

South Fork Rivanna Reservoir **Stewardship Task Force Report**

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Report of the South Fork Rivanna Reservoir Stewardship Task Force

The South Fork Rivanna Stewardship Task Force was appointed to articulate the benefits the South Fork Rivanna Reservoir (the "Reservoir") affords our community and to describe the measures that would need to be undertaken to maintain those benefits. This report presents the results of that work.

To understand the approach of the task force, it is important to understand the context in which it was created. For years – if not decades – the community has wrestled with how best to increase the amount of drinking water it can store to see it through times of drought. In June 2006, the community chose to expand the existing Ragged Mountain Reservoir, rather than increase the capacity of the South Fork Rivanna Reservoir, which is losing water storage capacity due to sedimentation. Having made this decision, it raised the question about what would become of the South Fork Rivanna Reservoir. While it has ably served the community as its major water storage facility, that role will be served in the future by the expanded Ragged Mountain reservoir, which does not fill with sediment. The task force was asked to describe the other benefits, beyond water storage, that the South Fork Rivanna Reservoir provides to this community. As a result of that charge to the task force, this report does not revisit the community's 50-year water supply plan. In fact, the task force was specifically instructed not to do so, so we have not. With that background, the Task Force is pleased to present this Report to its four appointing bodies for community consideration.

I. The Task Force Mandate

The Task Force was established by joint action of the Chairmen (or Mayor) of the City Council of Charlottesville, Albemarle County Board of Supervisors, the Rivanna Water and Sewer Authority (RWSA) and the Albemarle County Service Authority (ACSA). At its first meeting on August 12, 2008, the Task Force was presented with an "outline of work."¹ Thereafter, on October 27, 2008, the Task Force received clarification of its assigned purpose, as follows:

¹ "Outline of Work for the South Fork Reservoir Stewardship Task Force," prepared by the Mayor of the City of Charlottesville, the Chairman of the Albemarle County Board of Supervisors and the Chairmen of the two water Authorities. (Appendix A)

Joint Statement by
Charlottesville Mayor Dave Norris
and Albemarle County Board Chair Ken Boyd
Clarifying the Purpose of the South Fork Reservoir Stewardship Task Force
10/28/08

First, we want to thank the members of the South Fork Reservoir Stewardship Task Force, and the members of the public who have been attending these meetings, for your contributions to this important community discussion about the future of the South Fork Rivanna Reservoir.

We understand that there has been some confusion about the City's and County's expectations for this Task Force, and we came here tonight to share our perspective on this matter and hopefully bring more clarity and focus to your work. Note that this statement reflects our personal opinions as members of the "Four Chairs" group that chartered this Task Force, and has not been endorsed by either the City Council or the Board of Supervisors.

To understand the purpose of the South Fork Reservoir Stewardship Task Force, it's helpful to refer back to the water supply resolution unanimously approved by the City Council on 6/2/08 and by the County Board of Supervisors on 6/11/08, which included the following text:

"BE IT FURTHER RESOLVED that in addition to the specific elements of the local Water Supply Plan endorsed and approved by this Resolution, the City Council [Board of Supervisors] hereby requests the Rivanna Water and Sewer Authority to undertake a study of the South Fork Rivanna Reservoir and the viability and merits of maintenance dredging, siltation prevention and any other appropriate initiatives that could maintain and enhance the aquatic health and water quality of the South Fork Rivanna Reservoir, as a valuable water resource for the long term future benefit of the community."

It's important to note that this Task Force was conceived in the context of a joint City-County reaffirmation of the basic parameters of the proposed water supply plan. As is clear from the text we just read, measures to sustain the long-term health of the South Fork Reservoir (potentially to include dredging) were not envisioned as replacing, but rather supplementing, the other components of the water supply plan approved by the City and County. In other words, this Task Force was not charged with responsibility for reassessing the fundamentals of the water supply plan itself. In our opinion, that is outside of your purview.

Having said that, it's also important to note that in our resolutions, the City and County both acknowledged the valuable role that the South Fork Reservoir plays as a water resource for the community – not just a place where people go to fish and row and play and enjoy nature. While the Reservoir benefits our community in many ways, the Reservoir was created as a water supply vehicle and will continue to serve in that capacity under any water supply scenario offered to date. If this Task Force were to recommend that the Reservoir be dredged, to whatever extent and for whatever purposes, it is clear that water supply gains would result. Whether or not you decide that increasing the Reservoir's water storage capacity is one of the explicitly desired outcomes of a maintenance regimen, keep in mind that there is no consensus as of today as to whether those gains would be factored into the overall water supply equation and the water supply plan adjusted accordingly (as Mayor Norris has suggested), or whether they would simply be seen as creating additional supply to extend the life of the plan and/or give us greater capacity to manage any future water emergencies. Again, that is a decision which lies outside the purview of this Task Force.

In our opinion, the South Fork Reservoir Stewardship Task Force should focus its efforts on building a well-rounded case as to how the Reservoir benefits our community, what measures would be most effective in maintaining those benefits, what is likely to happen to the Reservoir if no such measures are undertaken, and what the next steps would be in order to move those measures forward. From there, as a result of your deliberations, we (the City, the County, the

Rivanna Water and Sewer Authority, and the Albemarle County Service Authority) can have a much more well-informed discussion about how to proceed in implementing those next steps.

Outside the scope of this committee's charge, but on the broader issue of how to proceed with the water supply plan itself, we both feel that the taxpayers and ratepayers of this community would be well-served by a more thorough assessment of the costs and feasibility of the various components of the adopted water supply plan, especially in light of the recent news about escalating costs of the Ragged Mountain dam expansion project. We commend RWSA for taking the proactive step of inviting in a panel of third-party experts to reassess the costs of replacing or repairing the Ragged Mountain Dam. Whether by broadening the scope of that review process or by proceeding with a parallel effort to engage independent experts in watershed and water supply management, we believe RWSA should take advantage of this pause in the implementation process to more closely analyze the key components of the adopted and alternative plans to ensure that the path we choose for meeting our community water supply goals truly is the most economically-and environmentally-responsible one. Finally, we would also remind our partners and the public that both the City and the County have called for the initiation of stronger measures to promote conservation and efficiency in our use of water, and that these too need to be incorporated into the community's long-term water supply plan.

Thank you for giving us the floor, and thank you again for your interest in preserving and enhancing this valuable community amenity.²

Accordingly, this report documents the work of the Task Force, starting with a brief description of how the work was undertaken (Section II). It presents relevant information regarding the history of the Reservoir and its current state (Section III). The report then responds to and addresses the four questions outlined in the Task Force mandate:

- A. How does the SFRR benefit our community? (Section IV)
- B. What measures (or actions) would be most effective in maintaining these benefits? (Section V).
- C. What is likely to happen to the Reservoir if no such measures are undertaken? (Section VI)
- D. What are the next steps that Task Force recommends in order to move these measures forward? (Section VII)?

