Virginia Water Central

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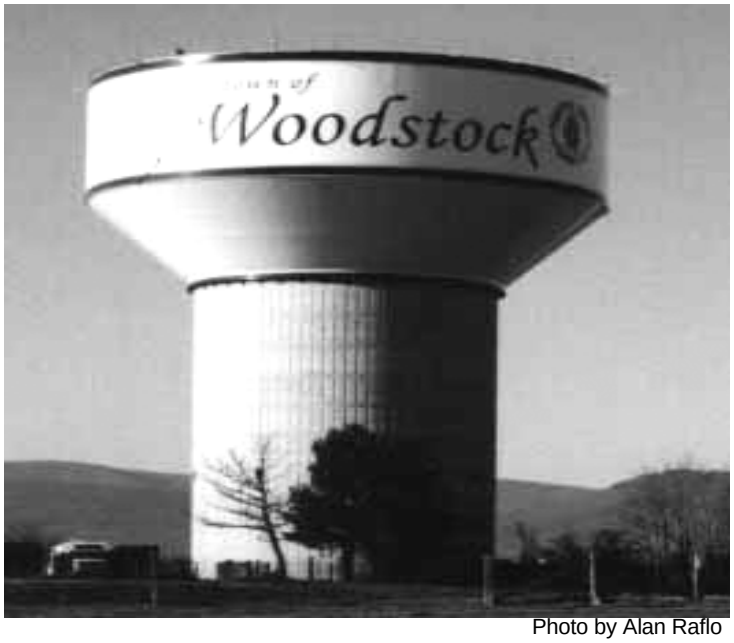

Photo by Alan Raflo

In this issue's Feature Article, one of Virginia's foremost experts on water resources policy sizes up water planning at the state level. Photo: Water-storage tank for the town of Woodstock, Virginia.

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Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

FEATURE ARTICLE

Planning Virginia's Water Future

Introduction

Water resource planning is not usually a topic of general conversation, but interest increases during a short window of time occurring after a serious drought. Virginians were in such a period recently, following the drought of 1999—2002, and since then water planning has been receiving more attention than it had over the previous two decades.

As the term is typically used, "water planning" refers to governmental activity for *assessing the water resource* and *analyzing alternative management actions* to ensure that supplies for human uses continue to be available and that natural water environments are sustained. In the more general sense, water planning also encompasses actions of individuals and organizations directed toward maintenance of adequate water conditions. In this view, water planning takes place at many levels and has a history as long as that of the Commonwealth. Water planning by individuals and organizations continues to be significant, but the need for public sector involvement has increased as more people receive water from centralized sources of supply and as greater conflict over water's use and development occurs (due to intensification and diversification of demands on the resource).
The extent of governmental involvement in water planning (or any other activity) at a particular time is a result of the extent to which problems have occurred and of prevailing philosophical views regarding appropriateness of governmental action. Public-sector planning usually occurs after undesirable conditions have already developed, creating concern that the conditions may become even more undesirable in the future. As long as conditions remain favorable, however, the incentive to plan is low.

Because Virginia has traditionally been a water-abundant state, governmental involvement in water planning has been slow to develop and has remained at relatively low levels. The earliest governmental involvement occurred at the local level, due in large measure to the philosophical view that water supply is primarily a local matter. Virginia's counties, cities, towns, and other special political subdivisions have long had responsibility for maintenance of water supplies under authority requiring limited direct state involvement.[1] Thus, systematic water planning by state government does

[1] Current authority for localities to operate waterworks is conveyed by *Virginia Code Ann.* Sec. 15.2-2109.

not have a long history in Virginia. This article reviews the history of state water planning in Virginia and evaluates the current status of state planning programs and efforts to expand statewide planning.

Historical Development of Water Planning

The earliest state activities that could be called water planning were limited to individual studies mandated by the General Assembly. They typically were short term in duration, with a narrow focus usually limited to navigation, water power (milldams), or fisheries. Early legislatively mandated studies rarely focused on water supply planning because supply shortages occurred infrequently and supply adequacy was primarily a local responsibility. State government did develop an early interest in the *public health* aspects of water supply as the relationships between health and drinking water became clear. A program to provide state oversight of waterworks operations through the State Department of Health was in place by the early 1900s.[2]

Virginia's development of water planning and management programs has been heavily influenced by federal initiatives. This influence existed in the case of drinking-water quality, but the connection was more direct in the creation of Virginia's pollution-control program in the 1940s. Virginia's program dates back to 1946, the year that the federal government first offered financial assistance in this area under a temporary measure that was to become the first permanent federal water pollution control program in 1948.[3] The State Water Control Law, adopted in 1946,[4] created the State Water Control Board (SWCB) and gave it responsibility for program administration.
Federal influence over water-quality management has continued to be strong to the present. Part of this influence has been the inclusion of extensive water-quality planning requirements. As will be noted in the following discussion, these requirements have had substantial impact on Virginia's approach to water planning in general.

A comprehensive approach to water resource planning was first developed in the 1960s, with federal incentives again playing an important role. Comprehensive state water planning legislation was adopted in 1966,[5] just after federal financial assistance was authorized under the federal Water Resources Planning Act (WRPA) of 1965.[6] Planning authority was originally given to the Division of Water Resources in what was then the Department of Conservation and Economic Development (now Department of Conservation and Recreation). The focus of this activity was comprehensive river basin planning, including water quality as well as quantity. By that time, the SWCB was heavily involved in water quality planning, making conflict inevitable. Resolution of the conflict involved transferring the program created by the 1966 legislation to the SWCB in 1972.

Several other developments were underway during this time that affected water planning either directly or indirectly. In 1971, a new state constitution was adopted that contained provisions for state management of natural resources and protection of the environment.[7] In 1972, the administrative branch of state government was re-organized to improve functioning of the agencies. To achieve better coordination and avoid conflict, agencies were grouped under secretaries[8] instead of answering individually to the governor as they had in the past. In 1977, a new water management entity, the State Water Study Commission, was created in response to a need perceived by some for review and possible modification of the state's basic water management institutions. One of the specific issues considered was the question of whether the state should establish an administrative water allocation system to replace the common law riparian doctrine that had operated over the history of the state. The Commission was not able to agree on such a course. It was continued several times, and was

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[2] Current regulatory authority is conveyed by *Va. Code Ann.* 32.1-167 *et seq.*

[3] Federal Water Pollution Control Act, Act of June 30, 1948, c. 758.

[4] Currently *Va. Code Ann.* Sec. 62.1-44.3 *et seq.*

[5] Currently *Va. Code Ann.* 62.1-44.38.

[6] Water Resources Planning Act, Pub. Law 89-90, July 22, 1965, 79 Stat. 244.

[7] *Constitution of Virginia*, Article XI.

[8] Currently *Va. Code Ann.* sec 2.2-200 *et seq.*

ultimately made permanent and re-named the State Water Commission.[9] The Commission did recommend changes to existing water planning legislation, which were adopted in 1981.[10]

Planning under the 1966 legislation continued through the 1970s and the early 1980s, but later in the 1980s planning activity began a period of significant decline, due to several factors. One obvious reason for less planning was the publication of the river basin plans that had been a major activity for a considerable period of time; this reflected the strong tendency to view planning as a *temporary* activity whose goal is the preparation of a *document*—"the plan." Another factor was the elimination during the Reagan Administration of the federal planning assistance program that had been established by the WRPA in 1965. A third factor was an equally important federal action: passage of the Clean Water Act (CWA)[11] in 1972, with an assortment of water-quality planning requirements and funding programs for the states. Virginia's participation in these programs required additional personnel and resulted in a conversion from broader water resource planning to the more specific planning and reporting requirements of the federal program. This transformation in agency priorities was facilitated by the absence of major statewide droughts or water shortage problems during the time period involved.

The reduction in *broadly focused* water resources planning has continued until near the present time, with at least three serious consequences, as the following paragraphs describe.

1) The overall managerial role of the state has diminished, including the ability to assist and provide guidance to local water suppliers. Water supply managers have been confused due to lack of guidance about what is expected under the current decision framework that places increased emphasis on protection of aquatic environments. They still feel the need to ensure a highly dependable water supply to customers, but they sometimes are vilified for the environmental consequences of projects to expand supply. Local officials normally resist increased state involvement in most areas, but many such officials have recognized the need for more guidance from the state.

2) Virginia's reduced water-management capacity has decreased the state's ability to participate in federal regulatory proceedings applicable to local water resource projects. Growth in federal regulation of water supply development has produced more conflict between localities and federal agencies. Helping to resolve such conflict between local water suppliers and federal regulators is an important state role that has not been met fully in recent years.

3) State regulatory programs are being forced to operate without adequate information about the water resources and potential environmental impacts of water development proposals. In fact, the state in the absence of continuous planning has begun to substitute regulatory proceedings for continuous planning. In this approach, most "planning" is done on an ad hoc basis in response to a permit application. This discontinuous approach has several serious limitations, which I will discuss later in this article [page 6].

Issues Associated with Current Efforts to Expand Planning

By doing what droughts typically do—placing stress on the water resource in a variety of ways and drawing attention to water-management deficiencies—the multi-year drought that ended in 2002 has produced a different view toward water planning and management in Virginia. The need to expand state involvement in planning, particularly in the area of water supply, has been widely recognized. One indication of increased recognition of the water supply issue was Governor Warner's issuance of the Water Supply Initiative, a 2002 executive order emphasizing the importance of water supply adequacy.[12] Another indication in 2002 was the creation by the State Water Commission and Secretary of Natural Resources of an advisory committee to develop recommendations for new legislation for water planning. The recommended legislation, which was passed by the 2003 General Assembly, provides for new local and state water planning. The key provisions of the legislation follow:

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[9] Currently authorized at *Va. Code Ann.* sec. 30-186.

[10] *Acts of Assembly*, 1982, c. 633.

[11] Clean Water Act, 33 U.S.C.A. sec. 1251 *et seq.*

[12] Executive Order 39, Dec. 13, 2002.

"The [State Water Control] Board…shall establish a comprehensive water supply planning process for the development of local, regional and state water supply plans…. Local or regional water supply plans shall be prepared and submitted to the Department of Environmental Quality in accordance with criteria and guidelines developed by the Board."[13]

The 2003 legislation requires counties, cities, and towns, acting independently or through regional cooperative approaches, to submit water supply plans after state regulations to guide the planning process are developed. A restructured advisory committee created to assist the Virginia Department of Environmental Quality (DEQ) in developing recommendations for these regulations has been active in 2003 and 2004. Deliberations of the committee, and ultimately of DEQ staff and the SWCB, must include a wide variety of issues associated with local plan development and submittal and with development of an expanded state planning process. Some of the basic issues, which are discussed in the remainder of this section, are the following:
comprehensiveness of local plan coverage of all existing and future water uses; adequate funding for local and state planning activities; adequacy of data collection and other supporting activities; acceptance of planning as a continuous process rather than a temporary action to produce a specific "plan"; coordination and integration of the management of water supply with that of water quality and environmental protection in general; and integration of planning results with regulatory proceedings and other aspects of water resources management.

•**A basic issue is ensuring that individual local plans cover comprehensively existing and planned water use.** Inclusion of self-supplied users and special political entities (such as water authorities) within the plans of counties, cities, and towns is essential, but it may pose special data collection and coordination problems. Regional approaches that view water supply on a broader basis than the individual locality would be advantageous. For example, inclusion of towns, other communities, and water authorities in a county's plans would ensure that water supply interactions are considered at a more appropriate level than the state level. This approach requires a degree of coordination and cooperation that may not be possible in some areas. Actually in some cases even broader approaches would be desirable, involving joint plan preparation among *multiple* counties and other political subdivisions, but this approach would confront additional obstacles.

•**The issue of funds to conduct planning needs attention, including the existence of significant financial inequalities among localities.** At a time when state finances are still considered to be in a fragile state, consideration of state funding for local planning is difficult. Without such funding, however, the new water supply planning requirements constitute a significant unfunded mandate. In addition, the state's ability to encourage regional planning through use of economic incentives is at stake, as is the state's ability to address special financial hardship likely to be created in some localities.

