Neversink Watershed Management Plan

A Plan to Protect & Restore the Neversink Watershed

2024 - 2029

Prepared by Friends of the Upper Delaware River

With support from Sullivan County and Trout Unlimited

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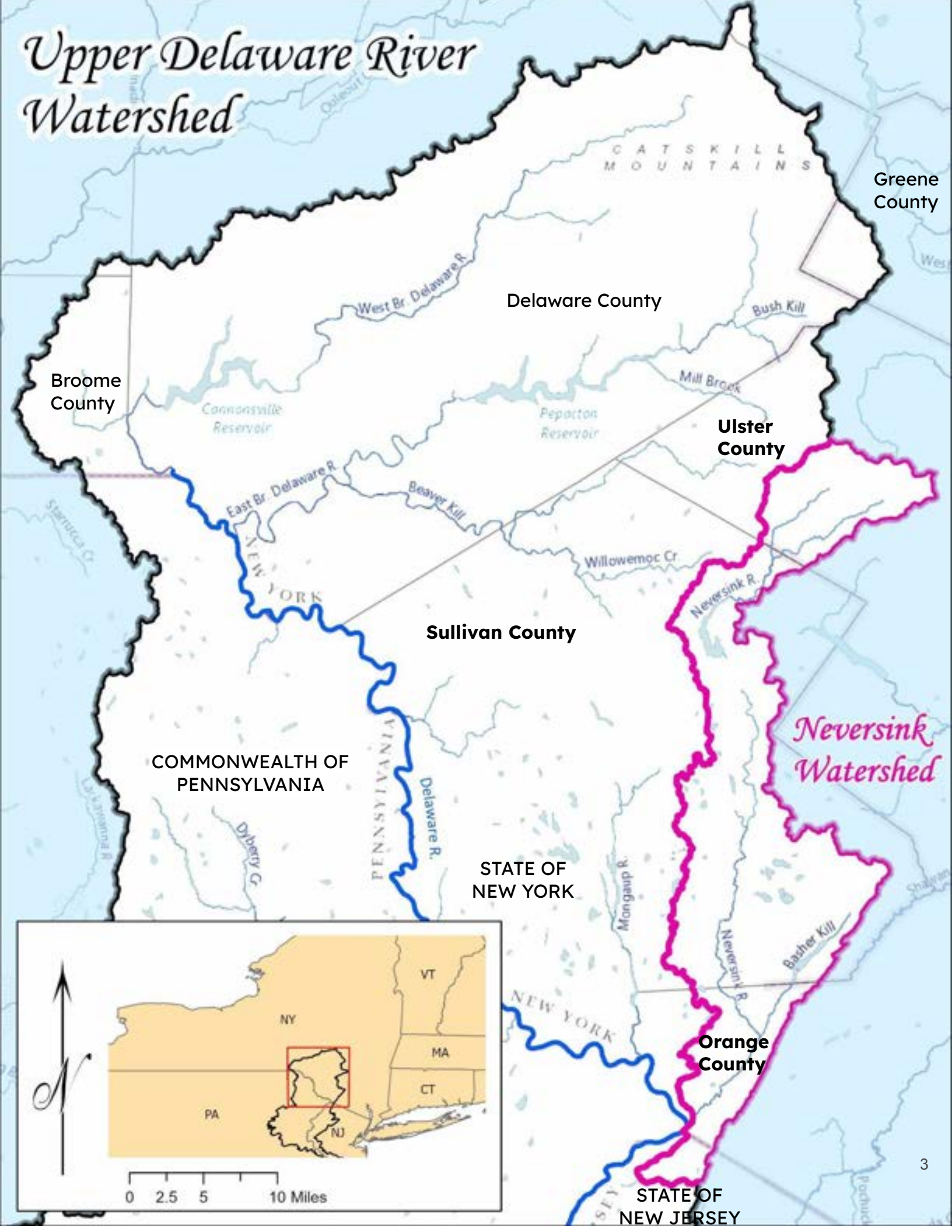
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Neversink Unique Area, image courtesy of Beth Brown , DRBC

Acknowledgements

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Lastly, a heartfelt thank you to the people of Ulster, Sullivan and Orange County NY who care deeply about the economic, historical, and environmental quality of this beautiful watershed. Through their involvement at public meetings and in the conception and development of the NWMP, they demonstrated a strong commitment to the future management and conservation of the watershed.

Bashakill Wildlife Management Area, image courtesy of Beth Brown, DRBC

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The plan's Authors and Steering Committee include representatives of conservation organizations at the regional and local level.

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Bashakill Wildlife Management Area, image courtesy of Beth Brown, DRBC

GLOSSARY

APCAW- Ability to Produce Clean and Abundant Water
BMPs- Best Management Practices
CALM- Consolidated Assessment and Listing Methodology
CAP- Climate Action Plan
CFS- Cubic Feet per Second
CRISP- Catskill Regional Invasive Species Partnership
CSSO- Conditional Seasonal Storage Objective
DEC- Department of Environmental Conservation
DEP- Department of Environmental Protection
DRBC- Delaware River Basin Commission
EPA- Environmental Protection Agency
FEMA- Federal Emergency Management Agency
FFMP- Flexible Flow Management Program
FUDR- Friends of the Upper Delaware River
GHG- Greenhouse Gas
GIS- Geographic Information System
GSI- Green Stormwater Infrastructure
HUC- Hydrologic Unit Code
IR- Integrated Reporting
LFA- Local Flood Analysis
MGD- Million Gallons per Day
MUA- Multiple Use Area
MUD- Metropolitan Urban Design
NAACC- North Atlantic Aquatic Connectivity Collaborative
NFIP-National Flood Insurance Program
NFWF- National Fish and Wildlife Federation
NWMP- Neversink Watershed Management Plan
NOAA- National Oceanic Atmospheric Administration
NYC- New York City
NYS- New York State
O&W- Ontario & Western
OSI- Open Space Institute
SALDO- Subdivision And Land Development Ordinance
SWOT- Strengths, Weaknesses, Opportunities, Threats
T- Trout population
TMDL- Total Maximum Daily Load
TNC- The Nature Conservancy
TS- Trout Spawning
TU- Trout Unlimited
USGS- United States Geological Survey
WI/PWL- Waterbody Inventory/Priority Waterbodies List

Executive Summary

Bashakill Wildlife Management Area, image courtesy of FUDR

Our purpose in developing the Neversink Watershed Management Plan (NWMP) is to create a plan that provides a framework and blueprint for Neversink watershed stakeholders to use as a guide for the future management of water resources.

The NWMP priorities are aligned with those of the federal Delaware River Basin Restoration Program which addresses flooding, water quality, habitat, and recreational opportunities throughout the basin.

In the Spring of 2022 a Steering Committee was formed to provide guidance and technical assistance to project leaders. Committee membership included some of the most active and knowledgeable watershed practitioners in the Neversink watershed.

Throughout 2023 and into 2024, project leaders implemented a comprehensive public outreach program that engaged a diversity of watershed stakeholders, interviewed dozens of local elected officials and agency personnel, and researched existing sub-watershed plans that predated this effort.

Through this outreach effort threats, important projects priorities, challenges to conservation initiatives, and the most available opportunities to ensure conservation advancements were identified.

Introduction

Blue Trail at Katrina Falls, image courtesy of Nancy Bachana

The Neversink Watershed Management Plan (NWMP) is a collaborative effort among government agencies, non-profit organizations, and watershed residents and stakeholders throughout Ulster County, Sullivan County, and Orange County NY. This plan provides an in-depth review of the entire New York portion of the Neversink watershed. A small portion of the Neversink watershed lies within the State of New Jersey and is not covered by this plan.

The NWMP is a non-regulatory guidance document that lays out a holistic multi-jurisdictional planning approach necessary to ensure the sound future management and conservation of the Neversink watershed. This plan acts as a tool for stakeholders to develop and work towards a shared vision and common goals that will benefit the future of the watershed. The NWMP reflects the interests and concerns of watershed residents, municipal officials, businesses, streamside landowners, and visitors. It is designed to be used by a wide range of watershed stakeholders to ensure that the watershed is managed properly for future generations to enjoy.

The plan promotes and supports clean and abundant water, healthy habitat, expanded recreation, infrastructure improvements, climate resilience, flood mitigation, sustainable economic development, and cultural and historic amenities. This document is the product of an extensive public outreach effort to gather important watershed information. A series of virtual and in-person public outreach meetings were held to provide a wide range of watershed stakeholders an opportunity to participate in the development of the NWMP. The public's input provided critical information that helped inform numerous parts of the plan. Local stakeholders were able to offer important information on flooding issues, development threats, historical information, and conservation opportunities. In addition to organizing several public outreach meetings, municipal leaders and elected officials were consulted to help identify high priority projects within their municipality.

Municipalities visited include the towns of Neversink, Fallsburg, Thompson, Forestburgh, Mamakating, Deerpark; the Villages of Woodridge, Monticello, and Wurtsboro; the City of Port Jervis; and Sullivan County. One of the most notable themes that emerged in developing the NWMP was that significant portions of the Neversink watershed are facing unprecedented challenges from the onset of rapid and unplanned development. In the Post-COVID era the region has seen a marked increase in people permanently relocating to the area from surrounding urban areas, particularly New York City. This trend is placing pressures on land and water resources, local government budgets, cultural trends, and housing availability. Numerous development projects have sprung up throughout the Neversink watershed to fill a growing market. Some of these projects have attracted controversy and opposition from residents and local governments. Increasing development was the number one concern of participants in the Neversink Strengths, Weaknesses, Opportunities, and Threats analysis (SWOT) that was conducted with a wide diversity of watershed stakeholders. Their concerns associated with rapid development included water availability, water quality impacts, habitat fragmentation, and sewage treatment. In the absence of adequate land use planning and a vision for the future that adjusts to the impacts of climate change and an increasing population, growth pressures will place added strain on the natural resource quality and value in the Neversink watershed.

Throughout the NWMP there are objectives that attempt to address the challenge of managing growth and development. While this is intended to be a non-regulatory guidance document, it's important to suggest that local governments, residents, and other watershed stakeholders consider updating or adopting land use protections as one tool to address these issues. Other tools discussed in the plan include protecting open space and areas of ecological significance, providing training for local municipal officials who are charged with managing growth, and maximizing public education efforts to ensure that watershed stakeholders understand the impacts of unplanned growth and can respond in effective and meaningful ways.

Bashakill Wildlife Management Area, image courtesy of FUDR

Background

Bashakill Wildlife Management Area, image courtesy of FUDR

Sullivan County, Friends of the Upper Delaware River (FUDR), and Trout Unlimited (TU) were awarded a federal grant in 2021 to develop a Neversink Watershed Management Plan (NWMP). The project was funded by the US Fish and Wildlife Service's Delaware River Basin Restoration Program which is administered by the National Fish & Wildlife Foundation. Throughout 2022 and 2023, Sullivan County, FUDR, and TU led a comprehensive and collaborative planning process with broad participation from Neversink watershed municipal representatives, residents, visitors, and business owners (collectively "the stakeholders") to develop the NWMP.

The NWMP is a non-regulatory guidance document that profiles the entire Neversink watershed, outlines management goals and recommendations, and identifies and prioritizes implementation projects. This NWMP marks the first time the entire Neversink River watershed in New York state has been addressed in a single planning document.

Development of the NWMP included a process that looked at all aspects of living and doing business in the watershed. The NWMP evaluates impacts to the watershed from existing and planned development and other land uses, flooding concerns, water quality/quantity issues, recreational opportunities, and how the river system contributes to local economic needs and interests.

Watersheds do not follow municipal boundaries, so a holistic multi-jurisdictional planning approach is necessary to ensure sound future management. This plan acts as a tool for municipalities, conservation organizations, community members, and other partners to develop and work towards a shared vision and goals that benefit all watershed stakeholders.

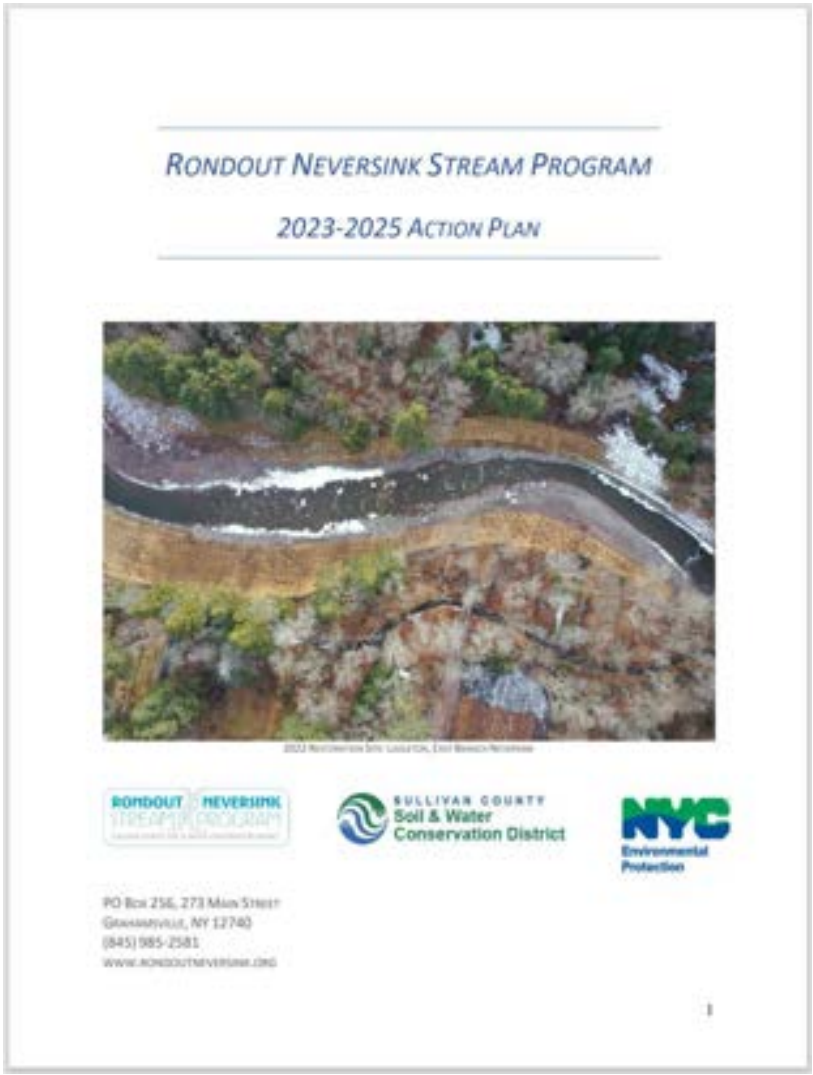
A series of community education and outreach meetings was planned throughout 2023 and 2024. The meetings were a mix of in-person and virtual. Each meeting had a different topic of discussion and speakers from various

backgrounds presented and encouraged dialogue among the community members who attended.

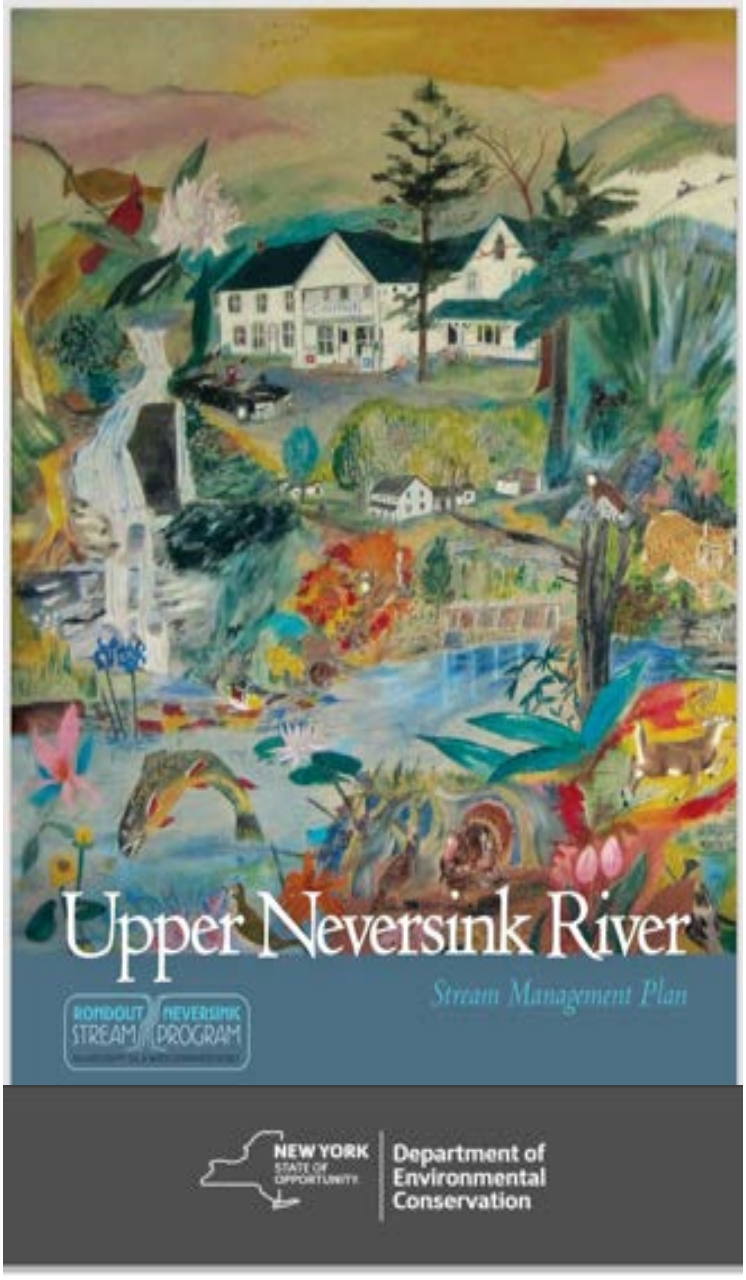
The NWMP was informed by an expansive public outreach effort that included local government leaders and public agencies, businesses that rely on tourism and natural resources, hunters and anglers, watershed home/landowners, conservation organizations, and members of the general public. The plan also benefited from the technical resources of Sullivan County agencies who provided mapping, GIS data, and field work on area streams.

In order to understand the Neversink watershed and its planning history, existing watershed plans for the watershed and region were reviewed and considered.

a. Watershed Management Plans;
    - 'Rondout Neversink Stream Program (2023-2025 Action Plan)' funded by the New York City Department of Environmental Protection. This plan explains the planned activities, goals to accomplish, and next steps in the management of the Rondout Neversink Stream. This plan is updated annually. (Pictured right).



- ’Upper Neversink River Stream Management Plan’ (2013) funded by the New York City Department of Environmental Protection. The Rondout Neversink Stream Program released this plan to be used as a guide indicating best management options for local residents/stakeholders, municipalities, interested organizations and agencies to conserve the upper Neversink watershed. This plan is in the process of being updated. (Pictured top right)



- ’Neversink River Unit Management Plan Draft’ (2022) by New York State Department of Environmental Conservation. This plan outlines the best management plans for the Neversink River that will ensure the sustainability, biological diversity, and protection of functional ecosystems. This plan is currently in the review and finalization process. (Pictured bottom right)

b. Comprehensive and Zoning Plans;

- ‘Sullivan 2020 Toolbox’ (2005) by Sullivan County. Sullivan 2020 was a Countywide comprehensive planning effort in 2005. The associated “Toolbox” contained resources and factsheets to help communities work towards their goals and visions. The Toolbox is still a useful document, but the County has plans to work on a new comprehensive plan that will address current trends, visions and goals. (Pictured top right)

FACT 1 SHEET

Glossary

Source: HRG Consultants

Affordable Housing – Housing developed through some combination of zoning incentives, cost-effective construction techniques, and governmental subsidies that can be rented or purchased by households who cannot afford market rate housing in the community. *(Definition from New York Municipal Insurance Reciprocal)*

Agricultural Land Protection – Any law, regulation, board, or process that has as its objective the preservation of farming on land dedicated to agricultural use. Examples include agricultural zoning, farmland preservation boards, and property tax relief for farmers, and anti-nuisance laws. *(Definition from New York Municipal Insurance Reciprocal)*

Agri-Tourism – The act of visiting a working farm or any agricultural, horticultural or agri-business operation for the purpose of enjoyment, education or active involvement in the activities of the farm or operation. *(Definition from West Kentucky Corporation)*

Agri-Business – Encompasses the sum of all activities that occur in farm production, farm resource supply, manufacturing and processing, storage, distribution, wholesale and retail sales of plant and animal food, natural fiber, medicinal plants and animals, forestry, horticulture and aqua-cultural products. *(Definition from Virtual farmers Market)*

Buffer – A buffer is an area of land that is used to protect something from encroaching development. An example is a stream that is protected from the impacts of development by a buffer of undeveloped land.

Brownfield – A former industrial or commercial site where redevelopment is complicated by real or perceived environmental contamination that can add cost, time or uncertainty to a redevelopment project.

Clearcutting – The harvesting and regeneration of trees, regardless of size, in one area of operation. This practices produces an even-aged forest stand. Clear-cutting is most often used with species like aspen or black cherry, which require full sunlight to reproduce and grow well, or to create specific habitat for certain wildlife species. *(Definition form New York State Envirothon)*

Cluster Subdivision/Development – A cluster subdivision places buildings on large lots near each other. The location of these buildings allows the preservation of the natural and scenic quality of the remainder of the land.

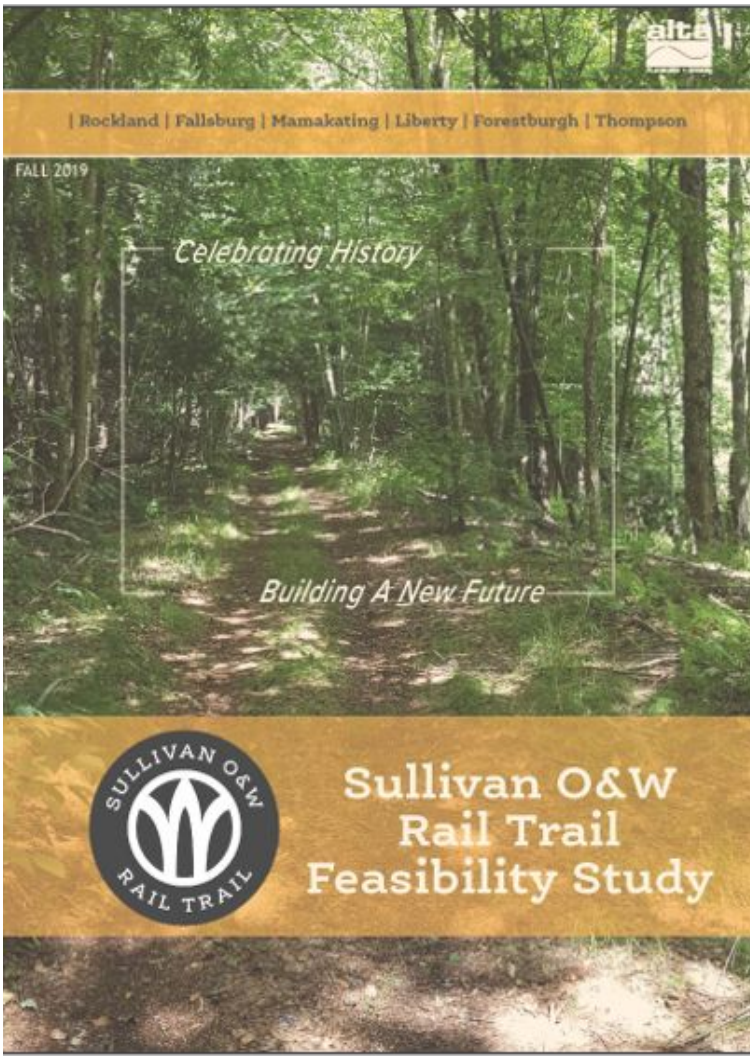
Comprehensive plan – A comprehensive plan is a written document that identifies the goals, objectives, principles, guidelines, policies, standards, and strategies based on a vision for the growth and development of the community.

"A Comprehensive Plan sets forth policies for the future of a community that serves as a guide for many public decisions, especially land-use changes and preparation of capital improvement programs, and the enactment of zoning and legislation. It is the result of public input as part of the analysis of existing physical, economic, and social conditions, and projection of goals and strategies for future development." *(Sullivan 2020)*

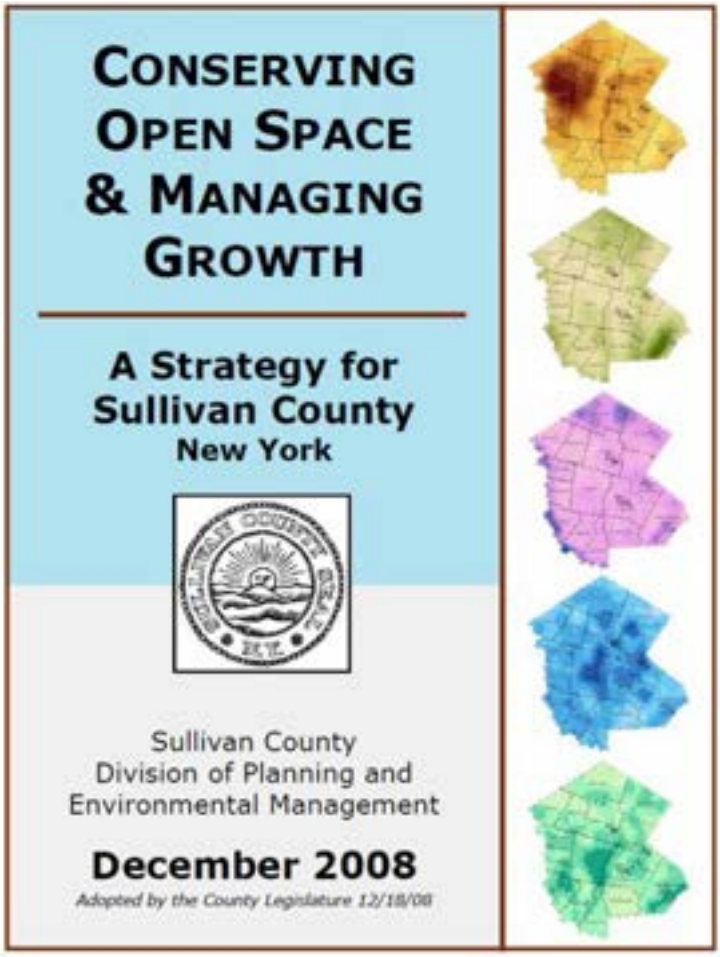
Conservation Easement – A conservation easement is a voluntary agreement between a private landowner and

Zoning: Sullivan 2020 Toolbox *Fact Sheet 1-1*

- ‘Sullivan O&W Rail Trail Feasibility Study’ (2019) by Sullivan County Division Planning and Environmental Management. This document depicts the need for safe alternative transportation routes, trail expansion to connect more communities, and economic improvements needed to enhance the experience of the O&W Trail.(Pictured bottom right)



- ‘Conserving Open Space & Managing Growth, A Strategy for Sullivan County New York’ (2008) by Sullivan County Division Planning and Environmental Management. This identifies Sullivan County’s existing natural resources so that open space conservation can be focused in areas that will have the greatest impact. (Pictured below)




Neversink Unique Area, image courtesy of TU

OUR VISION

The Vision Statement for the NWMP reflects the collective wisdom and aspirations of the many stakeholders who contributed to its development and conceptualizes what the watershed will look like in the future:

The Neversink watershed will support vibrant communities with clean water for humans and wildlife. The watershed will be resilient to flooding, support high quality habitat for wildlife, and have ample river access and open space for the public to enjoy.

Neversink Unique Area, image courtesy of Beth Brown, DRBC

Planning Process

The following steps were taken in the planning stages to complete the development of the NWMP:

1. Gathering a broad range of public input and building relationships among a diverse set of stakeholders across the watershed.
2. Extensively survey through field work the existing conditions in the watershed and poll stakeholders on their most important issues, concerns, and opportunities.
3. Take the information gathered from stakeholders and begin to identify projects that can help improve watershed conditions.
4. Prepare a final plan for publication that can help guide decision making, is useful for raising funds to meet the stated objectives, and can be changed and updated over time as the need arises.
5. Share the information in the plan with stakeholders and help establish an ongoing sustainable process for implementation.

This document has been developed through extensive public participation, analysis, and input during public education and outreach meetings. Geographic Information Systems (GIS) materials (such as maps), scientific reports and data, and the review of other watershed related documents were reviewed and taken into consideration. This approach provided a systematic way for watershed stakeholders to view conditions, strengths, concerns, weaknesses, opportunities and potential threats to the watershed. The approach used is to define, categorize and ultimately develop short and long-term goals, objectives and suggestions to guide the future management of the Neversink Watershed. The steps taken to complete the NWMP are as follows:

Public Outreach to Gather Public Input & Build Relationships

A good plan is based on information from all sources, especially from residents who know the most about where they live. To ensure broad public input, and a high quality plan, a goal was set to connect, educate and support stakeholders and community members, identify key individuals and organizations and structure a visioning process that would allow all voices to be heard. The full outreach plan is attached in Attachment B.

The outreach consisted of four rounds of public participation and outreach meetings that comprised nine meetings in total. These meetings provided invaluable assistance in the development of the NWMP. A critical need was to ensure a high level of public understanding and involvement for the NWMP planning process, the final product, and the future implementation of the plan. The meetings were a combination of virtual and in-person meetings that began the winter of 2023.

