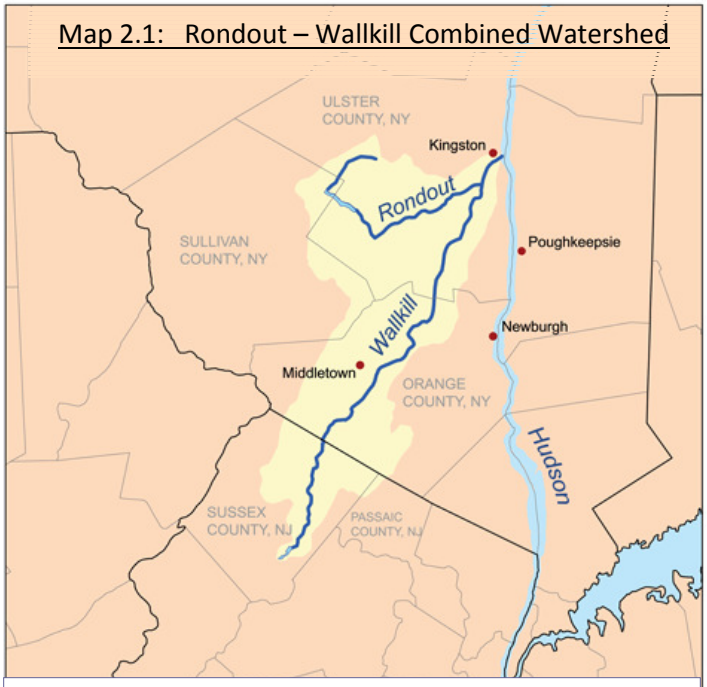
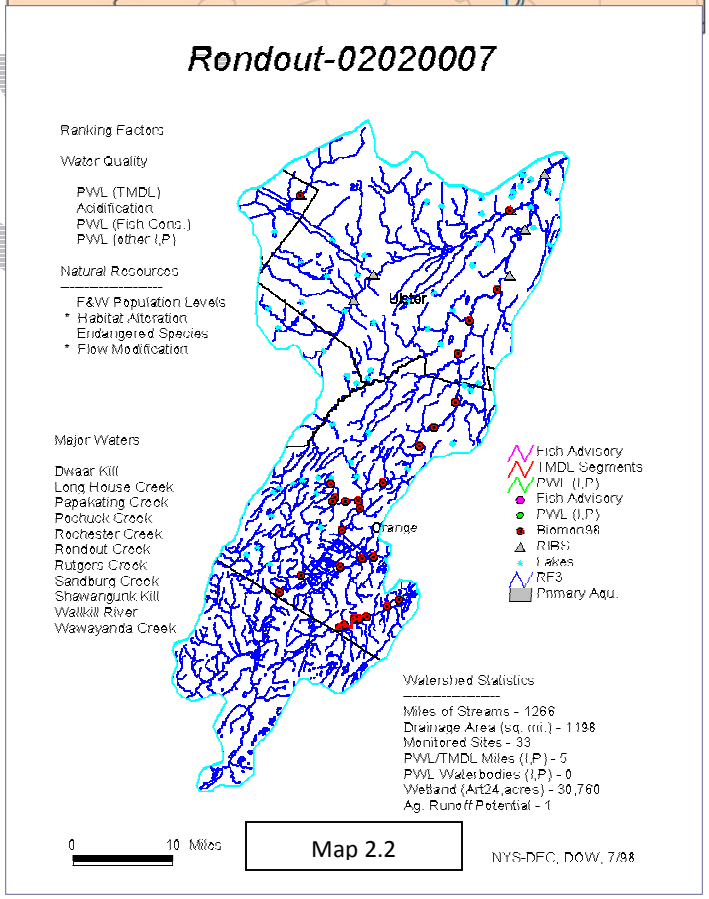
SECTION 2 - RONDOUT CREEK AND ADJACENT WATERSHEDS

2.1 The Rondout-Wallkill Watershed

The Rondout Creek is among the largest tidal tributaries to the Hudson River. The headwaters of the Rondout creek begin in Shandaken at an elevation of 3,837 feet (DEP, 2008). It is impounded at the Rondout Reservoir in Sullivan and western Ulster counties then travels southeast through Ellenville, where it bends northeast to the High Falls waterfalls. It is joined by the Wallkill River beyond the Central Hudson-owned hydroelectric plant at Sturgeon Pool in Rifton. The Wallkill River system and Rondout Creek system form the approximately 3,082-km^2 Rondout-Wallkill watershed, the largest tributary basin entering the Hudson River south of the head of tide at Troy. The Rondout then continues to flow north over the Eddyville dam, where it is tidal for a 4-mile stretch until it empties into the Hudson River in downtown Kingston at an elevation of 190 feet. The Rondout enters the Hudson River Estuary at River Mile ___ (148 km), far enough north of the limit of saltwater intrusion so that the Rondout is a tidal freshwater system.

