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Silviculture Prescription
Townsend Home Fuelwood

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Northeast District
Townsend State Forest
Townsend, MA

Prepared by:

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Approved by:

Management Forestry
Program Supervisor _____ Date: August 22, 2016

William N. Hill, CF

Site Data:

Cultural and Historical:

The Townsend State Forest is located in the north central section of the Town of Townsend, Middlesex County, Massachusetts. This project area is located along Fessenden Hill Road (29 acres), and an unnamed woods road (25 acres) leading from Brookline Road (Rt. 13) along a westerly and northerly route eventually connecting with Fessenden Hill Road (Appendix Map 1 and 2). This area of Townsend State Forest is part of approximately 1700 acres deeded to the Commonwealth in the 1930's by the Fessenden Companies based in Townsend. These lands, along with other acquisitions, were consolidated into what is now Townsend State Forest (Appendix Map 3).

Previous land use of this area was subsistence farming, livestock grazing and timber extraction. Evidence of previous land use prior to state ownership can be seen in the stone walls and old cellar holes found along Fessenden Hill Road. At the time of acquisition these properties were heavily cut over to provide the raw material necessary for the manufacture of barrels and other lumber products. Cutting was focused on trees that could provide the material necessary for industry and little focus was placed on promoting the long term viability of the forest. Extractive cutting of these forest lands left them in a degraded condition subject to outbreaks of wildfire.

Periodic fires are documented throughout the history of this area both anthropogenic caused and naturally occurring. The historical natural fire regime is classified as a "Type III" (35-100 years frequency, mixed severity). The last large forest fire in this area began on April 16, 1927 and burned over 28 square miles of land. It is thought that this fire was caused by the nearby Boston and Maine rail line (now abandoned) to the west of the project area. Since that time there has been significant increase in the number of inhabitants, and structures to this area thereby increasing the risk of property loss due to wildfire outbreak.[1]

The Massachusetts Department of Conservation and Recreation (DCR), acting through the Bureau of Fire Control and Forestry began to improve access and establish firebreaks within these forests to provide a break in fuel continuity and provide access for first responders. Previous access to major portions of this forest was extremely poor due to deferred maintenance and staffing reductions. The fire breaks are periodically mowed and prescribed fire is used to maintain them.

[1]Massachusetts Department of Conservation and Recreation, Bureau of Fire Control and Forestry, Hazard Mitigation-Federal Assistance 2004, Northern Middlesex County Hazardous Fuel Mitigation Planning/Treatment/Community Awareness

The home fuelwood program evolved from the earlier "Cut-A-Cord" program started in the early twentieth century. The program has been popular with homeowners and renters as it allows participants the opportunity to provide for themselves a source of affordable and renewable heat. The home fuelwood program integrates well into the goals of the bureau as it provides the manpower to expand the fuel breaks while supplying forest products to homeowners who may lack access to wood as a heat source and at the same time meeting guidelines set forth in the DCR Management Guidelines document.[2]

Geology and Soils:

Several thousand years ago this area was covered by the Wisconsin Glacier. It is estimated at its peak that this glacier was over 2 miles thick in some areas. The current landscape bears witness to this period and the subsequent retreat of the glacier and the soils deposited during this time. This area of Middlesex County has, in general, relatively thin soils, rocky outcrops, with the underlying bedrock close to the surface. The soils in this area generally fall into the glaciofluvial (glacial outwash) and glacial till types.[3]

Elevations within the project area range from approximately 350 feet in the southerly and easterly portions of the project area rising to approximately 600 feet in the northerly sections near the New Hampshire border. The topography can be described as generally rolling (0%-10% slope) in nature interrupted by short steep rocky outcrops (15%-25% slope) with an easterly and southerly aspect.

Since the project area is of limited in size and centered on the main forest roads the soils consist of several different series. Generally these soils fall into the Whitman, Carlton-Hollis, Hinckley, Carver and Montauk soils series (Appendix Map 4 and 5). The common theme among these soils is a sandy-loamy-stony nature due glacial origin. Soil productivity is moderate to good on these soils with site indexes ranging from 53 (eastern white pine (*Pinus strobus*)) for the Carver series to 75 (eastern white pine) for the Montauk series. Soil productivity, as it pertains to this project, will be protected during this project since vehicles are restricted to main roads thereby minimizing any chance for soil compaction or erosion.

Climate:

The project area is typical for this area of New England with weather patterns varying from season to season. According to the National Oceanic and Atmospheric Administration this area has an annual average precipitation of 34.5" and a mean annual temperature of 44.8°F.[4]

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[2] Landscape Designations for DCR Parks and Forests: Selection Criteria and Management Guidelines, March 2012 Edition
[3] USDA, NRCS, Soil Survey of Middlesex County, 2009
[4] US Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Annual Climatological Summary, Ashburnham North, MA US COOP:190192, generated 6-23-2016

Weather patterns affect forest development within this area with wind being the most significant driver of forest development over time. These winds, in general, originate from the south and southwest during warmer months, and north and northwest during cooler periods of the year.

Major episodic weather events (i.e. hurricanes, ice, etc.) are major factors in forest development throughout New England. The 2008 ice storm caused significant damage to portions of the project area ranging from lost and broken branches, to broken tops and damage to regeneration. Hardwood trees, in general, incurred more damage than softwood trees due to the latter's physical structure. These episodic events create small gaps in the forest canopy providing sites where regeneration becomes established creating a mosaic of age and species across the landscape.

Hydrology:

The project areas, as well as the State Forest as a whole, are part of the Nashua River Watershed. Water discharge from forest flows through many small intermittent streams and eventually ends up in the Squannacook River which flows approximately nine miles southeasterly into the Nashua River. The nearest public water supply source is located approximately 3/4 of a mile to the south of Fessenden Hill Road portion of the project.

