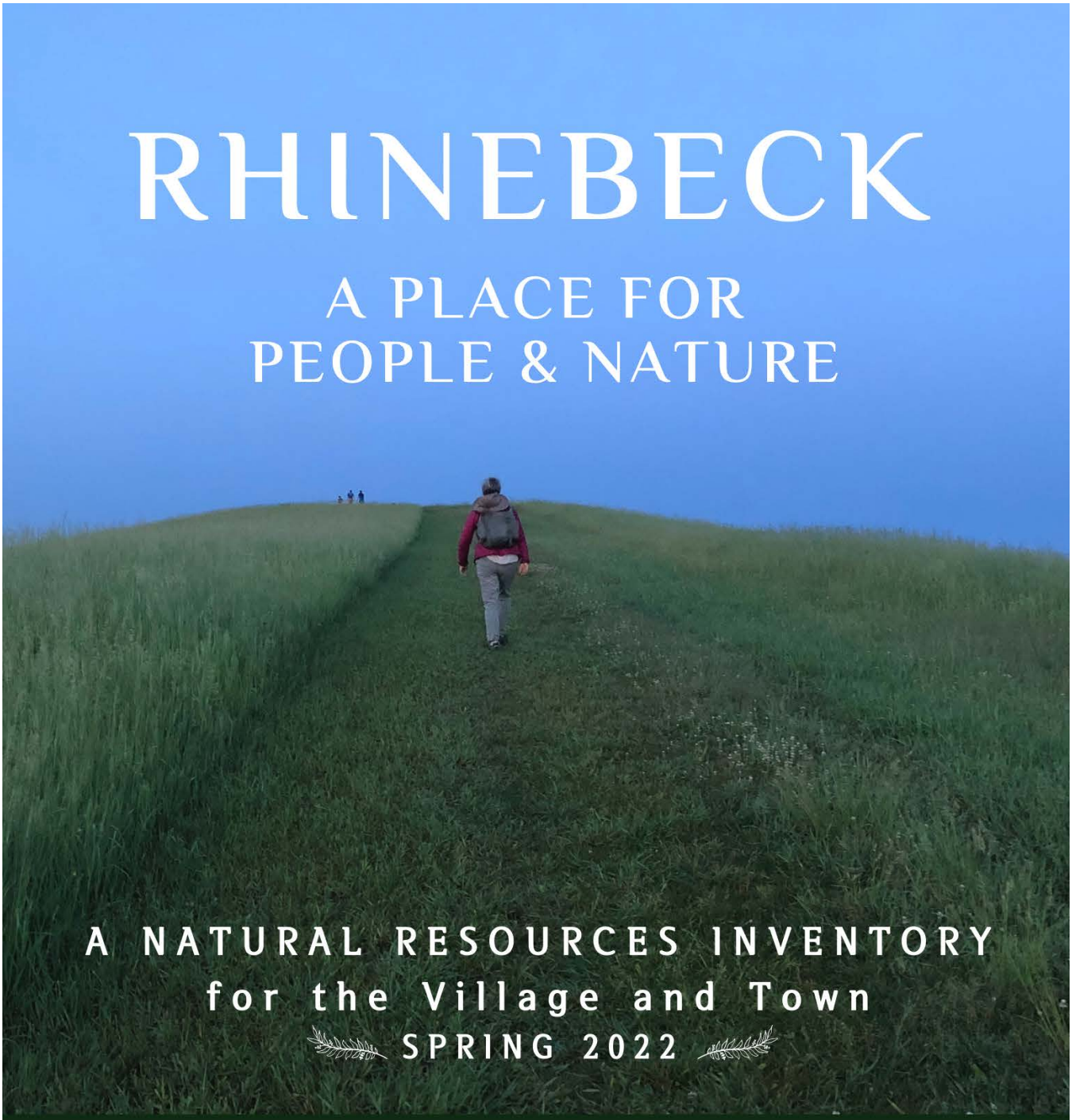


RHINEBECK

A PLACE FOR PEOPLE & NATURE

A NATURAL RESOURCES INVENTORY for the Village and Town

SPRING 2022

Prepared by Climate Smart Rhinebeck, the Rhinebeck Conservation Advisory Board, Dutchess Land Conservancy, DEC Hudson River Estuary Program/Cornell University, and Cornell Cooperative Extension of Dutchess County

Photo by George Beckwith

Table of Contents

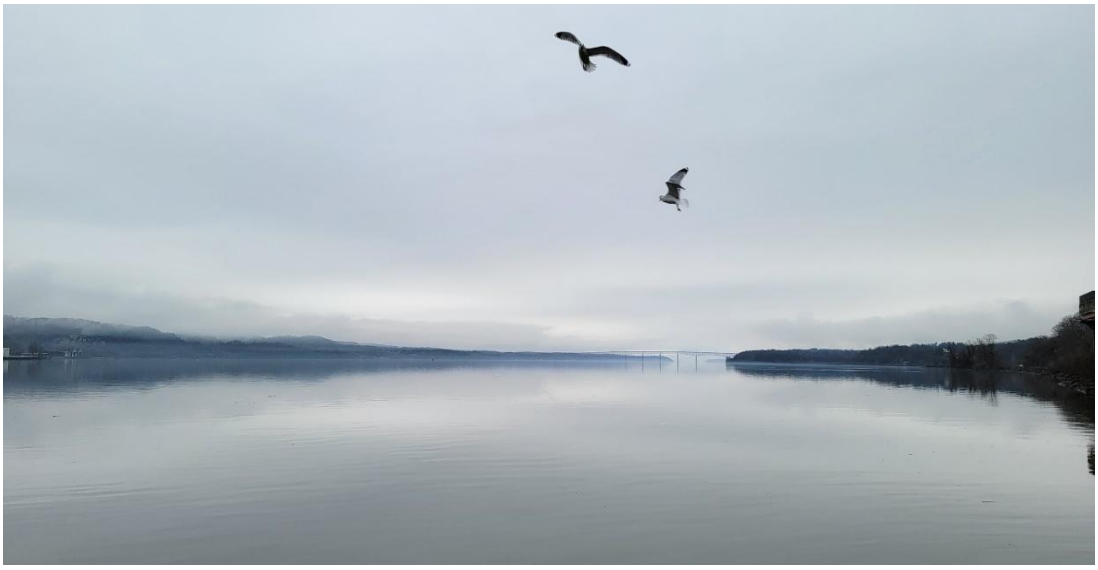


Photo by Peter & Stella Ilani

Contributors

Sean Carroll, Cornell Cooperative Extension Dutchess County

Nate Nardi-Cyrus, Dutchess Land Conservancy / NYS Department of Environmental Conservation, Hudson River Estuary Program and Cornell University

Vanessa Bertozzi, Trustee, Village of Rhinebeck, Climate Smart Rhinebeck Task Force Coordinator

Carli Fraccarolli, member of the Climate Smart Rhinebeck Task Force

Christopher Tavener, member of Rhinebeck Village Zoning Board of Appeals

Dan Shapley, Riverkeeper

Isabel Pronto, high school student, member of the Climate Smart Rhinebeck Task Force

Mark Dixon, Town of Rhinebeck Conservation Advisory Board

Mike Trimble, Town of Rhinebeck Planning Board

Jeff Walker, Vassar College

Russell Urban-Mead, Town of Hyde Park

Reviewers:

Ingrid Haeckel, NYS Department of Environmental Conservation, Hudson River Estuary Program and Cornell University; Christine Vanderlan, NYS Department of Environmental Conservation, Hudson River Estuary Program and Cornell University; John Clarke, Village of Rhinebeck Planning Board Member; Arthur "Dod" Crane, resident; Cecily Frazier, Cornell Cooperative Extension Master Gardener & Composter; Elizabeth Spinzia, Town Supervisor; Gary Bassett, Mayor; Josh Pulver, Town Councilperson; Mary Krembs, Bard Professor; Melodye Moore, Town Planning Board Chair; Steve Rosenberg, Village Comprehensive Plan Committee Member.

Acknowledgments

A huge thank you to our partners, Nate Nardi-Cyrus at Hudson River Estuary Program/Dutchess Land Conservancy and Sean Carroll of Cornell Cooperative Extension Dutchess County. Nate's upbeat task-mastering kept us on track and well-informed, and Sean's master map-making skills provided the bulk of our product. Mark Dixon led the charge town-side during the creation of the maps. Vanessa Bertozzi led from the Village side and stepped up when the Town CAB was not able to complete the project. Carli Fraccarolli brought her solar-siting expertise and her GIS skills, while Christopher Tavener's keen eye combed details on the maps. Thank you to John Clarke, who consulted on the project from a planning perspective, and to Mike Frazier who contributed fascinating historical context. Isabel "Scout" Pronto encouraged the Climate Smart Task Force to prioritize doing this NRI in the first place, and she contributed to the Habitat Resilience Score and Habitat sections. Scout's determination was backed up by the Town's Sustainability Coordinator, David Chernack, who completed a comprehensive review of our municipalities' policies and planning documents. David put forward the NRI as an excellent project for the Town and Village to pursue in his set of recommendations. Evan Pritchard, Algonquin scholar, graciously edited the text in the introduction about Rhinebeck's indigenous history. Dan Shapley stepped up to make major contributions to the report, especially with sections pertaining to water and habitats.

We did uncover an earlier draft of an NRI, dating from around the time of the Town's 2009 Comprehensive Plan. Thank you to Mike Trimble for sharing it and making contributions to this version with his expertise as a member of the Planning Board. Also, thank you to Arthur "Dod" Crane who grew up in Rhinebeck and added insights and color. We want to thank all the other professionals and residents who took time to review and provide comment on the NRI report and maps. Their input was critical to this project.

Both the Village and Town of Rhinebeck's Boards, Mayor Bassett, and Supervisor Elizabeth Spinzia have supported this project. It's an example of the Village and Town working together for the good of our land and our community.

We had amazing photographs submitted by 40 community members. As Kat Doughty put it, to live in Rhinebeck— "we really are lucky and blessed. I believe this blessing is a great gift to be enjoyed, as well as a great responsibility to be preserved, respected, treasured and shared with many, for years to come."

And of course, we give a gracious salute to our Hyde Park neighbors to the south, with whom we met over the course of 2021 and 2022.

This project was carried out through a partnership with Cornell University and the New York State Department of Environmental Conservation Hudson River Estuary Program with funding from the New York State Environmental Protection Fund.

Section 1: Introduction

Rhinebeck Village, 2020 by Roger Rosenbaum, Brand-News-Team

Prior to European colonization, the lands within Rhinebeck's current municipal boundaries were a confluence of indigenous cultures and dialects within the Algonquin language group: The Mohican Confederacy/Commonwealth to the north, the Wappingers Confederacy/Commonwealth to the South and East (with Mohican, Coastal Munsee and Quiripi influences) and the Esopus Munsee Confederacy/Commonwealth to the West. Each Commonwealth was made up of numerous interrelated sachemdoms, or groups of villages, and each village or camp often shared the same name as the natural features of a place and the people who lived there. The Sepasco ("place of the small river") who inhabited what is now Rhinebeck were Esopus Munsee and took their name from the confluence of what we call the Landsman Kill with the Hudson River, which in the Algonquin language is Mohicanituck, the "the river that flows both ways," or "greatest of estuaries." The confluence of waters was also a confluence of trade routes: the Sepasco Trail, which connected the Hudson River in the west to Lake Sepasco and points East (today's Route 308), a water crossing to the Minisink Trail to the West (today's Broadway/Route 209) and the Mohican Trail running north and south (today's Route 9).[1] Many of the descendants of the indigenous people of the region are now members of the Stockbridge-Munsee

[1] "Mapping Manahatouac: An Essential Handbook for Native American Studies and Land Acknowledgements for Manhattan, Long Island, Connecticut, Rhode Island, Northern New Jersey and Downstate New York" Evan Pritchard, 2021

Community, part of the federally recognized Mohican nation whose government is based in Wisconsin after being forcibly removed from their lands.[2,3] The Stockbridge-Munsee Community operates an Historic Preservation Office for our region in Williamstown, Ma., and conducts outreach in the Hudson Valley.[4] The Community has recently regained ownership of part of Papscanee Island in Rensselaer County.[5] The culture and society of these indigenous groups is and was based on reciprocity with the natural world, recognizing humans as being part of a community that includes the environment, rather than humans being separate from and above nature. Active management of the landscape was expected of each individual and council member to promote its health, abundance and usefulness.

Following Henry Hudson's voyage in 1609, private ownership of land was introduced to the landscape, as the Rhinebeck area became part of a Dutch colony in 1621, and later an English colony in 1664. The English promoted land settlement via a series of royal land grants to create agricultural manors. The first recorded land transfer, from the Sepasco, is dated 1686; it and subsequent patents involved Dutch and English families whose names are in many cases still prominent: Van Wagenen, Roosa, Elting, Kip, Schuyler, Beekman and Livingston. The first buildings that make up today's Village were built in 1706, and the place was given the name Rhinebeck in 1788 by the German Palatine settlers. Subsistence and commerce prompted dramatic changes to the landscape, as colonial settlers and later United States citizens cleared and used forests, dammed streams, planted farms, raised livestock, and built mills, homes, and businesses. Until New York State abolished slavery in 1827, these changes to the land and region were accomplished in part by enslaved people who were for decades forced to support the creation of wealth for their owners. The mansions on the river, their families, and their sublime views influenced the Romantic movement, with its celebration of awe inspired by natural landscapes. For decades around the turn of the 19th century, Rhinebeck was known as the Violet Capital of the World. Subdivision of land has continued, though uses of land have changed, and the natural environment has responded with the regrowth of forests on farm fields, for instance, and the introduction of many non-native species, both deliberately and inadvertently.[6]

---

[2] Stockbridge-Munsee Band of Mohican Indidans, https://www.mohican.com/

[3] Native Land Mapper. Native Land Digital. Canada. https://native-land.ca/

[4] Stockbridge-Munsee Community, Williams College Office of Institutional Diversity, Equity and Inclusion, https://diversity.williams.edu/the-stockbridge-munsee-community/

[5] Stockbridge-Munsee Community and Open Space Institute, "The Long Journey Home," 2020, available at https://storymaps.arcgis.com/stories/4b5d61785b064ff49ceff158e05e89fb

[6] Adapted from Kelly, Nancy, "A Brief History of Rhinebeck: A living past of a Hudson Valley community," 2001.

Sturgeon Point, View of the Hudson River by Dan Shapley

Today, the Town of Rhinebeck, has a population of 7,596[7], and encompasses the hamlet of Rhinecliff and the Village center, which has a population of approximately 2,500. The Village, through NY State law, retains its own level of local government with a Mayor and Board of Trustees. The Village provides a business district and an area of higher concentrations of housing, as well as public services such as the Fire Department, Police Department, and water and sewer service. Town Hall is located right across the intersection of Center Street from Village Hall, both on E Market St. Other public services, not overseen by the municipal government, are also located in the Village, such as the Rhinebeck School District and post office. Along the craggy banks of the Hudson River, the hamlet of Rhinecliff developed, with riverfront docks and housing which became a working-class neighborhood. Today, Rhinecliff retains its special character, with its tight knit community and dense cluster of homes.

Rhinebeck's forests, meadows, wetlands, streams, and shorelines are not only habitat for wildlife, but also provide many vital benefits to people. Many place names evoke past human relationships with the landscape and the natural world that are in some cases dormant: Sturgeon Point, for instance, abuts deep water habitat where Atlantic sturgeon congregate and were fished until 1996, when a coastwide ban on commercial fishing was enacted due to a rapidly declining population; Atlantic sturgeon, the icon of the Hudson River Estuary, appearing on blue signs where roads cross streams throughout the region, were added to the federal Endangered Species List in 2012. Many other place names derive from prominent families, including those granted patents hundreds of years ago, such as Livingston Street and Astor Drive.

Rhinebeck's ecosystems help to keep drinking water and air clean, moderate temperature, filter

[7] U.S. Census, as of April 1, 2020, https://www.census.gov/quickfacts/fact/table/rhinebecktowndutchesscountynewyork/PST045221#PST045221

pollutants, absorb floodwaters, generate productive soils, and provide for pollination of agricultural crops. They also present opportunities for outdoor recreation and education and create the scenery and sense of place that is unique to the community. Beyond these well-established "ecosystem services," increasingly, research is defining the importance of natural spaces for wellbeing[8], and in a growing number of cases, governments are recognizing in law not only the value of nature to humans but the intrinsic rights of nature.[9,10]

Land-use planning is instrumental to balancing future growth and development with protection of natural resources. Identifying important natural resources is the first step in proactive environmental planning and informed decision-making. This Natural Resources Inventory (NRI) identifies and describes the naturally occurring resources located in Rhinebeck, including topography, geology and soils, water resources, and habitat, as well as recreation and scenic areas, land uses, and climate conditions and projections. By bringing this information together in one place, the NRI can cultivate a better understanding and appreciation of the community's natural resources and set the stage for a wide range of planning and conservation applications. The NRI provides a foundation for land stewardship and conservation in Rhinebeck by informing comprehensive and open space plans, zoning codes, critical environmental areas, climate adaptation strategies, and other municipal plans and policies for Rhinebeck, as well as their implementation by elected and appointed boards, including conservation advisory boards, planning boards and zoning boards of appeals.

It is important to understand our local ecosystems and natural assets in their local and regional context, as well as certain global contexts. Global climate change will have specific local impacts, affecting our health, safety, and wellbeing; our built environment; and the ecosystem of which we are a part. Globally, climate change is only one important influence on accelerating extinction rates that are unique in the geologic record of the Earth, making local efforts to preserve both at-risk and now-common native species important. The Hudson Valley has been impacted by the exodus of New York City dwellers during the COVID-19 pandemic, and this may foreshadow future influx of climate refugees from nearby coastal cities or further afield, which could increase pressure for development[11]. A Natural Resources Inventory is a reference document for municipal government, but it also is an opportunity for a community to understand the impact of its local decisions in a global context.

---

[8] "Nurtured by Nature," American Psychological Association, 2020, https://www.apa.org/monitor/2020/04/nurtured-nature

[9] "The Rights of Nature – Can an Ecosystem Bear Legal Rights?" Columbia Climate School, 2021, https://news.climate.columbia.edu/2021/04/22/rights-of-nature-lawsuits/

[10] "Rights of Rivers: A global survey of the rapidly developing Rights of Nature jurisprudence related to rivers," International Rivers, 2020, https://www.internationalrivers.org/resources/reports-and-publications/rights-of-river-report/

[11] "Climate change and natural disasters can exacerbate threats that force people to flee within their country or across international borders. The interplay between climate, conflict, hunger, poverty and persecution creates increasingly complex emergencies.", UNHCR Global Trends 2019, p12. https://www.unhcr.org/5ee200e37.pdf

Data and Methods

This report and the accompanying maps are an update to the "Natural Resources Inventory for the Town of Rhinebeck," a draft from 2009 that was never published. The updated maps display data from federal, state, and county agencies; non-profit organizations including Hudsonia, The Nature Conservancy, and the Hawthorne Valley Farmscape Ecology Program; and prior planning efforts by Rhinebeck. The original source and publication year of data sets are included on each map and are described in the report.

All maps were produced using ESRI ArcGIS Geographic Information Systems (GIS) software and data in the NAD 1983 State Plane New York East FIPS 3101 Feet coordinate system. Information on the maps comes from different sources, produced at different times, at different scales, and for different purposes. Hudsonia data is the result of 2006-2007 fieldwork to provide research to the Rhinebeck Town Board and committees. The Hudsonia maps and report were contracted by the Town and delivered in 2007.

Most of the GIS data were collected or developed from remote sensing data (i.e., aerial photographs, satellite imagery) or derived from paper maps. For these reasons, GIS data often contain inaccuracies from the original data, plus any errors from converting it. Therefore, maps created in GIS are approximate and best used for planning purposes. They should not be substituted for site surveys. Any resource shown on a map should be verified for legal purposes, including environmental review.

Rhinebeck at Night by Roger Rosenbaum, Brand-News-Team

Information provided by the maps can be enhanced by local knowledge, and the NRI should be updated every 10 years as new data become available.

The draft NRI maps were made available for public comment via the Village of Rhinebeck's Climatesmartrhinebeck.org website and via the Town's website during the fall of 2021. Nate Nardi-Cyrus, Village Trustee Bertozzi, and Mark Dixon delivered presentations to the Town and the Village Boards, as well as their Planning Board and Zoning Board of Appeals. Trustee Bertozzi included solicitations for public feedback via the Climate Smart newsletter and social media.

During late February to the end of March, 2022, Trustee Bertozzi put out a Call for Photos[12], asking community members to submit photos illustrating elements of this report. 40 people submitted photos, as many as possible are included in this report. While the end use of these photos is intended to bring items to visual life within this document, the Call for Photos also serves as a way to engage the public and an entree into co-authorship and vested interest in the NRI.

The final NRI draft was circulated to the public during Spring 2022 and, after addressing comments, the final NRI was published in May 2022.

[12] https://www.climatesmartrhinebeck.org/rhinebecknriphotos

How to Use this Report

The NRI is a valuable land use planning tool as well as educational resource that documents aspects of Rhinebeck's diverse natural and cultural resources. The inventory provides an essential tool for the Town's Conservation Advisory Board, the Town and Village's Planning Boards and Zoning Boards of Appeals, and the Climate Smart Rhinebeck Task Force, as well as Town's Highway Department and Village's public works including Highway, Water and Wastewater Departments by officially identifying sensitive land and water resources. It discusses development considerations for the Planning and Zoning Boards, laying a foundation for land-use planning and decision-making, zoning considerations and municipal policy guidance, as well as environmental conservation. In addition, the NRI provides property owners, developers and their consultants with information they may need in considering the impact their project may have on Rhinebeck's natural resources. It can be used to address natural resources during project planning and design and to help expedite review and approval of their endeavors. It can also be used as a general reference for landowners to understand resources that may occur on their property and to inform stewardship. We welcome the Rhinebeck Central School District to integrate the NRI into the curriculum or for use in special educational opportunities.

As the Town and Village undertake updates to their Comprehensive Plans, committees devoted to those efforts can draw upon this NRI as a companion piece to further planning and maps detailing cultural and historical and demographic information. The Village comprehensive plan from 1993 states that "78% of residents rated protection of natural resources as very important."[13] In the Town Comprehensive Plan, under *Goals of the Rhinebeck Plan*, the fourth goal is: "Preserve the Town's historic, cultural, scenic, and natural resources and the lands that surround those resources."[14]

Keep in mind that the NRI is best suited for municipal scale planning but may be used as a screening tool at the site-scale to raise questions or identify the need for additional site assessment. The maps are not intended to provide site-specific accuracy and should not be used as a primary source for land use decision-making but may identify where further site assessments are needed.

The NRI maps and materials are available as PDFs on the Village and Town of Rhinebeck ecode360 databases and websites:

- www.climatesmartrhinebeck.org/natural-resources-inventory
- linked from www.villageofrhinebeck.org
- www.rhinebeckny.gov/nri-project.html

Physical copies are available at the Village and Town Halls. The PDF maps allow for ease of navigation with the ability to zoom in to an area of interest.

Many of the data sets shown in the NRI maps are available for more detailed viewing through online

[13] p.8 Village of Rhinebeck Master Plan, 1993.

[14] p. 1.14 Town of Rhinebeck Plan, 2009.

interactive maps. These include:

- Dutchess County Parcel Access
- Dutchess County Aerial Viewer
- Dutchess Historic Survey
- Hudson Valley Natural Resource Mapper
- DECinfo Locator
- Discover GIS Data NY
- National Map
- Web Soil Survey
- TNC Resilient Land Mapping Tool
- Scenic Hudson Solar Energy Toolkit
- Scenic Hudson Sea Level Rise Mapper
- Scenic Hudson Protecting the Pathways

Base Map (Map 1a and 1b)

Wayfinding in the Village, 2022 by Bill Peckmann

The Base Maps for the Town and Village are the foundation for the Natural Resources Inventory map series. They show municipal boundaries and transportation infrastructure including roads and railways. On the Town map, we see Red Hook to the north, Milan to the east, Clinton to the southeast, and Hyde Park to the south. The Town's western border is the Hudson River. Rhinecliff, a waterfront hamlet, is labeled on the eastern bank of the Hudson River.

CSX's tracks, used by both the national railroad freight company and Amtrak, run along the eastern side of the Hudson River, connecting New York City to Albany and beyond. Rhinecliff is a stop on the Amtrak line, with several trains running daily. During the writing of this report, local communities have been pushing to retain access to their waterfront, despite CSX's plans to fence off the tracks.[15] Part of this effort includes preserving and restoring historic truss bridges along the CSX line. In Rhinebeck, there is a private 1912 Warren Truss bridge that crosses the rail line to a riverside landing and seasonal dock. The bridge is located in and is a contributing feature to the Hudson River National Historic Landmark District[16].

Two thoroughfares, State Route 9 and 9G intersect just north of Rhinebeck Village and the northern gateway corridor with its commercial zone. To the northwest of Rhinebeck, Route 9G intersects with State Route 199, which leads to the Kingston-Rhinecliff Bridge to the west, and northern Dutchess County to the east. Route 9—the old post road and King's Highway, and before that the Mohican trail—runs north-south through the Village of Rhinebeck, where it intersects with Route 308. Rhinecliff Road connects the western side of the Village to the Hamlet of Rhinecliff.

On the Village base map, government services are shown on E Market St, the main east-west artery of the Village business district. The Village Hall and Firehouse are depicted as two icons

Sailing Under the Kingston-Rhinecliff Bridge by Michael Cassano

[15] https://www.scenichudson.org/our-work/advocacy/amtrak-fencing

[16] "Bridge Summaries." Scenic Hudson. https://www.scenichudson.org/wp-content/uploads/2021/08/2_Section1_BridgeSummarySheet_r.pdf

but are actually housed within the same building. Just across Center St, also on E Market St, we see Town Hall. The Village's Wastewater Treatment Plant is on Astor Drive (see **Regulated Facilities** and **Drinking Water Resources** sections).

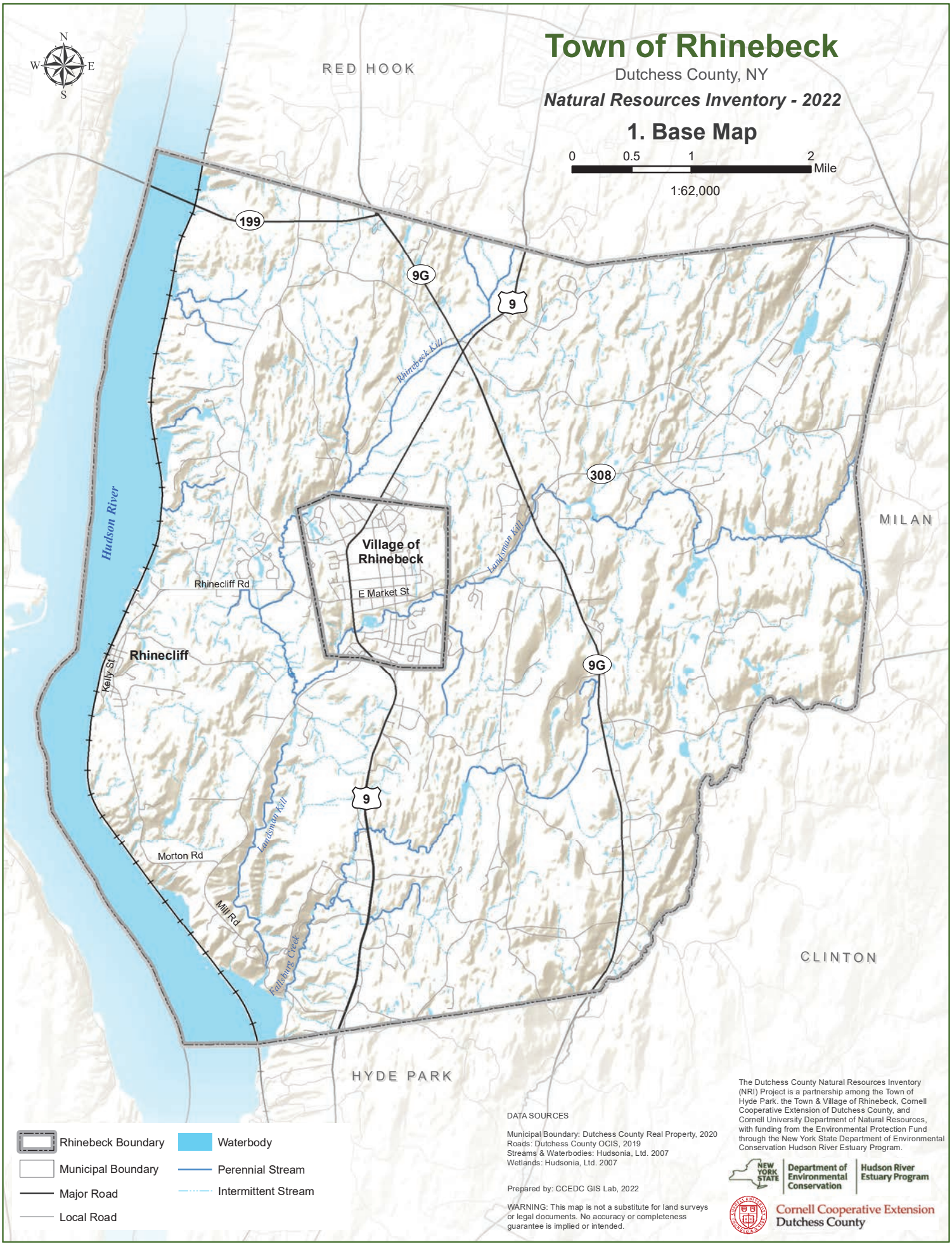
The base maps also illustrate general natural features such as open bodies of water, streams, rivers, and wetlands. Of note on the Town base map, the Hudson River flows on the western border of Rhinebeck. Tributaries that flow through Rhinebeck include the Fallsburg Creek and the Rhinebeck Kill, a tributary of the Landsman Kill, which, as we can see on the Village base map, runs directly through the Village of Rhinebeck east-west, and whose Asher Dam creates Crystal Lake. The Rhinebeck Kill runs across the northwestern edge of the Village. General topographic relief is shown using a shaded digital elevation model. These features are shown in more detail on other maps in the inventory.

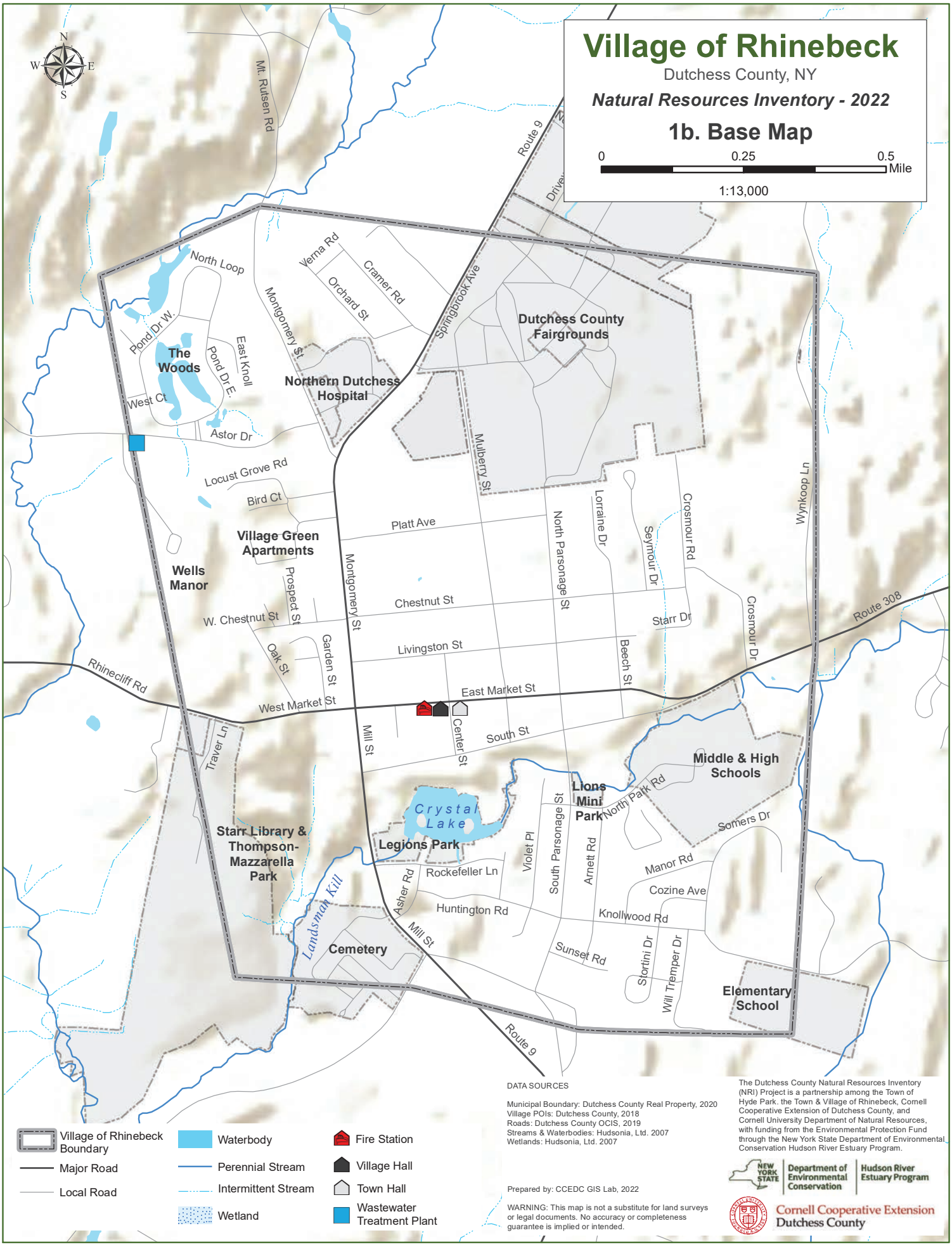
On the Village base map, we also see additional services and landmarks that play a major role in the human ecology of a tightly knit urban area. At the north of the Village, we see the Northern Dutchess Hospital and the Dutchess County Fairgrounds shaded in gray. On the southeast side of the Village, we have the Middle School/High School complex and Chancellor Livingston Elementary School. The Lions Mini Park and the Crystal Lake Park (also known as Legion Park) are overseen by the Village municipal government. The Thompson-Mazzarella Park and Rhinebeck Cemetery straddle the southwest border with the Town and are both overseen by the Town municipal government. While much of Rhinebeck Village's parcels are single family homes, multiple story commercial buildings (some with apartments) are concentrated at the main intersection of our Village. Larger apartment and condominium developments are labeled on the Village map: The Woods, Village Green Apartments, and Wells Manor, our affordable housing.

Tax Parcels

Alternate versions of the maps in this report are also available with property boundaries as reflected by tax parcel lines, which are used for tax collection purposes. State law requires local governments to prepare and maintain tax maps in accordance with standards established by New York State. Rhinebeck's tax map reflects the size, shape and geographical characteristics of each parcel of land in the assessing unit. The tax map is a graphic display of the Town and Village's land inventory, and as such is the major source to the real property assessment roll. The working copy of the tax map is used by the Town Assessor to record and analyze property transfers and record other features pertinent to the valuation of land.[17] Tax parcel data shown in the Natural Resources Inventory map series were published in 2021 by the Dutchess County Tax Services Department.

[17] "Tax Mapping in New York State." New York State Department of Taxation and Finance. www.tax.ny.gov/research/property/assess/gis/taxmap/.


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
1. Base Map
0 0.5 1 2 Mile
1:62,000
N
W
E
S
RED HOOK
MILAN
CLINTON
HYDE PARK
199
9G
9
308
Hudson River
Rhinebeck Kill
Landsman Kill
Village of Rhinebeck
E Market St
Rhinecliff Rd
Rhinecliff
Kelly St
Morton Rd
Mill Rd
Fallsburg Creek
Rhinebeck Boundary
Municipal Boundary
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County


Village of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
1b. Base Map
0
0.25
0.5
Mile
1:13,000
N
S
E
W
Mt. Rutsen Rd
Route 9
North Loop
Verna Rd
Cramer Rd
Orchard St
Springbrook Ave
Dutchess County Fairgrounds
Pond Dr W.
Pond Dr E.
East Knoll
The Woods
Montgomery St
Northern Dutchess Hospital
West Ct
Astor Dr
Locust Grove Rd
Bird Ct
Mulberry St
Wynkoop Ln
Platt Ave
Village Green Apartments
Wells Manor
Prospect St
Montgomery St
North Parsonage St
Lorraine Dr
Seymour Dr
Crosmour Rd
Chestnut St
W. Chestnut St
Starr Dr
Crosmour Dr
Route 308
Oak St
Garden St
Livingston St
Beech St
Rhinecliff Rd
East Market St
West Market St
Center St
South St
Mill St
Traver Ln
Middle & High Schools
Lions Mini Park
North Park Rd
Somers Dr
Crystal Lake
Legions Park
Starr Library & Thompson-Mazzarella Park
Violet Pl
South Parsonage St
Arnett Rd
Manor Rd
Cozine Ave
Rockefeller Ln
Asher Rd
Huntington Rd
Knollwood Rd
Landsman Kill
Cemetery
Mill St
Sunset Rd
Stortini Dr
Will Tremper Dr
Elementary School
Route 9
Village of Rhinebeck Boundary
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Wetland
Fire Station
Village Hall
Town Hall
Wastewater Treatment Plant
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE
Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension
Dutchess County

Town of Rhinebeck

Dutchess County, NY

Natural Resources Inventory - 2022

2. Aerial Imagery

0 0.5 1 2 Mile

1:62,000

DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Aerial Imagery: Dutchess County 2020 Aerials (via Maxar)

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Spring in the Village by Carli Fraccarolli

The Aerial View Maps gives a bird's-eye view of Rhinebeck, showing 1-ft resolution 4-band digital orthoimagery taken in natural color taken in 2020 by Maxar for Dutchess County. Orthoimagery is aerial imagery that has been georeferenced and digitally corrected to remove geometric distortion due to ground relief and camera position.[18] The resulting imagery is proportionally accurate and can be overlaid onto maps. The aerial imagery was taken in early spring prior to the leaf out of deciduous trees, resulting in a detailed view of vegetation types, land uses, and development. It can serve as a reference for comparison with features shown on other maps in the Natural Resources Inventory.

On the Town aerial map, one is struck by the close-knit crosshatch of the Village set within the rural Town, with another speckling of human habitat on the banks of the Hudson at Rhinecliff. The Town aerial view shows the mottling of tan meadows, brown forest, and dark lakes and wetlands. A walkable Village with sewer and water systems results in the concentration of our human impact on the ecosystem to the urban center. The Town has focused commercial activities, with their dependence on vehicles, to the gateway area along Route 9 to the north of the Village. This pattern—clustering new buildings and services into an urban area—generally presents opportunities for smart growth land use planning.

On the Village aerial map, we get a sense of its quaint human scale, set into pattern around the Crystal

[18] "Frequently Asked Questions – Digital Orthoimagery Information." NYS GIS Program Office. http://gis.ny.gov/gateway/mg/faq.htm

Lake millpond, and in keeping with 18th and 19th century traditional “small town America.” While it’s densely populated, we see street trees and private yards. However, we may not notice at first glance the lack of public green space, belied somewhat by eye being drawn to the open space of the Dutchess County Fairgrounds; these grounds are fenced and not publicly accessible. Starr Library and the Thompson-Mazzarella Park on the southwest boundary of the Village provide walkable public green space, as do the contemplative grounds of the Town Cemetery and the institutional athletic grounds of the High School and Middle School. The crosshatch of the Village is delineated by paved roads, and many of these impervious surfaces are quite wide, providing on street parking for our currently car-centric way of life.

Rhinebeck’s Traffic Light, 2022 by Bill Peckmann

For more detailed, interactive viewing of orthoimagery dating back to 1936, users can visit the Dutchess County Aerial Viewer at https://gis.dutchessny.gov/aerialaccess.

Village of Rhinebeck

Dutchess County, NY

Natural Resources Inventory - 2022

2b. Aerial Imagery

0 0.25 0.5 Mile

1:13,000

DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Aerial Imagery: Dutchess County 2020 Aerials (via Maxar)

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park, the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Village of Rhinebeck

Dutchess County, NY

Natural Resources Inventory - 2022

2b. Aerial Imagery

0 0.25 0.5 Mile

1:13,000

DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Aerial Imagery: Dutchess County 2020 Aerials (via Maxar)

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park, the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Section 2: Climate

As in most areas of the Northeast, Rhinebeck experiences cold winters with snow and warm summers. According to data collected at the closest available National Weather Service weather station in Poughkeepsie, for the period of 1981-2010 the average temperature was 49.2 degrees and the average precipitation received was 42.6°F inches.

Climate is the long-term average of weather, typically averaged over a period of 30 years. [Muni name] is already experiencing the effects of rapid climate change.

However, local data show steady and rapid changes in our climate that reflect global trends. It is vital for local decision-makers to understand these trends and the related climate hazards facing the region and to plan for future conditions. Many of the natural resources described throughout this inventory contribute to the community's safety and ability to adapt to the impacts of climate change. Natural areas like forests and wetlands furthermore help to sequester and store carbon, offsetting some of the impacts of local greenhouse gas emissions. This section presents general climate information prepared for Hudson Valley communities by the New York State Department of Environmental Conservation (DEC) Hudson River Estuary Program.[19]

Climate Projections

Responding to Climate Change in New York State (the ClimAID Report), written in 2011 and updated in 2014, is the current authoritative source for climate projections for New York State.[20] ClimAID translated Intergovernmental Panel on Climate Change (IPCC) scenarios into more robust regional-scale predictions incorporating local data inputs and expert knowledge. Rhinebeck is located within the ClimAID climate region 5. ***Note that models are inherently uncertain and simply present a range of possible scenarios to assist people and communities plan for the future***. Future climate changes in Rhinebeck could exceed or fall short of these

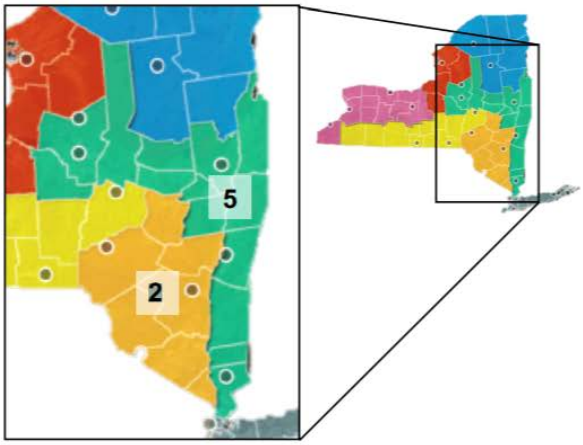


Figure 1. *Region 2 and 5 of the ClimAID report include the Hudson and Mohawk River valleys*

[19] Zemaitis, L. *Working Toward Climate Resilience: General Climate Information Prepared for Hudson Valley Communities*. DEC Hudson River Estuary Program, 2018.

[20] Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. "Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information." New York State Energy Research and Development Authority (NYSERDA), 2014, Albany, NY. www.nyserda.ny.gov/climaid

projections.

Looking towards the future there are three prominent climate trends that will affect Rhinebeck and the region: increasing temperatures, shifting precipitation patterns, and sea level rise (SLR).

Temperature. New York has experienced particularly rapid changes to the regional climate in the last century and this trend is projected to continue through the 21st century. Global average temperature has been rising in unison with increasing input of insulating greenhouse gasses, driving changes to regional and local climate. Warming atmospheric temperature alters the water cycle, leading to more extreme precipitation, short-term drought and severe storms. Since 1970, Rhinebeck has seen a 2°F increase in average annual temperature and a 5°F winter temperature increase. These increases are above both the national and global increase in annual temperature during the same period. Current projections see an additional increase of about 4-6°F in the coming decades and up to 11°F by 2100.

A Rare Experience: Ice Hockey on Crystal Lake, 2022 by Erich Graham

Increasing annual temperatures will lead to more frequent, intense, and long-lasting heat waves during the summer, posing a serious threat to human health and increased electricity demand from air conditioning. Heat waves are a particular concern in the Village and Rhinecliff hamlet, where the urban heat-island effect can further exacerbate high temperatures. By mid-century, Rhinebeck could annually experience 3 to 10 days above 95 degrees, and five to seven heat waves that last one to two days longer than average. Increasing temperature not only affects human health and ecosystems but can impact the electrical needs of a community putting strain on both budgets and the grid while creating more challenges in agriculture and other industries.

AIR TEMPERATURE PROJECTIONS FOR REGION 5

	Baseline 1971-2000	2020s	2050s	2080s	2100
Annual average air temperature	50°F	52.3 - 53.2°F	54.5 - 56.2°F	55.6 - 59.7°F	56.1 - 61.4°F
Increase in annual average	-	2.3 - 3.2°F	4.5 - 6.2°F	5.6 - 9.7°F	6.1 - 11.4°F

**Projections not available at this time*

Precipitation. Precipitation has become more variable and extreme, whereas total rainfall has changed only marginally. The amount of rain falling in heavy downpour events increased 71% from 1958 to 2012 in the Northeast.[21] Projections indicate total annual precipitation could increase as much as 12% by mid-century and 21% by 2100. Overall, New York State models project more dry periods intermixed with heavy rain and decreased snow cover in winter. However, precipitation is considered more uncertain since it is difficult to model. In addition to elevating flood risk, infrastructure such as roads and the town's wastewater system can become strained during heavy rains.

PRECIPITATION PROJECTIONS FOR REGION 5

	Baseline 1971-2000	2020s	2050s	2080s	2100
Total annual precipitation	51"	52" - 54.5"	53" - 57"	53.5" - 58.5"	53.5" to 61.5"
% Increase in annual precipitation	-	2 - 7%	4 - 12%	5 - 15%	5 - 21%
# Days with precipitation > 1"	10	14 - 15	14 - 16	15 - 17	*
# Days with precipitation > 2"	1	3 - 4	4	4 - 5	*

**Projections not available at this time*

[21] Melillo, J. M., T.C. Richmond, and G. W. Yohe. Climate Change Impacts in the United States: The Third National Climate Assessment. 841 pp. doi:10.7930/J0Z31WJ2, 2014. https://nca2014.globalchange.gov/

Contemplating Sea Level Rise, 2020 by Avery Gilbert

Sea Level Rise. Global sea level is rising due to various factors, including thermal expansion from warmer water temperatures and melting of land-based ice. The Hudson River is connected to and influenced by the sea; therefore, it experiences tides and is rising with global sea level. Since 1900, sea level in New York Harbor has risen 13 inches. In addition, the rate of sea level rise is increasing. From 2000 to 2014 the average rate was 6.8 millimeters per year compared to 4.6 millimeters per year from 1990 to 2014. Projections for additional sea level rise along the Hudson River range from one to 9 inches by the end of the 2020s and five to 27 inches by mid-century. It is possible that Rhinebeck could experience as much as 71 inches of sea-level rise by the end of the 21st century if rapid ice melt from the Greenland ice sheet continues. The Village has already undertaken projects to make its drinking water system resilient to these forecasted changes. Additional efforts, both by municipal governments, private landowners, and the owners and operators of the railroad tracks, will be necessary. In addition to risks to the built environment, sea-level rise poses a risk to the viability of tidal wetlands in the Hudson River, which may become inundated without land-side room to migrate.[22]

SEA LEVEL RISE PROJECTIONS FOR THE HUDSON

	Baseline 1971-2000	2020s	2050s	2080s	2100
Mid-Hudson region	-	1 - 9"	5 - 27"	10 - 54"	11 - 71"
NYC/Lower Hudson region	-	2 - 10"	8 - 30"	13 - 58"	15 - 75"

The Community Risk and Resiliency Act (CRRA) was signed into law in New York in 2014 to advance planning for climate resilience. DEC officially adopted sea-level rise projections (see **Table 1**) in 2017

[22] Hudson River Comprehensive Restoration Plan, "Tidal and Intertidal Wetlands Target Ecosystem Characteristic," 2018, available at http://thehudsonweshare.org/wp-content/uploads/2018/08/Tidal-and-Intertidal-Wetlands.pdf

and is developing guidance for natural and nature-based solutions. The NYS Department of State has developed model local laws to enhance community resiliency, available at https://www.dos.ny.gov/opd/programs/resilience/index.html.

