

Virginia Water Central

Virginia Water Resources Research Center

Blacksburg, Virginia

December 1999

FEATURE ARTICLE

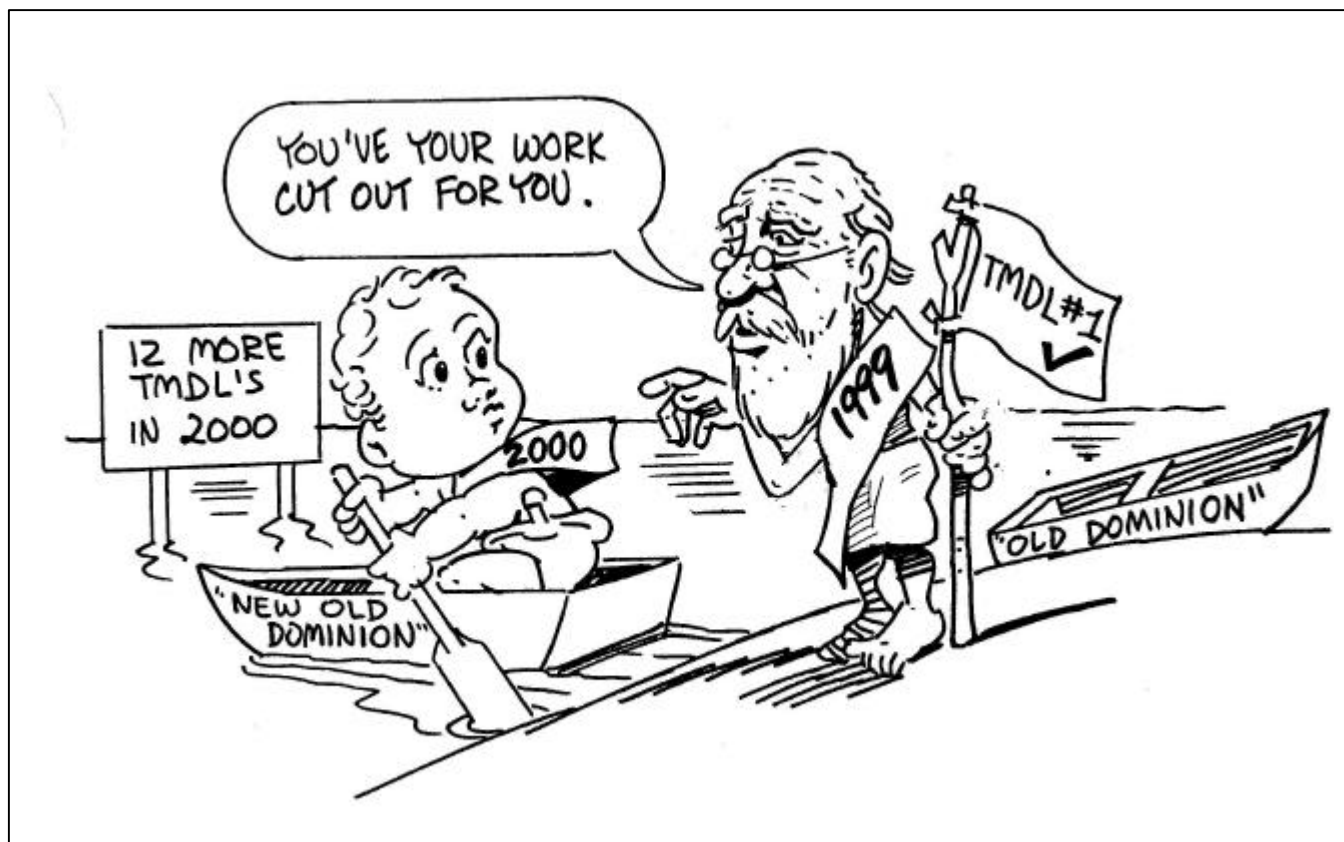
Views of the Virginia Impaired-waters List

Editor's note: In the last *Water Central*, we reported on major developments in Virginia related to *impaired waters* and *Total Maximum Daily Loads*, or *TMDLs*. This issue's Feature uses a series of graphs to summarize Virginia's most recent (1998) impaired-waters list, known as the *303[d]* list after the relevant section of the federal Clean Water Act.



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Stream Monitoring

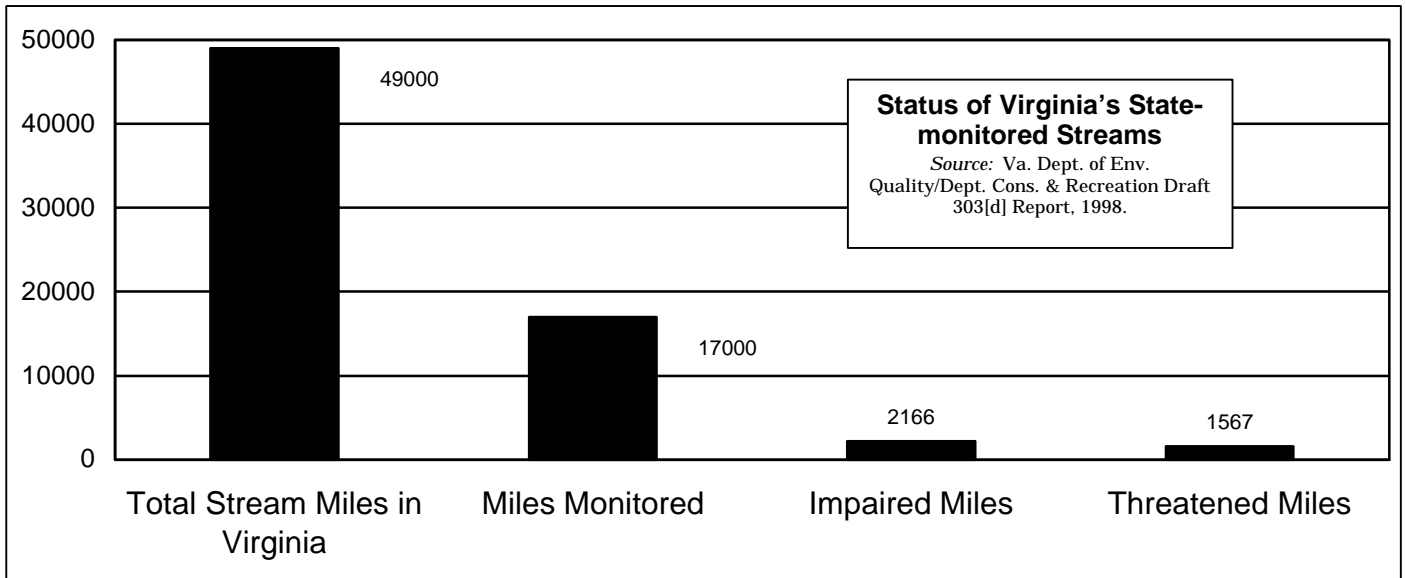
The Va. Dept. of Environmental Quality (Va. DEQ) monitors water-quality in 35 percent of Virginia's 49,000 miles of rivers and streams. Virginia is one of the top five states in number of monitoring stations and size of its water-quality database. Because monitoring is expensive and budgets are limited, the Va. DEQ focuses its monitoring resources on areas where it considers water-quality problems most likely to occur. Future budgets and new monitoring techniques may, however, allow the DEQ to increase its coverage of the state's waters.

