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CLAREMONT – RICE RESERVOIR
FOREST MANAGEMENT PLAN

1 PLAN PURPOSE AND DESIGN

The purpose of this forest management plan is to provide the city of Claremont and the resource manager with a comprehensive description of the property and proposed management activities. It is meant to be a "User's Guide" that reflects Claremont's objectives and will remain flexible as changes in the property condition or objectives change through time.

Management planning on the Claremont ownership is a threefold system including a master plan, forest management plans, and pre-harvest planning. The master plan covers broad property descriptions, ownership objectives, and management strategies. Forest management plans, such as this one, are the second piece of this threefold system. They cover specific property descriptions and management activities intended to span a 10-year period. Forest management plans are stand alone documents. The third part of this system involves pre-harvest plans, detailing even more specific management concerns and objectives particular to individual harvests. As their name indicates, pre-harvest plans are prepared prior to a scheduled harvest.

2 PROPERTY LOCATION AND BRIEF DESCRIPTION

Rice Reservoir forest is small, at 40.5 acres[1] of which 11.4 acres make up the water reservoir. The forest is located on the east side of Winter Street, near the intersection of Route 120. It is dominated by white pine between the road and the reservoir. East of the reservoir the forest is a mix of hemlock, white pine and hardwoods, primarily aspen, rd maple, red oak, sugar maple and white ash. The terrain is gentle west of the reservoir and increases in slope east of the reservoir.

The property is located amidst a rural neighborhood, and is primarily managed for its water resource. It currently receives fairly heavy motorized recreation use including snowmobiles and ATV's.

Woodlot History

The land likely was cleared for agriculture until early last century. The level terrain west of the reservoir was allowed to come in to nearly solid white pine, while the eastern section has a more diverse forest type. The agricultural land use came to a halt early last century when many farmers in

1 Mapped acres, 1/2008

New England abandoned their agrarian lifestyles and once open-land has since become reforested.

The forest has seen no recent harvesting activity. The white pine suffered damage during the multiple high wind events during the summer of 2007. Several large pine blew down during these events and remain on the forest floor.

3 LANDOWNER MISSION, PRINCIPLES, AND OBJECTIVES

As stated in Claremont's master plan, the mission and principles of management on the City of Claremont forestlands are:

Mission Statement

The City of Claremont will actively manage Claremont's natural areas with a strong land ethic in order to achieve responsible land stewardship. These stewardship activities will help to promote Claremont as a healthy community with a quality of life that values the environmental quality of forest ecosystems and the benefits of commercial and recreational land uses.

Principles for Management

- Adopt a holistic view of natural systems which places human activity within rather than apart from the natural environment.
- Implement forest management that is ecologically, economically, and socially responsible.
- Resource extraction should not exceed the regenerative capacity of the ecosystem or reduce natural productivity or diversity.
- Whenever possible management shall incorporate the results of previous actions into future decision-making efforts.
- Management practices shall support indigenous habitats and prevent fragmentation so that wildlife can migrate for seasonal food and reproductive needs.
- Manage for ecologically and socially sustainable recreational opportunities.

Management Objectives for Rice Reservoir

Overall:

- Be responsible *stewards* of the land and its resources
- Maintain the stability and integrity of the ecosystems within our control
- Maintain a healthy, productive and aesthetically pleasing forest
- Manage with respect to *Natural Community* type
- Maintain and improve natural *biological diversity*

Timber:

- Enhance the *quality* and *quantity* of our timber resource
- Manage for *Sustainable* harvest and growth
- Provide *periodic revenue* through the sale of forest products

Education and Recreation:

- Provide opportunities for *education*
- Create educational infrastructure such as interpretive signs and kiosks
- Identify and conserve important *archaeological* and *cultural* sites
- Provide for non-motorized sustainable *recreation* opportunities such as foot paths, and cross county skiing and snowshoe trails
- Create aesthetic *vistas* along recreational trails
- Create *wildlife viewing* areas
- Provide opportunity for *hunting*

Wildlife:

- Provide and enhance the naturally diverse variety of wildlife habitat in forest, wetland, and openland settings

Water Quality:

- Protect our *water resource*
- Protect and improve the *water quality* of streams and wetlands

4 GEOLOGIC ATTRIBUTES

Topography and Aspect

The Rice Reservoir Forest ranges from 780 to about 880 feet in elevation. The terrain is gentle, increasing in slope to the east. It has a westerly aspect overall.

Brooks, Ponds, and Wetlands

The primary feature of the property is the 11.4 acre reservoir. The reservoir is fed from the north. The outlet drains to the south from the dam and west across the property and eventually into the Sugar River. No other water features are located on the tract.

Recommended actions to improve and manage the wetland and water resource of Rice Reservoir[2]:

Riparian and Stream Ecosystems:

- Establish riparian management zones along streams, rivers, ponds, and lakes [and reservoirs]. These are not intended as no-harvest zones. Forest management systems, such as single-tree or small-group selections cuts, that retain relatively continuous forest cover in riparian areas (65-70 percent canopy cover) can help maintain biodiversity by protecting water quality, providing shade, supplying downed woody material and litter, and maintaining riparian wildlife habitat conditions.
- No-cut zones of 16 to 100 feet are recommended by several management guides on river or pond shores containing wet seeps, shallow or poorly drained soils, or area with slopes greater than 8 percent. Limited single-tree cutting can occur on other sites within this zone, with cabling from outside the zone suggested.
- Consider management at the watershed-level as an approach to avoiding stream channel degradation from excessive runoff.
- Road construction, stream crossings, skid trails, log landings, and all phases of timber-harvesting operations should conform to Best Management Practices

Springs and seeps:

- Avoid leaving slash in woodland seeps, springs, or associate wildlife trails.
- To the extent feasible, avoid interruption groundwater flow above or below seeps and above springs. When seeps and springs can't be avoided, minimize flow interruption by strictly adhering to appropriate Best Management Practices for water crossings.
- Where feasible, use woodland seeps and springs as nuclei for uncut patches to retain snags, cavity trees, and other site-specific features.

Soils

The upland soils were derived from glacial till and are primarily moderately well drained stony silt loam or sandy soils. The major soil types present include Bernardston silt loam and stony silt loam, Dutchess stony silt loam, Monadnock-Lyman rock outcrop complex, Pittstown silt loam, and Quonset-Warwick and Warwick-Quonset gravelly fine sandy loams. These soils are typically well to moderately

2 Riparian and Stream Ecosystem management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

well drained and fairly productive, but some have limitations due to rockiness. The more productive soils are to the east and growing white pine, while the less productive occupy the hemlock forest on the eastern half.

Recommended actions to improve and manage the soil resource of Rice Reservoir[3]:

Forest soils, forest floor and Site Productivity:

- 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.

5 NATURAL COMMUNITIES[4]

As written in the book *Natural Communities of New Hampshire* by Daniel Sperduto and William Nichols, “Natural communities are recurring assemblages of plants and animals found in particular physical environments. New Hampshire has a fascinating and complex variety of natural communities, from tidal marshes to alpine meadows, river banks to mountain forests, and streams to lakes. Each type of natural community has a unique set of environmental conditions that support certain species adapted to those conditions.”

“Just as individual organisms can be classified into species, plant assemblages can be classified into natural community types. Classifying natural communities is a useful way of viewing the landscape because it allows us to distill the broad range of complex interactions between species and their environments into a limited number of units that share certain key features.”

“Natural community types are usually defined in terms of plants because they are easy to study, often compose the physical structure to which most other organisms respond, and are sensitive indicators of physical and biological factors that influence many types of organism.”

“The need to classify natural communities is fundamentally pragmatic: People need a way to sort out, understand, and communicate about nature’s complexity on order to be good stewards.”

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3 Soil management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

4 All information on Natural Communities referenced from the publication: Natural Communities of New Hampshire, Daniel Sperduto and William Nichols, New Hampshire Natural Heritage Bureau and The Nature

Determining natural community types can be a challenge because it is uncommon to find land that has not been influenced by human intervention. Past agricultural and silvicultural practices often change the plant communities that you would find on any given acre naturally. Identifying natural communities then becomes a process of understanding the past management activities, the physical conditions of the site, and the plant communities currently found there and determining to the best of our ability what community would occupy that site without human intervention. The natural community types found on Claremont forestland has been identified on a broad level to the best of our ability. A more comprehensive and detailed study by an ecologist would be required to determine natural community types on a more fine-grained and certain basis.

Based on our interpretation, it is likely Rice Reservoir is comprised of two main natural community types. The eastern half of the forest is likely Hemlock-beech-oak-pine, a fairly common natural community type occupying glacial till and terrace soils of low to mid elevations in central and southern New Hampshire. It is a broadly defined type. The western half of the forest, currently dominated by white pine but growing on more productive soils and is regenerating to hardwoods dominated by sugar maple and ash may be a Semi-rich mesic sugar maple forest. These forests are distinguished from rich mesic forests by a more limited diversity of rich-site indicator species. The degree of enrichment depends on a complex combination of characteristics including but not limited to composition of the bedrock, topographic position, hydrologic and moisture features, and other soil characteristics. These forests are often managed “sugarbushes”. As this area transitions to a later stage of succession the natural community type will be easier to determine. See Appendix A for a map of the natural communities.

