

# Cooperative Planning for Source Water Protection: Targeting Sediment in the Upper Saluda River Watershed

Melanie Ruhlman<sup>1</sup>, Angela Vandelay<sup>2</sup>, Cindy Roper<sup>3</sup>

---

AUTHORS: <sup>1</sup>Water Resources Specialist, North Wind, Inc., 777 Lowndes Hill Rd., Greenville, SC 29607, USA, and President, Save Our Saluda, P.O. Box 345, Marietta, SC 29661, USA, <sup>2</sup>Senior Environmental Engineer, Wood Environment & Infrastructure Solutions, 720 Gracern Road, Suite 132, Columbia, SC 29210, USA, <sup>3</sup>PhD student, Policy Studies, Environmental and Natural Resource Policy, Clemson University, Clemson, SC 29634, USA.  
REFERENCE: *Proceedings of the 2018 South Carolina Water Resources Conference*, held October 17-18, 2016 at the Columbia Metropolitan Convention Center.

---

**ABSTRACT.** Save Our Saluda, in cooperation with partnering organizations, is developing a watershed plan to address sediment in the North Saluda River and Saluda Lake. The plan lays the groundwork for implementation of practices and measures to help reduce sediment runoff and stabilize streambanks to improve and protect the health of the river and lake. The project is funded through the South Carolina Department of Health and Environmental Control (SCDHEC) Nonpoint Source Program with support from the partnership.

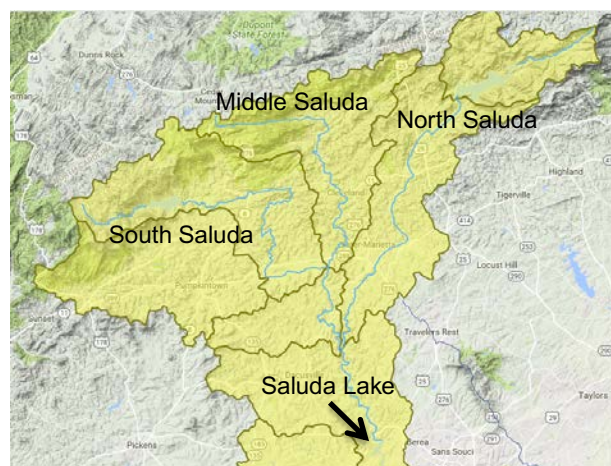
## INTRODUCTION

The U.S. Environmental Protection Agency lists sediment as the most common pollutant in rivers, streams, lakes and reservoirs. While natural erosion produces nearly 30 percent of the total sediment in the United States, accelerated erosion from human use of land accounts for the remaining 70 percent ([https://cfpub.epa.gov/npstbx/files/ksmo\\_sediment.pdf](https://cfpub.epa.gov/npstbx/files/ksmo_sediment.pdf)). Water quality, aquatic life, recreational use, and downstream reservoir storage are all adversely affected by sedimentation. Excess sediment not only fills rivers and lakes, it carries with it pollutants such as bacteria, nutrients, pesticides and metals that further degrade water quality and stream health.

Rivers and floodplains of the southeast Piedmont carry and store large quantities of legacy sediment from post-European settlement (Trimble, 2008). Present day land use practices also contribute significant amounts of newly eroded sediment to downstream waterbodies each year. Stream channel erosion is an additional contributing factor to overall sediment loading in Piedmont riverine systems. Stormwater runoff from developed areas can further destabilize streams and accelerate channel and streambank erosion. Because it is a nonpoint source pollutant, cooperative watershed-based solutions are needed to address water quality and other problems associated with sediment.

## BACKGROUND

Saluda Lake and its contributing rivers in the Upper Saluda Watershed are vital water resources for local communities in the Upstate (Figure 1). Headwaters feed Table Rock Reservoir on the South Saluda River and Poinsett Reservoir on the North Saluda River, supplying water to the greater Greenville area. Watershed areas above each of these reservoirs are protected through conservation easements and provide some of the highest quality drinking water in the country. Downstream near Greenville, Saluda Lake supplies water to the Easley area and its dam supplies hydropower. The Upper Saluda Rivers also support business and industry and provide recreational opportunities to thousands of Upstate residents and visitors.