To maximize participation, the following recruitment actions were undertaken for every public meeting:

- The placement of meeting notices in local newspapers and online local event boards at least two weeks prior to each meeting.
- Public meeting announcements utilizing multiple social media platforms, email networks, radio advertisements, and contacts of our government, nonprofit, and business partners.
- Press releases issued to local media outlets including, WJFF, Bold Gold Media, the River Reporter, and the Sullivan County Democrat.
- Generation of traditional media coverage including radio programming and news stories in local media outlets throughout the targeted communities.
- Virtual public meetings were recorded, uploaded to FUDR's Neversink specific website, and can be found by visiting the following website; www.fudr.org/neversinkwmp.

The first round of public meetings were held virtually. The first meeting was January 18th, 2023 with 71 participants. The definition of a watershed and general concepts on watershed management planning were discussed at this meeting. George Schuler, former Director at The Nature Conservancy, Heather Jacksy, Chief Planner at Sullivan County Division of Planning and Environmental Management, and Steven Schwartz, Consultant were the presenters.

The second virtual meeting was January 30th, 2023 with 65 participants. This meeting covered the basic functions of stream dynamics and how they interact with watersheds. Gian Dodici, Fish & Wildlife Biologist with U.S. Fish & Wildlife Service and Stacie Howell, Program Coordinator with Rondout Neversink Stream Program were the presenters.

The third virtual meeting was March 1st, 2023 with 49 participants. Historic flooding events, the impacts of climate change, and the economic/recreational benefits of stream protection and restoration in the Neversink watershed were reviewed. Freda Eisenberg, former Commissioner of the Sullivan County Division of Planning and Environmental Management and Shachi Pandey, Founding Principal at Metropolitan Urban Design (MUD) Workshop were the presenters.

The second round of public meetings was

conducted in-person at two different locations in Monticello, NY. The fourth and fifth meetings were completed in one day at the Ethelbert B. Crawford Public Library on May 3rd 2023. There was an afternoon session with 43 participants and an evening session with 21 participants. These meetings were about identifying open spaces to preserve and potential stream projects within the Neversink watershed boundaries. Large maps containing the watershed border were used by participants to identify this information. Jesse Vadala, Engagement Coordinator at TU, Nancy Bachana, Historic Tour Guide at NY-NJ Trail Conference, and Heather Jacksy, Chief Planner at Sullivan County Division of Planning and Environmental Management were the guest speakers at both of the sessions.

The sixth public meeting was on June 12th, 2023 and conducted at SUNY Sullivan with 27 participants. This meeting focused on developing a vision for the Neversink watershed. Large maps were used again to allow participants to focus on areas within the watershed they find meaningful and to identify those places. Presenters were Steve Schwartz, Environmental Consultant, Clay Smith, FUDR Board Member, and Jeff Skelding, FUDR Executive Director.

The third round of public meetings consisted of one virtual public meeting. This meeting was conducted over zoom on Thursday November 2nd, 2023 with 29 participants. The discussion and further development of the NWMP's vision statement, goals, strategies, and actions took place with watershed stakeholders. There was an opportunity for participants to ask questions and provide input verbally and in written form. Public comments were collected at the end of the meeting and were incorporated into the draft of the NWMP.

The fourth and final round of public outreach meetings consisted of two public meetings, one in-person and one virtual. The first meeting was held at the Ethelbert B. Crawford Public Library on May 2rd 2024 with 17 participants. At this meeting, the public had a first

NWMP public meeting at Ethelbert B. Crawford Public Library, image courtesy of FUDR

NWMP public meeting at SUNY Sullivan; Image courtesy of FUDR

view of the NWMP draft. There was an opportunity for participants to ask questions and provide input verbally and written. The second meeting was done over zoom on May 15th, 2024 with 19 participants. The public had a final opportunity to ask questions and provide input verbally and in written form regarding the final draft of the plan.

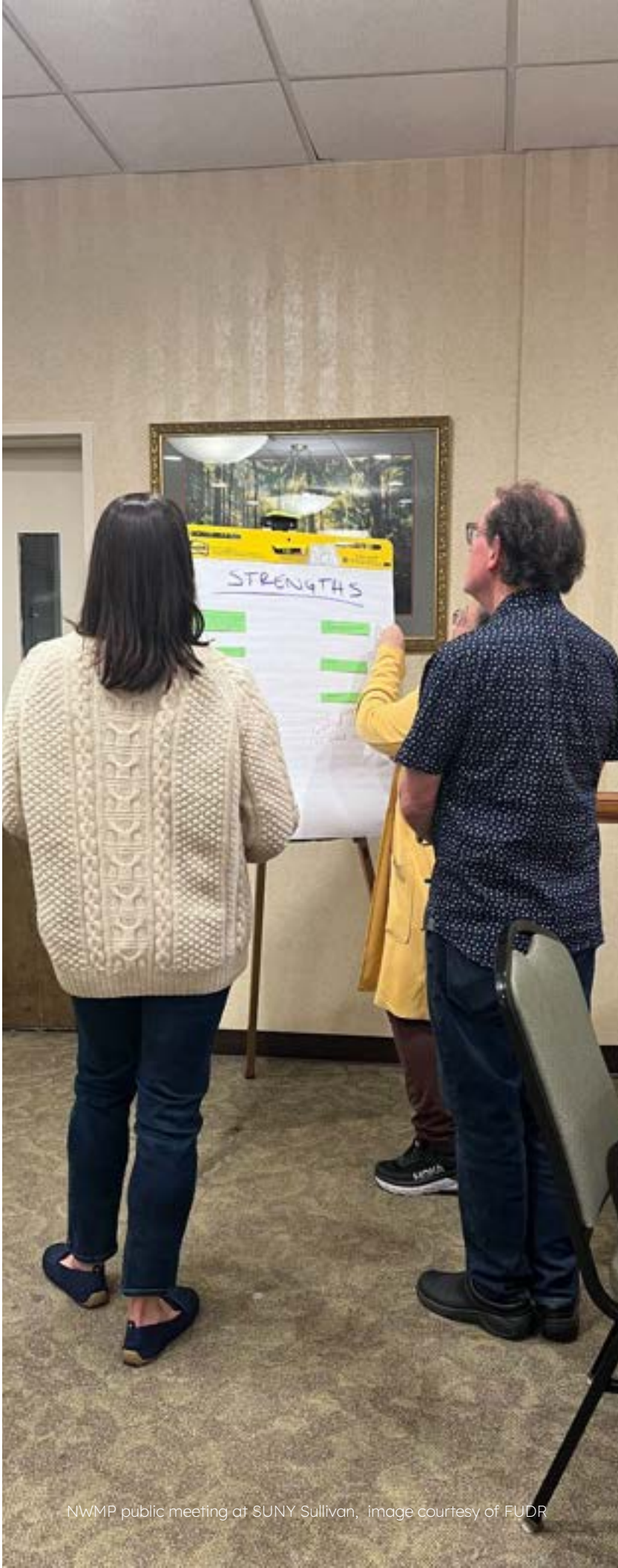
Strengths, Weaknesses, Opportunities & Threat Analysis (SWOT)

A SWOT analysis is a strategic planning technique to evaluate the watershed and to poll stakeholders on their most important issues, concerns, and opportunities during a project's planning process. Strengths describe the characteristics of the watershed that give it an advantage and make it a place of importance; weaknesses describe the characteristics of the watershed that create disadvantages or concerns within the communities; opportunities describe the elements that could be used to the advantage of the watershed and its stakeholders; threats describe the elements and characteristics that could cause issues for the watershed and residents.

A SWOT analysis was conducted throughout the public outreach and education meetings where diverse groups of individuals gathered and were free to provide realistic SWOT data input. The information gathered will begin to identify projects that can help improve watershed conditions. This effort was led by Steve Schwartz, Consultant and Clay Smith, an FUDR Board Member.

The unedited SWOT data collected from Neversink watershed stakeholders is as follows:

- Strengths: Significance of watershed to Sullivan County settlement; The Neversink Gorge; Forested habitat; Habitat for eagles and other species deserving protection; Exceptional water quality; World class fishing.
- Weaknesses: Overdevelopment of the Neversink area; Zoning; Inaction by DEC regarding contaminated water samples; Too little land protected by state/local government or conservation easements; Limited resources for regional planning; Siloed local efforts.
- Opportunities: Day hiking; Historic D&H Canal Feeder Lakes need protection; Access to recreation; Conserving additional land; Landlocked Atlantic salmon in the Upper Neversink; Complete regional trail system; Funding availability.
- Threats: Over development; Too many big box developments; Distribution centers being proposed; 325 home development in Fallsburg; Over sewer capacity in Fallsburg; Silt runoff; Too many people, not enough water; Lost Lake community; Climate change; Large scale industrial and commercial development; Outdated local zoning.



NWMP public meeting at SUNY Sullivan, image courtesy of FUDR

Final Steps

The final step in the NWMP planning process was to prepare a final plan for publication that can help guide decision making, is useful for raising funds to meet the stated objectives, is shared with stakeholders to help establish an ongoing sustainable process for implementation, and can be changed and updated over time as the need arises.

The NWMP drafting process was a collaborative effort of the Authors and Steering Committee members to gather all of the information collected from the public and municipal meetings. Once chapters were developed, both groups were asked to review and make comments to sections where their expertise was strongest. From that process, a NWMP draft was created and presented to the public for further review and comments. The public's comments were incorporated into the final version of this plan.

Neversink Unique Area, image courtesy of Beth Brown, DRBC

Watershed Characteristics

Watershed Overview

The assessment process used to develop a broad watershed overview of the Neversink watershed was developed by project leaders and a wide variety of watershed partners. These leaders collaborated to generate extensive localized information on existing stream management programs, public infrastructure, stream conditions, areas of vulnerability, flooding impacts, geologic characteristics, historic and modern land uses, water quality, and resource management recommendations and approaches. This information was supplemented by the expertise of various members of the NWMP Steering Committee. TU provided Geographic Information System (GIS) data and mapping in the Neversink watershed using databases provided by New York State. The Sullivan County Planning Department generated significant localized information on waterway characteristics and project needs.

General Description of Watershed Location

The Neversink watershed in the New York portion encompasses approximately 325 square miles. The watershed boundary extends into portions of 12 municipalities, two in Ulster County, eight in Sullivan County, and two in Orange County NY. The Neversink watershed is defined as the drainage area beginning at the headwaters of the East and West Branches of the Neversink River in Ulster County NY and going downstream as far as the City of Port Jervis in Orange County, NY.

The beginning of the Neversink watershed starts in the southern region of Ulster County NY near the border of Sullivan County NY. The East and West Branches of the Neversink River begin in Ulster County and flows south through the Towns of Shandaken and Denning. Both branches continue southwest crossing over the border into Sullivan County NY and joining to form the Neversink River in the Hamlet of Claryville. Downriver below this confluence, in the Town of Neversink, the river flows into the manmade Neversink Reservoir of the New York City Water Supply System which also connects to the Rondout Reservoir. The river and watershed continue south down through the following eight municipalities in Sullivan County NY; Neversink, Fallsburg, Woodridge, Monticello, Thompson, Forestburgh, Mamakating, Wurtsboro; eventually making its way through the following two Orange County NY municipalities; Deerpark and Port Jervis. Port Jervis is located at the confluence of the Neversink and Delaware rivers, as well as the border between New York, New Jersey and Pennsylvania. The southernmost portion of the Neversink River watershed lies within New Jersey.

Neversink History

Human history along the Neversink River is one of connections to the abundant natural resources of the region. While these connections have changed through the ages, they form a foundation for the people who now populate and visit the area.

The history begins with the Native American communities who once inhabited the lands surrounding the river as far back as 12,000 years ago. The Lenapé were of Algonquin origin and referred to the modern day Neversink as nkëchehòsi sipu (pronounced ‘neck ehh ch ha see sip ooo’), meaning “crazy river”. The Lenapé of the Neversink were hunters and fishers who found harmonious solutions for food, shelter, and medicine from the provisions of the rivers and forests around them. Standing tall and anchored were the legacy Eastern hemlocks (Tsuga canadensis) that protected, provided, and eventually became all but consumed by the industries of the Neversink. However, long before trading and value was cast upon the barks of streamside hemlocks, the Lenapé had developed a spiritual and medicinal connection to the trees of their land.

With the arrival of European settlers, the Neversink played a crucial role in the development of early communities, serving as a navigable waterway for transportation and trade. Over time, the river experienced the growth of industry and the construction of various mills along its banks, harnessing its power for economic purposes. European settlers in the 1600’s marveled at the restorative powers of the local Lenapé medicine, much of which came in the form of teas or pills derived from the barks of Willows (*Salix*), Cherries (*Prunus avium*), Dogwoods (*Cornus*), Birchs (*Betula*), Oaks (*Quercus*), and more. To honor their connection to the earth and its provisions, a ‘prayer always preceded treatment’ and a ritual was performed before the gathering of the medicinal goods. The Lenapé healers of the Neversink eased aches and pains with a tea made from the bark of Willow trees, which delivers salicin, an active ingredient found in modern day aspirin. Many years later as the climate became more temperate in the Neversink Valley, the Lenapé and other Delaware tribes took to farming crops of corn, squash, and beans in open grasslands adjacent to the river. As European settlers pressed harder upon the Lenapé, resources once cherished became

scarce and nearly all known tribal populations were driven West. In a similar fashion, numbers of hemlocks and other large shade bearing trees would soon be all but eradicated from the banks of the Catskill forests. Without these massive hemlocks to slow and deflect the vicious seasonal flows of the “Crazy River”, the Neversink lives up to and amplifies the very nature of its name.

Tanneries played a large role in the settlement of the Upper Neversink. In the 19th Century, the abundant hemlock trees and their bark with rich tannins were essential for leather-making. The establishment of tanneries and the subsequent removal of hemlock trees (hemlocks were generally left in place but with their bark removed they eventually died) led to pollution of local streams from byproducts of leather making and inputs of sediment now able to freely run-off the landscape unhindered by tree roots. Once world-class trout streams became a shell of what they once were.

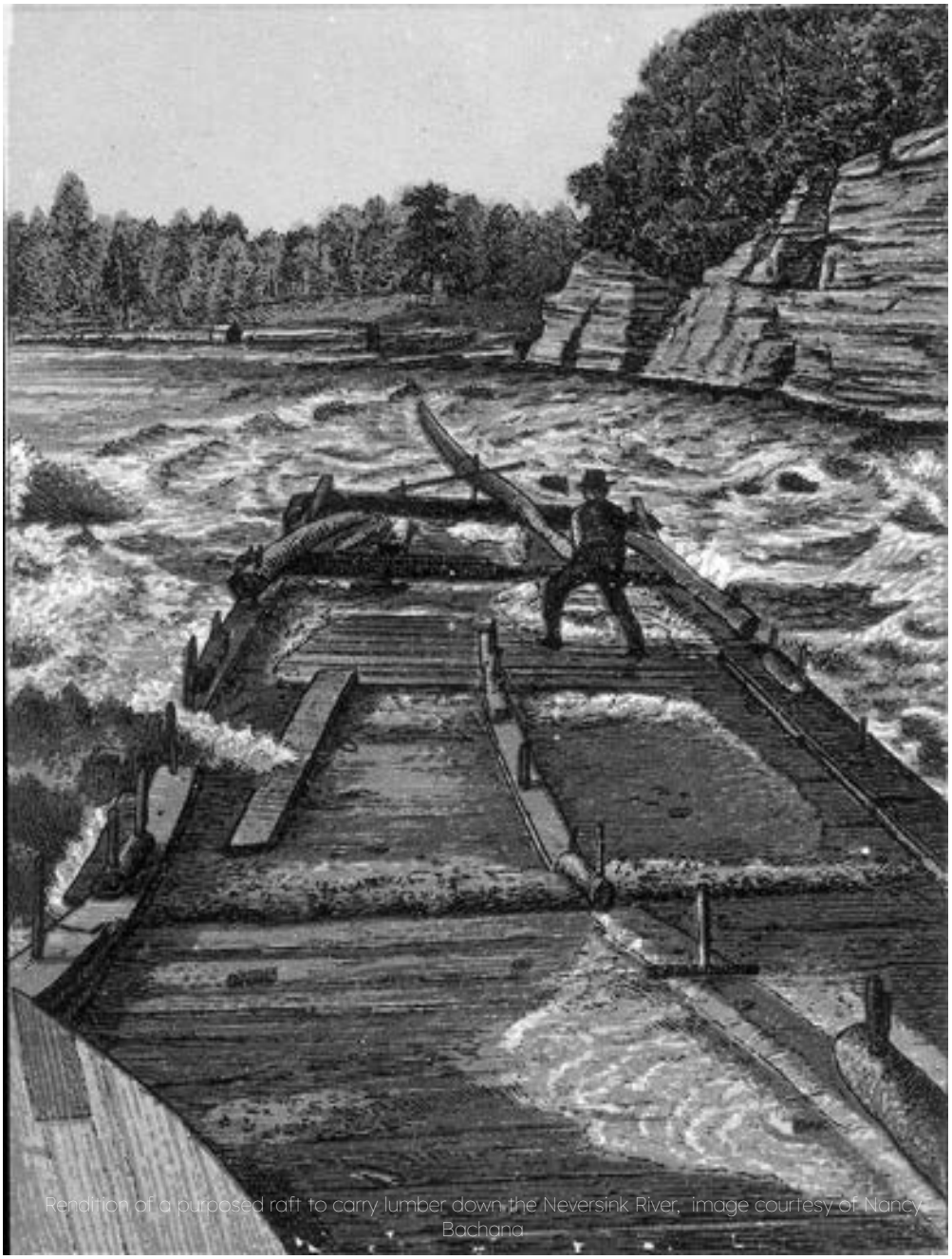
All of the tanneries were located on the East Branch of the Neversink except one that was located on the mainstem below the confluence of the East and West Branches. The West Branch of the Neversink primarily had sawmills located adjacent to the streams in order to harness the waterpower. While leather tanning byproducts did not leach into the stream on the West Branch, sawdust and scrap lumber did, which contributed to the pollution, stressing the aquatic and riparian ecosystems there. The most industrial of communities to develop within the Unique Area was Gilman's Station. This hamlet was located near the intersection of the O&W Railroad (Monticello to Port Jervis line) tracks and St. Joseph's Road. About 1850, W. W. Gilman began to establish one of the largest tanneries and sawmills in Sullivan County. In 1871, the O&W was providing tremendous opportunities for transporting merchandise. By the late 1890's, the industries at Gilman Station had for the most part ended.

Even with all this strain, the Upper Neversink and its tributaries began to recover toward the end of the 19th Century with the decline of the tanning industry in the area and became a popular area for dry-fly fishing because of the rebounding native trout populations. Theodore Gordon, considered to be the father of American dry-fly fishing, spent much of his time honing his craft on the Upper Neversink. Originally, Gordon used imported English flies that performed poorly in the Catskills as they were dissimilar to native species. By observing the local hatches of insects, Gordon created his own dry flies based upon those native insects and achieved great success. A prolific author of articles on fly fishing, his use of native flies and his techniques spread rapidly in the burgeoning fly-fishing community. Besides Gordon, the naturalist John Burroughs also spent time on the Neversink and wrote about it in his many popular nature writings.

At this time quarry activity was very extensive. High quality bluestone was known to occur in the area of the Unique Area but not every vein of stone would be valuable. This led to quick exploration for high quality stone with little or no care for the surrounding forest cover. Charcoal production would occur where there was a quantity of hardwood timber, especially oak. Trees would be cut, piled, buried, and burned to make charcoal. Forest fires were very common to areas where charcoal was produced. Not until 1924 did areas of the State outside the Catskill and Adirondack Park areas become included in forest fire control districts.

Perhaps the most significant change in the history of the Neversink River was the construction of the Neversink Reservoir. The

City of New York, in an effort to provide a supply of clean drinking water for its residents, used to eminent domain to obtain land in the area that was to become the reservoir. The lands that were the hamlets of Neversink and Bittersweet were condemned in order to build the reservoir. The hamlet of Neversink eventually moved to its present-day location but Bittersweet was never reconstituted. Construction of the reservoir began in 1941 and was put into service in 1954. This split the Neversink River between its upper portions (above the reservoir) and its lower portions (below the reservoir). The Neversink Reservoir is one of six reservoirs in New York City's West of Hudson Catskill-Delaware watershed, which together supply approximately 90% of New York City's water supply needs. This area is also part of the historic Borsht Belt, a period of time starting in the 1920s when tourists, primarily New York City Jews, were drawn by the expansion of the O&W Railroad, the beauty of the landscape, and discrimination from resorts closer to the City. Small bungalow colonies and hotels developed into a huge resort hotel industry that reached its height in the 1950s and 60s. Most were gone by the 1970s, with a few holding on into the 90s.



Rendition of a purposed raft to carry lumber down the Neversink River, image courtesy of Nancy Bachana

This history shows the competing interests in land use and natural resources; the spiritually connected Lenape displaced by the resource extraction driven European settlers, the evolution of fly fishing and tourism, and demands for clean potable water. Today, the Upper Neversink is overwhelmingly forested with significant portions owned by either the State of New York or City of New York. Large private holdings of fish and game clubs or non-profits such as the Frost Valley YMCA are also present. Developed land is primarily of single-family housing, either for full-time residents or as second homes with some agriculture lands. Development pressures for additional

housing, climate change and invasive species are now driving the changes in the region. This plan contains information and ideas that will hopefully lead to a natural and economic balance and resilient future for the region.

Neversink Watershed Demographic & Economic Profile

The Neversink watershed drains into the following three counties in New York; Ulster County, Sullivan County, and Orange County. Most of the Neversink watershed falls within Sullivan County, with small sections in Orange and Ulster County. An evaluation of the US Census data shows that Sullivan County is the least densely populated amongst the three counties while Orange County is the most densely populated.

The following two tables show a further look into US Census data for the following statistics for each county and municipality in the Neversink watershed;

- Land area per square mile
- Estimated population
- People per square mile
- Housing units
- Owner occupied houses
- Gender Female
- Gender Male
- Veterans
- Ages 65+
- Under age 18
- White
- Hispanic or Latino
- Black or African American
- Asian
- American Indian and Alaska Native
- Native Hawaiian and Other Pacific Islander
- Employment rate
- Poverty Rate
- 16+ working
- Median household income
- Median gross rate

People in the Neversink River at Bridgeville 1922, image courtesy of Nancy Bachana

Table below shows 2022 US Census Data for each county and municipality in the Neversink watershed.

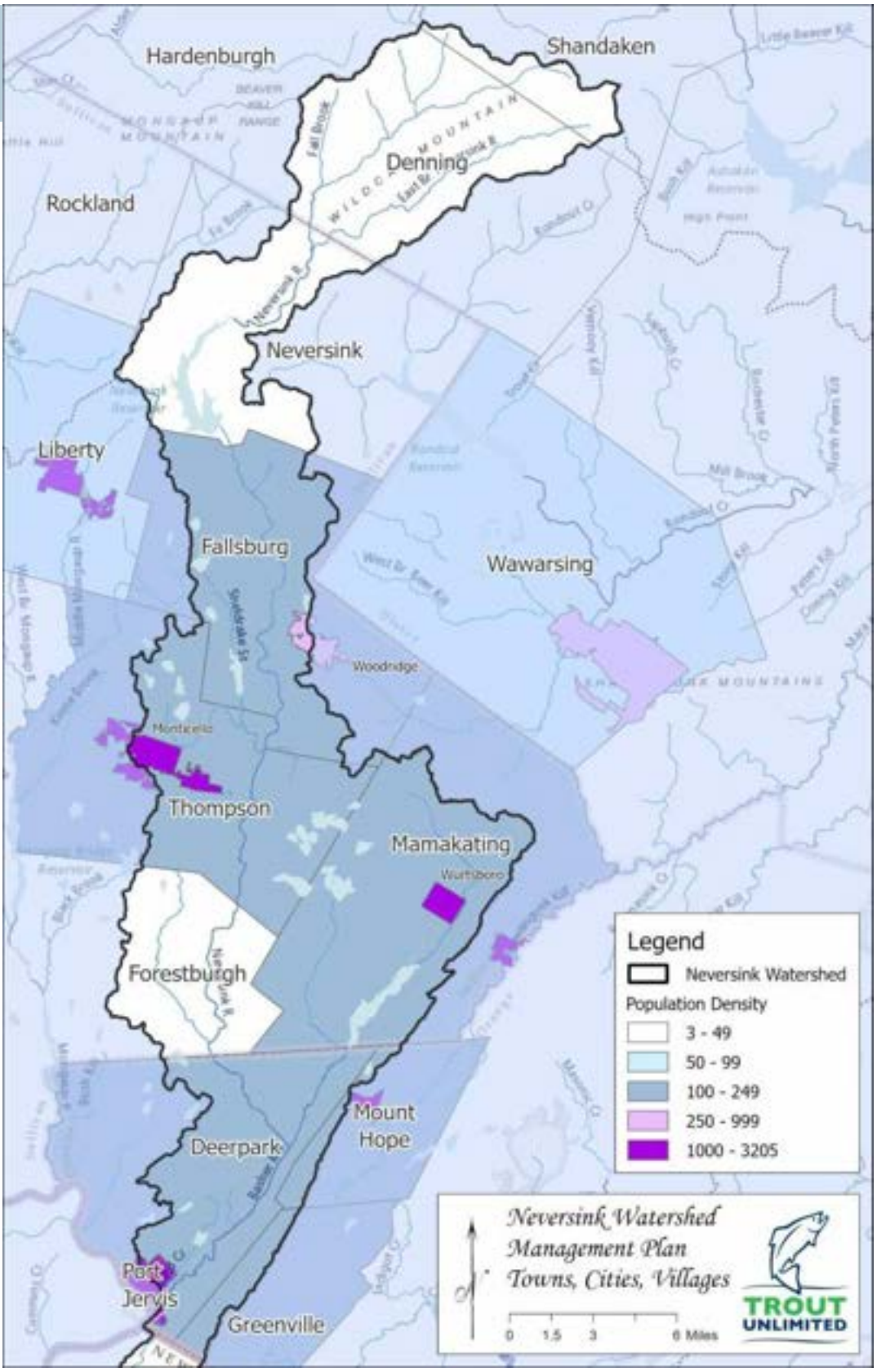
Location	Land Area Square Miles	Estimated Population	People Per Square Mile	Housing Units	Owner Occupied Houses	Gender Female	Gender Male	Veterans	Ages 65+	Under age 18
Ulster County	1,124.24	182,319	162.1	86,477	69.20%	50.10%	49.90%	5.10%	21.60%	16.80%
Town of Denning	105.3	493	4.7	501	34.30%	42.10%	57.90%	7.80%	13.40%	13.00%
Town of Shandaken	119.8	2,866	23.9	2,482	59.30%	44.50%	55.50%	7.10%	30.60%	15.50%
Sullivan County	968.15	79,568	82.2	49,960	69.10%	47.80%	52.20%	5.40%	19.40%	21%
Town of Fallsburg	77.62	14,637	188.6	8,830	58.70%	45.50%	54.50%	4.10%	13.90%	22.40%
Town of Forestburgh	56.8	808	14.2	552	68.30%	55.70%	44.30%	7.10%	24%	13%
Town of Mamakating	96.11	12,701	132.2	6,157	77.90%	46.90%	53.10%	6.90%	14.70%	23.00%
Village of Monticello	4.08	7,285	1,785.50	3,705	26.60%	49.70%	50.30%	4.50%	13.80%	22.90%
Town of Neversink	56.8	3,366	14.2	2,020	43.20%	43.70%	56.30%	8.60%	28.20%	22.20%
Town of Thompson	84.09	16,712	198.7	10,032	50.40%	47.20%	52.80%	5.80%	20.50%	21.30%
Village of Woodridge	1.6	747	466.9	825	25.30%	51.80%	48.20%	1.70%	15.70%	29.30%
Village of Wurtsboro	1.3	1,124	864.6	613	83.50%	54.30%	45.70%	8.60%	25.40%	24.30%
Orange County	812.32	405,941	499.7	149,912	68%	50%	50%	5.10%	14.70%	25.30%
City of Port Jervis	2.53	8,625	3,409.10	3,992	49.70%	51.30%	48.70%	6.20%	18.90%	21.10%
Town of Deerpark	66.5	7,417	111.5	3,195	73.60%	50%	50%	5.90%	19.20%	21.50%

Table below shows 2022 US Census Data for each county and municipality in the Neversink watershed.

Location	White	Hispanic or Latino	Black or African American	Asian	American Indian and Alaska Native	Native Hawaiian and Other Pacific Islander	Employment Rate	Poverty Rate	16+ Working	Median Household Income	Median Gross Rent
Ulster County	86.60%	11.60%	7.40%	2.30%	0.50%	0.10%	54.70%	17.70%	58.90%	$80,372	$1,492
Town of Denning	83%	6.10%	2.40%	0.60%	1.20%	0%	48.90%	28.50%	44.40%	$85,000	$1,268
Town of Shandaken	84.40%	8%	1.40%	1.80%	0.60%	0.03%	53.60%	20.50%	52.30%	$55,139	$1,324
Sullivan County	82.60%	18.30%	11%	2.20%	0.80%	0.10%	58.50%	16.40%	58.10%	$63,777	$993
Town of Fallsburg	60.20%	22%	17.30%	1.90%	1%	0%	46.90%	18.40%	51.10%	$63,438	$931
Town of Forestburgh	88%	4.70%	2.20%	2.80%	0%	0%	65.30%	5.40%	72.20%	$148,125	$1,196
Town of Mamakating	87.20%	9.80%	2.70%	1.10%	0.60%	0%	58.20%	13.60%	62.30%	$80,235	$1,260
Village of Monticello	47.60%	37.90%	21.90%	4.90%	1.80%	0%	59.90%	25.60%	65.70%	$45,531	$898
Town of Neversink	89.30%	6.60%	1.40%	1.30%	0.30%	0%	56.80%	9.60%	52%	$72,052	$1,071
Town of Thompson	62.10%	25.40%	13.50%	4.60%	0.80%	0%	54.70%	18.40%	60%	$61,029	$1,024
Village of Woodridge	57.80%	29.60%	9.00%	1.70%	0.30%	0%	41.60%	10.10%	48.60%	$70,313	$875
Village of Wurtsboro	76.20%	14.30%	4%	2.00%	0.40%	0%	54.60%	12.70%	49%	$74,048	$1,223
Orange County	77.60%	23.70%	14.80%	3.30%	1%	0.10%	58.40%	15.50%	62.30%	$89,037	$1,565
City of Port Jervis	67.50%	17.60%	10%	5.10%	2.90%	0%	50.70%	23.60%	55%	$38,804	$1,157
Town of Deerpark	73.60%	7.50%	7.30%	2.30%	0%	0%	51.80%	9.30%	56.60%	$68,511	$1,305

Neversink Population Density

The Neversink watershed is located in the southern portion of the Catskill Mountain region of southeast New York State. The headwaters flow from Slide Mountain in the Town of Shandaken, into the East and West Branches of the Neversink River which begin in the town of Denning in Ulster County, flowing southwest before coming to a confluence in the town of Neversink in Sullivan County. The mainstem of the Neversink that is formed by the confluence of the East and West Branches continues to flow for several miles before entering the Neversink Reservoir. From the outlet, the river then flows through parts of Fallsburg, Thompson, Mamakating, Deerpark and eventually drains into the Delaware River in Orange County.