Map 2.1: Rondout – Wallkill Combined Watershed

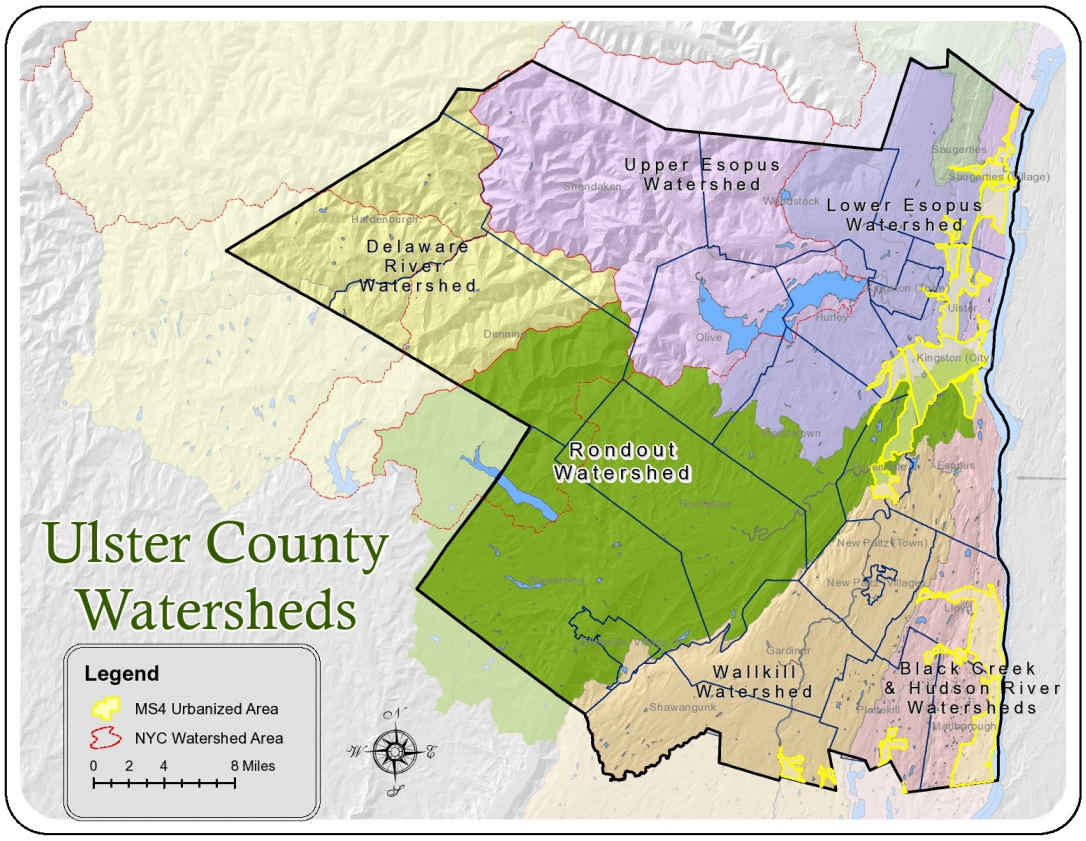




Delineation

Delineating the Rondout Creek watershed is challenging because it overlaps with the Catskill Park and the New York City Water Supply System for the Catskill and Delaware. In addition, the Hydrologic Unit Code (HUC # 02020007 – Map 2.2) is called Rondout, but includes the Wallkill Creek, which flows north from New Jersey through Orange County. A watershed management plan has already been created for the Wallkill *(cite),* so the Rondout Creek Interim Watershed Management Plan for the lower, non-tidal section has been designed interface easily

with this and other watershed planning and protection efforts in the adjacent watersheds, with a focus on the Upper Rondout (NYC DEP) and the Upper and Lower Esopus (LEWP).



Map 2.3 The full Rondout Creek Watershed covers most of the southwest portion of Ulster County with the Delaware Watershed in Delaware and Sullivan Counties to the west, the Upper and Lower Esopus to the north and the Wallkill and Black Creek to the east.

Impervious Surface in the Rondout-Wallkill Watershed

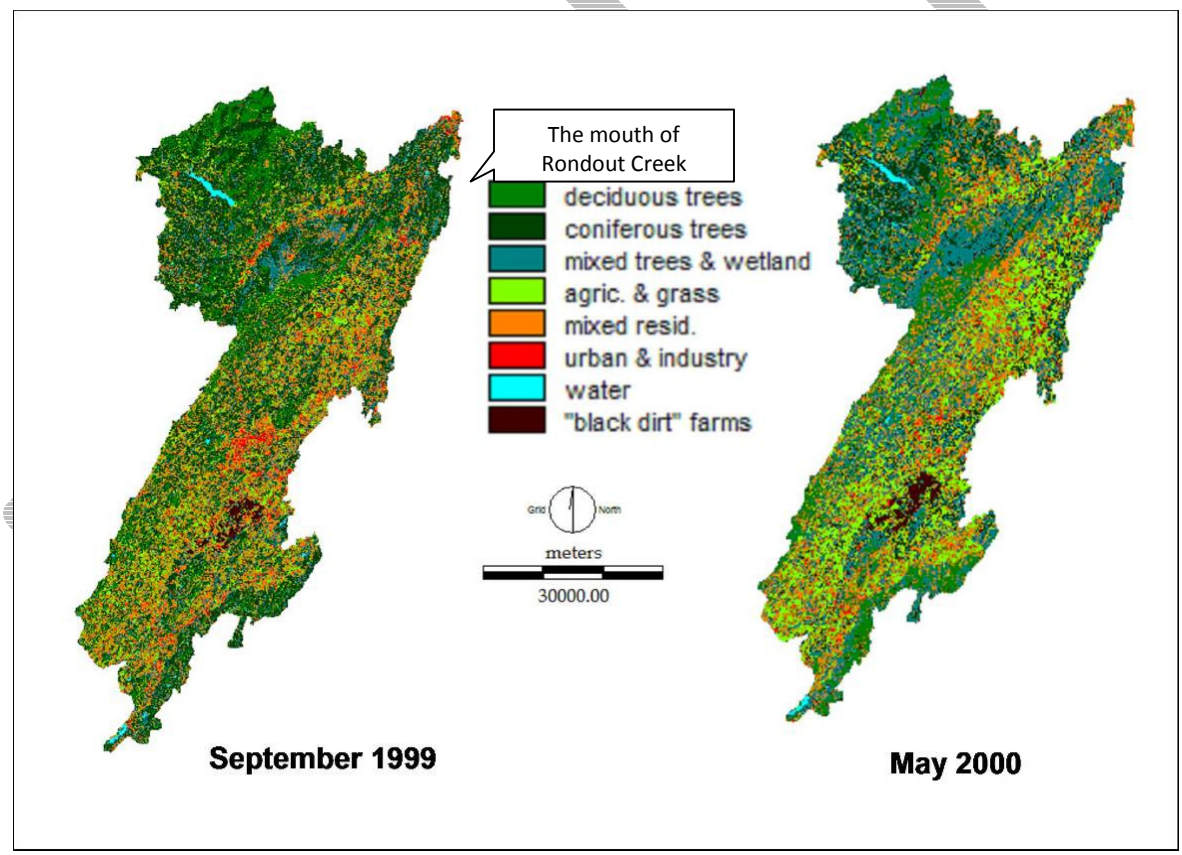
This section has been adapted from *Using a Shoreline Inventory for Conservation and Planning: the Rondout Creek Case Study,* original research by Chris Bowser (*Appendix E*).

