

## **MEMORANDUM**

**TO: RIVANNA WATER & SEWER AUTHORITY  
BOARD OF DIRECTORS**

**FROM: THOMAS L. FREDERICK, EXECUTIVE DIRECTOR  
ANDREA TERRY, WATERSHED MANAGER**

**SUBJECT: DRAFT DROUGHT RESPONSE AND CONTINGENCY PLAN**

**DATE: APRIL 24, 2006**

The members of this board and other local boards have recognized the need for a coordinated written plan among local agencies on how this community will respond to future drought conditions. The attached draft plan is being introduced to the public today to answer that call, and is the result of several months of work by the RWSA staff, with the significant assistance and support from the staffs of the City of Charlottesville Public Works, Albemarle County Service Authority, and the Albemarle County Community Development Department. This plan reflects a coordinated effort among local governments to effectively plan the use of our water resources when meteorological conditions beyond our control limit the availability of water. This plan offers an approach that is proactive, provides for managing our limited water resources with appropriate scrutiny, provides for coordinated community education, and provides for progressive stages with increasingly stringent restrictions on water use as the severity of a drought increases. The plan also is intended to satisfy the requirements of the Commonwealth of Virginia regarding local and regional water supply planning.

The structure of the plan places the responsibility to monitor the water supply for signs of stress on RWSA, with appropriate communication and coordination with the City, ACSA, and the County. This will be accomplished with the assistance of a hydrologic model which provides probability-based analysis of drought potential. The model estimates the rates at which water supply levels would diminish, based on the historical period of record, current operating rules, and current water demand projections. Three stages of drought are identified:

- Drought Watch – Alerts the public that drought conditions are emerging, calls for voluntary efforts to conserve water, and informs the public that mandatory restrictions may be necessary in the coming weeks if rainfall remains low.
- Drought Warning – Requests the ACSA and City to activate an initial phase of mandatory restrictions and other measures as defined by their respective ordinances, with the goal to reduce drinking water demand on the public water systems by a minimum of 5%.
- Drought Emergency – Requests the ACSA and City activate further emergency demand restrictions with the goal to reduce water demand by a minimum of 20%.

The plan that has been drafted incorporates by reference the ordinances of the County, City, and ACSA, as amended, and tasks these agencies with the responsibilities of enforcing their respective ordinances regarding water restrictions as well as providing public education. It also calls for a coordinating staff committee of all four agencies (including RWSA) to meet regularly while drought conditions exist so that actions are coordinated and seamless in terms of the messages to the public.

The plan is being introduced today to initiate discussion among the public and the boards of the various agencies. It is proposed that a public forum and panel discussion be scheduled and conducted as soon as possible to allow for public questions and comment regarding this plan as well as the ordinances that are referenced by this plan. To allow for public comment before action is taken by the RWSA Board, the staff is not recommending formal action on this plan be taken at this meeting.

It would be desirable that this plan be considered at its own necessary pace; unfortunately, we must also put this in the context of current conditions. Stream flow conditions remain unseasonably dry as reflected in the attached Figure 1, and we are at risk that drought conditions are developing that, absent more frequent rainfall in the coming weeks, could require water demand restrictions this summer. As this report is drafted, the forecast calls for a reasonable chance of rain on Friday, April 21 and Saturday, April 22 which we hope could bring some relief to current conditions. We intend to review stream conditions again immediately prior to the time of the Board Meeting on April 24 and advise the Board at the meeting with an up-to-the-minute prognosis on how close our current conditions are to the conditions defined for declaring a Drought Watch..

### **Board Action Requested**

Staff respectfully recommends the Board of Directors accept the attached draft plan for public discussion and call for a public forum to be scheduled as soon as possible for public discussion. Staff also requests the Board's guidance as to how the plan should be adopted and what other local government boards should be involved in the approval process.

Staff may also make further recommendations to the Board from the floor regarding current abnormally dry conditions after reviewing the results of rain forecasts for the weekend of April 21.

Attachments

# **DROUGHT RESPONSE AND CONTINGENCY PLAN**

## **DRAFT 4-24-06**

### **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 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 ground water must develop a drought contingency and response plan. This Plan is designed to fulfill these regulatory requirements on behalf of Albemarle County and the City of Charlottesville.

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 clearly 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 are specific to the limitations of our 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, it is widely recognized as human nature that many citizens will be motivated to achieve higher levels of conservation during times of "crisis", and it is extremely important to take advantage of those motivations 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 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, 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, but temporary, water use reductions. Drought management measures include curtailing demand by limiting non-essential uses of watering, 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 Drought Management 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.

## **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. Albemarle County estimates that there are about 14,800 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. Of the three systems supplied by RWSA, the Urban Water System is closest to approaching its existing safe yield. Therefore, the condition of the Urban Water System serves as an appropriate assessment for the impact of drought conditions for all systems. 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 criticality of 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 the most likely to be the earliest stressed system in an emerging drought, for reasons previously stated, 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. Further, at the time Albemarle County develops an active monitoring program for groundwater, this data will be incorporated into the overall Drought Management Plan.

