# Town of Washington
# and
# Village of Millbrook
# Natural Resources Inventory
# 2023

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# Acknowledgments

[Washington/Millbrook – add]

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Cornell University

# Contents

## List of Tables

## List of Figures

# Chapter 1: Introduction

[Introduction to community context, drawing from comprehensive plan and other municipal planning documents].

The Town of Washington and Village of Millbrook's forests, meadows, wetlands, streams, and shorelines are not only habitat for abundant wildlife and fish, but also provide many vital benefits to people. These ecosystems help to keep water and air clean, moderate temperature, filter pollutants, absorb floodwaters, 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 this community.

This Natural Resources Inventory (NRI) identifies and describes the naturally occurring resources located in the Town of Washington and Village of Millbrook, including climate, topography, geology and soils, water resources, and habitat, as well as farmland and conserved or publicly owned lands. By bringing this information together in one place, the NRI can cultivate a better understanding and appreciation of the community's natural resources and support a wide range of planning and conservation applications. The NRI provides a foundation for comprehensive and open space planning, zoning updates, identifying critical environmental areas, climate adaptation strategies, and other municipal plans and policies for the Town and Village. The NRI can also inform local land stewardship and conservation.

## How to Use the NRI

The NRI is a valuable land use planning tool as well as an educational resource that documents aspects of the Town and Village's environment. The inventory provides an essential tool for the local Building, Land Use, and Zoning Departments by identifying sensitive land, biological, 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 when considering the impact their project may have on natural resources. It can be used to address natural resources during project planning and design and help expedite the review and approval of their endeavors. It can also be used as a general reference for landowners to understand resources that may occur on and around their property and inform land management and stewardship.

It is important to keep in mind that the NRI is best suited for municipal scale planning but may be used as a screening tool to raise questions or identify the need for additional resource assessment at individual parcels. 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 does provide information about the value of natural resources to the community and can aid in understanding the context of individual sites.

The NRI maps are available as PDFs on the Town website and physical copies are available at the Millbrook public library. The PDF maps allow for ease of navigation with the ability to zoom in to an area of interest.

**Online Interactive Maps**

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

- Dutchess County Parcel Access - https://gis.dutchessny.gov/parcelaccess/
- Dutchess County Aerial Access - https://gis.dutchessny.gov/aerialaccess/
- Hudson Valley Natural Resource Mapper - https://www.dec.ny.gov/lands/112137.html
- DECinfo Locator - https://www.dec.ny.gov/pubs/109457.html
- Discover GIS Data NY - https://orthos.dhses.ny.gov/
- National Map - https://www.usgs.gov/programs/national-geospatial-program/national-map
- Web Soil Survey - https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
- TNC Resilient Land Mapping Tool - https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/resilientland/Pages/Mapping_Tool.aspx

**Data and Methods**

The NRI was completed through a technical assistance grant to the towns of Washington and Clinton provided by the DEC Hudson River Estuary Program (Estuary Program) and Cornell University staff in partnership with Cornell Cooperative Extension Dutchess County (CCEDC). Joint project meetings were held with volunteers from the Town of Clinton but separate NRIs were created for each community. Washington and Millbrook members of the NRI committee included members of the Town and Village Boards, Town Planning Board, Town and Village Conservation Advisory Commissions, Village Shade Tree Commission, and the Village Climate Smart Communities Task Force. Project facilitation and report writing were led by Estuary Program staff members Ingrid Haeckel, Christine Vanderlan, and Anna Palmer. The report is based on a template developed by Estuary Program staff with interpretation of local resources occurring in the Town and Village. Mapping was carried out by Sean Carroll of CCEDC.

The NRI incorporates information from Washington's 2015 *Comprehensive Plan*; Millbrook's 1985 *Master Plan*, the 2004 *Significant Habitats* study by Hudsonia, the 2010 *Dutchess County Natural Resources Inventory*, the 2000 *Natural Resource Management Plan for the Wappinger Creek*, the 2022 *Natural Resource Characterization and Recommendations Report for the Wappinger Creek Watershed*, the 2011 Village of Millbrook *Sewer and Water Comprehensive Plan*, and the 1992 *Water Supply Protection Program for Dutchess County*, among other plans and studies.

The NRI maps display data from federal, state, and county agencies, as well as local habitat and stream mapping from the *Significant Habitats in the Town of Washington* study completed by

Hudsonia in 2004. 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 Geographic Information Systems (GIS) software and data in the NAD 1983 State Plane New York East FIPS 3101 Feet coordinate system.

Note that information on the maps comes from different sources, produced at different times, at different scales, and for different purposes. 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 them. 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. The NRI is not a substitute for the collection of site-specific data or more detailed local knowledge. Information provided by the maps can be enhanced by local knowledge, and the NRI should be updated every 10 years and as new data become available.

During the NRI process, NRI committee members reached out regularly to Town and Village municipal leaders and citizens for their input and review. The draft NRI maps were made available for public comment … [describe public outreach process]

The final NRI draft was circulated with the public and selected reviewers during [when?]. After addressing comments, the final NRI was published [where?].

## Community Setting (Maps 1 and 2)

The Town of Washington is a rural community located in east-central Dutchess County, New York. The Town spans 58.8 square miles and includes the Village of Millbrook, located within its borders. The population was 4,522 as of the 2020 census. Washington is bordered by the Town of Stanford to the north, the Towns of Union Vale and Dover to the south, the Town of Amenia to the east, and the Towns of Pleasant Valley and Clinton to the west. Most of the town is drained by Wappinger Creek, a major tributary of the Hudson River. Sprout Creek drains the southwest part of the Town and flows into Fishkill Creek, another major tributary of the Hudson. The eastern third of the Town drains east to Wassaic Creek, which flows into the Housatonic River, eventually emptying into Long Island Sound.

### Settlement History

The Hudson Valley was settled by Native Americans at least 10,000 years ago following the last ice age.[1] The region including Washington and Millbrook is the ancestral homeland of the Munsee Lenape people. The Munsee Lenape lived along the tributaries and banks of the Hudson River, known as the Muhheacannituck, “the waters that are never still,” in the Munsee language. When European settlers arrived in the region, they referred to the native people as the “River

[1] “First Peoples.” New York State Museum (accessed 28 June 2023), https://www.nysm.nysed.gov/exhibitions/ongoing/first-peoples#

Indians." They were rapidly displaced from their homeland in the decades following European arrival in the 17th century. Native people were impacted by European settlement pressure, loss of traditional food resources, deliberate government efforts to remove them, and foreign diseases, against which they had no immunity. Despite tremendous hardship in being forcibly removed from their homeland, Munsee Lenape communities currently reside in Wisconsin, Oklahoma, and Canada. They comprise the Delaware Nation, Delaware Tribe, Stockbridge-Munsee Community Band of the Mohican Indians, Munsee-Delaware Nation, and Six Nations of the Grand River.

European settlement in the Town of Washington began in the 17th century, with early Dutch settlers followed by the English. In 1697, a group of settlers known as the Nine Partners received a patent from the Crown of England for 146,000 acres. Stretching from the Hudson River to the eastern border of New York State, it became known as the Nine Partners Patent. A portion of that patent became known as the Town of Washington. In the subsequent centuries, settlers included Quakers, farmers, bankers, businessmen. The Town of Washington was formed as part of the reorganization of Dutchess County in 1788.

The picturesque Village of Millbrook lies like a gem amid the rolling hills and broad meadows of the Town of Washington. It was not officially incorporated as a Village until 1895.

**Land Use History**

Hudson Valley ecosystems have been profoundly influenced by human land uses for millennia. Native Americans cleared fertile river valleys for agriculture and practiced widespread managed burning to promote an open forest understory conducive for hunting.[2] Fire management practices were used intentionally to promote the reproduction of valuable wild crops such as blueberries and are thought to have promoted the expansion of southern oaks-hickory forest communities and other fire-tolerant species.[3]

European settlement from the 16th to the early 19th centuries led to widespread forest clearing for agriculture. Even areas with marginal soils were cleared for pasture. By 1835, 75-80% of the land in neighboring Columbia County was cleared for agriculture.[4] Completion of the Erie Canal in 1825 spurred the first westward movement of American settlers, who began abandoning marginal lands in favor of high-quality farmland in the west. Expansion of railroads and industry throughout the 19th century led to the growth of urban population centers. By the early 20th century the trend in farmland abandonment was well underway. Between 1910 and 1992, farms in Dutchess County plummeted from 90% to 20% of the land area.[5]

[2] Kudish, Michael. *The Catskill Forest: A History*. Purple Mountain Press and ColorPage, Fleischmanns and Kingston, NY, 2000, pgs. 47-48.

[3] Ibid.

[4] Vispo, Conrad. *The Nature of the Place: A History of Living with the Land in Columbia County, NY.* Adonis Press, Hillsdale, NY, 2014.

[5] Stanton, Bernard F. and Nelson L. Bills. *The Return of Agricultural Land to Forest: Changing Land Use in the Twentieth Century*. Department of Agricultural, Resource, and Managerial Economics, College of Agriculture

Forests and other natural ecosystems have made a remarkable recovery, but land use history continues to exert strong influences on ecosystems and biodiversity. A study conducted by the Cary Institute in Washington found significant variations in vegetation consistent with prior land uses such as selective timber harvesting, cultivation, and pasture.[6] Other research in Dutchess and Columbia County has found higher diversity of native understory plants and lower prevalence of invasive species in older forests that were likely never fully cleared for agriculture.[7] Land use history is an important factor in the composition, structure, and quality of habitats we see today. Historical aerial photos, descriptions provided in old deeds, as well as information gleaned from stone walls and soils can provide insights into land use history.

## Base Map and Aerial View (Maps 1 and 1A)

The Base Maps (Maps 1 and 1A) are the foundation for the Natural Resources Inventory map series. They show municipal boundaries and transportation infrastructure, as well as topographic relief and surface water features. U.S. Route 44 traverses Washington from east to west, providing connections to Pleasant Valley and Amenia. The stretch of U.S. Route 44 east of the split with State Route 82 is also known as Sharon Turnpike. Other major roads include State Route 343, which runs east – west along the southern boundary of the Village of Millbrook; and State Route 82, which meanders a north – south trajectory through the Town. Local roads are also shown and labeled on the maps. Tax parcel data shown in the Natural Resources Inventory map series were published in 2022 by Dutchess County.

**A note on Town and Village maps:**

The Village of Millbrook boundary is shown on all maps in the NRI to facilitate identification and analysis of Village resources. In addition, the following maps are replicated at the Village scale: Wetlands, Habitats, Forests, Drinking Water Resources and Steep Slopes.

The Aerial View Map (Map 2) gives a bird's-eye view of the Town of Washington and Village of Millbrook, showing 0.5-ft resolution aerial imagery taken in 2020 by Dutchess County. 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. For more detailed, interactive viewing of aerial imagery dating back to 1936, users can visit the Dutchess

and Life Sciences, Cornell University, Ithaca, NY, 1992, pg. 38. http://publications.dyson.cornell.edu/outreach/extensionpdf/1996/Cornell_AEM_eb9603.pdf

[6] Glitzenstein, Jeff S., Charles D. Canham, Mark J. McDonnell, and Donna R. Streng. *Effects of environment and land-use history on upland forests of the Cary Arboretum, Hudson Valley, New York.* Bulletin of the Torrey Botanical Club 117(2), 1990, pgs. 106-122.

[7] Knab-Vispo, Claudia, and Conrad Vispo. *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation* Hawthorne Valley Farmscape Ecology Program, in cooperation with Hudsonia, Ltd., Ghent, NY, 2010.

County Aerial Viewer at https://gis.dutchessny.gov/aerialaccess/

# Chapter 2: Climate

> **Climate** is the long-term average of weather, typically averaged over a period of 30 years. Communities across New York are already experiencing the effects of rapid climate change.

Washington and Millbrook enjoy a temperate climate, experiencing cold winters with snow and warm to hot summers with a moderate amount of precipitation spread throughout the year. Local data show steady and rapid changes in our climate. New York has experienced particularly rapid changes (compared to natural rates of change during Earth's history) to the regional climate in the last century and this trend is projected to continue this century. Global average temperature has been rising along with increasing levels of insulating greenhouse gases in the atmosphere, driving changes to regional and local climate. Warming atmospheric temperature alters the water cycle, leading to more frequent extreme precipitation events, short-term drought, and severe storms.

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 also help to sequester and store carbon, offsetting some of the impacts of local greenhouse gas emissions.

This chapter presents information about key climate variables:

- Temperature
    - Observed changes
    - Projected changes
    - Extreme heat days and heat waves
    - Warming winters
- Precipitation
    - Observed changes
    - Projected changes
    - Flood risk
    - Drought

The National Weather Service (NWS) calculates normals, which are averages of weather variables over a thirty-year period. Normals are used as a ruler to compare weather day-to-day and to describe predicted future conditions.[8] Local weather normals are available from the closest NWS station in Poughkeepsie, which began recording weather data in 1931. The Cary Institute has a weather station, too, which began recording weather data in 1988.

For projected temperature, extreme heat, and precipitation, this report relies on the Climate Data Grapher provided by the New York State Climate Science Clearinghouse

[8] US Climate Normals. https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals)

(https://www.nyclimatescience.org/highlights/data_products).

**Temperature**

The mean annual temperature in Millbrook reported by the Cary Institute, for 1988-2022 as 50 °F.[9] This is nearly the same as the normal temperature at Poughkeepsie for the years 1991-2020, 50.5 °F s, calculated by the NWS.[10]

*Observed changes in temperature*

In New York, temperatures have risen almost 2.5 degrees °F since the beginning of the 1900s with temperatures in the 2000s higher than any other historical period.[11] Since 1970, Dutchess County has seen a 1.6°F increase in average annual temperature and a 2.4°F 1991-2020 winter temperature increase (Table 1). This is greater than the global increase in annual temperature during the same period.

At Poughkeepsie, the nearest weather station operated by the NWS for which data are available, annual average temperature data show a warming trend (Table 1). The average temperature has risen in every month of the year compared with 1970.[12]

Table 1. Average Annual Temperature for 30-year Periods at Poughkeepsie, NY, 1971-2020. Source: National Weather Service[13]

| Time period | Average Annual Temperature (°F) | Change from prior thirty-year period |
|---|---|---|
| 1971-2000 | 48.8 | |
| 1981-2010 | 49.8 | +1.0 |
| 1991-2020 | 50.5 | +0.6 |

*Projected changes in temperature*

Current projections show an additional increase of 5.5 to 9.7°F in annual temperature in Dutchess County by the end of this century (Table 2). Because these are based on possible scenarios of emissions of greenhouse gases, and there are uncertainties inherent to modeling

[9] Weather and Climate, Cary Institute, Millbrook, NY 2023. (https://www.caryinstitute.org/science/research-projects/environmental-monitoring-program/weather-climate)

[10] National Weather Service, Average Monthly Temperatures, Normal Comparison, Poughkeepsie, NY. https://www.weather.gov/images/aly/Climate/POU/POU_Temp_Normals_Comparison.png

[11] National Oceanographic and Atmospheric Association, National Centers for Environmental Information. State Climate Summaries 2022: New York. https://statesummaries.ncics.org/chapter/ny/

[12] National Weather Service. Average Monthly Temperatures, Normal Comparison, Poughkeepsie, NY. https://www.weather.gov/images/aly/Climate/POU/POU_Temp_Normals_Comparison.png

[13] National Weather Service, Average Monthly Temperatures, Normal Comparison, Poughkeepsie, NY.

future climate, high and low emissions scenarios were modeled.

Table 2. Projected Increases in Mean Annual Temperature, Dutchess County, NY, from a base temperature of 48.5 °F (the 1980-2009 mean annual temperature). Source: New York Climate Science Clearinghouse

| Scenario | 2030s | 2050s | 2070s | 2090s |
|---|---|---|---|---|
| High | +3 | +5.1 | +7.5 | +9.7 |
| Low | +2.9 | +4 | +5 | +5.5 |

*Extreme heat days and heat waves*

Increasing annual temperatures are predicted to lead to more frequent, intense, and long-lasting heat waves during the summer, posing a serious threat to human health, wildlife, and ecosystems. Extreme heat days are defined as those with maximum temperatures at or above 90°F. In Dutchess County, communities experience an average 8.7 days of extreme heat days in a year. The number of days with temperatures above 90 °F is projected to increase throughout this century (Table 3). Heat waves are defined as periods of three or more consecutive days with maximum temperatures at or above 90°F.

Table 3. Projected change in number of days with extreme heat, high temperature of 90 °F or above. Source: New York Climate Science Clearinghouse

| Scenario | 2030s | 2050s | 2070s | 2090s |
|---|---|---|---|---|
| High | +11.8 | +24.8 | +42.6 | +60 |
| Low | +10.8 | +17.2 | +23.6 | +26.1 |

Presently, Dutchess County experiences 1.2 days per year with a high temperature reaching **95 degrees** or higher. Projections are for 11 or 35 more days of such extreme heat by the 2090s (Table 4).

Table 4. Projected change in number of days with high temperature of 95 °F or above in Dutchess County, baseline number 1.2 days. Source: New York Climate Science Clearinghouse

| Scenario | 2030s | 2050s | 2070s | 2090s |
|---|---|---|---|---|
| High | +4.2 | +10.2 | +22 | +35.7 |
| Low | +3.7 | +6.5 | +9.8 | +11.1 |

The New York State Department of Health provides an estimate of the vulnerability of people in a community to health effects from heat. The Heat Vulnerability Index was developed by the Department of Health to help local and state public health officials identify and map heat-vulnerable areas and populations. People may be more vulnerable to heat due to their age, job, economic status, language, the local environment (urban heat islands experience higher temperatures and offer fewer areas for respite), or social isolation (living alone). Using the currently available index, compared to other communities in Dutchess County, overall people living in Washington have low vulnerability to heat, while people in Millbrook have moderate

vulnerability.[14]

*Warming winters*

The frequency of heat waves has increased across the contiguous U.S since the early 1900s, while the frequency of cold waves has decreased since the mid-1960s, but at a significantly faster rate. Winters in the northeastern U.S. have warmed three times faster than have summers, resulting in an increase in the proportion of winter precipitation falling as rain.[15]

Since 1988, Washington and Millbrook have experienced a growing season of 120-180 days.[16] The northeast is projected to experience a longer freeze-free season, lengthening by 2 to 3 weeks. This lengthening of the growing season may offer new opportunities for farmers, however, wetter springs may erode the benefits by limiting the opportunities for early planting.[17]

## Precipitation

Precipitation is highly variable year-to-year. The normal annual precipitation at Poughkeepsie for the period 1991-2020 was 41.9 inches.[18] Cary Institute reports the highest annual total precipitation from 1988-2022 was 65.8 inches in 2018; the lowest was 31.4 inches (2001).[19]

*Observed changes*

Precipitation has become more variable and extreme, whereas total rainfall has changed only marginally. Across the northeast, the proportion of total annual precipitation falling in the heaviest 1% of events increased 55% from 1958 to 2016. In the 2000s, New York has seen an increase in the number of events of extreme precipitation of 2 inches or more.[20]

*Projected changes in precipitation*

Precipitation is expected to become increasingly variable year to year and seasonally. Dutchess County is projected to see an increase in annual precipitation starting in the 2050s or 2070s, depending on the emissions scenario (Table 5). In both scenarios, precipitation during the spring is projected to increase, while precipitation in the summer will likely decrease. Precipitation projections are considered less certain since it is difficult to model.



[14] *Heat Vulnerability Index, Dutchess County, NY*, Center for Environmental Health, Bureau of Environmental and Occupational Epidemiology New York State Department of Health. Heat Vulnerability Index, 2017, https://health.ny.gov/environmental/weather/vulnerability_index/docs/dutchess.pdf

[15] *Observed and Projected Climate Change in New York*. New York State Department of Environmental Conservation, 2021, https://www.dec.ny.gov/docs/administration_pdf/ccnys2021.pdf

[16] Cary Institute of Ecosystem Studies, Weather & Climate. Millbrook, NY. 2023. https://www.caryinstitute.org/science/research-projects/environmental-monitoring-program/weather-climate

[17] NYS DEC 2021.

[18] NWS. Poughkeepsie, NY – Annual precipitation (inches), 1931-present. https://www.weather.gov/media/aly/Climate/POU/POU_Annual_Precipitation.pdf (accessed June 12, 2023).

[19] Weather and Climate. Cary Institute of Ecosystem Studies, Millbrook, NY, 2023. https://www.caryinstitute.org/science/research-projects/environmental-monitoring-program/weather-climate

[20] NYS DEC 2021.

Table 5. Projected change in annual precipitation, Dutchess County, NY. Baseline is 46.05 inches. Source: New York Climate Science Clearinghouse

| Scenario | 2030s | 2050s | 2070s | 2090s |
|---|---|---|---|---|
| High | -0.25 | +0.68 | +1.41 | +2.81 |
| Low | -0.79 | -0.41 | +1.05 | +.88 |

Overall, climate models project more dry periods intermixed with heavy rain and decreased snow cover in winter.

Table 6. Projected Change in the Number of Days with extreme precipitation, greater than 1 inch, Dutchess County. Baseline is 5.5 days. Source: New York Climate Science Clearinghouse

| Scenario | 2030s | 2050s | 2070s | 2090s |
|---|---|---|---|---|
| High | -0.25 | +0.68 | +1.41 | +2.81 |
| Low | -0.79 | -0.41 | +1.05 | +.88 |

Note: Negative numbers indicate reductions below the baseline (5.5 days), and fractions of days are included because precipitation does not fall in all parts of the county at once.

*Flood risk*

Downpours, with intense precipitation occurring over a period of minutes or hours, are likely to increase in frequency and intensity as the climate warms. These events elevate the risk for flooding due to stormwater runoff and/or tributary flooding. Flooding threatens many important assets, like transportation infrastructure, sewage treatment infrastructure, roads, businesses, recreational facilities, and more.[21]

Examples of flooding and infrastructure damage during storm events include washouts of Nine Partners, Church, and Stanford Roads during Hurricane Irene and the overflow of the Elm Drive Catch Basin during heavy rain events from May-August 2013. For more specific examples, please refer to the Floodplains and Riparian Areas section of this Report.

In Chapter 4: Water Resources, Map 11: Floodplains and Riparian Areas shows areas that have been mapped by the Federal Emergency Management Area (FEMA) as at risk of flooding. Wetlands play a key role in mitigating flooding, and Map 14: Wetlands shows wetlands throughout the Town and Village. Wetlands may be contributing to the community's resilience to climate change by capturing, slowing, absorbing, and then slowly releasing water.

