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TNSA Times

Tennessee Stormwater Association News & Information

July 2, 2014

THOSE LAZY, HAZY, CRAZY BOAT DAYS OF SUMMER

By Greg Upham - During my nine years of service with the Tennessee Nonpoint Source (319) Program, shoulder to shoulder with the incomparable Don Green, I learned that public education/outreach is the **most important component** of any water quality program, especially the MS4 Program. After all, the EPA crowned it as minimum measure #1 at the outset of its national program. How else do we expect to see a change in water quality if we do not gain stewardship for our water resources among our citizenry?

With this in mind, in 2006, I began what would be the first annual WaterFest event, comprised of several water quality exhibitors along the banks of Smyrna's Stewart Creek. The only problem was less than 15 citizens showed up. It was not until I joined the Stones River Water-

shed Association (SRWA) that same year that things began to change. We paddled and cleaned Stewart Creek then held the annual SRWA meeting at the Sam Davis Home in 2007 for WaterFest II.

During this time, the SRWA held its second annual boat day on Murfreesboro's West Fork of the Stones River. It was here I learned how to draw the crowds. Through the very valuable assistance of SRWA members Mayo Taylor, Toby Francis, Randle Branch, and Jim Barden, I initiated Smyrna's first Boat Day – WaterFest event with the intent of drawing folks to the water where they could learn about paddling, relax, and begin to understand the very important

relationship between water quality and quality of life.

Now, after 1,023 citizens, from all across middle Tennessee and actually a few from out of state, have experienced a Smyrna Boat Day – WaterFest event, the Town of Smyrna boasts its largest Boat Day – WaterFest event ever, with 257 citizens and five water quality agencies

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Using Stream Assessment Data to Track Changes and Prioritize Stream Restoration Projects

By Josh Upham

Why do we conduct Visual Stream Assessments and what can the data be used for? This may be a common question for MS4's when trying to justify using staff time or contracting out stream assessment work. Aside from fulfilling [MS4 Phase II](#) permit rule 5.2, these assessments can also be used to develop a water quality baseline for future assessments and help prioritize restoration projects.

After several years of conducting VSA's using only the Maryland

protocol which yielded large binders of data, the Murfreesboro Stormwater program began putting its stream assessment data into quickly read "dashboard" reports.

These dashboard reports are made up of graphics and maps that summarize and prioritize findings which are easily interpreted by other city staff less familiar with the program. For instance, the top five corrective action possibilities are displayed using the Maryland protocol prioritization scale along with feasibility analysis like

owner information and easement locations.

In addition to the basic VSA data, staff collects an assortment of data that populates the dashboard as well as generates a snapshot of water quality. cursory biological samples are taken and scored using an in-house macro invertebrate scoring system that is a simple way of identifying quantities of tolerant and intolerant species. Riparian information is collected in which percentages of inadequate buffer are tracked. This information is used for

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Federal assistance available from new *Local Foods, Local Places* program

Communities are invited to apply for assistance from **Local Foods, Local Places**, a new program supported by EPA, USDA, the U.S.DOT, the [Appalachian Regional Commission](#) (ARC), and the [Delta Regional Authority](#) (DRA) to help create more livable places by promoting local foods. Together, the agencies are investing \$650,000 in the **Local Foods, Local Places** program, which aims to:

- Boost economic opportunities for local farmers and businesses, and foster entrepreneurship;
- Improve access to healthy local food, particularly among disadvantaged groups with limited access to fresh fruits and vegetables; and
- Revitalize downtowns, main street districts, and traditional neighborhoods by supporting farmers' markets, food hubs, community gardens, community kitchens, and other kinds of local food enterprises, and by providing people with affordable choices for accessing those

amenities, such as walking, biking, or taking transit.

Local Foods, Local Places will provide direct technical support to selected communities to help them develop and implement action plans promoting local food and downtown revitalization. Special consideration will be given to communities that are in the early stages of developing or restoring local food enterprises and creating economically vibrant communities. Selected communities in Appalachia and the Delta region will be eligible to receive financial assistance to help them implement those plans.

