

Executive Summary

The Commonwealth of Virginia is rich in water resources; however, as the impacts of drought over the past two decades have demonstrated, we must work together to manage and protect water resources for future generations. Meeting long-term human and environmental needs can be accomplished most effectively by joint efforts of the Commonwealth and its localities. Comprehensive planning for the sustainability of the Commonwealth's water resources, as outlined in the Local and Regional Water Supply Planning Regulation (9VAC25-780) is designed to ensure the availability of adequate and safe drinking water to all citizens of the Commonwealth. Additionally, the planning process is established to encourage, promote, and protect all other beneficial uses of the Commonwealth's water resources, both in-stream and off-stream, and encourage, promote, and develop incentives for alternative water sources, including but not limited to desalinization. By Statute, all beneficial uses of our water resource, which includes the protection of fish and wildlife habitat, maintenance of waste assimilation, recreation, navigation, cultural and aesthetic values, agricultural, electric power generation, and commercial and industrial uses, must be protected for the maximum benefit to all. Improved coordination of water resource management activities at the local, regional, and state levels will ensure adequate water resources will be available for water demand for present and future beneficial uses.

The State Water Resources Plan (SWRP) is a compilation and synthesis of the 48 local and regional water supply plans¹ developed by local governments to assess their water supply needs 2010 to 2040, as well as information from other sources. Each water supply plan includes information concerning community water systems and self-supplied users, existing and potential sources of water supply, existing use, and anticipated future water demand. This information was entered into the Virginia Department of Environmental Quality's (DEQ) content management system for use in the cumulative impact analysis.

The Commonwealth realized a more proactive approach to water resources planning was necessary following the 1999-2002 drought event. Following the 2002 drought, the Local and Regional Water Supply Planning Regulation² was established, which required each locality to develop and submit a plan, either alone or in collaboration with other localities, by 2011. These plans have been collected and analyzed, and the results and recommendations are included in this report. The SWRP is designed, as required by statute,³ to encourage, promote, and secure the maximum beneficial use and control of the Commonwealth's water resources. In practice, the document will assist the DEQ in the efficient and effective regulation and management of water resources by examining projected water demand,

¹ See Appendix A

² 9VAC25-780

³ <http://lis.virginia.gov/cgi-bin/legp604.exe?2000+cod+62.1-44.38>

identifying water resources targeted to meet this demand, and analyzing potential impacts that may occur if the demand is met.

The SWRP takes a comprehensive look at the water sources currently being used in the Commonwealth and assesses the capacity of these sources relative to defined beneficial uses. An assessment of the ability of current sources to meet the projected water demand to 2040 is detailed.

This SWRP provides an opportunity to identify the likely challenges that will be faced by the many beneficial uses that depend on flow in Virginia's water resources. The information provided enables the identification of the probable location and types of impacts to beneficial uses and the various regulatory, infrastructure, and ecological challenges that these impacts might present. In addition to these areas of likely impact, the information in this plan can be used to target areas whose demands may jeopardize the sustainability of the water resource. These areas will require better understanding of aquatic resources, a more intense scrutiny to the accuracy of data, and a more thorough knowledge of water supply operations in those areas.

The cumulative impact analysis in the SWRP examined the data and information submitted during this water supply planning process and predicted a net increase of approximately 32% in mean daily water supply demand over the planning period 2010-2040. An estimated 450 million gallons per day (MGD) of additional water will be needed to meet the projected demands in 2040. This approximate 32% increase of water demands over the planning period is consistent with the Commonwealth's expected population increase for the same time period. Of this projected demand, about 77% is anticipated to come from surface water sources. The remaining estimated 23% demand is expected to come from groundwater sources.

During the drought of record simulation the challenge to the full range of beneficial uses will require greater attention in the follow up to this plan. The initial analysis indicated that in the future, there may be widespread areas of little to moderate impacts under normal conditions, punctuated by isolated areas with significant chronic impacts, and moving towards more widespread impacts under the driest conditions. For example, nearly 97% of the projected surface water demands in Virginia's streams are projected to come from approximately 25% of the stream reaches simulated. With 16% of streams predicted to see greater than 5% reduction in Drought of Record flows based on anticipated increases in use, drought-related impacts are likely to be more severe and last longer. This indicates a high probability that new management and/or infrastructure will be required to maintain safe yields at current levels. While systems that have built or are planning to build new storage will likely have adequate reserves to meet the predicted reduced drought inflows, systems without storage or with demands that are nearing existing safe yield may face challenges as the cumulative demands on streams increases.

