CITY OF ASPEN

Drought Mitigation and Response Plan

City of Aspen, Colorado

ELEMENT Water Consulting

JULY 2020

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CITY OF ASPEN DROUGHT MITIGATION AND RESPONSE PLAN

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List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
DMRP	Drought Mitigation and Response Plan
DRC	Drought Response Committee
gpm	gallons per minute
IRP	Integrated Resources Plan
NRCS	Natural Resources Conservation Service
SNOTEL	Snow Telemetry
SWE	snow water equivalent
USGS	United States Geological Survey
WATF	Water Availability Task Force
WEP	Water Efficiency Plan

INTRODUCTION

The City of Aspen (City or Aspen) owns and operates its water supply system, providing treated, i.e. potable, water to all customers in its service area and raw, i.e. non-potable, water for irrigation purposes to a small subset of customers. Aspen provides water for snowmaking from both treated and raw water supplies. The City is committed to sustainability and providing a quality potable water supply to the community. This Drought Mitigation and Response Plan (DMRP) provides a framework for Aspen to use water sustainably, particularly during drought and other conditions that create a water shortage. Water shortage occurs when water demands exceed available water supplies and is often driven by a combination of snowpack and precipitation conditions, temperature, and water use[1]. Implementation of the DMRP will support the wise use of water under all conditions, help preserve essential public services, and minimize the adverse effects of a water supply emergency on public health and safety, environmental resources, economic activity, and individual lifestyles. The DMRP works in concert with the City of Aspen Water Efficiency Plan (WEP) and programs implemented through the WEP, such as the Water Efficient Landscape Ordinance. These plans and programs encourage the efficient use of water at all times by establishing "normal" condition guidelines that are in place unless restrictions are imposed through action by City Council. Aspen staff rely upon national drought monitoring tools and indices as well as state and local hydrologic and climatic information to monitor for drought conditions. Through this monitoring, coupled with analyses and professional judgment, Aspen staff will recommend appropriate drought stage declarations for Council's approval under the DMRP. Section 6 of this plan provides an overview of the staged response program and Section 7 provides additional information about the implementation process.

PLAN FOCUS

Aspen obtains its water supply primarily from the surface water sources of Castle Creek and Maroon Creek which are tributaries to the Roaring Fork River. Aspen's water supply is highly dependent upon snowpack and the snowmelt runoff pattern. The City's water system does not currently include a significant water storage component that would allow it to store water supplies when they are available and release stored water when it is needed, retiming deliveries of water supplies to match timing of water demands. Without storage, the City is largely dependent upon streamflow availability at its river diversion points.

This DMRP focuses on managing the supplies that are available under the City's current surface water system operations. Potential future supply components, such as storage and use of ground water, are identified as longer-term water shortage mitigation strategies. Streamflow is susceptible to variation and changing conditions, including diurnal streamflow fluctuations, as well as catastrophic events such as landslides, fires, and other events that can prevent river diversions for some period of time. For Aspen, its surface water supply is vulnerable in the late summer, after the main snowmelt runoff period, when landscape irrigation demands are still high. Furthermore, Aspen is committed to protecting decreed instream flows and has adopted a policy to maintain streamflow in the creeks downstream of its diversion structures at flow rates that are at or above the Colorado Water Conservation Board's (CWCB) decreed

[1] This plan focuses specifically on mitigation and monitoring for drought indicators; however, many aspects of the response program are applicable for other types of water shortages. For purposes of this plan, the terms "drought" and "water shortage" are used somewhat interchangeably.

instream flow rights for the protection of the fishery and the associated aquatic habitats in those streams. At times, Aspen limits its river diversions to prioritize protection of the environmental flows.

Demand-side response strategies provide ways the City and its customers can reduce water use during a shortage. These strategies are the cornerstone of the City's DMRP. During drought conditions, water supply shortages are typically most pronounced during summer months, when demands are high due to irrigation. Therefore, the response measures in this DMRP generally target outdoor water uses. Additional detail regarding Aspen's water demands is available in the WEP.

This DMRP specifically applies to uses of the City's treated water supply. It also applies to use of the City's pressurized and non-pressurized raw water supply that is made available pursuant to agreements that provide for curtailment of water use or suspension of water delivery during water shortages or emergencies, as defined under Section 25.28 of the City Municipal Code. Some of the City's raw water supply is provided pursuant to longstanding agreements that do not contain curtailment provisions.

1. STAKEHOLDERS, OBJECTIVES AND PRINCIPLES

1.1 DROUGHT RESPONSE COMMITTEE

Historically, the Aspen Utilities Department has coordinated with other staff throughout the City as water supply monitoring began to indicate the potential for drought conditions. Staff have come together to make recommendations to City Council regarding water shortage declarations related to drought conditions. In 2019, a formal Drought Response Committee (DRC) was formed to support the planning for ongoing drought response efforts. Starting in 2018 and ending in summer of 2019 (the "2018" drought), Aspen was under a water shortage declaration. During this period, the Utilities Department staff realized that the success of an ongoing water shortage monitoring and response program would depend upon having an interactive, collaborative process with staff from other departments throughout the City. The DRC includes staff representing departments that need to be involved to monitor drought conditions, make recommendations for declaring a water shortage related to drought, communicate with elected officials and the public both before and during drought, evaluate the effectiveness of drought response, enforce drought restrictions, and provide recommendations for necessary actions. A list of the current DRC members and committee roles is provided in Table 1 below.

Table 1: Drought Response Committee Members and Roles.

Current Staff	Position	Committee Role	Committee Role Responsibilities
Scott Miller	Public Works Director	Final Decision Maker	Make final decisions in consideration of DRC input. Support Utilities Director and staff in development, promulgation, and implementation of Rules and Regulations.
Tyler Christoff	Utilities Director	Resource Authorization Lead	Assist in clarifying roles and providing staff support. Develop and promulgate Rules and Regulations to implement response plan under water shortage declaration. Ensure Rules and Regulations are carried out and provide coordination between departments.
Steve Hunter	Utility Resource Manager	Drought Response Team Leader	Lead the coordination, gathering, and dissemination of information and prepare recommendations for department heads and City Council.
Lee Ledesma	Utilities Finance Manager	Financial Advisor	Provide cost estimates to implement demand reduction programs, evaluate expected lost revenue estimates, and recommend drought pricing changes.
Austin Weiss	Parks Managers	Parks Advisors	Provide information and guidance on irrigation management of parks, golf course, and open spaces.
Rob Covington	Raw Water Supervisor	Watershed Conditions Advisors	Provide information and guidance on water supply availability, water rights, and operations.
Charlie Bailey	Water Treatment Supervisor	Water Treatment Advisor	Provide information and guidance on water treatment operations and water quality issues.
Ashley Perl	Climate Action Manager	Environmental Policy Advisor	Provide information and guidance on best science for monitoring climate and ensure that the drought response is coordinated with the City's environmental policy.
Mitzi Rapkin	Community Relations Specialist	Messaging Advisor	Lead the public outreach, messaging to customers, media relations, and messaging to staff.
Melissa Asay	Utility Billing Supervisor	Billing Advisor	Lead the implementation of database improvements and bill format changes to implement rate and fee changes and provide messaging information.
Chris Menges	E.H. Data and Research Project Planner	Efficiency Policy Advisor	Provide information and guidance on water demand reduction measures and associated cost estimates. Evaluate response effectiveness. Serve as the liaison between the WEP and DMRP.
Raquel Flinker	Project Manager II	Utilities Analyst	Serve as the liaison for internal planning and implementation efforts such as the City's exploration of Alternative Transfer Methods and the development of the Integrated Resources Plan.
April Long	Clean River Program Manager	River and Stormwater System Advisor	Provide information and guidance on impacts of drought to the health of the river and stormwater system.
Jim True	City Attorney	Legal Advisor	Provide legal advice on the drought response program, drought pricing changes, and need for City Council approval.

During the 2018 drought, four meetings were held with the DRC focusing on the drought conditions and response measures. The DRC meetings were designed to monitor drought conditions to inform ongoing drought stage recommendations while discussing long-term goals, objectives, and strategies for drought response planning and implementation. A significant amount of the DRC meeting time was spent discussing Aspen's unique customer base and how to engage and encourage customer and community support for efficient water use at all times. The DRC insight provided a broad perspective in developing this DMRP. When a drought occurs, the DRC will work together to move through water shortage declarations and implement a staged response plan.

1.2 OBJECTIVES AND OPERATING PRINCIPLES

Aspen's DMRP objectives and operating principles were established to guide the development of this plan while also supporting the City's water use priorities. The DMRP objectives are as follows:

- Maintain essential public services to preserve public health and safety, environmental resources, and economic activity during all drought stages.
- Provide guidance to prepare for and respond to drought conditions through a staged drought response program. This includes the framework for how to transition through varying drought stages depending on drought severity, as indicated through monitoring of available hydrologic, climatic, and water use information.
- Effective communication of drought awareness and response information to water customers.