Beginning at its headwaters in Ulster County, the Neversink watershed population per square mile is far less than the county average with roughly 3 – 49 people per square mile through Shandaken, Denning, and into the town of Neversink. In 2020, US census reports state the average population of Ulster County to be 161.8 people per square mile which is more than triple of each of the listed towns. Downstream of the Neversink Reservoir population centers begin to grow gradually. The towns of Neversink, Fallsburg, Thompson, Mamakating, Forestburgh and

Deerpark all reside within Sullivan County in the southern part of New York State.

Sullivan County is estimated to have 78,624 year round residents (with an estimated seasonal population surpassing 300,000) in 2020 by the US Census Bureau. That makes 81.2 people per square mile, far less than 428.7 people per square mile in New York State and 93.8 people per square mile in the United States. With the exception of several town centers having more than 250 people per square mile, the density is relatively consistent throughout averaging 100 – 249 people per square mile, half of the New York State population Density average.

The Neversink drainage meets the Basher Kill and eventually flows into the Delaware River through the towns of Deerpark, Greenville, and Mt. Hope within Orange County. Population density numbers remain relatively consistent at 100 – 249 people per square mile. This is similar to towns upstream in the drainage which is nearly less than half of the Orange County average at 494 people per square mile.

Neversink River Access & New York State Trout Stream Management Plan

The Neversink River offers a tremendous amount of public fishing rights access with unique opportunities to encounter a wide variety of both cold and warm water species. The Neversink of our history books was a haven for the native Eastern brook trout (*Salvelinus fontinalis*), thriving among the depths of its rich cavernous flows and mountainous tributaries. As rivers and streams across North America continue to warm, sensitive cold water species often migrate as a form of adaptation. Today, in tiny bubbling rocky pools within the densely wooded Upper Neversink and Neversink Unique Area, you can often find these charming little dark-eyed darting “brookies”, eager for a bite to eat. The Neversink River is renowned for its scenic beauty and its significance as a trout fishery, particularly for wild trout such as Brown trout (*Salmo trutta*) and native Brook trout. The current management strategy for trout in the Neversink River involves a combination of conservation efforts, strategic


Bashakill Wildlife Management Area, image courtesy o

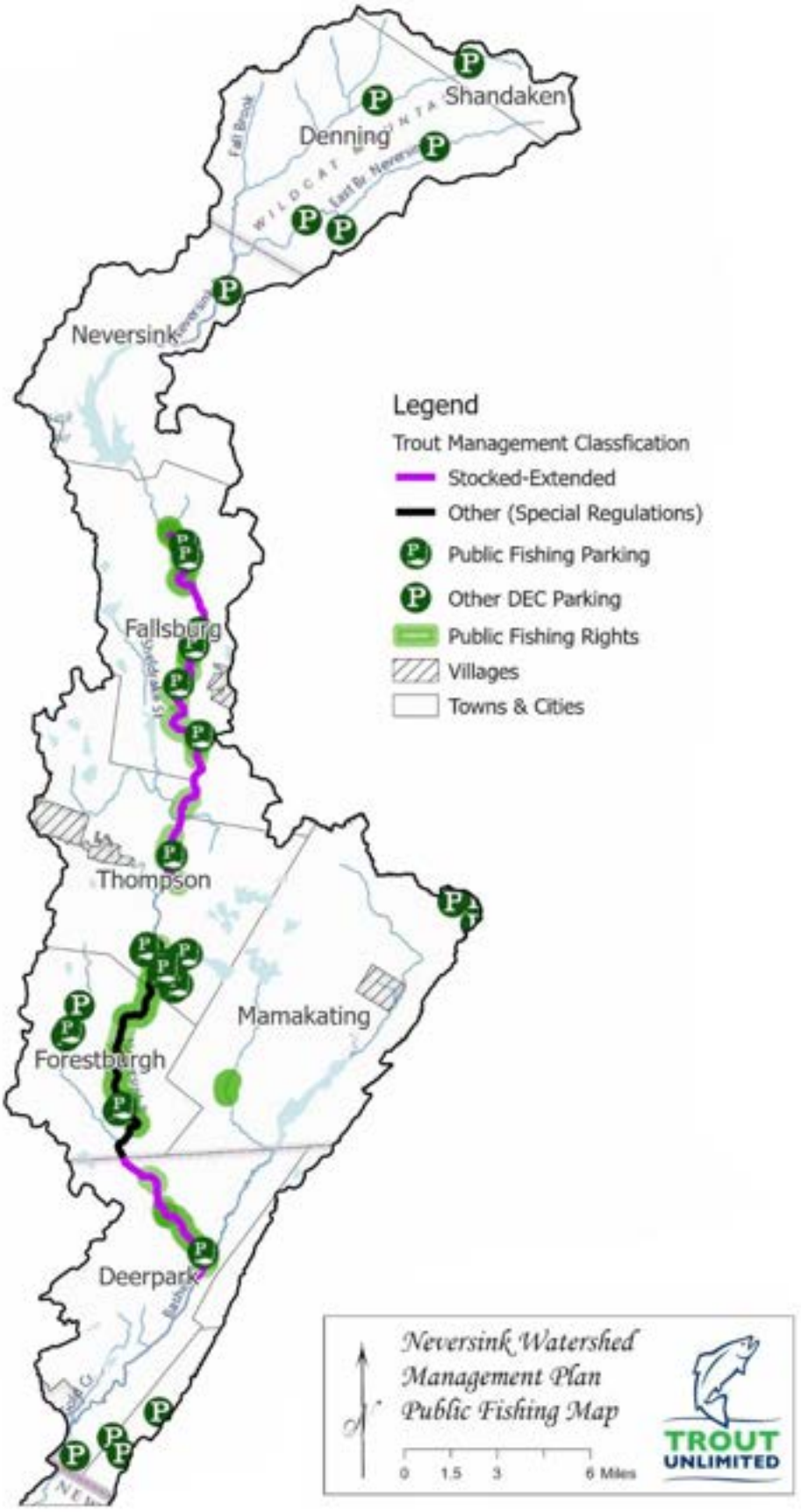
stocking programs, and angler regulations aimed at maintaining healthy trout populations while providing a variety of recreational opportunities for anglers. In 2020 NYS DEC developed the New York State Trout Stream Management Plan. This plan is founded on angler desires, sound science, and guiding principles that embrace simplicity, encourage angling participation and place value on managing for self-sustaining populations. The plan makes a sharp distinction between wild trout and stocked trout management, using a set of five management categories to clearly define fisheries management objectives. This approach balances the need to manage and restore natural populations while also supplying additional recreational opportunities.

Upper Neversink:

Brook trout, brown trout, and the occasional Rainbow trout (*Oncorhynchus mykiss*) or Landlocked Atlantic salmon can be found in the headwater reaches above the Neversink Reservoir. Ultimately, this section of the river provides the best opportunity to catch Brook trout in their native habitat.This section is currently managed as a "wild" trout stream under the NYS Trout Stream Management Plan.

Lower Neversink:

The Brown trout is a beloved game fish, a voracious predator, and an expert at finding shelter in challenging situations.

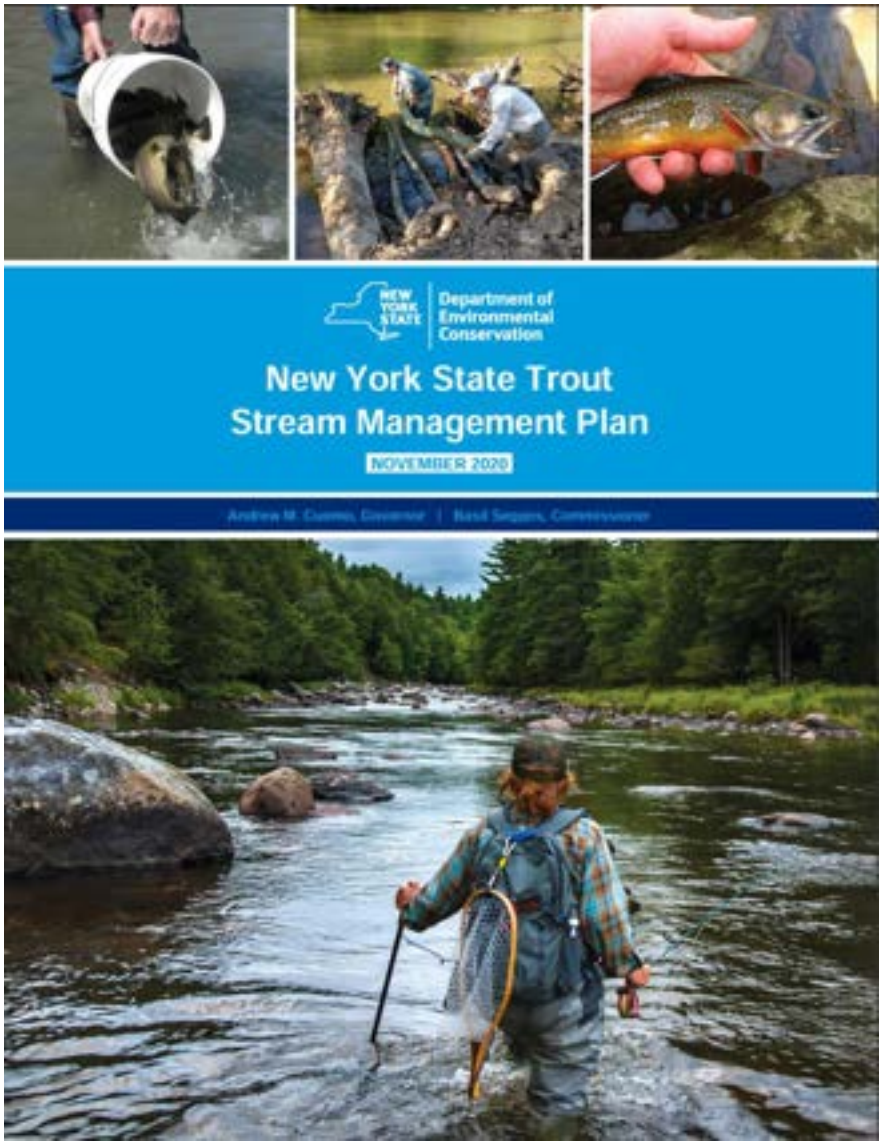


A mixture of both wild and stocked Brown trout inhabit the many miles of the Neversink, from the reservoir to its confluence with the Delaware in Port Jervis. The following explains the various trout management strategies currently operated by the New York State DEC: Tributaries and the bottom release dam on the Neversink provide a coldwater source that buffers the main river from extreme heating. These tributaries also provide key refugia for trout to survive periods of thermal stress.

There are three distinct sections of the lower Neversink River south of the reservoir that provide a variety of fishing opportunities. Each of these are listed and described below.

• Section 1: The first section extends from the mouth of Wynkoop Brook downstream to one mile below Bridgeville Road in the town of Monticello. This section has both wild and stocked Brown trout and is managed as a 'Stocked-Extended'* reach. This section is very popular as water temperatures typically remain cold throughout the summer months and provide anglers a chance of catching both wild and stocked trout. This section is known for trophy Brown trout *Fish are stocked multiple times a season to enhance opportunities for angler success.

• Section 2: The next section of river starts at Mercer Brook and continues downstream to the Sullivan/Orange County line. It primarily holds Brown trout. This area is known as the Neversink River Unique Area. With respect to these and many other native species found within the Unique Area, NYS DEC launched a “Wild Quality” designation specifically for the 8.91 miles of the Unique Area to further promote the advancement and protection of wild and native trout of the Neversink. In 2022, the Wild Quality designation



was supported with a “Catch and Release Only” stipulation.

• Section 3: The last section of river starts at the Sullivan/Orange County line and extends downstream to Guymard Turnpike in the town of Godeffory. This section of river is stocked with Brown trout but also has a population of Smallmouth bass. It is regulated as a 'Stocked-Extended' reach.

In the larger Neversink River today, the Brown trout makes

for a more common encounter when fishing the many miles of open public river. Author and Neversink fisheries pioneer, Leonard Wright stated: "*The first shipment of eyed, or fertile, eggs didn't reach our shores until 1883. These were a gift sent from a*

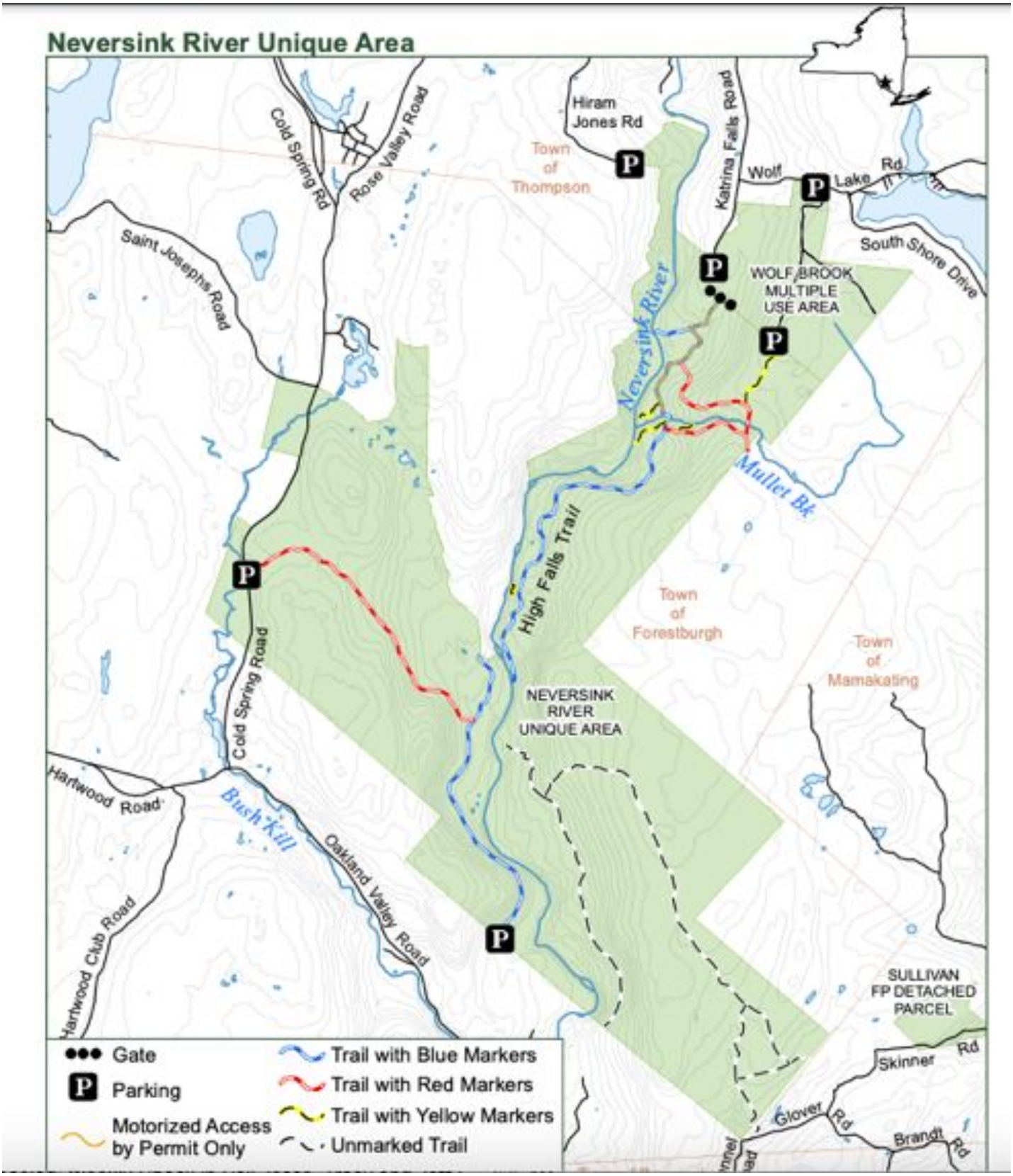
German fish culturist to Fred Mather, a New York State hatchery man. The next year Mather started receiving eggs from British fish as well, and these two slightly different strains were soon thoroughly mixed. The genes of both coexist in the fish we catch today.In 1886, a group of sportsmen stocked browns in Aden Brook- a medium sized tributary that now empties into the midsection of the reservoir- making the Neversink system one of the first in America to receive this new species." (Leonard M. Wright Jr. - 'Neversink') The Neversink watershed is flanked on either side by groundwater springs that emerge in the tributary headwaters and spring filled valleys.

Important tributaries to note would include *Wolf Pond Brook, Eden Brook*, *and Mullet Brook* as they provide cold water and adequate habitat for wild fish to persist below the reservoir located in the Neversink Unique Area. These fertile tributaries also provide crucial spawning substrate for brook and Brown trout.

Anglers should respect the presence of these fragile tributary influences that shape the Neversink River fishery. Fishing these tributaries often requires landowner permission or use of public land / conservation easements. Anglers should also utilize the DEC interactive trout map found in the DECinfo Locator or the Tackle Box app. This app allows the public to locate public land and river access / parking areas.

Public Fishing Stream, image courtesy of Beau Bealsey

Map below is of public parking and trails throughout the Neversink River Unique Area.



Physiography & Drainage

The Neversink River flows from its headwaters in the Catskill Mountains for 55 miles where it joins the Delaware River at Port Jervis, New York, at the state border with Pennsylvania. The Catskills are a physiographic province of the Appalachian Highlands and form the northeastern edge of the Allegheny Plateau. The dissected plateau of the Catskill Mountains were formed by geologic uplift and subsequent erosion by dominant watercourses.

The Neversink River is one of seven watercourses in New York flowing directly into the Delaware River forming the Upper Delaware River of New York and the border with Pennsylvania (table below). The Neversink River watershed area is 325 square miles. The watershed drains approximately 349.46 miles of stream and the watershed boundary extends into portions of 12 townships, composed of 11 sub-basins (HUC12). The highest point in the watershed is 4,180 feet on Slide Mountain in Ulster County, NY, the confluence at Port Jervis is the lowest point in the watershed at 400 feet The Neversink River can be further delineated into three HUC 12 basins to better describe the rivers characteristics - the upper basin above the Neversink Reservoir, mid basin between the Reservoir and what was the Cuddebackville Dam and the lower basin downstream of Cuddebackville to the confluence of the Delaware River.

Watersheds of the Upper Delaware River in NY

Watershed Name	HUC 10	Watershed size	Total River miles
Lower West Branch Delaware River	0204010103	270	234
Lower East Branch Delaware River	0204010205	566	321
Equinunk Creek	0204010104	57	36
Callicoon Creek	0204010105	171	165
Masthope Creek-Tenmile River	0204010106	32	27
Halfway Brook	0204010405	48	33
Mongaup River	0204010401	412	291
Neversink River	0204010403	488	397
➔ Neversink River - Bashakill	0204010402	127	105

The Upper Neversink River starts its journey in New York's Catskill State Park.The Park is over 700,000 acre forest preserve managed and protected by New York state law. The upper headwaters flow from the forested mountain slopes of the Catskills forming two main branches that continue southwest for approximately 12 miles. The East Branch Neversink River flows along the eastern slope of Wildcat Mountain where it joins the West Branch in the Hamlet of Claryville in Sullivan County, approximately 3 miles upstream of the Neversink Reservoir.

The Neversink Reservoir was placed into service in 1954 to supplement drinking water demands of New York City residents and at maximum capacity can hold up to 36.6 billion gallons of water. The Neversink Reservoir is one of three Delaware River reservoirs that supply drinking water. Historically, the headwater forested streams of the Neversink have been degraded by acid rain which has impacted survival rates and population composition of fish species such as Brook trout. To protect drinking water New York City has established the Rondout-Neversink Stream Management Program that has been focused on the recovery and protection of water quality in the watershed.

Downstream of the 1,480 acre reservoir is the mid Neversink River that flows from the outlet of the Neversink Reservoir dam for over 30 miles downstream to Cuddebackville. Since the 1980s U.S. Geological Survey (USGS), in cooperation with the New York City Department of Environmental Protection, The Nature Conservancy (TNC), and local towns have collected data on habitat, fish communities, flow patterns, channel geomorphology, basin physiography, and soil and water chemistry from many reaches throughout the Neversink River basin. Results from their work have documented impacts to water quality, macroinvertebrate composition and fish populations downstream of the reservoir. The disruption in sediment transport and impacted water quality can be observed as far downstream as Woodbourne, NY. From the outlet of the dam the river flows through broad floodplains until it enters the steep Neversink Gorge in the town of Forestburgh, NY. The Neversink Gorge Unique Area is both privately and publicly protected through historic efforts by conservation leaders creating a paradise for fly fishing, hiking and other recreation pursuits. Once the river flows out of the gorge near Oakland Valley the river valley opens up to broader floodplains as it flows into Orange County to the site of the demolished Cuddebackville dam remnants were removed in 2024. This was the first dam removal project in New York state to be removed for environmental concerns. The dam removal resulted in many ecological benefits including migration opportunities for American shad (*Alosa sapidissima*) and the protection of habitat for the endangered dwarf wedgemussel (*Alasmidonta heterodon*).

Below Cuddebackville the lower Neversink River joins the Bashakill in the town of Deerpark. The Bashakill is a sub-basin of the Neversink and is a predominantly wetland system dammed and managed by NYSDEC for wildlife and a state Bird Conservation Area. Beyond the confluence with the Bashakill the Neversink flows along the western slopes of the Shawangunk Mountains. The steep slopes of the Shawangunks confine the eastern river bank. Downstream the river winds its way through expansive floodplains and more concentrated developments along its banks to where it flows into the Delaware River at Port Jervis.

Climate

The climate of this region is very similar to most of New York and is classified as Humid Continental. The Upper Delaware River region generally experiences seasonal weather patterns characteristic of the northeastern United States. New York Mesonet at the University of Albany has two weather stations in the watershed; Claryville in the upper watershed and Woodborne in the middle

basin. The average summer temperature, as recorded by the National Oceanic and Atmospheric Administration (NOAA) is 78.6 degrees Fahrenheit. Average winter temperature is 25.3 degrees Fahrenheit with an average maximum temperature of 34.9 degrees Fahrenheit.

Recent weather patterns of more sporadic rainfall will lead to more frequent short (one to three months) seasonal droughts broken by large intense rainfalls. This type of deviation coupled with the fact that the flows in the Neversink River are controlled through the dam will alter downstream hydrologic regimes.

Higher temperature averages continue to have a profound impact on the streams and tributaries in the Neversink region. The controlled releases may not allow the river to react to the natural rain occurrences the same way the streams and tributaries do. The two different ways the river and its tributaries react to rainfall can cause degradation and instability in the streams, causing erosion and sedimentation to carry down to the Neversink River. There is a high level of certainty that these climate deviations will change the way our river valleys look. The continued accelerated sedimentation in the entire Neversink River system could present multiple problems.

The longer periods of drier weather may contribute to the rapid morphology of the streams lowering the water levels and exposing the stream bottoms more frequently and for longer periods of time. The result of this change could continue to create warmer water conditions and provide for the colonization of new plant species typically seen today in southern warmer climates. The result of this change could continue to create

Neversink Unique Area, image courtesy of Beth Brown, DRBC

warmer water conditions and provide for the colonization of new plant species typically seen today in southern warmer climates.

Precipitation

Precipitation is evenly distributed through the year with eastward-moving cold fronts bringing the area's most frequent rain showers. Tropical storms will typically move north from the warmer southern coastline and are responsible for larger storms with more rain. Differences in latitude and topography all have an effect on the climate across the Neversink watershed.

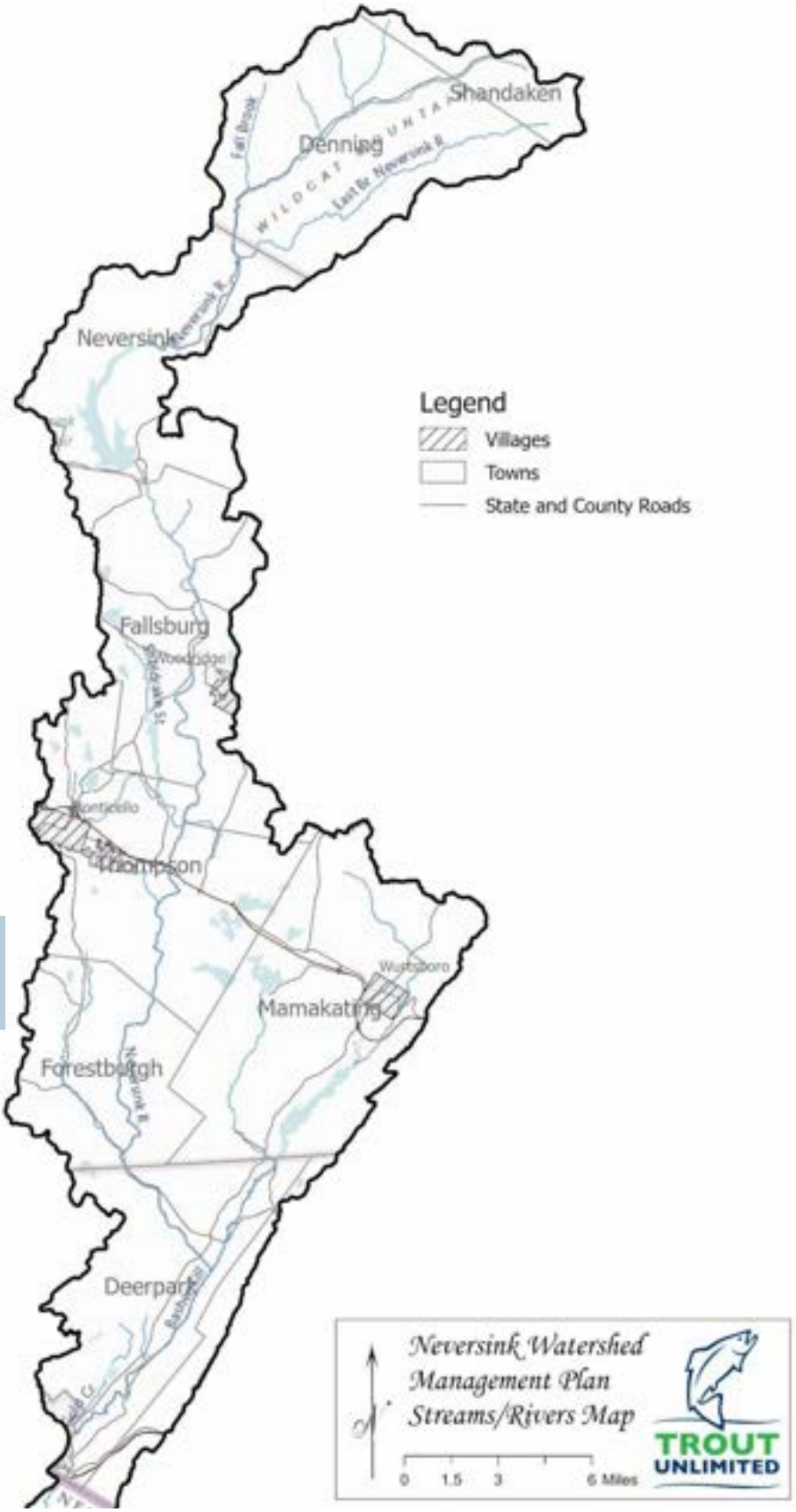
Moisture rich air moving in from the west runs into the Catskill Mountains, which act as a barrier. As the air moves up and over this mountain range, the air slows and cools forming raindrops leading to more rain falling over a shorter distance. The Neversink has an average of 39.5 inches of rainfall each year. This average is based on 106 years of rainfall data. The trend over the last century is an increase in the amount of rain since records were first being kept. For example, in the early 20th century, the average annual rainfall was between 36 inches and 38 inches compared to the early 21st century the average annual rainfall is between 42 inches and 43 inches.

The types of rainstorms the Neversink watershed experiences have also changed over the last several decades. NOAA reports the average number of rainstorms that produce two or more inches of rain has increased in the last two decades and it is anticipated that average annual rainfall amounts will increase by as much as 2.5 inches by the year 2060. Climate at a Glance. 5% with higher percentages of the annual rainfall falling during intense storms between short seasonal

droughts. This trend of more frequent and intense rainfall events (greater than 2 inches) is predicted to continue. A continuation of current trends could also lead to changes in streams and rivers whose physical shape is maintained by a balance between the amount of water flowing through them and the surrounding landscape. The Neversink watershed which has been disturbed by human activities (logging, dams, etc.) over the last 100 years, will experience notable damage during an intense rainfall event. The time required for a stream to find a new equilibrium now takes a longer time and the window between damaging rainfall events has shortened. The streambanks erode, sending trees and gravel downstream, reducing water quality and increasing flood debris risks.

