DCR-BOFF Forest Management Prescription

Project Name: Willis Road North and South	**Date Proposed: June 30, 2021**
Property Name: Lawton State Forest	**Town(s): Athol**
Acres: 214	**Landscape Designation: Woodland**
Forestry District: Mid State	**Rec Complex/District: Otter River State Forest**
Forester: Joelle Vautour	**FOTL/F&P Supervisor: Brad Gallant and Brandi King**

Approved by:
Management Forestry

Program Supervisor: [OBJ]___ _____ Date: 6/28/24_____
Thomas Brulé

MASSACHUSETTS FOREST ACTION PLAN GOALS

The goals listed below are sourced from page i of *DCR (Department of Conservation and Recreation) Bureau of Forest Fire Control and Forestry. 2020.* ***MASSACHUSETTS STATE FOREST ACTION PLAN 2020***

*** Increase resistance and resilience of trees and forests to mitigate and adapt to the effects of climate change**
*** Manage forest ecosystem health and biodiversity**
*** Enhance the connection between forests and people**

CLIMATE CHANGE ADAPTATION STRATEGIES AND APPROACHES

The strategies and approaches listed below are sourced from page 34 of *Swanston, Christopher W.; Janowiak, Maria K.; Brandt, Leslie A.; Butler, Patricia R.; Handler, Stephen D.; Shannon, P. Danielle; Derby Lewis, Abigail; Hall, Kimberly; Fahey, Robert T.; Scott, Lydia; Kerber, Angela; Miesbauer, Jason W.; Darling, Lindsay; Parker, Linda; St. Pierre, Matt. 2016.* ***Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd ed****. Gen. Tech. Rep. NRS-GTR-87-2. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 161 p. http://dx.doi. org/10.2737/NRS-GTR-87-2.*

*** 1: Sustain fundamental ecological functions.**
*** 2: Reduce the impact of biological stressors.**
*** 3: Reduce the risk and long-term impacts of severe disturbances.**
*** 5: Maintain and enhance species and structural diversity.**

GENERAL LOT DESCRIPTION

Acres	Forest Type		Stand Description
Stand 1: 6.8	Overstory: Red Pine Plantation (Treated 2022)	Understory: Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)"	Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)" and Forest Cutting Plan File Number 015-33896-22
Stand 2: 5.4	Overstory: Mixed Softwood Plantation (Treated 2022)	Understory: Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)"	Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)" and Forest Cutting Plan File Number 015-33896-22
Stand 3: 6.3	Overstory: White Pine-Red Pine Plantation (Treated 2022)	Understory: Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)"	Refer to "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)" and Forest Cutting Plan File Number 015-33896-22

Stand 4: 11.2	Overstory: Mixed Softwood Plantation (Norway spruce, white pine, red pine)	Understory: Eastern hemlock, northern red oak, red maple	This stand was planted to a mixture of softwood species on abandoned agricultural lands in the early 1900's and was extensively managed by previous owners for timber production. Norway spruce, white pine, and red pine are the dominant overstory species. Overstory trees are fair to poor quality. Red pine are declining due to red pine scale. Norway spruce are exhibiting rot issues. White pine quality is poor in the smaller diameter trees, where white pine needlecast disease seems to be aiding in their decline. Stand structure is homogenous, with an estimated basal area of 174.3ft²/acre, a median stand diameter of 15.3", 220 trees/acre, and a relative density of 85%. Regeneration presence is limited to areas with gaps in the canopy from natural mortality or recent past forest management efforts.
Stand 5: 184.3	Overstory: White Pine-Hemlock-Oak	Understory: Northern red oak, eastern hemlock, red maple	This stand regenerated on abandoned agricultural lands in the early 1900's and was extensively managed by previous owners for timber production. Overstory trees are of good quality. White pine needlecast, hemlock woolly adelgid, spongy moth are present in the area but not pervasive at this time. Stand structure is homogenous, with an estimated basal area of 175.4ft²/acre, a median stand diameter of 15.0", 247.8 trees/acre, and a relative density of 99%. Regeneration presence ranges from adequate to sparse, depending on percent canopy closure.

Description of Project Area: This silvicultural prescription describes the forest conditions and management practices prescribed for both the Willis Road North and Willis Road South forest management project proposals (posted June 30, 2021 respectively), excluding work that was completed in stands 1, 2, and 3 in 2022 that was prescribed in the "Lawton State Forest Silviculture Prescription Willis Road North – Softwood Plantations (March 4, 2022)". The project area was owned by the Lawton family for over 200 years before coming into Commonwealth ownership in 1987. Originally a dairy farm, the abandoned agricultural operation was converted to New England's first tree farm in the 1940's. The Lawton family created softwood plantations and managed naturally revegetated forest stands until the Commonwealth purchased the property. Most recent forest management activities occurred in the early 2000's with a combination of silvicultural practices that aimed to increase vigor in residual overstory trees while also creating conditions in the understory for regeneration establishment of mid-tolerant species. Current forest structure is homogenous and even aged. Species diversity is higher in the midstory than the overstory, providing opportunities for increasing forest resilience through strategic silvicultural practices that aim to increase structural complexity while maintaining and bolstering species diversity throughout the project area. This will be achieved by using uneven aged silvicultural systems (group selection) and variable retention thinning between groups to mimic natural disturbance.