One key consideration for localities in plan formulation will be the level of detail to be provided in describing the water resource and the potential impacts of additional water use and development. A major difficulty is identification of water needs associated with habitat preservation and other *instream* water uses. Some assessment of instream flow and other environmental needs is necessary, but a comprehensive evaluation is an expensive, long-duration activity. The regulations must balance the need for information and the feasibility of its collection and analysis.

Funding concerns are not limited to the local level. The state's role in the expanded planning process is significant and will require new resources. DEQ must review local plans to determine completeness and accuracy, and it must evaluate projected cumulative water use within river basins to see where shortages and/or environmental problems are likely. The potential for proposed uses to exceed supply or to create environmental damage makes necessary a process for resolving conflicts among plans within the same hydrological units. Although it has no general water allocation authority, the state can still serve as facilitator, but this will take staff time and money. Moreover, the approved local plans are but one input to the process of creation of a state water plan; the establishment and subsequent updating of a state plan will also involve expanded state activities requiring resources beyond those currently available. Typically, creation of new responsibilities

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[13] *Va. Code Ann.* sec. 62.1-44.38:1.

without the necessary resources takes attention away from other program areas and results in less than full compliance with legislative intent.

•A state planning program requires a variety of supporting activities, including adequate capabilities for data collection and analysis. Existing data vary among regions and with respect to the different forms of water (i.e., surface water vs. groundwater). Information about surface waters is generally better developed than in the case of groundwater. The state's cooperative program with the U.S. Geological Survey has produced much useful data, but many smaller watersheds remain ungauged. In addition, the number of gauges has been decreasing rather than increasing. The groundwater resource is not well defined west of the Coastal Plain, and the ability to predict the amount of available supply in many locations is limited. Protection of instream water uses is hindered by poor definition of those needs—a few intensive studies have been conducted in some geographical areas,[14] but no statewide assessment at a general level has been completed.

•A basic issue affecting whether the state planning program can realize its potential benefits is the distinction between a continuous planning *process* and preparation of *a plan*. The 2003 legislation mandates a planning process, but the danger continues that the focus will be placed on preparing a document as an end in itself. To be most effective, planning should be implemented on a continuous basis that transcends any individual document. Elements of planning such as analysis of policy alternatives and interest-group conflict are less tangible than locating facilities on a map, but nevertheless they must be viewed as a basic aspect of water management. The period of dormancy (mentioned above, page 3) beginning with publication of river basin plans in the 1980s illustrates the weaknesses of an approach relying on *plans* rather than *planning*.

•Another important issue is coordination of planning with other components of water management. Water planning must coordinate water supply adequacy (water quantity) with management of water quality and the broader environmental protection effort. Quantity and quality cannot be viewed independently, nor should one be viewed as subservient to the other. Maintaining a balanced approach is made difficult by the high degree of imbalance reflected in federal programs.

While protecting water quality is a major federal mission, federal interests in public water supply are largely limited to protection of drinking water quality. Concern for possible disruption of water supplies by terrorism *has* somewhat elevated supply adequacy as a federal issue, but federal programs traditionally have largely ignored supply adequacy (except in special cases like the Bureau of Reclamation projects in the western states).

Quantity/quality coordination requires interaction between the DEQ and the Virginia Department of Health (VDH). VDH regulations for waterworks primarily focus on drinking water quality, but they also impose standards for supply adequacy and planning requirements to maintain waterworks adequacy.[15] VDH requirements and procedures must be reviewed and merged into the water-supply planning regulations under development.

•Another aspect of needed coordination involves the relationship between planning and regulation. In the absence of a separate state water-planning effort in the recent time period, regulation has encompassed a substantial amount of ad hoc, short-term planning as regulators sought quick answers to questions raised by permit applications. In the ideal situation, planning should guide and facilitate appropriate regulatory decisions. Planning provides a more reliable and credible basis for decision making when conducted in a continuous, long-term manner not related to resolution of specific regulatory decisions.

But planning does not displace the need for independent regulatory decisions when specific water development projects are proposed. This issue arises in association with state approval of local plans. State approval of a local water supply plan containing a proposed water project could be viewed as approval of the project, but approval of a *plan* cannot guarantee final approval of a *project*. Rather, plan approval should be viewed as the state's agreement that a locality should continue the process of

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[14] For an example, see Humbert Zappia and D.C. Hayes, "Demonstration of the Instream Flow Incremental Methodology, Shenandoah River, Virginia," Water Resources Investigations Report 98-4157, U. S. Geological Survey, Richmond, Va., 1998.

[15] 12 *Va. Administrative Code* 5-590-520, 830.

determining a project's feasibility. One of the likely benefits of local plan preparation in some cases will be the early identification of serious objections to a given project; this would, of course, create doubt as to a project's acceptability. But the opposite situation—when no "fatal flaws" are discovered during initial planning—would *not* mean that final approval could be assumed.

Although plan approval does not constitute final approval of proposed projects, inclusion in an approved plan should have a favorable impact on subsequent decisions concerning the project. In general, the impact should be greater where the state imposes rigorous standards for determining the need for projects and for limiting environmental impact.

These considerations raise an interesting question: Should the state, perhaps acting through its plan-approving agency, become an *advocate* for projects contained in approved plans as the projects move through other state and federal decision processes?

States do act as advocates (often in the capacity of owner) for transportation projects and many other infrastructure and development projects (and as owner/advocates for water projects in some western states). Yet the concept of state advocacy for water projects in Virginia appears unacceptable to some. A supporting role can take many forms, but at a minimum it should include coordination and provision of input into other state proceedings. When matters of broad public interest are involved, agencies generally should not make decisions in isolation based on narrow criteria. For example, the decisions of the Virginia Marine Resources Commission (VMRC) regarding the use of state-owned bottomlands[16] in connection with proposed water-supply projects should be made only after the VMRC receives input concerning a project's inclusion in applicable water-supply plans and any previous analyses of the need for the project and its potential impacts.

Federal regulatory proceedings are another potential forum for state support of water supply projects included in approved plans. The federal role in water-supply decision making has greatly increased in recent years due to aggressive use of regulatory proceedings—such as the CWA section 404[17] permit program—to control construction of impoundments, intakes, and other water-supply facilities.

The federal perspective is generally adverse to water-supply development. While a mandate to protect water-related environmental values is recognized and institutionalized through regulatory programs and other measures, no generally applicable federal law or program focuses on water-supply adequacy (except for assurance of the *quality* of the water supplied). This absence of a federal water-supply mission and the resulting lack of a federal agency voice in support of adequacy of water supply heavily align the current federal position with the opponents of water-supply expansion. According to the position of the U.S. Environmental Protection Agency (which has been upheld in the federal courts), the CWA Section 404 program, which has become the primary regulatory measure for federal protection of wetlands, can be used to deny permits for water-supply projects without consideration of the need for the water supply in question.[18]

With no federal voice in support of water supply adequacy, state government should fill this role by identifying those projects it considers to be in the public interest and then attempting to facilitate their approval. Federal regulatory authority is superior to that of the state, and state positions may be rejected. But federal decision makers do consider state positions. The state at least should make its position clear, which in some cases will consist of the state endorsing water-supply expansion.

The impact of a state's position with respect to a water project in federal regulatory proceedings, and the general credibility of the position, depends on the rigor of the process through which the state's position is determined. Local governmental proposals have little credibility in such proceedings at present because of the historical tendency to estimate water needs conservatively and give little attention to demand management. Similarly, any state position based on endorsement of local proposals *without* rigorous review (according to standards reflecting current views of water supply adequacy) would also have little credibility.

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[16] Pursuant to *Va. Code Ann.* Sec. 28.2-1204.

[17] Clean Water Act, U.S.C.A. sec. 1344.

[18] See James City County vs. U.S. Environmental Protection Agency, 12 F.3d 1330 (4th Cir. 1993), *cert. denied* 513 U.S. 823 (1994).

Accordingly, the Virginia water-supply planning regulations currently being developed should provide guidelines for localities and regional organizations that address as many of the potentially controversial aspects of water-supply planning as possible. Examples of issues that should be covered by guidelines include safe yield determinations for assessing existing supplies, methods of demand projection for determining future water use, expectations for permanent water-conservation programs, and requirements for drought-response plans. Such guidelines must leave flexibility for recognition of local conditions that vary from average situations, but the regulations must require standard approaches to maintain credibility and facilitate evaluation of results.

Conclusion

The current effort to expand water-resource planning at the state and local levels of government in Virginia has a direct connection to the state's future welfare. While developing local plans is important, the role of state government is a *critical* consideration. The process of trying to balance offstream human water needs against environmental needs is complex, and the state perspective is uniquely suitable for this task. The local perspective is too narrow. Although an essential participant, local government's perspective is too limited geographically to consider all aspects and implications of management decisions, including the positive and negative consequences of decisions that may fall outside of local boundaries. On the other hand, the federal perspective is too remote, and, under current institutions, is substantially biased against balanced consideration of water-management needs. This federal bias needs counterbalance through greater state participation in regulatory and other proceedings.

But state participation must have a solid foundation based on sound planning—using all available information to analyze problems and potential management actions before the problems occur and alternatives are foreclosed. Implementing the needed planning program will require development of many operational details (e.g., deadlines for initial plan submissions and updates, mechanisms for local cooperation and coordination, mechanisms for state-local interaction, public participation requirements, and development of interagency coordination procedures) and will confront many obstacles. But diligence in overcoming the obstacles is essential. Expanded planning is a basic need that must be met if the citizens of Virginia are to receive maximum benefits from Virginia's water resources in the future.

By William E. Cox. William Cox is a professor in the Department of Civil and Environmental Engineering at Virginia Tech.

Commonly Used Acronyms

CWA—Federal Clean Water Act
DEQ—Va. Department of Environmental Quality
SWCB—Va. State Water Control Board
VDH—Va. Department of Health
WRPA—Federal Water Resources Planning Act of 1965.

Readings for Additional Historical Perspective on Water Planning in Virginia

"Virginia Water Policy: The Imprecise Mandate," by William R. Walker and William E. Cox, *William and Mary Law Review*, Vol. 14/No. 2 (Winter 1972).

Recommendations for Improving Water Resources Management in Virginia, by William R. Walker and William E. Cox, Virginia Water Resources Research Center Special Report No. 1 (April 1976). [Available online at www.vwrrc.vt.edu.]

Virginia Water Law: A Functional Analysis with Respect to Quantity Management, by William E. Cox and William R. Walker, Virginia Water Resources Research Center Special Report No. 7 (February 1979). [Available online at www.vwrrc.vt.edu.]

"Virginia Water Policy: Do We Need a Change?" by Edward Born, *Virginia Town and City*, Vol. 22/No. 2 (February 1987) [a publication of the Virginia Municipal League].

Status of Virginia's Water Resources: A Report on Virginia's Water Supply Planning Activities, by the Virginia Department of Environmental Quality, October 2001.

TEACHING WATER
Especially for Virginia's K-12 teachers

This Issue and the Virginia Standards of Learning

Below are suggestions for Virginia Standards of Learning (SOLs) that may be supported by this issue's Feature Article, Science article, Water Status Report, Tropical Storms Report, and For the Record section. The SOLs listed below are from Virginia's 2003 Science SOLs and 2001 Social Studies SOLs.
Abbreviations: BIO = biology; CE = civics and economics; ES=earth science; GOVT = Va. and U.S. government; LS=life science; WG = world geography.

