THE CATSKILL CREEK WATERSHED

"To foster appreciation and understanding of the Catskill Creek Watershed through outreach to regional stakeholders to promote protection, conservation and stewardship of our natural environment for the benefit of all."

A description of the watershed, initiatives and recommendations

Catskill Creek Watershed
Awareness Project
December 2020

Acknowledgements

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Cornell Cooperative Extension
Columbia and Greene Counties

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A Program of the New York State Department of Environmental Conservation

Special thanks to Elizabeth LoGiudice, who spearheaded the work on the Catskill Creek Watershed. Her dedication and leadership have been a driving force for the protection and management efforts in the watershed. She has endeavored to provide innovative education, promote stewardship and her hard work constitutes much of what is represented in this document.

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Contents

Purpose

The purpose of this document is to serve as a resource about the watershed, to help guide decision making for future watershed projects and foster collaborations among stakeholders. It provides a description of the watershed, background on watershed initiatives and recommendations for furthering protection, conservation and stewardship. The watershed characterization is comprised of existing publicly available information which is supplemented by maps created by Greene County Soil Water Conservation District (GCSWCD) and descriptions of projects supported through the Catskill Creek Watershed Awareness Project.

Catskill Creek Watershed Awareness Project

The Catskill Creek Watershed Awareness Project (CCWAP) was started by Cornell Cooperative Extension of Columbia and Greene Counties (CCE-CG) in 2008 with support from the NYS Department of Environmental Conservation Hudson River Estuary Program. Overarching objectives of the project are protecting high quality streams, improving water quality, improving flood resiliency, restoring habitat, prioritizing sites for riparian buffer protection or restoration, and improving understanding of quantities of water needed for stream habitat and water supplies.

The preliminary goals of the project involved raising knowledge and awareness, fostering the creation of a group of concerned citizens to pursue watershed protection, and gathering baseline information on the creek. Early activities have included a literature search on the Creek, creation of watershed map and a power point on watershed protection, field visits to sites on the creek, presentations and/or introductory letters to Town Boards in the watershed, and the production of the Hudson Basin River Watch (HBRW) Catskill Creek report card. Other educational activities included a water film series, indoor presentations and stream studies for adults and watershed studies with school groups and a listening session to gain input from attendees on perceived impacts on the streams in the watershed. The listening session, held in September of 2009, was attended by a group of 20 people who discussed impacts to the streams in the watershed and prioritized impairments. Attendees identified these top priorities: Erosion, buffer zone width, insufficient riparian vegetation, and loss of habitat. These initial efforts to achieve project goals culminated with formation of the Catskill Creek Advisory Committee in January 2010.

The advisory committee articulated a CCWAP mission "to foster appreciation and understanding of the Catskill Creek Watershed through outreach to regional stakeholders to promote protection, conservation and stewardship of our natural environment for the benefit of all", outlined a set of 3 main goals and worked with CCE-CG to pursue funding and activities relating to those objectives.

During 2010-2011 CCE-CG secured funding for the project through New England Interstate Water Pollution Control Commission (NEIWPCC) and The Bank of Greene County that provided general support for the project, continued education and collaborative research efforts.

The committee met on a monthly basis and supported several efforts to further the goals of the project. GCSWCD worked to delineate management units along the creek mainstem and developed a series of corresponding maps available in GIS format. In addition to numerous

educational programs, a facebook page was created and a page on the CCE-CG website was initiated. The CCWAP cooperated with Riverkeeper for two years to test the levels of Enterococcus bacteria in portions of the Catskill Creek. Each month from May to October, volunteers collected water samples and delivered them to the RiverKeeper patrol boat for testing. Another project the committee supported in partnership with Hudsonia, Inc. to map habitats in the Catskill Creek Watershed. The work resulted in a detailed report, "Significant Habitats of the Catskill Creek Corridor," which includes maps of habitat type along the Catskill Creek mainstem above the dam in Leeds.

After watershed communities sustained major flood damage from Hurricane Irene and Tropical Storm Lee in 2011, CCE-CG began collaboration in the Hudson Estuary Watershed Resiliency Project, now named the Climate Resilience Partnership (CRP). The CRP is a project of Cornell University and Cornell Cooperative Extension (CCE), in partnership with the NYS Water Resources Institute at Cornell University and with support from the NYS Department of Environmental Conservation's Hudson River Estuary Program. The role of CCE in this project was to develop capacity in local municipal officials, highway personnel, and riparian landowners to implement watershed resiliency strategies and minimize future flooding impacts, while also properly responding to storm impacts to streams and adjacent and associated infrastructure. As part of this regional project CCE-CG advanced a variety of CCWAP initiatives to educate and engage municipalities with a focus on watershed and climate resiliency. CCE-CG began working directly with municipalities and partners like GCSWCD to share information on stream science, flooding, and watershed planning. Independent of the CCWAP, Schoharie County Planning Department was awarded funding to develop a flood study of the Franklinton Vlaie which is the headwater source of the Catskill Creek watershed. "Franklinton Vlaie Tributary Improvement Study/Design" was completed in 2018 with funding from the New York State Environmental Protection Fund through the DEC Hudson River Estuary Grant Program awarded in 2016.

In 2017, CCE-CG was awarded funding from the New York State Environmental Protection Fund through the DEC Hudson River Estuary Program in support of the CCWAP project to continue to work with the watershed protection group and to work with municipalities to create a watershed protection plan. This effort has involved the re-engagement and expansion of the advisory committee, educational activities aimed to gather input and development of this resource document.

Introduction

"*Catskill Creek*" by Thomas Cole, 1845.

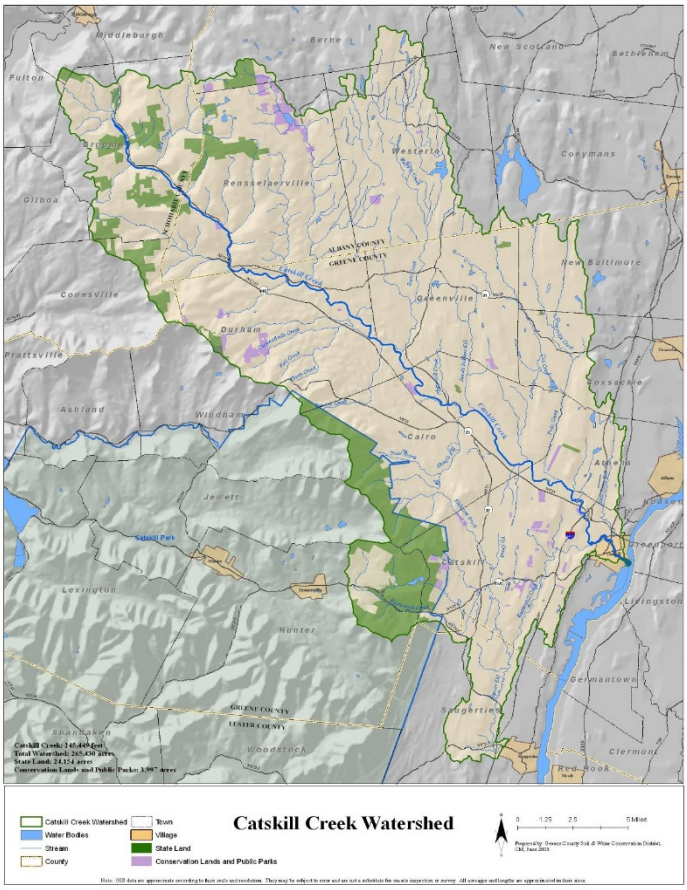
The Catskill Creek is a beautiful and vibrant stream that runs through the rural landscape of the Catskill Mountains' northern foothills. The creek has met the needs of human inhabitants of the Hudson River Valley for millennia, serving as a transportation route for indigenous peoples and the European settlers that followed. Catskill Creek has provided food, water, power and recreation for the people who live on its shore for thousands of years.

The creek also provides the aesthetic beauty that has helped make the Hudson Valley a destination for artists and nature lovers from around the world. In the 19th Century, the region was a mecca for painters from the Hudson River School of Art. Painter Thomas Cole, who built a home in the Village of Catskill, often depicted the Catskill Creek in his work. His pupil, painter Frederic Church, would build a magnificent villa, Olana, which sits high on a hill in Columbia County. There, it commands a view of the Hudson River and the Catskill Creek watershed on the river's western shore.

The Catskill Creek is an asset to the economy of the region. Its scenic beauty and recreational opportunities support tourism, marinas and fishing-related enterprises. Its waters are used for irrigation by several nurseries and farms, and a small hydro-electric dam is located on the Creek in Leeds.

The Catskill Creek is approximately 36 miles in length and is a major tributary to the Hudson River Estuary. The creek begins in the Franklinton Vlaie in the Town of Broome, Schoharie County, and meets the Hudson River at the Historic Catskill Point in the Village of Catskill. Upstream reaches of the Catskill Creek are considered prime trout habitat; portions of the stream are classed as supporting trout spawning by NYS Department of Environmental Conservation. The lower 1.5 miles of the creek are influenced by the Hudson River's tides and provide spawning grounds for many species of fish, including herring.

Watershed Boundaries



The Catskill Creek watershed is 415 square miles in size and is located in 17 towns in four counties. The Catskill Creek watershed comprises 927 miles of tributary streams, making it the third largest contributor of water to the Hudson River Estuary. It is only surpassed by the Rondout/Walkill and Kinderhook/Stockport watersheds, the first and second largest contributors, respectively.[1] The Catskill Creek watershed is bounded by the northeastern escarpment of the Catskill Mountains to the south, the Helderberg Plateau to the northwest, and the Kalkberg Hills to the east.

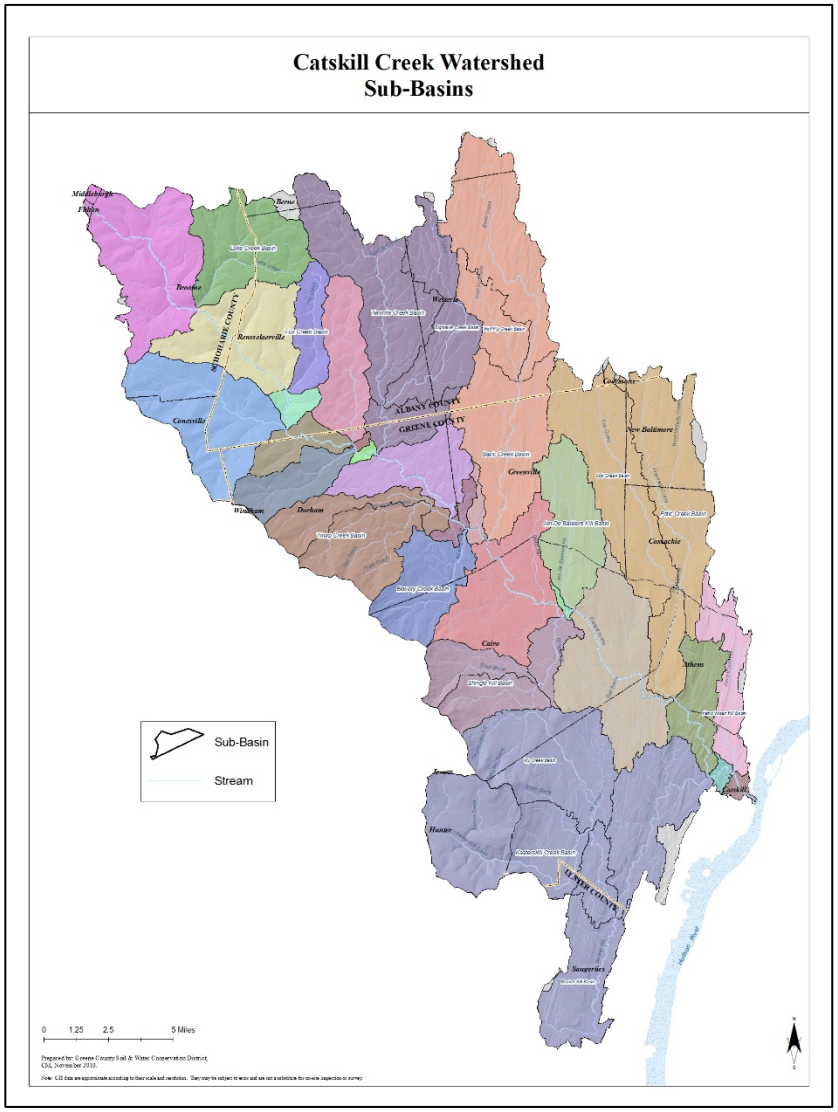
The municipalities located within the Catskill Creek watershed in Schoharie County include portions of the towns of Broome, Conesville, and a tiny land area straddling the towns of Fulton and Middleburgh. In Albany County, large portions of the towns of Rensselaerville and Westerlo as well as small sections of Berne and Coeymans, are within the watershed. In Greene County, eight of the thirteen towns are located within the Catskill Creek drainage basin. The towns of Durham, Greenville, Cairo and Catskill, as well as portions of the towns of Hunter, New Baltimore, Coxsackie and Athens are in the watershed. Northern portions of the town of Saugerties in Ulster County are also within the Catskill drainage basin, with the waters of the Beaverkill flowing north to meet the Kaaterskill Creek not far from its confluence with the Catskill Creek.

County	**Municipality**
Schoharie County	Broome
	Conseville
	Fulton
	Middleburgh
Albany County	Rensselaerville
	Westerlo
	Berne
	Coeymans
Greene County	Durham
	Greenville

[1] NYS DEC Lower Hudson Waterbody Inventory/Priority Waterbodies List Report, 2008

	Cairo
	Catskill
	Hunter
	New Baltimore
	Coxsackie
	Athens
Ulster	Saugerties

Sub-Basins



The Catskill Creek watershed encompasses thirteen sub-basins described by its named tributaries. In the northwestern area of the watershed, the Lake Creek basin straddles Schoharie and Albany Counties in the northern reach of the Towns of Rensselaerville and Broome.

In Rensselaerville, the Fox Creek basin is located southeast of the Lake Creek basin, and the Ten Mile Creek basin comprises a large landmass that encompasses parts of the Towns of Rensselaerville and Westerlo to the east. The Eight Mile Creek is a major tributary within the Ten Mile Creek basin.

The Basic Creek sub-basin drains the eastern portion of the Town of Westerlo, including the Basic Reservoir, which supplies water to the City of Albany. The Wolf Fly Creek is a tributary of the Basic Creek. The Basic Creek sub-basin ranges south to encompass a significant portion of the Town of Greenville.

Further to the east, the Potic Creek basin includes parts of the Greene County towns of Greenville, New Baltimore, Coxsackie and Athens, with tributaries that include the Cob, Grapeville and West Medway Creeks. Also in Athens, the Hans Vosen Kill Basin comprises the eastern-most sub-basin of the Catskill Creek watershed.

In the northwestern portions of Greene County, the Thorp Creek basin includes most of the Town of Durham, with the Fall Creek and Cornwallville Creeks entering the Thorpe Creek upstream

from its confluence with the Catskill. In the Town of Cairo, the Bowery Creek and Shingle Kill basins contribute to the land area that is not drained directly into the mainstem of the Catskill Creek.

The Kaaterskill Creek watershed is the largest sub-basin in the Catskill Creek basin, and encompasses portions of the Towns of Hunter, Catskill and Saugerties in Ulster County. Kaaterskill Creek itself flows dramatically off of the Catskill Escarpment as the two-tiered Kaaterskill Falls, which, with a total height of 259 ft, makes it the tallest waterfall in New York State.

