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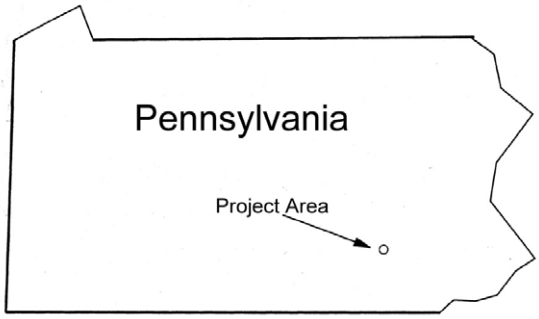

Figure 1. Location of Pequea and Mill Creek National Monitoring Program Project in Lancaster County, Pennsylvania.

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PROJECT SPOTLIGHT

Pequea and Mill Creek Watersheds Section 319 NMP Project: Effects of Streambank Fencing on Surface-water Quality

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Introduction

The Pequea and Mill Creek watersheds in central Lancaster County, Pennsylvania (Figure 1), are used primarily for crop production and livestock husbandry. Implementation of agricultural best-management practices (BMPs) in these watersheds has been promoted by the U.S. Department of Agriculture in order to alleviate problems associated with agricultural nonpoint-source (NPS) pollution. NPS pollution from high animal densities near stream channels is a common problem due to limited land available to pasture animals. Livestock are typically pastured near streams for drinking water purposes and to allow animals to cool themselves in the stream during the summer months. Streams in the watershed are impaired by elevated bacteria, sediment and nutrient concentrations. Streambank fencing is a BMP designed to reduce suspended sediment and nutrient inputs to streams by removing cattle access, eliminating streambank trampling, and promoting revegetation of streambanks. This article reports on an eight-year project, accepted into the National Nonpoint Source Monitoring Program (NMP) in 1993, to assess the effectiveness of streambank fencing in improving surface-water quality.

The water-quality effects of specific BMP implementation, such as streambank fencing, are not well understood at a basin scale due to difficulties in isolating impacts of one BMP from other activities in a basin, such as other BMP implementation, changes in

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agricultural practices or land use, or changes in point-source discharges (Mostaghimi et al., 1989). This study was coordinated with the Natural Resources Conservation Service and the Lancaster County Conservation District in order to ensure that other BMPs were not installed in the basin during the study period.

Study Area and Design

This study was located in the Big Spring Run basin, which is a small subbasin of the Mill Creek basin (see Figure 2). The study basin, which included a treatment and control basin, covered an area of about 3.2 square miles in size with about 80-90 percent of the land in agriculture, about 10 percent residential, and 5 percent forested. Approximately 90 percent of the basin is underlain by limestone with the remaining 10 percent underlain by dolomite and siliciclastics. Soils are predominantly fine, loamy, deep (reported soil depths are from 50 to 75 inches) and well drained. Slopes are low to moderate, ranging from 0 to 15 percent, but more commonly from 3 to 8 percent (Custer, 1985).

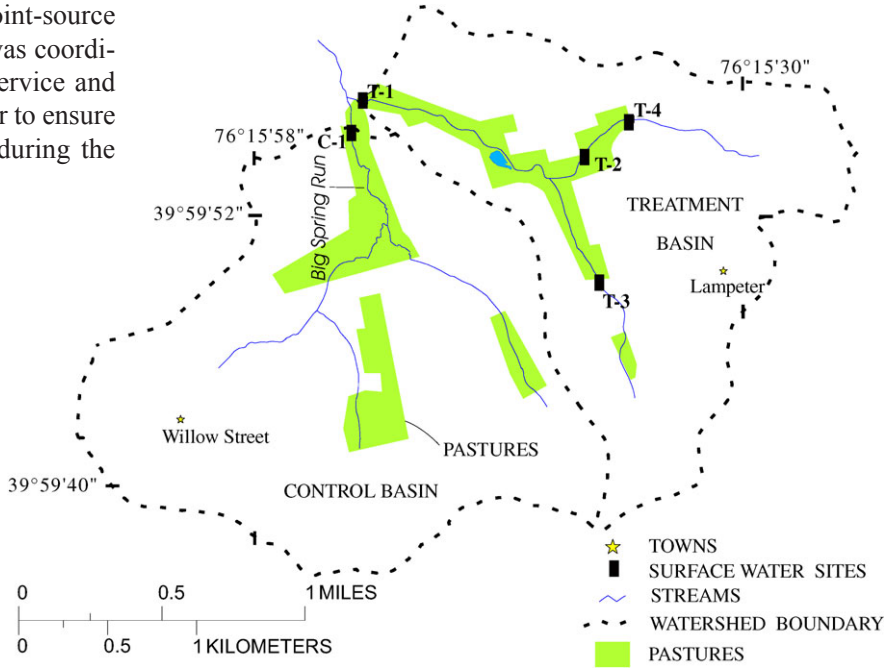

Figure 2: Location of surface water monitoring stations and pastured areas.