Newsletter Section	Science SOLs	Social Studies SOLs
Feature (State Water Planning)	None	CE.7, GOVT.8, GOVT.9, GOVT.16
Science (TMDL Development)	6.5, 6.7, 6.9, LS.12, ES.7, ES.9, BIO.9	CE.7, GOVT.9
Water Status (Precipitation)	3.9, 4.6, 6.6, ES.13	None
Tropical Storms Report	4.6, 6.6, LS.11, ES.13, BIO.9	WG.2
For the Record (Aquatic Life)	4.8, LS.5, LS.12, BIO.7, BIO.9	WG.7

SCIENCE BEHIND THE NEWS

TMDLs: What, Why, and How

Are you an outdoor enthusiast, a boater, a skier, a fly fisher, or do you just enjoy taking a dip in the river now and again? If so, you've probably asked yourself, "What's in this water? Will I become ill if I swallow some the water? Does anyone regulate water quality?"

These are questions that everyone should be asking themselves, because there are thousands water bodies across the nation that do not meet what are called "**water quality standards**" (**WQS**). A water quality standard consists of a group of statements that constitute a regulation describing specific water quality requirements. Some WQS identify specific environmental conditions to be maintained, such as the temperature or level of dissolved oxygen. Other standards specify the allowable limits of specific pollutants, such as mercury or bacteria.

Generally each state is responsible for establishing its own WQS. As a result, WQS vary from state to state. In Virginia the agency responsible for setting WQS is the Department of Environmental Quality (DEQ). In addition to setting WQS, under provisions of Section 303(d) of the federal Clean Water Act, the state is also responsible for assessing the condition of its waters. If the state determines a waterbody is not meeting the applicable WQS, the waterbody is considered **impaired**. According to the DEQ's *Water Quality Integrated Assessment Report* for 2004, in Virginia some 8,900 miles of streams and rivers are impaired, along with about 135,000 acres of lakes, and 2,100 square miles of estuaries. [*Ed. note:* Please see the last page of this article for more information on TMDLs in Virginia.]

If a waterbody is impaired, the Clean Water Act requires that some sort of watershed assessment and planning process be initiated to restore water quality. Developing a **Total Maximum Daily Load**, or **TMDL**, is one such process. In this article, I review basic information about the TMDL program and describe the process of developing and implementing TMDLs.

TMDL Basics

The concept of TMDLs first appeared in the 1972 federal Clean Water Act. For those waters that are impaired, states (or the EPA) must establish a TMDL for each offending pollutant. Simply put, a TMDL is a **pollutant budget**—a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. This budget is expressed in terms of loads: the

amounts of pollutants added to a water body during a given time or per volume of water. For example, a load allocation to a water body might be 2,000 metric tons of sediment per year for a given watershed.

Developing a TMDL involves a study that, first, identifies the sources of the pollutants causing water quality impairments; then quantifies the pollutant contribution from each source, or source category in the case of nonpoint source pollution (NPS); and finally determines the pollutant reduction from each source required to meet applicable state water quality standards.

Why are TMDLs Needed?

The underlying reason for developing TMDLs is to improve water quality. When a stream, lake, river, or estuary becomes impaired, the lives of humans and animals are impacted in many different ways, e.g. people may become ill, and fish kills can occur. Waterbodies that violate WQS also fail to meet their "**designated uses**." Designated uses are those uses specified in water quality standards for each waterbody. All Virginia waters are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish. Taken together, these uses are generally stated as "fishable and swimmable." In addition, some Virginia waters also have a designated use as a public water supply.

What Types of Pollutants are at Issue?

The specific pollutants of concern vary from watershed to watershed. In general, watersheds are subject to two broad categories of pollution sources: **point and nonpoint**. Point source pollution is typically associated with industrial discharges, municipal waste treatment facilities, and confined animal feeding operations. The effects can be directly traced to a particular source or facility (a "point"). Point source pollution can often be measured at an outfall or pipe. Nonpoint source pollution, on the other hand, is more difficult to identify. It includes pollution originating from diffuse sources on and above the landscape; examples include runoff from fields, stormwater runoff from urban landscapes, and roadbed erosion during forest harvesting operations. NPS pollution accounts for a significant percentage of water pollution in the United States (more than half, by some estimates).

How are TMDLs Developed?

In Virginia, TMDLs are developed by contractors (private consultants and/or university researchers) hired by the DEQ. TMDL contractors are typically engineers or scientists with experience in hydrology and watershed management. University researchers' involvement with TMDLs stems from the need to improve the science and procedures used to develop TMDLs. Active citizen stakeholder involvement is critical during the watershed characterization phase of TMDL development. Local stakeholders know the watershed, and they are a crucial source of both current and historical information that a TMDL contractor will undoubtedly find useful.

The first step a contractor should take when developing a TMDL is to characterize the impaired watershed. Watershed characterization involves determining the distribution of land uses within the watershed and, to the extent possible, accounting for all sources of the particular offending pollutant. Powerful geographic information system (GIS) computer software simplifies watershed characterization in a number of ways. For example, because we know that failing septic systems can be a potential source of bacteria contaminating a waterbody, and because data indicate that the age of a dwelling is correlated with septic system failure, GIS software can be used to determine the location of dwellings in the watershed that have septic systems and their age (within a range of years). This information can then used to estimate bacteria loads coming from failing septic systems within the watershed. Figure 1 (next page) shows an example of the kind of map contractors might generate during a TMDL study.

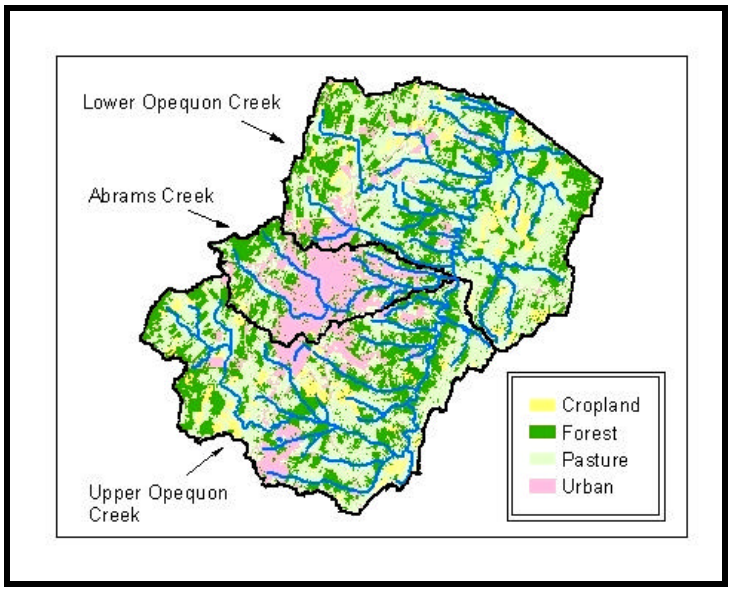

Figure 1. Land use distribution information used in the development of bacteria and biological TMDLs in Upper and Lower Opequon, and Abrams Creeks in Northeast Virginia.

Source: Mostaghimi, S., *et al.*, "Bacteria TMDLs for Abrams Creek and Upper and Lower Opequon Creek Located in Frederick and Clarke County, Virginia" (2003), available online at www.deq.virginia.gov/tmdl/apptmdls/shenrvr/abropefc.pdf (accessed October 2004).

Once the basic watershed characterization has been completed, the TMDL **target load** is determined. This phase of TMDL development often involves the use of computer simulation programs—"**models**." Watershed models are representations of the natural world that simulate specific hydrologic and water-quality processes and conditions. Hydrologic and water-quality models relate watershed characteristics like land use, topography, soil type, and pollutant sources to "outputs" like runoff and in-stream pollutant loads. Figure 2 illustrates the main idea of a simulation model.

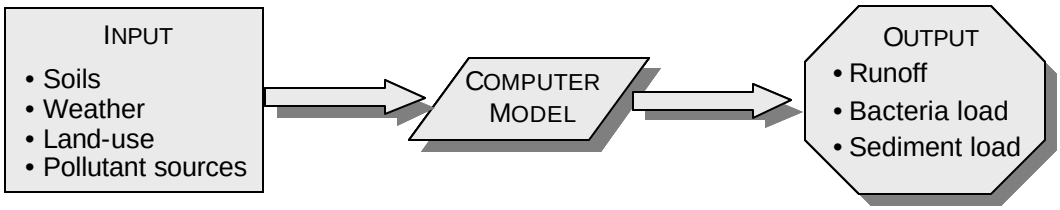

Figure 2. Illustration of hydrologic simulation models relating watershed characteristics to pollutant loads.

Once the TMDL target load is determined, the **load reduction scenario** is developed. Reduction scenarios allocate necessary pollutant load reductions to the different identified sources. Computer simulations are performed to develop alternative scenarios showing ways that the pollutant sources can be reduced to meet the TMDL target load. Once a model is developed for a particular watershed, it can be used to easily assess several different pollutant-management scenarios that, if implemented, should result in improved water quality. The final pollutant load reduction scenario must ensure that the TMDL target load is not exceeded. According to guidance outlined in the Clean Water Act, the final pollutant load reduction scenario should be economically feasible, practical, and acceptable to stakeholders. Reducing the pollutant load in the impaired watershed to the TMDL target load is expected to restore water quality.

Benthic Impairment TMDLs

Currently, the two most common types of TMDLs currently being developed in Virginia address **benthic** and **bacteria** impairments. "Benthic" refers to the aquatic organisms living in or on the bottom of a body of water. Benthic organisms include crayfish, aquatic snails, clams, leeches, aquatic worms, certain insect larvae and nymphs (e.g., mayflies, dragonflies), and adult aquatic insects (e.g., riffle beetles). Changes in water quality generally result in changes in the types, numbers, or diversity of the benthic community. Thus benthic organisms are indicators of water quality. [*Ed. Note:* For more on use of benthic organisms to assess water quality, please see the "Science Behind the News" article in April-June 2002 issue of *Water Central*.]

The most difficult task when developing a benthic impairment TMDL is determining the cause of the impairment. This process is often referred to as "**stressor identification"** (or **"stressor analysis"**). Stressor identification involves examining water quality data to look for the most probable pollutant or physical condition (stressor) causing degradation to the benthic community. Common stressors can include elevated levels of sediment, organic matter, toxins, nutrients, elevated temperatures, and channel or runoff modifications in the watershed.

If the identified pollutant is subject to a numeric water quality **criterion**—that is, a numeric value identifying the maximum level of the pollutant allowed under the relevant state WQS—that criterion is used to develop the TMDL. If no numeric water quality criterion exists for the identified pollutant (as is the case with sediment), another means for setting the TMDL pollutant load is needed. In these instances, a **reference watershed approach** is often used. A reference watershed is chosen on the basis of its comparability with the impaired watershed and, most importantly, must not be impaired. In the reference watershed approach, the TMDL of the identified stressor is calculated for the reference watershed and then used to set the target load for the impaired watershed.

For example, for the benthic impairment TMDL developed in 2003 for Stroubles Creek (which runs through Blacksburg and the Virginia Tech campus), the reference watershed was an adjacent, similar, unimpaired watershed, Toms Creek. For the Stroubles Creek TMDL, sediment was determined to be the primary stressor. Using a watershed simulation model, the sediment load in the load in Toms Creek (the reference watershed) was determined to be approximately 2,000 metric tons per year. The sediment load in Stroubles Creek (the impaired watershed) was determined to be approximately 7,000 metric tons per year. Based on these findings, the Stroubles Creek benthic-impairment TMDL calls for the sediment load reaching Stroubles Creek to be reduced by some 70 percent. TMDL implementation in Stroubles Creek will seek to apply **Best Management Practices** (**BMPs**) to reduce, over time, the sediment load from non-point sediment sources (stream bank erosion, runoff from construction sites, and others). BMPs are reasonable and cost effective means that reduce the likelihood of pollutants entering a waterbody.

