North Unit Irrigation District

Water Management and Conservation Plan

May - 2022

OAR 690, Division 086 (2002)

Prepared By

North Unit Irrigation District

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1. SYSTEM DESCRIPTION (OAR 690-086-0240)

1.1 History and Location

1.1.1 Brief History of the North Unit Irrigation District

The area around Madras was devoted exclusively to grazing for sheep and cattle during the early settlement years of the 1870s and 1880s. This was gradually replaced with dryland wheat farming on nearly 80,000 acres with the growth of the communities of Madras, Culver, and Metolius. Early on, yields were good; however, by the 1930s, during a series of dry years, dryland wheat production became unprofitable, and many farms were forced to discontinue operations. Early settlers acquired average landholdings of 160 acres under the Timber Culture and Desert Lands Act, but with reduced wheat yields, ownership of land became concentrated in fewer, larger, parcels.

Schemes for irrigating the area around Madras were formulated as early as 1913. North Unit Irrigation District was developed as part of the Deschutes Project to provide irrigation water to lands in the vicinity of Madras. In 1914, a comprehensive report was issued under the joint sponsorship and financing of the State of Oregon and the Federal Government. North Unit Irrigation District (NUID) was formed in 1916, and later issued bonds to finance the investigation and construction of a project that would irrigate 133,000 acres. Private consulting engineers, F. C. Herrmann, and A. J. Wiley investigated irrigation possibilities for NUID from 1917 to 1921. The results of this investigation were covered in a report dated April 1921. However, due to financial constraints, the investors originally considering funding the project did not undertake construction.

The U. S. Bureau of Reclamation (BOR) then reviewed the Herrmann-Wiley plan and supplemented it with a brief field study in 1921. This was followed by another study in 1924 under joint sponsorship of the State of Oregon and the Bureau of Reclamation. The district was known as the Jefferson Water Conservancy District in 1924, however, was renamed “North Unit Irrigation District” a few years later. BOR published a comprehensive study in 1936 of all storage possibilities above where Crooked River enters the Deschutes River. It was this report upon which project authorization was based.

The project was authorized by a finding of feasibility by the Secretary of the Interior dated September 24, 1937, and approved by the President on November 1, 1937. Construction commenced in 1938 on the Main Canal and in 1939 on Wickiup Reservoir.

World War II delayed the completion of other features until 1949. Haystack Reservoir construction began in 1956 and was completed in 1957. Operation and maintenance of NUID, including Wickiup Reservoir, was transferred to NUID on January 1, 1955.

Water was made available to the first block of ground in May 1946. The project furnishes irrigation water for about 59,000 acres of land within North Unit Irrigation District in the vicinity of Madras, north of Crooked River and East of Deschutes River, in Jefferson County, OR.

A 5-member board of directors, each elected for a 3-year term, sets policy for the district. Policy is carried out by the district manager. The board meets monthly or more often if necessary. The annual budget (prepared by the manager and staff), non-budgeted construction, and other major items must be approved by the board. The district prepares an annual report that includes the amount of water diversion, amount of water delivery, acreage irrigated, and crops grown. The district also provides a yearly report to OWRD of total water use.

The district serves 985 irrigation accounts.

1.1.2 Location, Climate, Maps, etc. (refer to Figure 1 – District Map)

NUID area occupies a lava plateau in the Deschutes River drainage basin, adjacent to the right or east bank of the Deschutes River, and north of Crooked River. Soils are typically shallow overlying rock. Elevations of the irrigated lands range from approximately 2,200 to 2,800 feet above sea level, and slope gently downward from south to north.

Climate in the area is generally characterized by low annual precipitation, moderate temperatures, and a relatively short growing season. Based upon the Madras Station (US Weather Bureau cooperative weather station previously located at the district office), average annual precipitation is 11.1 inches, with only 1.1 inches falling during the months of June, July and August. July temperature averages 66 ºF with an average annual growing season of 120 +/- days. However, it is not uncommon to experience frost in May, June and September. Irrigation is required to provide the desired yield and/or quality of all locally grown crops.

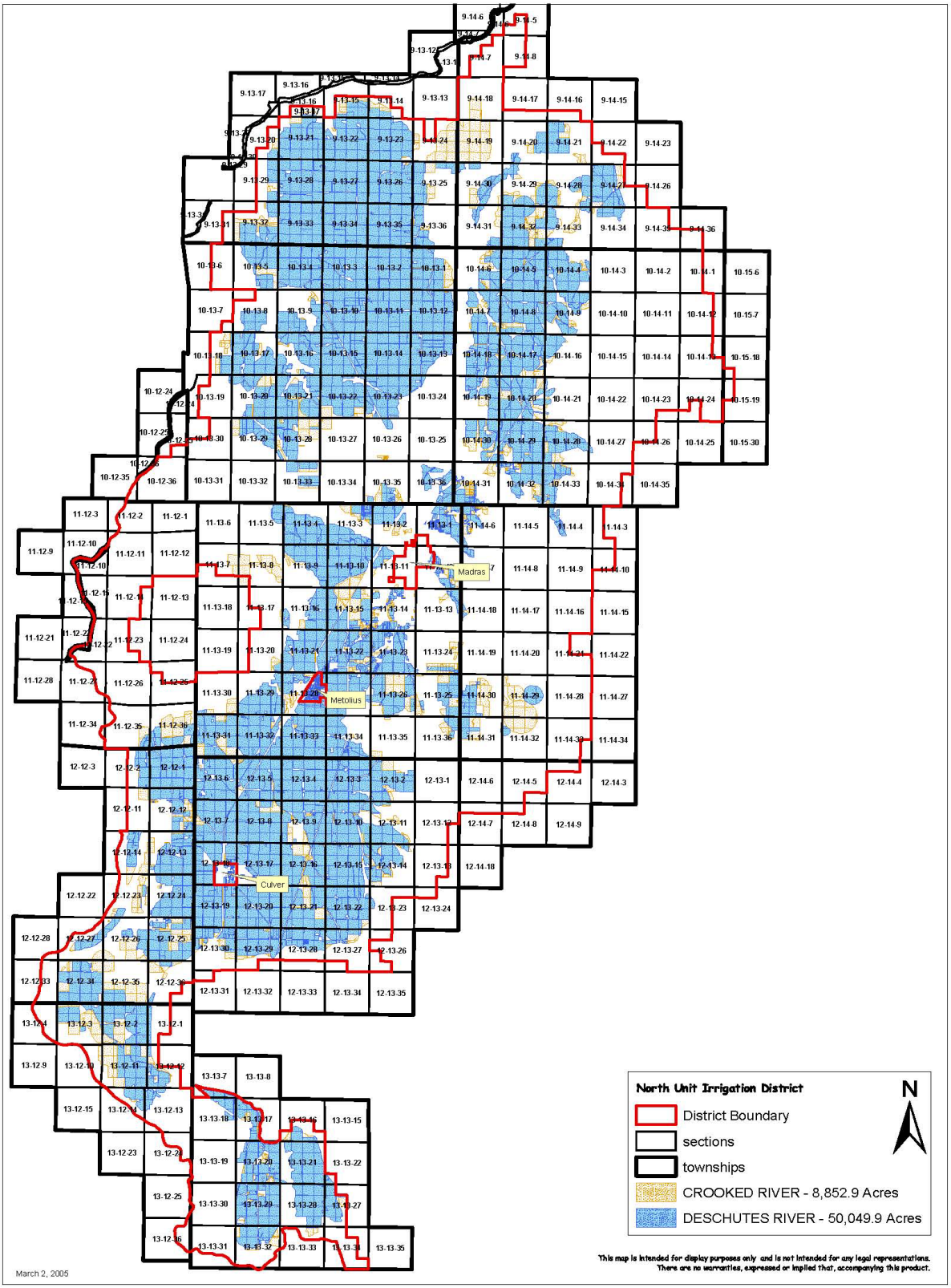


Figure 1 – District Map

1.2 Water Rights (OAR 690-086-0240 (1))

Water rights in the Central Deschutes area have become well-established during the past 100 years and are the basis for the present use of water. Events establishing the extent of water rights in the basin have been:

a. The adjudication proceedings for Tumalo Creek in 1911, Crooked River in 1914, Deschutes River in 1928, and subsequent modifications.
b. The State Engineers withdrawal of the Deschutes River in 1913 and the Crooked River in 1914.

Detail water rights for NUID include the following:

Right	Certificate	Permit	Season	Use	Acres	Rate/ Duty	Diversion Rate (cfs)	POD	Certificate / Permit Priority Dats
Deschutes Primary	72279 & 72280	S-23196	April 1 - October 31	Irrig	50,049.90	1/40 cfs, 5 1/4 AF, acre	1,101.00	Deschutes River, Wickiup & Haystack Reservoirs	February 28, 1913
Deschutes Primary	94079	S-23196	April 1 - October 31	Irrig	3,152.00	2 1/2 AF, acre	1,100.50	Deschutes River, Wickiup & Haystack Reservoirs	February 28, 1913
Deschutes Primary	93422	S-54930	April 1 - October 31	Irrig	520.00	4.04 cfs, 2 1/2 AF, acre	1,300.00	Deschutes River & COID North Canal	October 31, 1900 & December 2, 1907
Deschutes Primary	CW115	S-33954	April 1 - October 31	Irrig	642.10	18.56 cfs, 2 1/2 AF, acre	1,100.15	Deschutes River & COID North Canal	December 16, 2020
Deschutes Supplemental	72281 & 72282	S-25921	April 1 - October 31	Irrig	49,999.90	1/40 cfs, 4.0 AF, acre	200.00	Crooked River	June 23, 1955
Crooked River Primary	95488	S-33954	April 1 - October 31	Irrig	4,522.80	1/40 cfs, 4.0 AF, acre	200.00	Crooked River	September 18, 1968
Crooked River Primary	88877	S-33954	April 1 - October 31	Irrig	92.30	1/40 cfs, 4.0 AF, acre	201.00	Crooked River	September 18, 1968
	51229	R-1677	April 1 - October 31	Instream Lease 1770 / Storage	200,000.00			Deschutes River, a tributary of the Columbia River	February 28, 1913
	51230	R-1754	April 1 - October 31	Storage	5,650.00			Deschutes River, a tributary of the Columbia River	July 12,1955
Deschutes Primary	CW75, 80936, CW24, 94079, T-13554	S-23196	April 1 - October 31	Irrig	3,178.80	18.56 cfs, 2 1/2 AF, acre	1,100.15	Deschutes River, Wickiup & Haystack Reservoirs	February 28, 1913
Incoate/Crooked River	80937, CW24, 95488, CW102, CW115	S-33954	April 1 - October 31	Irrig					
Deschutes Primary	90217	R-11857	April 1 - October 31	Storage	50.00			Haystack Draw,a tributary of the Deschutes River	January 6, 1989
Deschutes Primary	93422, T13971, CW81	S-54930	April 1 - October 31	Irrig	920.00	4.049 cfs, 2.5 AF, acre		Deschutes River, a tributary of the Columbia River	
Deschutes & Crooked	89653, PC899, 88994, PC895		April 1 - October 31	Hydraulic				Deschutes River, Crooke River, Wickiup & Haystack Reservoirs	November 18, 2014

	Certificate Number	Use	Acres	Rate/Duty	Diversion Rate (cfs)
Deschutes					
Primary	72279 & 72280	Irrig	50,049.9	1/40 cfs / 5 ¼ AF / acre	1,101.0
Primary	94079	Irrig	3,152.0	2 ½ AF / acre	1,100.5
(POD is Deschutes River, Wickiup Reservoir and Haystack Reservoir) [1]					
Primary	93422	Irrig	520.0	4.04 cfs / 2 ½ AF / acre	1,300.0
Primary	CW115	Irrig	642.1	18.56 cfs / 2 ½ AF / acre	1,100.15
(POD is Deschutes River, and COID North Canal) [1]					
Supplemental	72281 & 72282	Irrig	49,999.9	1/40 cfs / 4.0 AF / acre	200.0
(POD is Crooked River) [1]					
Crooked River					
Primary	95488 & 88877	Irrig	4522.8	1/40 cfs / 4.0 AF / acre	200.0
(POD is Crooked River) [1]					
"	"	"	Ind.	5.0	1/40 cfs / 4.0 AF / acre	200.0

1 62 River Miles from 1st POD at Wickiup Reservoir to 2nd at Bend Diversion, then 26 Canal Miles to 3rd at Crooked River

Certificate/Permit Priority Dates

Certificate 72279/72280/80936 = Priority Date - February 28, 1913
Certificate 72281/72282 = Priority Date – June 23, 1955
Certificate 94079 = Priority Date – February 28, 1913
Certificate 93422 = Priority Date – October 31, 1900 & December 2, 1907
Certificate 95488/88876*/80937 = Priority Date – September 18, 1968
*As a result of CW-81 Certificate 88876 was superseded by a RR for CW-115 issued: C-95491 and holds a September 19, 1968 priority date.
Permit 47284 = Priority Date – October 21, 1982

In addition to the above certificates & permits, NUID holds several water rights that authorize the storage of water. The following describes those water rights held by NUID:

Permit R-11857
Date of Priority: January 6, 1989
Source: Haystack Draw, a tributary of the Deschutes River
Storage Facility: Haystack Reservoir
Allowed Use: Storage for multipurpose, non-consumptive including wildlife, fish habitat and recreation.
Volume Allowed: 50.0 acre-feet each year

Certificate 51229
Date of Priority: February 28, 1913
Source: Deschutes River, a tributary of the Columbia River
Storage Facility: Wickiup Reservoir
Allowed Use: Storage for irrigation and domestic, subject to the terms and conditions of State Engineer's Orders dated January 20, 1955 and February 4, 1955
Volume Allowed: 200,000 acre-feet each year

Certificate 51230
Date of Priority: July 12, 1955
Source: Deschutes River, a tributary of the Columbia River
Storage Facility: Haystack Equalizing Reservoir
Allowed Use: Storage for irrigation
Volume Allowed: 5,650 acre feet

Pending Water Right Actions

On April 1st, 2015 NUID submitted a Conserved Water Application (CW-115) to the Oregon Water Resources Department for the West-F Lateral Piping Project. The CW-115 will affect NUID Certificate 90177, and COID Certificate 83571. Further discussion on CW-115 and its benefits are discussed in Section 2.5 of the Water Management and Conservation Plan.

