continues. The district depends on annual assessments on all acres it supplies with water for revenues to cover annual operations and maintenance costs. To protect its assessment income, COID transferred water off the urbanized lands to other lands within the district, or to instream flow. Presently, COID supplies water to approximately 2,580 acres of irrigated lands within the Urban Growth Boundaries of Bend and Redmond.

Land development expanded housing projects in the UGBs, bringing homes and population in closer proximity to open irrigation canals and laterals. These changes bring encroachments on COID easements and increasing interface between homeowners, other urban citizens and the district in regard to easement use and protection of district infrastructure. Close proximity of homes and citizens to canals and laterals also means changes in how the district conducts maintenance work. These conditions require additional COID staff time for communication, education, problem resolution and maintenance and equipment planning, which increase its operations and maintenance costs.

Some of COID's most important operations and maintenance challenges are unknowns relative to its Pilot Butte and Central Oregon Canals and their routes across basalt rock formations located within, north of, and east of Bend. These formations are highly fractured and provide conduits for water seepage from the canals. Sink holes often develop in the canals when finer canal bed materials are carried into fractures by seepage water. Removal of these materials begins at the interface between rock fracture and overlying soil materials. Internal erosion continues from this interface upward to the canal bottom and causes sinkholes, which can then drain large quantities of water from the canal over a short time. COID attends to numerous sinkhole repairs each year.

Regulatory compliance needs have developed over the last several years that bring additional costs to the district's annual budget for professional and legal counsel. This issue is discussed in more detail below. The district is responding to issues relative to water quality and to re-introduction of federally listed steelhead.

The above financial considerations reflect much change in administrative and operational functions of the district. Most of these changes have occurred over the last 20 years. Costs of responding to these changes exceed the capacity of the district to cover these through annual assessments alone. Therefore, to sustain economic security, other opportunities must be identified and implemented to respond to present and future water resource issues.

Urbanization

Urbanization is the conversion of irrigated lands to urban uses and the related development of property in close-proximity to open canals and laterals. As described above, urbanization brings

encroachment into district easements. It increases operations and maintenance effort and procedure, increasing annual operations and maintenance costs. Safety is a major COID concern relative to proximity of developing and larger population to its open canals and laterals. The district's diversions in the southern and northern areas of Bend and its two main canals will remain in their current positions. The UGBs of Bend and Redmond have expanded the urban area around this infrastructure, bringing increased awareness of the district on potential safety issues and needs for responding to them.

A number of considerations are involved in responding to urbanization issues relative to open canals, operations and maintenance issues, safety concerns and costs. Operations and maintenance costs for open canals and laterals could be reduced by lining these conveyances; however, maintenance is still required. Rigid linings of concrete or shotcrete are subject to cracking and/or heave-breakage by freezing water. Crack sealing and replacement of broken liner areas are required. Lined canals and laterals can increase safety hazards through increased escapement difficulty. Lined canals or ditches continue function as an open channel with limited control over matching deliveries with demand in urbanized areas with intermixed urban and irrigated lands. Considering potential future growth and development, linings do not adequately respond to safety or operations and maintenance cost issues in urban areas.

Piping of canals and laterals eliminates open flow channels, water control limitations in urbanizing areas and related safety issues. Piping provides containment of water and much better control in matching deliveries with demand in intermixed urban/irrigation land areas. Piping, in these cases, reduces operational flow needs and spills, improving water use efficiency. Piping costs are generally higher than lining costs; however, piping comes with negligible maintenance needs and related costs, and provides a solution that is more compatible with urban areas.

An urbanization dilemma facing COID and other districts is irrigated land areas at or near the end of long laterals/ditches that pass through areas of prior irrigated lands that are now urbanized. Before urbanization, water conveyed in the laterals/ditches supplied water to each irrigated area and conveyance of this supply through the lateral/ditch also served as transmission water to supply the irrigation needs of lands at the end of the lateral/ditch. After urbanization, transmission water is still necessary to deliver the required volume at the end of the lateral/ditch such that more flow than required for the irrigation alone is required in the lateral/ditch. This promotes inefficient water use. The dilemma is whether to pipe the lateral/ditch considering that the remaining irrigated lands could be urbanized in the future, resulting in questionable benefits from the cost of piping.

Basin Water Supply Challenges

COID's principal concerns relative to basin water supply are the implications of growth, development, increasing water demand and CWA and ESA issues to basin water suppliers and users without a proactive, collaborative water management plan that recognizes and responds to

these issues. Improving stream flows to improve water quality and fish habitat are consistent with a growing concern about the adequacy of stream flows for watershed health, fish and wildlife. The district recognizes that water is available to improve supplies for agriculture, stream flows and for urban community needs. The district also recognizes opportunities to contribute to the water supply needs and its role in execution of opportunities that are consistent with the three DWA goals.

COID supplies water to approximately 45,000 acres of irrigated land through a network of main canals and laterals that are largely concentrated in the general Bend-Redmond areas. The Central Oregon Canal and its laterals supply a relative large area around Powell Butte, east of Bend and Redmond. Many of its canal reaches and laterals are constructed in highly-permeable basalt lava flows and other volcanic rocks. Fracture systems and the structure of basalt flows with highly-permeable interflow zones result in leakage of large quantities of water from the canals and laterals, primarily in the Bend-Redmond areas.

The district has conducted flow measurement analyses to quantify the volume of seepage loss and it is developing a prioritized list of canal and lateral piping projects to reduce seepage losses. Implementation of these projects will generate water supply that could be used to irrigate other lands within COID, irrigate lands in other irrigation districts for agricultural supply, augment flows in the upper Deschutes River during winter and in the middle Deschutes River below Bend during the summer, augment stream flows in response to the Habitat Conservation Plan, or supply water for a drought contingency plan.

COID also recognizes that municipal and other community water suppliers that depend on ground water will need water to meet their mitigation obligations under OAR 690-505. To date, mitigation water has been generated primarily through retirement of surface water rights and their transfer to a protected instream flow right in the appropriate zone of impact. Use of water for mitigation purposes is an opportunity for COID to help respond to its financial concerns through agreements with ground water users to transfer water off urbanizing lands and create mitigation credits.

Goals

Concerns relative to finance, urbanization, regulatory compliance and basin water supply were considered by COID in its efforts to resolve them. These considerations lead to identification of goals that COID desires to achieve in response to these concerns. The resulting COID goals are presented below (Table 4).

Water Supply Goals and Objectives - Final Report

Table 4. Central Oregon Irrigation District Goals.

	Finance	Urbanization	Regulatory Compliance	Basin Water Supply
Problem	Increasing operations and maintenance costs; assessment loss from urbanization; infrastructure improvement/maintenance; finance cost of regulatory compliance with ESA and CWA.	Fundamental problems include: <ol style="list-style-type: none"> 1. Safety of open canals in urban areas; 2. Right-of Way encroachments and related increase in operations and maintenance costs;. 3. Potential assessment loss by urbanization of irrigated land supplied by COID. 	The Habitat Conservation Plan and Total Maximum Daily Load processes may require COID to address water quality, quantity and instream habitat needs.	Instream needs relative to ESA/CWA implications; population growth & increasing water demand; uncertainty in supply reliability for junior ag water users; drought threat to water supply.
Goal	Improve long-term financial security.	<ol style="list-style-type: none"> 1. Reduce safety hazards resulting from changing land uses in urban areas; 2. Adapt financial management of COID to account for changing land uses in urban areas. 	Account for potential regulatory activities and manage potential adverse impacts on COID operations.	<ol style="list-style-type: none"> 1. Generate revenues; 2. Respond to ESA/CWA; Basin growth, and drought impacts.
Objectives	<ol style="list-style-type: none"> 1. Generate additional revenue sources; 2. Improve water delivery efficiency and effectiveness; 3. Improve cost management practices. 	<ol style="list-style-type: none"> 1. Offset potential assessment loss to urbanization (within Urban Growth Boundaries); 2. Upgrade infrastructure to urban environment and reduce operations and maintenance costs in UGB/URA areas. 	<ol style="list-style-type: none"> 1. Meet Total Maximum Daily Load for temperature in the middle Deschutes River; 2. Meet mitigation requirements for the Habitat Conservation Plan. 	Supply water through conservation, management, best practices to address: <ol style="list-style-type: none"> 1. HCP/instream needs; 2. Intra-district supply needs; 3. Drought contingency at DBBC level; 4. Potential municipal supply needs.
Proposed Actions	<ol style="list-style-type: none"> 1. Evaluate, develop and operate hydropower generation plants; 2. Evaluate pressurized water delivery systems; 3. Implement cost control/containment provisions in operations management. 	<ol style="list-style-type: none"> 1. Sustain assessments for 2,580 AC of UGB lands; 2. Supply water to new lands in COID; 3. Pipe canals & laterals in UGB/URA to improve public safety. 	<ol style="list-style-type: none"> 1. Supply water for instream use; 2. Reduce/eliminate Dry Canyon irrigation return flows to Crooked River; 3. Offset expected regulatory costs through additional revenue generation methods. 	Supply water through conservation, management, and best practices to address: <ol style="list-style-type: none"> 1. HCP/instream needs; 2. Intra-district supply needs; 3. Drought contingency at DBBC level; 4. Potential municipal/urban supply needs.

