CATEGORY: BEAVER CREEK RESERVOIR

1. ***Question / Issue:*** **Why has the Beaver Creek Reservoir not been selected for use as a permanent part of the Urban Water Supply Project? What sedimentation rate data is available for the Beaver Creek Reservoir? What work has been completed to evaluate Chris Green Lake and Lake Albemarle for use by the urban system?**

   Answer:
   Part 1 Beaver Creek Reservoir is a 521 MG reservoir that serves as the primary water supply to the RWSA Crozet Water Treatment Plant. The reservoir was built in 1963 for the purposes of water supply, flood storage, and recreation. In July 2004 Gannett Fleming evaluated the projected water supply needs of the Crozet Area, and then calculated the amount of excess water available within Beaver Creek for use in the Urban Water System. The amount available for use in the Urban Water System is highly dependent on the demand in the Crozet Area. As usage in Crozet increases, water available to the Urban system will decrease. In the initial years of the 50-year planning horizon, when Crozet demand is 0.4 mgd, the water available to the Urban system is 2.8 mgd. The residential demand is projected to grow to a build-out demand of 1.1 mgd by 2025. Theses demands are based on Albemarle County residential population projections for the Crozet Area, and do not include heavy commercial or industrial use of water in the Crozet Area. With the addition of a 0.5 mgd constant demand for industrial use, the future demands are 1.6 mgd per day. When evaluated, a constant demand of 1.6 mgd in the Crozet area results in 0.8 mgd of water available to the Urban system (assuming no loss of water in the transferring stream bed).

   Unlike the Urban water system with multiple reservoirs, the Crozet system is completely reliant on the Beaver Creek Reservoir for future demands. With only 0.8 mgd of unused projected safe yield at 2025 and the uncertainty of future Crozet water needs (beyond the twenty years projected by Albemarle County), the use of Beaver Creek Reservoir as a permanent water supply for the urban system was not recommended. Prior to complete build-out of the Crozet demands, the Beaver Creek Reservoir will be used to augment urban supplies during times of drought, to the extent that water is available.

   Part 2 Beaver Creek Reservoir was specifically designed to have a sediment storage component. No hydrographic surveys of the reservoir are known to have been completed since the dam was constructed; therefore, the present volume of sediment in the reservoir is not accurately known. The dead storage area in Beaver Creek Reservoir is larger than in SFRR in proportion to watershed area, and unless the sedimentation rate at Beaver Creek is greater by proportion than SFRR (for which there is no physical evidence from surface observations), accumulated sediment would not reduce the design water supply storage of the reservoir within the 50-year design horizon.

   Part 3 As part of the July 2004 Water Supply Alternatives Supplemental Evaluation, the increase in 2055 safe yield of the Urban Area System due to the use of available storage at Chris Greene Lake and Lake Albemarle was evaluated. This study concluded that the concept of using Chris Greene Lake and Lake Albemarle were not further developed due primarily to their minimal safe yield contributions, existing condition, ownership issues, and logistics of use.

CATEGORY: SFRR, DREDGING AND SEDIMENT

2. ***Question / Issue:*** **Can Dead Storage (in the South Fork Rivanna Reservoir) be used as a viable future water supply?**

   Answer:
   Dead Storage in the South Fork Rivanna Reservoir is defined as the volume of a reservoir that is between the elevation of the lowest water intake (for public water supply) and the bottom of the reservoir. In the design of a reservoir, this space is typically calculated based on the designer's estimate of the amount of sediment that will settle out and accumulate in the reservoir over its useful life. The water intakes are designed to withdrawn water from the reservoir down to the bottom of the defined Water Supply Pool (just above the Dead Storage), but not lower. In reservoir design and in regulatory review, it is considered standard practice to reserve the Dead Storage area for sediment and not include this volume in the calculation of the reservoir's safe yield. Consistent with this practice, the Dead Storage is not included in Gannett Fleming's calculations of safe yield.

   Because the South Fork Rivanna Reservoir is a long and narrow reservoir (as opposed to more round in shape), some of the sediment is dropping out in the upper portions of the reservoir, above the area defined as Dead Storage. It is the sediment accumulating above the Dead Storage (in the defined Water Supply Pool) that is resulting in the reduction of safe yield over time.

   Although dead storage cannot be counted as part of the useable water supply storage under normal circumstances, as a practical matter, if the community ever faced a more severe drought than the current drought of record, and water levels were approaching the defined interface between the Water Supply Pool and Dead Storage, RWSA would be actively obtaining data on the quality of any water in the Dead Storage to determine if that water could be removed by a sump pump and treated to drinking water standards. Since such practice would be exercised only under extenuating circumstances, and there is no guarantee the water in this zone would be suitable for treatment, it is not considered safe yield.

3. ***Question / Issue:*** **How is the proposed dredging work at the South Fork Rivanna Reservoir similar or dissimilar to that of Decatur, Illinois? What type of land uses surround the Decatur site? Additionally, has Decatur experienced aesthetic complaints from surrounding property owners (such as noise, etc)?**

   Answer:
   Part 1 & 2 The City of Decatur, Illinois has decided to embark on a multi-year dredging operation to reclaim volume already lost within its primary water supply, Lake Decatur. The table below provides information on the lake and watershed characteristics.

Lake Decatur vs. South Fork Rivanna Reservoir

Item	Lake Decatur	South Fork Rivanna Reservoir
Volume	9,125 MG	1,700 MG
Surface Area	3,000 acres	366 acres
Drainage Area	925 mi^2	259 mi^2
Storage Volume Loss	48 MG/Yr	15 MG/Yr
Treatment Plant Size	46 MGD	12 MGD
Sedimentation Rate per mi^2 of Watershed	0.052 MG/mi^2	0.058 MG/mi^2

Decatur has determined that they will conduct dredging over a 5-year period, removing 480,000 cubic yards of material per year for a total of 2.4 million cubic yards. To reclaim 5.5 MG of Safe Yield from the South Fork Rivanna Reservoir, approximately 5 million cubic yards of material will require removal.

