Cornwall Natural Resources Inventory:

Informing the Management of Our Natural, Historic, and Cultural Resources

Cornwall Conservation Advisory Council

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ACKNOWLEDGEMENTS AND CONTRIBUTORS

The *Cornwall Natural Resources Inventory: Informing the Management of Our Natural, Historic, and Cultural Resources* (*Cornwall NRI*) was developed by the Cornwall Conservation Advisory Council (Cornwall CAC). The *Cornwall NRI* uses maps and narrative to document the resources found in the Town of Cornwall and the Village of Cornwall-on-Hudson.

The *Cornwall NRI*'s development has been a labor of love that the Cornwall CAC could not have embarked upon without the support of Town Supervisor Richard Randazzo, Village Mayor Brendan Coyne, and the respective municipal boards. With board approval, the Cornwall CAC applied for a technical assistance opportunity from the New York State Department of Environmental Conservation Hudson River Estuary Program (HREP) and Cornell University for the development of an intermunicipal NRI. The assistance opportunity supported our work through the provision of data and content expertise from HREP's Conservation and Land Use Program Coordinator Laura Heady and Conservation and Land Use Specialist Nate Nardi-Cyrus. Their expert guidance over the course of this three-year effort was invaluable in ensuring the development of this comprehensive report. The assistance opportunity also funded Orange County Planning Department Benjamin Freiman's development of the maps included in this report and Orange County Water Authority Kelly Morris' support and guidance in their finalization. Orange County Land Trust Director of Conservation and Stewardship Matt Decker also supported this effort with additional data as well as content and GIS mapping expertise.

Because natural resources do not follow jurisdictional boundaries, HREP encourages municipalities to partner in the development of NRIs. The Town and Village had the pleasure of partnering with the Town of Blooming Grove Conservation Advisory Commission (Blooming Grove CAC), working closely with its volunteers on map reviews, writing, and final product development.

The Cornwall CAC would also like to thank and acknowledge the time and commitment of close to 350 community residents, local leaders, and regional experts who provided feedback on the maps as part of 34 Cornwall CAC public meetings and served as reviewers for the *Cornwall NRI*. We could not be confident in the quality and accuracy of the *Cornwall NRI* without their participation.

Many hands make light work. We thank our numerous partners for their support throughout this process. The Cornwall CAC plans to honor their contributions in the coming years by sharing the *Cornwall Natural Resources Inventory* findings with the community through the Cornwall CAC's outreach and education efforts. We hope you will find the maps and narrative informative and useful.

Carla Castillo, Chair, Cornwall Conservation Advisory Council – 2019

The Cornwall Natural Resources Inventory is funded by the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program, in partnership with Cornell University Department of Natural Resources.

CORNWALL CAC APPOINTED MEMBERS

The Cornwall CAC is a nine-member body appointed by the Town of Cornwall, with appointed members representing the Town and Village of Cornwall-on-Hudson. The appointed membership participating throughout the development of the *Cornwall NRI* is listed below; former members are identified as such. Former Town Councilperson Michael Summerfield served as Cornwall CAC Liaison to the Town Board throughout this time.

- Carla Castillo, Chair
- Barbara Smith Gioia, Vice Chair
- Shoshanna Abeles
- Abigail Birnbryer
- Katherine Goodspeed (former member)
- Anthony Incanno (former member)
- Jonathan Midler
- Niklas Moran, Tree Subcommittee Chair
- Michael Nichols (former member)
- Mary Pearsall
- Christine Ruppert
- Frances Schuster
- Dr. William Schuster (former member)
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- Layout & Design: Carla Castillo, Edward Warren, and Niklas Moran
- Photography: Abigail Birnbryer, Carla Castillo, Edward Warren, and as noted

Writers

The Blooming Grove CAC and Cornwall CAC worked together closely on the map reviews and development of the narrative. This collaborative effort is reflected below, with two writers often collaborating on the narrative for a single NRI map.

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    - Land Use: Farmland, with Johanna Kiernan; Conservation & Public Lands
- Carla Castillo
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    - Habitats and Wildlife: Stream & Riparian Habitat; Wetland Habitat, with Christine Ruppert
    - Climate Conditions and Projections
    - Land Use: Land Use & Land Cover; Zoning & Tax Maps, with Johanna Kiernan
- Anne Gayler, Blooming Grove CAC Appointed Member

- Johanna Kiernan, Planning Board, Town of Blooming Grove
- Niklas Moran
    - Habitats and Wildlife: Habitats
    - Proposed Fossil Fuel Infrastructure: Pilgrim Oil Pipeline and Anchorage Sites
- Christine Ruppert
    - Water Resources:
        - With Johanna Kiernan: Watersheds, Ground Water & Aquifers, Floodplains
        - Wetlands
        - With Johanna Kiernan and Anne Gayler: Streams & Water Quality
    - Geology & Soils: Soils
- Edward Warren
    - Executive Summary, with Carla Castillo
    - Base Map & Aerial Imagery, with Johanna Kiernan & Anne Gayler
    - Historic & Cultural Resources, with Johanna Kiernan
    - Habitats and Wildlife: Forests, Tidal Wetland Habitat, Grasslands & Shrublands
    - Geology & Soils: Bedrock Geology, Steep Slopes

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- William Braine – former Chair, Cornwall Economic Development Advisory Committee, and resident, Village of Cornwall-on-Hudson
- Thomas Bregman – Executive Director, Hudson Highlands Nature Museum, and resident, Town of Cornwall
- Margaret Bywater – Leader, Cornwall Girl Scouts, and resident, Town of Cornwall
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EXECUTIVE SUMMARY

The iconic Storm King Mountain, viewed across the Hudson River from Putnam County.

In defining the duties of the Cornwall Conservation Advisory Council (Cornwall CAC), the Cornwall Town code specifies that the Council will "conduct studies, surveys and inventories of the natural and man-made features within the Town of Cornwall." The *Cornwall Natural Resources Inventory: Informing the Management of Our Natural, Historic, and Cultural Resources* (*Cornwall NRI*) represents the fulfillment of that responsibility to this and future generations of Town of Cornwall and Village of Cornwall-in-Hudson residents.

The *Cornwall NRI* is a three-year effort on the part of the Cornwall CAC and the Cornwall community as well as representatives of various local and regional organizations dedicated to the recognition and conservation of natural resources in the Hudson Valley. As the birthplace of the modern environmental movement, Cornwall occupies a special place in the history of conservation efforts, so it is especially fitting that a comprehensive look at our natural resources be conducted and shared with the community. For Town and Village residents, however, it is our portion of the Hudson River, our mountains, and our beautiful night sky that inspire us. With the data presented in this report, we trust that Cornwall will be even better equipped to protect our heritage.

> *"Show me a healthy community with a healthy economy and I will show you a community that has its green infrastructure in order and understands the relationship between the built and the unbuilt environment."*
>
> Will Rogers

Before continuing with this executive summary, it is important to note that the *Cornwall NRI* was the first of three planning documents that were developed by the Cornwall CAC in the same three-year period. The *Cornwall NRI* was followed by the *Cornwall Scenic Resource Inventory (Cornwall SRI)*, which provides a more in depth analysis of the scenic resources that exist in Cornwall, including those scenic areas identified through public input. As with the *Cornwall NRI*, the *Cornwall SRI* informed the development of the *Town of Cornwall and Village of Cornwall-on-Hudson Natural Heritage Project – Open Space Inventory (Cornwall NHP)*. These documents were also developed in partnership with Cornwall elected officials and staff, residents and businesses, and local and regional partners. The Hudson River Estuary Program and Cornell University also supported the two additional planning efforts. And the Cornwall CAC also received guidance from the Orange County Land Trust, with a new partner, the Hudson Highlands Land Trust. Combined, these three planning documents are tools important to the preservation of our quality of life and natural heritage.

The *Introduction* that follows this executive summary provides an explanation of what an NRI is and why it was conducted. As the name implies, this is an informational tool – an inventory. It is intended as a guide to be referenced when making planning decisions. To that end, this report assembles multiple layers of information to both quantify what we have in the way of natural, cultural, scenic, and historic resources, and also to qualify them so that future planning efforts can be guided by a detailed knowledge of the underlying value that lies within the borders of the Town and Village.

The *Cornwall NRI* opens with a current snapshot of the Town and Village in the *Foundational Information* section, using a base map and aerial imagery showing boundaries, municipal structures, and transportation infrastructure. The map also shows the location of prominent historic structures, and scenic and cultural resources that contribute to Cornwall's unique character. Built upon this base are maps and narratives focused on habitats and wildlife, water resources, geology and soils, land use and zoning, and the potential impact of fossil fuel infrastructure and climate change on our community. Combined, the narrative and maps present a multilayered image of any one place in Cornwall and provides the means of assessing various characteristics.

> *"Plans to protect air and water, wilderness and wildlife are in fact plans to protect man."*
>
> Stewart Udall

Preserving biodiversity has increasingly become a priority for numerous environmental agencies at the regional, State, and federal levels. As we better understand the interdependent web of species biodiversity, ecosystem health, and the benefits humans reap from it, we also better understand the threat that habitat loss, chemical contaminants, and climate change pose to that biodiversity. It is important to consider the role Cornwall can play in preserving the plant and animal biodiversity found in the Hudson Valley. The *Habitats and Wildlife* section focuses on the many different types of habitats found within Cornwall, and the biodiversity that they support.

During the public input process for the *Cornwall NHP*, concerns about water quality and accessibility were paramount on the minds of residents. The health of our aquifers and watersheds has a direct impact on our drinking water and our ability to thrive as a community. The *Water Resources* section focuses not only on our surface and subterranean water resources, but also includes maps and narratives on our major floodplains and hydric soils, as well as wetlands that perform the vital function of absorbing stormwater runoff and mitigating flooding during heavy precipitation events.

The *Geology and Soils* section looks at the resources that underlie the Town and Village. Although not as visible as our forested land, meadows, and streams, these resources are no less important. Understanding bedrock formations can determine the viability and output of private wells; knowing the location and grade of slopes can help avoid erosion, unstable construction, and flooding from runoff; and recognizing the qualities of farmland soils can foster an appreciation for the value that agriculture can contribute to a community.

One major concern that is increasingly the subject of much planning and regulation in New York is climate change. Our State is seeing average temperatures and rainfall increase and periods of

drought last longer. As sea levels rise, flooding from storm surges presents a common challenge for all riverfront communities. The *Climate Conditions and Projections* section presents information vital to understanding how the preservation of our natural resources can protect Cornwall from the worst effects we may potentially face from climate change.

The final part of this report focuses on land use and land cover as well as public lands and zoning. The *Land Use* section is a key component of this report, as it ties in the layers of natural resources with existing land use and infrastructure. By looking at developed areas and contrasting them with undeveloped open spaces we can see how Cornwall is shaped as well as impacted by its natural resources. We can also look at municipal zoning through this same lens to better understand how zoning can be tailored to specific areas based on the presence or lack of valuable natural resources.

It is our hope that the *Cornwall NRI* will inspire the public to appreciate on a deeper level the important natural resources we have in our midst. We also hope that it will serve as a useful tool for current and future municipal leaders and planners to support a sustainable and prosperous future for the Town of Cornwall and Village of Cornwall-on-Hudson.

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INTRODUCTION

Why inventory our resources? Residents of the Town of Cornwall and Village of Cornwall-on-Hudson love and appreciate the scenic beauty and calmness of their community. We are never far from a mountain to walk or hike, a waterbody to enjoy, a tree to seek shade under, or a scenic road to bike on on our way to a local restaurant or a historic site.

Our natural resources are essential to our quality of life and are worth preserving. In addition to their scenic value, natural resources are also instrumental in supporting our tourism economy, providing clean and plentiful drinking water and clean air, moderating temperature, filtering pollutants, absorbing floodwaters, and providing habitat for pollinators. By learning about the location and condition of these resources, we can plan for our community's future and ensure we continue to receive these nature-based benefits.

The *Cornwall NRI* provides a baseline of information on our natural, historical, and cultural resources. It is meant to help municipal officials, developers, and residents make informed land use decisions that have the least negative impact on our resources as well as identify areas where our municipalities can apply improved conservation measures. By their very nature, natural resources inventories are educational in focus and, as such, the *Cornwall NRI* can also be used as a learning tool by the general public and the Cornwall Central School District.

What is a natural resources inventory? An NRI is a compilation of maps and descriptions of important naturally-occurring resources and cultural resources in a given area. New York State supports a municipality's interest in understanding and safeguarding its natural and cultural resources under General Municipal Law Article 12-F Sections 239-X/-Y. NYS town and village laws also permit the incorporation of an NRI into a municipality's comprehensive plan to formalize the documentation of resources and inform a municipality's planning and zoning (Town Law Section 272-A and Village Law Section 7-722). The *Cornwall NRI* allows us to visualize our land use patterns through maps of habitats and wildlife; aquifers, wetlands, and stream health; geology and soils; climate conditions and projections; and historic and cultural features. Also included in the *Cornwall NRI* are maps related to the fossil fuel industry, which can impact our community. Federal, state, and county agencies provided the digital data that was used to develop each map using geographic information system (GIS); data sources appear on each map. As NRIs are not meant to be static documents, the Cornwall CAC commits to updating the maps at five year intervals to ensure data are current and new data sets are considered. Additionally, the Cornwall CAC is interested in the identification and mapping of additional natural resources, such as smaller wetlands and streams, through citizen science projects. Working with the School District on such projects would provide a localized and exciting educational experience to our students and community.

How can a natural resources inventory be used? The *Cornwall NRI* maps and narrative report help us understand how our land use decisions relate to each other and impact natural resources across our Town and Village. The *Cornwall NRI* can be used for general planning purposes by municipal planning officials and consultants, developers, and residents; all are encouraged to refer to the maps as a preliminary measure for any proposed development to identify site features and constraints. (Please note, however, that the maps are not intended to replace site visits or survey requirements as identified by zoning codes.) Furthermore, the *Cornwall NRI* can support the development of regulatory and non-regulatory tools – such as laws, overlay districts,

supplemental zoning standards, and open space planning – to better protect our quality of life and natural resources. The *Cornwall NRI* also provides a "big-picture" view of natural systems, such as how streams flow across the municipalities or how large forests span our border with our neighboring Town of Blooming Grove. The development of an NRI, and its incorporation into a municipality's comprehensive plan, also clearly signals to potential public and private funders a community's interest in preventing the unintended loss of its natural assets.

How is this report structured? The report consists of narratives that describe the information depicted on resource maps. Each narrative includes two sections. The first section explains why the information on the associated map is important; this section is called either "Why You Need This Map" or "Why This Habitat Is Important". The second section describes the information depicted on the map, or maps, and shares the map title. The map that is described in the narrative appears immediately after the narrative.

The hyperlinks in the report go to sections within the report as well as to external sources. Internal hyperlinks will appear as black underlined words, slate blue underlined words, or *sea green italicized, underlined* words for maps. External hyperlinks will appear as electric blue underlined words.

When only Cornwall is used in a sentence, the content referenced applies to both the Town and Village. Content only applicable to a specific municipal jurisdiction will specify that jurisdiction if applicable.

Notes on the maps. We extend our deepest appreciation to reviewers who, during public input meetings and the narrative review process, identified and shared information they found missing from or incorrect on the maps. The information identified will be included in a future update of the maps. Map-specific updates are noted at the end of that chapter's narrative. Information applicable to all maps is listed below.

- Labeling of streams: Idlewild Creek, Canterbury Brook, Black Rock Brook, Deep Hollow Brook (Schunnemunk), Trout Brook.

Where can I view the *Cornwall NRI*? The *Cornwall NRI* will be available on the Town's and Village's websites. Hard copies also will be available at the Cornwall Public Library and at Town and Village halls. Maps will be available for viewing in various areas throughout the Town and Village. The *Cornwall SRI* and *Cornwall NHP* will also be similarly available. Comments on any of these documents can be left at the Town or Village halls to the attention of the Cornwall CAC or sent to cornwallnycac@gmail.com.

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FOUNDATIONAL INFORMATION

Sands Ring Homestead, built circa 1732.

CHAPTERS, MAPS, AND RELATED CONTENT

Base Map & Aerial Imagery

Base Map
Aerial Imagery 2007
Aerial Imagery 2016

Historic & Cultural Resources

Historic & Cultural Resources Map

BASE MAP & AERIAL IMAGERY

Map(s) referenced: Base Map; Aerial Imagery 2007; Aerial Imagery 2016

Why You Need This Map

A *Base Map* depicts background reference information such as roads, landmarks, political boundaries, and landforms, onto which the other thematic information of this NRI is displayed. The *Base Map* also provides a visual reference of areas of residential and commercial development, as well as important municipal features. The *Base Map* includes the entire Town and a one-mile extension to show the resources that extend beyond the municipal borders for all maps. The Town of Cornwall has a land area of 26.65 square miles based on 2010 US Census Bureau data.

Base Map

The map shows both the Town of Cornwall and the Village of Cornwall-on-Hudson. The Town of New Windsor borders Cornwall to the north, the towns of Highlands and Woodbury border to the south, and the Town of Blooming Grove borders to the west.

The *Base Map* includes key road names, route numbers, and municipal authority designations as well as other transportation infrastructure. Also included are important municipal structures and notable natural features like bodies of water and elevational topography.

Transportation networks

Cornwall is divided by two heavily travelled roadways, Interstate Route 87 and US (Federal) Route 9W. There are no access points in Cornwall for Route 87, but there are numerous access points for Route 9W. Some of the Route 9W access points can be considered dangerous due to the speed at which people drive and the angle of entry / exit. Roadways in Cornwall are either black topped or tarmac. In the preparation of tarmac roads, excess stone aggregate is moved to drainage ditches by moving cars. The excess stone aggregate is then transported to our streams during rain events. Cornwall's transportation networks are listed below.

- Interstate Route 87
- US (Federal) Route 9W
- NY State Routes: 94, 32, and 218 (Storm King Highway)
- County Roads: 20 (Orrs Mills Road), 32 (Willow Avenue), 79 (Pleasant Hill Road), and 107 (Quaker Avenue)
- Regional commuter rail stations (Salisbury Mills/Cornwall)
- Inactive railroad beds, which are of particular interest as potential rail trail recreation resources, are illustrated on the *Zoning & Parcels Maps* and found in grid sectors A2, B1, B2, and C2.

Important municipal structures

Cornwall's important municipal structures are largely concentrated in the vicinity of the roadway that begins as Quaker Avenue in the Town and transitions to Main Street, continuing onto Hudson Street in the Village. Fire houses and post offices are also located in hamlets. Cornwall's important municipal structures are listed below.

- Cornwall Town Hall; Cornwall-on-Hudson Village Hall
- Cornwall Central School District buildings

- U.S. Post Offices
- St. Luke's Cornwall Hospital
- Town and Village police departments
- Town and Village fire houses and Emergency Management Services
- Schools and local museums

Surface Water Features

Surface water features in the form of waterbodies and streams are prevalent throughout Cornwall. Some streams are adjacent to roadways, while others are pristine and sourced within Cornwall's state parks and conserved forest. Cornwall's surface water features are listed below.

- Water Bodies
  - Beaver Dam Lake
  - Upper Reservoir
  - Aleck Meadow Reservoir
  - Arthur's Pond
  - Sphagnum Pond
  - Sutherland Pond
- Streams
  - Moodna Creek
  - Woodbury Creek
  - Baby Brook

Major landmarks

- Municipal boundaries
- Hamlets

Aerial Maps: 2007 & 2016

The two *Aerial Imagery Maps* are also helpful for general orientation. They display two distinct views of the Town and Village eight years apart. The 2007 orthoimagery was taken using a DMC sensor flown at a nominal height of 4500 feet AMT (above mean terrain). The 2016 orthoimagery was taken using a Microsoft Ultracam Eagle sensor flown at a nominal height of 7400 feet AMT. The pixel sizes are half a foot for both natural color and color infrared images. The resolution is listed as being four feet horizontally at 95% confidence interval for true one-foot resolution. New York State started offering one-foot resolution after 2014.

A comparison of the two aerial images shows very little change to the general characteristics of the Town's development, open spaces, and forest cover between 2007 and 2016. Intermittent residential development along State Rt. 32 is the exception. Current zoning permits development of the unprotected stepping stone forest north of the intersection at Willow Avenue and Rt. 9W.

Notes on the Map(s)

The *Base Map* was noted to be missing the below listed information.

- Fire Engines: Highland Engine Company #1 at 1 Quaker Avenue, Cornwall, and Mountainville Engine Company #1.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Base Map

- Town and Village Boundary
- Other Municipal Boundary
- Hamlets
- Water Bodies
- Streams
- Interstate
- Federal Highway
- State Route
- County Road
- Local Road
- Schools
- Post Offices
- Police Station
- Firehouse
- Ambulance Corps
- Municipal Court
- Library
- Town Hall
- Village Hall
- Commuter Rail Station
- Hospital
- Museum
- Scenic Overlook

DATA SOURCES: United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/20/2018

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Aerial Imagery
2007

Municipal Boundaries

- Town and Village Boundary
- Other Municipal Boundary

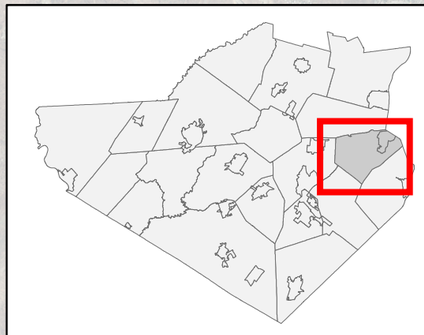
Roads

- Interstate
- Federal Highway
- State Route
- County Road

N

Scale 1:50,000

0 0.5 1 2 Miles



DATA SOURCES: United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; New York Statewide Digital Orthoimagery Program, 2016

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Aerial Imagery
2016

Municipal Boundaries

- Town and Village Boundary
- Other Municipal Boundary

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; New York Statewide Digital Orthoimagery Program, 2016

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HISTORIC, SCENIC, & CULTURAL RESOURCES

Map(s) referenced: Historic & Cultural Resources

Why You Need This Map

Cornwall has a rich recorded history stretching back to the voyage of Henry Hudson up the river named for him in 1609. Much of that history has been preserved and celebrated in the area, and Cornwall boasts more houses and landmarks on the National Register of Historic Places than any other municipality in Orange County. From its founding, through the War of Independence, and through the major expansion of the 1800s, which saw Cornwall Landing become a major port for Hudson River commerce, Cornwall has played an important role in the history of the Hudson Valley region. **The historical significance of Cornwall is important to regional tourism and local property values, and is an important resource to protect.**

Historic Resources

The area of modern day Cornwall was originally inhabited by the Waoraneck tribe, a Munsee-speaking subgroup of the Lenape (Delaware) nation of native peoples. The original name of the Hudson River is M'hikanituk, pronounced mough-hee-kan-i-tuck. Mough means "greatest of all," heekan means "arm of the sea," or estuary, and tuck means "a river that flows both ways" (Stony Point Center, 2018). The Lenape were one of many nations that made up the Algonquin peoples of the northeast woodlands.

Cornwall Quaker Meeting House, built circa 1790.

The official title of first Europeans in Cornwall belongs to the MacGregorie party, which settled in the area in 1685 around the mouth of the Moodna Creek, then known as the Waoraneck after the local tribe and later named Murderer's Creek by European arrivals. Members of this group established a trading post south of the Moodna on Sloop Hill within Cornwall's modern-day boundaries. Over the subsequent 50 years, English and Scottish families came to the fertile plateau above the river meadows naming it "New Cornwall" because of the marked similarity to the County of Cornwall, England. During this time, farming and livestock operations spread throughout the area and Cornwall became a supplier of milk, meat, and produce that was shipped by sloops down the river to a rapidly growing New York City.

During the War of Independence, the Continental Army traveled along the roads of the hamlets that made up New Cornwall from West Point to Newburgh, and General George Washington was known to stop and visit David Sands and other friends during that period (Town of Cornwall, 2018). **The Sands Ring Homestead, the David Sutherland House, and the Cornwall Friends Meeting House remain vivid reminders of the colonial period in our Town.** In 1788 Orange County was subdivided into numerous townships, thus officially creating the town of "New Cornwall." The Town's name was changed to "Cornwall" in 1797.

The early 1800s saw rapid development of the Cornwall waterfront, and Cornwall Landing became a hamlet unto itself. The transportation of coal brought by rail from Pennsylvania and other industries, like brickworks and lumberyards, led to a bustling waterfront that would be unrecognizable to today's residents used to the green spaces of Donahue Memorial Park. The shipwreck sheltering the entrance to the Cornwall Yacht Club and pilings from the old coal dock, which burned in the early 1900s are visible reminders of the riverfront's industrial past.

In the late 1800s Cornwall became popular as a health retreat. Up until the early 20th century, City residents flocked to the Hudson Valley region to experience the therapeutic powers they believed the region to hold. The mountains, fresh air, evergreen forests, and fresh produce were thought to offer the perfect conditions for good health and were not far from the City. Cornwall was especially popular, offering numerous boarding houses and many conveniences of the day, including accessibility to the railroad and steamboats, as well as a telegraph office and large library (Headley, 1908). **Former boarding houses, such as the Samuel Brooks House on Pleasant Hill Road and the Walter Hand and Patrick Piggot Houses on Angola Road, are just some of the Cornwall homes from this period on the Historic Register.** (A complete listing of the properties on the National Park Service's National Register of Historic Places appears at the end of this chapter. Additional properties of historic interest also appear at the end of this chapter.)

More recently, Cornwall became the birthplace of the modern environmental movement when a plan by Consolidated Edison in 1962 to build a pumped storage hydroelectric plant on Storm King Mountain was blocked.[1] This campaign, led by The Scenic Hudson Preservation Conference, and the ensuing legal decisions set new precedents for environmental activism and law, and became the basis for the National Environmental Policy Act (NEPA) and New York's State Environmental Quality Review Act (SEQRA), laws that have protected the environment for decades since (NYSDEC, 2018).

Storm King Mountain summit at sunset.

Scenic Resources

Cornwall is well known for its scenic vistas and rural character, even as it continues to evolve into a bedroom community for New York City. Storm King Mountain and its trails have drawn visitors to Cornwall for centuries. The *Historic & Cultural Resources Map* shows the Hudson Highlands Scenic Area, which includes land area on Storm King, the surrounding hills to the south in Highland Falls, and a large part of the Village of Cornwall-on-Hudson. **The Hudson Highlands Scenic Area is designated as a NYS Department of State (NYSDOS) Scenic Areas of Statewide Significance (SASS) for its unique, highly scenic, and outstanding landscape that is accessible to the public.** According to the NYSDOS, SASS "designation

[1] More information on this legal decision can be reviewed at the Environmental Law Reporter.

protects scenic landscapes through review of projects requiring State or federal actions, including direct actions, permits, or funding" (NYSDOS Office of Planning and Development, 2019).[2]

To the west, the Schunnemunk ridge descends into a valley that allows the Moodna Creek to flow eastward and then southward into Mountainville. This is where one of Cornwall's most iconic scenic resources, the **Moodna Viaduct**, crosses north to south over the Moodna as well as over Orrs Mills and Otterkill Roads. The Viaduct carries Metro North commuter trains between New Jersey and Port Jervis to the northwest. The Moodna Viaduct trestle, which was constructed between 1904 and 1908 by the Erie Railroad, spans the valley for 3,200 feet and is 193 feet high at its highest point, making it the highest and longest iron railroad trestle east of the Mississippi River (I Ride the Harlem Line, 2018).[3] The Moodna Valley and Viaduct are considered a scenic area of countywide significance, as identified in the *2014 Orange County Open Space Plan*.

Not listed as a statewide or countywide scenic area, but no less iconic and vital to local tourism and regional environmental conservation, is **Schunnemunk Mountain**.[4] The northern portion of the mountain ridge falls within the borders of the Town of Cornwall and runs southwest to its highest point in the neighboring Town of Blooming Grove. At 1,664 feet, Schunnemunk Mountain is the highest mountain in Orange County and offers stunning views of Cornwall to the east, the Wallkill River valley to the north, and beyond to the Shawangunk and Catskill mountains to the northwest. Due to its height and length, Schunnemunk can be seen from much of the rest of Orange County and nearby areas.

Cultural Resources

Storm King Art Center in the Fall.

Cornwall's most significant cultural resource is Storm King Art Center, a beautiful outdoor museum receiving over 200,000 visitors annually from the local area through to the international level. The Center's 500 acres of "vistas, hills, meadows, ponds, stands of trees, allées, and walking paths" offer a unique setting for the contemporary, large-scale sculptures (Storm King Art Center, 2019) on this pastoral landscape. The Center, founded by the late Ralph E. Ogden and H. Peter Stern, co-owners of Star Expansion Company based in Mountainville, NY, also

[2] NYSDOS notes that scenic resources are a major part of a community's character that should be protected and considered in the planning and decision-making process.
[3] The Tunkhannock Creek Viaduct in Pennsylvania holds the distinction of being the longest concrete railroad bridge.
[4] The conservation of Schunnemunk Mountain began with Mountainville Conservancy, which was organized by Star Expansion Industries, the Ogden Foundation, and Storm King Art Center. In 1996, The Open Space Institute purchased 2,100 acres of the Mountain and additional lands from the Conservancy; this acreage was sold to New York State in 2004 for creation of Schunnemunk Mountain State Park. The Nature Conservancy currently owns 163 acres on the northern end, with some additional land still owned by the Institute.

provides important habitat to wildlife by supporting the retention of its natural woodlands, 100 acres of native grass meadows and hayfields, and wetlands.

Notes on the Map(s)

The National Park Service lists the below properties on National Register of Historic Places as properties with local level of significance. Additional information on each property can also be accessed from the searchable properties table (National Park Service, 2019). Properties missing from the *Historic & Cultural Resources Map* will be added as part of a future update, at which time location markers will also be corrected. The marker for Storm King Art Center will also be added.

Historic Place	Address	Location
Adams-Chadeayne-Taft Estate (aka Nathaniel Adams Estate, Clark-King House, or Clark Stoneware House)	1-2 Riverbank Lane	Village
Amelia Barr House	Mountain Road	Village
Oliver Brewster House	66 Willow Avenue	Town
Samuel Brooks House	Pleasant Hill Road	Town
Camp Olmsted	114 Bayview Avenue	Village
Canterbury Presbyterian Church	30 Clinton Street	Town
Carvey-Gatfield House	375 Angola Road	Town
A. J. Clark Store	286 Main Street	Town
Isaac Cocks House	Old Pleasant Hill Road	Town
Cornwall Friends Meeting House	275 Quaker Avenue	Town
Cromwell Manor (aka David Cromwell House or Joseph Sutherland House)	Angola Road	Town
Deer Hill	58 Deerhill Road	Town
Dock Hill Road Extension Stone Arch Bridge (aka Upper Dock Hill Road Bridge)	Dock Hill Road Extension	Village
Firthcliffe Firehouse	196 Willow Avenue	Town
Gatehouse on Deerhill Road	Deerhill Road	Town
Elias Hand House	NY 32	Mountainville
Lower Dock Hill Road Stone Arch Bridge	Dock Hill Road	Village
Walter Hand House	520 Angola Road	Town
Vermont Hatch Mansion	Old Pleasant Hill Road	Town
The Kellogg House	Old Pleasant Hill Road	Town
LeDoux/Healey House	60 Deerhill Road	Town
Mountainville Grange Hall (aka Cornwall Masonic Temple)	NY 32, S of jct. with Creamery Road	Town
Patrick Piggot House (aka Angola Lodge)	105 Angola Road	Town
River View House	146 Bayview Avenue	Town
Sands Ring House	Main Street	Town
Scribner House	19 Roe Avenue	Town
Daniel Sutherland House	32 Angola Road	Town
David Sutherland House	70 Angola Road	Town

Union Chapel (aka Cornwall Landing Quaker Chapel)	Shore Road	Village
Upland Lawn	16 Duncan Lane	Town
Van Duzer-Mary Sayer House	Taylor Road	Town
A. Walsh Stone House and Farm Complex	1570 NY 94	Town
Wilford Wood House	58 Pleasant Hill Road	Mountainville
Woodruff House	NY 32	Village
Wyant-Talbot House	42 Clark Avenue	Village

Properties of Historic Interest. Additional sites of historic interest in the Town include Veteran's Triangle at Hudson and Main Streets, with Civil War and World War I cannons, a marker commemorating the 13 Civil War veterans of the Grand Army of the Republic, and the Veteran's Way obelisk. Additional sites in the Village are listed below (Village of Cornwall-on-Hudson, 2007).

Place of Historic Interest	**Address**	**Constructed**
Art Deco Movie Theater	River Avenue	1930s
Barn (Dr. Jerry's)	part of Homeland Estate	1850s
Barton and Spooner Souvenir Factory	Duncan Avenue	1890s
Brick Works Stable	Spruce Street	1860
Nathanial Brown House	Mountain Road	1700s
George Clark House	off River Avenue	1700s
HN Clark House	Clark Avenue	1843
Robert Cleland House	Idlewild Avenue	1860
Cliffside, David Carson-Albert Palmer House		1870s
Cock's Store	Hudson Street	1870s
Cornwall Bank (former Village Office)	River Avenue	1897
Cornwall Collegiate School	Hudson Street (Gold Cure)	1860s
Cornwall Professional Building (Power Company)		1907
Cornwall School District #4	Idlewild Avenue / Hudson Street	1868 & 1898 / 1922
Cornwall Local Building	Hudson Street	1840 & 1890
Cornwall Presbyterian Church	Hudson Street	1856
Donahue Farm (Cold Spring, Clark)	Bay View Avenue	
Col. James Duncan House	Duncan Lane	1820s
Duncan Farm Barn	Weeks Avenue	1820s
J. Dunn House	Hudson Street	1860s
Stephen C. Gillis House	Wilson Lane	1800s
Goodnough House (Hancon)	Avenue A	1860s
The Grail (Chas. Stillman)	Duncan Avenue	1870
Half-Moon House (M. Moony)	Bay View Avenue	1750
Dr. Harrison House	Hudson Street & Academy Avenue	1860
Idlewild	Idlewild Park Drive	1853
Kernochan House	Hudson Street	1840

The Knoll	Clark Avenue	1856
Montrose Cottage (Dr. Proulx's)	Hudson Street	
Mountain Road Schoolhouse	Mountain Road	1700s
Sheridan House	Hudson Street	1840s
Smith House	60 Duncan Avenue	1855
Preston-Smith House	Hudson Street	1830s
Ryckman	off River Avenue	1800s
Storm King School		1867
Sutherland Estate	Bay View Avenue	1850
Thomas Taft House	River Avenue	1860s
Levi Terwilliger House	Hudson Street	1820s
Upland Lawn	Duncan Avenue	1860s
Village Library (now Cornwall Central School offices)	Idlewild Avenue	1930s

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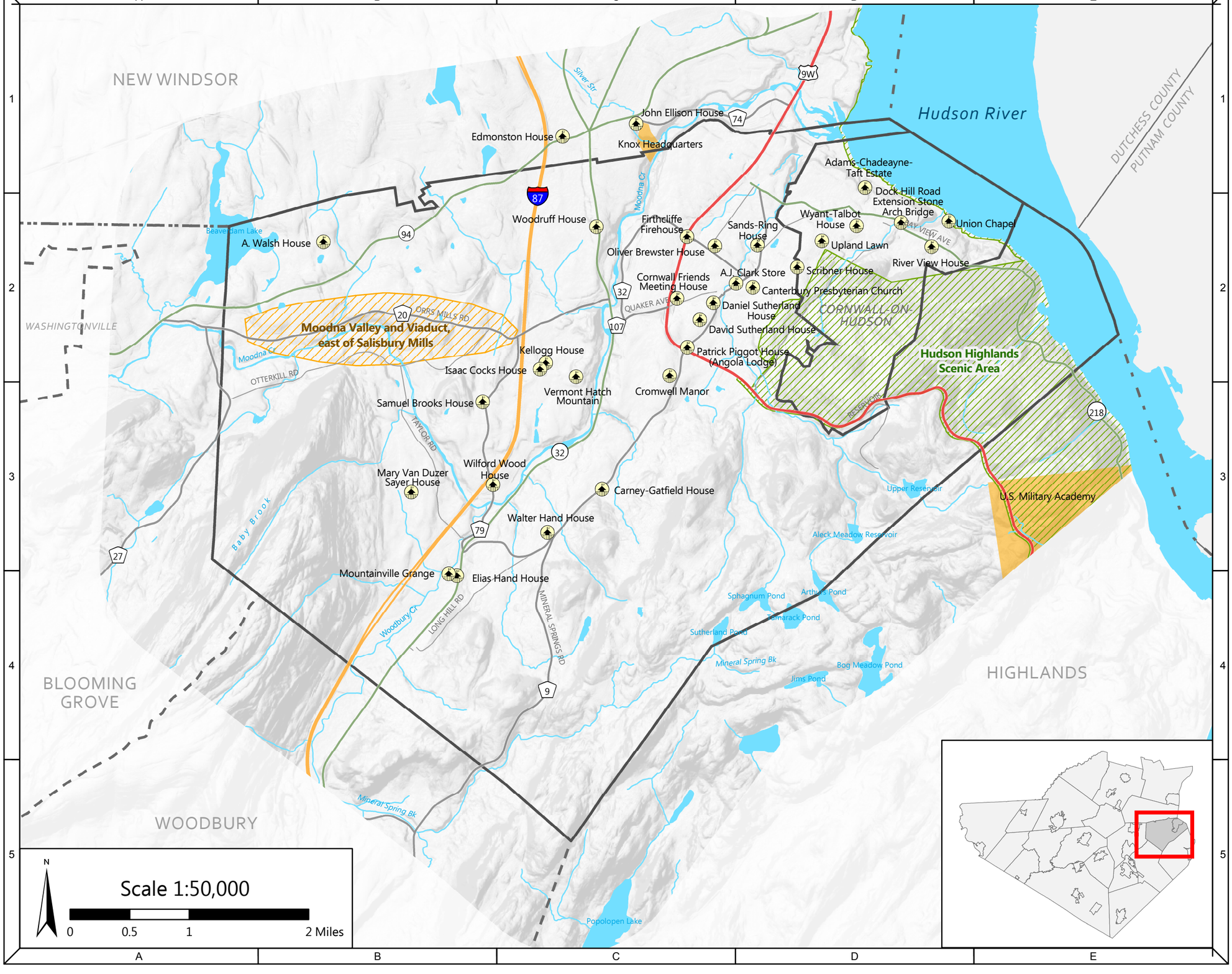
TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Historic and Cultural Resources



Historic and Cultural Resources

- Historic Sites
- Historic Areas
- Scenic Areas of Countywide Significance
- Scenic Areas of Statewide Significance

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

Hydrology

- Water Bodies
- Streams

DATA SOURCES: National Register of Historic Places, 2018; New York State Dept. of Transportation, 2017; United States Geological Survey, 2017; New York State Dept. of Enviornmental Conservation, 2017; Orange County Dept. of Planning, 2018

"The National Register of Historic Places (NRPH) is the official list of the Nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Park Service's National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources."
- National Register of Historic Places, 2017
https://www.nps.gov/nr/

Scenic Areas of Countywide Significance were identified in the 2004 Orange County Open Space Plan. Scenic Areas of Statewide Significance are areas defined by the New York State DEC that possess unique, highly scenic landscapes accessible to the public and recognized for their outstanding quality.

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HABITATS AND WILDLIFE

A Red-Spotted Newt (Notophthalmus viridescens viridescens) in Black Rock Forest, found in its terrestrial juvenile phase, commonly known as a red eft.

CHAPTERS, MAPS, AND RELATED CONTENT

Habitats

Areas of Known Importance

Areas of Known Importance Map
Significant Natural Communities and Biodiversity Areas Map
Appendix B: Known Species of Conservation Concern in the Town of Cornwall and Village of Cornwall-on-Hudson, NY

Forests

Forest Patches and Regional Forest Linkage Zones Map

Stream & Riparian Habitat

See Stream Classification Map in Streams & Water Quality chapter
See Stream Biomonitoring and Priority Waterbodies Map in Streams & Water Quality chapter

Wetland Habitat

See Wetlands & Hydric Soils Map in Wetlands chapter

Tidal Wetland Habitat

Tidal Wetlands & Submerged Aquatic Vegetation Map

Grasslands & Shrublands

Meadows, Grasslands, & Shrublands Map

HABITATS

Why Habitats Are Important

Healthy habitats are important to maintaining our community's ecological biodiversity. In *Biodiversity of the Moodna Creek Watershed*, Laura Heady describes biodiversity as "all the components of nature that are needed to sustain life…. Biodiversity refers to all living things, both rare *and* common, the complex relationships between them, as well as their relationships to the environment. Biodiversity includes genetic variety, species diversity, and variability in natural communities, ecosystems, and landscapes. All of these parts and processes comprise the web of life that contributes to healthy ecosystems." Heady highlights the importance of habitats, noting that the two "greatest threats to biodiversity are habitat loss and invasive species".