3.4 North Unit Irrigation District

3.4.1 District Characterization

North Unit Irrigation District (NUID) serves 981 accounts across 58,891.9 acres. Patrons irrigate approximately 52,832 acres each year and fallow or lease instream the remainder. They irrigate approximately 65% of these acres with sprinklers, 25% with furrow, and 10% with pivots and guns. NUID retains the greatest proportion of production agriculture in the region, reflected by the district’s relatively large average account size of 60 acres

NUID diverts an average of 188,046 af each year (Table 5). The district delivers an average of 107,022 af to farms each year. Estimated crop water use on-farm averages 93,109 af each year (Figure 7). However, district diversions vary widely each year. During most years, the district diverts at least 175,940 af at 3.19 af per acre (Table 5. North Unit Irrigation District Characterization, 1992 – 2011.). During low water years, such as 1995, though, district diversions have dropped as low as 134,677 af and 2.29 af per acre (Figure 8). NUID is currently evaluating its annual water supply and water demand to identify any additional water needs.

The district diverted between 11% and 78% of their water supply from storage each year between 1992 and 2011. On average, the district supplied approximately 51% or 85,237 af from storage (Figure 9). They used 131,679 af of storage in 1994, the maximum amount during the period of record (Figure 9). NUID only used 88,222 af of storage during 1995, the year with the lowest diversion in the period evaluated (Figure 9). They have indicated that their dry year supply was not adequate to meet their needs under the sequential dry year conditions experienced in 1995.

Table 5. North Unit Irrigation District Characterization, 1992 – 2011.

Approximate Acres	50,050 ac	8,842 ac
Primary Water Sources	Deschutes River, Wickiup; 1913	Crooked River; 1968
Supplemental Water Sources	Crooked River; 49,999.9 ac; 1955	None
Storage Use	85,237 af; 1.45 af/ac	
Diversions	188,046 af; 3.19 af/ac	
Deliveries	107,022 af; 1.82 af/ac	
Crop Water Use (estimated)	93,109 af; 1.58 af/ac	

Note: volume and per-acre duties represent median annual statistics.

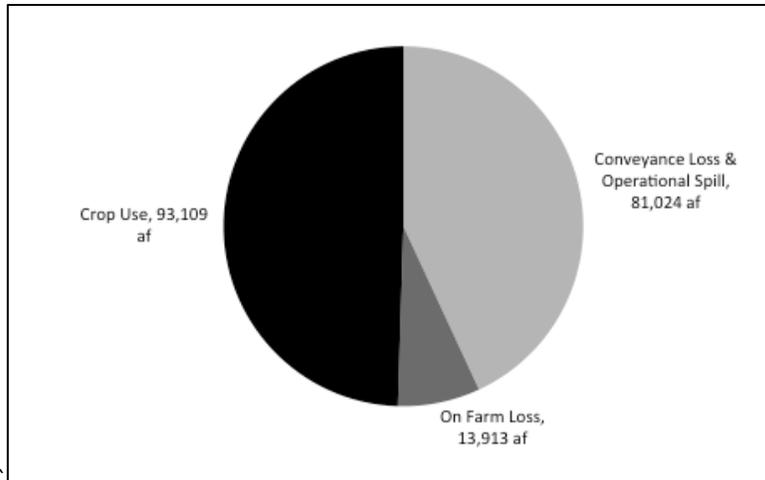


Figure 7. Opportunities for efficiency improvements in North Unit Irrigation District relate primarily to conveyance losses and operational spills.

NUID delivers water on an as-needed basis. Patrons pay a \$110.00 account fee and a tiered rate for each acre-foot of water delivered. Deschutes River patrons receive the first two af and Crooked River patrons receive the first acre-foot for \$43.45. NUID bills for the first additional acre-foot at \$26.07 and the second additional acre-foot at \$30.42. Patrons supplied with Deschutes River water receive 2 af per acre before additional charge and those supplied with Crooked River water receive 1 acre-foot per acre before additional charge. Patrons pay additional fees of \$18.42 per acre related to debt repayment and legal charges, plus a \$15.18 account charge for landowners with under 10 acres of irrigated land. The district maintains weirs at each lateral and point of delivery to accurately measure water throughout their delivery system.

NUID does not currently operate any hydropower facilities. They are currently assessing three hydropower opportunities within their delivery system. They also receive spills from Central Oregon Irrigation District's K Lateral. These spills pass through the Juniper Ridge hydropower project prior to entering NUID's system.

Water Supply Goals and Objectives - Final Report

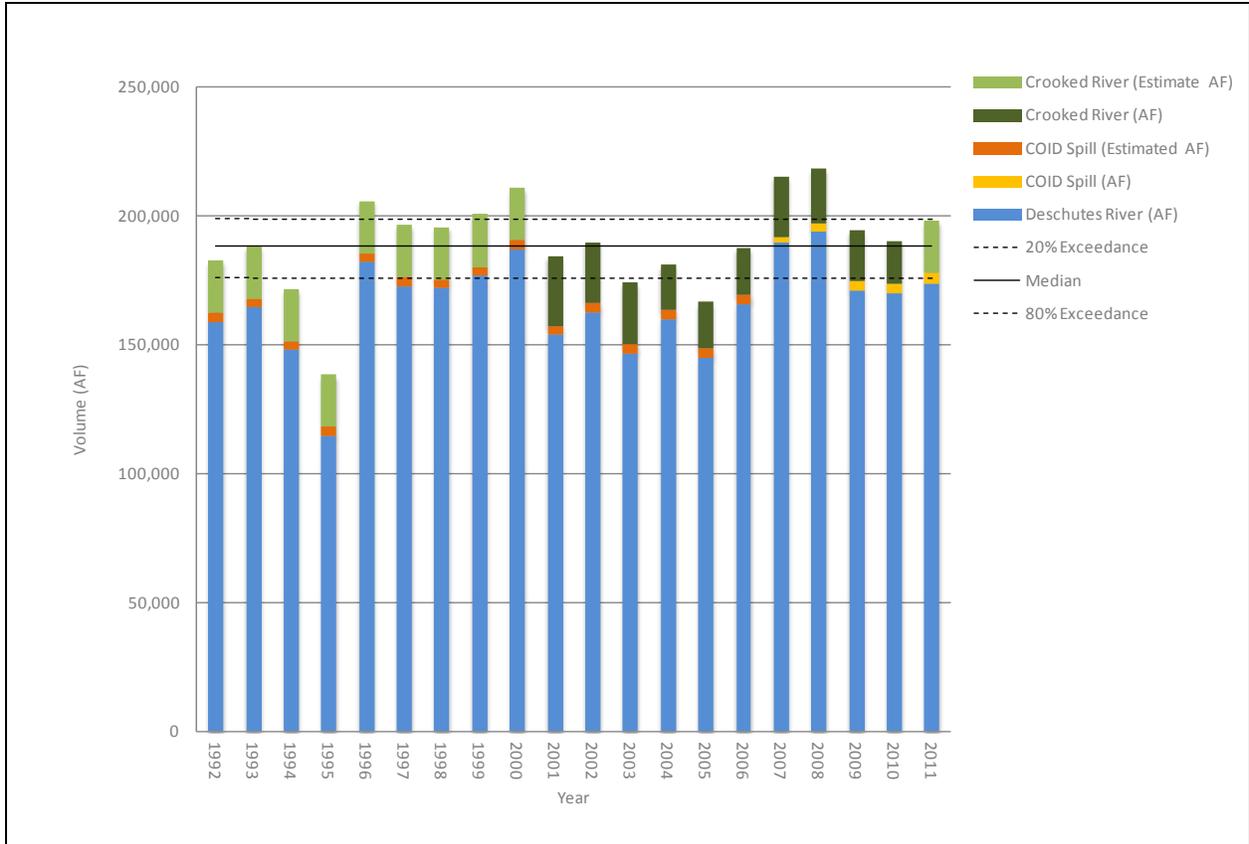


Figure 8. North Unit Irrigation District’s diversions fluctuated between 134,677 af and 217,956 af from 1992 through 2011. The district diverted at least 175,940 af during normal low water years, 188,046 af during an average year, and over 198,637 af during high water years. Deschutes River live flow and storage provided approximately 92% of North Unit Irrigation District’s water supply during this period.

