A River Network Publication
Volume 21 | Number 1 - 2011

River Voices

Restoring and Protecting Aquatic Ecosystem Integrity:

Clean Water Act (and other) Strategies for Citizen Activists

by *Robert W. Adler* *Professor of Law, University of Utah* *www.law.utah.edu*

Introduction

The federal Clean Water Act (CWA) establishes one of the most inspiring objectives in all of environmental law: "to restore and maintain the chemical, physical and biological integrity of the Nation's waters." This is more than a call to reduce or eliminate the discharge of harmful "point source" pollutants into our waterways. Although that goal is critical to human health and environmental welfare, it is not enough. Aquatic ecosystems are impaired by a daunting list of other insults, including polluted runoff from farms and streets; dams and water diversions; channelization and bank "stabilization" projects; loss or degradation of wetlands, floodplains, stream habitat and vegetated riparian zones; and exotic species from Asian carp to zebra mussels. (The CWA lumps those impairments into the broad category of "pollution" as opposed to discharges of "pollutants".) We need to address all ways in which our rivers and other water bodies are harmed, and we need to restore them from past damage while we protect them from new pollution.

© Tim Shields

Based on the legislative history of the 1972 CWA amendments (when the version of the law in substantially its current state was adopted), Congress meant what it said in establishing these goals of ecological integrity. The Senate Report indicated that maintaining ecological integrity "requires that any changes in the environment resulting in a physical, chemical or biological change in a pristine water body be of a temporary nature, such that by natural processes … the aquatic ecosystem will return to a state functionally identical to the original." The House Report defined "integrity" as "a concept that refers to a condition in which the natural structure and function of ecosystems is maintained….Any change induced by man which overtaxes the ability of nature to restore conditions to 'natural' or 'original' is an unacceptable perturbation." In other words, Congress intended the law to focus on more than just discharges of discrete chemical and other pollutants.

> "River activists should advocate for state adoption of biocriteria and expansion of how they are implemented."

Unfortunately, the regulatory and other tools Congress provided in the CWA do not match the breadth of the statutory objectives and legislative history. The law requires strict limits on discharges from "point sources" such as factories and sewage treatment plants, and includes tough governmental and citizen enforcement measures for violations. Controls on runoff pollution, by contrast, are left largely to individual states without significant EPA oversight, typically resulting in voluntary approaches to those problems. Measures to address the many other sources of aquatic ecosystem impairment are even more vague, or, in many cases, unspecified. And a series of confusing court opinions has left serious questions and uncertainty about what aquatic ecosystem components are even covered by the CWA.

One solution to this set of problems would be to amend the statute to clarify its reach and to provide a broader range of protection and restoration tools sufficient to match the statutory goals, as I have

cont. on page 4

River Network
Connecting People, Saving Rivers

CONTENTS

Editor: Katherine Luscher
Editorial Assistance: Merritt Frey and Gayle Killam
Design & Layout: Sue Greer

NATIONAL OFFICE
520 SW Sixth Avenue, Suite 1130 • Portland, OR 97204-1511
503/241-3506 • fax: 503/241-9256
info@rivernetwork.org • www.rivernetwork.org

River Network is a national, nonprofit organization whose mission is to empower and unite people and communities to protect and restore rivers and other waters that sustain the health of our country.

FROM THE PRESIDENT

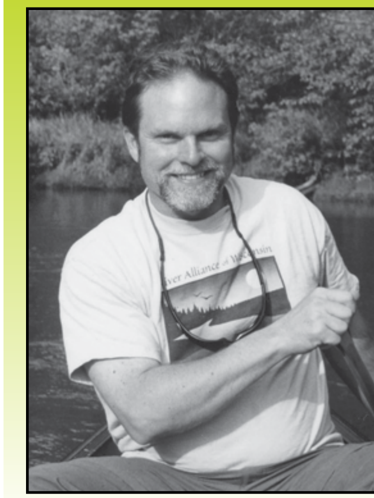


Photo Credit: River Network collection

The Clean Water Act—An Owner's Manual. I have liked that title ever since River Network first came up with it when the organization produced its first guide to using this landmark legislation to protect and restore the waterways of America.

After all, the waters of the United States are supposed to be held in trust for all of us; for future generations. When it was passed nearly forty years ago (in 1972), the Clean Water Act was our ticket to fishable and swimmable waters—by 1983.

We are just a little late.

Don't get me wrong, we have made progress. Rivers don't spontaneously combust anymore and for the most part, raw sewage doesn't grace the shores of our waterbodies.

But we have a long way to go. As Robert Adler describes in the lead article of this issue, the Clean Water Act's objective is about more than sewage … it sets out to "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Yet the physical and biological integrity pieces of that objective have long been neglected as we struggled to control chemical pollution.

In our new strategic plan, River Network's River Habitat Program has shifted our traditional focus on the Clean Water Act to take a harder look at how the Act can be used to revitalize river and wetland habitats and the biological systems they support. In this issue of *River Voices* you will learn a bit about what river and watershed groups are doing to use the Clean Water Act in creative ways that address issues such as habitat protection, flow restoration and more.

It has been nearly four decades—let's try something novel and fully embrace the vision of the Clean Water Act!

Todd Ambs, President
River Network

cont. from page 1 proposed in more detail elsewhere. Because that result is very unlikely in the current political climate, river activists should consider a range of options in the existing CWA, and in other federal, state and local environmental laws, to expand river restoration and protection.

Broader Goals through Biological Water Quality Criteria

State water quality standards define the goals of CWA programs and dictate the nature or stringency of other statutory tools. They identify the "designated uses" of particular water bodies (such as swimming, protection and propagation of fish and aquatic life, public drinking water supply or irrigation water), and water quality criteria to protect those uses. They also include "antidegradation" provisions to protect existing uses and to "keep clean waters clean." River activists have several bites at the apple to ensure that these standards are strict enough, because in addition to each state's approval process (and any opportunities for challenge in the state water quality agency or in court), EPA is required to review and approve state standards for consistency with the CWA and EPA regulations, and to adopt standards for delinquent states.

Water quality criteria come in different "flavors." *Narrative criteria* establish common sense expectations such as "no toxics in toxic amounts" or "free from floatable or putrescent wastes." While those criteria have some advantages due to their breadth, their vagueness can make them difficult to translate into enforceable pollution control requirements. Therefore, EPA also requires states to establish more precise *numeric water quality criteria* for individual pollutants or other water body attributes, which can more easily be translated into permit requirements for pollutant discharges. Some states also have "whole effluent toxicity" measures to address cumulative or synergistic effects of multiple pollutants.

Even this suite of water quality criteria, however, is insufficient to protect and restore aquatic ecosystem integrity from the full range of ongoing threats. For example, withdrawing water from already depleted streams may or may not lead to violations of numeric criteria for individual pollutants, but can severely impair stream habitat. One solution, which a few states have adopted and which is arguably necessary under the CWA, is minimum flow standards for water bodies. Likewise, stream habitat may be seriously impaired by factors such as channelization or bank stabilization, elimination of riparian vegetation or development in riparian wetlands or floodplains, or other factors not measured by individual numeric criteria.

Encouraged by EPA, many states have filled this gap by adopting biological water quality criteria ("biocriteria") to measure stream impairment relative to reference systems. For an example of biocriteria in action, see page 10. Biocriteria use statistical methods to compare numbers and diversity of aquatic species at multiple trophic levels to measure how much an impaired stream differs from what one would expect from a "natural" (unimpaired) water body of a similar type. They provide a more holistic measure of stream impairment than other kinds of criteria because they measure loss of aquatic ecosystem integrity more directly, and can be used to identify a wider range of impaired waters for protection.

River activists should advocate for state adoption of biocriteria and expansion of how they are implemented. Some states (like Ohio) have led the way in this area, but many others are behind the curve. Some (like my own state of Utah) propose to adopt biocriteria but argue that they are useful only in detecting impairment and cannot be independently implemented or enforced. This is illegal. The CWA requires that all water quality standards be implemented and enforced, although that is admittedly tricky for biocriteria. For example, it may be difficult to translate a loss of aquatic diversity into a corrective limit in pollutant discharges. However, if stream impairment is detected below—but not above—a major discharge, it is likely that something that is not currently addressed by the facility's permit is causing or contributing to the impairment. On investigation, it might be temperature, synergistic pollutant effects, unregulated pollutants, flow volume or other factors that can be addressed. Likewise, investigation may show that the impairment is caused by farm runoff or loss of instream spawning or rearing habitat, or by a reduction in flows or natural food sources.

Some ecological detective work and "outside the box" thinking may be needed to move from evidence of impairment to remedial measures. Detection of impairment through biocriteria, however, can provide the information, analysis of problems and potential solutions, and the legal leverage necessary to prompt adoption of those measures.

Making the Most of TMDLs

The CWA requires states to monitor all of their waters, to identify water bodies that are impaired by reference to water quality standards, to prioritize those impaired waters and to establish the "total maximum daily load" (TMDL) for pollutants identified as responsible for the violation. A TMDL is a calculation of the total amount of pollution a water body can receive without violating water quality standards, with an appropriate margin of safety and considering variations in seasonal flows.

River activists have been fighting for years to require states (or EPA, where states fail to do so) to list the full range of impaired waters and to prepare and implement the required TMDLs. However, because the TMDL provision focuses on "pollutants" rather than the full scope of aquatic ecosystem impairment, TMDLs present similar challenges of scope as water quality standards.

Fortunately, courts have ruled that TMDLs apply to both point sources and nonpoint sources. Other nonpoint source provisions of the CWA are relatively weak, leaving it largely to individual states to determine what controls, if any, are necessary to control runoff pollution and other aquatic ecosystem impairment. TMDLs can be used as additional leverage for nonpoint source controls. To approve a TMDL, EPA guidance requires "reasonable assurance" that whatever proportion of the total pollutant load allocation for a water body a state assigns to nonpoint sources will not be exceeded. Where voluntary or other relatively weak measures prove insufficient to provide that assurance, river activists can argue for regulatory or other mandatory measures to address those sources of impairment.