One of the more reliable experimental designs for documenting BMP effectiveness in improving water quality is the paired-basin monitoring design (Clausen and Spooner, 1993; Clausen et al., 1996), consisting of two relatively similar basins with one as the control and the other receiving treatment. A calibration period is required so that hydrologic correlations between the basins can be documented prior to any BMP implementation. This study employed the paired-basin design and also included a secondary approach of monitoring sites within the treatment basin before and after, and upstream and downstream, of BMP implementation to further document surface water quality changes.

The control basin covered 1.77 square miles, with 2.7 miles of stream in the basin – 1.9 miles of which flowed through open pasture. The treatment basin covered 1.42 square miles, with 2.8 miles of stream in the basin – 1.9 miles of which flowed through open pasture. The stream gradient was similar in both basins. In the lower part of the basins near the outlets, stream elevation decreased about one foot for every 100 feet of stream. In the upper parts of the basins, the gradient approached 1.5-2 feet of elevation change for every 100 feet of stream.

Land Treatment

From May to July 1997, fences were installed along stream channels in all pastures in the treatment basin, with 100 percent cost-share provided to landowners by the Chesapeake Bay Program. Approximately 1.9 miles of stream were fenced above T-1 (of about 2.8 stream miles). Approximately 0.2 miles of stream was fenced upstream of T-2 (of about 0.8 miles), and about 0.1 miles of stream was fenced above T-3 (of about 0.4 miles) (see Figure 2). One or two-strand high-tensile wire was used with an electrical current supplied by solar power. On either side of the stream, the distance between the streambank and the fence ranged from 5 to 12 feet. For each pasture fenced, approximately two cattle crossings were installed for the cows to access pasture and to supply an area for water consumption. Cattle crossings were cement slabs embedded in the stream channel (see Figure 3). After fence installation, a variety of brushy, herbaceous vegetation was naturally established (see Figures 4 and 5).

Figure 3: Installed cattle crossing located directly downstream of monitoring site T-1 at the outlet of the treatment basin.

Figure 4: Conditions at monitoring site T-2 prior to fence installation at a pasture in the upper part of the treatment basin, May 1996.

Figure 5: Conditions at monitoring site T-2 after fence installation at a pasture in the upper part of the treatment basin, May 1998.

EDITOR'S NOTE

In this issue of *NWQEP NOTES*, we continue our series on National Nonpoint Source Monitoring Program (NMP) projects that have been completed and have documented improvements in water quality due to best management practice (BMP) implementation.

The Pequea and Mill Creek watersheds, located in Lancaster County, PA, are used primarily for crop and livestock production. This eight-year monitoring project evaluated the single practice of streambank fencing as a method for reducing suspended sediment and nutrient inputs to streams. Approximately 2 miles of stream were fenced, with cement slab cattle crossings embedded in the stream to provide drinking water access. The paired watershed analysis showed yield reductions in total nitrogen, total phosphorus and suspended sediment due to fencing and subsequent streambank revegetation. Greater reductions in nutrients may have been observed had the cattle crossings been raised above the stream and alternate water supplies provided. This project supports previous studies documenting the effectiveness of livestock-exclusion fencing in reducing agricultural nonpoint source pollutants.

As always, please feel free to contact me regarding your ideas, suggestions, and possible contributions to this newsletter.

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Sampling Scheme

Surface-water samples were collected from June 1993 to early July 2001 at five monitoring sites (see Figure 2). The calibration (pre-fencing) monitoring period was June 1993 to July 15, 1997, while post-fencing monitoring was conducted July 1997 to July 2001. The monitoring design consisted of two paired watershed comparisons, with sites T-1 and T-2 in the treatment basin compared to C-1 in the control. Also, two upstream/downstream pairs were compared in the treatment basin (T-1/T-3 and T-2/T-4) before and after fencing. For purposes of this article, only the results from the main watershed comparison, T-1 to C-1, will be presented.

