Nevada Irrigation District

Agricultural Water Management Plan

April - 2021

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This report contains public information and District data and practices that were not developed under the direction of the Engineer.

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Draft AWMP Table of Contents

List of Acronyms and Abbreviations

Act	Agricultural Water Management Planning Act
AF	Acre-feet
AFY	Acre-feet per year
AW	Applied Water
AWMP	Agricultural Water Management Plan
BMP	Best Management Practice
CABY	Cosumnes, American, Bear, Yuba Integrated Regional Water Management Group
CCU	Crop Consumptive Use
CDFW	California Department of Fish and Wildlife
CIMIS	California Irrigation Management Information System
CWC	California Water Code
DEW	Drier, extreme warming scenario
District	Nevada Irrigation District
DWR	California Department of Water Resources
EP	Effective Precipitation
EQIP	Environmental Quality Incentives Program
ET	Evapotranspiration
ETo	Reference Evapotranspiration
ETAW	Evapotranspiration of Applied Water
EWMP	Efficient Water Management Practices
FAO	Food and Agriculture Organization
FERC	Federal Energy Regulatory Commission
°F	Degrees Fahrenheit
ft	Feet/Foot
GCM	Global Climate Models
GIS	Geographical Information System
hp	Horsepower
MI	Miner's Inch
ml	Milliliter
MPN	Most Probable Number
M&I	Municipal and Industrial
N/A	Not Applicable
NID	Nevada Irrigation District
NRCS	Natural Resource Conservation Service
PCWA	Placer County Water Agency
PFW	Plan for Water
PG&E	Pacific Gas and Electric
PNSSNS	Placer/Nevada/South Sutter/North Sacramento
RCD	Resource Conservation District
SVI	Sacramento Valley Index
SVWQC	Sacramento Valley Water Quality Coalition
SWP	State Water Project
SWRCB	California State Water Resource Control Board
TOC	Total Organic Carbon
UC	University of California
USBR	United States Bureau of Reclamation

USDA	United States Department of Agriculture
USGS	United States Geological Survey
WHO	Water and Hydroelectric Operations
WMW	Wetter, moderate warming scenario
WRCC	Western Regional Climate Center
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1 Agricultural Water Management Plan Introduction and Overview

This AWMP is the year 2020 AWMP as required by the Agricultural Water Management Planning Act (Act), pursuant to California Water Code (CWC) Section 10820(a). The Act requires all agricultural water suppliers that provide water to 10,000 or more irrigated acres within their service area to prepare an Agricultural Water Management Plan (AWMP or Plan). This AWMP was prepared with the assistance of the Nevada Irrigation District (District).

This AWMP addresses the District's water system and includes a description of the service area, water uses, water resources, and a comparison of water supply and water demands during the planning cycle (2016 through 2020). Also described are the District's water supply reliability, water use efficiency information, and drought plan. The Plan presents NID's past data and current operations, rules, and regulations as provided to develop the document.

The organization of this 2020 update generally follows the outline presented in the DRAFT DWR 2020 AWMP Guidebook. The final guidebook has not yet been released. This 2020 update solely addresses the legislative requirements. Relevant sections of the CWC are presented in italics throughout the plan to provide context to the respective section.

1.1 Agricultural Water Management Planning Act

10608.12(a) "Agricultural water supplier" means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water.

10820(a)(2)(A). The agricultural water management plan shall be updated on or before April 1, 2021, and thereafter on or before April 1 in the years ending in six and one.

NID is defined as an agricultural supplier per CWC Section 10608.12(a), and therefore, is required to update the AWMP per CWC Section 10820(a)(2)(A). The Act describes the contents of the AWMP as well as how agricultural water suppliers should adopt and implement the AWMP. The current version of the Act requires an AWMP to include:

- Description of agricultural water supplier and service area.
- Information on quantity of water uses.
- Description of quantity and quality of water supplies.
- Analysis of water supply reliability.
- Annual water budget based on quantification of all inflow and outflow components for the service area.
- Identification of water management objectives aimed at improving system efficiency or to meet other water management objectives.
- Quantification of water use efficiency using the methods(s) presented in DWR's 2012 Report to the Legislature, "A Proposed Methodology for Quantifying the Efficiency of Agriculture Water Use." The quantification for the efficiency of agriculture water use must account for all water uses, including crop water, agronomic, environmental, and recoverable surface flows.
- Inclusion of a Drought Plan for periods of limited water supplies available to the supplier. The Drought Plan describes actions for resilience and response planning.

In addition to the general requirements above, the Act includes submittal requirements:

- AWMP is to be adopted on/before April 1, 2021 (and every five years following).
- AWMP must be submitted electronically to DWR.

1.2 Description of Previous Water Management Activities

10826(e). Describe previous water management activities.

The District maintains an active and ongoing water resources planning program. Policy and strategic efforts are set by the Board of Directors through the Board's Strategic Plan, specific resolutions, and directions to staff. Previous planning efforts included AWMPs, Urban Water Management Plans, Integrated Regional Water Resource Management Plans through the Cosumnes/American/Bear/Yuba (CABY) group, Federal Energy Regulatory Commission license, and the Raw Water Master Plan. The most recent Board of Directors' District Goals identified the importance of developing and managing the District's resources in a self-determining manner to protect and provide local control of the water supply. The District is implementing this goal through the Plan for Water Program. Plan for Water (PFW) is an overarching effort to evaluate all the District's natural resources, the community's need for the resources, and developing strategies to match resources with the needs. PFW is an ongoing process that will continually evaluate data and trends to update and refine the water resource management strategies into the future.

1.3 Coordination Activities

The following subsections describe the District's actions to comply with the coordination requirements, including notification and public participation.

1.3.1 Notification of AWMP Preparation

10821(a). An agricultural water supplier required to prepare a plan pursuant to this part shall notify each city or county within which the supplier provides water supplies that the agricultural water supplier will be preparing the plan or reviewing the plan and considering amendments or changes to the plan. The agricultural water supplier may consult with, and obtain comments from, each city or county that receives notice pursuant to this subdivision.

The District notified cities and counties within the service area that this AWMP was being updated. The notification was mailed December 11, 2020 to the cities and counties as well as other stakeholders as listed in Appendix A. Table 1-1 provides a summary of the AWMP coordination.

Table 1-1. (DWR Worksheet 1) Summary of Coordination, Adoption, and Submittal Activities

Potential interested parties	Notified of AWMP preparation	Requested copy of draft	Commented on the draft/action taken by supplier	Notified of public hearing	Attended public hearing	Copy of AWMP sent
Nevada County	X					X
Placer County	X					X
Yuba County	X					X
City of Grass Valley	X					X
City of Nevada City	X					X
City of Lincoln	X					X
Yuba Water Agency	X					
Placer County Water Agency	X					
Placer County Agricultural Commissioner	X					
Placer County Farm Bureau	X					
Nevada County Agricultural Commissioner	X					
Nevada County Farm Bureau	X					
General public	X		X	X	X	
District Website	12/11/2020	--	--	--	--	--

Notes: The AWMP documents were provided online through the District's website and therefore it is unknown which entities downloaded the documents. The outreach and public hearing was conducted online and through web-based meetings and therefore it is unknown which entities attended the meetings.

1.3.2 Public Participation

10841. Prior to adopting a plan, the agricultural water supplier shall make the proposed plan available for public inspection, and shall hold a public hearing on the plan. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned agricultural water supplier pursuant to Section 6066 of the Government Code.

NID conducted public outreach through a variety of efforts. A news release as well as a website posting were released on and around December 11, 2020 announcing the District's efforts to update the AWMP and the Urban Water Management Plan. A Board workshop was held on March 10, 2021 and March 18, 2021 to review the AWMP requirements and present the District's approach to the draft plan. The Board workshops were publicized per normal Board of Directors meeting notification.

A public hearing was conducted on March 24, 2021 to present the Draft Plan and receive public input. The Draft Plan was provided to the public through the District's website for download seven days prior to the public hearing with reference to its location provided in public hearing notice. The public hearing was noticed in the Auburn Journal and Lincoln News Messenger, pursuant to Section 6066 of the Government Code.

The District received public comment at each meeting as well as submitted comments as included in Appendix A. The District updated and edited the draft Plan per corrections and clarifications.

A copy of the published Notice of Public Hearing is included in Appendix A. The public review comments received are also provided in Appendix A.

1.4 AWMP Adoption, Submittal and Availability

10841. After the [public] hearing, the plan shall be adopted as prepared or as modified during or after the hearing.

10820(a)(2)(B). An agricultural water supplier shall submit its plan to the department no later than 30 days after the adoption of the plan. The plan shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.

10843(a). An agricultural water supplier shall submit to the entities identified in subdivision (b) a copy of its plan no later than 30 days after review of the plan pursuant to subdivision (b) of Section 10820.
(b) An agricultural water supplier shall submit a copy of its plan to each of the following entities:
(1) The department.
(2) Any city, county, or city and county within which the agricultural water supplier provides water supplies.
(3) Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.
(4) The California State Library.

10844(a). Not later than 30 days after the date of adopting its plan, the agricultural water supplier shall make the plan available for public review on the agricultural water supplier's Internet Web site.

This 2020 AWMP was adopted by resolution of the District's Board of Directors on April 14, 2021. A copy of Board Resolution No. 2021-08 is included in Appendix B.

The District submitted this AWMP electronically to DWR for review within 30 days of adoption. The DWR Plan review checklist is presented in Appendix C. In addition, this AWMP will be sent to the City of Grass Valley, Nevada City, and Lincoln, as well as the counties of Placer, Nevada and Yuba, and the California State Library within 30 days of adoption, per DWR requirements.

The District has made this adopted AWMP publicly available at the following locations (within 30 days after adoption);

- District Administration building
- District website (www.nidwater.com)

1.5 AWMP Implementation Schedule

10842. An agricultural water supplier shall implement the plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.

The District will utilize the findings in this AWMP to inform its ongoing water management programs, as well as help inform the Plan for Water process. The District will continue to implement the efficient water management programs, water measurement practices, and water supply management practices described in this AWMP.

2 Description of Service Area

10826(a). Describe the agricultural water supplier and the service area, including all of the following:
(1) Size of the service area
(2) Location of the service area and its water management facilities
(3) Terrain and soils
(4) Climate
(5) Operating rules and regulations
(6) Water delivery measurements or calculations
(7) Water rate schedules and billing
(8) Water shortage allocation policies

The District was organized in 1921 under the California Irrigation District Act of 1897 as a nonprofit water agency, and operates under Division 11 of the State Water Code. NID is governed by a five-member Board who are elected by qualified District voters. Each Board member, representing a division with the District, serves a four-year term.

In addition to agriculture water deliveries (raw water), NID supplies treated water for municipal, domestic, and industrial purposes. Many parcels within the District service area are supplied by private wells and are not currently receiving District-supplied water.

The District also owns and operates hydroelectric generation and recreational facilities. The hydroelectric facilities have a capacity of 82.2 megawatts and produce approximately 375 million kilowatt hours per year. NID began producing power in 1966 with the completion of the Yuba-Bear Power Project, which includes Chicago Park, Dutch Flat, Bowman, and Rollins powerhouses. Recreational facilities owned by the District provide camping, fishing, and boating at Rollins Lake, Scotts Flat Reservoir, and Jackson Meadows – Bowman Lake areas.

Table 2-1 summarized the District's history and size, which is further detailed below. Service area gross acreage is determined through GIS mapping. Irrigated area acreage is determined from the annual customer self-reported surveys used to develop the crop reports.

Table 2-1. (DWR Worksheet 2) District History and Size

Date of Formation	August 15, 1921
Source of Water	
Local Surface Water	X
Local Groundwater	
Wholesaler	X (PG&E)
USBR	
SWP	
Service Area Gross Acreage[1]	287,000
Service Area Irrigated Acreage[2]	32,323

[1]Gross Acreage represents 2020 total area within service area boundary
[2]Irrigated Acreage from 2020 Crop Report

2.1 Physical Characteristics

Located on the western slope of the Sierra Nevada mountain range, the District encompasses 287,000 acres and covers portions of three counties: Nevada, Placer, and Yuba as shown on Figure 2-1. The District's watershed is located on the upper reaches of the Yuba River, Bear River, and Deer Creek. The

highest peak in the District is at 8,373 foot elevation at English Mountain. Ground elevations within the District's service area range from approximately 3,900 feet (ft) on Banner Mountain above Nevada City at the eastern edge of the District, down to about 200 ft near the City of Lincoln. The District transports raw water from high elevation mountain reservoirs to the lower elevation foothills and into portions of the northern Sacramento valley near the City of Lincoln. The District provides raw water to agricultural customers and some other municipal providers, and treated water to its own customers and some other municipal providers.

There have been no changes to the service area boundaries since the 2015 AWMP. The District considers service area expansion requests on a case-by-case basis. The District also receives new service request from parcels within its service area. Over the past five years, the District averaged approximately 20 new agricultural customers per year. Table 2-2 summarizes the expected changes to service area.

Table 2-2. (DWR Worksheet 3) Expected Changes to Service Area

Change to Service Area	Estimate of Magnitude	Effect on the Water Supplier
Reduced Service Area Size	0	None
Increased Service Area Size	0	None
New Governmental Entity	--	None
New Ag Customers Within Service Area	Since 2014, average of 20 new customers/ year, future connection projections will be addressed in Plan for Water.	Increased irrigated acreage, increased demand that must be met with District's supplies.

NID's water management facilities include storage, treatment, and conveyance facilities. The District operates and maintains nine reservoirs with a combined storage total of 280,085 acre-feet (AF). Capacities of the reservoirs are shown in Table 2-3. The two major distribution and storage systems within the District are the Deer Creek System and the Bear River System. These systems are a mixture of canals, siphons, pipelines, and other water conveyance structures. The locations of the reservoirs are shown on Figure 2-1. Table 2-4 presents a summary of conveyance and delivery infrastructure.

The system is supplied by diverting water per NID's surface water rights into the canals at either reservoirs or at other diversion facilities located on the streams. Typical canal operations divert enough flow to allow the purchased deliveries to each customer on the canal. To maintain proper flow rates through customer delivery points, the water surface in the canal is maintained at certain levels, as is typical for miner's inch delivery systems. However, this also results in water exiting the canal at the downstream terminus. Many of these spills are then captured again at the next downstream diversion point for another canal.