There are several intermittent streams, forested wetlands, swamps and a certified vernal pool found in the project area along Fessenden Hill Road (Map 2). The northern section of the project area contains none of the above mentioned resources. No work will be conducted within resource areas other than utilization of existing forest roads for access. All stream crossings located within the project areas are existing culverts.

The project areas are located within the Squannassit Area of Critical Environmental Concern (ACEC). ACEC areas provide protection to public and private groundwater supplies, provide flood control, and protect valuable fisheries and important wildlife habitat. Therefore, in order to minimize any site impacts there will be no cutting within 50 feet of streams, wetlands, or vernal pool areas. Resource areas will be buffered in the field with flagging and mapped in accordance with regulations found within the most recent edition of the Massachusetts Forestry, Best Management Practices Manual.[5]

Current and Potential Vegetation:

Methods:

A geographic information system (GIS) grid was developed in order to conduct a thorough stand exam within the project areas. Double Point sampling was conducted at 43 plots to inventory the overstory and understory component of the project areas. Fox DS Cruiser was used to process the

[5] Catanzaro, P., Fish, J., Kittredge, D., Massachusetts Forestry, Best Management Practices Manual, 2013 Edition

overstory data for incorporation into this document.[6] Understory vegetation was sampled at each inventory point using standards set forth in the DCR Manual for Continuous Forest Inventory for regeneration plots (0.0300 acre plot size). One hundred foot coarse woody material transects were conducted from each inventory point. [7] USDA, NED-3 software was used to process understory and coarse woody material data.[8]

Results:

The project areas currently support native vegetation types consistent with a mixed hardwood – eastern white pine forest. The forest canopy of "Unit A" consists of (in decreasing order of dominance), chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), black birch (*Betula lenta*), black oak (*Quercus velutina*), white pine, white oak *(Quercus alba*), and paper birch (*Betula paparifera*) (Chart 1, Tables 1 & 2).

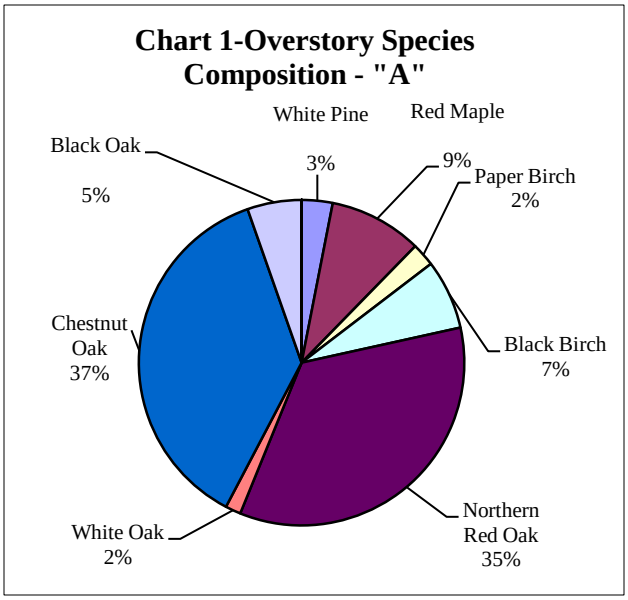


Table 1			Sawtimber	Total	Total	Topwood
	Sawlog	Pulp	Mean	Bf	Cords	Cords
Species	Bf/Acre	Cords/Acre	Ht (logs)	(Stand)	(Stand)	(Stand)
white pine	0.0	0.8		0.0	19.5	
red maple	0.0	1.1		0.0	26.7	
paper birch	0.0	0.3		0.0	6.8	
black birch	0.0	0.8		0.0	20.8	
red oak	1275.4	2.3	1.8	31885.3	58.2	11.3
white oak	0.0	0.0		0.0	0.3	
chestnut oak	762.3	3.9	2.3	19057.6	98.6	3.6
black oak	61.7	0.5		1543.7	13.2	
Total	**2099.5**	**9.8**		**52486.5**	**244.2**	**14.9**

[6] FOX DS Cruiser version 2007.2, New Hampshire Forests and Lands
[7] Massachusetts Department of Conservation and Recreation, Manual for Continuous Forest Inventory Field Procedures, February 2014 Edition
[8] USDA Forest Service, Northern Research Station, NED-3,Version 3.0.6.20

Table 2	Stocking Diagnostics					
			%			
	Total	Total	BA/ac			
Species	Trees/Acre	BA/Acre	by Spp	QMD	Rel Density	% AGS
white pine	16	2.0	3%	4.8	1.4	25%
red maple	36	6.0	9%	5.5	5.7	0%
paper birch	4	1.5	2%	8.3	1.4	0%
black birch	17	4.5	7%	6.9	4.0	11%
red oak	83	22.5	35%	7.0	21.3	76%
white oak	2	1.0	2%	10.6	0.9	50%
chestnut oak	81	24.0	37%	7.4	21.0	69%
black oak	17	3.5	5%	6.1	3.5	57%
Total	**256**	**65.0**	**100%**	**6.8**	**59.2**	**57%**
			Median Stand Diameter ->>	**8.6**	**59.2**	<<- Estimated Relative Density

The forest canopy of this area is a result of the regeneration that took place after the forest fire of 1927 and the trees are generally even aged and pole sized with a median stand diameter of 8.6". The stand contains approximately 65 square feet of basal area and approximately 256 trees per acre with red oak and chestnut oak comprising the majority of the stand. The stand is moderately stocked with an estimated relative density of 59.2.