The DEC has also published guidance for flood risk management[23] and using natural and nature-based measures to reduce flood risk[24] and the "Flood Resilience Handbook for Public Access Sites along the Hudson River." for tidal riverfront properties.[25]

Breakup of Ice on the Hudson River, 2022 by Jaki Levi

[23] New York State Flood Risk Management Guidance, NYS Department of Environmental Conservation. 2020. https://www.dec.ny.gov/docs/administration_pdf/crrafloodriskmgmtgdnc.pdf

[24] Using Natural Measures to Reduce the Risk of Flooding and Erosion, NYS Department of Environmental Conservation and NYS Department of State, 2020. https://www.dec.ny.gov/docs/administration_pdf/crranaturalmeasuresgndc.pdf

[25] The Flood Resilience Handbook for Public Access Sites along the Hudson River.https://www.dec.ny.gov/docs/remediation_hudson_pdf/hrefldhndbk.pdf

Table 1. *New York State Sea-level Rise Projections for the Mid-Hudson region (6 NYCRR Part 490). "Low" signifies the lower end of model forecasts, while "high" signifies the upper end over the range of different model formulations and initialization scenarios.*

Lower Hudson region (from Kingston south to NYC)

Time Interval	Low Projection	Low-Medium Projection	Medium Projection	High-Medium Projection	High Projection
2020s	2 inches	4 inches	6 inches	8 inches	10 inches
2050s	8 inches	11 inches	16 inches	21 inches	30 inches
2080s	13 inches	18 inches	29 inches	39 inches	58 inches
2100	15 inches	22 inches	36 inches	50 inches	75 inches

Discussion

Rhinebeck is taking steps to both reduce its emissions (mitigation) and become more resilient to the now inevitable impact of climate change (adaptation). Both the Village and Town have used NY State's Climate Smart Communities program[26] as a framework, and the Village achieved bronze certification in 2020 and is now working towards silver. Both Village and Town have accomplished many of the actions required in NYSERDA's Clean Energy Communities program[27] as well.

Mitigation

Anecdotally, Rhinebeckers are feeling the changes in the climate. Arthur "Dod" Crane, who grew up in Rhinebeck, recalls that "ice boating at Rokeby estate (just north of Poet's Walk) was common on the river every year in the 1960's, but is not possible now" except on rare occasions. With the negative impacts of climate change experienced in the present day, and more predicted for our future, acting swiftly to eliminate our reliance on fossil fuels is imperative. Comprehensive Planning should review transportation, zoning, waste management, and building codes through the lens of climate change. Transitioning municipal fleets to electric vehicles and designing streets to be more bike and pedestrian-friendly will help reduce emissions. Electrifying heating and cooling systems in buildings can also lead to cleaner air and reduce the likelihood of contamination and fire due to the elimination of combustibles and buried fuel tanks. In 2022, the Village began piloting a municipal compost program to reduce methane produced by food rotting

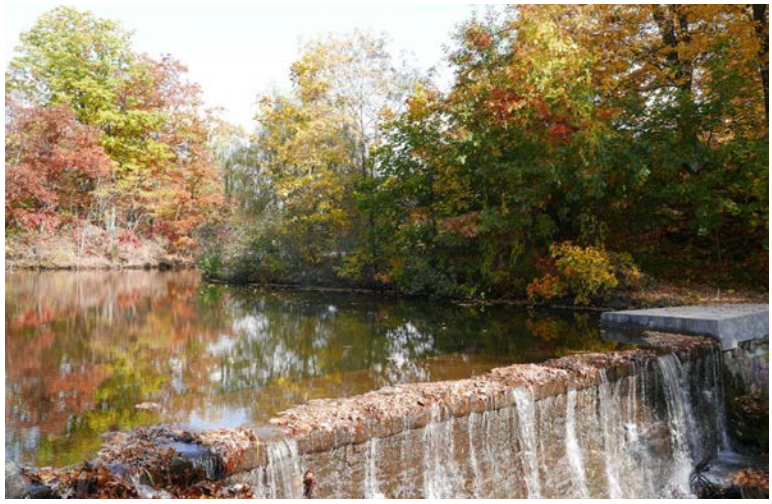
[26] https://climatesmart.ny.gov

[27] https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Communities

in landfills. These mitigation efforts also represent leadership: doing our part to end the devastation of ecosystems by fossil fuel industries and wasteful practices. See the **Solar Development Suitability** section for more on this topic.

Adaptation - Flooding

In terms of adaptation, Rhinebeck Village and Town have undertaken resiliency planning, with technical support provided by Cornell Cooperative Extension Dutchess in collaboration with the Hudson River Estuary Program's Climate Resilience Partnership[28]. Rhinebeck can reduce potential further damage due to increased stormwater runoff by preserving natural areas, implementing green infrastructure strategies[29] (including removal of unneeded dams), and limiting (current and future) impervious surfaces where applicable. In the Village, the installation of green infrastructure includes redesigning streets to include more street trees, catch basins to infiltrate stormwater into the ground, and rain gardens to process stormwater.



Asher Dam, 2020 by Vanessa Bertozzi

Conservation of floodplains, stream corridors, both inland and tidal wetlands, steep slopes, shorelines and forests will help reduce stormwater runoff, erosion and risk from flooding, as well as provide opportunities for plants and animals to migrate north and higher in elevation to adapt to warming conditions (See the **Habitat Resilience Score** section). Natural areas also act as carbon sinks, sequestering and storing carbon that helps offset local greenhouse gas emissions. Preservation of natural areas providing stormwater and flood control benefits can be cheaper and more effective than engineered alternatives, and often presents co-benefits, and should be prioritized wherever feasible.

Hurricane Irene in 2011 was the storm in recent history that opened the community's eyes to intense flooding, exacerbated by climate change. Water breached the Village-owned Asher Dam[30], which forms the man-made Crystal Lake. Water flooded over Route 9 and threatened the bridge over the Landsman Kill (https://www.youtube.com/watch?v=65NJA6jSOPo&t=49s). In

[28] Climate Smart Rhinebeck website. https://www.climatesmartrhinebeck.org/resiliency-planning

[29] Concept plan for reformatting a Village street to a new green infrastructure pattern. 2021. https://www.climatesmartrhinebeck.org/green-infrastructure

[30]

response, NY State and Dutchess County recently informed the Village that this bridge will be replaced sometime between 2022-2025. At the height of the storm, the only road exit out of the Village was to head west on 308 towards River Road and then head north on River Road.

While storms with Irene's impact have not hit Rhinebeck in the last decade, the region has been visited by frequent extreme storms—both tropical remnants and nor'easters— that have negatively impacted the community. A Christmas 2020 nor'easter that triggered erosion in the Catskill Mountains that led to turbid discharges from the Ashokan Reservoir to the Lower Esopus Creek that impacted drinking water treatment at Rhinebeck's treatment plant. A series of extreme storms in July and August 2021 caused flooding, drinking water treatment challenges and poor water quality in the greater Capital District, Schoharie Valley and Mohawk Valley, leading to impacts that included disturbance of Superfund toxic waste sites, sewage overflows, flooding, roadway damage and degraded water quality in the Hudson River that stretched from Albany to Staatsburg. Hurricanes Henri and Ida in August 2021 dropped record-breaking bursts of precipitation on the New York City area within days of one another, leading to deadly flooding, roadway damage, sewage overflows and other significant impacts. In several cases, bursts of 5 or more inches of rain have fallen in a matter of hours, and single storms have carried as much rain as typically falls in an entire month. We should anticipate these types of extremes will impact the Landsman Kill and other tributaries to the Hudson in the coming years.

The Village has an ongoing collaboration with Marist College Environmental Science and Computer Science students to research flooding on the Landsman Kill and create a predictive model for when to preemptively release excess water through opening the Asher Dam valves. The collaboration also undertook a DEC Hudson river Estuary Program Trees for Tribs streamside tree planting, where students and Climate Smart Rhinebeck volunteers planted over 100 saplings along the Landsman Kill behind the Village Highway Garage. See the **Streams & Watersheds**, and **Floodplains & Riparian Areas** sections for more discussion.

Adaptation – Sea Level Rise

Sea level rise will likely impact the Rhinebeck water treatment plant located on the banks of the Hudson River. (See **Drinking Water Resources** and **Floodplains & Riparian** sections.) The Village undertook a Vulnerability Assessment and made improvements to the plant, raising the lowlift pumps. In addition to sea-level rise, changing climatic conditions could significantly change source water quality, challenging treatment. Prolonged drought conditions, for instance, could allow the salt front—the leading edge of the ocean's salinity—to reach further north in the estuary than it has historically. It has infrequently reached Poughkeepsie during significant droughts in the last several decades, prompting short-term alerts to consumers who are on restricted-sodium diets.[31] Scientists have also warned that changing climactic conditions, coupled with the globally high nutrient load that is currently present in the Hudson Estuary, could result

[31]Salt and Drinking Water. NYS Department of Health
https://www.health.ny.gov/environmental/water/drinking/salt_drinkingwater.htm

in algal growth[3233] that leads to the formation of disinfection byproducts, a regulated contaminant, and/or the formation of cyanotoxins, an unregulated contaminant that has affected an increasing number of waters impacted by harmful algal blooms ("HABs") of cyanobacteria, which must be monitored under the federal Safe Drinking Water Act, and which is a candidate for further regulation.

Adaptation - Agriculture

As any resident who frequents the Rhinebeck Farmers' Market knows, increasingly unpredictable weather can be detrimental to our local agriculture. Rhinebeck is fortunate to have local food systems, which can result in a lower carbon footprint, in addition to providing local employment. However, local farmers are now struggling with unpredictable frosts, drought and flood, and hail storms. Compounding weather events like these in frequent succession could spell long term disaster for our local agricultural system. Increasing summer temperatures will be difficult for agriculture as well, with farm workers on the front lines in the sun, and crops and water systems impacted by drought and extreme heat. (See also the **Agriculture Resources** section.)

Adaptation - Heat

Special consideration should also be given to forecasts of increased temperature and heatwaves. Rhinebeck should plan for intensifying temperatures by increasing shaded areas in public spaces to offer relief; this can include trees and other structures. Forest areas of all sizes also contribute to moderation of local temperatures. (See **Large Forests / Forests and Street Trees** section.)

The DEC recommends developing or updating a heat emergency plan to provide a course of action during intense heat events, and the Village and Town are developing these, with Village Hall and Starr Library serving as cooling stations in heat emergencies. Forest fires are not common in our area, and the NY State Burn Ban is in effect March through May, when vegetation starts to green up. More information and resources on adapting to changing climate is provided in *Working Toward Climate Resilience*.[34]

To understand the need for resiliency measures, one must first see that climate change places more pressure on our ecosystem. Because of this, land use and zoning, preservation and conservation become even more important. See the Zoning section of this report for more discussion related to the Town of Rhinebeck's Comprehensive Plan (2009) and Chapter 120 of its municipal code and the Village of Rhinebeck's Land Conservation Overlay District. In 2020, the Town and Village Boards jointly retained

[32] Howarth, Robert, et al. "Climatic Control on Eutrophication of the Hudson River Estuary," JSTOR 2000, available at https://www.jstor.org/stable/3658636

[33] "The Hudson is the Most Heavily Nutrient-Loaded Estuary in the World. Should We Care?" Hudson River Foundation, 2011, available at http://www.hudsonriver.org/download/seminars/Howarth_March11.pdf

[34] Zemaitis, 2018.

David Chernack, a Bard graduate student at the Center for Environmental Policy, who conducted a thorough review of all Town and Village policies through the lens of climate and the environment[35]. Note that—unsurprisingly—he did not find any mention of climate change in the Village's 1993 Plan nor in the Town's 2009 Comprehensive Plan. The Village and Town are currently evaluating how to update their comprehensive plans to better reflect the urgency of the climate crisis.

[35] David Chernack's series of white papers, 1-pager recommendations, and presentation. https://www.climatesmartrhinebeck.org/comprehensive-review

Habitat Resilience Score (Map 3)

Climate change is bringing profound changes to natural communities in Rhinebeck. Warming temperatures and changing precipitation patterns will make conditions less hospitable for some of local flora and fauna and more hospitable to other species, including newcomers. This process is shifting species ranges and rearranging habitats in ways that are difficult to predict. The locations of rare species or important natural communities may change. Common habitats providing important ecosystem benefits to Rhinebeck will also be affected. These include large, intact forests, wetlands, and stream corridors that support stormwater management, flood control, aquifer recharge, climate moderation, and carbon sequestration.

Areas with:

diverse physical environments

complex topography

connected habitats

are most likely to support a diversity of plants and animals today, and into the future.

In a dynamic, changing environment, it is important to identify natural areas most likely to support biodiversity and ecosystem benefits into the future. Conserving these "strongholds" for nature will ensure that plants and animals have places to move and adapt as local climate conditions change. Conserving resilient sites for nature will also contribute to the Town and Village's adaptation and resilience to flooding, extreme heat, and other climate-related hazards.

The Habitat Resilience Score map shows climate resilience values for biodiversity and natural areas from the Nature Conservancy's *Resilient Sites for Terrestrial Conservation*[36] and *Resilient and Connected Landscapes*[37] projects. Modeling for climate resilience was based on three primary attributes: geodiversity (diversity of physical environments), topographic complexity, and landscape connectedness. Sites that have diverse physical environments, complex topography, and connected habitats are places most likely to support a diversity of plants, animals, and habitats today and in the future.

Geodiversity reflects unique combinations of geology, elevation, and landforms. Ecosystem and species diversity relate strongly to their associated geophysical settings. Conserving a range of physical environments will in turn protect a diversity of plants and animals under both current and future climates.

Complex topography is important because it creates a range of temperature and moisture options for

[36] Anderson, M.G., M. Clark, and A. Olivero Sheldon. 2012. Resilient Sites for Terrestrial Conservation in the Northeast and Mid-Atlantic Region. The Nature Conservancy, Eastern Conservation Science.

[37] Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.

the species, providing a variety of local microclimates. Factors that create microclimates include slope, aspect (i.e., north vs south-facing), shade, and proximity to waterbodies.

Connected landscapes are places that allow species to move and disperse, and processes like water movement can occur unimpeded. Maintaining a connected area in which species can move ensures that the area can adapt to climate change.

On the map, dark green indicates **high estimated resilience**. Brown indicates areas vulnerable to climate change. The map also includes modeling from TNC for species movement zones and corridors connecting resilient sites.

Discussion

Rhinebeck has a number of exceptional resilient locations, all of which are within the Town. Notable sites include areas adjacent to the mouths of the Landsman Kill, Fallsburg Creek, and Vanderburgh Cove; Sepasco Lake; and forests to the East of Route 9G. Given Rhinebeck's existing regulation of streams and wetlands, these refugia would benefit most from additional protections in the form of land conservation through conservation easements or the direct acquisition of properties for parkland.

The most climate resilient areas for habitat are comprised of both protected and unprotected parcels. Some dark green areas of high estimated resilience can be found within the 250 acres around **Sepasco Lake**, which are owned by Ramapo for Children, a non-profit that focuses on programming and retreats for children in need of various services.[38] In December 2013, Scenic Hudson conserved areas adjacent to **Vanderburgh Cove**, which includes two significant wetlands. The Southlands Foundation has also protected a significant area of land adjacent to Vanderburgh Cove "since December 1987, [with] a conservation easement donated to Scenic Hudson [which] protects the farm so that it will remain forever green."[39] **Ferncliff Forest**, owned by a private 501c3, is host to another dark green high estimated resilience area.[40] The forest was originally the game preserve of the Astor estate. Winnakee's recently protected **Vlei Marsh** also appears to be an area of high climate resiliency. "The second largest wetland area in Rhinebeck, Vlei Marsh consists of 165 acres, 90 acres of which are DEC designated wetlands, including 1,300 feet of headwaters of the Fallsburg Creek. The property is mapped as a core forest (See **Large Forests** map) in a Forest Linkage Zone (See **Landscape Context** map), meaning its intact forested connections between nearby matrix forest blocks allow animals and plants to move across the landscape. It is also designated as a DEC Significant Biodiversity Area in the Hudson Valley; it contains a wide diversity of bird life (including a heron rookery), beavers and amphibians."[41]

[38] Ramapo for Children. https://ramapoforchildren.org/about/campus

[39] Southlands Foundation. https://southlands.org

[40] Ferncliff Forest https://ferncliffforest.org

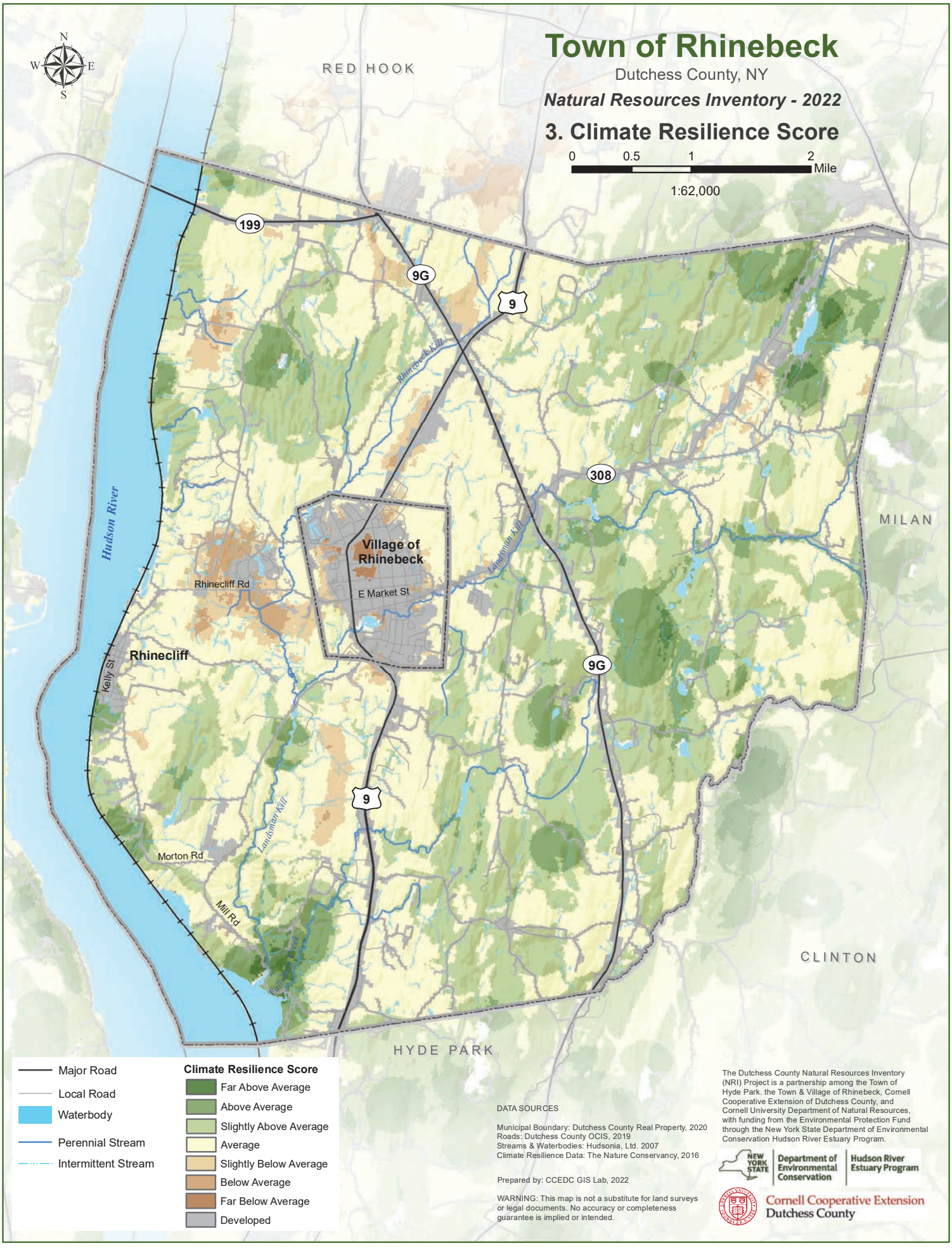
[41] Winnakee Land Trust. https://www.winnakee.org/visit-our-parks-preserves/vlei-marsh-preserve

Another place of interest is the green shaded area around a pond by Tappen Place and Kerr Road. It lies east of 68 acres of land located on Burger Road owned by Neighbors Rod and Gun Club, a member of New York State Conservation Council.[42]

The creation of additional nature preserves or use of conservation easements should be done in partnership with local land trusts (i.e. Winnakee Land Trust, Dutchess Land Conservancy, and Scenic Hudson) and state or local government agencies. The **Conservation, Recreation, and Scenery map** shows where current protected lands exist in the Town and Village.

Fall Walk in Ferncliff Forest by Jay B. Ballesteros

[42]Neighbors Rod and Gun Club. https://neighborsgunclub.com


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
3. Climate Resilience Score
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
Hudson River
Village of Rhinebeck
Rhinecliff
Rhinecliff Rd
E Market St
Kelly St
Morton Rd
Mill Rd
Rhinebeck Kill
Landsman Kill
199
9G
9
308
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Climate Resilience Score
Far Above Average
Above Average
Slightly Above Average
Average
Slightly Below Average
Below Average
Far Below Average
Developed
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Climate Resilience Data: The Nature Conservancy, 2016
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Sea Level Rise and Marsh Migration (No Map)

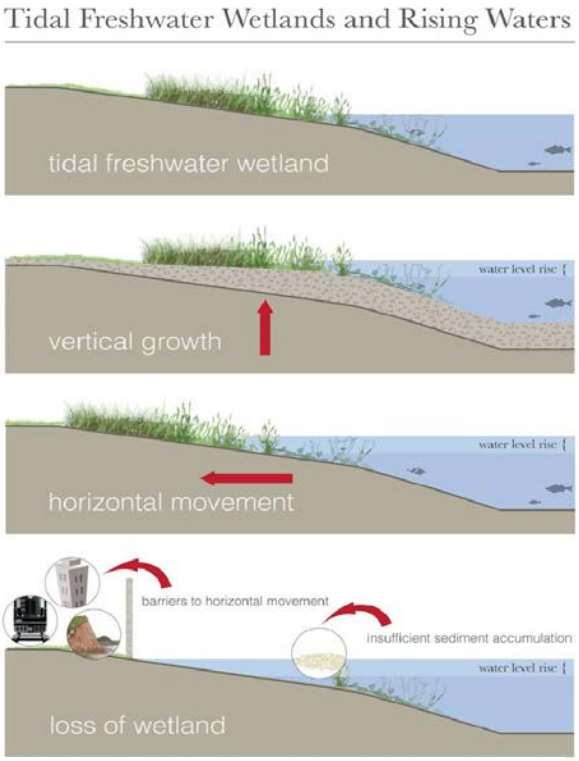


Figure 2. *Tidal Wetland Responses to Rising Waters.*

As sea level rises in response to climate change, natural systems and human infrastructure will need to move in response. Vulnerable human infrastructure includes Hudson River adjacent rail lines and stations, roads, public recreation spaces, and wastewater processing equipment. Some impacts to the human environment are discussed in the **Climate Change** section. Natural systems include tidal wetlands, creeks, and shoreline communities.

Tidal freshwater wetlands are among the most important wildlife habitats in the Hudson River Estuary, and the Hudson River Estuary is itself critical habitat for many Atlantic coast aquatic species. These habitats provide spawning, nursery, and feeding habitats for coastal migratory fish such as striped bass and American shad, estuarine species such as white perch and the federally-endangered shortnose sturgeon, and freshwater species such as largemouth bass. Large concentrations of fish spawn in these wetlands in spring and summer, and they serve as a nursery for young-of-year fish into the fall. These wetlands provide important feeding areas for waterfowl, especially during spring and fall migrations, including greater and lesser scaups, redhead, canvasback, common goldeneye, and mergansers, mallard, American black duck, wood duck, and blue-winged teal. Reptiles and amphibians that use these wetlands include wood turtle, water snake, red-spotted newt, redback salamander, American toad, gray treefrog, spring peeper, bullfrog, green frog and wood frog.[43]

Freshwater intertidal shores, tidal mudflats, tidal marshes, and the tidal creeks that are often connected to them are each imperiled ecological community types in New York State, meaning they are "very

[43] New York State Department of State, "Vanderburgh Cove and Shallows Coastal Fish and Wildlife Rating Form," available at https://dos.ny.gov/vanderburgh-cove-and-shallows

Sunrise over Rhinecliff by Norm Magnusson

vulnerable to disappearing."[44,45,46,47] Within New York State, these ecological communities are found almost exclusively along the Hudson River Estuary in Dutchess, Columbia and Greene counties. For more information on tidal wetlands habitats, see the **Coastal Habitats** section.

Their preservation is particularly important in light of historic loss of these habitat types throughout the Hudson River Estuary. The construction of the federal navigational channel, which involved dredging shallows and dumping dredge spoils in other shallows, destroyed habitat "on a massive scale,"[48] according to a state analysis of estuarine habitat, leading to the loss of at least 1,300 acres of intertidal habitats. "As a result, the upper estuary from Catskill to Troy, NY was transformed from a shallow, braided river channel with many islands and backwaters, to a river dominated by a deep channel with far fewer intertidal wetlands and vegetated shallows."[49] "Additional filling of many hundreds of acres throughout the rest of the estuary (unrelated to channel dredging) also occurred, especially along more urbanized sections of the lower estuary, where industrial and transportation infrastructure was built."[50] The railroad tracks along the shoreline of Rhinebeck are an example of this

[44] New York Natural Heritage Program. 2022. Online Conservation Guide for *Freshwater tidal marsh*. Available from: https://guides.nynhp.org/freshwater-tidal-marsh/. Accessed January 31, 2022.

[45] New York Natural Heritage Program. 2022. Online Conservation Guide for *Freshwater intertidal mudflats*. Available from: https://guides.nynhp.org/freshwater-intertidal-mudflats/. Accessed January 31, 2022.

[46] New York Natural Heritage Program. 2022. Online Conservation Guide for *Freshwater tidal creek*. Available from: https://guides.nynhp.org/freshwater-tidal-creek/. Accessed January 31, 2022.

[47] New York Natural Heritage Program. 2022. Online Conservation Guide for *Freshwater intertidal shore*. Available from: https://guides.nynhp.org/freshwater-intertidal-shore/. Accessed January 31, 2022.

[48] New York State Department of Environmental Conservation, "Hudson River Habitat Restoration Plan," 2013, available at https://www.dec.ny.gov/docs/remediation_hudson_pdf/hrhrp.pdf

[49] ibid.

[50] Hudson River Comprehensive Restoration Plan, Tidal and Intertidal Wetlands Target Ecosystem Characteristic, 2018, available at http://thehudsonweshare.org/wp-content/uploads/2018/08/Tidal-and-Intertidal-Wetlands.pdf

industrial and transportation infrastructure.

Approximately 6,750 acres of tidal freshwater wetlands occur today in the Hudson River Estuary. The Hudson River Comprehensive Restoration Plan sets a goal of increasing "the quality and functional capacity of intertidal freshwater wetland habitats," and increasing their extent by approximately 10 percent, to at least 7,500 acres. The tidal creeks that feed these coves are also critical habitats for many species, including American eel and river herring. Adjacent shallows, found west of at least some of the tidal freshwater wetlands in the Town of Rhinebeck, are also important habitats. These shallows support underwater beds of submerged aquatic vegetation (SAV) like water celery. Native SAV is "universally recognized as critical nursery areas for small fishes, important in contributing dissolved oxygen to the Hudson and contributing to sediment stability."[51] In addition to losses of this habitat from the same forces described above, motor boaters can inadvertently damage these sensitive habitats. Extreme storms, notably Hurricanes Irene and Lee in 2011, caused a 90% loss of SAV beds, which has been followed by only a 56% recovery.[52] Thus, not only has SAV extent been greatly reduced over the last 150 years, but significant acreage of this critical habitat has been lost in just the last decade. The Hudson River Comprehensive Restoration Plan has the goal of increasing native SAV to "approach or exceed previously documented coverage (~4500 acres, 1997)."

Vanderburgh Cove, located at the confluence of the Landsman Kill and Fallsburg Creek with the Hudson River, was created in the decades following the construction of the railroad causeway in 1851, which has since trapped sediment and allowed for the rapid accretion of marsh. Suckley Cove, as well as Astor Cove and several smaller coves, similarly have been identified as being created largely or wholly as a result of the railroad causeways. Recent research suggests that accretion of sediments in these tidal wetlands is keeping up with sea-level rise.[53]

Scenic Hudson's Sea Level Rise Mapper[54] shows the current water level and "100-year" flood zone with projections of potential **sea level rise** (SLR) at intervals from 12 to 72 inches over current levels, as well as modeling for tidal wetland pathways. Scenic Hudson utilized high resolution LiDAR topography and local tidal datum research in a modified-bathtub approach to estimate current and future inundation

---

[51] Hudson River Comprehensive Restoration Plan, Submerged Aquatic Habitat and Shallow Water Habitat Target Ecosystem Characteristic, 2018 available at http://thehudsonweshare.org/wp-content/uploads/2018/08/Submerged-Aquatic-Vegetation-and-Shallow-Water-Habitat.pdf

[52] NYS DEC, "The State of the Hudson 2020," available at https://www.hudsonriver.org/wp-content/uploads/2021/03/HREP_SOH_Final_12-2020.pdf

[53] Yellen et. al., "Rapid tidal marsh development in anthropogenic backwaters" Earth Surfaces Process and Landforms, 2020, available (by subscription) at https://onlinelibrary.wiley.com/doi/epdf/10.1002/esp.5045

[54] "Scenic Hudson Sea Level Rise Mapper." https://scenichudson.maps.arcgis.com/apps/MapJournal/index.html?appid=3a3d0dc3884c4637ad0a51f4aa912189

zones.[55] It's important to note that the modeling does not account for storm surge and wave action, and that estimates for future flood zones do not account for projected changes in precipitation patterns.

With a projection of 36-72" (3-6ft) of SLR by the end of the century, up to 4,000 acres of tidal wetland may be completely inundated in the estuary. Tidal wetlands along the Hudson River will disappear as water rises unless they can build up sediment in place (through the process of accretion; see Figure below) or move horizontally to higher ground. However, wetlands bordered by steep shorelines, walls, or existing development may have no place to go. Potential tidal wetland loss threatens the health of the entire estuary. Wetlands are also one of the most important tools in flood control as they can absorb and slow movement of rising waters. A recent study by Scenic Hudson shows areas along the Hudson most likely to support tidal wetlands in the future as sea level rises.[56]

The **tidal wetland pathways** show where tidal wetlands are likely to move by 2100 as sea level rises under the full range of sea level rise and accretion rates examined in the study. See the **Coastal Habitats** section for more information and mapped pathways.

Discussion

The most effective way for towns to conserve tidal wetlands in the face of projected changes is to protect and manage the areas where wetlands may move. Minimizing future development in the pathways and designing public waterfronts to allow for these changes will ensure that tidal wetlands have room to adapt to rising sea levels. This strategy will also reduce risks to communities and property owners in the changing Hudson River flood zone. For more information, see *Protecting the Pathways: A Climate Change Adaptation Framework for Hudson River Estuary Tidal Wetlands*. Sea level rise projections for Rhinbeck's waterfront can be viewed using Scenic Hudson's Sea Level Rise Mapper.[57]

While adapting to flood risks along the Hudson River, Rhinebeck can also reduce potential further damage due to increased stormwater runoff by preserving natural areas and implementing green infrastructure strategies and limiting impervious surfaces where applicable. Conservation of floodplains, stream corridors, wetlands, and forests will help reduce stormwater runoff and risk from flooding, as well as provide opportunities for plants and animals to migrate north and higher in elevation to adapt to

[55] "Scenic Hudson Sea Level Rise Mapper." Scenic Hudson, Poughkeepsie, NY. https://scenichudson.maps.arcgis.com/apps/MapJournal/index.html?appid=3a3d0dc3884c4637ad0a51f4aa912189

[56] Tabak, N., and S. Spector. *Protecting the Pathways: A Climate Change Adaptation Framework for Hudson River Estuary Tidal Wetlands*. Scenic Hudson, May 2016. http://www.scenichudson.org/wp-content/uploads/legacy/protecting-the-pathways.pdf.

[57] "Scenic Hudson Sea Level Rise Mapper." https://scenichudson.maps.arcgis.com/apps/MapJournal/index.html?appid=3a3d0dc3884c4637ad0a51f4aa912189

warming conditions. Natural areas also act as carbon sinks, sequestering and storing carbon that helps offset local greenhouse gas emissions. Preservation of natural areas providing stormwater and flood control benefits is in most cases cheaper and more effective than engineered alternatives and should be prioritized wherever feasible.

The Town of Rhinebeck adopted its Local Waterfront Revitalization Plan (LWRP) in 2007.[58] This adopted plan, which is a Federal program administered by the NYS Department of State, has a number of policies that address preservation of habitats along the Hudson River. It requires that any projects, be they Federal, State, County, MTA, etc., must be consistent with our LWRP or they cannot go forward.

[58] Chapter 119 of the Town Code: Waterfront Revitalization Program https://ecode360.com/10927754, https://dos.ny.gov/system/files/documents/2019/05/rhinebecktlwrp.pdf

Solar Development Suitability (No Map)

Wildflower plantings between panels by Rob Davis

Efforts at combating climate change include a rapid transition from fossil fuels to clean and renewable energy sources. Solar energy, in particular, is expected to become more widespread in the Hudson Valley in the coming years. Solar panels can provide energy for on or off-site use and can be integrated into building materials, installed on roofs, or mounted on the ground. Scenic Hudson projects that over 6,000 acres of land in the Hudson Valley alone will need to be converted to solar energy production to meet New York State's ambitious climate change mitigation goals.[59] While this type of land use change might be more reversible than more traditional development (e.g., residential, and commercial construction), large-scale ground mounted solar arrays should be carefully sited to avoid impacts to natural resources.

Scenic Hudson's Solar Mapping Tool identifies the location of power lines that are enabled to accept power onto the grid and where on the landscape solar panels are expected to have the least negative impact and produce the most energy. This four-part resource introduces users to the basics of solar development and provides a process for planning for solar at municipal and county scales. Data throughout this NRI can be used to identify priority sites for solar development including areas outside of large contiguous habitats, known important areas for rare species, and important water resources. For more information on the siting renewable energy projects, Clean Energy, Green Communities: A Guide to Siting Renewable Energy in the Hudson Valley provides a good overview of the factors land-use decision-makers must consider.

Discussion

Both the Town and Village of Rhinebeck have adopted the Unified Solar Permit for eligible solar photovoltaic (PV) installations, as recommended through NYSERDA's Clean Energy Communities program. The unified permit streamlines municipal processes while providing consistent and thorough review of solar PV permitting applications and installations. Upon approval of this application and supporting documentation, a building and/or electrical permit will be issued for the solar PV installation.

The Town of Rhinebeck permits rooftop, building-mounted/integrated, freestanding, and ground-mounted solar energy systems, as well as solar thermal systems that generate energy primarily

[59] Friedrichsen, A. Clean Energy, Green Communities: A Guide to Siting Renewable Energy in the Hudson Valley. Scenic Hudson, Inc., Poughkeepsie. https://scenichudson.org/wp-content/uploads/legacy/renewables-siting-guide_web.pdf

for on-site consumption in the heating of air or water, in all zoning districts subject to the applicable building permits, special use permits, and/or site plan approvals. Solar power plants, with the primary purpose of wholesale or retail sales of electricity, are permitted as ground-mounted and/or roof-mounted installations in certain zoning districts subject to a solar energy system building permit and both the authorization of a special use permit and grant of site plan approval.

Upon construction, solar energy systems, solar thermal systems, and solar power plants within the Town of Rhinebeck are subject to design requirements including surface area, height, angle, setbacks, yard/lot size and placement, materials, colors, textures, fencing, and screening. All applications for solar power plants must be accompanied by a decommissioning plan to be implemented upon abandonment or cessation of activity, or in conjunction with the removal of the facility.

For more information, please view section 125-47 in Article V of the Town Zoning Law. If the Town of Rhinebeck is interested in updating its zoning law to facilitate smart solar energy system development at all scales, Scenic Hudson's "Solar Ready, Climate Resilient" is a "how to" handbook for developing and updating local zoning laws. The handbook sets out a series of best practices, recommendations and practice tips to empower communities to take advantage of their solar energy resource and translate local policies and goals into clear and enforceable regulations.

General best practices for solar energy systems involve siting them on large rooftops, parking lots, brownfields, and other previously- or currently-developed areas. Most of the large building footprints in Rhinebeck fall within the Village of Rhinebeck, including:

- Northern Dutchess Hospital
- Rhinebeck Central School District buildings
- Dutchess County Fairgrounds structures.

Siting solar energy systems on buildings like these and others with building footprints greater than 0.5 acres has the potential to avoid impacting areas with valuable local resources like wetlands and floodplains, mature forests, and important areas for biodiversity and habitat.

Both the Town and Village municipal governments have installed rooftop solar on municipal properties, such as Village Hall, Town Hall Town Highway Garage, and the pool area at the Town Park. We should consider evaluating other municipal properties and installing more where appropriate. Perhaps additional shade structures in line with heat emergency planning should also be mounted with solar panels. The capped Town landfill was evaluated for ground-mounted solar but distance from the transmission line made the project unaffordable at the time. With NY State's energy goals hopefully prompting more incentives, we should watch this space.

Although productive farmland is another valuable local resource, especially in the Town of Rhinebeck, agriculture can often coexist with solar energy systems on the same property and bring benefits to both. "Agro-photovoltaics", "dual-use farming", "solar sharing", or "co-location" are all terms that describe concurrently using land for farming and solar energy production. Dual use of the land for farming and solar energy production reduces competition for land in areas with other natural resources or land with

potential for other uses, and also helps to keep farmland economically viable through lease payments from solar developers, diversification, and symbiotic productivity enhancement. For more information about co-location of agriculture and solar energy development, check out Part III of Scenic Hudson's Solar Mapping Tool.

One of the most important things to consider when siting solar energy systems is interconnection. Once a potential site is identified based on the values and priorities of a community, the current interconnection potential must be identified using hosting capacity maps developed by utilities and the location of high-voltage transmission lines. If there is not enough available hosting capacity, or if the potential site is not close enough to existing transmission lines, solar energy development may not be feasible in that area. Again, Part III of Scenic Hudson's Solar Mapping Tool goes into detail about interconnection.

Solar Panels on Village Hall, 2020 by Vanessa Bertozzi

Section 3: Physical Setting

Topography and Elevation (Map 4)

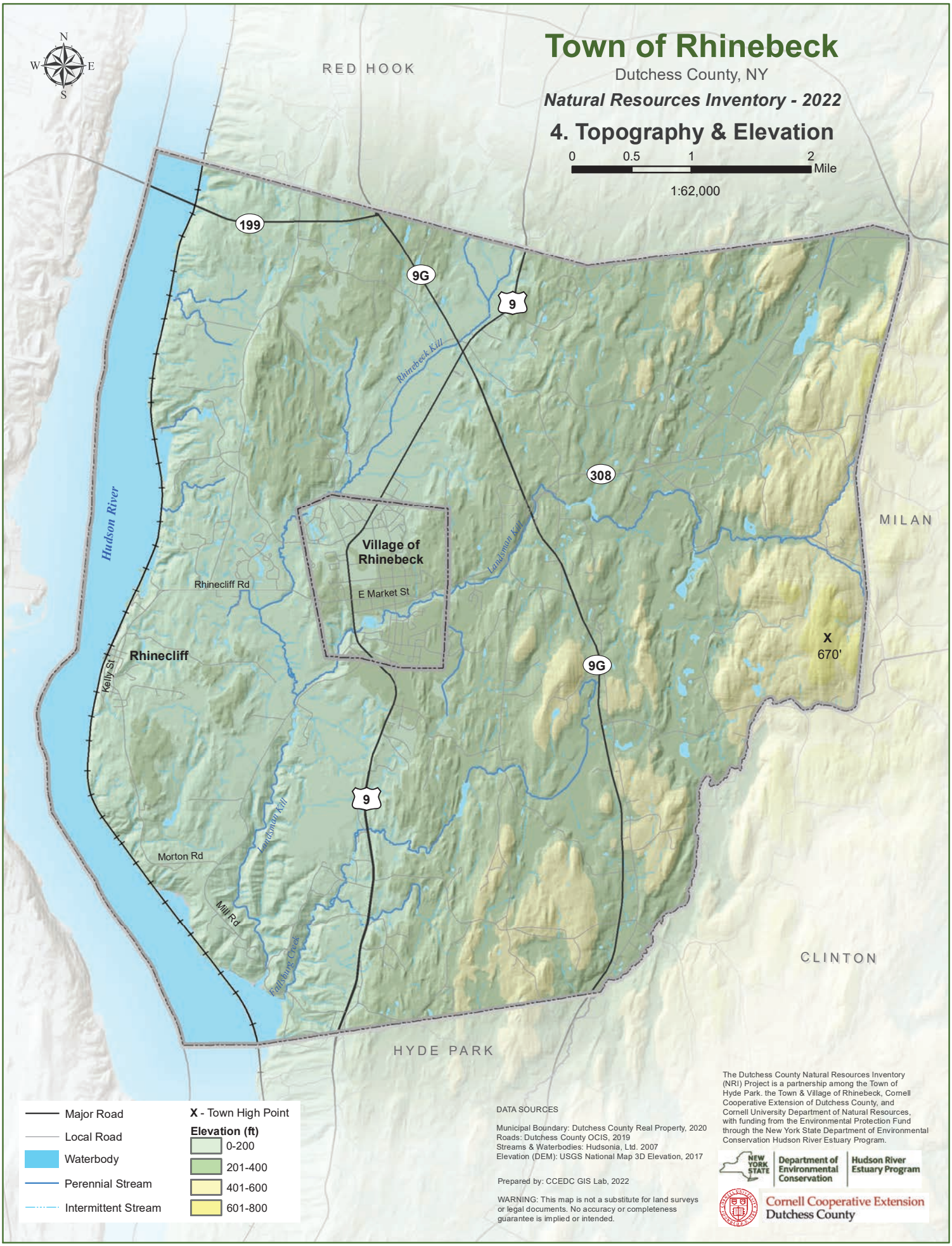
Rhinebeck has a variety of landforms and topographical areas. The highest elevations are found in the eastern portion of the Town, as you move away from the lowlands adjacent to the Hudson River. The highest elevation, near Hilltop Road, is around 670'. Higher elevations are also found adjacent to the southern portion of Route 9G (including Burger Hill) and to the north of Route 308. The lowest elevations are found at the Hudson River and the mouth of the Town's major tributaries, such as the Landsman Kill and Fallsburg Creek. The many streams that flow through the Rhinebeck landscape drain in mostly dendritic patterns, shaping the topographic landscape. The variation in the Town's topography reflects differences in the underlying geology and has been an important factor influencing the location of development.

Rhinebeck's highest point is:
670 feet above sea level
Its lowest point is:
0 feet above sea level at the Hudson River.

Discussion

It is critical to understand the topography of a site when designing development and construction projects. Overall elevation affects the layout of stormwater drainage and the developable land on a particular site. Low-lying areas can be prone to flooding, and understanding the absolute elevation as well as elevation change across a site can provide insight into the potential for the existence of floodplains, wetlands, steep slopes, and other sensitive environmental features. Development of higher elevation areas can impact surrounding lower-elevation areas unless stormwater is properly managed on site.

Early Morn on Burger Hill, 2021, by Dorna Schroeter


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
4. Topography & Elevation
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
199
9G
9
308
Hudson River
Rhinebeck Kill
Landsman Kill
Village of Rhinebeck
E Market St
Rhinecliff Rd
Rhinecliff
Kelly St
Morton Rd
Mill Rd
Fallsburg Creek
X
670'
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
X - Town High Point
Elevation (ft)
0-200
201-400
401-600
601-800
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Elevation (DEM): USGS National Map 3D Elevation, 2017
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Steep Slopes (Map 5a and 5b)

The topography of Rhinebeck is such that it has many areas with steep slopes, especially in the eastern hills and the clay ravines along the Hudson River.

Steep slopes pose significant limitations to development and are among the most sensitive environmental features in the landscape.

Slope is defined as the vertical change in elevation over a given horizontal distance. For example, a 10% slope is one that rises 10 feet over a horizontal distance of 100 feet. Steep slopes are environmentally sensitive land formations and valuable natural resources which are of benefit to the entire town and the surrounding region. Steep slopes with natural land cover provide unique wildlife habitat, create scenic backdrops, and help maintain water quality. However, steep slopes pose significant limitations to development and are among the most sensitive environmental features in the landscape.

The Steep Slopes Map includes the following slope classes, based on the national Soil Survey Manual:[60]

5-10% (gently sloping)

10 – 15% (strongly sloping)

15 – 20% (steep)

20 – 25% (steep)

Over 25 % (very steep)

Sledding on Burger Hill by Kerri Yamashita

Discussion

In general, slopes greater than 15% pose significant limitations to development and are among the most sensitive environmental features in the landscape. Development of steeply sloped landscapes can increase the danger of erosion, landslides, and excessive polluted runoff.[61] Steep slope disturbance can introduce sediment to streams and waterbodies, affecting

[60] Ditzler, C., K. Scheffe, and H.C. Monger (eds.). *Soil Survey Manual.* USDA Handbook 18. Government Printing Office, 2017, Washington, D.C.

[61] *Steep Slopes and Land Use Decisions*. Southern Tier Central Regional Planning and Development Board, February 2012. www.stcplanning.org/usr/Program_Areas/Flood_Mitigation/SCAP_steepslopes 2010_02_21_CR.pdf.

downstream water quality. Grading and construction on steep slopes can also be prohibitively expensive, and such sites may not be able to support a properly functioning public or private sewer system.[62] Steep slopes may also be important scenic resources visible from surrounding areas, and development on steep slopes can also obstruct scenic views. Many communities have passed local laws to regulate development on steep slopes in order to protect these critical resources.

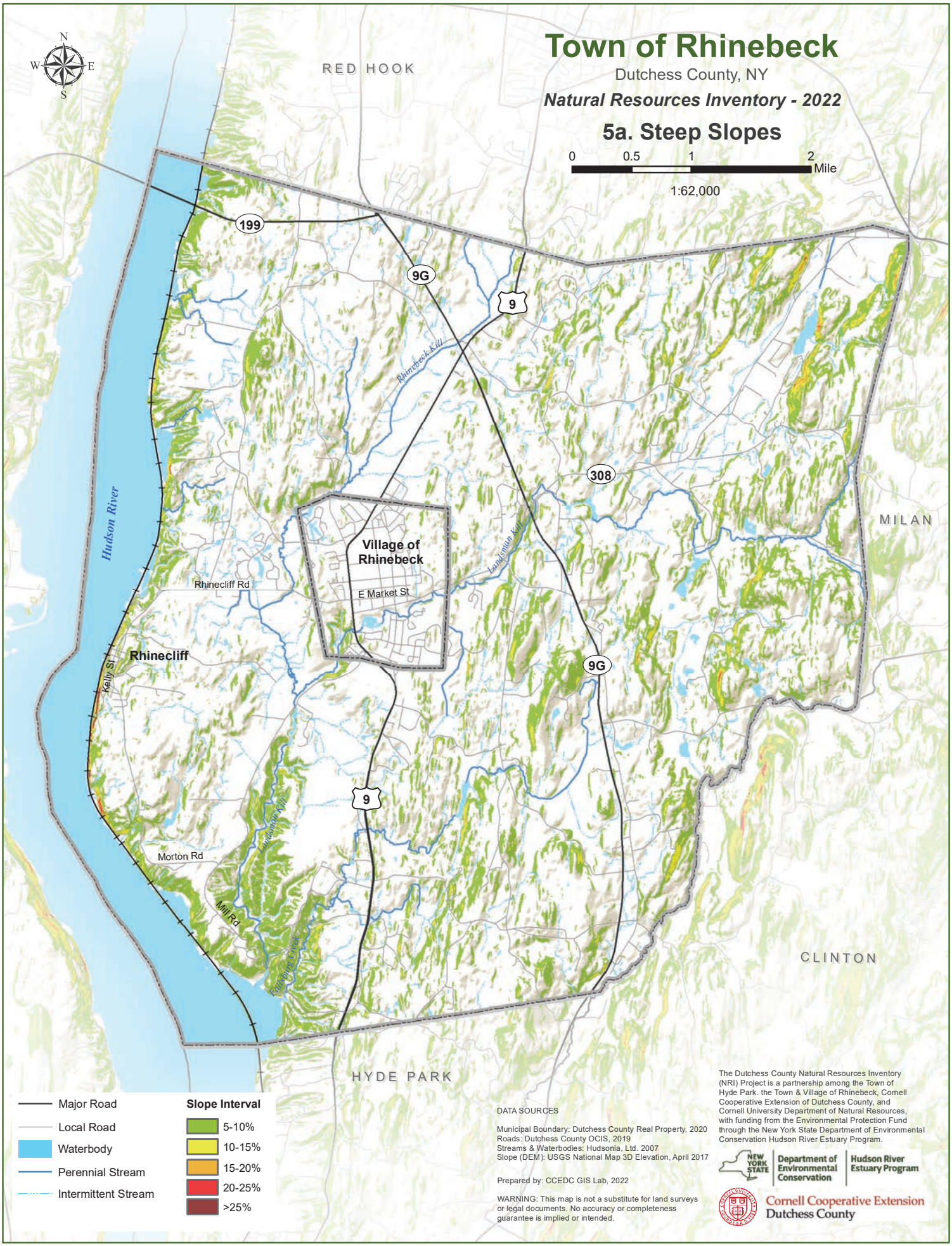
Several significant habitats are associated with steep slopes, as well. Thinly soiled steep slopes may support rocky ledges and talus, which are used for denning, shelter, foraging, and basking by various wildlife species.[63] Some steep slopes along the Hudson River support unique clay bluff and ravine habitat characterized by narrow ridges, steep-sided ravines cut by small streams, and steep bluffs fronting on the river. For more information on these habitats, see Significant Habitats in the Town of Rhinebeck.

Steep slopes located on glacial clay deposits may be prone to landslides. (See **Surficial Geology** section.)