The watershed area surrounding Lake Decatur is primarily composed of relatively flat agricultural land. The City of Decatur was able to purchase 640 acres of land, immediately adjacent to the Lake that will be used as a disposal site. The City anticipates dredging the sediment material directly to the bermed area with no additional handling. The area surrounding the South Fork Rivanna Reservoir has significant topographic variation, contains residential development, and has forested and stream areas.

The cost of dredging alone (including data from the City of Decatur and Fairfax County) is approximately $5 per cubic yard of material. The City of Decatur expects to expend another $750,000 to $1.0 M per year on operational expenses. The City has not determined how they will address any sedimentation issues beyond 2010.

Part 3 The surrounding area of Lake Decatur is made up of primarily farmland with some recreational use. The City of Decatur owns approximately 600 acres of the waterfront land that will be used for the dewatering of dredged materials. The dredging operations are not located near any significant amount of residential development and as such they do not expect to have noise or odor complaints.

4. ***Question / Issue:*** **What is being done to investigate the potential use of South Fork Rivanna Reservoir dredge spoil by the Charlottesville Albemarle Airport as fill material under the proposed runway expansion?**

Answer:
Gannett Fleming (GF) discussed the potential use of dredged material at the Charlottesville Albemarle Airport with their consultant Delta Airport Consultants (Delta). Delta asked GF to provide available data to them for their use in determining if the material could be used. GF has provided Delta with a package of data including the 3 soil sample results, cross sections, original reservoir bottom mapping and area topographic maps. We are awaiting a response.

5. ***Question / Issue:*** **What will the South Fork Rivanna Reservoir look like in 50-years? What type of future work effort will be needed to maintain the quality of the SFRR as a drinking water source?**

Answer:
Unfortunately, there is not a perfect "crystal ball" to tell us exactly what the reservoir will look like in 50 years. Most sediment transport occurs during moderate to extreme wet weather events, when stream velocities scour "broken" streambanks and across-the-land stormwater runoff scours areas that are not protected by sufficient vegetation. To an extent, accurately predicting sediment transport includes the ability to predict the sequence of weather events over a long period of time, a phenomenon widely recognized as tricky at best.

Some decisions can be made, however, that are known to help preserve the quality of the reservoir, regardless of its future shape or configuration. The most significant is to maintain and strengthen programs for controlling sediment, and in particular phosphorus, from entering runoff from upland properties as a result of human activities. Methods of human control include agricultural best practices, conservation land use practices including adequate buffers at all streams, stormwater controls that provide for nutrient removal, and avoiding the over fertilization of lawns. These practices are largely beyond the direct control of RWSA, but can be influenced though integrated resource planning among a group of agencies that can make a difference. To the credit of Albemarle County and Thomas Jefferson Soil & Water, some practices already exist within the South Rivanna watershed. RWSA's Watershed Manager is compiling a directory of these practices that will be available to the public later this year as a starting point for further discussion and planning. A collaborative method for developing an inventory of watershed problem areas and identifying new sources of revenue (grants, private foundation contributions) is also being discussed.

In general terms, if dredging is not performed, it is believed that the SFRR will continue to slowly reduce in volume of water storage over time, and over a period of years the upper reaches of the reservoir may become more like a river than a reservoir. As the storage area becomes smaller, the rate of settling of sediment may become reduced. As the reservoir becomes shallower, there could be an increased chance for aquatic growth to occur in shallow areas where sunlight can penetrate the bottom. In reservoirs at other locations with advanced sediment deposition, effective treatment for aquatic growth includes pulsing the water level of the reservoir to the extent dam outlets will permit, the careful application of copper sulfate, or dredging that is focused on reservoir maintenance.

It is expected that the use of the SFRR will continue as a drinking water source. Other communities using reservoirs with advanced sediment deposition have adjusted the use of chemicals, in combination with reservoir measures discussed above as appropriate, to provide treated water quality that continuously exceeds all Environmental Protection Agency drinking water standards. Licensed water treatment plant operators are well trained in making the appropriate chemical adjustments.

A well-prepared and implemented continuing monitoring program for the South Fork Rivanna Reservoir is recommended for the future, regardless of which water supply concept is selected for future water supply needs. Such a program provides for making sure issues are addressed at the time when there is a clear need. Such a program may include periodic bathymetric surveying, chemical and physical testing of water, and biological assessments; improved stream flow gage measurements; regular visual reservoir inspections with

documentation; and continued improvements in watershed management and monitoring practices. A program of this nature should include some on-going funding for sustainability, include outside expertise in initial planning and at appropriate intervals, and include a framework for public involvement. From the public comments received as part of RWSA's recent outreach program, long-term concerns for the SFRR go well beyond the continued use of SFRR for drinking water supply, to include aesthetics and recreational use.

6. ***Question / Issue:*** **Are there ways to reduce the amount of sediment coming in to the South Fork Rivanna Reservoir? How expensive or effective are these know methodologies?**

   Answer:
   The best method to reduce the amount of sediment entering a reservoir is to address it at its source. Albemarle County currently has in effect a Water Protection Ordinance which requires the establishment of buffer zones adjacent to streams and water bodies in the County. These buffer areas serve to help control nonpoint source pollution of the water resources, and minimize streambank erosion. Additional Best Management Practices (BMPS) on upstream properties (i.e., fencing livestock, limiting fertilizer use, etc.) also serve to reduce human-induced sediment inputs to the reservoir. These practices are encouraged by many local entities including Albemarle County, the Thomas Jefferson Soil and Water Conservation District, and The Nature Conservancy. These organizations provide information to local landowners on BMPS and funds are available to share the costs of these programs with the landowner.

   Unfortunately, there are limits to what can be accomplished. Numerous publications identify that sedimentation issues in the Rivanna watershed are in part the result of the natural transport of highly erodible soils from undisturbed land.

   One concept that has been evaluated by RWSA's consultant to reduce sediment inflow to the SFRR, is the use of forebays. A forebay is a man-made pond designed to capture the sediment flowing to a reservoir (either in the main stem of the river or in a tributary) by allowing it to settle out before it reaches the reservoir. Studies to date have indicated that the use of this method is not a cost-effective or environmentally sound means of sediment removal for the SFRR. Construction of a forebay could be likened to constructing a reservoir to the extent that it would involve measuring wetland and stream impacts. RWSA's consultant does not believe the use of this method would be advantageous on a cost or environmental impact basis.