Bacteria Impairment TMDLs

Bacteria impairments result when a certain percentage of water samples contain excessive numbers of indicator organisms (indicators of pathogen). In Virginia, one particular species of fecal coliform bacteria, *Escherichia coli*, is being phased in as the indicator organism in fresh waters. In marine waters, the indicator organism is the group of bacteria known as enterococci.[19]

The four major sources of bacterial contamination considered when developing upland TMDLs in Virginia are humans, pets, wildlife, and livestock. There are many sub-categories for each of these sources. An example of a human source is the effluent from a malfunctioning septic system that, rather than percolating into the soils, is rising to the soil surface where it could potentially runoff in to a

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[19] Under the relevant Virginia water-quality standards (9 VAC 25-260-170), the numeric limits for bacteria in freshwater for any given individual sample are 235 colony forming units of *E. coli* per 100 milliliters of sample (cfu/100 ml) and 126 cfu/100 ml as a geometric mean of two or more samples within any calendar month. The limits in marine waters are 104 cfu/100 ml of enterococci for a single sample, and 35 cfu/100 ml for the geometric mean.

waterbody. Examples of different wildlife sources include semi-aquatic mammals (beavers, muskrat, raccoons, etc.), waterfowl, and deer. Bacteria from wildlife can be deposited at different locations on the landscape or directly in the stream. Examples of livestock sources include, but are not limited to, cattle (dairy and beef), poultry, and horses. Like wildlife, livestock feces can be deposited directly on the land, either by the animal or via land application of stored manures in the case of a confined animal feeding operation, or directly in a waterbody.

TMDLs for bacteria impairments need to assess accurately the amount of coliform bacteria that could ultimately end up in a waterbody. To do so, all reasonable sources of bacteria in the impaired watershed must be considered. Determining the wildlife and livestock populations along with the number of septic systems in a watershed is a substantial part of the source-characterization process.

For bacteria impairment TMDLs, computer models are used to simulate the fate and transport (movement and disposition) of bacteria in the target watershed and impaired waterbody in response to precipitation and other climatic conditions. As was described above for benthic impairment TMDLs, computer models can be used in bacteria TMDLs to develop alternative pollutant-reduction scenarios that result in fewer bacteria reaching the impaired waterbody. The pollutant-reduction scenarios generally involve reducing or eliminating the bacteria **source**. For example, in an upland, *rural* watershed where livestock are the primary bacteria source and cattle have unrestricted access to a stream, direct deposition of feces and bacteria into the stream my result in WQS violations. One scenario for reducing the bacteria source in this example would to implement BMPs such as exclusionary fencing to keep the cattle out of the stream while providing off-stream watering for the cattle (see Figure 3). The computer simulation model that was used to develop the TMDL target load can also be used to simulate the effectiveness of BMPs implemented to reduce pollutant loads.

Figure 3. Example of exclusionary fencing designed to keep cattle from loitering and defecating directly in the stream.
Photo by Janelle Hope Cunningham.

When bacteria impairment is an issue in *urban* or *suburban* watersheds, BMPs must be tailored to address different conditions and circumstances. For example, the BMPs often used in urban and urbanizing areas to reduce human bacteria loading from failing septic systems and leaking sewer lines include education about proper septic system maintenance and a sanitary sewer inspection and management program. Other practices often considered for reducing bacteria loads in developed areas are improving garbage collection, improving street cleaning, and encouraging pet owners (either through educational programs or ordinances) to pick up their animals' waste.

As a Stakeholder, What Can I Do?

As a citizen living in an impaired watershed, you may ask yourself, "What can I do to get more involved in watershed planning and the TMDL process?" Stakeholders, as the name implies, have a stake in issues like water quality, so they are encouraged to get involved with watershed assessment and planning efforts like TMDLs, especially at the local level. Stakeholders often can and do provide information critical to the TMDL process. The more information that a TMDL developer has, more likely they are to produce an accurate, implementable TMDL that will result in real water quality improvement.

In Virginia, typically two general public meetings are held for every TMDL that is developed.[20] All interested citizens are encouraged to participate in these meetings. The focus of the general public meetings is to discuss the TMDL development process and its implications.

In addition to the general public meetings, the TMDL developer working with the state agency responsible for TMDLs will meet with a local stakeholder advisory group, to gather information needed to help the TMDL developer better characterize the watershed. This local stakeholder advisory group is often referred to as the Technical Advisory Committee (TAC). All TAC meetings are also publicized and open to the public.

At the first public meeting, typically held a few months into what is often a year-long process, the DEQ explains the TMDL process. The TMDL contractor attends this meeting and is available to answer questions about what has been learned about the watershed characteristics and potential pollutant sources up to that point. The contractor will also answer any questions about the tools that will be used to conduct the TMDL study and develop the TMDL allocation scenario. At the final public meeting, the DEQ presents the results of the TMDL study and the alternative allocation scenarios that would achieve the TMDL target load. Again, the TMDL contractor is present to address any specific questions about the TMDL study and how it was conducted.

What Happens After a TMDL Study is Completed?

Completion of a TMDL study is really just the starting point for improving the water quality of an impaired waterbody. The pollution reductions called for in the TMDL allocation scenario are used to develop an **implementation plan** for the impaired water body. Developing a TMDL implementation plan involves designing a detailed roadmap that specifies how watershed stakeholders will go about ensuring that water quality is restored and progress towards that goal is measured. Stakeholder involvement at this point in the TMDL process is critical. To be effective, TMDL implementation plans must be developed in a collaborative process between the plan developer and stakeholders. The Clean Water Act does not require each state to develop implementation plans, but many states, including Virginia, have passed their own laws requiring an implementation plan to be developed for each approved TMDL.[21]

Once an Implementation Plan has been developed, it may take up to 10 years for the plan to be fully adopted and the waterbody to be removed from the list of impaired waters. This may sound like a long time. But water quality doesn't degrade overnight, so one can't expect it to improve overnight either. The process is slow, but real improvements are possible. Most implementation plans rely heavily on the installation and use of various BMPs; monitoring to track water-quality improvements and make needed adjustments is also a critical part of TMDL implementation. The term **adaptive implementation** refers to the process of implementing BMPs that have the greatest potential for

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[20] The Va. DEQ's Public Calendar, available online at www.deq.virginia.gov/info/ lists all TMDL-related meetings in the state. One may also phone the DEQ Public Affairs Office at (804) 698-4447 to enquire about TMDL-related meetings or other events.

[21] The Water Quality Monitoring, Information, and Restoration Act of 1997 (Sec. 62.1-44.19:4 through 19:8 of the *Code of Virginia*), directs the Virginia DEQ to produce a list of impaired waters, develop TMDLs for these waters, and develop implementation plans for the TMDLs.

success, continually monitoring to gauge progress towards meeting applicable water-quality standards, and having the flexibility to alter the implementation plan and TMDL itself if necessary.

Conclusion

The term "TMDL" refers to a watershed-management process that seeks ultimately to improve water quality. To achieve that goal, the TMDL process requires four main parts: conducting a TMDL study, developing a pollutant target load and pollutant-allocation scenario, developing an implementation plan, and carrying out the implementation plan.

Developing and implementing a TMDL presents stakeholders with opportunities. Through the TMDL process, stakeholders can learn more about their watershed, the water quality in the watershed, and some of the challenges that must be addressed to improve water quality. Stakeholders also have an opportunity to make a difference in their environment by improving local water quality in the near term. And, for the long term, participating in planning that helps determine the future of water quality in their watershed.

To advance the science and technology, and to train the next generation of water quality and water resource professionals, several universities are examining a myriad of TMDL-related research questions and developing TMDL-specific curriculums. For example, Virginia Tech faculty recently established the Center for TMDL and Watershed Studies. The mission statement of that Center is "to conduct interdisciplinary research, teaching, and outreach to improve the integrity of the Nation's waters and watersheds by advancing the science, tools, and expertise available for developing, evaluating, and implementing watershed planning and management processes." That's a complicated mission statement, which is appropriate, because "TMDL" is shorthand for a complicated process.

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Mostaghimi, S., B. Benham, K. Brannan, T. Dillaha, R. Wagner, J. Wynn, G. Yagow, R. Zeckoski. "Bacteria TMDLs for Abrams Creek and Upper and Lower Opequon Creek Located in Frederick and Clarke County, Virginia." 2003. Available online at www.deq.virginia.gov/tmdl/apptmdls/shenrvr/abropefc.pdf (accessed October 2004).

Virginia Department of Environmental Quality (Va. DEQ). *Final 2004 305(b)/303(d) Water Quality Assessment Integrated Report*. Richmond, Va.: Va. DEQ, 2004. Available online at www.deq.state.va.us/wqa/ir2004.html (accessed October 2004).

—By Brian Benham

Brian Benham is an assistant professor in the Department of Biological Systems Engineering at Virginia Tech.

Legal and Regulatory Background on TMDLs in Virginia

*(Reprinted from the Virginia Department of Environmental Quality Web site, www.deq.**virginia.gov/tmdl/backgr.html;** accessed 10/27/04)*

§303(d) of the 1972 Clean Water Act (CWA) requires States to identify waters not in compliance with water quality standards, establish priorities for scheduling the development of TMDLs, develop a list of the impaired waters, and develop TMDLs for the waters on the §303(d) list. In July 1992, EPA promulgated regulations, 40 CFR §130.7, for §303(d) of the CWA. The CWA and the enabling regulations did not contain additional implementation measures. TMDLs were to be implemented through existing pollution reduction regulations and voluntary strategies.

In 1997, the Virginia General Assembly enacted the Water Quality Monitoring, Information, and Restoration Act, §62.1-44.19:4 through 19:8 of the *Code of Virginia*. This statute directs DEQ to develop a list of impaired waters and develop TMDLs for these waters. Also, the State statute directs DEQ to develop Implementation Plans for the TMDLs.

In 1998, DEQ and DCR signed a Memorandum of Understanding (MOU) with EPA agreeing to develop TMDLs in accordance with a schedule for the 247 DEQ listed impaired waters (excluding shellfish waters) on Virginia's 1998 303(d) List.

The MOU schedule was replaced a year later, by a schedule in a Consent Decree filed in the United States District Court for the Eastern District of Virginia. The American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with the provisions of §303(d) of the Clean Water Act in Virginia. In 1999, EPA signed a Consent Decree with the plaintiffs. The consent decree contained a 10-year TMDL development schedule through 2010, replacing the one in the MOU. The 10-year development schedule set forth by the consent decree also included some waters that were not on the 1998 303(d) TMDL priority list.

The [following] table shows the number of waters identified as impaired, the number of waters identified for TMDL action and the estimated number of TMDLs to be developed and submitted to EPA by 2010. The number of TMDLs differs from the number of waters identified as impaired because many waterbodies contain more than one pollutant; TMDLs must be completed for each pollutant.

Virginia Impaired Waters for TMDL Action and Number of TMDLs Due by 2010.

	Number of Waters Identified as Impaired	Number of Waters Identified for TMDL Action	Estimated Number of TMDLs
DEQ Waters	247	247	295
DEQ Shellfish Waters	285	260	260
U.S. EPA Additions	71	18	18
Consent Decree Additions	200	75	75
Totals	803	600	648

For More Information on Current Impaired Waters and TMDL Projects in Virginia

As of 10/15/04, the **2005—2006 TMDL Development Schedule**—the **draft** two-year status report for TMDL projects in Virginia that are due for submission to EPA on or before May 1, 2006—was available online at www.deq.virginia.gov/tmdl/2006.html. The **2003—2004 TMDL Development Schedule**—the status report for TMDL projects that were due for submission to EPA on or before May 1, 2004—was available online at www.deq.virginia.gov/tmdl/2004.html.

In both cases, the impaired waters are listed by major watershed (James, York, etc.).

Much more information on TMDLs in Virginia is available beginning at the home page for the DEQ's TMDL Web site: www.deq.virginia.gov/tmdl/. Or you may contact Charles Martin in the DEQ's Office of Water Quality Programs, P. O. Box 10009, Richmond, Virginia 23240-0009; (804) 698-4462; e-mail: chmartin@deq.virginia.gov.

Previous articles on TMDLs in Virginia appeared in the following issues of *Water Central*: October 1998, October 1999, December 1999, and December 2001 (starting on page 1 in all cases). All issues of *Water Central* are available online at www.vwrrc.vt.edu; paper copies are available by calling (540) 231-5463, or e-mail: water@vt.edu.

