Woodland Management Plan*

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NJ Approved Consulting Forester, NJ Licensed Tree Expert #376
NRCS Forestry and Wildlife Habitat Technical Service Provider # TSP-10-6805
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Prepared For:

Landowner:	Frelinghuysen Township (under a management agreement with NJA)
Mailing Address:	210 Main Street, Johnsonburg, NJ 07825
Property Location:	112 & 145 Lincoln Laurel Road, Frelinghuysen Township
Phone / Email:	Plan contact via executed management agreement – Don Donnelly
	908 396 7413 / don.donnelly@njaudubon.org
Plan Date & Period:	November 1, 2022 through October 31, 2032
Tax Block / Lots:	Block 201, Lots 6 & 8.08; Block 104, Lot 10
Property Size:	280.50 acres based on municipal tax records
Woodland Acreage:	258.14 acres
NJDEP Forestry #:	*****NEW PLAN*****

Plan being used for farmland assessment? Yes ☐ No ☒

Landowner Certification: I certify that I am the owner of the property or am authorized by the owner to make this certification. I have read the within forest stewardship plan and the information contained in the plan is true. To the best of my knowledge, the plan meets the requirements of the Forest Stewardship Program rules and applicable Federal and State law. The owner agrees to implement the plan, as approved or as subsequently amended.

Authorized Signature: _____ **Date:** 11/1/2022

Forester Certification: I prepared the within forest stewardship plan in consultation with the owner of the property. I certify that, to the best of my knowledge, the plan meets the requirements of the Forest Stewardship Program rules and applicable Federal and State law.

Approved Forester Signature: _____ **Date:** 10/32/2032

NJ Forest Service Use

Date Received: _____ Date Approved: _____

Start Date: _____ End Date:_____

State Forester Signature: _____

*Note that public land is not eligible for NJDEP approval under the Forest Stewardship Program, but this plan was prepared following the current Forest Stewardship requirements which exceed Woodland Plan requirements

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Background and Goals

Background

Location

The subject property, known as Frelinghuysen Forest Preserve (FFP), can be accessed from either State Route 94 or Lincoln Laurel Road in Frelinghuysen Township. The Route 94 access is located at the southernmost extent of the tract and lacks adequate parking for more than a few cars. The primary access is found at #139 Lincoln Laurel Road, which is a driveway on the north side of Lincoln Laurel Road, located approximately 1.3 miles east of Route 94. This driveway leads to a parking area, pond, and recreational facilities. Approximately 0.4 miles to the west of this entrance is a small gravel parking area that provides walking access into the southern end of the tract (for more details see the attached *Property Location* map).

Property Tax Blocks and Lots

The tract is owned by Frelinghuysen Township and is managed by the Township Land Manager Marty Connor and Assistant Land Manager Wendy Buttgereit, both of whom report to the Township Committee. The onsite recreation center is managed separately by the Township Recreation Committee. The tract is usually referenced as either the north or south sections depending on which side of Lincoln Laurel Road is being discussed. The northern section includes a single tax parcel known as Block 104 Lot 10, which according to municipal tax records, was acquired in 2015. The southern section that was acquired in 2011 includes two parcels known as Block 201, Lots 6 and 8.08. The acreages shown in Figure 1 are based on municipal property tax records compared to computer aided GIS measurements that are used for planning purposes in Figure 2. In accordance with New Jersey Department of Environmental Protection (NJDEP) Forest Stewardship Plan (FSP) requirements, all acreage is rounded to the nearest hundredth.

Block	*Lot*	*Acres listed in Municipal Parcel Records*
104	10	119.20
201	6	71.50
201	8.08	89.80
Total		280.50

Figure 1.

Total Acres	*Open Water Acres*	*Facilities and Open Field Acres*	*Forest Acres*
280.50	3.72	18.64	258.14

Figure 2. Land use category breakdown

Highlands/Pinelands Designation

As designated by NJSA 13:20-7, this property lies entirely within the Highlands *Planning* Area.

History and Prior Management Plans

A summary of the history of FFP property is listed below. The information was adapted from several sources including a review of periodic aerial imagery since 1930, from information contained in a site assessment report prepared for the township by Environmental Waste Management Associates, LLC (EWMA) in 2015, from the township website at: www.frelinghuysen-nj.us/wp-content/uploads/Frelinghuysen-Forest-Preserve.pdf, and from personal communications with Land Manager Marty Connor.

As it is known today, the preserve was established by township ordinance on April 15, 2015. Per the EWMA report, the northern side of Lincoln Laurel Road was a farmstead in the 1800's and became a camp in 1926. A review of the 1931 aerial imagery shows the primary access road for the camp leading to a single building visible on the property. The remaining land in 1931 was still being managed as agricultural fields or as sparsely treed livestock pasture. The only area that could remotely be considered wooded at the time was in the northern corner of the parcel, but even here the canopy is mottled and more indicative of pastureland. By 1939, multiple structures and the pond had been constructed, and by 1956, most fields in the northern side of FFP show signs of recent abandonment (i.e., woody encroachment present) except for the larger fields still in production along Lincoln Laurel Road, and some smaller fields used for recreation near the center of the property. By this time, rows of conifers were also established along the driveway and around the recreational facilities but not much else changed. The property was sold to the Archdiocese of Newark in 1959 (known as Camp Christ the King and Camp Lincoln Laurel). Successive photos in 1963, 1970 and 1985, show little change occurred across the property aside from some structures being removed and densification of the forest canopy, which appears to be fully coalesced on most of the property by the 1985 flight. The next notable land-use change was visible in the 1988 flight, whereas the large remaining fields adjacent to Lincoln Laurel Road were abandoned as farmland, and by 1995, eastern red cedar trees can be seen established throughout these fields. According to the EWMA report, the property was leased in 1993 by *Kids Corporation II* (operated under the name Kids Camp) and purchased by the same company in 2006, which continued camp operations until 2014. Based on the photographic evidence described above, most of the forest on the north side of Lincoln Laurel Road is less than 70 years old, and the stands near the road that are dominated by cedar trees are approximately 20-30 years old. Forests of this age and successional stage of development are emblematic of the widespread farm abandonment across the northern New Jersey landscape over the past century.

The two tax parcels that were acquired by the township in 2011 on the southern side of Lincoln Laurel Road were unrelated to the Kids Camp property described above, but the overall tract had undergone a very similar land-cover transformation during the past 90 years. The southern section was also predominantly open farmland in 1931 except for roughly 20 acres along the southeastern boundary that was fully wooded. By 1956, most of the land was either less intensively farmed or altogether abandoned, and there were only a few fields remaining in what appears to be hay production. Forest densification in these old fields continues through the 1970s, 1980s and into the 1990s. The only significant changes noticeable during this period is the improvement of a large road into the center of the property from Route 94 (completed sometime between the 1971 and 1984 flights), and canopy thinning in the older forest section near the southern border (sometime between 1992 and 1995) which was probably related to tree harvesting (stumps of undetermined age were also found in this area). Not much information was

readily available about prior owners of the southern tract, but according to current municipal tax records, both southern parcels were previously qualified together and assessed as farmland before being acquired by the township. Because the parcels were predominantly wooded in 2011, this means that land was managed for wood products under the direction of a Woodland Management Plan, and this assumption is corroborated by the numerous tree stumps of various sizes and levels of decay that were noted throughout the southern section of FFP. In some areas, the stumps are mostly small diameter cedar trees that were presumably thinned to concentrate growth on adjacent hardwoods. In other areas, larger diameter stumps may have been a product of timber and/or firewood harvesting. Several reports from the property acquisition period indicate that the land was under development pressure, so some of the tree harvesting may even have been done in anticipation of the site being developed rather than as a forest management tool. Based on this review of historic aerial photography, most of the forest in the southern FFP section is also less than 70 years old. The older area that was wooded in 1931 contains trees that are in the 100 - 120 year old range, but harvesting interventions over the years appear to have been focused on removal of larger/older oaks that released a subordinate cohort of maple stems – making the current stand structure not much different than the surrounding 70 year old forests.

The township has not engaged in any forest management activities since acquiring the properties. Other land management to date has been focused on removal and cleanup of unwanted remnants of the former day camp facility, improving the trail system, and promoting other passive recreation activities. In 2015, a "Stewardship Assessment Report" was prepared for the 161-acre southern section by *The Land Conservancy of New Jersey*. That report provides a qualitative evaluation of the vegetation and general site conditions, a list of trees, shrubs, plants, amphibians, reptiles, mammals, butterflies, and birds that were observed on-site, stewardship recommendations, and trail development recommendations. For reference, the three stewardship recommendations included in the report were to implement a deer population control program if herbivory pressure increases (the report notes that deer herbivory was not severe or problematic as of 2015), to control non-native plants along the trails via cutting and spraying as necessary in order to keep the trails open, and to install nest houses for wood ducks, blue birds and bats where appropriate (e.g., near the pond, etc.). While this report is informative, it does not address conditions in the northern section of FFP, nor does it contain quantitative forest data that is important for making informed stewardship decisions. To rectify these shortcomings, Frelinghuysen Township entered into a *Management and Land Use Agreement* with New Jersey Audubon in 2019, with the intention of developing a management plan for the entire preserve to guide ecological management. This FSP will serve as that management plan. Like any plan, the content will have limitations bound by budgets and whatever information is currently available. Undoubtedly, the content compiled in this document will raise new questions that may need to be addressed by future data collection and monitoring. Because a forest is not a static system and is continually growing and responding to changing conditions, the FSP should be treated as a living document that will be amended over time. Therefore, the recommendations contained herein need to be adaptive to those potential changes and be updated as needed, or least once every 10-years. It is also worth mentioning that the format of this FSP follows existing Forest Stewardship Program standards promulgated by the NJDEP that were established to guide plan development for private property owners for the purpose of meeting property tax abatement standards under the state's Farmland Assessment Program. Tax abatement obviously has no bearing here, but for regulatory consistency and for NJDEP approval there are certain forestry terms used and topics

addressed in this plan that have no relevance to this specific property or the landowner's goals but were included for consistency with existing state standards. We want to be explicit that even where standard forestry vernacular is used to describe or quantify the forest in terms of wood products, these descriptors should not be misconstrued to infer that the plan has an underpinning in forest management actions for wood extraction purposes, because the sole genesis for this plan was to address forest health and ecological concerns.

Forest Health and Biodiversity Implications

Because of their relative age, the forests on this property are mostly in a transitory period between being young and mature. At this successional stage of development, the forest is undergoing "stem exclusion", which is a natural period of intense competition between trees for growing space. When a new forest becomes established on open farmland, it typically starts out with thousands of trees per acre, and once the canopy coalesces by around age 20, the trees must compete for dominance to capture the available sunlight and resources. Over the next 60-80 years, tree mortality increases as growing space becomes limited and the less vigorous stems succumb. By around 100 years, a typical hardwood stand in northern New Jersey will have naturally thinned from several thousand stems per acre down to several hundred stems per acre, and throughout this process, even the surviving trees can be stressed and susceptible to other problems. Because of the dense shade cast on the understory during the stem exclusion period, ground-level and mid-tier vegetation development is normally poor, which is why middle-mature stands are usually considered less biodiverse than young or old stands. The most obvious example of stem exclusion on this property can be seen in the cedar stands along Lincoln Laurel Road. In these areas, monocultures became established at such high density that almost no plants persist in the understory aside from shade tolerant non-native species, and the condition of the stand is very homogenous. Because of the high level of competition, these cedar trees put all their energy into height growth, and being intolerant of shade, their lateral branches self-prune early. With diminished crowns, the trees cannot produce sufficient carbohydrates to add diameter growth or build energy reserves, which makes them increasingly susceptible to pests or disease. From the stand-level lens, the entire canopy becomes less vigorous and is compromised, so widespread mortality can occur from a single event like drought or windthrow. Although the visible symptoms of stem exclusion in hardwood stands is less apparent to most casual observers, much of this 250+ acre forest is undergoing the same process but at different degrees of impact.

Part of the forest inventory process includes noting any significant insect or disease problems that are present during property visits, and the only relevant problem seen on the property was ash decline from Emerald ash borer (EAB) infestation. Many people are already aware of the EAB problem that has resulted in widespread mortality of ash trees (*Fraxinus spp.*) throughout the Eastern United States in recent years. While there are several pesticide treatments options available to control EAB, none are practical for use in a forest setting, and it is reasonable to anticipate that all ash trees on this property will succumb to the pest within the next few years. According to the inventory data, about seventy percent of the acreage contains an ash component that averages roughly 8-10% of the growing stock (measured as a percentage of basal area). If the ash were evenly distributed throughout the forest, the effects of this mortality would probably be minimally noticeable at the stand level, but since ash tend to be concentrated more in wetter areas and lower lying sites where soil conditions are mesic, the mortality may be more profound

in some locations than the stand-wide average numbers suggest. If the standing dead trees do not present a direct threat to infrastructure and are beyond striking distance of places where visitors congregate, no mitigation is needed, and the trees should be left standing as important wildlife habitat that is in short supply on the property.

A discussion of forest health concerns would be remiss without addressing white-tailed deer and their effects on forest vegetation and biodiversity. The *Stewardship Assessment Report* produced by The Land Conservancy of New Jersey in 2015, indicated that deer browse evidence was low and the local deer population did not seem problematic, however, it is this authors opinion that the deer population is now very problematic based on recent observations. For example, during a 2-hour site visit in early October 2022, more than 12 deer were encountered in the southern section of FFP alone. While the appropriate number of deer that is compatible with a forest resource is debatable and dependent on alternate food sources in the surrounding landscape, many forest professionals consider the ecological carrying capacity for a healthy forest to be somewhere below the range of about 20 deer per square mile under normal conditions. If we consider that the 160-acre southern FFP covers approximately ¼ of a square mile, the theoretical maximum deer population should be fewer than five deer (and even then, some forest professionals would argue that five deer is still too high). While we acknowledge that this example is imprecise and consists of inadequate data to draw definitive conclusions, when combined with an understory vegetation assessment, it does suggest that the deer population may be significantly higher than ideal for forest health. Specifically, both the quantitative and more subjective qualitative understory assessment done for this plan indicate that unless it is a plant that is known to be unpalatable to deer, there is a lack of any meaningful amount of native understory vegetation on the property. Part of this dilemma is certainly the seral stage of the forest development and shade limitations, but other subtle indicators like a distinctive browse line (pictured in Figure 3), point to an excessive deer herbivory problem also. A probable causation for this abrupt change in conditions since the 2015 Land Conservancy report is that hunting pressure was likely higher here before the land was obtained by the township, and without hunting, the population grows rapidly.

In consideration of all forest health issues on this tract, an over-abundant deer herd is the single biggest health threat facing this forest because over-browsing can alter plant communities and the animals they support. Despite philosophical debates about recreational deer hunting, deer *management* needs to be considered similarly to any other aspect of property stewardship, and it is strongly recommended that this issue is confronted quickly to avoid long-term impacts that will become increasingly difficult to manage and will compromise the sustainability of this forest. One deer mitigation technique that often gets discussed is installing an 8’ wire fence around an area to exclude deer, and while fencing may be appropriate in some instances, fencing areas larger than 20-40 acres (depending on terrain) has proven to be ineffective for many reasons, and even if it were effective, a fence only displaces and further concentrates deer on adjacent properties, so it doesn’t really solve a community problem.

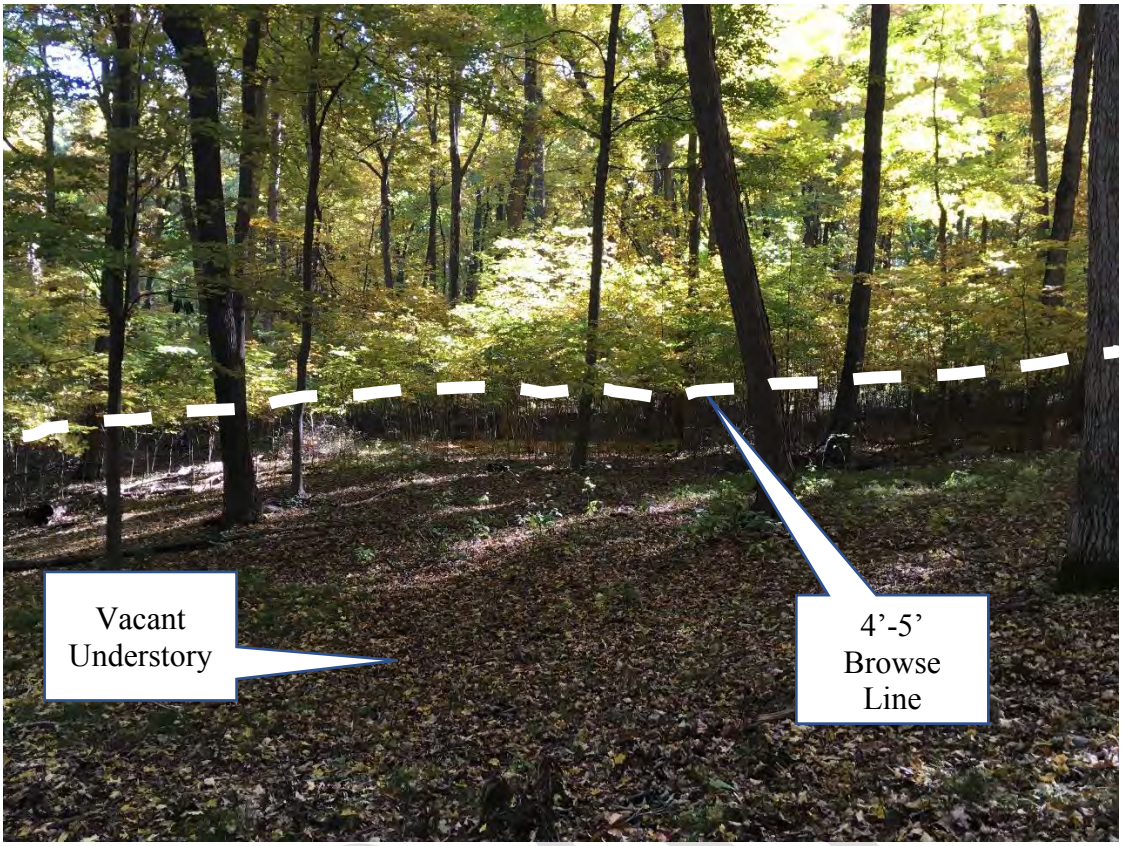


Fig. 3 Herbivory Browse Line

Aside from the loss of native understory flora that is important food / cover for native wildlife and for regenerating the forest, one of the more pressing problems with deer herbivory is the synergistic relationship between deer and non-native invasive plants (NNIP). As deer preferentially browse native plants and avoid eating less palatable non-native plants, the non-native plants gain a competitive growth advantage and can rapidly overtake large areas. This quickly affects local biodiversity because non-native plants are generally less nutritious for wildlife, and NNIP support fewer beneficial insects that are important for pollination or as food for songbirds, small mammals, forest bats, and amphibians. NNIP often forms a monoculture that does not provide structurally complex escape and nesting cover needed for native wildlife, which makes some wildlife more vulnerable to predation. In addition to negative biological impacts, when large portions of the forest understory are overtaken by thorny plants like Japanese barberry or multiflora rose, it can negatively affect aesthetics and the ability for park users to recreate in the woods. Studies have also demonstrated that tick populations are positively correlated with certain plants like Japanese barberry, so park users can be exposed to a higher incidence of tick-borne diseases in places where certain NNIP are overly abundant and have high deer populations.

Presence of Wetlands and Flood Hazard Areas

Does the property have wetlands mapped by NJDEP?	Yes ☒	No ☐
Are there possibly wetlands present that are not mapped by NJDEP?	Yes ☒	No ☐
Does the property have wetlands transition areas?	Yes ☒	No ☐
Does the property have surface water?	Yes ☒	No ☐
Does the property have Riparian Zones?	Yes ☒	No ☐
Does the property have FEMA Flood Hazard Areas?	Yes ☐	No ☒

Wetlands and water bodies are sensitive resources that have the potential to be negatively impacted by disturbances including poorly implemented forestry activities. Freshwater wetlands and their associated transition buffers are regulated in New Jersey under the *Freshwater Wetlands Protection Act* (FWPA) rules N.J.A.C. 7:7A, and activities in the riparian areas surrounding water bodies or in flood zones are regulated under the *Flood Hazard Area Control Act* (FHACA) rules N.J.A.C. 7:13. Forest management activities are permitted in regulated areas without the need to first obtain a permit from the NJDEP if they are conducted under specific conditions provided by a forestry exemption in the case of the FWPA, or via a permit-by-rule under the FHACA. The exemption from getting a permit requires that all regulated features be identified in a forestry plan that is approved by the NJDEP Forest Service with a description of all Best Management Practices (BMPs) that will be used to minimize negative impacts to those resources. Most of the pertinent BMPs are outlined in the *NJ Forestry and Wetlands BMP Manual, 1995*, but additional measures are sometimes needed depending on the site. Any forestry activity must be done in strict accordance with the approved plan to avoid violations imposed by the NJDEP Bureau of Land Use Compliance & Enforcement. Below is a description of regulated features at FFP that may by impacted by these rules.

Wetlands - A formal wetland delineation to determine the presence or absence of wetlands is beyond the scope of this plan, so the NJDEP 2012 wetland mapping is used as an initial screening tool for forestry purposes. According to that resource, there are no mapped wetlands in the northern section of the Preserve, but the southern section contains numerous patches scattered throughout the tract (see attached maps for the locations). The mapped wetlands will be afforded a 150' transition buffer in accordance with the wetland classification of *Exceptional Resource Value* since they are associated with a Category 1 waterbody (see paragraphs below), and they support documented habitat for threatened or endangered species. This latter assumption is founded on the rare species report for the property that was provided by the NJDEP Office of Natural Lands Management (attached to the plan for reference). Forestry activities that disturb the ground or vegetation within 150' of wetlands must adhere to BMPs discussed later.

Waterbodies - New Jersey assigns water quality classifications for antidegradation purposes to all waterbodies under the *Surface Water Quality Standards* (SWQS) N.J.A.C. 7:9B, and each classification has an assigned riparian zone width that is regulated for forestry purposes under the FHACA. In the southern section, there is mapped perennial pond/lake with an unnamed tributary to the Paulins Kill flowing through it, and a second unnamed tributary to the Paulins Kill that intersects the property boundary near Route 94. These tributaries have a SWQS classification of FW2-TMC1 (FW2 = fresh water influenced by man-made discharges, TM = trout maintenance, C1 = Category 1). Being that the pond is connected to the stream, the pond assumes the same

classification. Under the FHACA, the FW2-TMC1 designation is afforded a 300' regulated Riparian Zone extending from the bank. In the northern FFP section, there is also a mapped perennial pond/lake that is not assigned an SWQS classification. No other mapped water features exist, but there is an unmapped stream that leaves the pond and appears to eventually reach the Paulins Kill. In most situations, an undesignated waterway assumes the same classification as the waterbody that it feeds, so for the purposes of this plan, it will be assumed that the stream and pond in the northern section are also FW2-TMC1 (although from a practical standpoint, the pond is dammed and appears to be a warm water fishery that is incapable of trout maintenance, and the tributary was dry as of October 2022). Forestry activities that disturb the ground or vegetation within the 300' Riparian Zone of a waterbody must adhere to BMPs discussed later.

The New Jersey Forest Service requests information on Federal Emergency Management Agency (FEMA) delineated flood areas on the property, and according to the attached Flood Map produced via the FEMA website, there are no flood hazard areas within the property.

Legal Constraints or Property Easements

There are no utility rights-of-way or other visible easements on the property that appear to restrict the landowner's ability to manage for healthy vegetation.

Goals

Owners Long Term Goals

The management goals below were provided by Frelinghuysen Township officials, followed by the plan author's notes in italics.

- To establish a healthy forest. *Note that defining forest health can be somewhat subjective and some individuals might feel that the existing forest is already healthy based on their personal values. So, for the purposes of this plan, we define a healthy forest as one that is resilient to stressors. Specifically, that a healthy forest should be capable of recovering to its essential characteristics (including taxonomic composition, structure, ecosystem function, and process rates) following a disturbance.*
- To improve wildlife habitat. *No particular wildlife species were specified by the Township, so we will assume that rare species should be prioritized when possible over common species.*
- To control the deer population. *Self-explanatory.*
- To remove invasive species. *Self-explanatory.*
- To restore native plant varieties. *This presumably refers to areas where invasive species are removed, or more broadly, re-establishment once deer are controlled.*
- Protect ponds and streams. *Self-explanatory.*
- Maintain hiking trails. *Self-explanatory.*
- Remove undesirable trees. *This is a somewhat subjective goal depending on individual values, but undesirable is defined here as either being a non-native tree species or a low vigor tree whose removal would benefit the vigor of remaining trees.*
- Encourage passive recreation. *Self-explanatory.*

Cooperative or Regional Management
This property is not part of a cooperative management program, but it is adjacent to other public open space that creates greater passive recreational opportunities like hiking and nature study across multiple properties.