The online tool, Neighborhoods at Risk, provides information about several physical factors related to vulnerability to climate risks. In Millbrook, 8.1 percent of properties have some level of flood risk[22] and 7.6 percent of the village is in the 500-year flood hazard zone, mapped by

[21] [ADD FULL CITATION] Zemaitis, 2018, p.10.

[22] First Street Foundation. FloodFactor Model Methodology https://firststreet.org/research-lab/published-research/flood-model-methodology_overview/, as reported by

FEMA.[23] A high percentage of the village (59.2 percent) lacks tree canopy[24]; and 13 percent of the village is covered by roofs, driveways, roads, and other impervious surfaces.[25] These characteristics of the built environment increase the level of flood risk.

In Washington, outside of the Village, 11.2 percent of properties have flood risk;[26] 1.8 percent of the town is in the 500-year flood hazard zone.[27] Impervious surfaces cover 1.4% of the town.[28]

*Drought*

Droughts, or prolonged periods of dryness, are a normal occurrence in all of New York, but extreme droughts are less frequent.[29] The state experienced major droughts in the early 1930s and early 1960s,[30] which also were the driest multiyear periods in New York. [31] Higher temperatures in the summer and changing patterns of precipitation may lead to more frequent short-term drought in all of New York. More precipitation falling as rain due to warmer winters will mean less streamflow in spring. A greater amount of precipitation falling in extreme events may reduce groundwater recharge. Higher temperatures in spring and summer will increase evaporation. Together, these suggest droughts will occur more frequently. [32]

*Coastal storms: hurricanes and nor'easters*

New York experiences hurricanes, tropical storms, and nor'easters. These extreme weather events. The frequency, intensity, and duration of coastal storms and flooding are increasing. Projections of the number of hurricanes and tropical storms are uncertain, but the amount of precipitation and wind speeds are likely to increase. The number of the most intense hurricanes in the Atlantic basin is likely to increase, but it is uncertain what number of storms will impact New York. Projections of changes to the frequency of nor'easters are not clear.[33]



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Headwaters Economics' Neighborhoods at Risk. 2022 Retrieved June 2, 2023 from https://nar.headwaterseconomics.org/

[23] FEMA National Flood Hazard Layer (NFHL). Flood Risk Database (FRD) Technical Reference https://www.fema.gov/national-flood-hazard-layer-nfhl, as reported by Headwaters Economics' Neighborhoods at Risk. 2022. Retrieved June 2 from https://nar.headwaterseconomics.org/

[24] Homer CG, Dewitz JA, Jin S, Xian G, Costello C, Danielson P, Gass L, Funk M, Wickham J, Stehman S, Auch RF, Ritters KH. Conterminous United States land cover change patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing, 162, 184-199, at https://doi.org/10.1016/j.isprsjprs.2020.02.019, as reported by Headwaters Economics' Neighborhoods at Risk. 2020. Retrieved June 2, 2023 from https://nar.headwaterseconomics.org/

[25] Ibid.

[26] First Street Foundation, as reported by Headwaters Economics' Neighborhoods at Risk. 2022. Retrieved June 13, 2023 from https://nar.headwaterseconomics.org/

[27] FEMA 2022.

[28] Homer, Dewitz, and Jin, et al. as reported by Headwaters Economics' Neighborhoods at Risk. 2020. Retrieved June 13, 2023 from https://nar.headwaterseconomics.org/

[29] NYS DEC "Drought."https://www.dec.ny.gov/lands/5011.html .Accessed June 13, 2023.

[30] NOAA, National Integrated Drought Information System. New York, https://www.drought.gov/states/new-york#historical-conditions

[31] NOAA, National Centers for Environmental Information, 2022.

[32] Dutchess County. DMA 2000 Hazard Mitigation Plan, Update. 2016. pgs 5.4-2.5

[33] New York State DEC 2021. Observed and Projected Climate Change in New York State: An Overview. https://www.dec.ny.gov/docs/administration_pdf/ccnys2021.pdf

## New York State Climate Policy

New York's Community Risk and Resiliency Act (CRRA) was signed into law in 2014 to advance planning for climate resilience. CRRA requires the State to adopt sea level rise projections and update them every five years. In addition, CRRA requires state agencies to assess potential future climate risks related to sea level rise, storm surge, and flooding when making certain permitting, funding, and regulatory decisions. The 2019 Climate Leadership and Community Protection Act (Climate Act) amended CRRA to expand the list of climate hazards to be considered and the permit programs covered by the law. In fulfillment of CRRA, DEC and the NYS Department of State published model local laws to enhance community resiliency in 2019.[34] This voluntary guidance for municipalities includes a broad array of strategies to increase climate resilience through local land use regulations. In 2020, DEC published guidance for Using Natural Measures to Reduce the Risk of Flooding and Erosion[35] and New York State Flood Risk Management Guidance for implementation of CRRA.[36]

New York State's 2019 Climate Act is among the most ambitious climate laws in the world and requires New York to reduce economy-wide greenhouse gas emissions 40 percent by 2030 and no less than 85 percent by 2050 from 1990 levels.[37] The New York Climate Action Council approved a final Scoping Plan in December 2022, which provides a road map for how the State will reach its ambitious climate targets to achieve net-zero emissions, increase renewable energy use, and ensure all communities equitably benefit in the clean energy transition.[38]

## Washington and Millbrook Certification as Climate Smart Communities

Committee to add information about Town and Village Climate Smart activities and certification



[34] *Model Local Laws to Increase Resilience*, New York State Department of State and New York State Department of Environmental Conservation, 2019, https://www.dos.ny.gov/opd/programs/resilience/index.html

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

[36] *New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act,* New York State Department of Environmental Conservation, 2020, https://www.dec.ny.gov/docs/administration_pdf/crrafloodriskmgmtgdnc.pdf.

[37] *The Climate Act*, accessed November 2022, https://climate.ny.gov/

[38] *New York State Climate Action Council Scoping Plan,* 2022, https://climate.ny.gov/resources/scoping-plan/

# Chapter 3: Physical Setting

The Physical Setting chapter contains five parts, most with corresponding maps:

- Topography (Map 3)
- Steep Slopes (Map 4)
- Bedrock Geology (Map 5)
- Surficial Geology (Map 6)
- Soils (no map)

## Topography (Map 3)

Local topography reflects differences in the underlying geology and is an important factor influencing the location of development. Washington's terrain includes steep hills as well as extensive lowlands. The Town's varied topography offers both outstanding scenic views and challenges for land development and environmental protection.

Elevations in Washington range from 240 feet along Wappinger Creek to 1,360 feet on Tower Hill.

The Topography Map displays 3D digital elevation data from the U.S. Geological Survey. Elevations in Washington range from 240 ft along Wappinger Creek to 1,360 ft on Tower Hill, the highest point in the town. This is one of the greatest ranges in elevation of any town in Dutchess County. The *Significant Habitats* study states, "The eastern part of Washington is characterized by high hills, steep valleys, and deep ravines in the vicinity of Tower Hill, Deep Hollow, Butts Hollow, and Mutton Hollow. In the western part of town, most notably in the Canoe Hills area, there is complex terrain with north-south trending ridges and rock outcrops. Extensive wetland complexes occur in low-lying terrain in the Millbrook Marsh watershed, the Shaw Brook watershed, the Sprout Creek watershed, and in the floodplain of the East Branch of Wappinger Creek."[39] (pg 8)

Elevations in the Village of Millbrook range from 460 to 860 feet above sea level. U.S. Route 44 traverses the lower elevation along the southwestern boundary of the Village. The highest elevation is found near the Village's eastern boundary at Nine Partners Road.

## Steep Slopes (Map 4)

[39] Tollefson, J. and G. Stevens. *Significant Habitats in the Town of Washington*. Report to the Millbrook Tribute Garden, the Dyson Foundation, the Town of Washington, and the Dutchess Land Conservancy, Hudsonia, Ltd., 2004. https://www.hudsonia.org/maps-reports-copy.

Steep slopes are environmentally sensitive areas and often provide unique habitat as well as scenic value. 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 polluted runoff.[40] Steep slope disturbance can introduce sediment to streams and waterbodies, affecting downstream water quality. Grading and construction on steep slopes can also be expensive, and such sites may not be able to support a properly functioning public or private sewer system.[41] Steep slopes may also be important scenic resources visible from surrounding areas, and their development can obstruct scenic views.

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

Steep slopes may also support significant wildlife habitats. Steep slopes often have thin soils and rocky ledges, which are used for denning, shelter, foraging, and basking by a variety of wildlife species.[42] For more information on these habitats, see *Significant Habitats in the Town of Washington*.

Steep slopes shown on the map are derived from 3D digital elevation data from the U.S. Geological Survey. 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. The map includes the following slope classes, based on the national Soil Survey Manual:[43]

5-10% (nearly level to gently sloping)
10 – 15% (strongly sloping)
15 – 25% (steep)
Over 25 % (very steep)

Steep slopes (15% or greater) appear throughout the Town; in particular, along Butts Hollow Road and Stone Church Brook along State Route 343, and in the Tower Hill Road area. Steep slopes occur on approximately 21% of the Town land area, with 11% of land in the 20% or greater slope range and 5% of land in the very steep category (over 25% slope).

Areas of Millbrook with slopes of 15% or more include the golf course, Millbrook Central School campus, ridges along Front Street, along Nine Partners Road, and south of Sharon Turnpike.

The Town of Washington and Village of Millbrook have limited regulation of steep slopes in

[40] Southern Tier Central Regional Planning and Development Board. *Steep Slopes and Land Use Decisions,* 2021. https://www.stcplanning.org/wp-content/uploads/2020/09/SteepSlopes_LandUse.pdf

[41] Chemung County Environmental Management Council. *Chemung County Natural Resources Inventory.* 2008. https://chemungcountyny.gov/647/Natural-Resources-Inventory.

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

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

local code. Washington excludes slopes exceeding 20% from the calculation of buildable land under the Town's open space subdivision regulations (section 340). Millbrook's Design Standard regulations include a general reference to steep slopes in the list of potential lands unsuitable for development (section 201-21), which the Planning Board may require to be set aside during subdivisions.

## Bedrock Geology (Map 5)

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

Bedrock is the solid rock that lies beneath the soil and subsoil. Topography, ecological communities, development patterns, and mineral resources are all influenced by underlying bedrock geology. Geology also affects the quality and quantity of groundwater, migration of pollutants, drainage patterns, and soil characteristics.[44] This section describes the general bedrock geology of Washington, formed millions of years ago. Surficial geology deposits left by receding glaciers ~15,000 years ago following the last ice age are described in the following section. A more in-depth overview of local geology is available in the Dutchess County Natural Resources Inventory.[45]

The Bedrock Geology Map displays information from statewide maps produced by the New York State Museum at a scale of 1:250,000 and is best used as a general reference.[46] All of the bedrock in Washington was formed between about 500 and 400 million years ago, in the Cambrian and Ordovician periods of the early Paleozoic Era. They include two of the three major rock groups: sedimentary and metamorphic rocks. Sedimentary rocks are formed at or near the earth's surface by the accumulation or deposition of mineral or organic particles, and often have distinctive layering or bedding. They include shale, sandstone, limestone, and other carbonate rocks. Carbonate rocks are a class of sedimentary rocks composed primarily of calcium carbonate, such as limestone and dolostone. Metamorphic rocks are derived from sedimentary or igneous rocks that were transformed by heat and pressure into a new kind of rock. Examples in Washington include schist, phyllite, quartzite, and marble, which is a metamorphosed form of carbonate rock.

The bedrock geology of Washington is dominated by schist, phyllite, and metagraywacke, a type of sandstone. Smaller areas of limestone and marble occur in the central, northeast, and northwest part of town. The *Significant Habitats in the Town of Washington* report notes that

[44] Budnik, R. T., J.R. Walker, and K. Menking. "Chapter 3: The Geology and Topography of Dutchess County." In *Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[45] Ibid.

[46] Fisher, D. W., Y. W. Isachsen, and V. L. Rickard. *Geologic Map of New York: Hudson-Mohawk Sheet*. New York State Museum and Science Service, Map and Chart Series No. 15, 1970. http://www.nysm.nysed.gov/research-collections/geology/gis.

most of the bedrock outcrops observed during the field portion of the project were schist, with a large band of quartzite along the western edge of the town.[47] Marble and limestone outcrops appeared to be rare.

The Village of Millbrook is also predominantly underlain by schist, phyllite, and metagraywacke.

Bedrock characteristics are of greater importance for land-use planning purposes than the names of the specific bedrock types. In particular, bedrock geology strongly influences groundwater availability and biodiversity patterns.

**Bedrock and Groundwater Availability**

Since groundwater is obtained from fissures and cavities in bedrock, the quantity of water yielded depends on how much the rock is fractured and how well the fractures, crevices, and cavities interconnect. Carbonate rocks form the most productive bedrock aquifers in Dutchess County, and can in some cases yield hundreds of gallons-per-minute (gpm) from drilled wells.[48] Carbonate rocks are productive because they dissolve easily, allowing water to flow into the channels and caverns that develop in the rock, but this same quality increases their vulnerability to contamination and transmission of pollution. Locations where carbonate bedrock is overlain by highly permeable glacial outwash sand and gravel deposits have the highest water yields. Water from limestone is generally hard with relatively high levels of dissolved solids.

Carbonate bedrock is rare in Washington, though, and the predominant shales, graywacke, and schist have low porosity and low permeability, with slow movement of groundwater. Wells drilled into shale and greywacke are not reliable sources of groundwater, with volumes yielding an average 16 gpm, and the groundwater is moderately hard.[49] Wells in these areas may also be sulfurous. Mountainous areas underlain by quartzite have even lower well yields, averaging 10 gpm, and the groundwater is soft.[50] See the Surficial Geology and Drinking Water sections of the NRI for more information about groundwater supplies in Washington.

**Bedrock and Biodiversity**

Bedrock strongly influences soil properties, as well as groundwater and surface water chemistry, which in turn influence the establishment of ecological communities. Carbonate bedrock including limestone and certain shales often support rare plants and uncommon habitats. Limestone occurs in the center of Washington east of Millbrook, and in the northwest corner of Town. The northeast corner of Town is underlain by marble. The *Significant Habitats in the Town of Washington* report notes that most of the bedrock outcrops observed in Washington were

[47] Tollefson and Stevens, 2004.

[48] Findlay, Stuart, Dave Burns, Russell Urban-Mead, and Tom Lynch. "Chapter 5: The Water Resources of Dutchess County." In *Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[49] Ibid.

[50] Ibid.

not calcareous.[51]

## Surficial Geology (Map 6)

Surficial geology refers to unconsolidated sediments lying above the bedrock. The weathering of both bedrock and surficial geology deposits along with organic matter, water, and air is responsible for the slow process of soil formation and the properties of these "parent materials" strongly influence resulting soil chemistry, nutrients, and texture.

**Surficial deposits** are unconsolidated sediments primarily resulting from deposits left behind as glaciers retreated at the end of the last ice age, ~15,000 years ago. They are important sources of sand, gravel, and crushed stone.

Surficial geology is a determining factor in the location of aquifers (see Water Resources section) and other water supplies and in the location of valuable sand, gravel, and clay deposits. Protecting these resources where they exist may be important for potential future use. Surficial geology is also important for construction and transportation planning, and for siting potential sources of contamination that could pollute groundwater supplies.

The surficial geology of Washington reflects the retreat of glaciers following the last ice age. A giant ice sheet blanketed the area during the Wisconsin Stage of the Pleistocene Epoch, ~15,000 years ago. Glacial ice, as much as 5,000 feet thick, scoured the landscape and deposited boulders, sand, and gravel in its path. Glacial meltwater turned parts of the Hudson Valley into vast glacial lakes and left behind beaches, deltas, and deposits of silt and clay.

The Surficial Geology Map displays information from statewide maps produced by the New York State Geological Survey.[52] This map, like the one for bedrock geology, was developed at a scale of 1:250,000 and is best used as a general reference.

Glacial till is the predominant surficial material present throughout the Town. Till is more thinly deposited over bedrock in the Town's higher terrain. Most till in Washington is high in clay, which reduces its permeability, limits its usefulness for groundwater supply, and requires septic systems to be carefully designed and separated from wells.[53] Outwash sand and gravel deposits along with more recent alluvial (stream) deposits occur along the East Branch of Wappinger Creek and are the Town's most productive groundwater sources, capable of yields of hundreds of gallons per minute. They are important areas for groundwater recharge, but are also vulnerable to contamination from septic systems, salt, chemical spills, and other sources. Outwash deposits are

[51] Tollefson and Stevens, 2004.
[52] Caldwell, D. H., and R. J. Dineen. *Surficial Geologic Map of New York, Hudson-Mohawk Sheet.* New York State Geological Survey, 1987.
[53] Comprehensive Plan, 2012.

also valuable sources of sand, gravel, and crushed stone for building and road construction. Lake sediments include silt, clay, and sand deposits that originated in small glacial lake environments occur in the vicinity of Mabbettsville.

Glacial till is also the most common surficial deposit in the Village of Millbrook. There is one substantial sand and gravel deposit along Route 44 and North Avenue in the southern section of the Village.

## Soils (Map 7)

**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.

Soils are the foundation for the establishment of natural communities of plants and animals, agricultural production, and ecological processes that support the productivity of plants and water quality. Soils are also significant carbon storage reservoirs, and thus play a role in mitigating and preventing greenhouse gas accumulation in the atmosphere. Soil characteristics including reaction (acidity or alkalinity), drainage, texture, depth to bedrock, and slope inform the establishment of natural communities.[54] Soils also 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.

The *Soil Survey of Dutchess County*[55] was first published in 1939 and updated in 1955, 1972, and 2001. The 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's important to note that county soil maps are only approximate; any soil unit may contain "inclusions" of up to 2 acres of soil types different from the mapped unit. Field verification is necessary to confirm soil conditions and types on a particular site. The *Dutchess County Natural Resource Inventory* provides an introduction to soils of the county and discusses implications for land use decision-making.[56]

Soils data are most easily viewed online using the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey.[57] **Appendix A** lists soil types found in Washington along with selected soil characteristics, such as map symbol, soil name, depth to bedrock, drainage class, hydrologic soil group, and farmland classification, based on tabular information provided in the

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

[55] Faber, Marjorie. *Soil Survey of Dutchess County, New York.* United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with Cornell University Agricultural Experiment Station, 2001. https://www.caryinstitute.org/sites/default/files/public/downloads/lesson-plans/DutchessSoilSurvey.pdf

[56] Walker, J., E. Hoxsie, and P. Groffman. "Chapter 2: The Soils of Dutchess County." In *Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[57] Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

county soil survey. These attributes and their relevance to land use planning are described below.

***Depth to bedrock*** influences suitability for septic and other wastewater treatment systems, as well as the siting of buildings and roads. Shallow soils (<20 inches to bedrock) are often associated with steep slopes, increasing susceptibility to erosion. Shallow soils are also less capable of filtering pollutants draining to surface and groundwater supplies.

***Soil drainage class*** (dominant condition) indicates the possible presence of wetlands and is a particularly important factor to consider in the evaluation of proposed development. Somewhat poorly drained soils are good indicators of possible wetland areas and poorly drained and very poorly drained soils are indicators of probable wetland areas, and in most cases coincide with hydric soil classification.[58] In well drained and excessively well drained soils, water that is added moves through and out of the soil very quickly. These are usually soils with coarse texture, e.g., large sand grains.

***Hydric soils*** form under conditions of saturation, flooding, or ponding that last long enough during the growing season to result in anaerobic (no oxygen) conditions near the soil surface . Soils classified as hydric are commonly referred to as wetland soils, and largely correspond to poorly and very poorly drained soil classes.

***Hydrologic soil group*** (HSG) indicates the runoff potential of soils. Map 7 shows the hydrologic soil groups in Washington and Millbrook. HSG A soils are the most granular and least likely to produce runoff, 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. See the aquifer recharge rates and septic system density section below for more information.

***Soil reaction*** refers to the acidity or alkalinity of the soil, expressed in pH values. 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.[59] Soils developing over calcium-rich bedrock such as limestone often support disproportionately high numbers of rare plants, animals, and natural communities.

***Farmland classification*** identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops. Prime farmland soils are defined by the USDA and New York State and considered the most productive soils for farming. 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. Prime farmland soils are relatively limited in extent and scattered throughout the Town of Washington, without any noteworthy concentrations. Statewide important farmland soils are more widespread and account for 33% of all soils in Washington. They are most common in valleys and at lower elevations. Farmland soils are shown on Map 18 (Agricultural Resources).

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

[59] Kiviat and Stevens, 2001.

**General Soils Overview**

The following general soil descriptions are taken from the county soil survey. As noted above, within each major soil group, smaller areas, or inclusions, of different soils may be found. There are 38 soil types or series found in the Town of Washington. The most common soils are the Nassau-Cardigan complex (about 23 percent of the Town's area), the Dutchess-Cardigan complex (about 18.5 percent of the Town's area), Hoosic gravelly loam (about 10 percent of the Town's area), and Stockbridge silt loam (about 8.5 percent of the Town's area). General characteristics of these soils are summarized below but should not be substituted for site-specific analysis.

***Nassau-Cardigan complex (very rocky)***. Formed from glacial till, this soil contains about 40 percent shallow, somewhat excessively drained Nassau soils, 40 percent moderately deep, well-drained Cardigan soils, and 20 percent other soils including rock outcrops. In locations where slopes exceed 15 percent, these aforementioned ratios shift to 45 percent Nassau, 30 percent Cardigan, and 25 percent other soils. Because of the different soils within this complex that may be found on a particular site, depth to bedrock and depth to water table may be quite variable. While this soil series is generally moderately permeable (Hydrologic Group C), site specific conditions may vary due to the mix of soils present in this complex. Construction limitations may include shallow depth to bedrock and rock outcrops, moderate to severe erosion hazard depending on slope percentage, and frost action (freezing and thawing of soil moisture). For the placement of septic fields, limitations are shallow depth to bedrock and areas of rock outcrops. In addition, a water pollution hazard exists because the soil is not deep enough to filter effluent.