1.3 Source of Water (Storage and Regulation Facilities; and Summary of Transfer, Rotation, Exchange, or Intergovernmental Agreements) (OAR 690-086-0240 (2))

Streamflow is available up to April 15 and after October 15, and during the summer months, but only when the natural flow of the river exceeds 1,500 cfs. Other Central Oregon irrigation districts have prior rights to the natural streamflow.

Storage for NUID is provided in Wickiup Reservoir on the main Deschutes River, about 35 miles southwest of Bend. The reservoir has a capacity of 200,000 AF of storage and has an approximate 11,200 acres of surface area. Wickiup Reservoir is located in the upper part of the Deschutes River basin within the Deschutes National Forest. Releases from this reservoir in addition to releases from Crane Prairie Reservoir (water supply for Central Oregon Irrigation District, Arnold Irrigation District and the Crook County Improvement District (Lone Pine)) and Crescent Lake (water supply for Tumalo Irrigation District) provide a robust live river flow in the Deschutes River to and through Bend, Oregon during the irrigation season.

Each year the district files a Limited Water Use License with OWRD for 10,000 AF of stored water in Prineville Reservoir and enters into a Temporary Water Service Contract with the Bureau of Reclamation. This water is pursuant to section 4 of the Crooked River Collaborative Water Security and Jobs Act of 2014. This water is used to shore up NUID's water supply and can be injected into the system within 24 hours of release. The water is stored in Prineville Reservoir near Prineville Oregon and released by the Bowman Dam into the Crooked River. NUID has a pumping facility near Terrebonne, Oregon that lifts the water approximately 180' out of the Crooked River and deposits the water directly into the NUID main canal system.

In addition to the storage in Wickiup and Prineville Reservoirs, there is 5,650 AF of regulating storage in Haystack Reservoir. This reservoir provides off-stream storage and acts as a re-regulating reservoir at a very key location in the project.

Wickiup Reservoir has developed into a highly used recreation facility as well as a premium fishing resource facility in the upper Deschutes River basin. It is also heavily used by migrating waterfowl. Haystack Reservoir also provides recreation facilities and is used by many local people.

District Water Delivery Contracts and Agreements

On January 1, 2021 as part of the Endangered Species Act (ESA) NUID entered into a 30-year agreement with US Fish and Wildlife (USFWS), to institute a 30-year Habitat Conservation Plan (HCP). The HCP establishes a framework for district operations at Wickiup Reservoir and sets specific Deschutes River and Crooked River flow requirements. See 1.10 for additional HCP information.

The amended Inter-district Contract of 1938 covers the storage and use of water from Crane Prairie and Wickiup Reservoirs with the emphasis on Habitat Conservation Plan compliance.

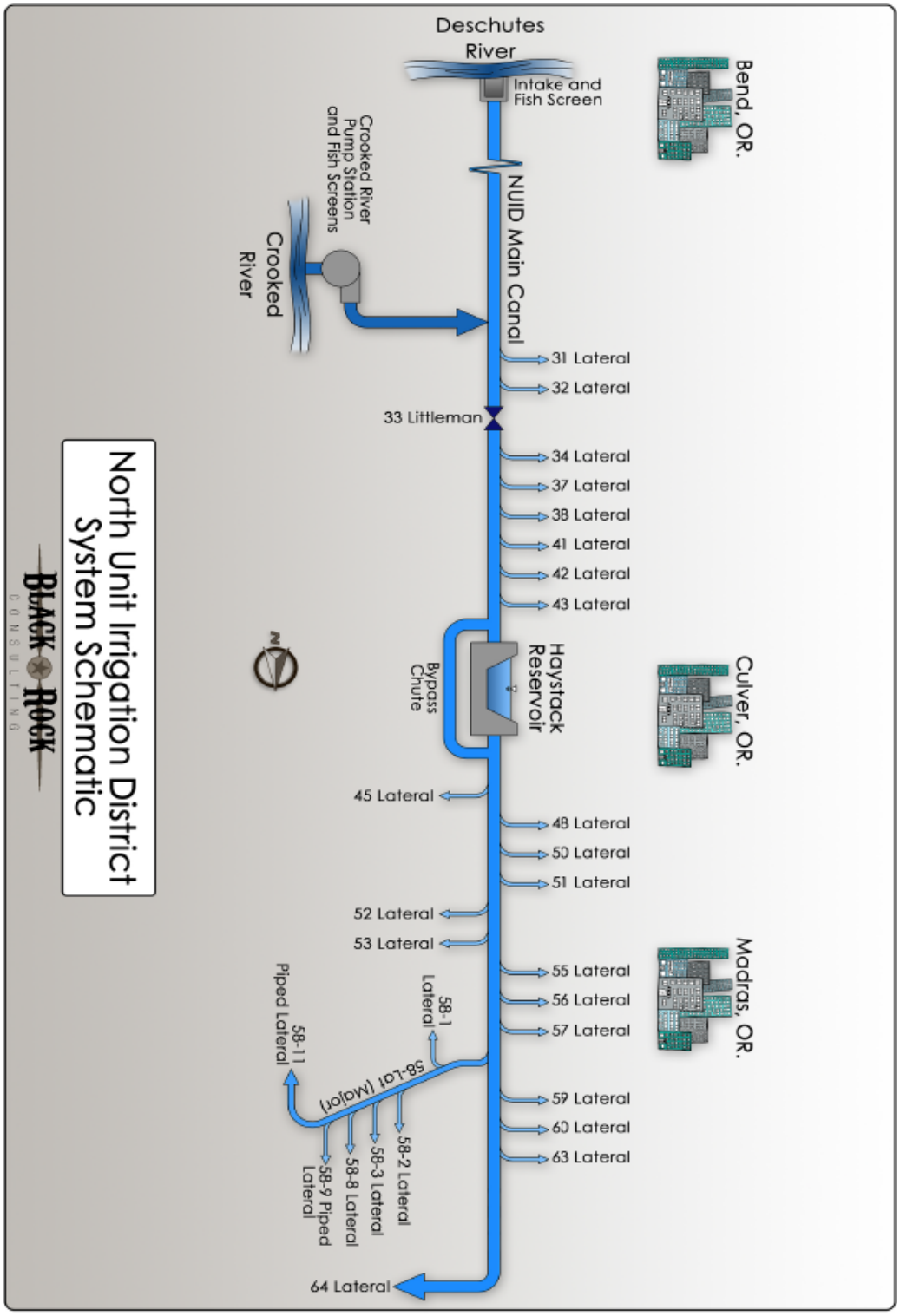
The State Engineer in 1955 ordered that the minimum release from Wickiup Reservoir shall be such that the flow of Deschutes River at Gaging Station No. 3136 shall not be less than 20 cfs.

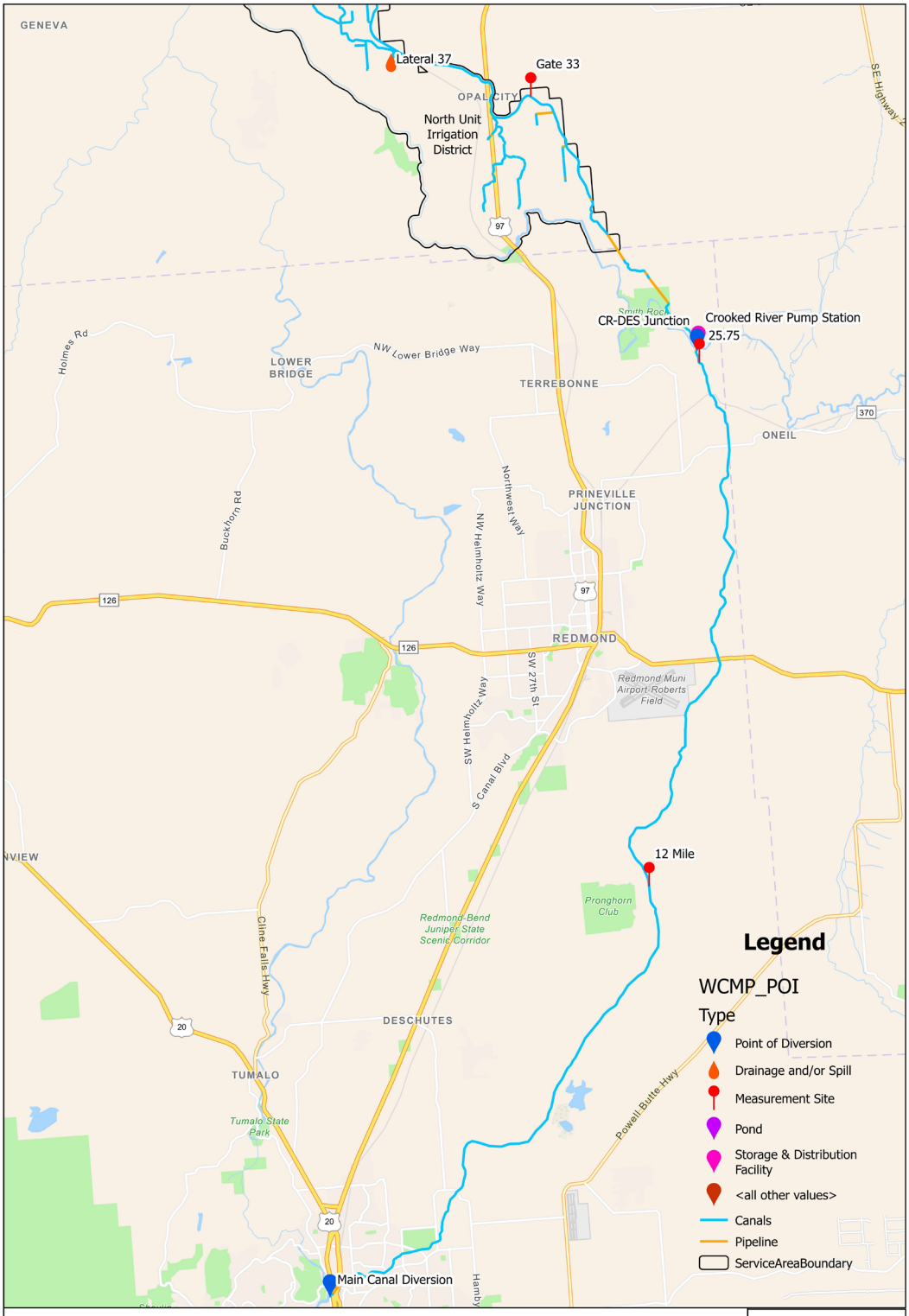
The AMENDATORY REPAYMENT CONTRACT between NUID and the Department of the Interior – Bureau of Reclamation dated February 13, 1954 (amended Public Law 110-229 May 8, 2008).

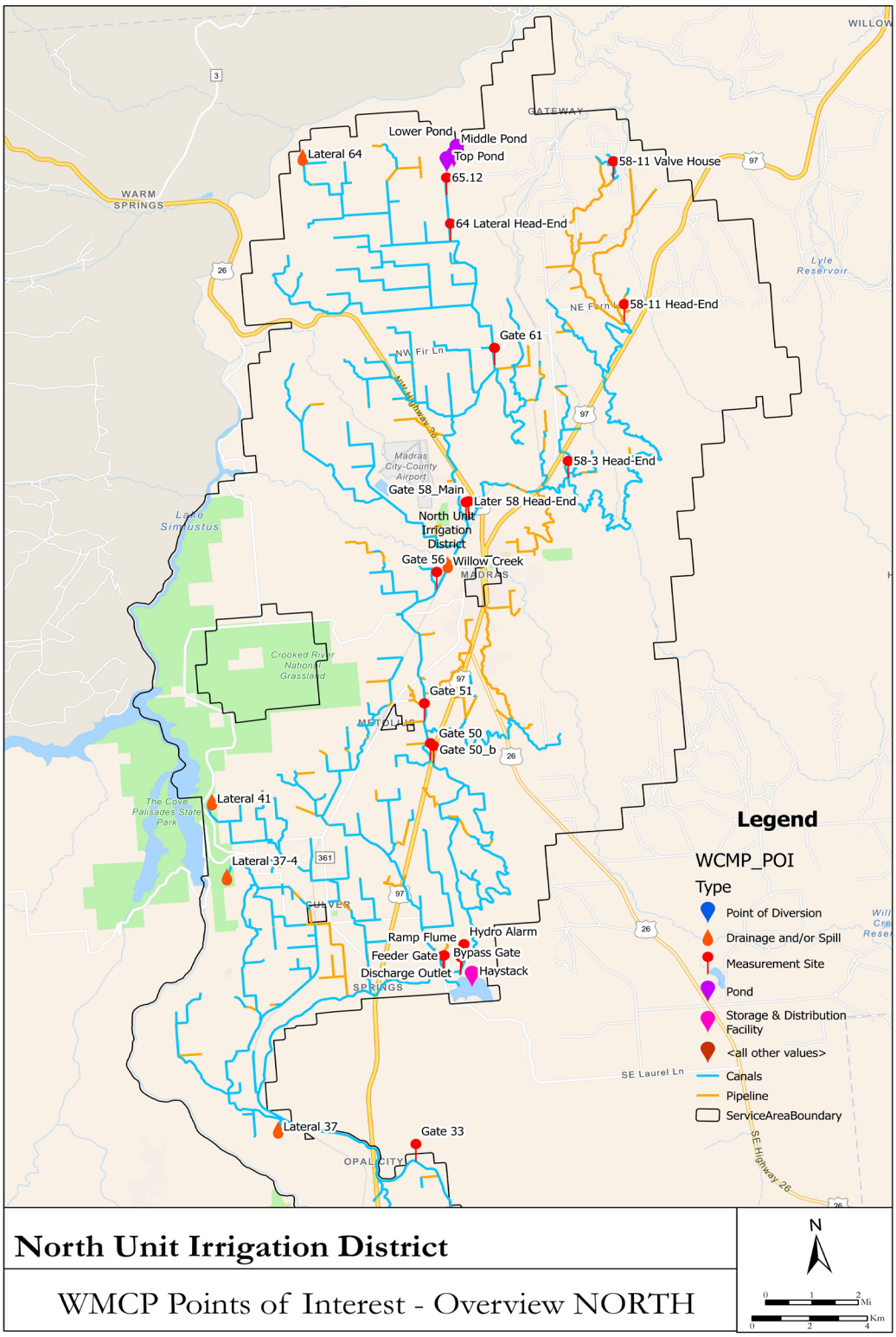
The Gentlemen's Agreement (NUID, Central Oregon Irrigation District, and Arnold Irrigation District) dated November 20, 1962, to allow for the release of not more than 30 cfs at the North Canal Dam to the Deschutes River to "maintain the quality of the fishery resources".