Monitoring, Record Keeping and Reporting
Although the property owner is not pursuing property tax abatement, pursuant to the Forest Stewardship rules at N.J.A.C. 7:3-5.11, landowners are obligated to carry out monitoring and recordkeeping of their annual activities. This requires that a forest stewardship plan must "establish the monitoring, recordkeeping and reporting necessary to document implementation of the forest stewardship plan, including documentation of activities and inspections performed". While this provision was intended for private landowners seeking property tax abatement, monitoring and recordkeeping are equally important for public landowners to know if their actions are meeting the intended goals, and how future actions might be adapted for better outcomes.

Property Overview

Boundaries
Having physically marked boundaries is a necessary component of good land management to ensure that stewardship activities occur on the correct parcel and that conflicts with neighbors are minimized. Some of the property lines here are easily identified with physical features like roads, where no additional marking is needed. Other boundaries that are shared with adjacent woodland owners should be permanently marked in some way. Common boundary markers include paint blazes on trees or posters.

Topography and Geology
The topography throughout the property is typical of the Ridge and Valley physiographic province, having rolling terrain that includes small hills and coves. In most places, slopes are gentle and the landscape can be characterized as undulating. In the northern section, the topography has an elevation range from approximately 520'to 660'. The southern section is slightly higher elevation at about 600' to 760', and a few of the hills in this section have steep gradients over short distances. Overall, the property doesn't have a single discernable aspect, but the entire site drains in a west-southwest direct towards the Paulins Kill River (see attached Topographic Map). Nowhere is the topography considered so difficult that it precludes access for stewardship activities.

The bedrock geology consists of sandstone, siltstone, shale, and slate that is overlaid on the surface by an unconsolidated till material known as *Kittatinny Mountain Till*, which was deposited directly from glacial ice during the late Wisconsinan glaciation period. The till consists of clayey to silty sand, with varying amounts of pebbles, cobbles and boulders. The profile is listed as being up to 150 ft. thick, but is generally less than 40 ft. thick.

Soil Characteristics

As mapped by the USDA Natural Resources Conservation Service (NRCS), the property boundary includes three primary soil types, one of which is represented by four phases that are differentiated by slope gradient. The soils are generalized in the table below, but a more comprehensive soil report (produced by NRCS) is included as an attachment to this plan along with a soil map. It is important to recognize that NRCS soil mapping is done at a scale that is not intended to provide a definitive demarcation of the soil boundary, but instead, the mapping provides a general representation of soil conditions that may require field verification if precise soil information is needed. Another important point is that there is almost always a transition or gradient between soil types that may be different than the typical soil conditions.

Soil Name (Symbol)	% of property	Slope	Erosion Hazard When Exposed	Site Index	Productivity (Cu ft/ac/yr)	Common Tree Species
Alden silt loam (AhbBc)	3.1%	0-8%	Slight	50	29	red maple
Fredon-Halsey complex (FrdAb)	0.3%	0-3%	Slight	50	29	red maple
Nassau-Manlius very channery silt loams (NauB)	8.5%	0-8%	Slight	60	57	northern red oak
Nassau-Manlius very channery silt loams (NauC)	29.0%	8-15%	Slight	60	57	northern red oak
Nassau-Manlius very channery silt loams (NauD)	37.5%	15 - 35%	Slight	60	57	northern red oak
Nassau-Manlius very channery silt loams (NauEg)	22.5%	35-60%	Slight	60	57	northern red oak
Water	0.9%	-	-	-	-	-

Biodiversity, Ecology, Wildlife and Fish Habitat, Fire

Some of the important ecology and biodiversity issues like deer herbivory and the effects of stem exclusion have already been introduced earlier in this plan, so they will not be revisited here in their entirety. From those earlier discussion points, it was made clear that biodiversity and ecological process are currently being impaired to varying degrees by excessive deer herbivory, expanding non-native plant populations, and a lack of horizontal and vertical structure across the forest. In a positive context, the property sits within the highly productive Ridge and Valley region that is known for its high biodiversity values, and the tract contains several cover types such as wetlands, open areas, and a conifer component, that add ecological value. For example, the interface between uplands, wetlands, and open areas, provide a gradient of site conditions where an excellent variety of trees have become established across the property. The original 2015 assessment of FFP South that was completed by *The Land Conservancy* listed 19 tree species on the tract. With the addition of FFP North, the total number of tree species noted for the tract is now 34. As shown below, only one of the 34 is considered an NNIS.

Property Tree List: (±) *denotes a non-native species* (*) *denotes a non-native invasive species*

Red oak	Scarlet oak	Sugar maple	American beech
Swamp white oak	Sweet birch	Box elder maple	Eastern red cedar
White oak	Gray birch	Red maple	Hemlock
Black oak	Shagbark hickory	Tulip poplar	White pine
Chestnut oak	Bitternut hickory	White ash	Red pine
Pin oak	Blackgum	Black ash	American sycamore
Ailanthus*	Sassafras	Black cherry	Hornbeam
Bigtooth aspen	Slippery elm	American elm	Hop hornbeam
Black locust	Black walnut		

The downside to having a gradient of growing conditions along habitat transition zones is that undesirable plants also tend to proliferate, especially in the understory. The combined plant lists from the 2015 Land Conservancy report and this current inventory are detailed below. Since certain wildflowers and herbaceous plants are ephemeral and the recent understory assessment was not repeated multiple times throughout the year, the list should not be considered inclusive of all potential plants that could be on the property. It is also noteworthy that while the plant lists may appear substantial at first glance, more than a third are non-native species, and most of the native species are found in relatively low abundance.

Property Woody Shrub List:

Witch hazel	Asian wineberry*	Buttonbush	Highbush blueberry
Japanese Barberry*	Multiflora rose*	Blackhaw viburnum	Lowbush blueberry
Staghorn sumac	Bush honeysuckle*	Autumn olive*	Silky dogwood
Spicebush	Asian wineberry±	Blackberry	Black raspberry

Property Vine List:

Oriental bittersweet*	Wild grape	Poison ivy	Virginia creeper
Japanese honeysuckle*			

Property Herbaceous Ground List:

Japanese stiltgrass*	Unidentified Grass spp.	Unidentified sedge spp.	Unidentified rush spp.
Mugwort*	Garlic mustard*	Black medic*	Jack-in-the-pulpit
Bracken fern	Sensitive fern	Christmas fern	Princess pine club moss
Running pine club moss	Spleenwort	Common blue violet	Indian tobacco
Spotted touch me not	White beardtongue	Enchanters nightshade	Canada mayflower
Partridgeberry	Shinleaf	Dwarf cinquefoil	Dogbane
Asiatic dayflower±	Red clover±	Crown vetch±	Cleavers±
Dames rocket±	Yarrow±	Deptford pinks±	St. Johnswort±
Oxeye daisy±	Daisy fleabane±	Curly dock±	Cyprus spurge±
Canada thistle*	Spotted knapweed*	Wild geranium	Spotted wintergreen
Mayapple	White snakeroot	Goldenrod spp.	Blue vervain
Water lily	Phragmites*	Cattails	Tick trefoil
Blue lobelia	Wood aster		

In many cases, non-native plants are introduced into new areas via roads, trails, and along non-forest edges, but many seeds are also carried to the forest interior by the wind, or by animals and

birds. Because they are widely dispersed and considered endemic throughout the landscape, there is really no way to permanently eliminate most non-native plants from a forest this size, and there may be no reason to focus on those that are not invasive. Instead, management should focus on gaining a threshold of control. When possible, control work should begin in locations where other actions will simultaneously be undertaken to make site conditions more favorable for native plants to compete equally with NNIPs. NNIP management can never really be considered a one-and-done action because there will always be a need for successive treatments to address plants that were initially missed and others that emerge from the seedbank. Land stewards often attempt mechanical methods for controlling NNIP because of the desire to avoid using herbicides whenever possible, but mechanical control methods are labor intensive and usually ineffective at killing the rootstock, so the plants quickly resprout. In most situations, plant control being done at scale requires the careful use of herbicides by a licensed applicator. One common approach to reduce chemical use for larger plants and plant populations is to combine an initial mechanical treatment to reduce biomass, and then chemically treat the resprouts. This also helps reduce any non-target overspray to desirable plants.

Because of the adjacency (and inclusion within) of roads and other permanent non-forest features like fields and homesites, a large proportion of this property is considered "edge" habitat; meaning that it is effectively a transitional habitat between non-forest and the interior forest conditions found in expansive wooded tracts. Edge habitats can be ecologically diverse, but they usually support a predominance of plants and wildlife that are considered generalists in their site requirements. And since edge habitat is the most common woodland habitat type throughout New Jersey, the species associated with edge habitats are typically common too. White-tailed deer are a classic example of an edge species. Other generalists that might be found here include gray squirrels, red fox, coyotes, chipmunks, and racoons. Conversely, many of the state's rare species either avoid edge habitats because of the human component, or they are forest interior obligates that need larger blocks of forest for breeding and foraging. There are a few sections of this property that can be considered interior or "core" forest habitat, which is often defined as a wildlife territory that is buffered from non-forest influences by at least 300'. Core forest habitat is important for rare species like Barred owls. It is also preferred breeding habitat for more common species of neotropical songbirds like Wood thrush. One common misconception is that the canopy of a core forest must remain unbroken or it becomes edge habitat, but canopy disturbances have always been a natural part of forest ecology that wildlife co-evolved with. The principal difference between edge creation and a canopy disturbance is what happens in the disturbed area. If the land is converted to a permanent non-forest use (e.g., a field or homesite) it creates edge habitat. If it undergoes succession and contains tree growth again, it is still a forest – just a structurally different part of the forest. In fact, recent research has demonstrated that many forest interior wildlife utilize different structure within a core forest for different parts of their life cycle, and those structural differences usually relate to canopy changes. This underscores the importance of spatial heterogeneity across the forest canopy for improved biodiversity.

Another important value of core forest habitat is that it provides a corridor for wildlife dispersal and is probably the reason why mammals like porcupines and fishers have successfully re-established themselves recently in the maturing forests of northern New Jersey after been extirpated during the early 1900 agrarian era. Other notable mammals on this property that use both edge and core forests are bobcats and black bears.

Although the fields mentioned above have some negative connotation in the context of edge habitat and forest continuity, open environments can be important pollinator habitat for insects, reptiles, small mammals (e.g., voles, mice, etc.) and if large enough, for ground nesting birds (although these fields are probably too small to be valuable bird nesting habitat). The fields were not surveyed as part of this "forest" inventory, but because they are remnant farm fields, they are most likely dominated by cool season forage grasses and other related weedy species. The fields should be more closely examined during the next growing season to evaluate their existing composition and if pollinator value can be improved through conversion to warm season grasses and a pollinator seed mix, or even establishing ¼ – ½ acre patches within the fields. Since the conversion will probably require killing back existing vegetation to establish new seeds, the field conversion should be staggered to preserve continuity of habitat for species that are currently using the sites. Assuming that is not the current practice, it will probably be beneficial to reduce mowing to once a year to allow plant development to occur, preferably during the dormant season.

The 2015 Land Conservancy report included a bird survey that recorded 33 different species, which represents good bird richness and probably reflective of the different habitat types on the property. Songbirds are an excellent index of biodiversity because they are more easily surveyed than many other forms of wildlife. Many of the species recorded here are migrants that breed in New Jersey forests and would benefit from better understory conditions for nesting success. In addition to escape and nesting cover, access to high quality soft mast and other seasonal foods (insects, seeds, etc.) is critical during migration, which speaks to the need for improving native understory diversity and abundance. This can be facilitated in areas of the forest where NNIP are controlled by hand-planting native shrubs and protecting them from deer browse using small wire cages.

Water and wetland resources are often corelated with high biodiversity because they support a wide variety of insects, amphibians, reptiles, waterfowl, fish, and other aquatic organisms. The pond and unnamed tributary in the southern FFP section presumably supports a trout population based on its SWQS classification, which in-itself is an indicator of high biodiversity. The pond on the northern section is used for fishing, and several visitors reported catching warmwater species like largemouth bass, crappie, and sunfish. Amphibians and reptiles that have been reported for the property include box and snapping turtles, wood frogs, green frogs, spring peepers, and American toads. The attached Natural Heritage Database (NHD) report provided by the NJDEP Office of Natural Lands Management, indicates that the site supports blue spotted salamander (state endangered), and the immediate vicinity of the property has been reported to have long-tailed salamander (state threatened) and wood turtle (state threatened). The NJDEP Landscape Project shows several areas of potential vernal habitat extending onto the property from nearby suspected vernal pools, but no pools are shown on the subject property (note that in this author's opinion, there is at least one unmapped area in FFP South that should be examined by a qualified amphibian biologist for vernal characteristics if it hasn't already been done). The tract undoubtedly also supports other more common salamanders like redbacks, and a few snake species like the northern water snakes and garter snakes. Waterfowl were observed during the inventory at the southern pond - although identification of individual species was not possible.

Open water bodies like these ponds are also natural foraging hot-spots for woodland bats and songbirds searching for insects, and are prime locations for predatory birds like the Great blue heron to hunt for aquatic organisms including snails, fish and frogs. The open wetland/pond in southern FFP is experiencing encroachment of phragmites on its eastern side. Phragmites is known to dominate and displace other vegetation in open wetlands and is generally thought of as having lower ecological value than other plants, so it would be good to begin controlling it before it takes over the entire wetland complex. One possible resource for assistance in doing this is the US Fish & Wildlife Service's *Partners for Fish and Wildlife Program*. Biologists who are familiar with treating phragmites can be reached through the Pleasantville, New Jersey, Field Office.

An important element of biodiversity and forest ecology is coarse woody debris (CWD), which includes standing dead trees (a.k.a., *snags*) that provide perching habitat for birds like the Coopers hawk, and cavity nesting habitat for small mammals and other birds like screech owls, woodpeckers, and nuthatches. Larger cavity trees (i.e., >17" DBH) are critical habitat for rare species like barred owls. When on the ground, logs and large branches provide cover for small mammals, amphibians, and reptiles. CWD is particularly important for salamanders to protect them from desiccation, and since there are several rare salamanders known in the area, it is probably a very important habitat component for this property. Having copious amounts of CWD in various stages of decay is also a key structural component of old growth character. Overall, the amount of CWD throughout this property is relatively low because of the relatively young state of the forest. The amount of CWD can be increased by girdling trees to kill them while standing.

The conifer component adds an excellent element of diversity on this property. One of the primary wildlife benefits of conifers is the thermal cover they provide to creatures during the hot summer daytimes and cold winter months, which is one reason conifers are favored habitat of many owls. Most of the conifer component is eastern red cedar, which is relatively short lived and uncommon in older forests. Accordingly, as this forest continues to mature, it can be expected that the cedar component will be lost unless a concerted effort is made to sustain some stems through thinning practices that release them from hardwood competition. Red cedar also produces an excellent soft mast for birds that can be more abundant when trees get adequate sunlight.

The Natural Heritage Database mentioned above details any known occurrences of endangered or threatened wildlife species on this property. The three species listed for the property are blue-spotted salamander (state endangered), barred owl (state threatened), and bobcat (state endangered). A few other species are listed as "special concern" because their populations have declined for various reasons, but they are not yet critically imperiled.

The primary BMP for protecting blue-spotted salamanders from adverse impacts is to avoid using vehicles and equipment within 1,000' of a vernal pool where they breed, which is the area defined as vernal habitat by the NJDEP. The vernal habitat on this property covers most of the

primary driveway and part of the fields / recreation area in FFP North. Eliminating vehicle use in the vernal habitat will not be feasible because it is the main access, but there are no recommendations in this plan to expand the use of vehicles into wooded areas, and if that were necessary for maintenance purposes, the activity should be done during frozen winter months to lessen the chance of impacting salamanders. A second concern is for the use of herbicides, which amphibians are highly vulnerable to compared to other animals because of their absorbent skin. The BMP to mitigate harm from herbicides is to only use formulations near water and wetlands that are approved for use in wetlands or aquatic situations, and these must be applied in strict accordance with the label. Other activities that increase the amount of CWD on the ground in vernal habitat will be beneficial for the conservation of this species.

Barred owls begin breeding around March each year in expansive (i.e., core) forests, with a preference for wetland and riparian woodlands that are generally more than 1,000' from humans. They typically utilize large cavity trees > 18" DBH for nesting but may use stick nests constructed by other birds when cavities are unavailable. Nesting is normally completed by the end of June, so the primary BMP to mitigate adverse and irreversible impacts to barred owls is to avoid disturbances within 1,000' of suspected nest trees during the breeding and nesting season. Activities that increase the number of larger diameter cavity trees may improve nesting success, and forestry treatments that improve plant biodiversity and small rodent populations may be beneficial for the conservation of this species.

Bobcats are elusive mammals that often den in rocky outcrops within closed canopy forests but prefer hunting small prey in the dense vegetation of shrubby, young forest habitat. They have home ranges that are larger than this parcel and move about frequently. Since they are highly mobile and evasive, they will quickly move away from human activity, so occasional forest stewardship activities are not considered to adversely affect bobcats. Forestry treatments that improve plant biodiversity and small rodent populations may be beneficial for the conservation of this species.

In addition to the state database report, an "official species list" was obtained from the US Fish and Wildlife Service (USFWS) to review the property's suitability as habitat for federally listed threatened and endangered species that may be found in the area (this document is also attached to this plan). Accordingly, there are four federally imperiled species that might be found in the region, but there are no critical habitats on the property. Those species are listed below with general descriptions and possible conservation measures.

<u>*Northern long-eared (NLEB) and Indiana bats (IB)*</u> – According to general information available about NLEB and IB, these bats use a wide range of habitat types including the type of forest found on this property. Knowing that suitable habitat exists and the property is within the range of these bats, another resource that is available through the USFWS NJ Field Office website and was updated last on as of October 2020, known as "bat-towns", was consulted to see if known occurrences occur in Frelinghuysen Township. Based on the bat-towns document, Frelinghuysen is *not* a known hibernation or maternity habitat area for these bats. Therefore, the probability of NLEB or IB being on this site is extremely unlikely.

According to the most current regional science synthesized in the *Forestry Habitat Conservation Plan for Bats* that was developed for the state of Pennsylvania in conjunction with the USFWS, the primary conservation measure to minimize impacts to NLEB or IB is to avoid clearcutting within ¼ mile of a hibernaculum and to avoid felling potential roost trees (e.g., those with cavities or exfoliating bark) during the period when pups are non-volant, which is between June 1st – July 15th. If NLEB or IB is eventually recorded on this property, following these timing guidelines will prevent adverse and irreversible effects on the species. Furthermore, the *Pennsylvania Forestry Habitat Conservation Plan for Bats* found that many forestry treatments improve roosting and foraging habitat, so forestry treatments to improve the health of this forest may be beneficial to the species recovery.

Bog turtle – Bog turtles prefer open wetland habitats that often have shallow areas of standing water interspersed with tussocks of grasses and sedges – similar to a wet meadow. The only potential area on this property - which is not exactly "classic" bog turtle habitat - is the ponded wetland in southern FFP. However, this property is not listed by the NJDEP as a known site with bog turtles, so it probably unlikely they occur here. The BMPs for protecting Bog turtles are comparable to what was detailed for salamanders, except that bog turtles rarely travel into uplands, so the habitat zone of avoidance for using vehicles is limited to the 150' wetland transition area. One exception could be if mechanical phragmites control is done in the wetlands using a low ground-pressure piece of equipment like a Marsh Master, which would need to be completed during winter hibernation when the ground is frozen without danger of crushing turtles.

Dwarf wedgemussel – These are small, freshwater mussels that are typically found in muddy or sandy bottoms of slow to moderately moving streams and rivers. They are known to occur in parts of the Paulins Kill River, which is about a half mile from the property. The only conservation consideration for this species is to avoid alterations to the tributary streams that will increase downstream siltation in the river, which will not be a factor for activities proposed in this plan.

The last component in this section is a brief discussion about wildfire hazards or the role of wildfire as a beneficial ecological process. To the first point, the existing wildfire hazard in this forest is low because the composition and distribution of fuels on the forest floor are not very conducive to ignition - even during dry periods. To latter point, there is a growing body of scientific evidence showing that fire helped shape forest composition throughout the eastern hardwood biome since the last ice age, including northern New Jersey. This was largely driven by native American burning to improve hunting and foraging opportunities. Evidence of this historic fire regime in the east draws upon markers such as soil charcoal, soil pollen records, and fire scaring on trees. A primary outcome of long-term repeated burning is that fire-adapted ecosystems evolve and remain stable on the landscape. In the east, this pertains to the persistence of upland oak forests. An excellent synthesis of fire science literature was produced in 2014 by the US Forest Service's Northern Research Station, and that review indicates that oak forests in the region probably had an average Mean Fire Interval (MFI) of about 13 years (meaning that fire passed through a site on average every 13 years) - although that figure is perceived to be conservative because lower severity fires may not have left much

tree scarring evidence, or scarring evidence may have been lost as trees died and decayed over time. The literature shows that in association with human occupation in some parts of the east, the MFI increased to every 7 years. So, although the regional variations in MFI imply that climate and geography are drivers for how fire naturally shapes forest composition, there appears to be a strong historical human influence as well.

From some of the historical data like pollen records, we know that forest types in northern New Jersey today have been consistent over 10,000 years, however, the structure of today's forests are over-simplified and highly un-natural compared to pre-settlement forests because they arose from wide-spread agriculture clearing and exploitive tree harvesting over the last ~200 years, and then collectively regenerated over large areas. This created large even-aged homogenous forests of similar age, like those at FFP. In contrast, a relatively frequent fire regime that burns irregularly across topographic features, creates multi-aged complexes with interspersed climax patches where fire was excluded. This permits a mosaic of growing conditions to occur across geographic features to sustain different habitats and species. In current times, human development patterns have necessitated the control of wildfire and thereby eliminated much of the randomness of how natural disturbance regimes like fire affect forests. Places that were naturally pre-disposed to higher disturbance frequencies now have buildings on them, and elsewhere, fires are quickly suppressed before affecting much area. As many of today's homogenous forests mature in the absence of significant disturbance forces, they are collectively undergoing mesophication that favors shade-tolerant ingrowth of mostly singular species like red maple and beech, or in some instances, invasive species invasions. As this trend continues, flora and fauna that co-evolved with disturbance dependent forest types will effectively disappear from the region. Perhaps more concerning is that large homogenous areas will eventually become susceptible to host-specific stressors and potentially be impacted all at once – like we are seeing with beech bark disease in New England. Restoring some of this imbalance can be accomplished by using prescribed burning in forests.

Threats to Forest Sustainability

Numerous threats to the sustainability of this forest have already been discussed in this report, including excessive deer herbivory, invasive plants, insect pests, disease organisms, and elevated stand density - which increases susceptibility to insect and disease problems. Some of these threats are easier to quantify than others because the symptoms and the response to mitigation efforts are more apparent and immediate. For example, non-native plants present a visible threat to a forest, and once they are controlled, that threat is mitigated. For these more obvious problems, treatment measures are reactionary. However, a forward-thinking land manager who wants to ensure that a viable forest is present for future generations will probably need to adopt proactive approaches that protect trees from compounding stress factors that are less obvious but will increase stand mortality over time. For example, removing some trees from a stand to reduce stocking and improve resource allocation for the remaining trees so that the residual stand is healthier can seem counter intuitive when all trees appear outwardly healthy and the thinning may increase other problems like undesirable plant growth in the understory. Accepting some measured risk in the short-term to improve long-term sustainability is a reality of any conservation decision because all actions, including doing nothing, involve tradeoffs.

