

FOREST MANAGEMENT PLAN

for the

Rye Town Forest

Rye, New Hampshire

222.2± acres



Prepared for Landowner:

The Town of Rye, NH (c/o Rye Conservation Commission)
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Prepared by:

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A handwritten signature in black ink, appearing to read 'Charles Moreno'.

Landowner

Date: August 2020

Charles Moreno, NH LPF #115
Consulting Forester
TSP #09-6203



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Above: White pine advance regeneration thrives beneath a mature pine canopy.

Cover: A stone wall traverses a section of salt marsh.

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The author of this forest management plan, Charles A. Moreno, NH LPF #115, certifies that the contents of the plan, except where footnoted, but including all written material, maps (base information referenced), plan format and organization, are original to the author.

The purpose of this plan is to provide natural resources information and forest management recommendations to the Rye Conservation Commission, citizens of Rye, as well as the 3rd party (e.g. Rockingham County Conservation District (RCCD) and their agents, if applicable. This document is a work for hire done by Charles A. Moreno for the Town of Rye, and may be used by same for any purpose. Copying of this plan by other individuals or organizations, including any written material, plan content and/or format, requires appropriate citation and/or the written permission of Charles A. Moreno, Consulting Forester. Any revisions to the plan cannot be made under the author's name without the author's written permission.



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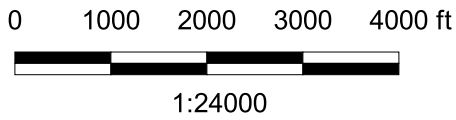
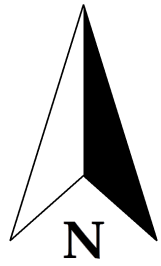


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MAPS

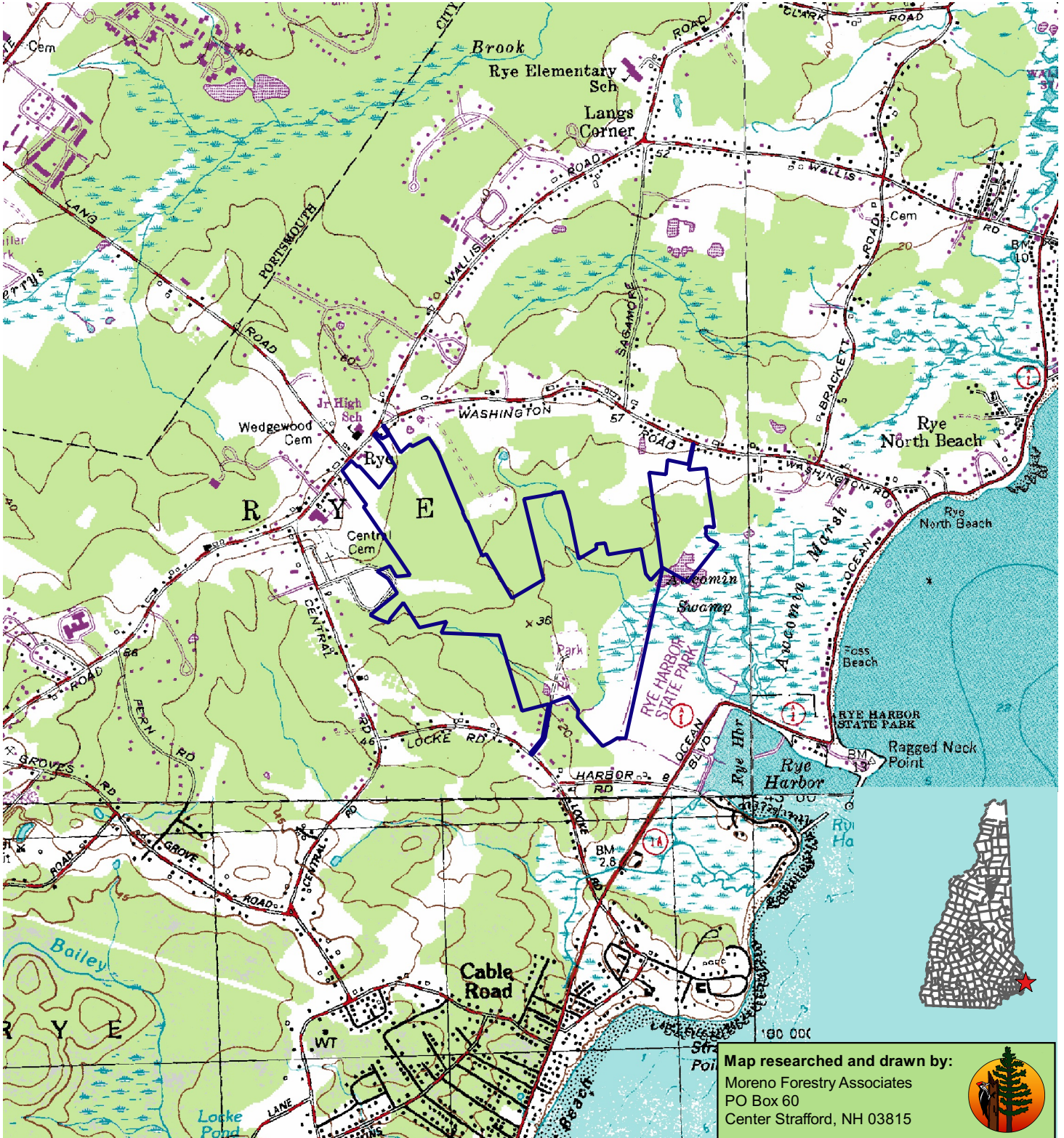




Locus Map of the RYE TOWN FOREST

Rye, New Hampshire
222.2± Acres

Parcel boundary information and USGS Topographic
1:24,000 dataset provided by NH GRANIT and the
Town of Rye. Map drawn March 2019.



Map researched and drawn by:
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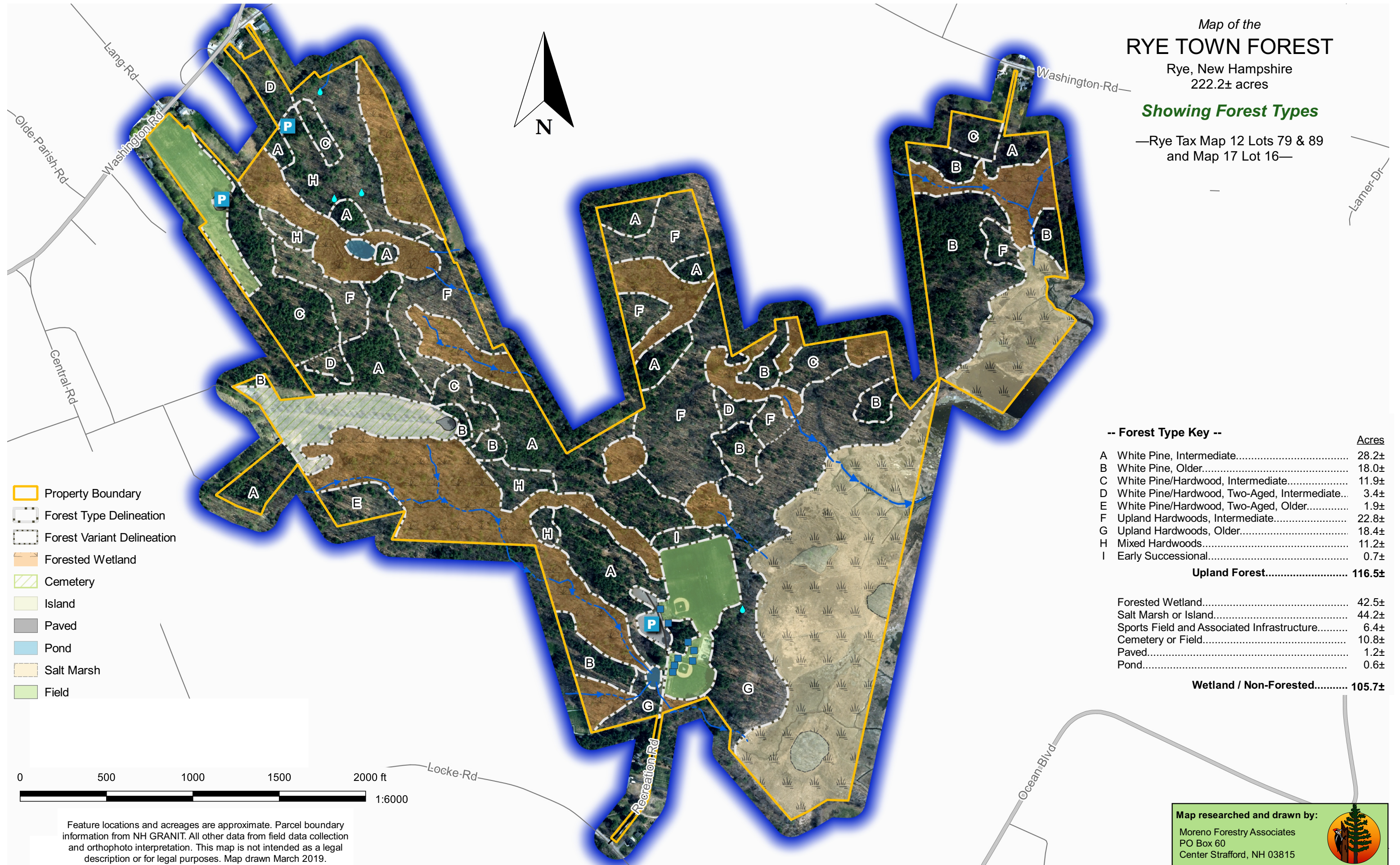


Map of the RYE TOWN FOREST

Rye, New Hampshire
222.2± acres

Showing Forest Types

—Rye Tax Map 12 Lots 79 & 89
and Map 17 Lot 16—



-- Forest Type Key --

	Acres
A White Pine, Intermediate.....	28.2±
B White Pine, Older.....	18.0±
C White Pine/Hardwood, Intermediate.....	11.9±
D White Pine/Hardwood, Two-Aged, Intermediate...	3.4±
E White Pine/Hardwood, Two-Aged, Older.....	1.9±
F Upland Hardwoods, Intermediate.....	22.8±
G Upland Hardwoods, Older.....	18.4±
H Mixed Hardwoods.....	11.2±
I Early Successional.....	0.7±

Upland Forest..... 116.5±

Forested Wetland.....	42.5±
Salt Marsh or Island.....	44.2±
Sports Field and Associated Infrastructure.....	6.4±
Cemetery or Field.....	10.8±
Paved.....	1.2±
Pond.....	0.6±

Wetland / Non-Forested..... 105.7±

- Property Boundary
- Forest Type Delineation
- Forest Variant Delineation
- Forested Wetland
- Cemetery
- Island
- Paved
- Pond
- Salt Marsh
- Field

0 500 1000 1500 2000 ft
1:6000

Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes. Map drawn March 2019.

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Map of the RYE TOWN FOREST

Rye, New Hampshire
222.2± acres

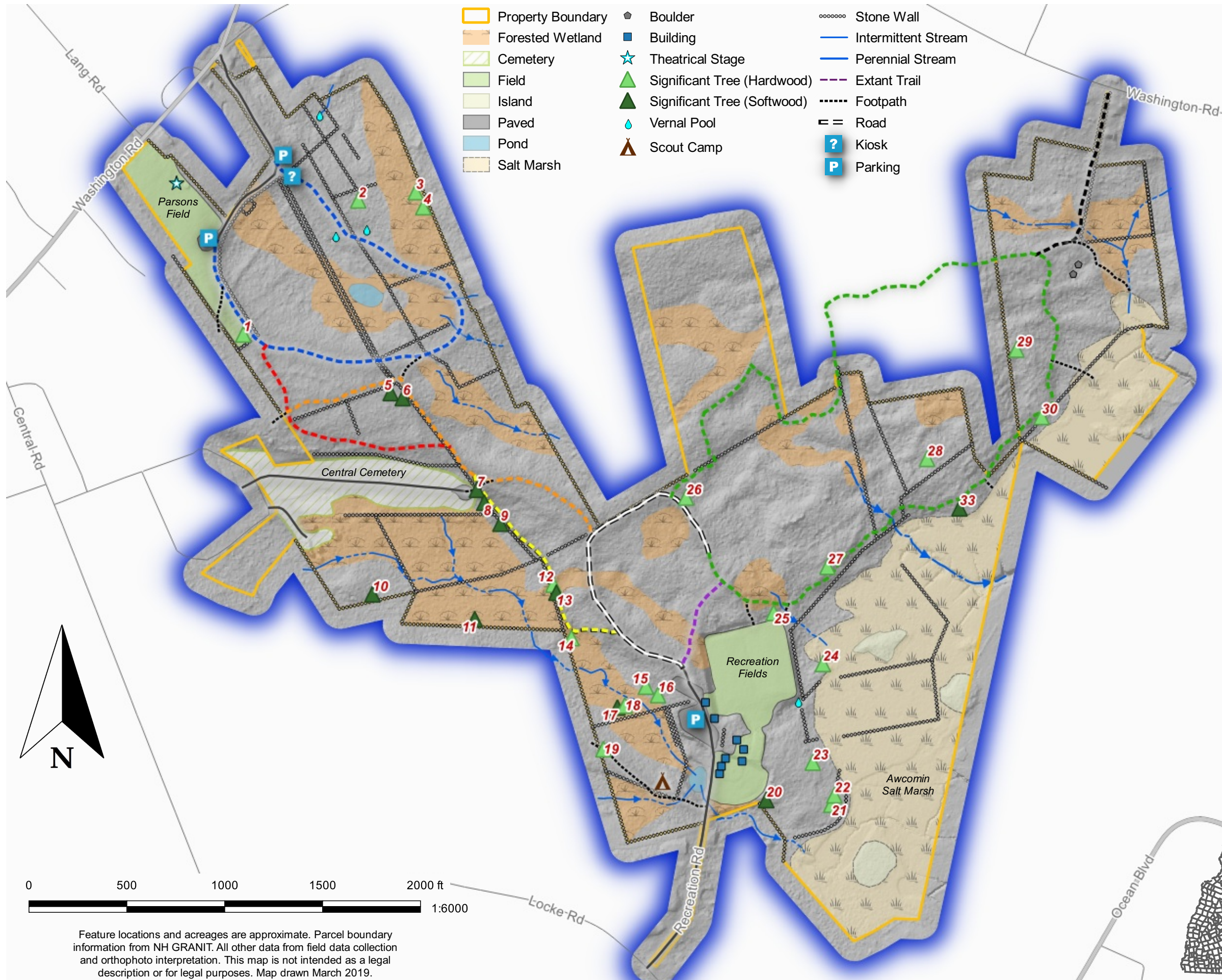
Showing Physical & Natural Features

—Rye Tax Map 12 Lots 61, 79, 80, 89 & 90 and Map 17 Lot 16—

- | | | |
|-------------------|-----------------------------|---------------------|
| Property Boundary | Boulder | Stone Wall |
| Forested Wetland | Building | Intermittent Stream |
| Cemetery | Theatrical Stage | Perennial Stream |
| Field | Significant Tree (Hardwood) | Extant Trail |
| Island | Significant Tree (Softwood) | Footpath |
| Paved | Vernal Pool | Road |
| Pond | Scout Camp | Kiosk |
| Salt Marsh | | Parking |

Significant Tree Index

1. Red oak, 29±" DBH, stunted (field grown)
2. Sugar maple, 32"
3. Black birch, 24"
4. Red oak, 28"
5. White pines, 35" and 31"
6. White pine, 38", on wall
7. White pine, 32", on wall
8. White pine, 36", on wall
9. White pine, 45+", "bull pine"
10. Stand of 10-12 white pines, 20-25", clean boles
11. White pine, 34"
12. Red oak, double, 36"
13. White pine, 32"
14. Yellow birch, 24"
15. Red maple, 25", broken top
16. Red maple, 32"
17. White pine, 36", on wall
18. Red oak, 40+", on wall
19. Red oak, 32", boundary tree
20. White pine, 40+", "pasture pine"
21. Red oak, 24", "stumpy" growth
22. Red oak, 36"
23. Red oak, 38", large crown
24. White oak, 34"
25. Red oak, 40"
26. Three red oaks, 25±"
27. Red oak, 27"
28. Red oak, 36", on wall, leaning 50-55°
29. Red oaks, 36" and 30", and red maples, 22" and 22"
30. Four red oaks, 28-36", along shore



Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes. Map drawn March 2019.