***Dutchess-Cardigan complex***. Also formed from glacial till, this complex includes about 40 percent Dutchess soils, 30 percent Cardigan, and 30 percent other soils including rock outcrops. Depth to bedrock is generally greater than 60 inches, except in and near rock outcrops. The soil is generally permeable (Hydrologic Group B), however, because of the intricate pattern of soil types included in this group, construction limitations may be present depending on specific site conditions. Construction limitations may include a shallow depth to bedrock and rock outcrops, moderate to severe erosion hazard depending on slope percentage, and frost action. For the placement of septic fields, depth to bedrock in areas of Cardigan soils and rock outcrops, as well as slow percolation in areas of Dutchess soils are the main concern.

***Hoosic gravelly loam.*** Formed in glacial outwash along alluvial deposits adjacent to major streams, these are very deep, highly permeable soils (Hydrologic Group A). Permeability in Hoosic soils is moderately rapid or rapid in the subsoil and very rapid in the substratum. These soils have few construction limitations but have poor filtering capacity for installation of septic tank absorption fields, posing risk for groundwater pollution. Specially designed septic systems are necessary in places.

***Stockbridge silt loam.*** Formed in glacial till deposits, these are very deep, gently sloping, and well drained soils. These soils have few construction limitations. Slow percolation is the main limitation for installation of septic tank absorption fields. Modifying a conventional system by extending the length of the distribution lines will allow onsite sewage disposal in most places.

## Aquifer Recharge Rates and Septic System Density[60]

Annual aquifer recharge rates along with rainfall data can be used to identify available groundwater capacity and develop recommendations for sustainable septic system density. A 2006 study, *Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations*,[61] identifies annual aquifer recharge rates for the four Hydrologic Soil Group (HSG) classes, which can be used to calculate water budgets and identify available groundwater capacity for parcels or larger areas. The same study 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 recharge rates and recommendations for septic system density are provided in Table 7.

Table 7. Aquifer Recharge Rates and Recommended Average Septic System Density for Hydrologic Soil Groups

| Hydrologic Soil Group (HSG) | Annual aquifer recharge rate | Average recommended septic system density |
|---|---|---|
| A | 17.3 inches/year | 1.4 acres |
| B | 12.6 inches/year | 1.9 acres |
| C | 6.5 inches/year | 3.5 acres |
| D, B/D, C/D | 3.6 inches/year | 6.2 acres |

These average densities do not apply where central water or central wastewater services are available. In addition, some clustering can be accommodated where nearby compensatory acreage is available. However, in general, sufficient local recharge must be available to dilute septic system discharges to ensure long-term proper functioning of domestic wells and septic systems. 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.



[60] This section adapted from text by Russel Urban-Mead for the Town and Village of Rhinebeck Natural Resources Inventory, 2022.

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

# Chapter 4: Water Resources[62]

All residents of Washington and Millbrook rely on groundwater for their drinking water, making the abundance, safety, and protection of water an issue of vital importance. This chapter describes the water resources of the Town and Village and contains maps and figures that demonstrate where groundwater and surface water are found, information about how they are being replenished, and land use considerations for maintaining and improving water quality. Some key water resource maps and images contained in this chapter include:

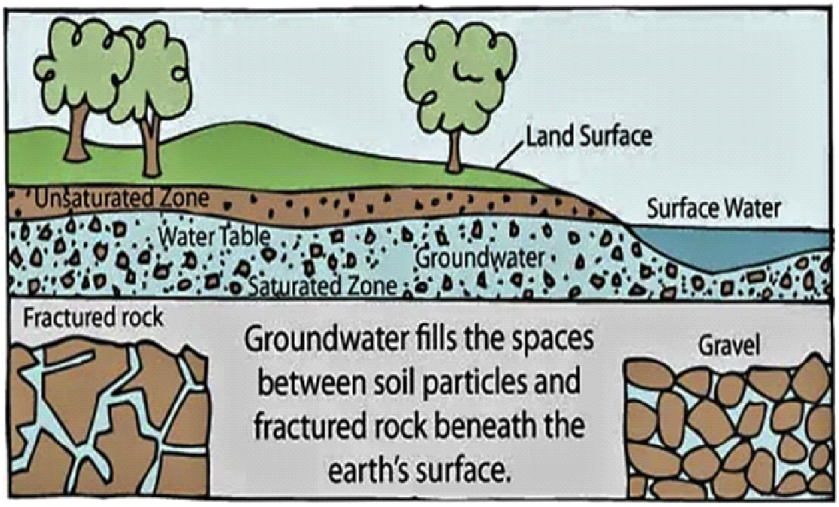
- Drinking Water Resources (Map 8),
- Watersheds (Map 9),
- Water Quality Classifications (Map 10),
- Floodplains & Riparian Areas (Map 11), and
- Wetlands (Map 13).

To maintain clean water, collective impacts on water resources must be considered during the local decision-making process. Although impacts to surface and groundwater can be from a single source, often many, smaller, defuse sources of pollution, such as nonpoint source pollution, can be responsible for degraded water quality.

## Drinking Water Resources (Map 8)

Groundwater is a resource of utmost importance in the Town and Village as it is the source of drinking water for the entire population. Groundwater is water that occurs below the ground surface, in the spaces between sand, sediments, and bedrock formations (see Figure 1). [63] People access groundwater by drilling wells into aquifers to pump the water for consumption. The depth of these wells can be shallow, say 20 feet, or as deep as hundreds of feet underground.

The Town of Washington's residents almost exclusively rely on groundwater from on-site private domestic wells as the source of drinking




**Source water** refers to untreated water from surface water (streams, rivers, lakes, and reservoirs) or groundwater (aquifers) used to supply water for drinking or other purposes.

[62]This chapter draws directly upon information presented i
"Chapter 5: The Water Resources of Dutchess County." in
2010. Available: https://www.dutchessny.gov/Departments/Planning/Docs/nrichapfive.pdf

[63] Groundwater Foundation. *What is Groundwater?* 2022 https://groundwater.org/what-is-groundwater

water.[64] The Village's ~1,500 residents rely on the municipally owned public water system that is supplied by a series of infiltration galleries directly fed by the Shaw and Mill Brook.[65]

Groundwater and surface water are connected by the water cycle and interact at many places throughout the landscape.[66] The strength and speed of the connection between depends on many factors including the soils, surficial geology, bedrock geology, weather, the extent human water use, and land use practices (see Bedrock and Surficial Geology sections of this NRI). The areas where the connection between groundwater and surface water in the Town some of the strongest, and most relevant to people, can be found in Map 8 which displays productive aquifers and sensitive recharge labeled 1-3 in order of sensitivity, which are described in the 1992 Horsley, Witten Hegemann, Water Supply Protection Program report, Inc as follows:[67]

> The areas along Mill Brook and Shaw Brook are especially important because this recharge zone feeds the aquifer that is the source of the municipal water supply for the Village of Millbrook.

- Zone 1-Primary Recharge–permeable deposits, directly overlying aquifer
- Zone 2-Secondary Recharge- less permeable deposits, upgradient from aquifer, contributes to recharge through infiltration and ground water flow
- Zone 3-Tertiary Recharge- contributing area around streams that will subsequently seep into aquifer through infiltration

Zone 1 water can infiltrate directly from the surface to the aquifer, carrying contaminants with it. In Zones 2 and 3, the extent to which contaminants are filtered as water passes depends on how porous and biological and chemically active the soil is. Where the soil is sandy or porous, water flows more quickly below the surface, and fewer contaminants are removed. Therefore, it is important to identify and act on threats to aquifers to ensure a steady supply of groundwater that can be used as clean drinking water. Map 8 shows the location of important high-yielding aquifers, contribution areas that recharge aquifers, and the sensitive source watershed catchment area for Millbrook's Village Water System.

Aquifers most capable of supporting high yielding wells generally consist of sand and gravel. These deposits lie along some of the county's major stream and river valleys, a result of glaciers leaving behind deposits after the latest glacial period. In

> It is important to protect wells, infiltration galleries, and other drinking water sources from potentially contaminating land uses.

[64] *2010 US Estimated Private Domestic Wells*. Environmental Prote
https://epa.maps.arcgis.com/home/item.html?id=626c197d3b864

[65] Annual Drinking Water Quality Report for 2022 The Village of M k Water,
Available:https://cdn.townweb.com/villageofmillbrookny.com/v OR-2022.pdf

[66] Winter, Thomas C., et al. *Ground Water and Surface Water: A Single Resource*. USGS Report 1139, 1998, https://pubs.er.usgs.gov/publication/cir1139

[67] Horsley Witten Hegemann, Inc. "Task 1 Delineation of Aquifer Protection Areas." *Water Supply Protection Program for Dutchess County, New York*. Prepared for Dutchess County Water & Wastewater Authority. 1992. pp1-2.

some places these glacial outwash deposits overlie limestone bedrock formations. Some bedrock formations in Dutchess County consist of carbonates (limestone, marble, or dolomite); these formations tend to be more fractured than other bedrock formations, so they can support high-capacity wells capable of withdrawing hundreds of gallons per minute.[68] In Washington and Millbrook the most productive, and the most vulnerable, aquifers areas are found along the Shaw Brook, Mill Brook, East Branch Wappinger Creek, and Wappinger Creek (see Map 8).

**Public Water Supply Systems**[69]

In NYS, the definition of a Public Water System (PWS) is an entity that provides water to the public for human consumption. Any system with at least 5 service connections or that regularly serves at least 25 individuals daily for at least 60 days of the year is considered a PWS and is categorized as one of the following types: community and non-community (including non-transient non-community and transient non-community).

***Community Water System (CWS)***: CWS are defined as Water Systems that serve the same people year-round (e.g. in homes or businesses). Examples include public municipally owned (cities, towns, or villages) water systems, or privately-owned water suppliers that maintain their own drinking water systems. See section on Village Community Public Water System and Source Watershed below. There is one small CWS' Great Oak Properties (NY1322771), in the Town that pumps and treats ground water for up to 90 people operated by Daniele Apartments.

***Transient Non-Community Water System (TNC)*:** A non-community water system that serves different people for more than six months out of the year. Rest stops, parks, convenience stores and restaurants with their own water supplies are examples of transient non-community water systems. There are ten TNCs in the Town and Village serving 850 people.

***Non-Transient Non-Community Water System (NTNC)*:** a non-community water system that serves the same people more than six months per year, but not year-round. Schools, colleges, hospitals and factories with their own water supplies are examples of non-transient non-community water systems. There a four TNCs in the Town and Village serving about 435 people.

Table 8 shows basic attributes of the Village's community water supply along with 15 other public water systems that deliver drinking water to residential communities, educational facilities, camps, schools, businesses, and public facilities throughout the Town. Data was retrieved from the EPA's Safe Drinking Water Information System (SDWIS) and Consumer

[68] Findlay, S., Burns D., Urban-Mead, R., and Lynch, T. "Chapter 5: The Water Resources of Dutchess County." in *Natural Resource Inventory of Dutchess County, NY*, 2010. Page 24-25 Available: https://www.dutchessny.gov/Departments/Planning/Docs/nrichapfive.pdf

[69] "Drinking Water Program: Frequently Asked Questions." NYS Department of Health, 2018, https://www.health.ny.gov/environmental/water/drinking/faq_def.htm

Confidence Report Databases (CCR).[70], [71], [72]

Table 8. Master List of Water Systems in the Town of Washington and Village of Millbrook

| System Number-PWSID | Water System Name | Population Served | Public Water System Type | Source Type |
|---|---|---|---|---|
| NY1302770 | MILLBROOK VILLAGE | 1,500 | C | Ground water under the influence of surface water |
| NY1330725 | ORVIS SANDANONA SHOOTING GROUNDS | 525 | TNC | Ground water |
| NY1316167 | DUTCHESS DAY SCHOOL | 194 | NTNC | Groundwater under influence of surface water |
| NY1319036 | EVANGELICAL FREE CHURCH/UPTON C.S. | 155 | NTNC | Ground water |
| NY1330409 | THE MARKET AT MABBETTSVILLE | 100 | TNC | Ground water |
| NY1322771 | GREAT OAK PROPERTIES | 90 | C | Ground water |
| NY1330171 | CARY INSTITUTE OF ECOSYSTEM STUDIES | 55 | NTNC | Ground water |
| NY1330636 | CARY INSTITUTE OF ECOSYSTEM - DAY CAMP | 50 | TNC | Ground water |
| NY1330089 | DUTCHESS COUNTY FARM & HOME CENTER | 31 | NTNC | Ground water |
| NY1330416 | MILLBROOK VINEYARDS | 27 | TNC | Ground water |
| NY1316595 | LANTERN INN | 26 | TNC | Groundwater under influence of surface water |
| NY1316619 | CHARLOTTES | 25 | TNC | Ground water |
| NY1313004 | COTTONWOOD MOTEL | 25 | TNC | Ground water |
| NY1330408 | MABBETTSVILLE EXPRESSMART INC. | 25 | TNC | Ground water |

[70] EPA's Safe Drinking Water Information System (SDWIS) search for Millbrook and Washington. Available at: https://enviro.epa.gov/enviro/sdw_form_v3.create_page?state_abbr=NY

[71] EPA's Consumer Confidence Report (CCR) Available at: https://ordspub.epa.gov/ords/safewater/f?p=ccr_wyl:102

[72] NYS DOH, Dutchess County Contact Report 2023. Available: https://www.health.ny.gov/environmental/water/drinking/pws_contacts/dutc_contacts.htm

| System Number-PWSID | Water System Name | Population Served | Public Water System Type | Source Type |
|---|---|---|---|---|
| NY1316622 | WASHINGTON TOWN PARK | 25 | TNC | Ground water |
| NY1330756 | WINGS CASTLE | 25 | TNC | Ground water |

**Village Community Public Water System and Source Watershed**

The Village of Millbrook's municipal water treatment facility located in the Town of Washington is a critical place where ground and surface water interact. The facility is located approximately one mile east of the Village along NYS Route 44. The Village owns and maintains a community public water system and distribution system that serves ~1,400 customers in (2022) through 720 connections.[73] The source water for Millbrook Village (NY1302770) is ground water under the direct influence of surface water pumped from a series of infiltration galleries installed within a gravel aquifer adjacent to Shaw Brook and Mill Brook in the Town. Two vertical turbine pumps with a combined rated capacity of 250 gallons per minute are located at infiltration galleries installed 12-15 ft. deep within a gravel aquifer. The infiltration galleries function like a horizontal drain that is positioned below the water table so that it collects the groundwater percolating through the soil. Analysis indicates that as much as 75 percent of total discharge to the public water system comes from surface water in the nearby brooks. Raw water is pumped to the water treatment plant, which enters a 45,000-gallon tank under the building. The supply capacity is 374,400 gallons per day.[74] The raw water is chemically treated to make it safe for human consumption before being pumped to a 500,000-gallon elevated storage tank on Haight Ave. In 2021 the Village received a new water treatment facility, including a new filtration system.[75] This filtration system completes a $1.9 million upgrade to the Village's water system that began in 2018. This upgrade included refurbishing the water storage tank.

Due to the proximity to the land surface, and permeable material in the recharge zones, the Village's PWS infiltration galleries are at risk of contamination when the Mill and Shaw Brooks flood and collect contaminants. Because of its proximity to surface water and the character of the aquifer, pathogenic organisms can move from the surface water source to the well or infiltration gallery. This risk is increasing with the increasing frequency of extreme wet weather patterns.[76]

[73] "Annual Drinking Water Quality Report," Village of Millbrook Water Department, 2022. Available at: https://villageofmillbrookny.com/wp-content/uploads/2022/05/MillbrookWaterProject.pdf

[74] R.S. Lynch & Company, Inc. *Comprehensive Sewer and Water Plan*. 2011. https://cdn.townweb.com/villageofmillbrookny.com/wp-content/uploads/2022/05/Task3-SewerandWaterCompPlan6-9-11.pdf

[75] RE Water Treatment Facility" Village of Millbrook Press Release January 5th 2021. Available at: https://cdn.townweb.com/villageofmillbrookny.com/wp-content/uploads/2022/05/New-Water-Plant-announcement-to-public.pdf

[76] Ground Water Under the Direct Influence of Surface Water Factsheet https://www.oregon.gov/oha/ph/HealthyEnvironments/DrinkingWater/SourceWater/Documents/gwudi/gwudi-fact-sheet.pdf#:~:text=Groundwater%20under%20the%20direct%20influence%20%28GWUDI%29%20of%20surface,water%20source%20to%20the%20well%20or%20infiltration%20gallery.

**Village's Source Watershed**

The source watershed for the infiltration galleries is outlined in yellow on Map 8. NYSDOH delineated this watershed in 2004 through the Source Water Assessment Program (SWAP) using topography (high points and ridgelines). The catchment area is oblong, extending about 11 square miles into the Town from Shaw Pond to the North and the headwaters of Mill Brook to the South. It includes the entire geographic land areas that drain to the infiltration galleries that serve the Village.

The concentrated population of the Village, and the dependence of this population on the public water supply, makes it especially important to avoid the siting of potentially contaminating land uses in the source watershed highlighted in yellow.

> It is important to protect drinking water sources, infiltration galleries, and wells from potentially contaminating land uses.

The Village could receive a guidance and an updated source watershed delineation and guidance by enrolling in the Drinking Water Source Protection Program (DWSP2).[77] DWSP2 is a locally led, state-supported program that empowers municipalities to take action to improve and protect their public water sources and surrounding environment. The Water Quality Improvement Project (WQIP) program is a competitive reimbursement grant program that funds projects directly addressing documented water quality impairments or protecting a public drinking water source.[78]

**Inconsistencies in Drinking Water Protection Across Existing Maps and Regulations**

There are inconsistencies between Town code and New York Public Health Law protecting the Village's public water supply. As noted in the recent Hospitality Report completed for the Town of Washington "The Village and the Town's aquifer protection maps are different and may present confusion or conflicts in determining land use development constraints."[79]

**Town Aquifer Protection Overlay District**

An Aquifer Protection Overlay District (AQ) exists in the **Town of Washington Zoning Law §314**, which created a district with a reference map dated December 27, 1989(see Figure 2 below).[80] In addition, actions undertaken within Millbrook's public water supply watershed must

[77] "Drinking Water Source Protection Program (DWSP2)." NYS Department of Environmental Conservation. https://www.dec.ny.gov/chemical/115250.html.

[78] "Water Quality Improvement Project (WQIP) Program" NYS Department of Environmental Conservation https://www.dec.ny.gov/pubs/4774.html

[79] Stolzenburg, Nancy., *Town of Washington, NY Hospitality Evaluation Report.* Community Planning and Environmental Associates, Berne, NY, 2022. Refer to page 5 for noted inconsistency of aquifer protection maps- https://www.washingtonny.org/document-center/comprehensive-plan/comprehensive-plan-review-documents/1331-cprc-final-recommendation-report-july-1-2022/file.html

[80] Town of Washington, Zoning Code 2008. *Section 314. AQUIFER PROTECTION OVERLAY DISTRICT REGULATIONS.*

comply with any standards, rules, or regulations promulgated by the NYS Commissioner of Health under Public Health Law **§ 1100.** In case of any conflict in such standards, the more restrictive standard shall apply. Specifically, Public Health Law **§ 1100-1107** applies to the source of the public water supply of the Village of Millbrook and defines protection zones as "any of the watershed management zones, as delineated on the watershed protection zone map, dated April 1992… these zones shall be designated Zone I, Zone II and Zone III."[81] The Town's Aquifer Overlay Zoning Map identifies high yield aquifer areas but not contributing zones that are also important to protect.[82] The AQ district is based on older mapping. The 2022 Town of Washington Hospitality Report recommends updating the code to be consistent Village definition of protection zones.[83]

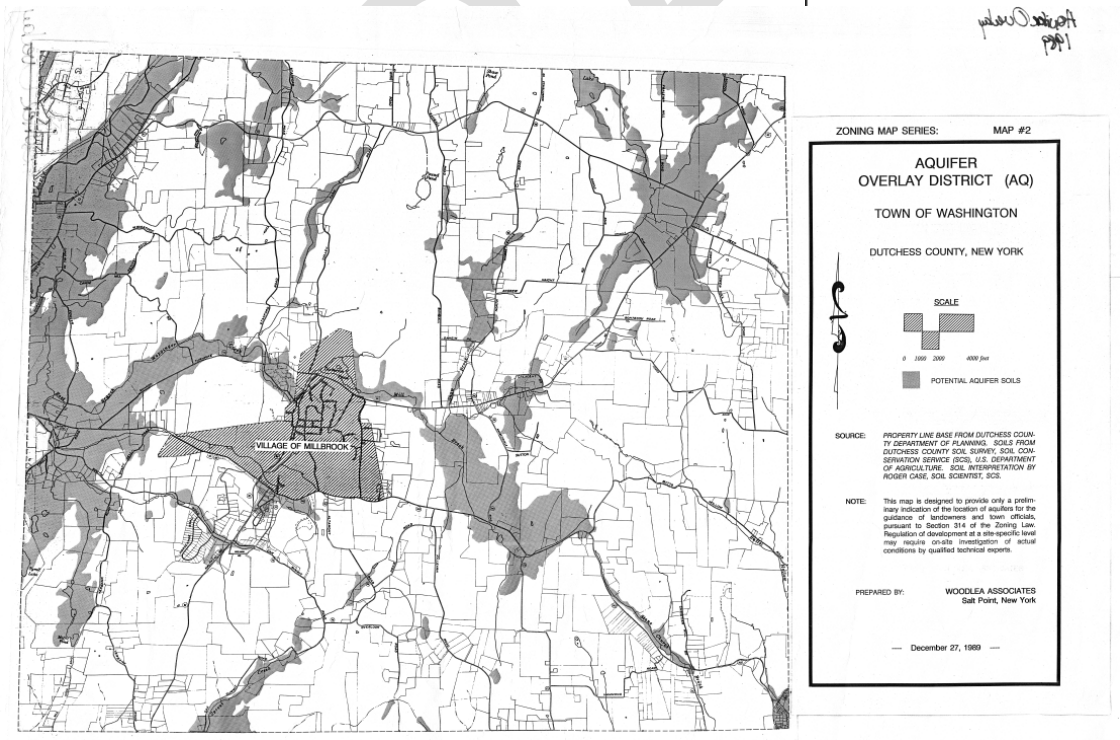
## Watersheds (Map 9)

Central to the information in this document is the concept of watershed. A watershed is the area of land from which water drains into a stream, river, lake, or other waterbody. Precipitation flows over and through the landscape into intermittent streams, creeks, rivers, aquifers, wetlands, and floodplains. The watershed concept helps to evaluate the impact of land use practices on water quality by specifying areas of land, streams, and aquifers that either are, or are not, connected.