Rivers & Streams

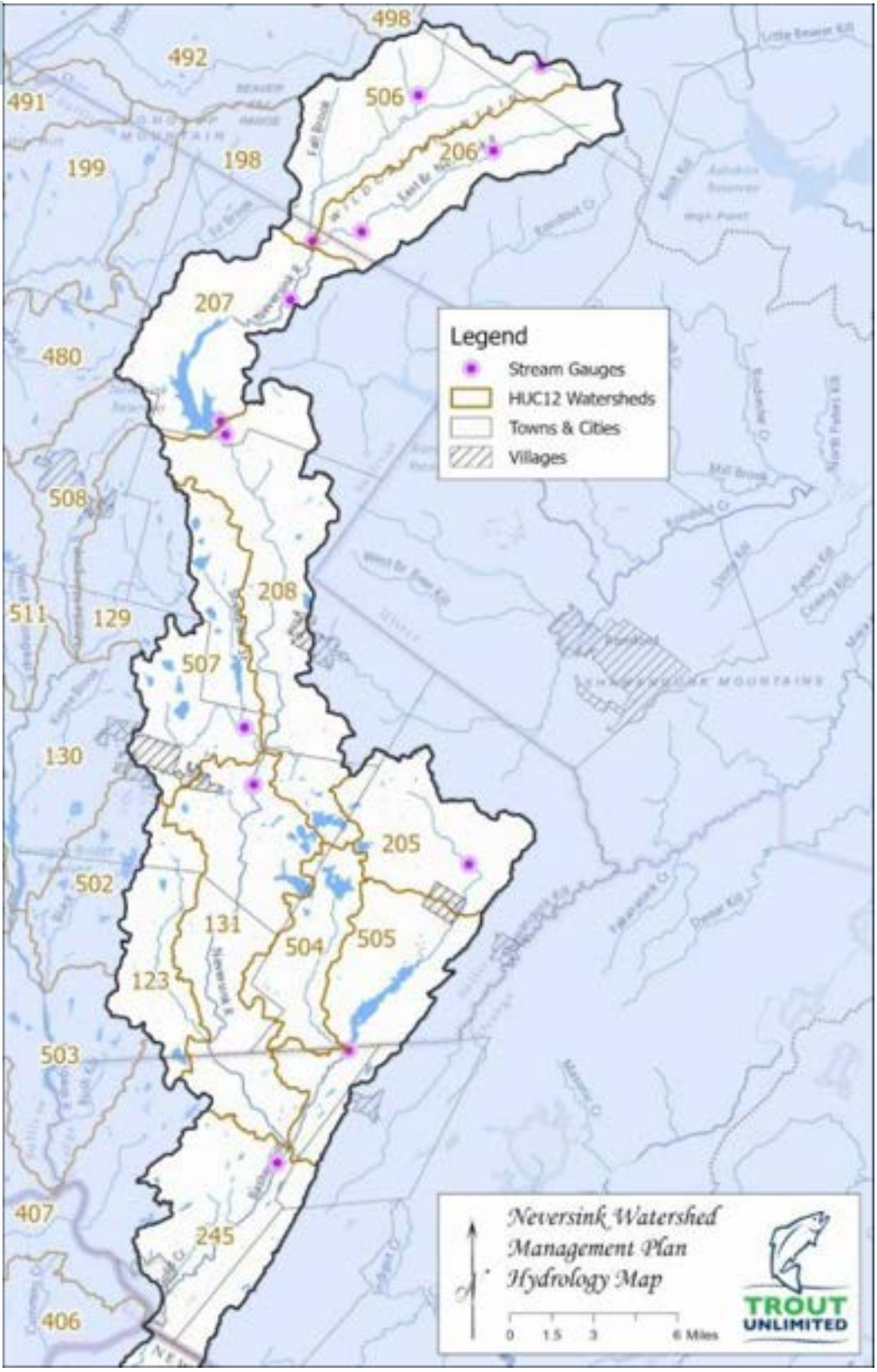
The Neversink River watershed encompasses over 325 square miles of watershed drainage area. Most streams in this watershed are perennial, meaning that they typically flow year round except for extreme drought conditions. From the confluence of the East and West Branch, the Neversink runs primarily Southwest before entering the Neversink Reservoir in the town of Neversink.



Hydrology

The Neversink watershed in total has fifteen live USGS stream gage stations that provide updated flow rate and discharge data by the minute. Each station also contains archived data that can be queried. Being a dammed watershed, the hydrology upstream and downstream of the Neversink Reservoir varies extremely.

Above the Neversink Reservoir the East and West freestone branches and their tributaries are quite flashy in nature and are most susceptible to flash flood events. The steep valleys holding these streams accelerate the rate in which precipitation enters the watershed above the reservoir. During high flow events the water's energy is captured and retained increasing scour and bank erosion. The increased sediment load travels downstream until it is deposited into the inlet of the reservoir. Base flow conditions in the upper watershed are generally lower ranging from 5 to 30 cfs and are climate dependent.



Below the reservoir the Neversink River changes from a freestone river* to a tailwater river**. Base flow of water leaving the reservoir ranges from 50 cfs in the summer to 300 cfs in the winter. During periods of high precipitation in the upper watershed the NYC DEP can adjust how much water is leaving the reservoir.

*A river that forms primarily from surface water.

**The section of a river below a dam.

The amount released is not unlimited but can be brought up to 200 million gallons per day.

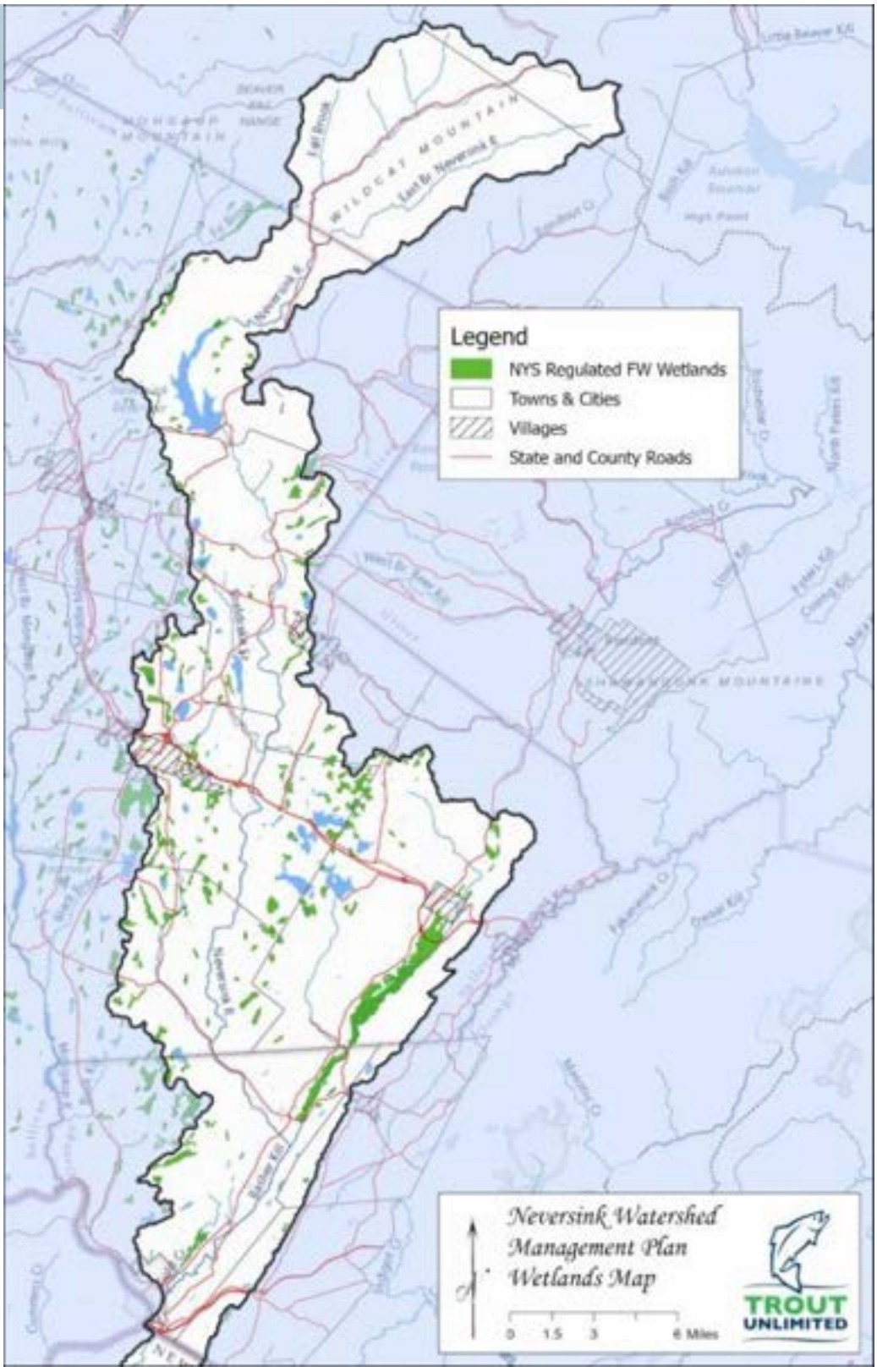
The river grows exponentially however it does not experience the same scour the upper watershed does because of its increased floodplain size which dissipates energy. Below the reservoir the river continues to increase discharge as more larger tributaries enter it. Some tributaries include the Sheldrake Stream, Bush Kill and Basher Kill. Sheldrake stream and Bushkill have a similar flashy hydraulic regime to the upper watershed. Instead of steep valleys increasing the rate of water flow into the streams, large areas of developed land and impervious surfaces do not allow for ground absorption and funnel water directly into the stream. Sheldrake Stream in particular experiences an abnormal amount of scour which in turn leads to more sediment entering the Neversink River. The largest tributary of the Neversink River is the Basher Kill. This is a large stream with riparian water primarily dominated by a wetland (Bashakill Marsh). The marsh filters water and allows it to utilize the large marsh floodplain during periods of high water.

The table to the right contains the name and location of each USGS live gage station on the Neversink River.

Watershed Position	Gage Location	Gage Name
Upper	West Branch Neversink River at Claryville	Winnisook L Nr Frost Valley NY
Upper	Biscuit Brook at Frost Valley	Biscuit Bk Above Pigeon Bk At Frost Valley NY
Upper	East Branch Neversink River	Northeast Of Denning NY
Upper	East Branch Neversink River	Claryville NY
Upper	West Branch Neversink River	Claryville NY
Upper	Neversink River	Claryville NY
Upper	Neversink River	Reservoir (Above)
Lower	Neversink River	Reservoir (Below)
Lower	Neversink River	Neversink NY
Lower	Sheldrake Stream	Thompsonville NY
Lower	Neversink River	Bridgeville NY
Lower	Neversink River	Godeffroy NY
Lower	Gumaer Brook	Wurtsboro NY
Lower	Basher Kill	Below Bashakill Marsh At Westbrookville
Lower	Basher Kill	Cuddebackville NY

Wetlands

The Neversink watershed contains wetlands throughout its length. The watershed has been divided into three different zones. Upper Neversink (above the reservoir), Lower Neversink (below the reservoir) and Basher Kill (large wetland dominant tributary). Wetlands mentioned have been classified by the DEC as state regulated freshwater wetlands. These wetlands are ranked from Class I (which provide the most benefits) to Class IV (which provide fewer benefits). These benefits represent Hydrologic function (storing water) and ecological function (providing wildlife habitat). To note, wetlands in the Neversink watershed do not all fit the common perception of cattail lined open swamps. Some of the Neversink watershed wetlands are shrub and forested swamps, and some are stream adjacent existing within the riparian flood zone.



The largest contiguous wetland in the Neversink watershed is the Bashakill Marsh. This is a state owned 3,107 acre wildlife management area. The Bashakill Marsh provides excellent protected habitat for waterfowl, fish, insects, and amphibians.Tributaries entering the Bashakill Marsh provide habitat for wild trout. The connectivity the Bashakill Marsh provides during periods of cooler water allows trout from the Neversink River to utilize the Basher Kill and its tributaries for spawning.

Table below represents Acres of wetland in Class 1-9 in the Neversink watershed.

	1 Most Beneficial	2	3	4	9 Least Beneficial
Upper Neversink	38.5	236.69	39.0	17.0	0
Lower Neversink	168.6	3517.4	432	74.6	83.9
Basher Kill	1809.7	1419.3	112.7	14.5	0
Total Watershed	2,016.8	5,173.3	583.7	106.1	0

Invasive Species

Education and outreach are crucial for the early detection and management of invasive species. Community awareness enables citizens to remain on the front line of invasion and is bolstered by technologies such as the imap invasives map. This software allows the public to locate and map sightings of invasive species. Partners such as Catskill Regional Invasive Species Partnership (CRISP) and the DEC have also been working to help track and mitigate the invasive species in the Catskills. As a vital hydrologic artery to the Delaware River, in recent years the Neversink River has been exposed to significant ecological pressures. In Sullivan County, the Neversink watershed is threatened by Invasive Species that inhabit the immediate riparian corridor and connected surrounding uplands.

Some Neversink specific impacts these species possess include the elimination of native flora that can indirectly alter the in-stream ecosystem function. Allochthonous inputs from native woody debris are crucial for maintaining stable aquatic food webs. Many invasive species present now feed on hardwoods and riparian growing trees thus not allowing for forest succession once the original stock is diminished. Wood in streams is utilized by aquatic macroinvertebrates grazers and shredders for food and without could alter community dynamics at the bottom of the food web.

The table on the next page shows the a list of invasive species that can be found in the Neversink watershed area.

Common Name	Scientific name	Habitat Impacted	Implications	Images
Spotted lantern fly	*Lycorma delicatula*	Riparian	Feeds on Riparian hardwoods	
Emerald Ash Borer	*Agrilus planipennis*	Riparian	Feeds of Riparian Ash Trees	
Hemlock Wooly Adelgid	*Adelges tsugae*	Riparian	Attacks Riparian Hemlocks	
Beach leaf disease Nematode	*Litylenchus Crenatae mccannii*	Riparian	Kills Beech Trees in Riparian zone	
Morrow's honeysuckle	*Lonicera morrowii*	Riparian	Suppress native plant & timber regeneration	
Black Swallowwort	*Cynanchum louiseae*	Riparian	Overgrow native plants	
Garlic Mustard	*Alliaria petiolata*	Riparian	Displaces native wildflowers and tree seedlings	
Tree of Heaven	*Ailanthus altissima*	Riparian	Outcompetes Native plants & provides food for SLF	
Water Chestnut	*Trapas natans*	Aquatic	Reduces biodiversity & hampers recreational activity	
European Frogbit	*Hydrocharis morsus-ranae*	Aquatic	Deplete oxygen levels in high densities	

Water Quality

Water pollution and degradation is caused by both “point source” and “nonpoint source” impacts. Point source pollution refers to contaminants that enter waterways from a distinct and often readily identifiable source such as a wastewater discharge pipe from a sewage treatment plant or a factory. Non-point sources of pollution are the result of diffuse, overland runoff of materials such as sediments and nutrients from fields and impermeable surfaces. Waterways within the scope of the NWMP project are primarily impacted by non-point sources.

Priority Waterbody List - Streams

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is New York’s collection of assessment data for each of the state’s water bodies. The Department of Environmental Conservation has recently transitioned to utilization of the Consolidated Assessment and Listing Methodology (CALM). Under this methodology, new assessment data is collected annually and each waterbody receives one of EPA’s (Environmental Protection Agency) eight Integrated Reporting (IR) designations. Those gaining an IR 5 (Impaired, Total Maximum Daily Load (TMDL) Required) or IR 5r (Impaired, TMDL Alternative) designation are sent to EPA for 303(d) listing every two years. For a waterbody to qualify as ‘Impaired’:

1) Water quality data demonstrates a violation of accepted standards
2) Best Uses not supported
3) Total Maximum Daily Load (TMDL) or alternative is necessary to mitigate the cause and/or pollutant

*These violations must be recorded > 1 time and from > 1 sampling year.

Sediment and Erosion

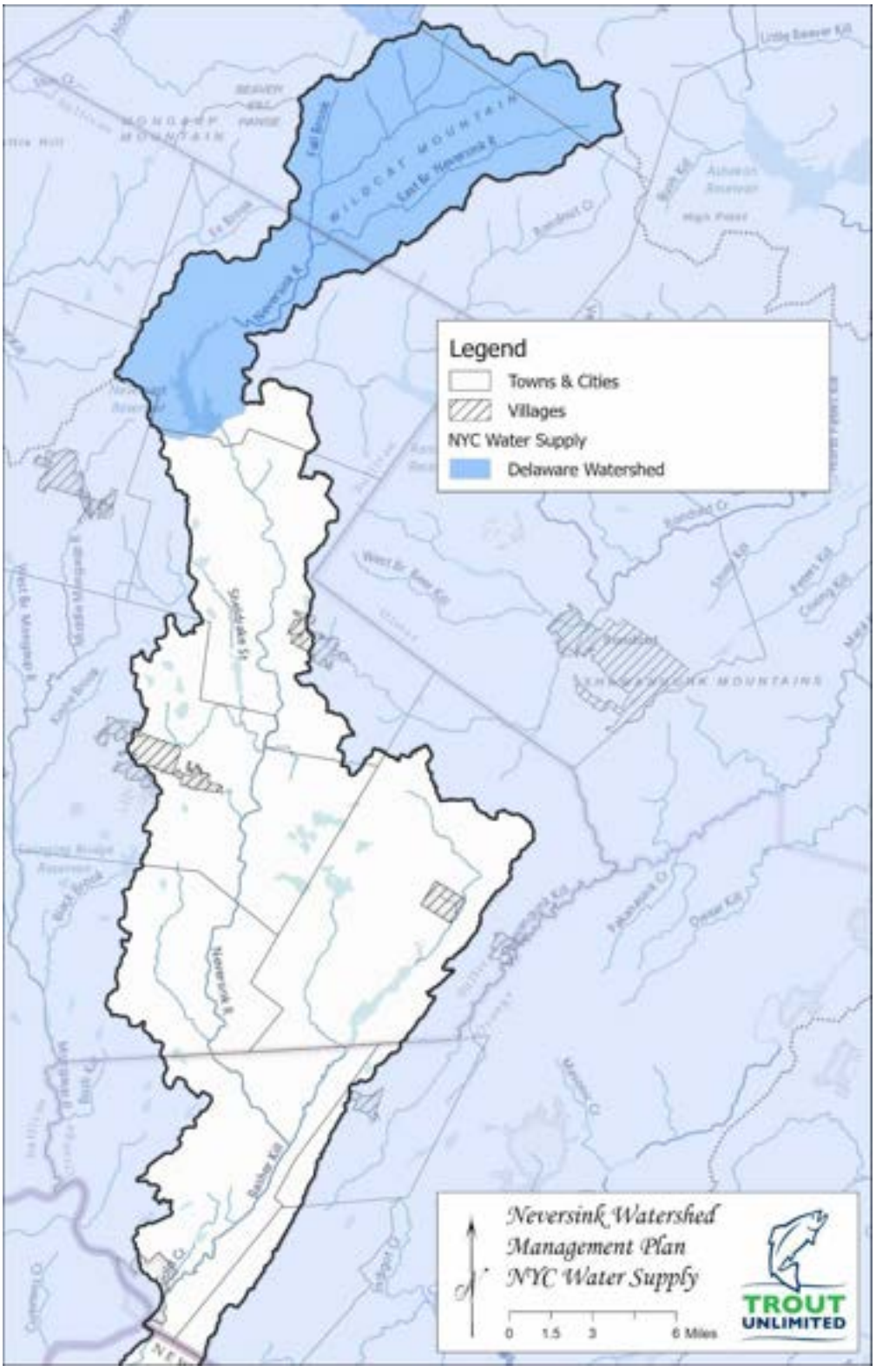
Sediment pollution, resulting from erosion, is one of the primary water quality impacts within the project area. The primary sources of sediment pollution are stormwater runoff from intensive land-based activities such as agriculture and development that creates impermeable surfaces including rooftops, roads, and structures. A secondary source of sediment pollution comes from accelerated transport of gravel, cobble, and other sediment within the stream channel. This is due to the often highly destabilized and erosive conditions of local waterways as a result of historic and modern day impacts. New York State has observed an increased rate of intense rainfall events over the past few years, exacerbating sedimentation resulting from both primary and secondary sources.

NYC Water Supply

New York City’s (NYC) Water Supply has evolved over the years as the population has demanded more freshwater. The initial settlers and colonists were able to obtain freshwater from local sources, but by the early 1800s, there was a glaring need for a safe and clean public water supply system. The Croton watershed was originally tapped to provide clean water to NYC in the 1830s, with clean water making its way to Manhattan in 1842. With more population growth in the early 1900s, the search for more freshwater led NYC to the Catskills. From the 1900s to 1960s, NYC constructed large reservoirs, aqueducts and tunnels to establish the Catskill and Delaware water supply systems. The Delaware Aqueduct is recognized as the longest continuous tunnel in the world and transports water 85 miles to NYC. Due to universal metering and conservation measures, NYC has been able to reduce the amount of water consumed by its

populace while the population of the City continues to rise. Peak demand was in 1979 and has gone down and eventually plateaued since then.

The Neversink Reservoir (and thus, the watershed draining into the reservoir) are contained within the Delaware water supply system. Full capacity of the reservoir is 36.6 billion gallons of water and drains 93 square miles of Neversink's headwaters. On the way to NYC, Neversink Reservoir water is transported:



- 6 miles through the Neversink Tunnel, to Rondout Reservoir
    - Mixes with water from Cannonsville, Pepacton, and Rondout Reservoir
- 85 miles through the Delaware Aqueduct, to
    - West Branch & Kensico Reservoirs after settling and mixing with Catskill system waters
- Neversink water enters one of two aqueducts and ends up in the Hillview Reservoir, in Yonkers
    - Here, water makes its way into NYC's water supply distribution system

NYS DEC Water Quality Classification

New York State's Water Quality Standards Program is designed as a basis for water protection. By United States Environmental Protection Agency definition, water quality standards should include criteria, designated (best) uses of the water, and an antidegradation policy.

Fresh surface waters are assigned a letter designating their "best uses". The letters and best uses are described in 6 NYCRR Part 701 and summarized below:

1. Class AA and A - drinking water
2. Class B - public swimming and contact recreation activities
3. Class C - fishing and non-contact activities
4. Class D - fishing, but these waters may not support fish propagation

In addition, Class AA, A, B, or C waters may have a "T" or "TS" attribution. This means they also support **T**rout populations or **T**rout **S**pawning.

Below is a breakdown of the water quality classifications for 549 miles of categorized stream segments within the Neversink watershed. Of these, there is a total of 336 miles with a (T) or (TS) attribution.

-Class AA and A - 47 miles
-Class B - 231 miles
-Class C - 266 miles
-Class D - 5 miles

The Delaware River Basin Commission (DRBC) is an interstate-federal water resource agency whose five equal members are Pennsylvania, Delaware, New York, New Jersey, and the United States.

The DRBC works closely with New York State Department of Conservation and New York City Department of Environmental Protection on permitting, flow management and water quality in the Neversink River watershed.

The 1954 U.S. Supreme Court Decree allows New York City (NYC) to take up to 800 million gallons per day (mgd) from three city-owned reservoirs in the Delaware River headwaters. The DRB Compact gives the DRBC broad powers to plan, develop, conserve, regulate, allocate, and manage the basin's water resources, but the commission cannot adversely affect the releases or diversions provided in the 1954 decree without the unanimous consent of the decree parties (NY, PA, DE, NJ, NYC).

DRBC staff provided technical and administrative support to the decree parties as they negotiated a long-term strategy for optimizing operation of NYC's Delaware Basin water supply reservoirs for multiple objectives, including drought management, protecting fisheries habitat downstream of the reservoirs, and enhancing flood mitigation, resulting in the 2017 Flexible Flow Management Program.

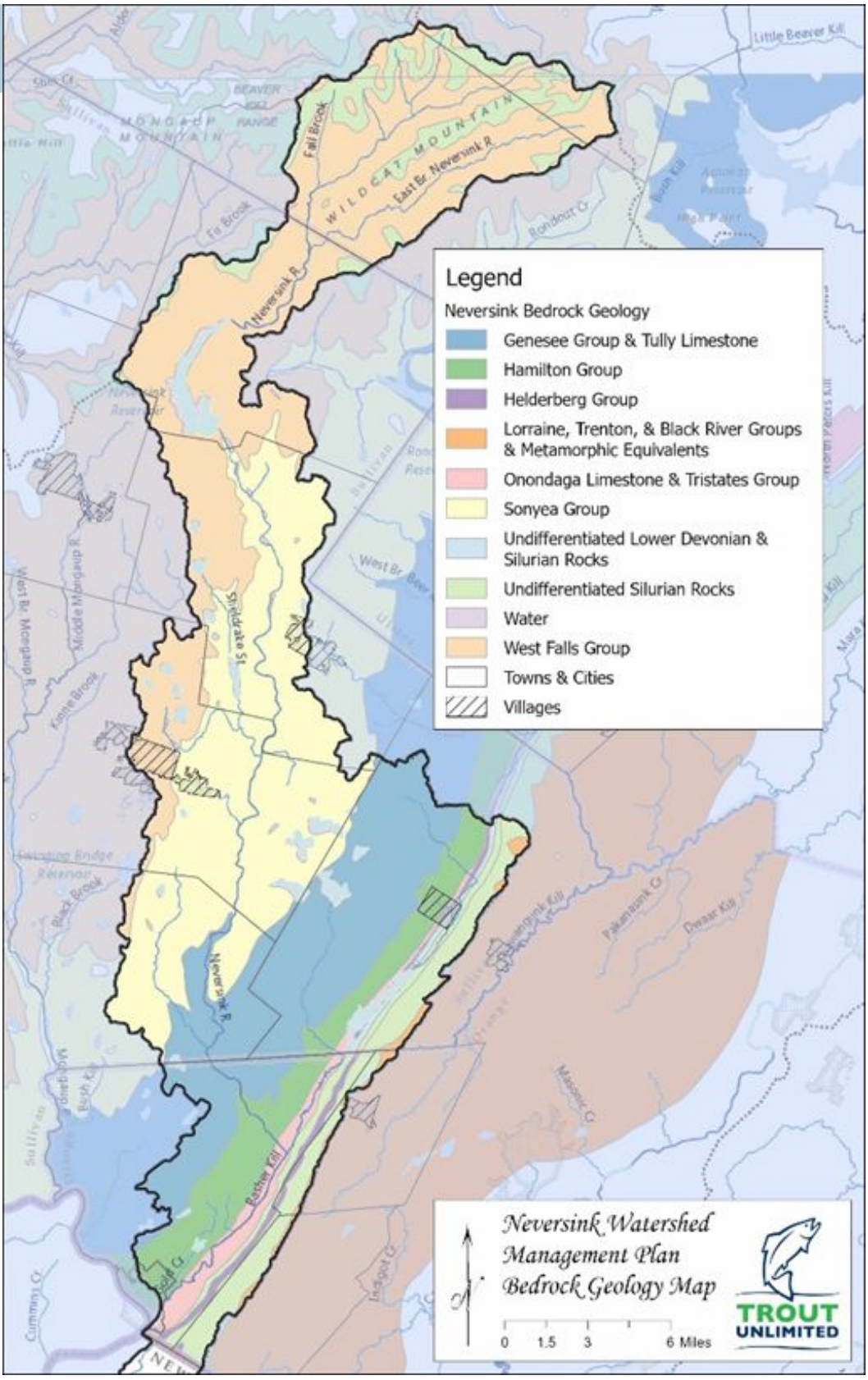
To implement the Commission's Special Protection Waters program and to ensure new development in the Neversink drainage area does not compromise water quality in the main stem Delaware River, DRBC developed a water quality model for the Neversink River. The model is used by DRBC in docket evaluations and facilitates the assessment of cumulative impacts on the waterway by both the DRBC and NYSDEC.

Neversink Unique Area, Image courtesy of TU

Geology

The Neversink's water quality is directly and indirectly influenced by the surrounding geology. The bedrock composition of the upper Neversink watershed is made up almost entirely of sedimentary rocks: shales, siltstones, sandstones, and at higher elevations conglomerate.