7. ***Question / Issue:*** **Provide a break out of dredging costs. What are the capital costs of dredging and what are the annual operational and maintenance (O&M) costs of dredging? Is there a financing benefit to on-going operational costs versus one time capital costs?**

   Answer:
   Making the assumption that dredging will be performed by a contractor (instead of RWSA purchasing the equipment and performing the work with their own forces); the capital costs would include the dewatering basins, environmental mitigation & permitting, and land acquisition for dewatering & disposal. Note that land acquisition for disposal could be phased such that the land is not purchased all at once. The initial capital cost at the start of the dredging operation is estimated at $1,900,000 (2005=$) including engineering and

contingencies. Land for disposal, purchased over time as needed, is estimated at an additional $7,425,000 with contingencies based on 20% reuse of material. Land costs are proportionally lower if reuse exceeds 20%, or are higher if reuse is less than 20%.

Operating costs would include contractor mobilization, dredging, hauling, and disposal costs. Using the assumption that dredging would be performed in each of 25 years at a rate of 200,000 cubic yards per year, the annual costs are estimated $5,100,000 (2005=$) with contingencies. Annual costs are half that amount in 2005 dollars if performed at a rate of 100,000 cubic yards per year for 50 years.

If dredging is selected and is spread out in approximately equal amounts of work over many years, it is proposed that the water rates generate sufficient revenue so that dredging operating costs can be paid out of current revenue ("pay-as-you-go") instead of being financed by debt. This type of financing does avoid bond administrative and closing costs as well as interest payments on debt. The water rate information presented in graphs on February 17, 2005, and provided in tables in response to Question 33 herein, take into account the savings associated with "pay-as-you-go" financing.

8. ***Question / Issue:*** **On dredging the SFRR, clarify the volume of sediment that will require removal and how the equivalent Scott Stadium volume was determined?**

Answer:
The volume of sediment to be disposed is approximately 5,000,000 cubic yards over a 50 year period, or approximately 100,000 cubic yards per year. This volume was determined based upon current estimates of accumulated sedimentation plus the volume loss of 15 mg/year projected during the next 50 years. The area of the field at Scott Stadium was estimated at approximately 11,200 square yards (140 yards x 80 yards) resulting in a ~26 feet deep "block" for each year of material. Considering the available space around the block back to seats, we estimated the total volume of the stadium at approximately 250,000 CY resulting in the estimate of the stadium being filled 20 times.

9. ***Question / Issue:*** **Can the silt from the upper end of the SFRR, be pumped and relocated to the dead storage area near the dam?**

Answer:
The practice of dredging one part of a water body and disposing of the material in another part of the same water body is typically performed only as a last resort when there is no other reasonable alternative for removing, transporting and disposing the material and no available beneficial use. Applying this technique in a reservoir like the South Fork Rivanna Reservoir is not a common practice and would be difficult to permit. Preliminary discussions with DEQ and the U.S. Army Corps of Engineers confirm there will be challenges associated with obtaining permits for overboard dredging of the SFRR. Although not contacted, it is highly likely that the U.S. Fish and Wildlife Service, Virginia Game and Inland Fisheries would also have significant concerns about this process. Verbal communications with the Virginia Department of Health indicated they would not permit this activity to occur. In summary, it would be very difficult to permit, and would result in an undesirable impact on the production of high quality water for the RWSA system.

10. ***Question / Issue:*** **What volume dump-trucks were used to calculate the cost associated with transporting SFRR dredge material to a disposal site? Are there cost advantages or size limitations on using a larger truck?**

Answer:
The cost estimate for hauling the dredged material was based on 6 CY dump trucks. While using larger trucks may reduce the transportation cost estimate slightly, other costs associated with hauling this material with larger trucks may increase the estimate. These costs are expected to be offsetting and could even increase hauling cost. There are also many issues that influence the size of truck used for hauling this material in addition to transportation cost. Primary issues include: maneuverability at the loading and disposal sites, as well as the ability to negotiate the haul route; impact to existing roads along the haul route; and safety for trucks and existing motorists along the route.

Larger trucks would require larger area to maneuver at both the loading and disposal areas. Wider haul roads with greater strength would also be required in unimproved areas between the loading and disposal sites and existing roads. The ability to negotiate existing roads may also limit the number of potential disposal sites or require roadway improvements to accommodate large trucks. Upon identifying existing roads that can be used, an evaluation of the anticipated impact of the heavy truck traffic would be necessary and improvements for heavier trucks probable. Typically, the roadway owner (usually VDOT) will also require a commitment to make repairs to the road following completion of the hauling before issuing permits. Since the dredging project is likely to take place over decades, significant costs associated with several roadway replacements are likely. In addition, when large trucks are used, there are safety and road repair issues for the haul route. Numerous large trucks traveling a regular route pose safety challenges for existing motorists traveling the route. Roadway improvements such as traffic signals and road widening may be necessary. Considering the described improvements and estimated 10 mile haul route, this could easily cost several million dollars.

Table 5 in the December 2004 Dredging Technical Memorandum indicates the estimated hauling cost is about $12 million or about 11% of the overall concept cost for the 20% material reuse assumption. The level of accuracy of current cost estimates would allow for any size truck. Uncertainties associated with this line item will not significantly impact the overall estimated cost.

11. ***Question / Issue:*** **Has RWSA talked to land owners such as Panorama Farms and the Airport to pursue dredge disposal areas?**

Answer:
RWSA staff has talked to both Panorama Farms and the Airport Authority. In addition, Gannett Fleming talked with a list of numerous businesses in site work construction or "sand and gravel" type operations prior to publishing the November 2004 Technical Memorandum, and RWSA has talked to a variety of individuals with ideas regarding dredging since the November meeting. Every suggestion has been reviewed.

Discussions with the Airport Authority were initiated in late January 2005, including direct consultations between Gannett Fleming and Delta Airport Consultants (Engineers representing the Airport Authority). Delta is reviewing a packet of technical information from Gannett

Fleming. No conclusions have been reached to report at this time, but this item will be follow-up and reported appropriately.

