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NEW RIVER VALLEY WATER SUPPLY PLAN

EVALUATION OF PHASE 1 & 2 STUDIES

AS COMPLETED BY THE STUDY CONSORTIUM*

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EXECUTIVE SUMMARY

A. BACKGROUND OF PROJECT

The New River Valley Planning District Commission (NRVPDC) and localities within the district recognize that there is an abundance of potable water supply capacity within the region, which far exceeds the current average daily demands of the public in the area. At the same time, some localities are faced with the prospects of having to increase their own water supply capacities, as a result of ongoing growth within their distribution systems. The potential for moving water from supplies with excess capacity to those facing expansions needs to be examined as an alternative approach to satisfying future demands. This interconnection of systems may provide a viable alternative for meeting future needs, while also providing water supply redundancy for some of the local systems.

The NRVPDC commissioned the "New River Valley Water Supply Plan – Phase 1" working document, dated September 29, 2004, and completed by New River Valley Planning District, Virginia Tech's Institute for Policy Outreach and New River Valley Development Corporation. The working document presented the available water supplies in the NRVPDC north of Interstate 81, their capacities and demands, and provided some potential means for the localities to share and distribute water between them to maximize the use of available water. In 2005, a Phase 2 study was drafted to refine the recommendations made in the Phase I work and to expand the area considered, to include the area in the NRVPDC south of Interstate 81. The two phases of work were completed using numerous resources on the subject of water supply in the area, and involved communication with most of the water suppliers in the NRVPDC area. The study used hydraulic modeling and was based on a number of assumptions concerning anticipated growth in the region and timing for necessary infrastructure extensions.

Recent actions in Virginia have resulted in legislative rules requiring local jurisdictions to develop long range water supply plans. The legislation was drawn in response to the drought that affected the State from 1999 into 2003, causing water shortages, voluntary and mandatory use restrictions, and diminished surface and groundwater resources. These studies take the first step toward discovery of potential regional solutions to ensure adequate water supply when the next drought comes to Virginia.

B. PURPOSE OF PROFESSIONAL EVALUATION

The purpose of the professional evaluation included in this proposal is to review the project methodology and study results included in the Phase I and Phase II Reports and render an engineering judgment on:

- Feasibility of the proposed water supply plan, for implementation in the New River Valley.
- Accuracy and completeness of the collected and compiled data used for evaluations.
- Reasonableness of the opinions of construction cost used in the evaluations.
- Accuracy and completeness of the conclusions and recommendations.
- Other aspects of consideration that may need to be evaluated in more detail.

The political feasibility, operational changes needed and ultimate range of user costs for water service are expressly omitted from discussions in this report, in accordance with the agreement for the terms of conducting this study. Technical and engineering solutions are reviewed and/or created based solely on engineering judgment. Modified plans represent our opinion of the best solutions for a regional water supply network.

C. CONCLUSIONS

If a regional water supply plan is to go forward, there will have to be some compelling reasons for the water suppliers to join in the implementation effort. Those suppliers and localities that struggled with water supply through the most recent drought as it peaked in 2002, could see the regional supply as an opportunity to have standby source available for their system. Those suppliers who are growing to meet their threshold water demand levels, requiring them to begin planning for new capacity, may see the opportunity to avoid local costs through sharing of excess water available from neighboring systems. And still others may see the water transmission mains discussed in this report as a means to extend water service to customers who have desired service, but local connections could not be justified on the basis of economics. The recommendations made herein, are based primarily upon economics, but consider the other

factors as well. Economically viable projects, when coupled with other incentives, are generally worthy to pursue when there is a need to be satisfied.

The Phase I and Phase II reports considered the acquisition of three water treatment plants and addition of considerable lengths of transmission mains with pumping stations and storage tanks to provide water service to areas that are growing in the near term, but will continue to grow in the future. This report adds the Giles County PSA water plant to the acquisition list. The reports used the production cost of $1.00/1,000 gallons as a benchmark cost for source and treatment at the two facilities with surplus capacity. Although we have not tested the production cost through analysis, it is used in this report as a representative cost for water taken directly from the City of Radford water treatment facility. When looking at the overall supply of the acquired water plants, it is evident that the unit cost of produced water increases slightly over the $1.00/1,000 galllons, as a result of the use of multiple plants, some with higher production costs.

This analysis indicates that there will be new costs in water supply for the region if the overall project is undertaken and assessed against existing users in the water supply systems. This is also true with the reduced cost scenarios. It is evident that some of the financing concerns with the total program alternative are due to the extensions of major water mains into unpopulated areas. While service in these areas could be expected to increase significantly, water suppliers need to be concerned about cost coverage in the near term. Unless sizeable grant financing is available, the total project as presented in the Phase I and II reports, or as presented here, should not go forward all at one time. The extensions into unpopulated areas can be reconsidered in the future.

A comparison of the Phase I and Phase II plan costs, with a plan of reduced infrastructure, is included in the following tables.

Table ES-1
New River Valley Regional Water Supply Plan
Phase I and Phase II Plan Cost Summary

Cost Element	Opinion of Cost/yr
Capital Cost (Including Grant and Loan Financing)	$2,907,500/yr
Operation and Maintenance of New Facility	$834,700/yr
Water Production	$3,080,300/yr
Total Estimated Additional Annual Costs	**$6,822,500/yr**
Estimated Quantity of Water Sold	7.30 MGD
Net Rate to Water Systems	$2.56/1,000 gal
This table adapted from Table IV-5 Production Cost compares to $2.00/1,000 gal currently averaged in the region	

Table ES-2
New River Valley Regional Water Supply Plan
Recommended Regional System Cost Summary

Cost Element	Opinion of Cost/yr
Capital Cost (Including Grant and Loan Financing)	$2,057,000/yr
Operation and Maintenance of New Facility	$ 777,900/yr
Water Production	$3.037,100/yr
Total Estimated Additional Annual Costs	**$5,872,000/yr**
Estimated Quantity of Water Sold	7.25 MGD
Net Rate to Water Systems	$2.22/1,000 gal
This table adapted from Table V-5, and uses Reduced Plan – Step 1 Production Cost compares to $2.00/1,000 gal currently averaged in the region	

To summarize feasibility, the engineering team has judged that a regional water supply authority is feasible. At the same time, although it is a sound plan for the future, there likely will be a need to provide additional funds in the near term to make it a reality. The plan can be completed as laid out in total or on a reduced scale basis as noted in Section IV. At a reduced scale, the funding that is needed should be significantly less than in the total plan. The provision

of grants and low interest loans toward the project will make the difference in determining the amount of additional funding required.

D. RECOMMENDATIONS

Phase I

Although the regional water supply program could be accepted in total, if accepted, its implementation could be staged over several years with certain projects of urgency taking precedence. In reviewing the project segments considered in this report, there are key components that should be started in the near term to maximize benefit for the most populated areas of the district. The projects that appear to be most beneficial are:

- Pulaski County PSA – Commerce Park Segment 1 from City of Radford to the Commerce Park. Use City of Radford, Pulaski County PSA and Town of Pulaski water plants to produce water for this area. (Phase I)

- Giles County PSA – Connection of Giles County through one of the potential routes (either Radford through Commerce Park to Pearisburg via Route 100, or Blacksburg to Newport via Route 460). Put Giles County PSA current source on standby and use new source for normal supply. (Phase I)

- Montgomery County PSA – Connection of the PSA's Riner system through one of the potential routes (either Radford via Forest Ave and Rock Rd, or from Christiansburg along Route 8). Put Riner current source on standby and use new source for normal supply. (Phase II)

- Floyd County PSA – Connection of the PSA's and Town of Floyd systems through extension of the main to Riner. Put Floyd current well sources on standby and use the new source for normal supply. (Phase II)

- Pulaski County PSA – For service to the south of Claytor Lake, an area that will experience growth in the near future, it is recommended that the main from Riner westerly to the Snowville area in Pulaski County be included in the initial project. (Phase II)

Because water from the City of Radford water plant can most reliably benefit Riner through a long connection from the City's water treatment plant, rather than from the closer periphery of the City's system, the potential for connection to the Town of Christiansburg should be reviewed in some detail for system supplement. Also, because the residents of eastern Giles County could be isolated from the PSA source and the redundant supply along Route 100 in the event of a watermain break along the spine of the GCPSA system (at the New River, in particular), and the community of Brush Mountain would be very difficult to serve from Giles County, the potential for connection to the Town of Blacksburg (or Water Authority) should be reviewed in some detail before committing to installation of watermain over Cloyd's Mountain (Route 100).

Later Phases:

The water main extensions in the southern portion of the district should be implemented at such times as economic justification for the mains can be more clearly shown.

I

INTRODUCTION

A. GENERAL INFORMATION

The New River Valley, in Virginia, extends from the North Carolina border to the West Virginia border through the southwest area of the Commonwealth. The New River Valley Planning District Commission (NRVPDC) is active in the northern portion of Virginia's New River Valley, including the political jurisdictions and water supply agencies identified below:

- Floyd County (and Public Service Authority)
- Giles County Public Service Authority (and Giles County Board of Supervisors)
- Montgomery County (and Public Service Authority)
- Pulaski County (and Public Service Authority)
- Blacksburg Christiansburg VPI Water Authority (in Montgomery County)
- City of Radford (between Montgomery and Pulaski Counties)
- Town of Blacksburg (in Montgomery County – BCVPI WA)
- Town of Christiansburg (in Montgomery County – BCVPI WA)
- Town of Dublin (in Pulaski County)
- Town of Floyd (in Floyd County)
- Town of Glen Lyn (in Giles County)
- Town of Narrows (in Giles County)
- Town of Pearisburg (in Giles County)
- Town of Pembroke (in Giles County)
- Town of Pulaski (in Pulaski County)

- Town of Rich Creek (in Giles County)
- Radford Army Ammunitions Plant (RFAAP) (part Montgomery and Pulaski Counties)
- Virginia Polytechnic Institute (Virginia Tech) (in Montgomery County – BCVPI WA)

The Planning District area has developed with relatively dense population centers along the Interstate 81 and US Route 11 corridors, as well as US Route 460. As a result, the most populous areas of the district are in the Montgomery County and Pulaski County jurisdictions. Giles County includes a portion of US Route 460 and has benefited from development along that corridor. Floyd County remains more rural than the rest of the district, with only one incorporated Town, that being the Town of Floyd. It follows that the larger existing water supply systems are located within the more populous Counties. The larger systems make use of the New River or its tributaries for source water. The smaller systems tend to depend upon wells for their water supply.

B. BACKGROUND OF THE PROJECT

The NRVPDC and localities within the district recognize that there is an abundance of potable water supply capacity within the region, which far exceeds the current average daily demands of the public in the area. At the same time, some localities are faced with the prospects of having to increase their own water supply capacities, as a result of ongoing growth within their distribution systems. The potential for moving water from supplies with excess capacity to those facing expansions needs to be examined as an alternative approach to satisfying future demands. This interconnection of systems may provide a viable alternative for meeting future needs, while also providing water supply redundancy for some of the local systems.

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The political feasibility, operational changes needed and ultimate range of user costs for water service are expressly omitted from discussions in this report, in accordance with the agreement for the terms of conducting this study. Technical and engineering solutions are reviewed and/or created based solely on engineering judgment. Modified plans represent our

opinion of the best solutions for a regional water supply network. In addition, recommendations for continued evaluation of alternatives are offered.

D. AUTHORIZATION

This evaluation is authorized by an agreement between New River Valley Planning District Commission and Anderson & Associates, Inc., representing the engineering team, which also includes Draper Aden Associates and Thompson & Litton. The agreement was signed and became effective on January 10, 2006.

II

ASSESSMENT OF NEEDS

A. SURVEY QUESTIONNAIRE DISTRIBUTED TO WATER PURVEYORS

As part of the evaluation activity for this project, the engineering team prepared and coordinated the distribution of a survey questionnaire to the water purveyors in the study region. A blank copy of the questionnaire is included in Appendix A of this report. Responses to the survey were received from about 50% of the water systems. The responses received were varied and appeared to depend upon a number of factors, including a) the administration's current level of satisfaction with water quantity and quality provided through existing means, b) the administration's perception of the cost of water to their customers, c) the effect of weather on their systems, either wet conditions leading to turbidity concerns, or dry conditions resulting in shortage of water (drought), d) growth of the service area or service base population, and the impending need for capital improvements in the system, e) pending and recently enacted regulations and f) other specific operational concerns in their respective systems. The responses to the survey were used in developing the following sections concerning the system needs.

B. POPULATION AND WATER DEMAND PROJECTIONS

The Phase I and Phase II reports examined historical populations and water demands within each of the political jurisdictions and water supply systems. Based upon history, recent trends, and anticipated growth areas within the planning district, population and water demand projections were developed to provide a sense of how the district will develop prior to 2030. The population projections were completed using a number of different techniques. Depending upon the method, and the assumptions associated therewith, some of the jurisdictions had a wide range of potential ultimate population and water demand. It is understood that over a long period of time, the influences affecting population growth and water demand can vary due to many different factors. One of the most significant factors in growth is the location of significant commercial or industrial concerns, which can steer prospective employee populations into the proximate area and increase water demands significantly. Such growth areas can occur at many

locations within the planning district. Population projections and water demands, therefore, can often only be used as a guide in the development of geographical areas. Accurate projections of the timing required for the improvement of water system infrastructure are rarely possible using local comprehensive plans, but more often it is based upon a critical level of water demand, the system's water production capability and other factors that become apparent only a short time (typically a couple of years) before the improvements need to be in service. Our review of the population projections and water demands reported in the Phase I and Phase II reports revealed no major concerns in methods or results. It does however need to be recognized that the projected timing of required system improvements is subject to significant potential change.