Rare Species and Unique Natural Communities

An in-depth flora and fauna survey was not within the scope of this plan. There were no endangered plants or animals knowingly encountered while collecting the data for this plan. The Natural Heritage Inventory, in Concord, New Hampshire, has been contacted and they have no records of any endangered plant communities in the vicinity. That does not mean there are not any, however.

Realizing the significant habitat conditions found on Rice Reservoir Forest demands *adaptive management*. All attempts will be made on the management level to identify unique areas, learn what makes them unique, how to best manage them and most importantly, refine the management of these areas as the knowledge base grows.

6 WILDLIFE HABITAT CONDITIONS

Rice Reservoir Forest provides a variety of habitats for wildlife, but is dominated by dense white pine, and hemlock-pine-hardwood mixed forest. The reservoir itself provides habitat for animals not often found in forestland including ducks, amphibians, and some furbearers including mink, muskrat, and beaver. The habitat provided by the forestland is limited by its small size, unless adjacent land types are taken into consideration. The hemlock found on the eastern half provide shelter during winter months for white tailed deer and other small mammals. The pine likely serves as habitat for certain songbirds, and is utilized by white tailed deer and other mammals. The most common mammal likely is squirrels, but other wildlife is certain to pass though including coyote, moose, fox, and even bear. It is likely turkeys utilize the forest as well. Forest management objectives will integrate actions that improve wildlife habitat found here, including attempt to mimic natural disturbances that will help to create and maintain young tree and shrub growth for browse opportunity and release of individual trees possessing important habitat features such as hard mast from oaks, cavity and snag trees and trees with biological legacy value.

The New Hampshire Wildlife Action Plan includes mapping of significant wildlife habitats as they occur throughout the state and provides strategies for the management of wildlife that occur on these habitats, especially as they relate to threatened and endangered species, but also including information on common wildlife species. According to their delineation, one wildlife habitat type dominates the Rice Reservoir Forest- Hemlock-Hardwood-Pine. A summary of this habitat type and the wildlife species found there is in Appendix B of the Master Plan.

Recommended actions to improve and manage the wildlife habitat of Rice Reservoir[5]:

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

5 Wildlife habitat management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

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.

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 ground is frozen or snow covered.

7 RECREATIONAL and EDUCATIONAL OPPORTUNITIES

Recreation

Rice Reservoir Forest provides limited opportunity for recreation. Given the primary ownership objective is to protect the water quality, motorized recreation is not a compatible use. Non-motorized recreation including foot traffic is justified al song as the water quality is not compromised.

Recommended Actions to Improve and Manage the Recreational Resource of Rice Reservoir:

- **Improve existing signage.**
  - Post a Welcome sign to the land that identifies the owner and what is allowed or encouraged on the land. This is not the best place to detail what is not allowed.
  - Post signs at all property corners and a intervals along the boundary identifying the landowner.
  - Improve informational signage about use of trails, explaining what is allowed and what is not allowed. For example:
    - Stay on the trail
    - Carry in and Carry out
    - Avoid trails if conditions are muddy
- **Clearly identify what trails are open to non-motorized use. Prohibit ATV and snowmobile use.**
  - Post a map of the trails and allowed uses.

- **Locate and maintain trails to prevent erosion**[6]
- **Locate trails** so they avoid sensitive areas or valuable wildlife habitat such as vernal pools and deer wintering areas.

Education

As with all of Claremont's forestland, educational opportunities are abundant from school trips to forest management based workshops. The general ease of access to this lot benefits its use for school trips. Forest management operations will also provide educational opportunities in the form of public workshops to see timber harvesting in action or school field trips focused on management of renewable natural resources or to learn more about what land ownership and management can be about. Interpretive signs put in place during forest management operations can be a helpful educational resource that aid in public relations and understanding of land management. The Sullivan County forester is an excellent resource for public education needs and is usually willing to participate in workshops or provide educational resources. There are many creative ways to educate; opportunities are not limited to those listed here.

Suggested opportunities to utilize the public education potential of Rice Reservoir:

- **Encourage local schools/clubs/etc. to utilize this valuable resource**
- Prior to any forest management activities, **promote and present workshops** inviting the public to come learn about management activities in Rice Reservoir
- **Create educational kiosk and signage** about Rice Reservoir and management philosophy and activities

8 FOREST CONDITIONS

Forest Types

The following forest type designations are used in the forest type map:

COVER TYPES

H ≥ 50% dominant & co-dominant trees are hardwood
S ≥ 50% dominant & co-dominant trees are softwood
HS = Mixed species but dominated by hardwood
SH = Mixed species but dominated by softwood
(in some instances a dominant species, such as WP or HE may be included in the cover type)

SIZE CLASS

1 = Seedlings or regeneration - 90% of stems < 3" DBH
2 = Saplings or small poles 3" - 8" DBH
3 = Large poles and or small sawtimber 9" - 12" DBH
4 = Sawtimber 13" and larger

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6 Two good resources include: *Lightly on the Land*, *The SCA Trail-Building and Maintenance Manual* by Robert C. Birkby and Best Management For Erosion Control During Trail Maintenance and Construction by New Hampshire Department of Resources and Economic Development, Division of Parks and Recreation, Bureau of Trails

CROWN CLOSURE/DENSITY
A = 75-100% crown closure of co-dominant or dominant trees
B = 50-74% crown closure of co-dominant or dominant trees
C = 0-49% crown closure of co-dominant or dominant trees

An inventory was conducted in December, 2007 consisting of 7 sample points. Data was collected as outlined in the Claremont master plan.

Age and Age Class Distribution

As with most forests in New England, Rice Reservoir Forest is largely even-aged, with the bulk of the trees getting their start after the abandonment of agriculture here early last century. That said, different species and individuals within the same species grow faster and mature at different rates than others. White pine, a fast growing tree can get to quite a large size, compared to a hemlock of the same age. Aspen, another fast growing tree, doesn't get as large as white pine and in addition, matures at an earlier age. So, variability exists within an evenage forest, providing opportunity to manage for multiple age classes and diversify the forest structure, providing better wildlife habitat, continuous forest cover, and relatively less intensive silvicultural management. In general, Rice Reservoir Forest is dominated by 60-70 year old white pine and hemlock in the overstory. Younger trees, often clusters of pole-sized hardwood species, can be found in pockets where past harvesting or natural disturbances, such as blow down, created openings.

Growth Rates

An in-depth study of tree growth is beyond the scope of this plan. While not statistically sound, some growth observations can be made by counting tree rings on old stumps and taking increment cores of some trees. Although volume growth is very difficult to accurately calculate using this method, some rules-of-thumb do apply. A tree's growth is directly related to the substrate on which it is located. Wet, ledgy, and dry areas do not promote rapid growth of trees. Lower elevation and cool moist but well drained areas support better tree growth as the soils are deeper and more fertile. The average managed woodlot in New Hampshire grows at a rate of 2 to 4 percent per year. This corresponds to volume increases of approximately 0.5 cords or 250 board feet per acre per year. Given the site conditions and the current density of the forest, it is likely that tree growth of the Rice Reservoir Forest falls within this range.

Tree Quality and Tree Health

Overall tree quality on the Rice Reservoir Forest is good. The overwhelming majority of sawtimber volume includes maturing white pine, comprising approximately 8,000 board feet per acre in Stand 1. Stand 2 data reported the staggering amount of 13,000 board feet per acre of pine, but likely the actual volume is smaller with this exaggeration due to plot location during the inventory. The quality

of the pine varies, from some little to no value “wolf pine” that are crooked, multi-stemmed, and branchy to some fairly decent quality, straight stemmed individuals. Given the age and average diameter of the pine, red rot (a common decay fungus in white pine, typically affecting the main stem) is likely present.

In addition to the common problem of red rot in pine, especially in pure, overstocked stands, the other notable problem is damage due to high winds and blow down during the summer of 2007. Several large trees blew down, but the quality of the timber in the down logs is decreasing rapidly and perhaps gone entirely due to blue stain. Blue stain is a common fungus that affects pine after it has been cut or blows over and reduces its value.

Forest Management Approach

Management on the Rice Reservoir Forest will utilize a combination of silvicultural techniques that typically are separated into two general categories, even-age and unevenaged management. Evenaged management methods include clear-cut, seed tree, overstory removal and patch cut applications and may be used to regenerate a new stand when deemed necessary. Unevenaged management methods generally include single tree and group selection used to regenerate small areas resulting in uneven age classes in a given stand. Often though, applied techniques fall somewhere in between these two text-book defined categories. One may define a large group opening (unevenage management) as a small clear-cut (evenage management). Improvement thinnings often fall somewhere in between as well, depending on the intended results and the actual results. A thinning may result in improved growth of the overstory trees, an even-aged treatment. A thinning may also provide similar conditions as single tree selection, an unevenaged technique, and result in regeneration of shade-tolerant species. Crop tree release, a practice where designated “crop trees” are released from shade of competing trees on typically 2 to 3 sides, falls somewhere in between as well. Given the variability of site quality and stocking, even within a defined stand, unless evenaged management is specifically called for, management typically will fall in the unevenage category.

Further discussion of unevenage management is required. Traditionally, the intent of unevenage management is to attain forest stocking conditions that mimic a specific diameter/age distribution. But, practicably speaking, unevenage management is often carried out as a simpler form of multiple-age management resulting in the introduction of a new age-class on a portion of a stand each harvest entry. Given the even-aged condition of the majority of land in New England, encouraging multiple age classes is a more attainable, practicable goal and in effect, desirable goal. To clarify discussion of management technique on Claremont lands, the term multiple-age management will replace traditional uneven-aged management, but will utilize the same techniques including single tree and group selection.