SOILS AND TOPOGRAPHIC FEATURES

Acres	Soil Type	Drainage Characteristic
3.4	Charlton Paxton Association	Well drained
17.7	Woodbridge-Paxton Association	Moderately well drained
42.2	Montauk-Canton association	Well drained

41.4	Ridgebury-Whitman association	Poorly drained
0.1	Charlton-Chatfield-Hollis association	Well drained
0.1	Charlton-Chatfield association	Well drained
125.7	Montauk-Scituate-Canton association	Well drained
0.1	Scituate fine sandy loam	Moderately well drained

Average Slope Percent: 5%	**Terrain Consistency:** Variable
General Aspect: Varied	**Terrain Position:** Multiple
Description of Soils and Topographic Features: Much of the project area contains well drained, deep soils that are rich in nutrients and have high water availability in the soil. There are no topographical limitations for operability. The majority of the project area is relatively flat, with slight rolling topography. There is one drumlin north of Willis Road with a west facing slope (average 25%). There are vast areas of poorly drained soils, or soils with perched water tables. Management will only occur in areas with stable soil conditions and all BMP's will be exceeded to prevent erosion and sedimentation.	

WETLAND FEATURES

	Present	Crossing	Work within Filter/Buffer
Wetlands:	**Yes**	**No**	**Possible**
Regulated Streams:	**Yes**	**Yes**	**Possible**
Non-Regulated Streams:	**Yes**	**Possible**	**Possible**
Vernal Pools:	**Possible**	**N/A**	**Possible**
Seeps:	**Yes**	**N/A**	**N/A**

Description of Wetland Features: Planning efforts are imperative for maintaining ecological function of wetland resources within and adjacent to the project area. Work within buffer and filter strips will coincide with silvicultural goals that increase forest resiliency. All resource areas will be mapped and BMP's will be utilized and exceeded when the Forest Cutting Plan is filed.

CULTURAL RESOURCES

	Present	At Risk	Work Within Buffer
Stone Walls:	**Yes**	**Possible**	**N/A**
Foundation / Cellar Hole:	**Yes**	**Possible**	**N/A**
Well:	**Possible**	**N/A**	**N/A**
Structures:	**No**	**N/A**	**N/A**
Cemetery:	**No**	**N/A**	**N/A**
Other: Stone piles	**Yes**	**Possible**	**N/A**

Description of Cultural Resources: A former farm, there are multiple stonewalls, stone piles, and one cellar hole within the project area. All surface features will be mapped and protected to the extent possible. It is possible that bridging over stone walls will be needed if existing barways are too narrow. Consultation with DCR Archaeology will be ongoing to protect cultural features.

NATURAL HERITAGE / WILDLIFE-HABITAT MANAGEMENT / OTHER RESOURCES

Natural Heritage Polygon: No	**Natural Heritage Restrictions: No**
Restrictions on Harvest Description: N/A	

Wildlife Specific Management: No	**Targeted Species: N/A**
Goals: N/A	

Additional Habitat Management: No	**Habitat Type: N/A**
Goals: N/A	

State Forest Action Plan: Yes	**State Wildlife Action Plan: No**
ACEC: No	**Public Water Supply: No**
BIO Map2: No	**Current Resource Management Plan: No**
Additional Detail: Maintaining hard and soft mast species is important for providing a diversity of wildlife food sources into the future. Additionally, diversifying structure will create nesting and foraging habitat for a variety of migratory songbird and mammal species. Applying an uneven aged management approach will maintain young forest on the landscape. It may be beneficial to implement larger openings in adjacent stands for future projects to maintain and enhance habitat opportunities for SWAP species.	

FOREST HEALTH / INVASIVE SPECIES

Forest Health Concern: Yes	**Species Affected: Multiple**
Management Considerations: Maintaining healthy individual tree species that could be genetically resistant to forest health issues is a priority. Due to climate change impacts, the presence of native and non-native damaging agents within our forests have increased. Project area concerns include, emerald ash borer, hemlock woolly adelgid, hemlock elongate scale, white pine needlecast disease, beech bark disease, beech leaf disease, spongy moth, and red pine scale. Maintaining a genetic presence of healthy individual trees that are affected by these agents is important for forest stand dynamics into the future.	