It is also noted that the water systems served by the Giles County PSA have traditionally experienced higher rates of unaccounted water than most systems. In water systems, unaccounted water volumes typically range from 15% to 20% of the water produced. It is thought that the PSA system exhibits unaccounted water less than the typical range, but that the Towns served by the PSA lose significantly greater amounts of water. One way to minimize the future need for development of new water sources, is to control leakage in water systems and maximize water conservation methods where possible. Potentially, the need for expansion of water systems in Giles County might be delayed for a period of time, if aggressive actions can be taken to find and repair leaks and encourage water conservation in the systems. The levels of unaccounted water in the other Counties does not afford the systems in those areas the same level of opportunity to save water.

Throughout the Planning District, the reports indicated that the 2003 population was around 165,000 persons, 113,000 of which are currently served with public water. The nearly one – third of Planning District residents who are now on private systems, represent potential future customers to a regional water system. If all persons could be served by public water, the water demand, at an accepted usage of 100 gpd/person, would be about 16.5 MGD. Assuming the growth projections of the Phase I and Phase II reports are representative, a potential increase of 20% in water demand may need to be satisfied by 2030. This would increase the overall water demand in the district to about 19.8 MGD (population about 198,000 for the district).

It is important to re-emphasize that the studies have been completed on the basis of long range planning. The nature of long range planning often calls for capital investment in the early

years in exchange for significant benefits at a later date. In the review of this report, local decision makers should look beyond the current day needs and assess how the potential regionalization of water systems could ultimately benefit all participants.

C. FLOYD COUNTY (INCLUDING PSA AND TOWN OF FLOYD)

Due to its isolation and dependence entirely on ground water, potable water systems in Floyd County were severely impacted by the drought conditions that existed between 1999 and 2003. As ground water elevations dropped, well systems were impacted through reduced yield and many new residential wells had to be drilled to replace existing wells that went dry. Throughout the rural county, water users are currently 100% dependent on either private or public wells for their drinking water. An alternative water source is desperately needed in Floyd County to provide an adequate source other than ground water.

Currently five wells and two storage tanks provide water to the Town of Floyd and the adjacent area. The remaining areas of the County lack a public water source and rely entirely on individual wells. This dependence on wells severely restricts development. The Phase I study indicated that an estimated 900 residents out of 14,500 residents in Floyd County received water from the Floyd-Floyd County Public Service Authority (PSA). This small percentage was due to the rural nature of the County and the lack of an adequate water distribution system. Even if a back up water source was in place, the lack of an adequate water distribution system makes the provision of affordable water a serious challenge for Floyd County. Although the cost associated with simply drilling another well with adequate capacity is substantial, it is very often the size and cost of the needed distribution system that makes a project in a sparsely populated rural area cost prohibitive. The combined costs can exceed the limited resources of a rural area.

Even in light of the existing water constraints, Floyd County is expected to continue developing rather rapidly over the next several years. During the 1990's, the County had the highest growth rate of the New River Valley jurisdictions, at 16 percent., It is anticipated that the existing water system located in the Town of Floyd will need to start planning for the delivery of increased capacities in the next five to ten years. The reports indicated that the Town's existing system is currently operating at approximately 69% of design capacity. The Virginia

Department of Health (VDH) will require the planning of improvements and up grades once the system reaches 80% of its capacity. This upcoming requirement should provide some incentive for the Town of Floyd and the County to consider the benefits of a regional water supply system. In addition to providing water to the Town, a regional water system that extends south from Montgomery County along Route 8 will support future growth along the Route 8 corridor The anticipated growth along Route 8 will allow Floyd County to take advantage of a number of connections between Riner and Floyd and generate revenue to offset the project's construction cost.

The high cost of installing the needed infrastructure magnifies the need to keep water production rates low for both Montgomery and Floyd Counties. If a connection from a regional system is to be extended deep into Floyd County and remain feasible, the concept will have to leverage the availability of large quantities of water at a low unit cost. In other words, the per gallon cost of the proposed Authority's water would need to be considerably less than the Floyd-Floyd County PSA's current production cost. Floyd County has a production cost of over $3.00 per 1,000 gallons according to the Phase I study. A decrease in the water production cost would allow for some of the capital costs for connection to be absorbed over time.

D. GILES COUNTY PUBLIC SERVICE AUTHORITY (INCLUDING GCBOS AND TOWNS)

The Giles County Public Service Authority (GCPSA) operates and maintains the primary water treatment plant (WTP) and two secondary chlorinated well sources within Giles County, along with the pumping and storage facilities necessary to provide wholesale bulk water to the following customers:

- Giles County Board of Supervisors
- Town of Glen Lyn
- Town of Narrows
- Town of Pembroke
- Town Pearisburg
- Town of Rich Creek

The customers of the GCPSA are responsible for operating and maintaining the facilities necessary to provide the residents access public water supplies.

The GCPSA-WTP is located in the central portion of Giles County and the well supplying the WTP has a rated capacity of 2.0 MGD. The two secondary chlorinated well sources (i.e., Well No. 4 and the Orchard Well) are located in the Town of Pearisburg and the Town of Narrows, respectively. Well No. 4 has a rated capacity of 0.45 MGD and the Orchard Well has a rated capacity of 0.13 MGD, resulting in at total rated capacity of 2.58 MGD for the GCPSA. Based upon data collected for fiscal year 2004 (July 04 to June 05), the WTP produced approximately 0.98 MGD, Well No. 4 produced approximately 0.12 MGD and the Orchard Well was not utilized. Therefore, it can be determined that the GCPSA was operating at approximately 43% of their total rated capacity for the fiscal year 2004.

Population projections presented in the PDC report indicate that Giles County will have a total population of approximately 20,693 by the year 2030 (i.e., 7.5% growth per 10 years from 2000 Census data). The PDC report also estimates that approximately 60% of the existing population is currently connected to a public water supply (i.e., supplied by the GCPSA) and assumes that percentage will increase to approximately 75% by the year 2020. By assuming the same rate of water system development, it can be estimated that approximately 82.5% of the 2030 Giles County population (i.e., 17,072 people) will be supplied by the GCPSA. Utilizing the typically accepted water usage rate of 100 gpd/person, the 2030 GCPSA water demand can be estimated to be approximately 1.7 MGD or 66% of their total rated capacity. It should be noted, other reports prepared for the GCPSA and the Giles County Board of Supervisors have predicted future system demands as high as 2.3 MGD or approximately 80% of the total rated capacity of the GCPSA system, which appears to fall in line with the upper demand analysis rate of 136 gpd/person identified in the PDC report. The PDC report also discussed the fact that several systems within Giles County have the capability to reduce the overall production rate by improving system accountability. Therefore, the demand projections presented in the PDC report predict that the GCPSA has adequate capacity through the year 2030. The regional options have a potential to reduce the costs of operating the current system of wells. The well system could be operated by a regional authority as a backup system.

The GCPSA has recently been evaluating potential alternate/back-up water source options throughout the County. As presented above, the GCPSA is not under pressure to expand the capacity of the water system, they are evaluating back-up supply options, in the event of a

main line failure, well failure, pump failure/maintenance or tank maintenance. A regional water distribution system connection could fulfill the GCPSA desire for an alternate/back-up source. The options being evaluated could range in cost from $ 500,000 to $ 4,000,000.

The connection of Giles County to a regional system is similar to that of Floyd County, in that both are some distance from the major population centers and larger water suppliers of the Planning District. There are at least two potential routes for connection of Giles County. The PDC report evaluated one of the two options, which would ultimately transfer water from the State Route 100 corridor in Pulaski County, northerly over Cloyd's Mountain, along the State Route 100 corridor in Giles County into the Town of Pearisburg. This option would serve as an alternate or back-up source to the GCPSA system. However, it should be noted that the opportunity for the GCBOS to obtain new connections along this route is limited by the remote nature of the lands along the highway and ranked fairly low in the *Giles County Water Master Plan Update* approved by the Virginia Department of Health on February 20, 2003. The second route would utilize the U.S. Route 460 corridor from either the north or west side of the Town of Blacksburg, over Brush Mountain to a connection with the GCBOS system near Newport. This option could serve as either an alternate or back-up source to the GCPSA system east of the Town of Pearisburg. The Brush Mountain development and other minor population centers in Montgomery County could be provided service from this line. However, just as in Floyd County any feasible interconnect for Giles County, must leverage the availability of water with low production cost (much less than current GCPSA rates), so that water transmission costs can be largely offset by the savings associated by the cost of water from the interconnection. Giles County PSA has a production cost of about $2.00 per 1,000 gallons, according to the Phase I study. A decrease in the water production cost would allow for some alternate capital costs to be absorbed over time.

E. MONTGOMERY COUNTY (INCLUDING PSA ONLY)

Ten independent water systems make up the Montgomery County Public Service Authority's (PSA) water system. The ten systems include: Bethel, Woodview, Mudpike, Prices Fork (including Midway & Merrimac), Plum Creek, Riner, Jennelle Road, Christianburg/Elliston, Warm Hearth, and Belview. Each system is unique. The Woodview and Riner systems operate independently off of wells, while the others are interconnected with

systems whose water source is provided by surface water sources. The Phase I study did note that the two systems that utilized ground water were susceptible to contamination through the migration of substances related to land use activities. The Riner system utilizes three wells and the Woodview system utilizes one well. The surface water source utilized by the other eight systems is the New River. The surface water is treated and conveyed to the Montgomery County systems by the City of Radford, the Town of Blacksburg, the Town of Christiansburg and the Radford Army Ammunition Plant.

The total permitted water capacity of the ten systems, both ground water and surface water is 2.41 Million Gallons a Day (MGD). This permitted capacity far exceeds the 2004 – 2005 total usage of only 0.88 MGD. It is important to note that although the overall water use in the County is well below the permitted capacity, individual isolated systems are beginning to approach the 80% capacity mark. At 80% capacity, the Virginia Department of Health (VDH) mandates that a system begin initiating upgrades to the system in order to ensure future capacity. Of the ten systems in Montgomery County, the Riner system is currently the one on track to hit the 80% milestone in the very near future. The Riner system is currently operating at over 70% of its capacity and will need to begin planning for upgrades very soon. The Christiansburg/Elliston system and the Prices Fork system are operating at slightly over 50% of their capacity.

In addition to areas currently served by public water systems in the County, there are other areas in the County in need of more reliable, and better quality public water. The McCoy/Longshop, Brush Mountain, and portions or Ellett Valley are areas of concern. These areas struggle with low well yields and poor water quality. As a result, these communities have expressed interest in a public water supply in the past. The McCoy/Longshop area could be served hydraulically from the Prices Fork System if flows from the Radford Army Ammunition Plant (RFAAP) were reliable. The Brush Mountain area and portions of Ellet Valley could be served by extensions from the Town of Blacksburg or the Blacksburg Christiansburg Virginia Polytechnic Institute (BCVPI) Water Authority.

Montgomery County and the numerous water systems that operate within Montgomery County could benefit from the shared capacity and redundancies provided by an interconnected regional water supply. The regional system would help in reducing the high production costs

associated with operating the numerous small sources. The shared capacity and the interconnectivity of the system would allow the smaller systems to gain capacity with a minimum outlay of capital. Other extensions to serve outlying areas of the County could also be constructed to serve those areas in need of public water.

F. BLACKSBURG CHRISTIANSBURG VPI WATER AUTHORITY (INCLUDING TOWNS AND VT)

The Water Authority operates a water source and treatment system, using New River water, then wholesales potable bulk water to the Towns of Blacksburg and Christiansburg and Virginia Tech. In some cases, the Towns sell water to communities outside the Water Authority service area in modest amounts. The Towns and Virginia Tech are members of the Water Authority. The Water Authority is positioned in an ideal location to provide a central hub for a regional water supply system. The Water Authority has a production capacity of 12.6 MGD and produces about 7.3 MGD on an average day basis to meet current water demands. Potentially, this would allow the Water Authority to sell a long term average of up to 4.0 MGD (max day about 5.0 MGD). With growth of the member Towns and Virginia Tech at a reasonable level, the report predicts that planning for increased capacity from the Water Authority's facilities will not be required prior to 2030. Other reports have projected a greater rate of growth on the system and anticipate that planning may be required prior to 2030. BCVPI Water Authority has excess water available to sell for many years to come. As noted, the Water Authority and its member systems are central to the Planning District and could provide water for service extensions to Floyd County, Giles County and/or Montgomery County.

With the Water Authority and its members in a good position to maintain excellent water sufficiency into the future, these water suppliers are understandably "satisfied" with the state of their water supply. As a result, there is little incentive for the Water Authority members to desire membership in a separate regional water authority. And there would seem to be concern that changes to the Water Authority system, by transfering water at peripheral locations or otherwise changing the usual operation of the system, might have negative effects on some of the customers of the system. At the same time, the Water Authority and its members have traditionally been good neighbors and have cooperated in matters that are for the greater public benefit. Whether the Water Authority ultimately would act to a) become a member of a regional

supply, b) provide wholesale water to a regional water supply and/or c) provide transmission of wholesale water through the Water Authority system, is yet to be seen. It is assumed that an avenue of cooperation can be found. However, the primary analyses of this report exclude consideration of Water Authority connections to a regional system. Alternative actions to include the Water Authority members as wholesale water providers to the regional system should be considered in some detail separately from this report.

