Deutsch Domestic Water Company

Drought Management Plan

Crawford, Colorado

1 Novemeber 2022

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1 Introduction

1.1 Profile of Existing System

The Deutsch Domestic Water Company (DDWC) is a Special Purpose Water Carrier Company serving the rural area southeast of the Town of Crawford, in Delta County, Colorado. The Town of Crawford had approximately 429 people during the 2020 census and is located about 72 miles southeast of Grand Junction [13].

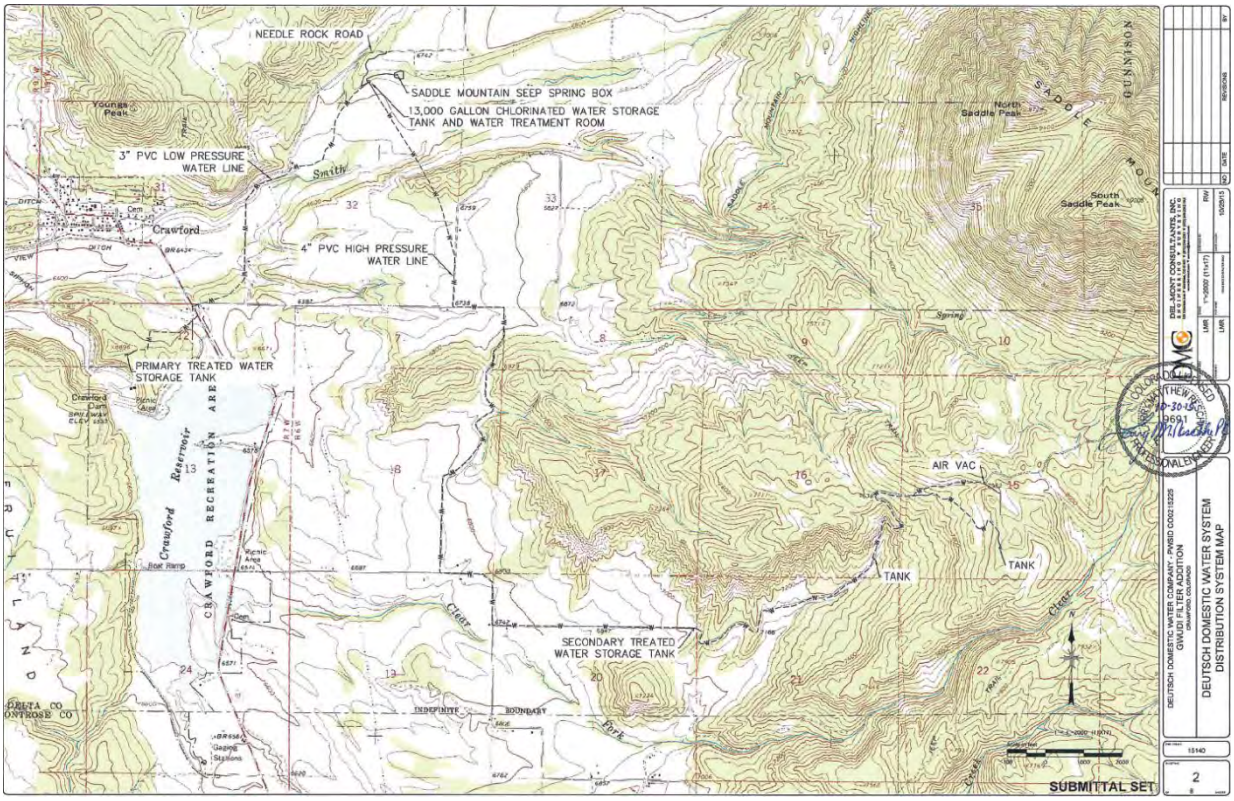

Figure 1: The DDWC system distribution map, dated 28 October 2015 [12].

1.2 Population

DDWC's tap holder and population projection on Table 1, below, focuses specifically on this area. The projection is based on historic company data for the past twenty years combined with an average 3.5 persons-per-household factor.

Table 1: Population projection for the DDWC service area.

DDWC Projected Population Growth				
Year	**Active Taps**	**Population**	**Change**	**Percentage**
2016	63	221	6	3%
2017	63	221	0	0%
2018	66	231	10	4%
2019	68	238	7	3%
2020	74	259	21	8%
2021	76	266	7	3%
2022	79	277	11	4%
2023	82	287	10	3%

2024	85	298	11	4%
2025	89	312	14	4%
2026	93	326	14	4%
2027	97	340	14	4%
2028	101	354	14	4%
2029	105	368	14	4%
2030	109	382	14	4%
2031	113	396	14	4%

1.3 Existing Water Supply

DDWC's water supply comes from a groundwater resource named the "Saddle Mountain Seep" located near the center of the Gunnison Basin watershed (HUC #140200). The Gunnison Basin watershed collects into the Gunnison River that empties into the Colorado River near Grand Junction, Colorado. Figure 2, below, illustrates the watershed boundary.

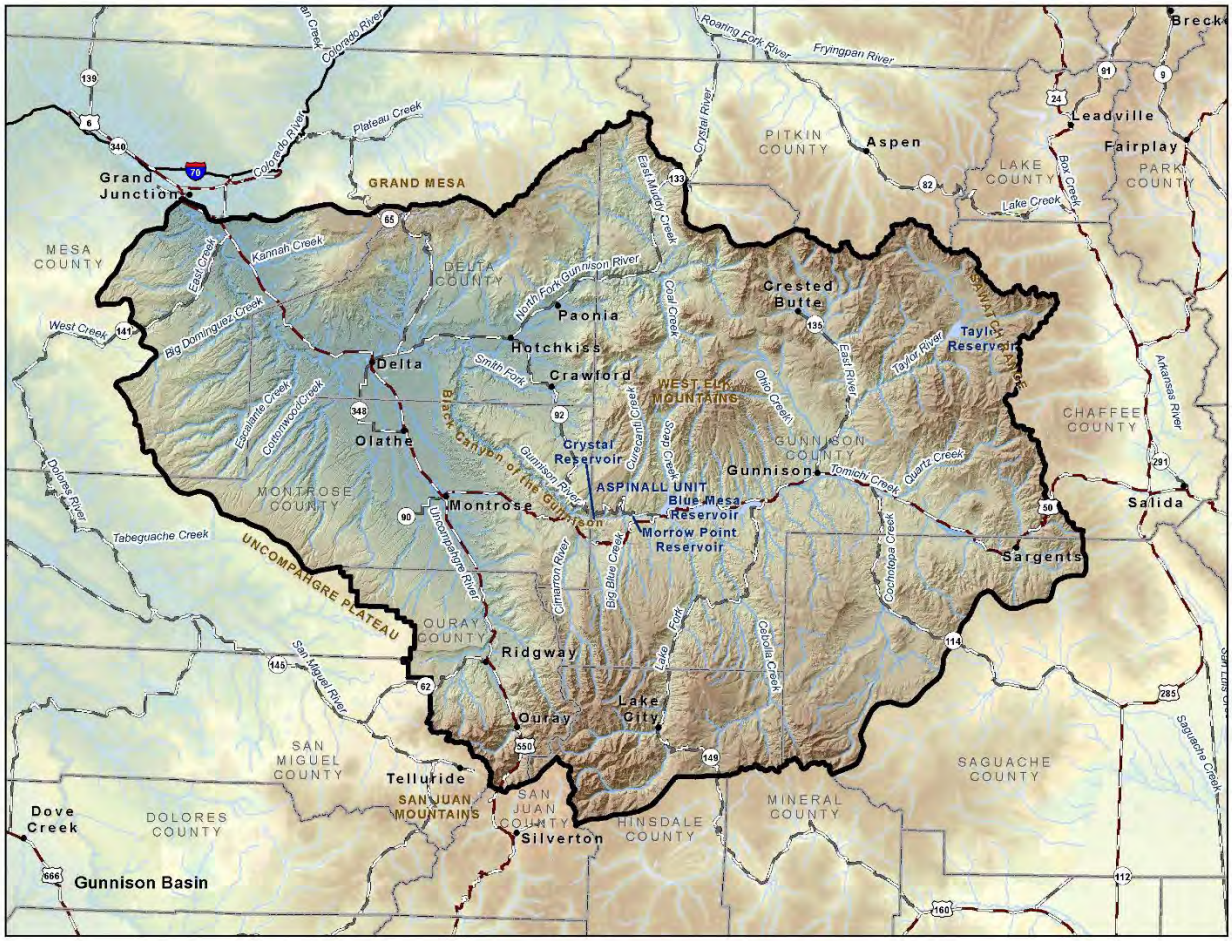

Figure 2: Local map with the showing an outline of the Gunnison Basin [4].

The Saddle Mountain Seep is a shallow, unconfined aquifer that is recharged from the Smith Fork tributary, which collects from the West Elk Mountains and discharges into the Gunnison River. The seep daylights to a spring where DDWC's collection point is located. The groundwater area covers approximately 0.3 square miles with 3.1-mile perimeter. Its strata are mostly shaly mudstone (Kmj) at

higher elevation draining to quaternary older alluvial (Qao) at its lower half. It has a quaternary landslide (Qls) feature around the collection point [11]. Figure 3, below, illustrates the seep area's approximate boundaries.

Decreed waters rights permit DDWC to collect and deliver 0.093 cfs during winter months to as much as .102 cfs during summer months (41.9 to 45.7 gpm) from its diversion structure #K25, also referred to as the "Spring Box", to its raw water receiving tank with excess returned to the Saddle Mountain Seep Ditch.

During summer months, an additional 0.34 cfs (152.6 gpm) is collected per an exchange agreement under the Young Ditch augmentation plan [18,19]. During winter months, DDWC has contracted with the U.S. Bureau of Reclamation (USBR) for the release of about 2.3 AF (average of about 4.3 gpm) from its Blue Mesa Reservoir in accordance with the augmentation plan,

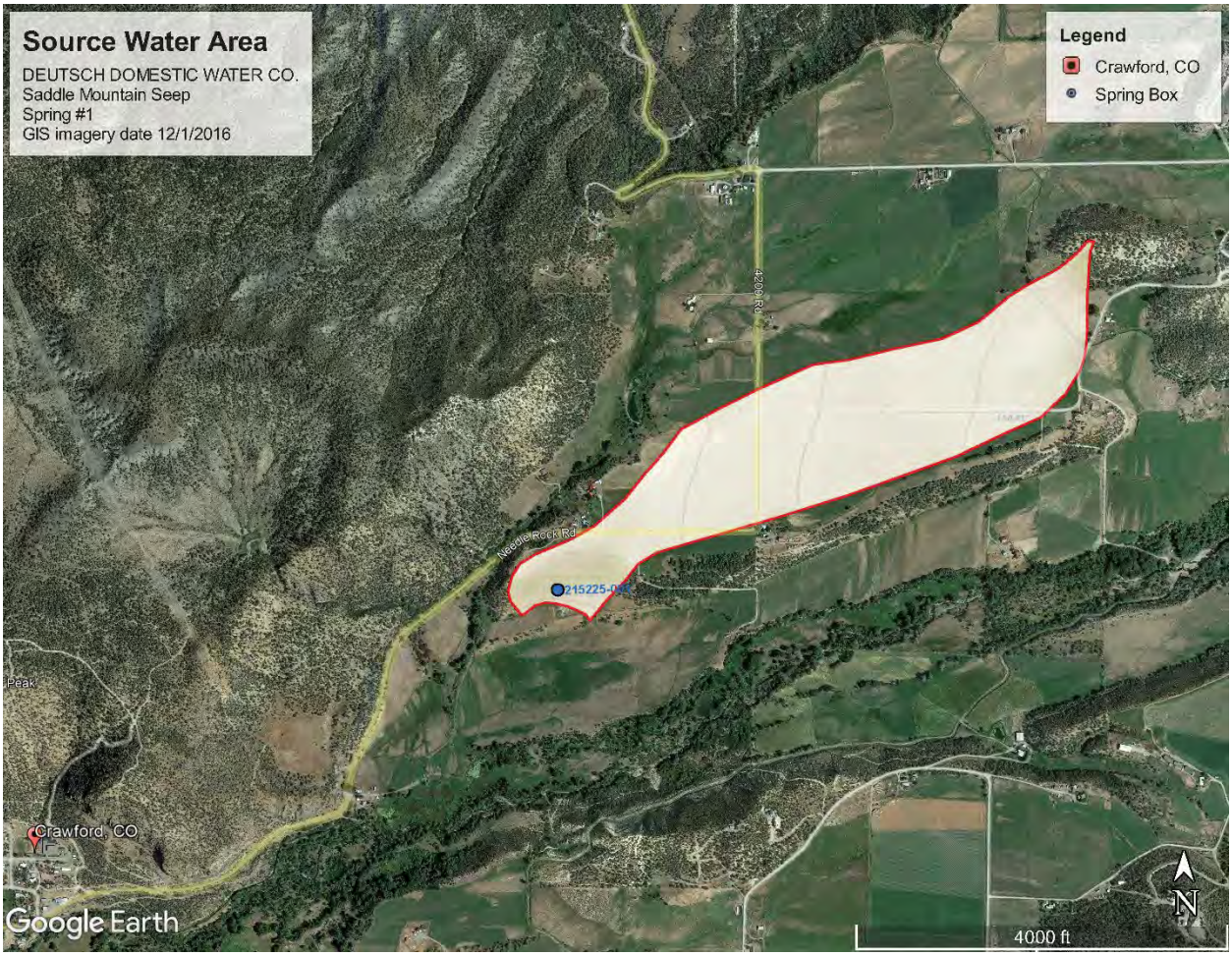

Figure 3: GIS closeup image of the Saddle Mountain Seep region [2].

