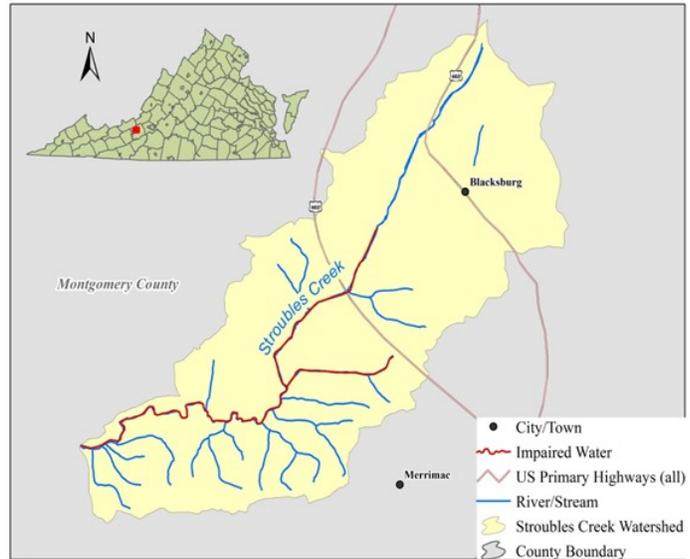


**Project Location and Background**

The Stroubles Creek watershed is located in the New River Basin in Montgomery County, Virginia. The headwaters of Stroubles Creek originate in the northeastern part of the town of Blacksburg, flowing in a generally southwestern direction. The Upper Stroubles Creek watershed contributing to the impaired section of the creek is 6,119 acres in size, and land use is mainly urban/residential (46%), forested (28%), pasture (21%), and cropland (5%). The urban and residential area is mainly in the northeastern (upstream) section of the watershed, and the forested area is mainly downstream in the southwestern corner of the watershed. Stroubles Creek was listed as impaired on Virginia’s 1996, 1998, and 2002 Section 303(d) Total Maximum Daily Load (TMDL) Priority List and Reports due to violations of the state’s General Standard (benthic). The TMDL was completed in 2003; a stressor analysis performed during TMDL development identified sediment as the primary stressor causing the aquatic life use impairment. A TMDL implementation plan was completed in 2006, and implementation projects were active from 2006 through 2014 through efforts of local partners, without Section 319(h) funding. Following a revision of the TMDL IP in 2014, and a 319(h)-funded implementation project was active between May 2014 and March 2017.



**Implementation Highlights**

The Stroubles Creek TMDL Implementation Project is administered by the Virginia Tech Biological Systems Engineering (BSE) Department, Blacksburg, Virginia. The Department was contracted to manage the 319(h) grant and provide technical assistance and educational outreach to watershed residents, landowners, and other stakeholders for agricultural, stormwater, and stream channel BMP implementation. The table on the right shows BMP implementation since the implementation plan was completed in 2006 and overall implementation goals for the project area. (continued on page 2)

**Table 1: Stroubles Creek BMP Summary: June 2006 – June 2017**

Control Measure	Units	Goal	Installed	%
<b>Agricultural</b>				
Stream Exclusion Fencing	F	13,937	10,560	76
Riparian Forest Buffer	A	30	6	20
<b>Urban/Residential Stormwater</b>				
Infiltration Trench Retrofits	CF	55,386	0	0
Urban Riparian Forest Buffer	S	7	2	29
Infiltration BMPs	S	10	0	0
Additional Bioretention BMPs	S	12	4	33
<b>Stream Channel</b>				
Stream Channel Restoration	F	6,881	6,336	92
Adopt-a-Stream Cleanup	F	N/A	6,336	N/A

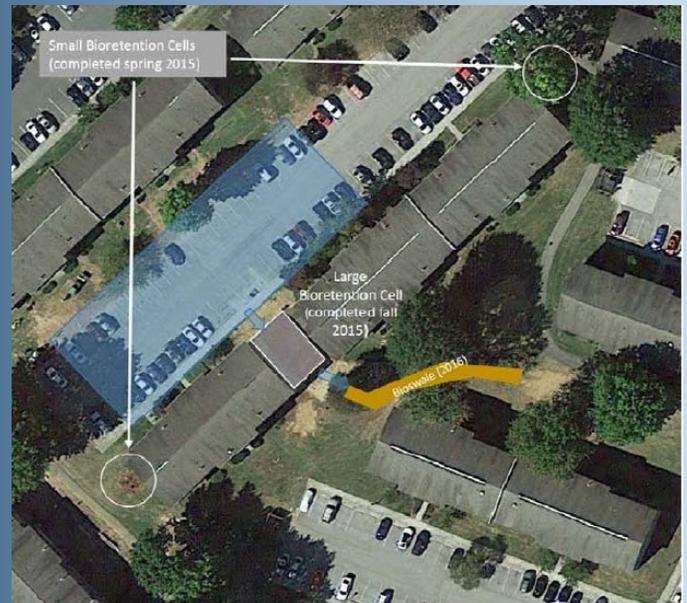
A =Acres, S =System, F = Feet, CF = Cubic Feet; Note: BMP counts do not include NRCS EQIP-funded practices.

