ALBANY WATER FORESTLAND

Working Woodlands Forest Management Plan

Land Owner: Albany Water Board
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Plan Date: December 12, 2018
Plan Expiration: December 12, 2028

Tract Location: Towns of Coeymans and Westerlo, Albany County, NY
Lat. 42.470089, Long. -73.926330

Tract Size: 6,601 acres | 2,672 hectares (GIS)
FSC Forestlands: 4,719 acres | 1,910 hectares (GIS)

Land Manager: Albany Department of Water & Water Supply
The Nature Conservancy, New York Program

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1. Introduction, Purpose & Goals

The Albany Water Board and Albany Department of Water & Water Supply work together with a mission to deliver a reliable and high-quality supply of water for their customers, including fire protection, and operate storm water and sewer infrastructure in and around the city. The Department operates three major storage and distribution reservoirs and various other facilities and infrastructure, that together produce over 19 million gallons of water per day with a goal of 100% reliability in both the quality and quantity of water they provide. To help protect this water supply, the Albany Water Board has also acquired approximately 6,600 acres of land surrounding the Alcove and Basic Creek reservoirs. These lands provide an important buffer for the water supply, naturally filtering and regulating groundwater that flows into the reservoirs and their tributaries.

1.1 Working Woodlands Program

In 2017, the Albany Water Board enrolled in The Nature Conservancy's Working Woodlands program to protect and manage the water supply lands surrounding the Alcove Reservoir, Basic Creek Reservoir, and Troutner Lake. Together, these three distinct properties are referred to as the Albany Water Forestlands. The Nature Conservancy is an international not-for-profit conservation organization whose mission is to protect the lands and waters upon which all life depends. The Nature Conservancy has a long track-record of working with landowners to protect their land and water for the benefit of both people and nature. The Working Woodlands program offers forest landowners an opportunity to ensure sustainable forest management while generating revenue from improved forest management and emerging carbon markets.

There are three main components to a Working Woodlands project: generation and sale of carbon offset credits, development of a sustainable forest management plan with 3rd party certification and long-term protection of the property through a working forest conservation easement. Sustainable forest management with a focus on carbon sequestration allows for more carbon to be removed from the atmosphere and stored in the trees than typical management focused on maximizing timber revenues, and provides important co-benefits such as protecting water quality and wildlife habitat. There is no direct cost to the landowner for participation, and they can continue to generate revenue from their property through the sale of both timber and forest carbon credits.

Working in partnership with The Nature Conservancy, the Albany Water Board and Department of Water & Water Supply will integrate all three of these components into the Albany Water Forestland Working Woodlands project. This Forest Management Plan will help to maintain water quality and other forest values by using the best available science to develop and guide active management strategies that promote a vigorous and resilient forest. The enhanced growth and carbon sequestration will be monetized, and the proceeds from carbon sales will provide funding that directly supports the stewardship and management of water supply lands. In addition, the Albany Water Board intends to grant a Conservation Easement on most of the

property to ensure that the water supply, as well as other social and ecological benefits provided by these lands, are protected into the future.

1.2 Forest Certification

As part of The Nature Conservancy's Working Woodlands program and the long-term commitment to sustainable forest management, the Albany Water Forestland properties included in the Working Woodlands project area will be enrolled in the Conservancy's Forest Stewardship Council (FSC) group certificate. Non-forested portions of the property (developed areas, agricultural areas, reservoirs, dam infrastructure, etc.) were not included in the Working Woodlands project as the current and potential future land use in these areas differs significantly from managed forestland. In total, 4,719 acres are FSC certified under the Working Woodlands project as of July 2018, including the entire 4,439 acres that is included in the carbon offset project area. The discrepancy in acreages is due to the exclusion of areas that do not support continuous forest cover (specifically wetlands) from the carbon offset project. (see Appendix 1 for maps of the various project area boundaries).

FSC certification includes third-party verification that any forest management activities are sustainable and conducted in an ecologically and socially responsible manner. Information on FSC principles and management criteria can be found at https://us.fsc.org/en-us. Regardless of FSC certification status, the Albany Department of Water & Water Supply strives to manage its entire ownership in a manner that is socially and ecologically responsible, while meeting water supply goals.

1.3 Stakeholder Engagement

In order to provide an avenue for stakeholder input on this Forest Management Plan, a draft of the Plan will be made public on the Albany Department of Water & Water Supply website and various stakeholders will be able to provide comments to the Department via phone or email. A summary of the Plan will also be presented during an Albany Water Board monthly meeting in October of 2018, which will be open to the public and provide another opportunity for comments. Local town offices and other key partners will also receive direct notifications that the draft Plan is available for review. Once completed, the final Plan will remain available on the Department website, and a list of plan reviewers, stakeholders and comments will be kept on file with the Department and The Nature Conservancy.

View looking southwest across the Alcove Reservoir toward the Catskill Mountains.

1.4 Forest Management Guiding Principles & Goals

As described above, the mission of the Albany Water Board and Department of Water & Water Supply is focused on the delivery of a reliable supply of high quality water to its customers. They also recognize that water quality is directly linked to the extent and health of forests in the watershed area, and that there are other important social, ecological and economic benefits that are gained by maintaining the quality and vigor of the forests in the watershed.

The United States Department of Agriculture's (USDA) Forests to Faucets program ranks the Alcove Reservoir/Hannacrois Creek watershed in their highest category (91-100, on a scale of 0-100) for the importance of the watershed to the drinking water supply, and in the third highest category (71-80, on a scale of 0-100) for the importance of the surrounding forest to maintaining the drinking water supply. See the USDA Forests to Faucets website for additional detail.. Numerous other scientific studies support the concept that properly managed watershed forestlands can protect drinking water supplies and reduce water treatment costs (see Ernst, 2004 as an example).

As detailed further in this Plan, it is also recognized that several conditions exist which jeopardize the future viability of the Albany Water Forestlands and their ability to continue to provide important watershed and source water protection benefits.

- Over 40% of the forestlands were found to be at 80% or more of their projected maximum density of trees, indicating that competition among individual trees is high. This leads to decreased growth and vigor of individual trees over time, and increased susceptibility to diseases, pests and other damaging agents. Active management to thin the forest can increase the availability of light, water, nutrients and other resources, thereby increasing the vigor and productivity of residual trees.

- The number of healthy young seedlings and saplings in the forest is very low, and likely not sufficient to fully replace the existing forest as trees age and succumb to natural mortality. Regeneration of desirable species—those that are resistant to pests/disease and can produce high quality trees—is particularly sparse, indicating that any subsequent forest will be lacking in quality and vigor. The scarcity of young trees is even more alarming given the potential negative impacts of climate change, introduced forests pests and other exacerbating conditions.

- White-tailed deer browse impacts on small trees are widespread and severe across Albany Water Forestlands. Data from the forest inventory suggests that nearly 80% of the property is highly impacted by deer and not likely to successfully regenerate following natural disturbances or management activities without active intervention to reduce deer browsing.

- While not as extensive as deer browse impacts, invasive plants—which compete with small trees for light and other resources and limit native forest undergrowth—are common. In some areas, invasive plants were present on as many as 35-45% of sample plots surveyed during the forest inventory.

Forest Management Principles

Based on this understanding of the importance of healthy forests to water quality and the current condition of forest on Albany Water Forestlands, the following forest management principles and goals were identified. These provide the direction and vision for the development of this Forest Management Plan, as well as the future management of the property.

Principle 1: Vigorous and resilient forest cover in a watershed promotes high quality water.

Forest cover in a source watershed provides myriad benefits over other land cover types in terms of maintaining water quality and regulating water flows from the watershed over time. Forest vegetation promotes infiltration of water into soils, reducing runoff and associated erosion and sedimentation of streams and other surface waters. Increased infiltration and snowpack retention slow the release of water into streams and rivers, mitigating flood risk and promoting a steadier supply of water throughout the year. Forest cover also helps to reduce nutrient flow into water supplies. As forest health declines—be it the result of climate change, poor management practices, forest pest outbreaks or excessive deer browse—the benefits to water quality provided by the forest also decline, impacting water quality and driving up water treatment costs.

Principle 2: Albany Water Forestlands can be managed to provide multiple economic, ecological and societal benefits.

Properly managing watershed lands to maximize water quality and quantity benefits can be fully compatible with providing a variety of other co-benefits, including generating revenue through carbon credit sales, contributing to local economic development from sustainable timber harvesting, conserving and creating high quality wildlife habitat, and providing public use and

enjoyment of aesthetic and recreational resources. In fact, many are complimentary. For example, active forest management that benefits the local economy can also improve forest health and condition, actively furthering water quality goals.

Forest Management Goals

Based on the principles above, the following goals were developed to provide a framework for this Forest Management Plan. As the primary property manager, the Department of Water & Water Supply strives achieve these goals within the constraints of managing the security of the water supply and associated infrastructure.

1. Maximize the capacity of the forest to promote a clean and continuous supply of water from the watershed by improving forest condition and resilience to climate change and other disturbances.

2. Generate revenue and help mitigate the impacts of climate change by enhancing carbon sequestration though improved forest management practices, and the associated generation and sale of carbon offset credits on the voluntary market.

3. Improve forest health and vigor through active forest management, encourage regeneration of resilient and desirable species and mitigate unwanted impacts of deer, invasive plants and other damaging agents. To the extent possible, conduct management in a way that produces financial returns to the Albany Department of Water & Water Supply from sustainable harvesting of timber and/or production of other forest products, and provides economic benefits to local communities.

4. Protect rare or unique species, wildlife habitat and other ecological values on the property. Where appropriate, favor forest management techniques that produce a diversity of forest successional and/or structural conditions over those that lead to widespread and uniform forest condition.

5. Provide opportunities for public recreation and other enjoyment of the property, to the extent that it is compatible with protection of the water supply and the above listed goals.

2. Property Description

2.1 Property Location & Description

The Albany Water Forestlands include three distinct properties surrounding the Alcove Reservoir, Basic Creek Reservoir and Troutner Lake in the towns of Coeymans and Westerlo, south-central Albany County, NY (Figure 1.). The Alcove Reservoir property lies in the town of Coeymans and Alcove roughly 6-8 miles west of the Hudson River, near the Hamlet of Coeymans Hollow and Alcove. It is bisected by New York State (NYS) Routes 143 and 32, as well as Albany County Route 411 and a number of smaller local roads. The Basic Creek Reservoir property is located in the town of Westerlo just to the west along Albany County Route 404, with a narrow finger of ownership connecting the two properties. Troutner Lake lies in the town of Westerlo about 3 miles to the north of the other properties, just north of the hamlet of Westerlo along New York State Route 143.

In total, Albany Water Forestlands cover approximately 6,600 acres, including 1,670 acres of open water in the three lakes. Table 1 provides a breakdown of the general land cover and project areas. The region typically receives just under 40 inches of precipitation per year, including nearly 60 inches of snow. Average monthly high temperatures range from 82°F in July to 31°F in January. The coldest monthly average minimum temperature is in January at 15°F. (US Climate Data, 2018).

Property	Total Acres	Open Water Acres	Total Land Acres	Natural Land Cover Acres	FSC Certified Acres	Carbon Offset Project Acres	Reservoir Capacity (gal.)
Alcove	5,535	1,396	4,139	4,069	4,026	3,828	13.5 billion
Basic	854	243	611	583	554	497	716 million
Troutner	212	31	181	139	139	114	NA
Total	**6,601**	**1,670**	**4,931**	**4,791**	**4,719**	**4,439**	**12.7 billion**

Table 1. Albany Water Forestland property with acres of land cover and project area acres. Acreages calculated in GIS based on available Albany County tax parcel data and digitized aerial imagery from 2014 and 2017.

2.2 Ownership, Management & Use Rights

All of the Albany Water Forestlands are owned in fee by the Albany Water Board. The Albany Department of Water & Water Supply manages these properties on their behalf and various portions of the property are subject to other legal interests, including leases, license agreements and management plans. While there has not been any active management on the properties in some time, the Department is working in partnership with The Nature Conservancy to begin actively and sustainably managing the forest and associated resource son the property.

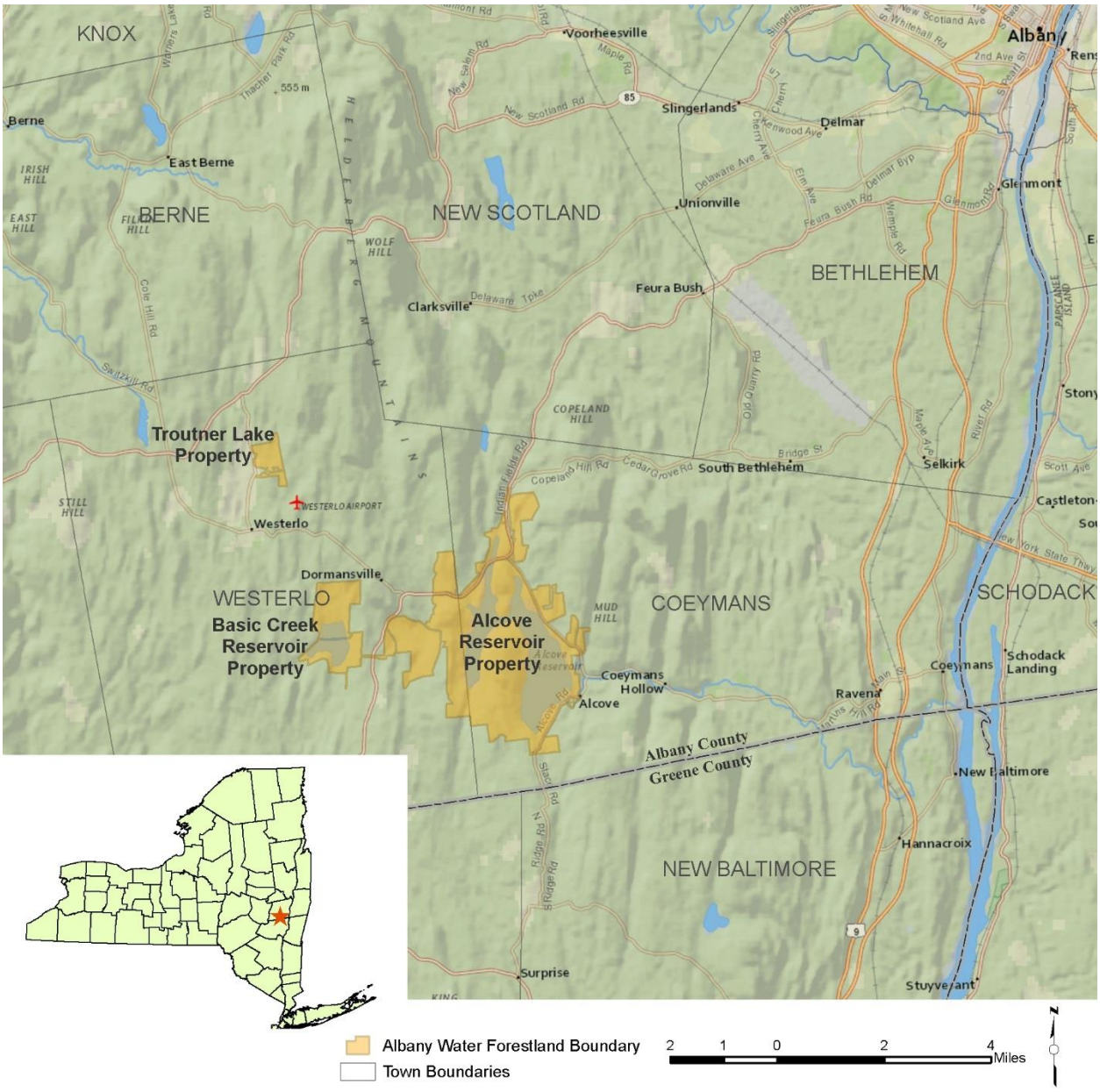

Figure 1. General location map of the Albany Water Forestland properties.

The Nature Conservancy also obtained the rights to market and sell carbon offset credits generated through the Working Woodlands project and provided support in the development of this Forest Management Plan. Accordingly, the Albany Department of Water & Water Supply and The Nature Conservancy will work together to manage the Albany Water Forestlands in a manner that is consistent with this Forest Management Plan and other management agreements and land use rights, and does not result in any degradation of the conservation value of the property, nor the ability of the property to serves as a drinking water supply. Consulting foresters and other independent contractors will be engaged as necessary to properly implement management activities.

Other Legal Interests

As part of the Working Woodlands project, the Albany Water Board intends to grant a Conservation Easement on approximately 6,400 acres of the Albany Water Forestlands to a qualified conservation entity. Once in place, this will convey the legal right to the easement holder to enforce the terms of the Conservation Easement to protect the conservation values of the properties.

A 193-acre portion of the Alcove Reservoir property known as the Bichteman Parcel—located just north of NY State Route 32 on the northwestern portion of the property—is currently occupied under a license agreement that remains in effect for the lifetime of the current tenants. They may continue living in the on-site house and are permitted to use the property as they did prior to acquisition by the Albany Water Board, provided that these activities do not conflict with protection of the water supply or other components of the Working Woodlands project. Upon expiration of the license agreement, all rights to the property revert to the Albany Water Board. While the majority of this parcel is included in the Working Woodlands project, the house and surrounding buffer areas have been excluded.

There are two agricultural leases on the properties, a 40-acre cattle farm near Troutner Lake and a 4-acre hayfield on the eastern edge of the Alcove Reservoir. Both are excluded from the Working Woodlands project, but the Albany Department of Water & Water Supply is still working closely with lease holders to improve practices for protection of water quality.

Several utility rights-of-way cross the project area. These locations were documented in the field, mapped, and excluded from the Working Woodlands project area. In addition, there are several portions of the properties that are subject to license agreements that grant access across Albany Water Board property, or permission to continue ongoing land use. These agreements are small in scale and only granted when compatible with property management goals.

2.3 Socio-Economic Setting

The towns surrounding Albany Water Forestlands are predominantly rural residential, with several small nearby hamlets. However, given the proximity to Albany, more urban sectors of the economy such as Government, Education, Health Care and Social Services, Retail and Manufacturing, are the main source of employment in the local area, as well as the Capital Region as a whole. Natural resource-based professions such as forestry, mining and agriculture make up less than 1% of overall employment. As of 2000, the median household income in the town of Coeymans was just over $47,000, slightly above the Albany County average of $43,000 (all demographic and economic information from Capital District Region Planning Commission, 2015 and Town of Coeymans, 2006).

The city of Albany is the major hub of economic activity for the region as well as entertainment, political and cultural activities. Historically, the Hudson River was extremely important to the settlement and development of early industries such as milling (including paper, timber, textile and grist mills), shipping, ice harvesting and agriculture. More recently, limestone from the Helderberg Escarpment has helped fuel a growing cement industry, including the current

LaFarge cement plant in Ravena. The Hannay Reels company, another major local employer, was started in Westerlo in 1933 and continues operations there today.

While outdoor recreation and tourism are becoming increasingly important economic drivers regionally, much of this activity is focused around nearby NY State Forest lands in the northern Catskill and southern Adirondack mountains, John Boyd Thatcher State Park near Voorheesville, the Hudson River and the Mohawk River/Erie Canal. Locally, the Basic Creek Reservoir is open to fishing, and the Rensselaerville State Forest and Partridge Run Wildlife Management Area, along with several town and county parks, provide additional outdoor recreational opportunities.

2.4 Landscape Context & Connectivity

The Albany Water Forestlands lie within a patchwork of rolling forested hills and open land (either active or former agricultural areas) at the very southern end of the Helderberg Mountain Range. Other major surrounding landscape features include the Catskill Mountains 10 miles to the south, the Hudson River an equal distance to the east, and the city of Albany approximately 12 miles to the northeast.

The properties fall in a region with a fairly large number of smaller fragmented parcels of state land or non-governmental organization (NGO) protected forestlands (Figure 2). The Alcove Reservoir and Basic Creek Reservoir properties are by far the largest contiguous protected properties in the towns of Coeymans and Westerlo. Other nearby protected lands include The Nature Conservancy's Bear Swamp Preserve in Westerlo, Lawson's Lake County Park in northern Coeymans, and various smaller land trust and town park properties.

In total, Albany County contains approximately 29,000 acres of protected lands (NY Natural Heritage Program, 2018a), of which Albany Water Forestlands comprise nearly 23%. The other large, relatively unfragmented protected lands in the region fall within Rensselaerville State Forest and Partridge Run State Wildlife Management Area in western Albany County and John Boyd Thatcher State Park to the north. While the properties do not fall in any major identified landscape connectivity corridors, their position in the landscape—situated between the Catskill Mountains and the Helderberg Escarpment—and the fact that they comprise one of the largest chunks of unfragmented core forest habitat in the immediate region, indicate that these properties may provide important habitat refugia and play a role in overall landscape connectivity.

An assessment of land cover and forest type data from LANDFIRE shows that surrounding lands in the towns of Coeymans and Westerlo are predominantly forested (67%) and interspersed with rural residential areas. Open land, including agricultural and reverting ag lands (14%) and developed areas (13%) are the other primary land cover types. The landscape becomes increasingly developed to the east along the US Route 9W corridor, and to the northeast towards suburban expansion surrounding the city of Albany.

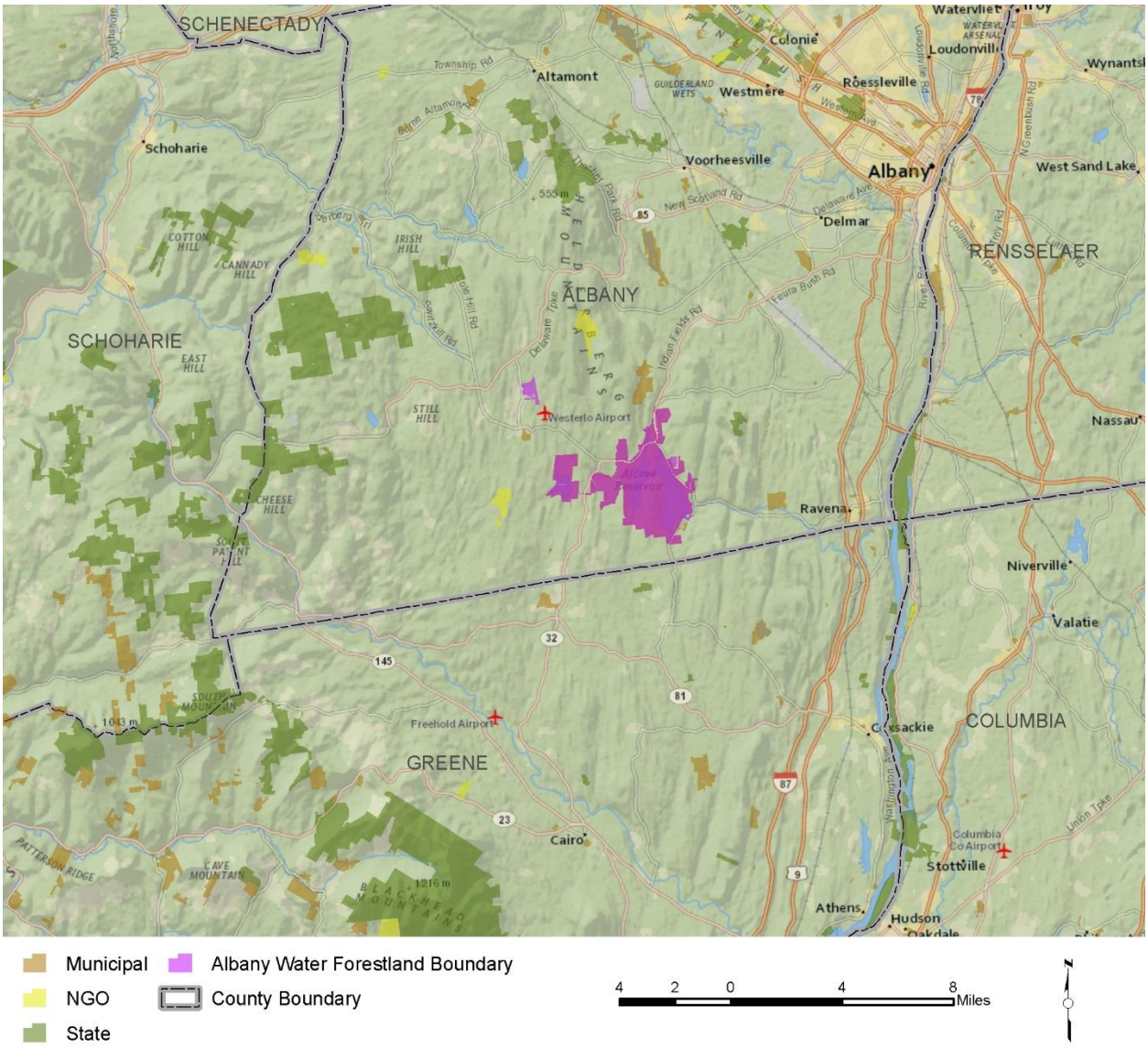

Figure 2. Map of Albany Water Forestlands in relation to other protected lands in the region. Data from NY Protected Areas Database (www.nypad.org).

Based on the same LANDFIRE data, dry oak forest types are the most common (Figure 3), particularly in more eastern portions of Coeymans where the elevation is lower but punctuated by prominent hills with steep slopes. Moving westward, elevation generally increases and vegetation transitions toward northern hardwoods. Riparian and bottomland forests are also common throughout the towns surrounding the numerous streams and wetlands.

See www.landfire.gov for additional information on the LANDFIRE program and various data available.

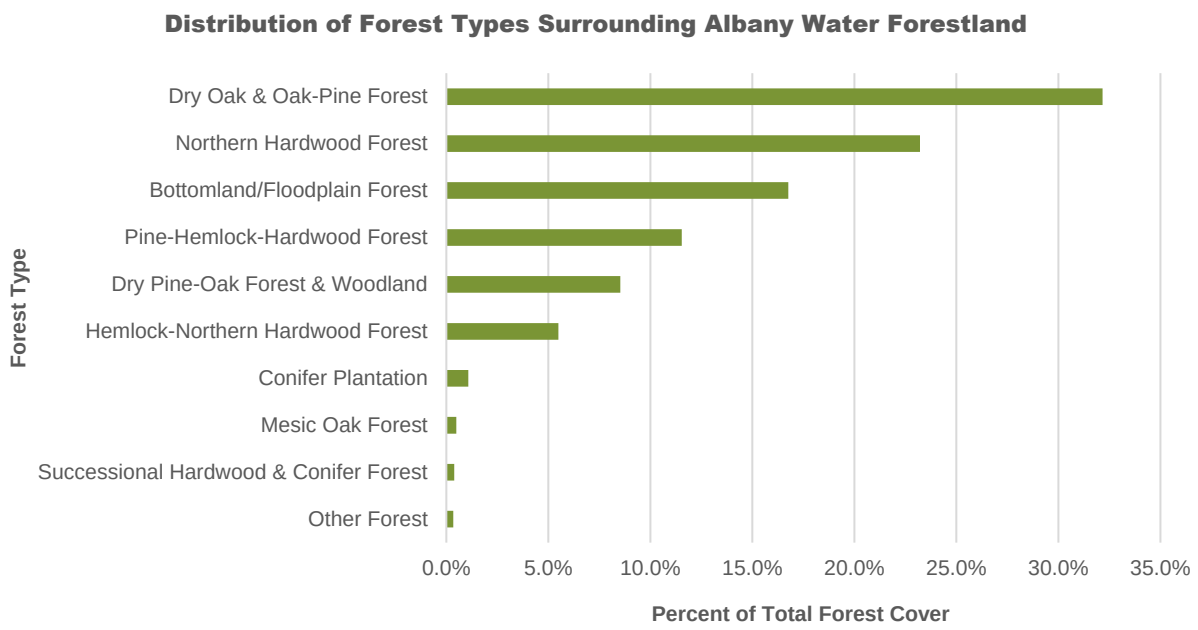

Figure 3. Graph of the relative abundance of forest types (shown as % of total forested area) in the towns of Coeymans and Westerlo, based on summarized data from LANDFIRE (www.landfire.gov).

2.5 Land Use History

The initial development of the Albany Water Board Reservoir System included the creation of two reservoir systems and the purchase and protection of approximately 4,500 acres between 1928 and 1932. The Alcove Reservoir—fed primarily by Hannacrois Creek and its major tributary, Silver Creek—serves as a primary drinking water supply reservoir for the city of Albany. The Basic Creek Reservoir was created by a dam on Basic Creek in the Town of Westerlo and provides additional supply to the Alcove Reservoir through a diversion tunnel that discharges into Silver Creek. Acquired in the 1970s, Troutner Lake was originally formed by an impoundment of a tributary of Basic Creek roughly four miles upstream of the reservoir to provide recreational opportunities for people vacationing at the surrounding cabins. The dam there was later breached due to flooding concerns. While not directly part of the Albany Water storage or delivery infrastructure, both Troutner Lake and the surrounding forest still help to protect water quality in Basic Creek upstream of the reservoir.

