The Volunteer Monitor

The National Newsletter of Volunteer Water Quality Monitoring
Vol. 7, No. 2, Fall 1995

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Special Topic: Monitoring Urban Watersheds

Co-Editors: Texas Watch

This issue was co-edited by Texas Watch, the volunteer monitoring program of the Texas Natural Resource Conservation Commission. Texas Watch presently includes over 200 groups across the state, representing about 4,000 individuals who monitor everything from bayous and wetlands to creeks, ponds, and storm drains. This large corps of volunteers is supported by 60 partners from industry, business, and local and regional authorities.

The following articles appear in this edition of *The Volunteer Monitor:*

Management"

- The Staff at The Volunteer Monitor

General Interest

- Secchi Dip-In
- Monitoring Stoneflies in January
- Monitors Take Action on Phosphate Problem
- New Program to Monitor Debris
- What's in a Name?

Information Sources

- Conferences
- National Organizations
- Resources
- Spanish-Language Publications for Volunteer Monitors

pH

- Comments on Calculating pH Statistics
    - Table 1. Hypothetical pH and Hydrogen Ion Data Analysis

Stormwater

- Derby Creek: Creek Critters Mark Buried Creeks
- Million Points of Blight
- NPDES Stormwater Permits
- Storm Drain Stenciling: The Street-River Connection
    - Supplies
- Storm Sewers in a Suitcase

Test Kits and Test Tips

- Combination Staff Gauge / Crest Gauge
- Does Community Education Reduce Water Pollution?
- Dissolved Oxygen Test Tip
- Low-Cost Biological Monitoring
- Test Kits for Organic Contaminants
- Storm Drain Monitoring Kits

Urban Waters

- Citizens Jump Barriers for Salmon
- How Significant is Urban Runoff?

- Making Connections Between People and Urban Waters
- Urban Watch: A New Approach to Monitoring Urban Nonpoint Source Pollution
- Urbanization and Water Quality: A Crash Course
- "We're *Already* Scientists!": Urban Kids Monitor Creek

The Volunteer Monitor, Vol. 7, No. 2, Fall 1995

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About *The Volunteer Monitor*

The Volunteer Monitor newsletter facilitates the exchange of ideas, monitoring methods, and practical advice among volunteer environmental monitoring groups across the nation.

Address all correspondence to: Eleanor Ely, editor, 1318 Masonic Avenue, San Francisco, CA 94117; telephone 415/255-8049.

Rotating Co-Editors

The Volunteer Monitor has a permanent editor and volunteer editorial board. In addition, a different monitoring group serves as co-editor for each issue. This unique structure ensures stability while allowing a variety of viewpoints to be represented.

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Subscribing

The Volunteer Monitor is published twice yearly. Subscriptions are free. To be added to the mailing list, write us. Your subscription will start with the next issue.

Reprinting Articles

Reprinting of material from *The Volunteer Monitor* is encouraged. Please notify the editor of your intentions, and send a copy of your final publication to the address above.

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Back Issues

The following back issues are available:

Fall 1991 -- Biological Monitoring (photocopy)
Spring 1992 -- Monitoring for Advocacy
Fall 1992 -- Building Credibility (photocopy)
Spring 1993 -- School-Based Monitoring
Fall 1993 -- Staying Afloat Financially<
Spring 1994 -- Volunteer Monitoring: Past, Present, & Future
Fall 1994 -- Monitoring a Watershed
Spring 1995 -- Managing and Presenting Your Data

To obtain back issues, or additional copies of this issue, send a self-addressed stamped envelope, 9 x 12 or larger, to *The Volunteer Monitor*, 1318 Masonic Ave., San Francisco, CA 94117. First-class postage is 78¢ for one issue, $1.24 for two, and $1.47 for three. For $3.00, you can get up to 15 copies. For larger orders, please call for shipping charges.

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From the Editor

A Not-So-Prestigious Ecological Address

A few months ago, while looking through the Summer 1994 issue of *River Voices* (River Network's newsletter), I came upon some rather poetic thoughts about the importance of knowing your "ecological address" -- that is, knowing what watershed you live in. This knowledge, said one writer, gives a person "an understanding of the interconnectedness of the human and natural environment." Another wrote, "A watershed is a gatherer -- a living place that draws the sun and rain together. Watershed consciousness is a form of home awareness."

Inspired, I opened my map of San Francisco to find my own ecological address. But I hit a snag right away -- I couldn't find any streams. So I asked around, and learned that San Francisco's streams are almost all covered up and have become part of the city's combined sewer system. Rainwater falling on my street, I was told, runs down the nearest storm drain and ends up at a sewage treatment plant.

Sewage treatment plant, indeed! I'd been looking forward to an ecological address of a bit more distinction. Where was the poetry? The sun and rain, the interconnectedness with the natural environment?

Still grasping for some shred of connection to nature, I persisted: "Well, but where does the water running off my street ultimately end up? It must be either the Bay or the ocean. Since the ocean is all downhill from my house, wouldn't the water end up there?" But my hopes were crushed by the answer I received: "Topography has nothing to do with it. You'll have to get a map of the sewers."

Other urbanites have had similarly deflating experiences. At the Watersheds 94 conference, Alan AtKisson spoke about his efforts to learn what watershed his Seattle home is in. His research led to "a vast underground network of rectilinear drainage pipes funneling into eight-foot-wide sewage mains: humanity's rivers." And in those sewers, "springwater from the last tiny section of Ravenna Creek joins the throng of waters collected from toilets and storm drains and sinks full of dishes."

I did eventually get a map of San Francisco's sewers, and found out that I live in the "sewershed" of San Francisco Bay. So I am connected to a beautiful body of water that I care about -- even if the conduits

that link me to the Bay are less romantic than I might have wished.

Because city dwellers tend to feel cut off from natural waters, often the first task for volunteer monitoring groups working in urban environments is simply to create basic awareness: there is a stream nearby; this is its name; this is where it goes. The next step is to help people feel personally connected to that water. Third is to build the understanding that our actions affect the water (as someone once commented to me, in a city the term "primary stream" essentially means your gutter). The final stage (which is dependent on getting the first three right) is to start changing behavior. The articles in this issue offer helpful ideas for successfully carrying out all four of these stages.

Next issue: Program management

What are the ingredients of a well-run volunteer monitoring program? What are the best ways to recruit and train volunteer monitors, foster volunteer leadership, keep enthusiasm high? How can volunteer monitors reach out to the wider community? These topics will be covered in the Spring 1996 issue, which will be co-edited by the City of Bellevue Stream Team Program in Bellevue, Washington.

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The Staff at *The Volunteer Monitor*

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OW-GENERAL@epamail.epa.gov

The Volunteer Monitor, Vol. 7, No. 2, Fall 1995

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Secchi Dip-In

These students in Kansas City, Kansas, were among the thousands of people across the country who participated in the All-American Secchi Dip-In last July. Dr. Robert Carlson of Kent State University, who organized the event, reports that so far he has received data forms from Dip-In volunteers in 37 states and Canada. The volunteers reported Secchi disk readings along with information on water uses and perceived water quality on the day of the Dip-In.

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Monitoring Stoneflies in January

by Joan Martin

In January, dedicated volunteers in the Huron River Watershed Council's Adopt-A-Stream Program take their nets down to local streams, braving snow, ice, and frozen fingers to do a special kind of macroinvertebrate monitoring -- looking for "winter stoneflies." Winter stoneflies have an unusual life cycle. Soon after hatching in early spring, the larvae bury themselves in the streambed. They spend the whole summer lying dormant in the mud, thereby avoiding problems like overheated streams, low oxygen concentrations, fluctuating flows, and heavy predation by fish. In late November they emerge, grow quickly for a couple of months, then lay their eggs in January.

Why monitor winter stoneflies? Mike Wiley, an aquatic ecologist at University of Michigan and advisor to the Adopt-A-Stream Program, explains that the January monitoring helps interpret the results of spring and fall macroinvertebrate surveys. In spring and fall, our volunteers do a thorough benthic survey, based on Protocol II of the EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers*. Some sites on urban streams have poor diversity and no sensitive families. The question then becomes: Is the lack of macroinvertebrate diversity due to specific warm-weather conditions such as high temperatures, low oxygen, or fluctuating flows, or is there some toxic contamination present? The January screening helps us answer this question. If winter stoneflies are plentiful, seasonal conditions were probably to blame for the earlier results; but if winter stoneflies are absent, the site probably suffers from toxic contamination that is present year-round.

For example, Mallett's is a city creek that lacks macroinvertebrate population diversity in the spring and fall. When volunteers monitored Mallett's in January, they did not find any winter stoneflies, leading them to suspect a persistent contamination problem. Further investigation supported this theory: conductivity testing revealed unusually high levels, above 1,000 æS/cm (microsiemens per centimeter) in many locations and occasionally above 3,000 æS/cm. The high conductivity indicates the presence of charged particles that may be contaminants.

The idea of searching for bugs in the middle of winter startles many people. Actually, the bizarre nature of the event is a great advantage since it captures media attention. Last January, our sampling was covered by stories and photographs in two local papers.

Recruiting volunteers for winter monitoring has not been not as hard as you might think. After all, during warmer months people have more alternative outings to choose from! Fortunately, the time spent on the actual monitoring is mercifully short -- if winter stoneflies are present they are usually abundant, and will be found in less than 15 minutes. Usually collection presents no special problems, though if the weather is very cold the sample may freeze in the net. Furthermore, if volunteers are lucky they sometimes get to see the bugs "hiking" in the snow along the stream, moving upstream to mate. All in all, our January monitoring is a lot of fun -- and nothing makes hot chocolate taste better.

Two genera of winter stoneflies are found in our region (southeastern Michigan), but only one of them -- *Allocapnia* -- is present in even the smallest streams, so that is the one we look for. *Allocapnia* occurs in most Eastern states as far south as Louisiana. In other parts of the country, other winter stoneflies in the families Capniidae and Taeniopterygidae might be used in a similar fashion. For information and advice, contact your state Cooperative Extension office or water quality agency. A good general reference book is *Nymphs of North American Stoneflies* by K.W. Steward and B.P. Stark (published in 1988 by the Entomological Society of America).

Joan Martin *is Director of the Adopt-A-Stream Program, a joint project of the Huron River Watershed Council and Washtenaw County Drain Commissioner. She may be reached at HRWC, 1100 N. Main St., Suite 210, Ann Arbor, MI 48104; 313/769-5971.*

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Monitors Take Action on Phosphate Problem

In fall of 1994, volunteer monitors near Camden, New Jersey, measured a 130 percent increase in phosphate levels on the Cooper River. The following spring, 87,000 local residents received a letter explaining the problem and giving helpful hints on nontoxic lawn care practices. Now there's an example of "data to action"!

The volunteers were part of the Delaware Riverkeeper Network (DRN) and had been monitoring the site since 1991 for a variety of chemicals. "We had seen phosphate spikes each year in spring and fall, when people treat their lawns with fertilizers," says Fred Stine, DRN's Estuary Coordinator. "But always before, the spike only lasted for one monitoring cycle (two weeks). Then in fall of 94 it stayed elevated for six weeks."

Seeking the source of the problem, the volunteers began working their way upriver. They continued to find high phosphorus levels until they got upstream of the last developed area, at which point the levels finally dropped.

The volunteers suspected two sources for the phosphorus. One was the stirring up of "old" phosphorus in river bottom sediments by recent heavy rains. (The sediments are nutrient-rich because prior to 1987, when a new regional sewage treatment plant was built, 19 municipal sewage treatment plants discharged 18 million gallons per day into the Cooper.) The other source was lawn care fertilizer, washed off in higher-than-usual concentrations by the same heavy rainstorms. The volunteers consulted a Department of Environmental Protection field biologist, who agreed with their analysis and confirmed that lawn fertilizers were a significant source of new phosphate to the river.

Stine explains that getting rid of the contaminated sediments would require dredging -- a procedure that costs millions and also has serious drawbacks, including the resuspension of metals and other toxics in the river water, and the problem of finding a disposal site for the dredge spoils. On the other hand, the influx of "new" phosphorus from lawn and garden runoff was a problem the volunteers could tackle.

The volunteers' results were published in the DRN newsletter, where they caught the eye of the New Jersey Environmental Federa-tion, a group that was already working to educate people about nontoxic lawn care alternatives. The Federation teamed up with DRN, and within a short time the two were joined

by a third partner -- the National Center for Environmental Strategies, a New Jersey-based national organization concerned with environmentally caused health problems.

Together, the three groups launched an ambitious public education effort aimed at changing residents' lawn care practices. Stine says, "Our goal was not to assign blame, but to take a positive approach. Our message was that we can all help fix the problem by changing our habits."

The campaign was kicked off by a press conference, featuring a speech by the mayor of one of the affected towns. Next, Girl Scouts, Cub Scouts, and adult volunteers distributed 8,000 doorhanger leaflets in the targeted neighborhoods. Under the headline "Why Does the Cooper River Turn Green?" the doorhanger explained the relationship between lawn care, nonpoint source pollution, and algal blooms, and provided helpful tips for nonpolluting lawn care methods.

