



# Esopus Creek NEWS

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*Esopus • Birch • Bushnellsville • Fox Hollow • Peck Hollow • Broadstreet Hollow • Woodland Valley • Stony Clove • Beaver Kill • Little Beaver Kill • Traver Hollow • Bushkill*

## Local Flood Analysis Results

## How to Read a Hydrograph

## Fishing Spider!

## Junior Water Scientists

## Watershed Video

## Watershed Detectives

## Upcoming Events

## Local Flood Analysis - Results!

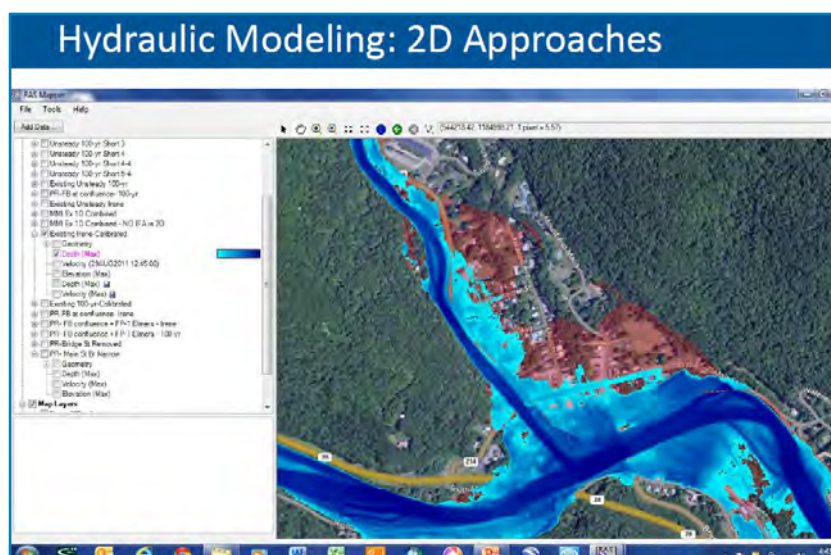
THE RESULTS ARE IN and as expected, there are no easy, or cheap solutions that completely remove flooding from the Ashokan watershed hamlets of Phoenicia and Mt. Tremper. But there are actions that computer and engineering analyses show can reduce the depth of flooding and the extent of smaller, but more frequent floods.

Towns still need to select by vote exactly which flood projects will move forward, and then locate funding for the projects. However, a benefit-to-cost ratio over 1.0 makes a project potentially eligible for FEMA assistance, and for funding from the Ashokan Watershed Stream Management Program (AWSMP) and the Catskill Watershed Corporation. The funding sources can each cover at least a portion of approved project costs.

Another approach Towns are pursuing is to work with County and State transportation

agencies to prioritize infrastructure improvements, like replacing culverts and bridges if according to analysis results, they are aging out and block floodwaters, putting public and private assets at risk.

The local flood analysis methodology was developed following the catastrophic flooding of Hurricanes Irene and Lee in 2011. The approach features computer modeling of stream systems and public engagement. All partners agreed that Towns should lead the analyses with funding provided by the NYC Department of Environmental Protection (DEP). DEP contracted with County organizations and the Catskill Watershed Corporation to assist the Towns. The first projects in the Ashokan Watershed were advanced by the Town of Shandaken, looking at options for Phoenicia and Mt. Tremper, and by the Town of Olive looking at Boiceville and West Shokan.



Consulting firms hired by the Towns first examined the extent and depth of predicted flooding to identify risks to the community. Here an advanced approach models the flow of water in multiple directions - including water flowing from the Stony Clove Creek (running from the top of image) onto Main Street before entering the Esopus Creek at Phoenicia, for a storm the size of Hurricane Irene.



The AWSMP provided the Town of Shandaken with funding to run a local flood analysis in 2014. Shandaken hired consulting firm Milone & MacBroom, Inc. (MMI) to do computer and engineering assessments and compile benefit-cost information used to determine project feasibility. Shandaken's flood advisory committee worked with MMI to hold a series of meetings at which members of the public identified a range of flood mitigation solutions to be evaluated. The maps at right show solutions that proved to be both cost-beneficial and feasible. Solutions were presented to the Shandaken Town Board in January 2016.