A habitat is a type of natural environment that provides conditions necessary for specific plants and animal species to live. Some major factors that contribute to terrestrial habitats are temperature range, amount of sunlight, moisture and precipitation levels, soil conditions, and the presence of food and predators. Flora and fauna species are specifically adapted towards certain habitats, with varying degrees of specificity and range. **Healthy, intact natural habitats are critical for hunters, hikers, and wildlife enthusiasts, and, where NY Threatened species like the bald eagle (*Haliaeetus leucocephalus*) are concerned, can often have a distinct cultural significance.** Major changes to the biodiversity within those habitats can and do have unintended ecological consequences.

Human influence on the landscape can create unique habitats that favor certain species over others due to their relative adaptability. Human development can fragment wildlife habitats, creating isolated "habitat islands" where animals cannot move safely across the landscape for foraging and breeding, resulting in diminished genetic diversity and less viable populations of species. Conversely, relatively intact and healthy habitats support species diversity that contributes to a functioning, balanced ecosystem and provides concrete benefits to people. For example, bats help balance insect populations; bees and other pollinators are vital for agriculture; coyotes help balance deer populations; and black and turkey vultures help to reduce carrion. **Knowing the location of different habitat types or the preferred habitats of endangered, threatened, or rare species can help prioritize conservation of those habitats and protect the existing population of those species.**

Northeastern land snail in Black Rock Forest.

Habitats and Endangered Species

If a species is endangered, it might be listed and therefore protected by the federal Endangered Species Act (ESA) or the Environmental Conservation Law of New York. A proposed project that is adjacent to or directly in an ESA endangered species' habitat will likely need to be

modified to accommodate these species and minimize the impact to their habitat. Significant time may be needed to work with the US Fish and Wildlife Service and other federal agencies to design the project to minimize what is known as a "taking." The ESA defines a "taking" as any of the following activities: harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species.

Appendix B – Known Species of Conservation Concern in the Town of Cornwall and Village of Cornwall-on-Hudson, NY, prepared by NYSDEC HREP and Cornell University's Department of Natural Resources, lists animals and plants of conservation concern. **There are currently five wildlife species classified as endangered at the federal or state level that have been identified in Cornwall: golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), and Indiana bat (*Myotis sodalist*).** Many other plant and animal species present in Cornwall are classified as Threatened (such as the timber rattlesnake (*Crotalus horridus*)), of special concern, rare, Species of Greatest Conservation Need, or a Hudson River Valley Priority Bird; the full list is found in Appendix B. It is important to note that the health of terrestrial habits directly impacts the health of aquatic habitats through the regional watersheds and aquifers that drain into major regional creeks like the Moodna and ultimately the Hudson River.

Habitats and Invasive Species

Invasive species, such as emerald ash borer (*Agrilus planipennis*) and southern pine beetle (*Dendroctonus frontalis*), thrive and spread much more aggressively than their native counterparts; non-native, invasive plants often lack predators to control their infestation. This can create an ecosystem imbalance and threaten native species that must compete with invasives for habitat. The spread of non-native and invasive species can be a sign that a habitat is not in good health and is being impacted by human activities or changes in climate, like temperature increases. One common way habitats are damaged occurs when increases in certain nutrients are outside the normal range for a particular habitat; nutrients such as nitrogen from the application of fertilizers to farmland, lawns, and golf courses are a prevalent example. The overabundance of certain species like algae and other plants are often a sign of point source pollution. Having up-to-date habitat maps can help track a habitat's evolution and help determine what measures, if any, are needed to mitigate damage from invasives and pollutants. **Municipalities can take steps to reduce the introduction and spread of non-native species by providing recommendations for native plants to residents, thus helping support healthier natural habitats.**

A High-Level Overview of Cornwall Habitats

- Forest habitats are the predominant habitat type within the Town and Village boundaries, particularly in the middle and southern portions of Cornwall. Much of the large, contiguous forest is deciduous, with oak predominating in the uplands and maples and other deciduous species at lower elevations. Patches of other forest community types, like pine, are interspersed, especially at higher elevation, rocky summits in the Hudson Highlands. Hemlock once had a significant presence in Cornwall forests, but has been decimated by hemlock woolly adelgid (*Adelges tsugae*), an invasive species that originated in Japan. Pines and other conifers comprise no more than 5% of our forests. Please refer to the *Significant Natural Communities & Biodiversity Areas Map* and *Forest Patches & Regional Forest Linkage Zones Map* for more information about the importance of our forest habitats and tree cover.

- Cliff/talus habitat is located on the elevated terrain of Storm King State Park, Schunnemunk Mountain State Park, and, to a lesser degree, Black Rock Forest.
- The Town's agricultural lands are found primarily adjacent to the Moodna Creek to the east and west of Interstate 87. Please refer to the *Meadows, Grasslands, & Shrublands Map* for more information on the importance of both active and fallow agricultural habitats.
- There are wetlands around the mouth of Moodna Creek, including tidal marsh and wooded swamp (refer to *Tidal Wetlands & Submerged Aquatic Vegetation Map*) as well as scattered wetlands in the lowland areas of Cornwall, including large complexes of marsh and swamp along Interstate 87 in the northern part of the Town (refer to the *Wetland Habitat* narrative and the *Wetlands & Hydric Soils Map* for more information).

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AREAS OF KNOWN IMPORTANCE

Map(s) referenced: Areas of Known Importance; Significant Natural Communities & Biodiversity Areas

Why You Need These Maps

The Hudson River valley has some of the greatest biodiversity in New York, owing to the combination of woodland, wetland, river, and mountain environments. Mature deciduous forests support an abundance of bird species as well as mammals, including black bear (*Ursus americanus americanus*) and bobcat (*Lynx rufus*). Streams and wetlands support native fauna as diverse as river otter and freshwater mussels. **A prerequisite for making nature resource-based decisions about land use is knowing the types and locations of ecologically significant habitats**. A "habitat" is a place where a particular species or group of species is likely to occur. The location and size of habitats relative to one another are also important to map as some habitats will not function in isolation or below a certain size threshold. When planning for future growth or conservation, the *Areas of Known Importance Map* and *Significant Natural Communities & Biodiversity Areas Map* should be consulted as a first step in identifying potentially significant habitats. This can inform planning and development in ways that minimize habitat degradation or loss.

New York Natural Heritage Program

Both maps in this chapter use data from NYSDEC New York Natural Heritage Program (NYNHP). The NYNHP data only shows locations where surveys have been conducted. A systematic survey of natural communities or biodiversity is not available for all areas of Cornwall. If such a survey existed, we would likely find other locations with significant natural communities and/or areas of high biodiversity. Therefore, the areas shown on these maps should not be considered the only areas that are important for biodiversity within the Town and Village. Field verification of habitats and their boundaries should be conducted prior to decision-making.

Areas of Known Importance Map

This map shows Areas of Known Importance for wildlife and plant habitats in Cornwall based on information from the NYNHP database of rare species and migratory fish runs as well as the Audubon Important Bird Areas (IBA) Program.[5] Areas of Known Importance are defined as lands and waters that support the continued presence and quality of known populations of rare animals and rare plants. In each case, these areas of importance are tied to a recorded occurrence of that plant or animal and include areas that

Wood Turtle (Glyptemys insculpta), found in streams. A NY species of special concern and of greatest conservation need.

[5] The Important Bird Areas Program is a global initiative of BirdLife International implemented by Audubon and other local partners in the US.

support the natural ecological processes critical to maintaining the habitats of these rare animal and plant populations. Due to the potentially sensitive nature of this information, exact locations and species are not shown. It is important to note that these data reflect *known* importance; there are many places that have never been surveyed by NYNHP and, therefore, there may be yet-unknown occurrences in other locations of rare species where habitat is suitable.

Rare Animals: The Areas of Known Importance for rare animals seen on this map are tied to known occurrences of rare animals listed in Appendix B – Known Species of Conservation Concern in the Town of Cornwall and Village of Cornwall-on-Hudson, NY. Areas may be important to a particular species for foraging, roosting, winter habitat, nesting, migration, and other uses. The vast majority of Cornwall has been identified as an important area for one or more of these rare animals. The areas of the Town with the greatest concentration of overlapping important areas for rare animals are Black Rock Forest, the Moodna Creek, the Hudson River, Schunnemunk Mountain State Park, and Storm King State Park.

Rare Plants: Occurrences of rare plants have been recorded in the general locations shown on the map. The corresponding areas of importance for these plants are in Black Rock Forest, Schunnemunk Mountain State Park, the Hudson River shoreline, and the mouth of the Moodna Creek at Kowawese Unique Area. A table of rare plant species that have been recorded in Cornwall can be found in Appendix B.

Migratory Fish: The Moodna Creek and Idlewild (Canterbury) Creek, as well as other streams that feed into them like Woodbury Creek and Mineral Spring Brook, are important spawning areas for migratory fish, including alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), bay anchovy (*Anchoa mitchilli*), Atlantic tomcod (*Microgadus tomcod*), and striped bass (*Morone saxatilis*). A substantial warmwater fish community inhabits the lower portion of Moodna Creek throughout the year (NYSDOS, 2012). Tributaries of the Moodna Creek upstream of the first dam are also important habitat for American eel (*Anguilla rostrata*), which spawn in the Sargasso Sea.

Birds: Significant portions of the Town, mostly centered on the large forested and preserved areas, have been identified as an IBA. In 2016, the Hudson Highlands West IBA was extended to include Black Rock Forest, Schunnemunk Mountain and the southern extension of the Schunnemunk Ridge, Woodcock Mountain (in the Town of Blooming Grove), and the surrounding areas. The Hudson Highlands West IBA defines an area of interior forest habitat that is critical for rare, threatened or endangered species, or species on Audubon's watch list, including the cerulean warbler (*Setophaga cerulea*), wood thrush (*Hylocichla mustelina*), blue-winged warbler (*Vermivora pinus*), worm-eating warbler (*Helmithros vermivorum*), and prairie warbler (*Dendroica discolor*). Black Rock Forest, which manages an extensive research database on birds, is home to over 150 species, about two dozen of which are considered threatened. A catalogue of these species can be found here.

Significant Natural Communities & Biodiversity Areas Map

Significant Natural Communities are defined by the NYNHP as locations of rare or high-quality wetlands, forests, grasslands, ponds, streams, and other types of habitats, ecosystems, and ecological areas. The NYNHP documents only those locations of natural communities where the community type is rare in New York State, or, for more common community types, where the community at that location is a high-quality example and meets specific, documented criteria for

state significance in terms of size, undisturbed and intact condition, and the quality of the surrounding landscape.

As the map indicates, the Town and Village are home to a number of natural communities of state-wide significance. These communities are typical of the Hudson Highlands and include forested communities like chestnut oak forest as well as communities of rocky ridges, such as rocky summit grassland and pitch pine-oak-heath rocky summit. They have been identified in the large protected areas within the Town's borders, including Schunnemunk Mountain State Park, Black Rock Forest, and Storm King State Park. More detail on the communities shown on this map can be found in Appendix B.

Significant Biodiversity Areas (SBAs) are areas that contain high concentrations of biological diversity or unusual ecological features. SBAs are defined by unique topography, geology, hydrology, and biology that distinguish them from neighboring areas. SBAs carry no regulatory designation. Instead, it is hoped that recognition of these areas will serve as a basis for their voluntary conservation through conservation partnerships involving multiple stakeholders (Haeckel & Heady, 2014).

Parts of the Town and Village lie within two SBAs identified in the Hudson River Estuary Corridor: Hudson Highlands and Mid-Hudson River (Penhollow et al., 2006).

Hudson Highlands Significant Biodiversity Area:
Fifty-one percent of the Town is in the Hudson Highlands (West) Significant Biodiversity Area encompassing portions of Black Rock Forest (grids C3/C4, D3/D4), Schunnemunk Mountain State Park (grids A3/A4, B3/B4), and Storm King State Park (grids D2/D3, E2/E3). Fifty-five percent of the Village is within the Hudson Highlands West Biodiversity area encompassing Roe Park and Donahue Memorial Park (grid D2).

Mid-Hudson River Significant Biodiversity Area:
Although not shown on this map, this area includes the Hudson River itself and the lower portion of Moodna Creek. Three percent of the Town (grids D1/D2, E1/E2), and 2% of the Village are in the Mid-Hudson River Significant Biodiversity Area.

Notes on the Map(s)
Future updates to the maps will include correction to the spelling of Audubon on the *Areas of Known Importance Map* and the extension of Oak-Tulip Tree Forest on the *Significant Natural Communities & Biodiversity Areas Map*.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Areas of Known Importance

Areas of Known Importance for:

- Rare Animals
- Rare Plants
- Migratory Fish
- Birds (Audobon Important Bird Areas)

Hydrology

- Streams
- Water Bodies

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; New York Natural Heritage Program, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2017

This map depicts areas of known importance for plant and wildlife habitat in the Town of Cornwall and the Village of Cornwall-on-Hudson in Orange County, NY, based on information from the New York Natural History Program's inventory of rare species.

Important Areas were mapped by the New York Natural Heritage Program and include lands and waters that support the continued presence and quality of known populations of rare animals and rare plants, or of documented examples of rare or high-quality ecological communities. Important Areas include the specific locations where the animals, plants, and/or ecological communities have been observed and also include areas that support the natural ecological processes critical to maintaining the habitats of these rare animal and plant populations, or critical to maintaining these significant communities.

"The Important Bird Area (IBA) Program of Audubon New York, in cooperation with a host of partners, has identified 136 critical bird breeding, migratory stop-over, feeding, and over-wintering areas in the state. Important Bird Areas have been identified throughout New York in all types of habitats, including forests, shrub/scrub, grasslands, freshwater and saltwater wetlands, and bodies of water."
- National Audobon Society, 2018

https://www.audubon.org/important-bird-areas/state/new-york

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/20/2018

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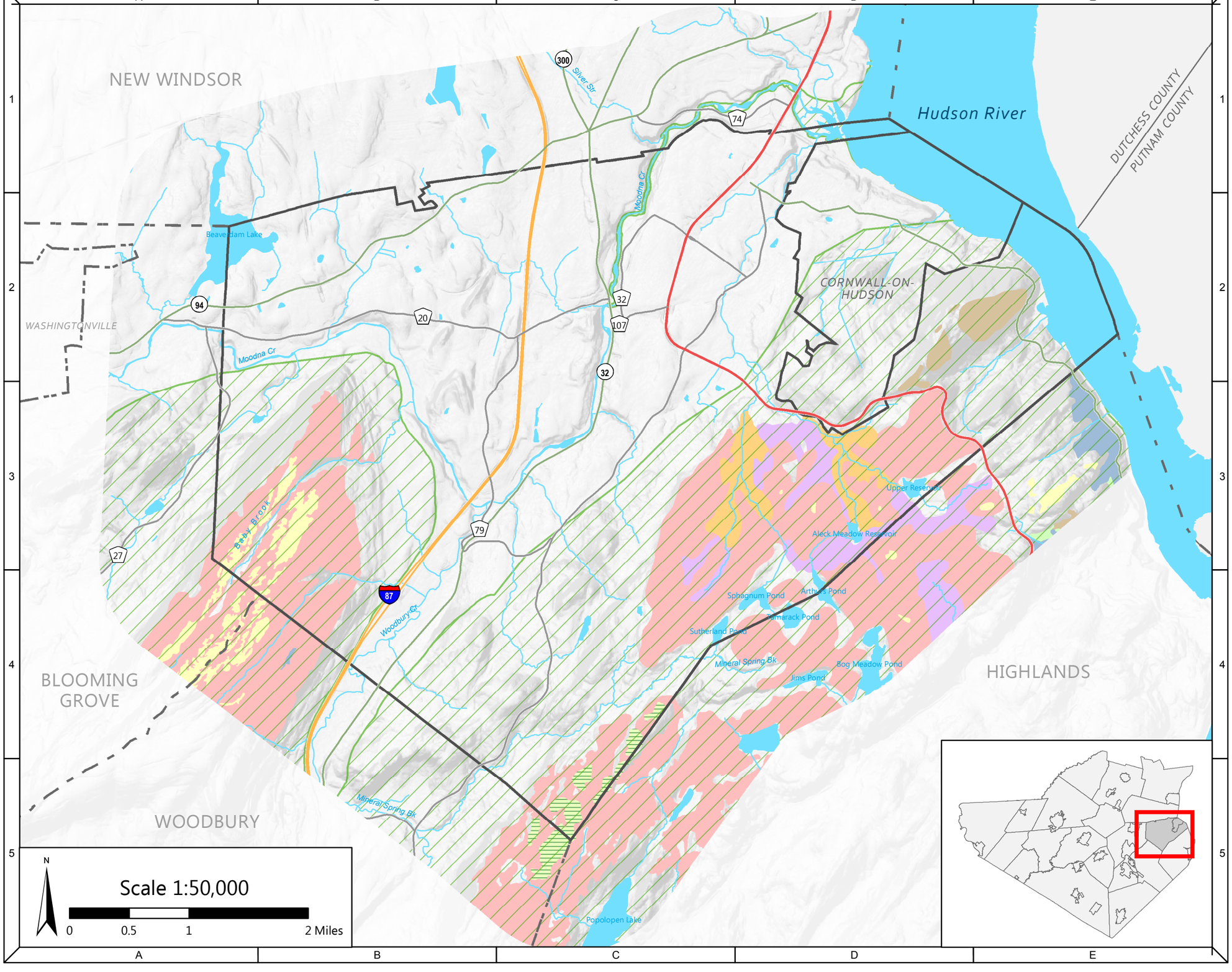
TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Significant Natural Communities and Biodiveristy Areas



Significant Natural Communities

- Appalachian Oak-Hickory Forest
- Acidic Talus Slope Woodland
- Oak-Tulip Tree Forest
- Chestnut Oak Forest
- Hemlock-Northern Hardwood Forest
- Pitch Pine-Oak-Heath Rocky Summit
- Red Cedar Rocky Summit
- Rocky Summit Grassland

Hudson Highlands Significant Biodiversity Area

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Hydrology

- Streams
- Water Bodies

DATA SOURCES: New York State Dept. of Environmental Conservation; New York Natural Heritage Program; United States Geological Sruvey; New York State Dept. of Transportation; Orange County Dept. of Planning

Significant Natural Communities are the locations of rare or high-quality wetlands, forests, grasslands, ponds, streams, and other types of habitats, ecosystems, and ecological areas. The NY Natural Heritage Program documents only those locations of natural communities where the community type is rare in New York State; or, for more common community types, where the community at that location is a high-quality example and meets specific, documented criteria for state significance in terms of size, undisturbed and intact condition, and the quality of the surrounding landscape.

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Cartography by Benjamin Freiman 2/16/2018

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FORESTS

Map(s) referenced: Forest Patches & Regional Forest Linkage Zones

Why This Habitat Is Important

The value of trees and green spaces to a community is almost universally understood. We all appreciate the shade, temperature moderation, and sense of well-being that trees bring to our lives. What many may not realize, however, is that patches of forest (both large and small) are also vital for providing wildlife habitat, mitigating the effects of air pollution, filtering water that drains into our aquifers and wells, and easing the increasing impacts of climate change. **Generally speaking, larger forests provide greater ecological value than smaller, fragmented patches; however, the value of each forest is relative to the values of other forests in the community, watershed, or natural landscape.** Even small patches of forest can be extremely valuable depending on different factors (Haeckel & Heady, 2014). If we look at the forest that borders the Moodna Creek, we see an important wildlife corridor that allows native species to move from one patch of forest to another. When we look at the forested land that extends out beyond the borders of our state parks, we see dense, deep-rooted growth that stabilizes our slopes and protects our homes and businesses from flooding and damaging erosion.

In general terms, forested land provides a community the following benefits (Bradford et al., 2012):

Forest along path to Aleck Meadow Reservoir in Black Rock Forest, with Precambrian granitic gneiss rock formation.

- Sequesters carbon.
- Protects watersheds and groundwater, holding soils in place and reducing runoff, recharging aquifers, and supplying clean water to our ponds, rivers, streams, and water supplies.
- Reduces flooding by slowing the release of storm water and snowmelt to downstream areas.
- Provides habitat and movement corridors for wildlife.
- Contributes to soil formation.
- Mitigates the effects of extreme weather by cooling the air on hot summer days and reducing wind chill factors in the winter.
- Produces oxygen, capture carbon dioxide, and help clean the air of pollutants.
- Wood products from the harvesting of timber.
- Non-timber forest products such as wild edibles (e.g., mushrooms and herbs) and wild game.

Forest Characteristics

Many types of forest can be found in the Hudson Valley region. Because our region is an important biome transitional zone between the oak-hickory, northern hardwood, and boreal forest types, we have "nearly 10 boreal and more than 20 southern temperate tree species living near or

at a range limit" (Columbia University Earth Institute, 2018). This means that we have more species of trees than other regions farther to the north or south, and this forest biodiversity in turn supports many important and iconic wildlife species such as Eastern black bear (*Ursus americanus americanus*), wild turkey (*Meleagris gallopavo*), and numerous migratory song birds. These species are dependent on healthy, intact forest patches to maintain their populations.

To better quantify the ecological and commercial value of forested land, it is important to designate its significance within the region.

- *Regionally Significant Forest* blocks, greater than 6,000 acres in size, contribute to resiliency in a changing climate and have a high conservation value because of that function. Preserving these larger blocks of forest and the linkage zones that connect them will maintain wildlife corridors, reduce the impact of invasive species, and provide recreational benefits to areas experiencing growth in eco-tourism.
- *Locally Significant Forest* blocks, 2,000-5,999 acres in size, are equally important to regulating temperature and controlling the effects of weather events, but often have reduced habitat value for wildlife. Areas where development has infringed on forest habitat often see a more limited capacity for forest regeneration due to a higher presence of invasive species and over browsing by deer, among other factors.
- *Stepping Stone Forest*, 200-1,999 acres in size, is important because it provides a bridge between larger patches of biodiverse forest and allows for the establishment of ecological networks or corridors that help lessen the fragmentation of forest habitat, maintain the integrity of migratory pathways, and generally increase the viability of plant and animal wildlife.
- *Matrix Forest Blocks*[6] "represent the largest, most intact forests [of a] size and natural condition [that] allow[s] for the maintenance of ecological processes, forest communities, and populations of forest interior species" (HREP, 2019). **Conserving these blocks enables plants and animals to adapt to a warming climate by providing connections for movement northward and to higher elevations.**
- *Regional Forest Linkage Zones* provide linkages between matrix forests for animals and plants. As largely intact forested areas, they facilitate connections between larger forest blocks as well as support healthier species populations by enabling genetic exchange (HREP, 2019).

Forest Patches & Regional Forest Linkage Zones Map

Because certain parts of Cornwall lie within the boundaries of two state parks and Black Rock Forest, Cornwall's overall forest cover is considerable compared with neighboring communities. This map shows the forest cover within the borders of Black Rock Forest and on the adjacent land of West Point to the south and the Hudson Highlands Nature Museum (Outdoor Discovery Center) to the northwest as regionally significant both for its size and the wildlife habitat that it provides.

Much of the Village is classified as locally significant forest, playing an important role in linking the regionally significant forest patches to the river as well as providing a buffer zone from more

[6] GIS.NY.GOV maintains many data sets, including the matrix forest blocks and linkages data set used for the development of the *Forest Patches & Regional Forest Linkage Zones Map*. The website explains the identification criteria used for matrix forest blocks: examples of dominant forest types were identified that, "if protected and allowed to regain their natural condition, would serve as critical source areas for all species requiring interior forest conditions or associated with the dominant forest types" (GIS.NY.GOV, 2019).

developed areas. The land protected by Schunnemunk Mountain State Park is similarly classified as being locally significant and is a reflection of the fact that continued development threatens to create a habitat island isolated from more biodiverse forest land.

Outside of these areas, the map identifies large parts of Cornwall as containing stepping stone forest cover. The map also shows that most of these stepping stone forest areas act as important regional linkage zones between locally and regionally significant forest patches, and even combine with the regionally significant forest of the Hudson Highlands to define the area between County Route 32 and the southeastern border of the Town as vital matrix forest (see Appendix A – Glossary and Acronyms). Parts of stepping stone forest in Cornwall, such as the land adjacent to State Route 9W and Moodna Creek, have been proposed for large scale residential development in the past and have more recently been rezoned for industrial development.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Forest Patches and Regional Forest Linkage Zones

Forest Patches (acres)

- Stepping Stone Forest (200 - 1999)
- Locally Significant Forest (2000 - 5999)
- Regionally Significant Forest (>6000)

Linkage Zones and Matrix Forest Blocks

- Regional Forest Linkage Zone
- Matrix Forest Blocks

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: New York State Natural Heritage Program, 2017; New York State Dept. of Environmental Conservation, 2017; National Oceanic and Atmospheric Association Coastal Climate Change Analysis Program, 2016; The Nature Conservancy, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

This map shows contiguous forested patches of New York State by acreage in the Town of Cornwall and the Village of Cornwall-on-Hudson in Orange County. Patches were delineated by Cornell University and NYS DEC using forest cover data from the Coastal Change Analysis Program. Size classes are based on ecological importance. Matrix Forest Blocks and Linkages were developed by The Nature Conservancy and The New York Natural Heritage Program.

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/20/2018

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STREAM & RIPARIAN HABITAT

Map(s) referenced: Stream Classification, Stream Biomonitoring & Priority Waterbodies

Why This Habitat Is Important

We all have enjoyed, been impacted by, or taken actions that impact Cornwall's stream and riparian habitats. Cornwall Elementary School at Lee Road students learn about the riparian habitat of Black Rock Forest reservoirs during their 3-season scientific expeditions. Parents and grandparents enjoy teaching their children and grandchildren how to fish at Rings Pond. Some children will disappear for hours along our many streams, exploring the plants and animals that call these habitats their home and cooling off on hot summer days. As the frequency of heavy rainstorms has increased by 71% since the 1950s (Melillo et al. 2014), we have also experienced the swelling of our streams beyond their channels to former floodplains where we have built many of our homes and other structures. We may have inadvertently exacerbated this situation by removing the vegetation that not only protects the plants and wildlife in our watercourses, but also protects our properties from these floodwaters.

Baby Brook, with headwaters in Schunnemunk Mountain, descending toward Moodna Creek.

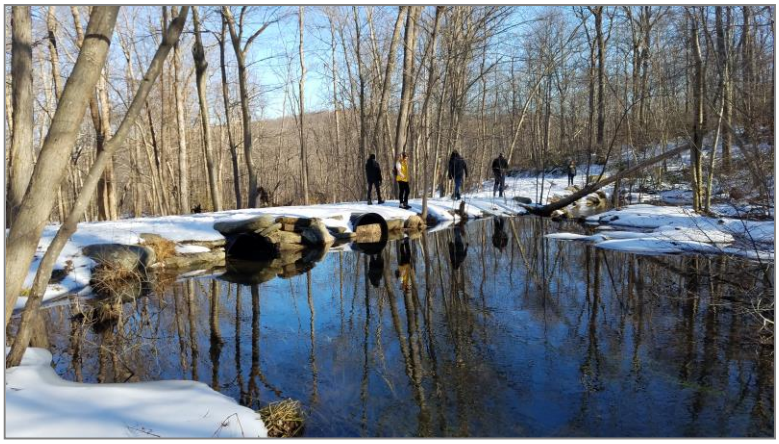
Streams and streamside, or riparian, areas are important transitional zones where land and water are linked (Haeckel & Heady, 2014). Streams include the banks, floodplains, and non-floodplain areas next to streams. Streams, if healthy, can support the plants and microhabitats of small aquatic animals that are important to the survival of native fish, like brook trout (*Salvelinus fontinalis*), American eel (*Anguilla rostrata*), and herring species. Additionally, streams are important to the life cycles of many other species, like mink, bats, belted kingfisher (*Megaceryle alcyon*), herons, wood turtles, stream salamanders, and dragon flies, by providing food and areas for breeding, migration, hibernation, and safety. (Appendix B provides a comprehensive listing of species of conservation concern.) Retaining current floodplains supports habitats, such as meadow, swamp, marsh, and lowland forest, that can withstand occasional flooding as well as support the animals that rely on these habitats and other animals that rely on them for food (Haeckel & Heady, 2014).

Maintaining the health of stream and riparian habitats involves the retention and addition of native trees for shading to keep streams cool for our coldwater fish, like brook trout. **The retention and addition of native shrubs, grasses, and wildflowers can protect animal life by preventing unwanted vegetation, sedimentation, and pollution reaching our streams and waterbodies as well as reduce the impact of flooding.** Orange County Water Authority's *Watershed Design Guide* provides a comprehensive visual explanation of healthy streamside plantings based on the recommendations detailed in its *Moodna Creek Watershed Conservation and Management Plan*. The Upper Esopus Creek Management Plan Newsletter of Cornell University Cooperative Extension Ulster County provides sample native streamside plantings for our neighbor to the north, Ulster County.

Stream Classification Map

This map, found in the Stream & Water Quality chapter, informs us of the existing or best uses of our local streams as well as their quality and purity. According to the 2017 NYS Department of Environmental Conservation data, many streams in the Town are suitable trout habitat, with some suitable for trout spawning, or release of eggs.

Stream Biomonitoring & Priority Waterbodies Map



Properly placed culverts in Black Rock Forest, allowing for the passage of fish.

Notable on this map, found in the Stream & Water Quality chapter, are the many dams and culverts that pepper our streams. Culverts, if properly installed, can foster the natural life cycles of trout and American eel (*Anguilla rostrata*), for example, by allowing them to travel upstream. **While long-standing dams have created much-appreciated features such as lakes and ponds, it is now understood that they also play a role in isolating and severely limiting the range of aquatic species and other organisms that use stream corridors; dams also play a role in increasing local flooding and deteriorating water quality** (Haeckel & Heady, 2014).

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WETLAND HABITAT

Map(s) referenced: Wetlands & Hydric Soils

Why This Habitat Is Important

Wetland habitats serve two very important roles: they are essential to the survival of many species while providing flood-control and water cleansing benefits for Town and Village communities. Wetland habitats come in many different forms and support many different types of species. They include both tidal wetlands associated with the Hudson River and non-tidal wetlands, such as wet clay meadows, hardwood swamps, emergent marches, and vernal pools. According to NYSDEC's Known Species of Conservation Concern (Appendix B), our wetlands are home to the following animals and plants that are threatened, of special concern, or of greatest conservation need: least bittern (*Ixobrychus exilis)*, common snapping turtle (*Chelydra s. serpentina*), northern copperhead (*Agkistrodon contortrix mokasen*), marbled salamander (*Ambystoma opacum*), clustered sedge (*Carex cumulata*), and large twayblade (*Liparis liliifolia*). Chapter 90 Freshwater Wetlands of the Town's Code provides a comprehensive listing of the vegetation that is associated with seasonal or permanently flooded wetlands. Beavers, muskrats, and dragon flies are just a few of the additional animals for which wetlands are important.

Cattails (Typha angustifolia) in summertime, before going to seed.

Vernal pools are of particular interest because they are typically small and not well documented. **These seasonal habitats don't always support wetland vegetation, but they are critical breeding habitat for several species of forest salamanders and frogs, such as wood frogs (*Rana sylvatica*)** (Haeckel & Heady, 2014). Cornwall is dotted with woodland pools, a type of vernal pool, due to our large forested areas. Conducting a wetland ground-truthing survey[7] would be instrumental to identifying seasonal wetlands as well as smaller wetland habitats that are not captured by the various data sources for the *Wetlands & Hydric Soils Map*. Important wetlands habitats are present on the grounds of the HHNM sites, the Outdoor Discovery Center and the Wildlife Education Center. Vernal pools are located at the latter site.

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[7] Ground-truthing is the collection of field data to confirm the presence of features identified by less local sources. In many cases, ground-truthing results in the identification of features that had not been noted by these sources, such as the potential wetland located near the Grail property. For wetlands, which can migrate over time, ground-truthing can inform the growth, movement, or encroachment of wetland boundaries. Ground-truthing plays an important role in ensuring that new construction and expansion projects do not encroach on nor eliminate existing wetlands.

TIDAL WETLAND HABITAT

Map(s) referenced: Tidal Wetlands & Submerged Aquatic Vegetation

Why This Habitat Is Important

Tidal wetlands are some of the most important habitats within the Hudson River Estuary. They support numerous unique species that rely on the changing water level to survive and that are especially suited for that habitat type. Tidal wetlands and submerged aquatic vegetation (SAV) not only support a great diversity of plant, animal, and insect life, they also contribute to the economic significance of the estuary.

> More than 200 species of fish are found in the Hudson, including key commercial and recreational species like striped bass, and species of conservation concern like Atlantic and short-nose sturgeon. SAV beds improve water quality in the Hudson and provide essential habitat for invertebrate animals, which feed fish and waterfowl that use the estuary. Tidal wetland habitats play a critical role as nursery grounds for fish and shellfish species, as well as provide nesting sites and migration stops for birds and sources of nutrients for the estuary food web. These wetland systems also help filter pollutants, buffer shoreline properties, and help stabilize the river's shoreline (Haeckel & Heady, 2014).

The Common Reed (Phragmites australis) is one of four subspecies of the genus Phragmites found in wetlands. This specific species is non-native and is now commonly found throughout the Hudson Valley.

Given rising sea levels caused by climate change, **it is also important to note that tidal wetlands can help reduce flooding by limiting wave action and acting as an intermediate habitat between the land and the water.** They are also great recreation areas, providing opportunities for fishing and exploration by kayak or canoe.

As extremely dynamic systems, tidal wetlands are constantly changing. However, long term changes can be seen in vegetation type and sediment levels. Many wetlands have been invaded by the common reed *(Phragmites australis)*. Areas with native cattail *(Typha angustifolia)* tend to be much more biologically diverse than areas invaded by Phragmites, and more biodiversity in the plant community can support a greater variety of other animals that use a given area for shelter or food. As the climate changes and sea level rises, water levels may increase faster than wetlands can gain new sediment, which could cause decreased amounts of these crucial habitats for plants and animals (NYSDEC).

Submerged aquatic vegetation (SAV) provides important habitat for juvenile fish that hide within the leaves. In addition to fish, SAV beds provide habitat for macroinvertebrates and food for

waterfowl, which either eat the plants themselves or eat the animals living in the plant beds. **SAV is an important source of dissolved oxygen that aquatic animals need to survive and is used as a key measure of water quality.** Water celery is the most common native submerged aquatic plant in the Hudson River. A very common invasive SAV species that is crowding out water celery is water chestnut (*Trapa natans*), which can be seen in almost every freshwater, slow moving area of the Hudson River in the summertime. Water chestnut creates mats of leaves at the surface of the water, shading out native water celery below. The water underneath water chestnut beds is known to have much lower oxygen levels than other areas. While water chestnut does produce oxygen, it releases it into the air through its floating leaves instead of directly into the water like other aquatic plants (NYSDEC, 2018).

Although these tidal wetland habitats support extraordinary biological diversity and provide important benefits to humans, they have been diminished, damaged, and disconnected by human patterns of development during the past 150 years. Vast areas of river bottom have been dredged to create and maintain a shipping channel. Tidal wetlands and shallows have been filled, and, in some areas, fill covers a third of the River's original surface area. Nearly half of the Hudson's shoreline has been straightened and hardened by human-made structures. Also, human responses to sea-level rise and increased flooding may include building dikes, which will prevent habitats from migrating landward. Finally, the ongoing accidental and deliberate introduction of invasive plants and animals continues to threaten native species and their habitats (NYSDEC, 2018).

Tidal Wetlands & Submerged Aquatic Vegetation Map

Cornwall has only a small area of tidal wetlands, but that area, the mouth of Moodna Creek, is an important component in Cornwall's contribution to the overall health of the Hudson River Estuary. The map shows the distribution of the two primary tidal wetlands reed species common to the area, *Typha angustifolia* (native) in yellow and *Phragmites australis* (invasive) in orange. Also shown are wooded areas (brown), barren areas and mud flats (purple), and areas of upper and lower intertidal mixed vegetation (pink and red, respectively).

Water Celery (Vallisneria americana) is a native aquatic plant that supports fish populations, water fowl, and releases oxygen into the water and atmosphere.

To the east of the Moodna outlet is a large area of submerged aquatic vegetation (dark green). This SAV growth follows along much of the Town's and Village's shoreline, with the exception of locations where development has occurred and hardened shoreline has been created (e.g., Donahue Memorial Park). Submerged aquatic vegetation is also present throughout most of the

Moodna Creek outlet and runs in patches approximately two-thirds of a mile up the Creek itself. All of this SAV provides important nursery habitat for numerous aquatic and land wildlife species.

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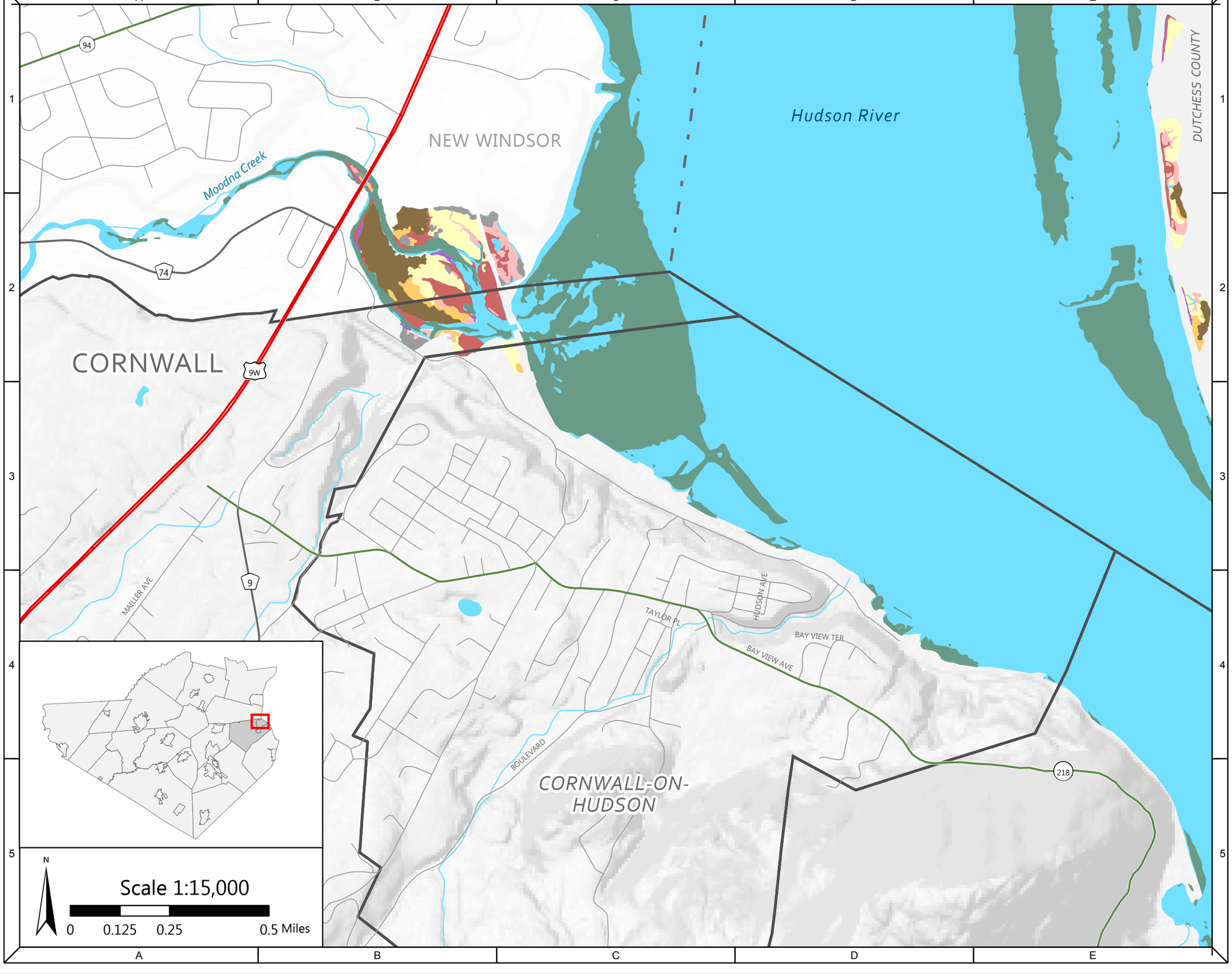
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Tidal Wetlands and Submerged Aquatic Vegetation



Tidal Wetlands and Submerged Aquatic Vegetation

- Phragmites Australis Dominant
- Typha Angustifolia Dominant
- Lower Intertidal Mix
- Upper Intertidal Mix
- Wooded Swamp
- Submerged Aquatic Vegetation
- Unvegetated Flats
- Scrub / Shrub
- Open Water

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

Hydrology

- Streams
- Water Bodies

DATA SOURCE: New York State Dept, of Environmental Conservation, 2017, Cornell Institute for Resource Information Sciences, 2017; Hudson River National Estuarine Research Reserve, 2017; New York State Dept. of Transportation, 2017, Orange County Department of Planning, 2018

This map depicts the extent and composition of tidal wetlands and submerged aquatic vegetation (SAV) along the Hudson River. This dataset was created by New York State Department of Environmental Conservation, the Cornell Institute for Resource Information Sciences, and the Hudson River National Estuarine Research Reserve.