Eligibility

Communities anywhere in the United States are eligible to apply. Particular consideration will be given to communities in the following places:

- **Areas served by the Appalachian Regional Commission** in Alabama, Georgia, Kentucky, Maryland, Mississippi,

New York, North Carolina, Ohio, Pennsylvania, South Carolina, **Tennessee**, Virginia, and West Virginia.

- **Areas served by the Delta Regional Authority** in Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and **Tennessee**.
- **USDA-designated StrikeForce counties** in Alabama, Alaska, Arizona, Arkansas, Colorado, Georgia, Kentucky, Louisiana, Mississippi, Nevada, New Mexico, North Carolina, North Dakota, South Carolina, South Dakota, **Tennessee**, Texas, Utah, Virginia, and West Virginia.

Submit letters of interest by email to Ed Fendley at lfip@epa.gov by **July 15, 2014**. Please include "Local Foods, Local Places" and the name of the community in the subject line of the email.

For more information and Click [Here](#) to apply.

TDEC Fee & Scope of Services Changes Effective July 1, 2014

TDEC- Division of Water Resources has recently changed the fees associated with water-related permitting. Additionally, DWR modified their list of services provided to the regulated community. The following changes take effect on July 1, 2014:

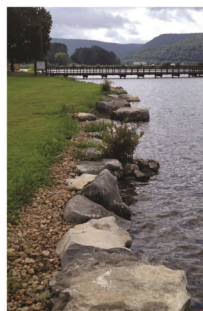
- TDEC-DWR will no longer conduct Hydrologic Determinations (waters of the state/jurisdictional waters determinations). A list of Qualified Hydrologic Professionals (QHPs) can be found at www.epsc.org and the attached documentation will explain the reasons behind this change. *The only QHP class scheduled this year is August 11-13 at Montgomery Bell State Park. Register!*
- General ARAP permits will have a \$500.00 fee for commercial activities; residential and agricultural entities will have a lower fee. Also, there will be an annual maintenance fee associated with those general ARAP permits.
- Coverage under the Tennessee Construction General Permit (TNCGP) will have an altered fee schedule relative to acreage disturbed. Also, an annual maintenance fee will be assessed based on acreage.
- Decentralized wastewater systems will now have an application fee, as well as engineering reports for all sewage treatment facilities. Other fees for SSDS subdivision plat approval, individual ARAP permits, and gravel dredging have increased with this fee change scenario



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Pictured in the Belgard Ad is a site located:

Gateway Village in Murfreesboro, TN

Details:

- **Developer:** Swanson Developments, Joe Swanson
- **Landscape Architect:** Ragan-Smith Associates Alan Thompson
- **Site Engineer:** SEC, INC Matt Taylor
- **92,000 SF Aqua Bric pavers**

From Memphis to Knoxville... & now on to the Nashville Area!

For more information, please contact Darryl Sapp at 865-388-8707 or Darryl.Sapp@oldcastle.com.

Webinar: Green Infrastructure: Enhancing Cities by Managing Stormwater

[Green Infrastructure: Enhancing Cities by Managing Stormwater](#) (July 2, 2014, 4:00 - 5:45 p.m. EDT) Robert Traver, Villanova University

Abstract

Stormwater Management has changed dramatically in the last several years, as it has moved away from a flood control perspective toward sustainability of our rivers and watersheds. We have moved from detention basins, to incorporating stormwater wetlands, to pervious pavements, green roofs and bioretention

and Low Impact Development utilizing green technologies. It must be understood that without considering all components of the physical processes and tools to include landplaning, this cannot be realized, and that we are just beginning to understand the linkages and unit processes needed to apply this design concept.