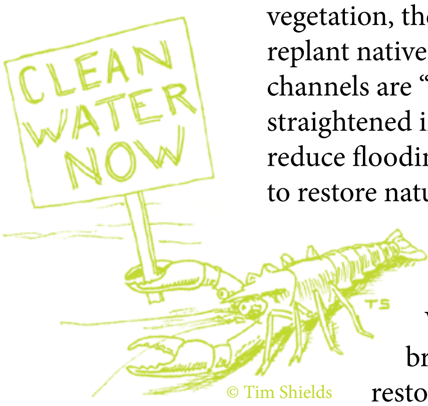
An interesting aspect of a TMDL is that it is a zero sum game. If more uncontrolled pollution comes from nonpoint sources, industrial and municipal point sources might face stricter discharge limits to meet water quality standards. So river

cont. on page 6

cont. from page 5

activists might find allies in powerful interest groups (permitees) who arguably face an unfair share of the water pollution control burden given the CWA's disparate treatment of point and nonpoint sources.

A more difficult but also important issue is the apparent disconnect between the circumstances that trigger TMDLs and the kinds of remedies included expressly in the CWA. The law requires a TMDL where existing point source controls are insufficient to meet any water quality standards, not just standards that address individual pollutants. But as discussed above, if biocriteria and certain other kinds of water quality standards are violated, states will not necessarily solve the problem by reducing discharges of pollutants. If stream temperatures are too high because the riparian zone has been stripped of vegetation, the best solution may be to replant native trees or shrubs. If stream channels are "stabilized" with riprap or straightened in an ill-conceived effort to reduce flooding, the best solution may be to restore natural bank morphology, stream meanders and riparian zone integrity.



© Tim Shields

Whether TMDLs require broader aquatic ecosystem restoration remedies is disputed legally, but it is not clear why they should be controversial as a matter of common sense. Some riparian landowners will resist restrictions on development necessary to protect adjacent waterways and will challenge efforts to do so as an unconstitutional taking of their property. However, private property rights should not include an unfettered ability to impair the public's interest in healthy aquatic ecosystems.

In many cases, habitat restoration simply makes more ecological and economic sense than using TMDLs to squeeze the last gram of pollutants out of point sources when that is not the main source of impairment. Regardless of the strict legal scope of TMDLs, like biocriteria they can be used to identify the real problems facing individual streams. We can then use other methods to correct those problems, such as conservation easements, land use controls or other methods to protect and restore damaged aquatic zones. Again, traditional point source interests may be allies in that effort. And as shown in the related article on habitat TMDLs (see page 19), this strategy is being used to good effect in some states.

Other Tools to Restore and Protect Aquatic Ecosystem Integrity

Once biocriteria and TMDLs are used to identify the full range of impaired streams and other waters in a state, and to evaluate the most pressing sources of harm in addition to inadequately controlled pollutant discharges, other legal tools are available to prevent further harm and to restore existing damage. Although it is not possible to give a complete analysis of each of those, the following are some of the other options river activists might want to pursue:

Water Quality Certification of Federal Licenses and Permits

Federally licensed or permitted projects, such as dams, hydroelectric and nuclear power plants and wetland fills, can stress aquatic ecosystems. Through water quality certifications, states have the authority to condition or even veto those projects to ensure compliance with water quality standards and other appropriate requirements of state law. Because water quality standards address a wider range of impairments to aquatic ecosystems than chemical pollution, especially in states that have adopted biocriteria and adequately protective antidegradation provisions, state water quality certifications can provide a potent strategy to ensure that federally licensed or permitted projects do not interfere with aquatic ecosystem restoration and protection. In one famous case upheld by the U.S. Supreme Court, the State of Washington used a water quality certification and its antidegradation regulation to condition a federal hydroelectric project on maintenance of sufficient instream flows to protect salmon runs. The accompanying article on page 16 provides several other examples of using water quality certification to protect aquatic ecosystem integrity.

Protecting and Restoring Wetlands

Riparian and other wetlands are often critical to the hydrological and ecological health of streams and other water bodies. Wetlands cycle nutrients and often remove sediment, toxic metals and other pollutants from runoff, keeping them out of flowing waters. They buffer storm surges and protect the physical integrity of stream banks and channels. They provide key habitat for water-dependent species, and a hydrological transition zone between aquatic and terrestrial ecosystems.

As such, advocates cannot ignore threats to wetlands if their goal is to protect and restore aquatic ecosystem integrity. One way to do so is to participate in permitting decisions by the Army Corps of Engineers for discharges of dredged or fill material under CWA section 404. Because those permits must ensure compliance with state water quality standards, and because they are also subject to water quality certifications, they provide another opportunity to implement and enforce biocriteria and other kinds of water quality standards. Section 404 prohibits wetland fills if there is a "less damaging practicable alternative," which is presumed for non-water dependant activities. Therefore, the statute forces an evaluation of alternatives that could fulfill project purposes without damaging, or with less damage to, aquatic ecosystems. Given the huge percentage of wetlands that have already been lost or degraded in most states due to past activities, strategic wetland restoration efforts can also help to improve aquatic ecosystem integrity.

Unfortunately, despite the relationship between wetlands protection and aquatic ecosystem health, the Supreme Court has created significant uncertainty about the reach of the CWA for wetlands that are not immediately adjacent to surface waters. Given lack of progress in amending the CWA to clarify that it protects all components of aquatic ecosystems, it is important to support or conduct research that shows the physical, chemical and biological "nexus" between wetlands and other associated waters. Although that connection may seem obvious to a river guru, it may not be to a federal judge absent scientific proof.

Maintaining Instream Flows

Although many states have argued that the CWA is limited to water quality issues, it is clearly not possible to maintain the physical, chemical and biological integrity of water bodies if they are dewatered. When the Supreme Court upheld Washington's instream flow requirement for a federally licensed dam, Justice O'Connor wrote than any effort to separate water quality and water quantity is "an artificial distinction." In many parts of the West, entire stream systems are over allocated under the prior appropriation doctrine, and are particularly vulnerable during droughts when more "senior" water rights take priority over the limited

cont. on page 8

cont. from page 7

instream flow rights that have been recognized in recent years. Even in the East, streams are under pressure due to population growth and other demands.

River advocates already care about flow protection for recreational and other uses. Many have learned to navigate their state water law systems, or to advocate water conservation, wastewater reuse, and other strategies to protect instream flows against consumptive uses and other demands. Some of the CWA tools discussed above, however, may also be helpful in protecting instream flows, including water quality criteria establishing minimum flow requirements for rivers or "conservation pools" for lakes, water quality certifications, and potentially flow provisions in TMDLs. Because pollution levels are a function of both the amount of pollution discharged and the volume of water available to receive it, it is "artificial" to consider one but not the other. Here in Utah, a proposed expansion of mineral extraction operations in Great Salt Lake would require a significant new water right, associated evaporative losses and potentially drastic reductions in lake levels. In addition to protesting the water right with the State Engineer, environmental groups argued in comments on the water quality certification that the activity would destroy existing lake uses in violation of the state's narrative water quality standards and antidegradation requirements.

Protecting Aquatic Ecosystems with other Federal Statutes

River activists who care about aquatic ecosystem integrity should not, however, put all of their fish eggs in the CWA basket. Several other federal statutes, as well as state and local land use and other tools, may be as or more useful in protecting and restoring aquatic ecosystem integrity, and some might be used in tandem with CWA provisions discussed above. A few examples are notable. First, water quality certification and other CWA provisions may be triggered by approvals under other federal statutes (such as dam licenses or license renewals under the Federal Power Act) or actions taken directly by federal agencies. Second, a major federal action might require an environmental impact statement under the National Environmental Policy Act. It might also require consultation with the Fish and Wildlife Service or the National Oceanic and Atmospheric Administration under the Endangered Species Act if it jeopardizes the continued existence of a threatened or endangered species or loss or impairment of critical habitat for those species. Those processes can generate scientific analysis that supports CWA protections. Like section 404, those laws also require an analysis of alternatives that might achieve the same or similar goals with less damage to aquatic ecosystem integrity.

Conclusion

The CWA is about more than pollution spewing from factory and sewage treatment plant pipes. Although those kinds of pollution prompted Congress to adopt the modern version of the law in 1972, it wisely chose a more sweeping set of statutory objectives. Unfortunately, enforceable mechanisms in the Act do not always match its full aspirations. Short of politically elusive statutory improvements, however, river activists still have a broad range of tools to help restore and protect aquatic ecosystem integrity.

© Tim Shields

Robert Adler is the James I. Farr Chair in Law at S.J. Quinney College of Law, University of Utah. He has published dozens of articles and reports in law, policy and science journals and, among other publications, has authored a book on the history and impact of the Clean Water Act. He recently launched a new environmental clinic in cooperation with Western Resource Advocates.