But the real coup was the mass mailing. Stine called the Camden County Municipal Utilities Authority (the sewage treatment plant) and asked if they'd be willing to put an insert in their next billing statement. (As Stine points out, "A bill is something people don't just throw out -- although they might like to.") The Authority said that would be fine; just give us the 87,000 copies. "We had no idea where we'd get the money for printing," says Stine. "We had barely been able to pay for the 8,000 doorhangers." But after Stine called back and explained the group's financial situation, the Authority agreed to pay all the printing costs.

And so it was that 87,000 Camden County residents opened their first-quarter billing statement to read about how volunteer monitors had found high phosphate levels in the Cooper River; how phosphates contribute to algae blooms; and how they themselves could help solve the problem.

*For more information, contact **Fred Stine**, Delaware Riverkeeper Network, 609/854-5108.*

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New Program to Monitor Debris

Many readers of *The Volunteer Monitor* have probably heard about -- if not participated in -- the Annual International Coastal Cleanup, which the Center for Marine Conservation (CMC) has coordinated for nearly a decade. Now CMC, with support from EPA, is taking the cleanups one step further with the National Marine Debris Monitoring Program.

For the program, the U.S. coastline has been divided into nine regions. Within each region, 20 coastal sites will be sampled monthly, for five years, by trained volunteers following a standardized, scientifically valid protocol. The data will be used to measure regional trends for 30 specific debris items. Regional analyses will be combined to get a national picture of marine debris.

For more information on how your organization can become a part of this exciting program, contact Jill Goodman, Program Manager, CMC Atlantic Regional Office, 306A Buckroe Ave., Hampton, VA 23664; 804/851-6734; e-mail goodmaj@hampton.mhs.compuserve.com

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What's in a Name?

Here's an idea for giving your outreach program an instant boost, without spending a penny.

Kathleen Edson, Assistant Program Coordinator for the Napa County Resource Conservation District, reports that the District was having trouble drumming up public interest in its new document, which bore the working title "Napa River Watershed Integrated Resource Management Plan."

"Whenever we tried to talk about it," she says, "people's eyes glazed over." The acronym, NRWIRMP, was even worse.

Then Dennis Bowker, the District's Resource Conservationist, had an inspiration: Change the title to "Napa River Watershed Owner's Manual."

"We saw an immediate improvement," says Edson. "Now, when we put the books out on a display table, people are interested. They'll pick up a copy and start thumbing through it."

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Conferences

Fifth National Volunteer Monitoring Conference

From August 3 to 7, 1996, volunteer monitors from around the country will be meeting on the University of Wisconsin campus in Madison for the Fifth National Volunteer Environmental Monitoring Conference. This year, the conference will focus on "protecting our watersheds." If you're on the mailing list for *The Volunteer Monitor*, you will be receiving an informational flyer on the conference in January.

The conference steering committee is soliciting abstracts from anyone interested in giving a presentation or leading a hands-on workshop, how-to demonstration, panel discussion, or field trip. If you're interested, contact conference organizer Celeste Moen (address below) for a conference abstract form. The form contains additional instructions and guidelines for presenters. All abstracts must be received no later than March 1, 1996.

For more information, please contact Celeste Moen, Wisconsin Self-Help Lake Monitoring Program, Wisconsin DNR - WR/2, P.O. Box 7921, Madison, WI 53707; 608/264-8878.

Third Trashed Rivers Conference

"Friends of Trashed Rivers III," the third conference organized by the Coalition to Restore Urban Waters (CRUW), will be held May 16 - 18, 1996, in Chicago. The conference is for everyone who has "a favorite ditch or culverted, riprapped, eroded, flooding, silted, denuded, garbage-filled, or polluted waterway." According to the organizers, "This is not a conference for the weak-willed or those with limited vision." For more information, please contact Friends of the Chicago River, 407 S. Dearborn,

Suite 1580, Chicago, IL 60605; 312/939-0490.

GREEN '96 conference

GREEN (Global Rivers Environmental Education Network) will hold its first "Conference of the Americas" July 10 - 12, 1996, in Ann Arbor, Michigan. The conference, on the theme of "Educating for Sustainable Watersheds," will bring together educators and community members to discuss such topics as school/community interaction, monitoring techniques, interdisciplinary studies, and action taking. To receive additional conference information and a registration packet, contact GREEN at 721 E. Huron St., Ann Arbor MI 48104; 313/761-8142.

NALMS Regional Conferences

NALMS (North American Lake Management Society) will hold four regional meetings in Feb-ruary and March of 1996. These conferences will include many workshops specifically designed for volunteer monitors of lakes and rivers. The South-eastern regional meeting will be held March 20-23 in Huntsville, Alabama; for more information, contact Gary Springston at 423/751-7336. The other three conferences will be held in Massachusetts, Texas, and Washington/Oregon; for exact dates and locations, please contact NALMS, P.O. Box 5443, Madison, WI 53705; 608/233-2836.

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National Organizations

Some of the organizations listed here focus primarily on environmental monitoring. Others have little or no direct involvement in monitoring, but offer support with advocacy, environmental protection, restoration, and other activities of interest to volunteer monitoring groups.

Izaak Walton League's SOS

Save Our Streams (SOS) is the Izaak Walton League of America's 26-year-old national river monitoring and restoration program. Through workshops, books, curricula, a video, and a technical assistance hotline (800/BUG-IWLA), SOS provides support in four program areas: (1) Volunteer Water Monitoring, (2) Stream Restoration, (3) Environmental Education, and (4) Urban Environments. SOS's national technical assistance database, called "Stream Doctor," helps people locate technical assistance, resources, and projects. For more information please write to SOS's new address: SOS, IWLA, 707 Conservation Lane, Gaithers-burg, MD 20878-2983; or call 800/BUG-IWLA.

Coalition to Restore Urban Waters

The Coalition to Restore Urban Waters (CRUW) was founded in 1993 as a network for groups concerned about urban waters. The network currently includes over 300 groups and is coordinated by a national steering committee of grassroots organizations. CRUW has just published its five-year plan for meeting the needs of urban rivers and people, as well as the first issue of its national newsletter, and is organizing its annual "Friends of Trashed Rivers" conference, to be held in May (see the Conferences article). For more information, or to obtain a copy of the five-year plan or newsletter, write to CRUW, c/o Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878-2983; 800/BUG-IWLA.

River Network

River Network's mission is to help people organize to protect and restore rivers and watersheds. The organization supports watershed advocates at the local, state, and national level, and promotes working together to build a nationwide movement for rivers and watersheds. River Network Partners receive assistance in the areas of watershed issue research, organization building, fundraising, campaign

strategies, and networking. Partnership dues are on a sliding scale and start at $60. Num-erous publications are available at a nominal cost, including *How to Save a River* (book) and *River Voices* (quarterly journal). For more information contact River Network, P.O. Box 8787, Portland, OR 97207; 503/241-3506; rivernet@igc.apc.org

River Watch Network

River Watch Network (RWN) works with conservation organizations, high school and college teachers and students, and citizen volunteers to develop river monitoring and protection programs. By offering organizational and technical assistance, RWN helps community groups to (1) define the issues they want to address; (2) design and execute scientifically credible studies; and (3) use the results of their studies to create strategies for river and watershed conservation.

RWN now has a corps of 10,000 volunteers working on over 150 rivers in 13 states, Canada, Mexico, and Hungary. For $25/year, members receive RWN's newsletter and 10% discount on publications. To join, or for a list of services, workshops, and publications, contact RWN, 153 State St., Montpelier, VT 05602; 802/223-3840.

GREEN: An International Network

GREEN, the Global Rivers Environmental Education Network, links students and teachers in 136 countries. Participants use computer networking to share ideas and water quality monitoring data. The program offers an interdisciplinary experience and involves students in real environmental issues in their communities. Members receive a quarterly newsletter and a special-rate GREEN EcoNet account. Student membership is $5 per year; individual memberships range from $25 to $100 per year; and group membership is $55 per year. For more information, contact GREEN, 721 East Huron St., Ann Arbor, MI 48104; 313/761-8142.

Center for Marine Conservation

For ten years, the Center for Marine Conservation (CMC) has coordinated the International Coastal Cleanup, which has grown to include 40 U.S. states and 68 countries. Cleanup volunteers record the amount and type of debris they collect on 81-item data cards and send the cards to CMC for analysis. Other CMC programs for volunteer monitors are the "Million Points of Blight" storm drain stenciling project and the new National Marine Debris Monitoring Program. CMC is headquartered in Washington, DC, and has regional offices in Virginia, California, and Florida. For more information on CMC's volunteer monitoring projects, contact the CMC Mid-Atlantic Regional Office, 306-A Buckroe Ave., Hampton, VA; 804/851-6734.

N. American Lake Management Society

The North American Lake Management Society, better known as NALMS, is a membership organization of lake property owners, volunteer monitors, scientists, consultants, academicians, and state and federal agency staff. Members receive the quarterly magazine, *LakeLine*, and the peer-reviewed journal *Lake & Reservoir Management*. Complimentary copies of either publication are available from the address below. (Volunteer monitors may be particularly interested in the April 1995 *LakeLine*, which contains a fascinating article by Bob Carlson on the Secchi disk.)

Members come together annually at the NALMS International Symposium (the next one will be held in Minneapolis in November 1996). Grants and scholarships for attending the Symposium are available. NALMS will also present four regional meetings in spring of 1996; please see the announcement for details. For more information on membership or conferences, please contact NALMS World Headquarters, P.O. Box 5443, Madison, WI 53705; 608/233-2836; gardner@nalms.org

Trout Unlimited

Trout Unlimited is a conservation group working to restore North America's trout and salmon fisheries and their watersheds. Founded in 1959, the organization now has over 85,000 members in 450 chapters. Membership is $30/year ($15 for youth and seniors) and includes the quarterly magazine *Trout*. Members are automatically assigned to a local chapter. Chapters hold monthly meetings and organize local conservation activities, often including stream monitoring and restoration projects. For more information, contact Trout Unlimited, 1500 Wilson Blvd., Suite 310, Arlington, VA 22209-2310; 703/522-0200.

Native Fish Association

Robert Rice, the membership director of the North American Native Fish Association (NANFA) recently contacted *The Volunteer Monitor* to say that NANFA is interested in featuring volunteer monitoring stories in its quarterly magazine, *American Currents*. Anyone with a story they would like to publicize is encouraged to contact NANFA at the address below.

Rice is also inviting volunteer monitors to join NANFA, a 20-year-old hobbyist group dedicated to studying and collecting native fish and raising them in aquariums. He will send a free sample copy of *American Currents* to anyone who is interested. For more information, contact Robert Rice, 2213 Prytania Circle, Navarre, FL 32566; 904/936-9261.

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Resources

Urban Watershed Bulletin

An excellent resource for urban watershed management is *Watershed Protection Techniques*. The publication's subtitle -- "A Quarterly Bulletin on Urban Watershed Restoration and Protection Tools" -- describes it well. Each issue is packed with technical (yet very readable) information. The summer 1995 issue focuses on urban stream restoration and includes seven case studies plus a number of other articles.

To subscribe to *Watershed Protection Techniques*, contact the Center for Watershed Protection, 8737 Colesville Rd., Suite 300, Silver Spring, MD 20910; 301/589-1890. Subscription (4 issues): $34 individual, $18 student, $54 organization; single issues $14. (If the subscription price is beyond your budget, check to see if local public or university libraries carry this very useful bulletin.)

Get Organized!

River Watch Network's new 24-page *Program Organizing Guide* covers 11 basic steps for organizing a river monitoring program. Drawing on techniques RWN uses to help groups design monitoring projects, the guide addresses such issues as identifying water quality issues, setting goals, raising money, recruiting volunteers, etc. To order a copy, send a check for $10, payable to River Watch Network, to RWN, 153 State St., Montpelier, VT 05602; or call 802/223-3840.

Urban Watershed Restoration Directory

The National Directory of Urban Watershed Restoration Efforts, 1994 edition, provides concise descriptions of 50 urban watershed restoration efforts representing every region of the country. The directory highlights projects that carry out physical restoration activities to improve water quality, habitat, or wildlife. Available for $6 from the Center for Watershed Protection, 8737 Colesville Rd., Suite 300, Silver Spring, MD 20910; 301/589-1890.

New Stream Restoration Handbook

The Izaak Walton League of America's Save Our Streams Program recently published *A Citizen's Streambank Restoration Handbook*, a 111-page looseleaf manual. The authors write, "Despite a wealth of knowledge about low-cost, sustainable, and ecologically sound stream restoration techniques, streams continue to be channelized, diked, and dammed." The guide teaches citizens how to restore streams using vegetation and natural stream forces to improve habitat and water quality. To order a copy, send a check for $15, payable to the Izaak Walton League of America, to IWLA, 707 Conservation Lane, Gaithersburg, MD 20878-2983; or call 800/BUG-IWLA.