These concepts have arrived in the ultra-urban environment. Combined sewer overflows, scarcity of land, trash challenges and maintenance costs require us to again refo-

cus on designs that can succeed within this environment. To really change the landscape of the site, we need to rethink our designs and incorporate green technologies, and challenge our past assumptions. Many of these Stormwater Control Measures have been constructed and are under study at Villanova University. Dr. Traver will discuss the issues, and results from these studies, focusing on biofiltration, and the lessons learned from using the campus as a field research site.

APWA's Certified Stormwater Manager Exam

Several people have indicated interest in taking [APWA's Certified Stormwater Manager](#) exam. Amy Murray with the City of Goodlettsville is coordinating an exam date the week of December 8-12, 2014.

In order to take this exam, you must be a current member in good standing with APWA (www.apwa.net).

The [eligibility application](#) must be postmarked by **October 3, 2014**. The [exam application](#) must be postmarked by November 7, 2014. The computerized exam is in [Gallatin](#) during the week of December 8-12, 2014. (At this time I do not know if the exam will be offered each day or one day during this time frame. Location and time details will be made available as the date approaches.)

John Chlarson, UT-MTAS, has graciously agreed to help us study for the exam. The study session takes place on Thursday, November 13, 2014, in Goodlettsville. Should additional time be needed to prepare, it will be finalized at the November 13th session. Study materials will be provided. For more information, contact Amy Murray at amurray@cityofgoodlettsville.org

2014 TNSA East Tennessee Development Symposium: *Registration is open!*

Join us at the Knoxville Convention Center November 4-5, for the 2014 TNSA East Tennessee Development Symposium as we explore challenges and discover solutions to the ever-changing world of land development and stormwater management in East Tennessee.

We will be bringing you presentations focusing on multiple aspects of the development industry in East Tennessee including: planning, design, construction, financing, BMP maintenance, regulatory compliance and environmental law and policy. In addition, you will hear case studies and success stories.


Early registration is now open for the 2014 TNSA East Tennessee Development Symposium (draft agenda will be posted on the website by August). Visit <http://tnstormwater.org/blog/2014-development-symposium/> to register.


Through this cart you can register one or more participants. In addition, sponsorship and exhibitor space can be purchased through this cart as well providing a one stop registration shop. Please see the sponsor/exhibitor benefits guide on the website for additional details on sponsorship.

If you have any questions regarding the 2014 TNSA East Tennessee Development Symposium, please contact Parci Gibson by phone or email. (865) 215-5861 or parci.gibson@knoxcounty.org


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Catalog of Green Infrastructure and Stormwater Finance Publications

With funding from the US EPA, the Environmental Finance Center at the University of North Carolina at Chapel Hill is [investigating innovative financing approaches for stormwater and green infrastructure](#).

A first step has been to catalog some of the existing publications in this area that have information on project financing. This [MS Excel table](#) is a catalog of forty-six (46) publications on green infrastructure for stormwater management that have finance relevance. A user can filter and sort the table according to location, audience, as well as several other criteria

Permanent Stormwater Ordinance Workshops

Our first Permanent Stormwater Ordinance workshop this past Friday, June 27th, was a resounding success! The workshop was well attended and lots of experiences and good advice on revising ordinances and educating councils and commissions on minimum water quality buffer widths were shared with the group.

The next 2 workshops scheduled include:

July 17– Madison County UT Extension Office, 309 N. Parkway, Jackson, TN 38305

July 24– UT Extension Eastern Regional Office, 1801 Downtown West Blvd, Knoxville, TN 37996

[Register Here!](#)

Summary:

TNSA, TDEC, UT-MTAS and UT-SMART

Center are offering 3 Permanent Stormwater Ordinance Workshops across the state this summer. These informal workshops are intended to assist you in initiating your draft stormwater ordinance revisions and to provide “lessons learned” discussions from MS4s that have completed this process.

The revisions are required by the MS4 Phase II permit to address permanent stormwater runoff from new development & re-development projects and should include the required minimum water quality buffer widths. Most MS4s have these requirements due by spring of 2015.



The workshops will cost \$25 per participant and scheduled from 10 AM - 2:30 PM.

