

DROUGHT RESPONSE AND CONTINGENCY PLAN

1. Background and Purpose

In 2004, a Rivanna Regional Drought Response Committee was formed to work cooperatively to provide a coordinated response to drought in this community. Members of the Committee include staff representing: Rivanna Water & Sewer Authority (RWSA), Albemarle County Service Authority (ACSA), City of Charlottesville (City), and Albemarle County (County). The two local governments and two authorities all have overlapping responsibilities for public service that are critical to responsive drought management planning for Albemarle County and the City of Charlottesville, and the Committee serves a role in assuring that these efforts are coordinated and synergistic.

The Commonwealth of Virginia, in its Local and Regional Water Supply Planning regulations (9VAC 25-780), has established a planning process and criteria for local governments to use in the development of local or regional water supply plans. These regulations include a component regarding drought response and contingency plans. Communities that withdraw more than 300,000 gallons per month of surface water and groundwater must develop a drought contingency and response plan. This Plan was designed to fulfill these regulatory requirements on behalf of Albemarle County and the City of Charlottesville. A letter of compliance from the VA Department of Water Quality was issued to RWSA in late 2013, which confirmed that the 2008 draft of this Plan complied with the provisions of the Local and Regional Water Supply Planning regulations.

The Commonwealth provides guidance to local governments on appropriate drought responses in the Virginia Drought Assessment and Response Plan (March 28, 2003). This plan identifies the Virginia Drought Monitoring Task Force as having the responsibility for monitoring drought conditions for the Commonwealth and issuing status reports on drought conditions. These reports provide insight to local governments on statewide conditions. It is stated in the Plan that, “While actions on the State level are important for the purpose of alerting localities and citizens of the advance of drought impacts, actions by local governments, individual water suppliers, and individual citizens are much more important and effective in actually addressing the impacts of drought.” It is the intent of this Plan to monitor drought conditions and provide for a call to action that reflects local drought conditions and is specific to the limitations of the local water supply.

This Plan discusses water conservation to be achieved during drought periods, through both the voluntary efforts of the community and mandatory restrictions on water use. While it is desirable that water conservation habits be practiced under all conditions, this plan recognizes that until such time as all citizens are consistently maximizing opportunities to conserve water on a regular basis, higher levels of conservation can be achieved during times of “crisis”, and it is extremely important to communicate both the condition and the opportunities when weather conditions threaten the short-term sustainability of the water supply. As a result, this Plan makes a distinction

between long-term water conservation programs that permanently reduce overall demand at all times, and short-term drought management programs which at least temporarily reduce water use during drought emergencies. Long-term conservation programs include measures implemented continually, regardless of the status of the water supply.

Examples of long-term conservation measures include: public education, conservation-oriented rate structures, conservation water use habits by individuals, low-flow plumbing rebate programs, and leak detection/repair. The long-term conservation programs implemented by the Committee members are expected to result in sustained reduction in future water demands per capita over long periods of time.

Short-term drought management programs include voluntary and mandatory water use restrictions and/or rationing which are implemented in response to the threatened status of the water supply and can result in significant water use reductions during a drought period. Drought management measures include curtailing demand by limiting non-essential uses of water, an example of which is irrigation, and can be as restrictive as water rationing. Drought management programs involving water use restrictions are reserved for periods when indications are present that the area is entering into a drought and as a result, the water supply may become threatened in the near future.

The Rivanna Regional Drought Response Committee takes its role in preparing the community for drought very seriously. The purpose of this drought contingency and response plan is to define a method for predicting and identifying drought conditions, specify drought stages, identify appropriate use restrictions for each drought stage, and clearly define the process of public notification and information dissemination.

This Plan will be reviewed and modified as needed, as the water supply system is modified, water supply operating rules are changed, or additional information and feedback is received which would help to more efficiently operate the system in the event of a drought.

With the recent completion of the expanded Ragged Mountain Dam (September 2014), it is necessary to update the Plan given the new storage and operating rules associated with it.