Table 2-3. (DWR Worksheet 5) Water Supplier Reservoirs

Reservoir	Capacity, AF
Jackson Meadows	69,205
Bowman	68,510
Jackson Lake	1,330
Sawmill	3,030
Faucherie	3,980
French	13,940
Rollins	65,988
Scotts Flat	48,547
Combie	5,555
Total Capacity	280,085

Source: NID website – accessed December 12, 2020

Table 2-4. (DWR Worksheet 4) Water Conveyance and Delivery System

System Used	Number of Miles
Canal	340
Flume	9
Penstock	1
Other/Creek	35
Siphon/Pipe	91
Tunnel	8

Source: NID GIS

The District does not have a formal tailwater recovery system with respect to capture of on-farm and field runoff. This District is in the process of installing spill measurement on some of its canals and will install more pending available funding. This District is not aware of any grower operated tailwater systems. Tailwater status is summarized in Table 2-5

Table 2-5. (DWR Worksheet 5) Tailwater/Spill Recovery System

System	Yes/No
District Operated tailwater/spill recovery	No
Grower Operated tailwater/spill recovery	No

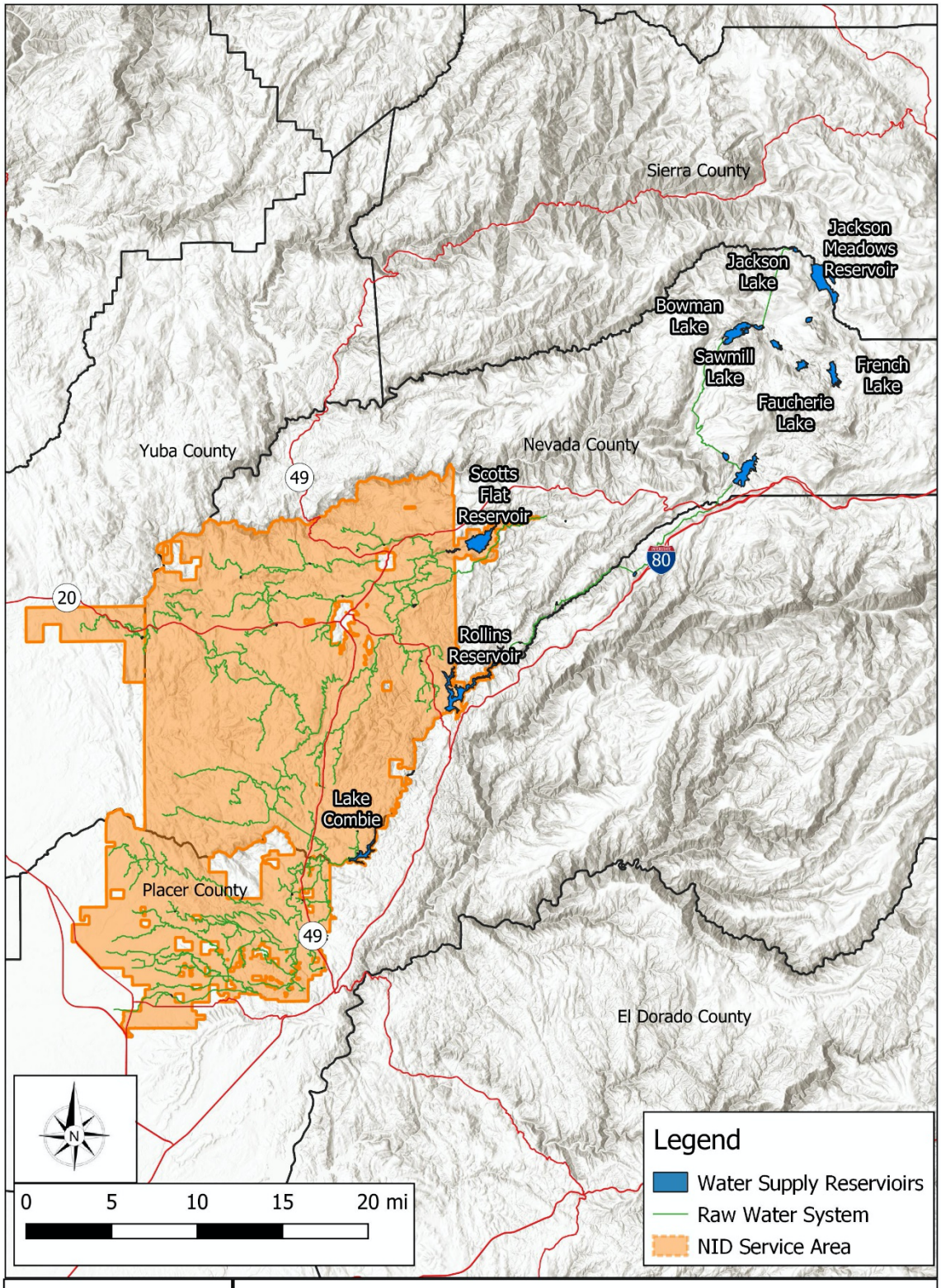

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Figure 2-1: NID Service Area and Raw Water System

2.1.1 Terrain and Soils

The service area covers the Sierra Nevada foothills, which is very different than agricultural areas in the Sacramento and San Joaquin Valleys. The service area topography contains many sloped areas with rock outcroppings, as well as less sloped areas better suited for pasture, orchards, and row crops. The foothill area contains numerous fractured rock systems that allow for private wells, but also complicate the ability to understand and quantify percolation and subsurface systems. Soil types, infiltration rates, and water holding capacities vary widely from a clay dominant soil type to a sandy, alluvial soil type in valley areas. Assumptions regarding percolation and other soil parameters are further discussed in Section 5 – Water Budget. A summary of the soil types within the District service area is provided in Table 2-6.

Table 2-6. (DWR Worksheet 7) Landscape Characteristics

Topography Characteristic (slope percent)	% of the District
<5	19%
5 to 10	15%
10 to 20	27%
20 to 40	33%
40 to 60	4%
>60	1%
Unknown	1%
Soil Characteristic/Classification	**% of the District**
Complex	21%
Gravelly Loam	5%
Loam	16%
Outcrop Complex	6%
Rock Outcrop Complex	16%
Sandy Loam	12%

Source: NID 2015 AWMP based on the Soil Survey Geographic Database (SSURGO) provided by the National Cooperative Soil Survey.

2.1.2 Climate

Summers are generally dry with mild to hot temperatures. Winters are relatively wet, especially in the upper elevations around Nevada City and Grass Valley, with snow levels usually around 3,500 ft and occasionally as low as 1,000 ft. Based on the historical data obtained from the California Irrigation Management Information System (CIMIS) and the Western Regional Climate Center (WRCC), the District's service area's average minimum and maximum monthly temperatures range from 26.4 to 92.5 degrees Fahrenheit. Table 2-7 summarizes the District's climate conditions in representative areas based on the CIMIS and WRCC databases of monthly averages of historic information.

Table 2-7. (DWR Worksheet 9) District Service Area Climate Characteristics

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Wet season (Nov-Mar)	Dry season (Apr-Oct)
Auburn (CIMIS Station No.195, WRCC Station No. 040383), 935' elev.															
Avg. ETo[1], in	1.13	1.83	3.05	4.62	6.23	7.46	8.28	7.57	5.66	3.77	1.78	1.02	52.42	8.81	39.62
Avg. max temp[2], °F	54.0	58.3	62.0	68.3	76.2	85.3	92.5	91.5	86.2	76.6	63.2	54.9	72.4	58.5	83.3
Avg. min temp[2], °F	36.6	39.3	41.4	44.8	50.3	56.5	61.8	61.0	57.3	50.7	42.9	36.8	48.3	39.4	55.28
Avg. rainfall[2], in	6.71	5.96	5.35	2.70	1.26	0.38	0.05	0.07	0.42	1.78	4.01	5.71	34.39	27.7	4.88
Avg. snowfall[2], in	0.4	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.3	1.2	0.2
Grass Valley No. 2 (WRCC Station No. 043573)[3], 2,400' elev.															
Avg. ETo, in	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg. max temp, °F	53.5	55.2	37.5	62.1	71.0	79.5	87.4	87.1	82.2	72.1	59.6	53.1	68.3	51.8	78.2
Avg min temp, °F	32.0	33.6	36.0	38.8	45.4	51.3	56.2	55.0	50.5	42.9	36.2	31.7	42.5	33.9	49.5
Avg rainfall, in	9.69	8.56	8.32	4.02	1.97	0.68	0.12	0.21	0.79	2.70	6.73	9.46	53.26	42.8	7.8
Avg snowfall, in	2.2	2.5	2.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.9	10.0	9.3	0.8
Nevada City (WRCC Station No. 046136)[4], 2,780' elev.															
Avg. ETo, in	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg. max temp, °F	50.7	53.3	56.7	63.2	71.0	79.8	88.4	87.4	81.5	71.0	58.7	51.4	67.7	54.2	78.6
Avg. min temp, °F	30.4	31.7	33.7	36.8	42.5	48.2	52.7	51.4	47.0	41.1	34.7	30.9	40.1	32.3	46.4
Avg. rainfall, in	10.22	9.29	8.20	4.34	2.21	0.65	0.05	0.14	0.76	2.86	6.22	9.37	54.31	43.3	8.15
Avg. snowfall, in	7.9	5.9	5.7	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.7	3.6	24.8	23.8	1.1

Table 2-7. (DWR Worksheet 9) District Service Area Climate Characteristics, continued

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Wet season (Nov-Mar)	Dry season (Apr-Oct)
Bowman Dam (WRCC Station No. 041018)[5], 5,390' elev.															
Avg. ETo, in	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avg. max temp, °F	45.0	46.1	49.5	55.2	63.7	72.1	80.0	79.8	73.8	64.1	52.8	46.1	60.7	47.9	70.8
Avg. min temp, °F	26.4	26.6	28.6	32.5	39.2	46.7	53.4	53.2	48.4	41.2	33.4	33.4	38.2	29.7	45.6
Avg. rainfall, in	11.74	10.06	9.09	4.56	3.49	1.24	0.20	0.40	0.90	4.14	8.14	10.83	64.78	49.9	10.8
Avg. snowfall, in	53.1	49.8	48.1	21.2	7.0	0.3	0.0	0.0	0.3	2.6	19.6	39.9	242.0	210.5	28.8

N/A = not available

[1]Period of record is 1/1/2005 through 12/31/2020.

[2]Period of record is 1/1/1905 through 6/10/2016.

[3]Period of record is 10/1/1966 through 6/10/2016.

[4]Period of record is 2/1/1893 through 6/10/2016.

[5]Period of record is 6/1/1896 through 5/31/2016.

2.2 Operational Characteristics

This subsection describes the operating rules and regulations for water delivery and billing, and allocation policies during water shortages.

2.2.1 Operating Rules and Regulations

The Board establishes and adopts the policies of the District and the Water Service Regulations. The Water Service Regulations provide for the equitable distribution and use of water within the service area. The Board reviews and makes revisions or amendments to the regulations as necessary. The most recent version of the District's Water Service Regulations (dated September 18, 2020) is included as Appendix D.

Water customers receive raw water through a variety of delivery systems and periods, as summarized in Table 2-8. The majority of raw water use is irrigation season (April 15-October 14). Fall and Winter use is available for purchase as available and often corresponds with dry Fall and Winter periods. NID provides a small percentage of raw water as wholesale water to other municipal water agencies. At times as available and as needed, NID will also provide raw water to other local or regional water providers on a case-by-case basis. The District also provides raw water intermittently through the other minor delivery methods as identified in Table 2-8.

The District sells agricultural and raw water based on flow and volume basis, depending on customer type, as identified in Table 2-9. The majority of irrigation customers are provided water based on miner's inch deliveries. Some of the wholesale sales to other agencies are based on volume and flow values per the purchase contracts

Purchase and ordering are also dependent on customer type and water type. Seasonal irrigation use is ordered by customers with at least a 48-hour lead time. Wholesale customers have annual water contracts that identify maximum flows and/or volumes over time. Other types of water orders also require a 48-hour lead time. Similarly, water shutoffs require at least a 24-hour lead time. Ordering times are summarized in Table 2-10.

Table 2-8. (DWR Worksheet 10) Supplier Delivery System (2020)

Type	Checked if Used
Seasonal Irrigation Service	X
Fall/Winter Water Service	X
Annual Raw Water Service	X
Intermittent Flow Service	X
Demand Water Service	X
Tank or Temporary Construction Water Service	X
Surplus Water Service (outside the District Service Area Boundaries)	X
Rotation	X

Table 2-9. (DWR Worksheet 11) Water Allocation Policy

Basis of Water Allocation	Checked if Used			Allocation	
	Flow	Volume	Seasonal Allocations	Normal Year	% of Water Deliveries
Area within the Service Area	X	X	X	100%	100%
Amount of Land Owned					
Riparian Rights					
Other					

Table 2-10. (DWR Worksheet 12) Actual Lead Times

Operations	Hour/Days
Water Orders	48 Hours
Water Shut-Off	24 Hours

2.2.2 Water Delivery Measurement or Calculations

The majority of the District's irrigation customers purchase irrigation season water, April 15 through October 14, based on miner's inch. The standard measurement for a miner's inch requires a six-inch head of water over the center of the orifice and the water to free flow through the delivery point. For customers that purchase 40 miner's inches or less, the amount of water is delivered through a standard water box and measured through an orifice sized for the amount of water purchased and the available head pressure. For purchases greater than 40 miner's inches, the measurement may be by any industry standard device such as a weir or Parshall flume that will give the most accurate measurement for the situation. Orifices used for customer delivery are checked at a minimum of twice a year for proper sizing, adequate head pressure, and condition of the service point. Flowmeters are included in a maintenance management program and are inspected annually and calibrated according to manufacturer recommendations. Records are kept stating when customer services are turned on and off to assist in calculating the volume of water delivered.

Field checks on canal measuring stations occur three to four times per year. This continual verification allows the District to maintain proper and accurate measurement records (Teledyne, 2016 and USBR, rev. 2001). Open channel flow sites are inspected to ensure structures are plumb, staff gages are level with flume floors and weir crests, approach flows are laminar, and that no backwater conditions exist in the tailrace of the structures. Current meters are used as a secondary verification to confirm the volume of flow.

Table 2-11 summarizes the measurement devices used by the District to measure water in the canals and deliveries to agricultural water customers, frequency of calibration and maintenance, and the estimated level of accuracy of the measurement devices. Additional water measurement information per the AWMP code requirements is provided in Section 8 and Appendix G.

Table 2-11. (DWR Worksheet 13) Water Delivery Measurements

Measurement Device	Frequency of Calibration, months	Frequency of Maintenance, months	Estimated Level of Accuracy, Error %
Orifice	Bi-Annual	Annual	5-12%
Flow meter	Bi-Annual	Annual	2-5%
Parshall Flume	Annual	Annual	5-12%
Uncontrolled flume sections	Annual	Annual	5-12%

While accuracy for weirs and flumes is likely better in laboratory-controlled environments, field conditions likely degrade accuracies. Due to the frequency of inspections and site management, District weirs, flumes and orifices have an estimated accuracy of 5-12 percent while flowmeter estimated accuracy is 2-5 percent. These values represent the District's best estimate with the existing facilities and information available.

