City of Beacon
Natural Resources Inventory
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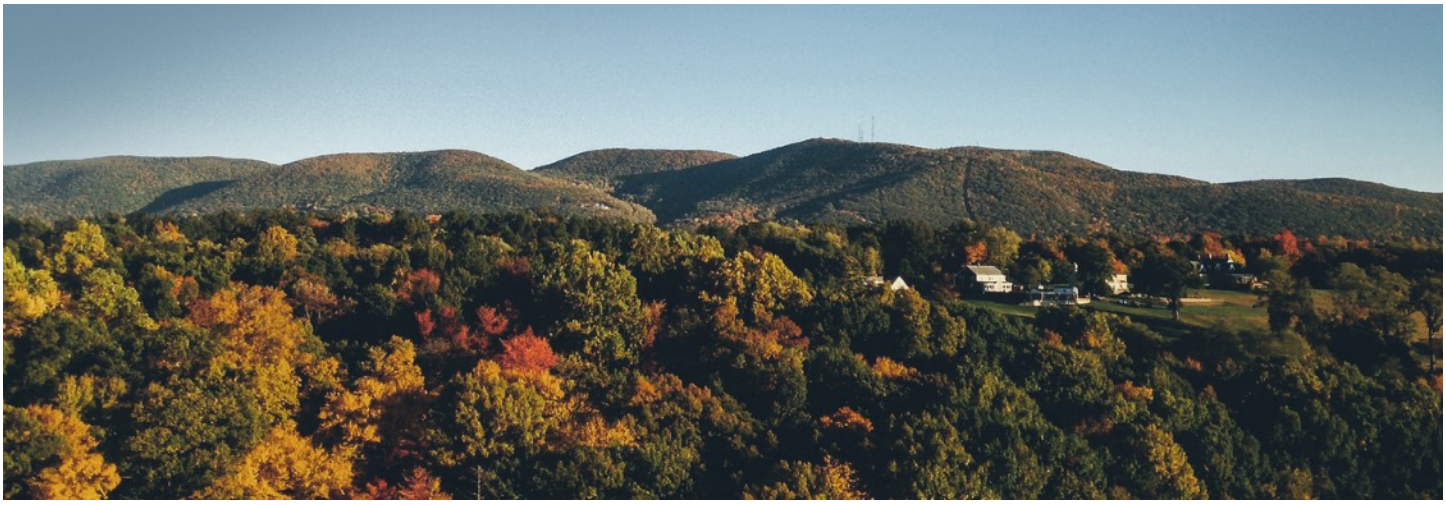

Photo Credit: Dennis O'Brien

Prepared by the City of Beacon Conservation Advisory Committee and Natural Resources Inventory Committee

November 2019

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

Cornell University

Table of Contents

1.0 Introduction

This Natural Resources Inventory (NRI) is an inventory and assessment of the current state of nature in Beacon, New York, a small city on the Hudson River. The NRI covers a wide range of resources, from soil types to endangered species to recreational features. It is based on existing data and did not involve new studies.

What the NRI Shows

Each section of the NRI focuses on a different natural element in Beacon (e.g., water resources or habitat/biodiversity). To help this be a useful tool, the term "natural resources" is used very broadly, including the living things and naturally occurring materials in the environment, as well as scenic and cultural resources, the history of human impacts, and current and future challenges.

The NRI is divided into sections that represent a natural resource. Each section consists of: a map accompanied by text that interprets the map; provides additional information on that element of our environment; and explains why the natural resource is relevant to Beacon with implications for decision-making.

Beacon is a city rich with natural beauty and resources that have fostered a strong sense of place in its residents and enabled its community to prosper. Beacon is situated in a unique environment of urban human development with pockets of open, green spaces packed between the slopes of Mount Beacon and the Hudson River, with the rushing Fishkill Creek flowing through the heart of the city. While geographically small (4.7 square miles), Beacon is environmentally complex, with many distinct areas, habitats, features, and considerations.

Historically, Beacon's natural bounty helped the native Wappinger tribe to thrive by hunting and fishing these lands. Dutch and English colonists utilized the Fishkill Creek's power for milling their grain and lumber harvests. Decades of heavy industry, now mostly gone, left its architectural mark on the city with brick factory buildings and workers' homes.

Today, tourists flock to enjoy the views of the mountain, quiet sunsets from the riverbank, and Beacon's rich cultural offerings. Diverse bird and fish populations still migrate through each year, and mammals as large as bears make use of the southeastern edge of the city - one of the few remaining greenways connecting the Hudson Highland mountains to the Hudson River.

How to Use the NRI for Decision-making

The NRI can be used by Beacon municipal officials, the planning board, zoning board of appeals, the conservation advisory committee, community groups, non-profit organizations, recreational groups, residents, and others to help assess the environmental impacts of proposed activities and development plans; to assist in completing environmental assessment forms; to guide the development of city policies and ordinances; to guide future comprehensive and land use plans; and to identify areas for natural resource conservation, management, and stewardship.

The NRI can be useful for those in Beacon's community who are interested in local nature or whose work intersects with environmental needs. The NRI can be a reference, conversation-starter, and tool to guide decisions for protecting and enjoying the natural elements of Beacon. A better understanding of Beacon's natural resources will enable the community to protect and conserve them for current and future generations.

The maps and data in the NRI should not substitute for site-specific studies. Municipal-level or parcel-level issues may need to be examined on a site-specific basis.

Implications for Decision-Making

The NRI resulted in these high-level recommendations:

- Consider climate change mitigation and adaptation in decision-making;
- Engage Beacon residents in the stewardship of its natural resources; and
- Consider the impact of development on Beacon's natural resources.

More in-depth recommendations can be found in Section 9.0: Implications of the NRI for Local Decision-making.

More Information & Sources

Please see the References section at the end of the document, which includes sources used to create each map and text, as well as useful documents, data sets, websites, and organizations.

1.1 Base Map

Why This is Relevant to Beacon

Beacon covers approximately 4.7 square miles, and includes approximately 4.3 miles of Hudson River shoreline. The land slopes from east to west, down from the mountainous Fishkill Ridge to the Hudson River. Fishkill Creek is the most significant water feature in the city after the Hudson, flowing toward the southwest through the center of the city over many waterfalls and dams, and entering the Hudson River via a natural bay south of Dennings Point.

Beacon has a variety of habitats, including forests and wetlands, and residential neighborhoods and yards, the riverfront, fields, and more all thrive within the city of Beacon. Some areas are maintained (e.g., mowed parks) while others are left in their more natural state.

Beacon is most densely developed along Main Street. The thoroughfare runs from the bluff over the river's harbor and the Metro-North Train Station southeast across Fishkill Creek to the foot of the mountains. Main Street is one mile long and features dozens of shops, restaurants, and other services. Development density generally decreases the further you get from Main Street, and the municipalities surrounding Beacon are not as densely populated as the city itself.

Beacon's built environment and population has remained fairly unchanged since 1950, with the population decreasing slightly between 1960 and 1990. According to the 2010 United States Census, the population of Beacon was 15,541, with a population density of 3,171 people per square mile. Recent and proposed residential development suggest there will soon be an uptick in population growth.

Other visible features are the Fishkill Correctional Facility, a New York State Prison with approximately 1,650 inmates, located in the northeast; and the shoreline of the Hudson River, which is completely undeveloped but includes the railroad tracks used by Metro-North and Amtrak.

What This Map Shows

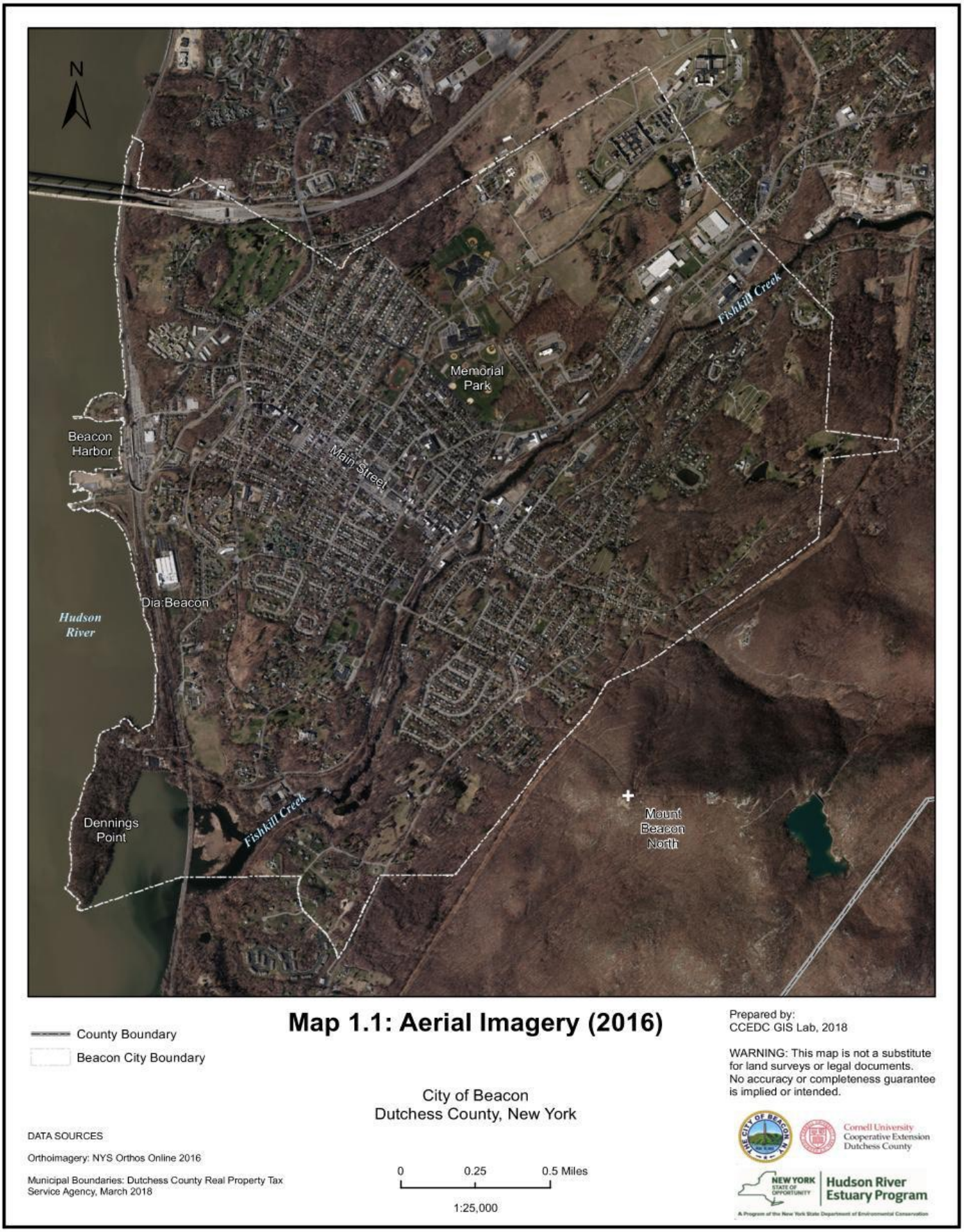
Map 1.1 is an aerial image from 2016 that depicts the context of the natural resources of Beacon, New York. All other maps in the NRI are based on this and similar aerial images, combined with factual information gathered from hundreds of sources ranging from property records to water tests.

The Base Map serves as the basis for all maps in the NRI. It highlights the following unique natural and cultural landmarks, which can be used for orientation on subsequent maps:

- Beacon Harbor
- The Hudson River
- Dennings Point
- Dia: Beacon
- Memorial Park
- Fishkill Creek
- Mount Beacon

Main Street and surrounding neighborhoods, looking west to the Hudson River. Photo by Scott Harrison.

Map 1.1 Base Map



1.2 Regional Context

What This Map Shows and Why This is Relevant to Beacon

Beacon is located in New York's Hudson Valley. Other than the small portion of the Town of Fishkill that wraps around the southern city limit, Beacon is the southernmost municipality in Dutchess County. The nearest point of the Putnam County line is just south of Beacon at the Breakneck Ridge trail of the Hudson Highland mountain range.

To the west, Beacon is bordered by the Hudson River Estuary, which is 1-mile wide at Beacon's shores and extends 153 miles from New York Harbor to Troy, New York. The river is a tidal estuary at Beacon, bringing salt water north and fresh water south, with two high and two low tides every 24-hours. The Hudson River and Hudson Valley have environmental, historical, and economic significance, both regionally and nationally.

The city of Newburgh in Orange County is across the river and is Beacon's sister city, connected by bridge, ferry, vistas, community, and a shared sense of responsibility for the river that flows between. Beacon is bordered by the Town of Fishkill in all other directions.

Geographically, Beacon is bordered to the east by the Hudson Highlands mountain range, which includes Mount Beacon North (1,531 feet) and Mount Beacon South (1,610 feet). These rocky, forested mountains rise steeply from Beacon and are predominately undeveloped until they drop in elevation where they meet Route 9 in Fishkill to the east.

To the north of Beacon is Interstate 84, which connects Beacon to communities and cities to the east and west. Twenty-five million vehicles drive through Beacon on I-84 across the Beacon-Newburgh Bridge each year, as it is a major artery for regional commerce between Pennsylvania and the Northeast of the United States.

Seven miles to the west is the New York State Thruway. Five miles beyond is Stewart International Airport, which offers flights on major airlines, such as Delta, American, and JetBlue. Additionally the airport recently offered direct flights to Europe.

Route 9D is the primary road connecting Beacon to communities to the north and south. The Metro-North Train Station connects Beacon to New York City, 60 miles to the south, and Poughkeepsie, the county seat of Dutchess County, 15 miles to the north.

A small city, Beacon is nestled in a narrow lowland between the mountains and the Hudson River. A person could walk the 1.8 miles from the train station at the river's edge to the foot of the mountain, or the 2.9 miles along Fishkill Creek through the length of the city. There are multiple trail heads within the city that provide access to Mount Beacon and Fishkill Ridge.

Implications for Decision-making

Beacon's location within the Hudson Valley, proximity to New York City, connection via major roads and train, and small size make it easily accessible and invaluable to residents, commuters, businesses, and tourists alike.

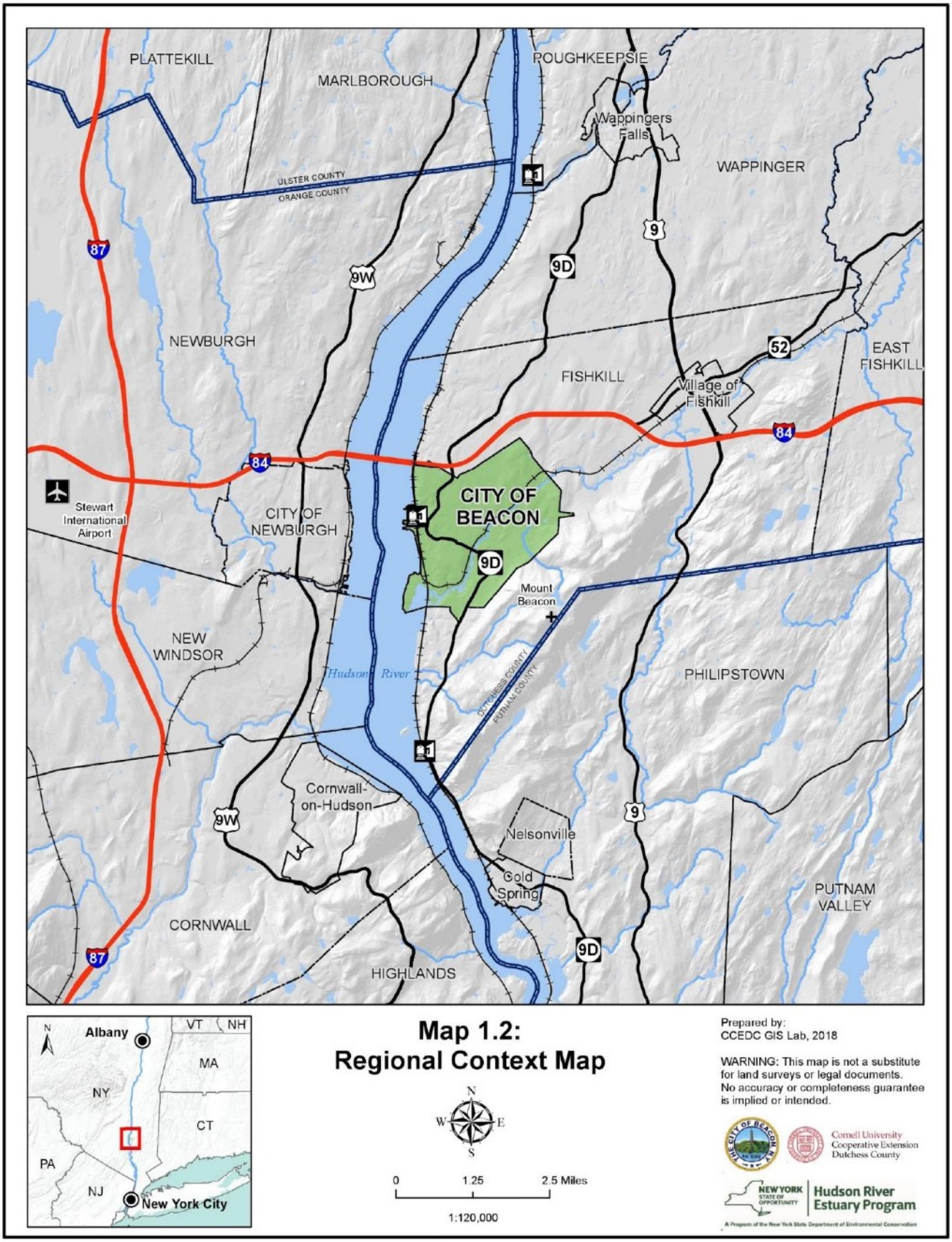
To protect Beacon's regional significance:

- Maintain strong relationships with neighboring municipal committees;
- Celebrate and expand upon Beacon's accessibility by all modes of transportation including train, bike, and pedestrian; and
- Continue to refine proactive development policies that accommodate sustainable growth while protecting the natural and cultural character of the city. Beacon is physically and politically bounded, so any population growth will have to be by density not sprawl.

This information largely comes from New York State Department of Environmental Conservation and New York Bridge Authority. For more information on these topics, see the References section.

View of Beacon, Fishkill, the Hudson River, and Orange County, looking north-northwest from Mount Beacon.

Map 1.2 Regional Context



2.0 Beacon's Unique History

The area considered Beacon today has evolved over centuries and been influenced by distinct periods of human involvement. This section provides a brief overview of Beacon's history.

Pre-Discovery: The land that is now Beacon was first settled by people of the Wappinger and Mahicannituck tribes, who were part of Lenape cultural group. The earliest detailed maps (such as the 1689 Rombout Patent) show native structures built along the Fishkill Creek in the area of today's Glenham neighborhood. The primary ways the first people used Beacon's natural resources were through fishing, hunting, small-scale agriculture (corn, beans, squash, and maple tapping), and harvesting wood for building and burning. These practices made little overall impact on the environment because human populations were small enough compared to the amount of land on which they lived.

Europeans: The first known European contact with Beacon was in 1609 when Henry Hudson sailed up the river that was to bear his name, and described Beacon and/or Newburgh as "…a very pleasant place to build a Towne on. The Road is very neere, and very good for all winds… The Mountaynes looke as if some ...minerall were in them." Native people paddled out to his ship and traded grains, animal skins, and stones for European goods. This began Dutch and English interest in profiting from the area's natural resources.

Beacon's first European settlers (among the first in the region) were Roger and Catheryna Rombout Brett, who in 1709 built what is known today as the Madam Brett Homestead (featured in section 7.2). Their first enterprise was building and running a highly successful grist mill on Fishkill Creek, grinding the grains grown by neighboring farmers. After Roger died five years later, Madam Brett continued to manage the lands. In 1748 the storehouse she built near today's Long Dock Park sparked river trade. The two villages of Fishkill Landing and Matteawan, centered around her gristmill and storehouse, eventually merged to create the City of Beacon in 1913.

Industry: Beacon remained a small farming hamlet until the War of 1812 jump-started an industrial revolution, with a population and building boom. In 1814 the first factory was built in town at One East Main St, and in 1815 Long Dock was built to meet increasing river merchant needs. Throughout the 1800's, large quantities of hats, bricks, fabric, and more were produced here. In winter ice cut from the frozen Hudson was shipped down to Manhattan. Beginning in the 1850s, railroads joined and then surpassed the river as primary transport for the goods produced here. Beginning in the early 1800s, Beacon remained a significant factory town through the 1950s.

Beacon was a well-known tourist destination during the early 1900s, with its most popular feature being the Mount Beacon Incline Railway. Opening in 1902, the Railway brought visitors to the top of Mount Beacon, where they take in the sweeping views of the Hudson River and Highlands from the Casino and Beaconcrest Hotel. Many tourists came from New York City, up the Hudson via steamship ferries. The Railway closed in 1978.

In the mid-1950s-1960s many of Beacon's suburban-style residential homes were constructed and some historic structures were demolished, including 150 homes at the western end of Main St which left the waterfront disconnected from the business district. The bridge connecting Beacon to Newburgh didn't open until 1963. Prior to then, only a ferry had connected the two banks for 220 years.