1.4 Existing Water Demand

Colorado's District Court, Water Division 4, has decreed the DDWC certain absolute water rights and has approved its augmentation plan to service up to 150 homes, with a calculated 65.3 ac-ft/yr normal supply [19]. During drought years 2018 and 2021 only about 45.0 ac-ft/yr was available from the diversion, necessitating about a 20.3 ac-ft (31.1%) reduction. Estimates from drought years 2018 and 2021,

illustrated on Table 2 and Table 3 found differences of about 13.6 and 15.4 GPCD from historic maximum demand.

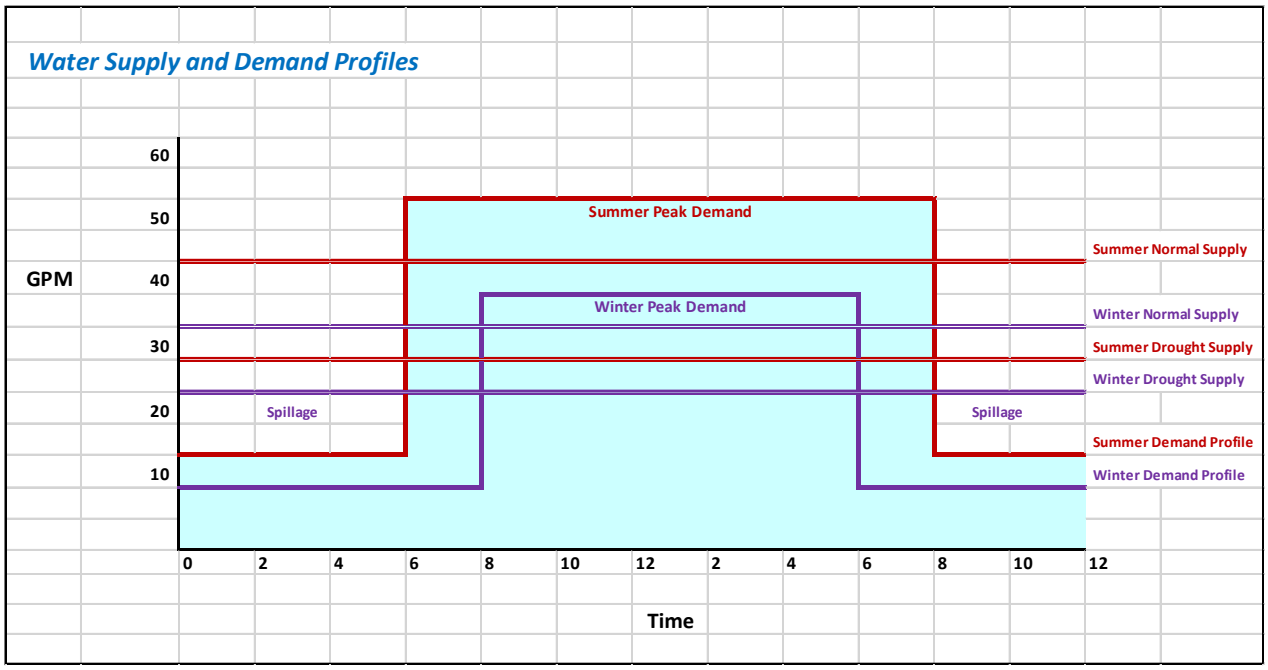

Figure 4: Estimate of water supply and demand profiles under both normal and drought conditions.

Table 2: Past per capita water requirements based on approved augmentation plan to achieve full build-out capacity. Year 2018 is recorded as a severe drought year with reduced supply.

DDWC Retail Water Deliveries over Past 5-Years (acre-feet/yr)						Average	
years	2016	2017	2018	2019	2020	2016-2020	Percent
			(drought yr)				
Water Supply	65.3	65.3	45.0	65.3	65.3	**61.3**	**100%**
Customer Category							
Residential	24.7	24.7	23.3	26.7	28.2	25.5	42%
Commercial	0.6	0.6	0.6	0.6	0.6	0.6	1%
Irrigation	2.0	2.0	1.5	2.1	2.2	1.9	3%
Live Stock	2.0	2.0	1.8	2.0	2.0	2.0	3%
Total Deliveries	**29.3**	**29.3**	**27.1**	**31.3**	**33.0**	**30.0**	**49%**
Spillage	36.1	36.1	17.9	34.1	32.4	**31.3**	**51%**
GPCD							
Residential Taps						150	100%
Active Taps	63	63	66	68	72	66	44%
Population	221	221	231	238	252	232	
Residential GPCD	100.0	100.0	90.0	100.0	100.0	98.0	
Total GPCD	**118.5**	**118.5**	**104.9**	**117.3**	**116.8**	**115.2**	

1.5 Future Water Demand

Future residential water demands for the region are extrapolated from historic tap quantities, assuming 3.5 persons per household. Commercial demand is assumed to remain constant. Agricultural demand is estimated to fluctuate between 200 head during off-season and 50 during the irrigation season.

Table 3: Current and projected per-capita use based on approved augmentation plan to achieve full build-out capacity. Year 2021 is recorded as a severe drought year with reduced supply.

DDWC Projected Retail Water Deliveries over Next 5-Years (acre-feet/yr)						Average	
years	2021	2022	2023	2024	2025	2021-2025	Percent
	(drought yr)						
Water Supply	45.0	65.3	65.3	65.3	65.3	**61.3**	**100%**
Customer Category							
Residential	26.5	31.0	32.5	34.1	35.7	31.9	52%
Commercial	0.6	0.6	0.6	0.6	0.6	0.6	1%
Irrigation	1.5	2.3	2.4	2.5	2.6	2.3	4%
Live Stock	1.8	2.0	2.0	2.0	2.0	2.0	3%
Total Deliveries	**30.3**	**35.8**	**37.5**	**39.2**	**40.9**	**36.7**	**60%**
Spillage	14.7	29.5	27.8	26.1	24.5	**24.5**	**40%**
GPCD							
Residential Taps						150	100%
Active Taps	75	79	83	87	91	83	55%
Population	263	277	291	305	319	291	
Residential GPCD	90.0	100.0	100.0	100.0	100.0	98.0	
Total GPCD	**103.1**	**115.7**	**115.3**	**114.9**	**114.6**	**112.7**	

1.6 Drought Mitigation and Response Planning

DDWC's President, with direction from the Drought Management Committee, is responsible for implementing drought mitigation measures and response planning.

Water supply and demand estimates suggest an appropriate water savings goal of seven acre-feet per year, or about 20% reduction on the supply side. This translates to about 13.6 and 15.4 GPCD reduction needs on the demand side during drought years 2018 and 2021. Local drought severity levels were mostly extreme (D3) to exceptional (D4) during those years. Consequently, a 20 GPCD reduction goal will be set for the highest severity response stage with additional strategically placed storage being required to achieve the higher conservation targets.

1.7 Historical Drought Planning Efforts

DDWC's has learned the importance of identifying drought conditions as soon as possible so can quickly implement conservation and mitigation measures to ensure essential needs are met. DDWC was reactive in its drought responses in the past. In general, it employed more frequent communications with tap holders regarding drought conditions, its ability to meet system demands, and mitigation measures being employed. DDWC also specifically targeted and began monitoring outdoor and non-essential uses more closely and asked tap holders to limit or curtail such uses until drought conditions improve. These tactics were effective with most tap holders.

1.8 Drought Planning and Water Conservation

Having learned the importance of identifying and responding to drought conditions quickly, DDWC has also begun working with the Gunnison Basin Round Table (GBRT) and the Crawford Water Conservancy District (CWCD) to more accurately collect and record spring and system flows (on a monthly basis) and advise on supplemental and/or backup water resources that DDWC might employ to help mitigate drought impacts.

2 Stakeholders, Objectives, and Principles

2.1 Drought Planning Committee

Stakeholders listed on Table 4, below, are responsible for the plan's development, implementation, and oversight to be carried out by DDWC's President.

Table 4: DDWC's Drought Planning Committee.

1)	Austin Hobbs	President overseeing operations.
2)	Lori Hobbs	Manager overseeing customer relations.
3)	Teryl Stacey	Engineer overseeing technical & design issues.
4)	Benny Archuleta	Operator in Charge overseeing water quality issues.
5)	Kermit Pipher	Maintenance Manager.
6)	Tim Cook	Future manager in training.

2.2 Government Stakeholders

DDWC's position in the Gunnison Basin makes it a significant and integral part of the management processes for the following government agencies.

USBR: The U.S. Bureau of Reclamation manages Smith Fork Project and the nearby Crawford Reservoir as integral with operations of its Upper Colorado River Basin operations.

CWCB: The Gunnison Basin Implementation Plan is published by the Colorado Water Conservation Board [4].

GBIP: The Gunnison Basin Implementation Plan is a section of the Colorado Water Plan published by the Colorado Water Conservation Board [3].

GBRT: The Gunnison Basin Round Table facilitates discussion and locally-driven solutions to water management concerns in the basin and plays a larger contributing role toward review and updates of the Gunnison Basin Implementation Plan.

2.3 Drought Definition

DDWC's proposed tiered response plans will correspond with published drought classification categories. Web resources that publish real-time updates will be routinely monitored for changes in the local conditions which may necessitate implementing or reducing a corresponding response stage. Multiple resources will be tracked, but emphasis will be placed on those that demonstrate the most correlation with supply impacts.

Table 5: Drought and wetness classifications and color scheme common to most drought monitoring resources shown with DDWC's corresponding response stages [6].

Category	Classification	Response Stage	Percentile Range
D4	Exceptionally Dry	Critical	0 to 2
D3	Extremely Dry	Emergency	2 to 5
D2	Severely Dry	Warning	5 to 10
D1	Moderately Dry	Watch	10 to 20
D0	Abnormally Dry	Advisory	20 to 30
	Neutral		30 to 70
W0	Abnormally Wet		70 to 80
W1	Moderately Wet		80 to 90
W2	Severely Wet		90 to 95
W3	Extremely Wet		95 to 98
W4	Exceptionally Wet		98 to 100

2.4 Objectives of the Drought Management Plan

DDWC's primary objective for the Drought Management Plan is to provide a proactive response strategy to ensure adequate supply remains available to meet critical needs. It's approach relies on the importance of identifying and declaring drought conditions as soon as possible so that conservation and mitigation measures will be effective in ensuring essential water supply needs are met.

Drought Plan Objectives:

- Assess and understand how past droughts impacted operations.
- Evaluate conservation and water efficiency issues to determine how best to mitigate drought impacts while providing operational benefits.
- Establish a tiered response plan corresponding to published drought severity levels.
- Reduce waste, excess, and non-essential uses.
- Find and repair distribution system leaks.
- Closely monitor drought conditions and spring flows.
- Install strategically placed storage to capture off-peak spillage to help meet on-peak demand.
- Investigate supplemental and backup water supply resources.

Water use priorities:

- Work with Tap Holders to establish water use priorities.
- Health and Safety.
- Emergency services such as fire protection.
- Indoor residential needs.
- Indoor commercial needs.
- Livestock watering.

3 Historic Drought and Impact Assessment

3.1 Water Provider

DDWC estimated twenty to forty percent reduction in spring flows during historic droughts. As a consequence, it experienced insufficient spring flow to meet customer summer demands and strained

relationships when it had to ask tap holders to reduce or curtail outdoor uses. Table 2 outlined water demands during previous droughts and Table 3 added a five-year forecast. These looked at per-capita water demands (GPCD), demands by customer type, and indoor and outdoor water uses.

3.2 Community and Societal

During the 2000-2004 drought period, DDWC was serving less than 20 households and had excess groundwater supply available to easily meet demand. Figure 5, below, illustrates the drought severity from 2002 to 2005. Extreme (D3) and drought exceptional (D4) persisted for eighteen months during this period [5].