In Town subdivision regulations, under General Requirements (Section 101-6.1.B), we have language that promotes the preservation of existing features, which includes steep slopes. The zoning law, under Conservation Subdivisions (Section 125-43.I.1), describes standards for protected open space, including steep slopes. Section 125-43.G.3.a, describes the delineation of open space lands, including steep slopes. It is also important to note that in determining the layout and buildable acreage in a subdivision, conservation or conventional, the Town zoning law, under the definition of density in Article XIII, Definitions, distinguishes between gross density, the entire area of a given lot, and net density, which is the buildable area once non-buildable areas are subtracted, including steep slopes over 25% gradient. This is significant because in Article IV, Area and Bulk Regulations (Section 125-23.A), maximum density per dwelling unit, it states: “In the HP20, RA10, AQSH-F and VG Districts, gross density shall be employed for the purposes of calculating maximum density. In all other districts where residences are permitted, net density shall be employed for the purpose of calculating maximum density.”

[62] Chemung County Environmental Management Council. *Chemung County Natural Resources Inventory.* 2008. https://www.chemungcountyny.gov/chemung_county_executive_s_advisory_commission_on_natural_energy_solutions/natural_resources_inventory.php.

[63] Kiviat, E. and G. Stevens. *Biodiversity Assessment Manual for the Hudson River Estuary Corridor.* New York State Department of Environmental Conservation, 2001.



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Slope (DEM): USGS National Map 3D Elevation, April 2017

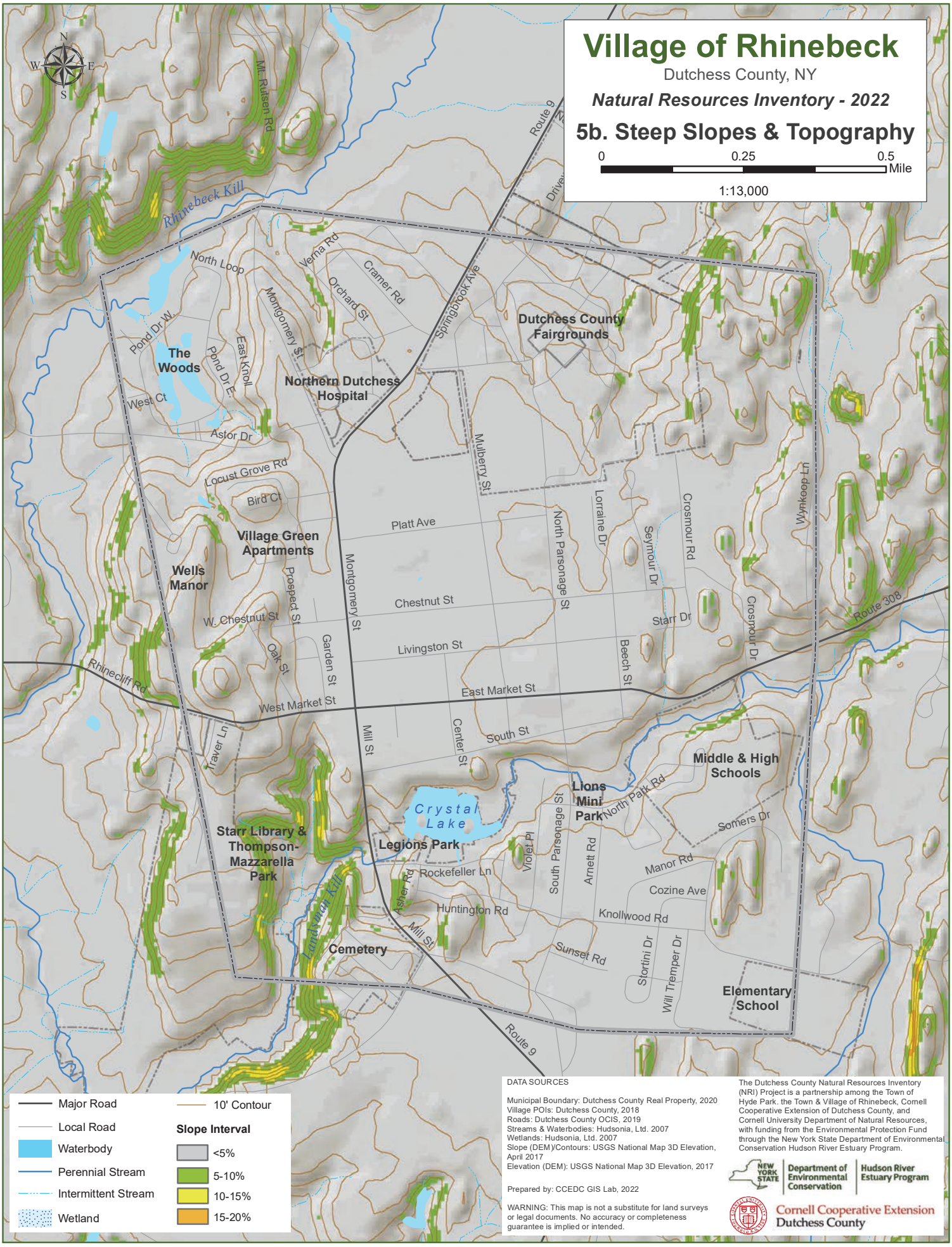
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County


Village of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
5b. Steep Slopes & Topography
0
0.25
0.5
Mile
1:13,000
N
S
E
W
Rhinebeck Kill
Mt. Rutsen Rd
Route 9
North Loop
Verna Rd
Cramer Rd
Orchard St
Springbrook Ave
Montgomery St
Pond Dr W.
Pond Dr E.
East Knoll
West Ct
The Woods
Northern Dutchess Hospital
Dutchess County Fairgrounds
Astor Dr
Locust Grove Rd
Bird Ct
Mulberry St
Lorraine Dr
North Parsonage St
Seymour Dr
Crosmour Rd
Wynkoop Ln
Platt Ave
Village Green Apartments
Wells Manor
Prospect St
Chestnut St
W. Chestnut St
Starr Dr
Route 308
Oak St
Garden St
Livingston St
Beech St
Rhinecliff Rd
East Market St
West Market St
Traver Ln
Mill St
Center St
South St
Middle & High Schools
Lions Mini Park
North Park Rd
Somers Dr
Crystal Lake
Legions Park
Starr Library & Thompson-Mazzarella Park
Violet Pl
South Parsonage St
Arnett Rd
Manor Rd
Cozine Ave
Rockefeller Ln
Asher Rd
Huntington Rd
Knollwood Rd
Landsman Kill
Cemetery
Sunset Rd
Stortini Dr
Will Tremper Dr
Elementary School
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Wetland
10' Contour
Slope Interval
<5%
5-10%
10-15%
15-20%
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Slope (DEM)/Contours: USGS National Map 3D Elevation, April 2017
Elevation (DEM): USGS National Map 3D Elevation, 2017
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Bedrock Geology (Map 6)

Geology influences many environmental factors, including topography, groundwater and mineral resources, and the establishment of natural communities.

Because soil cover is relatively thin in the Town of Rhinebeck, the nature of the bedrock is an important consideration when evaluating proposed development activities. All of the bedrock in town is about 450 million years old (old, even by geologic standards). It was formed and brought to its present configuration during a mountain building event caused when a small block of continental crust (the size of Japan) collided with the east coast of North America during the Taconic Orogeny. The mountains formed by this collision have long since eroded away; the rocks in Rhinebeck are the exposed core of those mountains. The following paragraphs summarize the characteristics of the rocks.

The bedrock map of the town is dominated by the **Austin Glen Formation (Oag).** This formation consists of interbedded sandstone and shale. An excellent exposure of the Austin Glen Formation is seen in the deep rock cut on the west approach to the Mid-Hudson Bridge. Because sandstone is resistant to weathering but shale is not, areas underlain by the Austin Glen Formation tend to have a hummocky topography with sandstone ridges separated by low (usually wet) areas underlain by shale. The general trend of the ridges (and the intervening wetlands) is NNE. The intervening shale wetlands tend to have internal drainage and remain wet unless artificially drained. Drainage may be challenging to install since it often requires excavating solid sandstone rock to create a channel. Examples of 19th and early 20th century artificial drainage can be seen in the hiking trails between FDR house and the Hudson River. Development is challenging in areas underlain by Oag because of the sandstone ridges, and the intervening wet areas, many of which are DEC regulated wetlands.

In the northeast corner of the town is a body of **Autochthonous Shale (Osh)** which was deposited on the continental shelf just before the Taconic Orogeny. This is a black shale that is often rich in sulfur. Shale is a fine-grained rock that tends to be impermeable, so surface drainage and percolation are often slow. The topography formed on the shale is subdued, and development can be challenging because there are often wetlands because of poor drainage. Wells in the authochthonous shale may be sulfurous.

There are two small bodies of **Taconic Mélange (Otm)** in the east and northeast of the town. The Taconic Mélange is a chaotic mix of large blocks of different rock types (mostly sandstone and limestone) in a matrix of fine, powdery black shale. It represents the rocks caught between the continental shelf rocks (Osh) and the Taconic Sequence (Ct - see below). For the most part in the Town of Rhinebeck the Taconic Mélange has good topography with few drainage problems but can be difficult to excavate given the large blocks of sandstone and limestone which occur randomly within it.

A large highland area in the eastern part of the town is underlain by the **Taconic sequence (Ct)**. The

Taconic sequence are deep-water marine sediments including shale, chert, and sandstone, that were shoved on top of the continental shelf during the Taconic Orogeny. The rocks of the Taconic Sequence are resistant to erosion and tend to create elevated topography (the southernmost body in the town is a continuation of the ridge upon which the Hudson Valley Psychiatric Center was built). They can be difficult to excavate, and their fine-grained nature can make them poorly drained.

Discussion

Because of the thin soil cover in the Town of Rhinebeck, bedrock is often prominent in the town, and provides important constraints on development.

Austin Glen formation (Oag) Development is challenging in areas underlain by Oag because of the prominent sandstone ridges, and the intervening wet areas, many of which are DEC regulated wetlands.

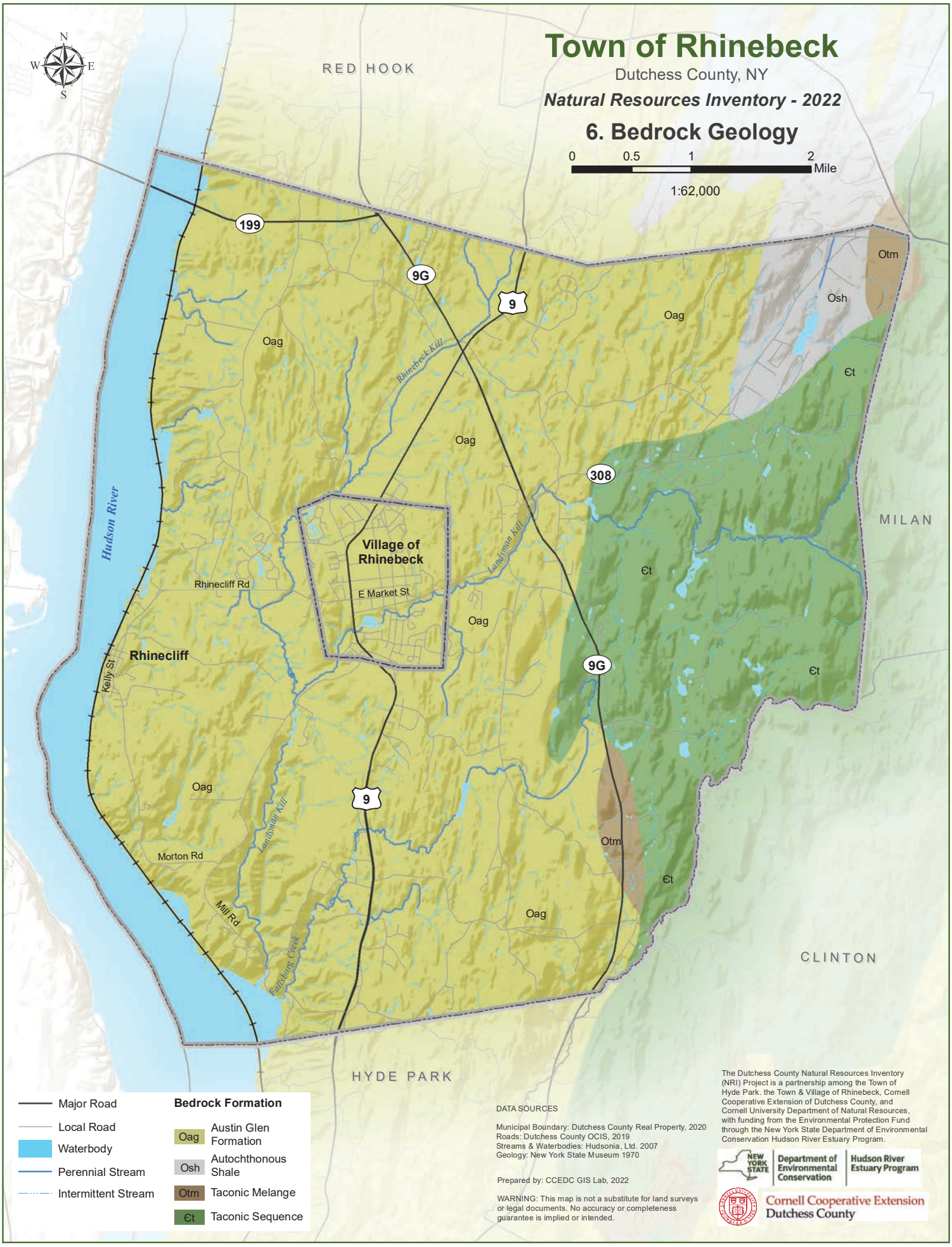
Allochthonous shale (Osh) Topography formed on Osh is subdued, and development can be challenging because these often underlie wetlands due to low permeability and poor drainage. Wells in Osh may be sulfurous. Osh is a minor component of the bedrock of the town.

Taconic Mélange (Otm) Topography on Otm has few drainage problems but can be difficult to excavate given the large blocks of rock which occur randomly within it.

Taconic sequence (Ct) Rocks of Ct can be difficult to excavate, and their fine-grained nature can make them poorly drained on a local scale, but it does not form large-scale wetlands.

Child perched on a rocky outcropping at the southeastern edge of the Village, 2018 by Vanessa Bertozzi

Exposed bedrock is a defining feature in the Town that provides significant habitat value, described in Hudsonia's report on significant habitats in Rhinebeck. Significant bedrock habitats include crest, ledge, and talus, as well as Hudson River rocky island and estuarine rocky shoreline habitats.


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
6. Bedrock Geology
0 0.5 1 2 Mile
1:62,000
N
W
E
S
RED HOOK
MILAN
CLINTON
HYDE PARK
199
9G
9
308
Hudson River
Rhinebeck Kill
Landsman Kill
Fallsburg Creek
Village of Rhinebeck
E Market St
Rhinecliff
Rhinecliff Rd
Kelly St
Morton Rd
Mill Rd
Oag
Osh
Otm
Ct
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Bedrock Formation
Oag Austin Glen Formation
Osh Autochthonous Shale
Otm Taconic Melange
Ct Taconic Sequence
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Geology: New York State Museum 1970
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Surficial Geology (Map 7)

The surficial geology of the Town of Rhinebeck is extremely important because the soils, which support all of the vegetation and often determine the type of development possible, are formed on these deposits, so the nature of the soil is directly related to the surficial geology. In general, the surficial geology of the town is characterized by a range of surficial deposits from a very thin cover over bedrock in the center and eastern parts of town, to thick stream and lake deposits on the bluffs overlooking the Hudson River to the west.

Surficial deposits are unconsolidated sediments primarily resulting from deposits left behind as glaciers retreated at the end of the last ice age. They are important sources of sand, gravel, and crushed stone.

A majority of the surficial materials of the town were laid down during the last glacial episode in eastern North America, which ended about 10,000 years ago. Starting about 25,000 years ago, a one-mile-thick glacier advanced out of Canada covering the land as far south as Long Island. As it melted, the glacier deposited the sediments it had scraped up as it moved south, leaving stream, lake, and till deposits across the landscape.

By far the largest body of surficial material on the map is **Bedrock**, which is predominantly sandstone ridges with intervening wetland valleys (see the Bedrock discussion). The bedrock is covered in many places by a thin veneer of "ablation till" which is made up of sediment left by the glacier as it melted in place. Soils formed on ablation till are thin and tend to be poorly drained especially in low-lying areas.

Glacial Outwash. Glacial outwash is the sediment eroded from the glacier that is transported away from it by running streams. Outwash deposits are typically well-washed sand and gravel. Soils that form on glacial outwash are deep, well-drained, and fertile and make very good farmland. However, because the deposits are stable, level, and well drained, they are also easy to develop. Development in these areas makes them unavailable as farmland, and as potential sand and gravel resources.

Lodgement till (labeled simply "**Till**") is thicker and denser than the ablation till that covers the bedrock because it was deposited directly by the advancing glacier and was compacted to a high density by the weight of the overriding ice. Lodgement till has low permeability because of its high density. It also can be difficult to excavate because glaciers carry rocks that can range in size from pea gravel to boulders, all of which can be found in till. Till is common in the central portion of the town and soils developed on it tend to be thin, rocky, and poorly drained.

A large portion of the western third of the town is as mapped as **Lake Sediments**. The nature of these sediments is variable. As the glacier retreated up the Hudson Valley 10,000 years ago, a large lake (Glacial Lake Albany) filled the valley behind the natural constriction of the Hudson Highlands between Storm King Mountain and Breakneck Ridge. The lake sediments of Rhinebeck were deposited in the main body of the lake (along the current course of the Hudson River) and in arms of the lake extending

up major stream valleys like the Landsman Kill and the Rhinebeck Kill. At the north end of town (near the intersection of 9G and 199) is a body of sand, probably deposited where a stream entered the glacial lake. These deposits, though well drained, are unstable and prone to land sliding. The balance of the lake sediments in the town are lacustrine silts and clays. They form fertile soils but can be more poorly drained due to their fine grain size, and drainage and slope stability problems can limit development. These areas are mapped as a clay bluff and ravine overlay in the Hudsonia habitat map for Rhinebeck. The larger, intact examples were found at Wilderstein, north of Vanderburgh Cove along the Landsman Kill, and an area between Astor Cove and the Kingston-Rhinecliff Bridge.

Discussion

Surficial geology deposits in the town control the nature (and fertility of soils) as well as the quality of drainage and the stability of slopes.

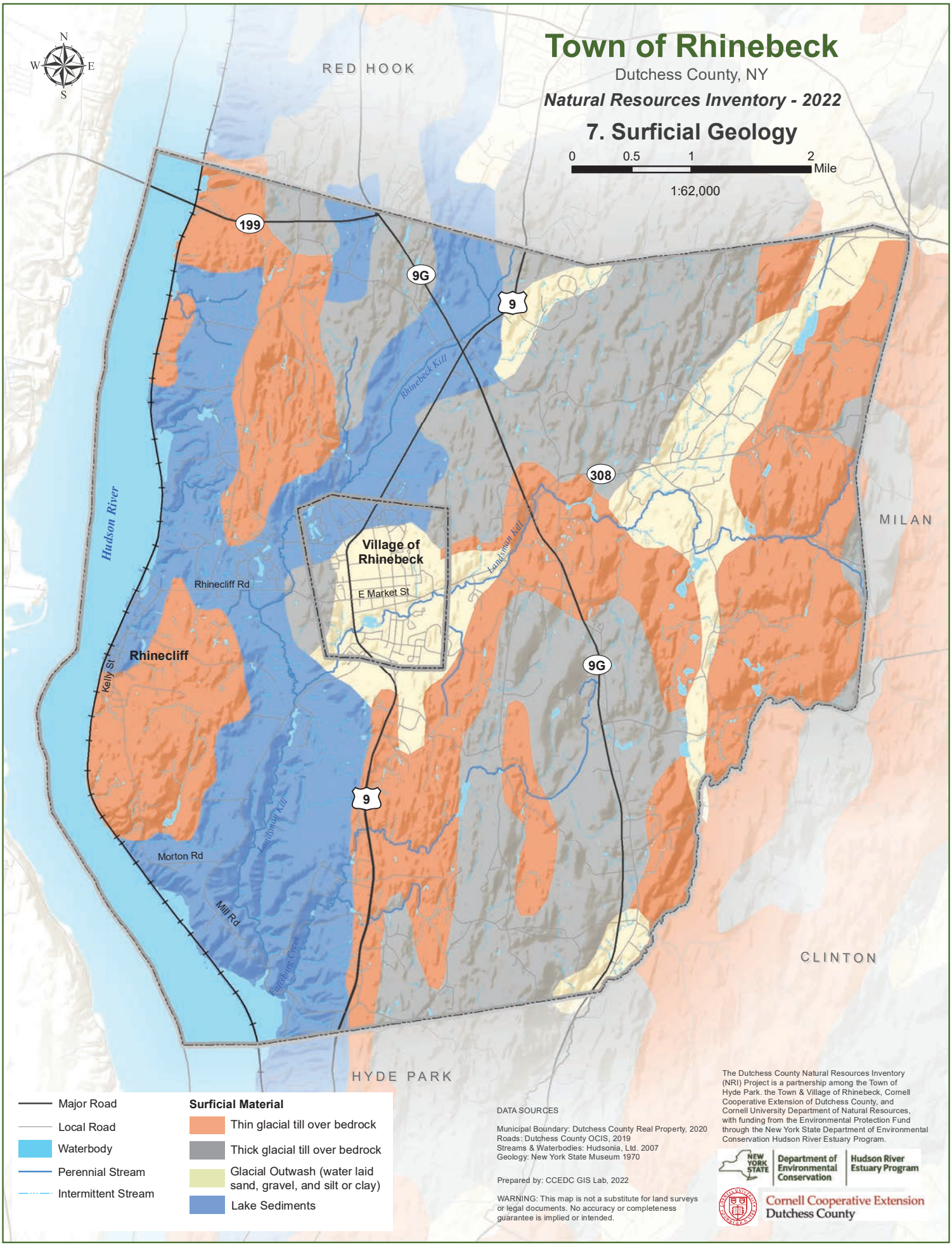
Children atop a steep slope with rocky outcropping in 2020, by Vanessa Bertozzi

Bedrock outcrops are prominent throughout the town and are often separated by wetlands, many of which are regulated by DEC. Development constraints include difficulty excavating bedrock, and difficulty draining wet ground. Soils are very thin.

Glacial outwash consists of well-sorted sand and gravel deposited by streams draining a melting glacier. The deposits are well drained, and sometimes occur in large enough quantities to be considered aggregate deposits. They also form fertile, well-drained soils that are excellent for agriculture. Glacial outwash deposits are easy to develop because of their flat slopes, good load bearing, and good drainage.

Till is dense, poorly sorted material deposited and compressed to high density by the glacier. Its high density is good for load bearing, but poor for drainage. Soils are thin and poorly drained.

Lake Sediments are of two kinds: 1) sands, and 2) lakebed silts and clays. Glacial lake sands are well drained but may be unstable and prone to slope instability. Lakebed silts and clays are fine-grained, and are liable to be poorly drained, and to form unstable slopes, but make fertile, moderately deep soils.



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Geology: New York State Museum 1970

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Soils (No Map)

Soils are the foundation for the establishment of natural communities of plants and animals as well as for critical ecological processes from decomposition and nutrient cycling to the water cycle. Soil characteristics including reaction (acidity or alkalinity), drainage, soil texture, depth to bedrock, and slope inform the natural habitats that become established in a particular area.[64] Soils also represent the "gateway" horizon governing rates of groundwater recharge into underlying geologic aquifer formations.

Soils determine the suitability of an area for particular land uses and are the foundation for the establishment of natural communities of plants and animals.

The Dutchess County Soil Survey includes detailed soil maps for the entire County along with descriptions of soil types and tables of chemical, hydrologic, and structural characteristics of the soils for various human uses. It is important to note that soil maps are only approximate; any soil unit may contain "inclusions" of up to 2 acres of soil types different from the mapped unit and imprecisions are inevitable although the soil survey serves as an excellent first estimate of likely soil in any location.

The soil maps and data may be viewed online using the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey. The soil survey report is available for download in PDF format on the NRCS website. Various critical soil parameters are discussed briefly below:

Soil drainage classes suggest the presence of wetlands, and are particularly important factors to consider in the evaluation of proposed development. Somewhat poorly-drained soils are typically found in areas with glacial till and clayey glacial lake deposits. They are good indicators of possible wetland areas and poorly drained and very poorly drained soils are indicators of probable wetland areas[65] (see the **Wetlands** section). Well-drained soils tend to be found on glacial outwash deposits and the sandier glacial lake deposits. Soil drainage classes and recommended building applications are found in the soil survey.

Depth to bedrock significantly influences land use planning and has influenced Rhinebeck's development to the present. Shallow soil depth complicates drainage, foundation design, and septic system applications, and shallow bedrock can significantly increase costs associated with road building. Shallow soils (<20 inches to bedrock) are also often associated with steep slopes, increasing susceptibility to erosion where soils are present. Depths to rock are estimated in the Soil Survey but must be verified locally.

---

[64] Heady, L., and G. Stevens. *Biodiversity Assessment Guidebook*, Hudsonia Ltd, 2018.

[65] Kiviat, E. and G. Stevens. *Biodiversity Assessment Manual for the Hudson River Estuary Corridor.* New York State Department of Environmental Conservation, 2001.

Soil reaction refers to the acidity or alkalinity of the soil, expressed in pH values.[66] Soil chemistry exerts a strong influence on plant and animal communities, and can be a useful predictor for certain habitats, from acidic bogs to calcareous wet meadows. Soils developing over calcium-rich bedrock such as limestone often support disproportionately high numbers of rare plants, animals, and natural communities. Most soils in Rhinebeck tend toward acidic based on low organic carbon content, negligible carbonate rock debris in the local glacial soil matrices, and slightly acidic precipitation.

Table 2. *Soils of Rhinebeck**

Symbol	Soil Name	Depth to Bedrock (inches)	Drainage Class (dominant condition)	Reaction	Farmland Classification
BeB	Bernardston silt loam, 3 to 8 percent slopes	>60	Well drained	Strongly acid	All areas are prime farmland
BeC	Bernardston silt loam, 8 to 15 percent slopes	>60	Well drained	Strongly acid	Farmland of statewide importance
BeD	Bernardston silt loam, 15 to 25 percent slopes	>60	Well drained	Strongly acid	Not prime farmland
BeE	Bernardston silt loam, 25 to 45 percent slopes	>60	Well drained	Strongly acid	Not prime farmland
Ca	Canandaigua silt loam, neutral substratum	>60	Very poorly drained	Neutral	Farmland of statewide importance
Cc	Catden muck, 0 to 2 percent slopes	>60	Very poorly drained	Not rated	Not prime farmland
DwB	Dutchess-Cardigan complex, undulating, rocky	20-40	Well drained	Moderately acid	All areas are prime farmland
DwC	Dutchess-Cardigan complex, rolling, rocky	20-40	Well drained	Moderately acid	Farmland of statewide importance
DwD	Dutchess-Cardigan complex, hilly, rocky	20-40	Well drained	Moderately acid	Not prime farmland
FcC	Farmington-Galway complex, rolling, very rocky	<20	Somewhat excessively drained	Slightly acid	Not prime farmland
FcD	Farmington-Galway complex, hilly, very rocky	<20	Somewhat excessively drained	Slightly acid	Not prime farmland

[66] Heady, L., and G. Stevens. *Biodiversity Assessment Guidebook*, Hudsonia Ltd, 2018.

Symbol	Soil Name	Depth to Bedrock (inches)	Drainage Class (dominant condition)	Reaction	Farmland Classification
FeE	Farmington-Rock outcrop complex, steep	>60	Somewhat excessively drained	Slightly acid	Not prime farmland
Fr	Fredon silt loam	>60	Somewhat poorly drained	Neutral	Prime farmland if drained
Ha	Halsey mucky silt loam	>60	Very poorly drained	Neutral	Not prime farmland
HeA	Haven loam, nearly level	>60	Well drained	Strongly acid	All areas are prime farmland
HeB	Haven loam, undulating	>60	Well drained	Strongly acid	All areas are prime farmland
Hf	Haven-Urban land complex	>60	Not rated	Strongly acid	Not prime farmland
HsA	Hoosic gravelly loam, nearly level	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
HsB	Hoosic gravelly loam, undulating	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
HsC	Hoosic gravelly loam, rolling	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
HtA	Hoosic channery loam, fan, 0 to 3 percent slopes	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
HtB	Hoosic channery loam, fan, 3 to 8 percent slopes	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
HvB	Hudson and Vergennes soils, 3 to 8 percent slopes	>60	Moderately well drained	Neutral	Farmland of statewide importance
HvC	Hudson and Vergennes soils, 8 to 15 percent slopes	>60	Moderately well drained	Neutral	Farmland of statewide importance
HvD	Hudson and Vergennes soils, hilly	>60	Moderately well drained	Neutral	Not prime farmland
HvE	Hudson and Vergennes soils, steep	>60	Moderately well drained	Neutral	Not prime farmland

Symbol	Soil Name	Depth to Bedrock (inches)	Drainage Class (dominant condition)	Reaction	Farmland Classification
Hy	Hydraquents and Medisaprists soils, ponded	>60	Very poorly drained	Slightly acid	Not prime farmland
Kn	Kingsbury and Rhinebeck soils	>60	Somewhat poorly drained	Neutral	Farmland of statewide importance
KrB	Knickerbocker fine sandy loam, undulating	>60	Somewhat excessively drained	Strongly acid	All areas are prime farmland
KrC	Knickerbocker fine sandy loam, rolling	>60	Somewhat excessively drained	Strongly acid	Farmland of statewide importance
KrD	Knickerbocker fine sandy loam, hilly	>60	Somewhat excessively drained	Strongly acid	Not prime farmland
KuA	Knickerbocker-Urban land complex, nearly level	>60	Not rated	Strongly acid	Not prime farmland
KuB	Knickerbocker-Urban land complex, undulating	>60	Not rated	Strongly acid	Not prime farmland
Ln	Linlithgo silt loam	>60	Somewhat poorly drained	Slightly acid	Prime farmland if drained
Lv	Livingston silt clay loam	>60	Very poorly drained	Neutral	Not prime farmland
MnA	Massena silt loam, 0 to 3 percent slopes	>60	Somewhat poorly drained	Neutral	Prime farmland if drained
MnB	Massena silt loam, 3 to 8 percent slopes	>60	Somewhat poorly drained	Neutral	Prime farmland if drained
NwB	Nassau-Cardigan complex, undulating, very rocky	<20	Well drained	Strongly acid	Not prime farmland
NwC	Nassau-Cardigan complex, rolling, very rocky	<20	Well drained	Strongly acid	Not prime farmland
NwD	Nassau-Cardigan complex, hilly, very rocky	<20	Somewhat excessively drained	Very strongly acid	Not prime farmland

Symbol	Soil Name	Depth to Bedrock (inches)	Drainage Class (dominant condition)	Reaction	Farmland Classification
NxE	Nassau-Rock outcrop complex, steep	Not rated	Not rated	Very strongly acid	Not prime farmland
Pc	Natchaug muck, 0 to 2 percent slopes	>60	Very poorly drained	Neutral	Not prime farmland
Ps	Pits, gravel	Not rated	Not rated	Not rated	Not prime farmland
PwB	Pittstown silt loam, 3 to 8 percent slopes	>60	Moderately well drained	Strongly acid	All areas are prime farmland
PwC	Pittstown silt loam, 8 to 15 percent slopes	>60	Moderately well drained	Strongly acid	Farmland of statewide importance
PzB	Punsit silt loam, 3 to 8 percent slopes	>60	Somewhat poorly drained	Slightly acid	Prime farmland if drained
Ra	Raynham silt loam	>60	Somewhat poorly drained	Slightly acid	Prime farmland if drained
Sc	Scio silt loam	>60	Moderately well drained	Moderately acid	All areas are prime farmland
SkB	Stockbridge silt loam, 3 to 8 percent slopes	>60	Well drained	Neutral	All areas are prime farmland
SkE	Stockbridge silt loam, 25 to 45 percent slopes	>60	Well drained	Neutral	Not prime farmland
SmC	Stockbridge-Farmington complex, rolling, rocky	<20	Well drained	Neutral	Farmland of statewide importance
Su	Sun silt loam	>60	Poorly drained	Neutral	Farmland of statewide importance
Ud	Udorthents, smoothed	>60	Well drained	Slightly acid	Not prime farmland
Ue	Udorthents, wet substratum	>60	Somewhat poorly drained	Slightly acid	Not prime farmland
UnB	Unadilla silt loam, 3 to 8 percent slopes	>60	Well drained	Strongly acid	All areas are prime farmland

Symbol	Soil Name	Depth to Bedrock (inches)	Drainage Class (dominant condition)	Reaction	Farmland Classification
Ur	Urban land	Not rated	Not rated	Not rated	Not prime farmland
W	Water	Not rated	Not rated	Not rated	Not prime farmland
Wy	Wayland silt loam	>60	Poorly drained	Neutral	Not prime farmland

*Soils within the Village are highlighted in light brown**

Many soils maps could be included in a NRI volume, but **Figure 2** from the Chazen Companies report titled, *Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations,* presents Hydrologic Soil Groups. All soils are assigned to a dominant Hydrologic Soil Group by the Natural Resources Conservation Service (NRCS). HSG A soils are most granular, HSG B soils are sandy-silt, HSG C soils tend toward silt, while HSG D soils are mostly clay-rich or lie in areas coincident with the water table. This 2006 Dutchess County study identifies the following rates of annual aquifer recharge through these four Hydrologic Soil Group classes:

- Hydrologic Soil Group A: 17.3 inches of recharge annually.
- Hydrologic Soil Group B: 12.6 inches of recharge annually.
- Hydrologic Soil Group C: 6.5 inches of recharge annually.
- Hydrologic Soil Group D, B/D, C/D: 3.6 inches of recharge annually.

These rates of aquifer recharge allow consideration of water budgets for parcels or regions, by multiplying study area acreages of each soil group by inches of rainfall to identify available groundwater capacity.

The same 2006 Dutchess County study[67] applied these recharge rates to septic system density models, to suggest minimum average sustainable septic system placement for locations where municipal wastewater is unavailable and domestic wells are in use. The average density recommendations are provided below:

- Hydrologic Soil Group A: 1.4 acres per septic system, average.
- Hydrologic Soil Group B: 1.9 acres per septic system, average.
- Hydrologic Soil Group C: 3.5 acres per septic system, average.
- Hydrologic Soil Group D, B/D, C/D: 6.2 acres per septic system, average.

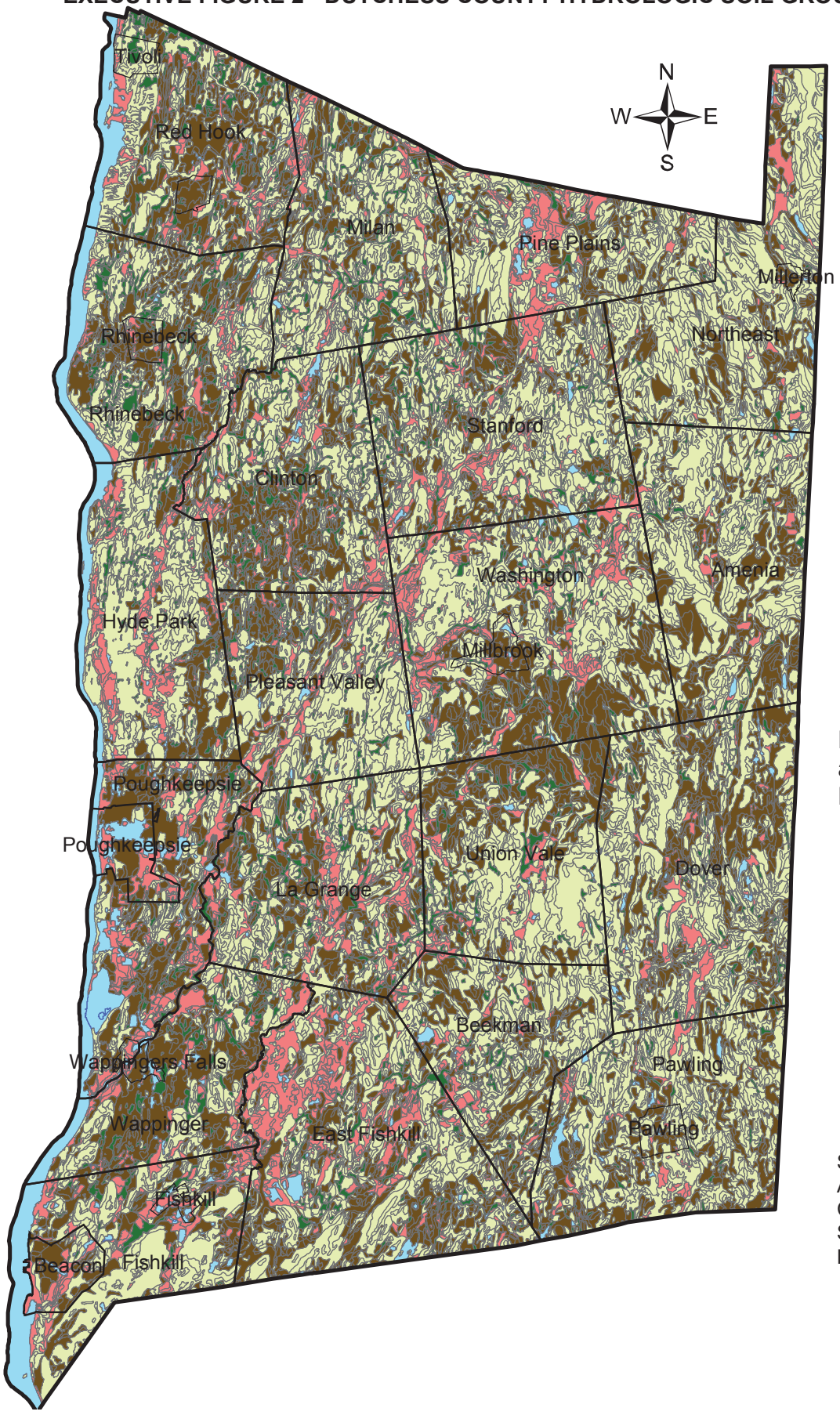
[67] Chazen Companies, 2006, Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations. Prepared for Dutchess County Water & Wastewater Authority.

These average densities do not apply where central water or central wastewater services are available and some clustering can be accommodated where nearby compensatory acreage is available but, in general, for domestic wells and domestic septic systems to function without interference on a long-term basis, enough local recharge must be available to dilute septic system discharges. Where HSG soils admit greater recharge (HSG A and B), septic system densities can increase to between 1.4 and 1.9 acres per septic system, but where clayey HSG C soils are present, septic system density should increase to approximately 3.5 acres per system to ensure that enough local recharge is available to provide appropriate wastewater dilution. Few septic systems are installed successfully in HSG D soils, but where they are attempted, density should be thinned to more than 6 acres per septic system, on average. Note that these recommendations only apply where wells and septic systems are both in use; greater septic system densities can be supported based on site specific design capacity and where community water system water supplies are in place.

Discussion

Soils play a fundamental role in determining suitability for land uses. Soil characteristics determine potential for agricultural production as well as vulnerability to flooding, soil erosion or instability, and efficiency at filtering pollutants and wastes. (Farmland soils are further discussed in relation to **Map 21**, **Agricultural Resources**.) Consideration of soil properties is important for planning and designing drainage systems; siting of structures; evaluating the potential for septic systems; assessing requirements for constructing foundations, basements, and roads; and determining the feasibility of excavation; among other uses. As discussed here, the **Drinking Water Resources** map focuses particularly on rates of aquifer recharge governed by Rhinebeck's soils, allowing consideration of groundwater budgets available for water supplies and sustainable septic system densities in areas likely to remain without central service into the future.

EXECUTIVE FIGURE 2 - DUTCHESS COUNTY HYDROLOGIC SOIL GROUPS



Legend

Hydrologic Soil Groups and Dutchess County Percent Coverage

- Waterbodies /Unclassified (4.0%)
- A and A/D Soils (10.5%)
- B (26.9%)
- C and C/D (53.2%)
- D (5.4%)

Source: U.S. Department of Agriculture, Natural Resources Conservation Service Soil Survey for Dutchess County, New York (2003)

The Chazen Companies
April 2006

Section 4: Water Resources

Drinking Water Resources (Map 8)

Rhinebeck relies on two primary sources of drinking water: the Hudson River Estuary, which serves approximately two-thirds of residents and most businesses and institutions via the Rhinebeck Village Water system; and groundwater, which serves both private homes and businesses via their own individual wells, and 19 public water supplies serving mobile home parks, camps, apartment buildings, businesses and other similarly sized entities.

The Hudson River provides drinking water for about **5,600 people** in Rhinebeck, more than two-thirds of the total combined population.

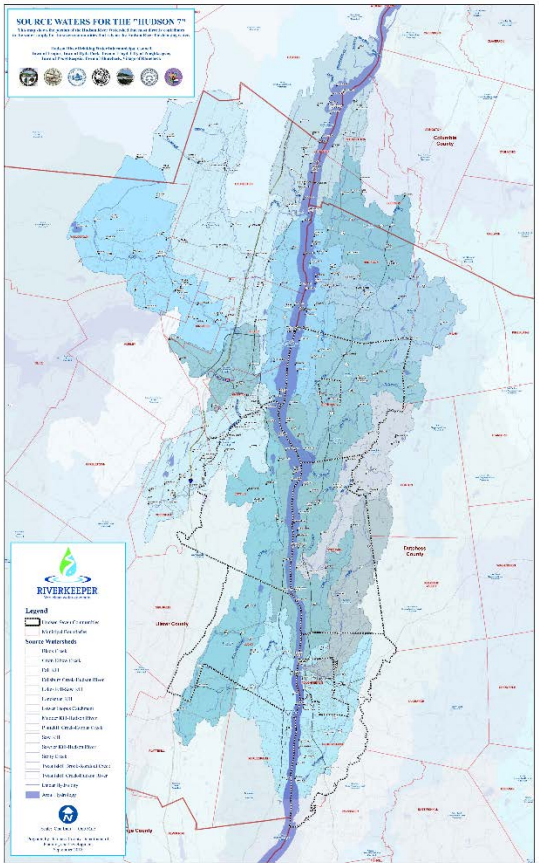


Figure 3. *Map of Hudson 7 communities and the watershed of their drinking water intakes.*

The entire Town of Rhinebeck is within the watershed area for its Hudson River drinking water supplies, including the intake for the Water Treatment Plant located on Slate Dock Road in the Hamlet of Rhinecliff. The **Streams and Watersheds** Map (Map 9) is also relevant for the drinking water supply, showing the portion of this watershed area that is within the Town of Rhinebeck. The Drinking Water Resources map shows features that are important to Rhinbebeck's groundwater supply, and the area served by the public water supply. Many residents and businesses in the Town of Rhinebeck depend on private well water, recharged by Rhinebeck's lakes, streams and wetlands, as seen on **Figure 3**. produced by the Dutchess County Planning for the Hudson 7.

Rhinebeck Village Water (PWS NY1302776) serves approximately 5,600 people in the Village and Town of Rhinebeck, more than two-thirds of the total population of the Town and Village. The water district includes the Village of Rhinebeck; the hamlet of Rhinecliff; properties between the two and extending up River Road and Astor Road to Ferncliff Nursing Home; properties bordering the eastern edge of the village in the vicinity of the village's water storage facility; portions of Route 9 and Old Post Road north of the village; and a portion of Morton Road south of Rhinecliff.[68] In addition to serving the majority of

[68] New York State Department of Health, Know Your NY Water, accessed February 1, 2022, and available at

the residential population of the Village and Town of Rhinebeck, the water district serves regional institutions like Northern Dutchess Hospital, Dutchess County Fairgrounds, and the Rhinebeck School District.

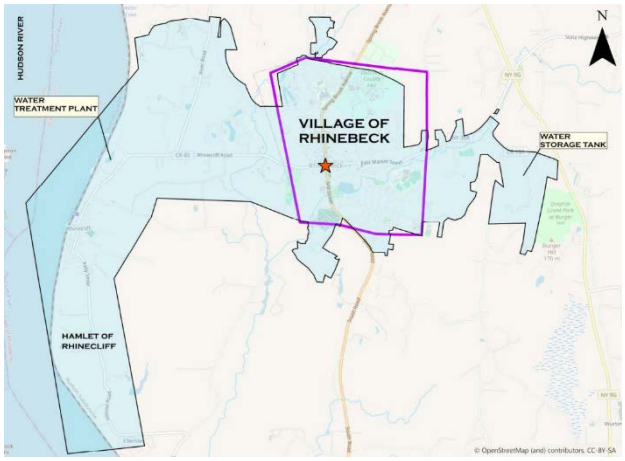


Figure 4. *Rhinebeck Water District*

The water source for Rhinebeck Village Water is the Hudson River Estuary. The treatment plant, constructed in 1968, is located off Slate Dock Road in the Hamlet of Rhinecliff, just south of the Kingston-Rhinecliff Bridge. The facility is certified by the State of New York to produce 1.5 million gallons of potable water per day. The daily average of water treated and pumped into the distribution system in 2021 was 463,000 gallons per day, and demand highest in the summer, when as much as 779,000 gallons of water may be used per day. The system utilizes 25 miles of pipeline and a 2 million-gallon water storage facility located off Violet Hill on Hilee Road. The plant utilizes direct filtration and conventional filtration utilizing rapid mix, coagulation, flocculation, sedimentation, filtration, and disinfection by the monitored use of chlorine. Orthophosphate is also added to reduce corrosion of any customer lead fixtures. Potassium permanganate is used as a pretreatment for the control of Zebra Mussels during the warm water months.[69] The Village is permitted to withdraw its water supply from the Hudson River as part of its NYSDEC Water Supply Application (WSA) 4716 that was approved September 3, 1964. Four wells that had served as the Village's original water source remain, but are not operational as auxiliary supplies.

The Hudson 7

Rhinebeck is located within the Hudson River Watershed. As such, all of Rhinebeck is part of the public water supply catchment for the Hudson River. All surface water and groundwater that doesn't evaporate or transpirate flows to the Hudson River and contributes to not only Rhinebeck's drinking water supply, but that of the other communities that draw water from the river: The City of Poughkeepsie (PWS 1330291), Town of Poughkeepsie (PWS 1302812), and the Towns of Esopus (PWS 5503382), Hyde Park (PWS 1302796) and Lloyd (PWS 5503368).

As part of the 1996 Safe Drinking Water Act amendments, Congress required the states to develop Source Water Assessments for each public drinking water supply. In 2005, New York State produced a Source Water Assessment for Rhinebeck Village Water that identified a source water assessment area for

https://water.ny.gov/

[69] Village of Rhinebeck, Annual Drinking Water Quality Report for 2020, accessed February 1, 2022, and available at https://villageofrhinebeck.org/water

the water supply that includes a portion of the Hudson River between Rhinebeck and Catskill, as well as the Landsman Kill and its watershed, and portions of the Rondout, Esopus and Catskill Creek watersheds. While the Department of Health noted that "the Hudson River watershed is exceptionally large and too big for a detailed evaluation," it identified a number of general source water concerns, including: "storm generated turbidity, eutrophication (excessive nutrients and algae) wastewater, toxic sediments" and the potential for saltwater from the Atlantic to affect intakes during periods of low freshwater flow. The assessment found an "elevated susceptibility to contamination" due to land uses in the watershed that include pasture, sanitary wastewater discharges, non-sanitary wastewater discharges, and discrete contaminant sources such as landfills and mines.

Riverkeeper Testing for Water Clarity by Dan Shapley

A Center for Watershed Protection report commissioned by Riverkeeper in collaboration with the Village and Town of Rhinebeck and five other municipalities that utilize the Hudson River as their drinking water source identified gaps in monitoring and modeling source water quality, in mapping land uses and other potential threats to water quality, and in managing relevant portions of the watershed to promote source water quality.[70] Among the report's recommendations was the formation of a new collaborative effort to address these gaps, and the seven communities formed the Hudson River Drinking Water Intermunicipal Council in 2018.[71] Known as the Hudson 7, the council has taken several actions to enhance protections of its shared water supply, share resources and information, and develop new initiatives to promote the protection of water quality for the region, including by advocating for tighter oversight and regulation of industrial barge, tanker and rail shipping; reduction of dumping of sediment from the Ashokan Reservoir into the Lower Esopus Creek; and protection of intakes from during the planned construction of electric transmission cable in the Hudson, and the planned cleanup of coal tar near Poughkeepsie, each of which has the potential to introduce contaminants into the water. In 2022, the Council started working with New York State Department of Health, Dutchess and Ulster Counties and other partners as part of the state's new Drinking Water Source Protection Program (DWSP2) to

[70] Center for Watershed Protection, "Drinking Source Water Protection Scorecard Review for Seven Hudson Communities: A review of programs and policies to protect drinking water supplies for the Towns of Esopus, Hyde Park and Lloyd, the City and Town of Poughkeepsie, and the Town and Village of Rhinebeck," 2018, available at https://www.hudson7.org/uploads/1/1/3/8/11382860/final_report_-_hudson_scorecard_review_2-6-2018.pdf

[71] Hudson River Intermunicipal Drinking Water Council, Memorandum of Agreement, May 2018, available at https://www.hudson7.org/uploads/1/1/3/8/11382860/hudson_river_drinking_water_intermunicipal_council_5_31_18.pdf

develop the first-ever drinking water source protection plan for the Hudson River.