It should be noted that some of the flood mitigation options recommended involve the relocation of businesses or residences out of zones where flood waters are predicted to be the deepest during floods. Any relocations that would occur are to be voluntary - the landowner must choose to enter into a buyout and relocation program, and may need to seek Town support. This means that any solution that moves forward would require the support of affected individuals, the community at large, permitting agencies and funders.

Town flood committees looked in particular at actions that would have off-site flood reduction benefits, meaning the action would benefit multiple businesses or residences or public infrastructure like roads and bridges. Typical actions evaluated included removing and replacing bridges with larger spans and altered structures, excavating and lowering floodplains adjacent to the channel, resizing channels through sediment removal, and building levees and berms.

Non-structural solutions like flood-proofing buildings, elevating utilities, and elevating buildings were also recommended. The Towns are examining the relocation of critical facilities such as firehouses and emergency response centers out of floodplains. Next steps for the Towns may be to seek funding for professional planning services and costs associated with relocating critical facilities.

## PHOENICIA

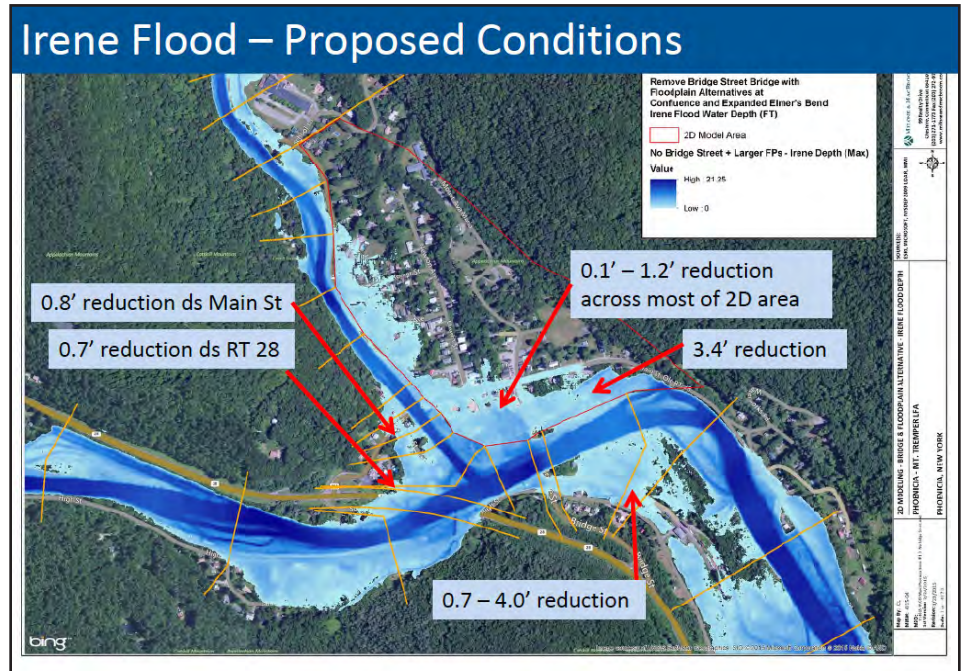
### Floodplain Creation and Bridge Replacement



*This floodplain enhancement scenario includes replacement of the Bridge St. bridge with a larger structure.*

FLOODPLAIN ENHANCEMENT (excavating within the existing floodplain to increase flood flow conveyance) was analysed along both banks of Esopus Creek and Stony Clove Creek in several configurations. The configuration that yielded the

greatest flood reduction benefit involves floodplain enhancement on both sides of Esopus Creek and the left bank of Stony Clove Creek, in combination with the replacement of the Bridge Street bridge with a larger structure.



*For this scenario the benefits outweigh the costs: Benefits = \$10,181,582, Costs = \$10,022,638.*



*Alternatives that yielded a benefit-cost ratio greater than 1.0 were floodplain enhancement in Phoenicia (with replacement of the Bridge St. bridge) and floodplain enhancement along the Esopus Creek in Mt. Tremper*