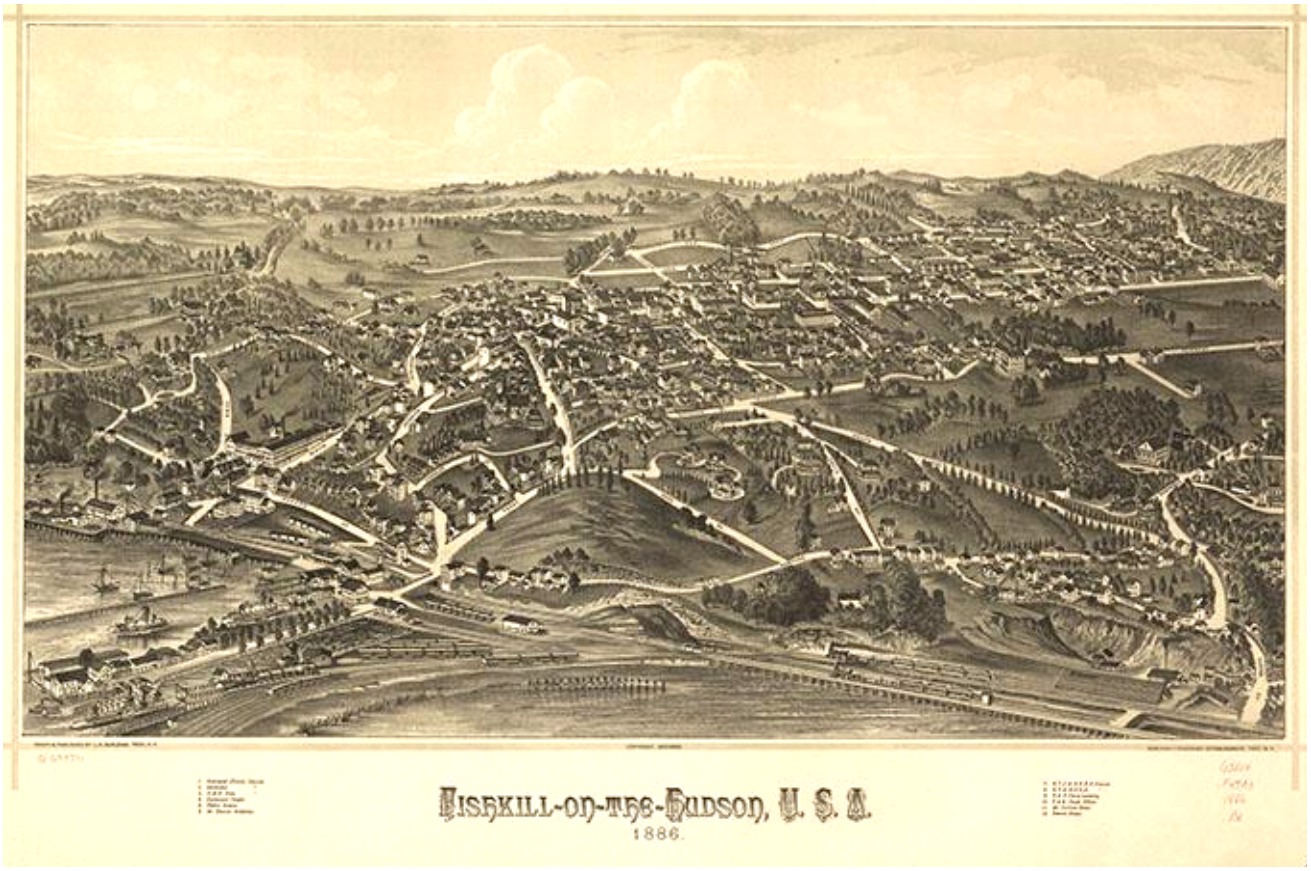
Decline: In the late 1970s, a national economic slump caused a significant decline in Beacon. Most factories closed, leading to the vacancy of approximately 80% of commercial spaces. The ski slope which had operated on Mt Beacon since 1967 closed in the late 1970s, along with the Incline Railway. The town remained underutilized and economically depressed until the early 2000s.

Renewal: Beacon's current revitalization began in the late 1990s and spiked when the Dia:Beacon museum opened, bringing visitors and businesses back to town. Beacon is now a thriving commuter, residential, and arts community, appears on top global tourism lists as a weekend getaway, and has a very competitive real estate market.

What These Maps Show:

- 2.0.1: 1886 landscape map of Fishkill-on-the-Hudson, aka Fishkill Landing, the west end of today's Beacon
- 2.0.2: 1886 landscape map of Matteawan, the east end of today's Beacon

Map 2.0.1: Fishkill-on-the-Hudson



Map 2.0.2: Matteawan, NY

2.1 Historical Images

What These Images Show

1. *Ship on river at Fishkill Landing.* The whole city has shifted three times in its history because of changes in transportation: At first it formed when the Hudson was the main highway for travel and commerce. Then in the 1800s, trains took precedence. Today, roads and highways primarily shape the centers and flow of the economy and residential settlement of Beacon.

2. *The 1960s "urban renewal" tearing down the neighborhood just east of the docks at Fishkill Landing, between today's train station and the intersection of Main St and Rt 9D (i.e. the Linkage Zone).* This was a predominantly poor, black neighborhood, and the majority of the residents who had lived here ended up relocating to the then-newly-built Tomkins Terrace public housing apartments after their homes were torn down. Many of those families still live there today.

3. *East Main St factories producing at their peak.* The economic strength of Beacon was largely powered by Fishkill Creek's rushing waters turning water-wheels in the factories built along its banks. From the late 1800s through the mid 1900s Beacon was a gritty industrial city, with dozens of factories and the majority of its residents working in the factories. Hats, bricks, rubber, electric blankets, mechanical parts, fertilizers and pesticides, fabric and fabric dyes, carriages, and more were all produced here in great quantities.

This created economic wealth for the factory owners, economic stability for the factory workers, tough working conditions leading to long-term health complications for many workers and their families (especially those in the hat and rubber factories), and long-term health and environmental impacts for Beacon. Most buildings and ground sites are cleaned up today, but the bed of Fishkill Creek itself remains polluted. The image shown here depicts the modern-day location of The Roundhouse Hotel and Restaurant. Most of the buildings have been demolished.

4. *Main St at Eliza St before the Post Office was built.* Beacon has been a city, or villages, in flux for its entire history. This is a city that has reinvented and rebuilt itself many times in just a few hundred years. This intersection was swampy and underdeveloped for much of Beacon's history. The Post Office was built here in 1935 as part of the Public Buildings Act after the Great Depression began to bring life to the center of Main Street. The DMV building later built where the billboards stand in this photograph was considered an eyesore and a community frustration, but has now been transformed into the beloved Towne Crier Cafe, which brings live music performance and dining to this neighborhood. Most recently, this intersection featured community debate due to the construction of 344 Main St, a 4-story commercial and apartment building.

Implications for Decision-making

- The marina and harbor remain an underutilized resource in the city. Collaborating with the Beacon Sloop Club to support boating and tourism will encourage more visitors and alleviate congestion elsewhere in Beacon;
- The race and class motivations and implications of rezoning and redevelopment must be very carefully considered, and those involved in making these decisions must ensure that they are getting a wide range of community input and making decisions that positively impact the hardest-off in Beacon's community;
- Beacon's historic factories were located along Fishkill Creek and powered by water. Future zoning does not need to follow this historic precedent set by necessity. The delicate ecosystem of the watershed should be prioritized in future decisions along Fishkill Creek; and
- Avoid making the same mistakes of the past, of encouraging industrial growth for the sake of Beacon's prosperity, to the detriment of Beacon residents' and environment's health.

Image 2.1.1 Ship on River at Fishkill Landing

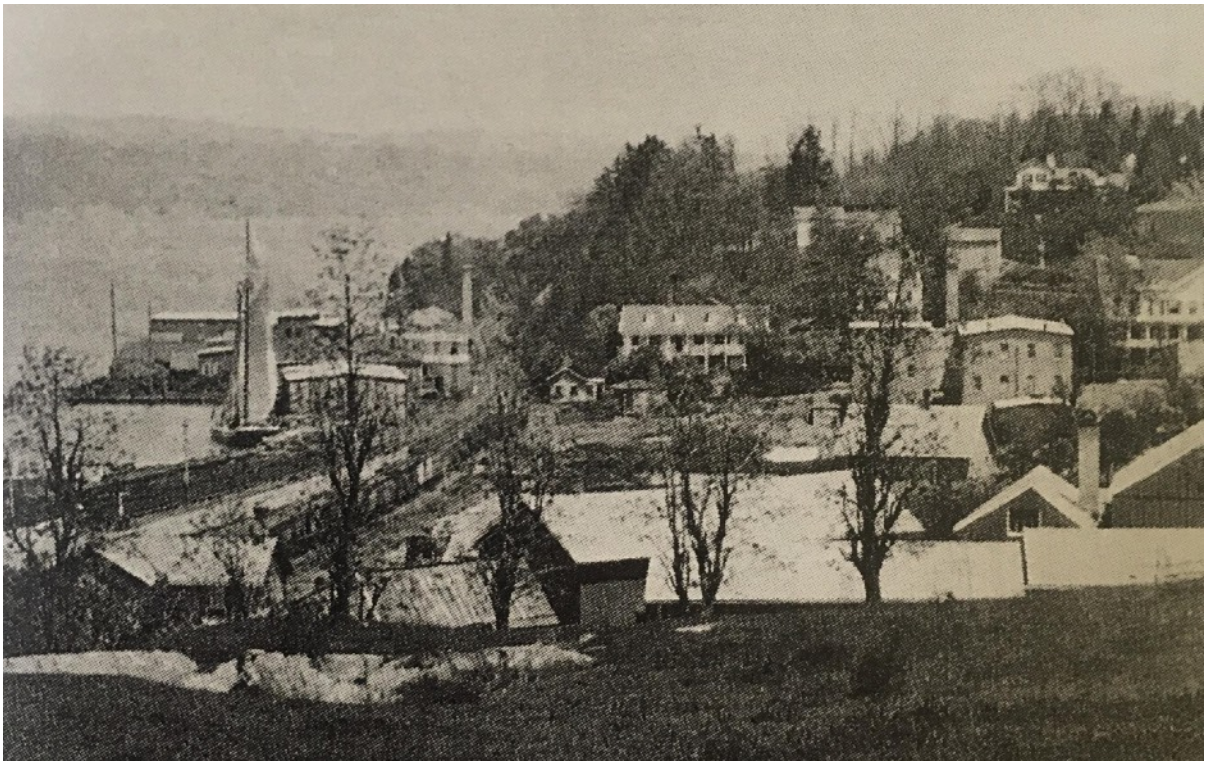


Image 2.1.2 “Urban Renewal”

Image 2.1.3 East Main Street Factories

Image 2.1.4 Main Street at Eliza Street

2.3 Historical Map 1876

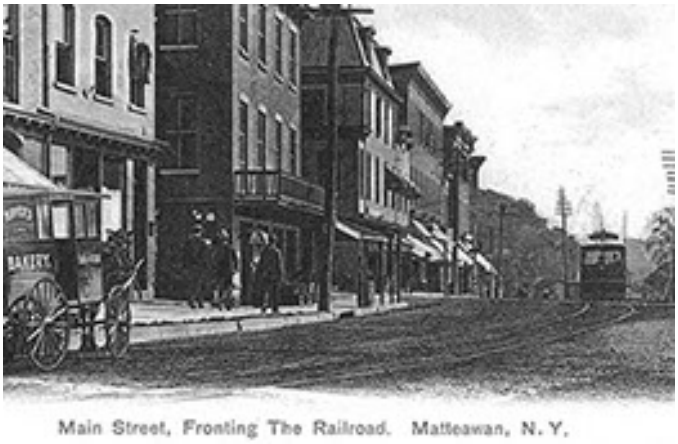
What This Map Shows

This map from 1876 shows the villages of Matteawan and Fishkill Landing, which would later merge to become Beacon in 1913. It represents an in-between time in history, when the center of the community along Main Street is developed with residences, businesses, and small factories in a built environment we would recognize today; the southern half of town has manor estates and their grounds amidst the trees; and farms, fields, and forests stretch north and south of the villages. Then, as now, the city is bounded east by the mountain and west by the Hudson River.

The primary connection to commerce in the village of Mattawan, centered around Fishkill Creek near One East Main Street, was through the train station at the bend of Main Street. Fishkill Landing was centered around the intersection known as "five corners," where Bank Square Coffeehouse stands today, and its commerce came from both river and rail trade. As the clustering on the map shows, residential and business construction was largely driven by the convenience of access to these village centers.

The largest plots of land shown on the map (i.e. De Wint, Vaneleeck, Wolcott) are remnants of the parcel granted by the Dutch to Madam Brett 300 years earlier. The vast majority of land in Beacon at this point in history is owned by a very small number of people, and despite bustling village centers, most of Beacon's land is predominantly undeveloped.

This map demonstrates the substantial changes in land use in Beacon over time. Two major building booms had already happened when this map was drawn, and three more had occurred between the time of this map and today. By 100 years from the time of this map, in the late 1970s, Beacon will be a mostly built environment in economic decline.



Main Street, Matteawan, NY, at the turn of the century, courtesy of the Beacon Historical Society

Implications for Decision-making

Beacon has been changing and growing from human influence since before European settlers arrived. At least four prior periods of significant growth have shaped Beacon to become the city it currently is, with most building happening in the last 120 years.

To protect Beacon's history and future:

- Consider the span of Beacon's complex history when making decisions;
- Protect historic properties and other remnants of the past that the community thinks are important;
- Encourage future development to follow historic patterns of building, i.e. denser along Main St corridor and less construction along the edges of town; and
- Encourage creative reuse of existing old buildings rather than tearing them down.

Map 2.3: Matteawan and Fishkill on the Hudson

2.4 Pete Seeger's Legacy

Pete Seeger (1919-2014) and Toshi Seeger (1922-2013) were prominent Beacon residents who sparked a resurgence in the interest of protecting the environment in Beacon and throughout the Hudson Valley. Thanks to their intervention, Beacon has some of the most green and accessible waterfront along the entire Hudson River. Their efforts to clean up the Hudson made vast improvements within a single generation.

What These Images Show

1: What is now called Riverfront Park was created as the city dump in the 1930s by sinking a perimeter of eight barges. In the 1950s when the barges were filled to capacity with trash, the pile was set ablaze weekly to dispose of residents' garbage, until Beacon's current incinerator was built in 1964. Beacon's trash was just one of the things that polluted the river during this era. Raw sewage, industrial waste, and other effluents from communities along its whole length made the river a toxic, unpleasant area.

2: In 1966 the Seegers co-founded the Hudson River Sloop Clearwater, based in Beacon, which seeks to protect the Hudson River and surrounding wetlands. Central to their success is the *Clearwater*, a 106-ft sloop sailing ship which docks at Beacon's marina by the train station. To this day the *Clearwater* brings kids and adults out onto the river to learn about the river's environment and how to protect the river. The annual Clearwater folk music festival in nearby Croton also brings thousands of people to the riverbank to enjoy the river, and raises funds to support environmental stewardship.

3: Starting in the 1970s the Seegers and neighbors joined together as the Beacon Sloop Club to bring more people to the riverbank. The Sloop Club continues to hold annual local strawberry, corn, and pumpkin festivals in Riverfront Park. They also bring neighbors out to sail on the river in a smaller sloop the *Woody Guthrie*, and celebrates the river in monthly chanty singalongs in their clubhouse at the marina. The Beacon Sloop Club manages the marina for the city.

4: In 1980 what had been the old city dump was rededicated as a town park, and was renamed the Pete & Toshi Seeger Riverfront Park in 2014 following their deaths. It remains today a beautiful, accessible community space, a tribute to how far Beacon came under the Seegers' leadership.

Implications for Decision-making

Beacon should continue its tradition as an environmental steward, setting a high standard in environmental leadership in order to improve the quality of life of Beacon's residents today and in the future, and setting an example which other communities can emulate.

To continue Pete and Toshi's legacy in Beacon:

- Continue to prioritize getting people outdoors as a way to spark caring about the environment, creating and maintaining easily accessible public outdoor spaces like parks, and host enticing events at these spaces;
- Continue to value environmental education as a key aspect of Beacon's community, in its schools and community spaces to include adults;
- Keep the working-class people of Beacon and the surrounding communities central to Beacon's collective priorities; and
- Support, protect, and enrich Beacon's natural resources by working in coalitions of grassroots organizations, lobbyists, musicians, and more.

Pete at the Clearwater Folk Music Festival in 2007

Image 1

Image 2

Image 3

Image 4

3.0 Geology

Why This is Relevant to Beacon

Geology is the study of naturally-occurring earth materials. This document breaks Beacon's geology into two sections:

(1) Surficial geology refers to the soils and rocks that loosely cover the ground. This affects which plants grow, what wildlife thrives, and how water drains. Protecting Beacon's surficial geology can prevent erosion, keep streams clean, and help maintain biodiversity.

(2) Bedrock geology refers to the solid rocks that lie beneath the loose surface rocks and soils. This determines topography and appropriate siting of development and drinking water wells. Applying in-depth knowledge of bedrock geology can prevent hazards like residential flooding, erosion, and groundwater contamination.

Bedrock geology also contributes to Beacon's success as a tourist destination, since Mount Beacon would not exist without the elevational differences in the underlying bedrock geology.

See recommendations and implications for decision making in Sections 3.1 Surficial Geology, and 3.2–3.3 Bedrock Geology and Topography.

SOURCES: This information largely comes from USGS, USDA, the Hudson River Estuary Program, and the Dutchess County NRI. For more information on these topics, see the References section.

Bedrock geology plays a major role in determining where wells are most successful, as well as which areas are amenable for retention of drinking water. The Beacon Reservoir (located in Fishkill) is pictured here.

A bedrock outcrop, where bedrock protrudes to the surface, is pictured here south of the train station.

Stream sediments and glacial outwash materials surround the southern portion of Fishkill Creek, a tributary of which is seen here.

3.1 Surficial Geology

Why This is Relevant to Beacon

The type of geologic materials that loosely cover the ground above the bedrock—soils and rocks—affect plant community composition and biodiversity, as well as how water flows and drains. They also affect decomposition rates and determine whether land is good for infrastructure and farming---or, in Beacon's case, smaller-scale gardening.

The sediments in Beacon today were deposited here 14,000 years ago when the previous ice age ended and the Laurentide Ice Sheet and Wisconsin glacier retreated. This major geologic event helped shaped the city's boundaries. The southeastern boundary of Beacon traces the bedrock-till divide.

As noted in Beacon's Comprehensive Plan, the city's drinking water sources are currently (1) two wells dug into bedrock aquifers to the north of Beacon, (2) a subsurface soil and gravel aquifer in the Village of Fishkill, and (3) three surface water reservoirs, all of which exist outside the city's boundaries. Surficial and bedrock geology together help retain water in these areas.

What This Map Shows

This simplified map of Beacon's surface geology shows that it consists primarily of glacial till (rocks and soils of various sizes and types that were carried here by the last glacier). Bedrock outcrops, where soils are extremely shallow or nonexistent, occur under the Beacon train station and in small portions on its north and east borders.

Lake sediments exist along the western border of Beacon, to the south of the train station. These sediments were left by Lake Albany, a massive glacial melt lake, which existed 13,000 years ago. They contributed to Beacon's long and rich brick manufacturing industry.

Small areas of stream sediments and glacial outwash materials surround the southern portion of Fishkill Creek. Glacial outwash materials, which were carried by the last glacier and deposited here by ice melt streams, and stream sediments both include small, fast-draining particulates like sand and gravel.

Implications for Decision-making

Soil types are a determining factor in infrastructure development. Hardy, faster-draining soils can withstand compaction from roads, large buildings, basements, and septic systems. More sensitive soils, like those near waterways, are less desirable sites for construction. If disturbed, sensitive soils will erode rapidly, causing nutrient leaching, stream sedimentation, and damage of aquatic life. A variety of soils supports a variety of flora and fauna.

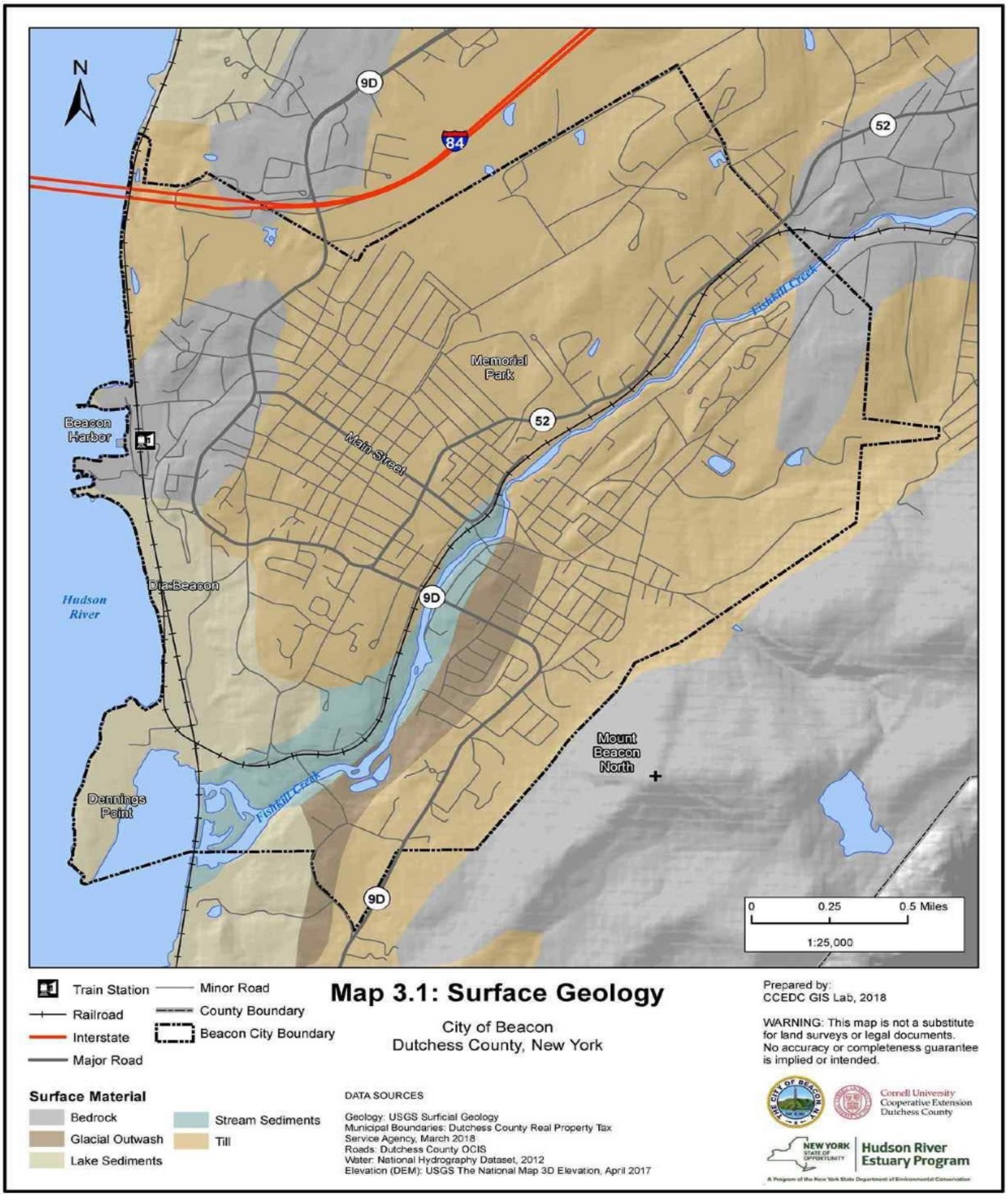
To protect Beacon's soil quality:

- Minimize development within stream sediment and glacial outwash zones;
- Minimize impervious surfaces in developments to lower soil erosion that can result from increased storm water flowing off-site;
- Use green infrastructure wherever possible to increase infiltration, including permeable pavement, enhanced tree pits, and green roofs;
- Test soil for pollutants in previous industrial zones and remediate if necessary; and
- Preserve areas of each soil type, which will in turn help protect Beacon's array of plant and animal biodiversity.