Changes in precipitation patterns and climate extremes are likely to produce or exacerbate water quality issues relevant to the Hudson River as a drinking water source. Prolonged drought conditions, for instance, could allow the salt front, or the leading edge of ocean salinity, to reach further north in the estuary than it has historically. It has reached Poughkeepsie every few years, during significant droughts, prompting short-term alerts to users of the public water supply who are on restricted-sodium diets.[72] Scientists have also warned that changing climatic conditions, coupled with the globally high nutrient load that is currently present in the Hudson Estuary, could result in algal growth[73][74] that leads to the formation of disinfection byproducts, a set of regulated contaminants, and/or the formation of cyanotoxins, an unregulated contaminant that has affected an increasing number of drinking water supplies impacted by harmful algal blooms ("HABs") of cyanobacteria; cyanotoxins and indicators of algal growth must be monitored by some water systems under the federal Safe Drinking Water Act, and are candidates for further regulation.

In addition to the Hudson River, groundwater is an important source of drinking water for the Town of Rhinebeck. The natural areas of Rhinebeck recharge the groundwater that wells access to supply drinking water to many of the Town's residents and businesses. In addition to individual private wells serving individual homes and businesses, there are 19 regulated drinking water systems in the Town of Rhinebeck, each using groundwater[75].

Table 3. *Regulated drinking water systems in Rhinebeck.*

System Name	PWS ID	Type	Population served
Ramapo for Children	NY1330310	Community	480
Rhinebeck Mobile Home Community	NY1302135	Community	100
Cove View Apartments	NY1303218	Community	60
Ramapo Apartments	NY1318861	Community	25

[72]Salt and Drinking Water. NYS Department of Health https://www.health.ny.gov/environmental/water/drinking/salt_drinkingwater.htm

[73] Howarth, Robert, et al. "Climatic Control on Eutrophication of the Hudson River Estuary," JSTOR 2000, available at https://www.jstor.org/stable/3658636 "The Hudson is the Most Heavily Nutrient-Loaded Estuary in the World. Should We Care?" Hudson River Foundation, 2011, available at http://www.hudsonriver.org/download/seminars/Howarth_March11.pdf

[74] "The Hudson is the Most Heavily Nutrient-Loaded Estuary in the World. Should We Care?" Hudson River Foundation, 2011, available at http://www.hudsonriver.org/download/seminars/Howarth_March11.pdf

[75] U.S. Environmental Protection Agency, Safe Drinking Water Information System, database query results from January 31, 2022, available at https://www.epa.gov/enviro/sdwis-search

System Name	PWS ID	Type	Population served
SS Water Works Corporation	NY1322609	Non-Transient Non-Community	161
Williams Lumber	NY1322622	Non-Transient Non-Community	60
Astor Plaza	NY1320809	Non-Transient Non-Community	52
Northern Dutchess Day Care	NY1322426	Non-Transient Non-Community	35
IXL Fitness Center	NY1330303	Transient Non-Community	105
Center for Performing Arts	NY1330317	Transient Non-Community	100
Four Brothers Pizza Inn Rhinebeck	NY1316633	Transient Non-Community	100
CJ's Pizza North	NY1316628	Transient Non-Community	67
Grand Cru Beer and Cheese Market	NY1316636	Transient Non-Community	50
Linwood Center / Sisters of St. Ursula	NY1330163	Transient Non-Community	45
Gary's Dairy and Deli	NY1330389	Transient Non-Community	27
Fairgrounds Deli (Mobil Gas Station)	NY1330463	Transient Non-Community	26
Del's Roadside	NY1316632	Transient Non-Community	25
Gendron Catering	NY1330551	Transient Non-Community	25
Rhinebeck Mobil	NY1330393	Transient Non-Community	25

Aquifer Protection Areas

The **Drinking Water Resources** map shows surface water features, areas critical to the recharge of aquifers, and wetlands that are important for supplying a sufficient quantity of groundwater for private and commercial use. At least 1,600 people in the Town of Rhinebeck rely on private wells supplied by aquifers and other groundwater stored in the cracks and fractures of bedrock.

One way to map aquifers in Rhinebeck is to focus on the higher-yield sand and gravel aquifer. **Zone 1** permeable deposits shown on the Drinking Water Resources map are the unconsolidated surficial geology deposits of sand and gravel likely to be able to store large quantities of groundwater and support higher-capacity wells. **Zone 2 areas** are the adjacent hillside areas where overland flow passes directly onto the Zone 1 aquifers, likely contributing additional direct Zone 1 recharge. **Zone 3** areas contribute to a stream which may subsequently be induced to contribute to the aquifer through infiltration.

The balance of the Town consists of upland bedrock aquifer areas, where recharge is both important to all residences and community areas with wells in these areas, but also which provide supplemental recharge migrating slowly through the bedrock fractures toward the Zone 1 permeable deposits. It is important to recognize that aquifers of importance are found in all parts of Rhinebeck, wherever wells are in use, whether higher-capacity Zone 1 sand and gravel aquifers or the lower-yield but equally critical and widely used bedrock aquifers.

Aquifers also provide important base flow to streams during dry periods of the year. Hydrology studies indicate that approximately half of stream flow comes from the aquifers, as groundwater seeping underground to reach the stream beds, weeks, months, and sometimes even years after discrete precipitation events. This baseflow is critical to preservation of stream flow. Watershed-wide residential development using wells and septic systems typically does not have a significant influence on baseflow reduction because septic systems return most of the pumped water back to the subsurface, but where high yield community wells or wells connected to centralized wastewater treatment systems are present, analysis is sometimes warranted to ensure that stream baseflow levels are not overly curtailed.

Discussion

It is important to avoid the siting of potentially contaminating land uses near drinking water wells. Wells may be contaminated by naturally occurring sources or human activities, including residential, commercial, agricultural, or industrial sources. The US Geological Survey publication *Groundwater and the Rural Homeowner*[76] discusses common well contamination problems and some remedies. Technical assistance and grant funding for drinking water protection plans are available through the DEC's Drinking Water Source Protection Program (DWSP2). The Water Quality Improvement Project (WQIP) program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments or protect a drinking water source.

Following research from the Cary Institute and best practices from the Adirondacks, both the Town and Village have made efforts to reduce salt use during winter storm road treatments. High usage of road salt can contaminate nearby wells and have an overall deleterious effect on the ecosystem. Scientists have warned of a looming ecological crisis from "Freshwater Salinization Syndrome" of streams, as salt levels increase.[77] Increasing indicators of salt concentrations have been documented in many Hudson

[76] *Groundwater and the Rural Homeowner.* US Geological Survey, 1994. https://pubs.usgs.gov/gip/gw_ruralhomeowner/index.html

[77] Cary Institute, "US Rivers and Streams are Compromised by Increasing Salt Loads," 2018, available at

River tributaries throughout the region,[78] and noted as a likely cause of multi-decadal ecological decline in streams across the state.[79] The Town has found success in the application of salt brine, as a preparatory coat on the road surface. Brine uses less salt, and because of its liquid form, does not present the problem of "bounce and scatter" of crystal salt to the roadside, where it seeps into the environment.

In the fall 2021, a report was created by NYS DEC as part of a survey of existing brownfields across the entire state to locate potential sources of drinking water pollution. The Village-owned Lions Mini Park had been identified as an inactive landfill in 2012, when during the repair of a water main, debris was uncovered and tested for toxins. In 2021, the DEC revisited to drill down and set up a monitor at the Lions Mini Park. The DEC's mission was twofold. 1- locate potential sources of drinking water contamination; 2 - sample any drinking water sources within ¼ mile downstream (above or below ground) to see if the contaminates appear. As the Village supplies municipal water, there are no drinking water wells within the survey area. The finding of the report was that there were no actionable items or remediations necessary to protect drinking water.

The Town's salt brine equipment that Town Highway Superintendent Bob Wyant constructed in 2021, by Vanessa Bertozzi

Sea level rise could impact our Water Treatment Plant located on the banks of the Hudson River on Slate Dock Road. (More on this in the Drinking Water Resources and Floodplains & Riparian sections.) The Village undertook a Vulnerability Assessment and made improvements to the plant, raising the lowlift pumps.[80]

In addition to sea-level rise, changing climate conditions could significantly change source water quality, challenging treatment. Prolonged drought conditions, for instance, could allow the salt front—the leading edge of the ocean—to reach further north in the estuary than it has historically. (See **Climate** section.)

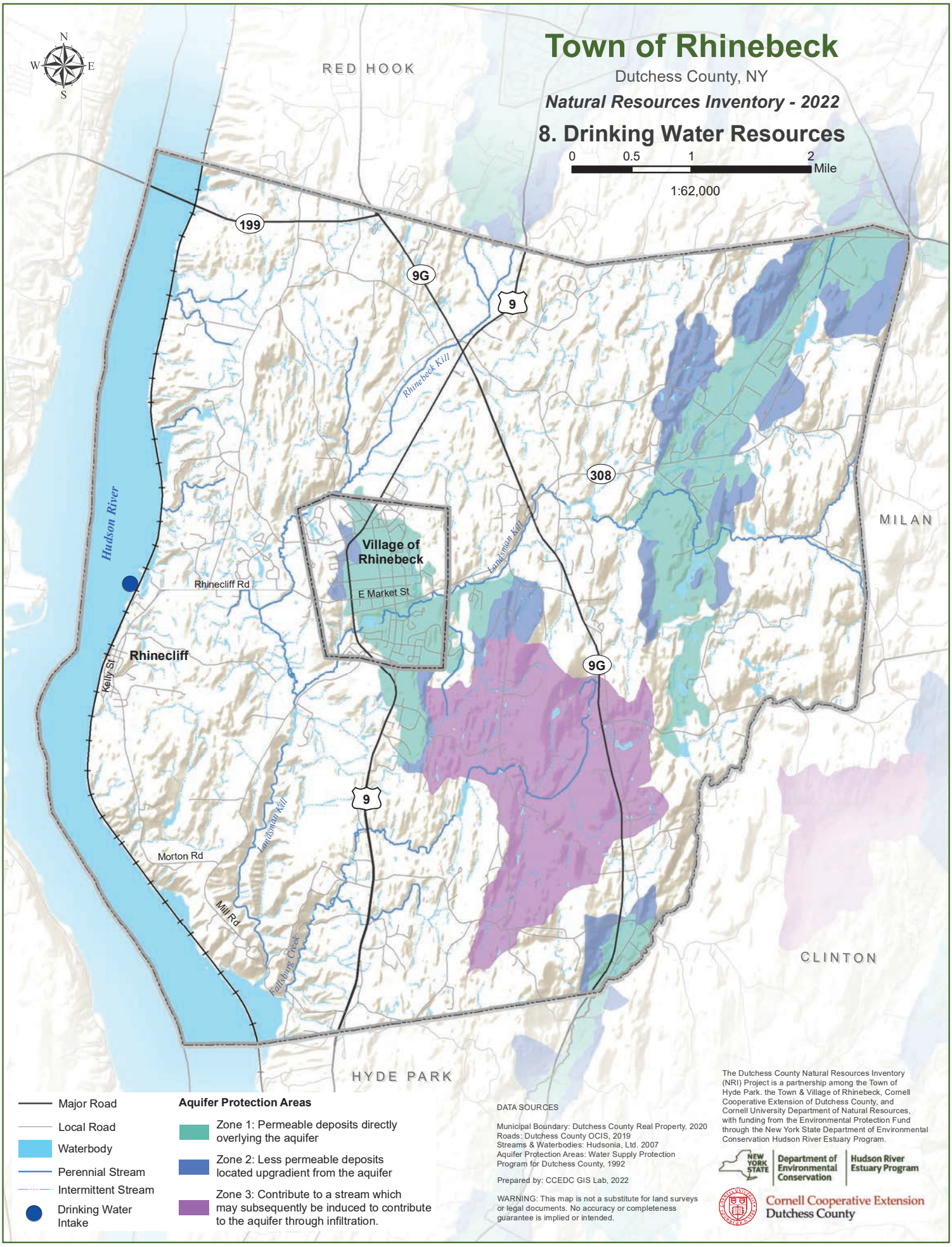
---

https://www.caryinstitute.org/news-insights/press-release/us-rivers-and-streams-are-compromised-increasing-salt-loads

[78] Meierdiercks, Katherine L., "Patterns of road salt water quality impacts in the Hudson River Watershed," January 2022, available at https://www.youtube.com/watch?v=H7ZcHvh70Mk

[79] Smith, Alexander et al, New York State Department of Environmental Conservation, Rivers and Research Applications, "Long-term trends in biological indicators and water quality in rivers and streams of New York State (1972-2012): Water Quality Trends in New York State," 2018, available at https://www.researchgate.net/profile/Alexander-Smith-5/publication/324802073_Long_term_trends_in_biological_indicators_and_water_quality_in_rivers_and_streams_of_New_York_State_1972-2012_Water_Quality_Trends_in_New_York_State/links/5c2e1439a6fdccd6b58f78dd/Long-term-trends-in-biological-indicators-and-water-quality-in-rivers-and-streams-of-New-York-State-1972-2012-Water-Quality-Trends-in-New-York-State.pdf

[80] Sea Level Rise. Climate Smart Rhinebeck. https://www.climatesmartrhinebeck.org/sea-level-rise


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
8. Drinking Water Resources
0 0.5 1 2 Mile
1:62,000
N
W
E
S
RED HOOK
199
9G
9
Rhinebeck Kill
308
MILAN
Hudson River
Village of Rhinebeck
E Market St
Landsman Kill
Rhinecliff Rd
Rhinecliff
Kelly St
9G
9
Landsman Kill
Morton Rd
Mill Rd
Fallsburg Creek
CLINTON
HYDE PARK
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Drinking Water Intake
Aquifer Protection Areas
Zone 1: Permeable deposits directly overlying the aquifer
Zone 2: Less permeable deposits located upgradient from the aquifer
Zone 3: Contribute to a stream which may subsequently be induced to contribute to the aquifer through infiltration.
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Aquifer Protection Areas: Water Supply Protection Program for Dutchess County, 1992
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Streams and Watersheds (Map 9)

A **watershed** is the area of land from which water drains into a river, lake or other waterbody. Watersheds are divided by high points on the land such as ridges, mountains and hills. Watersheds are nested, with smaller catchments or subwatersheds existing within larger watersheds. There is a strong relationship between land use and water quality in streams, wetlands, and other waterbodies. Land and water are connected through the interactions of water, soil, organisms, and chemical components. Healthy watersheds can recharge groundwater, reduce erosion and flooding impacts, minimize public infrastructure, and be more resilient to climate change—all ecosystem services that directly benefit Rhinebeck and cost less than the alternatives.[81]

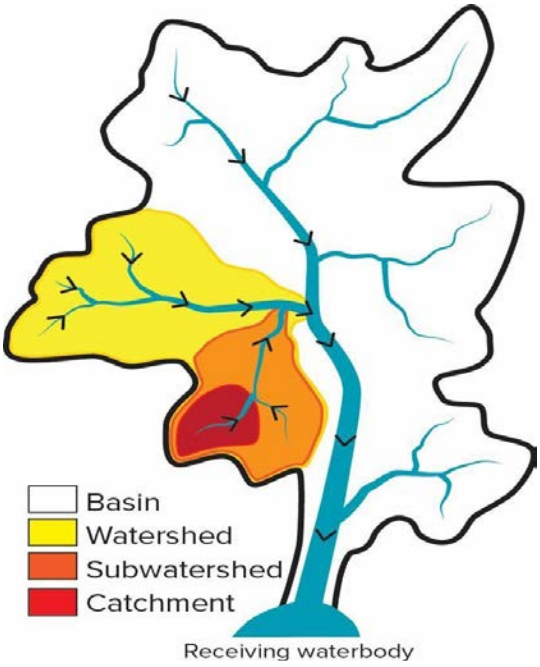


Figure 5. *Nested watersheds from NYS DEC*

A stream or river is a natural waterway with a detectable current, having defined bed and banks, and may have perennial, intermittent or ephemeral flow. Streams and rivers drain water from the land within a watershed. The bed is the bottom of a stream or river. The bank is the side of the stream or river, making up the land area immediately adjacent to and sloping toward the bed. The bank is necessary to maintaining the stream's structure and integrity. Natural meanders are curves in the stream that slow down the water and reduce the energy that could cause erosion. The character of a stream is influenced by the amount of water it carries, the geology and soil types that it flows through and the shape, slope, and land cover of its valley.

Perennial streams flow continuously throughout years with normal precipitation, though some may dry up during droughts. Intermittent streams only flow seasonally or after rain. Ephemeral streams only flow for a short time after a precipitation event. Intermittent and ephemeral streams are often unmapped, but are widespread, accounting for an estimated 59% or more of total stream length in the United States. These small

Healthy watersheds can:

- recharge groundwater
- reduce erosion and flooding impacts
- minimize needs for public infrastructure
- be more resilient to climate change

[81] "The Economic Benefits of Protecting Healthy Watersheds." US Environmental Protection Agency, 2015. https://www.epa.gov/sites/production/files/2015-10/documents/economic_benefits_factsheet3.pdf

streams play an essential role in maintaining water quantity, quality, and overall watershed function or health.[82] They also play a vital role in dissipating stream energy during storms and reducing erosion and downstream flood impacts. Both intermittent and perennial streams were mapped by Hudsonia in their 2007 report, Significant Habitats in the Town of Rhinebeck, and are shown on all the maps in this NRI. See the **Stream Habitats** section for further discussion of stream values.

Major watersheds and mapped streams in the Town are shown on the **Streams and Watersheds Map**. Standard watershed boundaries for the entire U.S. have been created through the United States Geological Survey (USGS) National Hydrography Dataset in a nested hierarchy by size and are referred to by their Hydrologic Unit Code (HUC) scale. The finest scale of standardized watershed data available for New York State are the HUC-12 watershed boundaries, delineated to encompass less than 40,000 acres or about 60 square miles each. The USGS StreamsStats tool can be used to delineate watersheds at a finer scale where desired. The watersheds on this map, mapped by Dutchess County Planning for the Dutchess County NRI (2010), break out the Fallsburg Creek-Hudson River HUC-12 unit into the Fallsburg Creek, Hudson River Direct Drainage, and Indian Kill[83] and the Mudder Kill-Hudson River HUC-12 unit into the Mudder Kill and Hudson River Direct Drainage. Because these two HUC-12 units share the Hudson River Direct Drainage watershed, land use statistics in the table below are given as a range. Streams and waterbodies on this and other maps in the inventory are from the USGS National Hydrography Dataset and were digitized from air photos.

Table 4. *Watersheds in the Rhinebeck (Numbers reflect the entirety of the watershed, including areas outside of the Town and Village).*

HUC-12 Watershed	Total Acreage	% Canopy Cover (2016)	% Impervious Cover (2016)
Saw Kill	16,789	68.1	3
Crum Elbow Creek	12,456	62.7	3.3
Landsman Kill	15,042	56.7	3.4
Mudder Kill-Hudson River (Mudder Kill and Hudson River Direct Drainage)	20,039	41.9-47.1	2.9 -3.8
Fallsburg Creek-Hudson River (Fallsburg	26,184	41.-47.1	2.9-3.8

[82] *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (Final Report)*. U.S. Environmental Protection Agency, EPA/600/R-14/475F, 2015, Washington, DC. https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=296414

[83] See Hyde Park's NRI for discussion about the naming of Indian Kill and whether it may be a misspelling of Ender Kill.

HUC-12 Watershed	Total Acreage	% Canopy Cover (2016)	% Impervious Cover (2016)
Creek, Indian Kill, and Hudson River Direct Drainage)			

The major streams include the Landsman Kill, Crum Elbow Creek, Fallsburg Creek, and Saw Kill, but there are several other tributaries that drain directly into the Hudson or are at the periphery of the Town. All the land in Rhinebeck ultimately drains to the Hudson River Estuary. The Hudson River Estuary Program provides technical assistance, grants, and training to municipalities and non-profits within the Hudson River estuary watershed. The Saw Kill Watershed Community (SKWC) is a smaller grassroots organization that is predominately based in Red Hook, but who aims to expand their work into other communities within their watershed. Guiding the group's work is their leadership team, which has identified science, education, stewardship, and municipal work as focal themes. The SKWC's projects have included long-term water quality monitoring, tree plantings, and educational programming.

Discussion

Land cover is closely linked to the health of a watershed and the water quality of its surface and subsurface waters. While the location and configuration of impervious surfaces (e.g., roofs, pavement, and other development) in a watershed does matter, some studies strongly suggest that there are critical thresholds of impervious cover in a landscape. Specifically, researchers have demonstrated that where watersheds exceed 10% impervious surface cover, the probability of stream degradation greatly increases.[84] [85] In research undertaken in several small Dutchess County watersheds, impacts to nutrient levels in streams have been found in watersheds less than 5% impervious.[86] Conversely, other studies have shown that watersheds with a greater percentage of forest cover are generally associated with higher water quality and can produce significant savings on drinking water treatment costs.[27] While none

[84] National Research Council, Committee on Reducing Stormwater Discharge Contributions to Water Pollution. 2008. Urban Stormwater Management in the United States. Water Science and Technology Board, Division of Earth and Life Studies of the National Research Council. National Academies Press, Washington D.C., pp 529. http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf

[85] Walsh C.J., A.H. Roy, J.W. Feminella, P.D. Cottingham, P.M Groffman, and R.P Morgan III. 2005 The Urban Stream Syndrome: Current Knowledge and the Search for A Cure. Journal of the North American Benthological Society, 24(3):706-723 pp18

[86] Cunningham M.A., C.M. O'Reilly, K.M. Menking,, D.P. Gillikin, K.C. Smith, C.M Foley, S.L Belli, A.M. Pregnall, M.A. Schlessman, and P. Batur. 2009. The Suburban Stream Syndrome: Evaluating Land Use and Stream Impairments in the Suburbs. Physical Geography. 30, 3, pp 269-284.

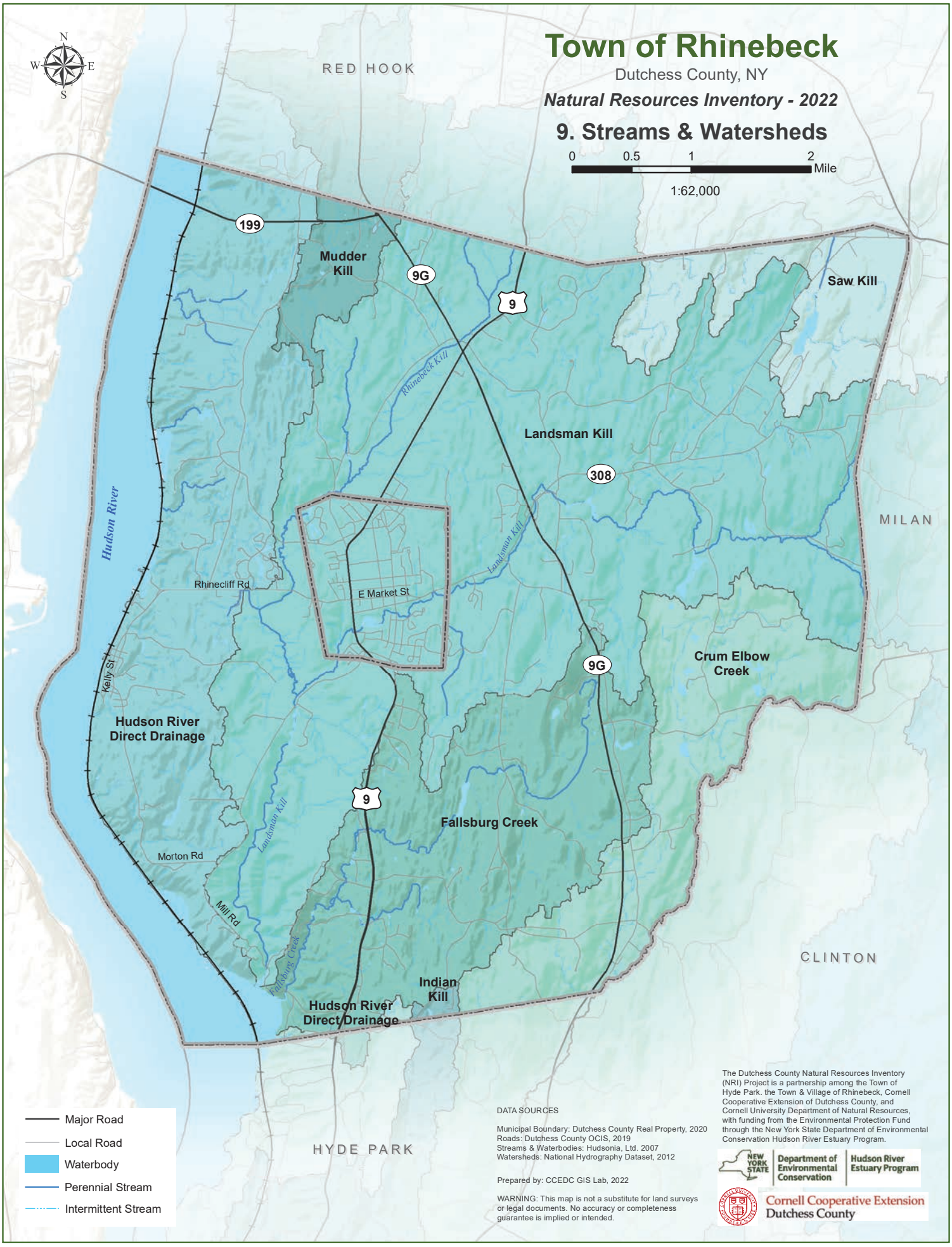
of the Town's watersheds have greater than 10% impervious cover, those with less than 5% impervious cover are still vulnerable to degradation.

In urbanized areas, watersheds and streams paths have typically been altered over time, and many streams have been placed in pipes/culverts and buried. Storm sewer systems (and wastewater systems) often change the natural path of water, altering subwatershed boundaries by collecting stormwater in one catch basin and conducting it through underground pipes to other subwatersheds. In contrast to a watershed, a sewershed is the area of land where all of the precipitation that falls and enters the sewer flows to a single end point. While houses in the Village of Rhinebeck are on their own septic systems, the Village of Rhinebeck has a municipal wastewater system that serves the business district, Northern Dutchess Hospital, Astor Services for Children, Wells Manor, TOPS/CareMount, The Gardens and The Woods developments (some of these are located outside the Village), ultimately discharging treated water into the Rhinebeck Kill (See State Pollutant Elimination System Permit).

The Village should study and map its aging stormwater system. The Village has discovered stormwater conveyed through its old system directly discharged into Crystal Lake. Using green infrastructure catch basins to percolate stormwater down through the ground better serves to clean the water of pollutants and prevent erosion—especially now with more frequent and intense storms due to climate change.

The Village has enjoyed an ongoing collaboration with the Environmental Science Department of Marist College. In 2021, students planned and implemented a DEC Hudson River Estuary Program "Trees for Tribs" streamside planting, resulting in over 100 saplings being planted along the Landsman Kill. The location, behind the municipally owned Village Highway Garage on Route 308, is upstream from areas of the Landsman Kill that frequently flood. The planting is also intended to shade the stream and deter invasive plant species, contributing to the health of its habitat.

Marist students assisting in the Trees for Tribs riparian planting behind the Village Highway Garage, 2021 by Vanessa Bertozzi


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
9. Streams & Watersheds
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
199
9G
9
308
Mudder Kill
Saw Kill
Rhinebeck Kill
Landsman Kill
Hudson River
Rhinecliff Rd
E Market St
Kelly St
Crum Elbow Creek
Hudson River Direct Drainage
Fallsburg Creek
Morton Rd
Mill Rd
Indian Kill
Hudson River Direct Drainage
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Watersheds: National Hydrography Dataset, 2012
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Water Quality Classification (Map 10)

> Activities allowed in and around waterbodies are regulated by DEC based on their classification and standard.

DEC designates the "best uses" that a waterbody should support, which forms the basis for New York State Protection of Waters regulations. Waterbodies are classified by the letters A, B, C, or D for freshwater. The letter classifications and their best uses are described in regulation NYS regulation 6 NYCRR Part 701. For more information about classifications, see the DEC's webpage on Water Quality Standards and Classifications.[87] For each class, the designated best uses are defined as follows:

Class A, AA-water supply, primary and secondary contact recreation and fishing

Class B-primary and secondary contact recreation and fishing

Class C-fishing, suitable for fish propagation and survival

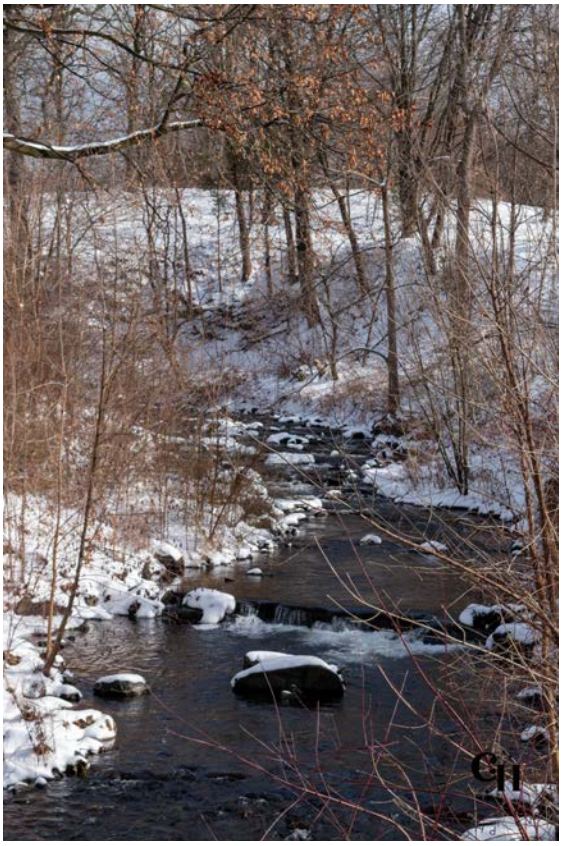
Class D-fishing

Waterbodies classified as A, B, or C may also have a standard of (T), indicating they are trout waters, or (TS), indicating they are trout spawning waters. The **Water Quality Classifications Map** shows the water quality classifications of surface waters in the Town. Note that the waterbody classification does not necessarily indicate good or bad water quality but is simply the designated "best uses" that should be supported. DEC recognizes that some waterbodies have an existing quality that is better than the assigned classification and uses an anti-degradation policy to protect and maintain high-quality streams.

Note that not all waterbodies appear on classification maps. However, the missing waterbodies will always have a classification. Waterbodies that do not appear on classification maps and have flow all year (perennial flow) have the classification of the waterbody into which they flow. Waterbodies that do not appear on these maps and have seasonal or intermittent flow have a classification of "D." DEC has the final authority to determine if a waterbody has perennial or intermittent flow.

DEC also establishes water quality standards, specific for particular parameters and pollutants, to protect the uses associated with these classifications. These standards are found in NYS regulation 6 NYCRR Part 703. Standards can be numerical or narrative. For example, dissolved oxygen has a numerical standard of no less than 7.0 mg/l in trout spawning waters. Turbidity has a narrative water quality standard which states there should be "no increase that will cause a substantial visible contrast to natural conditions." Information on surface water and groundwater quality standards can be found at Surface

[87] "Water Quality Standards and Classifications." NYS Department of Environmental Conservation. https://www.dec.ny.gov/chemical/23853.html



Waterfall on Landsman Kill below Asher Dam by Claudia Helms

Water and Groundwater Quality Standards.[88] If waterbodies are not supporting the standards for their best uses, they may be listed on the Priority Waterbody List as impaired (see the **Waterbody Monitoring** section). Waterbodies on this list are slated for watershed restoration plans and implementation strategies.

Certain activities allowed in and around waterbodies are regulated based on their classification and standard. C(T), C(TS) and all types of B and A streams (as well as waterbodies under 10 acres located in the course of these streams) are collectively referred to as "protected streams". They are subject to the stream protective provisions of the Protection of Waters regulations in Article 15 of the Environmental Conservation Law.[89] DEC regulates the bed and banks of protected streams, defined as the areas immediately adjacent to and sloping toward the stream. Activities that excavate, fill or disturb these beds or banks require a DEC permit. See Protection of Waters: Disturbance of the Bed or Banks of a Protected Stream or Other Watercourse for more information.[90]

Article 15 also offers protection to navigable waters of the state. DEC permits are required for direct or indirect excavating or filling of navigable waters, which can include perennial streams and intermittent streams. This regulatory authority also covers estuaries, marshes, tidal marshes and other wetlands inundated at mean high water level or tide that are adjacent and contiguous at any point to any of New York State's navigable waters (Protection of Waters: Excavation and placement of fill in navigable waters). DEC water quality certification permits, and U.S. Army Corps of Engineers (ACOE) permits may also be required for work involving streams; contact the DEC biologist responsible for applying state regulations in the protection of surface water resources for information regarding specific projects.

While the regulations stemming from stream classifications provide a level of protection from damage to the bed and banks of protected streams, lack of jurisdiction over "non-protected streams", including

[88] "Surface Water and Groundwater Quality Standards." NYS Department of Environmental Conservation. http://www.dec.ny.gov/regs/4590.html

[89] "Protection of Waters Program." NYS Department of Environmental Conservation. https://www.dec.ny.gov/permits/6042.html

[90] "Protection of Waters: Disturbance of The Bed or Banks of a Protected Stream or Other Watercourse." NYS Department of Environmental Conservation. https://www.dec.ny.gov/permits/6554.html

numerous class C streams, and over stream buffers more broadly may be an opportunity for local protection efforts, such as zoning setbacks or watercourse protection laws. Local stream protection efforts can play an important role in comprehensive watershed protection.

Discussion

The only extensive stretch of class A stream in Rhinebeck, recorded in dark blue, is the section of Crum Elbow Creek that serves as the southeast boundary of the Town of Rhinebeck with the Town of Clinton. Three small class A tributary streams flow south from the north into the creek. There are three short stretches of class B streams, shown in light blue. One is within the Village, where the Asher Dam creates Crystal Lake. The second is at the source of Fallsburg Creek, near Route 9G. The third is just above a fork in the Landsman Kill, east of the Village. The majority of the watercourses within the Town of Rhinebeck are small class C streams, feeding three larger streams with the same classification, the Rhinebeck Kill, the Landsman Kill, and Fallsburg Creek.

The upper reaches of both the Rhinebeck and Landsman Kills have significant stretches of trout waters, outlined in yellow on the map, as do the lower reaches of the Fallsburg. None are designated as trout spawning waters, however, just to the north of the Town the Saw Kill in Red Hook does have that designation. Since 1958, the Landsman Kill Stocking Club has taken on the responsibility of stocking the Landsman Kill with trout for the pleasure and education of young anglers.

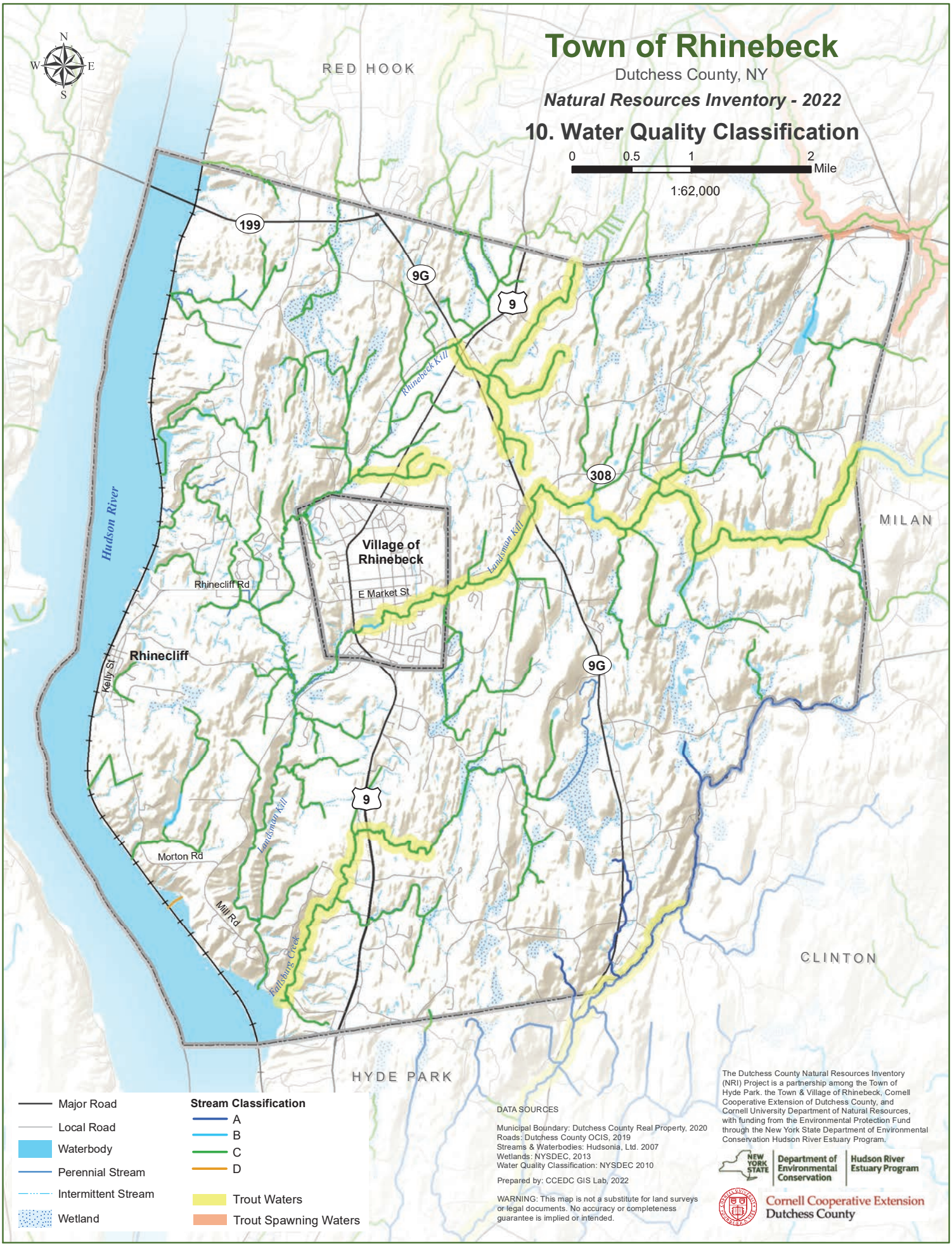
The Village has provided protection to the entire section of the Landsman Kill that passes through it under Article IX of Section 120 of the Village code, which establishes a Land Conservation Overlay on the Village zoning map. The article finds that ‘protection of lakes, stream corridors, wetlands and floodplains is an important public purpose’ and states ‘to the extent practical, future development in the Village shall minimize disturbance in these areas.’ While the overlay covers more than the Landsman Kill, the Village section of the kill includes a lake, a stream corridor, wetlands and a floodplain, so it is a major focus of the legislation. It makes all building and zoning permit applications subject to site plan approval and prohibits buildings, roofed or covered areas, paved roadways and parking areas within 40 feet of the edges of lakes, stream corridors and wetlands. It requires the buffer area to be vegetated with native trees, shrubs and grasses. It requires any permitted excavation to employ best management practices in line with guidance from the NYS DEC and the U.S. Army Corps of Engineers. In sum, it tries to minimize erosion of stream banks and pollution of the water, but it does not encourage or prohibit any use of the watercourse itself.

Consistent with the goal of the Land Conservation Overlay District, Chapter 106 - Trees of Village code is intended, among other reasons (see **Zoning** section) to ‘prevent soil erosion and provide protection to wetlands, waterbodies, and watercourses.’ However, the chapter is mostly concerned with the planting, care, inventory and removal of street trees, and presents no specific recommendations for control of these activities along the banks of the lakes and watercourses in the Village. Nor does it present any specific vision for the use of trees to enhance the appearance or use of public or private land adjacent to either Crystal Lake or the Landsman Kill.

Chapter 59 of the Village code, Flood Damage Prevention, does address its section of the Landsman Kill, but only insofar as it is a FEMA designated floodway and almost all of its banks are vulnerable to one hundred-year floods. It prescribed means to avoid damage to built structures and utilities in the recognized flood plain areas, but again is silent on the use of the watercourse.

The Town code is similar to the Village code in its treatment of flood damage (Chapter 73), but it also contains a chapter (Chapter 120: Freshwater Wetlands Law) governing activities in wetlands and in their associated buffer zones, which are defined as extending horizontally 100 feet from, and parallel to, the edge of the wetland and from either side of a stream that qualifies as a wetland. Further, to protect the watershed, water quality or wildlife habitats, this law allows the planning board, after due study and publication of its findings, to require and establish larger associated buffer zones for wetlands. Specific examples listed as justification for larger associated buffer zones include the protection of 'trout streams, steep eroding banks, or riparian habitats for species of conservation concern.' While the major focus of this Town law may be the protection of its drinking water supply (see Section 4, above), it is the only local law in both the Town and the Village that has the potential power to actively protect riverine species, trout in particular, and to improve the opportunities for recreational fishing. As noted above, much of the Landsman Kill above the Asher Dam, the headwaters of the Rhinebeck Kill, and the lower reaches of the Fallsburg Creek, are class C trout streams.

This chapter of the Town code also lists permitted uses of wetlands and their associated streams and buffer zones. While most concern agricultural activities in the buffer zone, it also permits passive recreation, which it defines as 'bird and wildlife observation, photography, boating, hiking, swimming, camping, picnicking, hunting and fishing and other similar outdoor activities, including the establishment of non-paved walking trails (excluding motorized vehicles) and individual recreational moorings, where no substantial adverse effect is involved or the activity is not otherwise prohibited.'


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
10. Water Quality Classification
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
Hudson River
199
9G
9
308
Rhinebeck Kill
Landsmon Kill
Village of Rhinebeck
E Market St
Rhinecliff Rd
Rhinecliff
Kelly St
Morton Rd
Mill Rd
Tallsburg Creek
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Wetland
Stream Classification
A
B
C
D
Trout Waters
Trout Spawning Waters
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: NYSDEC, 2013
Water Quality Classification: NYSDEC 2010
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Waterbody Monitoring and Assessment (No Map)

DEC monitors water quality through several routine statewide monitoring programs and publishes assessments that describe the quality of water resources. A waterbody's assessment results, compared with its classification, provides an understanding of its health and can lead to the designation of a stream or waterbody as impaired. A waterbody's level of impairment influences which programs, opportunities, and responsibilities the community has for addressing problems.

The NYS Waterbody Inventory/ Priority Waterbodies List (WI/PWL) is a document that lists New York State waterbodies and information about water quality in relation to the state's waterbody classifications

Stream Assessments

DEC's Stream Biomonitoring Unit conducts biomonitoring sampling throughout New York State. Based on the number and kinds of macroinvertebrates, each sample receives a Biotic Assessment Profile (BAP) score. In addition, DEC Division of Water runs a citizen monitoring program for biomonitoring called Water Assessments by Volunteer Evaluators (WAVE). Citizen monitors visit a stream and collect and identify stream organisms. WAVE data is included in federal and state water quality reports and will be used to focus DEC assessments and local restoration efforts to where they are most needed. WAVE is particularly useful for unassessed waterbodies.

The Saw Kill Watershed Community has a set of long-term water quality monitoring data, which was mostly collected within the Town and Village of Red Hook.

Impairment

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is a document that lists New York State waterbodies and information about their water quality. The WI/PWL documents support (or impairment) of water uses, overall assessment of water quality, causes and sources of water quality impact/impairment, and the status of restoration, protection, and other water quality activities and efforts. WI/PWL information is used to identify those water quality issues and specific waterbodies where efforts will have the greatest impact and benefit, objectively evaluate needs for project funding, monitor water quality improvement, and record and report changes over time. The WI/PWL includes waterbody fact sheets outlining the most recent assessment. The WI/PWL for Rhinebeck can be found in the table below.

Table 5. *Waterbody Inventory/Priority Waterbodies List for Rhinebeck*

Waterbody		Assessment	Pollution Sources
Lake	Sepasco Lake (CSLAP Report)	Some Uses Supported	Nutrients
Stream	Landsman Kill and minor tribs	Minor Impacts	Unknown
	Rhinebeck Kill and tribs	Needs Verification	pH
	Minor tribs to east of Hudson	Needs Verification	pH, dissolved Oxygen
	Landsman Kill, upper, and minor tribs	Unassessed	Unassesed
	Saw Kill and tribs	No Known Impact	N/A
	Crum Elbow Creek and tribs	No Known Impact	N/A

Discussion

The WI/PWL records for Rhinebeck can be found in the table above. Crum Elbow Creek and its tributaries and the Sawkill and its tributaries are rated as having 'no known impact,' the highest quality rating available. The Landsman Kill and Rhinebeck Kill were rated as having 'minor impacts' but the reason is currently unknown. The Citizens Statewide Lake Assessment Program (CSLAP) describes the conditions of Sepasco Lake, which was rated as having some supported uses limited by nutrients.

The Town of Rhinebeck regulates activities within all wetlands and watercourses through Chapter 120 of its municipal code. This regulated area includes swamps, marshes, bogs, fens, intermittent and perennial streams, vernal pools, lakes, ponds, and an associated buffer area of at least 100 feet. See also Town Code § 125-40 Development near streams, rivers, wetlands and other water bodies, which requires both special use permits (SUPs) and site plan approval for land use within 100 feet of most water bodies and 1000 feet from the mean high water mark of the Hudson. And also see Town Code § 125-54 Development within Water Resources Protection Overlay (WR-O) District, which offers very specific protection to streams and aquifers, requiring SUPs and site plan approval for land use within 100 foot buffers of streams. The WR-O is also a mapped overlay on the Town's zoning map.

The Village of Rhinebeck also regulates activities within and adjacent to wetlands and watercourses in its Land Conservation Overlay District. This includes a 40-foot setback for structures and roads and a

natural buffer area, at a width determined as a part of the site plan approval process. It is likely that these regulatory protections are helping to limit further degradation of water quality in Rhinebeck and beyond.

There has never been a Landsman Kill Watershed group, though there are numerous resources available to such a community effort, including Hudson River Watershed Alliance and our friendly neighbors to the north in Red Hook with their Saw Kill Watershed Community group. The Bard Water Lab also assists in water sampling and testing in the area.

Anecdotally, there is concern that old septic systems at homes along the Landsman Kill and Crystal Lake may be impacting water quality as the Landsman Kill enters the Village and through the Village.

Crystal Lake with Private Homes, 2020 by Vanessa Bertozzi

Floodplains and Riparian Areas (Map 11a and 11b)

The corridor around streams includes floodplains and riparian areas, which provide many critical functions for a healthy stream and its watershed. Successful stream management done on a watershed scale must include the condition and connection of a stream to its floodplain and adjacent riparian areas.

Floodplains and riparian areas can:

- prevent erosion
- provide habitat for plants and wildlife
- provide temporary storage of flood waters
- moderate peak flows
- maintain water quality
- recharge groundwater
- provide recreational opportunities
- improve aesthetics

Floodplains are low-lying areas, often next to streams and rivers, which are inundated during heavy precipitation or snowmelt events. They are naturally connected to streams but can extend far from a stream or river and aren't necessarily found alongside them. Flooding is a natural process and is one way a stream reacts to an increase in water coming into it. Streams of all sizes can have floodplains at various locations along their length. The total size of a floodplain and its distance from and connection to a stream can vary greatly with topography and other local conditions.

When left in a natural state, floodplains act as a natural infrastructure, providing a safety zone between people and the damaging waters of a flood. They provide the space streams need to expand, contract, and change course over time. Building in floodplains increases the risk of property damage and loss of life. The location of floodplain boundaries can change over time and in response to changing climate, watershed land use, obstructions in the floodway, stream infrastructure (including dams and levees), and natural stream processes. In many places, floodplains have been encroached upon by roads and other transportation infrastructure, as well as development.

The Floodplains and Riparian Areas Map shows flood hazard areas mapped by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program (NFIP).[91] Flood insurance rate maps (FIRM) show areas estimated to have a 1% chance (1 in 100) or greater probability of being inundated in any given year, areas commonly referred to as the 100-year floodplain. Some narrow additional flood hazard areas are mapped by FEMA with a 0.2% chance (1 in 500) or greater probability of flooding in any given year (referred to as the "500-year flood"). The floodway, 0.2% and 1% chance flood events are collectively referred to as FEMA Flood Hazard Zones on the map. FEMA

[91] "National Flood Insurance Program." Federal Emergency Management Agency. https://www.fema.gov/national-flood-insurance-program

recently updated many flood hazard maps across the country to reflect physical changes in floodplains, new data, and modeling capabilities. The most current FIRM maps for Dutchess County have an effective date of 2012.

FEMA mapping is a valuable tool, but it is important to note that FIRMs are only estimates based on the data and modeling technology available at the time of mapping, and they typically omit floodplains located along smaller streams. Due to the unpredictable nature of some kinds of floods, they often omit areas subject to flooding from localized drainage problems, including undersized culverts, ice jams, sheet flooding down a slope, and erosion hazards due to infrastructure. Climate change is furthermore changing precipitation patterns and increasing flood frequency in the Hudson Valley. Annual rainfall occurring in heavy downpour events across the Northeast increased 74% between the periods of 1950-1979 and 1980-2009.[92] See the **Climate** section for more information.