**Figure 1. Upper Saluda Watershed**

Sediment is a significant problem for Saluda Lake. In 2011-2012, approximately 320,000 cubic yards of sediment was dredged from the lake at a cost of seven million dollars to Easley Combined Utilities. Upper parts of Saluda Lake are already rapidly filling in with sediment again. Water quality in the lake and rivers

upstream is impaired, aquatic habitat is degraded, and recreation is diminished due to sedimentation, particularly in the North Saluda River (Figure 2).

Cost effective and sustainable watershed-based solutions are needed for long-term erosion prevention and sediment control. Strategies to minimize soil loss from the watershed will help protect drinking water sources, improve river and lake water quality, restore aquatic habitat conditions, and enhance recreational experiences for property owners and the public.



**Figure 2. North-South Saluda Rivers Confluence**

After prioritizing the North Saluda River for initial focus, a local non-profit organization, Save Our Saluda, recruited and coordinated project partners to develop a watershed plan to address sediment in the North Saluda River and Saluda Lake. The project was funded through the SCDHEC's Nonpoint Source Program with support from the partnership. Partners include multiple utilities, county stormwater programs, agricultural agencies, universities, and nonprofit groups whose representatives comprise the Technical Advisory Stakeholder Committee (TASC). The TASC met regularly to help oversee and guide the project, and additional focus meetings were held with agricultural, urban, and forestry stakeholders to discuss practices, regulations, and landowner issues related to sediment runoff in the watershed planning area.

## WATERSHED ASSESSMENT AND PLAN

The primary goal of the watershed plan is to reduce sediment loading to the river and lake. The plan lays the groundwork for implementation of best management practices (BMPs) and other protective measures to help control sediment runoff. Community outreach and education efforts are aimed at building community support for the protection and enhancement of land and water resources in the Upper Saluda Watershed.

Spanning Blue Ridge and Piedmont physiographic regions, the watershed planning area includes the Upper and Lower North Saluda subwatersheds and drainage areas around Saluda Lake (Doddies Creek-Saluda River subwatershed). It encompasses approximately 122.5 square miles in Greenville and Pickens Counties.

## Methods

The watershed assessment involved desktop and field surveys to gather land use and water quality data for the watershed planning area. A windshield survey was conducted to verify 2011 USGS National Land Cover Database land use mapping and to identify any obvious sediment source areas. Modeling of the watershed area was done using EPA's "Spreadsheet Tool for the Estimation of Pollutant Load" (STEPL). STEPL incorporates many of the watershed characteristics such as soils, land use, rainfall data and number of agricultural animals. It utilizes the Universal Soil Loss Equation (USLE) to estimate sediment load from surface runoff of different land use areas.

BMPs and other measures were selected and prioritized to address the greatest sources of sediment pollution. These include structural, programmatic, and educational BMPs. Sediment load reduction from implementation of the selected BMPs/management measures was estimated using a number of assumptions, included level of participation and the effectiveness of the practice for reducing sediment loading.

## Watershed Assessment Results

Land use data indicate that 77 percent of the North Saluda-Saluda Lake watershed planning area is forested land. Managed rural areas (pastures, crops and hay) make up 8 percent of the total area and 13 percent of land use is categorized as urban.

Assessment of existing water quality data corroborates designated impairments in the North Saluda River and Saluda Lake related to sediment. High sustained turbidity levels during and following stormflow have been observed in the North Saluda River and Saluda Lake. Greenville County has 17 continuous stream monitoring gages across the county that record turbidity at 15-minute intervals. The North Saluda station has the highest overall mean turbidity of all the county's stations despite its watershed area being the second highest percentage of forest cover (nearly 80%). Because forest is a fairly stable land use, this indicates that the sediment runoff reaching this monitoring station is coming from a relatively small proportion of the watershed. Bedload sediment in the North Saluda is significant, and many reaches are characterized by shallow water depths, lack of a discernable thalweg, poorly sorted sediments, and loss of pool-riffle habitat, all of which contribute to impaired aquatic habitat conditions.