When water shortages occur, water use restrictions are imposed in order to meet the most critical community needs. The general prioritization of water use under a water shortage condition is provided in Table 2. The City's first priority is to preserve the health and safety of the community, followed by the City's commitment to protect the natural environment through the preservation of decreed instream flows. Depending on the severity and duration of the water shortage, water uses described under Priorities 4, 5, 6, and 7 may need to be reduced or prohibited, starting with hydroelectric power generation as the lowest priority use. Restrictions under Priority 3 reflect 'nonessential' potable indoor uses; however, these restrictions could impact the business and commercial/recreational sector and would likely not be implemented except under severe, long-term shortages. While this sequence of priorities reflects the City's general philosophy for community water use during water shortage conditions, each water shortage circumstance is unique and will be evaluated by the City to determine the appropriate set of response measures. The DMRP provides a comprehensive yet flexible framework to guide the City through drought mitigation and response efforts, as well as the procedures to follow for declaring a drought and implementing drought response measures.

Table 2: General Water Use Priorities During Water Shortage Conditions.

Priority	Representative End Uses	Description
1	Health and Safety	Indoor sanitary uses for residential, commercial, schools, health services, etc.; firefighting and hydrant flushing.
2	Protection of Natural Environment	Protection and maintenance of decreed instream flows.
3	Discretional Commercial and Industrial Use	Non-sanitary indoor uses; outdoor commercial uses to support stability.
4	Public Parks and Recreation	Outdoor potable or raw water irrigation of public areas, including lawngrass in active recreation areas.
5	Residential Landscaping Features	Outdoor potable or raw water irrigation of trees and shrubs in residential areas.
6	Lawngrass Irrigation	Outdoor potable or raw water irrigation of residential lawngrass and public areas with low foot-traffic throughout the City.
7	Hydroelectric Power Generation	Generation of hydroelectric power from Maroon Creek diversions.

The following operating principles supported the development of this DMRP and provide a set of guidance criteria that will support the DRC while making decisions during times of a drought.

- Input from the DRC and other City representatives will be considered in the development and implementation of the DMRP.
- Response measures that limit and/or restrict water use of certain end-users will be implemented in a manner to reflect the priorities listed above, with the highest priority being the preservation of water for public health and safety purposes during periods of drought.
- Except when public health or safety is at risk, all reasonable efforts will be taken to preserve the environmental and recreational value of the surrounding lands which are important to the values and livelihood of City residents. This is the City's highest priority second only to public health and safety.
- Effective coordination and collaboration among City staff is crucial to the success of the DMRP. This plan provides a comprehensive framework for implementation of the staged drought response program based on available information. Exceptions/adjustments to this framework may be necessary during a drought or under other water shortage conditions. Any changes will be clearly communicated and coordinated among the appropriate City staff.
- The City will strive to minimize the severity of potential impacts through diligent planning and mitigation.
- Targeted communication and outreach with the community is critical to the implementation and success of any program requiring a reduction in demands. Developing an engaged and educated public will better support an effective drought response.

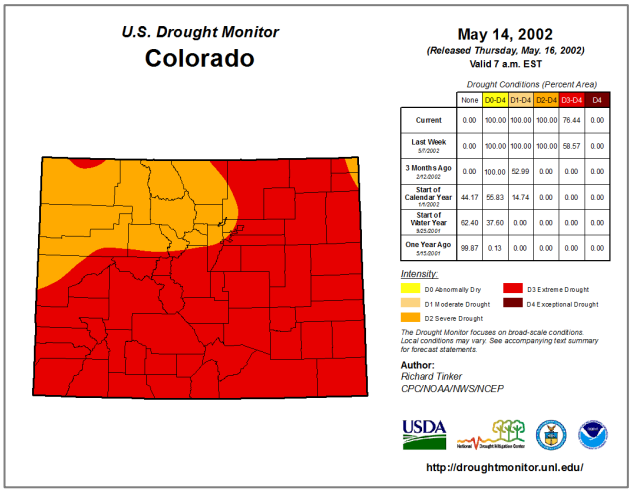
2. HISTORICAL DROUGHT AND IMPACT ASSESSMENT

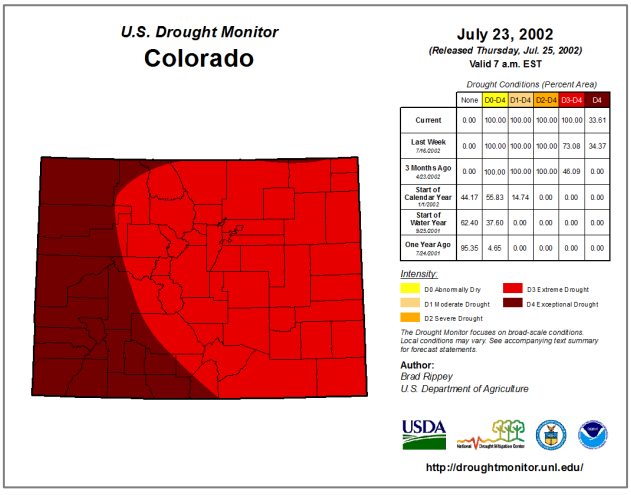
2.1 HISTORICAL ASSESSMENT OF DROUGHT, AVAILABLE SUPPLIES, AND DEMANDS

Droughts are cyclical and unavoidable, especially in Colorado's semi-arid climate. Our water history is reflected in terms of these historical droughts and how significantly streamflow was impacted. Historical periods of drought are often referenced in long-range water planning efforts to provide a "worst-case" planning scenario. The Aspen Utilities Department, for example, frequently references the 1977 drought to represent historically low streamflow. In fact, 1977 is known locally as the year that the Roaring Fork went dry through Aspen. In more recent history, 2002, 2012, and 2018 conditions influenced water shortage declarations in Aspen and across the state. In particular, 2002 was considered the worst drought year on record statewide in terms of streamflow. Without meaningful storage, Aspen relies completely on live stream conditions. Aspen considers these historical droughts in its water supply planning, as well as the potential for more severe or prolonged droughts to occur in the future. Following each of the recent droughts, Aspen has reevaluated its drought response and made changes to its drought response program and/or Municipal Code to reflect lessons learned and to more clearly define demand reduction goals, stages, and response mechanisms, as appropriate.

2002 Drought

At the end of April, 2002, the year-to-date precipitation at the Independence Pass SNOTEL site was at 64% of the long-term average. These conditions triggered the City to begin planning for a potential drought over the coming months. Streamflow projections were showing that runoff could peak as early as mid-May, which is about four weeks ahead of normal. There was another complicating factor due to atypical early administrative water rights calls on the river in the lower Gunnison and Colorado Rivers that impacted legally available supplies in the Roaring Fork Basin. Statewide, the Governor had declared a drought emergency by May of 2002, calling on local governments and others to do their part in conserving the State's water resources.





In early May, 2002, Aspen initiated a Stage 1 water shortage declaration, beginning with voluntary restrictions and an adjustment to its tiered rate structure in the highest tier. The City terminated the water shortage declaration and the associated temporary surcharges in October of 2002, never having advanced

beyond the Stage 1 declaration.[2] There has been a steady decrease in Aspen's potable demands, largely in response to the significant drought impacts and enhanced water efficiency focus following the 2002 drought. Aspen's ongoing conservation and efficiency activities have influenced a consistent decrease in water use over time and helped to mitigate drought impacts experienced in Aspen over the 2012 and 2018 droughts.

2012 Drought

By June, 2012, much of Colorado was experiencing some level of drought condition. The City was experiencing a reduction in supply from water that could not be produced from its wells due to water quality issues. Additionally, extremely low snowpack leading into the runoff season threatened late-summer streamflow levels. In June, 2012, Aspen initiated a water shortage declaration, beginning with voluntary restrictions and an adjustment to the highest tier of its rate structure. Aspen decided to keep the Stage 1 declaration through the 2012 – 2013 winter. Having the Stage 1 declaration in place at the beginning of the irrigation season was considered essential to early actions and educational outreach to City customers, allowing them an opportunity to initiate changes in irrigation and other uses that would conserve water throughout the 2013 irrigation season.