G. PULASKI COUNTY (INCLUDING PSA AND TOWN OF DUBLIN)

The Pulaski County PSA operates a 3.0 MGD water treatment plant located on Claytor Lake. Water demands on the PSA system are very close to the level where planning for water production will need to begin, about 2.1 MGD. The report indicates that planning should start in five to ten years, although there are some that feel that the process should begin much earlier to provide ample time for consideration of the many options available. At this time, it would appear that the PSA will be faced with a water treatment plant expansion to meet its future needs. This endeavor will be at a very substantial cost, perhaps $10 Million in the source and treatment area alone. The PSA water plant is in a key position in the region and could play a significant role as a supplier for the regional system. It is noted that water infrastructure has been designed to feed City of Radford water to the New River Valley Commerce Park along Route 100. The seven mile water main would provide a great deal of water system exposure within the PSA service area in lands that are ripe for development, but need water service. There is a great deal of water supply infrastructure already in place within Pulaski County. The interconnection of a regional water supply system should be simpler here than in lesser populated locations like Floyd County and Giles County. In Pulaski County, one also can have considerable optimism that populations will grow up around new water infrastructure in a short time frame after it is placed in service.

The PSA and the Town of Dublin can see benefit to their users from the provision of a regional water supply. With a major water treatment upgrade project in the relatively near future, there is benefit to considering establishment of regional water supplies.

H. TOWN OF PULASKI

The Town of Pulaski operates a 4.0 MGD water treatment plant using source water from the Gatewood Reservoir in the Peak Creek drainage basin. Until recently, the Town had a significant excess capacity of water available for sale. With the recent addition of a large industrial user in the Town, the excess capacity available has been diminished. Planning for additional capacity will likely need to start in the next several years. The Town of Pulaski system and the Pulaski County PSA system have major water mains in close proximity to each other. In an emergency, an interconnection can be activated to feed water from one system to meet the needs of the other. Some facilities may need to be placed to convey adequate water in such an emergency. Currently, additional permanent infrastructure to provide a strong connection is being considered. However, with limited capacities, there may be a time in the near future when sharing of water will have limited value. The boundaries of the service area of the Town will likely prevent water demands from rapidly increasing. Just the same, a permanent redundant water supply for the Town could be very valuable in the event that something happens to the source waters or excess water is needed for any reason. For the purposes of this report, it has been considered that the water treatment expansion noted above, for the PSA, would benefit the Town and the PSA and Town would share in the benefits of that project. The Town will probably be able to avoid other source and treatment costs in the near future. Similar to Pulaski County, the Town of Pulaski water plant is in a key position to be a supplier for the regional system. With a need for redundant source, beyond what can currently be provided by the PSA, there is benefit to the Town to consider connections to regional water supplies where possible.

I. CITY OF RADFORD

The City of Radford operates a water treatment plant with capacity of 8 MGD. Only 2 MGD is currently produced on average. As much as 4.5 MGD (6.0 MGD max day), on a long term average basis, is available from this plant. A project has been designed for installation of finished water pumps to send water to the New River Valley Commerce Park, where water usage of that magnitude in the future may be possible. With its own needs within the City service area satisfied, the City's water plant is in a key position to be a supplier for the regional water supply

system. With the routing of the main to the Commerce Park, interconnection with the Pulaski County PSA system and the Town of Pulaski is greatly facilitated. The addition of water from the City of Radford water plant can help delay the necessity for improvements to the PCPSA plant for many years and provide the redundant source needed by the Town of Pulaski. At the same time, interconnection would allow water to flow back to Radford in emergency conditions within the City. Further, the connection to the regional water supply could increase storage available to the City, thereby justifying a reduction or elimination of storage projects currently being planned by the City.

J. RADFORD ARMY AMMUNITIONS PLANT (RFAAP)

The RFAAP facilities are divided into two segments. One active potable water supply system serves the Pulaski County side of the Arsenal and the other serves the Montgomery County side. In general, both plants operate near capacity. Due to the sensitive nature of the site, security afforded and the reliability of the current systems, the sale or purchase of significant quantities of water from offsite, could be difficult to implement. The Arsenal system has also been known as a system with large percentage of unaccounted water. The systems can be considered for part of a regional system when reserve capacity is restored through better control of the unaccounted water.

It is also noted that RFAAP operates larger facilities for the production of filtered process water. The larger plants run from 15 to 25 MGD in capacity, and they are generally underloaded or out of service at this time. Making an agreement to purchase water, after adding disinfection, or re-commissioning an idle plant, provides opportunity for a major source near the center of the regional district. These larger facilities may have a role to play in regional water supply in the future, however, they have not been considered within the context of this report.

K. SUMMARY OF NEEDS

After a review of the various water supply systems involved in the Planning District, it seems apparent that the City of Radford and Blacksburg Christiansburg VPI Water Authority are the primary systems currently in production of potable water with an abundance of excess water

available for use in a regional system. The City of Radford water plant in combination with the plants currently operated by Pulaski County PSA and the Town of Pulaski appear to represent a viable regional source of public water. The BCVPI Water Authority is more reserved in its decision to become involved in a regional authority, but may be willing to participate in some capacity. On the other hand, the systems in Floyd County, Montgomery County and Pulaski County will need to begin planning for increased water supply capacity in the next five to ten years.. Giles County appears to have adequate source capacity for their needs through the study period. However the GCPSA has expressed interest in identifying an alternate or backup source to provide system redundancyor reduced treatment costs. Floyd, Montgomery and Pulaski County systems could benefit substantially by interconnection of systems and sharing of water regionally. Giles County could also benefit, but from the standpoint that the interconnection could serve as the alternate source being sought. As luck would have it, the Phase I and Phase II reports indicate that the City of Radford and BCVPI Water Authority systems produce potable water at a lower unit cost than any of the systems that will be in need. The production cost for BCVPI is identified as $0.97/1,000 gallons and the City of Radford as $1.25/1,000 gallons. All other systems have production costs that exceed $1.50/1,000 gallons with Floyd County at $3.05/1,000 gallons, Giles County at approximately $2.00/1,000 gallons and Montgomery County at $4.78/1,000 gallons. Pulaski County PSA and the Town of Pulaski production costs were identified as $1.62/1,000 gallons and $1.97/1,000 gallons, respectively. An interconnected regional system that can maximize water production at the Radford or BCVPI water plants, and economically convey those waters for use in systems where produced water is more costly, can provide some incentive for financing the construction of system extensions to reach those systems in need by partially offsetting the cost of the infrastructure improvements. This was the primary reason for the favorable Phase I and Phase II report feasibility determinations. For reference, the following estimate of the current water production costs in the region, is provided.

Floyd County	0.11 MGD at $3.05/1,000 gal=	$ 122,500/yr
Giles County	1.05 MGD at $2.00/1,000 gal =	$ 766,500/yr
Montgomery County	0.81 MGD at $4.78/1,000 gal=	$1,413,200/yr
Pulaski County	2.08 MGD at $1.62/1,000 gal=	$1,229,900/yr

Town of Pulaski	1.82 MGD at $1.97/1,000 gal=	$1,308,700/yr
City of Radford	2.00 MGD at $1.25/1,000 gal=	$ 912,500/yr
Total (w/o BCVPI)	7.87 MGD for	$5,753,300/yr
Net Average Water Production Cost across the region=		$2.00/1,000 gal

We have not verified the water production rates used in the analysis above as part of this report. However, based upon the Phase I and Phase II reports, and our knowledge of the water systems involved, the rates appear to be representative and appropriate for the various systems.

III

HYDRAULIC MODELING REVIEW/ANALYSIS

A. INTRODUCTION

The larger water systems in the New River Valley Planning District are fortunate to have water system hydraulic models to help them with analysis of water supply hydraulics, system pressures, water age and operations parameters within their systems. The Engineering Team has access to the models, and was able to use them in the work of this report.

The Engineering Team also obtained the water model information prepared for the Phase I and Phase II reports. That model provided the data that was used for the interconnection of various water systems throughout the PDC area. When connecting different water systems, it is important to realize that the systems may work at differing hydraulic gradients (levels and pressures), and may have restrictive infrastructure at the system periphery, where it would otherwise be most economical to connect a nearby system. The water models can help us determine where the best connection points need to be and what facilities are necessary to convey water from one of the systems to another. Water modeling technology has been available for over 25 years, and it continually changes to better meet the needs of the engineering analyst. Although the Engineering Team was not able to effectively use the results of the interconnected Phase I and Phase II report models for analysis, we were able to identify the infrastructure that was programmed into the model and create cursory models that would work with those already available for the existing water systems.

Traditionally, water system analysis has been focused on 1) verification that the piping can deliver the volumes of water needed under average day, maximum day and fire flow demand scenarios, 2) identification of low or excessive pressure areas in the system, 3) identification of major leakage problems or mis-positioned valves and 4) the capacity and pressures available for extension of water system outward from the existing system. More recently, the ability to determine water age in a distribution system has become a key element of modeling. When water is allowed to get very old in the system before being used, there is a significant risk of deteriorating water quality, with some of the contaminants that form with aged water having

been identified as carcinogens. Water system operators are currently very aware of the need to sample and test water frequently to assure that their water is not subject to excess contaminants of this nature. This is an area where caution is needed. As we look toward the possible regionalization of water systems, and the water used by some consumers travels much farther to reach their tap, the potential for formation of Disinfection Byproducts (DBP) will increase. Suppliers will have to work with their systems to maintain control of DBP's. It is also noted that the occurrence of DBP's is more common in surface waters than groundwaters, due to the presence of organic compounds in the surface water.

B. GENERAL ANALYSIS OF PHASE I AND PHASE II REPORTS

As part of this project evaluation we reviewed the concepts, methods and assumptions presented in the Phase I and Phase II reports. Although most of the report development appears to have followed generally accepted engineering project principles, certain elements were noted that were confusing to the engineering team, or may need further justification. A list of such issues that need to be considered as the project goes forward, are identified below.

- The Phase I and Phase II reports defined five (5) new water storage tanks at very high elevations, to increase the "reach" of public water. The reports suggested pumping from various low elevation areas in the region directly to these tanks as a transmission and storage system. In most cases, the pumping head required would exceed 500 feet (220 psi), and in one instance it reached 800 feet (350 psi). Water systems should not be operated at such high pressures unless absolutely necessary. An acceptable solution was identified in the reports, but required parallel mains and pressure reducing valves to provide local distribution at more typical pressures. The cost of this distribution infrastructure was not included in the prior reports, as this would be the responsibility of the local water suppliers. This report has reconfigured the transmission and storage facilities in a manner to allow direct connection for service from the transmission mains. This reconfiguration requires the placement of more tanks and pumping stations than included in the prior reports, but eliminates much of the high expense associated with pressure reduction and lower pressure distribution mains.

- The Phase I and Phase II reports assumed the purchase of water intakes and treatment plants from local suppliers and subsequent operations by the regional authority. Preliminarily, the City of Radford, Pulaski County PSA and Town of Pulaski plants were included for an estimated $18 Million. This report also assumes the purchase of the Giles County PSA supply and that all four entities can be acquired for $20 Million. The potential purchase pricing and the terms of utility infrastructure sales are highly subjective and obviously contingent on negotiations. The regional authority would produce the water at these facilities and sell in bulk to the suppliers for distribution and metered sales.

- The prior reports did not consider unaccounted water in the regional system. With the amount of transmission main proposed, even new, there is likely to be unaccounted water after it enters the regional system, potentially about 10%. The consequences are that water produced and bought wholesale for $1.00/1,000 gallons will have to be sold to the local water suppliers at a higher price, say $1.10/1,000 gallons to break even on the purchase/sale of the product.

- The prior reports assumed that water could be produced at the City of Radford for $1.00/1,000 gallons. Given the current part-time operation of the water treatment plant, we feel that this may be possible with transition to full time operation (See Table III-13), however, all the factors involved in the production of water need to be considered further.

- The prior reports assumed there would be new service connections added along the regional transmission corridors to enhance future revenues. Due to the uncertainty involved in this projection, we set forth to review the feasibility of the project without specific reliance on growth in these areas. We did however, concur with the growth projections shown for the existing water systems, due mostly to historical trends. This analysis, without assumption of new connections, should result in conservative conclusions.

- The prior reports did not recognize the potential requirement for water sources to modify disinfection procedures to minimize byproducts in the far reaches of a

connected system. There is a high likelihood that the regional water treatment plants will need to use an alternate disinfectant to prevent water quality problems at very distant service taps. BCVPI Water Authority has already converted its disinfection chemical to chloramines for that purpose.

- The prior reports did not take advantage of "avoided costs." Many systems will need capital improvements to meet demands and regulations. To the extent that the regional water supply system can eliminate or substantially delay the local costs involved in source or treatment, it is appropriate to use those programmed costs as an offset for funding of the regional water supply system.

- The Phase I and Phase II reports considered the Montgomery County systems as a single entity, rather than ten distinct systems. Although the report conclusions may not have been substantially changed by this assumption, this report recognizes that only one of those systems is nearing the point where expansion of facilities needs to be considered. Our analysis includes this system in the regional water supply network.

- The Phase I and Phase II reports arranged for normal water flow from Pulaski County to Giles County over Cloyd's Mountain, but also allowed for Giles County water to be fed back to Pulaski County in times of emergency. This report does not include the emergency provision in the same manner. It is instead proposed that in times of emergency, Giles County could be returned to its existing sources and discontinue use of water sourced in Pulaski County at those times. The provision of duplicate pumping stations, bypass mains and pressure reducing valves to provide back and forth flexibility is of limited value to the regional water supply network, particularly if the occurrence of emergency events is kept to a minimum..

- Hydro-power stations are mentioned in the Phase I and Phase II reports. This was primarily a byproduct of the storage of water at excessively high elevations. With the reconfiguration of the transmission and storage facilities, the value of hydro-power is considered very limited. An application that may deserve consideration

in the future would be for the water supply to Giles County. It is recommended that any such facility be considered following installation of the project and observation of the usage of this particular water main. A better determination for the benefits of energy recovery can then be made.