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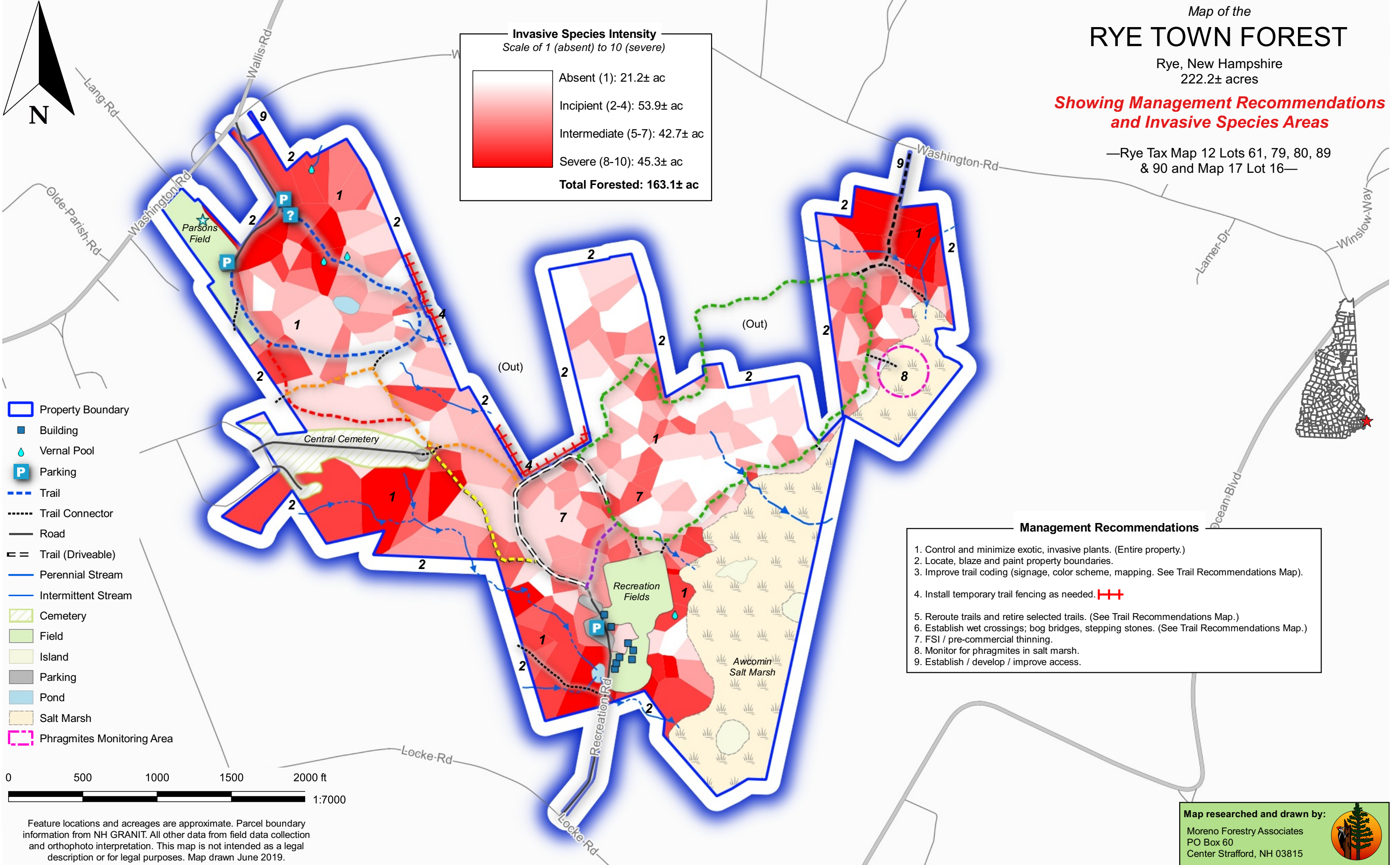
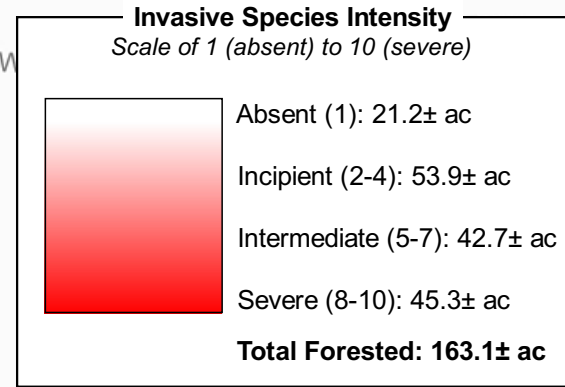


Map of the RYE TOWN FOREST

Rye, New Hampshire
222.2± acres

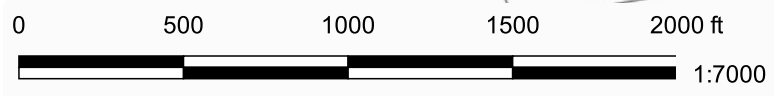
**Showing Management Recommendations
and Invasive Species Areas**

—Rye Tax Map 12 Lots 61, 79, 80, 89
& 90 and Map 17 Lot 16—



- Property Boundary
- Building
- Vernal Pool
- Parking
- Trail
- Trail Connector
- Road
- Trail (Driveable)
- Perennial Stream
- Intermittent Stream
- Cemetery
- Field
- Island
- Parking
- Pond
- Salt Marsh
- Phragmites Monitoring Area

- Management Recommendations**
1. Control and minimize exotic, invasive plants. (Entire property.)
 2. Locate, blaze and paint property boundaries.
 3. Improve trail coding (signage, color scheme, mapping. See Trail Recommendations Map.)
 4. Install temporary trail fencing as needed.
 5. Reroute trails and retire selected trails. (See Trail Recommendations Map.)
 6. Establish wet crossings; bog bridges, stepping stones. (See Trail Recommendations Map.)
 7. FSI / pre-commercial thinning.
 8. Monitor for phragmites in salt marsh.
 9. Establish / develop / improve access.



Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes. Map drawn June 2019.

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Map of the RYE TOWN FOREST

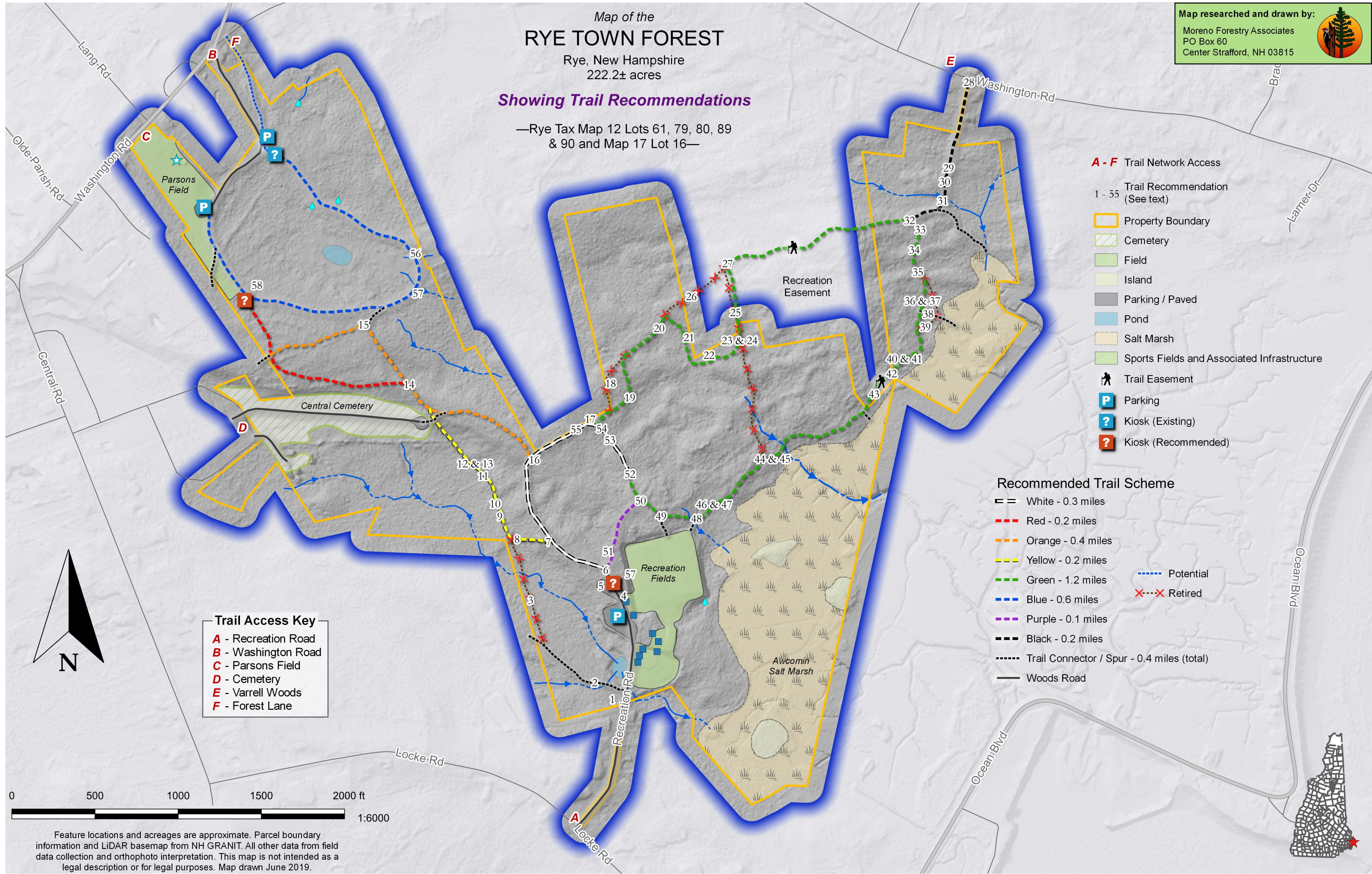
Rye, New Hampshire
222.2± acres

Showing Trail Recommendations

—Rye Tax Map 12 Lots 61, 79, 80, 89 & 90 and Map 17 Lot 16—

Map researched and drawn by:

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- A - F** Trail Network Access
- 1 - 55 Trail Recommendation (See text)
- Property Boundary
- Cemetery
- Field
- Island
- Parking / Paved
- Pond
- Salt Marsh
- Sports Fields and Associated Infrastructure
- Trail Easement
- Parking
- Kiosk (Existing)
- Kiosk (Recommended)

Recommended Trail Scheme

- White - 0.3 miles
- Red - 0.2 miles
- Orange - 0.4 miles
- Yellow - 0.2 miles
- Green - 1.2 miles
- Blue - 0.6 miles
- Purple - 0.1 miles
- Black - 0.2 miles
- Trail Connector / Spur - 0.4 miles (total)
- Woods Road
- Potential
- Retired

- #### Trail Access Key
- A** - Recreation Road
 - B** - Washington Road
 - C** - Parsons Field
 - D** - Cemetery
 - E** - Varrell Woods
 - F** - Forest Lane



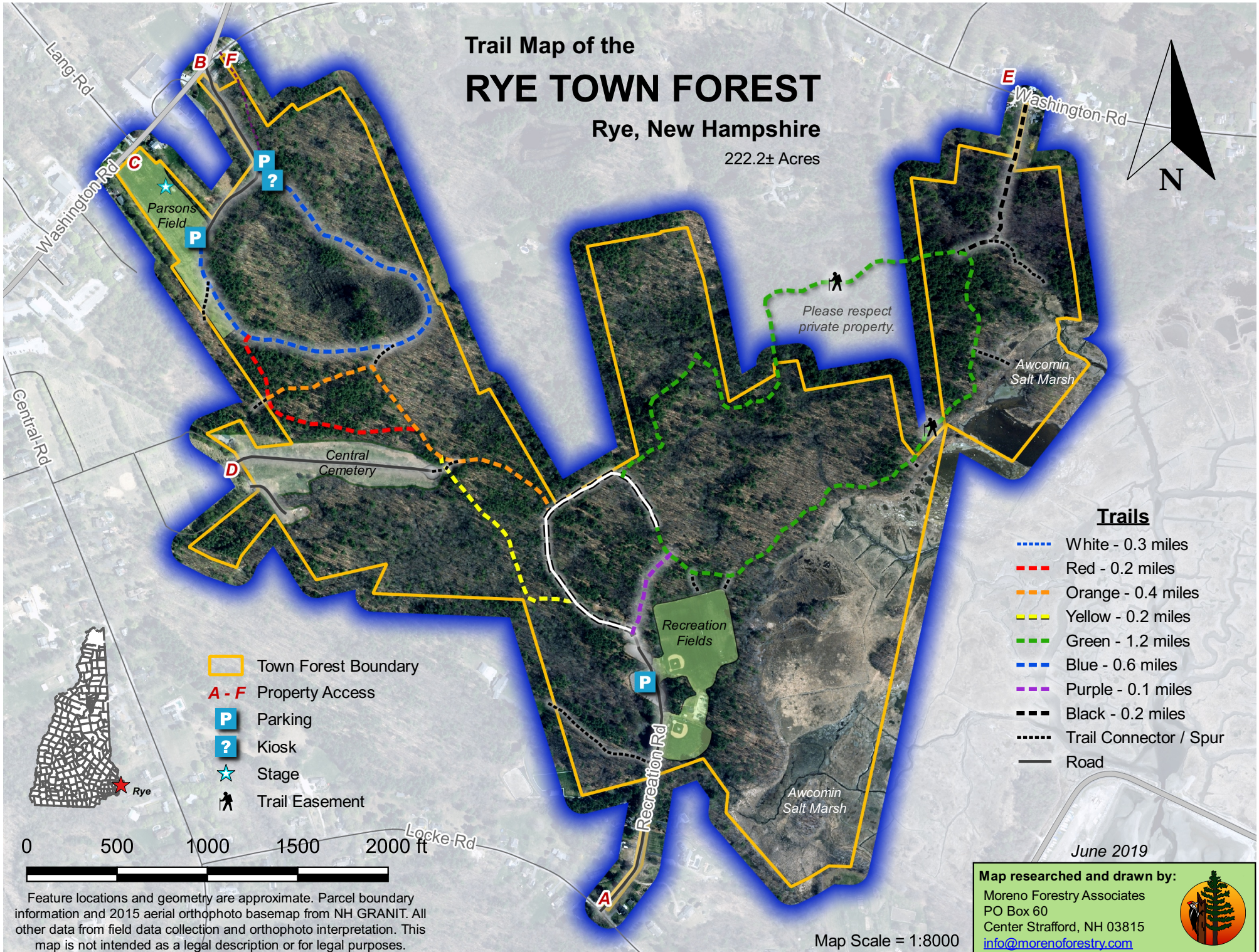
Feature locations and acreages are approximate. Parcel boundary information and LiDAR basemap from NH GRANIT. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes. Map drawn June 2019.



Trail Map of the RYE TOWN FOREST

Rye, New Hampshire

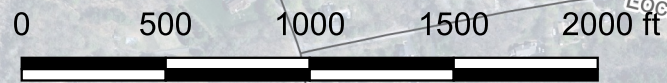
222.2± Acres



Trails

- - - White - 0.3 miles
- - - Red - 0.2 miles
- - - Orange - 0.4 miles
- - - Yellow - 0.2 miles
- - - Green - 1.2 miles
- - - Blue - 0.6 miles
- - - Purple - 0.1 miles
- - - Black - 0.2 miles
- - - - Trail Connector / Spur
- Road

- Town Forest Boundary
- A - F Property Access
- P Parking
- ? Kiosk
- ★ Stage
- 🚶 Trail Easement



Feature locations and geometry are approximate. Parcel boundary information and 2015 aerial orthophoto basemap from NH GRANIT. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes.

Map Scale = 1:8000

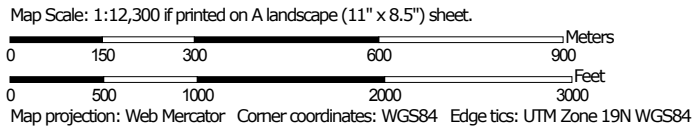
Map researched and drawn by:
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June 2019

Soil Map—Rockingham County, New Hampshire
(Rye Town Forest Soils Map)



Soil Map may not be valid at this scale.



INTRODUCTION



Rye Town Forest Rye, NH

INTRODUCTION

Located in the coastal community of Rye, New Hampshire, the Rye Town Forest comprises over 200 acres of forest, field and salt marsh. This remarkable property features extensive forest, a network of public trails, recreational facilities, scenic views and access to Awcomin Marsh, which has several exemplary salt marsh communities.

Owned by the Town of Rye, the forestland is managed by the Rye Conservation Commission. A conservation easement permanently protects the Town Forest from development; the easement is held and monitored by Rockingham County Conservation District (RCCD). As

development fragments New Hampshire's seacoast, expanses of forests, fields, and wetlands play an increasingly prominent role in protecting water resources and providing wildlife habitat and space for recreation.

This management plan provides a guide for the management and protection of the Rye Town Forest's natural and cultural resources. Forest management, recreation planning, and ecological health are addressed.



A scenic view of the Awcomin Marsh in the property's northeast.

PROPERTY INFORMATION

Location and Geography

The Rye Town Forest is located in Rye, New Hampshire, close to the town center. Various sections of the property are accessible from Washington Road, Recreation Road, and Central Road (via the Rye Cemetery). Parking is available at several entry points.