Prior to acquisition of the properties by the Albany Water Board, much of the land was used extensively for agricultural purposes, particularly dairy farming. The northern portion of the Alcove Reservoir property also had a small community of about 80 inhabitants known as Indian Fields which included a church, a hotel, several small stores and a number of local businesses. During the creation of the two reservoirs, the entire community of Indian Fields—along with 8 miles of roads, four cemeteries, numerous fences and all standing timber—had to be completely removed or relocated (Whitman et al., 1932). On lands that were not flooded, nearly 250 buildings were removed, indicating that both the Alcove Reservoir and Basic Creek Reservoir properties were extensively settled prior to acquisition by the City. Old stone foundations are commonly encountered on the property today, and a number of old cemeteries remain as well.

As one would expect, the current forest originated predominantly from succession of these abandoned pasturelands and homesteads over the past 60-100 years, and many of the dominant species (white pine, hemlock, oaks, black birch, red maple and hickory) are typical of post-agricultural succession in this region. Pockets of mature hemlock and oak forest remain, particularly on steeper slopes and less accessible areas, and very large sugar maples can be found along old hedgerows and stone walls. Areas that were abandoned more recently, or took longer to succeed due to poorer site conditions, are younger and consist of more characteristic early successional species, including redcedar, ash and white pine. Some areas also support extensive infestations of invasive shrubs, likely the result of both amenable soil conditions and more significant past soil disturbance, such as plowed fields and areas around old home sites.

While some timber harvesting occurred on the property in the late 1970s through 1990s, there has not been significant management other than general road and property maintenance since that time. Accordingly, much of the forest is mature, even-aged hardwood and conifer (mostly white pine and hemlock) with pockets of poletimber and more mature forest scattered throughout.

2.6 Topography, Soils & Geology

The topography of the Albany Water Forestlands is highly variable, including large, flat lowland swamps, moderate to steep upland hills, and deeply incised stream ravines (Figure 4). The Alcove Reservoir tract is the lowest of the properties, with the reservoir level at approximately 618 feet and maximum elevations of 900 feet on the Hogsback—a large, high peninsula that divides the reservoir into its two distinct basins—and 1,000 feet at the extreme northern end of the property. Slopes are highly variable and range from nearly flat in low lying wetlands and gently rolling hilltops, to 40-50% or more along the western basin of the reservoir, the Hannacrois Creek and Gulf Creek Ravines, and the slopes on the northern hills.

By comparison, the Basic Creek Reservoir tract to the west has far more consistent terrain. The reservoir sits in a small basin at approximately 940 feet, and the terrain rises gradually in all directions except for the outlet of Basic Creek. The maximum elevation at the north end of the property is just over 1,100 feet. The Troutner tract to the north sits slightly higher in the Helderberg Mountains but is relatively flat with elevations only ranging between approximately 1,300 and 1,350 feet.

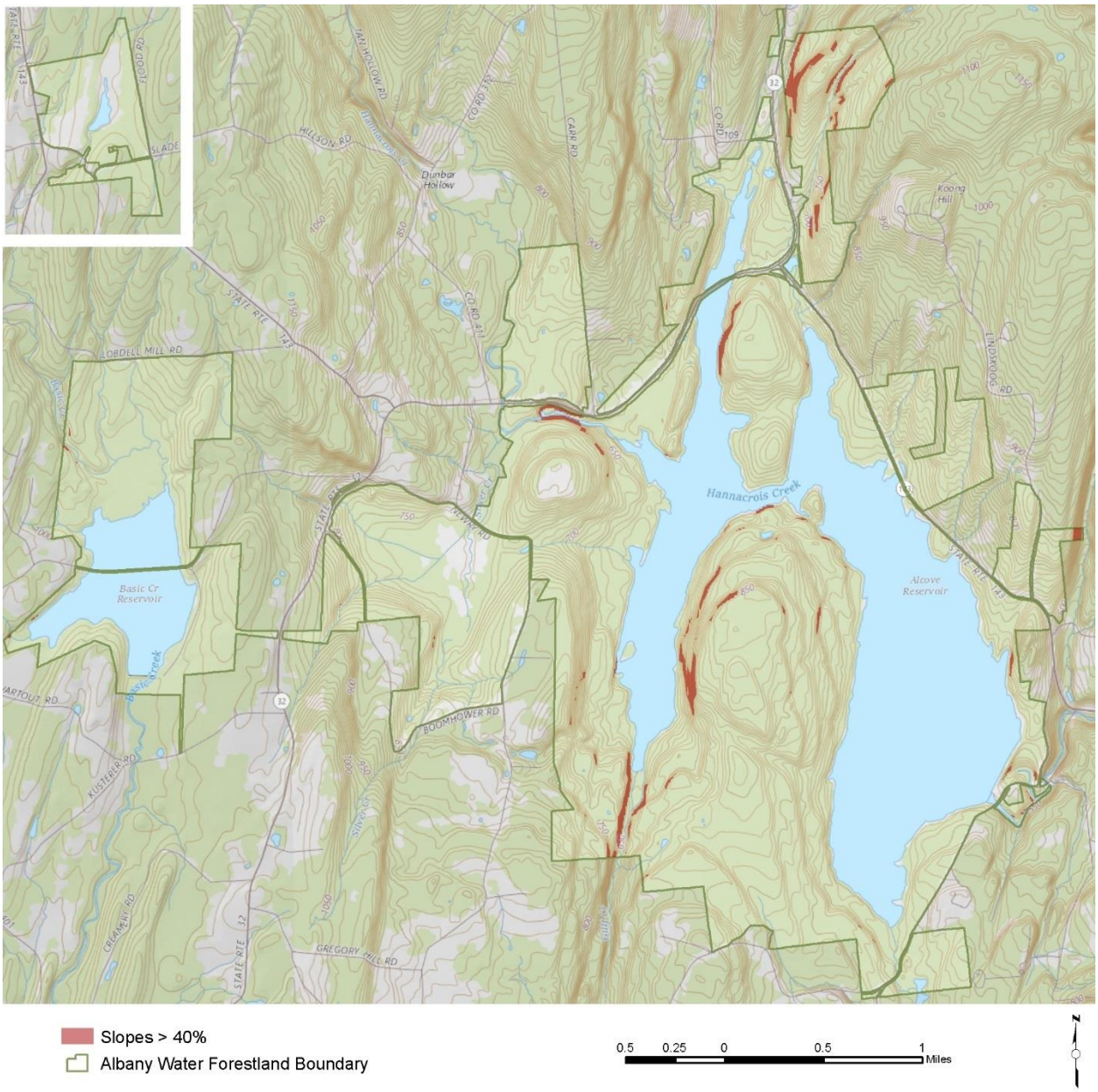

Figure 4. Topography of Albany Water Forestlands.

The region is underlain primarily by Hamilton group shales. Soils across the property are dominated by silt loams, interspersed with rocky soil complexes, outcrops and a few areas of alluvial deposit. Soil types for the property are shown in Figure 5 and Table 2.

Given the terrain and soil characteristics across the property, much of the area is suitable for forest roads with respect to drainage, although erosion potential due to steep slopes may restrict vehicle and equipment access in many places. Overall, more than 50% of the property is moderately to excessively well drained, with the majority of very poorly drained sites restricted to wetland areas (Table 3).

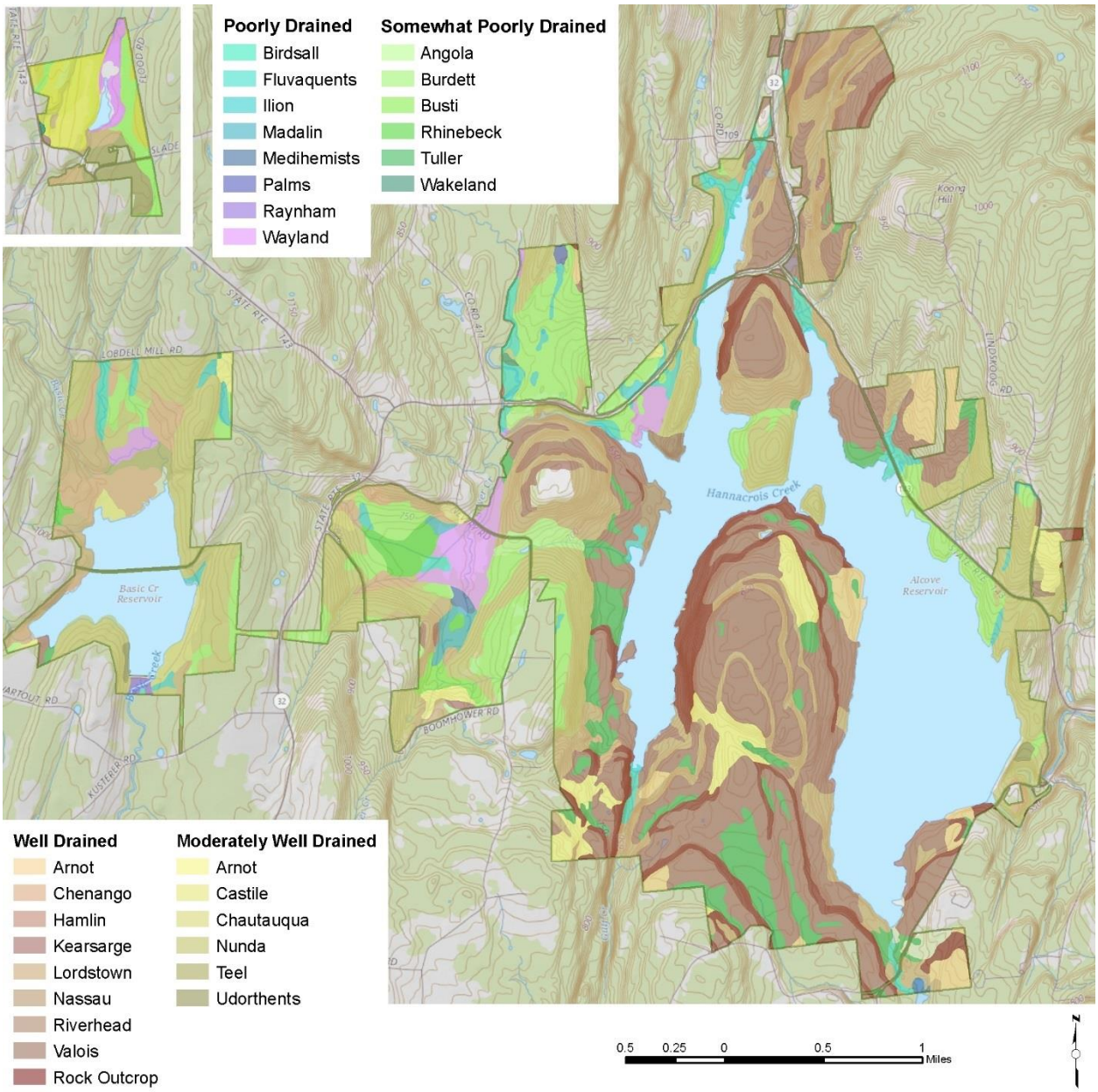

Figure 5. Soil map for the Albany Water Forestlands. Soils data from the Natural Resource Conservation Service Soil Survey Geographic Database (SSURGO).

Soils Series/Type	% of land area
Kearsarge, Nunda, Burdett silt loams	57%
Arnot and Lordstown, rock outcrop and very rocky complexes	15%
Lordstown, Arnot and Nassau channery and very channery silt loams	11%
Tuller-Green complex, loamy	5%
Chautauqua and Chenango gravelly silt loams	5%
Wayland Complex, silty	3%
Fluvaquents-Udifluvents complex, frequently ponded	2%
All other types	2%

Table 2. Distribution of soil types across Albany Water Forestlands (data from NRCS SSURGO database).

Soil Drainage Class	% of Property
Well-Excessively Drained	27%
Moderately Well Drained	24%
Somewhat Poorly Drained	17%
Poorly-Very Poorly Drained	7%
Little or no soil	6%

Table 3. Distribution of soil drainage classes across Albany Water Forestlands (data from NRCS SSURGO database).

2.7 Facilities & Property Infrastructure

The Albany Department of Water & Water Supply maintains several facilities on the properties as well as various components of their water supply infrastructure (Figure 6). In addition to the Alcove and Basic Creek reservoir dams and spillways, there is a tunnel with associated intake/outlet areas that connects the two waterbodies via Silver and Hannacrois creeks. There is also an office space and maintenance facility on Waterboard Road in Coeymans Hollow which serves as the base of operations for staff working on the Albany Water Forestlands and the primary storage location for supplies and equipment.

Maintaining and possibly expanding or improving these facilities and infrastructure is critical to the long-term sustainability of the Albany water supply system and is a major focus of the Department. There are currently plans to substantially rebuild the dam on the Basic Creek Reservoir, and there may also be expansion of the office/maintenance facilities on Waterboard Road. These areas have been mapped in GIS and excluded from the Working Woodlands project to avoid any conflicts with development of these facilities. In addition, buffers of 200-350 feet on the water infrastructure, along with selected forest polygons, have also been excluded from Working Woodlands project areas to provide flexibility for any necessary future improvements.

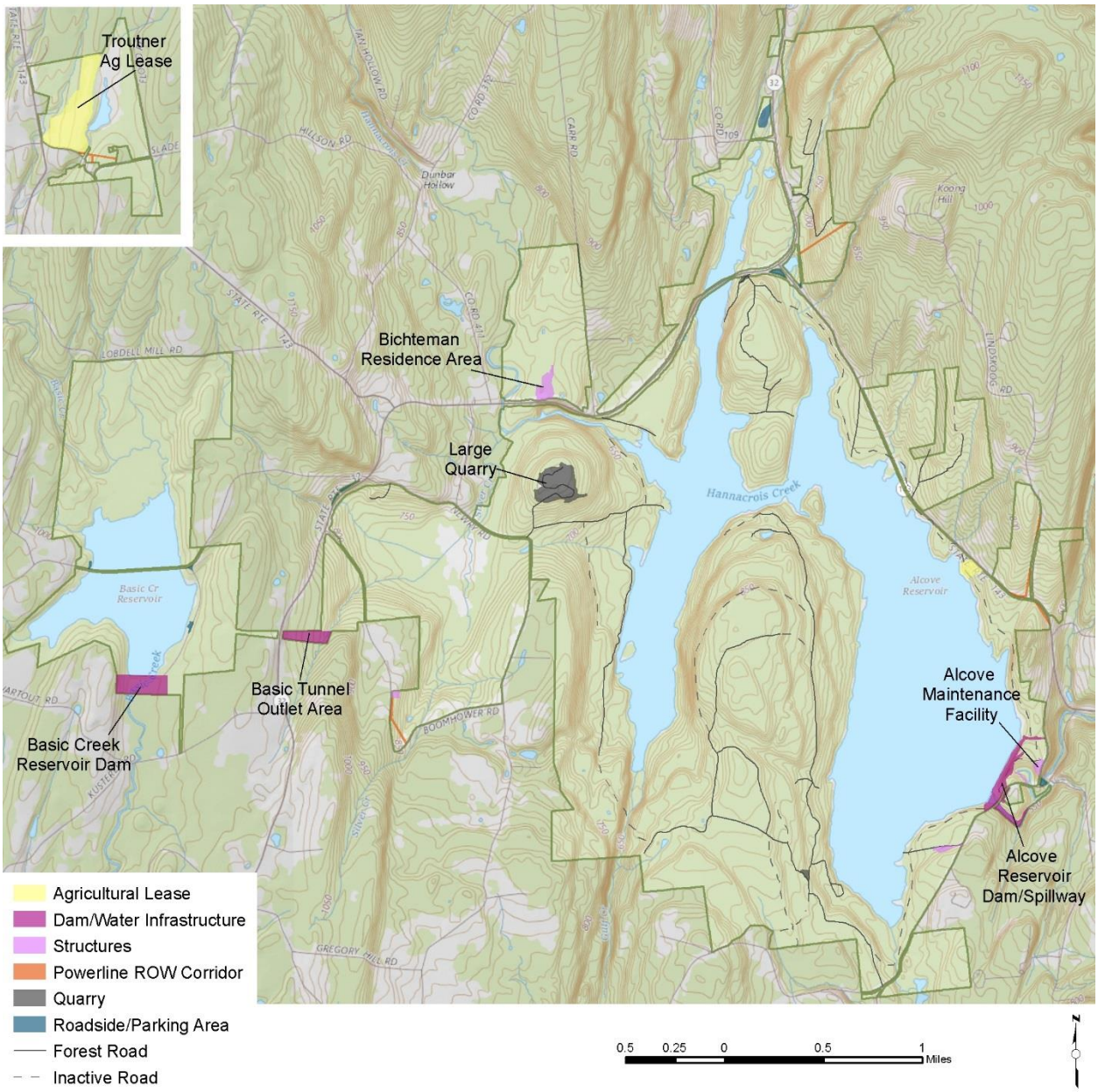

Figure 6. Roads and other infrastructure on the Albany Water Forestlands.

There are also several other structures on the Albany Water Forestlands, including two abandoned former residences on the Alcove Reservoir property—the Kleine house just off County Route 111 and an old mobile home on Boomhower Rd. A third residence, located on the Bichteman Parcel, is currently occupied under a lifetime license agreement with the current tenant (see Section 2.2 for detail). When the existing license agreement expires, the property will likely be evaluated as a site for equipment storage and maintenance. There are also several small barns and outbuildings within the Troutner agricultural lease area which are maintained by the lease holder.

Forest Roads & Landings

The Albany Department of Water & Water Supply maintains a number of roads on the property for various purposes. In total, there are approximately 13.9 miles of truck accessible forest roads, and 10.5 miles of former or degraded road that are only accessible via ATV or on foot. There are a few paved access roads for dams and infrastructure, but the vast majority of roads on the property are classified as forest roads. These roads are either crushed rock or dirt and vary significantly with respect to surface condition and drainage.

The Department has been increasing their road maintenance activities in recent years, focused on conducting critical repairs on the roads that receive the highest levels of use. Staff are currently in the process of inventorying the existing road system to systematically identify and prioritize road infrastructure maintenance needs. This will involve an inventory of road condition, use, drainage issues and any stream crossings and/or culverts, as well as a systemization of annual road monitoring.

Initial road maintenance and repairs will focus on replacing inadequate culverts and addressing other drainage issues, as well as stabilizing and closing abandoned road sections. Based on available GIS data, there are only two places on the properties where a maintained truck accessible road crosses a mapped stream. However, given the large number of unmapped ephemeral and intermittent streams and drainages, a comprehensive field inventory is needed to determine the number and condition of all stream crossings on the maintained forest road network. There are also several places where abandoned or unmaintained roads and trails cross streams, some of which have poor drainage and minor to moderate erosion issues. In addition to inventorying these crossings, short-term goals include addressing serious or potentially worsening drainage issues on the most used portions of the road system (Hogsback and Silver Creek areas) and bringing existing roads and trails into compliance with Best Management Practices (BMPs) found in New York State Forestry Best Management Practices for Water Quality—BMP Field Guide, 2018 Edition, or its successors (www.nysbmpguidelines.com).

In general, forest management activities on the property will utilize existing roads, particularly as haul roads, recognizing that many roads will require substantial upgrading to make them suitable for heavy trucks and equipment traffic. Most new roads will be temporary in nature, although some may be maintained as needed when they provide useful access. All new forest roads will follow published BMPs referenced above.

As there has been no active forest management for many years, there are no active log landings on the properties and any former log landings have since naturally revegetated. There are several staging areas for road maintenance material which are stable and could be used as landings if needed. Potential future landing areas may be established during road maintenance and repair to the extent that it is also beneficial for providing turnaround areas for equipment doing road work.

Quarries

To facilitate cost-effective and efficient maintenance of roads, parking areas and other infrastructure, the Albany Department of Water & Water Supply maintains several shale

quarries. There are currently two small active quarries on the properties, totaling approximately 1.5 acres, as well as larger 22-acre former industrial quarry where material is still occasionally removed to support road maintenance. All active quarries on the property are excluded from the Working Woodlands project areas but are valuable assets in achieving forest management goals.

While there may be limited expansion of quarry areas to accommodate various maintenance and construction projects, use is generally low and excavated material is only used on the Albany Water Board properties. The Albany Department of Water & Water Supply does not intend to disturb more than 50 acres of the current properties for mining purposes over the life of the Working Woodlands project, and will place a limit of 30 acres on active quarries at any given time. In addition, current NYS regulations stipulate that removal of more than 1,000 tons or 750 cubic yards of material from any individual parcel of the property within a one-year period would require a mining permit from NY Department of Environmental Conservation (DEC).

2.8 Applicable Laws and Regulation

There are currently very few statewide laws in New York that specifically govern timber harvesting and forest management on private lands, and no local ordinances in the towns of Coeymans or Westerlo that apply specifically to these activities.

The most applicable NYS regulations that generally apply to forest management activities in New York are NYS Environmental Conservation Law Article 15 which regulates crossings or activities which disturb classified streams and Article 24 which covers harvesting timber in state designated wetlands. The implications of these regulations for management and the use of BMPs for water quality are described further in Section 5.4. In addition, the NYS DEC regulations on endangered species (6 NYCRR Part 182) apply to any forest management that may impact state listed species (see Section 6.4).

Given that the properties contain and feed a public water supply, activities that could potentially contaminate reservoirs or their tributaries may also be subject to NYS Health regulations for public water supplies; however, these regulations do not cover forest management in general and are unlikely to apply to activities described in this Plan.

In addition to state regulations, certain activities may also be covered by Federal Regulations, including the Clean Water Act and Endangered Species Act. Road maintenance that involves permanent stream crossings may require a US Army Corps of Engineers permit under Section 10 of the Rivers and Harbors Act.

3. Forest Resource Conditions

Most forest on the Albany Water Forestlands is very typical of the post-agricultural succession that has occurred throughout the region over the past 60-100 years. Throughout the properties, northern hardwood species (particularly sugar maple and beech, but also sweet birch) are very common on finer textured soils and mesic sites. Pine, oak, and hickory dominate more well-drained soils while a mix of hemlock and hardwoods blankets steeper north and west facing slopes. Ash and red maple are common on a wide variety of sites, mixing with elm and oak in wet bottomlands and other species like poplar and cherry in younger more recently disturbed woodlands.

Most of the forest is even-aged the stand level, with a closed-canopy overstory composed of the first cohort of trees that successfully established following agricultural abandonment. As one would expect on an aggregated property of this size, there were a variety of past land uses, each with varying levels of intensity, soil disturbance and legacy effect. Accordingly, the resulting forest is highly heterogeneous across the ownership, with patch sizes ranging from just a few acres to a few hundred acres. Boundaries between forest types are often stark, and it is not unusual to encounter a successional redcedar woodland on one side of a stone wall and stands of mature sugar maple or red oak and white pine on the other. This patchiness and landscape mosaic of forest types is clearly observed in aerial imagery (Figure 7).

3.1 Forest Inventory

In total, approximately 4,592 acres of the Albany Water Forestlands are classified as forested based on an assessment of forest cover conducted from aerial imagery. Successional old fields, which are generally dominated by tree seedlings and saplings of various species, are included in forestland acreage as regenerating, but were not inventoried as they lack overstory trees.

During the comprehensive forest inventory in 2017, 647 field sample plots were measured, resulting in an overall sampling density of one plot per 5-7 acres across each of the three properties. Each plot consisted of a variable radius overstory point sampled using a basal area factor (BAF) 10 prism for trees with a diameter at breast height (DBH) of five inches or more, and a 1/100th-acre plot for seedlings (less than 4.5 feet tall) and saplings (1-5 inches DBH). Data on the number of merchantable sawlogs, presence of insects or disease, invasive plants/interfering vegetation and deer browse impacts were also collected.

In addition, the baseline forest carbon inventory was conducted in late 2017, consisting of 95 permanently marked, fixed radius plots, which will be re-measured periodically over time to assess forest growth. Data from carbon inventory plots were not used in the development of this Plan except for the calculation of periodic growth estimates.

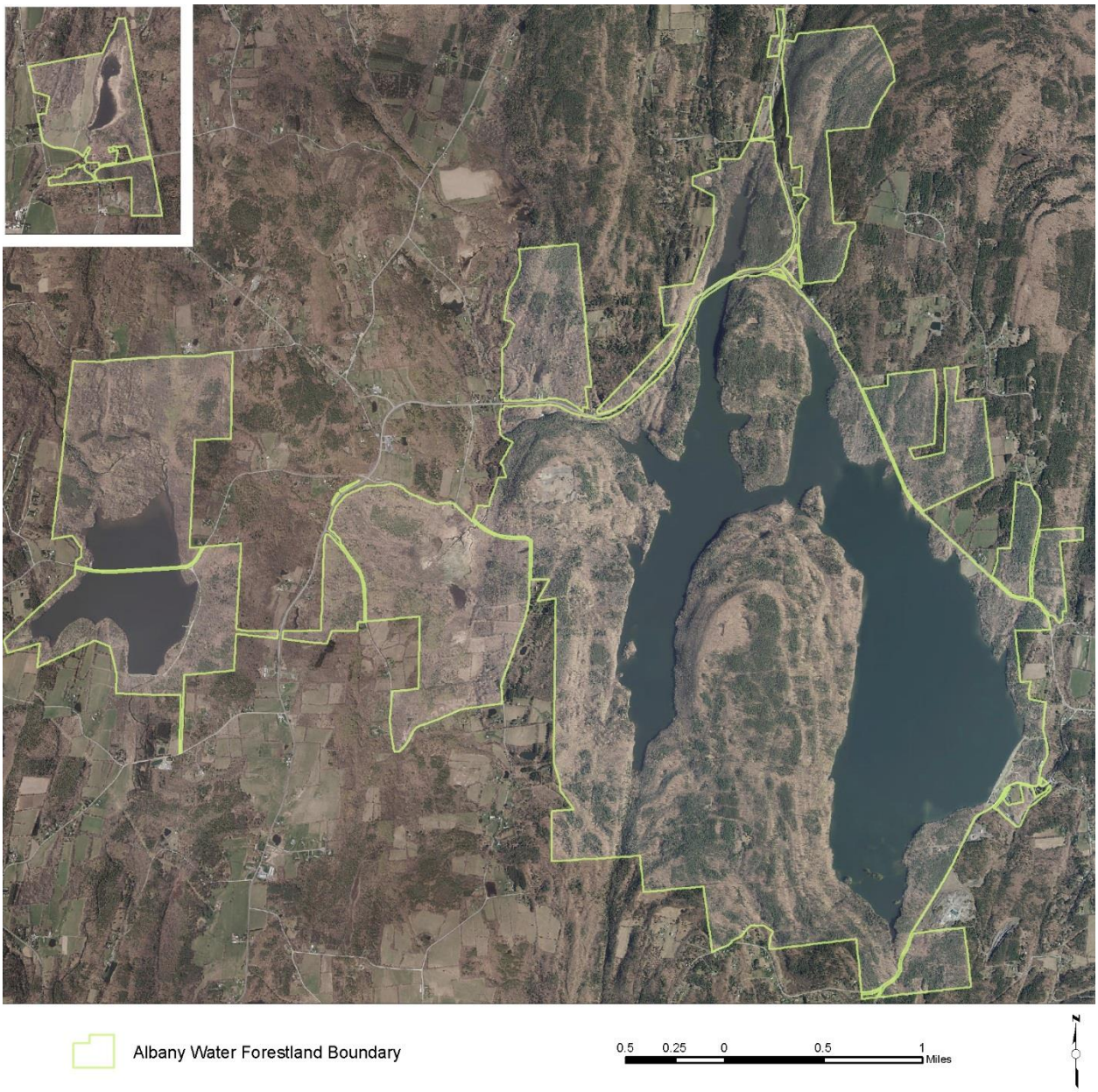

Figure 7. Aerial imagery of Albany Water Forestlands depicting forest heterogeneity due to past land uses and variable site conditions.

3.2 Forest Type Descriptions

Individual forest types were mapped in a Geographic Information System (GIS) database based on easily distinguishable characteristics in 1-foot resolution aerial imagery at scales of 1:3000-5000, and then classified based on the presumed dominant species. This mapping was then updated as needed to more accurately reflect actual vegetation boundaries and species composition following the field inventory (Figure 8).

