APPENDIX – A

Recommended Management Practices To Protect Soils and Water Quality

Recommended Management Practices to Protect Soils from the publication Good Forestry in the Granite State (Bennett, 2010)

- Avoid whole-tree removal, particularly on low-fertility sites (i.e., shallow to bedrock soils, coarse sands, wetlands, and area with high water tables), unless replacement of nutrients and organic matter is considered
- Conduct harvest operations during the season of the year that is most appropriate for the site. Operating on snow or frozen ground, whenever possible, minimizes effects of the soils and forest floor.
- Choose harvest equipment to suit the site and minimize disturbance. For example, in dry conditions, and in some wet conditions, consider using tracked vehicles to reduce rutting.
- Minimize skid-trail width using techniques such as bumper trees when appropriate.
- Establish skid trails that follow land contours where possible rather than directed straight uphill.
- When possible, conduct whole-tree harvests of hardwoods during dormant leaf-off season to retain nutrients on site.
- Avoid or minimize practices that disturb the forest floor, remove the organic soil or cover it with mineral soils, except as necessary to accomplish silvicultural goals and to regenerate certain tree species.

Water Quality Protection Practices from publication

Good Forestry in the Granite State: Recommended Voluntary Forest Management Practices for New Hampshire (Bennett, 2010)

Riparian and Stream Ecosystem Management Recommendations:

- Establish Riparian Management Zones (RMZs) along streams, rivers, wetlands, ponds, and lakes;
- Include maintaining or restoring riparian functions and values as a silvicultural objective in RMZs;
    - Retain trees with cavities, standing dead trees, downed logs, and large supracanopy trees (especially white pine);
    - Leave wind firm trees that are well-distributed. Leave other vegetation, including existing groundcover;
    - Choose a regeneration system most likely to maintain riparian functions and values and rapidly regenerate the site with the desired trees. Choosing a method is complicated by wet soils and the desire to maintain forest structure that contributes to wildlife habitat and other ecological values;
        - Use uneven-aged techniques such as single tree or small group selection, maintaining 60 to 70 percent crown closure or full stocking as recommended in silvicultural guides;
        - Use even-aged techniques such as shelterwood or patch cuts to achieve regeneration goals when rapid regeneration is likely;
- Locate new truck roads and log landings outside RMZs, except where doing so would result in greater overall adverse environmental impacts;
- Design roads and skid trails within RMZs to minimize the long-term impacts of water quality and wildlife habitat. Apply BMPs. Put roads to bed using BMPs to stabilize the soil, control run-off, and control unwanted vehicular access at the end of the harvest;
- Minimize ground disturbance. Operate ground-based equipment when the ground is dry or frozen.
- Time harvesting to avoid disturbance to nesting birds and other sensitive species;
- Leave the area closest to the stream, pond or wetland unharvested to provide increased protection to aquatic habitat, protect wildlife trails, and allow a reliable long-term supply of cavity trees, snags, and down woody material. Larger zones increase the protection of nontimber values; however, no-harvest zones may not always be consistent with ecological or silvicultural objectives;
- Keep trees along banks to stabilize shorelines;
- Avoid leaving isolated riparian management zones with long distances of abrupt edge. Riparian forests next to heavy cuts, agricultural, or urban land uses may be subject to increased edge effects (e.g. invasives, nest predation) and risk of blowdowns. Practices that minimize these risks include

limiting harvest within the riparian management zone, increasing the width of the zone, or feathering the edges of a heavy cut.

- Legal and recommended RMZs are given in the table below. The zone extends upland from the top of the stream bank or from the upland edge of any steam, pond, or lake-side wetland.

