

Virginia Water Central

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For generations, Loudoun County residents have seen groundwater become surface water at Leesburg's Big Spring, shown here on December 10, 2006. For information on recent water levels throughout Virginia, please see the Water Status Report.

FEATURE ARTICLE

The Supreme Court Again Stirs the "Waters of the United States"

By Jesse Richardson

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[Ed. note 2/19/07: This article provides factual information but also presents the author's viewpoints on recent Supreme Court cases and related issues of law. As with all opinions expressed by guest authors, the opinions expressed in this article are not necessarily those of *Water Central*, the Virginia Water Resources Research Center, or Virginia Tech. *Water Central* invites readers to submit opposing viewpoints for possible publication.]

Introduction

Rapanos v. United States (547 U.S. ___, 126 S.Ct. 208 [2006]) represents the U. S. Supreme Court's most recent attempt to determine the **jurisdiction** under Section 404 of the Clean Water Act (CWA) of the United States Army Corps of Engineers (Corps) over wetlands. The case involved two decisions by the U.S. Court of Appeals for the 6th Circuit: *United States v. Rapanos* (376 F.3d 629, 6th Cir. 2004), and *Carabell v. U.S. Army Corps of Engineers* (391 F.3d 704, 6th Cir. Mich., 2004). [Ed. note: At the end of the article, please see sections on legal citations and key terms from the CWA.]

Prior to *Rapanos*, the United States Supreme Court had ruled upon two cases that help delineate the outer boundaries of the Corps' jurisdiction over wetlands. In *United States v. Riverside Bayview Homes, Inc.* (474 U.S. 121, 1985), a unanimous Court found that wetlands "adjacent" to navigable waters fall within the jurisdiction of the Section 404 of Clean Water Act (CWA). The wetlands at issue in *Riverside Bayview* had a groundwater connection to adjacent navigable waters, but the decision failed to explain whether the *wetlands* actually abutted the navigable waters or were close by.

ALSO IN THIS ISSUE

Hear ye! The 2007 Virginia General Assembly is in session January 10 to February 24. *Water Central* will post online updates about water-related legislation. For details, please see page 27.

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S² on H₂O



By Stephen Schoenholtz, Director
Virginia Water
Resources Research
Center

Have you heard of **landcare**? I recently spent a lively two days with citizens and

agency representatives involved in this new land-management initiative in Grayson County and in the Catawba Valley near Roanoke. We had much discussion and encouragement that this grassroots approach can sustain and improve local communities, cultures, economies, and resources in a variety of settings.

Landcare (sometimes written “LandCare”) is a community-based conservation approach to land management. It aims to develop environmental, social, and economic benefits through a voluntary process involving citizens, government, and businesses. Landcare originated over 20 years ago in Australia, where more than 5000 landcare groups now exist. Groups have also formed in the Fiji, Germany, Kenya, New Zealand, the Philippines, South Africa, Tanzania, Uganda, and the United Kingdom.

Water quality and quantity are usually fundamental considerations of the landcare approach, and this is certainly the case in Grayson County and the Catawba Valley. In these localities, one goal is to improve water quality by restoring streamside buffers and implementing other best management practices as a part of progressive cattle farming. Such community-based approaches to sustainable land management are very encouraging as examples of *integrated* watershed management—that is, addressing how land uses affect water resources.

A Landcare Center has recently been established at Virginia Tech. Its mission is to develop landcare as an effective resource-management option through support of local landcare groups, coordination of a regional learning network to define best landcare practices, and development of a landcare training program. The Water Center will be working closely with the Landcare Center in the interest of promoting sound management of water resources.

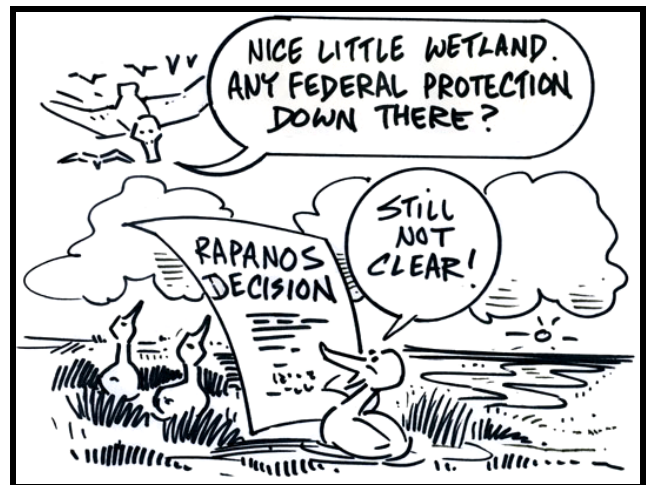
For more information on landcare, please visit www.landcarecenter.org.

Feature Article, cont. from page 1

In *Solid Waste Agency of Northern Cook County v. the United States Army Corps of Engineers* (531 U.S. 159, 2001)—usually referred to as the *SWANCC* decision—the Supreme Court considered the case of “isolated” water bodies. The water bodies at question had no hydrologic connection whatsoever to navigable waters and were not “adjacent” to such waters (in the sense of the *Riverside Bayview* decision), but the Corps maintained that use of the waters by migratory birds qualified the waters for CWA jurisdiction.¹ The Court, however, found that Congress had failed to give the Corps the authority to regulate such wetlands.

These two cases set the stage for *Rapanos*: isolated wetlands fall outside of the CWA, while adjacent wetlands are covered. Courts began to consider cases involving distant connections between wetlands and navigable waters, often consisting of miles of non-navigable ditches and drains. Do such wetlands fall within the protections of Section 404 of the CWA? The *Rapanos* case promised to answer this question.

In this article, I explain the various “tests” put forth in the *Rapanos* case—that is, the tests by which federal agencies and courts can decide if wetlands or other waters fall within CWA jurisdiction. Problems arise from each test, and I offer arguments why each test is wrong. I conclude with some thoughts on how to remedy this confusing situation.



¹ The rationale for this so-called Migratory Bird Rule was that migratory birds can be a factor in interstate commerce (for example, hunters may generate interstate commerce in pursuit of migratory waterfowl). The U.S. Constitution’s Interstate Commerce Clause is a key legal foundation for the CWA. This is discussed in more detail later in the article.

The Rapanos Decision

Facts of the Two Cases

As noted above, the Supreme Court's *Rapanos* decision addressed two cases from the 6th Circuit Appeals Court.²

The facts of the first case, *United States v. Rapanos*, began in April 1989, when John A. Rapanos deposited fill material without a permit into wetlands on three sites near Midland, Michigan. Wetlands at the Salzburg site on Rapanos' property were connected to a man-made drain that empties into Hoppler Creek. Hoppler Creek flows into the Kawkawlin River, which empties into Lake Huron's Saginaw Bay. Wetlands at the Hines Road site connected to "Rose Drain," which has a surface connection to the Tittabawassee River, a tributary of the Saginaw River, which also empties into Saginaw Bay. Wetlands at the Pine River site have a surface connection to the Pine River, a tributary of the Tittabawassee River. It was unclear from the facts presented in decisions by the District or Appeals courts whether connections between the wetlands and nearby drains and ditches—or the ditches and drains themselves—were **perennial** or **intermittent** (that is, with continuous or occasional flow).³ The District Court found the wetlands were subject to CWA jurisdiction because they were "adjacent" to other waters of the United States. The Sixth Circuit affirmed, finding "hydrological connections between all three sites and corresponding adjacent tributaries of navigable waters."

The facts of the second case, *Carabell v. U.S. Army Corps of Engineers*, began in 1993, when Keith and June Carabell sought a permit from the Michigan Department of Environmental Quality (MDEQ)—which has assumed permitting functions of the Corps—to fill in wetlands and construct 130 condominium units. The parcel in question consists of some 19.6 acres, 15.9 of which were forested wetlands. The property is located roughly one mile from Lake St. Clair, a 430-

square-mile lake located between Michigan and Canada, which is popular for boating and fishing. The longest side of the parcel runs from northeast to southwest alongside a man-made berm that separates the wetlands on the property from a ditch. Under pre-existing conditions—that is, without the deposit of fill in the wetlands that the landowners proposed—the berm ordinarily (if not always) blocked surface-water flow from the wetlands into the ditch. Near the northeast corner of the property, the ditch connects to the Sutherland-Oemig Drain, which carries water continuously throughout the year and empties into Auvase Creek; Auvase Creek, in turn empties into Lake St. Clair. At its southwest end, the ditch connects to other ditches that also empty into Auvase Creek.

The MDEQ denied the Carabell's permit request, but a state administrative law judge directed the agency to approve an alternative plan (proposed by the Carabells) that involved the construction of 112 units. This proposal called for filling in 12.2 acres of the property while creating retention ponds on 3.74 acres. The Corps of Engineers then claimed jurisdiction. The Carabells filed suit in United States District Court, challenging the Corps' claim of jurisdiction. The District Court upheld the claim of jurisdiction, stating that the wetland "is adjacent to neighboring tributaries of navigable and has a significant nexus to 'waters of the United States.'" ("Significant nexus" was the term used in the Supreme Court's SWANCC decision in 2000 to guide questions of CWA jurisdiction.) The 6th Circuit Appeals Court affirmed the District Court's decision.

Summary of the Decision

The Supreme Court agreed to review the *Rapanos* and *Carabell* cases (which were combined into one decision) to address two questions. The first question was whether the wetlands at issue are "waters of the United States" under the CWA, and, thus, subject to jurisdiction and permitting requirements under the CWA's Section 404. The second question was whether the Section 404 wetland regulation is constitutional at all.

The Court split 4-4-1 in this decision: four justices voted to **remand** the case (that is, send it back to the 6th Circuit for further consideration); one agreed to remand the case but for reasons different from the other four; and four voted to affirm the 6th Circuit decision. Because five justices agreed to remand the case, that was the Court's **holding**, accompanied by three main

² As of 1/3/07, the text of the *Rapanos* decision was available online at the Supreme Court's Web site, at www.supremecourtus.gov/opinions/05pdf/04-1034.pdf. The facts presented here paraphrase accounts provided in Justice Anthony Kennedy's concurring opinion.

³ **Perennial** streams tend to flow all year round (except in drought conditions). **Intermittent** streams typically flow after precipitation and when the groundwater table is relatively high but do not flow in relatively dry periods of the year. A third class of streams called **ephemeral** streams flow *only* during or just after precipitation. In practice, it can be difficult to make these distinctions.

opinions.⁴ Chief Justice John Roberts and Justices Samuel Alito, Antonin Scalia, and Clarence Thomas voted to remand the case and joined in a plurality opinion written by Justice Scalia (Chief Justice Roberts also wrote a brief concurring opinion). Justice Anthony Kennedy proved to be the swing vote, concurring in the holding but writing a very different opinion from Justice Scalia on the test required for a wetland or other water body to be considered part of the “waters of the United States.” Finally, Justice John Paul Stevens wrote a vigorous dissent, joined by Justices Stephen Breyer, Ruth Bader Ginsburg, and David Souter.

With this 4-4-1 split, the Court failed to answer definitively either question at issue in the case. Let’s examine how the opinions addressed “waters of the United States” and the constitutionality of the CWA’s Section 404.

Plurality Opinion

Justice Scalia identified that a significant part of the problem lies in the language used by Congress in Section 404 of the CWA (33 USC §1344(a)) that authorizes Corps to regulate “the discharge of dredged or fill material into the navigable waters....” Section 502(7) of the CWA (33 USC §1362(7)) defines “navigable waters” as “waters of the United States, including the territorial seas.” Unfortunately and predictably, Congress failed to define the term “waters of the United States.”

In addition, the Commerce Clause of the United States Constitution limits authority under the CWA. The Commerce Clause grants Congress authority “to regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes.” Accordingly, regulation under the CWA must address some activity that affects, or could reasonably be expected to affect, interstate commerce.

⁴ A Supreme Court decision consists of two basic parts. The **holding** is the action ordered by the court. Referring to the decision of the lower court(s), holdings usually are to affirm the lower court decision, reverse the decision, remand the case (send back to the lower court for further action), or a combination of these. **Opinions** are the commentaries that accompany the action and explain why justices voted how they did. If a majority agrees upon the holding and the reasoning, one member writes a **majority** opinion; those who disagree with the holding issue a **dissenting** opinion. If, however, a majority agrees to the holding but *less than* a majority agrees on the reasoning for the holding (as in the Court’s *Rapanos* decision), a **plurality** opinion will accompany the holding. Members who agree with the holding but not with the reasoning write a **concurring** opinion.