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

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GRASSLANDS & SHRUBLANDS

Map(s) referenced: Meadows, Grasslands, & Shrublands

Why This Habitat is Important

Meadows, grasslands, and shrublands are unique and valuable habitats that are critical for bird, plant, and wildlife communities. Historically, Native peoples, fires, and beaver were the primary forces responsible for creating and maintaining grassland and meadow habitats in New York. Native Americans created grasslands when they burned the land for agriculture and to improve forage for game species such as white-tailed deer. At the same time, ponds above abandoned beaver dams grew into grassy meadows after the water drained and the nutrient-rich soil was exposed to sunlight. In more recent history, fire suppression and limits to where beavers are allowed to build dams has meant that grass and shrublands are restricted mainly to agricultural areas. The peak of agricultural clearing in the Northeastern US occurred in the mid-1800s (UNH Extension, 2018). Since then, **the amount of land identified as grassland or shrubland has decreased rapidly in the Northeastern United States.** This is mostly due to increases in population and resulting development, and changes in agriculture that have resulted in the abandonment of many small, family-owned farms. Unused farm land has traditionally been a major target for sale and development, and is typically one of the first habitats to succumb to low-density residential development.

Meadow at Schunnemunk Mountain State Park.

Native wildflower growth in these habitats is vital to supporting pollinators. Numerous species depend on open grassland and shrubland habitats, especially grassland breeding birds that require large meadows for successful nesting. New York State's grasslands are home to significant populations of some of the highest priority birds in the Atlantic Flyway. These birds, which have been sentinels of environmental health for centuries, depend on hayfields, pastures, fallow fields, and other agricultural lands for essential habitat. But the same bird species are experiencing significant declines in populations. Scientists report a 90% decrease in targeted grassland species since 1966 (Audubon, 2018). Some of these species, such as Henslow's Sparrow (*Ammodramus henslowii*), Upland Sandpiper (*Bartramia longicauda*), Grasshopper Sparrow (*Ammodramus savannarum*), Short-eared Owl (*Asio flammeus*), and Eastern Meadowlark (*Sturnella magna*)are area-dependent species, meaning that they need large unbroken expanses of grasslands to thrive and reproduce. The amount of grassland habitat needed by these species depends on factors such as location, shape, surrounding habitats, and vegetative composition. However, as a general rule, grasslands need to be at least twenty-five acres in size to offer appropriate habitat for at-risk grassland birds in New York (NYSDEC, 2018).[8]

[8] The *Areas of Known Importance Map* shows the extent of the Audubon Important Bird Areas that lie within the borders of Cornwall. This IBA was designated because of its importance to interior forest breeding bird species.

Old farm fields or forest clearings are by nature transitional and relatively short-lived habitats, usually quickly colonized by shrubs and requiring periodic management to maintain openness. Shrublands in turn revert rapidly to forest without continued maintenance or disturbance, such as fire, that triggers young forest growth. **Where they still occur, conserving and managing large grasslands and shrublands benefits wildlife and can also support agricultural land uses and scenic values** (Haeckel & Heady, 2014).

Meadows, Grasslands, & Shrublands Map

Cornwall is home to a considerable amount of open meadow, grassland, and shrubland. Much of the Town's land that is not mountainous, wooded, or developed falls into this category. This map shows all of the significant areas within the Town and Village ranked by acreage. The lightest shading represents small areas of 10 or fewer acres, and the darker shading denoting large areas of more than 50 acres. On the map, some small areas are contained within the larger areas and should be considered contiguous.

Eastern Meadowlark (Sturnella magna), a species commonly found in large, open meadow habitats.

Most of Cornwall's large areas of grasslands and shrublands are located in the western portion of the Town, clustered at the foot of Schunnemunk Mountain. Other sizeable areas lie on either side of State Route 94 and County Route 20 (Orrs Mills Road), the Hudson Highland Nature Museum Outdoor Discovery Center and the adjacent dog park (grids C2/C3).

Cross referencing with the *Land Use & Land Cover Map* in the Land Use section shows that the majority of these grasslands and shrublands are either actively cultivated farmland and pasture, or preserved lands that were previously cultivated and left as pasture. Looking at the *Protected Open Space Map* in the Land Use section, one can see that significant portions of these preserved grasslands and pasture are now within the boundaries of state parks, public nature preserves, museums, or conservation easements. Annual mowing keeps these areas from becoming shrubland and returning back to forested land. As noted above, this is important for maintaining vital grassland bird habitat in the Hudson Valley.

While the Village of Cornwall-on-Hudson is heavily forested outside of its central developed areas to the north, it does contain a number of grassland areas, the most significant being the former Donahue Farm parcel off of Hudson Street. Privately owned and maintained land accounts for the other important grassland or shrubland areas in the Village.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Meadows, Grasslands, and Shrublands

Meadows, Grasslands, and Shrublands (acres)

- 0 - 10.0
- 10.1 - 25.0
- 25.1 - 50.0
- >50.1

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: National Land Cover Database, 2011; United States Geological Survey, 2017; New York State Dept. of Environmental Conservation, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; Hudsonia Ltd., 2017;

Meadows, grasslands, and shrublands were identified using the National Land Cover Database (NLCD), a satellite-based 30-meter-resolution land cover database with coverage of the United States. The NLCD land cover classes used to generate this dataset include "grassland/herbaceous", "shrub/scrub", "cultivated crops", and "pasture/hay".

The "Upland Meadow Areas" and "Wetland Meadow Areas" included on the map were identified by a group of volunteers that completed Hudsonia's Biodiversity Assessment Training in 2007. Habitats were identified through map analysis and aerial photograph interpretation. Note that while some locations were field verified, not all areas were checked.

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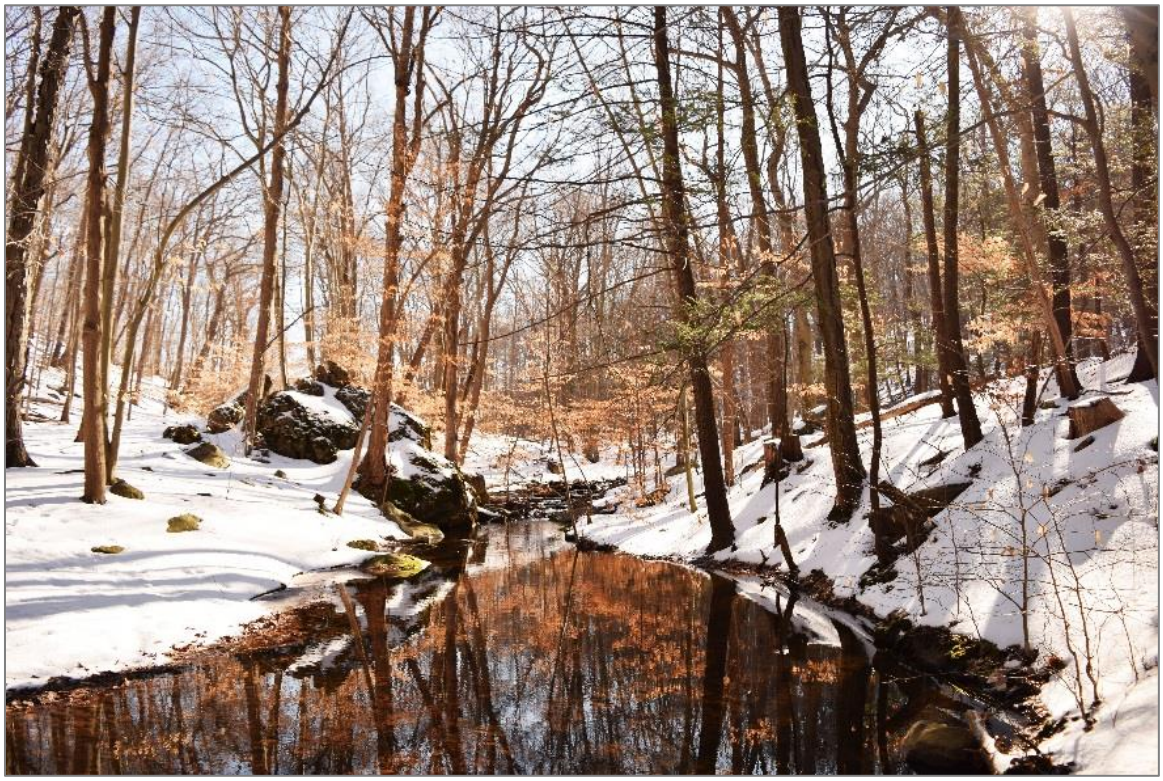
WATER RESOURCES



A tributary of Black Rock Brook, a DEC-classified Class A trout spawning stream, flowing from the Upper Reservoir in Black Rock Forest. This Brook flows into Idlewild Creek, locally known as Canterbury Brook.

CHAPTERS, MAPS, AND RELATED CONTENT

Watersheds

Watersheds & Sub-basins Map

Groundwater & Aquifers

Public Wells, Aquifers, & Risk Sites Map

Floodplains

Flood Zones & Flooded Roads Map

Wetlands

Wetlands & Hydric Soils Map
Appendix C: Summary of Municipal Wetland and Watercourse Protection Techniques
Appendix D: National Wetland Inventory Wetland Classes

Streams & Water Quality

Stream Classification Map
Stream Biomonitoring & Priority Waterbodies Map

WATERSHEDS

Map(s) referenced: Watersheds & Sub-basins

Why You Need This Map

When we view our communities using satellite imagery, we see the developed areas, green space – in the form of woodlands, farmland, and meadows – and waterbodies, such as streams, river, lakes, and wetlands. In a two-dimensional viewing, it is difficult to visualize the direction in which water naturally flows. A watershed map serves the purpose of identifying the direction in which all surface waters flow within a specific land area to a waterbody. Highpoints, such as ridges, mountains, and hills, form the typical dividing lines of watersheds and represent the point from which all water flows downward. Watersheds may be further divided into the smaller drainage areas, known as subwatersheds. **Because municipal boundaries rarely follow watersheds, working in a watershed context requires communication and coordination between multiple municipalities. Maintaining healthy watersheds is important because they provide critical natural services that sustain and enrich our daily lives, such as plentiful and safe drinking water.**

What are other critical natural services that healthy watersheds can provide?

- They reduce erosion and provide critical habitat for plants and animals.
- Watersheds dominated by pervious areas, such as forests and other natural open space, produce relatively little surface runoff, helping reduce flood risk in nearby downstream areas. For parts of Cornwall that are in and downhill from mountainous areas and hilly with steeper slopes, managing surface runoff reduces the risk to roads, drainage infrastructure, bridges, and other property and infrastructure
- Pervious areas enable more groundwater recharge, supplying aquifers used for water supplies.[9] Groundwater recharge is of critical importance during dry, warm weather seasons because the flow of water from aquifers back into streams comprises most of the water that is flowing in our upland streams during these seasons.

A watershed, its subwatersheds, and various land uses water may encounter as it flows over land.

- Watersheds are also areas of natural beauty that can offer wonderful opportunities for recreation and relaxation, like local streams and lakes. They are important features of our local geography and rural character.
- Healthy watershed can "minimize public infrastructure and water treatment costs and help increase our resilience to

[9] Managing watersheds to provide water retention and recharge function will become even more critical with changing weather patterns and the increased incidence of total annual rainfall in shorter, larger storms (Gruber, 2018). A broader discussion of the impact from climate change is found in the Climate Conditions and Projections section.

extreme weather events" by storing floodwaters in intact flood plains and riparian areas (Haeckel & Heady, 2014). **The Economic Benefits of Protecting Healthy Watersheds Factsheet highlights the economic benefits of watersheds, such as New York City's 80% cost savings from watershed conservation efforts when compared with the construction of new water filtration plants (EPA Factsheet, 2012).**

The watershed diagram on the previous page from the White River Alliance depicts the various developed features water may encounter on its way to a local waterbody, such as farmland, residential areas, industry, commercial areas, and transportation infrastructure. Local policies can dramatically impact a municipality's water availability and quality. For example:

- Does local zoning allow for structures to be constructed too closely to streams and wetlands, or are ample buffer zones incorporated into the zoning code?
- Is further development on remaining floodplains within a municipality being limited to protect existing and future construction from floodwaters?
- Collaboration with neighboring municipalities can be critical to fostering healthy watersheds and maintaining plentiful water in a local jurisdiction. Is there intermunicipal collaboration around the development of policies that can benefit many municipalities within a watershed? Watershed councils, such as the Moodna Creek Watershed Intermunicipal Council, play an important role in these intermunicipal collaborations in partnership with local water authorities, like the Orange County Water Authority.

Watersheds & Sub-basins Map

Orange County municipalities lie within 10 watersheds,[10] as is shown on the inset map of the *Watersheds & Sub-basins map*.

The Town lies primarily in the Moodna Creek Watershed. All of the waterbodies within this watershed drain to the mouth the Moodna, which straddles the towns of Cornwall and New Windsor along the Hudson River Estuary just north of the Village (grid D1). Two small portions of the Town fall within the Lower Hudson Watershed.

- The Moodna Creek Watershed within the Town's boundaries includes two sub-basins, the Woodbury Creek Sub-basin (darker green) and the Silver Stream-Moodna Creek Sub-basin (lighter green).
- The waterbodies in the Woodbury Creek Sub-basin flow into Woodbury Creek. This includes Mineral Spring Brook, with headwater at Sutherland Pond, and Woodbury Creek itself, which then joins Moodna Creek (grid B3).
- The waterbodies of the Silver Stream-Moodna Creek Sub-basin flow into Moodna Creek by way of Silver Stream in New Windsor and Idlewild Creek, with tributary sources in Sphagnum Pond, Arthur's Pond, Aleck Meadow Reservoir, and Upper Reservoir. These waterbodies are all located within Black Rock Forest.
- The Lower Hudson Watershed portions within the Town's boundaries includes the Breakneck Brook-Hudson River Sub-basin (brown) and the Popolopen Creek Sub-basin (dark pink), which flow to the Hudson River.

The Village lies almost entirely in the Lower Hudson Watershed (brown). In the Village, some streams flow directly to the Hudson River, including the streams coming from Deer Hill and

[10] For a more nuanced presentation of the sub-watersheds, see the Orange County Water Authority Watersheds of Orange County map. Also available is the EPA WATERS GeoViewer.

Storm King Mountain, such as Dock Hill Creek. Other parts of the Village drain to Idlewild Creek, which is a tributary of Moodna Creek.

All waterbodies within Cornwall's watersheds flow through developed areas (residential, commercial, industrial, and roadways) as well as natural open space areas with more pervious surfaces (farms, protected meadows, and pristine forest, for example).

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References & Resources

TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Watersheds and Sub-basins

USGS 12-Digit HUC

Moodna Creek Watershed Sub-basins

- Satterly Creek-Moodna Creek
- Silver Stream-Moodna Creek
- Woodbury Creek

Lower Hudson Watershed Sub-basins

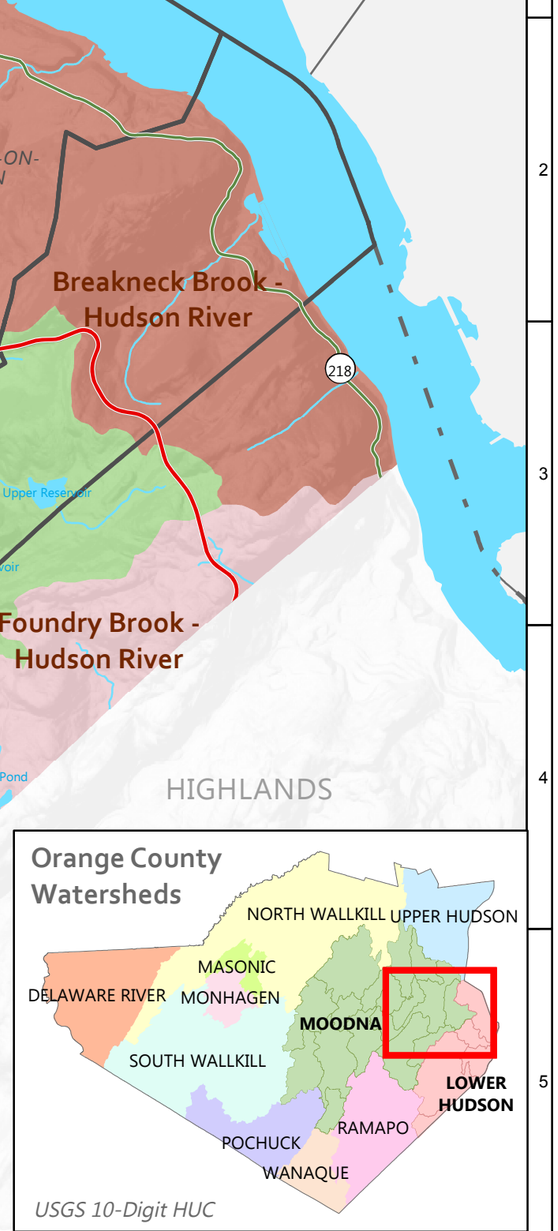
- Breakneck Brook-Hudson River
- Foundry Brook-Hudson River
- Popolopen Creek

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road



DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

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GROUNDWATER & AQUIFERS

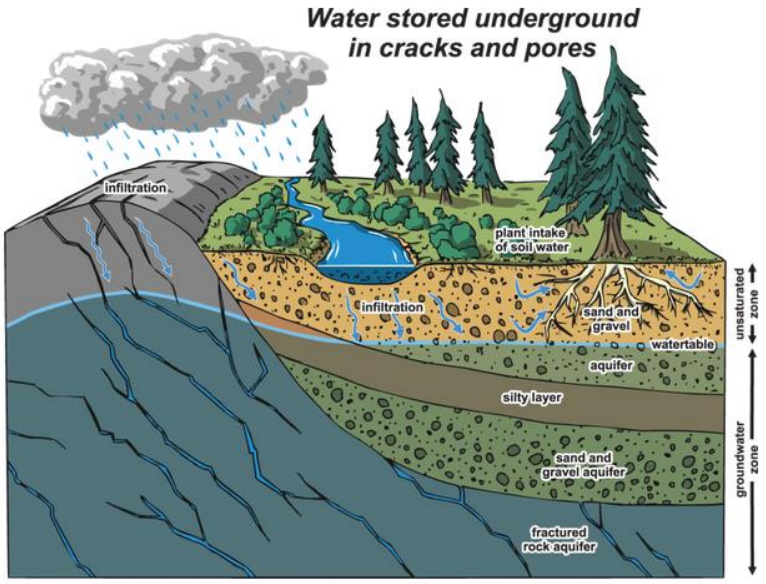
Map(s) referenced: Public Wells, Aquifers, & Risk Sites

Why You Need This Map

The Watersheds chapter discussed the water that flows over land and how it interacts with existing land uses, impacting water quality in our waterbodies. The policies and practices that a municipality may have in place to protect the health of our waterbodies also protect the health of groundwater. Additional protective measures are also needed to protect the health of groundwater as groundwater supports not only habitats and their species but also our drinking water.

Aquifers

This image from the Regional District of Nanaimo in British Columbia illustrates the interactions between precipitation, surface water, and groundwater. Precipitation can go directly to a waterbody, like a stream or pond, or it can infiltrate into soil and move into bedrock through cracks and pores. Aquifers are the "zones in sediments and bedrock that receive, store, and transmit *significant* amounts of water to wells and springs" (Haeckel & Heady, 2014). Water in the unsaturated zone lies above the water table; it is closely mixed with grains of gravel, sand, silt, and clay, and hydrates plants and soil-dependent creatures. Water in the saturated zone lies below the water table. The area of land that contributes to recharging aquifers is called the aquifer recharge area; this area can be as large as an entire watershed or a sub-basin. Aquifers also have discharge areas, which feed intermittent and perennial streams, linked ponds/lakes, and wetlands.



The various ways in which surface water replenishes aquifers.

With more than 25% of New Yorkers dependent on groundwater for drinking, municipalities have an important role to play in ensuring that drinking water remains plentiful and clean. Localized depletion can occur when withdrawals exceed natural local recharge rates and when impervious surfaces block recharge. Municipalities can implement protective measures to support a balance between withdrawals and natural recharge, thereby protecting wells and the waterbodies that depend on groundwater. Municipalities can also foster an awareness of aquifer pollution risks and enact preventive legislation. These efforts can focus on the various sources of aquifer pollution: chemical spills; runoff of oil, gas, and antifreeze from motor vehicles; road salt; common household cleaners, herbicides, and pesticides; underground storage tanks; and improperly spaced or faulty septic systems, and improperly maintained public sewer systems. An important first step can be the development of a management plan for the

protection of groundwater; the New York Rural Water Association offers technical assistance for the development of source water protection plans.

Public Wells, Aquifers, & Risk Sites Map

Cornwall is fortunate to be underlain by many overburden aquifers – sand and gravel aquifers that lie above bedrock. These aquifers are depicted as the yellow, pink, green, and brown areas on the map and are found in most valley locations. They lie at different levels in relationship to the water table, as is noted in the map legend. The Town's and Village's sizable, above water-table aquifers appear as yellow on the map. They are located primarily along the Moodna Creek, Woodbury Creek, and on the banks of the Hudson River.

As is discussed in the Bedrock Geology chapter, Cornwall is entirely underlain by bedrock. Aquifers are also found throughout bedrock, with some aquifers more accessible than others, based on their pathways, such as fractures and faults, and depth (Chandra et al., 2019).

Orange County Water Authority's *Moodna Creek Watershed Atlas* classifies all of Cornwall's aquifers as "Important Groundwater Sources" and, as such, they are an important drinking water source.

Wells

Residents in the Town and Village receive drinking water from the Village's municipal water supply, the Town of New Windsor's municipal water supply, and private, domestic wells. The Village provides drinking water to all residents in the Village as well as most Town residents. The balance of residents in the Town's Firthcliffe water district is supplied by New Windsor. This diversity of water sources for the municipal water system, as described below, provides great flexibility for uninterrupted, high quality drinking water to Cornwall residents. Many communities do not have this flexibility and diversity of sources.

Local water supply sources include public water system wells,[11] named Public Wells on the map legend, which are indicated by blue dots on this map. The drilling of new wells must be carefully monitored for negative effects on surrounding public and private wells. Excessive extraction not balanced by the return of nearly equal quantities of treated wastewater to the same watershed areas can cause significant aquifer declines and also change nearby stream flow and water temperature, affecting the survival and reproduction of aquatic life, and the loss of economic and social quality of life values.

Local public water system sources include:

- The Village-owned Taylor Road Well Field in the Mountainville area of Cornwall is located along Taylor Road, near the Moodna Creek (grid B3) and consists of two 65-foot-deep wells (Village of Cornwall-on-Hudson, 2018).
- Local surface water from Black Rock Forest reservoir system serves as backup water supply.
- The map also seems to indicate the presence of two additional wells along Angola Road just southwest of Route 9W and near the intersection of Angola Road and Mineral Springs Road; however, the Village Water Department has no knowledge of wells at that site.

[11] Public water system wells serve larger businesses, public institutions, and residential areas.

The New York City Ashokan Reservoir in Ulster County via the New York City Catskill Aqueduct is an additional municipal water supply source for both the Village and the Town of New Windsor. Firthcliffe residents may also receive water from three large production sites on the eastern side of New Windsor and in an emergency from the Silver Stream Reservoir and the City and Town of Newburgh (Town of New Windsor, 2018).

The Village of Kiryas Joel owns the land on which it has drilled new public water supply wells along Woodbury Creek off of State Route 32 (grid B4). The Village/Town of Woodbury has a public water system wellfield near the confluence of Trout Brook and Woodbury Creek. All of these public water supply wells withdraw water from overburden aquifers.

Risk Sites

The map also shows many risk sites. These include petroleum bulk storage facilities (brown dots) and remediation sites (pink diagonal lines), many of which are located directly over or adjacent to aquifers. There is only one chemical bulk storage facility of record located near the aquifer that underlays the Cornwall Town Landfill (grid C2). Removing these bulk storage facilities from these sensitive locations should be explored; change in property ownership may present opportune times for removal.

The map shows four NYSDEC remediation sites.[12] They include:

- Star Expansion: Located on Industry Drive in Mountainville, between the NYS Thruway and Woodbury Creek (grid B4). Groundwater at this site is contaminated with chlorinated solvents. Public water supply wells are located within 1,000 meters of the site, but are believed to be hydrogeologically upgradient (up-hill), meaning that any onsite contaminants cannot flow uphill. Private residential wells are located within 200 meters and have shown no contamination. The site presents a significant environmental threat due to ongoing releases of contaminants from the source areas into the groundwater and as vapor into the soil.
- Majestic Weaving Corporation: Located on Mill Street, along the Moodna Creek (grid C2). Remedial measures have removed contamination from the site and, assuming these measures were effective, future exposure to these contaminants are not expected.
- Cornwall Town Landfill: Located between the NYS Thruway and Route 32 on Halloran Road on the north side of the Town (grid C2). This municipal waste landfill was closed in 1977. The site is currently being used for leaf composting and storage of gravel. Nearby wells have been sampled by the Department of Health and no contaminants were found.
- United States Military Academy: The area at the southern tip of the Town, shared by the towns of Woodbury and Highlands, is the location of many unexploded ordnances that originated from training and related military activities. The ordnances accumulated over many years.

The map also shows three State Pollutant Discharge Elimination System[13] permitted locations, or SPDES sites (shown as purple diamonds): Star Mountainville Industrial Park (grid B4)

[12] Remediation sites are found on the DEC's Environmental Site Database Search webpage. These include sites in the following programs: State Superfund, Brownfield Cleanup, Environmental Restoration, and Voluntary Cleanup. Databases on spill incidences and bulk storage are also accessible from this webpage.
[13] The SPDES permit program is New York's framework for implementing the Federal requirements of the Clean Water Act, including this law's National Pollutant Discharge Elimination System (NPDES) provisions.

discharging into Woodbury Creek and discharges from sewage treatment plants into Moodna Creek at grid C2 and at the mouth of the Moodna (grid D1).[14] SPDES is New York State's permit program that allows permitted discharges of domestic, municipal, commercial, and industrial wastewater sources under highly regulated conditions to prevent the pollution of local streams and other waterbodies. Proper treatment of wastewater is important to reducing the negative impact on water resources.

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[14] A newly constructed sewage treatment plant for Storm King School (along Route 9W near Mountain Road) releases treated water into a nearby local stream. This plant is not shown on the map as it is not included in the SPDES list. The DEC notes that the SPDES list may not be complete and that new permits are added periodically. The list is accessible from the DEC's State Pollutant Discharge Elimination System (SPDES) Permit Program webpage.

TOWN OF CORNWALL
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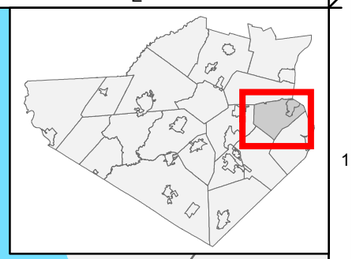
NATURAL RESOURCES INVENTORY

Public Wells, Aquifers, and Risk Sites



Wells and Environmental Risk Sites

- Public Wells
- SPDES Permits and Owners
- Petroleum Bulk Storage Facilities
- Chemical Bulk Storage Facilities
- NYS DEC Remediation Sites

Aquifers

- Stratified sand and gravel at land surface and below water table
- Stratified sand and gravel below clay or silt and the water table
- Stratified clay and silt with no or thin layers of sand and gravel at land surface and below water table
- Stratified sand and gravel at land surface and above water table

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

Hydrology

- Water Bodies
- Streams
- Direction of Flow

Scale 1:50,000

0 0.5 1 2 Miles

Descriptions of Risk Sites

SPDES - The State Pollutant Discharge Elimination System (SPDES) Permit Program is operated by the New York State Dept. of Environmental Conservation. The program is designed to eliminate and prevent the pollution of waters in New York State. Permits are granted to businesses, municipalities, and individuals that allow for the highly regulated and monitored disposal of wastewater.

Chemical Bulk Storage Facilities – The Chemical Bulk Storage Program, operated by the New York State Dept. of Environmental Conservation, monitors any aboveground storage tank larger than 185 gallons storing "hazardous substances" as defined in NYCRR Part 597. The program also monitors any underground storage tank regardless of size as well non-stationary tanks used to store 1,000 kg of chemicals for 90 consecutive days or more.

Petroleum Bulk Storage Facilities – The Petroleum Bulk Storage Facilities Program, operated by the New York State Dept. of Environmental Conservation, monitors any facility that stores more than 1,100 gallons of petroleum in aboveground and underground storage tanks. This program also monitors any facility with underground storage tanks larger than 110 gallons.

NYS DEC Remediation Sites – Remediation sites are contaminated sites controlled and monitored by the New York State Dept. of Environmental Conservation.

DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

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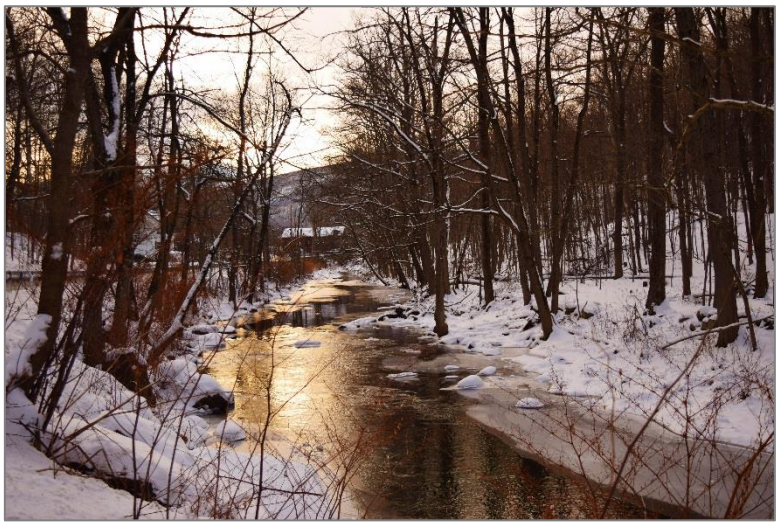
FLOODPLAINS

Map(s) referenced: Flood Zones & Flooded Roads

Why You Need This Map

The New York Climate Change Science Clearinghouse notes that the Northeast and New York State have seen a 71% increase in heavy precipitation events that have resulted in major and costly flooding (Melillo et al. 2014). Typically flooding happens in low-land areas that are naturally prone to flooding, known as floodplains. These areas are next to streams and other waterbodies that can become engorged and overflow during heavy rainfalls and from snowmelt from heavy snowfalls. (A broader discussion on the impact of climate change is found in the Climate Conditions and Projections chapter.)

Flood zones are delineated by the Federal Emergency Management Agency (FEMA) and the US Department of Housing and Urban Development. Delineated flood zones typically include historic floodplains and their floodways. Two flood zone categories are commonly used: 100-year and 500-year flood zones. Land areas and all structures lying within a 100-year flood zone have a 1% chance of flooding every year; areas within a 500-year floodplain have 0.2% chance of flooding annually. **Due to the increased frequency and severity of heavy precipitation events, communities throughout the US have seen multiple 100-year flood events happen in a given year and repeated, annual 500-year events.** The City of Houston, Texas, for example, has seen three 500-year floods in as many years (Vox, 2017).



Moodna Creek at Pleasant Hill Road lies in 100- and 500-year flood zones. During Hurricane Irene, the Moodna overflowed and closed this road.

Delineated flood zones, however, are not the only places where flooding can happen. Flooding can take place anywhere as a result of poorly designed or inadequate culverts and dams (see Streams & Water Quality chapter for further information). Haeckel and Heady explain that "[d]ue to many variables, such as the often-unpredictable nature of floods, local drainage problems, and the variable intensity of land development in watersheds, some flood-prone areas may not appear on designated floodplain maps, and floodplain designations may change over time as more information becomes available." The increase in impervious surfaces, like roads, driveways, and buildings, prevent absorption of floodwaters and results in increased stormwater runoff into waterways. In addition to the obvious risks that flooding presents to buildings, homes, and other properties and infrastructure, floodwaters can pick up pollutants and carry these materials to waterways and groundwater. Pollutants, such as toxic chemicals and hazardous materials, create additional risks to human health as well as negative impacts on wildlife habitat.

Planning around locally known flood-prone areas can help municipalities reduce the impact of floods on their communities. Cornwall, for example, has long been subject to flooding events that have eroded hillsides, damaged structures, and even caused dislocation from businesses and residences. **Local governments can institute policies and practices that harness and protect the benefits of undeveloped floodplains, such as slowing and storing floodwaters and reducing downstream flood damage, through conservative buffering around known flood-prone areas.** Other benefits of preserved floodplains include creating a natural vegetative safety zone for development and reducing the damaging impacts of floods. By implementing relevant policies, municipalities would also be supporting the plants and animals that live in natural floodplains and "tolerate occasional flooding and support the in-stream food web" (Haeckel & Heady, 2014).

Flood Zones & Flooded Roads Map

The most significant floodplain areas in Cornwall are located along the Moodna and Woodbury creeks, on the Hudson River shoreline, and along smaller streams in residential areas of the Town and Village (grid D2). The waterbodies shown on the map (springs, lakes, streams) contribute to Moodna Creek's flow. Moodna Creek begins in the Town of Blooming Grove where Otter Kill Creek and Cromline Creek converge, flows through the Village of Washingtonville and the Town of Cornwall, and passes through the Town of New Windsor before emptying into the Hudson River in Cornwall. It is the culmination of these water sources that can also lead to the flooding that has devastated portions of these municipalities.

The *Flood Zones & Flooded Roads Map* also shows roads that were closed and/or flooded during Hurricane Irene in 2011 (yellow) and the April 2007 spring northeaster (red). During these extreme weather events, many properties located near the mapped flood zones were flooded – even some that were not in delineated flood zones.

- Hurricane Irene closed many roads, including the segment of the NYS Thruway in Cornwall, Otterkill Road, portions of Route 32, Quaker Avenue, Continental Road, Hasbrouck Avenue, the Boulevard, and other smaller local roads.
- The April 2007 northeaster closed all of Route 9W in Cornwall, along with portions of Otterkill Road and Taylor Road near the Moodna Creek in the western part of the Town.

Stronger rain events also impact the Moodna in its more steeply sloped bank areas. After flowing through Salisbury Mills and Mountainville in western Cornwall as a relatively low-gradient stream in a flatter, valley-bottom landscape, the lower segment of the Moodna becomes somewhat steeper, beginning near the bridge at Route 32. In this area, the Moodna is flanked by steeper slopes in a deeper gorge comprised largely of glacial deposits that are steadily eroding. At Route 32 and other locations downstream of this point, this erosion presents a significant risk of impacting public and private properties at the top of slopes, including Mill Street across from the bridge at Route 32.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Flood Zones and Flooded Roads

FEMA Flood Zones

- 100-year Flood Zone
- 500-year Flood Zone

Flooded and/or Closed Roads

- Closed Roads - August 2011 (Hurricane Irene)
- Flooded Roads - April 2007

Other Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

Hydrology

- Water Bodies
- Streams

DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; US Army Corps of Engineers, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; Federal Emergency Management Agency, 2017

Flood zones are geographic areas that the Federal Emergency Management Agency (FEMA) has determined to possess a 1% annual chance (100-year flood) or a 0.2% annual chance (500-year flood) of being inundated by a flooding event. (Source: Federal Emergency Management Agency)

Hurricane Irene in August 2011 was Orange County's most intense flooding event in recent memory. At its maximum, over 11 inches of rain fell in parts of the county. The Nor'easter of April 2007, which produced 6 inches of rain in two days, previously held such a title.

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/20/2018

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WETLANDS

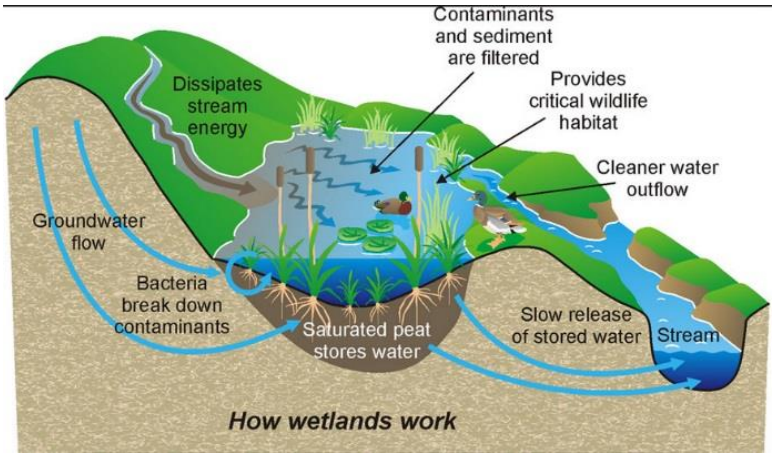
Map(s) referenced: Wetlands & Hydric Soils

Why You Need This Map

Whether you know them as marshes, swamps,[15] or bogs, the many benefits of wetlands to humans, animals, and plants are widely recognized through protective governmental legislation, by scientists, and by those who enjoy the recreational features supported by wetlands. Some of these benefits include:

- Holding and absorbing water, which helps control flooding and reduce damage downstream.
- Serving as naturally-occurring filtration systems, cleansing surface water of impurities. **Wetlands can remove or trap 20-60% of metals, 80-90% of sediment, and 70-90% of nitrogen** (Ecological Society of America, 2018).
- Holding and slowly releasing water from sources like snowmelt, rainfall, or runoff into groundwater, which help maintain base streamflow in dry weather and supports aquifers used for water supplies.
- **Storing 1-1.5 million gallons of floodwater for every acre of wetland** (US Environmental Protection Agency, 2001).
- Supporting 75% of commercially harvested fish through spawning areas (US Environmental Protection Agency, 2001). Producing food and organic material that supports commercial and sport fisheries. Wetlands also provide "breeding, feeding, and wintering habitat for hundreds of wildlife species," like birds, mammals, and amphibians. (USACE, 1998).
- Recreational activities, like kayaking, canoeing, birdwatching, hunting, and fishing.
- Serving as natural "carbon sinks" by helping reduce atmospheric greenhouse gases through excess atmospheric carbon storage (Association of State Wetlands Managers, 2018).

How do wetlands provide these important benefits? Wetlands are defined as "an area that is covered by shallow water or has waterlogged soils for long periods during the growing season in most years" (USACE, 1998). Additionally, wetlands must have hydric soils and support "plants that require saturated soils to survive … [or that] can tolerate prolonged wet soil conditions" (USACE Wetlands Identification, 2018). These features enable wetlands to act as, essentially, giant sponges. This image shows how wetland soils and their



The benefits wetlands provide.

[15] Marshes are wetlands with herbaceous plants as the dominant vegetation and are found inland near lakes and streams as well as coastal areas. Swamps are dominated by trees and other woody plants; they often have slow-moving and sometimes stagnant water, and are found near lakes and streams.

plants store water from both surface flow and groundwater flow, slowly releasing it to streams or aquifers.
Because of their critical ecological importance, wetlands are regulated by Section 404 of the Federal Clean Water Act and NYSDEC's Freshwater Wetlands Act. The presence of wetlands is often the reason many development projects are subjected to an environmental impact review under federal and/or state laws. The Freshwater Wetlands Act protects wetlands that are larger than 12.4 acres and the 100-foot buffer around them; smaller wetlands of unusual local importance can also be protected by the DEC. **Many communities in NYS have recognized the importance of wetlands by enacting legislation that protects smaller wetlands and vernal pools as small as 1/10th of an acre through local wetland laws, wetland overlay districts, and supplemental zoning standards.** (HREP and Cornell University created a very useful Summary of Municipal Wetland and Watercourse Protection Techniques, found in Appendix C.[16]). These wetland protection techniques can address the impact that land use decisions can have on wetlands by considering adjacent upland areas and connected hydrologic features, like streams.

