



Water Quality Policy Paper

Water Quality is one of the six primary goals identified by the Regional Water Resources Policy Committee (RWRPC) in the October 2004 *Shenandoah Valley Watersheds Policy Integration Assessment*.

Water Quality Goal Statement

“Aggressively achieve the level of water quality (ground and surface) required to support the human, business, and agricultural needs in the Valley, without sacrificing the needs of the watershed’s fish and other aquatic life.”

The purpose of this policy paper is to provide background information on water quality in the Shenandoah Valley in the areas of: Key Regulatory Drivers; Status of Existing Efforts; Relevant Regional Trends; and, Potential Strategies and Actions.

I. Key Regulatory Drivers

During the last few decades, the federal government has enacted considerable legislation addressing water quality. The Clean Water Act (CWA) is the most prominent, serving as the impetus for a majority of the regulatory drivers identified in this paper. The CWA sets the basic structure for regulating discharges of pollutants to waters and defines levels of accountability. The CWA requires state agencies and local jurisdictions to bear the responsibility of implementing and enforcing the various mandates.

NPDES Phase II Stormwater Requirements

The National Pollutant Discharge Elimination System (NPDES) Phase II stormwater program is a requirement of the federal Clean Water Act. In practical terms, the NPDES program regulates storm sewer outfalls in urban areas of less than 100,000 people (defined by the U.S. Census) as point sources for pollutant discharges. A primary goal of the program is to prevent polluted stormwater runoff from being transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local rivers and streams without treatment.

NPDES requires urbanized local governments to develop stormwater management plans (SWMPs) to control pollution to the maximum extent practicable (MEP). The SWMP must address six minimum control measures (MCMs), including:

- Public education and outreach
- Public participation and involvement
- Illicit discharge detection and elimination
- Construction site runoff control



- Post construction runoff control
- Pollution prevention and good housekeeping

In Virginia, the Department of Conservation and Recreation (DCR) has recently assumed NPDES permitting authority from the Department of Environmental Quality (DEQ). In West Virginia, the Department of Environmental Protection (DEP) is the permitting authority. Localities currently subject to NPDES Phase II permitting requirements in the Virginia portion of the Shenandoah Valley watershed include the City of Winchester, the City of Harrisonburg, and the Town of Bridgewater. In West Virginia, only the City of Martinsburg in Berkeley County is subject to NPDES Phase II. However, as population centers grow, additional localities may fall under the requirements.

Total Maximum Daily Load (TMDL) Requirements

The TMDL requirements of the CWA represent a significant regulatory challenge for the region. TMDL stands for Total Maximum Daily Load, and represents the maximum amount of a pollutant that can enter the stream without violating water quality standards. A TMDL must be developed for any stream identified as violating water quality standards. After the TMDL is set, the affected localities must develop a plan for how pollution will be reduced to the necessary levels. The most recent list of impaired waters for both Virginia and West Virginia was published in 2002.¹²

Significantly, TMDL reduction allocations can be incorporated into local government NPDES Phase II stormwater permits, which has the potential to make them mandatory. Most of the TMDLs address nonpoint source pollution from agricultural sources, although urban source nonpoint sources, point sources, and atmospheric deposition are also major causes for impairment.

Chesapeake Bay Agreement Nutrient and Sediment Reduction Goals

The multi-jurisdictional 2000 Chesapeake Bay Agreement commits Virginia and West Virginia to remove the Chesapeake Bay from the U.S. EPA's list of impaired waters by the year 2010. One potential implication of failing to meet this commitment is that the entire Chesapeake Bay watershed, including the Shenandoah River basin, could be subject to a TMDL. This would essentially replace the voluntary framework established through the Chesapeake Bay Program, meaning that the TMDL will be enforced by the U.S. EPA, not by local governments.

To meet this commitment, Virginia has developed a Nutrient and Sediment Reduction Tributary Strategy for the Shenandoah and Potomac River Basins, which was finalized in March 2005.³ Virginia's estimated cost to implement the strategy in the Shenandoah River basin is \$1.19 billion, funded by both public and private sources.

The West Virginia DEP, the West Virginia Conservation Agency, and the West Virginia Department of Agriculture partnered together to implement a parallel process for the eight Eastern Panhandle counties. West Virginia's estimated cost to implement the draft

¹ www.deq.virginia.gov/wqa/303d.html

² www.wvdep.org/item.cfm?ssid=11&ss1id=188

³ www.naturalresources.virginia.gov/Initiatives/TributaryStrategies



strategy is \$232 million. The strategy focuses on manure transport outside the watershed, compliance with urban storm water regulations, and reductions in point source nutrient loads. For a copy of the latest draft of the West Virginia document, go to www.wvnet.org.