Because it contains a high diversity of shoreline type in a relatively short stretch, it was used extensively and historically used as an early site for sampling, inventory and collection classification for many studies. Finally, the Rondout Creek contains, within a relatively small area, many of the same issues and challenges found along the greater mainstem estuary, including competing needs of economy and ecology as well as management across municipal borders. The design and implementation of a Watershed Management Plan that takes into consideration the Rondout Watershed's ecological assets and cultural highlights will establish the context of conservation needs and could best be applied to the larger whole (connectivity of all the watersheds) in the future.

Land Cover of the Rondout Watershed and Creek (Winter 1999, Spring 2000)

Percentage of impervious land cover within a watershed can be used as a general indicator of watershed health and non-point source pollutant loading. Impervious cover refers to roads, roofs, and parking lots that do not allow rainwater to penetrate soils, thus increasing the likelihood of erosion and non-point source pollutants to rapidly enter local waterways. Urban areas typically have a high percentage of impervious cover, agricultural areas less so, and forested areas have the least (For more information about impervious surfaces see Section 4.2).

Thirty-meter resolution Landsat imagery (bands 4, 3, and 2) of the Wallkill-Rondout watershed from both September 1999 (a month when deciduous trees are in full leaf) and May 2000 (a time before deciduous leaves have fully formed) were classified for land use cover using the IDRISI software package. Two seasons were used to examine the effect of multi-seasonal differences, such as deciduous leaf cover, on classification.



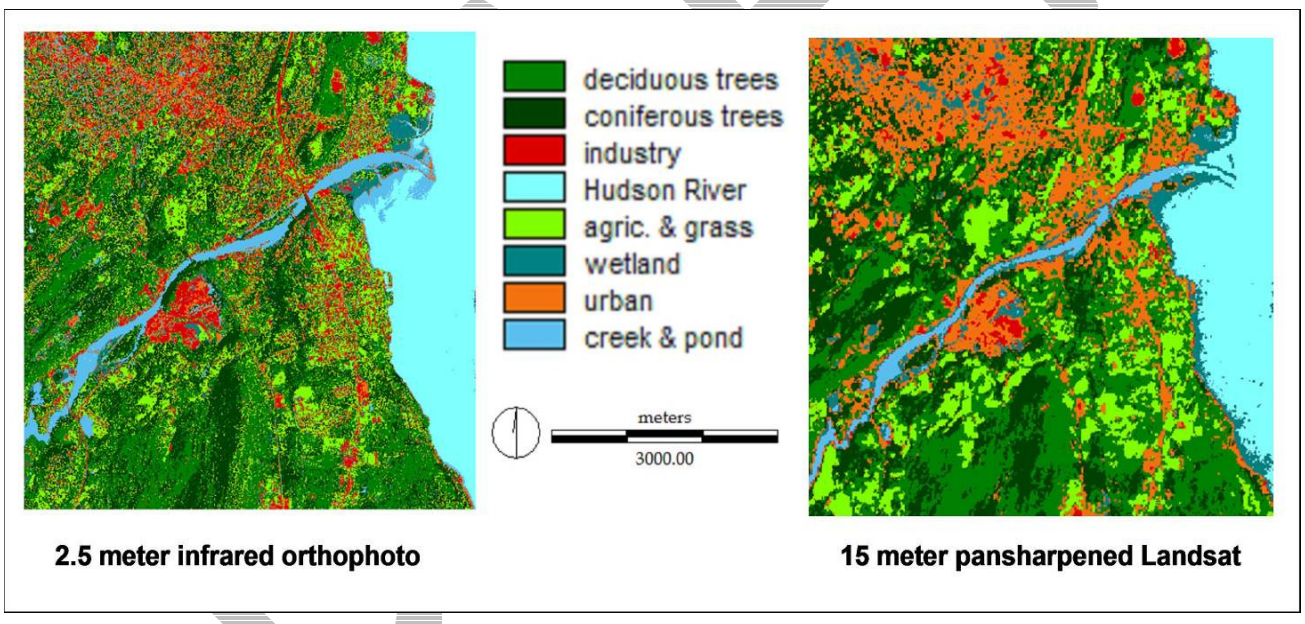
Map 2.4. Land use in the Rondout-Wallkill watershed *(Source of Landsat image: University of Maryland website: glcfapp.umiacs.umd.edu).* Note: This HUC map includes both Rondout and Wallkill watersheds.