Justice Scalia attempted to provide definitional clarity to “waters of the United States.” To do so, he resorted to Webster’s *New International Dictionary*, 2d ed. (1954). Justice Scalia concluded that waters of the United States could “not include channels through which water flows intermittently or ephemerally, or channels that periodically provide drainage for rainfall.” But this conclusion is confusing because Justice Scalia notes in footnote 5 that a seasonal river could be within the Corps’ jurisdiction. As in its 2001 *SWANCC* decision, the Court again found itself vexed by the Corps’ interpretation of Section 404 that “stretches the outer limits of Congress’ commerce power.”

Justice Scalia’s opinion set out the test for jurisdiction under Section 404 as “whether the ditches or drains near each wetland are ‘waters’ in the ordinary sense of containing a *relatively permanent flow* [emphasis added]; and [if they are] whether the wetlands in question are ‘adjacent’ to these ‘waters’ in the sense of possessing a continuous surface connection....”

Kennedy’s Concurring Opinion

Justice Kennedy’s concurrence called for the cases to be remanded to the Court of Appeals for “proper consideration of the significant nexus requirement” identified in the 2001 *SWANCC* decision. Justice Kennedy’s jurisdictional test would be as follows: “...to constitute ‘navigable waters’ under the Act, a water or wetland must possess a ‘significant nexus’ to waters that are or were navigable in fact or that could reasonably be so made.” Asserting that the nexus must be in regards to the goal of the CWA to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (33 USC §1251(a)), Justice Kennedy states that “...wetlands possess the requisite nexus, and thus come within the statutory phrase ‘navigable waters,’ if the wetlands, either alone or in combination with similarly situated lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as ‘navigable.’ When, in contrast, wetlands’ effects on water quality are speculative or insubstantial, they fall outside the zone fairly encompassed by the statutory term ‘navigable waters.’”

Dissenting Opinion

Justice Stevens’ dissent gives **deference** to the findings of the Corps; in this way, Justice Stevens follows a precedent by which the Court has ruled that courts should defer to federal

agency decisions so long as the interpretation of the agency is reasonable and is not foreclosed by Congress.⁵ Justice Stevens states, “In my view, the proper analysis is straightforward. The Army Corps has determined that wetlands adjacent to tributaries of traditionally navigable waters preserve the quality of our Nation’s waters by, among other things, providing habitat for aquatic animals, keeping excessive sediment and toxic pollutants out of adjacent waters, and reducing downstream flooding by absorbing water at times of high flow. The Corps’ resulting decision to treat these wetlands as encompassed within the term ‘waters of the United States’ is a quintessential example of the Executive’s reasonable interpretation of a statutory provision.”

Why All of the Tests in *Rapanos* are Wrong

Plurality Opinion

To reiterate, the plurality states the test for whether wetlands are subject to CWA Section 404 jurisdiction as follows: “whether the ditches or drains near each wetland are ‘waters’ in the ordinary sense of containing a relatively permanent flow; and (if they are) whether the wetlands in question are ‘adjacent’ to these ‘waters’ in the sense of possessing a continuous surface connection....” Case law provides no precedent regarding the opinion’s assertion that a permanent flow is necessary. But precedent does exist regarding the assertion that a *surface* connection is necessary: this requirement is *contradicted* by an earlier Supreme Court ruling. The wetland in question in the 1985 *Riverside Bayview* decision had a *groundwater* connection to the navigable water, and the Court unanimously found this wetland to be a “water of the United States.” **The plurality’s requirement of a surface connection, therefore, conflicts with established case law.**

Justice Kennedy’s Concurring Opinion

As noted above, Justice Kennedy’s test for CWA Section 404 jurisdiction over wetlands is that wetlands must possess a “significant nexus” with navigable waters by significantly affecting “the chemical, physical, and biological integrity of

other covered waters more readily understood as ‘navigable.’” The problem with this opinion is the reliance on the “significant nexus” term. As the plurality noted, Justice Kennedy takes a phrase mentioned in “SWANNC’s cryptic characterization of the holding of *Riverside Bayview*,” makes it the test, then makes the phrase unrecognizable to the context in which it was used.

Kennedy states that the *Riverside Bayview* decision “implies” the significant nexus requirement. In fact, the “significant nexus” test is not found within *Riverside Bayview*. In addition, the text of the CWA makes no mention of a significant nexus test. **Accordingly, the plurality is on firm ground in finding that Justice Kennedy’s significant nexus test is a slender reed.** Moreover, Justice Kennedy fails to give guidance on how the significant nexus test should be applied, leaving courts to decide on a case-by-case basis and leaving the regulated community nothing but doubt.

Dissenting Opinion

The dissent would give deference to the Corps and allow that agency to regulate in basically any situation it saw fit. The dissent, however, does not address the issue raised by the plurality that current Corps interpretation and application of Section 404 extends federal jurisdiction over much of the land in the United States and into areas that have generally been state and local matters. The plurality correctly characterizes the dissent’s test as extending jurisdiction to virtually any puddle of water in the United States. **The dissent fails to address the limitations imposed by the Commerce Clause of the Constitution** (if indeed the dissent would impose *any* limitations). This degree of deference invites the Corps to start down an extremely slippery slope.

Cases Interpreting *Rapanos*

Since the June 2006 *Rapanos* ruling, lower courts have begun considering the decision in relevant cases. Three examples follow.

In *U.S. v. Chevron Pipeline Co.* (437 F. Supp. 2d 605, 2006), the district court for the Northern District of Texas applied a test first set forth by the U.S. Court of Appeals for the 5th Circuit in the 2003 *Needham* decision (354 F.3d 340, 2003). Of all the federal appeals courts, the 5th Circuit court has issued the most *restrictive* definition of waters of the United States, holding that tributaries of navigable waters that are not themselves navigable cannot be jurisdictional

⁵ For examples of Supreme Court deference to agency decisions, see particularly *Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, (467 U.S. 837 [1984]) and the 1985 *Riverside Bayview* decision mentioned at the beginning of this article.

under Section 404. In support of its position in *U.S. v. Chevron Pipeline Co.*, the Texas district court cited the *Rapanos* plurality opinion, noting the lack of consensus. The district court found Justice Kennedy's "significant nexus" test impossible to apply, stating, "This test leaves no guidance on how to implement its vague, subjective centerpiece. That is, exactly what is 'significant' and how is a 'nexus' determined?" Finding no guidance in *Rapanos* beyond the Chief Justice's advice that courts make their way on a case-by-case basis, the Texas district court held that, "as a matter of law in this circuit, the connection of generally dry channels and creek beds will not suffice to create a 'significant nexus' to a navigable water simply because one feeds into the next during the rare times of actual flow."

In the U.S. Court of Appeals for the 9th Circuit, the court relied on *Rapanos* to affirm an earlier decision that applied the significant nexus test (*Baccarat Fremont Developers, LLC v. U.S. Army Corps of Engineers*; 425 F.3d 1150, 1157-58, 2005). The court explained that, when there is no majority opinion from the Supreme Court, the lower courts are required to select the narrowest grounds set forth by a justice concurring in the judgment.

In *Northern California River Watch v. City of Healdsburg* (457 F.3d 1023, 2006) the 9th Circuit again applied *Rapanos*, this time in a wetlands decision in Northern California. The case involved a 58-acre pond along the Russian River but separated from the river by a levee. There was no dispute that the Russian River is a navigable water, and the 9th Circuit found that there was a significant nexus between the pond and its wetlands and the river, thereby making the pond subject to CWA jurisdiction.

The Future of Section 404 of the Clean Water Act

The Supreme Court essentially has been asked in *Rapanos* and previous cases to draw a "bright line" delineating wetlands subject to federal jurisdiction. No easy or logical line exists.

Plurality decisions, as Chief Justice Roberts noted in his brief concurrence, always leave the lower courts with little guidance. Justice Stevens suggested that if on remand the 6th Circuit finds that either the plurality's test is satisfied or Justice Kennedy's test is satisfied, then the 6th Circuit should reinstate its judgments in these cases. This may be all the guidance that can be had from this Court, because it would make little sense for the Court to take another case involving

jurisdiction under Section 404 so long as it remains so deeply divided.

The root of the wetlands jurisdiction problem lies with Section 404 itself. Section 404 did not originally intend to encompass wetlands. An excellent law review article in the *North Dakota Law Review* describes the convoluted history of the Section 404. In the article, Sam Kalen explains that the precursors to Section 404 regulated commerce and water transportation. This focus stemmed from the limitation on Congress by the Commerce Clause of the Constitution, as has been described above. Since the passage of Section 404 in 1972, the courts and regulatory agencies have struggled to reconcile the limited authority of Congress with the desire to regulate all wetlands, regardless of the link to interstate commerce. Congress simply lacks the authority. Under the Constitution, the authority to regulate land use and environmental issues lies with the states. We are essentially attempting to fit a square peg into a round hole.

The recent cases amount to an invitation from the Supreme Court to Congress to fashion a resolution. The *SWANNC* case found that Congress had not given the Corps authority to regulate isolated wetlands. The *Rapanos* case indicates the total state of confusion existing as to the scope of Section 404's reach. These circumstances cry out for Congressional intervention. So far, however, Congress has reached no agreement on any intervention. For example, the "Clean Water Authority Restoration Act" (H.R. 1356 and S. 912) was introduced in Congress in early 2005.⁶ The act would remove from the CWA the term "navigable waters" and replace it with "waters of the United States" (as defined by the bill). The bills did not move out of their respective committees during the 109th Congress (2005-06), and they would have to be reintroduced in the new Congress (which convened January 4, 2007).

Another possibility is for the Corps to clarify the question through further regulation. In fact, Chief Justice Roberts wrote in his concurring opinion that the Corps should have revised its regulations after the 2001 *SWANCC* decision to have avoided *Rapanos*, and Justice Breyer urged the Corps to rewrite the regulations immediately. But given the limits of federal authority under the

⁶ Information on this bill and any of Congressional action is available at the Library of Congress' legislative information Web site, <http://thomas.loc.gov>.

Commerce Clause, an *adequate* regulatory fix appears unlikely.⁷

With these complications at the federal level, the time has come to change our focus in wetland regulation. If wetlands are to be rationally regulated in the United States, the regulation must come from the *states*. States clearly possess the authority to regulate wetlands.⁸ Perhaps using the Coastal Zone Management Act as a model, the federal government could provide technical assistance and funding for state programs sorely lacking in both.

In any case, the days of attempting to tinker with an unworkable federal regulatory regime for wetlands should be drawing to a close. The United States Supreme Court's fractured and nonsensical decision in *Rapanos* sheds more light by revealing the unanswerable questions than through any of the "answers" provided.

Sources for More Information

(Web sites listed were functional as of 12/28/06.)

Environmental Law Institute. *National Wetlands Newsletter*, Sept.-Oct. 2006 (Vol. 28, No. 5): special issue on the *Rapanos* decision. Check for this newsletter in your local library, or contact ELI at (800) 433-5120 or orders@eli.org (available online by subscription only).

Kalen, S. "Commerce to Conservation: The Call for a National Water Policy and the Evolution of Federal Jurisdiction Over Wetlands." *North Dakota Law Review*, Vol. 69 (1994), pp. 873-914.

U.S. Army Corps of Engineers' Statutory, Administrative, and Policy Materials Web site at www.usace.army.mil/cw/cecwo/reg/sadmin3.htm.

U.S. Environmental Protection Agency's Clean Water Act Web site at www.epa.gov/region5/water/cwa.htm#ECWA.

⁷ The Corps has had at least one official response to *Rapanos*. In a September 26, 2006, *Federal Register* notice, the Corps stated, "[The *Rapanos* decision] raises questions about the jurisdiction of the Clean Water Act, including Section 404, over some intermittent and ephemeral streams and their adjacent wetlands. The Corps will assess jurisdiction regarding such waters on a case-by-case basis in accordance with evolving case law and any future guidance that may be issued by appropriate Executive Branch agencies (e.g., the Department of Justice)." See "Proposal To Reissue and Modify Nationwide Permits; Notice," *Federal Register*, Sept. 26, 2006, p. 56261.

⁸ For information on state wetland programs, please see the State Wetland Managers Association's Web site at www.aswm.org/swp/index.htm.

The Format of Federal Legal Citations

Legal citations identify the series of books in which you can find the decision, as well as the volume number, the page on which the decision begins, and the year of the opinion.

U.S. Supreme Court decisions are compiled in several publication series. Three commonly cited series are the *United States Reports* (the official reports of the Supreme Court); *Supreme Court Reporter*, a commercial series published by Westlaw; and *United States Supreme Court Reports, Lawyers' Edition*, also a commercial series, published by LexisNexis. (Commercial series typically are available sooner than the *United States Reports* and contain notes for legal researchers. Check in larger libraries for these sets.) Here's how the *Rapanos* decision is cited in each series:

- *United States Reports*: 547 U.S. __, meaning Volume 547, with no page number yet available;
- *Supreme Court Reporter*: 126 S.Ct. 2208 [2006]), meaning Volume 126, starting at page 2208;
- *United States Supreme Court Reports*: 165 L.Ed.2d 159, meaning Volume 165, starting at page 159.