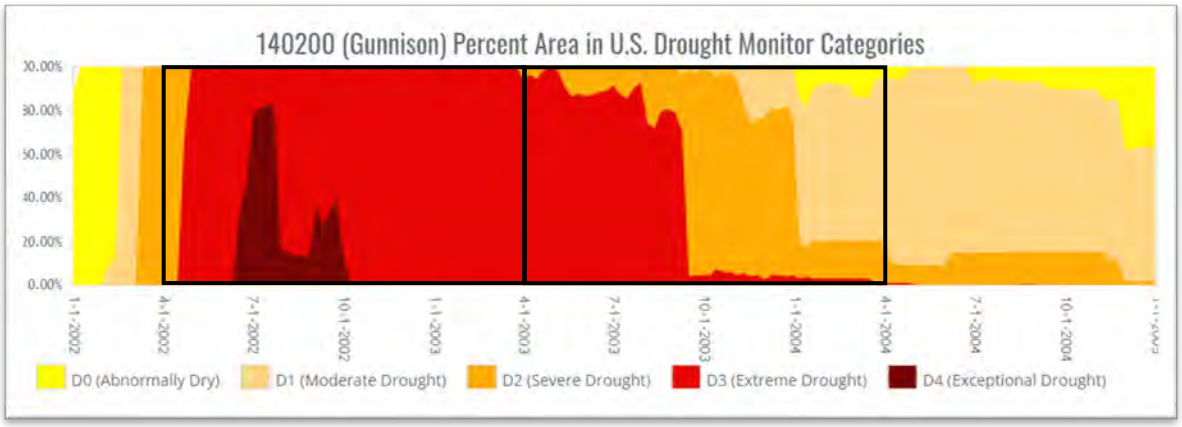

Figure 5: Drought ratings from 2002 to 2005 in the Gunnison watershed [3]. The year from April 2002 to April 2003 had: ***D2 = 6%, D3 = 82%, and D4 = 12%****. April 2003 to April 2004 had:* ***D0 = 3%, D1 = 21%, D2 = 35%, and D3 = 41%****.*

During the 2012 to 2014 drought period, DDWC had expanded to several more than 60 households and had installed some storage but still had to limit non-essential uses (irrigation and watering lawns) and employ rotating service interruptions. Figure 6, below, illustrates the drought severity trends during that period.

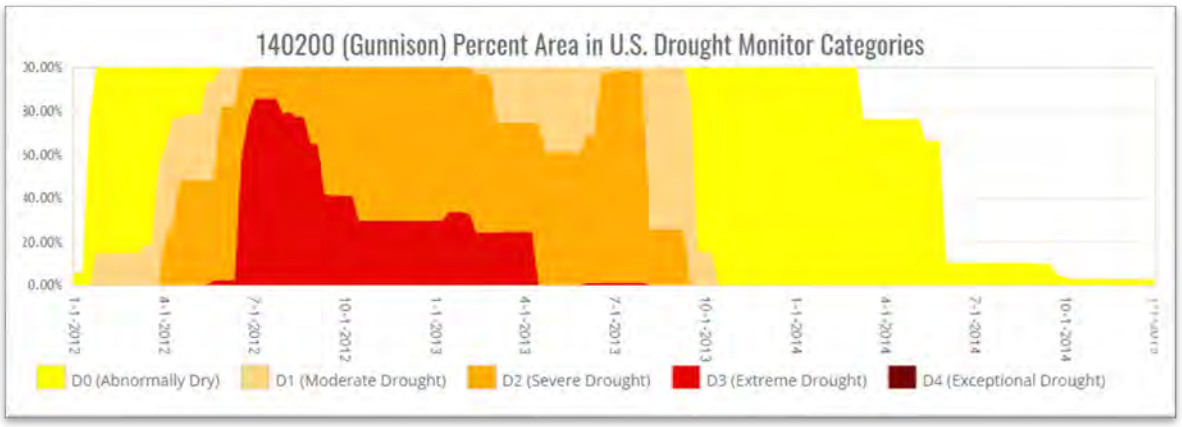

Figure 6: Drought ratings from 2012 to 2014 in the Gunnison watershed [5].

During the 2018 drought period, DDWC had expanded to serve about 70 households and was unprepared, did not have enough spring flow to meet demand and had to resort to severe water use curtailments and

rotating outages. Figure 7, below, illustrates the drought severity trends druing this period [5]. Calendar year 2018 was predominantly an extreme (D3) drought or higher in the Gunnison Basin watershed.

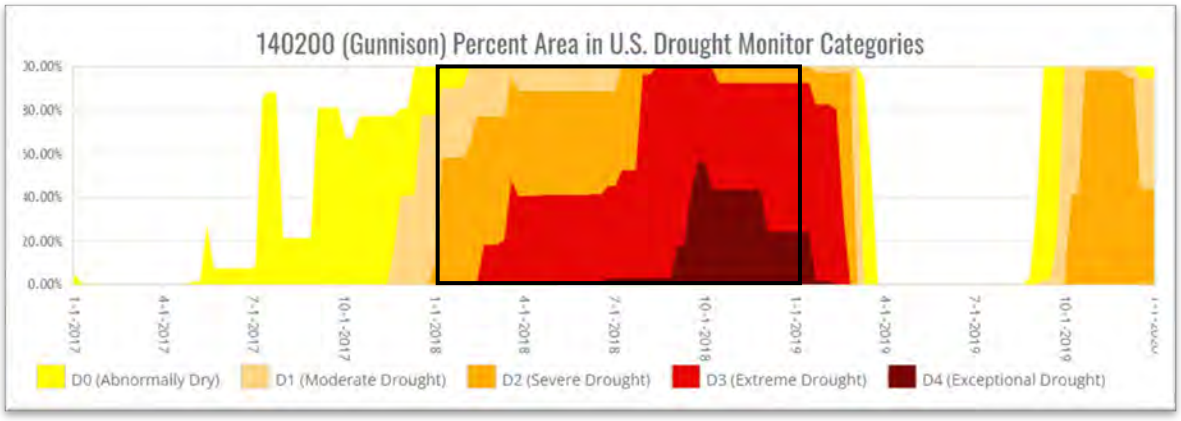

Figure 7: Drought ratings from 2017 to 2019 in the Gunnison watershed [5]. Weighted averages from calendar year 2018 on the image are: ***D0 = 1%, D1 = 10%, D2 = 31%, D3 = 46%, and D4 = 13%****.*

During the 2021 drought period, DDWC was better prepared, but still had to resort to curtailing outdoor water uses during summer months. Figure 8, below, illustrates the drought severity trends during this period. Sustained exceptional drought conditions spanned from October 2020 to August 2021. The drought year spanning September 2020 to September 2021 was predominantly an extreme (D3) drought or higher in the Gunnison Basin watershed.

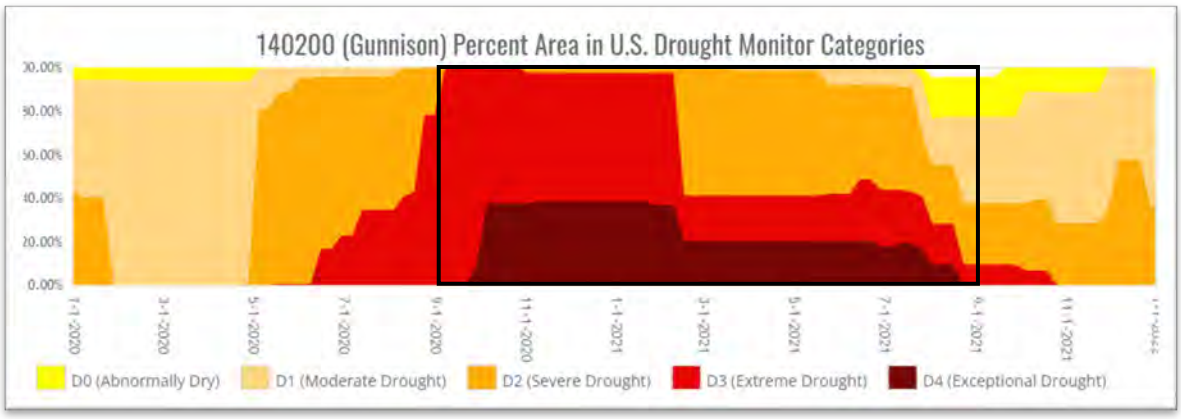

Figure 8: Drought ratings from 2020 to 2022 in the Gunnison watershed [5]. Weighted averages from September 2020 to September 2021 on the image are approximately ***D0 = 2%, D1 = 5%, D2 = 28%, D3 = 42%, and D4 = 24%. Less than 1% was no-drought****.*

3.3 Economic

Short-term impacts were reduced water supply and associated revenues, increased operating costs, and interruption of service to tap holders. Long-term impacts have been the inability to meet anticipated load growth.

3.4 Drought Vulnerability Assessment

3.4.1 Water Supply Reliability and Drought Management Planning

The DDWC's water system meets high adequacy, stability, and reliability standards from the implementation of the attached approved augmentation plan to expand our ability to serve 150 residents that included the purchase of senior water rights and other measures to assure adequate water supply during drought periods.

DDWC believes strategically placed storage, that makes use off-peak spillage to help meet on-peak demand, would significantly improve water system efficiencies, and use in coordination with water conservation measures to mitigate drought impacts. The GBRT concurs and has provided DDWC a letter of support for inclusion with its CWCB and USBR Storage Project grand applications.

The 1978 Water Rights Decree, Case #W3056. Established 0.09 cfs collection from Saddle Mountain Seepage area and Saddle Mountain Ranch Seep Ditch, Division Structure #K-25. Collected via a spring box and 4" diameter by 300-foot PVC pipe to a 1,600-gallon storage tank. Sent to distribution via 3" pipe [17].

The 2011 Water Rights Decree, Case #10CW19. Initially calculated a depletion of 25.730 ac-ft/yr, 3.462 of which are incurred during the non-irrigation season. The Young Ditch summer dry-up agreement provides 33.480 ac-ft/yr of augmentation credits. The non-irrigation season volume is contracted with Bureau of Rec to release from the Blue Mesa Reservoir [18].

The 2018 Water Rights Decree, Case #2017CW3005. This decree allocated more of the Young Ditch dry up to increase the authorized service from 100 to 150 homes. The recalculated requirements were based on meeting the anticipated population growth with new empirical demand data. The new demand of 65.327 acre-feet/yr translates to a subsequent depletion of 33.741 to augment. The Young Ditch's summer dry-up agreement provides 31.479 ac-ft/yr with the remaining deficit of 2.262 ac-ft/yr contracted with Bureau of Rec to release from the Blue Mesa Reservoir [19].

3.5 Drought Impact Assessment and Climate Change

DDWC's water resource is affected by available recharge water from the West Elk Mountains runoff. It has demonstrated shortages in the same years as shortages in local surface waters (see Figure 10 and Figure 11). This suggests short retention times in the seep, and significant influence from climate factors. The published drought classifications used by this drought management plan are based on historic, local statistics. An outlook that includes climate change assumes higher drought frequency and duration for years to come.

4 Supply-Side Mitigation and Response Strategies

4.1 Water Supply Augmentation

4.1.1 Establish drought reserves.

DDWC presently uses four ten-thousand-gallon storage tanks (40,000 gallons) for its lower system and one ten-thousand-gallon storage tank (10,000 gallons) for its upper system which are typically kept full except during peak demand periods.

4.1.2 Draw from drought reserves.

The existing storage provides a temporary buffer during dry conditions. DDWC is planning an increase to its holding capacity with the installation of new strategically placed storage tanks.

4.1.3 Develop supplemental groundwater/conjunctive use.
DDWC will reach out to the Town of Crawford to as to the availability of supplemental water supply during drought conditions.

4.1.4 Build new facilities to enhance the diversion.
DDWC is currently using less than 30% of the flow from the Saddle Mountain Seep and less than 70% of its decreed allocation. It would be feasible to enhance the existing diversion structure's collection capacity or to construct a functional second structure. DDWC believes such an enhancement is permissible under its existing augmentation plan provided all excess diversion is returned to the Saddle Mountain Seep Ditch.

4.1.5 Installing strategically placed storage.
DDWC has applied for CWCB and USBR Water Plan Grants for conducting a facility study, with engineering design, for the placement of about 120,000 gallons or more of strategically placed storage to improve operational efficiencies, help mitigate drought impacts, and help meet anticipated load growth. The GBRT concurs and has provided DDWC a letter of support for inclusion with its Storage Project grant applications.

4.1.6 When available, asking Tap Holders to utilize ditch water for irrigation and lawn watering purposes.

4.1.7 Explore feasibility of using a portion of the Young Ditch Dry up as supplemental supply during summer months.
DDWC proposes working with the CWCD and Division 4 Colorado District Court for approvals.

4.2 Water Supply Portfolio and Cooperative Agreements

4.2.1 Increase supply with unused surface water rights.
DDWC has determined that its additional water rights at Young Ditch can be used to supplement the supply during summer months [18,19]. It has submitted grant applications to the CWCB and USBR for the design and construction of additional transport and storage to make use of them. The proposed project would increase DDWC's storage capacity from 60,000 to 300,000 gallons, and it's estimated supply flows from 45 to 150 acre-feet per year. If awarded it is expected to complete in the summer of 2025.

4.2.2 Develop water transfers with other entities.
DDWC is planning to reach out to other nearby water rights holders to explore availability of supplemental water supply during drought conditions.

4.2.3 Irrigation Decrees.
DDWC will be exploring the full use of existing irrigation decrees and may seek supply decrees in extreme circumstances.

4.3 Improve Water Distribution Efficiency

4.3.1 Conduct distribution system water audit.
DDWC is working on a long-term plan to install flow measuring devices and electronic data collection sensors throughout its system. There are also still some unmetered taps and leakage losses that impede accurate and thorough accounting.