Comprehensive water resources management includes planning, developing, distributing, and managing water resources for optimum use. These interrelated tasks can be accomplished by considering the competing demands of beneficial uses for water, allocating water resources, and satisfying all uses and demands. In searching for lasting solutions to the growing and competing demands for Virginia's water resources, a balance is needed between beneficial uses and long-term water availability. Industries and communities need reliable water to be available and profitable in both the short and long term.

The compilation of the water supply plans revealed that there are approximately 800 surface water withdrawals (reservoir, stream, and spring sources) and 2,900 groundwater well withdrawals (excluding private groundwater well estimates) statewide. Reported groundwater withdrawals outnumber surface water withdrawals for all use types (community water systems, large and small self-supplied users), except agriculture. Totals from the water supply plans indicate that an estimated 1.6 million people in the Commonwealth use private groundwater wells for residential water supply.

Appendix B of this SWRP includes summaries for nine major river basins, based on Virginia Code Section 62.1-44.38: Albemarle-Chowan River Basin, Chesapeake Bay-Small Coastal Basin, James River Basin, New River Basin, Potomac-Shenandoah River Basin, Rappahannock River Basin, Roanoke River Basin, Tennessee-Big Sandy River Basin, and York River Basin. The Major Basin Summaries include the following information, as summarized from the water supply plans:

- A description of the water supply planning units and localities included in each basin.
- A comparison of the surface water and groundwater sources used and withdrawals by source category
- Interbasin and intrabasin transfers identified in the water supply plans.
- Projected water demand and anticipated water supply deficits.
- A statement of need and a list of alternative water sources that may be considered to address deficits.

The SWRP will help focus the attention of decision makers on key issues and educate the public about the importance of managing Virginia's water supply. This SWRP gathers relevant water resource information in one location, laying the foundation for informed decision making at all levels concerning future water supply and use. For the first time in Virginia's history, the Commonwealth has a process in place to analyze the expected cumulative impacts of future water demands on streamflows and groundwater resources continually, as conditions change, to assist in decisions about the management and development of water resources.

State and local agencies, water purveyors, and consumers face a number of water supply challenges over the next 30-50 years, and even sooner in some areas. The challenges identified in managing the

water resources and recommendations to address these challenges are outlined in the SWRP. The following issues are described:

1. Challenge: Understanding the Impact of Unpermitted Water Withdrawals

According to the 2014 Report on Virginia's Water Resources Management Activities⁴, 82% of the total surface water withdrawn in 2013 was excluded from permitting, thus making it difficult to manage water resources, particularly during low flow periods. Unlike permitted withdrawals, excluded withdrawals are not subject to permit conditions that require conservation during times of low flow to reduce water use or to limits on withdrawal that require a certain volume of water to flow by the intake or to be released from a reservoir. These conditions help to ensure the existing beneficial uses of the water resource, including those of the withdrawal, are sustained at all times and, particularly, during dry periods, as well as conserving the resource for the long term.

Recommendation 1.1:

As resources allow, DEQ plans to coordinate with localities and other pertinent stakeholders to see if operational rules can be developed for those surface water withdrawals and impoundment releases currently excluded from VWP permitting. The areas that are predicted to result in negative impacts to beneficial uses during times of low flow will be prioritized. DEQ expects to meet with relevant parties in these areas to see if there are actions that can be agreed upon that would alleviate or reduce impacts on beneficial uses. Target stream reaches have been identified in the following river basins: Chowan-Albemarle, James, Potomac-Shenandoah, Rappahannock, Roanoke, and York. Future options may include, but are not limited to, the following: establishment of Surface Water Management Areas and Groundwater Management Areas; changes to pertinent statutes and/or regulations to capture unpermitted withdrawals.

2. Challenge: Gaps in Water Withdrawal Reporting, Differences in Reporting Thresholds between WSP and VWWR Regulations, and Lack of Adequate Data

As data submitted with the local and regional water supply plans was evaluated, it was noted that there are data gaps in groundwater and surface water information. While there is some information on the water use for agricultural and some commercial institutions, such as golf courses and nurseries, for example, additional outreach needs to be done to determine if there are water uses in these categories that have not been accounted for in Virginia's water budget.

Recommendation 2.1:

DEQ will:

- a) Coordinate with localities and regions to update the data set to continuously improve model results.

⁴ http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterSupplyPlanning/AWRP_090814FINAL.pdf

- b) As resources allow, initiate a more systematic approach to registering those facilities that meet the threshold for VVWR reporting, but who are not currently registered and do not report.
- c) Train localities and other water purveyors to directly input data into the content management system for more timely information.

