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The DEP Stream Management Program (SMP) is a critical part of New York City's long-range watershed protection strategy. The SMP's mission is to restore stream stability and ecosystem integrity by encouraging long-term stewardship of Catskill Mountain streams and floodplains. To do this, the SMP establishes partnerships with the region's Soil and Water Conservation Districts (SWCD), landowners and other local agencies and municipalities.

By 2010, the SMP and its SWCD and Ulster County Cornell Cooperative Extension partners had constructed more than 25 stream restoration projects to improve water quality, reduce erosion and flood risks, and to enhance aquatic habitat. Stream management plans have been completed for the Esopus Creek and its Stony Clove and Broadstreet Hollow tributaries, the Schoharie River, the Schoharie Creek and its Batavia Kill, West Kill, East Kill, and Manor Kill. Stream management plans for the Rondout Creek and the Chestnut Creek. In 2011, a plan will be completed for the NeverSink River. To view these plans or find more information on projects, please visit [www.catskillstreams.org](http://www.catskillstreams.org).

### How Can I Get Involved?

Since 75% of the Catskill/Delaware watershed is privately owned, landowner decisions are very important. Streamside landowners are essential to the success of stream management plans and projects. They participate in Project Advisory Committees; they provide local history and anecdotal evidence of the changes in stream flows over the years. Local residents also organize watershed associations and stream clean-ups, as well as helping with streamside, or riparian, plantings and participating in educational workshops.

For advice about the protection of your local watershed and its stream, contact your county Soil and Water Conservation District or DEP's Stream Management Program, all listed below. Whatever your interests or talents, there's a role for you in stream stewardship.



Broadstreet Hollow residents display their smiles along with the garbage they collected during the annual Broadstreet Hollow stream clean-up day, a part of their Stream Management Plan.

### For more information, please contact:

DEP Stream Management Program  
Bureau of Water Supply  
71 Smith Avenue • Kingston NY 12401 • 845-340-7838  
[www.nyc.gov/dep](http://www.nyc.gov/dep); [www.catskillstreams.org](http://www.catskillstreams.org)

Delaware County Soil and Water Conservation District  
607-865-7161; [www.dcswcd.org](http://www.dcswcd.org)

Greene County Soil and Water Conservation District  
518-622-3620; [www.gcswcd.com](http://www.gcswcd.com)

Sullivan County Soil and Water Conservation District  
845-292-6552; [www.sullivancountyswcd.com](http://www.sullivancountyswcd.com)

Ulster County Soil and Water Conservation District  
845-688-3047; [www.esopuscreek.org](http://www.esopuscreek.org)

Cornell Cooperative Extension – Ulster County  
845-688-3047; [www.esopuscreek.org](http://www.esopuscreek.org)



## Stream Management in the Catskill/Delaware Watershed



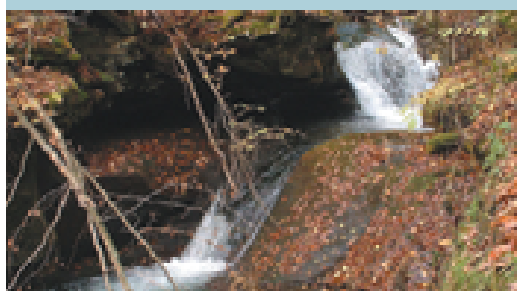
The source waters for 90% of New York City's drinking water supply, Catskill Mountain streams offer great beauty and wonderful recreation. These varied waters, the birthplace of fly fishing in America, are also hard workers: they provide the lifeblood of countless organisms; they drain floodwaters and they move rock and soil eroded from the highlands. When streams are changed — naturally or by people — stream health and water quality can be compromised and property can become threatened.



"Before" and "after" restoration images illustrate the water quality benefit that some stream restoration projects can provide. The Broadstreet Hollow demonstration project was designed and constructed by Greene County SWCD.