Monitoring data and other information are used to compile the state's *impaired-waters list*. The state's current list is in the December, 1998, draft report to the U. S.

EPA, required under Section 303[d] of the federal Clean Water Act. The 1998 report identified 240 impaired stream segments, covering 2,166 stream miles, as shown in the chart below. Impaired waters met one or more of the following criteria:

- water samples failed to meet one or more numerical water quality standards;
- biological monitoring indicated moderate to severe impairment;
- fish and shellfish restrictions had been issued by the Va. Dept. of Health (VDH).

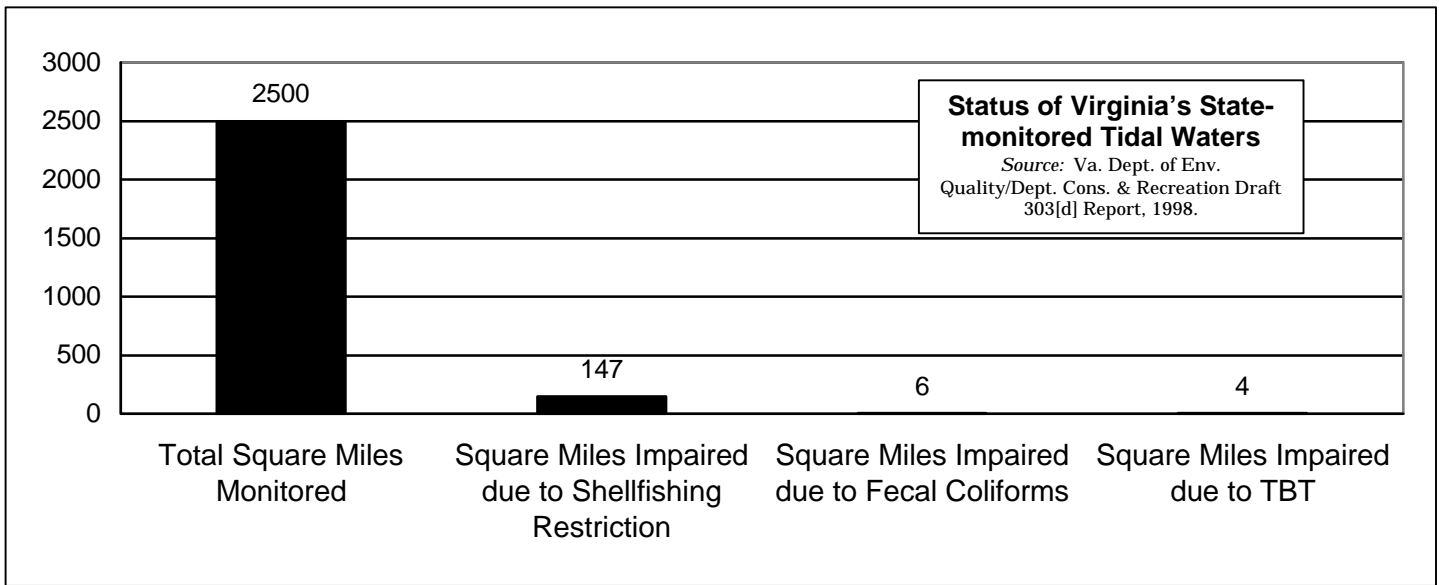
The report also identified 215 stream segments, totaling 1567 miles, of *threatened* waters. Threatened waters currently meet water-quality standards and support designated uses, but they show *some* evidence that the water quality is being stressed.



Tidal Waters Monitoring

Virginia's 1998 303[d] report also listed 157 square miles of impaired tidal or estuarine waters, as shown on the chart at the top of page 3. This is out of a total of 2500 square miles of such waters, including parts of the Chesapeake Bay, monitored by the Va. DEQ. The impairments were attributed to shellfishing restrictions designated by VDH; fecal-bacteria contamination; and sediments containing tributyltin (TBT), an anti-fouling paint for ships. The EPA, however, disputed Virginia's

decision not to include a large portion of the Chesapeake Bay on the 303[d] list. The EPA argues that the Bay should be listed because aquatic-resource goals are not being attained. The state has argued that there are no existing standards to trigger such a listing—that is, no *nutrient* (nitrogen and phosphorus) standards, the cause to which an impairment-listing would most likely be attributed. This matter is under discussion between the EPA and all of the Chesapeake Bay-watershed states.