Plant Invasive Species Present: Yes	**Species Present: Glossy buckthorn, multiflora rose, Japanese barberry**
Management Considerations: Invasive species presence is very minimal within the project area and can be maintained by mechanical hand pulling at this time. Future monitoring efforts will collect data on presence, extent, and percent cover, for further management and mitigation.	

Insect Invasive Species Present: Yes	**Species Present: Numerous**
Management Considerations: See "Forest Health Concern", above	

CLIMATE ADAPTATION AND CARBON CONSIDERATIONS

Action Type	Identified Issue	Action Description
Resilience	Homogenous, even aged overstory of mature species that lacks vegetative diversity and has a low-medium adaptive capacity in the face of climate change.	Diversification of species composition and structure will create more resilient conditions by increasing the sites adaptive capacity in the face of climate change. Transitioning the forest from an even aged homogenous structure, to an uneven aged heterogenous structure over time, by mimicking small scale natural disturbance patterns.

Adaptive Management Strategies: Maintaining vigorously growing trees that are well adapted to the site conditions, as well as favoring species diversity is a priority. Species present on the site, particularly associated with the central hardwood forest cover type, will be retained and bolstered. Protecting advanced regeneration where present, and monitoring and treating invasive species are important action items.

Climate Change Considerations	
DCR has determined that the decision to implement this project is consistent with EEA climate goals and guidelines and DCR land management objectives. Carbon and climate change considerations specific to the activities proposed for this project are discussed below.	
Proposed Activity	**Alignment of Activity with Climate Oriented Strategies and Recommendations**
Permanent stream crossing repair or replacement.	Size permanent crossings for the **predicted high flows influenced by climate change** on future storm characteristics (e.g., precipitation events will likely be more intense and occur with greater frequency) and how a stream's hydrology can change due to **forest conversion for development** in its watershed. • Design crossings that meet the standards in the Massachusetts Stream Crossing Handbook. • Crossings need to have the ability to **safely pass large volumes of water**, sediment, and debris stirred up by high flows. • Crossings are required to maintain **safe passage for emergency personnel and residents**. • Open arch or bridge spans are preferred over traditional culvert approaches because of their ability to withstand water volumes associated with **larger and more frequent precipitation events** anticipated under **future climate scenarios.** • Require less maintenance than culvert designs. • Open arch designs or bridges provide **adequate passage for both aquatic and terrestrial wildlife**.
Erosion and sedimentation control installation, including waterbar installation and seeding landings and other disturbed areas. Examples: a. In areas where steep grades cannot be avoided, install water bars to minimize erosion by facilitating the drainage of water from the skid trails. b. Reinforcing sections of soft ground with slash material. Installation of silt fencing or haybales at stream crossings, near wetlands or at landings. Stabilize the soil at the landing with grass seed or equivalent.	Water bars help stabilize skid trails and ensure that **excessive erosion** is avoided while maintaining the site for future forestry operations. Properly stabilized skid trails will **revegetate** naturally while being discernable enough to use in future operations. The size and frequency of water bar installation should be determined by: • Other types of uses that may be required or occurring between operations. Hiking trails, snowmobiles trails, as firebreaks, or a high instance of unauthorized uses (OHV/ATV), etc. • The **impacts of future climate conditions**, especially more frequent storms. • If the area is already known to be wet, and in the future **more frequent storms are expected**, more water bars than what may be normally installed are encouraged. • Consider seeding and mulching water bars on highly erodible soils, steep slopes, or excessively wet areas to ensure longevity and prevent water bar degradation.