Stream discharge was continuously monitored at all surface-water sites except T-3. Surface-water samples were collected during low flow at all sites and during stormflow at each continuous recording site. All samples were analyzed for dissolved forms of ammonia-nitrogen (N), nitrite-N, (ammonia plus organic)-N, (nitrite plus nitrate)-N, phosphorus (P), and ortho-P. Analyses also included total forms of (ammonia plus organic)-N and P, and suspended sediment. Low-flow (grab) samples were collected during the study period every 9-12 days from April through November and on a monthly basis from December through March whenever flow conditions were not changing due to a storm event. The more intensive sampling from April through November coincided with the typical period when cows are pastured in south-central Pennsylvania.

An automated sampler initiated by either an adjustable height float switch or an automated program was used to collect storm samples at C-1, T-1, T-2, and T-4. Samples were collected every 5-30 minutes (depending on the site and how fast conditions were changing) until the sampler was full or the stage receded below the stage that initiated the sampling. Aliquot volumes withdrawn from the sampler bottles and placed

in a composite container were proportional to actual discharge so that the composite sample represented the mean conditions for the storm event. Chemical and suspended-sediment analyses were conducted on the composited samples.

Analysis of covariance (ANCOVA) was conducted separately on low-flow and stormflow data in order to detect streambank fencing impacts relative to pretreatment and control conditions (Grabow et al., 1999). ANCOVA is a form of regression analysis that fits equations to both the pretreatment and post-treatment relation between paired sites (either paired watersheds or upstream/downstream pairs). This method tests for discrete (not gradual) changes in the relation between basins for that particular constituent. Regression lines relating the treatment to the control (control-basin outlet or upstream site) data were generated for both the pretreatment and post-treatment data.

Data were first tested for normality, and if necessary, log transformations (of both treatment and control data) were performed prior to analysis. Also, if the simple relation between pre- and post-treatment data did not yield a significant model, discharge for the control data (and the associated interaction terms) were incorporated into the model. A stepwise procedure was then used to identify the model with the best fit.

A difference in the regression lines from pre- to post-treatment indicates a change in water quality due to land treatment (Grabow et al., 1999). For this analysis, an alpha level equal to 0.10 was set as the criteria for model acceptance. If a significant model was identified for the relation, then fencing did change water quality. The SAS statistical package (SAS Institute Inc., 1999) was the software used for this analysis. An option in the program allows for output of predicted (least-square) mean values for the treatment basin that are based on the regression relation to the control data. The least-square means for pre- and post-treatment data were then used to determine a percent change in the treatment basin for that constituent from the pre- to post-treatment period according to a procedure developed by Grabow et al. (1999).

Other types of data collected in the study basins during the project time frame included shallow and deep ground-water quality, semi-annual benthic macroinvertebrate sampling, precipitation quantity, and agricultural activity. The final report for this project discusses in detail the response of surface water, shallow ground-water quality and the benthic macroinvertebrate community to streambank fencing. Two types of agricultural-activity data were collected from each farm operator in the study basins. Farm operators provided data on the dairy-cow activity in the pastures and the loading of inorganic and organic fertilizers within the study area.

Results and Discussion

Agricultural Activity

Agricultural activity in the study basin changed somewhat from the pre- to post-treatment period. There were 24 and 30 percent decreases in the amount of N and P applied to the land, respectively, as inorganic and organic fertilizers from the pre- to the post-treatment period in the treatment basin. However, for the control basin, there were 3 and 14 percent increases in the amount of N and P applied over the same period (see Table 1). The number of cows in the control basin decreased during the post-treatment period, primarily during the latter part of the period. The control basin showed about a 50 percent decrease in cow numbers from water year 1999 (WY1999) (water year 1999 begins October 1, 1998 and ends September 30, 1999) to WY2001, while the treatment basin showed a similar decrease from WY2000 to WY2001 (see Table 2).

Table 1. Estimated annual applications of nitrogen and phosphorus from inorganic and organic fertilizers to the treatment and control basins by water year (all units are in pounds per square mile).