United States District Court opinions are reported in the *Federal Supplement*, abbreviated as F.Supp. Once the reporter reaches volume 999, the next volume are referred to as 2d, as in F.Supp. 2d.

United States Court of Appeals Decisions are reported in the *Federal Reporter*. A reference to "457 F.3d 1023" would mean volume 457 of the *Federal Reporter* 3d, beginning at page 1023.

The *United States Code*, abbreviated as "USC," is where provisions of bills passed by Congress are "codified" into subject matter within the overall set of federal law. As an example, 33 USC §1344 means Title 33 ("Navigation and Navigable Waters") and Section 1344 ("Permits for Dredged or Fill Material") of the *Code*. Please note that Congressional bills have their own title or section notation that will vary from a bill's eventual *Code* notation. For example, the *Code* section cited above (1344) refers to Section 404 of the legislation known as the Clean Water Act. As of 12/28/06, the U.S. Code was available electronically at the Government Printing Office's Web site, www.gpoaccess.gov/uscode/index.html.

The *Code of Federal Regulations*, abbreviated CFR, is the record of regulations that implement acts of Congress. A sample CFR citation is as follows: 33 CFR 328.3 means Title 33 ("Navigation and Navigable Waters"), Part 328 ("Definition of Waters of the United States"), Section 3 ("Definitions"). As of 12/28/06, the Code of Federal Regulations was also at the GPO Web site, www.gpoaccess.gov/cfr/index.html.

Key Terms for Clean Water Act Jurisdiction

Many court cases under the federal Clean Water Act (CWA) involve questions about the **jurisdiction** of the CWA—that is, whether a certain body of water is subject to CWA provisions. (Water bodies covered by the CWA are often referred to as **jurisdictional waters**.) Criteria for determining CWA jurisdiction come from the language of the CWA, federal agency regulations issued to implement the CWA, and federal court decisions interpreting the CWA and its regulations.

The CWA states that it applies to “**navigable waters**,” and that this term “means the **waters of the United States**, including the territorial seas” (33 USC §1362, item 7).

Implementing regulations (33 CFR 328.3) define “waters of the United States” as follows:

- (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- (2) All interstate waters including interstate wetlands;
- (3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
 - (i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
 - (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
 - (iii) Which are used or could be used for industrial purpose by industries in interstate commerce;
- (4) All impoundments of waters otherwise defined as waters of the United States under the definition;
- (5) Tributaries of waters identified in paragraphs (a) (1)-(4) of this section;
- (6) The territorial seas;
- (7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.”

Part (b) of 33 CFR 328.3 defines **wetlands** as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.”

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, and Water Status Report. 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: Clean Water Act decision	BIO.9	CE.6, CE.8, GOVT.7, GOVT.9, GOVT. 10, GOVT.16
Science: Water-borne pathogens	LS.12, LS.13, ES.9, BIO.5, BIO.6, BIO.9	GOVT.16
Water Status Report: Groundwater	6.5, 6.7, LS.7, LS.12, ES.7, ES.9	WG.2
Water Status Report: Precipitation	4.8, 6.5, 6.7, LS.7, LS.12, ES.7, ES.9, ES.13	WG.2
Water Status Report: Stream Flow	6.5, 6.7, LS.7, ES.3, ES.7, ES.9	WG.2

SCIENCE BEHIND THE NEWS

A Pathogen Symposium Sampler

"Study Provides Link Between Drinking Water and Noroviruses," Water Quality and Health Council, www.waterandhealth.org/drinkingwater/index.html, 11/11/05.

"Chesapeake's Rockfish Overrun by Disease," *Washington Post*, 3/11/06.

"Bacterial Contamination Clears at Fairview Beach," *Fredericksburg Free Lance-Star*, 9/20/06.

"Improving Water Quality Starts with Identifying Pollutants," *Gloucester-Mathews Gazette-Journal*, 11/9/06.

In water-resources news, big headlines often come from small creatures. Streams, rivers, lakes, estuaries, and groundwater can contain microscopic organisms (collectively referred to as **microbes**) from one or more of several groups: bacteria, viruses, protozoans (single-celled animals), algae, and fungi. Many (if not most) of these organisms perform valuable services, such as producing food from sunlight, decomposing dead organisms, and providing food for animals. But some aquatic microbes are **pathogens** that can cause **waterborne disease**.

Pathogens are a concern in many uses of water resources. For example, various bacterial, viral, and protozoan pathogens can contaminate drinking water; bacterial contamination is one of the leading reasons why water-quality standards are not met by many rivers, beaches, shellfishing areas, and other waters in Virginia and nationwide; and various pathogens can affect game fish and other economically important aquatic animals.

Preventing disease from aquatic pathogens depends in large part on accurate and timely monitoring to indicate whether pathogens are present in water. In practice, water-resource managers and scientists monitor for **pathogen indicators**—types of bacteria that do not necessarily cause disease but indicate contamination by human or animal waste that may contain pathogens to humans. In Virginia, state regulations require agencies to use the bacterium *Escherichia coli* as the indicator in

fresh water and the enterococci group of bacteria as the indicator in marine waters.¹

On November 2, 2006, the Virginia Water Resources Research Center sponsored an **aquatic-pathogen research symposium**, "Pathways and Monitoring in Natural and Engineered Systems." Fifteen speakers addressed five areas of pathogen research: 1) methods of detecting *Cryptosporidium* (a protozoan pathogen that can contaminate drinking water); 2) research at Virginia Tech; 3) research at other Virginia colleges; 4) pathogens in coastal environments; and 5) state agency perspectives. Videotape of the pathogen symposium and a Water Center special report summarizing the presentations will be available by spring 2007 on the Water Center's Web site, www.vwrrc.vt.edu.

In this article, *Water Central* presents a sample of quotes from the symposium speakers, with photos illustrating aspects of waterborne pathogen research. Footnotes provide definitions of potentially unfamiliar terms used in quotes or presentation titles. A list of sources for more information follows at the end of the article.



¹ Most strains of *Escherichia coli*, or *E. coli*, do not cause disease, but strain 0157:H7 produces a toxin and can cause serious illness. Some species in the enterococci group can also cause disease.

Pathogen Symposium Keynote Speaker



•“Constantly we are finding out about new causes of waterborne disease.... The majority of waterborne disease that occurs in this country is [either] not reported or [in the case of] the disease that is reported, the...causative agent is unknown most of the time.”—*Valerie J. Harwood, University of South Florida Department of Biology, in “What’s In Your Water? Pathogen Detection & Water Quality Monitoring for the 21st Century.”*

Panel 1—Methods of Detecting *Cryptosporidium*

•“We have 16 valid, named species of *Cryptosporidium*, not just one.... A number of [these] species [are found in humans and] may be transmitted by water.”—*Ronald Fayer, U.S. Department of Agriculture, in “Water and Cryptosporidiosis.”*



A researcher examines a water sample during a project to determine the sources of *Cryptosporidium* in surface waters and develop techniques for accurate detection. Photo by Keith Weller, courtesy of the USDA’s Agricultural Research Service Photo Library.

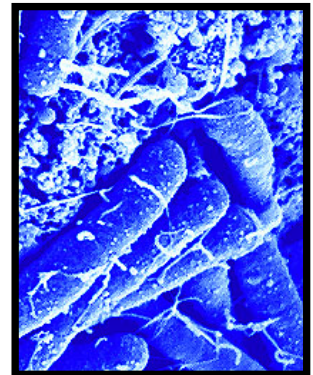
•“Method 1623 from the U.S. Environmental Protection Agency (EPA) uses antibodies attached

to magnetic beads to concentrate *Cryptosporidium* oocysts in a water sample.²—*Alan Lindquist, U.S. EPA Office of Research and Development, in “Detection of *Cryptosporidium* spp. in Water: Current Status of EPA Method 1623.”*

Panel 2—Pathogen Research at Virginia Tech

•“Of primary interest right now [in *Mycobacterium avium*] is...the increase of pulmonary disease in the elderly.”—*Joseph Falkinham, Virginia Tech Department of Biological Sciences, in “*Mycobacterium avium* in Biofilms.”*³

Bacteria creating a biofilm—Attached to a surface, these bacteria have produced extracellular materials that anchor the cells and provide attachment sites other microbes and debris. Photo by Sandra Silvers, courtesy of the USDA’s Agricultural Research Service Photo Library.



•“[Dr.] George Simmons [a long-time biology professor at Virginia Tech] was always fond of saying that when you’re...trying to determine...the sources of contamination [in a watershed], the ecologist’s rule of thumb is that 90 percent of the problems are at 10 percent of the contact points.”—*Charles Hagedorn, Virginia Tech Department of Crop and Soil Environmental Sciences, in “Microbial Source Tracking with Fecal Indicator Bacteria.”*⁴

•“[W]hat genes get turned on or turned off because the [bacterial] cells are...exposed to [a chemical contaminant]? ...Could [a bacterial cell’s response to a chemical stress] simultaneously be causing antibiotic resistance? ...Are chemical contaminants...in the environment indirectly

² This information is not a quote from Dr. Lindquist’s talk but was taken from his presentation slides. An **oocyst** is a fertilized egg is enclosed in a resistant cyst.

³ *Mycobacterium avium* is a bacterium found in natural waters, drinking water distribution systems, and soils. A **biofilm** is a thin layer of bacterial growth (typically along with other microbes and non-living debris) on pipes, filters, and other wet surfaces.

⁴ **Microbial source tracking** is the use of biochemical and genetic information to identify sources of bacteria or other fecal contaminants in water bodies.

leading to antibiotic resistance?”—*Ann Stevens, Virginia Tech Department of Biological Sciences, in “Pentachlorophenol Causes Increased Antibiotic Resistance in the Emerging Pathogen *Pseudomonas aeruginosa*.”*⁵

Panel 3—Pathogen Research at Other Virginia Colleges and Universities

•“There’s a huge soup of fecal bacteria in these [Shenandoah Valley] streams. ...Do pathogens exchange [antibiotic] resistance genes and virulence⁶ genes with native bacteria?”—*James Herrick, James Madison University Department of Biology, in “Environmental Reservoirs of Resistance and Virulence....”*

•“Our goal, and it’s probably everyone else’s goal working in [microbial] source tracking, is...to find and implement a method which is fast, inexpensive, precise, and accurate.”—*Brooks Crozier, Roanoke College Department of Biology, in “MST Research at Roanoke College.”*

•“Alternatives are needed [in treating for drug-resistant bacteria]. ...We are looking at using bacteriophage⁷ to treat drug-resistant bacteria. ...In North America, this is relatively new. However, in Eastern Europe...this has been practiced for many decades.”—*Hua Shen, Virginia State University, in “Research on Environmental Pathogens.”*



Electron micrograph of a cluster of *E. coli* bacteria. Photo by Eric Erbe, courtesy of the USDA’s Agricultural Research Service Photo Library.

⁵ **Pentachlorophenol (PCP)** is a chemical used in wood preservatives and formerly in herbicides. According to the federal Centers for Disease Control and Prevention, **antibiotic resistance** “occurs when bacteria change in some way that reduces...the effectiveness of drugs...or other agents designed to cure or prevent infections.”

⁶ **Virulence** refers to a pathogen’s disease-causing ability—the more virulent a pathogen, the greater its capacity to cause disease.

⁷ A **bacteriophage** is a virus that infects bacteria. Many types exist.

Panel 4—Fecal Indicators and Pathogens in Estuarine/Marine Environments

•“Methodology is really important when it comes to the microbiology of waters, for a variety of reasons: low concentration of target [species], random occurrence, and so on.... We may *never* have the appropriate methods, but we have to compromise.”—*Howard Kator, Virginia Institute of Marine Science (VIMS), in the introduction to this panel.*

A lab technician counts colonies of fecal coliform bacteria in a water sample. Photo by Peggy Greb, courtesy of the USDA’s Agricultural Research Service Photo Library.



•“[Part of our research is to use genetic methods to compare] the *Vibrio*⁸ burdens in *Crassostrea ariakensis* [a non-native oyster being considered for introduction to the Chesapeake Bay] vs. *Crassostrea virginica*, the native oyster, to see if differences exist.”—*Corinne Audemard, VIMS, in “Comparing Microbiological Characteristics of *C. ariakensis* and *C. virginica*....”*⁹

•“Sometimes there is no external lesion at all [in mycobacteriosis in Striped Bass].... So [you

⁸ ***Vibrio*** is a group of bacteria found naturally in coastal waters. According to the Virginia Department of Health, one species, *Vibrio vulnificus*, can cause serious illness or death in people with compromised immune systems or certain other conditions; infections, however (through contact of marine water with open wounds or through ingestion of raw shellfish), are rare in Virginia waters.