4.3.2 Repair leaks in distribution system.
Leak identification and repair is an ongoing priority.

4.3.3 Replace inaccurate meters.
Upgrading to automatic read meters would provide real-time system feedback. This could allow detection and warning to tap holders of suspected leaks. Accurate water metering would also lend itself to better water audits.

4.3.4 Install meters at key distribution points to isolate areas of overuse and probable leakage.
Intermediate flow meters are a high-priority step because of present difficulty locating damaged lines especially during winter conditions.

4.3.5 Minimize reservoir spills.
Focus on eliminating storage tank leakage and spillage. Install electronic water level devices to provide real-time tank volume information and automating control systems.

4.3.6 Change operations to optimize efficiency and distribution of supplies.
Long term improvement goals such as intermediate main line meters, replacing customer meters, electronic system tracking, and a website are significant opportunities for system optimization.

4.3.7 Change pattern of water storage and release operations to optimize efficiency.
DDWC plans to add strategically placed storage which would be filled from off-peak spillage to help meet on-peak demands.

4.3.8 Enhance efficiency of water treatment facilities.
Explore the possibility of electronic water quality devices. Develop a manual testing plan for quality assurance and calibration.

4.3.9 Install groundwater monitoring wells.
DDWC proposes working with CWCB, GBRT, and CWCD to install one or more monitoring wells in the Saddle Mountain Seep area to collect data that could be used by local planning organizations. The data could be combined with the collection point's water level to estimate groundwater flow rate and water surface drawdown in the seep. This would provide a better understanding of how quickly changes in the Smith Fork tributary streamflow translate to changes in the supply flows.

4.4 Emergency Response

4.4.1 Declare a drought/water shortage and appropriate stage.
Drought monitoring resources documented in this report will be checked at least monthly, and more frequently by its President when conditions worsen. Local current and forecasted conditions will be published equally as frequently on the DDWC website. Other public notice methods such as bill inserts and public flyers will be used to increase awareness.

4.4.2 Limit the sale of additional taps based on available water supply.
DDWC has capped the sale of additional taps as long as seasonal average demand exceeds its available seasonal average supply or until additional storage has been installed.

4.4.3 Identify state and federal assistance.
DDWC will be working with CWCB, GBRT, and CWCD for collaboration and assistance with the design and placement of additional storage. Refer to ¶4.2.1 for details.

4.5 Public Education and Relations

4.5.1 Establish a public advisory committee.
Reach out to Tap Holders and ask their communications preferences. Develop flyers and bill insert templates that can be quickly updated and printed.

4.5.2 Implement drought public education campaign with long- and short-term strategies.
DDWC's current long-term strategy is getting the website up and running to provide drought management and forecasting information and setting up customer billing accounts.

5 Demand-Side Mitigation and Response Strategies

5.1 Provider

5.1.1 Develop drought public education campaign with long-term and short-term demand management strategies.
DDWC's President shall direct the publishing of the drought mitigation plan on the DDWC website and send notices as billing inserts. Include a current and forecast status of the drought index in the Gunnison Basin watershed. Include a color-coded warning on the website's splash page during drought conditions. Include a similar, color-coded warning in bill inserts.

5.1.2 Identify high water use tap holders and develop water saving targets.

5.1.3 Implement conservation measures that also provide water saving benefits during drought periods (e.g., water fixture rebates).
Offer reasonable water fixture rebates during less severe drought stages to incentivize tap holders to install low flow fixtures.

5.1.4 Moratorium on the issuance of new taps until additional storage installed.

5.1.5 Consider the implementation of modified rate structure for drought periods.
DDWC to recover additional costs associated with mitigating drought impacts through increased rates during drought periods.

5.1.6 Conduct irrigation audits.

5.1.7 Recommend water saving measures to Tap Holders.

5.1.8 Consider limiting outdoor watering to specific times of the day.
Limit watering to nighttime (sunset to sunrise) to minimize evaporation.

5.1.9 Consider limiting number of watering days per week.

5.1.10 Set time limit for watering.

5.1.11 Limit watering during fall, winter, and early spring.

5.1.12 Converting sprinklers to low volume irrigation where appropriate.
Subsidize the installation of drip, bubbler, and stake-type irrigation heads.

5.2 Residential.

5.2.1 Encourage landscape watering restrictions.

5.2.2 Limit outdoor watering to specific times of the day.
Limit watering to nighttime (sunset to sunrise) to minimize evaporation.

5.2.3 Limit number of watering days per week.

5.2.4 Set time limit for watering.

5.2.5 Prohibit watering during fall, winter, and early spring.

5.2.6 Promote outdoor water audits.

5.2.7 Convert sprinklers to low volume irrigation where appropriate.
Subsidize the installation of drip, bubbler, and stake-type irrigation heads.

5.2.8 Limiting the filling and use of swimming pools.

5.2.9 Promote indoor water restrictions.

5.2.10 Promote indoor water audits.
Increasing a tap holder knowledge about their own water use may encourage them to take their own voluntary steps toward conservation.

5.2.11 Promote/require installation of water efficient appliances (e.g., dishwashers, clothes washer).
Offer rebates toward purchase and installation.

5.2.12 Promote water efficient fixtures and/or appliances on house resale or remodeling.

5.2.13 Provide historical monthly water usage on water bills.
Historic usage and billing chart added printed on customers' bill and made available on their website accounts.

5.3 Commercial and Industrial.

5.3.1 Promote outdoor landscape watering restrictions.

5.3.2 Promote indoor and outdoor water audits where applicable.

5.3.3 Promote installation of water efficient fixtures and appliances.

6 Public Campaign Strategies

6.1 Drought information to convey to the public.

6.1.1 Drought awareness: Status of current drought conditions, drought stage, and associated water restrictions.
DDWC's President or Manager will update its tap holders of the current, local drought index and corresponding response measures.

6.1.2 Where tap holders may access drought management plan.
DDWC's Manager will maintain a website where the plan as well as current conditions can be accessed.

6.1.3 Measures and/or impacts customers can expect if drought continues or intensifies.
DDWC's President and Engineer will also be implementing a Water Storage and Efficiency Plan that makes use of as much off-peak spillage as possible to fill strategically placed storage to help meet on-peak demands and used in coordination with water conservation measures to mitigate drought impacts. DDWC has made application with the CWCB and USBR for Water Storage and Efficiency Grants for the design and placement of strategically placed storage. The GBRT has provided a letter of support for inclusion with DDWC's applications.

6.1.4 Compliance with drought policies.
Tap Holders will be sent a written notice of suspected non-compliance and be asked to correct.

6.1.5 Explanation of potential rate increases/drought surcharges.
Monthly water bill inserts and the DDWC website may include tables and explanations of applicable modified rate structures and surcharges

6.1.6 Water savings tips.
The DDWC website will provide a list of water savings recommendation. Single-statement tips can be added to monthly bill notices.

6.1.7 Landscaping tips during a drought (e.g., which plants to convert to drip, which to save, which to let die).
Desert landscaping "xeriscape" is recommended for best performance in low watering conditions. Colorado State University provides a quick reference guide for such plants that do well in the state. Desert landscape tips can be printed on monthly billing statements.

6.1.8 Provide customers with a drought report card at the end of the year showing monthly/annual water use pre-drought and during the drought.
Monthly bill notices may include a graph of the past year's use. Drought reduction goals will be highlighted.

6.2 Communications Plan

DDWC's Manager is responsible for developing and using the company's website and monthly bill inserts to relay routine, drought-related communications, and updates. Specific notices such as leak concerns, warnings, or violations will be sent as a letter to tap holders.

DDWC's President, Manager and Engineer will also participate in educational outreach activities about the need for water efficiency and conservation planning. DDWC's goal is to reduce per-capita residential water demands, waste, excess, and non-essential uses during droughts. DDWC will determine where improvements may be made to its drought public information campaign and/or develop new strategies.

7 Monitoring Framework

7.1 Climatic and Hydrologic Data

DDWC's Engineer is responsible for monitoring and updating climate and hydrologic data. Notifications about drought condition changes will be given DDWC's Manager for further action in accordance with the Communications Plan.

DDWC's water is from a groundwater source. However, it has historically demonstrated some responsiveness to precipitation and evapotranspiration patterns. Changes at the collection point seem to lag behind Smith Fork flows by thirty to sixty days. Hydrologic factors in other local water bodies can also be correlated similarly. These can help illustrate the effects of past droughts and how to plan for future ones.

7.1.1 Streamflow

Surface streamflow seven-day average trends can be monitored, but with a caveat that the nearest gauge, #09136100 "North Fork Gunnison River," is on an adjacent tributary, located fifteen miles away near Lazear, Colorado. The information is only capable of demonstrating correlation because of proximal conditions, but not causation. That said, drought years 2012, 2018, and 2021 are visible on Figure 9, below. Figure 9, shows a closeup of the most recent [16].

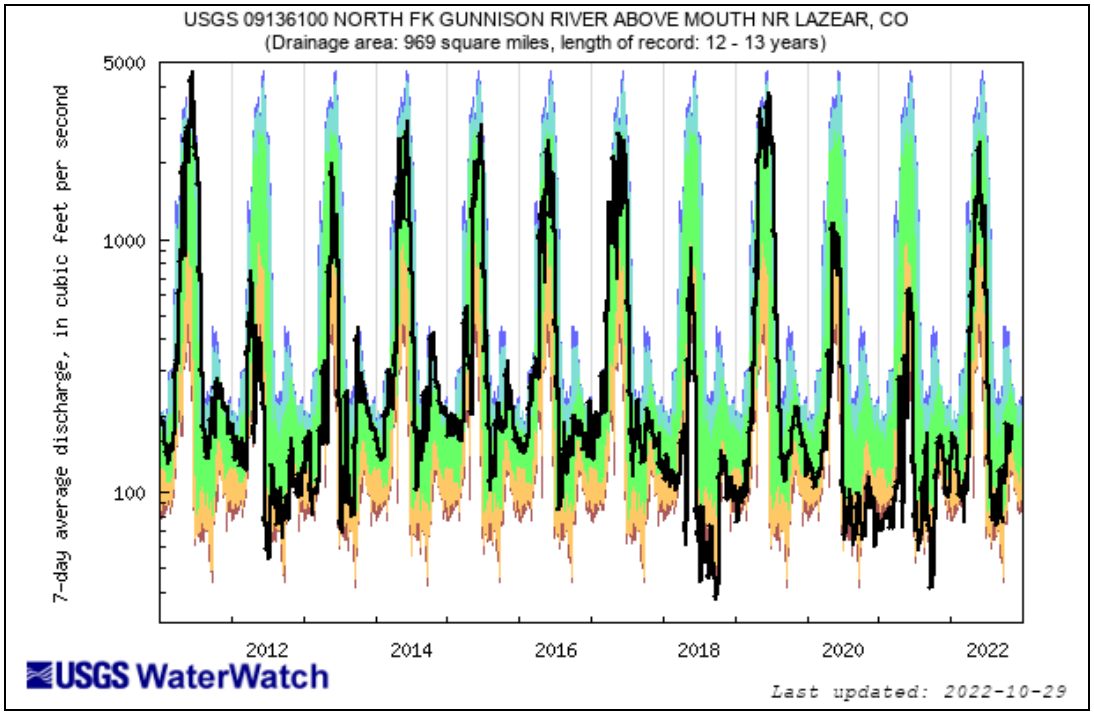

Figure 9: Streamflow seven-day averages measurements at gauge #09136100 "North Fork Gunnison River. It is on an adjacent tributary to Smith Fork where the DDWC Spring Box is located [14].

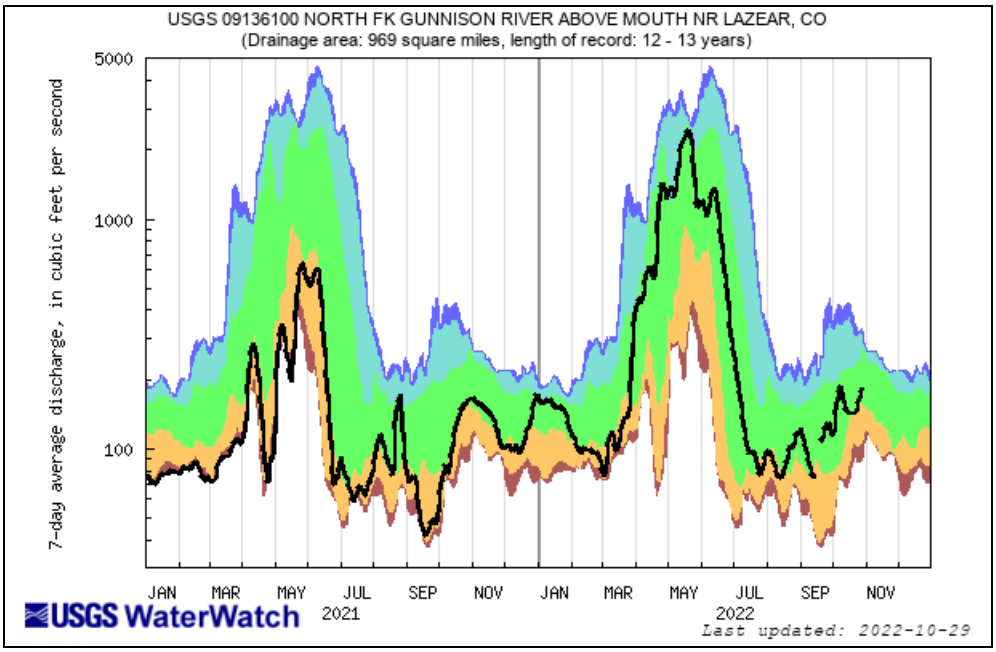

Figure 10: A close up of recent streamflow seven-day averages at gauge #09136100 North Fork Gunnison River [16].