Mayor Bassett and Trustee Lewit Opening the Valves at Asher Dam, 2019 by Brenda Bassett

Riparian areas are areas adjacent to streams, ponds, wetlands, and other waterbodies and generally include the floodplain. Riparian areas are sensitive transition zones between land and water and are vital to stream physical processes, habitat, and water quality. They support unique soil and vegetation characteristics that are strongly influenced by proximity to water. Healthy riparian areas help clean water by intercepting runoff and filtering sediment and nutrients. They can attenuate flooding by slowing down and absorbing floodwaters. Forested riparian buffers provide organic matter that supports the in-stream food web and shade that keeps water cool. They also support unique, diverse habitats and serve as wildlife corridors.

From the standpoint of stream protection, naturally vegetated riparian buffers provide different functions depending on width.[93] In general, wider buffers provide better habitat connectivity and more protection to the water quality of streams and other waterbodies. Recent studies recommend 100 feet as the minimum buffer protection width to improve wildlife habitat, water quality, and storm resiliency. Riparian buffers of 300 feet or more provide the greatest opportunity for natural functions to benefit

[92] Horton, R., D. Bader, C. Rosenzweig, A. DeGaetano, and W.Solecki. "Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information." New York State Energy Research and Development Authority (NYSERDA), 2014, Albany, NY. www.nyserda.ny.gov/climaid

[93] Sweeney, B.W. and Newbold, J.D. Streamside forest buffer width needed to protect stream water quality, habitat, and organisms: a literature review. JAWRA Journal of the American Water Resources Association, 50(3), pp.560-584, 2014.

ecological and human communities. While narrower buffers could still provide viable functions and critical protections, protecting existing buffers and restoring degraded ones can help protect streams.

The riparian areas shown were mapped by the New York Natural Heritage Program for the Statewide Riparian Opportunity Assessment.[94] They are delineated around streams based on digital elevation data, known wetlands, and modeling for the 50-year flood zone. The riparian areas overlap with FEMA floodplain data in parts of the map but also include mapping along smaller streams omitted from the FIRM modeling. They thus help identify additional flood-prone areas, though they are not a substitute for official FEMA FIRMs. Note that the riparian areas were developed through modeling and have not been field verified. Nevertheless, they can provide a starting point to inform land use and stream protection efforts. The Hudson River Estuary Program's "Trees for Tribs" initiative offers free consultation and native trees and shrubs for qualifying streamside buffer planting projects in the estuary watershed.[95]

Floodplain Forests are a subset of floodplain habitats that host a unique assemblage of plants and animals adapted to regular disturbance. The Hawthorne Valley Farmscape Ecology Program maps and describes these locally-rare habitats in their 2010 report titled, Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation. Notable concentrations of these natural floodplains can be found along the Landsman Kill, upstream of the Village, and along the Fallsburg Creek, near Route 9, but smaller occurrences of these habitats have been identified along tributaries throughout the Town.

Discussion

The Town of Rhinebeck's topography results in numerous floodplains, mapped as either FEMA Flood Hazard Zones, Riparian Areas, and/or Floodplain Forest. The Village also has significant floodplains associated with the Landsman Kill and Rhinebeck Kill. The Town and Village both regulate some activities within identified FEMA Flood Hazard Zones through a permitting process outlined in chapters 73 (Town - Flood Damage Prevention) and 59 (Village - Flood Damage Prevention) of their municipal codes.

The Town of Rhinebeck regulates activities within all wetlands and watercourses through Chapter 120 of its municipal code. This regulated area includes swamps, marshes, bogs, fens, intermittent and perennial streams, vernal pools, lakes, ponds, and an associated buffer area of at least 100 feet that often includes important floodplains. See also Town Code § 125-40 Development near streams, rivers, wetlands and other water bodies and Town Code § 125-54 Development within Water Resources Protection Overlay (WR-O) District.

---

[94] Conley, A., T. Howard, and E. White. *New York State Riparian Opportunity Assessment*. New York Natural Heritage Program, State University of New York College of Environmental Science and Forestry, 2018, Albany, NY. http://nynhp.org/files/TreesForTribs2017/Statewide_riparian_assessment_final_jan2018.pdf

[95] "Hudson River Estuary Trees for Tribs Program." NYS DEC Hudson River Estuary Program. http://www.dec.ny.gov/lands/43668.html

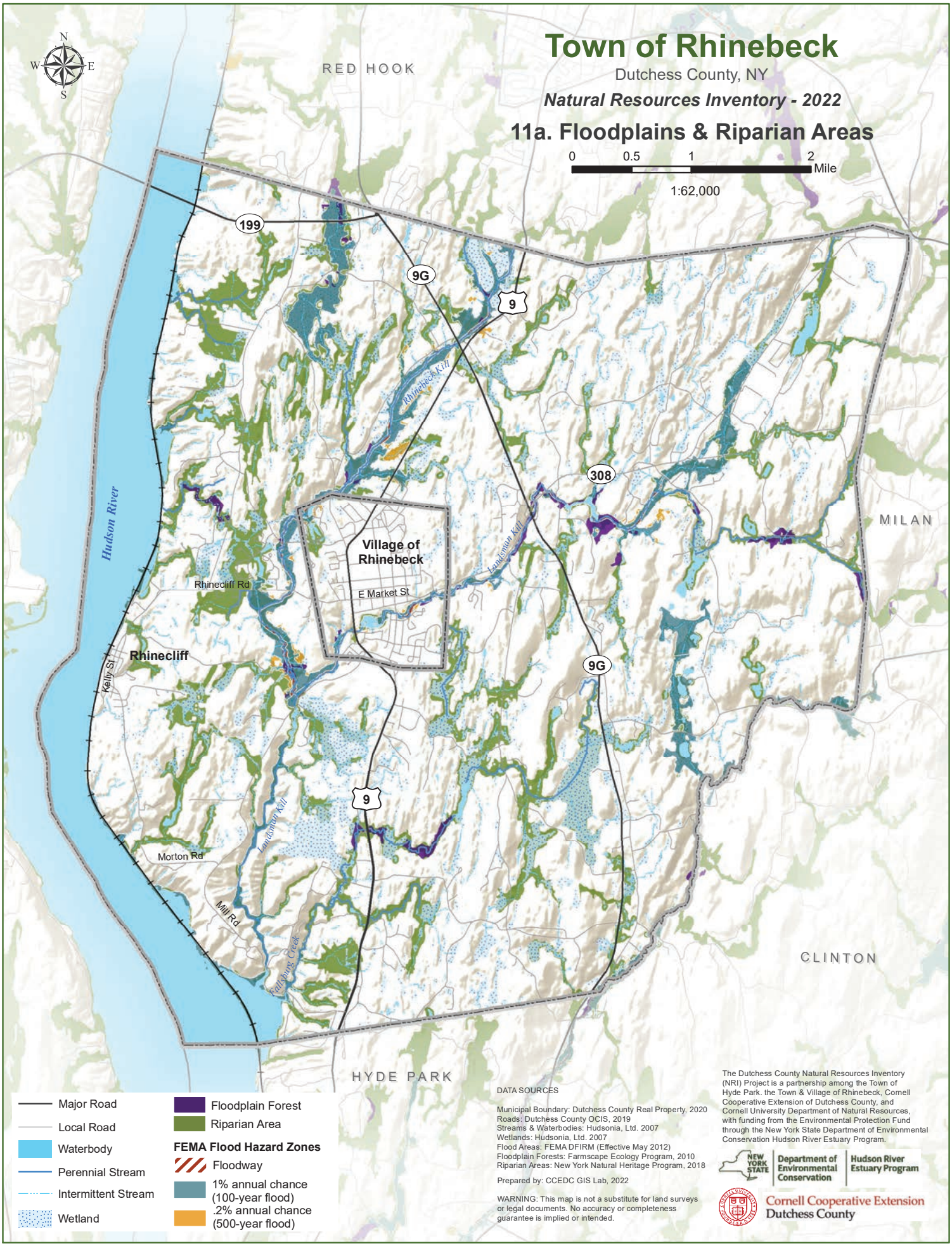
The Village of Rhinebeck also regulates activities within and adjacent to wetlands and watercourses in its Land Conservation Overlay District. This includes a 40-foot setback for structures and roads and a natural buffer area, at a width determined as a part of the site plan approval process. It is likely that these regulatory protections, especially where they include natural floodplains, are helping to mitigate downstream flooding in the community and elsewhere.

Storm surge on the Hudson River threatens infrastructure along its banks, such as the Amtrak station and train tracks. Flooding and storm surge combined with climate change-induced increased height in river water levels could also impact Rhinebeck's Water Treatment Plant located on the banks of the Hudson River on Slate Dock Road. (See the **Drinking Water Resources** and **Climate** sections.) The Village undertook a Vulnerability Assessment and made improvements to the plant, raising the lowlift pumps.[96]

The Village of Rhinebeck often experiences flooding along the Landsman Kill. With increasingly frequent and intense downpours and weather events, Village personnel need to open the Asher Dam valves to release water much more often. This chronic situation, as well as the notable breaching of Asher Dam and Route 9 during Hurricane Irene in August 2011, precipitated an ongoing collaboration with Marist College Professors Richard Feldman and Chris Algozzine which started in 2019. Upstream, on municipal property behind the Village Highway Garage on Route 308, the Marist Environmental Science students have installed a sensor and logging device in the stream. The data feeds into a browser-based dashboard: https://adas.ecrl-ext.marist.edu. Using this dashboard, Marist College Computer Science students are developing a predictive algorithm to alert the Village government when they need to open the Asher Dam valves to preemptively release water.[97]

[96] https://www.climatesmartrhinebeck.org/sea-level-rise

[97] Marist College collaboration with Rhinebeck Village, overseen by Professor Richard Feldman, PhD and Professor Chris Algozzine, https://www.climatesmartrhinebeck.org/marist-collaboration



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Flood Areas: FEMA DFIRM (Effective May 2012)
Floodplain Forests: Farmscape Ecology Program, 2010
Riparian Areas: New York Natural Heritage Program, 2018

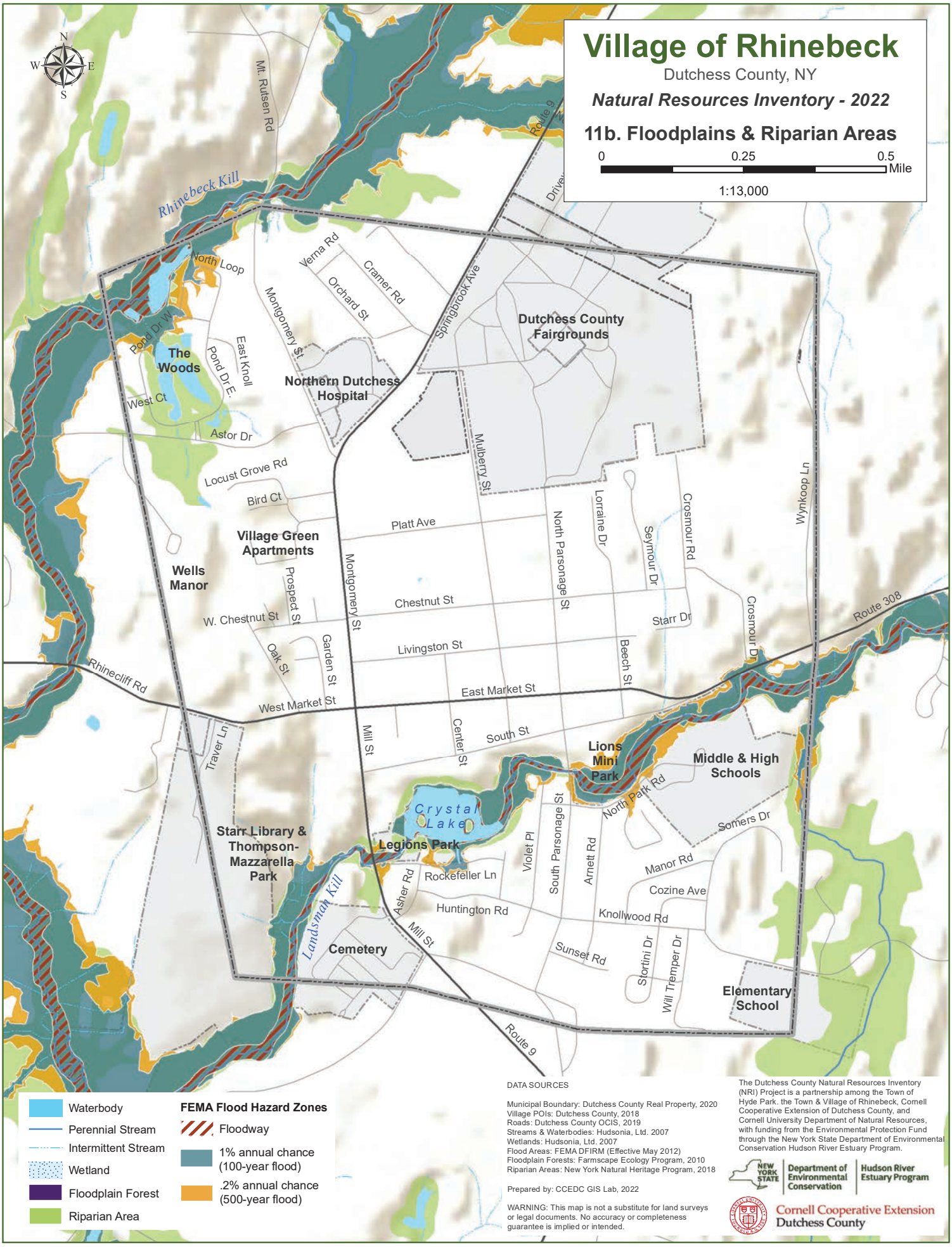
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Flood Areas: FEMA DFIRM (Effective May 2012)
Floodplain Forests: Farmscape Ecology Program, 2010
Riparian Areas: New York Natural Heritage Program, 2018

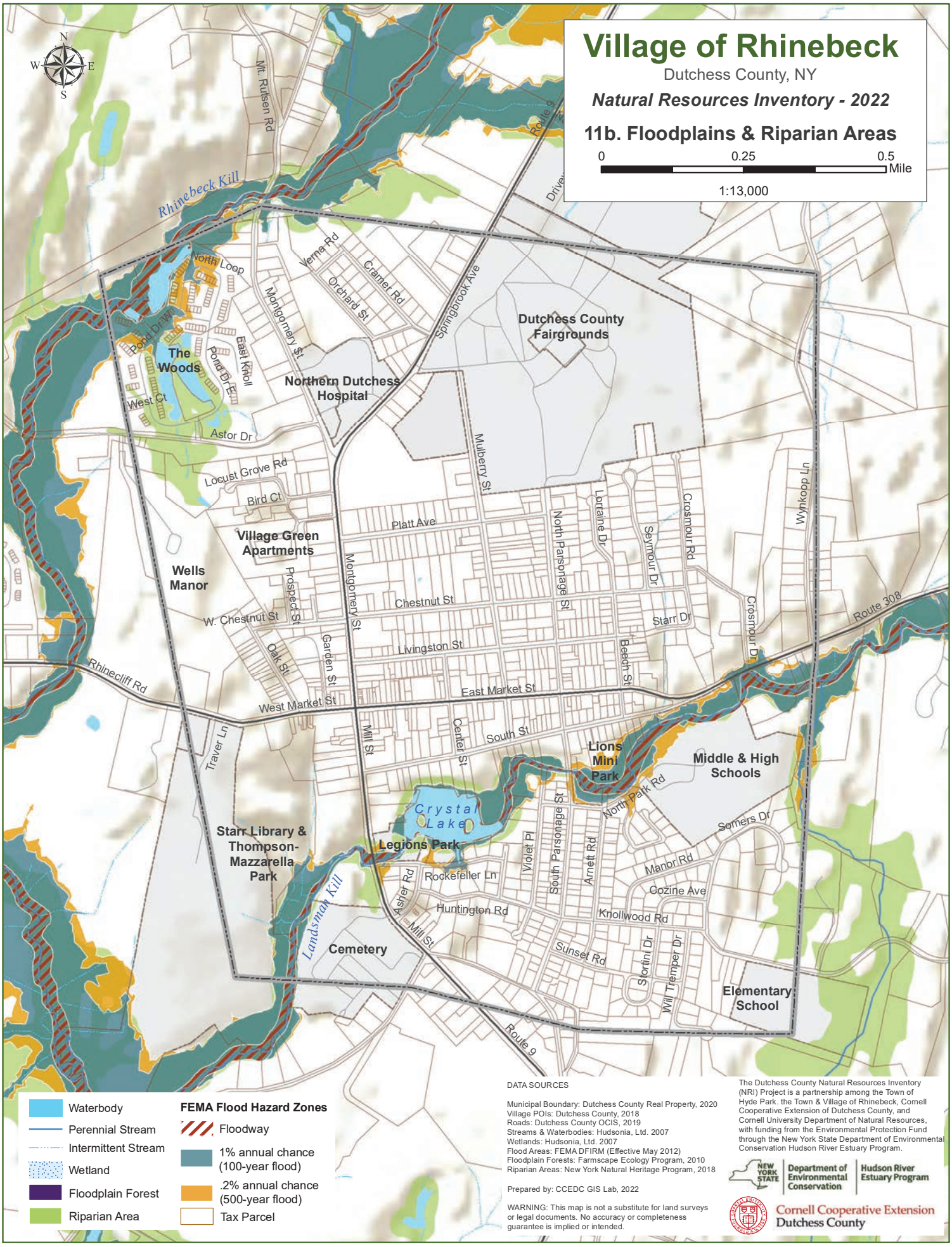
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Flood Areas: FEMA DFIRM (Effective May 2012)
Floodplain Forests: Farmscape Ecology Program, 2010
Riparian Areas: New York Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Stream Habitats (Map 12a and 12b)

From headwater creeks to meandering lowland rivers, Rhinebeck supports a variety of streams and rivers illustrated in the **Stream Habitats Maps**. The Town and Village's streams are an important water resource and support diverse aquatic life, as well as recreational activities like fishing and boating. Stream infrastructure such as dams and culverts play an important role in determining connectivity and access to stream habitat for fish and other aquatic species.

> *"In-stream and river environments provide critical biological resources including fish, eels, invertebrates, and plants that contribute to on-shore ecosystems and even to human food supplies."*
>
> - Dutchess County Natural Resources Inventory (2010)

Types of Streams and Stream Habitats

The beginnings of streams, referred to as headwaters, are often intermittent or ephemeral. Intermittent streams only flow during certain times of the year, fed by groundwater and runoff from rainfall and snowmelt. Some headwaters are ephemeral, only flowing after rainfall. Perennial streams and rivers flow year-round, with most water fed by smaller upstream intermittent and ephemeral streams or groundwater. Despite their seasonal nature, the vast network of intermittent streams in the landscape provide many of the same functions and values as larger perennial streams. Intermittent streams provide seasonal refuge and spawning habitat for small fish, habitat for macroinvertebrates that drift downstream to feed larger fish and organisms, and support nutrient cycling and flood control processes, among other benefits. However, they are often unmapped, underappreciated, and overlooked.

Streams share some common habitat features. Many streams have alternating deep and shallow areas called pools and riffles. The deep, slow water in pools provides shelter and resting areas for fish. Shallow, swift water in the riffles adds oxygen to the water and provides fish with spawning and feeding areas. The fast-moving water between riffle areas and pools is called a run. Some streams also form natural meanders or curves that slow down the water and absorb energy. These curves produce erosion such as cut banks and depositional areas like gravel bars where sediments are deposited. Large woody material such as logs, trees, and branches is an important component of in-stream habitat that supports the capture of sediment, gravel, and organic matter, prevents streambank erosion, and decreases water temperature – all factors that enhance habitat for fish and other organisms.

Beyond the stream channel and banks, riparian areas and floodplains support unique soil and vegetation that are strongly influenced by proximity to water and frequent flooding. Riparian trees are especially important for providing shade, bank stabilization, woody debris, and nutrients that benefit fish and other aquatic life. When inundated, floodplains also provide important fish breeding and nursery habitat areas. Many other wildlife species also depend on riparian and floodplain habitats and use them as travel corridors. See the **Floodplains and Riparian Areas Maps** for more information.

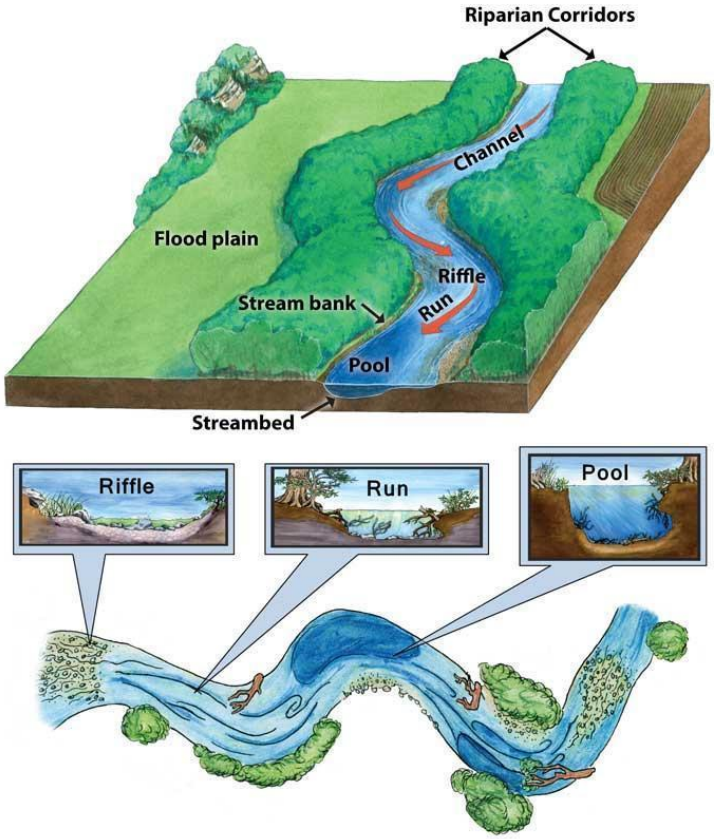


Figure 6. *Stream habitats diagram*[98]

Trout and Trout Spawning Waters. Trout are valuable indicators of healthy aquatic ecosystems because of their high-water quality and habitat requirements. They typically inhabit clear, cool, well-oxygenated streams and lakes and depend on clean gravel areas for spawning. DEC's Water Quality Standards provide a starting point for identifying trout or trout-spawning stream habitat and suggest there is coldwater habitat suitable for trout in the Fallsburg Creek, Landsman Kill, Rhinebeck Kill, Crum Elbow Creek, the Saw Kill and some of their tributaries.

Important Migratory Fish Habitat identifies areas along the Landsman Kill, Fallsburg Creek, Crum Elbow Creek, and Hudson River that are critical for sustaining known populations of declining species, mapped by the New York Natural Heritage Program and based on DEC Bureau of Fisheries surveys and other studies completed in New York since 1980. This data highlights stream reaches providing important passage for eel traveling between ocean and freshwater habitats. Routes were modeled from tributary stream reaches with documented eel presence to the Atlantic Ocean, where this species spawns. Important Areas, near the mouth of Hudson River tributaries, also include other migratory fish species

[98] https://texasaquaticscience.org/streams-and-rivers-aquatic-science-texas

with declining populations, such as alewives, blueback herring, and American shad. The important areas include upstream habitat and stream adjacent areas that support the health and integrity of stream habitats used by migratory fish.

Important Areas for Coldwater Stream Habitat were mapped using known populations of wild brook trout. Trout are valuable indicators of healthy aquatic ecosystems because they require cold and high-quality water to survive. Trout become thermally stressed when the water temperature rises above 70°F[99]. They typically inhabit clear, cool, well-oxygenated streams and lakes and depend on clean gravel areas for spawning. Among trout species, native brook trout are the most highly sensitive to increases in water temperature and sedimentation of stream habitats. A small area associated with the Saw Kill, in the northeastern corner of the Town, was the only Important area for Coldwater Stream Habitat mapped in Rhinebeck.

Dams and Culverts. Infrastructure in streams, such as dams and culverts, can isolate and severely limit the range of fish and other aquatic organisms that use stream corridors. Dams and culverts can present physical barriers to passage, and these structures can also become impassable by changing water quality (e.g., temperature) and quantity (e.g., high velocity). Dams can also lead to flow barriers, when the water in the impoundment behind the dam is used, consumed, or diverted for other purposes (e.g., drinking water supply), leading to lack of water downstream. In some cases, pollution and channel modifications can create the same kinds of barriers. Just as many forest-dwelling species are negatively impacted by forest fragmentation from roads and structures, stream barriers disconnect streams and decrease available habitat. Historically, as mills and road crossings were added to the streams of the Hudson Valley, dams and culverts blocked off and cut up the habitat for organisms like trout and American Eel. In addition to impacts on fish and other aquatic life, stream barriers can also have serious effects on local flooding and water quality. Streams flowing into undersized culverts can flood upstream and, in some cases, overtake and wash out a road during heavy precipitation or snowmelt.

Walking in a Forest Stream by Dan Shapley

Dam locations are provided from the **New York State Inventory of Dams**. While the DEC tries to

[99] New York Natural Heritage Program and New York State Department of Environmental Conservation, Biodiversity Databases [accessed 10/01/2021] Important Areas Digital Data Set, 2018, Albany, NY.

maintain an accurate inventory, this data should not be relied upon for emergency response decision-making. Note that assessments by the DEC Hudson River Estuary Program in trial watersheds indicate that perhaps two to three times as many barriers exist than are recorded in the NYS Inventory of Dams.

Culvert data are provided from the North Atlantic Aquatic Connectivity Collaborative (NAACC), a network focused on improving aquatic habitat connectivity across the Northeast region. Culverts were assigned a passability score that describes how much of a barrier the structure is to aquatic organisms, ranging from severe barrier to no barrier. Fourteen culverts have been formally assessed and identified as severe or significant aquatic barriers, but it is likely that many more barriers exist in the Town. The DEC Hudson River Estuary Program is leading efforts in the Hudson Valley to assess road-stream crossings for aquatic passability and to mitigate significant barriers to increase aquatic habitat available for Species of Greatest Conservation Need such as Brook Trout and American Eel.

Riparian areas are areas adjacent to streams, ponds, wetlands, and other waterbodies and generally include the floodplain. Riparian areas are sensitive transition zones between land and water and are vital to stream physical processes, habitat, and water quality. See the **Floodplains and Riparian Areas** sections for more information.

Discussion

Protecting and restoring vegetated streamside riparian buffers and restoring free-flowing streams where possible can be effective actions to conserve and restore stream habitat. The Town of Rhinebeck regulates activities within all wetlands and watercourses through Chapter 120 of its municipal code. This regulated area includes swamps, marshes, bogs, fens, intermittent and perennial streams, vernal pools, lakes, ponds, and an associated buffer area of at least 100 feet that often includes important floodplains. The Village of Rhinebeck also regulates activities within and adjacent to wetlands and watercourses in its Land Conservation Overlay District. This includes a 40-foot setback for structures and roads and a natural buffer area, at a width determined as a part of the site plan approval process. It is likely that these regulatory protections are helping to maintain quality stream habitat in the Town and Village.

Rich Matthies, head of the Landsman Kill Stocking Club, holding up a photo of its founder, Buss Van Keuren. 2022 by Vanessa Bertozzi

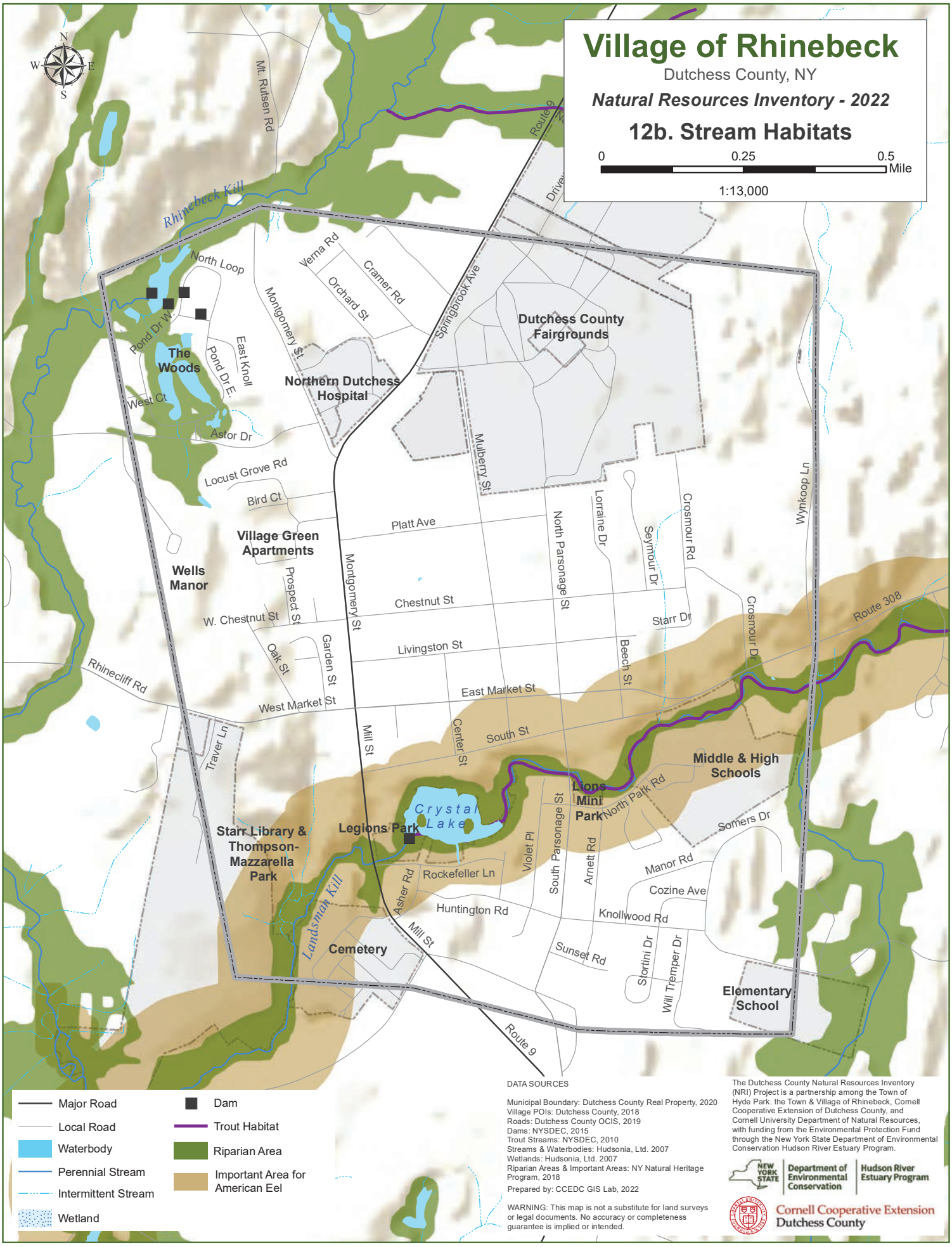
Bridges, open-bottom culverts and similar structures that completely span the waterway and associated floodplain/ riparian area generally have the least potential impacts on

stream hydrology, floodplains, and habitat. The Town should explore technical assistance and grants available from the DEC Hudson River Estuary Program to assess and prioritize known aquatic barriers for removal or mitigation. The first barriers to fish passage between the Hudson River and its tributaries should be priorities for assessment.

Note that there has never been a Landsman Kill Watershed group, but there is a strong community interest in fishing in the stream, which can be seen at the annual Trout Derby since 1958. This community event, organized by the Matthies and the Landsman Kill Stocking club, includes stocking the Landsman Kill with trout for the pleasure and education of young anglers. Families are encouraged to enter a fishing contest, bolstering interest in the stream and its ecosystem.

1966 Scrapbook of the Landsman Kill Stocking Club's Annual Trout Derby, courtesy of Rich Matthies collection


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
12. Stream Habitats
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
Hudson River
Village of Rhinebeck
Rhinecliff
Rhinecliff Rd
E Market St
Kelly St
Morton Rd
Mill Rd
Landsman Kill
Fallsburg Creek
199
9G
9
308
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Wetland
Dam
NYSDEC Stream Class Standard
Trout Habitat
Trout Spawning
Riparian Area
Important Area for Migratory Fish
Important Coldwater Stream Habitat
Culvert Passability Score
Severe barrier
Significant barrier
Moderate barrier
Minor barrier
Insignificant barrier
No score - Missing data
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Culverts: NAACC, 2018
Dams: NYSDEC, 2015
Trout Streams: NYSDEC, 2010
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Riparian Areas & Important Areas: NY Natural Heritage Program, 2018
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Dams: NYSDEC, 2015
Trout Streams: NYSDEC, 2010
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: Hudsonia, Ltd. 2007
Riparian Areas & Important Areas: NY Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Wetlands (Map 13a and 13b)

Wetlands are areas saturated by surface or groundwater sufficient to support distinctive vegetation adapted for life in saturated soil conditions.[100] There are many types of freshwater wetlands in Rhinebeck, including wet meadows, emergent marsh, forested and shrub swamps, vernal pools, floating and submerged vegetation, and open water. Because the Town is adjacent to the Hudson River Estuary, there are numerous tidal wetland habitats which are described in greater detail in the **Coastal Habitats** section of this report.

Wetlands can:

- provide critical habitat
- control flooding
- reduce damage from storm surge
- recharge ground water
- filter and purify surface water
- store carbon
- provide recreational opportunities

In addition to providing critical habitat for many plants and animals, wetlands help to control flooding and reduce damage from storm surge, recharge groundwater, filter and purify surface water, and provide recreation opportunities. The upland area surrounding a wetland is essential to its survival and function; both may diminish when a wetland is surrounded by pavement, buildings, and pollution-generating or other incompatible land uses.[101]

The **Wetlands Map** shows information from several existing sources that provide approximate locations and extent of wetlands. Open water habitats are symbolized in blue as "waterbodies." **New York State Freshwater Wetlands** only include wetlands larger than 12.4 acres, unless designated "of unusual local importance." Note that the New York State maps often underestimate wetland area and omit smaller and drier wetlands. In particular, vernal pools, wet meadows, and swamps are often under-represented on maps.[102]

In 2007, Hudsonia Ltd. produced Significant Habitats in the Town of Rhinebeck, NY, which included detailed mapping of habitats based on interpretation of aerial photographs and field surveys. **Wetlands** identified in this report were included in the Town's Wetlands map as a single feature, with more detailed classification of specific habitat types in the Village's Wetlands map. The following wetlands habitats were identified in Rhinebeck:

---

[100] "Wetlands." NYS Department of Environmental Conservation. https://www.dec.ny.gov/lands/305.html

[101] *Planner's Guide to Wetland Buffers for Local Governments*. Environmental Law Institute, 2008, Washington, DC. www.eli.org/sites/default/files/eli-pubs/d18_01.pdf

[102] *Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's*. Huffman & Associates, Inc. Prepared for New York State Department of Environmental Conservation, 2000. http://www.dec.ny.gov/docs/wildlife_pdf/wetstattrend2.pdf

- Buttonbush Pool
- Calcareous Wet Meadow
- Conifer Swamp
- Constructed Pond
- Hardwood & Shrub Swamp
- Hudson River
- Intermittent Woodland Pool
- Kettle Shrub Pool
- Marsh
- Mixed Forest Swamp
- Open Water
- Tidal Marsh
- Tidal Swamp
- Tidal Tributary Mouth

Hardwood and shrub swamp is by far the most extensive wetland type in Rhinebeck. The largest wetland in the town is Snyder Swamp, 149 acres. Swamp cottonwood (a New York State Threatened species) was documented at two locations in Rhinebeck and occurs in deep-flooding hardwood swamps.

Known Vernal Pools were also derived from this Hudsonia data and include intermittent woodland pool, kettle shrub pool, and buttonbush pool habitat types. Nearly 200 vernal pools have been mapped in Rhinebeck.

Vernal pools are small, isolated wetlands that are often dry in summer. They provide habitat for many animals, including a group of forest amphibians which use the pools for breeding. Vernal pools often go undetected in the forest due to their small size and seasonal drawdown. Specific development and management recommendations are available to minimize impacts to vernal pools and associated wildlife.[103] [104] Additional local studies or surveys could improve understanding of wetland habitat values in Rhinebeck and help to identify vernal pools and other currently unmapped wetlands.

---

[103] Morgan, D. and A. Calhoun. *The Maine Municipal Guide to Mapping and Conserving Vernal Pools*. University of Maine, Sustainability Solutions Initiative, 2012, Orono, ME. http://www.vernalpools.me/wp-content/uploads/2015/06/Maine-Municipal-Guide-to-Mapping-and-Conserving-Vernal-Pool.pdf

[104] Calhoun, A. and M. Klemens. *Best development practices: Conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States*. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, 2002, Bronx, New York. https://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/BestDevelopmentPractices20Oct2014.pdf.

Hudsonia biologists documented several occurrences of buttonbush pools and kettle shrub pools in Rhinebeck, habitats with similar characteristics to vernal pools. Buttonbush pools are seasonally or permanently flooded, shrub-dominated pools, with buttonbush normally the dominant plant. A kettle shrub pool is a specific type of buttonbush pool located in a glacial kettle—a depression formed by the melting of a stranded block of glacial ice. These pools are found in or adjacent to glacial outwash oils and have deep, mucky substrates. Kettle shrub pools are the core habitat of State-threatened Blanding's turtle and are also used by many pool-breeding amphibian species. Blanding's turtle may also use buttonbush pools, which have similar characteristics.

County soil maps are also a good source for predicting the location of potential wetlands. Soils classified in the Dutchess County soil survey as very poorly drained or poorly drained are good indicators of probable wetland areas, and soils classified as somewhat poorly drained may indicate possible wetland areas (see Soils section for further discussion of soil properties).[105] Note that the wetland soil areas cover a greater area than NWI and DEC wetland layers. Likewise, note that soil units are only mapped to an approximate area of about two acres, and that soils within the unit may not be homogeneous. Areas with mapped wetland soils should always be verified in the field for the purposes of environmental review. Existing state and federal wetland maps are inherently inaccurate and omit many smaller, drier wetlands. When it comes to identifying wetlands, there is no substitute for site visits and on-the-ground delineation.

Spotted Salamander at the Rhinebeck Big Night event, 2021 by Vanessa Bertozzi

A variety of imperiled wildlife that depend on wetlands have been documented in Rhinebeck. Records from the *NY Amphibian and Reptile Atlas* indicate that snapping turtle, Blanding's turtle, blue-spotted salamander, and marbled salamander inhabit wetlands in Rhinebeck. Similarly, the New York Breeding Bird Atlas documented other rare species that depend on wetlands, such as the least bittern (NY-Threatened) and osprey (NY-Species of Special Concern). Known state-threatened or endangered wetland plants documented by the NYNHP in Rhinebeck include swamp cottonwood, spongy arrowhead, cat-tail sedge, and buttonbush dodder.

State and federal laws protect some but not all wetlands. It is also important to recognize that upland buffer areas around wetlands play an essential role in protecting wetland habitat and water quality,

[105] Kiviat and Stevens, 2001.

although in many cases they have no formal protection. The New York State Freshwater Wetlands Act generally regulates activities in and around large wetlands, including a 100-foot adjacent area.[106] To be protected, a wetland must be at least 12.4 acres or considered of unusual local importance, and appear on the NYS Freshwater Wetlands Map. The U.S. Army Corps of Engineers regulates wetlands of all sizes in New York under section 404 of the Clean Water Act.[107] However, to be protected, wetlands must be connected to a navigable waterway. Vernal pools and other isolated wetlands less than 12.4 acres are generally unprotected by state or federal wetland regulations.[108] The Town of Rhinebeck also regulates wetlands, described below.

Discussion

Large wetland complexes occur throughout the Town, including Snyder and Vlei swamps, an area between Ackert Hook and Knollwood roads, an area southwest of the Village between Route 9 and Mill Road, and an area north of the Village between Route 9 and Old Post Road. Other wetlands of unique importance include Hudson River tidal wetlands identified as significant by the NYNHP because of their quality and rarity (See **Coastal Resources** map). The largest DEC-regulated wetlands are associated with the Mudder Kill and Fallsburg Creek, just to the west of Route 9G.

The Town of Rhinebeck regulates activities within all wetlands and watercourses through Chapter 120 of its municipal code. This regulated area includes swamps, marshes, bogs, fens, intermittent and perennial streams, vernal pools, lakes, ponds, and an associated buffer area of at least 100 feet that often includes important floodplains. The Village of Rhinebeck also regulates activities within and adjacent to wetlands and watercourses in its Land Conservation Overlay District. This includes a 40-foot setback for structures and roads and a natural buffer area, at a width determined as a part of the site plan approval process. In 2021, the Village banned the use of Glyphosate, a hazardous herbicide, on their municipal lands. It is likely that these regulatory protections are helping to maintain quality wetland habitat in the Town and Village.
Community interest in wetlands is growing through participation in annual Big Night events, organized by Climate Smart Rhinebeck[109]. These community science events are a part of a larger community science effort coordinated by the DEC's Hudson River Estuary Program each spring[110]. When conditions are right, volunteers venture out on dark, warm, rainy nights to spot and count amphibians migrating to their breeding grounds in vernal pools. Volunteers tally up sightings and report these findings to the

[106] " Freshwater Wetlands Program." NYS Department of Environmental Conservation. http://www.dec.ny.gov/lands/4937.html

[107] "Section 404 of the Clean Water Act." United States Environmental Protection Agency. https://www.epa.gov/cwa-404

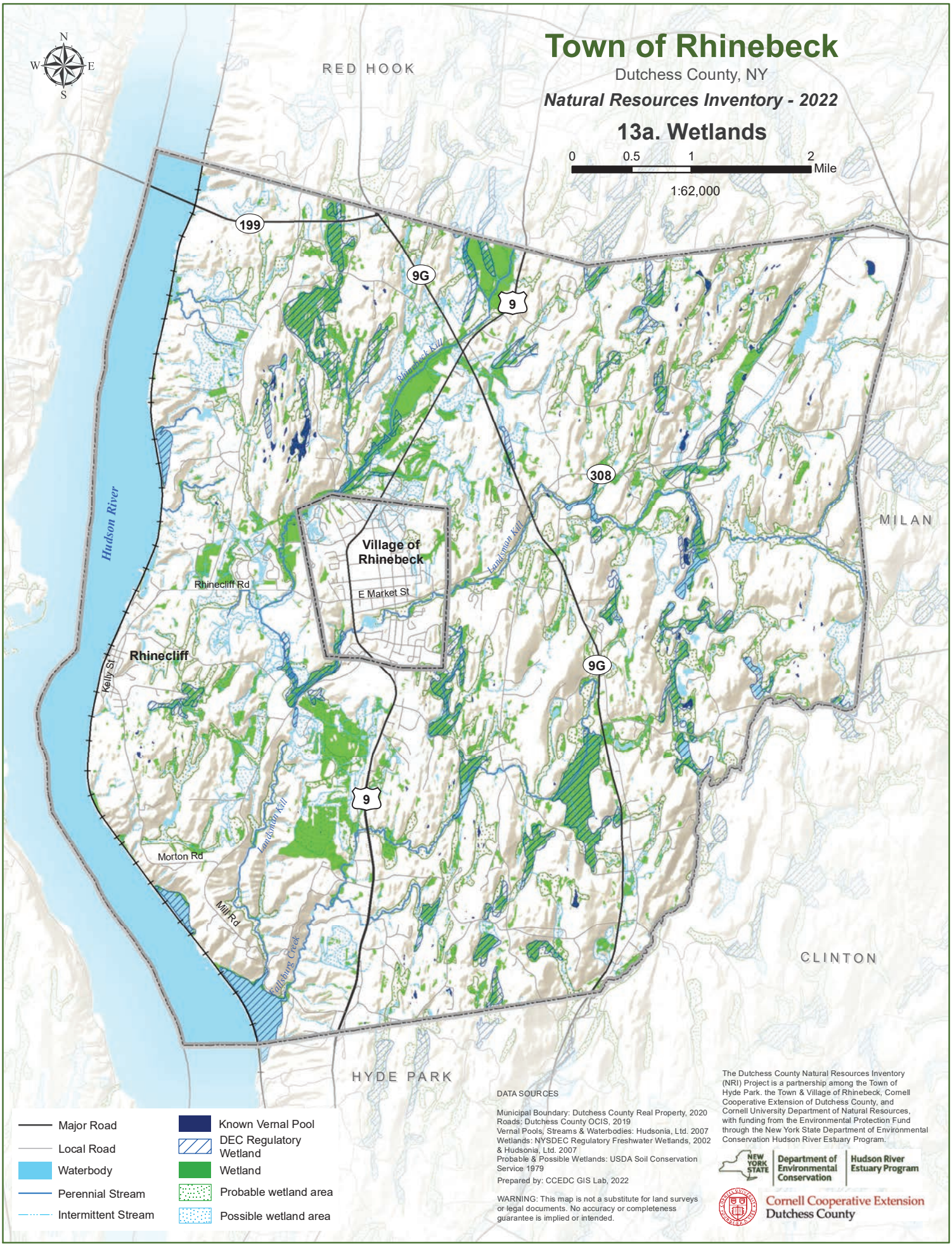
[108] "Conserving Small Wetlands in the Hudson Valley." NYS Department of Environmental Conservation. http://www.dec.ny.gov/lands/47486.html

[109] Amphibian Crossings. Climate Smart Rhinebeck. https://www.climatesmartrhinebeck.org/amphibian-crossings

[110] Amphibian Migration and Road Crossings, https://www.dec.ny.gov/lands/51925.html

DEC. In 2022, Climate Smart Rhinebeck joined forces with Winnakee Land Trust to promote Big Night and get Rhinebeckers involved. In 2022, Vlei Marsh, recently protected by Winnakee Land Trust, was highlighted as a migration hotspot. Lead volunteer Carli Fraccarolli used the Wetlands map from this report to identify potential road crossings by vernal pools, just one example of putting this NRI to practical use.

Rhinebeck Police assisting as volunteers work on Big Night, 2021 by Dairo Chamorro



DATA SOURCES

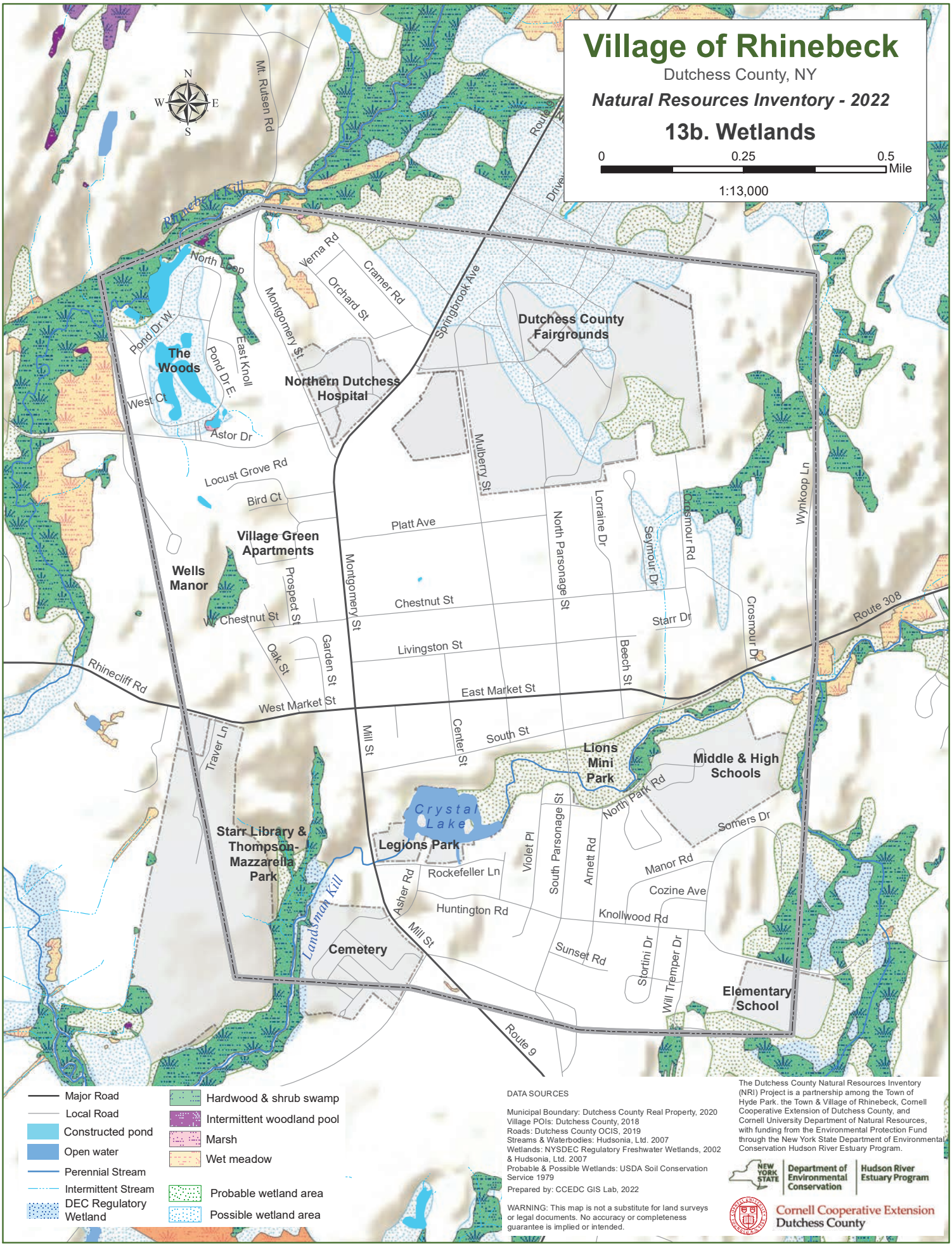
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Vernal Pools, Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002 & Hudsonia, Ltd. 2007
Probable & Possible Wetlands: USDA Soil Conservation Service 1979
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County


Village of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
13b. Wetlands
0
0.25
0.5
Mile
1:13,000
N
W
E
S
Mt. Rutsen Rd
Rte 9
Rinebeck Kill
North Loop
Verna Rd
Cramer Rd
Orchard St
Springbrook Ave
Dutchess County Fairgrounds
Pond Dr W.
Pond Dr E.
East Knoll
The Woods
Montgomery St
Northern Dutchess Hospital
West Ct
Astor Dr
Locust Grove Rd
Bird Ct
Mulberry St
Platt Ave
Village Green Apartments
Wells Manor
Prospect St
Montgomery St
North Parsonage St
Lorraine Dr
Seymour Dr
Crosmour Rd
Wynkoop Ln
W Chestnut St
Chestnut St
Starr Dr
Route 308
Oak St
Garden St
Livingston St
Beech St
Rhinecliff Rd
East Market St
West Market St
Traver Ln
Mill St
Center St
South St
Lions Mini Park
Middle & High Schools
North Park Rd
Somers Dr
Crystal Lake
Starr Library & Thompson-Mazzarella Park
Legions Park
Violet Pl
South Parsonage St
Arnett Rd
Manor Rd
Cozine Ave
Rockefeller Ln
Asher Rd
Huntington Rd
Knollwood Rd
Landsman Kill
Cemetery
Mill St
Sunset Rd
Stortini Dr
Will Tremper Dr
Elementary School
Route 9
Major Road
Local Road
Constructed pond
Open water
Perennial Stream
Intermittent Stream
DEC Regulatory Wetland
Hardwood & shrub swamp
Intermittent woodland pool
Marsh
Wet meadow
Probable wetland area
Possible wetland area
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002 & Hudsonia, Ltd. 2007
Probable & Possible Wetlands: USDA Soil Conservation Service 1979
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE
Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension
Dutchess County

Section 5: Habitats and Wildlife

Landscape Context (Map 14)

The first step to understanding habitats in Rhinebeck is to consider the Town and Village's larger ecological context. The Landscape Context map helps illustrate the major ecological features in Rhinebeck extending beyond the Town's borders, including habitat areas that have been identified as significant at the inter-municipal, regional, and statewide levels. This NRI was created in partnership with the Town of Hyde Park, and in the spirit of this collaboration, Map 14 showcases resources found in both municipalities.