The headwaters of the Neversink from Slide Mountain in Shandaken, at the highest point in the Catskills southward through the towns of Denning, Neversink and parts of Fallsburg is of the relatively flat-lying, sedimentary type Rhinestreet shales of the West Falls group that formed during the upper Devonian time period some 360 million years ago. Rhinestreet shale is a geologic formation in the Appalachian Basin and is an organic or black shale. In this there are thin beds of shale along with limestone concretions interbedded throughout the bed rock

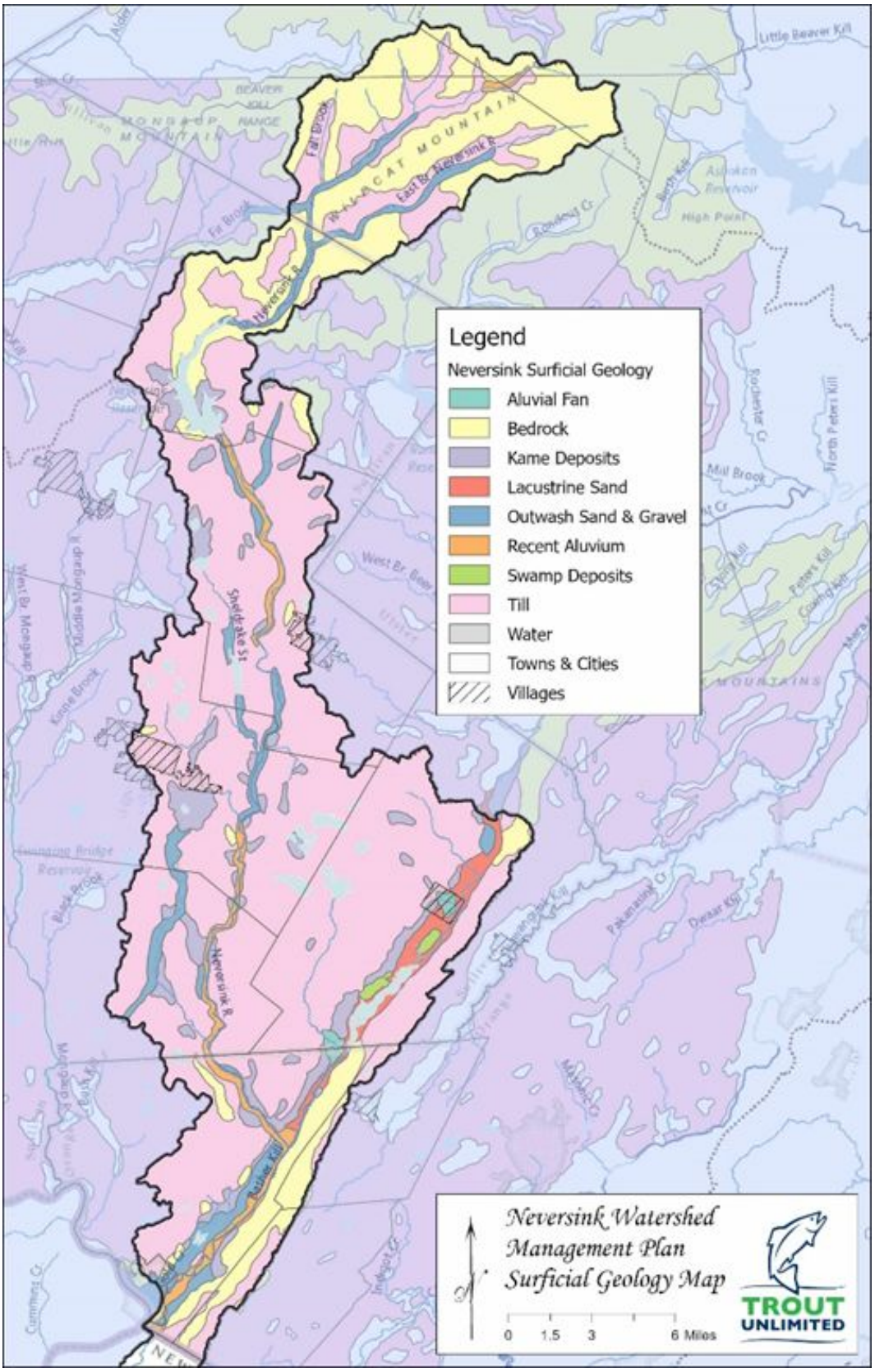


formations. In the headwaters bedrock exposures in the upland areas also include undifferentiated Silurian rocks. These rocks are made up of hard dolostone that formed from small bits of shells and corals that accumulated in warm, shallow ocean water during the Silurian Period

419 million years ago.

South of the Neversink Reservoir, in the towns of Fallsburg, Thompson and Forestburgh bedrock is primarily composed of the Sonyea group. Consisting of black shale and limestone, with a sequence of siltstone and silty shale, characteristic of the Catskill Delta formation.

As the Neversink River drainage passes through parts of Forestburgh, Deerpark, and Mamakating bedrock composition primarily contains undifferentiated lower Devonian and Silurian rock types. This consists of a mixture of Limestone, Dolostone, sandstones and shale. As the Neversink Rivers meets the Basher Kill eventually draining into the Delaware it passes through the towns of Mt. Hope, Greenville and is primarily composed of the Onondaga Limestone and Tristates group. This group of sedimentary rocks consisting of Limestones and dolomites formed during



the Devonian period.

This uniform and somewhat bland looking bedrock is important to maintaining stable stream conditions and flows throughout the Neversink headwaters. Both bedding plane partings and deep

perpendicular joints (i.e., horizontal and vertical cracks that form a grid like pattern) contribute significantly to the storage and slow release of groundwater to lower portions of the landscape. This helps maintain relatively even baseflow of cold water to the stream, especially during drier spells.

Surficial deposits are important to the Neversink watershed because this medium regulates groundwater recharge to the bedrock and in turn baseflow to the streams. Surficial geology is broken into three broad categories, and is specified by the way deposits were laid down: glacially-created, thin till over bedrock, or alluvial meaning transported by flowing water.

During the last glacial ice age, following the retreat of the continental ice sheet out of the Catskills large quantities of glacial deposits were left behind. Over time these glacial deposits began to fill in the deep river ravines that had once drained the land during the previous ice age, including the Neversink River. As the Neversink flows down from the higher bedrock elevations and into the valley much of the active stream corridor is covered with alluvial material typically ranging in sediment size from sand to large boulders.

These glacial deposits along with the headwater bedrock formations are largely what control the Neversink valley stream morphology characteristics such as slope, valley and stream confinement. Much of the surficial geology highlighted in pink is a mixture of saturated sediment that was carried along by ice and deposited as till - an unsorted assemblage of glacial sediment.

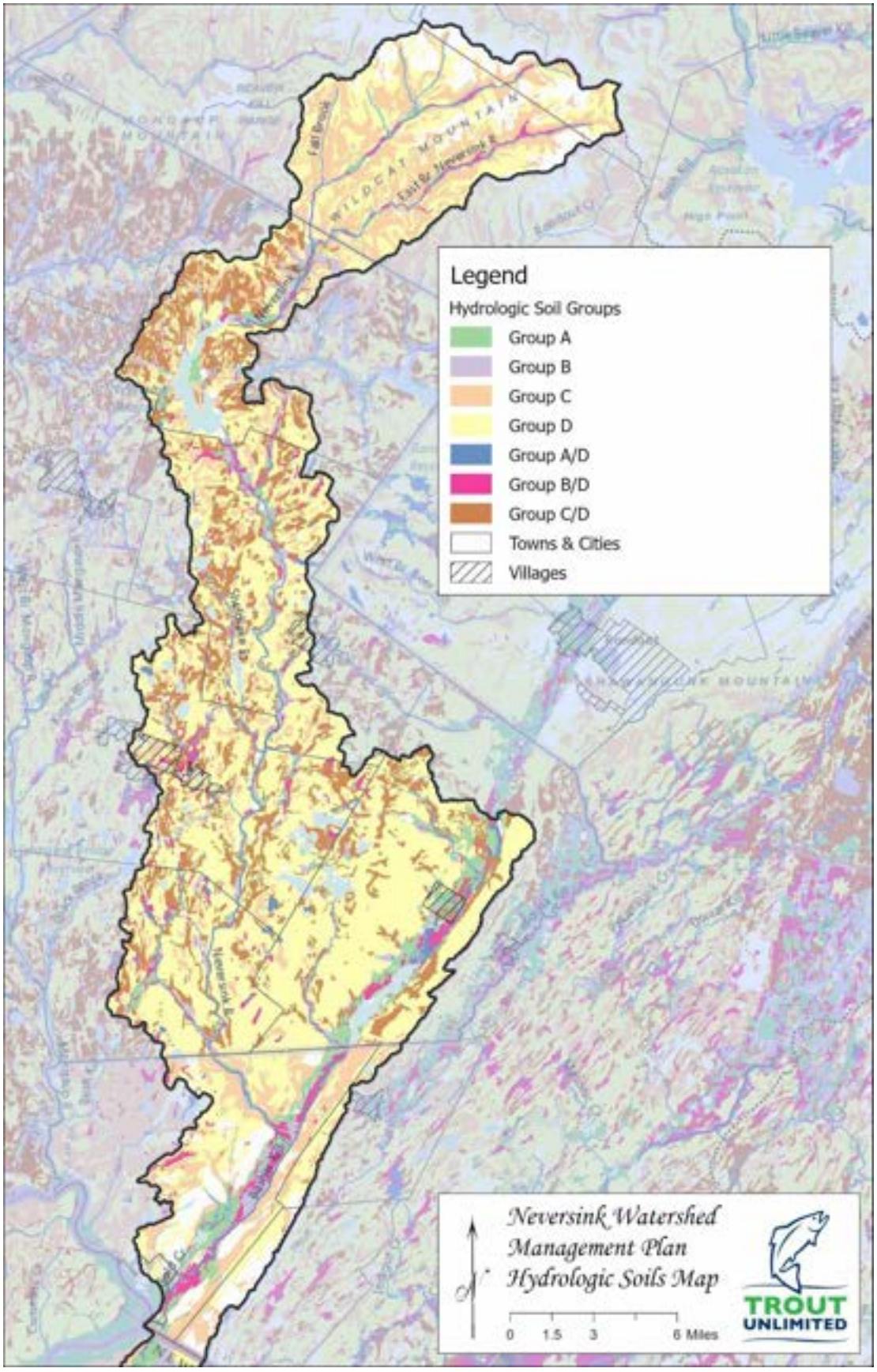
Soils

Once the glaciers retreated from the watershed nearly 11,000 years ago, physical, biological, and chemical weathering began creating the soils we see today. Similar to the changes observed in surficial geology, changes are also reflected in the soils data and correlate to the different characteristics of the glacial retreat.

At its most basic level soil can be defined as a natural body composed of minerals and organic matter, liquid, and gasses that occurs on the land surface. Soil is characterized by one or both of the following: layers (or horizons) that are distinguishable from the initial material or the ability to support rooted plants within the natural environment. Soils provide important environmental functions that include nutrient cycling, air and water purification, waste decomposition, food production and are a source of building materials. In the Neversink watershed soil plays an important role in regulating hydrologic and climatic processes by influencing surface runoff, infiltration and evapo-transpiration.

Low permeability soils, typically those with a higher clay content, will allow less water to move through them when compared to more permeable soils such as soils with high sand content. This classification is known as “runoff potential”. Soils classified as C or D are known to have higher runoff potential and consist of either sandy clay loam or clay loam; these have lower permeability rates. Soils with a lower runoff potential and higher permeability rates are classified as A or B and consist primarily of sand or silt loam. Water that does not infiltrate into soils will runoff over the surface of the land until either absorbed, evaporated, or it enters a waterway directly. The Neversink watershed is

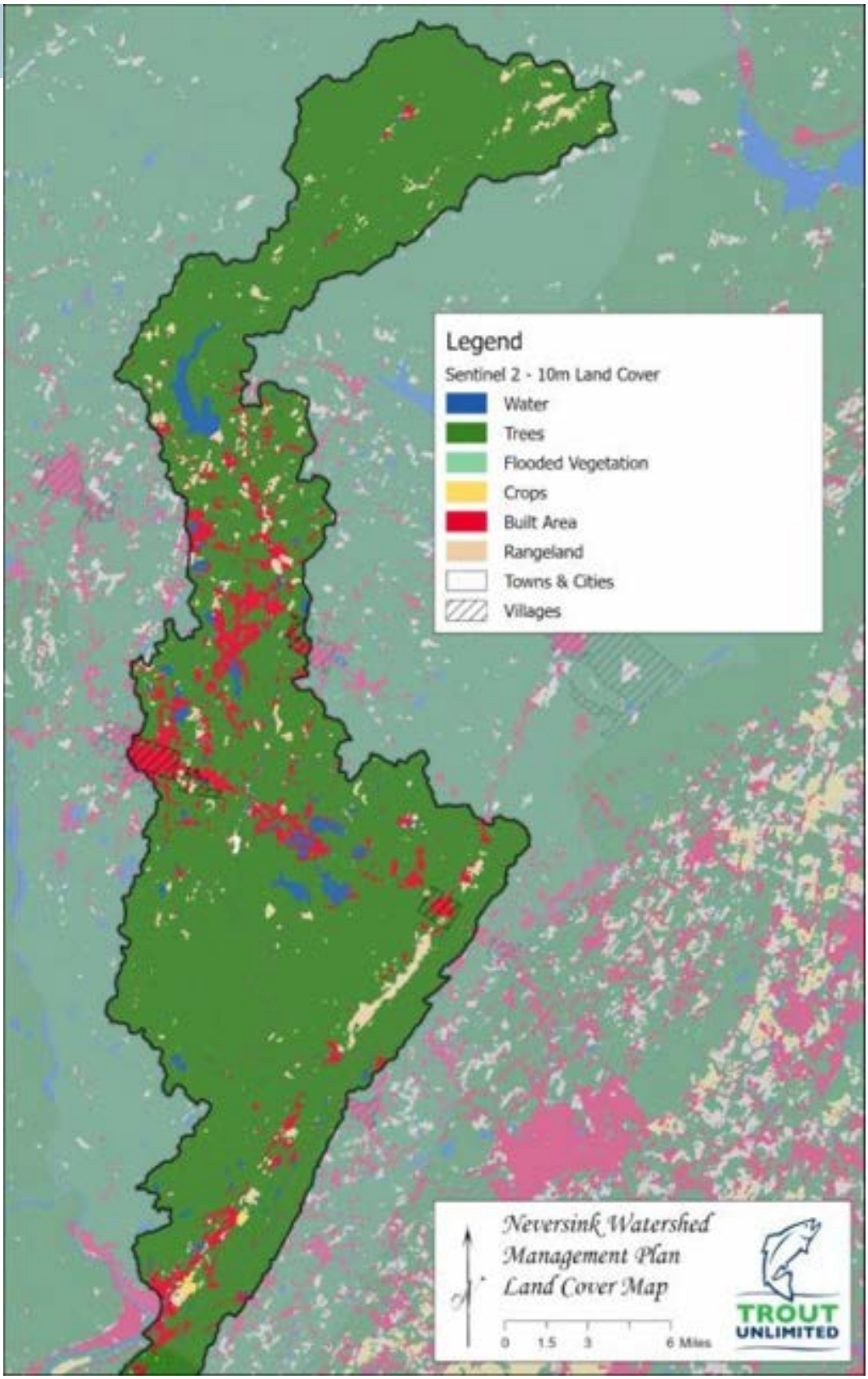
primarily classified as C or D, or both from its upper headwaters in Sullivan County to its confluence with the Delaware in Orange County.



Land Cover

Land cover throughout the Neversink watershed is directly correlated with impacts to stream hydrology by influencing stormwater runoff. In the northern forested areas of the Neversink, primarily above the reservoir natural meadows and wetlands absorb much of the rainwater and runoff from the residing mountains. These forested lands act much like a sponge allowing a portion of the rainwater to percolate back into the ground.

In contrast below the reservoir, built communities and impervious surfaces such as pavement, parking lots and other hard packed surfaces increase the amount of runoff that flows over the land. With these increases in rainfall runoff south of the reservoir, there is a reduction in the amount of water that percolates back into the soil to recharge ground water wells and streams. Not only does this exacerbate the effects of climate change there is also increased risk of pollutant recruitment into the stream directly affecting water quality in these parts. Further down in the drainage the towns of Forestburgh and Mamakating are primarily forested areas until reaching the population center of Port Jervis and finally draining into the Delaware River.



Subwatershed	ISF USFW Rank
Neversink Reservoir	Good
Turner Brook-Bush Kill	Good
West Branch Neversink River	Fair
Lower Neversink River	Fair
Middle Neversink River	Fair
Sheldrake Stream	Poor
Upper Neversink River	Moderate
East Branch Neversink River	Good
Basher Kill	Moderate
Gumaer Brook	Moderate
Pine Kill	Moderate

Impervious/Stream Temperature Impacts

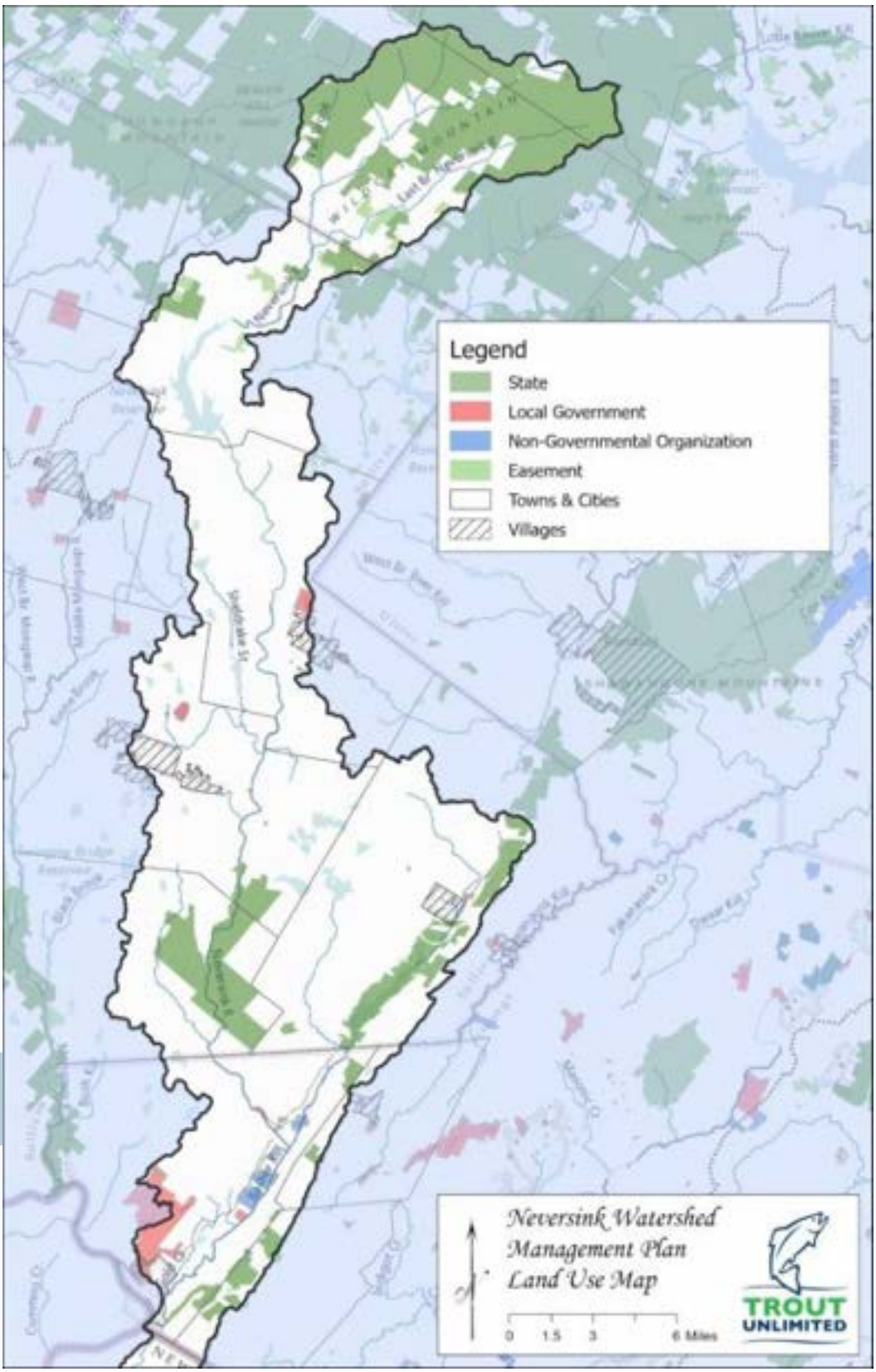
The thermal regime of the Neversink River can be impacted by impervious surfaces within the watershed's riparian corridor. Impervious surfaces act as solar sinks for the sun's rays trapping heat in the material (Roy et al., 2005). This heat is then transferred to water when runoff collects on these impervious surfaces. Once precipitation exits these surfaces it is at a higher temperature. This higher temperature water then enters the streams providing an adverse impact of negative thermal input to cooler ambient stream temperatures.

Utilizing USFW stream assessment protocol, each subwatershed of the Neversink River has been identified and assessed with the ESRI suite of remote sensing software. Visual assessments as well as Statewide Riparian Opportunity assessment data have been combined to prepare the most current Impervious Surface record used for prioritizing areas of thermal concern. Subwatershed Assessments break the Neversink watershed down into eleven different subwatersheds that function with differing thermal regimes.

Post assessment, the Sheldrake Stream was classified as poor. Sheldrake stream is a tributary of the Neversink River and in recent years its riparian zone has been encroached upon by new housing developments and impervious surface infrastructure. In some parts of the Sub-watershed, the Sheldrake Stream is flanked by parking lots and housing communities. These streamside structures increase overland flow and increase the temperature of runoff entering the stream post precipitation events.

Sheldrake Stream is going to be added to the 2024 temperature monitoring initiative.

Other Subwatersheds that were classified as Moderate are the Basher Kill, Gumaear Brook, and Pinekill. These tributaries of the Neversink will also be included in the 2024 temperature study. The East Branch Neversink, Bush Kill, and Neversink Reservoir subwatersheds have been classified as good meaning they have a very minimal number of impervious surfaces to their riparian corridor. It would be expected for these “Good” watersheds to have a more stable thermal regime than Sheldrake stream.



Land Use

The lands within the unit have been greatly influenced by historic natural resource extraction. Logging, mining, and to a lesser degree farming had significant influence on the current forest stand composition and soil conditions, it left telltale signs of human influence on the lands such as old carriage roads, dam ruins, abandoned quarries, and the O&W Railroad that can be found on land within the unit. Eastern hemlock was sought for its bark that was used to tan leather. Use of hemlock logs for lumber would have occurred when White pine was in limited supply. Often, hemlock logs were left

Trail along Neversink Unique Area, Image courtesy of Beth Brown, DRBC

after the bark was removed. Firewood was always needed for cooking and heating, and charcoal was made for blacksmith use. With the advent of the railroad, large amounts of timber, leather and stone could be transported as needed in a relatively short period. This promoted the increase of logging and quarrying.

Today, the Neversink watershed is heavily forested. Developed land is primarily of single-family housing, either for full-time residents or as vacation rentals with some agriculture lands. Large private holdings of fish and game clubs or non-profits such as the Frost Valley YMCA are also present. Still, development pressures exist for additional housing.

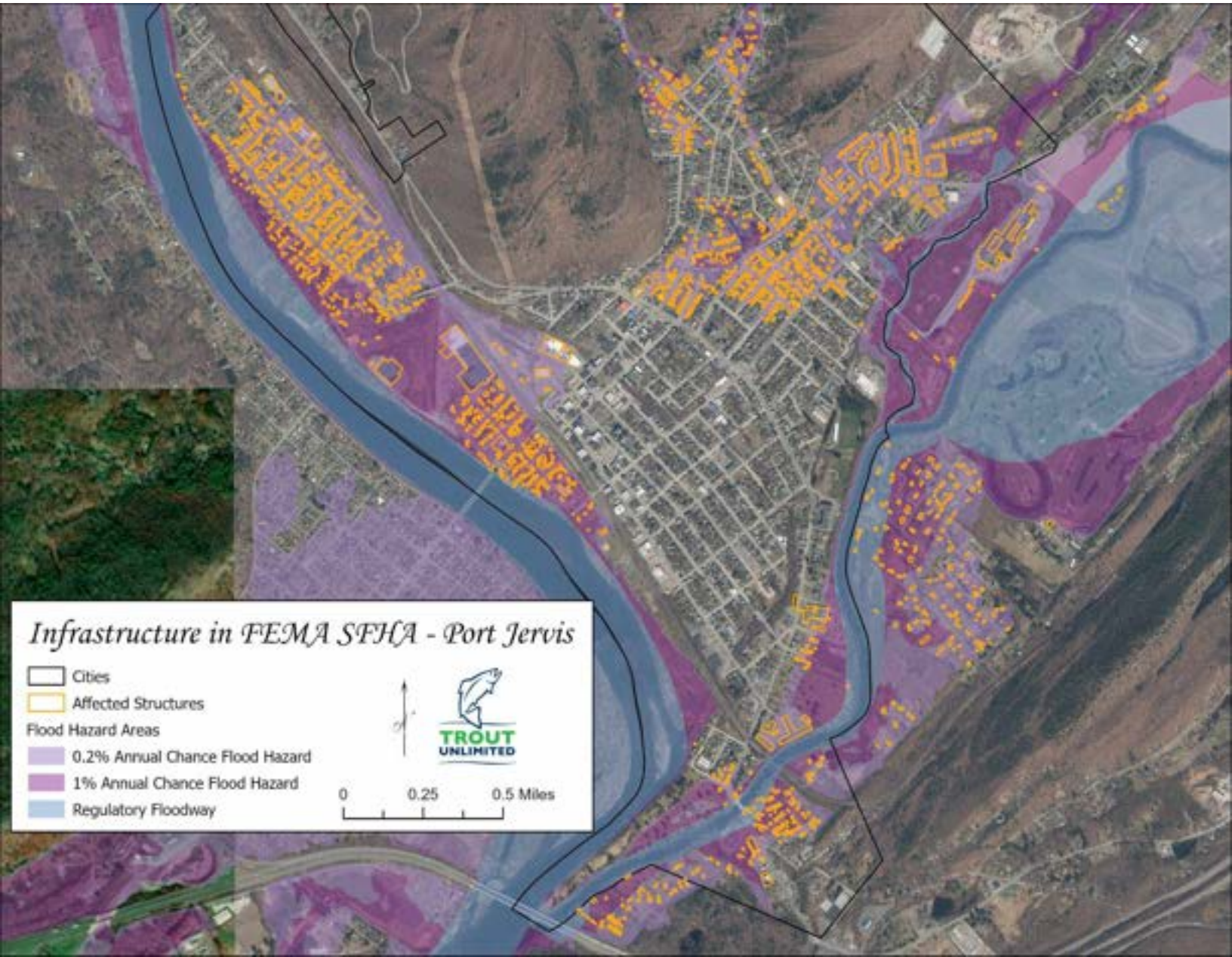
Flooding

Flooding is a natural phenomenon that is the result of precipitation and soil saturation levels in a particular area. When precipitation and runoff enter a stream channel beyond its natural capacity this results in flooding. This has the potential to inundate areas that are located within floodplains. Floodplains are a natural feature that provide vital and necessary ecosystem services. Unfortunately, many human population centers have been built within floodplains and are at risk of inundation.The Neversink River and its tributaries have been known to periodically experience high amounts of rainfall which have the potential to cause devastating floods. The Neversink Reservoir helps to buffer upstream rain events. While it is not designed or operated as a flood control reservoir, even when at 100% capacity, the reservoir provides a margin of flood protection for downstream communities. Without the reservoir,

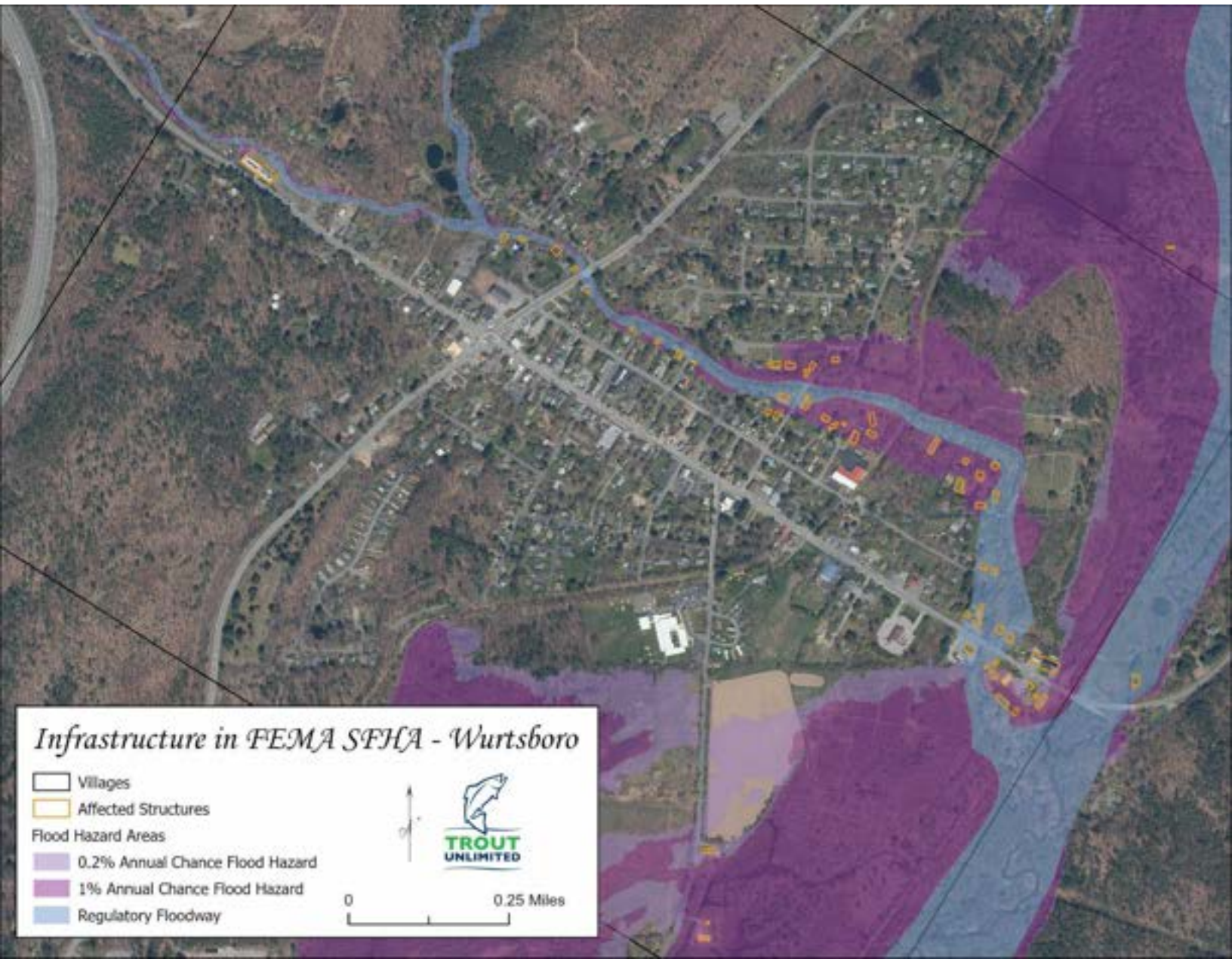
downstream communities would have no flood protection.