Applied Silviculture

Below are the generalized silvicultural systems and methods that will be broadly applied to the natural forest communities found on Rice Reservoir Forest and the forest stands within. The methods and their corresponding cutting cycles, rotation ages and target diameters are described and will serve as management guidelines for application in the field.

Hemlock/Hardwood Silviculture

The hemlock and hardwood community on Rice Reservoir forest will be largely managed using a multiple-age system. Methods of multiple-age management will involve a combination of singletree and group selection silviculture and will mimic singletree and canopy gap disturbances. These silvicultural methods are used to create and/or maintain a multi-aged stand of largely mid-tolerant and shade tolerant species. Residual stand basal area densities following cuts will range between 60-90 square ft/acre for the hardwood and 110-200 square ft/acre for areas dominated by hemlock. Where mixed types exist, basal area densities will average between the two types. Depending on a number of considerations, the cutting cycles using this multiple-age system will be between 15 and 20 years. Target diameters of the hemlock and hardwood components are listed below. However because of the variability of sites both diameters and age goals may or may not be reached. Target diameters are as follows:

White Pine	18-24	Beech	14-18
Hemlock	16-20	Aspen	12-14
White Ash	16-22	Sugar Maple	16-22
Black Cherry	14-18	Red Oak	16-24
White Birch	12-16	Red Maple	14-18
Yellow Birch	16-22		

White Pine Silviculture

White pine dominates Rice Reservoir Forest. White pine trees generally produce a seed crop every 7 to 10 years during a period commonly known as a “cone year”. The 100-200 seeds produced by each cone are delicately small and remain viable for a short period after dispersal, approximately a year. Because the pine seed is so small, it does not have the stored energy necessary to grow through the forest duff layer, particularly under shady conditions. This means exposed mineral soil, ideally in deep well-drained sandy loams, and heat are required for successful seed germination. Keeping this in mind, these conditions need to be present during the seeds year of viability. To create these requirements, the silvicultural method most appropriate for pine, or most softwood regeneration for that matter, is evenage. Silvicultural techniques that are best applied where opportunity exists are

patch, shelterwood and seed tree cuts. These techniques provide the stand dynamics required for pine regeneration that include space, heat, light, uniform canopy level, tight geotropic structure, hence an evenage structure. Timing of treatments is most effective during the snow-less season, where maximum soil scarification is attained. Another variable in obtaining sufficient pine regeneration is the overall ability of the soil to grow hardwood trees. A soil with a high site index for hardwoods is best suited to grow hardwood. In these soils there is a high level of available nutrients that will undoubtedly permit a layer of hardwood regeneration so thick that whatever pine is established will be overgrown readily. This hardwood competition is often seen on the nutrient poor sites as well, but these soils that are better suited for pine. On these sites precommercial weeding of the hardwoods is required for the pine continuance. This hardwood competition is due to the fact that once the seed germinates it has a slow growth rate for approximately 5 years before more rapid growth begins. Site wise, sandy soils, well-drained and low cation exchange, provide excellent pine sites. Timing, silvicultural technique and soil type is critical to promote the continuity of the pine resource.

Access

Road access to Stand 1 on the Rice Reservoir Forest is excellent. It lies adjacent to a town road and has gentle terrain. Getting to Stand 2 will be harder as it requires going around the northern end of the Reservoir and crossing the inlet or sneaking around the south side of the outlet and accessing the stand from the south. Alternate routes should be considered that involve crossing neighboring lands. All truck roads, landings and skid trails should be created and maintained according to Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire. Another helpful road building manual is a USDA publication #NA-TP-06-98: A Landowner's Guide to Building Forest Access Roads by Richard L. Wiest.

Operability

The terrain and ground conditions on this tract in general do not limit operability. As mentioned above, Stand 1 has gentle to nearly level terrain. The soils can be wet during certain times of the year limiting access to the drier seasons. Stand 2 has more moderate slopes, but in general they do not limit operability. Winter harvesting on frozen ground with good snow cover will provide the best protection for the soils found here. But, given the unreliability of winter conditions, operations may occur during the summer in dry periods as long as wet areas are avoided or tracked with equipment that minimizes impacts such as a cut-to length system that creates a mat of slash to drive over, therefore protecting wet ground from rutting and mitigating negative impacts.

Boundary Delineation

The Rice Reservoir Forest boundary is in variable condition and includes approximately 1 mile

of maintainable boundary line. A combination of stonewalls, wire fence, corner monumentation and painted blazes make up the boundary. The entire boundary should be blazed and painted where needed as soon as possible. It is recommended that all boundary corners be monumented with City of Claremont signs.

FOREST DATA

Stand 1 White Pine 3A 14.8 acres


Stand Structure


Stand Structure


Forest Canopy

GENERAL ATTRIBUTES

Natural Community Type:	Semi-rich mesic sugar maple forest (S3S4)
Past Management History:	Some timber stand improvement work done 10-15 years ago
Approximate Age of Dominant Trees:	60-70 years
Stand Health:	Generally good
Insects/Damage/Disease:	Likely some red rot

SITE CONDITIONS

Site class:	1A
Determined by:	Soils and field observation
Tree vigor:	Good
Soils:	Bernardston silt loam, Bernardston stony silt loam, Pittstown silt loam, Quonset-Warwick and Warwick-Quonset gravelly fine sandy loam
Parent material:	Glacial till
Soil texture:	Stony/silt loam
Drainage:	Moderate
Terrain:	Gentle slope
Aspect:	West
Elevation:	780-820’

Snags Per Acre

DBH Class	Moderately punky	Sound	Grand Total
<12"		96.3	96.3
12-18"	4.1	4.1	8.1
>18"		2.3	2.3
Grand Total	**4.1**	**102.6**	**106.7**

Table 1.1: Standing dead trees per acre by size and decay class.

Down Logs Per Acre

DBH Class	Moderately punky	Sound	Grand Total
<12"			
12-18"			
>18"			
Grand Total			

Table 1.2: Down logs per acre by size and decay class.

WILDLIFE HABITAT

Forest type:	White pine
Vertical diversity:	Low
Vegetative diversity:	Low
Hard mast:	Pine
Soft mast:	Some *Rubus*
Special habitat features:	
Snag trees:	Fair amount
Down logs:	Present, but didn't show up in inventory
Special wildlife practices:	Increase diversity, create large snag trees

RECREATION

Recreational features:	Off trail foot traffic; wildlife viewing
Recreational infrastructure:	None
Aesthetic resources:	Reservoir
Public access:	Open to foot traffic

SILVICULTURE

Structural and Silvicultural Attributes

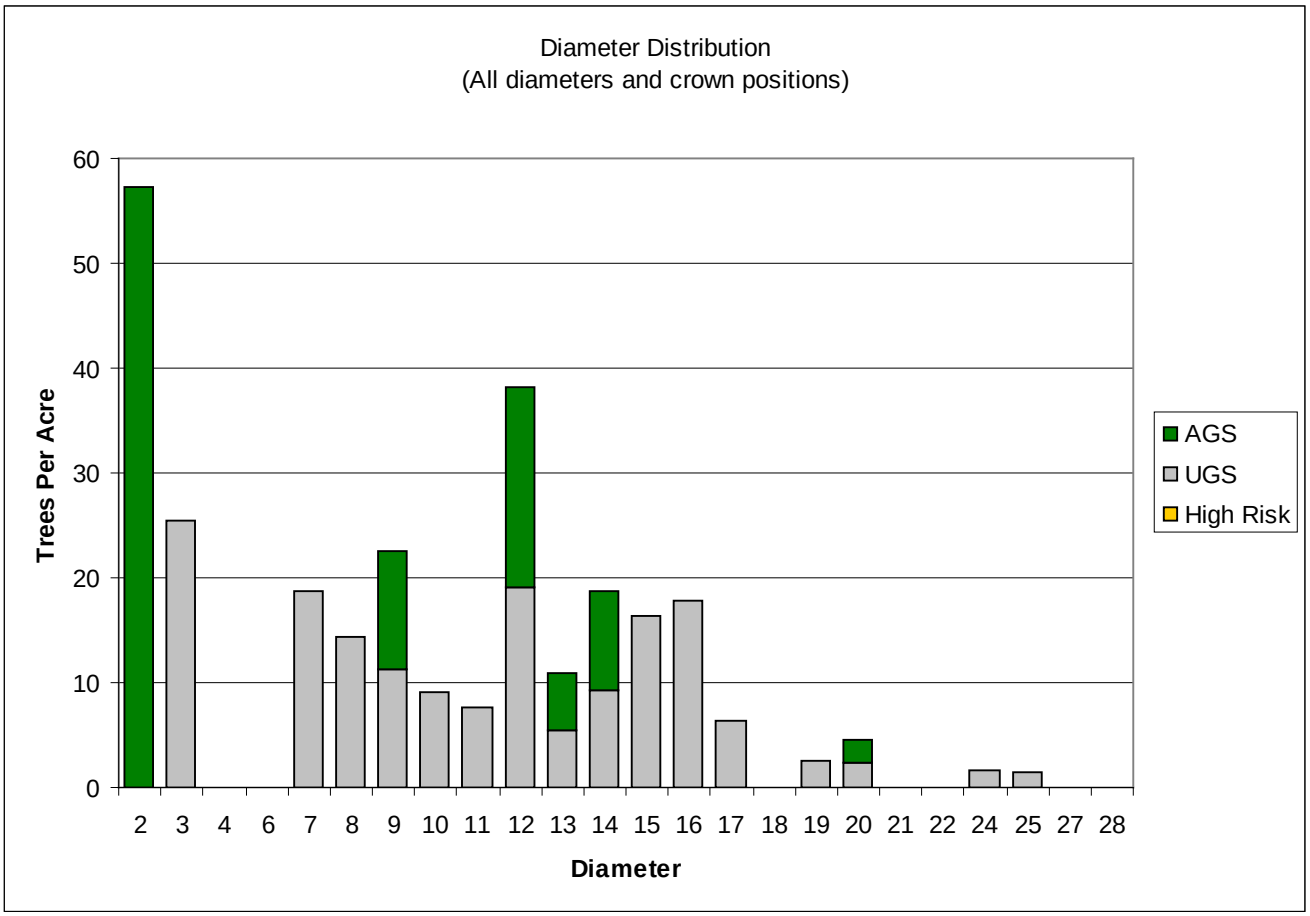
Broad Forest Type:	S3A
Size Class:	Small sawtimber
Stand Structure:	Evenage
Crown Closure:	95%
Total Basal Area Per Acre:	173
Total Merchantable Basal Area Per Acre:	170
Total Acceptable Basal Area Per Acre:	41
Trees Per Acre:	274
Quadratic Mean Stand Diameter:	10.8
Percent AGS Sawtimber:	35.1%
Basal Area of AGS Sawlogs:	35
Timber Quality:	Fair to Poor