2. Existing Water Sources

A. General

RWSA provides wholesale drinking water supply and treatment for the ACSA and City as three separate and distinct systems: the Urban Water System, which serves all of the City of Charlottesville and the urban area of Albemarle County that generally surrounds the City; the Crozet Water System, which serves the ACSA water distribution system in and around the Crozet community; and the Scottsville Water System, which serves the ACSA water distribution system for the Town of Scottsville.

In addition to the citizens served by public drinking water systems, Albemarle County encompasses a significant area that is rural in character with residences that receive water through individual on-site wells or privately operated community systems using groundwater. Albemarle County, in its Comprehensive Plan, estimates that there are about 18,500 dwelling units dependent on individual groundwater wells within the County.

During drought conditions, the extent of a threat to the sufficiency of a water supply will depend on the extent to which the demands on a given system are approaching the safe yield of the supply. The condition of the Urban Water System serves as an appropriate assessment for the impact of drought conditions for all systems, because it is the system that is currently closest to approaching its safe yield. It can be extremely difficult to assess the threat to individual on-site wells because their supply during a drought can vary widely depending on well depth and location.

The Rivanna Regional Drought Response Committee agreed that when drought conditions are present it is very important that all governing units (Albemarle County, ACSA, City of Charlottesville, and RWSA) are sending a consistent message to all of the public regarding the critical need for conservation of water. Given the diverse conditions of multiple water sources and the presence of both public water systems and on-site well systems, providing a consistent message requires that monitoring for drought conditions be diverse and prioritized. It also requires that conservation and use restrictions be tailored to the most stressed of the diverse systems that are present.

Since the Urban Water System is being used as the reference system for identifying drought conditions, much of the hydrologic monitoring by RWSA under this Drought Management Plan will be focused on the Urban Water System. However, hydrologic modeling of the Urban Water System will include assessment of open channel stream flows as well as reservoir levels. Stream flows are not only a good indicator of emerging stress on reservoir levels, they are also a good indicator of stress on groundwater recharge that could also impact on-site well conditions.