Virginia Stormwater Management Requirements

Current Virginia Stormwater Management Regulations establish mandatory stormwater management guidelines for municipalities. As of 2004, HB1177 requires that any locality regulated under the NPDES Phase II permitting requirements must develop and adopt a local stormwater management ordinance. HB1177 further directs the Department of Conservation and Recreation to administer stormwater management programs where localities are not subject to NPDES Phase II regulations and have chosen not to voluntarily adopt a local ordinance.⁴

Virginia Department of Health

The Department of Health (VDH) regulates private wells, sewage handling and disposal, sewage collection and treatment, and septic systems. For more information, please see: <http://www.vdh.virginia.gov/onsite/regulations.asp>.

Virginia Regulation for Wastewater Reclamation and Reuse

DEQ has prepared a Notice of Intended Regulatory Action (NOIRA) to develop technical regulations, requirements and standards for the reclamation and reuse of wastewater. The regulation promotes and encourages the reclamation and reuse of wastewater in a manner protective of the environment and public health.⁵

Groundwater Standards

As defined in 9 VAC 25-280-10, groundwater quality standards are: "Provisions of state law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Groundwater quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (62.1-44.2 et seq. of the Code of Virginia)."

Groundwater quality is particularly pertinent to the Shenandoah Valley region because it comprises a significant portion of the drinking water, as well as base flow levels for the Shenandoah River and its tributaries. In Shenandoah County, approximately 60% of the 38,000 residents obtain their drinking water from private wells. Five of the seven public service areas in the County also obtain their drinking water from wells, where the water is publicly treated. Comprehensive water treatment statistics for private wells do not exist, but are assumed to include a very low percentage well owners. Well testing conducted by a local environmental services company, usually in conjunction with the sale of a property, reflects that over time approximately 30% of the wells tested do not meet safe drinking water standards.

⁴ For more information, please see Title 4VAC50-60 of the Virginia Administrative Code: <http://leg1.state.va.us/000/reg/TOC04050.HTM#C0060>.

⁵ See: <http://www.townhall.state.va.us/chapter/ViewChapter.cfm?Vac=196&Chapter=740>.



Virginia Department of Mines, Minerals and Energy

Mining activities in Virginia are subject to State Water Control Law (Chapter 3.1, (§ 62.1-44.2 *et seq* of the Code of Virginia) and NPDES permitting regulations for the discharge of sewage, industrial wastes, and other wastes from coal surface mining operations. Mine operators must also have certified public liability insurance for underground coal mining operations which pose potential threats to water supplies. Virginia Code (§ 45.1-258) mandates that operators of any coal surface mining operation replace water supply where it has been affected by contamination, diminution, or interruption resulting from a coal surface mine operation.⁶

Virginia Department of Transportation

The federal Clean Water Act requires the Virginia Department of Transportation (VDOT) to provide erosion and stormwater runoff controls, including inspection services, during and after construction of highways. The purpose of the controls is to minimize the impact of pollutants from highway runoff into water resources. For further information visit: <http://www.virginiadot.org>.

Agricultural Stewardship Act

The Agricultural Stewardship Act Program (ASA) (Section 10.1-559.7 of the Code of Virginia) solicits farmers to be proactive in addressing water quality problems voluntarily before enforcement action is taken. ASA is a cooperative effort involving the Virginia Department of Agriculture and Consumer Services and Virginia's Soil and Water Conservation Districts. The program offers procedures for notifying individual agricultural producers to potential operational areas that may be causing water pollution and guidelines for developing best management practices to mitigate the problem areas.⁷

CERCLA/Superfund and Hazardous Waste Programs

Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA), better known as Superfund, is the federal government's program to clean up uncontrolled hazardous waste sites. Under the Superfund program hazardous wastes that pose a current or future threat to human health or the environment are cleaned up. Three Superfund sites have been identified within the Valley: Rhinehart Tire Fire Dump in Frederick County, Avtex Fibers, Inc. in Warren County and Leetown Pesticide in Leetown, Jefferson County, West Virginia.

Rhinehart Tire Fire Dump was deleted from the Superfund list on September 30, 2005. The site is located on 4.5 acres in the outskirts of Winchester and served as a storage area from 5 to 7 million tires. In late 1983, the tires caught fire, releasing toxic gases and melting into more than 800,000 gallons of oily wastes. In the 1980's, State monitoring indicated local groundwater contamination in aquifers nearby the site. The Leetown Pesticide Site was also listed in the early 1980's and deleted by August, 1996. The site contained a 1,200 cubic-yard pile of material contaminated with several pesticides. Groundwater contamination in the area was also a major concern.