The sources of wetland data have limitations, requiring public information and on-site observations to identify smaller wetlands and confirm regulated wetland size. For example, Black Rock Forest is known to contain more wetlands and hydric soils than are shown on the *Wetlands & Hydric Soils Map*. Haeckel and Heady note that the Federally-designated US Fish and Wildlife Service's National Wetland Inventory "maps often underestimate wetland area and omit smaller and drier wetlands." The wetland area at the Grail, by the intersection of Duncan Avenue and Stillman, is a case in point. Haeckel and Heady also note that the NYSDEC's Freshwater Wetland Maps were created with "minimal field checking, and are not intended to be accurate depictions of the limits of state wetland jurisdiction on any site." Both map sources are created by aerial photos analysis.

Wetland Mitigation

Mitigation, in the broadest sense, constitutes all the actions taken to counter adverse effects of a project. The term "wetland mitigation" is often used in a narrower, more specific way to mean creating new wetlands to provide equivalent value and functions when a proposed development project will destroy existing natural wetland. The science and practice of restoring, creating, or enhancing wetlands in a mitigation context is evolving, but still cannot replace the equivalent value and function of the original wetland. We should be cautious about permitting a wetland to be altered on the expectation that losses can be fully compensated. Protecting wetlands saves money by decreasing flood hazards, reducing the need for flood mitigation projects, and can decrease the cost of water treatment. **Priority must be placed on avoiding impacts to existing wetlands and flood plains given the uncertainties associated with mitigating loss of natural wetland values.**

Wetlands & Hydric Soils Map

This map shows four designations of existing and potential wetlands in the Town and Village: NYSDEC Wetlands (green), NWI Wetlands (purple), Probable Wetlands/Hydric Soils (pink), and Possible Wetlands/Somewhat Poorly Drained Soils (light brown).

Wetlands (green and purple) are primarily located at the bases of the mountains of the Hudson Highlands, including Storm King Mountain and Schunnemunk Mountain as well as areas within

[16] This document was provided by the Land Use Law Center of Pace Law School as part of its Land Use Leadership Alliance Training Program.

Black Rock Forest. In Cornwall, the largest wetlands areas are located west of Route 32 and near the NYS Thruway (Interstate 87) just south of the New Windsor border. Other significant wetlands lie near Orrs Mills Road and Route 94, to the west of the Thruway. Of the 722 NWI-classified wetlands in the Town, 57% are freshwater wetlands and 41% are estuarine and marine deepwater wetlands. In the Village, 98% of the existing, mapped wetlands are estuarine and marine deepwater wetlands. NWI-classified wetlands are also present on the grounds of the Hudson Highlands Nature Museum sites, the Outdoor Discovery Center and the Wildlife Education Center, with important vernal pools located at the latter site. (See Appendix D – National Wetland Inventory Wetland Classes.)

Probable Wetlands/Hydric Soils (pink) are found along the shores of the Hudson River, the Moodna Creek, Woodbury Creek, Canterbury Brook, and Baby Brook. Hydric soils have been mapped because they are areas where there is a particularly high potential for additional true wetlands. The widely scattered incidence of Possible (light brown) and Probable Wetlands interspersed in residential areas of the Town and Village should be carefully evaluated when those areas are targeted for any type of development or paving.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Wetlands and Hydric Soils

Wetlands and Hydric Soils

- NYS DEC Wetlands
- NWI Wetlands
- Probable Wetlands (Hydric Soils)
- Possible Wetlands (Somewhat Poorly Drained Soils)

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

DATA SOURCE: United States Geologic Survey, 2017; New York State Dept. of Environmental Conservation, 2017; National Wetland Inventory, 2017; United States Department of Agriculture, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

This map depicts wetlands delineated by the New York State Department of Envrionmental Conservation (NYSDEC) and wetlands identified in the USFWS National Wetlands Inventory. Probable and possible wetlands are also shown. These areas were identified based on soil drainage. Probable wetlands consist of hydric soil and possible wetlands consist of somewhat poorly drained soil.

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B. Freiman 6/20/2018

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STREAMS & WATER QUALITY

Map(s) referenced: Stream Classification; Stream Biomonitoring & Priority Waterbodies

Why You Need These Maps

Cornwall has a broad network of perennial, intermittent, and ephemeral streams that are admired for their beauty. Some are perennial, flowing continuously throughout the seasons, and some dry up during drier periods. The major perennial streams include the Moodna Creek and its tributaries flowing from the towns of Blooming Grove and New Windsor; Woodbury Creek and its tributaries flowing from the towns of Woodbury and Highlands; and a tributary of the Moodna, Idlewild Creek, and its tributaries flowing entirely from within Cornwall. With the exception of a few streams in southeast Cornwall, like Clove Creek and Dock Hill Creek alongside Pagenstecher Park that flow directly to the Hudson River, all streams in Cornwall flow into the Hudson River via the Moodna Creek and its tidal marsh. All are beautiful, but some are particularly magnificent like Baby Brook in Schunnemunk Mountain, pictured at left.

Baby Brook in Schunnemunk Mountain.

Our streams are also important for habitat health, water quality and availability for drinking water and irrigation, flood management, and recreational enjoyment. Streams add immeasurably to our residents' quality of life and to the value of many properties. Development of land usually causes increased surface water runoff through the reduction of permeable surfaces. This increase in impervious surfaces (buildings, parking areas, and roads) significantly impacts streams, hydrology, and water quality. Development also can result in the alteration of streams or modification of their flows from installation of culverts and dams. These changes can increase flooding, increase the deposition of pollutants in our waterbodies, and interfere with habitats (see Stream & Riparian Habitat and Floodplains chapters). With our changing climate, precipitation has become more variable and extreme in the Northeast, exacerbating the deposition of a wide range of contaminants into streams and other local waterbodies from increased stormwater runoff.

Assessing Water Quality

"The [federal] Clean Water Act imposes strict standards on water quality and pollutant levels…" (Haeckel & Heady, 2014). States are required to assess and report on the quality of their waterbodies by the Act. New York compiles the water quality assessment information in the Waterbody Inventory / Priority Waterbodies List database, which "…tracks the degree to which waterbodies are meeting their "best uses" based on their DEC classification…and monitors progress toward identification and resolution of water quality problems, pollutants, and sources" (Haeckel & Heady, 2014).[17]

[17] The water quality assessment process is fully explained in *The New York State Consolidated Assessment and Listing Methodology*.

The water quality assessment process begins with an analysis of the specific use a waterbody can support; this is presented in the *Stream Classification Map*. Additional data is analyzed to measure actual water quality and track impacts caused by humans; this additional analysis is combined with the use analysis to arrive at an overall water quality assessment for a waterbody.[18] The *Stream Biomonitoring & Priority Waterbodies Map* presents a summary of this complex, multi-data point analysis.

Stream Classification Map

Freshwater streams and waterbodies are classified by the DEC based on existing or best usage from classes AA or A for drinking water (in green on this map) to D, which is not suitable for drinking, swimming, nor for supporting fisheries. Streams with a classification of A, B, or C can also have a designation standard of T (may support trout) or TS (may support trout spawning). A summary description of NYSDEC's stream classification categories appears below.

- AA or A: Used as a source of drinking water (green on the map)
- B: Public bathing and other contact recreation is an appropriate use, but not for drinking (yellow)
- C: Waters supporting fisheries and non-contact activities (orange)
- D: Lowest classification (not on map as none identified in Cornwall)

"Waterbodies that are designated as C (T) or higher (e.g., C (TS), B, A, or AA) are collectively referred to as *protected streams*, and are subject to additional regulations and require a State permit for disturbance of the bed or banks" (Haeckel & Heady, 2014). As Cornwall has no streams in the D classification, all streams are protected by DEC regulations.[19] **It should be noted that many streams with sources in protected parks may be reclassified with a higher stream class and standard upon further analysis.**

In the Town and Village, well-shaded cool to cold-water streams with clean gravel bottoms are able to support trout, including native species like brook trout (*Salvelinus fontinalis*). Additionally, streams usually have a designation standard of T due to reliable discharges of cool aquifer groundwater that persists through the summer. These trout-friendly areas are listed below.

- Mineral Spring Brook: Is currently listed as a Class C (TS) stream capable of supporting trout spawning. (grids B5, C4/C5)
- Woodbury Creek: Is currently listed as a Class C (TS). (grid B4)
- Moodna Creek: The extension of the Moodna from the Town of Blooming Grove to Interstate 87 is currently listed as a Class C stream (grids A2/B2/B3). On the east side of the Thruway to just south of Orrs Mills Road, the Moodna is listed as a Class B (T) stream capable of supporting a trout population and suitable for swimming and other contact recreation (grids B3/C3/C2). It is again listed as a Class C stream until it empties in the Hudson River (grids C2/D1). Although Baby Brook, which begins in Schunnemunk Mountain State Park and joins the Moodna at Taylor Road, is listed as a Class C stream, upon further analysis it may be reclassified as a high as a Class A stream.

[18] Water quality in every major watershed in New York is assessed on a 5-year schedule as part of the DEC's Rotating Integrated Basic Studies (RIBS) Program.
[19] Other systems for classifying and describing streams are based on a range of physical conditions, habitat values, and human uses, but these are not addressed in this report.

- Idlewild Creek: Is largely classified as Class C (TS) stream (grids C4/D3/D2/D1). Its tributaries beginning deep in Black Rock Forest, including Canterbury Brook and Black Rock Brook, are listed as a Class A streams. From the Upper Reservoir, it is listed as a Class A (TS). (grid D3)

Stream Biomonitoring & Priority Waterbodies Map

Every natural waterbody is part of an ecosystem that can support a wide variety of plant and animal life. These aquatic ecosystems are directly affected by the quality and quantity of the water in them. Biological monitoring or biomonitoring evaluates and monitors water quality in waterbodies. Organisms, such as fish, macroinvertebrates, and sometimes plant life, are catalogued by number and type through standardize, controlled collection methods. The diversity, numbers, and types of organisms found determine the health of the waterbody. The results reveal if the organisms were collected from clean or polluted water. The single biggest cause of water quality impairment in our region, as determined by the DEC's Stream Biomonitoring Program, is excessive nutrients reaching many waterbodies (NYSDEC, 2004). Excess nutrient loading to streams, lakes, groundwater, and wetlands originates from many sources, including lawn fertilizer, pet waste, septic systems, wastewater discharges, and agriculture. This is one of the main drivers of increasing occurrences of harmful algal blooms that can present direct risks to the health of people, pets, and wildlife. Heavy salt use also negatively impacts waterbody habitats. Hydrologic modification was also found to be a primary source of impact as of 2008 (NYSDEC, 2008).

A culvert that interferes with the upstream passage of aquatic life.

Water quality in every major watershed in New York is assessed on a 5-year schedule as part of the DEC's Rotating Integrated Basic Studies (RIBS) Program. Water quality standards can be upheld through the State Permit Discharge Elimination System (SPDES) permit program, which issues discharge permits and enforces compliance in setting DEC Water Quality Classifications.

This map provides information on Cornwall's water quality via two assessment sources:

- The NYSDEC Waterbody Assessment uses six categories to describe the overall water quality of a waterbody: *impaired* waters, waters with *minor impacts*, *threatened* waters, waters with impacts that *need verification*, waters having *no known impacts*, or *unassessed* waters. Cornwall waterbodies fall under three categories only.
- The Water Quality Assessment (BAP Score), or Biological Assessment Profile, is a subset of the larger assessment methodology that informs the NYSDEC Waterbody Assessment. The BAP methodology assesses streams and rivers based on the health of their macroinvertebrate community and assigns waterbodies the following categories based on their scores: not impacted, slightly impacted, moderately impacted, and severely impacted. The Orange County Water Authority (OCWA) conducted this assessment as part of the NYSDEC Stream Biomonitoring Program.

- Both biomonitoring assessments are time and site specific.[20] The locations are shown as green, yellow, and orange circles for the BAP assessment and purple for the NYSDEC assessment.

Relevant BAP score are bulleted below. No streams in Cornwall that were found to be Severely Impacted. Three of the 18 assessment sites found moderately impacted water quality (D3 at Canterbury Brook, D2 at Idlewild Creek, B4 at Woodbury Creek). Nine sites found slightly impacted water quality. Six sites found not impacted water quality.

- Not Impacted (green dot) – Very good water quality. Virtually unaffected by human disturbance or receiving discharges that minimally affect biota.
- Slightly Impacted (yellow dot) – Good water quality. The macroinvertebrate community is slightly, but not significantly altered from the pristine state.
- Moderately Impacted (orange dot) – Poor water quality. Fish may propagate, but probably will not survive.

Relevant NYSDEC Waterbody Assessment descriptions are bulleted below. Assessments were made based on five sites primarily along the Moodna and Woodbury creeks, additional data collected from non-site specific sources, and the BAP assessments conducted by OCWA. Although Moodna Creek and most of its tributaries are assessed as having no known impacts, additional assessments are encouraged as the Moodna is known to be impacted by Route 32. Additionally, Baby Brook and a tributary of Woodbury Creek coming from Schunnemunk Mountain should be re-assessed to confirm their current assessment of minor impacts. This is also the case with the portion of Mineral Spring Brook that is in the protected environs of Black Rock Forest. The balance of streams and waterbodies are categorized as unassessed and would also benefit from an assessment process. The DEC is in support of assessments made by local watershed groups or citizen-based groups through existing State programs, like the Water Assessment by Volunteer Evaluators program.

- Minor Impacts (pink lines): The intended uses (see *Stream Classification Map*) are still supported despite some water quality impacts. "Although water quality improvement is desired, protection…strategies may be more appropriate for these waters" (NYS, 2017).
- No Known Impacts (green lines): Monitoring data and information point to no use restrictions or other water quality impacts.
- Unassessed Waters (blue): Water quality information is insufficient to evaluate use.

It is important to note that environmental conditions are always changing and newer data might show different results.

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[20] Additional information on the metrics that form the BAP scores is found in NYSDEC's Fact Sheet on Assessment of Water Quality Impact on Streams and Rivers.

TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Stream Classification

Stream Classes and Standards

- Class A
- Class A(T)
- Class A(TS)
- Class B
- Class B(T)
- Class C
- Class C(TS)
- Water Bodies

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

CLASSES - Stream classes are defined by the NYSDEC based on existing or best usage. The classification AA or A is assigned to waters used as a source of drinking water. Classification B indicates a best usage for swimming and other contact recreation, but not for drinking water. Classification C is for waters supporting fisheries and suitable for non-contact activities. The lowest classification and standard is D.

STANDARD - The standards of quality and purity established for all classifications (A, B, C, etc.). Waters with classifications A, B, and C may also have a standard of (T), indicating that it may support a trout population, or (TS), indicating that it may support trout spawning (TS). Special requirements apply to sustain these waters that support these valuable and sensitive fisheries resources.

NY State Public Health Law Statute PART 701 CLASSIFICATIONS-SURFACE WATERS AND GROUNDWATERS (Statutory authority: Environmental Conservation Law)

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Stream Biomonitoring and Priority Waterbodies

Water Quality Assessment (BAP Score)

- 7.5 - 10.0 Not Impacted
- 5.0 - 7.49 Slightly Impacted
- 2.5 - 4.99 Moderately Impacted

NYSDEC Waterbody Assessment

- Minor Impacts
- No Known Impact
- Unassessed Stream
- Unassessed Water Body
- NYSDEC Biomonitoring Sites
- Dams
- Culverts
- Direction of Flow

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; Orange County Water Authority, 2017; Orange County Dept. of Planning, 2018; New York State Dept. of Transportation, 2017; United States Geological Survey, 2017

Water Quality Assessment was performed by the Orange County Water Authority (OCWA) from 2004 to 2012. Biological Assessment Profile (BAP) scores are based on in-stream collection of benthic macroinvertebrate samples and subsequent lab analysis. Parameters for developing a BAP score include species richness, EPT richness, Hilsenhoff's biotic index, percent model affinity, nutrient biotic index, species diversity, and non-Chironomidae and Oligochaeta richness.

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N

Scale 1:50,000

0 0.5 1 2 Miles

GEOLOGY AND SOILS

Layered silt-stone boulder in Black Rock Forest.

CHAPTERS, MAPS, AND RELATED CONTENT

Bedrock Geology

Bedrock Geology Map

Soils

General Soil Classes Map
Calcareous & Glacial Outwash Soils Map

Steep Slopes

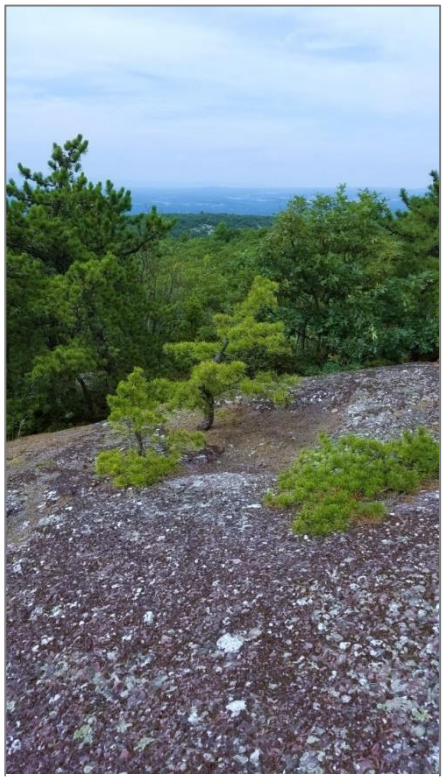
Steep Slopes Map

BEDROCK GEOLOGY

Map(s) referenced: Bedrock Geology

Why You Need This Map

A region's landscape is influenced by its geology and the processes which modify it. The Hudson Valley's diverse geology contributes to our local ecosystems and enables many human activities and industries as well. Gypsum and limestone deposits along the Hudson River support cement factories; shale and sand, and gravel mines dot the Valley's landscape; the "black dirt" region's fertile soils support agriculture; and mountain ridges and other geologic features are popular destinations for outdoor recreation. Bedrock and surficial geology influence soil properties as well as groundwater and surface water chemistry, which in turn influence the type of ecological communities that can thrive (Haeckel & Heady, 2014). More detailed information on the different types of soils found in Cornwall is available in the Soils chapter.



Puddingstone (Schunnemunk Conglomerate) is a unique surficial geologic feature that caps bedrock; found atop Schunnemunk Mountain.

Bedrock is solid rock that typically lies beneath soil and other broken or unconsolidated material (regolith). Bedrock is made up of igneous, sedimentary, or metamorphic rock, and it often serves as the parent material for regolith and soil. A bedrock deposit that occurs at Earth's surface is called an outcrop (Britannica, 2018). Knowledge of regional bedrock characteristics is important to municipal planning, as it plays an important role in determining the viability of well water access and productivity. The presence of bedrock can also influence the cost of road and building foundation construction as well as large-scale slope and grade stabilization. More detailed information about Cornwall's wells and aquifers can be found in the Groundwater & Aquifers chapter.

Surficial geology is the study of landforms and the geologic materials lying on top of the bedrock. These materials can be sand and gravel, clay and silts, and glacial tills[21]. **Mapping these glacial deposits and other aspects of surficial geology provides important information to aid land use decisions, such as building roads and other structures; safeguarding drinking water; preparing for natural disasters; protecting wildlife and their habitats; and mitigating the effects of geologic hazards[22].** Such information benefits residents and industry alike.

[21] The Encyclopaedia Britannica defines glacial till as "unsorted material deposited directly by glacial ice and showing no stratification. Till is sometimes called boulder clay because it is composed of clay, boulders of intermediate sizes, or a mixture of these."

[22] FEMA notes that non-seismic geologic hazards like landslides, land subsidence, and expansive soils cause average annual damage that may be comparable to damage caused by flooding, earthquakes, and volcanos, with atmospheric hazards like heavy rainstorms, flooding, and droughts exacerbating already present geologic hazards.

Bedrock Map

Cornwall has its share of stunning stone outcroppings in Storm King State Park that have captured the imagination of settlers, rusticators, and tourists for generations. This map identifies the four main types of bedrock to be found in the Town and Village.

- The southeast portion of Cornwall, which lies in the Hudson Highlands, is composed of undifferentiated gneiss, granite, and granitic gneiss (McGoey, 1994). Storm King Mountain is primarily composed of granite (granitic gneiss) and a small band of mafic gneiss. This bedrock was deposited during the Middle Proterozoic period.
- In the southwest portion of the Town, granite gives way to the layered siltstone and shale of the Martinsburg formation that forms Schunnemunk Mountain. In many places, the bedrock features mentioned above are overlaid with Schunnemunk Conglomerate, which is a grayish-purple sandstone embedded with quartz, quartzite, chert, and shale of differing colors. This is often referred to a puddingstone and is a unique feature of the Schunnemunk Ridge.
- Much of Cornwall's more developed areas and commercial corridors are underlain by graywacke and shale bedrock within the Mount Merino and Austin Glen formations. The western part of the Town north of Schunnemunk Ridge is also mostly greywacke, shale, and siltstone.
- Significant portions of land on either side of the Moodna Creek are comprised of overburden material like sand and gravel, otherwise known as alluvium, and other material of glacial origin, also known as drift, that were deposited during the Quaternary period. The bedrock geology for these areas is not known due to covering soils. A small portion at the southwest end is characterized by limestone, dolostone (dolomite), and carbonate mélange deposited during the Cambrian period.

The surface of the bedrock under the Town and Village varies in depth from surface exposure to greater than 100 feet deep. A 1994 report commissioned by the Orange County Water Authority found that wells drilled into bedrock units within the Town are typically not highly productive. Most residential wells within the Town are low yield bedrock wells. No high yield bedrock wells were identified as a part of this study (McGoey, 1994).

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
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NATURAL RESOURCES INVENTORY

Bedrock Geology

Generalized Bedrock Material

- Cambrian - Lower Ordovician, limestone, dolostone (dolomite)
- Cambrian - Middle Ordovician, carbonate, melange
- Lower Devonian - Silurian, limestone, dolostone (dolomite)
- Middle Devonian, shale, siltstone
- Middle Ordovician, graywacke, shale
- Middle Proterozoic, gneiss, granitic gneiss
- Middle Proterozoic, gneiss, quartzite
- Middle Proterozoic, granite, granitic gneiss
- Middle Proterozoic, granitic gneiss, metasedimentary rock
- Middle Proterozoic, mafic gneiss
- Quaternary, alluvium, glacial drift
- Holocene, water

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Hydrology

- Water Bodies
- Streams

DATA SOURCES: New York State Museum, 2017; United States Geological Sruvey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

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N

Scale 1:50,000

0 0.5 1 2 Miles

SOILS

Map(s) referenced: General Soil Classes; Calcareous & Glacial Outwash Soils

Why You Need These Maps

Familiarity with the c1haracteristics and different classes of soils is an essential starting point to understanding the natural processes that influence our environment. The soil information both drives and reflects the uses imposed on it by human activities. A soil is generally defined by common characteristics, such as acidic or alkaline, loamy, sandy, clayey, deep or shallow nature. It is important to consider these characteristics when a municipality is considering development and conservation plans. Soils function to regulate and filter water flow, decompose vegetative matter and other wastes, provide nutrients for agriculture, and support infrastructure. Soil data can play an important role in agriculture and forestry, as it tells us what plants can grow in a certain area and what level of irrigation and fertilization soil may need. **Specific soil properties are critical factors to consider in land use planning: whether it is appropriate or feasible to build, whether septic systems or other types of wastewater treatment can or must be utilized, or how much surface area should be left in a permeable state.** They can also dictate whether certain building or foundation materials would be subject to corrosion by the pH character of the surrounding soil.

Jones Farm, located on Soils of Statewide Importance.

Once polluted or depleted, soils can require long periods of replenishment/remediation or, worse, need to be abandoned. Recent studies have shown that soils, particularly those adjacent to roadways, are vulnerable to salt and other chemical and heavy metal runoff. Depending on drainage characteristics, nearby streams and other bodies of water can also be impacted to the detriment of their dependent organisms. Stormwater drainage infrastructure can slow the degradation of soils adjacent to roadways as well. Salt- and chemical-laden runoff from cold weather treatments on road surfaces is increasingly being recognized as a threat to soil quality adjacent to roads and can impact water quality of nearby streams and lakes. It is appropriate for municipalities to consider alternative treatments for road surfaces.

In cases where soil quality creates areas of prime agricultural value or supports habitat for rare or endangered species, it may be determined that these areas are valuable enough that they should not be subject to development.

General Soil Classes Map

The *General Soil Classes Map* focuses on the relative agricultural utility of the soils in our area. These classifications are determined by criteria set by the USDA. There are a number of small patches of Areas of Prime Farmland (Pink) and Prime Farmland If Drained (Purple) within the borders of Cornwall, often contiguous to each other. These soils possess the most ideal combination of physical and chemical characteristics for producing agricultural products and

growing feed for livestock. Looking at the *Calcareous & Glacial Outwash Soils Map*, we see that there is often a correlation between prime farmland and the presence of glacial outwash, which consists of fertile soil material as well as sand and gravel that aid in drainage.

Soils of Statewide Importance (Green) do not meet the criteria for Prime Farmland (or Prime Farmland If Drained), but still possess significant mineral loads that can support agriculture under the right conditions. Looking at the *Calcareous & Glacial Outwash Soils Map*, we see a correlation between these soils of statewide significance and the presence of calcareous and somewhat calcareous soils.

There are two very small deposits of black dirt/organic soil (Gray) in Cornwall, located in grid B2 on the *General Soil Classes Map*. These soils are highly fertile and contain high levels of organic matter and chemical nutrients. The dominant soil class shown on the *General Soil Classes Map*, however, is Non-Agricultural (Yellow). These areas are predominantly located in and around the mountainous and rocky areas of Storm King and Schunnemunk Mountain state parks and the ridgelines of Black Rock Forest where the soil coverage is comparatively shallow. It should be noted that much of the areas identified as Prime Farmland, Prime Farmland If Drained, and Soils of Statewide Importance are generally the location of residential and light commercial development within the Town. **The Town should consider identifying any undeveloped prime farmland that may remain and prioritizing it for preservation or agricultural use.** See the Land Use & Land Cover and Zoning & Tax maps chapters for more detail.

Calcareous & Glacial Outwash Soils Map

The soil types in Cornwall are dominated by silt, rock outcrops, gravel, and gravelly silt. These soils result from glacial till deposits and together form a drainage sequence from the excessively drained, mountainous soils, to the poorly drained silts. The *Calcareous & Glacial Outwash Soils Map* shows that the Calcareous (magenta) and Somewhat Calcareous (Yellow) soils, with their potential to provide habitats for rare species, are located throughout the lowland areas of the Town and Village. These areas are also characterized as "Soils of Statewide Importance" and have agricultural value even though they do not meet the criteria for Prime Farmland and Prime Farmland If Drained.

In geological terms, calcareous soils are those that contain a high proportion of calcium carbonate in the form of calcite or aragonite (limestone). Calcareous, or alkaline, soils serve as a habitat for a broad diversity of organisms and are often associated with uncommon habitats and rare species. Given their relatively high pH (7.5 to 8.4), they are not ideal for most agricultural uses. Somewhat Calcareous Soils can have a pH as low as 6.5, and can function as agricultural land with the introduction of manure and other nitrogen-rich soil additives like compost.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
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NATURAL RESOURCES INVENTORY

General Soil Classes

Soil Classes

- Prime Farmland
- Prime Farmland If Drained
- Soils of Statewide Importance
- Black Dirt / Organic
- Non-Agricultural

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Hydrology

- Streams
- Water Bodies

DATA SOURCES: United States Dept. of Agriculture Soil Conservation Service, 2017; Soil Survey Geographic Database, 2017; New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

PRIME FARMLAND – Soils that possess the most ideal combination of physical and chemical characteristics for producing agricultural products and for growing feed for livestock. These properties include resistance to erosion, infrequent flooding, and the ability to resist oversaturation. Prime Farmland soil criteria are established by the U.S. Dept. of Agriculture.

PRIME FARMLAND IF DRAINED – Soils that meet all criteria for Prime Farmland soil except for depth to seasonal high water table. These soils are suitable for drainage. New York State designates somewhat poorly drained soils as Prime Farmland if Drained as long as they meet all other Prime Farmland soil criteria.

SOILS OF STATEWIDE IMPORTANCE – New York State defines Soils of Statewide Importance as soils that do not meet all criteria for Prime Farmland or Prime Farmland if Drained, but still possess significant mineral loads and fall within land capability classes 2e, 2s, 2w, 3e, 3s, 3w, or 4w (see link below).

BLACK DIRT/ORGANIC – Black Dirt soils originate from the bottoms of ancient glacial lakes. These dark soils are highly fertile and are ideal for agriculture.

NON-AGRICULTURAL – These soils do not meet any of the above criteria for farmland use.

For more information regarding soil classes, the U.S. Dept. of Agriculture, and the Soil Survey Geographic Database (SSURGO), please visit: https://www.nrcs.usda.gov/.

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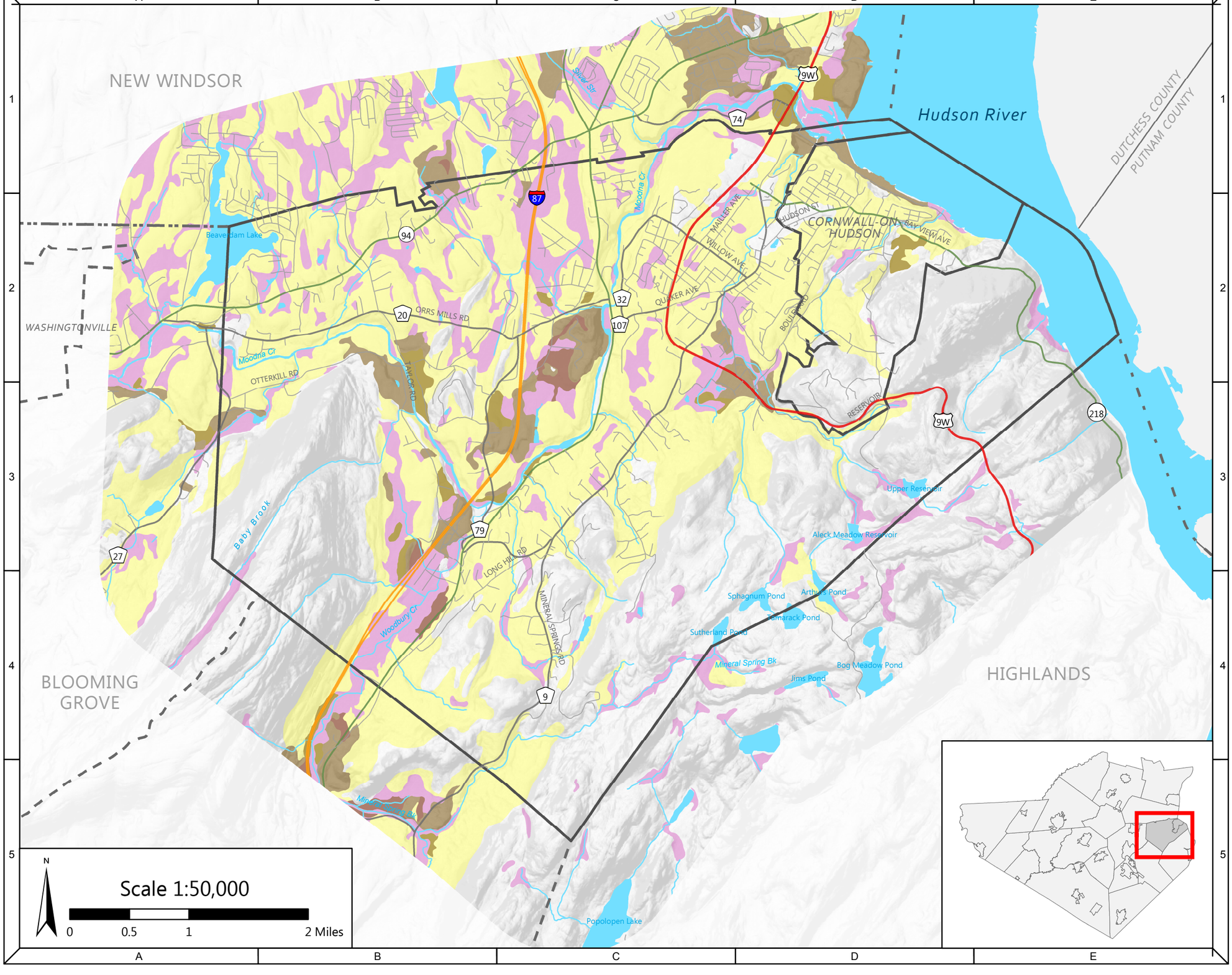
TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Calcareous and Glacial Outwash Soils



Soil Types

- Glacial Outwash
- Calcareous
- Somewhat Calcareous

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

DATA SOURCES: New York State Dept. of Transportation, 2017; United States Geological Survey, 2017; New York State Dept. of Environmental Conservation, 2017; Orange County Dept. of Planning, 2018; Natural Resource Conservation Service, 2017; Scenic Hudson, 2017

Calcareous or potentially calcareous soils are soil units with reaction [pH] of greater than 6.5 in surface, subsoil, or substratum layers.

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STEEP SLOPES

Map(s) referenced: Steep Slopes

Why You Need This Map

The topic of steep slopes is an important consideration for municipalities when planning development of any kind. Steep slopes may also determine the physical limitations of development within a given municipality. The major concerns around slopes are erosion and flooding, both of which impact the integrity of the natural and built environments around them. Trees and other vegetation hold the soils in place and can mitigate the effects of rain and wind on steeply sloped terrain. **Allowing development or otherwise disturbing steeply sloped areas makes soil unstable and more prone to erosion, and can have unintended adverse impacts on structures, roads, and natural and man-made drainage systems.** In addition to posing a hazard to nearby structures and transportation corridors, the erosion of steep slopes can also greatly impact water quality, as loosened soil is washed into streams increasing water turbidity and sediment deposition. Any pollutants present in slope soil will also be spread into drainage systems in this fashion. This has the potential to negatively impact surface drinking water sources.

An example of a steep slope requiring stabilization following clearcutting for development (not local).

Steep slopes are valuable resources and are notable for their scenic and environmental qualities, which can bring special character to a community. Ravines and steep hillsides often provide scenic vistas, hiking opportunities, and natural beauty that can boost eco-tourism and property values. In many cases there is limited accessibility to steeply sloped terrain, and these areas provide vital undisturbed habitat for many plant and animal species. Steep slopes and cliffs can also form microclimates that can support unique and rare specimens of plants and animals.

The steepness of a slope is usually expressed as a percentage (rise over run). In general, the stability of slopes is determined by their grade and length, but also by their soil geology, amount of vegetative cover, and the particular climate they are exposed to. Defining what constitutes "steep" for the purposes of slope regulation is at the discretion of each municipality, provided that the definition is reasonable. The United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) and numerous New York State municipalities more or less adhere to the following characterizations of steep slopes:

Minor Slopes < 8%	▪ Minor slopes are best suited for development and less costly to develop; ponding, runoff, and erosion may be a problem on nearly level slopes from 0-2%, unless the soils are well drained. ▪ Erosion can occur on slopes as slight as 2-3%, depending on the types of soils present.
Moderate Slopes 8-15%	▪ Present moderate septic problems because of possible seepage. ▪ Erosion potential exacerbated by the increase in grade.
Steep Slopes > 15.1% (Very or Extremely Steep Slopes >25%)	▪ Slopes of 15% and above are generally considered to be more vulnerable to soil erosion, sedimentation, and other problems than more gently sloping areas, with vulnerability increasing with steepness. ▪ Slopes greater than 15% have soils that tend to be thin and less fertile. ▪ Many municipalities have land use restrictions for slopes of over 15%. ▪ Construction on such areas can increase the sediment load of streams 100 fold. ▪ Slopes of >25% should be left in a natural condition, carefully maintained in grass or tree cover, or used as pastureland.

Adapted from Chatham Township Environmental Commission, 2004

Steep Slopes Map

The slope designations on this map are divided into three grades. Green indicates slopes of 8-15%, yellow indicates slopes of 15.1-25%, and red indicates slopes of greater than 25.1%. The white areas are areas that are below 8% of slope. A considerable amount of the land within Cornwall's borders is classified as steeply or very steeply sloped. The most significant areas of very steep slopes are encompassed within the borders of Schunnemunk Mountain State Park, Storm King State Park, and Black Rock Forest. Outside the borders of these protected areas, however, there are numerous areas of steep slopes within both the Town and Village borders. **Paired with the NRCS slope concerns mentioned above, municipal planning officials should primarily concern themselves with the yellow and red areas on this map when making decisions about land development or tree and vegetation removal.**

Significant portions of the Village of Cornwall-on-Hudson are also characterized by steeply sloped or very steeply sloped terrain. Residential areas along Mountain, Maple, and Deer Hill Roads as well as the Boulevard are potentially impacted by the slope considerations discussed in the chart above. The bluffs overlooking the Hudson River to the east account for the remainder of the steeply sloped land in the Village and erosion is currently a problem in certain areas where roads and development exists. Other steeply slopes areas in the Town of Cornwall are mainly found bordering the Moodna Creek and along the residential corridor of Angola, Mine Hill, and Mineral Springs Roads. There are locations along the Moodna Creek where significant erosion has occurred, largely a result of steep slopes in close proximity to the Creek. These areas will continue to pose a challenge to future Town governments, departments, and planning boards.

It should be noted that the Town of Cornwall zoning code generally considers slopes of >25% to be inappropriate for development.[23] However, given the challenges of increased erosion from heavier rain events due to climate change, the Town should consider revisiting this criterion. Many municipalities have a steep slope zoning overlay as part of their general zoning code. The Town's existing Ridge Preservation zoning overlay focuses only on the largely undeveloped, mountainous terrain within its borders. Given that significant parts of the Town and Village outside of that overlay are steeply sloped, Cornwall should consider developing a steep slope overlay to ensure careful consideration and management of development in these areas. For more information regarding recommendations for zoning, see the Zoning & Tax Maps chapter.

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[23] The Schunnemunk Agricultural Scenic Overlay terms slopes in excess of 30% as a significant barrier to development.

TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Steep Slopes

Slope Grade

- 8 - 15% Slope
- 15.1 - 25% Slope
- >25% Slope

Hydrology

- Streams
- Water Bodies

Roads

- Interstate
- Federal Highway
- State Route
- County Road

DATA SOURCES: United States Dept. of Agriculture Soil Conservation Service, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

Slope data acquired from the USDA Soil Conservation Service: Soil Survey of Orange County, NY; KS Olsen etal 1975. Soil map units analyzed by OCWA to three categories of slope: suffix "C" 8-15% slope; suffix "D" 15-25% slope or "moderately steep": and suffix "F" >25% slope "very steep".

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CLIMATE CONDITIONS AND PROJECTIONS

Storm King Golf Course inundated during Hurricane Irene (2011).

CHAPTERS, MAPS, AND RELATED CONTENT

Climate Conditions & Projections

Coastal Sea Level Rise Map

Appendix E: Additional Information on Climate Conditions and Projections

CLIMATE CONDITIONS & PROJECTIONS

Map(s) referenced: Coastal Sea Level Rise

The climate is changing and the associated impacts are being felt from the global level down to our local community. Increasing temperatures, rising sea level, and changing precipitation patterns are leading to cascading and interconnected impacts on our health, our environment, and our economic vitality. In order to increase our resilience to climate hazards – such as flooding, heat waves, and drought – we must first understand their predicted impacts and then use that information to guide all subsequent land use decisions, including adaptation. **Natural resources are an important asset in planning for resilience, managing climate risks, and recovering from extreme weather events** (Haeckel & Heady, 2014). A brief overview of the effects of our changing climate follows, with additional content found in Appendix E – Additional Information on Climate Conditions and Projections.

We are seeing **temperature** increases that are making our summers hotter and our winters warmer and shorter. Annual average temperatures have increased **2°F** and winter temperatures have increased **5°F** in New York since 1970. Temperature fluctuations are impacting the growing season of our food crops and the beauty of our autumnal leaf season. These changes, in turn, are impacting our produce and tourism economies.

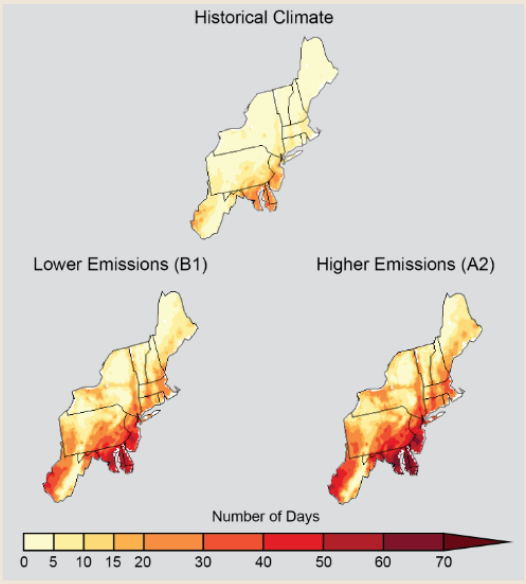


Figure 16.2. Projected number of days per year with a maximum temperature greater than 90°F averaged between 2041 and 2070, compared to 1971-2000 (Historical Climate), assuming continued increases in global emissions (A2) and substantial reductions in future emissions (B1). (Figure source: NOAA NCDC / CICS-NC).