	Treatment basin		Control basin	
Water year	Nitrogen	Phosphorus	Nitrogen	Phosphorus
1994 (PRE)[1]	20,600	3,300	56,700	9,700
1995	61,200	10,900	71,900	13,800
1996	61,700	11,200	61,100	11,300
1997	57,400	10,000	72,200	14,300
1998 (POST)	38,400	6,400	67,900	14,200
1999	40,300	6,700	68,400	14,100
2000	35,000	5,300	58,200	11,600
2001[2]	23,600	3,900	55,700	11,800

[1] The pre-treatment period ended mid-July 1997, so the last 2.5 months of water year 1997 were actually in the post-treatment period.
[2] Data for water year 2001 was collected from October 2000 through June 2001.

Table 2. Summary of cow-pasture data for the treatment and control basins from October 1, 1993 (beginning of water year 1994) through June 30, 2001 (units are the average daily number of cows in pasture for 24 hours divided by the total acreage of pasture along streambanks in both basins).

Water year	Treatment basin	Control basin
1994 (PRE)[1]	0.89	2.5
1995	1.3	3.3
1996	1.4	3.4
1997	1.6	3.3
1998 (POST)	1.4	3.4
1999	1.5	3.3
2000	1.5	2.4
2001[2]	0.79	1.8

[1] The pre-treatment period ended mid-July 1997, so the last 2.5 months of water year 1997 were actually in the post-treatment period.
[2] Cow-pasture data for water year 2001 was collected from October 1, 2000 through June 30, 2001.

For this study, it was assumed that, except for streambank fencing, other activities in the basin remained constant. The decrease in cow density in both basins was similar. Also, the change in nutrient applications was not found to be a significant explanatory variable, which was expected given the possible lag time between nutrient applications and those nutrients reaching the stream network. Age dating conducted during the study indicated that N applied to land reached springs (which were more predominant in the control basin) in 2-3 years, but recharge to shallow ground-water wells near the stream and piezometers located in the stream channel took anywhere from 15 to 39 years.

Precipitation

Precipitation was quite variable during the eight-year study period. The highest and lowest annual precipitation totals were for water years 1996 (54.6 in) and 1995 (34.2 in), respectively (see Table 3). The average monthly amount of precipitation during the pre- and post-treatment periods was 3.7 inches and 3.3 inches, respectively. This equates to about 44.9 inches and 39.8 inches of annual precipitation. Mean stream discharge for the post-treatment period was about 56-63 percent of the mean for the pretreatment period (see Table 3). The lowest mean discharge (for an entire year of record) for each site occurred in WY 1999. WY 1999 had the second lowest (37.8 in) annual amount of precipitation recorded for this study. WY 1995 had less precipitation than WY1999, but much (12 in) of the precipitation during WY 1999 occurred in September, and it is possible that much of the precipitation occurring in September did not recharge to the stream until after the end of the water year. The highest mean discharge for three of the four sites was recorded in WY 1996, when 54.6 inches of precipitation occurred.

Table 3. Precipitation amounts recorded at the outlet of the treatment basin (T-1), and pre- and post-treatment mean discharge, in ft^3/sec, for continuous surface water sites T-1 (treatment) and C-1 (control).

Water year	Inches	T-1	C-1
1994 (PRE)	48.0		
1995	34.2		
1996	54.6		
1997[1]	39.3		
Mean discharge PRE (ft^3/sec)		2.13	3.56
1998 (POST)	48.0		
1999	37.8		
2000	43.3		
2001[2]	25.8		
Mean discharge POST (ft^3/sec)		1.20	2.23
Overall mean discharge (ft^3/sec)		1.65	2.87

[1] The pre-treatment period ended in mid-July 1997, so the last 2.5 months of water year 1997 were actually in the post-treatment period.
[2] Data for water year 2001 were collected from October 2000 through June 2001.

Low Flow Water Quality

For discussion of each basin separately, the median concentrations and low-flow daily yields are presented below and in Tables 4 and 5. Low-flow data showed that median total-N and suspended-sediment concentrations for sites C-1 and T-1 decreased from the pre- to post-treatment period while median total-P concentrations increased for T-1 (see Table 4). The decreased N concentrations for low-flow samples for both sites during the post-treatment period were probably caused by changes in subsurface flow paths to the stream network. Less precipitation during the post-treatment period reduced the movement of water through the soil matrix, and the deeper ground-water movement to the stream was less concentrated with nitrate.