### Implementation Highlights— Continued

Between IP completion and December 31, 2013, a number of agricultural and stormwater management BMPs were completed in the Stroubles Creek watershed through the efforts of local partners. These BMPs include two stormwater pond stabilization projects, six bioretention ponds and a bio-cell, an infiltration trench, 1.3 miles of stream restoration, 9,260 linear feet of livestock exclusion fencing, 0.22 miles of tree planting along retention ponds, forested buffer along one mile of stream length, and an Adopt-A-Stream program for 1.2 miles of the creek.

Between May 2014 and June 2016, several stormwater management and agricultural BMPs were completed as part of this 319(h)-funded project. Three bioretention cells installed at an apartment complex to treat runoff from roofs and parking lots. One livestock exclusion practice was completed totaling 1,300 linear feet of fencing, as was a pipeline to connect a frost-proof trough servicing the livestock exclusion area. A riparian buffer was installed inside the livestock exclusion area, and other riparian buffer plantings were completed along Stroubles Creek between StREAM Lab and Merrimac Road. Additionally, monthly water quality sampling and monitoring of precipitation and stream flow were conducted and a data transmission system was completed to route data automatically through the existing StREAM Lab wireless system.

To showcase completed BMP projects and local partnerships, BSE created a project website: <http://stroubles.weebly.com>. The website is intended to showcase completed BMP projects and local partnerships. A story map was developed, which contains BMPs funded by this grant as well as those installed by the Town of Blacksburg. An education and outreach program was developed which included an infographic about Stroubles Creek for the public, a high school science module about Stroubles Creek, and an online self-guided tour of stormwater management and other important features within the watershed. Additionally, the project team created educational signage for the installed BMPs and worked with two student groups to add sections of Stroubles Creek to the Department of Conservation and Recreation's Adopt-a-Stream program.



Photos: (Top) location of stormwater bioretention cells; (Middle) large bioretention cell; (Bottom) small bioretention cell.

**Implementation Highlights— Continued**

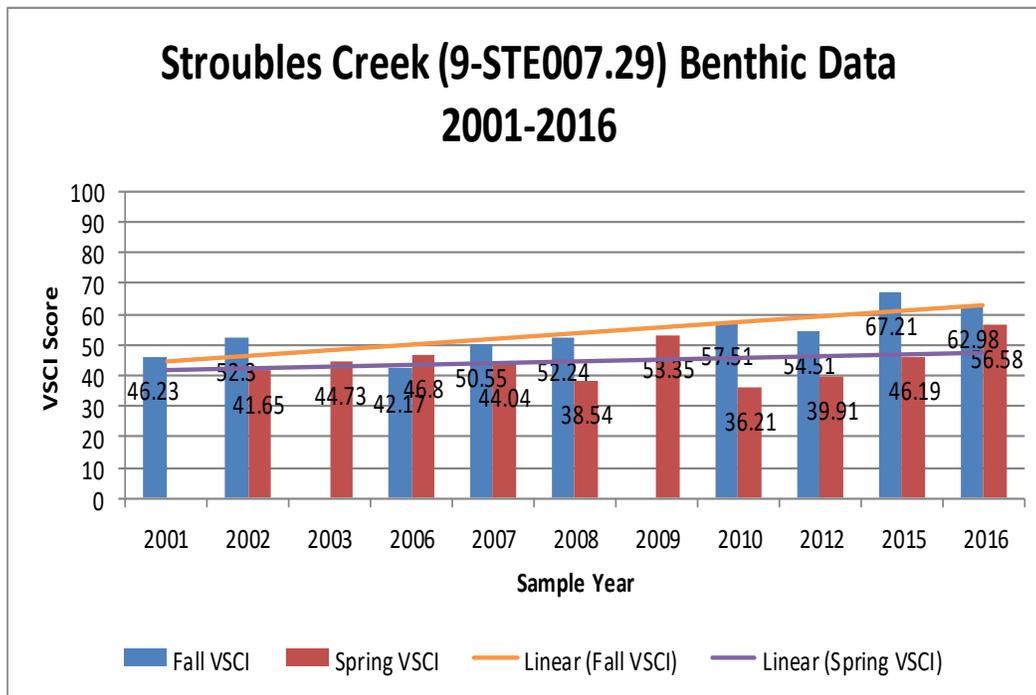
Pollution reductions resulting from the agricultural and septic BMP installations since the project’s inception are summarized in Table 2 below.