Temporary stream or wetland crossing. Examples: Limit the number of stream crossings, crossing at right angles, using portable bridges, or temporary culverts or pole fords.	Temporary stream crossings are occasionally necessary to facilitate forest management activities, though careful project layout can help **minimize the number of stream crossings required**. • Crossing design, installation, maintenance, and removal should be done so in accordance with the highest standard BMP's. • Plan on anticipated **climate scenarios** that generally indicate a greater frequency of higher intensity precipitation events. • Changing **climatic conditions** change will require the continuous evaluation on the types of structures used.
Invasive plant control, including pre- and/or post-harvest and follow up treatments. Example: The manual, mechanical, or chemical treatment of non-native, invasive, or interfering plants prior to or following a forestry operation.	Strong consensus exists among land managers and climate science experts regarding the **threat to future forest health** posed by the introduction and spread of invasive plants. **Invasive plants** can: • aggressively **outcompete native plant species,** • dominate understory communities, and even climb, kill, and topple mature trees, • threaten overall **biodiversity**. • threaten **soil health** and long-term **carbon storage**. **Monitoring and controlling** invasive and interfering plant populations prior to and following operations is a critical practice for **minimizing the risk of further impacts** inadvertently (though not unexpectedly) spread by harvesting-related activities.
Full overstory removal, complete stand, plantation conversion to native species. **This treatment will be conducted in stand 4.** Examples: a. Silvicultural clearcut with subsequent regeneration by natural seeding from adjacent forests or assisted seeding/planting. b. Removal of plantation overstory to release advanced regeneration of native species. Partial plantation removal (strips, patches) to stimulate regeneration, followed by removal of remainder of plantation.	Long considered a critical practice on agency lands to improve biodiversity and forest resilience, the **conversion of single-species conifer plantations** to more diverse mixes of native species has recently been encouraged as a climate-smart practice by NIACS and other climate adaptation experts. Tree monocultures, intensively managed throughout the world to produce much of the wood we all use, are **highly vulnerable** to the kinds of **pest and disease** impacts that are likely to worsen as climate changes. Conversion of monoculture plantations aligns with many climate-smart forestry practices highlighted in the CFC report, including but not limited to: • Improving **resistance to pests and pathogens**. • Increasing resiliency by promoting **diversity of plant species**. • Providing age class/**structural diversity**. • Improving conditions for a wide variety of local wildlife through the creation of temporary **young forest** habitat. • Promoting **future-adapted tree species** in the regeneration mix.
Full overstory removal, complete stand, final shelterwood cut.	Shelterwood systems have been identified as a preferred method for regenerating a number of **species expected to be well-adapted to future climate conditions** in Massachusetts. The final overstory removal in a shelterwood follows decades

Grouped (aggregate) reserves. Seed tree retention (?) **This treatment will be conducted in stand 4.**	of planning, monitoring, and preparatory treatments, often by multiple foresters. Unless rapid declines in stand health (pests, disease) are driving the initiation of a final cut, this phase occurs once the stand reaches the rotation age and understory conditions are determined to meet the goals and objectives of the landowner. • Works well in regenerating both **future climate adapted** species such as oak and hickory, as well as **climate vulnerable** species for which there is no substitute such as red spruce. • Generally, retains more residual structure diversity than clearcuts, and allows for much more sunlight than single tree selection or group selection. • Flexible and can be adapted to various site conditions, species mixes, and objectives. • **Higher residual stand densities** during each phase of the system and longer rotations result in **higher on-site carbon storage**. • Retention of snags, **retention of down material**, maintaining understory **vegetation diversity**, and addressing issues associated with **invasive vegetation** are priority considerations.
Full overstory removal, partial stand, variable retention harvesting **This treatment will be conducted in stand 5.**	Variable retention (VR) is a regeneration technique based on natural disturbance ecology that retains important biodiversity components of the stand during the harvest to meet habitat objectives. The retained components include a diverse species mix of live and dead trees in a range of diameters with an emphasis on the larger sizes, cavity trees, and large snags and logs of different decay stages. These are in a patchwork pattern across the stand from single trees to large groups measured in acres. • This practice more closely **aligns with natural disturbance patterns**. • Promotion of a diversity of age classes, species composition and structural diversity **enhances overall forest resiliency**. • **More carbon is left on the landscape** for longer periods, in live trees, snags, and coarse woody material while regeneration develops. • **Improving conditions for a wide variety of local wildlife** through the creation of temporary young forest habitat. • Maintenance of continuous forest corridors provides for wildlife habitat. • As part of a regeneration system this method can be used to **help guide species diversity towards more future-adapted mixes.**
Full overstory removal, partial stand, patch regeneration cut. **This treatment will be conducted in stand 5.**	Patch cutting is a regeneration technique that straddles the boundary between classic even-aged and uneven-aged forest management systems. Foresters select appropriate areas (‘patches’ or ‘groups’) covering a portion of the stand to harvest rather than removing the entire stand and then return periodically to repeat the process in other portions of the stand. In using patch cutting there is no final regeneration cut. Patch size and shape are determined by many different factors including overstory condition, desired species composition in the regeneration layer, other desirable herbaceous and woody vegetation, location, stand re-entry period, etc. Harvesting in patches aligns with many **climate-smart forestry practices**: • Increasing **structural diversity** improves resiliency by reducing the impact of age/size related disturbances.

	• Extending regeneration periods minimizes short term impacts to groundwater and nutrient cycling. • Partial stand overstory removals more closely align with natural disturbance patterns. • More **carbon is left on the landscape** for longer periods, and within-patch live tree, snag, and coarse debris retention allow for development of old forest characteristics. • Can also be used as opportunities to increase the stocking of **future climate adapted species, current climate imperiled species**, or other types of desirable vegetation.