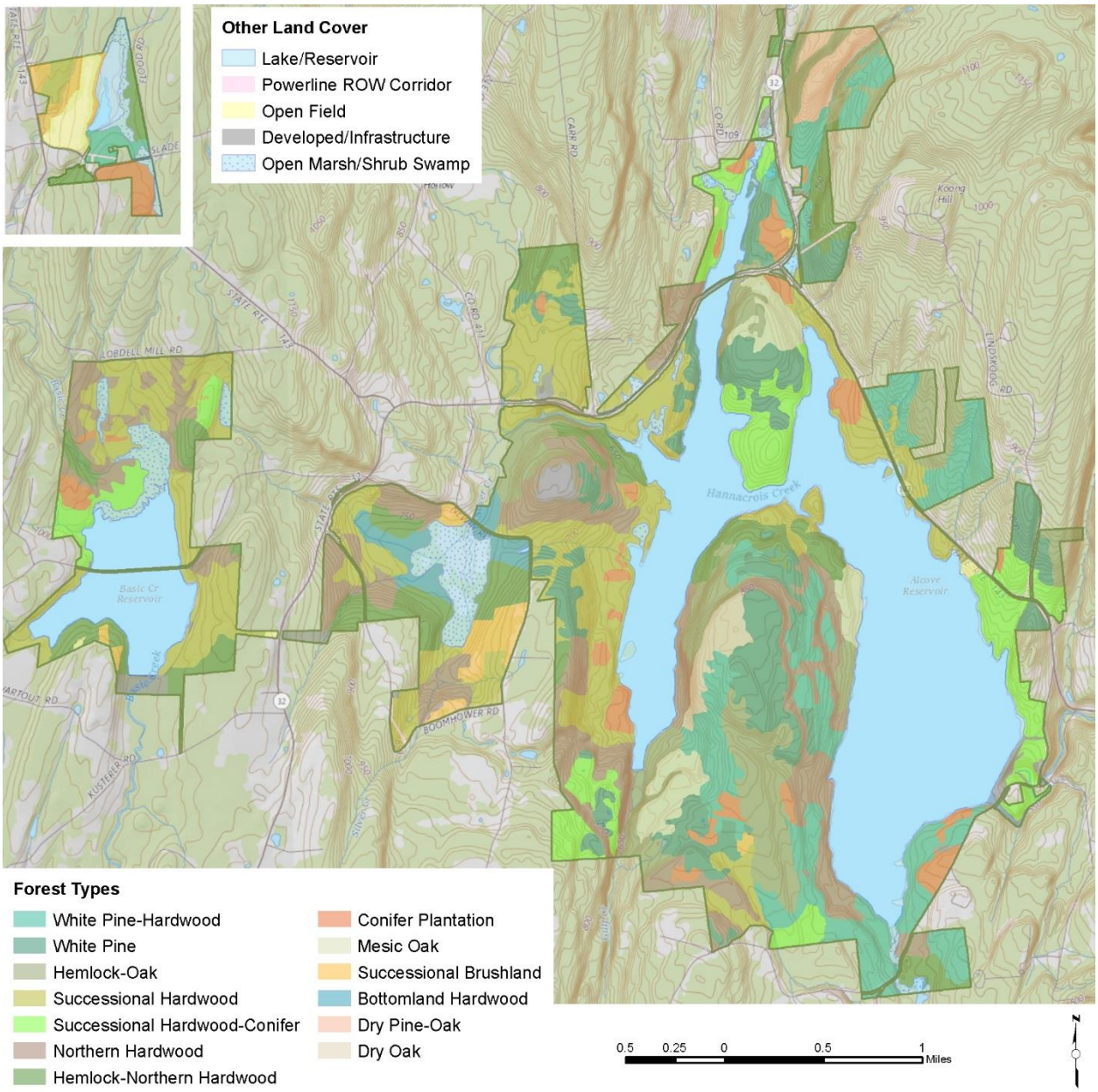

Figure 8. Mapped forest types on Albany Water Forestlands.

Several of these stand types were grouped into broader forest types that can be cross-walked to NatureServe Ecological Systems (NatureServe, 2018). Grouping mapped forest types this way allowed for comparison to regional and historical forest cover using larger scale spatial data obtained from LANDFIRE. Table 4 provides a breakdown of the major forest types on the property as well as the mapped stand level sub-types and associated acreages.

Forest Type	Acreage	% of Forest Land
Pine-Hemlock-Hardwood Forest	1,513	32.9%
White Pine-Hardwood (553 ac.)		
White Pine (492 ac.)		
Hemlock-Oak (468 ac.)		
Successional Hardwood & Conifer Forest/Woodland	1,370	29.8%
Successional Mixed Hardwood (963 ac.)		
Successional Mixed Hardwood-Conifer (407 ac.)		
Northern Hardwood Forest	669	14.6%
Hemlock-Northern Hardwood Forest	442	9.6%
Conifer Plantation	190	4.1%
Mesic Oak	123	2.7%
Successional Shrubland/Old Field	102	2.4%
Bottomland/Floodplain Forest	72	1.6%
Dry Pine-Oak Forest	52	1.1%
Dry Oak Forest	50	1.1%
Total	**4,583**	

Table 4. Mapped stand types for Albany Water Forestlands, with acreage and percent of total forest land.

Pine-Hemlock-Hardwood Forest

Pine-Hemlock-Hardwood forests on Albany Water Forestlands include several distinctly mapped types: pure stands of eastern white pine, stands of mixed pine-hardwood and stands dominated by a mixture of hemlock and oak.

Pure white pine stands are common on the Alcove Reservoir property, particularly in the Hogsback and Indian Fields areas, the two peninsulas that separate the Alcove Reservoir into its distinctive east and west basins. Many pure pine stands appear to be unmanaged plantations, probably ranging from 60-90 years of age, that have begun to revert to a more natural condition with some hardwood ingrowth. In general, these stands are moderately stocked with an overstory that is heavily dominated by eastern white pine with scattered sugar maple, red oak and other hardwood species. Many stands consist of large diameter trees due to their rapid initial growth; however, a large proportion of trees were severely damaged by white pine weevil so tree quality is often poor. The seedling and sapling layer in this type is sparse due to the relatively closed canopy and shady conditions, consisting primarily of suppressed white pines and a mix of other hardwood species.

White Pine-Hardwood stand types are among the most common and well distributed across all properties, in part because of the broad definition of the stand type. White pine is generally the most dominant species, but occurs in a codominant mix of hardwoods, primarily sugar maple, red oak, and red maple, but also including sweet birch, black cherry, hickory and ash. In some cases, stands also include a significant component of remnant eastern redcedar. This forest type is composed primarily of younger stands and can overlap in species composition with more successional forest types. Similar to pure white pine stands, the understory is somewhat sparse and dominated by suppressed pine saplings, sugar maple and a mix of hardwood species.

Hemlock-Oak stands are somewhat limited to the Alcove Reservoir property, but there are several extensive stands along the western slopes of the Hogsback area, the northern portion of the Silver Creek area south of Hannacrois Creek, and some areas east of Route 143 near the Alcove Reservoir. This type is dominated by eastern hemlock but includes a significant component of codominant oak, red oak being the most abundant but often including chestnut oak and white oak. This type includes a few stands with a some large (30+ inches in DBH) hemlock and oaks which appear to be several hundred years old. Although not particularly dense, the sapling layer is diverse, consisting primarily of hemlock and hophornbeam, along with a thinner mixture of beech, sugar maple, white pine, hickory and several other hardwood species.

This forest type has characteristics of both the Laurentian-Acadian Pine-Hemlock-Hardwood and Appalachian (Hemlock)-Northern Hardwood Forest ecological systems as described by NatureServe (2018); in fact, the two types often overlap in this region. Since there are more oak-dominated associations under the Pine-Hemlock-Hardwood type, including associations where white oak is more dominant, inclusion in the Pine-Hemlock-Hardwood was more appropriate for the purposes of this Plan.

Successional Hardwood & Conifer Forest

Another broadly defined type, Successional Mixed Hardwood & Conifer stands also cover a very large portion of the properties, particularly on previously disturbed sites. They are characterized by the presence of early successional/shade-intolerant species—such as aspen and cottonwood, ash, eastern redcedar, white pine and black cherry—mixed with more typical species such as sugar maple, red maple and red oak. On the Albany Water Forestlands, these stands are also characterized by mesic to bottomland site conditions, low basal area, a relatively open overstory canopy and generally poor tree quality and/or vigor. The understory is typically shrub dominated, often with a mix of invasive species such as multiflora rose, common buckthorn and bush honeysuckle. In both the hardwood and hardwood conifer versions of this forest type the sapling layer is lacking in both diversity and density. Ash seedlings and saplings may be abundant, and generally make up one-third to one-half of all stems in the understory.

The two mapped sub-types (Successional Mixed Hardwood and Successional Mixed Hardwood-Conifer) are only differentiated by the relative abundance of white pine and/or redcedar. The mixed hardwood type often occurred in areas that could be considered riparian or floodplain habitat. As a result, Bottomland/Floodplain Forest is probably underrepresented in the mapped stand types for the properties, as they were typically characterized as successional types based on species composition as opposed to topographic position or site moisture regime.

Northern Hardwood Forests

Northern hardwood forests are common across the properties, particularly on mesic sites with finer textured soils. They are somewhat variable, ranging from a mix of sugar maple, American beech, sweet and yellow birch and red maple to nearly pure sugar maple stands. Many stands also contain a significant component of red oak. Other common species are and shagbark hickory, white pine, white ash, hemlock, aspen, and American basswood. Size and age class for this forest type also vary widely across the property. Sugar maple is the dominant species in the

understory, and together with beech and hophornbeam comprises more than two-thirds of the sapling layer.

Hemlock-Northern Hardwood Forests

While they cover less area than Northern Hardwood forests, Hemlock-Northern Hardwood forests are one of the most widely distributed types and occur across all the properties. In these stands, eastern hemlock is the most abundant tree species; however, it typically occurs along with a mix of hardwood species and often makes up less than half the overall stand basal area. The most common associate species are sugar maple, sweet and yellow birch, beech, red maple and red oak. This forest type occurs most commonly on steeper north and west facing slopes on the properties, but also occupies some flatter sites in some cooler low-lying areas and at higher elevation on the Troutner property. There can be significant overlap in terms of species composition between Hemlock-Northern Hardwood and Hemlock-Oak forests—in part because red oak can be relatively abundant in both types—but Hemlock-Oak stands were distinguished by the dominance of oaks and hickories over sugar maple and other northern hardwood associates. The understory is somewhat representative of overstory composition, with beech sprouts, hemlock and sugar maple most common, along with hophornbeam and a mix of other hardwoods.

Conifer Plantations

Due to the variable land use history of the property, there are a number of unmanaged conifer plantations of various non-native or atypical species scattered throughout the properties. Pure red pine plantations are the most common type, but there are also pure stands of scotch pine, larch, and Norway spruce, as well as various mixtures of these species along with white pine and scattered pitch pine. Planted stands of pure white pine were included in the white pine forest type as they are native and generally appropriate to sites where planted. Many of these stands have also attained a more variable structure and species composition in the overstory than other plantation types.

In general, plantation forest types consist of densely packed pole-sized trees of low to moderate vigor due to the lack of past thinning or other management, although some individual stands had somewhat larger trees. Crown ratios and tree vigor tend to be low, and many stands—particularly red pine—are experiencing significant decline and overstory mortality and accompanying ingrowth of invasive shrub species. In a few cases, a dense seedling and sapling layer of red maple, with ash, white pine, and a variety other hardwood species has developed where overstory mortality has created openings.

Mesic Oak Forest

The few Mesic Oak Forest stands that exist in Albany Water Forestlands occur on relatively productive mesic sites in the Hogsback and Indian Fields areas of the Alcove Reservoir Property. These stands consist of mature forest dominated by mature red oak—with numerous trees in the 18 to 20-inch dimeter classes—and shagbark hickory. Sugar maple is also fairly common, with scattered white pine and hemlock. Because oak and hickory are often relatively abundant in Northern Hardwood stands on the properties and sugar maple is common in Mesic Oak stands,

there is some overlap between this forest type and Northern Hardwood forests. However, the predominance of oak and general lack of other northern hardwood species, such as beech and birch, are distinctive. Sugar maple makes up more than half of the understory stems, with hophornbeam and red oak relatively abundant as well.

Successional Shrubland/Old Fields

Although it was not inventoried due to the lack of overstory trees, this transition cover type is included with forests as it comprises abandoned agricultural fields that are reverting to hardwood forest regeneration. Much of the area is covered with a mix of hardwood saplings along with scattered eastern redcedar and white pine.

Bottomland/Floodplain Forest

Bottomland/Floodplain Forests are found in the large, low-lying floodplain wetlands along Silver Creek. These forests areas are characterized by periodic inundation and a very sparse overstory dominated by black and green ash, swamp white oak, American elm and red maple. The understory is generally sparse or composed of wetland shrubs and invasives such as multi-flora rose in some areas, but American hornbeam can be very prolific in localized patches with drier soil. Ash and swamp white oak are the only canopy species of note in the sapling layer. As described above, many forests that occurred on bottomland and/or floodplain sites on Albany Water Forestlands were mapped as Successional Hardwood and Conifer based on their species composition. For that reason, Bottomland/Floodplain Forests are probably underrepresented in the current forest type maps and data for the properties.

Dry Pine-Oak Forest

The Dry Pine-Oak Forest type consists of only one mapped stand at the far northern end of the Alcove Reservoir property. It sits on a rocky ridgeline and includes a unique mixture of pines (primarily red pine, but also white and pitch pines), red oak, white oak and red maple. Much of the pine occurring in the stand was likely planted at one point in the past. However, it was not mapped as a plantation due to the fact that a) it occurs on a suitable site for the forest type ; b) it blends into what appears to be naturally occurring red pine on the fringes of the planted area; and c) it has reverted to a structure that is becoming more representative of a natural forest than a plantation through natural self-thinning and ingrowth of oaks and other hardwood species, which are now codominant in some areas. Hemlock and red maple comprise the majority of regeneration in the stand, but hickory, hophornbeam, beech, red oak and sugar maple are all relatively abundant in the sapling layer.

Dry Oak Forest

Dry Oak Forest is also represented by one stand at the Alcove Reservoir Property, situated on the eastern side of the Hogsback area. This type occurs on a flat bench of relatively thin, rocky soils and consists mainly red and white oaks, along with a lesser component of shagbark hickory and scattered red maple, sugar maple and sweet birch. In general, the forest is not particularly dense or tall, and consists of a distinct overstory cohort of 12 to 14-inch diameter trees, with a second cohort in the 6 to 8-inch size classes. Hophornbeam is abundant and dominates the understory. The sapling layer consists primarily of sugar maple and, to a lesser extent, red oak

and hickory. In other regions of NY, this forest type is characterized by a dense layer of heath shrubs, but this is notably absent from the stand on Albany Water Forestlands.

3.3 Species Composition & Stand Characteristics

Table 5 lists general species composition and forest characteristics for Albany Water Forestlands. White pine is the most abundant and dominant species and inhabits a variety of sites across all the properties. Sugar maple, red oak and hemlock are also widespread and abundant in the overstory. Other species, such as red maple, ash and birch (mainly sweet birch, but also yellow and others), are fairly common and widespread, but not dominant. The remaining species, such as red pine, black cherry, beech, white oak and others, are generally restricted to one or only a few individual forest types.

Average sawtimber volume is moderate at 5,834 bd. ft. per acre, but highly variable by location and stand type across the properties. The overstory is composed of predominantly high value species, most notably white pine, red oak and sugar maple. The general poor quality of white pine stems due to white pine weevil infestations—indicated by the low proportion of trees with the potential to produce sawlogs (49%)—significantly impacts overall merchantable sawlog volume across the properties. However, due to its abundance and larger average diameter, white pine still has the greatest standing sawlog volume per acre. Given that it grows well across various sites on the properties, managing stands with an eye towards improving white pine form and growth could result in higher sawtimber yields from this species over time.

Red oaks are generally of high quality, and also represent a significant amount of high value sawlog volume per acre. However, the larger average diameter indicates that these species tend to occur predominantly as overstory trees, and they are not well represented in the smaller size classes. Sugar maple is also a high value species and may have more potential for long-term timber management given that it is shade-tolerant and more well distributed throughout the size classes.

Table 6 shows how forest stand characteristics vary across forest types. Dry Oak, Dry Pine-Oak, Hemlock-Oak and Hemlock-Northern Hardwood stands tend to be the most well stocked natural forest types in terms of relative density. Conifer plantations also have very high stocking, and many of these individual stands are significantly overstocked with poor quality pole-sized trees. Hemlock-Oak stands have the highest sawtimber volume, along with Hemlock-Northern Hardwood, Dry Pine-Oak and White Pine stands.

Species	BA (sq. ft./ac/)	% BA	Trees/ ac.	% TPA	QDM	% AGS (Saw)	Sawlog Volume (bd. Ft./ ac.)
White Pine (Pinus strobus)	26.7	23%	31.0	17%	12.6	49%	1,423
Sugar Maple (Acer saccharum)	19.4	17%	30.5	16%	10.8	70%	1,000
Red Oak (Quercus rubra, Quercus velutina)	13.3	11%	16.2	9%	12.3	90%	1,079
Eastern Hemlock (Tsuga canadensis)	12.8	11%	21.5	12%	10.5	58%	825
Red Maple (Acer rubrum)	6.7	6%	11.9	6%	10.1	58%	225
Ash (Fraxinus spp.)	6.1	5%	14.2	8%	8.9	37%	120
Hickory (Carya spp.), mainly shagbark (Carya ovata)	4.7	4%	8.2	4%	10.3	84%	285
Red Pine (Pinus resinosa)	4.7	4%	10.4	6%	9.1	49%	110
Black Cherry (Prunus serotina)	3.8	3%	6.9	4%	10.1	26%	89
Poplar (Populus spp.)	3.4	3%	4.7	3%	11.5	65%	209
Other Softwood	3.3	3%	6.0	3%	10.0	52%	100
Birch (Betula spp.), mainly sweet birch (Betula lenta)	2.7	2%	5.1	3%	9.9	65%	76
Other Hardwood	2.0	2%	5.2	3%	8.4	35%	29
E. Redcedar (Juniperus virginiana)	1.5	1%	3.6	2%	8.8	46%	15
American Beech (Fagus grandifolia)	1.8	2%	3.5	2%	9.7	29%	27
White Oak (Quercus alba, Quercus montana, Quercus bicolor)	1.7	1%	2.2	1%	12.0	79%	125
American Elm (Ulmus americana)	1.4	1%	4.0	2%	8.0	50%	16
Basswood (Tilia americana)	1.3	1%	1.6	1%	12.0	72%	80
Total	117.3	100%	186.4	100%	10.7	58%	5,834

Table 5. Forest species composition and stand characteristics for Albany Water Forestlands: Basal Area, Trees per Acre, Quadratic Mean Diameter, % Acceptable Growing Stock (for producing sawlogs), and Merchantable Sawlog Volume. In several cases, figures are reported by genus or groups of individual species to facilitate more efficient reporting.

Successional forest types are the least well stocked based on basal area and relative density. Along with Conifer Plantation types, they also have the poorest quality timber—with less than 50% of trees capable of producing a sawlog—and both also rank among the lowest in the percentage of all trees of acceptable growing stock (i.e. trees that are healthy and vigorous, regardless of form). Low overall AGS percentages for bottomland hardwood and hemlock types are due to the relative abundance of ash and hemlock respectively, both of which are experiencing decline associated with aggressive pests and pathogens.

Forest Type	BA/ac.	Trees/ ac.	QMD	% Rel. Density	% AGS	% AGS (Sawlog)	Sawlog Bd. Ft./Ac
White Pine-Hardwood	123	191	10.9	75%	78%	61%	5,557
White Pine	157	200	12.0	70%	74%	57%	8,431
Hemlock-Oak	143	214	11.1	93%	75%	65%	9,979
Successional Mixed Hardwood & Conifer	78	132	10.4	50%	70%	45%	2,747
Northern Hardwood	112	175	10.8	83%	80%	64%	5,962
Hemlock-Northern Hardwood	141	224	10.7	88%	70%	63%	8,606
Conifer Plantation	152	332	9.2	97%	61%	44%	3,174
Mesic Oak	104	174	10.5	82%	96%	87%	6,519
Bottomland Hardwood	76	151	9.6	56%	69%	62%	3,330
Dry Pine-Oak	143	216	11.0	93%	79%	72%	8,578
Dry Oak	110	215	9.7	98%	86%	78%	4,054
Grand Total	117	186	10.7	72.9	74%	58%	5,834

Table 6. Forest stand characteristics by forest type: Basal Area per Acre, Trees per Acre, Quadratic Mean Diameter, Relative Density, % Acceptable Growing Stock (healthy vigorous trees, including those with form defects), % Acceptable Growing Stock for Sawlogs (only includes healthy trees of sufficient form to produce a high quality sawlog), and Merchantable Sawlog Volume.

3.4 Forest Stocking

Forest stocking across Albany Water Forestlands was assessed using relative density, as calculated using NED-2 software (Twery et al., 2011). Relative density is designed to estimate the density of standing timber in a given area, expressed as a percentage of the projected maximum density. While this number is an approximation, it is useful in evaluating how much competition is occurring between trees on a site and it provides a guide for managers trying to maintain stand health and optimize growth rates and timber production over time. As relative density increases, competition among trees for light, water, nutrients and other resources intensifies. This not only reduces the net productivity and growth in the stand, but also reduces individual tree vigor and resilience to pests, pathogens, drought and other disturbance. Conversely, very low relative density indicates that there may be forest health issues or other factors that are limiting development of the stand.

There are numerous measures for evaluating stand density (e.g. crown competition factor, stand density index), but relative density is used in this Plan as it correlates well with traditional forest stocking guides that can be directly applied for management purposes. The following relative density/stocking classes represent conceptual breakpoints that are relevant to management as follows:

<40% Relative Density: Sparsely stocked or non-stocked stands. This represents stands where trees are not fully occupying the site. Unless there is significant regeneration, these stands are not likely to ever become fully stocked. This roughly correlates with stands that fall below the C-Line on a traditional stocking guide.

40-60% Relative Density: Understocked or minimally stocked stands. Crown closure for the stand and the onset of competition occurs in this range but the available growing space is not being fully utilized and, as a result, production is not being maximized. These stands may grow into fully stocked stands on their own, or there may be sufficient stocking for management to improve overall tree condition and/or encourage regeneration. This approximates the region between the B and C-Lines on a stocking guide.

60-80% Relative Density: Moderately stocked stands. Stands in this range are beginning to fully occupy the site, and production is at the lower end of optimal. This is often the target for residual stands following thinning treatments and is the lower half of the region between the B and A-Lines on a stocking guide.

80-100% Relative Density: Fully stocked stands. These stands are fully utilizing the site, and at the upper limit, are starting to experience stress, reduced vigor and density dependent mortality. They have been experiencing optimal production at the stand level but may require thinning or commercial harvest in order to maintain health, vigor and production levels into the future. This is the upper half of the B to A-Line region on a stocking guide.

>100% Relative Density: Overstocked stands. These stands are overcrowded and experiencing severe competition and extensive density dependent mortality from lack of available growing space. Overall stand production is decreasing, and general tree vigor is likely in decline. This is the region above the A-Line on a stocking guide.

Figure 8 shows the number of acres of Albany Water Forestlands in various stocking classes, based on assessments of relative density at the stand level. The majority of Albany Water Forestlands are moderately to fully stocked with trees greater than five inches DBH, with just over 25% in non-stocked or understocked condition and approximately 10% overstocked. In general, the moderate to high stocking levels in most stands on the properties indicate that there is significant potential for sustainable timber production, and severe competition that may be leading to declines in forest health is limited. Most stands have adequate stocking and can be expected to experience vigorous growth for at least some period of time into the future. However, stands in the 80-100% stocking class may require some thinning or intermediate stand management to maintain tree vigor production over time.

As described in further detail in Section 3.3, most of the understocked stands fall within the successional forest types, where the overstory tends to be sparse due to a variety of past land use and forest health issues. This represents nearly 1,400 acres that may not achieve full forest cover without active management. Many of the overstocked stands are dense conifer plantations that were never thinned and are now experiencing significant decline. and losing tree canopy coverage. Despite being at opposite ends of the stocking range, overstocked and understocked stands are experiencing similar declines in forest health and tree canopy coverage, potentially impacting water quality and forest health and resilience goals. Both are priorities for future management to facilitate desirable regeneration and promote mature forest cover.

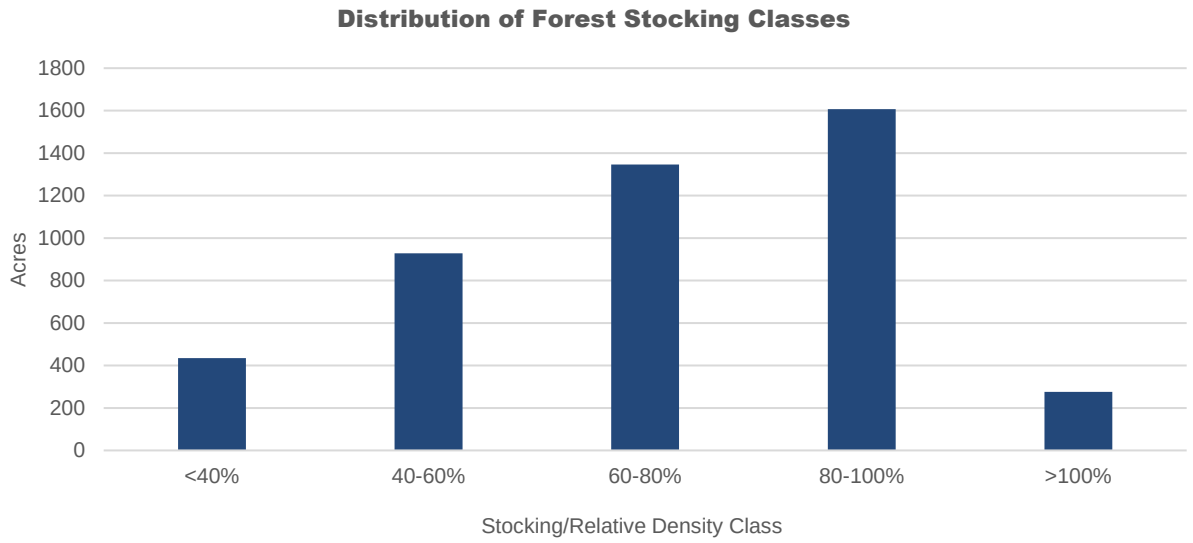

Figure 8. Distribution, by acreage, of stand-level forest stocking based on Relative Density Classes: Non-stocked (<40%), Understocked (40-60%), Moderately Stocked (60-80%), Fully Stocked (80-100%) and Overstocked (>100%).

3.5 Forest Size Class Distribution

Based on inventory plot data, mapped stands on Albany Water Forestlands were broken into size classes based on an interpolation of medial diameter between sample plots. Medial diameter is defined as the diameter of the tree at the mid-point of the basal area distribution (i.e. there is an equal amount of basal area above and below that diameter). While quadratic mean diameter (the diameter of the tree of mean individual basal area) is a more commonly used measure of average overstory tree size in a stand, medial diameter is a better representation of the "average" tree across all size classes and is the most useful indicator of how a person might experience a stand of trees (Twery et al., 2011).

Figure 9 shows the percentage of the Albany Water Forestlands in various 2-inch size classes: regenerating (0 to 4-inch size classes), poletimber (6 to 10-inch size classes), small sawtimber (12 and 14-inch size classes) and large sawtimber (16-in and greater size classes). As one would expect for a forest generally ranging from 60-100 years in age, the majority of Albany Water Forestlands fall into the small sawtimber size class, with younger stands of pole-sized trees common as well. Large sawtimber stands are present in some areas but not common. Although 18 inches is also sometimes used as a threshold for large sawtimber, stands of this size are even less common on the properties. Sixteen inches was used as the threshold in this analysis to highlight more stands that are somewhat larger than the than the "average" sawtimber stands.

An analysis of the distribution of medial diameter for all of the inventoried sample plots (Figure 10) shows that the vast majority of the plots fall within the 10-14-inch size classes or greater, indicating that commercial management is potentially viable across most of the Albany Water Forestlands. However, this does not account for tree form or condition, which can vary widely and limit merchantability. This chart also illustrates that many of the plots are currently in the

10-inch size class, indicating that there might be a significant ingrowth into the small sawtimber size classes in the next 5-10 years.

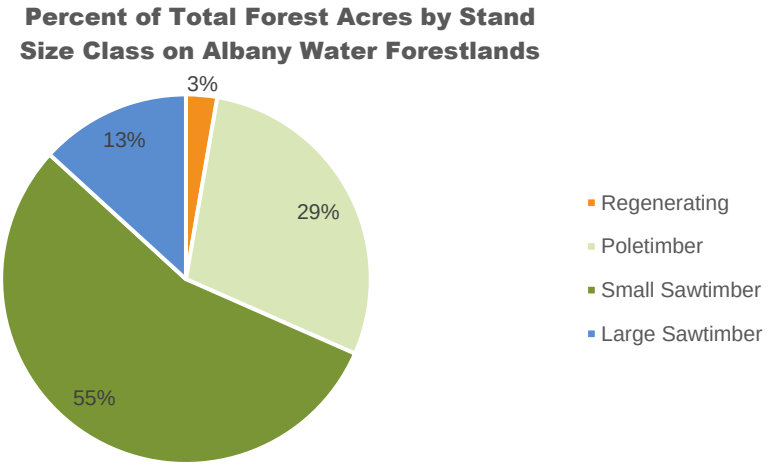

Figure 9. Proportion of Albany Water Forestlands in various stand size classes.

When broken down by forest type, (Figure 11) successional forests have one of the higher proportions of stands in the poletimber size class, although there are some stands of large sawtimber. These large sawtimber stands are most likely the result of a sparse overstory composed entirely of a few larger diameter trees, resulting in a large medial stand diameter. Conifer plantations are also largely in the poletimber size class. Besides a few stands in the successional forest types, large sawtimber stands are limited to the Pine-Hemlock-Hardwood (mostly White Pine and Hemlock-Oak stands), Northern Hardwood, and Hemlock-Northern Hardwood forest types, with a very small amount in the Mesic Oak type.