II. Organization of Work

The Task Force met together as a group thirteen times, from our first meeting on August 12, 2008, through to our final meeting on January 26, 2009, to approve this Final Report. We used the first meetings to collect information about the Reservoir and to help give Task Force members a common understanding of the history of the Reservoir, its current conditions, and how the Reservoir is being used (including and in addition to water supply and storage). To gain

² The Resolutions of the City Council and Board of Supervisors, dated June 2, 2008, and June 11, 2008, respectively, are set forth in the Appendix of this Report. (Appendix B, C)

this understanding, Task Force members developed a list of questions for RWSA staff, for which answers were provided and during early meetings heard presentations by staff of RWSA, Albemarle County, Virginia Department of Game and Inland Fisheries, and Charlottesville/Albemarle Airport. All minutes, presentations, answers to the above questions, and a short list of facts about the Reservoir are on the Task Force web-pages at the RWSA website (www.rivanna.org). In addition, Task Force members were provided with information through reports and personal communications, including the 2003 report, *South Fork Rivanna Reservoir And Watershed: Reflecting On 36 Years, Anticipating 50 Years*, by Stephen Bowler, formerly of RWSA and Albemarle County.

The Task Force also made site visits that included an on-the-water boat tour of the Reservoir (hosted by UVA Rowing) and tours provided by RWSA of the South Fork Water Treatment Plant and the Ivy Landfill (to see the ultimate deposition of solid material taken out of Reservoir water in Water Treatment Plant). To more clearly understand many aspects of dredging, the Task Force held a conference call meeting with Gahagan-Bryant, the dredging consulting firm whose representatives came to Charlottesville in May 2008, and who said, "In order to scope a dredging project, one must first define *why* one wants to dredge." Another dredging firm, the Blue Ridge Sand Company, also made a presentation to the Task Force. Minutes of each meeting and all presentations are included as appendices to this report. (Appendix D).

The Task Force heard from the public in a number of ways. The Task Force provided public comment periods at several meetings and also provided an email address that gave the public an easy way to address all Task Force members. To better understand how the public perceived the benefits of the Reservoir, a special public hearing was held on October 27, 2008.

In addition, written and web-based questionnaires were used to obtain information regarding public attitudes and expectations about the Reservoir. Three hundred seventeen respondents shared their ideas with the Task Force through the questionnaire, and the Task Force learned from and appreciated all the input. Respondents who expressed interest in dredging the Reservoir said it would save money and provide water supply capacity, or they expressed the feeling of ethical obligation to maintain this piece of infrastructure. The questionnaire was displayed on the RWSA website (www.rivanna.org), and all responses can be found there and in the Appendix of the Official copy of this Final Report. (Appendix E) The questionnaire was not a scientific or statistically valid survey, as noted in a statement contained at the top of the questionnaire.

The last several meetings were devoted to reflecting on what had been learned and to writing this report so that it would be most useful to the four chairmen and their organizations. This report attempts to provide clear recommendations, though consensus was not achieved on all issues.

III. History and Current State of the Reservoir.

The City of Charlottesville purchased the land for the Reservoir in 1962, and construction of the Reservoir and the South Fork Rivanna River Dam was completed in 1966 when the

Reservoir was filled.³ As constructed, the surface of the Reservoir comprised 390 acres with a watershed of 258 square miles.⁴ The Reservoir is serpentine in shape and measures 7 ½ miles in total length from its dam upstream to Buck Mountain Creek, its official end-point and extent of City ownership. In the year 2000, it was estimated that, during periods of average rainfall, 74,400 million gallons of water flow into the Reservoir annually.⁵ Of this annual inflow, it was estimated that 2.3% is lost to evaporation; 94.2% passes over the dam or through the hydro-electric plant; and 3.5% is withdrawn for treatment and community consumption.⁶

Interestingly, Stephen Bowler opined in his Report, “*South Fork Rivanna Reservoir and Watershed; Reflecting on 36 Years, Anticipating 50 Years,*” that the Reservoir is neither a lake nor a river but falls somewhere between these two designations.⁷ This is due to enormous water flow through the Reservoir, flow that transports considerable sediment especially during storm events that erode stream banks. Some of this sediment drops out when the river flow is slowed upon reaching the Reservoir. Also as suggested by Mr. Bowler, the Reservoir’s riverine personality simultaneously provides both a blessing and a curse.⁸ The blessing, of course, is abundant water supply and the curse is sedimentation.⁹

The placid present appearance of the Reservoir belies its turbulent first days. As described by former County Supervisor, Charlotte Y. Humphris, the first of several fish kills occurred in 1969 resulting in a public outcry about the terrible taste and smell of the Reservoir water.¹⁰ This initial fish kill and several others in the same year were probably the result of pollutants causing low night-time dissolved oxygen levels.¹¹ Other fish kills occurred in 1970 and 1972.¹² According

³ “South Fork Rivanna Reservoir and Watershed, Reflecting on 36 Years, Anticipating 50 Years,” Bowler, Stephen P., 2003, [hereinafter, “Bowler”] (Appendix F at page 3)

The Task Force (and community) is indebted to Mr. Bowler for his definitive history and technical analysis of the Reservoir, written in year 2003, while Mr. Bowler served as County Watershed Manager. At the time, responsibility for compensation for the Watershed Manager’s position was shared by the County and the RWSA.

⁴ “Bowler,” (Appendix F at page 5)

⁵ Id. at page 7.

⁶ Id.

⁷ Id. at page 12.

⁸ See, “Bowler,” (Appendix F at page 32)

⁹ It is noted in passing that under the approved Water Supply Plan, the new Ragged Mountain Reservoir, will be connected to and filled by a pipeline from the South Fork Rivanna Reservoir, providing the blessing of water supply, but without the curse of sedimentation. Also, the Ragged Mountain Reservoir is protected from any residential development around its rim.

¹⁰ “A Summary of Efforts to Protect the South Fork Rivanna Reservoir 1965-1999,” Humphris, Charlotte Y., [hereinafter, “Humphris”] (Appendix G at page 1)

¹¹ “Bowler,” (Appendix F at page 38)

to Ms. Humphris's account, "finger pointing" soon began. The City was blamed for not purchasing enough land around the Reservoir site to adequately protect it. However, the County had no zoning ordinances in effect during the early days to protect the Reservoir and took the position that it had no obligation to protect the "City's" water supply. When the County did first adopt a zoning ordinance, it proposed high-density zoning adjacent to the East end of the Reservoir.¹³

In spite of this difficult beginning, however, there was swift progress in Reservoir protection. Numerous experts were retained over the years to provide reports, studies and recommendations, and the County adopted stringent land use protections. This progress is fully documented in Mr. Bowler's report and in Ms. Humphris's paper and will not be recounted here, except to note several particularly significant developments. A significant event was the County's 1980 down-zoning of the rural area, which prevented high density development in order to protect the watershed. The initial plan for high density development adjacent to the Reservoir was abandoned in favor of low density, large-parcel development.¹⁴ Also of particular significance, the Crozet Interceptor was completed in 1985, thus removing inadequately treated industrial and residential sewage that had previously impacted tributaries of the Reservoir. Albemarle County's water protection ordinances that evolved represented a model for other jurisdictions to follow.¹⁵

Nevertheless, since the inundation of the river in 1966, natural forces have worked to return the Reservoir to a more river-like state. As documented for the Task Force by Greg Harper in his presentation and paper, "*The Loss of Water Surface and Formation of Land in the South Fork Rivanna Reservoir*," sedimentation of the Reservoir has been relentless.¹⁶ This was expected at the time the Reservoir was constructed in 1966, when it was estimated that storage capacity in the Reservoir would be lost at the rate of 19.6 million gallons per year.¹⁷ In fact, however, the loss has been much less, with an average annual loss of storage capacity of 15.6 million gallons

¹² Id.