7.1.2 Reservoir Levels

Supplied from the same tributary, at two miles away, the Crawford Reservoir station is well positioned for monitoring local conditions. Surface reservoir storage data should be tracked with the understanding the information only demonstrates correlation. Figure 11, below, illustrates the reservoir's storage volume over time. The impacts of drought years 2012, 2018, and 2021 are clearly visible on this graph.

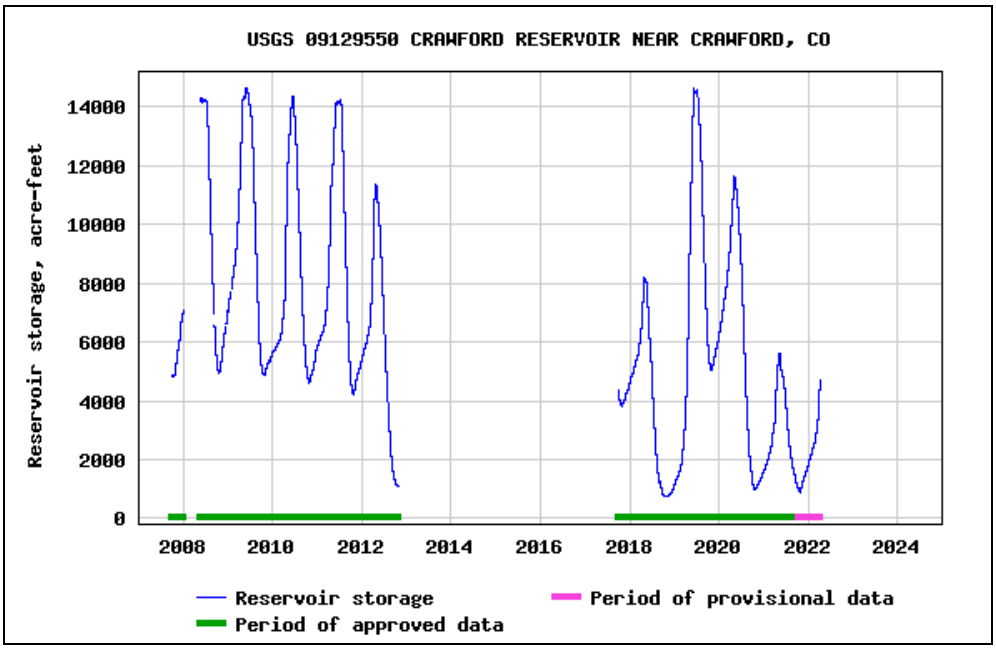

Figure 11: Storage volume measurements in Crawford Reservoir [14].

7.1.3 Precipitation Records

Drought classifications are based on comparing a present condition to statistical percentiles of its history. Figure 12, below, shows the current water year's snow-water adjusted precipitation for the Gunnison Basin. The trend is superimposed on the drought or wetness classifications' percentile ranges.

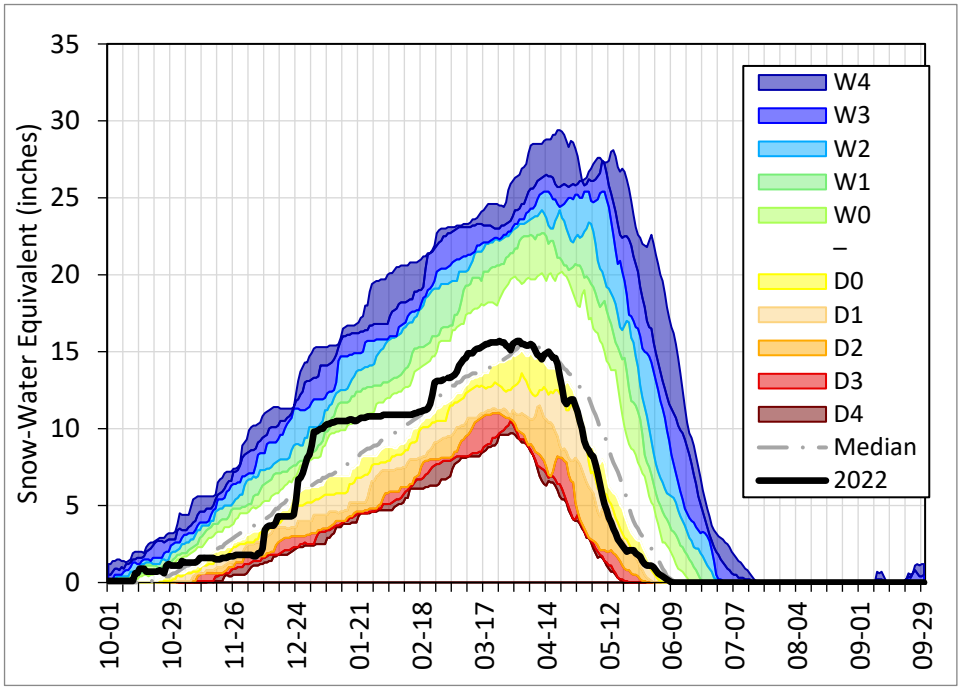

Figure 12: Snow water equivalent precipitation chart for the current water year, superimposed on percentile ranges matching the drought and wetness classifications [9].

Presently, there are seventeen NCRS precipitation measurement stations in the Gunnison Basin watershed. Eleven of them are Snotel-network devices capable of providing snow-adjusted precipitation measurements. These stations can be checked for specific precipitation information. Additionally, some of the indices already tracked in this drought plan also rely on data from these stations. Table 6Figure 13, below, list collection stations and their general information. The closest station to the DDWC Spring Box is #1609 "Cimarron" located about 13.5 miles southeast.

Table 6: Precipitation stations in the Gunnison watershed and their associated metadata [8].

ID	Station Name	County Name	Network	Latitude	Longitude	Elevation	HUC12 (12-digit)
1141	Upper Taylor	Gunnison	SNOTEL	38.99007	-106.74502	10640	140200010101
1188	Wager Gulch	Hinsdale	SNOTEL	37.88248	-107.36430	11100	140200020602
1609	Cimarron	Gunnison	COOPERATOR PRECIP GAUGES	38.55000	-107.45000	6900	140200021004
1713	Cochetopa Creek	Gunnison	COOPERATOR PRECIP GAUGES	38.43333	-106.76666	8000	140200030509
1959	Crested Butte	Gunnison	COOPERATOR PRECIP GAUGES	38.86666	-106.96666	8860	140200010206
3662	Gunnison 1 N	Gunnison	COOPERATOR PRECIP GAUGES	38.55000	-106.91666	7680	140200030605
380	Butte	Gunnison	SNOTEL	38.89433	-106.95300	10160	140200010206
409	Columbine Pass	Montrose	SNOTEL	38.41795	-108.38249	9400	140200050202
538	Idarado	Ouray	SNOTEL	37.93390	-107.67552	9800	140200060201
618	Mc Clure Pass	Gunnison	SNOTEL	39.12897	-107.28806	8760	140200040203
675	Overland Res.	Delta	SNOTEL	39.09056	-107.63472	9840	140200040101
680	Park Cone	Gunnison	SNOTEL	38.81996	-106.58974	9600	140200010107
682	Park Reservoir	Delta	SNOTEL	39.04644	-107.87414	9960	140200050111
701	Porphyry Creek	Gunnison	SNOTEL	38.48884	-106.33965	10760	140200030105
7460	Sargents	Saguache	COOPERATOR PRECIP GAUGES	38.40000	-106.41666	8470	140200030105
762	Slumgullion	Hinsdale	SNOTEL	37.99080	-107.20327	11560	140200020502
8184	Taylor Park	Gunnison	COOPERATOR PRECIP GAUGES	38.81666	-106.61666	9200	140200010113

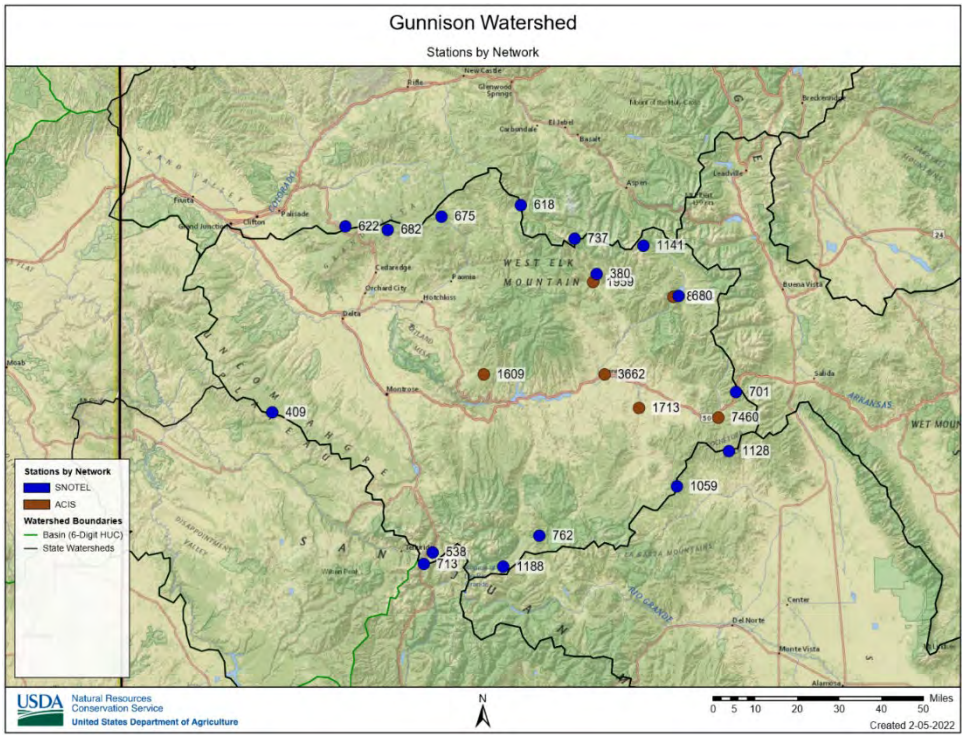

Figure 13: Map of the Gunnison watershed and its precipitation tracking stations [8].

Figure 14, below, shows the precipitation-based percentile ranking and corresponding drought classification readings at the monitoring stations shown.

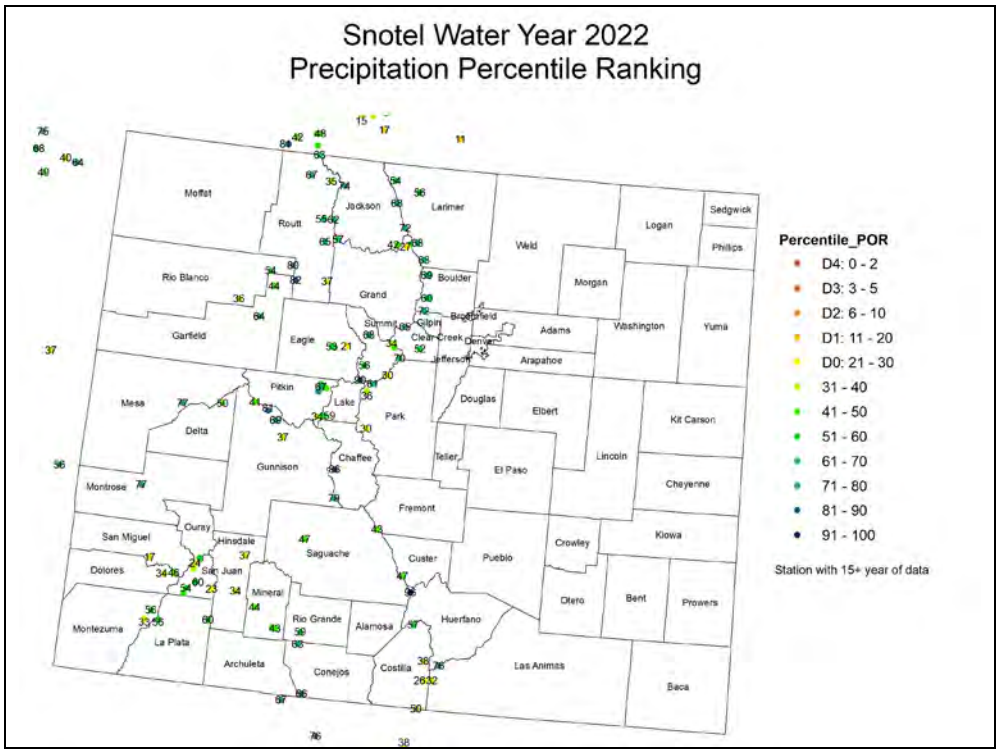

Figure 14: Precipitation records listed as drought classifications [1].