	Legally Required[1]		**Recommended**	
	Riparian Management Zone (feet)	**No Harvest Zone[2] (feet)**	**Riparian Management Zone (feet)**	**No Harvest Zone[2] (feet)**
Intermittent Streams	None	None	75	None
1st and 2nd order streams	50[1]	None	100	25
3rd order streams[5]	50[1]	None	300[4]	50[3]
4th order and larger streams[5]	150[1]	None	300[4]	25
Pond <10 acres	50[1]	None	100	None
Lake or Great Pond (>10 acres)	150[1]	None	300	25

1 Width required under RSA 227-J:9 (basal area law). Within a 12-month period, no more than 50 percent of the basal area may be cut in these areas. Includes ponds less than 10 acres associated with a stream or brook that flows throughout the year.
2 Portion directly adjacent to the water body in which no cutting is recommended. It may be desirable to expand it if there are steep slopes (>25%), unstable soils, sensitive wetlands, or exemplary natural communities. Increasing the width of the no-harvest zone will provide greater protection of nontimber values, but will also encumber a larger amount of timber. There may be valid ecological and silvicultural reasons to harvest in the no-harvest zone.
3 A 50-foot, no-harvest zone is recommended for 3rd order streams because of the importance of large woody material on streams of this size.
4 RMZ width on 3rd and 4th order and larger streams and rivers may expand to encompass known wildlife travel corridors, drinking water supply considerations, and the full extent of the 100-year floodplain.
5 For a list of 4th order and higher streams see NH DES Consolidated list of Waterbodies Subject to RSA 483-B.

Wetland Ecosystems:

- A wetland buffer is the vegetated upland area adjacent to a wetland. Deciding on the width and management actions in wetland buffers depends on what functions and values you want to preserve. It is difficult to generalize about wetland buffer widths because of the many types of wetlands and the diversity of wildlife.
- Designate a wetland buffer adjacent to forested and non-forested wetlands. Include steep slopes, highly erodible soils, known threatened and endangered species habitat, rare plants and exemplary natural communities, and heron, eagle or osprey nests. A buffer's effectiveness increases with its width. Sensitive wetlands require larger areas of upland to reduce the risk of disturbance.
- Different wildlife species require different widths for breeding, nesting, and overwintering. Leaving the understory adjacent to wetlands intact will provide many wildlife and water-quality services. Timber harvesting within a wetland buffer can provide benefits to wildlife habitat. The size of a buffer is influenced by, among other things, the type of wetland, steepness of slope surrounding the wetland, the erodibility of soils, the size and type of vegetation within the wetland, and the landowner's objectives.
- Leave the area closest to the stream, pond, or wetland unharvested to provide increased protection to aquatic habitats and to allow a reliable long-term supply of cavity trees, snags, and downed woody material. Larger zones will increase the protection of nontimber values, however, no-harvest zones may not always align with ecological or silvicultural objectives.
- Retain trees with cavities, standing dead trees, downed logs, and large supracanopy trees.

APPENDIX – B

Recommendations For Wildlife Habitat Management

Recommendations for Wildlife Habitat Management from the publication Biodiversity in the Forests of Maine (Flatebo, 1999)

Snags, cavity trees, and down logs:

- Avoid damaging existing downed woody material during harvesting, especially large (16"+) hollow logs and stumps.
- Leave downed woody material on site after harvest operations when possible.
- Leave several sound downed logs well distributed on the site, where possible. Especially important are logs >12 inches dbh and > 6 feet long. Hollow butt sections of felled trees are also good choices.
- Create additional snag trees by girdling large cull pine where possible. Attempt to retain or create a minimum of 4 secure cavity or snag trees per acre, with one exceeding 24" dbh and three exceeding 14" dbh. In areas lacking cavity trees, retain love trees of these diameters with defects likely to lead to cavity formation.
- Retain as many live trees with existing cavities and large unmerchantable trees as possible.
- When possible, avoid disturbing cavity trees, snags, and upturned trees roots from April to July to avoid disrupting nesting birds and denning mammals.
- Retain trees with cavities standing dead trees, downed logs, large trees, and large super canopy trees in the riparian management zone to the greatest extent possible.

