

**Final Copy as Approved on 6/29/11
With Changes**

RULE RELATED TO DECLARING AND REMOVING A DROUGHT ALERT AND ADDRESSING RESPONSES TO A DROUGHT OR POTENTIAL DROUGHT, THE CITY MANAGER MAY DECLARE.

1. Authority.

This rule is issued pursuant to Chapter 1-4, Rulemaking, and Sections 11-1-3, "Rules and Regulations," 11-1-27, "Water Restrictions in Case of Emergency," 11-1-48, "Declaring and Removing a Drought Alert Stage," 11-1-49, "Drought Response Measures," and 11-1-51, "Enforcement of Drought Response Measures", B.R.C. 1981 related to declaring and removing a drought alert stage and addressing necessary responses to a drought or potential drought. Under sections 11-1-48 and 11-1-49, B.R.C. 1981, the city manager may, depending on the severity of the drought and the declared Drought Alert Stage, impose drought response measures after twenty-four hours' public notice. The manager will determine the extent and duration of any drought response measures implemented.

In issuing this rule, the city manager has considered relevant factors, including:

- (1) Boulder's projected mountain storage during the ensuing May through June period based on snowpack measurements and the projected resulting streamflows during the spring runoff period;
- (2) Boulder's portion of water projected to be available in Colorado Big Thompson Storage Reservoirs during the ensuing May through June period;
- (3) Boulder's unrestrained water demand;
- (4) Other appropriate data and operating experience; and
- (5) Conservation responses to each Drought Alert Stage.

2. Purpose and Applicability.

The City of Boulder has adopted a Drought Plan that provides a framework for addressing droughts. The Drought Plan consists of two volumes that complement each other. Volume I is the *Drought Planning and Response Plan*, which includes a categorization of drought levels according to severity, and a summary of response measures that might be taken to respond to each drought alert level. Volume II is the *Drought Technical Information and Analysis* that provides the supporting documentation for the *Drought Planning and Response Plan*. Volume II contains the detailed background information and analysis behind the development of the drought response actions, the assessment of Boulder's water supply system, and implementation of the drought response plan.

The Boulder Revised Code (B.R.C.) authorizes the city manager to declare and remove a drought alert stage as well as to address necessary responses to a drought. The Drought Plan provides guidance for recognizing droughts that limit the city's available water supply and for responding suitably to these droughts. These rules and regulations provide the specific details that the city manager, in consultation with City Council, may use to declare and remove a drought alert stage as well as to guide an appropriate response to a drought event. Climate change or other unknown

factors may affect the implementation of these rules and regulations and therefore, conditions and the associated response may be different than currently anticipated.

The purposes of this rule are to:

- 1) Preserve and allocate water to protect the public health, safety, and welfare and to ensure an adequate amount of water supply for each particular water year, plus a reasonable amount of water reserved for future years;
- 2) Establish methodology used to inform the decision to declare and remove a drought alert stage in conjunction with other appropriate data and operating experience; and
- 3) Outline drought response measures to result in the necessary levels of water use reduction, promote the efficient use of water, support community goals, reflect the value of water, and avoid or minimize the costs of new water development and expanded water treatment.

3. Definitions and Abbreviations.

"Administrative Charges" means a financial penalty imposed under Section 11-1-51, "Enforcement of Drought Response Measures", B.R.C. 1981.

"AMU" means average monthly use.

"CBT" means Colorado-Big Thompson system. The CBT system is a water supply project owned by the Bureau of Reclamation and operated by the Northern Colorado Water Conservancy District. The system brings water from the western slope to northeastern Colorado to serve as a supplemental water supply to native basin supplies.

"CII" means Commercial/Industrial/Institutional customer account.

"Drought Stage" means the severity of the drought. There are four drought stages that include: Stage I - Moderate, Stage II - Serious, Stage III - Severe, and Stage IV - Extreme.

"ET" means evapotranspiration (also, see ET rate).

"ET rate" means the amount of water that vegetation will use through the natural processes of surface evaporation and plant transpiration (loss of water through the leaves) in an average year. The average annual minimum ET rate for a healthy bluegrass lawn less the average annual local precipitation is the basis for the annual application rate of 15 gallons per square foot (gpsf) used for calculating a city water customer's outdoor water budget. For single-family residential customers with more than 5,000 square feet of irrigable area, reduced ET rates are assumed for the areas in excess of 5,000 square feet to encourage use of grass types with lower water needs and xeriscaping for larger irrigable areas. The percentages for distribution of the annual ET rate in non-drought years are shown by month in the Table I. (Also see "Monthly Water Budget").