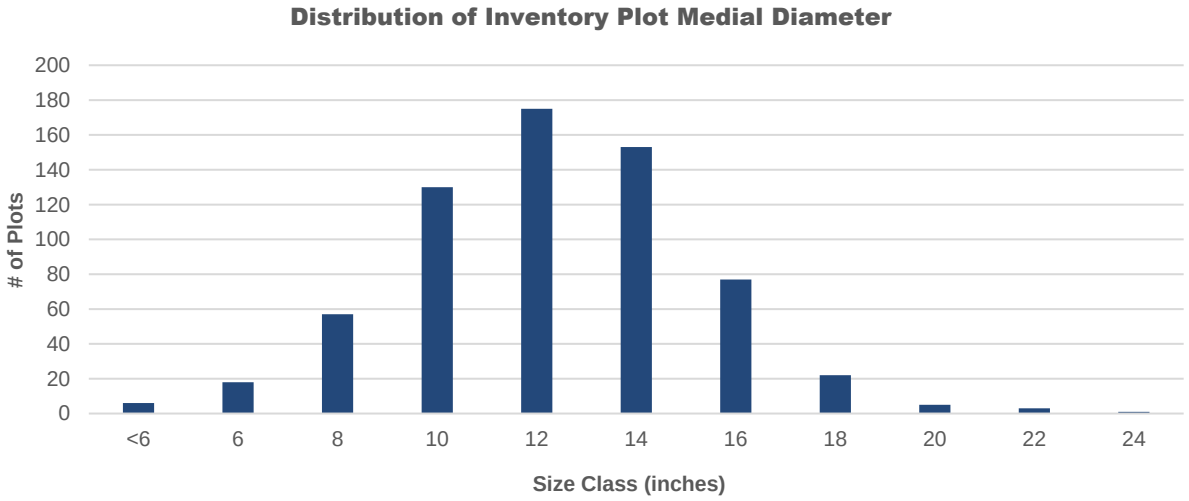

Figure 10. Distribution of inventory sample plot medial diameters on Albany Water Forestlands.

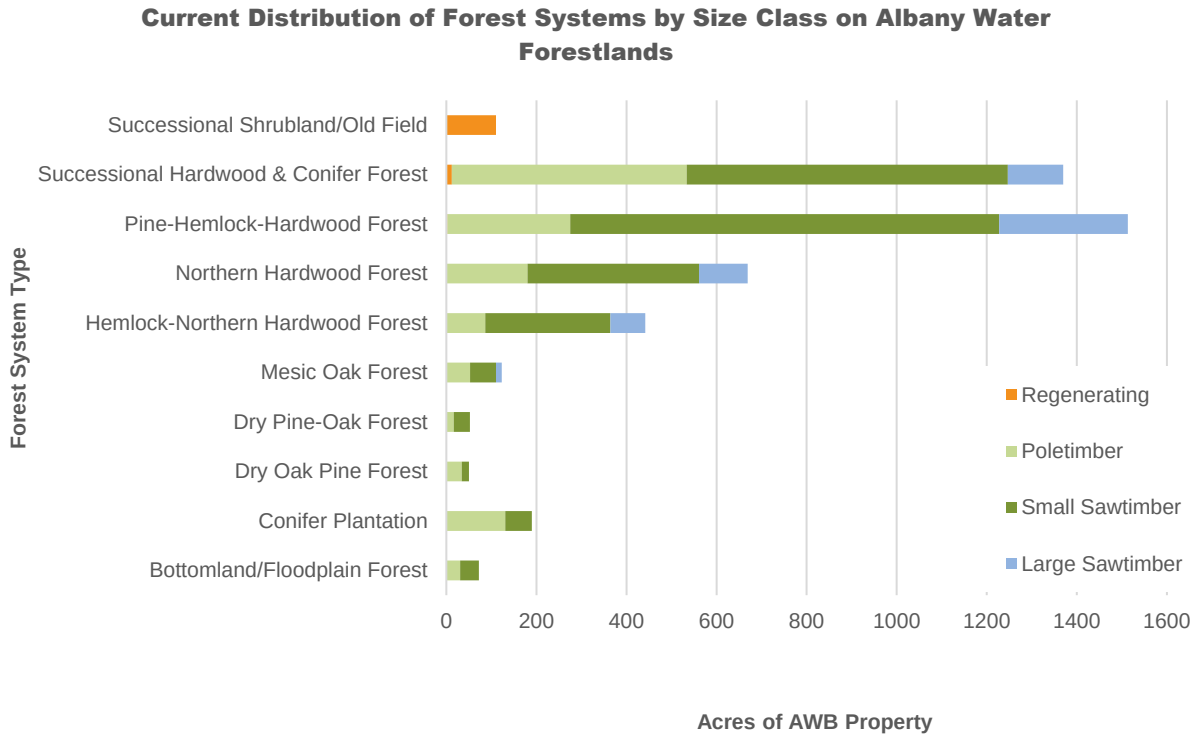

Figure 11. Acres of Albany Water Forestland by Forest Type and Stand Size Class.

This analysis of size class distribution shows a forest that is reaching ecological and economic maturity, as well as meeting goals for maintaining forest cover across the landscape for water quality protection and carbon sequestration and storage. While these are desirable characteristics, it does illustrate a forest that is relatively uniform in size and structure despite significant heterogeneity in species composition and land use history. It also appears that more stands will be moving into small sawtimber size classes in the near future, further reinforcing this trend. Where appropriate and compatible with other management goals, it may be desirable to implement forest management treatments that create more early successional/regenerating forest structure in some areas while attempting to accelerate the development of more complex, mature forest structure in others.

3.6 Forest Regeneration

Total sapling density (stems > 4.5 feet in height up to 4.9 inches DBH) on the Albany Water Forestlands is low at 383 stems/acre (Table 7). In addition, just over 50% of these saplings are undesirable species (Figure 12), either because they will not develop into overstory trees (e.g. hophornbeam and American hornbeam) or they are susceptible to a known pest or pathogen that will limit their ability to survive and restock the stand (e.g. ash, hemlock, beech). Observations during the inventory also suggest that, in many areas, a large number of the existing saplings of desirable species are also suppressed trees of low vigor. This seemed particularly true of sugar maple and white pine.

	Saplings/ac.	Seedlings/ac.
Ash	66	286
Sugar Maple	64	7
Hophornbeam	47	0
White Pine	33	8
Beech	26	72
Red Maple	25	24
A. Hornbeam	23	0
Other HW	22	11
Hemlock	20	0
Hickory	13	5
Cherry	13	7
Red Oak	10	9
Elm	7	4
Birch	6	3
Other SW	5	1
White Oak	2	9
	383	**446**

Table 7. Total seedling and sapling abundance on Albany Water Forestlands.

Seedling abundance was even more heavily skewed towards undesirable species, with only about 20% of stems representing desirable species (Figure 13). Although some stands have sufficient saplings in the understory, the current abundance of desirable regeneration across the property is likely not sufficient to restock the forest overstory following management actions or natural mortality. This is likely the result of several factors—including the stage of stand development and heavy shading in many areas—but heavy browsing by deer is a primary factor limiting regeneration of desirable species such as sugar maple and oaks. Other species of intermediate browse preference and shade tolerance, including red maple and white pine, could potentially be increased through management action.

It should be noted that early successional habitats were not inventoried, and likely have much higher seedling and sapling densities than listed above. Regardless, establishing adequate regeneration to replace existing stands following both large and small-scale disturbances is a critical management priority to ensure the future viability and resilience of forest cover.

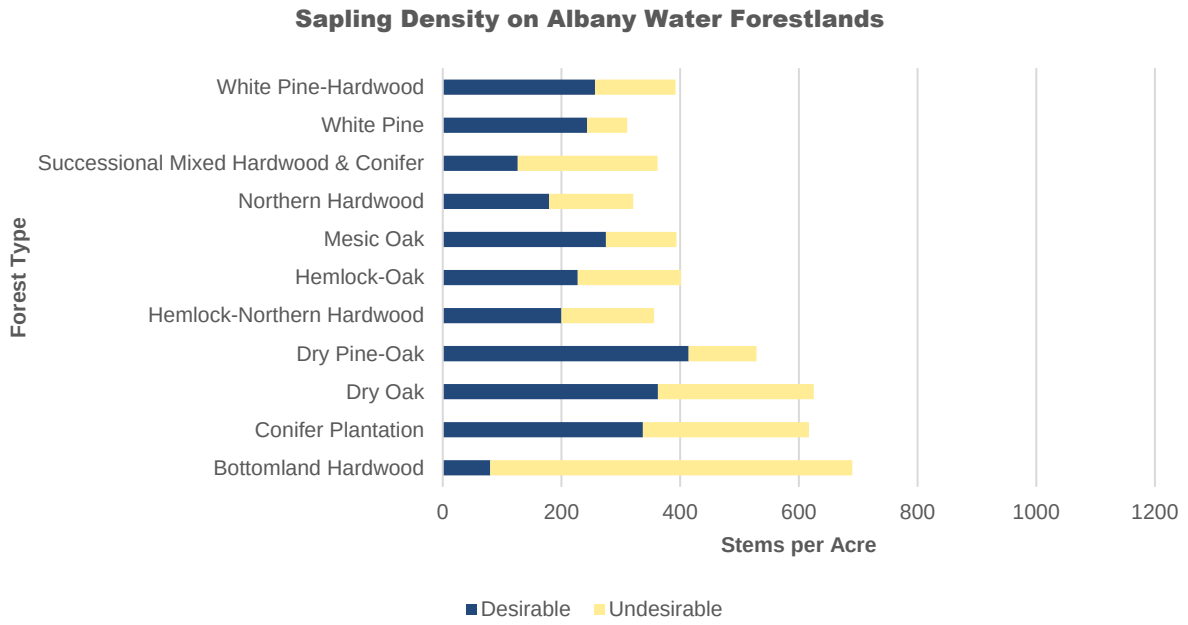

Figure 12. Sapling abundance by forest type and species desirability.

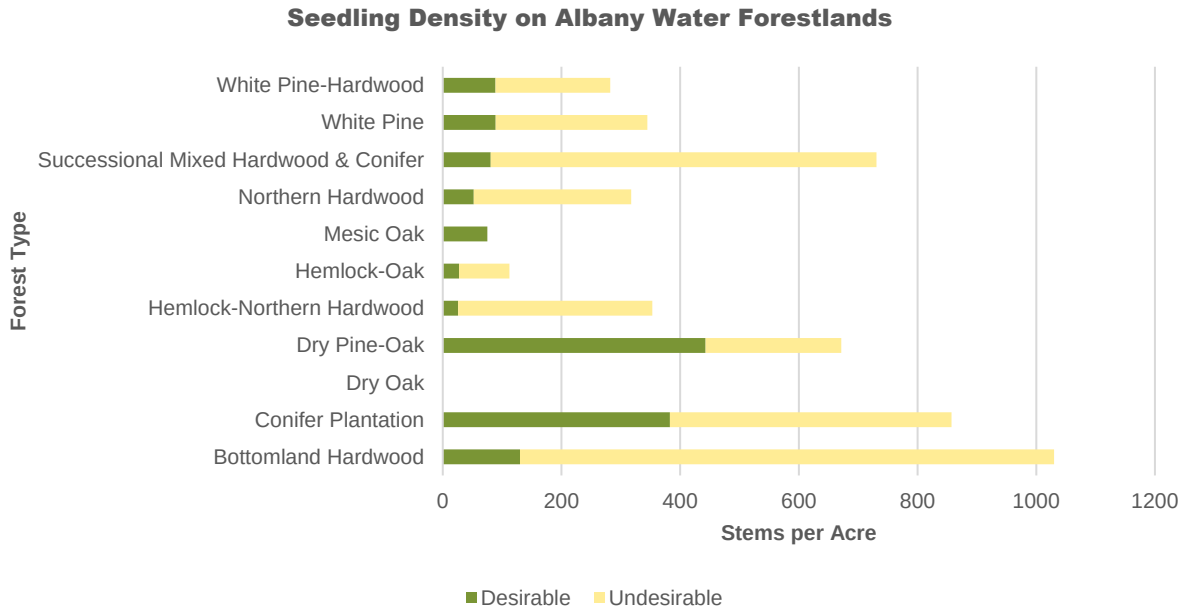

Figure 13. Seedling abundance by forest type and species desirability.

4. Other Resource Conditions

4.1 Water Resources

As a public water supply for New York State's capital city, maintaining water quality in the Alcove and Basic Creek reservoirs is the primary management consideration on Albany Water Forestlands. In addition to the Alcove and Basic Creek reservoirs, the properties contain abundant water resources including high quality streams, wetlands and vernal pools.

In total, there are approximately 15.7 miles of mapped perennial streams on Albany Water Forestlands. Table 8 shows major streams on the property and their NYS Department of Environmental Conservation (DEC) classifications (a complete description of NY stream classifications can be found on the NYS DEC website at http://www.dec.ny.gov). Most streams on the property are very high quality, providing fresh drinking water and important headwater stream habitat for fish, amphibians and other aquatic species. Hannacrois Creek and Basic Creek are also significant tributaries of the Hudson River (the latter flowing into the Hudson River via Catskill Creek) and thus contribute to the water quality of downstream resources. In addition, there are numerous unmapped intermittent and ephemeral streams on the properties.

Stream(s)	DEC Class	DEC-Listed Best Usage	Miles
Hannacrois Creek	A (TS)	Drinking water, swimming and other contact recreation, fishing (trout spawning habitat)	1.7
Other Alcove Streams	A	Drinking water, swimming and other contact recreation, fishing	9.9
Basic Creek—upstream of reservoir	A(TS)/A	Drinking water, swimming and other contact recreation, fishing (trout spawning habitat)	1.0
Basic Creek—downstream of reservoir	C(T)	Fishing, other non-contact recreation (trout waters)	0.2
Other Basic Creek tributaries	C	Fishing, other non-contact recreation	2.9

Table 8. Freshwater stream classifications on Albany Water Forestlands.

The properties also contain approximately 254 acres of NYS regulated wetlands, 218 of which are designated as Class I, reserved for wetlands that provide the greatest ecological and public benefits. These wetlands provide habitat for a wide variety of species and serve a number of critical functions including flooding attenuation, aquifer recharge and natural filtration of sediment and pollutants from the water. Because NYS DEC mapped wetlands only provide general locations and require field verification, visible wetlands were also digitized from aerial imagery during stand mapping, and these boundaries do not necessarily align. Figure 14 depicts all mapped water resources on the property.

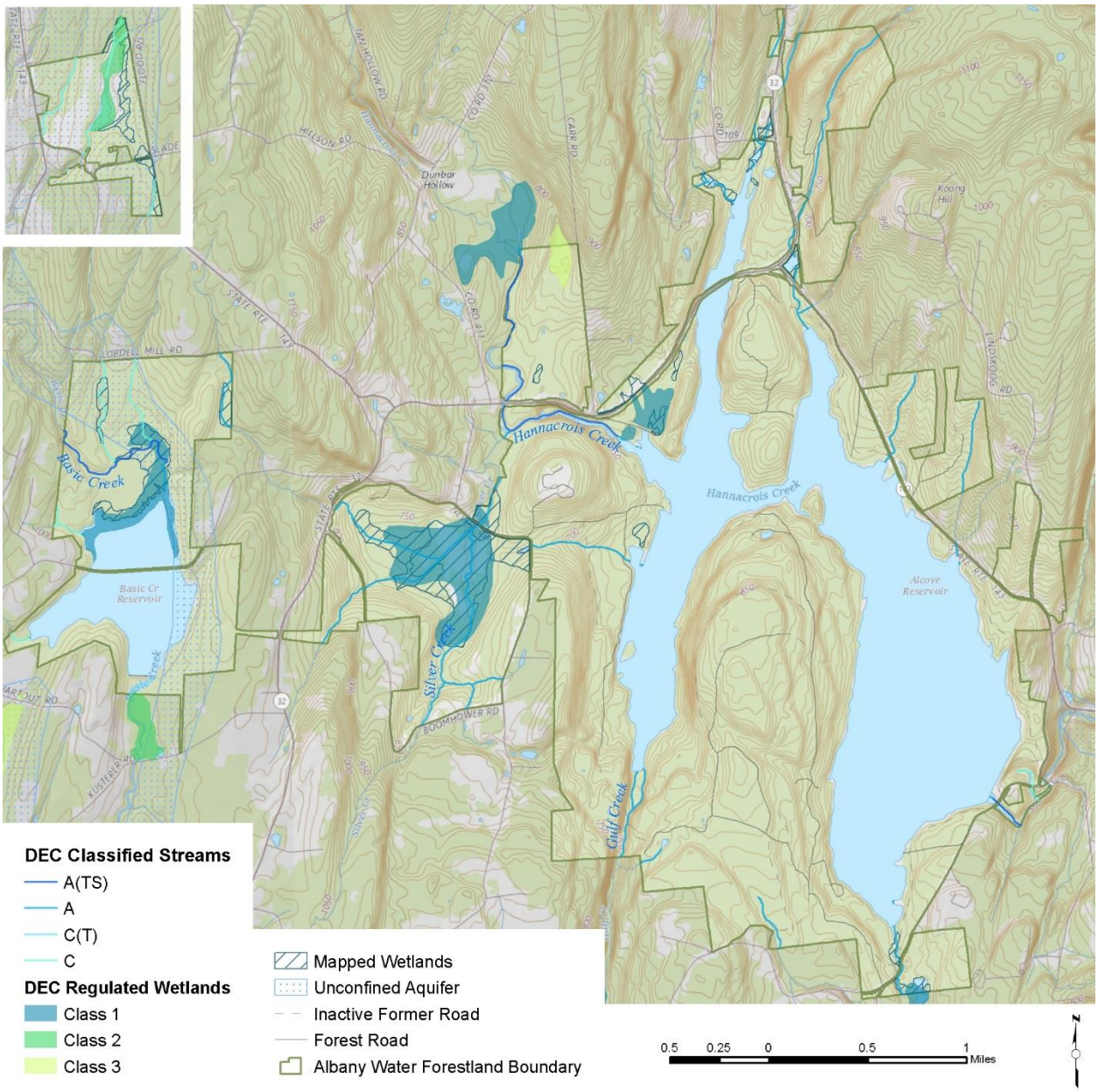

Figure 14. Freshwater resources on the Albany Water Forestlands.

While not comprehensively inventoried and mapped across the Albany Water Forestlands, vernal pools—a type of wetland that is generally small and seasonal in nature—are common across the property as well, along with natural springs and seeps. Because they are generally isolated and ephemeral in nature, vernal pools do not support fish populations and are therefore especially important breeding and nursery habitat for frogs, salamanders and other amphibians that are otherwise highly susceptible to predation.

Given the priority placed on maintaining surface water quality in the reservoirs, streams and wetlands on the properties, standards for management in streamside and wetland zones have been developed in this Forest Management Plan specifically designed to protect water resources (see Section 5.4).

In addition to important surface water resources, a portion of the Basic Creek Reservoir property also lies above a mapped unconfined aquifer. This aquifer could be an important water supply for local wells and may be susceptible to contamination due to its high levels of interaction with surface and soil water.

4.2 High Conservation Value Forests

Explicitly identifying High Conservation Value Forests (HCVF) is an important component of FSC certification, and also provides a framework for ensuring that important social and ecological values of the forest are not diminished by management actions. The following provides a brief description of HCVF areas identified on Albany Water Forestlands.

Consistent with the mission of the Albany Water Board and Department of Water & Water Supply, the most significant conservation value of the property lies in its ability to produce abundant, high quality water for the city of Albany and other customers. In particular, forested areas adjacent to reservoirs and major tributaries, along with their connected wetlands, provide a variety of functions to reduce sediment, nutrients and other contaminants from flowing into the water supply.

Accordingly, forest areas within the 300-foot riparian buffer zones have been identified as High Conservation Value (Figure 15), resulting in a total of 1,272 acres designated as HCV for source water protection. This acreage includes HCV wetland areas, a 100-foot no-harvest inner zone on these wetlands and major tributaries, and an additional 200-foot outer zone where harvest is limited to 50% of pre-harvest basal area and there is a long-term goal of maintaining at least 60% canopy cover of mature forest. See Section 5.4 for additional detail on management in riparian and other water resource buffers.

Given the past land use history, there are no known areas of primary old-growth forest on the properties (i.e. forest that has never been harvested). Some more mature, uneven-aged, stands (generally Oak-Hemlock and Northern Hardwood) with larger individual trees that appear to be over 200 years old were identified during the 2017 field inventory, and other potential secondary old-growth stands were identified through spatial analysis of inventory data. Follow-up field surveys using NY Natural Heritage old-growth assessment criteria as a guide (NY Natural Heritage Program, 2018b) did not identify significant late-successional stand attributes, such as the consistent presence of large/old trees, large coarse woody debris, pit and mound topographic features, and lack of past logging evidence. While these candidate areas did not meet the criteria for Type 2 Old-Growth and HCV designation, they are more mature than stands typically encountered on the properties and it was determined that any management that occurs in these areas will be specifically aimed at maintaining uneven age class distribution, increasing structural complexity, enhancing regeneration and promoting other late successional characteristics.

For a more detailed analysis of High Conservation Value Forest on the properties, see Appendix II.

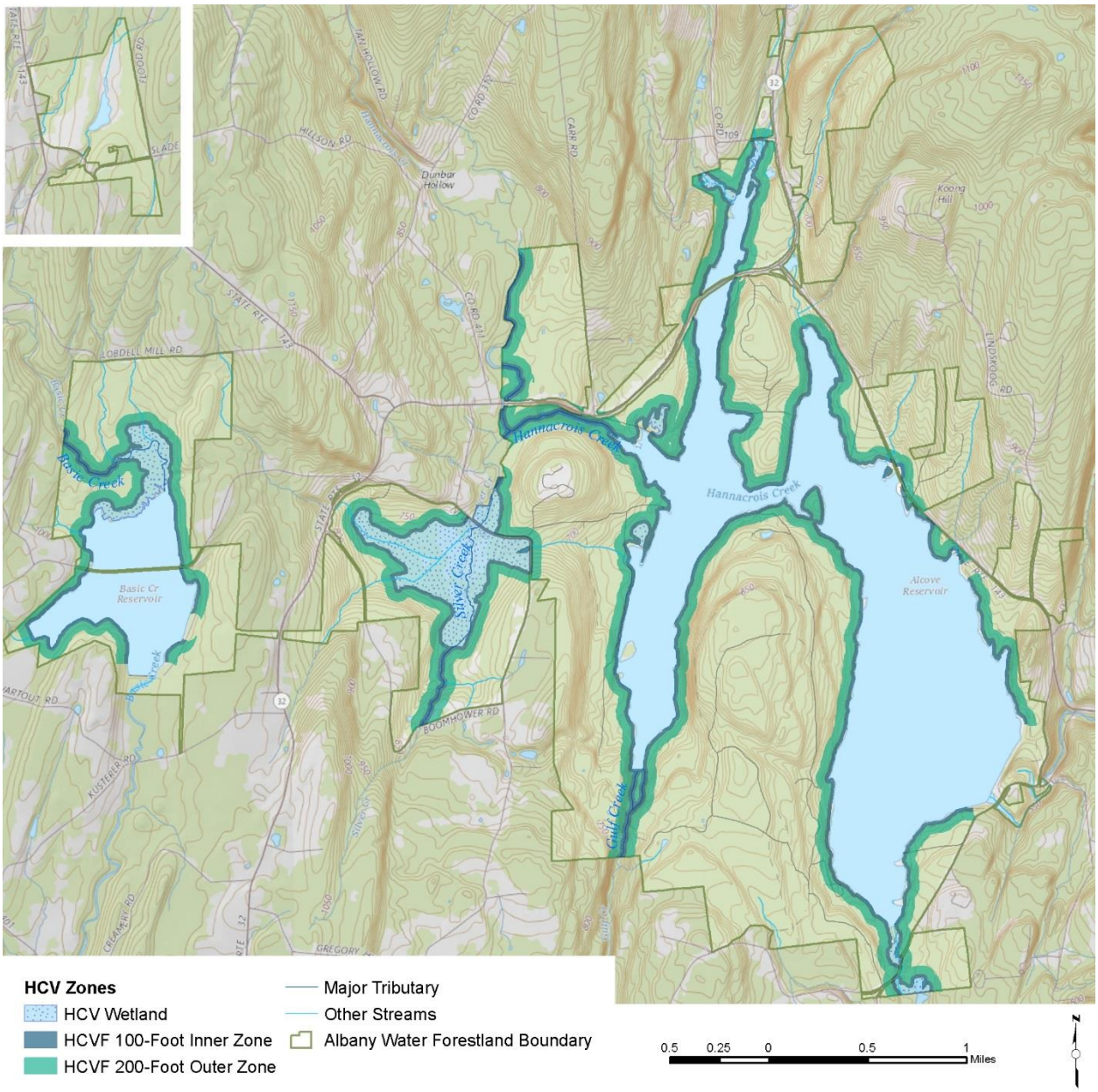

Figure 15. High Conservation Value (HCV) areas on the Albany Water Forestlands.

4.3 Wildlife Habitat

The Albany Water Forestlands have outstanding habitat features, including wetlands, large blocks of unfragmented forest habitat, open water, vernal pools, successional forest and others. The Alcove Reservoir was one of the early sites for the reintroduction of bald eagles in NY, and there are a number of active nest sites on the properties. The reservoirs also provide outstanding habitat for migrating waterfowl. In addition, there is a historical occurrence of pied-billed grebe—a state threatened species—on the Basic Creek Reservoir, and the properties could potentially provide summer habitat for northern long-eared bats. For more information on rare species and management implications, see Section 6.4.

Other than general monitoring of bald eagles and periodic bird counts, there have not been any recent comprehensive surveys of wildlife species on the properties. Bird count data and other observation suggest that the properties provide habitat for a wide variety of species, including a number of NYS Species of Greatest Conservation Need. As one of the largest unfragmented ownerships in the region, the Albany Water Forestlands may also serve an important role as a wildlife refugia and migratory pathway.

The Albany Water Board and Albany Department of Water & Water Supply recognize the value of their properties for wildlife habitat and support expanded cooperation with partners such as NYS DEC and NY Natural Heritage Program to conduct more detailed inventories and surveys for various species and important habitat features on the properties. These partnerships can also help to identify priority habitat management goals which are complimentary to ongoing statewide efforts (e.g. creation of early successional habitat as part of DEC's Young Forest Initiative).

4.4 Cultural & Historical Resources

Based on a screening of data from the NY State Historic Preservation Office (NYS SHPO), there are no known significant cultural and/or historical resources on the property that would be impacted by forest management activities. However, numerous historical features exist—particularly historic grave sites, old stone foundations and stone walls—many of which are outstanding in their size, complexity and architecture. These features are scattered throughout the property, and care should be taken to leave them undisturbed to the greatest extent practical during forest management activities.

Several small portions of the property have been identified by NY SHPO as archeologically sensitive areas. Timber harvesting and similar activities are not of concern, but activities such as road construction, installation of drainage structures or other excavation or soil disturbance would require a more detailed cultural resources screening and possibly an archeological survey. This screening typically happens through the general permitting process for these management actions. Should any potentially significant cultural, historical or archeological sites be found at any time on the property, they will be reported to NYS SHPO.

New York State SHPO also lists three American Indian Tribal Nations as having areas of interest that cover Albany County and the Albany Water Forestlands: the Delaware Tribe of Indians, Stockbridge-Munsee Community Band of Mohican Indians and the St. Regis Mohawk Tribe. Letters and follow-up communications were send to each Tribal Historic Preservation Officer describing the Working Woodlands project area and activities covered under this Forest Management Plan, and no tribal resources or cultural values were identified for any of the properties. However, should any artifacts or potential culturally significant sites be found during management activities, the sites will be protected from further disturbance and the appropriate Tribal Historic Preservation Officers will be notified.

4.5 Aesthetics & Recreation

The Albany Water Forestlands lie in a scenic, rural region of upstate NY. The Alcove Reservoir, in particular, is a prized aesthetic resource as it is highly visible from nearby roadways and offers scenic vistas of the reservoir framed by the Catskill Mountains in the distance. Passersby may also be treated to the sight of soaring bald eagles or migrating waterfowl on the water. Basic Creek Reservoir is also quite scenic, and parts of this property are also open to recreational access with a valid permit. Given the relative lack of other publicly accessible land in surrounding areas, it is a particularly popular site for shoreline fishing and birdwatching and an important recreational resource for the surrounding communities. Aside from the Basic Creek Reservoir recreational areas, no other public access is currently allowed on Albany Water Forestlands. Except for the Basic Creek Reservoir access road and parking areas, all access points to the properties are gated to prevent unauthorized entry.

While providing scenic and recreational resources to the community is not a primary management objective, the Albany Water Board and Department of Water & Water Supply recognize these benefits and strive to manage the property in way that does not disrupt their scenic and recreational value. The general goal for recreational opportunities is to maintain as much public access and enjoyment of the properties as possible, to the extent that it is compatible with maintaining a clean and secure water supply.