¹³ "Humphris," (Appendix G at page 1)

¹⁴ Some might argue that even to allow large parcel residential development around the Reservoir was a compromise, and that the better course, to more fully protect the Community's future water supply, would have been to allow no development around the perimeter of the Reservoir. It does not presently appear that this ever was a politically practical alternative.

¹⁵ From time to time the complaint is heard, that after construction of the Reservoir in 1966, the City and the County turned their governmental backs and walked away, willfully leaving the Reservoir to deteriorate. When the complete historical record is examined, however, it shows that this community has invested millions of dollars in reservoir protection, as well as enormous time and effort. Also, rural area property owners sacrificed greatly from the 1980 down zoning which limited future subdivision of parcels and development, an action the County was required to defend in the Supreme Court of Virginia, and subsequently won. In spite of these measures, sediment continues to fill in the upstream reaches of the Reservoir.

¹⁶ "*The Loss of Water Surface and Formation of Land in the South Fork Rivanna Reservoir*," Harper, Greg, 2008 [hereinafter, "Harper"] (Appendix H)

¹⁷ "Bowler," (Appendix F at page 14)

per year.¹⁸ Whether the initial estimates of storage loss were too high, or the extensive water protection efforts implemented over the years were in part successful in reducing sedimentation, is unknown. The Reservoir has a "dead storage" area immediately upstream from the dam, designed to receive sediment from upstream. But due to the Reservoir's long, narrow shape, the entering water slows down and drops sediment long before it reaches the dam, causing the upstream portions to be most affected by sediment.

Rather than plotting Reservoir storage volume loss in millions of gallons per year, however, Mr. Harper's analysis focused upon the amount of pool surface area that has been lost due to net deposition of sediment in spite of the small amount of pool surface area gained by bank cuts and erosion. By applying GIS measurements to aerial photographs of the Reservoir from 1974 and 2007, Mr. Harper was able to estimate the amount of pool surface area lost between 1974 and 2007, and with the data, make projections of the additional pool surface area that would be lost between now and year 2057. Mr. Harper's analysis focused upon two areas of the Reservoir—the Ivy Creek area and the main body of the Reservoir upstream from the Earlysville Road Bridge. (See Harper's paper in Appendix H for photographs)

With respect to the Ivy Creek area, Mr. Harper concluded that this area has lost 5.1 acres of pool surface since 1974 because of sedimentation. He also estimated that between the present and year 2057 an additional 7.7 acres of pool surface area will be lost if there is no intervention.¹⁹ He further concluded that by 2057 the Ivy Creek portion of the Reservoir will have reached a sediment-equilibrium and have restored itself as a creek.²⁰

Mr. Harper further concluded that in the main body of the Reservoir (upstream of the Earlysville Bridge) 17.2 acres of pool surface has been lost since 1974, and that an additional 26 acres will be lost by year 2057 without intervention and if sedimentation continues at a constant average rate.²¹ He emphasized that his technique is based on aerial photographs and cannot determine changes in the water depth; these projections simply extrapolate the past rate of surface area loss into the future. He also opined that between now and 2057 the Reservoir will narrow as the stream seeks a state of equilibrium with respect to sediment.²²

Mr. Harper's observations, however, do not quantify the amount of Reservoir storage capacity volume that has been lost already nor the volume that will be lost by 2057. A better indicator of storage capacity loss due to sedimentation is obtained from bathymetric studies, the last of which was conducted in March 2002. Based upon those data, it is estimated that the Reservoir's usable storage has dropped from 1,250 million gallons at the time of construction (1966) to 800 million

¹⁸ Id.

¹⁹ Harper, (Appendix H at page 3)

²⁰ Id.

²¹ Id. at page 4.

²² Id. at page 5.

gallons in 2002, and Gannett Flemming predicts that storage will further decrease to approximately 200 million gallons in another 50 years.²³

Recently, hydrilla, an invasive, non-native underwater plant has become established in the Reservoir, particularly in the upstream reaches. As noted in the discussion below, hydrilla's growth is a matter requiring close attention by RWSA.

IV. Benefits of the Reservoir To The Community.

The Reservoir continues to benefit the community by providing drinking water supply and drinking water storage as it was constructed to do. As the decades have progressed, other uses and benefits of the Reservoir have emerged. This section lists these beneficial uses and serves as a basis for Section IV, which recommends potential measures to preserve (or enhance) these beneficial uses into the future.

Drinking Water Supply

As noted above, the South Fork Rivanna Reservoir can be described as somewhere between a river and a lake. During normal periods of average rainfall, the Reservoir's riverine characteristics provide a primary benefit to the community. The water intake located near the dam functions as a "run-of-the-river" intake, where water is taken from the river before it passes over the dam or passes through the hydroelectric power plant. The vast majority of the community's drinking water—both now and in the future—is produced in this fashion. The water intake in the Reservoir is the principal source of drinking water supply to the Urban Development Area of the County and the City of Charlottesville.

The South Fork Rivanna River flowing into the Reservoir drains a 258 square mile watershed, and under the Water Supply Plan, it will continue to be the principal source of this community's water supply for the foreseeable future. About 96% of the urban water supply comes from the South Fork Rivanna River's watershed, now and in the future (the rest is from the North Fork watershed with a small amount --0.3% --from the Ragged Mountains watershed). The function of the Reservoir as a reliable source of water is a critical, most important benefit of the Reservoir to the community.²⁴

Drinking Water Storage

During periods of drought, the other part of the Reservoir's "dual personality" becomes more critical. As flow into the Reservoir slows, the community benefits from the Reservoir's lake

²³ Letter, dated June 15, 2005, from Gannett Fleming to RWSA, re: "Potential Dredging of the South Fork Rivanna Reservoir (SFRR)."

²⁴ Charlotte Humphris recorded a poignant statement by an official of the State Health Department made in the early 1970s. According to Ms. Humphris, Assistant Resident Engineer Stephen Young stated, "Charlottesville doesn't really have another water source. The Rivanna is the life of Charlottesville." (Humphris, Appendix G at page 3)

attributes. The Reservoir stores water to be utilized during dry periods when the abundant inflow to the Reservoir is reduced. The South Fork Reservoir provides about 50% of the current water system's storage capacity, down from 59% at its creation. Sedimentation over the past 42 years has reduced the Reservoir's storage capacity. With the approved Water Supply Plan, and without the additional expenditure of community funds for dredging, the benefit to the community provided by Reservoir as a water storage mechanism will continue to diminish.