7.1.4 Snowpack

Figure 15, below, shows the snowpack-based percentile ranking and corresponding drought classification readings at the monitoring stations shown.

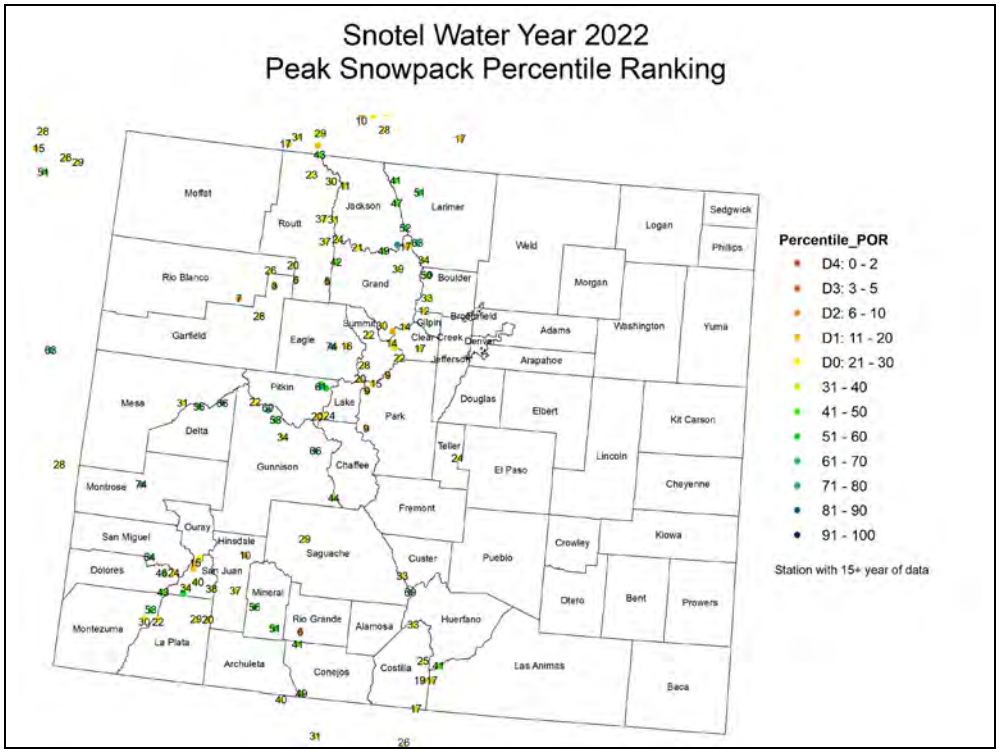

Figure 15: Drought classifications based on snow pack [1].

7.1.5 Groundwater Levels

There are no published groundwater monitoring stations in the area around the Smith Fork or its adjacent tributaries. There are some downstream, around the town of Delta, near the Gunnison River. Aside from being distant from the DDWC Spring Box, this chart also demonstrates no obvious response to recent drought years. DDWC may propose installation of its own monitoring well and/or working with the CWCD to install monitor wells for shared use.

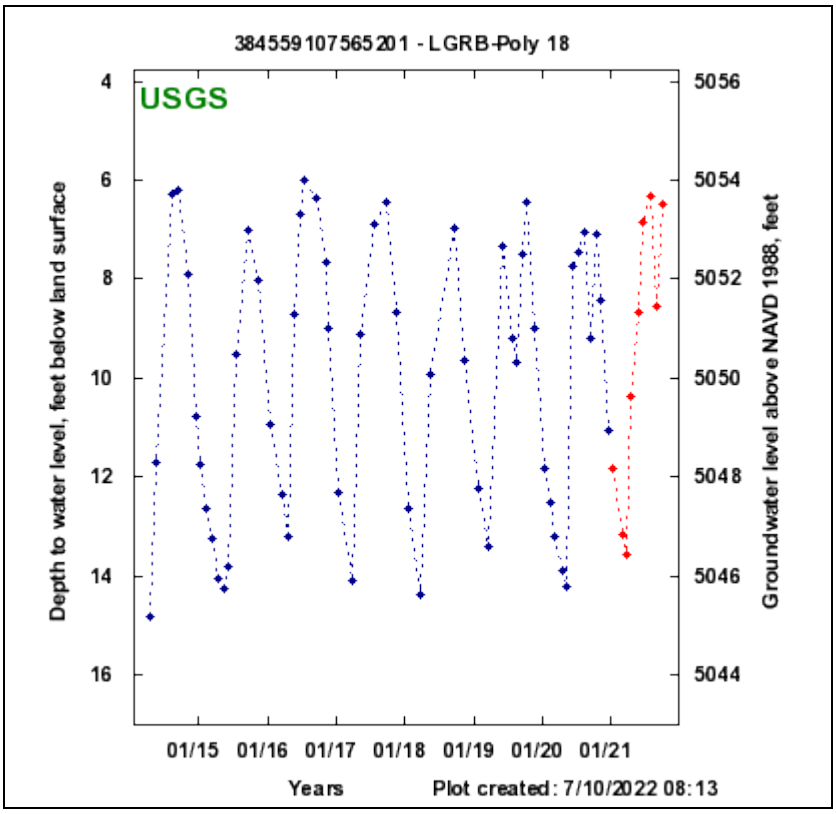

Figure 16: Groundwater surface elevation measurements at station #384240108000701, south of Orchard City [15].

7.1.6 Temperature

Temperature and temperature anomaly readings from the NOAA Climate Prediction Center are shown on Figure 17, below. Anomaly values measure departure from the historic average.

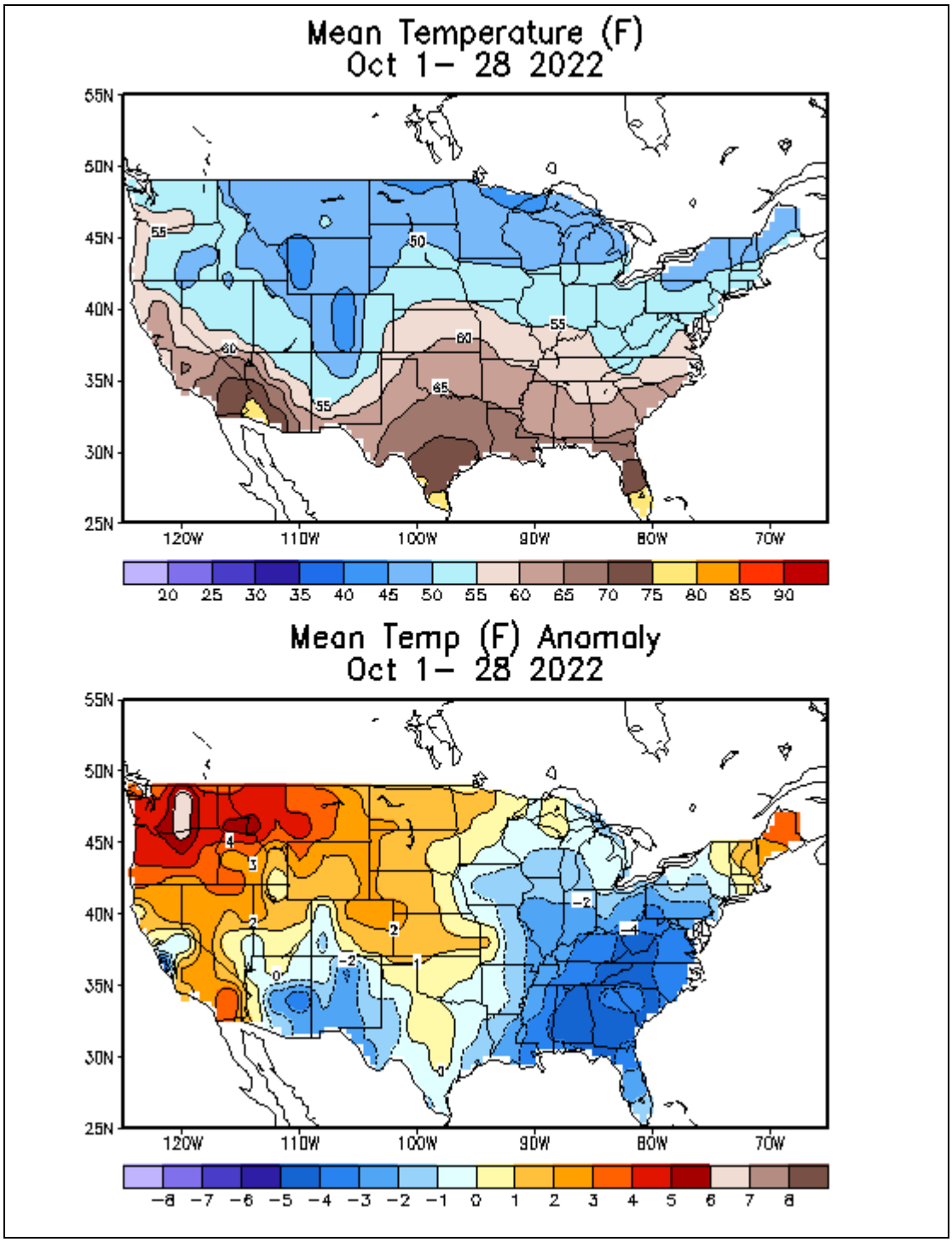

Figure 17: Current month-to-date temperature mean and mean anomaly [7].

7.2 Drought-Related Indices

Drought indices will be used as the drought stage triggers. The U.S. Drought Monitor's (USDM) published conditions for the State of Colorado will be the primary trigger factor for response stages in this management plan. Other indices will also be monitored to help forecast drought persistence and changes.

DDWC reserves the right to modify its drought response tier based on the other information if deemed necessary.

7.2.1 U.S. Drought Monitor

The USDM website publishes weekly updates on current drought conditions as well as monthly and seasonal forecasts. Figure 18, below, shows a heat map of current conditions across the state of Colorado.

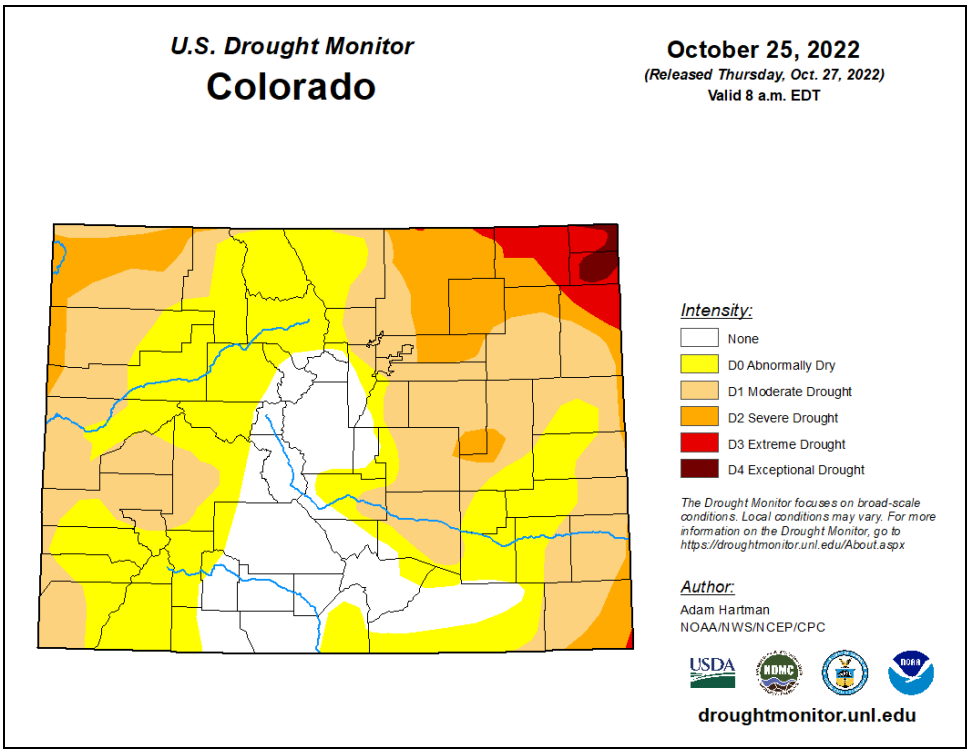

Figure 18: U.S. Drought Monitor map of current conditions in the state of Colorado [5].

7.2.2 Standard Precipitation Index (SPI)

Long time scales, typically one or two years, are recommended for SPI monitoring for water supply systems. The maps on Figure 19 and Figure 20, below, show classification data published for each monitoring station. The published data is updated weekly.