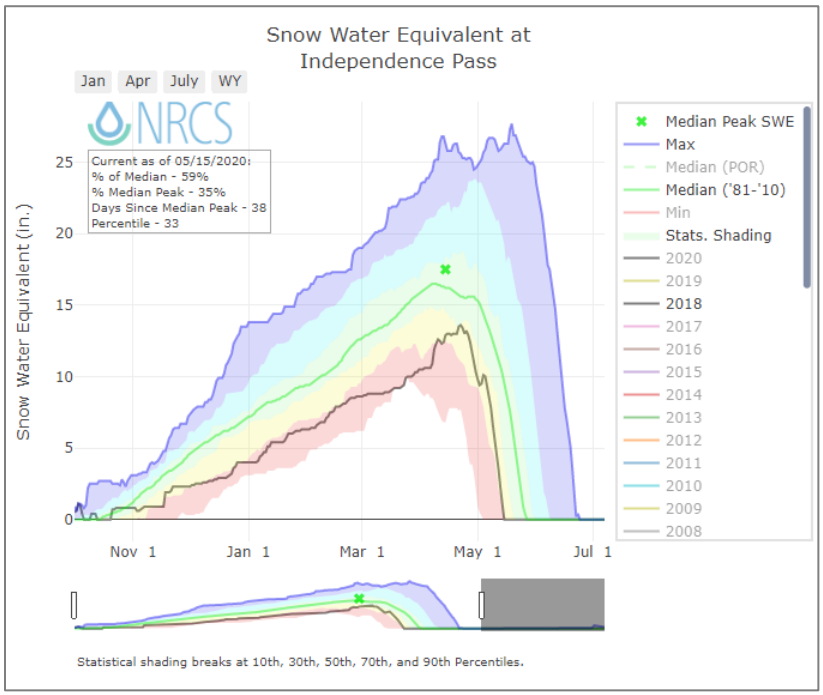
Aspen and the surrounding areas experienced strong monsoon weather patterns in late July through August of 2013, leading to improved instream flows in Castle and Maroon Creeks. In September, 2013, the City ended the Stage 1 declaration and all associated surcharges. The City experienced higher demands in 2012 with demands reducing in 2013 in response to ongoing Stage 1 declaration and voluntary reductions.[3] Following this drought, the City added water use reduction goals for pressurized and non-pressurized raw water systems.

2018 Drought

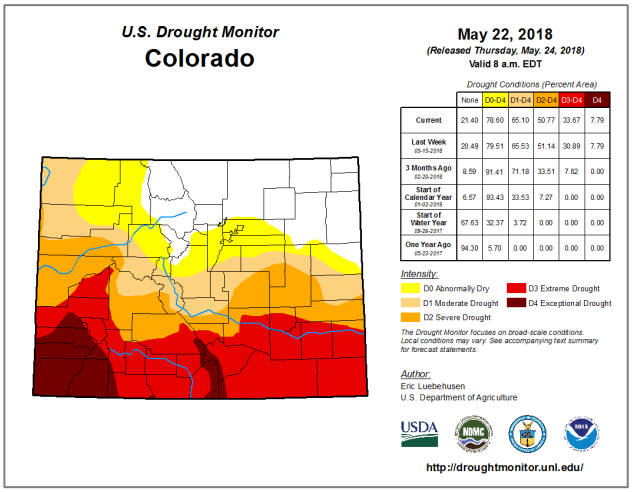
As of May 7, 2018, the year-to-date precipitation at the Independence Pass SNOTEL site was at about 60% of the long-term average. These drier than normal conditions were expected to impact the runoff season, both in terms of the time to return to baseflows and the volume of runoff available. Forecasts indicated the volume of runoff was expected to be 50% to 70% of normal for the Roaring Fork Basin.

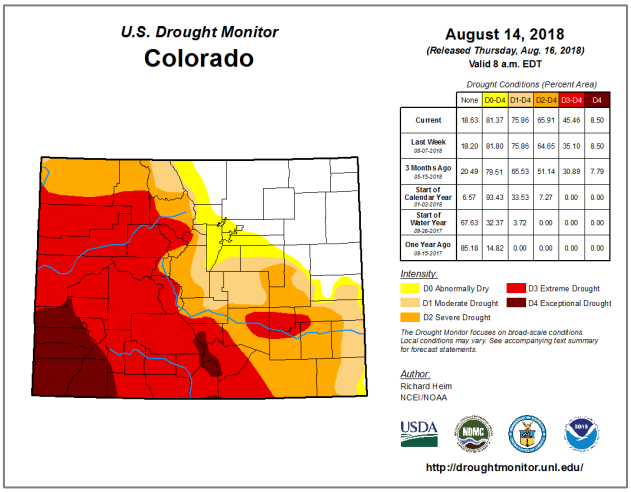
[2] Note that Stage 1 requirements in 2002 were different from the stages described herein.

[3] Note that Stage 1 requirements in 2012-13 were different from the stages described herein.



In mid-May, 2018, Aspen declared Stage 1 water shortage conditions. Under Stage 1, public facilities including parks and golf courses, were directed to lead by example and implement water use restrictions, public education materials were provided to the community to encourage voluntary efficient use, and temporary water surcharges were added to the upper tiers of the billing rate structure to encourage a reduction in water use. The City continued to monitor supply conditions and customer demands throughout the summer.





In mid-August, 2018, the City moved from a Stage 1 to a Stage 2 water shortage declaration. The goal under Stage 2 was to protect the health of Castle and Maroon Creeks while maintaining Aspen's municipal

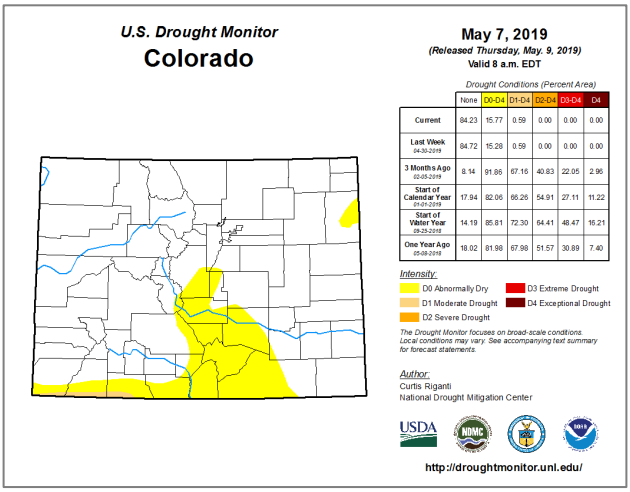
water supplies at levels that could meet customer demands and maintain healthy landscapes. Stage 2 included mandatory restrictions for all Aspen treated water customers, including:

- No watering of lawns between 10 a.m. and 6 p.m. or more than three days a week and no more than 30 minutes per sprinkler zone per day.
- No watering native areas more than two days a week or during rain events.
- No watering resulting in ponding or the flowing of water onto paved surfaces.
- No washing of sidewalks, driveways, patios, tennis courts and parking areas.

A City email address was provided to customers to report any observed violations and the City could issue fines for violations and disconnect water service for repeat violations. Temporary surcharges were increased for the upper tiers of the billing rate structure to support further reduction in water use. While revenue projections from water use in Tier 1 and Tier 2 were expected to decline once customers responded to the water shortage declaration, the City anticipated the decline to be offset to some extent by the increased rates for Tier 3 and Tier 4.

The City entered the 2018 – 2019 winter season under the Stage 2 water shortage declaration. Staff considered the pros and cons of remaining under the declaration through the winter versus relaxing or coming out from the declaration for the winter and then potentially having to re-establish the declaration in the spring or summer. Various climate projections were monitored and ultimately Aspen chose to maintain the Stage 2 declaration through the duration of the winter season. The primary justification was that if the 2018 – 2019 winter had another low snowpack with higher temperatures, Aspen was likely to advance the water shortage staged response program through the 2019 summer months. If the City came out of water shortage declaration during the winter, it would take time to re-engage the drought declaration should conditions not improve. Additionally, community outreach was already underway to support reductions in water use. City staff were concerned that interrupting the declaration would disengage the public. During the 2018 declaration process, staff had observed a large lag time between the stage being declared and the customer responses occurring. During fall of 2018, the DRC was engaged to support the planning for ongoing drought response efforts.

In early spring of 2019, the DRC was closely monitoring snowpack and weather conditions, meeting regularly to review conditions and prepare response strategies. Winter snowpack levels were below average until a large snow event in March brought snowpack levels up above average. The snowpack fluctuated but continued in an upward trend. By mid-April, the streamflow forecast through the summer was projected to be higher than 2018 conditions, indicating that the 2019 irrigation season would be significantly improved compared to the prior year. In May of 2019, Aspen lifted the Stage 2 restrictions and removed the water shortage declaration.



Enforcement was one of the largest challenges experienced during the 2018 – 2019 water shortage declarations. While customer complaint and reporting were the historical mechanism for enforcement, the DRC concluded that a more formal process for enforcing restrictions would increase the success of the drought response program. The City modified the "wasting of water" section of the Municipal Code to reflect more strict requirements for water use under normal conditions. The DRC also recommended transitioning Stage 1 restrictions from voluntary to mandatory and adding an "Emergency Response" stage to its water shortage categories, as reflected in this DMRP. Some additional changes to the Municipal Code Section 25.28 were made in conjunction with this DMRP.