As described by the Water Supply Plan, however, the expanded Ragged Mountain Reservoir will provide additional and sufficient water storage capacity to meet community needs through 2050. Upon completion of all components of the Plan, the Reservoir will be depended upon to provide only about 7% of the community's water supply storage capacity. Thus, while the community will continue to rely on the Reservoir's characteristics as a river to supply its water, it will no longer need to rely on the Reservoir's characteristics as a lake to store most of the water needed during times of drought. That storage role will be assumed by the newly expanded Ragged Mountain Reservoir.

Drinking Water Quality

The Reservoir benefits the community by providing high quality water. All samples of RWSA's finished drinking water from the Reservoir are in 100% compliance with United States Environmental Protection Agency and Virginia Department of Health Standards.²⁵ As discussed in Section III above, the watershed of the Reservoir is almost completely rural, and much of it is forested. There are no significant industrial land uses in the watershed that might contribute chemical pollutants. Watershed protection is an on-going concern of Albemarle County and is expressed in its land use practices and ordinances, and it is highly unlikely that any type of high-density residential development will be allowed in the Reservoir's watershed.

Nevertheless, sediment accumulation, depleted oxidation status, and turbidity can impact the quality of Reservoir water. The components of Reservoir sediment are known from only a few samples but appear consistent with normal Piedmont soil and do not contain metals or pesticides to any significant degree. The Reservoir, however, does have nutrient levels that can lead to algae blooms, poor light transmission to aquatic plants, and low dissolved oxygen levels in certain weather conditions. In warm months, aggressive water treatment is sometimes necessary to remove taste and odor compounds (algae, manganese, and iron) and to compensate for low dissolved oxygen in the raw drinking water.²⁶ All in all, however, the Reservoir benefits the community with high quality water. The Task Force notes, given the decision by the community to design its future water supply to draw water from its own watershed, almost all of which is within protected County borders, that the quality of Rivanna River water will continue to be an important benefit to and important responsibility for the community.

²⁵ Presentation to Task Force by Dr. Robert Wichser, RWSA, August 12, 2008, (South Fork Rivanna Reservoir Stewardship Task Force Minutes [hereinafter, "Minutes"], August 12, 2008, Appendix D at page 9)

²⁶ Id. at page 9-11.

Competitive Collegiate Rowing and Recreational Rowing

From the earliest days, the Reservoir has provided the benefit of a sports venue for competitive and recreational rowing. The University of Virginia's Women's Rowing Team (a UVA varsity sport), the UVA Men's Rowing Club (self-supported), and Community rowers (members of the Rivanna Rowing Club) all regularly use the Reservoir from a boat house and dock near the Woodlands Road/Earlsville Road bridges. Rowing and the other water recreational uses of the Reservoir have continued to increase and expand until it is the most utilized body of water for recreational pursuits in this community. It is estimated that more than 50,000 person-hours per year are expended in Reservoir rowing activities alone, comparable to a rough estimate of 60,000 to 75,000 recreation hours spent at each of the other County lakes and reservoirs. As discussed more fully in Section V below, continued sedimentation of the Reservoir constricts the area available for rowing. At some time in the future the University program may have to consider moving to another location.

Fishing

The Reservoir is generally viewed by sports fishermen as the best fishing spot in the County. The Reservoir contains self-supporting populations of largemouth bass, bluegill, red-ear sunfish, black crappie and channel catfish. Thirty-pound catfish are rumored to live there. There are approximately 7000 active fishing licenses issued in Albemarle County, and John Kauffman (Virginia Department of Game and Inland Fisheries) estimates that the Reservoir hosts 13,000 to 20,000 individual angler trips per year.

Paddling

Canoeing and kayaking (often coupled with fishing or birding) are also popular activities on this Reservoir that offers the longest stretch of flat water in the region. Sedimentation has resulted in very shallow water in some areas, thus limiting access to even very shallow-draft boats, but the total surface area of the Reservoir is extensive and otherwise accessible to canoes and kayaks. The most limiting factor to these activities is lack of adequate public access to the Reservoir. The owners of private property on the Reservoir do have access and are allowed to build boat docks for small un-motored craft under tightly controlled regulatory conditions.

Education

The Ivy Creek Natural Area, located at the convergence of Ivy Creek with the Reservoir, is owned jointly by the City of Charlottesville and Albemarle County and provides unique opportunities for nature study and education due to its location on the Reservoir and Ivy Creek. Classes and programs at the Natural Area are offered by the Ivy Creek Foundation. Also, summer camps for children are provided at Panorama Farms, a privately owned property located on the north side of the Reservoir. Because the Natural Area and the Reservoir offer natural settings that support local flora and fauna, a variety of groups use the area for educational purposes.

Ivy Creek Foundation's educational programs are designed to observe and interpret changes in the natural world. Although sediment accumulation in the portion of Ivy Creek immediately adjacent to the Ivy Creek Natural Area has changed the shores of the Natural Area, dredging this section of Ivy Creek to restore the original channel is not necessary for the continuation of these educational programs. If reservoir maintenance projects such as mechanical removal of hydrilla or opportunistic dredging were instituted, Foundation representatives have opined that efforts would be made to minimize any negative impacts these measures might have on their programming and on public use of the Natural Area, and that their curriculum may be adapted to incorporate these maintenance activities where appropriate.

Aesthetic Value

When the Reservoir construction began in the early 1960s, a beautiful 7-mile stretch of the South Fork Rivanna River was destroyed -- a stretch that was free-flowing and natural and had importance to local residents and others at the time. There was undoubtedly sadness when the river was inundated and the Reservoir formed, but we have no historic record of contemporaneous observations.²⁷ Even though some initial ugliness may have resulted from the construction activities, the 42-year old Reservoir is now a beautiful body of water. The Reservoir is a Community amenity for all who observe it from bridges, on the water, or from neighboring properties. Lack of access to the Reservoir limits its full appreciation. Sedimentation in the Reservoir has certainly changed the "picture" of what the Reservoir looks like, especially in the upper reaches of the Reservoir as well as the Ivy Creek portion of it. Islands have formed; shrubs and trees have filled out the islands. Though these are natural processes, it is impossible to conclude whether this has improved or lessened the aesthetics of the Reservoir. With beauty being in the eye of the beholder, it is likewise debatable whether dredging would improve, or damage, the Reservoir exclusively from the aesthetic perspective.

²⁷ While beyond the scope of the Task Force report, a few historical items are worthy of note and form part of the value of the Reservoir to our Community. Don Wagner, Chairman of the ACSA, recalls that at some time prior to 1959, the Hydraulic Sand and Gravel Company was located at the edge of the Rivanna River near where old bridges crossed Ivy Creek and the Rivanna River, close to where the Woodlands Road and Earlsville bridges currently cross the Reservoir. The Hydraulic Sand and Gravel Company mined sand and gravel from the Rivanna River. This is testament to the power of the Rivanna River to move sediment from upstream locations even before the Reservoir "captured" the sediment.