The understory of project area "A" consists of native tree and shrub vegetation. Red maple, chestnut oak, and eastern white pine are the most common species of trees found in the regeneration portion of the understory along with lesser amounts of northern red oak and black oak species (Table 3). No invasive species were noted in this area during the course of data acquisition.

Shrub vegetation found in this section of the project is dominated by mountain laurel (*Kalmia latifolia*), with lesser amounts of lowbush blueberry (*Vaccinimum angustifolium)*, American witch-hazel (*Hamamelis virginiana*), eastern teaberry (*Gaultheria procumbens*), starflower (*Trintalis sp*.), maple leaf viburnum (*Viburnum acerifolum*), Solomon's seal (*Polygonatum sp*.), cinnamon fern (*Osmunda cinnamomea*), striped maple (*Acer pensylvanicum*) and various unidentified grasses (Table 4).

Table 3- Regeneration stems per acre
Unit A

Name	<12"	1'-4.5'	4.5'-1"DBH	1"-4.9" DBH	Total
red maple	18	0	2	2	22
eastern white pine	5	0	9	0	14
chestnut oak	14	0	2	0	16
northern red oak	5	0	0	0	5
black oak	0	0	0	2	2
Total	**42**	**0**	**13**	**4**	**59**

Table 4- Shrub percent cover
Unit A

Name	Percent Cover
mountain laurel	38.7
lowbush blueberry	2.9
American witch-hazel	1.6
eastern teaberry	1.3
unidentified grass	0.5
Starflower	0.5
maple leaf viburnum	0.5
Solomon's seal	0.3
cinnamon fern	0.3
striped maple	0.2
Total	**46.8**

The forest canopy of "Unit B" consists of (in decreasing order of dominance) white pine, red oak, equal amounts of white oak and red maple along with equal proportions of chestnut oak, scarlet oak (*Quercus coccinea*), gray birch (*Betula populifolia*), black spruce (*Picea mariana*), white ash (*Fraxinus americana*), black birch, and black cherry (*Prunus serontina*) (Chart 2, Tables 5 & 6). Miscellaneous hardwood species such as American Beech (*Fagus grandifolia*), quaking aspen *(Populous tremuloides)*, and big tooth aspen (*Populous grandidentata*) can be found in this area and combined make up approximately one percent of the canopy.

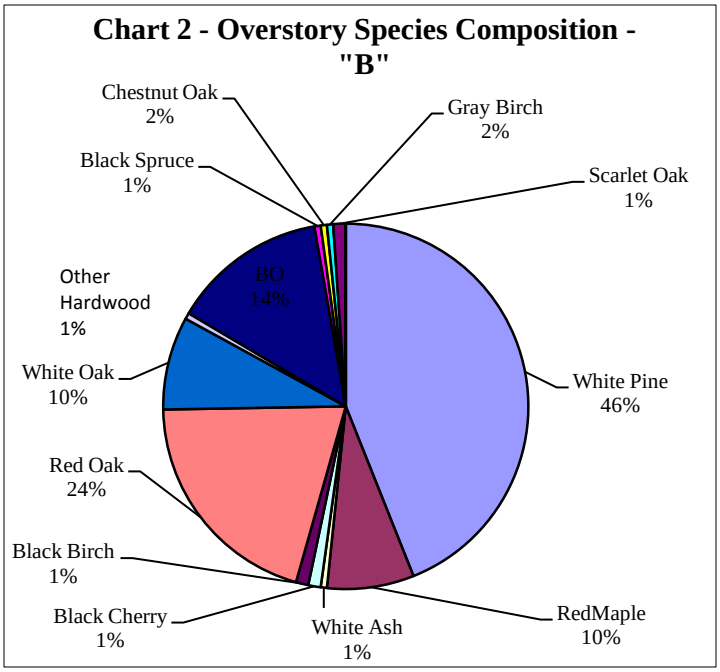


Table 5						
			Sawtimber	Total	Total	Topwood
	Sawlog	Pulp	Mean	Bf	Cords	Cords
Species	Bf/Acre	Cords/Acre	Ht (logs)	(Stand)	(Stand)	(Stand)
white pine	2363.9	4.9	2.4	68553.7	141.1	16.8
red maple	52.8	1.3	2.0	1530.3	37.6	0.4
black birch	59.7	0.1		1732.2	2.3	
red oak	1222.4	1.0	1.9	35450.8	29.4	12.5
white oak	58.5	1.1	2.0	1697.3	30.7	0.5
chestnut oak	59.7			1732.2		
black oak	483.6	1.2	2.0	14025.1	34.9	4.1
American chestnut	0.0	0.1		0.0	1.8	
scarlet oak	0.0	0.2		0.0	4.7	
Total	**4300.7**	**9.9**		**124721.7**	**282.5**	**34.3**

American chestnut (*Castanea dentata*) sprouts and a few small trees (<5" DBH) are found throughout the forest in this area but because of chestnut blight (*Cryphonectria parasitica*) these trees never reach maturity. It can be inferred that prior to the blight outbreak that chestnut was a major component of the forest canopy as evidenced by the numerous sprouts.