Water Supply Goals and Objectives - Final Report

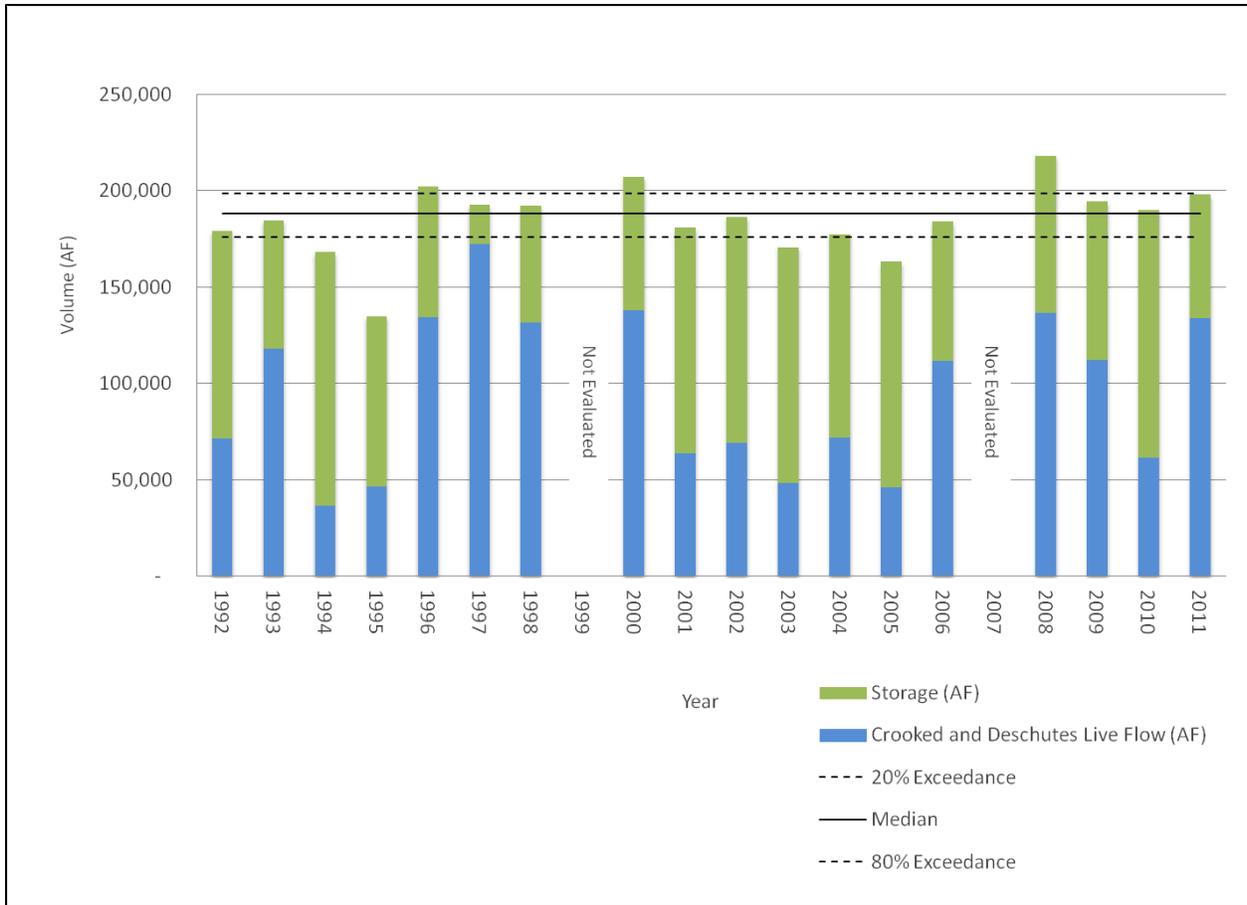


Figure 9. North Unit Irrigation District used an average of 85,237 af of storage each year between 1992 and 2011. The district’s storage use fluctuated between 20,671 af and 131,679 af. Storage represented approximately 49% of North Unit Irrigation District’s total water supply between 1992 and 2011. Storage numbers represent diversions at Bend and do not include any in-channel and reservoir losses. Storage data were not available during 1999 and 2007 so these years were omitted from this analysis.

3.4.2 Challenges and Goals

NUID depends on the Deschutes and Crooked Rivers to supply 58,891.8 acres of irrigated land in Jefferson County. Challenges facing NUID were clarified to provide a basis for setting meaningful goals for the district. This process helped the district to recognize its role among other water suppliers in developing water management solutions and helped it to develop a clear path for responding to its challenges. NUID primary challenges and goals are described herein. They relate to water supplies and finances.

Water Supply Challenges

NUID’s water rights allow the use of water from the Deschutes and Crooked Rivers and for irrigation of 58,891.9 acres, mostly in the Culver and Madras areas. Water for approximately 50,049.9 acres supplied by the district comes from the Deschutes River. Approximately 8,841.9 acres supplied by the district depend on the Crooked River.

NUID's water rights are junior to those of the other upper Deschutes Basin irrigation districts. NUID uses live river flows remaining after the more senior districts have diverted their portions of the available live flows. The live flows available to NUID are insufficient to meet its full supply need. Accordingly, NUID depends on winter storage in Wickiup Reservoir to meet the needs of its agricultural base. The district's water rights allow up to 200,000 af of storage in the reservoir for its use. Actual seasonal storage available to the district is subject to annual climate and precipitation conditions. Predicting available water supply for future irrigation seasons is subject to varying degrees of uncertainty.

Water is conveyed from Wickiup Reservoir by the Deschutes River to the NUID's diversion at the North Canal Diversion Dam in Bend. From the diversion, water is conveyed about 65 miles in the district's main canal to irrigated lands served by the district. The amount of water actually available at the farm turnouts is subject to losses in the Deschutes River and in the canal system.

Water losses occur in the Deschutes River between Wickiup Reservoir and the Bend diversion. Losses are primarily through seepage into fractured, permeable volcanic rock materials, particularly in the area of Benham Falls. OWRD reduces the total storage released from Crane Prairie and Wickiup Reservoir available to districts at Bend based on losses in the Deschutes River. OWRD reduces storage amounts by a fixed rate of 12.5% between Crane Prairie and Benham Falls and again based on measured losses, generally 7%, between Benham Falls and Bend. Losses also occur in the main canal and in the laterals and ditches that distribute water to irrigated lands. Seepage losses in the canal system average around 46 percent based on relationships between historic diversions and deliveries at farm turnouts for the period 1992 – 2011.

Analysis of the historic delivery record for the period 1992 – 2011 reflects an average (median) delivery volume of 107,022 af. This volume is the total for both Deschutes and Crooked River sources and corresponds to 1.82 af per acre delivered to the farm based on the district water right acreage.

The amount of water required to grow crops is the net irrigation requirement. It is based on naturally occurring moisture in the soil, temperature and evaporation. The net irrigation requirement for NUID is 1.85 af per acre based on the Oregon State University publication "Crop Water Use and Irrigation Requirements", Extension Miscellaneous Paper 8530, March 1999.

NUID's limited water supplies and reliance on stored water, coupled with uncertainties in climate and availability of storage supply, make it harder for farmers to select crops that take advantage of market conditions through increased margin opportunities. Limited and uncertain water supply compels the planting of crops with better tolerance for moisture limitations. Such crops may not bring the best margins to the farmers. Farmers have invested large amounts of their own money in pivot irrigation systems to improve irrigation efficiency, conserve water, and

use conserved water to expand its crop production. Pivots have been installed to better match supply with crop need, keeping the moisture zone to the depth of root penetration. Water that permeated below the root zone from other less efficient irrigation methods is now available for other crops.

The principal water supply challenge for the NUID is an average delivery rate to farm turnouts that is just short of the net irrigation requirement. Considering an on-farm efficiency of approximately 87 percent, the minimum consistent delivery at the turnouts should be at least 2.13 af per acre based strictly on the estimated irrigation requirements above, with no consideration for other influences on net amount of water available for irrigation and crop use.

Financial Challenges

The NUID operates within an annual budget that has a minimal margin for infrastructure upgrades and equipment maintenance that could reduce longer-term costs. District revenues from annual assessments and account fees provide the funds for its annual operations and maintenance costs. Increases in these revenue sources are not viable options to generate sufficient funds that for NUID to respond to its finance needs. The finance issue is a priority challenge to the district and one that it desires to resolve.

NUID can respond to financial challenges in three ways: reduce operation and maintenance costs, generate more revenues, or implement a combination of cost reductions and revenue increases. An opportunity to reduce operating costs exists with the NUID's Crooked River pump stations.

Part of the NUID water supply is the Crooked River. Water supply for up to 8,841.9 acres is obtained from river. This water must be pumped from the river and then discharged into the NUID canal system for delivery to farms. The pumping lift is approximately 185 feet, requiring up to 4,050 (9 pumps x 450 hp) horsepower for electric pumps to deliver the required amounts of water. The annual cost of electric power for this purpose can exceed \$300,000. The NUID anticipates future increases in power costs, which will exacerbate its financial challenges.

Increasing administrative, professional and legal costs further exacerbate NUID's financial challenges. As described under Section 2.1, increased attention to instream flow needs and potential regulatory compliance issues related to the Clean Water Act and the Endangered Species Act have prompted the Districts to participate in collaborative programs to meet both their needs and fish and wildlife needs. NUID recognizes these needs and its role in responding to them. The professional and legal counsel required to respond to these needs in a way that also protects the district's patrons and economic and operational viability have increased the district's costs and exacerbated financial challenges.

Goals

Water supply and finance have long been challenges that the NUID desires to resolve. The district identified these two challenges as priorities in development of the "North Unit Irrigation

Water Supply Goals and Objectives - Final Report

District Management Plan” in 2008. Water supply and finance were identified as the number two and number three goals of the district, respectively. District challenges were further evaluated in the 2011 DWA Work Plan and in the follow-up Deschutes Water Planning Initiative work. These two challenges were confirmed as district priorities for resolution. The resulting NUID goals are presented below (Table 6).

Table 6. North Unit Irrigation District Goals

	Water Supply Reliability	Finance
Problem	<p>NUID holds the most junior water rights of the upper Basin Districts and faces water supply reliability issues on a year-to-year basis and during drought periods. Important supply considerations include:</p> <ol style="list-style-type: none"> 1. Historic average delivery rate for full water right acres is 1.82 af/ac (1992-2011) compared to net average year irrigation requirement of 1.85 af/ac; 2. Low historic deliveries bring high degree of uncertainty in supply, leading to uncertainty in crop selection and missed opportunities in the agricultural crop market; 3. More certainty in supply means more production that is more consistent with market opportunities, less risk, reduced annual land fallowing, and improved agricultural economy. 	<p>District faces a number of financial threats including:</p> <ol style="list-style-type: none"> 1. Increasing power costs associated with pumping; 2. Financial cost of regulatory compliance with ESA and CWA actions; 3. Increasing operations and maintenance costs. Revenues are limited for responding to infrastructure upgrades, conservation and operations and maintenance requirements.
Goal	Increase water supply reliability on a year-to-year basis and during drought conditions.	Improve long-term financial security and capacity to upgrade infrastructure and improve operations.
Objectives	Secure additional water to deliver 2.5 af per acre each year.	Increase availability of annual revenues for responding to infrastructure upgrades, conservation and increasing operations and maintenance costs.
Proposed Actions	<ol style="list-style-type: none"> 1. Participate in water planning actions with other water suppliers to identify opportunities to increase year-to-year delivery supply by approximately 55,000 af; 2. Collaborate with other water suppliers to develop and implement conservation and water transaction projects to provide NUID with the additional annual water supply. 	<ol style="list-style-type: none"> 1. Offset or reduce annual power costs of \$300,000; 2. Offset or reduce regulatory compliance-related costs; 3. Offset or reduce increasing operations and maintenance costs.