Hydraulic Mills, once located at the juncture of Ivy Creek and the Rivanna River, played an important role in local history. John Perry purchased the mill in 1818, from which he supplied much of the lumber used to build the University of Virginia. By the mid-19th century, Hydraulic Mills had become the head of navigation for the Rivanna River, and the mill complex included a grist and merchant mill, a miller's house, a cooper's shop, a storehouse, a blacksmith's shop, a country store and, briefly, a silkworm industry. Farmers from throughout northern and western Albemarle brought wheat and tobacco to be processed here and sent down-river by bateaux to Richmond and beyond. In the mid-1880s, Hydraulic became the commercial and social center for the growing African American neighborhood known as Union Ridge. When completed, the South Fork Rivanna Reservoir flooded the junction of Ivy Creek and the Rivanna River, erasing all vestiges of this once vital community center. Also, it is known that there were ancient Indian settlements in the general area of this portion of the Rivanna River.

Biota

The Reservoir provides a variety of ecological habitats from lake to wetlands. The Task Force did not investigate what is known about the Reservoir's invertebrates. Fish are thriving (see above). Turtles and birds abound as well as some aquatic mammals. Hydrilla (*Hydrilla verticillata*), an invasive aquatic plant that is thriving in shallow waters throughout watersheds in the Southeastern United States has recently taken hold in the Reservoir. While hydrilla provides benefits such as nutrient-filtering and fish habitat, John Kauffman notes that it can create habitat problems when it covers more than 30% of a body of water. It is now a serious issue for rowers especially where it forms thick mats, according to Kevin Sauer, long-time Head Coach for UVA Women's Rowing. Its growth depends on light for photosynthesis, but it survives in lower light conditions than most plants and can grow to depths of 15 meters in clear water. Hydrilla is especially problematic during infrequent periods when water level is below dam height because then the plants lie sideways and can be especially impenetrable to boats. If it becomes too pervasive within the reservoir, it can also adversely affect fish habitat and water quality especially by absorbing too much oxygen. Its growth is a matter requiring close attention by the RWSA and Reservoir users.

At least one Task Force member has mentioned the possibility of breaching the Reservoir's dam to allow the river to flow naturally. One advantage of such a breaching would be the potential return of the American eel and American shad, gizzard shad, and herring to the upper reaches of the South Fork watershed. Shad and eels spend a portion of their life cycles inland and a portion in the ocean and dams prevent their access to critical upstream habitat.

V. Measures To Maintain Community Benefits.

Each of the community benefits listed above has some value, is threatened to a certain degree, and is worth some community effort to preserve or enhance. How great the value, how imminent and substantial the threat and how significant the investment we should make to maintain those benefits is for accountable local officials to decide. While the Task Force is not in a position to determine how the benefits of reservoir maintenance compare to other community priorities, we have educated ourselves on these issues and can suggest how the risks can be assessed by the elected officials and the two water-supplying authorities. We can imagine that the rate-payers and/or tax-payers will want a clear analysis of the cost/benefit of any maintenance activities, whether dredging out sediment or implementing measures to keep sediment from entering the Reservoir. In short, the Task Force can describe why and how we should maintain the Reservoir, but only accountable local officials can determine when such measures might be implemented, and whether it would be worth the cost. Accountable local officials may also decide to take no action, of course.

Removing Sediment from the Reservoir

Over time, the continued accumulation of sediment will affect beneficial uses of the South Fork Rivanna Reservoir. Specifically:

- Each year, sediment accumulation reduces the storage capacity of the South Fork Rivanna Reservoir.
- Each year, sediment accumulation restricts the area accessible to rowers, paddlers and boating fisherman.
- In roughly seven years, the UVA competitive rowing team may have to consider whether to move from this venue.
- In roughly 50 years, an estimated 33 acres of new land could form within the 390-acre Reservoir.
- In roughly 75 to 100 years, accumulated sediment in the dead storage area at the dam may clog the existing water supply intake and necessitate dredging in this area.

Water Storage. Past bathymetric studies clearly show that storage capacity has been diminished by sedimentation, and it is expected to diminish further as time progresses. The approved Water Supply Plan²⁸ which the Task Force was charged to accept²⁸ already accounts for that diminishing storage capacity of the Reservoir. Therefore regaining lost storage capacity is not a *reason* to dredge or slow sedimentation, but it is undeniably a *benefit* created by dredging or slowing sedimentation undertaken for whatever reasons. Maintenance dredging for any purpose would result in additional supplementary water storage capacity. Thus, the ancillary benefit of expanding water storage capacity by dredging should be factored into any consideration of dredging for other purposes. For example, if the community were to decide to continuously dredge to improve boater access to the Reservoir, this will also create additional water storage, which may result in the water supply, planned to meet needs for 50 years, actually meeting community needs longer than 50 years.

The Task Force discussed storage capacity benefits that might ensue in the short term and in the long term resulting from dredging, even if primarily for other purposes. In considering the short term, *i.e.* prior to completion of construction of the new Ragged Mountain Dam and Reservoir and the SFRR to Ragged Mountain pipeline scheduled for 2021, the Task Force discussed whether dredging in the near-term that resulted in additional capacity would reduce the risk of water storage shortages that might occur if demand exceeds planned capacity before 2021 or because of unexpected delays in the completion of the Ragged Mountain Dam and pipeline; or in the case of a drought of record in the interim.

Creating any additional storage capacity in the Reservoir would of course reduce risk during drought periods in the short-term. The Task Force was told by RWSA that the computer modeling that supports its drought-management strategy shows that the system has adequate capacity without dredging to meet community needs between now and 2021, even during a severe drought.²⁸ This would seem to allay the short-term risk concerns, but some members of the Task Force believe since this was not directly studied by the Task Force, officials should assure themselves that this risk is minimal. Other members of the Task Force have suggested, however, that to the extent that any short term risk exists, this risk can be ameliorated by earlier construction of the pipeline from the Reservoir to the newly enlarged Ragged Mountain Reservoir(s). If the short-term risks are a community concern, other drought-responses may be

²⁸ The Community drought management strategy, revised in 2006, now includes releasing water from the Beaver Creek Reservoir into the Mechums River, thence into the Reservoir.

appropriate, but the Task Force has not gone outside its charge to look at any other possible measures. If short-term risks are judged to be a significant concern, and if other reasons for dredging combine with that concern, the Task Force suggests in the final section of this Report a procedure for consideration of a modest level of dredging.

Rowing, paddling and fishing access. Removal of accumulated sediment would extend the range of access for rowers, paddlers and fisherman. As the Reservoir reaches sediment equilibrium, however, sediment will no longer accumulate in the main channel of the Reservoir, keeping that area open for these uses. Whether the remaining area of deep water sufficiently meets the demand of these users is unclear. In addition, paddling and other recreational boating activities are affected by the increasingly shallow areas caused by sediment, separate from the rowers' need for an open channel.