3. Challenge: Quantifying Current and Future Risks to Groundwater Availability Outside of Current Groundwater Management Areas

The degree of interconnectedness of fractured rock groundwater systems and surface water features in western Virginia is significant, resulting in unique challenges to assessing water supply risk. These systems can be highly influenced by annual precipitation, can be storage limited, and can recharge or decline on short time scales. In most watersheds, groundwater discharge to streams constitutes a significant portion of the water in the stream. Droughts over the last two decades have demonstrated that below normal recharge over as little as two years can significantly reduce groundwater contribution to streamflow. Increases in groundwater withdrawals in these systems can have the same effect in reducing streamflow, increasing the risk of impacts to beneficial uses in a watershed. During times of low recharge, this effect can be compounded by increased withdrawals.

While the structural complexity of these groundwater/surface water systems creates some practical limitations, the Commonwealth and its localities need to begin at least some preliminary quantification of risk. Seventy-five percent of the groundwater demand for 2040 is expected to occur outside the coastal plain GWMA. Therefore, it is important to start by creating some basic water budgets in these areas. These can start as simply as a comparison of rainfall volumes to expected withdrawal volumes.

As projections were gathered through the water supply planning effort, there is a better understanding of groundwater demands and reliance on this resource in the western half of Virginia. It was estimated that 137.81 MGD of water was used by small self-supplied users of private residences. Additionally, estimates of the projected future demand associated with these wells were made in the water supply plans. However, assumptions were made that groundwater resources could support this increased demand. This may or may not be the case; there is not enough information on the sustainability of groundwater wells in the western half of the Commonwealth to be sure.

To go beyond simple assessments, further investment is needed in targeted monitoring and model development to determine groundwater flow, relative storage in these systems, and the probable magnitude of impact under different meteorological and water use conditions.

Recommendation 3.1:

DEQ may facilitate efforts with localities and regional stakeholders (e.g., planning district commissions, utilities, public service authorities) to expand groundwater monitoring wells in localities

outside the Groundwater Management Area with expected significant increases in 2040 demands from groundwater and may be at high risk for negative beneficial use impacts. An increase in groundwater monitoring wells should improve our understanding of the groundwater resource and the impacts of pumping on the aquifer. State and local entities may coordinate efforts to identify financial resources to provide funding necessary for an expansion of the State Observation Well network. Additionally, DEQ plans to provide decision makers with all methodologies and analysis that DEQ has on the availability and sustainability of groundwater. DEQ may provide input and assistance if localities or regions conduct their own methodologies or analysis, including Recharge Analysis. As resources allow, DEQ staff will analyze data and provide outreach to localities and regions to ensure better management of the resources and water availability for all beneficial users. DEQ plans to target outreach efforts to localities that the cumulative impact analysis indicates groundwater uses exceed the annual recharge. These localities include the counties of Giles, Frederick, and Rockingham, and the cities of Martinsville, Radford, Roanoke, Salem, and Waynesboro.

4. Challenge: Reservoir Site Development

The process of identifying future reservoir sites can be difficult, potentially involving numerous competing interests, all of which can be the subject of much debate. Localities typically must consider planned projects, such as housing developments, major road, rail, or utility line construction, infrastructure development, and identification and protection of sites for future economic development. Federal, state, and local interests to protect natural ecosystems located within a reservoir footprint can also impact the viability of a site. Considerations such as cost, size, the distance to where water is needed, environmental and archaeological concerns, water quality and source water protection, and benefits beyond water supply (recreational uses and tourism) must also be considered. Maintenance of reservoirs to assure their storage capacity is another cost that should be considered. Any of these conditions can influence the viability of a new reservoir site and impact the ability of state or federal authorities to approve a proposed permit application.

Recommendation 4.1:

Based on the projected 2040 demand, localities and regions will need additional storage. DEQ will assist, as appropriate, in any efforts to optimize the use of the resource.

5. Challenge: Threats to Water Quality

Water supply plans listed a number of potential threats to water quality. The WSP Regulation section on “Existing Resource Information” requires all water supply plans to include “a description of existing environmental conditions that pertain to, or may affect, in-stream flow, in-stream uses, and sources that provide the current supply.” Required conditions to be considered included state or federal threatened or endangered species or habitats of concern, river segments that have recreational

significance, unusual geologic formations or soil types, wetlands, riparian buffers, land use including impervious surfaces, impaired streams, and point source discharge locations. Potential threats to water quality or quantity beyond this list were to be discussed in the plans.