Table 4. Median concentrations for total nitrogen, total phosphorus, and suspended sediment for the pre- and post-treatment periods for low-flow samples. All units are in milligrams per liter.

Constituent	C-1		T-1	
	PRE	POST	PRE	POST
Nitrogen	10.6	9.36	12.1	9.07
Phosphorus	0.040	0.036	0.040	0.066
Sediment	26	14	19	8

In addition, low-flow data showed that median total-N and suspended-sediment low-flow daily yields for sites C-1 and T-1 decreased from the pre- to post-treatment period while median total-P low-flow daily yields increased for T-1 (see Table 5). For low-flow samples, a low-flow daily yield was defined as the concentration multiplied by the stream discharge extrapolated over one day divided by the drainage area. The decrease in median low-flow daily yields of total N and suspended sediment at C-1 and T-1 during the post-treatment period was at least partially attributable to decreased streamflow during that time period. For C-1 and T-1, stream discharges sampled during the post-treatment period were about 30 percent less than those sampled during the pretreatment period. The majority (84 percent) of the total-N yield from T-1 occurred during low flow periods. For total P, data for C-1 showed a decrease in the low-flow daily yield, while T-1 showed an increase (mostly caused by a 65 percent increase in the concentration) from the pre- to post-treatment period.

Table 5. Median daily yields for total nitrogen, total phosphorus, and suspended sediment for the pre- and post-treatment periods for low-flow samples. All units are in pounds per day per square mile.

Constituent	C-1		T-1	
	PRE	POST	PRE	POST
Nitrogen	64.2	40.3	46.1	21.9
Phosphorus	0.212	0.152	0.143	0.163
Sediment	162	57.8	72.2	20.5

Increased concentrations and low flow daily yields of total P during low flow at T-1 were caused by increased concentrations of dissolved P in subsurface water in the upper parts of the treatment basin (as evident from a shallow well network located at site T-2). It is also likely that some P was deposited by cattle at crossings located at T-2.

The hydrologic variability between pre and post-treatment periods highlights the importance of utilizing ANCOVA for accurate interpretations of the changes in water quality due to stream fencing in the treatment watershed. ANCOVA results (see Table 6) for low-flow data during the post-treatment period indicated that low flow daily yields for total N and suspended sediment decreased at T-1 relative to C-1. However, there was a relative increase in the low flow daily yield of total P. The average relative reductions at T-1 in the low flow daily yields of total N and suspended sediment were 17 and 46 percent respectively. The average relative increase in low flow daily yield of total P at T-1 was 58 percent.

Table 6. Water quality changes in constituent yields for the treatment site T-1 for the post-treatment period based on analysis of covariance (ANCOVA) results.

Constituent	Low flow (% change)	Stormflow (% change)
Total nitrogen	-17	-19
Total phosphorus	+58	-22
Suspended sediment	-46	-36

Stormflow Water Quality

For discussion of each basin separately, the median stormflow concentrations and yields are presented below and in Tables 7 and 8. Stormflow data showed decreases in median total-N, total-P and suspended sediment concentrations and yields from the pre- to post-treatment period at C-1 and T-1. Again, the decreased yields were partially attributable to less stream discharge. The median discharge of sampled storms during the post-treatment period was 25-30 percent less than the median sampled during the pretreatment period. Stormflow contributed 93 percent of the suspended-sediment yield and 90 percent of the total-P yield for T-1.

Table 7. Median concentrations for total nitrogen, total phosphorus, and suspended sediment for the pre- and post-treatment periods for stormflow samples. All units are in milligrams per liter.

Constituent	C-1		T-1	
	PRE	POST	PRE	POST
Nitrogen	5.60	5.35	7.10	6.94
Phosphorus	0.630	0.558	0.780	0.759
Sediment	410	245	395	166

Table 8. Median yields for total nitrogen, total phosphorus, and suspended sediment for the pre- and post-treatment periods for stormflow samples. All units are in pounds per square mile.