⁶ For further information visit: http://www.mme.state.va.us/Coal_MM_DGOLaws.htm.

⁷ For more information please visit: <http://www.vdacs.virginia.gov/stewardship/index.html>.



Warren County, Avtex Fibers, Inc. was listed on the EPA Superfund in 1986. The site is located on 440 acres outside of Front Royal in Warren County and is considered one of the Country's most severely polluted sites. The facility manufactured synthetic fibers for 49 year and was the largest rayon manufacturer in the U.S. during WWII. The facility closed in 1989 after being cited for more than 2,000 violations of Virginia environmental laws, associated primarily with wastewater discharges into the Shenandoah River. Remediation of the site is currently underway. For more information visit: <http://www.epa.gov/superfund/>.

II. Status of Existing Efforts

Pure Water Forum

The Forum is a non-profit organization that promotes activities addressing water quality issues and environmental education in the Shenandoah River watershed. The Forum brings together under one umbrella a diverse group of community interests, including representatives from Valley citizen conservation groups, local and state governments, business and industry, agriculture, educators, conservation and planning districts, and others. The Forum promotes the sharing of resources to achieve the common goal of pure water.

Forum priority strategies include:

- *Improve Watershed Education in Communities and Schools:* Focus on water quality and watershed issues. Coordinate and build upon existing education efforts.
- *Support and Sponsor Environmental Programs and Projects:* Support existing environmental programs to encourage their growth and expansion throughout the watershed. Support existing projects by promoting networking, sharing of information, promoting regional networks, and disseminating information to users.
- *Share Watershed Information:* Facilitate communications that will connect the water user community and decision-makers to achieve all priority strategies.
- *Promote Regional Networks that Address Watershed Issues*
- *Facilitate Public Discussions of Major Issues in Water Quality:* Act as a neutral party to host public meetings and events to address current issues that are perceived to affect water quality.

Pure Water Forum Water Window

The Pure Water Forum's Shenandoah Water Window represents a major effort to consolidate in a user-friendly format water quality monitoring data collected by the Friends of the Shenandoah River through a network of volunteers in several community watershed organizations. The window provides map-based access to a wealth of water quality data and associated watershed information at nearly 200 locations in the Shenandoah Basin since 1996. The Water Window can be found at www.purewaterforum.org/waterwindow.



Community Watershed Organization Water Quality Monitoring Efforts

Several community watershed organizations in both Virginia and West Virginia collect chemical and biological water quality monitoring data. The Friends of the Shenandoah River, together with the Friends of the North Fork, the Three Rivers Monitors, and volunteers in all counties within the watershed, leads an extensive voluntary monitoring network that includes sites in Augusta County, Clarke County, Frederick County, Jefferson County, Page County, Rockingham County, Shenandoah County, and Warren County. Every two weeks over 75 volunteer monitors take approximately 160 water samples. For more information, please see: www.fosr.org/rivmon.cfm.

Chesapeake Bay Watershed Nutrient Credit Exchange Program

In March 2005, the Virginia General Assembly approved HB 2862, which established the Chesapeake Bay Watershed Nutrient Credit Exchange Program (amending Title 62.1 of the Code of Virginia). The adoption and utilization of a watershed general permit and market-based point source nutrient credit trading program will assist in three different goals:

- Meeting cap load allocations cost-effectively and as soon as possible in keeping with the 2010 timeline and objectives of the Chesapeake 2000 Agreement,
- Accommodating continued growth and economic development in the
- Providing a foundation for establishing market-based incentives to help achieve the Chesapeake Bay Program's nonpoint source reduction goals.

By January 1, 2006, or as soon thereafter as possible, the Board is expected to issue a Watershed General Virginia Pollutant Discharge Elimination System Permit (General Permit) authorizing point source discharges of total nitrogen and total phosphorus to the waters of the Chesapeake Bay and its tributaries. For more information, please see: <http://leg1.state.va.us/cgi-bin/legp504.exe?051+ful+CHAP0708>.

Shenandoah Valley Wastewater Treatment Plant Network

The purpose of the wastewater treatment plant network is to provide Valley treatment plant operators an avenue to exchange information and technical knowledge about their operations, to enable operators to help each other troubleshoot and problem solve with professionals in the wastewater treatment field, and to provide increased training opportunities for all. The Network currently has 37 members. For more information, please see: <http://www.svwwtpn.org/svwwtpn/>.