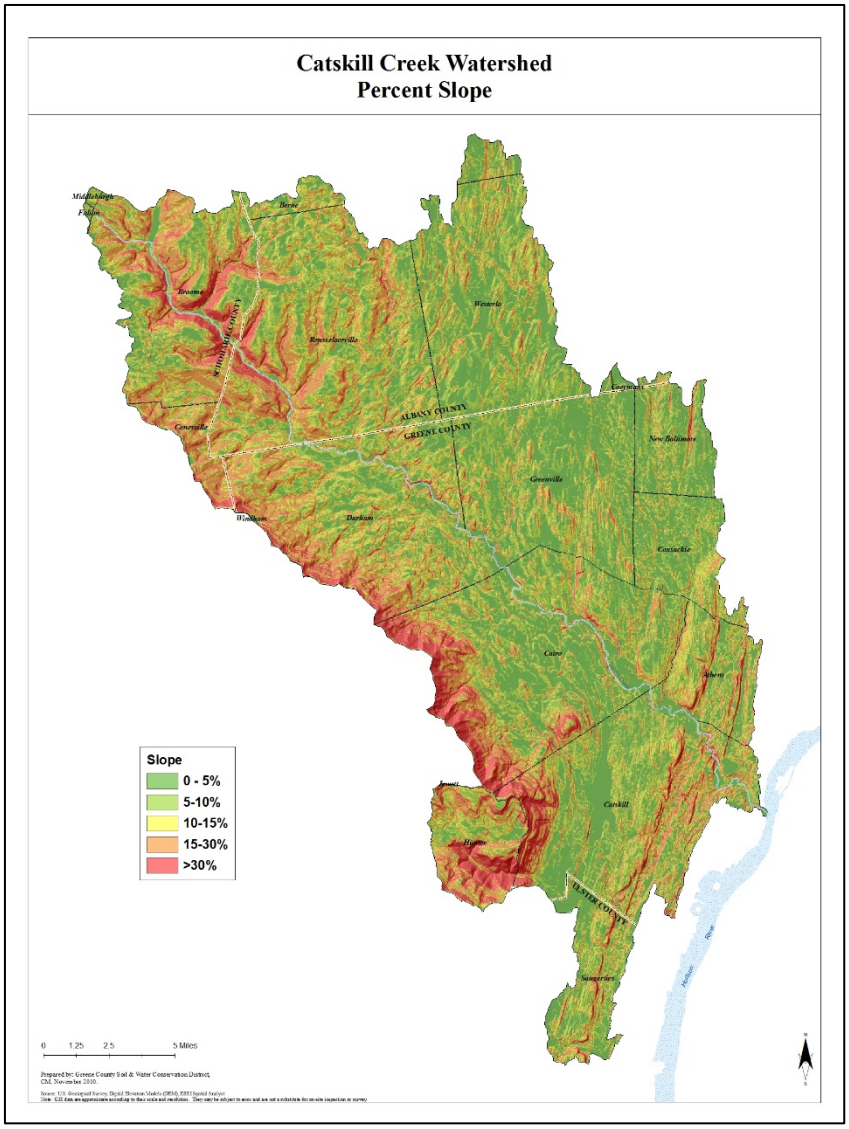
The Kaaterskill Creek has two major tributaries that are large enough to merit named sub-basins. The Vly Creek basin includes parts of the Town of Cairo and Catskill, with the Countryman Kill and the Kiskatom Brook as tributary streams. The Beaver Kill Basin is located in the Town of Saugerties, with the Beaver Kill flowing north into the Kaaterskill Creek. The Kaaterskill Creek has other named tributaries in addition to the Vly and the Beaver Kill, including Spruce Creek in the town of Hunter and the Stony Brook, which flows through the towns of Cairo and Catskill.

Landscape Features

Topography

The source of the Catskill Creek is at an elevation of 1,180 feet, and its mouth is only a few feet above sea level at the Hudson River Estuary. The Catskill Creek is considered a high to medium gradient stream in upland sections and the stream runs through areas of steep slopes (greater than 30%) in the northwest section of its corridor.

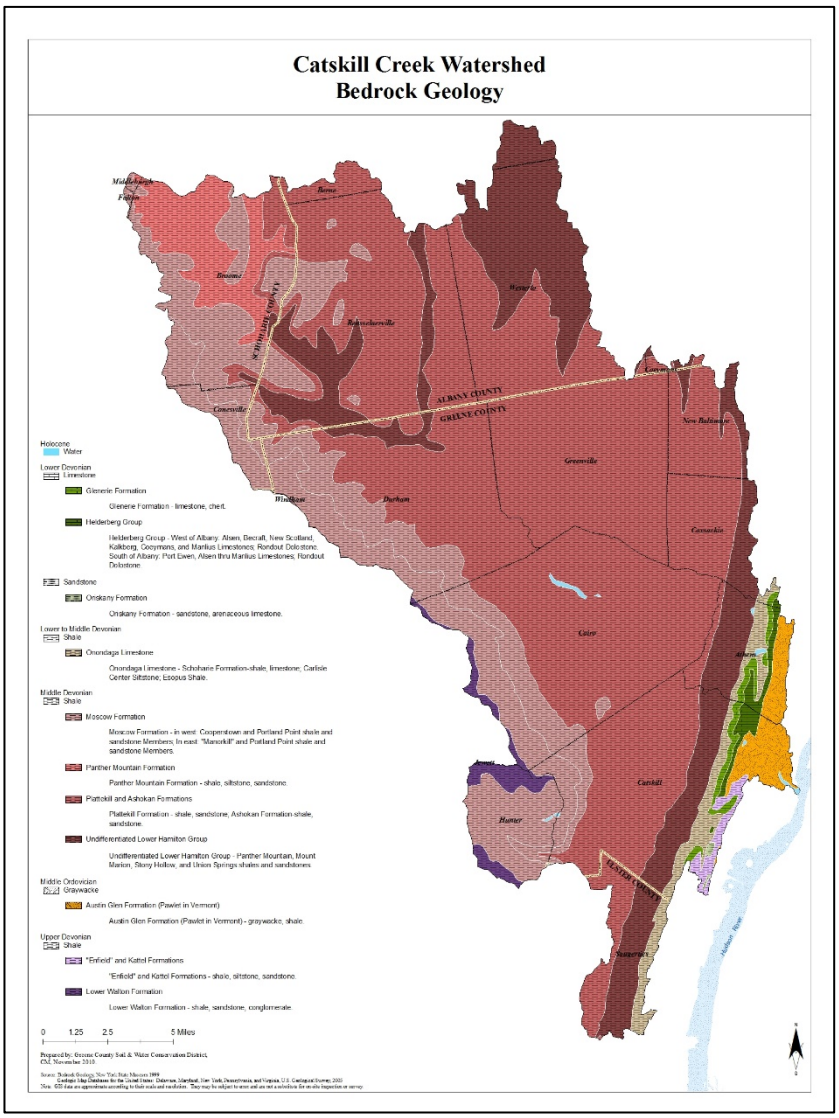
The topography of the watershed can be generally described as rolling hills, and much of the landscape is contained within the Appalachian Plateau. An exception to this description is the Catskill escarpment, which defines the southern extent of the watershed and rises to an elevation of 3,000 feet above sea level and to nearly 4,000 feet in the mountains which form a backdrop.



Geology

The Catskill Creek Watershed is located within two physiographic provinces: the Appalachian Plateau and the Hudson Valley section of the Ridge and Valley Province. The Catskill Escarpment is within the Catskill Section of the Appalachian Plateau. The Appalachian Plateau extends continuously from New York to Alabama and forms the western boundary of the Appalachian Mountains. The rocks of this plateau are sedimentary rocks of similar age and type to those found in the Valley and Ridge province.

In New York State, the Appalachian Plateau stretches eastward from south of Rochester and Syracuse to the Helderberg Escarpment southwest of Albany. The plateau surface rises in this direction until it becomes the Catskill Mountains. Rivers and their tributaries have cut the originally level Appalachian Plateau into hilly uplands. This branching drainage pattern typically is developed by streams eroding horizontal layers of rock (Rogers et al., Date Unknown).[2]



The second physiographic province in the Catskill Creek watershed is the Hudson Valley section of the Ridge and Valley Province. This Province has three physiographic subdivisions. The first subdivision is a level terrace boarding the Hudson River that is not considered within the boundaries of the Catskill watershed. The next section is a range of low hills about one mile wide, known as the Kalkberg (Dutch for "limestone mountain"). The Kalkberg hills range in elevation from 300 feet in the south to 500 feet in the north. They consist of limestone, shale and sandstone of Late Silurian and Devonian age. To the west, the Kalkberg hills meet the Hoogeberg (Dutch for "high mountain"), which are numerous rounded hills that range in elevation from 800 feet in the east to 1,000 feet in Durham. The elevation continues to increase until the Hoogeberg merges with the

[2] DMA 2000 Hazard Mitigation Plan, Greene County, NY, 2009

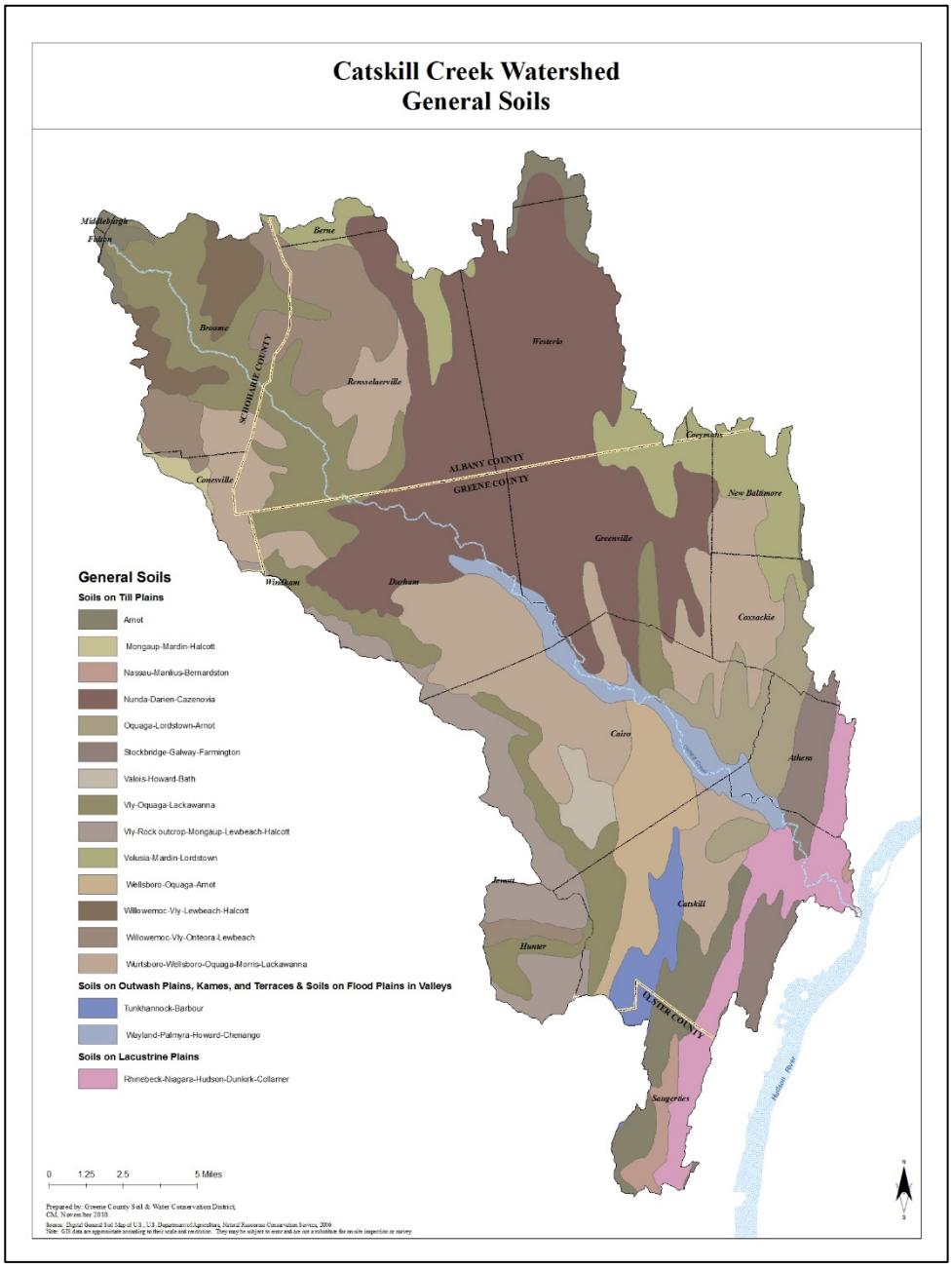
2,000 foot Heldeberg Plateau in Albany and Schoharie counties.[3]

The bedrock underlying the land in the Catskill Creek watershed is composed of limestone, sandstone and shale from the Devonian period. The majority of the land area, including all of the central portions of the watershed, is underlain by the Plattekill and Ashokan Formations (shale and sandstone). The southern boundary of the watershed, which is characterized by the Catskill Escarpment, is composed of Moscow Formation (shale and sandstone) from the Middle Devonian period. A portion of the northeast and northwestern boundaries of the watershed are underlain by undifferentiated lower Hamilton group (shale and sandstone). Sections of the town of Broome, including the Franklinton Vlaie, are underlain by Panther Mountain Formation. The eastern edge of the watershed is Onondaga limestone, with portions of Athens underlain by the Austin Glen Formation from the Middle Ordovician period and the Glenerie Formation (limestone, chert) and Helderberg group (limestone, dolostone) from the upper Devonian period.

[3] Soil Survey of Greene County NY, USDA, 1993

Soils

There is a diversity of soils in the Catskill Creek watershed. Soils identified as prime farmland include Tunkhannock, Lackawanna, Lordstown and Chenango, which are present in some areas of the watershed. Soils of state economic importance that are found within the watershed include Willowemoc, Volusia, Vly, Hudson and Arnot.