Low-Cost Methods Manual

GREEN (Global Rivers Environmental Education Network has just published the *Field Manual for Global Low-Cost Water Quality Monitoring*, which is designed to complement Mitchell and Stapp's *Field Guide for Water Quality Monitoring*. As its name promises, the new manual provides instructions on low-cost alternatives such as building your own equipment and making your own reagents. $19.95 + shipping. To order call GREEN at 313/761-8142.

"Data to Action" Guide

Water Quality Monitoring: Data to Action discusses ways to present volunteer monitoring program results to different audiences. It focuses particularly on presenting data in a professional, scientifically credible manner, devoting several chapters to tips on writing a formal scientific paper. This 96-page manual, written by Lara Laughlin and Helen Rosselli, is available for $10 from Save the Sound, Inc., 185 Magee Avenue, Stamford, CT 06902; 203/327-9786.

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Spanish-Language Publications for Volunteer Monitors

GREEN publications: The following three publications are available from GREEN (Global Rivers Environmental Education Network), 721 E. Huron St., Ann Arbor, MI 48104; 313/ 761-8142:

Manual de Campo del Proyecto del Río: Una Guía para Monitorear la Calidad del Agua. A translation of GREEN's *Field Manual for Water Quality Monitoring*, by Mark Mitchell and William Stapp; contains instructions for nine basic water quality tests and includes chapters on macroinvertebrate surveys, heavy metals testing, and land use analysis. The Spanish-language version includes an additional chapter with information and examples pertinent to the Rio Grande / Río Brava. $12.95 + shipping.

Planes de Lecciones para un Proyecto de Calidad del Agua de 15 Días. A series of lesson plans used in Project del RÍo, a cross-cultural program between schools on both sides of the Rio Grande/Río Brava. $10.95 + shipping.

Video para Monitorear la Calidad del Agua. A video demonstrating how to perform eight water quality tests (fecal coliforms, pH, total solids, total phosphates, nitrates, turbidity, dissolved oxygen, and BOD). $99.95 + shipping.

Manual para Monitoreo Voluntario del Medio Ambiente. A translation of Texas Watch's *Manual for Volunteer Water Quality Monitors*. Free to monitoring organizations. To order contact Texas Watch at 512/ 239-4741.

Manual de Campo para el Muestreo de la Calidad del Agua/Field Manual for Water Quality Sampling. A 60-page bilingual manual, jointly produced by the Arizona Water Resources Research Center and Arizona Department of Environmental Quality (ADEQ), that contains detailed instructions for collecting samples from surface water (streams, lakes, ponds) and groundwater. Topics include selecting containers, calibrating equipment, chain of custody procedures, and field measurements. Free to public agencies and institutions; $10 to private parties. To order, call Marlene Roden (ADEQ) at 602/ 207-2202.

Adopte una Quebrada. An adaptation of the University of Georgia Institute of Ecology's Adopt-A-Stream manual; specifically designed for use in Costa Rica. The manual covers physical and chemical parameters and habitat evaluation, and includes a chapter on biological monitoring in tropical systems and a case study from Costa Rica. Available in December 1995. To order, contact Tina Laidlaw, Institute of Ecology, University of Georgia, Athens, GA 30605; 706/ 542-1120.

H2O Info: Contaminación de Fuentes Difusas. A 1-page bulletin on nonpoint source pollution. Free. Order from Texas Natural Resource Conservation Commission (TNRCC) Publications, Mail Code 195, P.O. Box 13087, Austin, TX 78711-3087; 512/ 239-0028. (Note: Several Spanish-language bulletins on recycling are also available from the same source.) [Added note: In H2O, the 2 should be subscripted such that H2O is the chemical symbol for water.]

Bilingual software programs. The U.S. EPA and Purdue University have produced a number of software programs for environmental awareness. Several programs on pollution reduction practices for farms and homes are available in Spanish as well as English. For a complete list of titles and ordering information, please contact Glynis Zywicki at 312/ 886-4571.

TEACHER RESOURCES:

Usted Puede Ayudar a Detener la Marea de Basura: Guía Didáctica Sobre la Basura en el Mar. (A Spanish translation of EPA's coastal cleanup manual, *Turning the Tide on Trash: A Learning Guide on Marine Debris*.) This teacher's guide is designed to increase students' awareness of the impacts of marine debris and to teach them about pollution prevention techniques. It can also be adapted to teaching about debris problems in lakes and streams. For a free copy, contact EPA NCEPI, P.O. Box 42419, Cincinnati, OH 45242-2419. Be sure to include the EPA number in your request. Spanish version: EPA 842-B-93-003; English version: EPA-842-B-92-003.

Wet and Wild. A series of six bilingual (English and Spanish) units in marine education, for grades K - 6. Each unit contains approximately 25 multidisciplinary lesson plans. Individual unit prices vary from $8 to $23; the whole set is $85. For more information contact Sea Grant Program, Hancock Institute for Marine Studies, University of Southern California, Los Angeles, CA 90089-0373; 213/740-1963.

Agua en Tus Manos. Uses a comic-book format to teach kids in grades 4 through 6 about water pollution. Price for 10 - 49 booklets is 39¢ per booklet + $3.50 shipping & handling (for larger orders, call for prices). Teacher's guide (also in Spanish) is 50¢. Order from Soil and Water Conservation Society, 7515 N.E. Ankeny Rd., Ankeny, IA 50021; 800/ THE-SOIL (800/ 843-7645).

Safe Water: A Bicultural Bilingual Curriculum. A bilingual curriculum about protecting drinking water; for grades K - 8. Units include water and public health, the hydrologic cycle, and water conservation. The curriculum is currently being developed and should be available in early 1996. For more information, contact Michele Kimpel at SEAGO (SouthEastern Arizona Governments Organization), 118 Arizona St., Bisbee, AZ 85603; 602/ 432-5301.

Posters, fact sheets. The University of Puerto Rico Sea Grant Program has produced a number of posters and fact sheets -- some in Spanish, some in English, and some bilingual -- on marine topics. Of particular interest are "Edible Fish of the Caribbean," a bilingual poster ($4) and "Fishes of Puerto Rico," a 40-page booklet ($3). For a complete listing contact UPR Sea Grant Program, UPR-RUM, P.O. Box 5000, Mayagez, PR 00681-5000; 809/ 834-4726.

The Volunteer Monitor, Vol. 7, No. 2, Fall 1995

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Comments on Calculating pH Statistics

by Mark D. Mattson

In the last issue of *The Volunteer Monitor*, Julie Rector states that pH values should be transformed to hydrogen ion concentrations (by taking the negative antilog of the pH) prior to calculating the mean. The mean of the hydrogen ion concentrations is then calculated, and its negative antilog is reported as the average pH. (*EDITOR'S NOTE:* See " Variability Happens:' Basic Descriptive Statistics for Volunteer Programs," in the Spring 1995 issue of *The Volunteer Monitor*.)

In fact, converting pH to hydrogen ion concentration is not the best approach in every situation. Though the antilog method is often followed for studies of precipitation chemistry, other reference books on chemical analyses, such as the APHA's *Standard Methods*, refer to the precision and accuracy of pH measurements (not hydrogen ion concentrations) and report results in terms of standard deviations in pH units. Further-more, when large U.S. EPA surveys of surface water quality data report parametric statistics, they calculate in pH units, with no conversion to hydrogen ion. The method used to analyze and report pH data depends on the objective of the study and on the nature of the data.

One reason for the differences in methods is that hydrogen ions have some rather unique properties. Most water quality constituents are "conservative" -- in other words, if you pour together equal volumes of a 10 mg/L phosphorus solution and a 30 mg/L phosphorus solution, you will end up with a solution whose concentration is 20 mg/L phosphorus. However, in natural bodies of water hydrogen ions usually do not behave conservatively. Instead, their concentration is influenced by the presence of buffers. Obviously you cannot mix a pH 5 solution with a pH 7 solution and expect the result to be pH 6, because pH is a logarithm. But using the antilog method to convert pH to hydrogen ion concentration won't give you the right answer either, because carbonate buffering in the water affects the final pH of the mixture. In order to accurately predict the final pH you need to know the respective inorganic carbon concentrations of each solution and perform some rather complicated equilibrium chemical calculations.

Most studies of acid precipitation and acid inputs to watersheds are concerned with loading rates of hydrogen ions. These studies assume that hydrogen ions behave conservatively, which in this case is a reasonable assumption because most rain has little or no buffering capacity. So for these studies it is necessary and appropriate to calculate means based on the hydrogen ion concentrations.

However, studies of surface water quality usually have another purpose. Most such studies are not concerned with determining mass balances or loading rates of hydrogen ions -- nor would it make sense for them to attempt such calculations. Surface waters contain buffers, and thus hydrogen ions do not behave conservatively and loadings cannot be logically calculated. Instead, the purpose of surface water studies is usually to summarize the central tendency of a population of lakes, provide descriptive statistics, and possibly conduct statistical tests to see if one population differs from another. If the researchers in these studies use parametric statistics such as means, standard deviations, and t-tests, they should be careful not to violate the assumptions on which such tests are based. Parametric statistics assume a normal distribution of data. In most cases, surface water acidity data are more nearly normal when expressed as pH rather than as hydrogen ion.

As an example, suppose a hypothetical sample of pH readings from 11 lakes shows a fairly normal distribution (see Table 1). The question is, "What is the central tendency in this population of lakes, and how confident are we in the estimate?" If we use the pH data (without converting to hydrogen ion), we calculate a mean pH of 7, which appears reasonable and expected. If, however, we use the antilog method, we calculate a mean pH of 4.99, which does not appear central at all.

A more serious problem arises when we attempt to calculate our confidence in the mean. With the pH values there is no problem; using the mean pH of 7 and the standard deviation of 1.73 we calculate a 95% confidence interval of 5.84 to 8.16, which is reasonable. However, we run into trouble when we attempt to calculate the 95% confidence interval about the antilog mean. We calculate a lower confidence limit of 4.52, which perhaps might not seem too unreasonable -- but the upper confidence limit is calculated to be infinitely high, since the hydrogen ion concentration is predicted to be negative at that confidence limit! Calculating such statistics on the hydrogen ion data drastically violates the assumption of a normal distribution (compare the hydrogen ion distribution to the pH distribution in Table 1).

Admittedly, most lake surveys won't find such an extreme range of pH values as shown in the hypothetical example in Table 1. Still, typical lake surveys which use the antilog method to calculate means and standard deviations may be skewing their estimates of the central tendency and calculating misleading confidence intervals. A good way to resolve problems associated with non-normally distributed data is to avoid means and standard deviations altogether and instead use nonparametric statistics (such as median, range, and interquartiles), which don't assume a normal distribution. In fact, since many kinds of environmental measurements are not normally distributed, scientists are recognizing the value of using nonparametric statistics to summarize environmental data.

(EDITOR'S NOTE: A longer version of this article will be appearing in the next issue of NALMS' quarterly magazine, *LakeLine*. For more information on NALMS and *LakeLine*, please see National Organizations).

Mark Mattson *is a Senior Scientist at the Water Resources Research Center, Blaisdell House, University of Massachusetts, Amherst, MA 01003-0820.*

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Table 1. Hypothetical pH and Hydrogen Ion Data Analysis

DATA

pH	[H+] (mole/liter)
4	0.0001
5	0.00001
6	0.000001
6	0.000001
7	0.0000001
7	0.0000001
7	0.0000001
8	0.00000001
8	0.00000001
9	0.000000001
10	0.0000000001

DATA ANALYSIS

Statistic	calculated using pH units	calculated using H+ units
Mean	7.00	0.000010211 (pH = 4.99)
Standard Deviation	1.73	0.0000299251 (pH = 4.52)

95% LCL	5.84	0.0000303137 (pH = 4.52)
95% UCL	8.16	-0.0000098917 (pH impossible)

Return to "Comments on Calculating pH Statistics

The Volunteer Monitor, Vol. 7, No. 2, Fall 1995

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Derby Creek: Creek Critters Mark Buried Creeks

In another twist on stenciling, the Berkeley Citizens for Creek Restoration stenciled "creek critters" on Berkeley, California, sidewalks to mark the locations of culverted streams. Each of Berkeley's 12 creeks was represented by a different "critter." Richard Register, who designed the stencils, says the project's goal was to "wake people up" to the creeks buried beneath the city. In 1989 and 1990, the group stenciled 860 locations.

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Million Points of Blight

In June 1992, the Center for Marine Conservation (CMC) launched the "Million Points of Blight" program to serve as a network and clearinghouse for storm drain stenciling projects nationwide. The name refers to the project's goal: one million storm drains stenciled by the year 2000. To date, 95 organizations from 33 states and Canada are participating in the network.

Any group interested in stenciling storm drains is invited to join the "Million Points of Blight" network. There is no fee for membership, and members receive a free packet containing a storm drain stenciling fact sheet, a step-by-step brochure, sample flyers, and supply of data cards. CMC also offers stencils on loan, which may be a good option for smaller groups that don't want to invest in their own stencils. The data cards are to be used for recording the types of debris found at storm drain sites. This information will be compiled and analyzed by CMC.

So far, "Million Points of Blight" members have reported painting 229,000 storm drains. Laurie Halperin, who coordinates the program, says she is sure that this represents only a fraction of the actual number of storm drains that have been painted nationwide, and she urges everyone who has already done a stenciling project to "call and be counted."