Getting Started:

Using the Clean Water Act to protect and restore healthy aquatic life and habitat

1 Understand the fundamentals

Check with your state water quality agency about aquatic life use categories that have been established such as *warm water fishery* or *cold water fishery*. How do they protect those uses? Learn more: **www.rivernetwork.org/content/lesson-1**

2 Protect the high quality

Determine whether your state water quality agency protects the best of the best, such as reference reaches. Learn more: **www.rivernetwork.org/books/antidegradation-one**

3 Improve waters that are threatened or impaired

Ascertain how your state water quality agency addresses aquatic habitat problems such as erosion or insufficient streamflow. Learn more: **www.rivernetwork.org/content/lesson-3-identifying-threatened-and-impaired-waters** and **www.rivernetwork.org/content/lesson-4-restoring-imparied-waters-tmdls**

4 Guard against destructive wetland and stream alteration

Track proposed permits to alter wetlands and streams and use available regulatory tools to prevent impacts to aquatic life and habitat. Learn more: **www.rivernetwork.org/content/lesson-5-state-oversight-federal-permits** and **www.rivernetwork.org/content/lesson-6**

5 Stop the pollution

Examine and highlight the impacts of discharges on aquatic life and habitat by reviewing discharge permits. Insist on practices and technologies that prevent any harm to uses. Learn more: **www.rivernetwork.org/content/lesson-2a-pollution-discharge-permits** and **www.rivernetwork.org/content/lesson-2b-stormwater-pollution-discharge-permits**

6 Advocate for better and more monitoring

Raise questions about your state's biomonitoring program to your state water quality agency: how often and where do they monitor? Where are the data kept and how are they used? Learn more: **http://water.epa.gov/type/watersheds/monitoring/bioassess.cfm**

You don't have to tackle all these ideas…simply pick one that matches your watershed's needs as well as the available tools. For more specifics on each of these "to-dos", visit **www.rivernetwork.org/getstartedbio.**

Improving State Biocriteria Programs Provides Broader Support for Water Quality Management

by Chris O. Yoder
Center for Applied Bioassessment & Biocriteria

Midwest Biodiversity Institute

www.midwestbiodiversityinst.org

Background

Biological criteria or "biocriteria" are measures of aquatic assemblages (e.g., fish, macroinvertebrates, algae, aquatic vegetation, etc.) based on systematic monitoring of aquatic habitats. Because these assemblages inhabit a waterbody all of the time, they are an effective indicator of aggregate condition over time. Most state programs use biological assessments or "bioassessments" to determine the condition of aquatic resources. The results are reported to U.S. EPA and are used to delineate lists of degraded or "impaired" waters which are then targeted for the development of total maximum daily loads (TMDLs). However, variable levels of sophistication are employed among the states and this can significantly affect the quality of impaired waters delineations and restoration efforts.

Biological criteria have been shown to be more effective at assessing water body quality than chemical measures alone. In Ohio, a comparison of more than 2500 sampling points over 20 years revealed that bioassessments detected impairments in nearly 40% of the waterbodies that chemical assessment alone deemed acceptable. This reflects both the more comprehensive detection of non-chemical impacts and the effects of chemicals that "escape" traditional methodologies. More importantly high quality bioassessment programs reveal the effects of multiple stressors, not all of which are equally regulated under the Clean Water Act (CWA). As such, stronger state bioassessment programs should spur the development of more refined water quality standards (WQS), designated uses and more refined water quality criteria. Taken together these will assure better and more accurate NPDES permits, TMDLs, 404/401 decisions and nonpoint source management.

State Bioassessment Program Status

Because of the concern over the quality and level of technical rigor among state programs, we developed with EPA support a state program evaluation process. An important part of this process is the Critical Elements of State Bioassessment Programs methodology (Yoder and Barbour 2009). Twenty-two states have been reviewed and placed in levels 1-4 with the program rigor increasing as levels increase (i.e., level 4 programs represent the most rigorous). The results of state reviews (2004-9) show that there are two level 4, eight level 3 and twelve level 2 programs among the 22 states.

What is most revealing is that only the two level 4 and one of the level 3 states have biocriteria in their WQS (Ohio, Maine and Vermont). The evidence shows that what states can do with bioassessment information corresponds directly to the level of program rigor. The higher the level of rigor the more likely the state is to have biocriteria in the WQS, support detailed and innovative approaches to solving complex issues, support management programs on a day-to-day basis and include a broader array of stressors in TMDLs. Having biocriteria in state WQS is essential to closing the existing gaps in state program effectiveness.

Why Does It Matter?

A dichotomy exists among state bioassessment programs. Level 2 and some level 3 states may only use bioassesements to establish pass/fail status for impaired waters decisions. However, most level 3 and the level 4 states identify impairments and also use biological information to support important program functions such as pollution discharge permit decisions.

CONFUSED ABOUT THE TERMS SURROUNDING BIOCRITERIA?

U.S. EPA describes the basics this way:

> "The presence, condition and numbers of types of fish, insects, algae, plants, and other organisms are data that together provide direct, accurate information about the health of specific bodies of water. Studying these factors as a way of evaluating the health of a body of water is called biological assessment. Biological criteria (biocriteria) on the other hand, are a way of describing the qualities that must be present to support a desired condition in a waterbody, and they serve as the standard against which assessment results are compared."

Biological Assessments or **Bioassessments** are an evaluation of the biological condition of a waterbody using biological surveys and other direct measurements of resident biota (e.g. macroinvertebrates, fish, etc.). Bioassessements both support development of biocriteria and decisions about attainment of biocriteria.

Biological Criteria or **Biocriteria** are either narrative or numeric expressions that describe the reference biological integrity (structure and function) of various aquatic communities. The reference conditions become the "goal" or criteria for other similar waterbodies, and are used for Clean Water Act regulatory purposes.

References conditions or **reference reaches** are the foundation for biocriteria development. These reaches should represent unimpaired or minimally impaired conditions (i.e. "healthy" waterbodies) and are selected to be representative of the expected biological integrity of other similar waterbodies.

Adapted from U.S. EPA's Biocriteria and Bioassessement Basics at **http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/basics.cfm** and the related glossary found at **http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/glossary.cfm.**

These latter programs are much more likely to have refined relationships between their biocriteria and chemical, physical and biological stressors. These in turn take their place as refined management benchmarks towards which management programs strive to attain. Not only does this yield management programs that are more effective, but it builds a more complete awareness that leads to better legislation and policy.

Ohio EPA has been implementing biocriteria since the 1980s. This early work formed the basis for WQS that were then applied to water quality based permitting via the NPDES program. Success has been documented with the control of "conventional" pollutants such as oxygen demanding wastes, ammonia and selected metals. However, the initial process did not include nutrients like phosphorus as there were no criteria, but also because the results of enrichment were masked by more serious impacts from low dissolved oxygen and ammonia.

cont. on page 12

cont. from page 11

This evolution is demonstrated in the case of the Little Miami. Ohio EPA designated the Little Miami River as an Exceptional Warmwater Habitat (EWH) in the early 1980s following the first complete biological survey of the mainstem and key tributaries. The EWH use tier was assigned because the biological data demonstrated attainment of the EWH biocriteria. The next bioassessment conducted in 1993 documented improvements and increased attainment of EWH as the result of the water quality based permitting at municipal wastewater treatment plants (WWTPs) and compliance with those more stringent effluent limits after 1988.

However, suburban development in the surrounding communities increased WWTP flows and loads through the 1990s. A bioassessment in 1998 documented a decline in attainment, which appeared to be associated with increased phosphorus loadings. Phosphorus was not targeted as part of the earlier permit reductions that emphasized oxygen demanding wastes and ammonia. The biological assessment concluded that the impaired biota were indicative of the secondary impacts of nutrient enrichment. Following a determination that this was related to loadings discharged primarily during summer low flows, i.e., from municipal WWTPs, a phased reduction of phosphorus loadings by adding phosphorous limitations in NPDES permits was implemented by the largest WWTPs.

The next follow-up bioassessment in 2007 documented virtually complete attainment of the EWH biocriteria along most of the Little Miami, confirming the original hypothesis that the biological impairments were indeed linked to phosphorous loadings discharged by the point sources.

This represents one of the best examples of the before and after effects of NPDES permitting tied to biocriteria.

Another perhaps “non-traditional” use of bioassessment is in support of 404 and 401 dredge and fill permits and water quality certifications. Because the biological assemblages are affected by the modification of habitat that these projects are intended to regulate, predictable responses to varying levels of modification can be ascertained.

A suitable habitat assessment method is needed and it also needs to have a predictable relationship with the biological response to habitat modifications. Again, it is the level 3 and 4 programs that can accomplish this because of the level of detail in their bioassessment approaches. Once the relationships are quantified these “tools” can be used to make decisions about the state 401 certification of 404 permits. This process is the most legally defensible when the biocriteria are in the WQS since the connection to the legal requirement to certify that projects meet WQS is the most directly demonstrated. Ohio and California each have this embedded in their respective 401 certification processes. Without a bioassessment, many 404 projects are likely to be approved when they in fact likely cause adverse impacts and “violate” the state WQS.

Although states have been slow to develop biocriteria, the benefits of a good program are undeniable. Biocriteria can serve as an effective biological endpoint for any management program—discharge permits, TMDLs, 401 certification and beyond—where compliance with WQS is a primary goal.

Our Measuring Stick for Biological Progress:
Protecting Reference Streams

by Gayle Killam
River Network
www.rivernetwork.org
and
Judy Petersen
Kentucky Waterways Alliance
www.kwalliance.org

How do we know when our streams and lakes are sick? How do we know when we have adequately nursed them back to health? We typically reach for the numbers, the water quality criteria, that have been set by the state and federal governments to determine what amount of a pollutant is too much, what is not enough (e.g., dissolved oxygen) and what is the right level (e.g., pH). These numbers are supposed to be set to ensure the various uses (both human and ecological) will not be compromised. Yet, too often these numbers don't have sufficient connection to what is appropriate and achievable in each and every water body in this country.

In the previous article, Chris Yoder discussed the importance of biological assessment and setting biological criteria to understand the true health of streams and lakes and their potential. A key component in biological assessment is the identification of the reference condition, against which all other water bodies are measured.

The reference condition establishes the basis for making comparisons and for detecting use impairment; it should be applicable to an individual water body, such as a stream segment, but also to similar water bodies on a regional scale (Gibson et al. 1996)[1].

U.S.EPA defines the reference site as a specific locality on a water body which is unimpaired or minimally impaired and is representative of the expected biological integrity of other localities on the same water body or nearby water bodies[2]. Can you think of streams or stream segments that could be characterized as unimpaired or minimally impaired by human activity? Are they comparable to other degraded streams or segments? Reference conditions used in biological surveys are either site-specific (upstream or in a "paired" watershed from the waterbody being assessed) or regional where measurements from relatively unimpaired sites within a relatively homogeneous region and habitat type are collected and used for comparison[3].

How Can Reference Reaches be Used?