3. DROUGHT IMPACT ASSESSMENT

Impacts to the City during future droughts may be similar to those experienced in past droughts, although depending upon how climate change impacts local conditions, future droughts may be more frequent, intense, and/or prolonged relative to historical droughts. The level of severity for the anticipated impacts varies from minor to significant and is influenced by the magnitude and duration of the drought. One operating principle identified through this plan is to minimize the severity of potential impacts through planning and mitigation. Table 3 below shows potential future drought impacts and the anticipated level of severity based on historical impacts and the anticipated effects of mitigation and planning.

Table 3: Potential Future Drought Impacts.

Potential Future Impact	Potential Severity
Increased costs and staff time to implement drought plan	Minor
Reduced firefighting capability	Minor
Changes in water use behavior to conserve water	Moderate
Costs to increase water use efficiency	Moderate
Impacts to fish and wildlife habitat	Moderate
Loss of revenue from reduction in water sales	Moderate
Loss to recreation and tourist industry	Moderate
Restrictions/limitations on landscaping companies	Moderate
Disruption of water supplies	Moderate to Significant
Domestic landscaping stressed or lost	Significant
Increased risk of frequency and severity of wildfires/flood hazards	Significant
Loss of hydroelectric power generation	Significant
Public landscaping stressed or lost	Significant
Visual and landscape quality	Significant

4. DROUGHT MITIGATION AND RESPONSE

Drought mitigation measures are implemented prior to a drought to avoid, delay, or reduce potential drought impacts. Aspen actively manages its water resources through ongoing and diverse planning efforts, which supports long-term sustainability goals and the mitigation of drought impacts. To date, Aspen's primary drought mitigation measure has been the implementation of the City's 2015 WEP. The 2015 WEP works along with the Roaring Fork Regional WEP to support the City's conservation efforts. Programs implemented through these plans, including a professional landscape certification program, have advanced the City's outdoor water efficiency program. The City is in the initial phases of developing

an Integrated Resources Plan (IRP), which will evaluate the City's water supply portfolio and demand projections under future conditions, including climate change, ultimately leading to a future supply strategy.

Because Aspen relies predominantly on streamflow for its supplies, management of demands is of high importance. Even during average years, Aspen's water supply system reaches a stress-point in early spring and again in late summer when streamflow are relatively low, demands are relatively high due to irrigation, and Aspen is operating to protect decreed instream flows (see Figure 1). This figure is an illustrative example showing a dry-year water supply compared to a projected demand. Periods where the demand exceeds the supply reflect a water shortage. This illustrates the importance of ongoing conservation as well as drought response strategies.

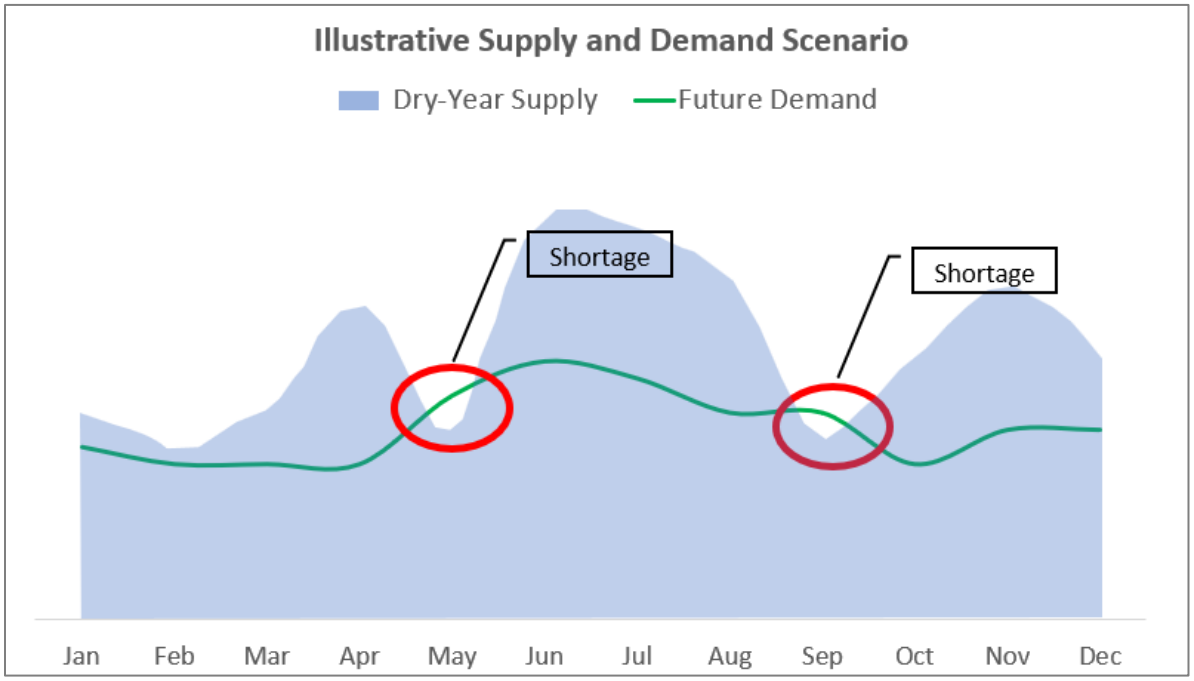


Figure 1: Illustrative Municipal Supply and Demand Scenario.

The following is a list of the City's historical and ongoing water shortage mitigation measures:

- Municipal Water Efficiency Planning
- Roaring Fork Regional Water Efficiency Planning
- Integrated Resources Planning
- Water Efficient Landscaping Standards
- Qualified Water Efficient Landscape Certification Program
- Leak Detection and Water Loss Audit Program
- Pursuit of an "Engaged Efficiency" Culture
- Ongoing Monitoring of Drought Indicators

4.1 SUPPLY-SIDE MITIGATION AND RESPONSE STRATEGIES

The City is in the process of expanding its existing water supply system to improve reliability, to firm its supplies for long-term drought mitigation and to further respond to an extreme or prolonged drought. The City recognizes that individual water supply sources may be impacted differently by drought conditions and will consider the availability of each supply and supply-side management strategies under each water shortage declaration. Potential supply-side strategies include the following:

- Storage would help the City to delay the initiation of a water supply shortage declaration under many conditions, particularly drought, and would provide a quantitative index for guiding drought stage selection. The City has conditional storage water rights and, at the time of preparing this plan, is in the process of studying storage site locations. Storage is an important part of Aspen's long-term drought mitigation strategy (although it will not fully eliminate the City's drought vulnerability). Until storage is available, Aspen's decisions regarding water shortage declaration under drought conditions are particularly complicated because water saved through early season demand reductions cannot be held over to meet demands during the latter part of the irrigation season. This requires a faster customer-side response to reduce irrigation demands once streamflow is low, and likely a more immediate implementation and enforcement of water use restrictions.
- The City owns alluvial groundwater rights that may be exercised in the future as a supplemental supply. At the time of this plan, the existing wells require additional costly treatment in order to be used. The City may retrofit piping from its decreed wells to deliver pumped water either into the City's water treatment plant or may provide further treatment at the wellhead to provide an additional potable supply into the distribution system. If implemented, this would mitigate and likely delay water shortage declarations due to drought by providing a supplementary, interim potable supply.
- The City may temporarily suspend some diversions of its irrigation water rights and associated deliveries in order to make more physical water available in the stream for diversion and treatment under its municipal water rights.
- During times that public health and safety is at risk, the City may divert and treat water that it would otherwise not divert because of its commitment to protect the CWCB decreed instream flow rights.
- The City has the right to reuse a portion of its water supply and is in the process of building a reclaimed water system to exercise this right. Reuse/reclaimed water is not subject to curtailment under this plan but may help mitigate future drought impacts by reducing irrigation by other water rights. Upon operational availability, the City may utilize reclaimed water supplies to irrigate higher priority outdoor water uses as identified in Section 1.2.
- The City's water supply depends upon diversions from Castle and Maroon Creeks and therefore data-informed monitoring of these watershed conditions is of critical importance. Monitoring of drought indicators is complicated by the fact that there are no automated snow depth and snow water equivalent (SWE) monitoring sites within the Castle and Maroon Creek watersheds and there is not an active streamflow gage located on Castle Creek. This makes it challenging to monitor the local snowpack and project the snowmelt runoff amount and timing. The installation and maintenance of a snow telemetry site (SNOTEL) and a Castle Creek streamflow gage would help improve the City's ability to monitor and make drought declaration decisions.

