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SEDIMENTS

Newsletter of the North Carolina Sedimentation Control Commission

Trying New Approaches to Maximize Erosion, Sediment and Turbidity Control

By Melanie McCaleb, MS, CPESC and Richard A. McLaughlin, PhD., Soil Science Department, NC State University, Raleigh, NC

Controlling sedimentation and erosion on construction sites requires time and effort not only in installing and maintaining the devices but also in understanding how they work and why they fail. We investigated the problem at several sites. The approach was to install measures to control erosion and sedimentation according to the original E&SC plans, then follow up with additional measures to improve the effectiveness of these devices. To manage turbidity, we used polyacrylamide (PAM) at various points on the site to flocculate suspended solids. Often the biggest challenge was not installing or maintaining the devices but that the dynamic nature of a construction site required constant adjustments. The key element to success was ensuring that runoff was routed through the treatment system, which is difficult to achieve as the site is graded, utilities are installed, and other disturbances occur.

We have evaluated the results at a number of sites. In this article, we highlight an example from one site where changes occurred within the sediment basin as well as to the drainage patterns flowing to the basin. This is an ongoing project and many of the lessons learned are helping us to develop strategies that developers can use to come into compliance with the new EPA turbidity guideline (280 NTU) required for sites disturbing 20 (August 2011) or 10 (February 2014) or more acres.

Changes to a site during construction and changes to sediment basins and other BMPs can dramatically affect effluent turbidity. Examination of the magnitude of and variations in turbidity levels allowed us to pin-point when construction activity was at its peak or when failures occurred due to poor maintenance.

Peaks in turbidity were evident immediately after the sediment basin had been reworked to include a riser for the proposed wetland that would eventually take its place (Figure 1). The result was a very large spike in the outlet turbidity compared to the skimmer, both due to the disturbance and the new outlet placement at the riser base (Figure 2). Because they installed this type of riser they no longer allowed as much pooling in this basin. This made it very important for us to control the erosion and turbidity on the site before the runoff ever entered the basin. We were able to protect the inlets and stabilize the soil with a combination of erosion control blankets, wattles and hydromulch with PAM.

The second spike in turbidity was the result of the installation of a new entrance

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Figure 1. Skimmer basin now converted to constructed wetland with a bottom outlet (see stone at bottom of riser). Note inlet protection and wattles on the ditch at the far end.

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SEDIMENTS is a newsletter published quarterly by the N.C. Sedimentation Control Commission to provide information and assistance to the regulated community and to facilitate communication among personnel of state and local erosion and sedimentation control programs. SEDIMENTS is available in electronic form at: *http://www.dlr.enr.state.nc.us/pages/sedimentationnewsletters.html.*

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In This Issue

State of North Carolina,
Department of Environment & Natural Resources
Dee Freeman, Secretary

Land Quality Section
Division of Land Resources
James D. Simons, Director and State Geologist

IECA Organization of the Year Award - NCDOT

The International Erosion Control Association (IECA) honored the North Carolina Department of Transportation's (NCDOT) Roadside Environmental Unit (REU) with the Organization of the Year Award. This award was accepted on behalf of NCDOT's REU by Ted Sherrod, PE, CPESC, CPSWQ at this year's International Environmental Conference, EC10, in Dallas, Texas. This award was based on the efforts that NCDOT has made in improving the level of erosion and sediment control (E&SC) and stormwater compliance on its projects. This award is granted each year to an outstanding organization that is involved with and supports the E&SC profession.

Ted Sherrod (right) accepting the Organization of the Year Award on behalf of NCDOT from IECA President, Michael Chase (left).

Low Impact Development: A Guidebook and On-Line Training for North Carolina, including Construction Considerations

In 2009, North Carolina State University's Cooperative Extension Service published "Low Impact Development: A Guidebook for North Carolina for the NC Department of Natural Resources (DENR)" to provide practical information to professionals, public officials, planners, and developers. In addition, a web site was created to compliment the Low Impact Development Guidebook by providing web-based training and technical resources for all citizens to access. The on-line training is a self-guided tour of each chapter of the Guidebook (plus bonus material), all presented through in-depth slides and helpful scripts. This is a comprehensive overview of the Guidebook that was pilot-tested throughout the state.