VIRGINIA WATER STATUS REPORT

This section of *Water Central* presents recent and historical data on Virginia's precipitation, stream flow, and groundwater levels (one topic per issue, rotating among the three topics).

Precipitation in Virginia, January—October 2004

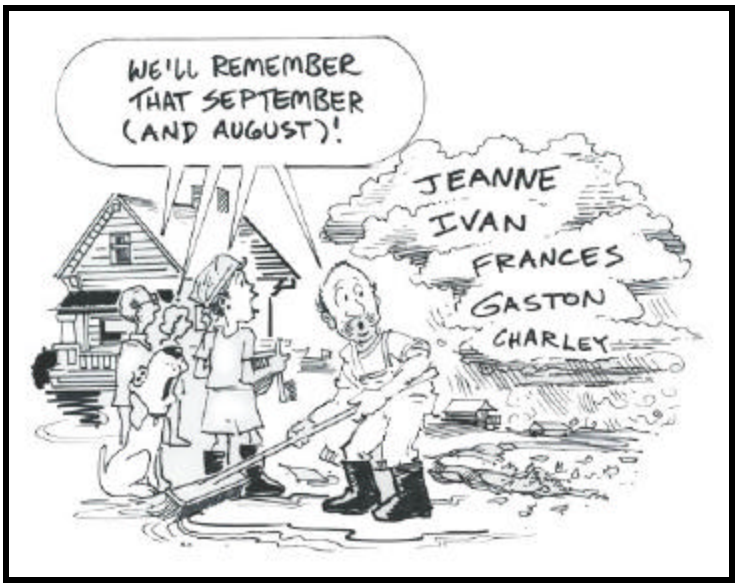
The chart below shows precipitation (in inches) recorded at seven National Weather Service observation sites in Virginia for each month from January—October 2004. The *top number* is the **total precipitation for that site and month**, including the equivalent amount of water contained in any snowfall or other frozen precipitation. These values were found at "Climate" sections of the Web sites of the National Weather Service offices in Blacksburg (www.erh.noaa.gov/er/rnk), Sterling (www.erh.noaa.gov/er/lwx/), and Wakefield (www.erh.noaa.gov/er/akq/) (as of 10/22/04). The *bottom number (in parenthesis)* is the **average monthly precipitation** over the period 1971—2000, according to the National Climatic Data Center, *Climatography of the United States No. 81* (accessed at www5.ncdc.noaa.gov/climatenormals/clim81/VAnorm.pdf on 8/9/04; as of 10/22/04, access to this Web address requires a user ID and a password). The monthly amounts shown here are classified as "preliminary data" by the National Weather Service; the National Climatic Data Center maintains any edited and certified data that are available.

Water Central's most recent previous report on Virginia precipitation (for January—December 2003) appeared in the January 2004 issue of (issue #29). (Please note: The chart in that issue showed departures from average for each month, rather than monthly averages as shown below.)

The Virginia State Climatologist publishes *Virginia Climate Advisory*, available online at climate.virginia.edu. To reach the State Climatologist's office by phone, call (434) 924-0548.

	Blacks-burg	Charlottes-ville	Lynchburg (Municipal Airport)	Norfolk (Internat. Airport)	Richmond (Byrd Intern. Airport)	Roanoke (Woodrum Airport)	Wash.-Dulles Airport
Jan. 2004	2.55 (3.37)	1.17 (3.71)	1.74 (3.54)	1.59 (3.93)	1.55 (3.55)	1.63 (3.23)	1.41 (3.05)
Feb. 2004	3.03 (3.02)	2.17 (3.30)	2.03 (3.10)	1.82 (3.34)	1.87 (2.98)	2.27 (3.08)	1.93 (2.77)
Mar. 2004	2.63 (3.83)	1.55 (4.05)	1.83 (3.83)	2.09 (4.08)	2.08 (4.09)	2.09 (3.84)	2.05 (3.55)
Apr. 2004	3.57 (3.83)	4.31 (3.34)	2.93 (3.46)	2.82 (3.38)	3.42 (3.18)	3.45 (3.61)	5.04 (3.22)
May 2004	5.79 (4.39)	5.45 (4.86)	2.22 (4.11)	4.67 (3.74)	3.06 (3.96)	3.89 (4.24)	3.06 (4.22)
June 2004	3.96 (3.93)	5.20 (4.46)	5.27 (3.79)	4.86 (3.77)	9.93 (3.54)	6.48 (3.68)	3.73 (4.07)
July 2004	3.37 (4.17)	4.43 (4.94)	2.64 (4.39)	10.89 (5.17)	6.44 (4.67)	4.33 (4.00)	3.73 (3.57)
August 2004	3.59 (3.68)	1.84 (4.14)	3.01 (3.41)	11.11 (4.79)	16.30 (4.18)	2.97 (3.74)	3.79 (3.78)
Sep. 2004	9.39 (3.39)	8.89 (4.85)	6.64 (3.88)	3.30 (4.06)	6.14 (3.98)	11.72 (3.85)	5.80 (3.82)
Oct. 2004	2.25 (3.19)	0.99 (4.22)	1.98 (3.39)	1.88 (3.47)	1.95 (3.60)	2.38 (3.15)	1.05 (3.37)
Total for period	40.13 (36.80)	36.00 (41.87)	30.29 (36.90)	45.03 (39.73)	52.74 (37.73)	41.21 (36.42)	31.59 (35.42)

Report on 2004's Tropical Storms Affecting Virginia



The Atlantic hurricane season, which runs from June 1 through November 30, is historically the most active during the month of September, and September of 2004 was no exception. Virginia experienced the aftermath of a number of hurricanes after their initial landfall in August and September, including Charley, Frances, Ivan, Jeanne, and the remnants of tropical depression Gaston.

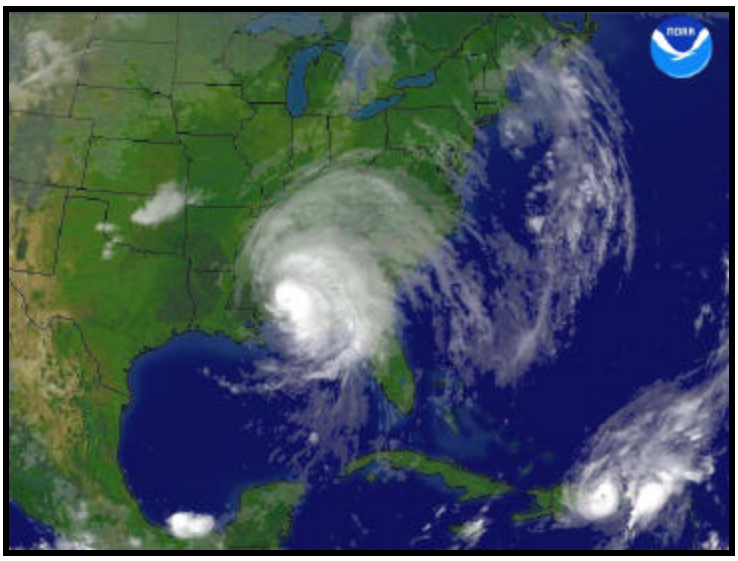
The first storm to hit Virginia was the remnants of Hurricane Charley on Saturday, August 14. Charley had previously gone through Florida, taking 25 lives and causing $7.4 billion in insured damage; Virginia, however, got off the hook relatively easy. Two rivers flooded: the Meherrin at Lawrenceville, which crested at 17.5 feet, 2.5 feet above flood stage, and the Nottoway near Stony Creek, which crested at its flood stage of 15 feet. Although Governor Mark Warner declared a state of emergency in some areas on August 14, relatively few people were impacted. According to the Virginia Department of Emergency Management, six counties (Suffolk, Portsmouth, York, Gloucester, Isle of Wright, and Southampton) opened shelters, but no storm-related injuries or deaths were reported. There were, however, some temporary road closures, and according to Virginia Power, around 2,717 customers briefly lost power.

The next storm to come through was tropical depression Gaston. This storm hit the Richmond area the hardest, flooding it with more than 10 inches of rain in less than 10 hours on August 30. As a result, Gaston left a number of area roads underwater or impassable, trees through apartment buildings, and more than 94,000 power outages in Richmond and 99,600 statewide. One of Verizon's facilities was underwater, which cut off phone service to between 2,000 and 3,000 customers. "The [University of Richmond] campus is in worse shape than when Isabel blew through [Virginia in 2003]," said Randy Fitzgerald, University spokesman, in an article for the *Times-Dispatch* on August 31.

The third storm to blow through Virginia was the remnants of Hurricane Frances on September 8, which forced Governor Mark Warner to declare another state of emergency. According to the Virginia Department of Emergency Situation Reports from September 8 and 9, 147 people were evacuated from Augusta, Culpeper, Galax, Henry, and Rockbridge counties; there were 60 reported primary road closures, and 122 secondary road closures; and 14,000 American Electric Power customers were without power. Two swift-water rescue teams were deployed to Roanoke when the Roanoke River crested at about three feet above flood level, and there were also unconfirmed reports that Frances generated nine tornadoes in the central Virginia area. Because of high winds, 11 homes and two businesses were destroyed, and another 36 homes and four businesses were damaged. Rainfall amounts as high as 10 inches were reported over the course of September 8 and 9 (Goshen in Rockbridge County).

The fourth storm to come through Virginia was Ivan on September 17. Dozens of *unconfirmed* tornadoes were reported on the 17th, with the most notable damage being in northern Virginia where around 170 homes were damaged and four were destroyed. By October 20th, the National Weather Service had

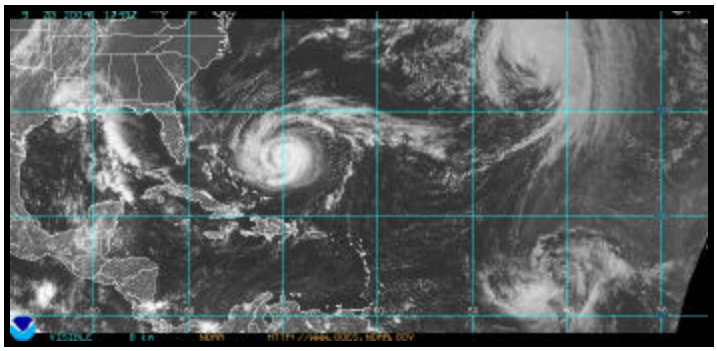
confirmed that 26 tornadoes occurred that day in the Baltimore-Washington service area (which includes parts of Virginia, Maryland, and West Virginia). Also in this area, almost 66,000 Virginia Dominion Power customers lost power, and one storm-related death was reported. Residents of West Virginia, Pennsylvania, and Ohio saw more water than wind. According to the United States Geological Survey's Web site on September 20, "nearly five dozen stream gages in the east were reporting water levels above flood stage," and "more than 350 gages reported new record high flows for September 19." The Ohio River crested at 9.3 feet above flood stage on September 19 in Wheeling, West Virginia, sending around 1,700 people scrambling to find shelter.



Tropical Storm Ivan, September 16, 2004.
Photo: National Oceanic and Atmospheric Administration, located at www.noaa.gov, 10/18/04.

In the Chesapeake Bay, scientists and government agencies confronted the effects of floodwaters that had washed sediment and debris into the Bay, a common occurrence after such a large storm. For example, U.S. Geological Survey scientists conducted sampling to evaluate water-quality impacts, and the Coast Guard issued warnings to boaters regarding the potential for damage to their vessels from floating rubbish.

On September 25, Hurricane Jeanne made landfall in Florida, following an extremely similar path to Hurricane Frances. The last state to endure four hurricanes in one season was Texas in 1886. Jeanne moved through Virginia on September 28, prompting another state of emergency. The storm caused flash flooding and heavy rainfall, such as in Busted Rock in Patrick County, which received 11.37 inches over a 24-hour time period. The Roanoke River in Roanoke crested at 17.9 feet (flood stage is 10 feet) at 3p.m. on the 28th. Approximately 269 roads were closed statewide on the 28th, eventually rising to 435 due to additional flooding. There were around 175 shelterees at the flooding's height, and one storm-related fatality was reported in Patrick County. As of October 14, it was estimated that Jeanne had caused at least $14 million of damage to the Roanoke Valley.