Carbon Stocks

The quantification of carbon sequestration and storage in forests (which are two separate processes that are often erroneously considered the same) is complicated because of the many variables involved. One part of carbon science that is clear is that the best way to *sequester* atmospheric carbon is to have relatively young forests that are fully occupied by fast growing trees to rapidly pull carbon in as they grow. As a fully stocked forest begins to mature, growing space becomes increasingly limited and the sequestration rate in a forest begins to slow in reaction to competition for resources. Concurrently, as natural mortality begins to increase in response to crowding, carbon is emitted during decomposition, which begins to balance some of the carbon gains vs. losses. However, if the remaining trees continue to grow and get bigger, carbon *storage* in the forest continues to come at a net increase, especially in the soil component of a forest. So, understanding where your forest currently sits on this spectrum can help guide management practices to either maximize sequestration or storage, depending on a landowner's objectives. It is also important to consider how management actions (both passive and active management) may affect the long-term *stability* of a forest carbon pool. An easy illustration of this - albeit an example that is not entirely applicable to this forest - are the large wildfires that have occurred in western states during recent years. For decades, land management policies in the west were directed towards aggressive fire suppression efforts that allowed vast areas to become carbon sinks that stored enormous amounts of carbon in unnaturally dense forests where fire had been excluded. Accordingly, the fuel load in these forests grew beyond what would normally be available, so, when a fire does occur, it becomes catastrophic and consumes all the trees while releasing the stored carbon back into the atmosphere at once and becoming a net carbon emission. A different management approach to *defend* the carbon pool and keep it stable might have allowed low intensity fires to occur periodically over decades knowing that less carbon would be stored annually per acre, but that the carbon would not be lost entirely in a single catastrophic event. It is imperative that land managers consider tradeoffs between maximizing short-term carbon storage and increasing the forest's vulnerability to future large-scale mortality events when making decisions based solely on carbon storage.

Most of the forest at FFP has reached the middle-mature transition stage where sequestration is slowing and storage is increasing. The plan recommendations employ a balanced approach that aims to defend the existing carbon pool by keeping healthy trees vigorous and resilient while accepting some amount of short-term carbon storage decline to accomplish this. This approach will provide for a relatively stable carbon pool over the long-term.

Cultural and Historic Resources

To assess any historical significance that the property has, the boundaries were compared to the NJDEP GIS layers for historic properties and historic districts. As illustrated on the attached *Historic Resources* map, there are no historic resources on or adjacent to this property that require special consideration for Forest Stewardship purposes.

Recreation and Aesthetics

The intent of this section is not to provide a comprehensive outline of all recreational activities that occur at FFP, but instead, to highlight relevant recreational and/or aesthetics concerns that might impact forest stewardship activities and vice versa.

The property offers a variety of recreational opportunities that include several miles of marked hiking trails, forest and field habitats for nature study and bird watching, warmwater fishing in the pond, developed facilities that are available for events, and other organized activities hosted by outside groups. Each time NJA staff visited the property, visitors were observed taking advantage of the different resources available here, which are clearly important to the local community. As has been documented for many public properties throughout the state, high visitation adds stress on natural systems that can lead to poor forest health and compromised ecosystem services. Because of this, establishing a balance between recreational uses and forest health is a growing issue on public lands, and is a significant task facing land managers because of the many competing interests of users. A proactive strategy of public education about relevant issues like deer management and protection of sensitive habitats is essential for gaining public buy-in to planned management policies, and to increase visitor tolerance for temporary inconveniences or changes from the status quo that may be necessary to sustain forest cover. Similarly, stewardship implementation will require coordination around planned visitor activities to lessen the direct impact, and to be mindful of aesthetic considerations that are important to users. The designated Township Land Manager(s) are best positioned to facilitate these details because of their knowledge of the property and the different groups using the site.

Timber Production, Wood Fiber and Agroforestry

Timber harvesting, wood production, and agroforestry are not goals of this plan. However, it is probably a matter of fiscal responsibility for any land manager to consider the economic costs of stewarding a forest or parkland, and sometimes even when wood production is not a management goal, the wood by-products that are generated while meeting some stewardship objectives can provide value to help offset implementation costs. Since wood markets fluctuate and change rapidly, any opportunities to capture wood value as a by-product of stewardship work will need to occur at the time of project implementation. This is especially true for a state like New Jersey, which has fewer wood market opportunities and greater transportation costs to reach existing markets that are out-of-state.

Estate Planning

Being in public ownership, estate planning has no relevance to this property.

Forest Stands

Forests are typically divided into sections called *stands*, which are collective groups of trees that are similar in size, age, species composition or in their geographic position on a property. The premise is that a stand is distinguishable from an adjacent group of trees, and because of its unique characteristics, a stand might be managed differently than the adjacent stand. While there are no definitive size limitations for what constitutes a stand, generally they must be at least a few acres to be effectively managed independently, otherwise, smaller pockets of different trees in a forest are just part of the normal variations that might be found in a larger stand. At FFP there are four areas that have been delineated as separate stands for this plan.

Stand 1

Acreage, Regulated Features and Access

Stand 1 covers approximately 143.97 acres across most of FFP South. As discussed in the *Wetlands and Flood Hazard Areas* section of this plan, regulated areas in the south include mapped wetlands, transition areas and riparian zones. These areas are depicted on the attached *Regulated Features and Stand Access Map*. The stand has a pre-existing access road that was presumably lawfully constructed many years ago. The road crosses an unnamed tributary, a wetland transition area and riparian zone, and provides access into the center of the stand. This road is well constructed and shows no signs of erosion or ongoing impacts to the regulated features. There are no recommendations being made in this plan for additional road construction or use of vehicles in regulated areas. If any stewardship activities are to occur in regulated areas of this stand (e.g., invasive plant control), they can be carried out using hand tools. If conditions change and equipment entry into a regulated area became necessary for some reason, a "practice plan" would need to be prepared and submitted to the NJ Forest Service before implementing those practices. The practice plan will describe the exact activities that are planned and what BMPs will be used to mitigate damage to sensitive natural resources.

Inventory Information

Forest data was collected from 58 evenly spaced inventory plots distributed across the stand using a 10-factor prism, which translates to roughly one inventory plot for every 2½ acres. Using a 90% confidence interval, the resulting stand data is within +/- 6% of the mean basal area, and within +/- 15% of the mean number of stems per acre.

Stand 1 Description

This is a mixed upland central hardwood stand that is categorized using the US Forest Service stand typing as *#520 – Mixed Upland Hardwoods*. No single tree species is dominant in the stand, but the most encountered species in the co-dominant crown class (~ 12" – 16" DBH) are pin oak, red cedar, sugar maple, red maple, white ash and black oak, which collectively make up 70% of the growing stock (i.e., basal area or BA). The red cedar component is on the smaller end of the co-dominant size range and is being overtaken by the hardwoods. Beneath the co-dominant crown class is a poletimber and sapling cohort (5"-11" and 0"-4" DBH, respectively) that is mostly populated with suppressed red cedar stems, which is common in a transition stand established on former farmland. Other associate species found here include black birch, bitternut hickory, white oak, shagbark hickory, red oak, tulip poplar, sassafras,

black cherry, ailanthus, chestnut oak, beech, black ash, black locust, swamp white oak, elm, sycamore, black walnut scarlet oak, and white pine. Stumps of various sizes are found throughout the stand in varying abundance, which is evidence of prior thinning and harvesting. Other factors that influence stand composition and the current concentration of certain species include prior farming practices and topography. Based on the review of historic aerial photographs, the stand is 70-80 years old (except for the older 20-acre area along the southeastern boundary that has since been cut-over at least once). The modeled stand-wide average *effective* age, which is an estimate of different species ages based on their diameter, is 91.

The average co-dominant tree height is over 80'. The average site index across the stand is about 60 for red oak, with average productivity of about 57 cu ft/ac/yr. Although wood production is not a goal of this plan, the volume was quantified for plan completeness as part of the entire data set. The total standing wood volume in Stand 1 averages 20.2 cords per acre. This can be broken down to 16.1 cords of firewood grade material and 2,606 board feet of sawtimber per acre using the Scribner log rule.

Tree stocking is a concept that was initially developed to understand wood yields for production forestry purposes based on a function of how many trees of a given size and of a given type can grow *well* on any acre. The relationship compares BA to the number of stems growing on the site to provide a stocking percent or relative density (RD). RD allows managers to understand current growing conditions in comparison to some ideal level for stand growth that balances utilization of all available growing space while minimizing competition for that growing space, and when thinning might be beneficial. Although stocking models were originally developed for production purposes, they are helpful for ecological forestry purposes because they are an index of the level of competition stress that affects tree vigor, and they infer canopy openness and light availability necessary for promoting certain understory characteristics or regeneration. This stand contains approximately 94 sq. ft. of BA per acre and there is an average of 177 trees per acre, with a RD of about 61%. At this RD, crowding among the co-dominant stems is not excessive and they are probably growing well. As a stand grows and reaches about 70% RD, the entire site is being used for tree growth and crowding starts to have a greater effect on smaller diameter stems. As the RD increases towards 80% and above, growing space becomes very limited and codominant trees must slowdown growth in response to the competition for resources (e.g., water, light, soil nutrients, etc.). When this happens, suppression mortality of smaller stems increases even more. Of the 177 trees per acre in this stand, about 50 are saplings that are mostly red cedar, red maple, and black birch. Although these small trees are not having much competition impact on larger stems, red maple and birch usually exhibit very good shade tolerance in the understory, and are likely to persist for many years at the expense of other ground level plants that may be more ecologically beneficial and desirable. The stand was modeled in the following table to show how it might develop at 25-year intervals over the next 50 years.

Comparison of Stand Conditions for Each Cycle: (2022 - 2072)

Year	Stems per acre	Basal area	Relative density	Total cords	MBF	Net growth (BA/year)	Mortality (BA/year)
2022	177.1	94.0	61.1	20.2	2.6		
2047	148.0	128.3	75.8	30.9	6.9	1.37	0.22
2072	125.9	156.6	87.3	40.0	10.3	1.13	0.26

Stand 1 Basic Variables

Name	Value
Forest Type	USFS #520 – Mixed upland hardwoods
Site Index	60 (red oak)
Medial DBH (in)	14.2
Quadratic Mean DBH (in)	9.9
Size Class	Small - medium sawtimber
Age Class	80
Total Basal Area (sq.ft/ac)	94.0
Basal Area in Saplings (sq.ft/ac)	4.5
Stems Per Unit Area (stems/ac)	177.1
Net Cord Volume (cords/ac)	20.2
Canopy Closure (% closure)	75
Productivity	57 cu ft/ac/yr.
Regeneration Status	Poor
Coarse Woody Debris Status	Low to moderate
Damage Causing Agents	white-tailed deer, EAB
Litter Depth (inches)	1 - 2
Relative Density (%) / vigor	61 / average - good vigor

The understory here was evaluated in the context of assessing predominant plant populations that are encountered at each inventory station using fixed radius plots to collect data. The intent is to provide estimates of the average abundance of the commonly encountered species instead of focusing on understory richness or occurrence data like some botanical surveys do. This approach may not account for small populations or individual species that are rare or uncommon. Japanese barberry was encountered on about 2/3 of the plots and is the most abundant species in the stand.

Understory Summary - Description of Understory Table Items:

- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.

- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values

Occurrence and Abundance

	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
Japanese barberry	65.52	18.18	13.2	31.10	22.46
wine raspberry	37.93	10.53	6.4	15.04	12.01
autumn olive	44.83	12.44	3.4	7.93	10.92
multiflora rose	34.48	9.57	2.2	5.08	8.06
spicebush	27.59	7.66	2.8	6.71	7.33
Japanese stilt grass	18.97	5.26	4.6	10.77	7.09
garlic mustard	22.41	6.22	1.4	3.25	5.22
grass *spp*.	17.24	4.78	0.9	2.03	3.86
fox grape	15.52	4.31	1.2	2.85	3.81
unidentified forb	12.07	3.35	0.8	1.83	3.00
fern *spp*.	12.07	3.35	0.9	2.03	2.91
Asiatic bittersweet	10.34	2.87	0.9	2.03	2.59
flowering dogwood	10.34	2.87	0.8	1.83	2.52
blackhaw viburnum	5.17	1.44	0.7	1.63	1.50
witchhazel	5.17	1.44	0.3	0.81	1.23
sedge *spp*.	5.17	1.44	0.3	0.61	1.16
highbush blueberry	1.72	0.48	0.7	1.63	0.86
poison ivy	3.45	0.96	0.2	0.41	0.77
unidentified species	1.72	0.48	0.4	1.02	0.66
bush honeysuckle	1.72	0.48	0.3	0.61	0.52
American hornbeam	1.72	0.48	0.1	0.20	0.39
blackberry	1.72	0.48	0.1	0.20	0.39
viburnum	1.72	0.48	0.1	0.20	0.39
Mile-a-minute	1.72	0.48	0.1	0.20	0.39
Totals	360.34	100.00	42.41	100.00	100.00

Stocking Tables

The stocking tables on the following pages provide a summary of the tree inventory data. The more frequently encountered species were tallied under the following abbreviations:

NPO = northern pin oak
RM = red maple
SB = black birch
SGH = shagbark hickory
SAS = sassafras
CO = chestnut oak
SWO = swamp white oak
BW = black walnut
ERC = red cedar
WA = white ash
H = misc. hickories
NRO = northern red oak
BC = black cherry
BA = black ash
AE = elm
SO = scarlet oak
SM = sugar maple
BO = black oak
WO = white oak
YP = yellow poplar
AIL = ailanthus
BL = black locust
AS = sycamore
WP = white pine

Stand 1 Overstory Summary

Composition - BA, percent BA, trees per acre

	all species	all oaks	PNO	ERC	SM	RM	WA	BO	SB	H	WO	SGH	NRO	YP	SAS	BC	AIL	CO	AB	BA	BL	SWO	AE	AS	BW	SO	WP
Total BA	**94.0**	**31.2**	15.2	11.7	11.2	10.2	9.1	8.6	4.5	4.3	3.3	2.6	2.4	2.1	1.7	1.4	1.2	1.0	0.9	0.7	0.5	0.5	0.2	0.2	0.2	0.2	0.2
Percent BA	**100**	**33**	16	12	12	11	10	9	5	5	3	3	3	2	2	1	1	1	1	1	1	1	0	0	0	0	0
Trees per acre	**177**	**29.7**	17.0	53.1	12.6	19.1	12.1	5.6	19.1	3.1	2.8	4.0	3.0	3.5	4.7	5.4	5.0	0.9	0.9	3.2	1.1	0.3	0.2	0.2	0.1	0.1	0.0

Diameters and Ages - inches, years

	all species	all oaks	PNO	ERC	SM	RM	WA	BO	SB	H	WO	SGH	NRO	YP	SAS	BC	AIL	CO	AB	BA	BL	SWO	AE	AS	BW	SO	WP
Medial diameter	**14.2**	**17.1**	15.1	7.6	15.2	12.8	15.8	19.1	8.9	18.1	17.4	12.3	20.3	19.2	11.2	8.8	8.6	19.3	14.8	9.0	9.3	19.3	12.0	14.0	22.0	16.0	34.0
Quadratic mean diameter	**9.9**	**13.9**	12.8	6.4	12.7	9.9	11.8	16.7	6.6	16.0	14.8	10.9	12.2	10.4	8.2	6.9	6.6	14.8	13.2	6.3	9.2	18.5	12.0	14.0	22.0	16.0	34.0
Effective age	**91**	**112**	101	55	102	66	80	127	67	121	116	82	108	103	80	47	62	129	99	71	62	129	80	93	147	107	227

Volumes (per acre) - Scribner Log Rule

	all species	all oaks	PNO	ERC	SM	RM	WA	BO	SB	H	WO	SGH	NRO	YP	SAS	BC	AIL	CO	AB	BA	BL	SWO	AE	AS	BW	SO	WP
Total Cords	**20.2**	**8.1**	3.8	1.1	2.7	2.4	2.3	2.3	0.7	1.1	0.9	0.6	0.6	0.5	0.0	0.3	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1
Net Firewood Cords	**16.1**	**5.7**	2.9	1.0	2.2	2.2	1.8	1.5	0.6	0.8	0.7	0.5	0.3	0.4	0.0	0.3	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Net Board-foot	**2605.7**	**1528.3**	617.5	43.7	274.3	91.6	283.6	551.9	22.1	172.5	111.0	55.5	197.6	101.2	0.0	0.0	0.0	14.6	0.0	0.0	0.0	28.3	0.0	0.0	12.4	7.4	20.3

Basal Area per acre

Basal area (live trees only)																									
Diameter	**all species**	**PNO**	**ERC**	**SM**	**RM**	**WA**	**BO**	**SB**	**H**	**WO**	**SGH**	**NRO**	**YP**	**SAS**	**BC**	**AIL**	**CO**	**AB**	**BA**	**BL**	**SWO**	**AE**	**AS**	**BW**	**SO**	**WP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**4.5**	0.0	1.9	0.0	0.5	0.2	0.0	0.9	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**6.7**	0.3	3.3	0.3	0.5	0.3	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**9.3**	1.0	3.4	0.9	0.7	0.7	0.0	0.7	0.0	0.2	0.7	0.0	0.2	0.0	0.3	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
10	**11.0**	1.7	1.7	1.0	1.2	1.0	0.3	1.0	0.5	0.3	0.3	0.0	0.2	0.7	0.2	0.0	0.2	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
12	**9.7**	1.9	1.0	1.2	1.4	0.9	1.4	0.3	0.2	0.0	0.3	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
14	**12.1**	3.1	0.3	1.7	2.4	0.7	0.2	0.3	0.3	0.5	0.5	0.2	0.0	0.2	0.3	0.3	0.2	0.3	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
16	**13.3**	2.6	0.0	2.2	2.6	1.4	1.6	0.2	0.9	0.5	0.5	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
18	**7.8**	1.4	0.0	1.4	0.7	1.6	0.9	0.0	0.3	0.7	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
20	**6.9**	1.2	0.0	1.7	0.2	0.5	1.2	0.0	0.7	0.7	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**5.2**	0.5	0.0	0.0	0.0	1.0	1.2	0.2	1.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
24	**3.1**	1.0	0.0	0.3	0.0	0.3	0.7	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
26	**1.2**	0.3	0.0	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**1.4**	0.0	0.0	0.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**1.2**	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.2	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.3**	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
36	**0.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**4.5**	0.0	1.9	0.0	0.5	0.2	0.0	0.9	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**27.1**	3.1	8.4	2.2	2.4	2.1	0.3	2.6	0.5	0.5	1.0	0.0	0.3	0.9	0.9	0.7	0.2	0.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0

SM SAW	**35.0**	7.6	1.4	5.2	6.4	2.9	3.1	0.9	1.4	1.0	1.4	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.3	0.0	0.2	0.2	0.2	0.0	0.2	0.0
MD SAW	**20.0**	3.3	0.0	3.1	0.9	3.1	3.3	0.2	2.1	1.4	0.2	1.0	0.7	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0
LG SAW	**7.4**	1.2	0.0	0.7	0.0	0.9	1.9	0.0	0.3	0.3	0.0	0.9	0.5	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Total	**94.0**	15.2	11.7	11.2	10.2	9.1	8.6	4.5	4.3	3.3	2.6	2.4	2.1	1.7	1.4	1.2	1.0	0.9	0.7	0.5	0.5	0.2	0.2	0.2	0.2	0.2
Percent		16.1	12.5	11.9	10.8	9.7	9.2	4.8	4.6	3.5	2.8	2.6	2.2	1.8	1.5	1.3	1.1	0.9	0.7	0.6	0.6	0.2	0.2	0.2	0.2	100.0

RD per acre

Relative density (live trees only)																									
	all species	**PNO**	**ERC**	**SM**	**RM**	**WA**	**BO**	**SB**	**H**	**WO**	**SGH**	**NRO**	**YP**	**SAS**	**BC**	**AIL**	**CO**	**AB**	**BA**	**BL**	**SWO**	**AE**	**AS**	**BW**	**SO**	**WP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**4.7**	0.0	2.0	0.0	0.6	0.2	0.0	0.9	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**5.6**	0.3	2.9	0.4	0.5	0.3	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**6.8**	0.8	2.6	0.9	0.5	0.4	0.0	0.5	0.0	0.2	0.5	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
10	**7.7**	1.2	1.2	1.0	0.8	0.5	0.2	0.7	0.3	0.3	0.2	0.0	0.1	0.5	0.1	0.0	0.1	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
12	**6.3**	1.2	0.6	1.2	0.8	0.4	0.8	0.2	0.1	0.0	0.2	0.0	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0
14	**7.5**	1.8	0.2	1.6	1.4	0.3	0.1	0.2	0.2	0.5	0.3	0.1	0.0	0.1	0.1	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
16	**8.0**	1.4	0.0	2.1	1.4	0.5	0.8	0.1	0.5	0.5	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
18	**4.5**	0.7	0.0	1.3	0.4	0.5	0.4	0.0	0.2	0.6	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
20	**4.3**	0.6	0.0	1.6	0.1	0.2	0.6	0.0	0.3	0.6	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**2.2**	0.2	0.0	0.0	0.0	0.3	0.6	0.1	0.5	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
24	**1.6**	0.5	0.0	0.3	0.0	0.1	0.3	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
26	**0.6**	0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.6**	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.6**	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

34	**0.1**	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**4.7**	0.0	2.0	0.0	0.6	0.2	0.0	0.9	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**20.1**	2.2	6.7	2.2	1.8	1.2	0.2	2.0	0.3	0.5	0.8	0.0	0.2	0.6	0.6	0.0	0.1	0.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
SM SAW	**21.7**	4.3	0.8	4.9	3.6	1.1	1.8	0.5	0.8	1.0	0.8	0.2	0.1	0.3	0.1	0.0	0.2	0.5	0.2	0.0	0.1	0.2	0.1	0.0	0.1	0.0
MD SAW	**11.1**	1.6	0.0	2.9	0.4	1.0	1.6	0.1	1.0	1.3	0.1	0.5	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
LG SAW	**3.6**	0.5	0.0	0.6	0.0	0.2	0.8	0.0	0.2	0.3	0.0	0.4	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Total	**61.1**	8.7	9.5	10.6	6.4	3.8	4.4	3.5	2.3	3.1	1.6	1.3	0.9	1.2	0.9	0.0	0.6	0.8	0.5	0.4	0.3	0.2	0.1	0.1	0.1	0.1
Percent		14.3	15.6	17.3	10.5	6.1	7.3	5.7	3.7	5.0	2.7	2.1	1.4	1.9	1.4	0.0	0.9	1.3	0.9	0.6	0.4	0.3	0.2	0.1	0.2	100.0

Trees per acre

Number of trees (live trees only)																										
	all species	**PNO**	**ERC**	**SM**	**RM**	**WA**	**BO**	**SB**	**H**	**WO**	**SGH**	**NRO**	**YP**	**SAS**	**BC**	**AIL**	**CO**	**AB**	**BA**	**BL**	**SWO**	**AE**	**AS**	**BW**	**SO**	**WP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**51.4**	0.0	21.7	0.0	5.9	2.0	0.0	9.9	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**34.2**	1.8	16.7	1.8	2.6	1.8	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.9	1.8	1.8	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**26.7**	3.0	9.9	2.5	2.0	2.0	0.0	2.0	0.0	0.5	2.0	0.0	0.5	0.0	1.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
10	**20.2**	3.2	3.2	1.9	2.2	1.9	0.6	1.9	0.9	0.6	0.6	0.0	0.3	1.3	0.3	0.0	0.3	0.3	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
12	**12.3**	2.4	1.3	1.5	1.8	1.1	1.8	0.4	0.2	0.0	0.4	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
14	**11.3**	2.9	0.3	1.6	2.3	0.6	0.2	0.3	0.3	0.5	0.5	0.2	0.0	0.2	0.3	0.3	0.2	0.3	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
16	**9.5**	1.9	0.0	1.6	1.9	1.0	1.1	0.1	0.6	0.4	0.4	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
18	**4.4**	0.8	0.0	0.8	0.4	0.9	0.5	0.0	0.2	0.4	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
20	**3.2**	0.6	0.0	0.8	0.1	0.2	0.6	0.0	0.3	0.3	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**2.0**	0.2	0.0	0.0	0.0	0.4	0.5	0.1	0.4	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0

24	**1.0**	0.3	0.0	0.1	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
26	**0.3**	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.3**	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.2**	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**51.4**	0.0	21.7	0.0	5.9	2.0	0.0	9.9	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**81.1**	7.9	29.7	6.1	6.8	5.6	0.6	8.3	0.9	1.1	2.6	0.0	0.8	2.1	3.1	2.7	0.3	0.3	0.9	1.1	0.0	0.0	0.0	0.0	0.0	0.0
SM SAW	**33.1**	7.2	1.6	4.8	5.9	2.7	3.0	0.9	1.2	0.9	1.3	0.3	0.3	0.5	0.3	0.3	0.4	0.5	0.4	0.0	0.1	0.2	0.2	0.0	0.1	0.0
MD SAW	**9.6**	1.6	0.0	1.6	0.5	1.5	1.5	0.1	0.9	0.7	0.1	0.5	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
LG SAW	**1.9**	0.4	0.0	0.2	0.0	0.2	0.5	0.0	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	**177.1**	17.0	53.1	12.6	19.1	12.1	5.6	19.1	3.1	2.8	4.0	3.0	3.5	4.7	5.4	5.0	0.9	0.9	3.2	1.1	0.3	0.2	0.2	0.1	0.1	0.0
Percent		9.6	30.0	7.1	10.8	6.8	3.2	10.8	1.8	1.6	2.3	1.7	2.0	2.7	3.0	2.8	0.5	0.5	1.8	0.6	0.2	0.1	0.1	0.0	0.1	100.0

Cords per acre

Total cord volume (live trees only)

	all species	PNO	ERC	SM	RM	WA	BO	SB	H	WO	SGH	NRO	YP	SAS	BC	AIL	CO	AB	BA	BL	SWO	AE	AS	BW	SO	WP
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**0.6**	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**1.5**	0.2	0.4	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	**2.2**	0.4	0.3	0.2	0.3	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
12	**2.2**	0.5	0.2	0.3	0.3	0.2	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

14	**2.9**	0.8	0.1	0.4	0.6	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	**3.4**	0.7	0.0	0.6	0.7	0.4	0.4	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**2.1**	0.4	0.0	0.4	0.2	0.4	0.2	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	**1.8**	0.3	0.0	0.4	0.0	0.1	0.3	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**1.4**	0.1	0.0	0.0	0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**0.8**	0.3	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.3**	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.4**	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.4**	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.1**	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
36	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**4.2**	0.6	0.9	0.4	0.5	0.4	0.1	0.4	0.1	0.1	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
SM SAW	**8.6**	2.0	0.3	1.3	1.7	0.8	0.8	0.2	0.3	0.3	0.3	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD SAW	**5.4**	0.9	0.0	0.8	0.2	0.9	0.9	0.0	0.6	0.4	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LG SAW	**2.1**	0.3	0.0	0.2	0.0	0.2	0.6	0.0	0.1	0.1	0.0	0.3	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Total	**20.2**	3.8	1.1	2.7	2.4	2.3	2.3	0.7	1.1	0.9	0.6	0.6	0.5	0.0	0.3	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Percent		19.0	5.5	13.2	11.8	11.2	11.5	3.3	5.5	4.3	2.9	3.2	2.5	0.0	1.2	0.0	0.9	1.0	0.5	0.5	0.7	0.2	0.2	0.2	0.2	100.0

Stand 2

Acreage, Regulated Features and Access

Stand 2 includes 42.47 acres that are spread throughout the center of FFP North. The stand does not have any mapped wetlands or obvious unmapped wetlands, but it does include the riparian zone around part of the pond and the drainage outlet leaving the pond. There are numerous pre-existing farm roads that provide access throughout the stand without the need to cross the intermittent stream that leaves the pond with equipment. There are no recommendations being put forth for additional road construction or the use of vehicles in regulated areas off existing roads. Any stewardship activities that might occur in a riparian zone (e.g., invasive plant control) can be carried out using hand tools. If that changes, a separate practice plan with working parameters and BMPs will need to be prepared and submitted to the NJ Forest Service for approval before implementing those practices.