5. Forest Management

5.1 Current & Desired Future Condition

The current condition of forests on the Albany Water Forestlands is highly variable based primarily on past land use history, pest and pathogen influences, and soil and other site conditions. In many ways, the forest is characteristic of the region in that the structure is generally mid-successional small sawtimber and somewhat fragmented with relatively small patch sizes. There are a variety of challenges to vigor and regeneration that may make it difficult to maintain forest canopy cover, productivity and health over the long term. However, the existing forest is generally moderately to well-stocked with a variety of species, several of which are valuable timber species. Despite approximately 25% of the forestland currently in a condition that would be considered "degraded"—from the perspective that it may have low stocking, poor tree quality and vigor and, in many cases, significant invasive species infestation—most of the property has the potential to develop high quality forest with proper management. In short, some areas are in need of more active restoration to ensure healthy forest cover into the future, while others have good potential for sustainable production of timber and other social and ecological benefits in their current condition.

The long-term vision of the Albany Water Board and Department of Water & Water Supply is a healthy, vigorous and productive forest that is resilient to natural and human-caused disturbances, provides a clean and reliable source of water and provides a variety of other ecological and social values, including carbon sequestration, wildlife habitat, and timber production. Accomplishing this vision will require a variety of management actions aimed at reducing invasive species infestations, improving degraded stands and managing the impacts of excessive deer herbivory and forest pests. See the Key Ecological Attribute table in Appendix III for additional detail on current conditions versus desired conditions for various forest characteristics.

5.2 Forest Management Objectives

The following is a list of specific management objectives that will need to be applied, as appropriate, to attain the desired future condition and reach the forest management goals described in Section 1.4.

- Protect surface water and soil resources, through best management practices and adherence to surface water buffer zones.

- Improve the ratio of acceptable growing stock (AGS) to unacceptable growing stock (UGS). This includes actively and/or passively facilitating shifts in species composition away from species that are highly susceptible to pests and pathogens (e.g. beech, ash, hemlock), and maintaining residual stocking with high quality stems and species that are resilient to climate change.

- Increase the amount and quality of forest regeneration in all forest types. This will likely require a variety of approaches to manage deer impacts, invasive species and other interfering vegetation, along with specific harvest treatments that facilitate regeneration of desirable species.

- Improve stocking and vigor of desired species in "degraded" stands, focusing on Successional Hardwood & Conifer and Conifer Plantation forest types. In most cases, this will require an integrated management approach to reduce invasive species infestations, intermediate stand management treatments and efforts described above to encourage regeneration or desirable species.

- Enhance forest structural complexity and habitat features where appropriate. This could include retaining snags and legacy trees, girdling and/or pushing over cull trees to create late-successional habitat features, increasing post-harvest basal area and harvesting to a sigmoid diameter distribution (i.e. increasing stems in the upper-middle portion of the diameter distribution relative to other size classes).

- Protect and/or enhance important wildlife habitats and other sensitive resources. This can also include working with NYS DEC and the NY Natural Heritage Program to conduct additional monitoring and surveys on the property.

5.3 Annual Allowable Cut

Providing a sustainable yield of timber over time—along with other benefits from the forest including protection of water quality, carbon sequestration and habitat conservation—requires that removals from timber harvest do not exceed forest growth over time. While it is possible for harvest to exceed annual growth during any one year, the moving average for harvest removals should not exceed growth over any 10-year period to ensure continued growth and vigor, and to meet management goals for maintaining forest cover and carbon sequestration.

An annual growth rate of 2.5% was derived from forest carbon inventory data and site adjusted forest growth projections using the Forest Vegetation Simulator. This correlates with volume growth of approximately 1,150,000 board feet (1,150 MBF) annually across 4,439 of forested land within the Working Woodlands carbon offset project area in the absence of harvest, or 259 board feet per acre.

Accounting for areas where little or no harvest will occur—including Representative Sample areas and Inner Zone water resource buffers (533 acres; see Sections 5.4 and 5.5 for additional detail)—reduces the average annual growth on lands available to harvest to approximately 1,012 MBF. Actual harvests over the next 10 years are expected to average approximately 200 MBF annually, which results in an harvest rate of approximately 19% of total growth over that period.

5.4 Streamside Management Zones

Protection of surface water resources is a critical management goal on Albany Water Forestlands. Accordingly, streamside and wetland management zones (collectively referred to as SMZs for convenience) and wetland buffers were established to limit disturbance in these areas and maintain critical functions for water quality. Given the sensitivity of water resources on the properties, these SMZs and wetland buffers exceed current published Best Management Practices (BMPs) for New York State and guidance published by FSC for the Appalachia region (the FSC-US standard does not include riparian zone guidance for the northeast).

SMZs and wetland buffers are designed with a specified inner and outer zone width. The inner zone is designated as a no harvest area, while the outer zone areas allow more flexibility in management while still maintaining the integrity of the streamside corridor or wetland buffer area. In addition, much of the designated SMZ and wetland buffer areas around reservoirs, major tributaries and connected wetlands on the property are designated as High Conservation Value (HCV) and used to capture Representative Sample Areas for various forest types, and any management in these zones must adhere to maintaining the conservation or representative value of these forests above and beyond what is required for streamside and wetland buffers (see Sections 4.2 and 5.5 for details).

Figure 16 depicts the general location of mapped Streamside Management Zones on the Albany Water Forestlands. These areas are based on the mapped location of streams and wetlands, but the location of these features should be field verified prior to management activities. In addition, there are numerous unmapped features, such as vernal pools and smaller forested wetlands, that require management buffers during timber harvest operations.

General guidelines for management in SMZs and wetland buffers are as follows:

- Inner Zone (IZ): No harvest area, no equipment entry except at necessary stream crossings. Limited, management may occur only if necessary to prevent degradation of riparian areas and/or maintain or enhance conservation values.
- Outer Zone (OZ): Maintain at least 50% of pre-harvest overstory BA distributed through the stand, with goal of maintaining greater than 60% canopy cover in trees >5” DBH over time.
- No new roads or skid trails constructed, unless construction within the SMZ provides a less impactful alternative than avoiding the SMZ. If roads/trails are needed for stream crossing, make crossing as short and direct as possible, and perpendicular to streams.
- No harvesting/operating on slopes >40% within IZ or OZ.
- Directionally fell trees away from waterbodies and inner zone areas. Debris that may disrupt or alter water flow must be promptly removed.
- No herbicides will be used in SMZs unless required for maintenance of water infrastructure, or to control infestations of invasive species that threaten the integrity of

the resource. Only herbicides labeled as safe for wetland and/or aquatic use will be used in SMZs.

- Wetland and/or vernal pool areas must be identified by individuals qualified and experienced in wetland delineation and based on clearly identifiable features such as physical structure, high water lines, plant species and/or other justifiable evidence.
- No harvest or other entry/disturbance in vernal pool depressions or delineated wetlands even when dry.

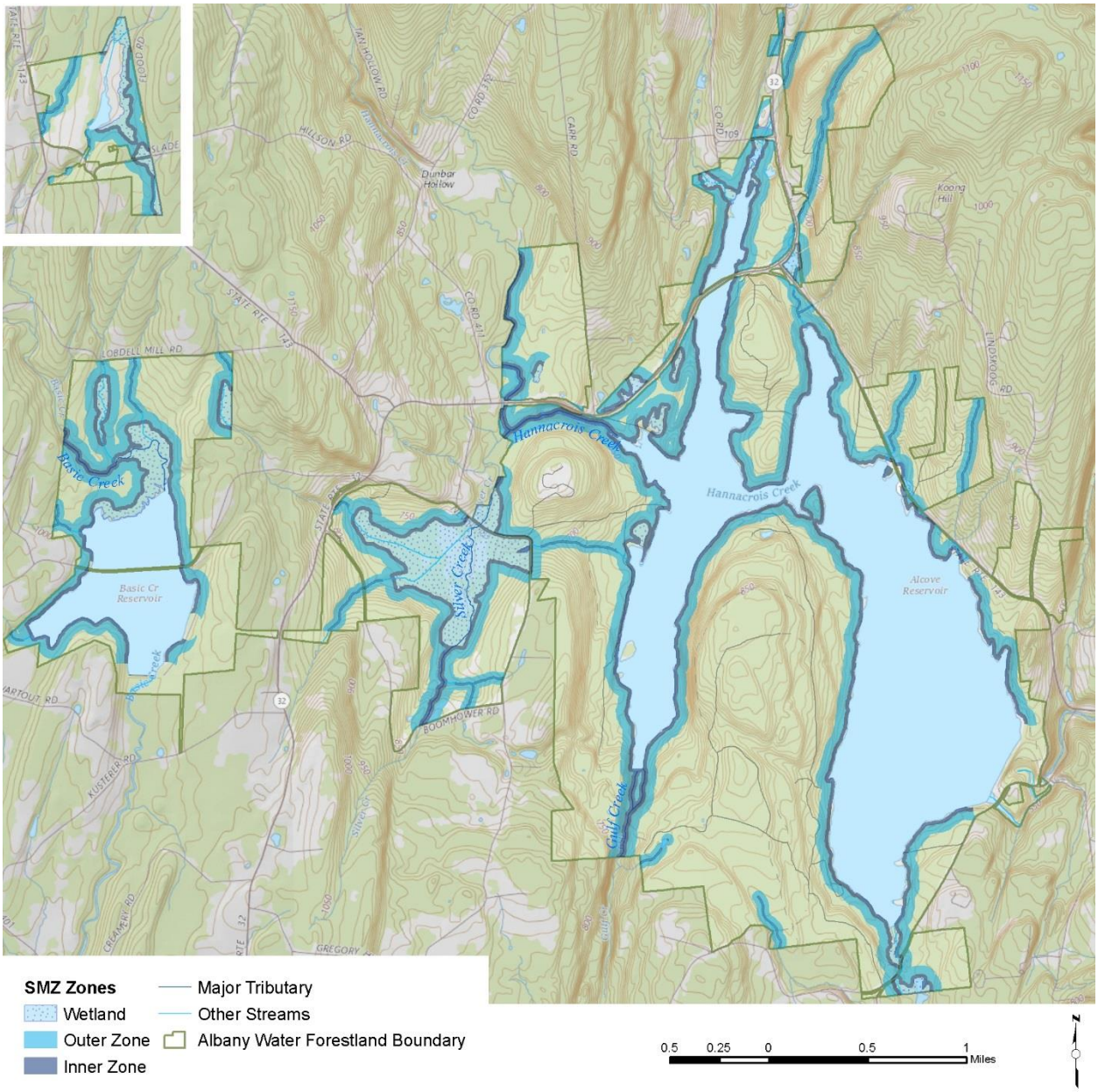

Figure 16. General location of mapped streamside and wetland management zones on Albany Water Forestlands.

Waterbody Type	IZ Width	OZ Width	Total Width	Other guidance
Reservoir: Alcove Basic Creek	100' from spillway height	200'	300'	Buffers are also designated HCV. Some areas may also be designated as RSA.
Major Tribs: Hannacrois Creek Silver Creek Gulf Creek Basic Creek	100' from top of bank	200'	300'	Buffers are also designated HCV. Some areas may also be designated as RSA. No stream crossings unless absolutely necessary and will require DEC permit.
Other Perennial Streams	50' from top of bank	100' (150' if slope >40%)	150' (200' if slope >40%)	Stream crossing will require DEC Permit for all A or C(T) Streams. Avoid in-stream crossings unless absolutely necessary.
Intermittent Streams	None	100'	100'	Entire buffer treated as OZ.
Wetlands	100'	200'	300'	
Vernal Pools	100'	200'	300'	
Springs and seeps	None	100'	100'	No operating in saturated soils, entire 100' buffer treated as OZ.

Table 8. Streamside and wetland management zones for Albany Water Forestlands.

While timber harvesting is not generally subject to DEC regulations, there are certain management actions which require DEC permits. Streams with a classification of AA, A or B—or C classification along with a standard of T or TS—are considered protected in NY under Article 15 of NYS Environmental Conservation Law, and a permit is required for any physical disturbance to the stream bank or channel. With respect to forest management, this would most commonly include stream crossings, such as fords, temporary bridges, placement of culverts or other drainage/diversion devices, or other disturbance that results in any fill entering a stream. In addition, Article 24 of NY Environmental Conservation Law prohibits clearcutting in wetlands without a permit from DEC. Under this Plan, no harvesting will occur within a wetland or the 100-foot inner zone buffer. While many wetlands were mapped as part of the forest inventory, forested wetlands were not easily distinguishable from aerial imagery. Care must be taken to review current state and federal wetlands maps, as well as existing site indicators, prior implementing any management activities in a specific area to avoid inadvertent impacts to wetlands.

Permits from the US Army Corps of Engineers are also generally required for any permanent stream crossings, as well as other activities that are not typically associated with forest management such as filling or dredging waterways. Regardless of stream classification and permitting status, all stream crossings, landings, roads, or other disturbances that may impact water quality will follow published BMPs for NYS (see www.nysbmpguidelines.com).

5.5 Representative Sample Areas

Representative Sample Areas (RSA), as defined in FSC Principle 6, are portions of the landscape that are excluded from management and maintained in a predominantly natural state, appropriate to the scale and intensity of management and the uniqueness of the resource. RSAs

are meant to preserve portions of forest types that would naturally occur on the forest management unit for the following purposes:

1. Establish and/or maintain an ecological reference condition
2. Create or maintain an underrepresented ecological condition
3. To serve as a set of protected areas or refugia for species, communities and community types

The goals of RSAs are similar in concept to those of the Preservation Core, as described by the Old-Growth Forest Network. This approach attempts to enhance the development of large, old trees and mature forest conditions to maximize carbon storage and provide old forest habitat for wildlife by setting aside permanent reserve areas within managed forests (Maloof and Abdo, 2018).

Biophysical Setting spatial data obtained from the LANDFIRE program models vegetation types that were likely dominant in an area prior to European settlement based on the current biophysical environment and an approximated historical disturbance regime. Based on this analysis for Albany Water Forestlands, naturally occurring forest types were Pine-Hemlock-Hardwood Forest, Bottomland/Floodplain Forest, Dry Oak & Oak-Pine Forest and Pine-Oak Forest & Woodland, Northern Hardwood Forest and a very small amount of Hemlock-Northern Hardwood Forest.

Figure 17 compares current vegetation types for the Albany Water Forestlands, as well as the surrounding region. Note that Pine-Hemlock-Hardwood forests were, and remain, the dominant forest type on the Albany Water Forestlands, while dry oak/pine types and northern hardwoods are more prevalent in the surrounding landscape. Also, as previously noted, Bottomland/Floodplain forest types are probably not currently as underrepresented as they appear in the graph due to many of these areas being classified as Successional Hardwood & Conifer based on their species composition.

Delineated RSAs (Figure 18) include representative examples of various successional stages of the major historical forest types on the properties, including Bottomland/Floodplain Forest, Dry Oak Forest, Dry Pine-Oak Forest, Hemlock-Northern Hardwood Forest, Northern Hardwood Forest and Pine-Hemlock-Hardwood Forest. In addition, a small amount of Mesic Oak Forest was also included as RSA. Although not technically a historical forest type on the property, it is a natural forest type and did occur regionally at low levels. Many suitable examples of RSA types were found in HCVF buffers which allow these low-intensity management areas to serve multiple purposes. For upland Dry Oak and Dry Pine-Oak forest types which were not found in existing management buffers, stand polygons were selected in areas that adequately represented forest type attributes as they currently exist on the property.

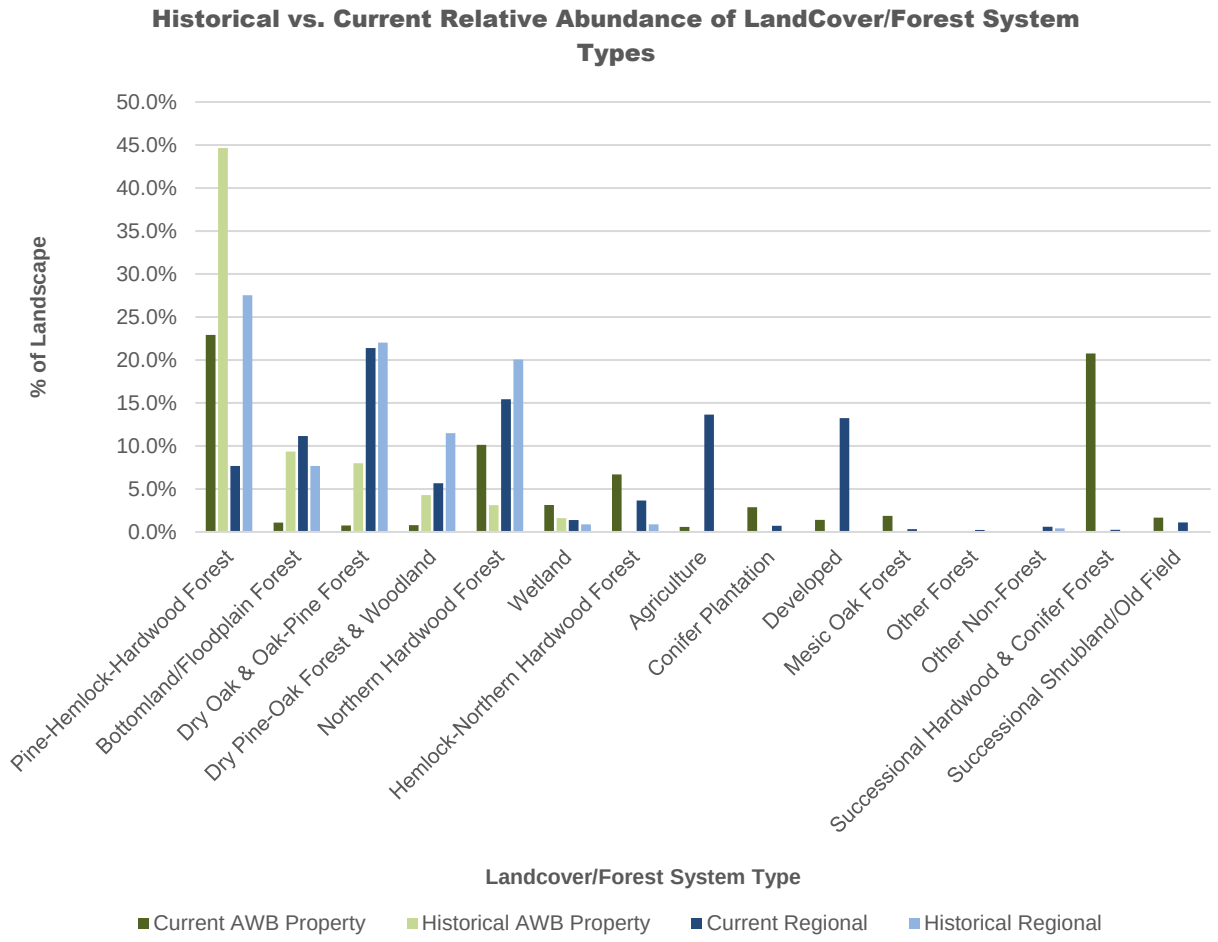

Figure 17. Comparison of current versus historical abundance of various forest types, both regionally and on the Albany Water Forestland properties.

Adequacy of designated RSAs was determined using the distribution of stand size classes and the percentage of each forest type represented (see Table 9 and Figure 19). In general, forest types that are less abundant or are underrepresented on the current landscape have a higher proportion designated as RSA. To the extent practical, RSAs captured the range of size class conditions within each forest type and, overall, the distribution of size classes within all RSA areas closely mirrors the distribution of size classes across the entire property (see Figure 9 in section 3.5 for comparison).

Given the overall purpose of RSAs and the fact that they substantially overlap with HCVF areas, management intensity in these areas will be very low and limited to activities that are compatible with RSA objectives. Any timber harvest or other management that does occur in RSAs must support or enhance the function of the stand to serve as an RSA, and/or protect the stand from threats that might degrade RSA values. Examples include low intensity management to facilitate development of mature forest conditions or enhance structural complexity, or treatment of insect pests to mitigate the impact of an impending outbreak.

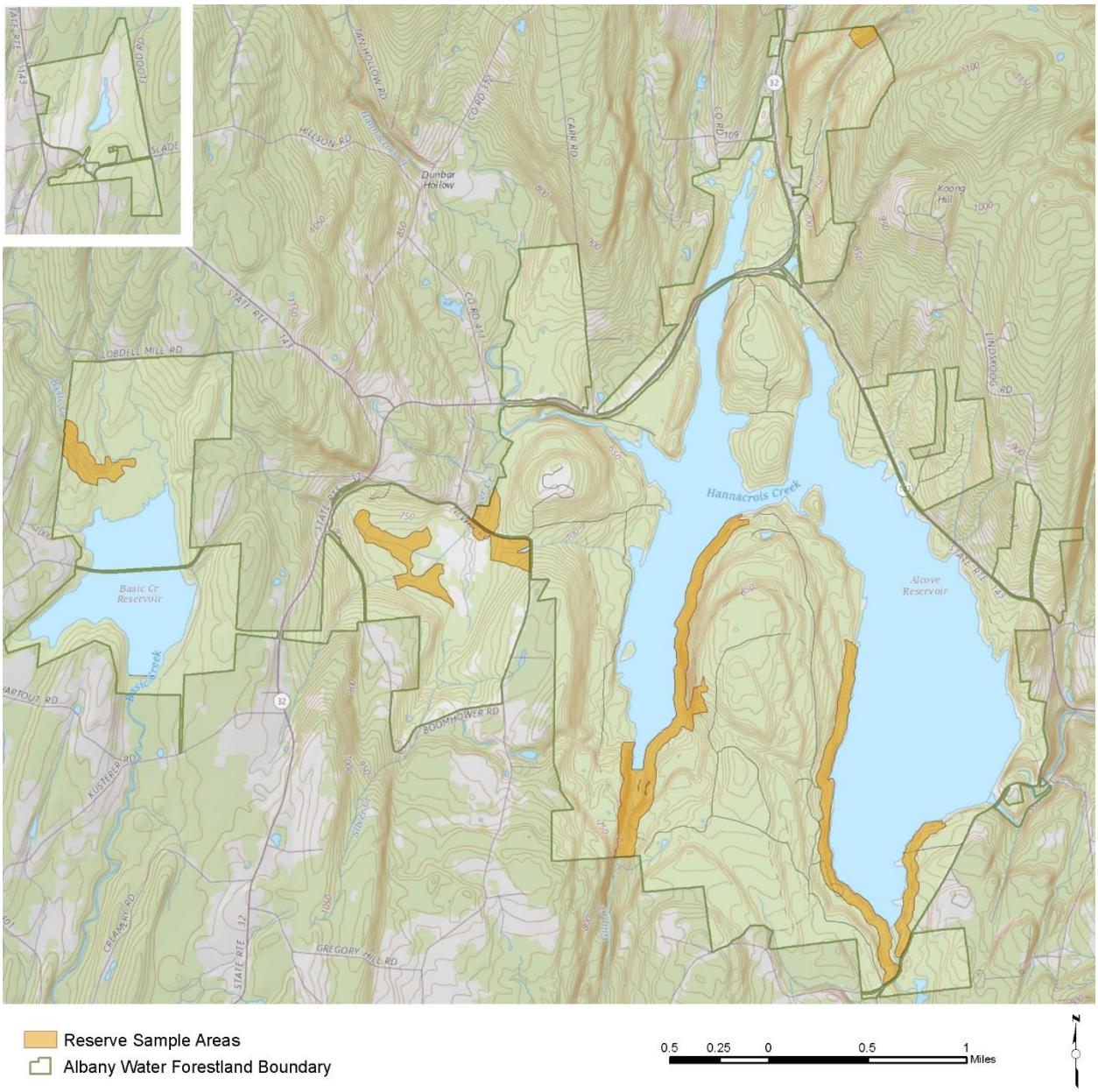

Figure 18. Mapped Representative Sample Areas on the Albany Water Forestlands.

RSA Acres by Size Class

	Regen	Pole	Small Sawtimber	Large Sawtimber	RSA Acres	Total Acres	% RSA
Bottomland/Floodplain Forest	0.0	30.8	41.4	0.0	72.2	72.2	100%
Conifer Plantation	0.0	0.0	0.0	0.0	0.0	190.0	0%
Dry Oak Forest	0.0	0.0	8.9	0.0	8.9	50.3	18%
Dry Pine-Oak Forest	0.0	7.0	0.0	0.0	7.0	52.3	13%
Mesic Oak Forest	0.0	0.7	3.2	0.0	3.9	123.0	3%
Hemlock-Northern Hardwood Forest	0.0	0.0	18.7	10.1	28.8	441.8	7%
Northern Hardwood Forest	0.0	21.7	49.1	24.6	95.4	669.1	14%
Pine-Hemlock-Hardwood Forest	2.4	33.9	46.0	11.5	93.8	1513.2	6%
Successional Hardwood & Conifer Forest	0.0	0.0	0.0	0.0	0.0	1369.8	0%
Successional Shrubland	0.0	0.0	0.0	0.0	0.0	110.3	0%
TOTAL	**2.4**	**94.0**	**167.4**	**46.1**	**309.9**	**4592.2**	**7%**

Table 9. Acreage of Representative Sample Areas designated across different forest types, by stand size class and in total, compared to total area of each forest type on the Albany Water Forestlands.

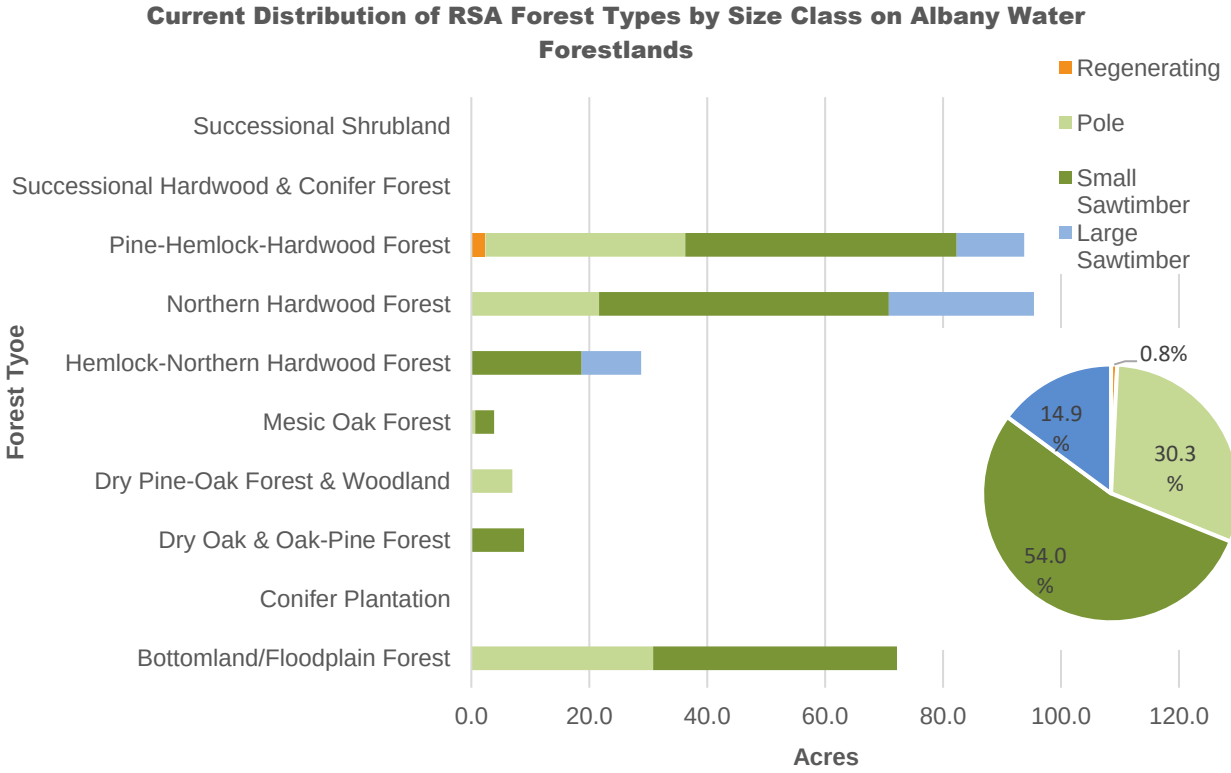

Figure 19. Distribution of Representative Sample Area acreages by forest type and stand size class. The total proportion of RSA in various stand size classes is shown for comparison to non-RSA areas in Figure 9.

5.6 Disturbance Regimes

Knowledge of past disturbance regimes can provide a useful context for understanding how silviculture and other management actions can affect the processes and dynamics of the current landscape. Disturbances can occur at multiple scales and have interacted with vegetation types over time to produce the forest structure and composition that we experience today. Natural disturbances in this region range from canopy gaps created by the loss of an individual overstory tree and small patch blowdowns (fractions of acres to a few acres in size) to large scale events such as wildfires, ice storms and pest outbreaks which may cover tens, hundreds or even thousands of acres with varying degrees of intensity. Small scale disturbances tend to create a more uneven-aged and complex forest structures dominated by shade-tolerant species, while larger and more severe disturbances produce even-aged stands dominated by early and mid-seral species. In a landscape with a fair amount of topographic complexity the variety of disturbance scales and intensities would likely create patches of forest with varying structure and composition.