For more information, or to join the network, contact CMC, 306A Buckroe Ave., Hampton, VA 23664; 804/ 851-6734.

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NPDES Stormwater Permits

The National Pollutant Discharge Elimination System (NPDES), mandated by the 1972 Clean Water Act (CWA), historically focused on point sources such as industrial discharges and sewage treatment plants. Then, in the 1987 amendments to the CWA, Congress required EPA to extend the NPDES permit program to stormwater runoff. In 1990, EPA published regulations stipulating that cities with populations over 100,000 must apply for NPDES permits for their storm drain discharges. In effect, runoff and dry-weather discharges from urban storm drain systems are now regulated similarly to industrial discharges.

Obtaining the NPDES stormwater permit is a rather involved process. The municipality must inventory its outfalls and perform both dry- and wet-weather monitoring. Dry-weather monitoring, which is aimed at detecting illicit connections and discharges to the storm drain system, consists of field screening outfalls for pH, chlorine, detergents, phenol, and copper, as well as noting color, turbidity, odor, and visual observations. Wet-weather monitoring is required for three storm events at five to ten major outfalls; over 140 constituents must be monitored for each sample.

The permit application must also describe the management practices, control systems, and engineering methods that the city plans to use to reduce pollutant discharges, as well as the long-term monitoring that will be performed. Most cities will include public education as a significant part of their management practices.

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Storm Drain Stenciling: The Street-River Connection

by Rhonda Hunter

Yes, Virginia, the pavement in the city is still part of the watershed, and water down a storm drain is not magically cleansed or sent off the planet.

Most people want to protect their local river, lake, beach, or groundwater aquifer. They value their clean water for drinking and recreation, and as fish and wildlife habitat. Yet these same people may dump used oil, antifreeze, and household or garden chemicals down neighborhood storm drains -- not realizing that there's a connection between storm drains and local waters.

To raise public awareness, young people and adults have been stenciling storm drains from Hawaii to New Hampshire with messages like "Dump No Waste -- Drains to River" (. . . or Bay, Lake, or Groundwater). Storm drain stenciling is an easy way for people to do something tangible about nonpoint source pollution in their own watershed.

An effective storm drain stenciling project shouldn't begin and end with simply painting the stencil. Following are some tips for making the most of the project before, during, and after stenciling day.

GETTING READY

Create a Flyer
Distributing information in the community is one of the most important things you can do, and a good flyer, brochure, or door-hanger is a vital part of this work. Vol-unteers can distribute flyers either on stenciling day or a few days before or after. Sometimes they also go door to door and talk to residents. The following points are useful to include in flyers:

- Enormous amounts of pollution come from the accumulated effects of all our individual actions.
- Contrary to popular belief, most storm drains are not connected to treatment systems. Instead, whatever enters the drain is discharged directly into local waterways.

- Other activities besides overt dumping also pollute storm drains. Examples include overfertilizing the lawn, washing the car on pavement, or dumping yard waste into the gutter.

Most important, the flyer needs to give people alternatives so they can avoid polluting. It should list nearby facilities for recycling automotive oil and household chemicals, describe alternative lawn and garden care, and so on. (Local governments can often provide brochures with this type of information.)

If stenciling is being done by a school class, the students can create their own flyer from information they research themselves. Students feel empowered by doing research that has a real-world impact.

Call First for Permission
For public streets, call the city or county Public Works Department (storm water utility or road maintenance division) for permission. Public Works will probably issue a permit or letter of approval. They may even help out by providing storm drain maps, traffic safety cones, and vests.

This is also a good time to find out whether your city will allow you to stencil on the sidewalk. (Some cities restrict paint on the sidewalk, out of a concern that it will be slippery for pedestrians.) If you aren't allowed to paint on the sidewalk, place the stencil on the street next to the storm drain, where your message can be easily seen.

For storm drains on private property (i.e., business or apartment parking lots), get the permission of the property owner.

Consider Safety
Especially when children are stenciling, seriously consider traffic safety issues when you select your site. Neighborhoods are usually safer than downtown city streets (and much of the nonpoint pollution down storm drains happens in residential neighborhoods). Place traffic safety cones, and assign at least one person to watch traffic at all times.

Prepare Materials
Before using stencils for the first time, "weed" remaining letters from the die cuts. This avoids having small plastic or oil board pieces wash into the drains while you're stenciling. "Stencil weeding" is a good activity for a short training meeting held before going out to paint.

For painting, an aerosol can of traffic-zone latex paint (without CFCs that harm the ozone) is a good option. Each can will mark about 20 drains. Some stencilers have also used a small roller with recycled or leftover latex-based paint. However, this method should be used only with adults or older students, who can master the technique of striking the extra paint off the roller. If this is not done properly, paint will run under the stencil, smearing the letters.

Call the Media
Notifying the media of a stenciling event can get your watershed protection message out to the whole

community. Young people in the project enhance media photo opportunities, and the city mayor can be a powerful draw. Don't forget to take your own pictures, too.

ON STENCILING DAY

Watch the Weather
Dry weather, dry pavement, and air temperature over 50 degrees ensure best results. If the weather is too wet or cold, reschedule. Stenciling in the rain is counterproductive because the wet paint runs straight down the drain.

Avoid Mess
Remind stencilers to wear old clothes. Rubber gloves and protective eyewear are helpful, as are plastic bags worn over shoes. Bring rags to clean up unexpected paint on arms and fingers, and plastic bags to bring back used gloves and rags (as well as any garbage you pick up, which otherwise could have gone down the storm drain).

Paint over-spray drifting onto nearby parked cars is guaranteed to result in unhappy neighbors. To avoid this problem, use a large box (2 to 3 feet tall) opened flat and set up as a shield around the stencil as you spray.

Work in Teams
Work in teams of 4 to 6. The team should include a traffic look-out. Rotate jobs for maximum enjoyment.

Tips for Applying the Stencil

1. Scrub the area briskly with a wire brush and dust it off with a whisk broom.
2. Lay the stencil on the sidewalk or street.
3. One or two people can hold the stencil flat. Bricks or rocks work well as weights on the corners.
4. If using spray paint, shake the can for one full minute. Hold the spray can about 6 to 8 inches from the stencil and use a series of back and forth sweeping motions to spray one line at a time until the letters are uniformly covered. If using a roller, strike excess paint from the roller, then apply evenly across the letters. Whether spraying or rolling, don't use too much paint -- it will run underneath and blur the letters.
5. When finished, carefully lift the stencil up off the street. If the stencil is not clearly readable, don't try to wipe it off and try again! That will only make a big mess. It's okay to go on and learn from small mistakes. These are not Rembrandts or Picassos, after all. The next one will be better.
6. After stenciling, lay stencils out flat to dry in a warm dry place for a day or so. When the paint is completely dry, gent-ly roll Mylar stencils to chip off the paint. This works best if paint does not build up too thick between cleanings.

FOLLOW-UP

A Ripple Effect

Storm drain stenciling does more than just put information on the street. It creates a local ripple effect of followup pollution prevention activities, especially if stencilers do a good job of leafleting the neighborhood and if the stenciling project gets some media coverage. Reminded of the street connection to the river, stencilers can go on to create city "stream teams" that clean up streams and restore stream banks or wetlands with native vegetation. These activities can kindle support for local government wastewater management plans.

For teachers, stenciling is an effective community service project that integrates classroom learning with environmental studies, civics, and language arts, especially if students create their own flyers. Some cities have also engaged students in youth-at-risk programs in storm drain stenciling. Taking action is very empowering for kids!

Rhonda Hunter *is the founder of Earth-water Stencils. 4425 140th Avenue SW, Dept. V, Rochester, WA 98579-9703; phone 360/956-3774; fax 360/956-7133.*

The storm drain stencils pictured in this article (not included in the Internet version), plus other designs, may be purchased from Earthwater Stencils. Write to the above address for a brochure.

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Supplies

Map of the neighborhood
Stencils
Paint
Whisk broom
Wire brush
Traffic cones, traffic flag
Safety vests
Cardboard box (for overspray shield)
Cleanup rags and bags

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Storm Sewer in a Suitcase

Volunteers and staff with Blue Thumb, Tulsa's Urban Water Quality Improvement Project, are using a nifty new educational tool called "Storm Sewer in a Suitcase" to demonstrate where stormwater runoff ends up. Storm Sewer in a Suitcase is a miniature (2' x 3') urban watershed model that consists of four houses located on a cul-de-sac with a stream running along the side. The model is contained in a handy portable case and is complete with lawns, cars, people, and functional storm drain inlets at the low points in the street. It was designed by Blue Thumb coordinators Sue Gray, of OSU Extension/Tulsa County, and Cheryl Cheadle, of Tulsa County Conservation District.

Because Storm Sewer in a Suitcase is interactive, it's a big hit at schools and fairs, and with youth groups. Participants enjoy applying mock pollutants (food coloring representing motor oil, antifreeze, fertilizer, or paint) to the road or lawns, then delivering "rain" from a spray bottle. The model's most distinctive feature is the plexiglass front through which viewers can peep at the inner workings of a subsurface storm sewer system. (The model is wired so that, when electricity is available, the front can be lit up for an even better view.) Participants can see for themselves that the polluted water disappearing down the storm drain receives no treatment; it goes directly to the stream.

"Even adults are often surprised to learn that stormwater does not go to a treatment plant," says Gray. (The model portrays a separate stormwater system, which is what Tulsa has.)

The "hands on" quality of the model reinforces the lesson that day-to-day activities like car maintenance, lawn care, or cleaning up after using oil-based paint can be harmful to water. It also helps teach how even slight behavioral changes can protect water. For example, a demonstration of the effects of over-fertilizing leads to a discussion of alternatives, such as testing the soil to see if fertilizer is needed, or using slow-release fertilizers.

The original prototype, built in 1993, was extremely popular, and people who saw it often asked, "Where can we get one of those?" So Gray and Cheadle decided to gear up for mass production. They had 23 cases and bases manufactured, then invited Blue Thumb volunteers to help finish the models. Though more accustomed to tasks like environmental education, stream habitat assessments, or chemical water quality monitoring, the volunteers pitched in enthusiastically -- putting together model houses, cutting and gluing felt "lawns," assembling the subsurface plumbing, affixing the lighting system, and painting

the streets and stream bottoms. "We originally had no idea how much work the assembly would be," says Gray, "but once the volunteers started rolling, there was no stopping until all 23 models were ready for new homes."

Each model sells for $250, plus $25 shipping and handling, and comes with cars, people, food coloring, dispensers for "pollutants" and "rain," and a curriculum with ideas for teaching about nonpoint source pollution. For more information, please call the Tulsa County Conservation District at 918/744-1595.

-- Cheryl Cheadle

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Combination Staff Gauge/ Crest Gauge

by Ken Pritchard

Materials needed:

- 6-ft fence post or rebar
- PVC pipe, 1" diam. (or wider), 4 or 5 ft long*
- 2 end caps for the PVC pipe
- 2 or 3 metal clamps or U-bolts
- Section of 2" x 2" wood, (apx. same length as PVC pipe)
- Wooden dowel, " to " diam., to fit inside PVC pipe
- Granulated cork

*length depends on anticipated change in stream level

Assembly:

1. Permanently mark 2" x 2" in 1/4 " increments. (Alternative: affix length of measuring tape to 2" x 2".)
2. Glue end cap to bottom of PVC pipe. Drill three or four vent holes in section of pipe that will always be immersed in water, to allow water to flow into pipe. Drill one vent hole near top of pipe, to allow air to escape.
3. Drive fence post or rebar into streambed in a location where water flows permanently and where you will be able to reach the gauge without getting wet.
4. Attach 2" x 2" to fence post or rebar using clamps or U-bolts.
5. Attach PVC pipe to 2" x 2", aligning bottom of pipe with zero point marked on 2" x 2".
6. Cut dowel to same length as PVC pipe (dowel should fit snugly so it won't float). Place dowel and granulated cork inside PVC pipe. Place end cap ((DO NOT GLUE) on top end of pipe.

Calibration: Calibrate the gauge by measuring the difference between the lowest point on the stream bed and the zero point on the scale marked on the 2" x 2". (Note that the lowest point on the stream bed won't necessarily be the point where the gauge is located, but it must be along the same cross section.) This "depth-of-stream factor" must always be added to the gauge readings. Recalibrate the gauge yearly, and also after severe episodes of erosion or deposition.

Reading the crest gauge: To read the crest gauge, remove the top end cap and take out the dowel. Use the scale on the 2" x 2" to measure the level of the cork powder "ring." Don't forget to add the depth-of-stream factor (see "Calibration," above). After taking the reading, wipe off the cork powder and replace the dowel. Occasionally you may need to add more cork powder.

For more information, contact Ken Pritchard, Special Projects Coordinator, Adopt a Beach, P.O. Box 21486, Seattle, WA 98111; 206/624-6013.