The "PAPER OF AUTHORIZATION" dated August 22, 1973 between NUID and Tumalo Irrigation District to Robert Main (Region Watermaster Oregon Water Resource Department) authorizing the Watermaster to regulate the flow of water from Crescent Lake and Wickiup Reservoir in a manner which promotes the most beneficial use of such waters to the Tumalo and North Unit Irrigation District.

1.4 Schematic of the Irrigation System (OAR 690-086-0240 (3)

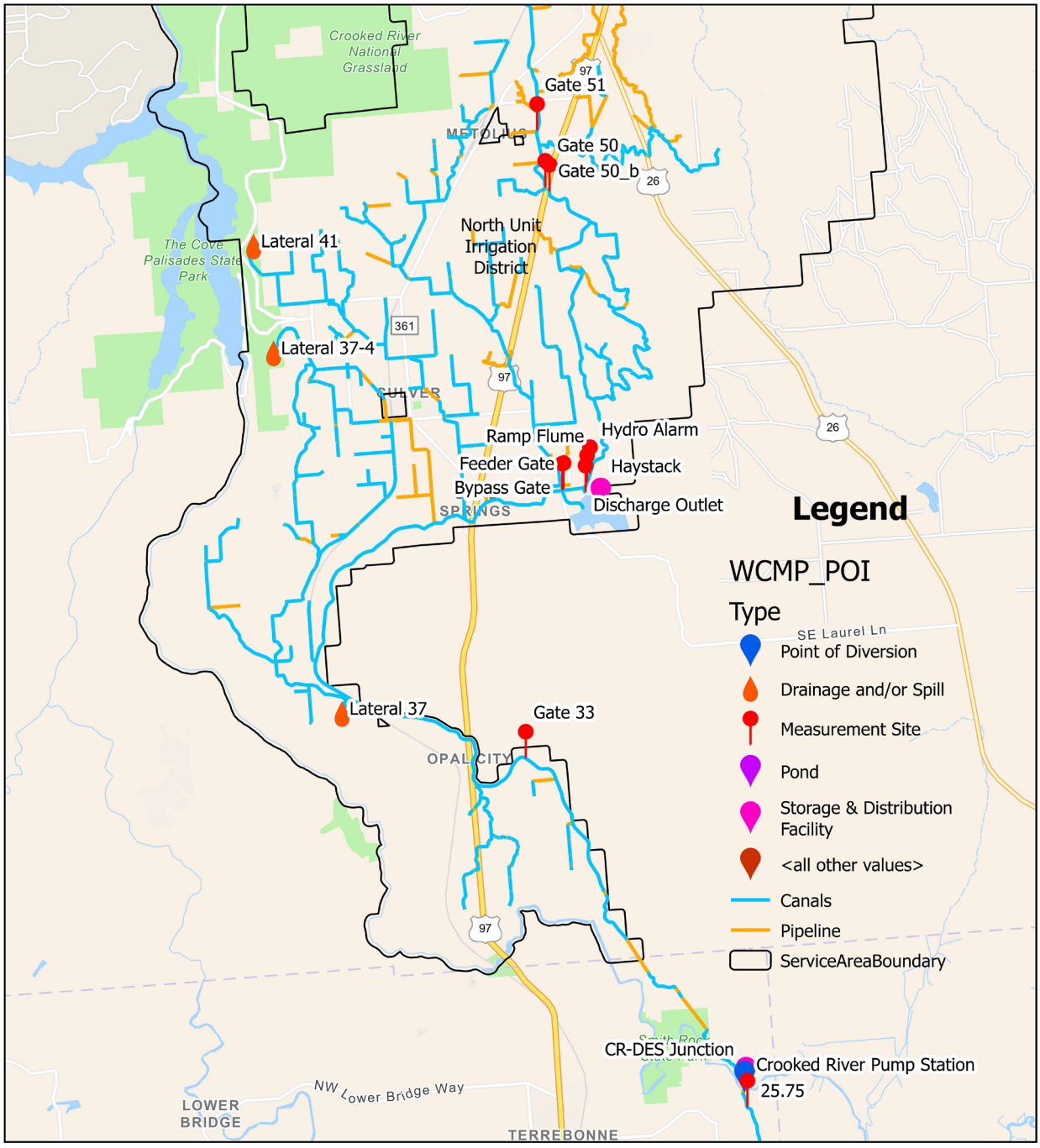



GENEVA
Lateral 37
Gate 33
OPAL CITY
North Unit Irrigation District
97
Smith Rock
CR-DES Junction
Crooked River Pump Station
25.75
Holmes Rd
LOWER BRIDGE
NW Lower Bridge Way
TERREBONNE
370
ONEIL
Buckhorn Rd
Northwest Way
PRINEVILLE JUNCTION
NW Helmholtz Way
126
REDMOND
SW 27th St
Redmond Muni Airport-Roberts Field
SW Helmholtz Way
S Canal Blvd
12 Mile
Pronghorn Club
Redmond-Bend Juniper State Scenic Corridor
Cline Falls Hwy
20
DESCHUTES
TUMALO
Tumalo State Park
Powell Butte Hwy
Main Canal Diversion
Hamby
Legend
WCMP_POI
Type
Point of Diversion
Drainage and/or Spill
Measurement Site
Pond
Storage & Distribution Facility
<all other values>
Canals
Pipeline
ServiceAreaBoundary
North Unit Irrigation District
WMCP Points of Interest - Overview SOUTH
N
0 1 2 Mi
0 2 4 Km



North Unit Irrigation District

WMCP Points of Interest - Overview NORTH



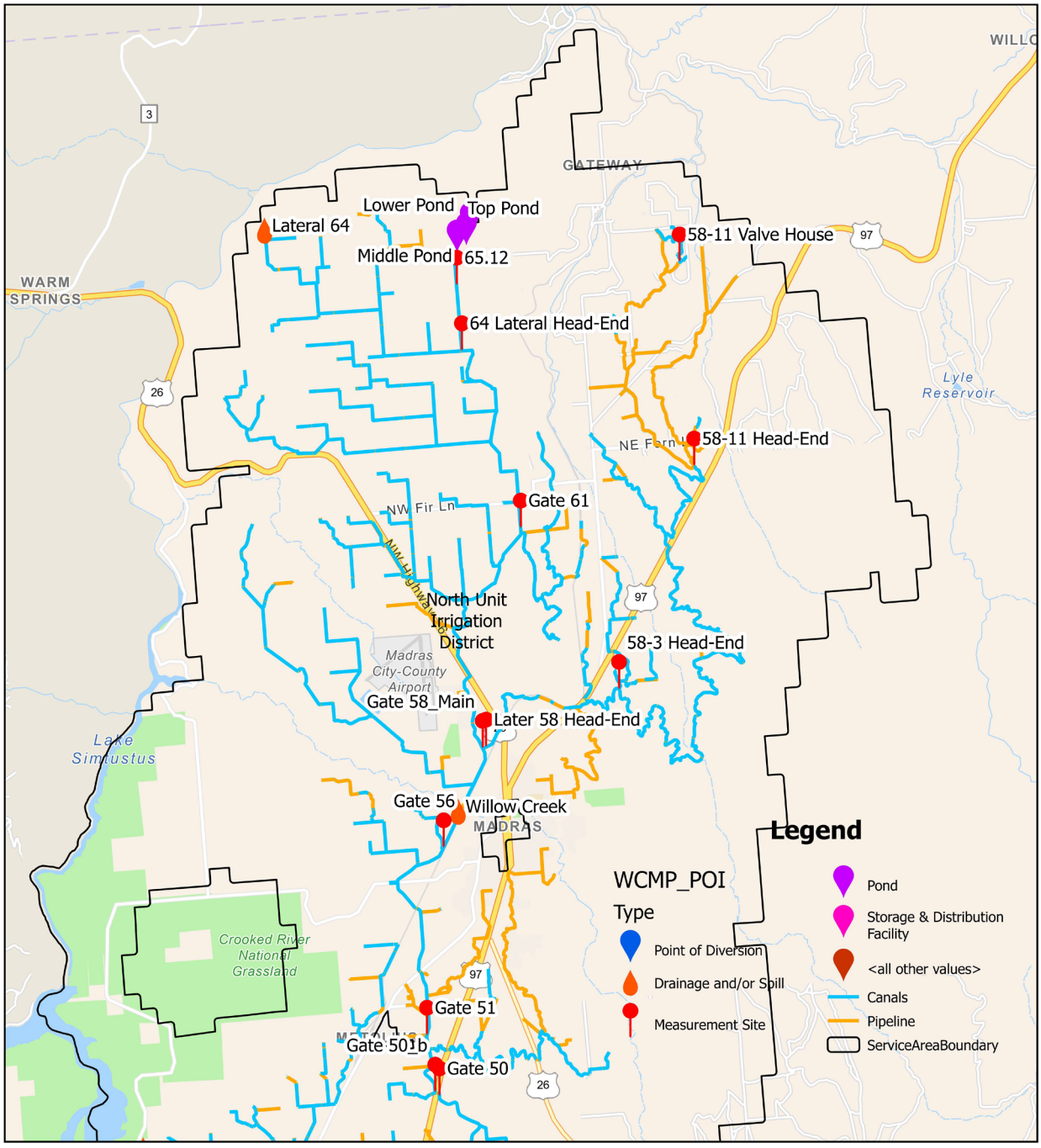
North Unit Irrigation District

WMCP Points of Interest - NORTH A

N

0 1.25 2.5 Mi

0 2.5 5 Km



North Unit Irrigation District

WMCP Points of Interest - NORTH B

1.5 Current Water Use and Return Flows (OAR 069-086-0240 (4))

Water use in the district was provided to the BOR in 2018 and 2019 as indicated below. The 2018 water season was the high-water supply year and 2019 was a low-water supply year for the evaluation period of 2011 - 2020.

Year	*Net Supply*	*Operational Spill*	*Transportation Losses*	*Delivered to Farms*
2018	**207,155 AF**	**1,494 AF**	**91,698 AF**	**113,963 AF**
		1.0%	**44.0%**	**55.0%**
2019	**134,677 AF**	**3,568 AF**	**59,019 AF**	**71,237 AF**
		3.0%	**44.0%**	**53.0%**
Ave	**187,351 AF**			**107,041 AF**

The values in the following table reflect the high seepage losses in the district's conveyance and distribution facilities (i.e. canals), but also reflect the high on-farm seasonal irrigation efficiencies. Values reflect an average for years 2011 - 2020.

Item	*Diversion*	*Crop Use Net Irrig Req*	*On-farm Delivery*	*Delivery Overall Efficiency*
All irrigated areas 53,284 irrigated acres	**187,351**	**96,557AF**	**107,041 AF**	**57.1 %**

Seasonal Water Use (2011 – 2020)

Total Acres Irrigated	*Diversion*	*On-Farm Delivery*
Average year, peak month (June '11-'20)	**36,466 AF**	**22,240 AF**
@53,284 acres		**0.43 AF/ac**
Peak year, peak month (May '18)	**40,258 AF**	**23,336 AF**
@54,677 acres		**0.58 AF/ac**
Average year, seasonal total ('11-'20)	**187,351 AF**	**107,051**
@53,284 acres		**1.97 AF/ac**
Peak year, seasonal total ('18)	**207,155 AF**	**112,692 AF**
@54,677 acres		**2.06 AF/ac**
Low year, seasonal total ('19)	**134,677 AF**	**72,088 AF**
@ 39,661 acres		**1.41 AF/ac**

Surface Return Flow from Irrigated Cropland – Return flows from irrigated cropland into the district's distribution facilities are essentially zero. However, some district patrons utilize "pump-

back" systems that re-use tailwater from irrigation that would have otherwise been lost or returned to the river.

Subsurface Flows into Canals or Return Drainage Water – Estimated at zero.

Canal, Lateral and Haystack Reservoir Seepage Losses – Seepage losses from Haystack Reservoir is determined to be near zero.

Summary – Estimated district-wide water losses (2011-2020)

Diversion (from records for both Deschutes & Crooked River)	Ave	187,351 AF
Farm deliveries (from records)	Ave	107,041 AF
Distribution system losses (*1)		80,310 AF
Farm deliveries (from records)		107,041 AF
Water use, NIR (*3) (53,284 irrigated acres)		96,557 AF
On-farm losses (*2)		15,032 AF
Total district-wide losses (Total diversion minus crop NIR) (includes both district and on-farm losses)		93,660 AF

(*1) Distribution losses include: canal seepage, operational and management spills, temporary canal storage, etc.

(*2) On-farm losses include: distribution system and pond seepage, deep percolation from both surface and sprinkler systems, wind drift and evaporation from sprinkler systems, runoff from surface irrigation systems, etc.