**Nested Watersheds**

Figure SEQ Figure * ARABIC 3 Nested Watersheds

Source: NYS DEC




Source: DEC

e-revised-

llbrook

f

Environmental Associates, Berne, NY, 2022. Page 9 notes inconsistency of aquifer protection maps https://washingtonny.org/wp-content/uploads/2023/07/Condensed-Comprehensive-Plan-Addendum-re-Hospitality.pdf "

Watersheds are divided by high points on the land, such as ridges, mountains, and hills. Ridges and hills that separate two watersheds are called the drainage divide. Larger watersheds contain many nested smaller sub-watersheds or catchments (see Figure 3). For example, the Mill and Shaw Brook sub watersheds are nested within the greater East Branch Wappinger Creek watershed, which is in turn nested within the Wappinger Creek watershed or basin.

Healthy watersheds have immense value to both humans and the natural environment and provide several ecosystem services that directly benefit the Town and Village and cost less than the alternatives.[84] A healthy watershed can be characterized by several key features such as:

- a balanced and sustainable water cycle.
- natural flood control mechanisms, such as wetlands and floodplains, that absorb and retain water during heavy rain events.
- effective nutrient cycling, with a balance between natural (rainfall) and human (fertilizer) sources of nutrients and "sinks" for these nutrients such as plants and soils that prevent the movement of nutrients to streams or lakes where they can stimulate overgrowth of algae (eutrophication).
- limited impervious surface so precipitation has access to soils with the capacity to absorb and filter rainwater, reducing erosion and sedimentation.
- the ability to support a diverse range of wildlife, including fish, amphibians, birds, and mammals, and provide habitat for native plant species.

> A **balanced water cycle** means that water is replenished and distributed evenly throughout the watershed, and enough water is available to support the needs of people, plants, and animals. A **sustainable water cycle** means that human activities do not degrade or disrupt the natural systems responsible for water storage, movement, and filtration.

The Streams and Watersheds Map (Map 9) shows streams that were created by Hudsonia in 2004 in the *Significant Habitats for the Town of Washington* report including streams that are classified as perennial (flowing year-round) or intermittent (seasonal flow). Perennial streams are distributed widely throughout the Town of Washington. Intermittent streams are most common in the more hilly terrain on the eastern and western edges of the town.[85] Intermittent streams run only after precipitation events or during certain times of the year. They are often the first ones to be buried, ditched, filled, etc. Current stormwater drainage patterns and conveyance attempt to recreate these ephemeral stream routes, and often lead to localized flooding. Intermittent streams are important to the overall watershed, and account for a high percentage of total stream miles

[84] "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

[85] Tollefson, J., & Stevens, G. "Significant Habitats in the Town of Washington, Dutchess County, New York" Report to Millbrook Tribute Garden, the Dyson Foundation, the Town of Washington, and the Dutchess Land Conservancy. Hudsonia Ltd., 2004. Page 62. Available: https://static1.squarespace.com/static/631110deada85121498e9d85/t/634dbe394422c66921671a16/1666039359283/Washington-report.pdf

like small and intermittent ones. They are part of the headwater stream network. See the Stream Habitat section of this NRI for further discussion of stream values.

**Healthy watersheds** save money by:

- providing clean and plentiful water resources that support a variety of uses
- recharging groundwater
- trapping sediments and nutrient pollution from fertilizers and septic systems
- minimizing need for public infrastructure and water treatment costs
- regulating water flow and reduce erosion and flooding impacts
- enhancing climate change resiliency by sequestering carbon,
- manage water more effectively during droughts and floods

## Watersheds and Major Streams[86]

Most of the Town, and the entire Village is drained by Wappinger Creek, a major tributary of the Hudson River.[87] Sprout Creek, which drains the southwest part of town, flows into Fishkill Creek, another major tributary of the Hudson.[88] The eastern third of town drains eastward to Wassaic Creek, and Tenmile River which flows into the Housatonic River in Connecticut, eventually emptying into Long Island Sound.

Map 9 The shows standard watershed boundaries from the United States Geologic Survey (USGS) National Hydrography Dataset. Map 9 shows watershed boundaries or hydrologic units that represent the area of the landscape that drains to a portion of the stream network. All surface water within a given watershed is part of a hydrologic system classified and maintained by the USGS in a nationally consistent Watershed Boundary Dataset comprised of nested Hydrologic Unit Codes (HUC). The boundaries on Map 9 correspond to the 12-digit HUC scale, an appropriate ecological scale for understanding and managing surface water resources. These

[86] Using the River Runner mapping tool, it is easy to imagine the downstream flow path of water droplets. Type in an address or drop a point, and it will show you from that point a water droplet's flow path downstream, including how many kilometers of various creeks and streams it goes to until it eventually ends up in the ocean. https://river-runner.samlearner.com/

The USGS StreamsStats tool can delineate watersheds at a finer scale where desired. https://streamstats.usgs.gov/ss/

The EPA has developed other Online Tools such as the EnviroAtlas that allows users to interactively summarize data. Many of these data layers including Land Cover are summarized by 12-digit hydrologic unit codes (12-digit HUCs), or sub-watershed basins. https://enviroatlas.epa.gov/enviroatlas/interactivemap/

The WikiWatershed tool also has a Runoff Simulation to show how impervious surface affects a watershed's amount of runoff. https://wikiwatershed.org/

[87] The Hudson River Estuary Program provides technical assistance, grants, and training to municipalities and non-profits within the Hudson River estuary watershed. The Hudson River Watershed Alliance also provides numerous resources.

[88] Tollefson and Stevens, 2004. Page 8.

watersheds are described below.

*Wappinger Creek Watershed*
The Wappinger Creek and its tributaries drain approximately 210 square miles, roughly one-fourth of Dutchess County.[89] Several reports have studied the Wappinger Creek Watershed because it is a significant natural resource.[90] Roughly sixty percent of the land in the Town and the entire Village land area is in the Wappinger Creek Watershed.[91] The watershed has been further divided into sub-watersheds. The Town intersects two sub-watersheds within the larger Wappinger Creek basin. These are: East Branch Wappinger Creek and Hunns Lake Creek-Wappinger Creek. The 2022 *Watershed Characterization and Recommendations Report for the Wappinger Creek Watershed* undertaken by the Village of Wappingers Falls in partnership with the Wappinger Creek Watershed Intermunicipal Council (WIC) describes natural features in the basin, sources of pollution, issues, and recommendations.[92] The 2022 Characterization study breaks down point (coming from a discernible, confined and discrete conveyance, like a pipe) and non-point (more diffuse) sources of pollution by subwatershed. For the Town and Village, relevant analysis and conclusions for the East Branch subwatershed, which drains over half of the Town and the entire Village's area are provided below:

- *East Branch Wappinger Creek Subwatershed* total watershed land area encompasses 33.6 square miles. Subwatershed land use consists of 30% agriculture, 54% forest, 7% wetlands and waterbodies, and 9% developed land. Waters of the East Branch Wappinger Creek originate at the confluence of Shaw Brook and Mill Brook. The Shaw Brook stream runs south and west into the Mill Brook stream. The aquifer that supplies the Village's water supply is traversed by the Shaw Brook and the Mill Brook streams. The Millbrook Sewage Treatment Plant discharges municipal wastewater into the East Branch Wappinger Creek below Dieterich Pond.

**Key Issues and Recommendations from page 103 of the 2022 Wappinger Creek Report**

**Summary of Key Issues**

Key issues affecting water quality in the East Branch Wappinger Creek subwatershed:

- Total Sediment Load - This subwatershed releases a total sediment load of 49.0 pounds per acre from land cover sources. Of the total land cover sediment load, 58 percent comes from agricultural lands and 27 percent from streambanks.
- Total Phosphorus Load - This subwatershed releases a total phosphorus load of 0.05 pounds per acre from land cover sources. Of the total land cover phosphorus load, 73 percent comes from agricultural lands and 13 percent from developed lands.
- Livestock – This subwatershed releases a model estimated yearly phosphorus load of 2,257 pounds from farm animal operations.
- Water Quality - This subwatershed recorded a median phosphorus concentration of 0.044 mg/L exceeding the New York ambient guidance value of 0.02 mg/L to protect recreational use of waters during the 2017-2018 watershed sampling. The phosphorus contribution can be attributed to agricultural and livestock operations and failing septic systems. It can be assumed Millbrook sewage treatment plant located in the central portion of the subwatershed is also a possible phosphorus contributor with a yearly estimated load of 1,875 pounds.

**Key Recommendations for the East Branch Wappinger Creek Subwatershed**

- Identify the farms that would be candidates for conservation easements, or

[89] It
[90] N
[91] F
[92] W

*Fishkill Creek*

Ten percent of the Town drains to the Fishkill Creek, via the Sprout Creek, which drains the southwest part of town.[93] A management plan for the Fishkill Creek watershed was prepared in 2005 for the Fishkill Creek Watershed Committee which includes sections on Sprout Creek in the Town of Washington.[94] 4,742 people in the Town are in the Fishkill Creek Watershed with a population density of 80 persons per square mile.[95]

*Tenmile River*

The eastern third of the town flows into the Tenmile River watershed, via Stone Church Brook and Butts Hollow Creek. The 2021 Ten Mile River Watershed Management Plan has information pertinent to the eastern part of the Town.[96] Noting that Dairy is a particularly large agricultural segment in Town of Washington (752 acres)[97]. Agricultural activities can increase nutrient and sediment pollution of water.

Because the Town of Washington is dominated by higher elevations than surrounding towns, the Town's Comprehensive Plan notes that: Except for a small area traversed by the Wappinger Creek, Washington does not receive waters draining from other towns. Instead, storm waters flow out of the Town into nine other municipalities in Dutchess County. This gives Washington both an advantage and a responsibility in terms of water quality and flood conditions. Likewise, most of Washington's surface waters and aquifers are not subject to contamination from land uses outside the Town, but land uses within the Town of Washington can affect flooding, water quality, and water supplies.[98]

**Watershed Land Cover and Land Use**

There is a strong relationship between watershed land use/cover and water quality in streams, wetlands, and other waterbodies. Each time the use and cover of a land area changes, it can affect the hydrology of the landscape. Land and water are connected through the interactions of water, soil, organisms, and chemical components. Land cover is closely linked to the health of a watershed and the quality of its surface and subsurface waters. Watersheds with a high percentage of forest cover are generally associated with higher water quality and can lead to reduced costs associated with treating drinking water for consumption. Expanding impervious surfaces in a watershed such as roofs, pavement, roads, and other development is conversely



[93] Tollefson and Stevens, 2004

[94] Foord, D., LiCausi, S., Buono, V., & Newman, B. *Natural Resource Management Plan for the Fishkill Creek Watershed.* 2005 https://hudsonwatershed.org/wp-content/uploads/2013/01/fishkillcreekmgtplan1.pdf

[95] Ibid page 64-65

[96] *Ten Mile River Watershed Management Plan*. Prepared by the Housatonic Valley Association. 2021 https://hvatoday.org/wp-content/uploads/2022/01/2021_10_1_FullTMRWBP_Draft.pdf

[97] Ibid page 77

[98] Town of Washington. *2015 Town of Washington Comprehensive Plan*, [adopted December 10, 2015.] Page 26 Available: https://washingtonny.org/wp-content/uploads/2023/07/Condensed-Comprehensive-Plan-Addendum-re-Hospitality.pdf

associated with stream degradation.[99] Even low amounts of impervious cover can result in impacts. Research by the Center for Watershed Protection generally found degraded streams when impervious cover in their watersheds reaches 10%. (See Figure 4 below). Research undertaken in Dutchess County found impacts on nutrient levels in streams in watersheds with less than 5% impervious cover. Table 9 summarizes streams, tree canopy cover, and impervious surfaces present by subwatersheds in the Town and Village.

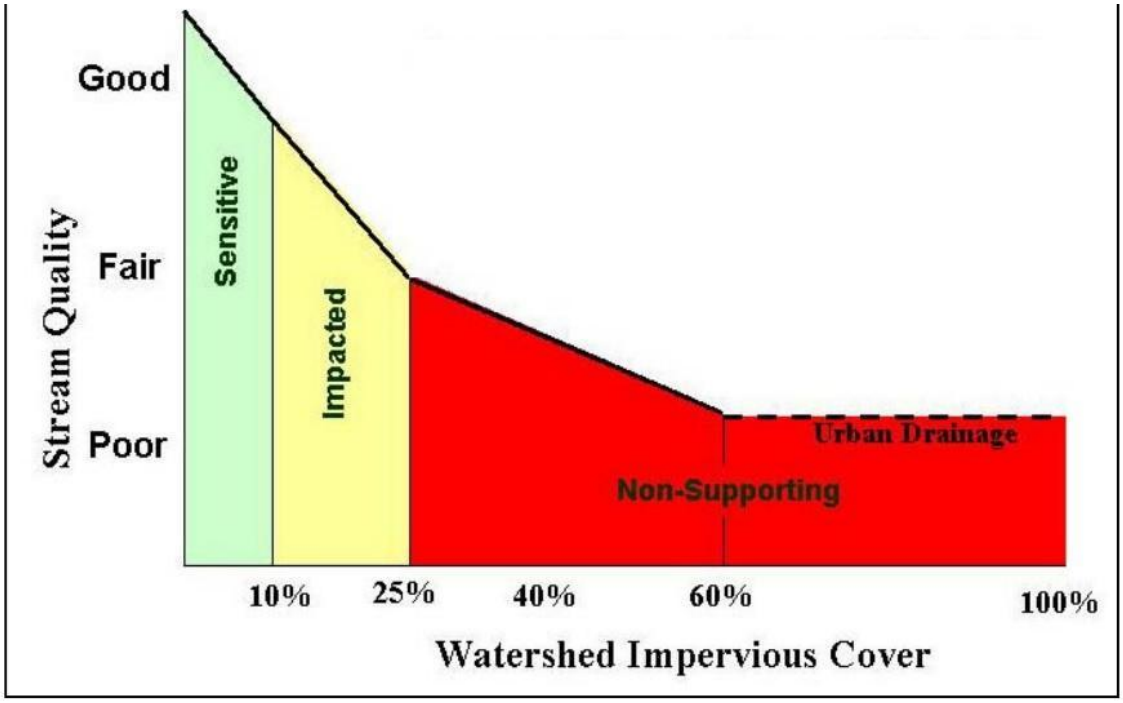



Figure 4. Percent Impervious Cover and Stream Quality

Source: Center for Watershed Protection

Table 9. Watershed and Subwatersheds in the Town of Washington, which encompasses the Village of Millbrook (Numbers reflect the entirety of the subwatershed, including areas outside of the Town and Village)

| Watershed (HUC 10) | Subwatershed (HUC 12) | Total Acreage | % Forest Cover 2016 | % Impervious Surface 2016 | Important Tributary Streams |
|---|---|---|---|---|---|

[99] 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

| | | | | | |
|---|---|---|---|---|---|
| Wappinger Creek (0202000802) | East Branch of the Wappinger Creek (020200080203) | 21,321 | 56 | 1.6 | -Mill Brook<br>-Shaw Brook |
| | Hunns Lake Creek-Wappinger Creek (020200080204) | 25,634 | 54 | 1.2 | -unnamed tribs |
| Fishkill Creek (0202000803) | Sprout Creek (020200080304) | 35,049 | 55 | 3.8 | -Sprout Creek |
| Tenmile River (0110000505) | Tenmile River (011000050506) | 26,942 | 64 | 1.8 | -Butts Hollow Brook<br>-Stone Church Brook<br>-headwaters to Wells Brook |
| | Wassaic Creek (011000050504) | 23,947 | 52 | 1.3 | -unnamed headwaters to Wassaic Creek |
| | Swamp River (011000050505) | 30,591 | 64 | 2 | -Stony Brook |

## Water Quality Classifications and Assessment (Map 10)

The New York State Protection of Waters regulations are a set of rules and guidelines designed to protect the quality of surface water in the state of New York.[100] . The regulations are enforced by DEC and apply to all waters within the state, including rivers, lakes, and streams. To achieve this, all waterbodies in NYS were assigned a class. Most of the waterbodies were assigned a class back in the 1950-1960s by NYS Department of Health while others were classified by NYS DEC using a letter-based system. Specifically for fresh surface waters there are four classes. The bulleted list below outlines the classification and designated best uses.

- 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

These classes help inform what Best Use is applicable to the waterbody (6 CRR-NY Part 701).https://govt.westlaw.com/nycrr/Document/I4ed867e4cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default) Each Best Use has applicable water quality standards that help protect and support its assigned best use. Some waterbodies classes may have an associated standard indicating either trout waters (T) or Trout Spawning Waters (TS) in which some water quality standards,

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

guidance values or temperature criteria apply specifically to this designation.[101]

The water classification system uses a letter-based system that ranges from Class AA to Class D. The classification system considers a wide range of factors, including the level of dissolved oxygen, pH levels, temperature, and the presence of pollutants. NYS DEC establishes a range of water quality standards for many specific substances and parameters in either a numerical or narrative context. Water quality standards are important as it sets maximum limits of chemical pollutants which assist with regulatory targets for permitting, compliance, enforcement as well as monitoring and assessing the quality of waters in NYS.[102] The designated "best use" of each water body is the basis of its Water Quality Standard (WCS). [103] For example, some water bodies classified as AA may be designated for drinking water supply, while others may be designated for recreation or aquatic life support.

Surface Waters of NYS are **Classified** to determine their best uses, then given a **Standard** to protect them.

Activities allowed in and around waterbodies are regulated by DEC based on the classification and standard of the waterbody.

Note that the waterbody classification does not necessarily indicate good or bad water quality – it relates simply to the designated “best uses” that should be supported. Table 10. below shows information about Stream and Waterbody Classifications in the Town. Water Quality Classifications and standards are available to the public on the DEC Environmental Resource Mapper tool. The Waterbody Inventory/Priority Waterbody List Factsheets for larger segments are available on the DEC info Locator tool[104] And the Division of Water Data Monitoring Portal provides all water quality data collected by NYS DEC from surface water bodies that are analyzed to inform the Waterbody Inventory/Priority Waterbody List.[105]

Table 10. Stream and Waterbody Classifications in the Town of Washington and Village of Millbrook



[101] Trout waters (T or TS) 6 CRR-NY 701.25NY-CRR701.25 https://govt.westlaw.com/nycrr/Document/I4ed867e4cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

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

[103] “Surface Water and Groundwater Quality Standards.” NYS Department of Environmental Conservation. https://www.dec.ny.gov/regs/2485.html

[104] DEC Info Locator Tool Available: https://gisservices.dec.ny.gov/gis/dil/

[105] DEC Division of Water Data Monitoring Portal Available: https://nysdec.maps.arcgis.com/apps/webappviewer/index.html?id=692b72ae03f14508a0de97488e142ae1

| Waterbody Segment (ID) | Class | Standard Managed/ Protected to Support Best Uses | Water Quality Use Assessment | Pollutants | Notes |
|---|---|---|---|---|---|
| Wappingers Creek, Middle, and Minor Tribs (1305-0014) | B | Fishing, swimming and other contact recreation | Stressed-Needs Verification[106] | pH | Portion of the Wappinger creek flowing through the north-western corner of the Town |
| East Branch Wappingers Creek , Lower and Tribs (1305-0022) | B | swimming and other contact recreation | Fully Supported-Needs Verification | Dissolved Oxygen, Nitrite, pH | This is the only segment with data in the village |
| East Branch Wappingers Creek, Upper, and Tribs (1305-0023) | A | Source of drinking water, | Impaired-Needs Verification | Iron | Stream and tribs above the Village of Millbrook |
| | | Fishing, swimming and other contact recreation | Stressed-Needs Verification | pH | |
| Sprout Creek, Upper and Tribs (1304-0022) | C | Fishing | Fully Supported-Needs Verification | Dissolved Oxygen, pH | In the southwest corner of the Town, along Oak Summit Road |
| Wells Stream and Tribs (1601-0023) | A | Source of drinking water, | Stressed-Needs Verification | Ammonia , Chloride, pH | In the southeastern corner of the Town, near Higher |

[106] Additional monitoring is needed to determine whether "best use" is in fact impacted or impaired.

| Waterbody Segment (ID) | Class | Standard Managed/ Protected to Support Best Uses | Water Quality Use Assessment | Pollutants | Notes |
|---|---|---|---|---|---|
| | | Fishing, swimming and other contact recreation | Stressed-Needs Verification | pH | Ground Frame Lane and Hammond Hill Road |
| Tenmile River, Upper, and minor Tribs (1601-0012) | C | Fishing and non-contact recreation | No Known Impact | | Includes Stone Church Brook and Butts Hollow Creek |
| Wassaic Creek and Tribs (1601-0024) | C | Fishing | Stressed-Needs Verification | pH | In the northeastern corner of the town near Bontecou Lake |
| Mill River and tribs (1601-0017) | unassessed | | | | |
| Shaw Pond (1305-0026) | unassessed | | | | |
| Round Pond (1305-0024) | unassessed | | | | |
| Dieterich Pond (1305-0025) | unassessed | | | | |



**Water Quality Monitoring and Assessment**

Waters within New York State are *assessed* to determine their ability to support their specific designated best uses. The processes used to assess the quality of New York State waters is contained in the New York State Consolidated Assessment and Listing Methodology (CALM). [107] Once valid water quality data is evaluated and categorized, and a waterbodies best use has been

[107] Consolidated Assessment and Listing Methodology NYS Department of Environmental Conservation. 2021, pg 8 https://www.dec.ny.gov/docs/water_pdf/calmmay2021.pdf

assessed an overall waterbody assessment is assigned. A waterbody is assigned one of five categories:

- Impaired— Data or information indicate failure to support Best Use(s). Any use is assessed as Impaired/Confirmed.
- Minor Impacts— Data or information indicate a potential impact to the Best Use(s). Any use is assessed as Stressed/Confirmed,unless a use is Impaired/Confirmed.
- Fully Supported— Data or information indicate no impact to the Best Use(s). All evaluated uses are assessed as Fully Supported/Confirmed.
- Needs Verification—Any use is assessed as Unconfirmed, unless a use is Impaired/Confirmed.
- Unassessed— Water quality data is unavailable or does not meet water quality data requirements All uses are unassessed.