Table 6	Stocking Diagnostics					
			%			
	Total	Total	BA/ac			
Species	Trees/Acre	BA/Acre	by Spp	QMD	Rel Density	% AGS
white pine	62	32.0	42%	9.7	13.3	66%
red maple	22	5.6	8%	6.8	4.9	14%
white ash	1	0.4	1%	7.9	0.0	0%
black cherry	2	0.8	1%	7.9	0.0	0%
black birch	7	0.8	1%	4.5	0.8	100%
red oak	35	14.8	20%	8.8	13.5	84%
white oak	16	6.0	8%	8.4	5.3	53%
chestnut oak	1	0.4	1%	7.9	0.0	100%
black oak	33	10.0	14%	7.5	9.3	76%
black spruce	1	0.4	1%	7.9	0.0	0%
American chestnut	3	0.4	1%	4.9	0.4	0%
gray birch	1	0.4	1%	7.9	0.0	0%
scarlet oak	4	0.8	1%	6.0	0.8	50%
Total	**188**	**72.8**	**100%**	**8.4**	**48.3**	**64%**
			Median Stand Diameter ->>	**10.7**	**50.0**	<<- Estimated Relative Density

The understory vegetation is comprised of native tree species comprised of white pine, red maple, and white oak comprising the majority of the regeneration portion within the project area with lesser amounts of other hardwood species (Table 7). No invasive species were noted in this section of the project area.

The shrub component of this area contains similar species as "Unit A" with the addition of species such as clubmoss (*Lycopodium sp.*), Canada mayflower (*Maianthemum canadense*), sheep laurel (*Kalmia angustifolia*), partridge berry (*Mitchella repens*), highbush blueberry (*Vaccinium corymbosum*), Canadian serviceberry (*Amelanchier canadensis*) and northern dewberry (*Rubus flagellaris*) (Table 8).

Table 7- Regeneration stems per acre - Unit B

Name	< 12"	1.0' - 4.5'	4.5 - 1" DBH	1"- 4.9" DBH	Total
eastern white pine	69	1	7	9	86
red maple	30	1	13	11	55
white oak	19	4	3	1	27
black birch	13	0	0	0	13
northern red oak	12	0	0	0	12
black cherry	11	0	0	0	11
chestnut oak	5	0	3	0	8
black oak	7	0	0	1	8
quaking aspen	5	0	0	0	5
Total	**171**	**6**	**26**	**22**	**225**

Table 8 - Shrub percent cover - Unit B

Name	Percent Cover
mountain laurel	12.6
lowbush blueberry	4.0
eastern teaberry	2.4
cinnamon fern	2.0
unidentified grass	1.7
clubmoss	1.5
Canada mayflower	1.2
starflower	0.9
sheep laurel	0.9
American witch-hazel	0.9
Solomon's seal	0.7
mapleleaf viburnum	0.5
partridgeberry	0.4
highbush blueberry	0.3
striped maple	0.2
northern dewberry	0.2
Canadian serviceberry	0.1
Total	**30.8**

This area of the forest was treated to a similar home fuelwood project in 1984-85[9]. Again as with the other project area the trees are generally even aged and pole and small saw log sized classes. This portion of the project area has a median stand diameter of 10.7". The stand contains approximately 73 square feet of basal area and approximately 189 trees per acre with white pine, red and black oak comprising the majority of the stand. The stand is moderately stocked with an estimated relative density of 50.0.

Analyzing the site productivity and complexity using GIS data layers of prime forest soils, potential vegetation complexity, late successional potential, forest diversity, early successional potential,

[9] NEM-184HF, NEM-385HF

continuous forest inventory (CFI) site index, and CFI stand structure verifies the low to moderate productivity of these forest stands.[10] Forests with low to moderate productivity levels lend themselves to even aged silvicultural systems.

Insects:


Gypsy moth larvae – USFS photo

This area of the forest was subject to Gypsy moth (*Lymantria dispar*) outbreaks in the early 1980's. The spring of 2016 has seen a resurgence of this forest pest as a result of environmental conditions beneficial to population growth of this introduced pest in other areas of Massachusetts. A small number of caterpillars were observed during the course of stand examination, but no significant amount of defoliation was observed. Oak species are preferred by this destructive pest, and repeated defoliation can lead to crown dieback and eventual mortality affecting the diversity of the forest.[11]

Emerald ash borer (*Agrilus planipennis*) is another introduced pest on the horizon for the forests of New England. Although ash does not constitute a major component of the forests within the project area it is found scattered throughout the forest. Trees infested by this pest experience rapid mortality.[12] This can lead to changes in forest structure and affect overall diversity as a result of species loss.


Emerald ash borer adult and larvae – USFS photo

[10] Goodwin, D.W. and Hill, W.N, 2012. Forest Productivity and Stand Complexity Model (A GIS Grid Analysis using ARCGIS), Massachusetts Department of Conservation and Recreation, Amherst, MA

[11] https://ag.umass.edu/fact-sheets/gypsy-moth

[12] https://ag.umass.edu/fact-sheets/emerald-ash-borer

Archeological Features:

The project area is located in a portion of the State forest that at one time was used for grazing of livestock and extraction of timber for industry. Evidence of human activity, although overgrown with vegetation, is still visible in the project area. There are two known cellar holes found within "Unit B" of the project area (Map 2). No cutting will be permitted within 50' of known cellar holes and flagging will be placed around these artifacts to alert woodcutters to their presence. There are no stone walls located within the project areas, and no archeological features located within "Unit A".

Wildlife:

The oak and white pine overstory within the project areas provides valuable habitat and food to native wildlife species. These forests provide mast (both hard and soft types) to many species of wildlife that feed on them along with valuable habitat for rearing young. Species noted within the area include: white tail deer, moose, black bear, coyote and a variety of avian, amphibian, and invertebrate species.

The Landscape Designation for DCR Parks and Forests: Selection Criteria and Management Guidelines recommend maintaining a minimum of 256 cubic feet per acre of coarse woody material (CWM). The project areas contain an average of 254 cubic feet per acre (Unit A), and 255 cubic feet per acre (Unit B) of this material respectively. The CWM consists of material greater than 3" in diameter and is composed of both hard (sound) and soft (decayed) types. Tree tops will be left onsite to decompose naturally and add to this amount of material.