Hurricane Jeanne, September 23, 2004.
Photo: National Oceanic and Atmospheric Administration, located at www.nws.noaa.gov, 9/23/04.

On September 22, the Federal Emergency Management Agency (FEMA) announced its approval of nearly $4.9 million for Tropical Depression Gaston recovery efforts. As of October 14, Virginia was still waiting to see if it would receive federal aid for the damage incurred by Frances, Ivan, and Jeanne. Information on later aid developments was not available in time for this article.

Summary of Tropical Storms Affecting Virginia in 2004

Storm	Virginia Areas/Dates of Greatest Effects
Charley	Central & Eastern; 8/14/04
Gaston	Chesterfield, Henrico, & Hanover Counties, and Cities of Colonial Heights and Richmond; 8/30/04
Frances	Central & Southwestern; 9/8/04
Ivan	Northern & Coastal; 9/17/04
Jeanne	Western; 9/28/04

Sources for this article:
Hurricane Charley: Situation Report from the Virginia Department of Emergency Management (VDEM), 8/15/04; Associated Press as reported in the *Tampa Tribune*, 8/25/04.
Tropical Depression Gaston: *Richmond Times-Dispatch*, 8/31/04; Public Disaster Relief Statement 1544-025, at www.fema.gov, 9/22/04.
Hurricane Frances: Situation Reports from the VDEM, 9/8 and 9/9/04; Public Information Statement from the National Weather Service, 9/9/04; *Roanoke Times*, 9/9/04.
Hurricane Ivan: *Washington Post*, 9/20/04; Associated Press as reported in the *Richmond Times-Dispatch*, 9/23/04; Associated Press as reported in the *Contra Costa Times*, 9/24/04; and National Weather Service 9/17/04 Tornado Report, at www.erh.noaa.gov/er/lwx, 10/28/04.
Hurricane Jeanne: Associated Press as reported on www.aimtoday.cnn.com, 9/27/04; *Roanoke Times*, 9/29 and 10/2/04; Situation Reports from the VDEM, 9/28 and 9/29/04.

—By Katie Moore

Katie Moore, a senior English major at Virginia Tech, was an intern at the Water Center for the Fall 2004 semester.

IN AND *OUT OF* THE NEWS
Newsworthy Items You May Have Missed

The following summaries are based on information in the source(s) indicated in parentheses, usually at the end of each item. Selection of this issue's items ended in mid-October 2004. Except as otherwise noted, the localities mentioned are in Virginia and the dates are in 2004.

In Virginia…

•**A 10-year effort to restore the watershed around Reston** is to begin in Summer 2005. Development has increased the area's stormwater flow, which in turn has increased erosion and sediment deposition into local lakes and streams. Overseers of the project include the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency (EPA), the Reston Association, the Virginia Department of Environmental Quality (DEQ), and the U.S. Fish & Wildlife Service. The project is expected to cost around $7 million and eventually restore 29 miles of streams. The project will also provide an area of streams that developers can help restore to compensate for development impacts elsewhere in the Potomac basin. (*Reston Connection*, 8/5/04)

•From July to September, **several million adult Atlantic Croaker (*Micropogonias undulatus*) turned up dead** due to profuse bleeding of the gills and probable suffocation, off the shores of New Jersey, Delaware, Maryland, Virginia, and Florida. Suspected factors for the kill include bacterial infection, a cold-water upwelling offshore, or a combination of both. Officials did not expect the kill to affect significantly the population of croaker, one of Virginia's top-ten most commercially fished species. (*Richmond Times-Dispatch*, 8/11/04; *Virginian-Pilot*, 9/9/04; and VIMS Press Release 9/7/04)

•On August 12, by a 5-3 vote, the Virginia Marine Resources Commission (VMRC) granted Newport News a **permit to draw water from the Mattaponi River** as a source for its **proposed reservoir in King William County**. This reversed the VMRC's May 14, 2003, vote to deny the permit on the basis of its predicted impact on shad in the Mattaponi. The permit requires the city to monitor shad-spawning indicators in the river for eight years, refrain from pumping water from March through July during those eight years, and then re-set the annual pumping break based on the eight years of data.

The next steps for the reservoir proposal were for state agencies to review it for compliance with Virginia's coastal resources laws, and then for the city to seek a final permit from the U.S. Army Corps of Engineers (the Corps has indicated it will grant the permit if all state approvals are in place). Lawsuits and possible opposition by the U.S. EPA could still pose obstacles to the proposal. In addition, the Mattaponi Tribe has petitioned the Virginia Supreme Court to review lower court rulings that rejected the tribe's challenge to the project. The tribe contends that the project would flood land within three miles of the Mattaponi Reservation and that the 1677 Treaty of Middle Plantation between the tribe and the Colony of Virginia prevents non-Indian development within that area. (*Richmond Times-Dispatch*, 8/13 and 10/7/04; and *Newport News Daily Press*, 9/2/9/04. *Water Central*'s most recent previous item on this story was in the April 2004 issue, p. 15)

•After receiving approval in August from the county board of supervisors, a **Bedford County** home will apparently be only the **second private residence in Virginia to use constructed wetlands** for onsite sewage treatment (normally performed by underground septic tank systems). The board approved a two-year pilot study. (*Lynchburg News & Advance*, 8/15/04)

•In September, **new federal rules** took effect to **reduce the impacts of power generators' water intakes on fish and shellfish**. The new rules also require fish-impact studies by the power generators. According to the Virginia DEQ, it will take several years for the state's power plants to conduct the studies and for new requirements to show up in permits. (*Newport News Daily Press*, 8/15/04)

•In September, the Virginia Department of Health (VDH) reported the results of its **survey of lead in drinking water** at 237 randomly selected **daycare centers and elementary schools**. Samples at eight sites had lead exceeding the EPA "action level" of 15 parts per billion, but only one site continued to show lead above the action level after the water lines had been flushed for 60 seconds. While VDH was working

with that site to define the problem and identify corrective action, children at the site were being provided bottled water. VDH also sent information to all elementary schools and day care centers in the state advising them to flush water lines for 60 to 90 seconds if water has been unused for six hours or more. More information on this survey is available by calling VDH's Kelly Lobanov at (804) 864-7553. (VDH Press Release, 9/17/04; and *Lynchburg News & Advance*, 9/21/04.)

•What do the medium-sized cities of **Norfolk** and **Roanoke**, the very small town of **Stanley** (Page County), and the enormous city of **Los Angeles** have in common? They all have one or both of two **problems with sewers** seen by many municipalities nationwide: infiltration of stormwater through cracks in aging sewer lines, and sewer-line blockages due to grease and other fats from residential or commercial drains.
Norfolk: From 2002 to 2004, at a cost of $17 million, the city reduced its overflows by 61 percent by repairing cracked lines and urging residents not to put grease or other fats down household drains (the city estimates that 70 percent of sewer backups are due to grease buildups). The city expects to spend $17 million on the problem *annually* for the next ten years.
Roanoke: The causes cited for this city's overflows are also stormwater coming through breaks in aging pipes and occasional blockages, plus some home gutters being tied into the sanitary sewer system. Following heavy rains from Hurricane Jeanne in September, between 400 million and 750 million gallons of sewage plus stormwater leaked out of the city's treatment plant and manholes. A $20-million treatment-plant upgrade completed in 2000 did not produce enough capacity to accommodate overflows, so the city is spending $50 million more on another upgrade. The city expects by 2006 to have a plan for upgrading the collection lines.
Stanley: The town also has a problem of stormwater infiltration through cracks in older sewer lines. Since 2002, the town has been working with the Virginia DEQ to locate cracked lines, and the DEQ wants the town to spend at least $20,000 per year over the next three years to solve its infiltration problem.
Los Angeles: In an August settlement with the U.S. EPA and Justice Department, the city agreed to spend $2 billion to rebuild old sewer infrastructure, control restaurant grease discharges, and take other actions to stop sewage overflows. (*Inside EPA's Water Policy Report*, 8/9/04; *Virginian-Pilot*, 9/6/04; *Page News and Courier*, 9/16/04; and *Roanoke Times*, 10/25/04)

In August, the EPA released *Report to Congress: Impact of Combines Sewer Overflows and Sanitary Sewer Overflows*. The report summarizes current information on causes of, impacts of, and actions to correct sewer overflows. The report is available online at www.epa.gov/npdes/csossoreport2004.

•Two recent incidents highlight how **observant citizens can help prevent water pollution**. In August the report by a road-building contractor of an odor led the James City Service Authority to a sewer-pipe crack that was allowing untreated sewage to flow into Powhatan Creek. The pipe was repaired and the authority planned to look at the condition of the whole 25-year-old sewer line. In Bristol on September 8, a citizen noticed a slow-moving black sludge in Beaver Creek and phoned 911 to report the problem. According to a Virginia Department of Emergency Management (VDEM) inspector, the sludge was coming from a nearby oil company that was unaware its runoff was going into a storm drain rather than a sewer drain—a problem the company could then correct.

The Virginia DEQ encourages citizens to report suspected water-pollution problems. During normal work hours, people should contact their regional DEQ office; at other times, phone the VDEM at (800) 468-8892. (*Bristol Herald Courier*, 9/9/04; *Newport News Daily Press*, 9/17/04; and Va. DEQ Pollution Response Program Web site, www.deq.state.va.us/prep/)

•Here are some recent **Chesapeake Bay items**:

••On July 16, the EPA released a **draft "permitting approach"** under which most large sewage-treatment plants in the Bay watershed would have to limit their discharge of nitrogen and phosphorus, key plant nutrients that underlie much of the Bay's water-quality. Under the proposal, states would set annual limits on the amount of the two nutrients that treatment plants could release. The limits would be incorporated as discharge permits for individual plants come up for renewal. Currently only a few plants in the watershed have nitrogen limits, although about half have phosphorus limits.

At its August 31 meeting, **Virginia's State Water Control Board** endorsed a plan to limit nitrogen in major wastewater discharges. Regulations could be in effect by late 2005. The Virginia plan, costing an estimated $1.1 billion, would have treatment-plant improvements in place by 2010 to cut annual nitrogen discharges from these sources by 8 to 9 million pounds. Under the Chesapeake Bay 2000 Agreement, by 2010 Virginia is to have cut by *26 million* pounds its *total* nitrogen input to Bay waters (from dischargers

and from nonpoint sources such as urban and agricultural areas). (*Washington Post*, 7/26/04; *Bay Journal*, September 2004; and *Richmond Times-Dispatch*, 9/1/04)

In a related item: In July, the **Loudoun County Sanitation Authority** began building a wastewater treatment plant that will discharge water with only three milligrams of nitrogen per liter (mg/l), compared to the current area average of 18 mg/l. The Broad Run Water Reclamation Facility will cost $200 million, begin operation in 2007, and eventually treat 20 million gallons of sewage per day. (*Washington Post*, 8/1/04)

••In August, the **Chesapeake Bay Foundation filed** two lawsuits in state circuit courts against the Virginia DEQ over discharge permits granted in June to the **Philip Morris tobacco plant** in Chesterfield County and the **Town of Onancock** in Accomack County (please see the August 2004 *Water Central*, p. 16, for a previous item). Those two permits were the first approved in Virginia with nitrogen-related requirements. In the suit regarding Philip Morris, the Foundation is claiming that the nitrogen limits were not strict enough. In the Onancock suit, the Foundation the DEQ should have placed some limit on Onancock's nitrogen discharge (the permit only required the town to monitor its discharges and prepare plant-modernization plans). (*Richmond Times-Dispatch*, 8/14/04; and *Virginian-Pilot*, 8/17/04)