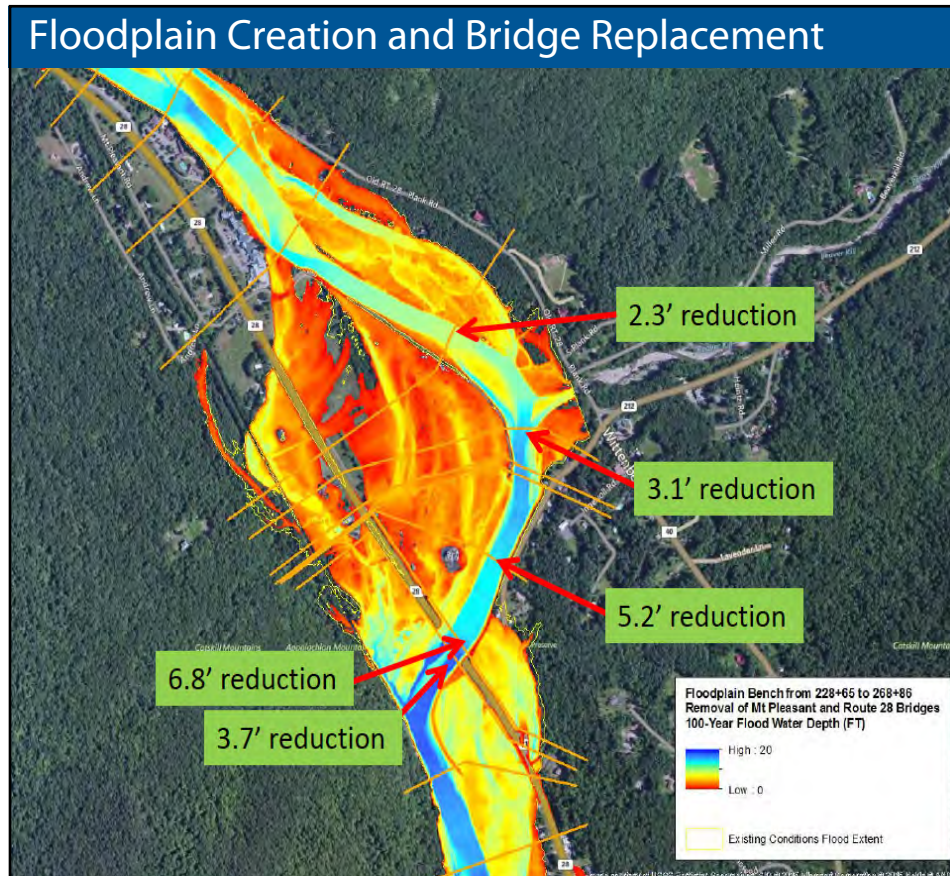
The following actions were recommended for both the Phoenicia and Mt. Tremper study areas:

- Seek to relocate the most flood-vulnerable properties where there is owner interest and funding available.
- Move existing structures out of the floodway.
- Some of the homes in the floodplain are rarely flooded. Residents and businesses may benefit from minor individual property improvements (see below).
- Investigate and address flooding associated with under-sized culverts and smaller drainageways.
- Work with property owners to secure or relocate fuel tanks to eliminate sources of potential contamination (funding is available from the Catskill Watershed Corporation).
- Work to identify and remove vacant and abandoned structures to prevent future hazards.

Potential property protection measures include (funding sources vary):

- Elevation of a structure.
- Construction of property improvements such as barriers and floodwalls (contact the local Floodplain Administrator about permit requirements; not funded by AWSMP, CWC or FEMA).
- Dry floodproofing of a structure to keep floodwaters from entering.
- Wet floodproofing to allow floodwaters to pass through the lower area of a structure unimpeded.
- Performing other home improvements to mitigate damage from flooding, such as relocating valuables and elevating utilities.

## MOUNT TREMPER



*The benefits outweigh the costs for the floodplain enhancement alone (a ratio of 1.63).*

OF THE VARIOUS Route 28 bridge configurations modeled, the greatest flood reduction benefit resulted from removal of road embankments on both sides of the Esopus Creek and replacement with a larger structure that would span the entire floodplain area. Floodplain enhancement would occur along 3,400 linear feet of the Esopus Creek channel on the inside of the bend just downstream of the Emerson Resort, as well as 1,800 linear feet of the channel on the inside of the bend just downstream of the Route 28 bridge.

The combined flood reduction benefits of floodplain enhancement and bridge replacement under a range of flows are substantial, and MMI recommended the Town pursue this option over the long-term.