Low impact development (LID) is a site planning, design, implementation, and maintenance program aimed at promoting environmental integrity with development and growth. LID, as a technique, began in the 1980's in Prince George's County, Maryland. Since that time it has become an international standard for combining development with environmental integrity. LID integrates stormwater practices into site design. Moreover, a fully LID site incorporates site assessment considerations to allow the use of existing topographic features to minimize grading during construction, preserve existing native vegetation and maintain adequate ground cover, incorporate site designs that use the most suitable soils within the site and protect the water resources. These site layout and construction considerations are usually consistent with minimizing sediment and erosion during construction, as well as post-construction. Both the Guidebook and the online training contain modules on "Site Assessment and Design" and "LID Construction" and are available through the NCSU LID Portal at: *http://www.ncsu.edu/lid*

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Send comments to Janalyn Vo, NCDENR-Land Quality, 1612 Mail Service Center, Raleigh, NC 27699-1612. Email: Janalyn.Vo@ncdenr.gov. To receive *Sediments* electronically, please subscribe at: *http://www.dlr.enr.state.nc.us/pages/sedimentationnewsletters.html* or contact bonnie_kurth@ncsu.edu or (919) 515-3723.

Personnel of the Land Quality Section of the NC Department of Environment and Natural Resources provide information and assistance for implementation of the NC Erosion and Sedimentation Control Program. For assistance, please contact the Regional Engineer or the Raleigh headquarters listed below:

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The North Carolina Sedimentation Control Commission

The Sedimentation Control Commission (SCC) was created to administer the Sedimentation Control Program pursuant to the NC Sedimentation Pollution Control Act of 1973 (SPCA). It is charged with adopting rules, setting standards, and providing guidance for implementation of the Act. The composition of the Commission is set by statute to encompass a broad range of perspectives and expertise in areas related to construction, industry, government, and natural resource conservation and quality. All members are appointed by the Governor and serve three-year terms, except for the Director of the Water Resources Research Institute of the University of North Carolina, who serves as long as he remains Director. The chairman of the SCC is named by the Governor. The following is a list of current members with the organizations they represent:

Chairman:
Donnie W. Brewer
Greenville
NC Environmental Management Commission

Commissioners:
W.T. "Buzz" Bryson
Raleigh
NC Public Utilities

Elaine C. Chiosso
Bynum
Non-governmental Conservation

Tommy Esqueda
Wake County
NC Association of County Commissioners

Joseph H. Kleiss
Raleigh
NC State University, Dept. of Soil Science

Grover McPherson
Winston-Salem
NC Soil and Water Conservation Commission

John William Miller, Jr.
Burnsville
NC Mining Commission

Michael P. Voiland
Raleigh
Water Resources Research Institute of
The University of North Carolina

Robin Smith
Burnsville
Non-governmental Conservation

Joseph E. Glass
Fayetteville
Professional Engineers of NC

Richard Vick
Wilson
Carolinas Associated General Contractors

Rob Weintraub
Wake Forest
NC Home Builders Association

News from Land Quality Section

Land Quality Section Summary Statistics:

Plan Approvals, Inspections, and Enforcement Activities in the Last Four Years - Regional LQS Offices (Local Programs are not included)

FY 2005-2006

40,110	Disturbed Areas per Year
4,870	E&S Plan Reviews
16,516	Site Inspections
3,374	Permitted Sites
731	Notices of Violations
77	Enforcement Case Referrals

FY 2006-2007

35,441	Disturbed Areas per Year
5,270	E&S Plan Reviews
13,189	Site Inspections
3,546	Permitted Sites
658	Notices of Violations
67	Enforcement Case Referrals