With widespread European settlement, the landscape changed dramatically, and for the past 200+ years humans have been the dominant disturbance agent on the landscape. Widespread clearing for agriculture, timber, settlements and industrial activities, followed by gradual abandonment and reforestation (including tree plantations), has left a patchwork of forest types age classes and structures, generally ranging from a few acres to a hundred acres or more. Introduced pests such as Dutch elm disease, chestnut blight and, more recently, beech bark disease and gypsy moth have affected the species composition and gap dynamics over time at very large scales.

5.7 Silvicultural Systems

The term silviculture has been defined in many ways, but generally implies active forest management based on the following principles:

1) controlling the establishment, composition, structure and growth of a forest based on a scientific understanding of tree species characteristics;

2) maintaining forest growth and productivity over time; and

3) incorporating a diversity of ecological and social values.

Despite being rooted in science, there is a certain amount of subjectivity and value driven approach to managing with various silvicultural systems. Achieving landowner objectives will likely involve a variety of silvicultural techniques and approaches applied across the landscape at different scales. The selection of the appropriate system in any given areas should be based on a detailed inventory of existing forest condition, in combination with a range of other factors including desired condition for the stand, site conditions, operational constraints, landscape context and potential stressors (i.e. deer browse, pests/pathogen issues, etc.).

In many cases, some degree of site preparation or intermediate stand management—also commonly referred to as timber stand improvement or TSI—will likely be a necessary to establish regeneration, increase acceptable growing stock and/or reduce low shade and understory competition prior to implementing more traditional silvicultural systems. In addition, the various silvicultural treatments will be scaled appropriately to match the various types of natural disturbances that would have occurred on the landscape.

The silvicultural systems described below are the most likely to be successful at achieving desired management goals across Albany Water Forestlands given the current stand conditions, although it is recognized that there are numerous variants of these systems and other types of treatments that may be desirable in certain instances. These descriptions are based heavily on recommendations and descriptions from Bearer and Anderson (2016) and additional details about most of the systems here can be found in their original text.

Site Preparation

As previously discussed, lack of adequate regeneration is a significant challenge across all forest types on the properties. The goal of site preparation is generally to enhance seedling development and growth by reducing low shade from competing vegetation and, in some cases, exposing mineral soil to enhance germination of desired species (e.g. oak). This can be achieved by hand cutting, mechanical removal (e.g. using forestry mulcher, mower, or other heavy equipment) or using chemical herbicides. See Section 6.6 for specific guidance on the use of chemical herbicides.

The type of site preparation depends on the amount and type of competing vegetation, the desired species for regeneration, and other considerations such as proximity to water or other sensitive resources. Each method has potential benefits and drawbacks to be considered. For example, hand cutting is the least impactful method, particularly around water bodies and other resources that may be sensitive to chemicals or soil sedimentation, but is labor intensive, generally requires multiple treatments of re-sprouting stems and does not scarify the soil. Mechanized treatments are efficient and can include scarification but may have undesirable impacts such as increased soil erosion potential.

Intermediate Stand Management

The condition of many stands on Albany Water Forestlands is such that some management may be required to improve overall stand condition, growth and/or ecological value. Often referred to as Timber Stand Improvement (or TSI), this can involve a range of activities, such as thinning to improve stand quality and vigor, cull removal to increase the proportion of acceptable growing stock in the stand and pruning to improve tree form and value. Crop tree release, where desirable trees are given more growing space by removing adjacent trees, can be a particularly effective treatment to focus growth on high value trees, and is often incorporated as a component other types of other silvicultural management strategies. Enrichment plantings can also be used to supplement natural regeneration and facilitate diversity of native trees, shrub and herb species. Only native, locally-adapted and site-appropriate seed and planting stock will be used for this purpose, and species selection should favor species expected to thrive under projected future stand and climate conditions.

The types of intermediate stand management implemented should be appropriate to the current condition of the stand and the desired long-term management strategy. In stands of very poor quality, the cost of intermediate treatments may be too high relative to the ultimate value of the stand, possibly making it more appropriate to regenerate the stand using an appropriate system described below. In general, Intermediate Stand Management should occur early in the stand development to have the greatest impact, with repeated low-intensity treatments occurring throughout the stand development.

Group and Single-Tree Selection

This method is based on removing individuals or groups of trees to create small to moderate sized (generally 0.1 – 2 acres) canopy gaps where a new cohort can develop, similar to small scale blow downs and other natural disturbances. While individual gaps are essentially small even-aged patches, this system can develop uneven-aged conditions and a wider diversity of structure and composition at the stand scale. In practice, this system is best implemented as irregularly distributed harvested patches with individual tree selection and/or crop tree release in the retained matrix between patches. The primary goals are to establish regeneration of desired species in gaps, increase growing space for high quality residual trees between patches and enhance structural and age class diversity across the stand.

The size of harvested groups is determined by the shade-tolerance of the desired regeneration—i.e. smaller gaps (<1 acre) are more appropriate for shade-tolerant species while larger gaps (up to 2.5 acres) are more appropriate for more shade-intolerant species. While this system may be used for a wide variety of forest types, it is generally most appropriate for Northern Hardwood, Hemlock-Northern Hardwood, Pine-Hemlock-Hardwood, and other forests that include a significant component at least moderately shade-tolerant species.

This system is only appropriate in fully stocked stands (relative density 80% or greater) that can support partial thinning, with adequate basal area of healthy, shade-tolerant species. A key focus should be increasing the proportion of acceptable growing stock in the residual stand and focusing growth on high quality trees. If group or individual tree selection is biased towards removal of large mature trees, this system can end up "high-grading" the stand resulting in reduced tree growth and quality over time.

Expanding-Gap Selection

Also referred to as "femelschlag", expanding-gap silviculture is a multi-step process that can be used to increase structural diversity in areas that are degraded and/or have variable stocking levels. The general process involves an initial group harvest—sometimes with a few reserved overstory trees—focused on releasing existing patches of advanced regeneration, and single-tree or small group selection in adjacent areas to begin to establish regeneration. In subsequent entries a crop tree release is conducted in the regenerating patch, along with an overstory removal in the adjacent thinned areas and single-tree selection on the fringes of the newly expanded gap. The process continues at 10 to 20-year intervals until the stand is fully regenerated.

This system is most appropriate in the Successional Hardwood and Conifer Plantation forest types as a means of regenerating degraded areas while maintaining predominantly forested cover in the stand over time. It is particularly well-suited to areas where a regeneration or seed tree harvest is either undesirable or carries a higher than normal risk of regeneration failure. This system may also be appropriate in poorly stocked and/or low-quality stand of other forest types as well.

The presence of advanced regeneration prior to the creation of gaps is critical to the success of this silvicultural technique. In many degraded stands, regeneration is either not present or is undesirable and site preparation will often be needed to establish adequate stocking of seedlings and saplings and manage competition from invasive plants.

Shelterwood

Shelterwood systems are typically characterized by a series of three successive partial harvests to establish a new cohort of regeneration, release the advanced regeneration with a canopy thinning, and ultimately remove all or most of the residual overstory. This system works particularly well for species of intermediate shade tolerance (e.g. oak), which germinate and develop well in partial shade, but require high light levels for the release of advanced regeneration. Shelterwood systems also work well in white pine and northern hardwoods and can be implemented in a two-step process depending on the silvics of the desired species.

While the series of cuts is generally conducted over a short rotation period (10-15 years), a variant of this system referred to as irregular shelterwood harvest extends the rotation time to allow longer periods of regeneration, and sometimes permanently retains some portion of the original canopy. Similar in concept to expanding-gap system, an irregular shelterwood system can be used to increase structural complexity across the stand while achieving similar levels of management efficiency to a traditional shelterwood. Shelterwood systems can also be implemented in "patches" across a large stand, or multiple stands across a landscape, in much the same manner as expanding-gap selection.

Shelterwood systems are best-suited for oak dominated forest types, Northern Hardwood Forest and Pine-Hemlock-Hardwood Forest stands that have a high proportion of white pine, oak and/or mixed hardwood species. Varying the amount of residual basal area following the overstory thinning can be used to influence the amount of shade-intolerant regeneration occurs. As with all treatments that focus on seedling establishment, implementation may need to include some level of site preparation and/or seedling protection.

Thinning to Accelerate Mature Forest Conditions

This type of silvicultural treatment is used to mimic natural disturbance patterns to enhance structural complexity in uniform, even-aged stands of poletimber or small sawtimber or in more mature stands that otherwise lack late-successional characteristics. As described by Bearer and Anderson (2016), this strategy involves a) non-uniform improvement thinning matrix where undesirable trees are removed; b) crop tree release through the creation of "gaps" or patches with less than 30 sq. ft./acre of basal area around retained trees with desirable characteristics and; c) "antigaps" that are left unthinned or only very lightly thinned.

Various different approaches have been described for accelerating the creation of mature forest conditions (also see Keeton, 2006), but the general strategy is some degree of non-uniform thinning with higher than average residual stand basal area, retention of trees that are resilient and well-formed, or that have desirable legacy characteristics (e.g. cavity trees, snags, soft-mast producers), and creation of gaps for regeneration and establishment of a new age/size class. Selecting large, vigorous trees as "crop trees" for release can focus post-harvest growth on the larger size classes and accelerate the development of very large trees (e.g. >36"). Very low-value trees can be girdled to create snags or pushed over to create tip-up mounds and enhance coarse woody debris, further enhancing late-successional forest characteristics.

This type of treatment can be implemented in any forest type where there is a desire to create more structural diversity. However, it is best suited to Northern Hardwood, Hemlock-Northern Hardwood, Pine-Hemlock-Hardwood and oak dominated types that are well stocked.

Restoring Mature Forest Understory Conditions

This strategy includes two types of harvests that are designed to allow for understory reinitiation in stands that have a mature overstory including large diameter trees, but otherwise lack in vertical complexity and regeneration. The first, called a modified transition harvest, involves a relatively heavy thinning—removing 30-50% of the trees—focused on intermediate and suppressed trees. This allows increased light to the understory to stimulate regeneration of a variety of mid-tolerant and shade-tolerant species. The thinning can be applied non-uniformly across the stand, with the incorporation of small gaps, similar to the approach for accelerating mature forest conditions.

Once regeneration is established this initial treatment can be followed up with a subsequent group selection harvest that focuses on releasing patches of established regeneration. Harvested patches should occupy approximately 15-20% of the stand and, similar to a typical group selection harvest, sized appropriately to the natural disturbance regime and the desired species' shade tolerance. If repeated over time through successive harvest, this group selection in older stands will lead to a true uneven-aged condition. Other elements of Accelerating Mature Forest Condition can also be applied as part of this strategy, including snag retention/creation and enhancement of coarse woody debris.

Given that this approach is best implemented in stands that area already quite mature, it is not as widely applicable as the Thinning to Accelerate Mature Forest Condition. While it is not restricted to any specific forest types, Restoring Mature Forest Understory Condition is currently most appropriate in large sawtimber stands of Hemlock-Oak and Northern-Hardwood. There may also be other Pine-Hemlock-Hardwood, Hemlock-Northern Hardwood and oak dominated stands where it could achieve desired results.

Seed Tree & Regeneration Harvests

Seed tree harvest and regeneration harvests involve removing all, or nearly all, of the harvestable trees in one entry, including poor-quality stems. Both treatments are administratively and operationally efficient and they can both be an appropriate way of regenerating stands when there is not sufficient acceptable growing stock to facilitate the

implementation of other silvicultural treatments, and/or to increase landscape level structural and species diversity. In general, both treatments strongly favor shade-intolerant species and produce early successional forest structure during the early stages of stand development.

In a seed tree harvest, all trees are removed except for selected individuals distributed throughout the harvest area. The density and arrangement of reserved trees is generally dictated by seedfall distance of those species. For this method to be implemented successfully, retained seed trees must be vigorous high-quality stems of desirable species. The seed tree method differs from shelterwood in that residual stocking is lower, and the retained trees may or may not be harvested in a subsequent entry.

Also referred to as a clearcutting, regeneration harvests involve removal of all trees from the harvest area to release existing advanced regeneration. Because no seed trees are left, regeneration harvests without adequate advance regeneration may result in failure to restock the stand and other issues, such as invasion by invasive species or other interfering vegetation. Any regeneration harvests that do take place on Albany Water Forestlands will be limited to 10 acres in size and at least some portion of the initial stand (>20 sq. ft. of basal area per acre harvested) will be retained in irregular patches or strips in the harvest unit to retain ecological values within the harvest unit. In addition, harvest areas should be irregular in shape to minimize visual impacts and increase the edge complexity of the residual stand.

Depending on the specific stand level objective, seed tree and regeneration harvests may be appropriate in nearly any forest type. However, this type of treatment will generally be limited in use to regenerating extremely poor-quality stands or for creating localized patches of early successional wildlife habitat.

5.8 Salvage

Salvage harvesting is the practice of removing timber from forests following heavy damage by insect pests, diseases or other disturbance for the purpose of extracting timber value that might otherwise be lost. In the Northeast, this is most commonly associated with impacts from forest pests and pathogens, or following severe storm damage. While pests such as hemlock wooly adelgid and emerald ash borer are likely to cause widespread and extensive mortality among target species, there are currently no plans to conduct salvage operations on Albany Water Forestlands. Given that generating economic returns from timber is a lower priority goal that maintaining ecosystem health and promoting forest resilience for watershed protection, salvage harvests focused primarily on recouping potential economic losses will generally not be conducted on the properties unless part of a more comprehensive strategy to benefit the forest ecosystem recovery process.

Pre-salvage harvests—harvesting healthy trees in anticipation of a potential disturbance—generally result in greater long-term losses to impacted species and/or forest types, including the loss of individuals that may have otherwise been resistant to the damaging agent. For this reason, harvests focused on pre-salvaging to avoid potential losses, particularly those that target individuals of a specific species, are strongly discouraged. If evidence suggests that some type

of intervention prior to the widespread onset of an insect or disease pest may benefit or accelerate the forest recovery process—for example, a silviculturally-based treatment designed to enhance forest regeneration prior to anticipated widespread canopy mortality—a properly designed and implemented harvest strategy may be appropriate for meeting forest management goals in stands that are likely to be impacted. However, care should be taken to retain at least some stocking of potentially impacted species, particularly healthy individuals that may have some level of resistance.

5.9 Non-Timber Forest Products

At the current time, there is no active management or harvest of non-timber forest products (NTFPs) from Albany Water Forestlands and no plans to develop any NTFPs commercially. Prior to the commercial development of any NTFPs such as maple syrup, harvesting of mushrooms or wild plants, or others, the Albany Department of Water & Water Supply will consult with The Nature Conservancy to ensure that such activities could be implemented in a sustainable fashion, are consistent with the conservation values of the property, and will not conflict with other forest or property management goals.

5.10 Property Access & Boundaries

Preventing unauthorized access, boundary encroachments and other trespass is necessary to avoid potential resource damage and conflicts with neighbors. Public access is currently only allowed on the Basic Creek Reservoir property, and all other roads and access points are gated and locked. A 24-hour security guard is on-duty at all times to patrol the properties and respond to any trespass or unauthorized use.

Property boundary lines on all Albany Water Forestlands are clearly blazed and posted. Roadside boundary signs are maintained annually, and the goal is to walk and repost all remote boundary lines on a five-year rotation. Neighboring landowner encroachments are inevitable on a property of this size with so many abutting parcels, and properties lines should be inspected at a frequency that is commensurate with the likelihood of encroachments or other trespass. All current known encroachments are minor and in the process of being resolved via direct communication between the Albany Department of Water & Water Supply and neighboring landowners.

6. Other Management Considerations

6.1 Forest Pests & Pathogens

As all management goals in this Plan are predicated on a healthy and vigorous forest, pests and pathogens on trees in the area are a significant management consideration. Table 10 lists a number of common and/or concerning pests and pathogens that are known to exist in the region or could possibly pose a risk to the property. The list above is not a complete inventory of forest health issues but includes the most significant current forest health concerns.

Hosts Species	**Pathogen**
Ash (*Fraxinus* spp.)	Emerald ash borer (*Agrilus planipennis*) Ash yellows (*Candidatus phytoplasma fraxini*)
Beech (*Fagus* spp.)	Beech bark disease (*Cryptococcus fagisuga* & *Neonectria* spp.)
Elm (*Ulmus* spp.)	Dutch elm disease (*Ophiostoma ulmi*, *O. novo-ulmi*, *O. himal-ulmi*)
Chestnut (*Castanea* spp.)	Chestnut blight (*Cryphonectria parasitica*)
Maple (*Acer* spp.)	Eutypella canker (*Eutypella parasitica*)
Oak (*Quercus* spp.)	Oak wilt (*Ceratocystis fagacearum*)—potential threat
White pine (Pinus. strobus)	White pine blister rust (*Cronartium ribicola*) White pine weevil (*Pissodes strobi*) Caliciopsis canker (*Caliciopsis pinea*)—possible
Red pine (Pinus. resinosa)	Red pine scale (*Matsucoccus resinosae*)—possible
Hemlock (Tsuga canadensis)	Hemlock woolly adelgid (*Adelgis tsugae*)

Table 10. Listing of various pests and pathogens of concern for Albany Water Forestlands.

During the 2017 forest inventory, forest pests and pathogens were observed in only 13% of inventory plots. The most commonly recorded impacts were from easily observable agents, including white pine weevil and beech bark disease. The presence of emerald ash borer was also confirmed on numerous sites, and both emerald ash borer and hemlock wooly adelgid were suspected at many additional plots. Given the prevalence and susceptibility of host species, emerald ash borer and hemlock wooly adelgid currently have the greatest potential to cause widespread damage on the properties. Ash mortality from emerald ash borer is already occurring in many areas and is expected to continue at high levels over the next 5-10 years. Although it is harder to predict, significant impacts to hemlock are also likely in the next 5-15 years. For additional information on these pests, visit the NYS DEC emerald ash borer and hemlock wooly adelgid websites.

The containment and prevention of damage from these and any other pest or pathogen to the forest cover on the Albany Water Forestlands is a significant consideration in forest management activities. While it is recognized that there is often little that can be done at a landscape scale to actively manage many of these pests once they are established, there are a number of general ways to reduce the impacts of established pests and pathogens on a particular

stand using an integrated pest management (IPM) approach. The American Tree Farm System's IPM website provides additional information on IPM methods.

During forest management activities, simple steps like timing to minimize spread (e.g. avoid times when fungal spores and/or insect pests are dispersing), proper handling of potentially infested material, and managing stand/site conditions (e.g. shading and moisture levels) can prevent spread or exacerbation of existing infestations. Stand level actions such as improving individual tree vigor through Intermediate Stand Management or other means, sanitation harvest or removal of affected individual trees, planting and/or facilitating natural regeneration of non-susceptible species, and possibly targeted biological and/or chemical controls can also reduce impacts at the stand level. These activities can be performed during regular harvest activities or as planned events on their own. Individual trees that display levels of resistance to these pests and pathogens can also be retained or favored in management activities.

There are numerous species that could pose a significant risk to Albany Water Forestlands if new infestations were to become established, and it is critical that management staff stay current on emerging threats and actively monitor for the presence of new pests when in the field. Oak wilt (*C. fagacearum*) has not yet been encountered on Albany Water Forestlands but poses significant management risk if it enters the area. Currently, the NYS DEC Oak Wilt Management Plan calls for eradication efforts to take place if the disease is found in Albany County.

Asian longhorned beetle is another forest pest of great concern that is not currently present but could severely impact the Albany Water Forestlands. Asian longhorned beetle is a wood boring insect of maples and a variety of other hardwood species. Because of its aggressive nature and wide spectrum of host species, this pest could have devastating impacts to hardwood forests across NY if populations were able to become established in natural forests. Additional information can be found on the NY DEC Asian longhorned beetle website.

All other quarantines and controls as listed by NYS DEC and USDA/EPA will be respected and monitored for changing conditions and species of interest.

6.2 Deer Herbivory

The impact of white-tailed deer on forest ecosystems is a well-documented ecological phenomenon in the scientific literature, and high deer densities are known to be one of the most significant limiting factors on tree regeneration in northeastern forests (Russell et al. 2017). In the absence of any natural predators, deer populations have rebounded dramatically from lows in the late 19th and early 20th centuries as abandoned agricultural lands have reverted to forest. At high population densities, excessive deer herbivory reduces the ability of many tree species to regenerate, reduces the diversity of plants in the forest and simplifies the forest structure by effectively eliminating the understory layer (Rawinski, 2014). These impacts can have a cascading set of consequences, often leading to loss of forest regeneration, habitat for other wildlife—particularly shrub and ground nesting birds—and proliferation of non-palatable native and invasive plants, such as hayscented fern, Japanese stiltgrass and garlic mustard.

Deer impact was measured on Albany Water Forestlands during the 2017 forest inventory, and significant impacts were nearly universal across the properties (see Figure 20). Approximately 77% of all plots were rated as having high or very high impacts, meaning that the regeneration of even non-preferred browse species is being significantly suppressed by deer. Just over 20% of plots are experiencing moderate impact which indicates that desirable regeneration is being significantly limited. Virtually none of the property had low or very low impact.

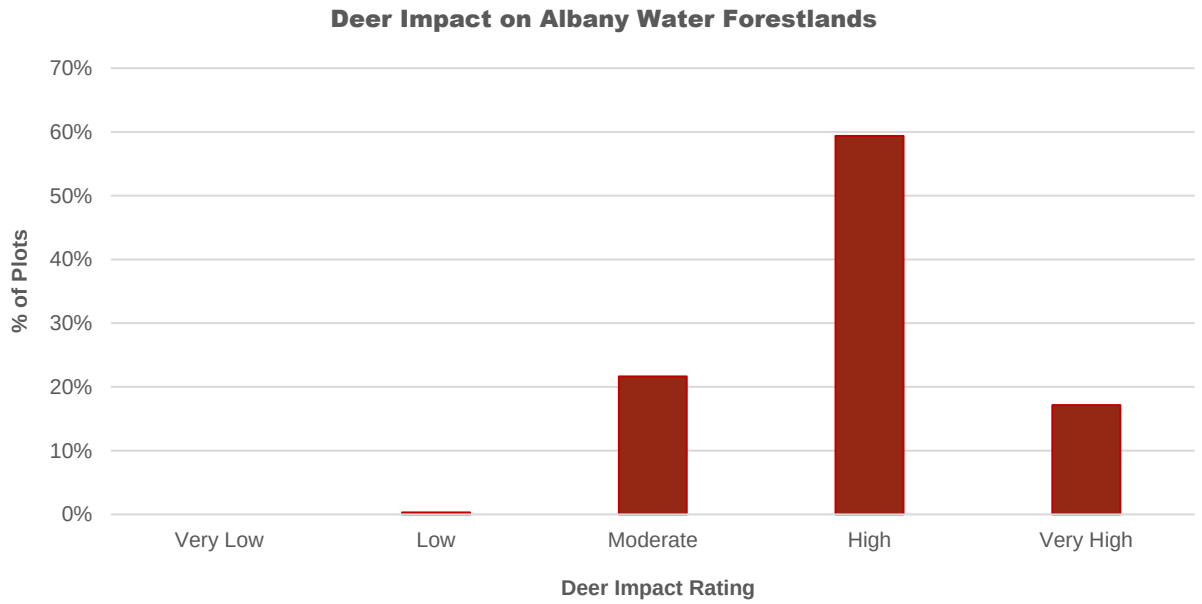

Figure 20. Percentage of inventory sample plots by deer impact rating.

Although seedlings are present in many places throughout the properties, individual stems that are tall enough to emerge from the annual snow pack are subject to repeated and extensive deer browse. This is particularly true for many desirable species such as sugar maple and oak which are preferred by deer; but even the growth of many non-preferred species such as white pine, hemlock and birch is likely being suppressed.

At the impact levels currently observed across the properties, it is unlikely that any silvicultural treatments or other management activities to encourage desirable regeneration will be successful without some measures to mitigate deer impacts. Generally, this can take two forms:

1) reducing deer populations on the property through recreational or managed hunting; and/or

2) protecting regeneration in managed areas from browse using tree tubes, fencing or other exclusion methods

Recreational hunting is the most cost-effective option, but results can vary and even the most robust recreational hunting program on an individual property can be ineffective if regional deer populations remain high. At the current time, there is no recreational hunting on the property, and a relict state law (ECL 11-0907) prohibits public hunting on the properties. It is

recommended that the Albany Department of Water & Water Supply investigate the feasibility of changing this law in partnership with The Nature Conservancy and NYS DEC to allow recreational hunting and look into alternative options such as leasing the property to a hunting organization or working with NYS DEC to issue deer damage permits as a means of temporarily reducing the deer herd locally until a more permanent solution can be identified.

Measures to exclude deer are generally more effective than hunting—fencing areas after harvest, for example—but are also far more expensive and labor intensive to maintain, often making them cost-prohibitive over large areas. However, fencing or other exclusions may be necessary in some areas in the absence of hunting, or if hunting or other population control measures do not sufficiently reduce browse impacts. Felling trees in an overlapping "jackstraw" pattern, creating walls of tree tops and slash, and other means of creating physical barriers can also be somewhat effective at allowing regeneration to establish after timber harvest or other forest stand improvement treatments.

At the current levels, deer impacts are severe enough that they will impact the ability to meet long-term forest management goals for protecting watershed values, maintaining resilient forest cover and promoting a diversity of wildlife habitats. Timber harvest and other forest management strategies are also not likely to be successful in meeting objectives for regeneration and long-term stocking and productivity at current deer impact levels due to regeneration failure and exacerbation of invasive species infestations. It is recommended that a comprehensive Deer Management Plan for the properties be developed in cooperation with NYS DEC prior to engaging in widespread active forest management.

6.3 Invasive & Interfering Plants

The presence of invasive plants and native vegetation that crowd out desirable regeneration is common throughout the northeast, and Albany Water Forestland properties are no exception. Based on the 2017 forest inventory results, approximately 41% of all plots had invasive plants present, and 20% had invasive species cover of >10%. Bush honeysuckle (*Lonicera* sp.), common buckthorn (*Rhamnus cathartica*) and multiflora rose (*Rosa mutltiflora*), were the most common species. Although not currently common on the properties, Japanese stiltgrass (*Microstegium vimineum*) is present on a number of sites. Observations from other properties in the region indicate that this species has the ability to expand rapidly under ideal light and moisture conditions. The frequency of species encountered during the inventory is shown in Figure 21.

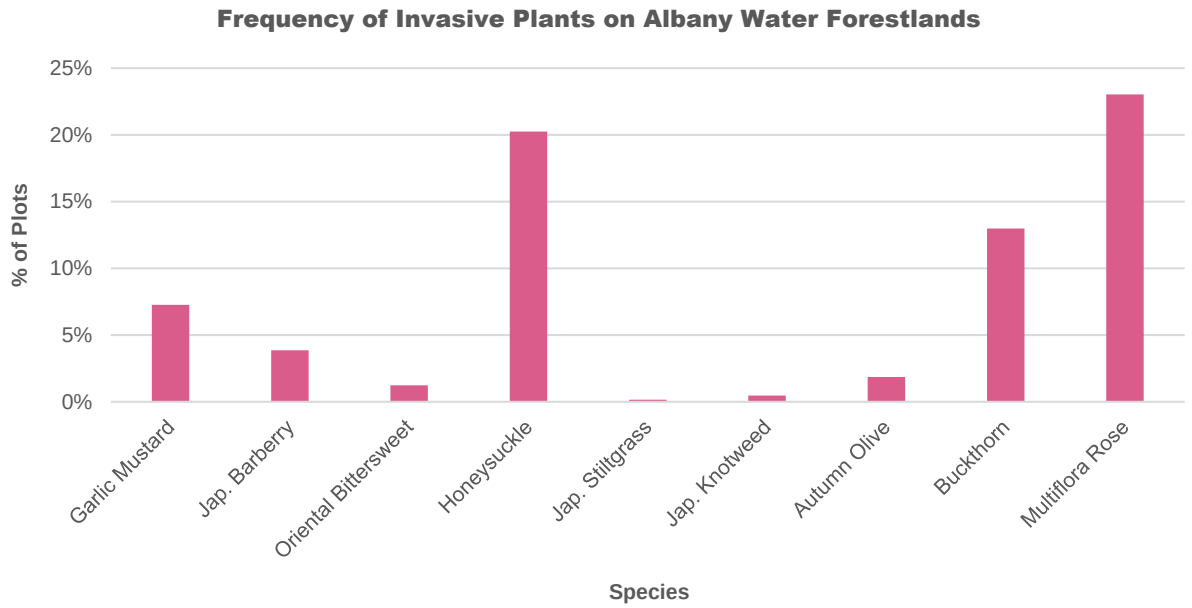

Figure 21. Percentage of inventory sample plots with occurrence of various invasive plant species.

Other species, such as common reed grass (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), are found on the properties but are not a management concern in forested areas. Black swallow-wort (*Cynanchum louiseae*) has recently been documented on the properties. The species has the potential to rapidly colonize forested uplands and should be monitored closely and removed if possible.