⁹ Ms. Audemard also presented “Application of qPCR for the Detection and Quantification of Pathogens and Indicators of Pathogens in Estuarine Waters.” PCR, for **polymerase chain reaction**, is a widely used procedure to increase the amount of a specific DNA sequence in a sample so that enough material is available for other DNA analyses on the sample. PCR is used in samples for medical diagnoses, crime forensics, environmental monitoring, and other purposes. **qPCR** stands for **quantitative PCR**, referring to methods that detect *how much* of a specific DNA sequence was originally present in a sample.

can] have fishermen out there catching, handling, and consuming fish which have [mycobacteriosis] infections and be totally unaware of it.”—*Martha Rhodes, VIMS, in “Mycobacteriosis in Striped Bass (*Morone saxatilis*): Human Health Implications.*”¹⁰

Panel 5—State Agency Perspectives

• “[About] 6700 miles [of Virginia streams] are impaired [due to] bacteria...out of a total [from all causes] of 9000 miles that are impaired.... We’re learning that significant management actions at high cost are needed to reduce sources of bacteria to meet [water quality] standards.—*Alan Pollock, Virginia Department of Environmental Quality.*

• “In order to meet [the bacteria water-quality standard]...one of our critical factors is not so much direct deposition [of animal waste] but...runoff events.—*Charles Lunsford, Virginia Department of Conservation.*

• “The U.S. EPA Science Advisory Board has cited disease-causing microbial contaminants as the greatest health risk [in] the management of drinking-water [supplies], and we can certainly attest to that in Virginia—it’s part of what we continue to have challenges with.”—*Wesley Kleene, Virginia Department of Health.*



Scientists conduct a rainfall-simulation test to measure bacteria levels in runoff water. Photo by Stephen Ausmus, courtesy of the USDA’s Agricultural Research Service Photo Library.

¹⁰ **Mycobacteriosis** refers to diseases caused by bacteria of the genus *Mycobacterium*. According to VIMS, these bacteria are widespread in nature, but only a few species are known to cause human or animal disease. For example, some species cause “fish-handler’s disease,” which can result if people with open sores handle infected fish. VIMS researchers have found several *Mycobacterium* species in Chesapeake Bay Striped Bass, including two new species that Dr. Rhodes and her colleagues first described in the scientific literature.

References and Sources for More Information

(All Web sites listed were functional as of 1/15/07.)

Carter, Gordon R. and Stephen M. Boyle. *DNA, Genes, and Genetic Engineering: A Concise, Comprehensive Outline*. Springfield, Ill.: Charles C. Thomas, 1998.

DeZuane, John. *Handbook of Drinking Water Quality*, 2nd. ed. New York: John Wiley & Sons, 1997.

U.S. Centers for Disease Control and Prevention’s “Health Topic: Water Quality” Web Site at www.cdc.gov/health/water.htm.

U.S. Environmental Protection Agency Web sites: Office of Groundwater and Drinking Water at <http://www.epa.gov/safewater>; and Office of Wetlands, Oceans, and Watersheds at www.epa.gov/owow.

U.S. Food and Drug Administration’s “Bad Bug Book” Web site at <http://vm.cfsan.fda.gov/~mow/intro.html>.

Virginia Department of Conservation and Recreation’s Soil and Water Conservation Programs Web site at

www.dcr.virginia.gov/soil_&_water/index.shtml

Virginia Department of Environmental Quality’s Water Quality Programs Web site at www.deq.state.va.us/water/.

Virginia Department of Health’s Waterborne Hazards Control Program Web site at www.vdh.state.va.us/epi/dzee/waterborne/index.asp.

Virginia Institute of Marine Science’s Environmental and Aquatic Animal Health Web site at www.vims.edu/env/.

Water Central has published four articles on bacteria or waterborne disease:

“Don’t Panic, But There’s a Huge Crowd of Bacteria Outside (and In),” Aug. 1998;

“Tracking the Wild—and Domestic—Bacteria” (on bacterial source tracking), Oct. 1999;

“What’s New—and Old—in Drinking-water Treatment,” Jan. 2001; and

“Beaches and Bacteria,” Aug. 2004.

All are available online at www.vwrrc.vt.edu/central/virginia.htm, or contact the Water Center for a paper copy.

Water Central thanks Angela Correa (Virginia Tech Department of Food Science) for help with photographs; Howard Kator (Virginia Institute of Marine Science) for providing information on PCR; and Anita Lahey (Virginia Tech Department of Fisheries and Wildlife Sciences), the Virginia Tech Video Broadcast Service, and the Virginia Tech New Media Center for help in recording the pathogen symposium.

VIRGINIA WATER STATUS REPORT

This section of *Water Central* presents recent and historical data on Virginia's groundwater levels, precipitation, and stream flow. (Please note: with this issue, we begin including all three reports in each issue, rather than our previous practice of rotating them among three issues.)

Groundwater Levels at Selected Virginia Wells, January 2007

The U.S. Geological Survey (USGS) and the Virginia Department of Environmental Quality monitor groundwater levels in about 350 observation wells in Virginia. The USGS publishes these measurements annually; the latest update is *Water Resources Data-Virginia-Water Year 2005, Volume 2* (available online at <http://pubs.usgs.gov/wdr/2005/wdr-va-05-2/>). As of January 4, 2007, *real-time data* (updated every 15 minutes) were being recorded from 57 observation wells in 27 Virginia localities and were available online at <http://waterdata.usgs.gov/va/nwis/current/?type=gw>. The table below shows one January 4 measurement (between 2 and 3 p.m.) from each of 20 real-time observation wells. **All measurements are in feet below the land surface, rounded to the nearest 0.1 foot.** The table also shows the deepest value (driest condition) and shallowest value (wettest condition) recorded for each well during the well's period of record. All January 2007 readings plus others marked with an asterisk are *provisional* (i.e., subject to revision).

Well (Local #)	1/4/07 Level	Record Deepest	Record Shallowest	Period of Record
Accomack (66M 19 SOW 110S)	8.1	11.3 (Mar. 1981)	7.4 (Apr. 2004)	Since Sep. 1978
Buckingham (41H 3)	22.8	36.4 (Oct. 2002)	7.4 (Apr. 1973)	Since Mar. 1971
Clarke (46W 175)	38.2	45.3 (Feb. and Aug. 2002)	25.1 (Mar. 1994)	Since Mar. 1987
Fairfax (52V 2D)	13.5	24.6 (Dec. 1998)	6.5 (Mar. 1984)	Since Oct. 1976
Frederick (46X 110)	39.9	47.9* (Jun. 2006)	18.2 (Sep. 2004)	Since Nov. 2002
Hanover (53K 19 SOW 080)	14.5	22.9 (Aug. 1984)	11.1 (Jan. 1978)	Since Jan. 1978
Loudoun (49Y 1 SOW 022)	58.4	61.5 (Nov. 1974)	52.0 (Nov. 1963)	Since Nov. 1963
Montgomery (27F 2 SOW 019)	2.9	7.3 (Dec. 1969)	0.0 (Mar. 1993)	Jul. 1953, then since Apr. 1969
Northampton (63H 6 SOW 103A)	2.9	10.0 (Oct. 2002)	0.9 (Oct. 1999)	Since Sep. 1977
Orange (45P 1 SOW 030)	23.7	39.0 (Aug. 2002)	11.8 (Apr. 1973)	Since Feb. 1965
Prince William (49V 1)	7.4	12.3 (Jul. 1970)	7.0 (Oct. 2003)	Since Nov. 1968
Roanoke County (31G 1 SOW 008)	18.5	19.3 (Aug. 1968 and Jun. 1987)	14.2 (Nov. 1985)	Since Aug. 1966
Rockbridge (35K 1 SOW 063)	21.4	30.4 (Sep. 2002)	14.3 (Apr. 1987)	Since Feb. 1964
Rockingham (41Q 1)	66.8	99.0 (Oct. 2002)	57.7 (Feb. 1998)	Since Aug. 1970
Suffolk (58B 13)	6.9	13.4 (Jan. and Feb. 1981)	3.0 (May 1979)	Since Mar. 1975
Surry (57E 13 SOW 094C)	6.4	11.2 (Dec. 1981)	3.9 (May 1980)	Since Jul. 1978
Virginia Beach (62B 1 SOW 098A)	1.9	12.0 (Sep. 1980)	1.0 (Apr. 1991 and Nov. 2006*)	Since Jun. 1979
Warren (45V 3)	10.24	106.1* (Apr. 2006)	85.0 (Jan. 2005)	Since May 2004
Westmoreland (55P 9)	-0.1	12.8 (Dec. 1998)	-0.4 (Feb. and Dec. 2003; Nov. 2006*; Jan. 2007*)	Since Jul. 1977
York (59F 74 SOW 184C)	1.7	14.1 (Jan. 2002)	0.5* (Nov. 2006)	Since Jun. 1990

Precipitation in Virginia, January-December 2006

The chart below shows precipitation (in inches) at seven National Weather Service observation sites in Virginia. The upper number for each entry is the **total precipitation** for the respective site and month (with yearly total at the bottom of the chart), including the equivalent amount of water contained in any snowfall or other frozen precipitation. These values were found (on 1/8/07) at the “Climate” sections of National Weather Service Web sites, as follows: www.weather.gov/climate/index.php?wfo=rnk, for Blacksburg, Lynchburg, and Roanoke; www.weather.gov/climate/index.php?wfo=lxw, for Charlottesville and Washington-Dulles; and <http://mi.nws.noaa.gov/climate/index.php?wfo=akq>, for Norfolk and Richmond. The lower number in each entry (in parenthesis) is the **average precipitation** for the respective site month (again, with yearly total at the bottom of the chart), over the period 1971–2000, according to the National Climatic Data Center, *Climatology of the United States No. 81* (accessed at <http://www5.ncdc.noaa.gov/climate/normal/clim81/VAnorm.pdf> on 1/8/07). RL and RH mean record low or high, respectively, for that month. The recent monthly amounts (but not the long-term averages) are classified by the Weather Service as *preliminary* data and are subject to revision; the National Climatic Data Center maintains any edited and *certified* data that are available.

More Virginia climate data and the *Virginia Climate Advisory* are available from the Virginia State Climatology Office, online at <http://climate.virginia.edu>. To reach the State Climatologist’s office, phone (434) 924-0548 or send e-mail to climate@virginia.edu.

	Blacksburg (Station #012)	Charlottesville (Station #023)	Lynchburg (Municipal Airport)	Norfolk (Internat. Airport)	Richmond (Byrd Intern. Airport)	Roanoke (Woodrum Airport)	Wash.-Dulles Airport
Jan. 2006	3.48 (3.37)	2.60 (3.71)	3.15 (3.54)	2.68 (3.93)	2.89 (3.55)	3.56 (3.23)	2.40 (3.05)
Feb. 2006	1.14 (3.02)	1.79 (3.30)	2.07 (3.10)	0.65 RL (3.34)	1.47 (2.98)	1.56 (3.08)	2.38 (2.77)
Mar. 2006	0.69 RL (3.83)	0.22 (4.05)	0.76 (3.83)	0.52 RL (4.08)	0.20 RL (4.09)	0.35 RL (3.84)	0.07 RL (3.55)
Apr. 2006	3.93 (3.83)	3.04 (3.34)	2.44 (3.46)	3.65 (3.38)	2.18 (3.18)	3.00 (3.61)	4.86 (3.22)
May 2006	3.00 (4.39)	1.67 (4.86)	1.65 (4.11)	2.96 (3.74)	3.24 (3.96)	1.46 (4.24)	1.80 (4.22)
Jun. 2006	10.96 RH (3.93)	8.48 (4.46)	6.75 (3.79)	10.53 RH (3.77)	7.85 (3.54)	8.51 (3.68)	11.79 (4.07)
Jul. 2006	3.61 (4.17)	2.77 (4.94)	2.37 (4.39)	1.34 (5.17)	4.59 (4.67)	1.92 (4.00)	2.45 (3.57)
Aug. 2006	3.66 (3.68)	2.68 (4.14)	4.19 (3.41)	3.13 (4.79)	5.99 (4.18)	2.35 (3.74)	1.24 (3.78)
Sep. 2006	3.16 (3.39)	5.76 (4.85)	7.73 (3.88)	11.64 (4.06)	9.52 (3.98)	3.21 (3.85)	7.12 (3.82)
Oct. 2006	4.91 (3.19)	7.35 (4.22)	6.76 (3.39)	3.54 (3.47)	6.12 (3.60)	5.33 (3.15)	4.82 (3.37)
Nov. 2006	3.71 (2.96)	5.37 (3.74)	4.77 (3.18)	6.46 (2.98)	6.67 (3.06)	4.22 (3.21)	5.31 (3.31)
Dec. 2006	1.83 (2.87)	1.71 (3.26)	1.66 (3.23)	2.06 (3.03)	1.42 (3.12)	1.98 (2.86)	1.74 (3.07)
Total for period	44.08 (42.63)	43.44 (48.87)	44.30 (43.31)	49.16 (45.74)	52.14 (43.91)	37.45 (42.49)	45.98 (41.80)

Stream Flow in Virginia, November 2006-January 2007

The graphs on this page, taken from the U.S. Geological Survey's Internet site, "WaterWatch—Current Water Resources Conditions" (<http://water.usgs.gov/waterwatch/?m=real&r=va&w=real%2Cplot>, 1/8/06) compare recent Virginia stream flow to historical records.