FY 2007-2008

31,569	Disturbed Areas per Year
4,611	E&S Plan Reviews
15,806	Site Inspections
2,972	Permitted Sites
492	Notices of Violations
88	Enforcement Case Referrals

FY 2008-2009

24,838	Disturbed Areas per Year
3,260	E&S Plan Reviews
19,884	Site Inspections
2,542	Permitted Sites
557	Notices of Violations
60	Enforcement Case Referrals

2010 Sedimentation Control Commission (SCC) Meeting Dates:

- Thursday, February 18
- Thursday, May 20
- Thursday, August 19
- Tuesday, November 30

Support documents for SCC actions may be found online at *http://dlr.enr.state.nc.us/scc.html*

To report possible violations of the NC SPCA call

1-866-STOPMUD 786-7683

Turbidity Control:
Part 1-The Basic Concepts

By Richard A. McLaughlin, Ph.D.,
Professor, Soil Science Department, NCSU

Many of you are aware that the US EPA has issued a rule regarding the allowable turbidity level in water discharged from larger construction sites. This was the subject of a previous Sediments article. The reason for this, aside from being forced to issue a rule by the courts, is that turbidity can cause substantial harm in many aquatic ecosystems. For instance, one study demonstrated the ability of bass to find prey was significantly reduced at turbidity levels much lower than the new EPA guideline will require.

Turbidity is simply the measure of how well light can pass through the water column. As you can see in the picture on page 5, it is hard to differentiate once turbidity is above 100 nephelometric turbidity units (NTU). Turbidity typically results from organisms growing in the water, natural colors released from soil or decaying vegetation, or suspended sediment from land or stream erosion. For runoff from construction sites, it is usually caused by erosion and suspension of fine soil particles. These fine particles are so small and have such a high surface area that it can take days, weeks, or even longer for them to settle out of the water. As a result, standard sediment control practices which have retention times of hours or less will not be able to achieve the turbidity goals in most areas. Runoff from construction sites is often well over the 1,000 NTU seen in the picture, even after passing through a sediment basin.

So what are the options for dealing with turbid runoff? One approach is to filter the runoff through various configurations of sand filters or similar media. These have met with limited success because some very fine particles can still pass through the sand and they are likely to clog under heavy sediment loading. Spreading the runoff into a buffer may help to some degree, but often the water finds channels and much of the fine sediment does not have a chance to settle. Some sites have infiltration rates high enough to absorb a certain amount of runoff, but often this is only for low flow events.

A final option is to add a chemical which will cause the fine particles to stick to each