On a landscape level, the Rye Town Forest is situated within a mile of the Atlantic Ocean, lying within the Awcomin Marsh and Rye Harbor watershed. The area is part of the Gulf of Maine Coastal Lowland





Bog bridges are commonly seen on the Rye Town Forest trails.

ecoregion subsection¹. The sea moderates local climate, allowing the northerly extension of the Appalachian oak-pine forest type. Thus, the property hosts southerly species such as white oak, shagbark hickory, black gum, and greenbrier.

The property's soils are generally formed from deep glacial tills, with a relatively small area of glacial outwash (see *Soils Map*, page 11, and *Soil Resources*, page 37). Stony terrain covers much of the property, though bedrock is not generally near the surface. Topography is typically level or mildly sloping. The lowest elevation on the property is just a few feet above sea level in the southern salt marsh, while the highest point, in the central region of the Town Forest, is 36 feet above sea level.

Reference Information

Deeds: Deed and Tax Map Information:

Rockingham County Registry of Deeds				
Book	Page	Date	Map-Lot	Acreage (Approx.)
2340	686	5/14/1979	12-79	178.9
2738	1452	5/5/1988	12-61	2.0
4739	109	11/22/2006	12-80	14.3
3181	2208	10/8/1996	16-170	20.5
n/a			12-90	1.8
3226	1265	12/4/1996	12-89	4.7

Surveys:

- Abutting property. "Subdivision of Land, Rye, New Hampshire – for Parsons Park Corp" by Durgin Associates, Inc. November 16 1978 (RCRD D-8514).

Conservation Easements:

- RCRD Book 3539 Page 0314, January 2001. Easement of 176 acres is held by the Rockingham County Conservation District.

¹ Keys, J.E. and C.A. Carpenter. 1995. Ecological Units of the Eastern United States: First Approximation. U.S. Department of Agriculture, Forest Service.



- RCRD Book 5327 Page 0477, June 2012. Trail easement across the abutting Connell Property (also conserved) is held by the Town of Rye.

Acreage

TOTAL: 222.2± acres

CURRENT CONDITIONS:

- Forest – 116.5± acres
- Forested wetland – 42.5± acres
- Salt marsh & islands – 44.2± acres
- Sports fields – 6.4± acres
- Cemetery – 6.4± acres
- Field – 4.4± acres
- Parking/paved – 1.2± acres
- Ponds – 0.6± acres



Interesting root structures are frequently found where forest meets marsh.

Property Features

The Rye Town Forest encompasses more than forest. It includes: Parsons Field, a much-enjoyed community gathering location for summer concerts and other events; The Rye Recreation Area, which contains two baseball diamonds and a soccer field; A Scout campsite, though unused of late, but still possible to restore; and, of course, the extensive and exemplary salt marsh lands. It is important to note that the Town cemetery, though not part of the Town Forest acreage, slices well into the property, and is used as an access point.

The Town Forest is identified as six parcels on the town tax maps. The town does not separate the recreational areas or salt marsh from the forest, therefore, the total area of 222.2± acres is all-encompassing, as are all the maps in this plan.

The actual wooded acreage, including forested wetlands, is 159± acres.



MANAGEMENT OBJECTIVES & RECOMMENDATIONS



LANDOWNER MANAGEMENT OBJECTIVES

Management objectives for the Rye Town Forest are based on recreation management and conservation interests that the Rye Conservation Commission has articulated, coupled with this study's natural resource findings. Management recommendations focus on the following objectives:

- **Managing the Town Forest's trail network.**
 - **Improving trail coding: signage, color scheme, mapping.**
 - **Minimizing ground and stream disturbance.**
 - **Minimizing trail use conflicts.**
- **Controlling/minimizing exotic, invasive plants.**
- **Managing for forest health, resilience, and biodiversity:**
 - **Minimizing the deleterious effects of exotic plants, insects and disease;**
 - **Encouraging structural complexity—fostering a mixed-age forest;**
 - **Encouraging biodiversity (native flora and fauna), including a diverse tree species mix. Controlling late-successional species dominance.**
 - **Maintaining forest value through sustainable management.**
- **Managing wildlife habitat.**
- **Preserving scenic values—forest, field, and marsh shoreline.**
- **Infrastructure upkeep: Trails, wood roads, gates, culverts, property lines.**



A forested section abutting Awcomin salt marsh.



SUMMARY RECOMMENDATIONS

2020 - 2021

- 1) Trails: Complete north-central trail relocation via Connell parcel.**
- 2) Trails: Retire selected trails—block with brush, if needed.**
- 3) Trails: Establish wet-site crossings: Bog bridges, steppingstones.**
- 4) Trails: Re-paint blazes on all trails using the updated color scheme.**
- 5) Trails: Install appropriate signage at trail junctions.**
- 6) Invasive plant control – heavily invaded small “islands”.**
- 7) Invasive plant control in entrance areas.**
- 8) Invasive plant control – lightly invaded areas.**
- 9) Install kiosk at recreation area entrance to the Rye Town Forest.**

2022 - 2023

- 1) Locate, blaze and paint property bounds (6600± feet)**
- 2) Invasive control – Light to moderately invaded areas.**
- 3) Invasive control – Follow-up in previously treated areas.**
- 4) Re-establish Access Point F, with connector link to the blue trail kiosk.**

2024 - 2026

- 1) Forest Stand Improvement (FSI) – Regeneration release (naturally seeded young growth).**
- 2) Culvert replacement and stone ford installation.**
- 3) Beautification of Washington Road entrance.**
- 4) Invasive control – Moderate to severely invaded areas.**
- 5) Invasive control – Follow-up in previously treated areas.**

2026 - 2030

- 1) Forest Stand Improvement (FSI) – Natural regeneration establishment and release. Forest thinning/habitat management.**
- 2) Invasive control – Moderate to severely invaded areas.**
- 3) Invasive control – Follow-up in all previously treated areas.**

Annual:

- 1) Invasive plant control.**
- 2) Update invasive control strategy/map.**
- 3) Trail maintenance: Clear fallen trees, re-paint blazes, signage.**



PROJECT SUMMARY / SCHEDULING

Year	Season	Whom			Activity
2020-21	Spring - Summer - Fall				Connell trail reroute—layout, clearing.
					Retire selected trails.
					Install bog bridges and steppingstones.
					Invasive plant control.
					Install kiosk.
					Color blaze the trails.
					Install signage.
2022-23	Winter- Spring				Blaze property lines.
	Spring-Summer-Fall				Invasive plant control.
					Clear Access F and connector trail.
2024-25	Spring-Summer-Fall				Invasive plant control.
	Summer-Fall-Winter				Forest Stand Improvement.
	Summer-Fall				Washington Road entrance enhancements.
2026-30	Spring-Summer-Fall				Invasive plant control.
	Summer-Fall-Winter				Forest Stand Improvement.
Annual					Update invasive control maps.
					Trail maintenance.

KEY	
	Rye Conservation Commission (RCC)
	RCC and Volunteers
	Forester
	RCCD
	Other Contractor
	AMC



MANAGEMENT CONSIDERATIONS & RECOMMENDATIONS

RECREATIONAL TRAILS

The Rye Town Forest’s trail network—collectively traversing approximately 4 miles—are a highly popular, public recreation venue. In order to manage the trail system, three subject areas covering contemporary trail issues were studied:

- Improving trail user experience,
- Methods to minimize impacts to the forest environment from increasingly heavy trail use, and
- Mitigating conflicts that public trail usage creates with neighboring private properties.

Discussion and recommendations follow for each.



Drainage devices help keep trails dry. This culvert is partially exposed however.

Improving User Experience

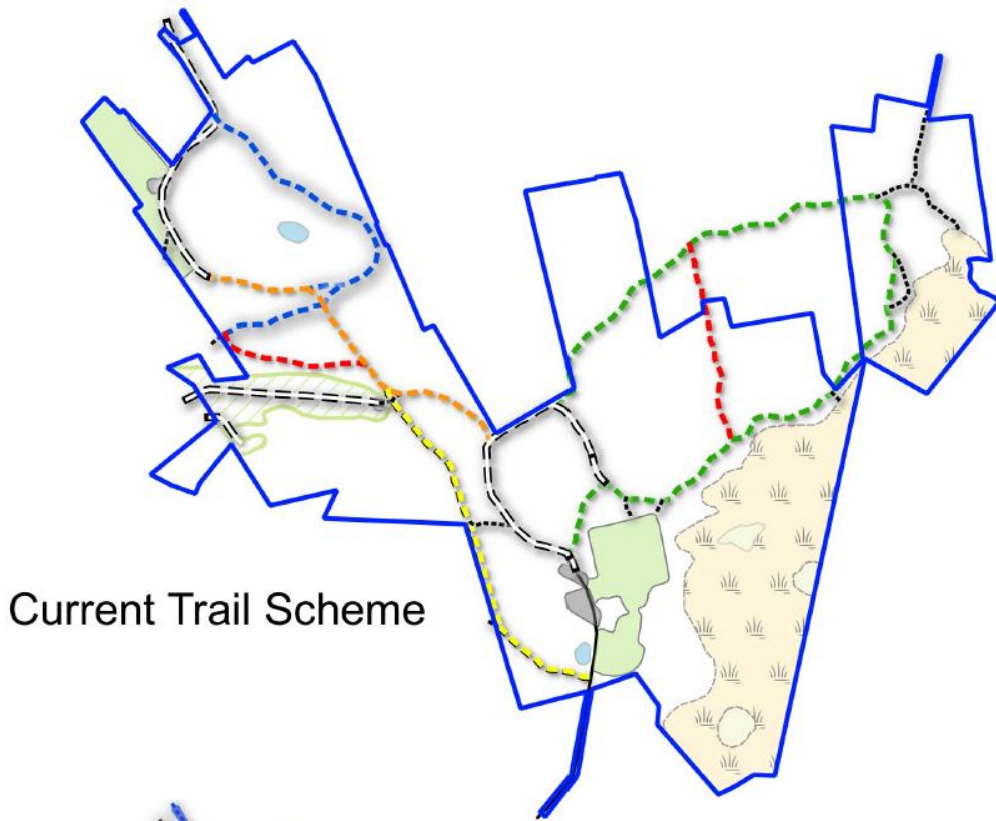
Issues include ambiguous trail coding, incomplete signage, and limited mapping. Additionally, certain upgrades are recommended for the property’s six official access points. Improvements in these areas will enhance user experience, especially for persons less familiar with the trails. There is also a safety component—improved trail coding expedites locating a person.

Trail Coding

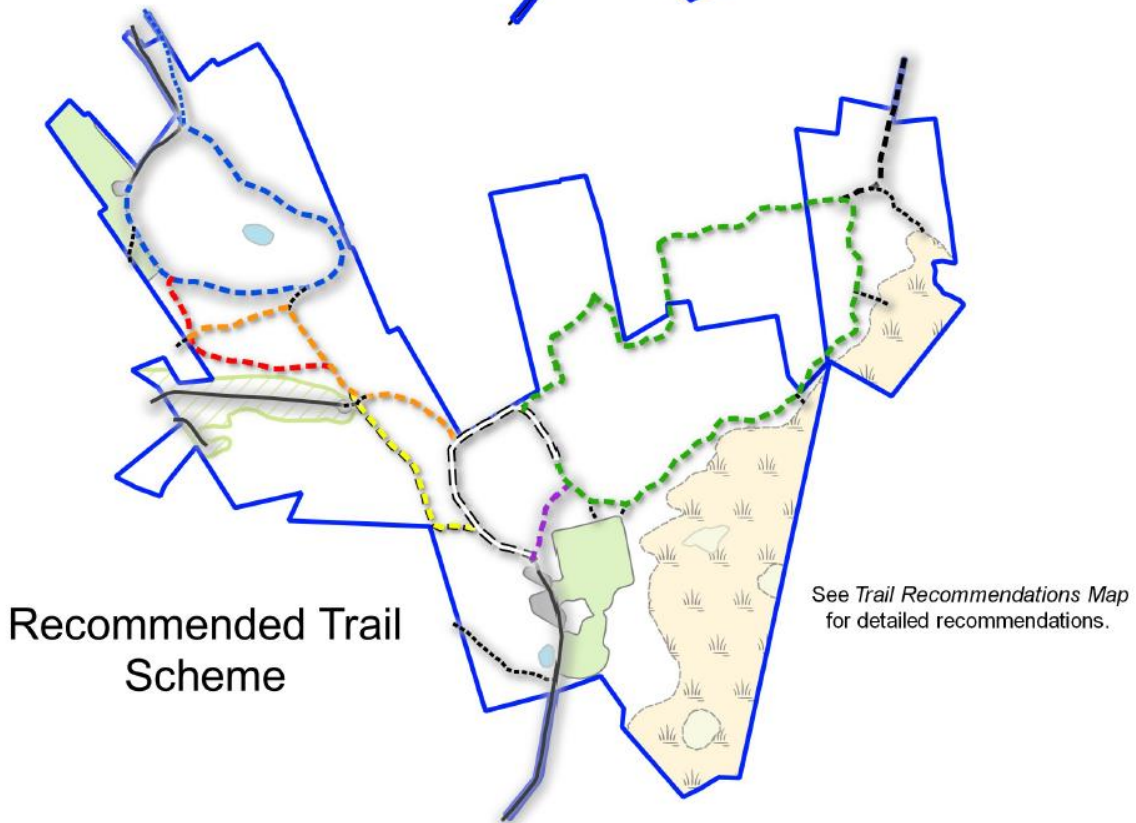
There are generally two components to **trail coding**. First, assigning a specific color to each trail. Secondly, trails can be named; naming, though optional, provides an additional, sometimes preferable, designation. It is essential that precise, continuous trail segments be identified by one color and name, and that the same (or similar) color, or name, is not used anywhere else on the property.

The maps below show the existing and proposed color schemes:





Current Trail Scheme

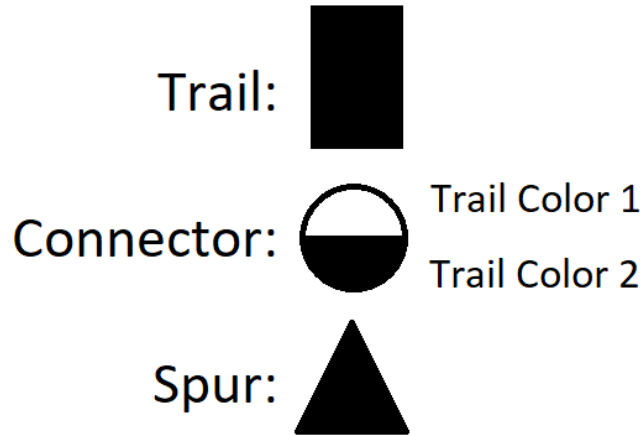


Recommended Trail Scheme

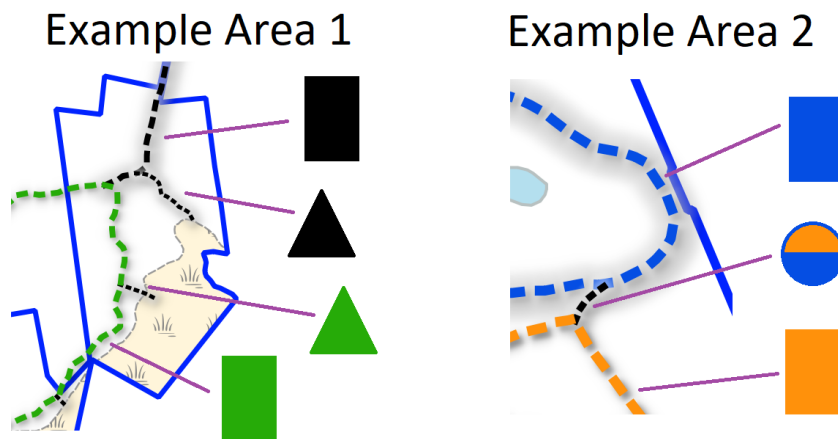
See Trail Recommendations Map for detailed recommendations.



Currently, different trails use the same color. At least one trail is designated with more than one color. The proposed scheme assigns distinct colors—primary or secondary colors—to the main trails. Trail connectors use the two colors of the adjoining trails as in the diagram below.



A shade of a primary color (use the color of the adjoining main trail), may be applied to the few trail spurs which dead end on the salt marsh or an abutting property. For spurs, it is recommended to use the adjoining trail’s primary color in a differently shaped blaze, such as a triangle, as depicted above. Examples of how this scheme may look are illustrated below:



Roads that are travelled by cars are not color coded, though the interior forest road—which serves as a core trail—may be assigned white (a color that has not been used).

We suggest painting the colored blazes directly on the bark of trees along the trails, using weather-resistant, brush-on paint. Repainting—an easy endeavor—is needed every 5± years. The use of metal color tags is popular, but not recommended because nails or screws are used to secure the tags. Even if space is left between the nail or screw head and the tree trunk, continued maintenance is required to reset the nails or screws. If maintenance lapses, the trees grow over the tags. Buried metal in trees is not advisable.