Lunch will be provided. Please bring a copy of your stormwater ordinances and a copy of your Water Quality Scorecard for reference (if you are an MS4). Register on our TNSA website [here!](#)

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EPA Region 4's Rain Catcher Award

USEPA Southeast Region announces the first annual [Rain Catcher Awards](#) for excellence in implementation of a stormwater green infrastructure project. Nominations will be accepted in four categories: Municipal, Commercial, Tribal, Neighborhood/Community levels. Winners will be announced at the joint International Erosion Control Association Region 1 and EPA, Region 4 Municipal Wet Weather Stormwater Conference in Charlotte, North Carolina on August 19, 2014. Winners will be notified no later than August 8, 2014. It is EPA's hope that winners can attend the Conference. The neighborhood/community category winner may be eligible for travel assistance to the Conference. Criteria for consideration are explained below.

Deadlines

June 30, 2014	Competition opens
July 31, 2014	Deadline for submissions
August 8, 2014	Winner notification
August 19, 2014	Award Ceremony at IECA/EPA Conference in Charlotte, NC

Eligibility

Projects submitted for consideration must meet all of the following criteria:

- Must have been installed in the ground within the last 10 years: January 1, 2004 – May 31, 2014.
- Must be located in EPA Region 4, that is, located in North or South Carolina, Georgia, Mississippi, Tennessee, Florida, Alabama or Kentucky.
- Must not include a proprietary practice

Cont'd from Page 1: **THOSE LAZY, HAZY, CRAZY BOAT DAYS OF SUMMER**

attending its seventh combined event.

Even though it requires three full days of hard labor by Dwaine Lawson and yours truly, the four hour event is a real joy to experience. Town of Smyrna events require hold harmless forms to be completed before wristbands are applied then wristbands must be shown to gain an applied lifejacket then a lifejacket must be worn before the boat loaders will assist anyone into a canoe or kayak. All Smyrna Boat Days are within buoyed (orange kitty litter bottles) areas with four on-the-water spotters.

As is the case with any success story one entity cannot carry off the event alone. Especially, in the case of the Smyrna Boat Day – WaterFest event, this is definitely true.

In January of each year, the Smyrna Town Council must approve the completed U.S. Army Corps of Engineers' Special Event Permit Application, then the Corps must pass its blessings over it. A TWRA application must also be submitted. By the close of the event, around 1PM on the next to the last Saturday in June, we gain the support of the Corps, SRWA (volunteers), Rutherford County Sheriff's Office (8 canoes/paddles/jackets), Smyrna Parks, Fire (exhibitors tents), and Police (protection) departments, Smyrna Town Center (tables and chairs), Smyrna Channel 3 (Facebook advertising...critical and during-the-event videoing), Sean 'Cole Train' Cole (disc jockey), Pam (Thompson) Memories Photography, Smyrna Rotarians (volunteers), Town of Smyrna staff (volunteers), and of course, our citizens

(volunteers and boat lending).

Smyrna may not draw the larger crowds of Murfreesboro's event but when you compare the populations of both municipalities Smyrna is doing alright. Thanks always go to the SRWA members who sponsor three June Boat Days. The first is on the East Fork near Woodbury in Cannon County, the second is on Stones River proper in Smyrna (always on the next to the last Saturday of June), while the final event is held on the West Fork in Murfreesboro.

If you should have any questions, please call Greg Upham, Town of Smyrna Stormwater Manager at 615/355-5701 or email at greg.upham@townofsmymrna.org.

And, hey, Boat Days are always free!!

**Registration
is now open!**

TNSA Annual Conference — September 23-25, 2014

Plan on joining us at scenic Henry Horton State Park in Chapel Hill, Tennessee, this September as we explore challenges and discover solutions to the ever-changing world of stormwater management in Tennessee. This year's theme is "Rockin' the Regs". [Register!](#)

We will kick off the Conference on Tuesday, September 23rd with field exercises: building a Rain Garden at the State Park on the morning of the 23rd and a 2-hour Visual Stream Assessment and Habitat Assessment Workshop in the Duck River that afternoon.