(*3) Calculation based on actual type and acres of crops grown on the irrigated cropland (average 2011-2020 records calculated based on irrigated lands).

The following table represents an analysis by the US Bureau of Reclamation (BOR) of the district's conveyance and distribution system. Estimates for seepage rated for specific reaches of canals and laterals were used. The results compare reasonably close to the previous analysis when actual records are used, i.e. within 11%. This analysis presents an opportunity for the district to prioritize specific reaches of canals and laterals for potential lining or piping.

Summary – Conveyance and Distribution Seepage Analysis (*1)
North Unit Irrigation District

Item	Length (miles)	Seepage Rate (estimated) ($ft^3/ft^2/day$)	(AF / year)
Main Canal			
Reach 1	24.5	1.00	33,480 AF/year
Reach 2	18.1	0.80	20,580
Reach 3	12.2	0.66	9,450
Reach 4	10.2	0.67	4,670
Lateral			
Lateral M-31	0.9	0.97	150
Lateral M-32	0.6	0.97	110
Lateral M-34	2.0	1.40	700
Lateral M-41	3.0	0.80	830
Lateral M-43	6.5	0.80	1,770
Lateral M-45	4.0	0.80	680
Lateral M-48	0.5	0.64	90
Lateral M-50	1.5	0.80	340
Lateral M-51	5.5	0.80	1,450
Lateral M-51 B	1.5	0.97	270
Lateral M-53	0.5	0.97	130
Lateral M-53 A	0.1	0.97	20
Lateral M-53 B	0.1	0.97	20
Lateral M-55	1.5	0.97	460
Lateral M-56	0.8	0.97	130
Lateral M-56 A	0.1	0.97	10
Lateral M-57	8.0	0.80	1,630
Lateral M-58	17.0	0.59	3,730
Lateral M-58 A	1.3	0.97	310
Lateral M-60	3.4	0.97	250
Lateral M-61	3.4	0.97	1,010
Lateral M-61 A	0.9	0.64	80
Lateral M-63	5.5	0.97	1,590
Lateral M-63 A	1.9	0.97	590
Lateral M-63 B	3.0	0.97	830
Lateral M-64	3.0	0.64	570
Lateral M-64 A	0.8	0.64	100
Total	148.9 miles		87,530 AF / year

(*1) Taken from BOR Special Report – "Upper Deschutes River Basin Water Conservation Study", April 1997.

Spills
Flushing or operational spills from the main canal from point of diversion at Bend to Haystack regulating reservoir are collected in Haystack Reservoir for redistribution.

Operational spills leaving the district exit the distribution system at the end of the distribution main canals, and at the end of several small laterals. Where opportunities exist, spill water is also provided to some users at the end of several laterals, generally to on-farm ponds and subsequently pumped to farm irrigation systems.

The entire spill at the end of the main distribution canal are collected in three ponds/reservoirs, which provides irrigation water supply to two water users at the north edge of the district. Flow is metered to the two users, so what goes past them into the Deschutes River canyon is net spill. It is estimated that net spill typically represents 2 – 3% of net supply and less than 1% of the total supply.

Farm Deliveries
Average crop water use – District-wide net irrigation requirement (taken from yearly patron crop reports) represents a weighted average for all crops being grown in the district. Every specific crop being grown in the district is not included in the crop reports, therefore, many crops were grouped together to determine the estimated net irrigation requirement.

Crop Water Use

Net Irrigation Requirement (NIR) (*1)	Total for season	96,557 AF
(53,284 irrigated acres)		1.97 AF/ac

(*1) Crop water use-value (net irrigation requirement) is based on OSU Publication 8530, "Oregon Crop Water Use and Irrigation Requirements, March 1999", for crops grown in the Madras area, and for a 50% probability (i.e. 5 of 10 years or for an average year) crop water use needs.

The availability of data from the Madras "Agrimet" weather station within the district provides an opportunity for irrigators to practice good irrigation scheduling techniques. Many irrigators use this service, although it is not known how many. The USDA NRCS has also provided up-to-date soil mapping in the Madras area.

It should be noted that crop water use needs typically peak in latter June, July, and early August, and are lowest in April and May in the spring, and September and October in the fall. The peak water use needs to match recorded diversion and delivery rates. This is typically due to the district's attempt to maintain Haystack Reservoir at or near capacity early in the season, especially during drought years.

1.6 Classification of User Accounts (OAR 690-086-0240 (5))

Use of NUID supplied water	Percent
Irrigation of crops	99.99
Environmental (temperature) control of crops	0
Industrial	0.01

District Patron Base/Acres

Acres	# of Patrons	Acres
<5	433 patrons	613
5-19	127 patrons	1,320
20-99	241 patrons	13,479
100-499	170 patrons	33,955
500+	13 patrons	9,520

NUID maintains 5 Crooked River acres of industrial right. The industrial right/use is intermittent use, typically of a miscellaneous nature e.g. contractors pumping water from a ditch/canal for construction purposes, dust control, etc.

1.7 Types of Irrigation Systems (OAR 690-086-0240 (6))

Three principal methods of irrigation water application exist in the district: surface, sprinkler, and drip. Of surface irrigation methods, graded furrow is the most prevalent. Common crops irrigated by graded furrows include: potatoes, garlic seed, carrot seed, and other seed crops. Common sprinkler-type systems irrigated by sprinkle method include: periodic move (side-roll wheel line, hand move lines, and solid sets), center pivots, and a few big guns. Drip systems (also known as micro or trickle irrigation) uses 20 to 50 percent less water than conventional irrigation systems. Typical crops grown with drip systems include carrot seed, hemp, and alfalfa.

Over the last several decades, a large percentage of the surface irrigated cropland converted to sprinkler irrigation systems once it was demonstrated in the 1970's that typically less water was required to grow the same crop, less labor was required, higher crop quality was obtained, and typically higher crop yields were obtained. Today, sprinkler irrigation systems are often used to germinate a crop and then a surface irrigation system is used to irrigate the crop through maturity, i.e. garlic, seed crops, where the overhead droplets can cause damage or seed loss.

Percent of the irrigated cropland by irrigation methods and systems in the district are estimated at:

Method	System	Percent
Surface	Graded furrow	25 %
Sprinkle	Periodic move	65 %
	(i.e. side-roll wheel line, hand move, solid set, etc.)	
Center pivot		8 %
Big gun type		2 %
Drip Irrigation	Drip tape installed next to seeds or starts	.05%

Of the sprinkle irrigated cropland in the district, nearly 90% is pressurized by pumping, either for supplying 100% power needs or boosting existing available pressures. The remaining 10% is pressurized by gravity pressure utilizing buried pipelines. These pipelines have replaced open laterals on steep slopes, either for reducing seepage and maintenance or for developing suitable pressure for operating sprinkler systems. Most pumps are powered by electric motors, with only a few using diesel engines where sprinkler systems are used temporarily for a specific crop, i.e. solid set systems on potatoes or to germinate seeds.

1.8 Crops Commonly Grown, Average and Peak Use (OAR 690-086-0240 (7))

The district collects data annually for crop type, by acre. All crop types grown in the district were included in the analysis. Major crop types that represent over 60% of the total irrigated crop in NUID include; wheat, hay(s) and grass seed.

Summary of average acres of irrigated cropland, other cropland, and other lands in NUID for the years **2011 – 2020** is as follows:

Crop	Acres	% of total area
Wheat	6638.7	11.0
Other Grain	642.4	0.1
Alfalfa Hay	12892.9	21.0
Other Hay (Grass Hay, Mixed Hay, etc.)	8863.0	14.0
Irrigated Pasture	4037.0	0.7
Grain Hay	1255.9	0.2
Silage	349.2	0.1
Beans, dry	130.1	0.0
Peppermint Leaves / Oil	708.7	0.1
Hemp	1011.2	0.2
Sugar Beets Seed	20.8	0.0
Other Misc. Field Crops	972.4	0.2
Nursery/Turf	288.7	0.0
Carrot Seed	3844.5	0.6
Corriander Seed	38.5	0.0
Garlic Seed	516.4	0.1
Grass Seed	8369.6	14.0
Potato Seed	410.5	0.1
Other Seed	2285.0	0.4
Potato, fresh	51.4	0.0
Other Vegetables	940.0	0.2
Family Gardens/Orchards	.6	0
Irrigated but not Harvested	1410.0	0.2
Total lands irrigated	55677.50 acres	
Non-Agricultural	641.4	0.1
Acres not Irrigated	5367.3	0.9
GRAND TOTAL	61686.2 acres	100%

1.9 Operations and Maintenance (OAR 690-086-0240 (8))

The District is divided into five divisions and governed by a five-member Board of Directors, one director per division, elected by the vote of the landowners. Each director serves a three-year term. The Board sets district policy and hires a full-time manager to implement policy and manage district

operations. The manager reports to the board; 27 full-time regular employees report to the district manager.

The district staff consists of a, general manager operations manager, office manager, watermaster and water operations specialist. Three administrative support staff includes Water Records Clerks I, II, and III. Operations staff includes a maintenance foreman, shop foreman, shop assistant, 4 maintenance personnel, 10 ditch rider/maintenance personnel and 2 dam tenders. Ditch rider/maintenance personnel focus on water deliveries to district customers during the irrigation season and maintenance activities during the non-irrigation months, typically mid-October through March.

NUID facilities are operated and maintained in Deschutes and Jefferson counties. The facilities include major storage and regulating reservoirs, 200 CFS pumping facility, smaller diversion features, and interconnecting conveyance and delivery systems.

NUID operations and maintenance (O&M) is responsible for the operation of the water control structures and maintenance of nearly 300 miles of canals and pipelines. In the summer months, the primary activity is the supply of water to the farmers for irrigation of their crops. Work is also performed to keep water flowing efficiently through the district's network of canals and pipelines.

Major O&M work, such as piping and lining of canals, repair and/or construction of delivery facilities, repair and cleaning of canals, ditches and service roads is performed in the winter months when water is no longer flowing.

Staff and operations personnel responsibilities include problem-solving for district customers, noxious weed management, main canal inspections, reservoir inspections and adjustments, pumping plant operations, fish screen inspections and maintenance, and miscellaneous repair work as required. District staff rotates on-call duty to ensure coverage during non-working hours.

Fulfilling district O&M responsibilities requires extensive involvement with multiple federal, state, local, and private organizations in addition to the general citizenry. O&M efforts by the NUID are centered in trying to best accommodate the public interest in a safe, efficient, and fiscally responsible manner.

1.10 Deschutes Basin Habitat Conservation Plan (DBHCP)

On December 31, 2020 the U.S Fish and Wildlife Service announced the completion of the Deschutes River Basin Habitat Conservation Plan (HCP). The HCP is a collaborative strategy to share water resources in the Deschutes Basin, covering irrigation and related water management operations while enhancing fish and wildlife habitats. Due to Endangered Species Act requirements, 8 members of the Deschutes Basin Board of Control and the City of Prineville worked together in a collaborated effort to put forth the HCP.

The HCP was part of an application for an Endangered Species Act Incidental Take Permit (ITP) that authorizes incidental take of listed species caused by covered activities. The applicants for the ITP included the City of Prineville and members of the Deschutes Basin Board of Control (i.e., Arnold, Central Oregon, North Unit, Ochoco, Swalley, Three Sisters, Tumalo, and Lone Pine Irrigation Districts in Oregon).

Conservation measures in the HCP are designed to minimize and mitigate impacts caused by the incidental take of covered listed species that may result from the storage, release, diversion and return of irrigation water by the Districts and the City of Prineville.

The aquatic species covered by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in this HCP include the Oregon spotted frog and bull trout - both federally listed as threatened. HCP Oversight on the bull trout is provided by National Marine Fisheries Service (NMFS), While USF&W oversees the Oregon spotted frog.

Starting January 1, 2021 NUID began a 30-year implementation process of the HCP. The implementation process includes set flow requirements during ramp-up / ramp-down and mid-season irrigation flow requirements. In addition to the flow requirements, NUID is required to bypass water that would otherwise be stored in the winter to enhance wintertime flows. The wintertime flow requirement is based on a multi-year multi-step increase (See Below)

- 2021-2028 - The minimum winter Wickiup flow releases shall be 100 CFS
- 2029-2033 - The minimum winter Wickiup flow releases shall be 300 CFS
- 2034-2051 - The minimum winter Wickiup releases shall be between 400-500 CFS

The goal of the DBHCP is to return normal flows to the Upper and Middle Deschutes River.

2. WATER CONSERVATION ELEMENT (OAR 690-086-0250)

2.1 Progress Report on Previous Measures (OAR 690-086-0250 (1))

In addition to numerous minor system operation and maintenance improvements, the following larger project measures were implemented over the period from 1995 to the present:

1995 – Lateral 52, installation of 12,500 feet of pipe to enclose an open canal.

1998 – Lateral 51-4, demonstration high head pressure pipeline system, installation of 25,000 feet of pipe to enclose an open canal.

1996-2000 - In the late 1990s, NUID lined a portion of the Main Canal from near its diversion point in Bend (canal mile 0.5) to approximately canal mile 11.8. The bottom is lined with roller-compacted concrete (RCC) and the sides are lined with shotcrete for the first 6.9 miles. From that point forward, only the bottom of the canal is lined with RCC. NUID estimates 23,000 AF of water was saved by the project, which represents a 51% reduction in total seepage losses.

2002 – Lateral 58-1, pipe approximately 5 miles of open canal to save water and reduce soil erosion by decreasing canal seepage.

2003 – North Unit Small Pipelines 2003 – piping of various short sections of canals in the distribution system to prevent erosive destruction of the canal banks by livestock and to save water. The project included the installation of three pipelines for a total of 6,291 feet.

2004 – Lateral 58, this project included 6,600 feet of pipe and abandon a section of lateral that passes through an industrial park. This piping project saved water and prevented soil erosion by decreasing canal seepage. Abandoning the section through the industrial park will keep runoff from parking lots and roofs from entering the irrigation system.