Inventory Information

Forest data was collected from 33 evenly spaced inventory plots distributed across the stand using a 10-factor prism, which translates to roughly one inventory plot for every 1 1/3 acre. Using a 90% confidence interval, the resulting stand data is within +/- 9% of the mean basal area, and within +/- 15% of the mean number of stems per acre.

Stand 2 Description

This stand has a smaller average DBH and more trees per acre than Stand 1, and has less of a pin oak component in the codominant crown class. The most abundant species in terms of BA are sugar maple, red cedar, white pine, black oak and black birch, which together amount to 55% of the growing stock. Having never been purposefully thinned like Stand 1, this stand has significantly more sapling and poletimber stems (220 here vs. 132 in Stand 1), and these are predominantly sugar maple and red cedar. The riparian corridor in the western part of the stand has a heavier component of white ash and black walnut in the codominant size class than the rest of the stand. The co-dominant size range is approximately 10” - 14” with scattered larger dominant stems that are often old pasture and hedgerow trees. Based on the site physiography and overstory composition, this stand is also considered USFS stand type *#520- Mixed Upland Hardwoods.*

The historic aerial images indicate that the stand initiated in the same general period as Stand 1 which makes it about 70-80 years old, and this aligns very well with the modeled effective stand age of 82. The medial diameter is 12.6” DBH and the average co-dominant tree height is over 70’. The average site index and productivity are the same as Stand 1, which is an SI of 60 for red oak and an average productivity of about 57 cu ft/ac/yr. Wood volume averages 24.1 cords per acre, broken down to 19.9 cords of firewood grade material and 2,605 board feet of sawtimber per acre.

There are an average of 275 trees per acre and 120 sq. ft. of BA per acre, with a calculated RD of 79%. This RD is above optimum for individual tree growth and the stems are strongly competing for growing space. Mortality in the smaller size classes is expected to increase significantly over the next 50 years as the larger trees continue to grow and cause crowding.

Comparison of Stand Conditions for Each Cycle: (2022 - 2072)

Year	Stems per acre	Basal area	Relative density	Total cords	MBF	Net growth (BA/year)	Mortality (BA/year)
2022	275.1	119.7	79.2	24.1	2.6		
2047	239.8	160.4	95.7	36.9	7.8	1.63	0.24
2072	90.6	156.5	82.0	41.7	12.1	-0.16	2.18

Stand 2 Basic Variables

Name	Value
Forest Type	USFS #520 – Mixed upland hardwoods
Site Index	60 (red oak)
Medial DBH (in)	12.6
Quadratic Mean DBH (in)	8.9
Size Class	Large poletimber - small sawtimber
Age Class	80
Total Basal Area (sq.ft/ac)	119.7
Basal Area in Saplings (sq.ft/ac)	7.3
Stems Per Unit Area (stems/ac)	275
Net Cord Volume (cords/ac)	24.1
Canopy Closure (% closure)	80-85
Productivity	57 cu ft/ac/yr.
Regeneration Status	Poor
Coarse Woody Debris Status	Low
Damage Causing Agents	white-tailed deer, EAB
Litter Depth (inches)	1 - 2
Relative Density (%) / vigor	79 / reduced vigor

The understory was evaluated using the same methodology as Stand 1 to estimate average abundance of the commonly encountered species.

Understory Summary - Description of Understory Table Items:

- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.

- **Dominance** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values

Understory Occurrence and Abundance

	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
Japanese barberry	72.73	23.30	8.0	24.65	23.75
autumn olive	42.42	13.59	4.7	14.42	13.87
multiflora rose	36.36	11.65	3.9	12.09	11.80
Japanese stilt grass	18.18	5.83	6.5	20.00	10.55
fox grape	24.24	7.77	1.2	3.72	6.42
bush honeysuckle	18.18	5.83	1.5	4.65	5.43
Asiatic bittersweet	18.18	5.83	1.2	3.72	5.12
wineberry	18.18	5.83	0.9	2.79	4.81
grass *spp*.	15.15	4.85	1.1	3.26	4.32
garlic mustard	15.15	4.85	1.1	3.26	4.32
flowering dogwood	9.09	2.91	0.8	2.33	2.72
blackhaw viburnum	9.09	2.91	0.5	1.40	2.41
eastern poison ivy	6.06	1.94	0.3	0.93	1.60
American hornbeam	3.03	0.97	0.6	1.86	1.27
blackberry	3.03	0.97	0.2	0.47	0.80
goldenrod *spp*.	3.03	0.97	0.2	0.47	0.80
Totals	312.12	100.00	32.58	100.00	100.00

Stocking Tables

The stocking tables on the following pages provide a summary of the tree inventory data. The more frequently encountered species were tallied under the following abbreviations:

NPO = northern pin oak **ERC** = red cedar **SM** = sugar maple **SAS** = sassafras **BC** = black cherry
RM = red maple **WA** = white ash **BO** = black oak **BEM** = boxelder maple **RP** = red pine
SB = black birch **H** = misc. hickories **WO** = white oak **BW** = black walnut **WP** = white pine
OST = hop hornbeam **NRO** = northern red oak **YP** = yellow poplar **AIL** = ailanthus **BTA** = bigtooth aspen

Stand 2 Overstory Summary

Composition - BA, percent BA, trees per acre

	all species	all oaks	SM	ERC	WP	BO	SB	WA	BC	PNO	RM	BW	NRO	RP	H	AIL	BTA	BEM	WO	OST	SAS	YP
Total BA	**119.7**	**23.6**	16.7	16.4	11.2	10.6	10.6	9.4	8.2	7.6	7.3	6.1	4.8	3.6	2.7	1.8	0.6	0.6	0.6	0.3	0.3	0.3
Percent BA	**100**	**20**	14	14	9	9	9	8	7	6	6	5	4	3	2	2	1	1	1	0	0	0
Trees per acre	**275**	**42.3**	41.8	80.6	6.5	20.6	19.2	11.0	14.8	15.3	28.3	7.0	5.9	4.8	9.2	5.5	0.6	1.4	0.5	0.6	1.5	0.1

Diameters and Ages - inches, years

	all species	all oaks	SM	ERC	WP	BO	SB	WA	BC	PNO	RM	BW	NRO	RP	H	AIL	BTA	BEM	WO	OST	SAS	YP
Medial diameter	**12.6**	**13.7**	11.7	7.6	19.1	13.1	12.6	14.7	11.9	13.2	9.8	16.3	15.3	12.3	10.0	8.7	14.0	9.0	16.0	10.0	6.0	22.0
Quadratic mean diameter	**8.9**	**10.1**	8.5	6.1	17.8	9.7	10.1	12.5	10.1	9.5	6.9	12.6	12.3	11.8	7.4	7.8	14.0	8.8	15.6	10.0	6.0	22.0
Effective age	**82**	**88**	81	57	128	91	86	74	60	91	55	109	76	82	72	58	93	60	107	67	40	110

Volumes (per acre) - Scribner Log Rule

	all species	all oaks	SM	ERC	WP	BO	SB	WA	BC	PNO	RM	BW	NRO	RP	H	AIL	BTA	BEM	WO	OST	SAS	YP
Total Cords	**24.1**	**5.7**	3.3	1.4	2.9	2.5	2.2	2.4	1.8	1.8	1.3	1.5	1.2	0.9	0.5	0.0	0.2	0.0	0.2	0.0	0.0	0.1
Net Firewood Cords	**19.9**	**4.6**	2.9	1.3	1.7	2.1	2.1	2.0	1.8	1.4	1.2	1.1	0.9	0.6	0.4	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Net Board-foot	**2604.9**	**682.1**	242.1	73.3	750.7	214.8	84.6	236.7	12.3	238.8	64.0	212.7	206.3	160.8	44.9	0.0	11.6	0.0	22.2	0.0	0.0	29.0

Basal Area per acre

Basal area (live trees only)																					
	all species	**SM**	**ERC**	**WP**	**BO**	**SB**	**WA**	**BC**	**PNO**	**RM**	**BW**	**NRO**	**RP**	**H**	**AIL**	**BTA**	**BEM**	**WO**	**OST**	**SAS**	**YP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**7.3**	0.9	3.6	0.0	0.6	0.3	0.0	0.0	0.3	1.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**12.1**	2.4	3.9	0.0	0.3	0.6	0.3	1.2	0.3	1.2	0.3	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0	0.3	0.0
8	**13.0**	2.7	3.9	0.0	0.3	1.2	0.9	0.0	0.0	1.2	0.6	0.9	0.3	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0
10	**18.8**	2.1	3.0	0.3	3.3	1.8	0.3	2.1	1.5	1.5	0.3	0.6	0.3	0.3	0.6	0.0	0.3	0.0	0.3	0.0	0.0
12	**17.6**	2.7	1.2	0.0	2.4	1.8	1.5	2.1	1.5	1.2	0.3	0.3	1.8	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
14	**14.8**	2.1	0.3	1.5	0.6	1.5	2.1	1.2	1.5	0.0	0.9	0.6	0.9	0.6	0.0	0.6	0.0	0.3	0.0	0.0	0.0
16	**11.8**	1.2	0.3	1.8	0.9	1.8	1.5	0.6	1.2	0.3	1.2	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**9.1**	0.9	0.0	1.8	0.3	1.2	1.2	0.6	0.6	0.0	0.9	1.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
20	**5.2**	0.3	0.0	1.5	0.6	0.0	0.9	0.3	0.6	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**4.5**	0.3	0.0	3.0	0.3	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
24	**3.3**	0.6	0.0	0.6	0.6	0.3	0.3	0.0	0.0	0.6	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.3**	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**1.5**	0.0	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.3**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**7.3**	0.9	3.6	0.0	0.6	0.3	0.0	0.0	0.3	1.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

POLE	**43.9**	7.3	10.9	0.3	3.9	3.6	1.5	3.3	1.8	3.9	1.2	1.5	0.6	1.2	1.5	0.0	0.6	0.0	0.3	0.3	0.0
SM SAW	**44.2**	6.1	1.8	3.3	3.9	5.2	5.2	3.9	4.2	1.5	2.4	1.2	3.0	1.2	0.3	0.6	0.0	0.3	0.0	0.0	0.0
MD SAW	**18.8**	1.5	0.0	6.4	1.2	1.2	2.4	0.9	1.2	0.0	1.8	1.5	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
LG SAW	**5.5**	0.9	0.0	1.2	0.9	0.3	0.3	0.0	0.0	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**119.7**	16.7	16.4	11.2	10.6	10.6	9.4	8.2	7.6	7.3	6.1	4.8	3.6	2.7	1.8	0.6	0.6	0.6	0.3	0.3	0.3
Percent		13.9	13.7	9.4	8.9	8.9	7.8	6.8	6.3	6.1	5.1	4.1	3.0	2.3	1.5	0.5	0.5	0.5	0.3	0.3	0.3

RD per acre

Relative density (live trees only)																					
	all species	**SM**	**ERC**	**WP**	**BO**	**SB**	**WA**	**BC**	**PNO**	**RM**	**BW**	**NRO**	**RP**	**H**	**AIL**	**BTA**	**BEM**	**WO**	**OST**	**SAS**	**YP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**7.9**	1.0	3.9	0.0	0.7	0.3	0.0	0.0	0.4	1.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**10.3**	2.5	3.5	0.0	0.3	0.5	0.2	0.9	0.3	1.1	0.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.0
8	**10.1**	2.7	3.0	0.0	0.2	0.9	0.5	0.0	0.0	0.9	0.5	0.7	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
10	**12.5**	2.1	2.0	0.2	2.2	1.2	0.2	1.1	1.0	1.0	0.2	0.4	0.2	0.2	0.0	0.0	0.2	0.0	0.2	0.0	0.0
12	**10.9**	2.6	0.7	0.0	1.5	1.1	0.7	0.9	0.9	0.7	0.2	0.2	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	**8.7**	2.0	0.2	0.9	0.3	0.9	0.8	0.5	0.9	0.0	0.5	0.3	0.5	0.3	0.0	0.2	0.0	0.3	0.0	0.0	0.0
16	**6.5**	1.1	0.2	1.0	0.5	1.0	0.5	0.2	0.7	0.2	0.7	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**4.8**	0.8	0.0	0.9	0.2	0.6	0.4	0.2	0.3	0.0	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
20	**2.4**	0.3	0.0	0.7	0.3	0.0	0.3	0.1	0.3	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**2.2**	0.3	0.0	1.4	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
24	**1.7**	0.6	0.0	0.3	0.3	0.1	0.1	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.3**	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.7**	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

32	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**7.9**	1.0	3.9	0.0	0.7	0.3	0.0	0.0	0.4	1.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**33.0**	7.3	8.5	0.2	2.7	2.7	0.9	2.0	1.3	3.0	0.9	1.1	0.4	1.0	0.0	0.0	0.4	0.0	0.2	0.3	0.0
SM SAW	**26.1**	5.7	1.1	1.8	2.3	3.0	2.1	1.6	2.4	0.9	1.4	0.7	1.8	0.7	0.0	0.2	0.0	0.3	0.0	0.0	0.0
MD SAW	**9.4**	1.4	0.0	3.1	0.6	0.6	0.8	0.3	0.6	0.0	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1
LG SAW	**2.8**	0.8	0.0	0.5	0.4	0.1	0.1	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**79.2**	16.2	13.5	5.7	6.7	6.7	3.8	3.9	4.7	5.5	3.4	2.8	2.2	2.0	0.0	0.2	0.4	0.6	0.2	0.3	0.1
Percent		20.5	17.1	7.2	8.5	8.5	4.9	5.0	6.0	7.0	4.4	3.6	2.8	2.5	0.0	0.3	0.5	0.7	0.3	0.3	0.1

Trees per acre

Number of trees (live trees only)																					
	all species	**SM**	**ERC**	**WP**	**BO**	**SB**	**WA**	**BC**	**PNO**	**RM**	**BW**	**NRO**	**RP**	**H**	**AIL**	**BTA**	**BEM**	**WO**	**OST**	**SAS**	**YP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**86.0**	10.4	41.7	0.0	6.9	3.5	0.0	0.0	6.2	13.9	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**61.7**	12.3	20.1	0.0	1.5	3.1	1.5	6.2	1.5	6.2	1.5	0.0	0.0	3.1	3.1	0.0	0.0	0.0	0.0	1.5	0.0
8	**37.3**	7.8	11.3	0.0	0.9	3.5	2.6	0.0	0.0	3.5	1.7	2.6	0.9	0.9	0.9	0.0	0.9	0.0	0.0	0.0	0.0
10	**34.4**	3.9	5.6	0.6	6.1	3.3	0.6	3.9	2.8	2.8	0.6	1.1	0.6	0.6	1.1	0.0	0.6	0.0	0.6	0.0	0.0
12	**22.4**	3.5	1.5	0.0	3.1	2.3	1.9	2.7	1.9	1.5	0.4	0.4	2.3	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
14	**13.9**	2.0	0.3	1.4	0.6	1.4	2.0	1.1	1.4	0.0	0.9	0.6	0.9	0.6	0.0	0.6	0.0	0.3	0.0	0.0	0.0
16	**8.5**	0.9	0.2	1.3	0.7	1.3	1.1	0.4	0.9	0.2	0.9	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**5.1**	0.5	0.0	1.0	0.2	0.7	0.7	0.3	0.3	0.0	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0

20	**2.4**	0.1	0.0	0.7	0.3	0.0	0.4	0.1	0.3	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**1.7**	0.1	0.0	1.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
24	**1.1**	0.2	0.0	0.2	0.2	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.1**	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.4**	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**86.0**	10.4	41.7	0.0	6.9	3.5	0.0	0.0	6.2	13.9	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**133.5**	24.0	36.9	0.6	8.5	9.9	4.7	10.1	4.3	12.4	3.8	3.7	1.4	4.5	5.1	0.0	1.4	0.0	0.6	1.5	0.0
SM SAW	**44.7**	6.3	2.0	2.7	4.3	5.0	5.0	4.3	4.2	1.8	2.1	1.2	3.4	1.2	0.4	0.6	0.0	0.3	0.0	0.0	0.0
MD SAW	**9.2**	0.8	0.0	2.9	0.6	0.7	1.2	0.5	0.6	0.0	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1
LG SAW	**1.6**	0.3	0.0	0.3	0.3	0.1	0.1	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**275.1**	41.8	80.6	6.5	20.6	19.2	11.0	14.8	15.3	28.3	7.0	5.9	4.8	9.2	5.5	0.6	1.4	0.5	0.6	1.5	0.1
Percent		15.2	29.3	2.4	7.5	7.0	4.0	5.4	5.6	10.3	2.5	2.1	1.7	3.3	2.0	0.2	0.5	0.2	0.2	0.6	0.0

Cords per acre

Net total cord volume (live trees only)																					
	all species	**SM**	**ERC**	**WP**	**BO**	**SB**	**WA**	**BC**	**PNO**	**RM**	**BW**	**NRO**	**RP**	**H**	**AIL**	**BTA**	**BEM**	**WO**	**OST**	**SAS**	**YP**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**1.1**	0.3	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

8	**2.0**	0.5	0.4	0.0	0.1	0.2	0.2	0.0	0.0	0.2	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	**3.7**	0.5	0.4	0.1	0.8	0.4	0.1	0.5	0.3	0.3	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	**4.1**	0.6	0.2	0.0	0.6	0.4	0.4	0.5	0.4	0.3	0.1	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	**3.7**	0.5	0.1	0.3	0.2	0.4	0.5	0.3	0.4	0.0	0.2	0.2	0.2	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.0
16	**3.1**	0.3	0.1	0.5	0.2	0.4	0.4	0.2	0.3	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**2.4**	0.2	0.0	0.5	0.1	0.3	0.3	0.1	0.2	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
20	**1.3**	0.1	0.0	0.4	0.2	0.0	0.3	0.0	0.2	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**1.2**	0.1	0.0	0.8	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
24	**0.9**	0.2	0.0	0.2	0.2	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.1**	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.4**	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**6.8**	1.2	1.1	0.1	0.9	0.6	0.3	0.7	0.4	0.7	0.2	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM SAW	**10.8**	1.5	0.3	0.8	1.0	1.2	1.3	1.0	1.1	0.4	0.6	0.3	0.8	0.3	0.0	0.2	0.0	0.1	0.0	0.0	0.0
MD SAW	**4.9**	0.4	0.0	1.7	0.3	0.3	0.7	0.1	0.3	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
LG SAW	**1.6**	0.2	0.0	0.4	0.3	0.1	0.1	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**24.1**	3.3	1.4	2.9	2.5	2.2	2.4	1.8	1.8	1.3	1.5	1.2	0.9	0.5	0.0	0.2	0.0	0.2	0.0	0.0	0.1
Percent		13.9	6.0	12.1	10.2	9.3	9.8	7.4	7.5	5.3	6.1	5.1	3.7	2.0	0.0	0.6	0.0	0.7	0.0	0.0	0.4

Stand 3

Acreage, Regulated Features and Access

Stand 3 includes 42.67 acres of similar aged cedar forest that occur in four distinct areas on the property. The two sections found in the Northern FFP have no regulated features, while the two southern areas border wetlands or transition zones. There are no waterbodies within these areas. All four areas are accessible from existing access roads without the need to make new crossings through regulated features, so there are no recommendations being made for additional road construction or the use of vehicles in regulated areas. Any stewardship activities that might occur in wetland transition areas or riparian zones can be carried out using hand tools, and if that changes, a separate practice plan with working parameters and BMPs will be prepared and submitted to the NJ Forest Service for approval before implementing those practices.

Inventory Information

Forest data was collected from 40 evenly spaced inventory plots distributed across the stand using a 20-factor prism, which translates to roughly one inventory plot for every acre. Using a 90% confidence interval, the resulting stand data is within +/- 12% of the mean basal area, and within +/- 20% of the mean number of stems per acre.

Stand 3 Description

This stand contains an overwhelming predominance of red cedar trees, which on average comprise about 77% of the BA. The two blocks on the north side of Lincoln Laurel Road are slightly younger have less hardwood encroachment than the blocks in the Southern section of FFP. Other associate species found here include black oak, red maple, white ash, black cherry, hickory, pin oak, white pine, red oak, black birch, white oak, and slippery elm. The US Forest Service stand type is *#402- Eastern Red Cedar / Hardwoods.* The stand is notably younger than the other stands on the property, and the initial regeneration in the northern section was very patchy and protracted over two decades spanning the 1980s and 1990s, making the collective stand approximately 30–50 years old.

The co-dominant size range is considered poletimber (approximately 6” - 12” DBH), and scattered larger hardwoods are more common in the southern sections. The medial diameter is 7.5” DBH and the average co-dominant tree height varies between 20’- 40’ (because of the patchy initial establishment). The average site index and productivity are the same as other stands (SI of 60 for red oak and an average productivity of about 57 cu ft/ac/yr.). Wood volume averages 14.3 cords per acre, broken down to 13.0 cords of pulpwood grade material and 746 board feet of sawtimber per acre.

This stand averages 1,082 trees per acre and 180 sq. ft. of BA per acre, with a calculated RD of 154%. This RD is extremely excessive for individual tree growth, and visual field evidence of this can be seen in the poor vigor quality and low live crown ratios of trees here. The stand is projected to experience heavy mortality over the next two decades, which is especially concerning because of the lack of understory except for undesirable plants like autumn olive - which will quickly capture the new growing space.