The 2017 Flexible Flow Management Program (FFMP), which governs releases and diversions from the Neversink Reservoir and other NYC Delaware System Reservoirs, has a Conditional Seasonal Storage Objective (CSSO). The CSSO maintains a void of 15% in the reservoir from November 1 through the following February 1 to help capture spring rain and snowmelt Runoff. Historically, this is the time of year when flooding is most likely to occur.

There is a common perception that releases from the Neversink Reservoir increase downstream flooding. The National Weather Service lists the flood stage at the USGS stream gage located at Bridgeville, NY as 13 feet. NYC does not release water from the Neversink Reservoir when the Neversink River at Bridgeville is above 12 feet or forecasted to be above 12 feet within a 48-hour period. This helps, but may not fully prevent, flooding from occurring immediately downstream of the reservoir. Flooding downstream (and upstream) of the reservoir is often the result of localized conditions and inputs from tributaries to the Neversink River and not from the reservoir releases.



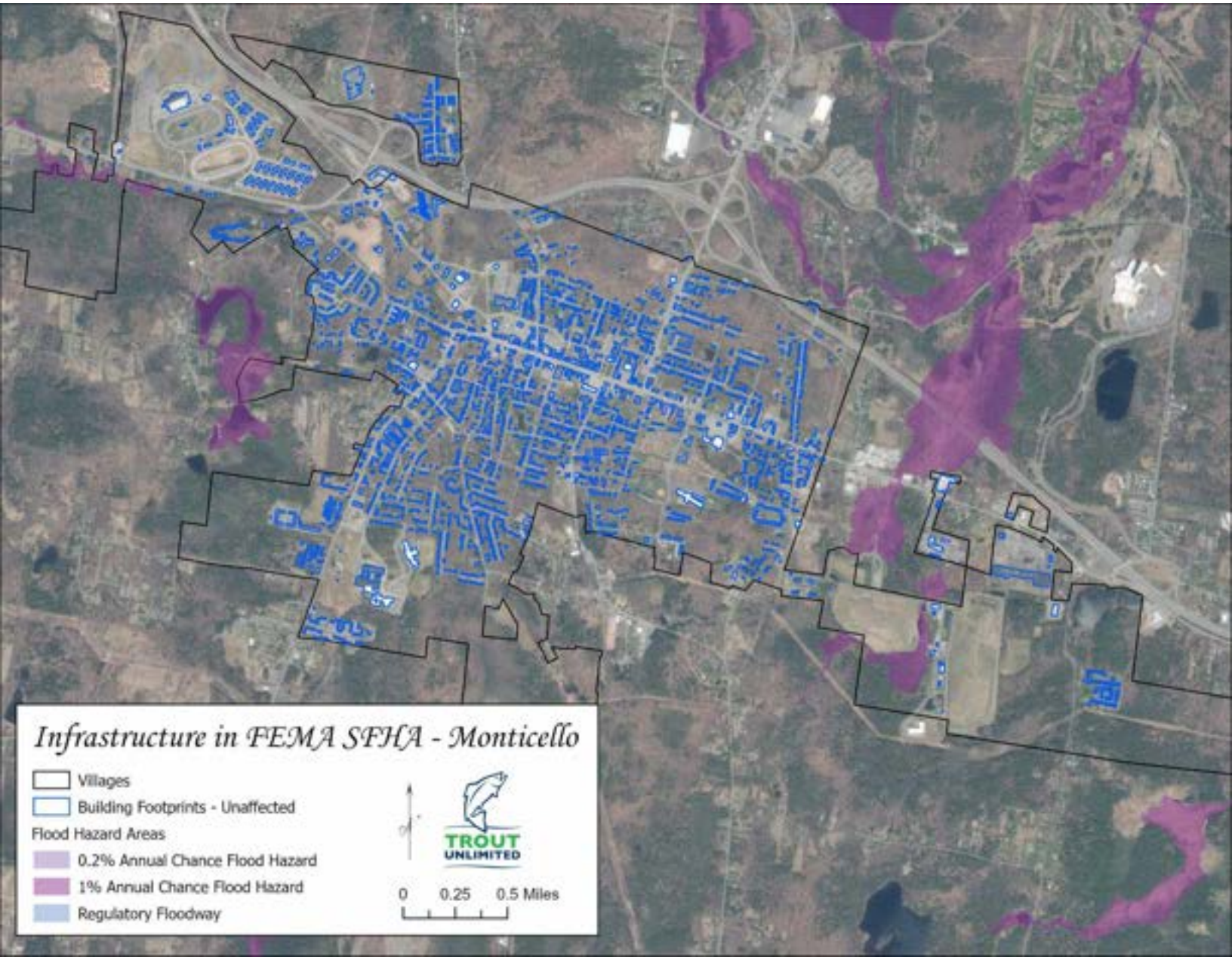
The Neversink Reservoir's dam and related infrastructure are highly regulated. The New York City Department of Environmental Protection (NYC DEP), the agency tasked with operating and maintaining the reservoir, has a dam safety office that routinely inspects the dam for deficiencies. NYC DEP spends millions of dollars each year on projects to maintain and upgrade its infrastructure including dam inspection and safety. In addition, NYC DEP works closely with the NYS Department of Environmental Conservation (NYS DEC), which regulates dams in the state to ensure that the Neversink dam is in good condition. NYC DEP also works closely with state and county emergency management departments and downstream communities and have created plans to respond to dam safety emergencies. In the highly unlikely event that a dam safety emergency occurs, DEP and its partners are well prepared to respond to the situation. At a more local scale, yearly flooding can occur at undersized road-stream crossings. Excessive volume of rainfall entering streams will end up backwatering undersized crossings causing damage to roadways, properties, and potentially downstream habitat. It is imperative that highway departments and private property owners ensure that their bridges, culverts, and other crossings are sized and oriented



appropriately to reduce the impact of these damages.

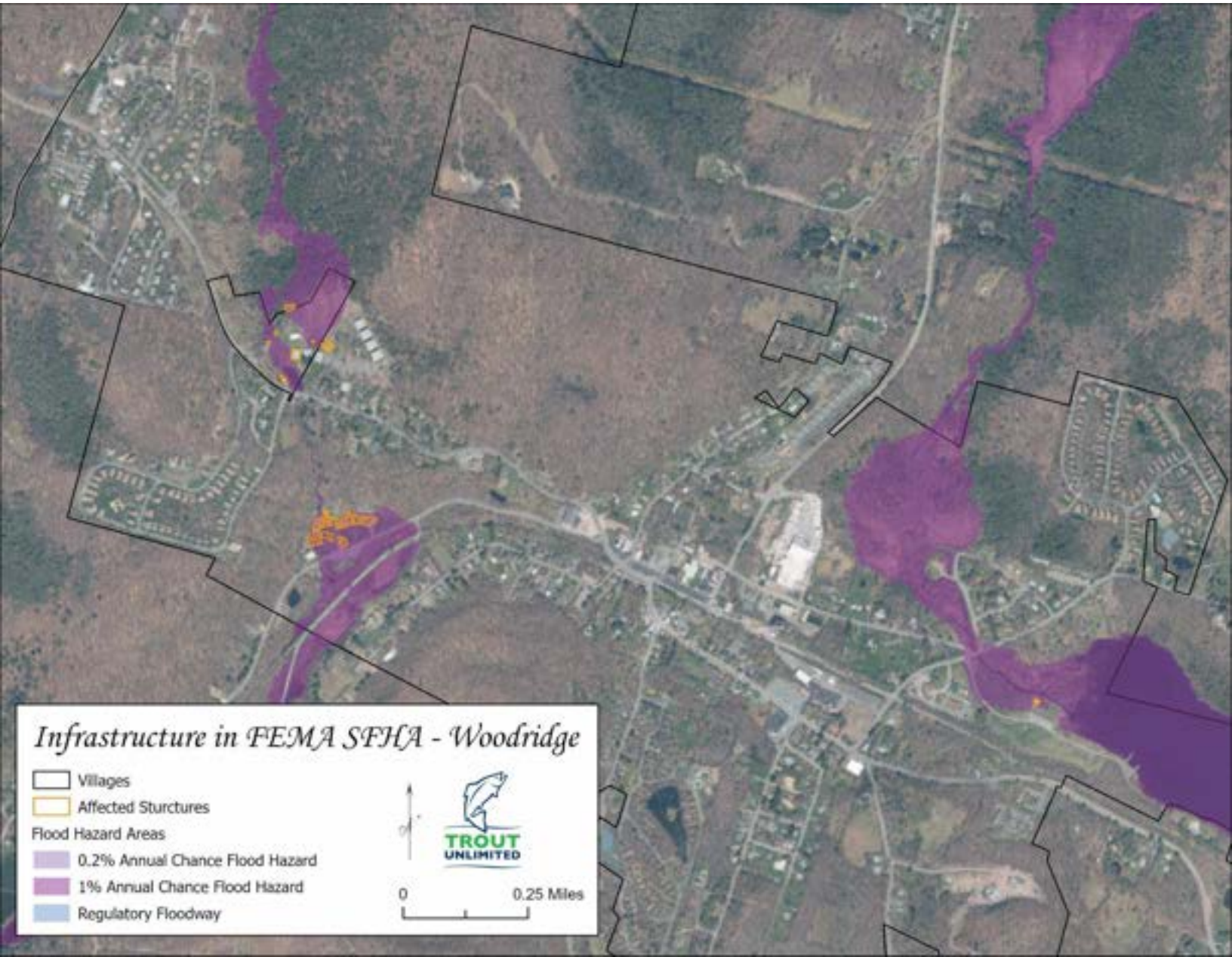
Floodplains in New York State are managed by the Federal Emergency Management Agency (FEMA) at the federal level, NYSDEC at the state level, and municipal floodplain administrators at the local level. FEMA administers the National Flood Insurance Program (NFIP) that provides floodplain mapping services for communities in the United States and flood insurance for those who live in communities who choose to participate in the NFIP. The NFIP and occasionally state and local programs offer funding to those with an NFIP flood insurance policy to retrofit their buildings to mitigate flood damage. Those who own structures located in a FEMA mapped floodplain are encouraged to take advantage of NFIP flood insurance (most homeowners policies do not cover damage from floods) and programs to mitigate their structures from flood damage.

Furthermore, many localities have more in-depth mapping and studies that better determine sources and impacts of flooding. For example, the East Branch of the Neversink completed a Local Flood Analysis (LFA) that helps determine the source and true extent of



flooding in that area. This and similar planning documents as well as local zoning can help communities better plan where development occurs and keeps new structures away from the floodplain and out of harm's way.

Flooding can be devastating to individuals and entire communities. Flooding also is a natural phenomenon that cannot, nor should not, be completely halted. Communities and individuals must work together with state and federal agencies to ensure that development occurs in appropriate locations and that existing development is mitigated to the effects of flooding as best as possible.



Wildlife

The Neversink watershed is made up primarily of large forested terrain and closely knit residential communities creating a shared balance between people and nature. From the headwaters in Shandaken, to its confluence with the Delaware River this watershed supports a diversity of wildlife.

There are many recreational opportunities throughout the Neversink watershed that allow individuals to enjoy the wildlife. Fishing, hunting, and hiking are a few of the popular activities this important place has to offer.

Fishing in the Neversink watershed is considered by some to be the best in the State and the birthplace of American fly fishing. Fishing represents an important component to the overall economy of the region as anglers travel from all over the world to fish the Neversink River, Neversink Unique Area, Bashakill Wildlife Management Area, and many more locations thought the watershed. The tributaries of these larger rivers provide opportunities for small creek fishing.

The Neversink Unique Area and Bashakill Wildlife Management Area have a variety of sought after mammals to harvest. Wildlife including big game, small game, game birds, and furbearers draw hunters from across the county in each year to hunt. Fishing and hunting requires individuals to purchase a new licenses each year through the DEC in order to participate in these wildlife recreations.

The Neversink watershed has a diverse landscape that offers hikers from all over and of all abilities exciting sighting of various wildlife. From birdwatching to mammal sightings to insect discoveries, no outdoor enthusiast will be disappointed in the wildlife the Neversink watershed has to offer. There are a multitude of miles of trails for hikers of all abilities to enjoy. DEC maintains many of those hiking trails throughout Wildlife Management Areas and Unique Areas.

Although the Neversink supports a wide variety of recreational opportunities and a diversity of fish and wildlife, it has its own share of ecosystem threats in this ever changing landscape. Ranging from environmental, natural, and human factors each of which can have a profound impact on this delicate ecosystem. The presence of at-risk species and rare communities along the Neversink and surrounding landscape are particularly susceptible to these influences. Focused conservation and management practices should be implemented throughout the watershed to protect these valuable and unique species from further decline.

State / Global Ranking System

S1 / G1: Critically Imperiled / Endangered: At very high risk of extinction due to extreme rarity, very steep declines, or other factors.

S2 / G2: Imperiled / Threatened: At high risk of extinction due to very restricted range, very few populations, steep declines, or other factors.

S3 / G3: Special concern / vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations, recent and widespread declines, or other factors.

S4 / G4: Secure / Stable: Uncommon but not rare; some cause for long-term concern due to declines or other factors. Secure/Stable S5 Secure: Common; widespread and abundant.

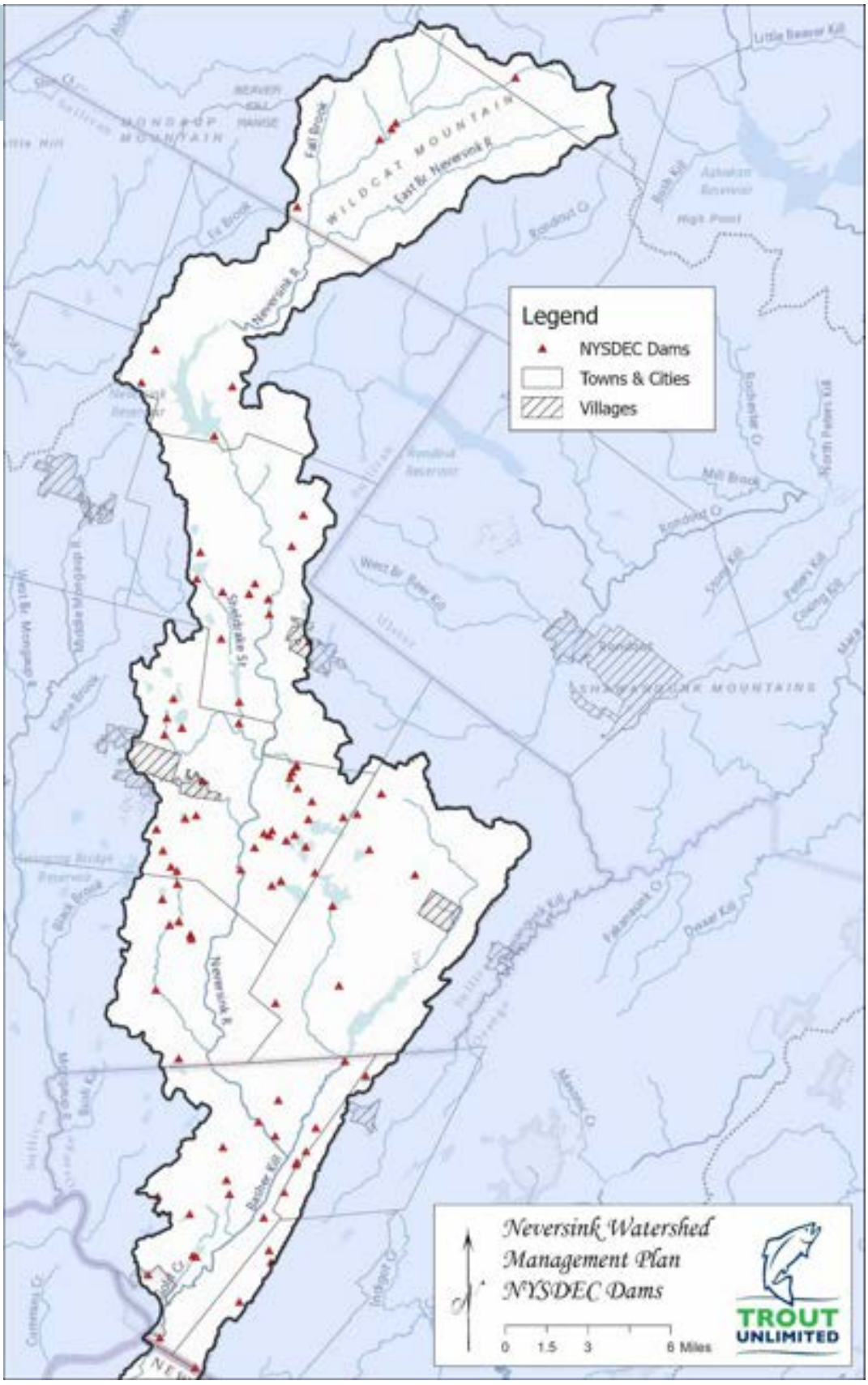
Table Below: Neversink Watershed Rare Animals and Species of Concern by County

Common Name	Scientific name	State Protection	County	State Rarity Rank	Global Rarity Rank	Images
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Neversink Watershed	S2	G3	
Northern Monkshood	*Aconitum noveboracense*	Threatened	Upper Neversink	S1	G3	
Bicknell's Thrush	*Catharus bicknelli*	Special Concern	Upper Neversink	S2	G4	
Jacob's-ladder	*Polemonium vanbruntiae*	Rare	Upper Neversink	S3	G3	
Bigleaf Yellow Avens	*Geum macrophyllum var. macrophyllum*	Not listed	Upper Neversink	S1	G5	
Appalachian Tiger Beetle	*Cicindela ancocisconensis*	Unprotected	Upper Neversink	S2	G3	
Barrens Buckmoth	*Lepidoptera Saturniidae Hemileuca maia maia*	Special Concern	Orange County	S1	G5	
Rapids Clubtail Dragonfly	*Gomphus quadricolor*	Not Listed	Orange County	S3	G3	
Dwarf Wedge Mussel	*Alasmidonta heterodon*	Critically Imperiled	Lower Neversink	S1	G1	
Brook Floater	*Alasmidonta varicosa*	Critically Imperiled	Lower Neversink	S1	G3	

Dams

Dams are defined as “barriers constructed to hold back water and raise its level.” Man-made dams of various forms and sizes are present across the landscape and present various opportunities for local communities. Documented dams across New York State are categorized for one of ten purposes -

1) Hydroelectric
2) Water Supply - Primary
3) Water Supply - Secondary
4) Recreation
5) Flood Control/StormWater Management
6) Navigation
7) Tailings
8) Fire Protection, Livestock, or Farm Pond
9) Debris Control
10) Other



In the Neversink watershed, there are 92 mapped dams. Of these dams, some contain a combination of purposes and many contain specific purpose designations, including **4** designated as Primary Water Supply, **2** for Hydroelectric, **60** for Recreation, and **2** for Flood Control/Stormwater Management. Although dams are designed to provide positive benefits to communities, the stored water and sediment behind dams pose a hazard to downstream residents and properties.

New York State Department of Environmental Conservation - Dam Safety Section maintains records of dams and are responsible for conducting safety inspections. These inspections result in a Hazard Classification for each dam, New York State utilizes five codes to classify dams:

1) A "Low Hazard"
2) B "Intermediate Hazard"
3) C "High Hazard"
4) D "Negligible or No Hazard"
5) 0 Hazard Code has not been assigned

The Neversink watershed contains 69 Class A dams, 8 Class B, 8 Class C, 5 Class D, and 2 Class 0. Of the Class C, "High Hazard " dams, 3 are in Deerpark, 1 is in Mamakating, 2 are in Thompson, 1 is in Fallsburg, and 1 is in Neversink. No deficiencies have been found in the Neversink Reservoir dam.

Road Stream Crossing Infrastructure

Transportation corridors are an essential component of all communities. They support local routes for residents to make their way to work, school, grocery stores, community spaces, and many more regular activities away from home. Roads are also used to support commerce, tourism, and many other critical sociological components that sustain the local economy. These ideas date back to the start of time, when water and rail were a significant means of transportation and allowed for the development of cities and towns along those routes. Today, our societies are highly dependent upon reliable, well-maintained roadways. When thinking about roadways, specifically their maintenance, most people think of the road surfaces. At critical points, roads have been forced to intersect streams and rivers. These points, known as road-stream crossings, require the installation of a culvert or bridge, so the water may pass under the road. Over the years, lessons have been learned about the construction of culverts and bridges. If a culvert or bridge is too small for a stream, it is vulnerable to plugging with debris, causing stream instability, and washing out to various degrees. Local municipalities struggle with some number of "problem culverts" which may require regular maintenance or flooding for nearby residents.

The sociological problems are compounded by an array of environmental harm that results from undersized crossings. These undersized crossings fragment stream networks that are critical for sensitive native flora and fauna, such as the native Brook trout.

Replacing "problem culverts" with appropriately sized structures for the stream are not cheap and require technical assistance, thus groups such as Trout Unlimited, Friends of the Upper Delaware, and Soil and Water Conservation Districts have been supporting Towns and participating in the North Atlantic Aquatic Connectivity Collaborative (NAACC). NAACC has provided a protocol, database, and format for completing assessments of road-stream crossings to determine the likelihood of passability by aquatic organisms. This metric is directly associated with the dimensions of the stream and existing crossing structure at that location. Following assessment and data upload/review, all information is publicly available online.

The Neversink watershed contains a total of 789 crossings that are currently included within the NAACC database. Of these crossings, there are a total of 131 evaluated as 'Severe' or 'Significant' barriers (Table A). This means that factors such as outlet drop, constriction, water

velocity, substrate and other metrics are far from ideal in terms of a natural section of the stream traversable by an array of organisms. Severe or Significant barriers are often (but not always) some of the same crossings that require maintenance by the Towns. Thus, it is important to also consider the number of crossings that are owned and maintained by the Towns (Table B). Total numbers differs from total number of NAACC crossings for the Neversink due to proximity to and completeness of the available NYS Street Layer.

Table A (top right table) shows the number of crossings evaluated as 'Severe' or 'Significant' barriers to aquatic organism passage, by Town, within the Neversink watershed.

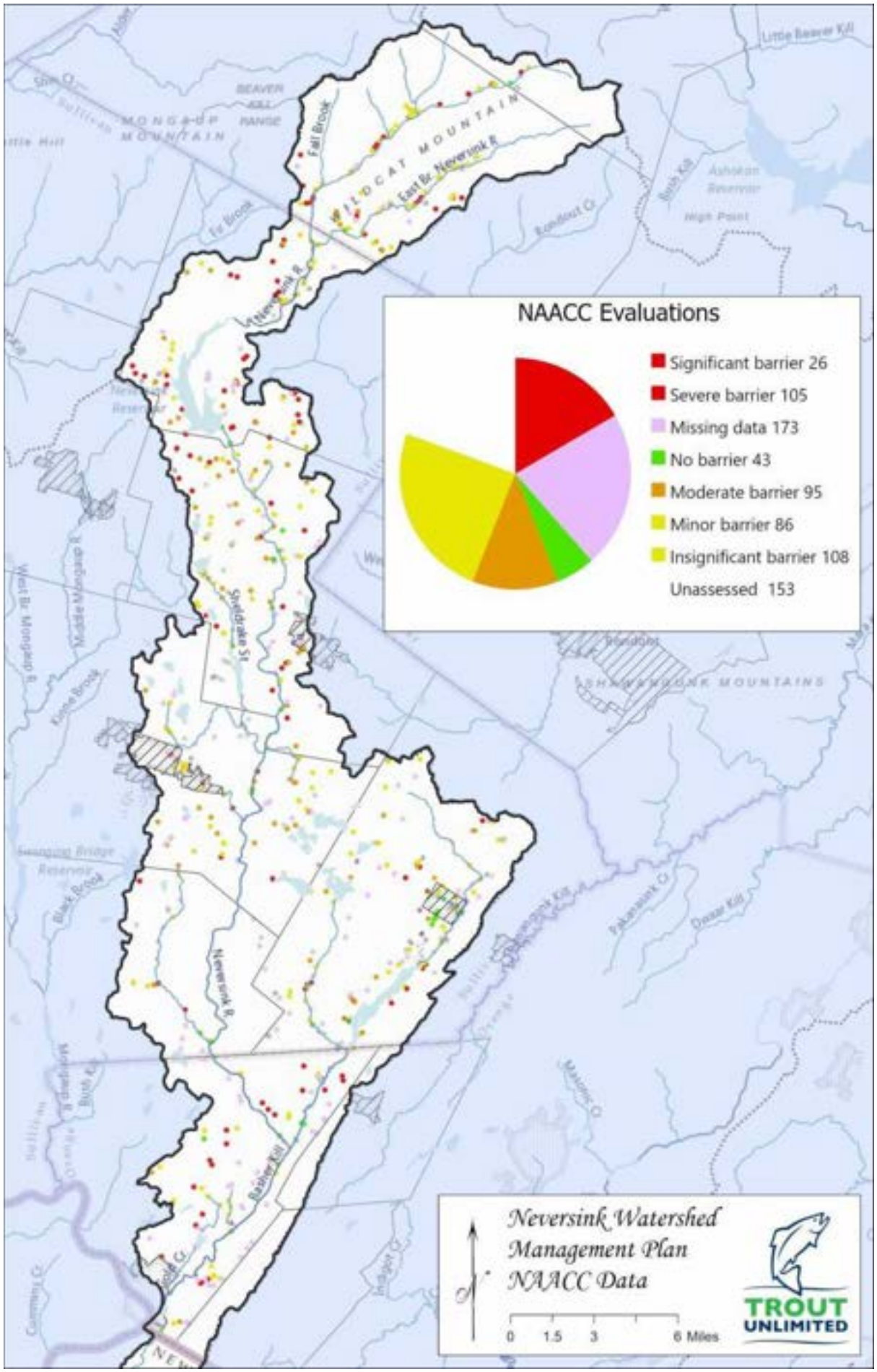
A.

Town	Severe Barrier	Significant Barrier	Total
Deerpark	19	5	24
Denning	25	4	29
Fallsburg	16	4	20
Forestburgh	4	1	5
Mamakating	10	2	12
Neversink	26	6	32
Shandaken	0	1	1
Thompson	5	3	8
Grand Total	**105**	**26**	**131**

Table B (bottom right table) shows number of crossings linked to State Routes, County Roads, Town Roads, Village Streets, and Private Roads within each Town of the Neversink watershed.

B.

Town	State Route	Country Road	Town Road	Village Street	Private Road	Total
Deerpark	15	13	52	0	6	86
Denning	0	32	55	0	0	87
Fallsburg	17	12	80	3	4	116
Forestburgh	0	8	8	0	0	16
Mamakating	30	15	63	12	1	121
Neversink	5	9	68	0	1	83
Shandaken	0	3	0	0	2	5
Thompson	7	10	60	10	1	88
Grand Total	**74**	**102**	**386**	**25**	**15**	**602**


NAACC Evaluations
Significant barrier 26
Severe barrier 105
Missing data 173
No barrier 43
Moderate barrier 95
Minor barrier 86
Insignificant barrier 108
Unassessed 153
Neversink Watershed
Management Plan
NAACC Data
0 1.5 3 6 Miles
TROUT UNLIMITED

Open Space

Bashakill Wildlife Management Area, image courtesy of Beth Brown, DRBC

Open space plays a critical role in the ecology, economy and quality of life for residents. Protecting open space protects wildlife and maintains biodiversity, conserves water quality by reducing pollutants that enter streams, mitigates flooding and helps to purify the air. Open space provides ecosystem services, such as the avoidance of health care and stormwater management costs and helps to grow natural resource -based industries. Retaining natural areas as communities grow ensures climate change mitigation and adaptation, especially for vulnerable populations. Retaining farmland ensures the economic vitality of agriculture and *silviculture. Open space provides land for recreation for all residents, improving the quality of life. This chapter describes:

- Open space priorities established through public meetings, stakeholder feedback and the results of online survey
- How water quality and land cover has changed from 2001 to 2019 in each of the subwatersheds in the Neversink watershed.
- Open Space protection techniques for municipalities
- Land use regulation techniques for municipalities

Open Space Goals & Objectives

Public Open Space Priorities

A public meeting called “Places of the Heart” was held at the Ethelbert B. Crawford Public Library in Monticello, NY on May 3rd, 2023. 45 members of the public attended this session. In the meeting, watershed residents and stakeholders attended a presentation on the ecology and special features of the watershed and

*Silviculture is the practice of controlling the growth, composition/structure, as well as quality of forests to meet values and needs, specifically timber production.

and then placed dots on maps to identify the open spaces that they would like to see protected. Staff from Sullivan County repeated this exercise at each municipality meeting with public officials.

The results of these exercises have been summarized in the chart below. The majority of the dots were placed along the Neversink River or adjacent to existing, preserved open space. Shandaken and Denning are north of the Neversink Reservoir and have a very high percentage of preserved land. Fallsburg and Thompson are more developed and Deer Park and Forestburgh are in between.