During the following two days, we will have a comprehensive session on TDEC's Runoff Reduction Assessment Tool (RRAT) and the forthcoming Tennessee GI/LID Handbook.

Additional potentially scheduled sessions include: Runoff Reduction Policies; Comparisons on Runoff Reduction methodologies; Watershed BMPs and Watershed Planning successes; LID Design competitions; Setting up Volunteer Riparian Buffer Programs; Compaction and Infiltration; BMP Case Studies; Pervious Concrete Maintenance & Inspection discussions; and many more timely and relevant sessions!

Sponsors & Exhibitors:

All exhibitors will be located in the Conference Lodge where all our refreshment breaks and many of our sessions will be scheduled.

Please see the online [sponsor/exhibitor benefits guide](#) for additional details on sponsorship.

Our Keynote Speakers will be Tennessee's Wild Side Hosts Bill Cody (of WSM 650 fame!) and Janet Ivey (Janet's Planet!)

EPA Region 4 Municipal Wet Weather Stormwater Conference

August 18-19, 2014, Charlotte N.C.: The EPA Region 4 and the Southeast Chapter of the International Erosion Control Association (IECA) are hosting an inaugural [Municipal Wet Weather Stormwater Conference](#).

Presentations will inform and educate MS4 operators, consultants, contractors and others practicing in the discipline of stormwater management, stormwater quality and erosion and sediment control.

**Municipal Wet
Weather Stormwater
Conference**


Charlotte, NC
August 18-19



SESWA: Annual Regional Stormwater Conference

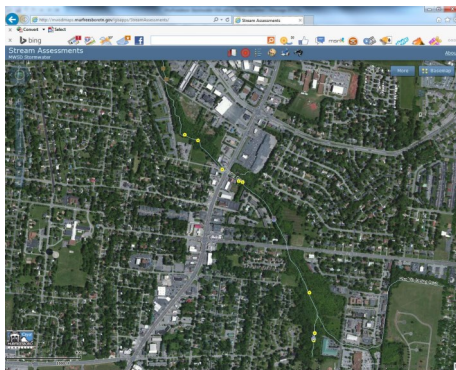
October 8-10, 2014, Charleston, S.C.: Join SESWA in charming Charleston, South Carolina as they explore stormwater innovations in the Southeast!

This year's [Conference](#) theme is "Improving Water Quality through Relationships, Regulations and Research" and will provide attendees with a wide array of technologies and strategies to address challenges in stormwater management. Attendees will be eligible for up to 14 PDHs/CEUs/Hours

Cont'd from page 1 Using Stream Assessment Data to Track Changes and Prioritize Stream Restoration Projects

follow-up education and vegetation giveaways. Various other sampling parameters are recorded and compiled to be compared with data collected in future watershed sampling cycles.

While developing procedures to streamline these findings into city planning hasn't happened yet, the assessments can provide valuable insight to city staff and the public.



Assessments have been conducted using mobile mapping software on smart phones and handheld GPS units. The data is then put on GIS [web maps](#) where staff plans to color code points based on their priority. For example, a trash accumulation point in a public easement may be labeled to show a good volunteer opportunity.

On the other hand, more significant problems like a large scale bank erosion site may be symbolized to indicate the need for a project or inclusion into the CIP schedule.

Assessments have also shown that a lot of the observations cannot be described using the typical VSA categories. Staff has used the "unusual condition" point with a large comment section to describe these observations which has presented problems when analyzing these locations.



At the end of the day staff has found that the presentation of assessment data is always changing to effectively communicate the condition of local streams.

Josh Upham is a Water Quality Specialist with the City of Murfreesboro. He may be reached at 615-848-3200 or by email at jupham@murfreesborotn.gov And yes—Josh is Greg's son! :-) -Jen

Agreement Signed to Restore and Protect Chesapeake Bay Watershed

ANNAPOLIS, Md. -- The Chesapeake Executive Council, which represents the seven watershed jurisdictions, a tri-state policy group and federal signed the [Chesapeake Bay Watershed Agreement](#), committing Chesapeake Bay Program partners to a set of interrelated goals to advance the restoration, conservation and protection of the Bay, its tributaries and the lands that surround them.