INFRASTRUCUTRE / RECREATION/ AESTHETICS

Access Road: Interior woods roads to Willis Road and Townsend Road	**Ownership:** Interior woods roads owned by DCR
Condition: Good	**Road Repair/Upgrade:** Yes
Existing Landing: Yes	**Landing Repair/Upgrade:** Yes
Project Access and Landing Site: Existing landing utilized in 2022, other landings last used in early 2000's. Use of existing woods roads will be prioritized for access to landings. Culvert replacements will occur in areas to repair failed culverts and improve drainage systems on woods roads with the anticipation of higher volume rain events as climate changes.	

Existing Skid Trail Network: Yes	**Pre-Harvest Repair/Upgrade:** No
Skid Trail Network Description: Skid trails utilized in 2022, north of Willis Road will be re-utilized. Additional skid trails will be designed to be least impactful to the site and most efficient in accessing the landings and utilizing the existing road network.	

Shared Infrastructure: No	**Road/Trail Names:** N/A
Management Considerations: N/A	

Official Trail Present: Yes	**Condition:** Good
Illegal Trail Present: Possible	**Condition:** N/A
Existing Trail Head: No	**Condition:** N/A
Recreation Facility: No	**Condition:** N/A
Recreation and Aesthetic Concerns/Opportunities: There are no official trailheads at Lawton State Forest. Recreational users park on old log landings and at gates along Townsend and Willis Roads, particularly near the ice ponds north of Willis Road.	

SILVICULTURE

Acres	Silviculture Type	Silviculture Description
Stand 4 - 11.2 acres	Shelterwood	A partial overstory removal will be implemented within the mixed softwood plantation. Poorly formed, failing white pine, Norway spruce, and red pine will be removed. Areas containing adequate stocking of advanced regeneration will have most of the overstory removed to allow full sunlight to reach the understory.
Stand 5- 86.9 acres	Variable Retention Thinning	A thinning, to mimic natural disturbance, will be implemented. Residual density will vary across the

		stand, depending on overstory species composition and advanced regeneration presence. Species diversity, across all size classes will be retained and enhanced by improved growing conditions and access to resources.
Stand 5- 97.4 acres	Group Selection and Variable Retention Thinning	Group openings with variable density thinning between the groups will be implemented. Opening sizes, orientation, and location will be variable and randomly assigned and will not exceed one acre in size. The thinning between groups will seek to maintain and enhance species diversity across all size classes, and to improve growing conditions for residual trees.

General Comments on Silviculture Proposed: Good quality overstory softwood species will be retained. Due to the anticipated decline in hemlock, and perhaps white pine, as climate change exacerbates, maintaining a stocking of Norway spruce as a softwood resource, particularly for wildlife habitat is important. Red pine cannot serve the same function, due to the widespread mortality that red pine scale infestations cause. Further treatments will be consistent with this prescription and will work to achieve three or more age classes within the project area.

STAND EXAM DATA

Stand/Type: Stand 4 - Mixed Softwood Plantation		
Overstory: Norway spruce, eastern white pine, red pine (Attachments, Table 1. Stand 4 - Mixed Softwood Plantation Stocking Diagnostics)		
Understory: Eastern hemlock, northern red oak, red maple (Attachments, Table 2. Stand 4 – Mixed Softwood Plantation Understory)		
Shrub/Herbaceous: Partridgeberry, winterberry, mixed fern species (Attachments, Table 3. Stand 4 – Mixed Softwood Plantation Shrub/Herbaceous)		
Snag/Acre: 2	**CWD/Acre:** 224cu.ft./acre	**Stand/Type:** Mixed Softwood Plantation
Stand/Type: Stand 5 – White Pine-Hemlock-Oak		
Overstory: White pine, northern red oak, eastern hemlock (Attachments, Table 4. Stand 5 - White Pine-Hemlock-Oak Stocking Diagnostics)		
Understory: Northern red oak, eastern hemlock, red maple (Attachments, Table 5. Stand 5 - White Pine-Hemlock-Oak Understory)		
Shrub/Herbaceous: Mixed fern species, winterberry, partridgeberry (Attachments, Table 6. Stand 5 – White Pine-Hemlock-Oak Shrub/Herbaceous)		
Snag/Acre: 13.4	**CWD/Acre:** 454.9cu.ft./acre	**Stand/Type:** White Pine-Hemlock-Oak

MARKING INSTRUCTIONS

Project Level: A cut tree marking system will be utilized with a 100% tally system implemented to estimate volumes for sale. Property boundary lines will be delineated, along with wetland edges, filter strips on streams, or other marking indicators that restrict where machinery should travel. The Forest Cutting Plan that is filed will have more detail on the marking system utilized, as well as the Project Contract at the time of advertisement.