Trail Signage

Trail signs were added, several years back, to intersections in the western part of the forest as part of an Eagle Scout project. While some existing signs are accurate, others are ambiguous, with need for reorientation or updated coloration. New signs are needed for the eastern half of the property. After implementing the revised color scheme for the trails through blazing, it is recommended that color-coordinated signage be introduced, comprehensively and appropriately oriented at the trail junctions. If trails are to be named, new signage is needed over the entire property, with trail names and corresponding colors. Specific recommendations for improving existing trail signage are found in the list in the “Minimizing Forest Impacts” section below, with matching locations on the **Trail Recommendations Map** (page 9).

A second purpose of signage is for notification(s). This form of signage is recommended for the trail easement through the Connell parcel (at both ends of the easement), entreating visitors to respect private property. Similar signage is essential, and has already been posted, along other abutting properties where trails approach the boundaries.

Trail Mapping

This forest management plan contains precise, GIS mapping of the property, including the trails. The **Trails Map** (page 10) is superimposed on an aerial photo but can also use LiDAR or topographic background. The map may be enlarged to poster size, and then laminated and displayed at the trailhead kiosks. For remote locations, smaller maps may be posted at trail intersections with a “you are here” symbol. These trail maps can also be made available on the town website to download for printing and/or uploading to a mobile device.

Access Points

With reference to the **Trails Map** (page 10), The Rye Town Forest has two major access points—Recreation Road (A) and the gravel road to Parsons Field off Washington Road (B). Both provide ample parking.

A few improvements are recommended for the main Town Forest entrance (A) off Recreation Road. These include the installation of an informational kiosk at the edge of the parking lot where the woods road enters the forest. Other recommendations include posting a GIS trail map in the kiosk, and invasive plant removal along the edge of the parking areas.

The Washington Road entrance (B) follows a narrow town-owned strip into Parsons Field. The west side of the road is covered by an impenetrable tangle of invasive plants. This unappealing thicket obscures the property boundary; consequently, there may be incursions over the line by an abutter. A potential solution is to create an attractive park entrance and define the property line as follows: a) First, remove the invasive thicket using a vegetation grinder/mulcher mounted on a skid steer. The abutter would have to agree to this treatment, since the property line is not recognizable and the thicket overlaps the bound; b) Secondly, the property line would be laid out (the corners are already monumented) and demarcated, perhaps using a simple wooden rail fence, for example; c) Finally, the invasive plant re-sprout would be treated by periodic bush-hogging and, eventually, mowing. An initial, single herbicide treatment may be needed.



The gravel road for entrance (B), Washington Road, leads to a parking area on the back edge of Parsons Field. A kiosk is located at the blue trailhead halfway up the road, where parking for 2 or 3 cars is also available. Though not ideal, cars and walkers sometimes share a short segment of the gravel road (between the current ends of the blue trail). If significant conflict arises, the secondary parking area may be expanded, or the blue trail can be rerouted through the forest parallel to the gravel road.

A third kiosk, where trail information and mapping can be posted, is planned for the southern end of Parsons Field where the blue trail enters the forest.

The four other property access points have lesser usage due to limited parking and primarily provide pedestrian access to adjoining neighborhoods.

Access point (C), Parsons Field, allows direct access into Parsons Field from Washington Road. This is a well-established pedestrian entrance, and no further improvements are identified (though the third kiosk may be located off the parking lot, somewhat closer to this entrance).

Nearby access point (F) is not presently developed, however there is interest in clearing a pathway through this narrow lane which is presently obscured by invasives. The pathway would then link to the existing blue trail entrance. Though close to road entrance (B), this new entry point circumvents the Parsons Field Road, thus separating pedestrians from cars and allowing walkers to avoid a long, dusty walk. It is likely that the town would post a sign identifying this as Town Forest access, in addition to vegetation clearing and coding the trail (blue blazes).

Entry point (D), Town Cemetery, is limited to pedestrian traffic. Parking within the cemetery is restricted to cemetery business. The small turnaround next to the Town Forest is no longer an available parking area for Town Forest access.

Access point (E), Varrell Woods, enters the far end of the Town Forest from Washington Road. Following a narrow, scenic stonewall-lined lane, this entry provides a ready route to the eastern Varrell Woods section of the forest. Slated improvements include removal of invasive plants which drape over the trail, trail coding (black), and entrance signage. A trail map may also be posted.



An overgrown trail leads into the property from access point "E", Varrell Woods..

Minimizing Forest Impacts

The Rye Town Forest's trail network traverses almost 4 miles of forest. The trails cross seasonal streams and wetlands in multiple locations. Discussion follows on the means to minimize forest and wetland impacts, methods and logistics to ford surface waters, the specifications of materials needed, and a detailed list of the overall trail improvements needed (including signage recommendations).



Minimizing Impacts

Minimizing the number of wetland crossings is an important aspect of reducing environmental impact from recreational trails. This is accomplished by: a) Rerouting trails to less-sensitive upland locations where practical; b) Retiring redundant trails—duplicate routes—while favoring the drier route; c) Discontinuing usage of little-used or unnecessary trails, especially if they substantially impact wetlands, but also, to retain blocks of trail-less forest for wildlife. On this latter point, trails are disruptive to wildlife, especially during breeding season, thus the Conservation Commission is opting to retire the central “red” trail to create a larger trail-less forest area. The new green trail configuration encompasses a 44-acre trail-less area, the Town Forest’s largest outside of Awcomin Marsh.

When trails are retired, the ends must be obstructed. This may be accomplished with impassable brush piles and arrows pointing in the desired direction. Over time, vegetation obscures the discontinued trail.

The **Trails Map** (page 10) in this management plan depicts the updated version of the trails network, which now totals 3.7± miles. Trails that are to be retired or rerouted are not illustrated. The planned trail reorganization eliminates several stream crossings and over 500 feet of wetland passages.

Methods and Logistics

The Rye Conservation Commission (RCC) is intent on mitigating the impact of pedestrian traffic on the remaining wetland crossings, as well as improving water drainage on the trails. Wet segments will be forded with bog bridges, some of which were already installed by AMC (Appalachian Mountain Club) contractors. Typically, bog bridges are constructed with two 4 by 8-inch timbers (8 feet long), though for very wet areas or bridges over streams, a wider platform with three timbers is preferable. The timbers are laid side by side with a separating gap 1 to 3 inches wide, which is adjusted for comfortable walking.



A combination of bog bridges and steppingstones offers an effective way to cross this wet area.

The timbers are spiked to three wooden supporting blocks spaced at intervals beneath the platform to avoid bounce. The foundational blocks are well-secured in the underlying earth. The bog bridge 8-foot segments are then laid end to end to ford the entire length of wetland. The overall results are a light footprint—only the supports touch the wet terrain—and the ability for water to drain beneath the ford. Surface water flow is not disrupted by rutted ground, stream siltation is prevented, and recreationalists avoid muddy feet.

Flat steppingstones are also utilized to cross mildly wet areas, especially for short distances. Sometimes a combination of bog bridges and steppingstones is optimal.

Project implementation requires wetland permitting, gathering a work force, ordering materials, and *transporting* the materials to the appropriate locations. *Permitting* requirements include submission of a trail notification permit which can be downloaded from the NHDES website. *Labor* to install the fords may be contracted, and/or community



volunteers might be enlisted by the RCC. A detailed list of the *materials* needed, including timbers and stone is provided below, though hardware (spikes, etc.) and tooling (hammers, mattock, etc.) are also required. Numerous heavy timbers are needed for the project; while these can be *carried* by a team of workers, it is expedient to cart the timbers to the correct locations using a tractor or work ATV.

Drainage structures such as water bars are useful on sloping trails to channel water into the adjacent terrain, thus preventing erosion of the trail surface. Due to mostly level terrain, the usefulness of waterbars is limited in the Town Forest. Other structures, including culverts and a specialized type of stone ford—a “mattress”—are recommended for stream crossings in a few locations. A mattress is a layered stone ford using a lower layer of riprap (large angular stone, 5+ inches) for horizontal water movement. The riprap is sandwiched between layers of geotextile fabric. The upper fabric layer is capped by gravel or ledge pack to create a smooth travel surface. For crossings through a wetland, mattresses more closely mirror wetland processes by enabling slow water seepage, while avoiding the maintenance which culverts require. NHDES permitting is required for any work involving the replacement or installation of a culvert or mattress.

Materials

Bog bridge installation is recommended for approximately 15 locations on the property, with the following total timber materials needed:

- Thirty-two (32) to thirty-four (34) eight-foot bog bridge sections [each using two (2) 4 x 8's and three (3) 24" 4 x 4 supports]
- One (1) 16-foot beam bridge section, using three (3) 16-foot 4 x 4's [and four (4) or five (5) 18" 4 x 4 supports], with strapping
- One (1) additional 16-foot 4 x 4 and strapping to reinforce existing the beam bridge

Steppingstones are needed in approximately 7 locations. The total projected linear distance (for all seven locations) is 64± feet, thus 30 to 40 flat stones approximately 1 foot or wider (allowing for gaps in between stones) are needed. These might be found on site or ordered as a pallet of flat stones.

At least two culvert replacements are advised, as well as replacing an existing culvert with a stone ford or mattress (where the trail leads to the Scout campsite).

In total, the Conservation Commission will likely order:

TIMBERS:

- Use pressure-treated wood, white oak, or northern white cedar (the latter two options are more costly and may require advance ordering).
- **(68) (Sixty-eight) 8-foot 4 x 8's** (for bog bridge platforms)
- **(52) (Fifty-two) 8-ft 4 x 4's** (cut these for supports for all bridge sections)
- **(4) (Four) 16-foot 4 x 4's** (for long bridge platforms—new and existing)
- **(3) (Three) 8-foot 1 x 5's** decking planks (to be cut on angle and used as underside strapping to reinforce the bridges)

FLAT (STEPPING) STONE (Optional):



- **1 pallet** of 12 to 18± inch flat stones, preferably at least 1½ inches thick

CULVERTS and ROAD STONE/GRAVEL:

- (2) 15" polyethylene culvert (15± feet long)
- 1 load of gravel or ledgepack (3" minus)
- 1 load of riprap (5 or 6"+)
- Geotextile (40± lineal feet, 12' wide)

Trail Recommendations

A list of specific trail improvements is itemized below. See the *Trail Recommendations Map* (page 9) to match the condition/recommendation with the trail location. A *quick reference guide* to the trail recommendations is found as *Appendix D* in this report, which clearly organizes remediations in table form.

1. Failed crossing, old steel culvert. Recommend removing culvert and installing mattress with spillway to address drainage.
2. Narrow steppingstone path is blocked by honeysuckle growth. Either retire trail (beyond scout campsite) or improve by pruning vegetation.
3. Old trail substantially impacts wetlands and is no longer easily accessed. Recommend permanently retiring.
4. A short trail leads from the corner of the parking lot to the athletic fields. Consider installing a trail sign.
5. Main Town Forest trail entrance. Attach updated trail map to kiosk.
6. Trail junction. Install trail signage.
7. Trail junction. Install trail signage.
8. Approximately 56' of bog bridging installed; additional 8' section needed on east end.
9. Approximately 24' of bog bridging installed; additional 35' of trail needs either further bog bridge spans or Steppingstones.
10. Muddy, wet trail conditions. Recommend 8' bog bridge and steppingstones at either end.
11. Trail is braided. Consolidate to one trail, or re-route.
12. Large aspen uprooted (hazard tree). Engage professional to remove.
13. Area of braided trail. Consolidate trails to single, driest route, or re-route to nearby high ground.
14. Two parallel trails exist, running on either side of a stonewall. Retire eastern trail, which impacts wetlands, and transfer full use to western trail, which needs minor vegetation removal to widen. Move existing trail sign to western trail junction and/or install arrow sign to instruct users of new scheme.
15. Trail junction. Install trail signage. Retire the unnecessary western leg of a trail triangle which connects the orange and blue trails.
16. Trail junction. Install trail signage.
17. Ensure that trail users no longer use the trail that ran north of stone wall (on neighboring Tilton property); alternative trail was recently installed though Town Forest property (see notes #18 and #19).



18. This trail section is also permanently closed to stay off neighboring Tilton property and is now re-routed on the Town Forest. Recommend permanently retiring this section. (See notes #17 and #19.)
19. Trail is now fully relocated within the Town Forest. Signage has been posted. Widen and improve trail as needed. May require light trimming of trees along path.
20. Stream crossing during wet seasons. Recommend installing 16' beam bridge (three parallel 16' 4x8 beams).
21. Re-route trail to circumvent the Lebosquet parcel. Gravel or alternative trail substrate will be needed near wetland by property corner. Install trail arrow at new junction to instruct users.
22. Wet area will require bog bridging (8') and steppingstones.
23. Wet area. Install steppingstones on extant trail.
24. Re-route trail south of Lebosquet parcel and retire existing central red trail. Install bog-bridging on new trail (approximately 18-20') to span wet ground.
25. Re-route existing trail onto Connell parcel across stone wall to avoid Lebosquet property. New trail will require layout and construction including clearing, bog bridge(s) and stone removal.
26. Permanently retire trail length within Lebosquet property, instead re-routing trail to remain on Rye Town Forest and neighboring Connell property. (See notes #21-25.)
27. Trail re-route. Install trail arrow to instruct users.
28. Entrance trail along old lane requires restoration. Clean trail as needed and install trail map or, at minimum, trail sign at trailhead.
29. Wet length of trail. Install 25' of steppingstones.
30. Trail is overgrown and inundated, at least seasonally. Install 24' of bog bridging and a simple timber dam to direct drainage, and clear overgrowth.
31. Two 16' 4x8 beams serve as a bridge over a wide stream. Reinforce this with a third beam and join with others. Additionally, install 32' of bog bridges to north and potentially another beam bridge.
32. Trail junction. Install signage. Trails to east requires general improvement.
33. A short spur, no longer well-used, makes a trail "triangle". Recommend retiring this spur (it is partially blocked by uprooted trees).
34. Wet length of trail. Install 24' of bog bridging and add steppingstones to each end.
35. Wet length of trail. Install 16-18' of bog bridging and another 12' of steppingstones.
36. Alternative link trail runs east of and parallel to main trail. Recommend retiring the link closest to the marsh, which is redundant. (See note #39.)
37. Wet length of trail. Install 24' of bog bridging.
38. Cut new spur trail to marsh overlook, replacing link trail. (See notes #36 and 39.)
39. Alternative link trail runs east of and parallel to main trail. Retire link permanently. (See note #36.)
40. Downed vegetation blocks the main path causing surface water braiding. Remove debris and establish a primary trail.
41. Trail runs through log across trail with cutout. Recommend widening gap.
42. Bog bridge requires repair. Install an additional 8' bog bridge.
43. Downed tree. Remove.



44. A small spruce obstructs the path here. Remove this and trim a larger one to improve trail flow.
45. Permanently retire the central red trail heading north. Block this route with brush and install signage for the green trail loop.
46. Wet length of trail, at least seasonally; roots make travel technical. Recommend installing 24' of bog bridging.
47. Install steppingstones in wet section south of stone wall, and proceeding north, 8' bog bridge section, additional steppingstones, and final 8' bog bridge.
48. Trail junction. Spur leads to athletic field. Install signage.
49. Trail junction "triangle". Spur leads to athletic field. Install signage.
50. Trail junction. Install signage.
51. Woody corduroy on the trail allows drainage but is difficult to walk on. Replace with bog bridges (40' with a jog). Trail improvement may require removal of one or more trees.
52. Culvert is partially above grade. Recommend re-burying and cleaning culvert to allow proper drainage.
53. Drainage device occluded. To avoid trail washout, locate or install drainage mitigation.
54. Trail junction. Install signage. (See note #17.)
55. Culvert or stone ford needed to avoid trail washout.
56. Replace 8" plastic pipe with a 12" polyethylene culvert, if small pipe deteriorates or does not handle high flowage conditions. Apply 1 foot of gravel cover over pipe/culvert.
57. Replace deteriorated 12" steel culvert with 12" polyethylene culvert. Use 1 foot of gravel cover.
58. Install kiosk with updated trail map.

Mitigating Trail Conflicts

Trail usage has increased tremendously in the Rye Town Forest over last 20 years, and dog walking is now the prevalent use of many trails. Controversy has stirred among forest users, as well as abutting landowners who are affected by people and dogs on their land. Dog waste stations have been installed and the town is working on dog control solutions.





A sign specifically forbidding dogs is posted at the boundary an abutting property.

One abutter's property is encompassed by Town Forest on three sides, and trails lie near or on the property line in several locations. This landowner has posted his land correctly, not allowing trespassing. To help address the abutter's concerns, several measures are in progress. First, the RCC recently relocated a trail (now designated as part of the green trail loop) away from the common property line. Secondly, signage was posted advising dog walkers to control their dogs, respect adjacent lands, and strictly not allow pets to wander onto these properties. Temporary fencing may be employed, on an interim basis, as needed for public safety, management deterrent or security. The following recommendations are made regarding fencing:

- Use 3-foot tall, *dark mesh* temporary fencing (steel or plastic) to allow the fencing to blend into surroundings and not detract from forest aesthetics.
- If installing temporary fencing along a property boundary, install the fencing on the Town Forest side of the property lines. Use substantial metal stakes to support the fence.
- If using small mesh temporary fencing and the length of fencing is greater than 50-feet, cut a few low, rectangular holes (6" high) at regular intervals (no greater than 50-foot apart) to allow small wildlife passage. Larger wildlife will either go around the fence, or in the case of deer, at times jump over it.