2.2.3 Water Rate Schedules and Billing

This District's current rate schedule is provided in Appendix D. Raw water rates are a uniform volumetric charge, consisting of a combination of fixed charge (a constant fee assessed to customer) and a water rate (a price per unit of water delivered). Raw water is sold by quantity in increments of either miner's inches or acre feet. The District has several rate schedules for raw water depending on the type of service provided. All water rates are determined on a cost of service basis, consistent with Proposition 218.

Similar to rates, the District also has several billing frequencies depending on the type of service. For a seasonal irrigation service, the customer has the choice of paying the amount in full or making payments in three installments. Most of the raw water customers purchase water for the summer irrigation season (April 15 to October 14). Tables 2-12, 2-13, and 2-14 describe relevant information from the District's current agricultural water rates.

Table 2-12. (DWR Worksheet 14) Water Rate Basis

Water Charge Basis	Check if Used	% of Water Deliveries	Description
Volume of Water Delivered	X	100%	Based on water volume ordered in miners inch
Rate and Duration of Water Delivered			
Acre			
Crop			
Land Assessment			
Other			

Table 2-13. (DWR Worksheet 15) Rate Structure

Type of Billing	Check if Used	Description
Declining		
Uniform	X	Based on volume ordered
Increasing Block Rate		
Other	X	Fixed fee

Table 2-14. (DWR Worksheet 16) Frequency of Billing

Frequency	Check if Used
Weekly	
Biweekly	
Monthly	X
Bimonthly	
Tri-Annually	
Annually	X

2.3 Drought Plan and Water Shortage Allocations Policies

The purpose of the Nevada Irrigation District's Drought Plan is to provide guidance to staff and customers to help minimize drought or water supply shortage impacts. The plan identifies drought action levels, appropriate agency responses, water demand reduction goals, and provides recommended demand management measures to assist customers in water conservation. This following drought plan is presented in accordance with the Urban Water Management Plan water shortage contingency plan requirements in order to maintain consistency across both documents.

2.3.1 Vulnerability to Drought

As described in Sections 4 and 6, the District's water supplies are vulnerable to drought and are expected to be further impacted by climate change. The supply system relies on spring and summer snow melt runoff, as well as capture and storage in reservoirs to release during the irrigation season. During droughts and periods of warmer winters when there is less snowpack, runoff is reduced, and the District must manage its storage and customer demands to meet requirements. The supply availability reduction is dependent on the severity and length of the drought. In addition to the hydrologic impacts on NID's supplies, there can also be regulatory reduction as well, as during the last drought the State mandated supply curtailments and NID was not able to access its available supply.

2.3.2 Resiliency Planning

NID conducts ongoing analysis of its supply reliability and reports on current understanding through its various planning efforts including the Urban Water Management Plan, Plan for Water, Staff Reports to Board, Raw Water Master Plan, and others. Plan for Water is the District's overarching integrated water resources planning effort. As part of the Plan for Water process, NID has developed a climate change hydrologic model to project and analyze supply availability under different climate change scenarios. Findings from this process will then be used to identify and evaluate mitigation measures. Mitigation measures could include the following:

- Data gathering and information analysis enhancement to further inform decision making
- Hydrologic modeling enhancements
- Demand reduction measures
- Supply augmentation opportunities
- Policy enhancements

The Plan for Water process is ongoing and has not yet begun the mitigation measure evaluation phase. The Plan for Water process is a deliberate, phased approach including customer and stakeholder involvement, and will continue for many months. Once the process develops mitigation strategies and decision support frameworks, NID will update the resiliency planning efforts in the next AWMP. As the Plan for Water process is developing mitigation measures for drought resiliency, NID will continue to implement its current drought and water shortage contingency efforts as described below.

2.3.3 Annual Water Supply and Demand Assessment Procedures

NID conducts an annual analysis of supply and demand projections to help inform water resources management decisions for the coming year. The analysis incorporates various data sources used as evaluation criteria to project probable demands and supply availability for the coming year. Data sources to consider include:

- Projected weather conditions
    - Precipitation versus historical on monthly basis
    - Snow survey results
- Projected Unconstrained Demand
    - Production versus historic on monthly basis
    - New customer growth
    - Water use objective monthly tracking versus goal
    - Identify demand for treated water-supplied water features separate from swimming pools and parks
- • Projected Supply Availability (assuming no constraints)
    - Reservoir storage
    - Forecasted runoff
    - PGE contract water
    - Recycled water

The general procedure is listed below. NID may modify this process based on available data, significant events, process restrictions, or other external factors that may impact the process.

1. Dry Year Projection
Compile existing weather data to characterize past 12 months conditions. Considering recent conditions and available forecasts, select a projected dry year scenario from the historical precipitation record. Dry year scenario to be at least 60 percent of normal precipitation at the Bowman Lake Reporting Station.

2. Demand Projection
Project unconstrained monthly demand for the next 12 months factoring in existing demands, water use budgets, weather projections, and growth projections.

3. Project Supply Availability
Utilize the existing conditions coupled with historic availability and other known conditions to project probable monthly availability. Summarize the current supply availability over the next 12 months

assuming no supply restrictions. Project next year supply availability over the next 12 months assuming the next year is a dry year as selected in Step 1.

4. Supply Infrastructure Restraints
Identify and describe any projected infrastructure restrictions to delivering supply in the next 12 months.

5. Project Next Year Supply Deliverability
Using results from Steps 3 and 4, identify the current conditions normal year and dry year projected supply delivery for the next 12 months.

6. Projected Dry Year Supply to Demand Comparison
Compare the projected next year unconstrained demand to the next year dry-year projected supply deliverability. Identify any projected seasonal shortfall in supply to meet the unconstrained demand, cross referencing the condition to one of the six water shortage levels identified below in this plan.

7. Develop and propose water resource management strategies to address the projected demand to supply comparison, including reference to the one of the water shortage stages identified in this section below.

8. The annual water supply demand assessment is presented to the Board of Directors for discussion and questions. Staff will modify/update the assessment per direction from the Board. The Board will approve the assessment and its findings, and can also provide direction to implement specific management strategies at that time. The general proposed timeline is as follows:

- Begin assessment by staff – February
- Present assessment to Board – no later than April
- Submit to State per CWC Section 10632.1 – by July 1

2.3.4 Water Shortage Stages and Responses

NID maintains this drought plan to identify and respond to potential and actual water shortage conditions. Six water shortage levels are presented per CWC Section 10632(a)(3). Proposed alternative response actions for each stage are identified with each respective projected impact on demand reduction or supply augmentation listed. NID will evaluate each specific shortage condition and select the appropriate response action(s) for implementation.

The District maintains a water conservation program that is ongoing, even during periods of normal water supply. The District has found this program to be effective in reducing overall water consumption and managing demands during periods of normal water supply and water shortage conditions. The District will rely on its regular conservation program as well as additional measures to respond to the range of water supply shortages that may arise.

Stage 1 – 10% Supply Shortage
Forecast April 1 Available Supply: 234,999 to 211,500 AF Actions include normal rules and regulations plus those listed below
Treated Water and Municipal Water Customers - Actions to Reduce Demand up to 10 Percent • Communicate conservation regulations as identified in Section 3.05 of District Rules and Regulations. • Encourage customers to limit outdoor irrigation to every other day. • Request fire department limit practices drills and hydrant flow testing.
Ag Water Customers - Actions to Reduce Demand up to 10 Percent • Allow Ag customers to voluntarily reduce purchase allotment for the year while reserving their right to return to their previous allotment in the following year if water supply is available.
District Actions • Declare no new or increased surplus water availability. • Leak repair receives higher priority. • Increase drought awareness through additional public outreach measures that notify public and customers for declared stage, requirements, and available conservation program support. • Standard rates in effect.
Enforcement Measures • Standard measures per District Rules and Regulations.

Stage 2 – 20% Supply Shortage

Forecast April 1 Available Supply: 211,499 to 188,000 AF

Actions include Stage 1 plus those listed below

Treated Water and Municipal Water Customers - Actions to Reduce Demand up to 20 Percent

- Outdoor irrigation limited to every other day and maximum three days per week.
- Odd address number can irrigate outdoors on Tuesday, Thursday, and Saturday.
- Even address number can irrigate outdoors on Wednesday, Friday, and Sunday.
- Customers shall adjust irrigation controllers to reduce usage for each zone by 20 percent.
- Corresponding to Fall Daylight Saving Time, customers shall strive to limit outdoor irrigation to only once per week.

Ag Water Customers - Actions to Reduce Demand up to 20 Percent

- Limit new water sales and increases to 1 miners inch.
- Impose changes to delivery schedules to achieve 20 percent demand reductions.

District Actions

- Declare no new or increased surplus water availability.
- Declare no new or increase in Fall/Winter deliveries.
- Communicate mandatory reduction targets to customers.
- Inform Municipal customers of mandatory 20 percent reduction requirement.
- Distribution system flushing only for public health & safety.
- Organize Drought Hardship Committee.
- Purchase available Contract water to achieve a target carryover of 110,000 acre feet.
- Implement Stage 2 conservation rates.

Enforcement Measures

- A written warning will be issued for a first violation.
- A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation.
- Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the stage, the General Manager may order the installation of a flow restrictor on service lines in question.
- Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibited water uses.

Stage 3 – 30% Supply Shortage
Forecast April 1 Available Supply: 187,999 to 164,500 AF Actions include Stage 2 plus those listed below
Treated Water and Municipal Water Customers - Actions to Reduce Demand up to 30 Percent • Outdoor irrigation limited to two days per week. • Odd address number can irrigate outdoors on Thursday and Sunday. • Even address number can irrigate outdoors on Wednesday and Saturday. • Customers shall adjust irrigation controllers to reduce usage for each zone by 30 percent. • Irrigation of ornamental turf in public street medians with treated water prohibited.
Ag Water Customers - Actions to Reduce Demand up to 30 Percent • Limit new water sale and increases to ½ miners inch. • Impose changes to delivery schedules to achieve 30 percent demand reductions.
District Actions • Declare no surplus water availability for exterior boundary customers. • Declare no Fall water availability. • Communicate mandatory reduction targets to customers. • Inform Municipal customers of mandatory 30 percent reduction requirement. • Purchase available Contract water to achieve a target carryover of 100,000 acre feet. • Implement Stage 3 conservation rates. • Dedicate additional staff for increased water waste patrols.
Enforcement Measures • A written warning will be issued for a first violation. • A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation. • Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the stage, the General Manager may order the installation of a flow restrictor on service lines in question. • Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibited water uses.

Stage 4 – 40% Supply Shortage
Forecast April 1 Available Supply: 163,499 to 141,000 AF Actions include Stage 3 plus those listed below
Treated Water and Municipal Water Customers - Actions to Reduce Demand up to 40 Percent • Outdoor irrigation limited to one day per week. • Customers shall adjust irrigation controllers to reduce usage for each zone by 40 percent.
Ag Water Customers - Actions to Reduce Demand up to 40 Percent • Impose changes to delivery schedules to achieve 40 percent demand reductions.
District Actions • Declare no new or increased Ag sales. • Communicate mandatory reduction targets to customers. • Inform Municipal customers of mandatory 40 percent reduction requirement. • Purchase available Contract water to achieve a target carryover of 90,000 acre feet. • Implement Stage 4 conservation rates.
Enforcement Measures • A written warning will be issued for a first violation. • A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation. • Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the stage, the General Manager may order the installation of a flow restrictor on service lines in question. • Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibited water uses.

Stage 5 – 50% Supply Shortage
Forecast April 1 Available Supply: 140,999 to 117,500 AF Actions include Stage 4 plus those listed below
Treated Water and Municipal Water Customers - Actions to Reduce Demand up to 50 Percent • Outdoor irrigation prohibited.
Ag Water Customers - Actions to Reduce Demand up to 50 Percent • Impose changes to delivery schedules to achieve 50 percent demand reductions.
District Actions • Communicate mandatory reduction targets to customers. • Inform Municipal customers of mandatory 50 percent reduction requirement. • Purchase available Contract water to achieve a target carryover of 80,000 acre feet. • Implement Stage 4 conservation rates.
Enforcement Measures • A written warning will be issued for a first violation. • A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation. • Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the stage, the General Manager may order the installation of a flow restrictor on service lines in question. • Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibited water uses.

Stage 6 – Over 50% Supply Shortage
Forecast April 1 Available Supply: less than 117,500 AF Actions include Stage 5 plus those listed below
Treated Water and Municipal Water Customers - Actions to Reduce Demand greater than 50 Percent • Health and safety use of water only.
Ag Water Customers - Actions to Reduce Demand greater than 50 Percent • Impose changes to delivery schedules to achieve target demand reductions.
District Actions • Communicate mandatory reduction targets to customers. • Inform Municipal customers of mandatory health and safety use only. • Purchase available Contract water to achieve a target carryover of 75,000 acre feet. • Implement Stage 4 conservation rates. • Other actions as identified specific to the shortage condition.
Enforcement Measures • A written warning will be issued for a first violation. • A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation. • Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the stage, the General Manager may order the installation of a flow restrictor on service lines in question. • Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibited water uses.

2.3.5 Communications

NID maintains an established and effective communications program to inform its customers, neighbors, and other stakeholders of issues, updates, and policies. Implementation of the drought plan will utilize the existing communication program structure to inform customers and others of the declared shortage stage and respective actions and restrictions in place.

The Board meetings addressing the Annual Water Supply and Demand Assessment and/or a potential water shortage declaration will be noticed per normal Board meeting public notification procedures. The meeting will also be announced through regular press release protocols.

Once a shortage stage has been declared by the Board of Directors, NID will notify its customers and others through a range of efforts. The stage and restrictions will be identified in a press release, as well as customer billing statements. The District's website will be updated to feature the shortage declaration, restrictions, and resources available to customers from the District and other entities to help meet the restrictions. Subsequent Board of Directors meetings will include a review of the shortage condition, customer response results, and discussion and recommendations for potential modifications.

2.3.6 Compliance and Enforcement

NID was formed as an irrigation district under the California Water Code and therefore is granted the authority to enforce its rules and regulations, as well as levy and collect fines. NID will declare a water shortage emergency within its service area boundaries when it determines through its best judgement that normal demands and requirements of its customers cannot be met with the projected supplies.

Once a water shortage stage has been declared, NID will enforce compliance through a multitude of measures commensurate with each reduction goal. The District will either implement measures per this plan or will provide further discrete requirements through ordinances.

Measures will be enforced through the following procedures, in addition to any enforcement measures identified in ordinances. NID will modify and adjust the compliance strategy as necessary for each respective situation.