12. ***Question / Issue:*** **Can dredging be done on a small scale to determine how it works, without committing to it as a permanent supply option?**

Answer:
Yes, dredging can be done on a small scale. In order to utilize public funds in an efficient way, there should be a well established public purpose and commitment for dredging, and the scope of the project should be designed toward achieving that defined purpose. Other possible purposes for dredging (besides water supply) may include recreational uses, aesthetic values, or water quality management.

The adopted RWSA 2005-09 Capital Improvement Plan includes a project to dredge sediment from the Lickinghole Creek Reservoir east of Crozet in FY 2009. The project purpose is to maintain the reservoir's purpose of settling sediments from Lickinghole Creek.

CATEGORY: SFRR 4-FOOT CREST GATE

13. ***Question / Issue:*** **Describe what guidance has been used to determine the environmental mitigation for wetlands and stream impacts. Does the regulatory guidance allow for a credit if new wetlands are established at the new SFRR pool elevation?**

Answer:
Part 1 The state and federal regulatory agencies maintain jurisdiction over "waters of the United States." Wetlands, recognized as having hydrophytic vegetation, are viewed as a subset of waters of the United States. The differences between wetlands and stream channels (open water) require separate methods of analyses and review when determining impacts and mitigation. Wetland impacts are measured in terms of area (square footage or acreage) while stream impacts are measured by distance (linear footage).

Wetlands - The U.S. Army Corps of Engineers and the Environmental Protection Agency have long held the policy that assessment of impacts and the determination of mitigation to achieve a no-net loss of wetlands should be based on the functions and values of the impacted wetlands. The Norfolk District uses acreage as a surrogate for functional replacement, requiring a standard ratio (replacement:impact) for forested wetlands at 2 to 1; scrub-shrub wetlands at 1.5 to 1, and emergent wetlands at 1 to 1. These standard ratios were used to calculate for comparison purposes the potential amount of wetland mitigation required for each alternative. Exceptions to these ratios may be allowed in some circumstances.

Streams - Stream systems, viewed as having different functions than vegetated wetlands, are treated differently by the Norfolk District of the Army Corps of Engineers when determining appropriate mitigation. In December, 2003, the District issued a public notice announcing a newly developed protocol for evaluating the quality of streams in the Piedmont physiographic region of Virginia (*Stream Attributes Crediting Methodology: Impact and Compensation Reaches*). The public notice states that all applicants proposing impacts to stream channels within the Piedmont region are required to use this protocol. The purpose of the protocol is to establish a reasonable approach to determining the mitigating needs for stream impacts, realizing that not all streams are the same. The protocol utilizes five variables determined to

be reasonable indicators of the overall stream's health and stability. These variables include channel incision, riparian condition, bank erosion, channelization, and instream habitat. Persons interested in reviewing more fully the stream attributes methodology can do so by accessing the following Norfolk District web site.

http://www.nao.usace.army.mil/regulatory/pn/streampn/stream%20attributes%20pn.htm

Prior to the beginning of field studies for each of the RWSA concept plans, the Norfolk District was contacted regarding the use of the stream attributes and wetland assessment methodologies. The Norfolk District indicated that the use of this methodology represented above is the correct tool RWSA should use to assess and compare impacts between concept plans.

In theory, wetlands that may become established around the new perimeter of an expanded reservoir may be used as compensation for unavoidable project impacts. It is a widely accepted fact that after the SFRR was first created, wetlands became established in association with the pool level where wetlands were not originally present. A repeat of the same process is likely to occur once the pool level is increased by 4 feet. Historically, however, regulatory agencies have refused to grant mitigation credit for such wetlands, or have offered only fractional credit. Furthermore, the regulatory agencies will not allow the RWSA to use the wetlands expected to establish around the new perimeter to serve as a means of reducing the initial impacts attributed to the proposed 4-foot crest increase. Based on the foregoing, VHB has estimated the wetland mitigation cost at $1,474,000. This cost is in addition to the much higher stream mitigation cost estimate of $8,500,000 to offset the estimated loss of 18,000 linear feet of stream channel caused by the 4-foot increase.

14. ***Question / Issue:*** **What properties along the SFRR will be impacted by raising the pool level of the Dam?**

Answer:
A map showing the impacted South Fork Rivanna Reservoir properties is attached. If this concept is selected, RWSA will perform a detailed land survey to identify exact easement requirements needed for all land acquisition.

15. ***Question / Issue:*** **Explain the cost differential between the 4-foot crest gate in as presented in 2002 and the recently presented information? Why are these costs different?**

Answer:
According to the report dated October 28, 2002 entitled "Multi-Step Integrated Water Strategy for the Urban Service Area", the SFRR 4 Foot Crest Project capital cost is $7.5 million (including $2 million for bridge replacement). No further breakdown of this cost estimate is available.

The $7.5 million estimate discussed above is presented as a capital cost. Cost estimates in the current studies are "project costs" and include the addition of a 20% allowance for engineering, permitting, and construction management, and a 25 % project contingency. If one is to compare the cost estimates in the 2002 report to the current studies, the same allowances should be added to the reported capital cost. If 20% is added for engineering,

permitting, and construction management and 25% contingency is added to the reported 2002 capital cost, the resulting "project costs" are $11.25 million.

It is further uncertain what portion of the reported 2002 capital cost, if any, is attributable to environmental mitigation.

The January 2005 Technical Memorandum on SFRR Expansion estimates the total project cost at $21.4 million. An "apples to apples" comparison is $21.4 million vs. $11.25 million.

The primary difference is environmental mitigation cost, which was not identified as a separate category in the 2002 estimate. It is uncertain what portion of the reported 2002 capital cost, if any, is attributable to environmental mitigation. Field work for environmental impacts was not completed until 2004. Environmental impacts presented by Gannet Fleming and VHB and in the referenced Technical Memorandum are based on completed field work and it appears that the amount of wetlands and stream impacts are much higher than anticipated in 2002. The current estimate includes $9,974,000 for mitigation of more than 30 acres of wetlands impacts and 18,000 linear feet of stream impacts. When engineering, permitting, construction management and project contingencies are added, this figure increases to $15.0 million.