CWM is desirable for many species of invertebrates, amphibians, and small mammals for part or all of their life cycles. CWM helps to develop soil structure as it slowly breaks down overtime adding valuable nutrients. CWM also acts as "nurse trees" for seedling recruitment within forests.

Snags are found throughout the project area and are a source of cavities and forage opportunities for wildlife species that are dependent on them. It is estimated that there are approximately 39 snags per acre in Unit A and 33 snags per acre in Unit B. All snag observations were less than 12" in diameter with 75% of snags being hardwood species (both Units). All existing snags will be retained, with exceptions for snags that may pose a risk to public safety along trails. Those snags will be cut and left on site as coarse woody material.

The partial cutting associated with the Home Fuel Wood Program harvest is unlikely to have substantial impacts on wildlife. Wildlife species associated with mature forest habitat will likely continue to use these stands and will benefit from the food and cover resources available to them. Over time this forest will produce more mast (primarily acorns) as crowns of released trees expand taking advantage of additional growing space.

Rare and Endangered Species:

Review of the 13th Edition of the Massachusetts Natural Heritage Atlas shows that the project areas do not fall within priority habitats for rare and endangered species.[13]

Water Resources:

As noted earlier there are several wetlands, intermittent streams, and a certified vernal pool located in the project area in Unit B and none in Unit A. Due to the limited nature of this project, and all work being conducted by hand, there are no anticipated impacts to resource areas. All resource areas will be buffered at a minimum 50' where no tree removals will take place.

Recreation and Aesthetics:

This area is widely used by constituents for passive recreation with walking, mountain biking, bird watching and hunting being the most common activities. Illegal all terrain vehicle use occurs within the forest, but is confined mostly to main forest roads.

As noted in the management guidelines document forest management activities occurring within trail corridors will focus on retaining larger diameter, healthy trees and promoting a safe experience for recreational users. Forest management activity will help to reduce the number of dead and dying trees located along forest trails to improve safety for users and improve access for first responders. Existing legal trails within the project areas will be utilized to access lots for tree removals. No slash will remain within 25' of trails, and slash will be treated to promote rapid decomposition and a light appearance.

Evaluation of Data and Projected Results:

Objectives:

Townsend State Forest is designated a Woodland. As noted in the Landscape Designations for DCR Parks and Forests: Selection Criteria and Management Guidelines- Management Approach for Woodlands this project fulfills the ecosystem services that Woodlands provide. Woodlands provide a range of ecosystem services such as, but not limited to, clean water, wildlife habitat, recreation opportunities and sustainable production of renewable wood products.

The Townsend Home Fuelwood Project objectives are:

- Provide a source of renewable fuelwood to local residents.
- Provide a break in fuel continuity to control possible wildfire outbreak.

[13] http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm, reviewed 7-19-2016

- Increase public safety by removing hazard trees along roads and trails within the project areas.
- Improve access for first responders.
- Improve growth and vigor of residual trees.
- Provide habitat for native wildlife.

Silvicultural Prescription:

As noted in previous sections the forest stands within the project areas are generally even aged oak-white pine forest types. Thinning is a method of improving future growth by regulating stand density.[14] Thinning trees within these stands will focus on removing poor quality, low vigor specimens while releasing larger diameter individuals to provide food and habitat for wildlife. Thinning these trees will improve their ability to withstand stressors such as defoliation by insects and drought stress.

Recommended thinning guidelines:

Unit	Current BA Ft^2	Current Rel Density	Residual BA Ft^2	Residual Rel Density
A	65	59%	44	40%
B	73	50%	60	40%

Providing a break in fuel continuity is also a significant goal of this project. This is accomplished by managing (thinning) the fuel loads within these breaks by manipulating the amount of flammable material that is available to burn. This work is to be completed in phases to meet these goals by implementing this project and work by DCR Bureau of Fire Control and Forestry:

1. Remove ladder fuels by cutting, mowing, and chipping (work performed by DCR).
2. Reduce stocking levels of residual trees to reduce fuel loading (home fuelwood project).
3. Maintain fuel breaks through periodic mowing and prescribed fire where appropriate (work performed by DCR).


Pre treatment example


Post treatment example

[14] Wenger et. al., Forestry Handbook, Second Edition, Society of American Foresters, pgs 420-421

Desired and Expected Results:

Immediately after operations are concluded the project areas will have a more open appearance due to the reduction in the number of trees making up the forest canopy. Average diameter distribution across the project area will consist of larger diameter specimens of all species. Increased sunlight to the forest floor as a result of openings in the forest canopy will stimulate growth of shrub and herbaceous vegetation. Within a few growing seasons canopy expansion of residual trees will result in increased mast production for the benefit of wildlife as oak and cherry fruits become plentiful.

Possible future silivicultural treatments may present the opportunity to stimulate regeneration in areas adjacent to the project areas by incorporating treatments such as the shelterwood method. Using this type of system establishes a new forest through a series of thinnings in which regeneration establishes under the protection of the forest canopy.

Sale Layout:

Within the home fuelwood program participants utilize main forest roads for access to their respective lots. There is no motorized equipment allowed within the lots with the exception of chainsaws and the possible use of a wood splitter roadside. All wood is either hand carried or moved via wheel barrow or cart to pickup trucks.

Typical trees designated for harvest will be less than 12" DBH as this program is aimed at non professional homeowners and smaller trees are more easily handled. Residual tree slash must be loped within 2 feet of the ground to promote rapid decomposition and no slash is to remain within 25 feet of the woods road. All stumps are to be cut as close to the ground as feasible to minimize any visual impacts to project area.