North River and Holman's Creek TMDL Implementation Projects

While there are several TMDLs and TMDL implementation plans being developed in the Shenandoah Valley, the North River Tributary in Rockingham County was selected by the Virginia Department of Environmental Quality to serve as a pilot project for actual implementation of on-the-ground best management practices designed to remove the impaired stream segment from the TMDL impaired waters list. This process will serve as a template for similar stream segments subject to TMDL requirements. The Holman's



Creek TMDL Implementation Plan was approved by the EPA in 2003 and is currently in the implementation phase.⁸

This program, administered by local Soil and Water Conservation Districts (SWCD), provides funds to farmers to help install conservation practices that protect water and make farms more productive. Funding availability varies by SWCD. The state provides districts funds to target areas with known water quality needs. Areas with the greatest need receive the greatest funding. The cost-share program supports using various practices in conservation planning to treat animal waste, cropland, pastureland and forested land. Some are paid for at a per-acre rate. Others are cost-shared on a percentage basis up to 75 percent. In some cases, USDA also pays a percentage. In fact, the cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner's expense to less than 30 percent of the total cost.⁹

Pesticide Applicator Certification

Private and commercial applicators of pesticides must be licensed by the Virginia Department of Agricultural and Consumer Services (VADACS). This is to prevent excessive use of pesticide, which can runoff of land and degrade water quality.¹⁰

Department of Forestry Audits

To ensure voluntary compliance with silvicultural water quality guidelines, the Virginia Department of Forestry (DOF) began conducting Best Management Practice Field Audits in 1993. The field audits are conducted twice a year, and provide a useful tool in monitoring the status of Virginia's water resources. Loggers must also provide notification to DOF within three days of the start of a logging operation; failure to provide notification will result in civil penalties.¹¹

Virginia Groundwater Protection Steering Committee

The Groundwater Protection Steering Committee was founded in 1986 and represents an allegiance between 11 state agencies including, the Department of Health, DEQ, the Department of Mines, Minerals and Energy, and the Department of Housing and Community Development. The inter-agency advisory committee works together to advocate and further ground water protection efforts. Key accomplishments of the committee include various wellhead protection activities. Currently, the committee is striving to increase education and outreach about groundwater.¹²

Friends of the Shenandoah River: Health of the Shenandoah River Series

The Friends of the Shenandoah River (FOSR) has prepared four reports on the health of the Shenandoah River watershed in Virginia. Once finished, the full report will include several parts and will expound upon water quality monitoring results from across six

⁸ For more information, please see:

<http://www.epa.gov/reg3wapd/tmdl/VA%20TMDLs/Holmans%20Creek/>.

⁹ For more information, please see: <http://www.dcr.virginia.gov/sw/docs/bmpsbro2.pdf>.

¹⁰ For more information, please see: <http://www.vdacs.virginia.gov/pesticides/certification.html>.

¹¹ For more information, please see: <http://www.dof.virginia.gov/wq/monitoring.html>.

¹² For more information, please visit: <http://www.deq.state.va.us/gwpsc/homepage.html>.



counties. Most recently, the reports have addressed results from Warren, Clarke, Page and Shenandoah Counties. Ultimately, the purpose of the reports is to provide a quantitative indication of the “health” of the river. Findings thus far indicate that tributaries in Warren County are the least impaired. However, results from monitoring in Clarke, Page, and Shenandoah were not as encouraging. High nitrogen levels were found in tributaries of the Main Stem in Clarke County, of the South Fork in Page County, and of the North Fork in Shenandoah County.

West Virginia University Water Quality Survey

During the summer of 2005, WVU conducted a water quality survey of residents of Virginia and West Virginia, living in the Opequon Creek Watershed. Opequon Creek and some of its tributaries, including Abrams Creek, are listed as impaired due to fecal coliform bacteria and benthic / biological impairments. TMDL plans have been approved for the Virginia part of the watershed and are under development for the West Virginia side. The study conducted by WVU sought to estimate the value of the benefits from TMDL water quality improvement for watershed residents. Results are currently being analyzed. However, the group expects that residents will have a positive willingness to pay for improved water quality and that the surveys will improve public participation and awareness of water quality issues.¹³

Canaan Valley Institute

The Canaan Valley Institute (CVI) was founded in 1995 and is a “nonprofit, non-advocacy organization committed to helping communities improve the quality of life in their watersheds by restoring aquatic resources using cost-effective, locally determined solutions.” The Institute addresses the scientific issues of water quality, while supporting local decision-making and sustainability. Its services focus primarily on supporting local-level stream restoration and wastewater treatment projects. In the past, CVI worked closely with the Berkeley County Source Water Protection Task Force to produce an educational booklet on drinking water protection.¹⁴

Shenandoah Watershed Roundtable

A basin-wide Shenandoah Roundtable was held in June, 2005. The Roundtable drew numerous participants from throughout the Valley, with the common purpose of discussing water issues. A report and additionally information on the Roundtable can be found at http://www.purewaterforum.org/roundtable_draft_reportv6.pdf.