The scenarios that were examined within the Mt. Tremper study area are:

1. Removal of Accumulated Sediment Bars in Esopus Creek

2. Mt. Tremper Dredging of Esopus Creek
3. Mt. Pleasant Bridge Removal
4. Route 28 Bridge Replacement
5. Enhance Levee in Place by Increasing its Height
6. Levee Relocation Scenarios
7. Mt. Tremper Floodplain Enhancement on Esopus Creek with/without Route 28 Bridge Replacement
8. Floodplain Bench on Beaver Kill
9. Plank Road Bridge Replacement

TO REVIEW the full range of options evaluated in both Phoenicia and Mt. Tremper and how benefits and costs were derived, view or download the full *Local Flood Analysis Report for Phoenicia and Mt. Tremper* at:

<http://ashokanstreams.org/publications-resources/>

Sources: Final Draft Local Flood Analysis Report for Phoenicia and Mt. Tremper, Milone & MacBroom, Inc.

## How to Read a Hydrograph



The United States Geological Survey (USGS) installs instruments in rivers and streams to measure the elevation of water and then convert the water elevation (called 'stage') to the amount of streamflow or 'discharge'.

The USGS is able to measure river stage to within 0.01 inches using several methods: floats inside a stilling well, pressure transducers, or with radars. At most USGS stream gages, the stage is measured every 15 minutes.

The data is stored in an electronic data recorder, most often powered by solar energy. The data is transmitted to the USGS using satellite, phone, or radio. Both the stage and streamflow data are then displayed on the USGS web pages.

There are 16 USGS gages in Ulster County recording stream flows. Ten of the gages are in the upper Esopus Creek watershed.

Funding to operate and maintain USGS gages in the Ashokan Watershed comes from the USGS Cooperative Water Program, the NYC Department of Environmental Protection, Ashokan Watershed Stream Management Program, and the NYS Department of Environmental Conservation.

### What is a hydrograph?

A stream discharge hydrograph shows the change in discharge of a stream over time.

A hydrograph shows how river flows are affected by precipitation events, like a rain storm or snow melt.

### Discharge

The discharge of a river (or stream) is the volume of water that flows past a point in the river's course per second. The volume is measured in cubic feet (cf) and it's reported per second, so the units of discharge are cubic feet per second, or cfs.

Baseflow is the normal day to day discharge of the river and is the consequence of groundwater seeping into the river channel.

### Stream Stage

A stream stage hydrograph shows how the height of the water has changed over time.

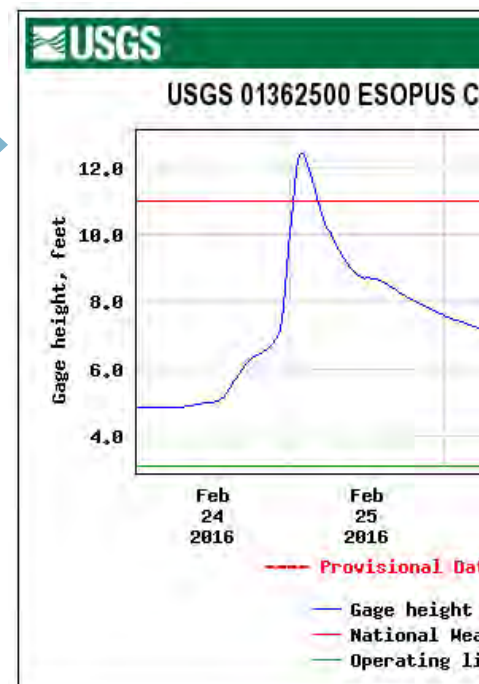
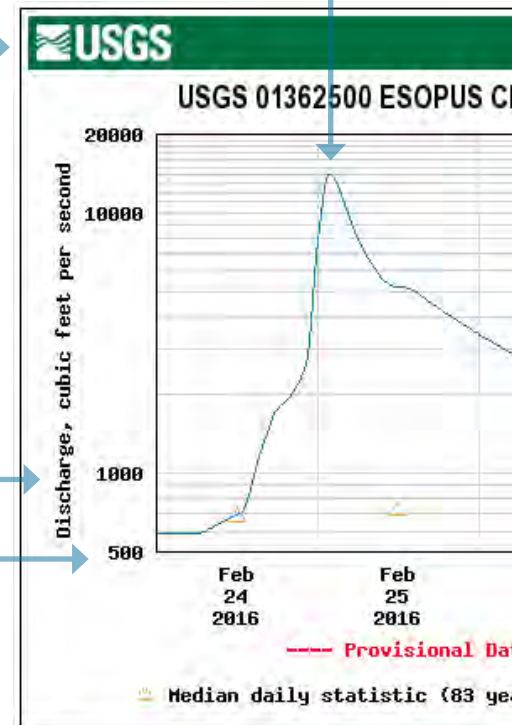
On February 24-25, 2016 about 3.6 inches of rain fell on the upper Esopus Creek watershed. The rain fell over 28 hours and the Esopus Creek was at base-flow conditions before the rain started.