Identified representative reference reaches can be used to:

- set biological, physical and chemical water quality criteria necessary for defining and protecting healthy ecosystems,
- establish targets for protection, restoration or management actions such as in Total Maximum Daily Loads (TMDLs), stormwater management plans or best management practices (BMPs), or
- evaluate the degree of effect from human disturbances: are aquatic life uses met? If so, to what extent?[4]

[1]Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C. (Section 3.4 - http://water.epa.gov/scitech/monitoring/rsl/bioassessment/ch03main.cfm#Section%203.4) Water; Washington, D.C. (Section 3.4 - http://water.epa.gov/scitech/monitoring/rsl/bioassessment/ch03main.cfm#Section%203.4)

[2]EPA Biocriteria website definitions (http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/glossary.cfm)

[3]Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C. (Section 3.4 - http://water.epa.gov/scitech/monitoring/rsl/bioassessment/ch03main.cfm#Section%203.4)

[4]Based on ideas in a presentation by Larsen, Phil. 2003. Basic Reference Condition and Classification Techniques, presentation at National Biological Assessment and Criteria Workshop, Coeur d'Alene, Idaho, March 31-April 4, 2003. http://water.epa.gov/scitech/swguidance/standards/upload/2004_03_05_biocriteria_modules_rfc101-01-introduction.pdf

cont. on page 14

cont. from page 13

The recently-released Florida nutrient criteria were based on ecoregional reference conditions, i.e., what nutrient reductions can be achieved throughout the state.

Chances are, you can think of a section of a river, stream or a lake, if not the whole water body, that could (and may already) serve as a reference site. Unfortunately, there is no assurance that these high quality conditions, essential to biological assessment, will be maintained and protected. In fact, our experience shows that the primary Clean Water Act tool designed for protecting existing high quality characteristics, has not been fully implemented or enforced in any state in the nation.

Kentucky Example

In Kentucky, the natural resources cabinet has developed a "reference reach" network. Surface waters that are in that network or that meet the following conditions have been designated as "Exceptional Value Waters":

a. A **fish community** that is rated "excellent" by the use of the Index of Biotic Integrity included in "Development and Application of the Kentucky Index of Biotic Integrity (KIBI)", 2003; or

b. A **macroinvertebrate community** that is rated "excellent" by the Macroinvertebrate Bioassessment Index included in "The Kentucky Macroinvertebrate Bioassessment Index," 2003[5];

These streams are the best of the best in each ecoregion within the state; they are used as the healthy measuring stick for all other streams. In some cases, they are used in determining if a stream is impaired.

Unfortunately, Kentucky's level of protection for Exceptional Value Waters is not sufficient to protect against new or expanded discharge permits or dredge or fill activity. Once a reference reach is degraded, it can no longer be a reference reach. As long as these waters are serving incredibly valuable ecosystem and regulatory purposes, reference reaches truly deserve the highest protection that the Clean Water Act can offer.

The Greatest Protection Available

The highest protection afforded by the Clean Water Act is reserved for the waters that are ecologically or recreational significant. When a state deems that waters are worthy of the highest protection, they assign the category of "Outstanding National Resource Water."[6]

Every state is supposed to establish a process for these designations as well as identify specific protections that will "maintain and protect" the water quality that, in the case of reference reaches, is responsible for its ecological significance.

As a part of Kentucky's last triennial review[7], Kentucky Waterways Alliance nominated several waters as Outstanding National Resource Waters. All of the five successful nominations were outstanding in many ways (within a National Forest and a National Wildlife Refuge, designated Kentucky Wild Rivers, designated Outstanding State Resource Waters or Exceptional Waters), but two of the five were also state-designated reference reaches.

[5] 401 KAR 10:030(2)(a)(3) & (4)
[6] 40CFR131.12(c)
[7] A process required of the states (by the Clean Water Act regulations) at least once every three years to hold public hearings for the purpose of reviewing applicable water quality standards (of which antidegradation policy is a part) and, as appropriate, modify and adopt them. 40CFR131.20(a)

Kentucky Reference Reach Outstanding National Resource Waters

1. **Marsh Creek - McCreary County**
"From the confluence of the Cumberland River to river mile 15 (approximately 1.9 miles upstream of KY road 478) were found eligible, possessing outstandingly remarkable recreational and wildlife values"[8]. This river segment is already designated in Kentucky regulations as a KY Wild River, OSRW, Exceptional Water and a reference reach stream.

2. **Rock Creek - McCreary County**
"A 17.5-mile segment from White Oak Junction to the Kentucky/Tennessee border was found eligible possessing outstandingly remarkable recreational, wildlife and water quality values"[9]. This river segment is already designated in Kentucky regulations as an Exceptional Water, CAH, OSRW and a reference reach stream. Additionally, two tributaries are also designated Exceptional Water and reference reach.

Timing is Critical

Unfortunately, too few states have established clear processes for designating and protecting Outstanding National Resource Waters (ONRWs), and too many streams, rivers or lakes that are qualified to be reference water bodies are threatened by ongoing or proposed human activity. River Network has worked with many watershed champions around the country to try to improve ONRW procedures and bring important designations to the state. We believe that the time is now to promote identified reference water bodies as ONRWs, and to work to strengthen the protections of ONRWs before we lose the real world examples of healthy functioning ecosystems by which we can set our goals for all waters.

[8]Draft Wild and Scenic Rivers Suitability Study and Environmental Impact Statement for Six Rivers On The Daniel Boone National Forest. United States Department of Agriculture. Forest Service. August 1994.

[9]Ibid

The (Possible) Power of Water Quality Certification to Protect Habitat and Flow

by Merritt Frey
River Network
www.rivernetwork.org

One of the Clean Water Act's (CWA) strongest tools for protecting physical and biological values of our rivers is also one of the most under-utilized: the Section 401 water quality certification process (hereafter, "water quality certification".) Water quality certification allows states to review and veto or place conditions on activities requiring a federal license or permit that may result in a discharge. States can place an incredible array of conditions (or deny certification) if necessary to comply with their water quality standards (including designated uses such as aquatic life uses) and other policies.

Water quality certification is triggered by the application for a federal license or permit, which includes but is not limited to wetland dredge and fill permits, Federal Energy Regulatory Commission hydropower licensing and pollution discharge permits in areas where U.S. EPA issues the permits.

This process is a rare chance to fundamentally change the way an activity is conducted or to stop it altogether. Through the water quality certification process, river advocates can make the case for very specific protections of riparian habitat, water quality and beyond. Various water quality certification processes have successfully addressed issues including—but not limited to—flow, habitat protection and aquatic life support.

Protecting Instream Flows for Aquatic Life

Two examples show that the power of water quality certification can cross even that most sacred of water law lines—the line imagined between water quality and water quantity.

The first example involves the most famous water quality certification case ever argued—PUD No.1 of Jefferson County v. Washington Department of Ecology[1]. This case involved a proposed hydroelectric project on the Dosewallips River in Washington. The project would have diverted about 75 percent of the river's flow for hydropower generation, and returned the flow about a mile downstream.

Photo Credit: Merritt Frey

Old dock on Lake Huron in Michigan

[1] This story has been adapted from River Network's *Clean Water Act Owner's Manual* which summarized the tale from Ransel, Katherine P., "The Sleeping Giant Awakens: PUD No.1 of Jefferson County v. Washington Department of Ecology," 25 Envtl. L. 255 (1995).

The project supporters applied for and received water quality certification from the state, but the state certification required a minimum in-stream flow ranging between 100 and 200 cubic feet per second. This case was argued all the way to the U.S. Supreme Court, which supported the power of the state to require in-stream flow in order to protect uses on the Dosewallips.

An example from 2011 involves Fay Creek, a tributary to the South Fork of Kern River in California. The courts found the U.S. Forest Service acted arbitrarily and capriciously when they re-issued a Special Use Permit (SUP) to operate a diversion and small dam on Forest Service lands without considering seeking water quality certification from the state. The SUP had allowed a rancher to take 100 percent of Fay Creek's flow.


Photo Credit: Tim Bruer

Healthy biological systems make for happy anglers.

According to the local group who challenged the SUP, this is the first time a court has held that the Forest Service must seek water quality certification for a SUP before it can allow a water diversion from an existing dam. The water quality certification may make a huge difference in the future of Fay Creek, because California requires at least some flow in the creek at all times to protect downstream resources, such as fish and riparian vegetation.

Protecting Habitat for Aquatic and Other Wildlife

If you are at all familiar with the water quality certification process, it is most likely through its application to wetland and stream alteration permits (404 permits) issued by the Army Corps of Engineers (Corps). Where states actively apply water quality certification to 404 permits, the physical habitat of a stream or wetland and the biological community can benefit enormously.

For example, every five years the Corps reissues a series of general permits known as the Nationwide Permits (NWPs). These permits allow a variety of activities that may harm wetlands and streams. The new round of NWPs was proposed in February 2011 and will be finalized by March 2012. As part of the reissuance process states will review each NWP and through water quality certification they may deny, certify or place conditions on each permit. (To get involved with our campaign to apply strong conditions to the new NWPs, visit www.rivernetwork.org/401andnwp)

In the last round of NWPs, some states used their water quality power to great advantage. For example, eleven states denied or suspended all of the NWPs outright—requiring either individual certification for each activity or developing state-specific general permits. More commonly, states applied a variety of conditions designed to limit the harm of the NWPs. Common "themes" for conditions included protecting impaired waters, special categories of waters, and/or special types of waters; limiting the size of the impact; limiting the types of activities; requiring notification; and limiting the use of "waivers" by the Corps. Each of these condition themes provides a mechanism to reduce the harm to the physical structure and biological communities of our rivers and wetlands.

cont. on page 18

cont. from page 17

Protecting Designated Uses from Physical Harm

As was made clear in the Dosewallips Supreme Court decision, water quality certification is not only about meeting numeric water quality criteria—it can also be used to protect designated uses such as aquatic life directly. For example, two nuclear power plants on the Hudson River—Indian Point Units 2 and 3—use outmoded technology to generate power and cool the plants. The systems withdraws 2.5 billion gallons of water a day from the Hudson. As the plants draw in water, plankton, eggs, larvae and even fish are drawn into the plant's systems or trapped against the intake screens, directly harming the designated aquatic life use.