Based on 2017 inventory data, it is notable that invasive plants are not uniformly distributed throughout the property. Figure 22 shows the frequency of plots that had invasive plant cover of greater than 10% within different management compartments on the properties. The Indian Fields-Bichteman, Basic Creek Reservoir and Alcove East areas had extensive coverage of invasive plants, and any forest management in these areas should consider the potential impacts of invasive species on forest regeneration. In contrast, the Hogsback area—one of the least fragmented and disturbed portions of the landscape—has very low levels of invasive plants. Accordingly, measures should be taken to avoid introducing new infestations or exacerbating existing low-level occurrences.

Though many of the species listed are found in low density on the properties, their prevalence throughout the region means that total eradication will be difficult, if not impossible. Timber harvests and other management actions in areas with invasive plant cover of >30% should include explicit plans to reduce or manage invasive plant coverage in some way to avoid regeneration failure and allow for native understory development.

In most cases, extensive invasive plant infestations are associated with successional forest types and are only one component of a larger suite of degraded stand conditions. Stand-alone treatment will be ineffective unless undertaken as part of a more comprehensive effort to improve stand conditions. This may require active steps to establish forest regeneration or other native vegetative cover and possibly controlling white-tailed deer impacts. High deer

populations aid the proliferation of invasive species as they generally exhibit a strong browsing preference for many native species which might otherwise establish and shade out non-native competitors.

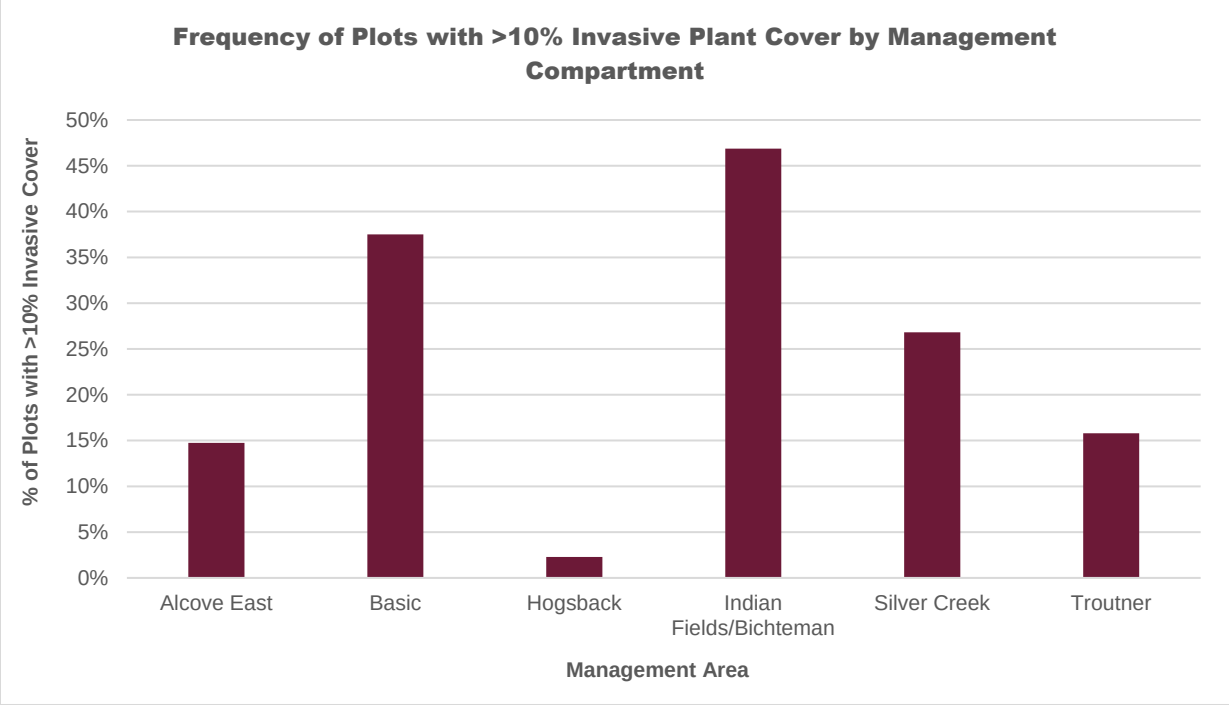

Figure 22. Percentage of inventory sample plots in various management areas of the properties with percent cover of invasive plants greater than 10%.

While interfering native vegetation is not as prevalent on the properties as non-native invasive plants, various grasses and ferns were commonly encountered. These species—which can cast heavy low shade and prevent tree regeneration from establishing—could proliferate following a timber harvest or other management activity that increases light availability or disturbs the soil. If management will occur in areas where interfering vegetation is present, even in low levels, the harvest plan should include steps to mitigate the potential impacts of these plants.

Similar to forest pests, management activities to deal with invasive and interfering plants will follow an IPM approach. Movement of these species to uninvaded areas should be prevented whenever possible by cleaning equipment and respecting state and federal quarantine regulations. When needed, active management will focus primarily on mechanical and/or manual removal. Grazing with domestic livestock may also be used where appropriate. Detail on the use of chemical and biological control agents is included in Section 6.6.

In the case of new or isolated occurrences of invasive species, the new infestation should be documented and monitored, and eradication efforts should be undertaken when feasible. Other resources on emerging invasive species threats include:

Capital/Mohawk Partnership for Regional Invasive Species Management (PRISM)
iMap Invasives Network
NY Invasive Species Information

6.4 Rare, Threatened and Endangered Species

While the properties forest, freshwater and wetland habitat for a wide variety of species, the bald eagle (*Haliaeetus leucocephalus*) and pied-billed grebe (*Podilymbus podiceps*) are the only two species known to occur at the properties that are federally or NY State listed as rare, threatened, or endangered. The northern long-eared bat (*Myotis septentrionalis*) is also known to inhabit hibernacula within 5 miles of the properties, and also requires management consideration. While some specific management guidance is provided below, regular consultation with NYS DEC, NY Natural Heritage Program, and the US Fish & Wildlife Service may be necessary to avoid impacts to these species, or other species that may be documented on the property.

Bald Eagles

Although officially removed from the federal list of endangered species in 2007 due to population recovery in the lower 48 states, bald eagles are currently state listed as Threatened, and are federally protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. There are nine recorded bald eagle nesting sites around the Alcove Reservoir (although some may no longer be active) and two known nest sites at the Basic Creek Reservoir. Wintering bald eagles have been recorded at both reservoirs as well. The Alcove Reservoir was also an important early site for the reintroduction of eagles into NY in the 1980s after they were very nearly extirpated from the state in the 1960s and 1970s, and the site has since continued to contribute to a robust statewide population of more than 250 nesting pairs (NY State Department of Environmental Conservation, 2016).

As fish are a primary food source, bald eagles generally nest in very tall, canopy emergent (or super-canopy) trees adjacent to open water along lakes, wetlands and rivers. Nest trees—most often white pine or cottonwood in this region—must have large branch structure high in the crown to provide adequate nest support and a suitable perch for spotting prey. Eagles vary in their sensitivity to human disturbance, but activities such as timber harvesting near nest locations can cause significant disruption to their breeding and nesting activities. In general, eagles prefer nest sites that are surrounded by undisturbed forest and are more sensitive to activities that are close to their nests, highly visible and/or involve loud noise.

The National Bald Eagle Management Guidelines (US Fish and Wildlife Service, 2007) provide specific recommendations for avoiding disturbance to eagles around nesting sites during various types of management activities, including timber harvesting. These guidelines should be consulted directly when evaluating management activities, but they currently recommend no tree cutting or other disturbance with 330 feet of nest trees and no tree cutting or other timbering operations within 660 feet of nest trees during the breeding season (currently specified as January 1 through September 30 according to the Conservation Plan for Bald Eagles in New York State, NY State Department of Environmental Conservation, 2016). DEC regularly monitors nest sites on the Albany Water Forestlands and should be consulted directly if there are questions about potential impacts to eagle nest sites from management activities, or if any other unrelated disruptions are noted.

Pied-billed Grebe

The pied-billed grebe is a small, diving waterfowl that inhabits wetlands, lakes and estuaries. While common globally, the species is listed as Threatened in NY as it is considered rare and possibly declining, and not widespread in its distribution (NY Natural Heritage Program, 2018c). Pied-billed grebes tend to inhabit shallow, marshy shoreline areas with a mix of open water and emergent vegetation, where they can nest discreetly and forage for aquatic prey. While not currently documented on the site, this species has been observed historically breeding at the Basic Creek Reservoir, and other habitat may exist in wetlands or lake edges in other parts of the properties. Management goals—which heavily emphasize water quality and protection of wetlands and other aquatic habitats—are fully compatible with pied-billed grebe conservation, and forest management activities should not be disruptive to this species.

Northern Long-eared Bat

The northern long-eared bat (NLEB) has been severely impacted by a disease known as white-nose syndrome, experiencing a 99% population decline in NY since the disease was discovered in 2008 (NY Natural Heritage Program, 2018c). The species is currently listed as Threatened by the US Fish & Wildlife Service (USFWS) and NYS DEC, and is regulated under Section 4(d) of the Endangered Species Act. Portions of the Albany Water Forestlands lie within a 5-mile radius of an NLEB hibernaculum, and timber harvesting in these areas is currently subject to NYS DEC regulations for protection of NLEB.

The following websites provide information in federal and state regulations related to NLEB and forestry activities:

US Fish & Wildlife Service NLEB Information
NYS DEC NLEB Information

While not in hibernation, the bats use large snags, cavity trees and trees with loose or sloughing bark as day roost sites. Cutting roost trees can cause direct mortality to the bats and is therefore restricted by USFWS and NYS DEC. While there are no known summer roost trees on the properties at this time, identification of roost trees would also require compliance with NYS DEC and USFWS regulations which limit tree cutting in the immediate vicinity.

Prior to any timber harvesting on the property, the harvest unit will be screened against current NYS DEC records for NLEB occurrences to determine which, if any, management restrictions apply. In addition, the following best practices can be applied to forest management activities occurring on the all portions of the properties:

- Leave all snags and cavity trees uncut during harvest operations, unless their removal is necessary to mitigate safety risks.

- If any bats are observed flying from a tree, or on a tree that has been cut, forestry activities in the area should be suspended and NYS DEC Wildlife staff notified as soon as possible

Other Species of Conservation Concern

In addition to the listed species, there are likely to be numerous other species of greatest conservation need (SGCN) on the property, particularly forest birds and odonates (dragonflies and damselflies). While management actions that may impact these species are not regulated, the Albany Water Board and Department of Water & Water Supply recognize the value of conserving habitat for these important species. Where they are known to occur, measures will be taken to prevent unnecessary impacts to these species or their habitat during any management activities in consultation with NYS DEC, NY Natural Heritage Program and others as appropriate.

6.5 Forest Carbon Sequestration

As described in Sections 1.1 and 1.4, carbon sequestration is an important management goal for the Albany Water Board and the Department of Water & Water Supply, and a forest carbon offset project is currently being developed under the American Carbon Registry's Improved Forest Management protocol. As part of this project, the Albany Water Board commits to maintaining forest carbon stocking above regional baseline levels, and carbon sequestration on Albany Water Forestlands will be confirmed through repeated forest inventories and third-party verification of all aspects of the protocol.

Credits are issued in terms of carbon Emission Reduction Tons (ERTs), based on the amount of carbon stored on the property above the calculated baseline amount. Current carbon stocking was measured through a forest carbon field inventory in 2017, and models were used to project future growth and carbon sequestration through time. Subsequent forest carbon inventories and accompanying verification will occur periodically through the life of the project to ensure that forest carbon sequestration is meetings desired targets. Any significant losses of carbon through timber harvesting or other natural disturbances will be tracked through time for incorporation into projected ERTs.

Timber harvesting and other forest management activities are currently included in ERT projections and are fully compatible with carbon sequestration goals, provided that carbon stocking on the property remains above the calculated baseline over time. Allowing carbon stocking to fall significantly below anticipated levels may result in loss of project revenue and possibly a project reversal—or the release of carbon back into the atmosphere for which credits have already been issued.

6.6 Use of Herbicides & Biocontrols

As water quality and prevention of contamination are the primary management concern, the Albany Department of Water & Water Supply has a policy of minimal chemical pesticide use on the properties, and maintains buffer areas around all water sources. However, since certain invasive species are not likely to be effectively controlled through other means, the use of chemical herbicides may be necessary to facilitate forest restoration and regeneration. In

addition, targeted application of other pesticides may be justified for the control of forest pests and pathogens.

Any application of chemical controls for these purposes will be conducted under supervision of a licensed applicator, following all applicable laws, product label specifications, and industry best practices. All chemical use, including types and quantities, will be properly documented through a Chemical Use Memo and reported annually to The Nature Conservancy's FSC Group Manager.

Prior to application, any planned chemicals will be checked against the current FSC list of Highly Hazardous Pesticides (HHP). No chemicals on the HHP list will be used.

Biological control agents can also be effective in controlling various pests, pathogens and non-native plants, and are often viewed as a less-impactful alternative to the use of chemical controls. However, biocontrols can be potentially harmful to non-target species, and will only be used when there is documented scientific evidence of their effectiveness and low likelihood of adverse effects to native species. Any biocontrol applications will be conducted by trained professionals, with a clear plan for monitoring and evaluation.

6.7 Wildfire & Controlled Burning

Forest fires have been a naturally occurring forest disturbance in the region for millennia, and small to moderate sized fires continue to occur periodically in forests throughout the region. The current forest types observed across the properties are not particularly fire-dependent nor fire-prone, and fuel loads are uniformly low, consisting almost exclusively of hardwood and conifer leaf litter. While infrequent fires may occur on the property, they are likely to be low intensity and limited in extent and severity given the heterogenous fuels, abundant wetlands, mesic forest types, and relatively good access for response. During management activities, care should be taken to avoid creating unnecessary concentrations of fuel or "jackpots", that may result in localized increases in intensity were a fire to occur, particularly around the bases of residual trees. Beyond that, the properties do not pose any significant wildfire concerns.

Controlled burning—often referred to as prescribed fire—can be a valuable forest management tool for creating favorable conditions for regeneration of desirable species such as oak and pine, controlling competing vegetation and invasive species, enhancing biological diversity, improving wildlife habitat, and a variety of other management objectives. Many of the more mesic forest types that currently exist on the properties would not benefit from controlled burning due to their site conditions, species composition and structure; however, prescribed fire could be a useful management tool on drier upland sites, particularly oak and pine forest types and potentially in pine hardwood forest types. Burning can be particularly useful in combination with silvicultural treatments such as shelterwood systems for establishing oak and pine regeneration on appropriate sites. In addition, prescribed fire may be used to meet other management objectives related to forestry, ecology or wildlife habitat.

Any controlled burning that does occur on the properties must be conducted in accordance with an approved prescribed burn plan and follow all applicable NY State Laws and Environmental Conservation Regulations. In addition, properly trained and qualified personnel must be available to supervise and implement burns.

7. Timber Harvest Operations

Carefully planning, managing and monitoring timber harvest operations is critical for ensuring that management goals are effectively achieved, BMPs are properly implemented and other social and ecological considerations are addressed. The following sections provide guidance on planning and implementing timber harvest operations to allow for beneficial and sustainable forest management while minimizing any unintended negative impacts.

7.1 Harvest Planning and Management Prioritization

At the time of this Forest Management Plan the Albany Water Forestlands have not been subject to timber harvest or active forest management, other than general road and property maintenance, for nearly two decades. As a result, no specific plan or prioritization for timber harvest units has been developed. However, several priorities have been identified based on overall forest management objectives which will guide the location and nature of management actions over the next 10 years.

Forest Types	Primary Management Objective	Primary Management Approach
Conifer Plantation Successional Hardwood & Conifer Forest Others as appropriate	Restore degraded stands	• Site prep (invasive species removal) • Improvement thinning, other Intermediate Stand Management to improve AGS/UGS ratio • Expanding-gap selection to regenerate stands where continuous forest cover is desirable • Seed tree and/or regeneration harvest in stands of excessively poor quality or where complimentary to other goals (e.g. shade-intolerant species diversity, wildlife habitat)
Pine-Hemlock-Hardwood (Hemlock-Oak) Northern Hardwood Others as appropriate	Improve regeneration in mature stands	• Restore mature forest understory condition treatments—modified transition harvest • Accelerate mature forest conditions—specific treatments to improve structural complexity where appropriate
Pine-Hemlock-Hardwood Northern Hardwood Hemlock-Northern Hardwood Mesic Oak Dry Oak Dry Pine-Oak	Enhance structural complexity in uniform, even-aged small sawtimber stands and increase regeneration	• Thinning to Accelerate Mature Forest Condition • Group selection, irregular shelterwood harvests to establish regeneration and increase landscape heterogeneity
All Types	Improve regeneration	• Develop and implement Deer Management Plan for the ownership

Table 11. Ten-year priority management actions and approaches for the Albany Water Forestlands.

7.2 General Timber Harvesting Guidelines

Whenever possible, the Albany Department of Water & Water Supply will award timber harvest and other forest management contracts to local operators, acknowledging that other criteria, such as the ability to competently and safely carry out the obligations of the contract, are critical selection factors as well. All contractors should have a demonstrated commitment to providing fair wages and a safe environment for workers. Utilizing local mills and striving to market harvested timber towards the highest and best use possible will also help ensure maximum community benefits from forest management activities and efficient revenue generation for the landowner.

In addition, the following guidelines are important for maintaining quality control, safety and efficiency of harvest operations:

- All logging equipment and machinery will be fully cleaned of dirt and other debris prior to arriving on-site to prevent the introduction of invasive species.
- NY Trained Logger Certification (or an acceptable equivalent certification) will be required for contractors operating on the property. If multiple employees within a single unit are working together, at least 1 out of 2 individuals must be certified, and others must be working towards certification.
- Timber harvest contracts will include stipulations that contractors adhere to all applicable laws and regulations, including health and safety regulations, and that adequate spill control measures are in place.
- All trails and roads installed during harvest operations will adhere to Best Management Practices (BMPs) described in New York State Forestry Best Management Practices for Water Quality—BMP Field Guide, 2018 Edition, or successors. Updated BMPs and other guidance can be found at www.nysbmpguidelines.com.
- Rutting from machinery or water scour will be limited to less than 6 inches in depth and all ruts will be repaired immediately following harvest operations. Rutting greater than 12 inches in depth will require immediate steps to repair and mitigate additional damage and may require suspension of harvest operations until conditions improve.
- Only seed mixes that are documented as being free of invasive species will be used to stabilize landings and other disturbed areas. Specifically, seed mixes may not include any species with an Non-native Plant Assessment score of 50 or greater for NY (i.e. a rank of Moderate or higher; see the NY Invasive Species Information website for species assessments). Seed mixes will favor native, locally-adapted and site-appropriate species whenever feasible.

Harvest Systems & Equipment

The harvesting systems and types of equipment that will most likely be used on Albany Water Forestlands are described below. Other systems, such as high lead cable or helicopter harvesting operations, could be used in theory but are not likely to be cost effective given the

relative accessibility of the properties for ground-based harvesting and the types of products that will generally be harvested.

Conventional: Hand-felling and cable-skidding is the most common harvesting technique in the region, and in many cases will be the most appropriate given the types of timber likely to be harvested from Albany Water Forestlands. This system has the advantage of being able to work on highly variable terrain and logs can be extracted from difficult or sensitive areas by cable, reducing the overall footprint of trails and equipment use.

Mechanized: This type of harvest method refers to a feller-buncher working in tandem with a skidder (often a grapple skidder) or forwarder. This system increases production rates, but this setup is generally more appropriate and cost-effective for higher intensity harvests in areas with little terrain. This can also be one of the more impactful harvesting techniques as it requires equipment access over nearly the entire harvested area.

Cut-to-Length: A single mechanized felling, delimbing and cut-to-length head, mounted on a small excavator or similar carrier can be an efficient and low impact harvesting method. Logs can be cut to length in the woods, staged by road and moved to landings on a rubber-tired forwarder. These systems can work in tight areas and harvest individual trees without excessive residual damage but are uncommon in the region.

Forestry Mulchers & Mowers: Various types of forestry mulchers and mowers mounted on excavators, loaders or skid-steers or other equipment may be used during site preparation operations.

7.3 Harvest Administration

The following steps will help ensure that there is proper planning and oversight of timber operations, and that management goals can effectively be met:

Sensitive Resource Assessment: This includes both a general screening for wetlands, rare species, cultural resources and other environmental considerations, as well as an on-site assessment to identify any on-site sensitive areas and verifying any necessary water resource buffers. All features should be clearly delineated in the field by Albany Department of Water & Water Supply staff or consultants who are adequately experienced and qualified to do so, included in harvest unit maps, and clearly communicated to the contractor prior to beginning any management activities.

Resources for screening harvest activity areas for wetlands and other sensitive resources:

US Fish & Wildlife Service National Wetlands Inventory Mapper
NYS DEC Environmental Resource Mapper
NYS SHPO Cultural Resource Information System (CRIS)

Pre-Harvest Inventory: This consists of a timber cruise to assess basal area, tree density, AGS/UGS, product volumes and grades, regeneration, and any forest health concerns. This

inventory is supplemental to the overall property-level inventory and forms the basis for the development of the stand prescription.

Harvest Road Layout: Similar to sensitive resources, the layout of skid trails, haul roads landings and stream crossings needed for forest operations will be clearly laid out by Albany Department of Water & Water Supply staff or consultants prior to harvest. If changes must be made to the layout due unforeseen circumstances, they must be approved by the Department staff overseeing the operation prior to relocating. Roads will not be placed within streambeds or wetlands, and any necessary stream crossings will be laid out perpendicular to water flow and in an area with the least possible potential impact to water quality. Bridges, culverts, mats, and other sediment control measures will be utilized as necessary.

Harvest Plan Development: A detailed harvest plan will be developed for the management unit based on information gathered in the steps described above. At a minimum, the harvest plan should include the following elements:

- Specific management objectives for the unit, and the silvicultural prescription(s) for meeting those objectives.
- A map of the harvest unit, including boundaries, roads and landings, and the locations of sensitive resources.
- The estimated volumes of different product grades to be harvested and target residual basal area and tree density by size class.
- Specific details on how the timber will be marked. In general, all trees to be cut will be marked with paint, including one mark at breast height and another below stump height.
- Guidelines for types of equipment to be used and steps to minimize waste of merchantable product and damage to residual trees.

Public Notification & Outreach: A close relationship with local communities and residents is important to the Albany Department of Water & Water Supply, and all timber harvesting activities will be communicated via the Department website and mailings or direct communication to town offices and any adjacent landowners. If harvest operations will be highly visible from public roadways and/or adjacent property, steps such as posting information signage and utilizing visual buffers can be used to minimize impact and communicate forest management goals.

Pre-Harvest Site Visit with Contractor: A pre-harvest meeting with the contractor is critical to review all elements of the harvest plan, clarify the location of sensitive resources, and identify any additional management considerations.

Monitoring of Harvest Operations: The Albany Department of Water & Water Supply staff overseeing the harvest will visit active sites at least once weekly as long as the harvest operation is taking place. These visits will include a brief assessment of the road/landing conditions, residual damage to the stand, sediment or water flow issues (with special attention paid to any stream/wetland crossings), and any other areas of concern within the harvest area. If issues

arise, remedial actions will be developed with the operator, promptly implemented and monitoring closely during follow-up visits.

Post-Harvest Evaluation & Inventory: This includes an evaluation of any operational considerations and post-harvest remedial actions (e.g. protection of sensitive resources, residual tree damage, repairing of ruts) to verify that all elements of the contract and harvest plan have been satisfactorily met. A post-harvest follow-up inventory should also be completed as soon as possible and used to verify management objectives and update the overall property forest inventory.

8. Monitoring

Routine monitoring of forest condition, conservation values and infrastructure is crucial to provide feedback on management effectiveness and prevent adverse impacts to timber and non-timber resources. Monitoring can take many forms and will be appropriate to the scale and intensity of management and potential impacts, and monitoring frequency will be based on the potential timeframe for significant impacts to occur. For example, harvest operations will be monitored weekly as negative impacts can occur in a matter of days if improperly implemented. Conversely, overall forest condition at the ownership scale, which changes relatively slowly, can be monitored at the scale of years to decades.

Incorporating monitoring results into ongoing planning and operations through an adaptive management process is critical for ensuring that activities are advancing the overall forest management goals in the most effective way. To incorporate this adaptive management process into annual work planning for management activities, The Nature Conservancy and Albany Department of Water & Water Supply staff will meet regularly—at a minimum, once per year in the fall or early winter—to formally review and discuss management activities and monitoring results from the previous year in order to incorporate this information into workplans for the upcoming year.

The following key areas are identified as priorities that require regular monitoring.

Harvest Operations

Monitoring of harvest operations will ensure that all stipulations of the contract are being met, and that all applicable BMPs and other operational restrictions (e.g. stream/wetland buffers) are being followed. Section 7.3 describes harvest administration procedures in more detail. At a minimum, monitoring of ongoing harvest operations will occur weekly while operations are underway. Harvest monitoring will also include a pre-harvest inventory and post-harvest inspection, along with follow-up inventory of the unit. Total timber harvest volumes will be documented and reported annually.

Water Quality

As the single highest management and conservation value of the properties, monitoring water quality is a critical function of the Albany Department of Water & Water Supply. Water quality is also a key indicator of overall forest health in the watershed. Water samples are taken monthly from the two reservoirs and analyzed for a variety of water quality indicators. In addition, a total of 12 tributaries are regularly monitored throughout the watershed. The frequency of tributary sampling varies throughout the year to coincide with various land use and management activities that are occurring in the various watersheds (e.g. more frequent sampling occurs in early summer when manure spreading on local agricultural fields is more common).

Roads

Road monitoring and maintenance is critical for effective access and forest management. The Albany Department of Water & Water Supply is currently in the process of developing a comprehensive forest road condition inventory, and this will guide long-term repair and maintenance needs. Road monitoring will also be systematized, so that the entire road network is inspected twice per year. This will typically occur once in the fall and once in the spring after mud season and focus on signs of erosion, drainage issues, rutting and unauthorized use. In addition, key culverts and drainage ditches will be inspected after prolonged or unusually heavy precipitation events. Additional casual observation of road conditions and maintenance needs will occur as staff access the property during their routine duties.

Stakeholder Feedback

Monitoring the concerns and feedback of various stakeholders is critical for maintaining long-term sustainability and maximizing the benefits that the Albany Water Forestlands provide to the local communities. Key stakeholders include water supply customers, contractors, neighboring landowners, town officials, state agencies, NGO partners, recreational groups and others. Monitoring stakeholder feedback consists mainly of having a clear channel for communicating various concerns to the Albany Department of Water & Water Supply, maintaining an updated stakeholder list with primary concerns, and reviewing these concerns regularly, at a minimum annually to incorporate any necessary adjustments into workplans for the upcoming year. In practice, Department staff are also communicating with and responding to concerns from various stakeholders regularly.

High Conservation Value Forest

As most of the HCVF identified on the properties is designated for source water protection, the water quality monitoring described above will be the primary indicator of HCVF health and function. In addition, informal visual monitoring will occur in these areas to identify any emerging potential forest health issues or threats. HCVF forest condition will also be more formally assessed through continuous forest inventory plots for carbon monitoring every six years, and re-inventory of the property associated with updates to this Forest Management Plan.

Boundary Lines

Consistent monitoring and maintenance is necessary to ensure adequate signage and prevent encroachments and unauthorized trespass. All roadside boundary signs are visually inspected at least once per year, although in practice this occurs routinely as staff travel around the properties on a regular basis. Property lines will be walked and inspected as frequently as needed based on the likelihood of encroachment from abutting landowners, and the Albany Department of Water & Water Supply will strive to re-post all boundary lines on a 5-year rotation.

Expenses & Revenues

Expenses and revenues associated with forest management activities will be documented and reviewed regularly to ensure that management operations remain sustainable over time. Since

generation revenue is not the highest priority management goal and there are other sources of funding (e.g. carbon offset sales, departmental budgeted funds) timber harvest revenues may not necessary need to exceed management expenses for a given time period, particularly for intermediate stand treatments aimed at improving forest condition. However, tracking project expenses and revenues provides critical feedback for annual budgeting and work planning.

Rare, Threatened and Endangered (RTE) Species

Bald eagles are the only RTE species which currently utilize the Albany Water Forestlands. Nest sites are monitored annually by NYS DEC via flyovers of the property. No formal monitoring is conducted by Albany Department of Water & Water Supply staff, although they routinely look for and report any new nest sites. If additional RTE species are identified on the property, Department staff will work with NYS DEC and the NY Natural Heritage Program to develop a suitable monitoring plan.

Forest Condition

Forest condition is assessed through a forest health report card based on a variety of Key Ecological Attributes (KEAs) that relate to forest composition, structure and threats. This report card is included in Appendix III, and the goal is to update this condition every 10 years following repeated forest inventories, along with updates to this Forest Management Plan.