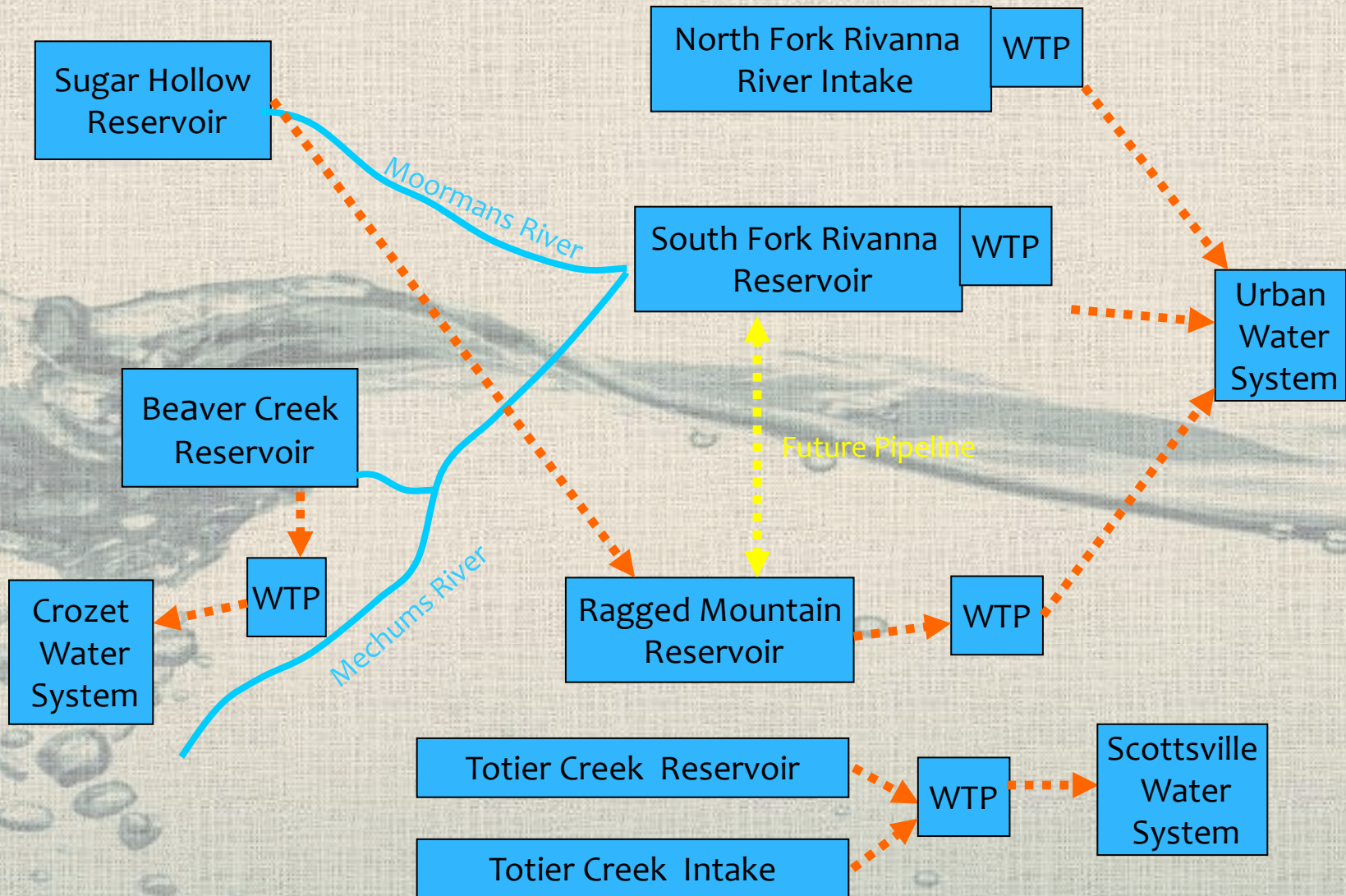
B. Description of Urban Water System

A schematic diagram of the RWSA Urban Water System is presented in Figure 1.

Raw water for the RWSA Urban Service Area is normally supplied from three water supply reservoirs and one river intake. The reservoirs which supply the system include: the South Fork Rivanna Reservoir (SFRR), Sugar Hollow Reservoir (SHR), and the Ragged Mountain Reservoir (RMR). The river intake is located on the North Fork Rivanna River. Summary information on the existing system is presented below.

Finished water for the Urban Water System is supplied from three water treatment plants (WTPs): 1) South Rivanna WTP, 2) Observatory WTP, and 3) North Fork Rivanna WTP. The South Rivanna WTP is served by the South Fork Rivanna Reservoir. Water from Sugar Hollow Reservoir overflows the Sugar Hollow dam and flows into the South Fork

Figure 1 - RWSA Water System Schematic



Rivanna Reservoir via the Moormans River. The Observatory WTP is supplied by water from the Ragged Mountain Reservoir through two parallel 18-inch diameter pipelines. Water from Sugar Hollow Reservoir can also be transferred to Ragged Mountain Reservoir. The North Fork Rivanna WTP treats water pumped from an intake on the North Fork Rivanna River.

South Fork Rivanna Reservoir has the largest drainage area in the system: 259.1 square miles. As part of the permit issued for the development of the Expanded Ragged Mountain Reservoir, regulatory release requirements were developed for the South Fork dam to maintain minimum instream flows for aquatic life, which mimic the natural environment. The minimum instream flow requirement varies based on total useable storage in the reservoir as well as the sum total of all Urban System reservoirs, and natural inflow to the reservoir; when useable storage is available in the South Fork reservoir the minimum release ranges from 70 % of natural inflow or 1.3 mgd, whichever is greater, to 30% of natural inflow or 1.3 mgd, whichever is greater. At no time is total downstream flow in excess of 20 mgd required. If useable storage in the reservoir is exhausted, the lowest intake must be open to pass all flow through the reservoir to the river downstream.