A current project cost of $6.4 million is derived when environmental mitigation costs are excluded. Other changes to the cost estimate include replacement of the route 676 bridge at Ivy Creek. Analysis of the bridge structure and conversations with VDOT indicated that the bridge deck would have to be replaced for route 676 resulting in a cost of approximately $1.5 million with engineering and contingency. This is lower than the 2002 estimate of $2.5 million in capital cost. There are likely other small differences that are attributable to available information and engineering judgment.

16. ***Question / Issue:*** **Is there the potential to raise the SFRR Dam to a height lower than 4-feet that will not require the replacement of the Woodlands Road Bridge?**

Answer:
This question has been posed to VDOT and we are awaiting a response.

17. ***Question / Issue:*** **Based on current demand projections, how far out does the 4-foot dam height raise at SFRR meet the communities needs?**

Answer:
Based on current demand and supply projections, assuming a reoccurrence of the drought of record, the current RWSA Board policy of supplementing flows during droughts with available supply from the Beaver Creek Reservoir is predicted to extend the date when demand equals supply to 2018. If the 4-foot crest gates were to be permitted by the regulatory agencies and installed prior to 2018, the larger reservoir would extend until 2031 the year when demand meets supply. The additional time is 13 years.

In general, it is good practice, when possible, to construct the next phase of water supply a few years earlier than the date when predicted demand meets supply. As the calculation of safe yield is applied, in theory, a recurrence of the drought of record in the year when demand and supply are equal would cause all reservoirs to just reach the bottoms of the water supply pools at the time rainfall starts the recovery from the drought.

18. ***Question /Issue:*** **Is it possible to draw only on the SFRR until drought conditions exist and then use water from Ragged Mountain, due to the length of time it takes Ragged Mountain to refill?**

Answer:
Yes, it is feasible to design the water system to operate in this manner. However, there are several issues that need to be considered with our existing system.

First, the water transmission system of RWSA currently has two key issues that inhibit the flexibility of moving water from the South Fork to all areas of the distribution system. The first issue is the lack of an adequately sized pipeline along US 29 North in the Forest Lakes area to transfer water from the South Fork to the North Fork zone in an emergency. The second is the lack of a transmission line between the storage tanks at Pantops and Avon Street that limit the capability of bring South Fork water to the University area. Both of these weaknesses are recognized and addressed in RWSA's current 2005-09 Capital Improvement Program. Until the southern loop (Avon to Pantops) is completed, the Observatory Plant needs to operate daily at a minimum of 1.5 MGD to 2.0 MGD to adequately serve the Observatory area.

Second, RWSA has instituted a policy of drawing down the Ragged Mountain Reservoir during the hurricane season, in response to dam safety issues, until proposed dam improvements are constructed.

Following the hurricane season in 2004, RWSA did limit the production at the Observatory Water Treatment Plant to promote a faster refill of the Ragged Mountain Reservoir. This operating method can be used again in a similar manner, consistent with the limitations defined above. As improvements described in the Capital Improvement Plan are completed, flexibility will improve.

CATEGORY: JAMES RIVER

19. ***Question / Issue:*** **How does Regional Cooperation fit into the James River Alternative?**

Answer:
The Rivanna Water & Sewer Authority has met with officials from both Fluvanna County and Louisa County on the potential for building a regional pipeline from the James River to serve both counties and the Authority. A private sector company currently operating the public water system for Lake Monticello has also been included in some of the discussions.

All discussions with Fluvanna and Louisa Counties have been undertaken with a clear understanding that RWSA has not made a decision to go to a James River water supply and is still actively considering options within the South Rivanna and Ragged Mountain watersheds as other alternatives.

The discussions have included a preliminary consideration of possible routes for a regional pipeline. One general route would include an intake near Bremo Bluff, VA on the James River, with a pipeline approaching Charlottesville in the area near where the Rivanna River crosses I-64 (close to RWSA's Moores Creek facility). Routes between these two end points

may include (1) parallel to a Dominion power transmission line between Bremo Bluff and Charlottesville); or (2) a route generally parallel to US 15 and Route 53.

Fluvanna County staff have expressed a desire to defer consideration of any financial participation in more detailed investigations until RWSA's study advances far enough to determine whether the James River intake and pipeline concept is selected as the RWSA preferred alternative. Both Fluvanna and Louisa Counties express an interest in RWSA's process.

If the James River concept should be selected, Fluvanna and Louisa Counties have expressed an interest in negotiations with RWSA for the performance of the necessary studies that would determine more fully if the permit application should be developed around a regional pipeline.

20. ***Question / Issue:*** **On the James River Alternative, clarify the proposed pipeline distance.**

Answer:
The proposed pipeline distance from the James River to Observatory WTP is approximately 121,000 linear feet. Also included in these alternatives is piping between Observatory WTP and Ragged Mountain Dam with a length of approximately 15,000 linear feet.

21. ***Question / Issue:*** **What are the anticipated impacts to the River and the Town of Scottsville of the James River Intake alternative?**

Answer:
The James River at Scottsville has a 1Q30 flow of approximately 338 MGD. The 1Q30 is the lowest one-day average flow expected to occur once in thirty years based on the available period of record and is common expression of low surface water flows in Virginia. Assuming a maximum RWSA withdrawal rate of approximately 15 MGD, only 4% of the 1Q30 flow in the James at this location would be withdrawn. The majority of the water withdrawn would be returned to the Rivanna River and through it to the James River, by means of treated wastewater discharges. Net water quantity impact to the James River downstream of the Rivanna River would be minimal. This data indicates there is more than adequate supply in the James River at all times to satisfy the projected RWSA water supply deficit without adverse effects to the James River. Impacts related to construction activities would occur outside of the historical areas of the town, would be temporary, and would be promptly restored.