The 22 **Significant Biodiversity Areas** within the Hudson Valley are landscape areas with a high concentration of biological diversity or value for regional biodiversity.

SBAs are defined by unique topography, geology, hydrology, and biology that distinguish them from neighboring areas.

Significant Biodiversity Areas
Rhinebeck and Hyde Park are both within the Dutchess County Wetlands Significant Biodiversity Area (SBA) and are adjacent to the Upper Hudson River SBA. These regionally significant landscapes are recognized by DEC's Hudson River Estuary Program for their important contributions to regional biodiversity.

The DEC's Hudson River Estuary Wildlife and Habitat Conservation Framework describes the **Dutchess County Wetland SBA** as:

> *"a network of four major wetland complexes that provide important habitat for a variety of amphibian, reptile, and bird species. This area contains the highest diversity of turtles in New York State"* and recommends the *"protection of wetlands and their buffer zones, as well as of the movement corridors and road crossings between wetlands."*

The **Upper Hudson River SBA** starts at the northern portion of the Town of Poughkeepsie and extends north to the end of tidal influence at the federal dam in Troy. This stretch of the Hudson River estuary is unique in that it is tidal but is primarily freshwater, which produces some globally-rare wetland habitats.

> *"The numerous creeks and tidal freshwater marshes in this stretch serve as breeding, nursery, and migration corridors supporting waterfowl, shorebirds, herons, raptors, and passerine birds. Regionally and globally rare tidal communities include freshwater tidal swamp, freshwater tidal marsh, freshwater intertidal mudflats, and freshwater intertidal shore."*

More information about SBAs can be found in the Hudson River Estuary Wildlife and Habitat Conservation Framework.[111]

[111] Penhollow, M., P. Jensen, and L. Zucker. *Wildlife and Habitat Conservation Framework: An Approach for Conserving*

Matrix Forest Blocks and Regional Forest Linkage Zones

The Nature Conservancy (TNC) has identified globally rare matrix forests at the statewide level. These forests are large enough to withstand major natural disturbances, maintain important ecological processes, and support populations of forest-interior wildlife and plants.[112] In partnership with the New York Natural Heritage Program, TNC identified forest linkage zones represent intact natural corridors that connect matrix forests at a regional scale across New York State.

Fox Kits Playing by Sue Sie

By visualizing how natural resources extend beyond political boundaries, municipalities can better understand the context of their decisions at a landscape scale. Furthermore, climate change, habitat fragmentation, and other human disturbance will continue to cause plants and animals to move across the landscape and municipal governments might be able to facilitate this movement through land use planning and decision-making. Whether planning or making decisions at the site or municipal scale, stepping back to understand a site's ecological context can help guide new development to avoid cumulative impacts or death by a thousand cuts to major natural features.

The Hudson River is perhaps the most important unifying feature shared by Rhinebeck and Hyde Park, and the **Coastal Resources** section (Maps 17a & 17b) provides extensive information on the Town's river habitats and the adjacent shoreline. Rhinebeck, and its neighbor to the south Hyde Park, also contain biologically diverse wetland complexes that are also part of an important corridor of forest land stretching from the southern Appalachian Mountains into northern New England. To the west of the Hudson River, the Towns of Esopus, Lloyd, and New Paltz are within a Matrix Forest Block that ultimately connects to the Shawangunk Mountains, Catskills, and Hudson Highlands. The forests in the southern and eastern portions of Rhinebeck serve to directly connect this important area to the forested landscapes of the Taconics, Berkshires, and Green Mountains.

Discussion

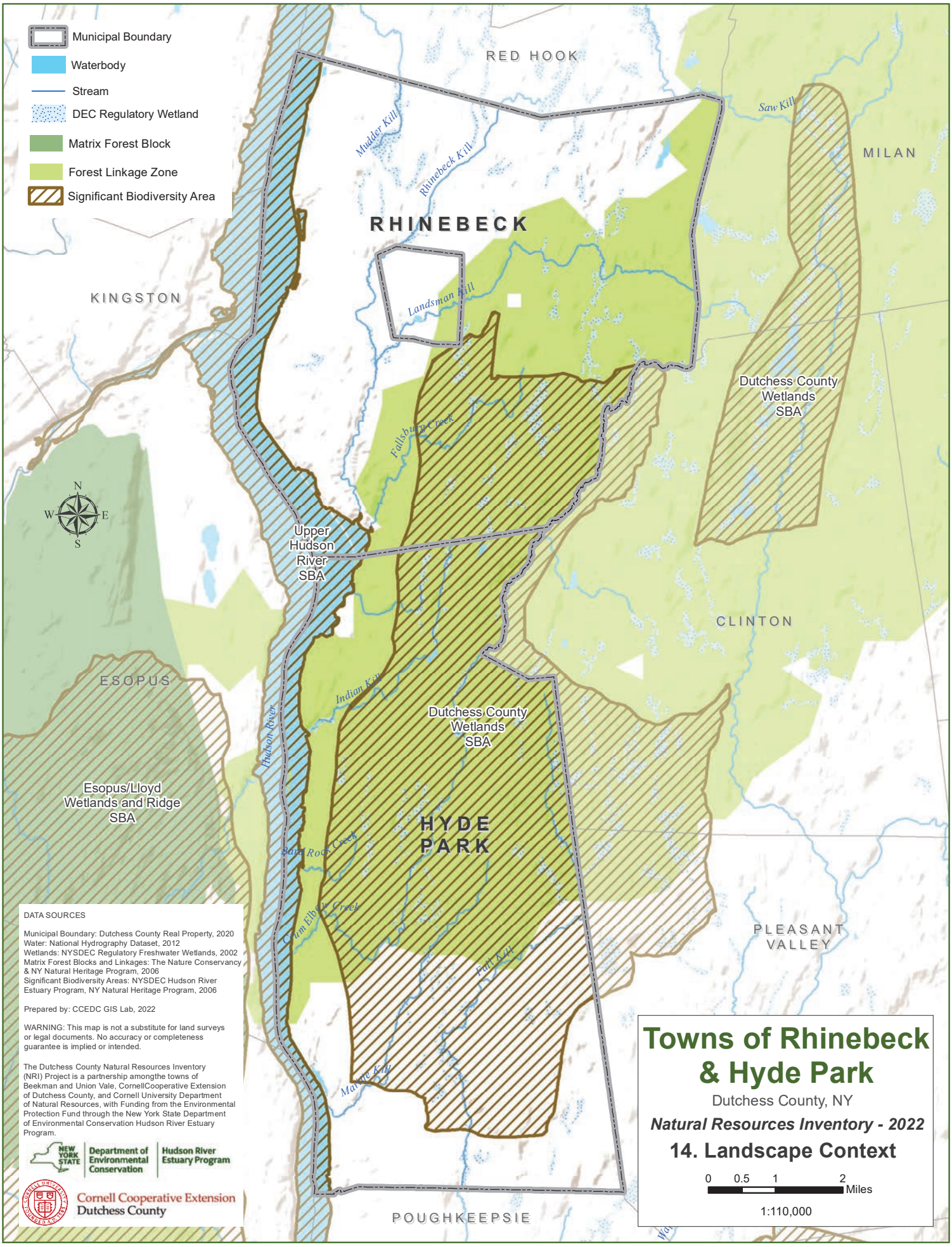
While the data shown in this map is of a courser scale than other data in this NRI, the identified areas are useful for conservation planning efforts, especially those completed in partnership with the neighboring

---

Biodiversity in the Hudson River Estuary Corridor. New York Cooperative Fish and Wildlife Research Unit, Cornell University and New York State Department of Environmental Conservation, Hudson River Estuary Program, 2006, Ithaca, NY. https://www.dec.ny.gov/lands/5096.html

[112] Anderson, M. and S. Bernstein (editors). *Planning methods for ecoregional targets: Matrix forming ecosystems.* The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, 2003, Boston, MA

community of Hyde Park. By including these geographic areas in open space plans, open space inventories, or other municipal plans, Rhinebeck can align its conservation priorities with those of regional organizations and increase the efficacy of their protection efforts (e.g. land acquisition and zoning updates).



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Water: National Hydrography Dataset, 2012
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Matrix Forest Blocks and Linkages: The Nature Conservancy & NY Natural Heritage Program, 2006
Significant Biodiversity Areas: NYSDEC Hudson River Estuary Program, NY Natural Heritage Program, 2006

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership amongthe towns of Beekman and Union Vale, CornellCooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Towns of Rhinebeck & Hyde Park

Dutchess County, NY

Natural Resources Inventory - 2022

14. Landscape Context

0 0.5 1 2 Miles

1:110,000

Significant Habitats (Map 15a and 15b)

In 2007, Hudsonia Ltd. (a non-profit ecological research institute) completed Significant Habitats in the Town of Rhinebeck, a report and accompanying maps that identify and describe the habitats found in the Town and Village. The habitat map was created through a combination of remote sensing and field verification of selected habitats. Remote sensing used a Geographic Information System (GIS) to overlay data to inform the identification of habitats. Data layers included topography, aerial photography, NYS geology maps, the Dutchess County soil survey, and mapped wetlands from the National Wetlands Inventory. Between 2006 and 2007, 62% of the undeveloped land area in Rhinebeck was field verified by trained biologists.

The Significant Habitats Map shows the great diversity of habitat types throughout the Town and Village of Rhinebeck. At the time of the 2007 report, 19,461 acres of Rhinebeck's total area are natural habitats (84%) while 3,707 acres are developed (16%). Wetlands, including streams and waterbodies, make up about 5,166 acres of the Town, 226 of which are within the Village (See **Wetlands Maps**). The waterbodies and streams mapped in the 2007 Habitat Map are used throughout this NRI (and wetlands on the Village maps) as they are considered to be the most accurate rendering of these resources currently available. Large contiguous forests and meadows were also mapped because of their value to sensitive species that require large undisturbed patches of habitat to thrive. Rare habitats include calcareous wet meadows, buttonbush pools, kettle shrub pools, intermittent woodland pools, oak-health barrens, conifer swamps, and tidal habitats. All were mapped and are further discussed in the accompanying report. **Tables 6** and **7** lists the significant habitats mapped in Rhinebeck with brief descriptions and total acreage.

Coyote by River Road, 2022 by Wil LaBossier

Table 6. *Area and Percent of the Town of Rhinebeck's Habitats*

Habitat		Acreage	Percentage
Buttonbush Pool	swamps that are seasonally or permanently flooded and have a shrub-dominated flora with buttonbush normally the dominant plant.	29.1	0.1%
Calcareous Wet Meadow	a wet meadow strongly influenced by calcareous groundwater or soils favoring establishment of a calcicolous plant community.	128.1	0.5%
Conifer Swamp	wetland dominated by conifer trees or shrubs (>75% of canopy).	11.8	0.0%
Constructed Pond	manmade body of water with a mostly managed shoreline (bordered by developed or cultural areas).	128.8	0.5%
Cultural	open area (may have scattered trees) mowed frequently or otherwise managed in an intensive way (lawn, playing field, golf course, garden, park, cemetery).	754.2	3.0%
Developed	buildings, roads, pavement, and adjacent lawn areas.	3,618.8	14.4%
Estuarine Rocky Shore	includes beaches of gravel, cobble, and natural rock rubble, as well as rock outcrops, ledges, and cliffs in and above the intertidal zone of the Hudson River.	4.1	0.0%
Hardwood & Shrub Swamp	wetland (identified by predominance of hydrophytic vegetation) dominated by trees and/or shrubs. (conifers make up < 25% of canopy).	1,565.5	6.2%
Hudson River	The Hudson River estuary.	2,054.2	8.2%
Hudson River Rocky Island	all islands in the Hudson River and in associated bays and coves with extensive bedrock substrates.	0.4	0.0%
Intermittent Woodland Pool	small, isolated, seasonally flooded pool, generally with an open basin, surrounded by forest.	28.4	0.1%
Kettle Shrub Pool	seasonally-flooded shrub swamp in a glacial kettle.	16.7	0.1%

Habitat		Acreage	Percentage
Marsh	wetland dominated by hydrophytic herbaceous vegetation that stays saturated/flooded most of the time.	160.6	0.6%
Mixed Forest Swamp	wetland with a mix of hardwood and conifers trees and/or shrubs (conifers make up 25-75% of canopy).	50.4	0.2%
Oak-heath Barren	open woodland with a sparse and often stunted canopy of pitch pine, oaks, and scrub oak, occurring on mountain summits or slopes with exposed bedrock and thin soils.	0.4	0.0%
Open Water	body of water (natural or manmade) with a mostly undeveloped shoreline.	117.4	0.5%
Orchard/Plantation	actively maintained or recently abandoned fruit orchards, tree farms, or plant nurseries.	81.3	0.3%
Red Cedar Woodland	overstory of widely-spaced eastern red cedar trees and grassy meadow remnants between them	99.4	0.4%
Stream	stream that has flow at least part of the year, including manmade ditches.	46.3	0.2%
Supratidal Railroad Causeway	the elevated railroad tracks that run along the shores of the Hudson River.	35.1	0.1%
Freshwater Tidal Marsh	a non-forested wetland that occurs in the shallow bays and tributary mouths along the freshwater tidal portion of the Hudson River.	124.4	0.5%
Freshwater Tidal Swamp	a forested or shrub-dominated wetland that occurs in the upper tidal zone of the freshwater reach of the Hudson River.	4.1	0.0%
Freshwater Tidal Tributary Mouth	the tidal reaches of Hudson River tributary streams.	7.7	0.0%
Upland Conifer Forest	non-wetland forest dominated by conifer trees (>75% of canopy).	198.9	0.8%
Upland Hardwood Forest	non-wetland forest dominated by hardwood trees (conifers make up < 25% of canopy).	9,682.9	38.4%
Upland Meadow	open area dominated by herbaceous vegetation (shrubs and saplings < 20% ground cover; may	3,539.3	14.1%

Habitat		Acreage	Percentage
	have scattered trees) and either unmowed or mowed infrequently (up to a few times a year, such as a hayfield); includes pasture, cropland, abandoned fields.		
Upland Mixed Forest	non-wetland forest with a mix of hardwoods and conifers (conifers make up 25-75% of canopy).	1,520.9	6.0%
Upland Shrubland	open (nonforested) area with shrubs making up > 20% of ground cover.	432.6	1.7%
Waste Ground	land that has been severely altered by human activity but lacks pavement or structures. Gravel mines, quarries, dumps, wetland fill, abandoned lots, or construction sites. Places where soil has been removed, and sometimes replaced with fill.	52.9	0.2%
Wet Clay Meadow	area of seasonally saturated or flooded clay soils dominated by hydrophytic herbaceous vegetation.	57.9	0.2%
Wet Meadow	area of seasonally saturated or flooded soils dominated by hydrophytic herbaceous vegetation.	635.0	2.5%
Total		*25,187.5*	*100.0%*

Table 7. *Area and Percent of the Village of Rhinebeck's Habitats*

Habitat	Acreage	Percentage
Constructed Pond	6.5	0.2%
Cultural	124.9	4.1%
Developed	2,281.9	74.5%
Hardwood & Shrub Swamp	199.2	6.5%
Intermittent Woodland Pool	0.2	0.0%

Habitat	Acreage	Percentage
Marsh	0.2	0.0%
Open Water	7.1	0.2%
Stream	8.7	0.3%
Upland Hardwood Forest	292.1	9.5%
Upland Meadow	123.1	4.0%
Upland Shrubland	14.9	0.5%
Waste Ground	1.0	0.0%
Wet Meadow	3.9	0.1%
Total	*3,063.7*	*100.0%*

Discussion

The Significant Habitats Map and the accompanying report can be used to inform planning for the protection of these habitats. The map can be used to review site-specific development proposals by providing habitat information about any given parcel along with important adjacent or contiguous habitats. During the review process, the report recommends that landowners, developers and reviewers should:

1. Consult the large format printed map showing the habitats. Check to see what types of habitats are on and near the proposed development and check to see if any habitats are listed in the Priority Habitats section of this report.
2. Read about the habitats in this report and note any recommendations. Table 2 on pg. 80 summarizes recommended conservation zones for priority habitats.
3. Consider whether the proposed development can be modified to minimize impacts to habitats. Some suggested modifications include:
    a. Minimize intrusion into large contiguous forests, large meadows, and wetland

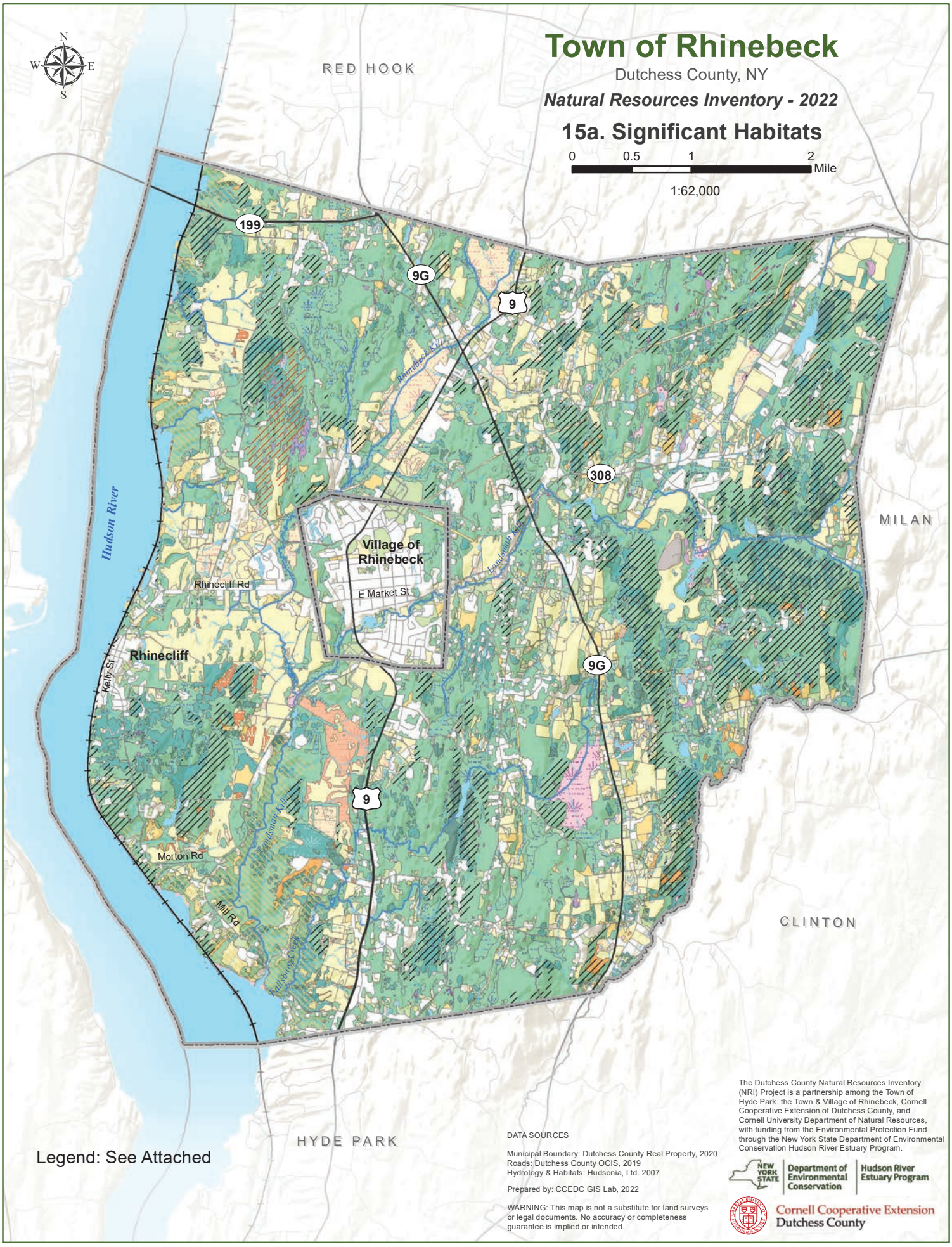
complexes.

b. Locate disturbance areas as far from sensitive habitats as possible.

c. Locate built features in such a way as to maintain connectivity between habitats; and restore cleared areas with native plantings wherever possible.

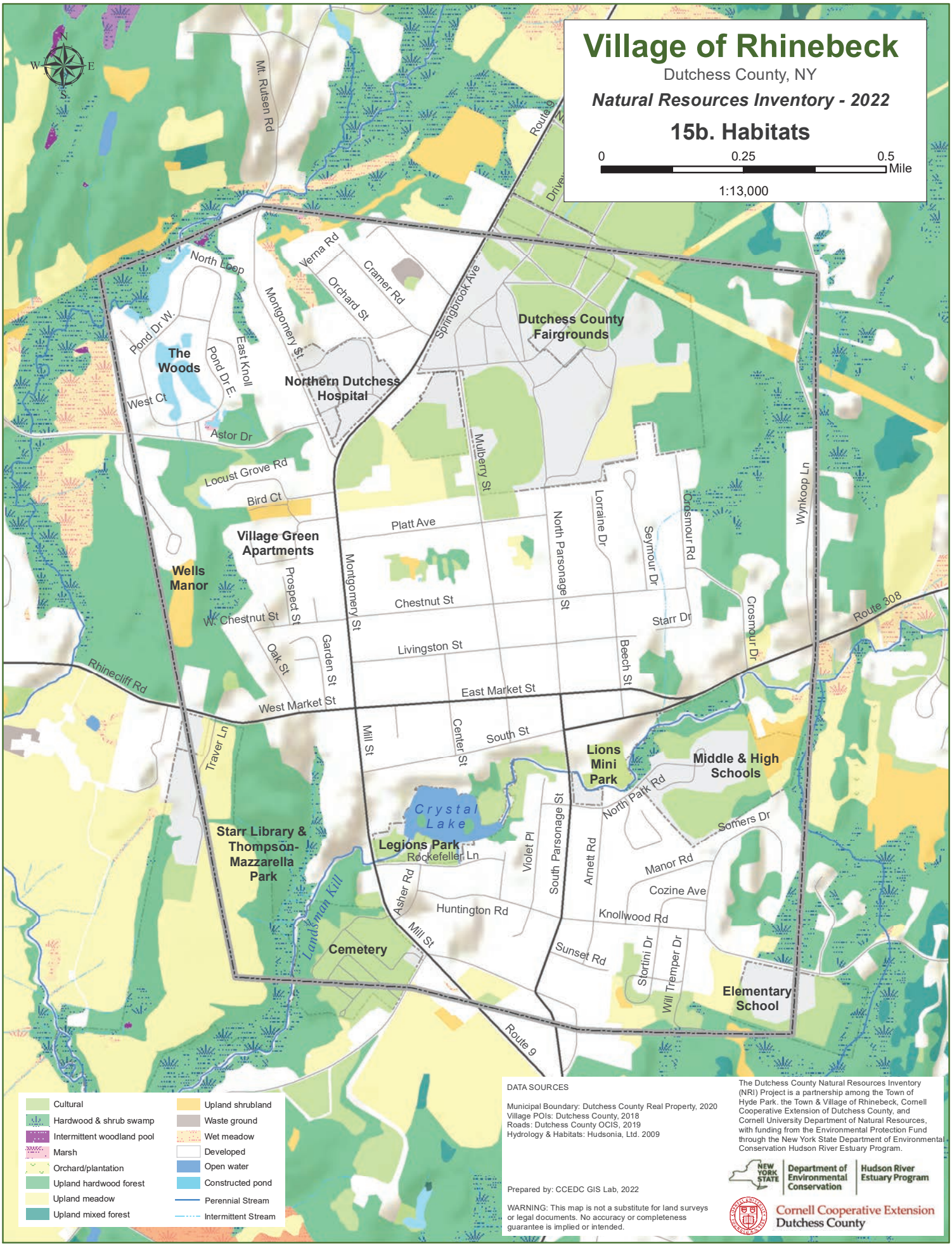
In 2009, the Town amended the code to require applicants before the planning board to complete a site resource analysis assessment for proposals that require any subdivision of land. This procedure protects important biodiversity by highlighting important habitats, as identified in *Significant Habitats in the Town of Rhinebeck*, and other natural and historic resources for planning board consideration. For more information see **Appendix A.** These highly accurate mapped habitats should also be used to establish jurisdiction for various location environmental regulations. (See **Wetlands** and **Water Quality Classification** sections of this report for more information)

The Significant Habitats Map has been prepared using remote sensing techniques and not all habitats have been field-verified. Therefore, it should be used as a general guide for land use planning, and field verification of habitats should be included in any formal environmental review process.


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
15a. Significant Habitats
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
Hudson River
Village of Rhinebeck
Rhinecliff
Rhinecliff Rd
E Market St
Kelly St
Morton Rd
Mill Rd
Landsman Kill
Rhinebeck Kill
Fallsburg Creek
199
9G
9
308
Legend: See Attached
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Hydrology & Habitats: Hudsonia, Ltd. 2007
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Map 15 – Habitats

Legend



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Hydrology & Habitats: Hudsonia, Ltd. 2009

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Important Biodiversity Areas (Map 16)

The Important Biodiversity Areas Map highlights the most significant ecological features in Rhinebeck based on limited information available in state and regional assessments. In addition, Hudsonia's *Significant Habitats in the Town of Rhinebeck* study identifies Priority Conservation Areas in Rhinebeck (see map in **Conservation, Recreation, and Scenery** section) especially valuable for biodiversity conservation. The Hudsonia study contains greater detail about the Town and Village's natural features.

The **New York Natural Heritage Program** is a partnership between DEC and SUNY ESF, with a mission to monitor and conserve New York State's rare plants, animals and habitats.

To request more detailed rare species or habitat data, visit their website at http://www.dec.ny.gov/animals/31181.html or e-mail them directly at NaturalHeritage@dec.ny.gov

Significant Natural Communities

The New York Natural Heritage Program (NYNHP) has mapped two rare and high-quality natural communities in Rhinebeck: freshwater tidal marsh and freshwater intertidal mudflats in Vanderburgh Cove. For more information, see the **Coastal Resources** section of this report.

Meadows Greater than 50 Acres

Recently disturbed sites, such as hayfields, abandoned farm fields, or forest clearings, can provide important habitat for species that require grassland, shrubland, and young forest habitats. Grassland or meadow habitat can support a variety of life, including rare plants, butterflies, reptiles, and birds, in addition to providing agricultural uses and scenic vistas. Large grasslands and meadows are particularly important for a subset of declining bird species that require these habitats for their breeding. This map shows meadows and grasslands larger than 50 acres, including the largest of these habitats in Rhinebeck. For more information, see the **Meadows, Grasslands, and Shrublands** Map.

Known Important Areas for rare plants, rare animals, and significant natural communities

The NYNHP has also identified important areas for sustaining populations of rare plants, rare animals, and significant natural communities based on documented occurrences.[113] These areas include the specific locations where a species has been observed, the adjacent habitat, as well as areas critical to maintaining the quality or integrity of the habitat or natural community. Proactive planning that considers how species move across the landscape, with careful attention to maintaining connected habitat complexes, will contribute to the long-term survival and persistence of rare species and significant natural communities.

[113] New York Natural Heritage Program and New York State Department of Environmental Conservation, Biodiversity Databases [4/13/2022], Important Areas Digital Data Set, 2018, Albany, NY.

NYNHP identified important areas in Rhinebeck for diadromous fishes, Atlantic needlefish, Blanding's turtle, eastern box turtle, wood turtle, russet-tipped clubtail, peregrine falcon, bald eagle, coldwater stream habitat, and a variety of rare plants. A complete list of species of conservation concern known from Rhinebeck is shown in **Table 8.**

Animals

Atlantic needlefish is a marine fish that sometimes migrates up the Hudson River as far north as Germantown during the summer months. The loss of submerged aquatic vegetation (see the Coastal Habitats Map) might be a threat to the population that uses the Hudson River but more research is needed.

Bald eagle (NY-Threatened) nesting has been documented in Rhinebeck along the Hudson River. While Bald Eagle breeding and non-breeding populations are increasing in New York, development pressure and its impacts on habitat remain significant threats. Nesting sites are sensitive to human disturbance.

Box Turtle Shells by Dan Shapley

Blanding's turtle (NY-Threatened, High Priority SGCN) is a mobile species that requires a variety of wetland and upland habitats. Their core habitats are kettle shrub pools, but they also use buttonbush pools, swamps, marshes, ponds, vernal pools, and upland areas for nesting. They move over land within their large habitat complex, at times traveling distances exceeding one mile; these movements increase their vulnerability to road mortality, collection, and injury or mortality from agricultural or mowing equipment. Habitat loss and degradation further threaten Blanding's turtle populations in Dutchess County.

Eastern box turtle (NY-Special Concern, High Priority SGCN) occurs primarily in well-drained and open deciduous forests, but may also be found in field edges, shrublands, marshes, bogs, and along stream banks. Rhinebeck is near the northern limit of eastern box turtle's natural range, an area that is particularly important for stewardship as climate changes and suitable habitat shifts north. Box turtles are threatened by habitat loss and fragmentation, vehicle strikes, and the pet trade.

Peregrine Falcon (NY- Endangered) was extirpated from the state in the 1960s by DDT and

PCB poisoning, but has been steadily recovering in New York since 1983. Nesting has been documented on every bridge over the Hudson River estuary. Threats include habitat disturbance and loss, human recreation disturbance near nests, nest poaching, shooting by hunters, and effects of contamination.

Russet-tipped clubtail is a state-rare dragonfly, generally associated with the Hudson River and its tidal tributaries, and is sensitive to water contamination, hydrological alteration, and other impacts from surrounding upland development.

Wood turtle (NY-Special Concern, High Priority SGCN) occurs along low gradient streams and adjacent forested and open uplands in Rhinebeck. Wood Turtles are threatened by habitat loss, stream degradation, vehicle strikes, nest predation, and the pet trade.

Plants

Important areas for plants include habitat for Delmarva beggar-ticks, cat-tail sedge, swamp cottonwood, buttonbush dodder, and/or spongy-leaved arrowhead.

Important Area for Bat Foraging

At-risk bats may travel long distances from their winter hibernacula during the summer months, using forested areas and stream corridors for shelter and foraging for insect prey. Female bats roost in trees and snags in maternity colonies to raise their young. Existing restrictions on tree cutting aim to protect threatened bat species, especially during the period when mothers are birthing and raising pups. Bat conservation areas depict bat summer habitat areas for rare bat species, including Indiana bat, in the Town of Rhinebeck. DEC recommends restricting any tree-cutting activities to the winter months (November 1-March 31) in areas occupied by protected bats to avoid direct impacts to the species.

Important Areas for Coldwater Stream Habitat

These areas were mapped based on records for known populations of wild brook trout. Trout are valuable indicators of healthy aquatic ecosystems because they require cold and high-quality water to survive. Trout become thermally stressed when the water temperature rises above 70°F. They typically inhabit clear, cool, well-oxygenated streams and lakes and depend on clean gravel areas for spawning. Among trout species, native brook trout are the most highly sensitive to increases in water temperature and sedimentation of stream habitats. *Please note that this data does not indicate areas with public fishing rights, and many areas are unsuitable for recreational trout fishing due to small populations and fish size.*

NOTE: The DEC Region 3 Office should be contacted at 845-256-3098 with any concerns or questions

about the presence of protected species in Rhinebeck.

Table 8. *Species and Ecosystems of Conservation Concern in Rhinebeck, NY*

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
Mammals								
little brown bat	*Myotis lucifugus*	cave, forest, wetland		xx				DEC
northern long-eared bat	*Myotis septentrionalis*	cave, forest		xx		US NY		DEC
Birds								
American black duck	*Anas rubripes*	wetland	x	xx				NYBBA
American goldfinch	*Spinus tristis*	young forest, shrubland	x					NYBBA
American kestrel	*Falco sparverius*	meadow	x	x				NYBBA
American redstart	*Setophaga ruticilla*	forest	x					NYBBA
American woodcock	*Scolopax minor*	young forest, shrubland	x	x				NYBBA
bald eagle	*Haliaeetus leucocephalus*	lake, stream, forest	x	x		NY		NYNHP
Baltimore oriole	*Icterus galbula*	forest	x					NYBBA
belted kingfisher	*Megaceryle alcyon*	lake, stream	x					NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
black-and-white warbler	*Mniotilta varia*	forest	x					NYBBA
black-billed cuckoo	*Coccyzus erythropthalmus*	young forest, shrubland	x	x				NYBBA
black-crowned night-heron	*Nycticorax nycticorax*	wetland	x	x				NYBBA
black-throated blue warbler	*Dendroica caerulescens*	forest	x	x				NYBBA
black-throated green warbler	*Dendroica virens*	forest	x					NYBBA
blue-winged warbler	*Vermivora pinus*	young forest, shrubland	x	x				NYBBA
bobolink	*Dolichonyx oryzivorus*	grassland	x	xx				NYBBA
broad-winged hawk	*Buteo platypterus*	forest	x					NYBBA
brown thrasher	*Toxostoma rufum*	young forest, shrubland	x	xx				NYBBA
chestnut-sided warbler	*Setophaga pensylvanica*	young forest, shrubland	x					NYBBA
chimney swift	*Chaetura pelagica*	urban	x					NYBBA

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
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 meadowlark	*Sturnella magna*	grassland	x	xx				NYBBA
eastern towhee	*Pipilo erythrophthalmus*	young forest, shrubland	x					NYBBA
eastern wood-pewee	*Contopus virens*	forest	x					NYBBA
field sparrow	*Spizella pusilla*	young forest, shrubland	x					NYBBA
grasshopper sparrow	*Ammodramus savannarum*	grassland	x	xx	x			NYBBA
least bittern	*Ixobrychus exilis*	wetland	x	x		NY		NYBBA
least flycatcher	*Empidonax minimus*	forest	x					NYBBA
Louisiana waterthrush	*Seiurus motacilla*	forest	x	x				NYBBA
marsh wren	*Cistothorus palustris*	wetland	x					NYBBA
northern flicker	*Colaptes auratus*	forest	x					NYBBA

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
osprey	*Pandion haliaetus*	open water, wetland	x		x			NYBBA
peregrine falcon	*Falco peregrinus*	cliff	x	x			NY	NYNHP
prairie warbler	*Dendroica discolor*	young forest, shrubland	x	x				NYBBA
purple finch	*Carpodacus purpureus*	forest	x					NYBBA
purple martin	*Progne subis*	wetland	x					NYBBA
red-shouldered hawk	*Buteo lineatus*	forest	x	x	x			NYBBA
rose-breasted grosbeak	*Pheucticus ludovicianus*	forest	x					NYBBA
ruffed grouse	*Bonasa umbellus*	young forest, shrubland	x	x				NYBBA
savannah sparrow	*Passerculus sandwichensis*	grassland	x					NYBBA
scarlet tanager	*Piranga olivacea*	forest	x	x				NYBBA
sharp-shinned hawk	*Accipter striatus*	forest	x		x			NYBBA
veery	*Catharus fuscescens*	forest	x					NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
willow flycatcher	*Empidonax trailli*	young forest, shrubland	x					NYBBA
wood thrush	*Hylocichla mustelina*	forest	x	x				NYBBA
worm-eating warbler	*Helmitheros vermivorum*	forest	x	x				NYBBA
yellow-billed cuckoo	*Coccyzus americanus*	young forest, shrubland	x					NYBBA
yellow-throated vireo	*Vireo flavifrons*	forest	x					NYBBA

Reptiles								
Blanding's turtle	*Emydoidea blandingii*	forest, wetland		xx		NY		NYNHP
eastern box turtle	*Terrapene c. carolina*	forest, young forest		xx	x			NYARA
eastern rat snake	*Pantherophis alleghaniensis*	forest		x				NYARA
northern black racer	*Coluber c. constrictor*	forest, shrubland, meadow		x				NYARA
snapping turtle	*Chelydra serpentina*	wetland, stream, forest, lake		x				NYARA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Amphibians								
blue-spotted salamander	*Ambystoma laterale*	vernal pool, forest		xx	x			NYARA
marbled salamander	*Ambystoma opacum*	vernal pool, forest		x	x			NYARA
Fish								
alewife	*Alosa pseudoharengus*	coast, stream, lake		x				DEC
American eel	*Anguilla rostrata*	coast, stream		xx				DEC
American shad	*Alosa sapidissima*	coast, stream		xx				DEC
Atlantic sturgeon	*Acipenser oxyrinchus*	coast		xx			US	NYNHP
Atlantic tomcod	*Microgadus tomcod*	coast		xx				DEC
brook trout	*Salvelinus fontinalis*	stream		x				DEC
fourspine stickleback	*Apeltes quadracus*	coast		xx				DEC

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
shortnose sturgeon	*Acipenser brevirostrum*	coast		x			US NY	NYNHP

Plants								
buttonbush dodder	*Cuscuta cephalanthi*	wetland					NY	NYNHP
cat-tail sedge	*Carex typhina*	wetland					NY	NYNHP
spongy arrowhead	*Sagittaria montevidensis ssp. spongiosa*	coast				NY		NYNHP
swamp cottonwood	*Populus heterophylla*	wetland				NY		NYNHP

Natural Communities	
freshwater intertidal mudflats	NYNHP
freshwater tidal marsh	NYNHP
tidal river	NYNHP

Historical Records*								
pied-billed grebe	*Podilymbus podiceps*	wetland bird	x	x		NY		NYNHP

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Delmarva beggar-ticks *	*Bidens bidentoides*	coastal plant						NYNHP

*Generally includes records from before 1980 where subsequent surveys did not confirm the presence of the species

This table 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.

Christine Vanderlan
Hudson River Estuary Conservation and Land Use Specialist
New York State Department of Environmental Conservation
21 South Putt Corners Road, New Paltz, NY 12561
845-256-3062 | Christine.vanderlan@dec.ny.gov
www.dec.ny.gov/lands/5094.html

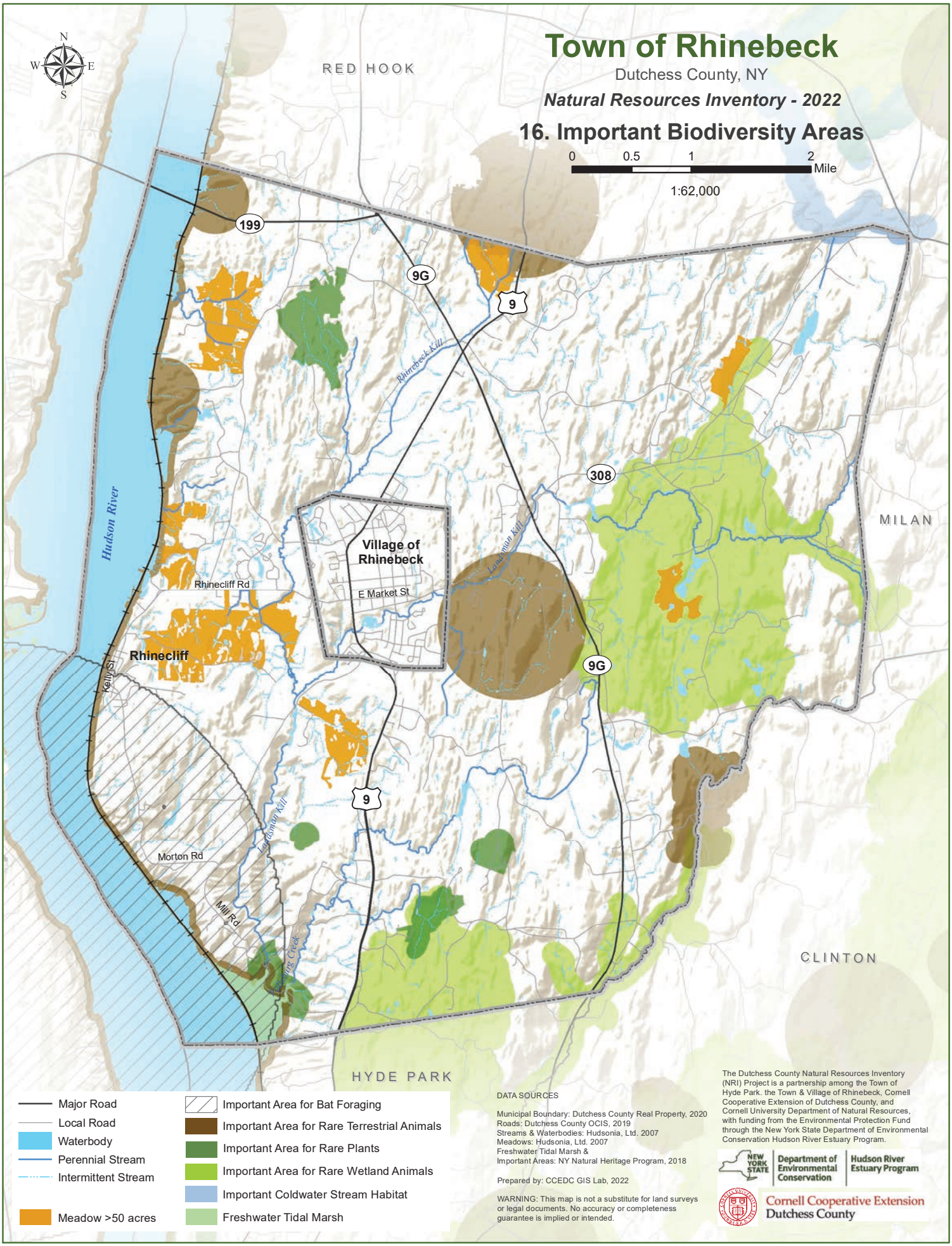
Discussion

Rhinebeck has a tremendous amount of biological diversity, including a number of rare plants and animals of concern. Important areas can be found throughout the Town but the largest concentration is within one mile of the Hudson River. In 2009, the Town amended the code, Section 125-59 of the Town zoning law, Habitat and Natural Resource Management, to require applicants before the planning board to

Eagle Soaring, 2021 by Wil LaBossier

complete a site resource analysis assessment for proposals that require any subdivision of land. This procedure protects important biodiversity by highlighting important habitats, as identified by the 2007 Hudsonia report titled *Significant Habitats in the Town of Rhinebeck*, and other natural and historic resources for planning board consideration. Section 125-59's intent is to *"...incorporate, where appropriate, habitat assessments into the decision-making of all Town boards charged with approval of actions under SEQRA."* The Planning Board routinely requires habitat assessments for projects having the potential to impact natural resources and habitats, identify appropriate mitigation measures if possible, or deny the application if the impacts cannot be adequately mitigated. For more information see **Appendix B.** The Hudson River Estuary Program's Conservation and Land Use team website, Conservation Planning is the Hudson River Estuary Watershed, has more information on local land use policies that can help protect biodiversity at the municipal scale.

In September 2021, Hudson Valley Wild, Dirty Gaia, The Climate Smart Community Task Force/Conservation Advisory Board, and Starr Library hosted its first annual BioBlitz, to better inventory the biodiversity of the Town and Village. During a two-day period, volunteers made over 150 observations, adding to a long running inventory of species that now totals at 1,027.



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Meadows: Hudsonia, Ltd. 2007
Freshwater Tidal Marsh &
Important Areas: NY Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Coastal Habitats (Map 17a & 17b)

Connections to upper watersheds, the Atlantic Ocean, and the changing tides make the coastal and shoreline zones of the Hudson River Estuary a dynamic area. While much of the Hudson River Estuary is salty (ocean water) or brackish (ocean and freshwater mix), areas north of Poughkeepsie are generally freshwater, supporting globally rare natural communities such as freshwater tidal marsh and swamp. Coastal habitats along the tidal Hudson River in Rhinebeck are shown in Maps 17a (north) and 17b (south).

> *"An **Estuary** is a partially enclosed body of water, and its surrounding coastal habitats, where saltwater from the ocean mixes with fresh water from rivers or streams."*
>
> - US National Oceanic and Atmospheric Administration (NOAA)

Tidal Wetland

Tidal wetlands are areas regularly inundated to some degree by tides. There are different types of tidal wetlands depending on plant life present and water depth during high and low tides. Tidal wetlands provide vital habitat in the estuary for rare plants and young fish. In addition, waterfront communities benefit from the ability of tidal wetlands to remove some pollutants from wastewater and protect shorelines from waves and strong storms. Tidal wetlands also store carbon in their vegetation and soils which plays a role mitigating global climate change.[114] For more information on tidal wetlands, see the **Sea Level Rise and Marsh Migration** section of this report.

These wetlands were mapped through a combination of efforts including Hudsonia's 2007 municipal habitat map and the Hudson River National Estuarine Research Reserve's (HRNERR) 2011 comprehensive Hudson River tidal wetland inventory. A more detailed breakdown of Rhinebeck's tidal wetland types from HRNERR can be viewed using the Hudson Valley Natural Resource Mapper. Notable concentrations of tidal wetlands can be found in Vanderburgh Cove and in two other coves to the north. All of these wetlands are bounded by a railroad and the associated causeway to the west.

The 2007 Hudsonia habitat map for Rhinebeck identifies and describes examples of freshwater tidal marsh and swamp, as well as tidal tributary mouth habitat. About 128 acres of tidal wetlands were mapped in Rhinebeck, predominantly tidal marsh. The largest tidal wetland is in Vanderburgh Cove and extends approximately 35 acres. Tidal mudflat habitats are also likely present but were not mapped owing to difficulty of confirming their presence at low tide. Tidal tributary mouths were mapped in four locations, the two largest of which were at the mouths of the Landsman Kill and Fallsburg Creek. The

[114] "Mitigating Climate Change through Coastal Ecosystem Management." The Blue Carbon Initiative. https://www.thebluecarboninitiative.org/

study also documented estuarine rocky shore and four examples of Hudson River rocky island habitats.

Significant Coastal Fish and Wildlife Habitats
Diverse coastal habitats occur in New York, providing critical habitat and feeding areas for animals as well as economic values to communities. The DEC has identified and evaluated coastal habitats throughout the state's coastal regions, contributing recommendations to the NYS Department of State (DOS) so that the most important or "significant" habitats may be designated for protection in accordance with the Waterfront Revitalization and Coastal Resources Act. The Significant Coastal Fish and Wildlife Habitats describe the highest quality habitats on the Hudson, outlining fish and wildlife values and activities that may have large impacts on the habitats. State and federal law requires that some projects may be reviewed for consistency with coastal policies on significant fish and wildlife habitat.