## DISCUSSION

Sedimentation is ongoing in the upper parts of Saluda Lake. Data indicate that turbidity in the lake increased during dredging operations, peaked in 2013, and remains higher than pre-dredging levels.

STEPL model results indicate that 74% of the overall sediment load originates from the Lower North Saluda River watershed and that 67% of the overall sediment load is coming from croplands. It should be noted that STEPL does not estimate in-stream erosion.

Watershed modeling and field observations confirm that intensively managed crop areas in floodplains are large contributors of sediment loading to the river and lake downstream. Therefore, these land use areas are the focus for ongoing and future sediment control projects as part of the watershed protection plan described below.

### Watershed Plan Implementation

The Watershed Plan for the North Saluda River and Saluda Lake identifies areas and strategies for watershed restoration and protection. Priority sources of sediment loading from the watershed planning area include:

- Runoff from crop farms,
- Livestock in streams,
- Runoff from pastures,
- Runoff from dirt roads, driveways, and roadside ditches,
- Runoff from development sites, and
- Eroding streambanks.

BMPs identified for sediment control are listed below for priority sources. Agricultural BMPs include:

- Cover crops
- Intercropping
- Conservation tillage
- Vegetated filter strips
- Field borders
- Pollinator strips
- Culvert/ditch stabilization
- Farm road stabilization
- Vegetated waterways
- Sediment control basins
- Terracing and contouring
- Streambank stabilization
- Conservation plans
- Livestock fencing/watering
- Loafing sheds
- Stream crossings
- Cross fencing
- Pasture planting
- Hay use area stabilization
- Vegetated riparian buffers

Programmatic measures for sediment control for existing and future urban source areas include:

- Land development regulations,
- Riparian buffer protections,
- Land conservation easement program,
- Citizen training and reporting, and
- Education and outreach.

The plan identifies technical and financial assistance needed for implementation and proposes solutions to help meet those needs, including grants and programs such as 319 Nonpoint Source Pollution Grants and the USDA NRCS Environmental Quality Incentives Program (EQIP).

Watershed planning provides a framework for action for restoration and protection of local water resources. Numerous stakeholders have a variety of motivations to protect and improve water quality. Engaging the stakeholders to cooperate to achieve the same overall goals of protecting and improving water quality can be both efficient and cost effective.

Watershed-based plans typically address nonpoint sources of pollution and do not include regulatory requirements. Developing a meaningful, cooperative watershed plan helps gain involvement from stakeholders, documents the water quality issues and proposed solutions, and will enable eligibility to obtain funding for implementation.

Many water quality issues require continued regional dialogue, cooperation, and stakeholder engagement for effective, long-term solutions. Additional planning and implementation efforts are ongoing for the Upper Saluda River Watershed above Saluda Lake. These include the first implementation project at a crop farm on the North Saluda River near Marietta, a crop farm workshop held in September 2018, and pursuit of funding to prepare a Watershed Plan for the South Saluda River Watershed. The TASC continues to support project stakeholder efforts to improve water quality by reducing sediment in waterbodies in the Upper Saluda River Watershed.

Thank you project partners: Clemson Cooperative Extension, Easley Combined Utilities, Furman University, Greenville County, Greenville County Soil and Water Conservation District, Greenville Water, Mountain Bridge Trout Unlimited, Naturaland Trust, Pickens County, Powdersville Water, Renewable Water Resources, Save Our Saluda, SC Department of Health and Environmental Control, SC Department of Natural Resources, SC Rural Water Association, Upstate Forever, Wood Environment & Infrastructure Solutions.

## LITERATURE CITED

- EPA, 2018. "Handbook for Developing Watershed Plans to Restore and Protect Our Waters." <https://www.epa.gov/nps/handbook-developing-watershed-plans-restore-and-protect-our-waters>.
- SCDHEC, 2014. "South Carolina Simplified Guide to Developing Watershed-Based Plans." <https://scdhec.gov/sites/default/files/Library/CR-010496.pdf>.
- Trimble, S.W. 2008. *Man-induced soil erosion on the Southern Piedmont*. Ankeny, Iowa: Soil and Water Conservation Society. New, Enhanced Edition of the 1974 edition with a Forward by Andrew Goudie (Oxford) and an introductory essay by S. W. Trimble.