The blue lines show that on February 24 the baseflow was about 600 cfs with a stage of 4.89 ft before the river started to rise, and that 18 hours later streamflow was over 14,000 cfs with a stage of 12.39 ft.

Sources: USGS National Streamflow Information Program - From the River to You: USGS Real-time Streamflow Information, <http://pubs.usgs.gov/fs/2007/3043/>

### Peak Discharge

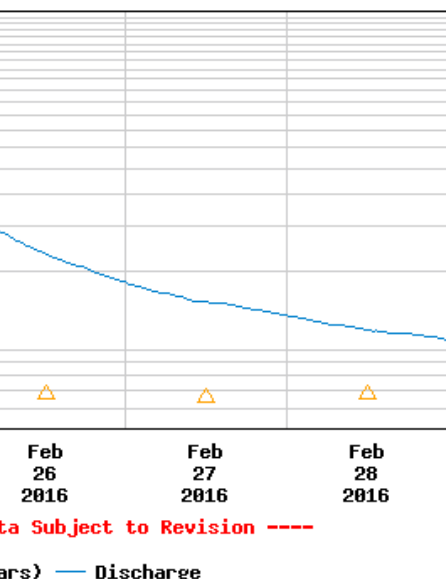
Peak discharge is when the river reaches its highest flow. There is a delay after a rain storm ends because it takes time for the water to find its way to the river.



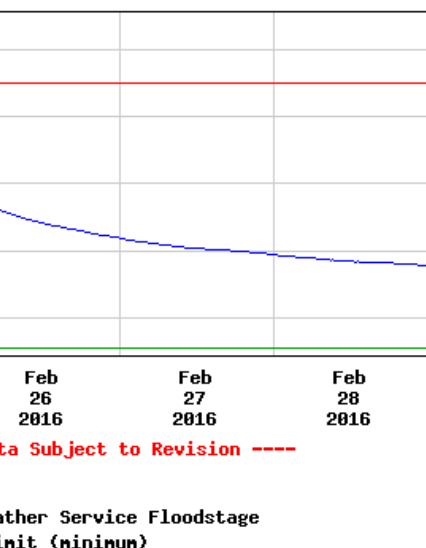


Discharge is measured over time and changes after a heavy rainfall.

### ESOPUS CREEK AT COLDBROOK NY



### ESOPUS CREEK AT COLDBROOK NY



Many factors affect how the river responds to precipitation and the shape of a hydrograph. Factors include the watershed's shape and valley steepness, soil and rock type, weather and climate, vegetation cover, and human activity.

Water takes longer to reach the mainstem of a river in a large, round watershed than it does in a small, narrow watershed with steep valleys.

Discharge is measured at gaging stations situated along the river. USGS gages in the Ashokan Reservoir Watershed include:

- Birch Creek at Big Indian
- Esopus Creek at Allaben
- Diversion from Schoharie Reservoir
- Woodland Creek at Phoenicia
- Warner Creek Near Chichester
- Stony Clove Creek Below Ox Clove at Chichester
- Beaver Kill at Mount Tremper
- Little Beaver Kill at Beechford near Mt Tremper
- Esopus Creek at Coldbrook
- Bush Kill below Maltby Hollow Brook at West Shokan