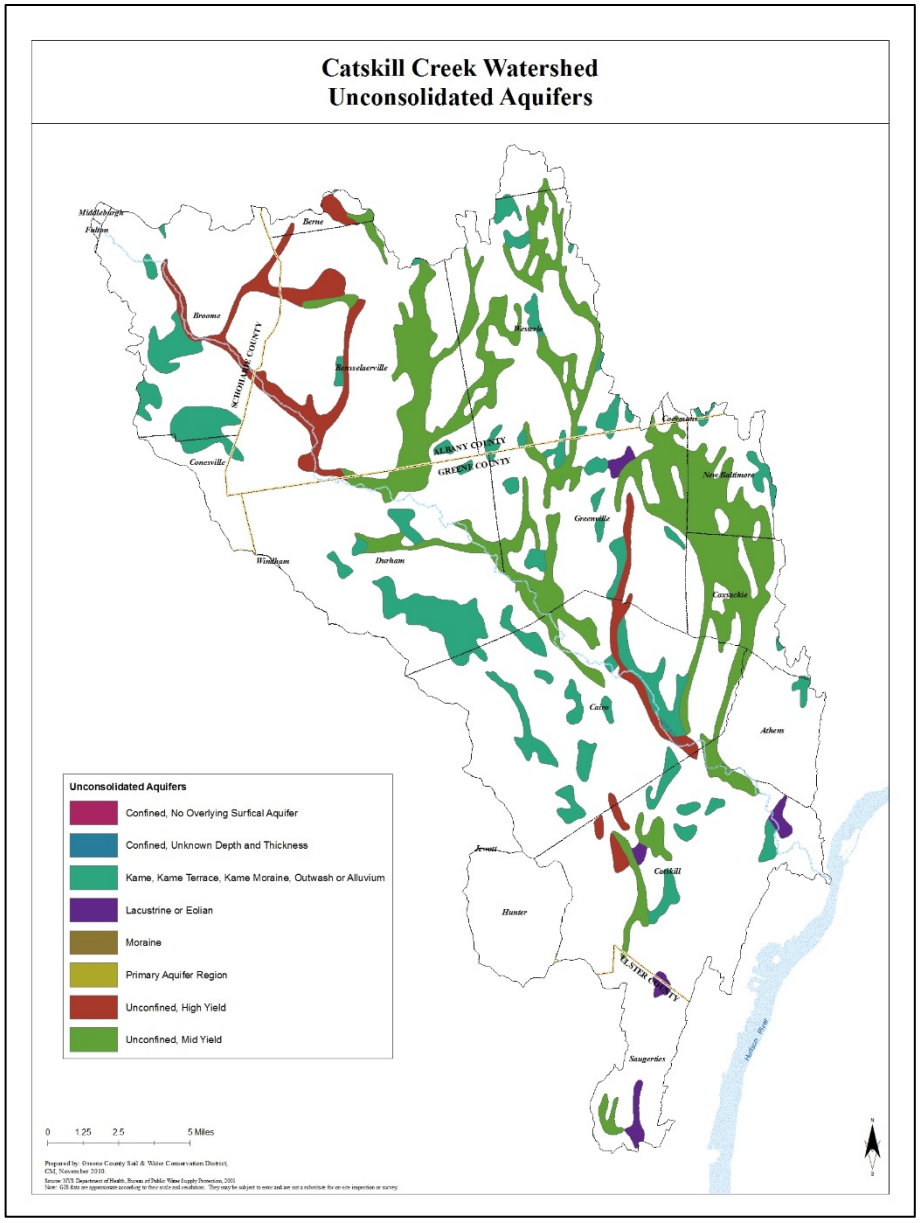


North western sections of the watershed, including portions of Broome, Rensselaerville and Durham, contain soils in the Willowemoc series, which consists of very deep, moderately well drained soils on glacial till plains. North central portions of the watershed are in the Nunda series, which consists of very deep, moderately well drained soils. Nunda soils are associated with Arnot, Lordstown and Tuller soils, which are shallower to bedrock.

East central portions of the watershed are dominated by the Arnot -Lordstown series, and far eastern sections of the watershed include soils of Lacustrine plains, such as Rhinebeck-Hudson series. In general, soils present in the watershed are limited in their ability to provide adequate absorption for sewage leech fields, but each locality should be evaluated individually before installation of on-site waste water treatment.

Aquifers

An aquifer is a geologic formation composed of rock, till, sand, gravel, and/or sediment that is capable of storing and transmitting water in usable quantity to a spring or well. An unconsolidated aquifer is defined as an aquifer that is comprised of loosely formed geologic materials, such as sand and gravel.[4] As the accompanying map illustrates, much of the Catskill Creek watershed is underlain by unconsolidated aquifers. An unconsolidated aquifer is a place where groundwater is stored in saturated sand and gravel deposits. Most such aquifers are in glacial outwash and kame deposits, and some are in lacustrine sands (Figure 5). The aquifers represent the largest and most accessible potential water sources for shallow wells. The aquifer areas are important for recharging groundwater through the coarse, permeable sand and gravel material, but that material is also an efficient conduit for contaminants introduced by above-ground human activities. For those reasons, protection of the aquifer areas from inappropriate uses is especially important.



Climate & Stream Flow

The Catskill Creek Watershed generally experiences seasonable weather patterns characteristic of the northeastern United States, but temperature averages vary over the watershed due to elevation and proximity to the Hudson River. Warm summers are typical, with occasional high temperatures and humidity. Midsummer temperatures typically range from about 68°F to 80°F. The winters of the region are long and cold. Winter high temperatures are usually in the upper 20s to lower 30s °F, with minimum temperatures of 15°F expected. As an inland, mostly mountainous watershed winter temperatures are relatively cooler than other areas in the NorthEast located near large bodies

[4] NYS Source Water Assessment Program Plan, NYS Department of Health (DOH), 1999

of water like the great lakes and ocean. Snow accumulates to an average depth of 68 inches each year, but this is dependent on elevation and proximity to the Hudson River, where the average snow depth is 44 inches each year (Greene County Department of Planning and Economic Development, 2000).[5]

The total annual precipitation is about 37 inches, 50% of which usually falls in April through September. The average relative humidity in the mid-afternoon is about 55 percent. Humidity is higher at night and the average at dawn is about 80%. The sun shines 60% of the time possible in summer and 40% in winter. The prevailing wind is from the south. The average wind speed reaches a high of 11 mph in spring. [6]

Stream flow was gauged at Oak Hill for 67 years (1910 to 1977) at an average annual rate of 126 cubic feet per second (cfs). Catskill Creek stream flows are extremely variable. The maximum flow of record for the creek at Oak Hill was 12,500 cfs during November of 1950. There was no flow for all or part of each of six days during September of 1964 and from August 29 to September 3, 1966.[7]

Land Cover

The Catskill Creek and its tributaries constitute a 927-mile river system. The watershed rises in the Franklinton Vlaie, a large marsh and lake complex in the Town of Broome, Schoharie County, and flows generally southeast approximately 36miles (58 kilometers), and empties into the Hudson River estuary in the Village of Catskill, Greene County.

The bedrock geology throughout the Catskill Creek watershed is sedimentary rock—shales, siltstones, and sandstones—and the surficial material is mostly glacial till (Fisher et al. 1970, Cadwell et al. 1986). The stream itself runs through a narrow corridor of glacial outwash alternating with alluvial deposits for much of its length (Cadwell et al. 1986), and is controlled by bedrock exposures at some places, most prominently in the lower reaches.

The Catskill Creek watershed is hilly and largely forested, but also contains significant areas of active and abandoned farmland. The creek mainstem runs through rural forested and open landscapes and several hamlets. Major tributaries to the Catskill include the Potic Creek, Kaaterskill Creek, Basic Creek, and Tenmile Creek. Most of the length of Catskill Creek mainstem is classified as a trout stream, and the reach above the Durham hamlet is classified as trout spawning habitat by the New York State Department of Environmental Conservation (NYSDEC), indicating cool, clean-water instream habitats with unsilted substrates, capable of supporting pollution-sensitive fish and other organisms.

[5] DMA 2000 Hazard Mitigation Plan, Greene County, NY, 2009
[6] Soil Survey of Greene County NY, USDA, 1993
[7] A Management Plan for the Trout Fishery of the Catskill Creek, NYS DEC 1995

Forest

The land cover of the Catskill Creek watershed is predominantly forested, with nearly 179,698 acres of forest, comprising 68% of the watershed. Deciduous forest is identified as covering nearly 44% of the landscape; evergreen forest comprises over 10% of the landscape, and the remaining 14% of woodlands are characterized as being mixed forests. The vast majority of these forests are second growth, the original forests having been cleared for agriculture in the 17th-19th centuries. Major forest communities include floodplain forests, sugar-maple dominated northern hardwood forests, oak-hickory-pine forests, rare limestone woodlands and dark hemlock ravines.

Rich calcareous hardwood forest and ledges on Catskill Creek

Farm Land

The Catskill Creek watershed includes other rural land cover, such as pasture and hayfields, which are especially abundant in the Albany County towns of Rensselaerville and Westerlo and the Greene County towns of Greenville and Durham. In addition to hay and livestock, agricultural endeavors within the Catskill Creek watershed include vegetable and fruit production, as well as maple syrup and other forest farming crops. Cultivated crops, pasture and hayfields employ 32,763 acres, covering over 12% of the watershed.

Ever-changing ecosystem: a willow struggles against seasonal flooding in Catskill Creek.

Grasslands, Shrub-lands & Barren Land

Land characterized as grassland and scrub/shrub are likely to be abandoned farm fields that are in stages of succession as they revert back to forest. Less than 1% of the watershed, or 2,270 acres

are identified as grassland or scrub/shrub lands. A little more than 178 acres, or .07% of the watershed is identified as barren land.

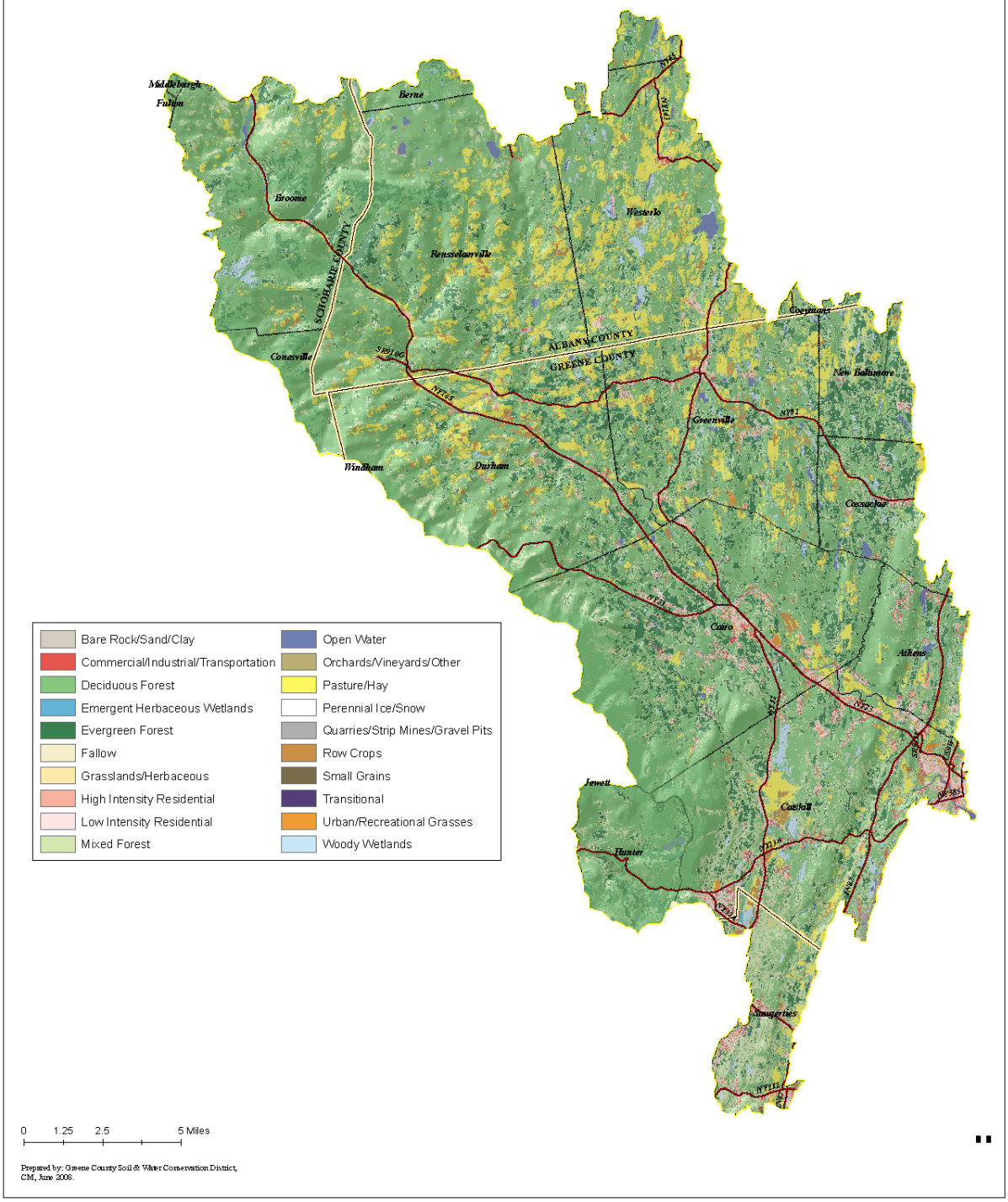
Developed Land

High, medium and low intensity human development constitutes 3,427 acres or 1.28% of the watershed. Typical of rural areas, the majority of this development is characterized as low intensity residential development (0.91%).

Developed Open Space

As defined by the US EPA, developed open space is grassy open land with less than 20% impervious surface cover, which constitutes more than 5% of the watershed. Developed open space includes municipal parks, golf courses and large lawn areas in residential settings.

Catskill Creek Watershed
Land Cover



Prepared by: Greene County Soil & Water Conservation District,
CM, June 2008.

Land Classification	Square Feet	Acres	Percent
Barren Land	7,778,151.6	178.56	0.07%
Cultivated Crops	311,201,846.7	7144.21	2.69%
Deciduous Forest	5,044,864,105	115,814.14	43.62%
Developed High Intensity	8,311,019.8	190.79	0.07%
Developed Low Intensity	105,822,775.7	2,429.36	0.91%
Developed Medium Intensity	35,163,957.9	807.25	0.30%
Developed Open Space	668,001,332.7	15,335.20	5.78%
Emergent Herbaceous Wetland	10,864,360.2	249.41	0.09%
Evergreen Forest	1,158,607,045	26,597.96	10.02%
Grassland/Herbaceous	50,461,217.7	1,158.43	0.44%
Mixed Forest	1,624,231,295	37,287.22	14.04%
Open Water	87,980,527.3	2,019.75	0.76%
Pasture/Hay	1,115,953,392	25,618.76	9.65%
Scrub/Shrub	48,408,720.8	1,111.31	0.42%
Woody Wetlands	1,288,433,778	29,578.37	11.14%
Total	**11,566,083,524**	**265,.520.74**	**100.00%**
Data from National Land Cover Database 2001 (NLCD 2001), US Geological Survey			

Streams & Water Quality

The Catskill Creek Watershed contains 927 miles of streams, making it the third largest contributor of water to the Hudson River Estuary. Named tributaries to the Catskill Creek include, from South to North- the Kaaterskill Creek, Hans Vosen Kill, Potic Creek, Bell Brook, Jan de Bakkers Kill, Platte Kill, Shingle Kill, Basic Creek, Bowery Creek, Thorp creek, Cornwallville Creek, Ten Mile Creek, Eight Mile Creek, Fox Creek and Lake Creek.

Water Quality Classification

According to the NYS DEC, different reaches of the Catskill Creek have different water quality classifications. A classification of AA or A is used to classify drinking water; classification B is suitable for swimming or other contact recreation, but not drinking water; classification C is for waters supporting fisheries, but not suitable for contact recreation; and the lowest classification is C. Waters are also designated as T if they are capable of supporting trout and TS if they are capable of supporting trout spawning. NYS DEC classifications of the Catskill Creek are as follows:

Catskill Creek at Hudson River to Cauterskill Road -Class C

Catskill Creek - Cauterskill Road to Route 23 crossing - Class B

Catskill Creek - Route 23 crossing to Freehold - Class B (T)

Catskill Creek - Freehold to CR 27 in Oak Hill -Class C (T)

Catskill Creek - CR 27 in Oak Hill to Vaughn Hill Road, Broome - Class C (TS)

Catskill Creek - Vaughn Hill Road, Broome to Franklinton Vlaie - Class B

Water Quality Data and Impairments

The Catskill Creek has been the subject of water quality monitoring both by the NYS DEC and Hudson Basin River Watch (HBRW). These water quality monitoring programs focus on the presence or absence of macroinvertebrates that have been identified as stream health indicators, as well as observation of the site as whole. Currently, none of the streams in the Catskill Creek Watershed appear on the NYS 303(d) list of impaired water bodies. The 1997 Rotating Integrated Basin Studies (RIBS) program monitoring of eight sites on the creek assessed five sites as non-impacted and three sites as slightly impacted. Slightly impacted sites include the Hamlet of Leeds just off Warren Stein Road (RM 13.7). This site also showed slight impacts during HBRW water quality monitoring in 2007. Another spot that was assessed as slightly impacted in 1997 is located in the Albany County town of Preston Hollow, off of NYS Route 145 (RM 29.4). This site was identified as non-impacted in the 2007 HBRW monitoring. The third site assessed as slightly impacted by DEC in 1997 is also in the Hamlet of Leeds, 50 m above the Route 23B bridge (RM 6.2). This site was assessed in 1997, 1998 and 2002 by DEC and in 2007 by HBRW and has been assessed as slightly impacted each year.