C. METHODOLOGY FOR OPINIONS OF COST

Capital cost estimating has been streamlined in this report, with the emphasis on capture of approximate costs for every key component of the regional system. This differs to some extent from the methods used in the Phase I and Phase II reports, where cost estimates for the primary facilities were provided at an elevated level, with the intent to accommodate auxiliary equipment and minor components through use of a high unit cost on water main alone.

Unit costs for capital facility in this report have been established as noted below:

- Water line with gate valves, air release valves, blow off valves, fire hydrants, highway crossings, stream crossings, aggregate and concrete in typical amounts.

24 – inch	$99/ft
16 – inch	$79/ft
12 – inch	$58/ft
10 – inch	$52/ft
8 – inch	$45/ft

- Elevated Water Storage Tank (Over 0.2 MG) $1.60/gal
- Ground Level Water Storage Tank (Over 1.0 MG) $0.60/gal
  (1.0 MG or less) $0.80/gal
- Booster Pumping Stations (Over 1.0 MGD) $0.10/gpd
  (1.0 MGD or less) $0.15/gpd
- Financing Annual Cost = Capital Cost x 0.08
- Construction Contingency Add 20%
- Soft Costs (Engineering, Legal, Bonding, Easements, Misc) Add 30%

Unit costs for annual operations and maintenance for this report have been set as follows:

- Motor Efficiency (Wire to Water) 70%

- Electrical Energy Cost $0.10 to $0.11/KwHr
- Labor Cost for Operation $25.00/hr
- Pumping Station Maintenance Annual Cost = Capital Cost x 0.05
- Tank Maintenance Annual Cost = Capital Cost x 0.025

D. SERVICE TO GILES COUNTY

The demand projections and water system development assumptions identified in the PDC report indicate that the GCPSA will be operating between 66% and 80% of their rated capacity by the year 2030. The GCPSA has recently been evaluating potential alternate/back-up water source options throughout the County. The evaluation has not been based upon the lack of water, but the provision of an alternate/back-up supply, in the event of a main line failure, well failure, pump failure/maintenance or tank maintenance. A regional water distribution system connection could fulfill the GCPSA desire for an alternate/back-up source. The PDC report evaluated one connection option, which would ultimately transfer water from the State Route 100 corridor in Pulaski County, northerly over Cloyd's Mountain, along the State Route 100 corridor in Giles County into the Town of Pearisburg. This option would provide an alternate or back-up source to the GCPSA system.

Description of Facilities Conceived in the Reports

The PDC reports proposed the installation of approximately 3.6 miles (19,000 linear feet (L.F.)) of parallel 16-inch water mains between Cloyd's Mountain and the Giles County line, to provide the GCPSA a connection point to the regional water system. This report includes a length of 12.6 miles (66,520 L.F.) between Cloyd's Mountain and the Town of Pearisburg, since Giles County's plans to extend water southerly on Route 100 are uncertain.. The hydraulic model prepared for the PDC reports illustrated that water would be fed from the proposed Cloyd's Mountain tank, to be constructed at an elevation of 2496 feet, into the Town of Pearisburg system without the need for pumping and/or pressure reducing facilities. The existing Town of Pearisburg Angels Rest tank has an overflow elevation of approximately 2215 feet, which would allow for 281 feet (i.e., 2496 feet – 2215 feet) of dynamic head losses between Cloyd's Mountain and Angels Rest. Based upon the size of water mains and transfer rates

identified in the report, it appears that the actual dynamic head losses would be much less, even at an overall distance of 12.6 miles, verifying that the Cloyd's Mountain tank could transfer into the Angels Rest tank at a rate sufficient to meet the demands of Giles County. However, it should be noted that due to the terrain variations between the two tanks, the water main could witness pressures in excess of 340 pounds per square inch (psi) in various locations. This condition will need careful consideration as planning continues.

Proposed Modifications to the Regional Plan Facilities

The facilities identified in the PDC report could be utilized to transfer water into Giles County from Pulaski County. However, there are options which could potentially reduce initial costs and/or improve operation and maintenance conditions. The first of these areas would be the proposed parallel 16 inch water mains along Route 100, which appear to be significantly oversized for the projected flows identified for Giles County. Elimination of the parallel installation could significantly reduce the initial construction cost of the project. The second area of concern would be the high operating pressures. Pressures of this magnitude present several concerns, a few of which are as follows:

- Inability to serve residential customers from main lines, resulting in an increased number of pressure reducing valves (PRVs) and parallel water service lines for adjacent connections.
- Increased maintenance, due to additional mechanical devices such as PRVs and increased deterioration of equipment.
- Hazardous maintenance conditions, due to potential for exposure to high pressure water lines.
- Increased leakage versus similar water lines operating under reduced pressures.

A single PRV installed along the main line, prior to entering Giles County, would reduce the normal operating pressures of the proposed water main, while eliminating the concerns identified above. The installation of a main line PRV would require the addition of a pump station to transfer water into the Town of Pearisburg. However, the cost saved by eliminating the parallel line should offset the initial cost of the pump station. The final area of potential modification

would be to plan for a connection to either 1) the GCPSA Riverbend water storage tank, or 2) the Phase I portion of the Route 100 Water Line Extension project, currently being designed for the Giles County Board of Supervisors (GCBOS), in lieu of connecting to the Angels Rest tank. A connection to the either location would reduce the length of water main to be constructed (i.e., approximately 50,000 L.F. versus 62,500 L.F.) for a regional water connection and ensure that the residents to be supplied by the GCBOS project could be supplied through the regional water connection. Option 1 would require the installation of approximately 12,500 L.F. of additional 16 inch water line and approximately 13,000 L.F. of parallel 8 inch water line throughout the existing systems. Option 2 would require the installation of approximately 16,000 L.F. of parallel 8 inch water line throughout the existing systems.

Engineers Opinion of Construction and Operations Costs for Modified System

The cost estimates below have been developed for the purpose of providing some verification that the PDC report considered most, if not all, of the key costs associated with the implementation of plans for putting the regional system into service.

Table III-1
Giles County Public Service Authority
Cloyd's Mountain to GCPSA - Option 1

Cost Item	Opinion of Cost
62,500 ft of 16-inch Water Main ($79/ft)	$4,938,000
13,000 ft of 8-inch Water Main ($45/ft)	$585,000
Pressure Reducing Stations	$75,000
Water Repump Station (3 MGD)	$300,000
50% Contingency for Construction and Soft Costs	$2,950,000
Total Estimated Project Cost	**$8,848,000**
Annualized Project Cost	**$707,800/yr**
Power Cost for Pumping (450 ft), 100 HP per 1.0 MGD*	$75,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$15,000/yr
Total Estimated Annual Cost Increase	**$807,800/yr**

* Certain costs are variable (*). Numbers based on 1.0 MGD

Table III-2 Giles County Public Service Authority Cloyd's Mountain to GCPSA - Option 2	
Cost Item	Opinion of Cost
50,000 ft of 16-inch Water Main ($79/ft)	$3,950,000
16,000 ft of 8-inch Water Main ($45/ft)	$720,000
Pressure Reducing Stations	$75,000
Water Repump Station (3 MGD)	$300,000
50% Contingency for Construction	$2,522,000
Total Estimated Project Cost	**$7,567,000**
Annualized Project Cost	**$605,400/yr**
Power Cost for Pumping (450 ft), 100 HP per 1.0 MGD*	$75,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$15,000/yr
Total Estimated Annual Cost Increase	**$705,400/yr**
*Certain costs are variable (*). Numbers based on 1.0 MGD	

Potential Alternative Actions

The Route 100 connection could provide service to Giles County, but comes with a number of potential problems. A few of the concerns are as follows:

- The GCPSA must utilize the regional water authority connection as their primary source to ensure a constant flow through the proposed water lines and avoid potential water quality issues. This would then require that the existing WTP be utilized as the alternate/back-up water source. The PDC report did discuss the purchase of certain existing treatment facilities; however, the GCPSA-WTP was not one of the facilities identified. It is proposed in this report for the regional authority to purchase the facility and maintain it for emergency operation.

- Due to the location of the connection point in relation to the existing WTP, the Route 100 connection, could have limited impact during certain main line failure, pump failure/maintenance or tank maintenance scenarios.,

- As currently being evaluated, connections along the Route 100 corridor will be supplied through pumping facilities transferring water from Pearisburg towards Pulaski County. The Route 100 connection would result in water being pumped from Pulaski County to Pearisburg, thereby creating the need to maintain pumps

for emergency use only, no matter which source is being utilized as a back-up.

A potential alternative to the Route 100 connection may be a Route 460 connection to Giles County from the north or west side of Blacksburg. This option would be contingent on a number of factors, including the willingness of Blacksburg or the Water Authority to sell water to non-member systems or become a part of the regional authority. However, a connection to supply the eastern end of Giles County would be a true alternate/back-up source for the GCPSA. A pump station would be required to transfer water to the top of Brush Mountain, where a tank and a PRV would be required to supply Giles County. However, beyond Brush Mountain water could flow back to the Town of Pearisburg with very few modifications within the existing GCBOS and GCPSA water distribution systems. This would provide the GCPSA an alternate route to maintain service to over half of their customer base during a main line failure, well failure, pump failure/maintenance or tank maintenance event. Additionally, the existing development along Brush Mountain and other minor population centers along the route in Montgomery County would provide a potential for new connections. This connection would be dependent upon successful negotiations with BCVPI, Town of Blacksburg or would need to be associated with the greater Prices Fork community.

Summary of Report Recommendations for Feasibility

The Route 100 service alternative can be constructed as outlined in PDC report. It should be noted however, that portions of the transmission main would be operating at pressures in excess of 340 psi, which would not typically be accepted by utility owners. In addition to pressure concerns, feasibility of the plan would also be contingent upon resolution of the following issues:

- The GCPSA utilizing the regional water authority connection as their primary source, while continuing to pay debt service on a back-up facility (i.e., the existing GCPSA-WTP) or selling the plant to the regional authority.

- Failure to meet all criteria established for evaluation of an alternate/back-up water source for the GCPSA. (Note: The water demand projections identified in the PDC report do not indicate that water capacity will be an issue in Giles County until well beyond the year 2030).

- Maintenance for back-up facilities during idle periods.

When significant benefits to the GCPSA have been established, interest in a regional water connection to the GCPSA should increase. Therefore, it is the recommendation of this report that the PDC consider further evaluation of a Route 460 connection. Based upon the preliminary information discussed herein, it appears that the GCPSA could identify several benefits to a connection in this portion of their system.

E. SERVICE TO SOUTHERN MONTGOMERY AND FLOYD COUNTY WATER SYSTEMS

The Phase I and Phase II reports recognized that the Riner water system in Montgomery County is operating at over 70% and will need upgrading in the future. Extending a regional water source to Riner would provide the additional source capacity needed for the system, and would also allow additional water transmission to other areas in southern Montgomery County, southern Pulaski County, and Floyd County. The Phase I and Phase II reports indicated that the driving force behind the Floyd connection is to provide an alternate source of water to the County and to alleviate the drought related concerns associated with a 100% reliance on local ground water wells. The lack of an alternate water source alone warrants that these communities look seriously at a regional water authority. The extension of a water transmission main from the City of Radford, through Riner, into the heart of Floyd County will provide a back up water source, additional storage, additional capacity, and most importantly a foundation for future expansion in these areas of the planning district. In addition, this extension opens the potential for connections to the Town of Christiansburg and/or Montgomery County's Bethel and Christiansburg/Elliston water systems. These connections would improve delivery and water quality in these areas.

Water service to this area of the planning district through a regional water authority is perhaps the only way a source can be economically provided.. Due to the sparsely populated and isolated nature of these large areas, the cost associated with constructing the proposed water facilities will need to be offset by lower unit cost for bulk water, lower O&M costs, additional connections, and the avoidance of costs for planned capital improvements, in order to make the regional water authority a viable alternative from an economic standpoint. Operations of the

various improvements in this area of the planning district will also be an important factor in addressing water quality concerns. Extending large water mains into rural areas, with relatively low usage, will result in a low turnover of the water. This in turn will result in water quality issues that will need to be addressed by an authority project.

Description of Facilities Conceived in the Reports

The water facilities proposed for this area includes a primary transmission line that flows large quantities of water from the City of Radford across the southwestern corner of Montgomery County to the Riner community. At Riner, the line feeds three water mains that extend in three different directions. The primary water main continues south from Riner approximately 15 miles down Route 8 to the Town of Floyd. The second extension runs from Riner, eastward 22 miles along Route 669, Route 610, and Route 221 to the Check community. The third extension runs from Riner, approximately 15 miles west into southern Pulaski County to serve the Snowville area. Service to the Pulaski County line will be sufficient from the new Riner tank at elevation 2500 without further pumping. Additional extensions outlined in the reports and located south of Riner along Route 8 include an extension from Route 8 west to the Alum Ridge Area of Floyd County, and an extension from the Town of Floyd east to the Check community.

The report indicates three water storage tanks would provide storage in the areas south of Riner. One tank was located on the terminal end of the Snowville extension. A second tank was located off Route 8 south of Riner. The third tank was located in eastern Floyd County near the Check Community. The model referenced in the prior reports used a large number of high horse power pumps to convey water to these tanks and into the area south of Riner.

Proposed Modifications to the Regional Plan Facilities

The Phase I and Phase II reports and the referenced model indicate that the water distribution system extends directly outward from the City of Radford's water system. A water main extending south into Riner and on to Floyd County would connect directly to the existing water line infrastructure just south of Radford on Highway 177. This line is part of the existing Montgomery County Bethel System. By tying directly onto the outer limits of the existing Radford system, the proposed extension serving southern Montgomery County and Floyd

County pulls water through the existing distribution system located within the City of Radford.

Increasing the flow of water through the City of Radford's water system would improve the quality of water within the City's system by flushing the system, increasing circulation and the rate that water is turned over within the existing system. Unfortunately, this benefit is overshadowed by the fact that the demand for water in southern Montgomery County and Floyd County exceeds the conveyance capacity of the Radford system that feeds the Bethel System.