Table I: Monthly Percentage for Distribution of Annual ET Rate in Non-Drought Years

Month	Percent of Annual ET Rate
January	0%
February	0%
March	1%
April	7%
May	14%
June	20%
July	20%
August	18%
September	12%
October	7%
November	1%
December	0%
Total	100%

“GPSF” means gallons per square foot.

“HMU” means historical monthly use.

“Irrigable area” means the area (in square feet) that a customer is required to maintain pursuant to Title 6, Title 8 and Title 9, B.R.C. 1981, is not covered by a hard surface (such as a roof, driveway, patio or sidewalk) and that may require outdoor watering.

“MFR” means multifamily residential customer account.

“Monthly Water Budget” has the same meaning as given in Section 4-20-25 “Monthly Water User Charges”, B.R.C. 1981, which is the amount of water allocated to the water utility customers to meet their anticipated watering needs for the month. The monthly water budget shall be the indoor and/or outdoor allocation for each water utility customer. The allocation shall be based on reasonable and necessary indoor and/or outdoor use, water conservation, and other relevant factors associated with water use in the City. The allocations shall be defined by rules and guidelines issued by the city manager.

“SFR” means single-family residential customer account.

4. Declaring and Removing a Drought Stage

The city monitors the snowpack levels in its Silver Lake Watershed beginning in February of each year, but the most appropriate time for final identification and classification of drought status and for planning drought responses is late April to early May. During this timeframe, knowledge of the expected maximum spring snowpack accumulation provides a relatively high degree of confidence regarding the amount of runoff that will occur and information about local soil moisture levels allows projections of expected water rights call patterns. In addition, the amount of water that Boulder will have available for the year from the Colorado-Big Thompson

(CBT) system is known. Demands can be projected for the year based on the irrigation season that still lies ahead.

Droughts can be categorized into four stages depending on the level of severity. Drought triggers corresponding to each drought stage were developed through modeling studies of the city's water supply system and are described in more detail in Volume II of the Drought Plan (*Drought Technical Information and Analysis*). The drought triggers reflect the city water supply storage levels that likely require an active drought response by the city to avoid threatening the reliability of the city's water supply and to avoid serious water supply shortages. The determination of the drought trigger values and the associated water use reduction percentages for each drought stage was based on the drought response values necessary to achieve the city's adopted water system reliability criteria throughout a modeled 300-year period of reconstructed historic streamflow. The drought triggers are intended to be used only as a guideline and in conjunction with other appropriate data and operating experience. The over-riding goal of achieving the city's water system reliability criteria should be kept foremost when evaluating the drought response suggested by the drought response triggers.

The drought triggers that the city manager will consider incorporate three main quantitative factors that have a large effect on the city's ability to provide a reliable water supply:

- Boulder's projected mountain storage during the ensuing May-June period based on snowpack measurements and the projected resulting streamflows during the spring runoff period. The potential for senior calls from the Platte River water users could affect the ability of the City of Boulder to store spring runoff.
- Boulder's portion of water projected to be available in CBT reservoirs following the ensuing May-June reservoir filling period.
- Boulder's unrestrained water demand, which is the average of Boulder's treated water demand from May 1 to April 30 of the previous two non-drought years.

The triggers illustrated in Table II incorporate all three of the factors listed above. Boulder's portion of CBT storage is discounted by 40 percent because of the multi-year carryover function of this supply and the methodology used to set the annual CBT quota for water deliveries. The trigger values presented in the table were calculated based on May 1 water supply conditions and projections of maximum expected reservoir levels reached during spring snowmelt. It may be appropriate to recalculate and confirm the Drought Alert Stage once the spring snowmelt period ends. The drought trigger values are not appropriately applied to water storage levels at any other time than the maximum spring filling of the reservoir.