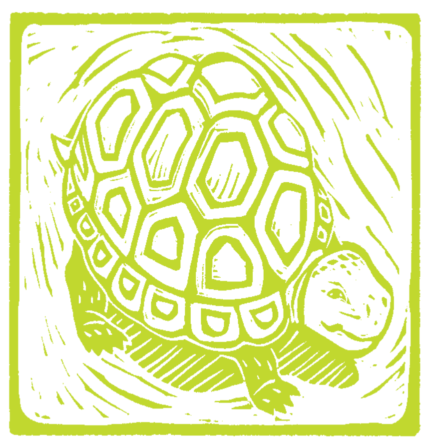
Photo Credit: Greg Porteus

The Riverkeeper boat cruises by Indian Point Units 2 & 3.

The plants' Nuclear Regulatory Commission licenses will expire in 2013 and 2015. As part of the renewal process, the plant owners applied for water quality certification from New York State. Riverkeeper—the main watchdog for the Hudson—along with other groups used the water quality certification process to request denial of the certification or the placement of conditions on the certification.

In early 2010 the state agency denied certification. Although that decision is being challenged, the process has already changed the debate. As things stand now, water quality certification has stopped the plants' license renewal; longer term it may change the plants' operation and directly protect aquatic life from physical harm, temperature violations and other problems, such as radioactive contamination.

The examples discussed here only scratch the surface of the power of water quality certification to protect the physical and biological systems of our waters. For example, water quality certification has been used to require fish passage, to require the creation of a recreational facility for enhanced access, to protect flows (and the resulting mist) over falls considered sacred under tribal law, and more. If you thought water quality certification was only about wetlands permits or only about numeric water quality standards, think again and explore what this powerful tool can mean for your watershed work.



Restoring Habitat and Flow...

Can the TMDL Program Help?

by Merritt Frey
River Network
www.rivernetwork.org

Habitat and flow impairments are often thought of as "untouchables" in the Total Maximum Daily Load (TMDL) world. Common thinking about the program often has been strictly focused on calculating a limit for a specific pollutant, which is then apportioned as an overall "load" among point and nonpoint sources of pollution.

Although load reduction is the heart of the TMDL approach, it doesn't have to be limited to that either. For example, the Ohio Environmental Protection Agency (OEPA) has long viewed the TMDL program just a little differently than other states. In part, this is a result of Ohio's strong biological monitoring program and the existence of strong biological metrics in its water quality standards (see related article on page 10) which allows the state to focus on attaining designated uses rather than only on a chemical surrogate.

As a result, Ohio TMDLs consider both reducing loads and building assimilative capacity—coming at pollution problems from both sides of the equation. While load reductions might include activities like tightening permit limits and establishing best management practices, increasing a stream's assimilative capacity might also include increasing the shade canopy over a stream or improving instream flows. Using both approaches has allowed the state to create "habitat" TMDLs that both achieve a specific water quality criteria and improve overall stream function.

The state creates TMDLs which link a specific measure—for example, the state's biocriteria standard—with a response indicator such as dissolved oxygen. That response indicator is then tied to an exposure indicator like nutrients or carbonaceous oxygen demand. Lastly, that exposure indicator is tied to stressors, such as wastewater discharges, habitat modification and flow. So in this example the TMDL might recommend a load reductions by changing wastewater treatment plant's permitted discharges for nutrients and oxygen demanding substances and boosting assimilative capacity by restoring the stream buffers and flows so it is better able to naturally process the remaining nutrients.

Photo Credit: Bill Zawiski, Ohio Environmental Protection Agency

Monroe Falls Dam on the Middle Cuyahoga River on August 2, 2005.

A Case in Point: Middle Cuyahoga

River advocates are familiar with Ohio's Cuyahoga River, although not for the most flattering of reasons: the fire which burned on the Cuyahoga in the '70s is credited with motivating the major overhaul of our federal approach to water quality law—resulting in what is today called the Clean Water Act.

cont. on page 20

cont. from page 19 Since the '70s, the Cuyahoga has seen large improvements in chemical and physical water quality. However, problems remain, particularly on the biology of the system. For example, the middle Cuyahoga was declared impaired by habitat and flow alteration, excessive nutrient levels and low dissolved oxygen. The OEPA identified flow modification, impoundments and municipal discharges as the sources of these problems.

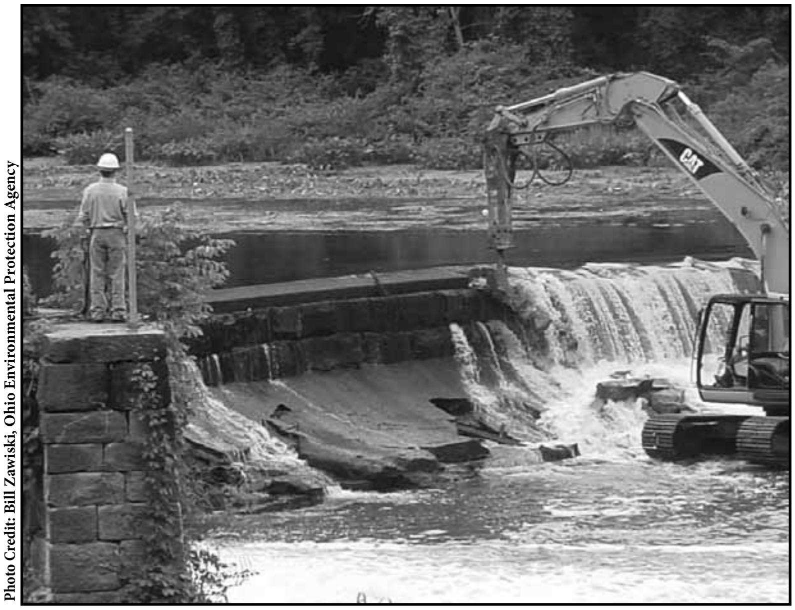


Photo Credit: Bill Zawiski, Ohio Environmental Protection Agency

The removal of the Munroe Falls Dam on August 15, 2005.

The overall goal of the TMDL was to achieve Ohio's biological water quality criteria. (For more on biocriteria and their uses, see article on page 10.) The TMDL established a target for dissolved oxygen as a proxy for progress toward meeting the biocriteria. To achieve the dissolved oxygen target, the TMDL identified the need to control nutrients and carbonaceous biochemical oxygen demand (CBOD), as well as address impoundments and flow modification problems.

How did the TMDL tie in the impoundments and flow issues? Lake Rockwell, a drinking supply reservoir located on the Cuyahoga mainstem, deprived flows to the Middle Cuyahoga resulting in very low dissolved oxygen readings below the dam—at times as low as 0.0 mg/L. Two smaller dams located in the Middle Cuyahoga downstream from Lake Rockwell exacerbated the problem and greatly reduced the natural assimilative capacity of the river resulting in the need for tighter pollution discharge for the wastewater treatment plants on the reach. And the dams themselves also harmed designated uses directly by limiting fish passage.

In the TMDL the OEPA laid out two possible implementation scenarios. The first scenario envisioned a voluntary mix of activities—a minimum release of 3.5 MGD from Lake Rockwell, along with removal or modification of the Munroe Falls and Kent Dams.

However, if the actions identified in the first scenario were not completed within a specified timeframe, the second, regulatory scenario would come into play. In this scenario, much stricter (in some cases zero) pollutant load limitations for CBOD and ammonia would be placed on all six of the wastewater treatment plants in the TMDL study area.

The City of Kent's website describes the decision confronting local governments: "The City was also informed that refusal to pursue and initiate a modification—removal of the dam would result in more stringent permit limits at the City's Water

Reclamation Facility (WRF). City officials knew that additional infrastructure at the WRF would be an expensive venture for Kent taxpayers and would yield minimal benefits to the river water quality."

As a result, the first scenario won the day. A minimum flow release from Lake Rockwell was agreed upon through another process. The historic Kent dam was modified in 2004 and the Munroe Falls dam was removed altogether in 2005.

Photo Credit: Bill Zawiski, Ohio Environmental Protection Agency

The former site of the Munroe Falls Dam on August 22, 2008.

Within a year of removing Munroe Falls dam, OEPA data showed dramatic improvements in the fish community and improvements in dissolved oxygen levels. By December 2009, dissolved oxygen criteria were met in the river, and the condition of the warmwater aquatic life community had improved dramatically, meeting state criteria for the diversity of the macroinvertebrate community and physical habitat. One stretch still does not meet the criteria for healthy fish communities, but it is on the way to full recovery.

By using all the components of the system (physical, biological and chemical) to inform the TMDL process, rather than take a myopic pollutant-specific approach, OEPA was able to offer the two scenarios as a way to meet the challenge. In the end, this type of creative thinking resulted in benefits far beyond simply load reductions for the river, the fish and the communities along the mighty Middle Cuyahoga.

Think creatively about the TMDL process. Consider how your flow or habitat problem relates to a pollutant that will lend itself to the process more easily. Temperature, dissolved oxygen, nutrients and many other more traditional parameters can be tied back to flow and habitat concerns. Even if your state is resistant to the idea of a flow or habitat TMDL, you may well be able to make the case that addressing these issues will save time and money, while providing a wider range of benefits.

Voices From the Field

As usual, River Network Partners are already out ahead of the field when it comes to using the Clean Water Act creatively to protect and restore rivers. Here are several examples of how Partners are using the tools discussed in this issue—as well as the 319 Program, which is not addressed—to restore the biological integrity of their watersheds.

The Clean Water Act - Arizona Style


Photo Credit: Prescott Creeks

To improve water quality, address local open space issues and provide habitat, Prescott Creeks is restoring Watson Woods Riparian Preserve. In central Arizona, Prescott Creeks' staff, members and community volunteers are protecting and restoring this rare and threatened forest using a combination of two 319 fund grants and state funding. The Clean Water Act funds are to address issues with the two main water bodies of our area that have been listed by the EPA as impaired. Immediately downstream from Watson Woods, Watson Lake's impairment is for low dissolved oxygen, high pH (9.5 - 9.8), and excessive nitrogen, with a fish kill; Granite Creek (which flows through the riparian preserve) impairment is for low dissolved oxygen.