The data in the graphs come from 94 sites that have at least 30 years of records. The left graph covers November 23, 2006—January 6, 2007; the right graph covers July 1999 through early January 2007. Each graph uses a "**stream flow index**," which measures how a site's average stream flow *over 24 hours* (the **average daily stream flow**) compares to the historical average stream flow *for that same site and date*. The graphs show a further average: the stream flow index averaged *over all 94 monitoring stations*.

Index values (1-7 on the vertical axis in the graphs) mean the following:

Values indicating dry conditions:

1 = average daily flow is record low for that date;

2 = average daily flow is in the lowest 10 percent of historical values for that date;

3 = average daily flow is in the lowest 25 percent of historical values for that date, but exceeds the lowest 10 percent.

Value indicating "normal" flow:

4 = average daily flow exceeds the lowest 25 percent of historical values for that date, but is less than the highest 25 percent of values.

Values indicating wet conditions:

5 = average daily flow exceeds 75 of historical values for the date, but is lower than the highest 10 percent of values.

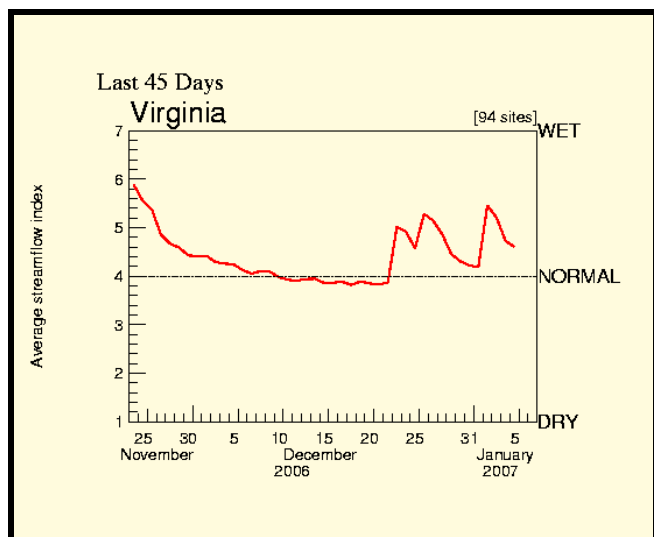
6 = average daily flow exceeds 90 percent of historical values for that date;

7 = average daily flow for the graphed date is record high for that date.

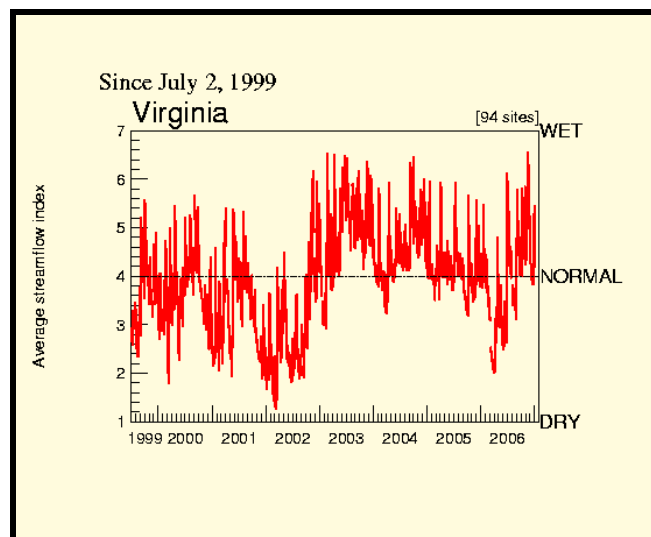
Gaps in the data: Data are not plotted for days when fewer than two-thirds of the sites report data (due to equipment or weather problems), because a statewide average on those days may misrepresent actual conditions.

Average Daily Stream Flow Index, Compared to the Historical Average for the Date

For November 23, 2006—January 6, 2007



For July 1999—Early January 2007



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 at the end of each item, unless otherwise noted. Selection of this issue's items ended December 15, 2006. Unless otherwise noted, localities mentioned are in Virginia and **dates are in 2006**. Web sites listed were functional as of 1/10/07.

Frequently used abbreviations include the following: DCR = Va. Dept. of Conservation and Recreation; DEQ = Va. Dept. of Environmental Quality; EPA = U.S. Environmental Protection Agency; SWCB = Va. State Water Control Board; USGS = U.S. Geological Survey; VMRC = Va. Marine Resources Commission.

Focus on Nutrient Regulations

You can't see them, but their effects can be distressingly obvious. They're needed for living thing' health, but too much of them is *unhealthy* for water bodies. Their concentration in water can be measured in small amounts known as parts per million, but their cost to the Chesapeake Bay and its tributaries is many millions of dollars.

Nutrients are substances necessary for living things to survive and grow. But in aquatic environments, excessive levels of two nutrients—**nitrogen** and **phosphorus**—can cause serious water-quality problems.¹ In the Chesapeake Bay watershed, reducing nutrients has been an official goal of the federal government and Bay states since the 1987 Chesapeake Bay Agreement. The follow-up Chesapeake 2000 Agreement re-established nutrient-reduction goals for 2010.

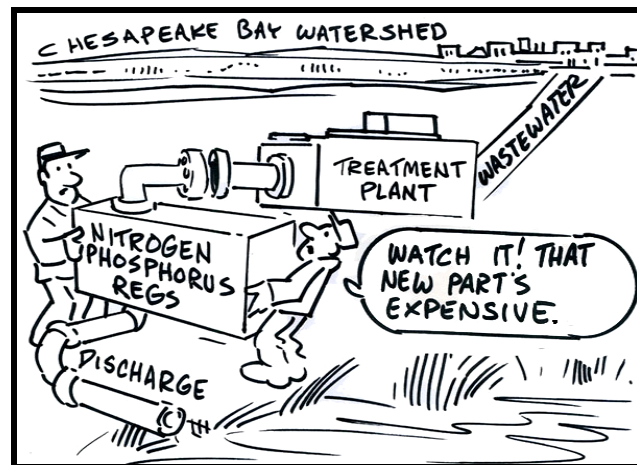
According to a March 2006 report from the U.S. Environmental Protection Agency (EPA), Bay states and the District of Columbia are looking to **wastewater treatment plants** to achieve about 20 percent of the Bay watershed nutrient reductions (other major nutrient sources include agriculture, urban and suburban stormwater runoff, air deposition, and septic systems).² Various regulatory efforts are underway in Virginia, Maryland, and Pennsylvania that will require wastewater treatment plants to reduce the concentration of nutrients in their discharges. In **Virginia** in 2005 and 2006, the State Water Control Board (SWCB) adopted regulations on nutrient discharges in the Bay watershed; nitrogen and phosphorus waste load allocations

(or “caps”) were assigned to 125 facilities that account for 90 percent of the treated wastewater in the Bay watershed; and the SWCB adopted a “general permit” establishing rules for facilities with nutrient allocations and a nutrient-credit-trading program among such facilities.³

Maryland in 2005 established water-quality standards that set nutrient limits for 66 major wastewater treatment plants in the Bay watershed; the state has also imposed a sewage fee to fund treatment plant improvements.

Pennsylvania in 2006 adopted limits for nutrient discharges in Bay tributaries and finalized the policy and guidelines for a state-run nutrient-credit-trading program (which began in 2005).

Following are some “snapshots” of the effects of recent nutrient-related developments.



In Virginia

- Various options are under consideration by the Hampton Roads Sanitation Authority to meet new nutrient limits at wastewater treatment plants in

¹ Excessive nutrients lead to water-quality problems by stimulating excessive growth of algae. Excessive algal growth can block sunlight to other aquatic plants that support many animals. Moreover, when the algae die, bacterial decomposition of the algae can reduce the oxygen dissolved in water to levels too low to support many fish and other animals.

² U.S. EPA Chesapeake Bay Program, *Chesapeake Bay 2005 Health and Restoration Assessment (Part Two: Restoration Efforts)*, March 2006 draft, p. 3.

³ Personal communication from John Kennedy, Va. Dept. of Environmental Quality, 1/9/07. The regulation for the general permit and nutrient-credit trading is 9 VAC 25-280 in the *Virginia Administrative Code*, available online at www.townhall.sate.va.us. A **credit-trading program** allows a permittee that discharges nutrients less than its allocation to sell credits to another permittee.

Mathews (Mathews County), **Urbanna** (Middlesex County), and **West Point** (King William County): upgrading the small localities' existing plants, installing new lines to take the localities sewage to larger plants, or building a larger facility in the area. (*Daily Press*, 4/11/06)

- In August, the **Harrisonburg-Rockingham County** Regional Sewer Authority estimated that about \$45 million in improvements will be needed to meet nutrient regulations. The improvements are to occur simultaneously with a \$19-million plant expansion to accommodate growth. (*Harrisonburg Daily News-Record*, 8/14/06)

- In September the **Berryville** (Clarke County) Town Council voted to increase sewer rates by 139 percent (from \$4.60 to \$11.00 per 1000 gallons) to qualify for a possible grant for 90 percent of the \$15-\$20 million needed for a new treatment plant. Without the rate increase, the Town would have qualified only for a 60-percent grant. (*Winchester Star*, 9/28/06)

- Between April and November, the cost estimate for the Town of **Culpeper's** two-million-gallon treatment plant expansion increased from \$15 million to over \$20 million. The town manager attributed the cost increase to high demand for qualified contractors, due to "a great deal of projects in the works" to meet new nutrient regulations. (*Culpeper Star-Exponent*, 11/1/06)

- In November, the **Prince William County** Service Authority announced a \$150-million plan to meet nutrient regulations and to increase capacity by 33 percent at its Woodbridge treatment plant. The project is Virginia's "largest wastewater treatment design-build contract" to date. (www.watertechonline.com, 11/29/06)

- The first wastewater treatment plant ever for the Town of **Washington** (Rappahannock County) will be financed by an interest-free \$4 million loan from the Virginia Clean Water Revolving Loan Program, managed by the Virginia Department of Environmental Quality (DEQ). The typical rate on loans from the fund is about three to four percent. "What [the zero-interest rate] means is the SWCB is really anxious for us to put this in," in order to improve the Rush River and ultimately the Bay, maintained Washington's Mayor Eugene Leggett. (*Rappahannock News*, 12/27/06)

- In December, Gov. Timothy Kaine proposed a **\$250-million bond package** (to be considered in the 2007 Virginia General Assembly) to help pay for nutrient-removal technology at 89 treatment plants. (*Richmond Times-Dispatch*, 12/14/06)

In Maryland

- In July, the U.S. **Department of Defense** agreed to spend \$22 million to upgrade wastewater treatment plants at five Maryland facilities, instead of paying the state's Bay Restoration Fund sewage fee of \$2.50 per month per household. The Navy had claimed that the fee was a tax and that the tax-exempt military did not have to pay. (*Baltimore Sun*, 7/20/06)

- As noted above, Maryland has targeted 66 large wastewater treatment plants for nutrient-removal upgrades under its Bay Restoration Fund. As of October 2006, two upgrades had been completed, 10 were under construction, 10 being designed, and 25 being planned. (*Washington Post*, 10/8/06)

Of the first 10 plant-improvements under construction, half will provide **not only nutrient-reduction upgrades but also more overall capacity** to support local growth. Debate has ensued over how state-supported sewage capacity increases will affect state or local growth-management policies, efforts to manage sprawl, and designated "critical environmental areas." (*Baltimore Sun*, 9/11/06)

- The state will use \$111 million from the Restoration Fund to pay for nutrient-removal improvements and capacity increases at seven plants in **Anne Arundel County**. The upgrades will allow the county to add about 37,000 septic systems to the wastewater-treatment system and help the county accommodate a large residential and commercial expansion at Fort Meade. (*Baltimore Sun*, 11/29/06)

In Pennsylvania

- In August, **Shippensburg** began construction of the state's first **biological nutrient removal facility**, in which bacteria convert nitrogen dissolved in wastewater to a gaseous form and bind phosphorus into solids that can be removed. (*Chambersburg Public Opinion*, 8/9/06)

- The **first sale under Pennsylvania's nutrient-credit program** was made in November to a developer in Susquehanna County. The developer bought credits in order to get approval for a wastewater-treatment plant at a proposed development. The credits were sold by Red Barn Trading Company of Lancaster, Penn., a broker selling credits generated by Pennsylvania farmers who export poultry manure outside of the Bay watershed. Two other credit brokers had been approved by state as of November 2006: the Mount Joy Borough Authority, will sell credits generated by farmers who reduce nutrient runoff; and the Milton

Regional Sewer Authority will generate credits by reducing its nutrient discharge below state limits. (*Patriot-News* [Harrisburg], 9/24 and 11/8/06)

For more information about nutrients and water quality:

U.S. Geological Survey Web site at <http://water.usgs.gov/nawqa/nutrients/>.