Habitat Connectivity:

- Avoid harvests that isolate streams, ponds, vernal pools, deer wintering areas, or other sensitive habitats
- Maintain the matrix of the landscape in relatively mature, well-stocked stands. Where even-aged management is practiced, consider the cumulative effects of multiple cuts and include wider habitat connectors as necessary.
- Consider opportunities for coordinating habitat connectivity with other, on-going land-management efforts that maintain linear forested ecosystems, such as hiking trial corridors and natural buffer strips retained to protect water quality. This may require expanding the physical size of the connector habitat and increasing structural values to fulfill multiple management goals. Also consider the potential for effects that may arise because of incompatible uses (e.g., heavily-used ATV or snowmobile routes around and through deer yards).

Deer Wintering Areas:

- Identify dense stands of mature softwood as potential DWAs, particularly in riparian ecosystems.
- Whenever possible, schedule harvests in DWAs are during December through April.
- Protect advance conifer regeneration during timber-harvesting operations.
- When conducting harvests in coniferous forest adjacent to watercourses, maintain an unbroken conifer canopy along shorelines to protect riparian travel corridors.
- When planning harvests within any DWA, (strive to) maintain a closed-canopy coniferous overstory over at least 50 percent of the area at any given time. Avoid constructing major haul roads within DWAs.
- Throughout the remainder of the DWA, maintain forage areas that provide a steady, abundant source of accessible browse b y clearcutting 1 to 5 acre openings using a 40-year rotation and 10 year cutting cycle. Locate browse cuts within 100 feet of core shelter areas (dense, mature softwood that provides cover).

Beaver influenced ecosystems:

- To the extent possible, locate new roads where they will not be at risk from flooding by beavers, or provide a base for the construction of new dams.

Vernal Pools:

- Identify and mark vernal pool edges in spring when they are filled with water to prevent damage during harvests conducted when pools are difficult to detect
- Avoid any physical disturbance of the vernal pool depression.
- Keep the depression free of slash, tree tops, and sediment form forestry operations.
- Maintain a shaded forest floor, without ruts, bare soil, or sources of sediment that also provides deep litter and woody debris around the pool. Avoid disturbing the organic layer or drainage patterns within the pool watershed.
- Whenever possible, conduct harvests when the rough is frozen or snow covered.

APPENDIX - C

Special Management Considerations For Bird Habitat

Special Management Considerations for Bird Habitat from Vermont Audubon:

Silviculture:

- **Retain, release, and regenerate soft mast species** such as black cherry, serviceberry, and apple that produce food sources in late summer which are critical for preparing for successful migration. Rubus spp that dominate openings are also important sources of soft mast for birds;
- **Retain, release, and regenerate yellow birch** (*Betula alleghaniensis*) whenever possible since the branches and foliage of this species are preferentially chosen foraging substrates for many insect-eating bird species including blackburnian warbler, black-throated green warbler, and scarlet tanager;
- **Retain softwood inclusions in hardwood stands** and hardwood inclusions in softwood stands. Overstory inclusions resulting from site conditions are more practical to maintain than those that are a result of disturbance history;
- **Control and monitor invasive plants.** Migratory songbirds will eat buckthorn, autumn olive, barberry, and honeysuckle berries during the post-breeding season when they are fueling up for fall migration, but the berries are not nutritious. When non-native invasive plants are present, strive to locate larger groups/patches near already disturbed areas (e.g. agricultural lands) and away from interior sections;
- **Maintain closed-canopy buffers along beaver ponds, wetlands, and riparian areas.** Layout riparian buffers to have variable widths based on stream morphology; avoid abrupt edges;
- **Retain a minimum of six snags per acre** with one tree > 18" DBH and three > 12" DBH and designate 3-5% of total stocking as potential cavity trees and source of future snags. Where lacking, actively recruit snags through girdling. Birch and aspen are preferred species;
- **Use snags and potential cavity trees as nuclei for retained patches during larger cuttings.** Retained patches may be islands or peninsulas extending from adjacent stands. Use woodland seeps and springs, which are early season sources of insects, green vegetation, and earthworms as nuclei for uncut patches to retain snags, cavity trees, and other site-specific features. Retained patches may be islands or peninsulas extending from adjacent stands;
- **Recognize that vertical structure is naturally limited in early and mid-successional stages.** Look for opportunities to enhance vertical structure over time;
- **Consider and protect vernal pools and riparian buffers** when laying out extent and location of openings;
- **Cluster intermediate treatments** conducted in the matrix in between groups along trails, and away

from openings and sensitive sites;

- **Manage for age-class diversity** over larger ownerships (>200 acres) where opportunities exist.