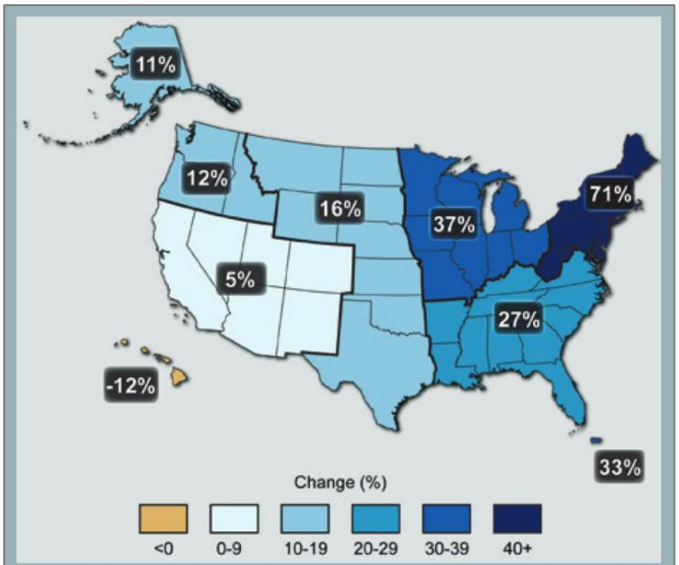
Projected increases in the number of days over 90 °F.

The incidence of **extreme temperatures** is also increasing. "By mid-century, the Hudson Valley could annually experience 3-12 days above 95°F, and four to seven heat waves that last 1-2 days longer than average" (Zemaitis, 2018). "Climate Impacts on Human Health" notes that these increases will put in danger the lives of our most vulnerable residents—our children and elders—from extreme heat and poor air quality.

The *Third National Climate Assessment* further notes that increasing temperatures are projected to result in **decreased air quality** from increased ground-level ozone and/or particulate matter air pollution (Melillo et al., 2014). "Ground-level ozone (a key component of smog) is associated with many health problems, such as diminished lung function, increased hospital admissions and emergency room visits for asthma, and increases in premature deaths" (Melillo et al., 2014). Ground-level ozone and particulate air matter will be of special concern in Orange County because cars are the greatest source of air pollution, given the high single-occupancy vehicle rate and commuting distances in Orange County; traffic at Stewart Airport, Interstate 84 and Interstate 87, and nearby power plants will also play a role.[24]

[24] Orange County has seen a general improvement in air quality since 1999 across many National Ambient Air Quality Standard (NAAQS) metrics, resulting in a decreased number of unhealthy days for people suffering from asthma, lung

Precipitation patterns are also changing. The Northeast and New York have seen a 71% increase in heavy precipitation events between 1958 and 2012 that have resulted in more frequent and costly flooding (Melillo et al. 2014). This type of intense rain event can quickly saturate soils to the point that they cannot recharge aquifers, even on some forest and undeveloped lands. Our aquifers are also seeing a lower recharge rate due to the reduction in snowpack, caused by increased winter temperatures. Snowpack decline is also negatively impacting our winter recreational industries and economy.



Percent changes in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012 for each region. There is a clear national trend toward a greater amount of precipitation being concentrated in very heavy events, particularly in the Northeast and Midwest. (Figure source: updated from Karl et al. 2009[c]).

Observed change in very heavy precipitation.

Rising **sea levels** are affecting all waterfront communities, including those located along the tidal Hudson River.[25] "Since 1900, sea level in the lower Hudson has risen one foot" (Haeckel & Heady, 2014), with an additional projected rise of up to 75 inches, or over six feet, for the Lower Hudson Valley by the end of this century (Horton et al. 2014). Rising sea levels will lead to flooding along estuary shorelines and tidal tributary waters, particularly in low lying areas. Flooding will be compounded by **heavy storm surges**, such as those we experienced from Hurricanes Irene and Sandy, and intense rainfall leading to additional tributary and stormwater flooding.

Sea Level Rise

The Village of Cornwall-on-Hudson has shoreline on the Hudson River and is vulnerable to sea level rise. This image shows two important community assets: Donahue Memorial Park in the Village and the wastewater treatment plant in the Town at the mouth of the Moodna (source: New York Climate Change Science Clearinghouse).

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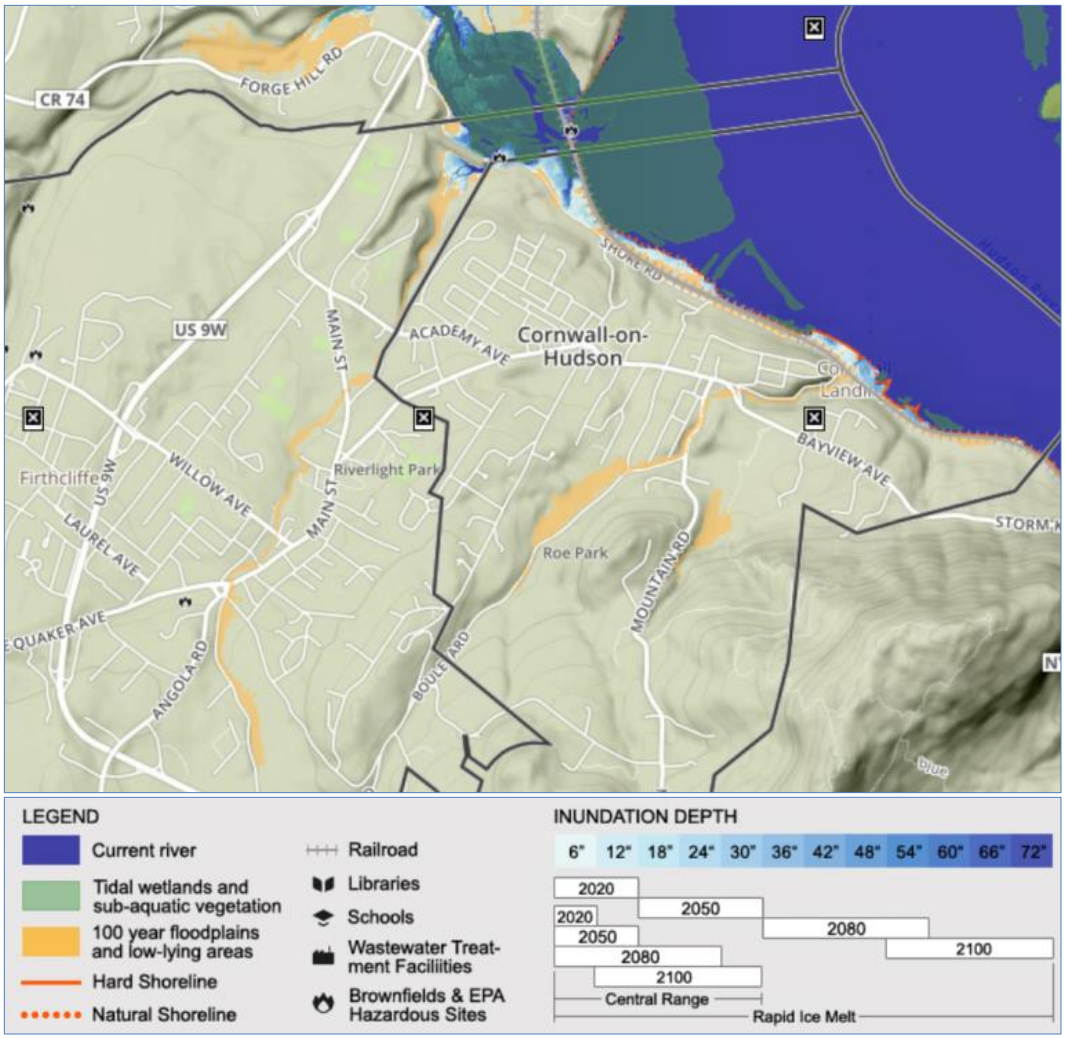
disease, and heart disease as well as for older adults, children, people engaged in outdoor activities, and the general population. (AirCompare, Scorecard, and Healthgrove)

[25] As Zemaitis explains (Zemaitis, 2018), "The Hudson River is connected to and influenced by the sea; therefore it experiences tides and contains saltwater in its lower reaches. This is why the River south of the federal dam at Troy is considered an estuary. It is also the reason why the Hudson River's water level is rising with global sea level".

In addition to the riverfront inundation, or flooding, modeled in the *Coastal Sea Level Rise Map*, the below image shows the flooding that would reach inland (orange) in a 6-foot sea level rise scenario. Source: Scenic Hudson Sea Level Rise Mapper.



Coastal Sea Level Rise Map

The *Coastal Sea Level Rise Map* at the end of this chapter depicts the areas of future inundation that Village and Cornwall residents would experience from a rising Hudson River. In a 3-foot sea level rise, 100-year flood scenario (yellow on the map), key portions of the wastewater treatment plant are submerged and Shore Road is almost inaccessible; half of Donahue Memorial Park is also submerged. **In a 6-foot sea level rise scenario (in red), the entire wastewater treatment site and Donahue Memorial Park are submerged and River access is at the train tracks.**

BECOMING A CLIMATE-RESILIENT CORNWALL

We are already seeing the costly effects of our changing climate and have responded to these impacts in different ways. For example, we have protected sewage treatment facilities by raising their height or hardening barriers, repaired drainage infrastructure destroyed by heavy storms, cleared away storm debris, and cleaned up our flooded houses. **Understanding the best-case and worst-case scenario projections arm us with the ability to take proactive measures to make our community more resilient to the impacts of climate-caused hazards.**

Below is a short list of actions that the New York State Climate Smart Communities Program recommends that communities like ours pursue as part of any resiliency planning and as a means of responding to the expected federal and state mandates for "strong coastal and floodplain construction standards and pre-disaster mitigation planning."

1. Conduct an assessment of municipal and county documents, where applicable, to determine the degree to which plans, ordinances, and strategies incorporate resiliency planning.
2. Develop or update a vulnerability assessment to identify "vulnerable populations, businesses, infrastructure, and natural resources". The assessment process assists municipalities with building their knowledge and ability to plan for climate-caused hazards.
3. Engage the public in identifying the effects of historic storms and make available to the public "information on the natural and beneficial functions of floodplains, wetlands, and green infrastructure". Periodically conduct storm preparedness outreach to residents and businesses.
4. Develop or update a heat emergency plan. Explore the expansion of cooling centers.
5. Increase shading in public spaces with trees and other structures.
6. In the municipal comprehensive plan, reference other plans that address hazard exposure reduction and reduction in property loss, such as a local multi-hazard mitigation plan, floodplain management plan, local waterfront revitalization plan, stormwater management plan, natural resources inventory/plan, etc. Include resilience in the comprehensive plan's mission, vision, or goals.
7. Incorporate future flooding and preferred adaptation strategies into local planning. Promote best practices and technologies to address flooding.
8. Right size culverts.
9. Seek financial assistance for flood adaptation.
10. Maintain existing natural infrastructure. Use natural vegetated buffers to protect assets from flood risk. Identify and conserve natural areas contributing to stormwater management.
11. Encourage building and permitting officials to complete training on retrofitting flood-prone residential buildings.
12. Implement a program to conserve and reuse water.
13. Create a source-water protection program.
14. Establish special area ordinances for habitat preservation.
15. Reduce greenhouse gas (GHG) emissions by supporting and implementing renewable energy and energy efficiency projects.
16. Pursue Clean Energy Communities designation and Climate Smart Communities certification.

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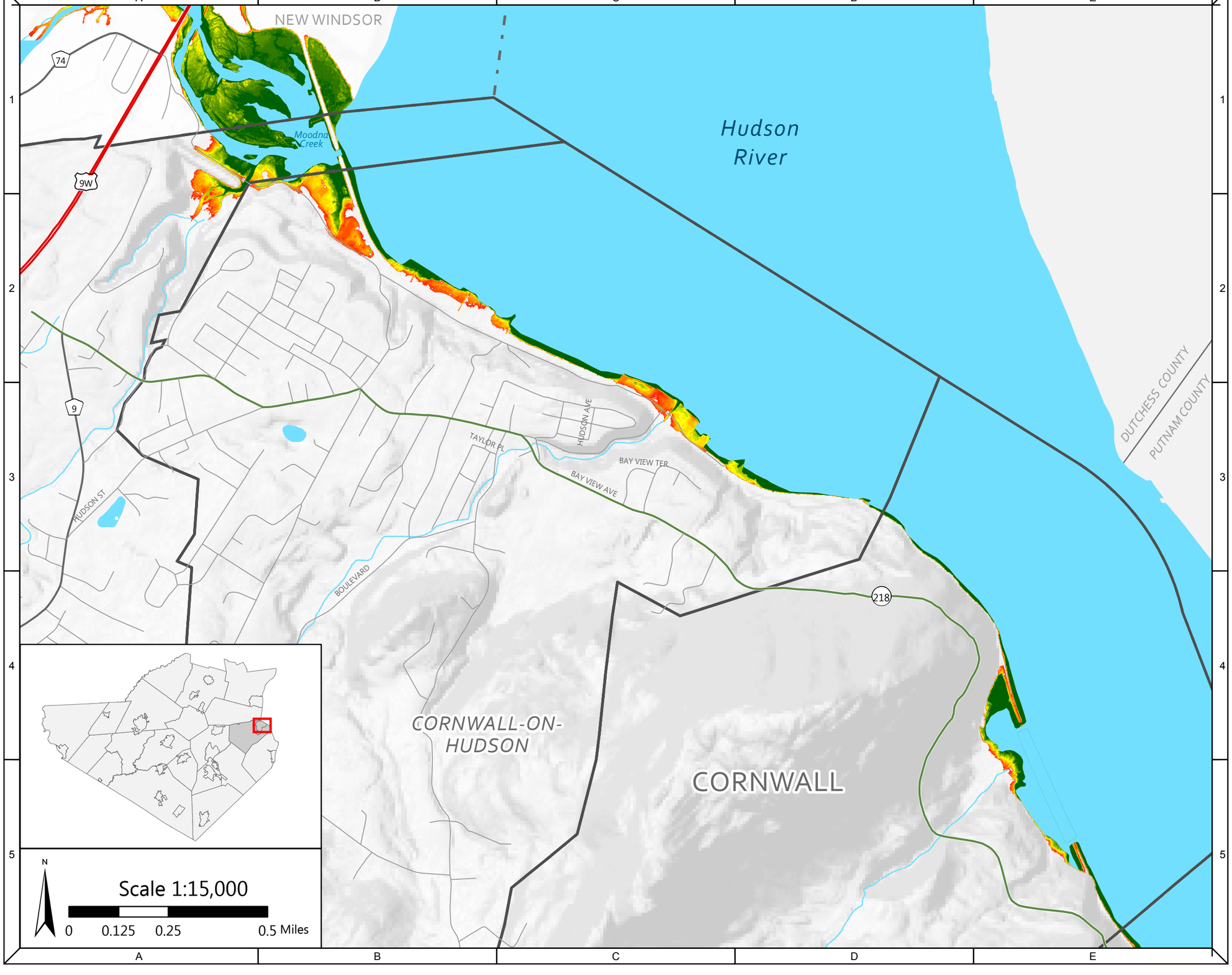
TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Coastal Sea Level Rise



N

Scale 1:15,000

0 0.125 0.25 0.5 Miles

100-Year Sea Level Inundation

0 ft.
3 ft.
6 ft.

Hydrology

Streams
Water Bodies

Roads

Interstate
Federal Highway
State Route
County Road
Local Road

DATA SOURCE: New York State Dept, of Environmental Conservation, 2017; Scenic Hudson, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

DESCRIPTION OF INUNDATION MODEL
(Scenic Hudson, 2017)

Scenic Hudson's inundation layer is a "modified-bathtub" model of current and potential future Hudson River inundation zones. The model uses a base condition of mean higher-high water (MHHW), which is the height of the higher tide each day averaged over a 19 year period. The extent of each vertical 6" (0.5 ft) increase in inundation above MHHW is modeled up to a level of 72" (6 ft). Raster values of 6-72 represent inches of increase above MHHW, while 0 represents the current extent of MHHW.

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/19/2018

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Cornell University

LAND USE

Aerial image of Cornwall, with portions of the towns of Blooming Grove, Highlands, and New Windsor.

CHAPTERS, MAPS, AND RELATED CONTENT

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Farmland Soils & Agricultural Parcels Map

Conservation & Public Lands

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Proposed Pilgrim Oil Pipeline Map
Proposed Anchorages Sites Map

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Appendix I: Preservation of Natural Features from Pace Law School Land Use Law Center
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LAND USE & LAND COVER

Map(s) referenced: Land Cover

Why You Need This Map

The natural beauty of the Hudson Valley is a source of pride for its residents and is responsible for our strong tourism industry. Our challenge is to preserve the region's remaining beauty while allowing for appropriate land uses that minimally impact the natural resources important to our health and the health of our biological communities.

Smart land use decisions are more important than ever. Extreme weather events and drinking water pollution and availability have highlighted the effects of poor land use decisions. For example, the increase in impervious surfaces from development of structures, parking lots, and roads have made some communities more flood prone. The fragmentation of undeveloped areas by roads and development impedes wildlife movement and reduces habitat quality. Poorly placed developments, such as those sited too close to streams or on steeply sloped land, can result in declining stream health, degraded aquatic habitats, and lower water quality due to erosion and pollution. Even agricultural land uses can have detrimental effects in a watershed if poor management practices permit excess nutrients, sediment, and pathogens to flow into waterways.

Cornwall Plaza, with minimal green stormwater infrastructure elements and high impervious surface area.

Better land use decision-making must start with an understanding of our natural resources. **By viewing land use and land cover data along with maps of streams, waterbodies, forest cover, wetlands and hydric soils, and other sensitive resources, communities can make better decisions for future growth.** According to the Smart Growth Network, one of the principles of smart growth is to preserve open space, farmland, natural beauty, and critical environmental areas by directing new development to existing community centers. These rediscovered traditional planning principles from centuries past can reduce municipalities' future infrastructure needs and costs, and foster more walkable communities that support commerce in community centers.

Haeckel and Heady (2014) note that "land cover data sets…should not be used for site planning and are not a viable substitute for on-the-ground knowledge and site visits…." Satellite-derived land cover data do, however, allow planners, planning boards, elected officials, and developers to understand patterns of land use and to identify possible impacts of development proposals on the larger context of surrounding natural resources.

Orange County Context

The National Oceanic Atmospheric Administration's Coastal Change Analysis Program (C-CAP) Land Cover Atlas for Orange County reveals an increase in development and impervious surface

area between 1996 and 2010: developed area increased by 14.23% and impervious surface area by 16.89%. The majority of the increase in development has been Low Intensity Developed (LID), which is typically comprised of single family housing, particularly in rural neighborhoods, but also includes other types of land uses. Forested and agricultural lands have lost the most land to development, with losses calculated at 6.06 square miles and 4.46 square miles, respectively. The chart below shows the percentages of total developed land and total impervious surface area in Orange County in 1996 and 2010.

Land Cover Changes	**1996**	**2010**
Percent Developed	9.6%	10.97%
Percent Impervious Surface Area	3.26%	3.81%

Land Cover Map

The *Land Cover Map*[26] shows natural land cover classes, such as forests and grasslands; semi-natural habitats, such as farmland, pastures, and managed woods; and developed land cover, which in the Town and Village can include residential, commercial, and institutional uses.

The majority of land cover for the combined municipalities is forest (see *Forest Patches & Regional Forest Linkage Zones Map*). Our community is fortunate to be cradled by large, unfragmented forests in Storm King State Park and Black Rock Forest along the southeastern municipal boundary and in Schunnemunk Mountain State Park along the southwestern boundary. There is additional undeveloped land in the form of wetlands, cultivated cropland, and land planted for pasture/hay. Forested areas appear in shades of green.

The map areas colored from pale pink to maroon represent the developed areas, with increasing percentages of imperviousness. Generally, the combined municipalities see development concentrations in the northeast areas in grids C2 and D2 as well as around Beaver Dam Lake straddling grids A1/A2 and B1/B2. Developed areas also follow the principal vehicular routes of Angola Road, Long Hill Road, Mineral Springs Road, Orrs Mills Road, Clove Road (aka County Road 27), State Route 94, State Route 32 (aka Woodbury Road), and Federal Highway 9W. **The Village's developed area is roughly a third of its total land cover. The Town's developed area accounts for roughly one eighth of the total land cover.**

Cross referencing the *Land Cover Map* with the *Steep Slopes Map* illustrates that development in the Town and Village is primarily located on slopes of less than 15%. Some development has occurred in the more wooded and steeper mountainous slopes between 15.1% and 25%. **Future development on these slopes should be discouraged due to the increased propensity for erosion and expensive drainage treatments that may not work for the long term.** Additionally, building in the more mountainous areas results in loss of forest cover and wildlife habitat. Only in relatively few areas have the Town and Village built on very steep slopes of greater than 25%. Current zoning no longer allows for construction on very steep slopes.

[26] The data sets for the *Land Cover Map* are drawn from the 2011 National Land Cover Database (NLCD). NLCD is hosted by the Multi-Resolution Land Characteristics (MRLC) consortium of 10 federal agencies that coordinate and generate consistent and relevant data cover information at the national scale for a wide variety of environmental, land management, and modeling applications. The data are collected by satellite at 30-meter resolution, and provide special reference and descriptive data for characteristics of the land surface, such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. (See www.mrlc.gov for more information.)

Agricultural production is present in Cornwall, represented on the map as cultivated crops, hay, and pasture, and running along the central area of both municipalities. These areas appear as browns, grays, and yellows. **Cornwall's agricultural areas are also some of the most scenically beautiful areas in our community.**

Woody and emergent herbaceous wetlands (slate blues) occur primarily in the lower elevations in the northern part of the Town and along waterways. They are not readily apparent on this map, but can be best identified when cross referencing the *Wetlands & Hydric Soils Map*. More details on the distribution of wetlands in the municipalities are included in the Wetlands chapter.

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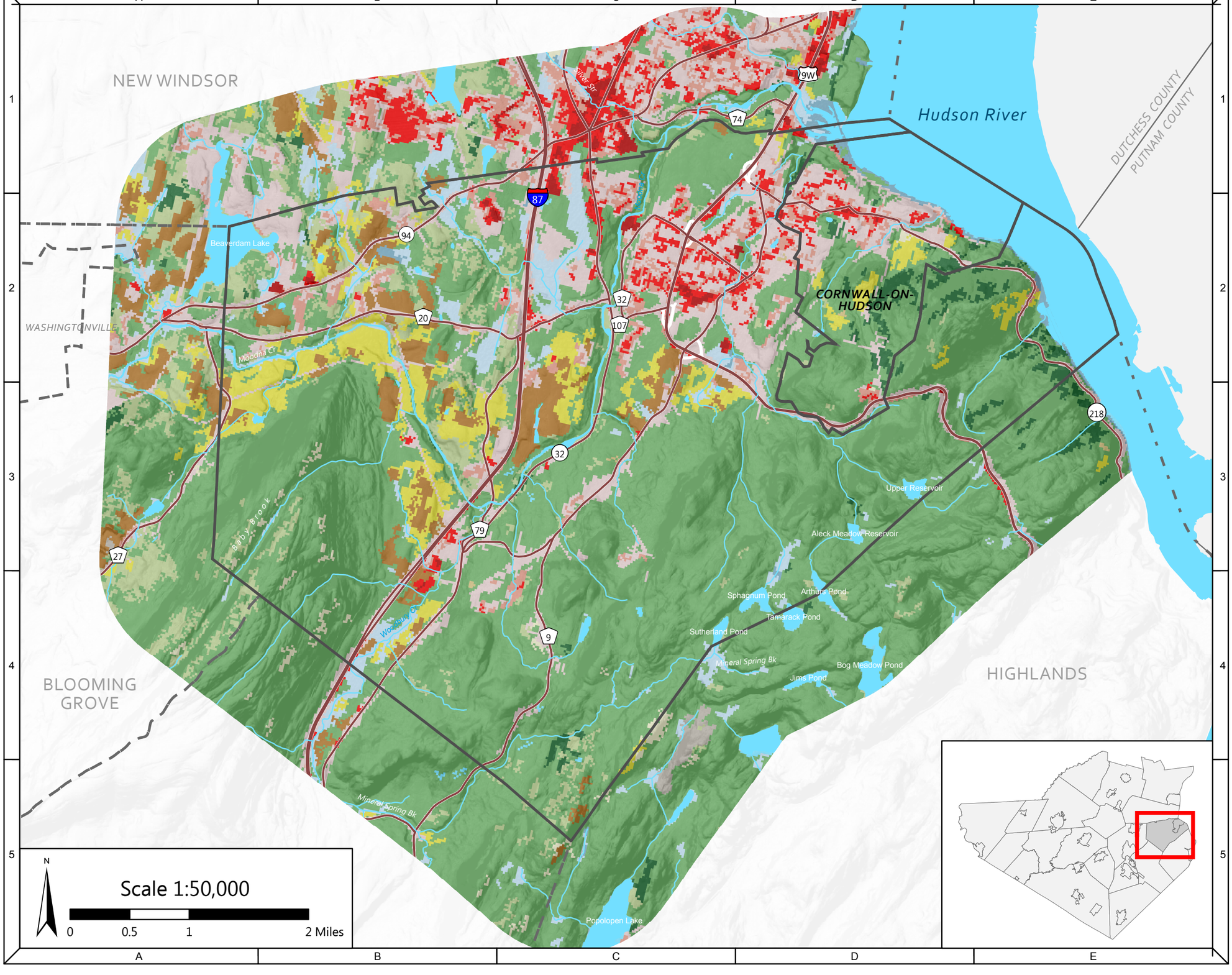
TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Land Cover



Land Cover Classes

- Open water
- Developed, open space; 0-19% impervious
- Developed, low intensity; 20-49% impervious
- Developed, medium intensity; 50-79% impervious
- Developed, high intensity; 80-100% impervious
- Barren land (rock/sand/clay)
- Deciduous forest
- Evergreen forest
- Mixed forest
- Shrub/scrub
- Grassland/herbaceous
- Pasture/hay
- Cultivated crops
- Woody wetlands
- Emergent herbaceous wetlands

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Hydrology

- Water Bodies
- Streams

DATA SOURCES: National Land Cover Database, 2011; United States Geological Sruvey, 2017; New York State Detp. of Environmental Conservation, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

Land cover classes are based on the National Land Cover Database (NLCD), a satellite-based 30-meter-resolution land cover database with coverage of the US. For more information, visit https://www.mrlc.gov/nlcd2011.php.

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FARMLAND

Map(s) referenced: Farmland Soils & Agricultural Parcels

Why You Need This Map

Agriculture is a significant part of the economy and character of the communities in Orange County and New York State. The Hudson Valley in particular has seen a boom in agro-tourism; breweries, wineries, and distilleries; and organic farming operations that feed urban demand for locally sourced produce. The definition of farmland in this chapter includes actively cultivated cropland, livestock pastures, orchards, hayfields, and nurseries. Statewide, there are more than 35,000 farms on approximately seven million acres, which represents more than 20% of the state (NYS Agricultural Society, 2018). New York ranks high among the major agricultural states in the nation, ranking in the top 10 in production of 30 commodities. It is the second largest producer of apples, snap beans, and maple syrup; third in cabbage, grapes, and dairy (which is the largest segment of the State's agricultural sector); and fourth in pears (NYS Department of Agriculture and Markets, 2018). Even so, **farmland in New York is rapidly diminishing in the face of increased residential development and the decline of small family-owned farms**. According to the American Farmland Trust:

- More than 4,000 farms in New York State have been lost to real estate development since the 1980s.
- More than 80% of the fruits and vegetables grown in New York come from farms that are currently threatened by development.
- 30% of New York farmland is owned by farmers who are over the age of 65.
- Only 5% of farmland in New York has been permanently protected.

Edgwick Farm raises goats and produces goat's milk products on a parcel zoned suburban low-density residence (SLR), which allows as a permitted accessory use the keeping of domestic animals on appropriately sized lots.

Creating an inventory of these farm parcels is vital to prioritizing the most important agricultural areas in the Hudson Valley region for preservation and encouraging new agricultural commerce on existing farmland.

Soil quality and characteristics are the foundation of the agricultural economy in New York, and soil features like nutrient load, acid/pH balance, the ability to hold or drain moisture, slope, and texture (grain size), are all important for agricultural productivity. These characteristics differ widely based on factors like the underlying geology, glacial history, and flooding frequency. Soils can sometimes be very different, even in two fields that are in close proximity. Because of

the importance of these soil qualities, soils are very specifically classified by the USDA. The classifications are then grouped into larger designations that generally indicate how productive the soil could be for agriculture. The chapters on Soils and Bedrock Geology provide additional detail on this topic and these designations.

Farmland Soils & Agricultural Parcels Map

If agriculture is important to the regional economy and the character of the Town, then it is important to know where farms are, and the location of the highest quality farmland soils. This map shows where various farm parcels are located within Cornwall's borders, as well as where the best agricultural soils are located, as identified by the USDA.

Cornwall does not have an abundance of farm parcels. Much of what was once farmland has been developed for residential, commercial, and municipal uses over the centuries. The majority of remaining farmland parcels is located in the western part of the Town and is dedicated to field crops like hay and horse farming pastures. There are a number of vacant farm parcels that feature prominently on the *Meadows, Grasslands, & Shrublands Map*. Also visible on the map are a single parcel classified as orchard located at Jones Farm and a single parcel classified as livestock and products along Route 94.

The shaded areas showing Prime Farmland, Prime Farmland If Drained, and Soils of Statewide Importance match the areas profiled on the *General Soil Classes Map*. More detailed descriptions of these soils can be found in the Soils chapter and glossary.

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Farmland Soils and Agricultural Parcels

NYS Real Property System Classes

- 105 - Vacant Farmland
- 110 - Livestock and Products
- 112 - Dairy Products
- 113 - Cattle, Calves, Hogs
- 116 - Other Livestock
- 117 - Horse Farm
- 120 - Field Crops
- 151 - Apples, Peaches, Cherries, etc.

Farmland Soils

- Prime Farmland
- Prime Farmland If Drained
- Soils of Statewide Importance
- Black Dirt / Organic

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Local Road

Hydrology

- Water Bodies
- Streams

DATA SOURCES: New York State Dept. of Taxation and Finance, 2018; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2017; New York State Dept. of Environmental Conservation, 2017

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N

Scale 1:50,000

0 0.5 1 2 Miles

CONSERVATION & PUBLIC LANDS

Map(s) referenced: Protected Open Space

Why You Need This Map

Conservation and public lands are areas where the natural resources identified in this report are most likely to be protected from future development. By mapping our existing protected lands, we can determine where identified resources are secure and where they are threatened. After identifying the gaps in natural resource protection, our community can prioritize threatened areas for future protection. Of particular importance are undeveloped areas that act as linkage zones between existing preserved lands. Linking and expanding these natural habitats can help sustain healthy wildlife populations and reduce the potential for isolated habitat islands that are created when natural areas become fragment or surrounded by development.

Cornwall is fortunate to have several large blocks of protected land, including Storm King State Park, Black Rock Forest, and Schunnemunk Mountain State Park. Each of these protected areas consists of over 1,500 acres that are rich in natural resources that will never be threatened by development. Much of this land was protected through the work of state agencies and non-profit organizations with a mission to conserve natural resources. There are numerous non-profit organizations that are active in the area, including Black Rock Forest, Hudson Highlands Land Trust, Open Space Institute, Orange County Land Trust, and Scenic Hudson. The amount of protected land is likely to continue to grow through their work.

The categories of protected land shown on the maps included with this report have differing methods and levels of protection. Conservation easements are areas where the land is owned privately, but future development is restricted in order to protect the property's conservation values. Municipal Parks may be protected with a primary goal of providing recreational opportunities to the community. There are also properties that are not shown on the map that are not formally protected, but function as conservation lands because they are owned by an entity that values natural resources, such as an educational institution.

Mineral Spring Falls in Black Rock Forest, a public nature preserve.

Protected Open Space Map

The Town and Village together contain 7,473 acres[27] of protected land, which represents approximately 38% of the land in these municipalities. Approximately 21% of the Village is protected.

[27] Some areas are protected as nature preserves owned by non-profits and are also protected by conservation easements. For the purpose of this statistic, these areas were counted only once.

The following is a description of the categories of protected land within the Town and Village:

State Parks: 2,933 Acres
Storm King State Park and Schunnemunk Mountain State Park are partially located in the Town of Cornwall. These parks are managed by the Palisades Interstate Park Commission and they are open to the public for passive recreation. Storm King State Park extends into the towns of Blooming Grove and Woodbury, and Schunnemunk Mountain State Park extends into the Town of Highalnds.

Nature Preserves: 4,092 Acres
Black Rock Forest is the largest protected area in the Town. Black Rock Forest consists of 3,914 acres, the majority of which are in Cornwall. The forest contains over 24 miles of trails that are open to the public for passive recreation. Black Rock Forest is also permanently protected by a conservation easement. Although the map classified Black Rock Forest as a public nature preserve, it is actually privately owned land with public access to trails during daylight hours. Black Rock Forest extends into the Town of Highlands.

Another protected area is Leone Preserve, which is owned by the Orange County Land Trust. The Hudson Highlands Nature Museum has two locations: the Village location, the Wildlife Education Center on the Boulevard, is owned by the Village; the Town location, the Outdoor Discovery Center on Route 9W, is permanently protected by a conservation easement held by Scenic Hudson.

Conservation Easements: 987 acres
There are 12 conservation easements in the Town and Village, which are held by various non-profits, including Storm King Art Center, Hudson Highlands Land Trust, Open Space Institute, Orange County Land Trust, and Scenic Hudson. Angola Road Park, commonly known as Cornwall Dog Park, is owned by the Town and has a conservation easement held by Scenic Hudson. Approximately eight acres of this 40-acre parcel is enjoyed by dogs and their owners.

Municipal Parks: 79 acres
Municipal parks include Riverlight Park, Roe Park, and Harold Avenue Park (Laurel Crest Park) in the Town, and Donahue Memorial Park in the Village. Some of these parks are designed and developed for active recreation with ball fields and facilities (such as Riverlight Park), while others are largely undeveloped and open for passive recreation (such as Roe Park).

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TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

Protected Open Space

Protected Areas

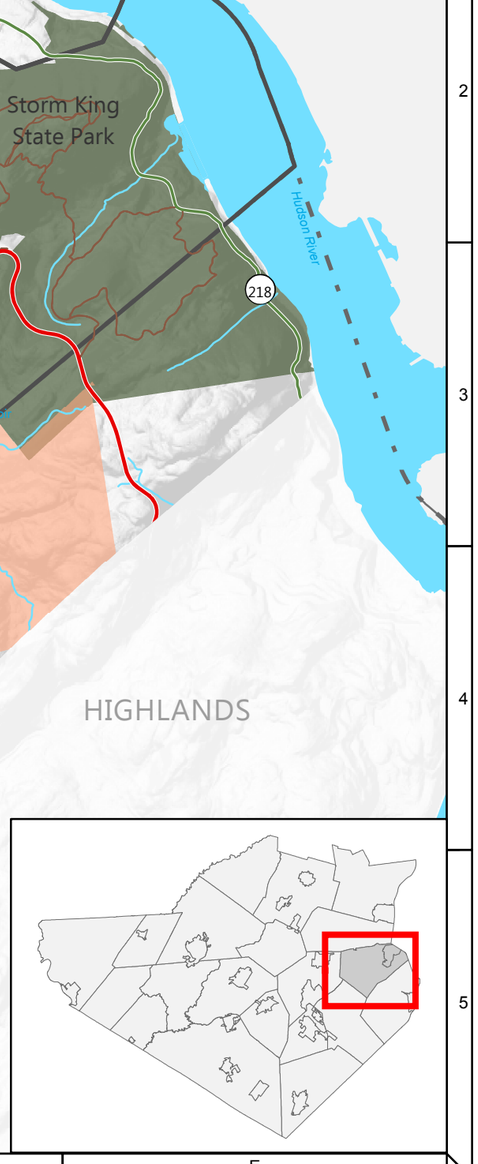
- Municipal Park
- County Park
- State Park
- Public Nature Preserves
- Conservation Easements

Hydrology

- Streams
- Water Bodies

Roads

- Interstate
- Federal Highway
- State Route
- County Road
- Hiking and Walking Trails



DATA SOURCES: New York State Dept. of Environmental Conservation, 2017; United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018

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B. Freiman 6/19/2018

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PROPOSED FOSSIL FUEL INFRASTRUCTURE

Map(s) referenced: Proposed Pilgrim Oil Pipeline; Proposed Anchorage Sites

In addition to the proposed fossil fuel infrastructure that is discussed below, Cornwall is exposed to fossil fuel related risks from the transport of oil on the CSX rail line along the Hudson River. The fuel is transported in primarily single-walled train cars, commonly referred to as bomb trains, and carry highly flammable Bakken crude oil. Bakken Crude comes from the Bakken shale formation in North Dakota, adjacent states, and some Canadian provinces.

Derailment of Bakken crude oil trains can cause fireballs burning so hot that they cannot be immediately addressed by emergency responders. Each train car can hold up to 30,000 gallons of crude oil; bomb trains can consist of up to 100 cars and, as such, pose a significant threat to local communities if they become derailed. "US Department of Transportation guidelines call for a one-mile "exclusion zone" for fires involving trains hauling flammable liquids and gasses such as Bakken crude oil" (Riverkeeper, 2019). The following Cornwall schools are all inside the one-mile exclusion zone: Cornwall-on-Hudson Elementary School at 0.31 miles from the CSX tracks, New York Military Academy at 0.75 miles, and Cornwall Central Middle School at 0.97 miles (Riverkeeper, 2019). Important habitat for migratory fish and eel along the Moodna Creek and Idlewild Creek also fall within the exclusion zone.

Map depicting transport of Bakken crude oil from shale formation locations to final processing points.

Proposed Pilgrim Oil Pipeline Map

This map shows planned fossil fuel infrastructure and its proximity to sand and gravel aquifers, public institutions, and other important natural areas. The proposed Pilgrim Oil Pipelines would carry both refined petroleum products (gasoline, diesel, heating oil, and kerosene) and crude oil underground between Linden, NJ and Albany, NY largely along the NYS Thruway. The project's co-lead agencies, New York State Thruway Authority (NYSTA) and NYSDEC determined the project would have "potentially significant impact on the environment" and hence issued a "Positive Declaration" under Article 8 of the Environmental Conservation Law. A "Positive Declaration" requires a full Environmental Impact Statement (EIS) with a public scoping requirement and public comment period.

The pipelines would be 356 miles long, with 116.4 miles being in New York State, with five laterals, four pump stations, 10 meter stations, and 35 permanent access roads. During construction there would be 50 temporary access roads and seven major construction zones/staging areas. Each pipeline would be 20 inches in diameter and have the potential to transport 8.4 million gallons per day (200,000 barrels/day). The pipelines would cross 257 waterways and would be run very close to municipal water supplies. There are also 296 (9.2 linear miles) crossings of wetlands, including 25 crossings of NYSDEC-protected freshwater wetlands (approximately 19 along mainline pipelines and six along laterals). Recent data

suggests that pipelines are prone to leaking and have unreliable leak-detection systems; sometimes days pass before a leak is detected and repaired.

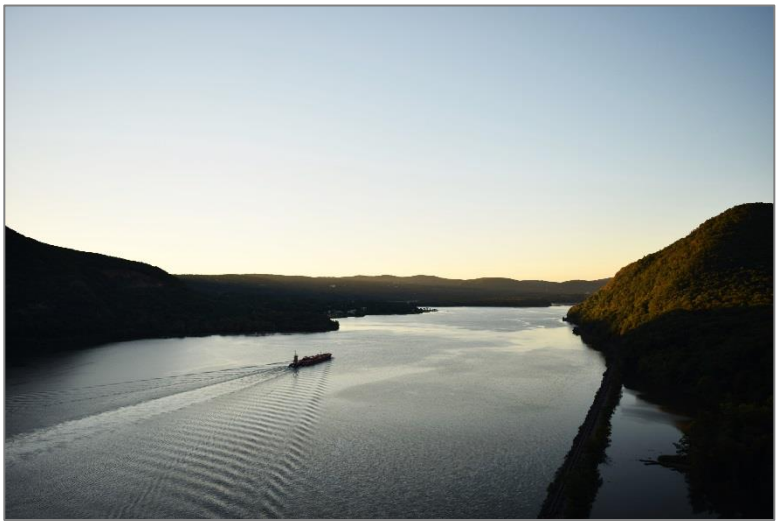
Cornwall

From the south, the pipelines would run adjacent to Schunemunk Mountain State Park and Storm King Art Center, which are important recreation sites and home to flora and fauna, several of which are listed by NYS as threatened or endangered. A little less than five miles of pipeline would bisect the Town's boundary. Much of the pipelines in Cornwall would be located on top of sand and gravel aquifers, which is described as stratified clay and silt with no or thin layers of sand and gravel at land surface and below the water table (USGS, 2018). A spill on top of a sand and gravel aquifer would increase the risk of serious contamination of groundwater. The pipeline would also traverse four waterways in Cornwall; five points that are designated as high-yielding well sites would be within one mile of the proposed pipelines. Two churches and Cornwall Central High School are within a 0.5 mile risk zone, shown as the dashed red line on the map. The half mile risk zone was added to the map to give viewers an idea of how close they would be to the dangers of a leak or an explosion.