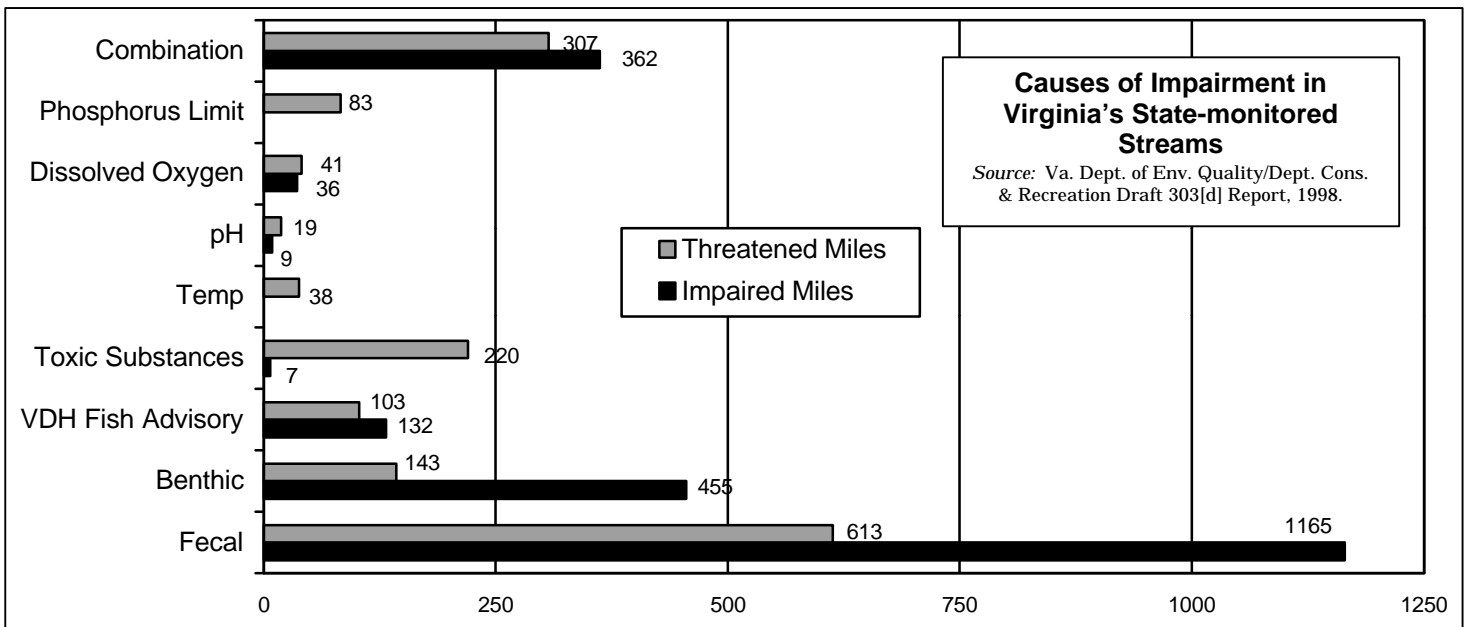
Impairment Causes

An impairment *cause* is the water-quality aspect not meeting state standards or not supporting a designated use for state waters. The causes of impairment in Virginia waters are shown in the chart below.

Fecal-coliform bacteria contamination and benthic-community degradation are the primary causes for Virginia streams being listed as impaired or threatened. *Fecal-coliform bacteria* in water indicates the water was contaminated by mammalian or bird feces, and consequently the water *may* harbor human pathogens. A stream's *benthic community* is the assortment of organisms

inhabiting the stream bottom; this community's status can indicate the overall health of an aquatic system.

Other impairment causes in the 1998 report were VDH *fish-consumption advisories*; *toxic substances* in sediments; high stream *temperatures*; *improper pH* levels (usually water being too acidic); low *dissolved oxygen*; and excessive *phosphorus* in permitted wastewater discharges. At this time, there are no standards for nitrogen or phosphorus in the state's waters (as opposed to the standards for *wastewater discharges*); if such standards were in place, relatively high amounts of these substances might cause more waters to be listed as impaired.

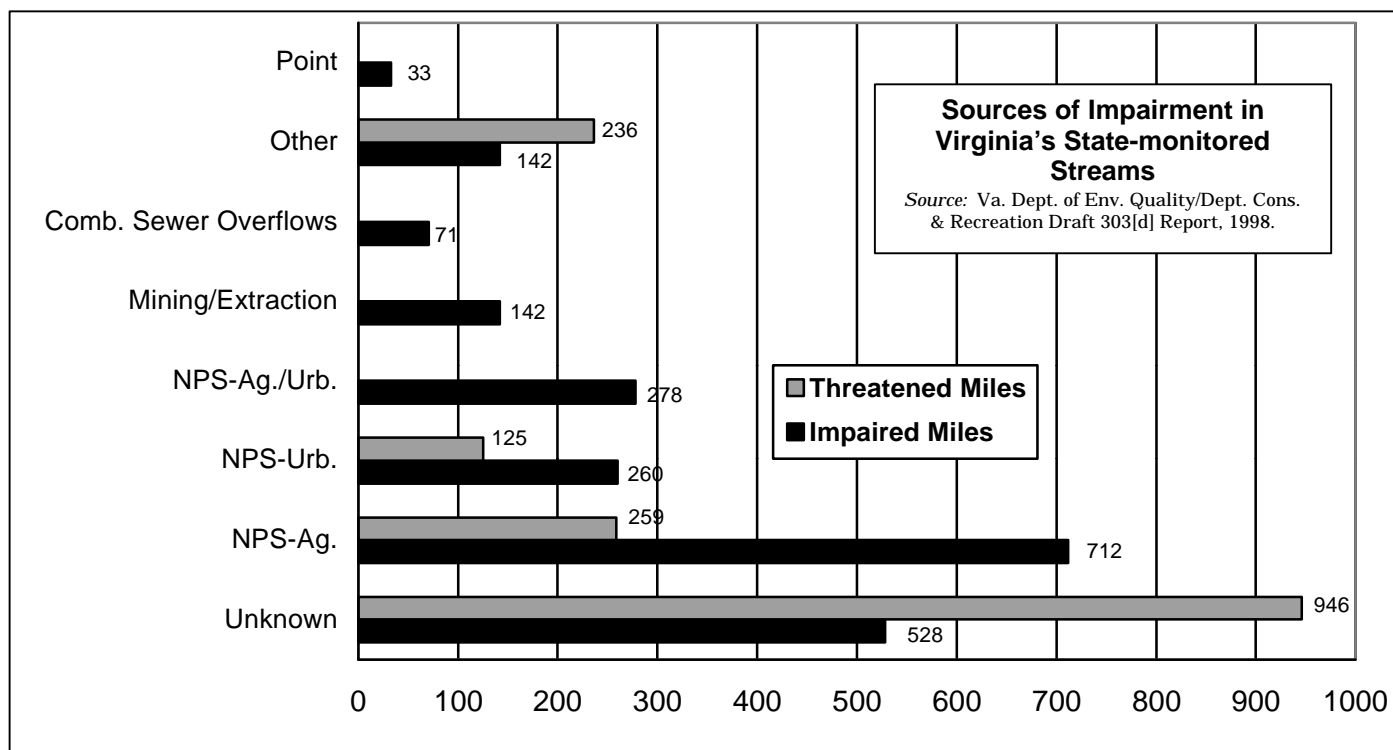


Impairment Sources

Sources of impairment are the activities or locations creating water-polluting materials. As shown in the chart below, sources of impairment in Virginia's streams are varied, and many sources of impairments listed in 1998 report are unknown.