Comparison of Stand Conditions for Each Cycle: (2022 - 2072)

Year	Stems per acre	Basal area	Relative density	Total cords	MBF	Net growth (BA/year)	Mortality (BA/year)
2022	1081.6	179.5	154.0	14.3	0.7		
2047	278.2	139.2	89.9	24.4	3.3	-1.61	3.40
2072	164.9	137.7	77.4	30.4	6.4	-0.06	1.46

Stand 3 Basic Variables

Name	Value
Forest Type	USFS #402 – Eastern red cedar / hardwoods
Site Index	60 (red oak)
Medial DBH (in)	7.5
Quadratic Mean DBH (in)	5.5
Size Class	Poletimber
Age Class	30-50
Total Basal Area (sq.ft/ac)	179.5
Basal Area in Saplings (sq.ft/ac)	61.5
Stems Per Unit Area (stems/ac)	1,082
Net Cord Volume (cords/ac)	14.3
Canopy Closure (% closure)	95% - 100%
Productivity	57 cu ft/ac/yr.
Regeneration Status	Poor
Coarse Woody Debris Status	Low
Damage Causing Agents	white-tailed deer, EAB
Litter Depth (inches)	< 1
Relative Density (%) / vigor	154 / severely reduced vigor

The understory was evaluated using the same methodology as before to estimate average abundance of the commonly encountered species.

Understory Summary - Description of Understory Table Items:

- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.

- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values

Occurrence and Abundance

	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
autumn olive	87.18	36.96	19.7	62.35	45.29
Asian bittersweet	30.77	13.04	1.9	6.07	10.67
Japanese barberry	25.64	10.87	1.5	4.86	8.83
bush honeysuckle	17.95	7.61	1.5	4.86	6.66
wineberry	17.95	7.61	1.4	4.45	6.53
fox grape	15.38	6.52	1.3	4.05	6.03
flowering dogwood	10.26	4.35	0.6	2.02	3.56
multiflora rose	7.69	3.26	0.5	1.62	2.70
blackhaw viburnum	7.69	3.26	0.4	1.21	2.57
Japanese stilt grass	5.13	2.17	0.8	2.43	2.25
unidentified species	2.56	1.09	1.3	4.05	2.07
grass *spp*.	5.13	2.17	0.5	1.62	1.98
silky dogwood	2.56	1.09	0.1	0.40	0.86
Totals	235.90	100.00	31.67	100.00	100.00

Stocking Tables

The stocking tables on the following pages provide a summary of the tree inventory data. The more frequently encountered species were tallied under the following abbreviations:

ERC = red cedar
WA = white ash
NPO = northern pin oak
SB = black birch
BO = black oak
BC = black cherry
WP = white pine
WO = white oak
RM = red maple
H = misc. hickories
NRO = northern red oak
SE = slippery elm

Composition - BA, percent BA, trees per acre

	all species	ERC	BO	RM	WA	BC	H	PNO	WP	NRO	SB	WO	SE
Total BA	**179.5**	138.5	10.5	8.0	6.0	4.5	2.5	2.5	2.0	1.5	1.5	1.5	0.5
Percent BA	**100**	77	6	4	3	3	1	1	1	1	1	1	0
Trees per acre	**1082**	1008.0	18.8	19.2	6.0	10.9	4.0	3.5	3.3	0.6	1.7	2.9	2.5

Diameters and Ages - inches, years

	all species	ERC	BO	RM	WA	BC	H	PNO	WP	NRO	SB	WO	SE
Medial diameter	**7.5**	5.8	13.8	11.5	15.3	9.6	10.8	12.8	11.0	23.3	12.7	19.3	6.0
Quadratic mean diameter	**5.5**	5.0	10.1	8.7	13.6	8.7	10.7	11.5	10.5	20.6	12.6	9.7	6.0
Effective age	**58**	48	95	58	77	48	72	85	73	117	84	129	40

Volumes and Values (per acre) - Scribner Log Rule

	all species	ERC	BO	RM	WA	BC	H	PNO	WP	NRO	SB	WO	SE
Gross Total Cords	**17.8**	6.6	3.0	2.0	1.7	1.1	0.7	0.7	0.6	0.5	0.4	0.4	0.1
Net Total Cords	**14.3**	5.3	2.4	1.6	1.4	0.9	0.5	0.6	0.4	0.4	0.3	0.3	0.1
Net Pulpwood Cords	**13.0**	5.0	2.0	1.5	1.2	0.9	0.5	0.5	0.4	0.3	0.3	0.3	0.1
Gross Board-foot	**902.5**	176.1	286.2	89.6	110.8	42.5	0.0	89.5	40.4	47.0	20.5	0.0	0.0
Net Board-foot	**745.8**	114.1	267.8	72.0	100.0	33.1	0.0	78.1	27.6	44.5	8.6	0.0	0.0
Dollars	**122.1**	10.7	17.2	11.4	40.2	13.0	1.1	1.6	1.0	24.4	0.7	0.7	0.1

Basal area per acre

Basal area (live trees only)

	all species	ERC	BO	RM	WA	BC	H	PNO	WP	NRO	SB	WO	SE
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**61.5**	61.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**47.0**	44.0	0.0	2.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
8	**31.5**	24.0	1.5	1.5	0.5	2.0	0.0	0.5	0.5	0.0	0.0	1.0	0.0
10	**13.5**	7.5	2.5	1.5	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
12	**10.0**	1.5	1.0	0.5	1.5	1.0	1.0	1.0	1.5	0.0	1.0	0.0	0.0
14	**4.0**	0.5	1.0	0.0	1.0	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.0
16	**3.5**	0.0	1.5	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**2.5**	0.0	0.0	1.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0
20	**2.0**	0.0	0.5	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

22	**2.0**	0.0	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**0.5**	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.5**	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
SAPS	**61.5**	61.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**92.0**	75.5	4.0	5.0	0.5	3.0	1.5	0.5	0.5	0.0	0.0	1.0	0.5
SM SAW	**17.5**	2.0	3.5	1.0	4.0	1.5	1.0	1.5	1.5	0.0	1.5	0.0	0.0
MD SAW	**6.5**	0.0	2.0	2.0	1.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0
LG SAW	**2.0**	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0
Total	**179.5**	138.5	10.5	8.0	6.0	4.5	2.5	2.5	2.0	1.5	1.5	1.5	0.5
Percent		77.2	5.8	4.5	3.3	2.5	1.4	1.4	1.1	0.8	0.8	0.8	0.3

RD per acre

Relative density (live trees only)													
	all species	**ERC**	**BO**	**RM**	**WA**	**BC**	**H**	**PNO**	**WP**	**NRO**	**SB**	**WO**	**SE**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**66.4**	65.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**41.5**	38.8	0.0	1.8	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.5
8	**23.7**	18.2	1.1	1.1	0.3	1.2	0.0	0.4	0.4	0.0	0.0	1.0	0.0
10	**9.0**	5.1	1.7	1.0	0.0	0.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0
12	**5.7**	0.9	0.6	0.3	0.7	0.4	0.6	0.6	0.9	0.0	0.6	0.0	0.0
14	**2.0**	0.3	0.6	0.0	0.4	0.2	0.0	0.3	0.0	0.0	0.3	0.0	0.0
16	**1.6**	0.0	0.8	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**1.3**	0.0	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.5	0.0	0.0	0.0
20	**0.8**	0.0	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**0.9**	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**0.1**	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

26	**0.2**	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.4**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
SAPS	**66.4**	65.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**74.2**	62.0	2.8	3.9	0.3	1.8	1.0	0.4	0.4	0.0	0.0	1.0	0.5
SM SAW	**9.4**	1.2	2.0	0.6	1.6	0.6	0.6	0.9	0.9	0.0	0.9	0.0	0.0
MD SAW	**3.0**	0.0	1.0	1.0	0.3	0.0	0.0	0.3	0.0	0.5	0.0	0.0	0.0
LG SAW	**1.0**	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0
Total	**154.0**	129.1	6.5	5.5	2.4	2.5	1.6	1.5	1.3	0.7	0.9	1.4	0.5
Percent		83.9	4.2	3.6	1.5	1.6	1.1	1.0	0.8	0.5	0.6	0.9	0.3

Trees per acre

Number of trees (live trees only)													
	all species	**ERC**	**BO**	**RM**	**WA**	**BC**	**H**	**PNO**	**WP**	**NRO**	**SB**	**WO**	**SE**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**704.7**	699.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**239.4**	224.1	0.0	10.2	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5
8	**90.2**	68.8	4.3	4.3	1.4	5.7	0.0	1.4	1.4	0.0	0.0	2.9	0.0
10	**24.8**	13.8	4.6	2.8	0.0	0.9	2.8	0.0	0.0	0.0	0.0	0.0	0.0
12	**12.7**	1.9	1.3	0.6	1.9	1.3	1.3	1.3	1.9	0.0	1.3	0.0	0.0
14	**3.7**	0.5	0.9	0.0	0.9	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.0
16	**2.5**	0.0	1.1	0.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**1.4**	0.0	0.0	0.6	0.0	0.0	0.0	0.3	0.0	0.6	0.0	0.0	0.0
20	**0.9**	0.0	0.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**0.8**	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**0.2**	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.1**	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
SAPS	**704.7**	699.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**354.4**	306.6	8.9	17.2	1.4	9.2	2.8	1.4	1.4	0.0	0.0	2.9	2.5
SM SAW	**19.0**	2.4	3.3	1.0	3.9	1.7	1.3	1.7	1.9	0.0	1.7	0.0	0.0
MD SAW	**3.1**	0.0	0.8	1.0	0.5	0.0	0.0	0.3	0.0	0.6	0.0	0.0	0.0
LG SAW	**0.4**	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Total	**1081.6**	1008.0	18.8	19.2	6.0	10.9	4.0	3.5	3.3	0.6	1.7	2.9	2.5
Percent		93.2	1.7	1.8	0.6	1.0	0.4	0.3	0.3	0.1	0.2	0.3	0.2

Cords per acre

Total cord volume (live trees only)													
	all species	**ERC**	**BO**	**RM**	**WA**	**BC**	**H**	**PNO**	**WP**	**NRO**	**SB**	**WO**	**SE**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**2.0**	1.6	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
8	**3.7**	2.3	0.3	0.3	0.1	0.4	0.0	0.1	0.1	0.0	0.0	0.2	0.0
10	**2.3**	1.0	0.5	0.3	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0
12	**2.2**	0.2	0.2	0.1	0.4	0.2	0.2	0.2	0.4	0.0	0.2	0.0	0.0
14	**1.0**	0.1	0.3	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0
16	**0.9**	0.0	0.4	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**0.7**	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0
20	**0.4**	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	**0.6**	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**0.1**	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.1**	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

34	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
SAPS	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**7.9**	4.9	0.8	0.8	0.1	0.5	0.3	0.1	0.1	0.0	0.0	0.2	0.1
SM SAW	**4.1**	0.3	0.9	0.2	1.0	0.4	0.2	0.4	0.4	0.0	0.3	0.0	0.0
MD SAW	**1.6**	0.0	0.6	0.5	0.1	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0
LG SAW	**0.6**	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0
Total	**14.3**	5.3	2.4	1.6	1.4	0.9	0.5	0.6	0.4	0.4	0.3	0.3	0.1
Percent		36.9	16.8	11.3	9.6	6.4	3.7	4.1	3.1	2.9	2.3	2.4	0.4

Stand 4

Acreage, Regulated Features and Access
This stand covers 29.03 acres in the northernmost corner of the tract. There are no wetlands, transition areas, waterbodies, or riparian zones in this stand. The stand is accessible from the existing road network near the developed recreational facilities in the center of FFP North.

Inventory Information
Forest data was collected from 23 evenly spaced inventory plots distributed across the stand using a 10-factor prism, which translates to roughly one inventory plot for every 1 1/3 acre. Using a 90% confidence interval, the resulting stand data is within +/- 9% of the mean basal area, and within +/- 23% of the mean number of stems per acre.

Stand 4 Description
This stand resembles the general characteristics of Stand 1 but has a stronger upland oak component and is slightly older, with an effective stand age of 100 years. The three most abundant species that make up 64% of the co-dominant size class are black oak, red oak, and black birch. Other associate species include chestnut oak, white oak, black cherry, red maple, black locust, sugar maple, beech, hickory, white ash, red cedar, bigtooth aspen, sassafras, and scarlet oak. The US Forest Service stand type is *#505- Northern Red Oak.* The stand has a moderate poletimber and sapling component that includes a good proportion of desirable species like oaks. The understory has low complexity and is depauperate of desirable native plants.

The co-dominant size range is considered small to medium sawtimber (approximately 12” - 18” DBH). The medial diameter is 15.9” DBH and the average co-dominant tree height is over 80’. The average site index and productivity are the same as other stands (SI of 60 for red oak

and an average productivity of about 57 cu ft/ac/yr.). Wood volume averages 25.2 cords per acre, broken down to 17.8 cords of firewood grade material and 4,703 board feet of sawtimber per acre.

There are an average of 142 trees per acre and 103 sq. ft. of BA per acre, with a calculated RD of 62%. At this RD there is only a moderate level of competition and most co-dominant stems are probably growing well - and should continue to grow well over the next decade.

Comparison of Stand Conditions for Each Cycle: (2022 - 2072)

Year	Stems per acre	Basal area	Relative density	Total cords	MBF	Net growth (BA/year)	Mortality (BA/year)
2022	142.3	103.0	62.5	25.2	4.7		
2047	119.4	139.6	77.6	36.7	10.6	1.46	0.21
2072	103.4	167.0	88.2	45.7	14.6	1.10	0.25

Stand 4 Basic Variables

Name	Value
Forest Type	USFS #505 – Northern red oak
Site Index	60 (red oak)
Medial DBH (in)	15.9
Quadratic Mean DBH (in)	11.5
Size Class	Small – medium sawtimber
Age Class	100
Total Basal Area (sq.ft/ac)	103
Basal Area in Saplings (sq.ft/ac)	2.6
Stems Per Unit Area (stems/ac)	142
Net Cord Volume (cords/ac)	25.2
Canopy Closure (% closure)	80-85%
Productivity	57 cu ft/ac/yr.
Regeneration Status	Poor
Coarse Woody Debris Status	Low
Damage Causing Agents	white-tailed deer, EAB
Litter Depth (inches)	1” – 2”
Relative Density (%) / vigor	62 / good - average vigor

The understory was evaluated using the same methodology as before to estimate average abundance of the commonly encountered species.

Understory Summary - Description of Understory Table Items:

- **Frequency** = The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Relative (Rel) Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Dominance** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.
- **Relative (Rel) Dominance** = Relative dominance, based on individual species dominance divided by the total of all species dominances.
- **Importance Value** = A value computed by arbitrarily adding together the relative values and dividing by the number of non-zero relative values

Occurrence and Abundance

	Frequency	Rel Frequency	Dominance	Rel Dominance	Importance Value
multiflora rose	13.04	12.50	2.0	19.57	14.86
Japanese barberry	17.39	16.67	1.1	10.87	14.73
Japanese stilt grass	8.70	8.33	2.6	26.09	14.25
autumn olive	13.04	12.50	0.9	8.70	11.23
grass *spp*.	8.70	8.33	0.9	8.70	8.45
Asiatic bittersweet	4.35	4.17	0.4	4.35	4.23
garlic mustard	4.35	4.17	0.4	4.35	4.23
blackberry	4.35	4.17	0.2	2.17	3.50
lowbush blueberry	4.35	4.17	0.2	2.17	3.50
Blackhaw viburnum	4.35	4.17	0.2	2.17	3.50
wineberry	4.35	4.17	0.2	2.17	3.50
black raspberry	4.35	4.17	0.2	2.17	3.50
eastern poison ivy	4.35	4.17	0.2	2.17	3.50
fox grape	4.35	4.17	0.2	2.17	3.50
hophornbeam	4.35	4.17	0.2	2.17	3.50
Totals	104.35	100.00	10.00	100.00	100.00

Stocking Tables

The stocking tables on the following pages provide a summary of the tree inventory data. The more frequently encountered species were tallied under the following abbreviations:

BO = black oak
CO = chestnut oak
RM = red maple
AB = beech
ERC = red cedar
SO = scarlet oak
NRO = northern red oak
WO = white oak
BL = black locust
H = misc. hickories
BTA = bigtooth aspen
SB = black birch
BC = black cherry
SM = sugar maple
WA = white ash
SAS = sassafras

Composition - BA, percent BA, trees per acre

	all species	BO	NRO	SB	CO	WO	BC	RM	BL	SM	AB	H	WA	ERC	BTA	SAS	SO
Total BA	**103.0**	26.5	24.3	14.8	7.0	6.1	4.8	3.9	3.0	3.0	2.6	2.6	2.2	0.9	0.4	0.4	0.4
Percent BA	**100**	26	24	14	7	6	5	4	3	3	3	3	2	1	0	0	0
Trees per acre	**142**	19.3	37.8	15.7	4.9	3.7	10.8	9.8	3.1	13.0	4.0	3.8	6.9	7.2	0.6	1.2	0.4

Diameters and Ages - inches, years

	all species	BO	NRO	SB	CO	WO	BC	RM	BL	SM	AB	H	WA	ERC	BTA	SAS	SO
Medial diameter	**15.9**	18.3	17.0	14.5	18.0	19.4	11.3	11.8	13.7	8.9	15.3	12.7	12.0	5.0	12.0	8.0	14.0
Quadratic mean diameter	**11.5**	15.9	10.9	13.2	16.1	17.3	9.0	8.5	13.4	6.6	10.9	11.3	7.6	4.7	12.0	8.0	14.0
Effective age	**100**	122	90	96	120	130	56	64	91	64	102	84	70	40	80	53	93

Volumes (per acre) - Scribner Log Rule

	all species	BO	NRO	SB	CO	WO	BC	RM	BL	SM	AB	H	WA	ERC	BTA	SAS	SO
Total Cords	**25.2**	7.3	6.1	3.4	1.9	1.7	1.1	0.8	0.6	0.5	0.6	0.6	0.4	0.0	0.1	0.0	0.1
Net fire wood Cords	**17.8**	4.5	3.8	3.0	1.3	1.0	1.0	0.7	0.6	0.5	0.4	0.5	0.4	0.0	0.1	0.0	0.1

Net Board-foot	**4703**	1837	1433	208	394	437	73	60	18	11	94	54	61	0.0	0.0	0.0	17

Basal Area per acre

Basal area (live trees only)																	
	all species	**BO**	**NRO**	**SB**	**CO**	**WO**	**BC**	**RM**	**BL**	**SM**	**AB**	**H**	**WA**	**ERC**	**BTA**	**SAS**	**SO**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**3.5**	0.0	1.7	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0	0.0	0.4	0.4	0.0	0.0	0.0
6	**4.3**	0.4	0.4	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.4	0.0	0.0	0.4	0.0	0.0	0.0
8	**2.6**	0.4	0.4	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0
10	**7.4**	0.0	0.9	2.6	0.4	0.4	0.9	0.9	0.0	0.0	0.4	0.4	0.4	0.0	0.0	0.0	0.0
12	**12.2**	1.7	1.7	2.2	0.9	0.0	1.3	0.9	1.3	0.4	0.0	0.9	0.4	0.0	0.4	0.0	0.0
14	**17.0**	4.8	2.6	3.5	0.4	1.3	0.4	0.4	0.9	0.9	0.4	0.4	0.4	0.0	0.0	0.0	0.4
16	**12.6**	2.6	3.5	3.0	1.7	0.0	0.4	0.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**12.6**	6.1	3.9	1.3	0.4	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0
20	**13.9**	4.3	3.9	0.9	0.9	2.2	0.4	0.4	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0
22	**6.1**	1.7	2.2	0.4	0.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**6.1**	2.6	1.3	0.4	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**2.2**	0.0	1.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.9**	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**1.3**	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.4**	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**3.5**	0.0	1.7	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0	0.0	0.4	0.4	0.0	0.0	0.0
POLE	**14.3**	0.9	1.7	3.0	0.4	0.4	2.2	1.3	0.0	1.3	0.9	0.9	0.4	0.4	0.0	0.4	0.0
SM SAW	**41.7**	9.1	7.8	8.7	3.0	1.3	2.2	1.7	3.0	1.3	0.4	1.3	0.9	0.0	0.4	0.0	0.4
MD SAW	**32.6**	12.2	10.0	2.6	1.7	3.5	0.4	0.4	0.0	0.0	0.9	0.4	0.4	0.0	0.0	0.0	0.0
LG SAW	**10.9**	4.3	3.0	0.4	1.7	0.9	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Total	**103.0**	26.5	24.3	14.8	7.0	6.1	4.8	3.9	3.0	3.0	2.6	2.6	2.2	0.9	0.4	0.4	0.4
Percent		25.7	23.6	14.3	6.8	5.9	4.6	3.8	3.0	3.0	2.5	2.5	2.1	0.8	0.4	0.4	0.4

RD per acre

Relative density (live trees only)																	
	all species	**BO**	**NRO**	**SB**	**CO**	**WO**	**BC**	**RM**	**BL**	**SM**	**AB**	**H**	**WA**	**ERC**	**BTA**	**SAS**	**SO**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**3.8**	0.0	1.9	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	0.0
6	**3.9**	0.4	0.4	0.0	0.0	0.0	1.0	0.0	0.0	1.3	0.4	0.0	0.0	0.4	0.0	0.0	0.0
8	**2.0**	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
10	**5.0**	0.0	0.6	1.8	0.3	0.4	0.4	0.6	0.0	0.0	0.4	0.3	0.2	0.0	0.0	0.0	0.0
12	**7.3**	1.1	1.1	1.3	0.5	0.0	0.6	0.5	0.8	0.4	0.0	0.5	0.2	0.0	0.2	0.0	0.0
14	**10.5**	2.7	1.5	2.0	0.2	1.2	0.2	0.2	0.5	0.8	0.4	0.2	0.2	0.0	0.0	0.0	0.2
16	**6.7**	1.4	1.9	1.6	0.9	0.0	0.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**6.8**	3.1	2.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
20	**7.6**	2.1	1.9	0.4	0.4	2.0	0.1	0.2	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0
22	**3.4**	0.8	1.0	0.2	0.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**2.8**	1.2	0.6	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**1.4**	0.0	0.6	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.6**	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.6**	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.2**	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**3.8**	0.0	1.9	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	0.0
POLE	**10.9**	0.7	1.3	2.1	0.3	0.4	1.4	0.9	0.0	1.3	0.9	0.6	0.2	0.4	0.0	0.3	0.0
SM SAW	**24.5**	5.2	4.4	5.0	1.7	1.2	0.9	1.0	1.8	1.2	0.4	0.8	0.4	0.0	0.2	0.0	0.2
MD SAW	**17.8**	6.1	4.9	1.3	0.9	3.2	0.1	0.2	0.0	0.0	0.8	0.2	0.1	0.0	0.0	0.0	0.0
LG SAW	**5.4**	1.9	1.3	0.2	0.8	0.8	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Total	**62.5**	13.9	13.9	8.5	3.7	5.6	2.5	2.6	1.8	3.1	2.5	1.6	1.2	0.9	0.2	0.3	0.2
Percent		22.3	22.2	13.7	5.9	9.0	4.0	4.2	2.8	4.9	4.0	2.6	1.9	1.4	0.3	0.5	0.4

Trees per acre

Number of trees (live trees only)																	
	all species	**BO**	**NRO**	**SB**	**CO**	**WO**	**BC**	**RM**	**BL**	**SM**	**AB**	**H**	**WA**	**ERC**	**BTA**	**SAS**	**SO**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**39.9**	0.0	19.9	0.0	0.0	0.0	0.0	5.0	0.0	5.0	0.0	0.0	5.0	5.0	0.0	0.0	0.0
6	**22.1**	2.2	2.2	0.0	0.0	0.0	6.6	0.0	0.0	6.6	2.2	0.0	0.0	2.2	0.0	0.0	0.0
8	**7.5**	1.2	1.2	1.2	0.0	0.0	0.0	1.2	0.0	0.0	0.0	1.2	0.0	0.0	0.0	1.2	0.0
10	**13.6**	0.0	1.6	4.8	0.8	0.8	1.6	1.6	0.0	0.0	0.8	0.8	0.8	0.0	0.0	0.0	0.0
12	**15.5**	2.2	2.2	2.8	1.1	0.0	1.7	1.1	1.7	0.6	0.0	1.1	0.6	0.0	0.6	0.0	0.0
14	**15.9**	4.5	2.4	3.3	0.4	1.2	0.4	0.4	0.8	0.8	0.4	0.4	0.4	0.0	0.0	0.0	0.4
16	**9.0**	1.9	2.5	2.2	1.2	0.0	0.3	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**7.1**	3.4	2.2	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
20	**6.4**	2.0	1.8	0.4	0.4	1.0	0.2	0.2	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0
22	**2.3**	0.7	0.8	0.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**1.9**	0.8	0.4	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.6**	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.2**	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.3**	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**39.9**	0.0	19.9	0.0	0.0	0.0	0.0	5.0	0.0	5.0	0.0	0.0	5.0	5.0	0.0	0.0	0.0
POLE	**43.2**	3.5	5.1	6.0	0.8	0.8	8.2	2.8	0.0	6.6	3.0	2.0	0.8	2.2	0.0	1.2	0.0
SM SAW	**40.4**	8.6	7.1	8.2	2.8	1.2	2.4	1.8	3.1	1.4	0.4	1.5	1.0	0.0	0.6	0.0	0.4
MD SAW	**15.8**	6.1	4.8	1.3	0.8	1.5	0.2	0.2	0.0	0.0	0.5	0.2	0.2	0.0	0.0	0.0	0.0
LG SAW	**3.0**	1.2	0.8	0.1	0.6	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total	**142.3**	19.3	37.8	15.7	4.9	3.7	10.8	9.8	3.1	13.0	4.0	3.8	6.9	7.2	0.6	1.2	0.4
Percent		13.6	26.5	11.0	3.5	2.6	7.6	6.9	2.2	9.1	2.8	2.6	4.9	5.1	0.4	0.9	0.3

Cords per acre

Total cord volume (live trees only)																	
	all species	**BO**	**NRO**	**SB**	**CO**	**WO**	**BC**	**RM**	**BL**	**SM**	**AB**	**H**	**WA**	**ERC**	**BTA**	**SAS**	**SO**
2	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**0.5**	0.1	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	**0.4**	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
10	**1.6**	0.0	0.2	0.5	0.1	0.1	0.2	0.2	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
12	**2.9**	0.4	0.4	0.5	0.2	0.0	0.3	0.1	0.3	0.1	0.0	0.2	0.1	0.0	0.1	0.0	0.0
14	**4.3**	1.3	0.7	0.8	0.1	0.3	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.1
16	**3.2**	0.7	0.9	0.8	0.5	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**3.5**	1.7	1.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
20	**3.8**	1.2	1.1	0.1	0.2	0.6	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
22	**1.7**	0.5	0.6	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	**1.8**	0.8	0.4	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	**0.6**	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
28	**0.3**	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	**0.4**	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	**0.1**	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAPS	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLE	**2.6**	0.1	0.3	0.6	0.1	0.1	0.4	0.3	0.0	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.0
SM SAW	**10.4**	2.4	2.1	2.1	0.8	0.3	0.6	0.3	0.6	0.3	0.1	0.3	0.2	0.0	0.1	0.0	0.1
MD SAW	**9.0**	3.4	2.8	0.6	0.5	1.0	0.1	0.1	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0
LG SAW	**3.2**	1.3	0.9	0.1	0.5	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total	**25.2**	7.3	6.1	3.4	1.9	1.7	1.1	0.8	0.6	0.5	0.6	0.6	0.4	0.0	0.1	0.0	0.1
Percent		28.8	24.4	13.3	7.6	6.7	4.4	3.0	2.5	1.9	2.2	2.4	1.8	0.1	0.4	0.0	0.5

Stewardship Issues, Desired Future Conditions (DFC) and Stand Recommendations
A Summary of primary stewardship issues discussed throughout this plan are listed as numbers 1-6 below.