UVA's competitive rowing program. On August 22, 2008, the Task Force conducted a field trip to the Reservoir escorted on boats provided by the UVA rowing program. At the time, the Reservoir was approximately 3 feet below its normal pool level due to exceedingly dry conditions. In normal rain-fall years, it is relatively rare for the Reservoir to be below its normal pool level, and, due to the very large size of the Reservoir's watershed, the Reservoir tends to refill rapidly after such events, as it did shortly after the field trip.

On the field trip, sandbars and islands created by sedimentation were evident upstream from the University's Boat House and immediately downstream from Ivy Creek. Hydrilla was very evident. Kevin Sauer estimates that 1½ miles of practice area that his crews used to enjoy have been lost to sedimentation.

The risk here is that the UVA and other competitive rowing programs will be increasingly constricted in practice area and might need to consider moving from this venue. There are 3,000 meters from the boathouse to the dam that is expected to remain clear, but ideally rowers would have a 100-foot lane clear, up to Reas Ford Bridge, allowing a total of 4,800 meters. Kevin Sauer does not think that the UVA teams will have to consider moving for at least another seven years. The risk to the University of Virginia and other competitive rowers of losing its competitive rowing venue should be weighed along with determining what amount of dredging will be needed to restore adequate rowing lanes in some areas. The situation requires close monitoring. If the community determines that the risk of loss of competitive and other recreational uses as discussed below are sufficient to require immediate dredging, Section VII discusses Next Steps to be taken.

Wetlands creation. Another storage capacity issue is a long-term one and is based on the proposition that maintenance dredging could be used to preserve the Reservoir adequately so that it might provide more storage in another 50 years, to respond to the risk that additional storage capacity might be needed then. Some Task Force members suggest that since wetlands constrict the storage capacity, if they were to become un-touchable by regulations, storage capacity would be permanently lost or too costly to restore. They suggest that dredging these shallow depositional areas now may be prudent before that potential loss. Other Task Force members expect that mitigation would be required but removal would be allowed if sufficient need were

proven. Information will need to be obtained from Federal and State regulatory officials to determine whether this concern of permanent loss is warranted.

The Task Force did not analyze the severity of the risk that this type of dredging will be permanently curtailed, nor the need for using the Reservoir for additional storage capacity after 50 years, but it suggests this type of risk analysis be done by RWSA with experts on this specific issue.

Removing Debris from the Reservoir.

The Task Force did not investigate physical maintenance such as removing fallen trees and snags that foster the creation of sandbars by slowing the flow of water. But recreational users point to these as a sign that no one is responsible for ongoing maintenance as would be found in a purely recreational lake. The Reservoir users might respond to the offer of an open dialogue on the issue of on-going maintenance.

Abating the Effects of Hydrilla.

The recent onslaught of hydrilla has created problems for rowers, paddlers and fisherman and has the potential to affect fish and water quality. Nation-wide, scientists are working to find ways to fight this invasive plant, without much success. RWSA and recreational users may have to work together to restrict its growth if the extent of the hydrilla begins to restrict severely the recreational uses of the Reservoir and threaten water quality.²⁹

Keeping Excess Nutrients Out of the Reservoir.

As discussed in Section IV above, there is no serious current threat to Reservoir water quality from industrial pollutants and run-off, due primarily to 40 years of County land use planning to protect the watershed. Run-off from agricultural fields and homes, however, is believed to contribute quantities of phosphorous and nitrates which impair water quality to some extent. At certain times these chemicals tend to promote the growth of algae, which causes taste and odor problems that require additional water treatment.³⁰ As the nutrients oxidize in the sediment and are released into the Reservoir water or deposited with the sediment, dealing with sediment would go a long way towards reducing nutrient problems. Educating landowners about proper application of fertilizers also would help the Reservoir.

²⁹ Many research articles are being written regarding hydrilla. It is not clear that dredging would do anything but further increase its presence, due to its ability to reproduce and survive in waters shallower than 15 meters. It can reproduce from cut segments, flower, root, tuber and axial seeds. Any maintenance dredging operation or other maintenance activities conducted in the future should take the presence of this nuisance into account, and the expansion of hydrilla should be monitored closely. (Summary of Information on Hydrilla, Ambler, Tamara, January 8, 2009, Appendix I)

³⁰ It is further noted, that in the early part of this decade, Albemarle County Police Department divers retrieved 3 automobiles from the bottom of the Reservoir at the Woodlands Road fishing ramp. Though in heavy use by sportsmen, this ramp makes the Reservoir vulnerable to misuse such as illegal dumping.

Keeping Sediment Out of the Reservoir.

Presently, the greatest threat to Reservoir water quality is the large amount of sediment that enters the Reservoir every year. Measures to decrease the sediment are on-going and should be continued. The County has over the years implemented increasingly aggressive water protection ordinances supported by citizens who are concerned about the health of waterways.³¹ It is difficult to quantify the degree of success these ordinance have had, but sedimentation of the Reservoir has been less than was estimated at the time of the Reservoir's construction. Most recently, in February 2008, the County passed an ordinance which allows the County to impose some regulatory control even on farmed and forested lands in identified erosion impact areas. Notwithstanding the County's arsenal of water protection ordinances, however, budget constraints have not allowed the County optimally to staff watershed protection positions, which can impair aggressive enforcement of its watershed protection ordinances.³²

The recently established Rivanna River Basin Commission (RRBC) is also fully engaged in analyzing methods to decrease sedimentation and siltation from the tributaries of the Rivanna River. It has established a Technical Advisory Committee, composed of staff members of the participating jurisdictions and private citizens with particular and varied scientific expertise. As time progresses, it is hoped that the RRBC will have considerable impact upon the problem of sedimentation and siltation which has plagued the Reservoir for 42 years.

There is a voluntary partnership of agencies concerned with sedimentation and other threats to the waterways. This partnership consists of the RWSA, Stream Watch, the Nature Conservancy, the Rivanna Conservation Society, the Thomas Jefferson Planning District Commission, the Thomas Jefferson Soil and Water Conservation District, Charlottesville and Albemarle County staff, the Rivanna Regional Stormwater Education Partnership, the University of Virginia and the Virginia Department of Transportation. The Thomas Jefferson Soil and Water Conservation District offers technical assistance and incentives to rural landowners to protect streams from erosion and over-land flow of sediment when funding is available. They also offer a Conservation Reserve Enhancement Program (CREP) and a TJSWCD Riparian Easement Program to provide permanent protection of forested buffers along streams.

One idea which was discussed is the concept of constructing a forebay at the upstream end of the Reservoir, perhaps near the Reas Ford Road Bridge. The concept would be to construct an

³¹ See, *Albemarle County Code*, Chapter 17.