In the Town of New Windsor, the lateral would run adjacent to the Quassaick Creek, which is an important habitat for eel species. Much of the pipeline's path would be built on top of a sand and gravel aquifer.

Proposed Anchorage Sites Map

This map displays one of the 42 long-term proposed anchorage sites on the Hudson River as was submitted by The Maritime Association of the Port of New York/New Jersey to the US Coast Guard in January 2016. The lifting of the oil export ban has increased barge traffic on the Hudson River, increasing the risk of an accident. The Newburgh hub could accommodate a total of eight barges, with space for five barges being moored adjacent to the City of Newburgh and three moored north of the Newburgh / Beacon Bridge. The first area of anchorage sites would make 445.34 acres of the Hudson available to barges and the latter would make an additional 305 acres of the Hudson available. Many of these barges will transport oil, presenting spill and explosion risks to the Hudson River. Additionally, environmental groups have noted that the anchorage sites would turn the Hudson River into a barge parking lot. Iconic Hudson River vistas from surrounding viewpoints would also be spoiled.



Barge headed south on the Hudson River, seen from High Point, Storm King Mountain, Route 218.

Due to backlash from engaged citizens, the Coast Guard abandoned the proposal and convened a Ports and Waterway Safety Assessment (PAWSA). Multiple workshops were held to gain

stakeholder insights and plan for a safe Hudson River. Furthermore, Governor Andrew Cuomo signed a bill in October 2017 that gives NYSDEC the authority to regulate oil barges on the Hudson River and instructs the agency to enact “tanker avoid zones”.

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Proposed Pilgrim Oil Pipeline Map

Legend

- MTA North
- Hamlets
- motorway
- trunk & primary
- minor roads
- minor roads
- rails
- water
- forest & park
- DEC wetland
- stream
- municipality
- school
- sand and gravel aquifer
- pilgrim pipelines

0 1 2 3 4 5 miles

NEWBURGH
NEW WINDSOR
Firthcliffe Heights
Firthcliffe
CORNWALL ON HUDSON
Scotchtown Mills
WASHINGTONVILLE
Storm King Art Center
CORNWALL
BLOOMING GROVE
Schunnemunk State Park
Mountainville
Black Rock Forest
HIGHLANDS
SOUTH BLOOMING GROVE
WOODBURY
HIGHLAND FALLS
INTERSTATE 87
9W

N

445 Acres

9W

INTERSTATE 87

Firthcliffe Heights

Firthcliffe

CORNWALL ON HUDSON

Salisbury Mills

Storm King Art Center

CORNWALL

Mountainville

Schunnemunk State Park

Black Rock Forest

9W

0 1 2 3 4 5 miles

Proposed Anchorage Sites Map

Legend

- MTA North
- Hamlets
- motorway
- trunk & primary
- minor roads
- minor roads
- rails
- water
- forest & park
- DEC wetlands
- streams
- municipality
- Proposed Anchorage Sites

ZONING & TAX MAPS

Map(s) referenced: Zoning & Parcels: Town of Cornwall and Village of Cornwall-on-Hudson

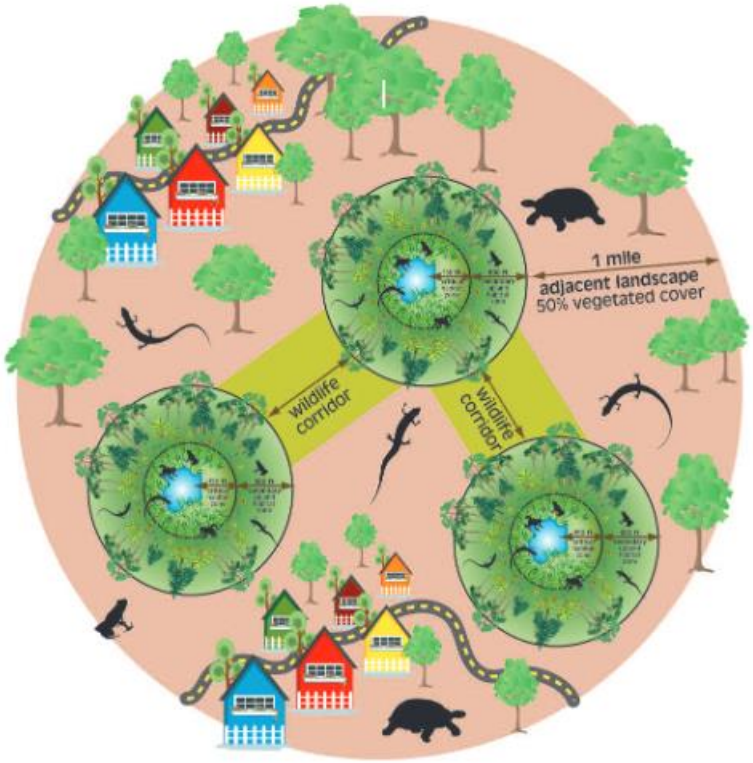
Why You Need These Maps

New York State's zoning enabling statutes state that comprehensive plans must provide for the "immediate and long-range protection, enhancement, growth, and development" of a locality, with land use regulations, including zoning, "conform[ing] to the locality's comprehensive plan" (Salomone, 2004).[28] All land use regulations are enacted to "promote the public health, safety, and general welfare;" "[z]oning is primarily enacted to control the use of land and the density of those uses" (Haeckel & Heady, 2014). **Local zoning can also impose greater restrictions than state law to protect, for example, natural areas and cultural resources, such as historic locales, scenic areas, groundwater, floodplains, wetlands, and wildlife habitats.**

The following maps for the Town of Cornwall and Village of Cornwall-on-Hudson show the zoning districts, special overlays/districts, and tax parcels within our community. The narrative will focus primarily on considerations for additional protective measures for our natural resources as authorized by Municipal Home Rule Law (Salomone, 2004).[29] The natural resources found in each district are described in relationship to the permitted uses within each district in Appendix F – Natural Resources within Zoning Districts and Overlays for the Town of Cornwall and the Village of Cornwall-on-Hudson.

Zoning & Parcels Maps: Town of Cornwall and Village of Cornwall-on-Hudson

The following sections will focus on recommendations for additional measures important to the immediate and long-range protection of our quality of life and natural resources. Although the recommended protective measures in the following sections are specifically associated with the Town or Village, most should be considered for both.



A visual representation of development that incorporates wetland habitat and wildlife corridor retention.

[28] New York State has been a national leader in the management of land use, with New York City being the first municipality to adopt a comprehensive zoning ordinance in 1916. The federal government followed suit in 1922 with the development of a model zoning enabling act and in 1928 a model act enabling the adoption of comprehensive plans. State legislatures were encouraged to adopt both acts and to delegate this authority to local governments.

[29] Hudsonia Ltd.'s General Conservation Measures for Protecting Natural Areas and Wildlife fact sheet provides high-level guidance on conservation and development.

(Additional information regarding the recommended measures below can be found in Appendices C, H, I, and J.)[30]

Town of Cornwall

Zoning Chapter 158 of the Code of the Town of Cornwall describes the uses allowed in 12 zoning districts and two overlays. The tables of General Use Regulations provide an overview of the uses permitted by right, uses by special permit, and permitted accessory uses.

- The Town should consider developing an **aquifer protection overlay district** as well as a **Source Water Protection Plan** to protect the supply and quality of drinking water. Exclusion of bulk storage should be considered.
- The Town should consider developing **steep slope regulations** that limit construction on slopes exceeding 15% to protect against erosion, sedimentation of streams and down-slope areas, landslides, and the degradation of scenic views.
- The Town should consider strengthening current language pertaining to tree removal (see chapter 75 – Clearing and Grading) by developing **tree preservation legislation**. Such legislation would enable the Town and its residents to take advantage of the natural benefits that are intrinsic to trees: flooding control, filtration of pollutants and prevention of erosion, protection of watershed areas, improvement of air quality, noise barriers, habitat for wildlife, and cooler micro-climates.
- The Town's Code chapter 90, Freshwater Wetlands Protection Law, is very comprehensive. The Town should consider improving the Law by supporting the identification of **wetlands as small as half an acre** and applying the existing Law to this wetland size.[31] (Half an acre of wetland can store up to three-quarters of a million gallons of floodwater at no cost to a municipality.) The identification of smaller wetlands can be done as a citizen science project in partnership with the Cornwall CAC, the Cornwall Central School District, and community residents.[32] Additionally, the Town should explore providing adequate protection for interjurisdictional wetlands by working to develop equally protective regulations with adjoining municipalities.
- Throughout the Town's Code, the presence of a wetland can result in the denial of a permit for clearing and grading and/or building within a 100-foot buffer. However, no such language exists for streams. The Town should consider developing a **Stream Buffer Overlay** for perennial and seasonal waterways in order to maintain water quality, recharging of groundwater, waterway health for wildlife, and bank stabilization and erosion control. A minimum buffer of 200 feet is recommended; wider buffers should be considered for habitat protection of specific wildlife (Strong, 2008). The Orange County Department of Planning has developed a model riparian buffer local law.
- The Town's Code includes language referencing the minimization of public and private losses from flood conditions by controlling the alteration of natural floodplains and their associated stream channels and natural protective barriers. The Town should consider developing a **Floodplain Overlay District** to clearly outline areas to be protected and, given the increase in severe storms, also consider protections to the five-hundred-year floodplain.

[30] The material in these appendices was provided by the Land Use Law Center of Pace Law School as part of its Land Use Leadership Alliance Training Program.

[31] The towns of New Paltz, Poughkeepsie, and New Castle have a minimum wetlands protection size of a tenth of an acre; the towns of Pawling and Philipstown protect from a minimum of a quarter acre.

[32] Wetlands designation must comply with the three characteristics of wetlands, as defined by the Army Corps of Engineers, before official designation: hydric soils, wetland vegetation, and wetland hydrology.

- The Town should consider referencing **green infrastructure practices** as part of Code Chapter 121 on Stormwater Management.
- The Town should consider expanding the application of Conservation Subdivision Design Layout to all districts currently zoned MCR and ARR as well as increasing the minimum percentage of **open space to 80%**. The positive resulting impact from these changes would include less expensive construction costs, less clearing and grading, and preservation of the visual and environmental integrity of most of the landscape (OCWA, 2014).
- The Town should consider tasking the Cornwall CAC with the development of a comprehensive listing of **native plantings** to support the intent of the Ridge Preservation Overlay District. Additionally, a listing of said planting can be made available to developers, residents, and businesses to further enhance the beauty of our Town without inviting nuisance plant species. (See Village recommendation for additional detail.)

Village of Cornwall-on-Hudson

Zoning Chapter 172 of the Code of the Village of Cornwall-on-Hudson describes the uses allowed in six zoning districts and two overlays.[33]

- The Village should consider **managing stormwater** by limiting impervious coverage through maximum development coverage areas rather than maximum lot coverage percentages. The former limits the portion of a lot covered by buildings, parking areas, accessory structures, and other impervious materials.
- The Conservation Residential CR-3 District (scenic) provides for a **conservation green belt setback** of 25 feet along both sides of Deer Hill Road where no tree cutting, construction, or other development is permitted. The Village should consider adding language to encourage bringing properties into conformance. The Village should also consider extending the existing **conservation green belt setback** at the Hudson Highlands Nature Museum Wildlife Education Center to continue the entire length of the Boulevard along both sides. Additional setbacks should be considered for The Grail at Duncan Avenue and along Shore Road.
- The Village should consider incorporating language that encourages the use of **native plantings** suitable for hardiness zone 6. NYSDEC's Division of Lands and Forests provides many native suggestions for flowers; grasses, ferns, groundcovers; shrubs; trees; and vines.
- The Industrial District's currently permitted uses may be negatively impacted by projected sea level rise. The Village should consider **additional limitations on industrial uses** or additional precautionary measures of currently permitted uses that may negatively impact existing aquifer, wetlands, and floodplains.
- The Village should consider referencing **green infrastructure practices** as part of Code Chapter 132 on Stormwater Management and for off-street parking for 10 or more vehicles.
- The Village should consider developing a **Floodplain Overlay District** to clearly outline areas to be protected and, given the increase in severe storms, also consider protections to the five-hundred-year floodplain.

[33] The View Preservation District Overlay as depicted on the Village of Cornwall-on-Hudson Zoning & Parcels Map has been updated. The updated Overlay includes: "Along Bayview Avenue extending 500 feet upland from Bayview Avenue from the intersection of Bayview Avenue with Dock Hill Road to the Village corporate line" and "Fronting on the Idlewild Park Drive cul-de-sac, including Tax Map parcels 102-1-1, 2, 3, 4 and 5, 102-18-1, 102-19-1, 46 and 47, 101-1-12, 13.1, 13.21, 14, 15, 16 and 17" (Village of Cornwall-on-Hudson Code Section 172-74(3)(b)[2]).

- The Village should consider developing a **Wetlands and Watercourses Overlay** with a minimum buffer of 200 feet for surface waters of the State of New York.
- The Village should consider a minor amendment to Chapter 151 Trees, Shrubs, and Bushes to increase successful plantings of trees on private properties: burlap should be removed prior to planting.
- The Village should consider amending its existing **View Preservation Law** to protect views *from* the Hudson River and Moodna Marsh, as well as public views of Storm King Mountain.

Return to Table of Contents
Return to Land Use section header
Appendix F: Natural Resources within Zoning Districts and Overlays
References & Resources

TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

TOWN OF CORNWALL
Zoning and Parcels

Zoning Districts

- **ARR** Agricultural Rural Residence
- **LS** Local Shopping
- **GC** General Commercial
- **HC** Highway Commercial
- **MCR** Mountain and Conservation Residence
- **MR** Mixed Residence
- **PCD** Planned Commercial District
- **PIO** Planned Industrial / Office
- **PRD** Planned Residential District
- **SLR** Suburban Low-Density Residence
- **SR-1** Suburban Residence
- **SR-2** Suburban Residence
- Schunnemunk Agricultural Scenic Overlay
- Ridge Preservation Overlay

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Municipal Boundaries

- Town and Village Boundary
- Other Municipal Boundary
- Parcels

DATA SOURCES: United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; Orange County Real Property Tax Department, 2018

The locations of tax parcel lines are approximate only and are presented solely as a general aid in understanding their approximate location in relation to other mapped features. No reliance whatsoever should be placed on the tax parcel depictions shown herein. The parcel lines are neither intended to be nor are they representations of the County's official tax maps prepared and maintained by the County Real Property Tax Department.

Creating Natural Resources Inventories (NRIs) in Orange County Communities is a partnership project between OCWA and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Orange County Department of Planning
B. Freiman 6/19/18

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The Orange County Water Authority | NEW YORK STATE CANAL CORPORATION Hudson River Estuary Program, A Program of the New York State Department of Environmental Conservation | Cornell University

TOWN OF CORNWALL
VILLAGE OF CORNWALL-ON-HUDSON
ORANGE COUNTY, NY

NATURAL RESOURCES INVENTORY

VILLAGE OF CORNWALL-ON-HUDSON

Zoning and Parcels

Zoning Districts

- **CR-1** Conservation Residential
- **CR-2** Conservation Residential (Rural)
- **CR-3** Conservation Residential (Scenic)
- **I** Industrial
- **SR** Suburban Residential
- **WR** Waterfront Recreation
- Central Business & Shopping District
- View Preservation District Overlay

Hydrology

- Water Bodies
- Streams

Roads

- Interstate
- Federal Highway
- State Route
- County Road

Municipal Boundaries

- Town and Village Boundary
- Other Municipal Boundary
- Parcels

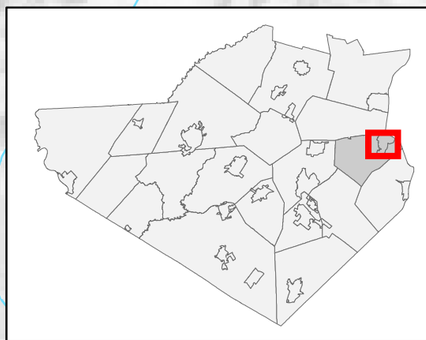
Hudson River

I
WR
SR
CR-1
CR-2
CR-3

9W
32
9
218

SHORE RD
WEST ST
SPRUCE ST
PINE ST
IDLEWILD AVE
CAROLYN WHITETER
AVENUE A
PAULA CT
JEAN CT
CURIE RD
HOLTS LN
FIRST ST
HUDSON ST
KELLY LN
WILLIS AVE
BARR AVE
WEEKS AVE
STILLMAN AVE
COLONIAL PL
CHURCHILL ST
CHURCH ST
SILVER AVE
DUNCAN AVE
DUNCAN LN
CLARK AVE
WINEBROOK AVE
CHERRY AVE
PATTSON RD
WOOD AVE
WILSON RD
WASHINGTON ST
LAFAYETTE ST
RIVERSIDE DR
TAYLOR PL
RIVER ST
GRANDVIEW AVE
CORNWALL AVE
DOCK HILL RD
BAY VIEW TER
TAFT PL
BRIGGS RD
MOUNTAIN HOUSE LN
LIPANI LN
BOULEVARD
RUGH PL
STABLE WAY
MAPLE RD
STILLWOOD RD
MOUNTAIN RD
MOUNTAIN AERIE
EAGLE HEAD RD
ABBOTT LN
DEER HILL RD
RESERVOIR

N
Scale 1:16,500
0 0.125 0.25 0.5 Miles



DATA SOURCES: United States Geological Survey, 2017; New York State Dept. of Transportation, 2017; Orange County Dept. of Planning, 2018; Orange County Real Property Tax Department, 2018

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NEW YORK STATE OF OPPORTUNITY. Hudson River Estuary Program
A Program of the New York State Department of Environmental Conservation
Cornell University

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Appendix A: Glossary and Acronyms

Alluvium	Loose, unconsolidated soil or sediments, which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting. Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. When this loose, alluvial material is deposited or cemented into a lithological unit, or lithified, it is called an alluvial deposit.
Aquifer	The National Geographic Society defines an aquifer as an underground layer of permeable rock with openings that liquids can pass through, such as sandstone and sand and gravel. Aquifers hold groundwater. They are filled by rainwater or snowmelt that passes through permeable surfaces, entering the aquifer through the joints and cracks in rocks.
Biota	Animal and plant life of a particular region, habitat, or geological period.
Biotope	A region uniform in environmental conditions and in its populations of animals and plants for which it is the habitat.
Boreal	Relating to, or comprising, the northern biotic area characterized especially by dominance of coniferous forests.
Carbonate mélange	A mixture of large blocks of carbonate rocks (limestone and dolostone) jumbled together with little continuity of contacts.
Chert	A fine-grained, sedimentary rock composed of microcrystalline or cryptocrystalline silica, the mineral form of silicon dioxide.
Developed Features	Developed features are made up of impervious surfaces, but also include landscaped lawns (and small amounts of other cover types, such as individual trees) that surround man-made impervious features.
Dolostone (dolomite)	A sedimentary carbonate rock that contains a high percentage of the mineral dolomite, CaMg2.
Gneiss	A common distributed type of rock formed by high-grade regional metamorphic processes from pre-existing formations that were originally either igneous or sedimentary rocks.

Grasslands	Areas where the vegetation is dominated by grasses (Poaceae); however, sedge (Cyperaceae) and rush (Juncaceae) families can also be found along with variable proportions of legumes, like clover, and other herbs. Grasslands tend to be native habitats created by fire, flooding, or the presence of shallow rocky soil incapable of supporting significant forest growth.
Graywacke (or Greywacke)	A variety of sandstone generally characterized by its hardness, dark color, and poorly sorted angular grains of quartz, feldspar, and small rock fragments or lithic fragments set in a compact, clay-fine matrix.
Habitat	The place or environment where a plant or animal naturally or normally lives and grows.
Hydric Soil	USACE Wetlands Identification defines hydric soils as having "characteristics that indicate they were developed in conditions were soil oxygen is/or was limited by the presence of water for long periods of the growing season."
Impact of Impervious Surfaces	When impervious surfaces cover areas where water naturally seeps into the ground, they reduce the amount of water available to recharge aquifers, wells, and springs. During storms, excess water that cannot seep into the ground instead flows across impervious surfaces where it can gather harmful pollutants (e.g., oil and fertilizer) and deposit them into surrounding waters and farther downstream. As impervious surfaces increase, so do stormwater runoff volumes, the velocity of stormwater flows, and pollutant levels in runoff (Schueler, 2000). Flooding impacts can be exacerbated.
Impervious Surfaces	An impervious surface is composed of any man-made material that impedes or prevents the natural infiltration of water into the soil. Such surfaces include building roofs, patios, sidewalks, driveways, paved streets, and parking lots. This definition does not include rock outcroppings or compacted earthen materials that could also increase or divert water flow, thus preventing infiltration.
Land Cover	According to NOAA, land cover refers to the physical land type, such as forest or open water.
Land Use	According to NOAA, land use documents how people are using the land. Built environments include semi-natural habitats, such as farmland, pastures, and managed woods.

Linkage Zone	The NYS GIS Clearinghouse defines a linkage zone as an aggregation of all the paths between two patches of matrix forest. Linkage zones are broader regions of connectivity important to facilitating the movement of multiple species and maintaining ecological processes.
Mafic	An adjective describing a silicate mineral or igneous rock that is rich in magnesium and iron, and is, thus, a portmanteau of magnesium and ferric.
Matrix Forest	The NYS GIS Clearinghouse defines a matrix forest as large, contiguous areas with a size and natural condition that allows for the maintenance of ecological processes, viable occurrences of matrix forest communities, embedded large and small patch communities, and embedded species populations. The goal of the matrix forest selection is to identify viable examples of the dominant forest types that, if protected and allowed to regain their natural condition, would serve as critical source areas for all species requiring interior forest conditions or associated with the dominant forest types.
Maximum Building Coverage	Percentage of lot area covered by building(s).
Maximum Development Coverage	Percentage of lot area covered by a building, parking area, accessory structures, and/or impervious materials.
Meadow	A field habitat vegetated by grass and other non-woody plants. Meadows may be naturally occurring or artificially created from cleared shrub or woodland. Agricultural land that is not grazed and allowed to grow seasonally for the production of hay is often referred to as meadow.
NYNHP	The mission of New York Natural Heritage Program is to "facilitate conservation or rare animals, rare plants, and natural ecosystems." Databases of flora and fauna provide important information for natural resource conservation.
NYS Real Property System Classification	The uniform classification system developed by the New York State Office of Real Property Services to be used in assessment administration in New York State. The system of classification consists of numeric codes in nine categories. Each category is composed of divisions, indicated by the second digit, and subdivisions (where required), indicated by a third digit. Classification codes in the 100 to 199 range indicate agricultural property used for the production of crops or livestock. (NYS Department of Taxation)

Pervious/Permeable Surfaces	A pervious or permeable surface allows liquids and gasses to pass through it, like soil. Certain permeable surfaces allow for liquids and gasses to pass through at a greater rate than others.
Ponding	When water is diverted into a lower area that has no outlet or is not suitable for drainage, water will begin to pool and, over time, the weight of the water will create a deeper pool, allowing more water to sit, eventually creating a permanent water feature. Some municipalities recognize this as an issue on private land
Prime Farmland If Drained:	Soils that meet all the prime farmland criteria, except for depth to seasonal high water table, and are suitable for drainage. In New York, somewhat poorly drained soils are designated as prime farmland if drained if they meet all criteria for prime farmland other than depth to water table. (USDA NRCS)
Prime Farmland:	Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from zero to six percent. (USDA NRCS)
Recharge Rate	The USGS defines recharge as the water that replenishes an aquifer. The rate of recharge can meet, exceed, or fall short of the speed at which water is pumped out of an aquifer. Aquifers can be fully drained, leaving no readily accessible water for communities dependent on an aquifer.

Regulatory Floodway	The US Department of Housing and Urban Development defines a regulatory floodway as the "channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. This is the segment of the floodplain that will generally carry flow of flood waters during a flood and is typically the area of greatest risk to structures in the floodplain."
Riparian	The Merriam Webster Dictionary defines riparian as relating to or living or located on the bank of a natural watercourse (such as a river or stream) or sometimes of a lake or tidewater.
Sediment Load	The amount of sediment carried by running water. Sediment load is measured by gauging the amount of sediment passing through a stream cross section in a specified period of time. This measurement is expressed in millions of tons (mt).
Shrubland	Scrubland, scrub, brush, or bush is a plant community characterized by vegetation dominated by shrubs, often also including grasses, herbs, and geophytes. Shrubland may either occur naturally or be the result of human activity.
Soils of Statewide Importance:	Includes soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law. In New York, Soils of Statewide Importance are soils that do not meet all the criteria for Prime Farmland or Prime Farmland if Drained, but are mineral soils in land capability classes 2e, 2s, 2w, 3e, 3s, 3w, or 4w. (USDA NRCS)
Stream Flow	A stream's water flow falls into three categories: perennial, intermittent, and ephemeral. *Perennial* streams normally have water in their channels at all times. *Intermittent* streams flow from rainfall runoff or springs, or from a surface source like snowmelt. *Ephemeral* streams flow only from precipitation, receiving little or no water from springs, melting snow, or other sources. (USGS)

Submerged Aquatic Vegetation (SAV)	Plants that are always under water. According to NYSDEC, the most common native species of SAV in the Hudson River watershed is water celery (*Vallisneria americana*), but other species include clasping leaved pondweed (*Potamogeton perfoliatus*), and such non-native plants as curly pondweed (*Potamogeton crispus*) and Eurasian water milfoil (*Myriophyllum spicatum*).
Talus	A slope formed especially by an accumulation of rock debris, or rock debris at the base of a cliff.
Tidal Wetlands	According to Haeckel and Heady, tidal wetlands are areas consistently covered by water during at least some tide stages. There are many different categories of tidal wetlands depending on the type of vegetation present and the amount of water during high and low tides. New York State uses specific categories and codes to describe and represent different types of coastal, tidal and freshwater wetlands.
Vernal Pool	The USEPA describes vernal pools as "seasonal depressional wetlands…[that] are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes…."
Water Turbidity	Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid includes clay, silt, finely divided inorganic and organic matter, algae, soluble colored organic compounds, and plankton and other microscopic organisms.
Watershed	A region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water.

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Known Species of Conservation Concern in the Town and Village of Cornwall, NY

The following table lists species of conservation concern that have been observed in the Town or Village of Cornwall. The information comes from the New York Natural Heritage Program (NYNHP) biodiversity databases, the 2000-2005 New York State Breeding Bird Atlas (NYBBA), the 1990-1999 New York Amphibian and Reptile Atlas (NYARA). Species from the NYBBA are included in the table if they were documented in Atlas blocks that are at least 50% in Cornwall. The table only includes species listed in New York as endangered or threatened (at the state (NY) and/or federal (US) level), special concern, rare, Species of Greatest Conservation Need (SGCN), or a Hudson River Valley Priority Bird species recognized by Audubon New York. Historical records are provided from the NYNHP biodiversity databases. Primary habitat types are provided for each species, but for conservation and planning purposes, it's important to recognize that many species utilize more than one kind of habitat. More information on rare animals, plants, and ecological communities can be found at http://guides.nynhp.org.
Note: Additional rare species and habitats may occur in Cornwall.

			NY Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Endangered	Threatened	NY Special Concern	NY Species of Greatest Conservation Need xx = high priority	Hudson River Valley Priority Bird	**Data Source**
Mammals								
Eastern Small-footed Bat	*Myotis leibii*	forest, caves			x	x		NYNHP
Indiana Bat	*Myotis sodalis*	forest, caves	US, NY			xx		NYNHP
Northern Long-eared Bat	*Myotis septentrionalis*	forest, caves		US, NY		xx		NYNHP
Birds								
Acadian Flycatcher	*Empidonax virescens*	forest					x	NYBBA
American Goldfinch	*Spinus tristis*	young forest, shrubland					x	NYBBA
American Redstart	*Setophaga ruticilla*	forest					x	NYBBA
American Woodcock	*Scolopax minor*	young forest, shrubland				x	x	NYBBA
Bald Eagle	*Haliaeetus leucocephalus*	open water		NY		x	x	NYBBA
Baltimore Oriole	*Icterus galbula*	forest					x	NYBBA
Belted Kingfisher	*Megaceryle alcyon*	open water					x	NYBBA
Black-and-white Warbler	*Mniotilta varia*	forest					x	NYBBA

			NY Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Endangered	Threatened	NY Special Concern	NY Species of Greatest Conservation Need xx = high priority	Hudson River Valley Priority Bird	**Data Source**
Black-billed Cuckoo	*Coccyzus erythropthalmus*	young forest, shrubland				x	x	NYBBA
Blue-Winged Warbler	*Vermivora pinus*	young forest, shrubland				x	x	NYBBA
Broad-winged Hawk	*Buteo platypterus*	forest					x	NYBBA
Brown Thrasher	*Toxostoma rufum*	young forest, shrubland				xx	x	NYBBA
Chimney Swift	*Chaetura pelagica*	urban					x	NYBBA
Cooper's Hawk	*Accipiter cooperii*	forest			x		x	NYBBA
Downy Woodpecker	*Picoides pubescens*	forest					x	NYBBA
Eastern Kingbird	*Tyrannus tyrannus*	young forest, shrubland					x	NYBBA
Eastern Towhee	*Pipilo erythrophthalmus*	young forest, shrubland					x	NYBBA
Field Sparrow	*Spizella pusilla*	young forest, shrubland					x	NYBBA
Golden Eagle	*Aquila chrysaetos*	forest, cliffs, rocky summit	NY			x	x	NYNHP
Kentucky Warbler	*Geothlypis formosa*	forest				xx	x	NYNHP
Least Bittern	*Ixobrychus exilis*	wetlands		x		x	x	NYNHP
Louisiana Waterthrush	*Seiurus motacilla*	forest				x	x	NYBBA
Northern Flicker	*Colaptes auratus*	forest					x	NYBBA
Peregrine Falcon	*Falco peregrinus*	cliffs	NY			x	x	NYBBA
Prairie Warbler	*Dendroica discolor*	young forest, shrubland				x	x	NYBBA
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	forest					x	NYBBA
Scarlet Tanager	*Piranga olivacea*	forest				x	x	NYBBA
Veery	*Catharus fuscescens*	forest					x	NYBBA

			NY Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Endangered	Threatened	NY Special Concern	NY Species of Greatest Conservation Need xx = high priority	Hudson River Valley Priority Bird	**Data Source**
Wood Thrush	*Hylocichla mustelina*	forest				x	x	NYBBA
Worm-eating Warbler	*Helmitheros vermivorum*	forest				x	x	NYBBA
Yellow-throated Vireo	*Vireo flavifrons*	forest					x	NYBBA
Reptiles								
Common Snapping Turtle	*Chelydra s. serpentina*	wetlands				x		NYARA
Eastern Box Turtle	*Terrapene c. carolina*	forest			x	xx		NYARA
Northern Copperhead	*Agkistrodon contortrix mokasen*	forest, rocky areas, wetlands				x		NYARA
Northern Map Turtle	*Graptemys geographica*	coastal				x		NYARA
Timber Rattlesnake	*Crotalus horridus*	forest, rocky summit		NY		xx		NYARA
Wood Turtle	*Glyptemys insculpta*	stream			x	xx		NYARA
Amphibians								
Marbled Salamander	*Ambystoma opacum*	forest, wetlands			x	x		NYARA
Fish								
American Eel	*Anguilla rostrata*	stream				xx		NYSDEC
Atlantic Sturgeon	*Acipenser oxyrinchus*	coastal	US			xx		NYNHP
Brook Trout	*Salvelinus fontinalis*	stream				x		NYSDEC
Shortnose Sturgeon	*Acipenser brevirostrum*	coastal	US, NY			x		NYNHP
Insects								
Barrens Itame	*Speranza exonerata*	forest, rocky summit						NYNHP

			NY Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Endangered	Threatened	NY Special Concern	NY Species of Greatest Conservation Need xx = high priority	Hudson River Valley Priority Bird	**Data Source**
Herodias or Pine Barrens Underwing	*Catocala herodias gerhardi*	forest, rocky summit			x	x		NYNHP
Toothed Apharetra	*Sympistis dentata*	forest, rocky summit						NYNHP
Significant Natural Communities								
Appalachian Oak-Hickory Forest								NYNHP
Brackish Intertidal Mudflats								NYNHP
Brackish Tidal Marsh								NYNHP
Chestnut Oak Forest								NYNHP
Hemlock-Northern Hardwood Forest								NYNHP
Oak-Tulip Tree Forest								NYNHP
Pitch Pine-Oak-Heath Rocky Summit								NYNHP
Rocky Summit Grassland								NYNHP
Tidal River								NYNHP
Plants								
Black-edge Sedge	*Carex nigromarginata*	forest, rocky summit		NY				NYNHP
Clustered Sedge	*Carex cumulata*	rocky summit, wetlands		NY				NYNHP
Glaucous Sedge	*Carex glaucodea*	forest		NY				NYNHP
Screw-stem	*Bartonia paniculata ssp. paniculata*	coastal	NY					NYNHP
Small-flowered Crowfoot	*Ranunculus micranthus*	forest, rocky summit						NYNHP
Spongy Arrowhead	*Sagittaria montevidensis ssp. spongiosa*	coastal		NY				NYNHP
Tooth-cup	*Rotala ramosior*	riparian areas		NY				NYNHP
Virginia Snakeroot	*Endodeca serpentaria*	forest		NY				NYNHP

			NY Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Endangered	Threatened	NY Special Concern	NY Species of Greatest Conservation Need xx = high priority	Hudson River Valley Priority Bird	**Data Source**
Historical Records								
Allegheny Woodrat	*Neotoma magister*	forest, caves, rocky summit	NY			xx		NYNHP
Gray Petaltail	*Tachopteryx thoreyi*	forest, stream			x	xx		NYNHP
American Waterwort	*Elatine americana*	coastal	NY					NYNHP
Estuary Beggar-ticks	*Bidens hyperborea var. hyperborea*	coastal	NY					NYNHP
Estuary Hatpins	*Eriocaulon parkeri*	coastal						NYNHP
Fairy Wand	*Chamaelirium luteum*	forest, meadow	NY					NYNHP
Large Twayblade	*Liparis liliifolia*	forest, wetlands	NY					NYNHP
Mead's Sedge	*Carex meadii*	fens	NY					NYNHP
Michaux's Blue-eyed-grass	*Sisyrinchium mucronatum*	meadow, shrubland	NY					NYNHP
Northern Quillwort	*Isoetes septentrionalis*	riparian	NY					NYNHP
Prairie Wedgegrass	*Sphenopholis obtusata*	coastal, riparian	NY					NYNHP
Rattlebox	*Crotalaria sagittalis*	disturbed sites	NY					NYNHP
Southern Arrowwood	*Viburnum dentatum var. venosum*	coastal		NY				NYNHP
Stiff-leaf Goldenrod	*Solidago rigida var. rigida*	forest, meadow, rocky summit		NY				NYNHP
Weak Rush	*Juncus debilis*	coastal	NY					NYNHP
Wild Hydrangea	*Hydrangea arborescens*	forest, stream		NY				NYNHP

This document was created by the New York State Department of Environmental Conservation's Hudson River Estuary Program and Cornell University's Department of Natural Resources with funding from the NYS Environmental Protection Fund.

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www.dec.ny.gov/lands/5094.html

Summary of Municipal Wetland and Watercourse Protection Techniques

The following table is a summary of the techniques that can be used to protect wetlands.

Technique	Description
Local Wetland Law	A Local Wetland Law is a resource specific law designed to address the gap in wetland protection afforded by state and federal regulations by applying to wetlands smaller than 12.4 acres, additional buffer areas, or regulating a broader range of human activities.
Wetland Conservation Overlay District	An overlay district adds standards to the base use and area requirements of the underlying zoning. The distinction from a local wetlands law is its application only to a district as defined on the official zoning map; would not apply to all land use and building approvals in the municipality. An overlay district could also be used in a town with a wetlands law, to increase protections in certain watersheds (e.g., Town of New Castle)
Wetlands Buffer in Supplemental Zoning Standards	Supplemental regulations are part of the zoning law that applies standards to all lands as defined in the regulations.
Basic Zoning Tools	Wetland protection can be incorporated into zoning setbacks, subdivision regulations, and other basic zoning tools.

The following table summarizes how municipalities have applied the various local law techniques to regulate freshwater wetlands and buffer areas. All of the examples are more protective than existing state or federal regulations, but otherwise provide different levels of protection. The key differences are which wetlands and buffers they protect, and how they define the land uses or management activities that are subject to the regulations (i.e., applicability).

- Because all wetlands, regardless of size or location play a role in reducing flood risk, a local wetland law is the most comprehensive approach. It typically regulates more wetlands and more situations than the other local options shown in the table. For example, the Town of Pawling regulates dredging, filling, dumping, removing vegetation, or building in wetlands as small as ¼ acre with a 100-foot buffer.

- Overlay zones might be used where wetlands are geographically limited; the Village of Trumansburg regulates wetlands in its overlay district as small as two acres for projects that require site plan review. Or, overlay zones can be used to provide additional

protection to sensitive areas; the Town of New Castle regulates smaller wetlands and larger buffers in overlay districts covering drinking water watersheds than in its town-wide wetland and watercourse law.

- Supplemental zoning standards can be used simply to require buffer on federal wetlands (Town of Coxsackie) in larger projects before the planning board or to require a permit for a range of activities in wetlands of any size (Town of Woodstock). It is important to note that all of the techniques are flexible and exempt specific types of activities from regulation (e.g., agricultural operations, collecting firewood).

Local Wetland Protection Approach	Minimum Wetland Size	Size of Buffer or Regulated Area	Applicability	Technique
Town of Pawling (NY) Wetland and Watercourse Law[i]	1/4 acre	100 ft; for wetlands surrounded by steep slopes, the buffer shall extend 100 ft from the top of the slope	Comprehensive. See Section 111-4 of the law	Local Wetland Law
Town of New Paltz (NY) Wetlands and Watercourse Protection Law[ii]	1/10 acre and vernal pools 100 sq. ft. or larger	50 ft from edge of wetland for wetlands 1/10 acre to < 1 acre; 100 ft for wetlands > 1 acre; 100 ft for quality vernal pool	Comprehensive. See Section 139-8 of the law	Local Wetland Law
Town of Poughkeepsie (NY) Aquatic Resource Protection Law[iii]	1/10 acre	25 ft for 1-5 acre, 50 ft for 5-9 acre, 75 for 9-12 acres, 100 for more than 12 acres	Comprehensive. See Section 116-5 of the law	Local Wetland Law
Town of Philipstown (NY) Freshwater Wetlands and Watercourses Law[iv]	¼ acre	land within 100 feet of the boundary of controlled wetland	Comprehensive. See Section 93-5 of the law	Local Wetland Law
Town of New Castle (NY) Wetlands Law[v]	1/10 acre	100 ft	Comprehensive. See Section 137-3 of the law	Local Wetland Law

Local Wetland Protection Approach	Minimum Wetland Size	Size of Buffer or Regulated Area	Applicability	Technique
Village of Trumansburg (NY) Wetland Conservation Overlay District [vi]	2 acres	none	Building projects that require site plan review, including 1- and 2–family buildings on a single lot	Wetland Overlay District
Town of New Castle (NY) Environmental Protection Overlay District[vii]	No minimum size	150 ft	Applies to certain drinking watersheds (i.e. Croton, Kensico, and Indian Brook Reservoirs)	Wetland Overlay District
Town of Coxsackie (NY) Natural Resource Protection Standards [viii]	federally regulated wetlands (as determined by the Army Corps of Engineers)	50 ft	All development activities except land alteration approved through subdivision or site plan review prior to effective date of law; or land alteration for development of single- or two-family residential lots in single lot ownership; or a minor subdivision	Supplemental Zoning Standards
Town of Woodstock (NY) Wetland and Watercourse Protection Standards[ix]	No minimum size; excludes stormwater detention basins and artificial ponds < 0.1 ac,	100 ft for wetlands > 0.1 acres, 50 ft for smaller wetlands	See Section 260-34C of the law	Supplemental Zoning Standards
Town of Ulysses (NY) Zoning Law [x]	Buffer areas apply to federally protected wetlands greater than one-tenth (0.1) acre	Varies from 0 - 100 ft based on zoning district	Depends on zone, primarily applies to structures or buildings	Simple Setbacks

The following table is a summary of the techniques that can be used to protect watercourses.