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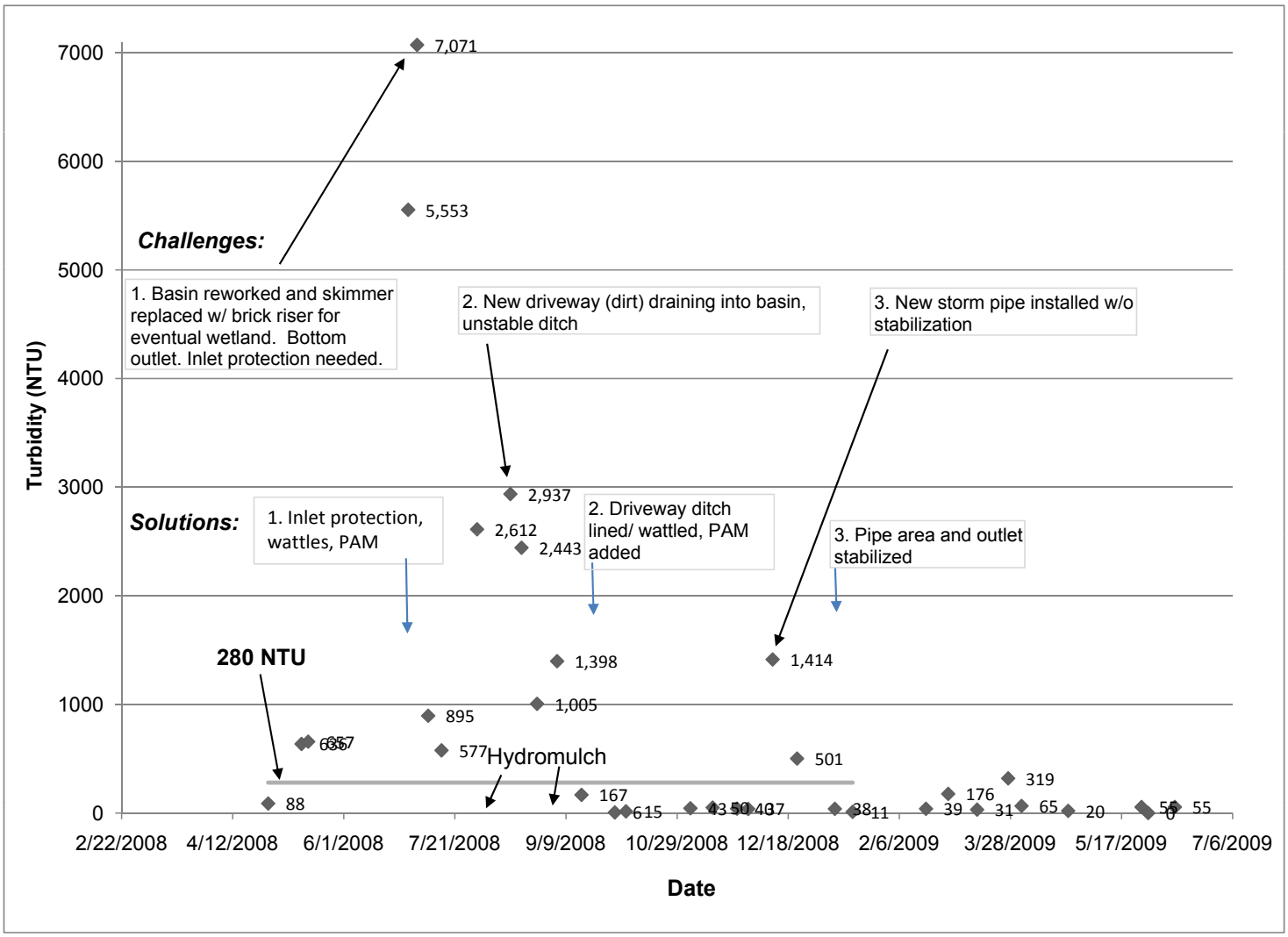


Figure 2. Turbidity in outlet water during a five month period with a variety of disturbances which received corrective action to control turbidity..

Maximize Turbidity Control

(*continued from page 1)*

road and a bare-soil ditch that conveyed water from it into the basin. To correct this problem, we lined the lower end of the ditch with excelsior erosion control blankets and added fiber check dams (coir) to reduce ditch erosion (Figure 3). We also added a geotextile liner at the point of discharge into the basin to prevent scour. Polyacrylamide powder was added to the check dams and

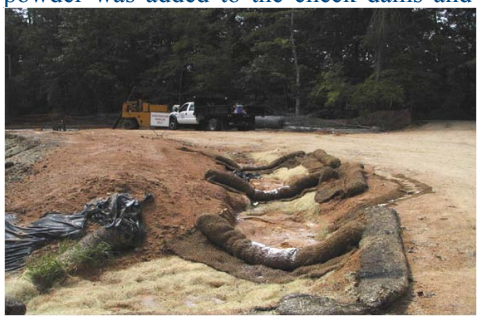


Figure 3. New entrance road with stabilized ditch (lining, fiber check dams) and PAM added to control turbidity..

liner for additional turbidity control. We also applied hydromulch to most of the bare soil around the basin as a way to reduce erosion until they returned to bring it to final grade and install a ground cover. Most of the subsequent storms resulted in effluent turbidity levels well below 280 NTU until the next site disturbance.