Non-point sources (NPS) of pollution are the biggest known source of stream impairment; these sources include *agricultural* fields and animal facilities, along

with *urban* streets, lawns, and buildings. *Point* source discharges from industry and wastewater plants were the least common source of impairment. In between these two extremes were *mining and extractive activities*, primarily due to impacts on stream-water pH and the benthic community; *combined sewer overflows*, where stormwater enters the wastewater system and occasionally exceeds the capacity of the treatment plant; and *other known* sources not included in one of the named categories.



No Need to be "Impaired" by Too Little Information

The Va. DEQ intends to implement methods soon for improving the public's access to the data used to compile Virginia's 1998 303[d] report. The next impaired-waters report for Virginia is due to the EPA in 2000. Right now, you can find more information on Virginia's 1998 list at the EPA's Web-site:

www.epa.gov/owow/tmdl/states.

The Va. DEQ's Web-site—

www.deq.state.va.us/quality/303d.html—does not have the 1998 report, because the

report is still officially only a draft. The site does have the 1996 report, which contains useful and still pertinent background information.

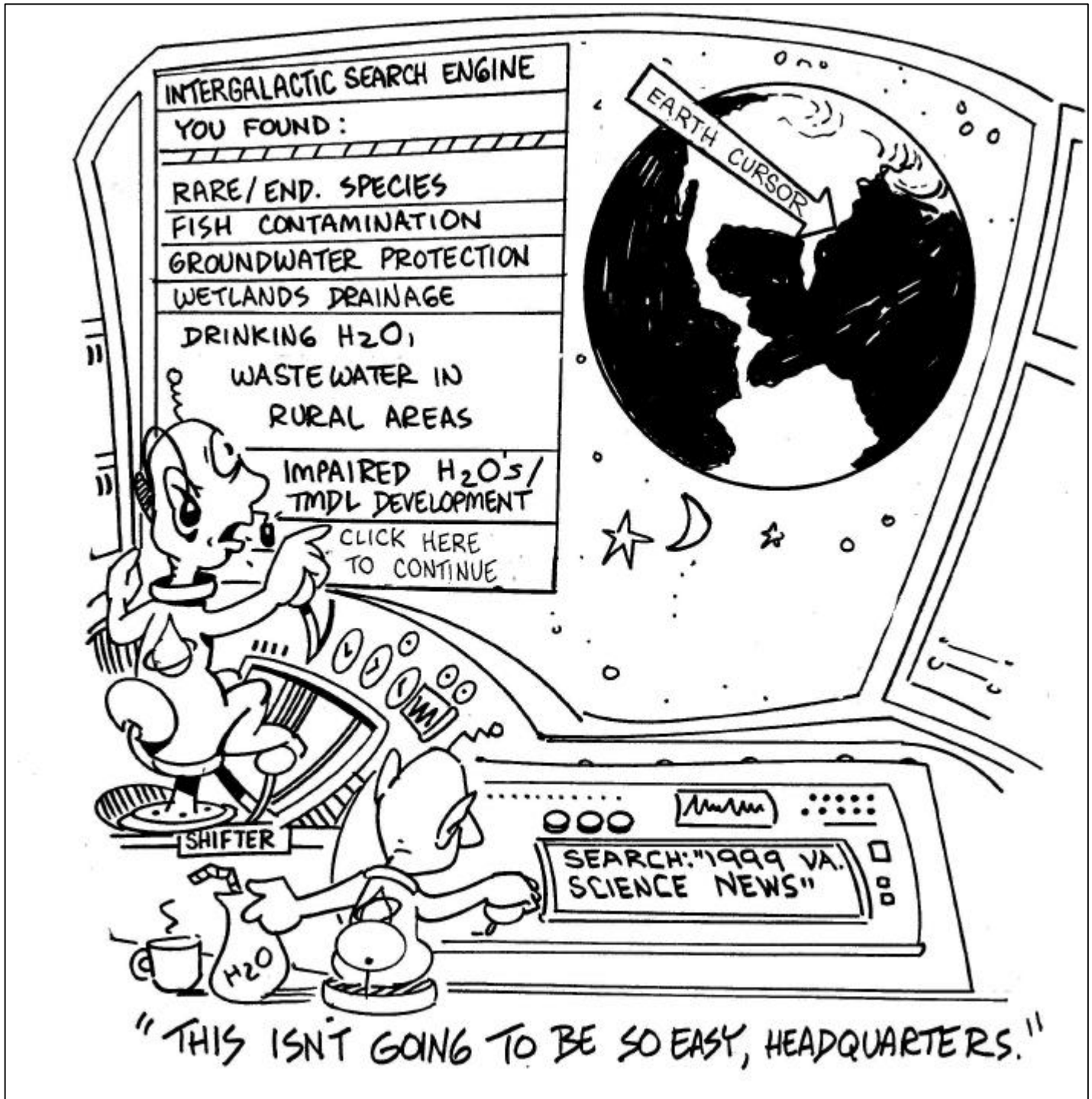
The Va. DEQ contact for information on the impaired waters list and the TMDL process is Charles Martin, (804) 698-4462; e-mail: chmartin@deq.state.va.us.

By the Water Center Staff

Water Central thanks the Virginia Dept. of Environmental Quality for providing data for this article.