With the expanded Ragged Mountain Reservoir, there is now one dam downstream of where there once were two dams in a series on an unnamed tributary to Moores Creek. The old dams have been breached, so that the new dam acts as the impounding structure for the entire reservoir. The drainage area of the Ragged Mountain Reservoir is 1.8 square miles. The minimum release required from Ragged Mountain Reservoir is 23,800 gallons per day.

Sugar Hollow Reservoir is located on the Moormans River and drains an area 17.5 square miles in size. As is the case with South Fork dam, regulatory release requirements at Sugar Hollow dam also vary based on total system storage, and natural inflow to the reservoir. Releases range from 100% of natural inflow or 10 mgd, whichever is less, when Ragged Mountain useable storage is equal to or greater than 1.08 billion gallons, to 100% of natural inflow, or 2 mgd, whichever is less, when Ragged Mountain useable storage is less than 1.08 billion gallons.

An intake and pump station with a permitted withdrawal capacity of 2.0 million gallons per day (mgd) are also located on the North Fork Rivanna River, which serves the northern section of the Urban Service Area.

C. RWSA Water Supply System Operating Procedures

Operating procedures for the RWSA Urban Service Area are in place to most efficiently utilize the existing raw water resources. Under normal operating conditions, the system is operated to maximize the quality of the water produced at each water treatment plant and to efficiently transport water to the water distribution systems of the Albemarle County Service Authority and the City of Charlottesville.

As drought conditions begin, total system storage decreases. The Sugar Hollow Reservoir will normally stop spilling, followed by the South Fork Rivanna Reservoir. As these conditions occur, RWSA will maximize production at the South Fork Rivanna Water Treatment Plant over the Observatory Water Treatment Plant, while maintaining operating pressures at all delivery points to the City of Charlottesville that do not exceed the reasonable operating limits of the City's system. As a drought becomes more persistent, production at the South Fork Water Treatment Plant will continue to be emphasized, and the drawdown of the Sugar Hollow Reservoir will take priority over the Ragged Mountain Reservoir since the larger watershed area upstream of Sugar Hollow will permit the water supply to recover more quickly when rainfall does occur. Storage in the Ragged Mountain Reservoir will be held as long as possible, except to the extent that the Ragged Mountain Reservoir will be drawn down enough to prevent transfers from Sugar Hollow to cause spillage from the dam.

Further optimization of the Water Supply System Operating Procedures would be possible if the North Rivanna and South Rivanna distribution systems were interconnected and a new pump station were built, and if the South Fork and Observatory water distribution systems were further reinforced by the completion of a transmission main between Pantops and Avon Street (referred to as the "Southern Loop"). The Route 29 Pump Station Site Acquisition is in the currently proposed RWSA Capital Improvement Program for 2015-2019. A location is established for emergency transfer of water between the North Rivanna and South Rivanna systems using portable equipment that will help provide needed service during a drought event.

Supplemental stream flows to the South Fork Rivanna Reservoir will be instituted during drought conditions as defined under Section 3 of this Plan.

3. Emergency Water Sources

A. Beaver Creek Reservoir

Beaver Creek Reservoir is not normally part of the Urban Water System. It is owned by Albemarle County, and RWSA manages it as a source of supply for the Crozet Water System. A safe yield study was completed for Beaver Creek Reservoir in June 2007, which calculated the safe yield of the reservoir as 1.8 mgd. Priority is always placed on meeting the demands of the Crozet Water System. Excess capacity from Beaver Creek Reservoir can then be used to augment the Urban Water System during a drought through in-stream releases from the dam to Beaver Creek, which flow through the Mechums River to the South Fork Rivanna Reservoir.