A hydraulic model of the City of Radford's water system indicates that unacceptable drops in residual pressures throughout the City occur when flowing the high water demands projected for southern Montgomery County and Floyd County. These projected flows impair the Radford system's ability to serve its consumers and more importantly cripple the Radford system's ability to provide an acceptable level of fire protection throughout the City. A more feasible hydraulic option would be to run a dedicated bulk transmission line from the City of Radford's water treatment plant directly to the Bethel area prior to extending the line south to Riner and into Floyd County.

Extreme variations in elevation along the proposed water line extensions into southern Montgomery and Floyd Counties create excessive pressures in many portions of the project area. The variable and often high pressures limit the primary water mains to the role of bulk water transmission only. Individual service connections to the water lines are impractical due to the high pressures. To minimize the impacts associated with the topographic relief along Route 8, we have proposed breaking the system down into additional pressure zones served by additional tanks. Each zone would have its own storage tank and pump station. The first proposed pressure zone would utilize the existing water storage facility in the Bethel system (elevation 2300+/-) (as indicated in the Phase I and II reports). This zone would be fed directly from the City of Radford's water plant as previously mentioned. The proposed system would include two new storage facilities strategically located along Route 8. The first storage facility would be located between Riner and the Little River, and the second facility would fall between the Little River and the Town of Floyd. The tanks, along with the transmission line running adjacent to Route 8, would provide the backbone of the proposed systems serving southern Montgomery, southern Pulaski and Floyd Counties. Extensions off of this trunk line include 1) a run from the Riner community into southern Pulaski County to serve the Snowville area, 2) a run from the Riner

community to the Check community, 3) a run from the Town of Floyd to the Check community, and 4) the Alum Ridge extension mentioned in the reports. Each of these runs would require the installation of additional storage and pump station facilities to serve their outlying areas. When reviewing the extensions from Riner to Check and from Floyd to Check, it was apparent that the location, sizing and number of pressure zones would depend on the timing and phasing of these extensions.

Engineers Opinion of Construction and Operations Costs for Modified System

The cost estimates that follow are developed for the purpose of providing some verification of the Phase I and Phase II reports. The cost estimates considered most, if not all, of the key costs associated with the implementation of plans for putting the regional system in place.

Table III-3
Montgomery County Public Service Authority
Section 1 – City of Radford to Riner

Cost Item	Opinion of Cost
70,000 ft of 16-inch Water Main ($79/ft)	$5,530,000
1.0 MG Ground Level Storage Tank ($0.80/gal) – 2 Each	$1,600,000
Water Repump Station (2.3 MGD)	$ 345,000
50% Contingency for Construction and Soft Costs	$3,738,000
Total Estimated Project Cost	**$11,213,000**
Annualized Project Cost	**$897,000/yr**
Power Cost for Pumping (600 ft), 150 HP per 1.0 MGD*	$100,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$18,000/yr
Tank Maintenance	$40,000/yr
Total Estimated Annual Cost Increase	**$1,065,000/yr**
* Certain costs are variable (*). Numbers based on 1.0 MGD	

Table III-4
Montgomery County Public Service Authority
Section 2 – Riner to Southern Pulaski County (County Line)

Cost Item	Opinion of Cost
77,000 ft of 12-inch Water Main ($58/ft)	$4,466,000
50% Contingency for Construction and Soft Costs	$2,234,000
Total Estimated Project Cost	**$6,700,000**
Annualized Project Cost	**$536,000/yr**
Total Estimated Annual Cost Increase	**$536,000/yr**

Table III-5
Floyd-Floyd County Public Service Authority
Section 3 – Riner to the Town of Floyd

Cost Item	Opinion of Cost
70,000 ft of 12-inch Water Main ($58/ft)	$4,060,000
0.5 MG Ground Level Storage Tank ($0.80/gal)	$ 400,000
Water Repump Station (0.6 MGD)	$ 180,000
50% Contingency for Construction and Soft Costs	$2,320,000
Total Estimated Project Cost	**$6,960,000**
Annualized Project Cost	**$556,800/yr**
Power Cost for Pumping (200 ft), 50 HP per 1.0 MGD*	$33,300/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$ 9,000/yr
Tank Maintenance	$10,000/yr
Total Estimated Annual Cost Increase	**$619,100/yr**

* Certain costs are variable (*). Numbers based on 1.0 MGD

Table III-6
Floyd-Floyd County Public Service Authority
Section 4 – Riner to Check

Cost Item	Opinion of Cost
116,000 ft of 12-inch Water Main ($58/ft)	$6,728,000
0.25 MG Ground Level Storage Tank ($0.80/gal) – 2 Each	$ 400,000
Water Repump Station (0.75 MGD) – 2 Each	$ 225,000
50% Contingency for Construction and Soft Costs	$3,676,000
Total Estimated Project Cost	**$11,029,000**
Annualized Project Cost	**$882,300/yr**
Power Cost for Pumping (600 ft), 150 HP per 1.0 MGD*	$100,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$12,000/yr
Tank Maintenance	$10,000/yr
Total Estimated Annual Cost Increase	**$1,014,300/yr**

* Certain costs are variable (*). Numbers based on 1.0 MGD

Table III-7
Floyd-Floyd County Public Service Authority
Section 5 – Hwy. 8 to Alum Ridge

Cost Item	Opinion of Cost
48,000 ft of 12-inch Water Main ($58/ft)	$2,784,000
0.25 MG Ground Level Storage Tank ($0.80/gal)	$ 200,000
Water Repump Station (0.05 MGD)	$ 8,000
50% Contingency for Construction and Soft Costs	$1,496,000
Total Estimated Project Cost	**$4,488,000**
Annualized Project Cost	**$359,000/yr**
Power Cost for Pumping (400 ft), 100 HP per 1.0 MGD*	$70,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance	$ 400/yr
Tank Maintenance	$ 5,000/yr
Total Estimated Annual Cost Increase	**$444,400/yr**

* Certain costs are variable (*). Numbers based on 1.0 MGD

Table III-8 Floyd-Floyd County Public Service Authority Section 6 – Town of Floyd to Check	
Cost Item	Opinion of Cost
71,000 ft of 12-inch Water Main ($58/ft)	$4,118,000
50% Contingency for Construction and Soft Costs	$2,060,000
Total Estimated Project Cost	**$6,178,000**
Annualized Project Cost (8%/yr)	**$494,200/yr**
Total Estimated Annual Cost Increase	**$494,200/yr**

Potential Alternative Actions

As mentioned earlier, a review of the regional water supply plan indicated that the Riner to Floyd water main actually needs to bypass the City of Radford distribution system. Results generated by a hydraulic model indicated a need for a dedicated water transmission line extending directly from the water treatment plant in the City of Radford, through Riner and south to the Town of Floyd. This separate, independent line would avoid the City of Radford's existing water system and would be dedicated entirely to transmitting large quantities of water to Riner and points south. By not interconnecting the two systems, adverse impacts to the City of Radford's system could be avoided. A major benefit of this line is that it conveys water directly to Riner and the Town of Floyd, both of which are high-density areas within Montgomery and Floyd Counties. Sized adequately, this water main can serve as the backbone of the proposed system for years to come. The City of Radford would also benefit from this main with the supply routed along the City's southern border, near Interstate 81.

The Riner to Check, Riner to Snowville area, Route 8 to Alum Ridge, and the Town of Floyd to Check water mains could provide additional service to the planning district. Unfortunately the demand is rather low in these areas at this time. A limited number of connections along these rural routes will result in very low water turnover and potentially poor quality water. With impending growth on the Riner to Snowville line, it is proposed that it be the only other line included among the four listed here, for immediate implementation.

It is unknown at this time whether the Towns of Blacksburg and Christiansburg, and the BCVPI Water Authority will participate in a Regional Authority, and to what extent they might participate. If the Town of Christiansburg were to participate, an alternative (or at least a back up source) could be provided to the Riner area with an extension from Christiansburg along Route 8. If this were the case, the proposed facilities from Radford to Riner could be re-sized and designed to allow the transmission of water from Radford into Christiansburg. This would provide a backup source to Christiansburg and would allow true "sharing" of the regional water resources. Alternately, a connection to Christiansburg could allow for elimination of the main bypassing Radford and make a connection to Montgomery County's Bethel zone, for small amounts of supplemental water, feasible.

Finally, with the pending construction of the Route 114 bridge replacement over the New River, there is an opportunity to include planning for the installation of a water main across the bridge. The benefits of this main could include some redundancy for the BCVPI water system, an alternate source for the MCPSA Prices Fork system or an alternate source for service to PCPSA Fairlawn area.

Summary of Report Recommendations for Feasibility

A water main from the City of Radford to the Town of Floyd, as discussed in the Phase I and Phase II reports will not be capable of delivering future water demands without first making significant improvements in the City's distribution system. In addition, with storage tanks and pumping stations noted, the transmission main will operate at excessive pressure in low areas, and the age of water in the system will likely cause the water quality to be marginal for compliance with the Disinfection Byproduct Rules (DBP). The overall feasibility of the plan will depend upon 1) the operators of the water treatment plant, optimizing the treatment protocol in order to minimize the DBP formation, 2) the commitment of Riner, the Town of Floyd and the Floyd County PSA to use the water regularly and flush the system routinely, and 3) a substantial growth in the user base of the Town of Floyd and the Floyd County PSA along Route 8 between Riner and the Town of Floyd.

The installation of a water main and multiple storage tanks between Radford and Floyd along Route 8 would have a very positive effect on the planning district. The proposed water

system, as modified in this report, would provide an immediate capacity increase to the water source feeding both the Floyd-Floyd County PSA system and the Riner community's water system. The three Floyd County extensions from the Route 8 backbone, should be financed and constructed at a later date, due to the limited amount of service and high costs of installation at this time.

F. BLACKSBURG CHRISTIANSBURG VPI WATER AUTHORITY (BCVPI)

The Phase I and Phase II reports noted that the BCVPI Water Authority has an abundance of excess water available to feed the needs of other water systems around the New River Valley. At this time, the Authority's role, if any, in the regional plan, is uncertain. However, it is thought that a role as a seller of water, may suit the Authority and the systems in need. There were no specific system upgrades identified and associated with the BCVPI system. Potential connection points at the north end of the Town of Blacksburg, and at the south end of the Town of Christiansburg, have been reviewed for availability of water, and the availability is substantial in each case suitable to feed Giles County to the north and southern Montgomery, southern Pulaski and Floyd Counties to the south.

The primary change to be observed by BCVPI taking a seller's role, will be the change in water production. Currently, the plant operates at slightly less than 60% of the plant capacity. The plant produces around 7.3 MGD and the Study Consortium has estimated that the cost to produce water at this facility is about $0.97/1,000 gallons. With an increase in output to 12.6 MGD, the total plant capacity, the Consortium has estimated that the production cost of water could be driven lower than its current level, but did not provide an estimate. It is reasoned that a potential cost reduction at this plant would be modest, say 10% range, if available at all. Should additional capacity need to be built for the Water Authority, it is expected that the unit cost of production would increase substantially at that time. At this time, without an added water main in the regional plan, the purchase of water from the Water Authority's system can not be conveniently arranged at the plant site. The locations where water will be needed are thought to be at the extremities of the member Town systems or from the flow divergent area between the Authority and the Towns. In any event, some water transmission costs would occur prior to the metering of water to the regional system. It is therefore anticipated that the cost of water,

including transmission, from the end of the systems, will be in the range of $1.20 to $2.00/1,000 gallons. Without prior negotiations, and a good understanding of the factors that would be considered in setting up an agreement, it is impossible to pin down the costs at this time. A table is provided below to identify the costs of 1.0 MGD, given a range of unit costs of water. These are figures that have not been scrutinized or validated as part of this report.

Table III-9
BCVPI Water Authority Water System
Water Purchase Cost Comparison

Cost Item	Opinion of Cost
Take 1 MGD at $1.20/1,000 gal	$438,000/yr
Take 1 MGD at $1.40/1,000 gal	$511,000/yr
Take 1 MGD at $1.60/1,000 gal	$584,000/yr
Take 1 MGD at $1.80/1,000 gal	$657,000/yr
Take 1 MGD at $2.00/1,000 gal	$730,000/yr

- Costs are for addition to new facility costs as plans are conceived. Wholesale cost savings may be one area where capital costs can be offset for the regionalization effort.

The wholesale costs above are provided for comparison to other systems as decisions are made to interconnect infrastructure components for regionalization. Since the water can only be taken after production and some transmission costs have been expended, the savings available to the receiving water supplier will need to be carefully reviewed before committing to supply.

As an aside, it is worth noting that BCVPI operates a single source and has no ready reliable standby system for use in emergency conditions. As considered in this report, the extension of water from the City of Radford water treatment plant to Riner, would put a major water resource in a convenient area for connection to the Town of Christiansburg, to backfeed water into the Authority member systems. In addition, with the operation of the Pulaski County PSA and RAAP water systems along the New River, near the BCVPI intake, there is good potential to make significant connections to backup the BCVPI system. One potential location for an interconnect water main in on the Route 114 bridge over the river. With replacement of

the bridge scheduled for the very near future, the water suppliers should begin negotiations with Virginia Department of Transportation (VDOT) for the installation of a support system and appurtenances to carry the main over the river.

It is emphasized here that all alternatives examined for interconnections between systems, have assumed that the BCVPI system and the systems operated by its members, will not be interconnected to others. Further investigation into the potential for these connection options is encouraged.