3.5 Swalley Irrigation District

3.5.1 District Characterization

Swalley Irrigation District supplies water to irrigated land in the area northwest of Bend. The district serves 666 accounts across 4,315 acres and 508 accounts hold six or fewer acres each. The district’s relatively small average account size of 6.47 acre reflects its urbanizing nature; approximately 1,727 acres irrigate turf grass in urbanized areas. During a typical year, patrons irrigate 4,056 acres, fallow 175 acres, and lease 75 acres instream.

The district has a senior live flow water right on the Deschutes River. They don’t have any storage rights. Historically, the district’s right has been 100% reliable because of its seniority. This senior water right attracted environmental funders to invest in large-scale water conservation in Swalley Irrigation District. As described below, recent decreases in the district’s diversion likely reflect these investments.

The DRC evaluated Swalley Irrigation District’s Swalley Canal diversions between 1992 and 2011. Following conversations with Oregon Water Resources Department, they did not consider data from 2008, 2009, and 2011. Swalley Irrigation District Swalley Canal diversions decreased for years evaluated between 1992 and 2010 (Figure 10). The district diverted a maximum of 38,095 af in 1992 and a minimum of 23,060 af in 2010 (Table 7). Decreases prior to 1999 were likely due to decreased demands within the district. Decreases between 1999 and 2006 were likely due to a combination of instream leasing and decreased demands.

The district completed its first permanent stream flow restoration project in 2007. Stream flow restoration projects between 2007 and 2010 reduced both the district’s demand and the district’s water rights. Decreases in diversions from 2007 through 2010 were likely due in large part to these restoration projects. The DRC was not able to develop summary statistics that describe Swalley Irrigation District’s diversions due to these relatively large decreases in diversions between 1992 and 2010.

Table 7. Swalley Irrigation District Characterization, 1992 – 2011.

Approximate Total Acres	4,315 ac
Primary Water Sources	Deschutes River; 1899
Supplemental Water Sources	None
Storage Use	None
Diversions	Not Available
Deliveries (estimated)	22,105 af; 5.12 af/ac
Crop Water Use (estimated)	9,947 af; 2.31 af/ac

Note: volumes and duties represent annual medians.

The district is currently participating in a water conservation study with Central Oregon Irrigation District and the DRC. This study will identify conveyance efficiency in the district and identify additional opportunities for conservation. Currently, the district estimates that it maintains a 73-77% conveyance efficiency.

Swalley Irrigation District delivers water based on a “point-in-time” basis where they deliver a set amount of water to each parcel at a set time each day. They do not adjust the amount of water based on the daily demands of that parcel. The district charges a \$540.77 account fee plus a tiered per acre assessment, with the per acre assessment decreasing for accounts holding more acres. The district operates one hydropower plant on the Swalley Canal to help subsidize district operations.

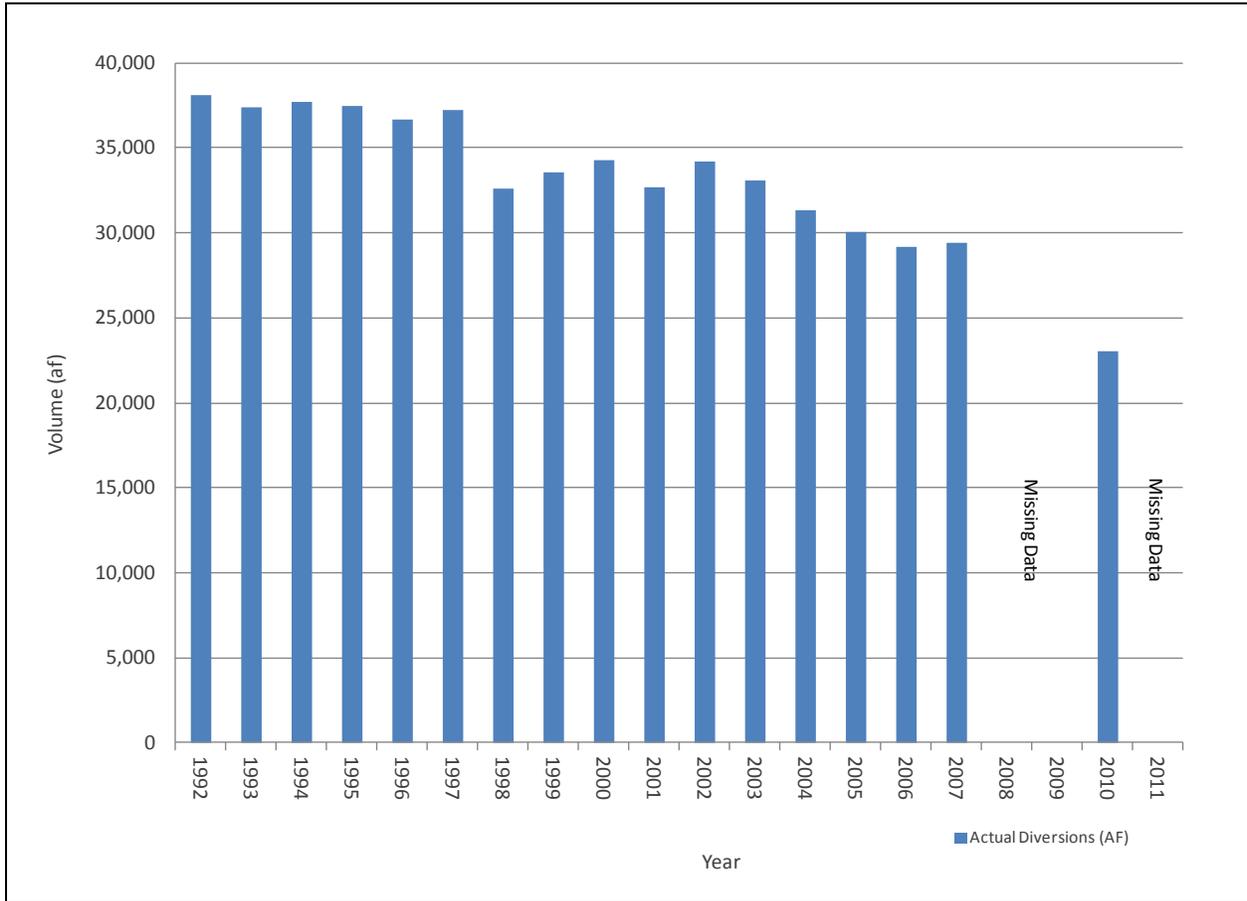


Figure 10. Swalley Irrigation District’s Swalley Canal diversions decreased between 1992 and 2010. The district diverted a maximum of 38,095 af in 1992 and a minimum of 23,060 af in 2010. The DRC did not develop summary statistics for Swalley Irrigation District due to its decreases in diversions during the study period.

3.5.2 Challenges and Goals

Challenges facing SID were clarified to provide a basis for setting meaningful goals for the district. This process helped the district to recognize its role among other water suppliers in developing water management solutions and helped it to develop a clearer path for responding to its challenges. Evaluation of SID’s situation in the upper Deschutes Basin and the issues it faces identified three principal challenges that are the framework for District goal-setting and related management actions. These challenges are summarized herein.

Water Supply Challenges

SID's water right is the oldest of the upper Deschutes Basin irrigation districts' with an 1899 priority date. As described earlier, the right allows SID to divert its entire supply from live flows in the Deschutes River. SID does not rely on any water that is stored over the winter as required for the other irrigation districts

SID's maximum diversion rate under its water right was originally 125 cfs. The district is authorized to divert up to 30 percent of the maximum rate during April 1 - 30 and October 1 - 30, 50 percent of the maximum rate from May 1 – 14 and September 15 -30, and 100 percent of the maximum rate between May 15 and September 14.

SID implemented four major conservation projects to reduce canal seepage and improve conveyance efficiency. All of the projects contributed portions of the conserved water to instream flow in the middle Deschutes River. The Kotzman, Deschutes and Frakes Laterals were piped in 2007, resulting in the contribution of 9 cfs to instream flow. The Main Canal was piped in 2010, resulting in the contribution of 29 cfs to instream flow. The instream flow contribution from the Main Canal pipeline project alone is the largest amount committed to instream flow in the upper Basin to date.