The drought triggers were derived from sophisticated water system modeling, but still cannot reflect all of the real-world conditions that may affect a decision to declare or remove a Drought Alert Stage. Other factors to consider might include soil moisture levels, rate of snowpack dissipation, streamflow response to snowmelt, pattern of water rights calls from Boulder Creek and the South Platte basins, state water administration issues, city water system operational constraints, the degree to which current unrestrained water demands approach projected build-out water demand levels, the exercise of drought reservation clauses in city contracts such as for the instream flow program, or any other factor that may be affecting either water supply or water demand during the drought period.

Table II: Suggested drought response triggers for May 1

Projected Storage Index ⁽¹⁾	Drought Alert Stage
Greater than 0.85	None
Between 0.85 and 0.7	I
Between 0.7 and 0.55	II
Between 0.55 and 0.4	III
Less than 0.4	IV

⁽¹⁾Projected storage index = (projected usable Boulder mountain storage + 40% of Boulder's portion of projected CBT storage) / Boulder's unrestrained water demand in non-drought years.

When deciding to declare a drought alert stage, at a minimum, the city manager will consider the three main quantitative factors listed earlier, as incorporated into the Projected Storage Index calculation, along with all other appropriate data and factors unique to the particular drought. Once a drought alert stage has been declared, the city manager will continue to monitor trends in snowpack, runoff conditions, reservoir filling and customer usage in order to determine if conditions change.

Each of the drought stages is associated with a certain level of reduction in Boulder's overall water use (see Table III) that is required to maintain the ability to supply enough water for Boulder's most important water needs until the drought is over. Achieving the total annual water use reduction goals is the overarching purpose of drought response efforts. The water use reduction goals associated with each drought stage were developed in conjunction with the drought response triggers through modeling studies of the city's water supply system, as described in Volume II of the Drought Plan (*Drought Technical Information and Analysis*). These goals may change with revised modeling or unexpected changes in water yields or demands projected for Boulder's build-out. The total annual water use reduction goals include reductions in both indoor and outdoor water use and represent the required percentage of reduction that must be achieved for the entire year to assure sufficient water supplies remain in storage to last through the drought.

Table III: Drought Stages and Annual Water Use Reduction Goals

Drought Alert Stage	Total Annual Water Use Reduction Levels
I	8%
II	14%
III	22%
IV	40%

The city manager will monitor changing water supply conditions and the results of drought response measures throughout the year, especially in June when the spring snowmelt is typically concluded and in the fall to evaluate the degree to which water use reduction goals have been achieved after the highest use season (irrigation in the summer). Due to the city's annual water supply being directly dependent on spring snowmelt, the decision to officially lift a Drought Alert Stage will not be made until the following spring (April/May timeframe). Although changes in water demand during the year will not affect the city's water supply availability sufficiently to remove a Drought Alert Stage declaration until the following spring, larger than expected water use reductions might be cause for an easing of the severity of drought response measures prior to the next spring snowmelt period. For instance, if city-wide water use is reduced sufficiently at some point during the year so that the annual water use reduction goals are achieved early, then the need for drought response measures will be reevaluated and may be reduced by the city manager. A Drought Alert Stage will remain in effect until the following spring, though it may be lessened. Once drought conditions have completely ended, as determined based on restoration of full city water supplies following spring snowmelt, the city will remove the drought stage declaration and will fully restore monthly water budgets, remove surcharges, and remove administrative charges for certain types of water use.

5. Strategies to Decrease Water Demand during a Drought

Response options: Some of the ways to decrease water use include reducing monthly water budgets, extensive drought-focused education efforts, adding drought surcharges, and implementing mandatory water use limitation. These response options would be considered at each of the four stages of the drought. The response options that are selected for implementation during any drought are those most likely to result in the reduction of annual water use levels for a drought. The city manager will monitor the results of the selected response options and adjust the type or stringency of response measures as required.

When monthly water budget reductions, surcharges and limitations are all used together, it is more likely customers will remain within their monthly water budget and that the burden of water shortages will be more fairly shared across all segments of the community. If drought conditions persist over an extended period of time (multi-year drought), then it may be necessary to implement a higher level response to sustain the required reductions; therefore, both the severity of the drought and the duration over which the drought is experienced will determine the appropriate response.