This combination gauge serves as both a **staff gauge** to measure the water level of a stream at the time of inspection, and a **crest gauge** to measure the highest level reached by that stream between the last inspection and the current inspection. A staff gauge can't tell you the high water level for a rain event unless you read the gauge at the actual time when the stream crests, whereas a crest gauge preserves a record of crest height that can be read at a later time.

The crest gauge shown here is based on the "bathtub ring" principle. It consists of a PVC pipe containing a wooden dowel and a supply of granulated cork. As the water rises, so does the powdered cork. When the water goes down, the cork granules remain stuck to the wooden dowel at the level of highest water.

By taking successive staff and crest gauge readings and plotting them on a time graph, you can obtain a general picture of how a stream behaves in response to rain. For instance, a rapid rise and fall in stream level would be diagnostic of the land's inability to slowly release water. Long-term trends can also show a correspondence between stream levels and land use changes. For example, the data might show that a new shopping center has caused the stream to crest several inches higher for the same amount of precipitation.

If you establish a flow curve that correlates stream height to flow rate for your stream, then in the future you will be able to estimate stream flow based on readings from the staff or crest gauge alone, without the need for a flow meter. (Stream flow rate is expressed in cubic feet of water per second, or cfs.) To establish the flow curve, you will need to use a flow meter. Volunteers who do not wish to invest in a flow meter (which may cost upward of $1,500) may be able to borrow one from the utility that controls stormwater. Flow readings at three or four different stream flow stages provide enough data to establish the curve.

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Does Community Education Reduce Water Pollution?

Volunteers Monitor "Paired Watersheds" to Find Out

by Joan Drinkwin

There's something going on in a small watershed in Austin, Texas, that could answer a big question about how to combat water pollution in the United States. In the East Bouldin Creek Project, volunteer monitors are using a sophisticated "paired watershed" monitoring design to find out if the community outreach and education programs being employed there are actually improving water quality.

What's new about this approach? First let's back up and define the problem. What is: sporadic and unpredictable, difficult to control, hard to detect using traditional water chemistry monitoring techniques, devastating to aquatic life? You've got it: nonpoint source pollution. Nonpoint source pollution is pollution carried into surface and ground waters by runoff from rain, snow, lawn sprinklers, and car washes. The exact place it comes from can't be pinpointed. Illegal dumping is also considered nonpoint source pollution because even though it may come from a specific location, or "point," that location is hard to track down.

Now, let's talk about solutions -- the techniques, or tools, used to control and prevent nonpoint source pollution. These tools, which are also called "best management practices" (BMPs), fall into two categories: structural and nonstructural. Structural BMPs, as the name implies, are physical structures, such as sediment fences placed around construction sites to capture sediment before it reaches streams and lakes, or sedimentation and filtration ponds built next to highways to trap oil and grease in road runoff. Structures like these usually control rather than prevent nonpoint source pollution. By contrast, nonstructural BMPs, such as land use ordinances and community education programs, are usually designed to prevent nonpoint source pollution from happening in the first place. Traditionally, government agencies have preferred structural BMPs, which give them something tangible to point to. As David Pimentel, former Director of Travis County Environmental Office, puts it, "Agencies have tended to shy away from nonstructural approaches, like community education, which they view as squishy.'"

All right, now we can get back to the monitors in the East Bouldin Creek watershed. The big question they're trying to answer is: Do these nonstructural tools really work? In other words, can you see an improvement in water quality as a direct result of community outreach and public education?

While a lot is known about the effectiveness of many structural methods used to control nonpoint source pollution, practically nothing is known about the water quality benefits of most nonstructural techniques. Before-and-after surveys, in which the same questions are asked before and after a community education campaign, have traditionally been used to find out whether education efforts increase public awareness. (For example, such a survey might ask local residents to rate the relative importance of various pollution sources.) Unfortunately, this kind of survey doesn't tell us whether water quality has improved, or whether the education campaign has actually succeeded in keeping pollution out of the water.

The goal of the East Bouldin Creek Project is to decrease the amount of nonpoint source pollution reaching East Bouldin Creek, which the City of Austin's Environmental Conservation Services Department identified as one of the most polluted creeks in urban Austin. To achieve this goal, an array of nonstructural prevention activities will be employed throughout the watershed. Local citizens, students, and businesses will adopt creek sections and carry out such projects as (1) revegetating stream banks for habitat restoration and erosion control; (2) placing signs to identify the creek and watershed (e.g., "Welcome to East Bouldin Creek Watershed"); and (3) stenciling storm drains to discourage illegal dumping of oil and yard waste. In addition, a local elementary school class is developing a watershed education program which the students will present at other schools throughout the watershed. The program will include a teacher's handbook and a three-dimensional model of East Bouldin Creek watershed, complete with local landmarks.

To determine whether all these activities are actually improving the water quality of East Bouldin Creek, volunteer monitors will use an innovative paired-watershed monitoring design. So what makes this design innovative?

Traditional monitoring designs fall roughly into three categories: ambient monitoring, upstream-downstream monitoring, and before-and-after monitoring. Ambient monitoring is generally used to gather baseline data and determine long-term trends; it is not used to determine whether pollution prevention or control tools are effective in the short term. In the upstream/downstream design, sites are chosen to bracket a specific location of interest (such as a structural BMP). This monitoring design answers the question: Is water quality downstream from the structure better than upstream? One problem with this design is that with nonstructural methods there is no specific location to bracket. In the before-and-after design, a site is monitored before and after something is done to control or prevent pollution. Unfortunately, weather plays such an important role in nonpoint source pollution that often results are masked by natural variation in rainfall. For example, if you install a structural BMP and then observe an increase in nitrates, you might conclude that the structure is not working. In reality, though, you might be seeing the increase because it's been raining more since the structure was built than during your "before" monitoring.

The paired watershed monitoring design tries to avoid or minimize the above problems by comparing the study creek with one or more control creeks. The control creek(s) should be similar to the study creek in size, slope, location, soils, and land cover. During an initial "calibration" phase, which precedes any pollution prevention activities, the study and control creeks are monitored over a period of time to determine the relationship between their water quality. Then, during the "treatment" phase, pollution control and prevention measures are applied only to the study creek; meanwhile, regular monitoring of both study and control creeks continues. The paired watershed study design does not require that the watersheds be the same, only that water quality in one creek should predict water quality in the others.

In the East Bouldin Creek Project, volunteers will monitor East Bouldin Creek (the study creek) along with two control creeks -- Blunn Creek and Harper's Branch. Since the three creeks are close together, weather is the same for all of them. The three watersheds are adjacent to each other, are similarly developed, and are all about the same size, so we expect that water quality in the three creeks will be related. For example, the level of dissolved oxygen in Blunn Creek may not be the same as that of East Bouldin Creek, but it should be predictably higher or lower at all times. Or, to take another example, we may find that conductivity in the creeks changes at the same rate relative to rainfall. Initial analysis of historical data indicates that the three creeks' water chemistry is related.

The volunteers are now carrying out the calibration phase. They are monitoring the three creeks for chemical and physical water quality variables on a weekly basis, and for benthic macroinvertebrates on a quarterly basis.

During the treatment phase, which will last about a year and a half, the nonstructural pollution prevention activities described above will begin in the East Bouldin Creek watershed. However, no such activities will be implemented in the control creeks' watersheds. Monitors will continue testing on all three creeks. After the treatment phase is completed, the water quality of the three creeks will be compared. If the statistical relationship between the water quality of the study and control creeks changes, this suggests the pollution prevention activities did affect water quality.

Evaluating the effectiveness of nonpoint source pollution prevention activities like community education is long overdue. This project will help to determine whether community outreach and public education really improve water quality. If they do, then more funding for such programs is justified. If they do not, then other innovative ways to combat nonpoint source pollution still need to be tried. Using volunteers to collect the water quality data is an important aspect of the project. Since intensive monitoring projects conducted by professionals can be very expensive, demonstrating that volunteers can conduct such a study will greatly enhance our ability to monitor what works against urban nonpoint source pollution.

Reference

U.S. EPA. "Paired Watershed Study Design." EPA Office of Water. An 8-page fact sheet. Free; available from NCEPI, P.O. Box 42414, Cincinnati, OH 45242; fax 513/489-8695. Ask for publication number 841-F-93-009.

The East Bouldin Creek Project is being implemented by Texas Watch, the volunteer environmental monitoring program of the Texas Natural Resource Conservation Commission. The project is funded in part by U.S. EPA through Section 319(h) of the Clean Water Act. For more information about Texas Watch or the project, please call ***Joan Drinkwin****, Texas Watch Nonpoint Source Projects Coordinator, at 512/ 239-4742.*

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Dissolved Oxygen Test Tip

GREEN (Global Rivers Environmental Education Network) has come up with a useful tip for monitors who use Hach field kits for testing dissolved oxygen. After collecting the water sample and adding the first two reagents (which fix the oxygen), GREEN volunteers add a small marble or boiling chip to the bottle before replacing the stopper. This has two benefits: first, "topping off" the level of liquid in the bottle eliminates the air bubble that sometimes forms between the liquid and the stopper. Second, the marble or boiling chip helps to mix in the powdered reagents when the bottle is shaken. Note that the marble or boiling chip should be clean, and should be added gently to prevent the possibility of introducing air into the bottle.

Here's one more tip: if you find that the stopper sometimes "freezes" in an empty dissolved oxygen bottle, wrap a piece of paper around the stopper before inserting it into the bottle for storage.

For more information, please call GREEN at 313/ 761-8142.

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Low-Cost Biological Monitoring

The device pictured at left costs less than $1 to make and is used by the City of Fort Worth Department of Environmental Management (DEM) for biological monitoring of storm drainage systems, especially in outfalls. (Outfalls are pools of water located where a storm drain pipe discharges to surface water.) The unit was originally designed by former DEM staffer John Falkenbury, and redesigned by staff members Gene Rattan and Brian Camp, who dubbed it the "stream sentinel." Basically, the sentinel is a 2-liter plastic soft-drink bottle that is punched with holes, attached to a styrofoam float, and tied to an anchor (a brick). Camp recalls, "We were drinking a lot of Coke until we found a bottle manufacturer and began buying directly!"

The stream sentinel is placed in an outfall pool, stocked with 6 fathead minnows, and checked at regular intervals (Fort Worth DEM usually checks their sentinels once or twice a week). If the fish die, it is likely that a pollutant was present at some time since the last check. If they don't die, they are released after two weeks.

The device can be placed in any outfall that has enough water to keep it afloat and can be left in place indefinitely, as long as it's restocked with fresh minnows every two weeks. Rattan says, "If you don't see any toxicity after 2 months, you have a very good urban site. If you don't see any toxicity after 6 months, you've got an excellent urban site."

The big advantage of the stream sentinel is that it permits round-the-clock monitoring. As Camp explains, "Storm drain pollution is mostly intermittent and transitory, so the odds of identifying toxic discharges with one-time sampling are low. But the fish stay in the water 24 hours a day."

So far, Fort Worth DEM has monitored about 100 outfalls with the stream sentinel. Because the unit is so cheap and easy to make and use, Rattan and Camp believe that it has great potential for volunteer monitoring groups and classroom teachers. It can be used in creeks and ponds as well as storm drain outfalls. Fort Worth DEM staff raise their own fathead minnows, and they say this is the trickiest part of the whole procedure. (Rattan points out that a minnow in the Fort Worth program has much better odds of surviving from egg to adult than a minnow in the natural world: 80 - 90 percent survival rate for stream sentinel minnows versus 1 - 5 percent in the wild.) However, most volunteer groups will probably opt to obtain their minnows from a bait shop or local university biology department. If fatheads are not

available, Rattan says that other minnows could be substituted, as long as they are not too pollution-tolerant, and not overly sensitive to natural conditions in your area. A state or federal wildlife agency should be able to suggest appropriate minnow species.

Fort Worth DEM has produced a video and manual explaining how to construct and use the stream sentinel. Both are available at no cost from Charlie Howell at EPA Region 6; phone 214/665-8354.

*For more information about using the stream sentinel contact **Gene Rattan** or **Brian Camp** at Fort Worth DEM, 5000 Martin Luther King Fwy, Fort Worth, TX 76119; 817/871-5450.*

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Test Kits for Organic Contaminants

by Joe Rathbun

Volunteer monitoring groups rarely test for toxic organic contaminants such as pesticides, herbicides, and petroleum hydrocarbons. Perhaps this is because the traditional assay methods (e.g., gas chromatography) are expensive, time-consuming, and difficult. However, many of these compounds are important pollutants that can cause acute toxicity and chronic health problems in aquatic and terrestrial creatures, including humans.

There are a number of relatively inexpensive test kits now on the market that could put testing for organic contaminants within the reach of many volunteer monitoring groups. These kits are all based on the principles of enzyme immunoassay (EIA), a technique that has been used in medical laboratory testing for several decades, and has been applied to environmental investigations in the last 10 years.