The green trail—the major trail loop through the eastern section of the forest—currently passes through two abutter's properties. The town has a permanent trail easement through the Connell parcel, but not the Lebosquet Lot. Consequently, the RCC is planning to relocate the green trail entirely off the Lebosquet Lot to preclude issues that may arise with future owners of this property. Keper Connell, owner of the Connell parcel, is extremely cooperative about allowing the RCC to re-route the trail along the edge of his property. The RCC plans to post signage informing trail users to respect the private property they are crossing.

INVASIVE SPECIES

Discussion:

Several forested areas of the Rye Town Forest are heavily colonized by invasive plant species. The severity of the invasion indicates that exotic, non-native plants likely first appeared on the tract 50± years ago. Initially few and undetected, the plants are proliferating towards alarming numbers. Control efforts were initiated by the Conservation Commission and RCCD about 2008±, targeting the areas north of the parking lot. Canvassing of lightly infested interior areas was also accomplished. In recent years, control has lapsed; the plants have continued to spread, and now exist throughout much of the Town Forest.





A trail winds through an area occupied by glossy buckthorn.



Exceptionally dense Oriental bittersweet poses a threat to forest health.

Using randomly located plots, a 2018 survey and mapping of the status of invasive plants was completed for this plan. Of the property's forested acreage, only 13% is free or nearly-free of invasive plants, whereas 33% is in an "incipient" stage of invasion, 26% is in an "intermediate" stage, and nearly 28% is in a "severe" state of invasion. (See **Management Recommendations and Invasive Species Areas Map**, page 8.) Wetlands, as well as areas near Recreation Road and Washington Road, are particularly affected. Invasion is generally lighter in interior, upland areas.

As invasive plant numbers surge, the task of control becomes more formidable and cost-intensive. However, *inaction leads to ever-increasing numbers of exotic plants*, threatening the long-term integrity of the forest and salt marsh. With these considerations, **it is recommended that control of the Town Forest's invasive plants continue as the number one management priority.**

The most concerning upland species on the property include oriental bittersweet (*Celastrus orbiculatus*) and glossy buckthorn (*Frangula alnus*), though several other species are also present. (Refer to **Appendix A**, page 45, for a comprehensive list.) Areas with dense thickets of invasives exist. Without constraint, the plants persist and propagate rapidly, displacing native flora while altering forest composition and wildlife habitat. Widespread and severe exotic plant invasions disrupt the forest ecosystem. Biodiversity and habitat are diminished, and perhaps most concerning, the forest's ability to successfully regenerate is increasingly compromised.



Of serious concern to the property's exemplary salt marsh community is the reemergence of small pockets of common reed (*Phragmites australis*), a widespread exotic plant which drastically compromises the ecological function of colonized areas. Intensive efforts in Awcomin Salt Marsh between 2001-2003 resulted in a landmark success, freeing the marsh from *Phragmites* and restoring ecological function. This outcome required an extremely arduous and costly campaign, with outstanding results, albeit a campaign that is not easily revisited. Incipient populations are always easier to control, thus continued monitoring and immediate eradication of *Phragmites* in the Rye Town Forest's salt marsh, and the Awcomin Salt Marsh in general, is paramount. Areas containing *Phragmites* within the Town Forest ownership are depicted in the **Management Recommendations and Invasive Species Areas Map** (page 8).



An incipient pocket of Phragmites is found in at least one salt marsh area on the property.

Recommendations: The magnitude of the exotic plant infestation (within the property's forested acreage) is mapped in the **Management Recommendations and Invasive Species Areas Map** (page 8), which can be used to devise a treatment strategy. For example:

Forest Strategy: In the first three years of control efforts (2020-2022), efforts are focused on lightly invaded areas, as well as heavily invaded pockets, or "islands", that are *embedded within* the low-density areas. **The objective is to treat and "clean" substantial acreage, and to isolate and "frame" the remaining heavily infested areas.**

In years four and five (2023-2024), the initial areas are retreated. New areas are then covered, including moderately invaded areas, while continuing to isolate the heavily-compromised patches.

The same strategy continues in succeeding years, always retracing previously-treated areas, and moving into the perimeter of the more heavily invaded zones, until complete coverage is eventually accomplished.

Coverage: The acreage treated annually depends on time and monetary constraints, as well as the degree of invasion, and the treatment methods used.

Methods: While wetland conditions or distance to a parking area may limit the areas in which machinery might be employed to conduct invasive control, a general control scheme for each level of invasion might look as follows [where the intensity of invasion ranges from 1 (absent) to 10 (severe)]:

- **"Absent" (1)** areas are free of exotics. Volunteers can be engaged and trained to conduct annual or biennial monitoring campaigns, the purpose being to a) identify and b) locate, if any, individual plants, which would then be hand-pulled on the spot.
- **"Incipient" (2-4)** areas are forest sections where stems are small and relatively few (1 to 500 stems per acre), and where a less intensive approach can be implemented. This largely involves



methodic forest canvassing, where invasives are located and then, size allowing, carefully hand-pulled. Additional control options include pulling with a mattock or weed-wrench, hand-cutting and applying herbicide to cut stumps, and/or foliar spraying. The exact method may vary based on the species or environmental conditions, and volunteers may help with mechanical methods. Successful control campaigns have occurred in the recent past by engaging RCCD to apply herbicides, and to train and organize volunteers. The forester may assist in efficiently canvassing widespread areas with relatively few, but difficult-to-detect exotics.

- **“Intermediate” (3-6)** areas are forest and wetland sections with a preponderance of large exotic shrubs, exotics with long rhizomes (such as Japanese knotweed), and/or between 500 and 2500± stems to the acre. Desirable saplings or shrubs in the invaded area are not yet overrun and are isolated enough to be protected. Typically, these areas require canvassing to locate scattered shrubs, and the treatment of dense pockets. Cut and spray treatment with an herbicide is usually most efficient, though some plant uprooting may also take place.
- **“Severe” (5-10)** areas are forest and wetland sections with over 2500 exotic stems to the acre. Densities can exceed 25,000 stems to the acre. Though desirable native stems may be present, they are compromised. In these areas, broad control methods may be employed including invasive understory shredding/mulching (Brontosaurus) or manual cutting followed by herbicide treatment of stumps or re-sprout.

Town Forest Entrance and Trailhead Strategy: In the **Trails Section**, recommendations were made to treat heavy invasive plant presence at the two main entrances to the Town Forest (A) and (B), from Recreation Road and Washington Road, respectively. For entrance (A), the specifications for this removal include herbicide treatment by a qualified licensed applicator such as RCCD, which has handled all control efforts on the Town Forest to date. The thicket along the gravel road entrance off Washington Road (B) likely requires a vegetation shredder/mulcher (mounted on a skid steer) followed by continued mowing. Other pockets that are embedded in the forest would likely be initially spot-treated with an herbicide.

Forest access points (E) and (F) require extensive exotic plant removals, possible as cut stem and spot herbicide application.



Parts of the central forested area are relatively free from invasives.



NATURAL RESOURCES SUMMARY



WATER & SOILS

Water Resources

The Rye Town Forest includes a section of Awcomin Salt Marsh, an outstanding surface water feature. Within its forest, the property contains several streams, forested wetlands and vernal pools, as depicted on the *Physical & Natural Features Map* (page 7) and listed below.

Salt Marsh

Approximately 44 acres of the Awcomin Salt Marsh complex lie within the boundary of the Rye Town Forest. The salt marsh is a brackish transitional zone between the salty, wave-laden ocean and fresh, relatively quiet, inland waters. Fed by several freshwater streams, Awcomin Salt Marsh lies in this intertidal niche between the Town Forest uplands and Ragged Neck Point Barrier Island. The marsh formed over time: as the streams washed tons of sediment into the lagoon behind Ragged Neck Point, suspended sand and dirt particles settled, while organic material accumulated, forming a mud flat.



The Awcomin Salt Marsh.

Water level, pH, and salinity are in constant flux; during high tide the flat is covered by brackish water; when the tide ebbs, the flat is exposed to the open air. The pulse of tides continually supplies nutrients and oxygen to specially adapted salt marsh grass, *Spartina*. At low tide, algal remains and marine organisms decay in the sun, fertilizing the flat. The tallest form of *Spartina*, saltmarsh cordgrass, is found growing along the tidal creeks at water's edge; the incoming tides repeatedly flush away debris from the plants' bases. Closer to shore, a shorter *Spartina*, saltmeadow cordgrass, forms a low, dense carpet of vegetation. However, unlike the front-line cordgrass that is constantly cleansed by the tides, the remains of saltmeadow cordgrass from the previous year does not wash out to sea. This dead grass layer decays to mulch, maintaining soil moisture and providing protective cover for wildlife, particularly meadow voles and garter snakes. Glassworts and widgeon grass are highly tolerant of salty conditions and may also be found growing in shallow dips or salt pans, where water is trapped as the tide recedes, and salinity rises through evaporation.

If the forest is harvested: To preserve the aesthetic and ecological integrity of the salt marsh, a 100± foot protective "minimal harvest" buffer is recommended along the upland forest edge. Minimal harvest is restricted to trees that are considered a trail hazard, are diseased, or have other pressing silvicultural concern. No more than 10% of the basal area may be removed in any 15-year period.

Forested Wetlands

The Town Forest contains approximately 42 acres of forested wetlands. The degree and periodicity of soil-water saturation influence wetland characteristics, which are variable. These wetlands contain tree, shrub, and herbaceous species indicative of wetland conditions, however, surface or near-surface water



presence is only seasonal. Somewhat wetter areas have uprooted trees, with resulting pit and mound topography, as well as denser shrub growth. Very poorly drained sections are characterized by vegetation growth on hummocks and areas of standing water.

Red maple is the dominant tree species in the forested wetland areas. Wetland hardwoods as well as white pine, hemlock, and spruce, are also present. The former understory of native fruit-producing shrubs such as winterberry holly and highbush blueberry is almost entirely compromised by exotic, invasive shrubs in several of the wetlands. Ground cover is dominated by cinnamon fern, sensitive fern, and gold thread.

The Town Forest's forested wetlands are greatly susceptible to, and often sustain, high densities of invasive species. Glossy buckthorn has overtaken extensive forested wetland areas.

The moist soils and native shrub cover are attractive habitat for small mammals such as southern red-backed voles and short-tailed shrews. Predators such as red foxes and barred owls hunt these small mammals along wetland edges. The dense shrub cover provides suitable nesting and/or feeding habitat for songbirds such as song sparrows, gray catbirds, and northern cardinals.

If harvesting is considered: Whereas in the past low-impact harvesting was recommended adjacent to forested wetlands to enhance habitat conditions (creating small openings to improve cover, native berry production and browse conditions), this approach is no longer feasible. The Town Forest's wetlands already sustain and are highly susceptible to invasive plants. Unless these exotics are controlled or eliminated, the creation of canopy openings will only spur the presence of invasives. It is therefore recommended that: A) Intensive efforts to control invasives in the property's forested wetlands be undertaken, and B) An uncut buffer (50 to 100± feet) adjacent to the forested wetlands be established to retain shaded canopy conditions with a surface duff layer that is undisturbed by logging equipment. Habitat management alongside wetlands can be revisited in the future, when exotic invasives are successfully treated.

Ephemeral Pools

An ephemeral pool is a small natural water impoundment that usually dries up for part of the year. Some ephemeral pools meet the NH State definition² of "vernal pool". Four ephemeral pools (possibly vernal pools) were observed during field examinations, as noted on the Natural and Physical Features Map. These wetlands fill with water in late winter/early spring and usually dry by mid- to late-summer. Since the pools desiccate, fish cannot form viable populations, while certain insects that prey on young frogs and salamanders are less abundant or absent. In the Town Forest, vernal pools are potential breeding sites for wood frogs, spotted salamanders, and possibly blue-spotted salamanders and fairy shrimp.

Wetland habitat on the Rye Town Forest can be protected by excluding harvesting or equipment travel through wetlands or near vernal pools. Equipment ruts near vernal pools may cause amphibians to deposit

² See NH DES, "Vernal Pools" @ <https://www.des.nh.gov/organization/divisions/water/wetlands/vernal-pools.htm>



eggs in the ruts, which often dry before the young are able to complete their development. Ground ruts may also cause changes in drainage, altering pool depth or the pool's hydroperiod. Equipment trails can be laid-out by a Forester to ensure that vernal pools are avoided even during dry summer periods.

Adult amphibians generally use vernal pools for only a few weeks during the breeding period; they spend the remainder of the year under leaf litter, stumps and fallen logs, often over 100 yards from the pool they breed in. Increasing the number of fallen logs, understory shrub cover, and herbaceous ground cover throughout the property, are measures that can be incorporated into silvicultural management to enhance amphibian habitat.

Other Features

A small pond is found near the recreation complex. A second pond, once used for ice gathering, is found in the northwestern forest area. Numerous seasonal streams drain the Town Forest.

Soil Resources

Soil Types (in descending order of extent)

Scituate-Newfields (code 447) – 80.2± ac: These intermixed sandy loams (till) underlie extensive areas throughout the wooded and forested wetland portions of the property. The soils range from moist in upland areas (*Newfields*) to somewhat poorly drained (*Scituate*) in forested wetlands or upland forest with a seasonally high watertable. *Scituate* areas are prone to wetness, particularly through the spring and in the late fall/winter when trails turn muddy, and forestry equipment would bog down. The *Scituate-Newfields* soil complex is productive for mixed hardwoods. White pine grows well, but trees are prone to blowdown, especially along exposed salt marsh edges.



The underside root mass of this pine tip-up showcases Scituate-Newfields soils.

Westbrook & Ipswich Mucky Peats, Udorthents (597, 397, 299) – 50.3± ac: These muck soils collectively underlie the property's saltmarsh. *Westbrook* and *Ipswich* soils are poorly drained. They feature peat layers of varying depth while supporting saltmarsh flora. Certain salt-tolerant trees including red and white oak, and black gum, are found in less saturated edges. The udorthent soils are previously disturbed areas (likely due to the creation of drainage ditches that allowed salt hay production and harvesting) consisting of organic loams intermingled with underlying mineral soils.

Walpole (546, 547) – 48.0± ac: These poorly drained fine, sandy loam soils underlie forested wetland areas in the central, southwest and northeast portions of the property. Wetland hardwoods, such as red maple—species with root systems that endure periods of water saturation—are typically associated with this soil. Mesic and hydrophytic shrubs including highbush blueberry, winterberry holly and nannyberry are common.



Hoosic (510) – 29.8± ac: These deep, somewhat dry, excessively drained sandy outwash soils occupy the northwestern property area including Parsons Field and the Town Cemetery. Hardwoods such as sugar maple, oak, hickory and beech are adapted to this soil type.

Scarboro (115) – 7.3± ac: This very poorly drained mucky peat soil underlies the northwest pond, surrounding shrub wetland, and adjacent forested wetland. This soil's peat layer is relatively shallow, usually not more than 1 foot in depth. The subsoil and substratum are sandy loam and sand, respectively. Bedrock is more than 5 feet below the soil surface. This soil is wet year-round, with the water table usually at or near the soil surface; surface flooding occurs in springtime.

Canton (43) – 4.7± ac: Two small pockets of Canton soil are found in central north and central south areas of the Rye Town Forest. This glacial till is deep and well-drained. The surface layer of Canton is gravelly loam, with a substratum (below 2½ feet) of loamy sand and varying amounts of silt. While seasonal high watertable is below 6 feet, Canton is typically wet during spring thaw or after extended rainy periods. This soil is productive for both pine and hardwood growth.

Pipestone (314) – 1.1± ac: A small pocket of this deep, poorly drained sandy outwash soil is found in the far north on the property, where native hardwoods (notably red maple and white oak) and myriad invasive shrub species predominate.

WILDLIFE HABITAT

The Rye Town Forest contains mostly forested habitat (approximately 74% of the property), including valuable mast forest. The remaining acreage is in non-forested condition: field, saltmarsh, athletic fields, etc. The property's extensive forest and variable structure provides habitat to many woodland species. A more extensive catalog and description of the property's wildlife resources is found in **Appendix E**.