4.2 Demand-Side Mitigation and Response Strategies

The City's primary demand-side mitigation measure, as identified above, is the implementation of the 2015 WEP. In particular, the City has developed outdoor landscape and irrigation efficiency standards to support the efficient outdoor use of water. The City's efficiency programs support a lower baseline demand through efficient water use practices, which delays and minimizes impacts caused by drought. Demand-side response strategies focus on further reducing water use during times of drought. Because most of the City's water demand is for outdoor use, particularly during summer when supplies are more vulnerable to drought impacts, these strategies target outdoor use. Generally, demand-side response strategies can be categorized as follows:

- Water restrictions on irrigation.
- Water restrictions on private outdoor swimming pools and hot tubs.
- Water restrictions on outdoor commercial or construction uses.
- Billed water use surcharges.

These demand-side strategies are important but may not be enough to successfully navigate all droughts into the future, which is why the City continues to evaluate and expand its water supply system and planning efforts.

5. Drought Stages, Response Targets, and Monitoring

5.1 Drought Stages and Response Targets

The City's drought response strategy is based on five stages representing increasingly severe drought conditions as shown in Table 4 below. These stages and response strategies were developed for water shortage declarations related to drought conditions; however, they may also apply to water shortages related to other circumstances. Each water shortage should be evaluated independently with Rules and Regulations created to specifically address those conditions. For each stage, the City has identified demand reduction targets on systemwide demands served by treated water and outdoor demands served by a combination of treated water, pressurized raw water, and non-pressurized raw water. These reduction targets connect with response strategies developed for each stage, as described in Section 6 of this plan. Municipal drought response strategies tend to focus on outdoor water use reduction programs, targeting irrigation uses to achieve the bulk of the demand reduction goals for a staged drought response; outdoor uses consume significantly more water than indoor uses, and are typically considered more discretionary than indoor uses. Therefore, reductions are typically focused first on outdoor uses. Planning for this type of staged drought response program makes sense for Aspen because the City's water supply system is currently dependent upon streamflow and is most likely to be limited during the later summer period when landscape irrigation demands are high. Future modeling, monitoring, and the future addition of storage may warrant a review and potential modification of these response targets.

Table 4: Staged Drought Response Categories and Water Use Reduction Goals.

Category	WATCH Normal	MODERATE Stage 1	SEVERE Stage 2	EXTREME Stage 3	EXCEPTIONAL Emergency Response
WATER USE REDUCTION GOALS					
Systemwide	Voluntary	5% - 10% Reduction	10% - 15% Reduction	15% - 25% Reduction	25% - 40% Reduction
Outdoor	Voluntary	10% - 15% Reduction	15% - 25% Reduction	25% - 60% Reduction	60%+ Reduction

5.2 MONITORING OF DROUGHT INDICATORS

The amount of water available for the City's municipal supply is currently dependent upon the physically available streamflow in Castle and Maroon Creeks. Both Castle and Maroon Creeks are snowmelt dominated streams, and the amount of summer streamflow is closely related to snowpack conditions that occurred the prior winter. Timing of peak snowmelt runoff is another significant factor in summer streamflow availability. To interpret local conditions, Aspen staff rely upon several hydrologic and climatic indices including snowpack, precipitation, temperature, wind, evaporation, streamflow, soil moisture, and weather forecasts to support professional judgment in making recommendations for declaring water shortages and moving through drought stages. The combination of conditions makes each year unique and requires ongoing monitoring. The time of year corresponding with each indicator is also important to consider, e.g. snowpack is used as a primary indicator during winter and early spring months while streamflow is used as a primary indicator during runoff and summer months. Table 5 shows typical monitoring data relied upon by Aspen to predict drought conditions and the associated time of year.

Table 5: Drought Indicator and Corresponding Time of Year

Indicator	Applicable Time of Year
Snowpack	November through May
Snowmelt	April/May Projections
Precipitation Snowfall Rainfall	 October/November through April May through September/October
Streamflow	April through October
Treated Water Demands	Year-Round
Temperature	Year-Round
Soil Moisture	Year-Round

Monitoring and data assessment are most intensive starting in February when snowpack levels start to show trends that can be compared to historical averages, continuing through August when Castle Creek and Maroon Creek flows are declining and outdoor uses are still high. The monitoring efforts challenging because there are no SNOTEL monitoring sites located within these watersheds and there is not an active streamflow gage located on Castle Creek. Because Aspen's supplies are driven by snowpack conditions and subsequent runoff patterns, it is difficult to accurately predict conditions far in advance. One large snow event can shift snowpack levels from far below average to above average. Similarly, early peak

runoff and abnormally high temperatures can result in reduced late-summer streamflow levels even if end-of-season snowpack data had indicated above-average levels. As such, monitoring is an ongoing process. Water shortage declaration is a near real-time decision made by analyzing and interpreting monitoring data, cross checking with other regional and local water resources experts, and applying historical experience coupled with professional judgment. Some events that may indicate drought include, but certainly are not limited to, include the following:

- Significantly lower than average peak snow water equivalent (SWE), or if the SWE level peaks early relative to historical average years, resulting in earlier than typical runoff.
- Above average temperatures.
- Dust on snow.
- Precipitation that falls in the form of rain rather than snow prior to April 1.
- Streamflow below 12 cubic feet per second (cfs) in Castle Creek and 14 cfs in Maroon Creek to support instream flows.
- Below average or no precipitation.

5.3 MONITORING REFERENCES AND RESOURCES

The City relies upon monitoring data and field observations to review local conditions. A combination of the drought indicators described above are used to evaluate conditions and make drought declaration decisions. Aspen also considers regional hydrologic and climatic data, drought indices such as the Palmer Drought Severity Index and the Surface Water Supply Index, information from other nearby water utilities, long-term weather forecasts, etc. The DRC provides a forum for soliciting monitoring information from multiple staff and further establishing key parameters and dates that are used to support monitoring through staff experience. Additionally, the City has a daily operational model of its municipal raw water system that can be used to predict available streamflow entering the City's system based on operational demand scenarios and streamflow projections. Because this is a predictive model, it can be utilized as an indicator but cannot be solely relied upon in making drought declarations.

Drought conditions change frequently and vary in extent and duration – no two droughts are exactly alike. Through ongoing tracking of water supply and demand conditions, before and during drought, the City can adapt its drought response strategy to meet changing conditions. This section of the DMRP documents information that has historically been used to monitor for drought conditions, which informs the City in its consideration of declaring water shortages and moving between stages of the drought response program. However, this is not a comprehensive list of resources reviewed and relied upon to support drought monitoring and declaration. Aspen will update its monitoring procedures as new resources and tools become available.

- The **US Drought Monitor**[4] provides broad-scale perspective on drought conditions nationally, regionally, and by state. The US Drought Monitor maps are updated weekly and released each Thursday. The author of the maps, who may be a different person each week, interprets quantitative data and qualitative information to update the drought intensity patterns. The maps show drought classifications based on geographic locations and range from "None" to D4 Exceptional Drought. This is an important tool for communicating with customers and can be

[4] https://droughtmonitor.unl.edu/CurrentMap.aspx

useful in evaluating current conditions relative to a prior period and over an expanded region. However, the drought designations shown in the US Drought Monitor do not reflect local drought declarations but rather provide a general reference for Aspen staff to consider. For example, the US Drought Monitor may show a D3 Extreme Drought condition for the Aspen area, but the City of Aspen may be in a Stage 1 drought declaration.

- The **Governor's Water Availability Task Force (WATF)**[5] monitors conditions that affect Colorado's supply, including snowpack, precipitation, reservoir storage, streamflow and weather forecasts. The WATF holds regular monthly meetings to present status reports from the State Climatologist and Natural Resources Conservation Service (NRCS), review outlooks on climate and streamflow conditions, and discuss potential water supply impacts. Drought monitoring and long-term mitigation are ongoing activities and the responsibility of the WATF. The **Colorado Drought Mitigation and Response Plan (Colorado Drought Plan)**[6], updated in 2018, outlines a mechanism for coordinated drought monitoring, impact assessment, emergency drought response, and mitigation of long-term drought impacts in Colorado. Drought monitoring is ongoing and facilitated through the WATF regular meetings. The WATF notifies the Governor when drought conditions reach significant levels and recommends activation of the Plan. The Governor activates relevant Impact Task Forces, which convene to determine the existing or potential impacts within sectors (municipal water, agricultural industry, wildlife, and energy). Implementation and the subsequent supporting actions are driven by the specifics of each emergency or disaster situation. The Colorado Drought Plan can be partially or fully implemented for any number of counties and classifications, allowing flexibility based on recommendations from the Impact Task Forces. Activation of the Colorado Drought Plan does not require any local drought response, although the it is a strong consideration for the City.
- The **Colorado Drought Plan Visualization Story Map**[7] was developed in association with the Colorado Drought Plan. The Story Map provides an interactive Drought Vulnerability Assessment summary (vulnerability scores and potential impacts) that are summarized by county for each of the following sectors: agriculture, energy, environment, recreation, socioeconomic, and state assets. The municipal sector is not explicitly referenced because of the uniqueness of each municipal water supply system. The Story Map provides a visual representation of counties that are currently triggered, allowing the user to select a county to view associated data for each of the defined sectors. The scoring for these sectors provides another indicator of drought conditions.
- Local snowpack conditions are a key water supply indicator that influences how snowmelt runoff will contribute to streamflow during the City's high outdoor water demand period of June through September. **NRCS Snow Telemetry (SNOTEL) Watershed Time Series Snowpack Graphs**[8] are published and updated frequently to show daily snowpack data by state or by river basin for the current year to date, the prior 3 years, median snowpack, and average snowpack. General statistics for current snowpack levels are updated with each published chart. This source is frequently used to monitor regional snowpack conditions that indicate the snow status and general seasonal trajectory.