Compared with its classification, a waterbody's assessment offers an understanding of the condition. This is valuable information as with waterbody assessments can attract more grant opportunities, prioritization of water quality improvement projects, inform proper permitting, compliance, and enforcement activities as well as development of clean water plans. Obtaining or currently having waterbody assessments helps with next steps on ways to protect healthier streams or restoring and improving impacted streams.

Two Water Inventory Priority Water Body List segments are explained further in detail below because they are pointing towards stressed/impaired. Recent observations reported in the 2022 Wappinger Creek study found the watershed to be overloaded with phosphorus and filled with silt.[108] The Wappinger Creek segment in the Town is designated as "Stressed-Needs Verification" (see Water Quality Use Assessment Column in Table 10 above). This means that additional monitoring and data is needed as there is not enough information to confirm whether the waterbody is supporting its best use. Three lakes in the Town are unassessed.

The Class A segment of the East Branch Wappingers Creek, Upper, and Tribs is considered Impaired- Needs Verification for iron. This means that additional monitoring and data is needed as there is not enough information to confirm whether the waterbody is supporting its best use.

The Aquatic Biomonitoring Unit samples water quality in streams throughout New York State on a rotating basis. Each sample receives a water quality score based on the number and kinds of macroinvertebrates (stream insects) present. Macroinvertebrates are commonly used as indicators of water quality because they have been shown to be sensitive to pollution and habitat quality. Results from DEC's most recent Aquatic Biomonitoring of the Shaw Brook, last monitored on 7/25/2017, and the Mill Brook last monitored 9/13/2007, found the condition of both were considered Slightly Impacted, which denotes good water quality.[109] This rating suggests that the

[108] *Watershed Characterization and Recommendations Report for the Wappinger Creek Watershed.* Prepared by KC Engineering and Land Surveying, for The Village of Wappinger Falls. 2022. https://hudsonwatershed.org/wp-content/uploads/Wappinger-Creek-Watershed-Characterization-Recommendations-Report-Final-June-2022.pdf

[109] NYS DEC "Fact Sheet on Assessment of Water Quality Impact in Streams and Rivers"

water quality usually does not limit fish survival but may be limiting to fish propagation. Refer to the DOW Data Monitoring Portal for more information.

**Priority Waterbodies List**

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) compiles waterbody assessment information for all lakes, rivers, streams, estuaries and coastlines in the state.[110][111] The WI/PWL Fact Sheets outline the most recent assessment based on the ability of waters to support their best uses. NYS DEC identifies water quality problems and potential pollutant sources and summarize activities to restore and protect each water body. Links to fact sheets for waterbodies in Washington/Millbrook are provided in the Table 10. Questions about the information provided in the WI/PWL factsheets can be directed to the Hudson River Estuary Program or Division of Water.

**New York State Stream Regulations**

Certain activities allowed in and around waterbodies are regulated based on their classification and standard. For example, DEC limits discharge from industrial and municipal wastewater treatment facilities to waters with a specific classification.[112] C(T), C(TS) and all types of B and A 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. 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 Map 10 for distinctions between each of the stream classifications.

While state regulations provide a level of protection to the bed and banks of protected streams, numerous class C and D streams as well as stream buffer areas along all streams lack these disturbance protections and present 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.

**Local Stream Protections**

The Town has a local wetlands and watercourses protection law, adopted in 2011, which protects and regulates activities in and near wetlands, potable water sources, and watercourses. Permitting is overseen by the Town Planning Board, in consultation with the Conservation Advisory Commission (CAC). **Town of Washington Zoning Law §396** includes a 100-foot wetland buffer for 1-acre wetlands and a 50-foot buffer for wetlands between ¼ and 1 acre.[113] For

https://www.dec.ny.gov/docs/water_pdf/bapnarrative18.pdf

[110] DEC Division of Water Data Monitoring Portal Available: https://nysdec.maps.arcgis.com/apps/webappviewer/index.html?id=692b72ae03f14508a0de97488e142ae1

[111] "Water Quality Monitoring," NYS Department of Environmental Conservation. http://www.dec.ny.gov/chemical/23848.html

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

[113]" WETLANDS AND WATERCOURSES LAW OF THE TOWN OF WASHINGTON" Section 396 Page 44

perennial watercourses there is a 100-foot buffer "controlled area". The Town has also adopted an Aquifer Protection Overlay District which prohibits disposal wells, recharge basins (stormwater), snow disposal, and animal waste disposal, and restricts several other uses. Other pertinent zoning code sections include **§316, Aquifer Protection Overlay**[114] and other Environmental Preservation District Regulations, including **§335 Erosion and Sedimentation Control**[115]. As mentioned in the Drinking Water section getting the maps and narratives in sync so that they are consistent between the Town and Village. Especially as it pertains to the Village's drinking water.

## Floodplains & Riparian Areas (Map 11)

Floodplains provide space for waterbodies to expand in times of rapid rain or snowmelt. Undeveloped floodplains are important safety zones, protecting people and development from damaging flood waters.

The Floodplains & Riparian Areas Map 11 shows approximate floodplains mapped by the Federal Emergency Management Agency (FEMA). Floodplains are low-lying areas, often next to streams and rivers that become inundated during heavy precipitation or snowmelt events. Floodplains are an integral and dynamic part of streams and rivers providing the space these waterbodies need to expand, contract, and change course over time. During heavy rains, the water runs off from the land into the river system, the water in the river rises, eventually it exceeds the channel, and it flows out onto its floodplains where it slows down, it spreads out. Floodplains are connected to streams but can extend far from a stream or river and aren't necessarily found alongside them.

Undeveloped floodplains serve as an important safety zone protecting people and development from the damaging waters of a flood. While flooding is a natural occurrence, flood damage commonly occurs when development is situated in a floodplain. Floods are the most common and expensive hazard in New York State in terms of human hardship and economic loss, particularly to communities that lie within flood-prone areas or floodplains of a major water source.[116]

The Wappinger Creek basin has experienced frequent flood events in the past. The majority of these flooding events have been caused by severe coastal storms and hurricanes. Dutchess County completed a County-Wide Hazard Mitigation Plan following requirements of the Federal Disaster Management Act (DMA). The plan includes Jurisdictional Annexes for each municipality describing the major flood events experienced between 2008 and 2016 (see Table

Available: https://washingtonny.org/wp-content/uploads/2023/06/Zoning-Code-Complete-revised-7-22-2022.pdf

[114] Ibid Page 17

[115] Ibid Page 55

[116] Hazard Mitigation Plan - Dutchess County, New York.2015: https://www.dutchessny.gov/Departments/Emergency-Response/Hazard-Mitigation-Plan.htm

11).[117], [118] Washington and Millbrook are subject to riverine flooding, flash flooding, ice jam flooding, and dam failure flooding.[119]

The Jurisdictional Annex for the Town of Washington in the Hazard Mitigation Plan documents that the Town experienced losses from one presidentially declared major disaster (Hurricane Irene) and other widespread flooding hazards between 2008 and 2016. The Jurisdictional Annex for the Village of Millbrook documents that the Village also experienced presidentially declared major disaster losses from Hurricane Irene as well as from remnants of Tropical Storm Lee and Hurricane Sandy, in addition to other widespread flooding events between 2008-2016.

Table 11. Flood-Related Hazards Documented in Town of Washinton and Village of Millbrook

| **Municipality** | **Dates of Event** | **Event Type** | **FEMA Declaration #** | **County Designated?** | **Summary of Damages/Losses** |
|---|---|---|---|---|---|
| Washington (T) | March 11-13, 2011 | Heavy Rainfall, Snowmelt, Ice Jams | N/A | N/A | x Roads Flooded. 3/11/11 - 7 men, 7 hours; Damaged bridge headwall and road required replacement on Shady Dell Rd; Butts Hollow Rd washed out – 8 hours, 3 men, and 10 loads of stone to fill; Kennels Rd washed out – 4 loads fine stone, grader and loader required; Killearn Rd and Hammond Hill Rd – pipes plugged, backhoe needed to |

[117] Town of Washington Jurisdictional Annex Section 9.23. Hazard Mitigation Plan - Dutchess County, New York. 2016. Dutchess County Department of Emergency Response. Available: https://www.dutchessny.gov/Departments/Emergency-Response/Docs/Section-9-23-Washington-T.pdf

[118] Village of Millbrook Jurisdictional Annex Section 9.25. Hazard Mitigation Plan - Dutchess County, New York. 2016. Dutchess County Department of Emergency Response. Available: https://www.dutchessny.gov/Departments/Emergency-Response/Docs/Section-9-25-Millbrook-V.pdf

[119] For more information from FEMA use the following resources:
Emergency Declarations for other Hazards can be retrieved from-www.fema.gov/data-visualization/disaster-declarations-states-and-counties
FEMA Geospatial Resource Center- www.gis-fema.hub.arcgis.com/
FEMA- National Risk Index- www.hazards.fema.gov/nri/map

| Municipality | Dates of Event | Event Type | FEMA Declaration # | County Designated? | Summary of Damages/Losses |
|---|---|---|---|---|---|
| | | | | | clean out pipes and 4 loads of fine stone |
| | August 26 – September 5, 2011 | Hurricane Irene | DR-4020 | Yes | 9/27-10/1/2011 - Bridge wall broken, roads washed out |
| Millbrook (V) | March 11-13, 2011 | Heavy Rainfall, Snowmelt, Ice Jams | N/A | N/A | Yes, tree damage and debris removal; excessive flows strained wastewater treatment facility; DPW overtime |
| | August 26 – September 5, 2011 | Hurricane Irene | DR-4020 | Yes | Yes, tree damage and debris removal; road raised and washout, fence repair, storm drain over capacity, fire dispatched to pump out basement; Road washouts on Nine Partners Lane, Church Street and Standford Road; flooding at water treatment plant in Mabbettsville; Fencing around water treatment plant and bandshell roof damaged due to fallen trees, propane tank at plant compromised; Overtime for DPW and Police – volunteer fire pumped basements for 36 hours |

| Municipality | Dates of Event | Event Type | FEMA Declaration # | County Designated? | Summary of Damages/Losses |
|---|---|---|---|---|---|
| Millbrook (V) | September 5- 8, 2011 | Remnants of Tropical Storm Lee | DR-4031 | No | Tree damage and debris removal, stormwater over capacity; DPW overtime |
| | October 27 – November 8, 2012 | Hurricane Sandy | DR-4085 | No | Yes, major rain event caused scattered tree damage and excessive stormwater flows; Overtime for DPW and Police – volunteer fire pumped basements for 48 hours |
| | May to August 2013 | Storm Water Emergency, Heavy Rain Event, Storm Water Flooding | N/A | N/A | Yes, Catch basin on Elm Drive exceeded capacity and overflow caused damage to private properties – driveway washout, fence repair, landscape and pool damage, debris removal; DPW overtime |



**FEMA Flood Hazard Areas**

FEMA has developed detailed maps of floodplains called special flood hazard areas to support the National Flood Insurance Program. These maps called Flood Insurance Rate Maps (FIRMS) are used to determine low-cost federal flood insurance rates and to develop local land use controls that comply with FEMA's requirements. FIRMs are the closest proximation available to identify floodplain locations but have limitations.

Locations within the "100-year" (1% annual chance) flood zone have at least a 1 in 4 (25%) chance of flooding during over the course of a 30-year mortgage.

The FIRMs show special flood hazard areas that are mapped based on flood frequency according to the extent of land expected to have a 1% or greater chance of being inundated in any given year, often referred to as the '100-year floodplain.' The '0.2% annual chance flood hazard' is the land areas that have a 0.2 percent annual chance of being flooded corresponding to the '500-year floodplain'. The flood hazard maps for Dutchess County have an effective date of 2012. Washington has a proportionately low percentage of land area located within the 1% special flood hazard areas (only 1.1% of Town land). About 7.8% of Village land is within the 1% special flood hazard area. See Table 12 for Total Land Area in 1% and 0.2% flood hazard area in each community according to the County Hazard Mitigation Plan's Flood Risk Assessment.[120] The Plan indicates that 68 people or 2.1% of the Town's population, live in flood prone areas defined as the 100 and 500-year floodplains. In the Village, 16 or 1.1% of the total population live in flood-prone areas.[121]

Table 12. Total Land Area in the 1-Percent and 0.2-Percent Annual Chance Flood Zones (Acres)

| | Total Area(acres) | 1% Flood Event Hazard Area | | 0.2% Flood Event Hazard Area | |
|---|---|---|---|---|---|
| | | Area (acres) | % of Total | Area (acres) | % of Total |
| Washington (T) | 36,401 | 661 | 1.8% | 661 | 1.8% |
| Millbrook (V) | 1,233 | 96 | 7.8% | 96 | 7.8% |

New York State provides direction for construction in floodplains but does not limit floodplain development[94] The federal government has no legal authority to regulate local land use. However, communities that adopt flood damage prevention law in accordance with FEMA guidelines can qualify for federal flood insurance and many different kinds of disaster assistance. FEMA requires that local laws for flood damage prevention contain specific standards for any development in federally mapped Special Flood Hazard Areas (generally the 100-year floodplain). In partnership with federal and local governments, DEC's Bureau of Flood protection and Dam Safety provides technical assistance to communities for administration of local floodplain regulations.

The Town of Washinton regulates buffers adjacent to streams including 100 feet from the bank of perennial streams and 50 feet from the bank of an intermittent stream channel.[122] Millbrook

[120] Hazard Mitigation Plan - Dutchess County, New York. 2015. Section 5.4.5: Risk Assessment – Flood. Available: https://www.dutchessny.gov/Departments/Emergency-Response/Docs/Section-5-4-5-Flood.pdf

[121] Ibid; see Table 5.4.5-6. Estimated Population Exposed to the Flood Hazard

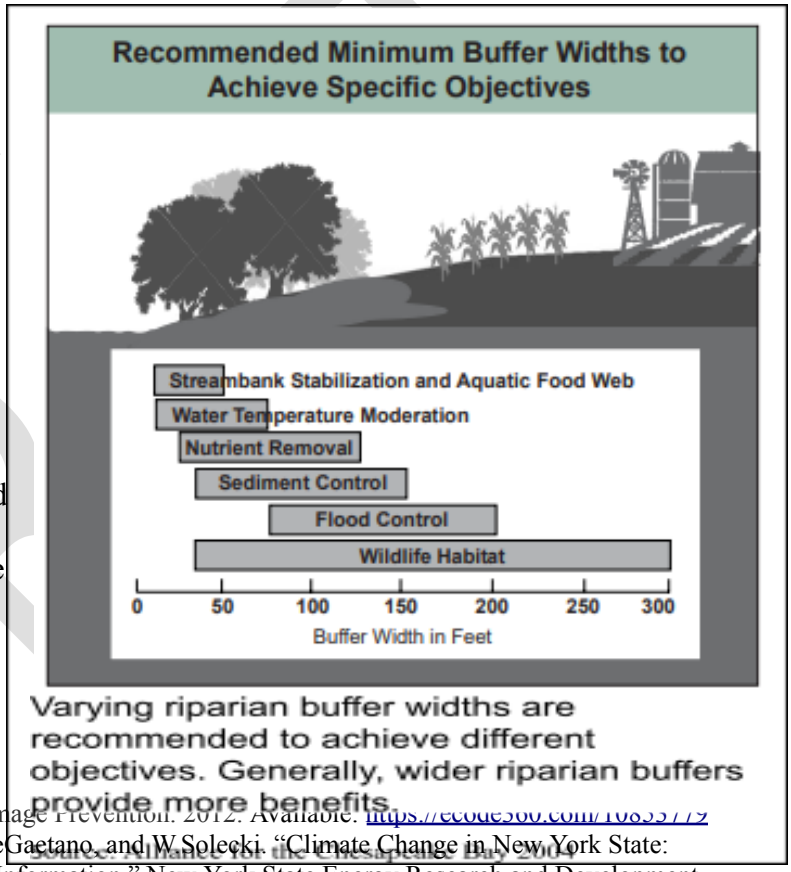
[122]Town of Washington, Section 396: Wetlands & Watercourses. 2012. https://www.washingtonny.org/document-center/wetlands-information/1071-wetlands-and-watercourse-legislatio

Flood Damage Prevention code contains a permitting process for development in special flood hazard areas.[123] [details to be added by local committee members]

FEMA mapping is a valuable tool, but it is important to note that flood hazard areas 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 New York.[124] See the Climate section for more information.[125]

## Riparian Areas

Riparian Areas are land areas adjacent to streams, ponds, wetlands, and other waterbodies and generally include the floodplain. Riparian buffers are strips of vegetated land adjacent to a body of water. Well-vegetated riparian buffers intercept stormwater runoff, filter sediment, and nutrients, and help attenuate flooding. Forested buffers provide organic matter that supports the in-stream food web and shade that helps maintain cool water temperatures. Natural buffers also support unique and diverse habitats and often serve as wildlife travel corridors. Refer to the referenced guides for more information about the numerous functions, design, establishment, and recommended the management of riparian forest buffers.[126,127]



Varying riparian buffer widths are recommended to achieve different objectives. Generally, wider riparian buffers provide more benefits.

Source: Primer for the Chesapeake Bay 2003

n/file.html

[123] Village of Millbrook GL Ch. 115 Flood Damage Prevention. 2012. Available: https://ecode360.com/10833779

[124] 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

[125] Flood Risk Factor Online Tool- www.riskfactor.com/county/dutchess-county ny/36027_fsid/flood#flood_risk_overview; Look up disasters for your County here- www.usatoday.com/story/news/investigations/2023/01/17/california-flooding-just-latest-natural-disaster-where-worst/11032443002/

[126] Bentrup, Gary. *Conservation Buffers Design Guidelines for Buffers, Corridors, and Greenways*. Gen. Tech. Rep. SRS-109., National Agroforestry Center, U.S. Department of Agriculture, Forest Service, Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. 2008, Available: www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf .

[127] Chesapeake Bay Program. *Riparian Forest Buffers Linking Land and Water: The Conservation and Restoration of Streamside Forests in the Chesapeake Bay Watershed*. Gen. Tech. Rep. 903-R-99-002 Chesapeake Bay

The riparian buffer areas shown were mapped by the New York Natural Heritage Program for the Statewide Riparian Opportunity Assessment to highlight important streamside areas that influence stream dynamics and health.[128] They are delineated around streams based on digital elevation data, known wetlands, and modeling estimates for the 50-year flood height. 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 can provide a starting point to inform land use strategies and stream protection efforts, but field visits are necessary to verify conditions for site-level planning or conservation actions.

In riparian areas that do not have a healthy buffer, it may be possible to reestablish native vegetation, The Hudson Estuary Trees for Tribs Program offers free consultation and native trees and shrubs for qualifying streamside buffer planting projects in the estuary watershed[129]. In agricultural areas the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS)[130] offers support for riparian buffers, filter strips, wetlands, and pollinator plantings through various incentive programs.[131]

**Floodplain Forests**

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.*[132] Notable concentrations of these natural floodplains in the Town can be found

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Program, Annapolis, MD, July 2004, Available: https://d38c6ppuviqmfp.cloudfront.net/content/publications/cbp_12999.pdf

[128] 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. https://www.nynhp.org/projects/statewide-riparian-assessment/

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

[130] USDA NRCS NY Main Webpage: https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/new-york

[131] Environmental Quality Improvement Program(EQIP): https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives/new-york/eqip

Conservation Stewardship Program (CSP): https://www.nrcs.usda.gov/programs-initiatives/csp-conservation-stewardship-program/new-york/conservation-stewardship-0

Conservation Reserve EncEnhancementogram (CREP) https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index

Agricultural Conservation Easement Program (ACEP): https://www.nrcs.usda.gov/programs-initiatives/ale-agricultural-land-easements/new-york/agricultural-land-easements

Agricultural management Assistance (AMA): https://www.nrcs.usda.gov/programs-initiatives/ama-agricultural-management-assistance/new-york/agricultural-management

[132] Knab-Vispo, Claudia, and Conrad Vispo. *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation.* Hawthorne Valley Farmscape Ecology Program, in

- recharge groundwater
- filter and purify surface water
- store carbon
- provide recreational opportunities

along the East Branch Wappinger Creek and along Mill Brook.

## Wetlands (Map 12)

Wetlands are areas saturated by surface or groundwater sufficient to support distinctive vegetation adapted for life in saturated soil conditions.[133] There are many types of freshwater wetlands in the Town, including wet meadows, emergent marsh, forested and shrub swamps, vernal pools, floating and submerged vegetation, and open water are ecosystems that are characterized by water-saturated soils and vegetation adapted to growing in waterlogged conditions. They often occur where the water table is near or at the surface for at least part of the year and serve as a transitional zone between dry uplands and areas dominated by water.

Different kinds of wetlands can exist depending on location, topography, geology, and hydrology. Wetlands do not always have to be wet and are not always situated along water bodies. Wetlands can persist as near permanent (rarely dry), intermittent (often seasonally dry) or ephemeral (only occasionally full). While many wetlands form along the floodplains of rivers, streams, and lakes, some are not located in direct proximity to open waterbodies at all.[134] These geographically isolated wetlands in non-floodplain or upland landscape settings often occur in depressions in the landscape and are influenced by groundwater flow and precipitation patterns.[135]

The net loss of wetlands in the region has been great, almost certainly more than 50% since European settlement.[5]

Wetlands play a critical role in the health of watersheds, forming a part of the natural system of land and water that helps make human communities livable.[136] They absorb the forces of floods and prevent loss of upland soil to erosion, store sediments, and filter pollutants from water before it reaches downstream areas[137]. Wetlands provide habitats for a wide range of animal and plant species and offer unique opportunities for people to experience nature[138]. See the Habitats and Wildlife section for more information about biodiversity and habitat value of wetlands.



cooperation with Hudsonia, Ltd., Ghent, NY, 2010. Available: https://hvfarmscape.org/sites/default/files/fep_floodplain_forest_report_nov_2010.pdf

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

[134] Zucker, Leslie, and Lau, Lana. 2009, pp. 1–13, *An Analysis of the Size and Distribution of Geographically Isolated, Small Wetlands in the Hudson River Estuary Watershed*. Available: https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/d/5327/files/2014/10/Isolated_Small_Wetlands-17hvvar.pdf

[135] Alexander, Laurie, et al. US EPA, 2015, pp. 1-408. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence.* Available: https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=296414

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

[137] See fact sheet *Wetland Conservation: What does the Hudson Valley have to lose?* for more information on the benefits of wetlands in the Hudson River Estuary. Available: https://www.dec.ny.gov/docs/remediation_hudson_pdf/wetlandsfs.pdf

[138] Kiviat, Erik, and Stevens, Gretchen. Hudsonia Ltd, 2001, pp. 1-373, *Biodiversity Manual for the Hudson River Estuary Corridor.*

**Wetland Buffers** are areas of land that lie adjacent to and surround wetlands.

Wetlands provide many ecosystem services, as described above, but these functions cannot be sustained without care for the uplands adjacent to wetlands—wetland buffers. When upland buffers surrounding wetlands are encroached on by development, including buildings, lawns, and pavement, the wetland's habitat quality, and other values are often degraded. For more information about well-designed buffers, see the Floodplains & Riparian Areas section. Additional context about local, state and federal regulations about wetland buffers are included in the Wetlands Law sub-section below.