Forest Composition and volume

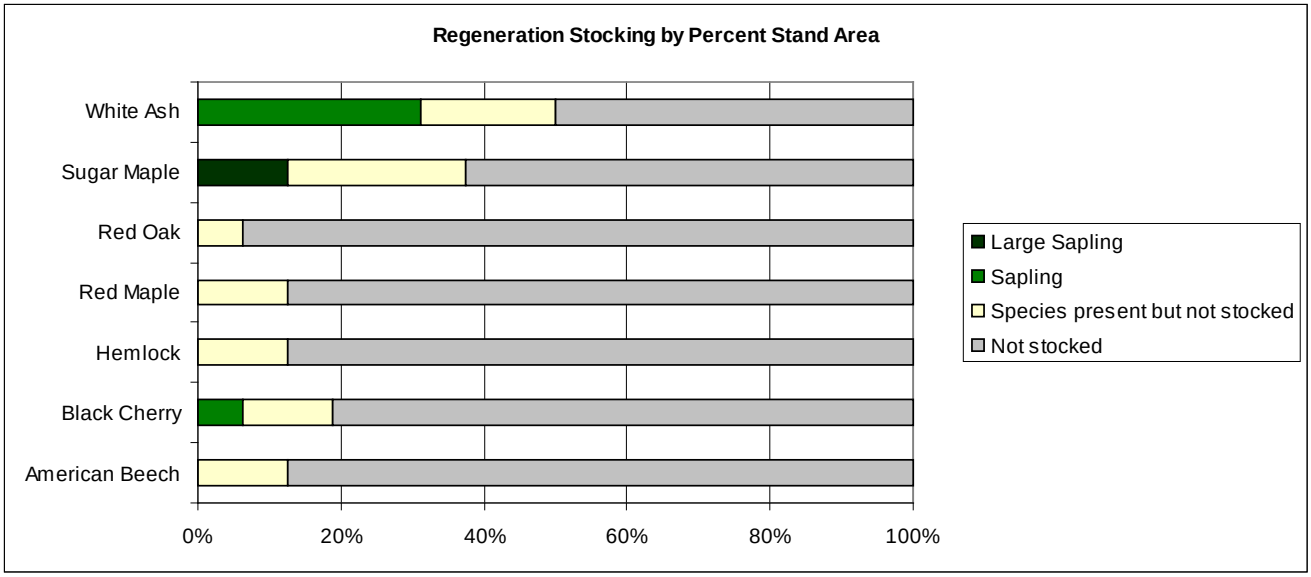
Species	% TPA	Veneer (bf)	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Total Cords	High Risk	AGS Saw	% AGS Saw
Aspen	6.9%	0	654	398	3	0.0	5.1	0	0	0%
White Ash	5.9%	0	0	0	1	1.0	1.7	0	0	0%
Total Hardwood Per Acre:	*12.8%*	*0*	*654*	*398*	*4*	*1.0*	*6.8*	*0*	*0*	0%
White Pine	87.2%	0	7,240	3,112	35	0.3	55.0	0	3,999	39%
Total Softwood Per Acre:	*87.2%*	*0*	*7,240*	*3,112*	*35*	*0.3*	*55.0*	*0*	*3,999*	39%
Total Volume Per Acre:	100.0%	0	7,895	3,510	39	1.3	61.8	0	3,999	39%
Stand Volume:		0	116,840	51,941	581	20	914	0	59,183	

Table 1.3: Stand volume by species and product per acre values.

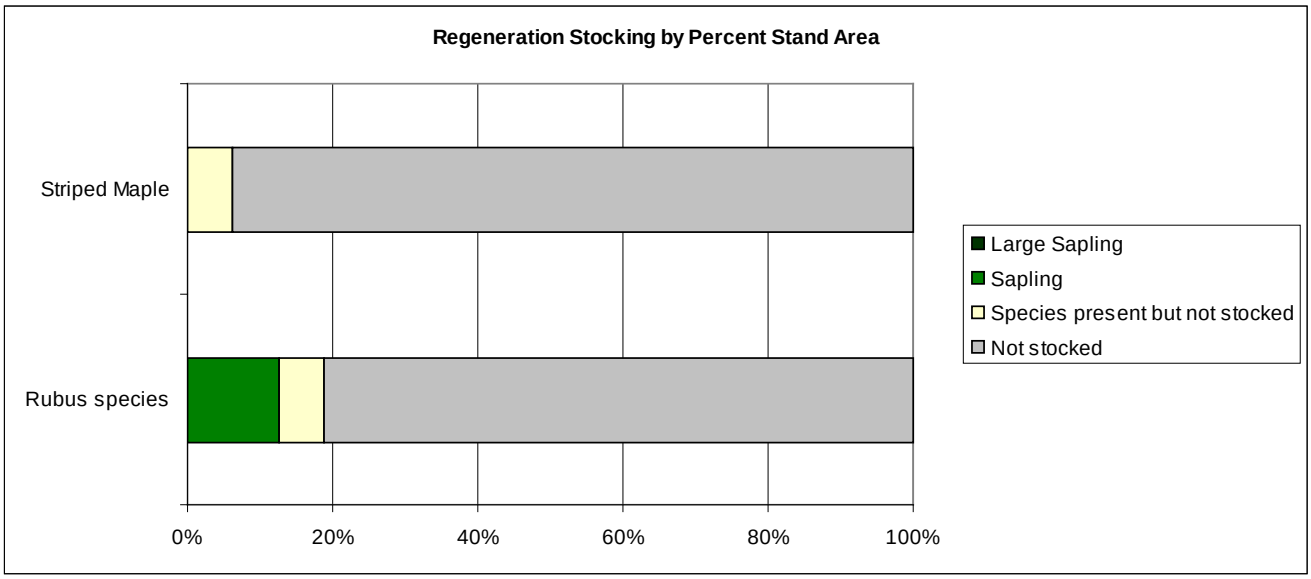
Graph 1.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



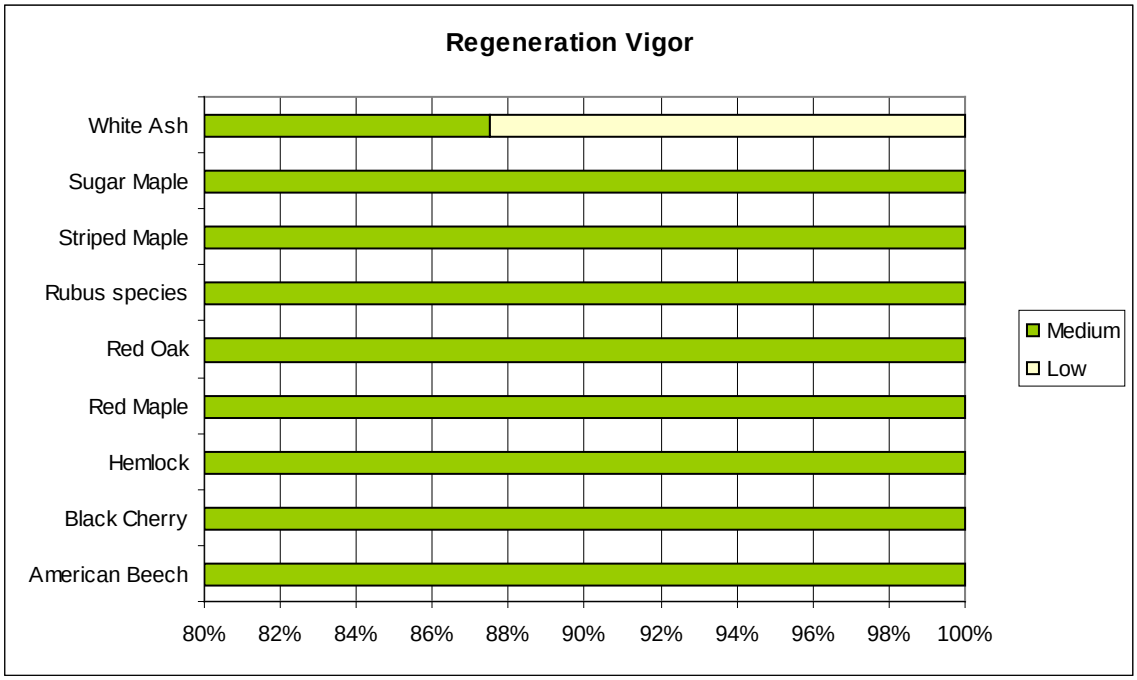
Graph 1.2: Regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