Habitat Summary

- The tract contains various habitats as follows:
 - i **Forest:** Upland forest covers ~52% of the Rye Town Forest. Upland forest habitats include white pine, white pine/hardwood, upland hardwoods, and mixed hardwoods. Substantial areas of this upland forest are invaded by non-native plant species which compromise forest health and adversely affects habitat.
 - ii **Freshwater Wetland:** These habitats, mostly in the form of forested wetlands, cover ~22% of the property. The property's streams meander and fan out to offer significant riparian habitat, influencing tree and shrub species composition. There are at least four vernal pools on the Rye Town Forest, as well as two small ponds (totaling 0.6± acres) featuring emergent vegetation. Invasive species are particularly dense in and near wetland areas.
 - iii **Salt Marsh:** The Awcomin salt marsh occupies roughly 20% of the property area. The marsh offers vital habitat for fish, mollusks, and wading birds. A major restoration effort,



begun in 2001, successfully eliminated common reed (*Phragmites australis*) from the marsh. Where the marsh meets the forest, however, woodland invasive species are present. Greenbrier, a southerly vine/bramble, creates dense cover along sections of the salt marsh edge.

- iv **Field:** A small (4.4 acre) field near Washington Road in the property's northwest offers open space and edge habitat, though wildlife utilization of this habitat is limited by human activity as well as proximity to Rye town center.
- Mast production—acorns, primarily—is abundant on the Rye Town Forest due to high numbers of large, maturing red oak trees, with some white and black oak present. Acorn production is especially favorable due to the size and distribution of oak trees. Beech (beech nuts) are also periodically plentiful.
- Scattered, old “legacy” trees—primarily red oaks, as well as other hardwoods and white pines, some exceeding 130 years in age and 2 feet in girth, remain on the Rye Town Forest. Such large trees are valuable roost/waypoint/perch spots for birds and provide den sites for mammals.
- Structural features of the existing forest that are valuable to wildlife include reasonably good canopy layering, and areas with substantial forest woody debris including deadfall, uproots, and large snags. Some dense, dark forest areas (hemlock and spruce) offer vertical and horizontal structural diversity.



Snags offer critical habitat for a variety of forest denizens.

- Snags (standing dead trees) and living cavity trees occur with moderate frequency on the property, providing critical habitat to birds and mammals.
- The property contains at least four ephemeral pools (possibly functioning as vernal pools). An important factor in vernal pool functionality is hydroperiod length. Isolated pools which remain flooded past mid-July typically allow successful fledging of a variety of amphibian species. Vernal pools are also important feeding areas for turtles and snakes. Wildlife travels between the pools and surrounding uplands.

Habitat Management Recommendations

General habitat recommendations:

- Immediately address invasive plant species. Take measures to prevent invasive plants from further colonizing the property, through periodic, property-wide monitoring, and immediate control (as outlined in the *Invasive Species* section, starting on page 20).
- Generally, allow the forest to gain older growth conditions over time. Preserve and protect exceptional old trees.



- Maintain a 100-foot natural disturbance buffer zone along Awcomin Marsh (this allows limited removal of trees under the conditions recommended in the *Salt Marsh* section, page 35). Avoid additional trail building along the marsh shoreline. Control of exotic plants in this buffer is acceptable.

Recommendations for forested, silviculturally-managed areas:

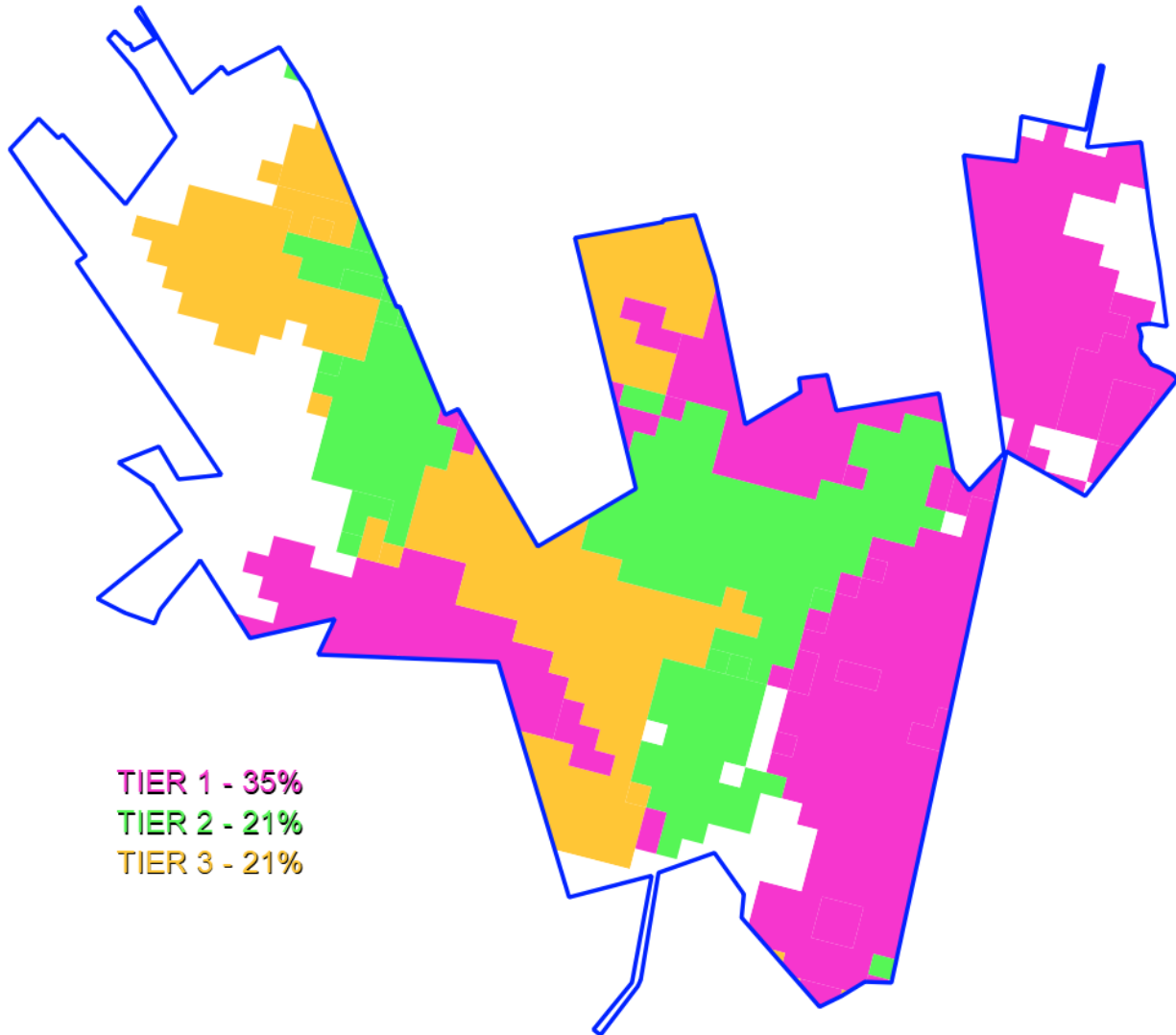
- Encourage the development of complex forest structure.
- Encourage stratification of canopy layers.
- Retain snags, cavity trees, and forest floor woody debris.
- Manage forest for the growth of large, healthy oaks, to optimize mast supply.
- Except for designated and retained “beech islands,” limit the proliferation of understory beech.
- Promote the growth of native shrubs.
- Do not expand the recreational trail network.



Highbush blueberry near the marsh edge provides valuable soft mast.



Wildlife Action Plan (WAP) Assessment



The Rye Town Forest contains various forested and wetland habitats, of varying wildlife value. Roughly 35% of the property is ranked as Tier 1 habitat (highest ranked in NH) in the 2015 *NH Wildlife Action Plan*³, while 21% ranks as Tier 2 (highest in biological region) and 21% as Tier 3 (supporting landscapes).

An extensive list of exemplary salt marsh natural communities is known to occur on and near the Rye Town Forest, as catalogued by the New Hampshire Natural Heritage Bureau (NHB), including low and high salt marsh, brackish marsh, and intertidal flats. These communities support rare plants (e.g., marsh elder and saltmarsh agalinis) and vertebrate species (e.g., purple martin, willet, and spotted turtle). A full report of known occurrences on and near the Rye Town Forest is found in Appendix C.

³ <https://www.wildlife.state.nh.us/wildlife/wap.html>



FOREST RESOURCES

In this section, the species composition, structure, and management recommendations of the Rye Town Forest's forested areas are discussed, and an overall forest description is provided. The **Forest Types Map** on page 6, shows a detailed schematic of the property's forest types.

Species Composition

The forested area of the Rye Town Forest has good tree species diversity. While three species dominate, a total of 24 tree species were noted, though some of these were represented by only one or two observations. In addition to the listed species, other species may be present.

A qualitative approximation of the property's forest **overstory** tree species abundance is:

- Abundant – White pine, red oak, red maple
- Common – Black birch, white birch, hemlock, beech, black oak, bigtooth aspen
- Scarce – Norway spruce, red spruce, elm, white oak, shagbark hickory, basswood, black cherry, gray birch, Norway maple, sugar maple, white ash, yellow birch, red cedar
- Rare – Black gum, apple

Forest Structure

The land's agricultural past influenced the present species mix and structure of the forest. An intricate network of stonewalls, often containing small enclosures that are typical of early settlement, is found on the property. The land was probably pastured for over 200 years before reverting to forest in the early 20th century (with a few more recently re-forested areas). Consequently, the matrix age of the forest is generally just over a century old, though a few older remnant trees are found which once stood within a field or along a stonewall.

Natural disturbance has played a prominent role in shaping the forest's current structure. Blowdowns have claimed many trees, especially pines, over the years. The coastal location leaves the forest exposed to Northeasters' and frequent storm events, as well as strong hurricanes, including '38, Carol (1954), and Bob (1991). Naturally-established seedlings follow in the spaces once occupied by large trees before they were toppled by high winds. This dynamic is readily visible within the forest along the salt marsh edge.



Old stone walls are frequently encountered at the Town Forest.



Over the course of the 20th century, logging also occurred in the Town Forest. It is likely that extensive timber salvage was conducted over a broad section of the forest after Hurricane Carol. Even-aged stands of 70± year old oak, as well as maple, now dominate these areas. Sections of the Town Forest were also carefully thinned commercially and storm-salvaged in 1992 and 2010. New generations of seedlings naturally regenerated with each of these entries; the natural dynamic was deliberately emulated in the latter two harvests.

With every disturbance, new tree generations are introduced. Over time—many decades, even centuries—a mixed-aged forest develops. Species diversity is also promulgated. These are desirable, natural traits, allowing for a more resilient forest to face the many agents of change that the future holds. If forest management were to be continued in the Rye Town Forest, these concepts would be the foundational basis. In other words, silviculture would be driven by the objective of maintaining a healthy, natural forest for the long run, and maintaining wildlife habitat, but *not* the motive of extracting timber for profiteering.

Management Recommendations

As stated, the continued application of silviculture in the Town Forest is motivated by the objective of maintaining a healthy, naturally-resilient forest. This involves the application of measures to encourage a structurally complex, species diverse forest. Wildlife enhancements are also incorporated. However, in addition to invasive plant control, silvicultural management includes tree cutting. Tree cutting, even when highly planned and controlled, is an activity on the Town Forest which may be misunderstood and resisted by the public. Therefore, educational outreach is critical.

A brief listing of recommended silvicultural practices includes a) providing additional sunlight to existing regeneration pockets; b) creating a new set of micro-sized regeneration openings; c) providing growing space to the crowns of the healthiest, most vigorous trees; and d) retaining large-crowned older trees for wildlife, for their scenic beauty, and as seed sources. These practices, and more, would be carefully applied in a continuing series of periodic harvests (12 to 20-year intervals) over time.

To start, forest management may be renewed over a small area, employing low-impact harvesting. The project requires meticulous preparation by a professional forester, with selection and marking of the exact set of trees to be harvested. Tree selection should be based on long-term forest health and viability, not short-term profit. Public outreach by the RCC, UNH Extension and others, in coordination with the forester, is vital during the project's various phases.



The next generation of forest trees begins unassumingly in a small opening created by the 2010 forest harvest.



APPENDICES



APPENDIX A – List of Observed Species

Native Trees

Deciduous

Spp Code	Common Name	Scientific Name
EL	American Elm	<i>Ulmus americana</i>
AP	Apple	<i>Malus spp.</i>
BW	Basswood	<i>Tilia americana</i>
BE	Beech	<i>Fagus grandifolia</i>
BTA	Bigtooth Aspen	<i>Populus grandidentata</i>
BB	Black Birch	<i>Betula lenta</i>
BC	Black Cherry	<i>Prunus serotina</i>
BO	Black Oak	<i>Quercus velutina</i>
BG	Black Tupelo (Black Gum)	<i>Nyssa sylvatica</i>
GB	Gray Birch	<i>Betula populifolia</i>
NM	Norway Maple	<i>Acer platanoides</i>
RM	Red Maple	<i>Acer rubrum</i>
RO	Red Oak	<i>Quercus rubra</i>
SH	Shagbark Hickory	<i>Carya ovata</i>
SM	Sugar Maple	<i>Acer saccharum</i>
WA	White Ash	<i>Fraxinus americana</i>
WB	White Birch	<i>Betula papyrifera</i>
WO	White Oak	<i>Quercus alba</i>
YB	Yellow Birch	<i>Betula alleghaniensis</i>

Coniferous

Spp Code	Common Name	Scientific Name
HM	Hemlock	<i>Tsuga canadensis</i>
NS	Norway Spruce	<i>Picea abies</i>
RSP	Red Spruce	<i>Picea rubens</i>
WP	White Pine	<i>Pinus strobus</i>



Shrubs and Vines*

Spp Code	Common Name	Scientific Name
ARR	Arrowwood	<i>Viburnum recognitum</i>
	Blackberry	<i>Rubus allegheniensis</i>
	Buttonbush	<i>Cephalanthus occidentalis</i>
	Common Juniper	<i>Juniperus communis</i>
GR	Grape	<i>Vitis spp.</i>
	Greenbrier	<i>Smilax spp.</i>
	Hawthorn	<i>Crataegus spp.</i>
HZ	Hazelnut	<i>Corylus spp.</i>
HBB	Highbush Blueberry	<i>Vaccinium corymbosum</i>
LBB	Lowbush Blueberry	<i>Vaccinium angustifolium</i>
MLV	Maple-leaved Viburnum	<i>Viburnum acerifolium</i>
	Poison Ivy	<i>Toxicodendron radicans</i>
	Red Raspberry	<i>Rubus idaeus</i>
	Spiraea	<i>Spiraea spp.</i>
	SF	Sweet Fern
	Sweet Pepperbush	<i>Clethra alnifolia</i>
	Winterberry Holly	<i>Ilex verticillata</i>
	WG	Wintergreen
WH	Witch Hazel	<i>Hamamelis virginiana</i>

Ferns and Herbaceous*

Common Name	Scientific Name
Bracken Fern	<i>Pteridium spp.</i>
Broad-Leaved Cat-Tail	<i>Typha latifolia</i>
Canada Mayflower	<i>Maianthemum canadense</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Common Clubmoss	<i>Lycopodium clavatum</i>
Hay-Scented Fern	<i>Dennstaedtia punctilobula</i>
Indian Pipe (Corpseflower)	<i>Monotropa uniflora</i>
Jack-in-the-Pulpit	<i>Arisaema triphyllum</i>
Marginal Wood Fern	<i>Dryopteris marginalis</i>
Ostrich Fern	<i>Matteuccia struthiopteris</i>
Pennsylvania Sedge	<i>Carex pensylvanica</i>
Pipsissewa	<i>Chimaphila umbellata</i>
Sarsaparilla	<i>Aralia nudicaulis</i>
Sensitive Fern	<i>Onoclea sensibilis</i>

*Lists are likely not comprehensive.



Invasive Species

Common Name

European Barberry

Glossy Buckthorn

Honeysuckle (unknown species)

Japanese Barberry

Japanese Knotweed

Multiflora Rose

Norway Maple

Oriental Bittersweet

Scientific Name

Berberis vulgaris

Frangula alnus

Lonicera spp.