SCIENCE FICTION BEHIND THE NEWS

Throughout Virginia and its neighboring states in 1999, water issues made news, challenging citizens to increase their awareness of the science underlying water-related news events. Observing our planet from a faraway galaxy, highly intelligent beings have decided to dispatch a team to provide scientific assistance on Virginia's water-related issues. We look in now as the space travelers approach their destination and their mission...



IN AND OUT OF THE NEWS

Newsworthy Items You May Have Missed

The following summaries are based on information in the source or sources indicated at the end of each item. Selection of this issue's items concluded December 7. Unless otherwise noted, all localities mentioned are in Virginia. If you have access to the Internet, you can follow water-related news with the "Daily News Update" at the Water Center's Web site (www.vwrrc.vt.edu).

In Virginia...

•To see some of the challenges localities face with their **water and wastewater-treatment infrastructure**, look to **Arlington County**.

On the *supply side*, the county has to replace 40-to-50-year-old valves controlling water distribution from two mains crossing the Potomac River. The valves are necessary to shut off parts of the mains for maintenance or emergencies.

On the *wastewater side*, a \$30-million renovation in 1998 to the treatment plant—converting the plant from a waste-incineration system to one where waste is hauled to farms for land disposal—did not control odor problems, according to nearby residents. Consequently, another multi-million dollar upgrade is now under consideration. Meanwhile, the county faces possible action from the Va. Dept. of Environmental Quality (Va. DEQ) for not monitoring stormwater quality as frequently as required, and for several recent accidental releases of partially treated sewage. To correct these problems, the county has had to purchase new stormwater-monitoring equipment, add staff, increase staff training, and construct a new \$5-million collector tank. (*Arlington Journal*, 9/29, 11/10, and 11/17/99; *Alexandria Journal*, 11/10/99)

•**Sanitary sewer overflows** is the collective name for releases of untreated or partially treated water from a wastewater facility, such as those noted in the Arlington County item above. Meeting in Williamsburg October 18-20, representatives from the U. S. Environmental Protection Agency (EPA), municipalities, state governments, and environmental groups agreed on draft regulatory language that would give local governments **limited legal protection for unavoidable overflows** (those caused by factors beyond the wastewater facility's control). (*Inside EPA's Water Policy Report*, 10/27/99)

•The **Loudoun County** Board of Supervisors has established an *ad-hoc* **committee of water and land specialists to investigate the county's water resources**. The action comes after some county areas experienced dry wells and

mandatory water restrictions in Summer 1999. Residents and elected officials are also concerned about the effect of the county's rapid development rate on water quantity and quality. With an estimated 67-percent population increase from 1990-98, Loudoun is Virginia's fastest-growing locality. (*Washington Post*, 10/7/99; Weldon Cooper Center for Public Service, 1/20/99)

•**Bedford County will purchase a 140-acre dairy farm** where groundwater was contaminated by methane gas, benzene, and vinyl chloride from a now-closed county landfill. The farm owners will drop two lawsuits in exchange for the \$1.3-million purchase. (*Hampton Roads Daily Press*, 10/13/99)

[For a previous item on this topic, please see the June 1999 *Water Central*, page 11.]

•**Lunenburg County** has adopted new **restrictions on hog farms**. One provision requires that hog waste be disposed of at least 3,000 feet away from a water source. (*Richmond Times-Dispatch*, 10/15/99)

•**Legal maneuvers over Total Maximum Daily Loads (TMDLs)** continue. [For background on TMDLs, please see the Feature article in the October 1999 issue of *Water Central*.] The Va. Association of Municipal Wastewater Agencies has asked the U. S. Court of Appeals for the Fourth Circuit to overrule Isat June's consent decree that settled a lawsuit against the EPA over Virginia's TMDL program. The appeal challenges the consent decree's requirement that EPA set the schedule for TMDL development in Virginia. (*Inside EPA's Water Policy Report*, 10/27/99)

As it stands now, that TMDL schedule for Virginia is "daunting" and will involve "millions of dollars," said Va. DEQ Director Dennis Treacy, speaking November 15 at the Virginia Water Research Symposium (sponsored by the Water Center). According to Clint Boschen of the Va. DEQ's Roanoke regional office, speaking in Blacksburg on December 3, the schedule requires TMDLs for 12 more stream reaches by 2000, 30

more by 2002, 55 more by 2004, 64 more by 2006, 69 more by 2008, and 70 more by 2010.

•A **\$1.5 million fine** has been levied on the Lone Mountain Processing Company of Lee County for **chemical contamination of the Powell River watershed in 1996**. The contamination, by iron and manganese from coal mining, killed 11,000 fish and may have harmed local freshwater mussels listed as endangered species. (Twelve species of mussels and clams occurring in Lee County are listed as federally endangered species, according to the Va. Dept. of Conservation and Recreation). The fine, imposed in U. S. District Court, will be used for the wastewater-treatment system around St. Charles, the town where the spill occurred. (*Associated Press*, 11/2/99)

•The **Citizens Wetland Advisory Committee** has recommended that, in order to reach Gov. James Gilmore's stated goal of expanding wetland acreage in Virginia, the state should do the following: hire 20 additional people; provide incentives for preserving wetland acres; and set new regulations on draining non-tidal wetlands.

The latter recommendation is a response to increased non-tidal-wetland drainage in Virginia and other states. The increases followed a federal appeals court ruling—the "**Tulloch Ruling**"—in June, 1998; the ruling stated that the U.S. Army Corps of Engineers has no authority to regulate ditching and draining in non-tidal wetlands, a process commonly referred to as "**Tulloch ditching**." Attorney General Mark Earley said in October, 1998, that the state currently has no authority to stop Tulloch ditching. (*Associated Press*, 11/2/99)

Meanwhile, in the Va. General Assembly, Del. Preston Bryant of Lynchburg plans to introduce legislation in January that would require a state permit before landowners drain non-tidal wetlands (permits are already required to *fill* non-tidal wetlands). In addition, the Commission Studying the Future of Virginia's Environment has formed a Tulloch Ditching Subcommittee; that subcommittee was scheduled to meet January 7, 2000, in Richmond. (*Associated Press*, 12/1/99)

The Tulloch-ditching issue is getting national attention, as well. In testimony in the U. S. Senate on October 13, EPA's Asst. Administrator for Water Charles Fox called for an amendment to the Clean Water Act that would create federal regulatory authority over Tulloch ditching. (*Inside EPA's Water Policy Report*, 10/27/99)

[For a previous item on this topic, please see the June 1999 *Water Central*, page 12.]