22. ***Question / Issue:*** **What is the difference in raw water quality between the James River and other existing RWSA water sources (South Fork Rivanna Reservoir, North Fork Rivanna River, Sugar Hollow Reservoir, and Ragged Mountain Reservoir)? Will the variation in James River raw water quality require treatment costs that exceed the treatment costs of current supplies? Is the James River inherently a lesser quality raw water source?**

Answer:
Raw Water Quality is a crucial factor in providing acceptable drinking water to consumers. The James River is used as a raw water source for numerous communities both upstream and downstream from the Scottsville area. Since water quality generally degrades downstream, two communities downstream of Scottsville were considered. The 132 MGD water treatment plant operated by the City of Richmond and the 55 MGD water treatment plant operated by

Henrico County were both in 100% compliance with all federal and state safe drinking water act requirements according to their 2003 water quality reports.

A comparison of general water quality parameters for 2004 James River raw water versus RWSA raw water showed:

PARAMETERS in mg/L

Raw Water Location	pH	Alkalinity	Hardness	TOC
James River (1)	8.4	31	ND	2.22*
James River (2)	7.5	48	64	2.40
Observatory WTP	6.8	13	13	1.18
SR WTP	6.9	18	20	1.90
NR WTP	7.4	16	18	1.97

James River (1) is at Lynchburg; James River (2) is at Richmond
*TOC for James River for years 2001-2002;
Values are mean numbers for year.
ND equals no data available

Based on the above data showing average values for year 2004, effective treatment can be attained from all of the above raw water sources using conventional water treatment processes. Costs for raw water treatment would vary in response to the utilized treatment chemical dosages. Major differences in treatment chemical costs would not be expected.

It is important to note that the Virginia Department of Health (VDH) is the state agency assigned to determine if a proposed water supply is acceptable from the standpoint of public health. VDH has reviewed all four of RWSA's short-list concepts and confirmed that they can support any of the concepts for drinking water supplies.

CATEGORY: WATER CONSERVATION AND DEMANDS

23. ***Question/Issue:*** **What is being done to reduce water usage through Water Conservation?**

Answer:
Projected water demands for the service area are documented in the report "Demand Analysis for the Urban Service Area" (Gannett Fleming, May 2004). Based on the current conservation programs implemented by the City and the Albemarle County Service Authority, it is assumed that service area demands could be reduced by a minimum of 5 percent during the planning period as a result of normal conservation measures.

It is important to define the difference between normal conservation measures and water use restrictions. Both types of conservation measures result in demand reductions. Normal conservation measures are those measures implemented continually, regardless of the status of the water supply and are expected to result in moderate demand reductions. Examples of normal conservation measures include: public education, conservation-oriented rate

structures, plumbing rebate programs, and leak detection. Water use restrictions are measures implemented in response to the threatened status of the water supply and can result in significant water reductions. Use restrictions include curtailing demand by limiting non-essential uses of watering, an example of which is irrigation, and can be as restrictive as water rationing. Water utilities carefully monitor specific predictors to identify when the area in which they operate might be experiencing the early warning signs of a drought. These predictors include meteorological data, and specific data related to the water supply system (i.e., reservoir capacity). Use restrictions are reserved for periods when indications are present that the area may be leading into a drought and as a result, the water supply may become threatened in the near future.

Water supply providers must plan to meet their projected demands. It is reasonable to assume that a moderate reduction to future demands can be expected by implementing normal conservation measures. Additional demand reductions can be expected through implementation of water use restrictions. However, these reductions often come at the inconvenience and expense of water users and as a result, use restrictions are not a part of normal operating procedures; they are only implemented during water emergencies. The potential reductions resulting from implementation of use restrictions are not incorporated into projections of future demand.

Normal water conservation measures are currently being implemented by ACSA and the City. A summary list of programs currently in place is presented below:

- Conservation-Oriented Rate Structures
- Conservation Education/Outreach Programs
  - Billing inserts
  - Distribution of Conservation Kits
  - Water usage data distribution
  - Information dissemination
- Rebate Programs for Plumbing Retrofits
- Municipal Building Retrofits and New Design
- Leak Detection and Repair Programs

Additional information on specific water conservation programs will be posted on RWSA's website in the near future.

24. ***Question / Issue:*** **Are we stuck with using 12 MGD as the starting point for computing future demand? Has future demand per household been based upon a computation using the same demand numbers that give rise to the 12 MGD starting point for demand? If so, we may be compounding a discrepancy.**

Answer:
Part 1 Computing future demand is a forecast of future conditions, and as such, is based on several educated assumptions. To develop assumptions with a high probability that supply will be sufficient to meet actual future demands, it is important to review cyclical trends in historical consumption. Historical water demands in Charlottesville-Albemarle reached 12 MGD in 2001, before reaching a downward cycle with the drought restrictions of 2002, followed by wetter than average years in 2003 and 2004 that tend to suppress water use for lawn sprinkling. Statistics by organizations such as the American Water Works Association

confirm that utilities go through such cycles, with demand cycles such as this region has experienced. Disruptions to the cycle result from permanent customer losses, such as the loss of population or loss of a significant industrial customer. 12 MGD was chosen as a starting point since historical cyclical trends have reached that point before.

Part 2 The demand forecast is detailed in a May 2004 report entitled *Demand Analysis for the Urban Service Area*. Four methods were used including: historical water production, population projections, comprehensive planning, and historical water demands. An average of the results from each method was calculated, then a downward adjustment was made in anticipation of further water conservation efforts in the future. This resulted in a 2055 projected demand of 18.7 MGD.

CATEGORY: COST AND RATES

25. ***Question / Issue:*** **Why are the costs presented in the Four Concept Presentations (in the September 2004 through January 2005) different than the Alternative costs presented in the July 2004 and February 2005?**

Answer:
The costs estimates presented for each of the four water supply concepts include only the elements necessary to develop that concept. Two of the four concepts do not satisfy the entire water supply deficit and must be combined with another concept. The July 2004 and February 2005 water supply alternatives include treatment and other system upgrades to fully develop a project that satisfies the entire 2055 water supply deficit. Differences between these are significant. The following definitions are presented for clarity:

Raw Water Concept - A way of increasing safe yield
Alternative - A stand-alone concept or combination of concepts –together with system upgrades - that delivers treated water to satisfy the projected water supply deficit

Cost differences between Technical Memoranda (Raw Water Concepts) and February 2005 cost estimates for Alternatives include the following changes presented by concept. General comments that apply to all concepts are also provided.