The kits are quite simple to use in either the field or the laboratory. Basically, a small volume of sample (less than 0.5 ml) is placed in an antibody-coated test tube, then several reagents are added, producing a colored solution. The intensity of the color is inversely proportional to the concentration of the compound being tested (i.e., the more pollutant present in the sample, the less color produced). The per-sample cost is in the neighborhood of $15. Required equipment includes small-volume pipettes (2 to 250 æL), and a spectrophotometer to read the color. Spectrophotometers are expensive, but volunteer groups that test chemical parameters may already own one, or have access to one. A cheaper alternative is a colorimeter, which reads only one or a few colors.

Quantitative results can be obtained by running several standard samples of the pollutant of interest to obtain a standard curve. For semi-quantitative, or threshold, testing, a single standard sample (usually at a concentration equal to a regulatory criterion) is used. Results are then reported as "greater than" or "less than" the criterion.

Kit performance can be optimized by steps like measuring the reagent solutions with calibrated pipettes rather than using the dropper bottles supplied with the kits, and by keeping the timing of each step in the analysis consistent. Please contact the author (address below) for details.

EIA test kits are available for a variety of toxic organic contaminants. (Note, however, that EIA can't be used for metals, with the exception of organomercury.) Kits for the following compounds may be of particular interest to volunteer monitors:

- petroleum hydrocarbons
- PAHs (polycyclic aromatic hydrocarbons)
- "BTEX" solvents (benzene, toluene, ethylbenzene, xylene)
- various individual herbicides and pesticides

Groups monitoring in urban watersheds may be especially concerned with petroleum hydrocarbons and PAHs. Petroleum hydrocarbons (petroleum-based oils, gasoline, and diesel fuel) enter rivers from street runoff, boat traffic and marinas, and discharges from oil refineries. They are toxic to a variety of organisms. EIA kits for petroleum hydrocarbons usually measure total petroleum hydrocarbons (TPH).

PAHs (polycyclic aromatic hydrocarbons) are byproducts of incomplete combustion. They enter rivers from parking lots and streets, oil refineries, and riverside coal piles. Some of the most potent carcinogens known are PAHs. There are dozens of PAH compounds; all available kits measure "total" PAH (the sum of the different PAHs in the sample).

The BTEX solvents (benzene, toluene, ethylbenzene, xylene) are industrial chemicals often used in the chemical industry, or for cleaning metal products. They are toxic to many organisms, and some are known carcinogens. The BTEX solvents are a subset of the petroleum hydrocarbons (which means that TPH kits will detect anything a BTEX kit will detect).

People tend to associate herbicides and pesticides with agriculture, and indeed these compounds are important pollutants in rural areas. However, some of them also occur in high concentrations in urban runoff, due to overuse of weed killers and household pesticides (e.g., ant poison). Kits are available for a large number of herbicides (including atrazine and 2,4-D) and pesticides (including chlorpyrifos and lindane). Since each kit is specific for one individual compound, it's essential to know which is likely to be present in the sample. Information on which herbicides and pesticides may have been used in a particular watershed should be available from state or county natural resource or agricultural agencies.

EIA kits for PCBs (polychlorinated biphenyls) are also available. They are mainly useful for testing soil and sediment, since water concentrations of PCBs are generally too low to be detected by the kits. Although PCBs have been banned since 1976, they still persist in the environment and are important pollutants because of their toxicity and carcinogenicity.

EIA kits are available from a number of manufacturers, including Millipore (800/ 645-5476), Ohmicron (800/544-8881), and Ensys (919/941-5509). Kit suppliers are generally quite cooperative about supplying literature, advice, and even training.

(EDITOR'S NOTE: *The Volunteer Monitor* is aware of only one volunteer monitoring group that has

used EIA kits. Friends of the North Fork Shenandoah River, in Virginia, used Ohmicron kits to test 24 wells for two herbicides, metolachlor and atrazine. They found that 22 wells had detectable levels of at least one of the herbicides. Any other groups who have used EIA kits are invited to share their experience with our readers; please contact the editor.)

Joe Rathbun *is an Aquatic Biologist/ Chemist for AScI Corporation, 15300 Rotunda Dr., Suite 307, Dearborn, MI 48120; 313/336-7200. He is also a technical advisor for GREEN.*

The Volunteer Monitor, Vol. 7, No. 2, Fall 1995

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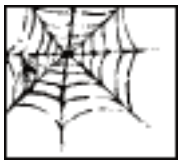

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Storm Drain Monitoring Kits

The kit used by Urban Watch volunteers was developed jointly by City of Fort Worth staff and LaMotte Company. It includes all the parameters required in EPA's NPDES permit regulations for dry-weather storm drain monitoring (chlorine, copper, detergents, phenols, pH, turbidity, and color), plus a thermometer and a test for ammonia-nitrogen.

NAPCO Chemical Company sells the Urban Watch kit (code XX00350) for $310 (or $300 apiece for orders over 10). For further information call Marilyn Grychka at 800/ 929-5976.

LaMotte Company's Storm Drain Pollution Detection Kit (code 7446) is identical to the Urban Watch kit except that it does not include the ammonia-nitrogen test or a thermometer. It sells for $275. For further information call 800/ 344-3100.

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Citizens Jump Barriers for Salmon

Volunteers working to restore their urban watershed near Tacoma, Washington, are finding that negotiating the maze of bureaucratic regulations can be just as daunting as repairing the physical damage to a stream. Under the leadership of Al Schmauder, citizens in the Clover Creek watershed formed the Clover Creek Council in 1991 and went to work to bring back a natural run of Coho salmon and "return the lost quality of life." But while the citizens labored to remove barriers to salmon, they found some local government barriers also had to be overcome.

Assessing the damage

The group's first step was to conduct a visual survey, which disclosed that about 75 percent of the stream's 12-mile course had been altered or rerouted in some way in the name of progress. The damaged stream bed was leaking so much water into the underlying aquifer that during the summer the flow dried up completely in some places. One two-mile section had been converted by the county into an asphalt-lined floodway in 1967. Along this floodway, nearly all trees had been removed and the bottom was periodically scraped clean of any gravel and rocks that accumulated.

These urban "improvements" had raised the water temperature, decreased flow, created barriers to fish passage, and destroyed spawning beds. As one Clover Creek Council flyer put it, the creek had been "channelized, denuded, punctured, lined with asphalt, and left to die."

Setting to work

The Clover Creek Council quickly mobilized the community -- schools, service organizations, and businesses. As Schmauder points out, "All the ingredients we needed were right here all along -- we had the trucks and tractors; we had the stumps, rocks, and gravel; we had the trees; we had the willing manpower. We just needed a catalyst to focus all the resources on the problem. The Clover Creek Council provided that critical function." The volunteers organized 100-person tree plantings. They located and sealed the worst areas of water loss, using student and citizen power to place clay, rocks, and bentonite along the banks. They built wooden fish ladders.

Then, in the spring of 1993, a major opportunity presented itself. A contractor was replacing a bridge over the asphalt-lined section of Clover Creek. At the Council's request, he agreed to make a road into the stream and spread truckloads of excess gravel, sand, and rock over the asphalt. Other volunteers, including Trout Unlimited members and 45 high school students, helped deliver and place large woody

debris and boulders needed to keep the gravel in place. "In just one day," says Schmauder, "1,500 feet of the desecrated stream bottom was converted into something closely resembling a natural streambed."

The actions of that day had two kinds of consequences. The stream segment now had a narrower, deeper channel to keep the water temperature down, and a bottom suitable for macroinvertebrate habitat. And the Clover Creek Council had a controversy on its hands -- because, as Schmauder explains, "At that point we had gotten into things that were illegal." Although the group had obtained a hydraulic permit from the State of Washington Department of Fish and Wildlife, they had not obtained permits from Pierce County.

The county's requirements were onerous indeed. According to the county rules, the volunteers needed all the same permits a developer would need: six permits in all, including a conditional use permit, a filling and grading permit, and a shoreline development permit. The approval process could take up to several years, and filing costs totaled $2,500.

David and Goliath

The county issued a "stop work" order and threatened to prosecute the volunteer leaders. When the story hit the local papers, Schmauder recalls, "We looked like David fighting Goliath. This turned out to be exactly what was needed to get the public aroused and grab the attention of elected officials."

The community rallied behind the volunteers. The local paper ran supportive editorials. The Rotary Club, the Chamber of Commerce, and the local school district all gave awards to the Council, and Schmauder was named "Citizen of the Year" by the local Kiwanis.

Schmauder says, "Nearly everyone -- even some of the county employees who were demanding permits -- knew that what the volunteers had done was the right thing. But the county rules were made for development, not restoration. There were no codes on the books for reversing development."

Through a series of public meetings and negotiations the citizens succeeded in getting the county rules changed to waive permit fees for volunteer restoration projects. Early in 1994, the Council filed the appropriate paperwork for the six permits -- but 18 months later the citizens are still waiting for permits to be granted for the work already completed.

Measures of success

Meanwhile, Clover Creek is returning to health. In 1993, longtime residents saw water in the creek in August for the first time in 20 years. Monitoring by the U.S. Geologic Survey showed a 1.5 cfs increase in stream flow between 1991 and 1993. Citizen monitors saw returning Coho salmon successfully pass through the fish ladder and go up the creek in the fall of 1994. In 1995, summer flow was the highest in memory, and a high school student monitor reported that the water temperature did not exceed 60°F.

Barriers start to crumble

Recently, the Washington State Legislature removed some bureaucratic barriers by passing a law requiring local and state agencies to accept a single permit application -- with no fees -- for volunteer

watershed projects.

"This legislation should reduce the time for permit approval from twelve months to two," says Schmauder. "We'll be able to spend less time on bureaucracy and more in the creek. Instead of treading water we'll be able to swim.

"The county machinery is slowly changing to work with us. We're persistent and have the will of the people behind us. Our motto is, Don't ever give up!'"

*For more information, or to obtain a copy of the new state law, contact the **Clover Creek Council** at 15206-B Fern St., S.W., Tacoma, WA 98498; 206/596-8222.*

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How Significant is Urban Runoff?

Urban stormwater pollution makes a large contribution to the overall degradation of our nation's waters. According to the EPA report *Environmental Impacts of Stormwater Discharges* (1992), urban runoff accounts for an estimated 18% of impaired river miles, 34% of impaired lake acres, and 62% of impaired estuary square miles -- figures that are very impressive in light of the fact that urban population areas take up only about 2.5% of the nation's total land surface, while rural activities take up about 53%.

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Making Connections Between People and Urban Waters

by Abby Markowitz

> *Optimism is the faith that leads to achievement. Nothing can be done without hope and confidence. -- Helen Keller*

Monitoring an urban environment can be an act of great optimism. Almost by definition, urban waters and watersheds are degraded resources, so monitoring them requires the belief that we can learn from our mistakes by not repeating them and, in some cases, by undoing them. (Note that the term "urban" isn't restricted to just inner-city areas and the downtowns of major cities. Any watershed where there is a significant amount of development and impervious surface -- a town, say, or a densely populated suburb -- can be classified as urban.)

Changing the lay of the land by increasing impervious surfaces, modifying hydrology, limiting natural vegetation, and otherwise altering natural habitats has rarely if ever improved water quality. Generally, we don't assess urban waters to find out if they are polluted or impaired, but to find out how polluted they are, and with what. We collect information to discern what specific actions are causing problems, develop strategies for improving the health of the watershed, and monitor the effects of those management and restoration strategies.

Certainly, then, one of the overriding challenges we face in developing and fostering volunteer monitoring programs in urban environments is finding ways to ignite, maintain, and spread the beliefs that (a) healthy ecosystems are important and (b) "urban watershed" and "healthy ecosystem" don't have to be mutually exclusive concepts. Following are some strategies that have worked in various urban watersheds around the country.

Create a watershed awareness

In non-urban areas, people tend to use the local water -- for fishing, boating, swimming, drinking-water supply -- which makes it easier for them to feel connected to the water and to believe that they have a community interest in protecting the watershed. However, in urban settings people usually are not as personally connected to the water. In fact, many urban river systems have been channelized or are

underground, basically making them invisible. So a critical first step in monitoring urban watersheds is to link people to the river and the watershed. Lynn Kramer, president of the Herring Run Watershed Association (HRWA) in Baltimore, says, "First, you've got to get people to understand that there's a stream nearby. In the city, many people don't realize that fact -- or they don't make the connection between stream' and the water they see running over the channelized section in their neighborhood." Through activities like watershed field trips, stream surveys, and tree plant-ings, HRWA helps show residents that "they are part of a nature-based watershed community, even though they are surrounded by concrete, brick, and steel."

Name that stream

In Maryland, we have a lot of streams that are simply called "unnamed tributary of [insert name of larger river]" -- which somehow doesn't evoke a strong sense of affection and stewardship. Try involving volunteers in a "name that stream" project. Monitors working with Maryland Save Our Streams came up with names like "Brownie Troop 56 Branch" or "41st Street Run." Even if it's only used in the local community, the name helps give the stream an identity. If you want to make the name official, contact the state Geological Survey or Department of Natural Resources to find out the procedure.

Sometimes a stream has a name, but no one knows what it is -- even people who drive over or under the stream every day. Signs on bridges, roads, tunnels, or buildings help build name recognition. Your state Highway Department (for major roads) or local Public Works Department (for local roads) can tell you the process for getting markers installed.