This information largely comes from USGS, USDA, the Hudson River Estuary Program, and the Dutchess County NRI. For more information on these topics, see the References section.

Glacial outwash and stream sediments—or rocks and soil particles that were semi-sorted in size by hydrological forces—are visible along the streambanks in Beacon.

Map 3.1 Surficial Geology



3.2–3.3 Bedrock Geology and Topography

Why This is Relevant to Beacon

Topography related to bedrock geology helped shape settlement patterns in Beacon, with the city's population concentrated along a relatively flat plain. The high terrain of nearby Mount Beacon and Fishkill Ridge to the east provide scenery and recreation opportunity for residents, as well as visitors who bring the economic benefits of tourism.

Bedrock geology also determines the best locations for high-production wells, as noted in Section 5 of the City of Beacon Comprehensive Plan. An area of Taconic Sequence bedrock in the northeast portion of the City is being explored for a potential new drinking water well. This is important, as all of Beacon's water sources are currently outside of the city's boundaries. They are: (1) two wells dug into bedrock aquifers to the north of Beacon, (2) a subsurface soil and gravel aquifer in the Village of Fishkill, and (3) three surface water reservoirs. Surficial and bedrock geology together help retain water in these areas.

What This Map Shows

Beacon's bedrock is primarily Austin Glen Formation (a type of sandstone) and Taconic Sequence (a coarse-grained shale that can be easily split into irregular pieces). Areas of Precambrian Granite and Gneiss exist along Beacon's eastern boundary. These are some of the oldest, hardest rocks around. They were formed over one billion years ago, and are highly resistant to erosion. They are the Hudson Highlands bedrock. A zone of Autochthonous ("formed-in-place") Shale is sandwiched between Precambrian Granite and Gneiss. Shale is a mix of fine-grained minerals that were formed through accumulation and low pressure, and it easily breaks into slabs.

Implications for Decision-making:

Bedrock is a determining factor in infrastructure development. Development of roads and structures on areas where bedrock is close to the surface may be costly and cause intensive erosion of thin, fragile surface soils. As mentioned, it is also a major factor in water flow, filtration, and storage.

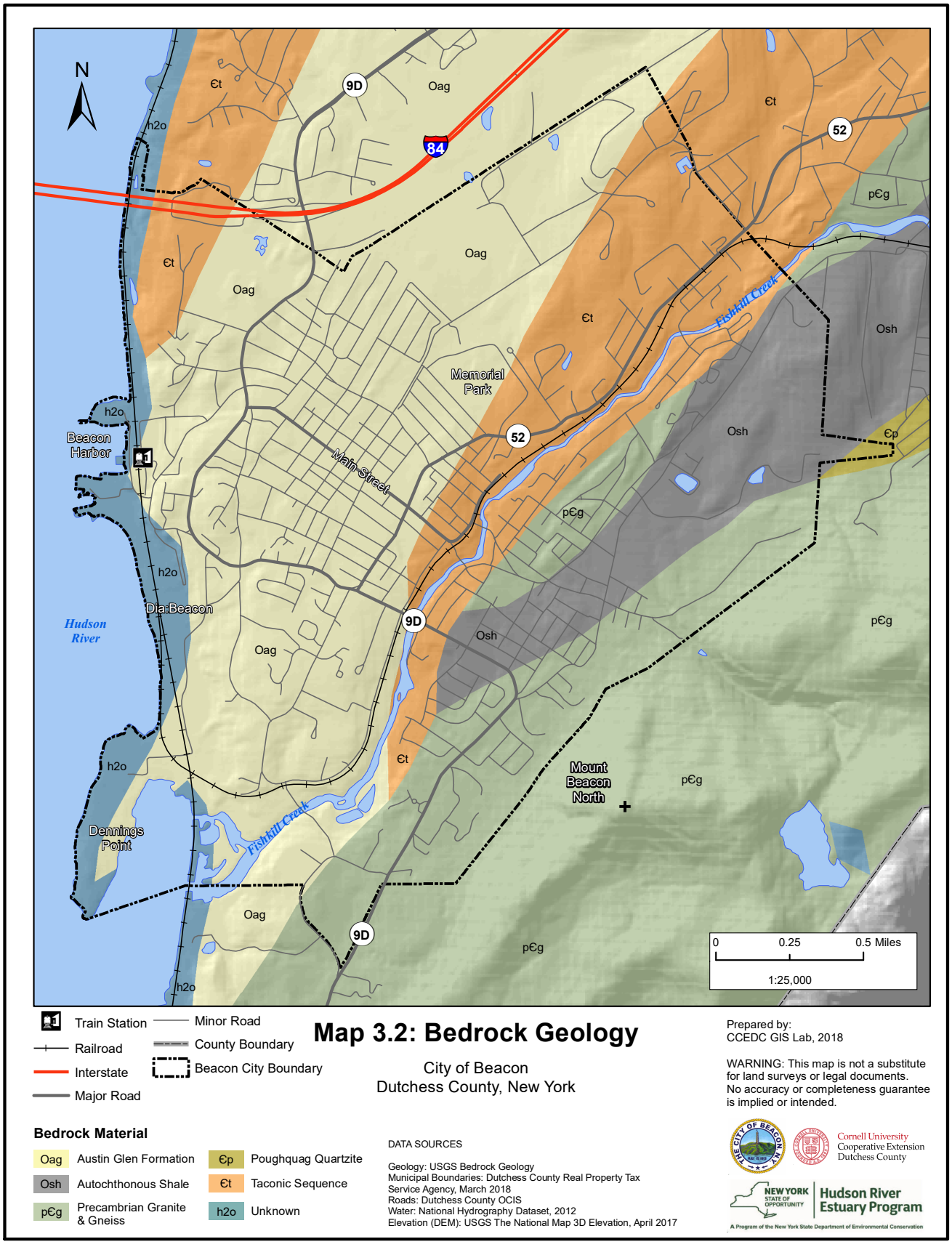
To make the best use of Beacon's bedrock resources:

- Limit development on steep slopes to avoid erosion and stormwater runoff;
- Preserve areas of land overlying each bedrock type, which will in turn help protect Beacon's array of plant and animal diversity;
- Protect interesting geologic features, such as glacial erratics;
- Properly cap and seal wells that are not in use, as well as exploratory well cuts, to avoid potential contamination of subsurface bedrock waterways; and
- In an emergency, be aware that different rates of pollutant flow occur in different bedrock types.

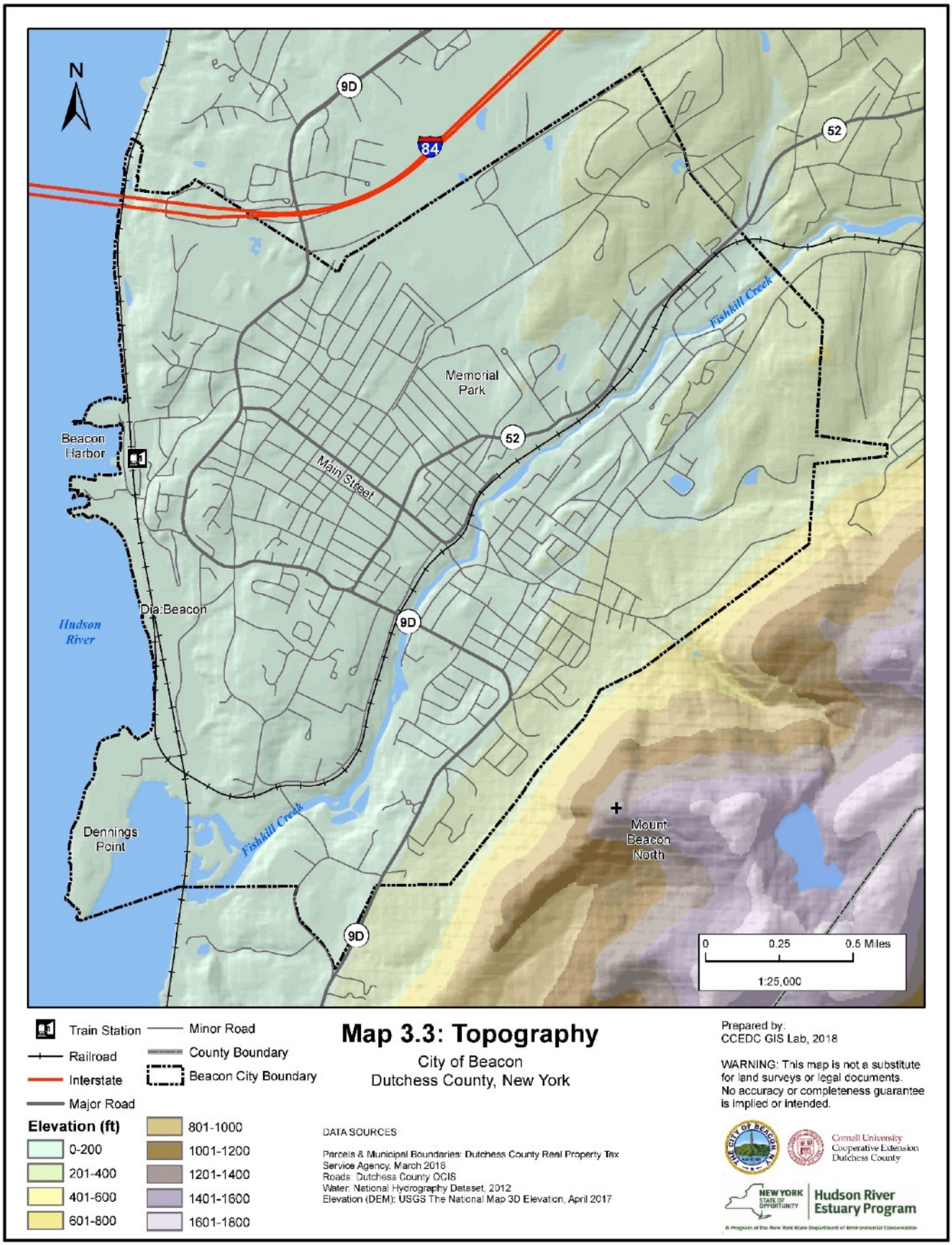
This information largely comes from USGS, USDA, the Hudson River Estuary Program, and the Dutchess County NRI. For more information on these topics, see the References section.

Striations typical of gneiss—a common bedrock along Beacon's eastern boundary—are visible on the rock in this photo

Map 3.2 Bedrock Geology



Map 3.3 Topography



4.0 Water Resources

Why This is Relevant to Beacon

Beacon is situated along an iconic and nationally significant waterway: the Hudson River. The Hudson and other waterways in Beacon, along with their adjacent riparian zones, provide many ecosystem functions and services for nature and people. For example, Fishkill Creek is an important spawning area for migratory fish, and the Hudson River provides scenic and recreational opportunities.

Stormwater and its management are also important to consider. Beacon's wetlands help to naturally regulate stormwater runoff flows, moderate flooding, and protect surface water quality. Engineered green infrastructure such as rain gardens can also help slow runoff, reducing the impacts of development on water quality and quantity.

Beacon relies on clean water to support biodiversity, recreation, and its drinking water supplies. Beacon's water comes from both groundwater and surface water sources, and water quality monitoring data can be used to confirm whether existing pollution controls are succeeding at achieving the desired water quality.

See recommendations and implications for decision making in Sections 4.1 Streams and Waterbodies, 4.2 Wetlands, 4.3 Sewersheds, and 4.4 Water Quality.

Kayakers at Long Dock Park. Photo credit: Scenic Hudson

Beacon Reservoir. Photo credit: Daniel Case

Fishkill Creek. Photo credit: John Leighton

4.1 Streams, Waterbodies, and Watersheds

Why This is Relevant to Beacon

Streams, rivers, and their adjacent riparian zones provide many ecosystem functions and services, such as clean water, recreational opportunities, scenery, and wildlife habitat. In addition, tributary streams deliver water, nutrients, sediment, and organisms to larger waterways.

Fishkill Creek and the Hudson River are identified as "rare assets" in the Beacon Comprehensive Plan. Fishkill Creek is an approved drinking water source for the city. Dry Brook, a tributary to Fishkill Creek, carries drinking water overland from the Beacon Reservoir into the city's water treatment system.

The Hudson River is an iconic and nationally significant waterway. It is a tidal estuary where salt and freshwater mix, resulting in high biodiversity. The Hudson's tides extend to the Capital Region, so Beacon's waterfront is influenced by tidal fluctuations.

Fishkill Creek begins in the Town of Union Vale, flowing southwest through the towns of Beekman, East Fishkill, and Fishkill before reaching Beacon. The Hudson's tides also reach into Fishkill Creek as far as the first road bridge crossing. The lower section of Fishkill Creek, from the mouth to the first dam, is an important spawning area for migratory fish that travel from the ocean, up the Hudson River Estuary, and into its tributaries to spawn. Stream barriers, such as dams and poorly designed and installed bridges and culverts, can have serious effects on stream habitat, local flooding, and water quality.

The economic and social value of water in Beacon are demonstrated by businesses such as the Roundhouse, which benefits from views of the waterfall on Fishkill Creek, and by the tourism draw of the Hudson River waterfront at Long Dock Park and Pete and Toshi Seeger Riverfront Park. The Newburgh-Beacon ferry that crosses the Hudson provides additional economic benefits to Beacon.

What This Map Shows

Beacon has two principal waterbodies: the Hudson River and Fishkill Creek. The lighter area of the map on the west side of Beacon drains directly to the Hudson. The darker area is a local sub-watershed where rainfall fills Beacon Reservoir, feeds surface flows of Dry Brook and Fishkill Creek, and helps recharge large groundwater aquifers at the foot of Mount Beacon.

Implications for Decision-making

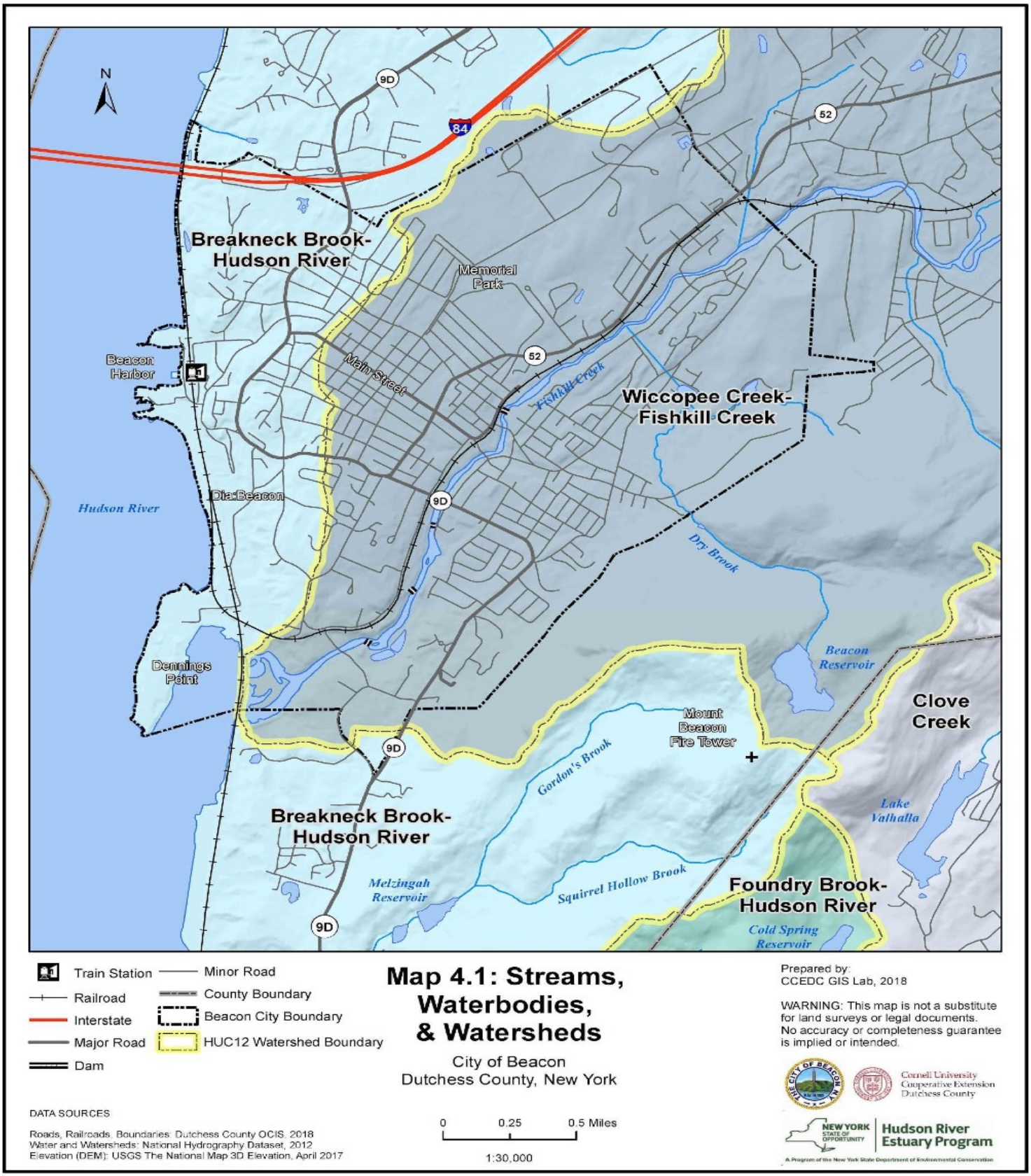
To protect Beacon's streams and waterbodies:

- Utilize a watershed management approach, which can comprehensively address a wide range of water quality and quantity issues;
- Preserve wetlands, stream corridors, and floodplains in their undeveloped states;
- Consider cumulative impacts before issuing permits;
- Evaluate dams and remove where practical;
- Replace poorly designed or undersized culverts with bridges, open-bottom culverts and similar structures that completely span the waterway and associated riparian area and floodplain;
- Protect large, contiguous blocks of habitat within 650 feet of large perennial streams;
- Require a building buffer from the mean high tide mark of the Hudson River and along stream courses;
- Protect and restore naturally vegetated areas along streams and rivers; and
- Control shoreline and streambank erosion using living shorelines or ecological materials.

This information largely comes from Dutchess County NRI, Hudson River Estuary Program NRI Guide, Hudsonia Habitat Fact Sheet, *Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for protecting the Biological Diversity of New York's Hudson River Valley*, Beacon Drinking water report, LHCCD/Emily Svenson, City of Beacon Local Waterfront Revitalization Plan, and *Watershed Design Guide: Best Practices for the Hudson Valley*.

For more information on these topics, see the References section.

Map 4.1 Streams, Waterbodies, and Watersheds



4.2 Wetlands

Why This is Relevant to Beacon

Wetlands are areas with saturated soils. Certain plants and animals are specifically adapted to wetland conditions, or the resources they provide. Some spend their entire lives in wetlands, while others require wetlands for part of their life cycles.

Wetlands provide multiple benefits to humans, such as regulating stormwater runoff flows, controlling shoreline erosion, protecting surface water quality, protecting groundwater quality, and attracting recreational users.

Tidal wetland habitats play a critical role as nursery grounds for fish and shellfish species, as well as providing nesting sites and migration stops for birds and sources of nutrients for the estuary food web. They can also serve as buffers to storm surge in the estuary and help to mitigate shoreline damage.

What This Map Shows

This map shows wetlands mapped by the U.S. Fish and Wildlife Service (USFWS) and New York State Department of Environmental Conservation (NYSDEC). Both of these sources are known to have omissions and inaccuracies, so the NRI map also includes poorly and very poorly drained soils, which can be indicative of where wetlands are likely to occur ("probable wetlands") and somewhat poorly drained soils, which indicate "possible wetland" locations. In contrast to the USFWS and NYSDEC maps, soil drainage maps may show overestimated wetland acreage.

The map notes four categories of wetlands mapped by USFWS in the National Wetland Inventory (NWI) in Beacon:

- Estuarine and Marine Deepwater: Open water estuary, bay, sound or open ocean
- Estuarine and Marine Wetland: Vegetated and non-vegetated brackish and saltwater marsh, shrubs, beach, bar, shoal or flat
- Freshwater Emergent Wetland: Herbaceous marsh, fen, swale or wet meadow
- Freshwater Forested/Shrub Wetland: Woody wetlands; forested swamp, shrub bog

The map shows that many of Beacon's wetlands are concentrated along the Fishkill Creek stream corridor and the Hudson River shoreline. It also shows that outside of these areas, most of the mapped wetlands are surrounded by larger patches of poorly drained or very poorly drained soils, indicating that federal and state maps may be underestimating the true extent of wetlands in Beacon.