This marks the first time that the Bay's headwater states of Delaware, New York and West Virginia have pledged to work toward restoration goals that reach beyond water quality, making them full partners in the Bay Program and its watershed-wide work.

Job Opportunity! Water Quality Specialist I—City of Franklin

Click [Here](#) for full description.

Assists with the operations of the Stormwater Division of the Engineering Department under the direct supervision of the Stormwater Management Coordinator. Assists in the administration and management of the Water Quality section of the Stormwater Management Program, in order to meet the goals and objectives of the City's MS4 NPDES permit and best management practices.

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TNSA Compiling Comments on Tennessee's TMSP Permit Re-Issuance

Tennessee's [TMSP General Permit](#) recently expired (May 14, 2014). TDEC will begin working on the draft re-issuance in the near future.

Please send me (Jennifer@tnstormwater.org) any comments you would like addressed during the drafting of this permit. I will compile these comments into a single document and send it on behalf of TNSA to the Division of Water Resources.

Upcoming Events

Please email [Jennifer Watson](#) with your upcoming events:

JULY

- July 10— [Belgard Networking Happy Hour](#) 4-7PM at Belgard Design Center 3035 Powell Avenue, Nashville, TN 37204
 July 17—[Permanent Stormwater Ordinance Workshop](#) 10AM—2:30 PM CT Jackson, TN Madison Co UT Extension Center
 July 20—[Water Education Event](#)—KY-TN WEA Walker Pavilion at Coolidge Park, Chattanooga TN 2-5 PM ET
 July 21-23 [KY-TN Water Professionals Conference](#) Chattanooga, TN
 July 24—[Permanent Stormwater Ordinance Workshop](#) 10AM—2:30 PM ET Knoxville, Eastern regional UT Extension Office

AUGUST

- August 11-13, [Tennessee Hydrologic Determination Training](#)—QHP TN-HDT course, Montgomery Bell State park
 August 18 & 19 [IECA Conference](#)—Charlotte, NC

SEPTEMBER

- September 2—West Tennessee Regional TNSA meeting, 1:30 pm at the City of Germantown. Economic and Community Development building 1920 South Germantown Road
 September 23-25—[TNSA Annual Conference](#), [Henry Horton State Park](#), 4209 Nashville Highway, Chapel Hill, TN 37034
 September 26-27 – [Bartlett Fall Festival](#), Freeman Park (The City of Bartlett will have a stormwater booth with a simple quiz and a prize (you've seen our visors, stress balls, lip balm, etc.!) for each correct answer).

OCTOBER

- October 8-10—[SESWA Annual Regional Conference](#) Charleston, S.C.

Fall Level I, Level II, and Recertification TNEPSC Course Schedule

TNEPSC Level I Certification Course	
July 30, 2014	Nashville (<i>Recently Added!</i>)
Sept. 9, 2014	Nashville
Sept. 11, 2014	Chattanooga
Oct. 8, 2014	Knoxville
Oct. 22, 2014	Jackson
Nov. 6, 2014	Johnson City
Nov. 20, 2014	Nashville
Dec. 16, 2014	Knoxville

TNEPSC Level II Certification Course *	
Oct. 29-30, 2014	Nashville

* Others to be scheduled: Chattanooga & Knoxville

Recertification Course (4 hour course with morning session only)*			
Sept. 4, 2014	Cleveland	Nov. 7, 2014	Johnson City
Sept. 17, 2014	Nashville	Nov. 13, 2014	Memphis
Sept. 23, 2014	Knoxville	Nov. 25, 2014	Knoxville
Oct. 15, 2014	Chattanooga	Dec. 9, 2014	Nashville
Oct. 23, 2014	Jackson	Dec. 10, 2014	Chattanooga