(a) Monthly Water Budget Reductions

The amount of monthly water budget reductions would be determined by the city manager, in consultation with City Council. Reductions in water budgets create a price incentive to decrease water use by moving a portion of the non-drought water budget amount into a more expensive rate block. The reduced monthly water budget amounts shown in Tables IV, V, and VI are based on current modeling and calculations, as documented in the *Drought Planning and Response Plan* (see Table 2, page six of the plan). If any of the conditions included in the current modeling change significantly, then customer monthly water budget reduction amounts may need to be revised in the future. These conditions might include any changes in water use patterns, such as

indoor/outdoor distribution or relative proportions of water use for each customer class, or revision of the annual water use reduction goals.

Table IV illustrates the monthly water budgets for the indoor allocation for residential accounts for each drought stage and for non-drought periods. Table V shows the percentage of the annual outdoor monthly water budget allocation to be applied in each month for the outdoor component of residential and indoor/outdoor commercial accounts and for all irrigation-only accounts in both non-drought and drought years. Monthly outdoor allocations for residential, indoor/outdoor commercial and irrigation-only accounts are calculated using the customer-specific irrigable area multiplied by the application rates set forth below and then allocated over the irrigation season using the appropriate monthly percentages set forth in Table V.

Non-drought year single-family residential outdoor allocations are calculated based on the following application rates:

- For the first 5,000 square feet of irrigable area: 15 gpf
- For the next 9,000 square feet of irrigable area: 12 gpf
- For irrigable area in excess of 14,000 square feet: 10 gpf

Non-drought year multi-family residential and all other outdoor allocations are calculated based on an application rate of 15 gpf for all irrigable area.

In order to reflect varying seasonal outdoor monthly watering requirements, the total annual allocation of water for irrigable area is distributed to each month based upon that month's percentage of the annual outdoor amount as described by the historic monthly distribution of the annual ET rate (Table I). Using the customer-specific monthly water budget allocation and the ET rate, the response for each drought stage can be defined as reductions to the monthly distribution percentages for the ET rates used for outdoor monthly water budget calculations.

Table IV: Suggested Monthly Water Budgets for Residential Indoor Allocation

Residential Indoor Use Monthly Water Budget	Non-Drought Year	Stage I Drought	Stage II Drought	Stage III Drought	Stage IV Drought
SFR gallons/month	7,000	6,400	6,300	6,200	6,000
MFR gallons/month	4,000	3,600	3,600	3,500	3,400

Table V: Suggested Monthly Percentages for Allocation of Annual Outdoor Water Budgets for Residential, Irrigation-Only, and Indoor/Outdoor CII Accounts (shown as a percentage of the total annual outdoor allocation allowed in non-drought years based on gpsf of irrigable area)

	Non-Drought Year	Stage I Drought	Stage II Drought	Stage III Drought	Stage IV Drought
Jan	0%	0%	0%	0%	0%
Feb	0%	0%	0%	0%	0%
Mar	1%	1%	1%	1%	1%
Apr	7%	7%	7%	7%	6%
May	14%	13%	13%	11%	8%
Jun	20%	19%	18%	17%	10%
Jul	20%	16%	14%	12%	7%
Aug	18%	12%	10%	9%	5%
Sep	12%	8%	6%	4%	1%
Oct	7%	2%	0%	0%	0%
Nov	1%	0%	0%	0%	0%
Dec	0%	0%	0%	0%	0%
Total	100%	78%	69%	61%	38%

CII has four sub-customer classes: 1) CII AMU; 2) CII HMU; 3) CII indoor/outdoor; and, 4) CII efficiency standard with and without irrigation. The method used to calculate the monthly water budget for each of these sub-customer classes is described in the Rules and Regulations: Water Budget Methodology 11-1-3.A(09). Monthly water budgets for the CII sub-classes HMU and AMU will be reduced as illustrated in Table VI. The outdoor use component of monthly water budgets for the CII indoor/outdoor sub-class and the CII efficiency standard with irrigation will reflect the monthly water budgets as illustrated in Table V. The CII efficiency standard without irrigation will reduce their budgets based on the overall goals for water use reduction for the entire city as illustrated in Table VI.