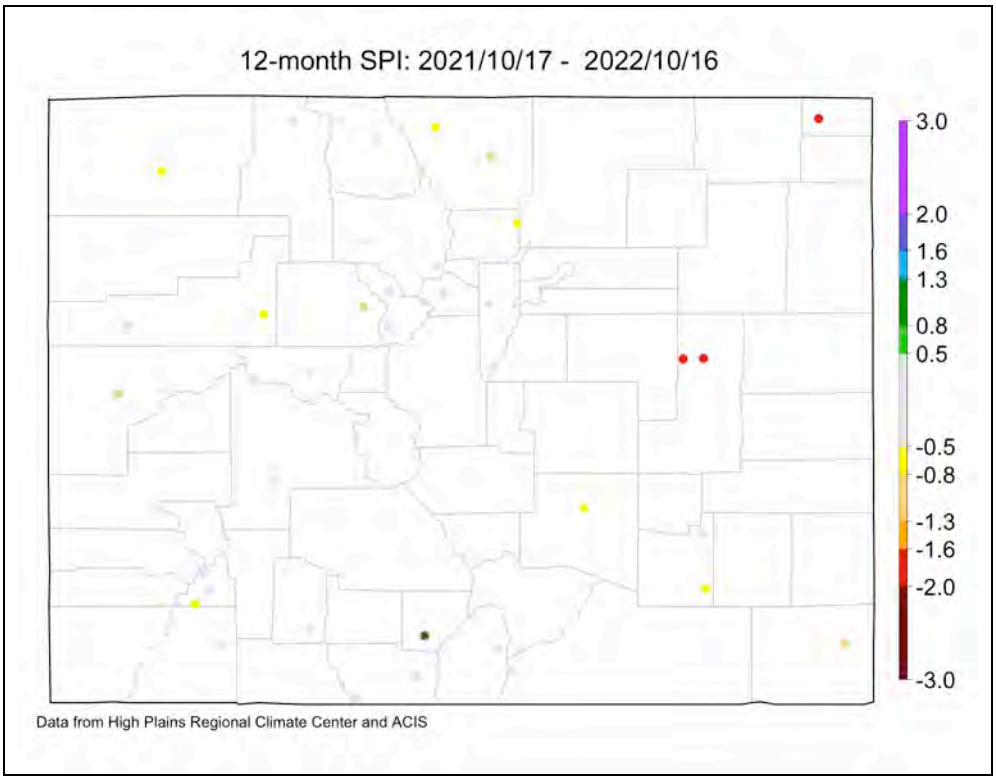

Figure 19: Twelve-month SPI at Colorado weather stations [1].

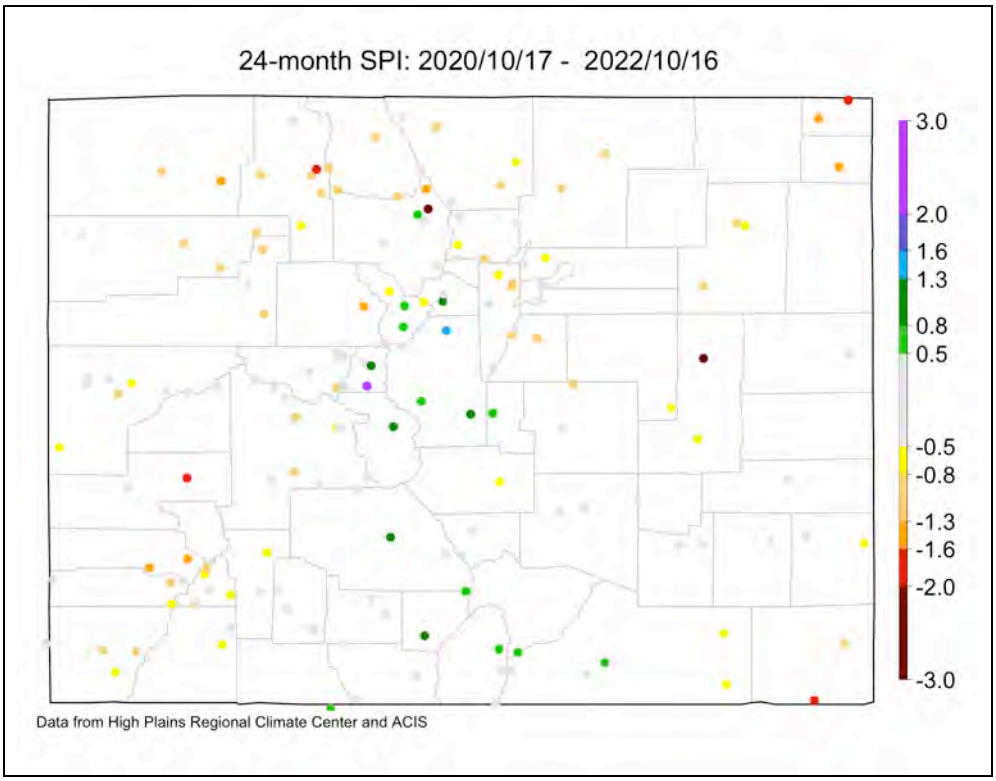

Figure 20: Twenty-four-month SPI at Colorado weather stations [1].

7.2.3 Evaporative Demand Drought Index (EDDI)

This index tracks evaporative demand instead of than direct precipitation. The map is updated daily, but there is a five-day lag from measurement to publication. Like SPI, long time scales are more useful to water suppliers when using EDDI to for water supply monitoring. A one-year scale is shown on Figure 21, below.

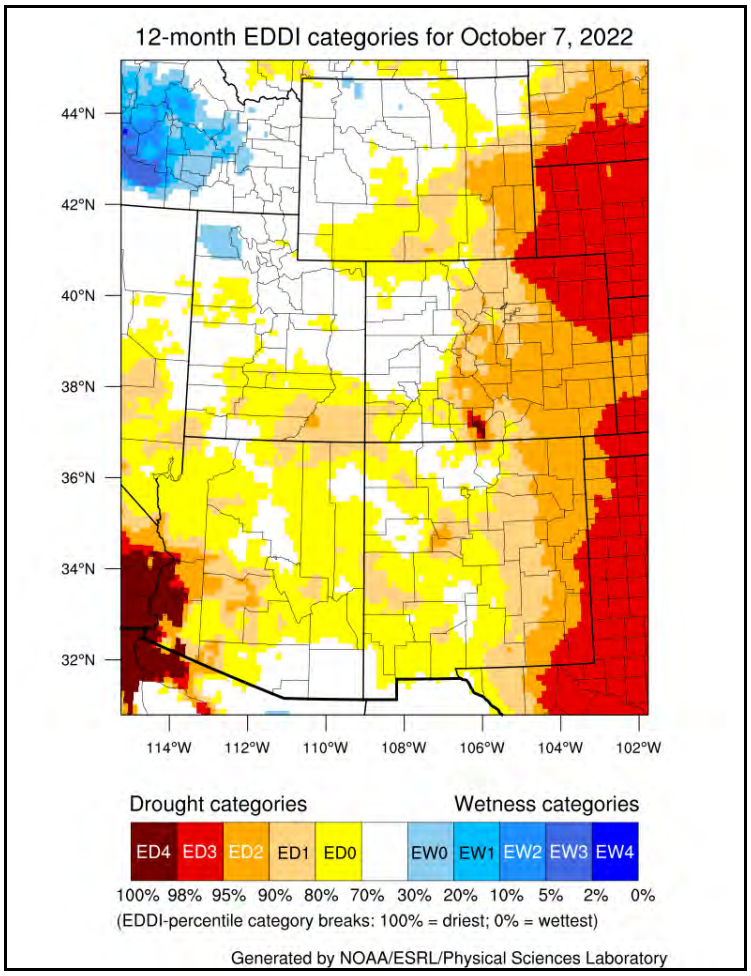

Figure 21: Twelve-month EDDI categories [10].

7.2.4 NOAA Climate Prediction Center Monthly and Seasonal Drought Outlooks

Figure 22 and Figure 23, below, provide one-month and seasonal (three-month) drought forecasts that can be used for future planning.

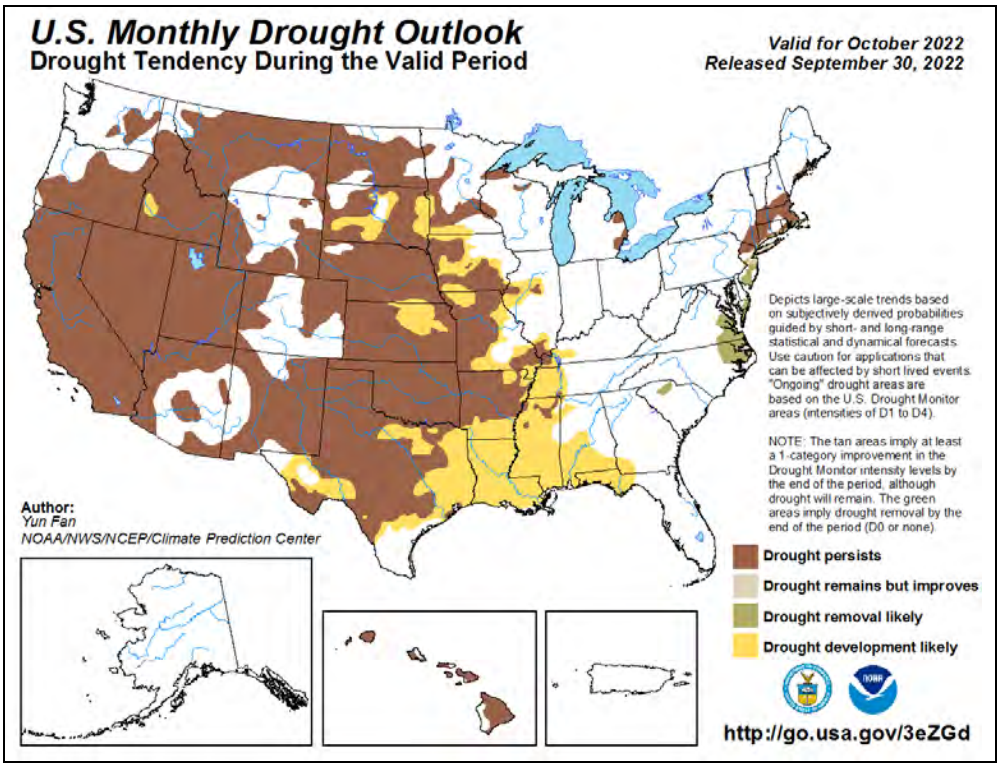

Figure 22: Drought persistence outlook for the coming month [7].

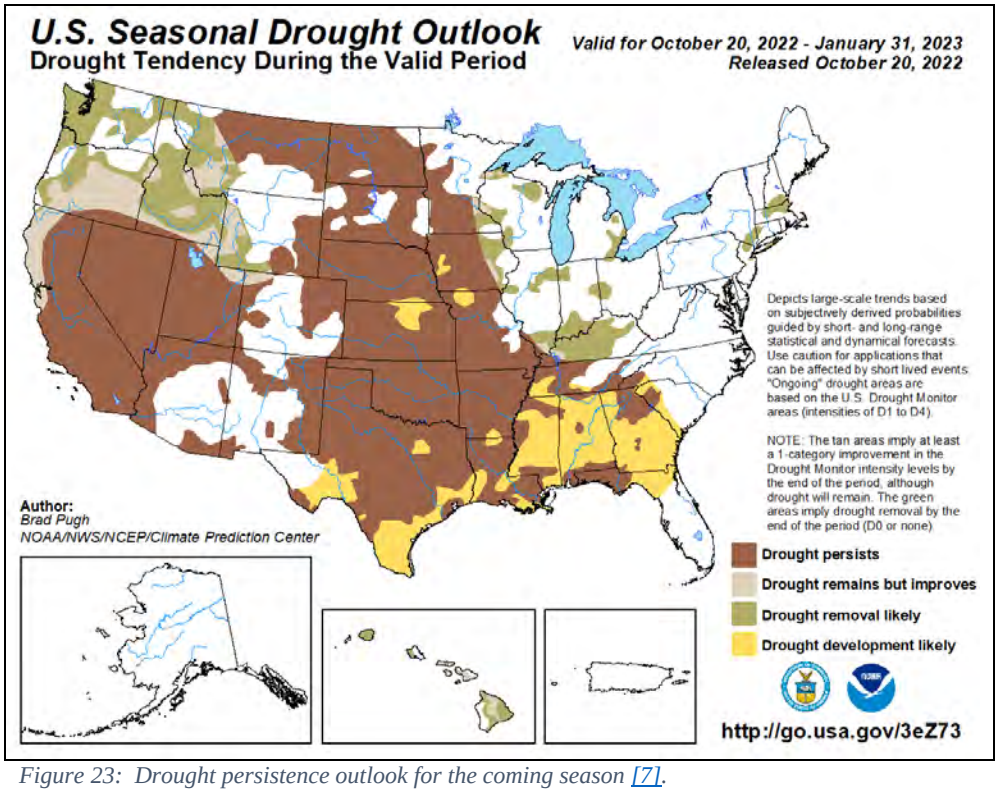

Figure 23: Drought persistence outlook for the coming season [7].

7.3 Resources

7.3.1 U.S. Drought Monitor

The U.S. Drought Monitor provides a maps for current drought status (https://droughtmonitor.unl.edu/) and time series data for history (https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx) [5].