Operations:

- **Keep woods roads and skid trails <20 feet wide** to avoid creating fragmenting barriers for interior forest species, such as the wood thrush and ovenbird;
- **Incorporate bends and twists into woods roads** and skid trails when laying out a new network. Nest parasites such as brown-headed cowbirds will travel into forest interiors along straight openings, but will avoid bends;
- **When feasible, avoid operating during peak breeding season** (15 May to 15 August). See table of breeding dates in the companion document *Birds with Silviculture in Mind* for individual species;
- **Operate during winter** under frozen conditions when appropriate to protect habitat features such as understory layers, leaf litter, forest floor topography, soils, and woody debris;
- **Leave as much woody debris on site as possible**. Avoid whole-tree harvesting when feasible. When appropriate, return landing debris to the woods;
- **Leave several large downed logs** well-distributed throughout the stand to serve as drumming sites for ruffed grouse and important habitat for man life forms;
- **Avoid disturbing existing tip-ups, stumps, and logs** during harvest and operations;
- **Create scattered slash piles** of fine woody debris where possible post-harvest to enhance songbird cover and foraging opportunities;
- **Protect shrub patches as well as tree seedlings and saplings during harvesting.** Avoid damage to understory layers during harvest and skidding operations by:
    - Using directional felling techniques;
    - Carefully laying out skid trails to avoid patches of advance regeneration;
    - Winching instead of skidding from each stump, when feasible;
    - Harvesting when a heavy snowpack is present.

APPENDIX – D

Climate Change and Adaptive Management

The effects of climate change on our forest and wetland ecosystems is a growing concern for land owners and land managers across the Northeast and beyond. Ongoing research and studies are providing us with important tools for evaluating risk and vulnerability, adaptive management techniques, and information on what to expect our future forests to look like in the upcoming century. Though much of this information is based on models, there are a few generalizations we can expect to occur in varying degrees of intensity provided in the USDA publication New England and Northern New York Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the New England Climate Change Response Framework Project (Janowiak, 2018):

- Temperatures will increase. Annual increases in temperature represent the broadest possible stressor, strongly influencing other stressors and ecosystem responses.
- Growing seasons will lengthen. Longer growing seasons have the potential to affect the timing and duration of ecosystem and plant physiological processes. Longer growing seasons may also result in greater growth and productivity of trees and other vegetation, by only if balanced by available water and nutrients.
- Temperatures will increase more in winter than in other seasons, leading to changes in snowfall, soil frost, and other winter processes including microbial activity, nutrient cycling, and the onset of the growing season.
- Total precipitation is generally expected to increase during winter and spring, but summer and fall projections are more variable.
- Intense precipitation events will continue to become more frequent, with resulting increase in damage from flooding and severity of soil erosion.
- Increased risk of moisture deficit and drought during the growing season will reduce tree vigor and increase tree mortality.
- Certain insect pests and pathogens will increase in occurrence or become more damaging. Forest impacts from insect pests and pathogens are generally more severe in ecosystems that are affected by drought and other stressors.
- Many invasive plants will increase in extent or abundance.
- Many northern and boreal tree species will face increasing stress from climate change.
- Habitat will become more suitable for southern species.
- Forest composition will change across the landscape but will take at least several decades to occur in the absence of major disturbance.
- Conditions affecting tree regeneration and recruitment will change. Evidence of climate change impacts on forest ecosystems is more likely to be seen in seedlings and early growth than in mature individuals.
- Forest productivity will increase during the next several decades in the absence of significant stressors

but are likely to be spatially variable.