Technique	Description
Local Watercourse Law	A resource-specific law designed to address the gap in existing state or federal stream protection by regulating activities within unprotected watercourses and lands adjacent to all watercourses. This is usually the most comprehensive approach because it applies to more streams and is more than a setback.
Stream Overlay District	An overlay district that adds standards to the base use and area requirements of underlying zoning. The difference from a local watercourse law is its application only to the district as defined on the official zoning map, such as an area along a specific stream. Some municipalities use an overlay district to apply riparian buffer provisions (e.g. City of Newburgh and the Town of Walkill).
Stream-Related Supplemental Zoning Standards	Standards within zoning law that apply to all lands with certain natural resource constraints. They can be used simply to require buffers on watercourses (e.g., Town of Coxsackie) in larger projects being considered by the planning board or to require a permit for a range of activities in watercourse buffers (e.g., Town of Woodstock).
Simple Watercourse Setbacks	A standard setback of specified width from the centerline of any watercourse as defined in the zoning. Simple setbacks are typically only building setbacks that apply to certain projects before the planning board.

The following chart illustrates how municipalities have applied the various local law techniques to regulate watercourses and buffer areas. All of the illustrations are more protective than existing state or federal regulations; however, they each provide differing levels of protection. The key differences are in their applicability; i.e., which streams and buffers they protect, and how they define the land uses or management activities that are subject to the regulations. All of the techniques are flexible and exempt specific types of activities from regulation (e.g., agricultural operations or collecting firewood).

Local Watercourse Protection Approach	Regulated Watercourses	Regulated Buffer	Applicability	Technique
Town of Pawling (NY) Wetland and Watercourse Law[xi]	Any natural or artificial, permanent or intermittent, public or private waterbody or water segment, such as ponds, lakes, reservoirs, rivers, streams, brooks, waterways or natural drainage swales.	100 ft as measured from the top of the bank of the watercourse	A permit is required for all activities identified in Section 111-4 of the law.	Local Watercourse Law
Town of New Paltz (NY), Wetlands and Watercourse Protection Law[xii]	Any natural, permanent, seasonal, or intermittent channel or water segment, rivers, streams, brooks, naturally occurring impoundments within such channels or other waterways that are contained within, flow through, or border on the town. Artificial water segments, such as swales and ditching, are excluded.	200 ft buffer for Wallkill River 100 ft buffer for perennial watercourse 50 ft buffer for intermittent watercourse	A permit is required for all activities identified in Section 139-8 of the law.	Local Watercourse Law
Town of Poughkeepsie (NY), Aquatic Resource Protection Law[xiii]	Any watercourse which appears as a solid blue line on the 2003 Aquatic Resources Map of the Town.	50 ft buffer for Wappinger Creek 25 ft for all other watercourses	A permit is required for all activities identified in Section 116-5 of the law.	Local Watercourse Law
Town of Philipstown (NY), Freshwater Wetlands and Watercourses Law[xiv]	Perennial and intermittent watercourses that are delineated on USGS topographic maps; and any other streams, brooks and waterways which are contained within, flow through, or border on the town, and any additional streams, brooks and waterways which are delineated on the map as defined as a watercourse in this § 93-4.	100 ft from the mean high-water mark, measured horizontally	A permit is required for all regulated activities listed in Section 93-5 of the law.	Local Watercourse Law
Town of New Castle (NY), Wetlands Law [xv]	Any natural or artificial, permanent or intermittent, public or private surface water body or surface water segment, such as ponds, lakes, reservoirs, rivers, streams, brooks or waterways	100 ft	A permit is required for all activities identified in Section 137-3 of the law.	Local Watercourse Law
Model Stream Overlay District for the Moodna Creek Watershed Intermunicipal Council (NY) [xvi]	The full length and width, including the bed and banks, of any watercourse that has a channel which periodically or continuously contains moving water. Excludes constructed drainage-ways, except modified natural streams.	Four options: 2 are fixed width (100 and 200 ft), the others options expand fixed width with floodplains, wetlands, and steep slopes; different activities are regulated in the primary and secondary buffers	To be defined by the municipality: apply to all proposed actions requiring [defined] approval	"Stream" Overlay District

City of Newburgh (NY), Waterbody Protection Overlay District	The overlay district consists of lands within 100 feet of 9 identified waterbodies, including the Quassaick Creek and Hudson River, as well as several lakes and ponds.	100 ft for principal structures 50 ft for accessory structures larger than 200 sq ft	Site plan review is required to clear, fill, dredge, excavate, deposit materials, and for all construction activities	Stream Overlay District
Town of Walkill (NY), Shawangunk Kill Corridor Preservation Overlay District (NY)[xvii]	The Shawangunk Kill Corridor, as described on the Town's Zoning Map.	Industrial uses: 250 ft Commercial uses: 200 ft Residential uses: varies from 65-100 ft based on floodplain width	All uses are prohibited except those exempted in Section 249-105. Special permits for water dependent uses in Section 249-107.	Stream Overlay District
Town of Coxsackie (NY), Natural Resource Protection Standards[xviii]	Any natural or artificial, intermittent, seasonal or permanent, and public or private water body or water segment. A watercourse includes rivulets, brooks, creeks, streams, rivers and other waterways flowing in a definite channel with bed and banks and usually in a particular direction.	150 ft for Hudson River 100 ft for perennial streams (solid blue line on USGS map) 50 ft for intermittent streams (broken blue line on USGS map) 25 ft all other watercourses	Exempts development improvements to single-family or two-family residential lots in single lot ownership; or a minor subdivision.	Supplemental Zoning Standards
Town of Woodstock (NY), Wetland and Watercourse Protection Standards[xix]	Perennial and intermittent, natural and artificial, having a defined channel. Drainage ditches/swales/stormwater conveyances may be regulated if they drain to a natural wetland or waterbody.	30 to 100 ft depending on the upstream drainage area and the slope of the land, according to "Applicable Watercourse Buffer" map (with default of 30 ft in all other cases)	A permit is required for all activities listed in Section 260-34C	Supplemental Zoning Standards
Town of Ulysses (NY) Zoning Law[xx]	Watercourses that carry water for at least 6 months of the year	Residential areas: 50 ft Intermittent streams: 50 ft Perennial streams in areas of more intense use: 100 ft May be increased by up to 50%, should the Planning Board find it necessary to minimize impacts	Projects that require building permits or planning board approval	Simple Setbacks

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[i] Town of Pawling (NY) Wetland and Watercourse Law (1993) http://ecode360.com/6968447

[ii] Town of New Paltz (NY) Wetlands and Watercourse Protection Law (2011) http://ecode360.com/9168154

[iii] Town of Poughkeepsie (NY) Aquatic Resource Protection Law (2003) http://ecode360.com/6321213

[iv] Town of Philipstown (NY) Freshwater Wetlands and Watercourses Law (1991) http://ecode360.com/6317362

[v] Town of New Castle (NY) Wetlands Law (1990) http://ecode360.com/11774386

[vi] http://www.trumansburg-ny.gov/docs/2012ZoningOrdinance.pdf

[vii] Town of New Castle (NY) Environmental Protection Overlay District (2002) http://ecode360.com/11759229

[viii] Town of Coxsackie Natural Resource Protection Standards, http://ecode360.com/13876388

[ix] Town of Woodstock (NY) Wetland and Watercourse Protection Standards (2011) http://ecode360.com/109422

[x] http://www.ulysses.ny.us/pdf/Zoning_Law_Revision_ADOPTED_12-17-13.pdf

[xi] Town of Pawling (NY) Wetland and Watercourse Law (1993) http://ecode360.com/6968447

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[xiii] Town of Poughkeepsie Aquatic Resource Protection Law (2003) http://ecode360.com/6321213

[xiv] Town of Philipstown, NY Freshwater Wetlands and Watercourses Law (1991) http://ecode360.com/6317362

[xv] Town of New Castle, NY Wetlands Law (1990) http://ecode360.com/11774386

[xvi] http://waterauthority.orangecountygov.com/PROJECTS/MOODNA_CREEK_WATERSHED/Model%20Local%20Law%20Stream%20Corridor%20Mgmt.pdf

[xvii] Shawangunk Kill Corridor Preservation Overlay District (2015) http://ecode360.com/30555215

[xviii] Town of Coxsackie, NY Natural Resource Protection Standards (Watercourse excerpt) http://ecode360.com/13876388

[xix] Town of Woodstock, NY Wetland and Watercourse Protection Standards (2011) http://ecode360.com/109422

[xx] http://www.ulysses.ny.us/pdf/Zoning_Law_Revision_ADOPTED_12-17-13.pdf

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Appendix D: National Wetland Inventory Wetland Classes in the Town of Cornwall and Village of Cornwall-on-Hudson

Table 1: Town of Cornwall NWI

Name	Acres	Percentage
Estuarine & Marine Deepwater	296	41%
Freshwater Forested/Shrub Wetland	171	24%
Freshwater Pond	107	15%
Freshwater Emergent Wetland	71	10%
Lake	56	8%
Riverine	20	3%
Total	**722**	**100%**

Table 2: Village of Cornwall-on-Hudson NWI

Name	Acres	Percentage
Estuarine and Marine Deepwater	390	98%
Freshwater Pond	3	0.8%
Freshwater Emergent Wetland	2	0.5%
Riverine	1	0.3%
Total	**397**	**100%**

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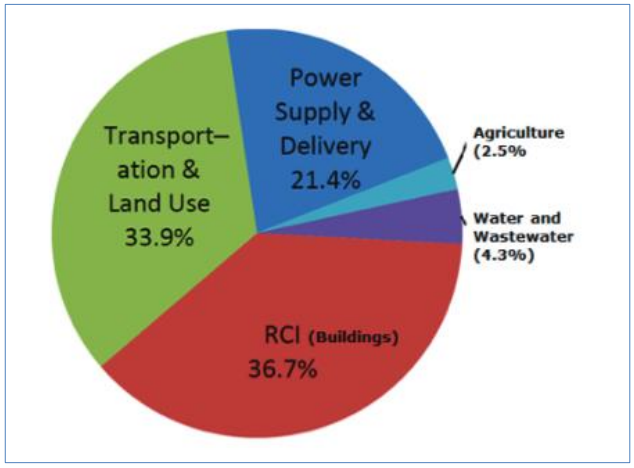
Appendix E: Additional Information on Climate Conditions and Projections

This section includes additional information on climate conditions and projections as they relate to greenhouse gas emissions, changes in temperature, the incidence of extreme temperatures, precipitation patterns, and air quality.

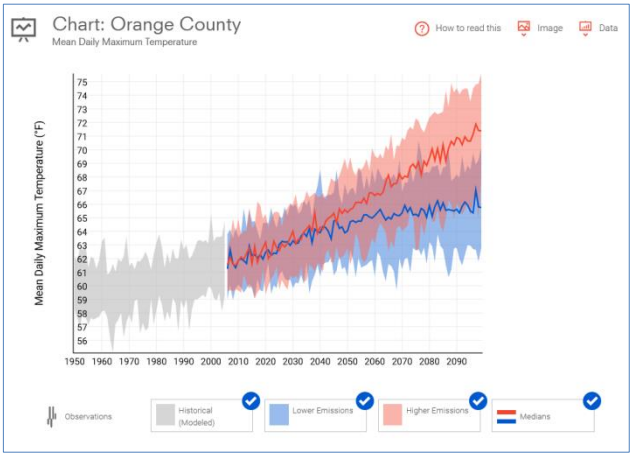
Greenhouse Gas Emissions

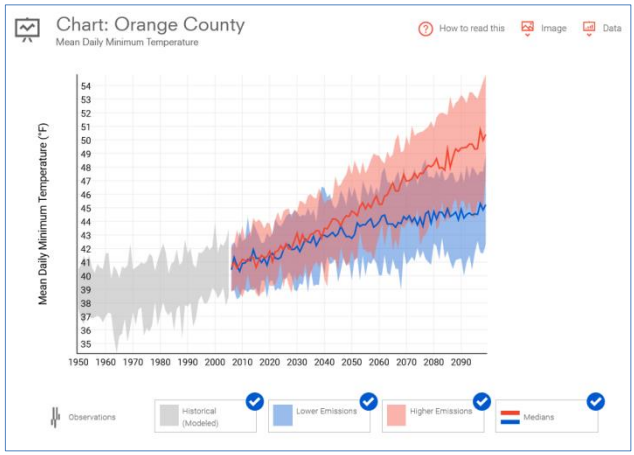


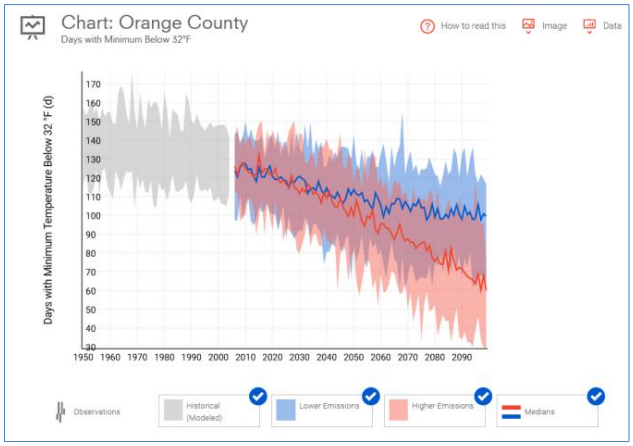
Greenhouse gases (GHGs) are a naturally-occurring phenomena that, at an appropriate level, keep our planet perfectly warm. GHGs include carbon dioxide, methane, and nitrous oxide. With the Industrial Revolution, production practices resulted in large additions of GHGs that have begun trapping more warmth in our atmosphere than needed. The residential, commercial/institutional, and industrial sectors are responsible for the greatest generation of GHG emissions. GHG emissions "are produced primarily from electric power generation, heating and cooling buildings, industrial process, and transportation and land use." Sources: Current & Future Trends in Extreme Rainfall across New York State and The Earth's Changing Climate.

Temperature

These charts present the increases in temperature under lower and higher GHG emission scenarios, beginning with historical data from 1950 through to projected data to 2100. In the lower emissions scenario (blues), global emissions stop increasing and become stable; the higher emissions scenario (pint/red) assumes business-as-usual, with continued increasing emissions. **Regardless of the scenario, there is an upward trend in temperature projected for Orange County.** There is an approximately 7°F difference between the two scenarios for both the mean daily maximum temperature (top chart) and the mean daily minimum temperature (bottom chart). Source: Climate Explorer.

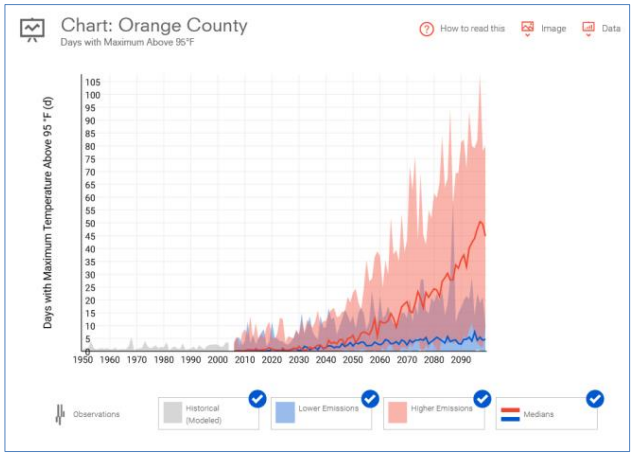






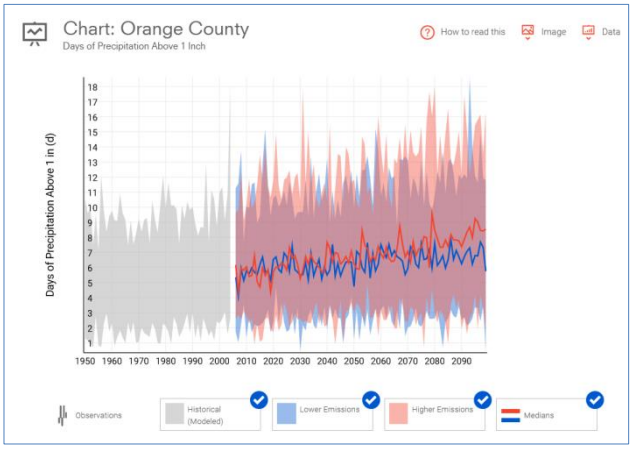
The number of days below 32°F is projected to decrease regardless of the emissions scenario applied, dropping from our current average of approximately 130 days annually to 105 day annually in a low emissions scenario and 60 days annually in a high emissions scenario. Our tourism and winter recreation economic sectors will be impacted, as will plants that require a certain number of below-freezing days before they will bud or bloom. Source: Climate Explorer.

Extreme Temperatures



This chart shows the increasing number of days with temperatures above 95°F. In the low emissions scenario, the number of extremely hot days is projected to increase from our current average of five per year to 10 per year by 2100. In the high emissions scenario, the number of extremely hot days is projected to increase to 50 per year. **"Depending upon humidity, wind, and access to air-conditioning, humans may feel very uncomfortable or experience heat stress or illness on very hot days."** Prolonged hot days can also negatively impact our agricultural production, animal health, and infrastructure as well as increase our demand for energy for cooling. Source: Climate Explorer.

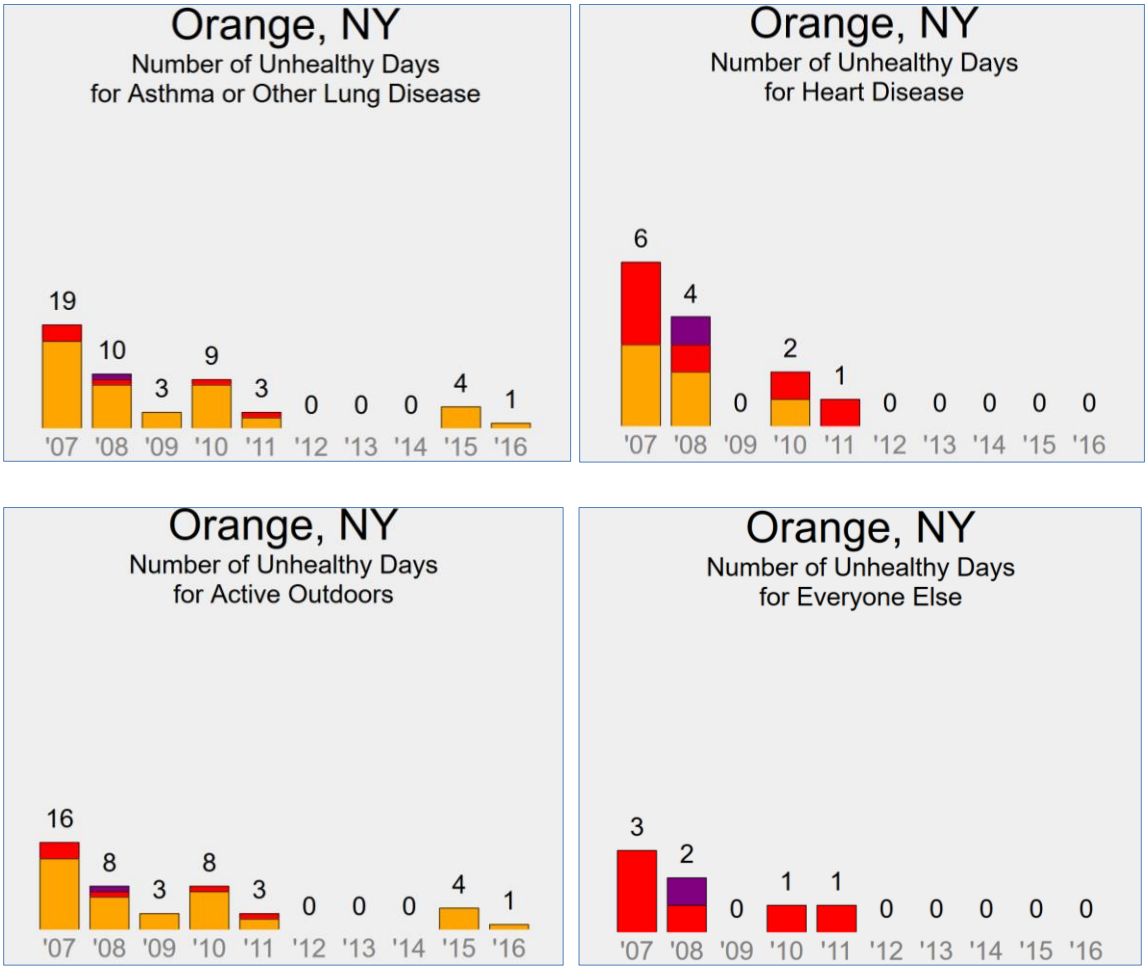
Precipitation Patterns



Orange County will continue a gradual, upward trend for mean daily precipitation, becoming wetter slowly over time. **By the end of the century, we will also see a greater number of days with precipitation greater than one inch**, ranging from approximately six in a low emissions scenario to nine in a high emissions scenario (left chart). The increase in heavy precipitation events may result in more flooding, requiring implementation of flood mitigation measures. Source: Climate Explorer.

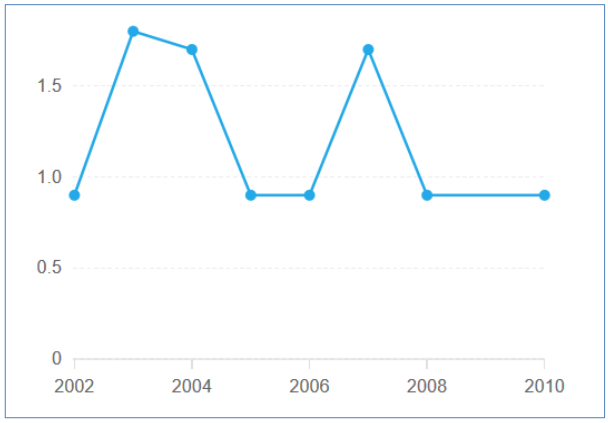
Air Quality

Unhealthy Air Quality Days



These four charts show that there has been a general downward trend in the number of unhealthy air quality days in Orange County over the 10-year period analyzed. The number of unhealthy days for sufferers of asthma and other lung disease mirrors that of older adults and children. Source: AirCompare.

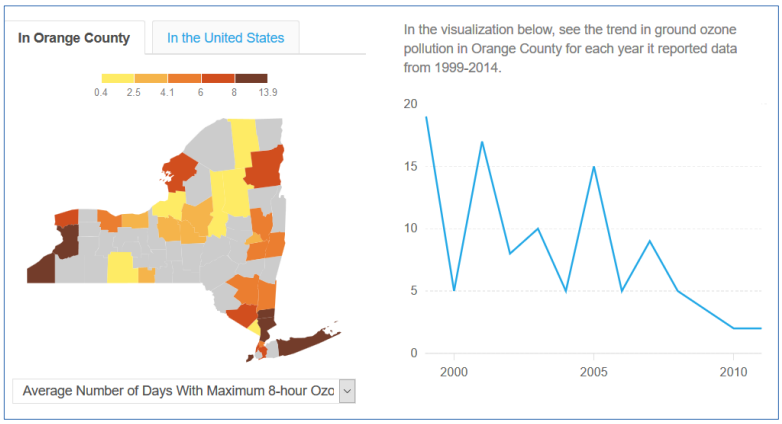
Particulate Matter Pollution



Particulate matter (PM) pollution is comprised of air-borne solid and liquid particles, such as dust, dirt, soot, smoke, and liquid droplets from various combustion sources, including cars, power plants, factories, construction activity, fires, and natural windblown dust. Particles smaller than 2.5 micrometers are more harmful because they are easily breathed into our lungs; they can affect our breathing, worsen existing respiratory and cardiovascular diseases, damage lung tissue, and contribute to cancer with long-term exposure. **The above graph shows no trend; Orange County had**

0.6% of days per year on average in excess of the maximum PM2.5 concentration for data reported from 1999-2014. Sources: Scorecard and Healthgrove.

Ozone Pollution



Ground-level ozone is created by the chemical reaction between sunlight, nitrogen oxides, and various organic compounds. It is a major component of smog. High ozone levels can damage lung tissue, reduce lung function, and cause lungs to be more sensitive to other irritants. **The above graph shows the decreasing trend in ground ozone pollution in Orange County. Over this same period, Orange County experienced an average of 6.4 days with maximum 8-hour ozone concentrations in excess of the National Ambient Air Quality Standard (NAAQS).** Sources: Scorecard and Healthgrove.

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Appendix F: Natural Resources within Zoning Districts and Overlays for the Town of Cornwall and the Village of Cornwall-on-Hudson

This Appendix refers to the *Zoning & Parcels Maps* for the Town of Cornwall and the Village of Cornwall-on-Hudson. Bulleted below are brief descriptions of permitted uses within each district as well as the natural resources contained therein.

Town of Cornwall

- Generally, the majority of districts allow varying levels of residential development.
- The Agricultural Rural Residence District permits uses related to agriculture, uses generally appropriate for large open spaces, and single-family detached homes.
    - The ARR district is underlain by **aquifers** in the flatter lands around Schunnemunk Mountain (see grids A2/A3/B2/B3 in this map and in *Public Wells, Aquifers, & Risk Sites Map*).
    - **Steep slopes** are found at the base of Schunnemunk Mountain (see grids A3/B3 and in the *Steep Slopes Map*), between Long Hill Drive and Mineral Springs Road (grid C4), and at the base of Black Rock Forest (grid C4).
    - Along Cornwall's southeastern border, stepping stone, locally significant, and regionally significant **forests** are part of this district.
    - Federally- and state-designated **wetlands** are found in this district. Also present are hydric soils, which are probable wetlands. (See grids A2/A3, B2, C4, D2; also see same grids in *Wetlands & Hydric Soils Map*.)
- The Local Shopping District permits a variety of uses, including gasoline service facilities by special permit, uses accessory to motor vehicle repair shops, and used vehicle sales.
    - Of the three areas where these districts are found, only the district in Mountainville, where Pleasant Hill Road and State Route 32 intersect, presents a concern as this area is underlain by an **aquifer**, is adjacent to a Class C trout spawning **stream**, and falls within a 100-year and 500-year **floodplain**.
- No concerns for uses permitted in the General Commercial Shopping District are identified as related to the Town's natural resources.
- The Highway Commercial District permits uses ranging from small-scale to large-scale commercial development, including automobile repair facilities, undertaking and funeral establishments, parking lots and parking facilities, large retail facilities, and gasoline service facilities. Use groups A thru J allow for high maximum development coverage, resulting is large portions of impervious coverage.
    - The District located along Federal Highway 9W northeast of Willow Avenue is located within a stepping stone **forest** and regional forest linkage zone.
    - The District located on State Route 32 near the Town of New Windsor border is underlain by an **aquifer**, falls within a regional **forest** linkage zone, and is adjacent to or within federally- and state-designated **wetlands**.
- The Mountain and Conservation Residence District permits appropriate uses with low maximum development coverage. Of the five areas zoned MCR, four fall entirely or partially within protected open space.
    - The area bounded by Orrs Mills Road, State Route 32, Pleasant Hill Road, and Interstate 87 (B2/B3 & C2/C3) is underlain by **aquifers**, contains **wetlands** of federal and state importance and hydric soils, has **steep slopes** in excess of 15%,

has a Class C **stream** supporting trout, prime **farmland** soil, and is a regional **forest** linkage zone with stepping stone forest.
    - The area west of Interstate 87 and north of the Schunnemunk Mountain State Park boundary has regionally significant **forest**, some prime **farmland**, and a Class C **stream** supporting trout.
- The Mixed Residence District permits a variety of uses, including single-family dwellings, multiple dwelling development, and clustered higher density residential development (two-family detached, townhouses, row). Use groups C and D permit high maximum development coverage.
    - The MR area in grids B1/B2, which is largely occupied by Cornwall Central High School, is underlain by **aquifers**, contains hydric soils and federally and state designated **wetlands**, a Class C **stream** supporting trout, and contains stepping stone **forest** within the regional forest linkage zone.
    - The MR area in grid A2 contains hydric soils and federally designated **wetlands** as well as stepping stone **forest** within the regional forest linkage zone.
- The Planned Commercial District permits many uses, including laboratories and related offices, light manufacturing, industrial parks, printing plants, and general manufacturing and industrial processing operations. These uses are allowed a high maximum development coverage. The PCD areas below are identified by the map grids in which they fall.
    - The area in grid D1, occupied by New York Military Academy, is adjacent to Idlewild Creek—a Class C **stream** supporting trout.
    - The area in grids C1/C2 is the former site of the Firthcliffe Carpet Mill Company and Majestic Weaving, and current site of a number of small businesses. This area is adjacent to the Moodna Creek, a 100-year **floodplain**, and a Class C **stream** supporting trout. It is currently designated a DEC **remediation** site and contains stepping stone **forest** within the regional forest linkage zone.
    - The area in grid B3, occupied by Tectonic Engineering & Surveying Consultants, is underlain by an **aquifer,** but has a relatively small percentage of impervious coverage.
    - The area in grid B4 is completely underlain by an **aquifer**; includes Woodbury Creek, a Class C **trout spawning stream**, 100- and 500-year **floodplain**; a federal **wetland** and hydric soils; prime **farmland** soils; and stepping stone **forest**. The majority of this area is protected by a conservation easement.
- The Planned Industrial/Office District permits many uses, including laboratories and related offices, light manufacturing, industrial parks, printing plant, outdoor storage of painting supplies, raw materials, fuels; general manufacturing and industrial processing operations; and above ground storage of crude oil and volatile products. Use groups A thru G are allowed a high maximum development coverage. The PIO areas below are identified by the map grids in which they fall.
    - The area in grid D1 is underlain by an **aquifer**; includes Moodna Creek, a Class C **trout spawning stream**, 100-year **floodplain** and a federal **wetland**.
    - The area in grids B1/C1 is almost entirely underlain by an **aquifer**; contains federally and state designated **wetlands**, and contains stepping stone **forest** within the regional forest linkage zone. Review of the Google Maps satellite image appears to show a sufficient buffer between the existing construction and adjacent wetlands. Development along Hollaran Road does not follow cluster development principles.

    - The area in grid B4 is underlain by an **aquifer**; includes the Woodbury Creek's, a Class C **trout spawning stream**, 100- and 500-year **floodplain**; contains **hydric soils**; prime **farmland** soil; and stepping stone **forest**.
- The Planned Residential District permits limited uses. This area in grid C1 is peppered with federal **wetlands** and contains stepping stone **forest** within the regional forest linkage zone. Conventional suburban development abuts the southwestern portion of this pristine patch of forest.
- The Suburban Low-Density Residence District permits a variety of uses, including single-family dwellings.
    - The area on both sides of Angola Road has a federal **aquifer** and hydric soils on the northern end, three Class C **streams** supporting trout, **steep slopes** in excess of 15%, and contains stepping stone and regionally significant **forests**.
    - The area north of Orrs Mills Road and west of Interstate 87 is underlain by a large **aquifer**, has a number of federally- and state-designated **wetlands** and hydric soils, two Class C **streams** supporting trout, and stepping stone **forest** in a regional forest linkage zone.
- The Suburban Residence 1 District permits uses related to outdoor recreation, agriculture, institutional, and low to medium density housing.
    - The area around Beaverdam Lake contains federal **wetlands** and hydric soils, a Class C **stream** supporting trout, and stepping stone **forest** in a regional forest linkage zone.
    - The area from grids B1/B2 to D1/D2 contains a number of federal and state **wetlands** and hydric soils, a number of Class C streams and Idlewild Creek—a Class C **trout spawning stream**, stepping stone **forest** in a regional forest linkage zone, and locally significant forest.
- The Suburban Residence 2 District permits uses largely related to small professional offices and low to medium density housing. The area in grids C2/D2 contains a Class C streams and Idlewild Creek—a Class C **trout spawning stream**, some prime **farmland**, and a small portion falls within a 500-year **floodplain**. Use groups D, G, H, and I have high maximum development coverage.
- The Schunnemunk Agricultural Scenic Overlay is located west of Interstate 87 and south of Moodna Creek and Orrs Mills Road. Clustered subdivision layout can be required by the Planning Board through a Conservation Subdivision Design Layout, with a minimum open space allocation of 50%. The Overlay terms slopes in excess of 30% as a significant barrier to development. Areas of 50-100 feet buffer waterbodies, waterways, and wetlands from development.
    - Within the Overlay is found 100- and 500-year **floodplains**, federal and state **wetlands** and hydric soils, **aquifers**, prime **farmland**, **steep slopes** in excess of 15%, and regionally significant **forest** within a regional forest linkage zone.
- The Ridge Preservation Overlay is designed to protect the visual and aesthetic resources of Schunnemunk Mountain and Hudson Highlands ridgelines. Planning Board review includes consideration for plantings of "appropriate native deciduous and/or evergreen vegetation."

Village of Cornwall-on-Hudson

- Conservation Residential Districts 1-3 and Suburban Residential District permit single-family cluster development, which was authorized, among other intents, "to preserve the natural and scenic qualities of open space and to protect local ecology, major stands of

trees, steep slopes, geological features, and other areas of environmental value" through flexibility in design and development of land.

- The Conservation Residential CR-1 District permits residential, recreational, and riverine uses, with a maximum permitted lot coverage of 15%.
    - The district is partially underlain by an **aquifer** and contains a Class C **stream** supporting trout.
- The Conservation Residential CR-2 District (rural) permits residential uses as well as uses compatible with residential and small scale agricultural development, with a maximum permitted lot coverage of 10%.
    - The district contains **hydric soils** and federally designated **wetlands**, a significant area of **very steep slopes** in excess of 25%, and is almost entirely covered by locally significant **forest**.
    - This zoning district contains Roe Park, the Hudson Highlands Nature Museum Wildlife Education Center, The Grail, and a portion of Storm King State Park. Along with Donahue Farm, located in the Suburban Residential District, these areas form a large contiguous habitat that extends beyond the borders of the Village into Black Rock Forest and the rest of Storm King State Park.
- The Conservation Residential CR-3 District (scenic) permits residential uses as well as uses compatible with residential development, with a maximum permitted lot coverage of 10%. The district includes a conservation green belt setback of 25 feet along both sides of Deer Hill Road where no tree cutting, construction, or other development is permitted. No criteria for bringing properties into conformance are identified.
    - The district contains a Class C **stream** supporting trout and is covered by locally significant **forest**.
- The Industrial District permits uses such as laboratory, manufacturing, printing, and high-density housing.
    - This district is underlain by an **aquifer**, contains a few federally-designated **wetlands**, is located entirely on a 100-year **floodplain**, and includes steep and very **steep slopes** on the southwestern edge of the district. By 2100, a 3-foot sea level rise would **inundate** over half of the district and a 6-foot rise would result in inundation of the entire area.
- The Suburban Residential District permits a variety of uses, including residential, recreational, and instructional.
    - The district contains areas within the 100- and 500-year **floodplains**, a Class C **stream** supporting trout, locally significant **forest**, and prime **farmland** soil. The district contains five **petroleum bulk storage** facilities on Hudson Street and State Route 218, one of which is located on a portion of Route 218 that flooded during Hurricane Irene.
- The Waterfront Recreation District permits riverine uses. The district is entirely underlain by an **aquifer** and includes an existing **petroleum bulk storage** facility, contains numerous federally-designated **wetlands**, falls within a 100- and 500-year **floodplain**, includes prime **farmland**, and contains a Class C **stream** supporting trout. By 2100, a 3-foot sea level rise would **inundate** over half of the district and a 6-foot rise would inundate the entire area.
- The Central Business & Shopping District includes Hudson Street up to River Avenue as well as streets on either side of Hudson and permits largely standard commercial uses. Any natural resources related to this district are mentioned in the SR District section above.

- The View Preservation District Overlay encompasses districts north of Hudson Street and State Route 218. The overlay provides for the preservation and protection of Hudson River **views** from existing public roads, parks, or legally accessible public property under the Village's Scenic Resources Protection Law. The Law declares the protection of these views for present and future generations in the broader public interest. The District Overlay ensures that use and development on private lands of structures and natural plantings do not impact the views from public areas. Any natural resources related to this district are mentioned in the SR, CR-1, I, and WR district sections above.
- The Village's Code includes a Steep Slope and Soils Preservation Law, Article IV of Chapter 172. The intent of this Law is to ensure that development and uses "…fit the topography, soils, geology, hydrology, and other conditions existing within these areas…". Applications for subdivision, site plan, or building permit approval are subject to the Law. The density formula in Section 172-14 applies a limitation on the developable gross area of a parcel based on the percentage of the total gross area with slopes equal to or greater than **very steep slopes** of 25%.

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Appendix G: Orange County Municipality Resiliency Code Audit

Code Audit Questions -->	1	2	3	4	5	6	7	8	9	10	11	12	13
Geographic Area	Overlay (Y/N)?	Bulk Storage Excluded (Y/N)?	Density Controls Soils (Y/N)?	Density Controls Slope (Y/N)?	Waterbody Buffers (Y/N)?	Erosion Control (Y/N)?	Vegetation (Y/N)?	Stormwater Measures (Y/N)?	Waterbody or Wetland Protection (Y/N)?	Open Space Dedication (Y/N)?	Open Space Protection (Y/N)?	Buffer Preservation (Y/N)?	Parking Reduction (Y/N)?
Blooming Grove town	Y	N	N	Y	Y	N	N	N	N	Y	Y	N	Y
South Blooming Grove village	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y
Washingtonville village	N	N	Y	N	N	N	N	N	N	N	N	N	N
Chester town	Y	Y	Y	Y	Y	N	N	N	Y	Y	N	N	Y
Chester village	N	N	N	N	N	N	Y	N	N	N	N	N	N
Cornwall town	N	N	N	N	N	N	Y	N	N	N	Y	N	Y
Cornwall-on-Hudson village	N*	Y	N	Y	N	N	Y	N	N	Y	Y	N	N
Crawford town	N	N	Y	Y	N	N	N	N	N	N	N	N	Y
Deerpark town	N	N	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y
Goshen town	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y
Goshen village	N	N	N	Y	N	N	Y	N	N	Y	N	N	Y
Greenville town	N	N	N	N	Y	N	N	N	N	N	N	N	Y
Hamptonburgh town	Y	Y	N	N	N	N	Y	N	N	Y	Y	N	N
Highlands town	N	N	N	N	N	N	N	N	N	N	N	N	N
Highland Falls village	N	N	N	N	N	N	N	N	N	N	N	N	Y
Middletown city	N	N	N	N	N	N	Y	N	N	N	N	N	N
Minisink town	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y
Unionville village	N	N	N	N	N	N	Y	N	N	N	N	N	Y
Monroe town	N	N	Y	N	Y	N	Y	N	Y	N	N	N	N
Harriman village (total)	N	N	N	N	N	N	Y	N	N	Y	N	N	N
Kiryas Joel village	N	N	N	N	N	N	N	N	N	N	N	N	Y
Monroe village	Y	Y	N	N	N	N	Y	N	N	Y	Y	N	Y
Montgomery town	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y
Maybrook village	N	N	N	N	Y	N	Y	N	N	N	N	N	Y
Montgomery village	Y	N	N	N	N	N	Y	N	N	Y	N	N	Y
Walden village	N	N	N	N	N	N	Y	N	N	N	N	N	Y
Mount Hope town	Y	N	N	Y	N	N	Y	N	Y	N	N	N	Y
Otisville village	N	N	N	N	N	N	N	N	N	Y	Y	N	Y
Newburgh city ***	N	Y	N	N	N	Y	Y	Y	N	N	N	N	N
Newburgh town	N	N	Y	Y	Y	N	Y	N	N	Y	N	Y	Y
New Windsor town	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N
Port Jervis city	N	N	Y	N	N	N	Y	N	N	N	N	N	Y
Tuxedo town	N#	N	Y	Y	N	N	Y	N	N	N	Y	N	Y
Tuxedo Park village	N	N	N	Y	N	N	Y	N	Y	N	N	N	Y
Wallkill town	Y	Y	Y	Y	N	N	Y	N	N	Y	Y	N	N
Warwick town	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
Florida village	N	Y	Y	N	N	Y	Y	N	N	N	N	N	Y
Greenwood Lake village	N**	Y	Y	Y	Y	N	Y	Y	Y	N	N	N	Y
Warwick village	N	Y	Y	Y	N	N	Y	N	N	Y	Y	N	Y
Wawayanda town	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	Y
Woodbury town	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR	NLR
Woodbury village	Y	N	Y	N	N	N	Y	N	N	Y	Y	N	Y

NLR = No Longer Relevant; the Town of Woodbury ceded land use authority to the Village of Woodbury in 2011

Notes: * = The Village of Cornwall-on-Hudson has a Waterfront Recreation District that serves essentially the same purpose as an overlay in this instance. ** = The Village of Greenwood Lake has a similar circumstance; Waterfront Residential is reserved for properties on the lake. *** = The City of Newburgh is undergoing a comprehensive zoning rewrite. The proposed water resource protection measures are stronger than those existing; however this audit was done on the existing code (as of November 2014) because the proposed update has not yet been adopted. If adopted, implementation is expected to be June 2015. # = There is no overlay district, but the Floodplain districts regulate uses along the waterway in the Town of Tuxedo.