³² The Task Force did not study possible deleterious impacts that upstream activities can have on the Reservoir. In the past, major public efforts in the watershed have improved the Reservoir. The Crozet Interceptor was the largest, taking wastes from a former food-processing factory as well as residential wastewater from the Crozet area, out of the Reservoir's watershed. Crozet's Lickinghole Creek Basin was built to collect storm water runoff from that area, further protecting the reservoir's tributaries. There also has been a ban on phosphorous in detergents which had clear effect. No major efforts of similar nature are currently being considered, except that restoring flow to the Moormans River, as will be accomplished under the permit for the Water Supply Plan, will have a beneficial effect on the Reservoir once the Plan is fully constructed. This further community benefit of the approved and permitted Water Supply Plan, which restores flow to the Moorman's River and protects flows below the dam in the South Fork Rivanna River, should not be underestimated. Indeed, it can be said that these sustainability features mark who we are as a community.

area that would serve to slow the flow of water incoming to the Reservoir sufficiently to cause major amounts of sediment to fall out before leaving the forebay and entering the Reservoir. The forebay itself, of course, would need to be periodically dredged or excavated to remove sediment that is captured, probably necessitating an access point in the Reas Ford Bridge vicinity. (See discussion in Section VII below, regarding next steps including a regulators site visit.) The RRBC might be able to provide technical support for examination of such a concept which could have application in other areas of the multi-jurisdictional watershed, including upstream from the Reservoir.

Improving Reservoir Access

The launch ramp at the Woodlands Road bridge is presently the only public access to the middle reaches of the Reservoir for fishermen and other small boaters, and its location is hazardous for those launching or offloading boats as well as local traffic. The City-owned access near the dam is avoided by boaters because of its steep drop-off into the water. Albemarle County plans a new boat-access near the dam, but will not have capital funding until after 2014. Private funds or donation of private land for additional access should be encouraged. If community resources are to be used to improve any users' recreation opportunities at the Reservoir, access for the public should be improved. Also, channels should be cleared of downed trees especially after storms since snags create sediment bars. Any approach ramps, such as may be needed for maintenance equipment, should be designed to become public access points if located in an area that can be made safe for cars, pedestrians and boats.

Supporting the Ivy Creek Natural Area.

The Ivy Creek Natural Area is uniquely situated to be a center for study of the Reservoir as a natural resource. Jointly owned by the City and the County, the Ivy Creek Natural Area provides an educational venue for the Ivy Creek Foundation (a non-profit organization), which conducts nature tours for school children, hosts educational programs that are free and open to the public in the old barn and the newer Education Center (which is also used by other local groups). The Foundation also maintains the trails for public use and works to foster partnerships in environmental and natural history education with other non-profits, area schools, community groups and the University. The Foundation welcomes public and private funds to help with staff and programs, as well as upkeep and upgrades to the public facilities at the Natural Area and this should be encouraged.

VI. Results of Not Implementing Suggested Measures.

This section discusses the effect that not implementing the suggested measures would have on the beneficial uses of the Reservoir identified by the Task Force.

Drinking Water Supply. As long as water continues to flow into the Reservoir, it will be the predominant source of our drinking water. As has been described, the South Fork Rivanna Reservoir will continue to receive sediment along with its copious supply of fresh water. In roughly 75 to 100 years, the area around the present intake will need to be cleared.

Drinking Water Storage. No maintenance of the Reservoir is necessary for meeting the community's water storage needs in light of the Community Water Supply Plan. If no maintenance is performed, an estimated 33 acres of land are likely to form in the reservoir. This may, or may not, affect the future expansion of the reservoir, if needed beyond the 50-year Community Water Supply Plan. (See discussion at page 14).

Drinking Water Quality. If the amount of sediment and nutrients entering the Reservoir is not reduced, we will not be able to reduce the amount of chemical treatment needed and thereby reduce our water treatment costs. If local organizations and agencies cease to work to maintain the river's health, and/or if the County changes its zoning and ordinances to allow more suburban and industrial development in the watershed, the quality of the water could be seriously impacted. Almost uniquely, our community's public water flows from within our own boundaries. We have the ability to be stewards of our own water; we have no one to blame but ourselves if we allow degradation of the Rivanna River and its headwater tributaries.

Competitive Rowing and Recreational Rowing, Paddling and Fishing. If measures are not taken to remove sediment or reduce the rate of sedimentation, the UVA competitive rowing team will likely have to find another venue for practices and meets, some time after seven years. Similarly, the area available for recreational rowing, paddling and fishing will continue to decline until the Reservoir reaches a state of sediment equilibrium. At that time, the Reservoir will resemble a wide river rather than a lake. The spread of hydrilla and the existence of debris in the Reservoir also restrict access to portions of the Reservoir for rowing and paddling. Finally, if public access is not improved, a decreasing proportion of the population will be able to utilize and appreciate the Reservoir. (Other lakes will undoubtedly be turned to, including the newly expanded Ragged Mountain Reservoir, to the extent that public access is allowed.)

Education. No reservoir maintenance is required to maintain the educational benefits of the Reservoir, but improved public access could increase educational opportunities.

Aesthetic Value. In the absence of maintenance, floodplains will form where sediment is deposited along the edges of the reservoir, and they will likely resemble the forested floodplains that existed before being inundated when the reservoir was created. Once the reservoir reaches sediment equilibrium, it will likely resemble the South Fork below the dam, a State Designated Scenic River.

Biota. There is little evidence that maintenance is required to preserve habitat in the reservoir, although the habitat will become more river-like than lake-like and hydrilla will probably become more pervasive.

VII. Next Steps.

The Task Force hereby recommends the following "next steps," consistent with the Task Force mandate which places the fundamentals of the Water Supply Plan beyond the Task Force

purview, and thereby precludes consideration by the Task Force of dredging solely to expand water storage capacity.

A. Investigate the Impact of the Encroachment by Wetlands.

The Task Force recommends that several specific aspects of the potential post-50 year risk be addressed by RWSA with consultants. One aspect is whether the Reservoir's inflowing sediment is now, and is likely to be, creating wetlands. "Wetlands" are extensively defined by Federal regulation. Experts can determine whether wetlands are forming in and around the edges of the Reservoir as defined by regulations of the U.S. Army Corps of Engineers and the Virginia Department of Environmental Quality. The behavior of the water flow in this river-like reservoir might be significant in determining whether wetlands will form.

If wetlands are forming or likely to form that constrict the Reservoir, we should determine whether removal of such wetlands is likely to be permitted in the future, when additional water storage capacity may be needed. RWSA should seek legal advice regarding the likelihood that future removal of such created wetlands would be permitted in order to expand drinking water storage.

After ascertaining the existence and potential of wetlands, it is recommended that appropriate personnel from the Virginia Department of Environmental Quality and the U.S. Army Corps of Engineers be invited to conduct an "on the water" site visit of the Reservoir. The purpose would be to evaluate the Reservoir for particular areas that potentially could be dredged for maintenance purposes. These areas may include places where the pool surface area has already been lost to sedimentation and areas near the shorelines that are becoming shallow due to sedimentation, but where the sediment has not yet breached the surface of the pool at normal Reservoir pool levels. The purpose would be to obtain regulatory guidance regarding whether Federal and State permits would be necessary to conduct maintenance activities by dredging in these identified areas, and to address the question of whether delaying maintenance dredging would preclude future dredging or entail additional regulatory burdens.