Releases will occur only when SFRR is not spilling and available water supply storage in SFRR is less than 97% of full pool. In most cases, the drought will have reached a declared "Warning" stage by this time (drought stages are further defined in Section 4 of this Plan). At all times, releases from the Beaver Creek Reservoir to SFRR will be shut off to preserve a water supply equal to 20% of the total water supply storage in Beaver

Creek Reservoir, plus the calculated storage needed to meet the water demands of the Crozet system as hydrologically modeled based on the drought of record.

It is anticipated that a portion of the water released from the dam would be lost as it travels through the streambed to the SFRR. In modeling the system, bed loss of 10% is assumed.

B. Chris Greene Lake

Chris Greene Lake is located on Jacob's Run, which flows to the North Fork Rivanna River upstream of the North Fork Rivanna WTP. Any releases from this lake would flow to the North Fork intake. It is currently used as a recreational facility.

Use of Chris Greene Lake as a water supply alternative was evaluated as part of the *Water Supply Alternatives Supplemental Evaluation* (Gannett Fleming, July 2004). In this study, it was estimated that drawing down the lake by 5 feet would result in an increase in safe yield of the system of 0.5 mgd. Because of the small yield of the alternative, it was not carried further for analysis as a water supply alternative. However, it has been considered for use in an emergency situation. During the 2002 drought, use of Chris Greene Lake as a supplemental source was considered, but never implemented. During the drought, improvements were made to the outlet structures should the need arise to use this lake as a source of supply. Because it is used recreationally, all swimming and contact use of the reservoir would have to be prohibited while it is used for water supply. Notice would be given to the Albemarle County Department of Parks and Recreation prior to any use of the lake for water supply.

B. Lake Albemarle

Lake Albemarle is a recreational lake located on Spring Creek, which flows to the Mechums River. The reservoir is managed by the Virginia Department of Game and Inland Fisheries. Use of Lake Albemarle as a water supply alternative to supplement flows to the SFRR via the Mechums River was evaluated as part of the *Water Supply Alternatives Supplemental Evaluation* (Gannett Fleming, July 2004). Based on this analysis, it was estimated that the system safe yield could be increased by 0.7 mgd. During the 2002 drought, an agreement was reached with the Virginia Department of Game and Inland Fisheries regarding use of Lake Albemarle as an emergency water source. This agreement allowed RWSA to withdraw water from the lake down to 15 vertical feet, when the combined reservoir level of the Urban Service area drops to 30% or less. The Agreement remained in effect until January 1, 2005. While RWSA was poised to use this source if the need arose, the 2002 drought never reached the 30% threshold.

There are several concerns regarding use of Lake Albemarle as an emergency source. There is no outlet structure on the dam to allow release of water downstream. A method of delivering the water to the stream would be required. In addition, it is necessary to

balance recreational uses with water supply needs. There are also water quality concerns and the amount of water delivered to SFRR would be impacted by bed loss. Additional study of these issues and coordination with the Virginia Department of Game and Inland Fisheries will be required in order to determine the practicality of using this source of emergency water supply. This would only be considered under the most extreme conditions.

4. Identifying Drought Conditions

A. OASIS® Hydrologic Computer Model

RWSA has contracted with Hydrologics, Inc., a water resources management consulting firm, to provide real-time probability-based analysis of drought potential specific to the RWSA Urban Water System. Hydrologics uses OASIS® software to analyze statistical probabilities as to the rate at which the water supply levels would diminish, using the historical period of record, current operating procedures, and existing water demand projections. Further, by evaluating the historical period of record for stream flow against the current demand for drinking water, the model can simulate the positive effects of water conservation on preserving water supply during droughts, and through an iterative process, determine at what time intervals it is most appropriate to call on the public for increasingly restrictive water conservation measures. These drought intervals are defined in three components: reservoir elevation, risk factor, and forecast horizon. When one or more of these intervals is reached during an actual drought, a formal declaration to the public is needed in order to activate both the public education measures and the water use restrictions that are necessary to achieve water conservation. This Drought Management Plan defines these time intervals as “Stages” of the drought.