Signage will be affixed within the project areas to alert users of program activities. All vehicles must display a valid permit while individuals are working on their respective lots. Activities are limited to the fall season until the first good snowfall (4") or January 1, whichever comes first.

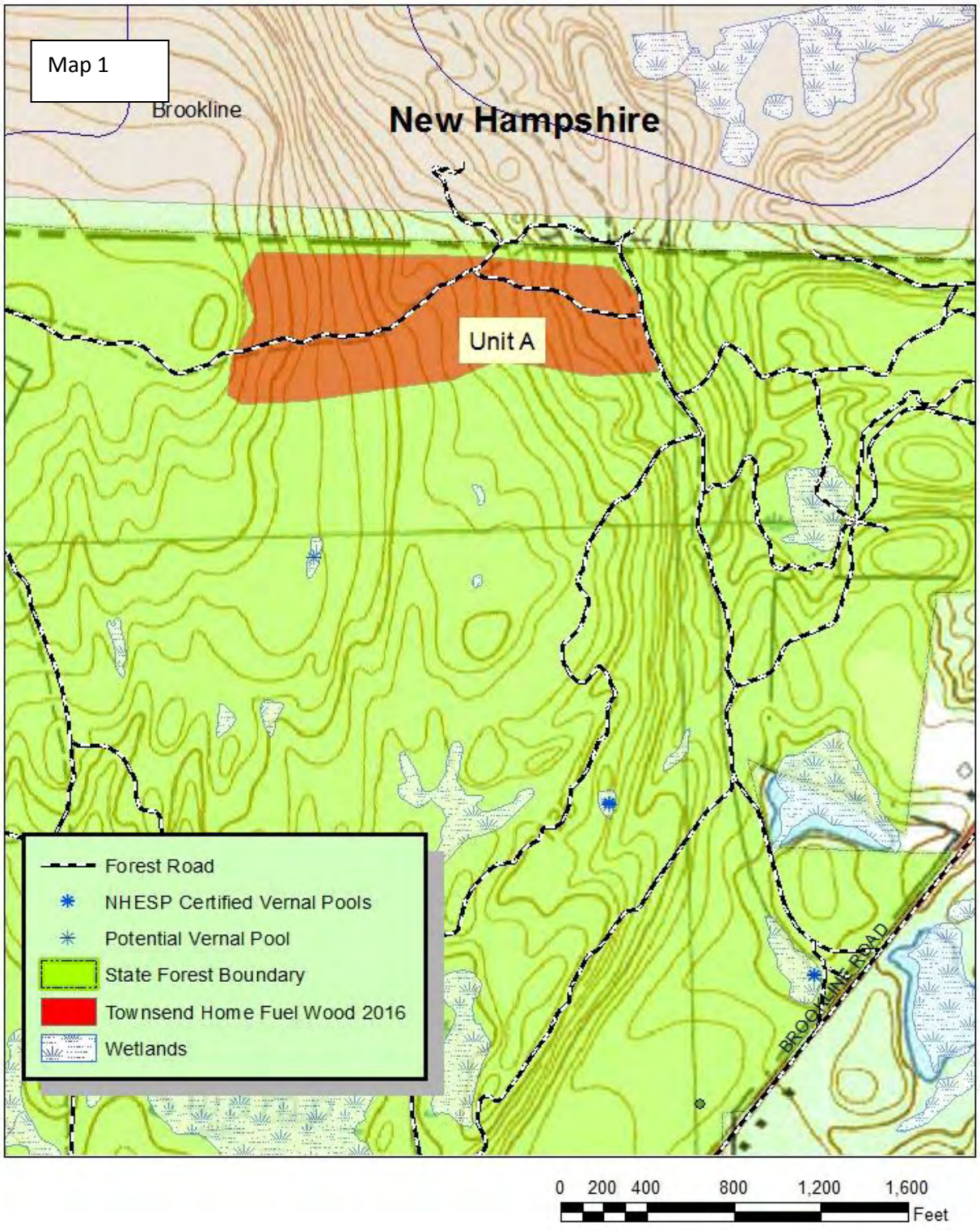
Marking Guidelines:

Trees are individually marked with paint (cut tree marked) prior to operations and lots are assigned a number for participants to bid on. Trees will be marked at DBH and root collar (this is to ensure that only designated trees are removed) with orange or blue paint facing away from the woods roads to minimize aesthetic impacts. Lots that are next to each other will have different color paint to minimize any confusion. Lots will be flagged out to demarcate bounds of cutting area.