Impacted Sites identified in RIBS, HBRW and NYSDEC Monitoring Programs

Location Municipality	Impact	Year	Monitoring Program
Warren Stein Road (RM 13.7) Hamlet of Leeds	Yes, slight	1997	RIBS
	Yes, slight	2007	HBRW
NYS Route 145 (RM 29.4) Preston Hollow	Yes, slight	1997	RIBS
	No	2007	HBRW
Route 23B Bridge (RM 6.2) Hamlet of Leeds	Yes	1997	RIBS
	Yes	1998	DEC
	Yes	2002	DEC
	Yes	2007	HBRW

The HBRW 2007 watershed report card for the Catskill Creek found three additional slightly impacted sites that were identified as non-impacted during the 2007 DEC assessment. Two of those sites are on tributary streams, the Cornwallville Creek in the town of Durham and the Shingle Kill in the Town of Cairo. The third site is located in the Town of Durham, just below the Route 67A bridge. This site is unusual of all the slightly impacted sites as the Impact Source Determination indicated a community affected by toxic sources, while other impacted sites indicated non-point nutrient additions.

In August of 2010 HBRW returned to four of the five sites that were assessed as slightly impacted in 2007 (Leeds RM 6.2 was not re-assessed). All four sites were assessed as non-impacted, but HBRW notes that the stream flow was so low in 2010 that results need to be verified with further monitoring.

In 2011, the Catskill Creek Watershed Advisory Committee began collecting water samples from the Catskill Creek in the Town of Catskill in collaboration with the Riverkeeper, Inc. Enterococcus study. *Enterococcus* is a fecal indicating bacteria that lives in the intestines of humans and other warm-blooded animals. *Enterococcus* ("Entero") counts are useful as a water quality indicator due to their abundance in human sewage, correlation with many human pathogens and low abundance in sewage free environments. Committee members collected samples at locations in the Village of Catskill to the stone bridge in Leeds and Riverkeeper examined the samples for the presence of Enterococcus bacteria, which can indicate sewage contamination of water. Committee members took samples four times during the summer of 2011 and continued the study through 2012. One sample was taken directly from the storm water outfall pipe in the Hamlet of Leeds that has been shown to contain sewage contamination, as well as upstream and downstream sites. The samples from the pipe consistently indicated unexceptable levels of Enterococcus. Interestingly, samples of creek water upstream of the outfall pipe also consistently indicated the presence of Enterococcus.

In general, contamination from illegal sewer pipe connections into Catskill Creek has been a major problem the creek's lower reaches. Investigations by state and local agencies resulted in enforcement action in 2012. The crackdown on illegal dischargers, along with upgrades to Cairo's municipal wastewater treatment plant in 2010, should lead to reductions in fecal-indicating bacteria in this part of Catskill Creek, and Riverkeeper's sampling program will monitor for improvements.

Beyond the Catskill Creek Watershed Advisory Committee sampling, staff of Cornell Cooperative Extension and community volunteers have continued sampling the Catskill Creek in partnership with Riverkeeper, Inc. As of 2020, 10 sites are routinely sampled from the headwaters to the mouth.

The Catskill Creek has one of the lowest overall levels of contamination (as measured by the weighted average of samples, the geometric mean) that Riverkeeper or other groups have measured in the Hudson Valley. At several sampling locations, water quality was often suitable for swimming and other "primary contact" recreation. Average Entero counts were about five times higher in samples collected after rain, compared to dry weather samples. Average Entero counts have increased since sampling began in 2012, with a pronounced upward shift in 2017.

According to the NYS DEC Lower Hudson Watershed Inventory/Priority Waterbodies List Report of 2008 (LHW WI/PWL), the Middle Catskill Creek and minor tributaries (from Cauterskill to Freehold) suffer from minor impacts, and water quality is stressed for public bathing, aquatic life, recreation and aesthetics by nutrients (phosphorous), pathogens, odors and solids. The source of pollution is the Town of Catskill sanitary discharge and suspected on-site septic system failures. The report states that six of the eight sites tested in this reach assessed as non-impacted, but unpermitted discharges into the creek in the Hamlet of Leeds was investigated in March, 2008. The lower portions of the Catskill Creek remain unassessed and the upper portion and minor tributaries have been assessed as having no known impacts.

Austin's Glen, Catskill, NY

Major tributaries of the Catskill Creek, including the Ten Mile Creek, Basic Creek, and Shinglekill are assessed as no known impacts. It should be noted that the Shinglekill had been included on the NYS 2008 Section 303(d) List of Impaired Waters due to raw sewage discharges. The Shinglekill received the no known impact rating after the Village of Cairo constructed a community wastewater treatment system in 2010. The lower main stem of the Catskill Creek remains unassessed and the upper portions and minor tributaries are assessed as no known impacts.

According to the NY Association of Conservation District's Catskill Creek Watershed Restoration and Protection Strategy, streambank erosion is primary issue affecting water quality in the Catskill Creek. To quote the strategy "A 1985 assessment flagged 93 sites along the Catskill in need of stabilization. Lack of funding continues to be the main obstacle in remediation."[8]

Flooding

Flooding is a major issue in areas of the Catskill Creek watershed. According to the Greene County Water Dependent Use Inventory and Assessment (2008) "Whereas damaging floods along the main river are relatively infrequent, this is not the case in the Catskill Creek area. On most days, the lower navigable section of the creek seems very tame, rising and falling with the tides. With increasing frequency, the lower Catskill Creek has been experiencing significant impacts from flood waters generated in the stream's watershed. The Catskill Creek drainage area is immense, stretching well into Schoharie and southwest Albany counties, and it often experiences major flooding.

Flood along Catskill Creek in Leeds

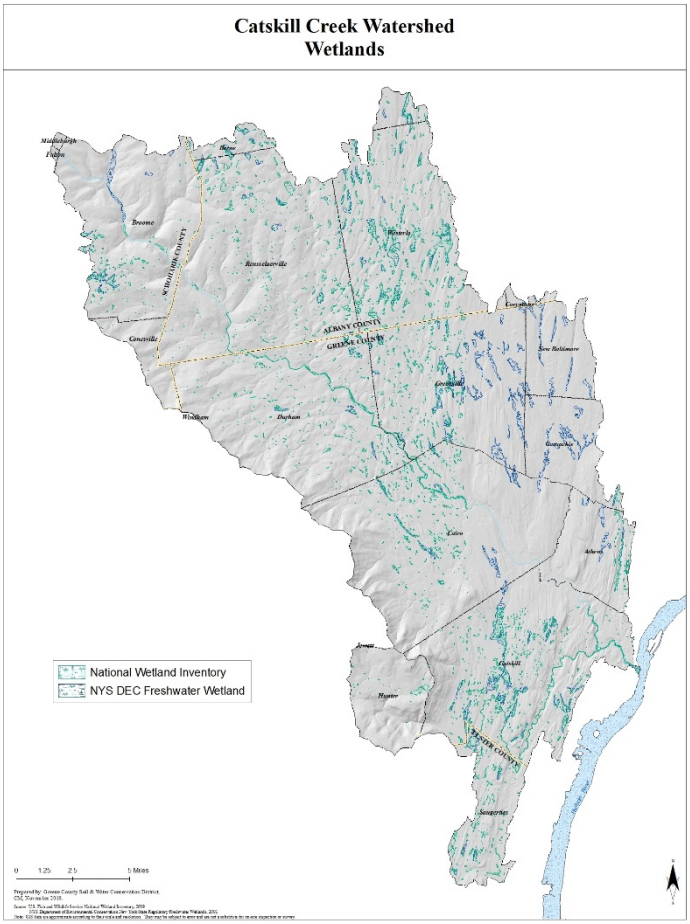
The flooding potential is further impacted by the watershed's characteristics. The steep north facing slopes of the Catskill Mountains have a tendency to cause many storms to dump excessive rainfall which drains to the Hudson. In addition, the Kaaterskill Creek, a primary tributary, is located just above the Village of Catskill. The Kaaterskill Creek is characterized by extremely steep topography and is frequently subjected to short-duration rain storms of very high intensity.

These factors, combined with the Kaaterskill's lack of major floodplains to attenuate flood waters, often result in high velocity discharges to the Catskill Creek. During these flood events, the velocity and elevation of the flood flows as well as the extensive woody debris washed from eroding stream banks in the watershed can cause serious damage to water dependent infrastructure."

In 2011, rainfall from Tropical Storms Irene and Lee demonstrated the impacts of flooding on the watershed. Gary Wall, the Associate Director for Science in the USGS New York Water Science Center, studied the sediment transport caused by these extreme events within the Hudson River Estuary. Data for discharge and suspended sediment was collected on the Catskill Creek with a monitoring station installed a few months prior to these events. The following is an excerpt from Sediment transport due to extreme events: The Hudson River estuary after tropical storms Irene written by LeeDavid K. Ralston,John C. Warner,W. Rockwell Geyer,and Gary R. Wall*"Tropical Storm Irene produced rainfall totals of 10 to 25 cm over eastern New York and western New England, but parts of the eastern Catskill Mountains in the Hudson watershed received up to 45 cm. About 2weeks later, the remnants of Tropical Storm Lee dropped heavy precipitation over northeastern Pennsylvania and central New York. Rainfall in the Hudson watershed was less than from Irene, but 8 to 20 cm fell on saturated soils and led to substantial runoff. The consecutive events produced flooding in the Hudson watershed and in the Catskills in particular, most notably Schoharie Creek that discharges into the Mohawk River and Catskill Creek that discharges into the tidal Hudson.... Shortly after Irene, new sediment was concentrated near the major fluvial sources: the Mohawk River (240 km) and Catskill Creek (180km). After the storm, the new sediment moved seaward and accumulated in several depositional regions, particularly near the source tributaries. The mass of new sediment in the upper river was greatest shortly after Lee (~day 155) and then decreased as it was remobilized and moved seaward."*

Wetlands and Water Bodies

A wealth of wetlands are contained within the boundaries of the Catskill Creek watershed. In the upland portion of the watershed, the 365-acre Franklinton Vlaie and several smaller wetlands comprise the headwaters of the creek. The Towns of Rensselaerville, Westerlo, Greenville and Catskill are particularly rich in wetlands. The Towns of Greenville, New Baltimore and Coxsackie contain a number of NYS DEC designated freshwater wetlands that are larger than 12.4 acres in size.



Wetlands and open water comprise 31,846 acres, or nearly 12% of the watershed. Woody wetlands are by far the largest identified wetland type, with over 29,578 acres or over 11% of the watershed according to the 2001 National landcover database.

The Catskill Creek watershed includes a handful of impounded reservoirs that are used by various communities for their public water supply. In the uplands portion of the watershed, Lake Myosotis is a 100 acre lake that provides drinking water for the residents of the Hamlet of Rensselaerville. The Basic Reservoir (237 acres) is located in the Town of Westerlo and is one of two reservoirs that supply water to the City of Albany. The Potic Reservoir (53.7 acres) located in the Town of Coxsackie, provides drinking water for the Village of Catskill and Hollister Lake (62.7 acres) in the Town of Athens provides drinking water for the Village of Athens. The Town of Cairo contains a surface water reservoir, but the Village of Cairo now operates two public water supply wells for their drinking water needs.

Wetland at Frankinton Vlaie, the head of Catskill Creek

A few lakes are notable for their public access and recreational uses. Lake Myosotis in Rensselaerville, Green Lake in Athens and North-South Lake in Hunter are all open water bodies that serve the recreational needs of residents and visitors alike.

There are a number of lakes and reservoirs that are listed as threatened or impaired on the NYS Lower Hudson Watershed Waterbody Inventory/Priority Waterbody List (LHW WI/PWL). The Potic Reservoir, which supplies drinking water to the Village of Catskill, is listed as threatened due to suspected pathogens entering the reservoir from agricultural sources. The Basic Creek Reservoir is located in the northwest section of the watershed and is one of two drinking water

supplies for the City of Albany. The Basic Creek Reservoir is listed as impaired for recreational uses due to nutrient (phosphorus) loading contributing to algal and weed growth. In the NYSDEC Lake Classification and Inventory Program of 2004, the reservoir was characterized as eutrophic. Water supply use of the reservoir is considered to be threatened due to the possibility of formation of undesirable by-products when the water is treated with chlorine for public use. The City of Albany currently uses the reservoir only as an emergency/backup source.

North and South Lakes are also listed as impaired in the LHW WI/PWL. Fish consumption in the lakes is impaired due to mercury contamination attributed to atmospheric decomposition. NYS Department of Health has issued a health advisory recommending eating no more than one meal per month of largemouth bass over 15 inches in length because of elevated mercury levels.

Hollister Lake, the drinking water supply for the Village of Athens, is listed as "needs verification/study" in the LHW WI/PWL. The waterbody is possibly stressed due to algal/weed growth and sedimentation.

Recreational & Open Space

Outside of state lands located along the upper reaches and a limited portion of the Catskill Escarpment, few hiking opportunities exist within the Catskill Creek watershed. This is in a large part due to the high percentage of parcels under private ownership. However, the lower two miles of the creek see considerable traffic by recreational boaters, and when water levels are high, stretches of the middle and upper portions of the creek and some tributaries may be tubed or kayaked. Recreational fishing along Catskill Creek and Ten Mile Creek is widely accessible through the public fishing rights easements described later. While Catskill Creek does not have the reputation of other regional streams regarding trout fishing, there are some excellent opportunities in the upper reaches of the creek. The lower, tidal portions of the creek are a popular area for anglers seeking striped bass and other larger species. Formerly, the mouth of Catskill Creek was also an important area for fishing shad and herring.

Information and maps on cultural resources, such as historic sites, scenic vistas, and recreation areas are also included in the Greene County NRI and accompanying story map (https://www.greenelandtrust.org/projects/nri-and-conservation-priorities)

While most of the land in the Catskill watershed is privately owned, a significant portion is owned and managed by NYS and municipalities.