General:
- A Ragged Mountain to Observatory pipeline was added
- A replacement of the Ragged Mountain Pump Station was added
- Easement costs were added for the Ragged Mountain to Observatory pipeline
- Electrical costs for the Ragged Mountain to Observatory pump station were added
- Added costs to increase total plant capacity to 30 MGD between Observatory and South Fork Water Treatment Plants.

Ragged Mountain Concept:
Comparing Ragged Mountain concept (technical memorandum) and Alternatives including this concept (Alternatives 1, 3, 4, 5, and 9) indicate the following changes were made to the cost estimates:

- Increased size of Sugar Hollow to Ragged Mountain Pipeline (recommended pipeline size still under investigation)
- Deleted land acquisition costs for RM land.
- Electrical costs for Mechums pump station were slightly increased
- The size of the dam increase for alternatives 3, 4, and 9 resulted in different costs for the dam raise and elimination of some line items that would no longer be impacted, such as culvert installation and embankment stabilization.

James River Concept:
Comparing James River concept (technical memorandum) and Alternatives 2, 6, 7, 8, and 9 indicate the following changes were made to the cost estimates:

- Unit costs for piping were changed to reflect current conditions
- An additional pump station was added to pump to Ragged Mountain from Observatory
- The concept did not include rehab of the Ragged Mountain dam at the current size
- Land acquisition was updated to include an additional pump station
- Electrical costs were updated based upon different operating conditions
- Electrical costs were modified to include Observatory to RM pumping.

Dredging Concept:
The changes to costs of the Dredging concept that were implemented in Alternatives 3, 5, 6, and 8 are:

- Environmental mitigation costs were updated from $150,000 to $320,000
- Mobilization costs were updated to reflect the number of years anticipated for dredging instead of 50 years.

4-foot Crest Gates at SFRR Concept:
There were no changes to costs for the 4-foot Crest Gate concept that were implemented in Alternatives 4, 5, 7 and 8.

Example:
The following example is provided to illustrate how costs from the James River Concept relate to the costs from the James River Alternative. The James River Concept cost (from the February 2, 2005 Technical Memorandum) is $ 49.9 million. The James River Alternative costs as presented at the February 17, 2005 presentation were $133.8 million.

The Differences include:

- Ragged Mtn. to Observatory pipeline added (including easement) at $5.2 million
- Added Ragged Mtn. pump station replacement at $2 million
- WTPs added at $26.2 million
- Unit cost increase based on additional information at $8.2 million
- An additional pump station for pumping to Ragged Mtn. at $1 million
- Rehabilitation of Ragged Mtn. Dams at current size at $3.5 million
- Revised easement cost at $100,000
- Revised land acquisition cost at $50,000
- Added electrical cost based on estimated usage at $12.3 million
- Additional engineering, permitting and CM (for above additions) at $8.6 million

The sum of these additions is $67.2 million. When 25% project contingencies are added, this value increase to $83.9 million which is the exact difference between the concept and alternative cost.

26. ***Question / Issue:*** **The costs presented at the February 17, 2005 Public Meeting are in 2005 dollars; is there a plan to present Net Present Value information?**

Answer:
It is the intention of RWSA to publish a Net Present Value for each of the final alternatives (concepts and combinations of concepts) as a part of the Final Report that will be submitted to the regulators with the permit application. The report will be available for public comment before being submitted to the regulators. The report has not been completed at this time.

Net Present Value is a different way of expressing cost information and is not the same as comparing capital cost. It is accepted by the regulators but can be confusing to some who are not already familiar with the concept. In simplified terms, if both the phasing schedule and the future capital costs are known for a particular alternative, Net Present Value defines how much money one would have to put into an interest bearing bank account today to pay for all of the improvements over time as they are scheduled. Net Present Value will vary, depending on the time value of money (expressed as an annual interest rate) that is assumed.

27. ***Question / Issue:*** **In 2002, RWSA increased wholesale rates to begin paying for water supply expansion bonds? What is the disposition of the funds collected for this work?**

Answer:
The Authority did increase rates in October of 2002 through an emergency drought rate. This was needed due to the reduction of flows resulting from the drought. The Authority is very reliant on water and wastewater flows, and the 30- 40% decrease of flows during the drought caused significant problems with meeting our expenses of the time. The authority had also used up quite a bit of cash in the previous years to fund our budget during the dry years prior to 2002. The emergency rates were reduced in February of 2003 after the budget issues concerning the drought were over. Both of these occurred in FY 2003. Therefore, the rate increases mentioned in this question were to address fiscal impacts of the drought and not the water supply.

The rate increase for the new water supply did go into effect for the fiscal year 2004. FY 2004 did generate reserves that are being held and not spent. Once a water supply option is selected and permitted, preliminary design would be performed in conjunction with a detailed financial plan to determine how to effectively finance needed improvements, including use of reserves. This plan will be presented publicly.

28. ***Question/Issue:*** **Could the information illustrated by graphs at the February 17 meeting ("Projected Water Rate Impact" and "Reserves for Future Capital – All Alternatives") be displayed in tabular form?**

Answer:
Yes, a table of the data represented in each graph is provided in the attached Table 1 and Table 2.

CATEGORY: REGULATORY / MANAGEMENT ISSUES

29. ***Question / Issue:*** **What is the current status of the Virginia DCR, Department of Dam Safety conditional operating permit for the Upper and Lower Ragged Mountain Dams? Why is it important that the Dam Safety issues be addressed?**

Answer:
Part 1 Currently, RWSA holds conditional operating permits for the Upper and Lower Ragged Mountain Dam structures. The permits were granted in July 2004 and expire in July 2005. The conditional operating permits were granted with the stipulation that RWSA "*resolve and rectify the existing inadequate spillway capacity. As Part of this requirement a design with time-table needs to be submitted within the period of this certificate*." At the time of permit issuance, RWSA discussed with DCR staff how the decision on the Ragged Mountain Dam rehabilitation was tied to the community water supply plan. DCR staff indicated that during the 12-month operating permit, progress should be made toward decision and design of the dam rehabilitation.

In subsequent conversations with DCR, the staff further clarified that although DCR was willing to grant another conditional operating permit to RWSA for the purposes of making forward step-by-step progress on the dam design, there were serious reservations and concern about issuing a permit in response to a delay in the water supply decision making process.