Implications for Decision-making

The need to protect wetlands has been recognized widely. However, many of the wetlands on this map are not protected, and it is likely that not all existing wetlands are mapped.

Land use in adjacent upland areas and hydrologically connected areas can impact wetlands, so it is important to closely examine relationships between wetlands and surrounding areas when making land use decisions. Similar management strategies can often be applied to wetlands and stream corridors.

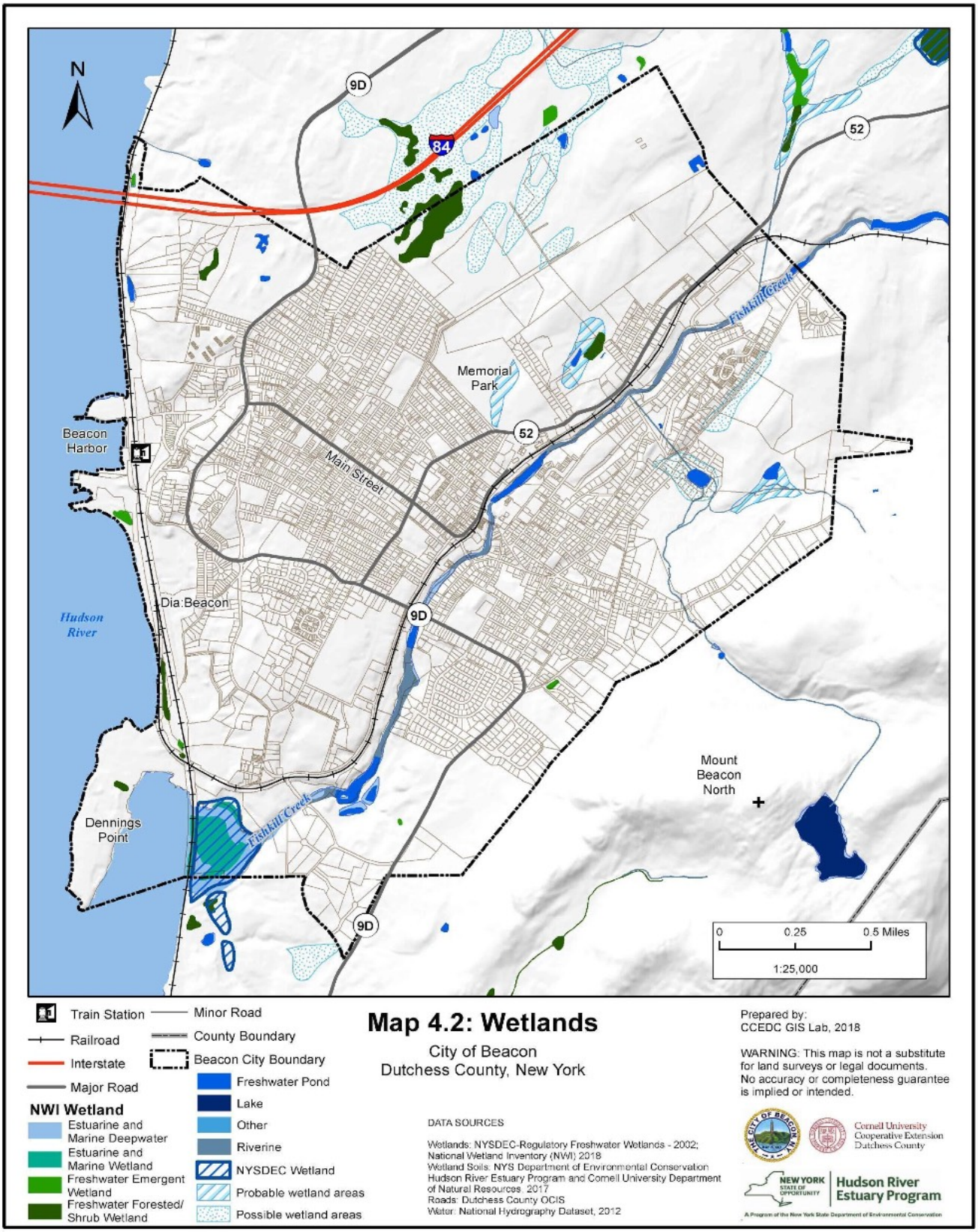
Small pockets of wetlands in the city, or locations of possible wetlands (based on soil drainage characteristics), can serve as "green infrastructure" that naturally helps to store run-off during storm events.

To protect Beacon's wetlands:

- Require mapping of all wetlands on project plans, with no minimum size;
- Consider establishing wetland protection ordinances for significant wetlands that are not currently regulated by State or Federal law;
- Preserve wetlands in their undeveloped states; and
- Avoid filling shallows and small wetlands.

This information largely comes from Local Strategies for Wetland and Watercourse Protection and the US Fish and Wildlife Service National Wetland Inventory. For more information on these topics, see the References section.

Map 4.2 Wetlands



4.3 Stormwater

(Map Not Available)

Why This is Relevant to Beacon

A sewershed is an area of land where any water running off the street surface drains via the storm sewer system to a single pipe that discharges into surface waters, such as the Hudson River or Fishkill Creek. Sewersheds are man-made, the product of human development patterns and stormwater system design.

Impervious surfaces, such as roads, rooftops, and parking lots, are a central feature of human development. In undeveloped areas, precipitation infiltrates soils and moves gradually into surface and ground waters, which helps maintain more stable stream flow over time. Impervious surfaces prevent rainwater from infiltrating into the ground, instead directing it into underground piping systems that are designed to convey stormwater runoff quickly and efficiently to surface waters. In this way, impervious surfaces drastically alter the timing and quantity of stream flow. Stormwater discharge pipes may also erode or scour stream banks and beds.

Impervious surfaces also have water quality impacts. As water flows over pavement, it picks up pollutants such as salt, oil, and sediment, and carries them into surface waters. The effects of impervious surfaces on surface waters are detectable even at low levels of development, around 5% to 10% of land area.

Green infrastructure is a category of stormwater management practices in which pervious surfaces, vegetation, and topography are used to slow the movement of runoff and promote infiltration, reducing the impacts of development on water quality and quantity. Green infrastructure practices often produce multiple benefits, such as creating wildlife habitat and increasing greenery in urban spaces.

Runoff carries nutrients, sediment, and pollutants in forms and concentrations that are atypical of undisturbed systems, and runoff changes the timing and magnitude of flow. Development within floodplains removes their ability to store and infiltrate water. Direct alterations to the stream channel, such as road crossings, culverts, and dams, also alter flow and affect habitat quality for fish and wildlife.

Implications for Decision-making

With an understanding of surface water drainage patterns, we can assess which land areas within Beacon have more potential to generate pollutants that wind up in streams and rivers. We can also begin to identify areas where green infrastructure practices may have the greatest impact. Beacon City Council adopted a resolution in support of green infrastructure in 2013.

Stormwater runoff from certain municipal areas is regulated under the New York State Municipal Separate Storm Sewer System Permit, or “MS4” program. Beacon is a subject to this permit program, which requires six “minimum control measures” to protect nearby surface waters:

1. Public education and outreach
2. Public participation
3. Illicit discharge detection and elimination
4. Management of construction site runoff
5. Management of post construction site runoff
6. Good housekeeping in municipal operations.

To manage stormwater in Beacon:

- Minimize impervious surfaces;
- Require new developments to retain all stormwater on site, or to treat stormwater runoff before it leaves the site;
- Upgrade old systems with green infrastructure or modern treatment practices;
- Install enhanced tree pits, which store water for plant uptake or groundwater infiltration;
- Ensure that downspouts and sump pumps are directed toward permeable areas instead of storm sewers; and
- Encourage construction of rain gardens and green roofs.

This information largely comes from Fishkill Creek Watershed Management Plan, US Environmental Protection Agency, and Orange County Watershed Design Guide. For more information on these topics, see the References section.

4.4 Water Quality

Why This is Relevant to Beacon

Clean water is necessary for the plants and animals that use Beacon's streams and rivers for habitat; for the people that fish and recreate in them; and for drinking water.

Groundwater resources include water located underground in the pore space of soil and rocks, and in aquifers. Surface water is water in a stream, lake, or wetland. After heavy rains, streams act as natural stormwater management systems and wetlands naturally filter pollutants. Beacon's drinking water sources consist of three surface sources – Cargill, Mt. Beacon, and Melzingah reservoirs, and three groundwater sources – Beacon wells 1 & 2 and Village of Fishkill well 8. Water from these sources are blended depending on source condition and demand for water.

Water quality monitoring data can be used to confirm whether existing pollution controls are succeeding at achieving the desired water quality. Where water quality goals are not being met, data can help identify areas where nutrient management, riparian shading, stormwater controls, or stream restoration are needed.

What This Map Shows

Under the federal Clean Water Act, all water bodies must be assigned a "best use" by the New York State Department of Environmental Conservation (DEC). This designation determines the water quality goals for the waterbody and has implications for what types of disturbance are allowed in the stream and along its banks. Water bodies that are not meeting their best uses are designated "Impaired." The best uses and corresponding classifications in New York State are:

Best Use	Classification	Waterbodies
Drinking	AA, A	Upper Dry Brook Cargill Reservoir* Melzingah Reservoir* Beacon Reservoir*
Swimming,	B	Hudson River
Fishing	C	Fishkill Creek Lower Dry Brook

*Located outside of Beacon's municipal boundary

DEC regularly monitors surface waters to assess whether the water quality supports the designated uses. DEC's assessment for Fishkill Creek was last updated in 2008, based on sampling in 2002, and indicated slightly impacted conditions. It identified nutrients (phosphorus) as a known pollutant, and pathogens, metals, unknown toxic substances, and silt/sediment as possible pollutants. Impacts are primarily from non-point sources and possibly from municipal and industrial toxic inputs. Beacon's drinking water reservoirs, Melzingah Reservoir, Beacon Reservoir, and Cargill Reservoir, were not assessed.

Implications for Decision-making

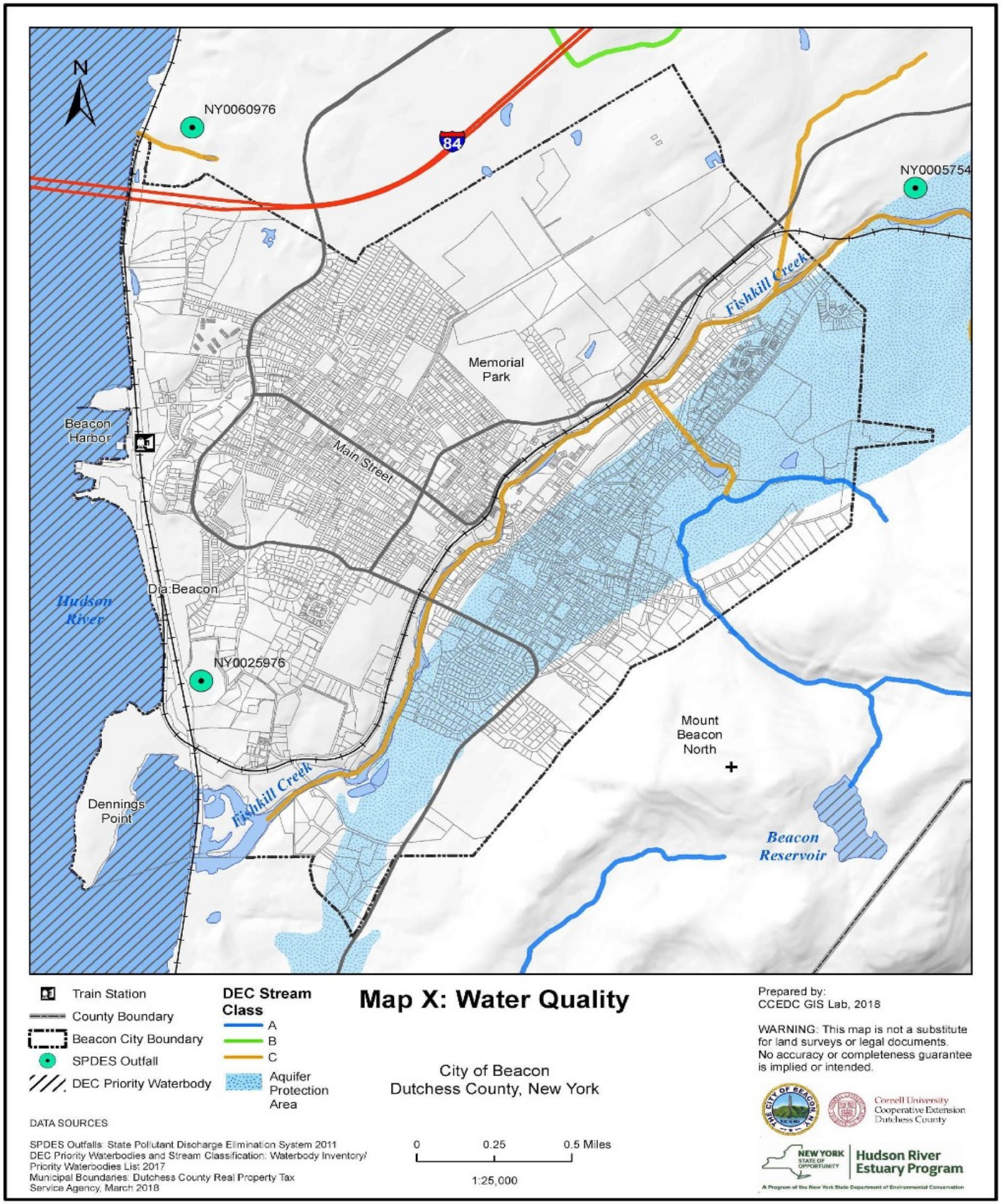
Pollution sources can be broadly classified into point sources, such as discharges from pipes, and nonpoint sources, such as stormwater runoff. Development causes runoff by creating paved surfaces, and poorly planned development can dramatically increase the amount of pollutants entering water bodies. On the other hand, municipalities can provide more comprehensive water quality protection than the county, state or federal level.

To protect water quality in Beacon:

- Continue providing annual water report;
- Regularly monitor water bodies;
- Review and adjust use of de-icing substances to minimize undissolved salt residues in surface and groundwater;
- Restore and maintain broad buffer zones of natural vegetation along streams and shorelines;
- Minimize areas of impervious surfaces (roads, parking lots, driveways, etc.);
- Participate in the Fishkill Creek Watershed Committee;
- Maximize onsite retention and infiltration of stormwater runoff; and
- Design new development such that surface runoff during and after construction does not exceed pre-construction runoff volume.

This information largely comes from DEC Waterbody Inventory, Natural Resources Management Plan for the Fishkill Creek Watershed, The Natural Resource Inventory of Dutchess County, NY, and Creating a Natural Resources Inventory: A Guide for Communities in the Hudson River Estuary Watershed. For more information on these topics, see the References section.

Map 4.4 Water Quality



5.0 Biodiversity and Habitats

Why This is Relevant to Beacon

Biodiversity encompasses the variety of life in all its forms, and the interactions between living organisms and their environment.

The health of the environment, including the people that inhabit it, depends on the health of each of its component parts. A biodiverse ecosystem tends to be more sustainable and adaptable over the long run. Each part---the forests, waterways, and individual species and plants---contribute to the health of the full system.

While some urban areas contain relatively low levels of biodiversity, Beacon is unique. The Hudson River Estuary to the west combined with the large forest blocks to the east, and the interspersed greenspaces, make for various high-quality wildlife habitats and relatively high biodiversity.

This section breaks down Beacon's biodiversity and habitats into six sections:

- Habitat Types
- Forests and Street Trees
- Important Areas for Rare Plants and Animals
- Coastal and Shoreline Habitat
- Wildlife Habitat Index
- Greenspaces

Implications for Decision-making

See subsection-specific recommendations for implications for decision-making.

This information largely comes from the Hudson River Estuary Program, the Dutchess County NRI, Hudsonia, and the New York Natural Heritage Program. For more information on these topics, see the References section.

A Monarch butterfly caterpillar is seen here on milkweed, its host plant.

The Hudson River Estuary, seen here south of Dennings Point, contains a high level of biodiversity.

5.1 Wildlife Habitat Index

Why This is Relevant to Beacon

Unfragmented habitat blocks are natural areas of the landscape that are undivided by roads or development. These intact natural areas can include forest, wetlands, meadows, open water, and farmland, often encompassing many habitat types and supporting a diverse array of plants and animals. Large, connected habitat blocks allow for the maintenance of ecological processes and disturbances that help sustain natural communities. They provide habitat for far-ranging species and those that are sensitive to human disturbance.

For example, certain migratory songbirds will not nest in forests of less than 500 acres. They require deep interior forest habitat to find essential microhabitats. The effects of development at habitat edges can cause disturbance for hundreds of feet into the interior of a habitat block, measurably altering light and temperature. Such disturbance creates favorable conditions for the establishment of invasive species and pests. Siting new development near existing roads and developed areas can help to avoid or minimize fragmentation of natural areas at the landscape scale and its negative consequences.

What This Map Shows

Habitat index values represent the sum of key habitat attributes: amount of forest cover, wetlands, stream corridors, and seasonal water resources. Dark areas (red-brown) represent areas of high value habitats, while lighter areas (yellow) show lower value habitat. High value habitat may be referred to as habitat "cores," while mid-value habitat may be referred to as habitat "edges."

Red, high-value areas on the map have high usefulness to a range of species. Yellow areas on the map can also be valuable to wildlife, however these areas support a more limited range and number of animals and plants as they often have higher levels of disturbance. Note the large, intact cores of habitat, as well as the connected blocks of darker shading, especially at the borders of the city. Hunting, spawning, nesting, and migrating species may use such core areas all year long, throughout their life cycles.

Implications for Decision-making

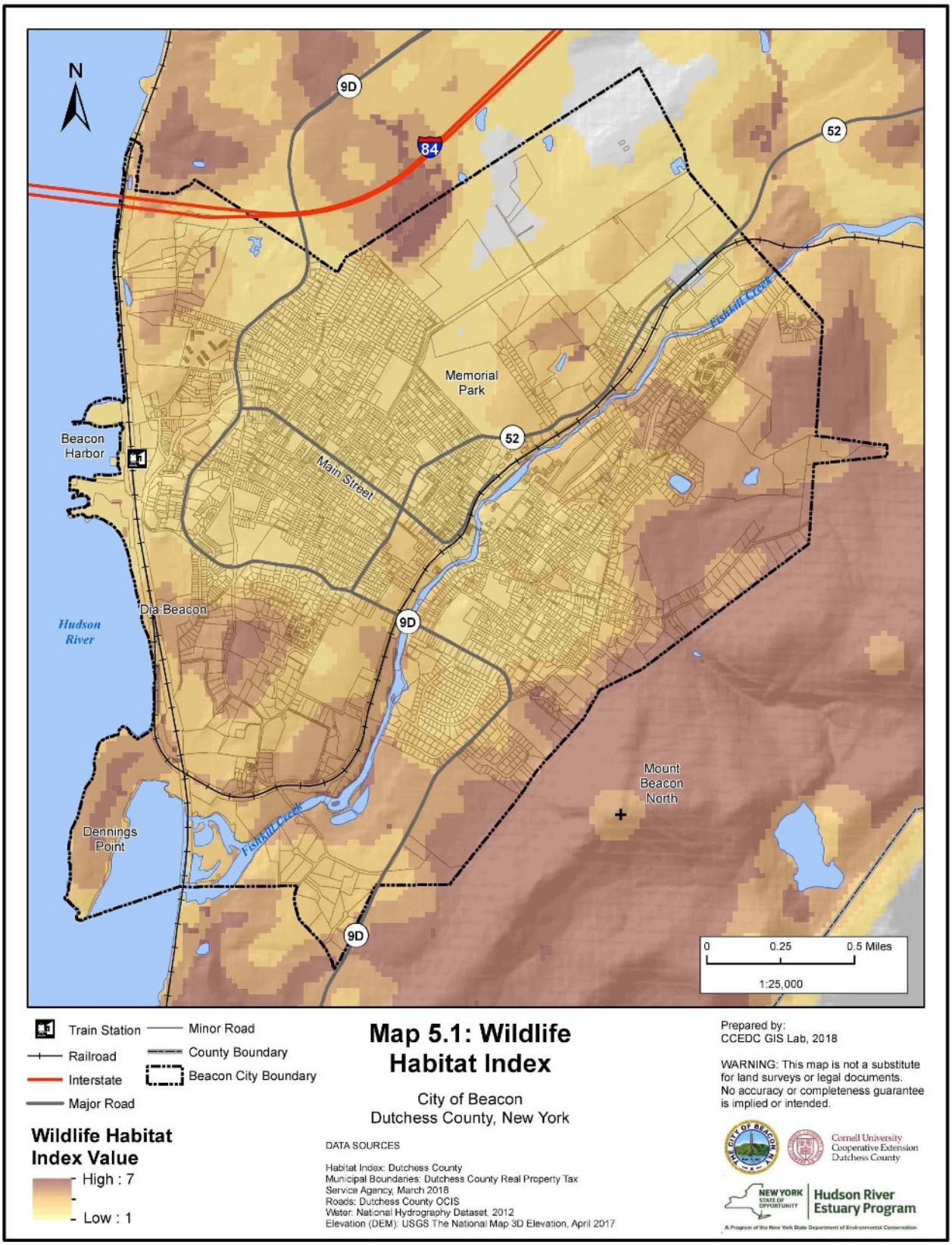
Through restoration, core habitat areas in and around Beacon can be connected to increase their value to wildlife. The habitat value of urban landscapes can also be maintained or increased while continuing to meet human needs. Careful planning can ensure that critical urban habitats continue to provide ecosystem services.

- Connect mid- and high-value habitat to protect Beacon's wildlife, and encourage surrounding municipalities to do the same;
- Concentrate new development away from mid- and high-value habitat to avoid further fragmentation;
- Manicured lawns are the most popular form of residential landscaping, but have a lower habitat value than almost any other type of vegetation. Consider replacing municipal lawns with wildflower meadows, perennial gardens, or ornamental woodlands;
- Reward residents who exchange yards for wild meadows to increase benefits for wildlife; and
- Landscape with native plants to support native pollinators and food webs.