1. The field evidence indicates that the property has an overabundant white-tailed deer population that is negatively affecting the forest in the following ways:
    - Poor understory structure and composition for both biodiversity and recreation purposes. There is a lack of high-quality nesting cover and forage for wildlife in the mid-tier and lower canopy levels, and impenetrable thickets of non-native thorny plants that make traversing the land difficult.
    - Native plant populations in the understory are diminished or insignificant, and composition is limited to species that have low palatability to deer.
    - Forest sustainability is compromised due to herbivory pressure and an inability to grow new trees. Until deer numbers are reduced on this property, it will be difficult to improve most other natural resources because deer are ecosystem engineers.

    The DFC to address #1 is to establish a deer control program that reduces the population to a level where native plants and tree seedling can be found growing without excessive browse symptoms. Different deer management programs have been used on public properties with varying degrees of success, but to date, the only cost-effective means for accomplishing this elsewhere has been through a culling program that utilizes licensed hunters to focus on removing female deer. Among the different program models, traditional hunting clubs that have exclusive permission to hunt a property are typically *ineffective* at achieving significant population reductions to an ecologically appropriate level. This is probably because their intention is recreational rather than stewardship driven. Popular strategies among local government units that implement deer programs include restricting the number of hunters on a property and the limiting the number of hunting days, which is usually based on perceived safety concerns. But these measures reduce the number of deer that can be taken, and the most effective population control occurs where unrestricted hunting access is permitted following state regulations without additional barriers. Despite the perception, there is no demonstrated increased risk to the non-hunting public that uses properties where unrestricted hunting occurs, like on state wildlife management areas and forests.

    It might be helpful to seek assistance from the New Jersey Division of Fish and Wildlife on this issue because the professionals in that agency are best positioned to advise Frelinghuysen Township on the legality and effectiveness of different deer management alternatives. This process will probably also require some stakeholder engagement to address a variety of issues and concerns that residents might have. Since the process could take several years to develop, it would be prudent to begin it immediately while concurrently initiating other stewardship activities.

2. Parts of Stands 1 and 2 are inundated with NNIP in the understory, and undesirable plants are present but less abundant in Stands 3 and 4. The distribution and abundance of these plants varies but is expected to become worse if steps are not taken to control them.

   Since most NNIP encountered here are endemic throughout northern New Jersey, complete eradication is impractical because of existing seedbanks and nearby source populations. So, the DFC to address #2 is to begin a control program to eventually reduce the abundance to a threshold below 5% of the ground cover in each stand before the populations expand and become unmanageable. This work should begin in the most accessible areas and will require multiple control methods based on the species involved and their size. It will also probably require repeated treatments in the same areas to target individuals that were initially missed or to treat new plants that emerge from the seedbank. Careful use of herbicides, overseen by a licensed applicator, are the only cost-effective means of controlling most NNIP. Mechanical control (e.g., cutting, mowing, hand pulling, etc.) is effective for reducing biomass, but most plants will resprout shortly after being mechanically treated. However, in many situations, mechanical control is the preferred first step needed to make a site accessible for chemical treatments, or to reduce the use of chemicals and make the application more targeted. A general approach for controlling NNIP here is to treat herbaceous plants and shrubs below 4' tall with a foliar application of a non-selective chemical like glyphosate or triclopyr, which are labeled as low toxicity products that have limited soil mobility or flashback. This can usually be done with low chance of affecting non-target plants when timed appropriately using a backpack sprayer. Expansive populations might be better treated using a mist blower as long as there are none or few desirables present. Larger shrubs (>4' tall) can either be treated using a basal bark or cut stump method if the density is low enough, or in high density populations, forestry mow first and then foliar treat the resprouts. The precise methods and chemicals will need to be altered when applying near wetlands and water resources based on the product label requirements.

3. Stand 3, which is dominated by red cedar, is severely overstocked with trees that are exhibiting very poor vigor and decline. Most cedar trees here have a live crown ratio below 30%, which is inadequate foliage to support vigorous stem growth. This dynamic makes the cedar component highly susceptible to mortality in the coming years, which is problematic because nearly 80% of the stand is cedar and non-native plants are predominant in the understory.

   Conifers with severely diminished crowns like those in Stand 3 do not often recover well even when they are freed from competition, but it is probably important to try and maintain a conifer component on the property and slow the natural succession towards hardwood dominance for general diversity purposes, and because certain wildlife prefer conifer habitats. The understory here is depauperate of vegetation except for non-native plants, so if nothing is done, non-native plants like autumn olive will increase in abundance as cedar mortality increases over time. This is especially true in the northern portions of FFP where

it seems like autumn olive is the only understory plant. It is recommended to try and preserve the best cedar stems by thinning away adjacent, less vigorous stems to relive competition. Invasive plant control must be completed concurrently or before the thinning so that they do not proliferate, and so that other desirable plants have an equal chance to become established in canopy voids. This will also require some ongoing herbicide maintenance as described for #2 above.

The cedar blocks in northern FFP are the recommended starting locations because they are slightly younger than the southern FFP blocks, and the trees may have a better response rate to being released. Autumn olive control in this stand is probably best accomplished with a basal bark treatment using triclopyr in an oil carrier (which can be done year-round), or as a cut-stump treatment that is done during the growing season after the spring sap flow. The thinning intensity will vary according to the canopy condition, with a targeted RD reduction down from 154 to approximately 100. Thinning should be concentrated in the 4"-6" DBH range where the greatest amount of crowding is. This will translate to removing about half of the stems in that size range (i.e., ~450/acre) and equate to roughly 50 sq. ft. of BA/acre (down from a total of 180). The culled trees can be left in place or removed and utilized as posts for other projects. Leaving them in place can aid in the establishment of new plants but will also hamper follow-up herbicide treatments to control undesirable plants. Not only will the residual live trees benefit directly from the thinning, but as their crowns expand in response to the additional growing space, soft mast production will increase, providing an important food source for songbirds. So, the DFC for Stand 3 is to control invasive understory plants to below 5%, and reduce the stand density by about 1/3 to concentrate growth on the remaining stems and improve their vigor.

4. The stand-wide average RD in Stand 2 is considered above optimum for individual tree growth and understory development, but since the canopy structure is somewhat variable because of past land uses, there are parts of the stand that are more heavily stocked where trees will benefit greatly from thinning.

   Here, the DFC focus should be on facilitating old growth characteristics like larger diameter trees and increased amounts of CWD. To accomplish this, longer lived hardwoods like sugar maple and red oak that are of good vigor and are in co-dominant or dominant crown positions should be released from competition so they can add diameter growth more quickly. This will sustain/improve their vigor while increasing mast and seed production to benefit wildlife and regeneration. The size range where thinning should be concentrated because crowding is highest is between 6" - 12" DBH. The RD should be reduced from 79 to about 65, which will add growing space for better stems while minimizing canopy openings where undesirable plant control maintenance will be needed. Like the Stand 3 recommendation, non-native invasive plant control need to be carried out concurrently or before thinning any part of the stand, with follow-up maintenance as needed. The treatment will entail removing about 20 sq. ft. of BA/acre (from 120 down to 100) by culling approximately 25-40 trees per acre. Unless there are structures or other

fixed targets where people might congregate (i.e., tables, kiosks, benches, parking areas, etc.) within striking distance of a tree, at least some of the cull trees should be girdled and left standing as wildlife habitat rather than being felled. Larger standing dead trees are a critical character component of old growth forests and are currently in relatively low abundance on the property, so whenever possible, leaving at least 5 larger diameter dead snags per acre would be desirable.

5. Stands 1 and 4 are of similar age and developmental stage. The stand structure is relatively homogenous (vertically and horizontally) and could benefit from treatments to add complexity. However, the stocking in either stand is not excessive in most places, and given the many higher priority tasks recommended above, no canopy altering treatments are being recommended at this time. These areas should undergo invasive plant control treatments and re-evaluated after 10 years.

6. The property has several open fields in FFP north that can be managed, at least in part, as pollinator habitat. These areas were not closely evaluated during the forest inventory for their current pollinator value and plant composition, but there may be potential to improve the availability of flowering species for nectar and pollen production throughout the growing season. Depending on the current condition, this might include tactics like delayed mowing to allow certain plants to develop, or it may be warranted to establish new plantings on at least ¼ acre sections of a field using a high-quality pollinator seed mix, which might require killing back competing vegetation like cool season grasses. A more detailed pollinator plan can be developed if there is interest in doing this.

Monitoring

The implementation of stewardship activities should be monitored to ensure that objectives are being met and that adaptive measures are not needed. There are many possible ways to accomplish this including the use of permanent inventory plots within treatment areas where measurements and photographs can be repeated at the same place to track progress over time. Gauging progress for goals like controlling the deer population may be more subjective and based on indices rather than the absolute number of deer. The Township Land Manager should determine the best methods to monitor outcomes for each project and keep appropriate records to document the progress. The New Jersey Forest Stewardship rules, which pertain only to private landowners, require monitoring be done at least every three years and this seems like a reasonable minimum to follow on public land as well.

Suggested Management Schedule

Activity schedules are included in forestry plans to establish a framework for meeting management objectives on a property, but many factors including budgets and the landowner's ability to implement the work can have an impact on the rate of progress. Below is a suggested schedule to begin work.

Activity	Stand	Year	Extent
Begin developing a deer management program for FFP. Solicit assistance from the NJ Division of Fish & Wildlife and possibly experiences from other townships with similar programs.	Entire property	2022	all
Obtain assistance from a licensed herbicide applicator and begin implementing non-native invasive plant control along the access road in southern FFP as described on page 59. Possibly assemble a volunteer group to assist with mechanical aspects of this work and be trained to assist with chemical treatments.	1	2023-2032	5 acres / year
Have a professional forester designate cedar trees for retention and begin the thinning and associated non-native invasive plant control as described on pages 59 – 60. Start in the cedar blocks in FFP north and progress into the south.	3	2024-2032	5 acres / year
Monitor activities completed between 2022 – 2024	1	2025	all
Monitor activities completed between 2025 – 2027	1	2028	all
Monitor activities completed between 2028 – 2030	1	2031	all
If thinning in Stand 3 is completed ahead of schedule, have a professional forester designate trees for retention and begin the thinning and associated non-native invasive plant control as described on pages 60 - 61.	2	Any year	5 acres/ year
Improve pollinator habitat by developing and implementing a pollinator management plan in the FFP north fields.	Fields	Any year	¼ acre minimum
Control phragmites in the wetland complex in FFP south before it expands and becomes dominant. Possibly seek assistance from USFWS.	Open wetlands	Any year	~2-3 acres
Prepare an updated plan for 2033 for all acreage.	All	2032	

Natural Resources Conservation Service (NRCS) Practices

Below are potential NRCS practices that may be applicable to this property

NRCS TITLE	***NRCS Code***	***Current Plan Potential***	***Stand #***
Forest Stand Improvement	666	X	2,3
Forest Trails and Landings	655		
Stream Crossing	578		
Road/Trail/Landing Closure and Treatment	654		
Riparian Forest Buffer	391		
Tree and Shrub Site Preparation	490	X	1,3
Tree and Shrub Establishment	612	X	1,3
Fencing	382		
Structure for Wildlife	649		
Upland Wildlife Habitat Management	645		
Early Successional Habitat Management	647		
Brush Management	314	X	1,2,3,4
Conservation Cover – Pollinator Habitat	327	X	Fields
Fuel Break	383		
Fire Break	394		
Prescribed Burning	338		

Attachments / Appendices List

- Glossary of Common Forestry Terms
- Maps:
  Property Location
  Stand Map
  Regulated Features (Riparian Zones and Wetlands) and Stand Access
  Topographic
  1930's
  Historic Resources
  FEMA Firmette
- USFWS – Trust Resources List
  (Federal Threatened & Endangered Species List)
- NJ DEP Natural Heritage Database Report
  (State Threatened & Endangered Species List)
- NRCS Custom Soil Report

Glossary of Common Forestry Trems

Age – Mean age of the co-dominant trees in a forest.

All-aged or Uneven Aged Stand – A forest compromised of trees of different ages and sizes.

Aspect – Compass direction to which a slope faces.

Basal Area – The cross-sectional area of all trees in a stand measured at DBH.

Codominant Trees – Trees of similar overall size with crowns that are not overtopped and are receiving light from above. Codominant stems collectively comprise the upper forest canopy.

Crown – Upper portion of the tree where most of the leaves are found.

DBH – Diameter at Breast Height. Tree diameter measurement taken 4.5 feet above the forest floor on the uphill side of a tree.

Dominant Trees – Trees with crowns receiving full light from above and at least partly from the sides; usually larger than the average trees in the stand. The crown extends above the others in the vicinity.

Even Aged – Stand of trees where there are only small differences in age among the individual trees.

FSI – Forest Stand Improvement. Improving the forest quality by removing or deadening undesirable trees to achieve desired stocking and species composition.

Forest Type – Groups of tree species commonly growing in the same stand because their environmental requirements are similar.

Girdling – A physical cutting or disruption of the cambial sap flow around the entire circumference of a tree.

Group Selection – The removal of small groups of trees to regenerate shade intolerant trees in relatively small openings (usually at least ¼ acre).

High Grading – A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality shade tolerant trees tend to dominate in continually high-graded sites.

Intermediate Trees – Trees receiving little direct light from above and none from the sides. Usually with small crowns that extend into the canopy of co-dominant trees.

Intolerant Species – Tree relatively incapable of developing and growing normally in the shade of other trees.

LCR – Live Crown Ratio, the percentage of live crown in comparison to the overall tree height

Mast – Fruits or nuts used as a food sources by wildlife. Soft mast includes fruits with fleshy coverings, such as dogwood or cherries. Hard mast refers to nuts such as acorn, beech and hickory.

Mid-tolerant Species – A tree species that can germinate and grow under some light shade cast by other trees – although many mid-tolerant species become increasingly intolerant of shade as they mature.

Relative density is a measure of tree crowding that accounts both for the size of each tree and the amount of space typically occupied by that species. A relative density of 100 percent implies that the growing space is fully occupied and trees must either slow their growth to survive, or some trees will be crowded out and die, making room for more vigorous ones. Crowding between trees decreases along a gradient to around 60% relative density. Below 60% there is very little if any crowding, and unoccupied growing space is available for new growth.

Site Index – A relative measure of forest productivity based on the height of co-dominant trees at base age of 50 years old.

Stocking – A description of the number of trees, basal area, or volume compared with a desired level for balanced health and growth.

Suppressed Trees – Trees with crowns receiving no direct light from above or the sides. Usually with small crowns that are entirely below the canopy of co-dominant trees.

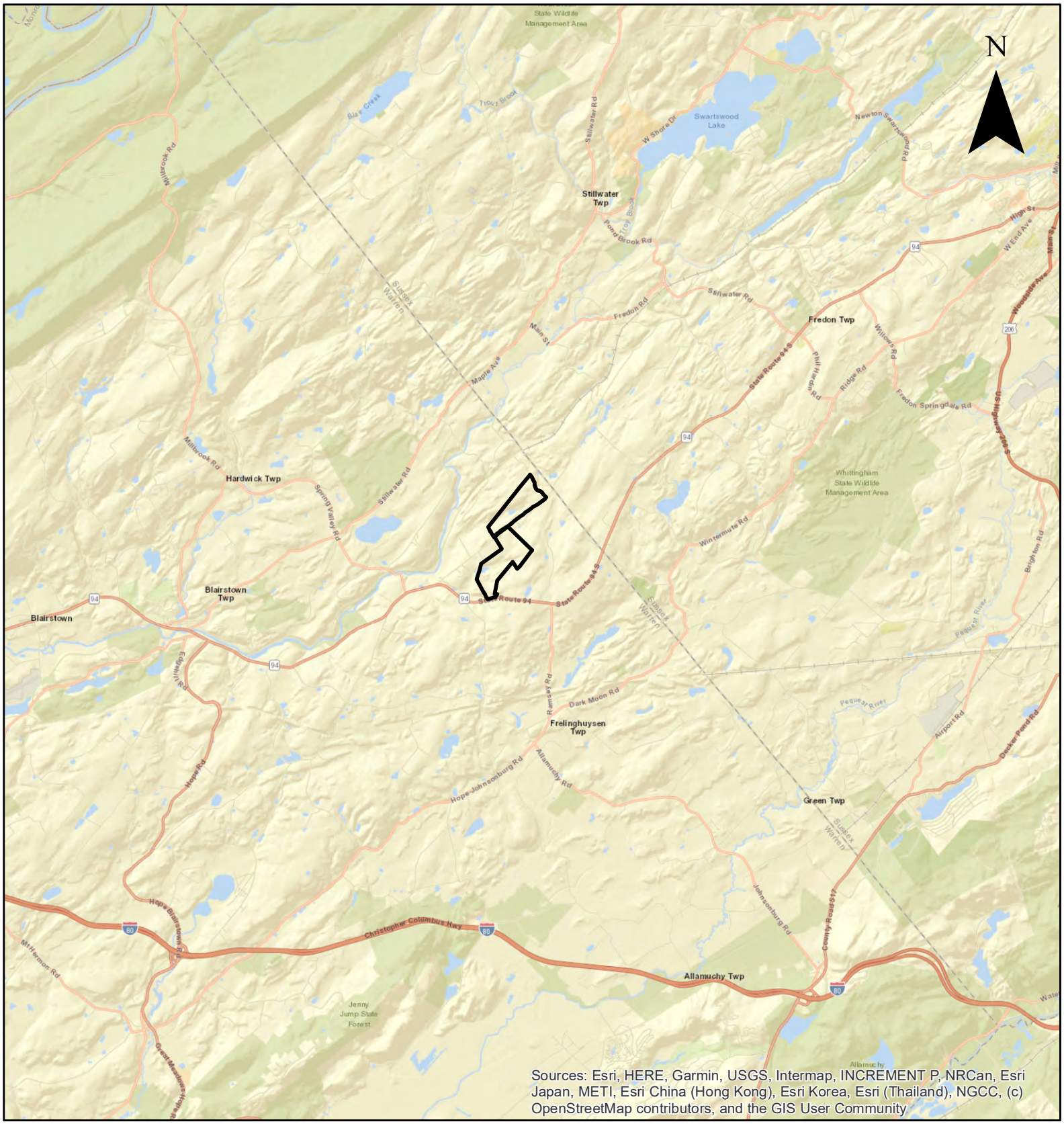
Thinning – A tree removal practice that reduces tree density and competition between trees in a stand. Thinning concentrates growth on fewer, better quality trees.

Tolerant Species – A tree species that has the ability to grow normally in the shade of other trees.