For the September and May images, impervious surface was calculated at 9.2% and 9.6%, respectively. The presence of leaves on the trees did not greatly affect the impervious cover calculations in this analysis. According to the Center for Watershed Protection *(cite),* watershed imperviousness of 10% to 25% indicates an impacted stream or estuary tributary likely to exhibit a decline in water quality, loss of biodiversity, greater storm flows and altered stream geometry.

Imperviousness beyond 25% indicates severe degradation, no longer able to support a diverse stream biota and likely having poor water quality. Similar thresholds have been linked to other indicators. Wang et al., (1997) found habitat quality and biotic integrity, based on an array of fish and invertebrate community metrics, with an impact range of 10% to 20% similar to that of Zielinski's land use thresholds of 10% to 25%.

The 1999-2000 average calculation of 9.4% impervious cover for the Wallkill- Rondout Watershed indicates a watershed that is on the borderline of experiencing negative water quality impacts from runoff and non-point sources associated with impervious cover.

A similar analysis of the area around the tidal Rondout Creek, located in the northeast corner of the watershed, reveals a smaller region of greater imperviousness. An impervious cover of 14.7% to 18.5% is higher than the overall imperviousness of the entire watershed (9.4%), and indicates the tidal Rondout Creek may be an impacted estuary tributary that is experiencing negative water quality impacts from runoff and non-point sources associated with urbanization at the local scale of land use immediately adjacent to the tidal Rondout Creek.



Map 2.5. Land use along the tidal Rondout Creek. (L) Derived from 2.5 meter orthophotos, April 2001. (R) Derived from 15-meter pan-sharpened Landsat, May 2000. *(Source: Ulster County Information Services, Kingston, NY).*

The Rondout-Wallkill watershed, specifically the area around the tidal Rondout Creek, exhibits a percentage of impervious cover (14.7% to 18.5%) that may lead to negative water impacts. In the case of the Rondout Creek, the effects of watershed-scale water quality is especially relevant since the lower portion of the creek is the "bottleneck" of the drainage basin before entering the Hudson estuary. The Creek's tidal nature at this point also means it has a more variable flushing rate and considerable re-suspension of sediments. Shoreline hardening and the reduction of riparian vegetation can lead to reduced filtration and greater inputs of pollutants and sediment into streams. Furthermore, urban waterfronts are usually associated with impervious parking lots and rooftops as well as hardened shorelines. It is typical that imperviousness will increase as development pressures in the watershed continue.

Section 2.2 Lower Non-Tidal (LNT) Rondout Creek Watershed

Watershed General Description *(this section needs citations)*

The Rondout Creek is a tributary of the Hudson River in Ulster and Sullivan countiesof New York State. It arises on Rocky Mountain in the eastern Catskills, flows south into New York City's Rondout Reservoir, then into the valley between the Catskills and the Shawangunk Ridge, where it goes over the spectacular High Falls and finally empties out into the Hudson at Kingston, receiving the Wallkill River along the way.

The lower, non-tidal portion of the Rondout, which is the focus of this management plan, begins below the Rondout Reservoir and includes the confluence with the Wallkill River in Creek Locks upstream of the Eddyville Dam. The mainstem of the LNT Rondout Creek is approximately _____ miles long and, with its tributaries, is part of a 383 sq. mi. drainage basin *(cite).* This includes major portions of the towns of Wawarsing, Rochester, Marbletown, and Rosendale. Thirty-eight tributaries flow into the lower non-tidal portions of the creek *(Appendix F: Table 3.1 Tributaries to Rondout Creek).* The creek in this section has ___dams and is channelized for approximately ___miles.

The name of the Rondout Creek comes from the fort, or redoubt, that was erected near its mouth. The Dutch equivalent of the English word redoubt (meaning a fort or stronghold), is reduyt. In the Dutch records of Wildwyck, however, the spelling used to designate this same fort is invariably Ronduyt during the earliest period, with the present form Rondout appearing as early as November 22, 1666.[3 cite]

The Rondout Creek became economically important in the 19th century when the Delaware and Hudson Canal followed closely alongside it from Napanoch to the village of Rondout, now part of the City of Kingston, which grew rapidly as the canal's northern port. Today it is important not only for the Rondout reservoir, which provides drinking water to nine million people in the greater New York City metroploitan area, but also for the fishing and other recreational opportunities it provides.

Including the contribution from the Wallkill, the Rondout drains a vast area stretching over 1,100 square miles (2,850 km^2) all the way down to Sussex County, New Jersey. *(cite).* The high mountains around its upper course and the reservoir, which collects water from three others, also add to it flow.