[5] https://cwcb.colorado.gov/water-availability-flood-task-forces
[6] https://drought.unl.edu/archive/plans/Drought/state/CO_2018.pdf
[7] https://lynker.maps.arcgis.com/apps/MapSeries/index.html?appid=8b8a995c2574439cbef10088a08d12ae
[8] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcs144p2_063323

- The **NRCS Colorado Basin-Wide Interactive SNOTEL Charts**[9] allow users to select and create SWE charts summarized by major river basin and by sub-basin, tracking average SWE levels from all SNOTEL sites within and adjacent to the selected watershed for any combination of years. The user can also develop interactive charts for precipitation. Both historical data and projection charts are available. While these may not provide a direct reflection of Aspen's local water supply conditions, these charts can be used to gain perspective of the overall basin conditions.
- **NRCS Colorado Site Interactive SNOTEL Charts**[10] allow the user to select a specific SNOTEL Site and open interactive charts for SWE or precipitation. Both historical data and projection charts are available. Unfortunately, there are no SNOTEL sites located within Aspen's water supply watersheds; however, the Independence Pass site is relatively close. Data from the Independence Pass SNOTEL site (Station ID 542) is monitored and used along with staff field observations to relate this information to snowpack within the Castle, Maroon, and Hunter Creek drainage areas , where Aspen's water supply is located, as well as the Roaring Fork.
- **Precipitation and temperature**[11] are compared to prior years and evaluated together with snowpack and streamflow. Early warming and rainfall enhance snowmelt and reduce snowpack. Temperature data from the Aspen 1 SW NOAA station or the Aspen Pitkin Co Airport Sardy Field NOAA station are used to observe the following:
    - The timing of when minimum daily (i.e. nighttime) temperatures start exceeding 35 degrees Fahrenheit.
    - Whether precipitation occurs as snow or rain below 10,000 feet elevation.
- **Streamflow** is monitored during the winter-to-spring transition period to observe the rate of snowpack dissipation (through inspection of the magnitude and shape of the streamflow curve) and streamflow response to snowmelt (runoff) through the change of season.
- The **NOAA Colorado Basin River Forecast Center**[12] develops geographic water supply forecasts for the Upper Colorado River Basin, Lower Colorado River Basin, and Eastern Great Basin. Through an interactive map of the basins, the user can select a station and view a hydrograph with observed streamflow, short-term forecast, and longer-term outlook. This website also shows snow conditions, reservoir conditions, precipitation, and soil moisture.
- Other national drought-specific resources including the **National Integrated Drought Information System (NIDIS)**[13], the **Advanced Hydrologic Prediction Center**[14]**,** the **Intermountain West Climate Dashboard**[15], the **Evaporative Demand Drought Index (EDDI)**[16], and the **USDA Topsoil Moisture Monitoring Maps**[17] are also relied upon.

Aspen also monitors its measured potable water use as follows:

- **Treated water production**[18] data provides an indication of how water demands are trending and is considered along with the water supply indicators to anticipate potential shortages.

[9] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcseprd1432263
[10] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcseprd1433035
[11] https://www.colorado.gov/cdss/climate-data
[12] https://www.cbrfc.noaa.gov/
[13] https://www.drought.gov/drought/states/colorado
[14] https://water.weather.gov/ahps/rfc/rfc.php
[15] https://wwa.colorado.edu/climate/dashboard.html
[16] https://psl.noaa.gov/eddi/
[17] https://www.drought.gov/drought/data-gallery/topsoil-moisture-monitoring
[18] https://www.cityofaspen.com/1165/Drought-Dashboard

- **Treated water demand** data are reported through Aspen's monthly billing software and tracked through an internal water use tool. Billed water use provides an indication of how water demands are trending by customer category. Billed demands are considered along with the production and water supply indicators to anticipate potential shortages.
    - Beginning in April, monthly water demand data are monitored by customer class relative to the prior 5-year period. Demand data are utilized to help focus recommendations for drought response measures and enhance customer outreach and communications.
    - During any declared water shortage, demand data summarized by customer category are evaluated for the effectiveness of response actions, including restrictions, water pricing, education, and enforcement, toward reducing demands and supporting recommendations for adjusting the drought response measures.

6. STAGED DROUGHT RESPONSE PROGRAM

The City's staged drought response program identifies appropriate response measures for each drought stage. This section outlines typical drought indicators and response measures, intended to provide a comprehensive set of activities to support the City's selection of staged response targets and guidance for developing Rules and Regulations when a water shortage is declared due to drought conditions. While many indicators are considered, all of the conditions listed below do not have to exist before declaring a drought. Similarly, the lists of shortage response measures provide a guide to water use modifications that will be considered during each shortage condition. This part of the DMRP will be used as a framework for developing the Rules and Regulations during a shortage declaration, which will provide details about the specific set of response measures to be implemented and enforced under the particular water shortage circumstances, as further described in Section 7.1 below. The City will modify the program elements as needed to meet demands under changing water supply conditions.

While some of the response measures rely on changes to City water uses and activities, the majority of response measures rely heavily on customer behaviors. The City will model effective drought response in its own water use and will provide the necessary information and tools to motivate a public response. However, it is ultimately in the hands of the City's customers to execute. As appropriate, modifications and adjustments may be made to the measures described here to best address the circumstances and conditions of a given water shortage. Any restrictions defined under a specific drought stage will continue through higher stages unless more strict restrictions are identified.

6.1 NORMAL CONDITIONS: WATCH

Under normal conditions, the City will implement normal monitoring activities. The City will actively implement the WEP programs and measures to manage the use of its finite water resource, minimize water waste, and encourage best practices. This is considered normal operation and does not require any formal action from City Council.

Common Indicators:

- Local watershed characteristics including snowpack, precipitation, streamflow, temperature, and soil moisture indicate normal conditions.
- Normal to above-average snowpack conditions during winter months.
- Normal to above-average measured and projected streamflow starting late-spring through fall.

- Average to below-average temperatures during all months.
- No indication that local conditions will deteriorate in coming months.

Common Response Measures:

- The City will work with the Colorado Division of Water Resources as needed to place administrative calls for water under the Colorado water rights priority system to protect supplies.
- All terms defined under Municipal Code Section 25.28 "Wasting of water prohibited" are mandatory at all times.

6.2 STAGE 1: MODERATE

Under Stage 1 conditions, the City will increase emphasis on basic water use reduction measures and wise water use practices implemented through public education and outreach. The City will promote rebates and support programs for low-flow water use fixtures, irrigation technology, irrigation assessments, etc. and will begin targeting high volume water users and lower-priority water uses. Mandatory restrictions and water bill surcharges will begin.

Common Indicators:

- Local watershed characteristics including snowpack, precipitation, streamflow, temperature, and soil moisture indicate moderately dry conditions.
- Below-average snowpack conditions during winter months.
- Below-average measured and projected streamflow starting late-spring through fall.
- Above-average temperatures during all months.
- Other water providers in the Roaring Fork Basin are preparing to respond to dry conditions.
- Indication that local conditions will likely deteriorate in coming months.
- Indication that the Governor may activate the Colorado Drought Plan or has activated it in neighboring counties.

Common Response Measures:

- Irrigation of existing lawns limited to 3 days/week. Customers may choose which days or the City may designate days, depending upon the shortage condition.
- Irrigation of existing flowers, vegetable gardens, shrubs and trees using overhead irrigation systems limited to 3 days/week; watering by hand, drip, or subsurface irrigation any day.
- Encourage HOAs and commercial customers to perform irrigation system audits on common areas and increase rebates to support audits.
- Encourage postponing new landscape installations unless converting to xeriscape. Any allowed new seed/sod should have signage posted regarding establishment.
- Encourage customers not to operate any existing outdoor fountain, waterfall, or pond that is not used directly for irrigation.
- Public facilities will be directed to implement water use restrictions by administrative order, including: limiting irrigation of public parks and golf courses to an extent greater than the target reduction in overall water use; reducing street washing to minimum level necessary to comply with air quality standards and suspending fire hydrant flushing and testing except when required for completion and acceptance of a newly constructed water systems or to support public health and safety.