Detailed descriptions of wetlands and practices for conserving them, are available in the *Significant Habitats in the Town of Washington* report.[139] Wetlands make up 9% of the Town land area. Wetland complexes – sets of interconnected wetlands, are found throughout the Town. Wetland complexes primarily occur in the low-lying terrain of the Hunns-Lake Wappinger Creek, the Wassaic Creek, and the Sprout Creek watersheds. The floodplain of the East Branch Wappinger Creek Watershed also contains large wetlands including an extremely valuable complex of fen, swamp, and marsh to the west of Little Rest Road and west of Fowler Road further downstream.[6]

In the Village of Millbrook there are marsh wetlands found around Dietrich Pond, which is a constructed pond. Wetlands are also present along the unnamed tributaries of the East Branch Wappinger Creek floodplain flowing throughout the Village.

The Wetlands Map presents the best available information about wetlands in the Town and Village. It is common for maps to have limitations or inaccuracies, particularly when it comes to complex and dynamic natural ecosystems such as wetlands. It is important to recognize these limitations when using maps for decision-making purposes and to supplement them with additional data and information, whenever possible. The *Significant Habitats* report provides more detailed descriptions of wetlands.[6] An online interactive version of Map14: Habitats is available.[140] Note that habitat boundaries can change over time and there is no substitute for site visits and on-the-ground field observations.

The Wetlands Map can be used for predicting the location of potential wetlands. The individual layers included on Map 12 are described below:

- Known Vernal Pools identified in the "Significant Habitats report" are represented in solid Purple. Vernal pools are essential breeding habitats for amphibians. Over 200 vernal pools have been mapped by Hudsonia Ltd 2004 in the Town[6].
- DEC Regulatory Wetland- Wetlands larger than 12.4 acres, unless designated "of unusual local importance. Note that the NYS Freshwater Wetlands layer is symbolized differently on the Wetlands Map than on other maps in this NRI. It is labeled as DEC Regulatory

[139] Tollefson and Stevens, 2004

[140] Hudsonia Ltd. Ecologically Significant Habitats in the Town of Washington, NY. Online Interactive Map Available: https://marist.maps.arcgis.com/home/webmap/viewer.html?layers=98d805a38e7343da836fb68f4dfcfd11

Wetland and is symbolized by hashed blue lines. All the other maps in this NRI feature the NYS Freshwater Wetlands symbolized by a dotted light blue symbol. New York State's wetland maps often underestimate wetland areas and omit smaller and drier wetlands, and do not accurately reflect the full extent of wetland habitats. In particular, vernal pools, wet meadows, and swamps are often under-represented on maps[141]

- Wetland (Hudsonia) - The bright green Wetlands layer combines the fourteen wetland habitat types identified in the "Significant Habitats report" [6]. The study concluded that wetlands make up 9% of the Town. Lists of the varied wetland habitats are provided below. For more detailed information about each of these habitat types and the species that depend on them, refer to the Habitats and Wildlife section.
- Probable wetland areas & Possible wetland areas – "Probable wetlands" are those soils classified in the Natural Resources Conservation Service soil survey as very poorly drained or poorly drained, and "possible wetlands" are those classified as somewhat poorly drained soils. "Soil drainage classes are the most reliable predictors of wetlands." (see Soils section for further discussion about soil properties).

Each of the following types of wetlands have been documented in the town, in the *Significant Habitats* report. See the Habitats and Wildlife section for further information about these wetlands.

- Hardwood and Shrub Swamp
- Marsh
- Wet meadows
  - Calcarecous wet meadow
- Fen
- Acidic Bog
- Circumneutral Bog Lake
- Intermittent Woodland Pools (see Vernal pools description above)
- Kettle Shrub Pool
- Open Water (natural ponds and lakes)
- Constructed Pond
- Springs, Seeps
- Perennial and Intermittent Streams
- Riparian Corridor

**Wetland Protection**

Freshwater wetlands are regulated in several different ways.

*Local Law*: **Town of Washington Zoning Ordinance §396 Wetlands and Watercourse Law** creates a permit process for activities in all wetlands larger than a quarter acre. All wetlands between 1/4-1 acre have an additional fifty-foot buffer of regulated area, and for wetlands greater 1 acre, the regulated area is within one hundred feet of the wetland.

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

*State Law:* DEC State-regulated Freshwater wetlands are the state protected wetlands according to Article 24 of the Environmental Conservation Law.[142] It used to only apply to those 12.4 acres or larger or have "unusual local importance". The NYS maps show only those wetlands that are currently mapped or officially proposed for addition to the wetland maps.[143] The law also regulates a 100-foot buffer zone around these wetlands, and the law is administered by the Department of Environmental Conservation (NYSDEC). "Around every state-protected wetland is an 'adjacent area' that is also subject to regulation in order to help better protect the wetland against surrounding disturbance. The adjacent area is a minimum of 100 feet, but that has been extended for a limited number of particularly sensitive wetlands."

*Federal Law*: US Army Corps of Engineers regulates wetlands with a continuous surface-water connection to navigable waterways under the Clean Water Act.

*Upcoming Changes to NYS Freshwater Wetlands Regulations*

Beginning in 2025, the NYS Freshwater Wetlands Act will no longer rely on state freshwater wetland maps to determine jurisdiction. The state is creating new wetland maps that will be for educational purposes.

In 2028, the size threshold for regulated wetlands becomes 7.4 acres (down from 12.4 acres). Any freshwater wetland of 7.4 acres or larger will be regulated by the state.

Wetlands smaller than 7.4 acres in size will be regulated if they have unusual importance, defined as a freshwater wetland, regardless of size, that possesses certain characteristics, as determined by the NYS Department of Environmental Conservation. Characteristics include:

1. in a watershed with significant flooding,
2. in an urban area,
3. supports rare plants
4. habitat for the essential behavior of endangered, threatened, special concern, species of greatest conservation need,
5. class 1 wetland,
6. previously designated a wetland of Unusual Local Importance (ULI),
7. productive vernal pools,
8. wetlands in floodways,
9. previously mapped wetlands,
10. wetlands of regional or local significance, or
11. significant for protecting the state's water quality. NYS DEC is beginning the process of developing the regulations to carry out the updated law.

[142] Article 24 of the Environmental Conservation Law Title 23 of Article 71. "Freshwater Wetlands" 1997. Available: https://www.dec.ny.gov/docs/wildlife_pdf/wetart24a.pdf

[143] NYS DEC "Freshwater Wetlands Mapping" https://www.dec.ny.gov/lands/5124.html

# Chapter 5: Biodiversity

Biodiversity (from "biological diversity") refers to the variety of life on Earth at all its levels, from genes to ecosystems.

> "The concept of biodiversity, or biological diversity, encompasses all of life and its processes, including ecosystems, biological communities, populations, species, and genes, as well as their interactions with each other and with the non-biological components of their environment, such as soil, water, air, and sunlight. Protecting native biodiversity is an important component of any effort to maintain healthy, functioning ecosystems that sustain the human community and the living world around us."[144]

This chapter begins by describing the ecological context of Washington and Millbrook and areas that have been identified as important for biodiversity from a regional perspective. It then provides information about habitats that have been mapped in the town and village, some of the species of plants and animals recorded locally, and invasive species common in the Hudson Valley. Information about biodiversity, such as what species of plants or animals actually occur in a particular location, is limited and incomplete. The areas and features shown on the maps and described in this report are not the only places that are important for biodiversity.

## Ecological context

### Hudson River Estuary Watershed

The town and village are part of the Hudson River estuary watershed, an area encompassing fifteen New York State counties bordering the Hudson River Estuary[145] from the federal dam at Troy to the river's confluence with the ocean. "The entire Hudson River Estuary corridor is a significant biodiversity area within the context of New York State and the New England and mid-Atlantic portions of the U.S."[146] While it accounts for 13.5% of the total land area of the state, the Hudson Valley contains nearly 85% of the bird, mammal, amphibian, and reptile species found in New York.[147] The streams that flow through Washington and Millbrook flow to the Hudson River and help support important coastal habitats downstream.

### Wappinger Creek – Significant Coastal Fish and Wildlife Habitat

The tidal portion of Wappinger Creek, from where it meets the Hudson to the first dam in

[144] Tollefson and Stevens, 2004, pg. 6

[145] 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.

[146] Penhollow, M.G., P.G. Jensen and L.A. Zucker. *Hudson River Estuary Wildlife and Habitat Conservation Framework: An Approach for Conserving 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, Ithaca, NY, 2006.

[147] Ibid.

Wappingers, is a Significant Coastal Fish and Wildlife Habitat. Conditions in the watershed of the East Branch of Wappingers Creek in Washington and Millbrook, support the habitats in the tidal portion downstream.[148]

**Harlem Valley Calcareous Wetland Significant Biodiversity Areas (SBA)**

The southeast corner of Washington is part of the Harlem Valley Calcareous Wetlands Significant Biodiversity Area.[149] The *Hudson River Estuary Wildlife and Habitat Conservation Framework*[150] describes key plant and animal habitats in the estuary watershed and highlights "Significant Biodiversity Areas," areas with a high concentration of biodiversity or unusual ecological features. Calcareous means rich in calcium, and the presence of this mineral in soils and waters often supports an unusual biological communities and rare species. These conditions are limited in the Hudson Valley. Wetland communities in the Harlem Valley Calcareous SBA include red maple-hardwood swamp, floodplain forest, fens, and shallow emergent marsh. High quality examples of these habitats support numerous wetland-dependent species. Some of the best bog turtle habitat in the Hudson River Valley is found in this area.

## Regional Forests (Map 13)

Forests in southern Washington, east of Overlook Road and west of Mutton Hollow Road, in the area of Chestnut Ridge, are part of the Mid-Dutchess matrix forest block which totals approximately 28,000 acres. This is shown in dark green on Map 13 Regional Forests. Within this matrix forest, there are three distinct patches of forest in the Town, two with core areas of approximately 500 acres in size, and one that extends into Union Vale of over 1,000 acres of core forest. Core forests are shown on Map 15: Large Forests.

The Nature Conservancy (TNC) and New York Natural Heritage Program have identified "matrix forests:" those large enough to withstand major natural disturbances, maintain important ecological processes, and support populations of forest-interior wildlife and plants.[151] The matrix forests are some of the largest intact areas of forest in northeastern North America, and are considered globally significant. "Forest linkage zones" are intact natural corridors that connect the matrix forests. A linkage zone is shown shaded light green on Map 13 in the Towns of Clinton, Hyde Park, Rhinebeck, and Stanford. The forest linkage zone is shown on the Regional Forests map in light green. It is considered a linkage between a matrix forest west of the Hudson River in Esopus to another surrounding Mount Washington in Massachusetts.

The Regional Forests Map shows only matrix forests and linkages; for other forests, see the maps

[148] NYS Department of State. *Coastal Fish and Wildlife Rating Form: Wappinger Creek*, NYS Department of State, Albany, NY, revised 2012.

[149] The designation Significant Biodiversity Area does not have any regulatory implications. It is for planning purposes only.

[150l] Penhollow, et al., 2006

[151] 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.

of Large Forests (15) and Habitats (14). Connected forests allow a wide range of wildlife to move safely to find mates and the resources they need. Forest linkages such as these may be vital to the ability of many species to migrate as climate changes.

## Habitats (Maps 14 and 14b)

A habitat is the place where a plant, animal, or other organism lives. Habitat can also be defined as the place where a biological community - an interacting group of various living things in a common location - occurs. Habitats are an appropriate feature to include in local planning: they are readily identifiable, and thus easy to incorporate into planning and decision making. Habitats must be considered not as discrete entities, but as parts of larger, interconnected systems. Many species use multiple habitats. Habitats in proximity may be considered together, as a habitat complex. Washington and Millbrook have some types of habitats that are common and widespread, others are less common, and some are rare.

The Habitats Maps (14 and 14b) display the habitats mapped by scientists with Hudsonia. Jenny Tollefson and Gretchen Stevens analyzed remote images (such as aerial photos) and verified the habitats they identified through numerous field visits, publishing the report *Significant Habitats in the Town of Washington, Dutchess County, New York*[152] in 2004. Boundaries of the habitats are approximate. The Habitat Maps are suitable for general land use planning but not appropriate for detailed planning, site design, or for determining state or federal regulatory jurisdiction. Boundaries of all habitats depicted here are approximate. Habitats were mapped based on aerial photographs from 2000; these data remain the best published source of information about habitats throughout the Town and Village. Detailed descriptions of habitats and practices for conserving them are available in the report by Tollefson and Stevens. That report also contains additional maps that are not reproduced here.

There are significant areas in Washington of continuous habitat uninterrupted by developed areas or roads. Within each habitat type, there is great variability in terms of the types of plants and animals (species composition), condition, quality, age, and other features. This report, the *Significant Habitats* report, and other source material can alert residents and others to where habitats occur or are likely to occur in Washington and Millbrook. Often, additional information will be required to support decision-making. Some types of habitats are difficult to identify without verifying them in the field, including crest, ledge, and talus, springs and seeps, intermittent and ephemeral streams, and intermittent woodland pools. In some cases, these habitats may occur in locations that are not shown on the map.

In their work in the Town of Washington, Tollefson and Stevens identified twenty-seven different habitat types considered ecologically important for one or more of the following reasons:

1. Habitats that are rare or declining in the region.
2. Habitats that support rare species and other species of conservation concern.

[152] Tollefson and Stevens, 2004

3. High-quality examples of common habitats (e.g. those that are especially large, isolated from human activities, old, or lacking harmful invasive species).
4. Complexes of connected habitats that, by virtue of their size, composition, or configuration, have significant biodiversity value.
5. Habitat units that provide landscape connections between other important habitat patches.

Brief descriptions of these habitats and their occurrence are described in Tables 13 and 14; more details are provided in the *Significant Habitats* report. Used in combination with the tables that follow, the Habitat map can be used to identify large areas of habitats and the types of habitat that may be impacted by proposed activities or which call for special consideration in project planning.

**Upland habitats**

Forests are the most common type of habitat in Washington, with upland meadows such as hayfields, pastures, croplands and abandoned fields also widespread. Many areas of exposed bedrock in the Town and some areas in the Village provide for crest, ledge, and talus, a habitat that is rarer in the Hudson Valley. Areas under more intense management, or with a history of disturbance such as orchards, plantations, large expanses of lawn, also have habitat value. The descriptions and notes on occurrence of upland habitats in Table 13 are drawn from the *Significant Habitats* report.

Table 13. Upland Habitats in the Town of Washington and Village of Millbrook

| Habitat type | Description | Occurrence |
|---|---|---|
| hardwood forest | non-wetland forest dominated by hardwood trees (conifers make up < 25% of canopy). | most widespread habitat type in Washington, highly variable |
| conifer forest | non-wetland forest dominated by conifer trees (>75% of canopy). | found throughout town, usually < 30 acres |
| mixed forest | non-wetland forest with a mix of hardwoods and conifers (conifers make up 25-75% of canopy). | found throughout town, rarely > 30 acres |
| red cedar woodland | widely spaced red cedar overstory interspersed with grassy patches | range in size from 1 - 22 acres, concentrated in west Washington; a few high quality, large red cedar woodlands |
| shrubby oldfield/ upland shrubland | open (non forested) area with shrubs making up > 20% of ground cover. | found throughout town, range in size of less than one acre to >40 acres |
| upland meadow | open area dominated by herbaceous vegetation (shrubs and saplings < 20% ground cover; may have scattered trees) and either unmowed or mowed up to a few times a year, such as a hayfield; includes pasture, cropland, abandoned fields. | second most common type of habitat in Washington, less intensively managed meadows uncommon |

| Habitat type | Description | Occurrence |
|---|---|---|
| crest/ledge/talus | partially or fully-exposed bedrock on a summit or knoll (crest) or slope (ledge). Talus occurs where rock fragments accumulate at the base of ledges and cliffs. | occur in many parts of Washington,large expanses on knolls and ridges on east and west edges of town, a few locations in Millbrook |
| orchard/plantation | actively maintained or recently abandoned fruit orchards, tree farms, or plant nurseries. | several Christmas tree farms and a winery |
| cultural | open area (may have scattered trees) mowed frequently or otherwise managed in an intensive way (lawn, playing field, golf course, garden, park, cemetery). | multiple different kinds of cultural lands |
| 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. | |

**Large meadows, shrublands, young forest**

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. Meadows are the second most extensive type of upland habitat in Washington, and sizeable meadows are found in the Village of Millbrook. Most of the open meadows are managed intensively. 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.

Shrublands and young forests are transitional habitats characterized by few or no mature trees, with a diverse mix of shrubs and/or tree saplings, along with openings where grasses and wildflowers grow. 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 trigger young forest growth, such as fires, have been suppressed. Records of breeding birds suggest that valuable meadows, shrublands, and young forests occur in Washington. The quantity and quality of meadows and other open habitats 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. This continuing trend threatens populations of birds that have adapted to the agricultural landscape.

The 2000-2005 NYS Breeding Bird Atlas documented breeding by four grassland bird species of conservation concern in the Washington and Millbrook area, including Species of Greatest Conservation Need. Records from the Breeding Bird Atlas support the presence of 12 species of conservation concern that prefer young forest and shrubland habitat.

Meadows, pasture, shrubland, and young forest 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.

**Wetland habitats**

Wetlands are described in Chapter 4 and also shown on Map 12. Table 14 provides information about the types and occurrence of wetlands in Washington and Millbrook, drawing from the *Significant Habitats* report.

The most extensive type of wetland is hardwood and shrub swamp, with some large examples. Many wetlands are much smaller, less than an acre to a few acres in size. Three rare types of wetlands - a circumneutral bog lake, shrub pools, and an acidic bog occur in Washington. Of open water bodies, the majority are constructed ponds, and natural lakes or ponds with undeveloped shorelines are rare. A large number (almost 200) of intermittent woodland pools have been identified. Several springs and seeps have been mapped, and there are likely more.

Table 14. Wetland Habitats in the Town of Washington and Village of Millbrook

| Habitat type | Description | Occurrence |
|---|---|---|
| hardwood & shrub swamp | wetland (identified by predominance of hydrophytic vegetation) dominated by trees and/or shrubs. (conifers make up < 25% of canopy). | most extensive wetland type in Washington; range from <1 to 75 acres in size; two calcareous swamps were mapped in the northeast corner of town |
| marsh | wetland dominated by hydrophytic herbaceous vegetation that stays saturated/flooded most of the time. | most are less than 3 acres and continuous with hardwood and shrub swamps and open water. Marsh in Mill Brook wetland complex comprised nearly 100 acres |
| wet meadow; calcareous wet meadow | area of seasonally saturated or flooded soils dominated by hydrophytic herbaceous vegetation; calcareous wet meadow…a wet meadow strongly influenced by calcareous groundwater or soils favoring establishment of a calcicolous plant community. calcareous wet meadows occur adjacent to fens, they should be considered potential habitat for the bog turtle (US Threatened, NY Endangered, Species of Greatest Conservation Need-high priority) | are widely distributed throughout Washington; often part of meadows and shrubby old fields; >30 calcareous wet meadows mapped in Washington |
| fen | shrub and herb dominated wetland fed by calcareous groundwater; any high-quality fen could be habitat for bog turtle | 26 fens in Washington; zero mapped in Millbrook |
| acidic bog | wetland perennially wet, very nutrient poor, dominated by shrubs of the heath family and carpets or floating mats of peat mosses and other vegetation | The only known occurrence of an acidic bog in the town is the constructed Fern Glen bog on the grounds of the Cary Institute of Ecosystem Studies. |

| Habitat type | Description | Occurrence |
|---|---|---|
| hardwood & shrub swamp | wetland (identified by predominance of hydrophytic vegetation) dominated by trees and/or shrubs. (conifers make up < 25% of canopy). | most extensive wetland type in Washington; range from <1 to 75 acres in size; two calcareous swamps were mapped in the northeast corner of town |
| marsh | wetland dominated by hydrophytic herbaceous vegetation that stays saturated/flooded most of the time. | most are less than 3 acres and continuous with hardwood and shrub swamps and open water. Marsh in Mill Brook wetland complex comprised nearly 100 acres |
| circumneutral bog lake | spring-fed, calcareous waterbody with floating peat mats supporting vegetation of acidic bogs and surrounding vegetation typical of calcareous marshes | Round Pond is the only circumneutral bog lake documented in the town. |
| intermittent woodland pool | small, isolated, seasonally flooded pools, generally with an open basin, surrounded by forest; provide crucial nursery and breeding habitat for a group of forest amphibians which use the pools for breeding. | Nearly 200 intermittent woodland pools have been mapped in Washington |
| buttonbush pool/kettle shrub pool | seasonally or permanently flooded shrubby pools dominated by buttonbush with kettle shrub pools located in glacial kettles; part of the critical habitat of the Blanding's turtle (NY Threatened, NY Species of Greatest Conservation Need – high priority) | one buttonbush pool and two kettle shrub pools in Washington |
| open water | body of water (natural or manmade) with a mostly undeveloped shoreline. | approximately 30, tend to be smaller than 2 acres |
| constructed pond | human created body of water with a mostly managed shoreline (bordered by developed or cultural areas). | most of the nearly 500 open water bodies in town are constructed |
| spring/seep | places where groundwater discharges to the surface at a single point (spring) or diffusely (seep). | likely numerous but only a few have been mapped |
| intermittent stream | stream that has flow at least part of the year, including man-made ditches. | add stream miles mapped |
| perennial stream | stream that generally flows year-round. | add stream miles mapped |



## Large forests (Map 15)

Forests vary in their ability to support native species and withstand or recover from external stressors such as fragmentation, severe storms, and invasive species. Large forests are a conservation priority for the Hudson Valley region. The Hudson Valley Forest Condition Index[153]

[153] 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

provides information about the relative condition of patches of forest of 100 acres and larger. The Index incorporates on a variety of factors relating to health, condition, and habitats (such as whether the forest patch includes a high percentage of wetlands or the presence of brook trout in streams in the forest).