The OASIS model is used to evaluate how well these stages would have worked in past droughts, and this increases the understanding of how well they will work in the future. The stages also provide a margin of safety for the uncertainty of climate change and the potential for more severe droughts in the future as compared to those in the historical record. The model uses a long inflow record to capture as many historic droughts as possible.

Formal public declaration of a change in drought stage for this Plan will be guided by the following:

- Determination by the Commonwealth of Virginia’s Drought Monitoring Task Force that a Watch, Warning, or Emergency condition exists for the Middle James region of Virginia. This is the region that includes Albemarle County and the City of Charlottesville in the Commonwealth’s drought management plan.
- A drought emergency declaration by the Governor of Virginia or the Virginia Drought Coordinator affecting the region of the Commonwealth which includes Albemarle County and the City of Charlottesville.

- Review of data maintained by the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS), and the Virginia State Climatology Office.
- Modeled hydrologic conditions (using OASIS®) predict a probability of a shortage of local water supply as follows:

Drought Watch Stage: 20% or greater probability that total useable reservoir storage will be less than 75% within 12 weeks. 75% total useable reservoir storage is equivalent to 78% of total reservoir storage.

Drought Warning Stage: 10% or greater probability that total useable reservoir storage will be less than 60% of full within 10 weeks. 60% total useable reservoir storage is equivalent to 74% of total reservoir storage.

Drought Emergency Stage: 5% or greater probability that total useable reservoir water storage will be less than 50% of full within 8 weeks. 50% total useable reservoir storage is equivalent to 70% of total reservoir storage.

- Review of streamflow data monitored by the U. S. Geological Survey for the Mechums River gage and the North Fork Rivanna gage.
- Water supply storage stages can also be declared due to unusual events that threaten the available supply of water, such as acute contamination of the water in a reservoir, loss due to a failure causing significant loss of stored water from a dam, or related types of circumstances.

These three stages of drought correspond to the Commonwealth of Virginia Local and Regional Water Supply Planning Regulations. A Drought Watch is issued as a means to increase public awareness that climatic conditions and stream flows are such that there is concern of an impending drought. A Drought Warning is issued when all indications show that the onset of a drought is imminent. A Drought Emergency is issued during a drought as a means of curtailing demand and extending supplies through the duration of the drought.

The OASIS® model is used based on the assumption that the community would be able to achieve a minimum of 5 % demand reduction during the Drought Warning Stage and a minimum of 20% reduction during the Drought Emergency stage. The specific use restrictions that will be implemented to meet the demand reductions are the responsibility of the retail service providers, ACSA and the City, and are discussed in Section 6.

5. Notification of Drought Conditions

When one or more of the conditions specified in Section 4 are met indicating that the local community has reached a Drought Watch stage, the Executive Director will recommend to the RWSA Board of Directors that a Drought Watch be officially declared

for the local water supply. At the time a Drought Watch is declared, the Board of Directors will authorize the Chair of the RWSA Board of Directors in consultation with the RWSA Executive Director, to declare a Drought Warning or a Drought Emergency should drought conditions later reach the levels defined by the guidance in Section 4. RWSA's Executive Director will provide appropriate immediate notification to the City, ACSA, Albemarle County and the news media at any time a new drought stage has been declared by RWSA. At that time, retail providers will activate water use restrictions and other conservation measures as defined under Section 6 of this Plan.

Because the Rivanna Regional Drought Response Committee is composed of two political entities and two authorities, specific actions must take place once a drought stage has been declared by RWSA. The ACSA and City will jointly exercise vigorous measures to encourage voluntary water conservation and encourage decreases in outdoor water use during a Drought Watch. The City of Charlottesville will require action by City Council to activate mandatory water use restrictions associated with a Drought Warning stage, and separate action to authorize additional restrictions during a Drought Emergency stage. The ACSA has policies in place to initiate mandatory water use restrictions as soon as RWSA declares a Drought Warning or Drought Emergency, provided that the Albemarle County Board of Supervisors has also declared that conditions exist whereby the ACSA is authorized to enforce mandatory restrictions. The Board of Supervisors' declaration is required only once, at the onset of the Drought Warning stage, and the form of this declaration will be as determined by the County Attorney in accordance with the requirements of the statutes of the Commonwealth of Virginia. Every effort will be made by each governing board to expedite the process and authorize the appropriate drought stage and associated restrictions as quickly as possible.