Other potential threats listed in the water supply plans include contamination from septic tanks, fuel spills, industry, landfills, landslides, radon emission, mining excavations, logging, junkyards, septic system failures, and agricultural runoff. Improper application or inappropriate storage of lawn and garden chemicals, paints, synthetic detergents, solvents, oils, medicines, disinfectants, pool chemicals, pesticides, batteries, gasoline, and diesel fuel are also considered threats to water quality.

Recommendation 5.1:

DEQ will continue to evaluate August Low Flow (aquatic life impacts), and 7Q10 (waste assimilation) to assess the probable impacts to certain beneficial uses. As resources allow, DEQ will add conditions to be considered to assess the potential impacts to the water resources.

6. Challenge: Understanding the Impact of Consumptive Use on Water Supply

Consumptive use, that portion of the water withdrawn that is lost to evaporation, transpiration, or consumption by humans or animals and is not returned to the water system, has the greatest impact on water availability. The impact of consumptive uses on beneficial uses is and should continue to be evaluated in water supply planning and permitting. Current regulations (WSP Planning, Water Withdrawal Reporting) do not require information on consumptive use. One of the main objectives of the cumulative impact analysis and water supply planning process is to ensure against future water shortages and unforeseen negative impacts to in-stream beneficial uses. As such, consumptive use must be factored into the modeling equation. Assumptions about consumptive use are conservative, erring on the side of assuming a higher level of net consumption from water use activities. Reporting of actual data concerning consumptive use will provide more accurate projections on the availability of water during low flows.

Recommendation 6.1:

Request approval to revise the Virginia Water Withdrawal Reporting Regulation (9VAC25-200-10 et seq.) to require the annual reporting of consumptive use.

7. Challenge: Promoting Increased Conservation to Reduce Long-Term and Short-Term Demand

The goal of water conservation is to maximize the benefit gained from each gallon of water used. Water conservation is increasingly becoming important as part of local governments' overall water management strategy across the Commonwealth, particularly during drought events. Water conservation practices can extend the use of a system's available water supply, reduce the impacts of drought, delay expansion of treatment facilities, reduce operating costs, and reduce costs to consumers as their use of water declines. Use of water conservation practices are described in

regional water supply plans and reflect that the more limited a region's water resources are or are expected to become, the more critical it is to have effective water conservation programs.

Water conservation can be an important component of water resource management. Although Virginia is rich in water resources, citizens must use water wisely to ensure the sustainability of the resource both during drought events and every day. As such, localities and other water purveyors are considering water conservation programs to ensure water is used as efficiently as practicable.

Recommendation 7.1:

DEQ will encourage localities and regions to place more emphasis on conservation efforts to reduce demand in their water supply plans.

8. Challenge: Critical Infrastructure Deficiencies

Water infrastructure in Virginia was built over many decades and, for many localities and systems, has not been maintained adequately due to insufficient funds and planning. The local and regional water supply plans reflect system losses from 4% to 50%, generally depending upon the age of the system. The American Society of Civil Engineers recently released the "New 2015 Report Card for Virginia's Infrastructure" (<http://www.infrastructurereportcard.org/virginia/virginia-overview/>) and gives Virginia a grade of 'C' based on the reported condition of existing assets, expected service life, current functionality and level of service, future growth needs, and anticipated level of funding required to maintain Virginia's infrastructure. The report continues that "Virginia reported \$6.1 billion in drinking water infrastructure needs over the next 20 years." While all systems will not fail at the same time, water treatment facilities and related distribution systems need to be properly maintained or replaced to ensure proper water efficiency.

VDH has prioritized drinking water loss in their grant/loan program. In the "Commonwealth of Virginia Drinking Water State Revolved Fund Program Intended Use Plan For the DWSRF FY 2015 Capitalization Grant," <http://www.vdh.state.va.us/ODW/financial/documents/pdf/2015%20IUP.pdf>, draft dated January 5, 2015, VDH established the Drinking Water State Revolved Fund (DWSRF) Program in accordance with the federal Safe Drinking Water Act Amendments of 1996. The goals of this program include assisting "waterworks owners in protecting water supplies, ensuring the reliable operation of water systems, preparing for future waterworks challenges, and developing their technical, financial, and managerial capacity."

Recommendation 8.1:

DEQ will provide VDH with a list of localities whose water supply plans indicated that they have high water loss so VDH can consider them for funding to improve their infrastructure.