•**It's definitely a drought when it happens to you.** On average, about four percent of the United States is in a drought at any given time (according to an assessment tool known as the Palmer Drought Index). But in mid-August, 1999—in the midst of the 1999 drought—only about 2.8 percent of the country was in a drought, less than the long-term average. Unfortunately for Virginia and neighboring states, the "epicenter" of that 2.8 percent was the Middle Atlantic states. (Va. State Climatologist Pat Michaels, speaking at the Virginia Water Research Symposium, 11/15/99)

•Plans to fill **377 acres of wetlands near Suffolk and the Great Dismal Swamp**, as part of a proposed \$300 million landfill project, have been changed. The Southeastern Public Service Authority (SPSA) will now pursue a smaller project costing an estimated \$25 million and affecting only 12 acres of wetlands. SPSA handles much of the solid waste for the South Hampton Roads area. (*Norfolk Virginian-Pilot*, 11/23/99)

...and Elsewhere

•**Near-boiling water is being used to kill weeds** in Carrboro (Orange County), North Carolina. A machine dispenses a stream of hot water that melts protective leaf coatings on the unwanted plants. The town is testing the equipment as part of its policy to reduce or eliminate herbicides on town property. (*North Carolina WRR News*, July/Aug. 1999)

•The EPA on September 24 proposed a plan for reducing the amounts of **toxic chemicals in the Great Lakes**. The plan focuses on a group of substances called *bioaccumulative chemicals* (including, for example, mercury and DDT) that tend to accumulate, rather than decrease, over time in natural environments.

If approved after a 60-day comment period, the plan would prohibit discharging such chemicals into so-called *mixing zones* in Illinois, New York, Ohio, and Pennsylvania. Mixing zones are relatively small areas where chemicals mix with water and, hypothetically, become diluted enough to meet water-quality guidelines before the chemicals reach a main body of water. The EPA plan, however, maintains that the mixing-zone concept is unsound for bioaccumulative chemicals. This use of mixing zones has already been prohibited by Indiana, Michigan, Minnesota, and Wisconsin. (*Washington Post*, 9/25/99)

•In Tarboro (Edgecombe County), North Carolina, the **wastewater treatment plant may be**

moved to higher ground in order to avoid a repeat of the flooding and sewage overflows that Hurricane Floyd caused. The Tarboro plant is in the Tar River's 100-year flood plain. Gov. Jim Hunt has requested \$75 million from the federal government to move the Tarboro plant and one in Kinston (Lenoir County), which is on the Neuse River. (*Raleigh News & Observer*, 11/7/99)

•**Overflows from hog-waste lagoons** in North Carolina are receiving increased attention as a result of Hurricane Floyd-caused flooding. An estimated 40 lagoons flooded and another 400 lagoons held dangerously high levels of waste as of mid-October. The state has requested \$50 million of federal money to move 333 hog lagoons out of flood plains (or improve the lagoons' disposal equipment); state officials estimate 1000 lagoons eventually must be moved or re-equipped. (*Associated Press*, 10/6/99; *Raleigh News & Observer*, 10/14/99)

•Under recently signed legislation, **California** now requires foreign ships to **exchange their ballast water in mid-ocean**. The purpose is to reduce the import of *non-native*, or *exotic*, aquatic organisms. Many exotic species are able to flourish in a new environment, in which case they are become "*invasive*." Invasive exotic organisms can displace native organisms, clog water-intake facilities, and cause other damage. A mid-ocean, ballast-water exchange flushes out organisms picked up at the embarkation port; mid-ocean organisms taken on in the exchange are unlikely to survive in the coastal destination waters. Shipping-industry representatives and university researchers in Oregon and Washington state are watching California's experience and considering whether to lobby for such legislation in their states. (*San Jose Mercury News*, 10/10/99; *Inside EPA's Water Policy Report*, 10/27/99)

[For a previous item on this topic, please see the June 1999 *Water Central*, page 12.]

•Rock, soil, and other **material remaining after surface mining of coal may be deposited in only the smallest class of stream channels**, according to an October ruling by U. S. District Judge Charles Haden II. The ruling, in a lawsuit filed by the West Virginia Highlands Conservancy, stemmed from the judge's reading of a U. S. Office of Surface Mining regulation (implementing the 1977 Surface Mining Control and Reclamation Act) that prohibits surface-mining activities within 100 feet of streams. Under the ruling, so-called **valley fills** resulting from surface mining would be allowed only in *ephemeral* streams, very small channels that have

water only during or just after a rain. No new permits would be allowed for valley fills in *perennial* streams (ones that normally flow all year) or *intermittent* streams (ones that normally flow a certain portion of the year).

The ruling was criticized by W. Va. Gov. Cecil Underwood and the state's Congressional delegation, including Sen. Robert Byrd (D). Sen. Byrd proposed an unsuccessful amendment to November's federal-budget legislation that would have negated the ruling. The state's Division of Environmental Protection, which is now trying to determine how many operations would be affected, plans to appeal the ruling to the 4th U. S. Circuit Court of Appeals. (*Charleston Gazette*, 10/22, 10/24, and 11/19/99)

•**How do you know when it's time to clean the filter?** If the filter in question is an extremely thin membrane used to remove salts and microorganisms from water, you might eventually be able to use **acoustic technology** being investigated at the University of Colorado-Boulder. The technique uses high-frequency sound to detect deposits—referred to as *membrane fouling*—that reduce membranes' performance. Detecting fouling in this manner could reduce the time and costs of cleaning the membranes. (*Univ. of Colorado Office of News Services*, 11/1/99)

•**"Eye-witness" information about hurricanes** is the goal of a Clemson (S. C.) University project. On 10 homes on the South Florida coast, the researchers will install equipment to measure and record wind speed and air pressure inside a hurricane, if and when one strikes the area. Besides seeking basic data about storms, the researchers hope to learn how well certain home-protection measures withstand hurricane forces. The monitoring system is to be expanded eventually to additional homes in other hurricane-prone areas. (South Carolina Sea Grant's *Coastal Heritage*, Fall 1999)

•Finally, **what's "good for General Motors" might be good for General Delivery**: A company in Colorado Springs has invented an automobile oil consisting of various vegetable oils, including soybean oil. Agro Management Group's patent states that the product is "derived from a renewable source,...biodegradable..., and non-toxic to flora and fauna." The company predicts mass-production of the oil within about two years, potentially offering a new and lucrative market to farmers in Virginia and other states. (*Va. Farm Bureau News*, November 1999)

N O T I C E S


Virginia Association of Wetland Professionals Seminar Series

The Association is offering the following seminars during 2000:

- “An Exploration of the Legal Foundations of Wetland Regulation”—February 18.
- “Communities, Agencies, and Developers: A Role-Play”—May 12.
- “What Consultants are Required to Do, and What Really Works”—September 15.