The Rondout goes through several different stages due to the changes in surrounding geography and past development, such as the canal and reservoir that has drawn on its waters. Its headwaters, above the reservoir, are typical of a mountain stream. Below the reservoir the streambed remains fairly rocky but widens into the floor of a narrow valley. At Napanoch, where it turns northeast and receives its first significant tributary, the Ver Nooy Kill, it becomes wider, as does the valley it drains, and deeper.

North of the Shawangunks, where the Wallkill trickles down from Sturgeon Pool, it is wide enough to be referred to as the Rondout River. At Creek Locks, the former northern outlet of the Delaware-Hudson canal, it becomes wide and deep enough to be navigable,

and several marinas line the banks of the tidal Rondout, now more than a hundred feet (30 m) wide, at Kingston just before its mouth.

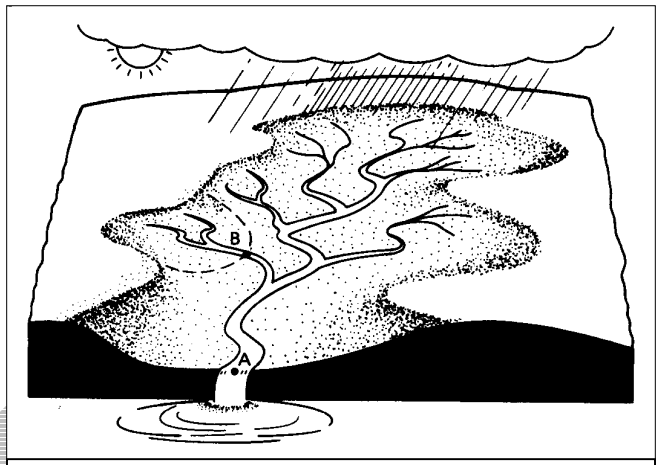
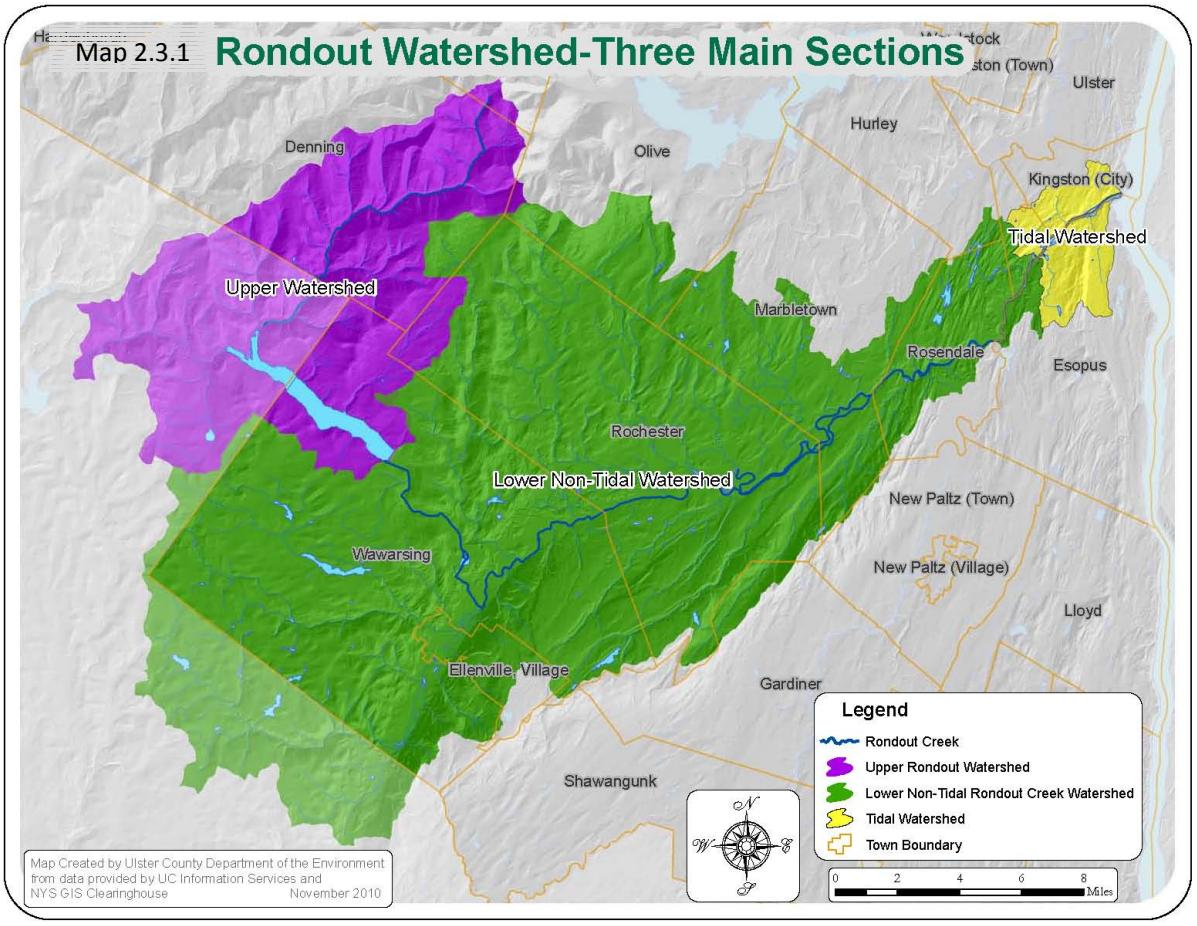