Constituent	C-1		T-1	
	PRE	POST	PRE	POST
Nitrogen	102	43.3	103	35.0
Phosphorus	10.3	5.56	9.26	4.85
Sediment	7,180	1,910	5,910	818

As stated above, due to the importance of adjusting for changes in hydrology, ANCOVA was used in the analysis of data to evaluate changes in water quality due to stream fencing in the treatment watershed. ANCOVA results (see Table 6) for stormflow data during the post-treatment period indicated stormflow yields for total N, total P, and suspended sediment decreased at T-1 relative to the control site C-1. The average relative decrease in the yield of total N and total P at T-1 was 19 and 22 percent, respectively. The average relative decrease in the suspended-sediment yield at T-1 was 36 percent. The reduction in suspended-sediment yield for stormflow samples indicated that the buffer strip was helping to trap sediment before entering the stream channel and/or the vegetation helped to stabilize streambanks, thus reducing bank erosion.

Overall Impacts

ANCOVA quantified the percent change for low-flow and stormflow samples during the post-treatment period for nutrients and suspended sediment at the treated site T-1 relative to the control site C-1. In order to determine an overall percent change for nutrients and suspended sediment, the ANCOVA results had to be applied to information gathered from estimating annual yields for both sites, which was conducted using multiple regression analysis that related stream discharge and seasonal variables to constituent concentrations. Models to estimate yield were developed for low-flow and stormflow data separately; thus the percentages of low-flow and stormflow of the total yield were estimated. These percentages were applied to the percent change determined from the ANCOVA procedures in order to estimate an overall percent change for the treated site T-1 (see Table 9).

The percent changes during the post-treatment period presented in Table 9 are those changes that occurred at T-1 relative to the control. During the post-treatment period, T-1 showed percent reductions in the yield of N species of 18 to 36 percent and a 14 percent reduction in total P yield. Given the percent contributions of different N species to the total N yield, the overall reduction in the total-N yield for T-1 during the post-treatment period was 19 percent. Also, during the post-treatment period, T-1 showed a 37 percent reduction in the yield of suspended sediment.

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- NCSU Water Quality Group home page: http://www.ncsu.edu/waterquality/
- U.S. Environmental Protection Agency's Office of Water publications list: http://www.epa.gov/OW/info
- WATERSHEDSS — Water, Soil, Hydro-Environmental Decision Support System, Internet-based management tool: http://www.water.ncsu.edu/watershedss/
- Understanding the Role of Agricultural Landscape Feature Function and Position in Achieving Environmental Endpoints: Final Project Report (to the U.S. Environmental Protection Agency) (1996) (118p) (*abstract and instructions for downloading the report available at: ftp://ftp.epa.gov/epa_ceam/wwwhtml/software.htm*

Production of NWQEP NOTES is funded through U.S. Environmental Protection Agency (EPA) Grant No. X825012. Project Officer: Tom Davenport, Office of Wetlands, Oceans, and Watersheds, EPA. 77 W. Jackson St., Chicago, IL 60604. Website: http://www.epa.gov/OWOW/NPS

Table 9. Overall water-quality changes in constituent yields for the treatment site T-1 for the post-treatment period based on analysis of covariance (ANCOVA) results and the separation of constituent yields into baseflow and stormflow components.

Constituent	T-1 (% change)
Total Nitrogen	-19
Dissolved nitrate-nitrogen	-18
Dissolved nitrite-nitrogen	-28
Dissolved ammonia-nitrogen	-36
DKN (dissolved ammonia plus organic nitrogen)	-20
TKN (total ammonia plus organic nitrogen)	-26
Dissolved Phosphorus	+19
Total Phosphorus	-14
Suspended sediment	-37

Conclusions

The decrease in suspended-sediment yield at T-1 was a result consistent with many previous streambank fencing studies. Also, the cumulative effect of 1.9 miles of fencing in the treatment basin helped to reduce nutrient yields at the outlet. The N reduction at the outlet was likely caused by vegetative uptake of nitrate, either by vegetation in the channel or along the banks. It is also possible that the reduced N application from primarily organic fertilizer in the treatment basin relative to the control did have some positive impact on water quality in the treatment basin during the post-treatment period; however, lag periods between application and recharge to the stream network may have muted or completely inhibited this response. The reduction in P at the outlet was caused by a decreased yield of suspended P, which was consistent with the decreased yield of suspended sediment.

Results from sampling at other sites (T-2, T-3, T-4) in the treatment basin revealed the importance of nutrient management in reducing P yields. Streambank fencing alone with small buffer widths cannot compensate for increased dissolved P moving to the stream system through shallow subsurface zones. Upstream in the treatment basin, cattle crossings were embedded in the stream, which was necessary for a drinking-water supply for the cattle and was less costly than installation of culverts and raising the crossing above the stream. However, cattle excretions at the crossings appeared to increase DKN and dissolved-P concentrations. This factor would be one reason to install crossings using culverts, if possible, and especially in pastures with high animal densities.