Celebrate the water

"People care about things they know and love," says Kramer. "For them to take care of the Herring Run, it must come alive for them -- its history, geography, and biology. And we must celebrate it now, in its imperfect condition." Festivals, canoe rides, art contests, and photo displays all make an urban river, and its potential, come alive.

HRWA holds an annual "Spring Migration" festival to focus attention on the fact that the Herring Run waters used to be clean enough for herring to spawn in the spring. One activity is a 5.5-mile streamside walk, following the route the migrating herring once took.

Address local issues

In addition to connecting people to the river, we need to make connections among populations and issues within the watershed. Before the first monitor steps into the water, program coordinators should attend meetings with active local civic groups, businesses, government agencies, PTAs, and church groups. Attend meetings not only to recruit volunteers but to listen to community concerns and look for ways to bridge seemingly contradictory interests.

A few years ago, SOS was working with a highly developed suburban neighborhood in eastern Baltimore County to establish a local adopt-a-stream project. During initial meetings with the county, we learned that some residents had begun to mow their lawns all the way down to the stream, decimating the riparian

zone and increasing the potential for erosion and flooding. Assuming that the mowing was a way to beautify the neighborhood, we prepared to give our basic presentation on the importance of natural buffers at the next community meeting. However, at the meeting, parents talked about a child who had been murdered while playing down by the stream in the tall grass. Suddenly we realized that a lack of ecosystem education was not the primary problem here. Rather, what was needed was for SOS to switch gears and work with the community and the county to develop ways to address the safety issue without sacrificing stream habitat.

Be creative in deciding what to monitor

Channelized or underground streams may be difficult -- if not impossible -- to monitor directly. So you need to think about the kinds of environmental stressors that can be easily seen, counted, and evaluated even if volunteers can't get to the water. For example, volunteers could conduct surveys to identify trash dumping areas, construction sites in violation of sediment control laws, pipe outfalls, sewage overflow points, oil or other substances being disposed of improperly, or areas that could be planted.

Are there vacant lots in the community? How many? Where? Can any of them be transformed into community gardens? These were among the questions answered by volunteers conducting a walking survey of inner-city neighborhoods as part of the *Revitalizing Baltimore* project. The project does not focus exclusively on water quality; rather, coordinators and volunteers have the broader goal of enhancing the quality of community life in the Gwynns Falls watershed. Knowing the locations and descriptions of vacant areas in the watershed has allowed community residents to create organic gardens, benefiting all parts of the watershed. Not only do the gardens help manage stormwater runoff, they also create productive community space, provide learning opportunities for local kids, beautify the neighborhood, and contribute an additional fresh food supply to local families.

Keep monitors motivated

Monitoring a degraded urbanized stream on a regular basis can be demoralizing -- and boring -- for volunteers. The temperature is always high, there is never much life, a vegetated riparian zone is almost non-existent. But there may be many reasons why it is important to continue monitoring -- developing a baseline for future restoration efforts, tracking the impact of a specific problem or management practice, evaluating seasonal trends and variation, or looking at upstream and downstream differences. Communicating these reasons to volunteers can provide motivation to keep at a seemingly hopeless task.

Adapt your training and protocols

Volunteers monitoring urban streams should receive field training on a like stream. Monitoring an urban stream has its own set of challenges, and volunteers need training that specifically instructs them in dealing with those challenges. In addition, wherever possible, field training should include a visit to a similar waterway in a less urban setting, for purposes of comparison. People may not recognize how severely their stream is impaired until they see one that looks significantly different. Comparing the two streams will sharpen volunteers' ability to pinpoint problem, such as habitat alterations.

Many monitoring protocols -- especially those for biological or habitat assessments -- were originally developed for rural waters and may need to be adapted for urban settings. For example, in some parts of

the country urban streams tend to have mud and gravel substrates with some areas of big boulders. Neither of these is prime habitat for aquatic organisms, and any critters that are still there are often small, making it easier for them to slip through a net. If they do make it onto the net, they're often buried in mud and sand. Volunteers -- even with 20/20 vision -- can be hard-pressed to find much on the net even when organisms are there.

When SOS and Baltimore County first implemented our biological monitoring program, we found that monitors in highly degraded areas were having trouble seeing and collecting critters from the net. We tackled the problem by giving volunteers more hands-on training in sifting through the gunk on the net; preparing site maps showing the exact location of riffles to be sampled; and giving volunteers better forceps and magnifying lenses. (For more on how SOS dealt with this problem, see the *Proceedings of the Fourth National Volunteer Monitoring Conference*, available from Alice Mayio, U.S. EPA, 4503F, 401 M St., SW, Washington, DC 20460; 202/260-7018.

Think early and often about safety

Safety is an issue for every monitoring program. There are the basics -- wear appropriate clothing, don't trespass, don't go into known dangerous areas, etc. However, in city monitoring there are additional considerations. Monitors are often sampling from road bridges, so there's traffic to watch out for. Sewage or other instream dumping is a threat; isolated stream areas sometimes become dumping grounds for broken bottles and used syringes. Crime can be a real concern in some locations. Form larger teams -- maybe 4 or 5 people -- to monitor questionable areas.

Feeling unsafe can also be a function of preconceived notions or unfamiliarity. It is not unheard of for monitors from upstream communities to express concerns about monitoring in certain parts of a city that they perceive as having a high crime rate. Whether a place is truly dangerous is not the only issue. If a volunteer feels unsafe about a location, don't try to talk them out of their fears even if you believe the site is safe. Send that person to a different location, or try teaming them with people more familiar with the area. In choosing monitoring locations, program managers need to strike a balance -- they should be aware of potential safety problems and respect people's concerns without writing off viable monitoring sites.

Monitoring urban watersheds requires many of the qualities that volunteer monitoring programs already possess: creativity, innovation, perseverance, and, perhaps most important, the belief that all watersheds are worthy of protection, and that we can improve even the most degraded watershed.

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Urban Watch: A New Approach to Monitoring Urban Nonpoint Source Pollution

by Joan Drinkwin

Two years ago, when I started working for Texas Watch (the statewide volunteer monitoring program coordinated by the Texas Natural Resource Conservation Commission), I was assigned the exciting job of implementing grant projects designed to get volunteers monitoring for nonpoint source pollution. I thought my job would be easy. After all, I had already been monitoring as a volunteer myself. Each week -- on the same day and at the same time of day -- I tested an Austin creek for basic water quality variables like dissolved oxygen. My monitoring protocol included such infamous nonpoint source pollutants as nitrate-nitrogen, orthophosphates, and fecal coliform.

I went to the cities where the projects focused and discussed the idea of having volunteers monitor for nonpoint source pollution within the city limits, using the same monitoring strategy that I had been using. I suggested to the various directors of public works and managers of environmental departments that the volunteers could help their staffs locate areas with nonpoint source pollution problems.

Blank stares.

I encouraged them to choose sites where volunteer monitoring would prove most useful to the cities.

Blank stares.

I asked them, "What are your greatest concerns regarding nonpoint source pollution?" Their answer: "The NPDES permit." They were referring to the National Pollution Discharge Elimination System permit that all cities with populations over 100,000 are required to obtain in order to discharge stormwater runoff into the surface waters of the state (see the article titled NPDES stormwater permits). Little else was on their minds.

I was convinced local support from city staff was critical to the success of the project. So I plodded on, trying valiantly to make my concept of volunteer nonpoint source pollution monitoring fit into the cities'

NPDES mindset.

Eventually I found myself in Fort Worth, facing the Director of the Department of Environmental Management, the Supervisor of the Stormwater Division, and two water quality specialists. I made my pitch.

Blank stares.

But then, they made a pitch. "Can we get volunteers to monitor for other stuff? We're not interested in dissolved oxygen or the other variables you're suggesting. What we could use is some help locating illicit discharges and illegal connections into the storm drain system. Could the volunteers monitor for metals, chlorine, detergents?"

Could they?

As it happened, the City of Fort Worth already had been working for some time with LaMotte Company to develop a storm drain monitoring field kit. The City wanted to use the kit for dry-weather screening of their 600 storm drain outfalls, as part of their NPDES permit requirements. The kit was specifically geared to detecting illegal or accidental dumping or cross-connections into the stormwater system, and included all the parameters outlined in the U.S. Environmental Protection Agency's stormwater regulations. The City had been using this type of kit for several years and had even trained nonprofessional paid interns to conduct the monitoring.

Urban Watch is born

The step from using paid interns to volunteers was one small step for the City and one giant leap for Texas Watch. It ushered in an entirely new direction for volunteer monitoring in Texas: Urban Watch. This direction is new because it moves away from regular sampling to focus on random pollution events, and it moves away from traditionally tested water quality variables to focus on parameters mandated by the NPDES program. Because its monitoring design is specifically tailored to complement NPDES permit monitoring, Urban Watch creates a strong working relationship between volunteers and local professional monitors. The program provides cities with data they need while at the same time educating citizens about nonpoint source pollution and involving them in its management.

Getting up and running

It didn't take long for the Urban Watch concept to become a reality. The City of Fort Worth agreed to help train and support volunteers. City staff proceeded to prioritize monitoring sites based on information collected by their paid interns. The Trinity River Authority, another Texas Watch partner in the Fort Worth area, pitched in with an offer to supply Urban Watch monitoring kits, using funds from the Texas Clean Rivers Program.

Texas Watch, the Trinity River Authority, and the City of Fort Worth worked together to develop a training and certification process for volunteers and an overall quality assurance program. Since the grant

project was federally funded under Section 319(h) of the Clean Water Act, a quality assurance project plan was submitted to the U.S. Environmental Protection Agency; the plan was approved in the fall of 1994.

What the volunteers do

The Urban Watch monitoring design closely follows the City of Fort Worth's original protocol. The primary purpose of the monitoring is to detect illicit discharges and illegal connections into the storm drain system. This means monitors are looking for flow in the storm drain system during dry weather (when flow should either be absent or consist only of natural base flow). Therefore, monitors never sample within 48 hours of significant rain.

Unlike most volunteer monitoring designs, which call for monitoring at regular intervals and at the same time of day, Urban Watch calls for random sampling. Midnight dumping and breaks in sewer lines can happen at random or they can be regular occurrences. So volunteers are asked to conduct their sampling at least once per month, but to vary the day and the time they visit their site. Random sampling means that volunteers are less likely to miss an occurrence just because they monitor on the wrong day, and also ensures that they see their sites at different times of the day.

Volunteers are asked to monitor their site twice in 24 hours, with at least four hours between samplings, as mandated in the U.S. EPA regulations. The combination of frequent monitoring and random intervals increases the likelihood that volunteers will identify isolated incidents of nonpoint source pollutant discharges.

The Urban Watch kit includes field tests for nine parameters: chlorine, copper, detergents, phenols, ammonia-nitrogen, pH, temperature, turbidity, and color. Monitors also take note of a variety of physical characteristics at their site, including the presence or absence of sewage, scum, and trash. It takes about an hour to perform all the tests.

Each variable in the kit is an indicator of specific pollutants related to illicit discharges and illegal connections. For example, copper is a heavy metal used in many industrial processes. Its presence is a problem in itself, and it also indicates the possible presence of other heavy metals and industrial pollutants. Chlorine is used in treating water for drinking, so its presence can indicate a leak into the storm drain system from the sanitary sewer system. Chlorine can also indicate problems with car washing, swimming pool draining, or industrial discharge.

Volunteers go through three phases of training: laboratory training, field training, and a site visit. They are asked to attend quality control sessions every six months and to commit to two years of sampling at their site (which is chosen jointly by the volunteer and the City of Fort Worth).

Since the first Urban Watch training in August 1994, 35 volunteers within the Dallas/Fort Worth metroplex have been trained. Eleven sites are now being monitored regularly, and Texas Watch is seeking to expand Urban Watch within the metroplex.

Urban Watch volunteers are enthusiastic about the program. They like the flexibility that comes with random sampling, and they find the data interesting because it tends to be more variable than typical results for ambient water quality monitoring.

Urban Watch in your city?

Nonpoint source pollution is finally being recognized as a major water quality problem in urban areas. With growing public awareness comes a groundswell of good intentions aimed at solving the problem. The Urban Watch program is a new approach that integrates these good intentions with the mandates put on cities by the federal and state governments.

For larger cities, the requirements of EPA's NPDES stormwater permitting program create a need for a program like Urban Watch. Gene Rattan, of Fort Worth's Department of Environmental Management, points out, "Whether they know it or not, every city over 100,000 has a vested interest in volunteer monitoring." But smaller cities can also benefit from the information produced by this type of monitoring. Anyone interested in starting an urban storm drain monitoring program is invited to contact Texas Watch at 512/ 239-4742 for ideas on how to do it.

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Urbanization and Water Quality: A Crash Course

by Eleanor Ely

After a good rain, the city sparkles; the air smells fresh. It feels like a new beginning, full of hope and promise -- or so it used to seem to me, back in my days of blissful ignorance. Now the effect is somewhat spoiled, because now I know that however much cleaner the city may look, somewhere nearby a stream or lake or estuary just got that much dirtier.