- A written warning will be issued for a first violation.
- A District imposed fine of $250 for a second violation, and any subsequent violation, and doubling with each subsequent violation up to a maximum of $1,000 for any single violation.
- Upon a fourth violation, or upon an earlier violation the General Manager determines to create a significant threat to the goals of the ordinance, the General Manager may order the installation of a flow restrictor on service lines in question.
- Similar penalties, fines and charges may be implemented by the District as needed to enforce the restrictions on specific prohibition water uses.

Upon declaration of a Stage 2 shortage, NID will appoint and convene the Drought Hardship Committee. The Drought Hardship Committee is an advisory body and shall consist of one appointee from each director's division and the Water and Hydroelectric Operations (WHO) Board Committee. District Operation's staff will work closely with the committee.

The Drought Hardship Committee's purpose is to review the applications and determine whether additional water can be provided to the applicant. Before any appeal for a variance can be heard by the Drought Hardship Committee, the customer must submit a Drought Hardship Application and provide proof the water is being used for commercial agricultural purposes.

For the purposes of this Plan, the definition of commercial agriculture is an agricultural producer engaged in a for profit operation with a minimum gross annual sales of $3,000 and a minimum capital investment of $15,000. Commercial agricultural producers file a Schedule F with the Internal Revenue Service for their farming or ranching operation.

Preference will be given to applicants with an economic hardship and/or those utilizing best management practices and with efficient irrigation practices in place. Variances may be approved for increases in water deliveries, seasonal variances or other protocols as determined by the Drought Hardship Committee. No such variance or appeal, however, shall be granted if the Board of Directors finds that the variance or appeal will adversely affect the public health or safety of others and is not in the public's best interest.

Under the California Water Code, in critical water supply situations, there is a priority that shall be allocated as follows:

1. Human Consumption
2. Livestock and Animals
3. Perennial Crops
4. Annual Crops

Upon granting a Drought Hardship Variance or appeal, the Board may impose any other conditions it deems to be just and proper.

2.3.7 Financial Considerations for Drought Conditions

Implementing any stage of the drought plan is expected to impact the District's financial status. As experienced during previous droughts, it is expected that revenues will decrease with decreasing usage, and expenses will increase with additional monitoring and enforcement responsibilities, as well as additional costs for replacement supplies if needed.

The District maintains a rate structure that includes a fixed meter charge plus increasing volumetric block rates for residential customers and volumetric rates for irrigation customers. Volumetric revenue is approximately 53 percent of total revenue. The drought rate structure is set to offset revenue loss from mandatory demand reduction up to 40 percent. Demand reduction above 40 percent will reduce revenue accordingly. Actual impacts will vary depending on customer response.

Enforcement, enhanced outreach, and increase of customer data tracking can add to the District's costs around a water shortage condition. Often times, these additional efforts are prioritized for current staff, and other normal work efforts are delayed or reassigned. If conditions warrant, the District will seek assistance through additional staffing or third-party service providers. These costs depend on the level of support and will be evaluated on a case-by-case basis. Increase in costs can also be associated with additional equipment obtained to support the District's outreach, enforcement, tracking, and management efforts.

Depending on the situation, the District may also be able to obtain supplemental water supplies to mitigate the water shortage condition. These supplies are expected to be more costly than regular supplies, and will be evaluated for each specific opportunity.

It is reasonable to expect financial impacts or changes in cash flow during a prolonged water shortage condition. The District will enact a range of management and financial resources depending on the specific situation that include:

- Drought rate surcharge
- Utilizing financial reserves
- Capital project deferment
- Operational and maintenance expense deferment
- Increased revenue from penalties
- And others as identified

2.3.8 Monitoring, Reporting, and Refinement

The drought plan aims to ensure demands are reduced and/or supply is augmented to balance supply and demand. The District will enact various actions commensurate with each respective stage. The District will then monitor results to maintain the supply/demand balance. Similar to the supply and demand projections used to establish a shortage condition in the annual assessment procedure, the District will monitor the same data to determine effectiveness and efficacy. District staff will report to the Board of Directors at least monthly on status and results. Data reporting will include:

- Actual demands to projected demands per customer class and on total
- Actual supply availability and utilized to projected availability per each supply source
- Projected supply availability for next 12 months per supply source
- Any specific requirements identified by the State in the future

Data will also be submitted to the State per any future reporting requirements.

Progress and efficacy will be summarized from the results data. The District will evaluate the need for any changes or modifications to the declared water shortage stage or actions based on the results. The District may determine to enact additional measures, develop ordinances, or update the drought plan as a whole. Any drought plan update or modification will be conducted through the Board of Directors meeting process, unless specific conditions require otherwise.

3 Description of Quantity of Water Uses

10826(b). Describe the quantity and quality of water resources of the agricultural water supplier, including all of the following:
(1)-(4) not shown here
(5) Water uses within the agricultural water supplier's service area, including all of the following:
(A) Agricultural
(B) Environmental
(C) Recreational
(D) Municipal and industrial
(E) Groundwater recharge, including estimated flows from deep percolation from irrigation and seepage

Water uses within the District's service area are agricultural, environmental, recreational, and municipal. The District does not use water for groundwater recharge. The District is currently not participating in any transfers and/or exchanges, but has in the past.

3.1 Agricultural Water Use

The District's agricultural water deliveries for the planning period are presented in Table 3-1. The District characterizes agricultural sales as applied water that does not include precipitation and distribution losses. Table 3-1 presents the applied water measured by the District.

The District service area does not overlay a California Department of Water Resources-defined groundwater basin (except for the far southwestern section of the service area by Lincoln). Limited amounts of groundwater are available throughout the service area through fractured rock groundwater systems (CABY, 2020 and USGS, 1984). The District does not utilize groundwater as a supply source. The District does not monitor or track private groundwater usage. As stated in Chapter 5, the District will coordinate with the counties in future to better understand private groundwater use.

Table 3-1. (DWR Worksheet 20) Annual Agricultural Water Use, AF

Source	Planning Cycle				
	2016	2017	2018	2019	2020
Agricultural Water Supplier Delivered					
Surface Water[1]	110,356	109,476	109,343	107,439	109,016
Groundwater	0	0	0	0	0
Other (Define)					
Other Water Supplies Used					
Surface Water					
Groundwater					
Other (Define)					
Total	110,356	109,476	109,343	107,439	109,016

[1]Ordered amount.

There are multiple crops within the District's service area that vary due to topographical, geological, climatic, and soil condition differences. NID surveys its agriculture customers annually to inventory the type and approximate acreage of crops cultivated by their customers. NID checks the reported value against past reports, but does not verify and validate every report. The customer-provided crop data is

tabulated into Crop Reports. Information from the reports is provided to the California State Water Resources Control Board with the District's annual water rights filings.

The District currently does not collect or maintain detailed independent cropping information. The District relies on the self-reported surveys provided by customers. The District also does not collect or maintain detailed parcel-level soil information, irrigation system information, or specific agronomic water requirements for individual customers. As such, the District uses the types of crops and acreages in the self-reported survey to estimate water use components (for example, evapotranspiration (ET)) in the water budget calculation as described in Chapter 5.

Data from the crop reports are summarized in Table 3-2 for 2016-2020. The largest crops by acreage for 2020 are irrigated pasture and family gardens/orchards (61 and 20 percent, respectively). Many of the District's irrigation customers have ten acres or less of irrigated land. Table 3-2 lists the year 2020 total inches sold as reported on the customer survey. The customer survey values, including actual crop types and acreage, are not verified by NID. Water sold cannot be used to calculate crop duty factor as they do not represent each individual user's irrigation patterns, strategies, or actual application. NID acknowledges the customer-supplied data is not verified, and is proposing to enhance the data collection and refinement process as described in the management objectives in Section 5.3.

Table 3-2. (DWR Worksheet 21) Agricultural Crop Data for 2016-2020, acres

Crop	Irrigated Acres					2020 Miners Inch Sold[2]
	2016	2017	2018	2019	2020	
Cereals - Corn	22	32	32	33	34	12.47
Cereals - Rice	157	157	154	96	97	5.69
Cereals - Wheat	2	2	2	2	2	0.49
Cereals - Other	29	29	29	29	30	12.99
Forage - Alfalfa Hay	116	134	134	155	155	43.37
Forage - Hay Other	824	808	802	853	826	227.92
Forage - Irrigated Pasture	18,867	19,309	19,419	19,702	19,727	7,043.42
Forage - Silage	9	9	9	9	19	4.54
Forage - Other	59	189	190	190	192	19.46
Fruits - Apples	224	228	229	239	248	90.15
Fruits - Berries - All	110	125	126	138	136	41.26
Fruits - Cherries	58	58	55	56	54	14.73
Fruits - Citrus - All	151	171	161	166	182	52.46
Fruits - Grapes - Table	56	54	50	52	54	16.56
Fruits - Grapes - Other	627	631	642	669	661	162.6
Fruits - Kiwi	23	24	24	21	21	11.39
Fruits - Peaches	100	103	105	112	118	39.47
Fruits - Pears	121	139	131	128	134	39.39
Fruits - Plums	140	142	144	148	160	49.79
Fruits - Other	112	114	229	208	218	70.87
Fruits - Persimmons	3	3	2	2	2	0.73

Crop	Irrigated Acres					2020 Miners Inch Sold[2]
	2016	2017	2018	2019	2020	
Fruits - Apricots	1	1	1	1	1	0.23
Nursery	383	371	378	376	348	206.46
Cannabis	N/A	13	13	14	12	2.42
Nuts	171	193	194	196	203	34.53
Nuts - Walnuts	15	15	14	12	8	1.92
Nuts - Chestnuts	15	15	12	12	12	6.8
Nuts - Pistachios	1	1	1	1	1	0.62
Nuts - Almonds	13	13	13	13	13	4.36
Other	754	743	722	729	731	62.63
Golf Course	984	984	984	986	986	674.50
Other - Parks	152	152	221	224	224	47.42
Other - Exempt	0	0	0	0	0	0
Family Garden, Orchard, YD.	6,026	6,146	6,174	6,244	6,409	3,073.60
No Report .5MI / A	304	361	444	398	307	153.39
Pond	11	11	11	11	12	52.54
Total Irrigated Acres[1]	30,629	31,470	31,835	32,205	32,323	12,306

[1] Totals may not add due to rounding. Data from NID agricultural customer survey

[2] Water sold cannot be used to calculate crop duty factor as they do not represent each individual user's irrigation patterns, strategies, or actual application

3.2 Environmental Water Use

A portion of the District's water is utilized for environmental purposes, which includes non-recoverable in-stream flows and environmental water sales to other agencies such as the CDFW for the Spenceville Wildlife Area. The non-recoverable in-stream flows are located in the Middle Yuba River below Milton Diversion, Canyon Creek below Bowman Reservoir, and the Bear River below Combie Reservoir. Under the 1963 California Department of Fish and Game (now known as California Department of Fish and Wildlife, or CDFW) Agreement, the Yuba-Bear FERC License, and from terms in water right permits and licenses, the District releases water to maintain environmental conditions in creeks and rivers downstream of District facilities. The total amount for non-recoverable instream flow and environmental water use for the period 2016 through 2020 is shown in Table 3-3. The values reported for streams in Table 3-3 are estimated values for 2016 through 2020. As a matter of conservative operational strategy, NID releases more environmental water than required to ensure flows remain above the minimum permit requirements. Future environmental flows due to pending federal and state regulatory requirements will be different (HDR, 2020).

Table 3-3. (DWR Worksheet 24) Environmental Water Use, AF

Environmental Resource	Water Use, Acre-feet				
	2016	2017	2018	2019	2020
Vernal Pools					
Streams	9,410	9,410	9,410	9,410	9,410
CDFW Purchase	1,270	1,270	1,270	1,270	1,270
Lakes or Reservoirs					
Riparian Vegetation					
Ponds					
Total	10,680	10,680	10,680	10,680	10,680

3.3 Recreational Water Use

The District owns and operates reservoirs in the Yuba and Bear River watersheds, which also provide recreational opportunities in addition to functioning as storage reservoirs. In the Mountain Division, the District owns and operates campgrounds at Faucherie, Bowman, and Jackson Meadows reservoirs. The Mountain Division campgrounds are normally snowed in during the winter and opened for recreation from Memorial Day through Labor Day.

In the Lower Division in the Sierra foothills at both Rollins and Scotts Flat Lake reservoirs, camping, fishing, swimming, sunning, boating, water skiing, sailing, board sailing, and other activities are popular. Day use parks, campgrounds, and beaches are operated by the District and in some cases by private operators under contract with the District.

The District sells water to homeowner associations which utilize raw water for recreational lakes and golf courses such as Lake of the Pines, Dark Horse Golf Course, Lake Wildwood, Alta Sierra, Nevada County Country Club, as well as Auburn Recreation District sports fields, Turkey Creek Golf Course, and Lincoln Hills, Sun City. Table 3-4 summarizes the recreational water use for golf courses and parks.

Table 3-4. (DWR Worksheet 25) Recreational Water Use

Recreational Facility	Water Use, Acre-feet				
	2016	2017	2018	2019	2020
Golf Courses	6,920	6,881	6,879	6,121	6,121
Parks	373	373	376	430	430
Total	7,293	7,254	7,255	6,550	6,550

3.4 Groundwater Recharge Use

The majority of the District has no groundwater aquifer per California Department of Water Resources Bulletin 118 with the exception of a very small portion of the District's service area in Lincoln, which is on the eastern boundary of the Sacramento River Basin, North American Sub-Basin. The District does not utilize groundwater as an existing or planned source of water supply for agricultural customers or recharge due to limited groundwater availability. The District has no groundwater facilities. The District is aware that many private users utilize groundwater for domestic usage. However the District does not track private groundwater use at this time.

The Act requires an estimate of seepage and deep percolation to be presented in the AWMP. Estimating such values is extremely difficult in a fractured rock system ranging from shallow bedrock to deeper alluvium areas. Until more detailed data is collected, and more substrate information is known, NID is estimating seepage and percolation as the water loss detailed below.

3.5 Municipal and Industrial Water Use

The District has retail and wholesale municipal and industrial customers. The District sells both treated and raw wholesale water to the City of Grass Valley, Nevada City, Nevada City School of the Arts, Lake Vera Mutual, and Placer County Water Agency (PCWA). The water sold to PCWA is for use in NID's service area in the City of Lincoln. The total municipal water sales for 2016 through 2020 are provided in Table 3-5.