The cost of each seminar is \$20 for Association members and \$25 for non-members. To reserve a seat, contact Magi Shapiro, P. O. Box 85, Montpelier, VA 23192; (804) 883-6337.

Virginia Millennium Water Conference '00

The annual conference sponsored by the Va. Lakes and Watersheds Association will be held March 12—14 in Fredericksburg. For more information, call (703) 642-5080; e-mail: kyoung@gky.com;  www.gky.com/vlwa.

Rural Water Flows into the 21st Century

The annual conference of the Va. Rural Water Association will be held March 20—22 in Williamsburg. For more information, call VRWA at (540) 261-7178; fax (540) 261-2465;

 www.nrwa.org/vrwa.

At the Water Center


•Small Water Systems Web-site

The Water Center has created the Virginia Small Water Systems Web-site to provide current information to and communication among operators, state agency personnel, and others interested in small water systems (systems serving fewer than 3,300 people). Links to other Web-sites can help viewers expand their search for information, and the Online Help page allows users to post questions and receive answers. You can find this site at www.vwrrc.vt.edu/sws. For more information about the Web-site, contact Jane Walker at the Water Center, (540) 231-4159; e-mail: janewalk@vt.edu.

•Virginia Water Monitoring Council

The first organizational meeting of the Virginia Water Monitoring Council was held on November 16, 1999, in Richmond. Approximately 50 people attended the meeting, including agency staff members, industry representatives,

educators, members of non-profit organizations, and other individuals. The Council's purpose is to help coordinate water-monitoring programs and efforts in all of Virginia's water environments.

To join the Council or to learn more about its goals and activities, please contact the Water Center, as follows: Tamim Younos, (540) 231-8039, e-mail: tyounos@vt.edu; or Jane Walker, (540) 231-4159, email: janewalk@vt.edu;  www.vwrrc.vt.edu.

•New Publication

A Guide for Financing and Rate-Setting Options for Small Water Systems. Special Report SR-17-1999.

Single copies are free to Virginia residents while the supply lasts; there is a small charge for out-of state residents. Contact the Water Center at (540) 231-5624; e-mail: water@vt.edu.

•New Service-Learning Collaboration

The Virginia Tech Service-Learning Center has given the Water Center \$500 to support student participation in stream water-quality research. The goal of the project, entitled “An Interdisciplinary Study of Water Quality and Stream Biota in the Stroubles Creek,” is to give students the chance to investigate relationships among stream water quality, stream-bed conditions and organisms, and stream fish. Stroubles Creek (a tributary of the New River) flows through Blacksburg, the Virginia Tech campus, and other parts of Montgomery County. The project director is Tamim Younos, associate director of the Water Center.

•New Water-quality and Wetlands Videotapes Available for Loan

The Water Center has available for loan the following new videotapes:

- 1) “**TMDLs and Water Quality Standards**,” running time 22:00, produced by the U. S. EPA, 1999; and
- 2) “**Use of Constructed Wetlands for Stormwater Runoff**,” running time 19:10, produced by the Educational Television Center at Cornell University, 1999.

To borrow a videotape for a two-week period (extensions available upon request), please contact the Water Center at (540) 231-5624; e-mail: water@vt.edu. There is no charge to borrow videotapes, but the borrower is responsible for return postage.

FOR THE RECORD



Sources for Selected Water Resources Topics

Water Law and Water Rights

Water law (like other areas of law) comprises two main types: **statutory law** (law created by legislation), and **common (or case) law** (law based on historical and judicial precedents). Adding to the complexity are the three levels of lawmaking: federal, state, and local (local laws are normally referred to as “ordinances”). Finally, Native American tribes have certain water rights deriving from treaties and other documents, and lands and water on reservations are subject to tribal regulation. (There are two Virginia reservations, both in King William County.)

The water-law sources below are listed from most general to most detailed; higher numbers indicate the source is for lawyers or determined non-lawyers. For each source, symbols indicate the type of law (statute or common) and level (federal, state, local, tribal) covered by the source.

Symbols used:

Statutes = ; Common (case) law = 

Federal level = **F**; State level = **S**;

Local level = **L**; Tribal level = **T**

F

1. *Hydrology: An Environmental Approach*, by Ian Watson and Alister Burnett, 1996. Appendix 2 of this textbook is a short (20 pages), readable, and informative introduction to water law. It includes discussion of federal environmental laws. Published by CRC Press, Boca Raton, Fla.

F S T

2. *Water Law in a Nutshell*, 2nd Edition, by David H. Getches, 1990; 459 pages. According to one of our reviewers for this section, this is the “best overall resource [on water law] for non-lawyers.” Published by West Publishing Co., St. Paul, Minn.


L

3. *Water Resources Management in Virginia and the Role of Localities*. This 68-page booklet is Volume B of the 10-volume *Sourcebook for Local Water Resources Management*, published in 1991-92 by the Va. Tech College of Architecture and Urban Studies. Although somewhat dated now, this document still provides a good overview of what Virginia localities can, must, and cannot do regarding their water resources. Contact CAUS, (0205), Blacksburg, VA 24061; (540) 231-6416.

We are not aware of any compilation of local Virginia ordinances dealing with water. For help finding such information, try contacting the Va. Assoc. of Counties (VACO), 1001 E. Broad Street, Ste. LL 20, Richmond, VA 23219-1928; (804) 788-6652; e-mail: Mail@vaco.org; or the Va. Municipal League (VML), P. O. Box 12164, Richmond, VA 23241; (804) 649-8471; e-mail: e-mail@vml.org.