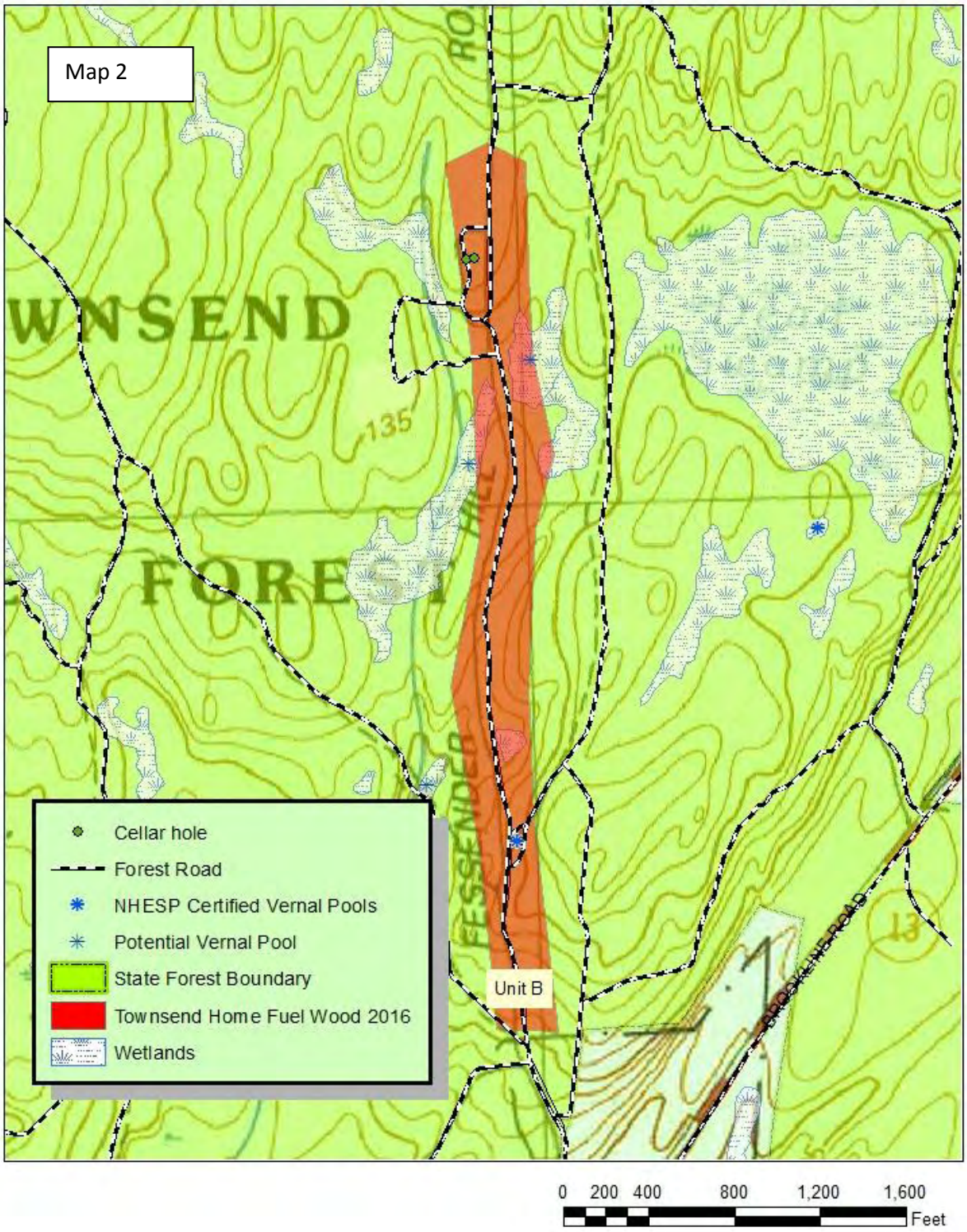
Large diameter trees will be targeted for retention and release. Removals will focus on trees showing signs of disease, rot, low vigor, shade suppression, etc. All snags will remain standing unless they pose a risk to public safety, in which case they will be cut and left onsite as coarse woody material.

Appendix

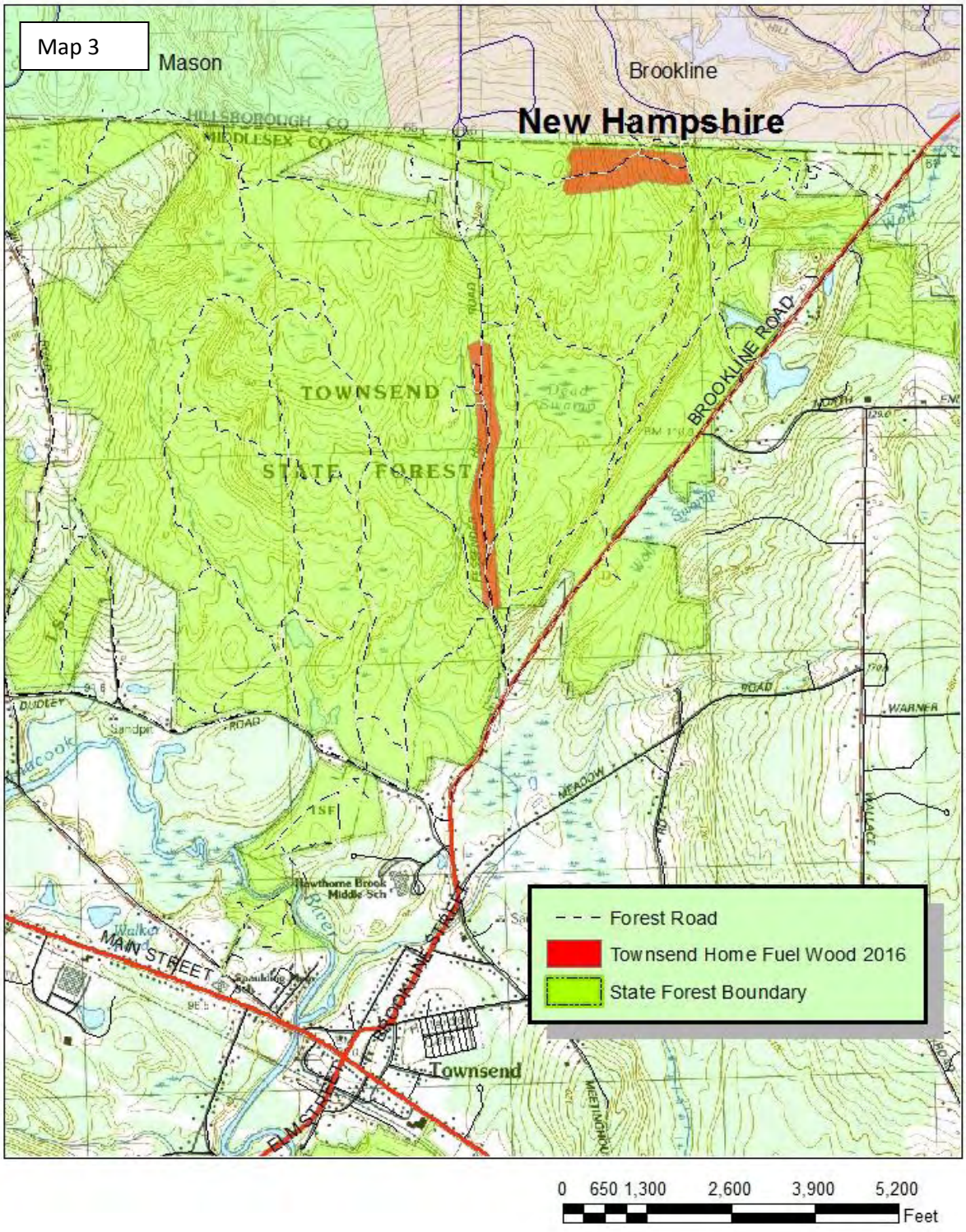
Townsend Home Fuel Wood 2016
Townsend State Forest
Townsend, MA