Berberis thunbergii

Fallopia japonica

Rosa multiflora

Acer platanoides


Celastrus orbiculatus



Soil Map—Rockingham County, New Hampshire
(Rye Town Forest Soils Map)

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 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Rockingham County, New Hampshire
Survey Area Data: Version 19, Sep 11, 2017

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

Date(s) aerial images were photographed: Jun 20, 2010—Jul 18, 2010

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
43B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	4.8	2.1%
115	Scarboro muck, coastal lowland, 0 to 3 percent slopes	7.3	3.3%
299	Udorthents, smoothed	14.6	6.6%
314A	Pipestone sand, 0 to 5 percent slopes	1.0	0.5%
397	Ipswich mucky peat, 0 to 2 percent slopes, very frequently flooded	6.4	2.9%
446A	Scituate-Newfields complex, 0 to 3 percent slopes	0.8	0.4%
447B	Scituate-Newfields complex, 3 to 8 percent slopes, very stony	80.0	36.0%
510A	Hoosic gravelly fine sandy loam, 0 to 3 percent slopes	9.0	4.1%
510B	Hoosic gravelly fine sandy loam, 3 to 8 percent slopes	20.8	9.4%
546A	Walpole very fine sandy loam, 0 to 5 percent slopes	24.8	11.2%
547A	Walpole very fine sandy loam, 0 to 3 percent slopes, very stony	23.3	10.5%
597	Westbrook mucky peat, 0 to 2 percent slopes, very frequently flooded	29.4	13.2%
Totals for Area of Interest		222.2	100.0%



NEW HAMPSHIRE NATURAL HERITAGE BUREAU

DRED - DIVISION OF FORESTS & LANDS

172 PEMBROKE ROAD, CONCORD, NH 03301

PHONE: (603) 271-2214 FAX: (603) 271-6488

To: Charles Moreno
Moreno Forestry Associates
PO Box 60
Center Strafford, NH, 03815

From: Sara Cairns, NH Natural Heritage Bureau

Date: 2018-07-24

Re: Review by NH Natural Heritage Bureau of request dated 2018-07-03

NHB File ID: 3006

Town: Rye, NH

Project type: Landowner Request

Location: Tax Map 12 Lots 61, 79, 80, 89 & 90; Tax Map 17 Lot 16

I have searched our database for records of rare species and exemplary natural communities on the property(s) identified in your request. Our database includes known records for species officially listed as Threatened or Endangered by either the state of New Hampshire or the federal government, as well as species and natural communities judged by experts to be at risk in New Hampshire but not yet formally listed.

NHB records on the property(s):

Natural Community	Mapping Precision	% within tract	Last Reported	Listing Status		Conservation Rank	
				Federal	NH	Global	State
Low salt marsh	High	9	1997	--	--		S3
High salt marsh	High	9	1997	--	--		S3
Brackish marsh	High	100	2011	--	--		S2
Intertidal flat	High	3	1997	--	--		S3
Salt marsh system	High	9	2007	--	--		S3
Plant species				Federal	NH	Global	State
Marsh Elder (<i>Iva frutescens</i>)	High	100	2013	--	T	G5	S2
saltmarsh agalinis (<i>Agalinis maritima</i>)	High	39	2013	--	E	G5	S1
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)				Federal	NH	Global	State
Willet (<i>Catoptrophorus semipalmatus</i>)	High	9	2014	--	SC	G5	S3B

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



NEW HAMPSHIRE NATURAL HERITAGE BUREAU

DRED - DIVISION OF FORESTS & LANDS
 172 PEMBROKE ROAD, CONCORD, NH 03301
 PHONE: (603) 271-2214 FAX: (603) 271-6488

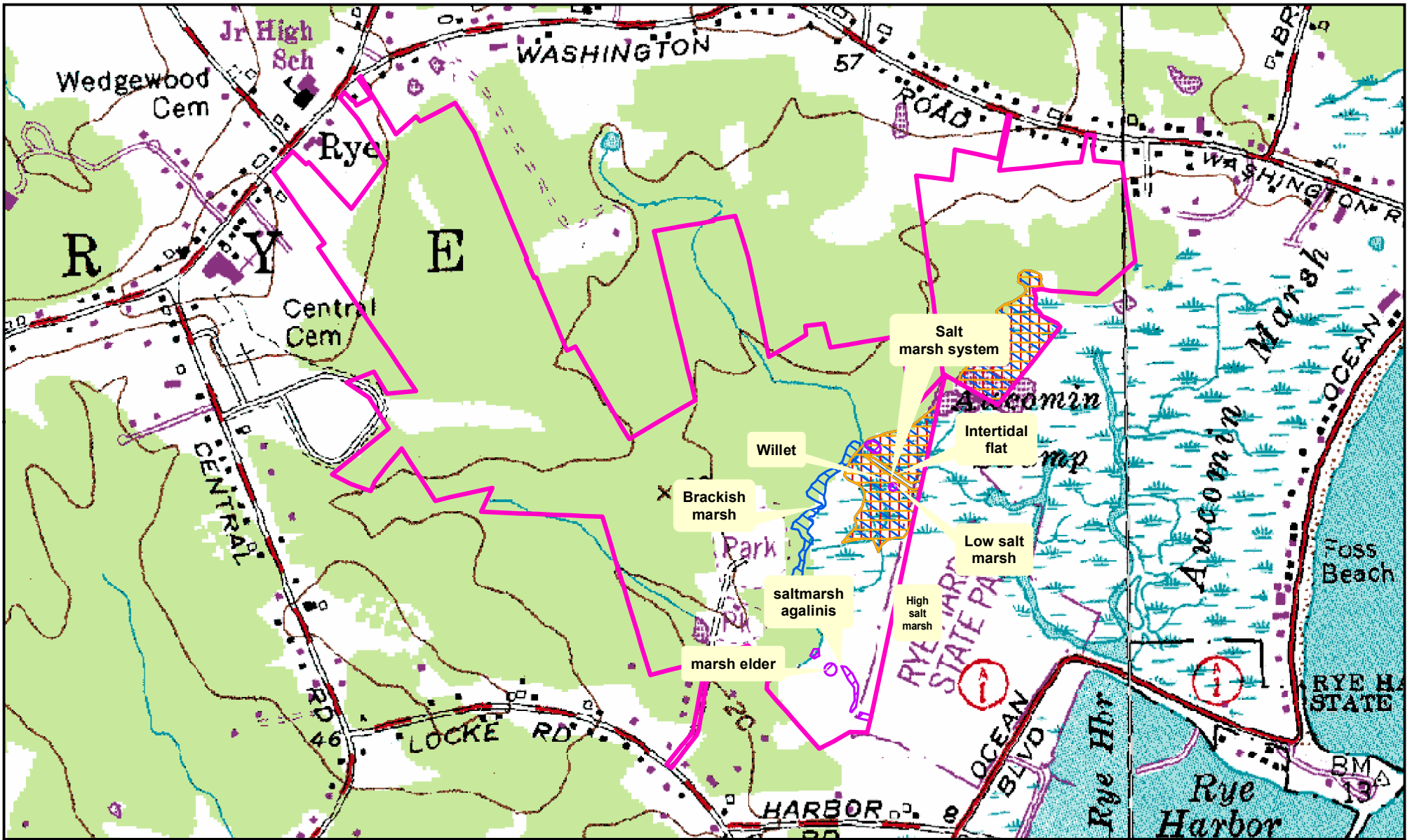
NHB records within one mile of the property(s):

	Last Reported	Listing Status		Conservation Rank	
		Federal	NH	Global	State
Natural Community					
Low salt marsh	1997	--	--		S3
High salt marsh	2006	--	--		S3
Brackish marsh	2010	--	--		S2
Intertidal flat	1997	--	--		S3
Salt marsh system	2010	--	--		S3
Plant species					
		Federal	NH	Global	State
Dwarf Glasswort (<i>Salicornia bigelovii</i>)	2011	--	E	G5	S1
saltmarsh agalinis (<i>Agalinis maritima</i>)	2013	--	E	G5	S1
northern tubercled bog-orchid (<i>Platanthera flava</i> var. <i>herbiola</i>)	2009	--	E	T4	S1
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)					
		Federal	NH	Global	State
Willet (<i>Catoptrophorus semipalmatus</i>)	2014	--	SC	G5	S3B
Purple Martin (<i>Progne subis</i>)	2016	--	SC	G5	S1B
Spotted Turtle (<i>Clemmys guttata</i>)	2010	--	T	G5	S2

Listing codes: T = Threatened, E = Endangered SC = Special Concern
 Rank prefix: G = Global, S = State, T = Global or state rank for a sub-species or variety (taxon)
 Rank suffix: 1-5 = Most (1) to least (5) imperiled. "--", U, NR = Not ranked. B = Breeding population, N = Non-breeding, H = Historical, X = Extirpated.

A negative result (no record in our database) does not mean that no rare species are present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

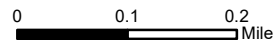
NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



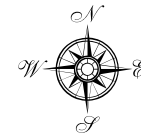
Natural Heritage Bureau Landowner Report

Project ID Number: 3006

NOTE: Any rare species and/or exemplary natural communities in this area are not shown unless they occur, at least in part, within the property bounds.



	Property Bounds	# of Records
	Plant Occurrence:	2
	Animal Occurrence:	1
	Natural Community:	4
	Ecological System:	1



New Hampshire Natural Heritage Bureau - Animal Record

Willet (*Catoptrophorus semipalmatus*)

Legal Status

Federal: Not Listed
State: Special Concern

Conservation Status

Global: G5: Widespread and secure
State: S3B: Rare or Uncommon

Description at this Location

Quality Rank: Not Ranked
Quality Comments:

Detailed Description: 2014: 1 individual observed on 7/14. 2010: 1 individual observed on 6/19.

General Area:

General Comments:

Mgmt Comments:

Location

Survey Site Name: Rye Harbor State Park
Managed By: Awcomin Marsh

County: None

Size: 143.9 acres

Town(s):

Elevation:

Precision: High

Directions:

Dates documented

First reported: 2010-06-19

Last reported: 2014-07-14

New Hampshire Natural Heritage Bureau - Natural Community Record

High salt marsh

Legal Status

Federal: Not Listed

State: Not Listed

Conservation Status

Global:

State: S3: Rare or Uncommon

Description at this Location

Quality Rank: Good

Quality Comments:

Detailed Description: 1997: Dominated by *Spartina patens* (salt-meadow cord-grass). Although the water table is always at or near the surface in the high marsh, tidal flooding decreases landward with increased elevation and microtopography, creating areas with higher soil oxygen that support a variety of species. *S. patens*, sensitive to tidal flooding, competitively excludes smooth cord-grass from the high marsh. Along the upland edge of the marsh, *S. patens* is itself competitively excluded by *Juncus gerardii* (salt marsh rush), the marsh perennial most susceptible to tidal flooding (Bertness 1990). Only the spring tides and storm surges reach this area along the upper edge of the high salt marsh. This zone had the highest species richness within the high marsh and included *Solidago sempervirens* (seaside goldenrod), *Festuca rubra* (red fescue), *Hierochloe odorata* (sweet grass), *Panicum virgatum* (switch-grass), *Aster novi-belgii* (New York aster), *Spartina pectinata* (fresh-water cord-grass), *Carex hormathodes* (necklace sedge), and *Festuca rubra* (red fescue). The high marsh supported a population of the rare *Salicornia bigelovii* (dwarf glasswort).

General Area: 1997: Other exemplary estuarine communities present include low salt marsh, brackish marsh, tidal creek bottom, saline/brackish intertidal flat, and undifferentiated saline/brackish subtidal channel/bay bottom.

General Comments:

Mgmt Comments:

Location

Survey Site Name: Rye Harbor State Park

Managed By: Awcomin Marsh

County: Rockingham

Size: 143.9 acres

Town(s): Rye

Elevation: 4 feet

Precision: High

Directions: From Locke Road west of Rte. 1A, turn north onto Town baseball fields access road and park at end. Trails lead east.

Dates documented

First reported: 1997-06-23

Last reported: 1997-06-23

New Hampshire Natural Heritage Bureau - Ecological System Record

Salt marsh system

Legal Status

Federal: Not Listed
State: Not Listed

Conservation Status

Global:
State: S3: Rare or Uncommon

Description at this Location

Quality Rank: Good
Quality Comments:

Detailed Description: A good-sized salt marsh with adequate tidal flow. Exemplary estuarine communities include high salt marsh, low salt marsh, and brackish marsh. Small inclusions of salt pannes and pools occur as patches within the marshes. Dwarf glasswort (*Salicornia bigelovii*), a rare plant species in the state, occurs here.

General Area: Bordered by development and roads seaward, and forested uplands to the west.

General Comments:

Mgmt Comments:

Location

Survey Site Name: Rye Harbor State Park
Managed By: Awcomin Marsh

County: Rockingham
Town(s): Rye

Size: 143.9 acres
Elevation:

Precision: High

Directions: Tidal estuary on the west side of Rte. 1A at Rye Harbor State Park.

Dates documented

First reported: 1997-06-23

Last reported: 2007-10-17

New Hampshire Natural Heritage Bureau - Plant Record

Marsh Elder (*Iva frutescens*)

Legal Status

Federal: Not Listed
State: Listed Threatened

Conservation Status

Global: G5: Widespread and secure
State: S2: Imperiled

Description at this Location

Quality Rank: Not Ranked
Quality Comments:

Detailed Description: 2013: Four individuals, 20-30ö tall, each with between a few to over a dozen stems. Vigor normal.

General Area: 2013: Associates in the high salt marsh include saltmeadow cordgrass (*Spartina patens*), herbaceous sea-blite (*Suaeda maritima*), Carolina sea-lavender (*Limonium carolinianum*), seaside alkali grass (*Puccinellia maritima*), and hastate-leaved orache (*Atriplex prostrata*). The southwest lobe of the salt marsh system (ca. 30 ac) is in a state of recovery following restoration activities that began in 2001 involving fill removal (Rye Harbor dredge spoils) and invasive species control. á

General Comments:

Mgmt Comments: 2013: Most of the Phragmites stands that have invaded the salt marsh are being managed by NRCS (since 2011).

Location

Survey Site Name: Rye Harbor State Park
Managed By: Rye Town Forest

County: Rockingham
Town(s): Rye

Size: 0.1 acres
Elevation:

Precision: High

Directions:

Dates documented

First reported: 2012/07/24

Last reported: 2013/08/14

New Hampshire Natural Heritage Bureau - Plant Record

saltmarsh agalinis (*Agalinis maritima*)

Legal Status

Federal: Not Listed
State: Listed Endangered

Conservation Status

Global: G5: Widespread and secure
State: S1: Critically Imperiled

Description at this Location

Quality Rank: Good
Quality Comments:

Detailed Description: 2013: Survey limited to the NE (Area 3) and SW (Area 1) corners of the marsh. Mapped eight pannes that support saltmarsh agalinis, collectively with several 1000 flowering plants. Two of these pannes in Area 1 were also mapped in 2012, though there were many more flowering individuals in the two pannes in 2013. Vigor normal; conditions for germination and growth apparently were exceptional this year. The number of populations and individuals within populations documented in 2013 greatly exceeded what this surveyor has documented in previous years (since 2011), not only in this salt marsh but also in other marshes. 2012: Survey limited to the SW (Area 1) corner of the marsh. Mapped two pannes that support saltmarsh agalinis, collectively with 100s of flowering plants. Vigor normal. 2011: Documented in five pannes on north (Area 3) and NW (Area 2) side of the marsh, collectively with perhaps a few 1,000 flowering individuals.

General Area: 2013: Area 1 and Area 3: Both forb panne and smooth cordgrass (short form) panne variants supported saltmarsh agalinis. Associates in forb pannes include a mix of saltmeadow cordgrass (*Spartina patens*), herbaceous sea-blite (*Suaeda maritima*), saltgrass (*Distichlis spicata*), Carolina sea-lavender (*Limonium carolinianum*), saltmarsh arrow-grass (*Triglochin maritima*), smooth cordgrass (*Spartina alterniflora*), common glasswort (*Salicornia depressa*), saltmarsh rush (*Juncus gerardii*), and scattered common reed (*Phragmites australis*). Smooth cordgrass pannes were dominated by the short form of smooth cordgrass. Species listed above in the forb panne also occurred in the smooth cordgrass panne but in low cover. Saltmarsh agalinis tended to occur near the drier edges of the smooth cordgrass pannes. Area 1: the SW lobe of the salt marsh system (ca. 30 ac) is in a state of recovery following restoration activities that began in 2001 involving fill removal (Rye Harbor dredge spoils) and invasive species control. 2012: Area 1: Associates in pannes include saltmeadow cordgrass (*Spartina patens*), herbaceous sea-blite (*Suaeda maritima*), saltgrass (*Distichlis spicata*), Carolina sea-lavender (*Limonium carolinianum*), saltmarsh arrow-grass (*Triglochin maritima*), smooth cordgrass (*Spartina alterniflora*), common glasswort (*Salicornia depressa*), saltmarsh rush (*Juncus gerardii*), and common reed (*Phragmites australis*). 2011: Area 2 and Area 3: Associates in forb pannes include saltmeadow cordgrass (*Spartina patens*), saltmarsh arrow-grass (*Triglochin maritima*), saltgrass (*Distichlis spicata*), coastal silverweed (*Argentina egedii* ssp. *groenlandica*), Carolina sea-lavender (*Limonium carolinianum*), smooth cordgrass (*Spartina alterniflora*), seaside plantain (*Plantago maritima* ssp. *juncooides*), seaside alkali grass (*Puccinellia maritima*), common glasswort (*Salicornia depressa*), saltmarsh rush (*Juncus gerardii*), and scattered common reed (*Phragmites australis*).

General Comments:

Mgmt Comments: 2013: Most of the *Phragmites* stands that have invaded the salt marsh are being managed by NRCS (since 2011).

Location

Survey Site Name: Rye Harbor State Park
Managed By: Rye Town Forest

County: Rockingham
Town(s): Rye

Size: 1.8 acres
Elevation:

Precision: High

Directions: 2013, 2012, 2011: Tidal estuary on the west side of Rte. 1A at Rye Harbor State Park.