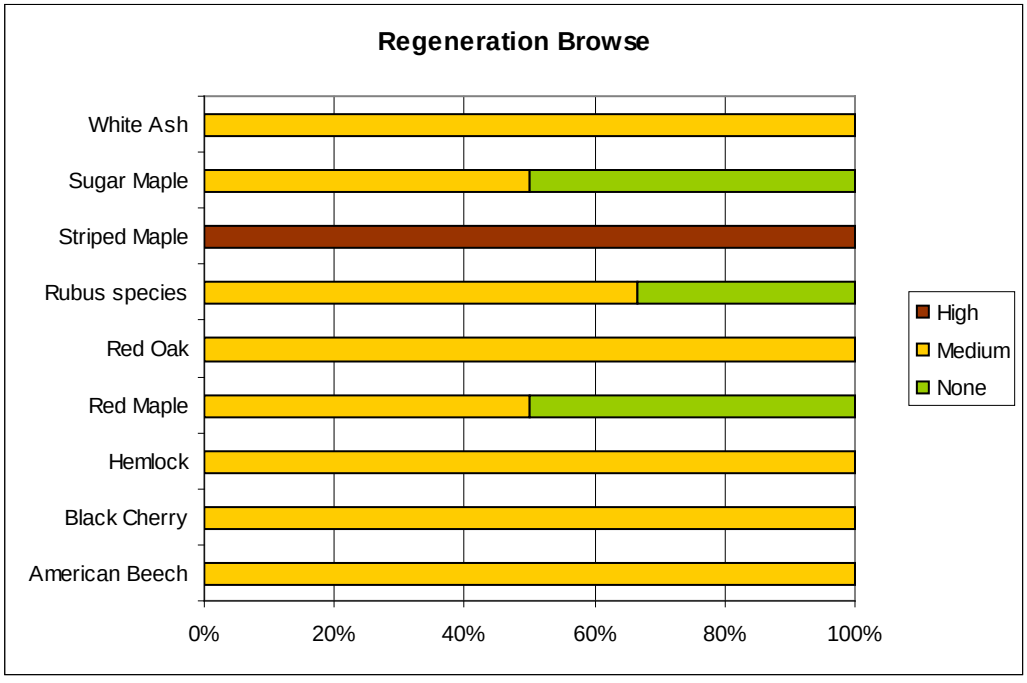
Graph 1.3: Shrub and competing species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 1.4: Vigor of all regeneration and shrub species.



Graph 1.5: Browse level of all regeneration and shrub species.



Silvicultural Objectives

Management system:	Even-aged; convert to multiple age over time
Harvest Entry:	15-20 years
Products:	White pine sawlogs and pulp/chipwood
Desired Composition:	Allow stand to naturally transition to hardwoods
Crop tree target diameter:	White pine 18-20”

Operational Considerations

Operability:	Operable
Seasonal limitations:	Dry summer or frozen winter with snow cover
Terrain:	Gentle
Access and landing area:	Easy access right off town road, landing same
Access distance:	Short
General maintenance:	None required
Brook-wetland crossings:	None required

STAND 1 SUMMARY AND 10-YEAR MANAGEMENT SCHEDULE

Stand 1 occupies the area of gently sloping terrain west of the reservoir. It is dominated by white pine, but does have some hardwood coming in and includes some mature/over mature aspen. The regeneration in this stand is quite good in areas, consisting primarily of sugar maple and white ash with some oak, hemlock, black cherry and beech mixed in. *Rubus* species (raspberry and blackberry) occur in pockets and striped maple is present but not in overwhelming amounts.

The pine here is in varying quality, from poor to good, but dominated by fair quality. The stand is currently overstocked and would benefit from some intermediate thinning. To avoid additional loss to blow down it will be necessary to leave the most wind-firm and vigorous trees. A mix of silvicultural treatments might work best here, combining some group selection where pockets of low quality and/or vigor trees exist especially where there is desirable regeneration established. This will accomplish two things at once, thinning the hardiest and wind firm trees and releasing hardwood regeneration to promote the natural transition of this stand to hardwoods.

Wildlife habitat can be improved by protecting existing snags and down logs and by creating additional ones by girdling cull trees, especially those with cavities, and by felling and leaving cull trees to create down logs.

The long-term goal of management in this stand is to slowly allow it to transition to hardwoods while improving growth and capturing value in the white pine. Ultimately it should be managed as a multiple-age hardwood stand indicative to the natural community type.

Silviculture: The focus of management here is to improve the growth on the highest quality and vigor and wind firm pine, release pickets of established hardwood regeneration especially where overtopped by poor quality pine. This will be accomplished by a mix group selection and thinning from above and below.

Priority: Medium-High

2009: Outside of reservoir buffer zone, reduce overall basal area to approximately 100 square feet through:

- **Group selection:** Group selection up to ½ acre trees to remove pockets of poor quality, mature, diseased, or damaged stems and release existing hardwood regeneration.
- **Thinning from above and thinning from below** to release the best quality, highest vigor and most wind firm pine.

(Reservoir) Riparian and Stream Ecosystems[7]:

- No-cut zones of 16 to 100 feet are recommended by several management guides on river or pond shores containing wet seeps, shallow or poorly drained soils, or area with slopes greater than 8 percent. Limited single-tree cutting can occur on other sites within this zone, with cabling from outside the zone suggested. The Rice Reservoir shall have a no-cut zone of 50 feet, increasing where needed as terrain dictates—including no-cut zones where slope is greater than 8% and where the soils are wet. Elsewhere within the buffer light single tree selection shall be allowed. No roads or landings shall be created within the buffer. Existing roads to access the reservoir shall be maintained according the New Hampshire BMP's.
- Establish riparian management zones along streams, rivers, ponds, and lakes. These are not intended as no-harvest zones. Forest management systems, such as single-tree or small-group selections cuts, that retain relatively continuous forest cover in riparian areas (65-70 percent canopy cover) can help maintain biodiversity by protecting water quality, providing shade, supplying downed woody material and litter, and maintaining riparian wildlife habitat conditions.
- Road construction, stream crossings, skid trails, log landings, and all phases of timber-harvesting operations should conform to Best Management Practices

7 Riparian and Stream Ecosystem management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

Stand 2 Hemlock/White Pine/Hardwood 3-4A 12.4 acres


Stand Structure


Stand Structure


Forest Canopy

GENERAL ATTRIBUTES

Natural Community Type:	Hemlock-beech-oak-pine (S5)
Past Management History:	No recent management
Approximate Age of Dominant Trees:	60-70 years old
Stand Health:	Good
Insects/Damage/Disease:	No serious problems noted

SITE CONDITIONS

Site class:	2A
Determined by:	Soils and field observation
Tree vigor:	Fair to Good
Soils:	Dutchess stony silt loam, Monadnock-Lyman rock outcrop complex
Parent material:	Glacial till
Soil texture:	Stony loam
Drainage:	Well drained
Terrain:	Moderate slope
Aspect:	West
Elevation:	820-880’

Snags Per Acre

DBH Class	Moderately punky	Sound	Grand Total
<12"	10.1		10.1
12-18"	4.8		4.8
>18"	2.8		2.8
Grand Total	**17.6**		**17.6**

Table 2.1: Standing dead trees per acre by size and decay class.

Down Logs Per Acre

DBH Class	Moderately punky	Sound	Grand Total
<12"			
12-18"			
>18"			
Grand Total			

Table 2.2: Down logs per acre by size and decay class.