Table 3-5. (DWR Worksheet 26) Municipal/Industrial Water Use

Municipal/Industrial Entity	Water Use, Acre-feet				
	2016	2017	2018	2019	2020
NID Retail Customers - Treated Water	7,178	7,818	8,101	7,933	8,522
City of Grass Valley - Treated Water	19	38	33	1	50
Lake Vera Mutual Water Company - Treated Water	18	18	22	24	22
City of Grass Valley Broadview Heights - Treated Water	34	37	41	36	36
Total Treated (customer meters)	7,249	7,911	8,197	7,994	8,630
Total Treated (WTP inflow[1])	8,942	9,752	10,061	9,269	10,537
NID annual raw customers – Raw Water	3,527	3,538	3,395	3,262	3,309
City of Grass Valley - Raw Water	942	957	1,041	842	862
Nevada City - Raw Water	187	267	214	114	507
Nevada City School of Arts - Raw Water	5	5	6	7	5
Placer County Water Agency - Raw Water	571	1,349	1,430	1,188	1,517
Total Raw	5,232	6,116	6,086	5,413	6,200
Total Municipal/Industrial	14,174	15,868	16,147	14,682	16,737

[1] WTP inflow is total raw water to NID treatment plants

3.6 Water Loss

Water losses in the agricultural distribution system consist of evaporation and canal leakage, seepage, spillage, stock usage, construction water, and other unauthorized usages. NID has assumed a 15 percent loss in its previous Raw Water Master Plan and canal analysis efforts. This loss factor is applied to the total raw water diversions as an estimate of water loss in the canal system. Future improvements and enhancements in canal flow and customer purchase measurement will improve water loss estimation. The water loss estimate is summarized in Table 3-6.

Table 3-6. (DWR Worksheet 29) Other Water Uses

Water Use	Water Use, Acre-feet				
	2016	2017	2018	2019	2020
Total Canal Diversions	133,682	136,219	144,786	141,482	152,947
Loss Factor	15%	15%	15%	15%	15%
Water Loss - Distribution, seepage, evaporation, spills[1]	20,052	20,433	21,718	21,222	22,942

[1]15 percent loss applied to total diverted into canal system.

3.7 Total Water Use

Total water use is summarized in Table 3-7.

Table 3-7. Total Water Uses

Use	Water Use, Acre-feet				
	2016	2017	2018	2019	2020
Agricultural (ordered)	110,356	109,476	109,343	107,439	109,016
Environmental	10,680	10,680	10,680	10,680	10,680
Recreational	7,293	7,254	7,255	6,550	6,550
Municipal	14,174	15,868	16,147	14,682	16,737
Groundwater Recharge	0	0	0	0	0
Canal water loss to deep percolation and other unmeasured uses	20,052	20,433	21,718	21,222	22,942
Total:	162,555	163,711	165,143	160,573	165,925

4 Description of Quantity and Quality of Supplies

10826(b). Describe the quantity and quality of water resources of the agricultural water supplier, including all of the following:
(1) Surface water supply
(2) Groundwater supply
(3) Other water supplies
(4) Source water quality monitoring practices
(5) quote not shown here

This section describes the quantity and quality of water resources available to the District and includes a description of water quality monitoring programs.

4.1 Surface Water Supply

The District's primary source of supply is local surface water derived principally from the Yuba River, Bear River, and Deer Creek watersheds that is diverted and stored under the Districts pre-1914 and post-1914 appropriative water rights. The water rights allow for diversion and/or storage of approximately 450,000 AF per year (AFY). The District has an extensive system of storage reservoirs that provides surface water supply to the District's six water treatment plants as well as to the raw water customers. The District also maintains a contract with PG&E to purchase surface water that originates from the same supply sources as the District water rights supply.

4.1.1 Water Rights

The District was originally organized for the purpose of storing and delivering irrigation water to farmers and ranchers. In the early 1920's the District acquired storage and regulating facilities in the upper reaches of the Middle and South Yuba Rivers. In 1926, the District acquired most of its Canyon Creek holdings including the Bowman, Sawmill, French, and Faucherie Reservoirs. Associated water rights were also obtained. Deer Creek water rights were obtained in the 1920's for the development of Scott's Flat Reservoir. The District's surface water supply water rights are divided into two main categories:

- Watershed runoff
- Carryover storage in surface reservoirs

Watershed Runoff. This supply includes water rights to runoff from the District's watershed. Watershed runoff is the District's primary water supply. The amount of runoff and the manner in which it is used depends upon the amount of water contained in the snowpack and the rate at which the snowpack melts. District water rights include 22 pre-1914 rights acquired from mining interests, along with 28 post-1914 rights filed with the State of California to provide for domestic, municipal, industrial, recreational, power, and irrigation uses, and three riparian rights. These include rights for both consumptive and power purposes. The total water right volumes consist of storage rights, direct diversion rights, and some are a combination of both. The total quantity estimated for diversion and/or storage under current consumptive water rights totals approximately 450,000 AF on an annual basis.

The most prominent and obvious cause for the fluctuation in natural runoff is the variability in hydrologic conditions, as seen in the wide variations in annual rainfall/snowpack accumulations. Over the last 30 years runoff has fluctuated from less than 80,500 AF in a dry year (2015) to over 541,100 AF in wet years (2017). Average runoff from the Upper Division watershed, including the watershed area feeding Scotts Flat Reservoir, is approximately 232,600 AFY. Due to provisions in the PG&E Coordinated Operations Agreement, hydrologic variability, and the fact that the District is not the senior water right holder, the historical runoff data evaluated to estimate the District's average runoff supply does not include supplies from the Bear River and the South Yuba River. The District is likely to receive some water from the Bear

River and South Yuba River sources in dry years. Due to the uncertainty of the amount of supply available from these two sources, it has not been quantified in this AWMP. NID is investigating methods to track this water use in the future.

The system of storage reservoirs and conduits used to transport water to the District's service area boundary is referred to as the Upper Division. The Upper Division is operated in conjunction with PG&E under the terms of a joint agreement.

The District's Yuba-Bear Project's Federal Energy Regulatory Commission (FERC) license (No. 2266) expired in July 2013. The Project is presently undergoing relicensing. The current proposed license includes increased environmental flow requirements, which reduces supply available to meet customer demands.

Carryover Storage. The second largest component of District's supply is carryover storage, which is the volume of water left in storage reservoirs at the end of the irrigation season, usually at the end of September. The District's main storage reservoirs can contain a maximum of 280,085 AF of water. Per the District's Drought Contingency Plan, carryover storage should be held at a level not less than 78,000 AF. This includes a total 33,800 AF of minimum pool requirements reserved for environmental needs and dead storage volume (includes siltation estimates) that cannot be counted upon as a supply resulting in an available storage capacity of 202,085 AF. As with most reservoirs, the District's reservoirs are slowly being filled with sediment. The District is currently studying removal of this material.

The water supply is dependent on snowmelt and rain to fill storage reservoirs, and the District manages its system based on the timing of those events. While there is some natural runoff during normal summer months, the irrigation season (April 15–October 14) demand is met primarily with withdrawals from storage reservoirs. Careful management and operation of the storage reservoirs is required to capture the maximum amount of runoff, minimize spillage from the reservoirs, yet insure there is sufficient volume available in the reservoirs to accommodate runoff during the spring snow melt and storm events. Carryover storage is also affected by Winter/Fall customer demands. Winter/Fall effectively uses carryover storage, meaning less water could be available for the following irrigation season.

4.1.2 Contracted Purchases

The hydropower potential of its water led the District to enter into an agreement with PG&E in 1924 to use of a portion of the District's water through PG&E facilities. At the same time the District secured the option to purchase PG&E water to augment its own supply. Over the years, this agreement has been modified to meet the changing conditions and requirements of both organizations. In 1963, the District and PG&E agreed to develop additional storage capacity on both Middle Yuba and the Bear River. Additional water was also made available by improved and new facilities in the upper Yuba Basin.

The PG&E contract has recently been renewed. The maximum amount available for District purchase is 54,361 AF with reductions based on the Sacramento Valley Index (SVI).

4.1.3 Summary of Surface Water Supply Quantity

The District's use of each surface water supply over the past five years is summarized in Table 4-1. The District's watershed runoff water supply sources are covered by a combination of pre-1914 water rights, post 1914-water rights, and riparian water rights. In some California watersheds including the Sacramento River watershed, the recent drought has resulted in diversion curtailment orders being issued in 2014, 2015, and 2016 on water rights going back to a 1903 priority date. NID assumes the Governor's Office and the State will also attempt to impose restrictions in the future, regardless of water right priority. There are many other potential regulatory and legal restrictions that could affect the District's water supplies. The legislative and regulatory environment at the State level has been trending towards increased water usage restrictions recently, with increased focus on managing to a water budget limit, as well as efforts to increase instream flow values. The District views these efforts as having significant

impacts to its current supply and reliability assumptions, and could greatly restrict supplies the District is allowed to use. The precipitation from 2016-2020 as measured at the NID Bowman Lake precipitation gage is presented in Table 4-2. The District's surface water supplies are summarized in Table 4-3.

Table 4-1. (DWR Worksheet 30) Surface Water Supplies

Source Water Supply	Diversion Restriction	Supply, Acre-feet				
		2016	2017	2018	2019	2020
Contract Supply - PG&E	54,361	488	0	0	0	0
Watershed Runoff	450,000	261,300	541,100	189,600	343,700	119,500
Carryover Storage	280,085	104,300	151,000	159,900	146,700	170,000
Total[1]		366,088	450,000[2]	349,500	450,000[2]	289,500

[1] Total does not represent actual supply available due to temporal differences between runoff and water rights.

[2] Total limited to NID water rights upper limit of approximately 450,000 AFY.

Table 4-2. 2016-2020 Annual Precipitation – Bowman Lake Rain Gage

2016	2017	2018	2019	2020
96.6 in.	118.3 in.	61.0 in.	87.8 in.	37.7 in.

Table 4-3. (DWR Worksheet 31) Restrictions on Water Sources

Source	Restrictions	Name of Agency Imposing Restrictions	Operational Constraints
Contract Purchase (PG&E)	Climatic	PG&E	Flow and volume availability
Watershed Runoff	Legal, environmental, climatic	SWRCB, FERC, other State/ Federal Resource Agencies	Flow and volume availability, temporal availability,
Carryover Storage	Legal, environmental, climatic	District	Volume availability
Recycled Water	Legal, environmental	SWRCB	Treatment Capacity

4.2 Groundwater Supply

Most of the Sierra Nevada foothills located in the District's service area have a fractured rock groundwater system (CABY, 2020), including granitic and metavolcanic (USGS, 1984). NID views the fractured rock groundwater system as low yielding and unreliable for a District supply source. The District does not utilize groundwater as an existing or planned source of water supply or recharge due to limited groundwater availability. The majority of the District's service area has no groundwater aquifer

per California Department of Water Resources Bulletin 118 with the exception of the very small portion of the District's service area in Lincoln, which is on the eastern boundary of the Sacramento River Basin, North American Sub-Basin. The District has no groundwater facilities and does not use groundwater. NID is aware there are private wells in the area used for domestic purposes, but NID does not track private groundwater well inventory or use at this time.

4.3 Stormwater

The District currently has a policy to not divert stormwater runoff as presented in the current stormwater policy (District Policy #6655), provided in Appendix F.

4.4 Recycled Water

Wastewater collection, treatment, and discharge in the District's service area is the responsibility of Nevada City, Grass Valley, and Auburn. The District has no authority or control over wastewater management in the District's service area. The District understands that reuse is an important element of integrated water supply planning and is open to investigations with any of the wastewater utilities to support further development of a reuse supply component.

All wastewater treated within the District service area is discharged to local watercourses. Once discharged, the flow is available for appropriation. Recycled water discharge comingles with the District's water-right supply being transported in the creeks. The combined waters are then diverted from creeks into canals as described below. This supply of water augments the District's overall water supply.

Nevada City: The District utilizes effluent from the Nevada City wastewater treatment plant discharged into Deer Creek. The effluent is comingled with Deer Creek flows and diverted for reuse as agricultural irrigation water.

Grass Valley: The District utilizes effluent from the Grass Valley wastewater treatment plant discharged into Wolf Creek. The effluent is comingled with Wolf Creek flows and diverted for reuse as agricultural irrigation water.

City of Auburn: The District utilizes effluent from the Auburn wastewater treatment plant discharged into Auburn Ravine Creek. The effluent is comingled with Auburn Ravine Creek flows and diverted for reuse as agricultural irrigation water.

Table 4-4 lists the recycled water use from 2016-2020. Use is estimated based on the WWTP-provided effluent flows during the April 15-October 14 irrigation season. Quality and volume of wastewater effluent discharged is outside of the District's control. However, if effluent volumes were decreased, NID would need to adjust its operations to divert more supply into the affected canal system. There is a large impact if water quality is degraded and NID was unable to divert flows due to contamination. Each respective WWTP is regulated by the State through a discharge permit that addresses actions and requirements to maintain effluent water quality.

Table 4-4. (DWR Worksheet 30/31) Recycled Water Supplies

Source	Restrictions/ Constraints	Supply, Acre-feet				
		2016	2017	2018	2019	2020
Recycled Water	Environmental/ treatment capacity	1,378	1,638	1,529	1,598	1,408
Total		1,378	1,638	1,529	1,598	1,408

Note: As reported to the SWRCB based on the irrigation system.

4.5 Drainage from Service Area

The District's agricultural irrigation system is different than typical valley-floor systems. The District's canals supply water to customers. For the most part, any drainage or runoff from customer's parcels are collected and transported downstream through the natural drainage system. The District does not operate or manage drainage canals. Often times the runoff in streams and creeks is re-diverted at a lower point, but NID does not measure runoff individually. NID does measure end-of-canal spillage at five locations where the water does leave the system once spilled. However, there are over 30 canal end spill points throughout the system as well as thousands of individual customer parcels, and therefore ability to measure all drainage is not available at this time.

Table 4-5 summarizes the total volume measured at the five end points leaving the system for the planning period.

Table 4-5. (DWR Worksheet 35) Drainage Discharge

Discharge Type	Discharge, Acre-feet				
	2016	2017	2018	2019	2020
Water Leaving Service Area	3,030	4,680	5,168	4,785	3,696
Total	3,030	4,680	5,168	4,785	3,696

4.6 Water Supply Quality

The District's source water quality and monitoring practices are described in the following subsections.

4.6.1 Surface Water Supply

The District identifies and monitors surface water quality through regular updates of the required Watershed Sanitary Survey. The most recent Survey was completed in 2017 and covers the District's watersheds (insert website reference address). The 2017 Watershed Sanitary Survey Update concludes:

- Areas in the upper watersheds are, in general, minimally impacted by current human activities. However, previous mining era activities have had an impact.
- Current and historic mining operations distributed over large areas in the watersheds have a combined high potential to impact raw water quality.
- During summer months, recreation in the upper watersheds, including body contact recreation, motorized recreation, camping and hiking, bring large numbers of visitors into the area. This increases the potential for source water contamination.
- Major highways, local access roads and railroads are located throughout the watersheds increasing the risks to source water quality.
- Various licensed pesticides and herbicides are used for weed control around the District's canals, however, during the maintenance period, the treatment plants are bypassed.
- Most canals are open; they receive untreated drainage from the uphill slopes and are not protected from vandalism or other sources of contamination.