G. PULASKI COUNTY WATER SYSTEMS

The Phase I and Phase II reports recognized that the Pulaski County PSA and Town of Pulaski water systems would reach the 80% levels of production requiring them to initiate the planning that would lead to an upgrade in the source and treatment capacity of the facilities. It has been assumed here that the PSA facility will be among the first in the area to reach this level. The treatment facility is a 3.0 MGD plant, with space set aside for the purpose of doubling the size of the facility. Fortunately, the PSA already has an intake permit suitable for the expanded facility. As a system in need of additional and standby water source, the Phase I and Phase II reports provided three primary watermain extensions to provide water from outside the County to the PSA residents. The source of water in each extension would primarily be the City of Radford water plant. One of the extensions could utilize water from the BCVPI Water Authority, if water is made available for sale from the Town of Christiansburg.

Description of Facilities Conceived in the Reports

The first extension is the Commerce Park Water Main, This is a seven mile long 24-inch diameter water main starting from a new finished water pumping station at the City of Radford Water Treatment Plant, elevation 1760, and capable of delivering up to 6 MGD of water to the Commerce Park Airport Tank. The model, within reason, replicates the designed route of the water main from the City of Radford to the Commerce Park, and shows the main continuing on northerly from the Commerce Park along Route 100 to Cloyd's Mountain. The model fails to show water storage and/or repumping on the Commerce Park site, although it is known that some will be required. In showing the water main continuing to the top of Cloyd's Mountain, the total static lift elevation for the Radford Pumps is over 700 feet. This elevation difference equates to

over 300 psi pressure, before any consideration for adding the dynamic head losses that need to be taken into account. This pressure is much higher than desired for the direct connection of consumers. Local distribution systems will need to be fed through pressure reducing valves. The flow in this main would be used to deliver water to the PCPSA and Town of Pulaski water systems, new tenants within the Commerce Park, unserved neighborhoods along the water main route, and/or Giles County along Route 100. In the future, development on the lower face, or at the base of Cloyd's Mountain could also benefit from the water delivered by this main. The water in this main must be used (turned over) to make the extension a viable and worthy addition to the regional water supply system, and to avoid water quality problems.

The second extension is the portion of the water main from the Commerce Park along Route 100 northerly to the top of Cloyd's Mountain at elevation 2496. The model shows parallel 16-inch mains through this section. It is anticipated that up to 3 MGD could be delivered through this main, with full service to Giles County PSA and adding user connections along the pipe route. Parallel 16-inch mains generally would be considered more size than needed for this delivery. For the Pulaski County portion of the main, use of the water would be limited to the few services along the highway corridor unless Giles County PSA committed to the use of this water and used their existing source as a standby source to their system. So again, we have the issue of water age for a large main in which the water is not adequately turned over.

The final extension relative to Pulaski County is one that has been extended from Riner in Montgomery County westerly into Pulaski County to serve the Snowville area. This line would help the PSA serve areas of the County south of Claytor Lake, where the availability of PSA water has been blocked in the past by the Lake. The proposed water flow through this line was not identified. It is proposed that a pumped flow through this line be set at approximately 0.5 MGD, with maximum daily demand of 0.2 MGD on the users in this area. It is noted that hydraulic gradients through the Montgomery County side of the service corridor are established at between 2250 and 2300. However, at the end of the line, in Pulaski County, a tank has been placed at elevation 3049, which would require a pump with 800 feet of lift to supply. This equates to nearly 350 psi, making user connections to the water main infeasible. Again, it would be necessary to pressure reduce sidestream flows to local neighborhoods for service under reasonable pressures. New connections and water demands will be critical in this area for the

rapid turnover of water in the system. Until water demands are adequate to provide the turnover needed, regular water main flushing may be required.

Proposed Modifications to the Regional Plan Facilities

The plan reported in the Phase I and Phase II reports has presented some concerns that can be easily addressed in this early planning stage. With regard to the first two water main extensions, the static lift is much higher than desired. The County has the benefit of having the Commerce Park, a very centrally located facility in the midst of future development, near the mid point of the mains between Radford and the top of Cloyd's Mountain. The Commerce Park also has an existing elevated 0.4 MG tank at a convenient service elevation (2262). With the infrastructure currently in place, there have been relatively tight limits to the volumes of water that can be delivered to the tank from the PCPSA system. The first water extension can remedy that concern. In the Commerce Park project, water storage for the site has been conceived as two 1.4 MG ground level storage tanks at elevation 2170, for large domestic flow, and two (one exists) 0.4 MG elevated storage tanks at elevation 2262, for fire flow and pressure to the Park. A pumping station would be provided to lift the water from the ground level tanks to the elevated tanks. Most of these facilities were for the convenience and flexibility of development of the Commerce Park. The components that would be most useful in the regional water supply plan would be a single 1.4 MG ground level storage tank and a pumping station that could provide pumping to the top of Cloyd's Mountain as well as lifting water into the existing on site elevated storage tank. A major benefit of this modification is that the seven mile transmission main will be able to be direct connected for water service to consumers through nearly its entire seven mile route (45 to 120 psi). In the future, a large part of the population in the area of the Commerce Park will be able to be served from the 0.4 MG elevated tank. Allowing transfer of water to this tank will provide significant benefit to the area users. With a ground level storage tank in place at the Commerce Park, it will be possible to program the amount of filling and draining required to assure that water does not reside in the system or in storage for extended periods of time. This regulation of water movement will help minimize the formation of the DBP's. For the water main headed north on Route 100, the size can be reduced to a single 16-inch main. The size of the storage on Cloyd's Mountain, 1.5 MG ground level, and the elevation of the storage appear to be optimal in the regional water plan.

For service to the Snowville area, the Phase I and Phase II reports referenced a pumping station to take water from Montgomery County from the County line westerly into Pulaski County. The facility arrangement called for pumping with a static lift of about 800 feet. Like the Commerce Park water line, the pressures will be higher than needed for municipal service at nearly 350 psi in several places. To allow service directly from the transmission main, it is suggested that a water storage tank be placed at a high spot along the line to allow for distribution to the public through most of the area. As the elevation of the main increases toward the west, a booster pumping station could be included to lift the flow to the terminal water storage tank identified in the Phase I and Phase II reports.

Engineers Opinion of Construction and Operations Costs for Modified System

The cost estimates below are developed for the purpose of providing some verification that the Phase I and Phase II reports considered most, if not all, of the key costs associated with the implementation of plans for putting the regional system in place.

Table III-10
Pulaski County Public Service Authority
Section 1 - Commerce Park Main
Radford to Commerce Park

Cost Item	Opinion of Cost
Finished Water Pumping Station (6 MGD)**	$300,000
38,900 ft of 24-inch Water Main ($99/ft)	$3,851,000
1.4 MG Ground Level Storage Tank ($0.60/gal)	$840,000
Water Re-pump Station (3 MGD)	$300,000
50% Contingency for Construction and Soft Costs	$2,646,000
Total Estimated Project Cost	**$7,937,000**
Annualized Project Cost	**$635,000/yr**
Power Cost for Pumping (400 ft), 100 HP per 1.0 MGD*	$70,000/yr
Labor Cost for Facility Operation, 400 hours/year	$10,000/yr
Pumping Station Maintenance (2)	$45,000/yr
Tank Maintenance	$21,000/yr
Total Estimated Annual Cost Increase	**$781,000/yr**

* Certain costs are variable (*). Numbers based on 1.0 MGD
** Station unit cost for construction is 50% of established unit costs due to existing clearwell at the City WTP. Operation and Maintenance costs are based upon full capacity of each pumping station.

Table III-11
Pulaski County Public Service Authority
Section 2 - Commerce Park Main
Commerce Park to Cloyd's Mountain

Cost Item	Opinion of Cost
27,800 ft of 16-inch Water Main ($79/ft)	$2,197,000
1.4 MG Ground Level Storage Tank ($0.60/gal)	$840,000
50% Contingency for Construction and Soft Costs	$1,518,000
Total Estimated Project Cost	**$4,555,000**
Annualized Project Cost	**$364,400/yr**
Power Cost for Pumping (300 ft), 75 HP per 1.0 MGD*	$52,500/yr
Labor Cost for Facility Operation, 100 hours/year	$2,500/yr
Tank Maintenance	$21,000/yr
Total Estimated Annual Cost Increase	**$440,400/yr**
* Certain costs are variable (*). Numbers based on 1.0 MGD	

Table III-12
Pulaski County Public Service Authority
Section 3 – Snowville Area Water Main
Montgomery County Line West

Cost Item	Opinion of Cost
County Line Pumping Station (1 MGD)	$100,000
30,000 ft of 10-inch Water Main ($52/ft)	$1,560,000
1.0 MG Elevated Storage Tank ($1.60/gal)	$1,600,000
Water Re-pump Station (<0.5 MGD) – 2 each	$150,000
7,000 ft of 10-inch Water Main ($52/ft)	$364,000
0.5 MG Ground Level Storage Tank (0.80/gal)	$400,000
50% Contingency for Construction and Soft Costs	$2,088,000
Total Estimated Project Cost	**$6,262,000**
Annualized Project Cost	**$501,000/yr**
Power Cost for Pumping (400 ft), 100 HP per 1.0 MGD*	$70,000/yr
Labor Cost for Facility Operation, 100 hours/year	$2,500/yr
Pumping Station Maintenance	$12,500/yr
Tank Maintenance	$50,000/yr
Total Estimated Annual Cost Increase	**$636,000/yr**
* Certain costs are variable (*). Numbers based on 1.0 MGD	

In addition to the costs noted above, the regional plan in Pulaski County calls for the regional authority to purchase the water treatment plants of the County PSA and the Town of Pulaski. The Commerce Park to Cloyd's Mountain portion of the main is virtually dedicated to serving Giles County. Unless a significant flow can be maintained in the main, it should not be constructed. To maintain a good rate of flow, the Giles County water plant would be idled except for backup service. This would allow all flow dedicated to Giles County to move through the main.

Potential Alternative Actions

We have reviewed options to achieve similar objectives in the regional water supply plan. The Commerce Park water main from City of Radford is a good project for service to areas that are anticipated to have significant growth over the next couple of decades. No option was considered for the Section 1 main. The Section 2 Commerce Park main can provide good service to Giles County, but comes with a number of potential problems in potential water quality and number of services available along the route. A good option to the Section 2 water main may be a Route 460 connection to Giles County from the north or west side of Blacksburg or a main from the BCVPI plant northerly on Prices Fork road to the Route 460 bypass. These options would be contingent on a number of factors, including the willingness of Blacksburg or the Water Authority to sell water to non-member systems. See the section on Giles County for further discussion of this option.

Summary of Report Recommendations for Feasibility

For the Commerce Park water main from City of Radford to the top of Cloyd's Mountain, the plan identified in the Phase I and Phase II reports can be installed as outlined in those reports. If provided in that manner, it must be recognized that the transmission main will operate at excessive pressure, at 300 psi or more, and the water age in the system will likely make the water quality marginal according to the Disinfection Byproduct Rules (DBP). Feasibility of the plan will depend upon 1) optimizing the water treatment process operation to minimize the DBP formation, 2) the conversion of the Giles County PSA water system to the regional water supply,

and/or 3) a substantial growth in the user base of Pulaski County PSA along the base of Cloyd's Mountain.

This report proposes that the first section of Commerce Park water main could be operated at significantly lower pressures than proposed in the Phase I and Phase II reports, if the Commerce Park location is used as a central storage and booster pumping location. Storage elevations can be established at the Commerce Park, which will allow direct connection of users to the delivery main through an area that is expected to be subject to substantial near term growth. The installation of this main would have a very positive effect on providing immediate redundancy to the Pulaski County PSA and Town of Pulaski water systems, as well as providing incentive for industrial siting at the Commerce Park. This report therefore recommends storage and re-pump facilities at the Commerce Park and the division of the Radford to Cloyd's Mountain water main of the Phase I and Phase II reports into two distinct sections. This would allow the regional system considerable flexibility with the staging of projects and their operations. The flexibility will likely be needed to obtain regulatory approvals to move forward with design and construction projects for the regional plan.

With the two Commerce Park water mains separated for consideration, the second portion of the main can be reduced from two 16-inch mains to a single 16-inch main. In order to be a feasible project, this second section of the Commerce Park main will still need to have the demand of the Giles County PSA system as a normal water source. Otherwise, the residence time for water in the system from the Commerce Park to Pearisburg will be far too long to maintain acceptable water quality. With that condition satisfied, the second section of the Commerce Park water main can be considered feasible.

For the PCPSA South of Claytor Lake water service main to the Snowville area, the plan included in the Phase I and Phase II reports can be installed as outlined. However, once again, if installed in that manner, the transmission main will have excessive pressure, which would have to be reduced to provide local service to the residents. Initial usage on this water main may also be small enough to give concerns about the formation of DBP's. Feasibility of the plan is entirely related to the amount of usage on the line or the ability to keep the contaminants flushed from the system. Operation of the line at high pressure is undesirable. Aside from having to provide higher pressure rated pipe, at a premium cost, pumping to the higher level of storage will waste energy. A lower pressure alternative should be found.

This report proposes that the pumping station at the County line be equipped to pump to a lower level storage tank, on high lands along the pipe route. In this case, public service directly from the transmission main would be possible if the storage tank is optimally located. The higher level storage tank can be placed into service along with a booster pumping station to feed the highest elevation services in this region. The demand from the higher tank would be expected to be less than the demand from the lower level tank. Like on the Commerce Park water line, the provision of multiple storage tanks will provide flexibility in the installation and operation of the system. The operation of the system will require less electrical power as well.

H. CITY OF RADFORD WATER SYSTEM

The Phase I and Phase II reports noted that the City of Radford has an abundance of excess water available to feed the needs of other water systems around the New River Valley. As a participant in the regional water system, there were no specific system upgrades identified and associated with the City. The finished water pumps needed for the transmission of the water from the water treatment plant, were included in the estimates provided for facilities in the Pulaski County PSA.