Effluent turbidity also spiked when a new storm pipe was installed into the side of the basin (adding an additional inlet) to accept drainage from a new driveway. This resulted in exposed soil. The disturbed area was stabilized with erosion control blankets and coir matting was installed below the pipe outlet to prevent scour (Figure 4). Other temporary materials such a synthetic geotextile or a plastic tarp could have been put below the pipe, but we wanted to apply PAM and so coir was selected for strength, durability, and ability to hold the PAM. After a spike of more than 1,400 NTU, this stabilization brought the turbidity down to values well below the required 280 NTU for most of the subsequent storms.

Figure 4. Stabilization of the basin slope with erosion control blankets. Note the coir matting installed below the pipe outlet to prevent scour and for PAM powder application..

With each challenge we were able to implement a solution that dropped the turbidity dramatically for each subsequent storm that was monitored. We were able to

continued next page

Maximize Turbidity Control

(*continued from page 4)*

control peaks in the 7,000 NTU range by simply stabilizing the disturbed soil with a combination of erosion control blankets and hydromulch along with PAM applications at strategic points. If these measures were installed immediately after the disturbance, the spikes could largely be avoided. While this was a relatively small site, the principles and practices for passive treatment of runoff with flocculants can be scaled up to any site. As mentioned earlier, the key to success is knowing where the water is going and treat it before it reaches the basin. It is likely that this job will have to be assigned to someone on the site who has the authority to make sure this occurs before the next storm. An alternative to a passive treatment system approach for large sites is to capture all of the runoff and pump it into a water treatment system – an expensive option. More on that approach in a subsequent issue. ❖

Turbidity Control: The Basic Concepts

(Continued from Page 3)

other and fall out of suspension. This is a practice that is thousands of years old, with good evidence that many ancient civilizations added wood ash, gypsum, or other materials to their drinking water supplies to remove sediment. Adding cations such as calcium from gypsum or aluminum from alum helps to overcome the negative charge on clay surfaces so they no longer repel each other and can start to form flocs, a process called coagulation. Another approach is to add a synthetic polymer, which also causes floc formation but through a variety of mechanisms beyond simply overcoming the clay charge. This is called flocculation. Both coagulation and flocculation are commonly used for many types of water treatment in industry, as well as municipal water and wastewater treatment. Polyacrylamide (PAM), a type of polymer, is currently added to irrigation water in furrow irrigated crops to keep the soil from becoming suspended as the water moves through the furrow.

Coagulants tend to be less expensive than flocculants, but they require much larger quantities to be effective. For example, gypsum might reduce turbidity at a rate of 20-30 lbs per thousand cubic feet of runoff, while an ounce of PAM would treat that volume. The difference is that coagulants would require significant materials handling capabilities to treat a typical storm event, and in addition, there would have to be an economical way to distribute the material into the storm flows. Finally, floc formation is relatively slow for coagulants compared to flocculants. As a result, most of the focus for treating turbid water has been with synthetic flocculants. Next issue: principles of getting flocculation working for you.

Examples of Turbidity

Turbidity, Erosion, and Sediment Control on Construction Sites

Installation of Construction Site Erosion & Sediment Control Devices

Credit: 3.5 Hours (Soil Scientists, Landscape Architects, Engineers, CPESCs)

June 3, 2010, Raleigh, NC

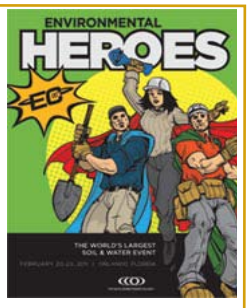
http://www.soil.ncsu.edu/training/training.php

Training on the development of erosion and sediment control plans is widely available, but proper installation of these devices is just as critical as a good plan. This workshop is designed for people who actually need to know how to install these devices. Attendees will learn what properly installed devices should look like and the common failures in their installation; how to install the most common devices by actually installing them; how to install alternatives to common rock systems and how to save some money using them.