WILDLIFE HABITAT

Forest type:	Hemlock/white pine/hardwood
Vertical diversity:	Medium
Vegetative diversity:	Medium
Hard mast:	Oak, pine, red maple
Soft mast:	
Special habitat features:	Mixed forest bordering reservoir
Snag trees:	Fair amount
Down logs:	Present, but didn't show up in inventory
Special wildlife practices:	Increase diversity, create additional snags and down logs

RECREATION

Recreational features:	Off trail foot traffic; wildlife viewing
Recreational infrastructure:	None
Aesthetic resources:	Reservoir
Public access:	Open to foot traffic

SILVICULTURE

Structural and Silvicultural Attributes

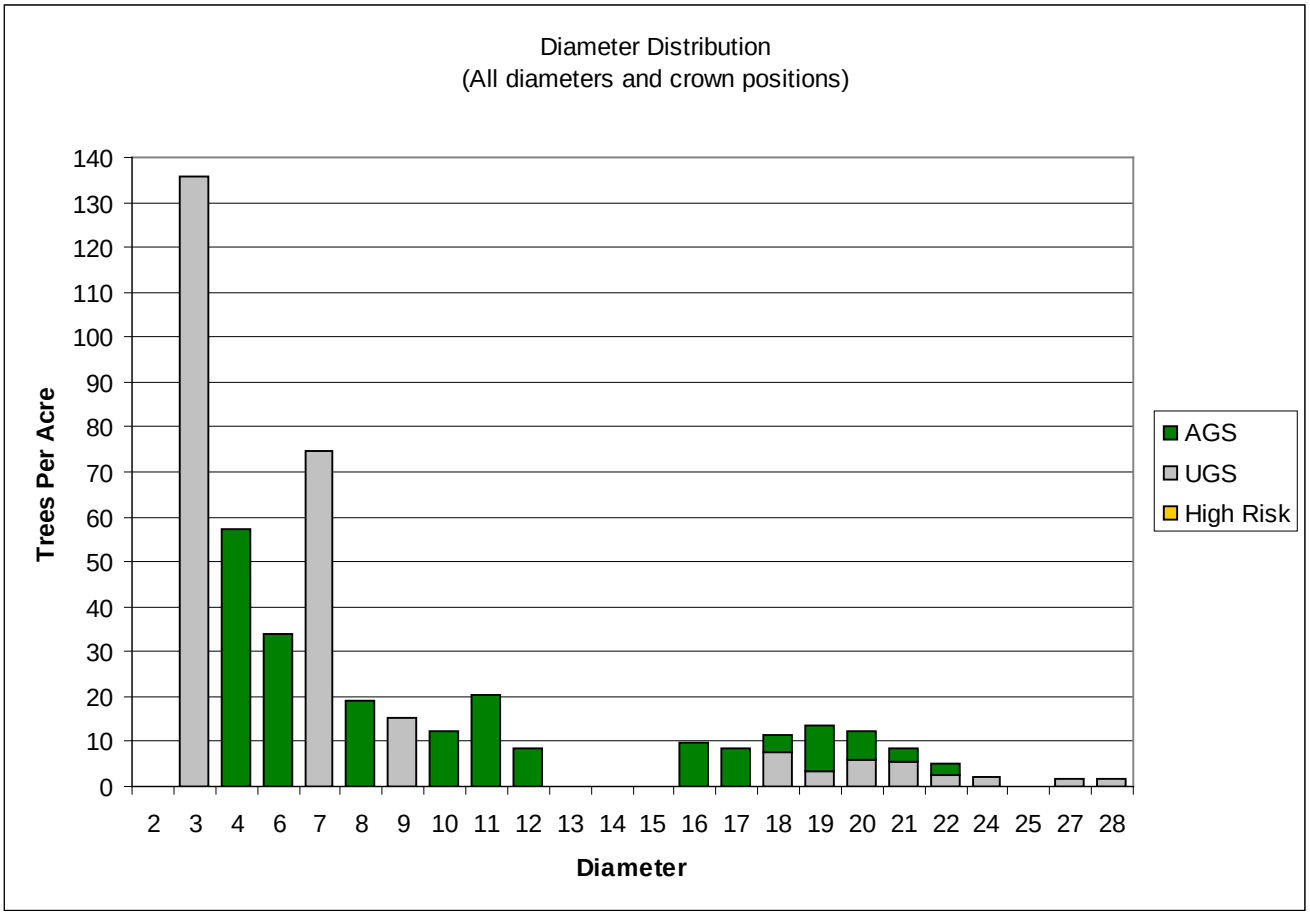
Broad Forest Type:	SH3-4A
Size Class:	Small to Large sawtimber
Stand Structure:	Evenage
Crown Closure:	95%
Total Basal Area Per Acre:	232
Total Merchantable Basal Area Per Acre:	220
Total Acceptable Basal Area Per Acre:	125
Trees Per Acre:	451
Quadratic Mean Stand Diameter:	9.7
Percent AGS Sawtimber:	69.9%
Basal Area of AGS Sawlogs:	100
Timber Quality:	Good

Forest Composition and volume

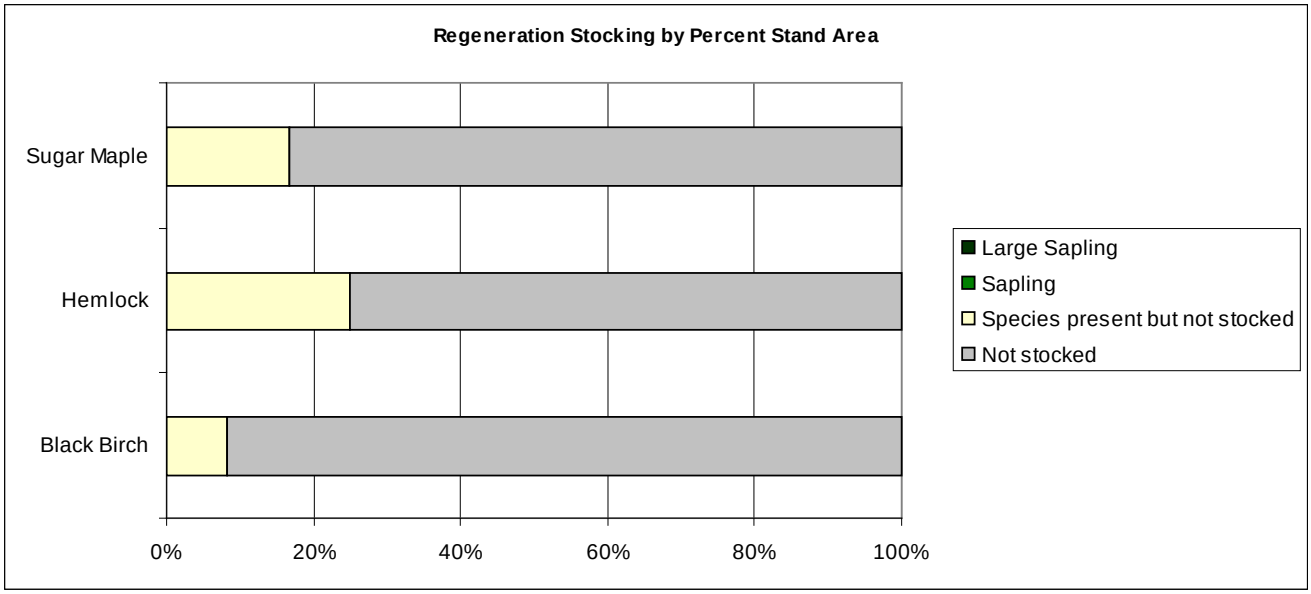
Species	% TPA	Veneer (bf)	Sawlog (bf)	Pallet/Tie (bf)	Pulp (cd)	Growing Stock (cd)	Total Cords	High Risk	AGS Saw	% AGS Saw
Red Maple	32.5%	0	0	0	4.3	1.0	5.2	0	0	0%
Red Oak	3.9%	0	0	0	1.1	1.0	2.1	0	0	0%
Sugar Maple	7.4%	0	0	0	0.8	0.9	1.7	0	0	0%
White Ash	8.0%	0	0	0	2.1	2.0	4.1	0	0	0%
Total Hardwood Per Acre:	*51.9%*	*0*	*0*	*0*	*8.3*	*4.9*	*13.2*	*0*	*0*	0%
Hemlock	5.6%	0	604	0	2.5	0.0	3.5	0	604	100%
White Pine	42.5%	0	13,345	4,437	34.9	0.0	64.9	0	12,253	69%
Total Softwood Per Acre:	*48.1%*	*0*	*13,948*	*4,437*	*37.3*	*0.0*	*68.4*	*0*	*12,857*	
Total Volume Per Acre:	100.0%	0	13,948	4,437	45.6	4.9	81.6	0	12,857	69%
Stand Volume:		0	172,959	55,017	565	60	1,012	0	159,427	

Table 2.3: Stand volume by species and product per acre values.

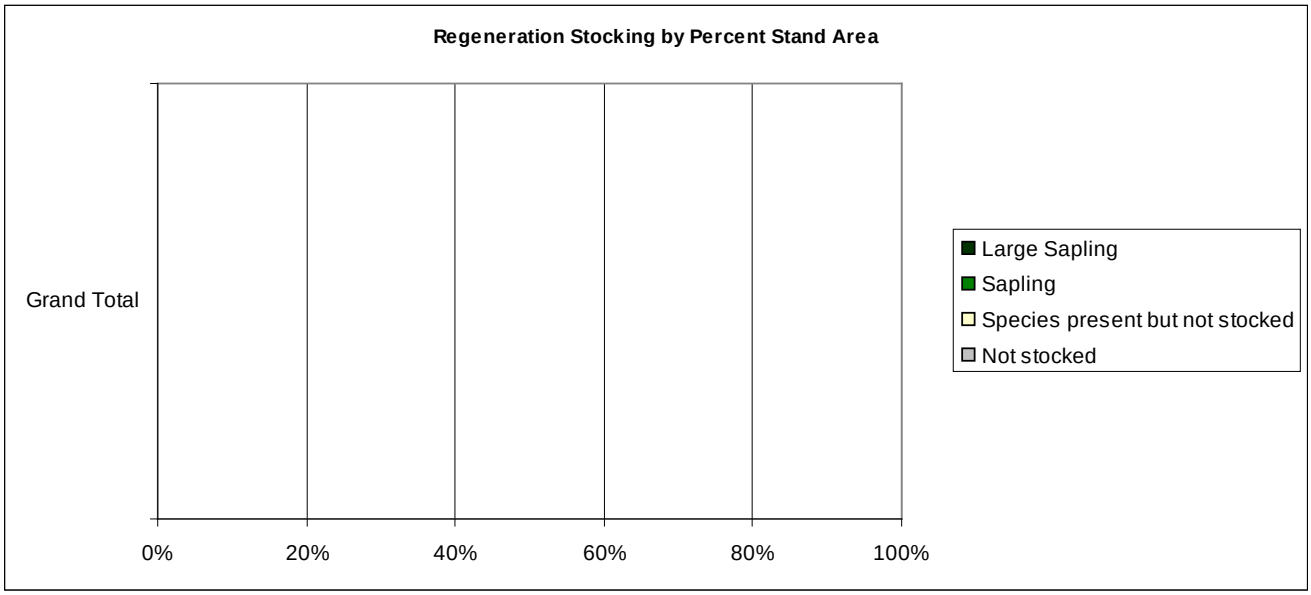
Graph 2.1: Diameter distribution showing trees per acre on the Y axis, diameter class on the X axis and tree condition. Includes trees in all canopy positions down to 2 inches in diameter.