- Lower-diversity systems are at greater risk.
- Tree species in isolated or fragmented landscapes will have reduced ability to migrate to new areas in response to clime change.
- Species or systems that are limited to particular environments will have less opportunity to migrate in response to clime change.
- Ecosystems that have greater tolerance to disturbance have less risk of declining on the landscape.

Adaptive management strategies can target climate change impact on a forest in three ways, including resistance, resilience, and transition. Adaptation strategies and approaches are identified in another recent USDA publication, Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd edition (Swanaton, 2016., pp. 29, 30).

> **Resistance** actions improve the defenses of an ecosystem against anticipated changes or directly defend the ecosystem against disturbance in order to maintain relatively unchanged conditions.
>
> Although this option may be effective in the short term, it is likely that supporting persistence of the existing ecosystem will require greater resources and effort over the long term as the climate shifts further from historical norms. This option may also be most effective in ecosystems with low sensitivity to climate change, or in areas that are buffered from severe climate change impacts.
>
> **Resilience** actions accommodate some degree of change but encourage a return to near prior conditions after a disturbance, either naturally or through management."
>
> Resilience actions enhance the ability of the system to bounce back from disturbance and tolerate changing environmental conditions and may be most effective in systems that can already tolerate a wide range of environmental conditions and disturbance.
>
> **Transition** actions intentionally anticipate and accommodate change to help ecosystems to adapt to changing and new conditions. Whereas resistance and resilience actions foster persistence of the current ecosystem, transition actions intentionally facilitate the transformation of the current ecosystem into a different ecosystem with clearly different characteristics. These actions may be considered appropriate in ecosystems assessed as highly vulnerable across a range of plausible future climates. Transition actions are typically designed for long-term effectiveness. They are often phased into broader management plans that predominantly have a shorter-term focus on resilience actions.

Adaptive management strategies are listed in the same publication, generally arranged under resistance, resilience, and/or transition options (Swanaton, 2016., p. 34):

- Resistance, Resilience, and Transition:
    - Sustain fundamental ecological functions (soils, nutrients, hydrology, riparian areas, fire);
    - Reduce the impact of biological stressors (pests, pathogens, invasives, herbivory);
    - Reduce the risk and long-term impacts of severe disturbances (wildfire, wind, ice);
- Resistance only:
    - Maintain or create refugia (unique sites, native species, biological legacies, diversity);
- Resistance and Resilience:
    - Maintain and enhance species and structural diversity;
- Resilience and Transition:
    - Increase ecosystem redundancy across the landscape (habitat over range of sites, expand reserves);
    - Promote landscape connectivity (reduce fragmentation, maintain corridors);
    - Maintain and enhance genetic diversity;
- Transition only:
    - Facilitate community adjustments through species transitions (adapted species composition);
    - Realign ecosystems after disturbance (revegetate with adapted species).

APPENDIX - E

Definitions of Silvicultural Treatments

Definitions of specific silvicultural treatments are listed below and are largely taken from the Society of American Foresters dictionary (Helms, 1998). Deviations from these treatments will be specified in stand prescriptions.

Crown Thinning (Evenage management): the removal of trees from the dominant and codominant crown classes in order to favor the best trees of those same crown classes

Free Thinning (Evenage or Multiple-Age management): the removal of trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position

Low Thinning (Evenage or Multiple-Age management): the removal of trees from the lower crown classes to favor those in the upper crown classes

Selection Thinning (Evenage or Multiple-Age management): the removal of trees in the dominant crown class in order to favor the lower crown classes

Patch Cut (Evenage or Multiple-Age management): the cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class (typically all Patch Cuts are laid out by delineating the boundary with marking paint; Patch Cut size will be specified in Silvicultural Prescription)