NYS & Municipally-Owned Lands

- *Wildlife Management Areas* - NYS Wildlife Management Area (WMA) land is primarily intended for the "production and use of wildlife". The properties are publicly accessible for fishing, boating, hunting and hiking. The Catskill Creek watershed contains three WMA properties: a 197-acre portion of the Franklinton Vlaie is a WMA in the Town of Broome, Schoharie County; Partridge Run WMA is a 1,463 acre property in the Town of Berne in Albany County; and the Great Vly WMA is a 184 acre property in the Towns of Catskill and Saugerties in Greene and Ulster counties.
  https://www.dec.ny.gov/outdoor/7768.html

- *State Forests* -State Forests (SF) protect water quality in upland sections of the Catskill Creek watershed. In the Schoharie County portion of the watershed, the complex of state forest land includes Stone Store SF (723 acres), Scott Patent SF (119 acres), Dutton Ridge SF (1,249 acres), Gates Hill SF (752 acres) and portions of Keyserkill (1,163 acres), Leonard Hill (1,617 acres), High Knob (1,344 acres) and Bates State Forests (1,140 acres). In Albany County, State Forest land includes the Rensselaerville (2,594 acres) and Partridge Run (4,594 acres) State Forests. Smaller Detached State Forest parcels exist along the lower reaches of the creek, including Cairo-Lockwood State Forest (48 acres), Coxsackie Forest Preserve Detached Parcel (33 acres) and the Athens Detached Parcel (80.5 acres). In total, approximately 12,000 acres of New York State Forest are within the Catskill Creek watershed. More information about State Forests management and rules is available at https://www.dec.ny.gov/lands/40672.html

- *Catskill Forest Preserve* - In 1894, New York State began setting aside land in the Catskills to be kept forever as wild forest. In 1904, the state established a boundary around 705,500 mountainous acres deemed "forever wild" in Greene, Delaware, Sullivan and Ulster counties, and the Catskill Park was born! Small sections of the face of the northern escarpment are within the Catskill Creek watershed, including portions of the Windham-Blackhead Range Wilderness and the Kaaterskill Wild Forest. A significant section of the North-South Lake Campground is located within the Catskill Creek watershed including the site of the Catskill Mountain House and the internationally famous Kaaterskill Falls. https://www.dec.ny.gov/lands/4960.html

- *Public Fishing Rights* - Public Fishing Rights (PFR's) are permanent easements purchased by the NYSDEC from willing landowners, giving anglers the right to fish and walk along the bank (usually a 33' strip on one or both banks of the stream). This right is for the purpose of fishing only and no other purpose._ Easements from landowners that allow anglers streamside access on the Catskill Creek from just west of the Greene County Hamlet of Freehold upstream to the Franklinton Vlaie. A total of 17.2 equivalent miles have been acquired along the Catskill Creek https://www.dec.ny.gov/docs/fish_marine_pdf/pfrcatskillc.pdf. (An equivalent mile equals two miles of stream bank). [9] The state maintains several parking areas to allow multiple access points to the creek. Public Fishing Rights have been secured on a large portion of the Ten Mile Creek as well https://www.dec.ny.gov/docs/fish_marine_pdf/pfrtenmilec.pdf.
- *Municipal Parks and Reservoirs* - Parks are located in a number of municipalities, including the Historic Catskill Point at the confluence of the creek and the Hudson River, and nearby Dutchman's Landing Park, both of which are located in the Village of Catskill. In the Town of Cairo, the Angelo Canna Town Park includes portions of the Shingle Kill and the 142-acre Siuslaw Model Forest, owned by Cornell Cooperative Extension of Greene County, contains portions of the Bowery Creek. The Cairo Natural Area is a preserved, publicly accessible property that contains the Village of Cairo's back up water reservoir. Other public parks in the Catskill Creek watershed include Brandow Park in the Hamlet of Oak Hill in the Town of Durham, and Elsbree Park in the Hamlet of Preston Hollow in the Town of Oak Hill. Both of these parks are located on the Catskill Creek.

Nature Preserves and Managed Lands

- Edmund Niles Huyck Preserve - 2,000 acre preserve in the Town of Rensselaerville on the Ten Mile Creek. The Preserve and biological research station, situated in the beautiful hill country southwest of Albany County, is a mecca for researchers, educators, and people seeking peace and serenity away from the pressures of modern life. Among the natural treasures found on the Preserve are hardwood and conifer stands more than 200 years old, Lake Myosotis, Lincoln Pond, and the dramatic Rensselaerville Falls. https://www.huyckpreserve.org/
- Bear Swamp Preserve - 310 acre preserve operated by the Nature Conservancy in the Albany County Town of Westerlo. https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/eny-bear-swamp-preserve/
- Siuslaw Model Forest - 142 acre NYC DEP Model Forest on the Bowery Creek in the Greene County Town of Cairo owned and operated by Cornell Cooperative Extension of Columbia and Greene Counties. Open to the public, the Siuslaw Model Forest is filled with walking trails, ponds, and wildlife. Educate yourself with a self-guided tour, look online for live classes, or read any of our educational signs. Check-in at the Cornell Cooperative Extension: Agroforestry Resource Center across the street for a trail guide or the trail sign inbox when you arrive. Dog are allowed but please keep them leashed while in the forest. http://ccecolumbiagreene.org/agriculture-and-natural-resources/natural-resources/agroforestry-resource-center/siuslaw-model-forest
- Mawignack Preserve - In 2016, Scenic Hudson partnered with Greene Land Trust to acquire 149 acres of pristine wetland and forest where the Kaaterskill Creek tributary enters Catskill Creek. The property contains two miles of creek shoreline and is located just outside the Village of Catskill, making the purchase one of environmental importance and offering recreational opportunities for nearby residents. The conserved land was also purchased for flood mitigation purposes. A kiosk and trail system (2017), along with interpretive signs (2019), have been established and a reforestation project is underway (2020).https://www.scenichudson.org/explore-the-valley/scenic-hudson-parks/mawignack-preserve/

Conservation Easements

Known Conservation Easements are held in the Town of Durham by the Durham Valley Land Trust and in the Town of Rensselaerville by the Catskill Center for Conservation and Development. The Greene Land Trust is in operation in Greene County with the potential to hold conservation easements in the Catskill Creek Watershed, although none are known at this time.

Wildlife, Fisheries and Biological Diversity

The Catskill Creek Watershed is an area of abundant wildlife, including diverse insects, reptiles and amphibians (NYS Herp Atlas), migratory birds, and other fauna ranging from small mammals to larger predators such as eastern coyotes, fishers, black bears and bobcats. The Catskill Creek and Ten Mile Creek are known to be trout streams and there is a long history of fisheries surveys being carried out by NYS on the Catskill Creek. Surveys were conducted in 1936, 1957, 1963, 1969, 1970, 1975, 1981, 1984 and 1993. These studies augmented and informed the NYS DEC Fisheries Management Plan, completed in 1995.

Fish of 13 families, 32 genera and 49 species were collected during those surveys from 1936 to 1993. Resident gamefish included chain pickerel (*Esox niger*), rainbow trout (*Oncorynchus mukiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*). Other fish species present include blacknose dace (*Rhinichthys atratulus*) and longnose dace (*R. cataractae*), common shiner (*Luxilux cornutus*), creek chub (*Semotilus atromoculatus*), fallfish (*S. corporalis*) and cutlips minnow (*Exoglossum maxillingua*). White sucker (*Catostomous commersoni*) are found throughout the watershed. American eels (*Anguilla rostrata*) are also found, at least in the lower sections of the watershed. Wild trout populations are found upstream of the Woodstock dam for approximately nine miles.

According to the NYS DEC Public Fishing Rights Maps, the upper 2 miles of the Catskill Creek is warmed by wetlands and is unsuitable for trout. For five miles downstream from this warm water area, the creek has abundant wild brown and rainbow trout. The 13 mile section from Preston Hollow in Albany County to the Freehold Airport in Greene County is stocked with brown trout. There are some wild trout present in this section. Freehold to the mouth the stream is considered to be warm water. As previously mentioned, the lower 1.5 miles of the Catskill Creek are tidal and support spawning populations of anadromous fish such as herring and striped bass.

Lower reaches of Catskill Creek

Stream corridors are known to be of high biodiversity, and the rural nature of the watershed favors the survival of a broad array of plants and animals. Several efforts to assess the biological diversity in the watershed have taken place under the direction of Hudsonia, Inc. In 2011-2012, Hudsonia biologists mapped ecologically significant habitats within a 35 mile, 300-meter-wide corridor centered on the non-tidal reaches of the Catskill Creek mainstem. The corridor extended from the creek's headwaters to just above the dam in Leeds.

The work was funded by the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation in partnership with the Cornell University Department of Natural Resources. According to Hudsonia, "[t]he purposes of the project were to provide a better understanding of the Catskill Creek landscape, and to help identify needs for riparian buffer restoration and bank stabilization, and areas critical for maintaining the structural and biological integrity of the stream. The map also provides a baseline for future monitoring of habitat and land cover change within the stream corridor."[10]

Ecologically significant habitats identified by Hudsonia along Catskill Creek, Schoharie, Albany, and Greene counties, New York, 2012.

Upland Habitats	Wetland Habitats
Upland hardwood forest	Hardwood & shrub swamp
Upland Conifer Forest	Mixed Forest Swamp
Upland mixed forest	Floodplain hardwood forest
Orchard/ plantation	Marsh
Upland shrubland	Wet Meadow
Upland meadow	Contructed Pond
Cultural	Open Water
Waste ground	Spring/seep
Bare ground	Stream
Crest/ ledge/ talus	Gravel bar
Ledge	

The natural resources of the areas of the Catskill Creek Watershed that lie within Greene County have been mapped and described in the Greene County Natural Resources Inventory (NRI), created by the Greene Land Trust, Hudsonia Ltd., and Cornell Cooperative Extension of Columbia-Greene Counties with funding from the New York State Environmental Protection Fund through the DEC Hudson River Estuary Program. The NRI compiles and describes important natural resources in Greene County such as forests, wetlands, surface and ground waters, and farmland. Accompanying the NRI is a web-based resource with interactive maps and information highlighting water resources, habitats and biodiversity https://ccegeomaps.maps.arcgis.com/apps/MapJournal/index.html?appid=dcbcee316d344fa9a72181dc1e63ee2f.

Areas of the Town of Berne and Rensselaerville, including portions of the E.N. Huyck Preserve, were assessed as part of a Hudsonia Biodiversity Assessment Training (BAT) in 2005. Information from this assessment about water resources, habitats and species lists can be found in the 2016 Huyck Preserve Stewardship and Management Plan

[10] Stevens, Gretchen and Chris Graham, Ingrid Haeckel, and Othoniel Vázquez Domínguez. Significant Habitats in the Catskill Creek Watershed. Report to the Hudson River Estuary Program, the Department of Natural Resources at Cornell University, and the Catskill Creek Watershed Advisory Committee. August 2014

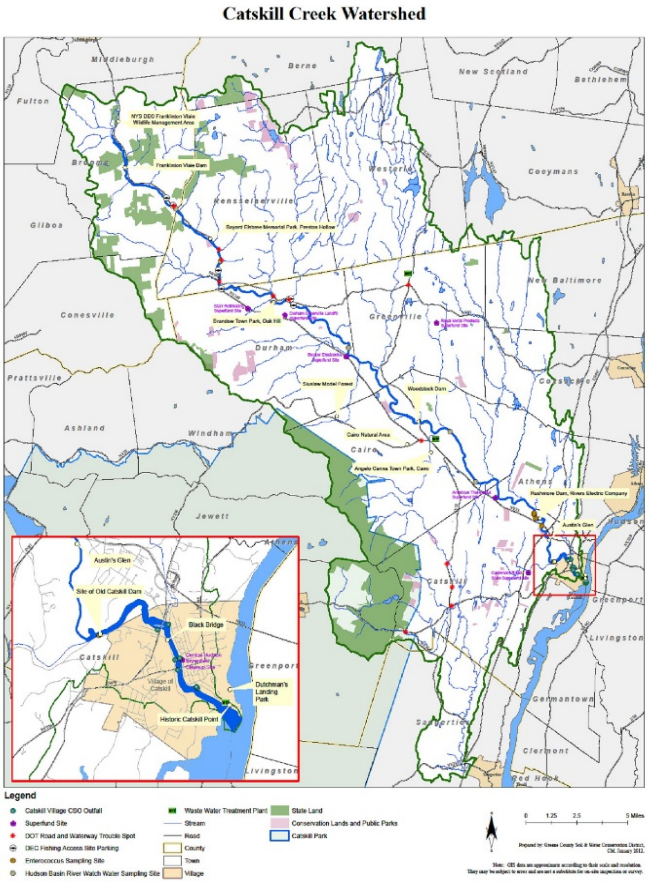
https://www.huyckpreserve.org/uploads/2/4/5/6/24560510/huyck_stewardship_and_management_plan.pdf.

Demographics

Catskill Point, flooded

The Catskill Creek watershed is largely rural, with population densities increasing in areas closer to the Hudson River Estuary. Population density is lowest in the Schoharie County Town of Broome and in the Albany County Town of Rensselaerville, with a density of approximately 20 people per square mile and 31 people per square mile, respectively. According to the 2010 census, Greene County has a population density of 75 people per square mile, and the Town of Saugerties in Ulster County has a density of 308 people per square mile. Over 95% of the population is white, with a smaller concentration of people of African American, Asian and Latino descent or of mixed racial backgrounds. The median age is 40 years and the median household incomes range from a low of $32,368 in the Town of Broom to a high of $48,488 in the Albany County Town of Westerlo.

Community Infrastructure



Road and Waterway Trouble Spots New York State Department of Transportation identifies at least a dozen areas of state highways that experience recurring problems with flooding and road failures in proximity to waterways. The majority of these problems are related to flooding of the roads. Slope failure due to changes in the creek channel is identified as a problem in a few spots. NYS Route 23A is plagued by problems caused by erosion and sedimentation on the Kaaterskill Creek. NYS DOT identifies landowners diverting stormwater to DOT drainage ditches as a major problem. DOT drainage ditches are designed to handle road runoff and cannot accommodate stormwater from developments. Planning for on-site stormwater mitigation is left to local Town Boards, Planning Boards and developers.

Water and Wastewater Infrastructure Land use in the Catskill Creek watershed is dominated by forests, agricultural land and rural residences. Areas of concentrated residential development are scattered throughout the watershed in the forms of Hamlets and Villages. Hamlets and Villages include: Catskill, Leeds and Palenville in the Town of Catskill; Cairo, Round Top, South Cairo and Purling in the Town of Cairo; East Durham, Durham and Oak Hill in the Town of Durham; Greenville and Norton Hill in the Town of Greenville; Rensselaerville, Medusa and Preston Hollow in the Town of Rensselaerville; and Livingstonville and Franklinton in the Town of Broome.

Several of these Hamlets and Villages maintain municipal water systems, but a much smaller percentage is serviced by municipal waste water treatment facilities. Cairo and Greenville are served by wells, while the Village of Catskill is served by a surface water reservoir.

Along the main stem of Catskill Creek, only the Village of Catskill and the Town of Cairo have municipal wastewater treatment systems. Upstream of Cairo, there are municipal wastewater treatment plants on the Tenmile Creek in Rensselaerville and Basic Creek in Greenville. Elsewhere in the watershed, communities are served by onsite wastewater treatment systems. In addition, the watershed has 42 small private, commercial, and institutional wastewater treatment plants.The village of Catskill has a combined sewer system, meaning that street runoff is combined with wastewater from homes and business before entering the treatment plant. During wet weather, the large volume of storm water can cause the combined flow to exceed the wastewater plant's capacity. When this happens, untreated sewage and storm water is dumped directly into Catskill

Creek. Six combined sewer overflow (CSO) outfalls discharge from the Catskill Wastewater Treatment Plant into Catskill Creek.

New York State regulates wastewater treatment plants (including CSO outfalls) through the State Pollution Discharge Elimination System (SPDES). Under the SPDES program, the Village of Catskill is required to develop a Long-Term Control Plan describing how it will bring its CSOs into compliance with Clean Water Act standards.

Information on SPDES permit compliance and enforcement can be found online at EPA's ECHO database.