Frelinghuysen Forest Preserve Property Location

Frelinghuysen Township
139 Lincoln Laurel Rd
Hardwick, NJ 07825

1 inch = 8,333 feet



Map created using ESRI GIS Layers

0 6,000 12,000 24,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

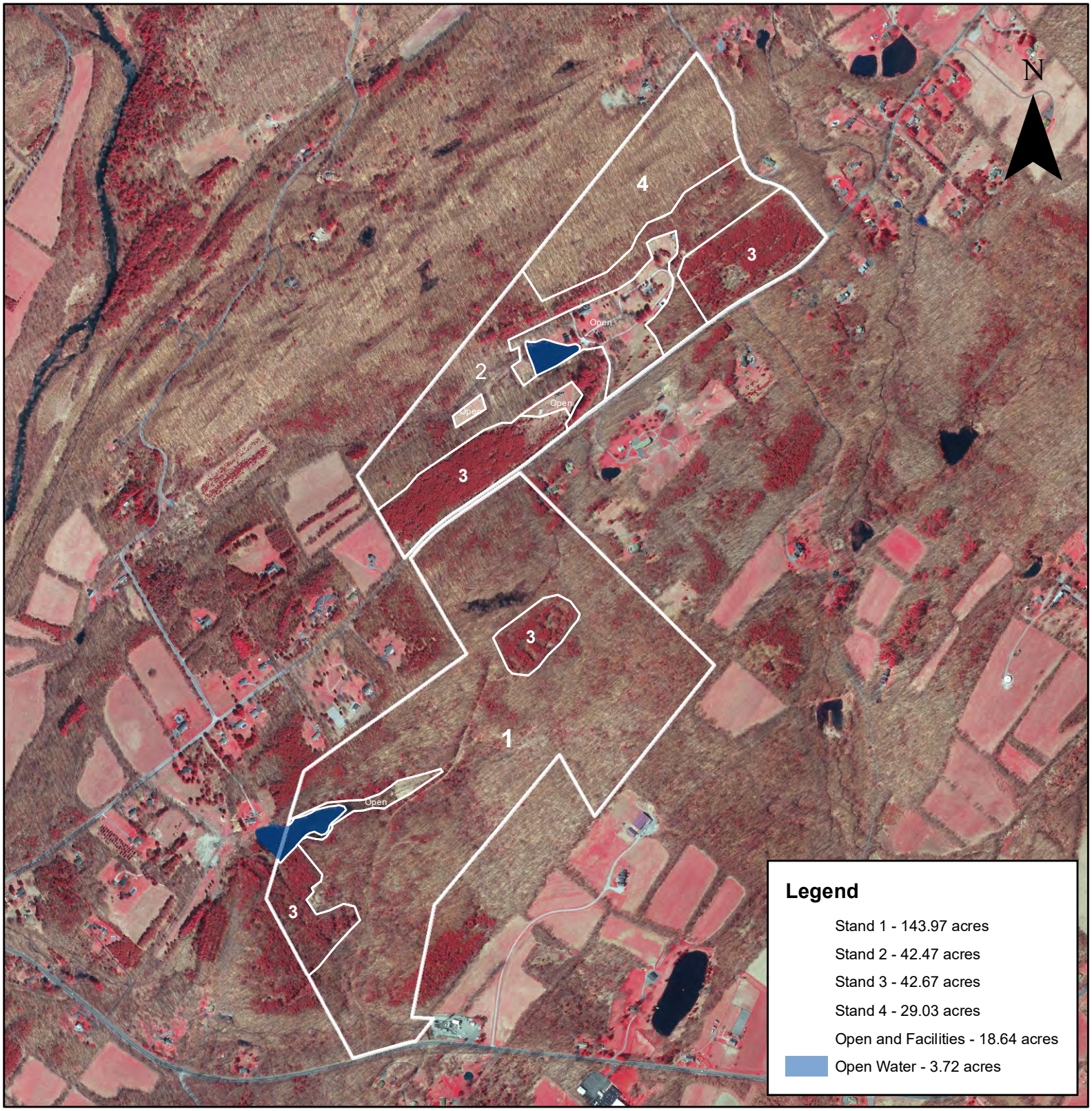
Frelinghuysen Forest Preserve Stand Map

Frelinghuysen Township
210 Main Street
Johnsonburg, NJ 07825
Woodland Acreage: 258.14 acres
Property Acreage: 280.50 acres

Frelinghuysen
Warren County
Block 201 Lot 6, 8.08
Block 104 Lot 10

Stand 1 USFS Forest type #520 Mixed Upland Hardwoods
Stand 2 USFS Forest type #520 Mixed Upland Hardwoods
Stand 3 USFS Forest type #402 Eastern Red Cedar / Hardwood
Stand 4 USFS Forest type #505 Northern Red Oak

1 inch = 1,059 feet



Map created using NJDEP GIS Layers

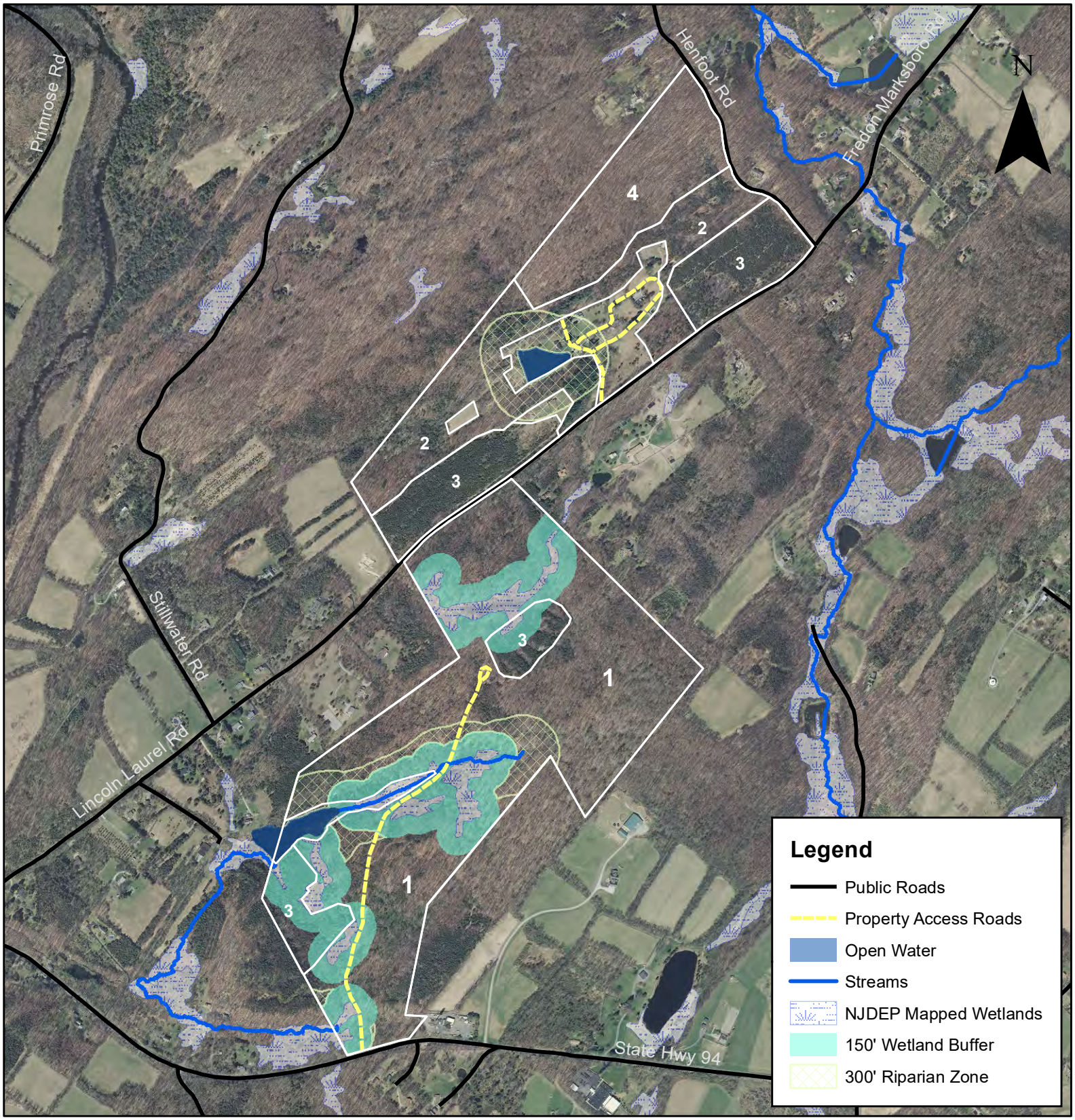
0 750 1,500 3,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

Frelinghuysen Forest Preserve Map
Regulated Features and Stand Access

Frelinghuysen Township
139 Lincoln Laurel Rd
Hardwick, NJ 07825

1 inch = 1,059 feet



Map created using NJDEP GIS Layers

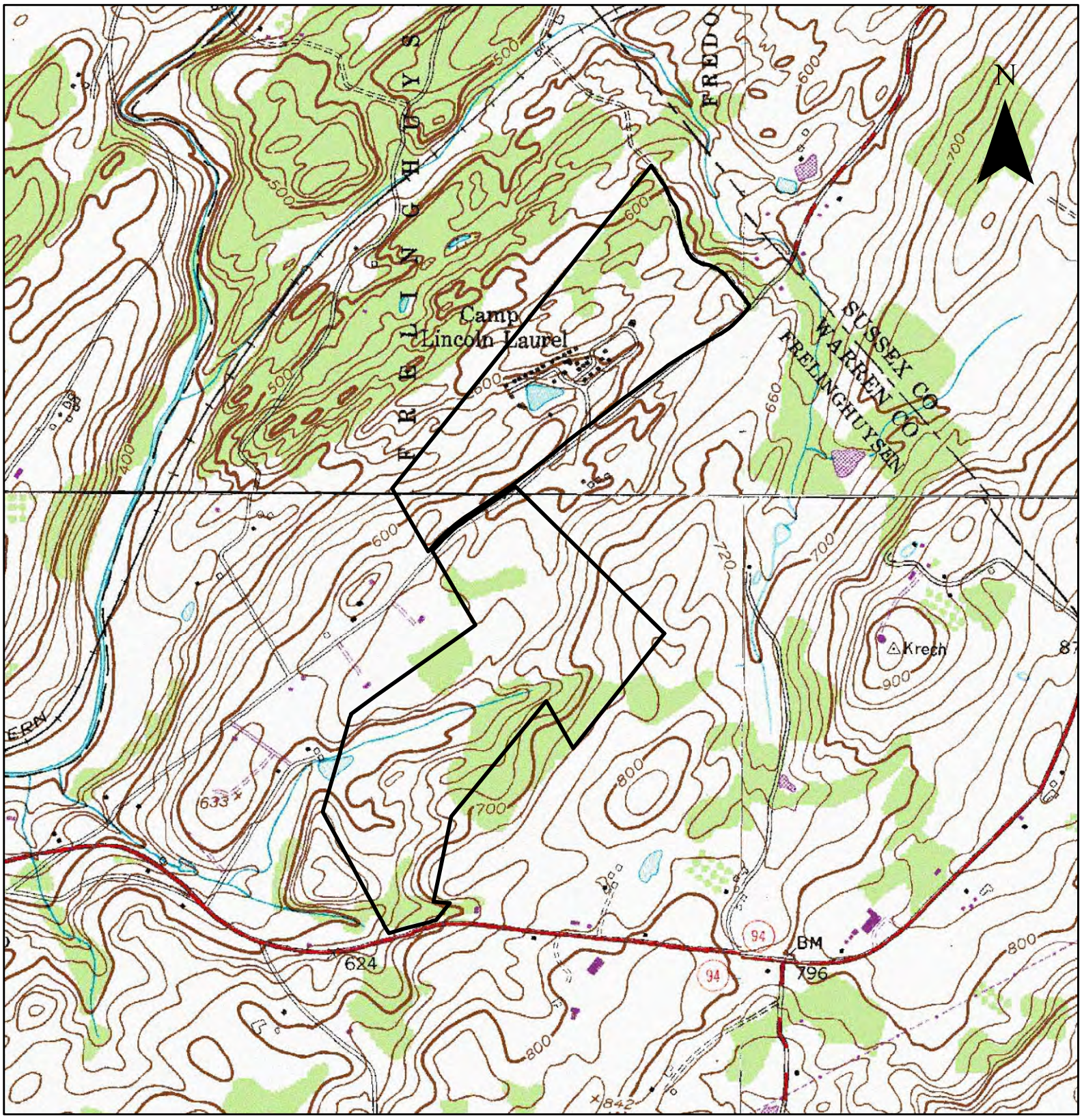
0 750 1,500 3,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

Frelinghuysen Forest Preserve Topographic Map

Frelinghuysen Township
139 Lincoln Laurel Rd
Hardwick, NJ 07825

1 inch = 1,376 feet



Map created using NJDEP GIS Layers

0 1,000 2,000 4,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

Frelinghuysen Preserve 1930s Aerial Map (with stand delineation)

Frelinghuysen Township
139 Lincoln Laurel Rd
Hardwick, NJ 07825

1 inch = 1,070 feet

Map created using NJDEP GIS Layers

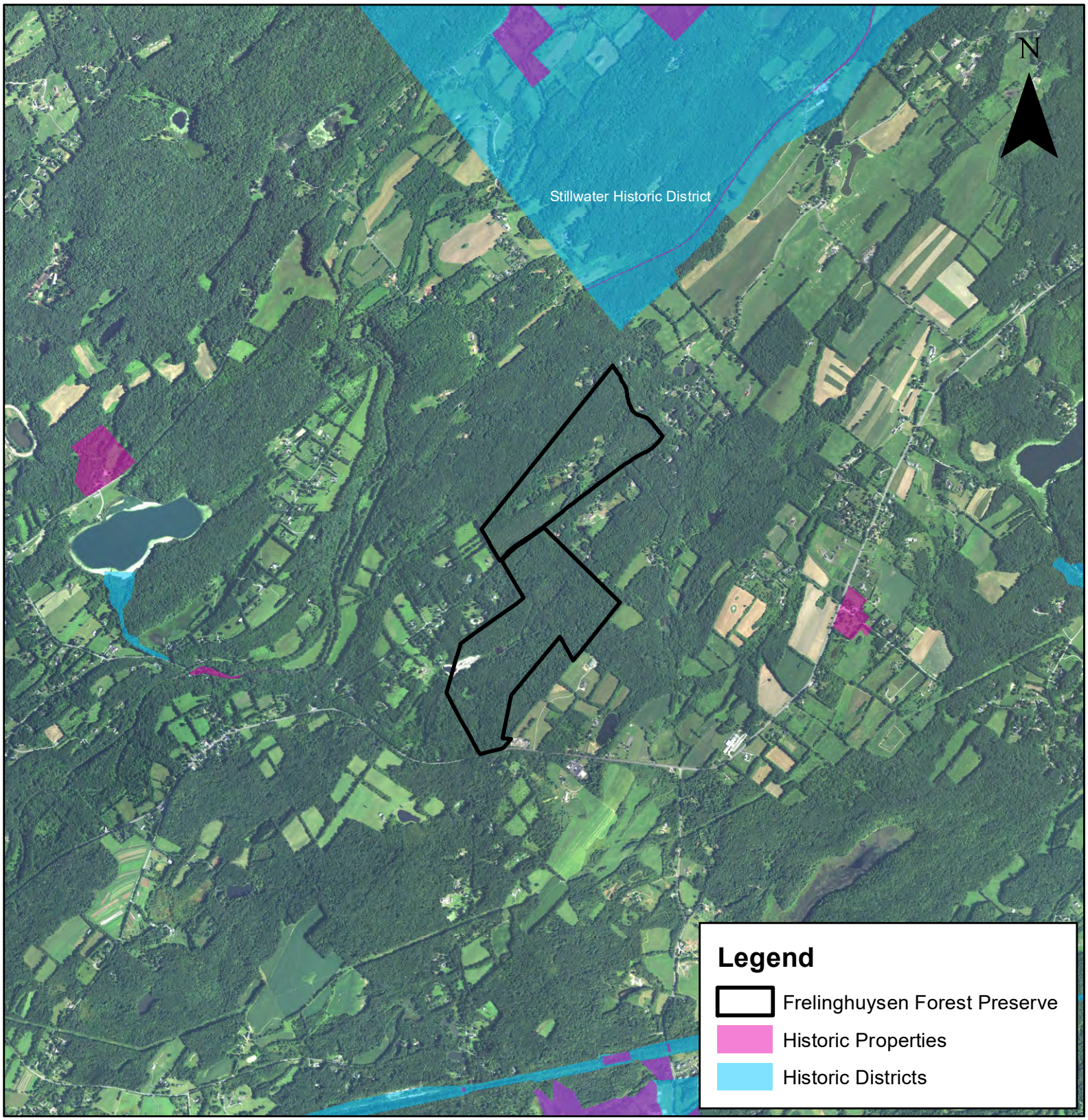
0 750 1,500 3,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

Frelinghuysen Forest Preserve
Historical Resources Map

Frelinghuysen Township
139 Lincoln Laurel Rd
Hardwick, NJ 07825

1 inch = 2,729 feet



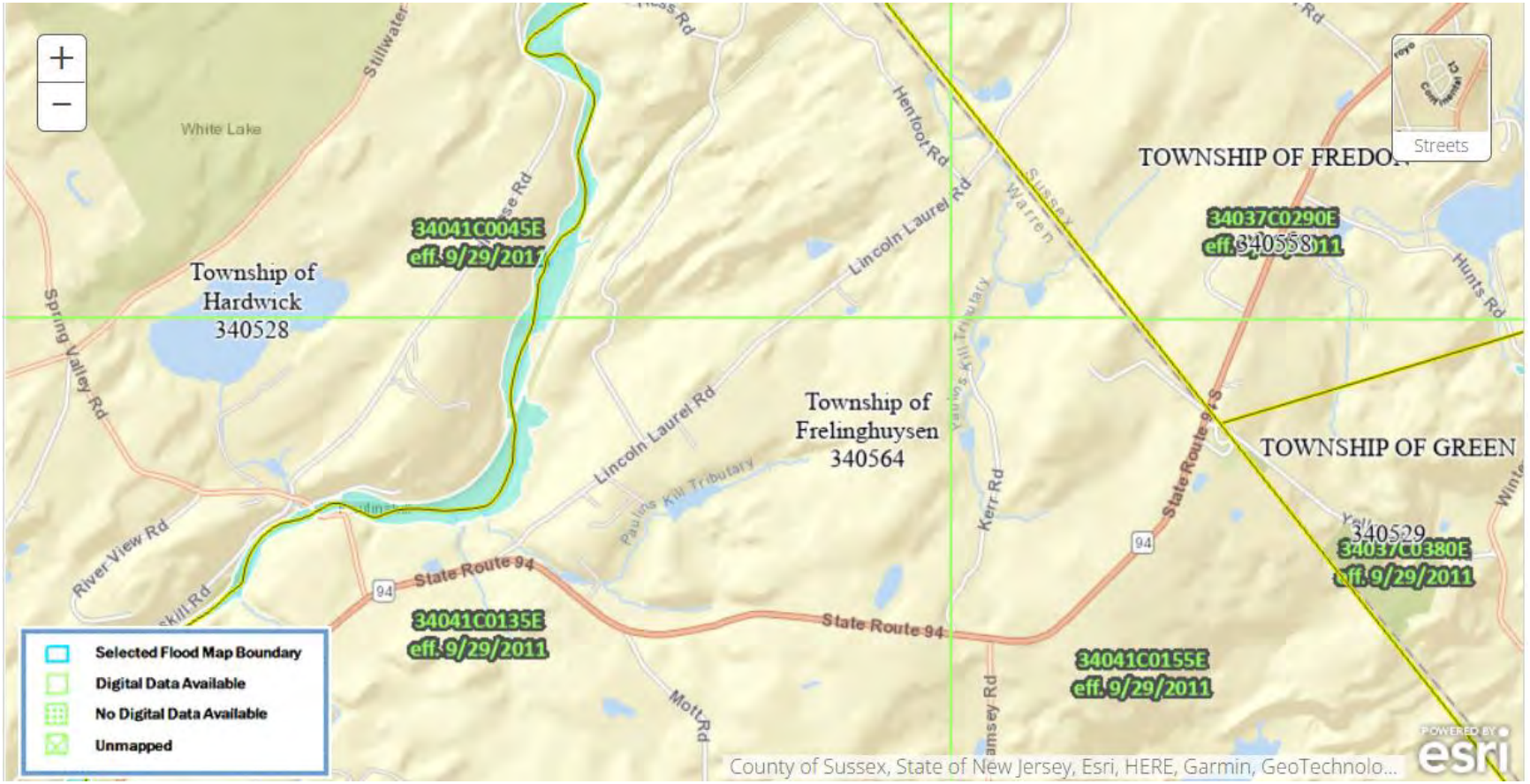
Map created using NJDEP GIS Layers

0 2,000 4,000 8,000 Feet

NEW JERSEY AUDUBON
www.njaudubon.org

FEMA Firmette Flood Map showing Frelinghuysen Forest Preserve Area and no Flood Hazard Areas

Printed October 2022 from the FEMA website



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Jersey Ecological Services Field Office
4 E. Jimmie Leeds Road, Suite 4
Galloway, NJ 08205
Phone: (609) 646-9310 Fax: (609) 646-0352
http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html

In Reply Refer To: February 23, 2022
Project Code: 2022-0011685
Project Name: Frelinghuysen Preserve

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

If the enclosed list indicates that any listed species may be present in your action area, please visit the New Jersey Field Office consultation web page as the next step in evaluating potential project impacts: http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html

On the New Jersey Field Office consultation web page you will find:

- habitat descriptions, survey protocols, and recommended best management practices for listed species;
- recommended procedures for submitting information to this office; and
- links to other Federal and State agencies, the Section 7 Consultation Handbook, the Service's wind energy guidelines, communication tower recommendations, the National Bald Eagle Management Guidelines, and other resources and recommendations for protecting wildlife resources.

The enclosed list may change as new information about listed species becomes available. As per Federal regulations at 50 CFR 402.12(e), the enclosed list is only valid for 90 days. Please return to the ECOS-IPaC website at regular intervals during project planning and implementation to obtain an updated species list. When using ECOS-IPaC, be careful about drawing the boundary of your Project Location. Remember that your action area under the ESA is not limited to just the footprint of the project. The action area also includes all areas that may be indirectly

affected through impacts such as noise, visual disturbance, erosion, sedimentation, hydrologic change, chemical exposure, reduced availability or access to food resources, barriers to movement, increased human intrusions or access, and all areas affected by reasonably forseeable future that would not occur without ("but for") the project that is currently being proposed.

We appreciate your concern for threatened and endangered species. The Service encourages Federal and non-Federal project proponents to consider listed, proposed, and candidate species early in the planning process. Feel free to contact this office if you would like more information or assistance evaluating potential project impacts to federally listed species or other wildlife resources. Please include the Consultation Tracking Number in the header of this letter with any correspondence about your project.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New Jersey Ecological Services Field Office
4 E. Jimmie Leeds Road, Suite 4
Galloway, NJ 08205
(609) 646-9310

Project Summary

Project Code: 2022-0011685
Event Code: None
Project Name: Frelinghuysen Preserve
Project Type: Forest Management Plan
Project Description: Forest Stewardship Plan
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.9939509,-74.88565855012227,14z

Counties: Warren County, New Jersey

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ The specified area occurs within the range of the northern long-eared bat. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Reptiles

NAME	STATUS
Bog Turtle *Glyptemys muhlenbergii* Population: Wherever found, except GA, NC, SC, TN, VA No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6962	Threatened

Clams

NAME	STATUS
Dwarf Wedgemussel *Alasmidonta heterodon* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/784	Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- The monarch is a candidate species and not yet listed or proposed for listing. There are generally no section 7 requirements for candidate species (FAQ found here: https://www.fws.gov/savethemonarch/FAQ-Section7.html).

Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

REFUGE INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Black-capped Chickadee *Poecile atricapillus practicus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 10 to Jul 31
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler *Cardellina canadensis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee

was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

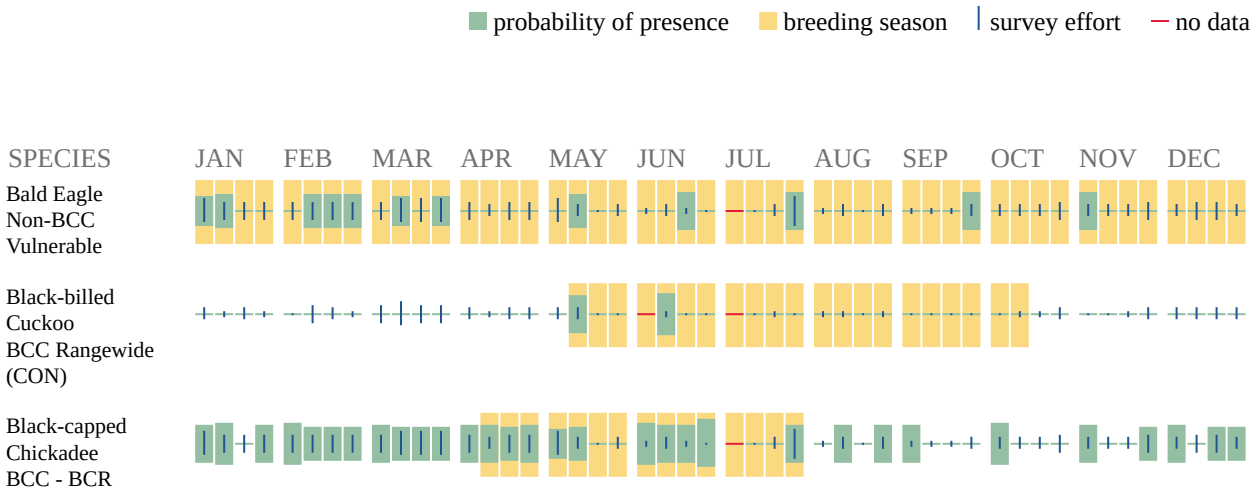
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

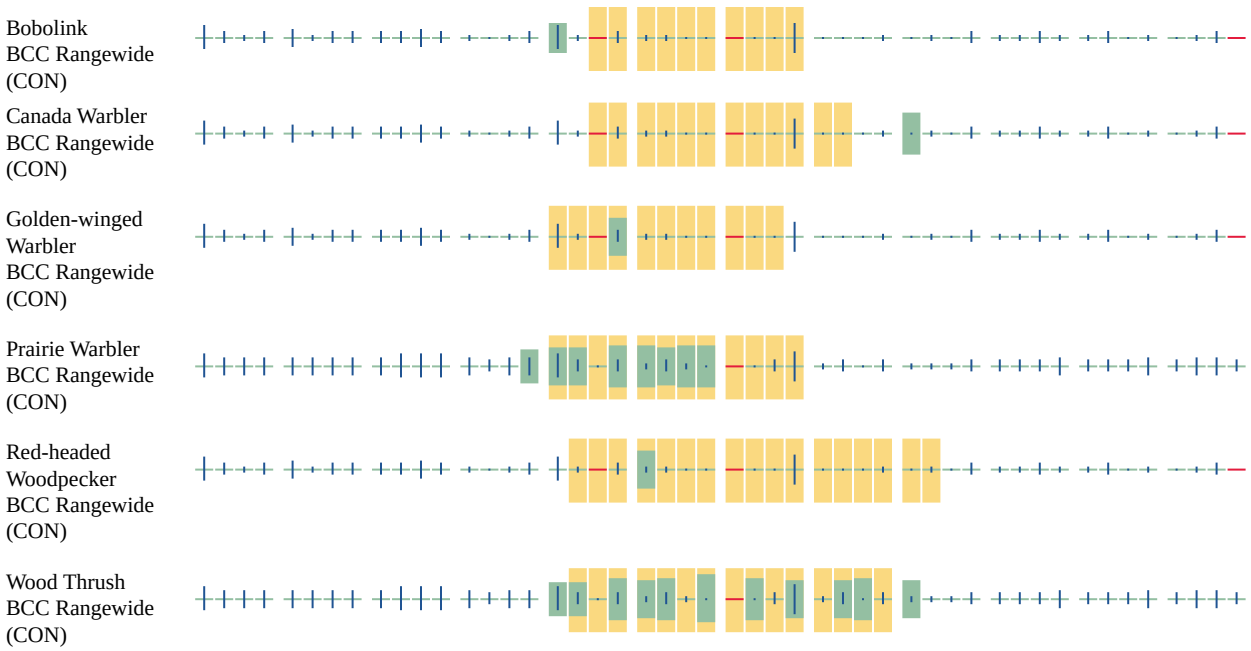
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R5UBH

FRESHWATER EMERGENT WETLAND

- PEM1Ch

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1E
- PFO1D

FRESHWATER POND

- PUBHh

IPaC User Contact Information

Name: Ryan Hasko
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State: NJ
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Email ryan.hasko@njaudubon.org
Phone: 9083966624

State of New Jersey
MAIL CODE 501-04
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE PARKS, FORESTS & HISTORIC SITES
OFFICE OF NATURAL LANDS MANAGEMENT
501 East State Street
P.O. Box 420, Mail Code 501-04
Trenton, NJ 08625-0420
Tel. (609) 984-1339 • Fax (609) 984-0427

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

SHAWN M. LATOURETTE
Commissioner

September 20, 2022

Ryan Hasko
New Jersey Audubon Society
1024 Anderson Road
Port Murray, NJ 07865

Re: Frelinghuysen Forest Preserve FSP
Block(s) - 104 / 201
Lot(s) - 10 / 6, 8.06
Frelinghuysen Township, Warren County

Dear Mr. Hasko:

Thank you for your data request regarding rare species information for the above referenced project site.