	Relative Frequency					
	Weekly	**Monthly**	**Biannually**	**Annually**	**5 years**	**10 years**
Harvest Operations	Site visits to inspect active harvest operations for BMPs, etc			Total timber harvest reported		
Water Quality		Reservoirs sampled monthly, 12 tribs sampled sporadically				
Roads	Informal condition assessments by field staff	Drainage systems inspected following major rain events	Full road network inspection in spring and fall			
Stakeholder Feedback	Harvest operation inspections with contractors	Regular interactions between various stakeholders and Department staff to identify concerns/conflicts.		Review/ update stakeholder issues raised during year.		
HCVF		Via water quality sampling		Informal condition assessments by field staff	CFI plot re-measurement	Full forest inventory
Boundary Lines	Boundaries patrolled as needed (e.g. more frequent inspections near recent encroachments, areas with numerous residential neighbors, etc.)			Roadside signage inspections	All remote boundaries walked/ reposted	
Expenses & Revenues		Department staff monitor expenses and revenues as needed to manage project activities.		Annual review of expenses and revenues to incorporate into upcoming budget and workplan		
RTE Species				DEC monitors RTE species annually. Field staff report new observations.		
Forest Condition				Informal condition assessments by field staff	CFI plot re-measurement	Full forest inventory & KEAs

Table 11. Regular monitoring activities based on approximate relative frequency.

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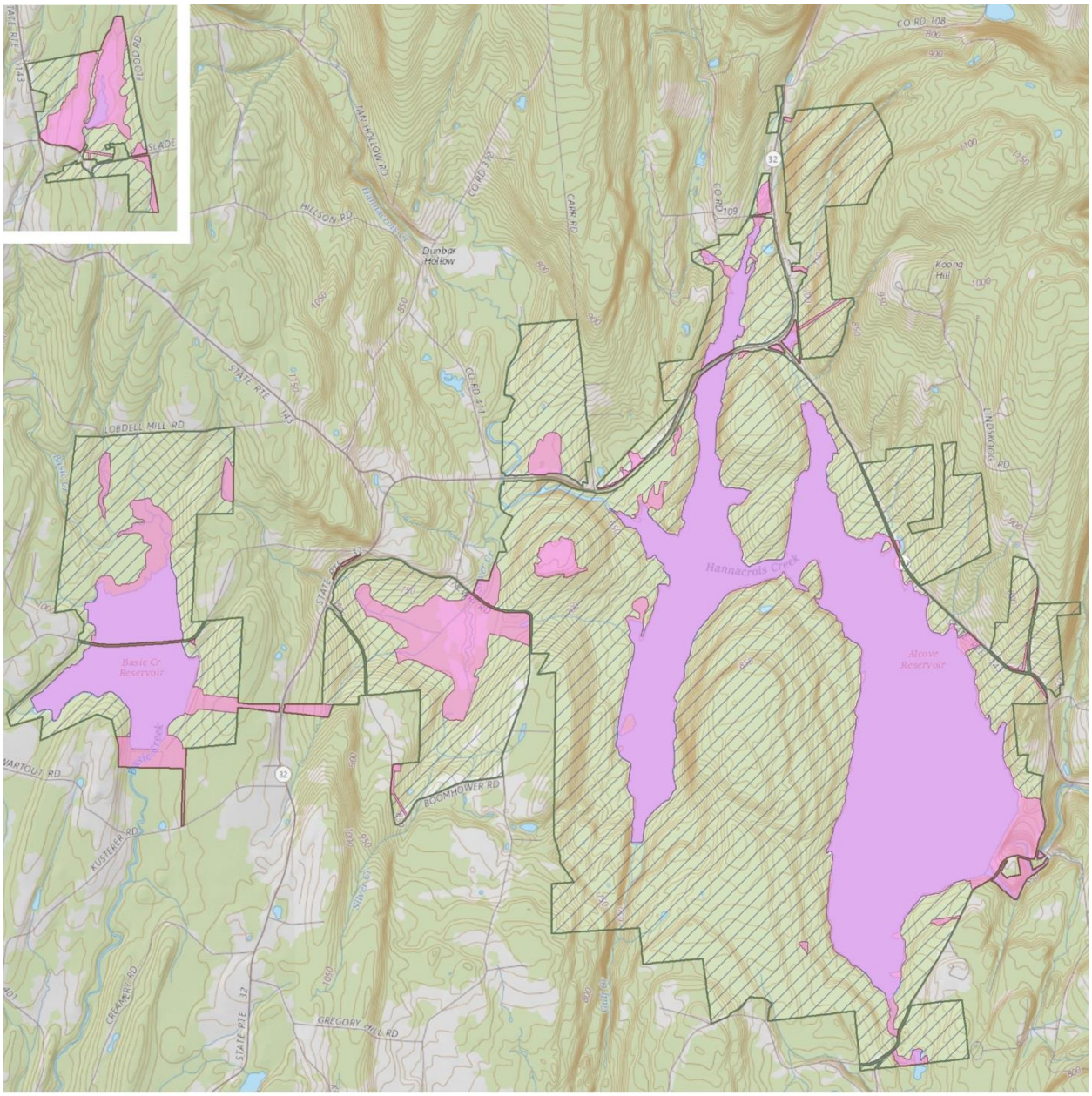
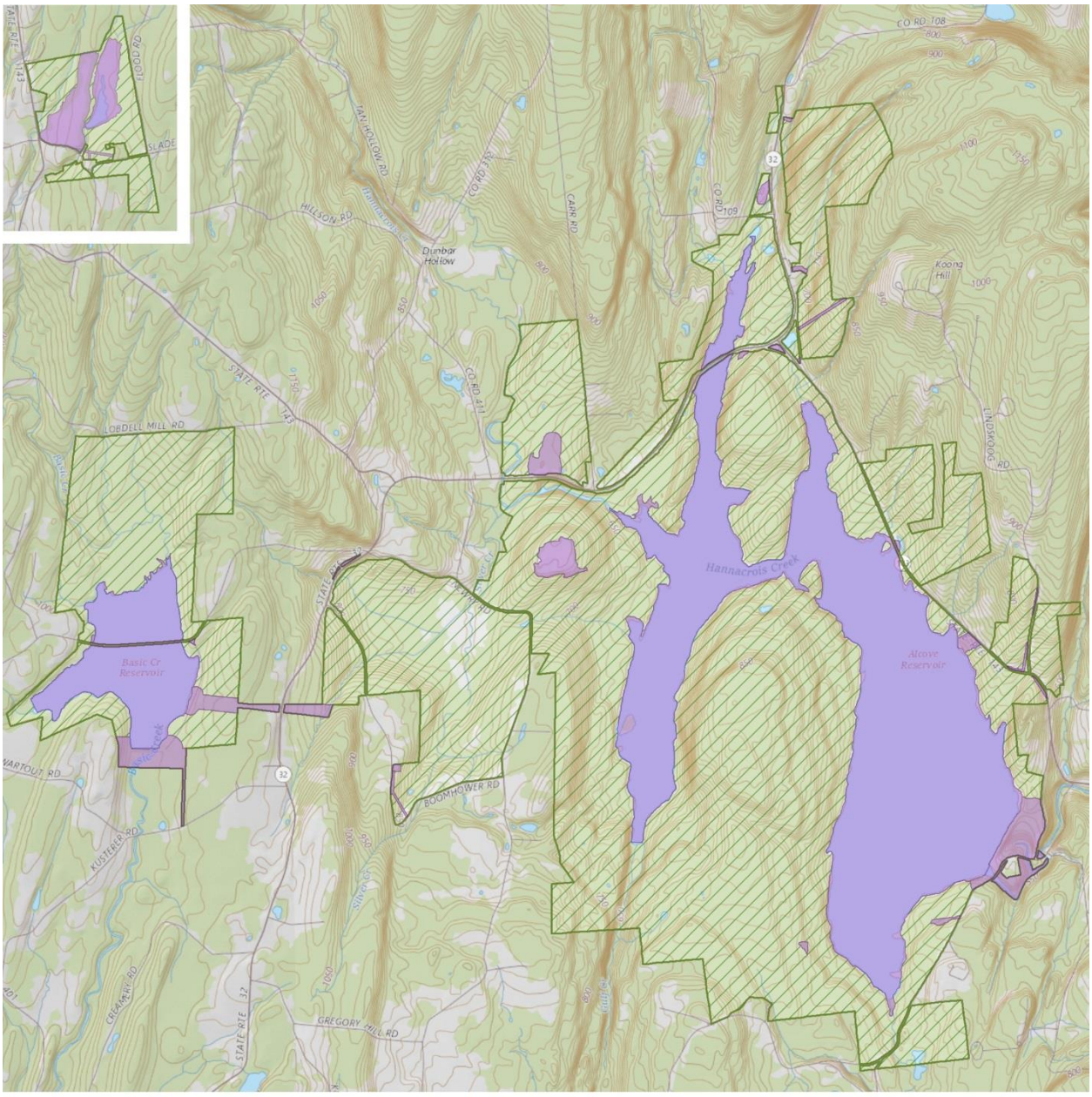
Appendix I. Project Area Maps

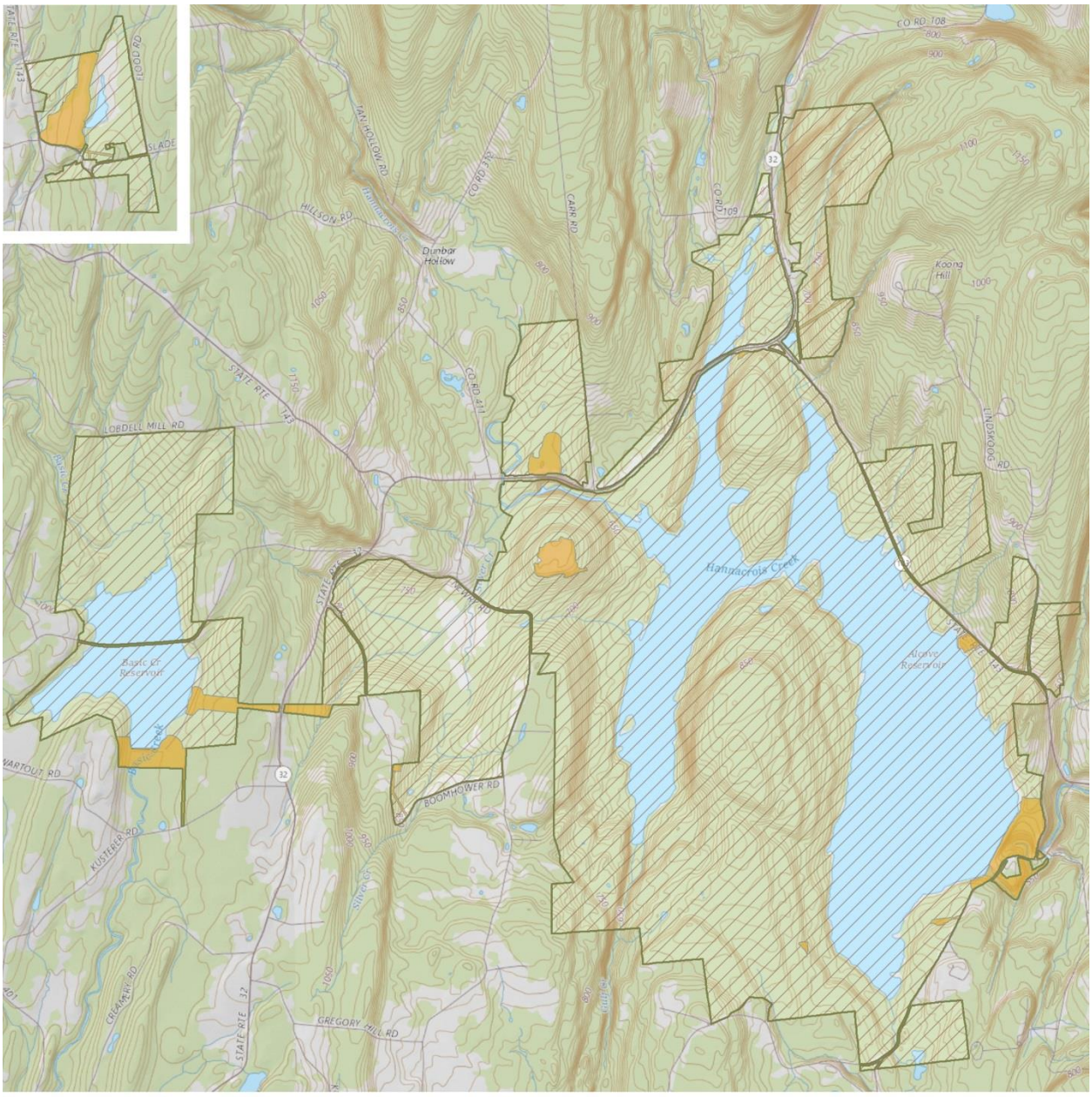
Carbon Project Area Map



FSC Certification Area Map



Proposed Conservation Easement Area Map



Appendix II. High Conservation Value Forest Analysis

I. High Conservation Value (HCV) Area Identification

Within Working Woodlands and on our FSC Group Certificate, our method to define and meet the HCV requirement follows the four-phased approach of assessment, consultation, inventory, and monitoring as outlined in the Standard and applied as follows.

In conjunction with Albany Water Board (AWB) staff, state ecologists, ecologists from The Nature Conservancy (TNC) and other partners have embarked on a process to identify and map HCV areas. One type of HCV has been identified on the AWB lands through a combination of biological database reviews, internal team expertise, and review of ecological priorities of state agencies and other conservation groups operating in the region. Rare species occurrence data from New York Natural Heritage Program was primarily relied upon for biological diversity assessments and they also provided a framework for assessing mature/old-growth forest characteristics. Consultations with Heritage staff and others are noted below. Additionally, a map demarcating HCVs is also embedded. The HCV framework includes the following six categories:

HCV 1: Forest areas containing globally, regionally or nationally significant concentrations of biodiversity (e.g., endemism, endangered species, refugia)

1.1 There are no legally protected or managed areas on the property.

1.2 There are only two known Heritage listed species on the property, one of which is an historical occurrence. This would not be considered a concentration of biodiversity relative to other sites in the region.

> Key resources: NY Natural Heritage species occurrence data and consultation with NY Natural Heritage and NYS Department of Environmental Conservation (DEC).

Total Acres of HCV 1: 0

HCV 2: Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance

Essentially all of the forests in this area, except for small wet and inoperable patches, have been logged or cleared several times in the past. As such, there are no large un-roaded areas or areas that lack a history of human disturbance.

2.1 No large, roadless areas are known to occur on the property. The property is fragmented by old roads and settlements and almost all of it has been harvested at one point or another.

2.2 There are no large landscape scale forests that are significant at the ecoregional scale.

Key resources: Historical knowledge of property, Albany Department of Water & Water Supply records.

Total Acres of HCV 2: 0

HCV 3: Forest areas that are in or contain rare, threatened or endangered ecosystems

3.1 No Type 1 old-growth. Some larger, uneven-aged, stands (generally Oak-Hemlock and Northern Hardwood) have been identified with larger individual trees that appear to be over 200 years old. However, field surveys of these areas using NY Natural Heritage guidelines for assessing old-growth characteristics did not identify any significant late-successional attributes (e.g. consistent presence of large/old trees, coarse woody debris, pit and mound topographic features). While these candidate areas did not meet the criteria for Type 2 Old-Growth, they are more mature that stands typically encountered on the properties and it was determined that any management that occurs in these areas will be specifically aimed at maintaining uneven age class distribution, increasing structural complexity, enhancing late successional characteristics and promoting understory reinitiation.

3.2 Again, no roadless areas are known to occur on the property due to prior management activities.

3.3 There are no threatened or endangered ecosystems on the property

Key resources: NY Natural Heritage draft old-growth rapid assessment protocols. Field surveys and inventory data.

Total Acres of HCV 3: 0

HCV 4: Forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control)

4.1 While the vast majority of the property provides a source of drinking water, the most critical areas to protect include the reservoirs, the four major tributaries (Hannacrois Creek, Basic Creek, Silver Creek and Gulf Creek), and their connected wetlands. All of these areas have 300-foot management buffers, with a 100-foot no-harvest Inner Zone and an additional 200-foot Outer Zone which has requirements for canopy cover retention (See Forest Management Plan for details).

4.2 Virtually the entire property lies within a source-water or public drinking water watershed for the City of Albany, but the truly High Conservation Value areas are those that buffer reservoirs, major tributaries and the connected wetlands as outlined above.

4.3 While there are wetlands within the water-supply watershed, they are not extensive nor are they forested. Assessment of FEMA maps shows that the property does not contain significant floodplains outside of wetlands and adjacent buffer areas already included in 4.1, so none of the property is considered HCV under this criterion.

4.4 While erosion is always a concern, the HCV buffers mentioned above and riparian buffers address those concerns. There are no areas on AWB lands that would be considered critical to prevent erosion, landslides, avalanches, etc.

Key resources: Consultation with Albany Department of Water & Water Supply and TNC staff, Aerial imagery interpretation, NYS DEC spatial data on streams, NYC Department of

Environmental Conservation Forest Management Plan and others, Wildlife Conservation Society's publication "Forestry Habitat Management Guidelines for Vernal Pool Wildlife".

Total Acres of HCV 4: 1272 acres total, including 155 acres of non-forested wetlands (602 acres of Inner Zone HCV buffer with no management, 670 acres Outer Zone buffers with management restrictions)

HCV 5: Forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health)

5.1 AWB lands would not be considered fundamental to meeting basic needs of local communities, other than for water provision, which is covered above.

Key resources: Local knowledge, Albany Department of Water & Water Supply records.

Total Acres of HCV 5: 0

HCV 6: Forest areas critical to local communities´ traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities)

6.1, 6.2 AWB lands would not be considered as fundamental to traditional cultural identity in the area.

Key resources: NYS Historic Preservation Office, outreach to tribal nations.

Total Acres of HCV 6: 0

II. Consultation with appropriate experts for the purposes of this assessment:

For the purposes of this assessment and more generally, AWB and TNC staff regularly consult with biologists from the New York Natural Heritage Program, and the Department of Environmental Conservation, State Historic Preservation Office and other conservation organizations. In particular, NY Natural Heritage helped provide information on HCV 1, 2 and 3 designations. Further, TNC has deeply invested in hiring biologists and foresters and consults with conservation staff throughout the organization on various aspects of this assessment, from identifying HCV areas to implementing management interventions, to monitoring the impacts of those activities over time.

III. Approach to Managing HCV Areas

HCV 3.1 – Pockets of older oak and hemlock

While not officially designated as HCV, these areas will be managed to enhance structural complexity, late-successional forest characteristics, and understory reinitiation, and they will be re-evaluated as HCV 3 in the future.

HCV 4.1 – 4.2 – Source Water Buffers

Drinking water supply areas, including reservoirs and major tributaries and connected wetlands have 300-foot management buffers, including a 100 foot no-harvest Inner Zone on either side of the stream and an additional 200-foot Outer Zone buffer. Active forest management can occur in the Outer Zone HCV buffers but there are guidelines for residual stocking. All management in HCV will need to support or enhance conservation values, as source water protection is the top priority forest management goal for the properties.

IV. Monitoring HCV Areas

HCV 4.1: Source water and riparian buffers and floodplains. Routine and regular water quality sampling is the primary monitoring tool for source water HCV areas. There is regular visual monitoring in buffers to observe potential forest health issues or unwanted management impacts. These areas will also be periodically reassessed during ongoing forest carbon inventories and property level re-inventory.

Appendix III. Draft Key Ecological Attribute (KEA) Assessment

Version 10.2.2018
Based on Key Ecological Attributes, Indicators and Ratings developed by TNC-PA, TNC-VA (Jenkins et al., 2009; Meade et al. 2015)

KEA 1. Total Forest Stocking

Indicator: Relative Density of all stems in the stand (output from NED-2 Software). *Relative density provides an estimate, or the proportion of total available growing space being used by standing trees, and is also often referred to as Percent Stocking. It is used here because it provides an easy reference to traditional stand stocking charts.*

Ratings:

Poor	<40%
Fair	40-59%, >120%
Good	60-79% or 100-120%
Very Good	80-100%

KEA 2. Growing Stock Quality

Indicator: % of Acceptable Growing Stock (AGS) for trees >5" DBH. *AGS includes all trees that are expected to grow vigorously in the stand for at least 15-20 years and are free from obvious signs of disease/decline, severe defect or other issues that may impact tree health in the foreseeable future. For this analysis, AGS trees do not necessarily need to have form sufficient to produce a merchantable sawlog.*

Ratings:

Poor	<40%
Fair	40-53%
Good	54-69%
Very Good	≥70%

KEA 3. Tree Species Diversity

Indicator: Species Richness of trees >5" DBH*. Total number of species present in the stand.*

Ratings:

Poor	<3
Fair	3-6
Good	7-9
Very Good	≥10

KEA 4. Tree Species Evenness

Indicator: Evenness in the distribution of tree species >5" DBH*. Described as a function of the actual Shannon-Weiner Diversity Index (H') relative to the potential maximum H' is all species were evenly represented. (Pielou's Evenness: J' = H'/H' Max)*

Ratings:

Poor	0-0.59
Fair	0.6-0.69
Good	0.7-0.79
Very Good	≥0.8

KEA 5. Large Live Trees

Indicator: Number of live trees per acre 20" or greater DBH

Ratings:

Poor	<3
Fair	3-5
Good	6-11
Very Good	≥12

KEA 6. Tree Diameter Distribution

Indicator: Number of 4" size classes present

Ratings:

Poor	<4
Fair	4-6
Good	7-9
Very Good	≥10

KEA 7. Large Standing Dead Trees

Indicator: Number of large snags (>10 ' DBH) per acre.

Ratings:

Poor	0-2
Fair	3-5
Good	6-8
Very Good	>9

KEA 8. Tree Regeneration

Indicator: Number of seedlings ≥12" tall per acre

Ratings:

Poor	<500
Fair	500-999
Good	1000-1999
Very Good	≥2000

KEA 9. Desirable Established Seedlings

Indicator: % of established regeneration representing desirable species*. Desirable species include white-cedar, eastern hemlock, eastern white pine, aspen, American basswood, yellow birch, sweet birch, paper birch, black cherry, elm, hickory, sugar maple, red maple, all oak species, black walnut, apple, and American chestnut.*

Ratings:

Poor	<25%
Fair	26-54%
Good	55-74%
Very Good	≥75%

KEA 10. Absence of Deer Browse

Indicator: Deer impact rating

Ratings:

Poor	High, Very High (4-5)
Fair	Moderate (3)
Good	Low (2)
Very Good	Very Low (1)

References

Jenkins, D., Eckley, M., and Bearer, S. (2009). *Key Ecological Attributes to Assess Forest Condition*. The Nature Conservancy, Pennsylvania Forest Conservation Program.

Meade, G., Beaty, B., and Watland, A. (2015). *Key Ecological and Economic Attributes to Assess Forest Condition on Lands in the Clinch Valley Conservation Forestry Program.* The Nature Conservancy, Clinch Valley Conservation Forestry Program.

Draft KEA Scorecard for Albany Water Forestlands

Based on forest inventory data collected in 2017.

Mgmt. Compart.	Forest Type	Acres	# Plots	COMPOSITION			
				Stand Relative Density	%AGS	Species Richness	Evenness
Alcove East	Conifer Plantation	23	4	168	75%	5	0.81
	Dry Pine-Oak	52	7	93	79%	11	0.88
	Hemlock-Northern Hardwood	51	6	85	91%	12	0.77
	Hemlock-Oak	127	19	107	71%	16	0.72
	Successional Mixed Hardwood & Conifer	204	22	103	64%	18	0.79
	White Pine	76	10	64	76%	8	0.34
	White Pine-Hardwood	169	27	71	69%	17	0.69
Basic Creek	Conifer Plantation	18	4	117	51%	5	0.72
	Hemlock-Northern Hardwood	90	16	92	74%	16	0.54
	Northern Hardwood	103	17	100	86%	18	0.51
	Successional Mixed Hardwood & Conifer	309	43	98	72%	21	0.86
Hogsback	Conifer Plantation	50	9	246	56%	8	0.53
	Dry Oak	50	8	98	86%	10	0.55
	Hemlock-Northern Hardwood	91	16	87	76%	16	0.69
	Hemlock-Oak	252	42	88	81%	18	0.65
	Mesic Oak	81	10	84	97%	9	0.63
	Northern Hardwood	240	30	81	81%	15	0.75
	Successional Mixed Hardwood & Conifer	91	11	134	77%	15	0.85
	White Pine	207	36	72	74%	12	0.49
	White Pine-Hardwood	349	57	78	83%	21	0.77
Indian Fields/Bichteman	Conifer Plantation	37	6	152	82%	8	0.62
	Hemlock-Northern Hardwood	34	4	91	93%	8	0.81
	Hemlock-Oak	32	4	90	97%	12	0.83
	Mesic Oak	42	6	80	93%	9	0.74
	Northern Hardwood	32	4	60	93%	11	0.71
	Successional Mixed Hardwood & Conifer	381	52	91	75%	25	0.75
	White Pine	140	18	74	69%	17	0.53
	White Pine-Hardwood	15	2	82	65%	7	0.81
Silver Creek	Bottomland Hardwood	72	10	56	69%	15	0.84
	Conifer Plantation	35	6	210	74%	8	0.40
	Hemlock-Northern Hardwood	152	18	87	56%	18	0.64
	Hemlock-Oak	57	8	93	49%	13	0.59
	Northern Hardwood	294	35	83	74%	19	0.52
	Successional Mixed Hardwood & Conifer	371	51	107	69%	27	0.79
	White Pine	69	10	65	78%	9	0.62
Troutner	Conifer Plantation	27	6	96	42%	9	0.65
	Hemlock-Northern Hardwood	25	6	86	51%	10	0.69
	Successional Mixed Hardwood & Conifer	14	3	66	55%	5	0.36
	White Pine-Hardwood	21	4	52	61%	8	0.84

KEY	Stand Relative Density	%AGS	Species Richness	Evenness
Poor	< 40%	< 40%	< 3	0 - 0.59
Fair	40-59%, >120%	40-53%	3 - 6	0.6 - 0.69
Good	60-79%, 100-120%	54-69%	7 -9	0.7 - 0.79
Very Good	80-100%	≥ 70	≥ 10	≥ 0.8

Mgmt. Compart.	Forest Type	STRUCTURE			REGENERATION		DEER
		Trees/ac. ≥20" DBH	# 4" Size Classes	Snags/ac. >10" DBH	Regen Stems/ac.	% Desirable Regen	Deer Rating
Alcove East	Conifer Plantation	1	8	3	1525	8%	4
	Dry Pine-Oak	4	5	8	1200	71%	4
	Hemlock-Northern Hardwood	4	5	2	1217	27%	4
	Hemlock-Oak	12	7	7	521	46%	4
	Successional Mixed Hardwood & Conifer	5	11	13	1382	14%	4
	White Pine	18	6	9	1610	22%	4
	White Pine-Hardwood	9	8	15	952	33%	4
Basic Creek	Conifer Plantation	3	5	9	3450	51%	3
	Hemlock-Northern Hardwood	11	8	4	894	17%	4
	Northern Hardwood	8	7	7	435	16%	4
	Successional Mixed Hardwood & Conifer	4	15	8	1395	13%	4
Hogsback	Conifer Plantation	0	8	0	800	68%	3
	Dry Oak	3	5	4	625	58%	4
	Hemlock-Northern Hardwood	5	7	2	450	71%	3
	Hemlock-Oak	9	8	3	557	52%	4
	Mesic Oak	4	7	4	600	80%	5
	Northern Hardwood	6	8	3	623	56%	4
	Successional Mixed Hardwood & Conifer	3	9	4	1055	49%	4
	White Pine	12	7	8	389	74%	4
	White Pine-Hardwood	6	9	4	539	72%	4
Indian Fields/Bichteman	Conifer Plantation	0	7	21	733	36%	4
	Hemlock-Northern Hardwood	9	6	0	625	20%	4
	Hemlock-Oak	3	6	4	500	60%	4
	Mesic Oak	9	6	1	250	53%	5
	Northern Hardwood	5	5	0	825	52%	5
	Successional Mixed Hardwood & Conifer	4	13	7	788	12%	4
	White Pine	14	9	11	872	57%	4
	White Pine-Hardwood	10	5	4	450	0%	4
Silver Creek	Bottomland Hardwood	3	6	6	1720	12%	4
	Conifer Plantation	0	7	9	1050	52%	4
	Hemlock-Northern Hardwood	6	6	2	522	36%	4
	Hemlock-Oak	6	6	3	275	32%	4
	Northern Hardwood	7	7	4	729	26%	4
	Successional Mixed Hardwood & Conifer	5	13	4	761	35%	4
	White Pine	9	7	4	270	67%	4
Troutner	Conifer Plantation	1	5	13	2300	57%	4
	Hemlock-Northern Hardwood	5	6	19	1017	25%	4
	Successional Mixed Hardwood & Conifer	2	4	0	5700	7%	3
	White Pine-Hardwood	2	6	3	850	18%	4

KEY	Trees/ac. ≥20" DBH	# 4" Size Classes	Snags/ac. >10" DBH	Regen Stems/ac.	% Desirable Regen	Deer Rating
Poor	< 3	< 4	0 - 2	<500	< 25%	4, 5
Fair	3 - 5	4 - 6	3 - 5	500 - 999	26 - 54%	3
Good	6 - 11	7 - 9	6 - 8	1000 - 19999	55 - 74%	2
Very Good	≥ 12	≥ 10	≥ 9	≥ 2000	≥ 75%	1