Publicly Owned Wastewater Facilities within the Watershed

- Hamlet of Rensselaerville Sewage System, Rensselaerville, SPDES Permit Number 0240770
- Town of Greenville Wastewater Treatment Plant, Greenville, SPDES Permit Number 0094854
- Cairo Wastewater Treatment Plant, Cairo, SPDES Permit Number 0260819
- Village of Catskill Wastewater Treatment Plant, Catskill, SPDES Permit Number 0020389

Dams and Diversions

Barriers to aquatic passage, such as dams and perched culverts, are a concern and should be mitigated when opportunities arise to benefit migratory and resident species, as well as improve the overall ecological health of Catskill Creek watershed streams. There are four dams or dam sites located directly on the Catskill Creek. Only two dams are still active and functioning, one in the lower reaches of the creek and one near the source.

- Heading upstream from the mouth of the creek, the first dam site, the former Rushmore Dam, is located north of NYS Route 9W, just outside of the Village of Catskill, downstream of the confluence of the Catskill Creek and the Kaaterskill Creek. Although evidence of this dam still exists, the dam has long been inactive and is no longer standing.
- The second dam is an active dam located in the Hamlet of Leeds in the Town of Catskill. Locally known as the Mill Pond Dam, this structure, rebuilt in 1987, is 200 feet in length and is now owned by Gravity Renewables. This dam is in active use and is part of a small, functional hydroelectric generating operation that produces almost 3,000,000 kilowatt hours of electricity. Gravity Renewables allows public access to the creek at the dam site for fishing. The hydroelectric facility and dam are overseen by the Federal Energy Regulatory Commission and slated for relicensing in 2022. The following reccomendations should be considered during this process:
    - The FERC relicensing process should include thorough studies of existing fish communities in Catskill Creek, in order to evaluate upstream and downstream fish passage needs and potential at the Mill Pond Dam.
    - Screens must be installed on the hydroelectric turbines at the Mill Pond Dam, to protect fish from being drawn through the turbines, which results in mortality.
    - Upstream and downstream passage for eels must be installed at the Mill Pond Dam.

    - Any future FERC license for hydroelectric facilities at Mill Pond Dam must include measures to ensure adequate ongoing maintenance of fish passage structures.
- The Woodstock or Klatz dam was once a structure actively used for hydroelectric generation. The remains of the dam is located on the Catskill Creek at NYS Route 32. This dam was once 24 feet high and 236 feet wide, but it has been crumbling and washing downstream with every storm event.
- The Franklinton Vlaie, known as the source water of the Catskill Creek, is dammed at the Hamlet of Franklinton in the Town of Broome, Schoharie County.

According to the Small Dams Inventory Report that was produced by David Clouser & Associates in 2010, there are 45 dams located in the Catskill Creek watershed, including at least 30 earthen or concrete dams on tributary streams. Additional dams appear to be ponds located on unmapped streams or not located directly on streams. Many of these dams were identified by Clouser & Associates using remote sensing techniques. Existence and location of a number of these dams were verified in the field during the summer of 2011.

The dams identified in the Small Dams Inventory Report were also cross referenced with the DMA 2000 Hazard Mitigation Plan for Greene County (August 2009). This report utilized data from the National Inventory of Dams (NID), County Planning Committee and the NYS DEC to identify dams and rate them according to the NID hazard potential. Nearly all of the dams identified in this inventory are identified as earthen dams with “low” hazard potential for loss of life or damage to the environment and property. The only dam with a “high” hazard potential in the Greene County portion of the Catskill Creek watershed is the Potuck Reservoir Dam, which supplies drinking water to the Village of Catskill.

The dam of Mill Pond Hydroelectric Plant, Leeds, NY. Photo from Gravity Renewables

Aquatic Barrier Assessment and Planning

Dams and poorly designed or undersized culverts affect the hydrology, sediment transport, and water quality of streams in addition to preventing aquatic organisms from accessing critical habitat. These aquatic barriers may also be liabilities to infrastructure and pose flood hazards. In an effort to identify the road stream crossings that are barriers to organisms and hazards to communities. CCE-CG and GCSWCD have worked to evaluate the road stream crossings since 2015, utilizing the standardized protocols developed by the North Atlantic Aquatic Connectivity Collaborative (NAACC), staff from the NYSDEC, Hudson River Estuary Program and the NYS Water Resources Institute. The NAACC is a network of individuals from agencies and organizations focused on improving aquatic connectivity across a thirteen-state region. The NAACC provides protocols for road-stream crossings (culverts and bridges) to assess and score crossings for fish and wildlife passability, as well as culvert condition and other data useful for evaluating risk of failure. The data from crossing assessments and scores are available on the searchable NAACC online database at https://naacc.org/naacc_data_center_home.cfm and can be downloaded in spreadsheet and GIS formats.

Building on the data available faculty, staff, and students at Cornell University and the NYS Water Resources Institute developed and maintain a culvert capacity model, using ArcGIS hydrology tools and Python. Given a culvert location and dimensions, the model predicts a contributing watershed area for the culvert, determines current and future (2050) peak flows in

the watershed, then compares this to the culvert capacity to estimate the current and future maximum passable storm event. Details about individual culverts can be found on the NYS Water Resources Institute interactive map at https://wri.cals.cornell.edu/hudson-river-estuary/watershed-management/aquatic-connectivity-and-barrier-removal-culvert-dams/.

In an effort to help communities utilize the field assessment data and capacity model outputs CCE-CG has engaged with several municipalities in a prioritization process and development of Road Stream Crossing Management Plans. These documents catalog all culverts in a municipality's jurisdiction, and prioritize them for replacement based on flooding risk, condition of the crossing, maintenance frequency, and potential for increasing the length of contiguous aquatic habitat. Municipalities can use these documents as a long-term resource to plan and apply for funding to support culvert right-sizing and repair. The initial concept and all templates related to creation of these town-specific Road-Stream Crossing Management Plans were collaboratively developed by the Housatonic Valley Association (HVA) and the Lower Hudson Coalition of Conservation Districts (LHCCD). These projects have been conducted in partnership with various partners including LHCCD, GCSWCD, Trout Unlimited (TU) and Greene County Highway department with support through the CRP, NEIWPCC and the Hudson River Estuary Stewardship grant program.

Superfund Sites

Thousands of contaminated sites exist nationally due to hazardous waste being dumped, left out in the open, or otherwise improperly managed. These sites include manufacturing facilities, processing plants, landfills and mining sites. In response, Congress established the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) in 1980. CERCLA is informally called Superfund. It allows EPA to clean up contaminated sites. It also forces the parties responsible for the contamination to either perform cleanups or reimburse the government for EPA-led cleanup work.

The following is a record of all Superfund sites that have been identified and mitigated within the Catskill Creek Watershed.

1.) **Central Hudson Brownfield Cleanup site - Water Street, Village of Catskill - Hazardous waste disposal period - 1858-1958.** This is the site of two former gas manufacturing facilities sitting directly on the Catskill Creek. Contamination includes coal tar, which contains benzene, toluene, ethylbenzene and xylenes (collectively referred to as BTEX) and polycyclic aromatic hydrocarbons (PAHs). In addition, elevated levels of contaminants including several PAH compounds were detected in the Creek sediment. The subsurface soil and sediment contamination has resulted in significant threat to the environment. The potential exists for the inhalation of site contaminants due to soil vapor intrusion for any future on-site redevelopment or new development for occupancy. People may come in contact with contaminants present in shallow creek sediments while entering or exiting the creek during recreational activities. (NYS Classification A - remediation underway).

2.) **Catskill Chrome Superfund site, West Bridge Street, Village of Catskill - Hazardous waste disposal period - 1992 - 1993.** Storage and disposal of residual plating wastes resulted in a declaration of the site as a public health threat by the USEPA Agency for Toxic Substances and

Disease Registry. Disposal areas for chromium and cyanide plating sludge materials were discovered outside of the building. The building was demolished, soil was removed and the site was fenced by the USEPA. (NYS Classification C -remedial action completed, 2007)

3.) **Cauterskill Road State Superfund site, Cauterskill Road, Town of Catskill - Hazardous waste disposal period - unknown to 1993.** The site is approximately half acre in size, and was used for storing and disposing off-spec. plating solutions and untreated plating sludges prior to 1993. The plating solutions, products and sludges found here came from a plating operation known as Catskill Chrome, located on West Bridge Street in Catskill. In addition to the surficial disposal, it is speculated that drums of waste and off-spec. solutions were also buried in the back-filled areas. Environmental sampling confirmed that soils were contaminated with cyanide at levels of up to 2640 ppm, cadmium at 110 ppm and chromium at 68 ppm. The property is bound by Cauterskill Road on the west, residential properties on the north and south, and the unnamed tributary to Kaaterskill Creek on the east. Kaaterskill Creek is about 4000 feet away. Soil removal was completed November 2005. The Remedial Action(RA) is complete. (NYS Classification 2 - significant threat to public health or the environment; delisted 2010).

4.) **American Thermostat Superfund site, County Route 23B, South Cairo - Hazardous waste disposal period - unknown - 1981.** The American Thermostat Company used chlorinated and non-chlorinated solvents in their manufacturing process. The waste solvents were disposed on the property and/or discharged to the sewage system. Manufacturing at American Thermostat ceased when the plant closed in 1985. Environmental investigations done at the site confirmed that there was solvent contamination in the groundwater and soil. Several nearby residential drinking water wells were contaminated with solvents also. Activated carbon filters were installed on the impacted drinking water wells in order to reduce contaminant exposure levels and water mains from the municipal water system were extended to the affected homes. The cleanup of contaminated soils at the site has been completed and treatment of contaminated groundwater has been ongoing since 1998. December 1998 and January 1999, VOC contamination was detected outside the previous limits of the contaminated groundwater plume. EPA undertook emergency actions to provide temporary sources of clean drinking water to the affected residents, while continuing to monitor the contamination in the affected wells. Individual GAC treatment systems for the affected properties were installed. EPA conducted a 5-year review in 2003, it stated all residential wells have met drinking water standards since January 2003. This site is located in close proximity to the Catskill Creek. (NYS Classification 2 - significant threat to public health or the environment, groundwater contamination; remediation underway)

5.) **Becker Electronics Superfund site**, **NYS Route 145, East Durham - Hazardous waste disposal period - 1976 - 1982.** Since 1980, groundwater in the area surrounding this site has been contaminated with solvents, primarily 1,1,1-trichloroethane. Solvents were used by the company in conjunction with their manufacturing operations. The groundwater contamination resulted from the company's practice of dumping waste solvents on the ground. Several nearby residential and business drinking water supply wells were impacted. Becker Electronics installed carbon filters on the impacted drinking water wells in order to reduce contaminant exposure from the drinking water. In 1982, Becker Electronics closed the facility and filed for bankruptcy. All of the carbon filter systems installed in conjunction with this site are currently maintained by the NYSDEC. The design of the final remedy at this site was completed in 1999. Remedial construction began in the fall of 2000 in accordance with the ROD. The following construction activities took place; the debris pile was capped, the chemical storage building was demolished, contaminated soil was

removed from the property, and an air stripper was constructed. The work has been completed. Groundwater pumping and treating is continuing, and the site is now in the site management phase. The site was re-evaluated in 2007 as one of New York State's Soil Vapor Intrusion Legacy Sites. The Site does not present a current or reasonably foreseeable significant threat to public health or the environment. (NYS Classification 4 - remediation completed, 2001; residential groundwater treatment and monitoring continues)

6.) **Durham Greenville Landfill Superfund site, NYS Route 145, Durham - Hazardous waste disposal period - 1969 - 1980.** Municipal waste from the Towns of Durham and Greenville, as well as industrial wastes from nearby Stiefel Labs, were disposed at this rural landfill. The wastes from Stiefel Labs reportedly consisted of soaps with small amounts of benzoyl peroxide, chelating agents, and aluminum chloride hexahydrate. The landfill was closed in 1982. Leachate outbreaks are prevalent on the property. Leachate samples collected during environmental investigations contained elevated levels of organic and inorganic compounds. Acetone was found in one leachate sample at 1,600 ppb and could be attributed to the reported disposal of acetone gel barrels at the site. Samples collected from an unnamed tributary to the Catskill Creek near the point where the leachate sample was collected show that the tributary is not being impacted at this time. This site was classified as a Class 3 site in 1993. (NYS Classification 3 - no significant threat to public health or the environment, 1993)

7.) **Starr Refinishing Superfund site, NYS Route 145, Durham - Hazardous waste disposal period - 1980 - 1988.** The Starr Refinishing Company operated a small furniture refinishing operation at this one acre site located in a rural area of the Town of Durham. Solvents were used to remove old finishes from furniture, and the resulting sludge was stored in a tank on the property. Between 1980 and 1988, the sludge was periodically removed from the tank and dumped behind the building. In addition, rinse-water that was generated during the stripping work was discharged to an open field near the building. Samples of sludge and soil in the discharge area revealed the presence of lead at levels high enough to be considered characteristic hazardous waste. Site conditions represented a potential threat to the groundwater beneath this site. The groundwater in this area is used as a drinking source. An Interim Remedial Measure (IRM) was completed in 1997 and it involved the removal of sludge from the property. During the fall of 2000, another IRM was carried out which involved the excavation and removal of the remaining contaminated soil from the property. Monitoring wells were installed on site in the fall of 2000. The wells were sampled in early 2001 and groundwater analysis showed that contaminant levels are below Part 703 groundwater standards. (NYS Classification C - remedial action completed and delisted, 2002)

8.) **Royal Metal Products Superfund site, West Road, Surprise - Hazardous waste disposal period - 1963 to 1986.** Royal Metals was a custom furniture manufacturer that operated a small plating operation at this site. The solvent tetrachloroethylene (PCE) was used to clean evaporation pans, and the untreated rinsewaters were discharged to small lagoons on the property up until 1986. These lagoons were not lined. The first of these lagoons was in service from approximately 1963 to 1983. This lagoon did not have an outlet and was taken out of service and then filled in with soil sometime in 1983. The area where this lagoon was is now the site of an addition to the main manufacturing building. The second lagoon was constructed to replace the first one and was used from 1983 to 1986. This lagoon had an overflow outlet that drained to a receiving basin. The third lagoon was constructed within the area of an intermittent tributary to the Jan De Bakkers Kill. A groundwater sample taken from an on-site production well was contaminated with lower levels of PCE. This contamination was caused by PCE disposal in the lagoons. Monitoring wells onsite

indicate the contamination is not a significant threat. (NYS Classification 3 - no significant threat to public health or the environment, 1993)

Challenges

Challenges to the health of the Catskill Creek watershed include flooding and subsequent erosion and other damage to both land and infrastructure, issues caused by impervious surfaces, run off of fecal bacteria, phosphorous, dissolved solids and various organic/inorganic contaminants, elevated summer water temperatures, trash/litter, invasive species and loss of habitat and riparian buffers. Fortunately, many former sources of contaminants no longer exist or were brought under control over the past five decades. However, thorough monitoring of water quality should expand and/or continue in order to identify new sources or contaminates. Development may increase somewhat over the next decade (and resultant impervious surfaces and habitat fragmentation), making smart growth decisions crucial.