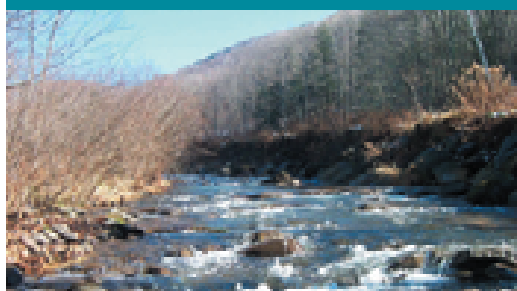
DEP works with the county Soil and Water Conservation Districts (SWCDs) and local project advisory committees. They assess stream conditions from the headwaters to the mouth, working in sub-basins, prioritized by their proximity to reservoirs and the water quality problems they present. Management plans are devised to achieve a wide range of goals. Restoration and protection projects are developed using the principles of natural channel design. Some areas simply require passive restoration — natural regrowth of native plants — while other areas dictate active restoration — the redirection of the stream channel over considerable length.

## Mountain Streams – A Living Network



### 1 High Gradient Streams

These headwaters drain steep mountain slopes, acting as important sources for stream sediment and providing nutrients from tree leaves and branches for the food web downstream. Cascading steps, deep pools and large boulders slow flood flows and reduce erosive stream power; overhanging tree branches keep the water cool.



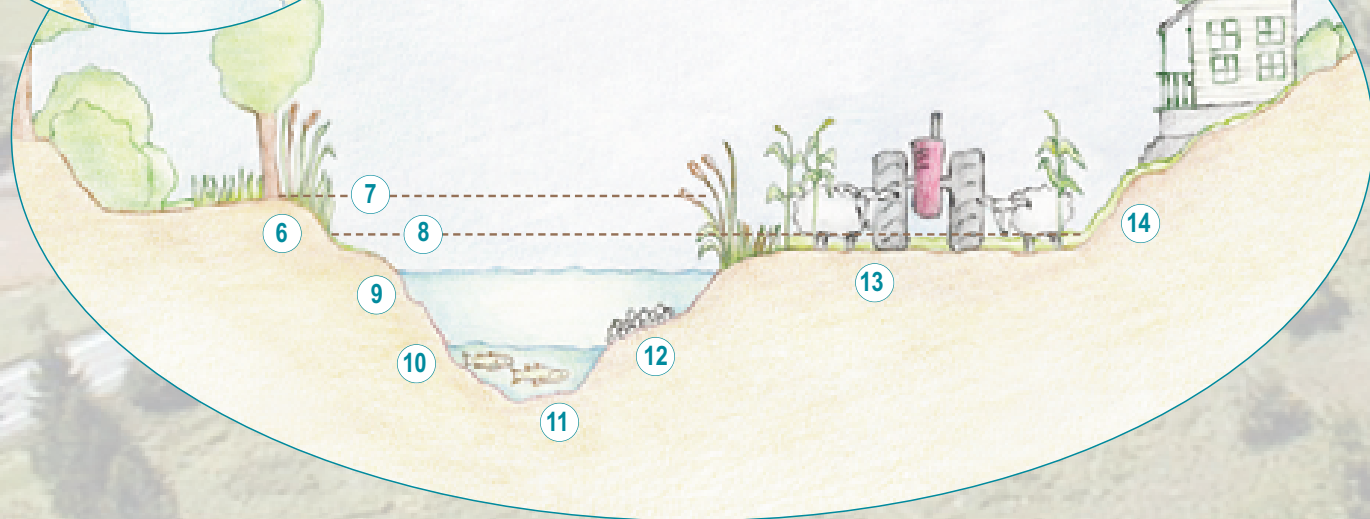
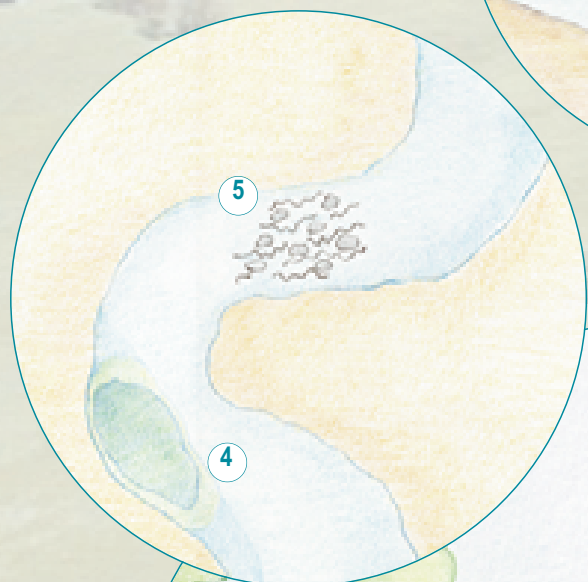
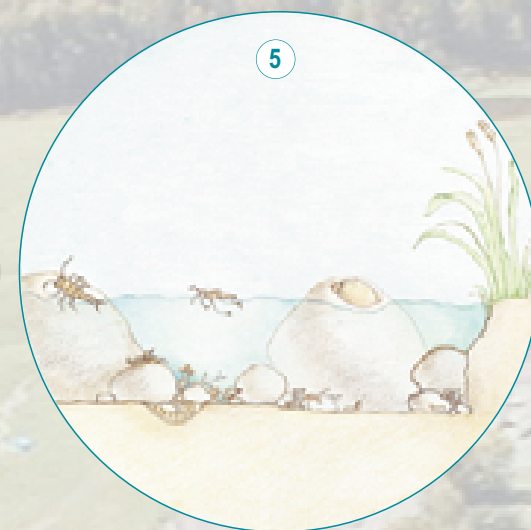
### 2 Medium Gradient Streams