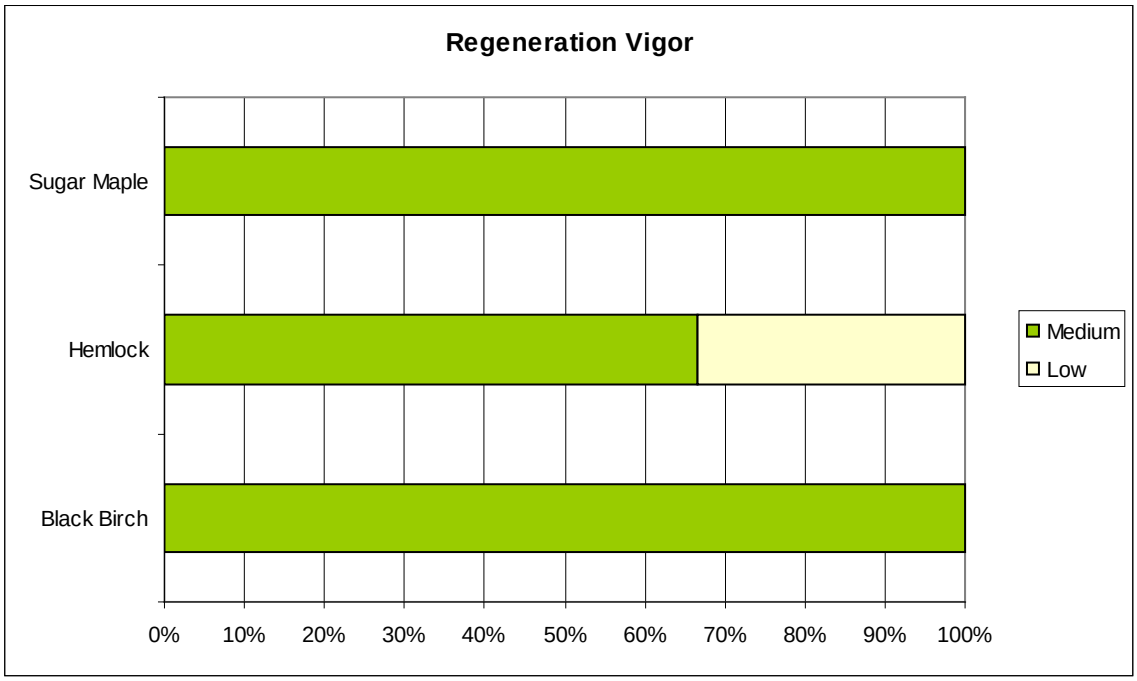
Graph 2.2: Regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



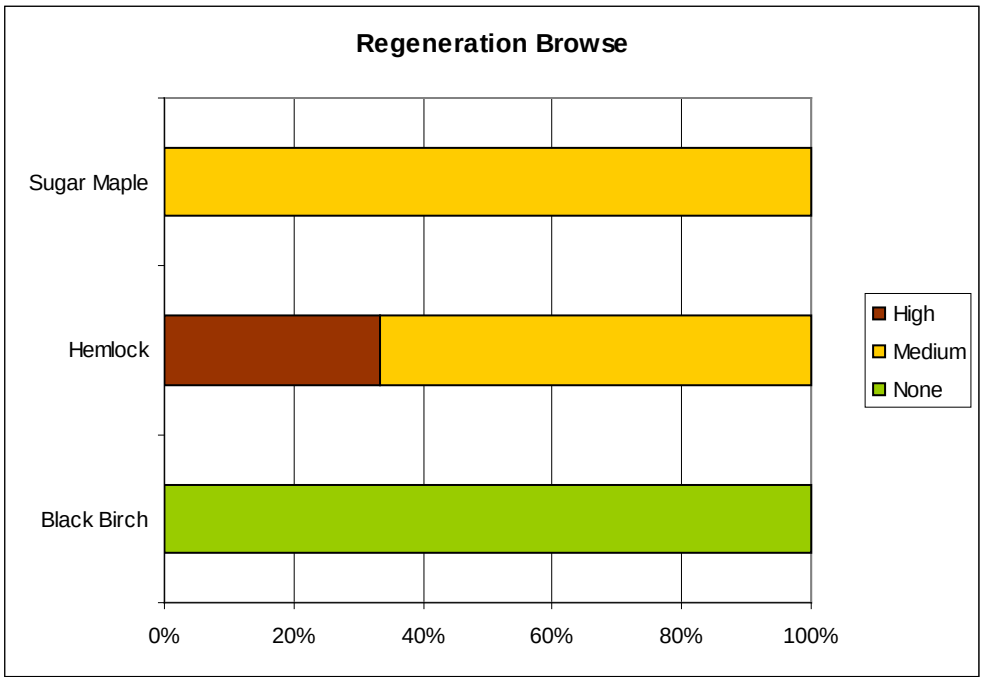
Graph 2.3: Shrub and competing species regeneration stocking by percent of stand, species and stocking class. The species is considered "stocked" if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter(Large Sapling), 5 stems between 3 and 5 feet tall (Sapling), or 25 seedlings less than 3 feet tall (Seedling). If a species is present but does not meet one of these conditions, it is recorded as present but not stocked.



Graph 2.4: Vigor of all regeneration and shrub species.



Graph 2.5: Browse level of all regeneration and shrub species.



Silvicultural Objectives

Management system:	Multiple age
Harvest Entry:	15-20 years
Products:	White pine sawlogs and pulp/chip, hemlock and hardwood sawlogs and pulp/chip
Desired Composition:	Manage towards natural community type, promote oak and pine
Crop tree target diameter:	White pine: 18-20”

Operational Considerations

Operability:	Operable
Seasonal limitations:	Dry summer or frozen winter with snow cover
Terrain:	Moderate slope, rocky
Access and landing area:	Access difficult because of reservoir. Need to go either north or south of reservoir and cross either inlet or outlet.
Access distance:	½ mile
General maintenance:	No infrastructure at present
Brook-wetland crossings:	Yes- either inlet or outlet of reservoir

STAND 2 SUMMARY AND 10-YEAR MANAGEMENT SCHEDULE

Stand 2 occupies the mixed forest east of the reservoir. White pine and hemlock dominate the stocking although pine overwhelmingly dominates the harvestable volume. The inventory data reported over 13,000 board feet per acre of pine; this likely is exaggerated due to plot location. It is difficult to efficiently get good data for small stands. The pine is ranges in quality and vigor. Some hemlock and a mix of hardwood is in the overstory, including red maple, red oak, sugar maple and white ash. There is very little regeneration in this dense stand. The stand falls on a moderate west facing slope and borders the Rice Reservoir.

Wildlife habitat here is benefited by a more diverse forest in terms of structure and species.

Accessing this stand will require crossing either the inlet or the outlet to the reservoir, either to the north or south.

The long-term goal of management in this stand is to continually develop multiple age classes of quality sawtimber trees of species well suited to the site, improve wildlife habitat, and provide for recreational opportunity. The multiple age classes will exist primarily as pockets of similarly aged trees mixed throughout the stand. This multiple-age composition will provide a diversity of forest structure beneficial to wildlife and will provide opportunity for a mix of silvicultural operations. The current species composition reflects the natural species mix, but over time likely the hemlock will make up a greater part of the composition.

Silviculture: The focus of management here is to improve the growth on the best stems and create openings for regeneration to become established. This will be accomplished by a mix of thinning out some area of higher quality stems, removing groups of low quality or diseased stems and by releasing individual crop trees. The majority of the volume to be harvested will include white pine. Attempt to

release 15-20 crop trees per acre on at least two sides. All treatments should be accomplished by removing the poorest quality and diseased individuals. Successful treatment will release the best growing stock while improving the AGS to UGS ratio.

Priority: Medium

2009: Outside of reservoir buffer zone, reduce overall basal area by 1/3 to approximately 150 square feet through:

- **Single tree and Group selection:** Single tree selection to capture value on mature or high risk trees. Group selection up to ½ acre trees to remove pockets of poor quality stems and create conditions for successful regeneration.
- **Crop tree release** on the best quality and vigor stems. Strive to release 15-20 crop trees on at least 2 sides per acre.