Municipality	*Open Space Votes*
Fallsburg (Sullivan County)	34
Forestburgh (Sullivan County)	23
Neversink (Sullivan County)	22
Mamakating (Sullivan County)	15
Thompson (Sullivan County)	13
Deer Park (Orange County)	13
Denning (Ulster County)	9
Greenville (Orange County)	2
Shandaken (Ulster County)	1
Woodridge Village (Sullivan County)	0
Monticello Village (Sullivan County)	0

Survey Results

An online survey asked residents and stakeholders what they cared most about, how important it is for them to protect open space, and what “big ideas” they have for the watershed. There were 60 respondents to the survey from throughout the watershed.

What do you care most about? (60 responses)

- 45% Development Threat
- 18% Clean water
- 13% Wildlife habitat
- 6% Opportunities for hunting and fishing
- 6% Public access to protected lands
- 5% Severe storm damage and loss
- Other
- Maintaining scenic views

I agree that it is important that land is set aside for the sheer purpose of preserving the natural landscape.

- 92% Strongly agree
- 8.5% Agree

Please let us know "one big idea" for conservation in the Neversink watershed. We received 42 responses to this question.

- 15 responses encouraged municipalities and counties to protect additional land.
- 13 responses encouraged enforcement of existing regulations or updates to land use regulations.

- 8 responses requested additional services including extra rangers present at existing parks, environmental education for children and adults, and signage regarding public access and fishing access.
- 3 responses requested enhanced stewardship including invasive species removal and streambank stabilization.
- 3 responses asked that all future development be limited.

Water Quality Model Results

Natural Lands, a land conservancy and one of the consultant team members for this plan, used the “Model My Watershed” Watershed Multi-Year model to estimate how water quality and land use have changed between 2001-2019. This tool is part of Stroud Water Research Center's WikiWatershed initiative. The estimated impact of development on runoff, infiltration, total suspended solids, nitrogen, and phosphorus was estimated. The results below are in descending order of % sediment change.

Natural Lands also reviewed model results from the “Ability to Produce Clean and Abundant Water” (APCAW) developed by the Open Space Institute (OSI). This model developed a metric to measure the relative capacity of small scale (HUC12) watersheds to produce clean surface and groundwater. The HUC based metrics consider watershed conditions (land cover, terrain, and hydrology) and their effects on the abundance and quality of surface and groundwater within a subwatershed boundary. The APCAW scores are applied to subwatersheds throughout the Delaware River watershed. There are 5 potential scores throughout the watershed including, “very poor”, “below average”, “average”, “above average” and “excellent”. All of the Neversink subwatersheds receive an APCAW score of “above average” or “excellent”.

The results of the Model my Watershed model results indicate that the greatest reduction in water quality is in the Sheldrake Stream and Upper Neversink River subwatersheds. The majority of the Upper Neversink River subwatershed is in Fallsburg. The Sheldrake Stream subwatershed is divided between Fallsburg and Thompson. The public “voted” for the greatest number of open space opportunities in the Town of Fallsburg where the model indicates the greatest degradation of water quality.

Hendrickson Mayfly, image courtesy of TU

HUC 12#	Name	2019 Sediment	2001 Sediment	% Change Sediment	2019 Nitrogen	2001 Nitrogen	% Change Nitrogen	2019 Phosphorus	2001 Phosphorus	% Change Phosphorus
20401040304	Sheldrake Stream	3,999,539	3,500,300	14.26	35,625	33,876	5.16	5,515	5,360	2.89
20401040305	Upper Neversink River	7,610,380	6,864,563	10.86	126,375	125,273	0.88	30,466	30,283	0.6
20401040203	Basher Kill	2,089,561	1,986,050	5.21	32,824	32,649	0.54	2,561	2,534	1.07
20401040307	Middle Neversink River	3,767,539	3,609,370	4.38	205,462	205,339	0.06	5,090	5,043	0.93
20401040301	West Branch Neversink River	1,326,100	1,296,926	2.25	26,865	26,801	0.24	1,378	1,368	0.73
20401040201	Gumaer Brook-Basher Kill	1,582,373	1,556,775	1.64	55,119	54,959	0.29	2,052	2,043	0.44
20401040308	Lower Neversink River	6,664,786	6,560,114	1.6	116,480	116,196	0.24	6,601	6,553	0.73
20401040303	Neversink Reservoir	2,133,717	2,122,302	0.54	27,933	27,961	-0.1	2,017	2,019	-0.11
20401040306	Turner Brook-Bush Kill	408,596	407,096	0.37	18,150	18,137	0.07	899	898	0.11
20401040202	Pine Kill	716,547	714,149	0.34	18,297	18,286	0.06	1,155	1,155	0
20401040302	East Branch Neversink River	1,078,693	1,075,704	0.28	25,350	25,328	0.08	1,273	1,273	0
	TOTAL CHANGE	31,377,832	29,693,350	5.67	688,480	684,805	0.54	59,007	58,530	0.82
***2019 and 2001 #'s for sediment, nitrogen and phosphorus are listed in lbs.										

- Shandaken (Ulster County) West Branch Neversink River- HUC ID: 020401040301. This subwatershed experienced less change in land use from 2001-2019. The West Branch subwatershed received a “excellent” APCAW score.
- Denning (Ulster County) West Branch Neversink River- HUC ID: 020401040301.This subwatershed experienced less change in land use from 2001-2019. The West Branch subwatershed received a “above average” APCAW score.
- East Branch Neversink River- HUC ID: 020401040302. This subwatershed experienced less change in land use from 2001-2019. The East Branch subwatershed received a “above average” APCAW score.
- Neversink (Sullivan County) Neversink Reservoir- HUC ID: 020401040303. This subwatershed had a 9% increase in low density development, and a 50% increase in medium density development. During this time, there was a 54% decrease in barren land. Sediment increased by 4.3% between 2001 and 2019. The Neversink Reservoir subwatershed received an “excellent” APCAW score.

- Upper Neversink River- HUC ID: 020401040305. This subwatershed had a 26% increase in low density development, an 86% increase in medium density development and a 67% increase in high intensity development. During this time, there was a 12% decrease in cultivated crops and an increase in shrubland. Sediment increased by 10.8% between 2001 and 2019. The Upper Neversink River subwatershed received a “excellent” APCAW score.
- Fallsburg (Sullivan County) Upper Neversink River- HUC ID: 020401040305. This subwatershed had a 26% increase in low density development, an 86% increase in medium density development and a 67% increase in high intensity development between 2001 and 2019. During this time, there was a 12% decrease in cultivated crops. Sediment increased by 10.6% between 2001 and 2019. The Upper Neversink subwatershed received an “excellent” APCAW score.
- Sheldrake Stream- HUC ID: 020401040304. This subwatershed had a 20% increase in low density development, an 64% increase in medium density development and a 50% increase in high intensity development. During this time, there was a 15% decrease in pastureland. Sediment increased by 14.2% between 2001 and 2019. The Sheldrake Stream subwatershed received an “above average” APCAW score.
- Thompson (Sullivan County) Sheldrake Stream- HUC ID: 020401040304. This subwatershed had a 20% increase in low density development, an 64% increase in medium density development and a 50% increase in high intensity development. During this time, there was a 15% decrease in pastureland. Sediment increased by 14.2% between 2001 and 2019. The Sheldrake Stream subwatershed received an “above average” APCAW score.
- Upper Neversink River- HUC ID: 020401040305. This subwatershed had a 26% increase in low density development, an 86% increase in medium density development and a 67% increase in high intensity development. During this time, there was a 12% decrease in cultivated crops and an increase in shrubland. Sediment increased by 10.8% between 2001 and 2019. The Upper Neversink River subwatershed received a “excellent” APCAW score.
- Middle Neversink River- HUC ID: 020401040307. This subwatershed had an 8% increase in low density development, a 44% increase in medium density development and a 56% increase in high intensity development. During this time, there was an 11% decrease in pastureland and an increase in shrubland. Sediment increased by 4.3% between 2001 and 2019. The Middle Neversink River subwatershed received a “above average” APCAW score.
- Mamakating (Sullivan County) Pine Kill- HUC ID: 020401040202. This subwatershed experienced considerably less change in land use from 2001-2019. This subwatershed had a 10% increase in low density development. The Pine Kill subwatershed received an “excellent” APCAW score.
- Gumaer Brook Basher Kill- HUC ID: 020401040201. This subwatershed had a 2% increase in low density development, a 22% increase in medium density

- development and a 60% increase in high intensity development. During this time, there was a 5% decrease in deciduous forest and a 5% decrease in pastureland. Sediment increased by 1.64% between 2001 and 2019. The Gumaer subwatershed received an “excellent” APCAW score.
- Basher Kill- HUC ID: 020401040203. This subwatershed had a 14% increase in low density development, a 35% increase in medium density development and a 50% increase in high intensity development. During this time, there was a 16% decrease in pastureland and an increase in shrubland. Sediment increased by 5.2% between 2001 and 2019. The Basher Kill subwatershed received a “above average” APCAW score.
- Forestburgh (Sullivan County) Turner Brook-Bush Kill- HUC ID: 020401040306. This subwatershed experienced considerably less change in land use from 2001-2019. There was a 13% increase in low density development. The Turner Brook-Bush Kill subwatershed received an “excellent” APCAW score.
- Middle Neversink River- HUC ID: 020401040307. This subwatershed had an 8% increase in low density development, a 44% increase in medium density development and a 56% increase in high intensity development. During this time, there was an 11% decrease in pastureland and an increase in shrubland. Sediment increased by 4.3% between 2001 and 2019. The Middle Neversink River subwatershed received a “above average” APCAW score.
- Deerpark (Orange County) Lower Neversink River- HUC ID: 020401040308. This subwatershed had a 2% increase in low density development, a 19% increase in medium density development and a 9% increase in high intensity development. During this time, there was a 6% decrease in emergent herbaceous wetlands. Sediment increased by 1.6% between 2001 and 2019. The Lower Neversink River subwatershed received an “above average” APCAW score.

- Greenville (Orange County) Lower Neversink River- HUC ID: 020401040308. This subwatershed had a 2% increase in low density development, a 19% increase in medium density development and a 9% increase in high intensity development. During this time, there was a 6% decrease in emergent herbaceous wetlands. Sediment increased by 1.6% between 2001 and 2019. The Lower Neversink River subwatershed received an “above average” APCAW score.

Implementation

Open Space Strategies

The priorities described are intended to bring a new strategic focus to implementing conservation and recreation goals. In addition to these public priorities collected at the places of the heart and survey as well as the water quality results above, there are two plans that are being developed for Sullivan and Orange County.

Sullivan County Resilience Plan

The Sullivan County Resilience Plan is still being drafted. The draft goals include:

- Protecting biodiversity, natural resources, and recreational systems.
- Development of model codes and incentives to aid municipalities in responsible, sustainable development
- Expansion of public transit to ensure equitable access to jobs, amenities, and social services
- Foster inter and intra municipal collaborations
- Uphold and agreed upon set of resiliency goals, priorities, and recommendations
- Outline steps for implementing resilience recommendations, including project/municipal partnerships, funding sources, and short-, medium- and long-term strategies.

When this plan is complete, recommendations should be reviewed and incorporated into the Neversink Watershed Management Plan priorities; specifically, open space opportunities and green stormwater infrastructure improvements that would enhance resilience.

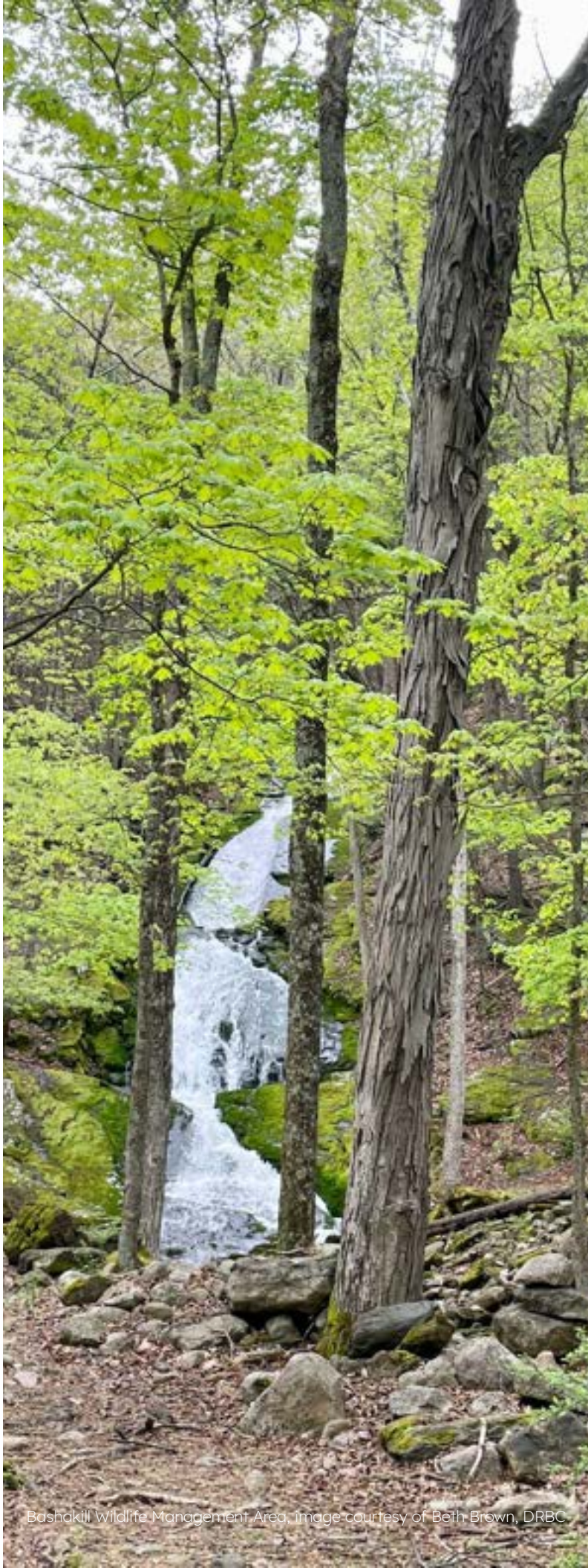
Orange County Open Space Plan

The Orange County Planning Department, in partnership with the Orange County Land Trust and with funding provided by the Hudson River Valley Greenway, is currently working to provide an updated Countywide Open Space Plan.

Updating the Plan will provide necessary guidelines to help balance this growth and establish and preserve buffers between open space and developed areas, as well as identifying critical linkages to promote connectivity between existing and future assets. When this plan is complete, recommendations should be reviewed and incorporated into the Neversink Watershed Management Plan Open Space priorities.

Open Space Protection Techniques

Successful implementation of the strategies



Bashakill Wildlife Management Area, image courtesy of Beth Brown, DRBC

identified above are key. Municipalities and Counties that are interested in protecting land can ensure successful implementation of this plan using the following techniques:

Purchase or Fee-Simple Acquisition

The most common means for a municipality to fully control land is through fee simple acquisition. This means the municipality owns the property and manages it as they see fit. Acquisition is likely the best solution for municipalities who would like to provide parkland and recreation facilities.

Acquisition should also be considered when a parcel contains a sensitive use, such as a natural area with important features, or a historic site, which would benefit from buffering. In some cases, fee simple acquisition may be followed by establishment of a conservation easement. Acquisition of large natural areas can also provide flood control, help to meet stormwater management goals and mitigate climate change.

Conservation Easements

In addition to purchasing land outright, municipalities can also purchase conservation easements to meet local open space goals. A conservation easement limits certain uses on a property (such as development) to advance conservation purposes, while keeping the land under private ownership and control. Conservation easements relieve the municipality of the burden of managing the land and the cost of maintaining it. Conservation easements are often used to preserve farmland, prohibiting future subdivision and enabling the farmer to live on and farm the property. Another use of the conservation easement technique would be to purchase a trail easement, thereby allowing public access in an interconnected trail network. The municipality would want to ensure that the easement permits the municipality (or group responsible for the trail) to maintain the trail. Because the land remains in private ownership, the cost of purchasing the conservation easement is lower than the cost of purchasing the property in total.

The municipality may wish to consider placing conservation easements on parks and open spaces to prevent their sale for profit during a period of robust development or times of financial struggle for the municipality. Easements should only be established after master planning and public input determine the best uses and layout for each park.

Sometimes municipalities face opportunities to acquire parcels they do not wish to manage in their entirety. In this case, the municipality may acquire the land, place trail and conservation easements on the property, ensuring its protection and contribution to the trails network, and then sell the property to a private owner. The private owner then maintains the land, eliminating the municipal burden to do so. As municipalities have little experience in the real estate business, elected officials are advised to work with a local land trust or real estate expert to complete the transaction. When critical trail connections are needed, this option is worth considering.

Dedicated Funding for Open Space

Municipalities may formalize their Open Space Committees often include landowners who have already donated land or conservation easements. Such advisory committees are required if the Town were to pass an open space referendum. With or without a local bond referendum, Open Space Advisory Committees keep open space on the front burner.

Landowner Outreach

The adoption of land protection priorities and appointment of an Open Space Advisory Committee sets the stage for landowner outreach. Successful landowner outreach usually occurs one of two ways. First, a landowner who has already conserved their land may invite others to a small gathering in their home, describing how and why they chose conservation. The Open Space Advisory Committee members can then note the municipality's interest in acquiring land either in fee or in purchasing a conservation easement. If there aren't any landowners who have conserved their property, however, a resident in a neighboring community, who protected their land, might be an effective substitute. These meetings are ideally hosted at the home of someone who has preserved their land, or at a small venue, other than the municipal offices. By starting the process with the dozen or so highest priority landowners, the Open Space Advisory Committee can gauge the willingness of landowners to conservation.

Transactional Assistance

As buying land is a "now and then" activity, and not a routine job responsibility, few Towns have staff with the time and/or expertise to purchase land. Towns can partner with land conservancies to negotiate with landowners, and ensure that transactional requirements such as appraisals, titles searches, environmental reviews and conservation easements, when applicable, are completed. For landowners donating conservation easements and taking a tax deduction, careful appraisals and thorough base line documentation is especially important and should be completed under the supervision of an accredited land conservancy.

High Falls Neversink River, image courtesy of Nancy Bachana

Master Plans for New Acquisitions

When land is added to the Township open space network, a master plan should be prepared to address both how the public will use the site and how municipal staff will maintain the property. Getting public buy-in and including maintenance staff in the process ensures well-used and well-maintained parks. The Open Space Advisory Committee can guide this process, as can Park and Recreation Boards.

Land Use Regulations

The next section discusses how natural areas and open space can be conserved as development occurs. Towns and Villages can rely on land use regulations to conserve some of the natural areas that residents enjoy, even as development occurs. This “buy the best and zone the rest” strategy is critical because municipalities can seldom rely solely on public funding and landowner generosity to meet their conservation goals.

Natural Resource Protection

Preserving natural vegetation, waterways and slopes, conserves water quality by reducing the amount of sediment and nutrients (Nitrogen and Phosphorus) flowing into streams; and encourages groundwater infiltration. One of the most effective ways to address natural features conservation is through a separate article in the Zoning Ordinance, “one-stop shopping” where an applicant sees the natural resource protection standards in one location. As Zoning applies to individual parcels, we suggest a threshold at which the standards are triggered and enforced by the Town. For example, it is logical to apply the standards to all major subdivision and land development applications, and to applications requiring stormwater permits, such as building additions. Or, to set an impervious cover threshold, such as 5,000 square feet, where the standards apply. Such standards would address:

Slopes over 25%

Slopes occur throughout the watershed and there are particularly steep slopes flanking the Neversink River. A Natural Features article in Zoning would prohibit disturbance of slopes over 25%, with the exception of an allowance for driveways and stream crossings.

Rivers, Streams and Wetlands

Vegetative buffers along waterways, in the form of trees, shrubs and tall grasses, are critical to removing sediment before it reaches waterways and to stabilizing slopes. Wider buffers enhance groundwater infiltration as well as sediment, nutrient and pollutant filtration. Based on a study published in the American Journal of Water Resources Association (June 2014, Stroud Water Research Center) it is recommend a 100 feet wide buffer be required from the banks of streams and 50 feet wide buffer be required for wetlands, dimensions which would be added to the Natural Features article. For subdivision and land development applications, the buffer should be planted with deciduous trees where gaps exist, so that a canopy forms to shade the stream and stabilize the stream bank. Buffered streams also mitigate flooding and lower stream temperatures, enhancing fish habitat.

Woodland Conservation

The watershed is still largely forested, and protections can be put in place to ensure that the potential for clearing is limited and trees are replaced when development occurs. Creating a conservation standard in Natural Features zoning article should limit tree clearing on new subdivision and land development applications.

development tract, one for one replacement, with 2 ½ inch caliper deciduous, native trees, should be required. Street trees, another important “green” element, are discussed later in this memo.

Conservation Subdivision Design

Conservation design rearranges the development on each parcel, as subdivision is planned, so that half or more of the buildable land, and all constrained land, is set aside as open space. By updating their land use ordinances conservation subdivision design, communities can conserve more of the forested hillsides, stream buffers and scenic vistas that draw people to the region.

Net or Adjusted Tract Acreage

Communities can calculate the maximum number of homes, or density, based on the land that is free of environmental constraints. This “net out” approach could be incorporated to all zoning districts and bases density on the environmental carrying capacity of the land. For example, by applying net-outs, a flat, well-drained site will yield more homes than a steep wet one. In conservation subdivisions, the open space consists of at least 50% of the “net” or “adjusted” tract area, plus the environmentally constrained land that is floodplain, wetlands and steep slopes. This ensures that some of the open space in a conservation subdivision is usable by residents and that fragile ecological areas are buffered from development impacts.

Applying Conservation Subdivision to Residential Zoning Districts

Successful communities have legally defensible, well-written zoning regulations that meet their “fair share” of future growth and provide for a logical balance between community goals and private landowner interests. Zoning options can be adapted to municipalities in the Neversink watershed in a manner that respects the private property rights of developers without unduly impacting the remaining natural areas that make the community a special place in which to live, work, recreate, and invest in.

Subdivision And Land Development Ordinance (SALDO) Updates

In managing residential growth, it’s important to set aside land for open space. It’s also important that the connectivity, use and aesthetics of this open space are considered in the Subdivision of Land Ordinance (SALDO) so that new development will contribute substantially to the community’s overall conservation objectives. The resulting “conservation subdivision” standards add design standards for the quantity, quality, and configuration of subdivision open space that must be delineated, conserved, and related to the municipality’s open space network.

Existing Resources/Site Analysis Plans

The first step to ensuring preservation of natural features is to require that developers document natural features on a plan, referred to as an Existing Features and Site Analysis Plan. This plan provides the information needed to identify open space first, thereby conserving highest priority natural and cultural features as new development occurs. The inventory requirements for existing resources, sketch plans, and site plans should mirror each other.

On-Site Visit

With the Existing Resources/Site Analysis Plan in hand, municipal staff, consultants and officials would walk the property with a view toward offering suggestions about the recommended location of open space. Without the benefit of experiencing the property in a three-dimensional manner (as opposed to reading a two-dimensional plan in a meeting room), it is extremely difficult to evaluate the proposed layouts.

Sketch Plan Overlay Sheet

Apart from the Existing Resources/Site Analysis Plan, the Sketch Plan is perhaps the second most important document in the entire subdivision process. This step is important because once an applicant has spent large sums fully-engineering a plan, they are understandably reluctant to modify the drawings in any way. The Sketch Plan process, combined with a Site Visit and Four-Step Design approach mentioned below, mean that open space is considered first, and not as an afterthought in the design process.

Four-Step Design Approach

It is believed that the most effective methodology for producing subdivision layouts centered on the principle of land conservation is one that begins with the determination of open space as the first step. If this is done, and if the ordinance requires that a significant proportion of the unconstrained land be designated as open space, it is nearly impossible to produce a truly inferior plan. In fact, to the extent that the property contains elements of the Town's network of conservation lands, the plan is likely to be at least fairly good. The second step, after locating the open space areas, is to select house locations, with homes positioned to take maximum advantage of the open space in neighborhood squares, commons, greens, As a general rule, when more than 25% of trees over 10 inches in caliper are removed from a playing fields, greenways, farmland,

Peversink River, image courtesy of Nancy Bachana

or forest preserves. The third step involves "connecting the dots" by aligning the streets and trails to serve the new homes. Drawing in the lot lines, Step Four, is the least significant part of the process.

Design of Conservation Lands

Establishing standards for what to include in conservation lands and how they should be configured is just as logical and essential as setting standards for development areas, such as front yard setbacks and side yards. The standards would require that the open space contain all constrained land (floodplain, wetlands and slopes over 20%), plus a substantial percentage, usually 50% of the net tract area, of secondary features such as woodlands, scenic views, meadows and other elements identified as critical features.

Green Stormwater Infrastructure

Green stormwater infrastructure (GSI) features provide water quality benefits and aesthetic benefits that make the municipalities more attractive for visitors and residents. Municipalities could encourage innovative stormwater solutions along roadways, in parking lots, common areas, on land owned by Homeowners Associations and near gateways. Pervious surfaces or landscaping should be encouraged (possibly with incentives). Green roofs, rooftop gardens and similar rooftop BMPs could be incentivized in the ordinances, typically by permitting increased height, or by reducing parking requirements.

Parking Lot Enhancement

Water quality and aesthetics improve when ordinances contain stronger design standards for parking lot design in mixed use and commercial areas, including a requirement for a percentage to be set aside as landscaped areas. There are opportunities to enhance parking lot design in rural commercial areas, gateways and tourist destinations. Landscaped areas in parking lots can be used for stormwater management, to mitigate the heat island effect and to improve the aesthetics and therefore economic success of a commercial area.

Regarding parking lot landscaping, it is recommended a planted island, a minimum size of one parking stall, every 15 parking spaces. Such standards would require that planted islands have notched curbs or depressed areas to enhance stormwater absorption. The parking lot design standards should be included in the SALDO, to include a list of native plants, with an emphasis on those that tolerate salt; as well as design standards for landscaped areas and pedestrian circulation.

Sidewalks and Street Trees

Sidewalks should be required wherever people walk, which is generally along any street lined with homes, shops and offices. Sidewalks are particularly critical in mixed use areas, like business districts. Sidewalks define the space between the road and residential properties. Sidewalks also provide separation between motor vehicles and pedestrians, including school children walking to and from the school bus, parents pushing strollers, people with disabilities, joggers and couples out for an evening stroll. Tree lined streets create gateways into main streets and business districts and contribute to the sense of place. Trees located between

pedestrians and streets provide a sense of separation and protection from vehicle traffic, defining the edge of the right-of-way, and creating leafy canopies to walk and drive under. For these reasons, it is strongly encourage municipalities to require street trees within the right of way. Street trees can also enhance property value. “Based on 2,608 real-estate transactions, researchers in Portland, Oregon, have documented that homes with trees between the sidewalk and the street sold, on average, for $7,130 more than homes without street trees (Donovan and Butry, 2010).”

Street trees should be required in both residential and commercial areas. The ordinance should specify planting native, deciduous shade trees, 2 ½ inch caliper at intervals of 40 feet or less on both sides of each street, in “tree lawns” at least 4 feet wide located between the edge of the pavement and the sidewalk. If no sidewalk exists, shade trees can be planted along the right of way. A list of suitable tree species, native to the region, should be developed and be accompanied by a list of prohibited species.

Conclusion

Communities that set open space conservation priorities can create a network of interconnected parks, greenways and preserves that encompass the forested hillsides, streams, farms and historic sites that add to the quality of life for residents and protect water quality. Implementation seldom relies on one technique. Implementation of this “green infrastructure network” employs strategic land acquisition and sound land use controls, protecting water quality for generations to come.

Watershed Wide Goals, Strategies, & Actions

Blue Trail Katrina Falls, image courtesy of Nancy Bachana

The NWMP is organized around five strategic goals. Each goal has strategies and actions. The goals are as follows:

1. Protect and Restore Water Quality
2. Protect and Improve Habitat
3. Strengthen Climate Resiliency and Flood Mitigation Measures
4. Protect Important Open Space
5. Maximize Recreational Opportunities

These five strategic goals were initially created based off of data and information collected from stakeholders throughout the first two rounds of public meetings. The goals, strategies, and actions were then reviewed and refined by the NWMP Steering Committee members. Once the goals were finalized with the committee, a public meeting was held to review them. There was an opportunity for participants to ask questions and provide input verbally and in written form regarding the goals, strategies and actions. Public comments were collected at the end of the meeting and were incorporated into the final draft of the NWMP.

Goal #1: Protect and Restore Water Quality

Protect and maintain water quality through projects and programs aimed at improving land and watershed management and reduce pollutants that can impair water quality.

Goal #1: Protect and Restore Water Quality
Clean and plentiful water is essential to sustain life and to ensure the healthy growth of our communities. Maintaining and restoring clean water will require a combination of collaborative and regulatory approaches that are fair and equitable, engage all watershed stakeholders, and result in multiple environmental and economic benefits for people and communities.
Strategies
Implement stream restoration projects that stabilize banks, reconnect floodplains, create aquatic habitat, and reduce erosion and
Improve stormwater controls and green infrastructure
Evaluate the extent of sewage pollution from small package plants and private septic systems
Ensure effective implementation of the State Pollutant Discharge Elimination System (SPDES) program
Curb the spread of Invasive species (for example knotweed, water chestnut, ash borer, lanternfly)
Encourage best management practices for forested areas
Identify and protect land that is critical to protecting water quality and enhancing aquatic health
Develop understanding of emerging contaminants and salt
Support and encourage water conservation
Create buffers to protect streams, rivers, wetlands, and surrounding bodies of water
Establish Critical Environmental Areas (CEAs)
Actions
Add riparian buffers to the miles/land required
Explore the potential of multijurisdictional sewer management and identify potential sewage pollution mitigation pilot projects
Secure grants for source water protection (Port Jervis)
Identify and prioritize the protection of acres of headwaters, riparian land/areas and wetlands
Develop public education programs that address forest management, emerging contaminants, stormwater controls and green infrastructure, invasive species, and water conservation methods
Identify and protect land in the headwaters, particularly to ensure healthy flows from privately held dams
Collect baseline water quality and habitat data

The Neversink watershed supports a diverse suite of fish and wildlife that depends on high quality water in the river and its tributaries. Great strides have been made in improving water quality in the basin since the 1970s but additional work is still needed to maintain and improve water quality for both people and wildlife. This program will focus on non-regulatory efforts to provide additional focus on habitat protection and conservation activities with the objective to protect water quality for both drinking water and the health of the fish and wildlife resources that depend on clean water.