Curves and vegetated streambanks absorb flood forces in streams running through narrow valleys and hollows; the streams provide a variety of habitats for different life-stages of many plants and animals.



### 3 Low Gradient Streams

These streams flow across broader valleys in wide curving meanders. Over time, people have straightened their meandering pattern of riffles and pools to make room for major roads and highways. Most development and agriculture occur along low gradient streams.



**4 Pools** - Typically found at bends in meandering streams, or at the base of rock steps in steeper streams. Their depth helps dissipate the energy of high flows and provides a place for sediment deposits after floods. Pools often have adjacent gravel bars, which can store finer sediment. Slower, deeper and colder water in pools offers critical habitat for aquatic species, enhanced by shade-giving trees during the heat of summer.

**5 Riffles** - Steeper and shallower than pools, riffles are typically found in straight sections between pools in meandering streams. Turbulence generated by riffles adds oxygen to the water, essential to the survival of many aquatic insect and fish species. Water speeds up as it flows through streambed gravels into the riffle, flushing the streambed with highly-oxygenated water, which provides the ideal location for fish eggs, deposited in clusters in the gravel called redds.

**6 Riparian Buffer** - The grass, shrubs, and trees along a stream make up a riparian buffer. These buffers offer many benefits. A buffer of native shrubs and trees filters out runoff and pollution between upland areas and the stream. The roots hold together streambanks,

protecting them and the floodplain above from excessive erosion. The buffer also provides food and cover to land and aquatic animals.

**7 100-year Flood Flow** - The 100-year flood has a 1% chance of occurring in any single year or a 30% risk of flooding over the life of a 30-year mortgage. This flow is used by the Federal Emergency Management Agency (FEMA) to identify areas at greatest flood risk.

**8 50-year Flood Flow** - The 50-year flood has a 2% chance of occurring in any single year. Bridge designers often use the depth and velocity of the 50-year flood in bridge designs.

**9 Bankfull Flow** - This is a common flood, occurring every year or two, that fills the active stream channel in the Catskills. This flow happens most often during spring snowmelt.

**10 Low Flow** - The deepest part of the channel, or thalweg, carries the low flows of summer. Low flow channel condition provides essential habitat during dry periods.

**11 Streambed** - The material that lines the stream channel bottom, or bed, moves during bankfull or higher flows. Various streambed areas provide important habitat for many stream organisms.

**12 Bars & Benches** - In gravel- and cobble-bed streams, bankfull and higher flows carry a lot of sediment. As floods recede and water slows, sediment begins to drop out or deposit, often as bars along the sides of the stream or behind obstructions. These features can change with each flood. Some bars become vegetated over time, with sedge or willow, eventually forming a low bench that functions as an important overflow area during floods.

**13 Floodplain** - Overbank deposits of fine sediment form the floodplain, an extension of the channel boundary that provides overflow areas during floods. The stream waters are spread out, vegetation slows over-bank flows, and water is absorbed into the ground, reducing flood peaks and protecting property.

**14 Terrace** - The active floodplain is the lowest terrace. Higher terraces are abandoned floodplains, formed when the streambed was at a higher elevation in the past.