••Along with wastewater plants' nutrient discharges, **animal waste as a source of excessive nutrients in Bay waters** continues to be a focal point. Two groups are studying Virginia's manure-handling standards: 1) the Joint Legislative Audit and Review Commission; and 2) a group comprising farmers, livestock owners, and Chesapeake Bay Foundation staff members. (*Richmond Times-Dispatch*, 7/29/04)

••In September, the **Chesapeake Bay Small Watersheds Grants Program** announced its 2004 grants, providing $3 million for 93 Bay- and river-restoration projects by local governments and community organizations. Since 2000, the program has provided $11.3 million for 350 projects. (Chesapeake Bay Program Press Release, www.chesapeakebay.net, 9/9/04)

••Federal management of the **Chesapeake Bay restoration effort came under increased scrutiny in August**. On the 12th, U.S. Senators Barbara Mikulski (D-Md.), Paul Sarbanes (D-Md.), and John Warner (R-Va.) wrote to the General Accounting Office (GAO) requesting an assessment of Bay-restoration progress reported by the EPA's Chesapeake Bay Program office. The senators' letter noted that "[q]uestions remain about whether the information currently reported by the Bay Program provides an accurate depiction of Bay conditions…." On the 17th, the GAO agreed to the request. Meanwhile, the U.S. House Committee on Government Reform launched an examination of the program in an August 20th hearing at Fort Monroe near Hampton. (*Washington Post*, 8/12 and 8/17/04; and *Newport News Daily Press*, 8/19/04)

••And Virginia's Bay-cleanup efforts were the subject of a **General Assembly retreat** held September 28—29 at Westmoreland State Park. Twenty-three legislators attended and exchanged views with administration officials on what the state has done so far to meet its commitments under the Chesapeake Bay 2000 Agreement, what is still needed, how much it will all cost, and who will pay. (*Richmond Times-Dispatch*, 9/30/04)

…and Outside of Virginia

•Under what conditions, if any, **is groundwater part of the "waters of the United States"** under the federal Clean Water Act (CWA)? That's the question in the case of *Northern California River Water v. City of Healdsburg*. On January 23, 2004, the U.S. District Court for the Northern District of California ruled that the city was required to get a CWA permit for a discharge into a pond connected only by groundwater to the Russian River. The CWA regulates "navigable waters" along with surface waters and wetlands that have some significant connection to navigable waters. In this case, the district court held that the groundwater connection *does* sufficiently connect the non-navigable pond to the navigable Russian River so that the pond comes under the jurisdiction of the CWA. The case is now before the U.S. Court of Appeals for the Ninth Circuit. (*Inside EPA's Water Policy Report*, 9/9/04)

•In Washington D.C.'s Spring Valley area, the U.S. Army Corps of Engineers has been testing the **use of ferns to help clean up high levels of arsenic** in the backyards of several local homes. Ordinarily, alleviating this problem would require digging up all of the affected soil, including what is under trees and driveways; this new method, however, offers hope for a less-intrusive alternative. The main fern species used are the spider fern *(Pteris multifada)* and table fern *(Pteris cretica)*. Edenspace Systems Corporation, which supplied the ferns, says these species can take up especially large quantities of arsenic. Preliminary

tests showed the ferns having reduced arsenic in the soil by 25 percent, but only down to about one foot deep (the limit to which the roots grow). (*Washington Post*, 8/26/04)

•A team headed by Carnegie Mellon engineering professor Metin Sitti has built **a tiny robot that can walk on water**, much like the surface-skimming insects known as water striders. The robot, weighing about a gram, has a carbon fiber body and eight legs coated with a water-repelling plastic; the materials used in the robot cost around $10. Such a robot might eventually be used to monitor water supplies. (Associated Press, as reported in *The Roanoke Times*, 9/24/04)

•On September 20, the **U.S. Commission on Ocean Policy issued its final report.** Among the report's 212 recommendations were the following: an international network of floating instruments used to monitor water conditions, a new government oversight body, comprehensive fishing regulations, a new trust fund set up with royalties from oil and gas drilling, and an increase (to $1.36 billion per year) in federal funding for marine research. The full report, *An Ocean Blueprint for the 21st Century*, can be found online at www.oceancommission.gov. (*Newport News Daily Press*, 9/24/04. A summary of the Commission's *draft* final report was printed in the August 2004 issue of *Virginia Water Central*.)

A Final Word

"We've built fences to keep out soldiers and special forces. We feel pretty confident we can build a fence that can keep out the cownose ray." That was the comment of Doug Martin, program manager for the U.S. Army Corps of Engineers' oyster-restoration work in Virginia. Mr. Martin was referring to predation by the cownose ray on oysters the Corps had placed in the Great Wicomico River. The Corps is investigating reseeding Chesapeake Bay waters with native oysters that have been genetically altered to be disease-resistant. (*Washington Post*, 8/25/04)

—By Alan Raflo and Katie Moore

A GUEST NEWS ESSAY

Virginia Case May Be Start of a Trend

A case decided in May 2004 by the United States District Court for the Western District of Virginia, *Express Carwash of Charlottesville, L.L.L.P. v. the City of Charlottesville*, may be the start of a trend that impacts private water wells.

The case involved restrictions on water use imposed by the City of Charlottesville, Virginia, during a severe drought in the summer of 2002. When the City's reservoir sank to 60 percent of capacity, the City imposed restrictions on water use. The restrictions applied to both private water wells and public water supply. One restriction prohibited the washing of any automobile or motor vehicle.

Express Carwash, a user of the public water supply, continued to wash cars until the city issued a written warning. Express then ceased washing cars, but submitted a letter requesting an exemption from the restrictions. The City never responded. Express filed suit in federal court, claiming that the restrictions enacted a taking of its private property for public purposes without just compensation in violation of the Fifth Amendment of the U.S. Constitution. Express estimated that the restrictions cost the business $60,000. In addition, Express pointed out that car washing in the area used only 7/10 of one percent of the average daily water consumption, making the restriction unreasonable.

The court dismissed Express' claim. Well-established legal rules require a person to attempt local and state remedies prior to filing a federal takings claim. The court found that Express could have, and should have, filed a takings suit in state court prior to coming to the federal courts for relief. The court essentially told Express to file the suit in state court.

This case is important not for the result, but for the issue it raised. Thus far, restrictions on water use have found to be takings in at least two circumstances: 1) a water-permit scheme in Oklahoma was found to be a taking of existing water rights; and 2) restrictions to protect endangered fish species under the Endangered Species Act enacted a taking from water users in Oregon.

In theory, water-use restrictions could amount to a taking in a wide range of circumstances. In reality, the expense and difficulty of these types of lawsuits make challenges rare. Future cases will more clearly mark the boundaries of the right to use water by private landowners. The Charlottesville experience indicates that such cases may come sooner rather than later.

—By Jesse Richardson

Jesse Richardson is an assistant professor in the Department of Urban Affairs and Planning at Virginia Tech.

SPECIAL NEWS ITEM

National Research Council Report on Water Research Needs

The following was printed in the August 2004 issue of Colorado Water, the newsletter of the Colorado Water Resources Research Institute. *Water Central* thanks the Colorado Water Center for providing the information and giving permission to reprint it.

On June 17, 2004, the Committee on Assessment of Water Resources Research, National Research Council (NRC), released a congressionally mandated report on the role of water research in addressing the nation's water problems. The Committee, chaired by Henry Vaux, retired Associate Vice President of the University of California, Berkeley, and former director of the University of California's Center for Water Resources, examined [the following]:

- the current and historical patterns and magnitudes of investment in water resources research at the federal level, and generally assess its adequacy; and,
- the need to better coordinate the nation's water resources research enterprise as well as identify institutional options to implement better coordination.

The committee noted that overall federal funding for water research has been stagnant in real terms for the past 30 years, and that the portion dedicated to research on water use and related social science topics has declined considerably. For example, while other fields such as the health sciences have seen large funding increases over the last three decades, per capita spending on water-resources research has dropped from $3.33 to $2.44, despite the growing number of water conflicts around the country.

Given the competition for water among farmers, environmental advocates, recreational users, and other interests—as well as emerging challenges such as climate change and the threat of waterborne diseases—the committee concluded that an additional $70 million in federal funding should go annually to water research, with the aim of improving the decision-making of institutions that control water resources and better understanding the water-use challenges that lie ahead.

The committee also concluded that a new entity is needed to coordinate water research at the national level because no structure is in place now that adequately prioritizes research for funding purposes, evaluates progress, or shifts priorities as new challenges arise. Either an existing interagency body, a neutral organization authorized by Congress, or a public-private group led by the Office of Management and Budget (OMB) could serve as the coordinating mechanism, the committee said. The coordinating group should regularly advise Congress and OMB, and provide guidance on the establishment of a new competitive grants program.

During the course of its work, the committee noted that Federal agencies and the states –to which the federal government has deferred much water-resources research in recent decades—have tended to focus on short-term water research likely to yield more immediate results. But it is long-term, basic research that will provide a solid foundation for applied science a decade from now, the committee said. It urged the federal government to commit one-third to one-half of its water research portfolio to long-term studies.

The government should improve monitoring of water conditions and levels over the long term, and archive this data, the committee added. In recent years, there have been substantial declines in the measurement of stream flow, groundwater levels, water quality, and water use, the committee found; in some areas measurements have been completely eliminated.

The report was sponsored by the U.S. Geological Survey. The National Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering. It is a private, nonprofit institution that provides science and technology advice under a congressional charter. Copies of report, entitled *Confronting the Nation's Water Problems: The Role of Research* are available from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242; or on the Internet at www.nap.edu/books/0309092582/html/.

N O T I C E S

State Water Meetings and Hearings

The Virginia Department of Environmental Quality (DEQ) posts notices of regulatory action, public hearings and meetings, and other events on-line at www.deq.state.va.us/info/ (click on "Public Calendar"). Following is a list of water-related events that occurred between August 26 and November 8, with contact information for further information. To reach the contact people by e-mail, go to the Public Calendar Web site, find the event, and click on the name; by phone, call the DEQ Public Affairs Office at (804) 698-4447.

8/26 and 10/20, Virginia Beach: Advisory committee on total maximum daily loads (TMDLs) for Back Bay and North Landing River watersheds. More information: Jennifer Howell.
8/28, Mineral: Meeting on TMDLs for Goldmine, Beaver, Pamunkey and Plentiful creeks and Mountain and Terrys runs. More information: Bryant Thomas.
8/31 and 10/14, Blackstone: Advisory committee on TMDLs for Nottoway River and tributaries. More information: Kelly Wills.
9/7, Isle of Wight: Advisory committee on TMDLs for Blackwater River tributaries. More information: Chris French.
9/8 and 10/18, Sussex: Meetings on TMDLs for Sappony and Raccoon creeks. More information: Chris French.
9/9, Cumberland: Meeting on TMDL implementation plan for Willis River. More information: Kelly Wills.
9/9, Richmond and 10/8, Glen Allen: Community involvement task force. More information: Bill Hayden.
9/14, Madison: Meeting on TMDLs for Robinson River and Little Dark Run watersheds. More information: Bryant Thomas.
9/15, Brookneal: Meeting on TMDLs for the Roanoke River and tributaries. More information: Kelly Wills.
9/15, Unionville: Meeting on TMDLs for Mountain Run and Mine Run watersheds. More information: Bryant Thomas.
9/20, Glen Allen: Water Policy Technical Advisory Committee (also met on several other dates). More information: Scott Kudlas.
9/21 and 11/16, Richmond: Groundwater Protection Steering Committee. More information: Mary Ann Massie.
9/22, Dayton and 10/7, Harrisonburg: Meetings on TMDLs for Beaver Creek. More information: Robert Brent.
9/23, Bridgewater and 10/14, Harrisonburg: Meetings on TMDLs for the North River. More information: Robert Brent.
9/30, Charlottesville: Meeting on intended regulatory action on a permit for minor water withdrawals. More information: Ellen Gilinsky.
10/5, Richmond: Advisory committee meeting on amendments to Virginia water protection general permits. More information: Brenda K. Winn
10/7, Roanoke: TMDL advisory committee meeting for Roanoke River and tributaries above Smith Mt. Lake. More information: Jason Hill.
10/15, Glen Allen: Public meeting on the revolving loan fund FY05 intended use plan and draft funding list. More information: Walter Gills.
10/20, Luray: Public meeting on TMDLs for Mill Creek. More information: Robert Brent.
10/20, Middlesex County: Public meeting on TMDLs for shellfish waters in Middlesex County. More information: Chester Bigelow.
10/20, Williamsburg: Public hearing on the proposed King William reservoir for Newport News. More information: Ellie Irons.
10/25, Surry: Public meeting on TMDLs for Blackwater River. More information: Chris French.
10/28, Blackstone: Public meeting on TMDLs for Nottoway River. More information: Kelly J. Wills.
11/4, Wise County: Public meeting on TMDL for Guest River. More information: Nancy T. Norton.
11/8, Bastian: Public meeting on TMDL for Hunting Camp Creek. More information: Nancy T. Norton.