Natural disasters can also impact water quality. The quality of water supplies can be dramatically affected by fire. Fire and storm damage to the District conveyance facilities may consist of the following elements:

- Damage to parts of canal intakes,
- Collapse or weakening of some sections of canal flumes,
- Erosion and sedimentation of, and landslides into, sections of the canals.

The above-listed damages can cause some temporary adverse water quality effects, and some short-term losses of the District's water supplies in extreme cases. Of greater concern to overall water quality are flood and precipitation related damage occurrences. These could cause longer term adverse water quality impacts such as excessive runoff and loading of surface contaminants (such as livestock manure, petroleum products, pesticides, and mineral wastes).

The District does not monitor runoff from pastureland or rangeland for pesticides in the watershed. The District has in the past monitored the raw water influent into its potable water treatment plants, which is representative of supply used for agricultural irrigation. A review of the treated water monitoring at the District's water treatment plants shows that there were no detections of the herbicides or pesticides tested for in the Yuba/Bear River water supply. Triclopyr (systemic, foliar herbicide) is not regulated in drinking water; therefore, there is no monitoring data available for this constituent in the treatment plant monitoring data (Starr Consulting et al., 2017). Annual ranges for raw water quality monitoring (coliform and E.coli) at the District's water treatment plant intakes is summarized in Table 4-6.

Table 4-6. (DWR Worksheet 36) Surface Water Supply Quality

Parameter	Units	2016		2017		2018		2019		2020	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Coliform	MPN/100 ml	0	>2,419.2	11	14,136	3.1	19,863	6.3	24,196	0	5,475
E.coli	MPN/100 ml	0	1,986.3	0	1,732.9	0	9,804	0	6,488	0	613.1

Source: NID 2019 Consumer Confidence Reports

Table 4-7 lists the 303(d) listed water bodies in the watershed per the State Water Board 2016 listing. As expected from the region's mining history, mercury and copper constitute the majority of the listed pollutants.

Table 4-7. 303(d) Listed Water Bodies

Name	Pollutant
Combie Lake	Mercury
Coon Creek (from confluence of Orr and Dry Creeks to East Side Canal)	Ammonia as N, Total
Deer Creek (Above Scotts Flat to Confluence of Deer Creek, North and South Forks)	pH
Deer Creek (Deer Creek Reservoir to Lake Wildwood	Indicator Bacteria; Mercury; pH
Lake Wildwood	Mercury
Little Deer Creek	Mercury; pH
Rock Creek	pH
Rollins Reservoir	Mercury
Scotts Flat Reservoir	Mercury
South Fork Yuba River (Headwaters to Spaulding Lake)	Copper; pH
Squirrel Creek	Indicator Bacteria
Upper Bear River (Rollins Lake to Camp Far West Reservoir)	Mercury
Wolf Creek	Indicator Bacteria

4.6.2 Groundwater Supply Quality

The District does not utilize groundwater as an existing or planned source of water due to limited groundwater availability and no groundwater aquifer per California Department of Water Resources Bulletin 118. The District does not monitor groundwater quality.

4.6.3 Recycled Water Quality

All wastewater treated within the District service area is treated under the State discharge permit system. Wastewater treatment is the responsibility of each respective wastewater treatment agency, as NID does not provide wastewater services. Assuming the treatment agencies are meeting their permit requirements, the effluent water quality is sufficient to be comingled with NID's supplies in the respective creeks, and diverted for use in NID's agricultural irrigation system. NID maintains close coordination with each wastewater agency so that NID can be notified of any potential effluent water quality issues.

4.6.4 Drainage from Service Area Quality

Drainages near agricultural lands and at points above the Sacramento River Basin are monitored for water quality parameters by the local agricultural water coalitions under the Sacramento Valley Water Quality Coalition (SVWQC). SVWQC reports the water quality data and analysis directly to the Irrigated Lands Regulatory Program of the Region 5 Central Valley Regional Water Quality Control Board. The Placer/Nevada/South Sutter/North Sacramento (PNSSNS) Watershed Coalition is the local agricultural organization that monitors water quality as it relates to agricultural production and discharges in the District's service area. The District does not monitor the water quality of outflow from the service area as the SVWQC is the responsible reporting entity under the Irrigated Land Regulatory Program

4.7 Source Water Quality Monitoring Practices

The District uses the irrigation raw water supply to also supply its potable water treatment plants. In addition to regularly conducting treated water quality monitoring, the District also monitors source water for coliform and E.coli. As summarized in the 2017 Watershed Sanitary Survey, the source water quality is extremely good as the watershed is relatively remote and at low risk of extensive contamination. However, there are emergency events that could impact source water quality. NID does conduct site-specific monitoring in response to known contamination events.

The source water is regularly sampled as part of the Watershed Sanitary Survey. The 2017 Survey raw water monitoring program aimed at assessing the Yuba and Bear Rivers' source water quality (Starr Consulting et al., 2017). Source water quality samples were monitored at various locations and frequencies. Parameters included turbidity, E. coli, Total Organic Carbon (TOC), and daily temperature (limited to Loma Rica WTP). Table 4-8 presents the District's water quality monitoring practices.

Table 4-8 (DWR Worksheet 38) Water Quality Monitoring Practices

Water Source	Monitoring Location	Measurement/Monitoring method or practice	Frequency
Various throughout the watershed	Various throughout the watershed	Determined by the watershed sanitary survey monitoring program	The watershed sanitary survey is updated every 5 years
Determined by location of contamination incident	Determined by location of contamination incident	Determined by type of contamination incident	Determined per event
Lake Spaulding[1] (via Banner Cascade Pipeline)	Loma Rica WTP E. George WTP	Turbidity, E. coli, TOC, Temp.[2]	Quarterly, Monthly, Bi-Monthly, Daily[2]
Deer Creek [1] (downstream of Scotts Flat Reservoir)	Lake Wildwood WTP Smartsville WTP	Turbidity, E. coli, TOC	Quarterly, Monthly
Rollins Reservoir[1] (via Bear River Canal)	N. Auburn WTP	Turbidity, E. coli, TOC, Temp.	Quarterly, Monthly
Bear River[1] (downstream of Rollins Reservoir)	Lake of the Pines WTP	Turbidity, E. coli, TOC, Temp.	Quarterly, Monthly

[1]Watershed Sanitary Survey (Starr Consulting et al., 2017)

[2]Loma Rica WTP only

5 Water Budget

10826(c). Include an annual water budget based on the quantification of all inflow and outflow components for the service area of the agricultural water supplier. Components of inflow shall include surface inflow, groundwater pumping in the service area, and effective precipitation. Components of outflow shall include surface outflow, deep percolation, and evapotranspiration. An agricultural water supplier shall report the annual water budget on a water-year basis.

Information on the development of the District's water budget is presented in this section. For each component included in the annual water budget, a description on the quantification of each is provided. NID's Water Management Objectives are presented. An estimate of the quantification of efficiency for agriculture water is presented.

5.1 Quantifying Inflow Water Supplies

The water budget presented includes surface inflow, groundwater pumping, and effective precipitation. Each subsection below presents the development and assumptions for each inflow component.

5.1.1 Surface Water Inflow

Surface water inflow is the raw water supply diverted into the raw water canal system. The District measures each diversion point. The majority of the raw water is then served to irrigation customers. The District maintains the flow diversion volumes and submits annual reports to the California State Water Resources Control Board. The majority of the District's irrigation customers are served water through a service box with orifice based on the miner's inch. The District's canal operation strategy emphasizes maintaining constant head in the canals to maintain consistent flow rates through the delivery boxes. The volume of agricultural water delivered is calculated using the flow-rate (miner's inch) and delivery duration period. It is recognized orifice-based metered delivery systems are less accurate than other turbine or ultrasonic type metering systems to measure and quantify deliveries. Converting the agricultural farm gate delivery mechanism to a metering systems that utilizes enclosed, pressure pipe methods will be an extensive and costly process that NID has yet to implement. Surface water inflow to the District's canal system is presented in Table 5-1.

5.1.2 Groundwater Inflow

As indicated throughout this document, NID does not provide groundwater supply. There is no DWR Bulletin 118 identified groundwater basin, but there is a fractured rock groundwater system. This fractured groundwater system is utilized for low producing domestic wells in the service area (USGS, 1984). NID is not aware of any agricultural irrigation customers using groundwater for agricultural irrigation. For this analysis, it is assumed any groundwater that may be used for agricultural irrigation is negligible compared to the total raw water supplied, and therefore groundwater inflow is assumed as zero for the water balance.

Tracking and quantifying of fractured rock private well groundwater use would benefit NID's ability to manage its water resources and support its customers. However, groundwater wells are currently regulated at the county government level, not by NID. The District will investigate options to partner with each respective county in the service area to further enhance private well groundwater usage understanding.

5.1.3 Effective Precipitation

The Draft AWMP Guidebook defines effective precipitation (EP) as the estimate of the amount of precipitation consumed by the crop. "A Proposed Methodology for Quantifying the Efficiency of Agricultural Water Use: A report to the Legislature, pursuant to §10608.64 of the California Water Code, May 8, 2012" presents detailed methods to calculate agricultural water use efficiency, including effective

precipitation. Other models also exist including CalSIMETAW, CUP Plus, and SIMETAW. These detailed methodologies require significant field-specific inputs such as soil characteristics and depth, crop types, irrigation areas and strategies, root system characteristics, agronomic practices, micro and macro climate factors, field runoff, and others. While these models and methodologies would be beneficial for NID's use, the detailed input data required for the models is not yet available for the NID service area. Not only is effective precipitation challenging to model, it is also challenging to estimate due to the wide variances in topography, climatic conditions, cropping types, and agronomic practices within the District's service area.

The body of data regarding agricultural use consists of the self-reported cropping surveys that are limited to crop type and estimated acreage for the irrigation season (April 15 – October 14). There is no crop type or acreage data available for Fall/Winter deliveries. A methodology commensurate with the available data and data quality is used to estimate effective precipitation as described below.

The EP methodology employs the Food and Agricultural Organization's (FAO) estimation method which apportions a percentage of the total monthly rainfall as the EP (Brouwer and Heibloem, 1986). The method is used when information on rainfall reliability, topography, soil texture and structure, depth of root zone, and prevailing soil type is generally unknown (Brouwer and Heibloem, 1986), as is the case for much of the District's service area.

EP is estimated for water years 2016 -2020 using average precipitation data from four weather stations for each year; Auburn, Colfax, Grass Valley, and Nevada City. The monthly precipitation totals for each site are averaged into a monthly precipitation (National Oceanic and Atmospheric Administration – California Nevada River Forecast Center (https://www.cnrfc.noaa.gov/). Average precipitation is input into the FAO formula to estimate the EP, which is then multiplied by the irrigation season acreage and Fall/Winter estimated acreage area to estimate total EP in acre-feet. The calculations are presented in Appendix H and results are reported in Table 5-1. The estimated accuracy of this calculation is +/- 25 percent due to numerous assumptions included in the calculation.

5.2 Quantifying Service Area Outflows

The water budget presented includes crop consumptive use, outflow, and deep percolation. Each subsection below presents the development and assumptions for each outflow component.

5.2.1 Crop Consumptive Use (CCU)

The crop consumptive use of applied water (CCU) is estimated using specific crop evapotranspiration rates published by the Irrigation Training and Research Center, California Polytechnic State University, San Luis Obispo. Based on the geographical location, the District's service area is associated within Zone 13. The calculations are presented in Appendix H and results are presented in Table 5-2. The estimated accuracy of this calculation is +/- 25 percent due to numerous assumptions of crop acreage, consistent evapotranspiration rates, and crop types included in the calculation.

5.2.2 Surface Outflows

As presented in Section 4.2, drainage and outflow within the NID service area is not measured. NID does not maintain a drainage collection system and any surface runoff flows into the natural drainage waterways. The gravity canal delivery system is designed to spill at the end points in order to maintain proper water elevation on customer service boxes. Most of these spills are upstream of another NID diversion structure, and therefore assumed to be diverted back into the canal system. NID does measure canal spills at the end of the system, where spills then flow out of the service area. These measured spills are the estimated outflow volumes. Therefore the outflow volume does not include other drainage or rainfall event drainage during the non-irrigation season. Estimated surface outflows are presented in Table 5-2.

5.2.3 Deep Percolation Outflows

The subsurface characteristics throughout the service area can vary from bedrock to shallow alluvium (USGS, 1984), creating varying conditions of direct runoff, percolation into rock fractures, and subsurface drainage to watercourses. The District does not measure or track agricultural field runoff, nor maintain detailed field subsurface conditions or irrigation practices for each customer, complicating development of irrigation percolation estimates.

As the purpose of quantifying percolation in this AWMP is to differentiate and identity water volumes necessary to serve irrigation water to meet irrigation requirements, the District includes canal seepage in this category. It is assumed the water lost from the canals due to seepage either percolates into fractured rock fissures or into nearby shallow alluvium, and is lost to the canal system. The District has estimated canal seepage in the Raw Water Master Plan at 15 percent of total canal flow. Estimated deep percolation outflows are presented in Table 5-2.

5.2.4 Municipal and Industrial (raw)

As indicated in Section 3.4, NID provides municipal and industrial raw water to other entities. The raw water deliveries from the canal system are presented in Table 3-6 and are quantified as an outflow in the water budget. The raw water is diverted by the District for subsequent delivery to the City of Grass Valley, Nevada City, Nevada City School of Arts, and Placer County Water Agency. Municipal and industrial raw water deliveries are included in Table 5-2.

5.2.5 Treated System

Portions of the raw water flows are diverted from the canal system into NID's water treatment plants. These diversions are metered at the treatment plant's raw water intake and are included as an outflow in the water budget. Raw water deliveries to the District WTPs are included in Table 5-2.

Table 5-1. Quantification of Service Area Inflows

Inflow Component	How Quantified?	2016 AFY	2017 AFY	2018 AFY	2019 AFY	2020 AFY
Effective Precipitation	Estimated	6,312	17,509	8,495	13,775	13,580
Water Supplier surface water diversions	Measured	133,682	136,219	144,786	141,482	152,947
Water supplier groundwater pumping	Measured	0	0	0	0	0
Private groundwater pumping	Estimated	0	0	0	0	0
Total:		139,994	153,728	153,281	155,257	166,527

Table 5-2. Quantification of Service Area Outflows

Outflow Component	How Quantified?	2016 AFY	2017 AFY	2018 AFY	2019 AFY	2020 AFY
Evapotranspiration (Crop Consumptive Use)	Estimated	95,015	88,226	98,501	90,051	104,240
Surface Outflows[1]	Measured	3,030	4,680	5,168	4,785	3,696
Deep Percolations	Estimated	20,052	20,433	21,718	21,222	22,942
M&I (raw)	Measured	5,232	6,116	6,086	5,413	6,200
Treated System	Measured	8,942	9,752	10,061	9,269	10,537
Total:		132,271	129,207	141,533	130,740	147,615

[1] For measured sites only.