Notwithstanding the provisions of this Plan, should the Governor of Virginia declare a drought emergency for the region including Albemarle County and the City of Charlottesville, the City and ACSA must enforce restrictions listed in Attachment A of Virginia Water Protection Individual Permit No. 06-1574, Major Modification No. 1, issued to the Rivanna Water and Sewer Authority, dated December 20, 2011.

With respect to well users, the County cannot impose restrictions on well users until the Governor of Virginia declares a drought emergency. At that point, the County must enforce the restrictions that the Governor has imposed. The County may also adopt an ordinance that restricts the nonessential use of ground water if it determines that the restriction is necessary to protect the public health, safety, or welfare. Such a restriction would apply only during a Drought Emergency that has been declared by the Governor. The County adopted restriction can not apply to agriculture. It is quite possible that the RWSA Executive Director may make a local Drought declaration prior to the Governor declaring a Drought Emergency. Without such a declaration by the Governor, however, the County may take measures such as disseminating conservation information, but it would have no authority to restrict the use of ground water.

In the event that the Committee feels there is an emergency need to enact a drought stage, and regularly scheduled meetings of the various Boards in the approval process do not

allow for actions without undue delay, the Committee can recommend that one or more Boards call a special meeting in order that all agencies take appropriate and coordinated actions without unreasonable delay.

Continued coordination by the Drought Response Committee is instrumental in ensuring that these processes are effective in meeting the conservation goals of this Plan.

Drought stages may be discontinued or reduced in severity after the water supply has sufficiently recovered such that water use restrictions are no longer necessary. It is recommended that drought declarations remain in force until recovery of useable storage is such that modeled water conditions result in a probability of recurrence less than the modeled hydrologic conditions defined for entering each stage in Section 4 of this Plan.

6. Implementation of Water Restrictions

During periods of time in which drought stages are declared, water use restrictions will be in effect and enforced within the following jurisdictional areas as defined below:

- A.** *Albemarle County Service Authority.* As defined by Section 16 of the Rules and Regulations of the Albemarle County Service Authority, as amended.
- B.** *City of Charlottesville.* As defined by Section 31-125 of the Code of Ordinances of the City of Charlottesville, as amended.
- C.** *Albemarle County.* As defined by Section 16-500 of the Albemarle County Code.

7. Public Awareness and Education

An active public involvement campaign shall be maintained at all times during which a drought stage has been declared by the RWSA. This campaign shall provide education of the public regarding the conditions of the drought, tips on how to conserve water, water use restrictions that are in effect, and the extent to which measured levels of water conservation have been achieved. The Rivanna Regional Drought Response Committee that includes representation from ACSA, City of Charlottesville, County of Albemarle, and RWSA will coordinate with each other as needed to ensure that campaign information is thoroughly integrated and is responsive to the need to achieve specific water conservation goals. Public education shall use all available forms of mass communication to include regular press releases, radio and television programming, cable local government channels, public meetings, and the internet (e.g., websites, social media).

The ACSA and the City of Charlottesville both have active water conservation programs during non-drought periods and drought periods. These programs are identified clearly in their respective websites which can be found at www.serviceauthority.org and <http://www.charlottesville.org/Index.aspx?page=632>.

8. Formal Review of Drought Response

The Rivanna Regional Drought Response Committee meets as necessary to coordinate and share information. When conditions are emerging that may develop into drought stages, or during a drought stage, the Committee will meet as frequently as needed, and will include in its activities a review of each drought stage and the response of the community to these stages. This will serve as important feedback regarding how efficient the plan is working, and what improvements would be warranted for the future.