Others to be scheduled: Memphis, Cookeville, Murfreesboro

Please contact [Tim Gangaware](#) with questions or visit the website: <http://tnepsc.org/>

TENNESSEE STORMWATER ASSOCIATION



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Tennessee Stormwater Association

TNSA Times, Volume 1, Issue 6

Purpose

The mission of the Tennessee Stormwater Association (TNSA) is to assist local government entities in their efforts to comply with State and Federal clean water laws and Stormwater Regulations promulgated by the Environmental Protection Agency and the Tennessee Department of Environment and Conservation; and through such assistance, to protect and improve the quality of the waters of Tennessee. This mission will be accomplished through TNSA members' exchange of information and knowledge regarding the design, construction, maintenance, administration and operation of stormwater facilities. The TNSA will promote the dissemination of information in stormwater control measures and the adoption of improved practices in stormwater administration.

Members

TNSA membership is composed of designated Municipal Separate Storm Sewer Systems (MS4s) including local governments (city and county), universities, military installations, and other entities such as TN Department of Transportation (TDOT). Associate members include environmental advocacy groups, non-profits, Tennessee State, sub-state or federal government entities consultants. Private sector membership is available to for-profit engineering, scientific and management firms or other organizations with an interest in stormwater.

Study: 100-Foot Buffers Keep Streams Healthy

Erosion Control magazine

AVONDALE, Pa., June 17, 2014 — Streamside forest buffers, long considered a best management practice, should be at least 100 feet wide on each side to adequately protect freshwater ecosystems from human activities according to an extensive scientific literature review published in the June issue of Journal of American Water Resources Association.

"That's a lot. We know it's a lot. But this is what the science is saying, and the reward for a wide forest buffer is huge," said study author Bernard W. Sweeney, Ph.D., director of the Stroud Water Research Center.

While the environmental benefits of streamside forest buffers have been known for decades, there was no consensus about how wide an effective forest buffer should be, until now. Current standards for a minimum forest buffer width vary from state to state and even from program to program, ranging from 35 feet to 100 feet.

The ecosystem benefits of wider forest buffers for streams include nitrogen pollution removal, soil sediment trapping, bank erosion prevention, improved temperature control, increased quantity of large woody debris, stream channel widening, improved channel

meandering, and healthier habitat for macroinvertebrates and fish. Meadows and grass buffers do not provide as many benefits.

"Most pollutants enter river systems in small streams, narrow enough to jump across. So it's vitally important that we protect their function," said study co-author J. Denis Newbold, Ph.D., a specialist in ecosystem processes at Stroud Water Research Center. Newbold explained that since small freshwater systems constitute 85 percent or more of the total stream miles in the world, they are more commonly in direct contact with human sources of pollution than are larger freshwater streams, such as large creeks and rivers.

The U.S. Environmental Protection Agency reported in 2013 that more than half of the river and stream miles in the United States are in poor condition and no longer able to support natural aquatic life or designated use by humans.

Sweeney and Newbold concluded that their review underscores the important role streamside forests play in protecting and enhancing water quality of downstream rivers and estuaries by providing important services, such as: sequestering carbon, metabolizing organic matter and degrading and processing pollutants.

Replanting forests in previously cleared land is a key component of Stroud Water Research Center's Watershed Restoration Team which helps farmers and landowner's access state and federal incentives that offset the costs of making improvements and keeping the land in its natural state.

Matt Ehrhart, director of watershed restoration at Stroud Water Research Center, said: "While not every farmer and landowner we work with will be able to accommodate a 100-foot wide forest buffer, citing this study enables us convey the importance of forest buffers and perhaps persuade landowners to establish wider forest buffers than they might previously have considered."

About Stroud Water Research Center

Stroud Water Research Center seeks to advance knowledge and stewardship of fresh water through research, education, watershed restoration and global outreach to help businesses, landowners, policy-makers, and individuals make informed decisions that affect water quality and availability around the world. For more information, please visit www.stroudcenter.org.