Strip Cut (Evenage management): the cutting of essentially all trees in a strip, producing a fully exposed microclimate for the development of a new age class (all Strip Cuts laid out by delineating the boundary with marking paint; Strip Cut dimensions will be specified in Silvicultural Prescription)

Clear Cut (Evenage management): the cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class (all Clear Cuts laid out by delineating the boundary with marking paint; Clear Cut size will be specified in Silvicultural Prescription)

Seed Tree (Evenage management): the cutting of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class in fully exposed microenvironment; (seed trees may or may not be removed after regeneration is established depending on 1: harvest opportunity 2: protection of established regeneration 3: long term success of regeneration)

Shelterwood (Evenage or Multiple-Age management): the cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment —note the sequence of treatments can include three types of cuttings: (a) an optional preparatory cut to enhance

conditions for seed production, (b) an establishment cut to prepare the seed bed and to create a new age class, and (c) a removal cut to release established regeneration from competition with the overwood; cutting may be done uniformly throughout the stand (uniform shelterwood), in groups or patches (group shelterwood), or in strips (strip shelterwood); in a strip shelterwood, regeneration cuttings may progress against the prevailing wind

Single Tree Selection (Multiple-Age management): individual trees of all size classes are removed more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration

Group Selection (Multiple-Age management): trees are removed and new age classes are established in small groups; the width of groups is commonly approximately twice the height of the mature trees with smaller openings providing microenvironments suitable for tolerant regeneration and larger openings providing conditions suitable for more intolerant regeneration (Patch Cutting differentiated from Group Selection in that Group boundaries are not delineated with marking paint where Patch Cut boundaries are; Group Selection size will be specified in Silvicultural Prescription)

Crop Tree Release (Evenage and Multiple-Age management): the crown release of selected trees on two to preferably three sides (Number of Crop Trees to be released per acre will be specified in Silvicultural Prescription)

APPENDIX - F

New Hampshire Taxes, Laws, and Required Permits

Best Management Practices: BMP's are for protecting water quality during forest harvests. Some BMP's are mandatory and others are voluntary. All BMP's are documented in Best Management Practices for Forestry: Protecting New Hampshire's Water Quality.

Current Use: Current Use is an "open space" taxation program (RSA 79-A). It is a property taxing strategy designed to encourage landowners to keep their open space undeveloped. It taxes agricultural and forestland on its "current use" rather than its real estate market value. Minimum requirements are 10 acres in size and buildings and other improvements must be excluded. Landowners must apply to their town and commit their land to open space conservation. When land is developed it is charged a land use change tax. Current use tax rates are variable, with the lowest rates given to un-posted land under Stewardship Category. This plan meets the Stewardship Category of Current Use.

Timber Tax Law: Ten percent of the value of every timber sale is returned to towns where cutting takes place (RSA 227-J:5 and 79:10). The State of New Hampshire requires filing an "Intent to Cut" form for loggers, foresters and landowners who wish to harvest timber. The Intent to Cut form is for tax purposes since timber is only taxed once it is cut, and is used to make municipal assessing officials aware of cutting operations. Once filed, a Report of Wood Cut form is filed with the town.

Wetlands Law: If harvesting is to occur in or near wetland areas, or which requires stream crossings, a Notification of Minimum Wetlands Impact must be filed with NH DES.

Driveway Permit: A driveway permit is required for vehicles entering a state road from the harvest site. The Driveway Permit application needs to be sent to and approved by the Dept. of Transportation.

Basal Area Law: This law (RSA 227:J:9) regulates cutting over 50% of the basal area adjacent to certain waters and along public highways and requires a Basal Area Variance Request.

Slash Law: The slash law (RSA 227-J:10) is intended to reduce fire danger caused by slash and to improve the aesthetics along roads and water bodies. It prohibits leaving slash in or near year-round streams, bodies of water, and along public roads, along railroad beds, on or within 25 feet of the property of another, in a cemetery and within 100 feet of any occupied structure

APPENDIX - G

New Hampshire Natural Heritage Bureau Records of Rare Species and Exemplary Natural Communities

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