Soil and Water Conservation Districts (VA) and Conservation Districts (WV)

Soil and Water Conservation Districts (SWCD) and Conservation Districts are local-level actors in promoting water quality. VA SWCDs play several important roles, including assisting with erosion and sediment control ordinances, farm conservation practices, and Chesapeake Bay Preservation Act ordinance implementation. WV Conservation Districts run local level programs including Stream Partners, in which communities work to improve streams and watersheds through various activities.¹⁵

¹³ For more information see <http://www.caf.wvu.edu/resm/faculty/borisova/OpequonProject.htm>.

¹⁴ For additional information visit <http://www.canaanvi.org/>.

¹⁵ For more information see <http://www.vaswcd.org/districts.htm> and <http://www.wvca.us/>.



Department of Environmental Quality (DEQ) Water Quality Monitoring

DEQ regularly collects water samples across the Shenandoah Valley watershed and conducts testing for various parameters including, levels of nutrients, solids, bacteria associated with human and animal wastes, toxic metals, some pesticides and harmful organic compounds. DEQ's scientists also perform on-the-spot field tests for dissolved oxygen, pH, temperature, salinity, and additional indications of water quality. Samples from the mud at the bottom of lakes and rivers also are tested for the presence of pesticides and other harmful compounds.¹⁶

South River Science Team

The South River Science Team was formed in 2000 as an interdisciplinary team of individuals from industry, government, citizens groups, academic institutions, and private research to revisit the issue of mercury contamination and the consequences caused by Du Pont Co. in Waynesboro. The group is involved with long-term DEQ monitoring, scientific studies, and public outreach and education efforts.¹⁷

III. Relevant Regional Trends

Shenandoah River Fish Kill

The Department of Environmental Quality and the Department of Game and Inland Fisheries observed a major fish kill on the North Fork of the Shenandoah River in 2004. This continued in April and July 2005 with most reports in April and May. These reports were from the South Fork, North Fork and Main Stem of the Shenandoah River. This fish kill is unusual in that it has been largely confined to adult smallmouth bass and redbreast sunfish and seems to have involved the entire river. Both the adult smallmouth bass and redbreast sunfish exhibited skin lesions on the surface of the body. Their immune systems seem to have been depressed subjecting them to secondary bacterial infections with the added stresses of spring spawning activity and the physical abrasion which occurs with territorial defense and nest building. Stress levels are constantly high because of the nature of the habitat provided by these rivers; quickly changing spring temperatures, occasional long periods of high turbid water that limits feeding, high nutrient content and occasional inputs of other contaminants with high runoff events. Approximately 80% of adult smallmouth bass adults are estimated dead.

As of now, there is no conclusive evidence suggesting a specific cause of the fish kill. Possible contributing factors are being evaluated by the Shenandoah River Fish Kill Task Force, a team assembled in July 2005 by DEQ and DGIF with the goal of identifying possible causes of the fish kill. This group is made up of state and federal water quality and resource management agencies, scientific experts, citizen groups, and the fishing community. The task force is evaluating multiple stressors that may contribute to the fish kill, such as: water quality impacts from point and non-point source pollution, disease, parasites, spawning stress, temperature, sediment chemistry, and fish population dynamics.

¹⁶ For more information visit <http://www.deq.virginia.gov/watermonitoring/homepage.html>.

¹⁷ For more information see <http://www.deq.state.va.us/fishtissue/mercury.html>.

Shenandoah Valley Water Resources Strategic Plan



The fish kill is significant because it signals that there is a problem whose cause, result, and solution may impact a combination of environmental, economic, health, and recreational factors. In addition, scientists have recently observed “intersex” smallmouth bass, or male fish that are developing eggs. They have been found more frequently in the upper reaches of the Potomac, but have also been sampled in the Shenandoah in very limited numbers. It is possible that hormone therapy for humans is affecting biological communities through hormone introductions to the rivers through sewer effluents.