Stand/Type: N/A

PERMIT REQUIREMENTS / OPPORTUNITIES

	Description
Seasonal Restrictions: No	**N/A**
Equipment Restrictions: Possible	**Determination will be made during field work for Forest Cutting Plan filing**
Recreation Restrictions: No	**N/A**
Green Docket: Possible	**N/A**
In-kind Services: Yes	**Culvert replacements/upgrades**

Potential Local Economic Benefits: Local economic benefits include, timber harvesters, machine servicing (welders, hose manufacturers), fuel and trucking, local wood producers, mill owners and workers, contractors, builders, and natural resources professionals, among others. The sale of forest products within the community helps underserved and rural economies in many ways. Historically, firewood that is harvested in this region of Massachusetts remain local and is sold and processed by local businesses to sell to local homeowners. Road and trail improvements services utilize local resources when hauling and/or the spreading of material is required. Improvements to hunting and fishing opportunities draw more sportsmen and sportswomen to the area where they may buy food and other provisions from local sellers.

Attachments:

Table 1. Stand 4 - Mixed Softwood Plantation Stocking Diagnostics

Species	Trees/acre	BA/acre	% BA/acre by species	Relative density	Sawlog Bf/Acre
Eastern white pine	60.9	57.1	33%	21.1	5,200.0
Red pine	20.8	20.0	11%	9.5	3,054.0
Eastern hemlock	9.1	11.4	7%	5.3	1,343.4
Red maple	55.8	25.7	15%	21.6	900.3
Black birch	2.1	2.9	2%	2.2	-
Northern red oak	10.1	11.4	7%	10.0	795.4
Norway spruce	61.3	45.7	26%	15.7	5,241.2
Total	220	174.3	100%	85.0	16,534.0

Table 2. Stand 4 - Mixed Softwood Plantation Understory

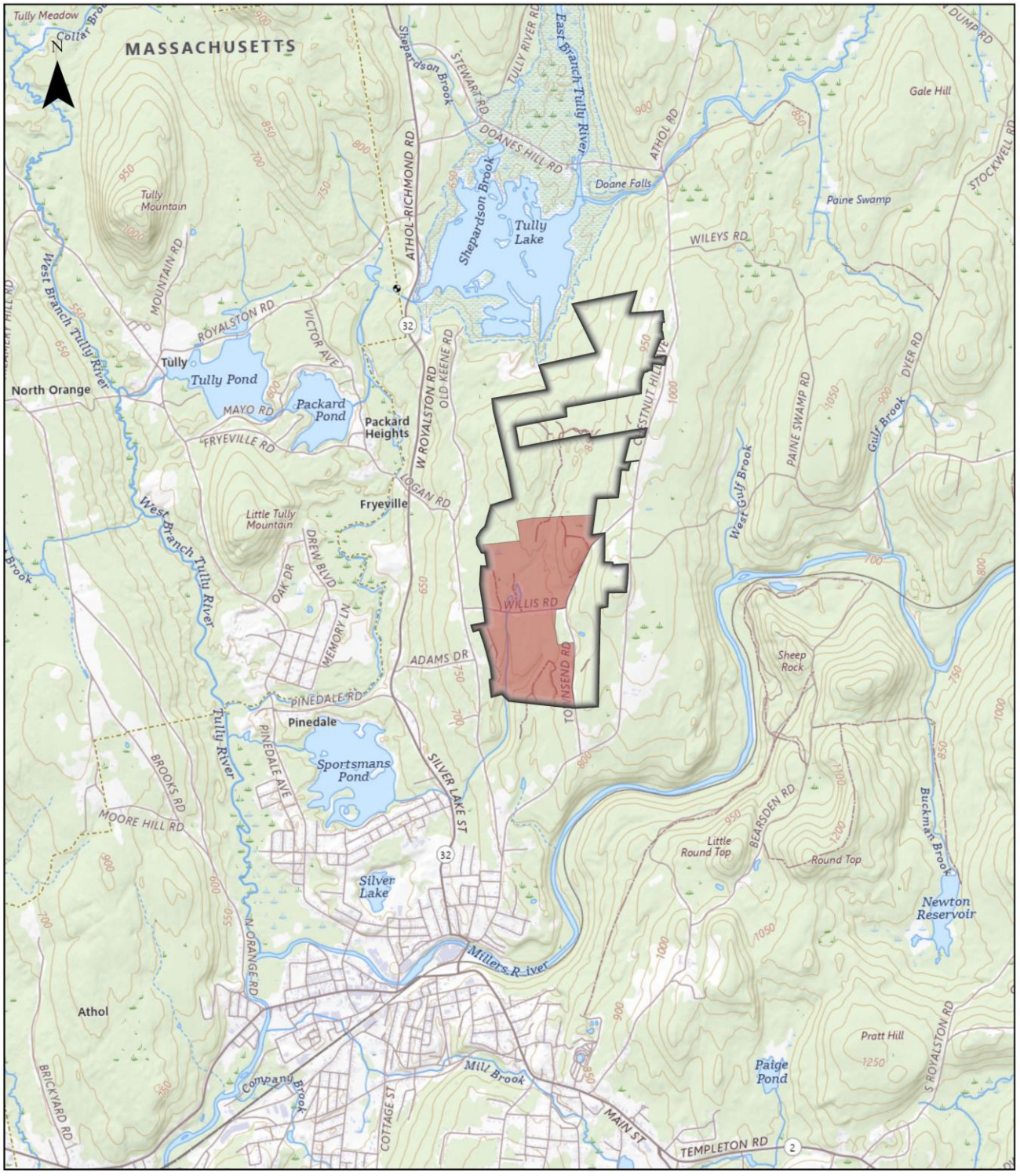
	Size Class 1	Size Class 2	Size Class 3	Size Class 4	
Species	≥ 3” to < 1’ in height	≥ 1’ to < 4.5’ in height	≥ 4.5’ to <1” dbh	≥ 1” dbh to <5”dbh	Total
Northern red oak	728.57	257.14	-	-	985.71
Red maple	557.14	85.71	-	-	642.86
Yellow birch	-	85.71	-	-	85.71
White oak	214.29	-	-	42.86	257.14
American beech	-	42.86	42.86	-	85.71
Eastern hemlock	600.00	428.57	128.57	85.71	1,242.86
Norway spruce	85.71	514.29	-	-	600.00
White ash	-	42.86	-	-	42.86
Black birch	-	-	-	42.86	42.86
Total	2,185.71	1,457.14	171.43	171.43	3,985.71