Bay Journal, published by the Alliance for the Chesapeake Bay and available online at <http://www.bayjournal.com>.

Virginia Water Central: "Nutrients in the News" and "Nutrients as Limiting Factors," Jun. 2003 issue; and "Nutrient-management Programs: Taking Steps Toward a Solution," Jan. 2004 issue.

Water Central thanks Karl Blankenship, editor of Bay Journal; Mark Dubin, University of Maryland; John Kennedy, Virginia DEQ; and Ann Smith, Pennsylvania Department of the Environment, for their help with this section.

Other News In Virginia...

•In June, the National Marine Fisheries Service announced plans for a January 2007 **re-opening of a 1000-square-mile scallop fishing ground** known as the Elephant Trunk. With Elephant Trunk open, officials are closing the nearby Delmarva Area and part of the Georges Bank off New England. Regulators use the opening/closing process to try to prevent over-harvesting of any one area. Scallops are currently Virginia's most lucrative seafood product, generating \$92 million in 2004. (*Virginian-Pilot*, 6/10/06)

•The U.S. Geological Survey (USGS) is coordinating a **study of groundwater quantity in Bedford County**. The county is providing \$100,000 for the multi-year study, which officials hope will help guide county land-use planning. (*Lynchburg News & Advance*, 6/18/06)

•Here on some developments in the situation of the **Crow's Nest peninsula in Stafford County** (for a previous *Water Central* item: Jun. 2006, p. 22). K&M Properties of McLean owns about 3,800 acres on the peninsula and has proposed a 688-home development on about 3,200 acres; the county and various groups have been for years to preserve the area from development. In September, the Stafford Board of Supervisors offered to buy the area for \$33.2 million, but the board said it would pursue condemnation of 2,887 acres for public use if the purchase offer were refused. Claiming their own appraisals supported their asking price of about \$60 million, the owners refused the offer. The county began the

condemnation process in November. Meanwhile, the owners are appealing to Circuit Court the county planning commission's denial of their subdivision plan. (*Fredericksburg Free Lance-Star*, 7/30 and 12/23/06)

•A James Madison University study released in August found that **Shenandoah River fish kills** in 2005 cost over \$685,000 in lost retail sales, license fees, and taxes. In December, state officials were investigating a large kill of Northern Hogsuckers and a small kill of Smallmouth Bass on the river. (*Harrisonburg Daily News-Record*, 8/12/06, and *Staunton News-Leader*, 12/13/06. For a previous *Water Central* item: Jun. 2006, p. 23.)

In other Shenandoah River news: In October, Virginia Attorney General Robert McDonnell **filed suit** against Shaeffer International for alleged violations of permit limits on **nitrogen and phosphorus discharges to the North Fork Shenandoah River**. Shaeffer subsidiary SIL Clean Water treats wastewater from two towns and two poultry plants in Rockingham County. The suit alleges allowances were exceeded by 800 percent in 2005 and 200 percent in 2004. (Associated Press, as published in *Daily Press*, 10/12/06)

•Discussions over a **possible joint water/sewer authority** between Culpeper County and the Town of Culpeper continue to "ebb and flow," according to the Culpeper town manager. The possibility, which localities have been debating for several years, is complicated by several issues, including control of current equipment and other assets, a boundary-line adjustment, differing wastewater load allocations determined by the Va. DEQ, and, not least, growth pressures in the area. (*Culpeper Star-Exponent*, 9/10/06)

Meanwhile in neighboring **Orange County**, the county administrator in September urged local elected officials to **consider a centralized water and sewer authority** to serve the county and the towns of Orange and Gordonsville. Administrator William Rolfe argued that county-town cooperation is needed to find new water sources to avert a shortage expected by 2010 to 2015. (*Fredericksburg Free-Lance Star*, 9/21/06)

And one more regional water item: **Frederick County** has proposed to build a water-treatment facility on the Shenandoah River in Warren County and pay Warren for water withdrawals. The chair of Frederick's board of supervisors said the plan could eventually lead to a regional system if other localities chose to participate. (*Winchester Star*, 12/8/06)

•Virginia's Eastern Shore is the focal point of a two-year **study to track Black Ducks** and help determine the species' food and habitat requirements. Since the mid-1950s, the Atlantic Flyway population of the bird has decreased by 60 percent. (*Richmond Times-Dispatch*, 10/2/06)

In a related item: Virginia's newest and 48th nature preserve is the 258-acre **Magothy Bay Natural Area Preserve** on the southern tip of Northampton County. The southern edge of the Eastern Shore is an important resting and feeding area for birds migrating along the Atlantic Flyway between Canada and South America. (*Virginian-Pilot*, 10/11/06)

•**Heavy rains October 6-8 caused flooding** in several localities, particularly in southeastern and central Virginia. According to the Virginia Department of Emergency Management (VDEM), as much as 12 inches of rain fell in some parts of the state. Rivers exceeding flood stage (in some areas) between October 6 and 12 included the Appomattox, Blackwater, James, Meherrin, Nottoway, Pamunkey, Rivanna, and South Fork Shenandoah. Several hundred people in Isle of Wight and Southampton counties and the city of Franklin temporarily lost water or wastewater service. As of the 11/9 VDEM report, the statewide costs for damage in 25 localities and for seven state agencies were \$6.9 (public) and \$5.5 million (private). Isle of Wight County had the highest estimated public damage, at \$2.05 million, while Franklin City had the highest estimated private damage, at \$3.15 million. (VDEM Situation Reports, 10/7-11/9/06, online at www.vaemergency.com/newsroom/sitreps/)

•The Hampton Roads Sanitation District (HRSD) is planning for **increased used of reclaimed water**. Reclaimed water is treated wastewater that can be used for non-drinking purposes, such as irrigation and industrial uses. Since 2002, HRSD has supplied a Yorktown refinery with reclaimed water. According to HRSD's chief of water reuse, the Navy may be the next user of some of the 150 million gallons per day of reclaimed water that HRSD could provide. Virginia is developing regulations for water reclamation and reuse; information is available at the DEQ's Water Regulations Web page, www.deq.virginia.gov/regulations/xwaterregs.html. (*Daily Press*, 10/21/06)

•"Sea grasses [marine flowering plants] are now challenged with rapid environmental changes as a result of coastal human population pressures." That's the basic message from "**A Global Crisis for Seagrass Ecosystems**," a study by Robert

Orth of the Virginia Institute of Marine Science (VIMS) and eleven national and international colleagues, published in the December 2006 issue of the journal *Bioscience*. The study found a large increase in the number of reported cases of seagrass losses worldwide over the past 40 years. (*W&M News*, 12/1/06)

•In November, Dominion Virginia Power's application for an **"early site permit" for two possible new nuclear reactors** at Dominion's North Anna nuclear station received certification from the Va. DEQ, with two conditions. 1) If the Nuclear Regulatory Commission approves Dominion's early site permit application, the company must conduct a comprehensive study of potential impacts on aquatic life in and downstream of Lake Anna. 2) Dominion must obtain all permits required under Virginia's Coast Program. (*Fredericksburg Free Lance-Star*, 11/22/06. For an in-depth previous *Water Central* item: Jun. 2006, p. 19.)

•Following a public hearing on November 28, the **Marine Resources Commission** (VMRC) voted 5-3 to deny a watermen's request to open for harvest an oyster sanctuary in the lower Rappahannock River that has been closed to oystering for 19 years. (*Daily Press*, 11/29/06. Minutes of VMRC meetings are available at www.mrc.virginia.gov/calendar.shtm.)

•On December 14, the **State Water Control Board** reversed a September decision and granted Newport News' request for a permit extension for the proposed King William Reservoir. (*Daily Press*, 12/2/06. SWCB meeting minutes are available online at www.townhall.state.va.us/Meeting/ListMeeting_Past.cfm. For a previous *Water Central* item: Sept. 2006, p. 13.)

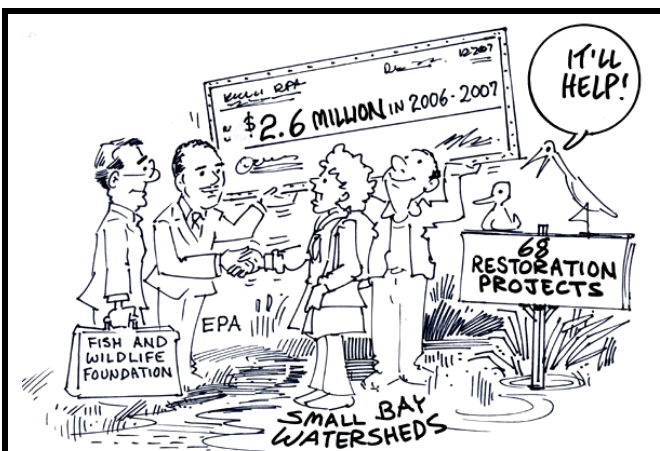
•Here are some **Chesapeake Bay items**:

••In October, the Atlantic States Marine Fisheries Commission (ASMFC) approved Virginia's plan to limit the industrial catch of **Menhaden in the Chesapeake Bay**. The plan calls for Omega Protein to limit its annual catch to 109,020 metric tons (the average harvest from 2001-2005). If Omega's catch falls below the limit one year, the company may take additional fish the following year. (*Daily Press*, 7/31/06, and www.asmfc.org, 1/12/07. For a previous *Water Central* item: Jun. 2006, p. 23.

••In November, the Chesapeake Bay Foundation (CBF) released its annual **"State of the Bay Report,"** with information through Summer 2006. CBF rates 13 biological and

chemical measurements from 0 to 100, with 100 intended to represent “pristine” conditions (prior to European settlement), then takes an overall average. The 2006 average score was 29, a slight increase from the past four years. CBF has set an average score of 40 as the goal for 2010. CBF reports are available online www.cbf.org, or contact CBF at (804) 780-1392 (Virginia office) or chesapeake@cbf.org. Following are scores from this year and the past four years:

	2002	2003	2004	2005	2006
Forested Buffers	54	55	55	55	56
Resource Lands	30	29	29	29	29
Underwater Grasses	12	22	18	20	18
Wetlands	42	42	42	42	42
Blue Crabs	40	38	38	38	38
Oysters	2	2	2	3	4
Rockfish	75	75	73	71	71
Shad	7	9	10	12	10
Dissolved Oxygen	15	12	13	12	16
Nitrogen	16	13	12	13	17
Phosphorus	16	13	16	20	29
Toxics	28	28	27	27	27
Water Clarity	16	14	15	15	15
AVERAGE	27	27	27	27	29



The **Chesapeake Bay Small Watershed Grants for 2006-07**, by the National Fish and Wildlife Foundation and the U.S. EPA's Chesapeake Bay Program, will provide \$2.6 million for 68 Bay and river restoration projects. Twenty-five Virginia projects are receiving grants, totaling \$928,465. For grant recipients and project descriptions for 2001 through 2006, see www.chesapeakebay.net/smallwatergrants.htm.

...and Outside of Virginia

•Fall 2006 brought **some relief from persistent drought** to parts of the United States, but many states continue to have some level of drought, according to the weekly U.S. Drought Monitor (www.drought.unl.edu/dm/monitor.html). The December 26 report indicated some drought in 34 states, with “severe,” “extreme,” or “exceptional” drought in Arizona, Colorado, Florida, Kansas, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming. “Abnormally dry” conditions were indicated for parts of Kentucky, Pennsylvania, Tennessee, and West Virginia.