There are three designated habitats in the portion of the estuary within Rhinebeck:

- Kingston-Poughkeepsie Deepwater
  This area includes nearly 6,400 acres along 25 miles of the Hudson River, from the Towns of Wappinger in the south to Rhinebeck in the north. Near continuous depths of 20-50+ feet provide *"one of the largest and most well-known spawning areas for Atlantic Sturgeon and overwintering areas for shortnose sturgeon in the Hudson River."*

- Vanderburgh Cove and Shallows
  This area includes about 600 acres of shallows and tidal marsh that straddle the Towns of Hyde Park and Rhinebeck. Habitats include those found in Vanderburgh and Suckley Coves, as well as tidal shallows on the west side of an active rail line that bisects the area. *"Vanderburgh Cove and Shallows represents one of the most southern occurrences of a large vegetated freshwater shallow in the Hudson River, which is a critical habitat for many fish species. The shallow submerged aquatic vegetation beds in the Vanderburgh Cove habitat provide spawning, nursery, and feeding habitats for coastal migratory and resident freshwater species…"*

- The Flats
  This area includes nearly 1,400 acres of Hudson River shallow, tidal, freshwater flats and undisturbed deepwater channel habitats, from the Town of Rhinebeck in the south to Red Hook in the north. The flats are *"...primary Hudson River spawning grounds for American shad…"* and also serve as important nursery and feeding habitat for migratory and resident wildlife. *"The abundant fisheries and waterfowl resources in this area provide excellent outdoor recreational opportunities, attracting anglers and hunters through the region."*

Documented Submerged Aquatic Vegetation (SAV) Habitat
Submerged Aquatic Vegetation (SAV) is a term for plants that grow underwater. SAV improves water quality by trapping fine sediment and organic matter and adding oxygen to the water. It also provides

essential habitat for organisms like insects, worms, and snails that feed fish and birds in the estuary. Native species of SAV in the Hudson, such as water celery, currently compete for habitat with invasive, non-native water chestnut. Water chestnut does not provide the same water quality benefit as native SAV because its floating leaves release oxygen into the air rather than into the water. The Coastal Habitats Map shows all areas where SAV has been found since 1997. Historic flooding from Hurricane Irene and Tropical Storm Lee in 2011 buried SAV beds with sediment throughout the estuary, including in Rhinebeck. Even if SAV is not present today, these areas could support it in the future.

Significant Natural Communities

The New York Natural Heritage Program (NYNHP) has mapped two occurrences of rare and/or high-quality tidal wetland communities in Rhinebeck. They include:

- Freshwater Tidal Marsh
  These habitats can be found in Vanderburgh Cove. The New York Natural Heritage Program describes the Vanderburg Cove tidal marsh habitat as an exceptionally large, biologically-rich and variable community, largely buffered from negative impacts by adjacent natural land cover. This marsh would benefit from more ecologically-minded management of the rail corridor that bisects these habitats.

- Freshwater Intertidal Mudflats
  The New York Natural Heritage Program describes this habitat as an exceptionally large, biologically-rich and variable mudflat community, largely buffered from negative impacts by adjacent natural land cover. Maintaining these natural lands are critical to maintaining the stability of this habitat over time.

Children exploring the petroglyph rock at the cove at Wilderstein, with tidal marsh and railroad tracks in the background, 2022 by Vanessa Bertozzi

Important Area for Migratory Fish

The Landsman Kill and Fallsburg Creek likely provide habitat for migratory American eel and herring species based on records from DEC Bureau of Fisheries data and an aquatic habitat connectivity study by NYNHP[115]. Many Hudson River tributaries comprise migratory routes for American eel, a fish species that begins life in the Atlantic Ocean and migrates to the headwaters of North American tributary streams as tiny "glass eels." The American eel is in decline throughout much

[115] *New York Freshwater Blueprint.* New York Natural Heritage Program. www.nynhp.org/FBP

of its range, and though eels are able to bypass certain dams, culverts, and other aquatic barriers, they rely on aquatic connectivity along streams to complete their life cycle and return to the sea to spawn. In addition, some stream reaches closest to the Hudson might provide spawning habitat for alewife and blueback herring, and shallow subtidal areas of the Hudson, especially 'The Flats' NYSDOS Significant Coastal Fish and Wildlife Habitat, serve as spawning sites for American shad.

Tidal Wetland Pathways

The Hudson River Estuary is connected to the Atlantic Ocean and affected by sea level rise (SLR) due to climate change. The Hudson has already risen by one foot since 1900 and is likely to rise an additional three to six feet due to SLR by 2100 (see Sea Level Rise Scenarios Map).[2] Such a rapid change in water levels threatens waterfront development and infrastructure as well as the future of tidal wetlands. Tidal wetlands along the Hudson River will disappear with SLR unless they can build up in place or move to higher ground. However, wetlands bordered by steep shorelines or existing development may have no place to go. Potential tidal wetland loss threatens the health of the entire estuary. A recent study by Scenic Hudson shows areas along the Hudson most likely to support tidal wetlands in the future as sea level rises.[116] For more information on this study and to view forecasted marsh migration across the Estuary, you can visit Scenic Hudson's project website: Protecting the Pathways

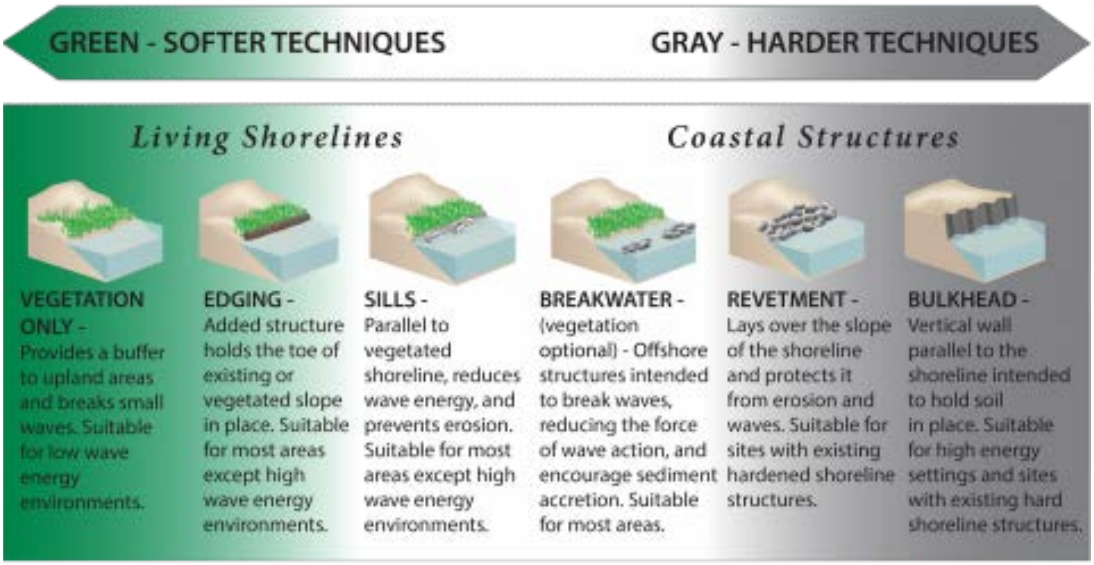


Figure 7. *A continuum of green to gray shoreline stabilization techniques, including soft (green), hybrid, and hard (gray) armoring techniques. Source: NOAA 2015; modified from SAGE 2015.*

[116] Tabak, N., M. Laba, and S. Spector, "Simulating the Effects of Sea Level Rise on the Resilience and Migration of Tidal Wetlands along the Hudson River," PLoS ONE 11(4), e0152437. doi:10.1371/journal.pone.0152437. 2017. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0152437

There are opportunities to conserve, restore, and manage shoreline habitats throughout the Rhinebeck and Rhinecliff waterfront areas. Parks, preserves, and regulated wetlands may offer a starting point to conserve or restore natural shorelines that will allow tidal wetlands to move with sea level rise. Even along working waterfronts there are ways to improve the habitat value of bulkheads and rip-rap revetments. The Hudson River Sustainable Shorelines Project provides information and tools on enhancing the ecology of built shorelines as well as how to conserve natural shorelines.[117]

Hudson River shoreline type

Tidal shorelines comprise lands directly on the Hudson River as well as the shorelines of tidal wetlands, tidal tributaries, and coves, including both naturally vegetated and hard engineered shoreline. This layer shows general shoreline type according to a 2005 inventory of Hudson River shoreline status by DEC and the Hudson River National Estuarine Research Reserve.

Rhinecliff Waterfront by Bill Peckmann

Discussion

The portion of Rhinebeck within or adjacent to the Hudson River has numerous documented important habitats. Areas of particular importance include significant natural communities (e.g. Vanderburgh Cove), documented migratory fish runs (e.g. Landsman Kill), and significant coastal fish and wildlife habitat (e.g. The Flats). Modeled tidal wetland pathways adjacent to Fallsburg Creek and those immediately along the Hudson, are vulnerable to development and other alteration. The Hudson River adjacent portions of the railroad causeway, maintained by CSX, are particularly vulnerable to damage

[117] "Hudson River Sustainable Shorelines Project." Hudson River National Estuarine Research Reserve. www.hrnerr.org/hudson-river-sustainable-shorelines/

from sea level rise. Many of these habitats are somewhat protected by state and municipal regulation (see **Wetlands** section) but opportunities exist to expand these protections to sensitive coastal areas.

Striped bass is an ecologically, recreationally, and economically important species of migratory fish that is found in the Hudson River. Adults spend most of their time in coastal waters and return to the fresh water of the Hudson River each spring to spawn before returning back to the Atlantic Ocean. DOS Significant Coastal Fish and Wildlife Habitats found in the Town (i.e. The Flats, Vanderburgh Cove and Shallows, and Kingston-Poughkeepsie Deepwater) are important nursery grounds for the newly hatched young-of-year bass, and in early fall they begin moving out of the estuary into near shore coastal areas.

The Town has been recently exploring the possibility of designating Vanderburgh Cove and some adjacent areas as a Critical Environmental Area (CEA); a designation under the State Environmental Quality Review Act that draws attention to key features during some types of planning board review. To the south, Hyde Park has already designated their portion of Vanderburgh Cove as a CEA.[118]

[118] Policy Aoption Fact Sheet: CEA Declaration for Vanderbugh Cove. 2020. https://static1.squarespace.com/static/5dce06ccb3f78e19d84921e6/t/5fc6aa543c6ccf69f34aea30/1606855254704/CEA+for+Vanderburgh+Cove.pdf

Town of Rhinebeck

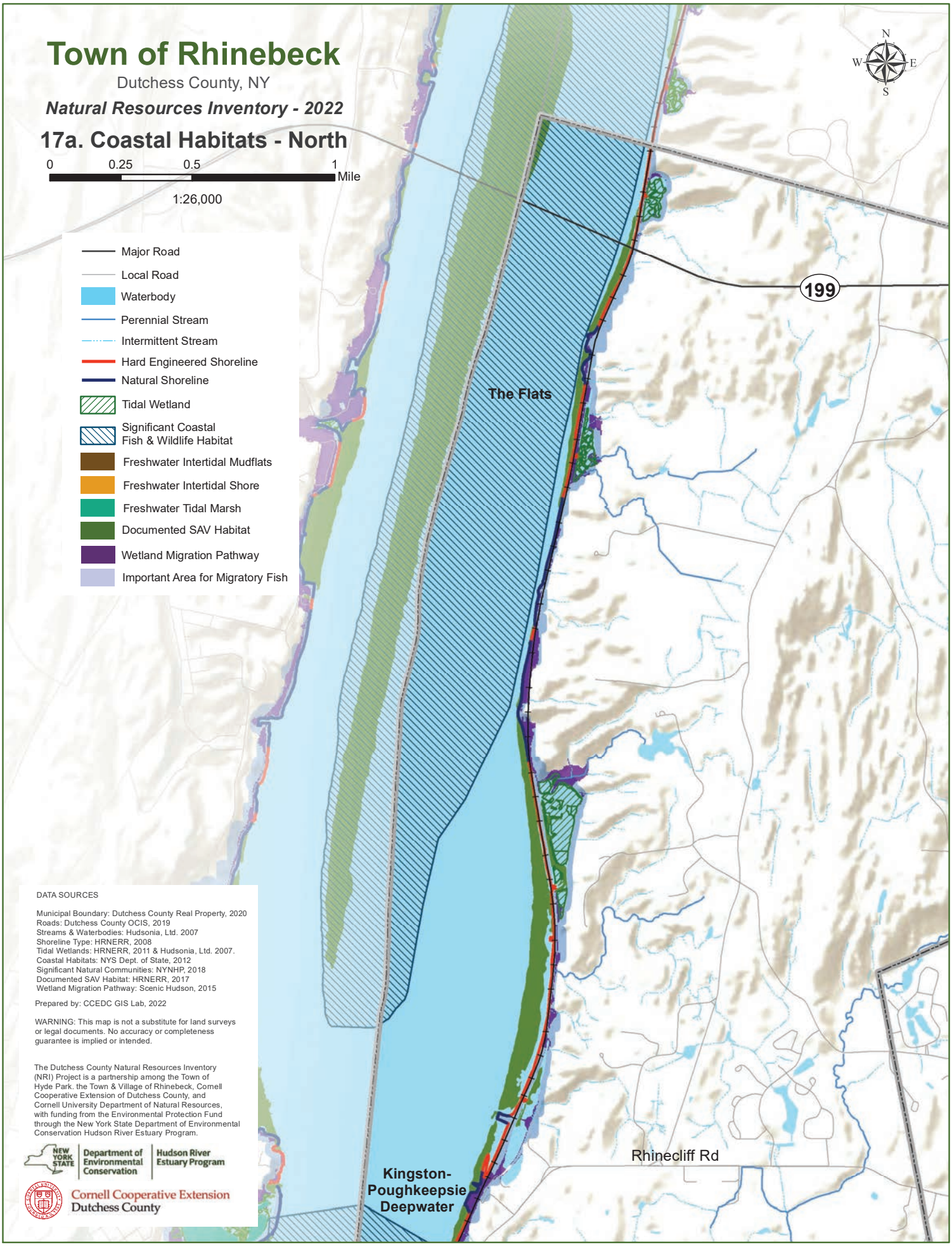
Dutchess County, NY

Natural Resources Inventory - 2022

17a. Coastal Habitats - North

0 0.25 0.5 1 Mile

1:26,000



- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Hard Engineered Shoreline
- Natural Shoreline
- Tidal Wetland
- Significant Coastal Fish & Wildlife Habitat
- Freshwater Intertidal Mudflats
- Freshwater Intertidal Shore
- Freshwater Tidal Marsh
- Documented SAV Habitat
- Wetland Migration Pathway
- Important Area for Migratory Fish

DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Shoreline Type: HRNERR, 2008
Tidal Wetlands: HRNERR, 2011 & Hudsonia, Ltd. 2007.
Coastal Habitats: NYS Dept. of State, 2012
Significant Natural Communities: NYNHP, 2018
Documented SAV Habitat: HRNERR, 2017
Wetland Migration Pathway: Scenic Hudson, 2015

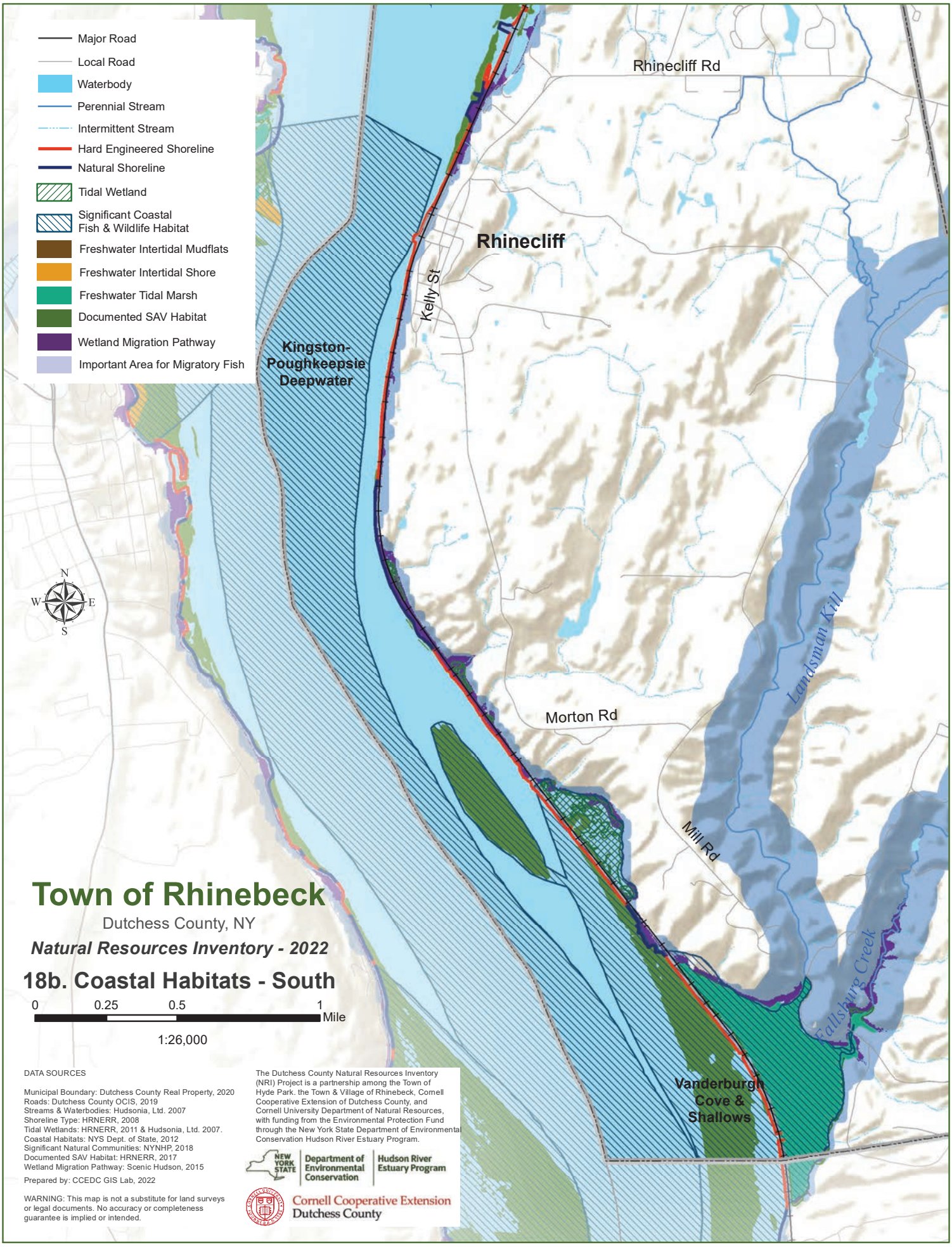
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County



Town of Rhinebeck

Dutchess County, NY

Natural Resources Inventory - 2022

18b. Coastal Habitats - South

0 0.25 0.5 1 Mile

1:26,000

DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Shoreline Type: HRNERR, 2008
Tidal Wetlands: HRNERR, 2011 & Hudsonia, Ltd. 2007.
Coastal Habitats: NYS Dept. of State, 2012
Significant Natural Communities: NYNHP, 2018
Documented SAV Habitat: HRNERR, 2017
Wetland Migration Pathway: Scenic Hudson, 2015

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Large Forests (Map 18a) and Forests and Street Trees (18b)

> According the Village's 2019 street tree inventory, **26%** of their street trees are either **Norway or sugar maples.** Best practices suggest no one genera should make up over 20% of an urban forest.

Forests provide numerous benefits including wildlife habitat, clean water, climate moderation, and forest products. Though each forest's value is relative to the surrounding landscape, in general, larger forests provide higher quality habitat and greater benefits than smaller ones. Over time, many large forests in the Town have been divided into smaller forest patches through the process of fragmentation. Forest fragmentation often occurs through clearing for new roads or development and is linked to decreased habitat quality and health, disruptions in wildlife movement, and the spread of invasive species. These impacts are greatest at forest edges but can extend for hundreds of feet into forest patches, often displacing sensitive species that depend on interior forest. **Figure 8** illustrates what happens when a forest is fragmented. After fragmentation occurs, interior habitat, or forest cores, are unable to support the same diversity of species because of the loss of core habitat.

Forest Condition Index

Forests vary in their ability to support native species and withstand or recover from external stressors such as fragmentation, severe storms, and invasive species. The Hudson Valley Forest Condition Index maps and prioritizes forest patches based on a variety of metrics relating to ecosystem health or integrity. Large forest patches in the estuary watershed were first identified through a landscape fragmentation analysis using forested and other woody land cover classes from the 2016 National Land Cover Database. The resulting areas represent continuous patches of forest unfragmented by major roads, railroads, and non-forest habitat, with a minimum patch size of 100 acres. The forest patches were then scored for 22 metrics related to forest condition, connectivity, stress, habitat, and other ecosystem values. These component metrics were summed to create the index and ranked according to percentile of all forest patches in the estuary watershed.[119]

Core Forests

Core forests are interior forest areas surrounded by at least a 100-meter-wide buffer of edge forest habitat. These interior forest areas support a unique array of plants and animals that are easily disturbed by human activity generally associated with more open habitats (e.g., agricultural fields, meadow, roads and developed areas). Core forest is especially important for sensitive wildlife including many forest songbirds, which avoid nesting near areas with human disturbance. Although the value of individual forest patches for wildlife depends on landscape context and other factors, core forests that are at least

[119] Conley, A. K., E. Cheadle, and T. G. Howard. *Updating Forest Patches and a Patch Assessment for the Hudson Valley.* New York Natural Heritage Program, State University of New York College of Environmental Science and Forestry, 2019, Albany, NY. www.nynhp.org/forest-patches

500 acres in size are more likely to provide enough suitable habitat to support a diversity of interior forest species. Core forests were mapped using the large forest patches identified for the Forest Condition Index, described above. Avoiding further fragmentation of core forests will help conserve the integrity and habitat value of ecologically significant forest patches. By guiding development toward the edges of forest patches, fragmentation of these resources can be limited, and vital benefits can be maintained. The highest quality forests are good candidates for protection or other municipal conservation efforts.

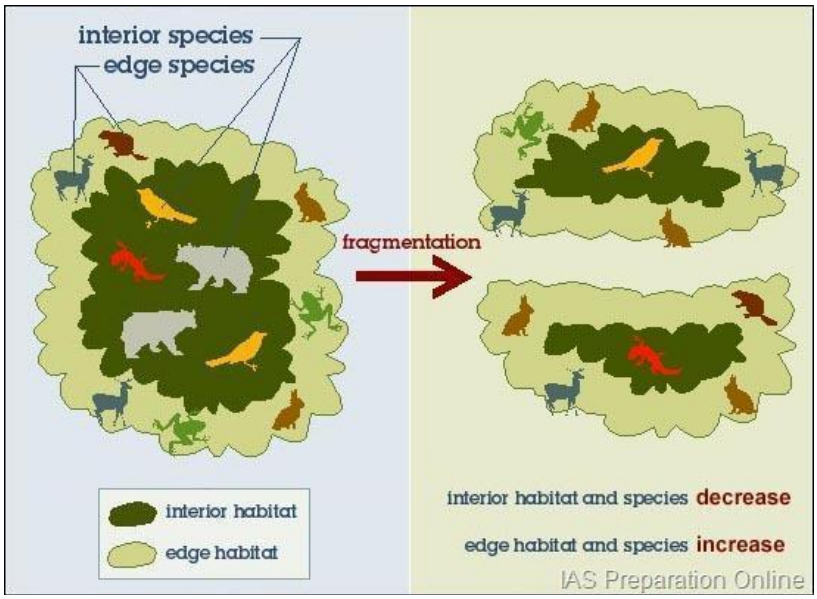


Figure 8. *The Effect of Forest Fragmentation on Species Diversity*

Forest Habitats

In 2007, Hudsonia Ltd. produced *Significant Habitats in the Town of Rhinebeck, Dutchess County, NY*, which included detailed mapping of habitats based on interpretation of aerial photographs and field surveys. **Forests** identified in this report were included in the Village's Forests and Street Trees map as a single feature, with more detailed classification of specific habitat types in the Town and Village's Significant Habitat maps.

The Village has the following forest habitats:	The Town has the following forest habitats:
● forest and shrub swamp ● upland hardwood forest ● upland mixed forest	● forest and shrub swamp ● mixed forest swamp ● conifer swamp ● freshwater tidal swamp ● upland hardwood forest ● upland mixed forest ● upland conifer forest ● oak heath barren ● red cedar woodland

Village Street Trees

Oak Tree Canopy at Night by Dan Shapley

The locations and sizes of Village street trees, shown on Map 18b, were documented by certified arborists from the Davey Resource Group (DRG). This street tree inventory was a project of the Village Tree Committee and the Board of Trustees, funded by the Frost Memorial Fund, and is the first step in reaching an understanding of the needs of the existing 'urban forest' and the development of a recommended schedule for tree care. A street tree management plan, based on the findings of the inventory and the needs and resources of the Village, will guide the maintenance of the Village's urban forest and enhance applications for NYS DEC Urban and Community Forestry Grants. This funding is intended to assist communities as they develop and implement projects that aim to create and maintain healthy forests for people and the environment.

The map shows trees greater than 1 foot in diameter at breast height (DBH). Although this map is a snapshot of the Village urban forest at the time of the survey, DRG created an online interactive mapper that will allow the Tree Committee to update the data as trees are planted, removed, treated or pruned. In the current data set, each tree has been identified by GIS location, species, diameter, and condition.

Forest Health

Beyond fragmentation, the greatest threats to forests in Rhinebeck today are from overabundant deer and the introduction of tree diseases, forest pests, and other invasive species. The Lower Hudson PRISM works to promote education, prevention, early detection, and control of invasive species and is helping communities to prepare for and respond to these threats. Guiding future development to minimize forest fragmentation will help avoid the spread of invasive species into interior forests and conserve important habitats in Rhinebeck.

Discussion

Rhinebeck has many large forests, with some ranking in the top 10% of all Hudson Valley forests in overall condition. The highest ranked forests are generally in the southern and eastern portions of Town, where they intersect with a mapped Forest Linkage Zone (See **Landscape Context**) that serves as a wildlife corridor between the large forests of the Catskill and Shawangunk Mountains with New England. The highest ranked forest (Top 6% in Hudson Valley) in the Town is to the west of Wurtemburg Road, in the southeastern corner of Town, and the highest ranked forest in the Village is west of Wynkoop Lane.

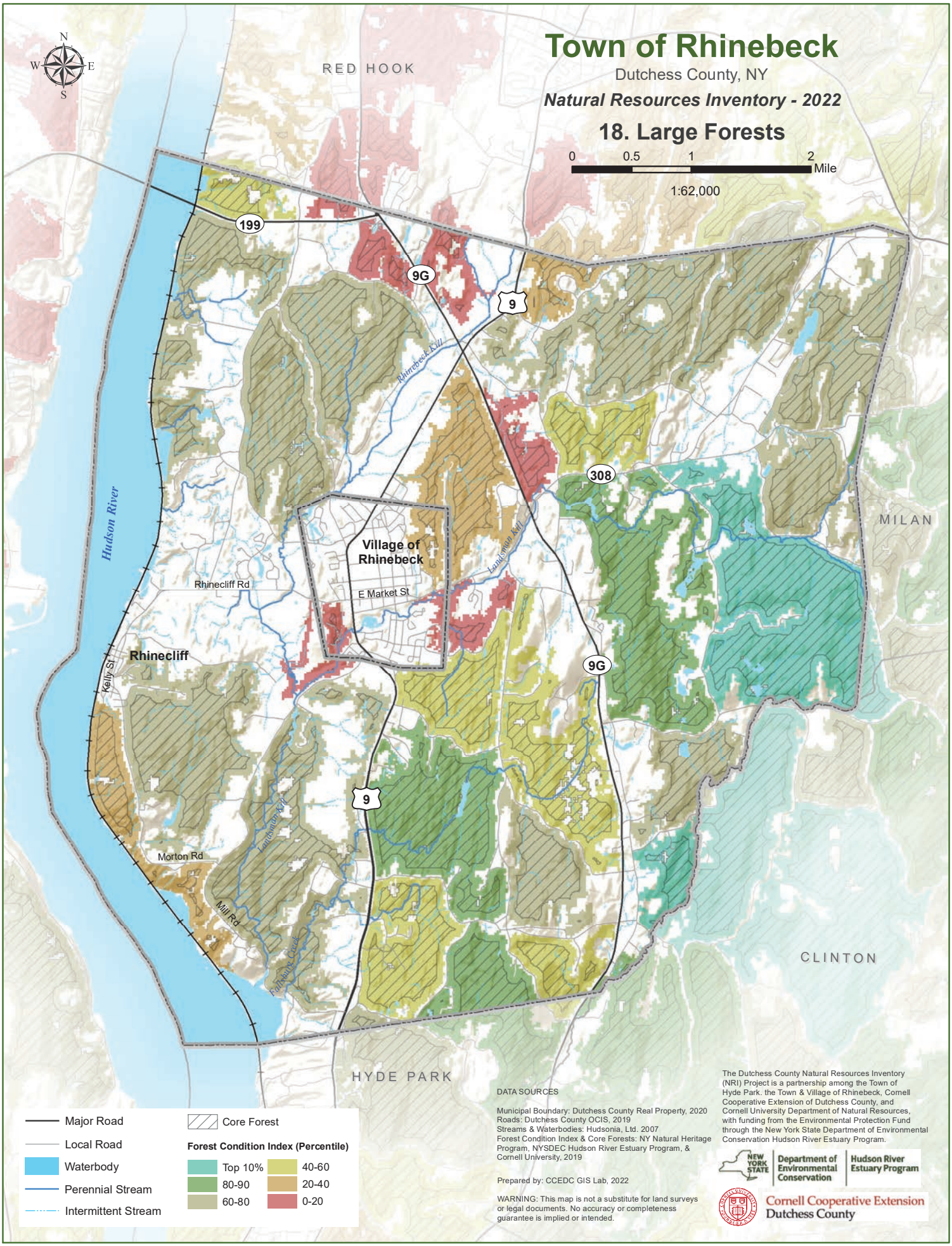
Large forests within the Village are along the perimeter of the municipality and are generally of lower quality than those within the Town. Trees and forests are still important in more densely settled areas, however, their benefits are generally seen through the lens of human needs (e.g. local climate moderation, air filtration, noise dampening, and improved aesthetics). The fragmentation of forest patches in and around densely settled areas like the Village seems almost inevitable and most planning professionals and environmentalists recommend that it is better to increase development within an established urban area than to promote the development of large, separated lots in the surrounding countryside. However, historical sources and aerial photographs of the Village reveal forest patches have actually become more widespread during the last century or more, largely a result of formally agricultural lands reverting to forest.

In 2009, the Village began regulating trees under Chapter 106 of its municipal code. This ordinance created a tree commission that has since been working to improve the number and quality of trees within the Village, principally along the rights-of-way but also in its parks and other public spaces, like the land around the Starr Library and, as recommended in the 1993 Village Masterplan, at the entrances to the Village. Working with the Town Highway Department and the Village Board of Trustees, this commission has organized groups of volunteers to plant trees each spring and fall along Village streets, and, with permission or at the request of the owner, on immediately adjacent private property. They also organize volunteers to prune younger trees, publish information on planting, pruning, fertilization and recognition of pests on the Village website, organize Arbor Day celebrations, and assist in the municipal land use review process. Since the establishment of the commission and the institution and annual funding of these programs, the Village earned the title of Tree City in 2010 and has maintained it ever since. The Tree Commission has been tasked with developing a tree inventory and management plan, increasing the percentage of canopy cover within the Village, creating a list of trees appropriate for planting, and to developing annual goals for pruning and removal of dead, dangerous or hazardous trees and tree limbs within the Village. The inventory has been completed and work has begun on achieving the other identified goals.

In 2009, the Town of Rhinebeck amended Section 125-59 of the Town zoning law, to require applicants before the planning board to complete a site resource analysis assessment for proposals that require any subdivision of land. This procedure protects important biodiversity by highlighting important habitats, including forests, as identified by the 2007 Hudsonia report titled *Significant Habitats in the Town of Rhinebeck*, and other natural and historic resources for planning board consideration. Section 125-59's intent is to *"...incorporate, where appropriate, habitat assessments into the decision-making of all Town boards charged with approval of actions under SEQRA."* The Planning Board routinely requires habitat assessments for projects having the potential to impact natural resources and habitats, identify appropriate mitigation measures if possible, or deny the application if the impacts cannot be adequately mitigated. For more information see **Appendix B**.

Land acquisition (i.e. conservation easements and parkland), through partnerships with local land trusts and government ardencies, is an important forest protection strategy. Landowners can also take an active

role in reforestation or invasive species management to increase the quality and quantity of forests in Rhinebeck. For more information on other conservation and regulatory strategies, refer to *A Municipal Official's Guide to Forestry in New York State*.



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Forest Condition Index & Core Forests: NY Natural Heritage Program, NYSDEC Hudson River Estuary Program, & Cornell University, 2019

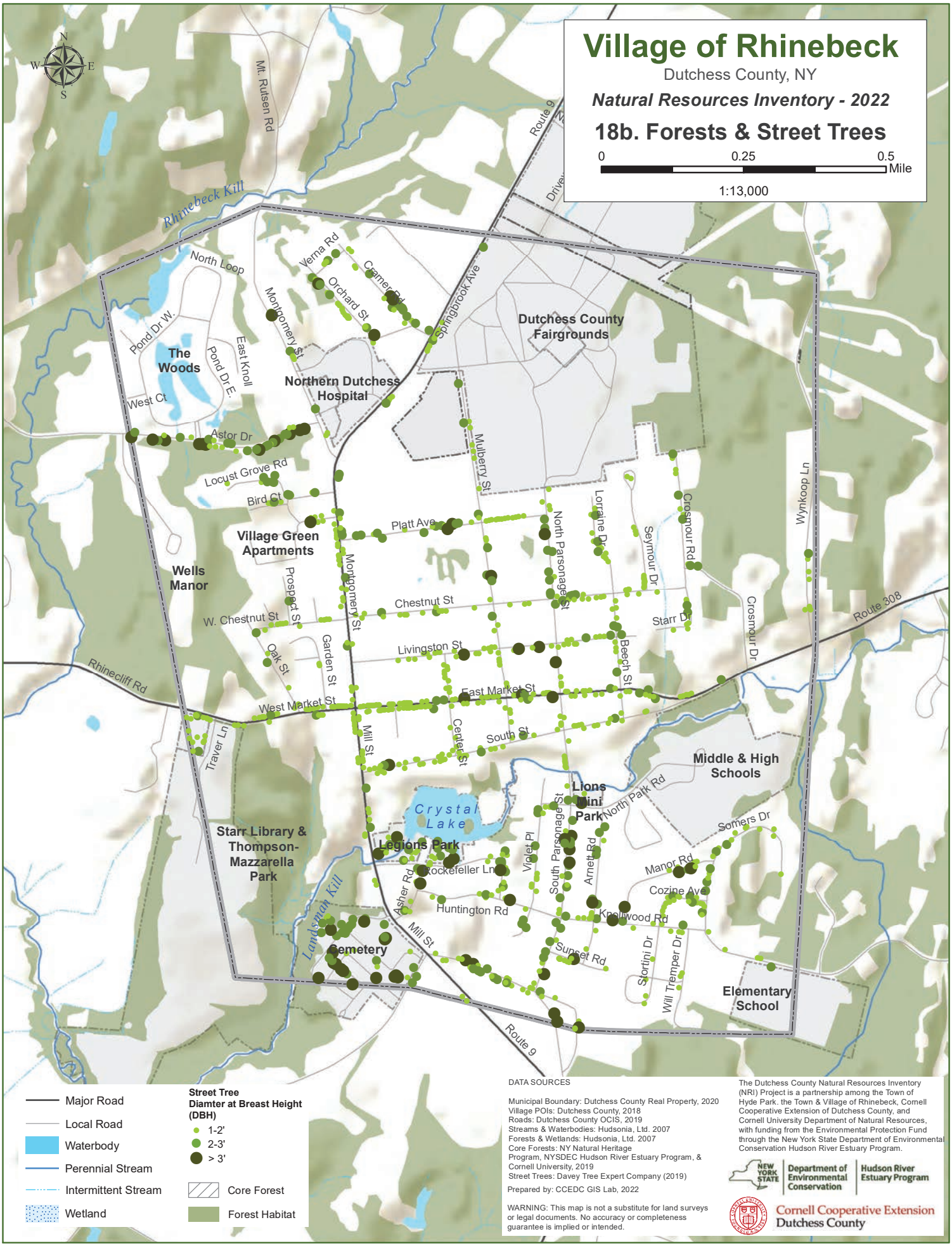
Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County


Village of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
18b. Forests & Street Trees
0
0.25
0.5
Mile
1:13,000
N
S
E
W
Rhinebeck Kill
Mt. Rutsen Rd
Route 9
North Loop
Verna Rd
Orchard St
Cramer Rd
Springbrook Ave
Dutchess County Fairgrounds
Pond Dr W.
Pond Dr E.
East Knoll
The Woods
Montgomery St
Northern Dutchess Hospital
West Ct
Astor Dr
Locust Grove Rd
Bird Ct
Mulberry St
Wynkoop Ln
Platt Ave
Village Green Apartments
Wells Manor
Prospect St
Montgomery St
North Parsonage St
Lorraine Dr
Seymour Dr
Crosmour Rd
Chestnut St
W. Chestnut St
Starr Dr
Crosmour Dr
Route 308
Oak St
Garden St
Livingston St
Beech St
Rhinecliff Rd
East Market St
West Market St
Traver Ln
Mill St
Center St
South St
Middle & High Schools
Lions Mini Park
North Park Rd
Crystal Lake
Somers Dr
South Parsonage St
Violet Pl
Arnett Rd
Starr Library & Thompson-Mazzarella Park
Legions Park
Rockefeller Ln
Manor Rd
Cozine Ave
Asher Rd
Huntington Rd
Knollwood Rd
Landsman Kill
Mill St
Cemetery
Sunset Rd
Sfortini Dr
Will Tremper Dr
Elementary School
Route 9
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Wetland
Street Tree Diamter at Breast Height (DBH)
1-2'
2-3'
> 3'
Core Forest
Forest Habitat
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Village POIs: Dutchess County, 2018
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Forests & Wetlands: Hudsonia, Ltd. 2007
Core Forests: NY Natural Heritage Program, NYSDEC Hudson River Estuary Program, & Cornell University, 2019
Street Trees: Davey Tree Expert Company (2019)
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE
Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension
Dutchess County

Meadows, Grasslands, and Shrublands (Map 19)

Pollinators at Work by Sue Sie

Recently disturbed sites, such as hayfields, abandoned farm fields, and forest clearings, can provide important habitat for species that require meadow, grassland, shrubland, and young forest habitats. Grassland and meadow habitat can support a variety of life, including rare plants, butterflies, reptiles, and birds, in addition to providing agricultural uses and scenic vistas. They can occur in recently cleared areas and abandoned farmland and are sometimes maintained along utility corridors by cutting or herbicides. These habitats are important for many wildlife species declining throughout the region because former agricultural areas have grown into forests and natural forest disturbances that maintain non-forest habitats, such as fire, have been suppressed.

The Meadows, Grasslands, and Shrublands Map shows patches of open habitat in shades of green:

- < 10 acres
- 10-50 acres
- > 50 acres

The layer was created using Hudsonia's habitat map, developed in 2007. Habitat types include upland meadow, wet meadow, calcareous wet meadow, and wet clay meadow (See the **Significant Habitats** section for more information). Note that edge habitats adjacent to roads, forests, and hedgerows can have detrimental effects on grassland and shrubland bird breeding success and raptor prey populations[120] but clusters of smaller open habitat patches can still offer many of the benefits of larger contiguous patches. Given the ephemeral nature of these successional habitats, additional verification is needed to determine habitat values for grassland, shrubland, and meadow dependent plants and wildlife. There may be local opportunities for protection, restoration, or management to benefit these species.

The 2000-2005 NYS Breeding Bird Atlas documented breeding by:

- **five (5) grassland/meadow** bird species of conservation concern in the Rhinebeck area, including Species of Greatest Conservation Need such as American kestrel, bobolink, eastern meadowlark, savannah sparrow, and grasshopper sparrow (NY-Special Concern).

[120] Strong, K., R. VanSchaack, and I. Haeckel. *Greene County Grassland Habitat Management Plan*. Greene County Soil and Water Conservation District and Greene County Habitat Advisory Committee. 82 pp. 2014, Cairo, NY.

- **Thirteen (13) shrubland** bird species of conservation concern in the Rhinebeck area, including Species of Greatest Conservation Need such as brown thrasher (high priority), black-billed cuckoo, blue-winged warbler, American woodcock, ruffed grouse, and prairie warbler.

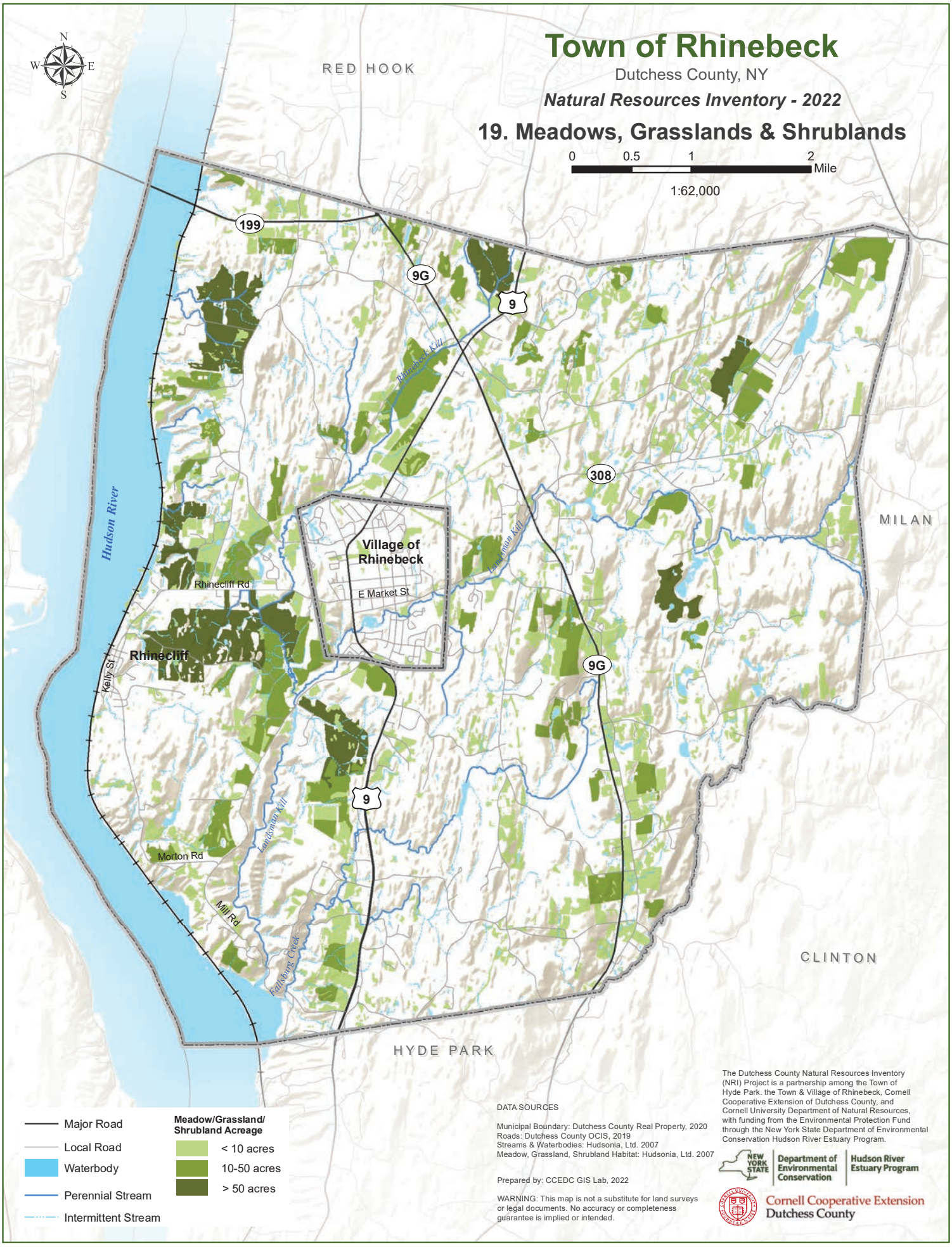
The quantity and quality of grasslands for wildlife have rapidly decreased in the Northeast during the last century due to increased human population, changes in agricultural technology, and abandonment of family farms. Grassland, shrubland, and meadow habitats are transitional and relatively short-lived. They typically require periodic maintenance (e.g. mowing, grazing, flooding, or burning) to avoid becoming more densely vegetated and eventually becoming forest. This continuing trend threatens species of birds that have adapted to the agricultural landscape.

Discussion

Upland meadow is the second most common habitat in Rhinebeck after forest, accounting for 19% of the total land area. The largest patches of Rhinebeck's grassland, shrubland, and meadow habitat occur to the west of Route 9, in close proximity to the Hudson River, but smaller assemblages can be found across the entire Town. Conservation of farmland, especially hay and pasture, is the best strategy to protect this grassland and meadow habitat on a large scale. Winnakee Land Trust maintains grassland habitat on their Drayton Grant Park at Burger Hill by scheduling haying before and after grassland breeding bird nesting season and by staggering the areas cut in a given year to provide refuge for meadow wildlife. For more information on best practices for meadow management for grassland breeding birds, see Audubon New York's Managing Habitat for Grassland Breeding Birds website. For more information on best practices for shrubland management for grassland breeding birds, see Audubon New York's Managing Habitat for Shrubland and Young Forest Birds website. The protection of current and former agricultural lands through conservation easements and direction acquisition can also protect these habitats and the species that rely on them.

Local conservationists have been organizing small-scale native meadow plantings as a part of the Pollinator Pathway project. Efforts are planned for the Town Park and will include outreach to private landowners to encourage restoration of their properties, both large and small[121].

[121] Climate Smart Rhinebeck's Pollinator Pathways website: https://www.climatesmartrhinebeck.org/pollinators

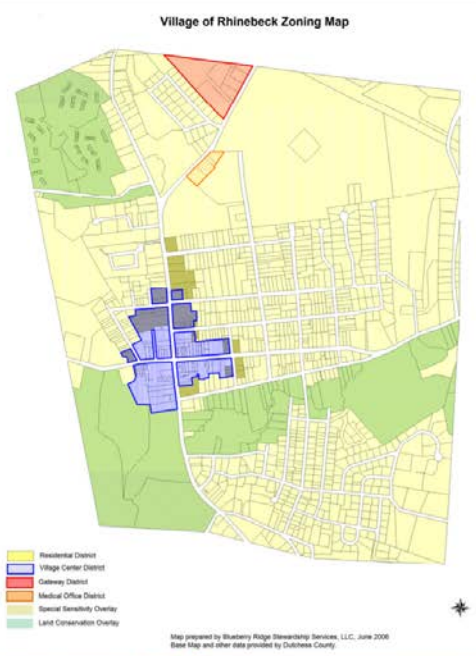

Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
19. Meadows, Grasslands & Shrublands
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
Hudson River
Village of Rhinebeck
Rhinecliff
Rhinecliff Rd
E Market St
Kelly St
Morton Rd
Mill Rd
Landsman Kill
Fallsburg Creek
199
9G
9
308
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Meadow/Grassland/ Shrubland Acreage
< 10 acres
10-50 acres
> 50 acres
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Meadow, Grassland, Shrubland Habitat: Hudsonia, Ltd. 2007
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Section 6: Land Use

Zoning (No Map)

> *"The power to enact local laws [including zoning] is granted by the State Constitution. The scope of this power and the procedures for implementing it are set out in the* ***Municipal Home Rule Law****. A local law has the same status as an act of the State Legislature."*
>
> - *NYS Department of State*

Cities, towns and villages in New York State are authorized by state statutes (called "zoning enabling laws") to regulate the use of land by enacting what is commonly referred to as "zoning." Zoning governs the way land in a municipality is used and developed. Its goal is to carry out the municipality's long-range land use objectives. Zoning regulates the uses to which property may be devoted, the siting of development on land, and the density of development on property. Parcels within overlay zoning districts are still subject to all of the underlying provisions of the district, along with the following additional restrictions. Typically, zoning laws divide the community into land use districts and establish building restrictions regarding building height, lot area coverage, the dimension of structures, and other aspects of building and land use. New York is a "home rule" state and municipalities have the choice of whether to implement zoning.