Photo Credit: Prescott Creeks


Photo Credit: Prescott Creeks


Photo Credit: Prescott Creeks

This 126-acre project is the remaining portion of what was once a 1,000-acre riparian forest of cottonwood and willow trees. The riparian habitat at Watson Woods had been lost or severely degraded as a result of livestock grazing, illegal dumping, firewood cutting and, most notably, sand and gravel extraction during the mid-20th century. Currently in the third year of a five year grant, the main part of the restoration is complete. The goals of this water quality improvement project are to improve and restore the Granite Creek channel function and existing riparian habitats, to (re)create riparian habitats within Watson Woods Riparian Preserve and to educate and involve the community in the restoration process.

These improvements will result in the natural maintenance of Granite Creek, which flows downstream to Watson Lake; the proposed project will have direct benefits to the improvement of water quality through the implementation of best management practices including: natural channel restoration, native plant community restoration and management, wetland (re)creation, channel stabilization and others.


Photo Credit: Prescott Creeks

Prescott Creeks (AZ)
www.PrescottCreeks.org

Voices From the Field

Bioassessment and the Clean Water Act in Washington State: A Streamkeepers Success Story

Photo Credit: Streamkeepers

When Streamkeepers, a volunteer watershed stewardship program of Clallam County, WA, submitted data for the 2004 WA Department of Ecology (WADOE) 303(d) report, the data included results of benthic macroinvertebrate sampling, analyzed using the Benthic Index of Biological Integrity (B-IBI) developed by Dr. James Karr of the University of Washington, which showed impairment in a number of sites not otherwise known to be impaired. That was the first year that such data were submitted to the State; the only other party submitting such data that year was WADOE's own Environmental Assessment Program. After reviewing our documentation, WADOE accepted the data and our impairment calls but put those sites on a special list, "Impaired by a non-pollutant," which meant that those sites wouldn't require cleanup under the Clean Water Act.

Clallam County objected to WADOE's treatment of this data, arguing that it should be treated similarly to other impairment data. Ultimately, the EPA sided with Clallam County and required WADOE to either investigate the source of the impairment or list the affected sites along with other impaired sites on the next 303(d) list. When the next list was published in 2008, our B-IBI "Impaired" sites were listed as Impaired under the parameter "bioassessment," and WADOE hired a staffer to deal with biological impairment and its causes. Meanwhile, a coalition of regional groups who collect B-IBI data, led by King County (the Seattle metropolitan area) have been funded by WADOE and EPA to collect all the B-IBI data and further refine the B-IBI for the Puget Sound region using EPA's Biological Condition Gradient framework. This will be a major step forward in achieving the goals of the Clean Water Act in Washington State.

Streamkeepers (WA)
www.clallam.net/streamkeepers/html/biological_monitoring.html

Voices From the Field

Rain, Rain, Don't Go Away

Huron River Watershed Council (HRWC) recently completed a successful Clean Water Act, section 319 project on Millers Creek. Millers Creek ripples down an unusually steep channel in northeast Ann Arbor, rests in the ponds of Geddes Lake and slowly meanders in a large wetland prior to flowing into the Huron River. It is small but powerful, includes several small lakes and flows through beautiful forest fragments and wetlands. However, parts of the land draining to the creek are heavily urbanized and the creek is overwhelmed by excessive volumes of stormwater. Whenever a substantial amount of rain falls or snow melts, the small stream rapidly becomes a torrent. The storm pulse of water scours the stream banks, moves large rocks in the stream bed, and in general, disturbs the stream habitat and makes it difficult for fish and insects to live in the creek.


Miller Creek Project - BEFORE

Photo Credit: Rod Ginter

There are three main causes of the problems. First, the creek naturally has a very steep gradient, which means the water can flow with a very high force. Second, the creek's path was shortened (and thus the gradient increased further) when the City of Ann Arbor constructed Huron Parkway. Third, the watershed is covered by extensive impervious surface, which results in excess runoff during storms. Part of this impervious surface is from the Orchard Hills-Maplewood area, a large residential community constructed in the headwaters area. The headwaters were put underground into a series of storm sewers, which route stormwater quickly to the creek.

HRWC initiated the Millers Creek Rainwater Project in 2006 with the purpose of reducing the flow and erosion problems of Millers Creek and, as a result, improving the biotic community. The way to accomplish this goal was to keep rainwater on the land where it fell, so as to prevent the water from being routed into the storm sewers and released into the creek as a tidal wave. HRWC focused its efforts in the residential neighborhood built over the creek's headwaters, mentioned above. With project partners, HRWC built two community rain gardens, areas designed to collect rainwater and allow it to slowly infiltrate into the ground. HRWC retrofitted a detention pond to hold more rainwater, helped four property owners design and build private rain gardens with the Washtenaw County Water Resources Commissioner and distributed 75 rain barrels throughout the project neighborhood. In addition, HRWC shared all of these efforts with the neighborhood residents, kept them involved in construction projects and maintenance activities and encouraged them to take the initiative in using their own property to reduce impacts on Millers Creek.

HRWC was not the only group working on Millers Creek. The City of Ann Arbor contributed significantly by implementing a stream bank stabilization project near the intersection of the creek, Huron Parkway and Glazier Way. Also, the City and Thurston Nature Center redirected the rainwater from several streets into Thurston Pond, where the rain is stored and slowly released to the creek.

HRWC's staff and numerous volunteers helped us monitor the creek to determine what changes occurred as a result of all of these activities. They collected stream flow, macroinvertebrate, habitat and channel shape data prior to and after project implementation. While the data still needs to be considered preliminary until more time passes and more data is collected, the initial results are very promising. The data has shown that the macroinvertebrate community has come back to levels not observed since 2002. Also, the stream flow data has provided some very promising results. By comparing 2010 storms to very similar storms in 2002-2006, we can see that after storms, the stream takes longer to reach the highest flow level and the highest flow is significantly reduced. In some cases the stream flow is 40% less intense now than it used to be after a very similar storm. This indicates that more water is being stored on land instead of going into the creek, and it takes longer for the water to reach the creek.

Miller Creek Project - AFTER

Photo Credit: HRWC

This does not mean that Millers Creek is cured, but rather that great strides were made in reducing erosion, regulating the water flow and creating a better environment for the fish and insects living in the creek. It also means that individual actions, such as rain barrels, rain gardens, native plants and homeowner practices can make a difference in protecting water quality and quantity. We all must continue to play a part in holding our rainwater on our property if we want to continue to see improvement in Millers Creek and all of our other urban creeks. Rain, rain, don't go away!

Huron River Watershed Council (MI)
www.hrwc.org

Partnering for Clean Water

In 2009, Friends of the Lower Greenbrier River collaborated with state and local government agencies, landowners and Downstream Strategies to sponsor a watershed-based plan for Muddy Creek. Muddy Creek is a sub-watershed of the Greenbrier River watershed, and is located in Greenbrier County, WV. The approved plan has led to 319 fund allocations for on-the-ground projects and education efforts. Agricultural and septic system projects are currently being developed and will be implemented by 2013. Education efforts are already underway with a 'State of the Watershed' document being circulated and public meetings and workshops being held.

Photo by Mark Blumenstein

Interested landowners learn about a stream crossing constructed on a farm in the Muddy Creek Watershed.

To help your project be more successful, recruit a landowner who has benefitted from a previous program to volunteer with you. They will be able to explain the benefits through a first-hand experience and convince their neighbors that they should sign-on as well.

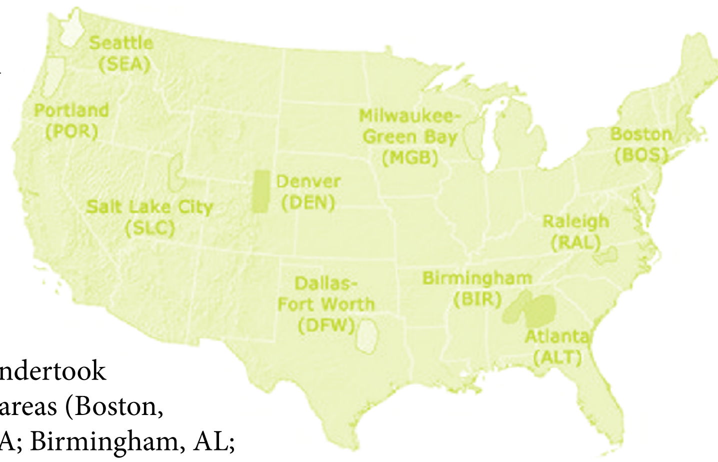
Friends of the Lower Greenbrier River (WV)
www.lowergreenbrierriver.org

Keeping Our Eye on the Prize:

Managing Stormwater for Habitat and Aquatic Species

Heavy rains. Pollution is swept from rooftops, sidewalks, lawns and roadways into our most treasured streams and lakes. Rain water moves swiftly across the hardened surfaces along the paths that used to be streams but now are streets with underground pipes. That fast-moving water reaches a softer riverbank and carves into the dirt, carrying it and the energy into the river which further carves unnaturally away at its sides. The dirt, the pollution connected to it and the sudden heavy flows dramatically alter the living conditions for fish and other aquatic life.

While we often speak of stormwater management and pollution control in urban settings, at construction sites and at industrial areas, we speak less often of the reason we care … the severe impacts on riparian habitat and aquatic species.



Based on findings from the USGS National Water Quality Assessment Program study on the Effects of Urbanization on Stream Ecosystems

The U.S. Geological Survey undertook a study of nine metropolitan areas (Boston, MA; Raleigh, NC; Atlanta, GA; Birmingham, AL; Milwaukee-Green Bay, WI; Denver, CO; Dallas-Fort Worth, TX; Salt Lake City, UT; and Portland, OR) to examine the impacts of urbanization on the aquatic ecosystem. This decade-long analysis speaks loudly and clearly to those who already work hard to encourage more sustainable development patterns that can protect intact riparian corridors (the truest "green infrastructure"), reduce imperviousness and improve management of stormwater flows and the control of stormwater pollution. In addition, it can speak to those who would ask why they need to be concerned about how fast stormwater travels, where it is inclined to go and what undesirable contaminants it takes with it.