Urbanization has a profound impact on water bodies -- and the pollutants that the rain washes from smoggy air and dirty streets are just one part of the story. The moment we start covering up the natural landscape with asphalt and concrete we start to change watershed hydrology.

Imperviousness

Almost by definition, development equals impervious surfaces -- roads, sidewalks, drive-ways, parking lots, rooftops. Rainfall can't soak into these surfaces, so most of it becomes runoff. In his article "The Importance of Imperviousness," Thomas Schueler calculates that the runoff from a one-inch rainstorm falling on a one-acre meadow would fill the average office to a depth of about two feet; but if that meadow were completely paved, the runoff from the same storm would completely fill the office . . . *and the two offices next to it.*

In urban areas, 40 to 80 percent of the land area is covered by paved surfaces and rooftops. Imperviousness brings a double whammy: not only is a whole lot more stormwater converted to runoff, but that large volume of water rushes down to streams much faster than it used to. Peak stormwater discharges can be two to five times higher than pre-development levels, and that water can reach the stream in half the time it used to take.

Changes in watershed hydrology

In response to this onslaught, stream morphology changes. The channel gets wider and the banks are undercut. Sediment eroded from the widening streambanks covers the streambed. Instream habitat structures such as pool and riffle sequences are lost.

Increased runoff volume means floods are higher and more frequent. Meanwhile, because less water

soaks into the ground to replenish groundwater, streamflow is reduced during dry weather periods; the stream may even run dry.

Another change is that the water warms up. In heavily paved areas, local air and ground temperatures can be 10 to 12 degrees warmer than if the area were in a natural state. Loss of streamside shade and reduced summer flows further contribute to stream warming.

Adding insult to injury, humans attempt to cope with the increased runoff and flooding by tampering with streams directly -- channelizing, rerouting, culverting, and even burying them.

Pollution

All the effects described so far would happen even if urban runoff were perfectly clean -- but of course it is not. Rain (or snow) falling through the air above a city starts picking up pollutants before it even hits the ground, then collects many more as it flows over rooftops, streets, and parking lots. Some of the most important urban runoff pollutants, along with major sources, are:

Sediment (construction sites)
Nutrients (fertilizer; phosphorous attached to sediment)
Bacteria (pet wastes; sanitary sewer overflows)
Toxic substances, including

- Herbicides and pesticides (lawn and garden care)
- Metals (vehicle brake pads and tires; building materials)
- Hydrocarbons (vehicles)
- Industrial and household chemicals (paint, cleaning products)

Sediment, nutrients, and bacteria are "conventional" pollutants that often cause problems in rural as well as urban watersheds. Herbicides and pesticides likewise are important pollutants in both rural and urban areas. Metals, hydrocarbons, and other toxic chemicals are more specific to urban runoff.

For most people, the words "toxic runoff" conjure up the mental image of some giant factory disgorging vile corrosive liquids. Actually, the image of a clogged freeway, or of a block of perfect, weed- and bug-free lawns, would be closer to the mark. Indus-trial discharges have been strictly regulated over the last 20 years, and most of the worst problems have been cleaned up. Now the everyday actions of individuals contribute a greater share of urban runoff pollution.

Vehicles are probably the single worst offenders. They are a major source of copper, lead, cadmium, and chromium -- all of which are toxic to either humans, aquatic life, or both. Because brake pads and tires wear directly onto roads, the metals and other contaminants that they deposit are transported very efficiently to the stormwater system. Vehicles are also the leading source of hydrocarbons in urban runoff. Oil and other automotive fluids are constantly leaking onto roads and parking lots. And illegal dumping and accidental spillage of motor oil from do-it-yourself oil changes annually totals more than 10 times the amount spilled by the Exxon Valdez.

Lush green lawns and pretty gardens may look like a welcome spot of nature, but what you don't see are the excess nutrients (fertilizer) and toxic chemicals (herbicides, pesticides) that wash off with rain or when the lawn is watered. In fact, urban gardeners use up to 10 times more toxic chemicals per acre than farmers.

Harm to aquatic life

Not surprisingly, the cumulative effects of urbanization are devastating to aquatic life. Sedimentation, pollutants, high storm flows, low summer flows, and high temperatures all take their toll. Numerous studies have shown that after urban development fish and macroinvertebrate communities alike decrease in total numbers, become less diverse, and are composed of more pollution-tolerant species.

What can we do?

Although a volunteer monitoring group probably can't do much to reduce imperviousness in their city, volunteers can at least reverse some of the damage through restoration activities like revegetating stream banks, restoring stream bottom habitat, and uncovering stream portions that have been paved over.

Volunteer monitoring groups do have a fighting chance at reducing the amount of pollution that reaches an urban waterway. Volunteers in programs like Maryland Save Our Streams' "Mud-Busters" are reducing the amount of sediment carried in runoff by monitoring construction sites to see that they comply with sediment and erosion regulations. (For more on the Mud-Busters, see the Fall 1992 issue of The Volunteer Monitor. The Fall 1992 issue can be back-ordered, see details at *The Volunteer Monitor* Home Page.) And in Texas, volunteer monitors are helping to detect illegal or accidental connections to storm sewer systems.

Observational monitoring, such as "streamwalking" or "watershed walking," helps in two ways. First is the educational value of letting people see for themselves the abuses that urban streams are subjected to. Second, observational monitors can inventory pollution sources like yard wastes dumped into streams, eroded land or stream bank areas, dumpster spillage, vehicle fueling areas, parking lots, industrial sites with poor housekeeping practices, and so on.

Changing behavior

Probably the best way to fight urban water pollution is to change people's behavior, and many volunteer monitoring groups use public education campaigns to try to do just that. The first step in changing behavior is to help people feel connected to the water, as Abby Markowitz points out (cover story). The next is to show them how their ordinary, everyday activities can hurt water quality.

Geoff Brosseau, Executive Director of Bay Area Stormwater Management Agencies Association, says, "We've been concentrating on the message that Stormwater runoff isn't treated' -- that it goes directly to the stream. And that's an important message -- but it won't do any good if people aren't even aware of when they're using the stormwater system. Essentially people are using the system all the time -- every time they wash the car, water the lawn, rake leaves into the gutter."

Often monitoring groups build a community education program around storm drain stenciling. This is an excellent approach -- but groups should be careful not to make their focus too narrow. At least the person pouring used motor oil directly into a storm drain probably has some awareness that they're using the storm drain system, even if they don't understand the harm they're causing. But what about the folks up the block, over-watering their over-fertilized lawn? Or the neighbor who's hosing cement and paint wastes into the street? The slogan "Don't Dump" may not reach these people since they probably don't think of their actions as "dumping." Educational flyers need to clearly explain the less-obvious ways that people pollute storm drains.

"Cars cause water pollution"

The majority of educational materials aimed at reducing car-related urban runoff limit their advice to the following three points: (1) maintain your vehicle to prevent leaks; (2) dispose of used motor oil properly; and (3) don't wash your car in the driveway (wash it on the grass or at a car wash facility instead). Very few mention that driving itself is a source of water pollution. Kelly Moran, Water Pollution Prevention Program Manager for the city of Palo Alto, California, says, "We've talked for years about cars and air emissions. We haven't even started talking about cars and water pollution. We need to start publicizing the message that Cars cause water pollution.' Whenever you drive, you're leaving tire particles on the road. Every time you touch your brake pedal, you're depositing brake dust, which often contains copper."

Grounds for optimism

Though changing human behavior is not usually regarded as an easy task, in this case there may be grounds for optimism. After all, hardly anyone wants or intends to pollute water; people just don't know that's what they're doing. Once educated, they are often more than willing to change. Brosseau tells about the time he went over and talked to a neighbor who was emptying his swimming pool into the street. The man was very surprised to learn that the water was running untreated into the nearby creek -- and very eager to learn about alternatives that wouldn't harm the creek.

Of course there is only so much that can be accomplished through appeals to individuals to change their behavior. The way most American cities and suburbs are laid out, combined with inadequate public transportation, almost forces people to depend heavily on automobiles. To address this larger problem, urban volunteer monitors might consider forming alliances with groups advocating for clean air, public transit, human-friendly urban design, and related issues.

References

American Rivers. 1995. *No Fishing, No Swimming, No Drinking: America's Urban River Crisis.* 16 pages. Available for $5 from Amer-ican Rivers, 801 Pennsylvania Ave. SE, Suite 400, Washington, DC 20003.

Johnson, Carolyn. 1992. "Urban Runoff: How Polluted Is It?" 6-page flyer; available for free from Carolyn Johnson, University of Wisconsin-Extension, 1304 S. 70th St., Suite 228, Milwaukee, WI 53214-3154; 414-475-2881.

Schueler, Thomas R. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs.* Washington Metropolitan Water Resources Planning Board.

Schueler, Thomas R. 1994. "The Importance of Imperviousness" *in Watershed Protection Techniques* vol. 1 no. 3 (Fall 1994). Issue available for $14 from Center for Watershed Protection, 8737 Colesville Rd., Ste. 300, Silver Spring, MD 20910; 301/589-1890.

U.S. EPA Office of Water. 1992. *Environmental Impacts of Stormwater Discharges: A National Profile. EPA 841-R-92-001. Available for $6.50 + $2 shipping from ERIC, 800/276-0462 (ask for pub # W286).*

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"We're *Already* Scientists!" Urban Kids Monitor Creek

Wildcat Creek begins its 12-mile journey to San Francisco Bay in scenic parklands high in the East Bay hills. But soon it descends into highly urban communities, flowing for its last seven miles past parking lots and businesses, under a freeway, alongside roads, and behind modest houses. At virtually every point where the creekbed is accessible to the public, it is littered with broken glass, garbage, and the inevitable shopping carts.

Yet, compared to many urban creeks, Wildcat has been fortunate. Only a few short stretches have been culverted, and in most places the banks are shaded by native trees. Most important, the creek has strong advocates in the community.

These community activists have more on their minds than pretty scenery. Their first concern is for the people, especially those in the low-income neighborhoods near the mouth of Wildcat Creek. Lillie Mae Jones, a longtime local resident and a member of the Wildcat Creek Watershed Council, sums up the key challenge facing the Council this way: "How can we affect the people who live here for the better, in terms of health and employment, for both youth and adults?"

Given these community priorities, it is fitting that the newest activity on Wildcat Creek -- weekly water quality monitoring by local elementary and high school students -- doesn't just benefit the creek. It's also providing some hands-on teaching experience for the high school students, juniors and seniors enrolled in Richmond High School's innovative "Teacher Cadet" program to encourage minority students to pursue careers in teaching. And it's giving the elementary students a taste of what it's like to be a scientist.

The monitoring project was initiated by the Urban Creeks Council (UCC), a local nonprofit organization, with funding support from an EPA 319 (nonpoint source pollution reduction) grant. Last winter, UCC's Ellie Insley approached the Teacher Cadets' teacher, Lana Martarella, and asked if she'd like to get her class involved in the project. Martarella was delighted at the opportunity -- especially since, as it happened, her students had already been studying creeks for several months. Explaining why she had chosen to focus her class on creeks, Martarella says, "My most important job is to give my students self-confidence. Most of them speak English as a second language, and many will be the first in their family

to graduate from high school. So I wanted them to become experts in something, and I decided on creeks. Using the creek theme as a basis, the students could create lesson plans for science, math, English, music, and art."

After Insley showed Martarella's students how to do the monitoring procedures, they began weekly testing of Wildcat Creek for temperature, turbidity, pH, conductivity, ammonia, and dissolved oxygen. By spring, the Teacher Cadets had indeed become creek experts. Now they were confident enough to take their knowledge into Dover Elementary School, where they taught the procedures to 3rd and 4th graders. With the assistance of the Cadets, the elementary students performed weekly testing at the same site, on a different day.

"The elementary kids were totally into the monitoring," says Insley. "Their teacher had told them, You guys are scientists. You were born scientists.' So when I asked them if they thought they might be scientists when they grew up, they were indignant. They told me, We're *already* scientists.'"

While the 8- and 9-year-olds were seeing themselves as scientists, the high school students were seeing themselves not only as teachers, but as citizens with the power to make a difference. "Most of my students feel powerless," Martarella says. "I'm trying to show them they can take personal responsibility for their environment, both physical and social. The Wildcat Creek project was career education, it was community activism -- the students could see that this was real life."

This year the program is expanding to include five more schools monitoring at different locations along the creek. The City of San Pablo is lending enthusiastic support. "This project will help us meet the monitoring requirements for our NPDES stormwater permits, since all our storm drains go to the creek," explains Adle Ho, San Pablo's NPDES Coordinator. In fact, Ho specifically requested that the monitors add ammonia to their battery of tests because high levels of ammonia are a clue that sewage may be getting into stormwater, perhaps via illegal connections. Ho says the program is also helping San Pablo fulfill the public education component of its NPDES program. (EDITOR'S NOTE: See the NPDES Stormwater Permits article for more information.) The City is providing educational materials, helping in the selection of monitoring sites and testing parameters, and paying for quality control testing. "We're really excited about getting to the kids," says Ho. "They are the future of the city and the environment."