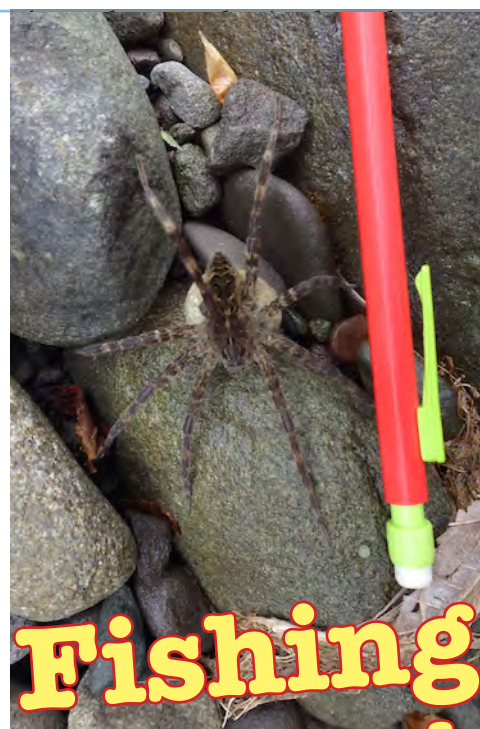
The Esopus Creek at Coldbrook NY station is a gage with a National Weather Service predicted flood stage. You can sign up for a WaterAlert email and text message alerts for this site.

Subscribe to WaterAlert for the Esopus Creek at Coldbrook gage at:  
<http://water.usgs.gov/wateralert/>

To see where floods are occurring around the country and in the Northeast:

<http://water.usgs.gov/floods/>  
<http://www.weather.gov/nerfc/>

USGS stream data can be accessed using a mobile app. If you allow the app to use your location, it will zero in on local stream gage locations. Go to:  
<http://m.waterdata.usgs.gov>



## Fishing Spider!

*The Fishing Spider (Dolomedes spp.) shown above burst out of cover and ran across the turbulent waters of Warner Creek in the Town of Shandaken!*

The Fishing Spider hunts for food in streams and can run on water! Fishing Spiders hunt by putting their forelegs in the water and feeling for vibrations from aquatic prey (fish, beetles, shrimp, and other invertebrates), and then dive in to grab the prey. They run very well on water. They are common on streams or the sides of ponds. Fishing Spiders belong to the family Pisauridae and resemble wolf spiders, but have smaller eyes and legs that are held more widely to the sides of their body. They can be large, with a leg spread of three inches. These spiders are rovers, and the female spins a web only for her young.

See: [http://www.dec.ny.gov/docs/wildlife\\_pdf/commonspiders.pdf](http://www.dec.ny.gov/docs/wildlife_pdf/commonspiders.pdf)

## BUSTED! Junior Water Scientists on Patrol

The AWSMP is running an exciting new program for all Onteora School District first graders as part of our expanded youth education offerings. The Junior Water Scientist program is designed to introduce young students to basic watershed concepts with an emphasis placed on protecting and conserving our fresh water resources. At the culmination of this program, each student was awarded their very own Junior Drip Patrol Inspector badge and ID card.



*Local first-graders are learning about water - where it comes from and where it flows, and how to conserve our water resources.*



Matt Savatgy, Watershed Youth Educator with Cornell Cooperative Extension of Ulster County (CCEUC), reports that the children are very excited about teaching their families, friends and neighbors about taking care of our water and gently reminding them when needed about not wasting it. With their new badges in hand, we are confident these youngsters will help spread the word that our water is important.



*Watching for tadpoles as part of stream and wetland ecosystem study.*

students to receive water, stream and watershed science lessons when classroom teachers request them. The focus is on hands-on learning. Students are able to take field trips to explore the Esopus Creek and smaller tributaries, including those on school property that become living laboratories where students can carry out stewardship projects and studies.

The school programs are supported by the AWSMP and the Catskill Watershed Corporation, both funded by the NYC Department of Environmental Protection.

The AWSMP Youth Education Program expanded at the Bennett Intermediate School, and for the first time was offered at Woodstock and Phoenicia Elementary Schools in the 2015/16 school year. Offerings include after-school clubs and a range of opportunities for all

## Lights, Camera, Action!

The Bennett Intermediate School Watershed Detectives have been hard at work creating a new educational science movie about watersheds. Working in collaboration with David Laks, a local videographer and retired Onteora music teacher, the students are taking basic water science concepts they have been learning about all year and turning them into a video that others can learn from.

According to CCEUC Educator Matt Savatgy, "The students are involved with many aspects of the film's production, including: writing, acting, filming, lighting and sound." In addition to making the movie, many of the students are also hard at work creating and performing a musical number that will be included in the finished product. We are eagerly anticipating the results of their work!