Table 3. Stand 4 - Mixed Softwood Plantation Shrub/Herbaceous	
Species	Average % Cover
Fern spp.	34.3
Lowbush Blueberry	1.4
Sphagnum	5.0
Canada Mayflower	13.7
Starflower	1.6
Winterberry	4.4
Partridgeberry	15.7
Witch hazel	0.1
Clover	1.4
Wild Sarsaparilla	4.0
False Solomons Seal	1.6
Virginia Creeper	0.7
Serviceberry	0.1
Rubus spp.	6.0
Glossy Buckthorn	0.9
Sensitive Fern	1.4
Grapevine	1.4
Milkweed	0.4
White Aster	0.7
Burning Bush	1.4
Sedges	0.7
Rattlesnake Plantain	0.1

Table 4. Stand 5 - White Pine-Hemlock-Oak Stocking Diagnostics					
Species	Trees/acre	BA/acre	% BA/acre by species	Relative density	Sawlog Bf/Acre
Eastern white pine	53.2	61.5	35%	22.5	7,279
Eastern hemlock	75.7	52.3	30%	23.8	3,363
Sugar maple	2.0	0.5	0%	0.5	-
Red maple	52.1	16.9	10%	14.8	302
White birch	22.9	5.6	3%	5.1	-
Yellow birch	1.4	1.0	1%	-	64
Black birch	15.8	5.1	3%	4.5	119
American beech	1.8	2.6	1%	2.0	129
Northern red oak	19.7	28.2	16%	24.6	2,670
White oak	0.6	1.0	1%	0.8	54
Norway spruce	2.7	0.5	0%	0.3	-
Total	247.8	175.4	100%	99	13,981

Table 5. Stand 5 - White Pine-Hemlock-Oak Understory					
	Size Class 1	Size Class 2	Size Class 3	Size Class 4	
Species	≥ 3” to < 1’ in height	≥ 1’ to < 4.5’ in height	≥ 4.5’ to <1” dbh	≥ 1” dbh to <5”dbh	Total
Black cherry	19.57	19.57	-	-	39.13
American beech	91.30	150.00	26.09	6.52	273.91
Northern red oak	782.61	208.70	26.09	6.52	1,023.91
Red maple	547.83	52.17	39.13	117.39	756.52
Yellow birch	143.48	97.83	26.09	6.52	273.91
Black birch	-	-	6.52	39.13	45.65
Eastern hemlock	613.04	123.91	136.96	65.22	939.13
White oak	13.04	58.70	13.04	-	84.78
Chestnut oak	6.52	6.52	-	-	13.04
Norway spruce	13.04	-	-	-	13.04
Paper birch	-	-	-	6.52	6.52
Striped maple	6.52	-	-	-	6.52
Total	2,236.96	717.39	273.91	247.83	3,476.09