- Provide public education materials to increase awareness about water supply conditions, mandatory restrictions under Stage 1, and inform the public that worsening conditions may lead to more restrictive stages. Recommend hospitality and recreation-based establishments help communicate about water smart uses.
- Increases in water rates for tiers three (3) and four (4), shall be imposed as mandated by the City of Aspen City Manager up to the maximum rates defined in Municipal Code Section 25.28.

6.3 STAGE 2: SEVERE

Under Stage 2 conditions, Aspen will work to keep trees, shrubs, vegetable and flower gardens, and lawns alive but will limit outdoor water use and nonessential uses. Aspen will emphasize wise water use practices through public education and outreach and eliminate wasteful water use and target reduction of excessive water use. Surcharges and rate increases will be implemented to further support conservation and to provide revenue stabilization. The City will advance demand reductions in lower-priority water uses. The response measures listed in this section assume that any restrictions required under Stage 1 will continue unless more strict response measures are specified under Stage 2.

Common Indicators:

- Local watershed characteristics including snowpack, precipitation, streamflow, temperature, and soil moisture indicate severely dry conditions.
- Below-average snowpack conditions during winter months with projections indicating conditions will not improve.
- Below-average streamflow starting late-spring through fall with projections indicating conditions will not improve.
- Above-average temperatures during all months with projections indicating conditions will not improve.
- Other water providers in the Roaring Fork Basin are actively responding to water shortage conditions.
- Strong indication that local conditions will continue to deteriorate in coming months.
- Colorado Drought Plan activated for Pitkin County.
- Aspen treated demands projected to exceed available supplies without further demand reduction, unless decreed instream flows are depleted, especially in mid to late summer.

Common Response Measures:

- Irrigation of existing lawns limited to 2 days/week based on customer address. The City may specify days of the week to certain customer classes (e.g. single family versus others) to help focus field monitoring and identify larger water uses.
- Irrigation of existing flowers, vegetable gardens, shrubs and trees using overhead irrigation systems limited to 2 days/week; watering by hand, drip, or subsurface irrigation any day.
- There shall be no new public or private landscaping installations allowed with the exception of that required as a minimum for erosion control of disturbed surfaces as determined by the City.
- Watering of golf courses and parks shall be managed to achieve the target reduction in water use based on type of specified water and delivery mechanism.
- There shall be no filling or refilling of single-family residential swimming pools with water provided by the City. Operation of other swimming pools is permitted.

- There shall be no operation of existing outdoor fountains, waterfalls, or refilling of ponds. No new water features allowed.
- There shall be no noncommercial washing of privately-owned cars, other motor vehicles, trailers or boats, except from a bucket and except that a hose equipped with a positive shut-off nozzle may be used for a quick rinse.
- No new or expanded water connections shall be authorized; however, existing authorizations shall be honored, provided, however, that this shall not apply to emergency situations in which a well user's indoor-use well has run dry.
- Dust control and construction water allowed on a case-by-case basis.
- Except for fighting fire, there shall be no use of water from a fire hydrant or specially designated loading hydrant for human consumption or for use in connection with animals, street washing or construction water supply. Hydrant draft permits for any of the foregoing uses shall be suspended for the duration of the Stage 2 designation.
- Aspen will take the following actions: increase media briefings and coverage with specific messages; increase monitoring and send reminders to top 10% water users; establish a water waste hotline/web address; create a pledge program for community leaders (businesses) to take steps toward smart water usage and conservation within their organizations; ask to display drought messaging signs.
- Surcharges may be imposed.

6.4 STAGE 3: EXTREME

Under Stage 3 conditions, Aspen will work to sustain mature trees to the extent possible but recognizes that there may be a major loss of lawns, gardens, some trees, and some shrubs. Most low-priority water use, including many of the outdoor water use and non-essential uses listed in Table 2 under Priority Numbers 4 through 7, will be eliminated. The City will operate an aggressive public education and outreach program and will eliminate wasteful water use and excessive water use. Surcharges and rate increases will be implemented to further encourage conservation and to support revenue stabilization. Under an extreme condition, the City may pursue supply-side response measures including operating its physically available senior water rights to divert water even though they deplete the decreed instream flow. This will occur only when public health and safety is at risk. These response measures are considered to be subsidiary and may have legal or water quality implications that will be further investigated. The response measures listed in this section assume that any restrictions required under Stage 1 and 2 will continue unless more strict response measures are specified under Stage 3.

Common Indicators:

- Local watershed characteristics including snowpack, precipitation, streamflow, temperature, and soil moisture indicate prolonged, extremely dry conditions.
- Well below-average snowpack conditions during winter months with projections indicating conditions will deteriorate.
- Well below-average streamflow starting late-spring through fall with projections indicating conditions will deteriorate.
- Above-average temperatures during all months with projections indicating conditions will deteriorate.
- Other water providers in the Roaring Fork Basin and Colorado River Basin are actively responding to extreme water shortage conditions.

- Strong indication that local conditions will continue to deteriorate in coming months.
- Colorado Drought Plan activated for Pitkin County.
- Aspen treated demands projected to require diversion of senior rights that will reduce decreed instream flows, or, in a worst-case scenario, exceed available supplies under decreed municipal rights, especially in mid to late summer.

Common Response Measures:

- Irrigation of existing lawns limited to 1 day/week based on customer address.
- Irrigation of existing flowers, vegetable gardens, shrubs and trees limited to 1 days/week and watering only allowed by hand, drip, or subsurface irrigation.
- There shall be no new landscaping installation allowed.
- Athletic fields, trees, and golf course greens irrigated by mandatory schedule or water budget only. There shall be no daytime irrigation. This will influence both potable and raw supply reductions.
- There shall be no filling or refilling of swimming pools.
- There shall be no filling or refilling of water features.
- There shall be no car washing.
- There shall be no new or expanded water connections authorized; however, existing authorizations shall be honored provided, however, that this shall not apply to emergency situations in which a well user's indoor-use well has run dry.
- There shall be no water used for dust control, except pursuant to authorization from the City or Pitkin County Environmental Health Department and only to the extent necessary to comply with air quality standards.
- Hydrants allowed for fighting fire only.
- Increase frequency of public outreach.
- Surcharges may be imposed.

6.5 Emergency Response: Exceptional

Emergency conditions are highly unlikely but require prioritizing essential uses. Long-term loss of landscape should be expected and indoor uses may be restricted. The response measures listed in this section assume that any restrictions required under Stages 1 through 3 will continue unless more strict response measures are specified under the Emergency Response. Under an emergency response condition, the City may pursue supply-side response measures including operating its senior water rights to divert water, even though they deplete the decreed instream flow, and reducing diversion of the City's raw water irrigation rights. This will occur only when public health and safety is at risk.

Common Indicators:

- Local watershed characteristics including snowpack, precipitation, streamflow, temperature, and soil moisture indicate prolonged, exceptionally dry conditions.
- Significantly below-average snowpack conditions during winter months with projections indicating conditions will deteriorate.
- Significantly below-average streamflow starting late-spring through fall with projections indicating conditions will deteriorate.

- Significantly above-average temperatures during all months with projections indicating conditions will deteriorate.
- Other water providers in the Roaring Fork Basin and Colorado River Basin are actively responding to extreme water shortage conditions.
- Indication that prolonged, extremely poor local hydrologic and climatic conditions will continue.
- Drought indicators predicting exceptional drought levels statewide.
- Colorado Drought Plan activated for Pitkin County.

Common Response Measures:

- Irrigation of lawns or plant material not allowed, except trees and shrubs may be watered by hand no more than 1 day/week.
- Irrigation of golf courses and parks not allowed. This will influence both potable and raw supply reductions.
- There shall be no new or expanded water connections.
- There shall be no dust control or construction water.
- Hydrants allowed for fighting fire only.
- There shall be no irrigation of public facilities.
- Consider supply-side response measures including diversion of senior water rights that will deplete instream flows if necessary to protect public health and safety.
- Surcharges may be imposed.

7. IMPLEMENTATION

7.1 WATER SHORTAGE DECLARATIONS

The City's Municipal Code provides authority for implementing and enforcing staged responses during a water shortage and requires City Council approval to declare and advance drought stages. Likewise, City Council approval is required to de-escalate drought stages and to rescind restrictions with the lifting of any drought status. As described in Section 25.28 of the City's Municipal Code, when the City Council passes a resolution declaring water shortage and stage, it will direct the City Manager to promulgate and enforce Rules and Regulations that define response measures to be implemented under the particular water shortage circumstances. The City Manager and supporting staff will utilize the DMRP framework for selecting the specific set of response measures to include in the Rules and Regulations.