### ***B. Description of Urban Water System***

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 Reservoirs (RMR). The river intake is located on the North Fork Rivanna River. Detailed information on the existing system is presented in the report Safe Yield Study (Gannett Fleming, January 2004) and Safe Yield Study Supplement No. 1 (Gannett Fleming, July 2004). A summary of this information is presented below.

Finished water 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 dam and flows into the South Fork Rivanna Reservoir via the Moormans River. The Observatory WTP is supplied by water from the Ragged Mountain Reservoir system through an 18-inch diameter pipeline and from the Sugar Hollow Reservoir through another 18-inch diameter pipeline interconnected with the Ragged Mountain pipeline. 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 is the largest reservoir in the system and has a drainage area of 259.1 square miles. There is no regulatory release requirement on the South Fork dam, but RWSA has made a voluntary commitment to release a minimum flow of 8 mgd except during severe drought conditions when such a release would threaten the ability to meet public water supply needs. When reservoir inflow is less than 8 mgd, releases equal the natural inflow to the reservoir.

There are two dams in a series on an unnamed tributary to Moores Creek, which form the Ragged Mountain Reservoir system. The drainage area of the Ragged Mountain Reservoir system is 1.8 square miles. There is no regulatory minimum release requirement from the Ragged Mountain Reservoir system.

Sugar Hollow Reservoir is located on the Moormans River and drains an area 17.5 square miles in size. Although there is no regulatory minimum release requirement from the reservoir, the RWSA has made a voluntary commitment to release 400,000 gallons per day to the Moormans River at all times unless total available storage falls below 80 percent.

An intake and pump station with a 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. This system is currently isolated from the rest of the finished water distribution system, and is currently operated solely to meet the demands of the North Fork service area. A project to interconnect the North and South Rivanna systems has been approved in RWSA's current Capital Improvement Plan.

### ***C. RWSA Water Supply System Operating Rules***

Operating rules for the RWSA Urban Service Area are in place to most efficiently utilize the existing raw water resource. 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, the Ragged Mountain Reservoir will normally stop spilling, followed by the Sugar Hollow 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 Lower Dam, or to the extent that a drawdown of water in the Ragged Mountain Reservoir is necessary for dam safety reasons.

During recent studies of the safe yield of the Urban Water System, it was concluded that further optimization of the Water Supply System Operating Rules would be possible if the North Rivanna and South Rivanna distribution systems were interconnected by an adequately-sized transmission water main (referred to as the “US 29 Pipeline”), 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”). Both of these system improvements are in the adopted RWSA Capital Improvement Program for 2006-11. Once these improvements are completed, RWSA will adopt operating rules that permit Observatory WTP operators to be cross-trained at the North Fork WTP to permit both North Fork and South Fork water sources to be emphasized over Observatory/Ragged Mountain/Sugar Hollow Reservoir during the early stages of a drought.

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. 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, if not all cases, the drought will have reached a declared “Warning” stage (drought stages are further defined in Section 4 of this Plan) by this time. 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 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. As a means of estimating “bed loss” of the water released from the Beaver Creek Reservoir to SFRR during a drought, RWSA will measure the flow released at the Beaver Creek dam at the time of release and compare that flow rate to the stream flow measured at the United States Geological Survey stream gage on the Mechums River (at the Garth Road bridge).

**B. Chris Greene Lake**

Chris Greene Lake is a recreational lake 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. 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.

Additional study is required and will be carried forward to determine the feasibility of using Chris Greene Lake as a source of water during a Drought Emergency stage.

**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 to the Creek. 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 VDGIF will be pursued in order to determine the practicality of using this source of emergency water supply.

**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 rules, and current 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 confidence that they will work well 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.
- 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 80% 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 70% 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 60% of total reservoir storage.

- Water supply storage stages can also be declared due to unusual events that threaten the available supply of water, such as chronic 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 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 predicated on being 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 defined 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 region. At the time a Drought Watch is declared, the Board of Directors will authorize the Chairman 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. The City of Charlottesville will require action by City Council to activate a drought stage.

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 such time that recovery has reached a minimum level of 95% of combined reservoir water storage and modeled water conditions result in a probability of recurrence less stringent than the modeled hydrologic conditions defined for 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 to 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 meet at least bi-weekly, and more often as necessary, to assure that campaign information is thoroughly coordinated 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. Recommended guidance documents for the planning of a drought public involvement campaign include the following:

- **Water Resources Planning (M50).** AWWA planning manual.
- **Water Conservation Programs – A Planning Manual (M52).** AWWA planning manual.

**Figure 1: 14-Day Running Average Stream Flow**  
**Mechums River Near White Hall VA: January 1- June 30**  
(Source: US Geological Survey)