The survey of the Reservoir and consultation with regulatory officials would be coordinated by the RWSA, which (before or after the regulators' visit) may wish to consult legal counsel with experience in water supply regulatory matters. Additionally, information could be gained from these regulatory officials with respect to regulations that pertain to the construction of a forebay, as referenced in Section V above, relating to "drinking water supply," and advise RWSA on the practicality of a forebay in that specific location.

B. Begin a dialog with the University of Virginia and Recreational Users.

It is recommended that the City, the County, the RWSA and the ACSA maintain a dialog with the University of Virginia, probably through the Planning and Coordination Council (PACC) to monitor the University and other competitive rowers' needs with respect to maintaining a continuous length of adequate depth for competitive rowing programs. Groups providing other recreational programs and individual recreational users of the Reservoir should be involved in

the discussion when possible. If there is perceived value in the recreational pursuits provided by the Reservoir, then the community must decide whether an investment in its future is important. If the University determines that dredging will be necessary to continue use of the Reservoir, instead of moving its program elsewhere, the University should be requested to provide its view of when this maintenance would need to be accomplished. Maintenance short of dredging, such as removing snags that foster the creation of islands, should be discussed, with the goal of keeping the waterways as open as possible for all the users. This venue could be used to discuss hydrilla since at this time it interferes more with recreation than with water-quality.

C. Support Efforts to Reduce Sedimentation and Excessive Nutrients.

The Task Force urges continued Community efforts to reduce sediment and pollutants entering the Reservoir, such as supporting agencies and organizations that are concerned with the sedimentation problem and the health of the watershed. We encourage strengthening and enforcing water protection ordinances and programs such as those of the Thomas Jefferson Soil and Water Conservation District.

Regarding a forebay, RWSA said in answer to a Task Force question, "There may be some [forebay] strategies that can make some improvement in where sediment drops out, but it is not likely to find an economical solution that is completely effective. In order to identify the options in greater detail, or determine if the benefits outweigh the costs, we would recommend retaining a consulting firm with the expertise to gather appropriate data and develop conceptual alternatives." The Task Force did not study the practicalities of a forebay but recommends that it be pursued at least to the point of having a consultant assess the specific SFRR situation and advise on its potential, in terms of feasibility, effectiveness and probable cost. Something akin to forebays but farther upstream than the Reservoir's slack waters can be part of RRBC's analysis of the watershed, with a goal of slowing the storm-created waterflows that scour the stream banks and deliver sediment to the Reservoir.

D. Monitor the growth of hydrilla and study the most effective way of managing this invasive grass.

This effort has already begun, but the Task Force was impressed with the rampant growth of hydrilla and recommends it be closely monitored.

E. Investigate the cost of selective dredging when purposes, priorities and specifically identified areas have been established

If and when Community decision makers determine the purposes for which dredging might be done (for example, to prevent wetlands formation after duly studying their legal status or to facilitate recreational activities), public officials should determine whether the benefits of any measure to maintain the reservoir are worth the cost of that measure. In order to assess those potential costs, we recommend that the following actions be taken.

1. Identify areas of highest priority for potential dredging, based on identified purposes

- a. Working with University and community rowers, other boaters, and fishermen, develop a map which clearly identifies the priorities for specific areas of the Reservoir that would most usefully be kept clear.
- b. Identify areas that would need to be dredged to preserve the Community's ability to restore the storage capacity of the SFRR beyond the 50-year Water Supply Plan if wetlands are allowed to encroach on the Reservoir's area, should the legal opinion justify such an operation, and decision-makers consider the risk sufficient enough to create the need for action.

2. Collect data about high priority areas for potential dredging.

- a. Determine whether the presence of obstacles would substantially increase the cost of dredging (e.g. tree stumps left at the bottom of the Reservoir when it was constructed). If so, determine whether there are tree stumps or other obstacles to dredging in the areas of the Reservoir where dredging would be required to maintain the rowing and recreational uses of the Reservoir and/or to prevent the formation of wetlands, should wetlands prevention be necessary. Technology exists to map contours, presence of underwater aquatic plants and depth of sediment in specific areas of interest. An intriguing resource is the aqua-view underwater video cameras used by fishermen on the Reservoir. Their knowledge of the Reservoir floor could be extremely useful (and inexpensive to gather) when mapping areas for dredging or other maintenance such as removing snags.
- b. Undertake bathymetric studies in the critical areas for dredging to quantify the location and amounts of sediment to be removed. Though RWSA has periodically done bathymetric studies, and this type of survey of the entire reservoir may continue, it could be done to a finer degree in the high priority areas of potential opportunistic dredging. We also note that this step is important to provide data to assess the effectiveness of any future efforts aimed at reducing sediment inflow (such as forebays or strengthening of water protection measures).³³
- c. Take geotechnical core samples to determine the constituents of the sediment in the critical areas for dredging.
- d. Identify and consider purchasing or optioning one or more potentially suitable access points, staging areas and dewatering sites on the

³³ Of course, RWSA may choose to expand the area of any study if the cost of an expanded study is not significantly higher and meets other needs, such as regulatory requirements.

perimeter of the Reservoir that could be utilized by a dredging company.

- e. If relatively small amounts are to be dredged in order to fit a defined purpose, the Task Force recommends first giving consideration to "opportunistic" dredging as likely to be the least expensive method. "Opportunistic dredging" is defined as dredging contracted for when market conditions make it attractive for contractors to remove dredged materials at relatively low cost to RWSA (because the profit from reuse or sale of dredged materials covers the cost of dredging). If authorities identify other dredging scenarios to fit a defined purpose, the cost of the method that fits those reasons should be further analyzed.
- f. Estimate the likely duration and impact of dredging operations on residents and aquatic habitat, including the locations affected, the presence of equipment and piping, noise or fumes, and hours of operation, under various alternative approaches.
- g. Dredging's impact on water quality will also need to be considered. RWSA will need to assess whether its water treatment plant will have appropriate methods and capacity to handle any of those effects on water quality, and rigorous safeguards would need to be put into place to prevent any fuel spills.

3. Finally, based on the information garnered by these steps, and assessing the community's risks, infrastructure needs and financial priorities, the funding authorities should make a decision on whether the public interest would be served by issuance of a Request for Proposals for removal of sediment.

The members of the Task Force wish to express appreciation for this opportunity to serve. The views and recommendations contained in this Final Report relate solely to measures for future stewardship of the South Fork Rivanna Reservoir in light of the Community's decision to expand the Ragged Mountain Reservoir rather than the South Fork Rivanna Reservoir. We who have served on this Task Force hope that the recommendations contained herein will bring renewed focus upon the Reservoir and the need for Community stewardship.

Respectfully submitted,

Chair, The South Fork Rivanna Reservoir
Stewardship Task Force