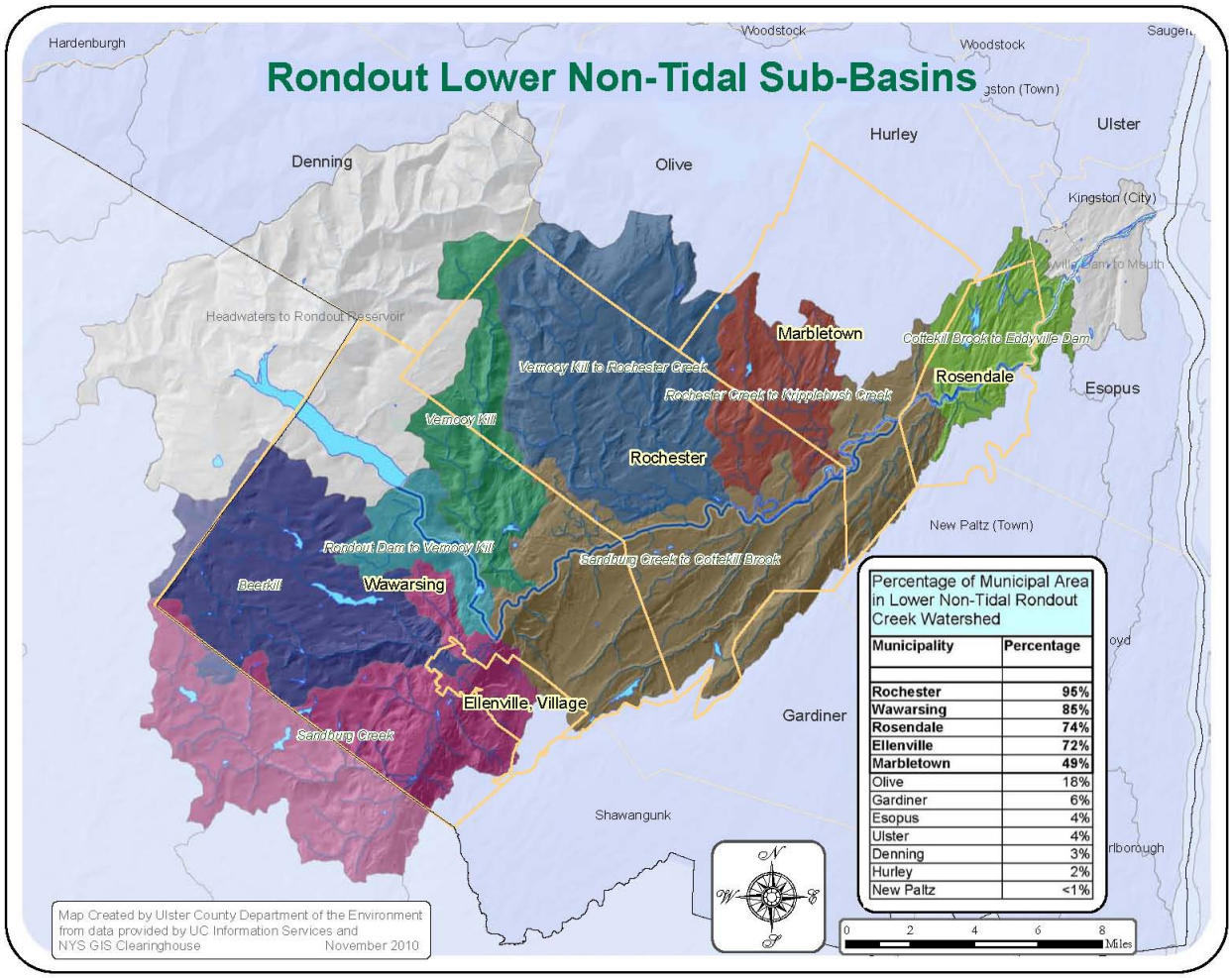
Figure 2.3.1. Delineation of a watershed boundary.

Delineation of the LNT Rondout Creek

The concept of a watershed is basic to all hydrologic designs. Since large watersheds are made up of many smaller watersheds, it is necessary to define the watershed in terms of a point, which is referred to as the watershed "outlet". With respect to the outlet, the watershed consists of all land area that "sheds" water to the outlet during a rainstorm. Using the concept that "water runs downhill," a watershed is defined by all points enclosed within an area from which rain falling on these points will contribute water to the outlet.