2004 – Lateral 51-1, piping approximately 3,500 feet of the distribution system to prevent seepage losses and soil erosion.

2005 – Automation and Telemetry Financial and Technical Assistance to install telemetry at Haystack Reservoir, 58 lateral turnout, 37–6 lateral and 58-11 lateral to conserve water and enhance water management through automation.

2005 – GIS and Aerial Imagery Consortium: Using Technology, Best Practices and Information System Management to Support Conservation Program Development and Implementation.

2006 – Lateral 58-3, pipe 1,800 feet to conserve water and enhance on-farm irrigation efficiency.

2007 – Piping Laterals 53, 58-13 and 63-1. Upgrade 3 laterals from open ditch or leaking pipe to plastic pipe to conserve water, increase water use efficiency and enhance water management.

2007 – Water 2025 Challenge Grant, Telemetry & Action Plan. Partner with 5 other irrigation districts in Central Oregon to install flow measurement telemetry stations at 18 strategic locations across the 5 districts to measure the benefits of water conservation. Two sites were installed on the district.

2007 – Lateral 58-9 Pipeline Phase I –improve Lateral 58-9 by converting one-half mile of open earth ditch to two parallel pipes to conserve water and thereby increase available water supplies associated with Reclamation's Deschutes River Project.

2008 – Pipelines 41-6 Lateral and 43-7-1 Lateral convert sections of two earthen ditches to pipe to conserve water by reducing seepage and evaporation losses.

2011-2019—Pipeline 58-11. Constructed large intake structure with self-cleaning automatic screen and converted 8 miles of open ditch to HDPE pipe.

2018 – Lateral 64 4-2 converted approximately 1000' of wooden pipe to PVC pipe.

2010 to 2022 – Continuous installation of automation hardware to measure flows and remotely control water within various control structures, rated canal sections, and headgates. Projects include 12 mile measurement site, and automation of gates 50, 51, 56, 58, and 61.

2.2 District Water Measurement Program (OAR 690-086-0250 (2))

An extensive flow measurement and water accounting system is installed and used within the district. All measuring devices within the district are standard devices operated by district staff.

- Outflow from Wickiup Reservoir is measured and recorded as a rated section using a continual recording staff gauge and data logger (operated by OWRD personnel).
- Point of diversion from Deschutes River at the North Canal at Bend is measured and recorded as a rated section using a continual recording staff gauge and data logger (operated by OWRD personnel).
- Several locations along the main canal are measured with continuous recording gauges. Access to the existing current flow at the end of the main canal is available by anyone in district operations having access to a computer, tablet, or smartphone.
- Several locations on the main canal are also measured to determine high seepage loss areas, using ramp-type flumes.
- Many of the sub-main canals have measuring devices at the turnouts from the main canal, i.e. standard trapezoidal weirs.
- Each lateral is measured using standard trapezoidal weirs.
- The points of delivery to water-users are all measured using standard trapezoidal weirs (Yakima Weir), submerged orifices, or flow meters inside conduits.
- The district continually evaluates prospective locations for additional flow measurements that will improve operation and management.
- Standard devices include stream rating sections, ramp flumes, trapezoidal weirs, submerged orifices, and flow meters.
- Measuring (SonTek doppler technology) and telemetry systems have been added to Haystack Reservoir and Lateral 58.
- A flow meter policy that will have a standard uniformity has been established for water users that have metered deliveries. The policy regulates how water through flow meters will be delivered and how volumes will be calculated.

Diversion flow measurement and annual reporting to OWRD and USBR meet OAR 690 Division 85 requirements. All on-farm delivery points and major flow measurement points are measured. Locations of these sites and the continuous recording devices used meet OAR 690 Division 85 requirements.

2.3 Other Conservation Measures Currently Implemented (OAR 690-086-0250 (3))

The following projects are either under current construction and/or implementation or were completed in the last two years:

2019—Lateral 58-11 Piping. Install 8.5 miles of HDPE pipe to provide improved water management; eliminate soil erosion; pressurize a portion of the water delivery system and improve water quality. This project includes a concrete surge pond with a self-cleaning screen, a pressure-reducing station, and an automated valve at the end of the pipeline to control flows.

2020—Ramp Flume modification—Haystack Reservoir. Increased the height of an existing ramp flume measuring structure 1’ to mitigate the effects of downstream hydro station operations.

2022—Lateral 41-9 Piping. Install 1500 feet of 15" pipe to provide improved water management; eliminate soil erosion; and improve water quality. This project includes a new head-end concrete intake structure and concrete weir pools at the end.

2022—Lateral 58-3-2 Piping. Install 2,550 feet of 12" pipe to mitigate excessive seepage from an existing open ditch lateral. This pipeline will provide improved water management; eliminate soil erosion; and improve water quality.

2023—Install a geomembrane liner within a 1.5-mile section of NUID main canal to mitigate seepage.

2022-2023—Upgrade/Install 16 new headgates with automated controls within various sites on the NUID Main Canal. This project will upgrade 3 existing check structures that currently have 1 automated gate to 3 automated gates and replace other antiquated gates within the NUID Main Canal system. All sites will have new headgates, motors, and automated controls. This will greatly enhance the operations department control over water in the main canal system and help mitigate flow issues that are caused by existing hydro site operations.

2023-2030—Lateral's 31,32,34,43 Piping project. This multi-phase and multi-year project will pipe approximately 25 miles of laterals. This project will greatly reduce water loss from seepage, evaporation, and other environmental issues. It will provide pressurized water to many district patrons. The project will consist of multiple Pressure reducing stations, tail-end cleanout ponds, concrete structures, and individual patron water meters.

2.4 District Goals for Improving Water Conservation and Management (OAR 690-086-0250 (4))

Overall

- Provide irrigation water delivery to district users, keeping within the district's authority.
- Meet delivery needs for irrigated lands within the district keeping deficit supply to a minimum.
- Investigation of computerization for field data input, data processing and data access for operations and management of water in the district.
- Maintain irrigation acreage base.
- Maintain water rights for customers in the district.
- Continue to improve the distribution system through piping of canals and laterals.
- Support users in the elimination of pumping plants, with gravity pressure supply pipelines.
- Support education of users in water delivery.
- Aggressively pursue water conservation measures to improve water delivery to users.

The district determines annually what the highest priority projects are that are to be implemented in any particular year. Priority is based on many long-term objectives, i.e. water conservation, improved water distribution management, reduced operation and maintenance, liability risk reduction, etc. Of particular note are the ever-increasing costs of pipe material.

Short Term Goals, 1 – 5 years

- Construct the 41-9 and 58-3-2 piping projects.

- Install a Geomembrane liner in high seepage areas of the District Main Canal.
- Complete the final stages of the Environmental Assessment for the proposed multi-year, multi-phase 31, 32, 34, and 43 pipeline project.
- Upgrade existing Main Canal headgates, motors, and automation.
- Continue to develop and promote an online "Customer Portal" where NUID patrons can place water orders online, check account balances, and pay their water bills.
- Continue to refine and develop a detailed database and map (using GPS mapping techniques) that includes: The location and elevations of all laterals and the canal, water control structures, flow measurement sites, bridges, points of spill, points of delivery, including all irrigated lands. This will provide a database whereby the district can determine high-priority areas/projects for implementation.
- Support and cooperate with individuals and groups of water users for the installation of pipelines on private ditches, i.e. downstream from point of delivery.

Long Term Goals, 5 – 20 years

- Research the possibility of installing a pumping plant on Lake Billy Chinook and pumping water directly to the NUID main canal at the mile 37 location.
- If the Lake Billy Chinook pumping plant is feasible, NUID will secure funding and construct the pumping station, retention ponds, pipelines, and spill structures.
- Install approximately 25 miles of pipeline, thus improving management, control, and water delivery to users, and potentially reducing diversion needs from the Deschutes River watershed system by an estimated 10%.
- Install a complete telemetry system for all flow-measuring devices on all large laterals. Automate main canal check structures and delivery systems with state-of-the-art canal modernization programs.
- The district plans to continue an aggressive program, as they have in the past, for the installation of pipelines to replace open earth laterals, and improve management and control at all water control structures, as funding becomes available. The district will aggressively pursue funding, from any and all sources, i.e. NRCS, DRC, BOR, BPA, etc.
- The district will continue to support and cooperate with individuals and groups of water users for the installation of pipelines on private ditches, i.e. downstream from the district's point of delivery.

2.5 Improving Water Use Efficiency (OAR 690-086-0250 (5))

The North Unit Irrigation District has continued to become increasingly involved in conservation planning and implementation as well as developing key partnerships with Federal, State and local agencies, NGOs and tribes to develop comprehensive programs that benefit not only the environment, but substantially improve system efficiencies and conservation. In addition to those projects implemented, under development, or planned above (see 2.1 - 2.4 above), the district has been instrumental in working toward basin improvements that eliminate or reduce seepage losses while also eliminating or reducing migration of sediments to watersheds. Piping improvements in the North Unit Irrigation District generally result in multiple basin and district benefits including conservation of seepage losses, prohibition of sediments to the canal conveyance systems, and potential pressurization and reduction of pumping energy use or even development of hydroelectric power renewable energy resources.

2.5.1 Assessment of Whether Water Deliveries are Insufficient to Meet Crop Needs

The District's water rights are junior to those of the other upper Basin Districts such that it can use live river flows remaining after the more senior Districts have diverted their supplies from live flows. The live flows available to the NUID, in this case, are insufficient to meet its full supply need. Accordingly, the NUID depends on winter storage in Wickiup Reservoir to meet the needs of its agricultural base. The District water rights allow up to 200,000 acre-feet 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 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 around Benham Falls. The Oregon Water Resources Department (OWRD) deducts 25 percent of the flow released from Wickiup Reservoir to account for losses. 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 48 percent based on relationships between historic diversions and deliveries at farm turnouts for the period 2011 – 2022.

Analysis of the historic delivery record for the period 2011 – 2022 reflects a median (average) delivery volume of 107,041 acre-feet. This volume is the total for both Deschutes and Crooked River sources and corresponds to 1.97 acre-feet 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, which is based on naturally occurring moisture in the soil, temperature, and evaporation. The net irrigation requirement for NUID is 1.97 acre-feet per acre based on the Oregon State University publication "Crop Water Use and Irrigation Requirements", Extension Miscellaneous Paper 8530, March 1999.

This supply condition, coupled with uncertainties in climate and availability of storage supply, brings uncertainty to farmers in selection of crops that take advantage of market conditions on a broader scale with increased margin opportunities. Limited and uncertain water supply is compelling to planting 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 their crop production. Pivots have been installed to better match supply with crop needs, 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. In addition to pivot's, carrot seed farmers have been installing drip irrigation systems to further reduce the consumption of water. Drip irrigation systems are tedious to install, maintain, and are moderately expensive.

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 delivery at the turnouts should be at least 2.13 acre-feet per acre, with no consideration for other influences on net amount of water available.

Generally, the district committed to furthering these programs as follows:

2.5.2 District Wide – General

- Continue to install pipe (HDPE & PVC) in laterals and sub-laterals identified as 'high priority". The goal is to improve operations, reduce maintenance, reduce seepage, and improve delivery to all users.
- Maintain intensive management and control of all water diverted and delivered and provide full water accountability to the board of directors and to all water users, through the existing extensive flow measurement system.
- NUID works with private and public water conservation organizations, i.e. Jefferson County SWCD, Deschutes River Conservancy, Coalition for the Deschutes, Oregon Basin Land Trust, Oregon Water Trust, Trout Unlimited, Oregon Environmental Council, etc., for addressing regional concerns related to water conservation issues.
- NUID works collaboratively with all of the irrigation districts in Central Oregon and the Confederated Tribes of Warm Springs to coordinate basin-wide water conservation and improvement to the overall operation and management of water resources in the basin. In the near future, municipalities and private water purveyors will be brought into the region-wide coordination effort. Region-wide management schemes will be developed that all will have input in.
- The district supports other local groups and agencies in their water conservation and management activities and programs, i.e. BOR, NRCS, & OSU Extension.

2.5.3 On-farm

The district supports other local groups and agencies in water conservation and management activities and programs, i.e. NRCS, OSU Extension, Jefferson County SWCD, Trout Creek & Willow Creek Watershed Councils, electric power company and electric utility energy audits and water management assistance programs, etc.

OSU has provided soil moisture monitoring and irrigation scheduling assistance to water users within the three county Central Oregon area in the past. The program was sponsored by grants to OSU from NWEEA, and NRCS. NUID supported and cooperated with this program.

Energy Trust of Oregon, Incentives converting outdated electrical and gas equipment to more energy efficient on-farm irrigation infrastructure.

The *Save Water-Save Energy* program, in coordination with this grant, will first help irrigators operate their systems at peak efficiency by replacing old nozzles, leaky gaskets, and analyzing the pumping plant. Following this step, a professional SIS advisor will work with each irrigator to install and provide technical assistance with soil moisture monitoring equipment.

SIS's scientific tools include *AgriMet*, a website that helps irrigators assess local weather conditions and *IrrNet*, SIS's internet-based tool which uploads data from the soil sensors placed strategically on the irrigator's land.

Partners in this grant program include the North Unit Irrigation District, Central Electric Cooperative, Bonneville Power Administration, Pacific Power, the Energy Trust of Oregon, and both the Jefferson and Deschutes Soil & Water Conservation Districts.