(Reservoir) Riparian and Stream Ecosystems[8]:

- No-cut zones of 16 to 100 feet are recommended by several management guides on river or pond shores containing wet seeps, shallow or poorly drained soils, or area with slopes greater than 8 percent. Limited single-tree cutting can occur on other sites within this zone, with cabling from outside the zone suggested. The Whitewater Reservoir shall have a no-cut zone of 50 feet, increasing where needed within the buffer as terrain dictates—including no-cut zones where slope is greater than 8% and where the soils are wet. Elsewhere within the buffer light single tree selection shall be allowed. No roads or landings shall be created within the buffer. Existing roads to access the reservoir shall be maintained according the New Hampshire BMP's.
- Establish riparian management zones along streams, rivers, ponds, and lakes. These are not intended as no-harvest zones. Forest management systems, such as single-tree or small-group selections cuts, that retain relatively continuous forest cover in riparian areas (65-70 percent canopy cover) can help maintain biodiversity by protecting water quality, providing shade, supplying downed woody material and litter, and maintaining riparian wildlife habitat conditions.
- Road construction, stream crossings, skid trails, log landings, and all phases of timber-harvesting operations should conform to Best Management Practices

8 Riparian and Stream Ecosystem management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

RICE RESERVOIR FOREST
TOTAL FOREST TIMBER AND PULP VOLUME
December, 2007
27.2 Forested Acres

Species	Sawlog (bf)	Tielog (bf)	Total BF	Pulp (cords)	Growing Stock (cords)	Cull (cords)	Total Volume in Cords	Percent Cords
Hardwood								
Aspen	9,682	5,888	*15,570*	47	0.0	0.0	*75.0*	*3.9%*
Red Maple	0	0	*0*	53	12.0	0.0	*65.0*	*3.4%*
Red Oak	0	0	*0*	13	12.0	0.0	*26.0*	*1.3%*
Sugar Maple	0	0	*0*	10	11.0	0.0	*21.0*	*1.1%*
White Ash	0	0	*0*	36	40.0	0.0	*76.0*	*4.0%*
	9,682	5,888	15,570	159	75.0	0.0	*263.0*	
Softwood								
Hemlock	7,486	0	*7,486*	31	0.0	0.0	*44.0*	*2.3%*
White Pine	272,630	101,071	*373,701*	956	4.0	11.0	*1,618.0*	*84.0%*
	280,116	101,071	381,187	987	4.0	11.0	*1,662.0*	
	289,798	106,959	396,757	1,146	79.0	11.0	*1,925.0*	

RICE RESERVOIR FOREST

10-YEAR TREATMENT SCHEDULE

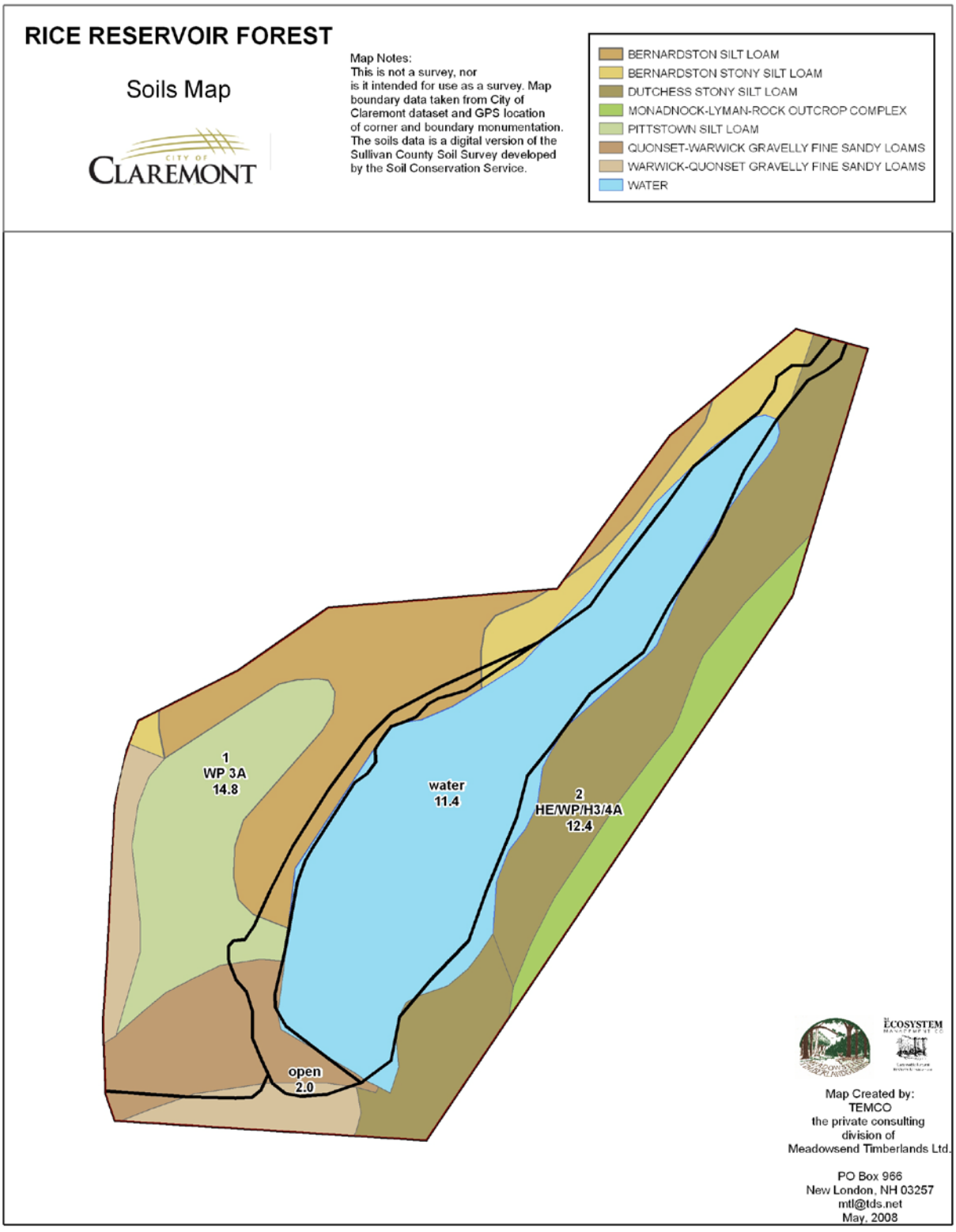
The dates given in this treatment schedule are meant to help prioritize work on the entire Claremont ownership. It is meant to be flexible and may change due to weather and market conditions or to unforeseen opportunities and access issues. The treatment activities may change due to the same reasons if silviculturally justifiable and agree with landowner mission, principles and management objectives.

Stand #	Type	Acres	Treatment	Year
1	**WP3A**	**14.8**	Thin, Group Selection	**2009**
2	**HE/WP/H 3/4A**	**12.4**	Single tree/group selection, CTR	**2009**
all			Blaze and paint property boundary lines	**ASAP**
all			Reevaluate and update management plan	**2018**

APPENDIX A: NATURAL COMMUNITY MAP


RICE RESERVOIR FOREST
Natural Community Map
CLAREMONT
Map Notes:
This is not a survey, nor is it intended for use as a survey. Map boundary data taken from City of Claremont dataset and GPS location of corner and boundary monumentation.
The Natural Community delineation is based information from "Natural Communities of New Hampshire", by Daniel E. Sperduto and William F. Nichols, 2004.
Reservoir
Hemlock-beech-oak-pine forest
Semi-rich mesic sugar maple forest
1
WP 3A
14.8
water
11.4
2
HE WP H3 4A
12.4
open
2.0
ECOSYSTEM
Map Created by:
TEMCO
the private consulting division of
Meadowsend Timberlands Ltd.
PO Box 966
New London, NH 03257
mtl@tds.net
May, 2008

APPENDIX B: SOILS MAP


RICE RESERVOIR FOREST
Soils Map
CITY OF CLAREMONT
Map Notes:
This is not a survey, nor is it intended for use as a survey. Map boundary data taken from City of Claremont dataset and GPS location of corner and boundary monumentation. The soils data is a digital version of the Sullivan County Soil Survey developed by the Soil Conservation Service.
BERNARDSTON SILT LOAM
BERNARDSTON STONY SILT LOAM
DUTCHESS STONY SILT LOAM
MONADNOCK-LYMAN-ROCK OUTCROP COMPLEX
PITTSTOWN SILT LOAM
QUONSET-WARWICK GRAVELLY FINE SANDY LOAMS
WARWICK-QUONSET GRAVELLY FINE SANDY LOAMS
WATER
1
WP 3A
14.8
water
11.4
2
HE/WP/H3/4A
12.4
open
2.0
Map Created by:
TEMCO
the private consulting division of
Meadowsend Timberlands Ltd.
PO Box 966
New London, NH 03257
mtl@tds.net
May, 2008

APPENDIX C: NEW HAMPSHIRE IMPORTANT FOREST SOIL CLASSIFICATION

Productivity of New Hampshire Forest Soils*

1A: Deeper, loamy soils, moderately to well-drained; prime northern hardwood sites.

1B: Sandy or loamy soils, moderately to well-drained; oak and beech depending on sites.

1C: Outwash sands and gravels; white pine sites.

2A: 1A and 1B soils with limitations, for example, very steep, shallow, or rocky; northern hardwood sites.

2B: Poorly drained soils; spruce/fir sites in northern New Hampshire.

Not considered because they generally rank low in timber productivity, despite often being very high in wildlife ecological value: Muck and peat, rock outcrop, gravel pits, marsh, etc.

**New Hampshire Forest Land Base Study, 2000*