This information largely comes from the Hudson River Estuary Program and Hudsonia. For more information on these topics, see the References section.

Grey tree frog inhabits moist, deciduous woodlands

Map 5.1 Wildlife Habitat Index



5.2 Forests and Street Trees

Why This is Relevant to Beacon

Forests provide wildlife habitat, water filtration, and climate moderation. While large forests provide more ecosystem services and higher quality habitat, small patches of forest also have value. They can also provide habitat and contribute to a better quality of life in residential areas. Even single street trees help moderate temperature and intercept stormwater.

Along streams, networks of forest patches create riparian corridors that help maintain water quality and provide habitat for aquatic as well as terrestrial wildlife.

The large forested slopes of Mount Beacon are identified in the Beacon Comprehensive Plan as a "rare asset of the city" to be protected due to their tourism and recreational values.

What This Map Shows

The southeastern border of Beacon contains the edge of a "regionally-significant" forest block (10,000+ acres). It includes forest communities such as Appalachian oak-hickory forest and oak-tulip tree forest. It covers Mount Beacon and extends beyond the city limits along Scofield Ridge and Breakneck Ridge toward the Hudson River and Cold Spring. It is part of a larger complex of Hudson Highlands forests that form a connected corridor of habitat used by breeding and migratory birds, resident amphibians and reptiles, and rare plants and communities (Penhollow et al. 2006). The forest complex has been recognized as a Significant Biodiversity Area by the Hudson River Estuary Program (Penhollow et al. 2006) and an Important Bird Area by the Audubon Society. Its proximity to Beacon provides benefits to residents, including clean air and water, scenery, and recreational opportunities that also attract visitors and tourism.

Smaller, isolated patches of forest are interspersed within the developed parts of Beacon. A notable example is the "stepping stone" forest block at the mouth of Fishkill Creek that extends in a narrow band to the northeast along the creek and further south along the Hudson River. While relatively small, this patch helps to create streamside habitat, protect water quality, and mitigate the impacts of flooding along Fishkill Creek and the Hudson River.

Additionally, there are small wooded areas that contain forested wetlands as well as individual street trees, primarily along Main Street.

Implications for Decision-making

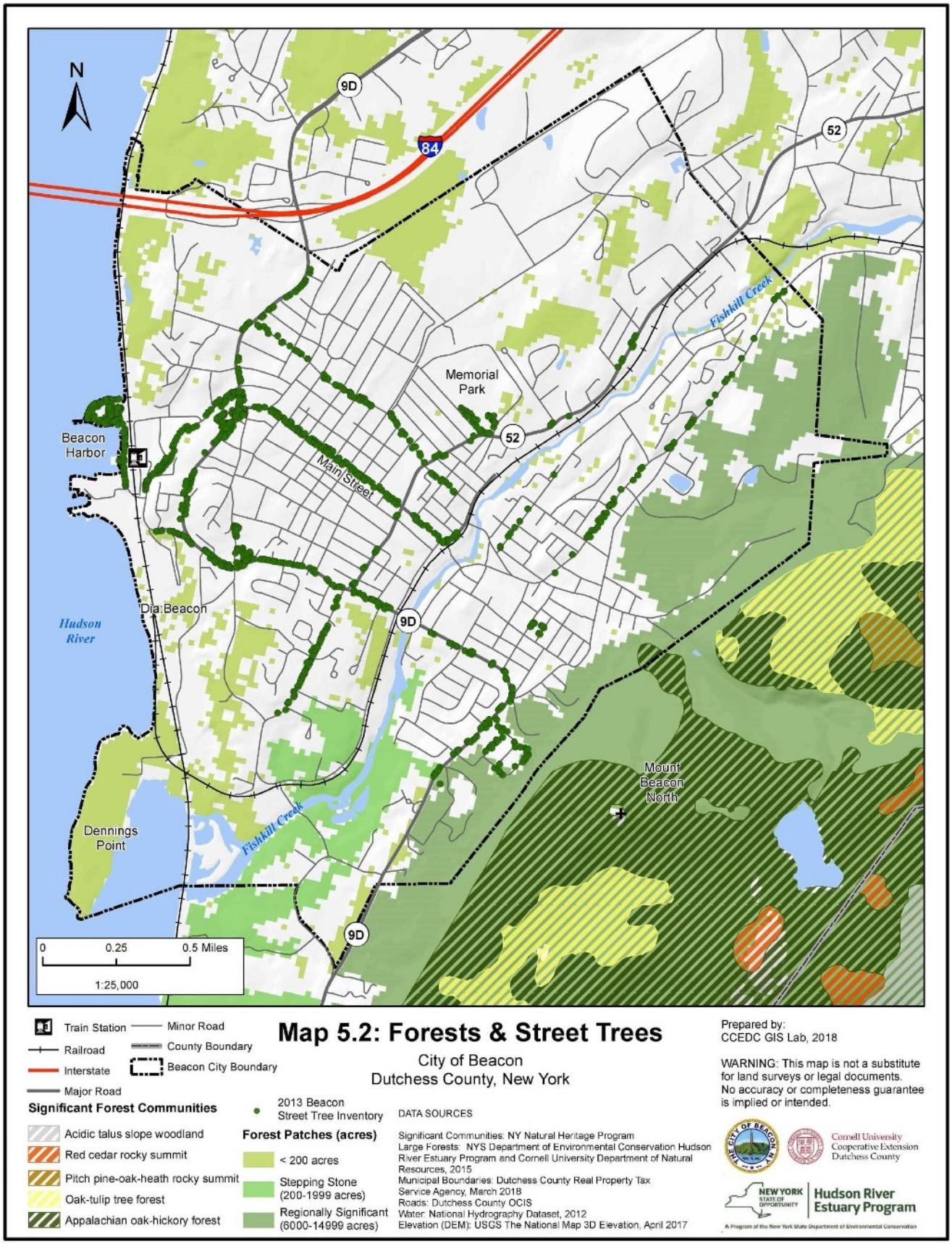
The Forests and Street Trees map, along with the Wildlife Habitat Index Map, can be used in concert with other NRI information to consider conservation and restoration opportunities in the city. Larger, intact wooded areas will benefit from conservation efforts that prevent further fragmentation. Streamsides and neighborhoods where there is limited canopy may present restoration opportunities that will improve quality of life for residents and improve stream habitat and water quality.

To protect forests:

- Keep large forests and mature forests intact and unfragmented;
- Minimize construction of new roads, houses, and other forms of development in forests, especially in large or mature forests;
- Concentrate any new development near existing developed areas;
- Maintain intact habitats between forest patches to allow for migration and dispersal of plants and animals;
- Avoid tree cutting on steep slopes, and leave tree crowns in the woods to conserve soil fertility and increase habitat diversity;
- Minimize gap size and road construction to prevent the establishment of non-native species (e.g., tree-of-heaven);
- Minimize off-road vehicle use, which damages vegetation, compacts soil and disturbs wildlife; and
- Update the 2013 Street Tree Inventory, and expand the planting of street trees for beautification, stormwater absorption, and temperature moderation.

This information largely comes from L. Heady Beacon Biodiversity Memo, Hudson River Estuary Program, and Hudsonia. For more information on these topics, see the References section.

Map 5.2 Forests and Street Trees



5.3 Habitats

Why This is Relevant to Beacon

Beacon is part of the Hudson Highlands, an area that is recognized by the state and nation for its incredible biodiversity. The Hudson River, its tributary streams, the toe-slopes of Mount Beacon, and the interspersed green spaces provide a variety of habitats for wildlife.

The presence of a variety of wildlife and plants keeps Beacon's environment healthy. It also provides for recreation like bird-watching and fishing. Many animals migrate to and from this area, like anadromous fish and migratory songbirds, so Beacon's environmental health also affects lands and waters far beyond its borders.

Running along Beacon's western border is a unique habitat type: the Hudson River Estuary. An estuary is a place where fresh and saltwater mix. The estuary here is home to an incredibly diverse array of plants and animals that depend on its waters for essential activities such as spawning and overwintering.

The Hudson River's waters flow cleaner today than they have in decades. Years of hard work by scientists, government officials, river lovers, and local environmentalists like the Seegers, have re-opened the Hudson's shores to swimming, fishing, and boating. Keeping this habitat clean benefits both humans and wildlife.

What This Map Shows

Beacon contains many different types of habitat, as illustrated by Hudsonia's habitat map for the city. Some of the most prevalent types are:

- Upland Hardwood Forest: These areas contain wildlife typical of "Appalachian oak-hickory" forest species, ranging from small grey tree frogs to large white-tailed deer.
- Cultural: Cultivated lawns, sports fields, and cemeteries are grouped into this category. These areas, though green, have low value for wildlife.
- Upland Meadow and Upland Shrubland: These areas are more open than forests, with lower tree canopy cover. Both are important areas for mammal forage, ground-nesting bird nest sites, and pollinating insects.
- Seeps and Hardwood/Shrub Swamp: Water resources like these are critical for wildlife. A seep is where the groundwater reaches surface-level and flows across land, while a swamp is a type of shrubby or forested wetland.
- Tidal Tributary Mouth: Areas where freshwater streams meet saltwater estuaries are extremely high in biodiversity.

Each habitat type has value on its own. When combined with surrounding areas, multiple habitats can create ideal conditions for wildlife that have different daily habitat needs, like a fox that may forage in a meadow and sleep in a forest.

Many species require multiple habitat types throughout their life cycles. For instance, some forest amphibians, like mole salamanders and wood frogs, must move to vernal pools to breed. Having connected habitats is vital to their survival.

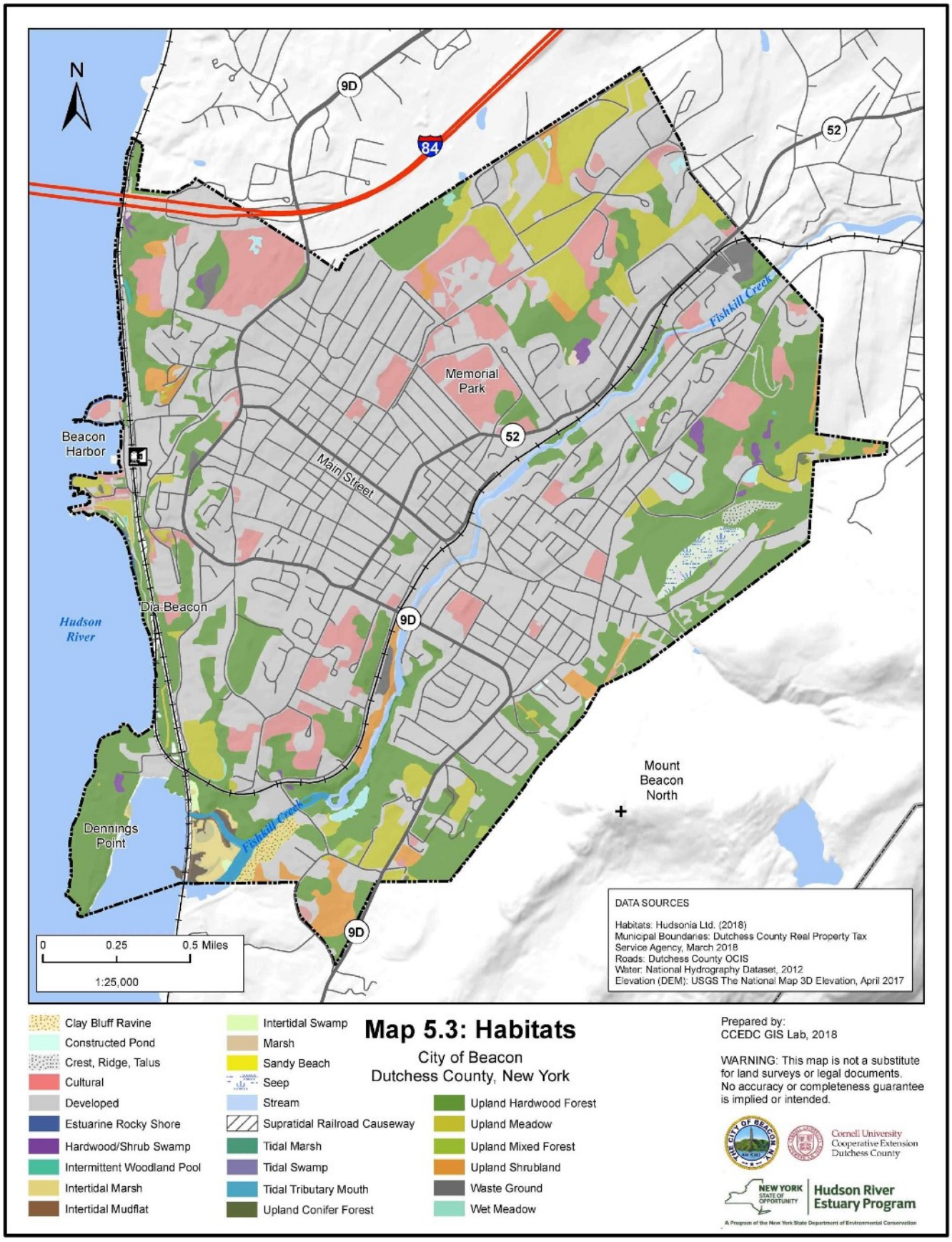
Implications for Decision-making

To protect habitats:

- Connect isolated green spaces to ensure that wildlife and plants can move, Tensuring they can exchange genetic material so their populations stay healthy;
- Support this biodiversity and enhance Beacon's urban environment by encouraging green infrastructure, low-impact site design practices, and native plant landscaping;
- Consider the special value of the Fishkill Creek mouth when evaluating stormwater management aspects of site plans, as well as any projects that directly affect the stream banks or bed;
- Create a biotic management plan that includes removal of select invasive species to help maintain and increase populations of high-value species that are at risk; and
- Identify and protect vernal pools.

This information largely comes from L. Heady Beacon Biodiversity Memo, Hudson River Estuary Program, USFWS, and Hudsonia. For more information, see the References section.

Map 5.3 Habitats



5.4 Hudson River Coastal and Shoreline Habitat

Why These are Relevant to Beacon

The Hudson River is a tidal estuary, or a place where freshwater and saltwater mix. It hosts an extremely high amount of biodiversity. Shoreline habitats such as tidal marshes and mudflats support a great diversity of life and contribute to the economic significance of the Hudson River Estuary. The underwater plants, or submerged aquatic vegetation (SAV), in the estuary shallows along the Beacon waterfront improve water quality in the river and provide foraging and refuge habitat for invertebrates, fish, and waterfowl. Tidal wetland systems help filter pollutants and buffer shoreline properties by stabilizing the shoreline and providing protection from storm surge.

Beacon's shoreline is home to several rare plant species. Fishkill Creek is a major crossing point of the Hudson Valley for migratory raptors, and is an overwintering site for bald eagles. The mouth and lower section of Fishkill Creek (up to the first dam) are important spawning areas for multiple species of migratory fish, which travel from the Atlantic Ocean, up the Hudson River Estuary, and into its tributaries to spawn. The mouth of Fishkill Creek is also an overwintering area for striped bass. As such, it is a popular feeding area for heron and egret.

Several recreation and tourism attractions along the Beacon waterfront are based upon, or derive value from, the natural surroundings. Dennings Point Park, Long Dock Park, Klara Sauer Trail, and Pete and Toshi Seeger Waterfront Park are examples.

What This Map Shows

The western boundary of Beacon is the Hudson River Estuary. Its tidal influences are felt as far as Fishkill Creek to the first dam, approximately a mile upstream from the estuary. The mouth of Fishkill Creek, and the Hudson shoreline including Dennings Point and its bay, are recognized by the NYS Department of State as a Significant Coastal Fish and Wildlife Habitat. The Hudson River Estuary Program designated the estuary a Significant Biodiversity Area because it's a globally rare ecosystem that supports many threatened species as well as regionally important fisheries (Penhollow et al. 2006).

The mouth of Fishkill Creek supports a variety of tidal wetlands, including brackish intertidal mudflats, brackish tidal marsh, and SAV. These tidal wetlands are spawning and nursery habitats and a migratory pathway between the upper and lower estuary for anadromous and resident fish.

Implications for Decision-making

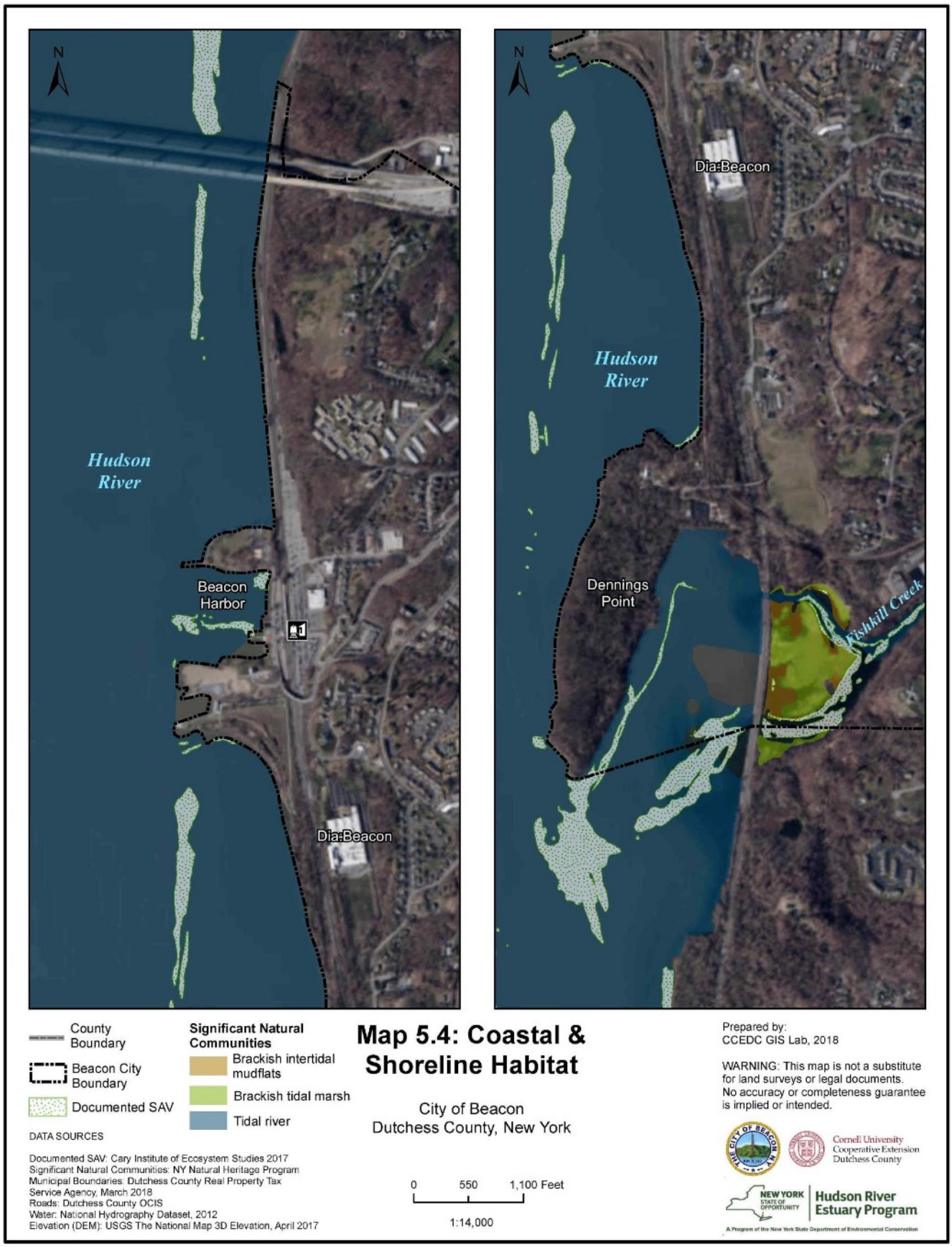
Water and habitat quality in the mouth of Fishkill Creek are heavily influenced by actions further up the watershed, including: upland development; modifications to stream banks and beds; and point and nonpoint source pollution. Global sea level rise is projected to fundamentally affect the shoreline of the Hudson River Estuary in the coming decades. Natural shorelines will allow for the inland migration of tidal and shoreline habitats as sea level rises.

To protect the Hudson River Shoreline:

- Avoid filling shallows and small wetlands;
- Restrict herbicide use along roads and railroads, which could destroy adjacent rare plant populations;
- Control point and nonpoint sources of water pollution throughout the watersheds;
- Restore and maintain broad buffer zones of natural vegetation along shorelines;
- Preserve natural features and minimize impervious surfaces in developments;
- Use green infrastructure wherever possible to increase infiltration and/or treat stormwater runoff;
- Remove dams where practical to restore tidal an d upstream habitat;
- Require mapping of all tidal wetlands on plans for projects along the Hudson River shoreline;
- Require a building buffer from the mean high tide mark of the Hudson River;
- Protect and restore naturally vegetated areas;
- Take steps to stop water chestnut invasion around the mouth of Fishkill Creek; and
- Control shoreline and streambank erosion using living shorelines or ecological materials.

This information largely comes from US Fish & Wildlife Service, NYS Department of State, DEC Hudson River Estuary Program, and L. Heady. For more information on these topics, see the References section.

Map 5.4 Coastal and Shoreline Habitat



5.5 Plants and Animals of Conservation Concern

Why This is Relevant to Beaco:

The presence of rare plants and animals in Beacon adds to the city's significance for New York State biodiversity. Rare biota are one of the most vulnerable parts of the ecosystem. Their continued existence in turn supports the health of a full ecosystem and keeps it biodiverse as well as high-functioning. A diverse system is more sustainable and adaptable in the long run.

Some rare biota are important for medical or industrial purposes, and their applications may not yet be fully realized. Other rare plants and animals may be of interest to eco-tourists.

The New York Natural Heritage Program keeps a statewide database on the status and location of rare species and natural communities.