Aspen's Utilities Department is primarily responsible for ongoing monitoring of drought indicators and for providing recommendations to City Council on drought stage declaration. The DRC will typically meet each February or March to review water supply and demand conditions and projections that are prepared by Utilities staff based on monitoring data. Upon anticipation of a water shortage declaration related to drought conditions, the DRC will increase its drought monitoring efforts and determine the frequency of meetings needed. Monitoring data along with professional judgment and historical experience will support staff recommendations for stage declaration and adjustments to the response program, which are ultimately presented to City Council for discussion and approval. Because certain water sources may be more or less impacted than other sources during a drought, drought response measures will be developed based on a review of the specific conditions. The DRC Communications representative will lead

public drought communication efforts and will rely upon the DRC for recommended content and messaging strategies.

Timing of drought stage declaration is very important for Aspen to allow ample time for staff to implement and engage the public in the staged response program. If a water shortage declaration does not occur with enough lead time for implementation and response effects to be achieved, decreed instream flows may be depleted and demands may exceed supplies, resulting in emergency situations. Public response lead time is a crucial consideration, as many customers are not full-time residents and may not initially be engaged enough to quickly react to an early water shortage declaration. This also highlights the importance of fostering an ongoing and engaged efficiency culture. Conversely, declaring a water shortage or advancing a drought stage prematurely can result in unnecessary restrictions, impacting community confidence as well as City revenue.

7.2 DROUGHT PUBLIC INFORMATION CAMPAIGN

A primary discussion topic during the DRC meetings was the need for a more formal communications plan providing ongoing education, messaging, and customer support before, during, and after a drought. The City recognizes that providing public information and maintaining its working relationship with customers are critical to the success of any water shortage response program. In order to encourage a positive response from customers, the City needs to communicate with customers about water supply conditions and the reasons for potential implementation of mandatory restrictions. Public response is more successful when customers are educated about local water supplies. A primary communications challenge with the City's customer base is that while many of the full-time residents are engaged and informed on local conditions, the majority of customers served during peak periods are seasonal residents or visitors who are less informed about and engaged with local conditions. Examples of potential messaging challenges that were identified by the DRC and will be further addressed in its ongoing education campaign include:

- The Roaring Fork River flows provide a visual indicator of water supply conditions to the public. However, flows in the Roaring Fork River may or may not correlate to Aspen's water supply conditions in the Castle Creek and Maroon Creek watersheds. Therefore, it is important for the City to continuously educate the public about where their water comes from and the conditions that pertain to Aspen's water supply.
- Public/athletic fields and parks may be allowed watering exceptions during some water shortage conditions. This is fairly standard practice for municipal uses but necessitates communication with the public to message the policy.
- Some properties are supplied by raw water for irrigation. Colorado water law, the customers' raw water contracts, and City policies may influence different water management criteria for these supplies during certain water shortage conditions. Therefore, it is important for the City to educate the public about how different types of water supplies may be affected under water shortage conditions.

The DRC acknowledged that a consistent customer outreach and messaging program could help support future drought responses, an engaged efficiency culture, and other planning efforts. The public drought campaign will be closely coordinated and developed with the City's current conservation and efficiency

education programs as well as other planning efforts underway for the City's Integrated Resource Plan development. The drought campaign will be adapted in each of the following phases:

1. *Normal Conditions:* Aspen's outreach will focus on consistent messaging to support conservation and efficiency efforts and to communicate local conditions including "where our water comes from", typical Roaring Fork Basin hydrology, general climate conditions, and how efficient water use helps reduce municipal streamflow diversions thereby leaving more water in the streams. Outreach will occur at regular intervals and will maintain consistency with other local areas including messaging provided by the Roaring Fork Conservancy. Information on local projects or programs will be integrated as appropriate. This messaging will be ongoing and will occur at all times outside of drought or water shortage conditions.
2. *Active Drought Conditions*: During this phase, Aspen will increase messaging frequency to communicate anticipated drought conditions and associated response measures. This will begin prior to initiation of a water shortage declaration, when monitoring data indicate potential drought conditions. Messaging will be focused on hydrologic conditions and the implementation of the staged drought program. As drought stages are advanced, messaging will focus on mandatory water restrictions, the City's responses, and progressing conditions. This messaging will continue through the duration of the drought.
3. *Post-Drought Reflection*: This phase will occur after all drought restrictions and declarations have been lifted or restrictions have been reduced. Aspen will provide a look-back at the drought impacts and response measures. Aspen may request targeted feedback on impacts from residents and local businesses at this time to evaluate the effectiveness of program implementation and outreach strategies. This information will be used to prepare for and ideally mitigate impacts from future droughts and, as warranted, make updates to this plan and the Municipal Code.

7.3 ENFORCEMENT

The City's Municipal Code provides the Utilities Department, in concurrence with the City Manager, the authority to enforce the response measures described in the Rules and Regulations governing the water shortage declaration. Education and outreach are utilized to promote efficient water use and inform customers about expectations in all drought stages. Warnings, citations, fines, and, in the most extreme cases, installation of flow restrictors inhibiting water use or terminating service altogether are common drought response program enforcement mechanisms. Municipal Code Section 25.08.040 provides the City Manager, Superintendent, or other designated official authority to inspect any premises where water from the City is used to determine if water is being wasted. The City can issue fines for violations and disconnect water service for repeat violations. Upon first violation, the owner or occupant will be issued a written warning. Upon further violations within the water shortage declaration period at the same premises, the owner or occupant will be advised in writing and a penalty charge will be added to the water bill in accordance with Section 25.28 of the Municipal Code.

The Director of Utilities and Utilities staff will be responsible for administering the enforcement of the staged drought response program and ensuring that the messaging associated with the enforcement are appropriate and reflective of the drought program. Utilities will need to work with the Finance Department to issue fines through water billings and to record and manage citations and associated fines. The City may consider hiring seasonal monitors to patrol and report excess or wasteful water use during periods of drought. It is anticipated that the City will also utilize its advanced metering infrastructure in the future to evaluate customers' water use during water shortage declarations.

7.4 REVENUE IMPLICATIONS AND FINANCIAL BUDGETING PLAN

A reduction in water use due to drought restrictions will result in reduced water sales and revenue. The City's Municipal Code Section 25.28 defines billing surcharges through drought stages. Surcharges are intended to offset revenue reductions during a water shortage, at least in-part. The City Manager determines the necessary rate changes and Utilities staff will work with the Billing Department to monitor water use and revenue, making recommendations to City Council to adjust surcharges as needed to offset revenue loss impacts. Additional costs associated with the implementation of the staged drought response program including the public drought campaign and enforcement may also have revenue implications. At the onset of a water shortage declaration, Utilities and Finance staff will develop a cost estimate associated with the implementation and enforcement of the drought response program under the given circumstances. Internal funding will be identified, and any additional funding needs will be pursued through available drought-related loans, grants, etc.

7.5 MONITORING OF PLAN EFFECTIVENESS

The City plans to monitor the effectiveness of this plan through ongoing and post-drought evaluations. Ongoing monitoring will be conducted in conjunction with the City's active review of water efficiency activities. An annual DRC meeting will be held in February or March to reflect on prior year observations and activities, review current monitoring data, and discuss anticipated watershed conditions and characteristics for the coming irrigation season. Depending on anticipated conditions, the DRC will either plan for increased monthly meetings in preparation for potential water shortage declaration or will focus discussions solely on ongoing planning efforts and review. The following monitoring data will be collected and presented at this DRC meeting by the appropriate committee members:

- Municipal water demands
- Drought indicator data
- Lessons learned or recommended modifications to the program
- Drought mitigation measures, specifically water efficiency efforts and programs
- Public outreach and information campaign status

This monitoring supports an assessment of the staged drought response program's effectiveness and allows the City to adjust mitigation and response programs as appropriate. It also facilitates recommendations for plan updates and improvements.

7.6 PLAN APPROVAL

Aspen's DMRP was approved and adopted by City Council on July 28, 2020 by Resolution #062.

7.7 FUTURE UPDATES

This plan may be updated to reflect modified operational conditions or as new water supplies and operational management components such as storage, potable-use wells, and non-potable reuse become available. The City is in the process of developing an IRP which will evaluate the City's supply status and future municipal demands. This plan will be reviewed and revised as necessary based on findings from the

IRP efforts. This plan may also be updated as needed based on plan monitoring and lessons learned as the City implements the staged drought response plan as described herein.

8. REFERENCES

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Conditions Map: NOAA Colorado Basin River Forecast Center Website. https://www.cbrfc.noaa.gov/

CWCB 2018: Colorado Drought Mitigation and Response Plan. Prepared for Colorado Water Conservation Board by Wood Environment & Infrastructure Solutions Inc in Coordination with the Drought Mitigation and Response Planning Committee and the National Drought Mitigation Center. August 2018.

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United States Drought Monitor: United States Drought Monitor Map Website. https://droughtmonitor.unl.edu/CurrentMap.aspx.

USGS Streamflow: USGS National Water Information System Site Inventory for Colorado Website. https://waterdata.usgs.gov/co/nwis/inventory.

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