EPA Effluent Guideline Breaking News

The Small Business Administration has submitted a petition to EPA to Reconsider the Construction and Development Effluent Limitations Guideline (ELG) *http://www.sba.gov/advo/laws/comments/epa10_0420.html*

IECA's Environmental Connection- The World's Largest Soil & Water Event!



February 20-23, 2011

Disney's Coronado Springs Resort - Orlando, Florida USA

The premier educational event for the erosion and sediment control industry. Environmental Connection has more erosion, sediment control, and stormwater focused training, technology and networking events than any other event.

Over 4 days, Environmental Connection provides peer–reviewed education, products and technology which address eight technology sections:

- Slope Stabilization
- Stream Restoration
- Vegetative Establishment
- Stormwater Management
- Wetlands Technology
- Erosion and Sediment Control
- Beach and Shoreline Stabilization
- Wind Erosion Technology

Information: *http://www.ieca.org/conference/annual/ec.asp*

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Sedimentation Control Commission
c/o NCSU Water Quality Group
Campus Box 7637
Raleigh, NC 27695-7619

Calendar of Events

5/11/2010	**How to Control Turbidity on Construction Sites,** Raleigh, NC *http://www.soil.ncsu.edu/training/training.php*
5/18/2010	**Level I & II Recertification: Erosion & Sediment Control/Stormwater Recertification, Hickory, NC** *http://www.bae.ncsu.edu/workshops/dot/*
5/18-20/2010	**River Course 201: Stream Restoration Design Principles,** Asheville, NC *http://www.ncsu.edu/srp/rivercourse.html*
6/02/2010	**Level III-A: Design of Erosion & Sediment Control Plans,** Raleigh, NC *http://www.bae.ncsu.edu/workshops/dot/*
6/03/2010	**Level III-B: Design of Erosion & Sediment Control for Reclamation Plans,** Raleigh, NC *http://www.bae.ncsu.edu/workshops/dot/*
6/03/2010	**Installation of Construction Site Erosion & Sediment Control Devises,** Raleigh, NC *http://www.soil.ncsu.edu/training/training.php*
6/22/2010	**Level I & II Recertification: Erosion & Sediment Control/Stormwater Recertification, Raleigh, NC** *http://www.bae.ncsu.edu/workshops/dot/*
6/23/2010	**Level II: Erosion & Sediment Control/Stormwater Site Management, Raleigh, NC** *http://www.bae.ncsu.edu/workshops/dot/*
6/24/2010	**Level I: Erosion & Sediment Control/ Stormwater Inspector/Installer, Raleigh, NC** *http://www.bae.ncsu.edu/workshops/dot/*
6/29-30/2010	**Bioretention Summit: Ask the Researcher**, Raleigh, NC *http://www.bae.ncsu.edu/stormwater/training.htm*
7/7-9/2010	**LID FastTrack Certification,** Wilmington, NC. *http://www.bae.ncsu.edu/topic/lid/workshops.html*
7/15-16/2010	**Bioretention Summit: Ask the Researcher**, Annapolis, MD *http://www.bae.ncsu.edu/stormwater/training.htm*
7/18-21/2010	**2010 Soil and Water Conservation Society (SWCS) International Annual Conference**, St. Louis, Missouri. Abstracts Due Dec. 17. *http://www.swcs.org/en/conferences/*
9/13-14/2010	**River Course 401: Construction Practices for Stream Restoration,** Asheville, NC *http://www.ncsu.edu/srp/rivercourse.html*
11/15-18/2010	**SE Regional Stream Restoration Conference**, Raleigh, NC. Abstracts Due June 30. *http://www.ncsu.edu/srp/2010conference/*
2/20-23, 2011	IECA Annual Environmental Connection. Orlando, FL. http://www.ieca.org/conference/annual/ec.asp