2.6 Evaluation of Water Conservation Projects (OAR 690-086-0250 (6))

All potential management or conservation measures that the district undertakes must be reasonably feasible, in the following categories:

- Practically feasible, i.e. can be physically constructed, resources are available
- Technically feasible i.e. equipment is available & affordable, meets operation & maintenance requirements
- Economically feasible i.e. benefits to user outweigh costs, funding is available, risk is acceptable to both the user and the district
- Environmentally feasible, i.e. existing environmental regulations are met

2.6.1 Energy audits for users

NUID provides information to its patrons about the energy efficiency programs offered by Bonneville Power Administration (BPA), Energy Trust of Oregon, (ETO), Central Electric Cooperative (CEC), Portland General Electric (PGE), and Pacific Power. These programs are developed and designed to assist utility customers who are water users with energy audits, learning techniques to reduce energy bills, saving water, and tax incentives. CEC and BPA offer cash rebates for installing new premium irrigation pump motors and upgrading their sprinkler equipment. NUID posts current energy program information on its website and has included information in the quarterly district newsletter to patrons.

2.6.2 Alternative Rate Structure

The district has a tiered rate structure in place to encourage the economical use of water. The rate is jointly determined by the NUID Board of Directors and BOR as per provisions in our repayment contract and may be changed if necessary. For the Deschutes River acreage, a minimum rate is charged for the first 2.0 AF/acre, with a different rate for the first acre-foot used over 2.0 AF/acre and an increased rate for any usage over that. For the Crooked River acreage, a minimum rate is charged for the first 1.0 AF/acre and a different rate for the first acre-foot use over the 1.0 AF/acre and an increased rate for any usage over that. No change to this rate structure is planned.

The tiered rate structure is considered a conservation method as water users track their use to avoid going over the base rate (2.0 AF/acre for Deschutes and 1.0 AF/acre for Crooked) and subsequent increased water rate.

The acreage requiring seasonal gross application greater than 2.0 AF/acre include all crops being grown within the district. Actual crops/fields having seasonal applications of greater than or less than 2.0 AF/acre are not documented, only the users who purchased additional water during the

year, and how much was purchased. During the near typical water supply year of 2013 and above water supply year of 2018, additional water was purchased as follows:

	1st AF	2nd AF
2013	14,936 AF	417 AF
2018	7,124 AF	81.35 AF

During the water short years, no additional water was purchased since it was not available. Sharing amongst the users provided the necessary water to critical crop acreage.

2.6.3 Lining/Piping of Earthen Canal and Laterals

Canal Lining
The district will actively pursue additional canal lining projects to reduce seepage, but each project will be evaluated on a site-by-site basis for district-wide water needs vs water savings vs cost-effectiveness as per discussed procedure. See BOR/OWRD Report, "Upper Deschutes River Basin Water Conservation Study", April 1997, and NUID System Improvement Plan June 2017

Piping
The district will continue to actively pursue evaluating and installing additional pipeline projects that reduce seepage, decrease maintenance, improve operation management, and provide gravity pressure (also see discussion on Pressurize Laterals). Each will be evaluated on a site-by-site basis for benefits (water savings, O&M reduction and gravity pressurize potential) vs cost. See BOR/OWRD Report, "Upper Deschutes River Basin Water Conservation Study", April 1997 and NUID System Improvement Plan June 2017

Feasibility Evaluation of Potential Piping and Lining Projects:
A feasibility evaluation that includes a cost vs water savings analysis shall be provided to assist in determining conservation measure priorities within the district. Many other needs and opportunities for the district also enter into the evaluation comparison, priority setting and final selection process. They include:

- Project total and annual cost (materials and/or construction)
- Project total estimated water savings
- Comparing present and future annual O & M cost
- Pipeline pressurization potential
- Water needs for users within the district
- User interest and support
- Net cost to user
- Availability and cost of funds – within the district as well as outside
- Purpose and beneficiary of water conservation project, i.e. district, Community, Watershed, etc.
- Other questions: Is the project also practically and technically feasible, i.e. can the district construct the project with their own forces and equipment and to what extent, or will a general contractor be required?

This evaluation process was generally followed by the district to determine the priority and final selection of conservation measures that have been recently installed using district, public and private funding.

System Improvement Plan

A System Improvement Plan (SIP) was completed June 2017. With support from the Energy Trust of Oregon. The purpose of the SIP was to develop a well-considered evaluation of NUID primary and secondary canal systems. Once completed, district management determined the best course of action would be to pursue piping of laterals; starting with the most water savings possible.

Lateral 31, 32, 34, and 43 Piping

The final stage of the environmental assessment, cultural, and historical requirements will be completed by December 2022. After completing all NEPA requirements, NUID will pursue piping approximately 145 thousand feet of laterals with an estimated water savings of 16 CFS. The proposed piping will be a multi-phased, multi-year project. The district has secured 25 Million worth of funding from the Watershed Protection and Flood Prevention Act PL-566. A 25% match funding will be required by the district, which will be partially supplied by the Clean Water State Revolving Fund Program (CWSRF), direct district funding, and other available grants/funds.

2.6.4 Pressurize laterals

There are many opportunities to replace existing laterals with buried pipelines within the district. Many could provide gravity pressure to operate sprinkler irrigation systems without pumping. See BOR/OWRD Report, "Upper Deschutes River Basin Water Conservation Study", April 1997 and the North Unit Irrigation System Improvement Plan June 2017.

During the past years, several open laterals have been replaced with buried pipe (i.e. Lateral 58-11, 64-4-2, and 64-4-I). Also, resource conservation services have assisted the district in providing preliminary evaluations for replacing open Laterals 31, 32, 34, and 43 with buried pipe. Benefits to the district include reducing operation and maintenance, eliminating seepage losses, reducing management and operation spills, decreasing people safety hazards, and reducing user pumping requirements for sprinkler irrigation system operating pressure.

This program will be aggressively pursued in the future as funds become available to the district for engineering and installation, user interest arises on specific laterals, and sufficient gravity pressure would be developed. Total benefits to the district and to the users on selected laterals are typically good. The district will assist users in identifying laterals, provide technical assistance for design and typically provide the necessary equipment to install the pipe. However, total water savings is small compared to total water savings from canal lining. Total annual water savings for the proposed piping of laterals 31-34 are estimated at 828 AF and 4860 AF for lateral 43.

Parcels of one acre or less using district water are few. The potential water savings from these would not be significant. NUID's available funds and man hour are currently being applied to pressurizing canals and laterals where the greatest amount of water can be conserved.

2.6.5 Irrigation Scheduling Assistance

Data collected from the existing Madras "Agrimet" weather station is transmitted to the GOES satellite system and downloaded at the regional BOR office in Boise, ID, where the raw data is converted to a calculated crop ET (evapotranspiration) using a modified Penman equation. Calculated crop ET data provides the basis for irrigation scheduling of many local crops. Crop ET and scheduling information for the Madras "Agrimet" site as well as for all of the Pacific Northwest "Agrimet" sites are available on the BOR website at: www.pn.usbr.gov

A number of district patrons are participating in a Scientific Irrigation Scheduling Project, supported by the district and Wy'East RCS. SIS's scientific tools include *AgriMet*, a website which helps irrigators assess local weather conditions and *IrrNet*, SIS's internet-based tool which uploads data from the soil sensors placed strategically on the irrigator's land.

The district does not provide direct assistance to the users for use of the "Agrimet" program, however, the district does provide information via website links from the NUID website to the National Weather Service, local television stations and newspapers and the Oregon State Research Center Weather Station (i.e. temperature, evaporation, precipitation, etc.). With the existing low water use rate and high overall seasonal on-farm irrigation efficiency, cost-effective water conservation benefits would not be reasonably attainable, when comparing cost of personnel and equipment to provide this assistance to users.

2.6.6 Re-regulation Reservoirs

Re-regulating reservoir facilities such as Haystack Reservoir, smaller reservoirs within the canal/lateral delivery system, large canals acting as reservoirs, and on-farm ponds/reservoirs have been thoroughly investigated over the many years. Haystack Reservoir was constructed resulting in drastically reducing seasonal canal transmission and spill losses.

Small re-regulating reservoirs have been constructed at end of main canals and laterals to collect operation and management spills. This has provided irrigation water supply for several users, thereby freeing up additional delivery water to other users. No additional reservoirs are planned in the near future. Many on-farm ponds have been constructed by individuals to provide flow delivery and runoff regulation.

It has been determined by studies by the BOR and the district, minimal water conservation benefits could be available for cost expended for any additional re-regulation reservoirs within the district.

2.6.7 Educational Program

NUID fully cooperates with other local, federal and state agencies in all local program water conservation efforts, i.e. Natural Resource Conservation Service, Farm Service Administration, Oregon State University Agricultural Extension, U.S. Bureau of Reclamation, Oregon Water Resource Department, Soil and Water Conservation Districts, Oregon Department of Agriculture, etc.

The district will initiate including "Irrigation Tips" type of information in the newsletter that is emailed out to patrons that have email addresses on file with the district, and placed on the district

website. Information for "Irrigation Tips" is available from NRCS, OSU, and BOR as well as from private irrigation enterprises. Small water savings are expected, but this is a low-cost item to implement.

The district will continue to update its website, provide newsletters and office space to display and distribute information about conservation and educational programs and opportunities to all of its patrons and water users.

Landowner/Water user Tours
The district conducts periodic landowner/water user tours to educate its landowners and water users on various issues about the district. The tour includes visits to the Bend Headworks, Wickiup Reservoir, Crooked River Pumping Station, Haystack Reservoir, portions of the main canal that have been lined and portions that remain unlined. The tour provides a history of the district, challenges the district faces, O&M activities and conservation activities and their benefits.

Various interpretive talks and tours for schools, commissions, and groups
The district provides interpretive talks and tours to various schools, commissions, and groups. Past and current interpretive talks and tours have included university students, elementary grade students, state and federal agencies and commissions, environmental and conservancy organizations, and various groups including congressional delegations.

Jefferson County Historical Society tours
Annually the district provides tours to the Jefferson County Historical Society. The tour provides insight into the history of the NUID project and compares it to where the district is today.

Central Oregon Farm Fair
Annually the district supports an informative booth at the Central Oregon Farm Fair. The district also provides a presentation on district activities, conservation projects, water use, and a water report for the upcoming irrigation season.

Jefferson County Rural Living Handbook
The district in coordination with various public and private contributors participated in the development of a Jefferson County Rural Living Handbook. Among other items, the handbook provides information including an explanation of water rights, irrigation and water management keeping irrigation water clean, water management techniques, and the benefits of irrigation water management. The handbook is a free publication made available at the district office and website and through various distribution locations across Jefferson County.

Oregon Department of Agriculture - Irrigation Water Management Group (IWM)
The district is a member of the Oregon Department of Agriculture Irrigation Water Management Group (IWM). The ODA IWM membership is comprised of various interests from Jefferson, Deschutes and Crook counties. Members of this group include the Oregon Dept. of Ag, irrigation districts, energy providers, Soil and Water Conservations Districts, and the Natural Resource Conservation Service. NUID is committed to disseminating program information and educational information to all of its water users that these groups and or the IWM provides that would be beneficial to district patrons and water users.

2.6.8 Sharing of Water

NUID participates and encourages in sharing of anticipated non-used water between users within the district, that helps provide a seasonal irrigation water supply to those needing it. During the water short years when extra water was not available for purchase, sharing of water between users was common place. Those choosing to increase idle lands or decrease seasonal application those particular years, shared their water with other users that were in critical need. This program resulted in small water savings, other than that it made water available to where it was more critically needed. Sharing of water between users is encouraged and facilitated by the district, however, total seasonal water savings is rather small and will not be actively pursued by the district.

2.6.9 Flexibility of Water Delivery

The district operates a metered demand-type delivery system, i.e. 24 hour notice for all delivery orders. This system requires a larger capacity canal delivery system when compared to a continuous flow system, and works very well with the location and operation of Haystack Regulation Reservoir. Delivery schedules reviewed included: Continuous flow, Rotational, Arranged, Demand (sprinkler), and Demand (surface). The district is currently operating at peak management using the Demand type system and no increase in water savings would be expected by changing, in fact, it would most likely decrease.

Modifying or improving existing distribution facilities to improve the flexibility of water delivery was determined to not be needed. The existing system works extremely well.

2.6.10 Deschutes Water Bank Pilot Program

The Deschutes Water Bank Pilot Program is a voluntary program through which participating and eligible Central Oregon Irrigation District (COID) Patrons may provide water that would have otherwise been delivered to them by COID for use in NUID and to provide environmental benefits to the Deschutes River through increased instream flows in the winter. NUID will directly compensate COID landowners for the transferred water and agrees to place 25% of the water back into the Deschutes River during winter releases.

2.6.11 Conversion to metered and pressurized deliveries to developments with parcels of one acre or less.

The district continues to evaluate potential conversion to metered and pressurized operations where water is currently being delivered/used in small parcel developments, there are only a few developments currently existing inside the district using district water. Potential water savings are not all that great; however, any amount can improve firming up total water supply for other users. All new developments are being reviewed during the planning process.

In order to develop on irrigated land, most developers chose to relinquish water rights and discontinue use of irrigation water on that land.

2.7 Schedule for Implementation of the Projects (OAR 690-086-0250 (7))

- 2022 – 2029 - Install approximately 20 - 30 miles of pipeline thus replacing existing open earth laterals and canals. Environmental Assessment will be completed by the end of 2022 and piping is planned to start for Laterals 31, 32, 34, and 43.
- 2022 - 2023 – Convert approximately 1,500 linear feet of open earthen canals to pressurized pipe on lateral 41-9.
- 2022 – 2023 – Replace 16 Main Canal Headgates to a fully automated remotely controlled system.
- 2024 – 2030 – Install rated flow measuring/control devices to the head/tail end of laterals that have the potential to return to natural water sources, thereby reducing the loss of water.
- Ongoing - Support and cooperate with individuals and groups of water users for the installation of pipelines on private ditches, i.e. downstream from point of delivery.

2.8 Programs for Evaluation of Projects (OAR 690-086-0250 (8))

Future conservation projects are likely to be done with cooperative funding partnerships from state and/or federal agency programs. At the time of project funding, the method of evaluation will be consistent with the funding agency's criteria.