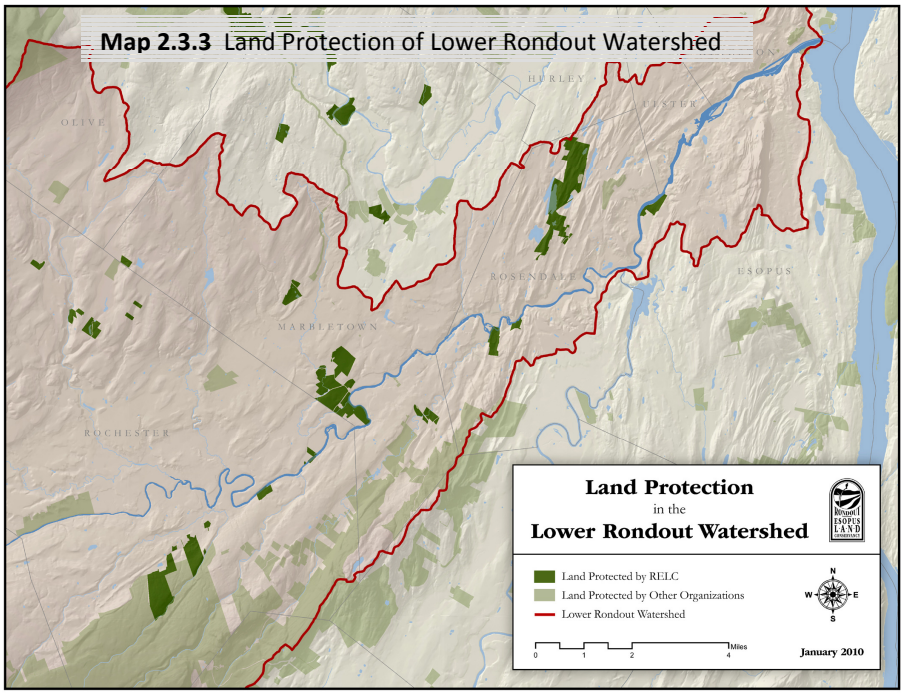
The Lower Non-Tidal Rondout, which is the focus of this document, is located between the Upper Rondout, for which a management plan has been developed by New York City Department of Environmental Protection *(Appendix G – Upper Rondout Watershed Management Plan)*, and the Tidal portion which includes about half of the City of Kingston and portions of the Town of Esopus and the Town of Ulster.





Map 2.3.2 Smaller Sub-Basins of Lower Non-Tidal Rondout Creek Watershed

Approximately 95% of the Town of Rochester is in the LNT Rondout Creek Watershed, 85% of Wawarsing (including 72% of Ellenville), 74% of Rosendale and 49% of Marbletown; in addition to smaller parts of Olive (18%), Gardiner (8%), Esopus (4%), Denning (3%), Hurley (2%) and <1% of New Paltz. In addition, the LNT section of the Rondout includes parts of Fallsburg and Mamakating in Sullivan County.



Land Use in the LNT Rondout Creek

Open space preservation is often the first line of defense and the most effective strategy for protecting water resources. The responsibility for protecting large or significant portions of the watershed is often assumed by or designated to area land

trusts, of which the Rondout Esopus Land Trust (RELT) is an important organization in this watershed. Map 2.3.3 shows the lands protected by RELT (in dark green), and those protected by other organizations (in lighter green), extending all the way out to the Hudson River and includes the tidal portion of the Rondout Creek Watershed. Note the large amount of protected lands along the Shawangunk Ridge, much of which is protected by Mohonk Preserve and the Nature Conservancy *(check this).*

Fig. 2.3.3 Scenic view of Shawangunk Ridge from the Rondout Valley.

This area, along with the farms in along the Route 209 corridor, create a very scenic byway. Area land trusts and related organizations have partnered with local municipalities to form the Shawangunk Mountains Scenic Byway Regional Partnership (www.mtnscenicbyway.org) to preserve the region's beauty.

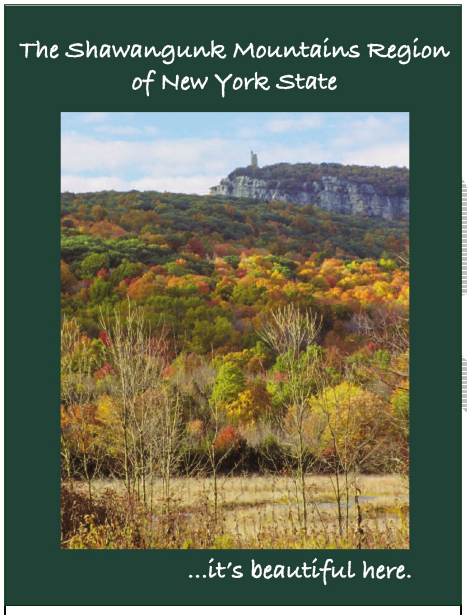


Fig. 2.3.4 Shawangunk Mountains Scenic Byway Partnership brochure.

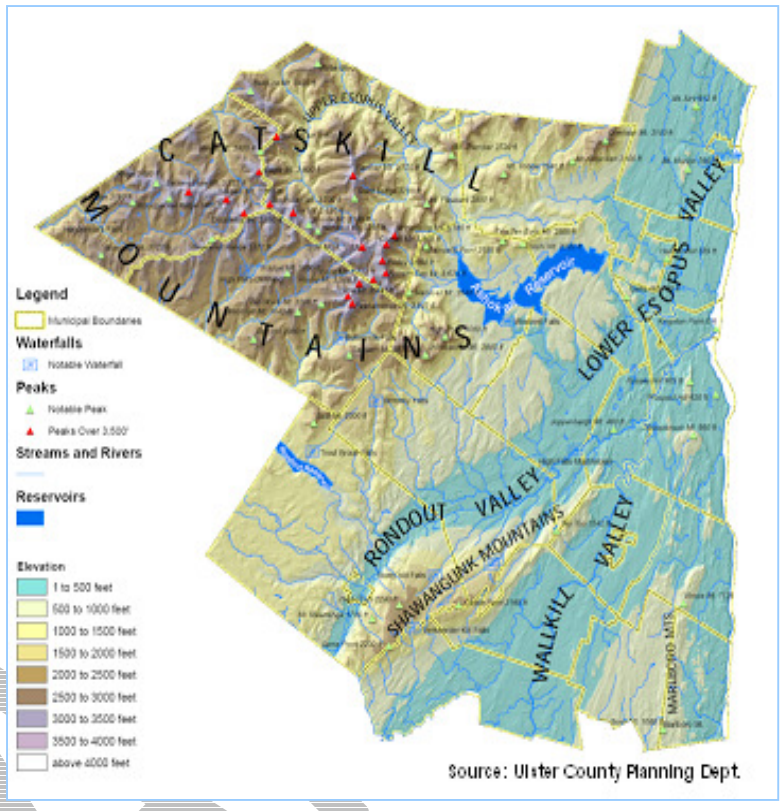
During the six years of planning the byway, nine towns and two villages came to realize that they have a lot in common and to appreciate the synergy that can be achieved by working together so they formed an intermunicipal partnership to implement a corridor management plan, to help improve transportation systems, and to advance their mutual goals of advancing economic growth through tourism, while helping to preserve the important resources of this region. The Shawangunk Mountains Regional Partnership includes the towns of Crawford, Gardiner, Marbletown, Montgomery, New Paltz, Rochester, Rosendale, Shawangunk, Wawarsing and the villages of Ellenville and New Paltz and is the management organization for the Shawangunk Mountain Scenic Byway with Al Wegener as its Executive Director.