Finally, a lesson learned from this study was that fixed-time sampling was not appropriate for conducting paired-basin analysis in these small basins. It was found that during storm events in small basins, the rate of change in stream discharge did not permit for reliable paired grab samples between two sites. Automatic samplers to cover entire events are necessary for reliable paired analysis. This study did have automatic samplers for storm events, but the original work plan called for fixed grab samples based on the theory that grab samples could adequately cover the flow distribution. This was not the case. Most grab samples were for low-flow events, and it was decided some time into the project to discontinue truly fixed sampling and conduct grab sampling at a variable (9-12 days) fixed-time interval that would only capture low-flow events.

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WEB RESOURCES

New Online Toolkit and Directory on Urban Water Management

Urbanwater.info, a new online toolkit and directory on urban water management, has recently been released by a group of 14 local government councils in the State of New South Wales (NSW) Australia (the Hunter & Central Coast Regional Environmental Management Strategy group (HCCREMS)). The web site is funded by the NSW Government through its Stormwater Trust.

The Urbanwater.info site uses extensive links and references to relevant Australian and international manuals, articles, models, web pages and case studies, creating a comprehensive, easy to use directory to water management information and decision support tools. The website makes extensive reference to US sites and has broad applicability for North American practitioners.

Through the Urbanwater.info website, planners, engineers, environmental professionals, educators, community groups and interested individuals have access to:

- A comprehensive on-line directory to the latest, best practice in water sensitive urban design, stormwater engineering, land use planning, catchment management and community development and education.
- Decision support tools to help address the technical and organizational challenges of managing water sustainably; and
- Educational resources, including a short documentary showcasing best practices from Council innovators in urban, suburban and regional NSW.

The access to cross-disciplinary scientific and technical information makes Urbanwater.info a valuable tool for facilitating a holistic, total water cycle approach to water management. Information about the Urbanwater.info project can be found at **www.urbanwater.info.**

New Section 319 Nonpoint Source Success Stories Website

EPA has established a new *Section 319 Nonpoint Source Success Stories* website. The website can be accessed through a link at the top of the Nonpoint Source Homepage at **http://www.epa.gov/owow/nps.**

This website features projects receiving grant funds from the Section 319 program that have achieved documented water quality improvements through implementation of nonpoint source management measures and practices. Water quality improvements are demonstrated through the achievement of: water quality standards for one or more pollutants/uses; nonpoint source total maximum daily load allocations (and removal from the state's section 303(d) list of impaired waters); measurable, in-stream reduction in a pollutant; or improvement in a parameter that indicates stream health (e.g., increases in fish or macroinvertebrate counts). Stories also demonstrate innovative strategies used to reduce nonpoint source pollution, the growth of partnerships, and diversity of funding sources.

For more information, or to recommend additional stories for the website, contact Stacie Craddock by phone at 202-566-1204 or by e-mail at **craddock.stacie@epa.gov**.

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INFORMATION

New EPA Guidance Available on NPS Pollution Control from Forestry

EPA announces publication of *National Management Measures to Control Nonpoint Source Pollution from Forestry*, a technical guidance and reference document for use by State, territory, and authorized tribal managers as well as the public in the implementation of nonpoint source pollution management programs in forest settings. The new guidance enhances the technical information contained in the Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, published by EPA in January 1993 under section 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Whereas the 1993 guidance was regulatory, this document does not set new or additional standards for either CZARA section 6217 or Clean Water Act section 319 programs.

The new guidance contains information on the best available, economically achievable means of reducing nonpoint source pollution that can result from forestry activities. The guidance is applicable to inland as well as coastal areas and provides background information about NPS pollution related to forestry activities, the broad concepts of assessing and addressing water quality problems on a watershed level, and up-to-date technical information about how to reduce forestry NPS pollution. Because the guidance is national in scope, it does not address all practices and techniques specific to local or regional soils, climates, or forest types.

For more information about the guidance or to download the document in PDF format, visit **http://www.epa.gov/owow/nps/forestrymgmt/**. To receive a free copy, contact the National Service Center for Environmental Publications at 1-800-490-9198 or **http://www.epa.gov/ncepihom** and request Publication # EPA 841-B-05-001.