Note: The Village of Rhinebeck Zoning Map does not show the Historic District Overlay

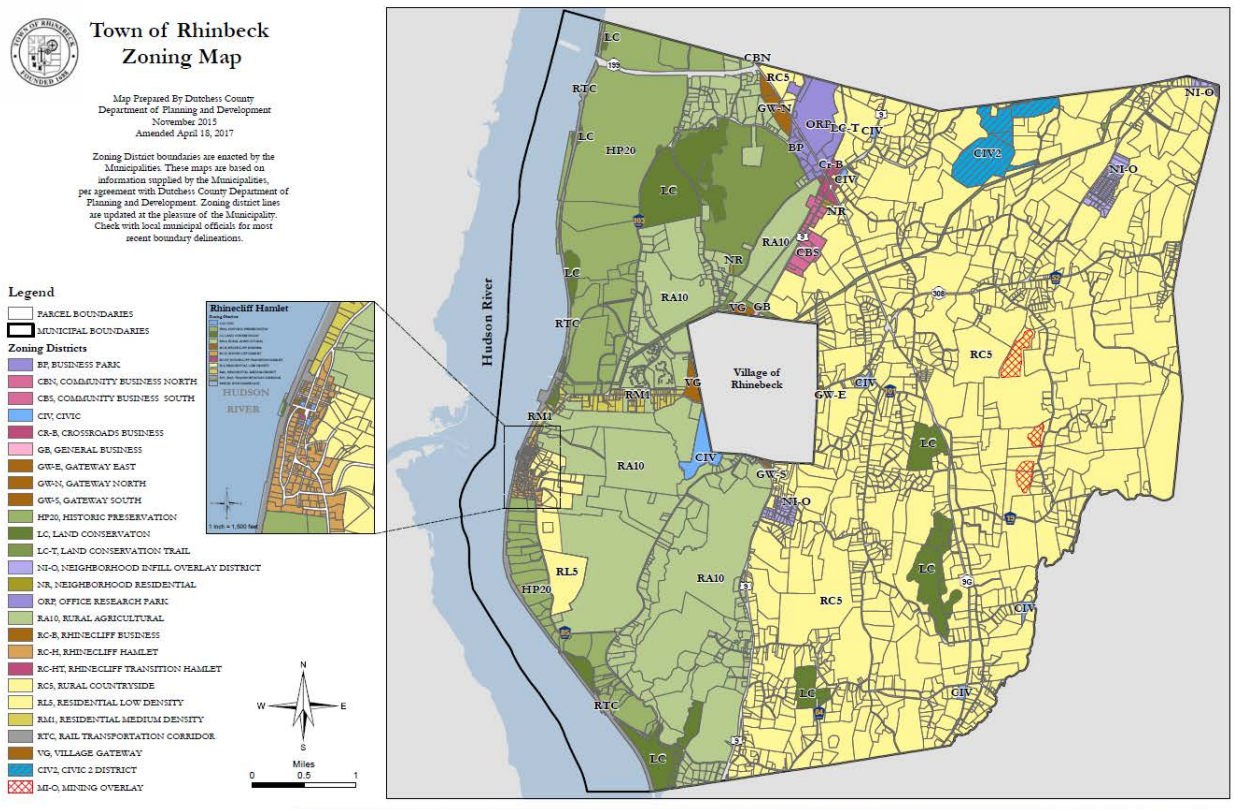


Table 9. *Town of Rhinebeck Zoning Districts*

Town Zoning District	**Abbreviation**
Business Park	BP
Community Business North	CBN
Community Business South	CBS
Civic	CIV

Town Zoning District	Abbreviation
Crossroads Business	CR-B
General Business	GB
Gateway East	GW-E
Gateway North	GW-N
Gateway South	GW-S
Historic Preservation	HP20
Land Conservation	LC
Land Conservation - Streams	LC-S
Land Conservation - Trails	LC-T
Neighborhood Residential	NR
Office Research Park	ORP
Rural Agricultural	RA10
Rhinecliff Business	Rc-B
Rhinecliff Hamlet	Rc-H

Town Zoning District	**Abbreviation**
Rhinecliff Transition Hamlet	Rc-HT
Rural Countryside	RC5
Residential Low Density	RL5
Residential Medium Density	RM1
Rail Transportation Corridor	RTC
Village Gateway	VG
Utility Corridor	UC
Civic District	CIV
Civic 2 District	CIV2
Overlay Districts	**Abbreviation**
Mining Overlay	MI-O
Rhinecliff Overlay	Rc-O
Neighborhood Infill Overlay District	NI-O
Water Resources Protection Overlay	WR-O

Town Zoning District	Abbreviation
Flood Fringe Overlay	FF-O
Floating Districts	
Active Senior Housing	ASH-F
Workforce Housing District	WH-F

Table 10. *Village of Rhinebeck Zoning Districts*

Village Zoning Districts	Abbreviation
Residential Districts	RD
Village Center District	VC
Medical Office District	MO
Special Sensitivity Overlay	SSO
Land Conservation Overlay	LCO

Discussion

Examining the zoning map and tax parcels in relation to other maps of the Natural Resources Inventory can provide insight into potential development scenarios which could affect the existing natural resource base, ecology, and other significant features.

Zoning districts in the Town with specific natural resources protection include:

- **Land Conservation**

  This district is intended to provide for conservation of natural and cultural resources, open space, agriculture, forestry and limited recreational use of the Town's most ecologically sensitive lands, including those most closely related to the principal watercourses and wetlands throughout the Town.

- **Land Conservation - Trails**

  This district is intended to provide for conservation, open space and eventual public recreational use of the former Hucklebush rail corridor as shown on the Zoning Map. Winnakee Land Trust started planning a trail along the old Hucklebush rail line, but many of the property owners were not in favor of the trail so no further action has been taken.

- **Land Conservation-Streams**

  The Land Conservation - Streams (LC-S) District is intended to provide for conservation of water resources, which represent some of the most sensitive environmental features found in the Town.

- **Flood Fringe Overlay**

  The Flood Fringe Overlay (FF-O) District encompasses those lands designated by the Federal Emergency Management Agency (FEMA) as a floodplain area with special flood hazards that has a one-percent chance of a flood occurring during any given year.

- **Water Resources Protection Overlay**

  The Town of Rhinebeck deems the protection of its surface water and groundwater resources to be an important public purpose and finds that, to the extent practicable, future development of the Town should minimize alteration of, or construction within, these significant environmental resource areas.

The Town of Rhinebeck provides more information on these districts under Chapter 125, Section 15 of their municipal code.

In the Village, the **Land Conservation Overlay** adds an additional layer of protection to those properties that are adjacent to and incorporate portions of lakes, stream corridors, wetlands and floodplains. The Village of Rhinebeck provides more information on this district under Chapter 120,

Section 40 of their municipal code.

Discussion

Bobcat Family on the Patio by Mardi Mauney

Future zoning updates should consider the Dutchess County Centers and Greenspaces Plan, which has mapped the potential priority growth areas and conservation targets in the Town. This map is also useful when placed in relation to the other NRI maps when making decisions about how to update the comprehensive plan and zoning districts.

To protect important natural habitats, development should be clustered in the Village, hamlets, and commercial gateway zones where the Town enters the Village. The Village should continue to promote mixed-use and pedestrian-scale development as "human habitat" that can reduce the per capita carbon footprint of the community (e.g. a walkable and bikeable Village means less traffic and emissions). Compact development in the village and hamlet centers also decreases per capita energy consumption, impervious surfaces, and water usage. The Town zoning should aim to prevent sprawl by employing smart growth principles that reduce impervious surfaces and retain open space such as intact forests, wetlands, and meadows.

Regulated Facilities (No Map)

State and federal agencies regulate many types of facilities to maintain environmental quality and public health. The New York State Department of Environmental Conservation (DEC) has created an online web map, the DECinfo Locator, which provides digital access to regularly updated DEC documents and public data about the environmental quality of specific sites. Please refer to the DECinfo Locator to view locations of these regulated facilities in Rhinebeck.

The New York State Department of Environmental Conservation (DEC) has created an online web map that provides digital access to regularly updated DEC documents and public data about the environmental quality of specific sites.

The **DECinfo Locator** is a free resource that can be found at the following web address: https://www.dec.ny.gov/pubs/109457.html.

SPDES Permit Sites

New York's State Pollutant Discharge Elimination System (SPDES) program is intended to control surface wastewater and stormwater discharges in accordance with the Clean Water Act. Permits are required for constructing or using an outlet or discharge pipe (i.e., a "point source") discharging wastewater to surface waters or ground waters of the state and disposal systems such as a sewage treatment plant.[122]

The Village's Wastewater Treatment Plant, which serves the Village's business district, Northern Dutchess Hospital, Wells Manor, Village Green Apartments, and additional residences, is located on Astor Drive. After treatment, it is permitted to discharge up to 26,000 gallons per day of treated effluent to the Rhinebeck Kill, a tributary of the Landsman Kill. Per its 2007 permit last renewed for a five-year term in 2018, treatment consists of oxidation, clarification, filtration, and disinfection. Effluent limitations are in place for carbonaceous biochemical oxygen demand, suspended and settleable solids, pH, ammonia, dissolved oxygen, and fecal and total coliforms.[123]

A smaller wastewater facility serves the Vanderburgh Cove Sewer District. After treatment, it is permitted to discharge up to 8,000 gallons per day of treated effluent to the Hudson River. Its newly awarded 2021 permit will require renewal in 2026.[124] The Town of Rhinebeck has transferred this Wastewater facility to the Dutchess County Wastewater Authority.

---

[122] "State Pollutant Discharge Elimination System (SPDES) Permit Program." NYS Department of Environmental Conservation. https://www.dec.ny.gov/permits/6054.html.

[123] State Pollution Elimination Discharge System (SPDES) permit, Village of Rhinebeck Wastewater Treatment Facility, 2007, available at https://www.dec.ny.gov/data/IF/SPDES/NY0110281/

[124] State Pollution Elimination Discharge System (SPDES) permit, Village of Rhinebeck Wastewater Treatment Facility, 2007, available at https://www.dec.ny.gov/data/IF/SPDES/NY0110281/

Petroleum Bulk Storage Facility

These locations are regulated under the NYS Petroleum Bulk Storage (PBS) program, which applies to facilities that store more than 1,100 gallons of petroleum in aboveground and underground storage tanks.[125]

About 20 such regulated tanks are within the Village, with the remaining 26 found throughout the rest of the Town. The highest concentrations of tanks are within the more developed areas of Rhinebeck, including the Village, and the Route 9 and 9G corridors.

Salt Bulk Storage Facility

These facilities are locations where road salt and other materials used for snow and ice operations by public works and roadway agencies are stockpiled. The Town Highway Garage and Dutchess County Highway Construction and Maintenance Division facility on Route 308 store road salts. These are both now covered storage facilities to prevent stormwater from washing salts into the environment. The Town and Village are working to minimize their applications of road salts through their intermunicipal Road Salt Reduction Project.

Active or Reclaimed Mine

These are regulated sites in the mining and oil and gas industries. There are 2 reclaimed and 3 active sites in the Town, which are primarily sand and gravel operations.[126] The largest of the active operations is Red Wing Mining's 43-acre operation on White School House Road.

State Superfund Site

The NYS Superfund Program is an enforcement program whose goal is to identify and characterize suspected inactive hazardous waste disposal sites and to ensure that those sites which pose a significant threat to public health or the environment are properly addressed. These are locations where the presence of a consequential amount of hazardous waste has been confirmed and to which various tracking, remediation, environmental management and reporting requirements apply. There are two sites in the Town; the former Rhinebeck Town Landfill[127] and the Hudson River.[128] The former landfill is within a wetland and has been monitored for leachate and groundwater contamination by order of DEC.

Discussion

[125] "Bulk Storage of Chemicals, Petroleum, and Liquefied Natural Gas." NYS Department of Environmental Conservation. https://www.dec.ny.gov/chemical/287.html.

[126] "Mining and Reclamation." NYS Department of Environmental Conservation. https://www.dec.ny.gov/lands/5020.html.

[127]

[128] "State Superfund Sites." NYS Department of Environmental Conservation. https://www.dec.ny.gov/chemical/8439.html.

Understanding the sites of potential contamination, in relation to other maps in the Natural Resource Inventory, can provide insight into threats (i.e., pollution) to natural resources and other significant features in the Town and Village. A majority of the regulated facilities are along Route 9 or are in the Village; however, there are facilities subject to DEC permits throughout the Town (see the **Drinking Water Resources** section for related discussion about protection).

Agricultural Resources (Map 20)

The Agricultural Resources Map shows the distribution of high-quality farmland soils and designated agricultural districts in Rhinebeck.

> The **NYS Agricultural Districts Law** allows for state review of local laws affecting farms located within an agricultural district.
>
> In cases where a local law is determined to be unreasonable, the NYS Department of Agriculture and Markets will work with the local government to develop mutually acceptable alternatives.

Soils

Successful agriculture requires quality soils. High quality soils require small fertilizer and nutrients inputs, leading to lower costs and higher production rates. Prime Farmland Soils are defined by the USDA and New York State and considered the most productive soils for farming.[1] Farmland Soils of Statewide Importance are soils that do not meet all criteria for Prime Farmland. Though not as productive as Prime Farmland, if managed properly, these soils can produce fair to good yields. There are soils conducive to agriculture found across the Town.

A large swath of prime farmland stretches from Route 9 south of the Village (owned by Elijah Bender), along to the west of the Village (including the Town Cemetery and Town Park), and down along Rhinecliff Road heading toward the hamlet of Rhinecliff, with Bently Scholldorf's dairy farm on the south side of Rhinecliff Road and Creed Ankony Farm to the north side. Note that much of this farmland, particularly parcels on the roads, has been developed as single-family homes, and in the case of The Gardens, into condos. To the east side of Rhinebeck, along the border with Milan, we see less farmable land, as this tends to be rockier and more steeply sloping. The areas associated with Ferncliff Forest have similar constraints. Prime farmland and prime farmland if drained runs along the Rhinebeck Kill by the intersection of Route 9 and 9G. The Dutchess County Fairgrounds host the only large section of undeveloped prime farmland within Village borders.

Tax Exemptions and Agricultural Districts

County agricultural district designation entitles landowners to a mix of incentives aimed at preventing the conversion of farmland to non-agricultural uses. Agricultural tax exemptions limit local property tax liability to a prescribed agricultural assessment value. According to Dutchess County Real Property, agricultural exemption is given to properties over seven acres with a farm income of $10,000 or more. For farms under seven acres, their farm income would need to be $50,000 or more.

Notable farms within the Town include:

- Bently Scholldorf's dairy
- Creed Ankony Farm
- Saltsman Christmas Tree Farm
- Wonderland Christmas Tree Farm
- Cedar Heights Orchards
- Falcon's Fields Beef Farm
- McLaughlins
- Goober Hollow Farm

In the Village there are four parcels with agricultural tax exemption:

- 2.1 acres on Route 9 at Mill St, at the southern end of the Village
- 13.75 acres on Route 9/Montgomery Street (Huck Hill's Sugar Maple Farm)
- 1.5 acres and .46 acres behind the high school/middle school

Cattle at Stickle Farm by Dan Shapley

Large areas of farmland can promote a critical mass of farming, which is important to the long-term viability of agriculture in Rhinebeck and in the county. Understanding the distribution of these agricultural resources should be an important consideration in Rhinebeck's planning and development management processes. Growing food locally can benefit the local economy, the environment, and the health and welfare of the community if sustainable agricultural practices are used. In addition to providing the community with a local source of crops, livestock, and economic benefits, farmlands can also serve as an important source of food and cover for wildlife, and provided certain practices are used, can help control flooding and protect wetlands and watersheds. Farmland also contributes to scenic beauty and open space.

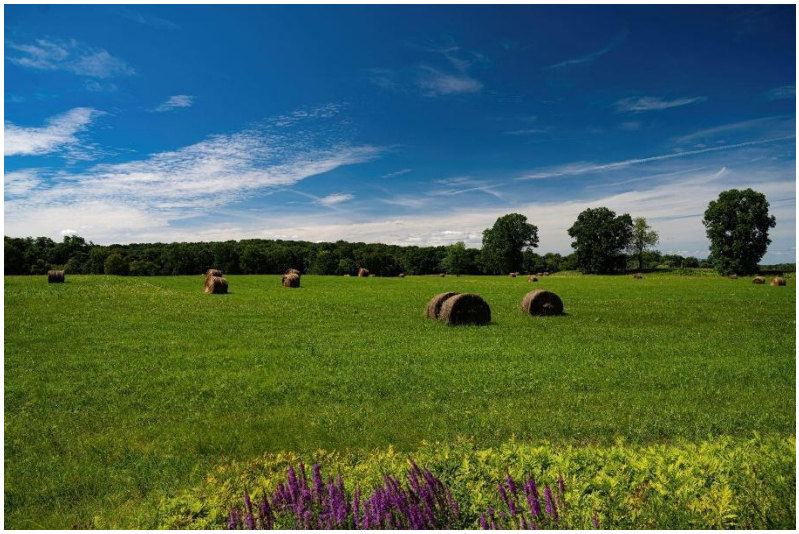
Discussion

As of 2020, the Town and Village had 195 farm parcels, covering 8,483 acres (33% of Rhinebeck) and with an average size of 43 acres. Nearly half of the agricultural land was in hay, corn, and field crops, over 15% was in beef and livestock farms, and about 10% was in dairy.[129]

As pointed out in Bently Scholldorf's interview for "The Dairyman," in the 1960s Rhinebeck was home

[129] Rhinebeck, New York Community Profile: Agriculture and Farms – 2020. Cornell Cooperative Extension Dutchess county. https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/48457/2020_Community_Ag_Profile_-_Rhinebeck.pdf?1607536767

to over 30 dairy farms, and now Bently's 96-acre farm is the last remaining.[130] Bently and the Town have an agreement where he farms part of the Thompson-Mazzarella Town Park. Green Owl, a Rhinebeck farm under 7 acres which grows garlic and saffron, is an example of a small farm that does not qualify for agricultural tax exemption. The Town could consider how to further support small scale "micro-farms" under 7 acres.



Hay Bales on Mill Rd by Wil LaBossier

Rhinebeck should engage its farmers in supporting sustainable agricultural practices such as no-till, cover crops, and rotation with grazing animals who fertilize the soil. Such practices, rooted in indigenous knowledge of long-term stewardship, build the soil rather than desiccating it. Current climate change research is proving regenerative farming practices to be fertile ground in carbon sequestration. The transition to these practices for farmers who have been using industrial methods can take a few years. After that transition, the farmer is able to cut their dependence on an escalating need for inputs and a corresponding degradation of the soil.[131] Climate change will—and is— affecting farms by increasing the growing season but often wreaking havoc with intense and abnormal weather. Drought or deluge pose risks to crops, farmers' livelihoods, and farm workers' health. (See more in the **Climate** section.)

The Rhinebeck Farmers' Market[132] was founded in 1994 and operates most of the year on Sundays in the Village municipal parking lot. The market has become a nexus for community and support of local food systems. The market's facilitation of EBT/SNAP has provided access to healthy, local food for food-insecure members of the population.

Beyond professional farms, Rhinebeck should promote private backyard local food systems. Local non-profit organizations, such as Dirty Gaia[133], promote backyard vegetable gardens and organize the donation of excess produce to the local food pantries.

The Conway School Study of the Thompson-Mazzarella Park made recommendations to plant "food

---

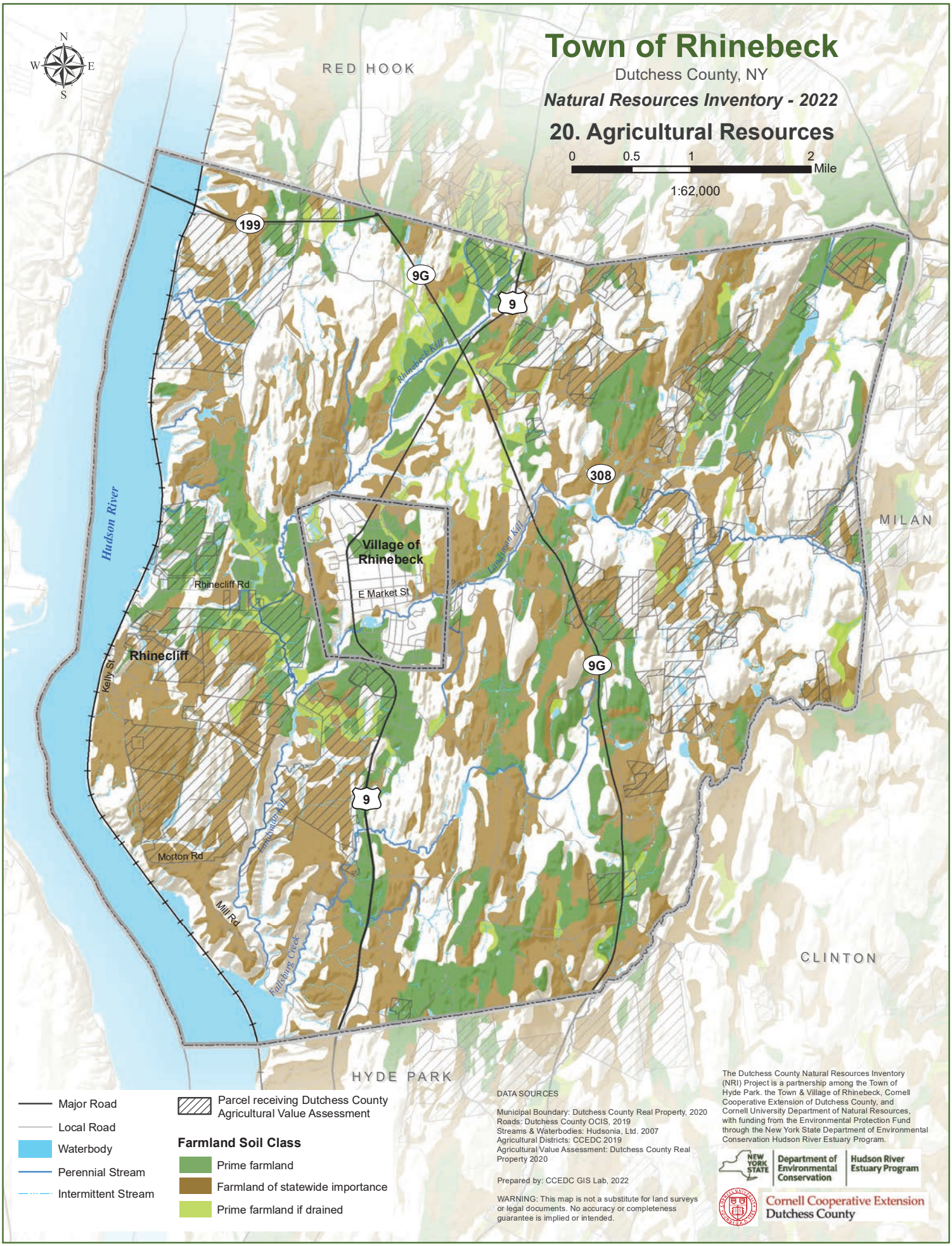
[130] Hudson Valley Oral History Project, https://www.youtube.com/watch?v=1hXMnHtxQ_Q
[131] Kiss the Ground Website. https://kisstheground.com

[132] Rhinebeck Farmers' Market Website. http://www.rhinebeckfarmersmarket.com/

[133] Dirty Gia Website https://www.dirtygaia.org

forests" at the town park[134]. Village and Town could encourage Rhinebeckers to plant not just fruit trees and vegetable gardens, but also pollinator friendly gardens[135]. The decline in pollinators due to pesticides, invasive species, and climate change pose an enormous threat to food systems. These sorts of community-oriented projects provide education and engagement with youth and citizens of all ages—raising the awareness of healthy, nutrient rich food, and the economic and climate-related importance of local food systems.

[134] Conway School of Landscape Design Thompson-Mazzarella Park study. 2020. https://www.climatesmartrhinebeck.org/town-parks-conway-study
[135] https://www.climatesmartrhinebeck.org/pollinators


Town of Rhinebeck
Dutchess County, NY
Natural Resources Inventory - 2022
20. Agricultural Resources
0 0.5 1 2 Mile
1:62,000
RED HOOK
MILAN
CLINTON
HYDE PARK
Hudson River
Village of Rhinebeck
Rhinecliff
Rhinecliff Rd
E Market St
Kelly St
Morton Rd
Mill Rd
Rhinebeck Kill
Landsmeer Kill
Fallsburg Creek
199
9G
9
308
Major Road
Local Road
Waterbody
Perennial Stream
Intermittent Stream
Parcel receiving Dutchess County Agricultural Value Assessment
Farmland Soil Class
Prime farmland
Farmland of statewide importance
Prime farmland if drained
DATA SOURCES
Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2007
Agricultural Districts: CCEDC 2019
Agricultural Value Assessment: Dutchess County Real Property 2020
Prepared by: CCEDC GIS Lab, 2022
WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.
The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park. the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.
NEW YORK STATE Department of Environmental Conservation
Hudson River Estuary Program
Cornell Cooperative Extension Dutchess County

Conservation, Recreation, and Scenery (Map 21)

Access to parks and open space within a community brings substantial social, environmental, economic, and health benefits.[136] These places help define a municipality by giving residents opportunities to enjoy the natural beauty of the region and provide areas to promote relaxation and exercise.

Winnakee Land Trust:

- is 32 years old
- has created 20 miles of new trails
- hosts over 100,000 visitors annually
- has protected over 5,000 acres

As climate change puts more pressure on our ecosystem, stewardship of water resources and important habitats becomes even more critical. Preservation and management of forests and marshland in particular sequester carbon from the atmosphere.

Parks and Protected Lands

A variety of parks, preserves, and other protected lands in Rhinebeck were identified using data from local land trusts and the NY Protected Areas Database (NYPAD), a spatial database of lands protected, designated, or functioning as open space, natural areas, conservation lands, or recreational areas. NYPAD uses the term "protected" broadly, including lands that may be public or private, open or closed to public use, permanently protected from development or subject to future changes in management. NYPAD was created by the NY Natural Heritage Program, and can be accessed through NYPAD.org, or through the Hudson River Valley Natural Resource Mapper.[137] **Tables 9** and **10** show the protected lands in the Village and Town by protection type shown on the map.

Lions Mini Park, 2020 by Vanessa Bertozzi

[136] Sherer, P. M. *The Benefits of Parks: Why America Needs More City Parks and Open Space*. 2006

[137] "Hudson Valley Natural Resource Mapper." http://www.dec.ny.gov/lands/112137.html

Table 11. *Protected Land by Acreage in the Village of Rhinebeck*

Protected Area	Acreage	Percentage
Federal	-	0.0%
State	-	0.0%
Local	13.2	0.4%
NGO	-	0.0%
Private	0.1	0.0%
Conservation Easement	17.3	0.6%
Total	*30.6*	*1.0%*

Table 12. *Protected Land by Acreage in the Town of Rhinebeck*

Protected Area	Acreage	Percentage
Federal	-	0.0%
State	-	0.0%
Local	110.4	0.4%
NGO	137.1	0.5%
Private	188.1	0.7%

Conservation Easement	1,480.4	5.9%
Total	*1,916.0*	*7.6%*

A conservation easement is a voluntary legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect its conservation values. Landowners retain many of their rights, including the right to own and use the land, sell it, and pass it on to their heirs.[138] NRCS offers voluntary easement programs to landowners who want to maintain or enhance their land in a way beneficial to agriculture and/or the environment.[139] Local lands trusts, such Scenic Hudson, Winnakee Land Trust, and Dutchess Land Conservancy, also offer conservation easement programs and may purchase land directly to help residents preserve their land for future generations.

Pedestrian and Bicycle Access

Safe access for pedestrians and bicycles allows residents to use alternate forms of transportation, which helps reduce car congestion, increases overall health of the community, and provides economic benefits.[5] In recent decades, shared-use bicycle and pedestrian paths have become a trademark of "livable" communities, making them more attractive to potential home buyers and businesses. The should prioritize the creation of safe, dedicated cycling routes in the Village for school children to make their way to and from school, to encourage more shopping in the Village center by bike, to make the Village a destination for bicycle tourists traveling through the region, and to reduce auto traffic and parking congestion, all of which will help to reduce the community's carbon footprint and make it a healthier and safer place to live and work.

A small portion of the 750 mile-**Empire State Trail** is concurrent with Route 199 and River Road in the extreme northwest corner of the Town.

Scenic Views

The visual character of the Hudson Valley is defined by its beautiful and abundant natural scenery. Whether it's a dramatic vista or a quiet place in nature, the river and its valley are known for inspiring those who have lived here. This includes world-famous artists such as Fredrick Church and Thomas Cole, who pioneered the first major art movement in the United States: the Hudson River School. The sentiment continues today. In a recent survey of Hudson Valley residents, their favorite word to describe

[138] "What can you do?" Land Trust Alliance. https://www.landtrustalliance.org/what-you-can-do/conserve-your-land/questions

[139] "Protecting and Enhancing our Natural Resources. USDA Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements

the Hudson River was "Beautiful." [140]

Fall on Route 9G by Dorna Schroeter

In addition to creating a community's sense of place, views of nature can have direct economic and health impacts, benefiting tourists and residents alike. Natural scenery is the backdrop for New York State's nearly 115-billion-dollar tourism industry; the state's third largest employer[141]. Residents also enjoy viewing nature, either through active recreation or by admiring it as they go about their daily business. Numerous studies document the health benefits of simply looking at trees, which include reduced stress, improved mental health, increased academic performance, and enhanced social cohesion.[142]

Portions of the Town and Village are within the Estates District **Scenic Area of Statewide Significance (SASS)**. This area runs from Germantown and Clermont in Columbia County through Hyde Park, to the west of Route 9. There are 29 subunits of this SASS. The scenic quality of this district is recognized under Article 49 of the Environmental Conservation Law through designation of the Mid-Hudson Historic Shorelands Scenic District and several **State Scenic Roads** in Town: Rhinecliff, Morton, and South Mill Roads, parts of County Route 103, and NY Route 199 from its junction with NY Route 9G west to the Kingston-Rhinecliff Bridge.[143] The **Local Scenic Roads** identified on map 21 are from the Town's 2008 Comprehensive Plan and were identified through its associated public process.

For more information on scenery protection tools available to Rhinebeck, you can visit the Hudson River Estuary Program's website on this topic. Specifically, the *Scenic Resources Protection Guide for the Hudson River Valley* explores methods of inventory, prioritization, planning, and protection. Also, see Scenic Hudson's Hudson Valley Conservation Strategy: https://scenichudson.org/wp-content/uploads/legacy/pdf-downloads/HVCS-report_web.pdf

---

[140] *Perceptions of the Hudson River: Public Opinion Survey to Identify How Hudson Valley Residents Perceive the Hudson River and Why.* Marist College, 2018.

[141] "Tourism." Empire State Development. https://esd.ny.gov/industries/tourism.

[142] Bowyer, J., S. Bratkovich, K. Fernholz, J. Howe, H. Groot, E. Pepke. *The Human Health and Social Benefits of Urban Forests.* Dovetail Partners Inc. 2016. https://www.dec.ny.gov/docs/lands_forests_pdf/ucfdovetail2016rpt.pdf].

[143] Scenic Areas of Statewide Significance. New York State Department of State. 2004. https://dos.ny.gov/system/files/documents/2020/08/hudson-river-valley-sass.pdf

Climate Change

Land conservation is also becoming a critical tool in fighting climate change. Rhinebeck and land conservation groups are increasingly viewing potential acquisitions and conservations through the lens of climate change: connected areas of biodiversity and climate resiliency, water resources and riparian areas which temper flooding, and forests and marshland, which can sequester carbon in massive amounts.

An essential component of combating climate change is the implementation of renewable energy, and in particular, solar. In order to achieve this goal, Rhinebeck will need to balance the protection of scenic resources with new renewable energy projects and find ways to get to "yes," that may require changes to the built and unbuilt Rhinebeck environment that may not have previously been considered. See, Scenic Hudson's How to Solar Now resource for strategies to achieve these goals without unnecessarily compromising natural and scenic resources: https://www.scenichudson.org/our-work/climate/renewable-energy/howtosolarnow/

Biodiversity and Priority Conservation Areas

In their 2007 report and accompanying maps, *Significant Habitats in The Town of Rhinebeck, Dutchess County, New York*, Hudsonia identified *"locations in Rhinebeck that encompass several of the priority habitats described [within their report], and we recommend these as priorities for conservation."* The map showing these areas can be found at the end of this report.

- Hudson River Corridor
- Ferncliff-Snyder Swamp Complex
- Mill Road
- Vlei Swamp
- Hilltop
- Slate Quarry
- Rock City

Refer to Hudsonia's Significant Habitats report for discussion of the "features that make these areas especially valuable to biodiversity conservation."

Snowy Salisbury Turnpike, 2021 by Glenn Hirshon

Discussion

The Conservation, Recreation & Scenic Areas map, along with Hudsonia's *Significant Habitats in the Town of Rhinebeck, Dutchess County, New York,* can help Rhinebeck consider how projects adjacent to parks, open space, and trails may impact the value residents gain from these areas, as well as ways to maintain habitat connectivity with preserves and other protected lands. This map can also help identify opportunities to grow and connect parks, preserves, paths, and trails as new projects arise. During site

plan and subdivision review, Rhinebeck should consider creating and maintaining habitat connections for the movement of plants and animals. And as noted above, Rhinebeck should proactively identify ways that renewable energy sources can be created, including on rooftops, former commercial and industrial properties, municipally-owned sites, and otherwise, while balancing the need to maintain the Town and Village's scenic character.

Rhinebeck should also consider creating new connections among parks and trails, and the potential to create connections among future trails, for pedestrian and bicycle mobility and accessibility. (Creating these connections can also advance habitat connectivity objectives.) In order to accomplish these objectives, land can be set aside, and deed restricted, put under a conservation easement, or conveyed to Rhinebeck on site and subdivision plans for these purposes. As of 2022, the Town of Rhinebeck, with help from consulting firm ALTA, is leading a project to create a path along Rhinecliff Road, which would connect Rhinecliff to the Village, with the Thompson-Mazzarella Town Park along the way[144]. Rhinebeck should consider additional ways to connect to the Empire State Trail.

Locations of scenic roadways can inform planning and design of new development projects, including badly needed affordable housing, as well. The Town may consider adoption of design guidelines to maintain community character and minimize impacts to scenic resources. Currently, on designated scenic roads, any development does require site plan approval from the Planning Board before a building permit can be issued.

View of Hudson River from Wilderstein, 2021 by Susan Rich

As for the Village, its 1993 comprehensive plan points out that the Village is on the very low end of having the recommended amount of municipal green space. "*The National Recreation and Park*

[144] Village to Train Trail Feasibility study. Alta. 2021. https://rhinebecktrailstudy.com/wp-content/uploads/2021/04/Rhinebeck_Report.pdf

Association recommends between 6.25 and 10 acres of accessible public open space per 1,000 people to be served…The minimum parks and recreation needs of the Village are between 17 and 27.25 acres. Even including the Town-run [Park], the Village only has 17 acres of total park space…Therefore, it is important that the Village consider providing for the development of additional recreation space. Future recreation development should seek to develop space that is generally accessible to the public near the center of the Village, rather than attached to private development proposals at the edges."[145]

The Village owns and maintains the Lions Mini Park, a small 1.2-acre park with a gazebo, play structures donated by the Lions Club. The park runs along the southern bank of the Landsman Kill. Its central location and proximity to the schools make it a very visible community resource. The Village also owns and maintains Crystal Lake, a manmade mill pond dating back to the Colonial era. The Crystal Lake Park (also known as Legion Park) is actually two disconnected park parcels, 4.7 acres total, both with greenspace and access to the lake, however bifurcated by a private parcel. The main part of the park, with entry via Route 9, has a small parking lot and picnic table, and provides waterfront access via a dock. This part of the park is also home to Asher Dam. The other parcel of the park has an entry on Rockefeller. Crystal Lake itself is almost entirely surrounded by private property owners, many of whom have kayaks and canoes with which to enjoy the lake. Because the lake is obscured from public view, many residents and visitors don't even know of its existence. Longtime residents remember swimming in Crystal Lake 20 or 30 years ago. It is currently "swim at your own risk" and not many do given the large Canada goose population.

Steenberg's Mill 1909, from the Rhinebeck Historical Society's Postcard Collection

Another large swath of greenspace within the Village is the Dutchess County Fairgrounds, owned by Dutchess County Agricultural Society, Inc. The land is fenced off and not open to the public, except for

[145] Rhinebeck Village Master Plan. Village of Rhinebeck. Pg 60. 1993.

ticketed events. It would be highly desirable for the Village to engage in conversations with the Fairgrounds to explore ways in which the property can be made publicly accessible in safe and responsible ways, and can host solar energy, possibly through the creation of a community solar project that benefits both the Fairgrounds and Village residents. Because parcels in the Village are nearly totally developed, the local government should consider any open land—especially any centrally located and/or linked to current parks—for public access.

The Town Park: Thompson-Mazzarella Park, is jointly owned by the Village and Town and maintained and managed by the Town. It is "protected under an open space easement with Winnakee Land Trust. The park is 72 acres with 2.2 miles of multi-looped foot trails that weave through agriculture fields. The park features open recreational fields, active farming, a thriving community garden, towering tulip poplar forest, and is bordered by the rich habitats of the Rhinebeck Kill and Landsman Kill."[146] In 2020, the Conway School's graduate program in Sustainable Landscape Design worked with the Town's Parks & Rec Committee to create a vision for how to transform the land into a more climate resilient and engaging space for visitors.[147] Currently, the Park & Rec Committee is working with Rhinebeck Soccer League to expand its potential for athletic fields. The Park is also home to the Starr Library and the Town pool, playground, summertime recreation camp, tennis and basketball courts and baseball field.

Thompson-Mazzarella Park, 2020 by Vanessa Bertozzi

Thompson-Mazzarella Park is also the site of a Native American village, the remains of which remain buried under the fields.[148] Bard archeology professor, Christopher Lindner, conducted an archeological study.

Several of the other protected areas in Rhinebeck can be enjoyed by the public while also serving as important conservation areas.

- **Drayton Grant Park at Burger Hill** provides one of the most exquisite views of the area atop one of the highest points in Rhinebeck. This 76-acre park hosts habitat for the bobolink and other grassland breeding birds. Scenic Hudson gifted the land to Winnakee Land Trust in 2005 but continues to hold a conservation easement on the property.[149] Burger Hill is also a popular sledding spot for locals.
- **Ferncliff Forest** also boasts an incredible sweeping view of the Hudson River Valley from its

[146] Thompson-Mazzarella Park Website. https://www.winnakee.org/visit-our-parks-preserves/thompson-mazzarella-park

[147] A resilient Future for Thompson-Mazzarella Park. The Conway School. 2020. https://ecode360.com/documents/RH0960/public/555328456.pdf

[148]

[149] Drayton Grant Park at Burger Hill Website. https://www.winnakee.org/visit-our-parks-preserves/drayton-grant-park-burger-hill/

fire tower. “In 1964, Brooke Astor deeded the land to the Rotary, stipulating that it must remain ‘forever wild.’ Homer K. Staley Sr. was named Ferncliff's first Forest Ranger and served as ranger for 30 years. At his request, the property was transferred to Ferncliff Forest, Inc., a not-for- profit organization.”[150] Its 200 acres and extensive trails are a favorite among locals, as well as the annual Turkey Trot it hosts.

- **Rhinecliff Landing** is a small waterfront park right on the Hudson River in Rhinecliff. The park has picnic tables and shade structures and provides a boat launch for small vessels and kayaks. Recently, there’s been excitement over the Solaris, a new solar-powered boat capable of traversing the Hudson River from its home in Kingston at the Hudson River Maritime Museum[151].
- **Vlei Marsh,** with a total of 165 acres, was recently protected by Winnakee Land Trust and offers a trailhead and parking.[152]

Some of the Town’s properties don’t provide public access. The Town of Rhinebeck owns about 200 acres of forest around the closed landfill, off of Stone Church Road. No protections have yet been instituted. See also the CEA proposal for Sepasco Lake, prepared by Hudsonia and included here in the Appendix. Bard graduate student David Chernack, in his extensive review of Rhinebeck environmental policies, also recommended pursuing a CEA for Vanderburgh Cove.

Vlei Marsh by Roger Rosenbaum, Brand-News-Team

Various non-profits own historic buildings, which in addition to being architectural and historic treasures, they often possess noteworthy viewsheds.

- The Quitman House, on Route 9 to the north of Rhinebeck, is owned by the Town and houses the Museum of Rhinebeck History.[153] It has views of the Catskills from the back of the house.
- Wilderstein, on Morton Road, with its view of the Hudson River, is also home to a rare Native American petroglyph on a boulder at the river’s marshy edge.

Strategic conservation and protection of viewsheds, environmentally sensitive areas, public access, and climate resilient and connected lands can be assisted by overlaying the various maps in this NRI, to reveal points of intersect and shared assets. The Town and Village could also seek to enact a Community Preservation Fund, which with voter approval, would create a real estate transfer tax to fund conservation and preservation, perhaps even considering shared goals with affordable housing.

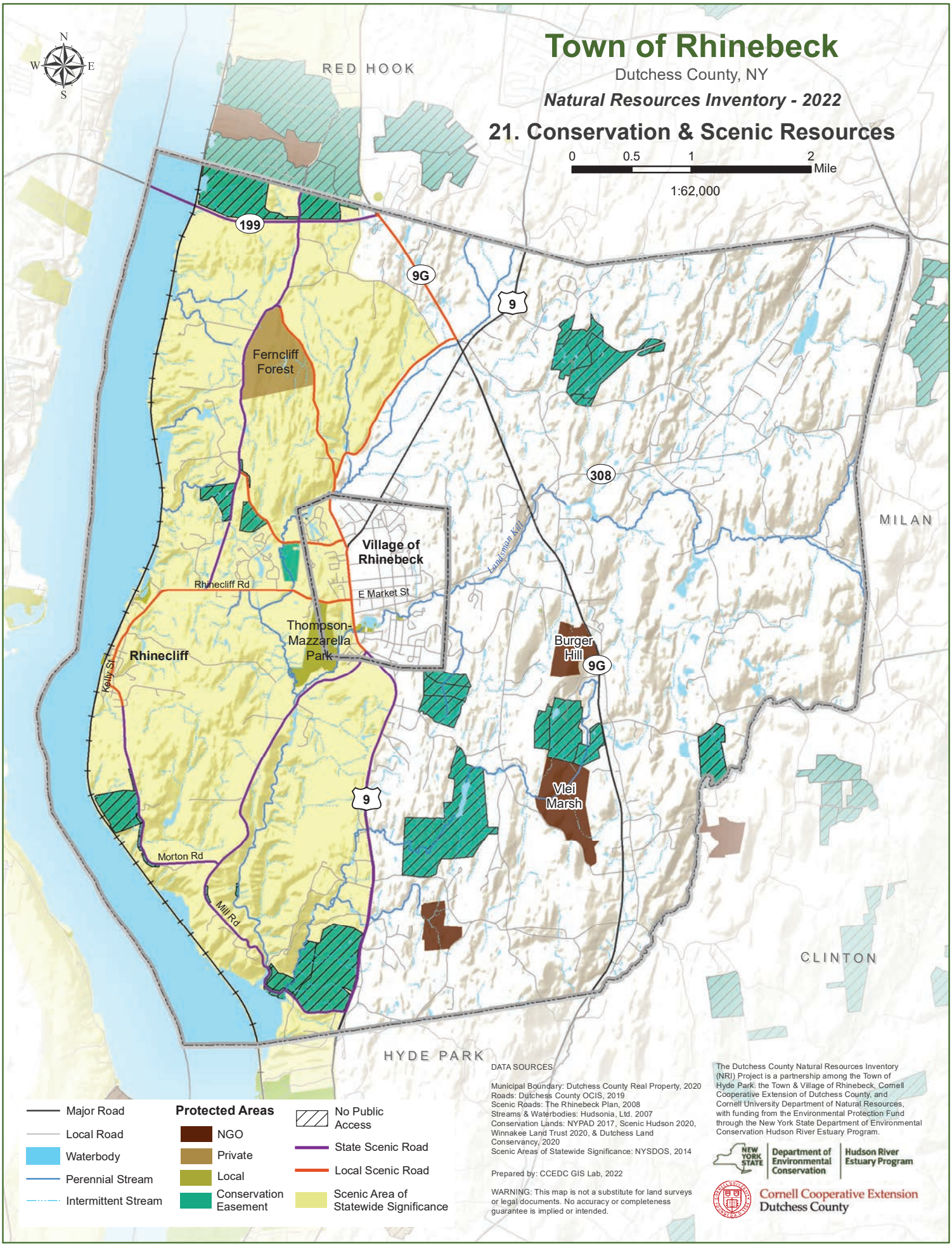
---

[150] Ferncliff Forest Website. https://ferncliffforest.org/history/

[151]The Hudson River Maritime Museum’s Solaris Website. https://www.hrmm.org/meet-solaris.html

[152] Vlei Marsh Website. https://www.winnakee.org/visit-our-parks-preserves/vlei-marsh-preserve/

[153] The Rhinebeck Museum Website. https://rhinebeckmuseum.com/



DATA SOURCES

Municipal Boundary: Dutchess County Real Property, 2020
Roads: Dutchess County OCIS, 2019
Scenic Roads: The Rhinebeck Plan, 2008
Streams & Waterbodies: Hudsonia, Ltd. 2007
Conservation Lands: NYPAD 2017, Scenic Hudson 2020, Winnakee Land Trust 2020, & Dutchess Land Conservancy, 2020
Scenic Areas of Statewide Significance: NYSDOS, 2014

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Project is a partnership among the Town of Hyde Park, the Town & Village of Rhinebeck, Cornell Cooperative Extension of Dutchess County, 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.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

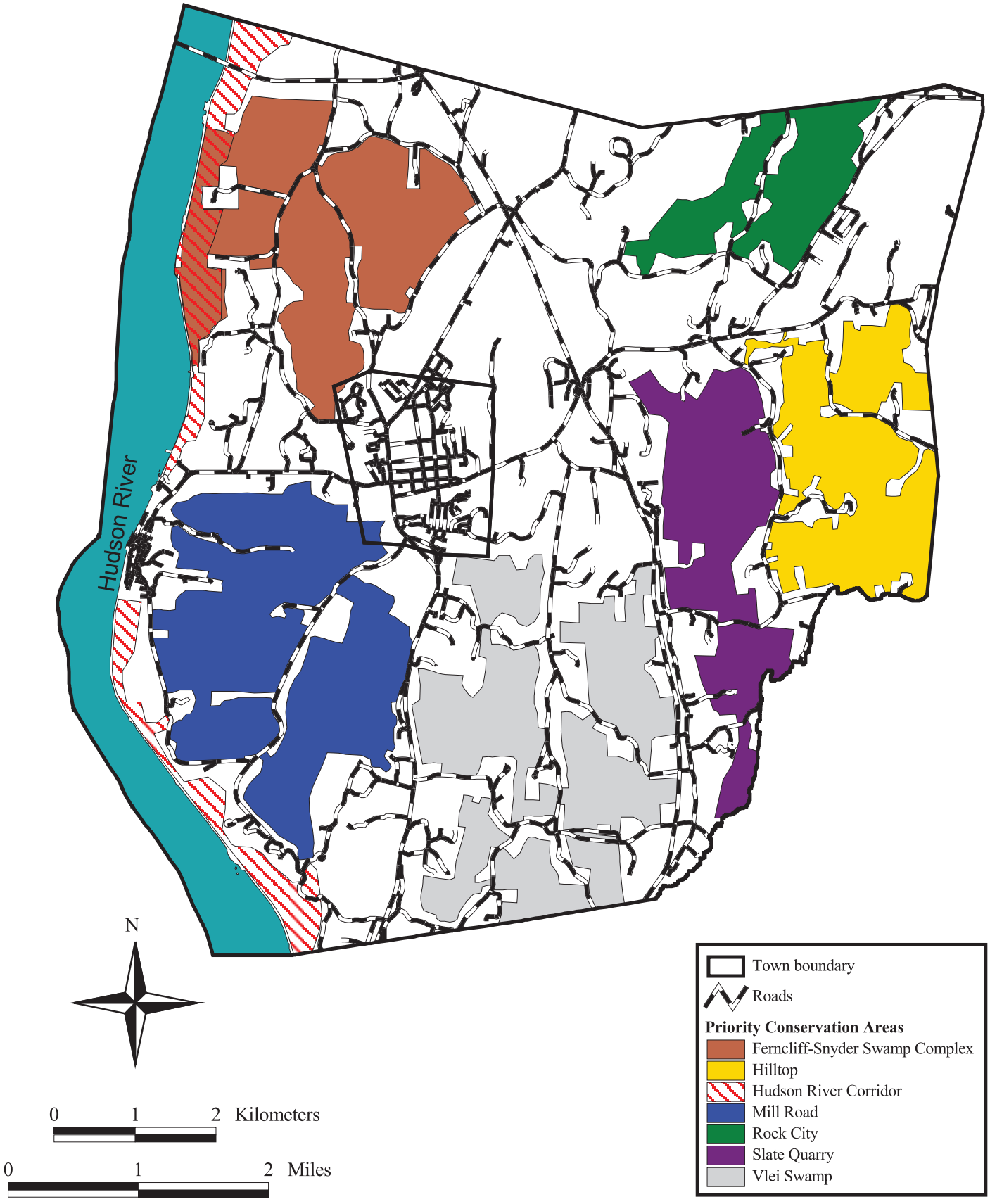


Figure 11. Priority Conservation Areas in the Town of Rhinebeck, Dutchess County, New York. The map shows areas with especially high biodiversity value, but does not depict all areas of conservation concern. Hudsonia Ltd., 2007.

Appendices

Appendix A: Significant Habitats in the Town of Rhinebeck, Dutchess County, NY.

Appendix B: Rhinebeck Site Resource Analysis Assessment

Appendix C: Critical Environmental Area Proposal