The Town of Washington has forests ranking at the high end (95-99 percentile, which equals the top 2-5%) and the low end (0-20 percentile), relative to all the forests in the Hudson Valley. Each patch shown on the Large Forests Map (Map 15) represents a continuous patch of forest unfragmented by major roads, railroads, and non-forest habitat, with a minimum forest size of 100 acres. Each patch is color coded based on its relative score. High quality forests are good potential candidates for protection or other conservation efforts.

**Core forests**

Core forests are interior forest areas surrounded by at least a 100-meter-wide buffer of edge forest habitat.[154] 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 500 acres in size are more likely to provide enough suitable habitat to support a diversity of interior forest species. Avoiding further fragmentation of core forests will help conserve the integrity and habitat value of ecologically significant forest patches. As shown on the map, numerous large, core forest areas occur throughout Washington, in addition to the matrix forests.

Large core forests can be found throughout Washington, and further details are available by viewing the Forest Condition Index layer in the Hudson Valley Natural Resources Mapper: [155]

- In the southwest corner of town, extending into Pleasant Valley and LaGrange, a large intact forest of 3,150 acres scores in the highest 5% of forest cores in the Hudson Valley. In Pleasant Valley, NYS DEC owns 917 acres of this forest patch, and manages is at the Taconic Hereford Multiple Use Area. This forest is notable for its large size, having a very large intact core, and being located in an area where species encounter relatively few barriers to movement (roads, agriculture, or developed areas).
- Another forest scores in the top 10%: located east of Valley Farm Road, it includes Round Pond and a stream that flows to Millbrook. It is notable among forests in the valley for having a high percentage of intact core area, low density of buildings, and relatively low stressors to forest health (such as roads and impervious surfaces).

[154] Core forests were mapped using the large forest patches identified for the Forest Condition Index, described earlier in this section.

[155] Hudson Valley Natural Resources Mapper. Accessed June 23, 2023. https://gisservices.dec.ny.gov/gis/hvnrm/

- As mentioned earlier in the chapter, forests in southern Washington, east of Overlook Road and west of Mutton Hollow Road, in the area of Chestnut Ridge, are part of the Mid-Dutchess matrix forest block which totals approximately 28,000 acres. There are three distinct patches of matrix forest in the Town, two with core areas of approximately 500 acres in size, and one that extends into Union Vale of over 1,000 acres of core forest (and which ranks in the 80-90 percentile in the Forest Condition Index).
- The Village of Millbrook has few forests greater than 100-acres, and those forests extend beyond the Village boundary. Millbrook has very little core forest.

All or nearly all the forests in Washington and Millbrook were cleared or logged at one time. In the *Significant Habitats* report, Tollefson and Stevens describe two distinctly older forests in the Town, and there may be others that have not been documented:

- "At the Millbrook School "ski hill," a 100-150 year-old forest with trees in the range of 12-25 inches in diameter (30-65 cm) was dominated by oaks and sugar maple with shagbark hickory, pignut hickory, American beech, and yellow birch (Kiviat 1994)."
- "On the west side of town, a cove on the Rockefeller University property contained a mature forest with large eastern hemlock, sugar maple, and tulip trees."[156]

Wildlife records reflect the abundance of high-quality forest interior habitat in Washington. The records of scarlet tanagers and wood thrush breeding suggest large forests are offering quality interior habitat.

There are a number of threats to the health of forests in this region, including pests/pathogens, invasive species, and the over-abundant white-tailed deer populations. For example, Hudson Valley forests have been significantly impacted in the recent decades by the spread of hemlock wooly adelgid and emerald ash borer, which are expected to eventually kill most large eastern hemlock and white ash trees in the region. Deer browse preferences often facilitate the competitive edge of invasive plant species over native tree and understory regeneration. The resulting decline in forest understory development has cascading effects on other wildlife populations and threatens the long-term regeneration of forests.

## Stream Habitats (Map 16)

Streams, their floodplains, adjacent wetlands, and other "riparian" or streamside habitats provide important ecosystem services including clean water, flood management, and recreational opportunities like fishing and kayaking. In addition, they provide some of the most productive wildlife habitat in the region. The Stream Habitats map shows the best available mapping for perennial and intermittent streams and riparian areas. All streams are important for biodiversity. This report highlights some streams or parts of streams that are known to be important for species of conservation concern, however, other streams are also

**Stream habitats**

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

[156] Tollefson and Stevens, 2004

important for biodiversity, and are part of the interconnected freshwater system.

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. 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 aquatic insects and other macroinvertebrates that drift downstream to feed larger fish and organisms and support nutrient cycling and flood control processes.

The Stream Habitats Map includes many intermittent streams mapped for the *Significant Habitats* study, but it is likely that some intermittent streams remain unmapped.

Significant aquatic habitat areas in Washington and Millbrook include trout and trout spawning waters, and streams important to migratory fish.

**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. The reach of the Wappinger Creek in the Town has suitable waters for trout spawning and is also an important area for migratory fish. The East Wappinger Creek also has reaches that are suitable for brook trout habitat and is an important stream for migratory fish. See the factsheets in the Water Quality Classifications and Assessment Section for more information.

**Known important areas for migratory fish**

NYNHP identifies areas along Crum Elbow Creek, and Wappinger Creek as important for migratory fish (based on DEC Bureau of Fisheries surveys and other studies completed in New York since 1980). These 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.

**Dams and culverts**

The quality of stream habitats is reduced due to the presence of barriers such as dams and poorly designed or installed culverts.[157] There are 30 dams recorded within the Town and Village.[158]

[157] See *AQUATIC CONNECTIVITY Identifying Barriers to Organisms and Hazards to Communities* for more information. Available.: https://www.dec.ny.gov/docs/remediation_hudson_pdf/culvertfactsheet19.pdf

[158] See Dam Inventory Layer on the Hudson Valley Natural Resource Mapper

Information about each dam is available on the DEC info Locator including hazard descriptions and other select attributes.[159] The Hudson River Estuary Program has funded the planning, engineering and implementation of dam removal and culvert replacement projects in the Hudson River Estuary watershed to restore habitat connectivity and stream restoration. Dam locations in the Stream Habitats Map are provided by the New York State Inventory of Dams.[160] Assessments by the DEC Hudson River Estuary Program in trial watersheds indicate that two to three times as many barriers exist than are logged in the NYS Inventory of Dams.

Poorly designed and undersized culverts are barriers to aquatic organisms and hazards to communities during storms. Streams are linear habitats for aquatic and semi-aquatic species such as American eel, herring, stream salamanders, turtles, and crayfish. Road crossings can fragment streams into small pieces, preventing organisms from accessing critical habitats. Culverts also may be infrastructure liabilities and flooding hazards for communities. During storms, undersized or improperly installed culverts can become clogged with debris or overwhelmed, leading to road flooding, stream bank erosion, or even washout of the whole road.
The Town and Village have at least 44 documented culverts according to the data 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. Map 16: Stream Habitats displays the culvert scores as small colored circles, with red indicating severe barriers, and blue indicating no barrier.

**Riparian areas**

Riparian areas are areas adjacent to perennial streams, ponds, wetlands, and other waterbodies and include streambanks and floodplains, shown in green on Map 11, Floodplains and Riparian Areas.

Riparian corridors support unique, diverse habitats and serve as wildlife corridors. Forested riparian buffers provide organic matter that supports the in-stream food web and shade that keeps water cool. Riparian areas are important travelways for animals that move throughout our landscape. Undeveloped riparian areas offer paths in areas otherwise unfavorable to their movement. 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.



https://gisservices.dec.ny.gov/gis/hvnrm/

[159] See more about Dam Safety: https://www.dec.ny.gov/lands/4991.html

[160] While the DEC tries to maintain an accurate inventory, this data should not be relied upon for emergency response decision-making.

**Floodplain forests**

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.*[161] Notable concentrations of these natural floodplains in the Town can be found along the East Branch Wappinger Creek and along Mill Brook. Floodplain forests are shown in purple on Map 11: Floodplains and Riparian Areas.

Even though the floodplain forests along Wappinger Creek are relatively small and disconnected from each other*, "the sheer length of Wappinger Creek makes it a potential ecological corridor crossing much of the county, and every bit of ancient or recently reforested floodplain forest currently present in this corridor might be particularly valuable because of its role in facilitating the connectedness of a large area."*[162]

## State-Mapped Important Biodiversity Areas (Map 17)

**Important Areas for rare animals and plants**

The New York Natural Heritage Program (NYNHP) has identified Important Areas for sustaining populations of rare animals and rare plants based on existing records and the species' habitat requirements. These Important Areas, shown on Map 16, Stream Habitats, and Map 17, Important Biodiversity Areas, include the specific locations where species have been observed, as well as areas critical to maintaining the species' habitat. Considering these areas in proactive planning may aid the long-term survival and persistence of species.

Note that the Important Areas are based on the best available information, but do not represent a comprehensive inventory of all resources or habitats. NYNHP is continually adding new information to its databases. Lands outside of the mapped Important Areas may also support rare animals and plants and significant ecosystems or provide ecological benefits.

NYNHP has documented known important areas in Washington for the following species:

- Pied billed grebe (NY Threatened, Species of Greatest Conservation Need, Audubon Priority Bird List, protected at the federal level by the Migratory Bird Treaty Act) is a rare to uncommon bird, associated with complexes of large wetlands. Wetland alteration and destruction is the greatest threat to pied billed grebe, which diminished the available habitat or impacts their food sources.[163]

[161]Knab-Vispo, Claudia, and Conrad Vispo. *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation.* Hawthorne Valley Farmscape Ecology Program, in cooperation with Hudsonia, Ltd., Ghent, NY, 2010. Available: https://hvfarmscape.org/sites/default/files/fep_floodplain_forest_report_nov_2010.pdf

[162] Ibid.

[163] New York Natural Heritage Program. Online Conservation Guide for Podilymbus podiceps. Available from:

- Blanding's Turtle (NY Threatened, Species of Greatest Conservation Need-high priority) is a long-lived, shy, gentle turtle. Blanding's turtles may move between multiple sites across a large area. Blanding's turtles use a variety of habitats, ponds, shorelines, uplands, and vernal pools. They are vulnerable to vehicle strikes when they move between their hibernation sites near ponds and wetlands and nesting sites in upland areas. "Loss of adult females by vehicle strikes is likely the most significant cause of population declines across the species' range."[164] Since Blanding's turtles mature late and their populations depend on adults reproducing throughout their relatively long lifespan, the loss of even a single female can have a major impact on a population."[165] Further information is available in the online conservation guide: Online Conservation Guide for Emydoidea blandingii. Available from: https://guides.nynhp.org/blandings-turtle/.
- Bog Turtle (US Threatened, NY Endangered, Species of Greatest Conservation Need – high priority) is threatened at the federal level and endangered in New York. It is one of the smallest turtles, with a total length of about 4 inches. It uses open-canopy wet meadows, sedge meadows and calcareous fens. In the Hudson Valley, they live in wetlands that are isolated as well as wetlands that are part of wetland complexes. The Hudson Valley is in the northern end of the bog turtle's geographic range. Bog turtles occur in small local populations, and their habitats tend to be small, too, making them very vulnerable. They are threatened by habitat loss, fragmentation, and degradation as well as higher predation by human-subsidized predators, invasive species, collection (for the pet trade), and vehicle strikes.[166]
- Eastern Box Turtle (NY Special Concern, Species of Greatest Conservation Need – high priority) occurs in a variety of habitats. They primarily use well drained forests and open deciduous forests, but are also found in field edges, shrublands, marshes, bogs, and stream banks. The Lower Hudson Valley is the northern limit of the range of box turtle. Stewardship of species at northern range edges is particularly important as climate changes and suitable habitat shifts north. Box turtle is threatened by habitat loss and fragmentation, vehicle strikes, and the pet trade.
- Wood Turtle (NY Special concern, Species of Greatest Conservation Need – high priority) lives primarily along low gradient perennial streams and may spend time in adjacent forests and meadows. Wood turtle occurs along stream corridors and is threatened by habitat loss, stream degradation, nest predation, and the pet trade.
- Timber Rattlesnake (New York Threatened, Species of Greatest Conservation Need – high priority) – was once common throughout the state. But for many decades, timber rattlesnakes were persecuted and killed indiscriminately. Today, they are found in isolated populations in southeastern New York, the Southern Tier and the eastern periphery of the Adirondack Park.[167] They live in forested areas (deciduous or mixed forests) with hilly

https://guides.nynhp.org/pied-billed-grebe/. 2023. Accessed July 28, 2023.

[164] NYS DEC "Blanding's Turtle" https://www.dec.ny.gov/animals/7166.html accessed July 28, 2023

[165] NYS DEC "Blanding's Turtle" https://www.dec.ny.gov/animals/7166.html accessed July 28, 2023

[166] New York Natural Heritage Program. Online Conservation Guide for *Glyptemys muhlenbergii*. Available from: https://guides.nynhp.org/bog-turtle/. 2023. Accessed July 28, 2023.

[167] New York Natural Heritage Program. 2023. Online Conservation Guide for Crotalus horridus. Available from:

terrain, den in crevices or talus, and use open areas with rocky surfaces for basking, birthing, and shedding.[168] Timber rattlesnakes are threatened by loss of habitat, habitat fragmentation, road mortality, illegal collecting, persecution, and disease. They migrate from their winter denning sites up to several miles.[169]

- New England Cottontail (NY Special Concern, Species of Greatest Conservation Need – high priority) is the only native cottontail east of the Hudson River in New York and its range has been greatly reduced in the state due to forest maturation, habitat loss, and competition with the more abundant Eastern cottontail. It prefers open woods, disturbed areas, shrubby areas, thickets, and marshes.
- Migratory fish. American eel (NY Species of Greatest Conservation Need, high priority). The portions of the streams in Washington and Millbrook that are known to provide important passage for American eel are shaded pale orange on the Stream Habitats map. The important areas include both upstream habitat and areas adjacent to the stream that support the health and integrity of stream habitats. American eel is in decline throughout much of its range, and though eels are able to bypass certain dams, culverts, and other aquatic barriers, they rely on connected, free-flowing streams to complete their life cycle and return to the Atlantic Ocean to spawn.
- Brook Trout, wild (NY Species of Greatest Conservation Need) Brook trout generally live in small-to moderate-sized streams, lakes, and ponds, wherever cool (below 72 degrees Fahrenheit) water is available. They tend to prefer colder water than rainbow and brown trout, and they are often found in the headwaters of streams.[170]

The areas are shown on the maps for categories of animals (aquatic animals, terrestrial animals, migratory fish) rather than species to protect those that may be vulnerable to collecting or other harm. A complete list of animals of conservation concern documented in the Town of Washington is provided in Table 15.

**Important coldwater stream habitat**

NYNHP identifies streams with important coldwater habitat likely to support native brook trout and adjacent areas contributing to habitat quality, including Butts Hollow Brook, Stone Church Brook, areas draining to Wells Brook which begins south of the town boundary, and an unnamed stream flowing into Sprout Creek. Note the map does NOT indicate areas with public fishing rights, and many areas are unsuitable for recreational trout fishing due to small fish populations and small fish size.

## Wildlife (no map)

https://guides.nynhp.org/timber-rattlesnake/. Accessed August 1, 2023.

[168] NYS DEC https://www.dec.ny.gov/animals/7147.html. Accessed August 1, 2023.

[169] New York Natural Heritage Program. Online Conservation Guide for Crotalus horridus. Available from: https://guides.nynhp.org/timber-rattlesnake/. 2023. Accessed August 1, 2023.

[170] DEC Fishing for Stream Trout https://www.dec.ny.gov/outdoor/62477. Accessed August 1, 2023

Table 15 lists species of conservation concern that have been recorded in the Town of Washington and the Village of Millbrook. The information comes from a number of sources: the NYNHP biodiversity databases, the NYS Fish Atlas, the 1990-1999 New York Amphibian and Reptile Atlas (NYARA), the 2000-2005 New York State Breeding Bird Atlas (NYBBA), and from staff at the NYS DEC. Species from the NYBBA are included in the table if they were documented in Atlas blocks that are at least 50% within the Town.

The table is not a comprehensive list of species found in Washington and Millbrook. It only includes species listed in New York as:

- endangered (at the state (NY) and/or federal (US) level): any native species in imminent danger of extirpation or extinction in New York State.
- threatened: any native species likely to become an endangered species within the foreseeable future in New York State.
- special concern. Species of special concern warrant attention and consideration but current information, collected by the NYS DEC, does not justify listing these species as either endangered or threatened.
- Species of Greatest Conservation Need (SGCN). SGCN are species identified in
- the State Wildlife Action Plan that are experiencing some level of population decline, have identified threats that may put them in jeopardy, and need conservation actions to maintain stable population levels or sustain recovery (NYSDEC 2015). High priority SGCN are species in need of timely management intervention or they are likely to reach critical population levels in New York within 10 years.
- a Hudson River Valley Priority Bird species by Audubon New York. Audubon New York identified the Hudson River Valley priority birds by assessing continental, national, and regional bird planning initiatives in addition to state and federal priority designations.

For each species, the table lists generalized primary habitat types, but for conservation and planning purposes, it is important to recognize that many species utilize more than one kind of habitat. More information on rare animals, plants, and ecological communities can be found at http://guides.nynhp.org. Additional rare species and habitats may occur in Washington or Millbrook.

Table 15. Species of Conservation Concern documented in the Town of Washington and Village of Millbrook.

| | | | 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** | | | | | | | | |
| New England Cottontail | *Sylvilagus transitionalis* | shrubland | | xx | x | | | NYNHP |
| **Reptiles** | | | | | | | | |
| Blanding's Turtle | *Emydoidea blandingii* | forest, wetland | | xx | | NY | | NYNHP |
| Bog Turtle | *Glyptemys muhlenbergii* | wetland | | xx | | US | NY | NYNHP |
| Snapping Turtle | *Chelydra serpentina* | wetland, stream, forest, lake | | x | | | | NYARA |
| Spotted Turtle | *Clemmys guttata* | wetland | | xx | x | | | NYARA |
| Wood Turtle | *Clemmys insculpta* | stream | | xx | x | | | NYARA |
| **Amphibians** | | | | | | | | |
| Four-toed Salamander | *Hemidactylium scutatum* | wetland | | xx | | | | NYARA |
| **Birds** | | | | | | | | |
| American Bittern | *Botaurus lentiginosus* | wetland | x | x | x | | | NYBBA |
| American Goldfinch | *Spinus tristis* | young forest, shrubland | x | | | | | NYBBA |
| American Kestrel | *Falco sparverius* | meadow | x | 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 | |
| American Redstart | *Setophaga ruticilla* | forest | x | | | | | NYBBA |
| American Woodcock | *Scolopax minor* | young forest, shrubland | x | x | | | | NYBBA |
| Baltimore Oriole | *Icterus galbula* | forest | x | | | | | NYBBA |
| Black-and-white Warbler | *Mniotilta varia* | forest | x | | | | | NYBBA |
| Black-billed Cuckoo | *Coccyzus erythropthalmus* | young forest, shrubland | 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 |

| | | | 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** |
| Chestnut-sided Warbler | *Setophaga pensylvanica* | young forest, shrubland | x | | | | | NYBBA |
| Chimney Swift | *Chaetura pelagica* | urban | x | | | | | NYBBA |
| Cooper's Hawk | *Accipiter cooperii* | forest | x | | 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 |
| Least Flycatcher | *Empidonax minimus* | forest | x | | | | | NYBBA |
| Louisiana Waterthrush | *Seiurus motacilla* | forest | x | x | | | | NYBBA |
| Northern Flicker | *Colaptes auratus* | forest | x | | | | | NYBBA |
| Northern Goshawk | *Accipiter gentilis* | forest | x | x | 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 |
| Pied-billed Grebe | *Podilymbus podiceps* | wetland | 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 |
| Savannah Sparrow | *Passerculus sandwichensis* | grassland | x | | | | | NYBBA |
| Scarlet Tanager | *Piranga olivacea* | forest | x | x | | | | NYBBA |
| Sharp-shinned Hawk | *Accipter striatus* | forest | x | | x | | | NYBBA |
| Willow Flycatcher | *Empidonax trailli* | young forest, shrubland | x | | | | | NYBBA |
| Wood Thrush | *Hylocichla mustelina* | forest | x | 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 | |
| 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 |
| **Plants** | | | | | | | | |
| No records | | | | | | | | |
| **Fish** | | | | | | | | |
| American Eel | *Anguilla rostrata* | stream | | xx | | | | NYDEC |
| Brook Trout | *Salvelinus fontinalis* | stream | | x | | | | NYDEC |
| **Insects** | | | | | | | | |
| No Records | | | | | | | | |

## Invasive species

Invasive species are non-native species that can cause harm to the environment, the economy, or human health. Invasive species are one of the greatest threats to New York's biodiversity. They cause or contribute to:

- habitat degradation and loss
- the loss of native fish, wildlife, and tree species

- the loss of recreational opportunities and income
- crop damage and diseases in humans and livestock and
- pose risks to public safety.

The Lower Hudson Partnership for Invasive Species Management provides information about invasive species present in the Hudson Valley, their identification, and management. The species listed on this page are already common in the Hudson Valley. For species considered Tier 1 and 2, the partnership requests people notify them of sightings of these species using a reporting form available online at https://www.lhprism.org/hudson-valley-species.

**Common Invasive Species in the Hudson Valley**

| Terrestrial | Aquatic | Forest Pests |
|---|---|---|
| Burning bush | Brittle naiad | Asian jumping worms |
| Common buckthorn | Brazilian elodea-Tier 2 | Beech leaf disease |
| Japanese barberry | Chinese mystery snails | Emerald ash borer |
| Japanese stiltgrass | Curly-leaf pondweed | Hemlock woody adelgid |
| Multiflora rose | Eurasian watermilfoil | Spotted lanternfly- Tier 1 species |
| Oriental bittersweet | Hydrilla-Tier 2 | |
| Tree of heaven | Water chestnut | |
| Wild parsnip | Zebra mussels | |
| Wineberry | Fanwort- Tier 2 | |
| Yellow iris | | |

Recognizing that different invasive species pose different levels and types of threats, and there is variation in how widely established invasive species are in the region, Lower Hudson PRISM has categorized the species present in the lower Hudson Valley. Information about individual species and management recommendations, including non-chemical methods for a number of species, are available online from the New York Invasive Species Info website (https://nyis.info/species-information/), which is maintained by Cornell Cooperative Extension and NOAA SeaGrant.