L

4. A Web-site by the U. S. EPA provides tools, sample language, and real-life examples of local water-quality ordinances nationwide.


 → www.epa.gov/owow/nps/ordinance/.

S


5. *Water Rights of the Eastern United States*, 1998; 149 pages. Focuses on 31 eastern states, including Virginia, falling under the riparian-rights doctrine. Published by Amer. Water Works Assoc., Denver, (800) 926-7337;

 → www.awwa.org.

F


6. *Congressional Quarterly*. Congressional Quarterly, Inc., publishes various journals and books on the federal legislative process. *CQ Weekly* reports on all major bills currently before Congress. Check your local public library, or contact CQ, Inc., Washington, D.C., (202) 728-1863;  → www.cq.com/.

F S


7. *Environmental Law Reporter*. A wide-ranging monthly publication “written by attorneys, for attorneys.” Published by Environmental Law Institute (ELI), it includes news, analysis, and reference material on federal and state environmental laws, litigation, agency actions. Check your local library, or for subscription information contact ELI, Washington, D.C., (202) 939-3800;  → www.eli.org.

F S T

9. *Waters and Water Rights*, edited by Robert E. Beck, 1991 (updated annually). This seven-volume set covers topics from “Abandonment of Rights” to “Taste of Water.” The Cumulative Index lists statutes discussed by state, so you can locate Virginia laws and the relevant *Virginia Code* section. Look for this comprehensive resource at your library. Published by Lexis


Publishing Co., Charlottesville, Va., (800) 446-3410;  www.lexis.com.

 **S**

10. *Code of Virginia of 1950*. The multi-volume *Virginia Code* (some 25 books) includes all the laws passed by the Virginia General Assembly. The *Code* is well indexed, and the Index itself includes useful instructions for finding your topic of interest. An electronically searchable version is available at the following Internet address:  leg1.state.va.us/. Paper copies of the *Code* are available at many public libraries.

 **F**

11. *U. S. Code*, containing the statutes passed by Congress. It is arranged by a series of 50 subject areas, called *titles*. Water-related laws are located in various titles (such as Title 16, Conservation, or Title 43, Public Lands). You can find printed copies of the *Code* at larger libraries, but if you

have access to the Internet, try using the Web-site maintained by the Legal Information Institute of the Cornell University Law School:  www4.law.cornell.edu/uscode/.

Water Central thanks William Cox and Jesse Richardson, both faculty members at Virginia Tech, for their assistance with this section.

Upcoming “For the Record” Schedule

2000

February – Following the Va. General Assembly
 April – Following State Water Regulations
 June – Following Federal Water Regulations
 August – Water Maps: Types and Sources
 October – Drinking-water Information Sources
 December – Water-quality Information Sources

Schedule subject to change

TEACHING WATER
 For Virginia’s K-12 teachers

This Issue and the Virginia Standards of Learning


In this section, *Water Central* suggests Virginia Standards of Learning (SOLs) that the “Feature” and “For the Record” parts of this issue may support. We welcome teachers’ comments on the applicability of these articles to the SOLs listed or to others.

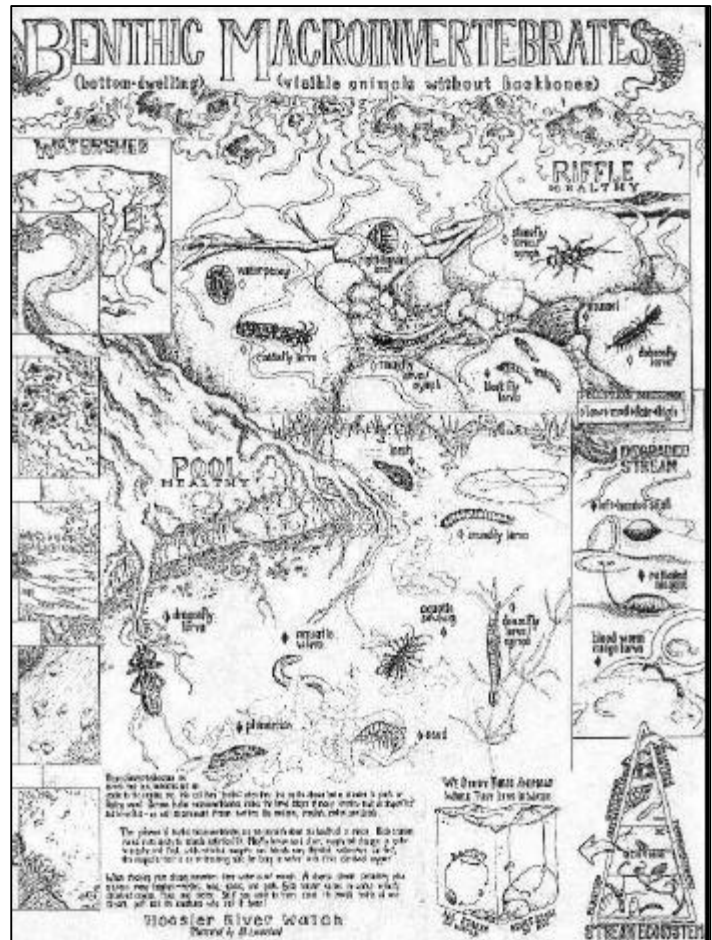
Abbreviations: **BIO**-biology, **ES**-earth science, **LS**-life science

Feature Article—Impaired-waters Graphs
 Science SOLs: 6.11, LS.12, ES.9, BIO.9.
 Social Studies SOLs: 7.2, 7.4, 12.6, 12.7.

For the Record—Water Law
 Computer/Technology SOLs : C/T 8.4.
 Social Studies SOLs: 7.2, 7.4, 11.1, 11.15, 12.6, 12.7, 12.8, 12.9, 12.16.

Teaching about Streams or Invertebrates?

A 16”x 22” color poster of the picture to the right is available from the Va. Dept. of Env. Quality. Contact Marcy Judd, (804) 698-4198, e-mail: marjoriecjudd@deq.state.va.us. 



Virginia Water Central

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