Shenandoah River Fish Kill Task Force

As of spring 2006, the Shenandoah River Fish Kill Task Force is continuing an ongoing effort to determine the cause of dead and ailing fish in the North and South Fork Shenandoah rivers. During 2006, the Task Force work will focus on recent scattered reports of dead fish and fish with lesions during March, the discovery of intersex fish, daily water quality testing, real-time monitoring of water quality, and extensive fish health studies for identifying signs of chronic stress and immune system effects. Among the key investigations under way this spring is a comprehensive DEQ water quality study in which daily samples will be collected at nine sites on the North and South Forks. Normally, samples are collected about once a month; this expanded effort will evaluate short-term changes in water quality and may identify stressors that are missed during routine sampling. This study will intensify during periods of heavy storm water runoff with the collection of samples several times a day at each site.

Impaired Waters in the Shenandoah Valley Watersheds Planning Area

There were 68 stream segments listed on the Virginia Department of Environmental Quality 2002 Impaired Waters Fact Sheet. The following table depicts the number of impaired waters and approximate total stream miles impaired in each County.

County	Number of Impaired Waters	Total Stream Mileage Impaired*	Water Body Names
Augusta	14	202.95 miles	Cockran Spring, Middle River, Lewis Creek, Moffett Creek, Christians Creek, Polecat Draft, North River, Mossy Creek, Long Glade Run, Naked Creek, South River, Back Creek, Saint Marys River, Mills Branch
Berkeley	12	No data	Harlan Run, Dry Run, Tuscarora Creek, Evans Run, Opequon Creek, Middle Creek, Mill Creek, Goose Creek, Torytown Run, Sylvan Run, Silver Spring Run, Eagle Run
Clarke	2	54.75 miles	Spout Run, Opequon Creek
Frederick	6	82.91 miles & 115.2 acres	Hogue Creek, Opequon Creek, Abrams Creek, Crooked Run, Back Creek, Cedar Creek
Jefferson	9	No data	Teagues Run, Hopewell Run, Elk Branch, Shenandoah Rover, Evitts Run, Cattail Run, NFSR, Bullskin Run
Page	4	47.59 miles	Mill Creek, Pass Run, Hawksbill Creek, Naked Creek
Rockingham	27	462.44 miles	Long Meadow Run, Fridley Run, Blacks Run,

Shenandoah Valley Water Resources Strategic Plan



			Pleasant Run, North River, Briery Branch, Beaver Creek, Dry River, Muddy Creek, Cooks Creek, Mill Creek, Cub Run, Boone Run, Quail Run, Turley Creek, NFSR, Linville Creek, Smith Creek, Mountain Run, SFSR, Dry River, Wolf Run, Mossy Creek, Naked Creek, South River, Long Glade Run, Middle River
Shenandoah	10	119.11 miles	Laurel Run, Orndorff Spring Branch, Holmans Creek, NFSR, Smith Creek, Mill Creek, Toms Brook, Narrow Passage Creek, Stony Creek, Cedar Creek
Warren	1	51.1 miles	Crooked Run

*Many streams cross jurisdictional borders, but are listed as a single impaired reach; therefore, the stream miles per county are estimated if a stream reach crosses one or more counties. This table does not include a segment measuring 128.82 miles that is impaired by mercury. This segment includes the South River, the South Fork, North Fork, and main stem of the Shenandoah River, and crosses through Augusta County, Rockingham County, Page County, Warren County, and the City of Waynesboro.

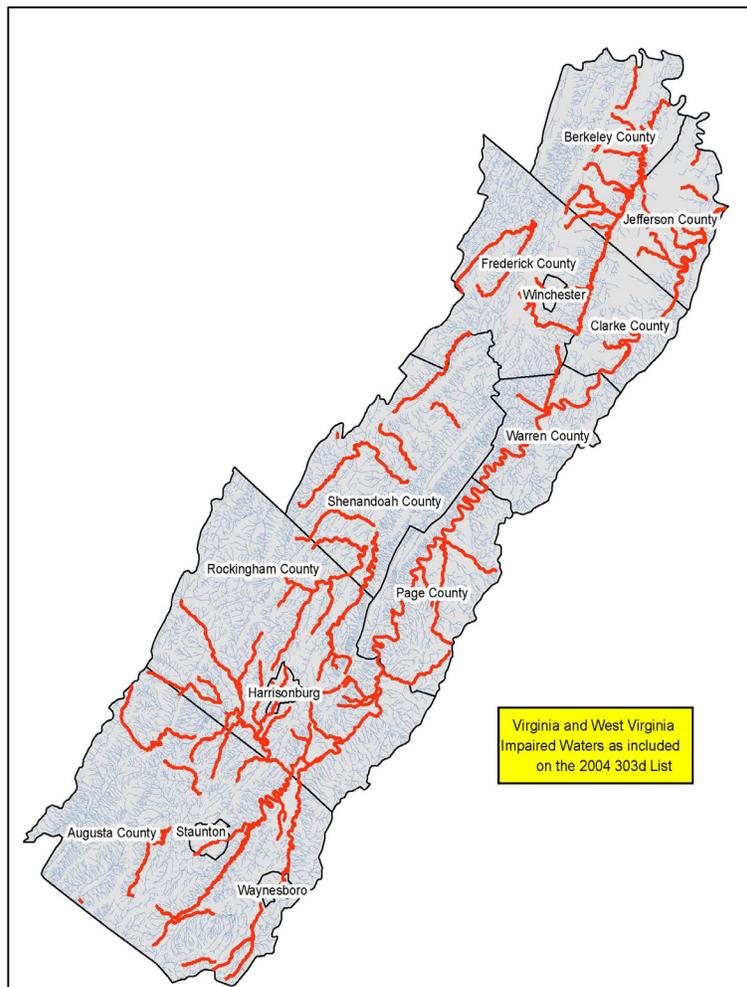
These waters had the following impairments:

- General Standard (benthic)
- Bacteria (fecal coliform)
- Total Phosphorus
- pH (acidity or alkalinity)
- Nitrate-Nitrogen
- Dissolved Oxygen
- Mercury
- Polychlorinated biphenols (PCBs)

The impairment causes include the following:

- Non-point source runoff (agriculture and urban)
- Wildlife
- Trout farms
- Municipal point sources
- Atmospheric deposition
- Industrial dumping
- Unknown

In addition, there were 29 stream segments listed on the 2002 303(d) Waters of Concern Fact Sheet. See the map below for geographical locations of impaired waters. The map references the 2004 303d listings.



2004 Water Quality Assessment Integrated Report

Section 303(d) of the Clean Water Act and regulations developed by EPA require states to identify all waters that do not meet water quality standards even after pollution controls required by law are in place. Waterbodies not meeting the appropriate water quality standards are considered to be impaired. The Impaired Segments identified by the states comprise each state's 303(d) list (or Section 303(d) list). The 303(d) list of impaired waters must be submitted to EPA for review and approval. TMDLs must be developed for all waterbodies on the approved 303(d) list.

The Virginia Department of Environmental Quality (DEQ) released the Final 2004 305(b)/303(d) Water Quality Assessment Integrated Report (Integrated Report) on September 20, 2004. The Integrated Report combines both the 305(b) Water Quality Assessment and the 303(d) Report on Impaired Waters. This report was available for public comment from March 22, 2004 through April 23, 2004. Comments were received from the public and the United States Environmental Protection Agency (EPA). In response to comments, the report was revised and resubmitted to EPA in August 2004.



and later approved. DEQ has proposed that a TMDL will be developed for the following waters in 2006:

Proposed TMDLs

Water Body ID	Stream	County/City	Length	Cause
VAV-B17R	North River	Rockingham	25.12 Miles	Bacteria
VAV-B18R	Beaver Creek			Benthic
VAV-B21R	Dry River	Rockingham	2.86 Miles	Temp*
VAV-B23R	North River	Rockingham, Augusta	16.13 Miles	Benthic
VAV-B38R	Mill Creek	Page	6.73 Miles	Bacteria
VAV-B45R	North Fork Shenandoah River	Rockingham, Shenandoah, Broadway, Timberville, Mt. Jackson	4.86 Miles	Benthic
VAV-B45R	North Fork Shenandoah River	Rockingham, Shenandoah, Broadway, Timberville, Mt. Jackson	14.27 Miles	Bacteria
VAV-B47R	Smith Creek	Rockingham, Shenandoah	31.18 Miles, 15.71 Miles	Bacteria Benthic
VAV-B29R	Mill Creek	Montgomery, Rockingham	5.68 Miles, 2.66 Miles	Bacteria
VAV-B48R	Mill Creek	Shenandoah	15.03 Miles	Benthic
VAV-B49R	Stony Creek	Shenandoah	5.65 Miles	Bacteria
VAV-B50R	Toms Brook	Shenandoah	7.18 Miles	Benthic
VAV-B39R	Hawksbill Creek	Page	19.3 Miles	Bacteria
VAV-B52R	Cedar Creek	Shenandoah	18.94 Miles	Temp*

*indicates natural condition

Water Quality Synoptic Sampling, July 1999, North Fork Shenandoah River

A USGS study was conducted of water-quality conditions that may affect aquatic life during periods of low streamflow on the North Fork Shenandoah River. Monthly mean streamflows in July 1999 at three streamflow-gaging stations were the lowest measured during the historical record on the river. Daily extremes of dissolved-oxygen concentrations were measured, along with pH, specific conductance, and water-temperature values, at 52 sites along 80 mi of the North Fork Shenandoah River from Cootes Store, Va., to its confluence with Passage Creek, near Strasburg, Va.