The primary change to be observed at the City's water plant, with the implementation of a regional water supply, will be the change in water production. Currently, the plant operates at 50% capacity over a period of about 12 hours per day to achieve output of about 25% of the plant capacity. The plant produces around 2 MGD and the Study Consortium has estimated that the cost to produce water at this facility is approximately $1.25/1,000 gallons. With an increase in output to 4 MGD, and with an operations crew at the plant for a period of 12 hours per day, the Consortium has estimated that the production cost of water could be driven as low as $1.00/1,000 gallons. It would seem to follow that by doubling operating shifts, and increasing chemicals and power, further increases to produce up to 8 MGD in a 24 hour period, with continual plant operation, would tend to allow the 12 hours unit costs to be maintained. The Phase I and Phase II reports have used these numbers in the analysis of costs. These are figures that have not been scrutinized as part of this report, but appear to be reasonable assumptions.

Table III-13
City of Radford Water System
Water Production Cost Comparison

Cost Item	Opinion of Cost
At Current Rate of Production (4 MGD)	
Make 2 MGD at $1.25/1,000 gal (12 hour shift @ 4 MGD)	$912,500/yr
Make 4 MGD at $1.25/1,000 gal (24 hour shift @ 4 MGD)	$1,825,000/yr
At Higher Rate of Production (Capacity – 8 MGD)	
Make 4 MGD at $1.00/1,000 gal (12 hour shift @ 8 MGD)	$1,460,000/yr
Make 8 MGD at $1.00/1,000 gal (24 hour shift @ 8 MGD)	$2,920,000/yr

- Unit costs are from Phase I and Phase II reports, but were not reviewed.
- Costs are for addition to new facility costs as plans are conceived. Production cost savings should be one area where capital costs can be offset for the regionalization effort.

The production costs above are provided for comparison to other systems as decisions are made to interconnect infrastructure components for regionalization. Since the water can be taken directly from the water treatment plant, City of Radford distributon system upgrade costs should be able to be avoided in the project. In addition, with regional connections to new transmission and storage, Radford's distribution storage improvements, currently being planned, may be avoided.

I. RADFORD ARMY AMMUNITIONS PLANT (RFAAP) WATER SYSTEM

The RFAAP facilities have not been considered within the New River Valley Regional Water Supply Plan. At this time, the potable water plants in production are very near capacity and the distribution system is aged and losing a large percentage of the water produced. The site also includes the process water and filtered process water plants, which could be converted to potable water service. However, the site ownership, security issues, reliability of the systems and the cooperation of the site owner and other factors will make the analysis of this site very subjective relative to a role in the regional plan. This facility certainly could be reviewed in the

future as conditions change, and could ultimately become a customer of the regional water authority..

IV

ANALYSIS OF OVERALL REGIONAL PLAN

A. COST CONSOLIDATION

Capital costs for the overall regional system have been estimated in the previous sections. A summary of the estimates is provided in the following table. All estimates consider the City of Radford, PCPSA and Town of Pulaski water plants providing the total amount of water for the region and provide for local water service to all water main corridors considered in the Phase I and Phase II reports.

Table IV-1
New River Valley Regional Water Supply Plan
Capital Cost Summary

Cost Item	Opinion of Cost
Giles County – Cloyds to Pearisburg	$8,848,000
Montgomery County – Radford to Riner	$11,213,000
Montgomery County – Riner to Pulaski County Line	$6,700,000
Floyd County – Riner to Floyd	$6,960,000
Floyd County – Riner to Check	$11,029,000
Floyd County – Floyd to Alum Ridge	$4,488,000
Floyd County – Floyd to Check	$6,178,000
Pulaski County – Radford to Commerce Park	$7,937,000
Pulaski County – Commerce Park to Cloyds	$4,555,000
Pulaski County – County Line to South Claytor Lake	$6,262,000
Total Estimated Construction Cost	**$74,170,000**
Annualized Construction Cost	**$5,933,600/yr**

For development of the regional system, there is a high level of construction cost required. However, if expended, the construction cost can help the localities avoid cost expenditures that they will have to face in coming years. The Table below estimates the costs that could be avoided by localities when the regional system is committed to implementation.

Table IV-2
Individual Local Water System
20 yr. Capital Source and Treatment Cost Estimate
(Avoidable Capital Cost Summary)

System and Features	Opinion of Cost
Floyd County – Add 0.2 MGD Municipal Wells and Piping	$800,000
Giles County – Add River Wells and 2.0 MGD Treatment	$4,000,000
Montgomery County – Riner System Expansion	$1,200,000
Pulaski County – Add 3.0 MGD Treatment Capacity	$10,000,000
Town of Pulaski – No Additions	$0
Blacksburg Christiansburg Water Authority – No Additions	$0
City of Radford – New Storage Tanks	$1,500,000
Total Estimated Construction Cost	**$17,500,000**
Annualized (Avoidable) Construction Cost	**$1,400,000/yr**

Note: The avoided costs are estimated at roughly the same level as the subjective estimate for acquisition of the water treatment plants. For purposes of this study, it is assumed that the water treatment plants would be acquired in exchange for the benefit in avoided costs.

We also need to consider the operating costs of the new facilities. Estimates have been provided in the tables listed throughout Chapter III. Recognizing that the City of Radford can produce up to 8 MGD for the regional system, we need to consider that a long term output might average as much as 7.5 MGD, due to scheduled downtime for filter backwashes. The Radford water plant would become the primary supply for users of the regional system.. Since the production cost of water at the City is lower than other sources, that plant would be relied upon for day to day operation at capacity, with supplemental supply being scheduled with operation of the PCPSA and Town of Pulaski water plants. Recall that the cost tables in Section III included estimates based upon transmission of 1 MGD through the system. The variable costs in the tables, those that were based upon 1 MGD, must be adjusted for anticipated flows. The following table estimates those costs and assigns the approximate existing flows to each supplier. For the flow assumptions, see section B that follows.

Table IV-3
New River Valley Regional Water Supply Plan
Operation and Maintenance Added Cost Summary

Cost Item	Opinion of Cost
Giles County – Cloyds to Pearisburg (1.155 MGD)	$111,600/yr
Montgomery County – Radford to Riner (0.385 MGD)	$106,500/yr
Montgomery County – Riner to Pulaski County Line (0.11 MGD)	$ 0/yr
Floyd County – Riner to Floyd (0.11 MGD)	$ 32,700/yr
Floyd County – Riner to Check (0.02 MGD)	$ 34,000/yr
Floyd County – Floyd to Alum Ridge (0.02 MGD)	$ 16,800/yr
Floyd County – Floyd to Check (0.02 MGD)	$ 0/yr
Pulaski County – Radford to Commerce Park (4.29 MGD)	$376,300/yr
Pulaski County – Commerce Park to Cloyds (1.155 MGD)	$ 84,100/yr
Pulaski County – County Line to Snowville Area (0.11 MGD)	$ 72,700/yr
Total Estimated Additions to O&M Costs	**$834,700/yr**

Adjustment has been made in these tables to reflect the projected current average day demands (x1.1 for unaccounted water) required by systems in need. See Section B which follows below.

Finally, we can review the water production costs, assuming that the Radford water use is maximized and the other supplies are used supplementally. To meet the production requirement of 8.03 MGD for current users demanding 7.3 MGD, the average plant production and cost of water production would be as follows:

City of Radford WTP	7.5 MGD x $1.00/1,000 gal =	$2,737,500/yr
Pulaski County PSA WTP	0.3 MGD x $1.62/1,000 gal =	$ 177,400/yr
Town of Pulaski WTP.	0.23 MGD x $1.97/1,000 gal =	$ 165,400/yr
Water Production Cost Estimate		$3,080,300/yr
Cost per 1,000 gallons produced		$1.05/1,000/gal
Cost per 1,000 gallons sold		$1.16/1,000/gal

The next step is to compile all the costs, to determine the approximate rate that could be offered to the water suppliers from the regional water supply system.

Table IV-4
New River Valley Regional Water Supply Plan
Cost Estimate for Regional System – Total Plan
Traditional Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Traditional Financing)	$5,933,600/yr
Operation and Maintenance of New Facility	$834,700/yr
Water Production	$3,080,300/yr
Total Estimated Annual Cost of Regional System	$9,848,600/yr
The cost of plant acquisition is not included herein, since it was earlier determined that acquisition could be traded for avoided costs in the locality water systems.	

With the costs noted above, and sales from the regional system at about 7.3 MGD, the sale price of water to the localities would have to be approximately $3.70/1,000 gallons to recover all the costs of operation.

Some investigations have been made into the potential for grant and low interest loan financing available for a regional project of this nature. It has been preliminarily determined that approximately 30% of the overall capital cost could be covered by federal grants, and a low interest loan with terms for 4.75% interest over a 40 year period could be provided to cover the balance of capital costs. Considering these changes to the financing, the following revised analysis is presented.

Table IV-5
New River Valley Regional Water Supply Plan
Cost Estimate for Regional System – Total Plan
Grant and Loan Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Grant and Loan Financing)	$2,907,500/yr
Operation and Maintenance of New Facility	$834,700/yr
Water Production	$3,080,300/yr
Total Estimated Annual Cost of Regional System	$6,822,500/yr
Grant amount 30% x $74.17 Million = $22.251 Million Annual Loan Debt 0.056 x $51.919 Million = $2,907,500	

With the identified grant and loan package, the rate for sale of water from the regional water system can be reduced to $2.56/1,000 gallons

Some of the ways the annual cost can be further reduced, and the feasibility of this plan can be increased, include the following:

- Examine potential to feed southern Montgomery County and Floyd County from Christiansburg
- Examine potential to feed Giles County from Blacksburg
- Eliminate water mains that appear to be non cost effective (Floyd County)
- Justify additional local "avoided costs" for any facilities that may be planned by localities, but would be unnecessary with the regional plan implementation
- Review the Operations and Maintenance costs in this report; the regional system may be able to be operated more efficiently than considered herein
- "Sell" new connections as much as possible along the water main extension corridors to increase the revenue side of the regional finances

B. FLOW ASSUMPTIONS FOR THE TOTAL PLAN

We have reviewed the water demands of each of the studied areas and have formatted the analysis to this point on the basis of delivery of water approximating the current demand levels. We have done this to generally determine the immediate impact to user rates, which will be most

visible to the water user. Just the same, the long term benefits of regional water supply should ultimately over ride the short term costs. All of this needs to be considered in the determination of the manner to proceed with this plan.

Purchasing Entity	Sold By Region	Produced by Region
Giles County	1.05 MGD	1.155 MGD
Montgomery County	0.15 MGD	0.165 MGD
Floyd County	0.10 MGD	0.110 MGD
Pulaski County (Commerce)	2.08 MGD	2.288 MGD
Pulaski County (Snowville)	0.10 MGD	0.110 MGD
Town of Pulaski	1.82 MGD	2.002 MGD
City of Radford	2.00 MGD	2.200 MGD
Totals	7.30 MGD	8.030 MGD

C. REDUCED REGIONAL WATER SUPPLY CONCEPT – FIRST STEP

Based upon the relatively high rate for water using the total plan identified above, we recommend plan reduction in a manner to reduce some of the projected capital costs. In this scenario, the water mains from Riner to Check, Floyd to Check and Highway 8 to Alum Ridge will be eliminated, and considered at a future time.

Using Table IV-1, the removal of the three feeds off of Route 8 in the Town of Floyd, result in capital cost of $52,475,000. With a 30% grant and 4.75% interest loan for 40 yrs, the annual debt retirement will be $2,057,000.

From Table IV-3, reduction of Operation and Maintenance to $751,200/yr would be possible.

Water production and usage would be virtually the same under the total program and the reduced program. The summary of costs included in the reduced program would be as follows:

Table IV-6
New River Valley Regional Water Supply Plan
Cost Estimate for Regional System – Reduced Plan Step 1
Grant and Loan Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Grant and Loan Financing)	$2,057,000/yr
Operation and Maintenance of New Facility	$751,200/yr
Water Production	$3,080,300/yr
Total Estimated Annual Cost of Regional System	$5,888,500/yr
Grant amount 30% x $52.475 Million = $15.743 Million Annual Loan Debt 0.056 x $36.732 Million = $2,057,000	

With the identified grant and loan package on the reduced scope system, the rate for sale of water from the regional water system can be reduced to $2.21/1,000 gallons

D. REDUCED REGIONAL WATER SUPPLY CONCEPT – SECOND STEP

There continues to be a relatively high rate for water using the first reduced plan identified above. An additional step of reduction can be reviewed to reduce more of the projected capital costs. In this scenario, the water mains from Riner to Pulaski County (Snowville area), are added to those that were previously removed from consideration. The line could be reconsidered at a future time.

Using Table IV-1, the removal of the additional main in Montgomery County and Pulaski County, results in capital cost of $39,513,000. With a 30% grant and 4.75% interest loan for 40 yrs, the annual debt retirement will be $1,548,900.

From Table IV-3, reduction of Operation and Maintenance to $678,500/yr would be possible.

Water production and usage would be virtually the same under the total program and the reduced program. The summary of costs included in the reduced program would be as follows:

Table IV-7
New River Valley Regional Water Supply Plan
Cost Estimate for Regional System – Reduced Plan Step 2
Grant and Loan Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Grant and Loan Financing)	$1,548,900/yr
Operation and Maintenance of New Facility	$678,500/yr
Water Production	$3,080,300/yr
Total Estimated Annual Cost of Regional System	$5,307,700/yr
Grant amount 30% x $39.513 Million = $15.743 Million Annual Loan Debt 0.056 x $27.659 Million = $1,548,900	

With the identified grant and loan package on the reduced scope system, the rate for sale of water from the regional water system can be reduced to $1.99/1,000 gallons.