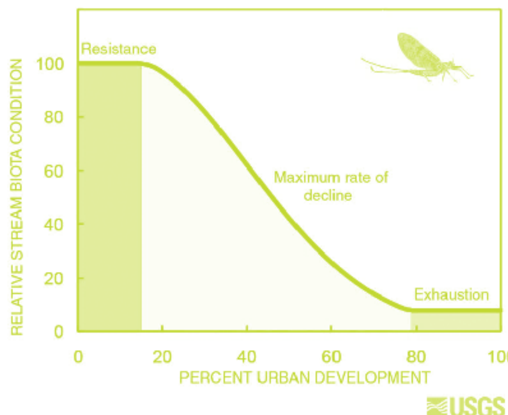
The following **key findings** of the USGS National Water Quality Assessment Program study on Effects of Urbanization on Stream Ecosystems (**http://water.usgs.gov/nawqa/urban/html/findings/index.html**) can contribute greatly to the analysis and messages focused on improving regulatory stormwater programs based on ecoregional specificity.

Place Matters:
Response to Urban Development Depends on the Region of the Country

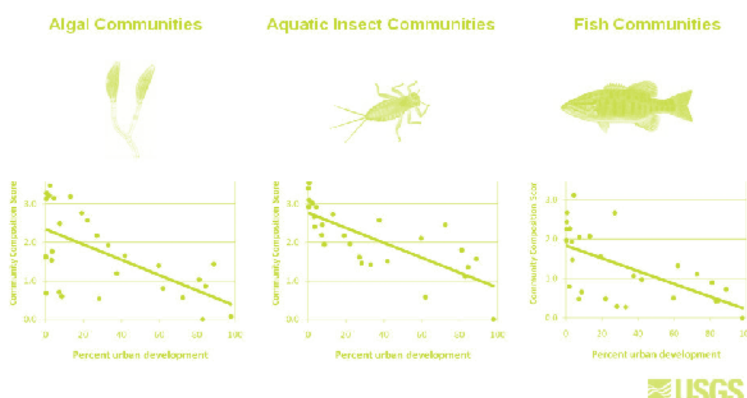
A stream's physical, chemical and biological characteristics will respond to changes in both urban and natural characteristics. Ecoregions reflect differences in climate, geology, natural vegetation and historical land use patterns and provide a template that is more important for determining the overall composition of stream biota than the level of urban development. For example, when invertebrate community data from all 265 study watersheds from the nine studies were analyzed together, the most striking result was that the watershed-specific macroinvertebrate community composition scores did not group together by level of urban development, but by ecological region.

The Hypothesized Response of Stream Biota to Urbanization

A commonly anticipated response of a stream biological community to urban development is a period of resistance to changes at low levels of urban development, a period of rapid change in the community as development increases until an exhaustion threshold is reached, at which point the biological community is composed mostly of tolerant organisms and little additional change is possible. For this reason, over the last decade many communities have developed land management practices that have limited development intensity, assuming that limiting impervious cover within a watershed to less than 10 percent of watershed area would be protective of stream biota.



All Biological Communities Showed Signs of Negative Impacts from Urban Development



Urban development significantly affected one or more biological communities in eight of the nine metropolitan study areas, with Denver being the exception. The macroinvertebrate community showed a response to urban development in all study areas except Denver. In Portland, Birmingham, Atlanta, Raleigh and Boston, either the algal or fish communities, or both, also showed a response to urban development. All three biological communities showed a response to urban development in Portland and Boston, and among the nine study areas, the responses of the three communities were strongest in Boston.

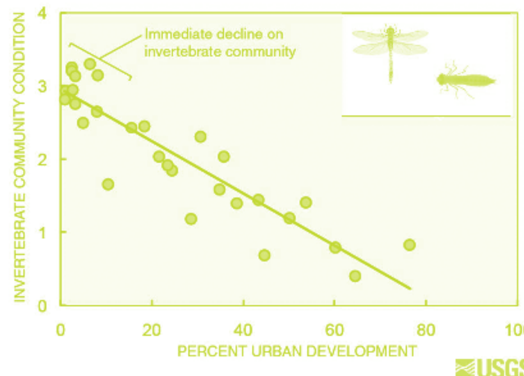
Immediate Decline in Macroinvertebrate Community as Urban Development Increases

Even small levels of urban development had an immediate negative effect on macroinvertebrates. This linear response pattern of macroinvertebrates to urbanization is illustrated by the immediate decline in a composite measure of the invertebrate community composition as the level of urban development in Boston watersheds increased. This response is continuous over the entire range of urban development and shows no period

cont. on page 28

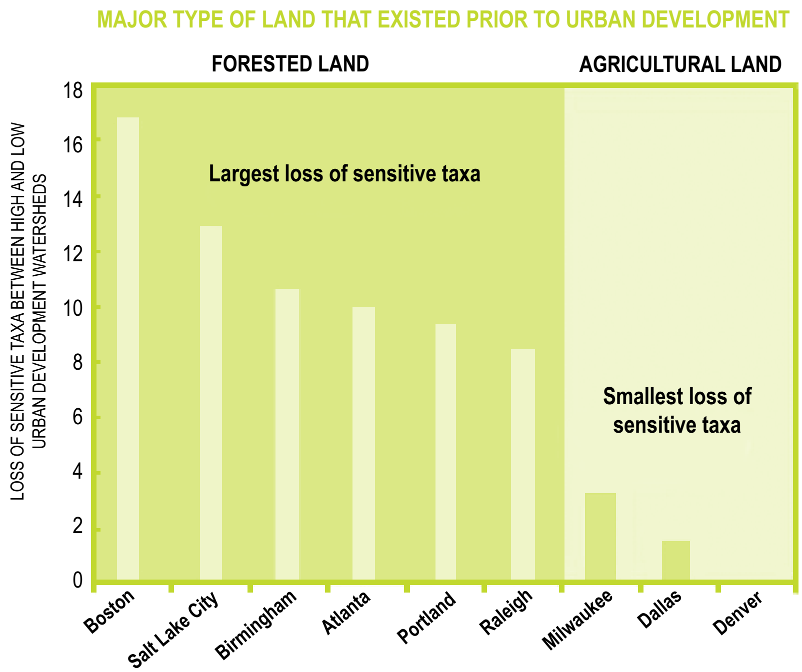
cont. from page 27

of resistance to the effects of urban development and never reaches a state of exhaustion.



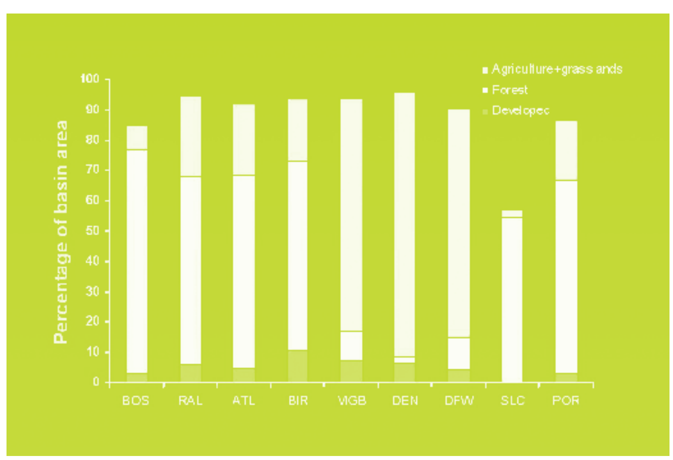
Regional Differences Exist in Land Types Converted to Urban Uses

The land cover types being converted to urban uses varied among metropolitan areas. Forest is the predominant pre-urban development land in Portland, Salt Lake City, Birmingham, Atlanta, Raleigh and Boston; whereas, in Denver, Dallas and Milwaukee the predominant pre-urban development land cover is associated with some form of agriculture. The type of land cover that is being converted to urban uses is important, as the terrestrial characteristics and activities associated with these two land cover types may mask the influence urban development has on the stream ecosystem. For example, although agricultural practices have evolved dramatically in the last 100 years, nutrient enrichment, soil erosion, monoculture practices and loss of natural habitat are still major concerns. Watersheds where the predominant pre-urban development land cover is agricultural land already have some degree of water quality impairment prior to urbanization that can obscure the effects of urbanization.

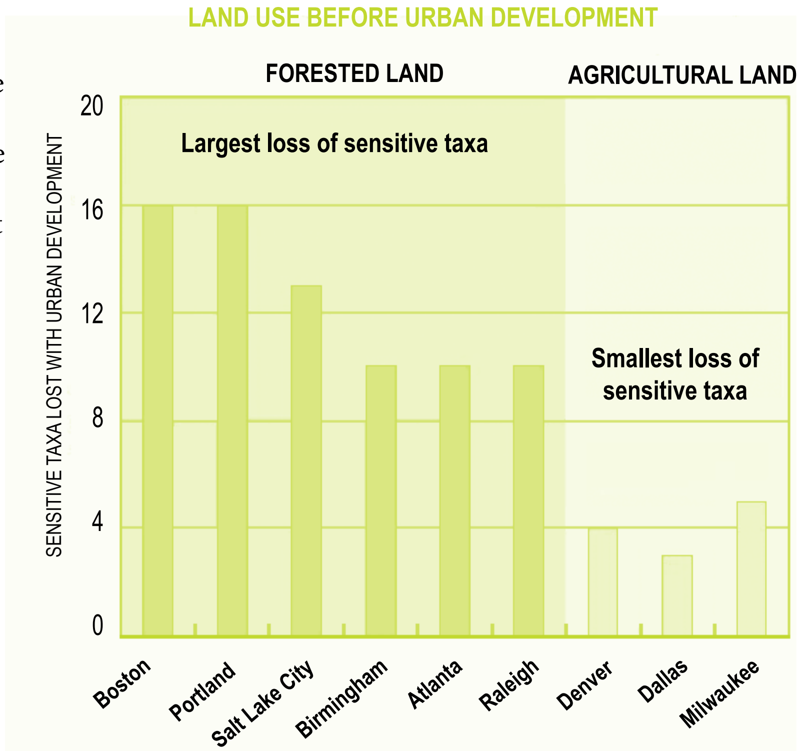


The Response of Biota was Weaker Where Prior Land Use Activities Had Already Degraded Streams

The importance of recognizing the influence of pre-urban development land use is that the response of stream biota to the stresses associated with urban development is likely to be stronger when urban development occurs in watersheds that have natural flows and vegetation. In Dallas, Denver and Milwaukee, little variability was seen in the composition



of the invertebrate communities across the urban gradient and these communities generally lacked the more sensitive species. The weaker response pattern was not because the biological communities in these three study areas were more resilient to stressors from urban development. Instead, the communities had already endured some degree of degradation that was caused by underlying environmental factors that were associated with prior land use activities. In regions where the response to urban development was clear, much of the change to the invertebrate communities came from a loss of sensitive insect species as well as the increase in more tolerant non-insect species.