As a result of these four piping projects, the SID water right was modified by subtracting the 38 cfs in conserved water contributed to instream flow from the original maximum diversion rate of 125 cfs. The full adjusted rate of 87 cfs can be diverted during the summer and peak demand period. SID can now divert only up to 34 cfs in the spring and fall shoulder seasons

SID deliveries to farm turnouts are sufficient for demand during the peak summer season. However, the district's reduced rate has unintentionally led to supply deficiencies in the shoulder seasons. Prior to the rate adjustment, SID could divert up to 37.5 cfs during the spring and fall shoulder season. This rate allowed some "carry-water cushion" to get sufficient supply throughout the canal-lateral-ditch system for each farm turnout. The reduced rate of 34 cfs reduced the carry-water cushion. SID can no longer consistently deliver sufficient supply to the farm turnouts during the spring and fall shoulder seasons. Urbanization Challenges

SID is the smallest of the Deschutes River irrigation districts at 4,315 acres. At one time, potential City of Bend Urban Growth Boundaries and Urban Reserve Areas enclosed roughly one-third of the irrigated lands within the district. These potential boundaries have been drawn back; however, they are not yet finalized.

Due to its small size and impacts of lost assessments through urbanization, SID is concerned with the potential location of the UGB and acreage of irrigated land it supplies that could be enclosed and ultimately urbanized. The district's financial stability has little tolerance for loss of assessments on urbanized land.

SID has evaluated its options for relocating water from urbanizing lands to other sites for irrigation and sustaining the assessments it needs for its annual operating budget. The district

did not identify any clear opportunities for the transfer of water to new lands or for new customers for irrigation. Any option, including instream transfers, must have provisions to protect SID's assessments and operating revenues.

The district's principal concern related to urbanization is the reduction in irrigated acreage due to land and water "takeaways". The district cannot tolerate shrinkage but it recognizes that this will likely happen over time. SID's question is how to manage the threat of future urbanization.

Although the principal issue behind urbanization is the threat to the district's financial stability, other factors contribute to higher operations and maintenance costs. Roughly 500 of the district's 664 accounts are parcels of 6 acres or less in size. The development of smaller parcel sizes served with the original ditch systems increases the time and effort of SID to manage its water supply process. This results in increasing operation and maintenance costs. This can also lead to infrastructure upgrade needs and related costs. Another consideration relative to irrigation of smaller parcels is water use efficiency by the end user which SID desires to improve.

Goals

Concerns relative to water supply, urbanization and regulatory compliance issues were considered by SID in its efforts to resolve them. These considerations lead to identification of goals that SID desires to achieve in response to these concerns. The resulting SID goals are presented below (Table 8).

Water Supply Goals and Objectives - Final Report

Table 8. Swalley Irrigation District Goals.

	Water Supply	Urbanization	Regulatory Compliance
Problem	SID is short of water during its spring and fall “shoulder” seasons. SID committed 38 cfs of conserved water to instream with four piping projects with very significant benefit to middle Deschutes flows in summer. Unintended over-commitment left SID with supply deficiencies during spring and fall shoulder seasons.	SID is relatively small at 4,315 acres. Bend’s UGB brings the threat of land and water “takeaways”, bringing threat of assessment loss on urbanizing lands. UGB planned earlier cover about 1/3 of SID acres. Pulled back since; yet uncertainty in future UGB impact is important issue for SID’s long-term financial stability. Urban influence & owner withdrawals from SID can bring intermixed irrigated/urban lands & related O&M cost increases, plus loss of assessments.	The Habitat Conservation Plan and ODEQ TMDL processes may require SID to address water quality, water quantity and instream habitat needs.
Goal	Restore water supply reliability in spring & fall seasons.	Maintain financial stability in an urbanizing environment.	Respond to ESA & CWA implications and related costs.
Objectives	Restore 1000 AF of supply by: <ol style="list-style-type: none"> 1. Collaborate with other suppliers to obtain 1,000 AF. 2. Pipe/line canals/laterals. 3. Educate/train landowners on smaller parcels about irrigation methods & efficient water use. 	<ol style="list-style-type: none"> 1. Develop & implement urbanization plan focused on likely urbanization areas. 2. Develop opportunities to sustain SID operations & finance. 3. Develop solutions to offset potential assessment loss. 	SID has contributed 38 cfs to middle Deschutes flows in summer through four conservation projects.

3.6 Tumalo Irrigation District

3.6.1 District Characterization

Tumalo Irrigation District (TID) serves 680 accounts across 8,115 acres. Parts of the district have been urbanized, and the district delivers water to 7,425 acres for irrigation and 690 acres for domestic irrigation within the City of Bend. Patrons do not irrigate all of their land every year. During an average year, patrons lease 348 acres instream and fallow an additional 97 acres. The district has an average account size of 13 acres, reflecting the urbanized nature of portion of the district.

The DRC evaluated Tumalo Irrigation District’s Tumalo Feed and Bend Feed Canal diversions for 1992 through 2011. Data for 1998, 2006, and 2011 were either missing or unreliable and the DRC did not evaluate those years. During the evaluation period, Tumalo Irrigation District

Water Supply Goals and Objectives - Final Report

diverted an average of 45,725 af, or 5.63 af/ac (Figure 11, Table 9). The district delivered an estimated 25,149 af, or 3.10 af/ac, to farms (Table 9). All of their turnouts have meters and district staff measure or calculate any direct from the river diversions. Out of the water delivered to farms, an estimated 16,347 af, or 2.20 af/ac, was used by crops in irrigated areas excluding Bend domestic use (Figure 12).

Table 9. Tumalo Irrigation District Characterization, 1992 – 2011.

Approximate Total Acres	8,115 acres
Primary Water Sources	Tumalo Creek, Deschutes River, plus tributaries
Supplemental Water Sources	Crescent Lake
Storage Use	16,296 af; 2.01 af/ac; 2.19 af/ac irr. acres excluding Bend
Diversions	45,725 af; 5.63 af/ac; 6.16 af/ac irr. acres excluding Bend
Deliveries (estimated)	25,149 af; 3.10 af/ac; 3.39 af/ac irr. acres excluding Bend
Crop Water Use (estimated)	16,347 af; 2.20 af/ac irr. acres excluding Bend

Note: volumes and duties represent annual medians.

Tumalo Irrigation District diverts water from the Deschutes River and Crescent Lake through the Bend Feed Canal and from Tumalo Creek through the Tumalo Feed Canal. The district diverts an average of 19,909 af through the Bend Feed Canal and an average of 23,626 af through the Tumalo Feed Canal between 1992 and 2011. The district typically relies heavily on diversions through the Tumalo Feed Canal early in the irrigation season and shifts to relying more on diversions through Bend Feed Canal by mid-July (Figure 13).

Tumalo Irrigation District bills its patrons following the typical pattern in the upper Deschutes Basin. Patrons pay an account fee of \$625.00 and an additional fee of \$59.00 per acre. The district does not operate any hydropower facilities to offset its operating costs and is not currently considering any hydropower opportunities.

Water Supply Goals and Objectives - Final Report

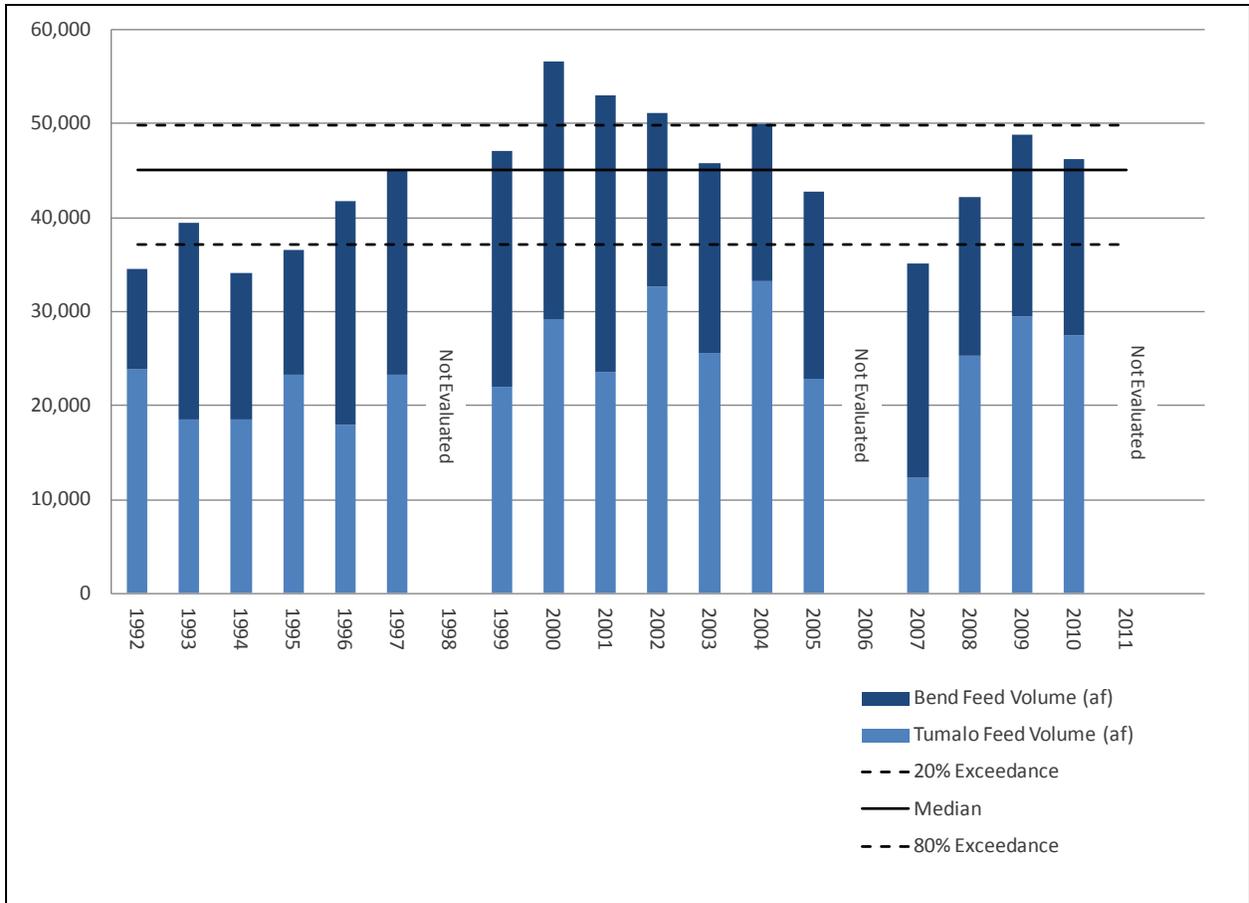


Figure 11. Tumalo Irrigation District’s Bend Feed and Tumalo Feed Canal annual diversions varied between 34,978 af and 56,577 af between 1992 and 2011. On average, the district diverted 45,149 af annual through these two canals. The DRC did not evaluate 1998, 2006, and 2011 due to unreliable or unavailable data.