V

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

If a regional water supply plan is to go forward, there will have to be some compelling reasons for the water suppliers to join in the implementation effort. Those suppliers and localities that struggled with water supply through the most recent drought as it peaked in 2002, could see the regional supply as an opportunity to have standby source available for their system. Those suppliers who are growing to meet their threshold water demand levels, requiring them to begin planning for new capacity, may see the opportunity to avoid local costs through sharing of excess water available from neighboring systems. And still others may see the water transmission mains discussed in this report as a means to extend water service to customers who have desired service, but local connections could not be justified on the basis of economics. The recommendations made herein, are based primarily upon economics, but consider the other factors as well. Economically viable projects, when coupled with other incentives, are generally worthy to pursue when there is a need to be satisfied.

The Phase I and Phase II reports considered the acquisition of three water treatment plants and addition of considerable lengths of transmission mains with pumping stations and storage tanks to provide water service to areas that are growing in the near term, but will continue to grow in the future. This report adds the Giles County PSA water plant to the acquisition list. The prior reports used the production cost of $1.00/1,000 gallons as a benchmark cost for source and treatment at the two facilities with surplus capacity. Although we have not tested the production cost through analysis, it is used in this report as a representative cost for water taken directly from the City of Radford water treatment facility. When looking at the overall supply of the acquired water plants, it is evident that the unit cost of produced water increases slightly over the $1.00/1,000 gallons, as a result of the use of multiple plants, some with higher production costs.

The analysis completed in prior sections indicates that there will be new costs in water supply for the region if the overall project is undertaken and assessed against existing users in the

water supply systems. This is also true with the reduced cost scenarios. It is evident that some of the financing concerns with the total program alternative are due to the extensions of major water mains into unpopulated areas. While service in these areas could be expected to increase significantly, water suppliers need to be concerned about cost coverage in the near term. Unless sizeable grant financing is available, the total project as presented in the Phase I and II reports, or as presented here, should not go forward all at one time. The extensions into unpopulated areas can be reconsidered in the future.

There are some bright spots in the plan, and a reduced program of improvements could well be more affordable. For that reason, we are repeating the tables from above, with a focus on serving the northern portion of the PDC, having a single water main extension to Riner and Floyd and extending a main from Riner westerly in the Snowville area.

Table V-1
New River Valley Regional Water Supply Plan
Recommended Plan Capital Cost Summary

Cost Item	Opinion of Cost
Giles County – Cloyds to Pearisburg	$8,848,000
Montgomery County – Radford to Riner	$11,213,000
Montgomery County – Riner to Pulaski County Line	$6,700,000
Floyd County – Riner to Floyd	$6,960,000
Pulaski County – Radford to Commerce Park	$7,937,000
Pulaski County – Commerce Park to Cloyds	$4,555,000
Pulaski County – County Line to Snowville Area	$6,262,000
Total Estimated Construction Cost	**$52,475,000**
Annualized Construction Cost	**$4,198,000/yr**

Table V-2
Individual Local Water System
20 yr. Capital Source and Treatment Cost Estimate
Recommended System (Avoidable Capital Cost Summary)

System and Features	Opinion of Cost
Floyd County – Add 0.2 MGD Municipal Wells and Piping	$800,000
Giles County – Add River Wells and 2.0 MGD Treatment	$4,000,000
Montgomery County – Riner System Expansion	$1,200,000
Pulaski County – Add 3.0 MGD Treatment Capacity	$10,000,000
Town of Pulaski – No Additions	$0
Blacksburg Christiansburg Water Authority – No Additions	$0
City of Radford – New Storage Tanks	$1,500,000
Total Estimated Construction Cost	**$17,500,000**
Annualized (Avoidable) Construction Cost	**$1,400,000/yr**

Table V-3
New River Valley Regional Water Supply Plan
Recommended System Operation and Maintenance Added Cost Summary

Cost Item	Opinion of Cost
Giles County – Cloyds to Pearisburg (1.155 MGD)	$111,600/yr
Montgomery County – Radford to Riner (0.325 MGD)	$100,500/yr
Montgomery County – Riner to Pulaski County Line (0.11 MGD)	$0/yr
Floyd County – Riner to Floyd (0.11 MGD)	$ 32,700/yr
Pulaski County – Radford to Commerce Park (4.29 MGD)	$376,300/yr
Pulaski County – Commerce Park to Cloyds (1.155 MGD)	$ 84,100/yr
Pulaski County – County Line to Snowville Area (0.11 MGD)	$72,700/yr
Total Estimated Additions to O&M Costs	**$777,900/yr**
Adjustment has been made in these tables to reflect the projected current average day demands (x1.1 for unaccounted water) required by systems in need	

Finally, we can review the water production costs, assuming that the Radford water use is maximized and the other supplies are used supplementally. To meet the production requirement of 7.97 MGD for current users demanding 7.25 MGD, the average plant production and cost of water production would be as follows:

City of Radford WTP	7.5 MGD x $1.00/1,000 gal =	$2,737,500/yr
Pulaski County PSA WTP	0.3 MGD x $1.62/1,000 gal =	$ 177,400/yr

Town of Pulaski WTP.	0.17 MGD x $1.97/1,000 gal =	$ 122,200/yr
Water Production Cost Estimate		$3,037,100/yr
Cost per 1,000 gallons produced		$1.04/1,000/gal
Cost per 1,000 gallons sold		$1.15/1,000/gal

The next step is to compile all the costs, to determine the approximate rate that could be offered to the water suppliers from the regional water supply system.

Table V-4
New River Valley Regional Water Supply Plan
Cost Estimate for Recommended System Plan
Traditional Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Traditional Financing)	$4,198,000/yr
Operation and Maintenance of New Facility	$777,900/yr
Water Production	$3,037,100/yr
Total Estimated Annual Cost of Recommended System	$8,013,000/yr

With annual costs at the level shown above, water sales would have to be at a rate of about $3.03/1,000 gallons to recover all costs, using traditional financing. With grant and loan funding in place the costs would change as shown below.

Table V-5
New River Valley Regional Water Supply Plan
Cost Estimate for Recommended System
Grant and Loan Financing

Cost Element	Opinion of Cost/yr
Capital Cost (Grant and Loan Financing)	$2,057,000/yr
Operation and Maintenance of New Facility	$777,900/yr
Water Production	$3,037,100/yr
Total Estimated Annual Cost of Regional System	$5,872,000/yr
Grant amount 30% x $52.475 Million = $15,743 Million Annual Loan Debt 0.056 x $36.732 Million = $2,057,000	

With annual costs at the level afforded by the grant and loan package, this option can be reduced to a rate of about $2.22/1,000 gallons.

To summarize feasibility, the engineering team has judged that a regional water supply authority is feasible. At the same time, although it is a sound plan for the future, there likely will be a need to infuse additional funds to make it a reality. The plan can be completed as laid out in total or on a reduced scale basis as noted in Section IV. At a reduced scale, the funding that is needed should be significantly less than in the total plan. The provision of grants and low interest loans toward the project will make the difference in determining the amount of additional funding required..

B. RECOMMENDATIONS

Phase I

Although the regional water supply program could be accepted in total, if accepted, its implementation could be staged over several years with certain projects of urgency taking precedence. In reviewing the project segments considered in this report, there are key components that should be started in the near term to maximize benefit for the most populated areas of the district. The projects that appear to be most beneficial are:

- Pulaski County PSA – Commerce Park Segment 1 from City of Radford to the Commerce Park. Use City of Radford, Pulaski County PSA and Town of Pulaski water plants to produce water for this area. (Phase I)

- Giles County PSA – Connection of Giles County through one of the potential routes (either Radford through Commerce Park to Pearisburg via Route 100, or Blacksburg to Newport via Route 460). Put Giles County PSA current source on standby and use new source for normal supply. (Phase I)

- Montgomery County PSA – Connection of the PSA's Riner system through one of the potential routes (either Radford via Forest Ave and Rock Rd, or from Christiansburg along Route 8). Put Riner current source on standby and use new source for normal supply. (Phase II)

- Floyd County PSA – Connection of the PSA's and Town of Floyd systems through extension of the main to Riner. Put Floyd current well sources on standby and use the new source for normal supply. (Phase II)

- Pulaski County PSA – For service to the south of Claytor Lake, an area that will experience growth in the near future, it is recommended that the main from Riner westerly to the Snowville area in Pulaski County be included in the initial project. (Phase II)

Because water from the City of Radford water plant can most reliably benefit Riner through a long connection from the City's water treatment plant, rather than from the closer periphery of the City's system, the potential for connection to the Town of Christiansburg should be reviewed in some detail for system supplement. Also, because the residents of eastern Giles County could be isolated from the PSA source and the redundant supply along Route 100 in the event of a watermain break along the spine of the GCPSA system (at the New River, in particular), and the community of Brush Mountain would be very difficult to serve from Giles County, the potential for connection to the Town of Blacksburg (or Water Authority) should be reviewed in some detail before committing to installation of watermain over Cloyd's Mountain (Route 100).

Later Phases:

The water main extensions in the southern portion of the district should be implemented at such times as economic justification for the mains can be more clearly shown.

APPENDIX A

SURVEY QUESTIONNAIRE

SURVEY QUESTIONNAIRE

New River Valley Regional Water Study

As part of the ongoing New River Valley Regional Water Study initiated by the New River Valley Planning District (NRVPD), Anderson & Associates, Inc., Draper Aden Associates, and Thompson & Litton, Inc. have been hired to evaluate aspects of the current Regional Water Study from an engineering standpoint. The following questionnaire has been prepared for the Engineers to gain a better understanding of the current potable water needs in both the urban and rural areas that make up the City of Radford, the Counties of Giles, Pulaski, Montgomery, and Floyd as well as the incorporated Towns within these Counties.

With that in mind, we ask that you please take the time to answer both sides of this questionnaire (Questions 1 thru 7). We request that all questionnaires be returned no later than February 3, 2006. A representative from Anderson & Associates, Inc., Draper Aden Associates or Thompson & Litton will be in contact with you over the next week to discuss this in more detail.

Organization Name _____

Contact Name (s) _____

1. Please list any areas within your existing system(s) that experiences potable water concerns due to water quantity.

2. Please list any areas within your existing system(s) that experiences potable water concerns due to water quality.

3. Please list any areas within your existing system(s) that have proven unreliable, whether it be water source or infrastructure related.

4. Please list all areas within your service area, currently served by private wells that historically experiences potable water concerns (please indicate reasons if known, i.e., drought, quantity, quality, contamination).

5. Please list all anticipated and/or targeted growth areas within your service area.

(Questionnaire continues on back)

6. Please list all the benefits you would like to see from joining a regional water authority.

7. Please list all the concerns you may have regarding joining a regional water authority.

Once completed please return the Survey Questionaire to one of the following:

Thomas DiGiulian, PE, LS
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Blacksburg, VA 24060

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Gregory H. Hurst, PE
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203C Rock Road
Radford, VA 24141

Jared L. Linkous, PE
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Radford Corporate Campus West
203C Rock Road
Radford, VA 24141

FIGURES

PRELIMINARY

N

Giles Co

Town of Rich Creek

Town of Glen Lynn

Town of Narrows

Town of Pearisburg

Town of Pembroke

Newport

Ground Tank
1.5 MG
Elev. +/- 2550'

Optional
Phase I

Phase I

Montgomery Co

Town of Blacksburg

VPI

Ground Tank
1.5 MG
Elev. 2496'

City of Radford

Town of Christiansburg

Town of Dublin

Optional
Phase II

Ground Tank
0.25 MG
Elev. +/- 3000'

Town of Pulaski

P.S. 6 MGD
Elev. 1765'

Riner

Snowville

Check

Ground Tank
1.5 MG
Elev. 3045'

Phase II

Pulaski Co

Ground Tank
1.5 MG
Elev. 2500'

Town of Floyd

Floyd Co

Existing Water Lines

0 5 10 15 Miles

Existing water system information was obtained from a variety of sources and may contain errors and omissions

Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA

Phase I & Phase II Report Recommendations

New River Valley PDC Water Supply Plan

DESIGNED	GRM
DRAWN	SMF
CHECKED	GRM
DATE	03-09-06

Scale: 1:250,000
Plan No. B06104-01

Figure

1

PRELIMINARY

N

Giles Co

Montgomery Co

Pulaski Co

Floyd Co

Town of Rich Creek

Town of Glen Lynn

Town of Narrows

Town of Pearisburg

Town of Pembroke

Newport

Ground Tank
1.5 MG
Elev. +/- 2550'

Optional
Phase I

P.S.

Phase I

Optional

Ground Tank
1.4 MG
Elev. 2496'

Airport Tank
0.4 MG
Elev. 2262'

P.S.

Ground Tank
1.4 MG
Elev. 2170'

Town of Dublin

P.S.

Town of Blacksburg

VPI

Town of Christiansburg

City of Radford

Town of Pulaski

Bethel Tank
1.0 MG
Elev. +/-2300'

Optional
Phase II

Ground Tank
0.25 MG
Elev. +/- 3000'

Riner

Future

Ground Tank
0.25 MG
Elev. +/-2680'

Check

Snowville

Tank
1.0 MG
Elev. 2450'

Phase II

Ground Tank
0.25 MG
Elev. +/-2800'

Ground Tank
0.5 MG
Elev. 3049'

Elevated Tank
1.0 MG
Elev. 2550'

Future

Alum Ridge

Future

Tank
0.25 MG
Elev. +/-2923'

Tank
0.5 MG
Elev. +/-2600'

Town of Floyd

Existing Water Lines

0 5 10 15 Miles

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Phase I & Phase II Revised Recommendations

New River Valley PDC Water Supply Plan

DESIGNED	GRM
DRAWN	SMF
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Figure 2