9. Challenge: Sea Level Rise, Changes in Precipitation Patterns, and Land Subsidence

Environmental issues such as sea level rise, changes in precipitation patterns, and land subsidence may have impacts on water resources in the Commonwealth. “The changing climate impacts society and ecosystems in a broad variety of ways. For example climate change can increase or decrease rainfall, influence agricultural crop yields, affect human health, cause changes to forests and other ecosystems, or even impact our energy supply. Climate-related impacts are occurring across regions of the country and across many sectors of our economy.”⁵

Recommendation 9.1:

- a) DEQ will conduct a Cumulative Impact Analysis annually and will evaluate the impacts on streamflow of the most recent climate change model scenarios available in time for each five-year review cycle for local and regional water supply plans.
- b) DEQ will develop a subsidence monitoring plan to better characterize the amount of sea level rise due to land subsidence over time to inform water supply-related local adaptation strategies.

10. Challenge: Source Water Protection

Many local and regional water supply plans acknowledge that the VDH Source Water Assessment Program indicated high susceptibility for their sources of water supply, yet only 15 of the 48 water supply plans indicate a source water protection plan program has been completed or is under development. Completion of the Source Water Protection Plans process, using the same funding strategy mentioned above in coordination with VDH, should improve the long-term viability of storage and infrastructure in the Commonwealth.

Recommendation 10.1:

DEQ will coordinate with VDH and localities to urge localities to develop and implement Source Water Protection Plans. Localities can begin by reviewing the Source Water Assessment conducted by VDH and determining whether additional study of additional threats is needed. Land areas should be defined that contribute water to the system. Localities can develop zoning ordinances and other tools to ensure these areas are protected from water quality threats.

11. Challenge: Conflict Resolution

As discussed in the 2012 Final Report for the Water Supply Plan Advisory Committee, the SWRP is used as an informational tool for future water supply decisions and not for conflict resolution. The information derived from local and regional plans can be used to evaluate alternative water sources and to determine the extent of hydrologic conflicts between localities, regions, existing users, and

⁵ <http://www.epa.gov/climatechange/impacts-adaptation/>

other in-stream and off-stream beneficial uses. When conflicts are identified, DEQ can provide informal facilitation if requested, but attempts to resolve the conflict should be at the local level. Should it not be practical or logical for issues to be resolved at the local level, there are other remedies available that may assist with resolving issues between stakeholders. DEQ does not currently have the authority necessary to resolve conflicts beyond identifying them and facilitating discussion between localities and regions.

Under the current regulatory framework, conflicts arising from planned implementation of local and regional water supply plan alternatives can be resolved through the following methods:

- a) Issuance of Virginia Water Protection permits.
- b) Creation or use of a legislative or voluntary body (such as a river basin commission).
- c) Regulations, such as declaration of a Surface Water Management Area or Groundwater Management Area.
- d) Litigation among parties.

Recommendation 11.1:

DEQ should continue to work within the current regulatory framework to resolve conflicts.

12. Challenge: Public Education and Outreach

All residents of the Commonwealth should understand the need for managing Virginia's water resources so state, regional, and local water supply planning will be more effective. When people understand that the Commonwealth's water resources are not finite and that active management of existing resources is essential to meeting future demand, statewide educational efforts will likely be more successful, as localities may coordinate activities and inspire each other as they consider ways to reach more citizens. DEQ, other state agencies, and all localities must work in concert to provide accurate and useful information to ensure that citizens learn about the opportunities and benefits of improving water use efficiency. A comprehensive, statewide public education and outreach program can have a positive impact on Virginia's water resources.

Recommendation 12.1:

DEQ will engage localities and planning regions in water supply planning efforts, as follows:

- 1) Communicate the findings of the State Water Resources Plan, including the Cumulative Impact Analysis and probable impacts to water resources.
- 2) Assist localities with water supply planning compliance efforts as outlined in their condition of approval.
- 3) Improve modeling results by increasing the accuracy of the data, as follows:
 - a.3.1 Partner with a locality willing to serve as a pilot for the direct input of data into the DEQ content management system, ensuring the system is user friendly and easily accessible

a.3.2 Train localities and water purveyors to directly input data into the content management system

4) Expand public education and outreach efforts to impress upon citizens the importance of water supply planning and conservation during drought.

In summary, the SWRP presents relevant information for local communities and their consultants to use when planning for future water supply needs, such as projected demand, anticipated deficits, potential water supply alternatives, and addressing the various state regulations and programs that affect water supply planning. The water supply planning regulation anticipated that localities would use the information included in the SWRP in their planning. To that end, DEQ anticipates updating the SWRP at five-year intervals, with each update reflecting the most recent local and regional water supply plans, water withdrawal data, and demand projections. The SWRP is intended to be a dynamic, iterative document that will be updated as new data becomes available.