By joining this partnership the towns participated in an intermunicipal agreement (IMA), forerunner to the one signed by the four central Rondout municipalities for watershed protection.

SECTION 2.3 ADJACENT WATERSHEDS

The Rondout Creek watershed in the Rondout Valley roughly parallels the Lower Esopus Valley, which is to the northeast, as they both flow northward towards the Hudson River, passing through many of the same towns. The Rondout Creek flows on the eastern and southern portions

Marbletown, (almost all of Rosendale), and the Town of Ulster, and the City of Kingston. The Esopus Creek flows to the west and north of the elevated limestone ridge that shaped the Esopus Valley and gave many of the early settlements a high place to grow and expand. *(A full description of both the Upper and Lower Esopus watersheds and the Ashokan Reservoir, which separates them -- as the Rondout Reservoir does the Upper and Lower Rondout -- is attached as Appendix H.)* The Wallkill Valley and its watershed are to the southeast of the Rondout and flow into it at Creek Locks. Glacial activity in these adjoining watersheds repeatedly covered and melted, scraped and deposited the land forms and soils and outwash that defined the valley forms and their composition.



New York City Water Supply System:

Another a major adjacent watershed is the Catskill/Delaware Watershed, which is New York City's West-of-Hudson water supply. A smaller source in Westchester and Putnam counties is the East-of-Hudson Croton Watershed. The Catskill system was built in 1927, the Delaware portion of the system in 1967, and the Croton system in 1842. East of the Hudson River, the "Cat-Del" system as it has come to be called is comprised of a series of reservoirs. The Ashokan is the major reservoir of the Catskill system. The Delaware system, consisting of the Cannonsville, Pepacton and Neversink reservoirs, is connected to the Rondout Reservoir in the Hudson watershed by aqueducts, which represent a major inter-basin transfer of water across watershed boundaries. This transfer is under the jurisdiction of the Delaware River Basin Commission. The Cat-Del system has 580 billion gallon storage capacity. Both the Catskill/Delaware and the Croton systems are connected by aqueducts to the greater New York City metropolitan area. Together theses systems deliver approximately 1.4 billion gallons of high-quality water each day to nearly nine million people in New York City and Westchester, Orange, Putnam and Ulster counties.

In addition to assuring water quality these areas provide important fish and wildlife habitat, open space preservation, and recreational opportunities. The New York City Department of Environmental Protection has carefully protected these major drinking water supplies by promulgating strict regulations and entering into related Memoranda of Understanding (MOUs) with municipalities which are located in these drainage basin and those through which the aqueducts run. To assure watershed protection in agricultural areas of these watersheds, the NYC DEP has worked with the Watershed Agricultural Council to implement Whole Farm Planning projects in which farmers participate in the design, installation and management of a variety of systems on their own farms that protect water resources, especially these critical reservoirs. Technical assistance and funding provided by New York City, NY State and related agencies.

Ecosystems Protection Pays Off

In the 1990's as development pressures increased in the area, the Catskill-Delaware System was threatened with increasing pollution due to construction, agricultural runoff and other activities. The City was faced with an important decision: whether to build an artificial filtering system at a cost of approximately $6-$8 billion or to invest $1 billion in sustainable development practices which would restore the Catskills' natural filtering purification capacity. Choosing to protect ecosystems and the services they provide they convened a multi-stakeholder process to encourage Whole Farm Planning, pass of Well Testing and Aquifer Protection laws, upgraded sewage treatment plants to tertiary treatment and implemented other watershed protection measures. In 1997, EPA issued a five-year Filtration Avoidance Determination, which ultimately saved City taxpayers $5 to $7 billion in construction costs and actually increased property values in these rural areas. (Penn State College of Ag Sciences, Coop Extension & Center for Biodiversity Research, Environmental Resources Research Inst., *Biodiversity: Our Living World: Your Life Depends On It!,* Penn State U: University Park, PA 2001, p. 7.) Under the Surface Water Treatment Rule, New York City is required to filter water from the Croton system, which provides 10 to 15 percent of the City's water, however, many of the protections developed for the Cat-Del system also apply in the Croton watershed. *(EPA)*

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