Period	Pathogens (Coliform) (CFU)	Nitrogen (lbs/year)	Phosphorus (lbs/year)	Sedimentation (tons/year)
July 2014-June 2017	6.58E+14	6,397	1,151	1,066

**Table 2: Pollution Reductions for Stroubles Creek Watershed**

**Water Quality Monitoring Results**

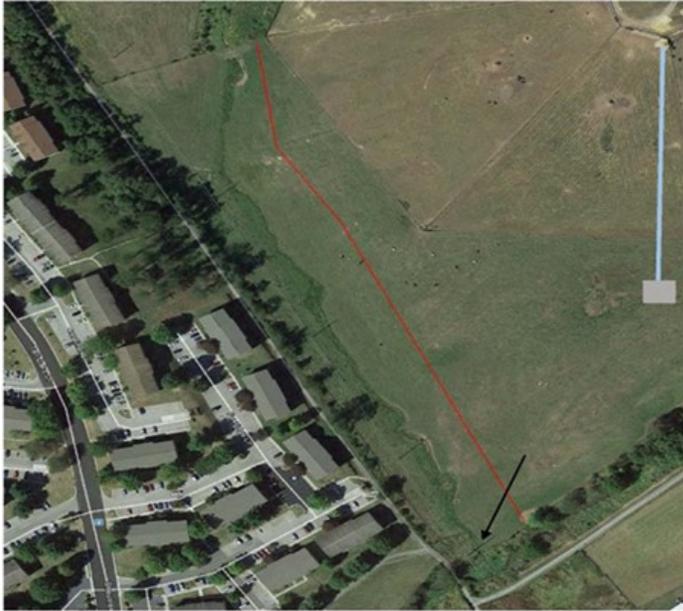
DEQ monitors water quality at several stations throughout the Stroubles Creek watershed. Water quality data collected were analyzed to determine the impact of BMPs implemented in the project area on the biological conditions and associated long-term trends, if any, in water quality conditions. The Virginia Stream Condition Index (VSCI) is used to designate biological impairment of a stream. Streams with VSCI scores greater than 60 are considered non-impaired, whereas streams scoring less than 60 are considered impaired. The biological water quality samples collected at monitoring station 9-STE007.29 in spring and fall seasons between 2001 and 2016 were analyzed for VSCI scores, and the results are shown in Graph 1 below. The number above each bar shows the VSCI score. Long-term VSCI scores are trending positively for both spring and fall with higher scores typically achieved in the fall season.



**Graph 1: Biological monitoring data for Stroubles Creek (Station 9-STE007.29), 2001-2016**

**Project Funding**

Federal 319 funds provided \$36,843.50 in cost-share/BMP funding and \$45,126.88 in technical assistance funds for Virginia Tech staff to administer the agricultural and urban stormwater program. Matching contributions totaled \$46,437. Total project funding was \$81,970.38.



**Photos :** (above) *location of livestock exclusion practice;*  
(below top) *livestock exclusion fencing;* (below bottom) *tree planting*



### **Closeout Analysis**

The Stroubles Creek Implementation Project encountered multiple issues throughout the grant period, which inhibited BMP implementation. They include the following:

- ⇒ The Town of Blacksburg as well as the Virginia Tech campus are becoming increasingly developed. New construction contributes to the sediment issue in Stroubles Creek. When the Implementation Plan was developed, urban/residential land use represented 46% of the watershed.
- ⇒ Virginia Tech and the Town of Blacksburg have specific requirements regarding development including BMP implementation. The entities strive for new development to be aesthetically pleasing which at times limited BMP implementation.
- ⇒ Montgomery County, the Town of Blacksburg, and Virginia Tech all implement a Municipal Separate Storm Sewer System (MS4) Permit. The MS4 permit limited the 319(h)—funded BMPs that could be implemented within the MS4 permit area. Implementation efforts focused on private property and areas outside of the MS4 permit area.
- ⇒ A 2012 survey concluded that more than half of residents surveyed did not know the name of the creek flowing through Blacksburg, and 75% did not know where their stormwater goes. This project made great strides in education through the development of several education modules, and interest in the modules was very high.
- ⇒ Regarding the riparian buffer tree/shrub survival rate, the project team found deer browse to be an issue and concluded that some of the shorter tree tubes needed to be replaced with longer tubes to alleviate the problem.

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