5.3 Identify Water Management Objectives

10826(f). Identify water management objectives based on the water budget to improve water system efficiency or to meet other water management objectives. The agricultural water supplier shall identify, prioritize, and implement actions to reduce water loss, improve water system management, and meet other water management objectives identified in the plan.

The District is at the crossroads of a unique opportunity. Water management throughout the State of California is shifting, with urban, agricultural, environmental, and social interests all working to reimagine water resources management priorities and responsibilities. Being situated at in the headwaters of the watershed that supplies the majority of the state, NID's water resources are highly valuable to downstream interests throughout the state. As stated in the District's adopted Strategic Plan Goal #3, NID will develop and manage its resources in a self-determining manner that protects and provides local control of the water supply. NID is taking this opportunity in water management shifts to locally develop the vision and water resource needs for its community. Plan for Water is NID's ongoing effort to develop this community-focused vision and subsequent strategies for implementation. Plan for Water will identify the community's need for water resources within the context of community visioning. Alternative strategies and projects will be developed and compared to support an ongoing strategy and implementation plan for policy decisions, management enhancements, operational modifications, infrastructure requirements, and others as identified. The Plan will identify triggering points and re-analysis updates in order to maintain current and responsive to future scenarios.

The Plan for Water provides the overarching long-term strategy for the District. To support the strategy, the District will need enhanced data collection and data analytics to inform decision making and track implementation progress. There are also new or pending regulations that will require enhanced data analytics such as water budget assignment by State and FERC license monitoring requirements. The following lists efforts NID will implement in the near future to enhance its water management capabilities:

1. Continue to evaluate and implement as feasible options to increase understanding of agricultural irrigation customer water uses and field characteristics. Crop type and irrigation area currently self-

reported. NID will investigate means and methods to improve accuracy and validation of irrigation customer practices, including available aerial imagery

2. Continue to evaluate and implement as feasible options to increase measurement accuracy. NID irrigation customers are mostly served through the miner's inch orifice distribution box. NID will investigate methods to improve the measurement accuracy and temporal patterns to better quantify individual customer use.

3. Continue to evaluate and implement as feasible options to increase canal water balance accuracy. NID will investigate options to increase flow measurement throughout its canal system to allow refined understanding of water in, water out, and seepage.

4. Investigate land use and latent water demands within the service area as part of the Plan for Water process. NID only serves a portion of the parcels within its service area. Many unserved parcels are either undeveloped or use private domestic groundwater wells. Should wells fail, or parcels be developed, NID may be asked to provide service. This latent demand needs better quantification in order to improve understanding of potential future demands.

5. Reduce water demands. NID will continue to implement its conservation programs and demand management measures for agricultural and treated water customers. NID will investigate new programs as identified and modify the conservation program offerings as selected. On the treated water side, DWR and the State Board will soon be enforcing water budgets for indoor use and landscape irrigation. NID will develop the necessary data analytics to support the management and water demand reporting requirements.

6. Resource Stewardship. NID will continue its watershed management program and practices. NID will investigate new programs as identified and modify the watershed program offerings as selected.

7. Modify water system in step with changing hydrology. The State of California is projecting hydrologic scenarios that portend warmer conditions resulting in less snowpack and more rain. NID's current system relies on the slow melting of the snowpack over the spring and summer to supply irrigation demands. If there is less snow and more rain in the future, NID will need to make operational, facility, and/or watershed changes to store more of the winter rainfall for use during the irrigation season. The District will continue its efforts to identify future potential changes and evaluate alternatives to address these climate impacts.

8. Fractured rock groundwater system investigations. NID will investigate options to partner with the respective counties in the service are to better understand private well groundwater use and trends to support water accounting and future demand needs.

5.4 Quantify the Efficiency of Agricultural Water Use

10826(h). Quantify the efficiency of agricultural water use within the service area of the agricultural water supplier using the appropriate method or methods from among the four water use efficiency quantification methods developed by the department in the May 8, 2012, report to the Legislature entitled "A Proposed Methodology for Quantifying the Efficiency of Agricultural Water Use." The agricultural water supplier shall account for all water uses, including crop water use, agronomic water use, environmental water use, and recoverable surface flows.

The quantification of the efficiency of the District's water agricultural water use employs Method 1 (Crop Consumptive Use Fraction) from DWR's report to the Legislature entitled, "A Proposed methodology for Quantifying the Efficiency of Agricultural Water Use" (DWR, 2012). Specifically, Method 1 compares the evapotranspiration of applied water (ETAW) with the total applied water (AW) for the reported irrigated acres during 2020. Values for AW are reported as the amount purchased by agricultural

customers, including Fall/Winter customers. Calculations are presented in Appendix H and results are presented in the following Table 5-3.

Table 5-3. (DWR Table D.1) Crop Consumptive Use Fraction (2020)

Evapotranspiration of Applied Water (ETAW)[1] AFY	Applied Water (AW)[2] AFY	Crop Consumptive Use Fraction No units
90,660	109,016	83%

[1]Equal to evapotranspiration (Table 5-2) minus effective precipitation (Table 5-1).

[2]From Table 3-1.

Both ETAW and AW are estimated. Accuracy of crop consumption ratio is unknown.

6 Climate Change

10826(d). Include an analysis, based on available information, of the effect of climate change on future water supplies.

Climate change is increasingly at the forefront of water resource management discussions. This District's snowpack-based supply and delivery strategy could be extensively impacted by changing temperatures and precipitation. As such, the District undertook an analysis of climate change impacts to future supplies. The analysis included projecting future hydrologic conditions and their potential effect on the District's water supplies, specifically watershed runoff. The approach, State and Global Climate Model (GCM) datasets incorporated, assumptions, and results of the analysis are documented in the technical memorandum titled, "Hydrologic Analysis Technical Memorandum – Final Report" (HDR, 2020).

6.1 Climate Change Modeling Results

The modeling and analysis produced hydrologic data sets that represent historic and projected climate change condition for the year 2070 that can be used to quantify how much of the projected watershed runoff is available to be used as District water supply.

Table 6-1 presents the projected 2070 runoff values at four locations in the District's watershed under the various climate scenarios compared to the historical average runoff at each location. Results from the modeling and analysis indicated that changes in runoff volume are not directly proportional to changes in precipitation volume between scenarios. Variation of temperature, rainfall intensity, and rainfall duration impact the projected runoff. The detailed monthly model results also indicated a shifting of runoff to earlier in the year, as is expected with predicted warmer temperatures.

Table 6-1. Percent of Average Annual Historic Runoff

Location	Percent of Average Annual Historical Runoff at Each Location		
	2070 DEW	2070 Median	2070 WMW
Middle Yuba River at Milton Diversion Dam	92%	104%	126%
Canyon Creek at Bowman Dam	92%	104%	125%
Bear River at Rollins Dam	90%	109%	148%
Deer Creek at Scotts Flat Dam	90%	108%	147%

DEW - Drier, extreme warming scenario
WMW - Wetter, moderate warming scenario

The analysis also evaluated runoff projections under drought condition. A five-year historic drought (1987-1991) was input into the hydrology, with results presented in Table 6-2. Note the projected runoff values are solely based on the hydrologic characteristics of the five-year drought selected, and a different five-year period will result in different results. Results indicate the watershed is significantly impacted in this drought condition, with runoff reducing up to 75 percent in the early drought period, and 50 percent in later drought period. The average year 2070 runoff projected in the hydrologic model (383,500 AF) includes additional subbasins that are not included in the Upper Division dataset that lists an average historical runoff of 232,600 AFY in Section 4.1.1.

Table 6-2. Projected Watershed Runoff during Historical Five-Year Drought (1987-1991)

2070 Projected Average Year Runoff, AF	Drought Year 1, AF	Drought Year 2, AF	Drought Year 3 AF	Drought Year 4, AF	Drought Year 5, AF
383,500	97,200	95,200	315,900	158,200	166,700

The annual precipitation as measured at the NID Bowman Lake rain gage from 1987 through 1991 is presented in Table 6-3.

Table 6-3. 1987-1991 Annual Precipitation - Bowman Lake Rain Gage

1987	1988	1989	1990	1991
45.5 in.	49.1 in.	62.4 in.	44.8 in.	54.0 in.

6.2 Climate Change Impacts

The modeling results indicate NID should expect changes to the existing runoff patterns. In addition to NID's own supply and demand impacts, climate change could also affect NID with respect to state-wide needs and local agriculture.

As evidenced by the modeling results, runoff will be affected under the modeled climate conditions. However, the State's water management strategies also rely heavily on snowpack. It is expected similar changes will affect state-wide supplies and operations. Resulting policies, regulations, and legal impacts could likely impact NID's supply availability for local use.

Local climate change impacts will likely affect current supply source options. There are approximately 52,000 parcels in the District's service area. Only approximately 25,000 receive NID treated or raw water. It is assumed the remaining 25,000 parcels are served by fractured rock wells or are undeveloped. A prolonged drought, or increased winter runoff could reduce the amount of water that percolates into the rock fractures, reducing the amount of fractured rock groundwater. This in turn could cause private wells to be insufficient for use. Failing wells will likely cause an increase in the NID customers and subsequent demands, as existing residences will need to connect to the water system. Some of these users may be too far from existing infrastructure making it potentially cost prohibitive to connect, however, the District does expect new customers in the "soft service areas", which are areas near existing infrastructure.

Local climate changes could also affect the community's long-standing agriculture presence. Changing temperatures and precipitation patterns could affect crop types and irrigation demands, open up higher elevations to plantings, affect crop yields, change agronomic practices, and others. Each of these will have an effect on NID supply requirements, operational strategies, and infrastructure requirements.

In addition to supply and demand issues, NID also expects impacts to its other responsibilities. Watershed impacts will affect forest management practices, implementation of the FERC license requirements, and increase catastrophic fire risk. Existing recreation opportunities may be altered or not available under certain conditions. Hydropower generation, which provides significant revenue to the District, may be shifted into less beneficial market pricing periods. Hydropower generation may also

decrease as the normal high revenue summertime generation period may not have the water supply to generate as in the past.

Enhancing climate change resiliency is an important element for all levels of water resources planning across the state. The State is pursuing numerous avenues to quantify potential issues and develop mitigation alternatives. NID will follow these efforts and participate as available. Regionally, groups of agencies and other stakeholders are also addressing these issues and developing mitigation efforts, such as CABY, American River Basin Study, Association of California Water Agencies Headwaters initiatives, and others. Locally, NID is committed to controlling its own water resources in a self-determining manner per its strategic plan. The Plan for Water is NID's vehicle to assess climate change impacts and develop and implement mitigation strategies and modifications to operate within climate change.

7 Water Use Efficiency Information

10608.48(d). Agricultural water suppliers shall include in the agricultural water management plans required pursuant to Part 2.8 (commencing with Section 10800) a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination.

The AWMP Act calls for agricultural water suppliers to report on which efficient water management practices (EWMP) they have implemented and plan to implement and to describe the associated water use efficiency improvements. The District's EWMP implementation is described in this section.

7.1 EWMP Implementation and Reporting

The following subsections report on the EWMPs planned, implemented, and improvements that have occurred since the 2015 AWMP. There are two Critical EWMPs that every supplier must implement. There are an additional 14 Conditionally Required EWMPs that should be implemented if cost effective or technically feasible.

7.1.1 Critical EWMPs

1 - Water Measurement - All of the District's customer delivery points are measured. Service outlets are checked numerous times per year for accuracy of water delivery. Orifice plates, screens and boards are replaced as necessary. All measurement structures are installed to professional engineering design standards. All structures are checked prior to irrigation season and numerous times during the season as necessary for accuracy by inspecting the levelness and to verify that the staff gages are set to the appropriate level. A standard AA current meter measurement is used to compute flow when necessary. In addition, locking of all irrigation boxes to prevent theft is currently being employed. Implementation of this EWMP is complete and NID will continue to maintain the measuring devices.

2 - Volume-Based Pricing - The District's water rates are shown in Appendix D. The uniform water rates are based in part on quantity delivered. The District approves water rates annually based on the cost of service, and consistent with Proposition 218. Implementation of this EWMP is complete, and rates structures are updated on a regular basis per Board direction.

7.1.2 Conditionally Required EWMPs

1 - Alternate Land Use - The District is not aware of customers with lands that have an exceptionally high water duty or whose irrigation contributes to significant problems. Some irrigation customers are required by the Central Valley Regional Water Quality Control Board to participate in a water coalition to protect water quality and minimize run-off through EWMPs. The District employs a water waste policy that prohibits excess runoff from a parcel. If a site is identified that is contributing to significant problems, the District will investigate solution options per the EWMP. Budget for implementation of this EWMP over the next 10 years is included in the regular budget for staff costs.

2 - Recycled Water Use - The District currently uses recycled water from urban wastewater treatment plants that is discharge to creeks per discharge permit requirements. The discharge is comingled with the District's water and diverted into the canal system. A total of 7,551 acre-feet of water supply was conserved from 2016 through 2020. Pending continued acceptable water quality, the District will continue to utilize recycled water for agricultural deliveries over the next 10 years. Budget for implementation of this EWMP over the next 10 years is included in the regular budget for staff costs.

3 - Finance On-Farm Irrigation Systems - This EWMP is not implemented as described in Section 7.4.

4 - Incentive Pricing Structure - The District currently has incentive pricing with volumetric uniform water rates that provide motivation to use water efficiently. The District's pricing consists of a combination of fixed charge (a constant fee assessed to customer) and a water rate (a price per unit of water delivered). The District's pricing structure promotes more efficient use of water at the farm level. Implementation of the EWMP is ongoing, with rates updated as determined by the Board. Budget for implementation of this EWMP over the next 10 years is included in the regular budget for staff costs.

5 - Infrastructure Improvements - The District lines and encases canal sections annually. The District also applies for grant funding when applicable. The benefit-cost ratio for this EWMP is low due to the cost per mile to gunite canals (a minimum of $125,000/mile). Even though some herbicide and soil erosion control costs may decrease by canal lining, cleaning silt and debris costs increase. In the last five years, the District has spent over $40 million on encasement and realignment of distribution lines and canals. Recent budgets have allocated over $1 million per year in raw water infrastructure and system improvements. Implementation of the EWMP is ongoing. Pending available funding, the District will continue to allocate $1 million annually for the next 10 years. Staff costs for capital projected implementation are included in the regular budget for staff costs.