Table 6. Stand 5 - White Pine-Hemlock-Oak Shrub/Herbaceous	
Fern spp.	8.4
Canada Mayflower	3.6
Wild Sarsaparilla	0.9
Starflower	3.7
Partridgeberry	7.9
Rubus spp.	1.3
Grasses	2.5
Winterberry	9.0
Princess Pine	0.3
Sphagnum	3.2
False Solomons Seal	0.3
Japanese Barberry	0.0
Beaked Hazelnut	0.0
Mountain Laurel	2.6
Witch hazel	1.1
Lowbush Blueberry	1.2
Hawthorne	0.1
Glossy Buckthorn	0.0
Clover	0.7
Rattlesnake Plantain	0.0
Serviceberry	0.0
Hobblebush	0.2
Indian Cucumber	0.2

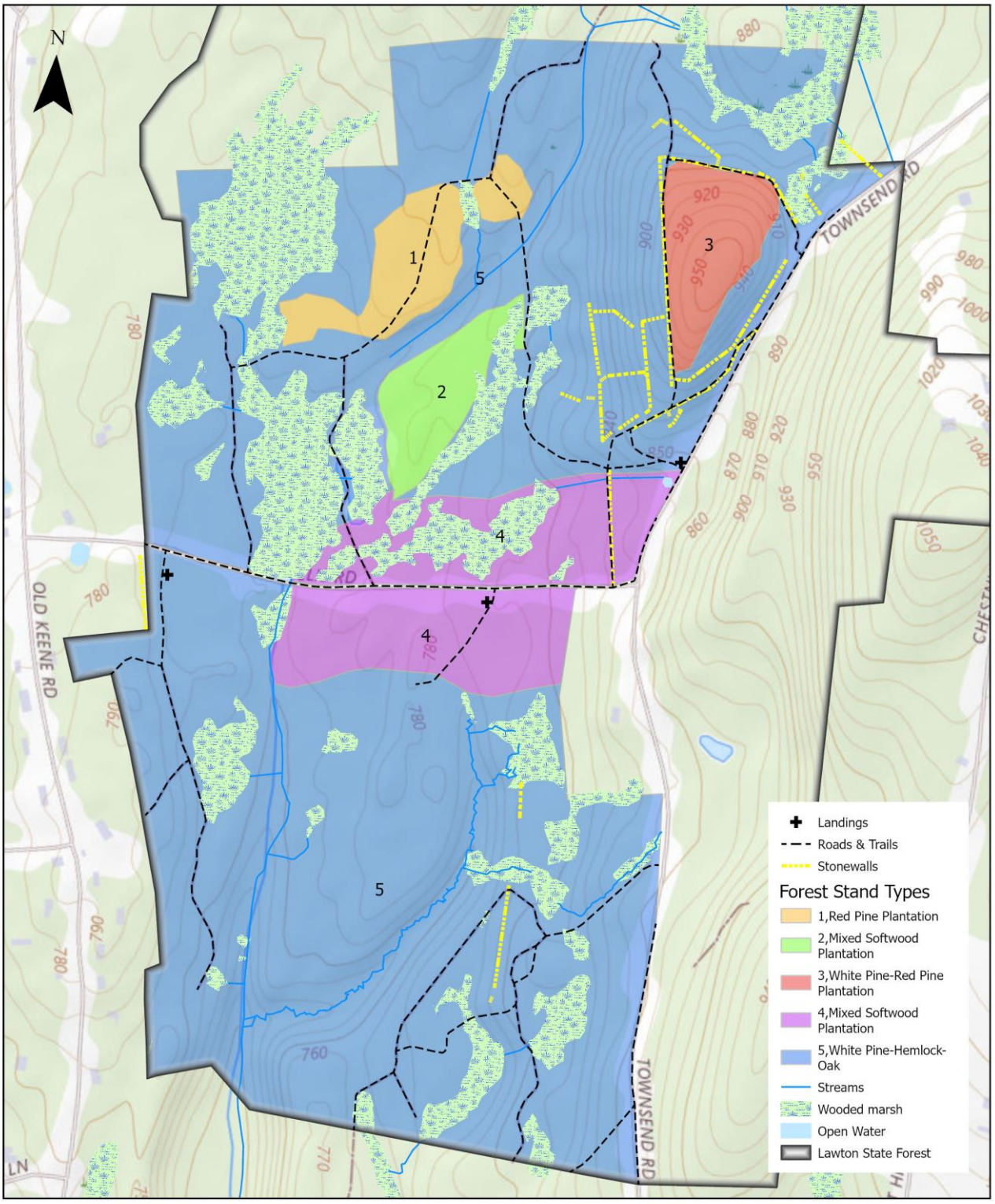


Locus Map
Lawton State Forest - Willis Road North and South Project
Athol, Massachusetts

0 0.25 0.5 1 Miles

Lawton State Forest

Willis Road North and South Project Area



Project Map
Lawton State Forest - Willis Road North and South Project
Athol, Massachusetts