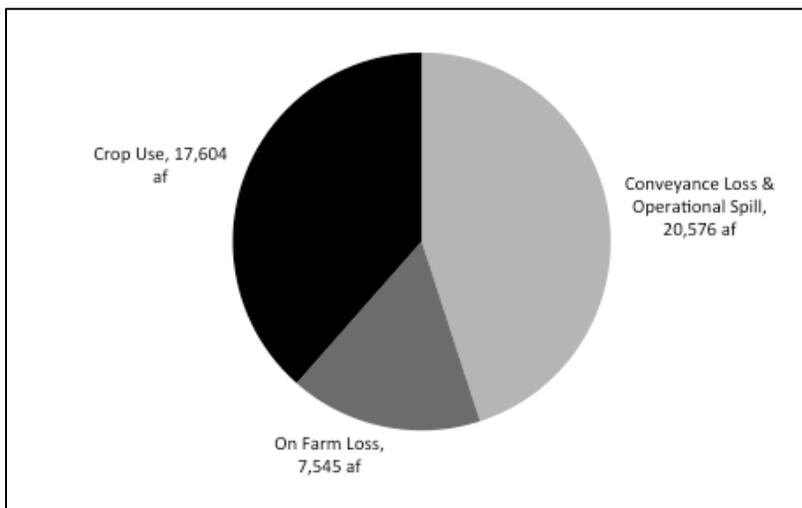


Figure 12. Conveyance loss and operational spill provide the greatest opportunities for efficiency improvements in Tumalo Unit Irrigation District.

Water Supply Goals and Objectives - Final Report

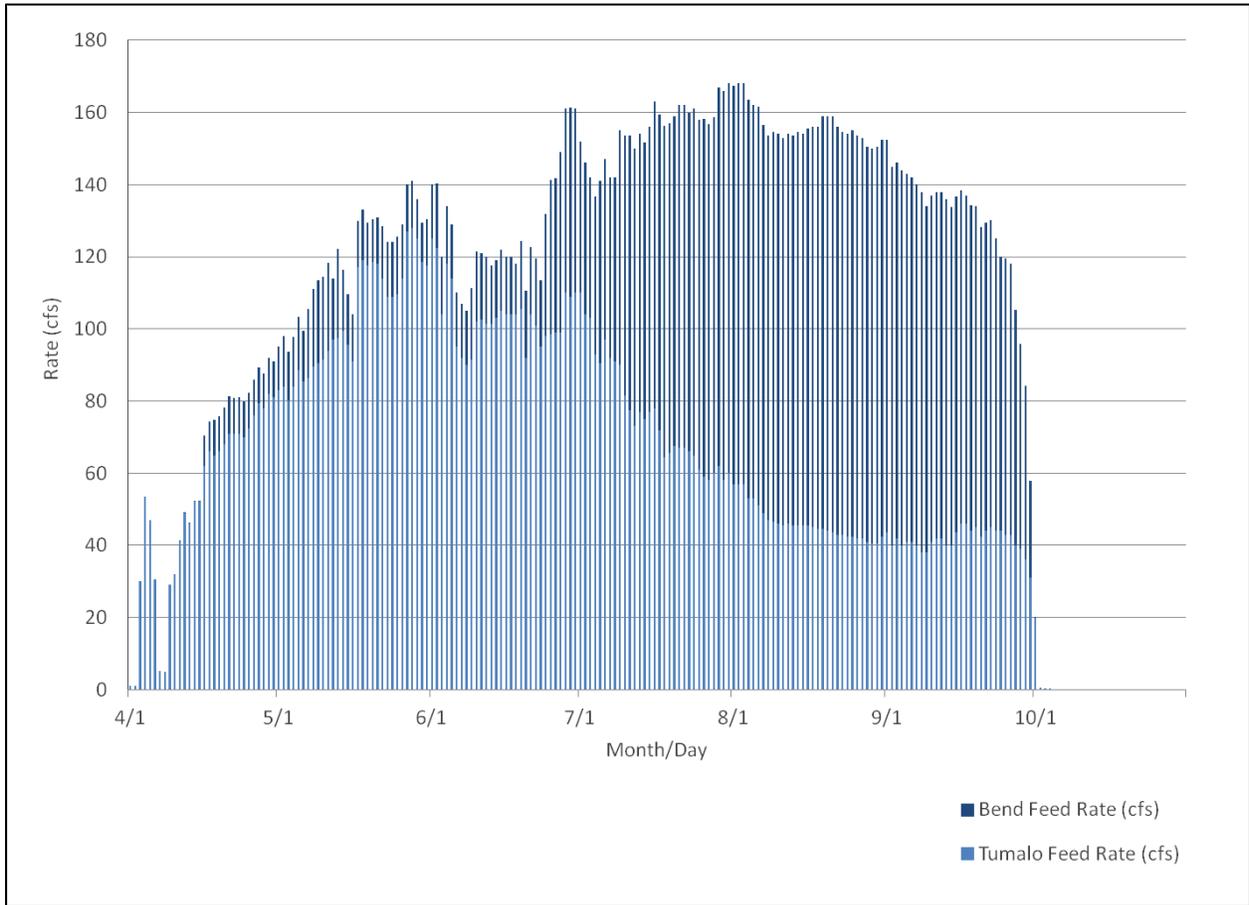


Figure 13. During a typical year, Tumalo Irrigation District relies heavily on diversions through the Tumalo Feed Canal early in the irrigation season. The district shifts to relying more on diversions through Bend Feed Canal by mid-July.

3.6.2 Challenges and Goals

Goal-setting is a critical process, tied to the more important issues, concerns and problems that TID wants to resolve. Therefore, the first steps in goal-setting are to clarify the more important problems facing the district, clearly define them, and then develop achievable goals for responding to them.

The more important issues facing TID relate to water supply and regulatory compliance. Other TID concerns include financial stability in light of increasing operations and maintenance costs and other relatively new costs in connection with regulatory issues. Key challenges facing TID and resulting goals are summarized herein.

Water Supply Challenges

TID relies on Tumalo Creek and its upper tributaries for its primary water supply. TID relies on Crescent Lake for supplemental storage supply. The district relies heavily on storage in spring and in peak July-September irrigation season. Wide diurnal flow variations in Tumalo Creek during the early season require use of Crescent Lake storage for consistent supply needs. Crescent Lake rarely fills, leading to a supply risk in dry years. The main problem during dry years is a deficiency in water delivery to farms due to extended drawdown of Crescent Lake storage. Deficiencies occur during multiple years of drought and they are exacerbated by seepage losses in canals. This results in uncertainty in water supply during longer-term droughts. Another problem is the untimely matching of supply with demand under wide variations of Tumalo Creek flows in the early season.

Drought impacts on TID water supplies depend on the volume of storage in Crescent Lake at the onset of drought conditions and duration of the drought. TID generally has an adequate supply for drought periods of 2 to 3 years and sometimes up to 4 years, depending on the volume of storage at the onset of the drought. However, TID is short on supply for drought periods of 5 years and longer. Records of Crescent Lake inflow and outflow maintained by TID reflect drought cycles on a frequency of roughly 10 to 11 years over the last 50 years. The duration of drought periods on the record ranges from 4 to 7 years, suggesting that TID can manage its supply and can improve its drought supply for most of these drought events through water conservation projects.

In the early season, Tumalo Creek flows are subject to temperature variations in the upper watershed. Warm temperatures induce snow melting, which increases runoff and creek flows. Cold temperatures induce snow and water freezing, which decreases runoff and creek flows. These conditions result in wide variations in creek flows. They require TID to rely on Crescent Lake in order to maintain supply that is consistent with demand. When freezing temperatures reduce creek flows, TID shifts to Crescent Lake to maintain consistent supply. The problem in this shift is the time lag for Crescent Lake water to arrive and maintain consistency in supply. It

generally takes about 5 or more days for water released from the lake to reach TID diversion. To avoid a gap in supply, TID monitors weather and temperature forecasts. If freezing conditions are in the forecast, it will release lake water early so that supply to its patrons is consistent through this weather and creek flow change. Flow that is released early from the lake that is not used by TID remains in the Deschutes River. This situation may also be an opportunity for other water suppliers or for instream flows to obtain additional supply under a water management program.

Goals

Concerns relative to water supply and regulatory compliance issues were considered by TID in its efforts to resolve them. These considerations lead to identification of goals that TID desires to achieve in response to these concerns. The resulting TID goals are presented below (Table 10).