Table VI: Suggested Annual Water Budget Reductions for CII Sub-Classes: HMU, AMU, & Efficiency

	STAGE I	STAGE II	STAGE III	STAGE IV
CII HMU & AMU	13%	23%	34%	50%
CII Efficiency Standard w/o irrig	8%	14%	22%	40%

(b) Surcharges and Rates

Drought surcharges would be used by the city manager to encourage a reduction in water use. A drought surcharge is a multiplier applied to the normal charges (standard block rates) for water. During a drought, surcharges would be applied to normal water charges in blocks 3, 4, and 5. The city manager may implement drought surcharges based on Table VII, which was derived from modeling of the current water rate structure and price elasticities for the purpose of achieving the water use reduction goals necessary at each drought stage. If during the course of a drought event, the suggested drought surcharge rates do not support the intended result of achieving the necessary water use reduction goals appropriate for the declared drought stage, the City Manager, in consultation with City Council, may modify the surcharge rates.

In addition, with approval by City Council through an ordinance, the city may adjust the standard water block rates that existed prior to the drought stage declaration. This may be necessary to maintain revenue stability for the water utility during a drought.

Table VII: Surcharge Rates for each Drought Stage

Surcharge Rates (amount x base)					
	Non-Drought Rate	Stage I Drought	Stage II Drought	Stage III Drought	Stage IV Drought
Block 1	¾ x base	¾ x base	¾ x base	¾ x base	¾ x base
Block 2	Base	Base	Base	Base	Base
Block 3	2 x base	2 x base	2 x base	2 x base	3 x base
Block 4	3 x base	3 x base	3 x base	4 x base	4 x base
Block 5	5 x base	5 x base	7 x base	8 x base	8 x base

(c) Water Use Limitations and Penalties for Violations

Mandatory water use limitations may be necessary in more severe droughts to achieve the quick response needed to protect reservoir levels and to assure that the burden of water use reductions are shared by all socio-economic classes. Customers may not feel the impacts of rate-based incentives to use less water until the first water bill is received one month or more after a Drought Stage Alert is declared. In a drought, reservoir levels may be so greatly reduced in this one month period that water use limitations going forward are required to be more stringent than if an immediate response were achieved to the drought declaration. Therefore, quick implementation of mandatory measures during more severe or extreme droughts may reduce the overall severity of drought response measures that are required. For a summary of possible response measures, see Table 3 on page 10 of the *Drought Planning and Response Plan*. The city manager may impose water use limitations and penalties for violating as described in Table VIII or may impose other limitations that are deemed necessary to encourage efficient water use and to protect city water supplies needed for essential purposes.

Table VIII: Possible Penalties for Violating Water Use Limitations Per Drought Stage

Drought Stage	Water Use Limitations	Penalties for Violating Water Use Limitations
Stage I Moderate	Discourage 3 consecutive months of block 5 water use.	Send reminder warning notice to customers who are using block 5 water for 3 consecutive months.
Stage II Serious	Limit of 3 consecutive months of block 5 water use.	If block 5 water use continues for 3 consecutive months, then penalize with administrative charges.* Consider installation of flow restrictors.
Stage III Severe	Limit of 2 consecutive months of block 4 or 5 water use.	Apply administrative charges* following 2 consecutive months of water use in blocks 4 or 5. Consider installation of flow restrictors.
Stage IV Extreme	Limit water use in blocks 3, 4, or 5. Consider moratorium on building permits.	Apply administrative charges* following 1 month of water use in blocks 3, 4 or 5. Consider flow restrictors or, for extreme water waste offenders, termination of water service.

**Administrative charges are per Section 11-1-51, "Enforcement of Drought Response Measures", B.R.C. 1981, which include the following: (1) a \$100 water waste charge; and (2) a \$300 water waste charge. Failure to pay administrative charges may, in turn, trigger water cut off, criminal penalties, or both.*

6. Public Facilities Drought Response Measures.

As part of the development of the Drought Plan, the city held numerous public meetings in order to elicit feedback on responding to drought. The city received extensive public input at these meetings as well as in response to the city's watering restriction program in 2002. The details of the public process and feedback can be found in Volume II. One of the key issues raised in the process was that while maintaining equity between all customers was a good thing, it may be necessary to allow a different watering standard on "public property" than on private property. "Public property" includes those properties that are owned and operated by the government (such as the City of Boulder, University of Colorado, and the Boulder Valley School District properties) for use by residents. These public areas (such as parks and athletic fields) may need to have a higher degree of flexibility for water use than private areas, in order to preserve the ability to use these limited public areas during a drought. However, the public areas still must comply with the overall water reduction objective but they may do so with the flexibility to manage their entire systems. For example, the City of Boulder's Department of Parks and Recreation may use the overall water budget reduction goal as outlined in Table III to reduce irrigation at some lesser-used parks and increase water use on higher-use athletic fields or to

irrigate mature and critical trees. In total, the Parks and Recreation Department will still need to meet the overall water budget reduction goal. This concept can be incorporated into each of the Drought Alert Stages.