The previously approved WMCP and SIP identified numerous conservation programs the district has since implemented, modified, suspended, or rejected. These programs were evaluated and discussed in detail in section 2.1.

3. WATER ALLOCATION AND CURTAILMENT ELEMENT (OAR 690-086-0260)

A. Drought History / Assessment of Vulnerability

Frequency, duration, severity, shortage of supplies, potential for catastrophic loss of water

North Unit Irrigation District's water supply comes from storage in Wickiup Reservoir, the Crooked River, and from the Deschutes River when the natural flow of the river exceeds 1,500 cfs (see discussion on Waters Rights, Part I, p3). Haystack Reservoir acts as a regulating reservoir.

The Revised Inter-district agreement of 1938 covers the storage in, and use of, all water from Wickiup and Crane Prairie Reservoirs for purposes of implementing the Deschutes Basin Habitat Conservation Plan (DBHCP) for: Jefferson Conservancy District (North Unit ID), Central Oregon ID, Arnold ID, and Crook County Improvement District No. 1 (Lone Pine area). This inter-district contract is critical to all districts during low water supply years and implementation of the DBHCP.

During the analysis period of 2010 to 2021, total on-farm delivery during the extreme low water supply year of 2021 by NUID was 61% of average year delivery. All irrigation districts obtaining water from the Deschutes River Basin provided a reduced delivery to their users during 2021. Total

diversion for NUID occurred during the extreme low water supply years of 2019 and 2021 (i.e. where diversion was supplied from both Deschutes and Crooked Rivers). This also agrees with date of highest storage capacity in the spring in Wickiup Reservoir, as displayed in the following table for the years 2010-2021. One needs to keep in mind that the average year water supply in the district is less than the minimum necessary to fully supply crop needs for the total irrigated acreage.

Displayed in the following table is the highest storage level for Wickiup Reservoir at or near the start of irrigation season for recent years. This information shows the effect of low runoff during the winter and early spring. Capacity is rated at 200,000 AF.

Year	Month/Date Highest reading	Capacity (Acre-Ft)	Comment
2010	3/30	201,172	full
2011	4/2	200,950	full
2012	4/1	200,505	full
2013	4/6	200,839	full
2014	4/12	201,908	full
2015	4/7	200,218	full
2016	3/26	174,749	very low year
2017	4/3	174,342	very low year
2018	3/29	199,995	Considered full
2019	4/17	139,076	extremely low year
2020	3/31	141,317	extremely low year
2021	4/1	115,807	extremely low year

Period of 2010 to 2021. The below-average total water supply (diversion) represents 6 years of 12 years. Interestingly, all 6 years occurred during the period of 2016 – 2021, or what local people describe as the “extreme drought years”.

Period of 1989 - 2021. During the spring (March and/or April), the reservoir did not fill 15 of the 33 years and very low reservoir storage occurred during early fall (end of Sept) for the reservoir 19 of the 33 years, generally the same years but not always. The low early fall storage indicates the effect of low runoff during spring and summer from the watershed.

For the most recent period years of 2007 - 2021 the district experienced 8 years in which NUID was required to establish rationing or allotments of water to its patrons due to water availability conditions. In those years - 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021 – Wickiup Reservoir reached fill levels of 201,908 allotment lifted, 200,218, 174,749, 174,342, 199,995, 139,076, 141,317, and 115,807 respectively.

Storage in Wickiup Reservoir is affected by outflow from storage rights in Crane Prairie Reservoir (COID, AID, and Crook County Improvement District), and natural flow from Deschutes River above Crane Prairie Reservoir, Browns Creek and Davis Lake outflow below Crane Prairie Reservoir, etc. Due to complexity of inflow and outflow to meet water rights for the several irrigation districts in Central Oregon, as well as maintain natural stream flow to meet water rights for Swalley Irrigation District, no analysis is provided other than displaying the data (mean & minimum storage for all months during the year).

Vandalism or sabotage to existing water control structures and/or accidental or intentional contamination of water supplies can potentially occur, and depending on severity, could cause a severe water shortage to the district. Wickiup, Crane Prairie, Haystack, and Prineville Reservoirs and all-natural lakes in the Deschutes and Crooked River Basins are available for public recreation use. Full-time caretakers are provided at Wickiup and Haystack Reservoirs. Conveyance canals and distribution facilities operated by the district are crossed by literally hundreds of public and private roads. Only the principal control structures, i.e. pumping plant, reservoir control gates, etc. are fenced and locked to prevent public access, however, all water control gates themselves are chained and padlocked. The district feels controls to key structures are adequately protected. If a condition occurred where storage or streamflow was totally or partially lost due to vandalism, sabotage or contamination, curtailment, and allotment procedures would be followed, as outlined in Part E.

Sudden full or partial structural failure of any multi-district operated facility would demonstrate the vulnerability of NUID's principal structures and distribution facilities. These structures and facilities provide principal infrastructure (for storage, diversion, conveyance, and distribution) that provides the irrigation water for the 59,000 acres of irrigated lands in the district. If full structural failure to Wickiup Reservoir Dam, or to the diversion structure at Bend ("North Canal Dam"), or to the Crooked River Flume occurred, delivery of water could potentially be zero to much of the NUID irrigated area until emergency repairs or replacement could be made. The irrigated area served from Haystack Reservoir could yet be provided limited water if the three above-mentioned facilities failed. If Wickiup Reservoir Dam failed, storage water from this source would not be available. If the "North Canal Dam" at Bend failed, stored water from Wickiup and Crane Prairie Reservoirs plus natural streamflow would not be available from Deschutes River for NUID and two other irrigation districts (COID & Swalley ID). If the Crooked River Flume failed, water would not be available from Deschutes River or Crooked River.

If the Crooked River pumps failed, water would not be available for the Crooked River water right acreage and there wouldn't be any supplemental water for the Deschutes water right acreage. Failure of all of the facilities at one time is highly unlikely, as it would probably occur only during severe seismic action.

The diversion structure at Bend, ("North Canal Dam") being nearly 120 years old, although stable, may be subject to failure due to severe seismic action. If a condition occurred where water supply, storage facilities, diversion or principal conveyance facilities were either fully or partially lost due to vandalism or other structural failure, curtailment and allotment procedures would be followed, as outlined in Part E.

B. Planning for Drought

Meetings involving irrigation district managers and the OWRD Watermaster for the Deschutes River Basin are held on a regular basis (monthly) during water-short years. Potential drought conditions and water shortages to irrigation districts have been key discussion topics in the past and will continue in future meetings. Discussions on current and projected water supply are on the agenda for every meeting. District Managers review available SNOTEL, Climate, and real-time water tracking data on a monthly basis when making recommendations to the NUID Board of Directors.

Cooperative Agreements

There is no formal agreement between the irrigation districts in the basin to share or exchange water amongst themselves, other than the Revised Inter-district Contract of 1938 that only pertains to storage in and use, of all water from Wickiup and Crane Prairie Reservoirs for: Jefferson Water Conservancy District (North Unit ID), Central Oregon ID, Arnold ID, and Crook County Improvement District No. 1 (Lone Pine area).

The Deschutes Basis Board of Control was created in 2002 to facilitate a meeting place for all 8 Central Oregon Irrigation Districts (North Unit, Central Oregon, Arnold, Three Sisters, Swalley, Tumalo, Lone Pine, and Ochoco) to coordinate and share their respective resources and management assets to conserve water, improve their services for farm and ranch families, and enhance river conditions.

The districts in the basin have in the past shared and exchanged water during drought years under the direction of the Central Oregon Watermaster. However, all of the irrigation districts in Central Oregon strongly desire to maintain the existing situation, i.e. no formal agreement as to who shares what water and when, other than as controlled by the Revised Inter-district Contract of 1938 that pertains to storage in Wickiup Reservoir and implementation of the DBHCP.

Past drought mitigation procedures

Water delivery was reduced unilaterally (62% of average year delivery) to all users during the low water supply year of 1962. A reduced delivery was maintained throughout the irrigation season, whereby users with critical crops could meet minimum crop needs. Set aside and/or non-irrigated lands were prevalent in those years. The board of directors provides the final decision for reduced delivery based on recommendations of staff.

2021 the Irrigation allotment was set to 1 acre-foot and was reduced to .80 acre-foot due to diminished water supply. Due to HCP limitations on how much water could be released from Wickiup Reservoir, the historically low allotment was followed up by placing a cap on how much water patrons could order at any given time. NUID ran out of water on August 21, 2021.

C. Triggers

Information sources that may indicate water shortages agreed to by the Board include:

Water supply projections – NRCS and US Weather Service provide public forecast information for potential runoff from January through early spring months in all river basins in Oregon. This information is readily available on computer internet websites for BOR, USGS, NRCS and US Weather Service.

The district very closely observes the NRCS snowpack measurement data in the upper watershed (particularly Irish-Taylor, Cascade Summit, and Cultus Lake snow pillow sites) therefore, runoff projections are known immediately upon release.

The following indices, trends, reports, etc., are used to support pending drought conditions:

- BOR Hydromet System Data, i.e. daily storage level/capacity on all reservoirs in the Deschutes River Basin, and specifically Wickiup Reservoir.

- NRCS Snotel System data and runoff projection,
- NUID staff provides their own evaluation of projected runoff as to how it applies to the filling of Wickiup and Haystack Reservoirs.
- OWRD's Watermaster for Central Oregon provides a daily updated storage level/capacity on all storage reservoirs in the Deschutes River and Crooked River Basins.

Triggers for a declaration of potential drought conditions by NUID Board of Directors include:

- the lack of low-elevation winter precipitation becomes critical at 50% of normal by March 1,
- and the March 1 reservoir storage is a 75% of normal,
- and when the projected runoff for April – June reaches 75%

The Board will provide a detailed self-evaluation of the potential irrigation season water supply for potential reduced delivery and potential drought declaration, taking into consideration all available "triggering" factors.

NUID Board of Director's actions include:

Water users will be informed of potential water supply reduction through local media and district mailings as early as possible so each user can plan on crops to be irrigated, irrigation water management techniques, priorities for fields to be irrigated, and fields that will not be irrigated.

Variations in weather patterns in the spring or summer can correct a drought situation before it becomes critical, i.e. heavier than normal spring and summer rains or cooler spring temperatures may alleviate the effect of low winter precipitation and runoff. There is no way to predict a potential drought situation with precision.

At any time in the spring or early summer, should potential drought conditions change to a more normal water supply, the same communication procedures that were followed to initiate action will be followed to un-initiate action.

D. Courses of Action

When the trigger level is reached, the following local community actions occur

- Local irrigation districts, plus federal and state agencies, cooperatively assess conditions based on accumulated low-elevation winter precipitation, existing reservoir storage, and projected runoff.
- When a potential drought condition is viewed as a real issue by local groups, county officials are brought into the discussion by the local irrigation districts. The local county commissioners then request the Governor to officially declare the local area or region as a "Drought" area.
- The Oregon Drought Council (representatives from state agencies, federal agencies, and the Governor's office) meet to assess the request and local conditions. This group makes

recommendations to the State Emergency Management Group. The State Emergency Management Group provides a recommendation to the Governor.
- The Governor then officially declares a "Drought" Area, County, or Region, to be in effect.
- North Unit Irrigation District is then allowed to use any of the applicable tools under OAR 690-19, for water right transfer, water supplementation, qualification for federal relief funds, etc. See OAR 690-19-020 (12) for definition of temporary water right transfer (i.e. it means temporary change in use, change in place of use, or change in point of diversion).

Other courses of action

During officially declared "Drought" conditions in the Deschutes River Basin, alternative sources of water and/or transfers in diversion point from within the basin for additional water are not reasonable alternatives. OAR 690-19 authorizes transfer of water, but water may not be available. When Deschutes River Basin is water short, typically so are all adjoining basins and sub-basins in Central Oregon, i.e. Crooked River, Ochoco Creek, Little Deschutes River, Squaw Creek, and Metolius River.

During the low water supply years of 2019, 2020 & 2021, NUID purchased 10,000 AF of water each year from BOR from the unassigned storage space in Prineville Reservoir. Pending the outcome of BOR's assignment of the unassigned storage space in Prineville Reservoir, purchase of water from that water source may or may not be an option in the future.

E. Curtailment and Allocation Plan & Procedures

Upon recommendations of district staff, the Board of Directors provides the final decision and direction for curtailment and allocation of water based on the projected water supply. Degree of curtailment and allocation will be based on projected water supply reduction, NUID's water rights (see Part I), Revised Inter-district Agreement of 1938 for storage in Wickiup Reservoir, and to other irrigation districts prior water rights within the Deschutes River and Crooked River Basins.

Curtailment

- Delay turn-on date to conserve water for use during peak consumptive use period to meet projected adjusted season water needs vs projected water availability.
- Provide increased control of all water within the district.
- Provide intensive information programs to users on reducing on-farm water use.
- Evaluate the potential for installing temporary critical water conservation measures in high seepage loss areas, where feasible.
- Provide a comprehensive weekly analysis of water availability during irrigation delivery season to Ditch riders and users.
- Water would be totally shut off when it is deemed impractical to maintain canal and lateral flow for deliveries to all users.
- Work closely with other federal and state agencies, irrigation districts, ditch companies, and M&I users within Deschutes River and Crooked River Basins for potential water sharing

Allocation

Water delivery to all users will be reduced uniformly in accordance with projected percentage reduction in water supply or individual users will be provided alternatives for reduced water delivery such as:

- Voluntarily reduce irrigated acres.
- Voluntarily sharing of water, limited to water right source and application on specific water right acreage.
- Not irrigating during selected months, i.e. during peak use period, or quit irrigating for the remainder of the season after a selected month/day.

NUID will provide information to users on water application techniques that optimize water use on the variety of crops typically grown in the area.

Total projected water delivery for the irrigation season cannot exceed water availability, when applying the selected allocation alternatives.