Part 2 The Upper and Lower Ragged Mountain Dams do not satisfy current design standards for dams per Virginia State Law. For example, neither dam has adequate spillway capacity to safely pass the spillway design flood designated for these structures. As a result, the structural integrity of either or both dams could be compromised during a very large flood event. The structural integrity of either or both dams could also be compromised during a large earthquake event. Structural failure would result in partial or full uncontrolled release of the Ragged Mountain Reservoir depending upon the severity of the failure. Any uncontrolled release of the reservoir could result in loss of life and significant damage to public and private property in the Moore's Creek valley downstream of the dams which includes portions of the urban area of Charlottesville. In addition, any failure of this facility would diminish the capability to provide public water supply for an extended period of time until repairs or rebuilding could be completed. Therefore, the dams must either be repaired in combination with development of a replacement source of supply as soon as practical to eliminate the current potential hazard to public safety and public water supply.

30. ***Question / Issue:*** **How were wetlands and wetland amounts determined in this evaluation?**

Answer:
Wetlands and waters for all the alternatives, including the SFRR concept, were identified using the procedures outlined in the 1987 Corps of Engineers Wetland Delineation Manual and related guidance documents. This work included the review of available data in the office followed by site specific field investigations.

As a result, the wetland boundaries have been accurately defined, enabling a confident assessment of wetland impacts for the SFRR 4-foot crest concept plan. Available to wetland scientists and GIS specialists were high resolution, color, digital ortho aerial photographs

taken in 2003 with one-foot contour lines. In addition to the color aerials, GIS specialists obtained survey-rectified 1994 color infrared aerial photographs of the study area. Both the color and color infrared photographs covering the entire reservoir were printed at 1 inch = 100 foot scale with the 386-foot contour line demarcating the upper limits of the study area. The photographs were studied for specific wetland photographic signatures in the office prior to the field site visits.

Canoes were used to access the entire study area. Biologists evaluated the presence of wetlands to elevation 386 feet utilizing the three parameter approach outlined in the 1987 Corps of Engineers Wetland Delineation Manual. The physical boundaries of the wetlands in the field were first identified followed by field measurement of the wetland dimensions (width and lengths) for transfer to the aerial photographs. Field investigations involved the confirmation of hydric soils, hydrophytic vegetation, and wetland hydrology. In many cases, the actual boundaries of the wetlands were completely flagged, providing a greater degree of accuracy compared to a typical walkover. Abrupt wetland boundaries were often clearly recognizable on the 2003 color and 1994 color infrared aerial photographs based on textural (i.e. vegetative) and color differences between community types. For wetland boundaries that were not discernable on the aerials, biologists used a combination of other photographic features (tree species, field edges, reservoir coves, structures, etc.), GPS, and the field-measured wetland dimensions to accurately map wetland boundaries. Wetland habitat types (i.e., emergent, scrub-shrub, forested) were also mapped during the field inspections using the aerial photographs in-hand.

31. ***Question/Issue:*** **Are we presently considering options that the regulators are unlikely to approve? If so, why?**

Answer:
Federal and state regulations require that permit applicants examine a wide range of potentially-available alternatives. The extent of the inquiry into each alternative must be sufficient to determine, based on reasonably available information, whether the alternative has potential to be the least environmentally damaging, practicable alternative. Prior studies have already concluded that sufficient information exists to demonstrate that some alternatives would not satisfy that regulatory requirement. Among those alternatives are the Buck Mountain Reservoir, and Indirect Reuse of Wastewater.
Additional studies are now nearing completion and indicate to Gannett Fleming, in consultation with VHB and Ellis & Thorp, that alternatives incorporating the Four Foot Crest Gate concept will not be the “least environmentally damaging”. In addition, they have indicated that alternatives incorporating dredging SFRR Reservoir for purposes of increasing water supply will not be “practicable” owing to logistical problems that cause disproportionate costs, and uncertainties that cannot be eliminated with any reasonable level of investigation.

32. ***Question/Issue:*** **Once an option or options are selected and permits are obtained, how long will we have to build/construct the options before the permits expire? For example, if we select a combination of options, can we build one and wait thirty years to build the other?**

Answer:
The regulatory process requires that communities look at its long-term needs (e. g., 50 years) when preparing a plan that results in a permit application for water supply, and the preferred alternative should be consistent with that long-term need. However, the process does not require a community to construct for its fifty year need all at once; in other words, phasing is acceptable.

The US Army Corps of Engineers will issue a permit for a 10-year period if the preferred alternative is approved. This permit would allow RWSA to initiate construction of a project (which could be only a phase of the projects defined to meet the 50-year needs) anytime within the 10 year period. The Corps of Engineers does have a process for granting extensions to this 10-year period, however, in most cases they want to see that some significant progress toward implementation has already been accomplished when considering an extension.

If a later phase project that contributes to the 50-year need is proposed to start long after the first 10 years, it should be anticipated that the Corps of Engineers will want the study process to be updated. The extent of that update, by comparison to the current process, would depend on whether or not new opportunities or technologies had emerged since the current plan. If changes in technology or knowledge base had occurred over time warranting a change in direction, the new study could be an avenue to update or redirect the community water supply plan at the time a later phase project would be needed.

33. ***Question / Issue:*** **Who will be making the final decision on which water supply alternative will be selected?**

Answer:
The responsibility for the application for a federal permit to increase water supply rests with the Rivanna Water & Sewer Authority Board of Directors. However, pursuant to its charter and as a practical matter, the RWSA exists to serve the needs of its wholesale customers, and RWSA's decisions regarding the increase in water supply must also conform to the zoning and land use requirements within the local government jurisdiction(s) where the improvements are proposed. The Board of Directors is made up of representatives of the City of Charlottesville, County of Albemarle, and the Albemarle County Service Authority. Given the importance and impact on the community of the Community Water Supply decisions, the RWSA Board of Directors desire that the decision on which of the water supply concept(s) will be included in the federal permit application be made with the input and concurrence of the Albemarle County Board of Supervisors, the Albemarle County Service Authority Board of Directors, and the Charlottesville City Council.