6 - Order/Delivery Flexibility - The District's licensed distribution operators work with customers on an individual basis for canal rotations and delivery flexibility. In addition, the District allows for proration of account if service is impacted or for requested demand water. Implementation of the EWMP is ongoing and is expected to continue for the next 10 years. Staff costs for this practice are included in the regular budget for staff costs.

7 - Supplier Spill and Tailwater Systems - Tail water from higher elevation canals is recaptured in lower elevation canals due to the change in elevation of the extensive distribution system. The District has the right to resell return flows within the District boundaries. Therefore, this water is being recovered and utilized during the irrigation season. The District utilizes 15 automated gaging and telemetry stations within the canal system to increase efficiency and minimize spills. Implementation of the EWMP is ongoing. The District plans on increasing the measurement sites at non-recapturable end points, adding up to 10 sites over the next 10 years, assuming budget availability. The costs for these sites is included in the infrastructure improvement EWMP budget of $1 million per year.

8 - Conjunctive Use - Not applicable as only fractured rock groundwater is present in the service area.

9 - Automated Canal Controls - The District researched automation of canal structures, where applicable, for design, efficiency, and feasibility. Automatic gate control devices were installed at two of the District's large capacity canals. If feasible, the District will incorporate automation and/or telemetry into canal structures at the time of replacement. Implementation of the EWMP is ongoing. The District plans on installing up to 10 real-time monitoring stations over 10 years. The costs for these stations are included in the total infrastructure improvement EWMP budget of $1 million per year.

10 - Customer Pump Test/Evaluation - Not applicable. The District is not aware of any private groundwater customer wells used for irrigation.

11 - Water Conservation Coordinator - Since 2011, a full time water efficiency coordinator develops and coordinates educational programs, including fairs and events, irrigation workshops, customer surveys, newsletters, website information, demonstration gardens, and landowner site visits. The coordinator also provides customers with information on local cost-share and technical assistance programs. In addition, the District offers multiple programs including rebates, mulch giveaways, irrigation workshops, large landscape projects, and school presentations. Implementation of the EWMP is ongoing. Implementation

of this EWMP is complete and NID will continue to maintain the conservation coordination position and duties at a budget estimate of $100,000 per year for the next 10 years.

12 - Water Management Services to Customers - The District provides information and education to customers via the District's website (www.nidwater.com), inserts into the customer's bills, pamphlets and brochures, and an onsite Demonstration Garden. Throughout the year the District provides irrigation efficiency workshops that are free to customers, as well as free seminars and other events which promote water use efficiency through Best Management Practices. Further, the District responds to water waste reports and currently has a "Report Waste" link on their website. The District provides educational material and information on cost-share incentive programs that are offered by other agencies.

The District works closely with local and regional resources such as the USDA Natural Resource Conservation Service (NRCS) and Resource Conservation Districts (RCDs), University of California (UC) Cooperative Extension Farm Advisors, UC Certified Master Gardeners, and local county agricultural commissioners to provide customers with technical assistance and new advances in best management land practices, BMPs for herbicide use, conservation measures for environmental habitat, and the efficient use of water.

Implementation of the EWMP is ongoing and is expected to continue for the next 10 years. Staff costs for this practice are included in the regular budget for staff costs.

13 - Identify Institutional Changes - The District has riparian rights and pre- and post-1914 water rights for most of its water supply. The District's Board of Directors has the legal authority to directly set and implement policies that affect the distribution of water. The District evaluates its policies, rules, and regulations regularly to address regulatory and other changes. For the small portion of supply from the District's contract with PG&E, additional flexibility in timing and location of purchased water was incorporated into the recent PG&E agreement renewal.

Implementation of the EWMP is ongoing and is expected to continue for the next 10 years. Staff costs for this practice are included in the regular budget for staff costs.

14 - Supplier Pump Improved Efficiency - The District does not pump from groundwater and most of the distribution system is gravity flow. In a few isolated cases, 100-150 hp pumps lift water a short distance to a nearby reservoir. The pumps are inspected daily and any debris is removed. All pumps are inspected annually and are on an annual maintenance schedule to ensure efficient operations. The District replaces inefficient pumps as grant funding and/or budget is available. Implementation of this EWMP is ongoing. It is anticipated that the District will conduct two pump efficiency tests (and subsequent replacement based on available grant funding), during the next five and 10 years. Budget for testing is included in the regular operations budget, with identified replacement needs to be funded through budget and/or grants.

Table 7-1 presents the District's additional raw water system delivery improvements over the last five years.

Table 7-1. NID Raw Water System Infrastructure Efficiency Improvements (2015-2020)

Improvement	Location/List
New Gaging Stations	Riffle Box Canal at End Grove Canal at End Wolf Hanaman Canal at End Kyler Canal at Head Rock Creek Intertie Station Flow Meter for the DS Pumps
Replaced/Improved Gaging Stations	Red Dog Canal at Head Kilaga Springs Canal at Head Woodpecker Canal at Head Sazarac Canal at Head Oest Canal at Head Sanford Struckman H-Flume at Head Tarr at Hog Chute Gage Station Bowman Spaulding Canal at Head Allison Ranch at End
Telemetry – Real Time Data	Wilson Creek Diversion Ogee weir on Deer Creek DS Canal at Head Newtown Canal at Head Tunnel Canal at Head Tarr Canal at Head Chicago Park Canal at Head Loma Rica Reservoir Combie Phase I at Head Combie Ophir I at Head Gold Hill Canal at Head Camp Far West Canal at Head Auburn Ravine I Canal at Head Hemphill Canal at Head China Union Canal at Head
Canal Lining and Encasement	Bowman Spaulding Canal - 1,325 LF Chicago Park Canal – 280 LF Maben Canal Phase 1-3 – 5,320 LF Newtown Canal – 1,470 LF Combie Phase 1 – 8,900 LF
Canal Repairs	Shotcrete Canals - 7,700 Feet Encased canals (Due to leakage) – 18,740 Feet Repaired Canal leaks – 867 Repaired Reservoir Leaks – 3 (Alta Hill / Ruess 2 x's) Shotcrete Reservoirs – 1 (Ruess 2x's) Pipes Replaced (Over Shots / New Structures) – 220 Feet

Improvement	Location/List
	Berms Repaired (Downed Tree / Leaks / Up-Graded / Storm Damage) - 16, 050 Feet Repaired Control Structures – 2 (Gold Hill II - Head / Markwell – End)
Other Improvements	Installed Snowfox and monitoring equipment for real time snow data

Table 7-2 presents the District's schedule, finance plan, and budget to implement the EWMPs.

Table 7-2. (DWR Table VII.A.3) Schedule to Implement EWMPs

EWMP No.	Implementation Schedule	Finance Plan	Annual Budget Allotment
Critical 1 - Water Measurement	Completed	Rates	Included as part of larger operations budget
Critical 2 - Volume-Based Pricing	Ongoing/Completed	Rates	Included in various staff salaries budget allotment
1 – Facilitate alternative land use changes	Ongoing	Rates	Included in various staff salaries budget allotment
2 - Recycled Water Use	Ongoing	N/A	No cost for recycled water supply
4 - Incentive Pricing Structure	Ongoing	Rates	$50,000 (Proposition 218 process/education per rate case)
5 - Infrastructure Improvements	Ongoing	Rates	$1 million
6 - Order/Delivery Flexibility	Ongoing	Rates	Included as part of larger operations budget
7 - Supplier Spill and Tailwater Systems	Ongoing	Rates	Included in EWMP No. 5 budget allotment
9 - Automated Canal Controls	Ongoing	Rates	Included in EWMP No. 5 budget allotment
11 - Water Conservation Coordinator	Ongoing	Rates	$100,000
12 - Water Management Services to Customers	Ongoing	Rates	$50,000
13 - Identify Institutional Changes	Ongoing	Rates	Included in various staff salaries budget allotment
14 - Supplier Pump Improved Efficiency	Ongoing	Rates/Grants	Included as part of larger operations budget
Grand Total all EWMPs			$1.2 Million[1]

[1]Grand total budget allotment for implementation of EWMPs is over $1.2 million. Staff labor and regular operational budget are not quantified in this total.

7.2 Critical EWMPs

The District implements the mandatory Critical EWMPs: No. 1, Water Measurement, and No. 2, Incentive Pricing Structure. A description of how the critical EWMPs are implemented by the District is provided in Section 7.1. Additional background information is provided below.

7.2.1 Critical EWMP No. 1 – Water Measurement

All of the District's customer delivery points are measured. The majority of the District's irrigation customers purchase summer season water, April 15 through October 14; the typical duration of water delivery is 182 days. The standard measurement for a miner's inch requires a six-inch head of water over the center of the orifice and the water to free flow through the delivery point. For customers that purchase 40 miner's inches or less, the amount of water is delivered through a standard water box and measured through an orifice sized for the amount of water purchased and the available head pressure. For purchases greater than 40 miner's inches, the measurement may be by any industry standard device such as a weir or Parshall flume that will give the most accurate measurement for the situation. The customer's water boxes and orifice plates are checked at the beginning of irrigation season and periodically throughout the season for accuracy. Records are kept stating when customer services are turned on and off to assist in calculating the volume of water delivered. Volume is calculated as follows:

$$\text{Volume} = \text{Flow} \times \text{Duration}$$

Where,

Flow = miners inch delivered converted to flow rate based on orifice

Duration = Time of water service/delivery

7.2.2 Critical EWMP No. 2 – Incentive Pricing Structure

All water rates are determined on a cost of service basis, consistent with Proposition 218, and are reviewed annually. Raw water rates are a uniform volumetric charge, consisting of a combination of fixed charge (a constant fee assessed to customer) and a water rate (a price per unit of water delivered). Raw water is sold by quantity in increments of either miner's inches or acre feet. The District has several rate schedules for raw water depending on the type of service provided. Similar to the rates, the District also has several billing frequencies depending on the type of service. For a seasonal irrigation service, the customer has the choice of paying the amount in full or making payments in three installments. Most of the raw water customers purchase water for the summer irrigation season (April 15 to October 15). The current District water rates are provided in Appendix D.

7.3 Conditional EWMPs

The District continues to implement cost-effective or technically feasible conservation measures including, but not limited to, the practices described in Section 7.1. All of the applicable Conditional EWMPs are being implemented with the exception of No 3, On Farm Capital Improvements. Some irrigation customers are required by the Central Valley Regional Water Quality Control Board to participate in a water coalition to protect water quality and minimize run-off through efficient water management practices.

7.4 Documentation for Non-Implemented EWMPs

The efficient water management practices that the District has determined are not locally cost effective or technically feasible are listed in Table 7-3.

Table 7-3. (DWR Table VII.A.4) Non-Implemented EWMP Documentation

EWMP No.	Description	(check one or both)		Justification and/or Documentation
		Technically Infeasible	Not Locally Cost-Effective	
3	On-Farm Irrigation Capital Improvements		X	The District provides information and resources to customers for local, state and federal cost-share and technical assistance programs such as the USDA Natural Resource Conservation Service EQIP, local RCDs and UC Cooperative Extension Farm Advisors. It is not locally cost effective for the District to finance capital improvements to agricultural customers because due to the District's water rights and supply infrastructure fixed costs, there are no incremental cost savings from potential local on-farm capital improvements.

8 Supporting Documentation

The Agricultural Water Measurement Regulation applies to water suppliers that serve more than 25,000 acres (excluding recycled water), and requires that water measurements be conducted at the farm-gate of a single customer and that measurement devices are certified as accurate through field-testing, laboratory/engineer certification, or inspection. In this section the term "delivery point" is used in place of the term "farm-gate" to be consistent with the District's terminology for the location at which the District transfers control of the delivered water to the customer.

8.1 Legal Certification and Apportionment Required for Water Measurement

The District can measure water at the delivery point for all customers and therefore does not need to submit legal certification and apportionment required for water measurement. This DWR AWMP Guidebook Attachment A requirement is not applicable to the District. There are no legal constraints to installing or operating water meters for any of the District's customers.

8.2 Engineer Certification and Apportionment Required for Water Measurement

The District can measure water at the delivery point for all customers. Therefore, the District does not need to submit engineer certification and apportionment required for water measurement. This DWR AWMP Guidebook Attachment B requirement is not applicable to the District. There are no physical constraints at the delivery points that prevent the installation or operation of water meters for any of the District's customers.

8.3 Description of Water Management Best Professional Practices

This section provides a description of the Best Professional Practices about the collection of water measurement data, frequency of measurements, method for determining irrigated acres, and quality control and quality assurance procedures.

8.3.1 Water Measurement Data Collection

Water measurement data are collected based on orifice plate settings for the duration of the customers purchase, either seasonally (from April 15 to October 14) or annually. As needed and if requested, the District will review, test, and evaluate the measuring device and its ability to provide the water accurately to the customer. Appendix G contains a memorandum from the District's interim engineering manager stating that the District's current methods of measuring customer deliveries meets raw water measurement best management practices under California Code of Regulations Section 597.2.

8.3.2 Measurement Frequency

Each customer is provided an orifice size which continuously measures the amount and limits the maximum amount of water at specific conditions. The orifice size is set on a regular basis per the respective ordered water supply.

8.3.3 Method for Determining Irrigated Acres

The District sends out a Crop Acreage Report form annually for the customer to report the irrigated acreage and types of crops with the application for water. The type of information required to be provided by the customer is:

1. Crops grown and irrigated acreage by crop type
2. Total acreage

8.3.4 Quality Control/Assurance Procedures

Information provided by the customers on the Application for Water and Crop Acreage report form sent out annually by the District is cross-checked by the District against prior reports and the total amount of acreage owned. If necessary, the District contacts the customer for clarification of the data submitted and/or conducts a site visit.

8.4 Documentation of Water Measurement Conversion to Volume

The orifice measurement is based on the miners inch. The District makes every reasonable effort to set the orifice to the proper head and allow free flow through the orifice and assumes 1 miners inch equals 1.5 cubic feet per minute. The size of the orifice (defining quantity of miners inch) along with the delivery duration (in days) is used to convert the water measurement to volume. Duration is based on the customer order, which is usually for the entire irrigation season. In the event a customer requests a shutoff, turn on, or Fall/Winter delivery, these durations are factored into the duration total.

8.5 Device Corrective Action Plan Required for Water Measurement

Orifices used for customer delivery are checked at a minimum of twice a year for proper sizing, adequate head pressure, and condition of the service point. Flowmeters are included in a maintenance management program and are inspected annually and calibrated according to manufacturer recommendations.

Field checks on canal measuring stations occur three to four times per year. This continual verification allows the District to maintain proper and accurate measurement records (Teledyne, 2016 and USBR, rev. 2001). Open channel flow sites are inspected to ensure structures are plumb, staff gages are level with flume floors and weir crests, approach flows are laminar, and that no backwater conditions exist in the tailrace of the structures. Current meters are used as a secondary verification to confirm the volume of flow.

8.6 References

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