# Chapter 6: Land Use

The Land Use Section is divided into four parts, many with corresponding maps:

- Zoning
- Regulated Facilities
- Agricultural Resources
- Conservation and Public Lands

## Zoning

> *"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 to regulate land use by enacting what is commonly referred to as zoning. Zoning governs the way land in a municipality is used and developed with the goal of carrying out the municipality's long-range land use objectives. Zoning regulates property uses and the siting and density of development. 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. The Town of Washington and Village of Millbrook zoning maps are shown as insets below and are available online.[171,172] Town and Village zoning districts are listed respectively in Table 16 and 17.

Examining the zoning maps in relation to the NRI resource maps can provide insight into potential development scenarios that could affect the existing natural resource base, ecology, and other significant features.

Table 16. Zoning Districts in the Town of Washington

[171] Town of Washington Zoning Map, 2017, https://www.dutchessny.gov/Departments/Planning/Docs/washington.pdf

[172] Village of Millbrook Zoning Map, 2020, https://www.dutchessny.gov/Departments/Planning/Docs/Millbrook.pdf

| Code | Description |
|---|---|
| HM | Hamlet Mixed Use |
| RH-1 | High Density Residential |
| RM-2 | Medium Density Residential |
| RL-5 and RS-5 | Low Density Residential |
| RR-10 and RS-10 | Rural Residential |
| LC | Land Conservation |

Table 17. Zoning Districts in the Village of Millbrook

| Code | Description |
|---|---|
| BCD | Bennett College District |
| GB | General Business |
| R | Residential |
| RLD | Residential Low-Density |
| RMF | Multifamily Residential |
| RT | Transitional Residential |
| RU | Rural |

In addition to base zoning districts, the Town and Village have established some overlay zones, which supplement the requirements of the underlying districts. They include the Agricultural Protection and Aquifer Protection Overlay districts in the Town, and the Thorne Center Overlay district in the Village.

The following Town of Washington zoning districts offer some specific natural resource protections:

*Agricultural Protection Overlay District*
The purposes of this district include to preserve agricultural land and working farms; prevent conflicts between incompatible land uses; and maintain the rural, natural, and scenic qualities of the Town, among others. The regulations allow some additional uses and create a special permit process for farmworker housing and agriculture-related service or commercial uses. Conservation Density Subdivisions are encouraged, and a cluster plan may be required for residential subdivisions within this district. Siting standards are also established to maximize the

area remaining for agricultural use and to buffer new residences from neighboring agricultural uses.

*Aquifer Overlay District*
This district is intended to preserve and maintain the quality and quantity of groundwater found in aquifers, and thereby protect this water supply source for the Town. The regulations establish development standards to protect groundwater and restrict certain uses. In addition, actions undertaken within Millbrook's public water supply watershed must comply with any standards, rules, or regulations promulgated by the NYS Commissioner of Health under Section 1100 of the Public Health Law.

*Potential Environmental Preservation Districts*
Town code includes provisions for the creation of Environmental Preservation Districts, a type of floating district that the Town Board has yet to enact. Floating districts are unmapped overlay zones with defined characteristics and may be created by application to the Town Board. The regulations would require any building permit or other land use permit aside from exempted uses to go through the site plan approval process. The regulations would also establish a list of Type 1 Actions for projects within the districts (requiring a Full Environmental Assessment Form) pursuant to NYS SEQRA.

The Town of Washington provides more information on these districts under Article III of the zoning code.[173] The Village of Millbrook does not have any specific natural resource protection districts or overlay zones. Millbrook's zoning code is available in Chapter 230 of village code.[174]



[173] Town of Washington Zoning District Regulations, https://www.washingtonny.org/document-center/building-zoning/town-code/1379-zoning-code-complete-revised-7-22-2022/file.html
[174] Village of Millbrook zoning code, https://ecode360.com/10855096

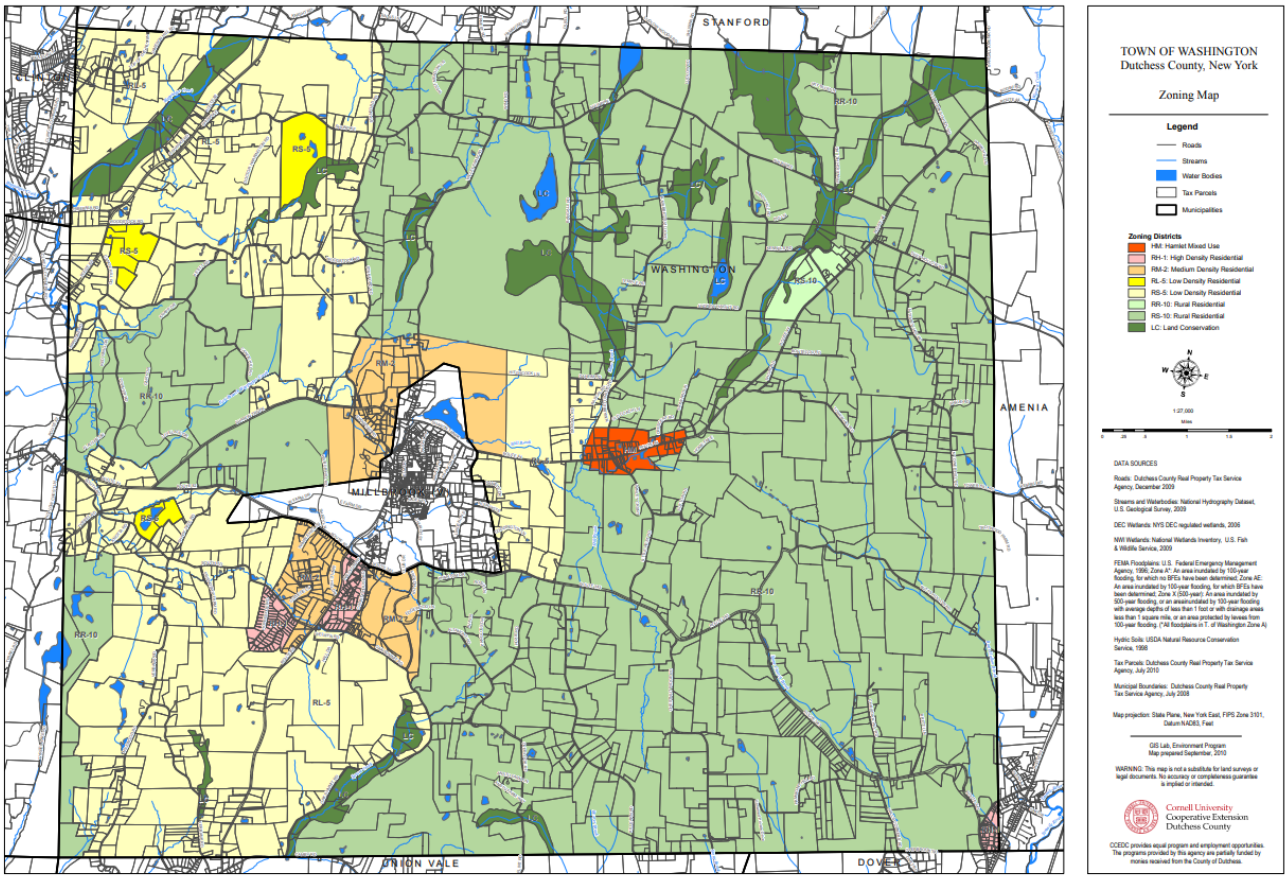


Figure 6. Zoning Map, Town of Washington

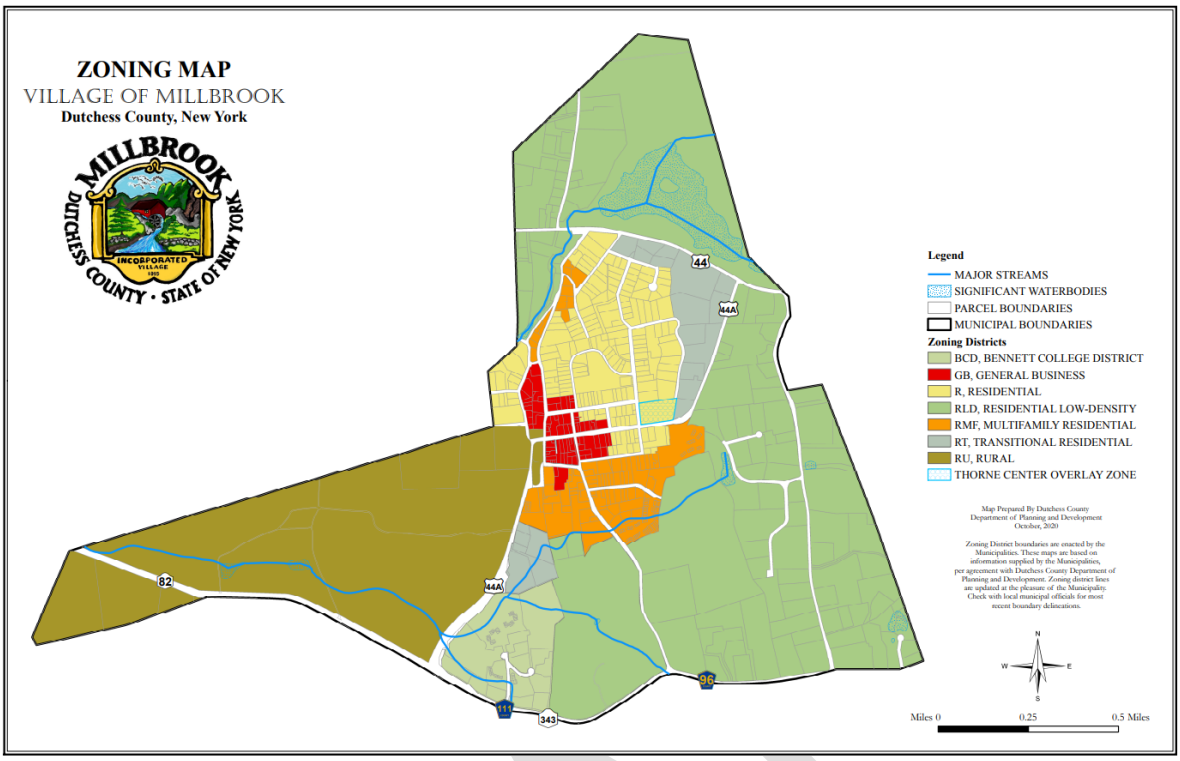


Figure 7. Zoning Map, Village of Millbrook

## Centers and Greenspaces

The Centers and Greenspaces map was prepared by Dutchess County as part of a county-wide initiative to promote smart growth principles and avoid strip-and-sprawl development patterns, including:[175]

- Reinforce existing centers and main streets;
- Mix uses to promote walking and biking;
- Connect major centers with transit services;
- Locally identify priority growth areas for close-in expansion and conversion of strip districts or subdivisions into new centers
- Employ a range of protection measures for farmland and natural wildlife areas;
- Adopt policies that support agriculture;
- Plan for continous greenspace systems;
- Locally identify priority greenspaces for future public or private conservation.

Note that the map and following descriptions of the centers and greenspaces were developed by Dutchess County in 2015.

Millbrook grew into a village after its railroad station was built in 1870 between the two much earlier settlements of Hart's Village and Mechanic. The station and tracks are now gone, but Millbrook retains its village green at the southern entrance, an inviting main street character, and walkable access to the Town and Village Halls, Library, Post Office, schools, and commercial services. It remains an exemplary village model in many ways, most of all because it has avoided the all-too-typical commercial strip along its entrance road. The Town Comprehensive Plan recommends that any new commercial uses, compact residential development, or affordable housing be placed in the Village to strengthen its primary center and protect the Town's surrounding rural qualities. The most available properties for potential new development are the abandoned and deteriorated portions of the Bennett College campus on the south side of the Village.

Mabbettsville, home to the 29-acre Town Park, is designated as a mixed-use hamlet district in the zoning code. It is intended as an area of mixed residential and non-residential uses in which the historic character is preserved, pedestrian activity is encouraged, and suburban strip shopping plazas are discouraged. The Town Comprehensive Plan proposes no significant changes to existing land uses, settlement patterns, or infrastructure in the Mabbettsville area.

The Centers and Greenspaces map identifies 12 areas of continuous greenspaces with agricultural and natural land over 1,000 acres in size in the Town of Washington. Greenspaces include approximately 11,200 acres of unbuildable area including stream corridors, State and Federal wetlands with their buffers, floodplains, and steep slopes of 20% or more. These unbuildable areas may act as biodiversity connectors between greenspaces.

[175] "Centers and Greenspaces," Dutchess County, https://www.dutchessny.gov/Departments/Planning/Centers-Greenspaces.htm

## Regulated Facilities

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 Washington. 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 Washington and Millbrook.

The **DECinfo Locator** is an online map that links to DEC databases to share information about environmental quality, monitoring, and permits. It is available at https://www.dec.ny.gov/pubs/109457.html.

- **Inactive Landfill -** The Millbrook landfill, located on Sharon Turnpike, is about one acre in size and was used for disposal of municipal waste from 1935-1985. It was evaluated for placement on the State Superfund Site list but did not qualify. A Phase II Investigation concluded that there is no evidence for the disposal of hazardous waste at this site. See the DEC's Environmental Remediation Database record for more information.[176]

- **Transfer Station -** A transfer facility is a facility where waste is received, consolidated, and then transported to a subsequent facility for processing, treatment, further transfer, or disposal. Often, residents or local haulers bring waste to transfer facilities, where the waste is consolidated and then transferred to larger facilities. The Town of Washington Transfer Station is located at 711 Route 343. The Station's annual report may be viewed using the DEC infoLocator tool.

- **Active or Reclaimed Mine -** There is only one active sand and gravel mine in the Town of Washington at the time of writing, located off Route 82 and Canoe Hill Road.[177] Six additional reclaimed sand and gravel mines are documented in the Town.

- **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.[178] There

[176] "Millbrook Village Landfill." NYS Department of Environmental Conservation Environmental Remediation Database, https://www.dec.ny.gov/cfmx/extapps/derexternal/haz/details.cfm?ProgNo=314043

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

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

is a single SPDES permit in the Village of Millbrook where the Millbrook Sewage Treatment Plant discharges to the Wappinger Creek.

- **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.[179] Examples of these sites in Washington include gas stations, schools, municipal facilities, and some farms.

## Agricultural Resources (Map 18)

Understanding the distribution of agricultural resources and working farms should be an important consideration in local planning and development processes. Growing food locally can benefit the economy, the environment, and the health and welfare of the community. In addition, farms often support valuable wildlife habitats and water resources. Local farms are also important contributors to scenic beauty and open space in the community.

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.

The 2015 Comprehensive Plan notes that the amount of farmland in the Town has remained relatively stable over the past three decades, though the nature of farming has changed, with a shift to both larger production farms and smaller specialty farms. The Plan notes concern that the current concentration of farmland ownership among fewer than 50 property owners poses risk to the Town's agricultural land base, as high costs of ownership drive farmers to consider selling or subdividing land.

The Agricultural Resources Map shows the distribution of farmland soils, designated agricultural districts, and properties with agricultural assessments in the Town of Washington and Village of Millbrook.

**Agricultural Soils**

Farming often relies on the availability of high-quality soils. High quality soils require smaller inputs of fertilizer and nutrients, leading to lower costs, higher production rates, and less environmental impact. Prime Farmland Soils are defined by the US Department of Agriculture and New York State as the most productive soils for farming.[1] Prime farmland soils are relatively limited in extent and scattered throughout the Town of Washington, without any noteworthy concentrations. There are 4,642 acres of Prime Farmland Soils in the Town

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

representing 12.3% of all soils. An additional 569 acres are classified as Prime if Drained, which may include wetland areas.

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. Statewide important farmland soils occur throughout the Town. There are 12,491 acres of farmland soils of statewide importance in Washington, representing 33.2% of all soils. Prime and Statewide Important Farmland Soils are present throughout the Town but are most common in valleys and at lower elevations.

**Agricultural Districts**

New York State enacted the Agricultural Districts Law in 1971 to provide basic "right to farm" protections to keep agricultural land in production. Participation in agricultural districts is voluntary and benefits landowners by reducing tax liability and protecting farmers against overly restrictive local laws and private nuisance suits involving agricultural practices. Farm owners in agricultural districts can receive real property assessments based on the value of their land for agricultural production rather than on its development value. Agricultural properties in Washington are within Agricultural District #21. The Town of Washington (including Village of Millbrook) has more farmland acreage in an agricultural district than any other municipality in Dutchess County, with 24,797 acres total, which is 66% of the Town's total land area.[180] From 2008 to 2022, the amount of land in the agricultural district in Washington grew by 8%.

**Agricultural Assessment**

New York State Agricultural Districts Law provides for a reduction in property taxes for land in agricultural production. The agricultural assessment is based on the following qualifications:

- Minimum of seven acres farmed by a single operation. Total acreage of less than seven acres may still qualify if gross sales are at least $50,000 per year.
- Lands have been in production for the preceding two years.
- Farm operation grosses an average of $10,000 or more in sales per year.

At the time of writing, there are 17,461 acres of land in Washington receiving an agricultural assessment, which is 46.4% of the Town.

**Farming in the Town of Washington**

As of 2022, over 40% of the Town's agricultural area was dedicated to production agriculture, 21% was beef and livestock operations, and approximately 15% was horse farms. Table 18 provides a summary of farm enterprises in Washington.

Table 18. Farm enterprises by area in the Town of Washington

| Farm Enterprise Category | Acres | Percent |
|---|---|---|

[180] Cornell Cooperative Extension of Dutchess County, 2022, *Washington, New York Community Profile: Agriculture and Farms*, https://ccedutchess.org/agriculture/2022-town-agricultural-profiles.

| | | |
|---|---|---|
| Production Agriculture (hay, corn, and field crops) | 10,244 | 43.4% |
| Beef and Livestock | 5,006 | 21.2% |
| Horses | 3,489 | 14.8% |
| Buffer (vacant, residential, or open space parcels that border farm property and/or could be developed for farming operations) | 2,115 | 9.0% |
| Specialty Crops (e.g., Christmas trees, orchards, vegetable farms, flowers) | 1,055 | 4.5% |
| Dairy | 752 | 3.2% |
| Other | 1,680 | 7.1% |

Examples of farms in Washington include: (committee members to edit this text and list)

- AKM Farm
- Evergreen Christmas Tree Farm
- Millbrook Vineyards and Winery
- Stonewood Farm
- Victory Lane Farm
- Wallbridge Farm
- Yellowframe Farm

**Forestry Lands**

Approximately 67% of Washington is forested,[181]The ability of private forest landowners to periodically harvest timber or other forest products provides an important source of income that can help landowners avoid subdivision of land or conversion to non-forest uses. Working forests also contribute to the local economy and demand very little in the way of community services in return for the property taxes their owners pay. DEC's Municipal Guide to Forestry in New York State offers guidance to encourage local governments to actively support and promote multiple forest uses and stewardship of the land.[182]

To encourage the long-term management of woodlands to produce forest products, the State of New York in 1974 enacted the 480-a Forest Tax Law to qualifying owners. Any tract of forest land is eligible if it consists of at least 50 contiguous acres, exclusive of any portion not devoted to the production of forestry. Participants must commit land to the production of forest crops and to follow a management plan, prepared by a forester and approved DEC, for the next succeeding

[181] Calculation based on 2016 National Land Cover Database classes for woody vegetation.

[182] Daniels, K.H. 2005. A Municipal Official's Guide to Forestry. A joint publication of the New York Planning Federation, Department of Environmental Conservation, and Empire State Forest Products Association. Albany, NY. Available at: http://www.dec.ny.gov/docs/lands_forests_pdf/guidetoforestry.pdf

ten years beginning each year that they receive a tax exemption. The Agricultural and Forestry Resources Map shows tax parcels enrolled in the 480-a program at the time of writing in 2020. A total of 11 parcels were enrolled, with 1,556 acres committed to the program. More information about the 480-a program is available at https://www.dec.ny.gov/lands/5236.html.

About 9,400 acres or 25% of the Town of Washington land area was enrolled in the 480-A program in 2023. These parcels are outlined on Map 15, Large Forests. Additional properties may be managed for forestry without enrollment in 480-a. All private, non-industrial, forest landowners who are looking for introductory management and technical advice are eligible for a free visit with a DEC forester. More information about DEC's Forest Stewardship Program is available at https://www.dec.ny.gov/lands/4972.html.

## Conservation and Public Lands (Map 19)

Conserved lands and publicly accessible open spaces provide substantial environmental, social, economic, and health benefits. Conserved lands offer long-term habitat protection, help manage water and air quality, and support community resilience to climate change. In response to global climate and biodiversity crises, nations around the world have signed an agreement to conserve 30% of land and water by 2030. New York has also committed to the 30 by 30 goal to promote biodiversity and preserve land and water. Currently, about 14.6% of the Town of Washington (including Millbrook) is publicly owned or preserved under conservation easement.

The Conservation and Public Lands Map can help Washington and Millbrook 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, and trails as new projects arise.

Dutchess Land Conservancy (DLC) is a non-profit conservation organization dedicated to preserving the rural character, important resources and open lands of Dutchess County. Most of the protected land in the Town of Washington is held under conservation easement by DLC.

A total of 5,510 acres of conservation easements and publicly owned lands were mapped in the Town of Washington and Village of Millbrook. These properties were identified from parcel data and information provided by local land trusts. The NY Protected Areas Database (NYPAD) was also used as a reference. NYPAD is a spatial database of lands protected, designated, or functioning as open space, natural areas, conservation lands, or recreational areas created by the NYNHP. Conservation and public lands are classified based on ownership and summarized in Table 19.

Table 19. Conservation and Public Land in the Town of Washington by Ownership Type

| **Ownership Type** | **Acreage** | **Percent of Town** |
|---|---|---|
| Dutchess Land Conservancy Conservation Easement | 5,294 | 14.1% |
| Town/Village | 156 | 0.4% |
| Non-Profit Conservation Organization | 60 | 0.2% |
| **Total** | **5,510** | **14.6%** |

Conserved lands include fee-owned properties and properties protected with conservation easements.

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Village of Millbrook. *Master Plan 1985-2000*, Millbrook, NY, Date. pages missing

# Appendix A

## Soils Table