Dissolved-oxygen concentrations ranged from 2.1 to 16.4 milligrams per liter (mg/L). Dissolved-oxygen concentrations were equal to or less than the State water-quality minimum of 4.0 mg/L at 18 of 52 monitoring sites; all 18 sites were in the upper and middle portions of the river, where more than half of the first 34 sites had minimum dissolved-oxygen concentrations equal to or less than 4.0 mg/L. There were large variations from minimum to maximum dissolved-oxygen concentrations, with concentrations fluctuating as much as 10 mg/L per day; and typically 5 mg/L per day during the study period.



Measures of pH ranged from 7.6 to 9.6, with pH values frequently greater than 9.0 in the downstream portion of the river. Along the length of the North Fork Shenandoah River, longitudinal variation in water-quality parameters was small. Groups of sites that differed from the general pattern define reaches where increased monitoring may help determine the factors that affect water quality at those sites. For more information, please see: <http://pubs.usgs.gov/sir/2004/5153/>.

Groundwater Quality

The USGS 2004 Water Resources Data¹⁸ report contains groundwater data for Frederick, Clarke, and Warren Counties. Data was available for dissolved oxygen content, pH, alkalinity, and tritium. Data was not available for calcium, magnesium, potassium, sodium, chloride, fluoride, or bromide content. Data was also unavailable for silica, sulfate, sulfide, ammonia, nitrite, and phosphorous content. Of the constituents for which data was available, the only statewide groundwater quality standard is for tritium at 20,000 pCi/L. All of the tritium measurements for the three counties were well under this amount.

The State Water Control Board of Virginia has established groundwater quality standards for each of four physiographic provinces within the state. Frederick County falls within the Valley and Ridge province while both Clarke and Warren Counties are split between two provinces, the Valley and Ridge province and the Piedmont and Blue Ridge province.

The pH standard established for the Piedmont and Blue Ridge province is a range between 5.5 and 8.5, while the standard established for the Valley and Ridge province is between 6 and 9. For alkalinity, the range for the Piedmont and Blue Ridge province is 10-200 mg/l and the range for the Valley and Ridge province is 30-500 mg/L. All of the pH and alkalinity measurements for the three counties were within acceptable ranges according to the standards. There is no established standard for dissolved oxygen within the groundwater quality standards for Virginia.

IV. Potential Strategies/Actions

The following are potential strategies and actions identified during the *Watersheds Policy Integration Assessment* as well as meetings of the Regional Water Resources Policy Committee and its technical committees.

- A. Determine the role of the region in the new State nutrient credit trading program.
- B. Emphasize regional source water protection and wellhead protection coordination; identify threatened groundwater recharge areas and create a regional wellhead protection plan.
- C. Coordinate on a regional level the development of a model stormwater management ordinance that can be used by local governments to meet new

¹⁸ United States Geological Survey. Water Resources Data. Virginia. Water Year 2004. Volume 2: Groundwater level and groundwater quality records. VA-04-2



- stormwater quality requirements of HB1177.
- D. Engage in a massive regional campaign of public awareness and education regarding water quality. The campaign could address cost-share BMPs on riparian shoreline, septic system maintenance, and stormwater management.
 - E. Promote the enhancement of soil quality in production agriculture and the urban setting to improve water efficiency.
 - F. Examine the Chesapeake Bay Watershed Model for the accuracy of nutrient and sediment load estimates.
 - G. Enhance the region's ability to continuously monitor water quality parameters, including ammonia, to develop an understanding of daily, monthly, and annual trends.
 - H. Evaluate whether BMPs and both state and local environmental regulations are adequately protecting water quality.
 - I. Establish a communications network to alert Valley residents about toxic spills that may affect water quality and supply. Establish a regional incident response team to address toxic spills and other quality events.
 - J. Seek state funding for the implementation of Smart Growth principles.
 - K. Examine the adequacy of local erosion and sediment control programs in the Shenandoah Valley.
 - L. Regionally evaluate the use and adequacy of alternative septic systems and community wastewater management systems.
 - M. Continue to investigate the cause of the fish kill and take mitigation measures, including local and regional water supply planning, to prevent a similar event from occurring.
 - N. Encourage jurisdictions to develop their own Watershed Management Plans.
 - O. Determine a way of getting Planning Departments in each jurisdiction to track permits for wells and septic systems; increase local septic system inspections and monitoring.
 - P. Establish local policies and regulations to address riparian buffer strips.
 - Q. Seek sustainable and dedicated funding sources in addition to state funding.