Invasive species also pose significant threats to the watershed. Japanese knotweed (*Fallopia japonica*), which dominates the banks of much of Catskill Creek and its tributaries, prevents regeneration of trees and native plants. Various other plants as well as insects, fungi and pathogens are rapidly destroying native tree species that are dominant members of floodplain forest communities. Native trees in danger of extirpation include all ash and elm species, which are disappearing at an alarming rate. Surely but slowly, butternuts and hemlocks are also dying, but newly-released biocontrols offer some hope for hemlocks. The loss of canopy cover, particularly by hemlocks in tributary streams, will likely lead to higher water temperatures (and declines in trout and other species) as well as adversely impacting the nitrogen cycle.

Invasive earthworms – above all the Asian jumping or crazy worms – are beginning to have adverse local environmental impacts as they spread throughout the watershed and dramatically change forest understory soils. Impacts from these worms include declines in both biodiversity and tree health as well as increased soil runoff. And there are many more threats, including non-native algal species that smother creek bottoms and various macroinvertebrates that have the potential to completely change benthic ecosystems in the watershed. Education about and control of invasive species must be a priority in the fight to steward and protect Catskill Creek.

Significant Catskill Creek Watershed Initiatives and Management Planning

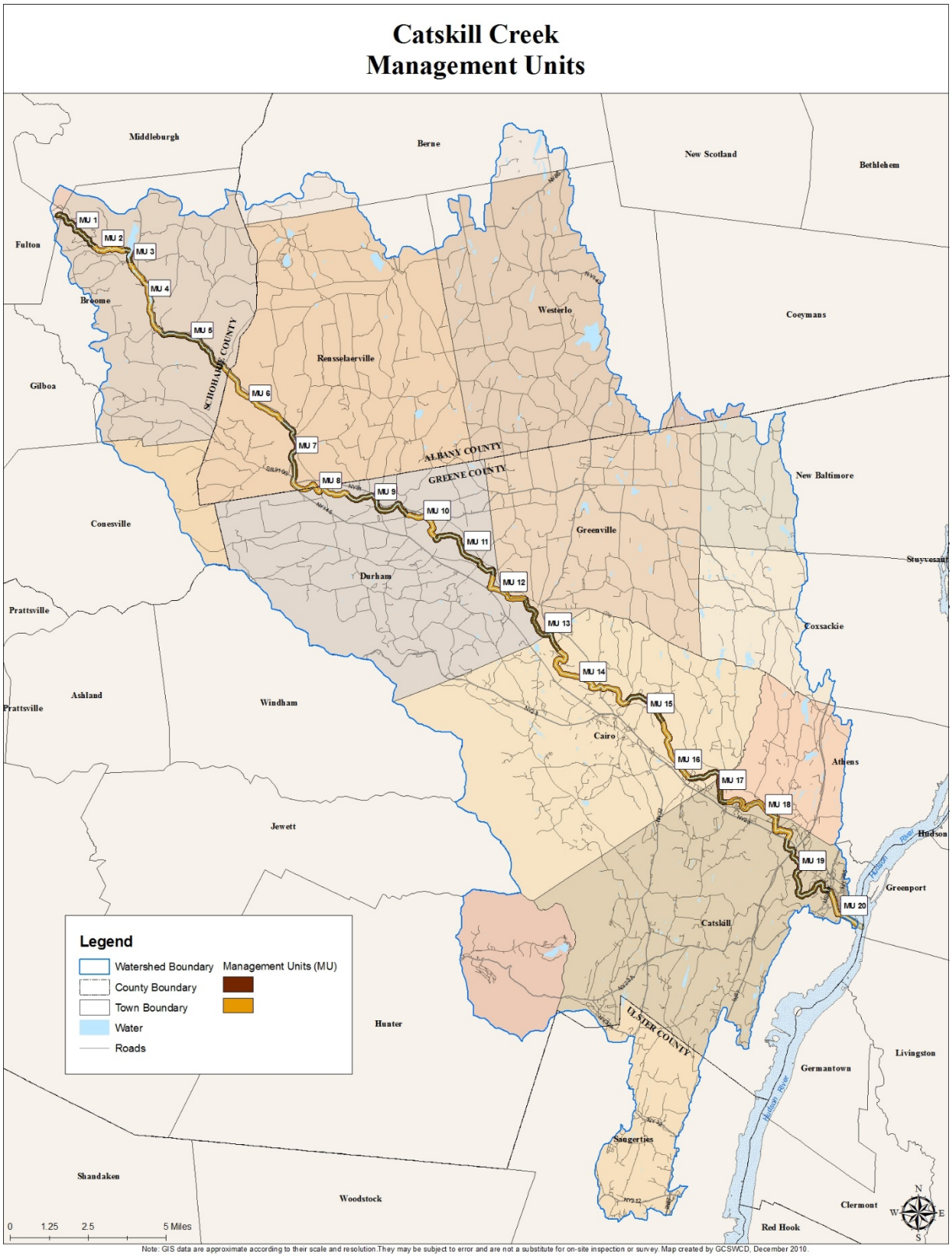
The CCWAP has supported many projects since its beginning in 2008. Early initiatives focused on raising public awareness through educational programming, formation of the advisory committee and information gathering. During this time the CCWAP initiated efforts to identify and prioritize impacts and supported two significant watershed level projects that included:

Biodiversity Assessment and Mapping of the Catskill Creek Corridor (2011-2014)

This project was conducted in partnership with Hudsonia, Inc. and resulted in a detailed report (Appendix A), large format maps (available upon request from CCE-CG). The report and maps were revised in 2014 to reflect the landscape changes caused by the flooding during Hurricane Irene and Tropical Storm Lee.

Delineation and Mapping of Management Units of the Catskill Creek Corridor (2010- protocol description Appendix B)

This project was conducted in partnership with GCSWCD. The creek was divided into twenty management units based on stream characteristics and hydrology. Corresponding maps of aerial imagery, topography, floodplains and wetlands were created for each management unit (MU 1-2 no floodplain data; MU 1-2, 15-17 no wetland data). The maps are intended to help facilitate management are available upon request from CCE-CG.


Catskill Creek
Management Units
Middleburgh
Berne
New Scotland
Bethlehem
Fulton
Broome
Westerlo
Coeymans
Rensselaerville
Gilboa
SCHOHARIE COUNTY
ALBANY COUNTY
GREENE COUNTY
New Baltimore
Conesville
Greenville
Stuyvesant
Durham
Prattsville
Coxsackie
Ashland
Windham
Cairo
Athens
Jewett
Hudson
Greenport
Catskill
Hunter
ULSTER COUNTY
Germantown
Livingston
Saugerties
Shandaken
Woodstock
Clermont
Red Hook
MU 1
MU 2
MU 3
MU 4
MU 5
MU 6
MU 7
MU 8
MU 9
MU 10
MU 11
MU 12
MU 13
MU 14
MU 15
MU 16
MU 17
MU 18
MU 19
MU 20
Legend
Watershed Boundary
County Boundary
Town Boundary
Water
Roads
Management Units (MU)
0 1.25 2.5 5 Miles
N
W
E
S
Note: GIS data are approximate according to their scale and resolution.They may be subject to error and are not a substitute for on-site inspection or survey. Map created by GCSWCD, December 2010.

Subsequent to the creation of the advisory committee, and the development of the now-named CRP in response to the impacts of Hurricane Irene and Tropical Storm Lee, CCE-CG led many projects that were implemented with a focus on municipal engagement and management planning activities outlined below.

Catskill Creek Watershed Post Flood Evaluation (2012 – Synopsis Appendix C)

Following the events of Hurricane Irene and Tropical Storm Lee, Catskill Creek Watershed municipalities were surveyed and interviewed to assess the needs and concerns of the communities. The post flood evaluation also solicited suggestions for future projects and next steps to address the issues that were identified.

Municipal Flood Guide (2013-2014)

Developed in partnership with LHCCD, *Flood Preparedness and Response: A Guide for Municipalities* is a guide for municipal officials, highway supervisors and contractors to help them address the flooding of streams and creeks that affects bridges, roadways and other public infrastructure. It includes an overview of flooding concepts and terminology, outlines flood-smart strategies and how to prepare for a storm, explains what to do during and after a storm, provides information about a number of technical and funding resources and contact information for local, state, and federal agencies that can help.

Post Flood Stream Intervention Training (2013)

A two-day training including field demonstration site visits for highway personnel and contractors with developed and delivered through the CRP in collaboration with Greene and Dutchess Soil and Water Conservation Districts, NYC Department of Environmental Protection and NRCS.

Riparian Plantings (2013-2015)

Identification of potential planting sites for the Hudson Estuary Trees for Tribs program were actively pursued in 2013. The Trees for Tribs coordinator and Highway Superintendents and/or municipal leaders were engaged in the towns of Broome, Cairo, Durham and Rensselaerville resulting in plantings at four locations. Assistance with promotion, recruitment and coordination of volunteers was provided, with one large effort involving fifty middle school and high school volunteers.

In 2014, another riparian planting was installed for a landowner on the Bowery Creek at a site that was too small for a Trees for Tribs planting. In 2015, volunteers were engaged to maintain the Trees for Tribs plantings on the Catskill Creek during a Riversweep event on and as part of Cornell's NY Master Naturalist weekend at the Agroforestry Resource Center. Support was also provided with volunteers and installation of another Trees for Tribs planting on Kaaterskill Creek.

Educational Programs (2013-2016)

Sixteen educational programs were held in locations throughout the watershed reaching over 300 stakeholders. Topics of the presentations provided included: USGS Stream Gages & Tour, Stream Geomorphology, National Flood Insurance Program & Community Rating System, Climate

Adaptive Design, Aquatic Barriers and Connectivity, Watershed Management, Planning, Stream Habitats & Flood Resiliency, and Forests & Wetlands for Flood Attenuation.

Streambusters Handout (2014 Appendix D)

Created and distributed a handout to be used as a guide for landowners in the event of a flood. The handout contains information on who to call, how to prevent erosion and stabilize stream banks, how to deal with flood damaged property, permitting and includes technical and regulatory contacts that can help in the region.

Village of Catskill Waterfront Flooding Task Force (2014)

Supported the Village of Catskill as one of four Hudson River communities to create a Waterfront Resilience Task Force. Participated in the Task Force with Scenic Hudson, the Consensus Building Institute, and NYS DEC Hudson River Estuary Program, to develop a set of strategies to reduce flood risk. The task force studied current and future flood risk, and recommended actions to increase the safety of waterfront areas (https://www.dec.ny.gov/docs/remediation_hudson_pdf/catskilltffr.pdf). Continued support of the Village to implement these actions and join a network of other Task Force communities to address common issues related to flooding.

Village of Catskill Floodguide for Residents and Businesses (2015)

The Village of Catskill has created a Flood Preparedness Guide for Residents and Businesses. The guide offers preparedness and recovery tips and provides a directory of local resources available during a flood. This guide serves as a customizable template for other communities and the Village of Athens created one in 2020 with one also planned to be created for the Town of Cairo in 2021.

Climate-Adaptive Design (CAD) Studio, Village of Catskill (Fall 2015)

Provided support and facilitated the Village of Catskill in hosting a CAD studio with Cornell University and NYS DEC Hudson River Estuary Program. The CAD Studio links Cornell University students in landscape architecture with Hudson Riverfront communities. Through this collaboration, graduate students in land-scape architecture created designs for more flood-adaptive and connected waterfront areas in the Village along the Catskill Creek and business district. A presentation on CAD was provided to the Catskill Planning Board and ZBA and posters featuring designs from the CAD Studio were hung in three storefronts on Main Street during month of August to provide education on and facilitate implementation of “green alley” designs. Support was also provided at a public hearing on the re-designation of Canal and Factory Streets to eliminate vehicular traffic as part of installation of CAD designs.

Culverts Assessments and Management Plans (2015-2020)

Staff from the NYSDEC, Hudson River Estuary Program and the NYS Water Resources Institute, CCE-CG and GCSWCD have assessed road stream crossings under NAACC protocols since 2015. Utilizing this data the following municipalities in the Catskill Creek Watershed have developed Road Stream Crossing Management Plans and been provided hard copies of the documents which are available on request from CCE-CG. *Full description provided above in Dams and Diversions section.*

Town and Village of Athens, 2018 (LHCCD, GCSWCD, CCE-CG)

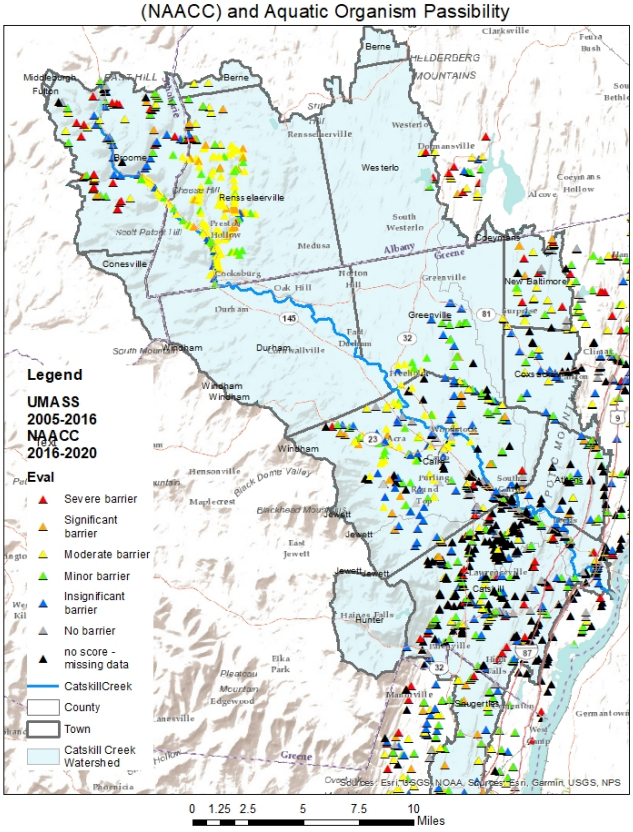
Town and Village of Coxsackie, 2018 (LHCCD, GCSWCD, CCE-CG)

Town of Cairo, 2018 (CCE-CG)

Town and Village of Catskill, 2019 (CCE-CG)

Town of New Baltimore, 2020 (CCE-CG, TU)

Catskill Creek Watershed Road Stream Crossing Assessments
(NAACC) and Aquatic Organism Passibility



Cornell Cooperative Extension
Columbia and Greene Counties

Map created by: Audrey Kropp
Natural Resources, Climate Change & Environment
December 2020

Bowery Creek Training Facility (BCTF 2015+)

Statewide and locally, regions are experiencing increased rain events that impact the form and function of streams. The responsibility for dealing with these streams often falls on the impacted municipalities, who don't always have opportunity or resources to learn about and practice effective strategies.

Partnering with the NYS Water Resources Institute at Cornell and the Hudson River Estuary Program, CCE-CG embarked on the formal development of the Bowery Creek Training Facility in 2015. The purpose of the BCTF is to provide communities with tools to enhance their understanding of stream dynamics, floodplain function and watershed planning to reduce their vulnerability to floods in an era of increasing heavy precipitation events. Initial work done include taking baseline data from the existing learning stations identified along CCE-CG's reach of the

Bowery Creek. Development of a hands-on field curriculum was accomplished in 2018 – 2019 through the Schoharie Watershed Stream Management Plan Implementation Program.

Increased extreme weather events have necessitated the establishment of a demonstration and education facility to provide municipalities and others concerned with stream functions, with hands on opportunities and information on stabilizing streams pre and post event. A tributary of Catskill Creek, Bowery Creek, of which a part is owned by CCECG, was recognized as an ideal location to establish such an education and demonstration resource for watershed and flood resiliency efforts.