What This Map Shows

The identified Important Areas for rare plants and animals represent the lands and waters needed to support the continued presence of species of conservation concern. Not surprisingly, they coincide to a high degree with areas recognized for other natural resources, such as large forest blocks, high-value wildlife habitat, water resources, and significant natural communities.

The areas that are most important for rare animals are primarily located along the shoreline of the Hudson River and in the southern and eastern portions of Beacon. A state and federally-endangered species of bat uses the forests. Likewise, interior forest species of birds, like wood thrush and scarlet tanager, can be found in Beacon and its vicinity. Both species are considered Species of Greatest Conservation Need by DEC.

Important areas for rare plants encompass Dennings Point and the mouth of Fishkill Creek. They have also been recognized by New York's Department of State as Significant Coastal Fish and Wildlife Habitat. It also supports a regionally important fishery and globally rare ecosystem.

Migratory fish, like alewife and blueback herring, use the creek for spawning, foraging, and refuge. Submerged aquatic vegetation creates safe habitat for fish as well as waterfowl and aquatic invertebrates. Both Atlantic and shortnose sturgeon, both federally endangered species, can be found in the nearby deep waters. Bald eagle, which are considered a threatened species in New York, forage and nest in the area. Other raptors such as osprey can be found along the creek, especially during migration periods.

Concentrating development away from the Important Areas, including conserving high-quality wildlife habitat, will help ensure that rare animals and plants survive. Other, more common species will also benefit from protection of these ecosystem areas, and will help keep Beacon's environment healthy.

Implications for Decision-making

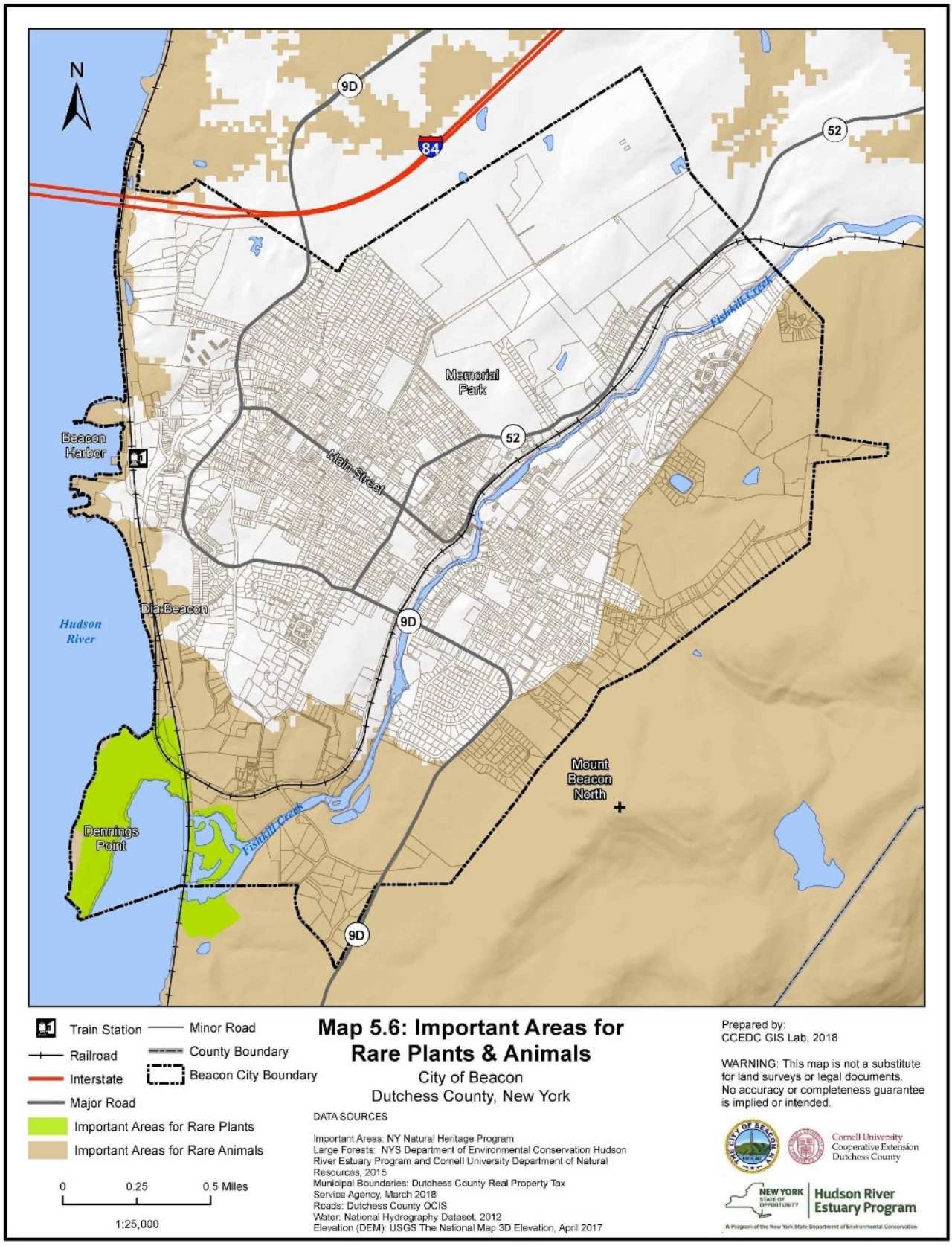
Because successful conservation of rare species requires protecting their habitats, this map should be considered alongside the maps of Wildlife Habitat Index; Forests and Street Trees; and Hudson River Coastal and Shoreline Habitat maps. Proactive planning that considers how species move across the landscape, with careful attention to maintaining connected habitat complexes, will contribute to the long-term survival of rare animals and to the persistence and dispersal of rare plants.

To protect Rare Plants and Animals:

- Use the New York Natural Heritage Program Online Conservation Guides to identify species-specific threats, conservation strategies, and management practices;
- Continue to work in partnership with the Hudson River Estuary Program and the New York Natural Heritage Program to develop and implement holistic conservation strategies for rare animal and plant habitat;
- Minimize disturbance to and fragmentation of the Important Areas and surrounding lands; and
- Minimize or eliminate use of motorized vehicles in Important Areas.

This information largely comes from Beacon Biodiversity Memo (L. Heady), HREP NRI Guide, and NYS Department of Environmental Conservation. For more information on these topics, see the References section.

Map 5.5 Important Areas for Rare Plants and Animals



6.0 Land Cover and Greenspaces/ Protected Areas

Why These are Relevant to Beacon

Patterns of human land uses and natural land cover strongly influence water resources and biological communities. Changes in natural land cover (especially forests, floodplains, and wetlands) accompanying conventional development often result in substantial increases in impervious surfaces (e.g., roofs, parking lots, and roads) and can drastically alter water quality.

Land cover types can generally be classified into two categories: “pervious surfaces,” or areas where rainwater can be absorbed, and “impervious surfaces,” where rainwater runs off. Understanding the locations of these land cover types can help determine where flooding risks are highest, as well as where vegetated buffers exist or may be needed near surface water bodies.

Open spaces and protected areas provide many ecological services. They may have high biodiversity, act as havens for wildlife, provide recreational opportunities, mitigate flooding from large precipitation events, and generate ecotourism revenue.

Implications for Decision-making

Land cover information can be used to help determine potential risks and opportunities, such as the mitigation of stormwater runoff and protection of water quality. One key value of mapped open space (or greenspace) and protected areas is to show how protected areas relate to each other, and where there may be opportunities to better connect these protected areas for trails, wildlife habitat, stream corridor protection, park enhancement, etc.

The information in this section largely comes from the City of Beacon Comprehensive Plan (2007), Comprehensive Plan Update (2017), the National Fish & Wildlife Service, and Hudson River Estuary Program. For more information on these topics, see the References section.

Increasing pervious surfaces helps reduce flooding and protect water quality of Fishkill Creek, pictured here.

An evening view from Scenic Hudson’s Long Dock is pictured here.

Artists perform at Pete & Toshi Seeger Riverfront Park, pictured here.

6.1 Land Cover

Why This is Relevant to Beacon

"Pervious" or permeable areas allow water to infiltrate underlying soils. When precipitation falls on natural areas like forests and wetlands, stormwater swales, and even pervious pavement, it can soak into the ground and become groundwater.

Water cannot percolate through "impervious" surfaces, however. When rainwater hits surfaces like asphalt, concrete, roof shingles, and bedrock, it runs off and cannot soak into the ground. These surfaces also can contribute to urban heating.

The negative impacts of impervious surfaces can be offset by conserving and restoring areas of natural cover. This will be especially important as storm intensities and air temperatures continue to increase due to climate change.

What This Map Shows

Impervious surface from commercial and residential development is spread across the city, with the highest degree of development---seen in dark red on the map---centering around Main Street. It also spreads along the Route 52 and 9D corridors.

There is a partial ring of natural cover types around the city, especially to the south and east. These pervious areas are primarily deciduous and evergreen forest (in green on the map), occurring primarily in public open space and protected areas. Other natural cover types on the map include wetlands, open water, and mixed forest, as well as hay/pasture land (yellow), developed-open space (light pink), and developed-low intensity (medium pink), which often represent pervious areas of mowed lawns and managed fields.

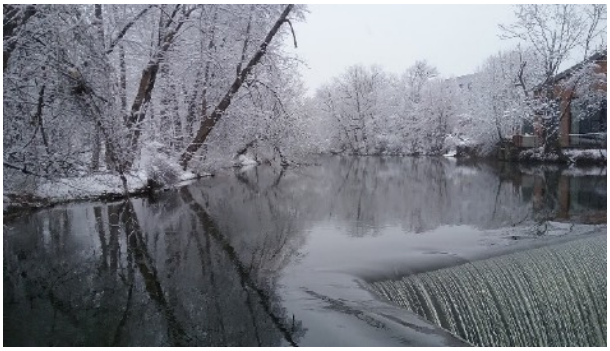
Implications for Decision-making

It's not surprising that an urban community like Beacon has high-density development, but the resulting impervious cover can contribute to increased stormwater flow and flooding.

To reduce impervious surfaces:

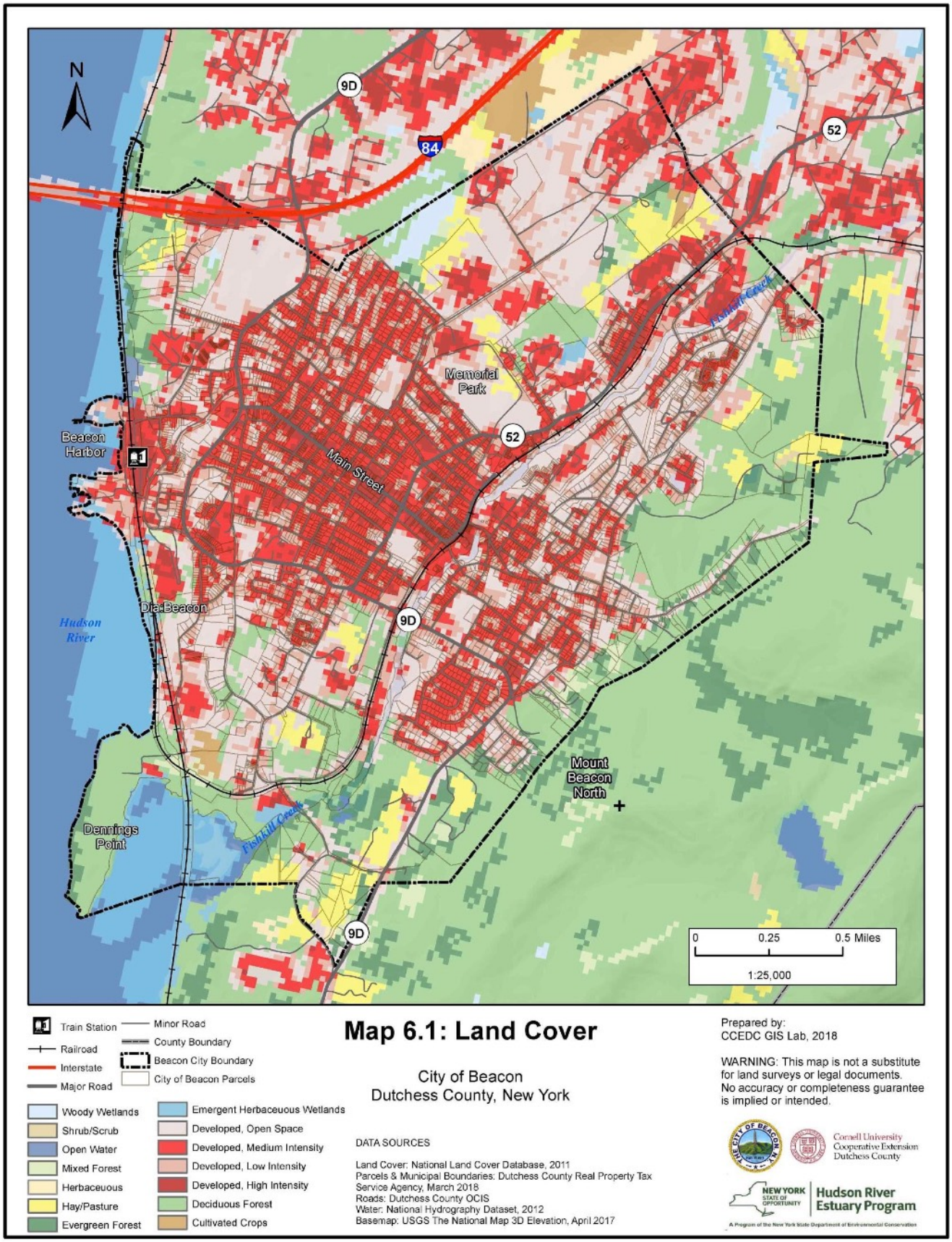
- Promote development practices and restoration projects that improve conditions and help Beacon to be more resilient to climate change and related intense storms;
- Offset the creation of new development with creation of new pervious surfaces elsewhere, which would lower flood risk throughout the city;
- Keep a large buffer of natural vegetation around waterways, especially wetlands and Fishkill Creek;
- Support green infrastructure like pocket parks, rain gardens, and green roofs, which can mitigate effects of impervious surfaces; and
- Encourage homeowners to convert their mowed lawns to meadows, which are more effective at absorbing stormwater.

This information largely comes from the City of Beacon Comprehensive Plan (2007), Comprehensive Plan Update (2017), the National Fish & Wildlife Service, and Hudson River Estuary Program. For more information on these topics, see the References section.



Natural vegetation helps to absorb stormwater that runs off impervious surfaces, like roads, during precipitation events. Increasing natural areas and pervious surfaces can help to reduce flooding and protect water quality of Fishkill Creek (pictured here).

Map 6.1 Land Cover



6.2 Open Space and Protected Areas

Why This is Relevant to Beacon

Beacon is known for its exceptional "greenspaces," which are large natural areas, parks, and protected lands in an urban environment. They provide scenic views and recreational opportunities, and increase the health and happiness of residents and visitors. They are also significant sources of ecotourism revenue.

Ecologically, these protected areas are biodiversity strongholds. They provide many ecosystem services, including wildlife habitat, water and air purification, and stormwater runoff and floodwater mitigation.

What This Map Shows

Beacon has a mix of open spaces, ranging from small pocket parks to 100+ acre conserved lands. This map shows the mosaic of land ownership across Beacon's open space areas.

As seen on the map, these open areas are primarily owned and protected by:

The City of Beacon, including:

- Memorial Park
- Pete & Toshi Seeger Riverfront Park
- South Ave Park
- Green Street Park

The State of New York, including:

- Dennings Point
- University Settlement Camp

Dutchess County, including:

- Hiddenbrooke

Scenic Hudson Land Trust, including:

- Scenic Hudson's Long Dock Park
- Madame Brett Park
- Mount Beacon trailhead area (and a portion of the park, located beyond Beacon's boundaries)

Implications for Decision-making

In unprotected areas of high natural resource values, such as large undeveloped parcels, wetlands, stream corridors, and land with steep slopes, further land protection may be desirable. Different municipal, county, state, and nonprofit partners may have different tools available for protecting further land, including parkland acquisition, development rights purchases (conservation easements), and/or conservation subdivisions.

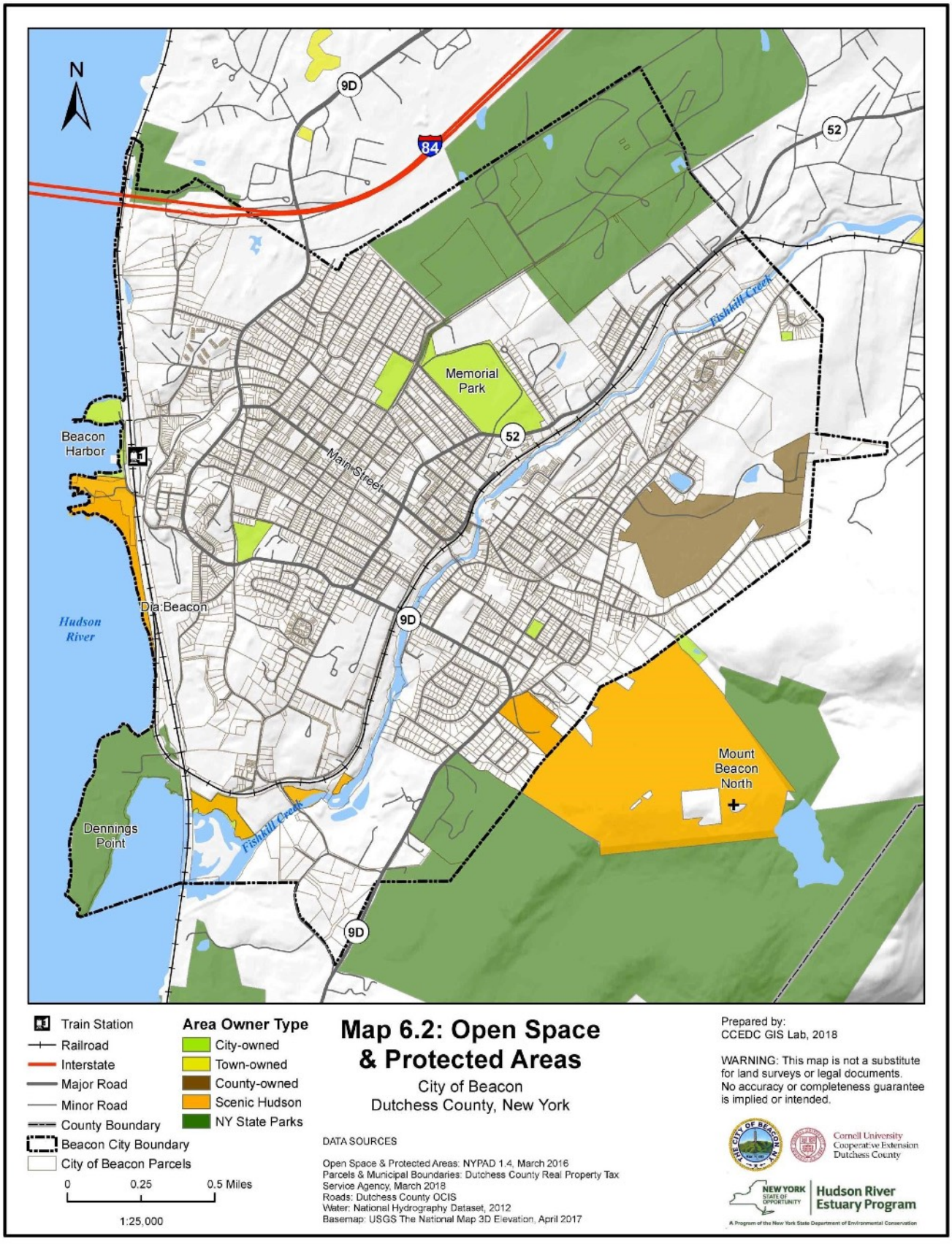
To support these natural resources:

- Encourage the creation of an Open Space Inventory by the CAC, which will aid in prioritization of important natural areas in the city;
- Subsequently develop an Open Space Plan with strategies to conserve priority areas; and
- Encourage the creation of an Urban Design Plan with recommendations of interspersed pocked parks on undeveloped lots, which can both increase ecological services and community engagement.

This information largely comes from the City of Beacon Comprehensive Plan (2007), Comprehensive Plan Update (2017), and Hudson River Estuary Program. For more information on these topics, see the References section.

Beacon has multiple public open space areas made possible by various conservation partners, including this view of Memorial Park during an Independence Day celebration.

Map 6.2 Open Space and Protected Areas



7.0 Scenic, Cultural and Recreational Resources

Why These are Relevant to Beacon:

The identity of Beacon today is inseparable from the cultural history of the city's past. As Beacon builds its way into the future, insight from the city's history illuminates where the city has been, and where it is going.

Beacon's built environment, including storied religious institutions, former factories, and other historic sites, reflects its culture and history. Similarly, Beacon's natural resources, including the Hudson River, Fishkill Ridge, Fishkill Creek, and beyond create a sense of place and belonging to the city's identity as one rich in scenic and recreational resources.

The City of Beacon uniquely offers a mix of cultural heritage and outdoor recreational opportunities that few municipalities in the Hudson Valley can match. It is important to identify the full range of Beacon's opportunities in order to weigh the impacts of the city's development and growth against strategies for preserving Beacon's unique culture and environment.

This section's three maps outline Beacon's scenic, cultural, and recreational resources and offers implications for policy decisions.

Looking downriver from Long Dock Park. Photo by Zoë Markwalter.

Historic Main St buildings.

7.1 Scenic Resources

Why This is Relevant to Beacon

The New York Department of State's Scenic Areas of Statewide Significance report recognizes the Hudson Valley region for its unique, highly scenic landscapes of outstanding quality that are accessible to the public. The wealth of accessible scenic viewpoints in Beacon draws local citizens and tourists alike and helps to define the character of the city. Beacon is beautifully situated between the Hudson River to the west and the mountains of Fishkill Ridge to the east, with Fishkill Creek running through the middle. These natural features lie within the Hudson Highlands, which is a region that the state of New York recognizes for its high scenic quality. Beacon's location affords the city numerous scenic resources that provide cultural and economic value, while contributing to the preservation of open space and habitat. These scenic resources are vital to Beacon's high quality of life and growing tourism industry. The City of Beacon's Comprehensive Plan includes recommendations to protect the city's scenic resources as part of its plan for future development.