Interested in Water Quality?

If you are, here are three reports of note:

•The Latest Virginia Water Quality Report

The final version of Virginia's biennial water-quality report was approved by the U.S. EPA on September 7. The report, entitled *2004 305(b)/303(d) Water Quality Integrated Assessment Report*, is available online at www.deq.Virginia.gov/wqa/ir2004.html. For more information about the report, contact Darryl Glover at the Virginia DEQ, (804) 698-4321, or e-mail: dmglover@deq.virginia.gov.

•A North Fork Shenandoah River Report

The U.S. Geological Survey (USGS) recently published *Water Quality Synoptic Sampling, July 1999: North Fork Shenandoah River* (Scientific Investigations Report 2004-5153). Currently the report is available only online, at water.usgs.gov/pubs/sir/2004/5153.

•And a *National* Water Quality Report

The U.S. Geological Survey's National Water Quality Assessment Program Water Quality has published *Nation's Streams and Aquifers: Overview of Selected Findings, 1991—2001* (USGS Circular 1265. The report is available online at water.usgs.gov/pubs/circ/2004/1265/. For a paper copy, phone (888) ASK-USGS (275-8747).

Keeping Track of Well Permits

A recent article in *The Cross Section* describes a new Geographic Information System (GIS) developed at Texas Tech to "streamline management of well-permit records. The newsletter is available at www.hpwd.com/news/crosssection, or contact High Plains Underground Water Conservation District 1 in Lubbock, Tex., (806) 762-0181.

Report on "Smart Growth" and Water

A new publication from the U.S. EPA, *Protecting Water Resources with Smart Growth*, describes 75 approaches for managing development in ways that support water-quality goals. The report, publication 231-R-04-002, is available online at www.epa.gov/smartgrowth/; for a paper copy, phone (800) 490-9198 or e-mail ncepimal@one.net.

Also Out There…

From the many water-related publications that arrive in the Water Center's mail, here's a brief description of a recent, detailed article:

•"Achieving Effective Physical Attributes in Constructed Marshes"—Discusses criteria that can be used to assess whether constructed wetlands perform desired ecological functions. *National Wetlands Newsletter*, July-August 2004; Environmental Law Institute, Washington, D.C., (800) 433-5120, or e-mail: orders@eli.org.

AT THE VIRGINIA WATER CENTER

To reach the Virginia Water Resources Research Center: phone (540) 231-5624; FAX (540) 231-6673; e-mail water@vt.edu; Web site www.vwrrc.vt.edu.

Water Professionals of the Future

The Virginia Tech Student Chapter of the American Water Resources Association (AWRA) has been selected as the AWRA Outstanding Student Chapter for 2004. Water Center staff provided leadership to form the interdisciplinary chapter in 1996 and continues to assist in advising the group.

New Roles for Younos

Interim Director Tamim Younos was selected recently for two new leadership roles within the water-resources profession. First, the Universities Council on Water Resources (UCOWR) has elected Dr. Younos as the president-elect of the organization; he will be elevated to the president in July 2005. (UCOWR is an interdisciplinary organization of about 85 universities. Information about UCOWR is available online at

ucowr.siu.edu.) Second, the American Water Resources Association has selected Dr. Younos for a three-year term on the organization's Board of Directors, beginning in January 2005.

What Do *You* Think Needs Some Research?

If you have ideas about water research in Virginia, we want to hear them! The Water Center is conducting a **water-research needs survey**. Please submit a few sentences on what you believe are the highest-priority water research needs in Virginia. The Center will use the survey results to identify research areas to be highlighted in an upcoming request for proposals (RFP). Please submit your comments by **December 3** to Tamim Younos, 23 Agnew Hall (0444), Blacksburg, VA 24061; or via phone, FAX, or e-mail address as listed above. Thank you!

We're eager to hear what you think needs investigating!

NATIONAL COMPETITIVE GRANTS PROGRAM REQUEST FOR PROPOSALS

National Institutes for Water Resources and U.S. Geological Survey

Water Resources Research National Competitive Grants Program
Request for Proposals for FY 2005

The U.S. Geological Survey (USGS) in cooperation with the National Institutes for Water Resources (NIWR) requests proposals for matching grants to support research on the topics of water supply and water availability, which are issues of importance nationwide. Proposals are sought not only for the area of the physical dimensions of supply and demand, but also for the areas of quality trends in raw water supplies, the role of economics and institutions in water supply and demand, institutional arrangements for tracking and reporting water supply and availability, and institutional arrangements for coping with extreme hydrologic conditions.

For planning purposes, the amount available for research under this program is estimated to be $1,000,000 in federal funds, though there has not been a FY 2005 appropriation of funds for this program as of the date of this Announcement. Any investigator at an institution of higher learning in the United States is eligible to apply for a grant through a Water Research Institute or Center (in Virginia, that's the Virginia Water Resources Research Center) established under the provisions of the Water Resources Research Act of 1984, as amended. Proposals involving substantial collaboration between the USGS and university scientists are encouraged. Proposals may be for projects of 1 to 3 years in duration and may request up to $250,000 in federal funds. Successful applicants must match each dollar of the federal grant with one dollar from non-federal sources.

Proposals must be filed on the Internet at https://niwr.org/ by 5:00 p.m. EST, **February 22, 2005**, and must be approved for submission to the National Competitive Grants Program not later than 5:00 p.m., EST, March 4, 2005, by the Institute or Center through which they were submitted. The Government's obligation under this program is contingent upon the availability of appropriated funds.

Award Recipients for FY 2004 Funding

For the *FY 2004* National Competitive Grants Program by USGS and NIWR, 45 proposals were submitted for almost $7 million in federal funds. The amount available was $1 million, as it is in FY 2005. Following are the eight proposals that were selected. More information is available online at http://water.usgs.gov/wrri/04grants/national/nationalindex.html.

- *Carbonaceous Material Fractions in Sediments and Their Effects on the Sorption and Persistence of Organic Pollutants in Small Urban Watersheds*, by Charles Werth, University of Illinois at Urbana-Champaign ($170,956 in federal funds for three years).
- *Development of Water Use Benchmarks for Thermoelectric Power Generation in the United States*, by Ben Dziegielewski and Tom Bik, Southern Illinois University ($94,245 in federal funds for two years).
- *Estimating Shallow Recharge and Discharge in Northeastern Illinois Using GIS and Pattern Recognition Procedure*, by Yu-Feng Lin and Albert Valocchi, University of Illinois at Urbana-Champaign ($91,197 in federal funds for two years).
- *Forward and Inverse Transient Analytic Models of Groundwater Flow*, by Shlomo Neuman, University of Arizona ($131,976 in federal funds for three years).
- *Groundwater Sustainability in a Humid Climate: Groundwater Pumping, Groundwater Consumption, and Land Use Change*, by Madeline Gotkowitz and David Hart, Wisconsin Geological and Natural History Survey ($69,246 in federal funds for two years).
- *Institutional Re-arrangements: Forcing "Smart Use" Water Policy Coalitions at the Intersection of Geo-technical Engineering with Open Space*, by Helen Ingram, University of California at Irvine ($70,767 in federal funds for two years).
- *Pharmaceutically Active Compounds: Fate in Sludges and Biosolids Derived from Wastewater Treatment*, by David Quanrud, Wendell Ela, Robert Arnold, and Hon Chorover, University of Arizona ($152,926 in federal funds for three years).
- *Space-Based Monitoring of Wetland Surface Flow*, by Shimon Wdowinski, Falk Amelung, and Timothy Dixon, University of Miami ($158,687 in federal funds for two years).

FOR THE RECORD
Sources for Selected Water Resources Topics

Aquatic Life Information Sources

This topic was previously covered in the November 2000 *Water Central*. Except as noted below, the information contained in that article was still correct as of October 25, 2004. To view the previous article online, go to the "Previous Issues" link on the Virginia Water Resources Research Center home page, www.vwrrc.vt.edu. To request a paper copy, phone (540) 231-5463.

Updating Previous Sources

The Status and Trends of Our Nation's Biological Resources

This is a 1000-page, two-volume report from the U.S. Geological Survey. The Web address for the online edition is now biology.usgs.gov/s+t, and the report is now available for purchase online at bookstore.gpo.gov, (stock # 024-001-03603-7) for $108. The book is also available in libraries.

National Biological Information Infrastructure (NBII)

The NBII (referred to as the National Biological Information System in the November 2000 *Water Central*) is a "broad, collaborative program to provide increased access to data and information on the nation's biological resources," according to its Web site at www.nbii.gov. The NBII's section on Fisheries and Aquatic Resources is located at http://far.nbii.gov; this site has links to species information, management, maps, tools for education, and other topics.

Va. Fish and Wildlife Information Service

This Web-based service is provided by the Virginia Department of Game and Inland Fisheries and the Conservation Management Institute at Virginia Tech. The direct Web address is now vafwis.org/WIS/ASP/default.asp. For more information, phone (804) 367-6913.

NatureServe and Natural Heritage Programs

In the November 2000 *Water Central*, NatureServe was listed under "Association for Biodiversity Information." This non-profit organization's Web site, www.natureserve.org, provides access to species and ecosystem information from a nationwide network of **natural heritage programs**. Natural heritage programs provide information on organisms and ecological communities, particularly rare or endangered species or communities. The Web site for **Virginia's Division of Natural Heritage** is now www.dcr.virginia.gov/dnh.

New Sources

Museums and Collections on the Web

Natural history museums offer a wealth of biological information through their species collections, exhibits, curators, and reference materials. At the following Web address, the Science Outreach Program at Virginia Tech provides a link to many such museums (including the Natural Museum of Natural History in Washington, the American Museum of Natural History in New York): www.vtmnh.vt.edu/webcollx.html; for more information, phone (540) 231-3001.

U.S. Forest Service's Watershed, Fish, Wildlife, Air, and Rare Plants Web Site

This site is located at www.fs.fed.us/biology. Of particular note is the Plants Database, at www.fs.fed.us/biology/plants/plants.html, which has names, images, and other information on plants (including aquatic plants) of the United States.

USGS Nationwide Data Warehouse

The National Water Quality Assessment Program (NAWQA), which the U.S. Geological Survey (USGS) has conducted since 1991, has included collection of data on fish, algae, and invertebrates from dozens of watersheds, including the Chowan, Delmarva, New, Potomac, and Upper Tennessee basins in Virginia. The data are available at water.usgs.gov/nawqa/data. For more information, contact Sandy Williamson, NAWQA

National Database Team Leader, at (253) 428-3600, ext. 2683 (in Tacoma, Wash.), or e-mail: akwill@usgs.gov.

—By Jackie McGeehan and Alan Raflo

Jackie McGeehan was an intern at the Water Center in Summer 2004.

Next "For the Record": Water Maps

For a list of all previous "For the Record" topics, please see the Guide to Past *Water Central Articles* (Topic Area: Sources of Information) in the January 2004 issue of *Water Central*.

Virginia Water Central

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