The Bowery Creek Training Facility utilizes a unique combination of on-site impacted and non-impacted stream reaches, a gravel pit for practicing in-stream techniques, an existing model forest that is funded by the NYC DEP and dedicated organizational personnel to deliver Post Flood Emergency Stream Intervention and stream processes training to a variety of audiences. The facility is designed for use by any qualified education and outreach professionals with curricular materials and site development options established to augment on-site staffing.

Through past education and outreach efforts and input from partners, the following audiences have been identified: municipal, county and state highway personnel; municipal officials; zoning and planning boards; landowners; construction contractors; community and environmental groups; and faculty and students. Given the wide range of riverside stakeholders, a training facility that will help to support a paradigm shift away from traditional river control methodologies and towards an application of natural channel design requires a range of programming initiatives.

Standardized field components are available for delivery here at the BCTF. Target audiences include highway personnel and contractors; NYCDEP, SWCD, NRCS and NYS DEC agency staff; municipal officials; stream-side landowners; and students. In addition, a hands-on training curriculum developed for our gravel pit focuses on one PFSI/ESI activity/skill set to train highway and contractor equipment operators. The field-based Lesson Plans are available for use by professionals on the Bowery Creek training reach and indexed to specific Learning Stations and associated cross-sectional and profile data. It is possible that the Lesson Plans be applicable at other locations within the Catskill Creek Watershed and Hudson Valley, though the idea has been to bring trainees to a site that has good geomorphological data for quality control.

Management Planning Efforts

On October 15, 2015, representatives from towns along the Catskill Creek corridor gathered with state and county officials to discuss issues related to the waterway. The meeting was hosted by Cornell Cooperative Extension and the NYS DEC Hudson River Estuary Program, and was held at the Agroforestry Resource Center. The meeting featured presentations on the CCWAP and the work of the Hudson River Estuary Program in the Catskill Creek watershed. Group discussions focused on challenges and opportunities that towns face, and the potential for inter-municipal cooperation to address them.

A roundtable brainstorming session and dot voting exercise provided a quantifiable prioritization. The top challenge identified was education (getting the word out/uninformed public). Protecting habitat and climate change namely sea level rise and flooding were also identified as top challenges tied with the second largest number of votes each. Several other challenges prioritized in this

process included maintaining infrastructure, sediment (erosion and siltation), balancing regulation/bureaucracy, maintaining momentum of watershed level planning/efforts and funding. The rest of the challenges identified were more specific issues that can be categorized under the higher ranking topics outlined below:

Education (getting the word out/uninformed public)

- Lack of understanding of connection between municipalities of connections in the watershed
- Lack of flood insurance information (no flood analysis in some areas)
- Engaging the community and officials
- Emergency Preparedness
- Trainings
  Protecting habitat

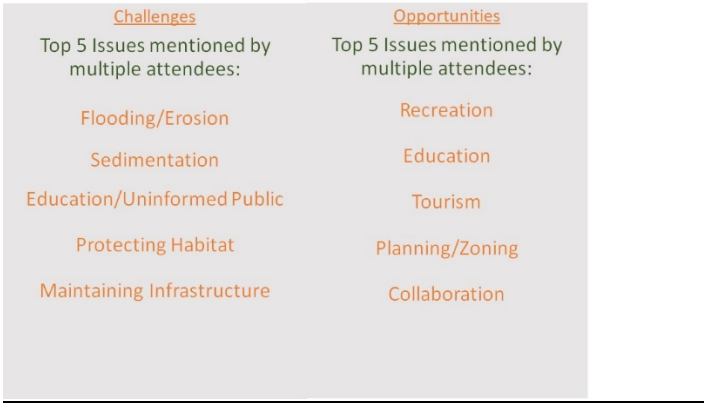
Protecting Freshwater Resources

- Land Use Policy
- Incorporating watershed planning in existing planning
- Damage caused by stream work
- Fixing current issues (septic draining into creek)

Climate Change – Sea Level Rise – Flooding

- FEMA/NFIP / Increasing flood insurance rates – Too expensive
- Emergency Preparedness
- CSO's

The brainstorming for opportunities was very productive, with numerous ideas presented which is exemplary of the positivity and hopefulness of the watershed stakeholders. Recreation (swimming, fishing, kayaking, boating) was the highest ranked opportunity identified by far. In addition to being prioritized as a challenge education, specifically of residents and developers, was prioritized as second highest opportunity. The third ranked opportunity was tourism with habitat protection, planning/zoning/comprehensive plans ranking next highest. Collaboration was also a category that many participants mentioned and prioritized.



A second event co-hosted by the Village of Catskill and Cornell Cooperative Extension, as a follow-up to the Catskill Creek Summit was held at Joe's Garage event space on Thursday May 19, 2016. This meeting included an hour-long training on watershed planning and an opportunity to continue the dialogue about concerns related to the creek and its tributary streams. During the roundtable participants reiterated many of the priorities mentioned during October summit in addition to elucidating some new topics and ideas.

Opportunities

- Tourism & recreation
- Coordinated creek-wide events & trail network
- Create a watershed plan
- Coordinated streamside/floodplain zoning
- Education of officials and residents

Challenges

- Flooding/sedimentation
- Funding
- Public Indifference
- Effective communication with public
- Creek Access Tourism can lead to exploitation/over-use
- Tourism is not a great economic driver
- Economic difficulties/genuine economic opportunities are rare –need light industry
- Zoning is contentious and difficult to achieve
- Need for support on infrastructure –both water and sewer

In 2017, the effort to re-engage the advisory committee and develop this resource was initiated with funding from the New York State Environmental Protection Fund through the DEC Hudson River Estuary Program. Existing and new committee members convened for meetings 2018 and 2019 that involved review of past projects with update sharing, discussion of planning/priorities in the watershed and brainstorming ideas for educational/outreach efforts. The development of this resource also involved stakeholder input gathered via surveys at public events and municipal outreach. In partnership with River Haggie Outdoors. CCE-CG developed a survey and an educational display that was presented at Catfish Derby, Dutchmans Landing (7/20/19), Greene County Youth Fair, Cairo (7/26/19-7/28/19) and the E.N. Huyck Preserve Thursday Night Lecture Series, Rensselaerville (8/20/2019). Each event involved setting up the informational display materials and conducting the dot survey with attendees. The Lecture Night event also involved collaborating with Riverkeeper to provide educational presentations for the lecture entitled *Community Science and Water Quality in the Catskill Creek Watershed*. The educational focus was on watershed planning and management and Catskill Creek projects including the water quality sampling project coordinated by Riverkeeper. Municipalities in the watershed were also mailed the survey with responses requested in follow-up outreach. The input gathered from these efforts further supported interest in the priorities identified previously. Residents to both the public event and municipal surveys expressed the highest support for watershed protection initiatives.

Public responses indicated strong support for educational initiatives and better access. Support for partnership projects and kayak water trails was also relatively high in public opinion. Municipal respondents also prioritized support for initiatives that address flooding and sea level rise.

Recommendations

Below are possible recommendations to address the challenges and opportunities that were identified through management planning process.

Climate Smart Communities Program (CSC)

Municipalities in the watershed should consider joining the CSC program. There are a variety of actions that could be undertaken to advance watershed initiatives. Communities could seek to coordinate intermunicipal projects to achieve actions that apply to larger watershed level scales.

The Climate Smart Communities program now includes over 100 different climate mitigation and adaptation actions. These are organized by specific elements within the Climate Smart Communities Pledge. Pledge Element 7: Enhance community resilience to climate change and Pledge Element 6: Implement climate-smart land use in particular include many water-related actions.

Actions in Pledge Element 7 now include:

- flood mitigation plans with hydrologic/hydraulic assessment (ex.in Saw Kill and Moodna Creek watersheds)
- watershed characterizations and plans that focus on water quality (ex. Quassaick Creek Watershed Management Plan https://hudsonwatershed.org/watershed-management-plans/)
- source water protection using the Drinking Water Source Protection Program (DWSP2) framework; and
- vulnerability assessments to analyze and prioritize climate hazards and risks (like Community Resilience Building workshops/reports).

For watershed-based plans, point levels are based on how much of the municipality is included within the plan. For source water protection, points are available for planning and implementation of protection strategies.

Other actions in Pledge Element 7 include: climate adaptation plan, hazard mitigation plan, conserve natural areas, green infrastructure, culverts and dams, riparian buffers, nature-based shorelines, and water conservation and reuse.

Actions in Pledge Element 6 include: comprehensive plan with sustainability elements, green parking lot standards, natural resources inventory, and protecting natural areas through zoning or other regulations.

Model Local Laws

Municipalities should review and consider implementing Model Local Laws.

The New York State Department of State has released Model Local Laws to Increase Resilience (https://www.dos.ny.gov/opd/programs/resilience/). These model laws, which local governments may adopt voluntarily to be more resilient to sea-level rise, storm surge, flooding and erosion cover five general topics:

- Basic Land Use Tools for Resiliency
- Wetland and Watercourse Protection Measures
- Coastal Shoreline Protection Measures
- Management of Floodplain Development
- Stormwater Control Measures

Education

- Provide ongoing educational outreach to municipalities to provide updates on projects and resources as well as inform new representatives.
- Development of municipal packets to inform newly elected officials and staff about the watershed and initiatives.
- Update and revision of the Streambusters document.

Update and expand inventories and mapping utilizing new or updated data. Maps that could be updated or expanded include:

- Landcover
- Preserved/Conserved areas
- Scenic Areas
- Recreation Areas and Opportunities (including camping, hiking, swimming and non-motorized boating i.e. canoeing/Kayaking)
- Road stream crossings aquatic passability and capacity mapping
- Invasive species that impact water resources (riparian areas and watershed wide)
- Water and wastewater infrastructure

Advancement of the BCTF vision/goals

- Support development and implementation of learning stations and demonstration sites
- Delivery of newly developed curriculum and related educational programs
- Continued monitoring and data collection at learning station sites

Aquatic Barriers and Road Stream Crossings

- Update and expand road stream crossing NAACC assessment, inventories and management planning.
    - Re-assessment of crossings assessed under outdated protocols prior to 2016
    - Updates to existing plans
    - Watershed level inventory and planning

- Identification and mapping of dams
- Prioritization of structures for replacement/rightsizing/removal
- Pursue partnerships and projects to design and implement replacement/removal priorities
- See recommendations specific to the Catskill Creek Mill Pond Dam Hydroelectric Facility in Dams and Diversions section on pages 31-32.

Riparian Area Restoration and Trees for Tribs Plantings

- Continue maintenance of existing plantings
- Identification of new sites and installation of plantings
- Assessment or inventory of riparian areas
- Investigate the potential to utilize Statewide Riparian Opportunity Assessment tools https://www.nynhp.org/treesfortribsny

Agricultural Areas

- Encourage utilization of Local, State and Federal programs to minimize agricultural environmental impacts on waterbodies and groundwater sources such as the Agricultural Environmental Management program.

Wastewater Infrastructure

- Ensuring that the watershed's 42 small private, commercial and institutional wastewater treatment plants are well managed.
- Septic districts or other septic system management options should be considered to ensure that homeowners can affordably maintain their septic systems.

Recommendations from Significant Habitats in the Catskill Creek Corridor Report (Appendix A)

Conclusion

This document is intended to be used as a resource in helping to inform and guide further planning and management in the Catskill Creek Watershed. This draft should be considered an initial step in an ongoing process to protect and enhance the health of the watershed. This resource should be reviewed periodically to update and expand both the information/data/maps and recommendations over time.

Appendices List

Appendix A - *Significant Habitats in Catskill Creek Corridor Report*

Appendix B – *Catskill Creek Management Unit Delineation Protocols*

Appendix C - *Catskill Creek Watershed Post Flood Evaluation Synopsis*

Appendix D - *Catskill Creek Watershed Streambusters Handout*

Appendix E – Full Page Maps

Past CCWAP Members and Partners

Involvement with the CCWAP has included municipal officials, residents and leaders from throughout the watershed. CCWAP has attempted to engage representatives from every municipality as well as stakeholders from as many agengies, organizations and the community as possible. Their participation over the years has been important in furthering watershed efforts and is much appreciated.

Government Officials

Magee, Tracey- Assemblyman Lopez's rep., serving all of Greene County

Quigley, John- Senator Amedore's office- Constituent Coordinator

Tatun, Tom- Senator Amedore's office- Rep.

Municipal Officials

Larry Federman, Town of Catskill Planning Board

Jared Giordiano, Town of Catskill Councilman

Joseph Izzo, Town of Catskill Planning Board

Hudson Talbott, Town of Catskill Board Member

Heather Bagshaw, Village of Catskill Trustee

James Chewens, Village of Catskill Trustee

Nancy Richards, Village of Catskill Community Development Coordinator

Vincent Seeley, Village of Catskill President

Kevin Crosier, Berne Town Supervisor

Ted Banta, Cairo Town Supervisor

Dan Joyce, Cairo Board Member

William Carr, Durham Town Supervisor

George Decker, Durham Councilman

Linda Sutton, Durham Board Member

Paul Macko, Greenville Town Supervisor

Amy Wayman, Middleburgh Planning Board

John Mormile, Rensselaervile Zoning Board of Appeals Chairman

Highway Department

Jason Wayman, Middleburgh Highway Superintendent

Private Landowners

Mark Vian, Catskill

Elizabeth LoGiudice, New Baltimore

Rebecca Platel, Rensselaerville

Soil and Water Conservation Disctricts

Peter Nichols, Schoharie County

Shane Nickle, Schoharie County

Joel Dubois, Greene County

Jeff Flack, Greene County

Teachers/Educators

Rachel Anderson, Greenville High School

Business Owners

Mike Aguire, Riverview Marina, Catskill

Fred Calvo, GNH Limber, Catskill

Hudson River Estuary Program Specialists

Fran Dunwell, Coordinator

Ingrid Haeckel- Conservation and Land Use

Andrew Meyer- Conservation

Beth Roessler- Stream Buffer Coordinator

Maude Salinger- Communication

Emily Vail- Watershed Outreach

Libby Zemaitis, Climate Outreach

Partner Organizations

Maureen Cunningham, Hudson River Watershed Alliance Director

Vince Dubois, Columbia Greene Trout Unlimited President

Woodstock "Dam," Cairo, NY

Resources, Studies and Reports

- A Management Plan for the Trout Fishery of the Catskill Creek, NYS DEC, 1995
- Durham Valley Scenic By-Way Plan & Headwaters Protection Plan, ERO Resources Corporation and Hudsonia, Inc.
- Catskill Creek Watershed Restoration and Protection Strategy, NY Association of Conservation District's Community Conservation Assistance Program
- DMA 2000 Hazard Mitigation Plan, Greene County, NY, 2009
- Franklinton Vlaie Tributary Improvement Study/Design, MILONE & MACBROOM, INC., 2018
- Greene County Economic Development Plan, 2007
- Greene County Water Dependent Use Inventory & Assessment, 2008
- Groundwater Resources Study and Protection Plan for the Town of Cairo, New York Rural Water Association, 2009
- Hudson Basin River Watch 2007 Water Quality Report Card for the Catskill Creek
- Lower Hudson River Basin WI/PWL Report, NYS DEC Division of Water, 2008
- NYS DEC Public Fishing Rights maps
- Significant Coastal Fish and Wildlife Habitats, NYS DOS Division of Coastal Resources
- Significant Habitats in Catskill Creek Corridor Report, Hudsonia, Inc. 2014 (App. A)
- Small Dam Inventory Report, 2010
- Village of Catskill Scenic and Natural Treasures report, Scenic Hudson, Inc.