F. Education/Cooperation

North Unit Irrigation District Board will:

- Provide users with pre-drought water supply projections, planning process, and decision-making process, so the users can be informed as to the potential effects on water availability, crop plantings, and seasonal irrigation needs.
- Keep users updated on water supply projections (drought conditions) and the water delivery process by way of newsletters, local media, website, providing telephone service, ditch riders, etc.
- Provide detailed weekly analysis of water availability, crop water needs (i.e. "Agrimet" data) to users and to all staff.
- Work closely with federal, state, and local agencies to assist in providing accurate and timely information to users for on-farm irrigation management techniques to minimize water use and maximize production or quality.
- Actively cooperate with irrigation scheduling programs currently sponsored by OSU.

G. Other

North Unit ID will provide an evaluation at end of each officially declared drought year, to determine the effectiveness of decisions and procedures, and the effects on: water users, reservoir drawdown, stream flows in Deschutes River and Crooked River, and the effects on fish and wildlife in district-owned and operated facilities.

3.1 Frequency and Magnitude of Past Supply Deficiencies (OAR 690-086-0260 (1)

See Section A above

3.2 Criteria for Implementation of Water Allocation/Curtailment Element (OAR 690-086-0260 (2)

See Section E above

3.3 Procedure for Allocation of Water During Shortages (OAR 690-086-0260 (3)

See Section E above

4. WATER SUPPLY ELEMENT (OAR 690-086-0270)

4.1 Long-Range Water Demand Projections (OAR 690-086-0270 (1))

4.1.1 Projection of Water Demand in 20 years

In the district, farm area is expected to stay nearly constant, total crop pattern should remain the same and crop water needs should remain nearly constant. Variations may occur as a result of cropping patterns, climate change, commodity prices, etc., farm sizes should remain constant, but overall irrigated agricultural land may decrease due to encroaching urban development. The Madras farming community should remain a principal rural community in Oregon.

To provide a local economical agricultural community, agricultural food and fiber, plus other amenities that an irrigated agricultural community provides, water usage for NUID is expected to remain nearly the same.

Very long-range water use needs for existing crops may increase as (if) global warming occurs. Local research may provide crops and crop varieties that will provide similar yields, acceptable quality, and economic benefit, and with nearly the same water requirements.

As the Deschutes River Basin (i.e. Bend, Redmond, Madras, etc.) becomes more populated, higher demands will be made on the existing water resource, both surface and ground waters.

Should changes in cropping patterns occur and smaller acreages of specialty crops become predominant, then adjustments must be made by the ditch riders in delivery schedules and amounts of water. Typically, orders are more frequent for smaller amounts of water.

An increase may occur in small acreage developments due to urban growth near and around Madras, Metolius, and Culver communities. The district will work very closely with developers, community planners, and water distributors to implement water conservation facilities, i.e. rate structure, distribution system and delivery pipelines, flow meters, etc.

4.1.2 Conservation and technology

New technology will improve delivery and on-farm water use efficiencies. “Agrimet” data allows growers and irrigation district managers to track anticipated water demands more precisely. The district will see an increase in use of this data as water resources in the Deschutes River Basin and the district become more of an issue.

Agriculture research and other water resource agencies providing technical assistance will continue to promote and adopt new water conservation practices. The district will stay abreast of improvements and help promote technology transfer to users.

The district launched an “Online Customer Portal” in 2019, which enables district patrons the ability to track their water account balance, start/stop water deliveries, and pay their bill. This tool helps patrons track real-time consumption of their water allotment.

With technological help from Campbell Scientific Logger Net system, the district has the capability of remotely tracking flows throughout the entire system. Not only can district Watermasters track flows, but they have the ability to program timed changes to dam facilities and check structures. Alarms are sent via email, text, and phone if flow parameters are exceeded at any time of the day. In addition to the current systems, NUID will begin experimenting with automated headgates from Rubicon Technologies, which, once programmed, will automatically maintain set flows.

4.2 Projected Water Needs and Size and Reliability of Water Rights Permits and Contracts (OAR 690-086-0270 (2))

The existing water rights held by the district generally provide sufficient supply to the lands within the district boundaries. During peak summer temperatures, the supply in many areas of the district can become marginal, especially due to system losses.

Coupled with the ongoing drought, decreased Wickiup Reservoir storage levels forced the district to temporarily suspend deliveries from August 22, 2021 through October 5, 2021. Along with the suspension, we had to drastically reduce allotments and place an order cap on how much a patron could order at a time. Once senior water right holders ceased their deliveries for the season, NUID was able to divert that flow for our junior water right holders.

As the district moves forward with such projects as the 31, 32, 34, and 43 piping project(s), such supply is enhanced and more reliable to the district's irrigators. For this reason, the district intends to continue pursuing conservation projects in its systems to enhance supply and deliveries without affecting storage releases.

Farming within the district is production farming and although crop rotations and other cropping patterns may vary slightly over time, generally, the overall irrigation water applied within the district is stable and changes little from year to year. The exception to this rule is seasons of drought, which NUID has experienced over the past 3 years. NUID continues to support conservation projects in other Deschutes Basin Irrigation Districts. The conserved water will help NUID shore up existing summer supplies while the conserved water will help Winter HCP flow requirements (see 4.3). The existing secured water rights permits, and contracts indicated in 1.2 above appear to be sufficient for the districts near term purposes however, such supply will be enhanced with conservation where practical and subject to the availability of finances.

4.3 Potential Water Sources (OAR 690-086-0270 (3))

Potentially, treated municipal sewage from Bend, Redmond, Madras, Prineville, etc, could be an alternative source for irrigating field type crops, however, it is deemed at this time to not be a practical water resource, as well as in the near future, due to water quality requirements of surface waters within Oregon. It may yet be a suitable source at some time in the distant future as water resource use becomes an issue.

Analysis for potential pumping from Lake Billy Chinook is being pursued. This pumping facility would potentially provide either the main source or supplemental source of water for the irrigated

lands in the district. District staff are currently working with representatives from the Bureau of Reclamation to conduct an Appraisal study of the proposed project.

As part of the HCP; NUID in cooperation with DBBC Irrigation Districts, have begun the process of piping large sections of open earth COID canals. The water savings from those endeavors will be made available to NUID district patrons during irrigation season (April-October). NUID will be required to place any conserved water back in-stream during the following storage season (November-March).

On April 1st, 2015 the Deschutes River Conservancy (on behalf of NUID and COID) filed a Conserved Water Application for the West-F Lateral Piping Project. The project is located within COID and involves piping approximately 2,210 feet of COID's open unlined F-Lateral under Certificate 94956 with High Density Polyethylene (HDPE) pipe. The piping project is expected to eliminate approximately 5 cubic feet per second (cfs) and 1,605.2 acre-feet (AF) of seepage losses of Deschutes River Water. The second step of the conservation project involves NUID "drying-up" of approximately 642.1 acres of land that currently receive Crooked River water under 95491 at a rate of approximately 1/43 cfs per acre and duty of 3.97 acre-feet per acre. This would result in a reduction in demand from the Crooked River of 14.77 cfs and 2,542.72 AF under Certificate 95491. The 642.1 acres of NUID lands would receive the 1,605.2 AF of Deschutes River water conserved by COID's piping of the F-Lateral at 2.5 acre-feet per acre. This results in a reduction in the use of water for the Deschutes River System as a whole of approximately 9.77 cfs and 937.52.

4.4 Comparison of Potential Water Sources (OAR 690-086-0270 (4))

As indicated above, there are multiple potential water sources that NUID is developing.

Treated Municipal waste will not produce a significant volume of water in the immediate future and there are many obstacles to overcome before this water becomes available.

If the Lake Billy Chinook pumping facility were constructed, it would supply long-term drought resiliency and water dependability to NUID. As stated above, NUID is currently researching the feasibility of this project and will continue to explore this option.

North Unit Irrigation District has identified water conservation as one of the most cost-effective tools for providing additional water resources to the district. Prior to developing CW-75, NUID and the Deschutes River Conservancy evaluated conservation projects within the district and in other districts as potential sources of additional water supplies. As a result of the evaluation, the best-identified water source for NUID patrons is helping other Deschutes Basin Irrigation Districts conserve water. This is accomplished by piping or lining existing canals/laterals. NUID, in conjunction with many basin partners, help source funding for these conservation projects. Typically, all conserved water from these projects goes to NUID during Summer Irrigation Season. The flows are released in the Winter by NUID to help meet HCP requirements.

Current processes in place to further evaluate potential water sources, costs, availability, feasibility, and regional impacts includes work being performed by the Deschutes Water Alliance, Deschutes Water Planning Initiative, Deschutes River Conservancy, and the Deschutes Basis Water Collaborative.

4.5 Evaluation of the Effects of Long-Range Water Needs (OAR 690-086-0270 (5))

NUID in collaboration with other basin irrigation districts, are evaluating the transfer of water via conserved water projects or other water rights that may provide water for transfer to NUID. The current focus is on feasibility of transfers between NUID and Central Oregon Irrigation District

Transfer of either existing water rights or conserved water with COID under the premise of providing Deschutes water supply to displace the need for NUID to pump water from the Crooked River. This would provide for higher flows within the Crooked River at critical locations for present fish species, either listed or not. The Crooked River water is considered more valuable for the environmental benefits.

Preliminary discussion has occurred within the membership of the Deschutes Basin Board of Control (members include the eight irrigation districts in Central Oregon) for the evaluation of a voluntary drought plan water management whereby one district could make an arrangement with another district for additional supply of natural flow or storage rights if available.

The urbanization of district lands within district boundaries will continue to be an element of the district now and in the future. The district works closely with local government to address development, protection of farmlands, and district water rights. The area around Madras and its surrounding communities (City of Culver and Metolius) remain predominately rural-agricultural. Review of the Jefferson County Comprehensive Plan suggests that although development is planned for these local communities, the impact to NUID is rather small. For example, of the 3,818 acres noted in the Jefferson County Draft Urban Reserve Area, 68 acres are considered prime agricultural lands. Although the effects of development on these lands may be small to NUID the process requires close coordination with NUID to ensure no adverse effects to the district or surrounding community.

5. ADDITIONAL REQUIREMENTS (OAR 690-086-0225)

5.1 List of Affected Governments, Copy of Comments (OAR 690-086-0225 (5))

At least 30 days prior to submitting a draft plan to OWRD, each agricultural water supplier must make the draft plan available for review by each affected local government.

The following is a list of affected governments and/or agencies that will be emailed, for their review and comment, a copy of the North Unit Irrigation District Water Management Conservation Plan:

Irrigation Districts:
Arnold Irrigation: Steve Johnson
Central Oregon: Craig Horrell
Ochoco Irrigation: Bruce Scanlon
Swalley Irrigation: Jer Camarata
Three Sisters Irrigation: Marc Thalacker
Tumalo Irrigation: Chris Schull
Lone Pine: Terry Smith

Cities:
City of Madras: Gus Burril
City of Culver: John Nachbar
City of Metolius: Patty Wyler
City of Bend: Patrick Griffiths
City of Redmond: John Roberts

Counties:
Deschutes County: Peter Gutowsky
Crook County: Bill Zelenka
Jefferson County: Scott Edelman

State:
OWRD: Kyle Gorman, Region Manager
OWRD: Jeremy Giffin, Region Watermaster
ODOT: Barry Zelmer
OWRD: Kerri Cope

Federal
US Bureau of Reclamation: Gregg Garnet

Other
Deschutes Valley Water District: Joel Gehrett

5.2 Submittal of Updated Plan, Implementation Schedule - OAR 690-086-0225(6)

The primary implementation activities identified in this WMCP involve capital improvement projects which can take significant time to implement given funding constraints and construction timelines. With respect to available current supplies, the district can generally meet existing needs and does not anticipate significant impacts from urbanization over the next ten years. For these reasons, NUID proposes to update the WMCP in ten years. An updated plan will be submitted to OWRD by December 31, 2032.

6. BACKGROUND INFORMATION

6.1 History of District

The first serious study of irrigation for the North Unit area was done in 1913 by the State of Oregon and the Bureau of Reclamation with a water permit established on February 28, 1913. It was not until July 21, 1938 that construction actually began on the North Unit project. World War II halted construction, but water was delivered to 17,000 acres during 1946 and 1947 and to all of the 50,000 acres by the spring of 1949. The project was set up and operated by the Bureau of Reclamation until 1955, when North Unit Irrigation District took over the operation.

Haystack Reservoir was constructed in 1956-57 to regulate the delivery of irrigation water to the water users on the north end of the project. The capacity of Haystack Reservoir is 6,500 acre-feet and covers a surface area of 225 acres. The dam at Haystack Reservoir is 105 feet high, the base is 755 feet across and it is 25 feet wide at the top.

The Crooked River pumping facility was constructed in 1968. There are nine 450 horsepower pumps at the Crooked River pumping facility, located on the south side of the Crooked River near Smith Rock State Park. The water is pumped 180 feet up the canyon where it enters the main canal and crosses the Crooked River Canyon/River via the Crooked River flume.

The elevation of the land ranges from 2,400 to 2,700 feet above sea level, which is about a thousand feet above the adjacent river canyons. In the early days, the land that is now part of the North Unit Irrigation District was used for grazing cattle and sheep. Beginning in the 1900's dry wheat farming gradually replaced grazing, until most of the area was made up of large dry wheat farms. Farmers experienced a shortage of moisture in the years following 1925 and those remaining in the area knew that to exist they needed a reliable source of water.

The average annual temperature for the area is 48 degrees with an average minimum of 33 degrees and an average maximum of 64 degrees. The highest temperature recorded is 118 degrees and the lowest is minus 40 degrees. Since 1928 the average annual precipitation at Madras is 12.13 inches. The average growing season is 120 days (this is between the last 28 degree temperature in the spring and the first 28 degree temperature in the fall).

Some of the main crops grown on the project are wheat, alfalfa hay, other hay, grass seed, garlic seed, and carrot seed. Pastures are watered to raise cattle, sheep, horses, and other livestock.