What Does This All Mean?

It is imperative that we work on stormwater issues and encourage stormwater management and control at a watershed scale in order to keep the ecosystem and biological goals in mind. The National Research Council report on *Urban Stormwater Management in the United States* in 2008 recommended

> *"There are many implications of redirecting the stormwater management and regulatory system from a site-by-site, [stormwater control measure-by-stormwater control measure] approach to an emphasis on attainment of beneficial uses throughout a watershed. Most fundamentally, the program's focus would shift to a primary concentration on broad goals in terms of, for example, achieving a targeted condition in a biological indicator associated with aquatic ecosystem beneficial uses or no net increase in elevated flow duration."*

We must encourage coordination among jurisdictions within a watershed to best understand, invest in and manage for the protection and restoration of riparian heath and aquatic species. We cannot stop growth and development, but we can work to shape it and guide it in sustainable patterns from both human and ecosystem perspectives.

Resources and References

Manuals, Toolkits, & Trainings

River Network's 401 webinar series is recorded and online for your learning pleasure. This three-installment series includes The 101 on 401 (introductory), 401 Certification and the New Nationwide Permits (intermediate) and 401 in the Real World: Case Studies (intermediate). www.rivernetwork.org/river-network-webinars

Basic Reference Condition and Classification Techniques, is a copy of a presentation from the National Biological Assessment and Criteria Workshop, Coeur d'Alene, Idaho (2003). http://water.epa.gov/scitech/swguidance/standards/upload/2004_03_05_biocriteria_modules_rfc101-01-introduction.pdf.

Clean Water Act Section 401 Water Quality Certification: A Water Quality Protection Tool for States and Tribes is a great resource provided by U.S. EPA's Office of Oceans, Wetlands and Watersheds. Although targeted for state and tribal government staff, the manual covers the federal requirements under 401 and provides examples of how the states are tackling tough issues in the program. http://water.epa.gov/lawsregs/guidance/cwa/upload/CWA_401_Handbook_2010_Interim.pdf

River Network's The Clean Water Act Owner's Manual (2nd edition) provides advice about how to use the Act to solve real-world problems. It includes sections on several of the topics in this issue, including 401 certification, biocriteria and Total Maximum Daily Loads. You may also find River Network's Online Clean Water Act Course www.cleanwateract.org helpful. www.riverntwork.org /marketplace

Podcast on Effects of Urbanization on Stream Ecosystems. Development can have negative effects on streams in urban and suburban areas. In this podcast, USGS scientist Jerry McMahon describes two take home messages for managers. www.usgs.gov/corecast/details.asp?ep=127

Programs, Websites & Databases

U.S. EPA's bioassessement and biocriteria program website provides a basic introduction to biocriteria and bioassessement, technical guidance, information about the federal program and information about state and tribal biocriteria programs. http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/index.cfm.

Effects of Urbanization on Stream Ecosystems is a USGS website that describes a decade-long program that examined the response of streams' biological communities, hydrology, habitat and stream chemistry to urban development, and how these responses vary across the country. http://water.usgs.gov/nawga/urban/

To learn more about the **Middle Cuyahoga TMDL story** told in this issue, visit EPA's TMDLs at Work story on the example at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/cuyahogariver.cfm or the **City of Kent's website** at www.kentohio.org/reports/dam.asp

Ohio is often held up as one of the few examples of a strong biocriteria program. Learning more about **Ohio's biocriteria** program may help you understand the value of advocating for biocriteria in your state. www.epa.state.oh.us/dsw/bioassess/ohstrat.aspx.

EPA's Biocriteria website provides a definition of reference condition, as well as numerous links to other resources. www.epa.gov/bioiweb1/html/reference_condition.html

Publications & Papers

The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity, a 2003 article by Robert Adler, in large part inspired this issue of River Voices. If you're intrigued by the ideas Mr. Adler raises in the lead article of this issue, this paper will provide much more food for thought on those ideas and others. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1683724

Resilience, Restoration and Sustainability: Revisiting the Fundamental Principles of the Clean Water Act, a more recent (2010) article by Robert Adler explores four policy areas in need of attention if we are truly committed to move beyond the strictly chemical focus toward achieving the Act's broader objective. http://papers.ssrn.com/so13/papers.cfm?abstract_id=1652951

This very readable legal article, ***The Sleeping Giant Awakens: PUD No.1 of Jefferson County v. Washington Department of Ecology***, tells the story of the most famous case involving 401 certification in the nation – the Dosewallips example briefly summarized in this issue. Ransel, Katherine P., 25 Envtl. L. 255 (1995).

Stormwater Treatment: Assessment and Maintenance is a 2010 University of Minnesota publication addressing the impacts of urban stormwater. http://stormwaterbook.safl.umn.edu/content/impacts-urban-stormwater

The Reformulated Impervious Cover Model: Implications for Stream Classification, Subwatershed Management and Permitting (Technical Bulletin No. 3). Tom Shueler, Chesapeake Stormwater Network, has updated his well-known impervious cover model that he developed in 1994. www.chesapeakestormwater.net/all-things-stormwater/the-reformulated-impervious-cover-model.html

Urban Stormwater Management in the United States is a report produced by the National Research Council in 2008. www.nationalacademies.org/morenews/20081015.html

Volume-Based Hydrology: Examining the shift in focus from peak flows and pollution treatment to mimicking predevelopment volumes is an article by A.J Reese printed in Stormwater, September 2009. www.stormh2o.com/september-2009/volume-based-hydrology.aspx

River Network Partners

Enhanced Benefits Now Available

River Network is proud to present our enhanced package of Partner benefits! By upgrading or renewing at the new Partner Annual Dues below, organizations are eligible to receive the following great new benefits:

- Discounted ***National River Rally*** rates and scholarships.
- Free access to the ***NOZA Database of Charitable Giving*** (River Network pays the subscription fee on your behalf—an $800 value!)
- Access to discounted ***Directors and Officers and General Liability insurance*** (Partners have saved hundreds when switching to the River Network rate.)
- Quarterly ***webinars*** on the issues that matter most—a $200 value.
- And much more!

Annual Dues	
Nonprofit Organizations and Local, State and Tribal Government Partners	
Annual Budget	Annual Partner Dues
<$25,000	$150
$25,001-$100,000	$200
$100,001-$250,000	$275
$250,001-$500,000	$375
$500,001-$1,000,000	$500
$1,000,001-$2,000,000	$675
>$2,000,000	$900
Business and Consultant Partners	
Annual Gross Revenue	Annual Partner Dues
<$500,000	$500
>$1,000,000	$1,000

To renew, upgrade or join as a Partner, please mail in this form with your check to River Network (520 SW 6th Ave, Suite 1130, Portland, OR 97212) or pay by credit card at www.rivernetwork.org/marketplace:

Contact Person ____________________

Org/Gov't/Business Name ____________________

Street Address ____________________

City, State, zip ____________________

Phone with area code ____________________

Fax ____________________

Email (required) ____________________

Website (if applicable) ____________________

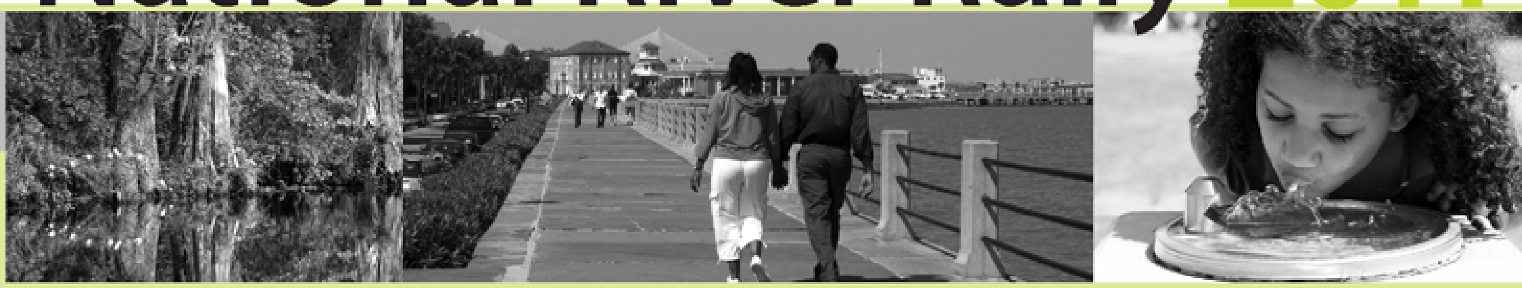
Mission (if applicable) ____________________

____

____

River Network
Connecting People, Saving Rivers
520 SW Sixth Avenue, Suite 1130
Portland, Oregon 97204-1511

National River Rally 2011



North Charleston, South Carolina, June 3-6

Education, Inspiration, Celebration

Join Us ! . . .

River Rally is the perfect place to build on what you have already learned about your local river, lake, stream or bay.

Come to South Carolina and learn about the best strategies for river restoration, collect new tools and resources for watershed protection, and connect with the people you need to achieve your goals.

Find out more and register for the River Rally at **www.rivernetwork.org/rally**

Here are a few of the workshops topics:

- Education, Outreach & Communication
- Clean Water Act
- Diversity
- Water & Green Infrastructure
- Fundraising
- Human Health
- Climate, Energy & Water
- River Habitat Tools
- Health Organizations
- Social Networking
- Water Quality Monitoring
- Partnerships & Collaborations