7.3.2 Colorado Water Conservation Board

Colorado's Water Plan details water conservation plans and goals for the state as a whole (https://cwcb.colorado.gov/read-plan) [3].

The Gunnison Basin Implementation Plan details plans and goals specific to the Gunnison Basin (https://cwcb.colorado.gov/colorado-water-plan/basin-implementation-plans) [4].

7.3.3 Colorado Climate Center

The Colorado Climate Center website publishes drought classification updates for precipitation, snowpack, SPI, and EDDI indicators tracked in this document (https://climate.colostate.edu/drought/) [1].

7.3.4 National Resources Conservation Service

NCRS provides access to local precipitation monitoring stations (https://www.nrcs.usda.gov/wps/portal/wcc/home/) [8,9].

7.3.5 National Oceanic and Atmospheric Administration

The NOAA climate prediction center provides month-to-date temperature data (https://www.cpc.ncep.noaa.gov/products/tanal/30day/max_min/20220206.30day.max_min.F.gif) [7].

NOAA drought persistence one- and three-month forecasts (https://www.cpc.ncep.noaa.gov/products/expert_assessment/month_drought.png and https://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.png) [7].

7.3.6 U.S. Geological Survey (USGS)

Resources for streamflow and water quality information at the North Fork station on the Gunnison River (https://waterwatch.usgs.gov/wwapps/wwdur.php?sno=09136100&yr=&ytp=yv&dt=dv07d&nyr=12&xps=none&otp=plot) [12].

Resources for surface elevation and storage volume measurements in the Crawford Reservoir (https://nwis.waterdata.usgs.gov/nwis/uv?cb_00045=on&cb_00054=on&cb_62614=on&format=gif_default&site_no=09129550&period=&begin_date=2007-01-01&end_date=2024-12-31) [14].

Resources for periodic groundwater data in the Gunnison River near Delta, Colorado (https://groundwaterwatch.usgs.gov/AWLSites.asp?mt=g&S=384559107565201&ncd=awl) [15].

8 Drought Stages, Trigger Points, and Response Targets

8.1 Drought Response Stages

DDWC's Engineer will be responsible for monitoring and updating the drought stages, trigger points, and response targets for implementation by its President. Notifications about drought condition changes and response recommendations will be given to DDWC's Manage and President for further action in accordance with the Communications Plan. DDWC will focus on identifying and declaring drought conditions as early as possible so that conservation and mitigation measures will be effective in ensuring essential water supply needs are met.

DDWC's tiered response plans will correspond with published drought classification categories, D0 to D4. The USDM, SPI, and EDDI drought indices will be used to set DDWC's drought condition stages at least monthly. The USDM's published conditions will be the primary trigger source. Other indices will also be monitored to help forecast drought persistence and changes. DDWC reserves the right to modify its drought response tier based on the other information if deemed necessary. Emphasis will be placed on those that demonstrate the most correlation with supply impacts if there are circumstances where sources disagree.

Table 7: Worksheet F - Drought stages, trigger points, and response targets.

Stage	Drought Category	Drought Trigger Point(s)	Response Targets (Water Savings)	Summary of Key Response Actions
None	-	USDM, SPI, EDDI rating.		
Advisory	D0	USDM, SPI, EDDI rating.	0 gpcd	Focus on public awareness.
Watch	D1	USDM, SPI, EDDI rating.	5 gpcd	Focus on voluntary responses.
Warning	D2	USDM, SPI, EDDI rating.	10 gpcd	Focus on planning and preparation.
Extreme	D3	USDM, SPI, EDDI rating.	15 gpcd	Focus on initial, mandatory responses.
Exceptional	D4	USDM, SPI, EDDI rating.	20 gpcd	Focus on supplemental, mandatory responses.

8.2 Long-Term Improvements

The effectiveness of indices, climate factors, and hydrologic data presented herein will be assessed after the plan has been in use for a while. DDWC is planning a series of system improvements to increase long-term efficiency and minimize losses. Among these improvements include main line flow monitoring devices and electronic data collection devices. These will improve DDWC's ability to track its own system's behavior over time. This will enable better comparisons to the aforementioned factors. Upon which time improvements to the drought management approach may be possible.

DDWC also hopes to implement a Water Storage and Efficiency Plan that makes use of as much off-peak spillage as possible to fill strategically placed storage to help meet on-peak demands and used in coordination with water conservation measures to mitigate drought impacts. DDWC has made application with the CWCB and USBR for a Water Storage and Efficiency Grants for the design and placement of strategically placed storage. The GBRT concurs and has provided DDWC a letter of support for inclusion with its Storage project grant applications.

9 Tiered Drought Response Program

DDWC's Drought Management Committee is responsible for managing and overseeing the Tiered Drought Management Plan for implementation by its President and Managers.

9.1 Supply-Side Response Strategies

Table 8: Worksheet G – Supply-side drought response measures based on local drought classification.

Response Strategies	Advisory (D0)	Watch (D1)	Warning (D2)	Emergency (D3)	Critical (D4)	¶
Response Target	Watch	5 GPCD reduction	10 GPCD reduction	15 GPCD reduction	20 GPCD reduction	
Supply-Side Response Strategies						
Water Supply Augmentation						
Establish drought reserves.	X	X	X	X	X	4.1.1
Draw from drought reserves.			X	X	X	4.1.2
Develop supplemental groundwater/conjunctive use.			X	X	X	4.1.3
Build new facilities to enhance the diversion.	X	X	X	X	X	4.1.4
Installing strategically placed storage	X	X	X	X	X	4.1.5
When available, asking Tap Holders to utilize ditch water for irrigation and lawn watering purposes.				X	X	4.1.6
Explore feasibility of using a portion of the Young Ditch Dry up as supplemental supply during summer months.				X	X	4.1.7
Water Supply Portfolio and Cooperative Agreements						
Increase supply with unused surface water rights.	X	X	X	X	X	4.2.1
Develop water transfers with other entities.				X	X	4.2.2
Use irrigation decrees.				X	X	4.2.3
Improve Water Distribution Efficiency						
Conduct distribution system water audit.		X	X	X	X	4.3.1
Repair leaks in distribution system.	X	X	X	X	X	4.3.2
Replace inaccurate meters.	X	X	X	X	X	4.3.3
Install meters at key distribution points to isolate areas of overuse and probable leakage.	X	X	X	X	X	4.3.4
Minimize reservoir spills.	X	X	X	X	X	4.3.5
Change operations to optimize efficiency and distribution of supplies.			X	X	X	4.3.6
Change pattern of water storage and release operations to optimize efficiency.			X	X	X	4.3.7
Enhance efficiency of water treatment facilities.			X	X	X	4.3.8
Install groundwater monitoring wells.	X	X	X	X	X	4.3.9
Emergency Response						
Declare a drought/water shortage and appropriate stage.			X	X	X	4.4.1
Limit the sale of additional taps based on supply available.			X	X	X	4.4.2
Identify state and federal assistance.				X	X	4.4.3
Public Education and Relations						
Establish a public advisory committee.			X	X	X	4.5.1
Implement Drought Public Education Campaign with long- and short-term strategies. (See Worksheet D).	X	X	X	X	X	4.5.2

9.2 Demand-Side Response Strategies

Table 9: Worksheet G – Demand-side drought response measures based on local drought classification.

Response Strategies	Advisory (D0)	Watch (D1)	Warning (D2)	Emergency (D3)	Critical (D4)	¶
Response Target	Watch	5 GPCD reduction	10 GPCD reduction	15 GPCD reduction	20 GPCD reduction	
Demand-Side Response Strategies						
Provider/Municipality						
Develop drought public education campaign with long-term and short-term demand management strategies.	X	X	X	X	X	5.1.1
Identify high water use customers and develop water saving targets.			X	X	X	5.1.2
Implement conservation measures that also provide water saving benefits during drought periods (e.g., water fixture rebates).		X	X	X	X	5.1.3
Limit the issuance of new taps until additional storage installed.			X	X	X	5.1.4
Consider the implementation of modified rate structure for drought periods.				X	X	5.1.5
Conduct irrigation audits.				X	X	5.1.6
Recommend water saving measures to Tap Holders.	X	X	X	X	X	5.1.7
Consider limiting outdoor watering to specific times of the day.				X	X	5.1.8
Consider limiting number of watering days per week.				X	X	5.1.9
Set time limit for watering.					X	5.1.10
Limit watering during fall, winter, and early spring.					X	5.1.11
Converting sprinklers to low volume irrigation where appropriate.				X	X	5.1.12
Residential						
Encourage landscape watering restrictions.		X	X	X	X	5.2.1
Limit outdoor watering to specific times of the day.		X	X	X	X	5.2.2
Limit number of watering days per week.			X	X	X	5.2.3
Set time limit for watering.					X	5.2.4
Prohibit lawn watering during fall, winter, and early spring.					X	5.2.5
Promote outdoor water audits.		X	X	X	X	5.2.6
Convert sprinklers to low volume irrigation where appropriate.				X	X	5.2.7
Limiting the filling and use of swimming pools.					X	5.2.8
Enforce indoor water restrictions.					X	5.2.9
Promote indoor water audits.		X	X	X	X	5.2.10
Promote/require installation of water efficient appliances (e.g., dishwaters, clothes washer).				X	X	5.2.11
Promote water efficient fixtures and/or appliances on house resale or remodeling.			X	X	X	5.2.12
Provide historical monthly water usage on water bills.	X	X	X	X	X	5.2.13
Commercial and/or Industrial						
Promote outdoor landscape watering restrictions.		X	X	X	X	5.3.1
Promote indoor and outdoor water audits where applicable.			X	X	X	5.3.2
Promote installation of water efficient fixtures and appliances.				X	X	5.3.3

9.3 Public Education Campaign Activities

Table 10: Worksheet G – Drought-related public education and outreach plans and drought stages where applicable.

Response Strategies	Advisory (D0)	Watch (D1)	Warning (D2)	Emergency (D3)	Critical (D4)	¶
Response Target	*Watch*	*5 GPCD reduction*	*10 GPCD reduction*	*15 GPCD reduction*	*20 GPCD reduction*	
Public Education Campaign Activities						
Drought awareness: status of current drought conditions, drought stage and associated water restrictions.	X	X	X	X	X	6.1.1
Where customers may access drought management plan.	X	X	X	X	X	6.1.2
Measures and/or impacts that customers can expect if drought continues or intensifies.		X	X	X	X	6.1.3
Enforcement of drought policies and penalties for violations.				X	X	6.1.4
Explanation of rate increases/drought surcharge.				X	X	6.1.5
Water savings tips.	X	X	X	X	X	6.1.6
Landscaping tips during a drought (e.g., which plants to convert to drip, which to save, which to let die).			X	X	X	6.1.7
Provide customers with a drought report card at the end of the year showing monthly/annual water use pre-drought and during the drought.				X	X	6.1.8

9.4 Enforcement Activities

Table 11: Worksheet G – Drought-related penalty and enforcement plans and drought stages where applicable.

Response Strategies	Advisory (D0)	Watch (D1)	Warning (D2)	Emergency (D3)	Critical (D4)	¶
Response Target	*Watch*	*5 GPCD reduction*	*10 GPCD reduction*	*15 GPCD reduction*	*20 GPCD reduction*	
Enforcement Actvities						
General public education campaign activities.	X	X	X	X	X	
Courtesy letter of suspected leak or water loss.	X	X	X	X	X	
Warning letter for violation.		X	X	X	X	
Fee for violations.		X	X	X	X	
Installation of a flow restrictor.			X	X	X	

10 Formal Plan Approval and Updates

10.1 Roles and Responsibilities

DDWC's President and Engineer will periodically review the monitoring plan effectiveness and propose new response measures or index monitoring as applicable. The Manager will disseminate updates by regular bill inserts, flyers, and website as needed.

10.2 Public Review Process

On May 18, 2022, DDWC's President and Manager conducted an in-person meeting with its Tap Holders and other stakeholders to review the draft Drought Management Plan, answer questions, and collect comment for finalizing the plan. They will continue to conduct in-person meetings with Tap Holders on an annual basis to update stakeholders on progress with implementing the Drought Management Plan and seek feedback.

10.3 Drought Management Plan Approval

DDWC's draft Drought Management Plan was approved during the Drought Planning Committee Meeting #3 on April 25, 2022 and presented to Tap Holders and other stakeholders in a public forum on May 18, 2022. Each attendee was given an opportunity to review the plan, ask questions, and provide comment prior to formal approval. DDWC is not subject to ordinances or polices necessary to implement the Plan because if its small size and location outside any municipal government.

10.4 Periodic Review and Update

The Drought Planning Committee will review the management plan at least every five years during non-drought periods, and every year during drought periods. The plan will also be reassessed in the year after any major system improvements or changes. Reviews will focus on comparing the new supply and demand performance data with drought reductions to determine if the current response strategies need to be modified.

10.5 Acknowledgments

This drought management plan was created under a grant by the Colorado Water Conservation Board, a division of the Colorado Department of Natural Resources.

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