Water Supply Goals and Objectives - Final Report

Table 10. Tumalo Irrigation District Goals

	Water Supply	Regulatory Compliance
Problem	TID relies on Crescent Lake storage and Tumalo Creek for primary supply. Heavy reliance is on storage in spring and then later during peak demand periods from July to September. Wide diurnal flow variations (freeze-thaw) in Tumalo Creek in early spring require the use of storage for consistent early-season supply. Crescent Lake rarely fills, leading to limited supply after successive dry years. TID can typically manage a 3-year drought. Droughts of 4 to 7-years may result in deficient supply.	The HCP and ODEQ's TMDL processes may ultimately require TID and the other Districts/City to address water quantity, quality and instream habitat needs. TID recognizes this potential responsibility and is concerned about the implications it might bring in the future. It is noteworthy that TID has already restored flows in the 9 miles of Tumalo Creek upstream from its existing diversion and augmented the flows in the reach downstream from its diversion by approximately 10 cfs. Before this work, both reaches were essentially dry during summer months.
Goal	Increase reliability of water supply in drought years.	Recognize and account for regulatory activities, and manage potential adverse impacts on TID operations.
Objectives	Decrease seasonal storage withdrawals to preserve long term storage volumes in Crescent Lake.	<ol style="list-style-type: none"> 1. Implement conservation projects to augment flows in Tumalo Creek downstream from the TID diversion to 20 cfs at completion of Tumalo Feed Canal Project, with potentials to exceed 30 cfs with the completion of other longer term projects 2. Implement conservation projects to add on to the 5 cfs flow augmentation in Crescent Cr. through prior TID projects and bring total augmentation volume to 2,700 af (maximum potential augmentation flow rate of 13 cfs depending on ODFW flow management).
Proposed Actions	<ol style="list-style-type: none"> 1. Reduce diversions through conservation projects from present peak range of 165-172 cubic feet per second (cfs) to potential target peak diversion of 140 cfs. This target corresponds to approximate conveyance efficiency of around 100 percent and would reduce the annual average diversion volume by about 11,000 to 12,000 af. 2. Increase operational efficiencies to the point where TID stores more water, on average, than it would require for District operation. 	<ol style="list-style-type: none"> 1. Implement conservation projects to augment flows in Tumalo Creek downstream from the TID diversion to 20 cfs at the completion of Tumalo Feed Canal Project, with potentials to exceed 30 cfs with the completion of other longer term projects 2. Implement conservation projects to add on to the 5 cfs flow augmentation in Crescent Creek through prior TID projects and bring total augmentation volume to 2,700 af (corresponding to a maximum potential flow augmentation rate of 13 cfs depending on ODFW flow management).

4 MUNICIPALITIES

Using water resources as efficiently as possible to meet multiple water supply objectives, including the needs of agricultural and instream interests, has long been an important issue in the Deschutes Basin. More recently, growing demand for municipal water supplies has forced water management decision makers to consider a new set of issues. These include the impacts of urbanization on agricultural water users, meeting new regulatory requirements when reallocating water supplies, and ensuring a long-term water supply for communities while protecting the natural resource based amenities that draw people to the region.

Increasing populations and associated water demands in the upper Deschutes Basin increase the potential for conflict over water supplies, water quality, flow depletion and irrigation district urbanization. Basin water suppliers and other stakeholders have two choices: let things sort themselves out on their own or implement proactive measures that resolve any issues. The DWA's planning efforts show that mutually beneficial opportunities exist for irrigation districts, municipalities and flow restoration interests to deal with their water supply needs and other related issues. This knowledge provides a clear basis for a collaborative process that responds to these issues and the growing conflict potential.

Water supply for future needs of the municipal and urban community suppliers in the upper Deschutes Basin has become more uncertain in light of rapid population growth and associated water demands and increasing complexity in obtaining ground water rights to meet present and future demand. Municipal and urban suppliers in the upper Deschutes Basin rely primarily on ground water. The availability of ground water for future needs is tied to availability of other existing surface water rights that can be retired and transferred instream to mitigate the impacts of ground water pumping on surface waters.

The added complexity associated with obtaining new groundwater rights increases uncertainty for municipal and urban community suppliers. They need to meet 20-year supply requirements, an objective made more challenging by ground water mitigation requirements. This uncertainty means that water suppliers must collaborate with other water users to meet their future supply needs. The collaboration process must account for the needs of the various suppliers and stakeholders.

Collaborative problem-solving must begin with clearly defined goals and objectives. The following sections outline goals, objectives and challenges for the Cities of Bend, La Pine and Redmond, the Avion Water Company, and Deschutes Valley Water District.

4.1 Challenges and Goals

Municipal and urban community water suppliers must maintain the capacity to supply clean, economical water to their customers. Capacity requirements change with growth in population

and industry. Growth trends help the suppliers project their future needs, plan for them, and expand supply and infrastructure as needed.

Municipal and urban community water suppliers are required by law to provide for water supply out to 20 years in the future. Rapid growth, shifts in growth trends and water demand, and availability of supply sources bring significant challenges to municipal and urban community water suppliers in the upper Basin.

The listed municipal and urban community suppliers all rely on ground water for supply. The City of Bend also relies on surface water with the advantage of a dual water source. Deschutes Valley Water District also relies on surface water from Opal Springs for part of its supply. The spring is fed by the aquifer system that supplies its wells. Although ground water is physically available in the regional aquifer system of the upper Deschutes Basin, certainty in its availability at the present time as a supply source depends on whether suppliers can satisfy the mitigation requirements for new ground water permits under Oregon Administrative Rules 690-505.

Mitigation for new ground water uses is intended to offset the impacts of ground water pumping on surface waters and other senior water rights. This requirement is based on hydrologic connectivity between the aquifer system and surface waters. Mitigation is required for the volume of ground water use that is actually consumed and does not return to the hydrologic system. This volume is in the general range of 40 to 60 percent of the total annual volume of ground water withdrawn for municipal and quasi-municipal use.

Presently, mitigation is achieved by retiring an existing, valid surface water right and transferring the right back to its source stream. The right is then protected as an instream water right. In general, 1.8 af of water or 1.8 mitigation credits are issued for a one acre irrigation water right in the upper Deschutes Basin. The number of water right acres needed for a given mitigation obligation depend on the amount of the proposed ground water use and consumption volume. This situation means that a new ground water use can be allowed if an existing out of stream water use of equal consumption volume is discontinued. A new ground water use can also be allowed if an existing ground water use in equal consumption volume is discontinued.

The ability to satisfy a mitigation obligation for a new ground water permit depends on the availability of valid water rights with the appropriate volume, timing and location. Ground water pumping can affect different streams or stream reaches in the upper Deschutes Basin, depending on the location of the pumped well relative to streams or stream reaches. For example, well pumping in the upper Deschutes River subbasin requires mitigation in the Upper Deschutes Zone of Influence. Well pumping in the Bend-Redmond area requires mitigation in the General Zone of Influence (general Central Oregon area). Well pumping east of Redmond, in the Powell Butte and Terrebonne areas, and in Prineville requires mitigation in the Crooked River Zone of Influence.

A critical challenge to a municipal and urban community supplier using ground water is being able to satisfy its mitigation obligation for 20 years into the future considering the constraints on water availability for mitigation, timing of availability, and location of the mitigation water relative to zone of influence. These factors increase uncertainty relative to future water supplies. An additional challenge is the 200 cfs cap on new ground water permits established by the OWRD. This cap has been reached with a total of about 14,000 af of mitigation obligations for the various permit applications. Unless this cap is adjusted to allow for more ground water permits, uncertainty exists in the ability of municipal and urban community suppliers to meet their 20-year supply requirement.

Challenges facing individual suppliers who have a direct link to the Initiative and their associated goals appear below.

4.1.1 Avion Water Company

The Avion Water Company (Avion) is an Oregon Corporation and a fully regulated Class A Water Utility Company. It relies on ground water withdrawn from the upper Basin regional aquifer system. Ground water rights presently held by Avion will be fully exercised by approximately 2020 to 2023 and additional rights will be required. Avion has two more recent ground water permits with a plan for incremental mitigation as more water is withdrawn under these permits. Avion must provide mitigation in the General Zone of Influence.

Avion concerns include those described in the above “Challenges” section. One Avion concern in particular is the 200 cfs cap on ground water use authorized under the mitigation program. This cap has been reached by ground water uses requested under pending permit applications and authorized under the final order and permits issued. Avion’s concern is that the filled cap may preclude ground water as an option for long-term water supply.

Avion’s immediate water supply goal is to secure mitigation water in the volume it needs at the time it needs it. The approximate timeline for mitigation need based on Avion’s incremental mitigation need is shown on the attached Figure.

4.1.2 City of Bend

The City of Bend has ground water rights that authorize the use of up to 68.24 cfs. Certificated rights authorized up to 31.43 cfs and permits authorize the remaining 36.81 cfs of the total. The most recent permits obtained by the City authorize the use of up to 24.0 cfs in total. Mitigation is required for both of these permits and the City intends to meet this obligation through an incremental mitigation plan. Its total mitigation obligation is 3,223 mitigation credits (or 3,223 af). The City must provide mitigation in the General Zone of Influence.

A fundamental concern of the City is the uncertainty in obtaining additional ground water permits for future needs. This concern stems from the factors discussed in the above “Challenges” section. Similar to Avion, the City is concerned about the cap on ground water use under the mitigation program and uncertainty it brings in using ground water for its long-term

water supply. As for Avion, the City is concerned that the filled cap may preclude ground water as an option for long-term water supply.