Searches of the Natural Heritage Database and the Landscape Project (Version 3.3) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the map(s) submitted with the Natural Heritage Data Request Form into our GIS. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Landscape Project habitat mapping and the Biotics Database for occurrences of any rare wildlife species or wildlife habitat on the referenced site. The Natural Heritage Database was searched for occurrences of rare plant species or ecological communities that may be on the project site. Please refer to Table 1 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented on site. A detailed report is provided for each category coded as 'Yes' in Table 1.

We have also checked the Landscape Project habitat mapping and Biotics Database for occurrences of rare wildlife species or wildlife habitat in the immediate vicinity (within ¼ mile) of the referenced site. Additionally, the Natural Heritage Database was checked for occurrences of rare plant species or ecological communities within ¼ mile of the site. Please refer to Table 2 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented within the immediate vicinity of the site. Detailed reports are provided for all categories coded as 'Yes' in Table 2. These reports may include species that have also been documented on the project site.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. Please refer to Tables 1 and 2 (attached) to determine if any priority sites are located on or in the immediate vicinity of the site.

A list of rare plant species and ecological communities that have been documented from the county (or counties), referenced above, can be downloaded from https://nj.gov/dep/parksandforests/natural/heritage/database.html. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from https://nj.gov/dep/parksandforests/natural/docs/nhpcodes_2010.pdf.

Beginning May 9, 2017, the Natural Heritage Program reports for wildlife species will utilize data from Landscape Project Version 3.3. If you have questions concerning the wildlife records or wildlife species mentioned in this response, we

recommend that you visit the interactive web application at the following URL, https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=0e6a44098c524ed99bf739953cb4d4c7, or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292-9400.

For additional information regarding any Federally listed plant or animal species, please contact the U.S. Fish & Wildlife Service, New Jersey Field Office at http://www.fws.gov/northeast/njfieldoffice/endangered/consultation.html.

Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements (species and/or ecological communities) or their locations. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Robert J. Cartica
Administrator

c: NHP File No. 22-4107418-25792

Table 1: On Site Data Request Search Results (6 Possible Reports)

Report Name	Included	Number of Pages
1. Possibly on Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	No	0 pages included
2. Natural Heritage Priority Sites On Site	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.3	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Stream Habitat File	No	0 pages included
6. Other Animal Species On the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Amphibia								
	Blue-spotted Salamander	Ambystoma laterale	Occupied Habitat	4	NA	State Endangered	G5	S1
Aves								
	Barred Owl	Strix varia	Breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Wood Thrush	Hylocichla mustelina	Breeding Sighting	2	NA	Special Concern	G4	S3B,S4N
	Worm-eating Warbler	Helmitheros vermivorum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
Mammalia								
	Bobcat	Lynx rufus	Capture Location	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Live Individual Sighting	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	On Road	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Physical evidence	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Telemetry: Home Range	4	NA	State Endangered	G5	S2

Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.3

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Vernal habitat area	3068

Total number of records: 1

Table 2: Vicinity Data Request Search Results (6 possible reports)

Report Name	Included	Number of Pages
1. Immediate Vicinity of the Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	No	0 pages included
2. Natural Heritage Priority Sites within the Immediate Vicinity	No	0 pages included
3. Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches	Yes	2 page(s) included
4. Vernal Pool Habitat In the Immediate Vicinity of Project Site Based on Search of Landscape Project 3.3	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat In the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Stream Habitat File	No	0 pages included
6. Other Animal Species In the Immediate Vicinity of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Amphibia								
	Blue-spotted Salamander	Ambystoma laterale	Occupied Habitat	4	NA	State Endangered	G5	S1
	Longtail Salamander	Eurycea longicauda longicauda	Occupied Habitat	3	NA	State Threatened	G5T5	S2
Aves								
	American Kestrel	Falco sparverius	Breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	American Kestrel	Falco sparverius	Nest	3	NA	State Threatened	G5	S2B,S2N
	Barred Owl	Strix varia	Breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Barred Owl	Strix varia	Non-breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Bobolink	Dolichonyx oryzivorus	Breeding Sighting	3	NA	State Threatened	G5	S2B,S3N
	Eastern Meadowlark	Sturnella magna	Breeding Sighting	2	NA	Special Concern	G5	S3B,S3N
	Grasshopper Sparrow	Ammodramus savannarum	Breeding Sighting	3	NA	State Threatened	G5	S2B,S3N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Savannah Sparrow	Passerculus sandwichensis	Breeding Sighting	3	NA	State Threatened	G5	S2B,S4N
	Veery	Catharus fuscescens	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
	Wood Thrush	Hylocichla mustelina	Breeding Sighting	2	NA	Special Concern	G4	S3B,S4N

Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.3 Species Based Patches

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
	Worm-eating Warbler	Helmitheros vermivorum	Breeding Sighting	2	NA	Special Concern	G5	S3B,S4N
Mammalia								
	Bobcat	Lynx rufus	Capture Location	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Live Individual Sighting	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	On Road	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Physical evidence	4	NA	State Endangered	G5	S2
	Bobcat	Lynx rufus	Telemetry: Home Range	4	NA	State Endangered	G5	S2
Reptilia								
	Wood Turtle	Glyptemys insculpta	Occupied Habitat	3	NA	State Threatened	G3	S2

Vernal Pool Habitat
In the Immediate Vicinity of
Project Site Based on Search of
Landscape Project 3.3

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Vernal habitat area	3045
Vernal habitat area	3068

Total number of records: 2

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Warren County, New Jersey

Frelinghuysen Forest Preserve

October 14, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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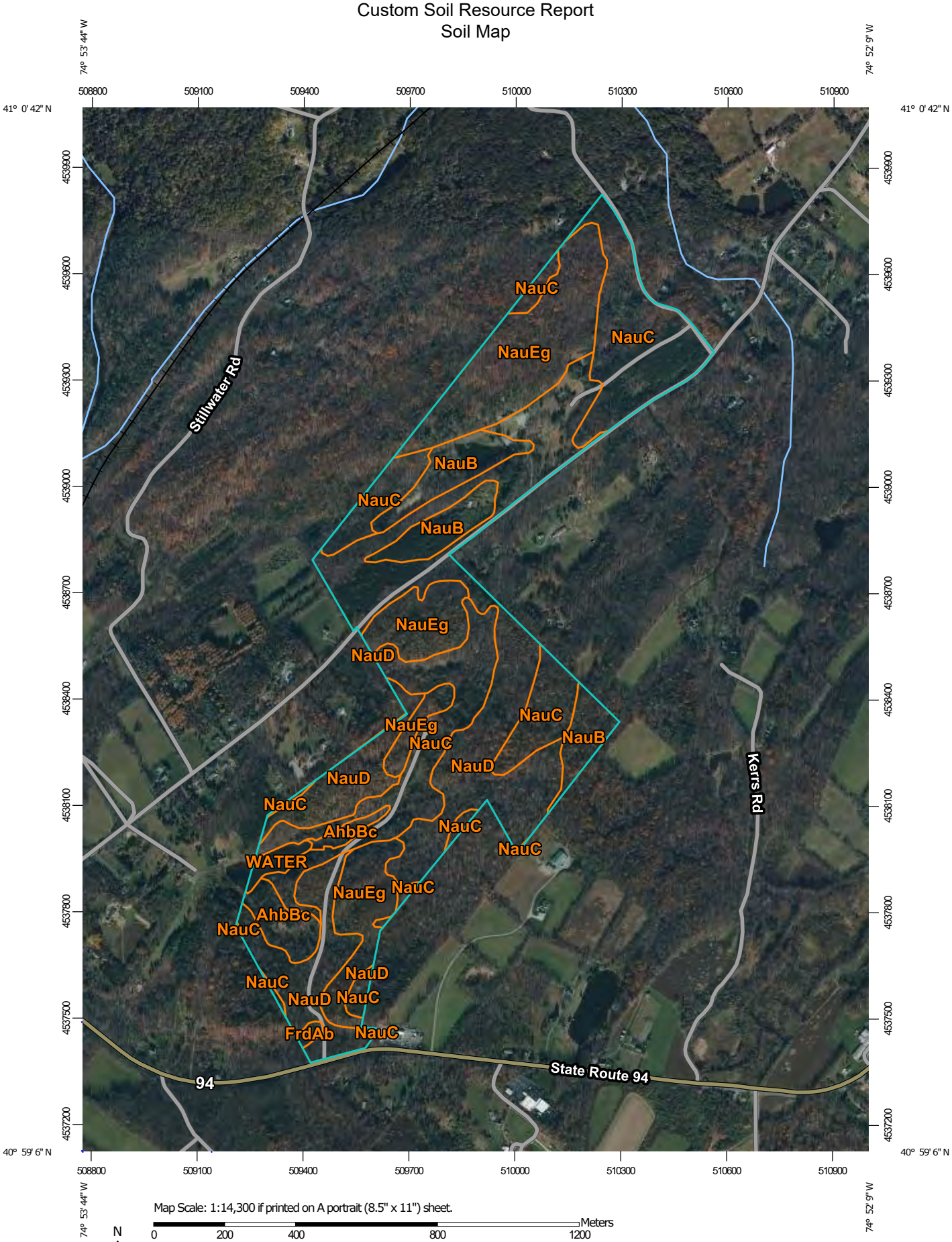
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:14,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Warren County, New Jersey
Survey Area Data: Version 17, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 5, 2019—Nov 8, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AhbBc	Alden silt loam, 0 to 8 percent slopes, extremely stony	8.6	3.1%
FrdAb	Fredon-Halsey complex, 0 to 3 percent slopes, very stony	0.8	0.3%
NauB	Nassau-Manlius very channery silt loams, 0 to 8 percent slopes, rocky	23.9	8.5%
NauC	Nassau-Manlius very channery silt loams, 8 to 15 percent slopes, rocky	80.8	29.0%
NauD	Nassau-Manlius very channery silt loams, 15 to 35 percent slopes, rocky	99.5	35.7%
NauEg	Nassau-Manlius very channery silt loams, 35 to 60 percent slopes, very rocky	62.9	22.5%
WATER	Water	2.5	0.9%
Totals for Area of Interest		**279.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Warren County, New Jersey

AhbBc—Alden silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 17j10
Elevation: 400 to 1,800 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Alden, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alden, Extremely Stony

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Silty colluvium derived from sandstone over fine-loamy till derived from sandstone

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: silt loam
Bg1 - 7 to 14 inches: silt loam
Bg2 - 14 to 28 inches: silty clay loam
Bg3 - 28 to 43 inches: loam
C - 43 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 5.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Chippewa, extremely stony

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

FrdAb—Fredon-Halsey complex, 0 to 3 percent slopes, very stony

Map Unit Setting

National map unit symbol: 17j1k
Elevation: 400 to 800 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Fredon, very stony, and similar soils: 50 percent
Halsey, very stony, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fredon, Very Stony

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse-loamy over sandy and gravelly glaciofluvial deposits derived from limestone, sandstone, and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 8 inches: silt loam
Bw1 - 8 to 14 inches: silt loam
Bw2 - 14 to 18 inches: loam
Bw3 - 18 to 23 inches: loam
2C1 - 23 to 31 inches: extremely gravelly loamy coarse sand
2C2 - 31 to 36 inches: extremely gravelly coarse sand
2C3 - 36 to 45 inches: very gravelly coarse sand
2C4 - 45 to 55 inches: extremely gravelly coarse sand
2C5 - 55 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent

Surface area covered with cobbles, stones or boulders: 1.0 percent
Depth to restrictive feature: 22 to 40 inches to strongly contrasting textural stratification
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: F144AY029NY - Semi-Rich Wet Outwash
Hydric soil rating: No

Description of Halsey, Very Stony

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse-loamy over sandy and gravelly glaciofluvial deposits derived from limestone, sandstone, and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A1 - 1 to 5 inches: silt loam
A2 - 5 to 11 inches: silt loam
Bg - 11 to 20 inches: silt loam
2Cg1 - 20 to 25 inches: loamy sand
2Cg2 - 25 to 35 inches: very gravelly coarse sand
2Cg3 - 35 to 49 inches: very gravelly coarse sand
2Cg4 - 49 to 56 inches: extremely gravelly coarse sand
2Cg5 - 56 to 60 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 1.0 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Very poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D

Ecological site: F144AY030NY - Semi-Rich Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Hero, very stony
Percent of map unit: 10 percent
Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

NauB—Nassau-Manlius very channery silt loams, 0 to 8 percent slopes, rocky

Map Unit Setting
National map unit symbol: 2wh28
Elevation: 360 to 1,570 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition
Nassau, very channery, and similar soils: 50 percent
Manlius, very channery, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau, Very Channery

Setting
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile
Ap - 0 to 7 inches: very channery silt loam
Bw - 7 to 13 inches: extremely channery silt loam
2R - 13 to 23 inches: bedrock

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: 6 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Manlius, Very Channery

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Ap - 0 to 9 inches: very channery silt loam
Bw - 9 to 20 inches: extremely channery silt loam
CB - 20 to 29 inches: extremely channery silt loam
2R - 29 to 39 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Dutchess

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, footslope, toeslope

Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Alden

Percent of map unit: 4 percent
Landform: Swales
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 1 percent
Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

NauC—Nassau-Manlius very channery silt loams, 8 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: 2wh29
Elevation: 290 to 1,540 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau, very channery, and similar soils: 50 percent
Manlius, very channery, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau, Very Channery

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Ap - 0 to 7 inches: very channery silt loam
Bw - 7 to 13 inches: extremely channery silt loam

2R - 13 to 23 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 6 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Manlius, Very Channery

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Ap - 0 to 9 inches: very channery silt loam
Bw - 9 to 20 inches: extremely channery silt loam
CB - 20 to 29 inches: extremely channery silt loam
2R - 29 to 39 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Dutchess

Percent of map unit: 9 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

NauD—Nassau-Manlius very channery silt loams, 15 to 35 percent slopes, rocky

Map Unit Setting

National map unit symbol: 2wh2b
Elevation: 290 to 1,550 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau, very channery, and similar soils: 50 percent
Manlius, very channery, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau, Very Channery

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Ap - 0 to 7 inches: very channery silt loam
Bw - 7 to 13 inches: extremely channery silt loam

2R - 13 to 23 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 6 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Manlius, Very Channery

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Ap - 0 to 9 inches: very channery silt loam
Bw - 9 to 20 inches: extremely channery silt loam
CB - 20 to 29 inches: extremely channery silt loam
2R - 29 to 39 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 20 to 39 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Dutchess

Percent of map unit: 9 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

NauEg—Nassau-Manlius very channery silt loams, 35 to 60 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2wh2d
Elevation: 290 to 1,550 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau, very channery, rocky, and similar soils: 50 percent
Manlius, very channery, rocky, and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau, Very Channery, Rocky

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 7 inches: very channery silt loam

Bw - 7 to 15 inches: extremely channery silt loam
2R - 15 to 25 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 9 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Manlius, Very Channery, Rocky

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Loamy skeletal till derived from acid shale

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: very channery silt loam
Bw - 3 to 17 inches: extremely channery silt loam
BC - 17 to 29 inches: extremely channery silt loam
2R - 29 to 39 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 20 to 39 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C

Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Dutchess
Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, base slope, crest
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Landform: Hills, ridges
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

WATER—Water

Map Unit Setting
National map unit symbol: b0ks
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Land Management

This folder contains a collection of tabular reports that present soil interpretations related to land management. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Land management interpretations are tools designed to guide the user in evaluating existing conditions in planning and predicting the soil response to various land management practices, for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture, and rangeland. Example interpretations include suitability for a variety of irrigation practices, log landings, haul roads and major skid trails, equipment operability, site preparation, suitability for hand and mechanical planting, potential erosion hazard associated with various practices, and ratings for fencing and waterline installation.

Hazard of Erosion and Suitability for Roads on Forestland

This table can help forestland owners or managers plan the use of soils for wood crops. Interpretive ratings are given for the soils according to the limitations that affect various aspects of forestland management. The ratings are both verbal and numerical.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified aspect of forestland management (1.00) and the point at which the soil feature is not a limitation (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils. More detailed information about the criteria used in the ratings is available in the **National Forestry Manual**, which is available in local offices of the Natural Resources Conservation Service or on the Internet.

Ratings in the column **hazard of off-road or off-trail erosion** are based on slope and on soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column **hazard of erosion on roads and trails** are based on the soil erosion factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance; and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column **suitability for roads (natural surface)** are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use. *Well suited* indicates that the soil has features that are favorable for the specified kind of roads and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified kind of roads. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified kind of roads. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National forestry manual.

Report—Hazard of Erosion and Suitability for Roads on Forestland

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Hazard of Erosion and Suitability for Roads on Forestland–Warren County, New Jersey							
Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhbBc—Alden silt loam, 0 to 8 percent slopes, extremely stony							
Alden, extremely stony	90	Not rated		Slight		Poorly suited	
						Ponding	1.00
						Wetness	1.00
						Rock fragments	0.50
						Low strength	0.50
						Dusty	0.02
FrdAb—Fredon-Halsey complex, 0 to 3 percent slopes, very stony							
Fredon, very stony	50	Not rated		Slight		Moderately suited	
						Wetness	0.50
						Low strength	0.50
						Dusty	0.02
Halsey, very stony	40	Not rated		Slight		Poorly suited	
						Ponding	1.00
						Wetness	1.00
						Low strength	0.50
						Dusty	0.02
NauB—Nassau-Manlius very channery silt loams, 0 to 8 percent slopes, rocky							
Nassau, very channery	50	Not rated		Slight		Well suited	
						Dusty	0.01
Manlius, very channery	40	Not rated		Slight		Well suited	
						Dusty	0.01

Hazard of Erosion and Suitability for Roads on Forestland–Warren County, New Jersey							
Map symbol and soil name	Pct. of map unit	Hazard of off-road or off-trail erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NauC—Nassau-Manlius very channery silt loams, 8 to 15 percent slopes, rocky							
Nassau, very channery	50	Not rated		Slight		Moderately suited	
						Slope	0.50
						Dusty	0.01
Manlius, very channery	40	Not rated		Slight		Moderately suited	
						Slope	0.50
						Dusty	0.01
NauD—Nassau-Manlius very channery silt loams, 15 to 35 percent slopes, rocky							
Nassau, very channery	50	Not rated		Slight		Poorly suited	
						Slope	1.00
						Dusty	0.01
Manlius, very channery	40	Not rated		Slight		Poorly suited	
						Slope	1.00
						Dusty	0.01
NauEg—Nassau-Manlius very channery silt loams, 35 to 60 percent slopes, very rocky							
Nassau, very channery, rocky	50	Not rated		Slight		Poorly suited	
						Slope	1.00
						Dusty	0.01
Manlius, very channery, rocky	45	Not rated		Slight		Poorly suited	
						Slope	1.00
						Dusty	0.01
WATER—Water							
Water	100	Not rated		Not rated		Not rated	

Vegetative Productivity

This folder contains a collection of tabular reports that present vegetative productivity data. The reports (tables) include all selected map units and components for each map unit. Vegetative productivity includes estimates of potential vegetative production for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture and rangeland. In the underlying database, some states maintain crop yield data by individual map unit component. Other states maintain the data at the map unit level. Attributes are included for both, although only one or the other is likely to contain data for any given geographic area. For other land uses, productivity data is shown only at the map unit component level. Examples include potential crop yields under irrigated and nonirrigated conditions, forest productivity, forest site index, and total rangeland production under of normal, favorable and unfavorable conditions.

Forestland Productivity

This table is designed to assist forestland owners or managers in planning the use of soils for wood crops. It provides the potential productivity of the soils for wood crops.

Potential productivity of merchantable or *common trees* on a soil is expressed as a site index and as a volume growth rate number. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. *Common trees* are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. More detailed information regarding site index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet.

The *Base Age* is the age of trees in years on which the site index is based. "TA" indicates total age. "BH" indicates breast height age. "N/A" indicates that base age is not applicable.

The *Site Index Curve Number* is listed in the National Register of Site Index Curves. It identifies the site index curve used to determine the site index.

The *Volume Growth Rate* is the maximum wood volume annual growth rate likely to be produced by the tree species. This number, expressed as cubic feet per acre per year, is calculated at the age of culmination of the mean annual increment (CMAI). It indicates the maximum volume of wood fiber produced per year in a fully stocked, even-aged, unmanaged stand.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National Forestry Manual.

Report—Forestland Productivity

Forestland Productivity–Warren County, New Jersey				
Map unit symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site Index	Volume of wood fiber	
			Cu ft/ac/yr	
AhbBc—Alden silt loam, 0 to 8 percent slopes, extremely stony				
Alden, extremely stony	Red maple	50	29.00	Eastern white cedar, White spruce
FrdAb—Fredon-Halsey complex, 0 to 3 percent slopes, very stony				
Fredon, very stony	Eastern white pine	70	129.00	Eastern white pine, Norway spruce, Tuliptree, White spruce
	Northern red oak	60	43.00	
	Red maple	70	43.00	
	Tuliptree	80	72.00	
Halsey, very stony	Red maple	55	29.00	Eastern white pine, White spruce
NauB—Nassau-Manlius very channery silt loams, 0 to 8 percent slopes, rocky				
Nassau, very channery	—	—	—	—
Manlius, very channery	—	—	—	—
NauC—Nassau-Manlius very channery silt loams, 8 to 15 percent slopes, rocky				
Nassau, very channery	—	—	—	—
Manlius, very channery	—	—	—	—
NauD—Nassau-Manlius very channery silt loams, 15 to 35 percent slopes, rocky				
Nassau, very channery	—	—	—	—
Manlius, very channery	—	—	—	—
NauEg—Nassau-Manlius very channery silt loams, 35 to 60 percent slopes, very rocky				
Nassau, very channery, rocky	—	—	—	—
Manlius, very channery, rocky	—	—	—	—
WATER—Water				
Water	—	—	—	—