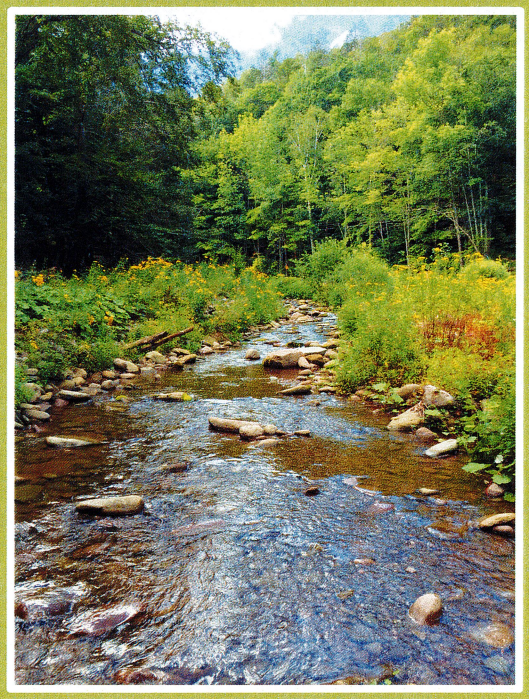
Code audit questions / Column Number:

1. Is the watershed recognized as an overlay district in the municipality's zoning?
2. Is bulk storage excluded or prohibited within the watershed?
3. Does the municipality control density through soil-based zoning or by removing unbuildable soils from the net development area?
4. Does the municipality control density through removal of steep slopes from the net development area?
5. Are buffers required around bodies of water?
6. Does the municipality require erosion control measures beyond those required by the state?
7. Does the municipality set standards for vegetation in the site development process? These standards could include: minimum percentage of the site (or parking area) to be vegetated, whether planting is required, how much of the site may be cultivated and how much must be left wild.
8. Does the municipality require stormwater management measures that go above and beyond the standards set by New York State?
9. Does the municipality have waterbody or wetland protection measures of their own, in addition to state or federal regulations?
10. Does the municipality require dedication of open space as part of a development application?
11. Does the municipality require that open space area of a clustered subdivision be protected, either by conservation easement or some other measure, in its natural state?
12. Does the municipality protect, either by conservation easement or some other measure, vegetated buffers around waterbodies and wetlands?*(This is similar to question 5, but question five includes all buffers—no primary buildings, no buildings at all, no development at all, and natural vegetated buffers)*
13. Does the municipality allow reduction of parking spaces through land banking, requiring a maximum or median number of spaces rather than a minimum, use of pervious pavement or other porous surfaces, compact spaces, or other measures that reduce the amount of impervious parking area onsite?

LAND USE LAW CENTER

2018 LULA Training for the
Wallkill River Watershed

WATER QUALITY & QUANTITY PROTECTION



Preserving natural features and fostering compact development are critical first steps to protecting water quality. In addition, communities may consider other specific strategies to protect water quality and quantity:

Water Quality:

- **Protect drinking water sources**
- **Regulate potential pollution sources**
- **Control erosion**
- **Manage stormwater with natural filtration**

Water Quantity:

- **Protect aquifers**
- **Manage stormwater to reduce runoff and increase infiltration**

Why is water quality protection important?

Protecting drinking water from pollution is essential to community health and safety. This includes both groundwater that feeds wells, and surface water reservoirs and rivers that are used for municipal supplies.

Other waterbodies may also need protection. Some communities regulate specific pollution sources, including maintenance of septic systems; storage of salt and hazardous materials; application of fertilizer, pesticides and manure; and activities like mining and hydrofracking.

Because sediment can clog drainage ways, harm stream habitat, and carry phosphorus, controlling erosion is critical. Erosion control comes into play in construction site management, clearing and grading, timber harvesting, and steep slope protection laws.

Why is water quantity protection important?

In a natural system, most rain water is absorbed into the ground to recharge groundwater, and slowly flows toward waterbodies. When that process is interrupted, there can be two problems: (1) When aquifers are not recharged, drinking water shortages can result, and stream base flow can be depleted. (2) When water runs off too quickly, it can cause erosion and flooding downstream.

Reducing impervious surfaces and managing stormwater with green infrastructure can help maintain or mimic natural hydrology. Benefits include preserving aquifer recharge to maintain groundwater supplies, maintaining stream base flows, and preventing runoff-driven streambank erosion and flooding. This is especially important to mitigate effects of climate change including heavier storms, hotter summers and longer dry periods.

TOOLS

Ordinance: Ordinances typically regulate both construction and other activities in protected areas throughout the municipality. They often contain a permitting process to allow disturbance under prescribed conditions.

Conservation Zoning District: Establishing a defined zoning district for a sensitive area allows the municipality to limit land uses in that area.

Overlay District: An overlay district can span parts of multiple zoning districts, adding extra requirements for sensitive areas. This technique is frequently used to protect stream corridors

Allowed Uses: A community can ban unwanted uses in a specified area or throughout the municipality.

Special Use Permit: Uses can be allowed only if awarded a Special Use Permit. The zoning code can specify the criteria for when that use will be allowed.

Critical Environmental Area: Municipalities can designate CEAs through a simple process, and subsequent projects in those areas will need to consider effects on the sensitive resources. More information: https://www.dec.ny.gov/permits/6184.html

LOCAL EXAMPLES

DRINKING WATER - GROUNDWATER

Protection of subsurface water sources takes two main forms: Aquifer protection focuses on preserving the quality and quantity of water throughout an aquifer system. Wellhead protection focuses on the area directly around a public water supply well to prevent pollution.

Town of Warwick – Wellhead Protection
Chapter 159 – Wellhead Protection
A short chapter on wellhead protection provides basic pollution controls for municipal and private water supply wells.

Town of Warwick – Aquifer Protection Overlay District (focus on water quality)
Section 164-47.2 – "Aquifer Overlay District" in zoning code
The town mapped key aquifers and recharge areas, and established an overlay district intended to prevent groundwater pollution. Various uses and activities are prohibited in the district.

Town of Goshen – Aquifer Protection Overlay District (focus on water quantity)
Section 97-27 – "Aquifer Overlay District" in zoning code
The town conducted a Potable Water Study that mapped the town into watersheds. Residential density is limited to 3 or 6 units per acre based on watershed. The code also incorporates pollution controls.

Town of Shawangunk – Aquifer Protection Critical Environmental Area & Overlay District
"Wallkill Public Water Supply, Water Shed, & Aquifer CEA"
A Critical Environmental Area covering the Tin Brook Aquifer protects drinking water wells for the hamlet of Wallkill: https://www.dec.ny.gov/docs/permits_ej_operations_pdf/wallkillpws.pdf
Section 177-6(N) – "Aquifer Protection Overlay (AQ-O)" in zoning code
An overlay zone complements the CEA by placing controls over development to protect both the quality and quantity of water in the Tin Brook Aquifer.

Town of Wawayanda – Aquifer Protection Overlay Districts
Section 195-25 – "Water supply protection" in zoning code
The town created two overlay zones to protect its aquifers: The first protects the immediate area around the public water supply, and the second expands to the contributing watershed. A comprehensive set of regulations limits potentially polluting uses and requires special stormwater controls. The code also requires special use permits for "any proposed use or activity that removes 1,000 gallons per day or more from the aquifer."

Town of Clinton (Dutchess County) – Zoning District to Protect Lakes and Aquifer
Section 250-10 – "Conservation Agricultural Residential (C) District" in zoning code
The "C" district was drawn specifically to protect the watershed of three lakes that provide important habitat, as well as to preserve water quality in an aquifer. Limited uses are allowed, and district regulations restrict potentially polluting activities.

Town of Dover (Dutchess County) – Aquifer and Wellhead Protection Overlay District
Section 145-14 – "Aquifer Overlay District" in zoning code
This ordinance includes wellhead protection buffers as well as broad protection for mapped aquifer areas. It regulates numerous potentially polluting uses and activities in the designated area.

Town of Amenia (Dutchess County) – Aquifer Protection Overlay District
Section 121-15 – "Aquifer Overlay District" in zoning code
This detailed ordinance regulates activities in multiple zones based on aquifer mapping. It promotes both water quality and quantity protection. It is based on the Dutchess County model aquifer protection law:
http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/16891.htm

DRINKING WATER – SURFACE WATER

Town of Goshen – Reservoir Protection Overlay District

Section 97-26 – "Stream Corridor and Reservoir Watershed Overlay District" in zoning code

Goshen's stream protection overlay district also includes all lands lying within the Village of Goshen water supply reservoir watersheds. It requires site plan review and erosion control for projects that wouldn't otherwise receive those protections.

Town of Newburgh – Reservoir Protections through SEQRA and Critical Environmental Area

Section 185-22(C) – "Chadwick Lake Critical Area of Environmental Concern";
"Chadwick Lake Reservoir Environs CEA"

The town designated a Critical Environmental Area around Chadwick Lake, a drinking water source. The code specifies that all development in CEAs should be treated as Type 1 actions under SEQRA, and it specifies limits for development within the Chadwick Lake CEA in particular.
https://www.dec.ny.gov/docs/permits_ej_operations_pdf/chadwicklkres.pdf

POTENTIAL POLLUTION SOURCES

Town of New Paltz – Prohibition of Polluting Uses and Hydrofracking

Section 140-9 – "Prohibited industrial uses" in zoning code

The extensive list of prohibited uses in New Paltz reflects a variety of environmental and community concerns. Numerous potentially polluting industrial uses are prohibited, along with natural gas exploration and extraction.

Town of Rosendale – Prohibition of Natural Gas and Petroleum Extraction

Section 75-9 – "Prohibited uses" in zoning code

Exploration for and extraction of natural gas and petroleum are prohibited townwide, along with associated activities.

Septic Systems

Communities in the Croton watershed (which serves New York City) have septic system maintenance requirements to reduce septic failures. This approach could be adopted in other sensitive watersheds. See, e.g.:

Town of North Castle (Westchester) – Chapter 254: "Sewer Systems, Private"
Town of Pawling (Dutchess) – Chapter 159: "Septic Systems"

STORMWATER MANAGEMENT

New York State requires certain standards for erosion control on construction sites, as well as long-term (post-construction) stormwater management for larger projects. In denser "MS4" communities, the municipality must ensure compliance.

Upgrade opportunities:

(1) Non-MS4 communities can adopt stormwater regulations and review each project's stormwater pollution prevention plan (SWPPP).
(2) MS4 communities can require stormwater controls for projects smaller than the statewide thresholds.

DEC provides a model local law and other tools: https://www.dec.ny.gov/chemical/9007.html

Town of Warwick – Enhanced Stormwater Controls
Section 164-47.10 – "Stormwater management" in zoning code
Warwick's zoning code establishes goals for stormwater management, including minimizing total runoff rates, recognizing stormwater as a valuable resource, and even integrating artistic elements into stormwater practices. In addition to DEC-mandated controls, it adds a level of "intermediate SWPPP" for activities deemed to present potential pollution risks due to soils, slopes, proximity to sensitive resources, and other criteria.

Village of New Paltz – Enhanced Stormwater Controls
Chapter 165 – "Storm Sewers and Stormwater Management"
The Village requires post-construction stormwater controls for smaller disturbances than the state mandates. A full SWPPP can be required for projects with land disturbance of 5,000 square feet that create impervious cover of 1,000 square feet. (§ 165-29(A)(2)).

EROSION CONTROL

Timber Harvesting
Tree removal operations should be carefully managed to reduce soil erosion and disturbance of streams and wetlands.

Town of Wawayanda – Forestry Regulations in Zoning
Section 195-43 – "Forestry" in zoning code
Requires site plan approval and special use permit, with specific permit requirements, for commercial forestry operations.

Town of Pine Plains (Dutchess County) – Special Use Permit Requirements
Section 275-56(P) – "Commercial logging/timber harvesting" in zoning code
Requirements to receive a SUP for logging include permits for stream and wetland disturbance. The Planning Board can seek advice from the Soil & Water Conservation District in reviewing the plan. The Zoning Administrator may stop work if conditions make soil erosion probable.

Town of Pawling (Dutchess County) – Comprehensive Timber Harvesting Regulations
Chapter 187 – "Timber Harvesting"
This full chapter of timber harvesting regulations requires thorough review and permitting of operations.

Steep Slopes
Development on steep slopes is susceptible to erosion.

Town of New Paltz – Development Restrictions on Steep Slopes
Article XV – "Steep Slope Protection" in zoning code
On slopes over 15%, special permitting requirements are imposed.

Town of Cortlandt – Development Restrictions on Steep Slopes
Chapter 259 – "Steep Slopes"

On slopes over 15%, special permitting requirements are imposed.

Soil Based Controls
Several towns in Orange County incorporate regulations in their zoning and subdivision codes based on soils. Goals include reducing erosion, ensuring septic system function, etc.

Town of Chester – Soil-Based Building Controls
Sections 83-25 and 83-26 – "Soil Groups" in subdivision code
For each soil type, the code states whether septic systems are allowed and identifies erosion risk level. For soil types that typically pond with water, the code requires replacement of stormwater storage lost due to development.

Town of Wallkill – Soil-Based Subdivision Limits
Based on soil group, the code assigns an environmental factor that limits subdivision density.
Section 209-23 – "Soil Groups" in subdivision code

RESOURCES

Wallkill River Document Library – *Wallkill River Watershed Alliance*
The WRWA hosts a thorough library of documentation for the Wallkill River, including water quality information and planning documents.
http://www.wallkillalliance.org/documents/

Waterbody Inventory – *NYS Department of Environmental Conservation*
For each river, stream and lake, the inventory provides an overview of water quality conditions and potential pollution sources.
https://www.dec.ny.gov/chemical/36730.html

Orange County Resources – *Orange County Water Authority*
Groundwater studies: http://waterauthority.orangecountygov.com/groundwater.html
Water Master Plan: http://waterauthority.orangecountygov.com/county_plans.html

Stormwater Management Guidance Manual for Local Officials – *NYS Department of Environmental Conservation*
This guide discusses municipalities' opportunities to mitigate stormwater pollution and includes a sample local law.
https://www.dec.ny.gov/chemical/9007.html

Green Infrastructure Examples for Stormwater Management in the Hudson Valley – *Hudson River Estuary Program*
Take a virtual tour of green stormwater practices in use throughout the Hudson Valley.
https://www.dec.ny.gov/lands/58930.html

Green Infrastructure Video Series – *Lower Hudson Coalition of Conservation Districts*
This video series showcases green infrastructure types with an explanation of how they work.
https://www.lhccd.net/green-infrastructure.html

Reviewing Stormwater Management in Site Design: A Guide for Planning Board Members – *Lower Hudson Coalition of Conservation Districts*
Planning Board members can learn how to use NYS stormwater regulations to press for better site design, including preservation of natural features, minimizing impervious surfaces, and effectively incorporating green infrastructure practices.
https://www.lhccd.net/uploads/7/7/6/5/7765286/planning_board_sw_guide_2015.pdf

Road Salt: Moving Toward the Solution – *Cary Institute for Ecosystem Studies*
The Cary Institute maintains a wealth of information on the problem and solutions to road salt pollution in the Hudson Valley.
http://www.caryinstitute.org/science-program/research-projects/road-salt/road-salt-moving-toward-solution

Water Resource Laws, Policies and Watershed Protection – *Hudson Valley Regional Council*
A set of fact sheets and articles covers various aspects of stream and watershed protection, including NYS Watershed Rules and Regulations for drinking water sources.
http://hudsonvalleyregionalcouncil.org/regional-initiatives/water-resource-laws-policies-and-watershed-protection/

Gaining Ground Database – *Pace Land Use Law Center*
This library of local laws contains examples from New York State municipalities.
https://appsrv.pace.edu/gainingground/

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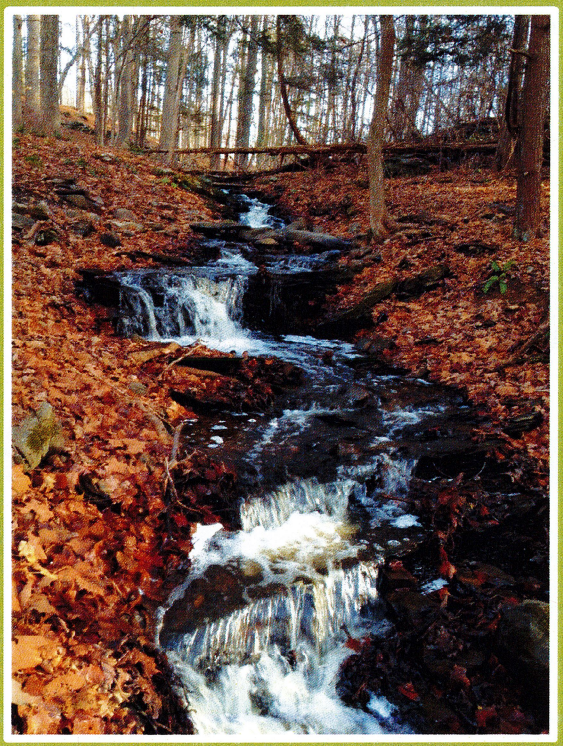
PRESERVATION OF NATURAL FEATURES



Key resources to protect for watershed health:

- **Wetlands, including vernal pools**
- **Stream corridors**
- **Floodplains**
- **Farmland**
- **Ridges**
- **Trees**

An essential component of watershed protection is to preserve intact natural systems, including river and stream corridors, wetlands, and quality uplands including forest and farmland. These features maintain both water quality and water quantity naturally.

Why protect natural features?

Wetlands filter pollutants and capture runoff to recharge aquifers and prevent flooding. Preserving a broad vegetated buffer adjacent to streams and wetlands absorbs pollutants, prevents erosion and provides shade to cool the water.

Protecting quality uplands, including forest and farmland, reduces runoff and maintains infiltration and groundwater recharge.

Preserving these resources yields additional benefits including wildlife habitat and scenic beauty.

TOOLS

Ordinance: Ordinances typically regulate both construction and other activities in protected areas throughout the municipality. They often contain a permitting process to allow disturbance under prescribed conditions.

Conservation Zoning District: Establishing a defined zoning district for a sensitive area allows the municipality to specifically limit land uses in that area.

Overlay District: An overlay district can span parts of multiple zoning districts, adding extra requirements for sensitive areas. This technique is frequently used to protect stream corridors or watersheds.

Subdivision Regulation: Environmental requirements can be incorporated into subdivision regulations if environmental impacts of residential development are a particular concern.

Critical Environmental Area: Municipalities can designate CEAs through a simple process, and subsequent projects in those areas will be required to consider effects on the specified resources. More information: https://www.dec.ny.gov/permits/6184.html

LOCAL EXAMPLES

WETLANDS AND STREAMS

Federal and state law provides limited protection of certain wetlands and streams. Municipalities can protect smaller and seasonal wetlands and streams. Protecting the adjacent buffer areas maintains water filtration and habitat functions.

Town of New Paltz – Wetland and Watercourse Ordinance
Chapter 139 – "Wetland and Watercourse Protection"
This comprehensive wetland and stream protection ordinance protects streams, wetlands and vernal pools with buffers of 50-100 feet. It designates a 200-foot buffer for the Wallkill River. The ordinance regulates land disturbance, dumping, construction and other activities in regulated areas.

Town of Lewisboro (Westchester County) – Wetland and Watercourse Ordinance
Chapter 217 – "Wetlands and Watercourses"
This broad ordinance protects wetlands and streams townwide with a buffer of 150 feet. It regulates filling and construction activities in protected areas with a permitting program.

Town of Gardiner – Wetland and Watercourse Provisions in Zoning
Section 220-35 – "Wetland and Watercourse Protection" in zoning code
The Town of Gardiner adds some extra protections to state-protected streams, regulating disturbance within 150 feet of Class AA, A, B, and C(t) streams. It also authorizes the Planning Board to require protections for state- or federally-designated wetlands.

Town of Goshen – Stream and Reservoir Overlay

Section 97-26 – "Stream Corridor and Reservoir Watershed Overlay District" in zoning code

Goshen has multiple overlay zones for environmentally sensitive areas. The stream and reservoir overlay applies to land adjacent to the Wallkill River and other streams, as well as throughout the watershed of the water supply reservoir. It requires site plan review and erosion and sediment plans for projects that wouldn't otherwise produce them.

Town of Wallkill – Stream Overlay

Section 249-101 – "Shawangunk Kill Corridor Preservation Overlay District" in zoning code

This overlay district applies immediately adjacent to the Shawangunk Kill and restricts most construction and other uses in the stream corridor.

Town of Chester – Subdivision Regulations

Section 83-24(C) – "Preservation of Natural Features" in subdivision code

Many subdivision codes make general statements about preserving natural features, but Chester's is very specific about preserving stream corridors, wetlands, and other features.

Model Stream Corridor Overlay

The Orange County Water Authority offers model language for a stream corridor overlay as part of its Watershed Design Guide (see Sample Municipal Model Code for Watershed Protection): http://waterauthority.orangecountygov.com/design_guide.html

FLOODPLAINS

Most municipalities have a basic floodplain law required for participation in the National Flood Insurance Program, but these laws are aimed at reducing property damage, not maintaining floodplain functionality. Some municipalities add additional protections to preserve the integrity of floodplains.

Towns of Chester, Goshen & Wallkill – Floodplain Overlay District

Town of Chester – Section 98-26 – "Floodplain and Ponding Area Environmental Subdistrict" in zoning code

Town of Goshen – Section 97-25 – "Floodplain and Ponding Area Overlay District" in zoning code

Town of Wallkill – Section 249-15 – "Floodplain and Ponding Area Subdistricts" in zoning code

These overlay districts allow very limited uses as-of-right (e.g., recreation, agriculture), with discretion for planning board approval of other uses only if they are shown to be appropriate. The Town of Wallkill specifically limits fill along the Wallkill River corridor.

FARMLAND

Multiple methods can be used to preserve rich agricultural soils, providing multiple benefits including protecting open space and farm viability.

Town of Warwick – Farmland Overlay

Section 164-47.3 – "Agricultural Protection Overlay District" in zoning code

Through an overlay district, the Town of Warwick offers opportunities to preserve farmland in the development process. Section 164-47.4 introduces the opportunity for a transfer of development rights program.

Town of Goshen – Farmland Protection Program
Chapter 71 Open Space Preservation and Acquisition
Aimed at preserving farmland and other valuable open space, this program includes land acquisition and purchase of development rights programs.

Town of Red Hook (Dutchess County) – Agricultural Zoning District
Section 143-39.1 – "Agricultural business district"
The Town of Red Hook has planned and zoned with farmland preservation in mind. In the agricultural business district, allowed uses are focused on farms and related enterprises. Limited residential subdivision is allowed, with a purchase of development rights program available.

RIDGES

Sensitive ridge areas can be fragile ecosystems, prone to erosion, and important scenic viewsheds to preserve.

Town of Gardiner – Ridge Protection District
Section 220-16 – "Shawangunk Ridge Protection District" in zoning code
This district maintains low-intensity development in mountainous parts of the town to protect water quality and biodiversity, as well as scenic views.

Town of Shawangunk – Critical Environmental Area
"Shawangunk Ridge" CEA: https://www.dec.ny.gov/permits/25157.html
The CEA was designated because of soil type, slope and wildlife habitat.

TREES

Some communities choose to preserve mature trees when land is being developed.

Town of New Paltz – Tree Ordinance
Chapter 130 – "Tree Conservation"
A permit is required to cut any tree over 7" in diameter.

Town of Chester – Subdivision Code
Section 83-24(C) – "Preservation of Natural Features" in subdivision code
Trees greater than 12" in diameter cannot be removed unless allowed by the Planning Board.

Town of Mount Hope – Subdivision Code
Section 210-53(B) – "Preservation of Natural Features" in subdivision code
Trees greater than 8" in diameter cannot be removed unless allowed by the Planning Board.

OTHER SENSITIVE AREAS

Town of Rosendale – Overlay District for Sensitive Area
Section 75-58 – "Binnewater Lakes Conservation Planning Development Area"
For this sensitive lake and forest ecosystem, the Town wishes to preserve ecosystem health while encouraging appropriate redevelopment of a traditional resort area. The code provides for master

planning that will support flexible redevelopment while protecting resources. Open space protection, stormwater management, and other protective measures are required.

RESOURCES

Conserving Natural Areas and Wildlife in Your Community – *Hudson River Estuary Program*
This guide provides background on the protection of biodiversity in the Hudson Valley and rich resources for local action.
https://www.dec.ny.gov/lands/50083.html

Strategies for Sustainable Tributaries – *Hudson Valley Regional Council*
This guide covers the scientific and legal basis for protecting streams and includes a model law.
http://hudsonvalleyregionalcouncil.org/wp-content/uploads/2015/11/Strategies-for-Sustainable-Tributaries-A-Guidance-Manual.pdf

Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands – *American Rivers*
American Rivers' publication covers the reasons to protect headwater streams and small wetlands.
https://www.americanrivers.org/conservation-resource/small-streams-wetlands/

Creating a Natural Resources Inventory – *Hudson River Estuary Program*
Written specifically for Hudson Valley communities, this guide explains how to create a Natural Resources Inventory for your municipality. Documenting sensitive resources is an important step in protection.
https://www.dec.ny.gov/lands/100925.html

County-Wide Plans – *Ulster and Orange Counties*
Ulster County's Open Space Plan features information on water resources and conservation needs specific to Ulster County.
http://ulstercountyny.gov/planning/open-space-plan
Orange County's Water Master Plan provides data on water resources and protection needs in Orange County.
https://www.orangecountygov.com/376/Orange-County-Plans-Documents

Watershed Design Guide – *Regional Plan Association & Orange County Water Authority*
This guide provides details on integrating natural resource protection into development design including preserving natural features.
https://www.orangecountygov.com/DocumentCenter/View/4135

Mid-Hudson Sustainability and Smart Growth Toolkit – *Orange County Planning & Regional Plan Association*
Water resource protection and agriculture are among the topics covered in this survey of smart growth practices.
https://www.orangecountygov.com/DocumentCenter/View/8360

Gaining Ground Database – *Pace Land Use Law Center*
This library of local laws contains examples from New York State municipalities.
https://appsrv.pace.edu/gainingground/

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COMPACT DEVELOPMENT & INFILL

"Zero Place" – New Paltz

Elements of compact development:

- **Open space protection**
- **Infill development**
- **Higher density zoning**
- **Reduced parking area**
- **Clustered subdivisions**

To preserve watershed health, communities should guide new growth in more compact forms. A key is infill development – guiding new construction to existing developed areas, while keeping rural areas in a more natural state. When there is new commercial and residential development outside existing centers, it can benefit from more compact layouts.

Why is compact development important?

Watershed health can be severely affected by suburbanization. Converting forest and farmland to subdivisions and shopping centers disrupts hydrology and removes protective natural features.

Concentration of new development in existing developed areas and at higher densities protects water quality and quantity and provides other smart growth benefits. Redeveloping sites within cities, villages and hamlets offers an opportunity to incorporate modern stormwater practices and reduce pollution from runoff.

Municipalities can ensure that their codes allow for denser development and can incentivize infill development in particular. They can also take measures to reduce development in rural areas.

TOOLS

Zoning District: Zoning districts can be established to promote greater density in core areas or maintain the rural character of outlying areas.

Floating Zone: A floating zone allows for a desired development type without pre-determining the location. If conditions are met, the zone can be "fixed" to a lot.

Priority Development Area: Communities can use PDAs to encourage and incentivize infill development in preferred areas.

Priority Growth District: PGDs can take the form of zoning districts, floating zones or overlays. They encourage new growth in a specified pattern, typically adjacent to existing developed nodes where infrastructure is available.

Planned Unit Development: Municipalities can allow PUDs that create new nodes of mixed-use development, without being bound to general zoning restrictions.

Density Bonus: Communities can provide an incentive for developers to build needed features (e.g. public amenities, affordable housing) in exchange for allowing an increased number of housing units. This can be desirable where density is appropriate.

Accessory Dwelling Unit: Allowing accessory dwelling units in single family zones is a simple way of increasing density by permitting a second small dwelling unit on the same lot as a single family home, or attached to the home.

Subdivision Regulation: Conservation or cluster subdivisions can be used to allow developers the number of units calculated under traditional subdivision rules, but in a more compact form that preserves sensitive environmental areas and open space.

Purchase/Transfer of Development Rights: PDR and TDR programs protect open space by compensating landowners in rural areas for permanently reducing the development potential of their land. These rights may be purchased and extinguished or transferred to another site for increased density where it is desired by the community.

Open Space Plan: Open space planning can be conducted at the municipal scale, to document and plan for the undeveloped land the community would like to maintain as open space. Such a plan can form a sound foundation for selecting land for PDR/TDR and open space set-asides in subdivisions.

LOCAL EXAMPLES

OPEN SPACE PROTECTION

Local communities use numerous methods to preserve open space, through zoning and proactive preservation programs.

Town of Goshen – Rural Zoning District
Chapter 97, Article IV – "RU District" in zoning code
Much of the town is zoned as "rural," with specific development options that preserve open space.

Town of Gardiner – Rural Zoning Districts
Chapter 220, Article V – "Residential Development in RA and SP Districts" in zoning code
The Rural Agriculture (RA) and Shawangunk Ridge Protection (SP) districts prioritize open space protection and require a conservation analysis to preserve high quality natural features.

Town of Warwick – Floating Zone for Open Space Preservation
Section 164-47.6 – "Incentive zoning for open space preservation" in zoning code
This floating zone offers incentives for development in accordance with an open space preservation plan, when deemed appropriate by the town board.

Town of Goshen – Open Space Purchase of Development Rights (PDR) Program
Chapter 71 – "Open Space Preservation and Acquisition"
The town established an Open Space Preservation and Acquisition Fund, managed by an Open Space Board, which is used to purchase development rights in targeted open space and farmland.

Town of New Paltz – Open Space Purchase of Development Rights (PDR) Program
Chapter 44 – "Agriculture and Open Space Preservation and Acquisition"
A Clean Water and Open Space Commission guides the acquisition of development rights in farmland and open space, and stewardship of those lands. The town established a Preservation and Investment Fund for this purpose.

Town of Warwick – Transfer of Development Rights (TDR) Program
Section 164-47.4 – "Transfer of development rights (TDR)" in zoning code
The program allows transfer of development rights from the Agricultural Protection Overlay District to districts where density is desired.

Low Density Rural Areas
Subdivision of land allows for residential sprawl and suburbanization. One remedy is to deter subdivision in rural parts of the community by requiring a higher acreage per residential unit.

Towns of Rhinebeck and Red Hook (Dutchess County) – Large Lot Zoning
In Rhinebeck, the "Historic Preservation" district along the Hudson River requires 20 acres per unit, and the "Rural Agricultural" district requires 10 acres per unit. In Red Hook, the "Waterfront Conservation" and "Limited Development" districts require 10 acres per unit. These combine with other tools to steer density to central areas.

INFILL DEVELOPMENT

Promoting infill in existing villages and hamlets accommodates growth without sprawl, and can lead to vibrant, walkable places.

Village of New Paltz – Mixed-Use Village Zoning District
Section 212-13(G) – "Neighborhood Business Residential Mixed-Use District"
In an effort to guide the conversion of a highway business area to become a denser, walkable part of the village, New Paltz established the NBR district. It requires multistory buildings and provides

minimal setback requirements, allowing more intensive use of sites. The district offers flexibility on parking requirements, and focuses on pedestrian and bicycle amenities.

Town of Gardiner – Density and Incentives in Hamlet
Section 220-7(D) – "Hamlet Mixed-Use District (HM)" in zoning code
The HM district aims to maintain the traditional characteristics of the central hamlet while allowing it to become more economically viable. The code calls for Traditional Neighborhood Development design principles (§220-12.1), and allows for density bonuses if developers provide infrastructure (§220-11(D)).

Town of Malta (Saratoga County) – Downtown Form-Based Code
Chapter 167, Article XVI – "Downtown Malta Form-Based Code" in zoning code
A detailed form-based code prescribes development patterns to encourage denser infill of Malta's downtown.

Town of Hyde Park (Dutchess County) – Historic Crossroads Infill
Section 108-5.11.1 – "Crossroads Core District" in zoning code
The Crossroads Core district encourages infill development in a historic crossroads hamlet by boosting density, relaxing parking requirements, and focusing on pedestrian-oriented design.

Towns of Rochester and Warwarsing – Hamlet Revitalization through Brownfield Program
http://ulstercountyny.gov/ulster-county-revitalization-opportunity-areas
Kerhonkson is one of the Revitalization Opportunity Areas that Ulster County is pursuing with partner municipalities through the Brownfield Opportunity Area program (see Resources). The goal is to promote investment in underutilized properties in the hamlet of Kerhonkson.

HIGHER DENSITY ZONING

Higher density zoning can be appropriate in existing villages and hamlets, as well as adjacent areas targeted for expansion.

Village of New Paltz – High Density Residential
"R-3 District" in zoning code
New Paltz has multiple residential districts, with some core areas zoned R-3, which allows up to 12 dwelling units per acre.

Village of Walden – Downtown Mixed-Use and High Density
Chapter 305 – Multiple business, mixed-use and high-density residential districts in zoning
The central business district allows apartments over nonresidential first-floor uses, and surrounding neighborhood districts allow multifamily housing with up to 29 units per acre.

Town of Gardiner – Priority Growth District
Section 220-14 – "Hamlet Expansion Overlay District (HEO)" in zoning code
This overlay district designates areas outside the existing central hamlet where hamlet-style development may be extended when infrastructure allows.

Town of Wawayanda – Density Bonus for Multi-Family Housing
Section 195-55(F) – "Multifamily residential uses" in zoning code
Multifamily development is offered a 100% density bonus over the number of single-family units that would otherwise be allowed.

Town of Montgomery – Accessory Dwelling Units

Section 235-6.5(B) – "Accessory building use" in zoning code

In selected residential districts, "[a]n existing single-family dwelling unit may be enlarged or converted or an existing detached structure may be converted to include one accessory dwelling use (AU)." This allows for small apartments that increase housing density within the fabric of residential neighborhoods.

PARKING AND STREETS

Reduce Parking Area

Excessive parking requirements can unnecessarily consume land, increase stormwater, and work against density and walkability, while also adding costs. Parking waste can be reduced by encouraging shared parking, using on-street parking, reducing the number of required parking spaces, and reducing the dimensions of parking spaces. See Resources section for technical guidance.

Town of Goshen – Flexible Parking Standards

Section 97-48 – "Off-street parking and loading" in zoning code

Goshen's parking standards encourage site-specific analysis rather than simple formulas to determine parking needs. Likelihood of walking and biking are considered in the determination. The Planning Board can consider on-street parking, shared parking lots and municipal parking lots in meeting parking demand. The code also provides for a "fee in lieu" option in which the developer pays into a town fund for creation of municipal parking.

Village of Walden – Shared Parking

Section 305-28 – "Off-street parking for mixed uses" in zoning code

Within the Mixed Use district, parking can be provided multiple ways, including using on-street parking and shared parking. Parking spaces can be reduced if different uses within a building will demand parking at different times of day.

Village of New Paltz – Flexible Parking in Mixed-Use Zoning District

Section 212-13(G) – "Neighborhood Business Residential Mixed-Use District" in zoning code

New Paltz has a parking space size of 9x18 feet and somewhat flexible parking requirements throughout the Village. In the NBR district, there is additional flexibility and compact parking provisions, including the opportunity to count on-street spaces toward parking requirements, and support for shared parking arrangements, with up to 30% reduction when uses have different peak parking times.

Reduce Street Widths

Most communities have specifications for new streets. In some cases these can be reduced. Narrower streets mean less impervious surface. They can have other benefits like reducing speeds and maintaining rural character. The NYS Stormwater Design Manual states:

> "AASHTO recommends that for low volume local roads with less than 400 average daily trips and design speeds of 40 mph or less, the width of the traveled way can be as little as 18 feet. Adding two-foot shoulders on either side, the total would be 22 feet."

The Center for Watershed Protection echoes this recommendation. Also consider whether new streets are required to have curbs and gutters, which can impede green design options.

CLUSTERED SUBDIVISIONS

Many communities provide an option for clustered subdivisions, in which homes are grouped rather than spread evenly across a site. Clustering is most effective when it includes a strategy for preserving specified high-quality lands that protect water resources, habitat or scenic quality.

Town of Warwick – Multiple Clustering Formulas

Chapter 164, Sections 41.1 and 41.2 – "Cluster subdivisions" and "Conservation density subdivisions"

Cluster subdivisions focus on grouping houses to preserve high quality open space, with a specific design process to maximize conservation value. Density bonuses are available for extra conservation measures. The town also provides a conservation density subdivision option, allowing low-density subdivisions with shared driveways.

Town of Hamptonburgh – Conservation Subdivision with Density Bonuses

Section 150-21 – "Conservation subdivisions; incentive zoning in conservation subdivisions" in zoning code

The code authorizes the Planning Board to require the applicant to submit a conservation subdivision design when necessary to protect important natural features. As an incentive, it also provides a density bonus "if a minimum of 50% of the land area in the subdivision is set aside as a separate parcel and reserved in perpetuity as open space."

RESOURCES

County-Wide Open Space Plans – *Ulster and Orange Counties*

County open space plans can be a helpful starting point for town open space planning or selection of open space in subdivisions.

http://ulstercountyny.gov/planning/open-space-plan
https://www.orangecountygov.com/301/Open-Space-Plan

Breaking Ground: Planning and Building in Priority Growth Districts – *Pace Land Use Law Center*

This guide describes the process of designating and planning for priority growth districts. It features local examples: Warwick, East Fishkill and LaGrange.

https://law.pace.edu/emplibrary/Land_Use%20Breaking%20Ground.pdf

Centers and Greenspaces Greenway Guide – *Dutchess County*

Applicable throughout the Hudson Valley, Dutchess County's Centers and Greenspaces guide promotes strengthening of centers and preservation of surrounding greenspaces. It features Red Hook as a "rural success story."

http://www.dutchessny.gov/CountyGov/Departments/Planning/26180.htm

Mid-Hudson Sustainability and Smart Growth Toolkit – *Orange County Planning & Regional Plan Association*

This guide provides best practices for strengthening existing centers and preserving open space.

https://www.orangecountygov.com/DocumentCenter/View/8360

Code and Ordinance Worksheet – *Center for Watershed Protection*
This guide contains detailed recommendations for evaluating whether your municipal code maximizes conservation potential, particularly focused on reducing stormwater runoff. Take note of the section on parking, which provides specific provisions to reduce pavement area, including parking space dimensions of 9'x18'.
https://owl.cwp.org/mdocs-posts/better-site-design-code-and-ordinance-cow-worksheet-2017-update/

Transfer of Development Rights – *NYS Department of State*
This guide describes how to design and operate a successful TDR program.
https://www.dos.ny.gov/lg/publications/Transfer_of_Development_Rights.pdf

Brownfield Opportunity Area – *NYS Department of State*
Infill in some communities requires redeveloping former industrial sites. New York State assists communities in planning for reuse of these sites.
https://www.dos.ny.gov/opd/programs/brownFieldOpp/index.html

Creating Great Neighborhoods: Density in Your Community – *Local Government Commission & US Environmental Protection Agency*
This guide covers the benefits of density in creating vibrant downtowns and neighborhoods, with plentiful examples.
https://www.epa.gov/smartgrowth/creating-great-neighborhoods-density-your-community

Revitalizing Hudson Riverfronts – *Scenic Hudson*
Though focused on communities on the banks of the Hudson, the principles in this guide can provide guidance and inspiration for all Hudson Valley communities.
https://www.scenichudson.org/ourwork/riverfrontcommunities/publications

Gaining Ground Database – *Pace Land Use Law Center*
This library of local laws contains examples from New York State municipalities.
https://appsrv.pace.edu/gainingground/

Town of Cornwall
183 Main Street
Cornwall, NY 12518
(845) 534-9100

Village of Cornwall-on-Hudson
325 Hudson Street
Cornwall-on-Hudson, NY 12520
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