The City's immediate water supply goal is to secure mitigation water in the volume it needs at the time it needs it. The approximate timeline for mitigation need based on the City's incremental mitigation need is shown on Figure 14.

4.1.3 Deschutes Valley Water District

The Deschutes Valley Water District (DVWD) supplies water to Culver, Madras and Metolius in Jefferson County. The DVWD depends on ground water and surface water for its supply.

DVWD diverts surface water from the lower Opal Springs near the bottom of the 900-foot deep Crooked River canyon about one-half mile upstream from Lake Billy Chinook. The DVWD also appropriates ground water from three wells at the Opal Springs facilities. The aquifer supplying the wells is under artesian pressure and also supplies water to Opal Springs.

The DVWD appropriates ground water under a new permit that requires mitigation. The DVWD intends to provide the required mitigation under an incremental plan. Concerns of the DVWD include those described above under "Challenges". Other challenges it faces include fish passage provisions at its hydropower dam on the Crooked River and a new pipeline from the Opal Springs facilities to the reservoirs at the top of the Crooked River Canyon.

One DVWD goal relative to water supply is to evaluate options for improving effectiveness of using its surface and ground water rights. This evaluation includes consideration of options for responding to its mitigation needs for the ground water permit considering issues described above under "Challenges". A second water supply goal is to secure its mitigation water in the volume it needs at the time it needs it. The basis for this goal is need for certainty in mitigation supply as reflected in general concerns of other municipal water providers described above under "Challenges". The approximate timeline for mitigation need based on the DVWD's incremental mitigation plan is shown on Figure 14.

4.1.4 City of La Pine

The City of La Pine relies fully on ground water for its supply. Provision for future ground water supply is available under a Final Order issued by the OWRD in response to the City's prior application for a new ground water permit. Mitigation is required before the permit can be issued by the OWRD. The City plans to meet its mitigation obligation through an incremental mitigation plan.

The City's water supply goal is to secure mitigation water in the volume it needs, at the time it needs it. Mitigation must be achieved in the Little Deschutes Zone of Impact. Availability of water for mitigation in this zone at a reasonable cost is highly uncertain due to lack of water rights available for this purpose. Accordingly, the City has interest in a collaborative plan with irrigation districts to acquire its mitigation water. This may be possible through a combination of conservation projects and the allocation of stored water from Crescent Lake to instream use. The

Water Supply Goals and Objectives - Final Report

goal in this regard is to create mitigation credits for water transferred to instream use in Crescent Creek, then to the Little Deschutes River. The approximate timeline for mitigation need based on the City’s incremental mitigation plan appears below (Figure 14).

4.1.5 City of Redmond

The City of Redmond relies fully on ground water for its supply. The City holds permits and certificated water rights that allow its use of ground water. The City’s maximum day demand was approaching its maximum water rights limitation and the City applied for a new ground water permit in 1999 to augment supply for future needs. The Final Order was issued in 2009 with a mitigation obligation of 1,746 credits in the General Zone of Impact. The City has provided 102 mitigation credits toward this obligation and is presently in the process of developing the remaining 1,644 mitigation credits from Central Oregon Irrigation District water rights utilized by the City. The City’s goal relative to water supply is to meet the full mitigation obligation in one step and obtain its new ground water permit for an additional appropriation rate of 25 cfs.

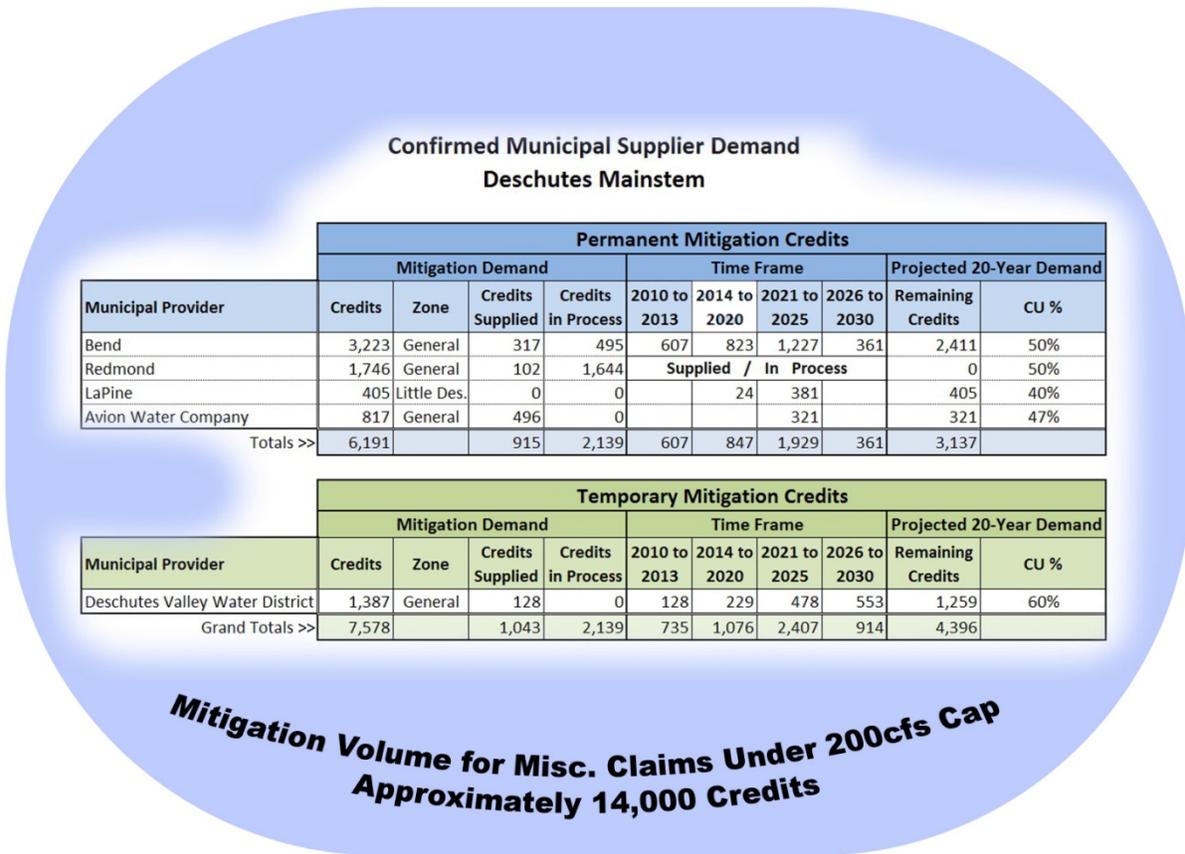


Figure 14. Confirmed municipal supplier mitigation demand along the mainstem Deschutes River.

5 ENVIRONMENT

5.1 Characterization

The upper Deschutes River is characterized in the Upper Deschutes River Background Paper (Appendix A). Information characterizing the Little Deschutes River System, Crescent Creek, and Tumalo Creek is forthcoming.

5.2 Challenges and Goals

Several agencies (US Forest Service, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, and US Fish and Wildlife Service) have been in discussions to characterize instream flow needs and to recommend instream goals for this initiative. It is widely accepted amongst these agencies that flow restoration that brings the river closer to its natural flow regime will incrementally improve the potential for the restoration of physical and ecological processes associated with the river. The long-term goal of these agencies is to move as far as possible towards the natural hydrograph in target reaches while maintaining the interests of other water users.

For the purposes of this initiative, the existing instream water rights are considered reasonable flow goals (Table 11). The Oregon Department of Fish and Wildlife (ODFW) has applied for and received instream water rights to support aquatic life in most reaches of the Deschutes Basin. The targets were set as minimum flows to support salmon and trout populations.

A number of assessments of flow-habitat relationships in the upper Deschutes system are planned or on-going, and are expected to inform outcomes associated with instream flows. These include assessments of Oregon spotted frog habitat under the Habitat Conservation Plan, the relationship of the flow regime to water quality; and further examination of the relationship of flow to additional fish life cycle stages, channel geomorphology, and potential for active channel restoration.

The agencies recognize that the actual incremental resource benefits realized through flow restoration will ultimately be discovered through monitoring. If the stakeholders are successful in meeting existing instream water rights and monitoring ecological outcomes, they will have learned a lot about flow-habitat relationships in the river. This information will inform future restoration goals for this or other voluntary initiatives.

Water Supply Goals and Objectives - Final Report

Table 11. Instream water rights in the mainstem Deschutes River and tributaries.

Source	From	To	Certificate	Priority Date	Instream Rates (cfs)											
					Jan-Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Upper Deschutes R	Wickiup Reservoir	Little Deschutes	59776	11/3/1983	300	300	300	300	300	300	300	300	300	300	300	
Upper Deschutes R	Little Deschutes	Spring River	59777	11/3/1983	400	400	400	400	400	400	400	400	400	400	400	
Upper Deschutes R	Spring River	North Canal Dam	59778	11/3/1983	660	660	660	660	660	660	660	660	660	660	660	
Little Deschutes R	Crescent Creek	Mouth	73226	10/11/1990	200	236	240	240	200	126	74.5	92.2	116	164	196	
Crescent Creek	Crescent Lake	Mouth	73234	10/11/1990	75	125	125	125	75	50	50	50	50	108	125	
Tumalo Creek	S. Fk. Tumalo	Mouth	73222	10/11/1990	47	68.7	76.6	82	47	32	32	47	65.3	47	47	
Middle Deschutes R	North Canal Dam	Round Butte Res	Pending	9/24/1990	250	250	250	250	250	250	250	250	250	250	250	