7. Exceptions/ Variances to Drought Response Measures.

The City of Boulder may, at its discretion, grant exemptions from the drought response for individual water customers. The city manager may approve exemptions in instances of extreme economic impacts or health and safety issues. Violation of any term or condition of an exemption may result in the variance being revoked after the water customer has an opportunity for a hearing under chapter 1-3, “Quasi-Judicial Hearings,” B.R.C. 1981.

8. Drought Response Measures Example.

The tables below illustrate examples of different customer types and the possible impacts during a Drought Stage II-Serious. Table IX is an example of a SFR customer with 5,000 square feet of irrigable area. If the city declared a Stage II – Serious drought and the city manager implemented the rules and regulations, the example shows the possible impact to a SFR customer depending on which drought response measures were implemented.

Table IX: Example of a Single-Family Residential Customer in Drought Stage II

Drought Response Measures		Non-Drought Year	Stage II Drought
Monthly Water Budget	Monthly Indoor Budget	7,000 gallons	6,300 gallons
	Monthly Outdoor Budget	18% (Aug.)	10% (Aug.)
	Total August Budget	20,500 gallons	13,800 gallons
Surcharges*	Surcharges for Block 5 Water Use	\$14.50 per 1,000 gallons (5 x base rate)	\$20.30 per 1,000 gallons (7 x base rate)
Water Use Limits and Penalties	Water Use Limitations	No limits.	Block 5 water use (3 consecutive months)
	Penalties for Violations	No penalty.	1 st violation = warning notice; 2 nd violation = \$100 water waste charge

**The example uses the 2011 utility rates, in which the base rate is \$2.90.*

Table X is an example of a CII customer that has an average monthly usage (AMU) water budget, which means the budget does not change from month to month. In this example, the CII customer has an annual water budget of 795,000 gallons and a monthly water budget of 67,000 gallons. If the city declared a Stage II – Serious drought and the city manager implemented the rules and regulations, the CII customer’s water budget would be reduced by 23 percent annually.

Table X: Example of a CII Customer (using AMU) in Drought Stage II

Drought Response Measures		Non-Drought Year	Stage II Drought
Monthly Water Budget	Monthly Budget	67,000 gallons	51,012 gallons
	Total Annual Budget	795,000 gallons	612,150 gallons
Surcharges*	Surcharges for Block 5 Water Use	\$14.50 per 1,000 gallons (5 x base rate)	\$20.30 per 1,000 gallons (7 x base rate)
Water Use Limits and Penalties	Water Use Limitations	No limits.	Block 5 water use (3 consecutive months)
	Penalties for Violations	No penalty.	1 st violation = warning notice; 2 nd violation = \$100 water waste charge

**The example uses the 2011 utility rates, in which the base rate is \$2.90.*

Table XI is an example of an irrigation-only customer with 30,500 square feet of irrigable area and an annual water budget of 457,500 gallons. In August, the monthly percentage of allocation for annual outdoor water would normally be 18 percent. If the city declared a Stage II – Serious drought and the city manager implemented the rules and regulations, the example shows the possible impact to an irrigation-only customer depending on which drought response measures were implemented.

Table XI: Example of an Irrigation-Only Customer in Drought Stage II

Drought Response Measures		Non-Drought Year	Stage II Drought
Monthly Water Budget	Monthly (August) Outdoor Budget	82,350 gallons (18%)	31,570 gallons (10%)
	Total Annual Budget	457,500 gallons	315,675 gallons
Surcharges*	Surcharges for Block 5 Water Use	\$14.50 per 1,000 gallons (5 x base rate)	\$20.30 per 1,000 gallons (7 x base rate)
Water Use Limits and Penalties	Water Use Limitations	No limits.	Block 5 water use (3 consecutive months)
	Penalties for Violations	No penalty.	1 st violation = warning notice; 2 nd violation = \$100 water waste charge

**The example uses the 2011 utility rates, in which the base rate is \$2.90.*