•In August, the U.S. Army Corps of Engineers began **construction of the first phase of the Everglades restoration plan**. The “Everglades Agricultural Area Storage Reservoir-Phase 1” project will construct an approximately 25-square-mile reservoir intended to “improve the quantity, quality, timing and distribution of water within the greater Everglades,” according to the project Web site. The entire Everglades restoration is expected to take 30 years and cost \$10.5 billion. (*National Wetlands Newsletter*, Sep.-Oct. 2006; and Everglades Restoration Plan Web site at www.evergladesplan.org/index.aspx, 1/12/07)

•Since 1986, the Ocean Conservancy has organized an **annual international coastal cleanup**. Data on debris found in the cleanups has been collected since 1987, but in 2002 the Ocean Conservancy began a more statistically valid monitoring effort called the National Marine Debris Monitoring Program. Data collection is to run through May 2007. The Conservancy expects the data to help target sources of beach and ocean trash. (*Volunteer Monitor*, Fall 2006)

Some Final Words about Fish

•“This will be Fish City up here.”—Bill Martin, president of Blue Ridge Aquaculture, speaking about **Virginia Cobia Farms**, a Cobia-culture facility planned for Saltville (Smyth County), Virginia. (*Wytheville Enterprise*, 10/21/06)

•“It’s about the prettiest fish going.”—Jeremy Shiflett, a James Madison University graduate student, referring to **Brook Trout**. Mr. Shiflett is working with the Smith Creek Restoration Project in Rockingham County, part of the larger Eastern Brook Trout Joint Venture to improve habitat on streams that at one time supported native Brook Trout. (*Harrisonburg Daily News-Record*, 11/4/06)

N O T I C E S

If you would like to receive a weekly e-mail notification about *upcoming meetings, conferences, and other events related to water quality*, you may do so by joining the Virginia Water Monitoring Council; contact Jane Walker at the Water Center at (540) 231-4159 or jnewalk@vt.edu.

Also, please see the Water Center's "Quick Guide to Water-related Meetings and Conferences in Virginia," on our Web site at www.vwrrc.vt.edu.

All Web sites listed in this section were functional as of 1/10/07.

State Meeting Review

This section lists most water-related public meetings and hearings that occurred September 27—December 22, 2006, as listed on the **Virginia Regulatory Town Hall** Web site, at www.townhall.state.va.us/Intro.cfm. The Town Hall site posts minutes of these and all public meetings by Virginia's boards, commissions, and departments. The lists below give the date of the *most recent* meeting and include the name of a contact person for further information. To find the e-mail address or phone number of the contact people, go to the Regulatory Town Hall Web site, click on Meetings (Future or Past), and then click on the particular event. You can also request state employee phone numbers by calling (800) 422-2319, and you can find the e-mail address of any state employee online at www.employees.state.va.us/directory-search.cfm.

Total Maximum Daily Load (TMDL) Meetings

Under the federal Clean Water, when a water body fails (with a certain frequency) to meet state water-quality standards, the water is to be designated as "impaired," requiring development of a total maximum daily load (TMDL). A TMDL *study* identifies the pollutant source(s) causing the impairment and determines how much of the pollutant(s) the water can receive (the "load") and still meet standards. A TMDL *implementation plan* (required by Virginia law) maps a process for reducing the pollutant load to the TMDL level. Many Virginia TMDLs are underway, each involving many public meetings.

During the period noted above, TMDL-related public meetings were held regarding the waters listed in the table below (listed alphabetically by localities). The contact people listed for TMDL meetings are Virginia Department of Environmental Quality staffers unless otherwise noted. Information on the status of all TMDLs in Virginia is available online at <http://www.deq.state.va.us/tmdl>.

Location	Water(s) & Impairment	Larger Watershed(s)	Latest Meeting Date	For More Information
Albemarle, Culpeper, Fauquier, Greene, Madison, Orange, Rappahannock, and Spotsylvania counties.	Blue Run, Browns Run, Cedar Run, Craig Run, Hazel River, Hughes River, Marsh Run, Rapidan River, Rappahannock River, and Rush River, all for bacteria	Rappahannock River	Dec. 15	Katie Conaway
Albemarle and Fluvanna counties	Hardware River and North Fork Hardware River for bacteria	James River	Nov. 30	Robert Brent
Alleghany and Botetourt counties and City of Covington	Jackson River for aquatic life and dissolved oxygen	James River	Sep. 28	Jason R. Hill
Botetourt County	Back Creek, Mill Creek, and Looney Creek for bacteria	James River	Dec. 7	Jason Ericson*
Bristol City	Beaver Creek and Little Creek for bacteria and sediment	Holston River	Dec. 7	Theresa Carter*
Buchanan County	Garden Creek for bacteria and chlorides	Levisa Fork/Big Sandy River	Nov. 9	Allen J. Newman
Dickenson, Russell, and	Lick Creek for aquatic life and	Russell Fork/Big	Nov. 28	Allen J.

Wise counties	bacteria	Sandy River		Newman
Essex County	Occupacia Creek and tributaries for bacteria	Rappahannock River	Nov. 30	Chris French
Floyd County	Dodd Creek for bacteria	New River	Nov. 9	Jason Ericson*
Isle of Wight County	Jones Creek and Pagan River for bacteria	James River	Sep. 28	Jennifer Howell
Mathews County	Shellfish waters in East River for bacteria	Mobjack Bay/Chesapeake Bay	Oct. 18	Chester Bigelow
Montgomery County	Mill Creek for bacteria	New River	Nov. 6	Jason Ericson*
Page County	Hawksbill Creek and Mill Creek for bacteria	Shenandoah River	Nov. 14	Nesha Mizel*
Westmoreland County	Nomini Creek watershed shellfish waters for low dissolved oxygen	Potomac River	Nov. 15	Chester Bigelow
Several Virginia localities plus parts of Maryland and D.C.	Tidal Potomac River and tributaries for PCBs (polychlorinated biphenyls)	Potomac River	Oct. 31	Mark Richards

*Department of Conservation and Recreation

Other State Meetings and Hearings
(Items are listed alphabetically by agency or group, then by topic, shown in bold. Date listed is that of the most recent meeting on the topic.)

Department of Conservation and Recreation (DCR)-Land Conservation Foundation on **criteria for conservation tax credits** (Oct. 18). The Foundation met Nov. 21 to review **grant manual criteria**. More information: David Dowling.

DCR Virginia Outdoors Foundation public meeting on **easements** (Nov. 16). More information: Trisha Cleary.

DCR's regional meetings on the **2007 Virginia Outdoors Plan** (Oct. 30-Dec. 6). More information: Janit Llewellyn or Robert Munson.

Department of Environmental Quality (DEQ)'s **Recycling Markets Development Council** (Dec. 5). More information: Thomas J. Smith, Prince William County Public Works, (703) 792-6252 or tsmith@pwcgov.org.

(DEQ) meeting with stakeholders on implementation of HB447/SB88, **Removal of Mercury Switches from Automobiles** Prior to Demolition (Nov. 29). More information: Steven E. Frazier.

DEQ public meeting on efforts to develop **water-quality criteria for nutrients in freshwater** (streams, rivers, lakes, and reservoirs) (Oct. 23). More information: Jean W. Gregory.

Department of Health (VDH) advisory committee on **sewage handling and disposal regulations** (Nov. 17). More information: Donald Alexander.

Department of Mines, Minerals and Energy's (DMME) **Energy Plan Advisory Group**

meeting (Nov. 2). The last of five public listening sessions on the plan was held Dec. 4. The DMME is responsible for developing a state energy plan as called for in SB 262 (2006 Virginia General Assembly). More information: Eileen Dean.

DMME's Division of **Mined Land Reclamation Regulatory Work Group** (Dec. 11). More information: Leslie S. Vincent.

DMME's **Surface Mining Reclamation Fund Advisory Board** (Dec. 7). The Governors Mined Land Reclamation Advisory Committee also met Dec. 7. More information: Gerald D. Collins for the Fund Advisory Board; Leslie S. Vincent for the Governor's Advisory Committee.

DMME workshop on **total maximum daily loads (TMDLs) for streams impaired by resource extraction**, particularly coal mining (Sep. 28). More information: Joey O'Quinn.

Game and Inland Fisheries Board's committee on **education, planning, and outreach** (Dec. 12). More information: Beth Drewery.

Land Conservation Foundation public meeting on criteria for verifying conservation value of donations that result in **land conservation tax credits** in the amount of \$1 million or more (Nov. 2). More information: David Dowling.

Soil and Water Conservation Board's technical advisory committee on **dam safety** (Oct. 31). More information: David Dowling.

Soil and Water Conservation Board's technical advisory committee on **stormwater management regulations** (Oct. 16); on Oct. 12, the Board met to discuss **nitrogen and phosphorus criteria** for incorporation into the stormwater regulations. More information: David Dowling.

State Water Control Board (SWCB) advisory committees (joint meeting) on a proposed **general permit for minor surface withdrawals** (Oct. 26). More information: William K. Norris.

SWCB workgroup meeting on *implementation* of the general watershed permit regulation for **nitrogen and phosphorus discharges and nutrient trading in the Chesapeake Bay Watershed** (9 VAC 25-820); this regulation was adopted on 9/6/06 and became effective 11/1/06 (Nov. 29). More information: Kyle Winter.

SWCB advisory committee on **triennial review of water quality standards** (Dec. 1). More information: Elleanor M. Daub.

SWCB public meeting on use of the **Virginia Clean Water Revolving Fund** for Fiscal Year 2007 (Nov. 9). More information: Walter Gills.

SWCB public meeting on amendments to **water-quality standards** (Oct. 12). An advisory committee to assist in developing amendments met Dec. 1, 2006, and is scheduled to meet in 2007 on Feb. 21, Mar. 21, Apr. 18, and May 9. More information: Elleanor Daub.

SWCB **water reclamation and reuse** advisory committee (Dec. 5). More information: Valerie Rourke.

Regular Meetings of Statewide Boards and Commissions

Chesapeake Bay Local Assistance Board—meets March, June, September, and December. The Board's Northern and Southern Area Review Committees, which review compliance by local Bay Preservation Area programs, meet in February, May, August, and October. More information: (800) CHESBAY; www.cblad.state.va.us.

Game and Inland Fisheries Board—meets bimonthly. More information: www.dgif.virginia.gov.

Groundwater Protection Steering Committee—meets third Tuesday of odd-numbered months. More information: www.deq.virginia.gov/gwpsc/.

Land Conservation Foundation—meets about three times per year. More information: Dept. of Conservation and Recreation (DCR), (804) 786-3218; www.dcr.virginia.gov/virginia_land_conservation_foundation/index.shtml.

Marine Resources Commission—meets monthly. More information: (757) 247-2200, TDD (757) 247-2292; www.mrc.state.va.us.

Professional Soil Scientists and Wetland Professionals Board—meets quarterly. More

information: Dept. of Professional and Occupational Regulation, (804) 367-8500, TDD (804) 367-9753;

www.state.va.us/dpor/ssc_main.htm.

Scenic River Advisory Board—More information: DCR, (804) 786-8445 or the DCR central office number, (804) 786-1712.

Soil and Water Conservation Board—meets bimonthly. More information: DCR, (804) 786-1712;

www.dcr.virginia.gov/soil_water/vs&wcb.shtml

State Water Control Board—meets March, June, September, and December. More information: Dept. of Environmental Quality (DEQ), (800) 592-5482; www.deq.virginia.gov/cboards/homepage.html#water.

Waste Management Board—meets about three times per year. More information: DEQ, (800) 592-5482;

www.deq.virginia.gov/cboards/homepage.html#waste.

Waterworks and Wastewater Works

Operators Board—meets March, June, September, and December). More information: Dept. of Professional and Occupational Regulation, (804) 367-8500, TDD (804) 367-9753; www.state.va.us/dpor/www_main.htm.

Other Notices

Construction Runoff BMP Slide Show

A Washington (state) Department of Ecology slide show on how citizens can recognize correct and incorrect use of best management practices (BMPs) to reduce construction-site stormwater runoff is available at online at www.re-sources.org/stormwater_slideshow/bmp1.htm.

Guide to Underwater Grasses

Maryland Sea Grant has published *Underwater Grasses in Chesapeake Bay and Mid-Atlantic Coastal Water*, an 80-page guide for identifying common submerged aquatic plants. For more information: (301) 405-6376 or Connors@mdsg.umd.edu; Web site: www.mdsg.umd.edu/sav.

University of New Orleans Hazards Center Asking for Book Donations

Hurricane Katrina destroyed about half of the library at the University of New Orleans' Center for Hazards Assessment, Response, and Technology (CHART). CHART is asking for book donations through the online book seller Alibris (www.alibris.com/wish/donate-a-book.cfm; click on Louisiana on the map). CHART welcomes books

from other sources but requests that donors notify them (chart@uno.edu) so that the donated title can be removed from the online list.

Post-Katrina/Rita Progress Reports

The anniversary of the devastating 2005 hurricanes—particularly Katrina and Rita—was marked by publication of many “one-year-after” reports on response and recovery. Such reports have been done the American Red Cross, American Society of Civil Engineers, Brookings Institution Metropolitan Policy Program, Office of the Governor of Mississippi, Rockefeller Institute of Government, U.S. Department of Homeland Security, and many others. A list of reports from these and other organizations is available in the November 2006 issue of *Natural Hazards Observer* (pp. 21-24), online at the Natural Hazards Center’s Web site, www.colorado.edu/hazards/. To request a paper copy, contact the Natural Hazards Center at (303) 492-6818 or hazctr@colorado.edu.