*Filming is underway! With help from teachers and a local videographer, students grades 4-6 are having fun with sharing science.*



# Watershed Detective for a Day

**Editor's Note:** We asked CCE 4-H Youth Educator Matt Helfrich to visit the Environmental Lab and Watershed Detectives Club at Bennett Intermediate School in Boiceville and describe his experience. Here's Matt's report!

Though I've known about the Watershed Detectives at the Onteora School District for a couple of years, on March 15th, I finally had the chance to visit and observe the program. I entered Bennett Elementary School just before the end of the school day with the intention of discussing the program with its teacher and creator, CCE Educator Matt Savatgy, before the kids arrived. Once I found my way to the classroom however, all I wanted to do was explore the displays in the room itself. Turns out, Matt Savatgy has transformed one of the classrooms in the school into a natural history museum!

There is a large section of a hollow tree towering overhead, there are animal furs, bones, a preserved snapping turtle, a log chewed by beavers, guide books, shells, and mineral samples just to name a few of the hundreds of objects decorating the room. Mr. Savatgy admitted that it was sometimes a challenge to keep kids attention on the lesson of the day when there is so much cool stuff to explore in the classroom. But I was able concentrate on Matt as he outlined his work with the School District, at least until the students began to arrive.

Eight students were in attendance. This year, these students will be working together to make a video on the Ashokan Reservoir Watershed, and they discussed the different ways the students could be involved, whether it be writing, acting, designing, or creating music for the production. The

movie will be in the style of the popular Bill Nye video series. The kids listened intently as Mr. Savatgy described the incredible amount of work that goes into creating a 10-15 minute film.

the students saw houses washed away by the deluge, and witnessed the futility of building on low ground.

After the bell rang and the kids left to take the late bus home,



Bennett School students manipulate a floodplain model in Mr. Savatgy's Environmental Lab.

After movie time, the group quickly transitioned to an activity they had begun at their previous meeting. The kids joined Mr. Savatgy around a low table and began to experiment with the stormwater floodplain simulation model, a large acrylic aquarium with landforms that allows students to witness how stream flow is affected during times of high runoff. During the previous class, students had learned various methods of flood control and techniques for mitigating damage from storms. Today they tried new ideas, including making levees out of modeling clay and other methods for protecting homes along a floodplain. Once the houses were placed, the "rain" fell out of a pitcher and into a basin above the model that let the water out through tiny holes and simulated rainfall. Some things worked, and others didn't and

Mr. Savatgy took me for a quick tour of another classroom. About ten steps from the door leading outside, a forest awaits - nature's classroom. A place to explore, a place to play, a chance to practice in a real setting some of the lessons learned inside. There is even a tiny stream cutting through the kid-maintained trails that disappears into a culvert and goes under the playground before emerging again to continue its journey to the Esopus then Hudson River, eventually reaching the Atlantic Ocean. One could hardly plan a better scene. Mr. Savatgy assures me that most days the class takes place here, which is exactly what I expected. After all - to paraphrase Richard Louv, author of *Last Child in the Woods* - if we are going to save the environment, we have to save an endangered indicator species: the child in nature.

# Esopus Creek News

## AWSMP UPCOMING EVENTS



Join us for Family Fun & Fish Day on June 5.

### Saturday, May 14

#### Beaver Kill Stream Walk

Interpreted walk exploring the Beaver Kill stream in the Town of Woodstock. Registration required.

### Saturday, June 11

#### Rondout Valley Scout Camporee

Floodplain Model demo for scouts. 10:00am-3:00pm

### Sunday, June 5

#### Family Fun & Fish Day!

Learn to fish and bring the entire family to Kenneth Wilson State Park, Mount Tremper. \$6 admission to park. All other activities are free. 12pm-2:30pm. To register: [https://reg.cce.cornell.edu/familyfishingday2016\\_251](https://reg.cce.cornell.edu/familyfishingday2016_251)

*Call the AWSMP at (845) 688-3047 to register, or for more information*



Ashokan Watershed  
Stream Management Program



Cornell University  
Cooperative Extension  
Ulster County



Soil and Water  
Conservation District  
PO Box 667, 3130 State Route 28, Shokan, NY 12481  
5 Park Lane, Highland, NY 12528



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