What This Map Shows:

Beacon has three primary natural scenic viewsheds: The Hudson River, Fishkill Creek, and Fishkill Ridge, which includes Mount Beacon.

- Long Dock Park, Riverfront Park, and Dennings Point afford direct river viewpoints with walking trails, playground equipment, picnic areas, fishing areas and boat launching facilities.

- The Greenway Trail and Madam Brett Park offer access to Fishkill Creek for walking, biking, fishing, and bird watching.

- Mount Beacon Park and its interconnected trails offer views of the entire city of Beacon and beyond, including Fishkill Creek, the Hudson River, the mountains of the Hudson Highlands, and the Shawangunk Ridge.

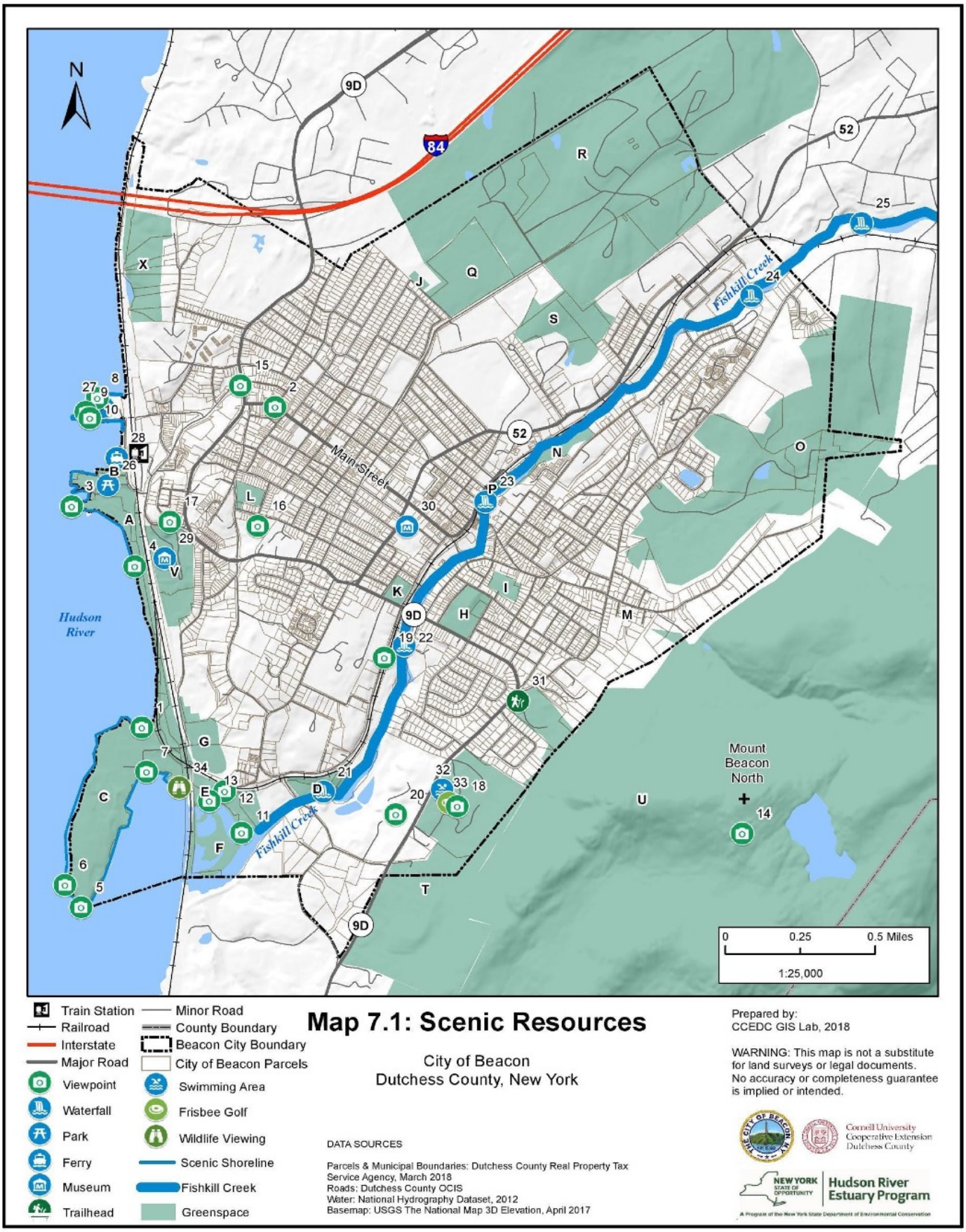
Implications for Decision-making:

- Ensure that preserving Beacon's scenic resources and viewsheds remains a top priority during any development plans that affect the city's three primary scenic viewsheds: the Hudson River, Fishkill Creek, and Fishkill Ridge, which includes Mount Beacon;
- Seek to expand direct access to the Hudson River for outdoor recreation; and
- Create multi-use linkages (e.g., walking and biking paths) that connect Beacon's three main scenic areas, to increase accessibility for residents and tourists.

This information largely comes from New York State Department of State's Scenic Areas of Statewide Significance report , City of Beacon Comprehensive Plan, and The National Register of Historic Places. For more information on these topics, see the References section.

View of Beacon from Mount Beacon Summit.

Map 7.1 Scenic Resources



7.2 Cultural Resources

Why This is Relevant to Beacon

Beacon has a rich cultural history, including Native American settlements, well-preserved colonial landmarks, and a plethora of historic buildings that highlight the city's colonial and industrial past. Beacon's built environment - from the buildings that house businesses on Main Street to the historic landmarks - form part of the cultural fabric of Beacon's identity. As former factories get converted into condominiums, hotels, and other businesses, and the renovation of the city's historic brick buildings create new shops and restaurants, it is more important than ever to honor Beacon's past as the city builds its future. Beacon's Comprehensive Plan states that residents regularly cite the city's historical and cultural legacy as a point of pride and distinction.

What This Map Shows

Main Street in Beacon, as well as its environs, is dotted with cultural and historical landmarks including Madam Brett Homestead Museum, Howland Library, Howland Cultural Center, DIA:Beacon, Mount Gulian Historic Site, and many more. Beacon contains many historic religious institutions such as St. Luke's Episcopal Church, Reformed Dutch Church of Fishkill Landing, United Methodist Church, St Lawrence Friary, Carmelite Communion Nunnery, and the Beacon Hebrew Alliance.

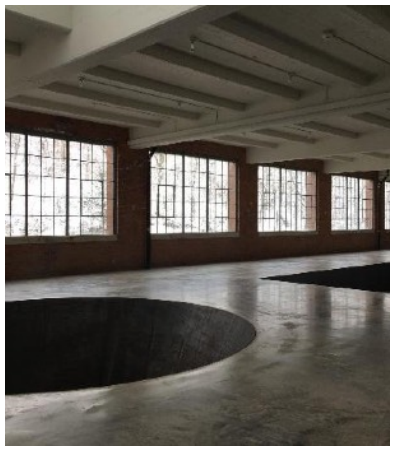
Beacon also contains a number of scenic buildings and structures on the National Register of Historic Places, including:

- Mount Gulian State Historic Site;
- Mt. Beacon Inclined Railway;
- Mt. Beacon Fire Observation Tower;
- Tioronda Bridge (former);
- Eustatia; and
- Lower Main Street Historic District.

Implications for Decision-making

- Consider preserving historic structures, even ones not listed on the State or National Registers of Historic Places. If modified, consider how best to retain historical character, and incentivize maintenance;
- Periodically evaluate historic sites, structures and buildings within the city for proposal for inclusion on the State or National Registers of Historic Places; and
- Research, identify, and honor pre-colonial historic sites, including those of importance to Beacon's indigenous people.

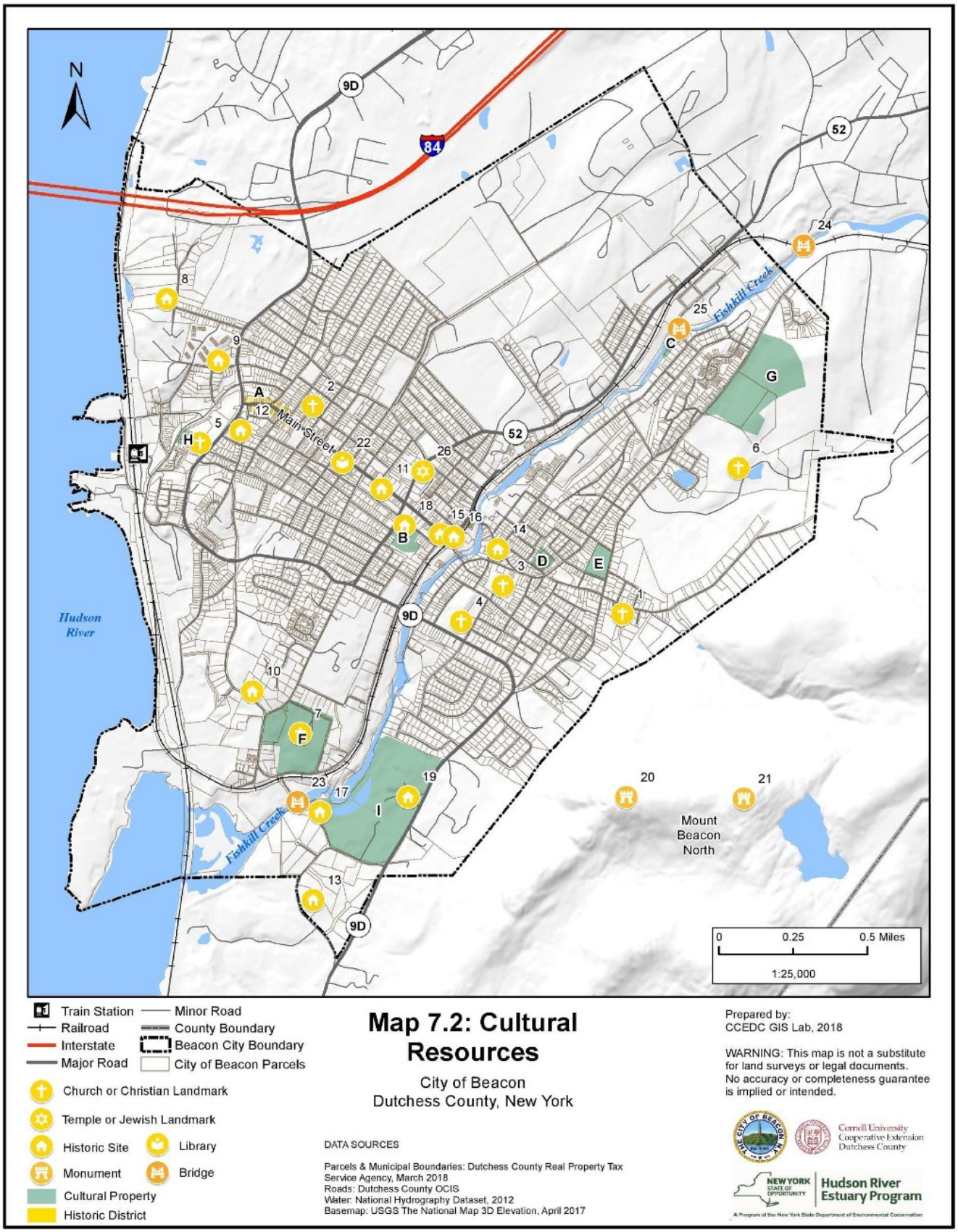
This information largely comes from the City of Beacon's Comprehensive Plan and the Dutchess County NRI. For more information on these topics, see the References section.



Dia:Beacon.

Howland Cultural Center

Map 7.2 Cultural Resources



7.3 Recreational Resources

Why This is Relevant to Beacon

Recreational opportunities abound in Beacon. Indeed, the city is known for the diversity of high-quality outdoor activities right at its doorstep. One can hike Mount Beacon, cast a line in Fishkill Creek, and birdwatch along the Hudson River. Hiking, biking, fishing, boating, wildlife viewing, playgrounds, sport fields and courts, and more greet the recreation enthusiast looking for a chance to get outside. The city's public parks such as Memorial Park and Pete and Toshi Seeger Riverfront Park, combined with Scenic Hudson-owned parks like the Mount Beacon Park trailhead, Long Dock Park, and a unit of Hudson Highlands State Park at Dennings Point, provide the outdoor enthusiast or the casual citizen with ample recreational opportunities within the city's neighborhoods, or among its protected mountains, woods, creeks, and trails.

What This Map Shows

Beacon contains a wide variety of recreational resources that belies the city's small size:

- Sport fields and courts for basketball, soccer, tennis, football, baseball and softball, a frisbee golf course, fishing piers, a skatepark, track, and more can all be found within the city's public parks such as Memorial Park, Greene Street Park, South Avenue Park, and at The Settlement Camp. Additionally, Southern Dutchess Country Club offers golf.

- Beacon's parks boast five picnic pavilions, several picnic areas, four playgrounds, an official dog park, a natural play area, and miles of walking paths.

- Beacon offers swimming at the Beacon Pool at The Settlement Camp, Riverpool in the Hudson River (pictured right), lap swim and open swim at the Beacon High School pool, and community pool membership at Southern Dutchess Country Club.

- Nature is always nearby with miles of hiking trails, mountains, waterfalls, creeks, and the Hudson River. The city park of Hiddenbrook, Scenic Hudson parks such as Long Dock Park, Madam Brett Park, and Mount Beacon, Hudson Highlands State Park's Dennings Point unit, and more all offer opportunities for exploring Beacon's natural environment.

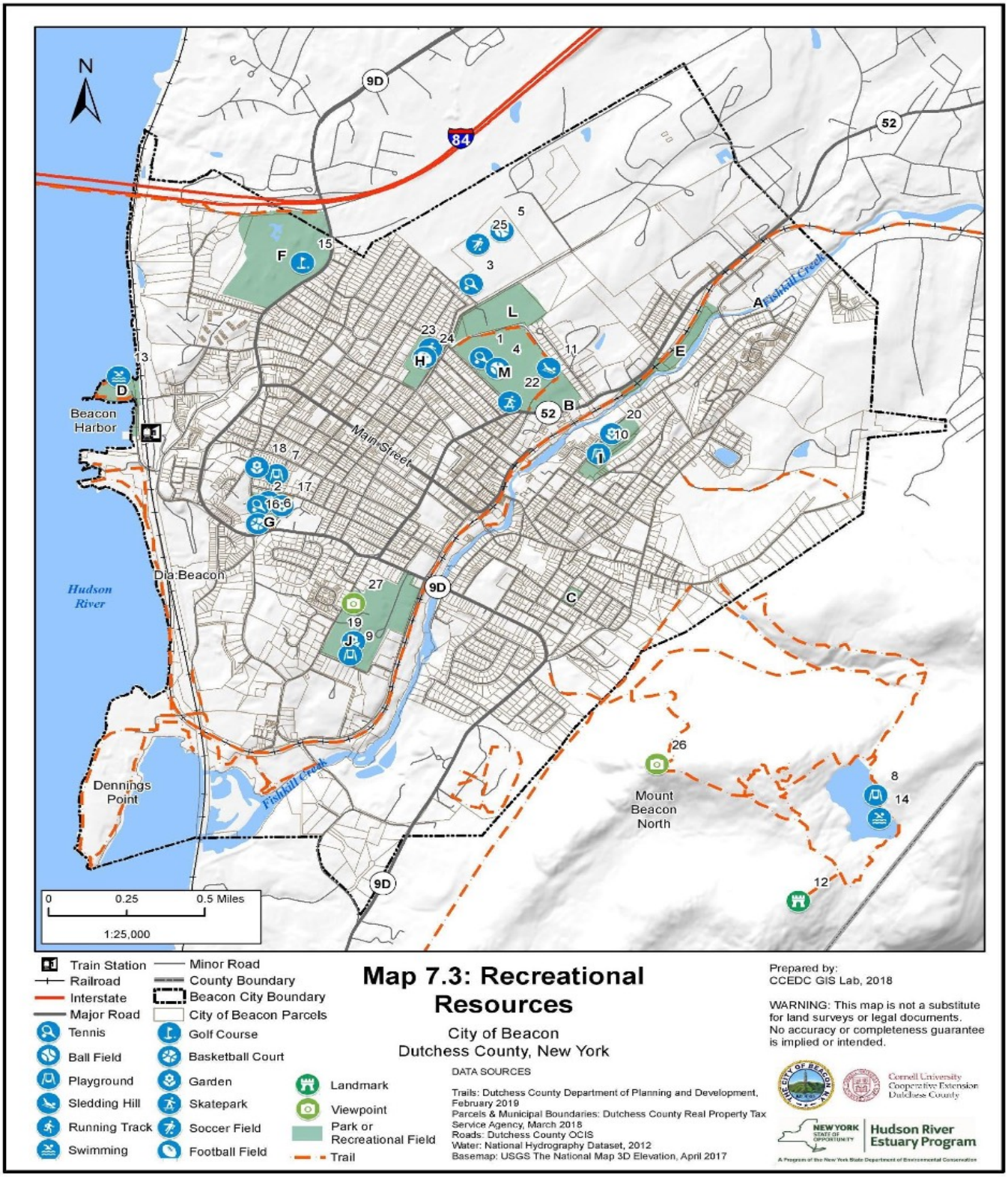
Implications for Decision-making

- Maintain and, where possible, increase access to the Hudson River and Fishkill Creek;
- Preserve open space and protect large tracts of forest, field, and waterfront;
- Ensure that various recreational opportunities are accessible to all and for all;
- Partner with non-profit partners like Scenic Hudson and state entities like NYS Office of Parks, Recreation, and Historic Preservation for the effective management of their properties within the city limits; and
- Consider adding more land dedicated to recreation to meet the National Recreation and Park Association's standard of 10 acres per 1,000 residents.

This information largely comes from City of Beacon Parks and Recreation, and Scenic Hudson. For more information on these topics, see the References section.

The Riverpool at Riverfront Park.

Map 7.3 Recreational Resources



8.0 Current and Future Challenges: Human Health, Population Growth, Water Supply, and Climate Change

Why This is Relevant to Beacon

Population growth and climate change are pressing global challenges. By 2050, the human population vulnerable to floods is expected to at least double to two billion. Through this lens, Beacon's current and future challenges are part of a global trend and are directly related to human safety and quality of life.

Communities anticipating future changes have the ability to ensure that they will continue to thrive naturally and economically. Beacon is uniquely situated in nature with advantageous proximity to New York City, a metropolitan hub of commerce, international and cultural distinction, theatre, music, visual, and culinary arts.

The combination of Beacon's and neighboring towns' historic industrial buildings, and its proximity to the Metro North, makes Beacon both a residential and commuter city of interest to long-standing and incoming residents and businesses alike. These uncommon qualities that support economic diversity are worth utilizing and protecting for future generations by protecting the natural environment and, in turn, human health.

What These Tables Show

Tables to the right show statistics of historic and future population growth projections in Beacon and neighboring communities.

Implications for Decision-making

- Revisit low-impact areas for high-density development;
- Increase public transportation;
- Incentivize green infrastructure;
- Develop land trust solutions for city-held property;
- Educate residents on conservation; and
- Create a city-wide sustainability policy specific to development.

Population statistics of Beacon and surrounding communities shows population increase of 10.9% in Beacon over 35 years (excerpted from the Beacon Comprehensive Plan).

Table 3-1: Population of the City of Beacon & Surrounding Communities, 1980 to 2015

Year	City of Beacon	City of Newburgh	City of Poughkeepsie	Town of Wappinger	Town of Fishkill
			Population Count		
1980	12,937	23,438	29,757	26,776	15,506
1990	13,243	26,454	28,844	26,008	17,655
2000	13,808	28,259	29,871	26,274	19,256
2010	14,599	28,866	31,045	27,048	23,049
2015	14,347	28,290	30,371	N/A	N/A
			Percent Change		
1980-1990	+2.4%	+12.9%	-3.1%	-2.9%	+13.9%
1990-2000	+4.3	+6.8%	+3.6%	+1.0%	+9.1%
2000-2010	+5.7%	+2.1%	+3.9%	+2.9%	+19.7%
2010-2015	-1.7%	-2.0%	-2.2%	N/A	N/A
1980-2015	+10.9%	+20.7%	+2.1%	N/A	N/A

Source: US Census Bureau, Decennial Censuses & 2015 Annual Resident Population Estimate.

Table of Beacon and surrounding communities between 2010 and 2021 forecasts an additional 10% increase in Beacon. Projected increase in surrounding towns is less than 5%.

Table 3-2: Population of the City of Beacon & Surrounding Communities, 2010-2021

Year	City of Beacon	City of Newburgh	City of Poughkeepsie	Town of Wappinger	Town of Fishkill
2010 (historic)	14,599	28,866	31,045	27,048	23,049
2021 (forecasted)	16,054	30,473	31,961	28,265	23,600
Change, 2010-2021	+10.0%	+5.6%	+3.0%	+4.5%	+2.4%

Source: US Census Bureau, 2010 Decennial Census & ESRI Population Forecasts, 2021.

Table of Beacon's ethnic and racial communities shows a decline of Black, Asian, and Latino communities in the four years immediately following a population surge.

Table 3-3: Population by Mutually Exclusive Race-Ethnicity, City of Beacon, 2000 to 2014

	Count			Change	
	2000	2010*	2014	2000-2010	2010-2014
Total population	13,808	14,599	14,437	+12.6%	-7.1%
White, non Hispanic	8,377	7,828	8,211	-0.5%	1.5%
Black or African American, non-Hispanic	2,556	3,036	2,494	+26.4%	-22.8%
Asian/Other, non-Hispanic	232	333	312	+53.0%	-12.1%
Two or more races, non-Hispanic	309	378	499	+30.1%	+24.1%
Hispanic or Latino	2,334	3,024	2,921	+37.9%	-9.3%

Note: [*] Race and ethnicity population estimated for 2010 by Urbanomics based on the 2010 Decennial Census and following population count revision released by the US Census Bureau on 10/22/2012.