Upcoming Conferences and Workshops

In Virginia

•**Streams of Stewardship: A Symposium on Water Management.** Feb. 24, 2007, Richmond. Organized by Lewis Ginter Botanical Garden and the Virginia Society of Landscape Designers. More information: (804) 262-9887; Web site: www.lewisginter.org/streamsofstewardship.

•**Virginia Water Conference 2007.** Mar. 11-13, Richmond. Organized by the Virginia Lakes and Watersheds Association. More information: Stuart Stein, (703) 642-5080 or sstein@gky.com; Web site: www.vlwa.org.

•**Environment Virginia 2007.** Apr. 10-12, 2007, Lexington. Organized by Virginia Military Institute. More information: Justin Spears, (540) 464-7750 or spearsja@vmi.edu; Web site: <http://environmentva.org>.

•**7th Passive Sampling Workshop and Symposium.** Apr. 24-26, 2007, Reston. Organized by the U.S. Geological Survey and Virginia Department of Environmental Quality. For more information: David Alvarez, (573) 441-2970 or dalvarez@usgs.gov; Web site: www.cerc.usgs.gov/Research/Passive_Conference/psws.htm.

•**Working Waterways & Waterfronts-National Symposium on Water Access.** May 9-11, 2007, Norfolk. Organized by Virginia Sea Grant. More information: Thomas Murray, (804)

684-7190 or tjm@vims.edu; Web site: www.wateraccess2007.com.

Elsewhere

•**Nutrient Removal 2007: State of the Art.** Mar. 4-7, 2007, Baltimore. Organized by the Water Environment Federation. More information: (803) 684-2441 or registration@wef.org; Web site: www.wef.org/ConferencesTraining/Conferences/SpecialtyConference/NutrientRemoval.htm.

•**Hazards in Water Resources.** Jul. 24-26, 2007, Boise, Idaho. Annual conference of the Universities Council on Water Resources. More information: Rosie Gard, (618) 536-7571 or gardr@siu.edu; Web site: www.ucowr.siu.edu.

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.

2006 Symposium Award Winners

The Water Center congratulates the following recipients of awards at the Water Science and Technology Symposium in November 2006:

Water Resources Leadership Award

Joseph Maroon, Director of the Virginia Department of Conservation and Recreation. Clifford W. Randall, Emeritus Professor of Civil and Environmental Engineering at Virginia Tech.

Walker Graduate Fellowship Award

Rachel Lauer, Virginia Tech Department of Geosciences.

Awards for Best Presentation by Students

Jose Cerrato, Virginia Tech Department of Civil and Environmental Engineering.

John Jastram, Virginia Tech Department of Crop and Soil Environmental Sciences.

Zunyang Zhao, Virginia Tech Department of Dairy Science.

New Project

“Analysis of Nutrient-Response Characteristics to Support Criteria Development for Constructed Impoundments”—a \$46,000, two-year project beginning October 2006, funded by the U.S. EPA-Region 3. For more information, contact Tamim Younos at the Water Center.

VIRGINIA WATER RESOURCES RESEARCH CENTER RESEARCH FUNDING AND PRESENTATION OPPORTUNITIES FOR 2007

For more information about the opportunities listed on this page: Please contact Dr. Tamim Younos, Virginia Water Resources Research Center, 210 Cheatham Hall, Virginia Tech, Blacksburg, VA 24061-0444; phone (540) 231-8039; FAX (540) 231-6673; e-mail: tyounos@vt.edu. Application materials and research proposal guidelines are available at the Water Center's Web site, www.vwrrc.vt.edu. **Application materials should be submitted by March 31, 2007, 5:00 p.m. via e-mail to water@vt.edu.**

Walker Graduate Research Fellow Award

The Water Center's William R. Walker Graduate Research Fellow Award provides up to \$2,500 to individuals preparing for a professional career in water resources. Only individuals pursuing graduate work in a field *different* from their field of emphasis as an undergraduate, or individuals with work experience returning to graduate school, are eligible to apply. A special panel selects the award recipient. The award will be effective July 1, 2007, and can be used at the recipient's discretion during residency in a university as a student, for professional development (such as attending workshops and conferences), and purchasing materials that will enhance professional productivity (such as books and software).

Undergraduate Research Fellowship Awards

The Water Center awards undergraduate research summer fellowships related to water resources protection and management. The goal of the program is to provide a research opportunity for outstanding undergraduates with anticipation that these students will pursue a graduate degree in a water resources field.

Water Center Competitive Research Grants

The Water Center will consider research proposals for up to \$20,000 and project duration of one year (July 1, 2007—June 30, 2008). Proposals will be considered in areas related to water sciences (including socio-economic topics) and engineering. A useful publication, *Water Research Needs in Virginia* (January 2005) is available online at www.vwrrc.vt.edu/publications/recent.htm.

Submission of interdisciplinary proposals is encouraged. Research proposals should do the following:

- demonstrate the potential for significant contribution to advancing the scientific foundation for water resources management in Virginia;
- demonstrate the importance of the research to decision making in Virginia; and
- provide research opportunities for graduate and undergraduate students

A detailed budget justification is required. Funds may not be used to purchase office supplies or pay tuition (please see the proposal preparation guidelines for more details). Grant awardees are expected to submit a final report, present a paper at the Annual Virginia Water Science and Technology Symposium sponsored by the Water Center, and acknowledge the Water Center in all publications that may result from the funded research.

Successful proposals will be announced by May 30, 2007.

Water Center Seed Grants

The Water Center will fund a limited number of research seed grants—of up to \$5,000—to be used in support of background studies and preliminary research that will lead to submission of full research proposals to outside funding agencies. Seed grant proposals will be considered in areas related to water sciences (including socio-economic topics) and engineering. A useful publication, *Water Research Needs in Virginia* (January 2005) is available online at www.vwrrc.vt.edu/publications/recent.htm.

By accepting a seed grant award, the principal investigators commit to the development of a full proposal suitable for submission for full funding to outside funding agencies.

Duration of each award is one year (July 1, 2007 to June 30, 2008). Funds may be used for student support, lab supplies, preliminary analysis to develop a project proposal, and travel to visit a potential research site or to establish appropriate linkages with funding agencies. Funds may not be used to purchase office supplies or pay tuition. Recipients of seed grants are expected to submit to the VWRRC a brief (two pages) progress report by December 30, 2006; and a final report in the form of copy of a full research proposal suitable for submission to a funding agency by June 30, 2008.

Successful proposals will be announced by May 30, 2007.

THE VIRGINIA STEP PROGRAM in SUMMER 2006

Through the **Service Training for Environmental Progress (STEP)** program, college students live in a Virginia community and work on a water-related project identified by the community. If you are a member of **community group** interested in STEP assistance, or a **student** interested in a STEP internship, please contact STEP by **February 28, 2007**, at 210 Cheatham Hall (0444), Blacksburg, VA 24061; (540) 231-5463; arafflo@vt.edu. Students must be a current junior, senior, or graduate student or have graduated within the past year, and must be either a Virginia resident or attending college in Virginia. You can get more information about STEP at the Water Center's Web site at www.vwrrc.vt.edu/step/STEPHome.htm

Following are summaries of the two STEP projects in Summer 2006. A list of all previous STEP reports (since 1986) is available at the STEP Web site. For a copy of any full STEP report, please contact STEP at the address, phone number, or e-mail address listed above.

"Riparian Buffer Evaluation and Education in Rappahannock County, Virginia," by Meghan Gloyd.

Ms. Gloyd worked with Rappahannock Friends and Lovers of Our Watershed (RappFLOW) in support of the group's goals to create a system of riparian (streamside) plant buffers in Rappahannock County and to promote increased understanding within the county of the benefits of riparian buffers. Her objectives were as follows:

- 1) Create a handbook to be used during training sessions for volunteers who would evaluate existing buffers.
- 2) Plan and lead a volunteer-training session in July.
- 3) Compile material for landowners to explain what a buffer is and why they are important, along with information on RappFLOW and its mission.
- 4) Create a comprehensive long-term riparian buffer project plan.
- 5) Compile a forested riparian buffer planting guide that includes plant suggestions.

Ms. Gloyd's report provides background on current environmental issues within the Rappahannock County, details the results of the summer work, and contains samples of the documents she produced for RappFLOW.



Meghan Gloyd

"Natural Resource Inventory for the New River Valley Regional Water Supply Plan," by Carrie Hileman.

Ms. Hileman's project was to compile a section of a regional water supply plan for the New River Valley Planning District Commission (serving the counties of Floyd, Giles, Montgomery, and Pulaski and the City of Radford). State legislation in 2005 requires all localities to adopt water supply plans either independently or on a regional basis by 2011. Ms. Hileman completed the plan's Existing Resource Information section by gathering data on the following topics:

- threatened or endangered species or habitats of concern;
- anadromous, trout, and other significant fisheries;
- river segments that have recreational significance, including state scenic river status;
- sites of historic or archaeological significance;
- unusual geologic formations or special soil types;
- wetlands;
- riparian buffers and conservation easements;
- land use and land coverage;
- impaired streams and the type of impairment;
- locations of point source discharges;
- potential threats to the existing water quantity and quality.



Carrie Hileman

TRACKING WATER-RELATED BILLS IN THE 2007 VIRGINIA GENERAL ASSEMBLY

The 2007 Virginia General Assembly session runs from January 10 to February 24. During the 2007 session, *Virginia Water Central* will post regular updates on water-related legislation on the Water Center's Web site, www.vwrrc.vt.edu. We will provide a list of water-related bills and resolutions, summaries as composed by the Virginia Legislative Information System, and bills' current status. At this time, we do not intend to send e-mail or print reminders or updates, but rather leave it to readers to access the Web site as they choose. Below are some key session dates to check for changes in bills' provisions, status, or both. Please contact the *Water Central* editor, Alan Raflo (540-231-5463, or araflo@vt.edu) if you have questions about this new service or suggestions for how it might work better for you.

As has been done for the past several years, *Water Central* will print an inventory of water-related legislation—both those bills that passed and those that failed—in the first issue following the close of the General Assembly.

Some Key Dates in the 2007 Virginia General Assembly

January 19—All bills and resolutions must be filed with clerk by 5:00 p.m.

February 1—Committees responsible for correctional impact, appropriation, debt, revenue, and Virginia Retirement System bills to complete work by midnight.

February 4—Committees responsible for Budget Bill to complete work by midnight.

February 6—Each house to complete work on its own legislation except Budget Bill.

February 8—Houses of introduction to complete work on Budget Bill.

February 13—Committees responsible for revenue bills of the other house to complete work by midnight.

February 14—Each house to complete work on Budget Bill and revenue bills of other house.

February 19—Last day for any committee action on legislation.

February 20—First conference on Budget Bill to complete work by midnight.

February 22—Budget Bill conference report due by noon; last day to put bills in conference.

February 23—Only conference reports and certain joint resolutions can be considered.

February 24—Adjournment *sine die*.

For current information about the General Assembly (including lists and summaries of all bills, budget information, member information, committee schedules, and more) visit the Legislative Information System Web site at <http://leg1.state.va.us>. You may also check on a bill's status by phone toll-free at (877) 391-FACT (House of Delegates) or (888) 892-6948 (Senate).

According to the "Citizen Participation" information at the General Assembly's Web site (<http://legis.state.va.us>), when the General Assembly is in session the House of Delegates and Senate jointly operate a telephone message center to accept calls from citizens wishing to express an opinion on legislation. The messages are relayed to members' offices as requested. Phone the Constituent Viewpoint operators toll-free at (800) 889-0229 (outside Richmond) or 698-1990 (Richmond area).



Workers apply stucco finish to the west wing of the Virginia State Capitol Building in June 2006, part of a three-year renovation and expansion project. The 2007 regular session will be held in the Patrick Henry Building; the Capitol Building is expected to be reopened for use during the reconvened session in April 2007. For more information on the Capitol renovation and expansion project, visit www.virginiacapitol.gov. Photo courtesy of the Virginia Department of General Services.

Virginia Water Central

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You can find *Water Central* on the Internet at www.vwrrc.vt.edu. If you prefer to read the newsletter there, instead of receiving a paper copy, please send an e-mail requesting this to water@vt.edu, and we will notify you whenever a new issue is posted.

Please notify *Water Central* at (540) 231-5463 or araflo@vt.edu if your address has changed or if you no longer wish to receive the newsletter.

Thank you!

YOU GET THE LAST WORD

Please answer the following questions to let us know whether the newsletter is meeting your needs. Please mail this page to the Water Center address listed in the box to the left, or e-mail your responses to araflo@vt.edu. Thank you.

1. Would you rate the content of this issue as good, fair, or poor?
2. Would you rate the appearance as good, fair, or poor?
3. Would you rate the readability of the articles as good, fair, or poor?
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5. Do the issues come too frequently, too seldom, or about right?
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