Townsend Home Fuel Wood 2016
Townsend State Forest
Townsend, MA

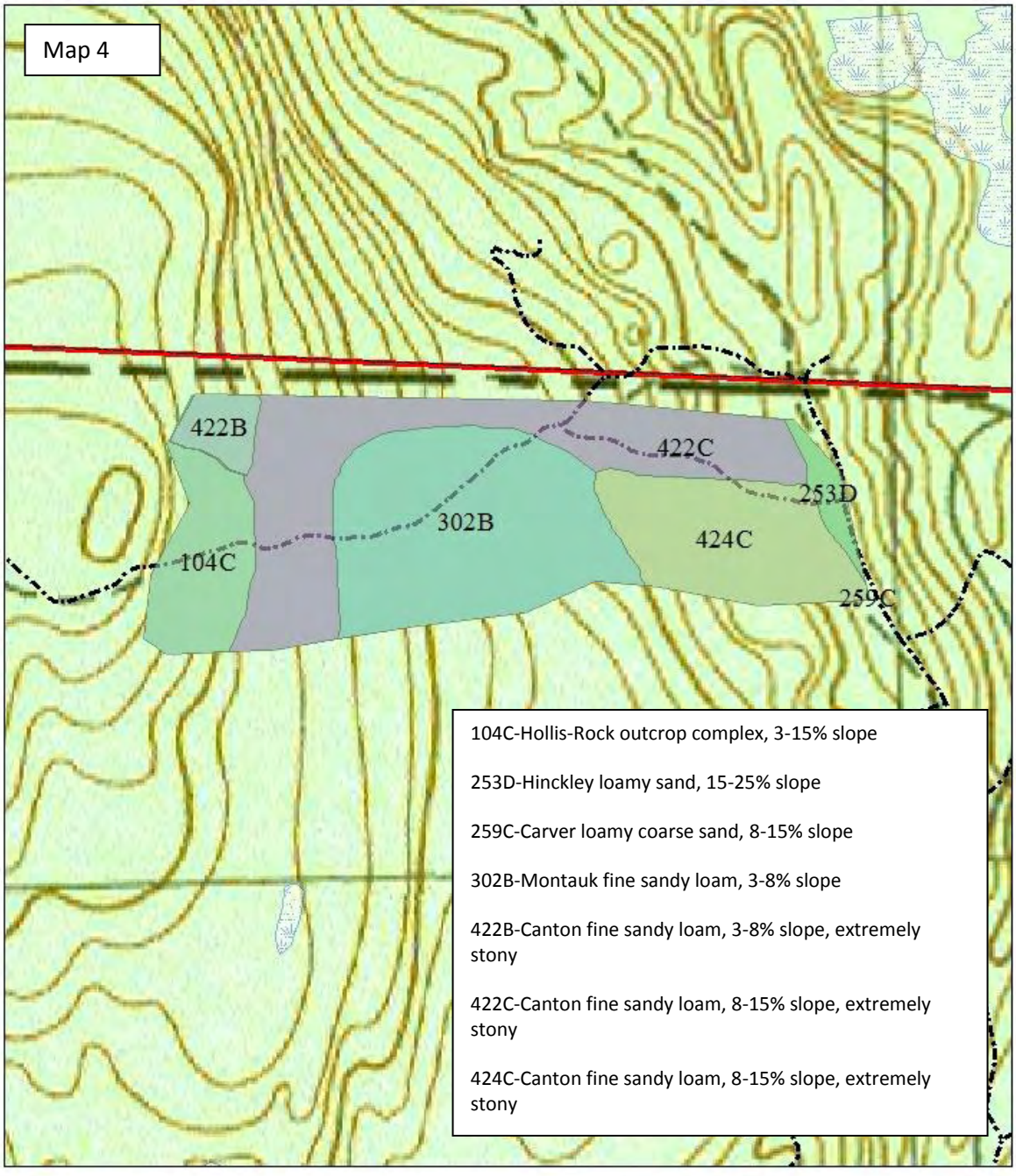


Townsend Home Fuel Wood 2016 Locus Map
Townsend State Forest
Townsend, MA



N

Townsend Home Fuelwood
Soils Map- Section A



N

Townsend Home Fuelwood
Soils Map- Section B