Source: US Census Bureau, 2000-2010 Decennial Censuses & ACS 2010-2014 5-Year Estimate.

This table reflects Housing supply comparison of Beacon to Dutchess County. From 2000 - 2010 Beacon's supply increased about half as much as the county. From 2010-2014, both growth rates slowed, but Beacon's supply was 13 times greater than the county's.

Table 3-6: Housing Supply

	Count			Percent Change	
	2000	2010	2014	2000-2010	2010-2014
City of Beacon	5,406	5,715	5,862	+5.7%	+2.6%
Dutchess County	106,103	118,638	118,848	+11.8%	+0.2%

Source: US Census Bureau, 2000-2010 Decennial Censuses & ACS 2010-2014 5-Year Estimate.

The information for Chapter 8 largely comes from the US Census Bureau, the City of Beacon's Comprehensive Plan, the Dutchess County NRI, the City of Beacon Parks and Recreation, and Scenic Hudson. For more information on these topics, see the References section.

8.1 Current and Future Challenges: Human Health, Development, and Brownfields

Why This is Relevant to Beacon

From the 2016 census to long term build-out estimates, Beacon is facing a 30% population growth. An increase of human activity means more cars, more emissions, more waste management, more energy use, and more environmental pressures. Examples of the rippling environmental impacts of human population increase are identified below.

At the time of this writing (2019), Beacon's transportation infrastructure is being updated. For instance, aging sidewalks are being replaced and, in some areas, installed for the first time. Traffic patterns are being considered as pedestrian, bicycle, and other recreational traffic increases in areas that were once dominated by cars.

Beacon's large population of incarcerated individuals is not included in the city's population estimates. However, they affect Beacon's and surrounding areas' water and sewer systems, and have the same needs for clean water.

Impervious surfaces increase when vegetated areas are converted to roads, parking lots, and rooftops. This means that waterflow from storms and flooding will not absorb into the earth. Increased runoff changes nearby waterways. It may negatively affect aquatic life and water quality, while causing erosion to streambanks.

Former Texaco Research Center in Glenham. This site has been discussed for potential development.

West End Lofts on Wolcott Ave required tree removal and increased impervious surfaces locally.

What This Map Shows

This is a future land use map from the City of Beacon Comprehensive Plan, dated April 14, 2017. It does not specifically include neighboring municipality brownfield areas for potential development, nor Comprehensive Plan discussions of future zoning within the city.

Implications for Decision-making

Population increase is inevitable, and Beacon's is a result of growing families, the elderly wishing to remain in Beacon, and an influx of new people seeking residency in Beacon and neighboring communities. There are also a number of brownfields and power-plants in the area including:

- the former Texaco research site in Glenham;
- Danskammer in Newburgh;
- CPV Energy Center in Middletown; and
- Cricket Valley Energy Center in Dover.

Following Scenic Hudson's model, Beacon could act as a lead city in the environmental restoration process. Rather than developing new sites in town, focus instead on supporting collaborative research and redevelopment of existing impacted sites (such as abandoned buildings) among neighboring towns for businesses and residential units, therefore protecting the natural habitats that makes Beacon one of the most desirable places to live in 2019. The discussion of Beacon's population, development, and water supply are inherently tied to environmental protection.

Map 8.1 Future Land Use Map

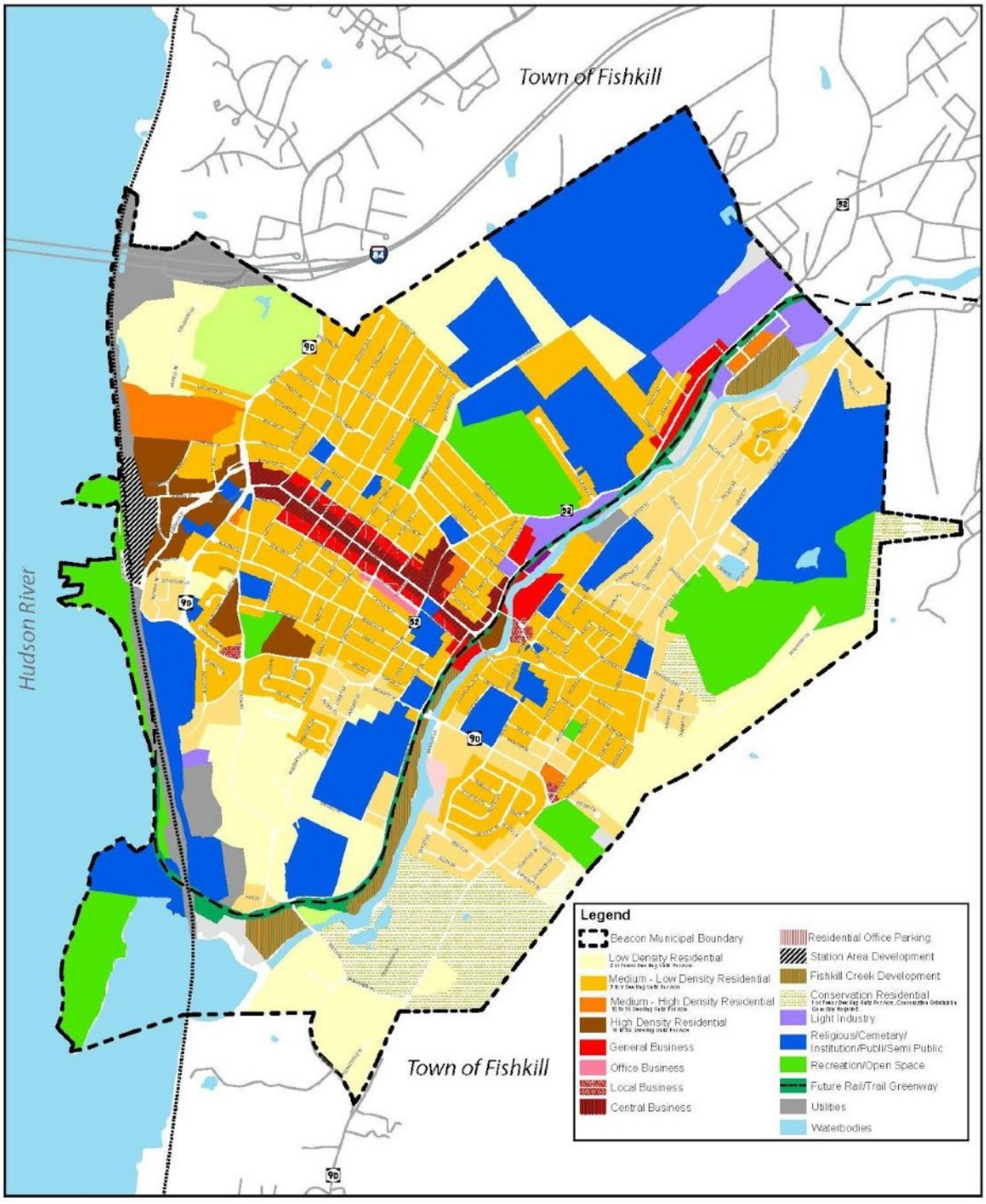


FIGURE 11-1: FUTURE LAND USE MAP

CITY OF BEACON COMPREHENSIVE PLAN UPDATE

BFJ Planning

8.2 Current and Future Challenges: Human Health and Water Supply

Why This is Relevant to Beacon

According to Beacon's Comprehensive Water Supply Plan, Beacon's current development projects are expected to increase the population by 13-15% between 2016 and 2019. In addition, the population is expected to increase by another 15% at maximum build-out. By 2050, 32% of counties in the United States are projected to be at high or extreme risk of water shortages. Although the Hudson Valley is not heavily impacted in these national projections, unmitigated population increase, and non-renewable power plant production would have negative impacts on the long-term security of clean water in Beacon and the Hudson Valley.

Beacon's Comprehensive Plan identifies that the water supply can meet the needs of more than a 10% residential population growth between 2010 and 2021. This projection does not clearly reveal how it will support an up-to-15% population increase by 2019. Care must be taken now to ensure collaborative protections for the infrastructure and sources of drinking water in the region.

Altered groundwater recharge due to development, as well as an intensified demand on supply due to resident, commuter, and tourist population increases, will pose challenges for the maintenance of consistent, high-quality water supply.

What This Map Shows

Beacon's water supply wells and reservoirs are located in the neighboring towns of Fishkill and Philipstown. The interjurisdictional nature of Beacon's water sources limits the city's ability to sufficiently enact or enforce source water protection planning.

Implications for Decision-making

Climate change is making water supply less predictable due to droughts, floods, and pollution. Aging infrastructure in Beacon will require ongoing monitoring and periodic replacement to ensure proper flow.

According to the Comprehensive Water Supply Plan of March 2018, infrastructure leaks accounted for a 22% loss on output. At the current rate of development, in order to supply enough water to Beacon's growing population, infrastructure leaks will need to be fully repaired by the time the build-out is complete.

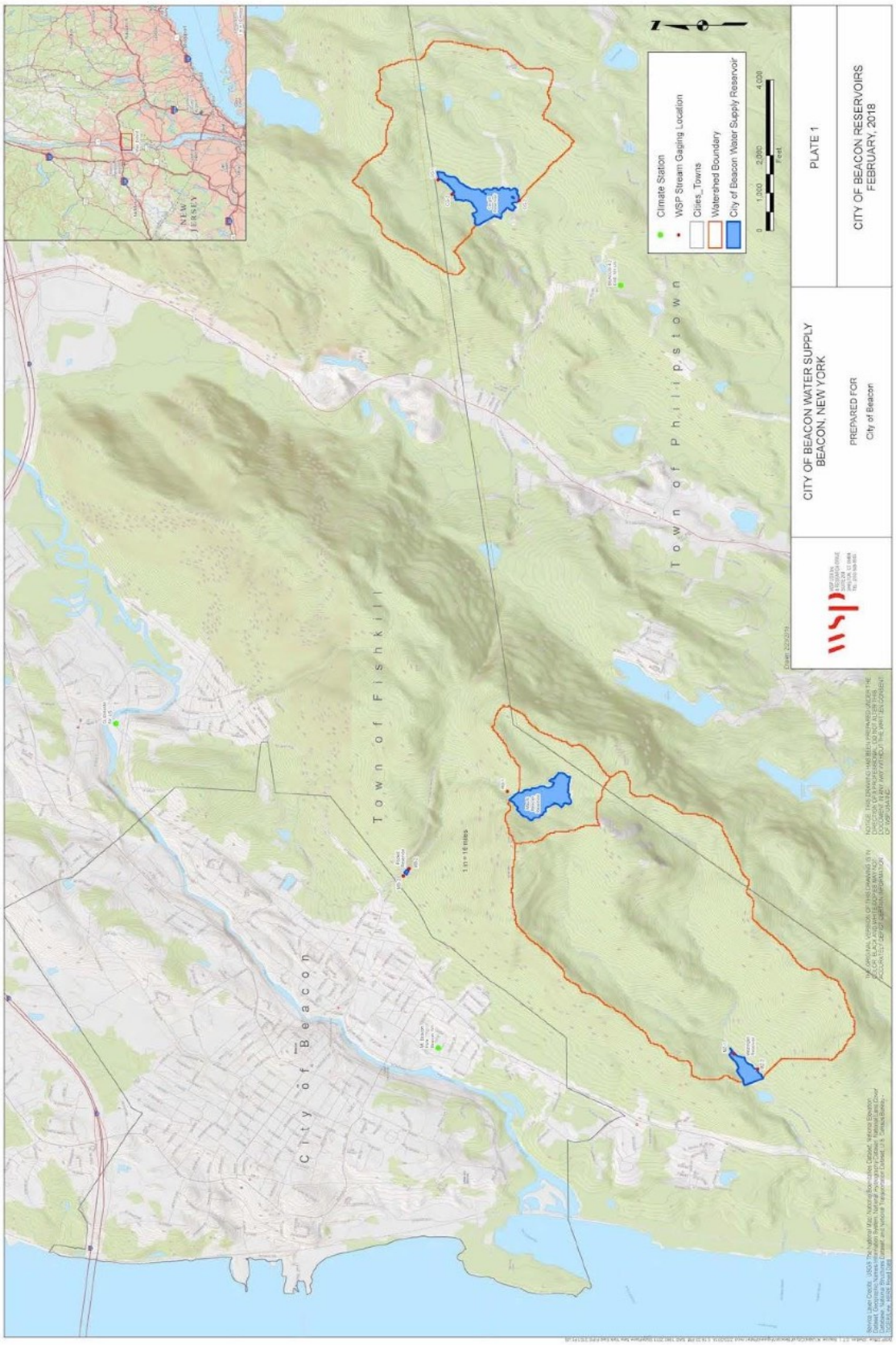
Greenhouse gas emissions and water supply pollution from neighboring municipality power-plants and brownfields require extra consideration in securing Beacon's water supply for the long term.

A moratorium on the city's development in 2017 was conducted to quantify future water supply. An additional study to focus on water quality may be beneficial. Meanwhile, creating requirements to ensure that new developers and infrastructure projects establish water-source preservation plans in their designs would help further protect water quantity and quality.

Low-flow showers and toilets; rooftop gardens; rainwater / greywater catchment systems; and stormwater gardens and swales are all accessible investments in water protection.

New sidewalks being installed along the east end of Main Street in June 2019.

Map 8.2 Water Supply



8.3 Current and Future Challenges: Human Health, Flooding, and Climate Change

Why This is Relevant to Beacon

Climate change, describing significant changes in climate over long periods of time, is the paramount environmental issue now and in the coming decades. Climate change effects, like increased precipitation, extreme weather events and sea level rise, will directly affect Beacon.

According to Cornell University, "New York's Climate is changing faster than national and global averages." Their study charts describe exponential increases in climate related extreme weather events.

What This Map Shows

A "100-year flood" is a high-intensity flood with a 1% likelihood of occurring any year; or, one that typically occurs only once every 100 years. These events are becoming increasingly common due to climate change. Areas within 100-year flood zones may now be in danger of frequent flooding.

Hudson River - At the upper range, some forecasts estimate that water levels will rise as much 6 feet within 100 years. Beacon's waterfront will be severely impacted by these changes, with Long Dock Park, Metro North, the Pete and Toshi Seeger Riverfront Park, and Dennings Point lying within the AE 100-year Flood Zone. Flooding in these areas will significantly impact tourism, recreation, and commuting.

Fishkill Creek - A floodway area surrounds Fishkill Creek through Beacon. Several small sites in the city, including The Lofts at Beacon, lay in the AE 100-year Flood Zone. Additional areas noncontiguous to the creek lay within the A 100-year Flood Zone.

In general, flooding and sea level rise threaten infrastructure in various locations throughout Beacon.

Implications for Decision-making

Every community has the opportunity to develop unique solutions. Green infrastructure should be considered in all development to help mitigate environmental events.

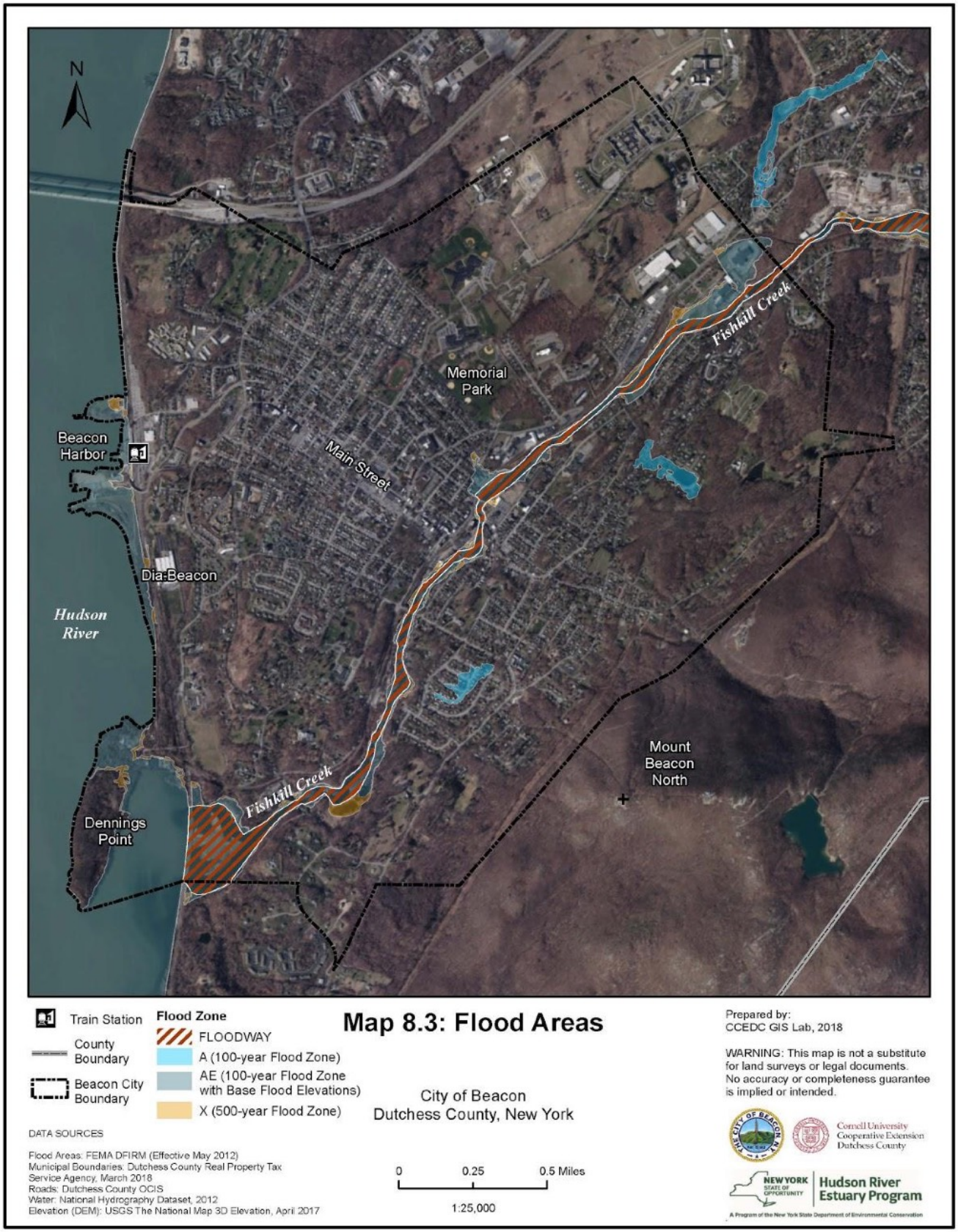
Climate change will impact food security, efforts toward disease prevention, and the economy at large. Resiliency plans are crucial to future survival rates and successful communities. Creating a plan to conserve wetlands and forests to manage stormwater, recharge groundwater, and mitigate flooding would be highly beneficial, and may include recommendations to:

- conserve, revegetate and reconnect floodplains and buffers in riparian areas;
- prohibit new construction in flood-prone areas;
- protect bluffs and eroding cliffs from disturbance or development; and
- increase tree canopy to reduce heat impacts.

Graphic of Green Infrastructure provided by the Environmental Cooperative at Vassar Barns

Metro-North parking lot flooded by the Hudson River in 2017. P

Map 8.3 Flood Areas



9.0 Implications of the NRI for Local Decision-making

The City of Beacon's Natural Resources Inventory is a public resource for all stakeholders interested in learning more about Beacon's rich natural environment. As the data was assessed within the NRI, common themes emerged that have considerable implications across all of the city's natural resources. As noted in Section 1.0 Introduction, the NRI resulted in these high-level recommendations:

- Consider climate change mitigation and adaptation in decision-making across all sectors;
- Engage Beacon residents in the stewardship of our natural resources; and
- Consider the impact of future development on Beacon's natural resources.

These recommendations are outlined in greater detail below.

Consider climate change mitigation and adaptation in decision-making across all sectors

Climate change is the biggest threat today, both globally and locally. To help Beacon prepare for and adapt to a changing climate:

- Create plans to mitigate flooding and sea level rise;
- Create emergency storm management and community adaptation plans;
- Inventory our emissions, energy use, and municipal material sourcing; and
- Create a local Climate Action Plan, which outlines the policies and measures that Beacon can enact to reduce greenhouse gas emissions and increase the community's resilience to climate change.

Engage Beacon residents in the stewardship of our natural resources

Despite the negative impact humans have had on Beacon's natural environment, its residents are the greatest asset in protecting and stewarding Beacon's natural resources. Beacon residents should:

- Keep the people of Beacon and its surrounding communities engaged in decision-making around protecting natural resources; and
- Increase public access to Beacon's natural resources, such as the Hudson River, Fishkill Creek, and the Hudson Highlands, as part of a comprehensive strategy to expand and promote our city's natural environment.

Minimize the impact of development on Beacon's natural resources

As Beacon continues to grow and flourish, its residents should:

- Pursue proactive conservation of priority resources, including development of an open space plan and participation in broad efforts like watershed planning for Fishkill Creek, and considering designations such as "critical environmental areas" as a tool to bring conservation attention to the community's priorities; and
- Consider each proposed development, redevelopment, and/or infrastructure adjustment with respect to its potential effect on Beacon's natural, cultural, and scenic resources.

10.0 What Comes Next and Acknowledgements

What Comes Next

We hope this document is useful to Beacon city officials, committees, and residents as they learn about the city's environment and lead towards Beacon's future with consideration of its natural context.

We hope that this NRI can be the basis for developing an Open Space Plan for Beacon, and for guiding city-wide as well as site-specific plans and developments.

If you have related information that you would like included in the online resources related to this document, or would like to be part of ongoing conversations related to the content in this NRI, please contact the city's Conservation Advisory Committee (CAC) at beaconcac@cityofbeacon.org. The CAC holds monthly meetings and welcomes the public: see the City of Beacon's website for the time and location of their next meeting.

Thank you!

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On behalf of all the inhabitants of the City and Beacon's environmental future, thank you!

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