Dates documented

First reported: 2011-07-27 Last reported: 2013-08-14

APPENDIX D – Quick Reference to Trail Improvements

Point #	Clear vegetation	Install bog bridge	Install Steppingstones	Install culvert / mattress	Install signage	Reroute / retire trail?	Other / Notes
1				Remove culvert; install mattress			
2	✓					Improve or retire	
3						Retire	
4					✓		
5					Improve		
6					✓		
7					✓		
8		✓					
9		✓	✓				
10		✓	✓				
11						Re-route or consolidate	
12	✓						
13						Re-route or consolidate	
14	✓				Arrow	Retire eastern trail	
15					✓	Retire connector	
16					✓		
17						Retire / reroute	
18						Retire	
19	✓						Widen trail
20		Beam bridge					
21					Arrow	Reroute	
22		✓	✓				
23			✓				
24		✓				Retire / reroute	
25	✓	✓				Reroute	
26						Retire	
27					Arrow	Reroute	



28	✓				✓		
29			✓				
30	✓	✓					Install diversion
31		✓; Improve beam bridge					
32					✓		General improvement
33						Retire	
34		✓	✓				
35		✓	✓				
36						Retire	
37		✓					
38							New spur trail
39						Retire	
40	✓					Reroute	
41							Widen log gap
42		✓; Improve existing					
43	✓						
44	✓						
45					✓	Retire	
46		✓					
47		✓	✓				
48					✓		
49					✓		
50					✓		
51	✓	✓					
52				Clean culvert, cover with gravel			
53				✓			
54					✓		
55				✓			
56				Eventually replace culvert			
57				Eventually replace culvert			
58							Install kiosk with map



APPENDIX E – Wildlife Resources⁴

Wildlife Habitat Features

The Rye Town Forest is unique in that it contains four broad, but diverse, habitats types with excellent attributes for wildlife. These include the property's: 1) forested wetlands, some of which contain dense shrub-dominated areas; 2) extensive upland forest; 3) field land; and 4) and coastal wetland, the Awcomin Salt Marsh area. A summary of the property's natural habitat follows, with recommendations for maintaining these habitats.

Open Space

The Rye Town Forest is an integral component of a 300-acre block of undeveloped open space that is located amidst one of the more heavily developed areas in southern New Hampshire. As discussed in the Introduction, substantial areas of *unfragmented* forest and wetlands represent increasingly critical wildlife habitat. Although some wildlife species may spend their entire life on the Town Forest property (red-backed salamanders, white-footed mice), most species travel through the property daily (fisher, deer), or as their food and cover needs change with the seasons (scarlet tanager, cedar waxwing, American goldfinch). Adjacent open space plays a critical role in how wildlife uses the Rye Town Forest. Discouraging further development on surrounding properties benefits the integrity of the open space area.

Wetlands

The varied and extensive surface water resources of the Town Forest complement the diverse forested habitat available to wildlife. Water resources include the ponded areas such as the recreation area pond and the old ice pond, ample palustrine (forested wetland/shrub swamp) areas, seasonal and year-round streams, ephemeral (vernal/autumnal) pools, and coastal salt marsh. The Rye Town Forest is unique in containing coastal salt marsh habitat. Each wetland type meets the habitat requirements for various species of fish, amphibians, reptiles, birds, and mammals.

Salt Marsh

Wildlife found in salt marsh habitat have evolved to deal with a constantly changing environment. Despite the harsh, alternating condition of exposed, then submerged, soils and vegetation, many animals depend on salt marshes for survival. Salt marshes, such as the Awcomin Salt Marsh, act as a fish nursery, a wave buffer, a water purifier, an oxygen pump, and a food pantry to wildlife (Benyus 1989).

Most wildlife activity occurs in and around the tidal creeks. Fresh food and nutrients are brought in with the tides. Tall saltmarsh cordgrass along the banks provides shelter for wary marsh birds (Virginia rail and American bittern) and nesting sites for songbirds (marsh wren and savannah sparrow, salt marsh sparrow). Fiddler crab dwell along these banks and serve as a food staple for many marsh animals (gulls, black-crowned night heron, and green heron). Raccoon and muskrat forage for mussels, and muskrat den

⁴ 2019 review for accuracy and commentary by UNH Cooperative Extension Wildlife Biologist Matt Tarr has been integrated into the Wildlife Resources section.



in lodges or “bank burrows” along the tidal creeks. Mink are active nocturnally, hunting for fish and small rodents (meadow vole).

Inland Wetlands and Streams

Forested wetlands range from incipient to well-established, having an interesting variety of fruit-bearing shrub species including northern arrowwood, high-bush blueberry, and winterberry holly. Forested wetlands and riverine habitat accommodate several species of aquatic mammals, birds, and amphibians. Pools of slow or stagnant water allow for prolific insect reproduction (mosquito, caddisfly, midge larvae, etc.). These insects supply nutrient rich food for bats (possibly little brown bat and big brown bat), and other insectivorous small mammals (star-nosed mole, short-tailed shrew). In addition, the perennial streams hold native crustaceans year-round, and attractant raccoon, mink, and river otter. Patchy dense fruit-bearing vegetation growing along these riparian areas provide fine perching and foraging habitat for birds that eat insects (eastern phoebe, common yellowthroat, song sparrow) or soft-mast (black-capped chickadee, tufted titmouse, gray catbird, northern cardinal), as well as excellent escape cover for a multitude of animals. Stream-dependent amphibians such as the northern dusky salamander and two-lined salamander may be found along the edges of the property’s intermittent drainages.

There is presently limited opportunity to silviculturally enhance habitat in wetland interiors and edges due to the potential of spreading invasive plants. If exotic invasives were eradicated in the Town Forest, small canopy openings would promote the growth of wetland forbs and shrubs as valuable food and cover sources.

Upland Mast Forest

The Rye Town Forest is endowed with upland forest habitat that include extensive oak stands, dense softwood areas, and mixed species forest. The oak forest is dominated by red oak, with varying amounts of white and black oak, representing a substantial mast production area. Acorns rank among the most important wildlife foods in our local forests, utilized by a great variety of animals (squirrels, chipmunks, foxes, porcupine, deer, blue jays, wild turkeys, wood ducks). White oak acorns are a preferred hard mast type. Older oaks with a well-developed crown are favorable for producing copious amounts of acorns. A silvicultural objective is to encourage and maintain an abundance of mast-producing trees—white and red oak, beech, and hickory. Over the long-term, healthy, large-crowned mast producers, ranging from 100 to over 200 years of age, will likely be well-represented in the Rye Town Forest.

Softwood Cover

The Rye Town Forest contains extensive softwood cover. White pine areas provide perch/roost sites for owls and hawks, and required habitat for pine warbler. Moreover, white pine stands offer an abundant, albeit cyclical, source of seeds. Red squirrel, red breasted nuthatch, and evening grosbeak feed on pine seeds. Hemlock is also a significant species, providing valuable winter cover. Deer congregate or “yard” as an energy conserving measure under dense hemlock canopy where snow depths are shallow. Hemlocks also provide year-round thermal cover to wildlife, required nesting habitat for Blackburnian warbler, and preferred foraging habitat for porcupine and golden-crowned kinglet. While hemlock and spruce saplings are of moderate food value to wildlife, they provide year-round travel cover. Major wildlife travel



corridors are found in dense hemlocks that sometimes line stream and wetland edges. It is recommended that pockets of pine and hemlock be silviculturally maintained in roughly the same proportion as the present total (30±%), though this area is likely to diminish in the future as hemlocks succumb to the Hemlock Woolly Adelgid.

Mixed Forest

Mixed forest areas represent varied conditions, including areas with combined mast and softwood cover conditions; mesic hardwoods (yellow and black birch, red and sugar maple, white ash, basswood, red oak, aspen, black cherry); aspen (popple) pockets; and young/old tree mixes. Mesic hardwoods offer another variety of seeds and mast, as well as soft trees such as popple or basswood for cavity-making. Mature white ash, sugar maple and red maple produce samaras (seeds) during the spring and fall that are eaten by small mammals and turkey. (White ash will likely soon be lost to the Emerald Ash Borer). Aspen (popple) is an important species for beaver and ruffed grouse. Beaver prefer aspen growing within 300 feet of swamps. It is recommended that silviculture encourage the growth of a variety of hardwoods, particularly in moist (mesic) areas.

Old Forest

In the 19th century, the Rye Town Forest was entirely open fields, as indicated by the numerous stone walls that demarcate former field edges. The present forest is variously aged, with age groupings often predicated on when these fields were abandoned, as well as past logging. Most of the Rye Town Forest is between 60 and 110 years old, though some areas contain trees up to 125± years. It is possible that a few, scattered individual trees in the Town Forest range up to 200 years of age.

A long-term silvicultural objective is to increase the number of old trees, and to develop areas with old growth conditions for wildlife. Conversely, only a small amount of the Town Forest (<1%) is covered by young, early forest succession growth. As an increasingly uncommon, but important, habitat type, it is recommended that existing early-successional areas be maintained.

The silvicultural management of the forest is recommended, partly to encourage the development of mixed-age conditions. This approach favors a mixture of mature forest, with integrated mid-aged trees and young growth (polewood), as well as ample natural regeneration. Long-lived species, such as pine and oak (and hemlock, if it survives the Hemlock Woolly Adelgid), can be retained indefinitely, both individually scattered and in groves. These species may survive for several hundred years, barring natural loss.

Young, Early-Successional, Forest

Early-successional forest has an abundance of pioneer species, i.e., trees that tend to become established under full sunlight conditions. These include gray and white birch, white pine, aspen, red maple, black cherry, and sumac. A variety of shrubs and vines also thrive under full sunlight; hawthorn, highbush blueberry, and blackberry are three types that were noted in Stand I (the forest type representing early-successional growth in the Town Forest). Since recently abandoned pasture is scarce in New Hampshire (New Hampshire is the second most forested state in the nation), early-successional habitat is increasingly in short-supply to the many wildlife that depend on it. As part of the overall management approach,



maintaining the early-successional nature of Stand I (only 0.7± acres) is recommended for the important diversity of habitat it represents.

Other Wildlife Features: Snags, Cavity Trees, and Downed Wood

Along with live trees, standing dead trees (snags) and downed woody biomass are essential components of a forest, providing critical wildlife habitat. A forest devoid of dead trees is unnatural and unfavorable to wildlife. Wetland forest areas contain great numbers of snags, which at various stages, may be inhabited by woodpeckers, black-capped chickadee, tufted titmice, wood duck and mergansers. Large dead trees within and along the edge of wetlands may support the stick nests of great blue heron and osprey. As the trees in the Town Forest age, snags and remnant woody material on the forest floor will become increasingly abundant. These should be left behind where possible (except for hazard trees overshadowing Town Forest trails) for use by wildlife.

Endangered Wildlife Species

Though no endangered or threatened wildlife species were noted in the Rye Town Forest, it is possible that the following species may be sighted on the property's upland or wetland habitats.

Comments by wildlife biologist Matt Tarr:

“The forest of the property may very likely provide summer roosting and breeding habitat for three endangered bat species (little brown bat, big brown bat, tri-colored bat). These species may roost in trees during the day and feed over the marsh at night.”

“Endangered northern harriers would be expected hunting over the marsh during spring and fall migration.”

“Endangered peregrine falcons would be expected to hunt over the marsh during migration and possible during the breeding season if they are nesting anywhere nearby.”

“Very possible that threatened black racers may den/nest in rocky outcrops and hunt small mammals and nestling birds in and around the edges of the marsh. “

Wildlife Recommendations Summary

General Measures

Conduct wildlife surveys including: birds (migratory and breeding counts), mammal (sign, sighting, winter tracks), amphibians (in ephemeral pools and forested wetlands).

Set-up nesting boxes along wetland and salt marsh edges.



Protect unique natural communities (e.g., Awcomin Salt Marsh) from pollution sources or unwarranted disturbance.

Silvicultural measures to complement existing wildlife features and habitat:

Open Space/General

- Maintain forest diversity, particularly, tree age, density, and species mix.
- Throughout the forest, stratify tree-canopy layers, to maintain vertical cover and habitat.

Wetlands

- Maintain wildlife corridors, specifically by retaining shrubby vegetation or areas of young hemlock along streams and wetlands.
- The following recommendation **is no longer encouraged**, due to the high density of invasive plants in the Town Forest's forested wetlands: "Harvest of red maple on wetland edges to create stump sprouts and release wetland shrubs".
- Encourage native, wetland wildlife shrubs—winterberry holly, highbush blueberry, silky dogwood, speckled alder, arrowwood, northern wild-raisin—in wetlands or wetland edges.

Upland Mast Forest

- Desirable native, upland wildlife shrubs include: staghorn and smooth sumac, beaked hazelnut, witch-hazel, maple-leaved viburnum, nannyberry. Desirable native vines or cane plants include: grapevine, Virginia creeper, blackberry, raspberry, and dewberry.
- Retain abundant, healthy mast trees, especially large-crowned oak, hickory, and beech.

Softwood Cover

- Maintain areas of dense young and/or older hemlock, both scattered and in groves, for yarding, thermal cover, and travel corridors. However, due to the presence of the exotic insect, Hemlock Woolly Adelgid, which is likely to decimate the Town Forest's hemlock over the next two decades, this recommendation may no longer apply. A possible biological control is being developed which may offer a reprieve from the otherwise expected loss of hemlock.

Mixed Forest

- Perpetuate the presence of aspen groves where they exist.

Mixed-age Forest

- If silviculture is to be applied, encourage the development of a mixed-aged forest with ample representation of young, mid-aged, and older-growth forest.
- Increase overall average mature forest upper canopy trees age to 125+ years.
- Retain "legacy" trees (30+ inches) throughout the forest indefinitely, i.e., 150+ years.

Other

- Retain dead trees, snags, cavity-trees, potential den trees, and downed woody biomass.
- Create small, scattered brush piles from tree limbs left after logging.
- After use, seed landing areas and forest roads with clover and native grasses attractive to pollinators and mammals.



APPENDIX F – Forester Professional Qualifications

CHARLES MORENO, LPF Consulting Forester, Forest Ecologist

**New Hampshire Licensed Professional Forester #115
Maine Forester License #2000**

EDUCATION

B.S. FORESTRY – University of New Hampshire, Magna Cum Laude, May 1980
SAF Study Tour of France – Three-week study of French silvicultural methods, September 1983
AFF Study Tour Germany/France/Switzerland—Mixed-aged silvicultural methods, Oct 2016

PROFESSIONAL SERVICE and AFFILIATIONS

Forest Stewards Guild – Board of Directors (1999-2005), Chair (2005)
Society of American Foresters (SAF) – NH Chairman (1996)
New Hampshire Tree Farm Program – Executive Committee (1984-87) Society for the Protection of New Hampshire Forests

WORK EXPERIENCE

1980 - Present **FORESTRY CONSULTANT**, founder and proprietor of Moreno Forestry Associates. Forty years' experience managing private and public forests in New Hampshire. Projects include forest and wildlife management planning and implementation, ecological assessments, forest inventory and appraisals, timber sales, mapping, forest taxation and litigation, forest improvement and habitat enhancement, and conservation plans for towns, conservation organizations, corporations, and private landowners. 40,000+ acres under management.

1984 - Present **TOWN FOREST MANAGER** for the Towns of Exeter, Londonderry, Candia, Plaistow, Atkinson, East Kingston, Deerfield, Epping, Brentwood, Sandown, Rye, Pittsfield, Chichester, Derry, Dover, Strafford, Northwood, Rollinsford, and Rochester developing/implementing multiple-use plans for publicly-owned forests.

1988 - Present **FOREST MANAGER** for multiple forest properties owned by conservation organizations, land trusts, and schools. Prepared and presented numerous workshops and field tours teaching silviculture, wildlife habitat management, natural history, forest ecology, low impact harvest techniques, and other topics.

1990 - Present **FOREST CONSULTANT** for environmental studies, forest appraisals, and/or project management including Pease Tradeport (Newington, NH), Emerald Necklace (Boston, MA), Trust for Public Lands, Southeast Land Trust, and Siemon Family Charitable Trust.

2009 - Present **TECHNICAL SERVICE PROVIDER (TSP)** for Natural Resources Conservation Service (NRCS). Approximately 75 NRCS funded management plans completed, as well as project management for forest improvement, habitat enhancement, invasive control, & woods road construction.

PROFESSIONAL RECOGNITION

New Hampshire Outstanding Forester Award (Society of American Foresters) – 2001
National Outstanding Tree Farm Inspector Award – 1999
Austin Cary Practicing Professional Award (New England SAF) – 1998
NH Wildlife Stewardship Award – 1995
Outstanding New Hampshire Tree Farm Award – 1987, 1992, 2002, & 2006
NH Tree Farm Inspector of the Year – 1985, 1990, 1992, 1993 & 1998
Xi Sigma Pi (Forestry Honor Society) – 1978
Eagle Scout (1976)