Water quality is essential to protecting human health and wildlife that rely on clean water to survive and thrive. Water quality threats occur because of human activities such as poorly planned development projects, inadequate sewage treatment (both public and private systems), road treatments especially salt application in the winter months, and accidents where dangerous substances enter waterways. The Neversink SWOT analysis revealed that water quality in the upper portion of the Neversink watershed is generally regarded as very high quality. This is an excellent starting point for future watershed planning because it allows stakeholders to focus on protection (rather than restoration) and pollution prevention (rather than response). Water quality problems tend to increase in the middle and lower regions of the and include things like failing septic tanks and inadequate sewage treatment, isolated spills, road salt contamination, stormwater runoff of sediment, greases, and grimes, and legacy pollutants from historic land use activities.

In meetings with municipal officials concerns that unplanned and rapid growth put pressure on both surface and groundwater reserves due to sewage contamination, aquifer depletion, and stormwater runoff were discussed.

Goal #2: Protect and Improve Habitat

Sustain and restore fish and wildlife populations through conservation and restoration of their associated habitats and promote native ecosystem restoration.

Goal #2: Protect and Improve Habitat
Healthy habitat means ensuring high functioning physical conditions both in the river, along the river, and throughout the watershed. These include natural stream bed composition, riparian buffers that filter and curb runoff, functioning floodplains, and protecting important natural areas throughout the watershed. Healthy habitat goals are integrally linked with other conservation objectives including water quality, recreation, wildlife conservation, and land protection.
Strategies
Curb the spread of Invasive species (for example knotweed, water chestnut, ash borer, lanternfly)
Provide stream connectivity throughout the watershed by replacing failing or undersized culverts, and removing other impediments to aquatic passage
Restore streams, create aquatic habitat, and reduce erosion and sedimentation by stabilizing banks and reconnecting floodplains to protect instream and riparian habitat
Encourage best management practices for forested areas
Identify and protect land that is critical to protecting habitat and enhancing aquatic health throughout the watershed
Ensure regulated flows as outlined in the Flexible Flow Management Plan (FFMP) are protective of habitat
Promote and establish healthy buffers along waterways
Explore the possibilities of establishing additional Critical Environmental Areas (CEAs)
Ensure effective stormwater controls on projects adjacent to streams
Actions
Develop public education programs that address forest management, emerging contaminants, and invasive species
Protect acres of headwaters, riparian land and wetlands
Implement stream restoration projects
Maintain communication with NYC Department of Environmental Protection (DEP) and the public about water releases from the Neversink reservoirs
Facilitate communication with Department of Environmental Conservation (DEC) around the possibility of establishing additional Critical Environmental Areas (CEAs)
Increasing education with contractors about stormwater best management practices (BMPs)
Identify and protect land in the headwaters, particularly to ensure healthy flows from privately held dams

The Neversink watershed has high quality habitat that supports an diverse array of fish and wildlife, ranging from densely forested cold water headwater streams with naturally reproducing wild trout to more densely populated, warmer waters in its lower reaches. This NWMP will work to protect and restore ecological function to the important habitats to support sustainable fish and wildlife habitat. Conservation and restoration of these habitats will result in ecological, recreational, and commercial benefits.

Protection of watershed habitat is essential to ensure the integrity of stream dynamics and to maximize conditions for multiple species to thrive. Habitat protection actions can include in-stream and terrestrial based management initiatives such as reconnecting floodplains, installing physical structures to improve living conditions for plants and animals, stabilizing erosive areas, and repairing public infrastructure such as bridges and culverts. The SWOT analysis revealed that the major habitat impacts in the Neversink watershed include climate change, erosion and sedimentation, floodplain and river channel disturbances, and tributary destabilization all caused by both human and natural causes. The Neversink region is one of the wettest areas of the state and the impacts of climate change and increasingly severe and frequent storms are a main contributor to riverine habitat impacts. Historic land uses, particularly logging, quarrying, agriculture, and mills have left legacy impacts on habitat quality throughout the watershed. Modern day roadbuilding, poorly planned development, and increasing population pressures are increasingly contributing to the habitat degradation in the lower portion of the watershed.

Goal #3: Strengthen Climate Resiliency & Flood Mitigation Measures

Protect and maintain water quality through projects and programs aimed at improving land and watershed management and reduce pollutants that can impair water quality.

Goal #3: Strengthen Climate Resiliency and Flood Mitigation Measures
Climate change is altering our natural environment in significant ways. The increasing frequency and severity of storm events in New York is well documented and is contributing to harmful impacts on the landscape especially in our waterways. Climate change leads to warming water temperatures that are injurious to cold water species like trout. It also can result in increased flooding that threatens human life and places strain on community infrastructure including houses, roads, and bridges.
Strategies
Reconnect floodplains to store flood water during high water events
Create stream buffers to enhance flood resilience, stabilize stream banks, and cool the river during high air temperatures
Improve stormwater controls and green infrastructure
Ensure communication with NYC Department of Environmental Protection (DEP) and the public about reservoirs levels
Maintain forest cover to maximize absorption of storm water and to sequester carbon
Right size bridges and culverts to strengthen resilience to storm events
Maintain culverts and roadside ditches
Improve groundwater baseflow recharge and infiltration- strategy
Improve community resiliency by working to understand and address the causes of flooding, flood risk, and emergency response and recovery- strategy
Actions
Identify locations for stream buffer projects and wetlands protection
Host meeting with departments of public works and highways to discuss culvert and roadside ditch maintenance
Evaluate and potentially request updates to FEMA floodplain maps
Educate the public about floodplain development
Implement seasonal voids in reservoirs per FFMP to minimize flood risk to downstream communities
Implement stream projects to restore floodplains
Repair or right size culverts
Continue to review and update county Hazard Mitigation Plan with municipalities as necessary

There are increasingly higher demands on the water resources in the Neversink watershed, a challenge that will be exacerbated by the impacts of climate change. Climate change has altered weather patterns leading to an increase in both the frequency and severity of storms as well as prolonged drought and warmer air temperatures. The Neversink watershed is known as an especially wet area of the country and thus is particularly exposed to the damaging outcomes of increased flooding due to climate change.

The Neversink SWOT analysis revealed that flooding is a concern for all stakeholders throughout the Neversink watershed. Flooding not only threatens human life and property but it causes environmental damage by accelerating sedimentation and erosion, altering riparian sedimentation and erosion, altering riparian areas and stream channel configuration, and degrading habitat and water quality. Municipal officials throughout the watershed talked about their challenges and efforts to adjust their budgets to develop and implement flood prevention measures to adapt to these changing weather conditions. Chief among their concerns were a lack of funding and technical expertise.

Sullivan County is in the process of adopting a countywide climate change resilience plan that addresses flooding concerns. The FFMP requires seasonal voids in the reservoir for flood protection. For more info see Attachment E (page 98).

Goal #4: Protect Important Open Space

Protecting open spaces in order to protect wildlife, maintain biodiversity, conserve water quality, mitigate flooding, and help purify the air.

Goal #4: Protect Important Open Space
The protection of open space reduces the amount of nitrogen, phosphorus and sediment in our waterways. Development leads to increased impervious surfaces which prevent rainwater from naturally infiltrating into the ground. Instead, water flows over these surfaces, picking up pollutants that end up in our rivers. Land use regulations can play a crucial role in protecting water quality as well as environmentally sensitive features like riparian buffers, steep slopes and wetlands.
Strategies
Identify open space priorities in the watershed
Support implementation of Orange County Open Space Plan
Protect land using conservation easements or purchase by state, county, municipal officials, land trusts
Encourage municipalities to consider land use regulations that protect the water quality and prevent degradation of waterways
Secure conservation easements and pursue land acquisition opportunities
Actions
Identify and prioritize the protection of land contiguous to existing protected land, including the Bashakill, the Neversink Gorge and the Neversink Unique Area.
Identify and protect land that is critical to protecting habitat and enhancing aquatic health throughout the watershed
Identify and prioritize the protection of headwaters, riparian land/areas, and wetlands
Secure conservation easements and pursue land acquisition opportunities focused on public access
Identify and prioritize the protection of land to limit the impact of development on water quality.
Provide guidance to municipalities that are considering land use regulations

A significant portion of the Neversink watershed is experiencing increasing growth and development that is placing pressure on natural resources, exacerbating the impacts of climate change, and challenging local governments with constrained budgets to make adjustments in land use planning and environmental protections. In the SWOT analysis and public outreach efforts, Neversink watershed stakeholders continually emphasized the need to develop local open space plans and initiatives to protect and preserve the most important natural areas based on the ecological services they provide such as drinking water protection, habitat conservation, and enhancing recreational opportunities.

While land use protections are supported by most stakeholders, there is a notable lack of expertise and resources among elected officials and agencies to adopt and implement them at the local level. It was widely recognized that significant new resources need to be identified and secured to enhance awareness, develop expertise, and put in place mechanisms to implement and administer local land use protections.

Goal #5: Maximize Recreational Opportunities

Provide recreational opportunities which promote conservation of natural resources and instill a stewardship ethic among recreational users.

Goal #5: Maximize Recreational Opportunities
Recreational opportunities in the watershed are important contributors to community health and local economies. The desire to "get outside" has dramatically increased in a post-Covid world as more and more people seek quality outdoor recreational experiences like fishing, hiking, biking, and boating. These goals can be accomplished through the expansion of trail systems, increasing public access to waterways, and enhancing municipal park systems.
Strategies
Improve and expand public access to streams, rivers, wetlands, and surrounding bodies of water
Support implementation of the Sullivan County Park Plan
Support implementation of the Orange County Open Space Plan
Support continued development of the Sullivan O&W Rail Trail
Secure public access easements and pursue land acquisition opportunities focused on public access
Improve urban and working waterfronts
Increase hunting and fishing opportunities and access
Actions
Continue development of the O&W Rail Trail into Orange County with termination in Port Jervis
Identify possibilities of protecting more land around Basherkill
Expand Neversink Unique Area
Ensure adequate public information and amenities are provided at all public access sites (for example parking, restrooms, boaters safety)
Expand NYS Department of Environmental Conservation (DEC) Public Fishing Rights (PFR) program and ensure public access is available
Expand and protect D&H Canal system
Create a new boat ramp in Port Jervis

The Neversink River and its watershed offers high quality outdoor and recreational activities for both residents and visitors to the region. Local governments and residents of the UDR watershed are increasingly reliant on tourism and recreation as an important and growing economic engine for the region. The close proximity to large northeastern U.S. urban areas such as Boston, New York City, and Philadelphia combined with the positive rural qualities and outdoor opportunities available in the region (clean water, clean air, open space, river access, hunting/angling, boating, etc) attract increasing numbers of visitors every year. Because of its location less than a day's drive from multiple large urban centers, the Neversink basin offers relatively easy access to outdoor recreational opportunities for millions of people.

The Neversink region provides recreational experiences, including boating, hunting, fishing, hiking, biking, wildlife viewing, birding, and scenic touring.

In the SWOT analysis the revenue generated from outdoor activities in the Neversink watershed is becoming increasingly important to local governments and businesses. Public access to waterways should be enhanced while balancing the need to protect private property rights. Participants also expressed the need for expanded and interconnected trail systems, more access to waterways for fishing and boating, and new and improved public park systems.

Cross-Program Strategies

Angler on the Neversink River, image courtesy of TU

The Neversink Watershed Management Plan requires strategic actions that will apply to all of the goals and objectives of the plan. Below are the plans five Cross-Program Strategies:

1. Engage the public through outreach, education, and citizen involvement to increase capacity and support for coordinated restoration and protection activities in the basin.
2. Facilitate strategic planning to maximize adaptive potential of natural systems in changing watershed conditions.
3. Increase scientific capacity to support planning, monitoring, and research activities necessary to carry out coordinated restoration and conservation activities in the basin.
4. Provide technical assistance for restoration and conservation activities.
5. Conserve areas of regional significance.

Cross-Program Strategy 1:

Engage the Public through Outreach, Education, and Citizen Involvement to Increase Capacity and Support for Restoration and Protection Activities

Increase awareness of the recreational, educational, and economic contributions made possible by the Neversink River to increase the sense of stewardship among residents and visitors.

Many people, both residents and visitors to the area, rely on the natural resource services provided by the Neversink River basin. It is

important to engage all members of society to improve their understanding of direct connections between the river ecosystem and their daily lives in their communities and surrounding areas. Improved community education and engagement will increase stewardship and ensure a healthy future of the river system and its associated communities.

Objectives:

- Convey the economic and quality of life benefits that a healthy river provides for all
- Enhance engagement of citizen scientists in programs and volunteer activities
- Enhance interpretive programming focused on the basin's natural history
- Develop a mechanism to provide the public with information on public access points and recreation opportunities in the basin

Cross-Program Strategy 2:

Facilitate Strategic Planning to Maximize Natural System Adaptability in Changing Watershed Conditions

Ensure that important areas and habitats are protected during changing land use and environmental conditions in order to maintain or improve ecological function.

Improving the capacity of the watershed to adapt to stressors and impacts is necessary to ensure resources and ecological functions are maintained during changing environmental conditions, such as climate change and land use. To conserve fish and wildlife resources, as well as water quality and quantity, implemented projects should not only conserve existing resources but also make them better able to respond and adjust to changing conditions.

Objectives:

- Identify, conserve, and restore natural habitats that are impacted by changing land use
- Identify, conserve, and restore areas of unique habitats that may be threatened by changing environmental conditions
- Promote floodplain connectivity, stream buffers, remove barriers, and conserve and restore wetlands to improve flood tolerance and reduce damage during flooding conditions

Cross-Program Strategy 3:

Increase Scientific Capacity to Support the Planning, Monitoring, and Research Necessary to Carry Out Coordinated Restoration and Conservation Activities

Increase coordination of scientific resources among partners to support decision making and measure improvements to natural resources after project implementation.

There are several organizations and institutions currently working on natural resource conservation issues in the Neversink River basin. Increased coordination can improve current scientific capacity, reduce duplication of efforts, and identify gaps where additional capacity is needed. Improving existing monitoring and identifying new priority monitoring programs will also assist in measuring project related outcomes that conserve and restore our natural resources. The program can guide future priority setting and decision making and preparing for future changes to the landscape.

Objectives:

- Improved inventory and monitoring of existing waterways, land use, and ecological conditions to determine priority areas for project implementation
- Provide monitoring capabilities to assess improvements to natural resources based on implementation of program projects

- Establish science-based decision support tools to determine priority areas for conservation and restoration projects
- Evaluate effectiveness of projects to increase citizen's stewardship of natural resources
- Document economic benefits of project implementation
- Establish data management and data analysis capabilities, as well as provide a mechanism for data sharing between NYS partners to support projects and priorities

Cross-Program Strategy 4:

Provide Technical Assistance for Restoration and Conservation Activities

Provide a process for providing technical assistance for project development and implementation across the partnership.

Technical expertise for a variety of resource conservation and restoration work can be found in Federal, State, and local government entities and non- government organizations across the basin, but capacity is limited. For more effective use of the limited existing resources and technical expertise that exists for project planning and implementation, organizations should collaborate and share these resources across projects.

Objectives:

- Identify and utilize existing resources for technical expertise among partners and organizations in the watershed
- Provide coordination in the form of technical support and project review
- Build and enhance partner capacity to provide technical assistance
- Provide assistance with project permitting
- Engage in conversation with regulators about actions that impact the Neversink watershed
- Organize training for Municipal Officials
- Promote well-planned and ecologically sound development

Cross-Program Strategy 5:

Conserve Areas of Regional Significance

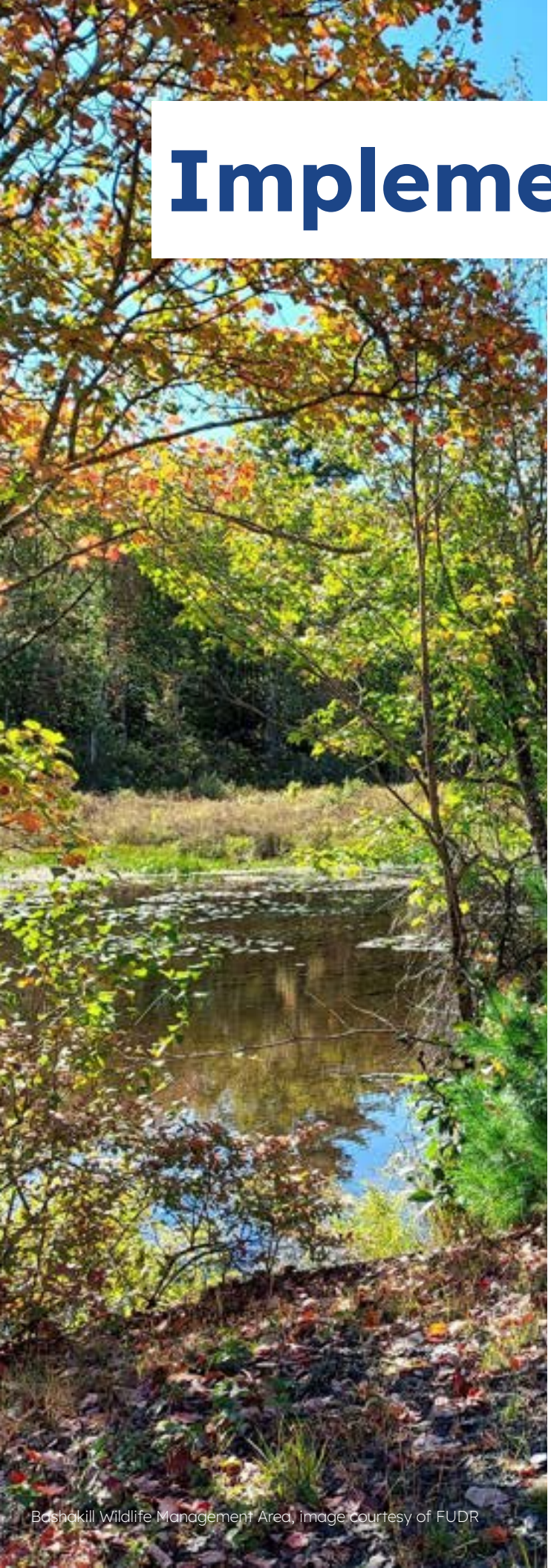
Use available tools and resources to identify unique places throughout the Neversink basin, and avoid and mitigate impacts of changing land use that would alter the function of those locations in the basin while conveying their importance.

The Neversink River basin watershed is rich with places of outstanding significance to communities and our nation. These areas support tourism, the economy, our shared heritage, and our cultural identity. Many of these unique places face significant pressure for land use; therefore, conservation of these places is vital to the economy and cultural identity to residents in the watershed.

Objectives:

- Identify regional areas of significance through existing and new tools
- Maintain and restore regional areas of significance

Implementation Plan



Bashakill Wildlife Management Area, image courtesy of FUDR

The NWMP was developed with a primary focus on the implementation of on-the-ground projects that will advance the conservation goals and objectives set forth in the plan. A project list was developed through conversations with municipal officials throughout the Neversink watershed who are directly involved in project identification and implementation. These include Town Supervisors, Village Mayors, local highway departments, community planning organizations, county planning agencies, county legislators, and soil and water conservation districts. Projects were also identified through an extensive public outreach effort with a wide diversity of watershed stakeholders including landowners, recreational interests, civic organizations, hunter/angler groups, and private citizens.

The discussions with each of these stakeholders focused on water resource management and needs. The feedback provided during these meetings helped plan developers understand the current conditions of each municipality in the Neversink watershed. There were some common problems shared by most municipalities that included aging infrastructure (culverts, bridges, roads, water/sewer pipes and equipment), erosion, accelerated sedimentation, and stream bank failure, and development pressures. Some, but not all, of the municipalities who participated in the development of the plan identified flooding as an issue.

In terms of need, all of the Neversink municipalities expressed the challenge of a lack of funding to implement projects. Budgets at the local level are extremely constrained and the resources available to them to seek external funding from government programs and private sources is extremely limited in every municipality. Attachment D identifies some funding programs that are available to municipalities to help implement the objectives of the NWMP. This is not an exhaustive list but is meant to be a starting point for municipalities and other watershed

stakeholders to consider as they seek resources to implement the projects identified in the NWMP. Attachment A lists all of the projects identified by stakeholders throughout the public outreach process. This list represents a snapshot in time. It is a living document that will be amended as new projects are identified and to reflect project completion. The attached list contains identifying information about each project including: the project description; the county, town, village, and city (if applicable) where the project is located; the priority level of the project, the lead and supporting partner.

Ruins of a sawmill on the Neversink River , image courtesy of Nancy Bachana

The O&W Rail Lines & Stream Management

Public trail along Neversink River, image courtesy of FUDR

The relationship between the O&W Railroad right of way and the myriad of streams and rivers it travels alongside of and crosses is undeniable. The O&W meanders through a large section of the Neversink watershed crossing over and often running parallel to the Neversink River itself. The cut and fill nature of the railroad construction as well as its age causes the railbed to influence these waterways. As this former railroad bed is developed into a multi-use trail, there are ways to consider the aging infrastructure's connection and interference with the watershed and improve and repair the relationship.

When New York's Ontario & Western (O&W) Railway ceased operations in 1957, it was the first Class I railroad in the United States to be fully abandoned. The old railroad bed is still evident, along with old stations and equipment. The following decade saw the beginnings of the rails-to-trails movement in America and, over time, portions of the O&W rail bed were converted into trails for pedestrian and bicycle use.

In 2019, Sullivan County completed a feasibility study to map out a way to connect the developed sections of trail and create a 50+ mile multi use trail corridor, with a 10 mile spur. The Sullivan O&W Rail Trail will provide an opportunity for people to enjoy the natural settings of the watershed, and it is well known rail trails provide a plethora of benefits, from health improvements to economic development. The development of this trail also provides the opportunity to help restore the health of a watershed. Beyond Sullivan County, in Orange and Ulster Counties, opportunities also exist, and can be explored when

interest from the communities is shown.

Environmental Sustainability

Sullivan County adopted New York State's Climate Smart Communities Pledge in 2010, and achieved certification as a Climate Smart Community by the NYS Department of Environmental Conservation in July 2017. It was the sixth County and the 15th municipality in New York State to achieve certification as a Climate Smart Community, and to be a designated Clean Energy Community.

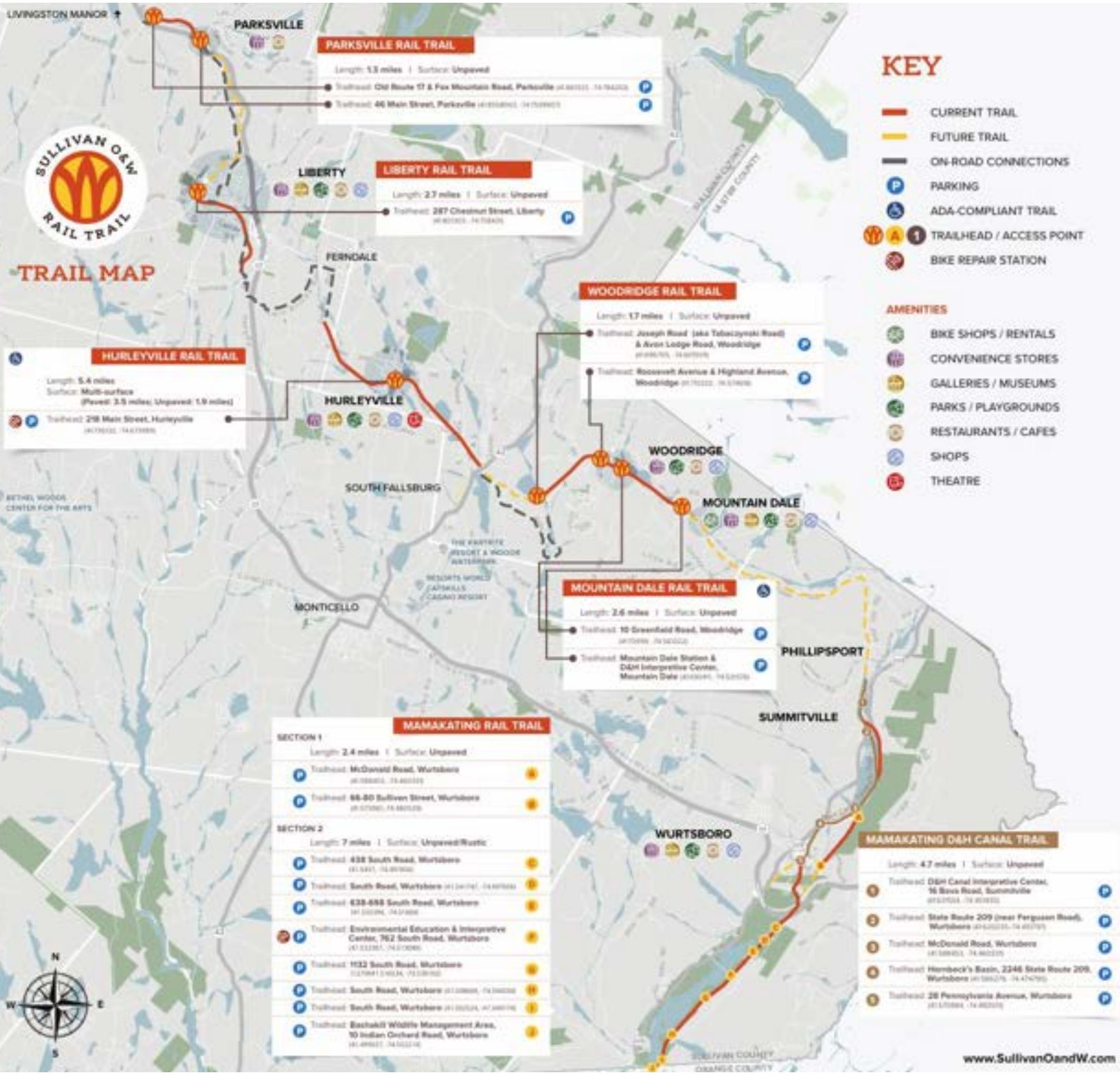
Initially certified as a Climate Smart Community at the "bronze" level, the County is intending to recertify and advance to the "silver" threshold. Sullivan County's original Climate Action Plan (CAP) was completed in 2014 and sets specific targets for Greenhouse Gas (GHG) emission reductions, including in transportation. In March 2022, the County's Office of Sustainable Energy completed a Sullivan County CAP Report and Update that reported on progress in meeting the 2014 goals and set new targets for GHG reduction across the County.

As a non-motorized transportation facility, the Sullivan O&W Rail Trail is the essence of sustainability, facilitating car free travel through the county (and eventually beyond it) and reducing dependence on fossil fuels. As a rail trail, the Sullivan O&W Rail Trail reuse of abandoned infrastructure is also environmentally sustainable.

To date, climate change and environmental justice have been considered during the project planning and implementation process resulting in the following features:

- The trail will connect our most vulnerable communities to jobs, goods and services, including public transit. As an extension of the trail amenity benefits, MOVE Sullivan, the County's transit system, will collaborate on revising routes to incorporate trailheads when segment length and level of trail use make it appropriate.
- The standard for trail development calls for pervious surfacing using crushed stone (i.e. "crusher run" or "stone dust") compacted to support road bicycles and strollers but pervious so as to minimize stormwater runoff and erosion, and potentially be more resilient against frost heaves. Geocell technology can also help increase the pervious nature of the trail.
- The trail corridor will be primarily shaded, providing heat mitigation to the watershed.
- Research has been initiated into the use of goats rather than mowing where needed to reduce emissions.
- The spread of invasive species such as Japanese knotweed, which is present in some trail areas, is being evaluated for mitigation measures. Pilot projects on managing invasives are being conducted elsewhere in the County.
- High-speed electric charging stations will be added to trailheads. These will support both the trail and the nearby downtown communities where users can shop or dine while their vehicle is charging.
- Sullivan County has been working with the Town of Fallsburg, Friends of the Upper Delaware River and Trout Unlimited to assess and resolve the way existing sections of the trail have been blocking stream crossings and water flow in the Neversink River watershed. The County is now implementing a grant from the National Fish and Wildlife Federation (NFWF) to support the partnership with these organizations in preparing a

watershed management plan for the Neversink River that includes redesigning stream crossings and habitat connections along sections of the trail within the watershed. The pilot project is expected to be replicable throughout the O&W trail system as well as to other rail trail facilities. The map below shows the entire Sullivan O&W Rail Trail.



Attachment A

The Project List- Click Here

Neversink River, image courtesy of TU

Attachment B

Community Outreach & Participation Plan- Click Here

NWMP public meeting at SUNY Sullivan, image courtesy of FUDR

Attachment C

Community Input- Click Here

Neversink Unique Area, image courtesy of Beth Brown, DRBC

Attachment D

Open Space Grant Funding- Click Here

Neversink River, Image courtesy of Nancy Bachana

Attachment E

Managing NYC Watershed Lands- Click Here
Flexible Flow Management Plan (FFMP)- Click Here

Peekskill Wildlife Management Area, , image courtesy of FUDR

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