National Water Program Guidance Now Available on the Web

The National Water Program Guidance for FY 2006 is now available on the U.S. EPA Office of Water website at **http://www.epa.gov/water/waterplan**. The Guidance describes strategies for accomplishing the key environmental and public health goals in the EPA Strategic Plan. EPA Regional offices will be working with States and Tribes to develop "commitments" under these measures over the next several months using general "targets" in the Guidance. These final commitments are to be included in State/EPA grant agreements, performance partnership agreements, and other documents. The Guidance also includes information about the management system for assessing progress toward the environmental goals and the new Agency initiative to link program grants to support of these environmental goals. Printed copies of the Guidance are available from EPA Regional Offices and from Elana Goldstein in the Office of Water (202-564-1800).

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MEETINGS

Call for Presentations and Posters

2006 USDA-CSREES National Water Conf: Feb 5-9, 2006, San Antonio, TX. Abstracts are solicited for topics on Agricultural Best Management Practices, Rural Environmental Protection, Conservation and Resource Management, and Watershed Assessment & Restoration. Abstracts for oral presentations will be accepted through **October 5, 2005**. After October 5, only abstracts for posters will be accepted. Contact Dr. Greg Jennings for questions regarding submission of abstracts at greg_Jennings@ncsu.edu. Website for Abstract Submission Form: http://www.extension.iastate.edu/waterconf2006/AbsSubmit.aspx. Conference website: http://www.soil.ncsu.edu/swetc/waterconf/2006/main.htm.

Meeting Announcements — 2005

October

The National Water Research Symposium: Balancing Water Law and Science: Oct 10-12, 2005, Blacksburg, VA. See website: http://ww.conted.vt.edu/vwrs/.

2005 Pennsylvania Stormwater Mgmt Symp: Stormwater Management Implementation – Are We Getting It Right?: Oct 12 – 13, 2005, Villanova, PA. For more information visit the Villanova Urban Stormwater Partnership homepage: http://www.villanova.edu//vusp/ or contact Robert Traver at Robert.Traver@Villanova.Edu.

4th National Conf – Nonpoint Source and Stormwater Pollution Education Programs: Oct 17-20, 2005, Chicago, IL. Cosponsored by Chicago Botanic Garden and U.S. Environmental Protection Agency. Contact Bob Kirschner, Chicago Botanic Garden, 1000 Lake Cook Rd., Glencoe, IL 60022; e-mail: bkirschn@chicagobotanic.org.

32nd Annual Conf on Ecosystems Restoration and Creation: Oct 27-28, 2005, Tampa, FL. For more information, Tel: 813-253-7523; website: http://www.hccfl.edu/depts/detp/ecoconf.html.

November

American Water Resources Assoc 2005 Annual Conf: Nov 7-10, 2005, Seattle, WA. Visit website: http://www.awra.org/meetings/Seattle2005/index.html.

XII International Rainwater Catchment Systems Conf — Mainstreaming Rainwater Harvesting: Nov 15-18, 2005, Vigyan Bhawan, New Delhi, India. For more information contact the Conference Coordinator, Dr. Namrata Pathak, Action for Food Production (AFPRO), 25/1A, Institutional Area, Pankha Road, D-Block, Janak Puri, New Delhi-110058, India. Tel: +91-11-25555412, 25553652, 25592456, 25511575; Fax: +91-11-25500343; Email: ircsamail@afpro.org; Website: http://www.ircsa2005.org/.

December

Stormwater Funding and Utility Development; BMPs: Pollutants, Selection and Maintenance; and the Complete NPDES Program from Design to Implementation – Full Day Workshops & Exposition. Dec 2, 2005, Nashville, TN. See website at: http://www.sstormccon.com/nashville.

Meeting Announcements — 2006

May

5th National Monitoring Conf Monitoring Networks: Connecting for Clean Water: May 7–11, 2006, San José, CA. For more information, contact the Conference Coordinator at NWQMC2006@tetratech-ffx.com; Tel: 410-356-8993; Website: http://www.nwqmc.org (click on "2006 National Monitoring Conference").

Challenges in Coastal Hydrology and Water Quality: May 21-24, 2006, Baton Rouge, LA. See website: http://www.aihydro.org/.

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